CONCRETE SELF HEALING 3D PRINTED AND POWDER MIX AGENT CAPSULES DESING FOR LONGER LASTING AND SUSTAINABILITY IMPROVEMENT

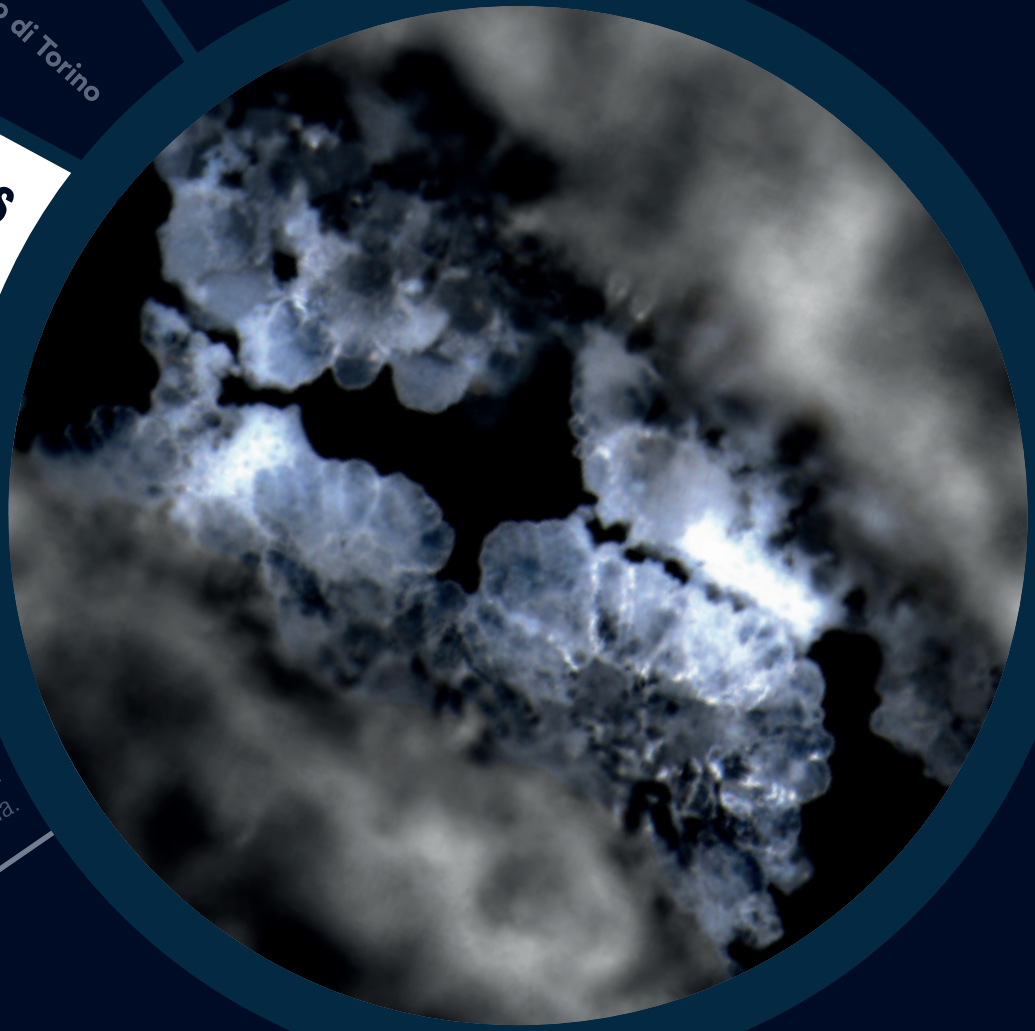
Politecnico di Torino

Master degree thesis - Architecture for the sustainability design
Tesi di Laurea Magistrale - Architettura per il progetto sostenibile

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Concrete self healing 3D printed and powder mix agent capsules desing for longer lasting and sustainability improvement

Capsule per calcestruzzo autoriparante stampate 3D ed agente di guarigione in polvere per incrementare la durata e contribuzioni al loro sviluppo sostenibile

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GREETINGS

To Politecnico di Torino, for the opportunity of studying in Italy and finish this stage of my studies though the double degree program, for the knowledge shared and the possibility of developing this thesis with the support of its professors and laboratory installations.

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ABSTRACT:

Concrete is the most used and produced material in the world, the high compressive resistance, and notable stability to traction efforts due to the reinforcement with steel bars, has made of it one of the best solutions for construction in history, revolutionizing architecture and engineering.

Nowadays, is well known that the environment is facing a dramatic climatic crisis due to the excessive CO_2 emissions, water pollution, waste, and many other factors; it is important to use wisely a material that require such an important amount of natural resources, fuels for its production and important waste generation. The purpose of this research is to contribute in a field of study focused on the extension of concrete lifespan by introducing a determined amount of capsules, with the objective of producing a self healing effect able enough to fill the possible cracks produced during its use, preventing an exposition of steel bars to environmental conditions that could produce oxidation in the reinforcement, that limits or reduces to null its tensile strength properties, giving as result the collapse of a structure.

In this study, will be considered one of the most common concrete damages, such as the water penetration in the material due to cracks previously formed (due to shrinkage, carbonation, shocks...), having direct contact with steel bars and catalyze its oxidation transforming them into a powder with no mechanical resistance.

For all these reasons, arises the idea of producing water activated capsules; small tubes filled up with two possible healing agents: 1) a liquid agent: such as polyurethane, able to reunite both parts with a certain resistance gain, already developed in other studies but updated in this research by the use of a more efficient 3D printed cover with a higher humidity proofing; or 2) with an innovative powder agent developed in the present study as a blocking system to prevent the passage of water into the core of concrete; this powder, that contains cement, a petrous origin material, can be compacted by applying pressure in presence of elevated temperature to create a self standing cylindric element named "virtual capsule", setting aside the necessity of a container and presenting a longer lasting expected period, compared to liquid filling agents. This gives as result a total of 3 types of capsules: 1) 3D printed liquid filled, 2) 3D printed powder filled, 3) virtual capsule.

This research includes all of the methodology, design process, variables and its solutions, development of molds and capsules, mixture design, productive process, verification tests, results, comparison between the three capsule types, suggestions for use, and recommendations for future studies.

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1

INTRODUCTION AND THEORETICAL BACKGROUND



1.1 Introduction

1. Chapter 1: Introduction and theoretical background

Concrete is the most used and produced material in the world, the high compressive resistance, and notable stability to traction efforts due to the reinforcement with steel bars, has made of it one of the best solutions for construction in history, revolutionizing architecture and engineering.

Nowadays, is well known that the environment is facing a dramatic climatic crisis due to the excessive CO_2 emissions, water pollution, waste, and many other factors; it is important to use wisely a material that require such an important amount of natural resources, fuels for its production, and non totally renewable waste generation.

In this section will be introduced the reasons, hypotheses and ideas for new technological solutions in the field of self healing materials and techniques for producing longer lasting concretes with the intension of increasing its life span, support the re-use of high quality and durable structures; and reduce the waste production by demolishing it for damages, pathologies or new uses.

Concrete is one of the most produced materials in the world due to its versatility and effectiveness for structural development; in terms of sustainability, cement production require the extraction of natural mineral material that needs to be processed with the application of high temperatures producing CO_2 emissions that contributes to the climatic change.

Also, in the end of the lifespan of a building, concrete is normally demolished producing non easily recyclable wastes, many of these rubble pieces are crushed to be used as alternative aggregates in new concretes, but its use is still not permitted in high resistance concrete and many large structures.

For the reasons previously exposed, and taking into consideration that replacing concrete with the current technologies in construction now a days is still not applicable for all the cases; one of the solutions in order to reduce waste and obtain the maximum profit is to produce longer lasting reusable concrete structures.

Improving the concrete quality is possible to increase its lifespan and use the maximum of it. Also preventing concrete pathologies such as cracking, steel oxidation due to moisture or waterproofing lacks, and a correct preventive maintenance can enlarge the structure duration.

One of the newest advances in technology and research for protecting concrete structures are the self–healing concrete techniques and devices; it is a field of study based on the natural capacity

of biological organisms to regenerate its tissues or cellular structures to preserve its life.

The concept of developing concretes supplemented with substances directly mixed in the paste or enclosed in capsules, that could be activated when a fissure is produced, exposing the healing agent to environmental conditions that normally catalyzes its reactions, is proposed.

These capsules introduced in concrete structures could prevent the fissures expansion by the use of adhesive or expansive substances that could lead to a resistance recovery for traction efforts.

In addition, they could also stop the water flow into the crack preventing the steel oxidation and loose of the tensile strength properties in structures and concrete elements.

Capsules for self–healing concrete are normally filled with synthetic liquid polymers such as polyurethane in the case of this research; these substances tent to be very sensitive to humidity requiring complex production processes.

The idea of these research is to simplify the production process by using new technologies and improvement of alternatives for its realization. One of these alternatives is the 3D printing for capsules production, that in previous experiences has presented porosity and discontinuity.

Another drawback of the use of polyurethanes is the hardening of the substance before its activation when contained in the capsule; this occurs due to the composition and nature of PU, as it is composed of polyol, isocyanates and additives to be catalyzed by environmental humidity. Even when moisture can not reach it by the waterproofing layer of the capsule, the insulated material (PU) keeps on reacting very slowly and is also affected by the humidity when packed, manipulated and introduced in the containers.

Taking into consideration the previous facts the following hypothesis can be formulated: is it possible to develop new capsules designs better insulated with the use of new technologies, and a new powder substance for concrete self–healing, only activated by water, with a longer lasting lifespan, all under sustainable criteria?

1.1.3. Hypothesis Definition

Concrete self-healing capsules lasting and production can be improved by the development of an alternative new container design using updated techniques, and by the development of healing agents in powdered form, water activated only, to reduce the use of solvents and slowly reacting substances for increasing its lifespan in a more sustainable approach.

1.1.4. General and Specific Aims

General aim:

To develop new capsules designs and water activated concrete self–healing agent for a longer lasting lifespan under sustainable criteria.

Specific aims

1–. To develop a new 3D printed capsule design.

1.1–. to improve the 3D printing quality with the use new technologies and configurations.

1.1.1–. To calibrate the printer

1.1.2–. To program the main settings for the gcode.

1.1.3–. To select the material

1.1.4–. To 3D print different test

1.2–. To develop a new container design for the healing agent.

1.2.1–. To study the dimensions for the capsule modeling.

1.2.2–. To design the cap closing system

1.3–. To model in digital 3D software the capsule.

1.4–. To print the 3D capsules

1.5–.To test the capsule capacity of containing the healing agents.

2–. To develop a powder water activated healing agent for concrete

2.2–. To identify different possible water reactive substances

2.2–. To understand the different substance's products and characteristics while reacting with water

2.3–. To test different combinations and proportions of substances

2.4–. To evaluate the resistance of the main combinations to select a definitive mixture design

2.5–. To test the mixture design in capsules on malt prisms

2.5.1–. To test the sealing effectiveness

2.5.2–. To test the mechanical recovery

3–. To compare the results with other researches

3.1–. To compare the production process steps and resources needed

3.2–. To evaluate improvements in terms of sustainability

1.2. Theoretical Background

1. Chapter 1: Introduction and theoretical background

To make the initial approach possible and understand the dimension and context behind the hypothesis and decisions necessary to find an alternative solution for the concrete durability increase problem, and to deepen in the necessary concepts and existing solutions in order to elaborate an original idea, in this chapter, a theoretical approach that will be used as general guidelines for the further steps in this research will be presented.

1.2.1. Sustainability in Construction

Construction field, nowadays with the population growth, and complexity of new buildings is a high demanded field world wide, demanding more and more materials, new transformations and finishes, incrementing emissions for processing them, more machinery and transport, and waste generation with non renewable products or difficultly recyclable and reusable procedures.

For these reasons, for reducing the environmental impact of all these elements and the climate change current crisis; the sustainability criteria is taking everyday more place and relevance.

For understanding this concept, it is necessary to review the historical process and its ideas evolution, highlighting all of the environmental effects discovered and communicated for years until obtaining the concrete notion humanity currently has.

The beginning of this process is considered to occur in 1972, with the report "The limits to grow" from the club of Rome, a non governmental organization funded in Rome on 1968, with the aim of improving the world's future in long term.

> *"The Limits to Growth report (1972) from the Club of Rome brought computer modeling to global forecasting, and warned that the world had about a hundred years left before we begin running out of just about everything. The theme of diminishing resources and excessive growth was echoed in 1973 in E.F. Schumaker's classic economic treatise, Small is Beautiful who labeled society's unsustainable path as "...conducting the economic affairs of man as if people really did not matter at all". (Sarokin,D. 2021)*

Bibliographic references:
-Sarokin, D., 2021. A Brief History of Sustainability. Corporate Sustainability: Does It Make A Difference, [online] pp.1-13. Available at: <https://www.researchgate.net/publication/351759689_A_Brief_History_of_Sustainability> [Accessed 16 January 2022].

In this report is established the reality that population is growing and resources demand and use is increasing more everyday; this idea was reinforced also with the fuels crisis in 1973 and 1979, where the lack of resources was even more tangible.

Also in 1972, occurs what is called the first world conference on environment, where the environment issue is formally considered by being conscious of the impact technology had and the increase on resources consumption.

> *"The 1972 Conference on the Human Environment in Stockholm, Sweden, attended by 113 states and representatives from 19 international organizations, was the first truly international conference devoted exclusively to environmental issues. (...) Another result of the Stockholm Conference was the creation of the United Nations Environmental Program (UNEP) (...)*
>
> *This conference played a catalytic role in promoting the subsequent adoption of international agreements concerned with ocean dumping, pollution from ships, and the endangered species trade. It also adopted the "Stockholm Declaration on the Human Environment", which included forward-looking principles, such as Principle 13, that declared the need for integration and coordination in development planning to allow for environmental protection" (Bâc, D. 2008)*

The most important aspects of this declaration are the safeguard of natural resources, the use of science to improve the environmental conditions, the UNEP creation that supports the sustainable development and the availability of resources for future generations.

Bibliographic references:
-Bâc, D., 2008. A history of the concept of sustainable development: Literature review. [ebook] University of Oradea, pp.1-6. Available at: <https://www.researchgate.net/publication/242219096_A_history_of_the_concept_of_sustainable_development_Literature_review> [Accessed 16 January 2022].

"In 1983, the UN General Assembly created the World Commission on Environment and Development which was later known as the Brundtland Commission, named after its Chair, Gro Harlem Brundtland, then Prime Minister of Norway and later head of the World Health Organization. In 1987, the Commission published the Brundtland Report, entitled Our Common Future168. It built upon what had been achieved at Stockholm and provided the most politically significant of all definitions of sustainable development: "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" . The definition contains two major concepts: firstly, the concept of 'needs', in particular the essential needs of the world's poor, to whom overriding priority should be given; and secondly the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs" (Bâc, D. 2008)

In 1987, as seen before, occurred the Brundtland report, one of the most famous in this field, as this document provides a section with the sustainable development definition that involved the use of resources to satisfy the needs of the present without compromising the possibility of future generations to meet their own needs.

Here is notable an initial concept of consciously use of resources, taking into consideration that many of these are finite and the next generations will also require them and should have this right as people has it today.

It was criticized for being vague at the moment, and by the use of the three "P" Planet, Property, and people; was centered mainly in the human being and not in the rest of living species.

Bibliographic references:
-Bâc, D., 2008. A history of the concept of sustainable development: Literature review. [ebook] University of Oradea, pp.1-6. Available at: <https://www.researchgate.net/publication/242219096_A_history_of_the_concept_of_sustainable_development_Literature_review> [Accessed 16 January 2022].

Again in 1987, is developed another relevant document was the Montreal Protocol; the aim of this convention was to reduce the dangerous gases that affects the ozone layer, attempting against the normal temperatures and climatic condition's stability.

> *"The Parties to this Protocol, Being Parties to the Vienna Convention for the Protection of the Ozone Layer, Mindful of their obligation under that Convention to take appropriate measures to protect human health and the environment against adverse effects resulting or likely to result from human activities which modify or are likely to modify the ozone layer, Recognizing that world-wide emissions of certain substances can significantly deplete and otherwise modify the ozone layer in a manner that is likely to result in adverse effects on human health and the environment,"(Ozone Secretariat, United Nations Environment Programme. 2020)*

One of the main dangerous substances baned and relevant for the industrial and construction field was the Chlorofluorocarbon (CFC) that contains chlorine, that is very reactive with ozone, transforming this gas in the atmosphere, reducing its amount, allowing UVA and UVB rays to reach the ground level of Earth.

The chlorine atoms were replaced with hydrogen atoms, conforming the anhydrous—hydro—chlorofluorocarbons that are not reactive with ozone, but contributed to the global warming effect and therefore, the climate change.

This idea takes experts to the creation in 1987 of the Intergovernmental Panel on Climate Change (IPCC) whose aim is to develop scientific studies of climate change, and bring objective information of its impact and risks.

Bibliographic references:
-Ozone Secretariat, UNEP, 2020. Handbook for the International Treaties for the Protection of the Ozone Layer. 14th ed. [Nairobi]: Ozone Secretariat, UNEP, pp.874-960. Available at: https://ozone.unep.org/sites/default/files/Handbooks/MP-Handbook-2020-English.pdf [Accessed 16 January 2022].

Climate change is the modification of the normal weather patterns due to the use of fossil fuels and the release in the atmosphere of substances deriving from production processes, construction, transportation and many more.

> *"The next step was the UN Conference on the Environment and Development (UNCED), which was held in Rio de Janeiro, Brazil, during the summer of 1992, an unprecedented historical event with the largest gathering of 114 heads of state (...)*
>
> *The key outputs of the Conference were: the Rio Declaration, Agenda 21, and the Commission on Sustainable Development. All are quite explicitly concerned with sustainable development and it is thus, at the conclusion of the Earth Summit that the concept truly arrives on the international scene."(Bâc, D. 2008)*

The 1992 "Earth Submit in Rio" originated the agenda 21, that contains protocols for governments to achieve changes for century XXI, required to arrive to an agreement between each country govern and its population for reducing the impact, and to implement more equitable measures and take action against poverty.

Extending the aims established in the Rio conference, in 1997, the Kyoto Protocol, targeted the aim of reducing the greenhouse effect, in very few words, the phenomena that occurs due the accumulation of CO_2 in the atmosphere and entraps the heat produced by solar radiation, increasing the world temperature.

Bibliographic references:
-Bâc, D., 2008. A history of the concept of sustainable development: Literature review. [ebook] University of Oradea, pp.1-6. Available at: <https://www.researchgate.net/publication/242219096_A_history_of_the_concept_of_sustainable_development_Literature_review> [Accessed 16 January 2022].

In the 1997 Kyoto conference on climate change, developed countries agreed on specific targets for cutting their emissions of greenhouse gases, (...) The U.S. proposed to stabilize emissions only and not cut them at all, while the European Union called for a 15% cut. In the end, there was a trade off, and industrialized countries were committed to an overall reduction of emissions of greenhouse gases to 5.2% below 1990 levels for the period 2008-2012. (...)

Unfortunately the USA has refused to ratify the Kyoto Protocol. The EU has ratified the Kyoto protocol but this has not been enough. The Union has failed to reduce CO2 emissions. The overall picture of the situation in 2030 is pessimistic. (Bâc, D. 2008)

As seen in the previous citation, the protocol established that the greenhouse gases emissions in 2008—2012 had to be 5.2% lower than the ones produced during the year 1990. This reduction is not considered enough, the production processes are still too dependent of fuels, combustion and CO_2 emissions, it is necessary a more substantial decrease, and experts forecasts for 2030 are still very negative.

In the year 2001, the UNESCO added a 4th pillar to the sustainability definition representing the cultural diversity, not only representing the different countries, but also the education necessary to reach the sustainable model.

"There are four dimensions to sustainable development - society, environment, culture and economy - which are intertwined, not separate. Sustainability is a paradigm for thinking about the future in which environmental, societal and economic considerations are balanced in the pursuit of an improved quality of life. For example, a prosperous society relies on a healthy environment to provide food and resources, safe drinking water and clean air for its citizens." (UNESCO 2021)

Bibliographic references:
-UNESCO, 2021. Sustainable Development. [online] UNESCO. Available at: <https://en.unesco.org/themes/education-sustainable-development/what-is-esd/sd> [Accessed 17 January 2022].

In the same year, the Stockholm Convention established the ban of persistant organic pollutants (POPs).

In the year 2007, the "fourth assessment report" of the Intergovernmental Panel on Climate Change (IPCC) formalizes the correlation between the CO_2 and global warming causing the temperature increase, the polar ice melting, the oceans level raising, ecosystems alterations and more.

In 2015 was developed the United Nations Conference of the Parties, COP 21 or CMP 11; aimed at reducing and limiting the average global temperature increase. To enter into force, it must be signed by at least 55 nations and represent at least the 55% of the global CO_2 emissions.

Once understood this quick general historical background, all of the problematics discovered and the different solutions developed by experts and organizations, having a clear panorama of the main origins of the current environmental changes, it is possible to define and understand the concept of sustainability and the importance of technological innovations and science advances to provide solutions everyday more efficient to the current problematic.

Sustainability Concept Evolution Timeline

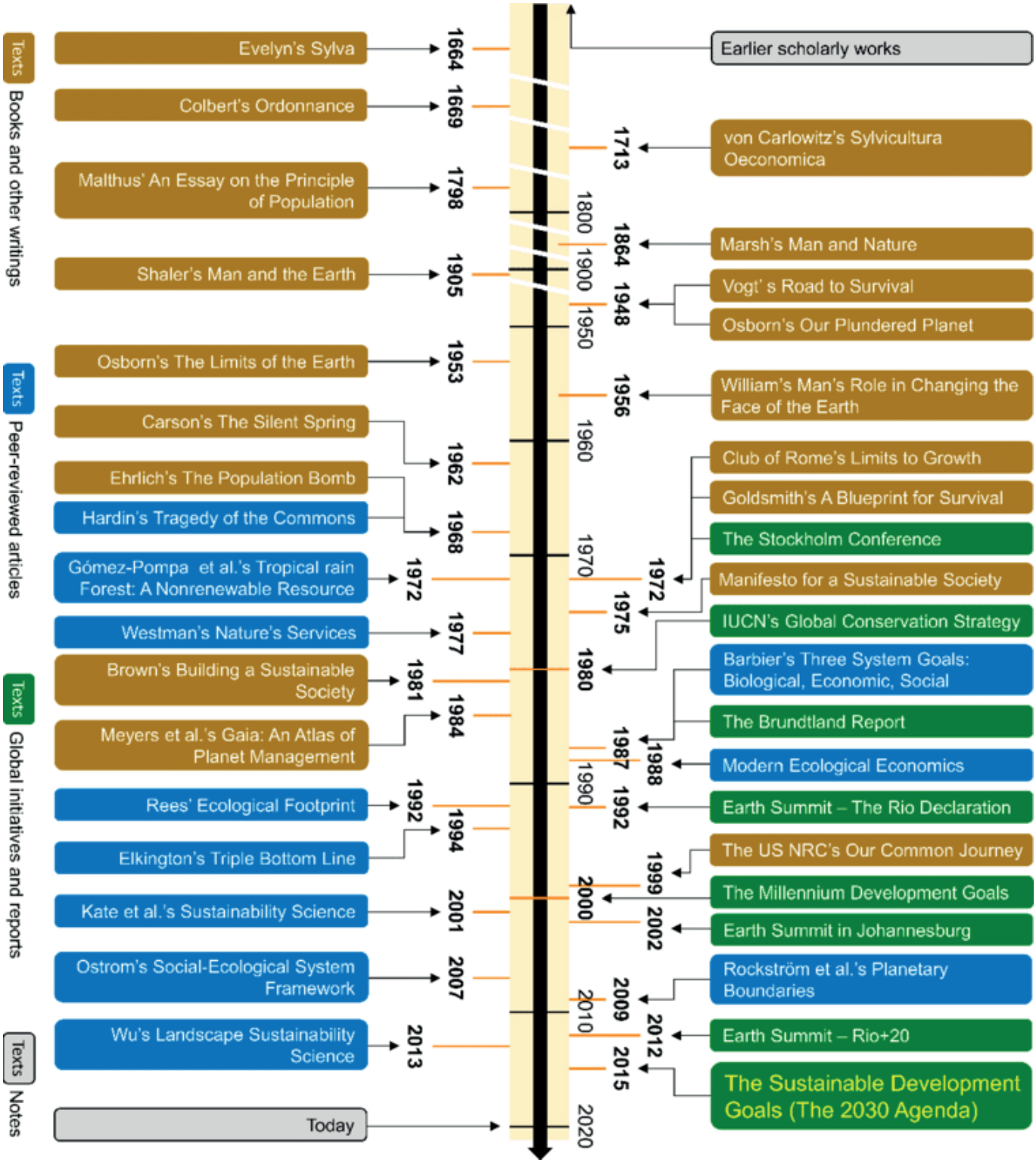


Image reference:
-Estoque, R., 2020. Timeline showing how the sustainability concept has been advanced by scholarly works and global policy initiatives.. [image] Available at: <https://www.researchgate.net/figure/Timeline-showing-how-the-sustainability-concept-has-been-advanced-by-scholarly-works-and_fig2_341838567> [Accessed 17 January 2022].

Sustainable Development definition:

"Sustainable development has been defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable development calls for concerted efforts towards building an inclusive, sustainable and resilient future for people and planet.

For sustainable development to be achieved, it is crucial to harmonize three core elements: economic growth, social inclusion and environmental protection. These elements are interconnected and all are crucial for the well-being of individuals and societies."(UN. Sustainable Development Agenda. 2020)

"five pillars of sustainability: economy (material sustainable growth), equity (social well-being though social cohesion), ecology (environmental well being through natural harmonization), culture (cultural well-being through intercultural dialogue) and security (peace and sustainable stability)." (Brevar, M. bertoncelj, A. 2016)

The general updated definition is: the development that fulfills the necessities for the present, without compromising the possibility for the future generations to meet them too. Achieved by supporting the five pillars: 1—. Economy, that refers to the conscious use of resources and its re—integration in a circular model; 2—. Equity, meaning social well—being, rights and justice; 3—. Ecology, referring to environmental protection and ecosystems maintaining; 4—. Culture, that involves education and multilateral respect and exchange; 5—. Security, refers to peace and resilience, guarantying the life and its protection.

Bibliographic references:
-UN, 2020. The Sustainable Development Agenda - United Nations Sustainable Development. [online] United Nations Sustainable Development. Available at: <https://www.un.org/sustainabledevelopment/development-agenda/> [Accessed 17 January 2022].
-Bervar, M. and Bertoncelj, A., 2016. The Five Pillars of Sustainability: Economic, Social, Environmental, Cultural and Security Aspects. [ebook] Pula, Croatia: MIC Management international conference, pp.1-2. Available at: <https://www.hippocampus.si/ISBN/978-961-6984-26-3/151.pdf> [Accessed 17 January 2022].

5 Pillars of Sustainable Development Matching the UN 17 Aims

1. Universal

In 2015 a total of 193 countries, including Belgium, signed the SDG declaration. This means that every actor involved has a moral duty to contribute to the implementation of this international agenda.







2. Inclusive

"Leave no one behind" is the principal message behind the sustainable development goals.

3. Indivisible

All 17 goals are inter-connected. Contributing to one goal will also help the other goals move forwards.



4. Integrated approach

The issues confronting society today which the SDGs aim to tackle are so complex that they require a multi-disciplinary, transversal approach, also at the local level.



5. 2030 Agenda

The SDGs are a moral compass for a long-term vision. 2030 may cross the boundaries of policy terms, but 2030 is now. We will need to start working today to achieve the goals in 2030.

6. Cooperation

The SDGs can only be attained if we collaborate with all actors involved: the various levels of government, civil society within the municipality, the private sector, the schools, the various services within the municipality, etc.

6 Messages

17 sustainable development goals, 169 targets, 244 indicators: it is a comprehensive and wide-ranging agenda, which underlying vision can be summarised in 6 values. The SDGs are Universal, Inclusive and Indivisible. They offer a Long-Term vision and require and Integrated approach, in which partnership is key.

Image references:
- VVSG, 2018. Integrating SDGs in local election manifesto. [image] Available at: <https://www.local2030.org/library/421/Recommendations-to-integrate-the-SDGs-into-local-party-manifestos.pdf> [Accessed 17 January 2022]

Sustainable development in construction:

"Sustainable Buildings and Construction (SBC) includes the planning, design, commissioning, construction, maintenance, refurbishment and end-of-life stage of buildings. Sustainability in this regard refers to the use of natural resources such as water, energy, minerals, natural materials, and land as well as the quality of the building in terms of its designed purpose, such as a healthy and comfortable living environment. SBC therefore requires frameworks and schemes that facilitate policy implementation and the exercise of skills and techniques to reduce the energy used in producing building materials.

The building sector is economically important in practically all countries, employing 10 percent of the global workforce (De T'Serclaes, 2007) and typically contributing 10–15 percent to countries' GDPs (UNEP-SBCI, 2009). Moreover, in many countries people spend on average 90 percent of their time inside buildings and cars (see, for example, Brasche and Bischof (2005) for a detailed analysis in Germany).

In terms of sustainable production, measures frequently relate to technical changes, such as the use of durable, efficient and healthy materials of high construction quality. They focus on the entire production process, in terms of its requirements for both energy and other resources, seeking to improve resource efficiency overall (see, for example, Zhang et al. (2013) for a life-cycle assessment in Hong Kong)." (UNEP. 2017)

Bibliographic references:
-UNEP, Ekins, P., Hughes, N. and et al., 2017. RESOURCE EFFICIENCY: POTENTIAL AND ECONOMIC IMPLICATIONS International Resource Panel Report. International Resource Panel. ISBN: 978-92-807-3645-8, pp.1-167. Available at: <https://www.resourcepanel.org/sites/default/files/documents/document/media/resource_efficiency_report_march_2017_web_res.pdf> [Accessed 17 January 2022].

Sustainable development in construction, in a very general sense, and taking into consideration the UNEP concept, refers to the design, execution, use and disposal of any kind of building with the conscious use of materials and technologies in order to reduce the consumption of minerals, energy, land surface and other components required for a building production, without compromising the life quality, comfort and security of its occupants.

For these reasons it is important for this research the production of high quality structures in order to wisely use the available material in the most efficient way possible, with the capacity of being re—used or presenting an extensive lifespan to avoid unnecessary demolitions or waste generation, and take the maximum profitability of it.

Concrete and sustainability importance:

Concrete, as expressed before, is one of the practical, versatile and most used construction material in the world. It is composed normally of Portland cement (a product deriving from minerals extraction and high temperature treatment), gravel, crushed rock and sand and uses important amounts of water for its reaction, is reinforced with steel bars, and can include chemical products as admixtures (substances included to modify concrete's properties. Concrete definition is detailed in the following section 1.2.2).

In the following graphs, it is possible to see the most produced and extracted materials in the world, Figure A corresponds to the most consumed materials in the period 2002–2005, being conscientious and cement the highest and notably superior values in the list. In Figure B the global annual materials extracted for 2011, and a projection for 2060, where sand, gravel and crushed rock are the notably highest values. In Figure C, for the year 2017 the same minerals presented in figure B are on top of the list, and iron ore for steel production is the most extracted mineral.

Considering these information, the concrete production is involved in a huge amount of raw materials and minerals extraction, by being its components in the first place on the list since at least 2002 and with an increasing tendence.

By quarrying these raw materials, very important environmental damages occur (rivers deviations, ecosystems alteration, pollution, emissions for processing), so it is important to reduce concrete consumption and increase the structures lifespan to take the maximum profit and minimize the impact.

Figures references:

-Figure A: UN Environment, 2022. Figure 2. Estimated consumption of common materials 2002-2005 - Eco-efficient cements: Potential economically viable solutions for a low-CO2 cement based materials industry. [image] Available at: <https://wedocs.unep.org/bitstream/handle/20.500.11822/25281/eco_efficient_cements.pdf> [Accessed 17 January 2022].

-Figure B: Aurora Torres, Mark U. Simoni, Jakob K. Keiding, Daniel B. Müller, Sophus O.S.E. zu Ermgassen, Jianguo Liu, Jochen A.G. Jaeger, Marten Winter, Eric F. Lambin, 2021. Figure 1. Global annual material extraction in 2011 and projected extraction for 20602 Adapted from OECD - Sustainability of the global sand system in the Anthropocene. [image] Available at: <https://www.sciencedirect.com/science/article/pii/S259033222100230X#fig1> [Accessed 17 January 2022].

-Figure C: OECD, 2019. Figure 5.2 - Global Material Resources Outlook to 2060: Economic Drivers and Environmental Consequences, OECD Publishing, Paris,. [image] Available at: <https://read.oecd-ilibrary.org/environment/global-material-resources-outlook-to-2060_9789264307452-en#page122> [Accessed 17 January 2022].

Figure A Estimated consumption of common materials 2002–2005.

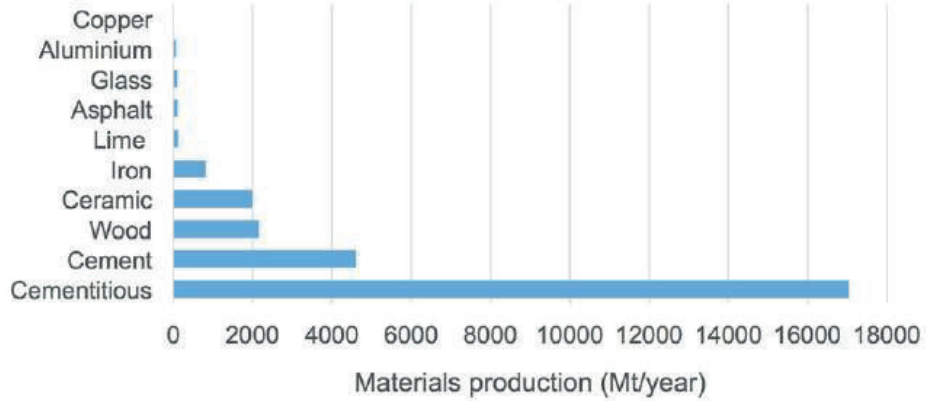


Figure B

Global annual materials extracted for 2011

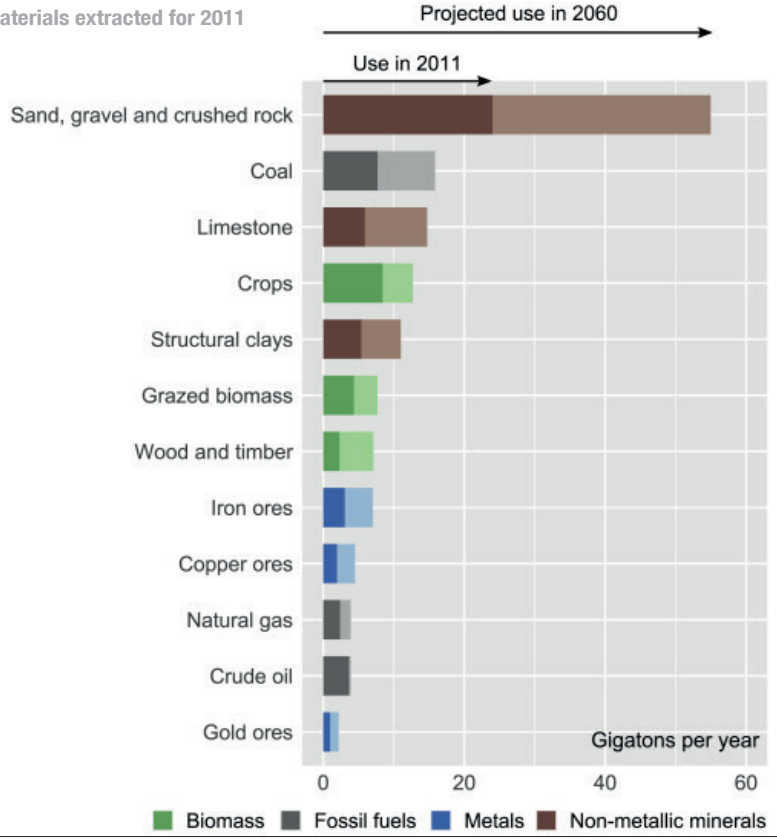
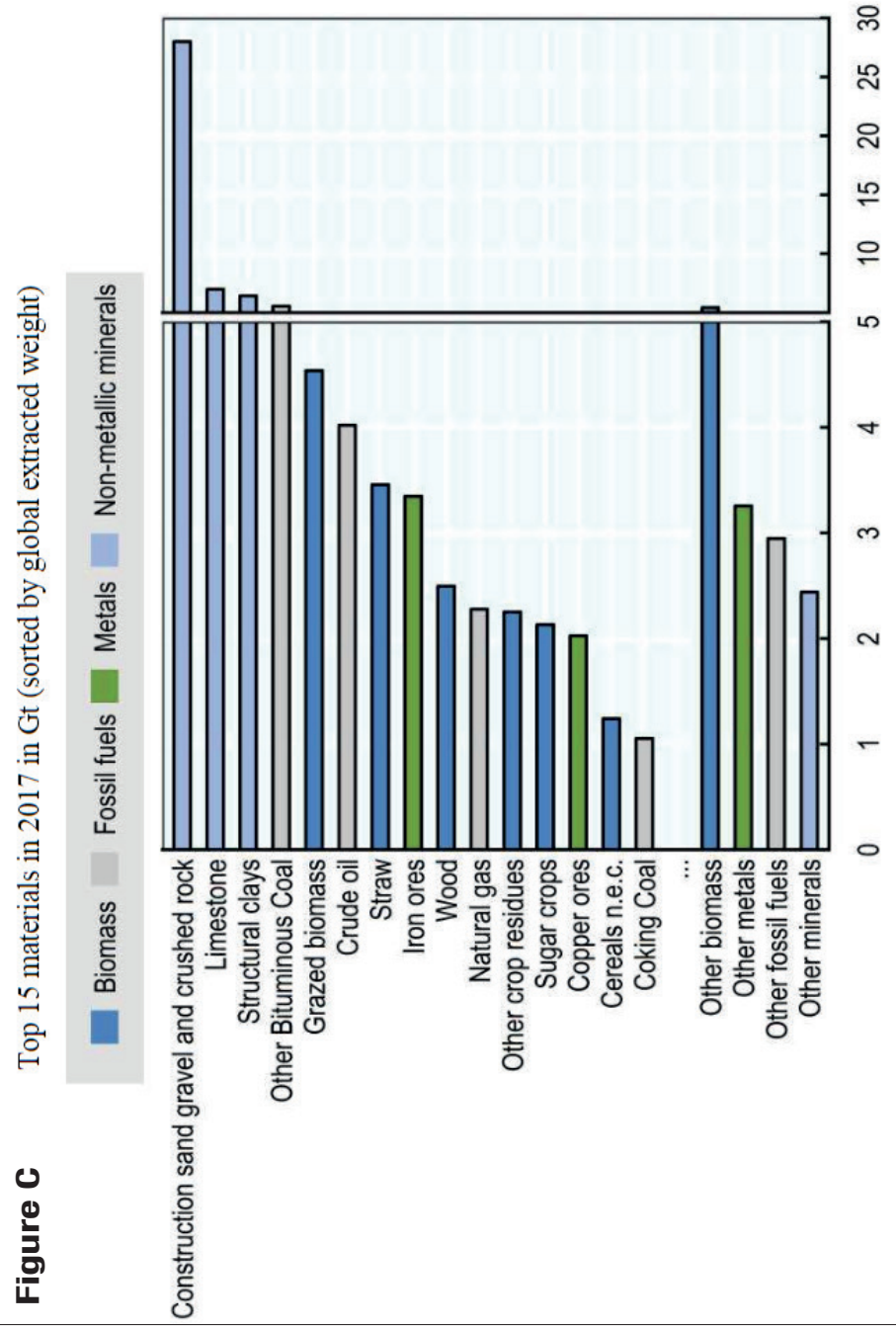


Figure C



1.2.2. Cement and concrete

Cement and concrete definition:

As explained in the previous section, concrete is one of the most relevant construction material, and it has been the predominant material in architectural history, variating its components and proportions. Is the material with which entire cities worldwide were built.

For understanding the current definition of concrete, and cement, its principal component, it is necessary to review their history and evolution, as one of the oldest and transcendental high resistance building materials, that has significantly evolved throughout time.

"The first examples of Roman concrete date to 300 B.C. The Romans not only improved concrete technically, they also gave it a name. The word "concrete" comes from the Latin concretus, meaning grown together or compounded.

A concrete made with pozzolanic, hydraulic cement, developed by the Romans in 75 B.C. was used in building the theater at Pompeii and the Roman baths. The cement was a ground mix of lime and volcanic ash containing silica and aluminum, found near Pozzuoli, Italy, hence the name, pozzolanic cement." (Steiger,R. 1995)

"Puzzuolana is a silicate of alumina in which the silica exists in a state easily attacked by caustic alkalies . Hence it readily combines with lime in the mortar."(Lesley, R. 2016)

Pozzolanic cement is the first Green cement that has been used in many roman countries under Roman Empire since 79 A.D. Romans had mixed 1/3 lime with 2/3 of volcanic ash powder and light lava rock and water to make material solid and cohesive building used in the construction of buildings, bridges, waterway and temples and most of these roman structures are still standing. (Alkhalfah, D. 2017)

Bibliographic references:
-Steiger, R., 1995. The history of concrete. Concrete Journal, [online] (PUBLICATION #J950584), pp.1-3. Available at: <https://pita.ess.washington.edu/tswanson/wp-content/uploads/sites/9/2018/10/The-History-of-Concrete.pdf> [Accessed 17 January 2022].
-Lesley, R., 2016. History of the Portland cement industry in the United States. Chicago, IL, USA: Forgotten books, pp.19-351. Available at: <https://www.forgottenbooks.com/en/download/HistoryoftthePortlandCementIndustryintheUnitedStates_10680450.pdf> [Accessed 17 January 2022].
-Alkhalfah, D., 2017. Pozzolanic Cement. 10.13140/RG.2.2.31110.06725. [ebook] pp.1-5. Available at: <https://www.researchgate.net/publication/319314980_Pozzolanic_Cement> [Accessed 17 January 2022].

As seen before the concept of concrete has its origins in the ancient Rome, and it is also truth that previously in middle east and Asian regions a similar heated stone derivate material was used, but romans gave it the definitive name and combined it with other aggregates to obtain the binding compressive resistant final material.

This very initial concrete mixture was composed by the first natural cementitious material used, as is pozzolanic cement, obtained from volcanic ashes and rocks in Pozzoli, Italy, a city in the vicinity of Mount Vesuvius. This material contains alumina—silica, that is very reactive with calcium hydroxide (portlandite), present in burnt lime.

This mixture was used for the construction of important buildings such as the Pantheon in Rome, to join the rocks and bricks that conform the walls that are still standing today after hundreds of years.

Due to the difficulty at that time for transporting the Italian volcanic origin material to different countries, it was regularly used only lime mortars, until a new technological advancement occur in 1756 by the engineer John Smeaton.

> *"He undertook a program of trial and error, combining all of the known materials used to produce mortar from various parts of England and the Continent. Finally he made a real breakthrough when he combined burnt Aberthaw blue lias, a limestone from South Wales, and an Italian pozzolan from Civitavecchia. With this combination Smeaton produced the first high-quality cement since the fall of the Roman Empire." (Steiger,R. 1995)*

"Smeaton used this hydraulic cement in the mortar to key and cement stone blocks together to create the first Eddystone Lighthouse in 1759. Smeaton's lighthouse endured for more than a century"(Steiger,R. 1995)

In this period it is possible to see a variation of the initial composition, this time by using a different type of limestone with pozzolana from cittavecchia, Lazio which develops another cementitious mixture with high resistance, also used for building with a particular technique very similar the bricks and mortar used nowadays.

Then in 1796, James Parker discovered that by accidentally burning some beach stones left in the fireplace for a long time, they became ashes and calcined fragments, becoming a matter of interest for further studies.

"Undertaking some experiments, he was able to develop a natural cement he believed to be the reincarnation of the Roman cement of ancient times. Large quantities of the stones, which were actually nodules of septaria from the London clay, were collected from the Thames Estuary to make a cement which remained popular until the middle of the 19th century. The first major use of Parker's cement was in mortar for the first tunnel under a navigable river, the 1,200-foot-long brick tunnel under the Thames River."(Steiger,R. 1995)

This contribution is very important in the concrete and cement history because it is an initial step in the production of cementitious materials by directly burning and crushing stones, without the necessity of volcanic derived rocks and it is also very similar to the current production process.

Bibliographic references:
-Steiger, R., 1995. The history of concrete. Concrete Journal, [online] (PUBLICATION #J950584), pp.1-3. Available at: <https://pita.ess.washington.edu/tswanson/wp-content/uploads/sites/9/2018/10/The-History-of-Concrete.pdf> [Accessed 17 January 2022].

Portland Cement:

"Portland cement was developed from cements (or correctly hydraulic limes) made in Britain in the early part of the nineteenth century, and its name is derived from its similarity to Portland stone, a type of building stone that was quarried on the Isle of Portland in Dorset, England. Joseph Aspdin, a British bricklayer, in 1824 was granted a patent for a process of making a cement which he called Portland cement. (...) PORTLAND cement is the most common type of cement in general usage in many parts of the world, as it is a basic ingredient of concrete, mortar, stucco and most nonspecialty grout. It is a fine powder produced by grinding Portland cement clinker (more than 90%), a maximum of about 5% gypsum which controls the set time, and up to 5% minor constituents (as allowed by various standards)." (Baghchesaraei, A. 2012)

At the beginning of the 18th century, in Great Britain, Joseph Aspdin developed a new process and combination of raw materials that became the well known Portland Cement. It is said that this name is inspired by the local Portland rocks existing in the island of the same name in Dorset (UK), due to the similitude with its very characteristic gray color. Aspind's initial result is known as proto–portland cement, the starting point for the one currently used.

Nowadays, Portland Cement is the fine powder, produced from the firing of limestone and clay , and combination with complementary substances, obtaining as result a binding material used as the main component for concrete, mortars, and other mixes.

Bibliographic references:
-Baghchesaraei, A. and Reza Baghchesaraei, O., 2012. Portland Cement. International Conference on Transport, Civil, Architecture and Environment engineering (ICTCAEE'2012), [online] pp.1-5. Available at: <http://psrcentre.org/images/extraimages/11.%20Portland%20cement.pdf> [Accessed 17 January 2022].
Next page Figure reference:
-Wansbrough, H., 2017. THE MANUFACTURE OF PORTLAND CEMENT. NZ Institute of Chemistry, [online] IX-Materials-B-Cement-7, pp.1-8. Available at: <https://nzic.org.nz/app/uploads/2017/10/9B.pdf> [Accessed 17 January 2022].

THE MANUFACTURE OF PORTLAND CEMENT

Wansbrough, H. 2017

Cement is the substance which holds concrete together, which means that it is extremely widely used in our society. It has been manufactured in New Zealand for more than 100 years, and during this century production has increased one hundred-fold.

Portland cement (the only type of cement in common use today) is manufactured in a four step process.

Step 1 - Quarrying
Limestone and a 'cement rock' such as clay or shale are quarried and brought to the cement works. These rocks contain lime ($CaCO_3$), silica (SiO_2), alumina (Al_2O_3) and ferrous oxide (Fe_2O_3) - the raw materials of cement manufacture.

Step 2 - Raw material preparation
To form a consistent product, it is essential that the same mixture of minerals is used every time. For this reason the exact composition of the limestone and clay is determined at this point, and other ingredients added if necessary. The rock is also ground into fine particles to increase the efficiency of the reaction.

Step 3 - Clinkering
The raw materials are then dried, heated and fed into a rotating kiln. Here the raw materials react at very high temperatures to form $3CaO^{\bullet}SiO_2$ (tricalcium silicate), $2CaO^{\bullet}SiO_2$ (dicalcium silicate), $3CaO^{\bullet}Al_2O_3$ (tricalcium aluminate) and $4CaO^{\bullet}Al_2O_3{}^{\bullet}Fe_2O_3$ (tetracalcium alumino-ferrate).

Step 4 - Cement milling
The 'clinker' that has now been produced will behave just like cement, but it is in particles up to 3 cm in diameter. These are ground down to a fine powder to turn the clinker into useful cement.

Cement production has several quite serious environmental hazards associated with it: dust and CO_2 emissions and contaminated run-off water. Both cement works in New Zealand have measures in place to minimise these hazards.

Portland Cement:

This material is produced by extracting the raw materials (limestone and clay), transporting and crushing them to facilitate the next steps: then, they are introduced into a rotary kiln (a cylindric rotary chamber for high temperature heating) of around 50–120 meters length, and is heated at 1450C° where they are calcined and sintered. The burnt product obtained is known as "Clinker", that is cooled, transported, and introduced into a final grinder mill (a cylindric chamber with steel balls that by weight and movement supports the clinker pulverization). During this last step, the clinker is mixed with 5% of gypsum that prevents an early setting of cement when reacting with water. Finally, it is packed and transported for selling and construction.

The final product contains:

*45–65% by weight of tricalcium silicate (C_3S or $3(CaO)SiO_2$ – mineral phase: Alite)

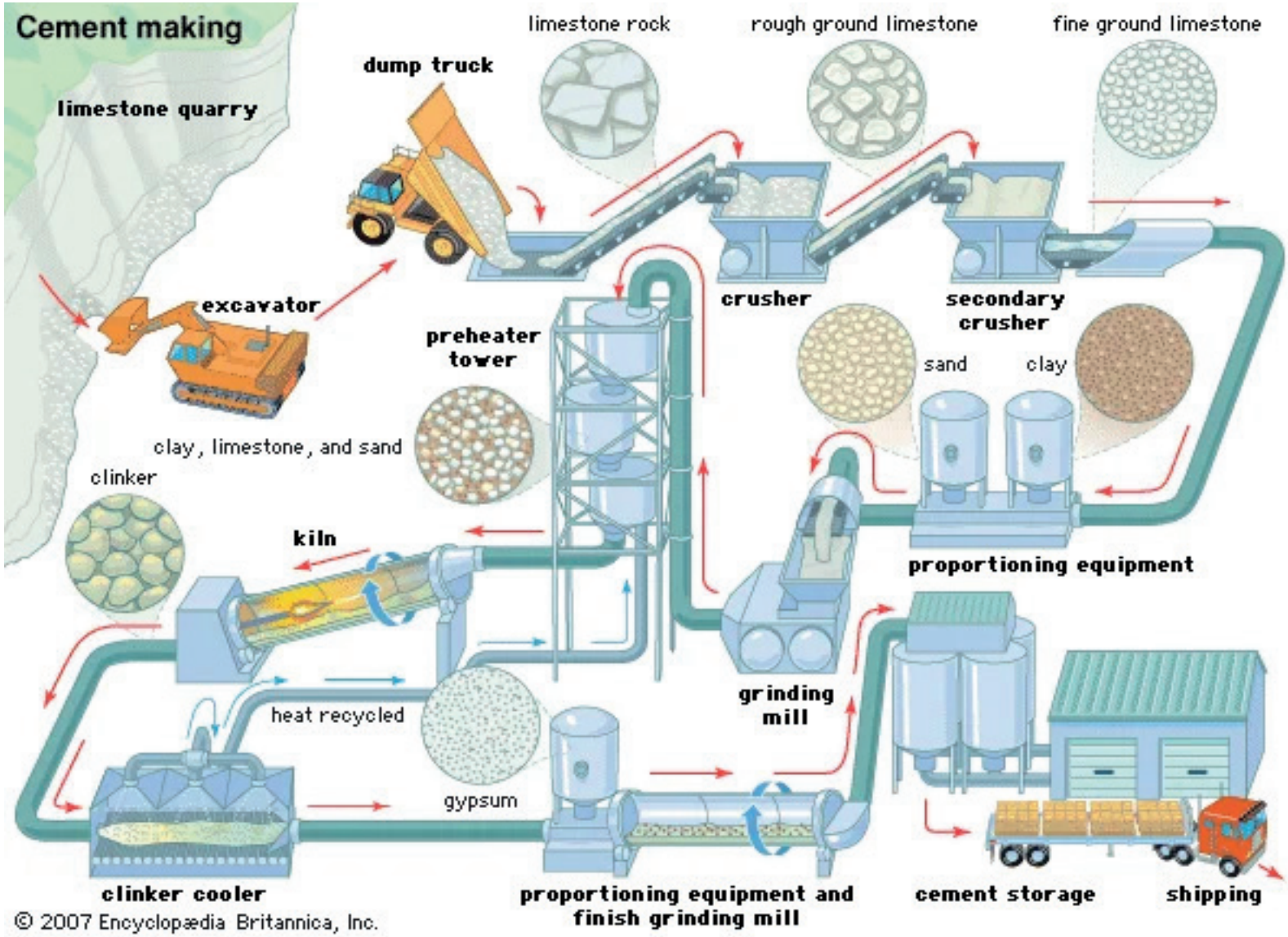
*15–30% by weight of dicalcium silicate (C_2S or $2(CaO)SiO_2$ – mineral phase: Belite)

*5–10% by weight of tricalcium aluminate (C_3A or $3(CaO)Al_2O_3$–mineral phase: Aluminate)

*5–15% by weight of tetracalcium aluminoferrite (C_4AF or $4(CaO)Al_2O_3Fe_2O_3$– mineral phase: Ferrite)

*5% by weight gypsum (CSH_2 or $CaSO_42H_2O$).

Bibliographic references:
-Tulliani, J., 2021. Lecture 11, Cementitious materials. Master in architecture for the sustainable project. Politecnico di Torino, Turin, Italy. Materials science department.
Next page figure references:
-Encyclopædia Britannica, 2007. cement-making process. [image] Available at: <https://www.britannica.com/technology/cement-building-material#/media/1/101833/114022> [Accessed 18 January 2022].


Cement making
limestone quarry
dump truck
limestone rock
rough ground limestone
fine ground limestone
excavator
crusher
secondary crusher
preheater tower
sand
clay
clay, limestone, and sand
clinker
kiln
proportioning equipment
heat recycled
grinding mill
gypsum
clinker cooler
proportioning equipment and finish grinding mill
cement storage
shipping
© 2007 Encyclopædia Britannica, Inc.

These components by reacting with water produce the following effects:

1—. Tricalcium aluminate reacts with gypsum producing ettringite a calcium aluminum sulfate mineral that will then transform because of instability, this transitional state prevents the early setting of cement (that is mainly supported by tricalcium aluminate hydration). Ettirngite supports also the cement cohesion.

2—. Tricalcium silicate when hydrated produces calcium silicates hydrates (CSH) in the form of gel with fibers that by being combined creates an initial network that contributes to the strength and adhesion to gravel and sand.

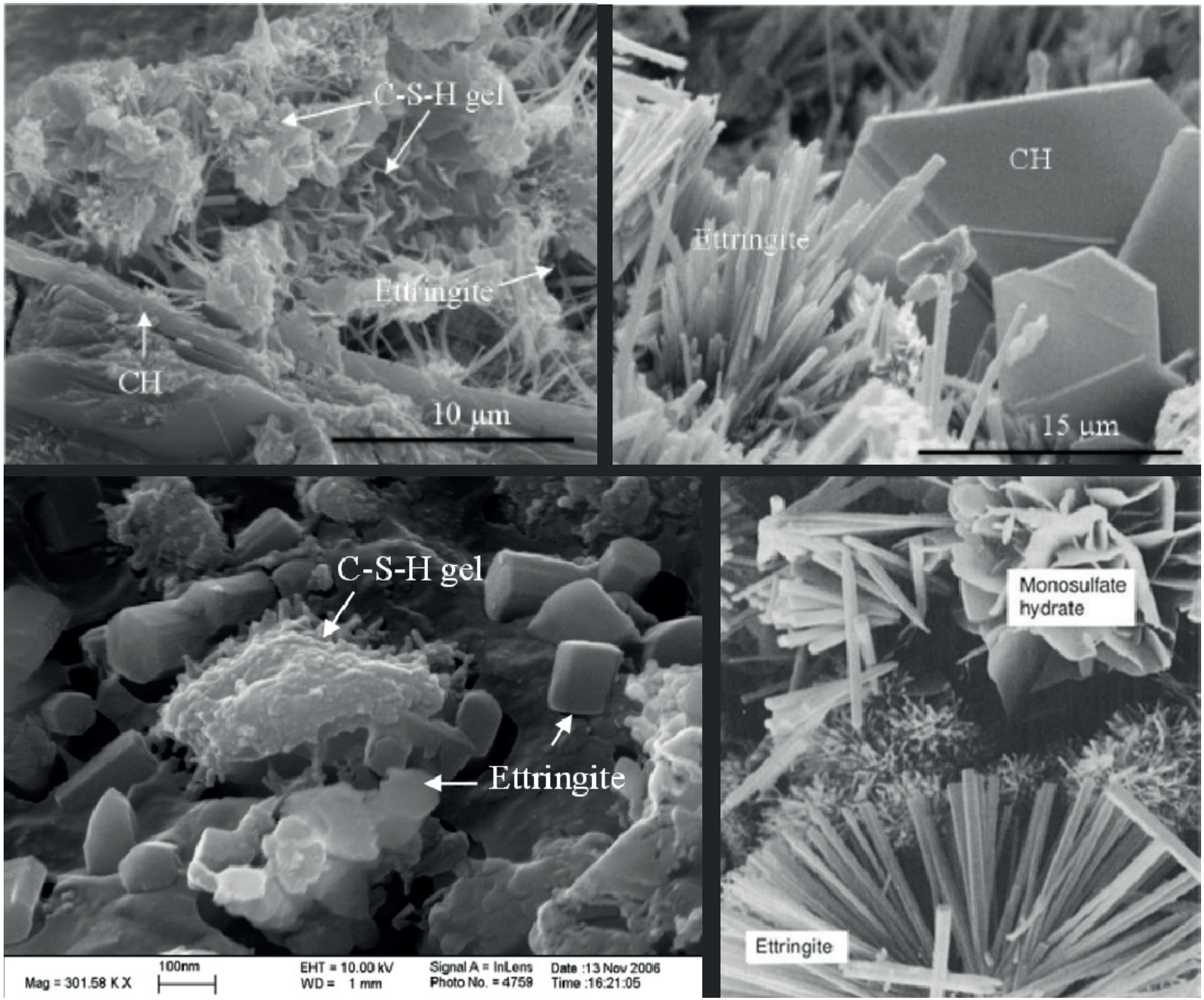
During C_3S hydration calcium hydroxide(CH), known as Portlandite, is also produced. CH maintains the ph between 12 and 13 as an alcaline reservoir and protects rebars against electrochemical corrosion.

3—. When all the gypsum reacted, the ettringite crystals formation stops and becomes unstable, reacting finally with the remaining molecules of tricalcium aluminate, producing monosulfate aluminate crystals, that are also unstable and returns to the ettringite structure but in an enlarged size crystal form, producing micro—fissures.

4—. Dicalcium silicate hydrates and produces calcium silicate hydrates in the shape of thick needles forming also a 3D mesh providing strength. Here a reduced amount of Portlandite is also produced.

5—. Ferrite is only converted into garnets and has non major contributions.

Bibliographic references:
-Balina, C., n.d. Hydration. [online] The Pennsylvania State University. Available at: <https://www.engr.psu.edu/ce/courses/ce584/concrete/library/construction/curing/Hydration.htm> [Accessed 18 January 2022].
-Giraldo, M., 2006. EVOLUCIÓN MINERALÓGICA DEL CEMENTO PORTLAND DURANTE EL PROCESO DE HIDRATACIÓN. Dyna rev.fac.nac.minas, [online] 73(148). Available at: <http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0012-73532006000100007> [Accessed 18 January 2022].
Next page figures:
-Fengjuan Liu, 2014. Early-age hydration studies of Portland cement. [ebook] Available at: <https://www.semanticscholar.org/paper/Early-age-hydration-studies-of-Portland-cement-Liu/f3a93b9feeb63afefbc3143b6aeedbd53119f611#paper-header> [Accessed 18 January 2022].



Microscopic view of cement hydration structures formation (extracted from Fengjuan Liu. 2014 paper)

Concrete definition and production:

> *"The term concrete refers to a mixture of aggregates, usually sand, and either gravel or crushed stone, held together by a binder of cementitious paste. The paste is typically made up of portland cement and water and may also contain supplementary cementing materials (SCMs), such as fly ash or slag cement, and chemical admixtures" (Kosmatka,S. 2011)*

As seen in the previous definition, concrete is a mixture of different components producing a paste that is able to harden, normally in 28 days; also, combined with steel bars, it is adaptable to a variety of shapes to commonly conform resistant structural elements. This is due to the combination of its excellent compressive strength properties with the tensile efforts resistance of steel.

Its components can be divided in groups:

1—. The binders, that normally is cement powder, but can be complemented with pozzolana/ blast furnace slag for reducing the clinker usage.

2—. aggregates, that are sands, gravel and crushed stones, which must present a progressive granulometry. This means that the difference of aggregate sizes between sand, gravel and stone must be gradual, a very important difference could produce the precipitation and stratification of the aggregates.

3—. Admixtures: are chemical substances used as a complement in the mix to modify the concrete properties, such as workability, fluidity, setting and hardening time, and more.

Bibliographic references:
-Kosmatka, S. and Wilson, M., 2011. Design and control of concrete mixtures. 15th ed. Skokie, Ill: Portland Cement Association, pp.1-10.Available at: < https://secement.org/wp-content/uploads/2019/01/eb001.15.pdf> [Accessed 18 January 2022].
-Porrero S, J., 2004. Manual del concreto estructural. Caracas: Sidetur, pp.1-503.

4—. Water: is not a solid component but is the responsible of cement activation and reaction, fluidizes the mixture by lubricating the components, and is the main responsible of the curing process.

Water dosage:

The water dosage is one of the most important parameters for a correctly concrete production. As seen in the previous section, it is responsible for the development of all the chemical reactions and structures of hydrated cement phases. The quality of these mineral microscopic networks will depend on how well hydrated the cement grains are.

Water participation does not only include its incorporation into the mixture; once concrete is casted in the form—works, correctly vibrated, set, and starts its hardening process, another amount of water can be put on top of its surface in order to preserve the moisture and bring enough humidity to allow cement components to fulfill their hydration process. This operation is called the "curing", and the moisture must be maintained at least until 7—10 days counting from the moment of the mixture.

A normally used water—cement ratio is 50 liters by every 100 kg of cement, it must be drinkable as the presence of organic matter, salt and excess of minerals can produce alterations in the normal cement reactions. When the W/C ratio is equal to 0.7 the hydration rate is 100% (all the cement grains are hydrated), and the longest the curing step, the better the hydration grade; the minimum acceptable W/C is 0.4, with a hydration rate of 50% reducing workability, that can be improved with admixtures.

Bibliographic references:
-Tulliani, J., 2021. Lecture 11, Cementitious materials. Master in architecture for the sustainable project. Politecnico di Torino, Turin, Italy. Materials science department.
Next page figure references:

Concrete Admixtures:

"Chemical admixtures are those ingredients in concrete other than hydraulic cement, supplementary cementitious materials (SCMs), water, aggregates, and fiber reinforcement that are added to the mixture immediately before or during mixing. There are a variety of chemical admixtures available for use in concrete mixtures to modify fresh and hardened concrete properties. (...)

The major reasons for using chemical admixtures in concrete mixtures are:

1. To achieve certain properties in concrete more effectively than by other means;

2. To maintain the quality of concrete during the stages of mixing, transporting, placing, finishing, and curing (especially in adverse weather conditions or intricate placements);

3. To overcome certain emergencies during concreting operations; and

4. Economy." (Kosmatka,S. 2011)

As seen in Kosmatka's concept, admixtures are chemical substances, introduced in the mixing process, used as a complement to modify concrete's properties, such as workability, homogeneity, mechanical strength, and durability.

Two of the most used products are: retardants, for preventing early setting, ideal for the premixing trucks when concrete is prepared in a different location and must be transported to the placing site. And superplasticizers to increase its fluidity; used mainly in high buildings and skyscrapers to pump concrete through pipes to the highest levels.

"Chemical admixtures can be classified by function as follows:

1. Air-entraining

2. Normal, Mid-range, and High-range water-reducing

4. Set accelerating

5. Set retarding

Bibliographic references:

-Kosmatka, S. and Wilson, M., 2011. Design and control of concrete mixtures. 15th ed. Skokie, Ill: Portland Cement Association, pp.1-10.Available at: < https://secement.org/wp-content/uploads/2019/01/eb001.15.pdf> [Accessed 18 January 2022].

6. Hydration-control
7. Rheology modifying
8. Corrosion inhibitors
9. Shrinkage reducers
10. Permeability reducing admixtures
11. Alkali-silica reactivity inhibitors
12. Coloring admixtures
13. Miscellaneous admixtures such as workability, bonding, grouting, gas-forming, anti-washout, foaming, and pumping admixtures"
(Kosmatka,S. 2011)

All these different classes of admixtures are used to produce a variety of concrete types and mixes that are detailed in the following section.

Types of concrete:

Knowing that concrete is a combination of different components, it can be made of a variety of mixes depending on the proportion of each other in the mix; and are prepared with particular properties according to the specific case; the use, dimensions, placing accessibility, location and more. The most used concrete types are the following:

1—. High Strength Concrete (HSC): that uses a low W/C ratio, its resistance can reach up to100 MPa compressive strength and is used for high buildings.

2—. High Performance Concrete (HPC): with low W/C ratio combined with superplasticizers and pozzolanic cement, leading to a compact concrete with 85 MPa compressive strength.

3—.Densified With Small Particles (DSP): Uses silica fume and aggregates with sizes minor to 1 mm. Normally used with fibers due to its brittle nature.

Types of concrete based on:
-Tulliani, J., 2021. Lecture 11, Cementitious materials. Master in architecture for the sustainable project. Politecnico di Torino, Turin, Italy. Materials science department.

4—. Reactive Powder Concrete (RPC): contains silica fume, used to fill in the voids between the cement grains; complemented with fibers to increase its resistance to crack propagation.

5—. Self Compacting Concrete (SCC): composed of high a cement dosage and aggregates with size lower than 16 mm, complemented with a viscosity modifying agent (VMA admixture); producing a super flowable paste that require no vibration during placing.

6—. Fiber Reinforced Concrete (FRC): Uses PP, PVA or glass fibers as reinforcement; this limits the plastic shrinkage cracks generation.

7—. High Performance Shotcrete (HPS): concrete made of very small aggregates with the aim of being sprayed.

8—. Rheo—Plastic Concrete: Rheo makes reference to its fluency, and plastic to its cohesion; is a maximum viscosity concrete prepared with low W/C ratio and aggregates of less than 20 mm. Used for pre—stressed concrete and pumped concrete for example, that facilitates its placing.

9—. Lightweight Concrete: is composed of light aggregates such as expanded clays or pumice rocks, producing a low density concrete, mechanical strength, and fire expansion, and high acoustic insulation.

10—. Self Compacting Lightweight Concrete (SCLC):
Is made of 52.5R cement, a fast hardening cement with very high strength. It is a weight reduced concrete normally used for new superior floors creation on existing structures, for expanding and remodeling buildings.

11—. Recycled Concrete Aggregates (RCA): uses recovered concrete parts from demolitions as aggregates; normally for roads, not structural uses.

Types of concrete based on:
-Tulliani, J., 2021. Lecture 11, Cementitious materials. Master in architecture for the sustainable project. Politecnico di Torino, Turin, Italy. Materials science department.

12–. Polymer Impregnated Concrete (PIC): is a concrete mix made with the addition of methyl metacrilate which increases the mechanical and tensile strength.

13–. Self Compensated Concrete (SCC): contains calcium oxide as an expanding agent; used for concrete repair, compensating shrinkage, avoiding cracks generation.

14–. Mono–granular Concrete: is made with a low cement dosage and its finest aggregates must be of one to two centimeters, leading to a porosity of 20%.

15–. Aerated Concrete: is concrete complemented with surfactant admixtures that produce a foam effect, lowering its thermal conductivity, mechanical strength and improving its fire resistance.

16–. Photo–catalytic Concrete: made of white cement (composed of pure clay and limestone) combined with titanium oxide (white coloring pigment, one of the whitest color substances). In this case titanium oxide decomposes organic matter by its reaction with ultra violet sun rays, also, it does not allow it to attach to the surface (the organic matter) and then is cleaned by rain.

17–. AS–Cast: is a high workability compact concrete for aesthetic finishings. It is possible to use rubber molds to imprint a texture, which must be removed before one day after its collocation, when the mix is still wet, to obtain high quality durable textures.

Concrete and sustainability:

In the previous sections, all of the components that involves concrete production were explained. It is also known that the greatest part of them are sands and gravel that are extracted from natural formations, producing an important impact for other specie's ecosystems. Sand is extracted from riversides, which normal course can be modified too, originating flooding and other prejudicial effects.

Another important component responsible for relevant amounts of CO_2 in the world is cement; which is produced by burning limestone and clay.

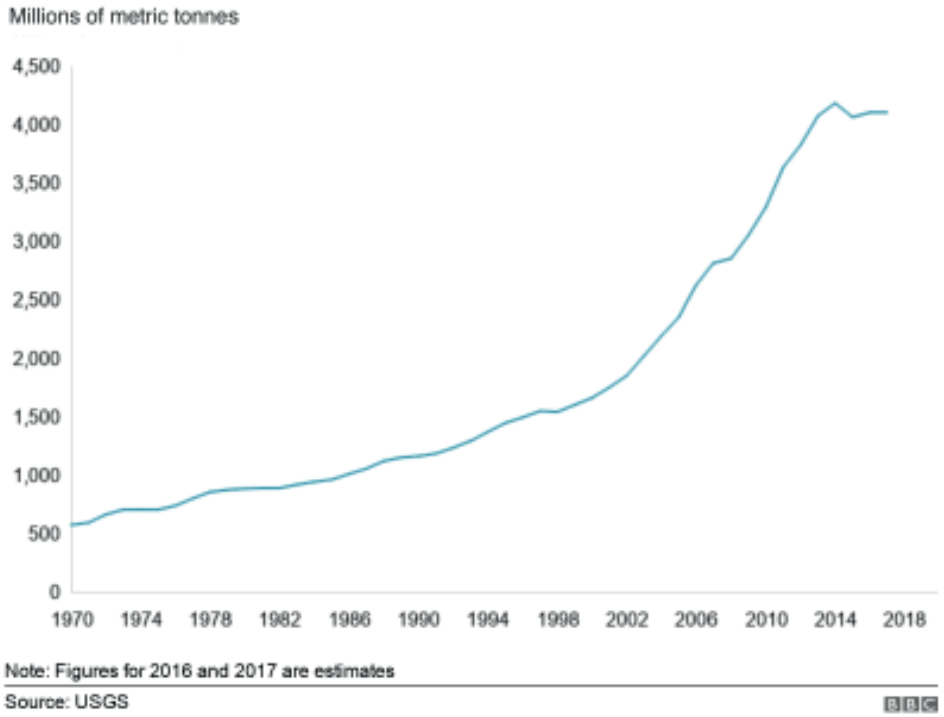
Limestone in presence of heat produces calcium oxide and releases CO_2 as a consequence of this reaction. It is estimated that cement production contributes each year to about 5% of total anthropogenic CO2 emissions.

> *"First is the chemical reaction involved in the production of the main component of cement, clinker, as carbonates (largely CaCO3, found in limestone) are decomposed into oxides (largely lime, CaO) and CO2 by the addition of heat. (...) these so-called "process" emissions contribute about 5% of total anthropogenic CO2" (Andrw,R. 2019)*

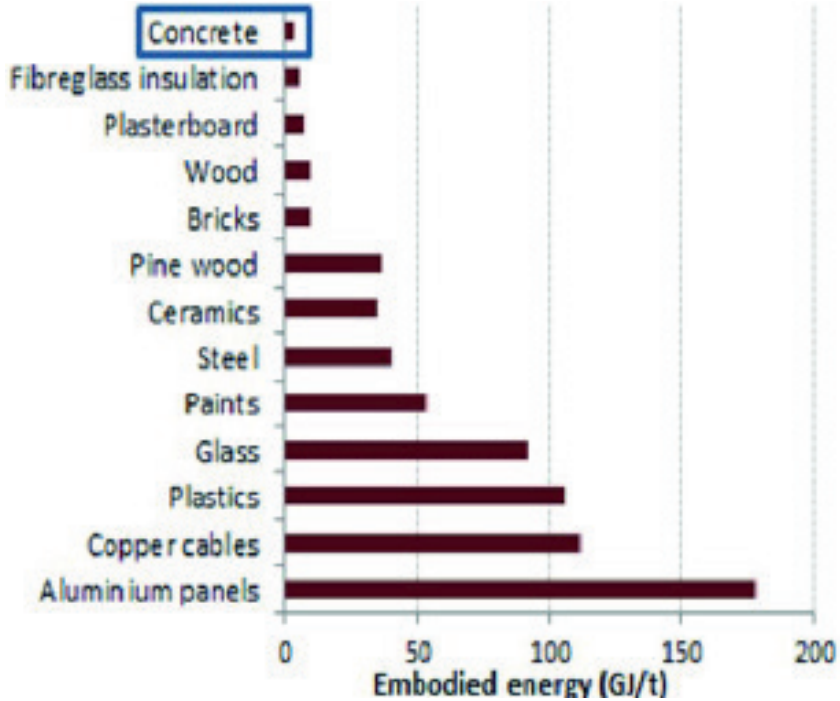
Then, the amount of energy necessary to heat the material into the rotary kiln at 1400 °C must be considered. Normally, hydrocarbons and oil derivate products are used which increase the percentage to the 8% of the total global CO_2 emissions, this means around 4000 millions of metric tons.

Bibliographic references:
-Andrew, R., 2019. Global CO2 emissions from cement production, 1928-2018. Earth System Science Data, [online] 10(4), pp.2213-2239. Available at: <https://essd.copernicus.org/preprints/essd-2019-152/essd-2019-152.pdf>.
Next page figures references:
-Rodgers, L., BBC, 2018. Climate change: The massive CO2 emitter you may not know about. BBC News, [online] Available at: <https://www.bbc.com/news/science-environment-46455844> [Accessed 18 January 2022].
-Seddik, M., 2017. Comparison of embodied energy of construction materials Per ton of product. - Recycled aggregates in concrete production: engineering properties and environmental impact. [image] Available at: <https://www.researchgate.net/figure/Comparison-of-embodied-energy-of-construction-materials-per-ton-of-product-9_fig4_314487061> [Accessed 18 January 2022].

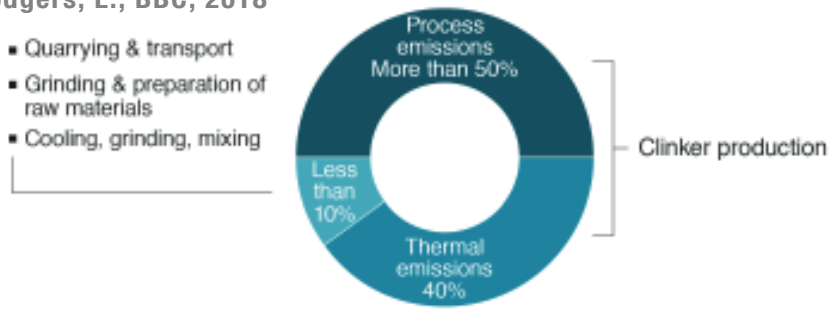
Global cement production has risen sharply, but appears to have levelled off Rodgers, L., BBC, 2018



Comparison of embodied energy of construction materials Per ton of product (Seddik, M. 2017)



The production of "clinker" accounts for most of the CO2 emissions of cement production
Rodgers, L., BBC, 2018



Action and the possible impact on cement-related CO2
(% reduction in emissions)

Carbon capture and storage	95-100%
Novel cements	90-100%
Clinker substitution	70-90%
Alternative fuels	40%
Energy efficiency	4-8%

Source: Chatham House



Rodgers, L., BBC, 2018

As seen in the previous page figures, cement and concrete production emissions are very high, but its embodied energy is one of the lowest, compared to other construction materials. Therefore, innovative solutions for reducing or re–using the CO_2 released during this process could support its transition to the sustainable development.

One of the techniques proposed nowadays is the carbon "sequestration" or "capture and storage"; this means to collect the gas released and apply high pressures until it becomes liquid and can be used or other processes, instead of releasing it into the atmosphere contributing to global warming and climate change effect.

Another solution is to use alternative fuels and energies that don't release CO2. This can be also combined with a very effective insulation of the kiln chamber, to avoid thermal looses and take the maximum profitability of the energy used.

There is also the possibility of preferring supplementary cementitious materials to Portland cement, such as pozzolana, silica fume, fly ashes, blast–furnace slag, all wastes from other industries. Rice husk ashes that derives also from vegetal products can be added too. All these cements are known as blended cements.

Another possibility is to produce very high quality concretes with a high durability and permit the re–usage of the structural elements instead of demolishing and re–building a different one every–time a new project is developed or the uses for the building change.

High quality concrete under sustainable criteria:

Nowadays, using technology available, it is possible to produce more sustainable conscious concretes and durable structures; one way to do it is applying the following recommendations:

1—. Prefer blended cements respect to ordinary Portland cement, as explained before;

2—. Do a correct mixture and placing, do not poor concrete from more than 1 meter height, to avoid components segregation and aggregates accumulation that produce weak points.

3—. Do a correct curing, to allow water to hydrate all the cement phases for higher strength and durability.

4—. Consider the use of high strength concrete, that require admixtures but the material amount for producing it can be reduced, meaning less stones, gravel and sand extracted from nature.

5—. Make low W/C ratio concretes with the use of plasticizers admixtures, to reduce the porosity, and the water penetration, to avoid cracks that allows the access of humidity, producing carbonation and steel reinforcement corrosion, reducing its structural properties.

6—. In accordance with point number 5, do preventing maintenance and carefully inspect the production process, to avoid as much as possible the "concrete pathologies" or damages due to a group of phenomena that will be explained in the following section.

Based on:
-Tulliani, J., 2021. Lecture 11, Cementitious materials. Master in architecture for the sustainable project. Politecnico di Torino, Turin, Italy. Materials science department.

Concrete Pathologies or Degradation:

Concrete is also a material susceptible to environmental conditions, is to say that it can be affected by many different factors, such as humidity, erosions by use and transit, chemical reaction of its components with external elements, specifically if is inadequately executed during the construction process. Many of these factors can be avoided by doing strict revisions during the construction period and periodical inspections and preventive maintenance.

When this doesn't occur, it can present the following damages that can be classified into 5 main groups: chemical, physical, mechanical, structural and biological. Hereafter, are presented the cracking causes:

1-. Chemical degradation:

This type of degradation can occur due to chemical reactions with internal or external substances or other materials present in construction, modifying concrete's original properties producing even strength losses compromising the structure. Some of them are:

1.1-. Corrosion of embedded metals:

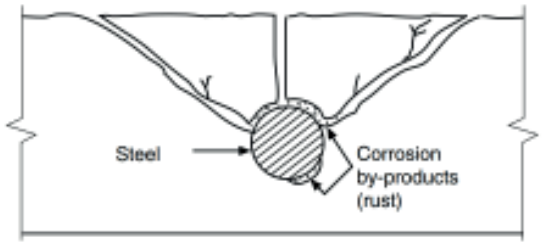
> *"When steel corrodes, the resulting rust occupies a greater volume than the steel. This expansion creates tensile stresses in the concrete, which can eventually cause cracking, delamination, and spalling. (...) For corrosion to occur, four elements must be present: There must be at least two metals (or two locations on a single metal) at different energy levels, an electrolyte, and a metallic connection."(Portland Cement Association. 2002)*

Bibliographic and figures reference:
-Portland Cement Association, 2002. Types and Causes of Concrete Deterioration. [ebook] Illinois, USA: Portland Cement Association, pp.1-16. Available at: <https://www.cement.org/docs/default-source/fc_concrete_technology/durability/is536-types-and-causes-of-concrete-deterioration.pdf?sfvrsn=4> [Accessed 19 January 2022].

In this particular case, as concrete is normally reinforced with steel bars, these are susceptible to oxidation under specific conditions. Humidity is required (that combined with concrete becomes an electrolyte, a free ions containing substance), as well as the presence of metals (that will act as anodes and cathodes, could even be two steel reinforcement bars or two different points of it), and a metallic or conductor connection (again even a steel embedded bar is enough).

So the effect that occurs is basically the galvanic batteries principle, using the humid concrete as electrolyte, an oxidation–reduction reaction occurs, it means the movement of electrons from one bar or a part of it to another. On the cathode side, iron oxides accumulate and react with water to form iron hydroxides. These last compound produce a volume increase where the material is accumulated on the bar, producing internal forces in concrete, fissuring its surface and exposing steel (to the exterior, the environment). This last effect can accelerate its oxidation until the point of transforming it into oxide powder, loosing its tensile strength properties, compromising the structure (in a very advanced and critical case).

It can be avoided preventing high humidity levels, a correct building waterproofing, or low permeability concrete.



Portland Cement Association, 2002. "Figure 2"

1.2-. Chloride Ions:

"Exposure of reinforced concrete to chloride ions is the primary cause of premature corrosion of steel reinforcement. The intrusion of chloride ions, present in deicing salts and seawater, into reinforced concrete can cause steel corrosion if oxygen and moisture are also available" (Portland Cement Association. 2002)

In this case the damage occurs by the introduction of a substance dissolved in water that permeates into the concrete by its pores, that, by being connected enough, can lead it to the steel bars; it is hypothesized that chloride affects the exterior layer of steel, making it even more susceptible to corrosion.

1.3-. Carbonation:

"Carbonation occurs when carbon dioxide from the air penetrates the concrete and reacts with hydroxides, such as calcium hydroxide, to form carbonates. In the reaction with calcium hydroxide, calcium carbonate is formed" (Portland Cement Association. 2002)

In this case, it occurs by exposition and sequestration of CO_2 into the concrete, affecting the concretes pH and producing calcium carbonate that affects the external layer of steel bars, but is not directly responsible of its corrosion. However, carbonation leads to a decrease of the pH value which favors rebars corrosion.

1.4-. Dissimilar metal corrosion:

"When two different metals, such as aluminum and steel, are in contact within concrete, corrosion can occur because each metal has a unique electrochemical potential. A familiar type of dissimilar metal corrosion occurs in an ordinary flashlight battery." (Portland Cement Association. 2002)

Bibliographic reference:
-Portland Cement Association, 2002. Types and Causes of Concrete Deterioration. [ebook] Illinois, USA: Portland Cement Association, pp.1-16. Available at: <https://www.cement.org/docs/default-source/fc_concrete_technology/durability/is536-types-and-causes-of-concrete-deterioration.pdf?sfvrsn=4> [Accessed 19 January 2022].

As seen in the previous definition, this case is a galvanic effect, similar to the corrosion of embedded metals, there is an oxidation reduction reaction, due to the presence of two different metals in contact. This can occur by attaching aluminum, zinc, or other metals to a concrete element, contacting both metals and using humid concrete as an electrolyte; this can produce an alteration of both metals, and in consequence, the steel corrosion.

1.5 Salt and alkalis:

> *"Most ammonium salts are destructive because, in the alkaline environment of concrete, they release ammonia gas and hydrogen ions. These are replaced by dissolving calcium hydroxide from the concrete. The result is a leaching action, much like acid attack. Strong alkalies (over 20 percent) can also cause concrete disintegration"*
>
> *(Portland Cement Association. 2002)*

In this case, the presence of salts in concrete that, when introduced in the capillary pores, can dissolve some of its components cracking it and dividing it into pieces, disintegrating the agglomerated material

1.6 Alkali aggregates:

Is the deterioration occurring when some aggregates react with cement alkali hydroxides, increasing its size and cracking in long term.

2-. Physical:

These kind of damages are related to effects occurring by internal forces, effects and alterations of the material and are also linked to chemical causes. Some of them can be:

2.1-.Freeze-Thaw Deterioration:

> *"When water freezes, it expands about 9%. As the water in moist concrete freezes, it produces pressure in the capillaries and pores of the concrete. If the pressure exceeds the tensile strength of the concrete, the cavity will dilate and rupture" (Portland Cement Association. 2002)*

In very few words, this kind of damage is due to the fact that water, when introduced into the pores and capillaries, in presence of low temperatures, can freeze, and tends to increase its volume. When this occurs in a rigid material as concrete, that can not absorbs these changes, the force produced by water, tends to produce fissures and affect the external layers.

2.2-. Aggregate expansion:

In this case, the aggregates contained in concrete, can absorb important amounts of water in humid environments; this, in presence of low temperatures, produce again an expansion of water and the aggregate, producing forces that originates fissures.

2.3-. Plastic Shrinkage Cracking:

> *"When water evaporates from the surface of freshly placed concrete faster than it is replaced by bleed water, the surface concrete shrinks. Due to the restraint provided by the concrete below the drying surface layer, tensile stresses develop in the weak, stiffening plastic concrete, resulting in shallow cracks of varying depth" (Portland Cement Association. 2002)*

In this case, a very quick water evaporation in fresh concrete, and associated to the difference of humidity content and consolidation of the superficial dried and the deepest wet and stronger layers, tensile strengths are produced, originating

Bibliographic reference:
-Portland Cement Association, 2002. Types and Causes of Concrete Deterioration. [ebook] Illinois, USA: Portland Cement Association, pp.1-16. Available at: <https://www.cement.org/docs/default-source/fc_concrete_technology/durability/is536-types-and-causes-of-concrete-deterioration.pdf?sfvrsn=4> [Accessed 19 January 2022].

cracks. This can be avoided with a correct curing process, re—integrating water on the surface to keep a constant moisture condition.

2.4 Thermal Cracking:

> *"Concrete expands when heated and contracts when cooled. An average value for the thermal expansion of concrete is about 10 millionths per degree Celcius (5.5 millionths per degree Fahrenheit). This amounts to a length change of 5 mm for 10 m of concrete" (Portland Cement Association. 2002)*

One of the most common cracking causes in concrete is the expansion—contraction effect due to the variation of temperatures. In very large concrete elements some weak points can be originated, due to the displacement of material by increasing or reducing its size by dilation effect, compressing and tensioning it internally. This is the reason why some intentional joints are placed, in order to create a safe calculated separation to avoid cracking.

3-. Mechanical:

This deterioration occurs by the action of external forces that affect the concrete consolidation. Some of them are:

3.1-. Hydraulic Abrasion:

> *"in hydraulic structures is caused by the abrasive effects of waterborne silt, sand, gravel, rocks, ice, and other debris impinging on the concrete surface. Although high-quality concrete can resist high water velocities for many years with little or no damage, the concrete may not*

withstand the abrasive action of debris grinding or repeatedly impacting on its surface (...) Fatigue due to vibration, rushing water striking irregular surfaces, and mechanical failure due to vibrating reinforcing steel can cause significant concrete damage." (Portland Cement Association. 2002)

In the case of concrete structures placed on running water environments, where sand, rocks and gravel are impulsed by the water flow; some of these hard elements can hit the surface or produce an erosion effect by scratching it at high velocities. This reduces gradually the external layer, and water vibration can be transmitted to steel bars producing cavities, lack of material and micro—cracking.

4-. Structural Origin Damages:

In this class are grouped the damages produced by structural failures or problems, normally excessive or non expected forces such as the ones produced in an earthquake, or by applying superior loads. Some of them are:

4.1-. Overload and impact:

"overloading can occur for a variety of reasons - a change in use of a structure without proper structural upgrades, unintentional overloading, and other unusual circumstances. Earthquake damage is a classic example of the overloading of concrete structures. (...) Overload damage can occur during construction when concrete has not yet reached design strength. Early removal of formwork can result in the overloading of certain concrete members"(Portland Cement Association. 2002)

Structural elements normally work and are calculated for resisting compressive and tensile strengths; concrete is an excellent material for resisting compressive stresses. However, concrete

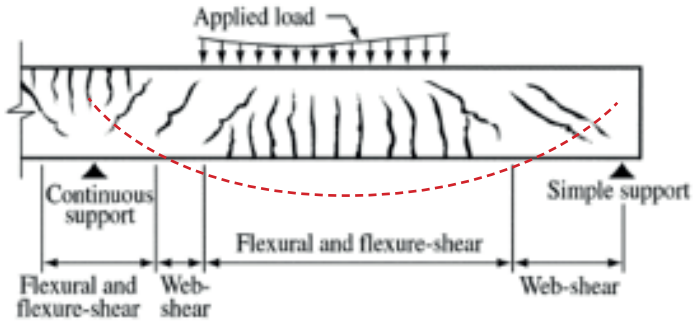
Bibliographic reference:
-Portland Cement Association, 2002. Types and Causes of Concrete Deterioration. [ebook] Illinois, USA: Portland Cement Association, pp.1-16. Available at: <https://www.cement.org/docs/default-source/fc_concrete_technology/durability/is536-types-and-causes-of-concrete-deterioration.pdf?sfvrsn=4> [Accessed 19 January 2022].

is not the best material talking about tensile efforts, in presence of these kind of forces the material tends to crack and disaggregate. This is the reason why it is reinforced with steel, that has an excellent tensile strength.

In the case of a beam, for example, the normal forces that act on it, are compressive strengths in the upper layer, and tensile strength in the inferior one, that in concrete is reinforced with steel. When the load acting over it overpasses the tensile strength of concrete and steel together, projecting an inverted arch shape, the weakest material under tensile efforts (concrete) tends to the deformation or cracking. When this occurs, there is no transmission of stresses between both materials and the structural element is seriously compromised.

4.2-. Loss of support:

Concrete structures can be sometimes built in very weak soils, without a hard mineral conformation that could stand the weight of a building. The combination of this ground condition with moisture or other factors, such as earthquakes; can produce a loss of support, originating a sinking effect on a section of the structure, producing tensile efforts and rotations non calculated, overpassing the concrete's resistance, and finally cracking.



Baghi, Hadi, 2015. Types of cracks in concrete beams subjected to shear and bending moments

Figure reference:
-Baghi, Hadi, 2015. Types of cracks in concrete beams subjected to shear and bending moments - Shear strengthening of reinforced concrete beams with SHCC-FRP panels. [image] Available at: <https://www.researchgate.net/figure/1-Types-of-cracks-in-concrete-beams-subjected-to-shear-and-bending-moments-ACI_fig1_312593062> [Accessed 19 January 2022].

Self-healing materials and techniques:

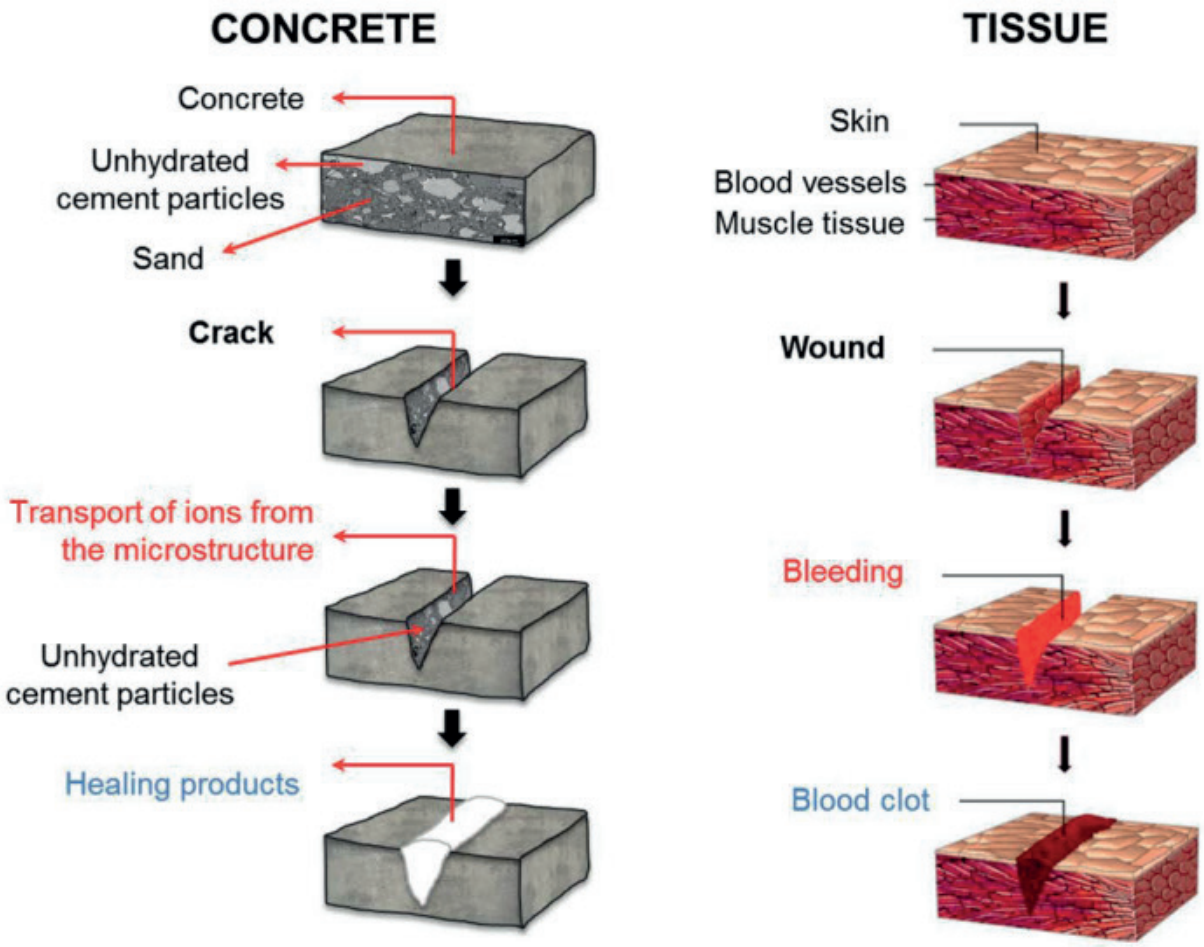
Once understood in the previous sections the historical importance of concretes for construction, the environmental costs it implicates in extractions, environmental alterations, CO_2 emissions, and how important it is to use wisely this material, enlarge its lifespan increasing the quality, using admixtures and new technologies.

Some of the most common and relevant degradation classes and the reasons why it is important to avoid them were explained. But sometimes, its prevention is not possible and new techniques are necessary to support the material protection and increase its durability. One of the most innovative solutions for these cases are the Self Healing Concrete.

This technological advance is inspired in nature, and how living organisms are able to overpass damages and restore its cellular structures to the original state or the most similar possible. These repairing systems work from molecular scales to macroscopic recoveries, from DNA chain molecules restitution to entire anatomic structures as lizards can do.

"The self-repair of tissue and bones in biological materials has always been an interesting concept. Mimicking natural phenomena and mechanisms gives often the possibility to develop new materials with smart behavior. The self-healing characteristic, i.e. the ability of material to sense and repair inner damage without human intervention, is one of the most desirable properties in material science." (Rajczakowska, M., 2019)

Bibliographic and next page figure reference:
-Rajczakowska, M., 2019. Self-Healing Concrete. [ebook] Luleå: Department of Civil, Environmental and Natural Resources Engineering Luleå University of Technology, pp.1-103. ISSN 1402-1757. ISBN 978-91-7790-490-8 (print). ISBN 978-91-7790-491-5 (pdf). Available at: <https://vpp.sbuf.se/Public/Documents/ProjectDocuments/3dfcd114-34c0-4874-b35c-da3b88510ffd/FinalReport/SBUF%2013296%20Slutrapport%20-%20Sj%C3%A4lvl%C3%A4kning%20av%20betong%20med%20milj%C3%B6v%C3%A4nligt%20bindemedel.pdf> [Accessed 19 January 2022].



(Rajczakowska, M. 2019)

Figure 1.1. Self-healing of concrete by mimicking tissue healing; modified from (Tavangarian & Li, 2015).

1.2.3. Self-healing materials and techniques

> *"concrete exhibits brittle behaviour and very limited tensile strength. This makes it prone to cracking which provides a way for acidic ions to reach the reinforcement leading to its corrosion and deterioration of concrete microstructure." (Rajczakowska, M., 2019)*

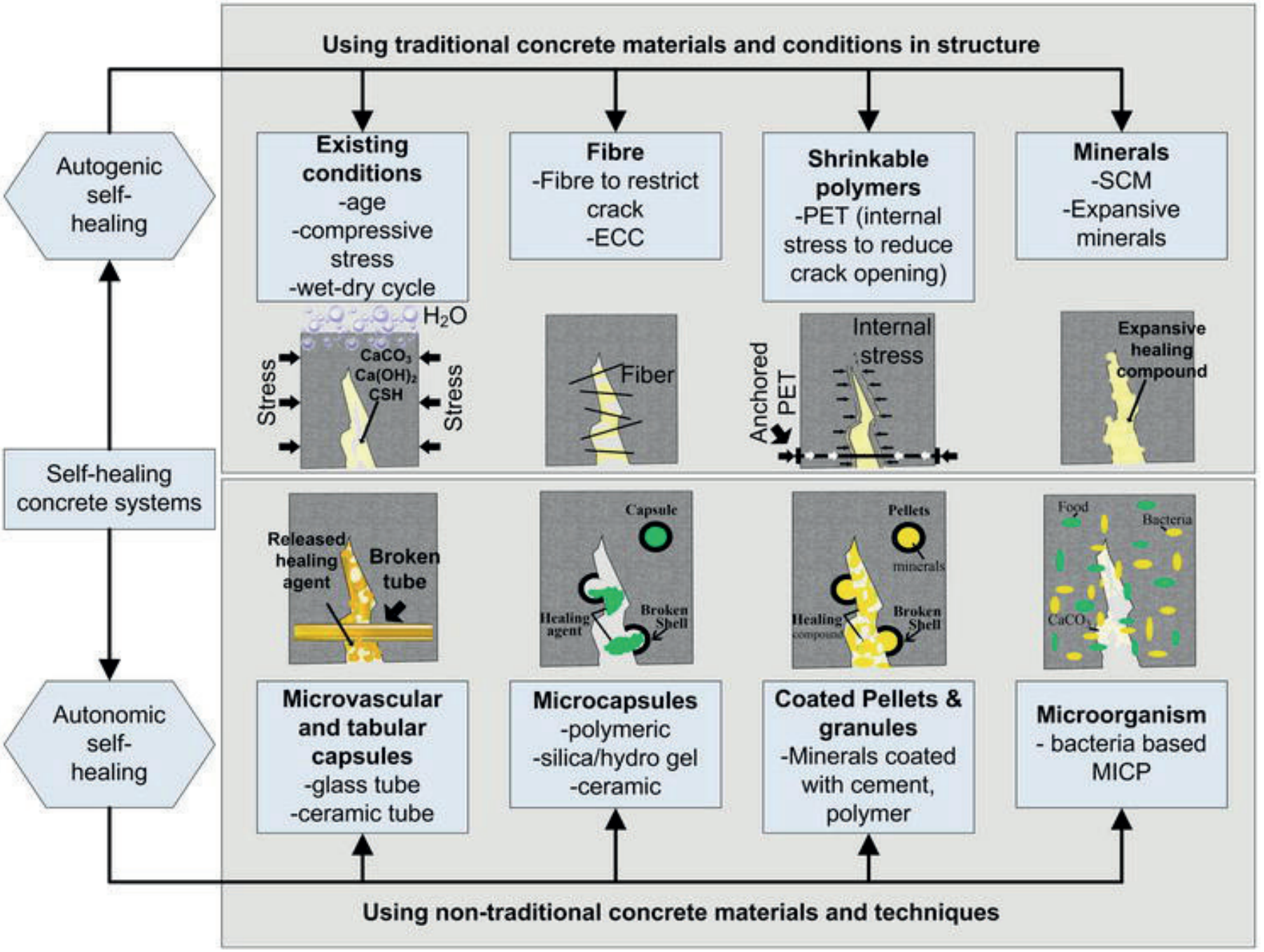
As seen in the previous sections of this chapter, the majority of the concrete's deterioration effects tent to originate cracks in the material. In addition, when fissures are produced, the internal steel bars become very sensitive and susceptible to corrosive effects, that normally can go unnoticed, corrective maintenance procedures are not applied, and can produce serious structural resistance damages.

This is one of the main reasons for the use of self healing techniques; the possibility of counting on an automatic system included in the concrete that could be activated when cracks are developed, and block the passage of moisture, water, gases and other compounds. Is ideal for protecting the steel bars, cement hydration products and aggregates, from chemical damages or alterations, increasing notably its lifespan and becoming even safer for the inhabitants.

Furthermore, some self healing agents are even able to develop a mechanical recovery, is to say that, when activated and reacted, produces adhesive and hardening effects, strong enough to recover the initial resistance the concrete element had, or even more, before the fissuring moment.

Self healing techniques are mainly classified in two groups, autogenous and autonomous, presenting the following definitions:

Bibliographic reference:
-Rajczakowska, M., 2019. Self-Healing Concrete. [ebook] Luleå: Department of Civil, Environmental and Natural Resources Engineering Luleå University of Technology, pp.1-103. ISSN 1402-1757. ISBN 978-91-7790-490-8 (print). ISBN 978-91-7790-491-5 (pdf). Available at: <https://vpp.sbuf.se/Public/Documents/ProjectDocuments/3dfcd114-34c0-4874-b35c-da3b88510ffd/FinalReport/SBUF%2013296%20Slutrapport%20-%20Sj%C3%A4lvl%C3%A4kning%20av%20betong%20med%20milj%C3%B6v%C3%A4nligt%20bindemedel.pdf> [Accessed 19 January 2022].
Next page figure reference:
-Qureshi, T. and Al-Tabbaa, A., 2020. Self-Healing Concrete and Cementitious Materials. Advanced Functional Materials, [online] Available at: <https://www.intechopen.com/chapters/72141> [Accessed 19 January 2022].



(Qureshi, T. and Al-Tabbaa, A. 2020. Figure 2.Self-healing concrete systems.

1-.Autogenous self healing techniques:

> *"Autogenous self-healing in cement was spotted early in the twentieth century by Lauer and Slate, and the concept was gradually established by different researchers. The crystallisation of calcium carbonate within the crack is the primary process in autogenous self-healing of matured concrete. Reactions involved in the deposition of calcium carbonate are presented in Eqs." (Qureshi, T. and Al-Tabbaa, A., 2020)*

The word autogenous, by its roots "auto", that means self; and "genes", referring to formation, creation, generation.

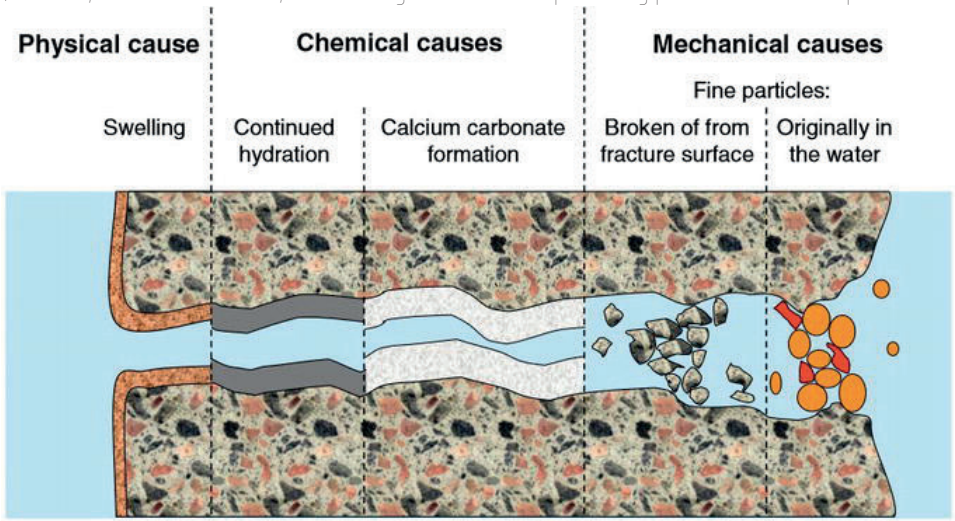
This term is used to name this self healing technique, because of the use of internal substances or structures directly mixed in the original concrete paste, so it could be able to repair the fissure with its own components and complements without the use of external substances or encapsulated reservoirs.

One example of these cases is the combination of the calcium ions from concrete with water and CO_2 from the environment, this reaction curring when a fissure is originated, produces calcium carbonate that precipitates and accumulates into the crack, blocking it from external corrosive agents.

Another general example is the use of the same broken fragments from concrete, or particles present in water that accumulate in the crack serving again as a blocking system.

Bibliographic reference:
-Qureshi, T. and Al-Tabbaa, A., 2020. Self-Healing Concrete and Cementitious Materials. Advanced Functional Materials, [online] Available at: <https://www.intechopen.com/chapters/72141> [Accessed 19 January 2022].

(Qureshi, T. and Al-Tabbaa, A. 2020. Figure 4. five steps taking place within three processes



1.1-.Factors affecting autogenous self healing:

There are many factors that influence the autogenous healing process, but some of the most important are the age of that specific hardened concrete, and the presence of some compression forces that keep both fissure's sides in contact.

> *"Concrete prisms with cracks up to 50 μm were autogenously healed under 0.1, 1 and 2 Mpa compressive stresses" (Qureshi, T. and Al-Tabbaa, A., 2020)*

In early ages of concrete, the process is more effective, due to the cement structure formations that are still in course, making it more reactive in presence of humidity; it is important to remember that concrete is one of the very few materials that keep increasing its strength (in very small amounts but positive) with time, by the continuous hydration of cement crystals and minerals. This property allows the contact and re-joining of mineral structures from both sides of very small fissures, supported by moisture, as if it was a curing process.

1.2-.Effect of admixtures and complements:

"It was observed that the use of expansive additive (CSA: calcium sulfoaluminate) and crystalline additive (CA: reactive silica and some crystalline catalysts) enhanced the surface crack closing (...) With these additives the maximum healed crack width increased from width from 150 μm to 400 μm. The water permeability of the healed specimens decreased significantly. Calcium carbonate precipitation was noticed especially on the mouth of the crack" (Rajczakowska, M., 2019)

"Sulfoaluminate cement (SAC) has been known as a low carbon and energy cementitious material as it can be produced at lower temperature, lower lime content, and improved grindability compared to ordinary Portland cement (OPC). (...) SAC has promising properties that can overcome certain limitations of OPC. For example, shrinkage leading to cracks can be overcome using calcium sulfoaluminate" (Kedsarin. 2018)

In this case of autogenous self healing, the proposal is to include calcium sulfo—aluminate; it is important to remember that calcium aluminate in ordinary Portland cement is the component that supports the setting of concrete pastes; so in this case, cements complemented with this additive are able to react and set quickly.

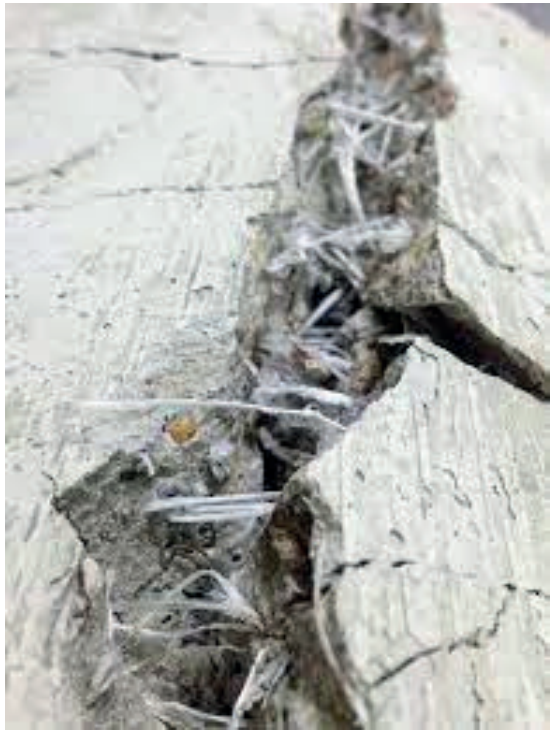
By including this element in a concrete paste, aluminate presence is increased, and when cracks are produced, the aluminate phase is able to react with water and to hydrate, reducing the time for developing new mineral structures.

Bibliographic reference:
-Rajczakowska, M., 2019. Self-Healing Concrete. [ebook] Luleå: Department of Civil, Environmental and Natural Resources Engineering Luleå University of Technology, pp.1-103. ISSN 1402-1757. ISBN 978-91-7790-490-8 (print). ISBN 978-91-7790-491-5 (pdf). Available at: <https://vpp.sbuf.se/Public/Documents/ProjectDocuments/3dfcd114-34c0-4874-b35c-da3b88510ffd/FinalReport/SBUF%2013296%20Slutrapport%20-%20Sj%C3%A4lvl%C3%A4kning%20av%20betong%20med%20milj%C3%B6v%C3%A4nligt%20bindemedel.pdf> [Accessed 19 January 2022].
-Kedsarin Pimraksa, Prinya Chindaprasirt, 2018. 14 - Sulfoaluminate cement-based concrete. [ebook] Woodhead Publishing, pp.355-385. Available at: <https://www.sciencedirect.com/science/article/pii/B9780081021811000149> [Accessed 19 January 2022].

1.3-.Use of embedded fibers:

> *"Fibres can restrict the propagation of crack width, and smaller crack width is favourable for enhanced autogenous healing in concrete. Fibre is a common feature in Fibre-Reinforced Composite Concrete (FRCC) and ECC. Randomly distributed fibres can bridge over cracks, which can decrease the crack width and block the migration of aggressive agents" (Qureshi, T. and Al-Tabbaa, A., 2020)*

In this case, the concrete paste uses fibers as complement for mechanical resistance; these are mixed directly with the other components, so they place randomly and in many directions inside of the paste, making it resistant and avoiding the crack expansion when happening. The compact network created also hinders the access of external possible corrosive substances; then by wetting and drying cycles, concrete could seal again the fissure.



Euclid Group TOXEMENT, 2016

Bibliographic reference:
-Qureshi, T. and Al-Tabbaa, A., 2020. Self-Healing Concrete and Cementitious Materials. Advanced Functional Materials, [online] Available at: <https://www.intechopen.com/chapters/72141> [Accessed 19 January 2022].
Image reference:
-Euclid Group TOXEMENT, 2016. Prueba de resistencia - Fibra Tuf Strand SF. [image] Available at: <https://www.toxement.com.co/media/1598/brochure__fibras.pdf> [Accessed 19 January 2022].

1.4-. Shrinkable polymers:

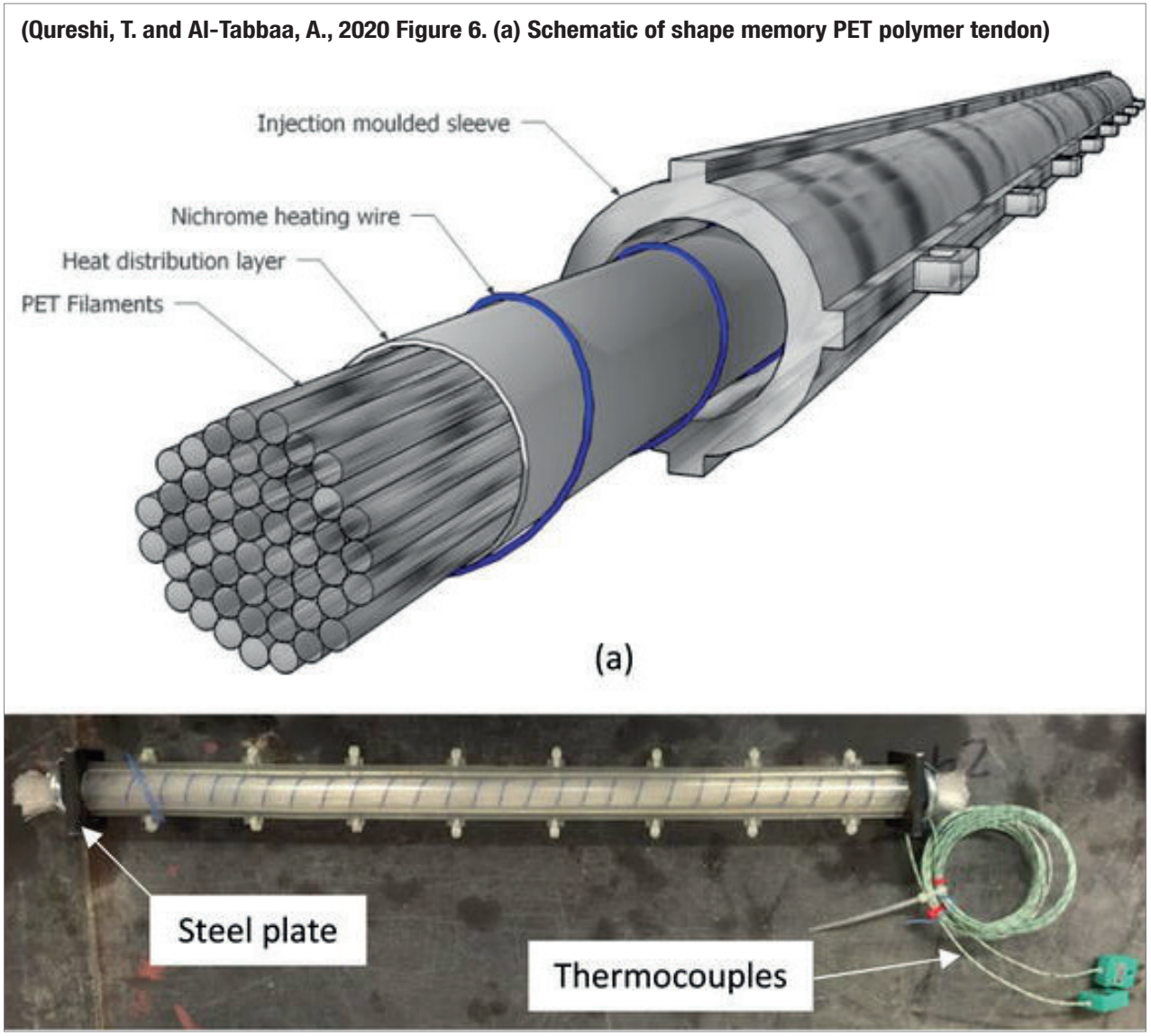
"The shrinkable polymers such as PET can shrink when activated by heating in a specific condition. This shrinkage stress can be used for pre-stressing the concrete thus bringing crack-tip closure for efficient healing. Crack closure is achieved by thermally activating the shrinkage mechanism of the restrained polymer tendons (PTs) after the cement-based material has undergone initial curing. Upon activation, the polymer tendon completely closes the preformed macrocracks and imparts significant stress across the crack faces. This enhances the autogenous self-healing process in concrete." (Qureshi, T. and Al-Tabbaa, A., 2020)

In this method, PET, polyethylene terephthalate fibers are used. This is a thermo—plastic polymer, it has the capacity of modifying its shape in presence of temperature by the particular bond condition between the polymeric chain.

This specific feature is used as an advantage by including it in concrete, applying heat through some conductive materials connected to each fiber group, it reduces its size after the initial curing phase, producing a positive compressive strength, which in the case that a fissure could be originated, these tendons compressive forces can re—join both parts of the fissure and keep the crack closed.

Bibliographic and image reference:
-Qureshi, T. and Al-Tabbaa, A., 2020. Self-Healing Concrete and Cementitious Materials. Advanced Functional Materials, [online] Available at: <https://www.intechopen.com/chapters/72141> [Accessed 19 January 2022].

(Qureshi, T. and Al-Tabbaa, A., 2020 Figure 6. (a) Schematic of shape memory PET polymer tendon)



2-.Autonomous self healing techniques:

> *"In the autonomic self-healing system, different kinds of active healing agents are encapsulated into the concrete or composites. Popular encapsulation systems are microvascular glass tube network and microcapsules" (Qureshi, T. and Al-Tabbaa, A., 2020)*

This term comes from "auto" meaning self, and "nem", assign; used to refer to the self healing technique which healing agents are not directly mixed into the concrete paste; in this case, the healing agent is introduced in capsules that acts as reservoirs of these materials, waiting to be activated when the tensile strengths of the fissure formation breaks its container, exposing the substance to environmental condition, reacting and closing or blocking the crack.

In this type of healing technique, are commonly used two classes of devices, one is the capsule, that is a small container filled with the healing agent and placed separately one from the other in the concrete paste. The second system is called vascular network, that works similar to veins with blood, is a network of long small pipes connected each other and containing the healing substance. It is made in this way to cover a bigger area and increase the effectiveness.

As seen in the following table of Qureshi, T. 2020, many different materials combinations and shapes can be used. In this section some of the most relevant ones for this research will be mentioned.

Bibliographic and next page table reference:
-Qureshi, T. and Al-Tabbaa, A., 2020. Self-Healing Concrete and Cementitious Materials. Advanced Functional Materials, [online] Available at: <https://www.intechopen.com/chapters/72141> [Accessed 19 January 2022].

(Qureshi, T. and Al-Tabbaa, A., 2020 Table 2. Autonomic self-healing: Encapsulation materials and techniques used)

		Shell material	Core material	Øi (μm)	Øo (μm)	Wall thickness (μm)	Length (mm)	Mixed in
Capsule for self-healing	Spherical	Expanded clay	Na_2FPO_3	x	4000	x	x	√
		Expanded clay	Bacteria	x	1000–4000	x	x	√
		Expanded clay	$CaC_6H_{10}O_6$	x	1000–4000	x	x	√
		Diatomaceous earth	Bacteria	x	_	x	x	√
		Gelatin	Acrylic resin	—	125–297	—	x	—
		Gelatin	Epoxy	—	50	—	x	√
		Gelatin	Tung oil	—	50	—	x	√
		Gelatin	$Ca(OH)_2$	—	50	—	x	√
		Wax	Retarder agent	—	120	—	x	√
		Paraffin	Water	—	900	—	x	—
		Cement + paraffin	SAP	—	—	—	x	—
		UF	Epoxy	—	120	4	x	√
		UFF	Epoxy	—	20–70	—	x	—
		PU	Na_2SiO_3	—	40–800	—	x	√
		Silica gel	MMA/ TEB	—	4.15	—	x	√
		Silica	Epoxy	—	—	—	x	√
		Silica Gelatin + acacia gum	Na_2SiO_3 Mineral oil+ Na_2SiO_3	– –	5000 300–700	– 5–20	x x	/ √
	Cylindrical	Glass	CA	800	1000	100	100	/
		Glass	CA	800, 1500, 3000	—	—	75, 75, 100	/
		Glass	epoxy	3000–4000	5000–7000	—	250	/–
		Glass	CA	3200	4000	400	200	/
		Glass	CA	—	100	_	63.5	√
		Glass	CA, epoxy, polyacrylate, PU, bacteria	2000–3000	2200–3350	100	20–80	/
		Ceramics	PU	2500–3500	3000–4000	250	15–50	/
		Perspex	Epoxy	—	—	—	—	/
		Plant fibre	—	—	40–188	—	—	—
		PP with wax concentric glass capsule	MMA MgO, bentonite, lime	– 6150	– 11,400	– 450	– –	/ √
	Pellets	Cement PVA PVA	Na_2FPO_3, Na-MFP MgO CSA	– – –	~4000 600–4000 500	– 10–50 12–73	x x 500	√ √ √
Vascular network for self-healing	Tubular	Glass	Alkali silica, epoxy	800	2000	600	x	/
		Glass	CA	3000	4000	500	x	/
		Glass	Epoxy	4800	6000	600	x	/
		Glass	CA	3200	4000	400	x	/
		Glass	Foam, epoxy, silicon, CA	1500	—	—	x	/
		Spiral twisted wire with EVA	Epoxy	2000	3400	700	x	/
		Porous concrete	Epoxy	—	25,000–35,000	—	x	/

2.1-.Bacteria filled capsules:

"There are two main mechanisms governing bacterial self-healing of concrete, i.e. bacterial metabolic conversion of organic acid (Figure 2.2b left) and enzymatic ureolysis (Figure 2.2b right). The self-healing product that fills the crack is calcium carbonate." (Rajczakowska, M., 2019)

"Alkali-resistant endospore-forming bacteria that precipitate calcite through biological metabolism are used for self-healing in concrete. Examples of these bacteria are B. cohnii, B. pseudofirmus and B. sphaericus. (...) About to micron sized (0.15 mm width), cracks were sealed. However, the main drawback in the bacterial pellet process is the negative impact on the mechanical performance of concrete." (Qureshi, T. and Al-Tabbaa, A., 2020)

In this case, the interesting fact is that the healing agent placed into the capsule is not a polymer or a chemical substance, it is a bacteria that, with the use of its metabolism derived products, calcium carbonate can repair cracks.

These particular effects occur due to the hydrolysis of urea with the enzyme urease, made by these bacterias, producing amonia and carbonates, increasing the pH of bacteria. This acidity alterations combined with bacteria properties, produce the calcium carbonate precipitation,

Bacteria are introduced in spores inside of capsules, pellets or containers, because these organisms can not survive in concrete, and its lifespan wouldn't be too long.

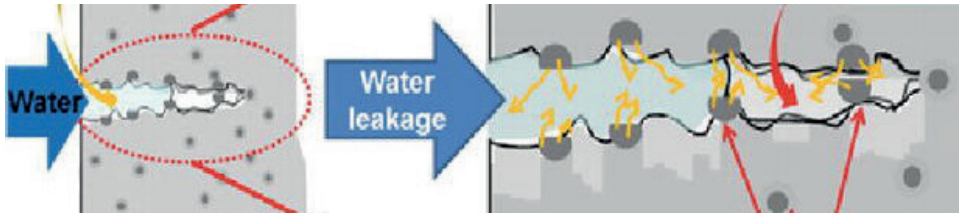
Bibliographic reference:
-Rajczakowska, M., 2019. Self-Healing Concrete. [ebook] Luleå: Department of Civil, Environmental and Natural Resources Engineering Luleå University of Technology, pp.1-103. ISSN 1402-1757. ISBN 978-91-7790-490-8 (print). ISBN 978-91-7790-491-5 (pdf). Available at: <https://vpp.sbuf.se/Public/Documents/ProjectDocuments/3dfcd114-34c0-4874-b35c-da3b88510ffd/FinalReport/SBUF%2013296%20Slutrapport%20-%20Sj%C3%A4lvl%C3%A4kning%20av%20betong%20med%20milj%C3%B6v%C3%A4nligt%20bindemedel.pdf> [Accessed 19 January 2022].

2.1-.Coated mineral capsules:

> *"Although the direct addition of potential minerals to the concrete mix improves autogenous self-healing performance, protecting those minerals in initial mixing may further enhance the healing process. (...) A PVA-coated granulated CSA (calcium sulpho aluminate)-based expansive mineral was used for improving the self-healing performance of cementitious materials [48]. Replacement of CSA pellets was up to 10% by wt. of cement and mortar was prepared with 1:3 cement-to-sand ratio and w/c = 0.5. Cracks in the range of 0.1-0.2 mm were healed completely within 14 days whereas larger crack >0.2 healed within 16 days." (Qureshi, T. and Al-Tabbaa, A., 2020)*

This particular type of capsules work with the concept that cement hardens due to mineral structures occurring when hydrated; in this case, the idea is to complement the concrete element with minerals that can support the re-generation of these crystals networks. However, instead of mixing them directly in the concrete mix, as occurs in the autogenous system; here the complementary minerals are coated to avoid their reaction before the fissure generation.

PVA is used as the coating material, a water soluble synthetic polymer, that usually is sprayed over calcium sulpho-aluminate, insulating it. There are other minerals that can be used; the effect generally is the same, the mineral expands when reacting with cement and blocks the crack.



(Qureshi, T. and Al-Tabbaa, A. 2020. Figure 13. Concept of self-healing concrete with granules containing expansive mineral agents

Bibliographic and image reference:
-Qureshi, T. and Al-Tabbaa, A., 2020. Self-Healing Concrete and Cementitious Materials. Advanced Functional Materials, [online] Available at: <https://www.intechopen.com/chapters/72141> [Accessed 19 January 2022].

1.2.3. Self-healing materials and techniques

Capsule's coating existing system:

"The mechanism of the capsule-based self-healing systems consists of three components. The first is the trigger, which depicts the process of activating the capsule by damaging its walls. The next component is the healing agent, i.e. the substance, being the core of capsule, which is released into the crack upon activation. Finally, the capsule shell material (different protection coatings) which is used to prevent the contact of the healing agent with the healed matrix."(Rajczakowska, M., 2019)

As seen in the previous citation, normaly self healing capsules are made in 3 parts, 1—. a core of healing agent, the substance which after reaction will support the crack blocking; 2—. the shell, that is normally a container or a layer able to protect the core from the last layer and the exterior; 3—. the "trigger" or most external layer, that insulates the entire capsule from environmental conditions.

Patented self healing systems:

"Song et al. proposed a system in series to recycle solutions containing healing agents in concrete cylinders partitioned axially. The aim was to compare the solid medium's permeability and the healing agent's sealing potential, as a less permeable medium would denote greater self-regeneration. (...)

Shin et al. devised sealing not by immersion in a solution but through a diffusion process of gases applied orthogonally to a concrete block. The test specimen had a crack through which the gases could penetrate and promote the concrete regeneration process. (...)

Jonkers [39] report that some genera of bacteria are preferable for the self-healing of concretes, such as Planococcus, Bacillus, and Sporosarcina, especially Bacillus. (...)

Bibliographic reference:
-Rajczakowska, M., 2019. Self-Healing Concrete. [ebook] Luleå: Department of Civil, Environmental and Natural Resources Engineering Luleå University of Technology, pp.1-103. ISSN 1402-1757. ISBN 978-91-7790-490-8 (print). ISBN 978-91-7790-491-5 (pdf). Available at: <https://vpp.sbuf.se/Public/Documents/ProjectDocuments/3dfcd114-34c0-4874-b35c-da3b88510ffd/FinalReport/SBUF%2013296%20Slutrapport%20-%20Sj%C3%A4lvl%C3%A4kning%20av%20betong%20med%20milj%C3%B6v%C3%A4nligt%20bindemedel.pdf> [Accessed 19 January 2022].

Wiktor and Jonkers proposed a method for conditioning concrete to bacterial action for self-healing through a mixture of two liquids: a healing agent and a gelling agent. This mixture promotes the self-healing of concrete, mainly on inclined surfaces or ceilings, where the weight force of a more fluid liquid impedes it from staying in place. (...)

Li et al. suggest implementing concrete containing calcium lactate salts and perlite granules to protect basophilic organisms, such as Bacillus cereus, from unfavorable environmental conditions. According to the inventors, Bacillus cereus in the dormant state in a dry environment can remain viable for up to 50 years.

Keung et al. created a method for forming microcapsules with the capacity to promote the self-healing of concrete. This development involved the initial mixture of surfactants (polyethylene glycol dioleate, sorbitan laurate, polyethylene glycol isostearate, and others), healing agents (such as colloidal silica), and encapsulating polymers (such as polyurethane and polystyrene)." (Pinto, P. et al., 2021)

It is important for this research, to understand the variety of systems studied nowadays, and their potential uses. By studying the patented self healing techniques, it is possible to know the most successful methodologies, and the universe of solutions available nowadays.

As seen in the previous citation, the general idea is based on the development of bacteria capsules, or the enlargement of its lifespan, and the use of minerals and reactive substances with cement. All are conceptually similar as explained in this section.

Bibliographic reference:
-Pinto, P. et al., 2021. Self-Healing Concrete: Background, Development, and Market Prospects. Biointerface Research in Applied Chemistry, [online] 11(6), pp.14709-14725. Available at: <https://biointerfaceresearch.com/wp-content/uploads/2021/04/20695837116.1470914725.pdf>.

Relevant previous case study:

Once seen all of the different definitions, classifications, capsule's types and strategies applied by different authors, there is one particular case study with two interesting features for this research.

1—. 3D printed capsules: in this research the design, development and use of 3d printed containers for the healing agent is presented, as well as a procedure using innovative technologies and precise modeling tools for obtaining a high quality and homogeneous result.

2—. The use of polyurethane foam as a healing agent, an instantaneously reactive compound which presents interesting results for crack blocking and strength recovery.

This research is titled: "Sviluppo di nuove capsule polimeriche per materiali cementizi autoriparanti", in English, "Development of new polymeric capsules for self healing concrete materials", developed in the Politecnico di Torino, Turin, Italy in 2017 by Carrillo, S. and Paganelli, G.

In very general terms, this research is about the use of 3D printed, and cement extruded capsules for self healing concrete, using 3 healing agents, polyurethane, bacteria, and sodium silicate. To the aims expressed at the beginning of this section, only the 3D printed capsules and the use of polyurethane as healing agent will be considered.

Results and images extracted from:
-Carrillo, S. and Paganelli, G., 2017. Sviluppo di nuove capsule polimeriche per materiali cementizi autoriparanti. Turin, Italy: Politecnico di Torino, pp.1-378.

1-.3D Printed Capsules procedure:

For producing this type of capsules, 4 different materials were used:

1—.Polyethylene Terephthalate (PET): Transparent material, corrosion resistant, low humidity absorption; non toxic, non biodegradable, wimp at 70C°. Optimal printing temperature: 235C°

2—.Polyethylene Terephthalate Glycol (PETG): Similar to PET, but is more durable, better layers adhesion, more transparent; wimp at 80C°, ventilation can reduce the layer adherence. Printing temperature: 220—250C°.

3—.Polylactic Acid (PLA): Very stable material, easy and faster printing, is produced from natural resources, recyclable, low mechanical resistance; sensitive to humidity, wimp at 60C°. Printing temperature: 200—230C°.

4—.Poly—Methyl Methacrylate (PMMA): Transparent polymer, resistant, durable, good resistance traction—compression, acid, and UV rays, low water absorption. presents bubbling effect (bubbles are created when heated), has low bed adhesion, difficult to print. Printing temperature: 245—255C°

1.2.4. Relevant previous case study

The 3D printer model used was the "3D Prusa i3 Hephestos" from the brand "3D maker" popular in 2017 (produced in 2014) for its updated features; in this section will some weak points will be analyzed to be taken in consideration for studying the results of this research.

It is important to say that these technology was among the best available at the moment. However, it has been notably improved nowadays, so the lack of some features are comprehensible considering the year when these studies were developed.

The printer Is a small dimensions desktop machine; with aluminum frame, with 3d PLA printed joints and has a printing space of 20x20x18 cm.

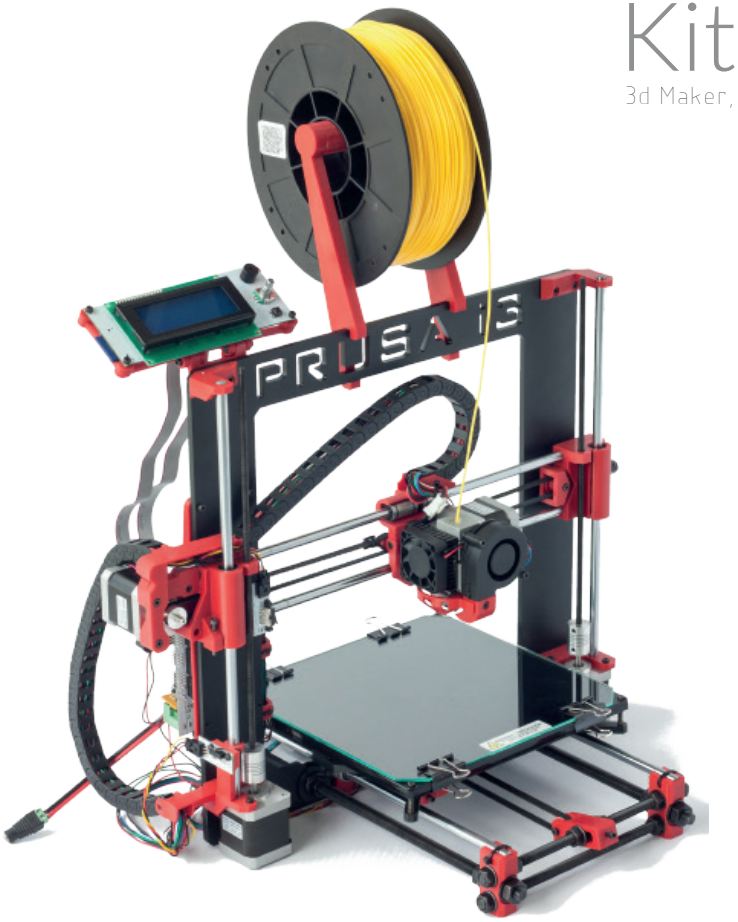
Some weak points of this model for producing very high quality printed models of reduced dimensions, such as self healing capsules, are:

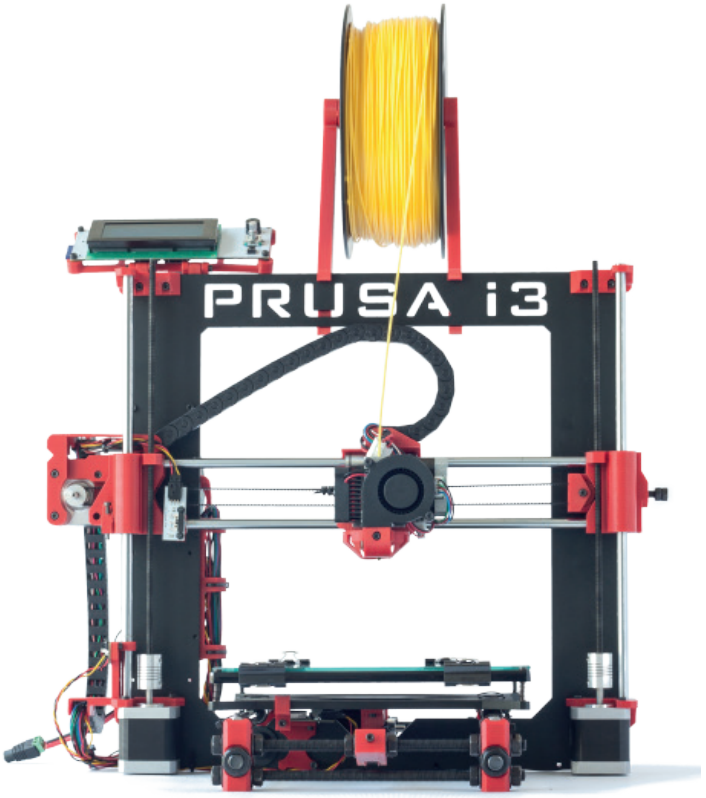
1—.Use of a glass bed as printing surface, that nowadays is improved with new porous surfaces for better performance. Also this surface is not heated, which affects the adhesion of the 3D printed model to the moving surface. This is not problem with PLA, but can produce complications and defects in other materials.

2—. 3D printed joints and screwed elements for the vertical axis can be susceptible of vibration, transmitting it to the nozzle, reducing the quality and continuity of the layers.

3—.The users community had to adapt reinforcing bars to the original frame for vibrations reduction.

Results and images extracted from:
-Carrillo, S. and Paganelli, G., 2017. Sviluppo di nuove capsule polimeriche per materiali cementizi autoriparanti. Turin, Italy: Politecnico di Torino, pp.1-378.
Next page figure:
-3d Maker, Manual zz, 2022. User manual | Kit Prusa i3 Hephestos TECHNICAL SPECIFICATIONS. [image] Available at: <https://manualzz.com/doc/12196011/kit-prusa-i3-hephestos-technical-specifications> [Accessed 20 January 2022].





TECHNICAL SPECIFICATIONS

All of the electronics in the Prusa i3 HEPHESTOS have been tested and calibrated to ensure optimum functionality. Both the drivers and the firmware are pre-configured to allow users to begin printing as soon as they have finished assembly.

Dimensions and weight

Dimensions, printer: 460 x 370 x 510 mm (without PLA spool)
460 x 370 x 583 mm (with PLA spool)
Dim., print area: 215 x 210 x 180 mm
Dimensions, boxed: 408 x 425 x 233 mm
Weight, boxed: 11 Kg

Extruder mechanics

Own-design extruder
0.4 mm nozzle, for 1.75 mm filament
Fin heat sink with axial fan
Cooling nozzle for printed objects

4—. The Y axis moving belt require a new fixing system for improving its functioning

5—. The bed leveling (the moving surface where the model is printed) is not automatic or digital assisted, it has to be manually leveled, this system is not totally precise, and can originate problems in the model's extruded layers. Nowadays, 3D printers presents digital and automatic leveling tools with precision of decimals of millimeters.

6—. Electronic installation (wires and connections) are not fixed, this produces also vibrations and discomfort while working.

2-.The 3DPrinting results:

Once selected the materials in Carrillo's research, the authors proceeded to print the first capsules and filling them with water, to test the presence of porosity. In the following picture the printing results are presented, where some initial printing problems are highlighted. In this case there is the presence of discontinuity and minimum pores in the surfaces; also some irregular accumulations of material due to vibrations, temperature problems or calibration.

Initially for the water protection good results were obtained, but there is still the possibility of presenting weak points where moisture could access.

Results and images extracted from:
-Carrillo, S. and Paganelli, G., 2017. Sviluppo di nuove capsule polimeriche per materiali cementizi autoriparanti. Turin, Italy: Politecnico di Torino, pp.1-378.
Next page figure:
-3d Maker, Manual zz, 2022. User manual | Kit Prusa i3 Hephestos TECHNICAL SPECIFICATIONS. [image] Available at: <https://manualzz.com/doc/12196011/kit-prusa-i3-hephestos-technical-specifications> [Accessed 20 January 2022].



Carrillo, S. and Paganelli, G., 2017. Figura 4.21

In further parts of the study, it is possible to find some electronic microscope's views of the different 3D printed capsule's surfaces, where the presence of pores and discontinuity can be identified.

In these cases, the porosity is produced due to a lack of layer adhesion, this could be the result of:

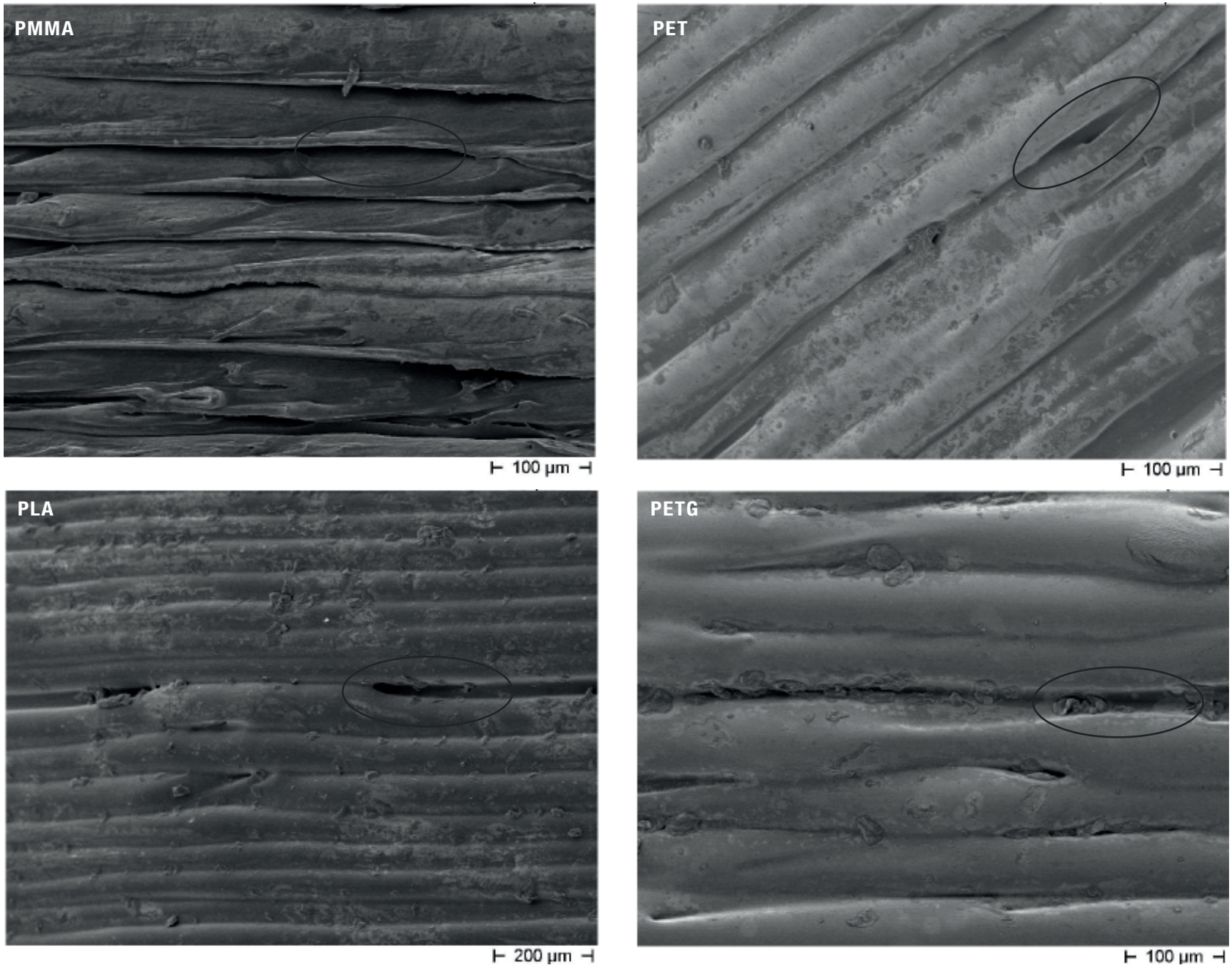
1—.Insufficient temperature: by not heating enough the material for allowing it to bind to the previous layer, or present variations on it due to external factors

2—.Printing velocity: when this value is not perfectly calibrated, a too fast printing can prevent the correct material adhesion. On the contrary, a very low printing speed can overheat the previous layer, melting part of it again and affecting its continuity.

3—.Quality of the printer: it is possible to consider that the machine is not designed for such a technical and precise work, and is not precise enough for matching the layers perfectly, from a microscopical point of view.

4—.Incorrect calibration: The lack of a very precise bed—nozzle calibration, and bed material quality or degraded, can produce a non uniform initial material placing, that could produce a domino effect in the rest of the layers, repeating the deformation every time.

5—.G—code specifications: The g—code is the final printing program set for a particular model, it can be understood as a group of instructions the machine will follow. The amount of controlled variables by the printer software and the programmer is also important, the most accurate the instructions in the G—code, the better the result. For sure, there must be a software able to program them, and a machine able to follow the instructions.



Carrillo, S. and Paganelli, G., 2017. Figura 4.103-106. (Modified for explicative reasons)

3-.The Polyurethane use:

The polyurethane foam is a polymer mainly composed of polyol and isocyanates, the mixture of these two components produces a polymeric resin, that in presence of humidity is catalyzed by water, that by reacting with isocyanates, releases CO_2. This gas creates bubbles in the resin, producing its characteristic foam effect (a further explanation is developed in chapter 2, section 2.1.1, polyurethane definition).

This substance, as explained before, is very sensitive to environmental humidity, specially the commercial product used "Carbostop U" (detailed in section 2.1.3 Polyurethane selection for self healing) that is specially designed for presenting that feature.

When the capsule presents pores, environmental humidity can ingress to the container, and catalyze the reaction; as the foam is produced by gas releases, the internal pressure increments and the resin is expelled through the weakest points, the pores again.

In the following images, it is possible to see, how the polyurethane resin is activated, even when the capsule is closed; if the pressure is strong enough, by passing through the pores the foam made can even detach part of the layer joints to leave the capsule.

It is important to say, that this particular product is such a humid sensitive substance, that can present an early catalysis, even in the capsule filling phase.

Results and images extracted from:
-Carrillo, S. and Paganelli, G., 2017. Sviluppo di nuove capsule polimeriche per materiali cementizi autoriparanti. Turin, Italy: Politecnico di Torino, pp.1-378.



Carrillo, S. and Paganelli, G., 2017. Figura 4.25 (Modified for explicative reasons)

Similar effects ocurred with polyurethane in the successfully insulated capsules, where the material did not present early foam formations, but gave irregular results.

In this case, the healing agent presented a premature hardening effect, this happened due to the presence of microscopical pores in the waterproofing layer also; as it is made of an epoxy resin, very dense and sticky, it is difficult to spread it perfectly uniform on the entire surface.

Additional to this problem, are the pores in the 3D printed capsule, allowing the humidity access to the core, catalyzing early the substance. As said before, the exposure time during the filling period could have been also responsible of these drawbacks.

Important lessons:

This previous experience and the problems originated during its development are very important information that will support this new research; the weak points and discovered difficulties, that could have only been done by the experimentation, are vital tips to take into consideration for the new model deign parameters.

This section and the entire chapter are the bases and guidelines for understanding the materials behavior, its impact in the world, the importance of a wise use of them and enlarging its life span, and the self healing as a technological advance to make it possible.

Results and images extracted from:
-Carrillo, S. and Paganelli, G., 2017. Sviluppo di nuove capsule polimeriche per materiali cementizi autoriparanti. Turin, Italy: Politecnico di Torino, pp.1-378.













Carrillo, S. and Paganelli, G., 2017. Figura 4.4.9



LIQUID HEALING AGENT USING 3D PRINTED CAPSULE



2.1. Polyurethane Healing Agent Explanation

Polyurethane on its liquid presentation is one of the most used substances for self healing concrete because of its reactivity. Volume increase, due to its transformation into a dense foam, adhesion capacity and many other factors that will be explained in the following chapter. Its composition, historical evolution and technical data to understand its feasibility and efficiency for fissures filling and strength recovery in this field will be specified.

2.1.1. Polyurethane Definition

"Polyurethanes are versatile materials used widely in many applications. Annual production of polyurethanes is increasing day by day. The most important application of polyurethane covering its major market is polyurethane foam. Different type of foaming systems and foaming processes are used for synthesis of foam." (Shoaib Suleman, M. (2014)

Polyurethane foams are oil derivate products known for example for being used in its liquid presentation for thermal insulation of buildings, pulverizing it along a surface filling the internal chambers of outer walls. It is also known for its use, on its flexible state, as furniture filling material for couches, armchairs, automobile seats, for producing sponges and more. It is estimated that around three quarters of the total polyurethane is for the foam production.

"The first urethane was synthesized in 1849 by Wurtz. Afterwards, in 1937, Otto Bayer synthesized PUs from the reaction between a polyester diol and a diisocyanate. Indeed, this was a major breakthrough at the time, as it consisted of a new class of polymerization reaction called polyaddition, which is also known as step polymerization. Nevertheless, at first, this polymer was considered useless.

PUs are polymers that are formed by the reaction between the OH (hydroxyl) groups of a polyol with the NCO (isocyanate functional group) groups of an isocyanate, and the name is associated with the resulting urethane linkage. This reaction is exothermic, and leads to the production of urethane groups..." (Gama, N. 2018)

In other words, polyurethanes are defined as macromolecules composed substances formed by the reaction of polyol and isocyanate:

Bibliographic references:
-Shoaib Suleman, M., Shahzad Maqsood Khan, Nafisa Gull, Waqas Aleem, Muhammad Shafiq and Tahir Jamil, 2014. A Comprehensive Short Review on Polyurethane Foam. International Journal of Innovation and Scientific Research, [online] 12(1), pp.165-169. Available at: <https://www.researchgate.net/publication/287980431_A_Comprehensive_Short_Review_on_Polyurethane_Foam> [Accessed 14 January 2022].

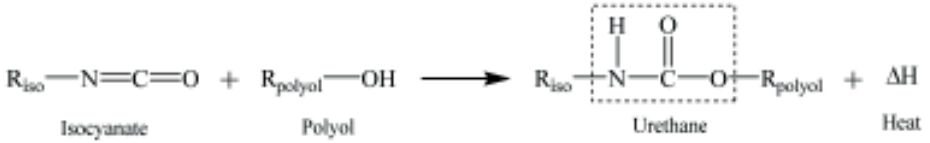
Polyol:

Is an organic chemical compound presenting many hydroxyl (HO– radical) groups, specifically an alcohol, notable by the nomenclature suffix ”ol”, is also known as Polyhydric Alcohol, normally deriving from propylene oxide, extracted in oil refineries.

Isocyanate:

Is an organic functional group with the form: R–N=C=O; is a grouping of atoms responsible for the reactivity and chemical behavior of an organic compound.

In this case, the functional group belongs to the group R, that means: non aromatic or aliphatic, conformed by carbon and hydrogen only. It is normally derivate from phosgene, a highly toxic chemical compound obtained from carbon monoxide; this last one also produced industrially by carbon burning. Isocyanate is also a very toxic organic compound that must be manipulated carefully and following safety rules with special equipment.



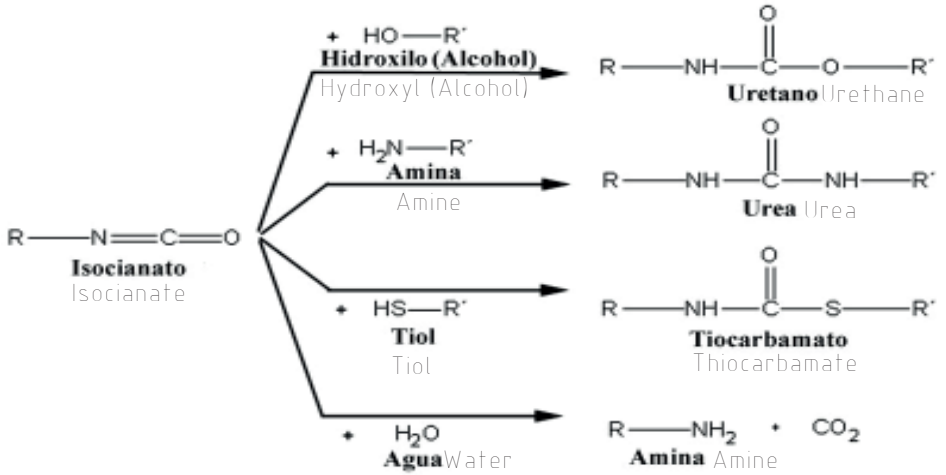
Gama, N., Ferreira, A. and Barros-Timmons, A., 2018.

In the chemical reaction of these two components, isocyanate is the main substance, because of the reactivity of its carbon atom, that by being combined with substances presenting very labile or responsive hydroxyl groups, such as polyol, produces urethane or polyurethane.

Bibliographic references:
-Gama, N., Ferreira, A. and Barros-Timmons, A., 2018. Polyurethane Foams: Past, Present, and Future. Materials, [online] 11(10), pp.1-35. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6213201/> [Accessed 15 January 2022].

2.1.1. Polyurethane Definition

The urethane formation occurs by the addition of hydrogen to the amine (N) group and double bond oxygen to carbon atoms, that by using diols or diamines as chain extenders, urea linkage is produced, and the polyurethane polymer is created (in a very general sense).



(Pozytron. 2012. Isocianato reacciones.) Translation by author: Panza, A. 2022

As seen in the previous image, the isocyanates reaction with water is also very important due to the CO_2 release in the process, this particular effect is normally used in the polyurethane formation to generate a gas that is accumulated into the resin, increasing its size and forming the characteristic foam.

The chemical reaction occurs in five stages: (Based in concepts from: Valderrama, C. 2004)

1-. Mixture:

The first stage is the mixture of polyol and isocyanate in an homogeneous compound. This is a very initial and short period respect to the other stages.

2-. Foam "cream" stage:

Image Reference:
-Pozitron, 2012. Isocianato reacciones.tif. [image] Available at: <https://commons.wikimedia.org/wiki/File:Isocianato_reacciones.tif> [Accessed 15 January 2022].
Bibliographic References:
-Valderrama, C., 2004. Efecto del Poliol poliéster en espumas rígidas de poliuretano - Monografia para optar al título de ingeniero mecánico. [ebook] Bogota, Colombia: Universidad de Los Andes, Departamento de Ingenieria mecánica, pp.2-80. Available at: <https://repositorio.uniandes.edu.co/bitstream/handle/1992/21133/u246049.pdf?sequence=1> [Accessed 15 January 2022].

This is the moment in the reaction where the foam generation begins, changing the substance color and presents a creamy texture, similar to the coffee milk cream.

3-. Gelling:

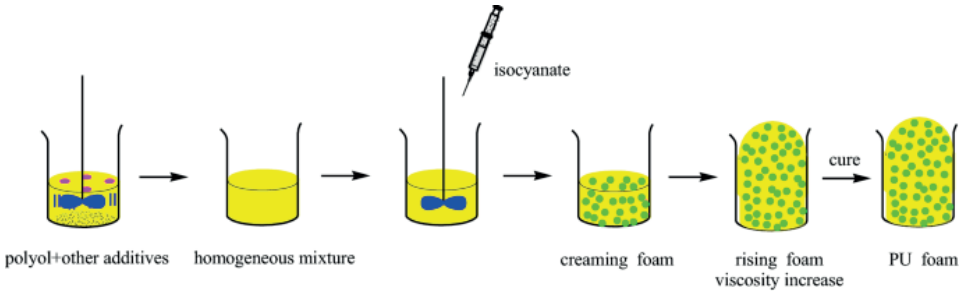
In this stage, the foam increments its viscosity, the gas is still produced and the size also increases, but at this moment is sufficiently completed to notice the structural mesh.

4-. Constant Growing:

The following step in the reaction is a constant foam growth, having a defined structural network, it can keep on increasing its size without collapsing; but is not consolidated enough to reach the final features.

5-. Free tact (hardening):

This last step is the moment when the foam looses its viscosity to the point it can be touched without attaching to the skin; it is also the stage where the material hardens and preserves the current shape as definitive.



Riyapan, D., Saetung, A. and Saetung, N., 2019. Figure 1

Complementary References used for this section:

-Elaplas©, 2021. Acerca del poliuretano - Elaplas. [online] Elaplas.es. Available at: <https://www.elaplas.es/productos/acerca-del-poliuretano/> [Accessed 15 January 2022].

-Touchet, T. and Cosgriff-Hernandez, E., 2016. Hierarchal structure property relationships of segmented polyurethanes, Advances in Polyurethane Biomaterials, Woodhead Publishing,, [online] pp.3-22. Available at: <https://www.sciencedirect.com/science/article/pii/B9780081006146000019> [Accessed 15 January 2022].

-Riyapan, D., Saetung, A. and Saetung, N., 2019. A Novel Rigid PU Foam Based on Modified Used Palm Oil as Sound Absorbing Material. Journal of Polymers and the Environment, [online] 27(8), pp.1693-1708. Available at: <https://link.springer.com/article/10.1007/s10924-019-01460-9#citeas>.

2.1.2. Polyurethane Historical Evolution

After the first laboratory reaction developed by Otto Bayer in 1937, polyurethane has been used in many different fields; it was introduced in construction in the 1940's period, as an insulating material for exterior walls, something that is still used nowadays, representing 16% of the PU foam production.

Then in the 50's began a serial industrial production of this material, to be used in furniture, automobile seats, sound insulation and acoustic comfort systems, and more.

With the evolution came also the regulations; polyurethane without particular additives is inflammable, as explained before it is produced from oil derivate products including alcohol. In 1984 the law imposed the use of fire retardants for PU in Italy.

Then in 1989, the Montreal Protocol entered into force an international legally binding written agreement developed with the objective of reducing the damages in the ozone layer.

> *"The production of PUFs was greatly increased in the late 1950s by the discovery and use of chlorofluorocarbons (CFCs) as a physical blowing agent. Due to the excellent chemical and thermal stability and low cost, CFCs were the blowing agent of choice for all of the PU foams, especially rigid thermal insulation foams. However, later, it was proven that CFCs destroy the ozone layer (...) the Montreal Protocol, which restrained the production and use of substances that deplete the ozone layer [11,24]. As a result of this, CO2 and pentane are now commonly used as a blowing agents".(Gama, N. 2018)*

So the process of production and the component for PUFs reactions were modified following the protocol's parameters.

Bibliographic references:
-Gama, N., Ferreira, A. and Barros-Timmons, A., 2018. Polyurethane Foams: Past, Present, and Future. Materials, [online] 11(10), pp.1-35. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6213201/> [Accessed 15 January 2022].
Image Reference:
-OLMO Group, 2013. Guide to the Polyurethane Foam. [ebook] Olmo studies, pp.1-26. Available at: <https://www.olmogiuseppespa.com/public/pdf/Page/GuidaPoliuretano_2013-ENG.pdf> [Accessed 15 January 2022].

1937 ***Prof. Otto Bayer*** *produces the first laboratory polyaddition reaction and develops polyurethane chemistry.*

1940 ***Dr. A. Hoechtlen*** *and* ***Dr. W. Droste*** *make the first laboratory polyester foam.*

1942/45 *The first foam is used in the building sector to fill cavities.*

1951 *The first polyether foam is produced in a laboratory.*

1952 *The first machine producing slabstock foams in continuous process at a speed of 20 kg/min is introduced on the market.*

1955 *More than 500.000 kg of polyester foam are produced. The use of this new material for pillows and mattresses met with a favourable response from both operators and general public.*

1956 *Soft polyether foam is industrially produced for the first time.*

1968 *European production of this special product, fruit of polyurethane chemistry, exceeds 200 million kg/year.*

1973 *1.2 billion kg of polyurethane foam are produced and approx. 2 kg per capita are used in Northern Europe.*

1984 *A rule requiring the use of flame retardant polyurethanes in public entertainment places come into force in Italy.*

1989 *The British Government requires the use of modified combustion polyurethanes (CM-HR) in household furnishings.*

1990/95 *First viscoelastic foams are introduced on the market. They are mostly PU-polyester. The main application is in mattresses.*

OLMO Group, 2013

> *"Pentane (n-pentane, iso-pentane, or cyclopentane) is a physical blowing agent type that is considered a zero ozone-depleting potential (ODP) blowing agent. It has been used since the mid-1990s, for example, in the production of continuous rigid-faced lamination where the most stringent fire and thermal conductivity performance are required, in the production of shoe soles, or low thermal conductivity PUFs" (Gama, N. 2018).*

As seen in the previous citation, pentane is one of the recently used physical blowing agents, a substance that produces gases to turn the resin into foam, and these gas does not affect the ozone layer as the previous components used to do.

Nowadays, some components have been modified for a more sustainable and lower environmental impact result, such as low isocyanate PU foams, reducing the amount of the most contaminant product. Also polyols can be produced from vegetable resources, avoiding the use of oil derivate at least for this component.

Another solution is the use of air filters with activated carbon to reduce the toxic compounds released in the atmosphere, being very effective for PU foam produced industrially.

As seen before, the tendency for modifying the composition of the PU reaction, emissions reduction and contaminants limitations is supporting the sustainability concept to reduce the environmental impact, but in the other hand, many additives and components still used, also the containers to transport it and other aspects are still very pollutant, so it is necessary to keep on developing new products and technology to improve it.

Bibliographic references:

-Gama, N., Ferreira, A. and Barros-Timmons, A., 2018. Polyurethane Foams: Past, Present, and Future. Materials, [online] 11(10), pp.1-35. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6213201/> [Accessed 15 January 2022].



Image references:
-Smooth-On, Inc., 2022. FOAM-iT!™ Series Castable Rigid Urethane Foam. [image] Available at: <https://www.smooth-on.com/product-line/foam-it/> [Accessed 15 January 2022].

Once understood the functioning of polyurethanes, it is important to select the correct formulation taking into consideration the following requirements:

1-. Reaction Violence:

Considering that polyurethane will be introduced into a capsule with very reduced dimensions, the substance must be very efficient, it must be able to produce the larger amount of foam possible with the lowest quantity of liquid PU in the less time possible.

2-. Humidity sensibility:

As the only way for the water obtaining way is a 1 to 4 mm fissure, it is necessary to use a very sensitive PU formula that could be importantly catalyzed with the minimum exposition to environmental humidity and produce enough foam and gas pressure to be released through the small crack.

3-. Foam generation:

The foam required for this process must present a very stable structural polymeric mesh to be strong enough to pass through the fissure and seal it.

4-. Hardening period:

The hardening period is also very important for self healing, it is required to occur in a reduced period in order to stop the water flow into the crack, and also recover the strength of the concrete element to avoid the fissure growth.

Bibliographic references:

-Orica, 2014. Scheda tecnica - Carbostop U. Carbostop U#it22. [online] Orica, pp.1-4. Available at: <https://www.minovaglobal.com/media/1663/carbostop-u-tds.pdf> [Accessed 15 January 2022].

5-. Capsule crafting:

It is also necessary to consider the filling process and how the capsule is made; meaning that the PU selected, must be able to not react while it is injected into the container and sealed with the epoxy resin.

Taking in mind these five conditions, the commercial product "Carbostop U" from the company "Orica" was selected.

Translating from the technical data sheet of the product, presented in the following page:

<< Mono-component Polyurethane resin, Water reactive, with absence of CFC and plasticizers. Ready to use, without mixing. Used for:

-Blocking of transuding water, even salt water, in fissures

-Tunnel filtrations sealing.

-Gravel consolidation

-Orifice sealing.

Applicable in room temperature 0-40Cº. Approved by German standards ZTV-RISS as pre-sealing substance for concrete structure sealing. >> (Orica. 2014. Translated by author Panza, A. 2022)

2.1.3. Polyurethane Selection For Self Healing

As seen in the product technical data sheet and the previous translation, it is a polyurethane resin which components proportions such as modified isocyanates, and plasticizer additives permit it a violent reaction in contact with water and environmental humidity, being ideal in this case for the previously mentioned requirements 1,2 and 3.

It hardens in very reduced periods of time, and after finishing this process, the final product does not changes its size, corresponding to requirement number 4.

The only possible difficulty is the insertion period into the capsule, were environmental humidity could early activate the material; for this it is important to work in a humidity controlled area or use retardants if possible.

Also, it is important to take into consideration that this product respects the Montreal Protocol conditions and is chlorofluorocarbon emissions free; but the rest of the components are not extracted from renewable resources or at last it is not declared on its official technical data sheet.

(Complete data sheet available in the chapter Annexes 2.1.3 only in Italian version)

CarboStop U

Monocomponente!
Pronto all'uso senza miscelazione

Descrizione

Resina poliuretanica monocomponente, reattiva all´acqua, esente da CFC e plastificanti. Pronta all'uso senza miscelazione.
Viene utilizzato per:

- blocco di trasudamenti d'acqua, anche marina, in fessure
- sigillatura in galleria
- consolidamento di sabbia ghiaiosa
- sigillatura di fori

Applicabile a temperature ambiente comprese tra 0 e 40 °C.
CarboStop U è approvato sulla base della normativa tedesca ZTV-RISS come presigillante per la sigillatura di strutture in calcestruzzo.

Caratteristiche Tecniche

I dati di seguito elencati sono relativi a valori ottenuti in laboratorio in reazione non contrastata. Nella messa in opera in cantiere essi possono subire variazioni dovute a scambi di calore fra la resina e l´ambiente circostante, in funzione delle caratteristiche della roccia o del terreno, dell´umidità, della pressione e di altri fattori.

Dati dei Componenti

		CarboStop U
Densità a 25 °C	kg/m³	1100 -1140
Colore		marrone
Punto di Infiammabilità	°C	> 100
Viscosità a 5 °C	mPa*s	2500 - 6000
Viscosità a 10 °C	mPa*s	1900 - 4500
Viscosità a 15 °C	mPa*s	1100 - 2500
Viscosità a 25 °C	mPa*s	270 - 1000

Dati della miscela

Temperatura	5 °C	10 °C	15 °C	20 °C	25 °C	
Inizio	27"	26"	24"	22"	20"	± 5"
Fine	4'20"	3'20"	2'50"	2'20"	2'00"	± 15"
Fattore di schiumatura	30 - 60				30 - 50	

La reazione avviene con l'aggiunta del 10% di acqua alla miscela appena preparata
Se necessario la reazione può essere accelerata con CarboAdd X.

2.2. Capsule: 3D Printed + Liquid core.

2. Chapter 2: Liquid Healing Agent Using 3D Printed Capsule.

As seen in the previous explanation, polyurethane is a material with an interesting performance that is very useful for the concrete self healing field, due to the condition of being a liquid compact substance that, in contact with environmental humidity, can increase considerably its volume and fill for example cracks in concrete elements, with also an adhesive ability.

For encapsulating substances as sensitive as this one, the design of very precisely produced containers, able to contain these materials without activating it due to the presence of pores or superficial discontinuities is required. In this chapter the design process and proposal for 3D printed capsules will be presented.

2.2.1. Introductory explanation

As explained in the previous section, polyurethane healing agents are the most common and effective substances for concrete fissures, due to the violent chemical reaction with ambient humidity catalyzing it immediately after breaking the capsule, also because of the fast growth and adhesive capacity, ideal to re—connecting both parts of a non structural failure crack.

Normally, the process of production of these capsules takes many steps, requiring different procedures and materials to ensure the correct development of the capsule, making of it, difficult to manufacture and making them expensive. It also demands very delicate and specific techniques that not always guarantees uniformity in terms of final dimensions and could produce some material losses; it could be cataloged in many cases as a ”craft” activity more than a systematic production.

Keeping in mind these reasons, the idea of producing uniform 3D modeled and printed capsules arises, ensuring the agent waterproofing and preserving specific dimensions by using new technologies and allowing a possible massive production with lower material losses, universality on its development and reducing material looses. In this chapter the productive process, the modeling requirements and design facts, the 3D printing parameters and final product will be explained.

2.2.2. Capsule design

Moving on, in the development of the ideas introduced before, it is necessary to consider characteristics for the design process of the capsule:

1—. Tightness: defined as:

> *"(In compounds) not allowing the substance mentioned to enter. (Ex.) Measures to make your home weathertight" (Definition of tight adjective from the Oxford Advanced Learner's Dictionary. 2021. Oxford University Press).*

Essential for preserving the chemical compounds for a longer time; it is important to avoid as much as possible the direct contact of the polyurethane with the exterior, as it is very reactive with ambient humidity. Also, the 3d printed envelope must be perfectly continuous to avoid its activation during the filling and sealing process (period before being insulated by a surrounding layer of an epoxy substance) and permit the correct enclosing and preservation.

2—. Sealing: in this case in two different senses:

> *A-. "[Often passive] seal something (up) (with something) to close a container tightly or fill a crack, etc., Especially so that air, liquid, etc. Cannot get in or out. (Ex.) The organs are kept in sealed plastic bags." (Definition of tight adjective from the Oxford Advanced Learner's Dictionary. 2021. Oxford University Press).*

The first one referring to the capacity of being correctly closed, avoiding it to spill the liquid inside. This condition implicates the production of

Bibliographic references:
- Definition of tight adjective from the Oxford Advanced Learner's Dictionary. 2021. Oxford University Press. Available at: https://www.oxfordlearnersdictionaries.com/definition/english/tight_1#:~:text=%E2%80%8B,to%20move%2C%20open%20or%20separate

an effective cap to block the open part of the container from where is filled up.

> *B-. "[often passive] seal something (with something) to cover the surface of something with a substance in order to protect it. (Ex) The floors had been stripped and sealed with varnish." (Definition of tight adjective from the Oxford Advanced Learner's Dictionary. 2021. Oxford University Press).*

This sense of the definition makes reference to the necessity of a covering epoxy substance that could waterproof even micro pores from the exterior, also protects the capsule against hits or scratches that could break it before the concrete hardening. Also prevents direct reaction with the water contained in cement.

3—. Brittleness: understood as:

> *"The fact of being hard but easily broken (...) the fact of appearing to be strong but actually being easily damaged." (Definition of tight adjective from the Oxford Advanced Learner's Dictionary. 2021. Oxford University Press).*

Defined with this adjective because of the importance for the capsule to be more be resistant (in terms of compressive strength and shape retention) but must be also easily broken in presence of tensile stresses, the same that concrete will present in the cracking moment.

Producing and materializing the capsules also depends on the definition of two main groups of technical features for achieving better results: the software and hardware.

The hardware conditions:

Are related to the printer model and characteristics; in this case, the printer used is an Anycubic Chiron, updated for 2020. (Photo in the next page)

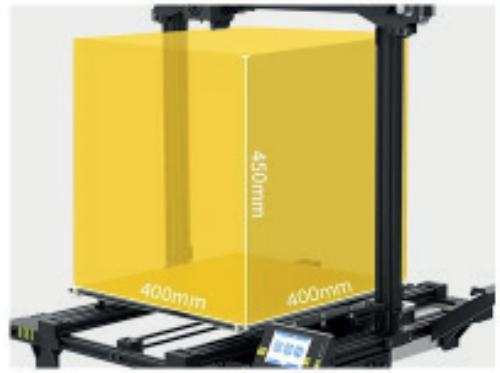
"Technical Specifications:
-Printing Technology: FDM (Fused Deposition Modeling)
Large build volume: 400mm × 400mm × 450 mm
-Print accuracy:0.05-0.3 mm
-Positioning Accuracy: X/Y 0.0125mm, Z 0.0020mm
-Extruder Quantity: Single
-Nozzle Diameter: 0.4 mm Print Speed: 20~100mm/s
-Materials: PLA, ABS, HIPS, Wood, TPU
-Temperature Ambient Operating Temperature: 8ºC - 40ºC
-Operational Extruder Temperature: max 260ºC
-Software Input Formats: .STL, .OBJ, .JPG, PNG
-Software Output Formats: GCode
-Connectivity: Memory card; Data cable
-Electrical Input rating: 110V/220V AC, 50/60Hz"
(ANYCUBIC. 3D printing. 2021)

This device works with a warmed movable surface, and a head that contains a metallic nozzle where the plastic filament is extruded by heating it, to create the different layers that conforms the printed object. It is necessary to calibrate accurately the distance between the nozzle and the bed (surface) to guarantee an adequate layer adhesion and continuity, if this process is not executed correctly, the printed surfaces will present voids and regularities.

Citation and next page images references:
-ANYCUBIC 3D Printing, 2021. Chiron. [online] ANYCUBIC 3D Printing. Available at: <https://www.anycubic.com/products/anycubic-chiron-3d-printer?__pos=1&__sid=b17185d81&__ss=r> [Accessed 18 December 2021].

ANYCUBIC CHIRON

More than BIG.



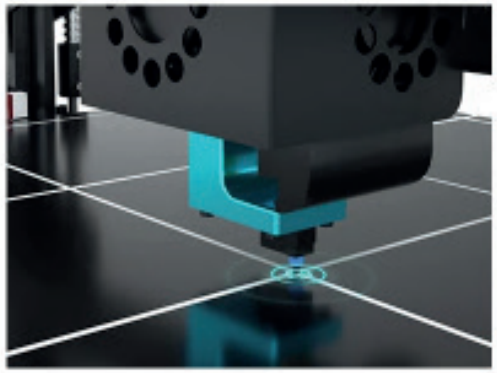
Huge Build Volume

400mm*400mm*450mmMore space for creation



Double Z Limit Switch

Offers more stable levelness of the print bed.



Matrix Automatic Leveling

Automatically detect 25 points, supports real-time adjustment Real-time compensation of nozzle height.



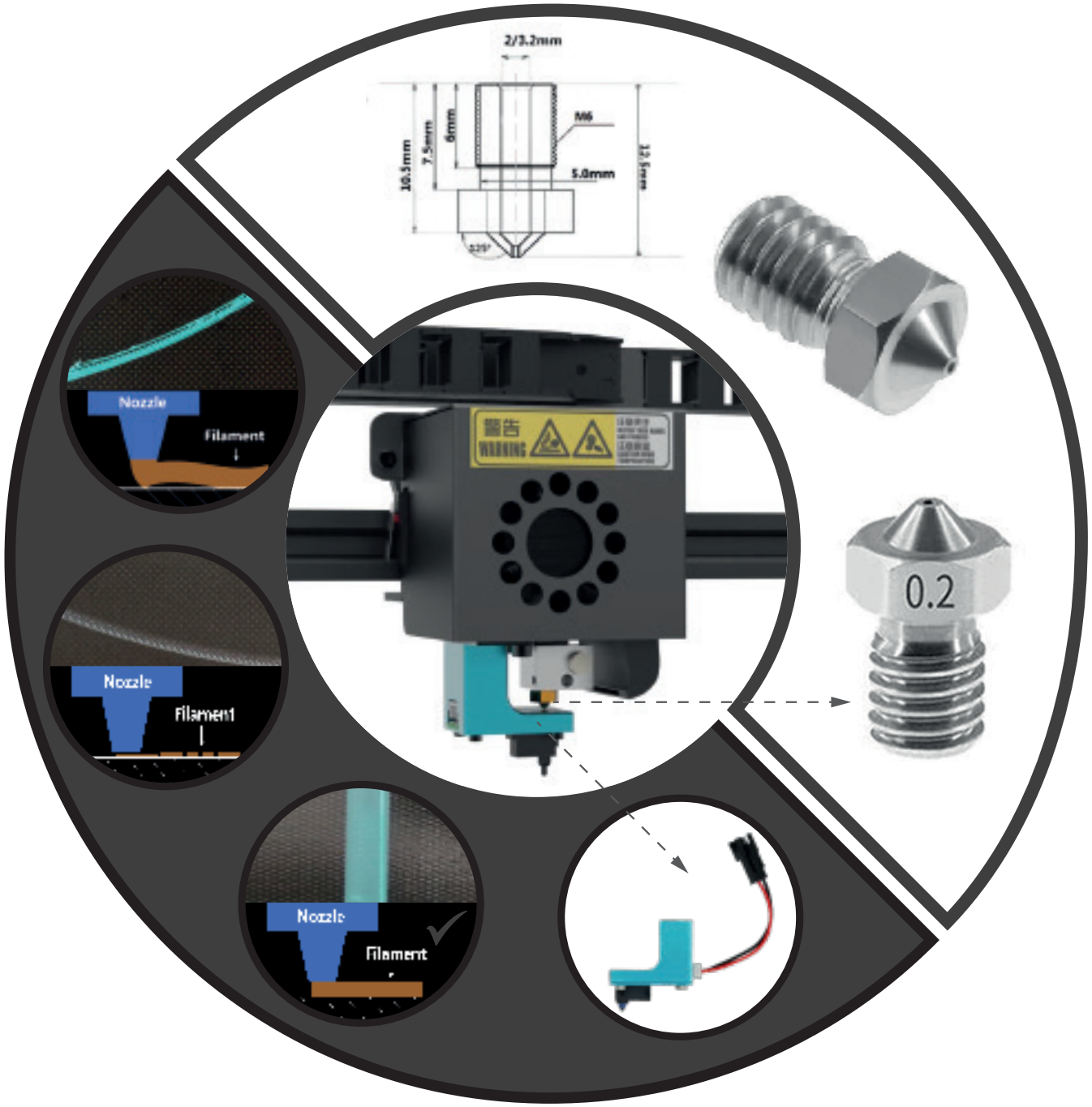
ANYCUBIC

The 3D printer model used includes a digital assisted calibration system, with the use of a pressure sensor that automatically adjusts the distances between the bed and nozzle. Then, after a print test, the weak points could be identified and digitally modify in decimals of millimeters this distance in order to obtain more accurate results and increase the printing quality.

In the following page are shown the differences in the extrusion quality depending on the calibration; when the nozzle is not close enough to the surface, the filament does not attach properly. On the other hand, when the distance is too small, the material flow is not consistent, producing blank areas and also over heating the previous layer in beyond phases.

The nozzle size is another important variable, related to the extruded filament diameter in the printer, in this case it must be thick enough to produce a firm surface but also thin enough to be brittle in traction; as the 0.4 mm nozzle was not fulfilling this characteristics, the nozzle diameter used is 0.2 mm, able to print thin curves.

Next page graphics images references:
-ANYCUBIC 3D Printing, 2021. Chiron. [online] ANYCUBIC 3D Printing. Available at: <https://www.anycubic.com/products/anycubic-chiron-3d-printer?_pos=1&_sid=b17185d81&_ss=r> [Accessed 18 December 2021].
-AliExpress, 2021. 1 5pcs 3D V6 Ugello In acciaio inox M6 Filo del Foro di Diametro 0.2/0.25/0.3/04/0.5/0.6/0.8/1.0 millimetri per 3D 1.75 millimetri Stampante Filamento.|3D Printer Parts & Accessories| - AliExpress. [online] aliexpress.com. Available at: <https://it.aliexpress.com/item/32968293590.html> [Accessed 18 December 2021].


2/3.2mm
M6
10.5mm
7.5mm
6mm
5.0mm
12.5mm
Nozzle
Filament
Nozzle
Filament
Nozzle
Filament
0.2

2.2.2.1.1 Material Selection - PLA

Once selected the printer and nozzle, it is important to determine the material considering the initial features described in the section 2.2.2. In the 3D printing field many polymers in filament are available for extrusion, some of them are flexible (similar to rubber), others soluble in water, ABS for example presents very high resistance to impacts and heat; PETG is similar to PET, it is good for containers production but pollutant; Carbon fiber filament used for higher resistances.

The polymer selected for this project is PLA for the following reasons:

"Poly(lactic acid) (PLA) belongs to the family of aliphatic polyesters commonly made from a-hydroxy acids, which include polyglycolic acid or polymandelic acid, and are considered biodegradable and compostable. PLA is a thermoplastic, high-strength, high-modulus polymer that can be made from annually renewable resources to yield articles for use in either the industrial packaging field or the biocompatible/bioabsorbable medical device market. (...) PLA is degraded by simple hydrolysis of the ester bond and does not require the presence of enzymes to catalyze this hydrolysis..." (Garlotta,D. 2001)

" PLA is the most popular resin for 3D printing because it is easy to use and has almost no odor. It adheres well to masking tape without requiring a heated printing bed or noxious solvents. It is an optimal choice for homes, schools and laboratories, and has many commercial applications.

- Diameter: 1.75 or 2.85 mm; Weight: 0.5 or 1 kg/spool
-Dimensional accuracy: ±0.03 mm
-Vacuum-sealed with desiccant in resealable bags
-Recommended print temperature: 200 to 220 °C
-Recommended bed temperature: 22 to 50 °C
-Spool diameter: 7¾"; Spool width: 2½";
Hub diameter: 3½"; Hub hole diameter: 2" "
(MGChemicals. 2018. PLA technical data sheet).

Bibliographic References:
- Garlotta, D., 2001. A Literature Review of Poly(Lactic Acid). Journal of Environmental Polymer Degradation, [online] 9(2), pp.2-23. Available at: <https://www.researchgate.net/publication/227206624_A_Literature_Review_of_PolyLactic_Acid> [Accessed 8 January 2022].
-MG Chemicals, 2018. PLA Technical data sheet. SAI Global File: 004008. [online] Burlington, Ontario, Canada: MG Chemicals, pp.1-6. Available at: <https://www.mouser.com/datasheet/2/265/tds-3d-filaments-pla-1308054.pdf> [Accessed 8 January 2022].

MG Chemicals®

PLA Technical Data Sheet

Usage Parameters

Properties	Value
Storage temperature	18–27 °C [65–80 °F] [a]
Shelf life, unopened package	1 y from date of purchase
Shelf life, opened package	Variable depending on storage conditions

Temperature Ranges

Properties	Value
Print temperature	200–220 °C [392–428 °F]
Bed temperature	22–50 °C [72–122 °F]

Properties

Physical Properties	Method	Value
Density	ASTM D 1505	1.24 g/cm³
Tensile strength	ASTM D 882, Machine Direction	100 N/mm² [15 000 lb/in²]
% Elongation	ASTM D 882, Machine Direction	180%
Young's modulus	ASTM D 882, Machine Direction	3 500 N/mm² [500 000 lb/in²]
Elmendorf tear	ASTM D 1922, Machine Direction	670 g/mm [17 g/mil]
Optical, haze	ASTM D 1003	2.1%
Optical, gloss 20°	ASTM D 1003	90%
Thermal Properties	**Method**	**Value**
Melting point	ASTM D 3418	115 to 170 °C [239 to 338 °F]

Dimensions for 0.5 kg Spool

Filament Diameter	Filament Length
1.75 mm	167 m

Dimensions for 1.0 kg Spool

Filament Diameter	Filament Length
1.75 mm	335 m
2.85 mm	126 m

NOTE: Dimensions listed above are approximations.

Net Weight	Net Volume	Packaging Weight
1.0 kg [2.2 lb]	806 mL [1.70 pt]	1.35 kg [2.98 lb]

As seen before, PLA is an ideal material, it is compatible with almost any 3D printer; also, it is one of the polymers that requires the lowest temperature range for extrusion and very reduced or non heat in the machine surface (bed) to sustain it while printing.

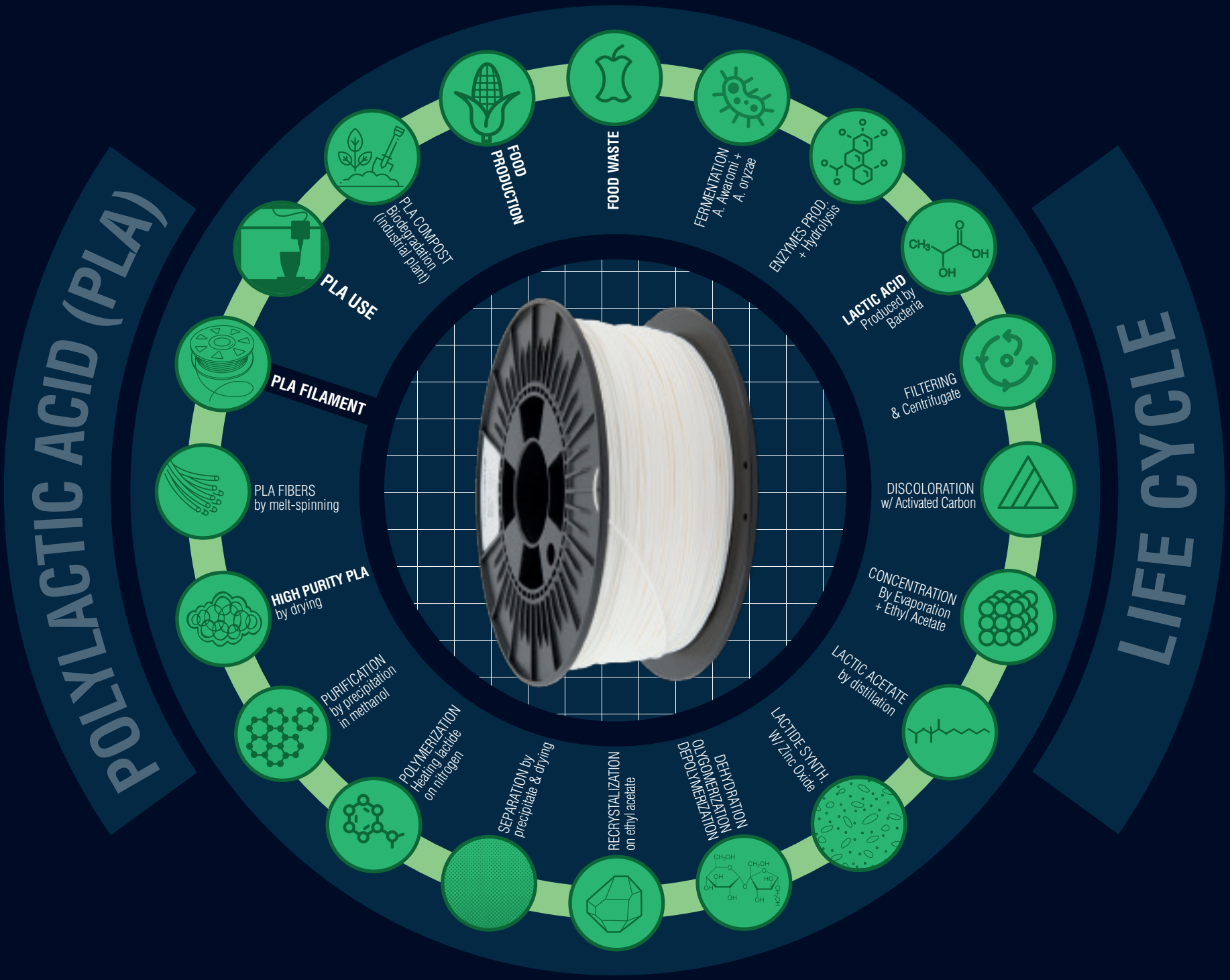
Furthermore, it is easily molding, does not deform after cooling, and is brittle in traction and compressive efforts, compatible with the original design principles of section 2.2.2. In addition the capsule will preserve its shape while containing the healing agent, and break under tensile stress into the crack.

Also, it is important to consider that this polymer is produced from corn thus, it is a vegetal origin material, non toxic, compostable and biodegradable with non enzymes or catalysts. In other words, it is safety to use, and produces the lowest impact possible with a brief degradation period.

By requiring very low temperatures for its extrusion, the energy for the capsule's production process is low, considering that the most of the electricity in the 3D printer is used for heating the electric resistances in the bed and nozzle.

Next page image, made by author Panza, A. Is based on the reference video:
- Conversion of Food Waste into Poly(Lactic Acid) Fibre. 2016. [video] Directed by HKRITA. Hong Kong: Hong Kong research institute of textiles and apparel. Available at: https://www.youtube.com/watch?v=qTxd1kW-BkA

POLYLACTIC ACID (PLA) LIFE CYCLE



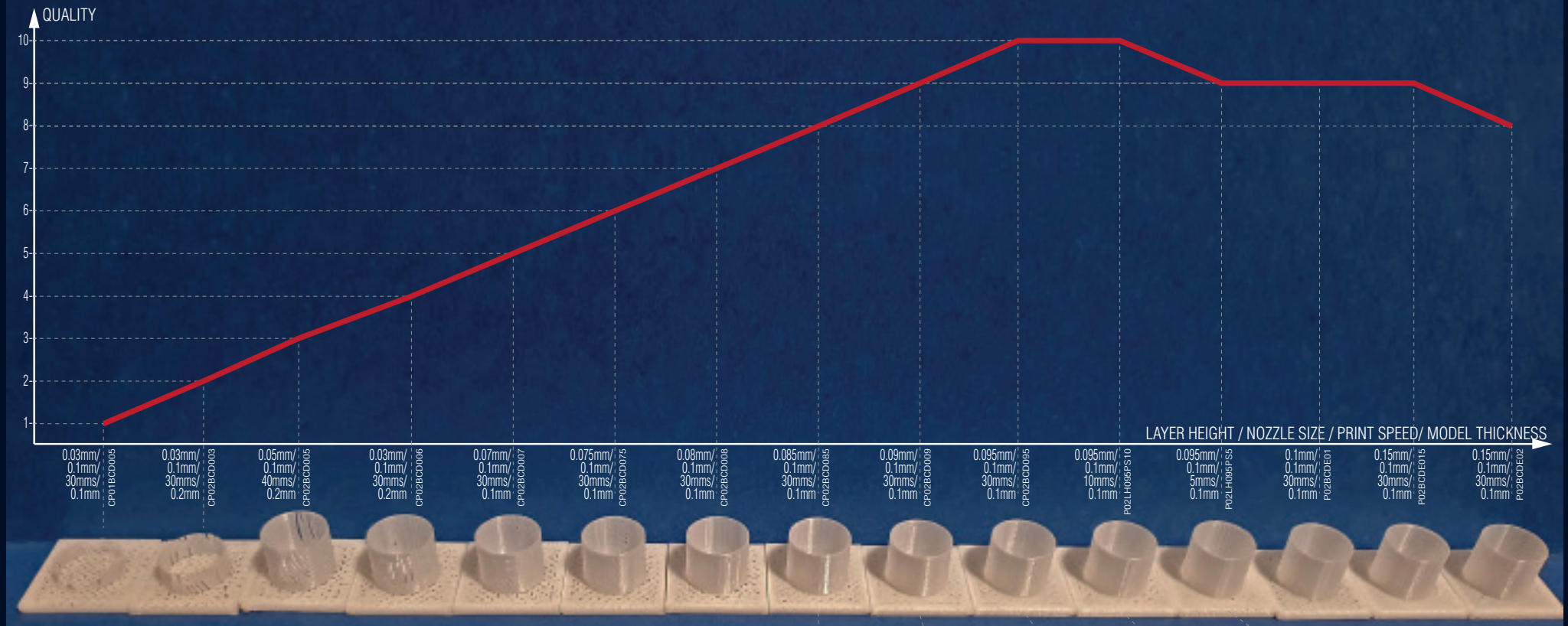
In the case of the software, there are two digital tools to manage, the 3d printing programming and the 3D modeling:

The 3d printing programing software:

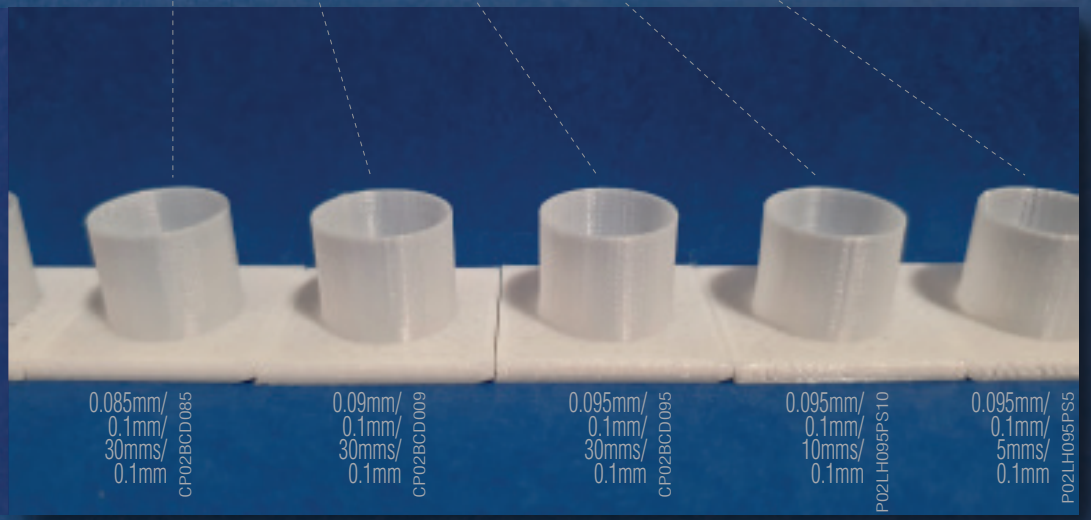
For this project the software Cura version 15.04.6 has been used. This tool is compatible with the 3D printer, allows the control of many variables and a digital preview of the final result including a simulation of the printer head movements.

As the capsule design require a very thin continuous surface to conform the container, the print programing conditions are different to the regular configurations for a typical solid filled object. For these reasons it was necessary to generate a series of cylindric samples made of one single layer of 0.2 mm thick, 6 mm radius and 2 cm height; to test the different programing variables modifications until obtaining the desired results.

In the following graph the evolution of the printing quality in terms of reducing voids and imperfections on the sample in function of the printing properties and modeling dimensions is shown.



PRINT TEST ON ANYCUBIC CHYRON 2020 EDITION
MATERIAL PLA - TEMPERATURE 220 ºC
CILINDER DIAMETER 6mm
CILINDER HEIGHT 10mm



MARCH 2021, TORINO - ITALIA
AUTHOR: ANDRES M. PANZA U.
TUTOR: JEAN M. TULLIANI

In the first test, the specimen CP01BCD005 was developed using a 3d model with a wall thickness of 0.05 mm to give margin to the nozzle of 0.2 mm to correctly print the curve. For the programming code, the layer height is 0.05 mm, printing velocity 30 mm/s, the nozzle size configured is 0.1 mm. This because of the difficulties for the printer software to identify curvilinear movements and tends to discompose it in rectilinear parts. The dimensions were reduced with the objective of increasing the quality and softness.

The CP02BCD003 configuration is similar to the previous one, the only parameter modified is the layer height to 0.03 mm and the 3D model thickness to 0.2 mm; with the intention of increase the material. In this case the capsule is produced with a very poor surface, but more continuous than the previous.

In CP02BCD005, the previous settings were used (the evolution is accumulative, modifying values based on the previous version) but modifying only layer height to 0.05 mm and printing velocity to 40 mm/s; increasing the speed to avoid surface overheating due to a lower exposition time to the nozzle. Now the surface presents long voids but reduced in quantity.

For CP02BCD006, layer height was changed to 0.06 mm and printer speed to 30 mm/sg again. In this case the printer has identified the total curve of the circle, and presents reduced voids respect to the previous one.

On CP02BCD007, layer height has been improved to 0.07 mm and 3D model wall thickness of 0.1 mm; supporting the curves generation and reducing all the long voids, remaining circular smaller ones.

CP02BCD075 presents an increase of layer height to 0.075 mm, and surface continuity improved.

From CP02BCD008 to CP02BCD009 the layer height was increased to 0.080, 0.085 and 0.090 respectively, and voids were reduced significantly, presenting only density regularities that could mean microscopic pores.

CP02BCD095 is one of the best results, where the quality is ideal, the circular shape is smooth, regular and presents occasional pores.

P02LH095PS10 is the updated version of the previous explained, using the same configuration but reducing the printing velocity to 10 mm/s, taking advantage of the extra exposition time to nozzle heat for melting all layers together, unifying the surface and reducing porosity the maximum possible.

PLH095PS5 is a variation of the previous version changing the printer speed to verify the possibility of a more accurate melting, but excessive heat produced new irregularities in the surface.

From P02BCDE01 to P02BCDE02 layer height was increased to test if this variable could increase the quality, new pores were produced.

2.2.2.2.1 3D Printer Programming

Once the general variables were managed in order to produce a clear printed shape,some other parameters were modified in order to increase the quality.

In the following pages the final print configuration used for all of the capsules on this research is presented, illustrated from the software (the complete Gcode is available on annexes 2.2.2.2.1).

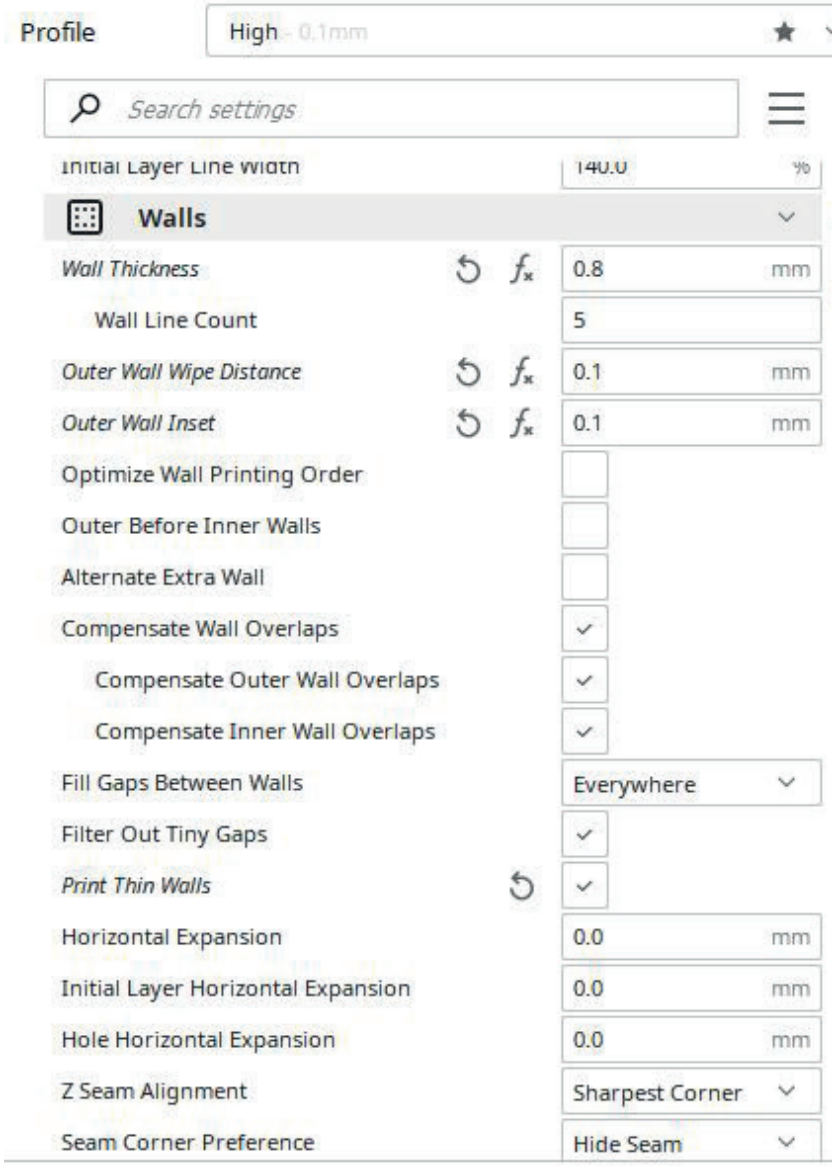
As general information, the nozzle size registered in the Gcode is 0.1mm, even if using a 0.2 mm one on the printer, the layer height is 0.095 mm as the P02LH095PS10 settings; outer walls overlap is compensated and "print thin walls" is enabled to avoid pores.

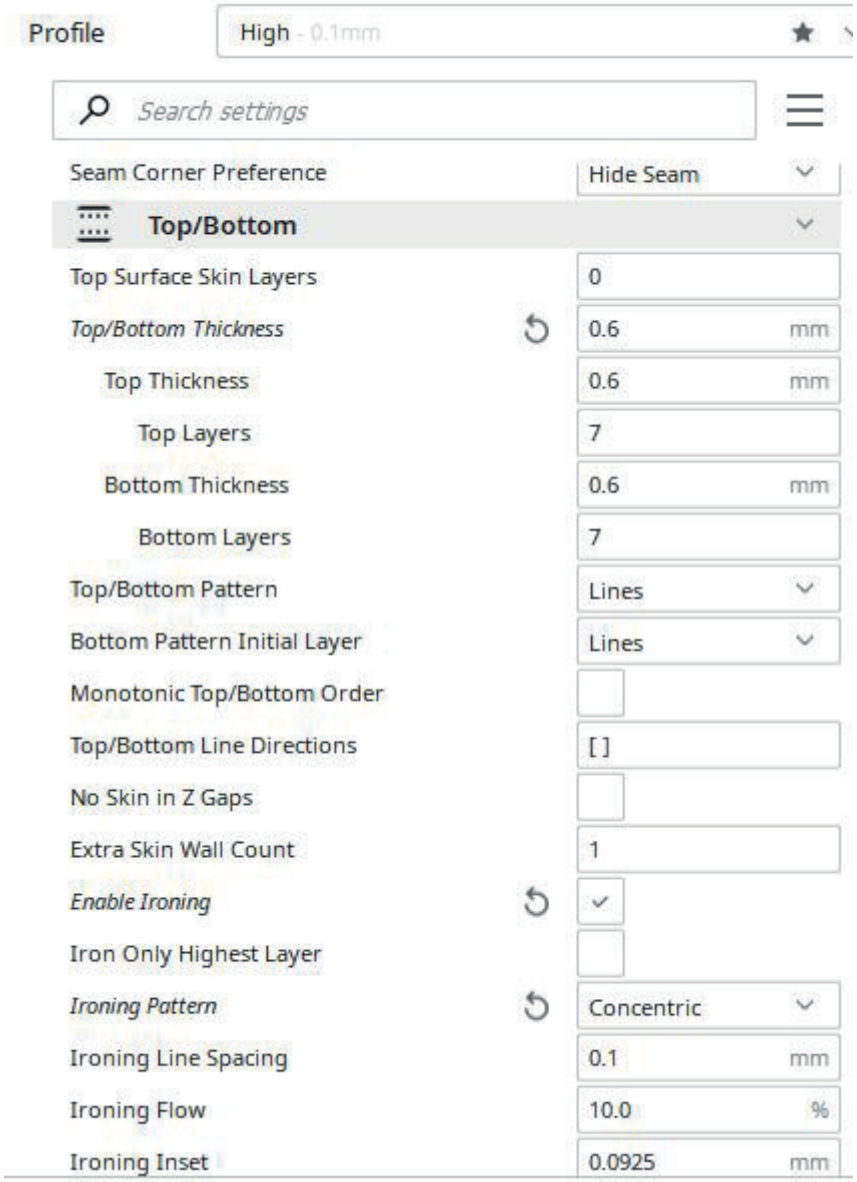
The ironing function is enabled, allowing the printer to smooth the horizontal printed surfaces by passing the heated nozzle without extruding material, melting again the PLA, consolidating the bottom of the capsule and the top of the cap. The final printing temperature is 200 °C (maximun for PLA is 150 °C).

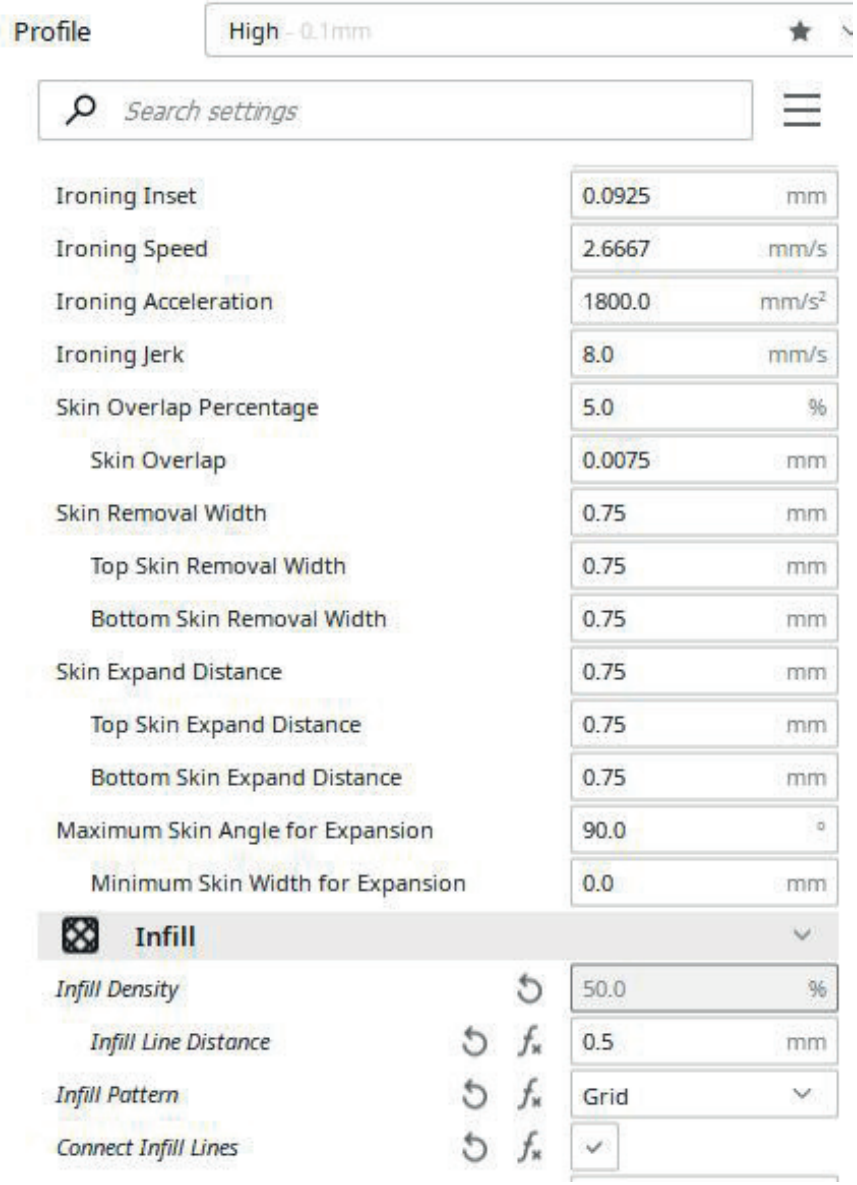
Print speed is 10 mm/s but for outer walls is 25mm/s to avoid overheating and material accumulations on the thinner surfaces.

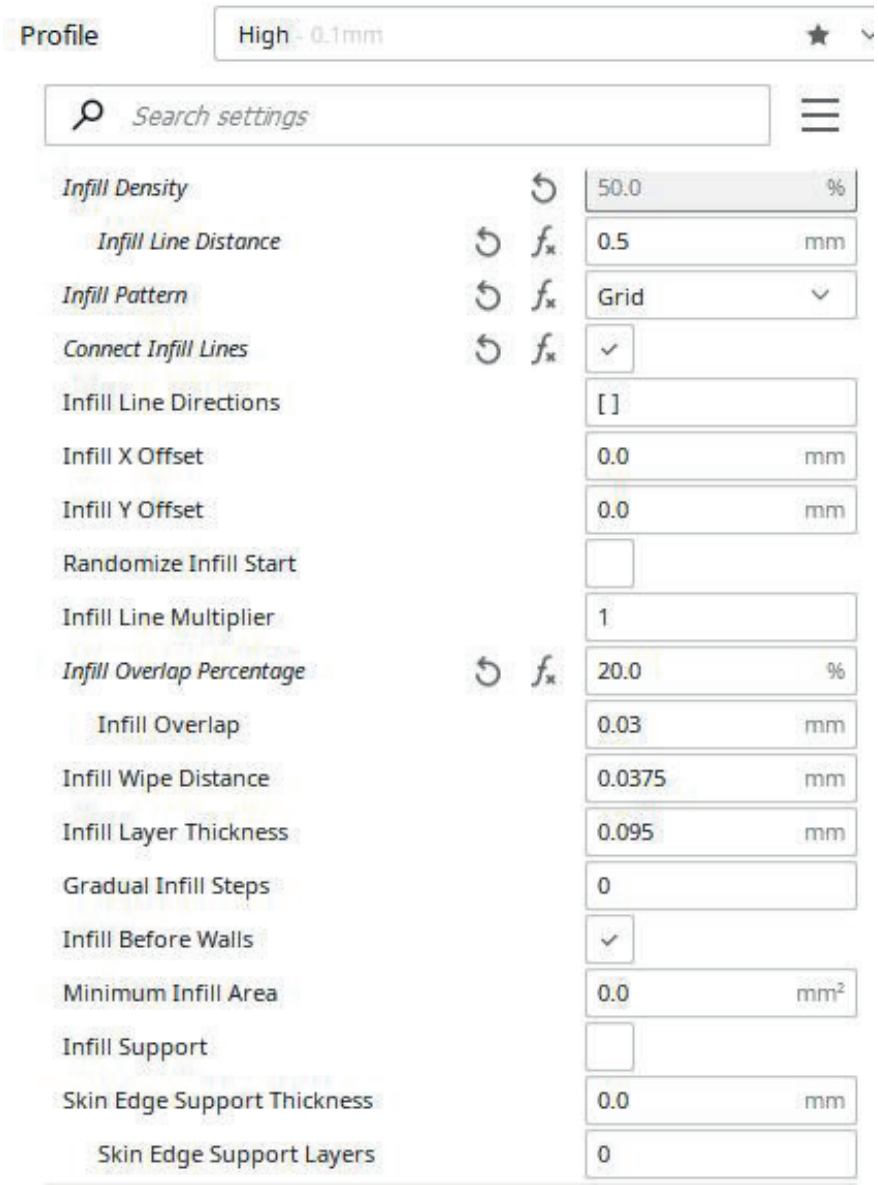
The infill pattern is a grid with a line distance of 0.5mm, combined with the ironing effect produces a sealed surface. In the last page of this sequence a preview of the cap is available, to notice the movements pattern.

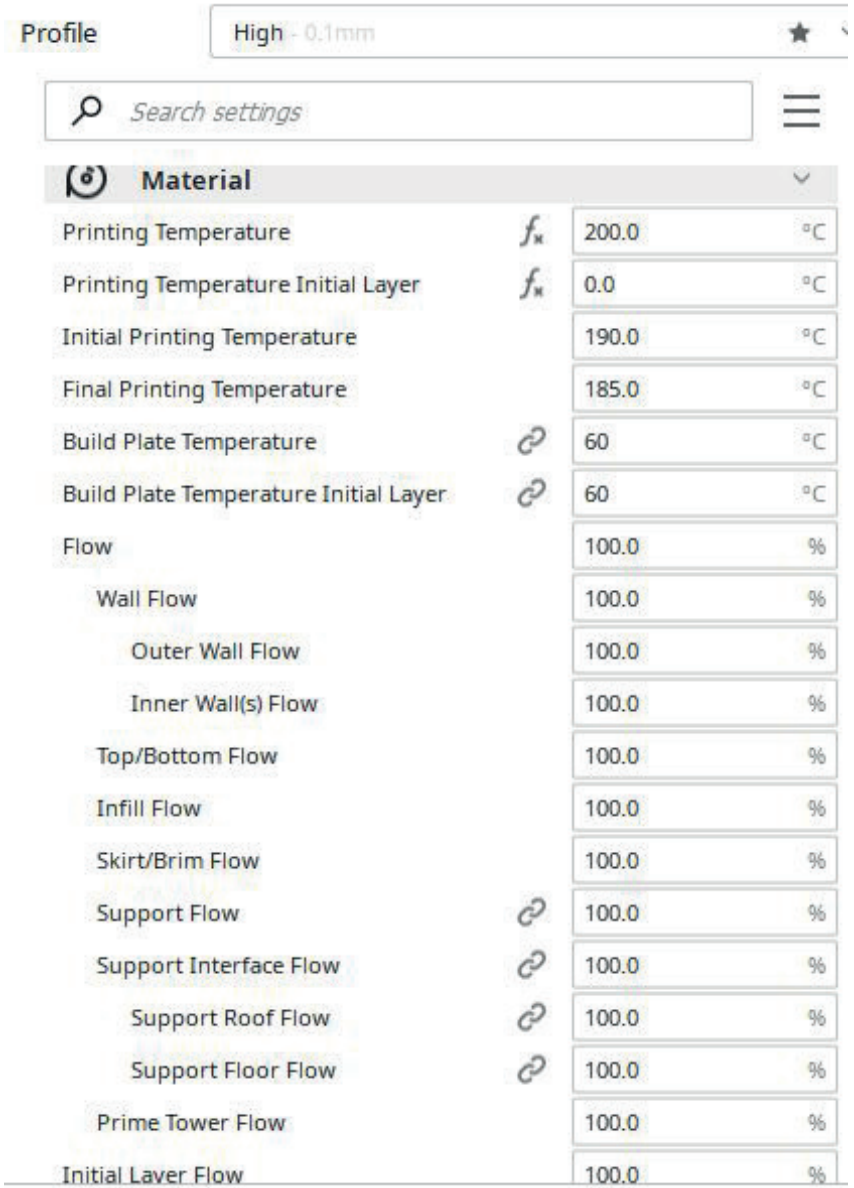

Profile
High - 0.1mm
Search settings
Quality
Layer Height 0.095 mm
Initial Layer Height 0.1 mm
Line Width 0.15 mm
Wall Line Width 0.15 mm
Outer Wall Line Width 0.15 mm
Inner Wall(s) Line Width 0.15 mm
Top/Bottom Line Width 0.15 mm
Infill Line Width 0.15 mm
Skirt/Brim Line Width 0.15 mm
Support Line Width 0.15 mm
Support Interface Line Width 0.15 mm
Support Roof Line Width 0.15 mm
Support Floor Line Width 0.15 mm
Initial Layer Line Width 140.0 %
Walls
Wall Thickness 0.8 mm
Wall Line Count 5
Outer Wall Wipe Distance 0.1 mm

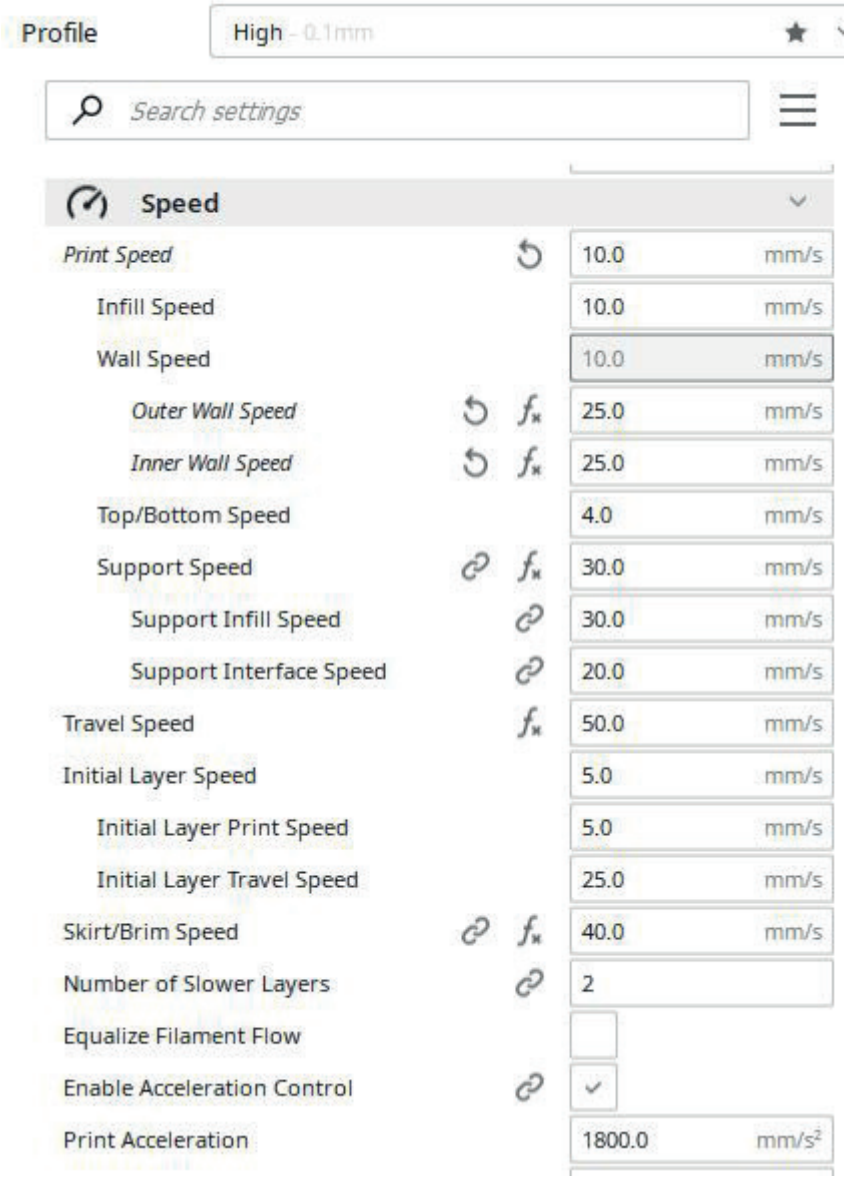

Profile
High - 0.1mm
Search settings
Initial Layer Line Width 140.0 %
Walls
Wall Thickness 0.8 mm
Wall Line Count 5
Outer Wall Wipe Distance 0.1 mm
Outer Wall Inset 0.1 mm
Optimize Wall Printing Order
Outer Before Inner Walls
Alternate Extra Wall
Compensate Wall Overlaps
Compensate Outer Wall Overlaps
Compensate Inner Wall Overlaps
Fill Gaps Between Walls Everywhere
Filter Out Tiny Gaps
Print Thin Walls
Horizontal Expansion 0.0 mm
Initial Layer Horizontal Expansion 0.0 mm
Hole Horizontal Expansion 0.0 mm
Z Seam Alignment Sharpest Corner
Seam Corner Preference Hide Seam

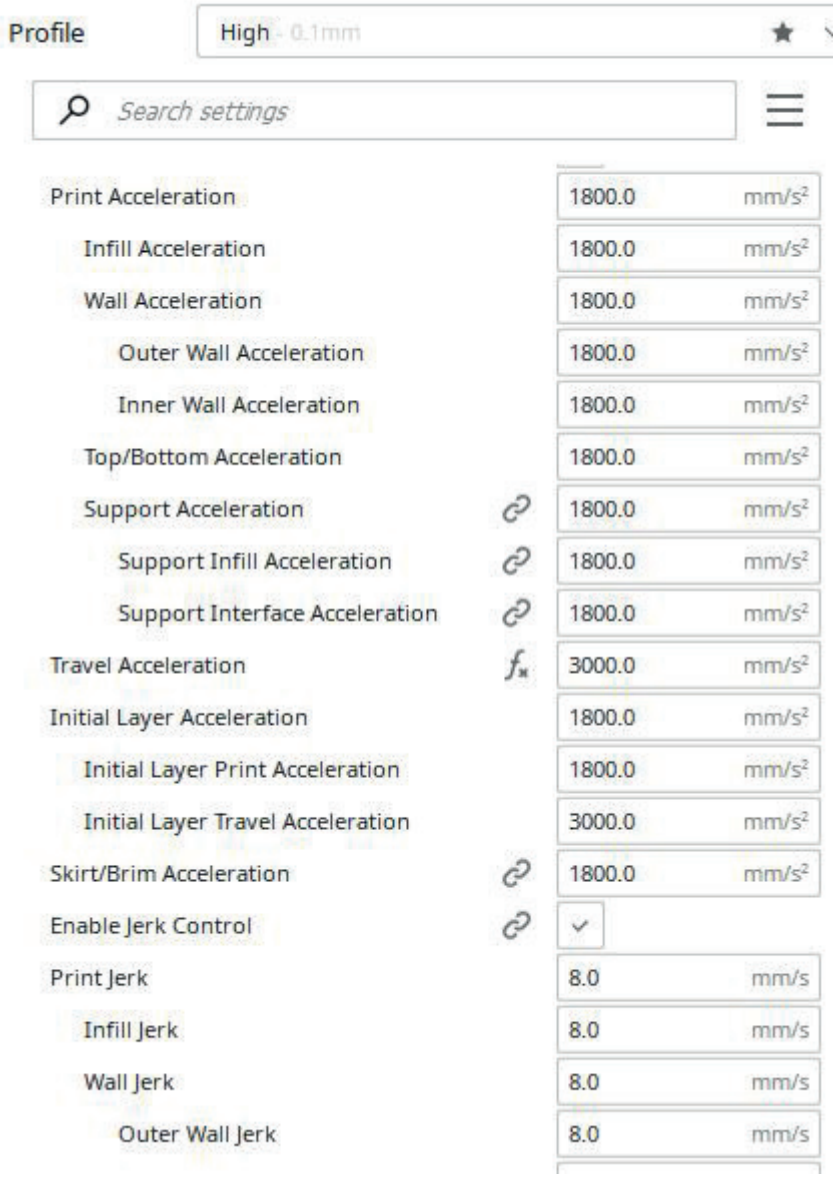

Profile
High - 0.1mm
Search settings
Seam Corner Preference
Hide Seam
Top/Bottom
Top Surface Skin Layers
0
Top/Bottom Thickness
0.6 mm
Top Thickness
0.6 mm
Top Layers
7
Bottom Thickness
0.6 mm
Bottom Layers
7
Top/Bottom Pattern
Lines
Bottom Pattern Initial Layer
Lines
Monotonic Top/Bottom Order
Top/Bottom Line Directions
[ ]
No Skin in Z Gaps
Extra Skin Wall Count
1
Enable Ironing
Iron Only Highest Layer
Ironing Pattern
Concentric
Ironing Line Spacing
0.1 mm
Ironing Flow
10.0 %
Ironing Inset
0.0925 mm

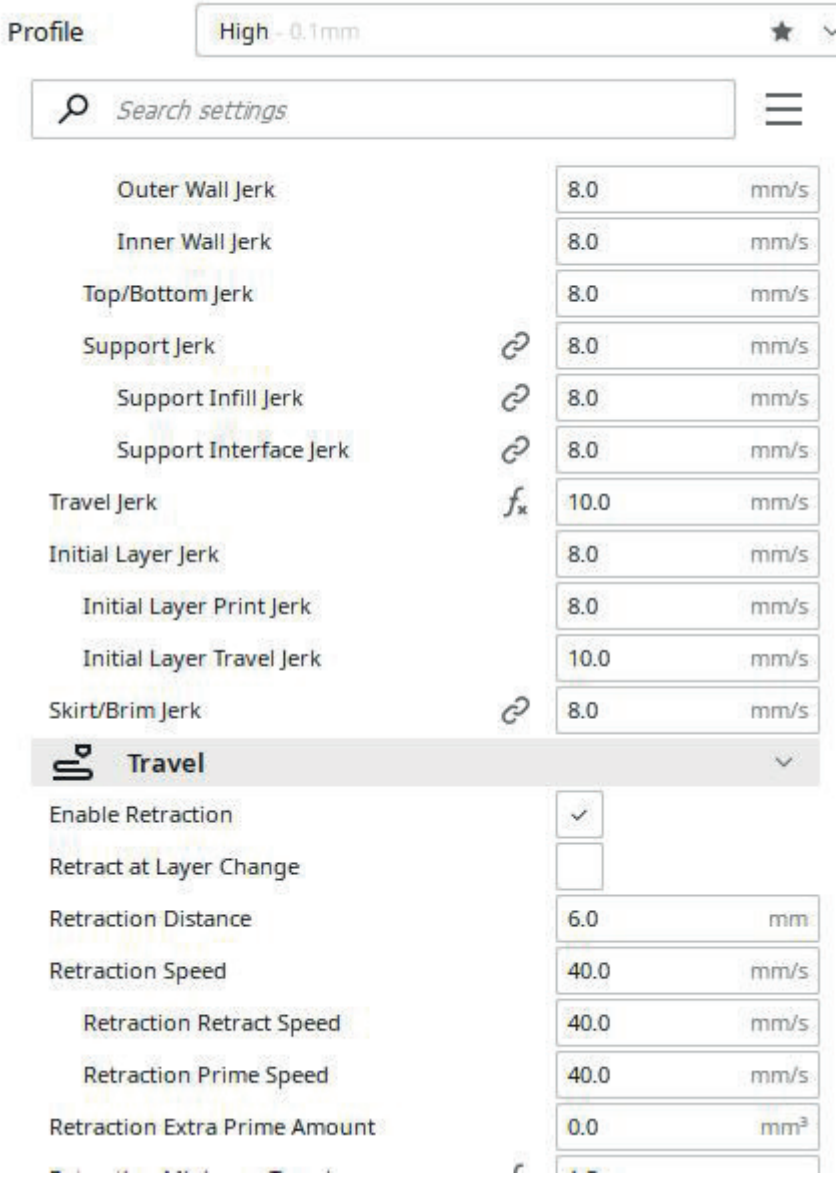

Profile
High - 0.1mm
Search settings
Ironing Inset
0.0925 mm
Ironing Speed
2.6667 mm/s
Ironing Acceleration
1800.0 mm/s²
Ironing Jerk
8.0 mm/s
Skin Overlap Percentage
5.0 %
Skin Overlap
0.0075 mm
Skin Removal Width
0.75 mm
Top Skin Removal Width
0.75 mm
Bottom Skin Removal Width
0.75 mm
Skin Expand Distance
0.75 mm
Top Skin Expand Distance
0.75 mm
Bottom Skin Expand Distance
0.75 mm
Maximum Skin Angle for Expansion
90.0 °
Minimum Skin Width for Expansion
0.0 mm
Infill
Infill Density
50.0 %
Infill Line Distance
0.5 mm
Infill Pattern
Grid
Connect Infill Lines

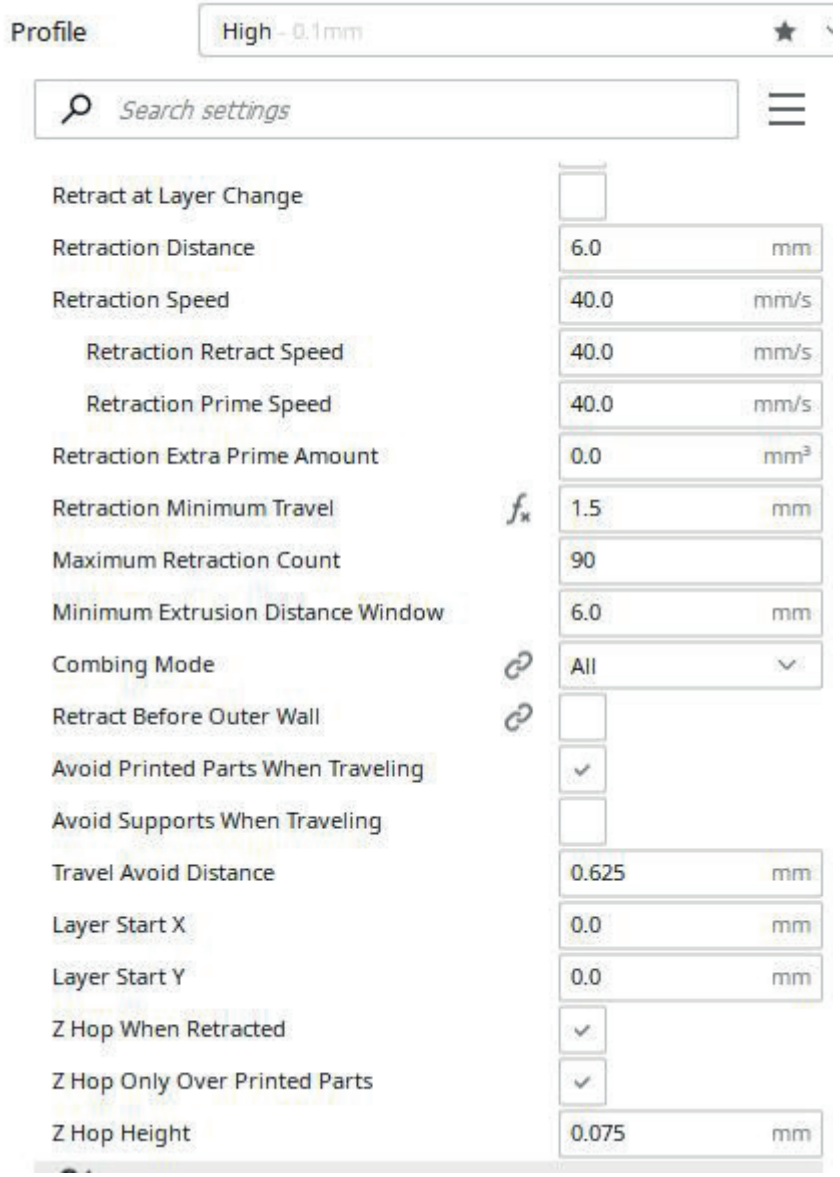

Profile
High - 0.1mm
Search settings
Infill Density
50.0 %
Infill Line Distance
0.5 mm
Infill Pattern
Grid
Connect Infill Lines
Infill Line Directions
[ ]
Infill X Offset
0.0 mm
Infill Y Offset
0.0 mm
Randomize Infill Start
Infill Line Multiplier
1
Infill Overlap Percentage
20.0 %
Infill Overlap
0.03 mm
Infill Wipe Distance
0.0375 mm
Infill Layer Thickness
0.095 mm
Gradual Infill Steps
0
Infill Before Walls
Minimum Infill Area
0.0 mm²
Infill Support
Skin Edge Support Thickness
0.0 mm
Skin Edge Support Layers
0

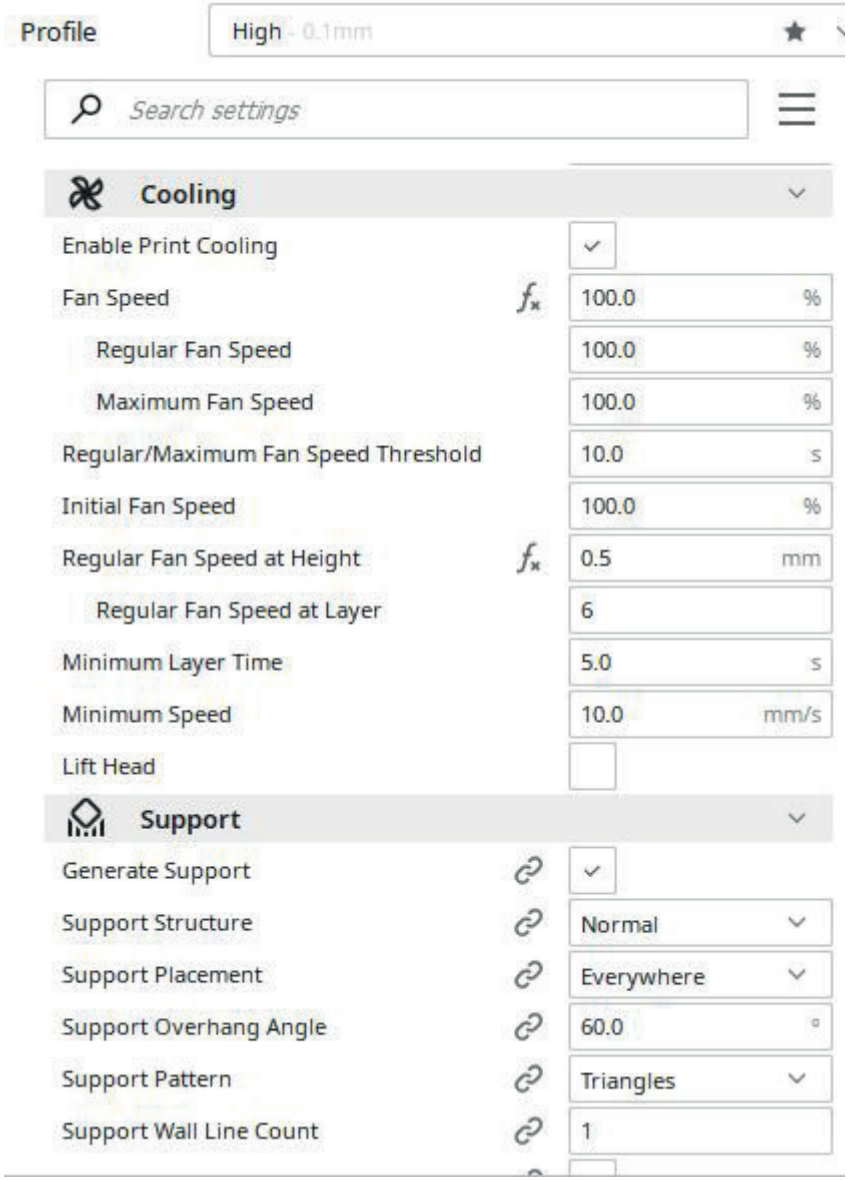

Profile
High - 0.1mm
Search settings
Material
Printing Temperature
200.0 °C
Printing Temperature Initial Layer
0.0 °C
Initial Printing Temperature
190.0 °C
Final Printing Temperature
185.0 °C
Build Plate Temperature
60 °C
Build Plate Temperature Initial Layer
60 °C
Flow
100.0 %
Wall Flow
100.0 %
Outer Wall Flow
100.0 %
Inner Wall(s) Flow
100.0 %
Top/Bottom Flow
100.0 %
Infill Flow
100.0 %
Skirt/Brim Flow
100.0 %
Support Flow
100.0 %
Support Interface Flow
100.0 %
Support Roof Flow
100.0 %
Support Floor Flow
100.0 %
Prime Tower Flow
100.0 %
Initial Layer Flow
100.0 %

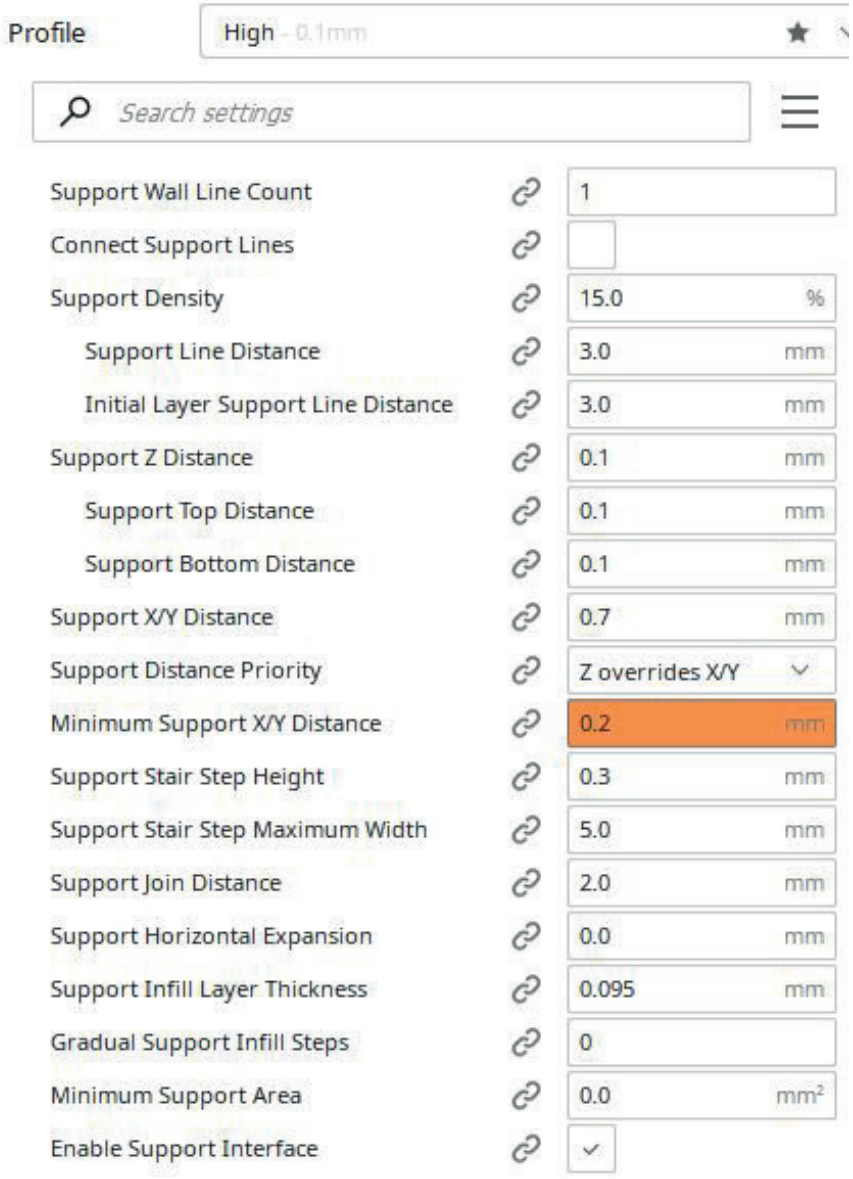

Profile
High - 0.1mm
Search settings
Speed
Print Speed 10.0 mm/s
Infill Speed 10.0 mm/s
Wall Speed 10.0 mm/s
Outer Wall Speed 25.0 mm/s
Inner Wall Speed 25.0 mm/s
Top/Bottom Speed 4.0 mm/s
Support Speed 30.0 mm/s
Support Infill Speed 30.0 mm/s
Support Interface Speed 20.0 mm/s
Travel Speed 50.0 mm/s
Initial Layer Speed 5.0 mm/s
Initial Layer Print Speed 5.0 mm/s
Initial Layer Travel Speed 25.0 mm/s
Skirt/Brim Speed 40.0 mm/s
Number of Slower Layers 2
Equalize Filament Flow
Enable Acceleration Control
Print Acceleration 1800.0 mm/s²

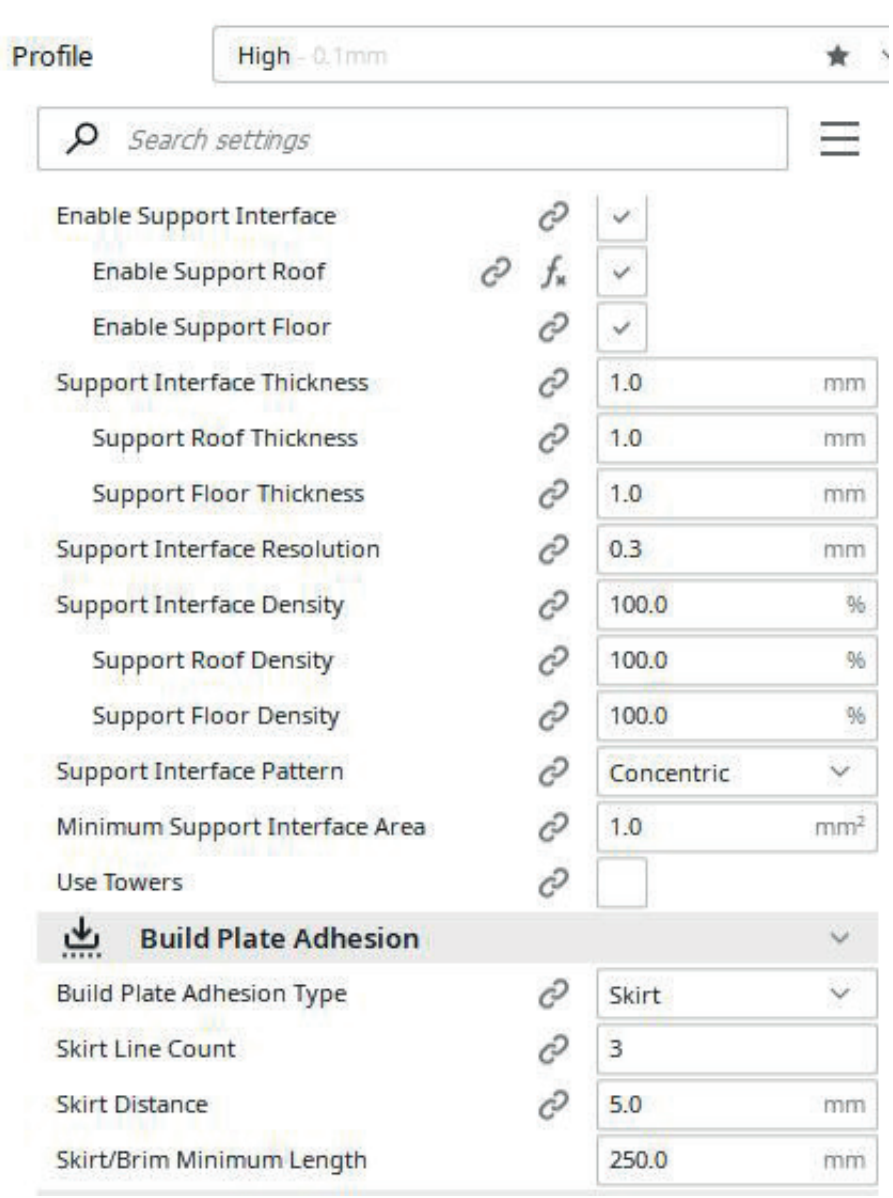

Profile
High - 0.1mm
Search settings
Print Acceleration 1800.0 mm/s²
Infill Acceleration 1800.0 mm/s²
Wall Acceleration 1800.0 mm/s²
Outer Wall Acceleration 1800.0 mm/s²
Inner Wall Acceleration 1800.0 mm/s²
Top/Bottom Acceleration 1800.0 mm/s²
Support Acceleration 1800.0 mm/s²
Support Infill Acceleration 1800.0 mm/s²
Support Interface Acceleration 1800.0 mm/s²
Travel Acceleration 3000.0 mm/s²
Initial Layer Acceleration 1800.0 mm/s²
Initial Layer Print Acceleration 1800.0 mm/s²
Initial Layer Travel Acceleration 3000.0 mm/s²
Skirt/Brim Acceleration 1800.0 mm/s²
Enable Jerk Control
Print Jerk 8.0 mm/s
Infill Jerk 8.0 mm/s
Wall Jerk 8.0 mm/s
Outer Wall Jerk 8.0 mm/s

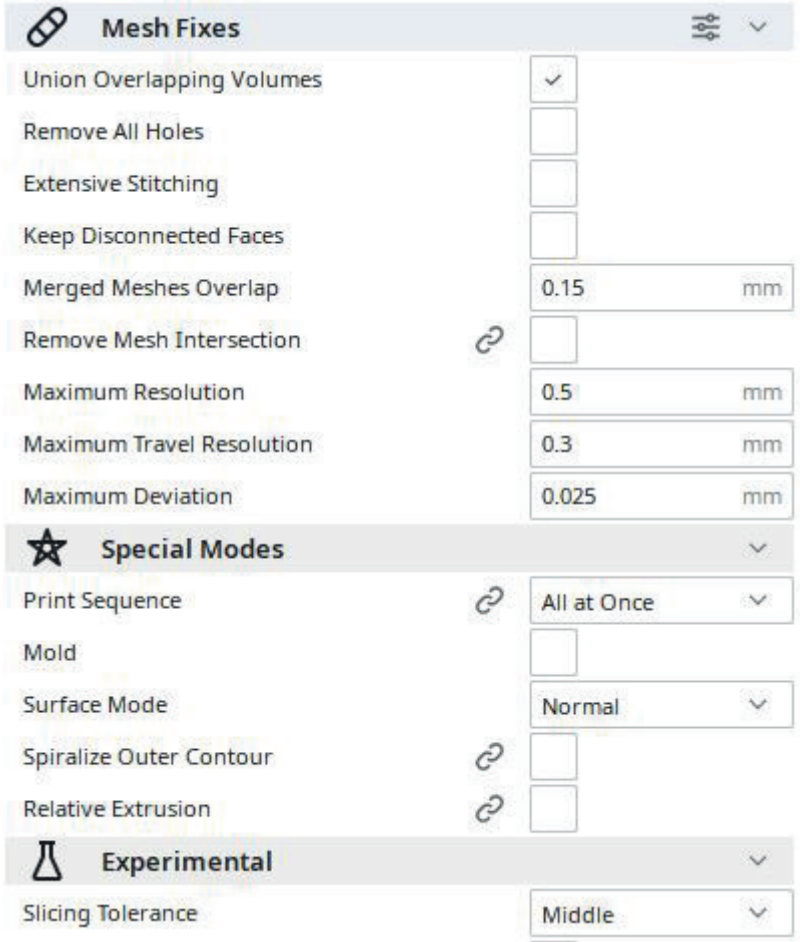

Profile
High - 0.1mm
Search settings
Outer Wall Jerk 8.0 mm/s
Inner Wall Jerk 8.0 mm/s
Top/Bottom Jerk 8.0 mm/s
Support Jerk 8.0 mm/s
Support Infill Jerk 8.0 mm/s
Support Interface Jerk 8.0 mm/s
Travel Jerk 10.0 mm/s
Initial Layer Jerk 8.0 mm/s
Initial Layer Print Jerk 8.0 mm/s
Initial Layer Travel Jerk 10.0 mm/s
Skirt/Brim Jerk 8.0 mm/s
Travel
Enable Retraction
Retract at Layer Change
Retraction Distance 6.0 mm
Retraction Speed 40.0 mm/s
Retraction Retract Speed 40.0 mm/s
Retraction Prime Speed 40.0 mm/s
Retraction Extra Prime Amount 0.0 mm³


Profile
High - 0.1mm
Search settings
Retract at Layer Change
Retraction Distance 6.0 mm
Retraction Speed 40.0 mm/s
Retraction Retract Speed 40.0 mm/s
Retraction Prime Speed 40.0 mm/s
Retraction Extra Prime Amount 0.0 mm³
Retraction Minimum Travel 1.5 mm
Maximum Retraction Count 90
Minimum Extrusion Distance Window 6.0 mm
Combing Mode All
Retract Before Outer Wall
Avoid Printed Parts When Traveling
Avoid Supports When Traveling
Travel Avoid Distance 0.625 mm
Layer Start X 0.0 mm
Layer Start Y 0.0 mm
Z Hop When Retracted
Z Hop Only Over Printed Parts
Z Hop Height 0.075 mm


Profile
High - 0.1mm
Search settings
Cooling
Enable Print Cooling
Fan Speed
100.0 %
Regular Fan Speed
100.0 %
Maximum Fan Speed
100.0 %
Regular/Maximum Fan Speed Threshold
10.0 s
Initial Fan Speed
100.0 %
Regular Fan Speed at Height
0.5 mm
Regular Fan Speed at Layer
6
Minimum Layer Time
5.0 s
Minimum Speed
10.0 mm/s
Lift Head
Support
Generate Support
Support Structure
Normal
Support Placement
Everywhere
Support Overhang Angle
60.0 °
Support Pattern
Triangles
Support Wall Line Count
1

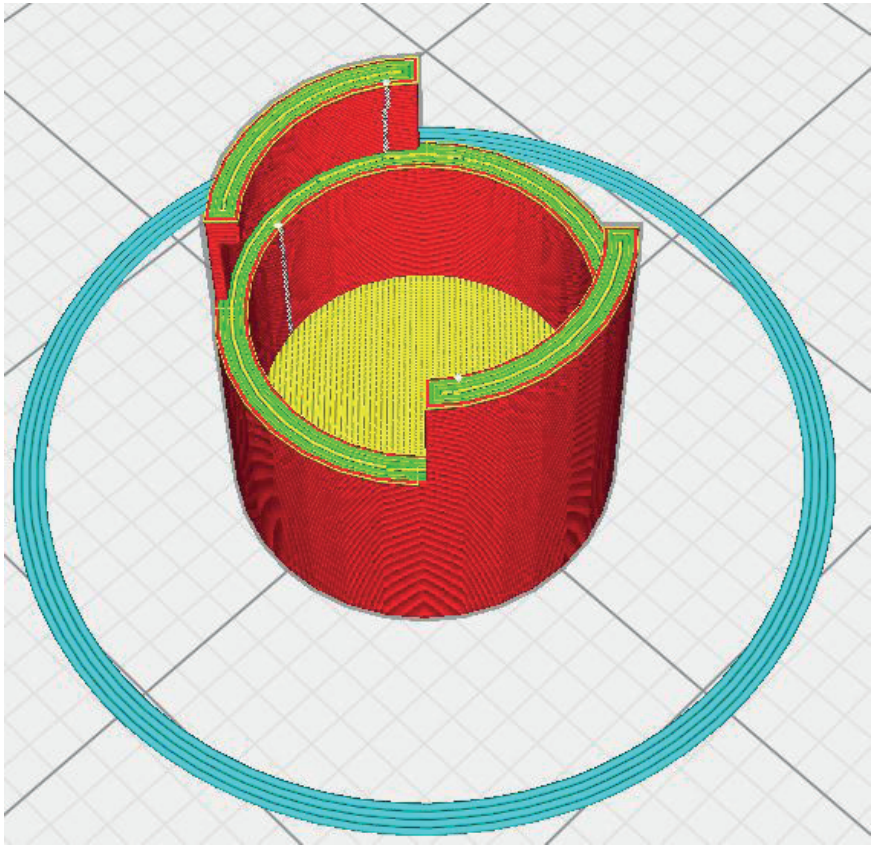

Profile
High - 0.1mm
Search settings
Support Wall Line Count
1
Connect Support Lines
Support Density
15.0 %
Support Line Distance
3.0 mm
Initial Layer Support Line Distance
3.0 mm
Support Z Distance
0.1 mm
Support Top Distance
0.1 mm
Support Bottom Distance
0.1 mm
Support X/Y Distance
0.7 mm
Support Distance Priority
Z overrides X/Y
Minimum Support X/Y Distance
0.2 mm
Support Stair Step Height
0.3 mm
Support Stair Step Maximum Width
5.0 mm
Support Join Distance
2.0 mm
Support Horizontal Expansion
0.0 mm
Support Infill Layer Thickness
0.095 mm
Gradual Support Infill Steps
0
Minimum Support Area
0.0 mm²
Enable Support Interface


Profile
High - 0.1mm
Search settings
Enable Support Interface
Enable Support Roof
Enable Support Floor
Support Interface Thickness 1.0 mm
Support Roof Thickness 1.0 mm
Support Floor Thickness 1.0 mm
Support Interface Resolution 0.3 mm
Support Interface Density 100.0 %
Support Roof Density 100.0 %
Support Floor Density 100.0 %
Support Interface Pattern Concentric
Minimum Support Interface Area 1.0 mm²
Use Towers
Build Plate Adhesion
Build Plate Adhesion Type Skirt
Skirt Line Count 3
Skirt Distance 5.0 mm
Skirt/Brim Minimum Length 250.0 mm


Mesh Fixes
Union Overlapping Volumes
Remove All Holes
Extensive Stitching
Keep Disconnected Faces
Merged Meshes Overlap 0.15 mm
Remove Mesh Intersection
Maximum Resolution 0.5 mm
Maximum Travel Resolution 0.3 mm
Maximum Deviation 0.025 mm
Special Modes
Print Sequence All at Once
Mold
Surface Mode Normal
Spiralize Outer Contour
Relative Extrusion
Experimental
Slicing Tolerance Middle

Experimental

Slicing Tolerance	Middle
Infill Travel Optimization	
Enable Draft Shield	
Make Overhang Printable	
Enable Coasting	
Enable Conical Support	
Fuzzy Skin	
Flow Rate Compensat...ax Extrusion Offset	0.0 mm
Flow Rate Compensation Factor	100.0 %
Use Adaptive Layers	
Wipe Nozzle Between Layers	
Small Hole Max Size	0.0 mm
Small Feature Max Length	0.0 mm
Small Feature Speed	50.0 %
Small Feature Initial Layer Speed	50.0 %



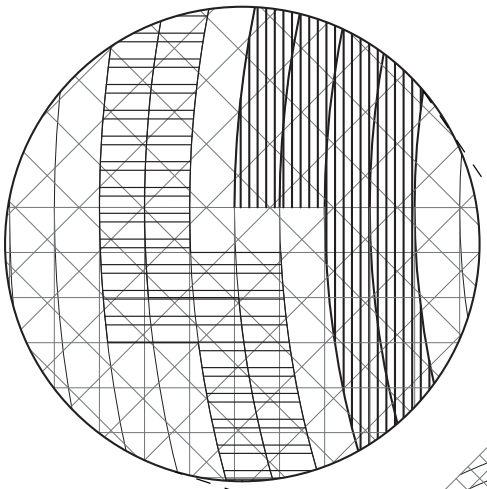
Once set the 3d printer configuration, it is necessary to develop the capsule and cap 3D model; for this procedure, it is important to remind that the printer nozzle diameter is 0.2 mm; that is to say, the minimum amount of extruded material will be 0.2 mm thick, so thinner dimensions could not be printed.

For these reasons, it has been decided to establish a modular geometric mesh for defining the minimum thickness and distances between pieces. It is made of an initial reticular pattern composed of 0.2 mm side squares; which circular limits with the same offset measure are drawn from the center. Finally the main square diagonals are defined and another square mesh is created, this time rotated 45° (respect to the initial mesh).

Some limit measures have been taken in consideration; as normally in concrete elements, the sections distances between steel and the outer finished surface are from 3 cm to 5 cm, it is recommended to keep a maximum diameter of 10 to 12 mm. That is to say by using the mesh pattern, the 10mm diameter circle is chosen as the maximum axis.

By using this pattern the measures of the capsule (smallest piece) and the cap (biggest piece) with a final thickness of 0.4mm in model can be determined. This will serve to help the printer software to identify two layers of material, the minimum amount necessary to produce a brittle surface but also non porous and uniform.

CAPSULE MODULAR



MODELING GEOMETRY

After establishing the minimum dimensional rules, it is required to design the final details for the capsule closing. Considering the sensitivity to humidity of the healing agents that would be contained, both pieces must firmly match each other, being water and air proof, and easily attached to not produce excessive stresses that could break or separate the extruded layers.

The Cap Closing Procedure:

Taking into consideration the reasons before explained, a cap that could be slipped over the capsule surface surrounding it was designed. It is an embedded positive–negative, male–female, or dovetailing system, that, by turning the pieces, both parts will match providing a resistant joint.

Cap-Capsule Joinery:

This previous joint system has minimal requirements: as the printer works by layers, the horizontal continuity is important, many variations and voids in the layers could produce a disconnection of the supporting pieces. These layers are also very brittle, which means that is required a minimum thickness of 2 mm or 10 layers in this case is required, to be resistant enough to manipulate the cap and keep it in place. Less layers could break while closing, allowing air humidity to access the chamber and early activate the healing components.

Cap Sealing:

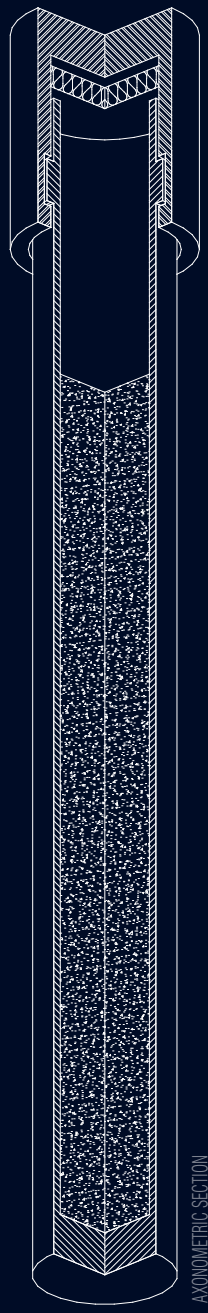
Matching and producing a mechanical attach for the cap and capsule is not enough to preserve the content; nevertheless the air trap formed by introducing part of the capsule inside of the cap, makes difficult the access of water and humidity. It is important to remind that PLA is a rigid material and the 3d printer has microscopic variations that doesn't permit the generation of perfectly smooth surfaces, producing microscopic spaces between both parts.

For this reason it has been considered to use an epoxy material that could adapt to the inner cap top and the cylinder edges to seal it. Silicone products could be also introduced between both pieces while pressing one into the other, to increase the possibilities of an optimum sealing).

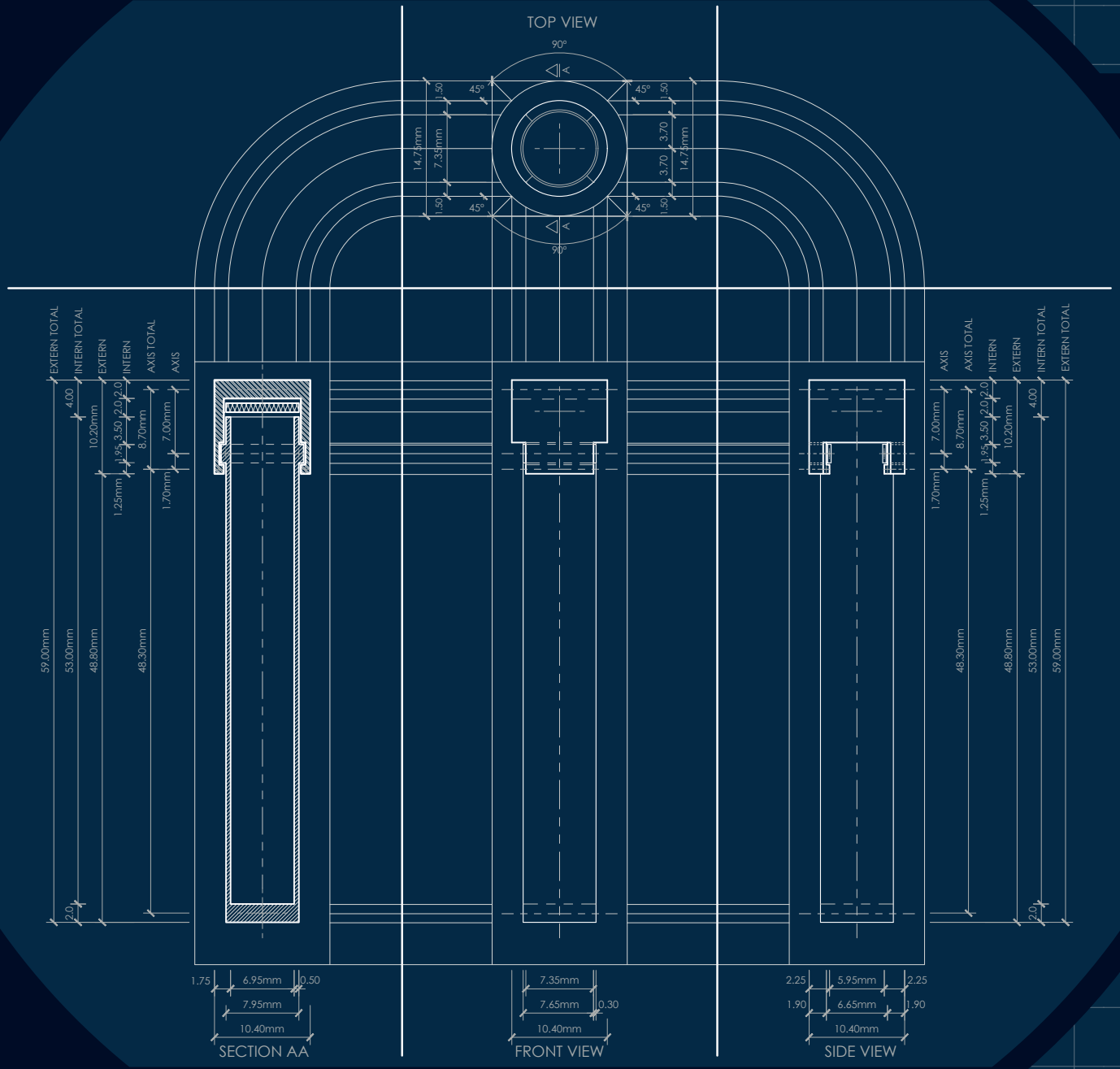
The maximum length for this design is 60 mm, providing an internal volume of 4 cubic centimeters. This measure is long enough to facilitate the transversal break, but not being very fragile (the closer to the longitudinal center, the more brittle it is). Also this length is convenient for small dimension concrete prisms, such as concrete joists.

In the following page, the final dimensions and details of the capsule will be illustrated:

3D PRINTED CAPSULE MODEL DESIGN

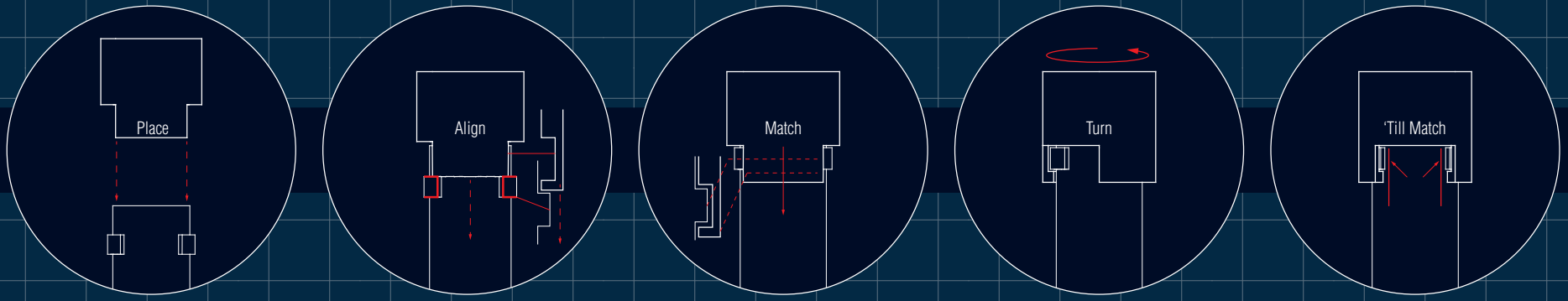


AXONOMETRIC SECTION

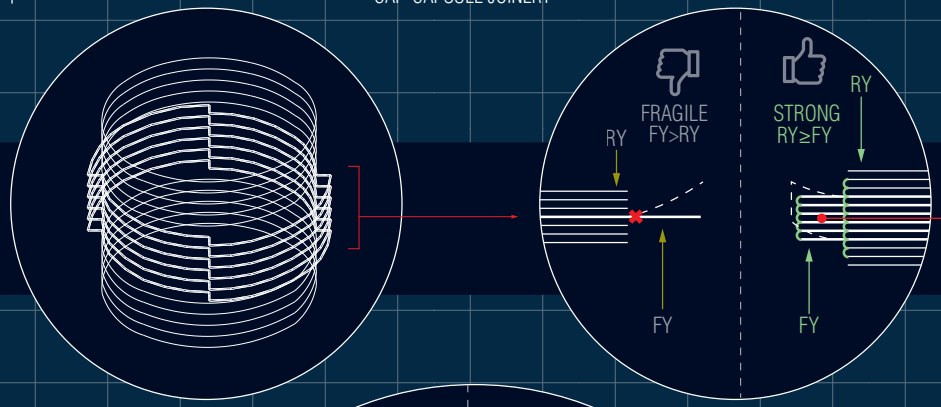


A. PANZA UGUZZONI - SEPTEMBER - 2021 - TORINO, IT.

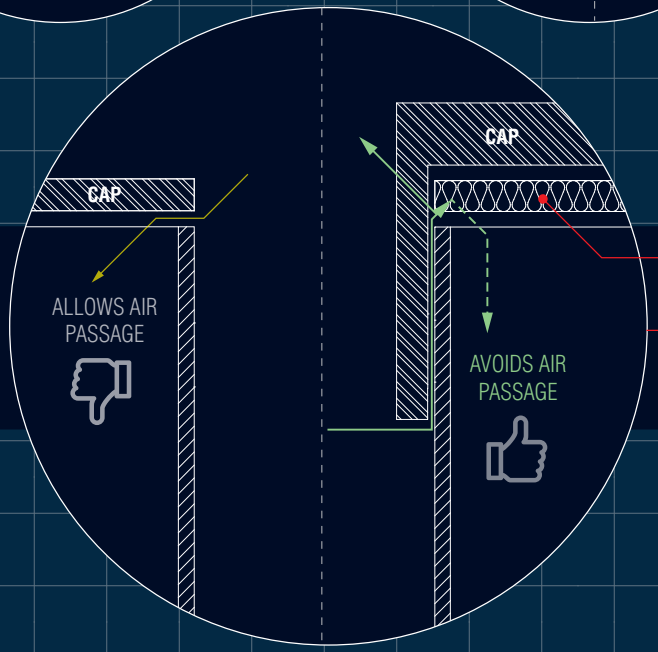
CAP CLOSING PROCEDURE

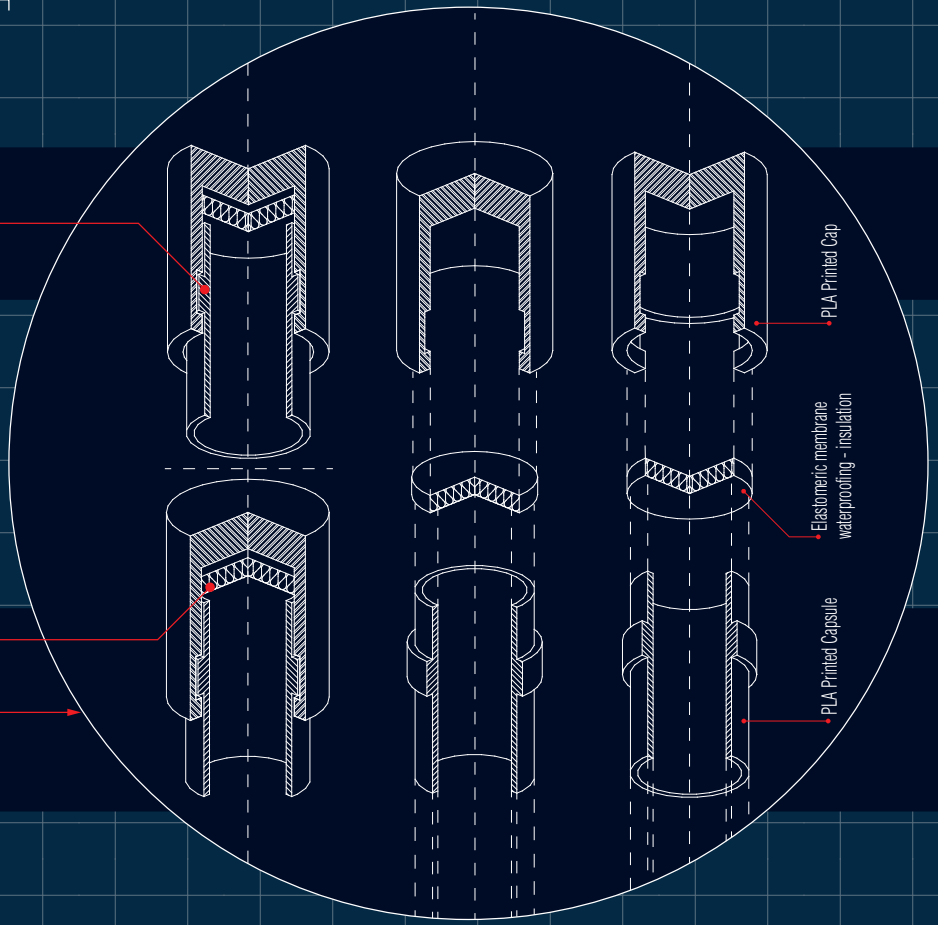


CAP-CAPSULE JOINERY

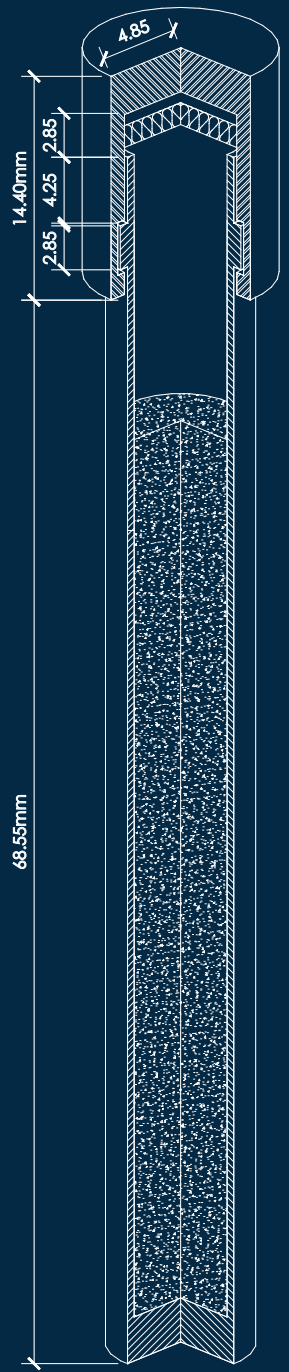


CAP INSULATION

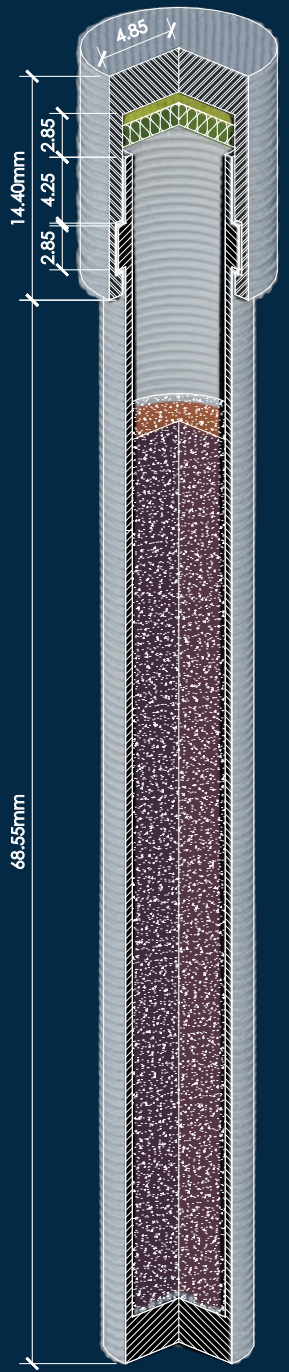




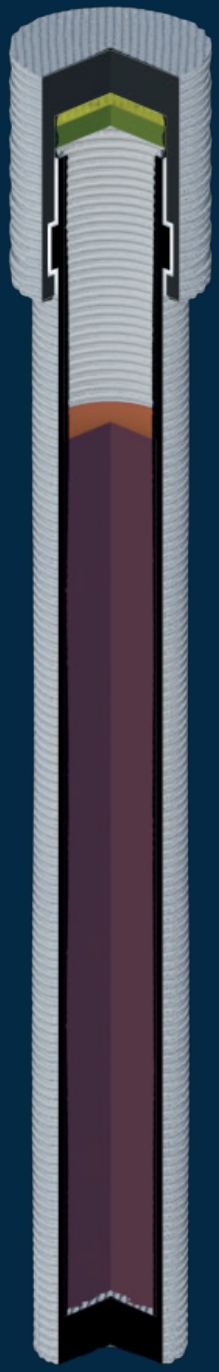
CAP-CAPSULE CLOSING SYSTEM DETAILS



DIAGRAMS PLANNING



3D MODELING



3D MODEL RENDER



3D PRINTED CAPSULE



REAL SCALE 1:1



After designing and modeling the capsule, it is finally printed using the program settings and machine adjustments explained before; once obtained the capsule, it has been observed in the electronic microscope, to verify the presence of porosity.

As shown in the next figure "3D printed PLA capsule microscope view" the layer composition is shown in magnified scale, where the different PLA extruded filaments can match perfectly each other and are bound together, filling the contact points and avoiding porosity.

It has been also compared to the PLA printing result from the previous research of Carrillo and Paganelli 2017, where the presence of non correctly bound layers produced notable pores, allowing polyurethane leaking and ingress of ambient humidity. This was due to the difficulties and lack of precision of previous technologies in 3D printing, nowadays calibration, temperature and g-code programming are much more accurate.

Once printed, the capsule is ready to be covered with an external layer of bi-component epoxy resin, in this case the commercial product "StuccoK" from the brand "API" is used, a fast hardening resin to waterproof the container, fragile enough to be broken during a fissure generation.

Carrillo and Paganelli image in the figure " 3D printed PLA capsule microscope view" extracted from:
-Carrillo, S. and Paganelli, G., 2017. Sviluppo di nuove capsule polimeriche per materiali cementizi autoriparanti. Turin, Italy: Politecnico di Torino, pp.1-378.

09/03

STUCCOK

descrizioneprodotto

Adesivo epossidico bicomponente tissotropico senza solventi.

Campi principali di impiego
E' adatto come adesivo per incollaggio e piccole riparazioni su calcestruzzo, inghisaggi. Presenta caratteristiche di resistenza meccanica e di adesione superiori a quelle del calcestruzzo e presenta elevata resistenza agli alcali e ai solventi.

normegenerali

Confezionamento
Confezioni: kg. 6 peso netto
(3 kg. ciascun componente)

Solventi per pulizia attrezzi
SOLVENTE N.1080 (infiammabile).

Norme di igiene e sicurezza
Evitare il contatto
con la pelle e con gli occhi.
Durante l'applicazione
usare creme barriera.

cicloapplicativo

Preparazione delle superfici
Si consiglia di eseguire una molatura con mezzi meccanici.
Dopo tale trattamento la superficie deve risultare compatta, asciutta, pulita e senza polvere.
La compatezza di supporti porosi può essere migliorata usando, prima della stuccatura, il PRIMER DUE.

Modalità di applicazione
Il prodotto previa accurata mescolazione della base con l'indurente, si applica mediante spatola dentata o a filo diritto.

Temperatura di applicazione
Non è consigliabile applicare il materiale sotto i 5°C ed al di sopra dei 35°C. La temperatura del supporto deve essere almeno 3°C al di sopra del punto di rugiada.

caratteristichetecniche

Caratteristiche chimico fisiche

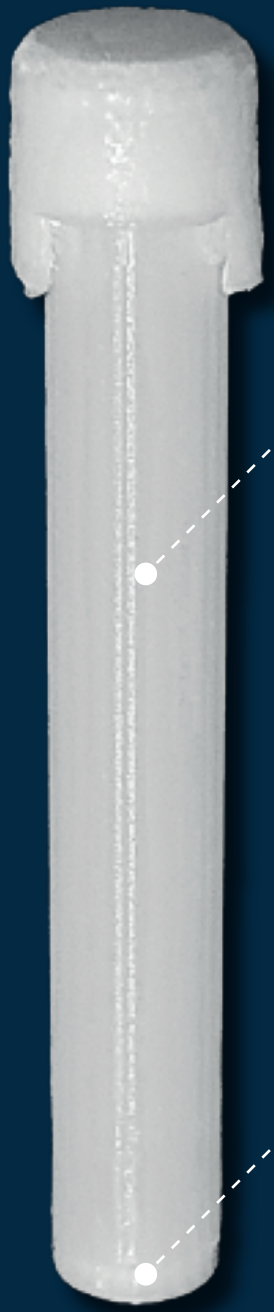
Natura del veicolo	*:epossidico*
Contenuto in solidi	*:100%*
Peso specifico	*:1,7 kg/dm^3*
Colore	*:Componenti: bianco e grigio scuro*
	Miscela: grigio chiaro

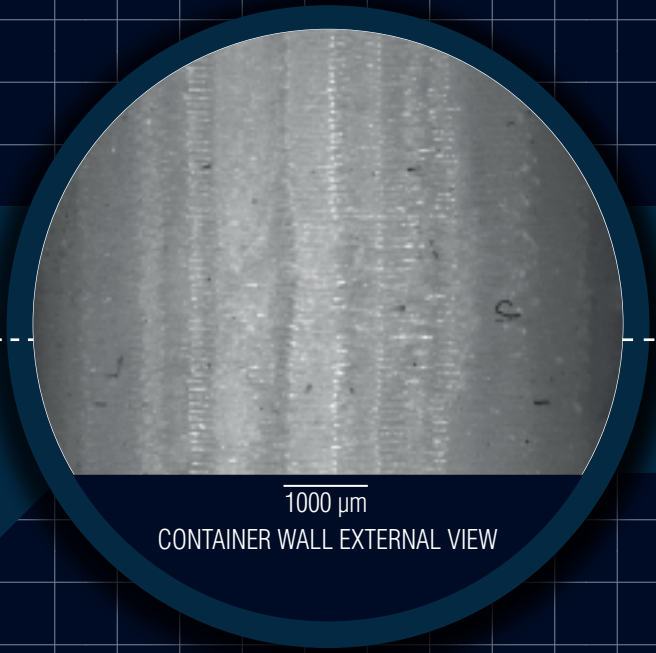
Dati tecnici

Pot-life a 23°C	*:60 min*
Rapporto impiego	*:1 a 1 in peso e in volume*
Primo indurimento a 23°C	*:10 h circa*
Indurimento completo a 23°C	*:4 giorni circa*

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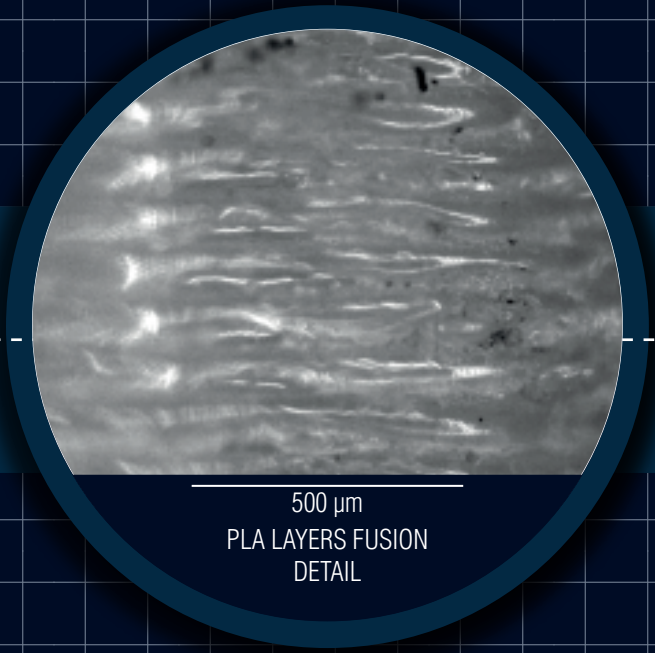
API spa Via Trieste 13 - 16018 Mignanego - Genova (Italy) - Ph. +39010 772.07.51 - Fax +39010 772.02.48





1000 µm

CONTAINER WALL EXTERNAL VIEW



500 µm

PLA LAYERS FUSION
DETAIL



1000 µm

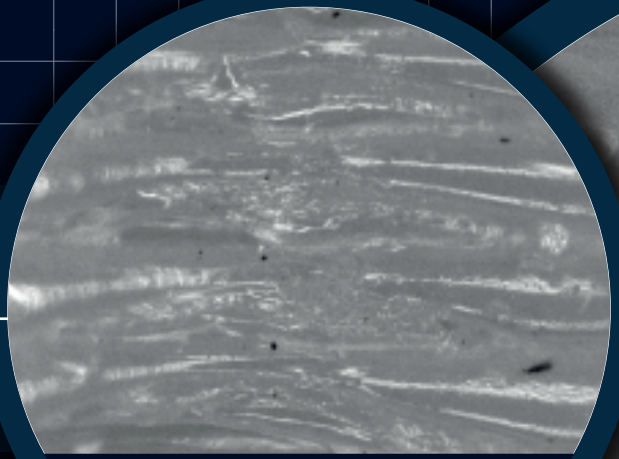
CONTAINER BOTTOM EXTERNAL
DETAIL VIEW



500 µm

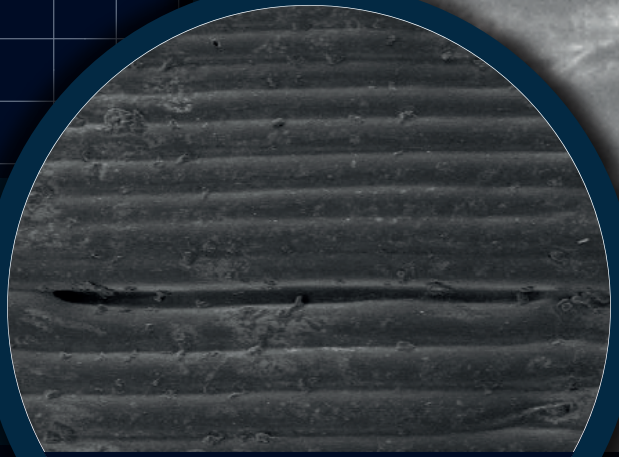
CONTAINER BOTTOM INTERNAL
DETAIL VIEW

3D PRINTED PLA CAPSULES MICROSCOPE VIEW



250 µm

PLA LAYERS FUSION
DETAIL



400 µm

PLA LAYER PORUS DETAIL FROM
CARRILLO AND PAGANELLI
RESEARCH

250 µm

PLA LAYERS FUSION DETAIL SHOWING A TOTAL
FUSION AND COMBINATION WITH
NO PORES

Once printed, the capsule is filled with the healing agent, closed with the cap, and sealed with epoxy resin. The capsule is embedded in concrete ready to be activated when cracking the concrete. Its functioning process is in accordance with the following steps:

1-. Concrete Fissuring:

Due to tensile stress, and other effects (explained in detail in the section 3.1.2.1), cracks are originated in concrete, these forces are able to crack the epoxy layer and PLA container, exposing the healing agent to exterior conditions, environmental moisture or even water

2-. Healing agent activation:

Moisture and/or water in contact with the healing agents catalyzes it (increases the reaction speed in the case of polyurethane; and water activates the powder agent explained in chapter 3).

3-. Healing agent growth

After the activation, the healing agent will increase its size initially blocking the crack (polyurethane will produce a foam in the first 5 minutes with a positive pressure overflowing the crack) this will prevent the access of water into the fissure, protecting the steel reinforcement.

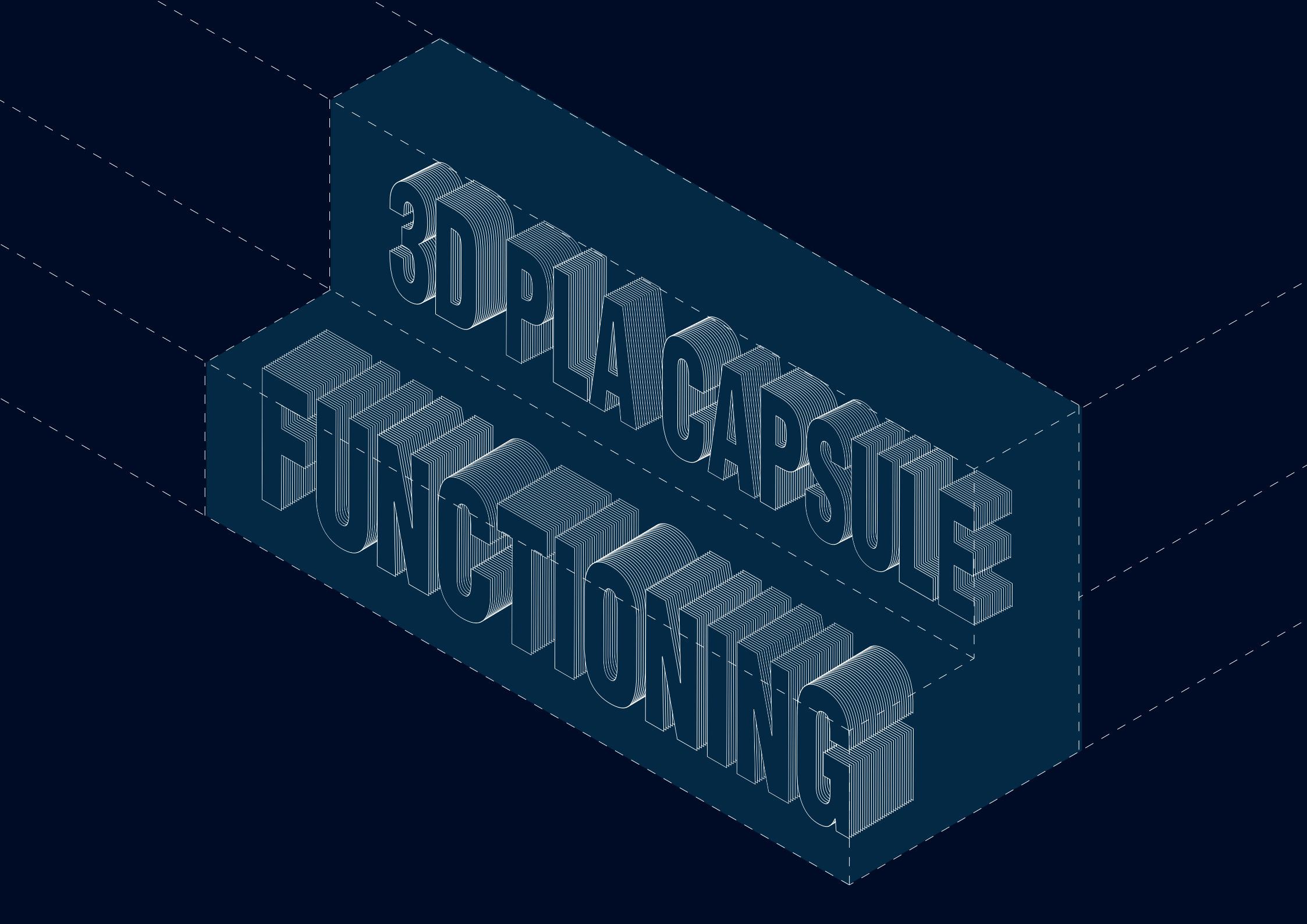
4-. Crack sealing:

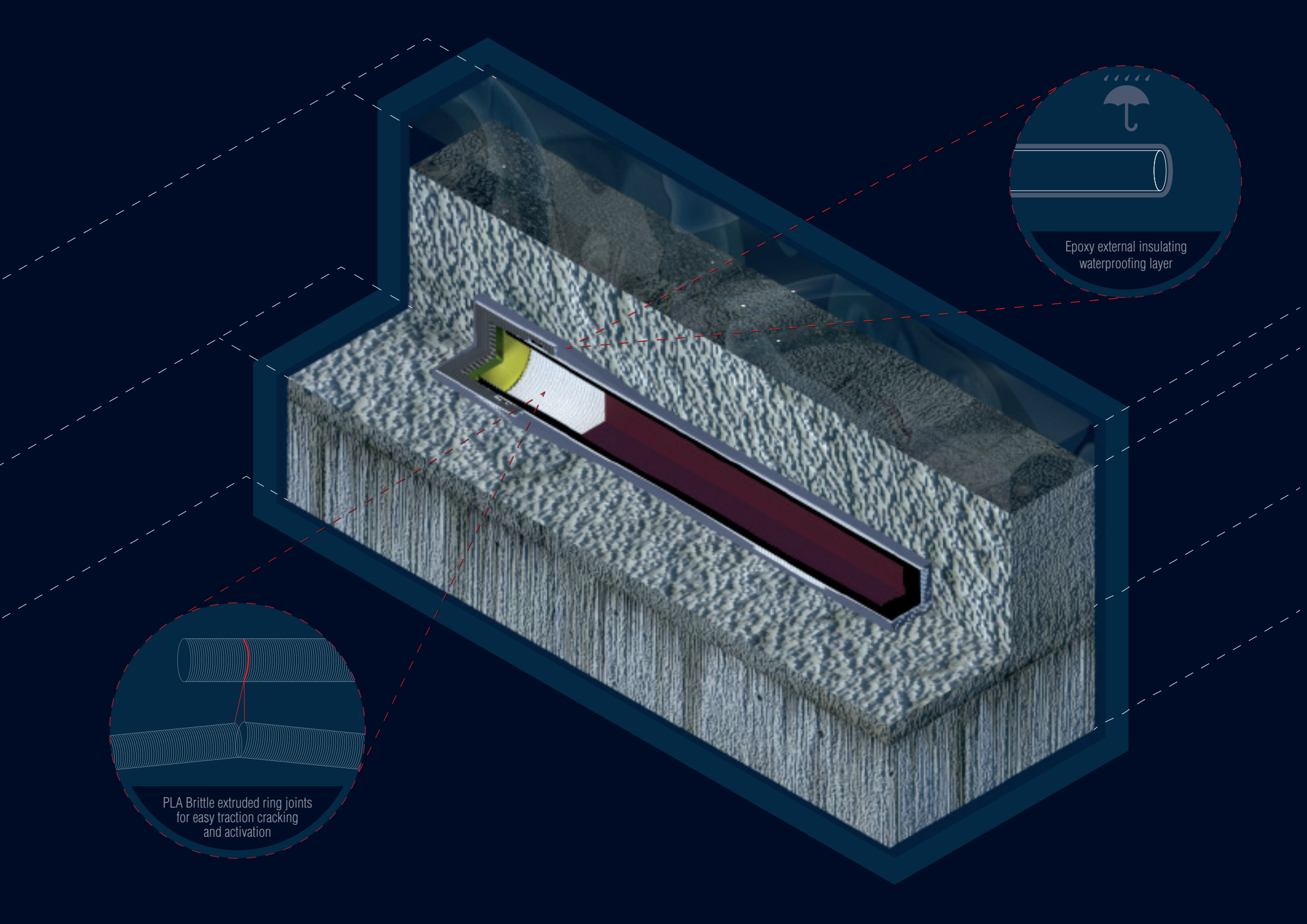
Once blocked the fissure, polyurethane will

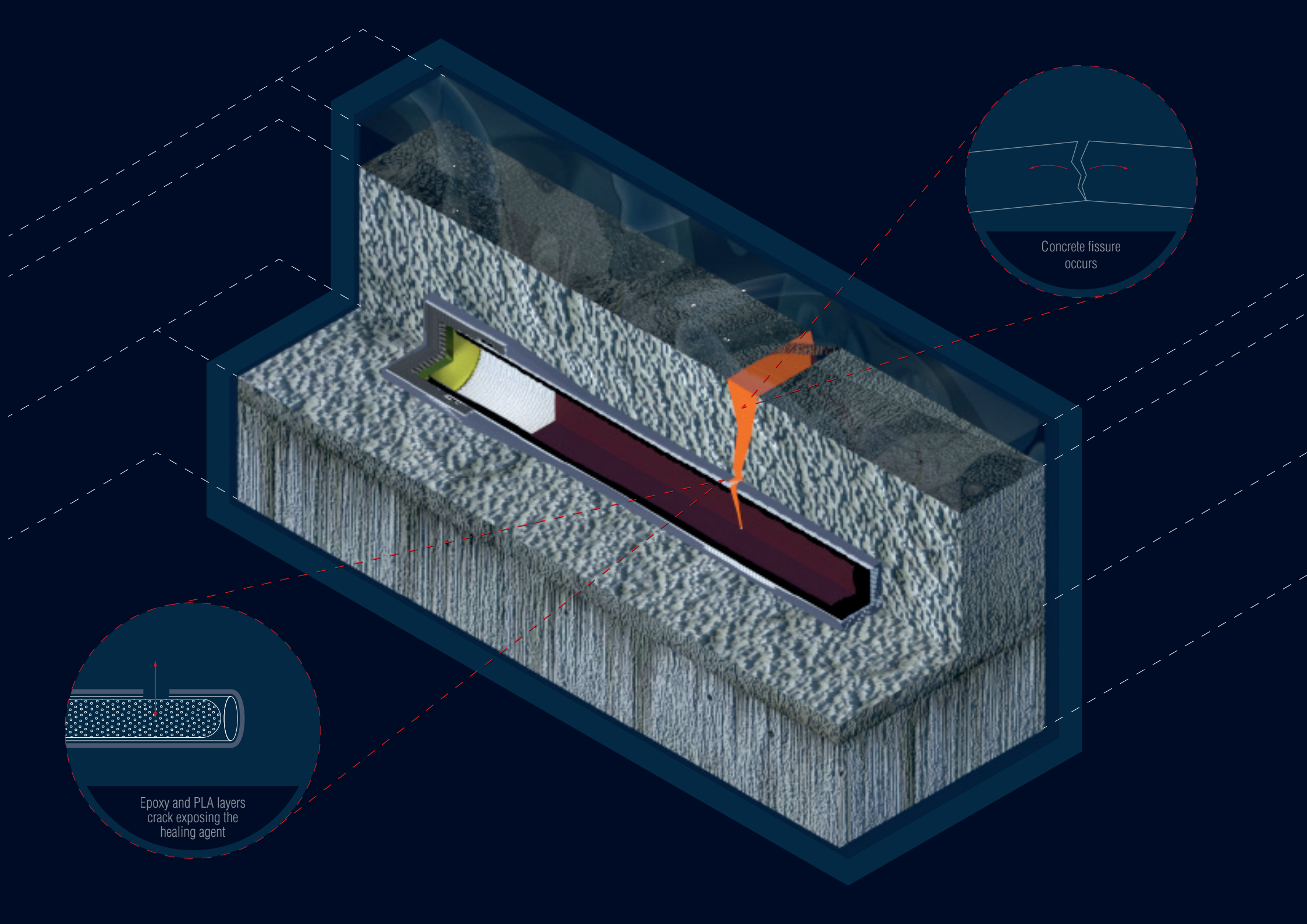
continue growing producing a foam waterproof cap that will act as an external shield for moisture, water and contaminants; then this agent tend to harden until producing an adhesive mass that will keep both surfaces of the fissure joined.

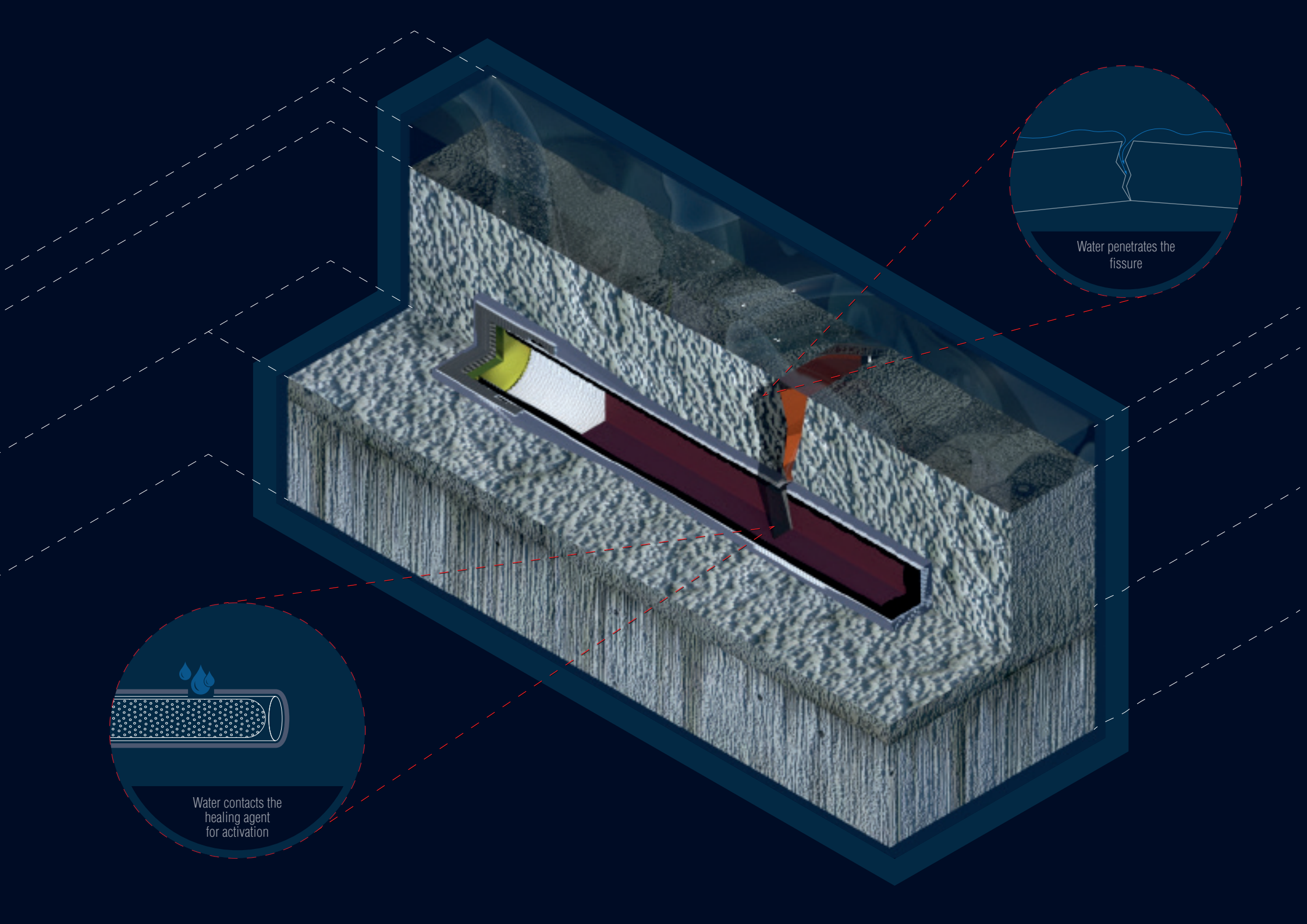
In this case, as polyurethane is already a mix of two components, and water or environmental moisture is only a catalyst, the chemical reaction of these combined parts continue to react into the container.

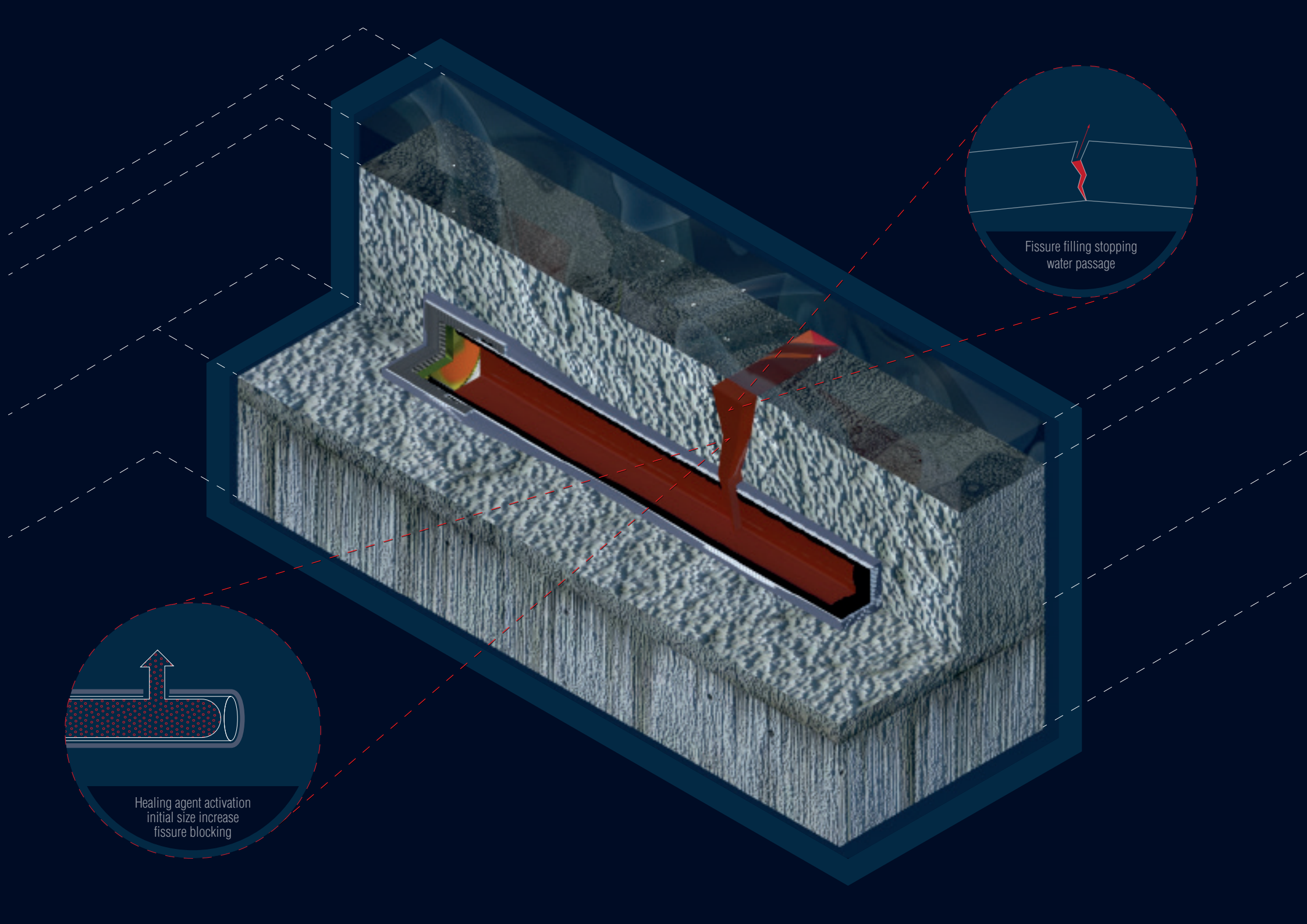
This chemical reaction is very slow, that is to say that for short periods of time it will preserve its expansive an adhesive properties; but for long term, when all the material has slowly reacted inside of the capsule, PU will harden, loosing the foam properties, adhesion, and use.

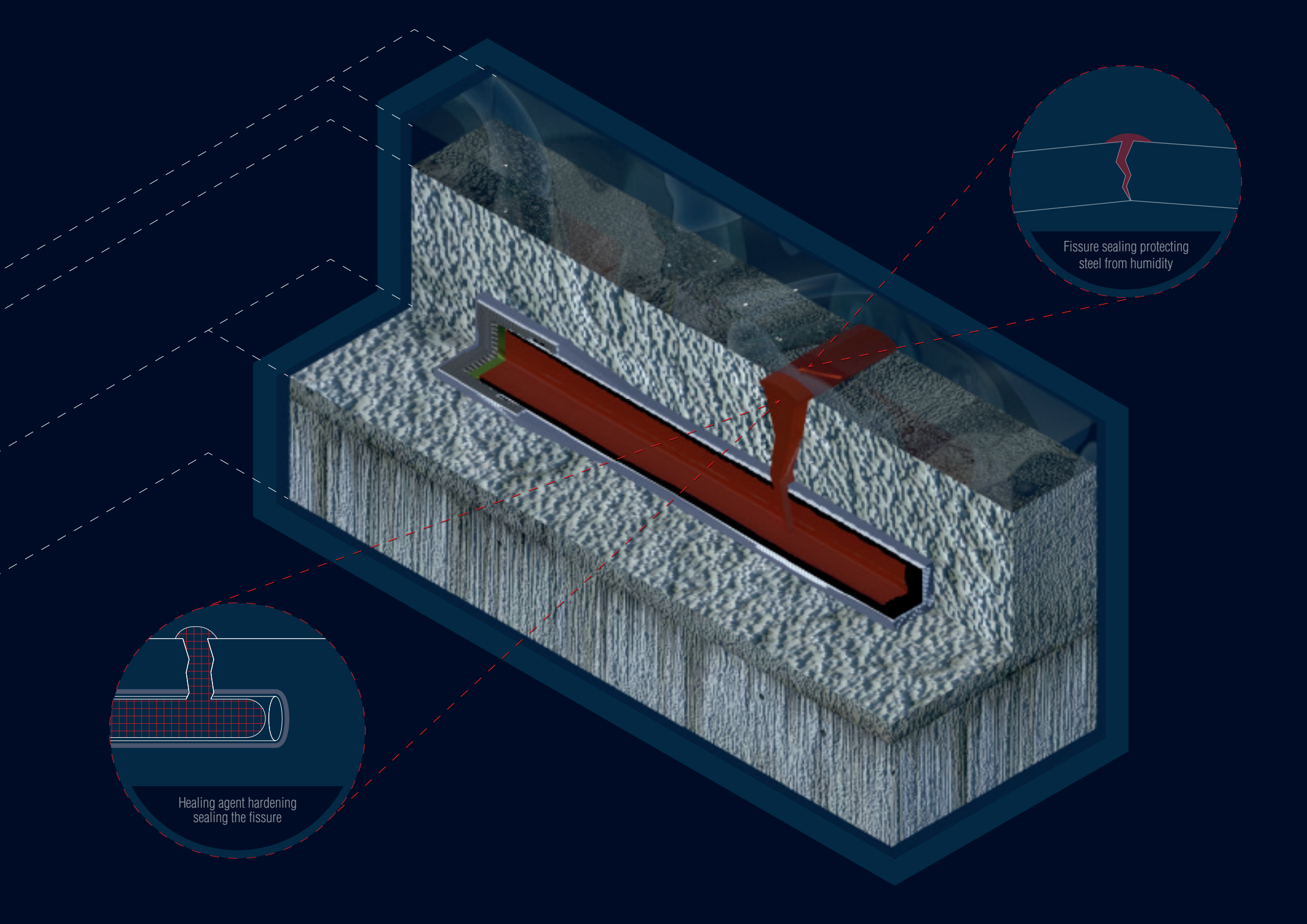

3D PLACAPSULE
FUNCTIONING


Epoxy external insulating
waterproofing layer
PLA Brittle extruded ring joints
for easy traction cracking
and activation


Concrete fissure occurs
Epoxy and PLA layers crack exposing the healing agent


Water penetrates the fissure
Water contacts the healing agent for activation


Fissure filling stopping
water passage
Healing agent activation
initial size increase
fissure blocking


Fissure sealing protecting
steel from humidity
Healing agent hardening
sealing the fissure

3

SOLID HEALING AGENT USING 3D PRINTED AND VIRTUAL CAPSULE



3.1. Introduction

Knowing the liquid healing agents, such as polyurethanes and the different synthetic, expansive and adhesive compounds made of complex polymers and its catalysts; many difficulties for its encapsulation are noticed, such as the perfect waterproofing and the very short period of time available for sealing it before its reaction with ambient humidity.

Also the very short period enclosed in a capsule before its hardening, due to the slow reaction occurring independently of the presence of humidity, taking into consideration that water is a catalyst (and not as an activator), so it continues to react. Furthermore a hardening effect which transforms the agent into a rigid polymer occurs, loosing all the healing abilities.

Taking into consideration all these drawbacks, the idea of producing a solid healing compound, less reactive when enclosed, and requiring the presence of water as an activator of the reaction arises. In other words, a compound which agents are not reactive without the addition of water as a solvent to mix and start the chemical reaction for all of them. This could be an advantage for increasing the capsule's lifespan because of the lack of a chemical medium where these powders can react (also with the lack of any solvent that could evaporate or produce any premature chemical change).

Further, in this chapter, two different possibilities for encapsulating this powdered agent will be explained; one of them, enclosing it into a 3D printed PLA capsule (the same model and composition as the explained in the previous sections), and the other, applying pressure and elevated temperatures for a period of time, to compact it for obtaining a particular shape and be insulated from ambient humidity using an epoxy; economizing in the production of a physical container to store the agent before the waterproofing.

3.2. Solid Agent – Preliminary Approach

As explained in the previous chapter, substances such as polyurethanes or other catalyst and solvents containing healing agents can present a premature hardening condition or very slow chemical reactions reducing its healing capacities. For these reasons, a healing powdered agent is developed, the absence of a liquid media where to react difficult the premature activation of its components.

To obtain the final mixture used for this research, testing different chemical components and substances was necessary, in order to identify through an experimental approach, the one with the best performance possible.

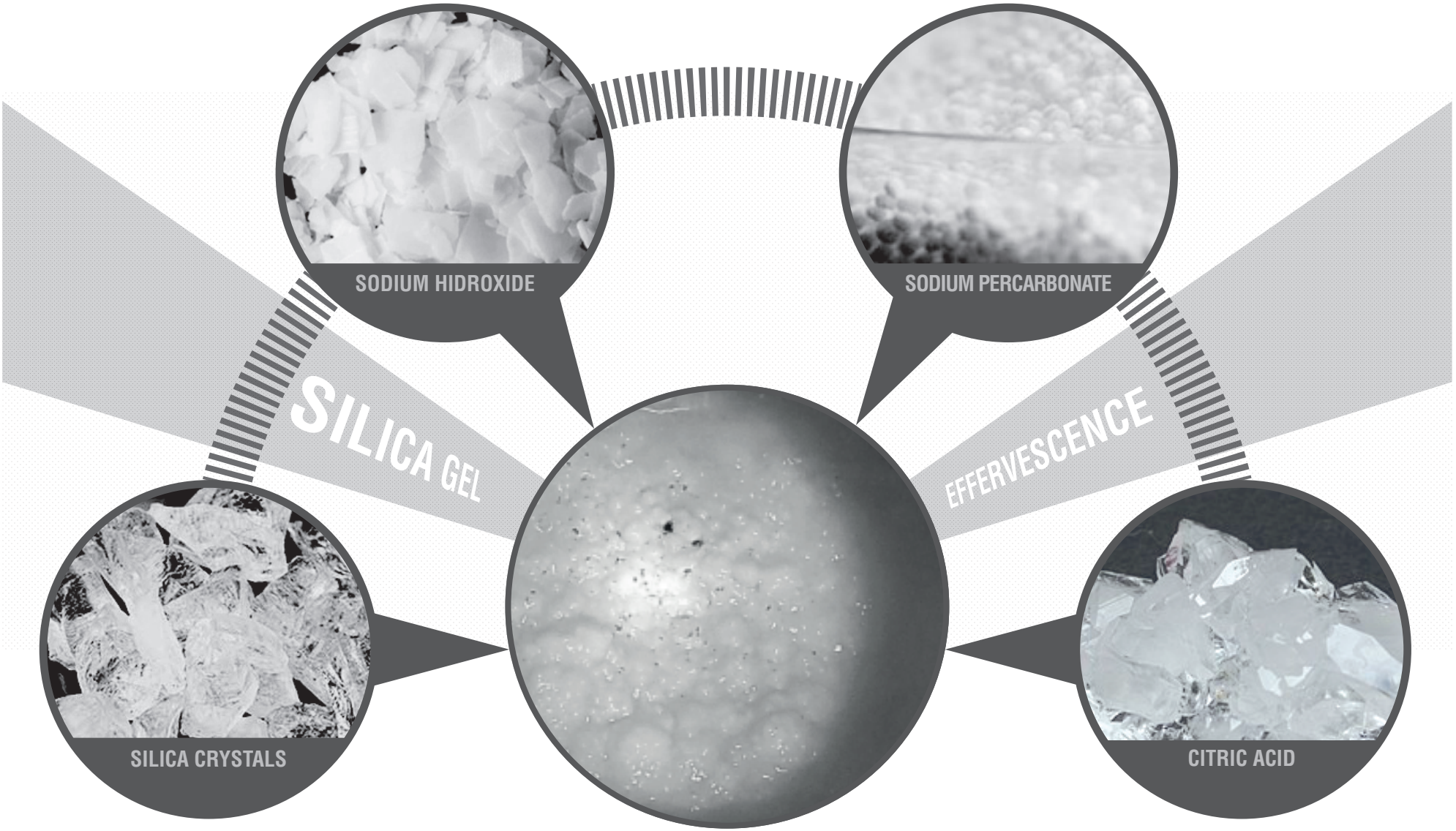
3.2.1 Silica gel mixture tests

Once known the requirements expressed before, the challenge is to produce a combination of powder agents that could be able to expand for blocking fissures, preventing water to access and have direct contact with steel and oxidate concrete's reinforcement, reducing its tensile strength; and produce a solid fixed component for a longer lasting protection. Many preliminary tests for different common compounds in a granulated presentation were required.

A very initial idea was to mix:
—Sodium silicate crystals (Na_2SiO_3),
—Sodium Hydroxide (NaOH),
—Sodium Per—carbonate ($Na_2CO_3 \cdot 1.5\ H_2O_2$)
—Citric Acid ($C_6H_8O_7$)

The logic of this combination was to create a reaction between sodium silicate, sodium hydroxide and water, to produce a liquid silica gel as an adhesive healing agent; complemented with the effervescent reaction occurring between the sodium per—carbonate and citric acid, with the intension of generate a foam with an expansive effect, able to fill up the fissure and attach both parts. Results in these tests were unsatisfactory, due to the plenty of time required for the total hardening of silica gel, and the fact that water, as the solvent of this reaction, is always able to re—melt the compound and penetrate the fissure again; this solution was not violent and quick enough to be considered as an ideal healing agent in this opportunity.

Next page images references:
Silica cristals: COPYRIGHT © 2019 QINGDAO TENSILEWELD WELDING CONSUMABLES CO., LTD.(2019) available at: https://www.tensileweld.com/sodium-silicate-lumps.html
Sodium hydroxide: Happy Bee Garden Co., Ltd (2021). available at: https://it.aliexpress.com/item/32908041429.html
Sodium Percarbonate: CHENGYUAN (2021) available at: https://www.chengyuan-chem.com/spc-sodium-percarbonate/48.html
Citric Acid: wikipdia (2021) Available at: https://en.wikipedia.org/wiki/Citric_acid


SODIUM HIDROXIDE
SODIUM PERCARBONATE
SILICA GEL
EFFERVESCENCE
SILICA CRYSTALS
CITRIC ACID

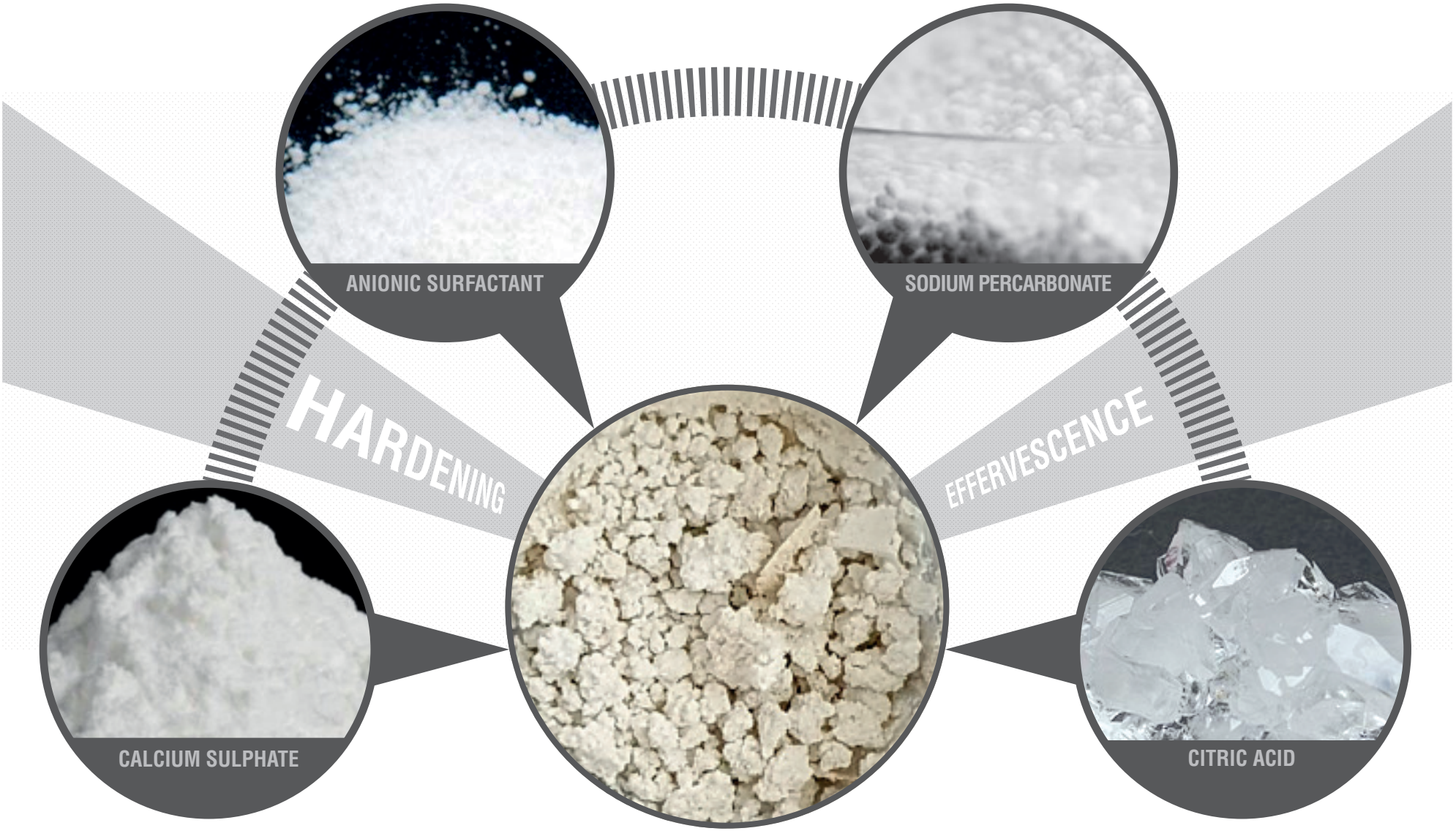
Following the tests procedure, noticing the unsatisfactory results, it was necessary to rethink the compounds,

A second idea was to mix:
—Calcium sulphate dehydrate ($CaSO_4.2H_2O$)
—Anionic surfactant,
—Sodium Per—carbonate ($Na_2CO_3 \cdot 1.5\ H_2O_2$)
—Citric Acid ($C_6H_8O_7$)

This mixture design intension was to produce a gypsum (Calcium sulphate dehydrate) foam by combining it with water, Sodium Per—carbonate and Citric Acid; this reaction initially was very adequate to the expected results, a scum in the beginning of the reaction was produced, but then precipitated quickly when most of the CO_2 of the effervescence effect was released.

It was considered to add an anionic surfactant for these reasons, to support the emulsion and reduce the superficial tension, increasing the reaction with water and expecting to activate the most of the gypsum powder in the less time possible. In this case the result, in terms of a faster reaction and hardening, was very satisfactory, but in spite of the velocity and solidification in this reaction, the final product was very brittle, it presented a very poor resistance to compression and tensile strength; also, after a hardening period and without any other process, gypsum tent to dissolve or disaggregate in presence of water, so the expected durability of the healing effect was not the most adequate for this case.

Next page images references:
Calcium Sulphate: Neelkanth Fitraids And Mineral Products - IndiaMART InterMESH Ltd, 2022. Neelkanth Calcium Sulphate Dihydrate. [image] Available at: <https://www.indiamart.com/proddetail/calcium-sulphate-dihydrate-22483429530.html> [Accessed 3 February 2022].
Anionic Surfactant: Artekas Innovation - Amazon.com, Inc., 2022. Artekas Innovation Sodium COCOYL ISETHIONATE (SCI) - Anionic, Foaming Surfactant - Powder (200 g | 7.06oz). [image] Available at: <https://www.amazon.com/Sodium-COCOYL-ISETHIONATE-SCI-Surfactant/dp/B08W3T2QHZ> [Accessed 3 February 2022].
Sodium Percarbonate: CHENGYUAN (2021) available at: https://www.chengyuan-chem.com/spc-sodium-percarbonate/48.html
Citric Acid: wikipdia (2021) Available at: https://en.wikipedia.org/wiki/Citric_acid


ANIONIC SURFACTANT
SODIUM PERCARBONATE
HARDENING
EFFERVESCENCE
CALCIUM SULPHATE
CITRIC ACID

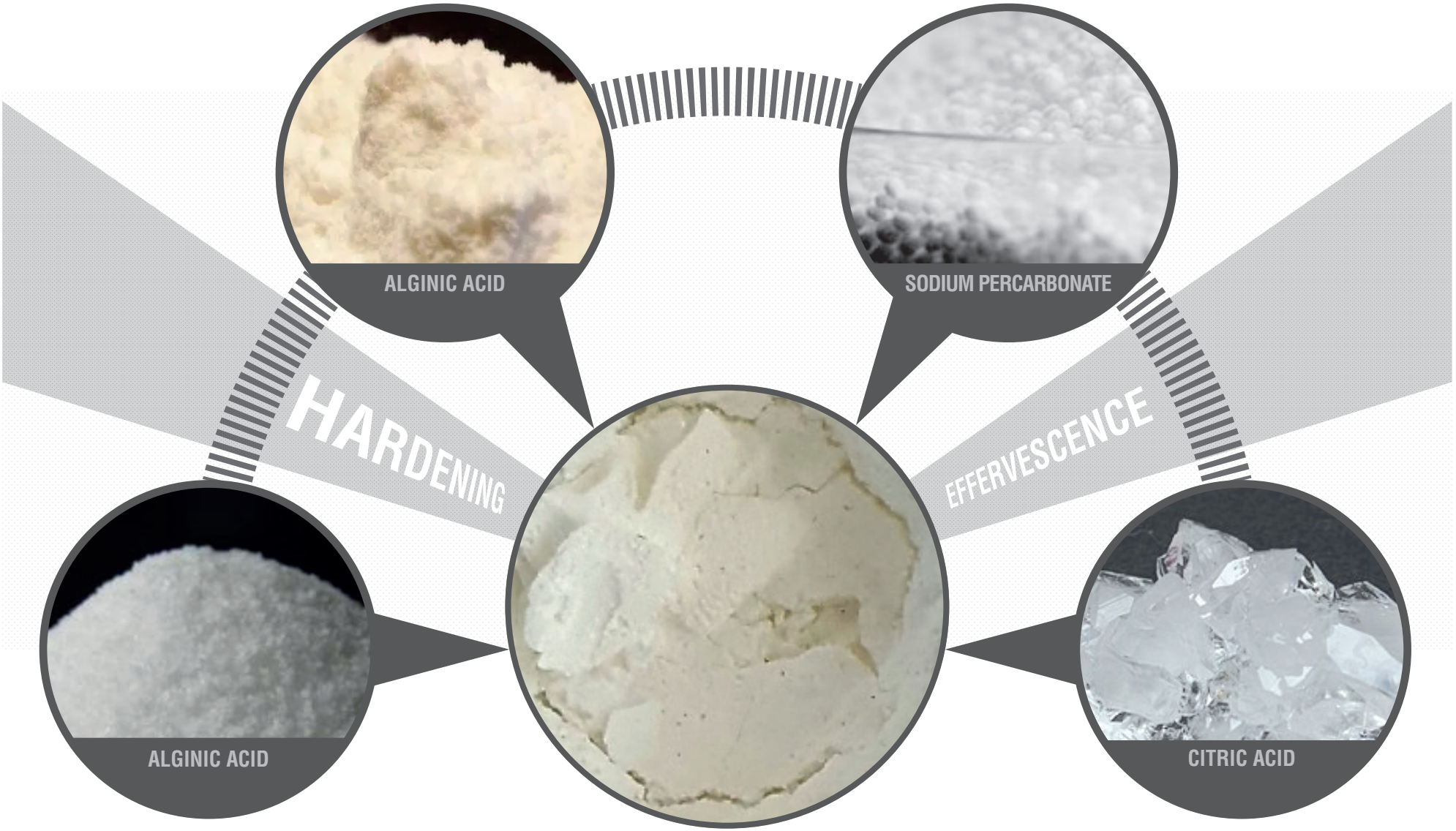
The use a gum forming agent was another hypothesis, testing the following mix:

—Alginic acid ($C_6H_8O_6$)n
—Sodium Per—carbonate ($Na_2CO_3 \cdot 1.5\ H_2O_2$)
—Citric Acid ($C_6H_8O_7$)

"Alginates (ALG) are a group of naturally occurring anionic polysaccharides derived from brown algae cell walls, including Macrocystis pyrifera, Laminaria hyperborea, Ascophyllum nodosum, and several bacteria strains (Azotobacter, Pseudomonas). This term usually referred to alginic acid and its salts, but it can also be used for all derivatives of alginic acid. (...) ALG can be easily formed into diverse semisolid or solid structures under mild conditions because of their unique ability of sol/gel transition. Therefore, ALG are commonly used as viscosity increasing agents, thickeners, and suspension and emulsion stabilizers in food and pharmaceutical industry" (Szekalska Marta et al. 2016. Alginate: Current Use and Future Perspectives in Pharmaceutical and Biomedical Applications. , Article ID 7697031).

In this case, to take advantage of the Alginic acid properties when hydrated was the idea, by producing a compact gum able to preserve a specific shape, commonly used for gypsum figures molds. To produce a foam, as tried in the previous tests, to fill up the fissure and block it was always the intension; but these results were dissatisfying as well, the algin hardening did not occur quick enough to enclose the gas produced in the beginning of the reaction. Also, algin can loose its properties in presence of water after its hardening process.

Szekalska, M. and et al, 2016. Alginate: Current Use and Future Perspectives in Pharmaceutical and Biomedical Applications. International Journal of Polymer Science. Hindawi Publishing Corporation, [online] (7697031), pp.1-17. Available at: <https://core.ac.uk/download/pdf/195004404.pdf> [Accessed 6 October 2021].
Next page images references:
Alginic Acid (inferior image): Aashi Chem - IndiaMART, 2022. Alginic Acid, Packaging Size: 25 Kg, Packaging Type: Bag. [image] Available at: <https://www.indiamart.com/proddetail/alginic-acid-14302319373.html> [Accessed 3 February 2022].
Alginic Acid (superior image): Prem Chand & Sons - IndiaMART, 2022. Sodium Alginate Powder, 25 Kg. [image] Available at: <https://www.indiamart.com/proddetail/textile-grade-sodium-alginate-17881407955.html> [Accessed 3 February 2022].
Sodium Percarbonate: CHENGYUAN (2021) available at: https://www.chengyuan-chem.com/spc-sodium-percarbonate/48.html
Citric Acid: wikipdia (2021) Available at: https://en.wikipedia.org/wiki/Citric_acid


ALGINIC ACID
SODIUM PERCARBONATE
HARDENING
EFFERVESCENCE
ALGINIC ACID
CITRIC ACID

3.3. Solid healing agent development:

3. Chapter 3: Solid Healing Agent using 3D Printed and Virtual Capsule

The core of this research, as an innovative contribution in self–healing concrete, is the development of a powder healing agent that block concrete's fissures without the complications of managing liquid agents as expressed before. The three previous tests were hypothesis that conducted to the reasoning of a viable chemical agents combination that could fulfill the requirements presented before. In this section of chapter III the final mixture used, its components and functioning will be explained.

3.3.1 Solid healing powder composition:
3.3. Solid healing agent development:

As the previous tests were very intuitive, by using basic notions of materials behavior (useful to have a starting point to define a direction to focus the research), a mapping of different procedures was developed to obtain more information. The most of the existing self healing techniques require liquid agents and very few studies used powdered components; anyway, it is a reference from The Faculty of Engineering and Architecture from Ghent University (Belgium) presenting similar concepts:

> *"Concrete has an autogenous healing capacity as unhydrated cement is present in the matrix. When water contacts the unhydrated cement, further hydration occurs. Furthermore, dissolved CO_2 reacts with Ca2+ to form CaCO3 crystals. These two mechanisms, however,* ***may only heal small cracks****. (Kim Van Tittelboom, Didier Snoeck). (...)*
>
> *Superabsorbent polymers (SAP), or hydrogels, are able to take up a large amount of fluid (up to 500 times their own weight) and to retain it in their structure without dissolving. When cracks occur, SAP are exposed to the humid environment and swell. This swelling reaction partly seals the crack from intruding potentially harmful substances. After swelling, SAP particles desorb and provide the fluid to the surrounding matrix for internal curing, further hydration and the precipitation of CaCO3. In this way, cracks may close completely. (Didier Snoeck)*
>
> *Due to the fact that the pH in concrete drops from 12.8 to 9-10 when a crack occurs, it is useful to investigate pH sensitive hydrogels. These will only swell when a crack occurs and fresh water penetrates. (Arn Mignon)" (Ghent University. 2014. available at: https://www.ugent.be/ea/structural-engineering/en/research/magnel/research/research3/selfhealing)*

Reference:
-Gent University and Gruyaert E., Snoeck D., Steuperaert S., Van Tittelboom K, Wang J., 2014. Self-healing of concrete. [online] Universiteit Gent. Available at: <https://www.ugent.be/ea/structural-engineering/en/research/magnel/research/research3/selfhealing> [Accessed 23 November 2021].

In this article, that collects results and experiences from different researches, the use of super–absorbent polymers is evident; with the intension of producing a cap waterproofing effect, this concept is very useful for fissures presenting minor dimensions.

SAP itself could not be able to successfully block large fissures; also, this material is very susceptible to erosion and could be easily removed from cracks water or air currents, specially when the crystals expel all the humidity contained, reducing its size and superficial tension.

Based on this information, it is possible to rethink the mixture; making away with the idea of producing a foam and substituting it with SAP, as a size increasing blocking agent.

Also, an adhesive component in the healing agent is required, in this case cement is a very compatible choice by being a water reactive powdered material, able to produce a join between both crack parts, keeping SAP crystals on its position, and reducing the erosion susceptibility. Cement also presents similar dilation coefficient of concrete, where the fissure is occurring.

The final mixture is composed by the following agents combination:

- Alpha (α): Fast hardening cement.
- Beta (β): The combination of Sodium Acid Carbonate, Malic Acid, and Tartaric Acid.
- Gamma (γ): Sodium Polyacrylate crystals.

Gamma: is a growing agent in presence of water for producing the fissure blocking; Beta: is a physical mixing agent that supports the combination of every component with water and the powdered material dis—compacting, exposing the most of the grains contact surface possible; Alpha: is an adhesion compatible element to connect both fissure sides and keep gamma crystals in place.

3.3.1.1 Alpha Component - Fast Hardening Malta

3.3.1 Solid healing powder composition:

3.3. Solid healing agent development:



Alpha component is the binder element of the mix, in this case, setting and hardening time are crucial to control cracks. This selected cement malt mix, present an acceptable setting and resistance, in the lower time possible, and without the use of any other liquid admixture.

Images references:

-Ambiente Colore Srl (n.d.). Cemento rapido grigio. Marca:Rassasie. Available at: https://www.ambientecolore.net/it/prod/cemento-rapido-in-polvere-rassasie-649

"CARATTERISTICHE TECNICHE: Il cemento rapido è una miscela di cementi grigi, inerti quarziferi e additivi speciali in grado di sviluppare resistenze meccaniche elevate in intervalli di tempo molto brevi e con minimi ritiri. (...) Mescolare il cemento rapido con 23-25% di acqua fresca e pulita calcolato il peso sulla polvere, avendo cura di versare sempre la polvere in acqua e non il contrario, fino ad ottenere una pasta priva di grumi. (...)

PRESTAZIONI FINALI

Resistenza alla compressione a 15 minuti: 6 N/mm2

Resistenza alla compressione a 1 ora: 9 N/mm2

Resistenza alla compressione a 3 ore: 15 N/mm2

Resistenza alla compressione a 3 giorni: 25 N/mm2

Resistenza alla compressione a 28 gg.: 40,5 N/mm2

Resistenza alla temperatura: da -30°C a +90°C"

(Rassasie. 2021. scheda tecnica)

<< Technical data: The "Fast Cement" is a mixture of gray cement, inert quartz, and special admixtures; able to develop elevated mechanical resistance in brief time period and with minimal retraction. (...) Mix "Fast Cement" with 23-25% of clean fresh water, calculated in weight in reference to the powder, giving attention to pour the powder in water and not vice, untill obtaining a pasty consistence without lumps.

Final Feautres:

Compressive ressistance at 15 min.: 6 N/m2

Compressive ressistance at 1 hour: 9 N/m2

Compressive ressistance at 3 hours: 15 N/m2

Compressive ressistance at 3 days: 25 N/m2

Compressive ressistance at 28 days 40.5 N/m2

Temperature resistance: from -30ºC to +90ºC>>

(English translation by author: A. Panza Uguzzoni. Reference cite: Rassasie. 2021. scheda tecnica)

RASSASIE. Codice Fiscale: 00627720378. Partita Iva: 00519761209, 2021. SCHEDA TECNICA Prodotto : CEMENTO RAPIDO. [online] Bologna, Italy. Available at: <https://www.rassasie.com/prodotti/cementi/cemento-rapido.html> [Accessed 10 November 2021].

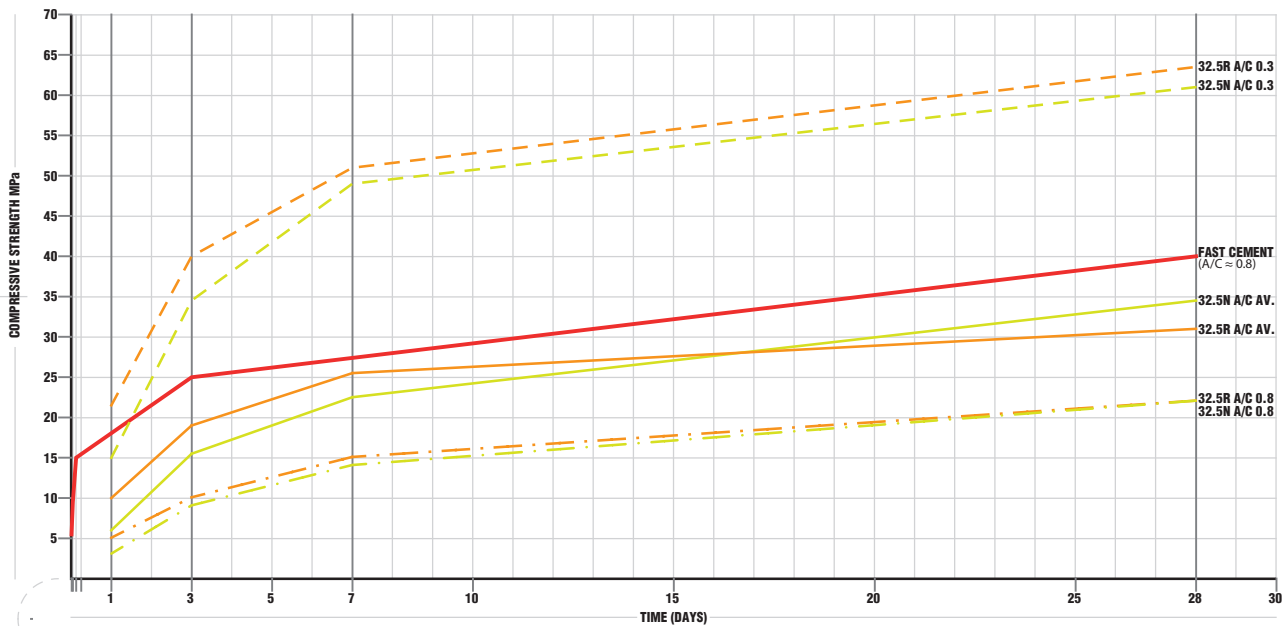
Due to the mechanical strength reached in the very first minutes of the hardening period with the less retraction possible, this cementitious material has been specifically chosen for the production of the powder agent, reducing also the possibility of pores and fragile points when activated. In the following graph, the comparison of this material (fast cement) with a 32.5N and a 32.5 R cement, (including its different referential water/cement ratios) is presented.

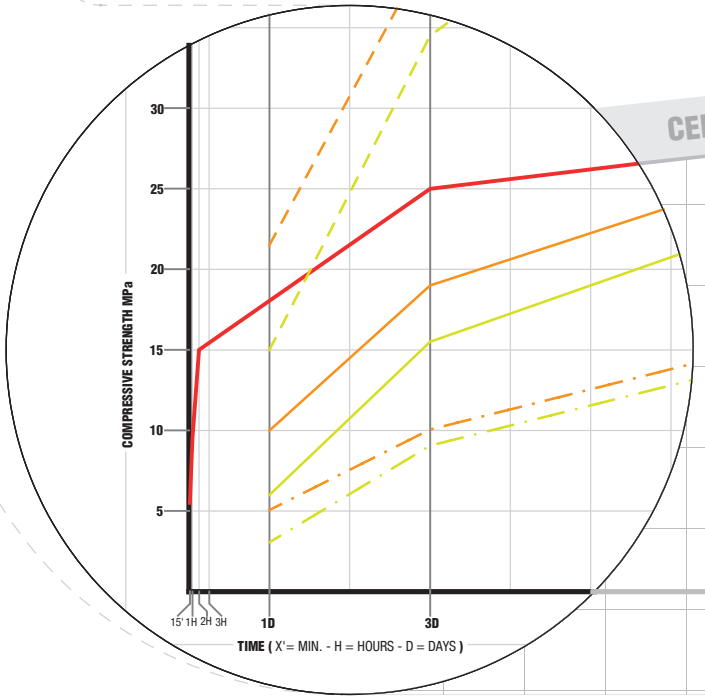
According to the technical data (extended information available on annexes 3.3.1.1.A), it is known that the "fast hardening cement" contains a 25 to 35% of Portland cement clinker, and it is suggested to be prepared with a 25% of water (in weight); following this logic it is possible to estimate a W/C ratio of ≈ 0.8.

Known the W/C of the product used, it was compared with both 32.5 cement presentations in different W/C conditions, one at 0.3 (the highest resistance), which is barely probable to obtain into a capsule enclosed on a crack; another at 0.8, the same relation as the one presented in the fast hardening cement; and another calculating and average of the ratios from 0.3 to 1.0. (References in annexes 3.3.1.1.B).

In this way, the fast cement can be considered as the fastest hydration and reaction in the less time possible, presenting in 15 minutes the compressive strength that 32.5 R and N cement develop in 1 or 2 days (at least considering the average and the 0.8 W/C).

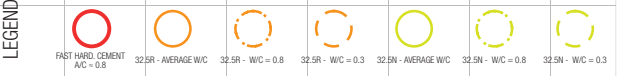
Images references:
Image produced by the author: Panza, A (2021) using the following references (graphics available in the annexes section):
-RASSASIE. Codice Fiscale: 00627720378. Partita Iva: 00519761209, 2021. SCHEDA TECNICA Prodotto : CEMENTO RAPIDO. [online] Bologna, Italy. Available at: <https://www.rassasie.com/prodotti/cementi/cemento-rapido.html> [Accessed 10 November 2021].
-Coppola, L., Buoso, A., Crippa, E. and Lorenzi, S., 2015. STRUCTURAL MATERIALS EXERCISES HANDBOOK APPENDICI A - B. [ebook] pp.1-40. Available at: <http://www00.unibg.it/dati/corsi/20057/71243-Appendici%20A%20e%20B_rev2015.pdf> [Accessed 22 November 2021].





CEMENT COMPRESSIVE STRENGTH COMPARISSON

Comparison of the Fast Hardening Cement (cemento rapido "Rassasie") with the 32.5R and 32.5N compressive strength development in time. In the upper part is shown the 28 days period, in the circle zoomed graphic has been detailed the very initial behavior of the fast cement hardening, as declared by the company (it has been estimated a W/C =0.8 for fast cement). Reference data in annexes 3.1.1.2.1B.



3.3.1.2 Beta Component - Acid - Base - Neutralization

3.3.1 Solid healing powder composition:

3.3. Solid healing agent development:



Beta component as explained before, is required to produce an effervescent effect. In Italy, there is a traditional use of many commercial products for this function on drinkable water, with long conservation and lasting periods, safety use and barely pollutant. The commercial product "Idrolitina" is the most adequate for this research, because of its reaction's velocity and violence, and due to the absence of sugar, colorants or other compounds that could affect the cement reaction.

Images references:

-Dambros (n.d.). Preparato per acqua da tavola 20 buste idrolitina 200g Ristora. Available at: https://dambros.it/ecommerce/prodotto/id/0000030231/

"Idrolitina è il nome di una nota polvere per rendere l'acqua naturale effervescente. Una volta sciolta in acqua, idrolitina permette di ottenere una bevanda dissetante e rinfrescante, indicata anche a fine pasto per facilitare la digestione. Nella sua formulazione classica, idrolitina si presenta come una polvere granulare bianca, che a contatto con l'acqua libera una piacevole effervescenza. (...) Si tratta nello specifico di una polvere ad uso alimentare "da aggiungere all'acqua per renderla effervescente" (...) La miscela di polveri contenuta nelle bustine di idrolitina è stabile in assenza di acqua, mentre a contatto con essa il bicarbonato di sodio reagisce con gli acidi liberando anidride carbonica, responsabile dell'effervescenza. www.prezzisalute.com. (...)

Ingredienti: Carbonato acido di sodio (E 500), acido malico (E 296), acido tartarico [L(+)-] (E 334)."

(Ferraressi, G. 2020. Copyright © PrezziSalute.com.Testo Riproducibile Citando la Fonte: https://www.prezzisalute.com/Integratori/Idrolitina.html)

<< Idrolitina is the name of a commercial powder to transform natural water into effervescent. Once dissolved in water, Idrolitina permits to obtain a refreshing drink, indicated for after lunch to facilitate digestion. On its classic formula, Idrolitina is presented as a granulated white powder, that, in contact with water, produces an effervescent effect. (...) Is specifically a dietary powder to add on water to make it effervescent (...) The powder mix contained in every pack is stable in absence of water, but, in contact with it, sodium bicarbonate reacts with the other acids releasing carbonic anhydride, resposible for the effervescence (...)

ingredients: Sodium Acid Carbonate (E 500), Malic Acid (E 296), and Tartaric Acid [L(+)-] (E 334)>>

(English translation by author: A. Panza Uguzzoni. Reference cite: Ferraressi, G. 2020. Copyright © PrezziSalute.com. Testo Riproducibile Citando la Fonte: https://www.prezzisalute.com/Integratori/Idrolitina.html)

Acid base obtainment from generic salts at 99% concentration for not depending of a commercial product:

As seen in the previous section, the acid base component used is a commercial product, but this may not be found at any part of the world or can be not practical for a mass production, for this reason the proportions of Malic Acid, Sodium Bicarbonate, and Tartaric acid was calculated, in order to obtain it with raw salts (the original components at 99% concentration).

For its obtaining, the commercial product is reacted with water, measuring its pH and the volume of gas released from a controlled amount; in this case 0.50 gr of mixture in 50 ml of distiled water.

It was necessary to use an Erlenmeyer flask to mix the substance, closing it with a cap, connected to a pipe inserted on a water filled inverted graduated cylinder posed on a water filled tray, producing a communicating vessel effect for measuring the CO_2. When the gas is produced, is able to move through the pipe and accumulate in the cylinder, displacing the water to the tray and accumulating, to be measured with the cylinder marks to know the final amount released (as shown in the following figures).

The data obtained from the commercial product is: 50 ml of gas and a solution pH of 5.10; from a reaction of 0,50 gr of mix with 50 ml of distilled water at 19,8C°.

This data was included in the perfect or ideal gas formula:

$$PV=nRT$$

P: gas pressure
V: gas volume
n: Mols number
R: ideal gas constant (0.082 atm*Liter/(mol*Kelvin)
T: temperature in Kelvin

The variable n is cleared:

$$n = \frac{P * V}{R * T}$$

$$nCO2 = \frac{1atm * (50ml * \frac{1000ml}{1L}}{0.082 * (19.8C\text{º} + 273)}$$

The number of moles of CO_2 are 0.02 in this reaction; by using the atomic mass of sodium bicarbonate (the main responsible of gas formation, where the HCO_3^- from this component reacts as $HCO_3^- + H_3O^+$ producing $2H_2O+CO_2$), is found the mass in grams, due to the relation of 1 mol of Sodium bicarbonate produces 1 mol of CO_2:

$$nCO2 = \frac{mass\ gr\ Na\ bicarbonate}{84{,}007\ Bicarbonate\ atomic\ mass}$$

Clearing the variable of the mass of sodium bicarbonate:

$$m(gr)Na\ bicarbonate = \frac{0.002mol}{84{,}007}$$

Obtaining a mass of 0,17 gr of sodium bicarbonate, and a resultant mass of 0,33 grams from the mix of malic and tartaric acid; forming the total 0.50 gr used.

These calculations were only referential, to obtain a starting point and producing a series of proportions tests, measuring the pH until obtaining the final combination. It is also important to know that in the original product the malic acid is used as an acidity corrector, so its amount must be minor than tartaric.

The initial test used equal proportions: , 0.165 gr malic acid (M), 0.165 gr tartaric acid (T), 0.17 gr bicarbonate(B), giving as result a PH of 2.6 (proportion M:T:B 1:1:+−1).

Then, by reducing tartaric acid and increasing malic acid, M = 0.082 gr, T = 0.248 gr, B = 0.17 gr; with a pH of 2.36 (proportion M:T:B 0,5:1,5:1).

As PH value kept on decreasing, to obtain the opposite effect and approximate better the 5.1 PH value desired, the sodium bicarbonate was increased: M = 0.082 gr, T = 0.246 gr, B = 0.246 gr, obtaining pH of 3.25 (proportion M:T:B 0.5:1.25:1.25)

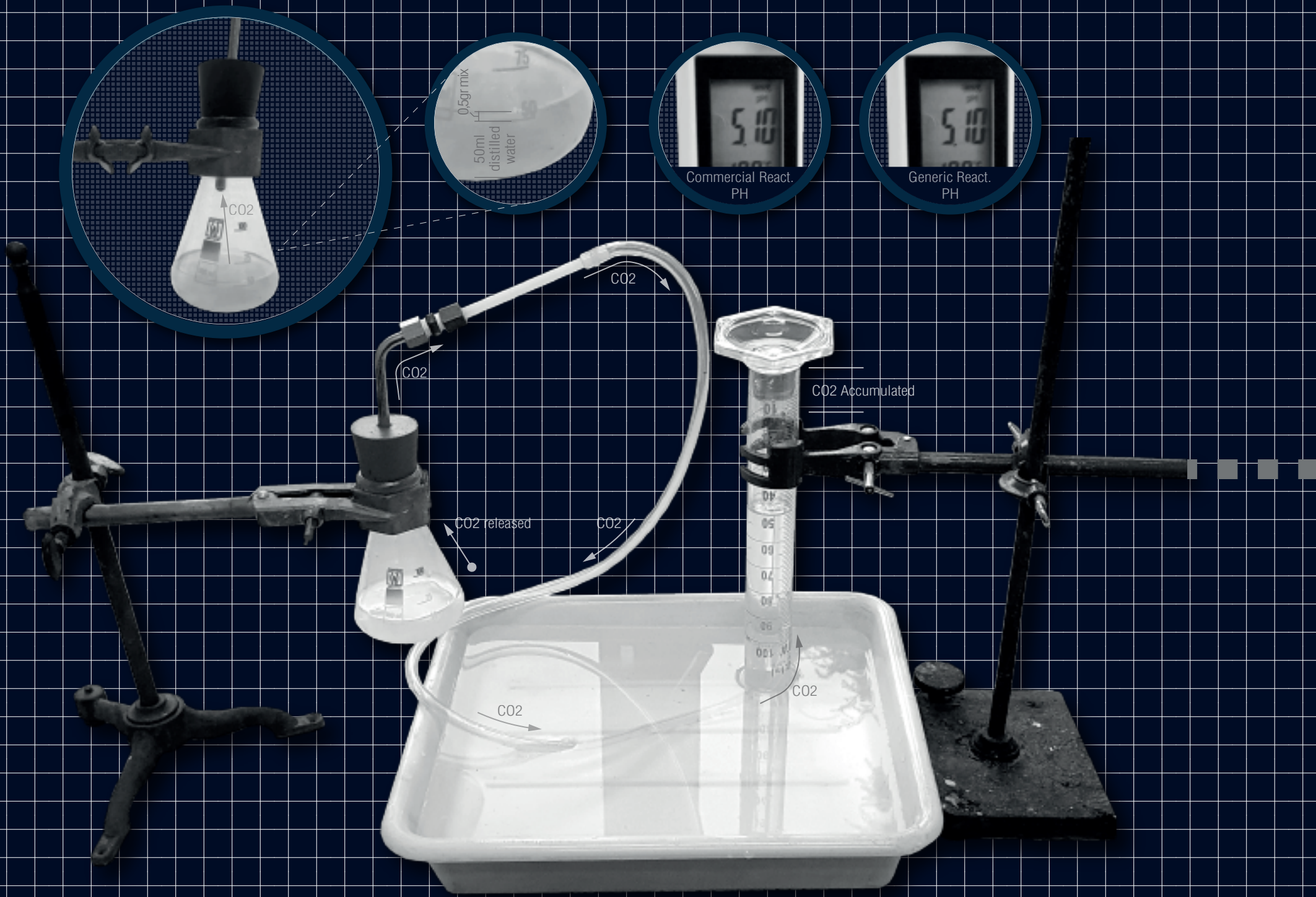
As this last operation was successful, the malic is reduced and the subtraction distributed into the other two components. M = 0.041 gr, T = 0.246 gr, B = 0.287 gr; obtaining a pH of 3.85 (proportion M:T:B 0,25:1,25:1,5).

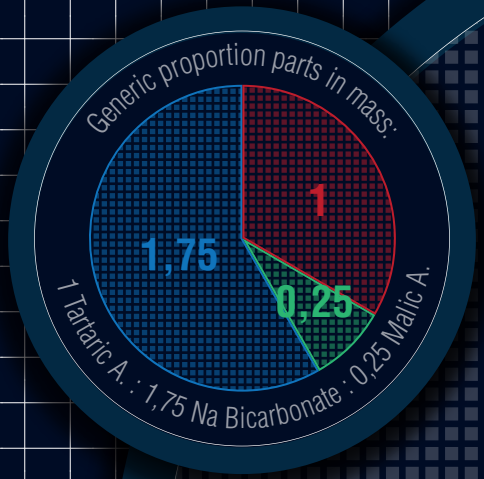
The final combination presenting the better results is: M = 0.062 gr, T = 0.126 gr, B =

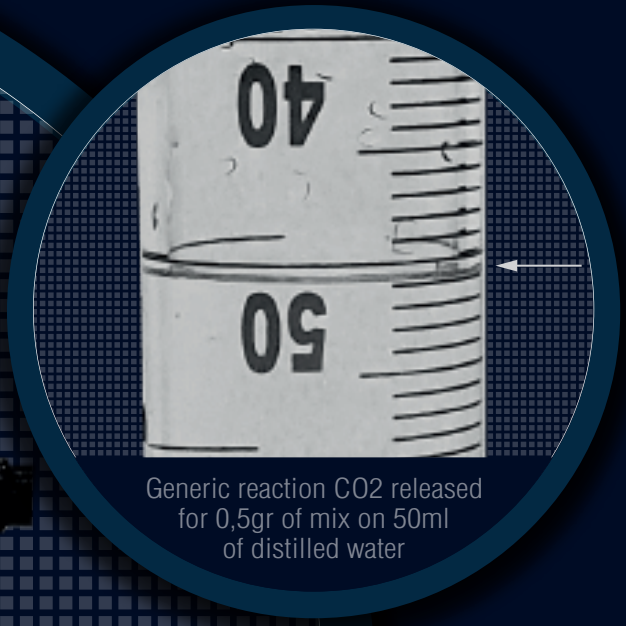
0,312 gr, obtaining a pH of 5.1, such as the commercial product (proportion M:T:B 0,25:1:1,75)

After obtaining the proportion, the gas measuring test is repeated, but now using the generic salts using the relation M:T:B of 0,25:1:1,75.

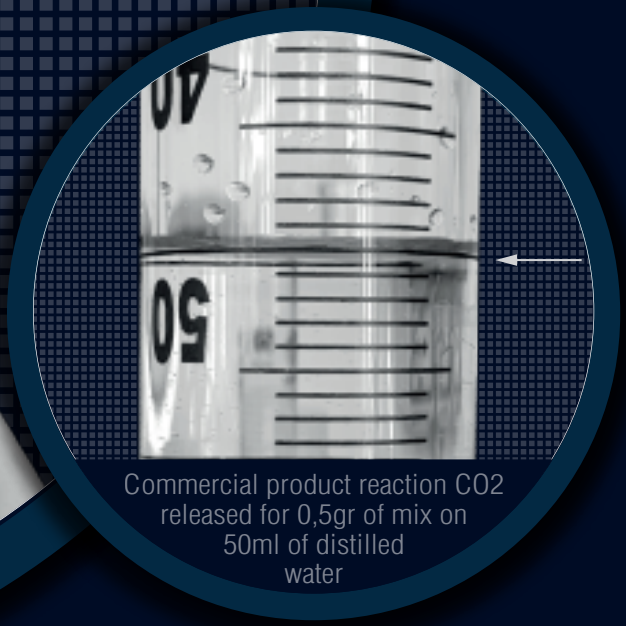
From this experience 50ml of CO_2 were released, the same amount the commercial product presented; that is to say at least in the variables required for this research and correct functioning of the powder healing agents such as pH and CO_2 volume, this generic mixture design can be a perfect substitute, turning the process into a more universal method, using basic chemical products found practically worldwide.


CO2
0,5gr mix
50ml distilled water
Commercial React. PH
Generic React. PH
CO2
CO2
CO2 Accumulated
CO2 released
CO2
CO2
CO2





Generic reaction CO2 released for 0,5gr of mix on 50ml of distilled water



Commercial product reaction CO2 released for 0,5gr of mix on 50ml of distilled water

3.3.1.3 Gamma Component - Sodium Polyacrylate Crystals

3.3.1 Solid healing powder composition:

3.3. Solid healing agent development:



For Gamma component the obtainment of a powder able to increase it size and block the fissure to avoid excess of water penetrating it is required, for this reason Sodium Polyacrylate is ideal.

Images references:

-Alibaba.com. All rights reserved © (1999-2021). Environmental Hydrogel For Agriculture Super Absorbent Polymer goods in stock. Available at: https://www.alibaba.com/product-detail/Environmental-Hydrogel-For-Agriculture-Super-Absorbent_60441616298.html

"ISodium polyacrylate is an example of a superabsorbent polymer. Superabsorbents operate on the principle of osmosis, the passage of water through a membrane permeable only to the water. Here, osmotic pressure results from the difference in sodium ion concentration between the inside of the polymer and the solution in which it is immersed.

This osmotic pressure forces water into the solid polymer lattice in an attempt to equilibrate sodium ion concentration inside and outside the polymer. The electrolyte concentration of the water will effect the osmotic pressure, subsequently affecting the amount of water absorbed by the polymer. For example, sodium polyacrylate will absorb approximately 800 times its own weight in distilled water, but will only absorb about 300 times its own weight in tap water, due to the high ion concentration of tap water.

Sodium polyacrylate is manufactured by the free-radical polymerization of a mixture of sodium acrylate and acrylic acid, and a cross linker such as trimethylol propanetriacrylate (...)

Sodium polyacrylate is nontoxic. However, it is irritating to the eyes and also to nasal membranes if inhaled"

(© Flinn Scientific, Inc. All Rights Reserved. (2017). Sodium Polyacrylate Superabsorbent Polymers. Publication No. 755 032417. Available at: https://www.flinnsci.com/api/library/Download/70bf9b583a324cf2929d7974bd700f80)

Once selected all of the components because of its specific characteristics (cement due to its fast initial hardening; Acids and base due to the velocity, violence of reaction and long lasting in powder; polyacrylate crystals because of its potential size increase, reduced grain size, capacity of absorption–release of water in multiple times without ruining, and long lasting while dry), the behavior between all of them reacting together must be evaluated, considering that all of the elements presents different chemical reaction velocity, being this delay ideal for the aim proposed.

The reaction occurs in 5 main phases:

1–. Effervescence: Mix and dis–compacting;

2–. Polyacrylate absorption: fissure blocking and water retention;

3–. Cement Activation: fissure filling;

4–. Cement Hardening and Cure: fissure reduction;

5–. Crystal sealing: fissure healing.

These phases presents different duration times, some of them overlapped such as 2 and 3; other repetitive as phase 3; and some other very long lasting, never ending or with variable results such as 5.

1-. Effervescence: Mix and dis-compacting:

The first components reacting in contact with water are the combination of Sodium Acid Carbonate, Malic Acid, and Tartaric Acid, releasing CO_2 in the form of a gas to the atmosphere and acidifying the solution. This gas produced in small burbles supports the decompression of the capsule enclosed powder (that require to be previously vibrated to be introduced and could be consolidated after a long time enclosed by being placed on a structure for years).

Additionally, the turbulence created by the CO_2 release, is used as a physical mixing agent, giving the grains movement, allowing water to hydrate every component as much as possible.

Another possible function of this substance is the acidification of the water inside the fissure, theoretically assisting the non-reacted cement grains activation in the concrete fissure limits, supporting the self sealing effect and the creation of a new minerals to re-unify the surface.

2-. Polyacrylate absorption: fissure blocking and water retention:

In this phase, sodium polyacrylate crystals through the osmosis effect absorbs water, increasing its size and preventing the excess penetration, avoiding more damages origination by increasing its size or by humidifying steel reinforcements supporting its oxidation.

This contained water will serve as a reserve for keeping the humidity in cement supporting the curing process.

3-. Cement Activation: fissure filling:

Afterwards, cement hydration and reaction beginning, it is important to remind that this "cement malt" presents fast setting, developing 6 MPa compressive strength in the first 15 minutes, obtaining a consolidated mix in contacting both of the crack surfaces and keeping polyacrylate crystals in place.

Another particular characteristic of this phase is the cement grains agitation by the effervescence effect and pressure variations in the crack; this also tends to be expelled, an attached in the fissure faces or in other micro–cracks nearby (this with a very reduced effect).

4-. Cement Hardening and Cure: fissure reduction:

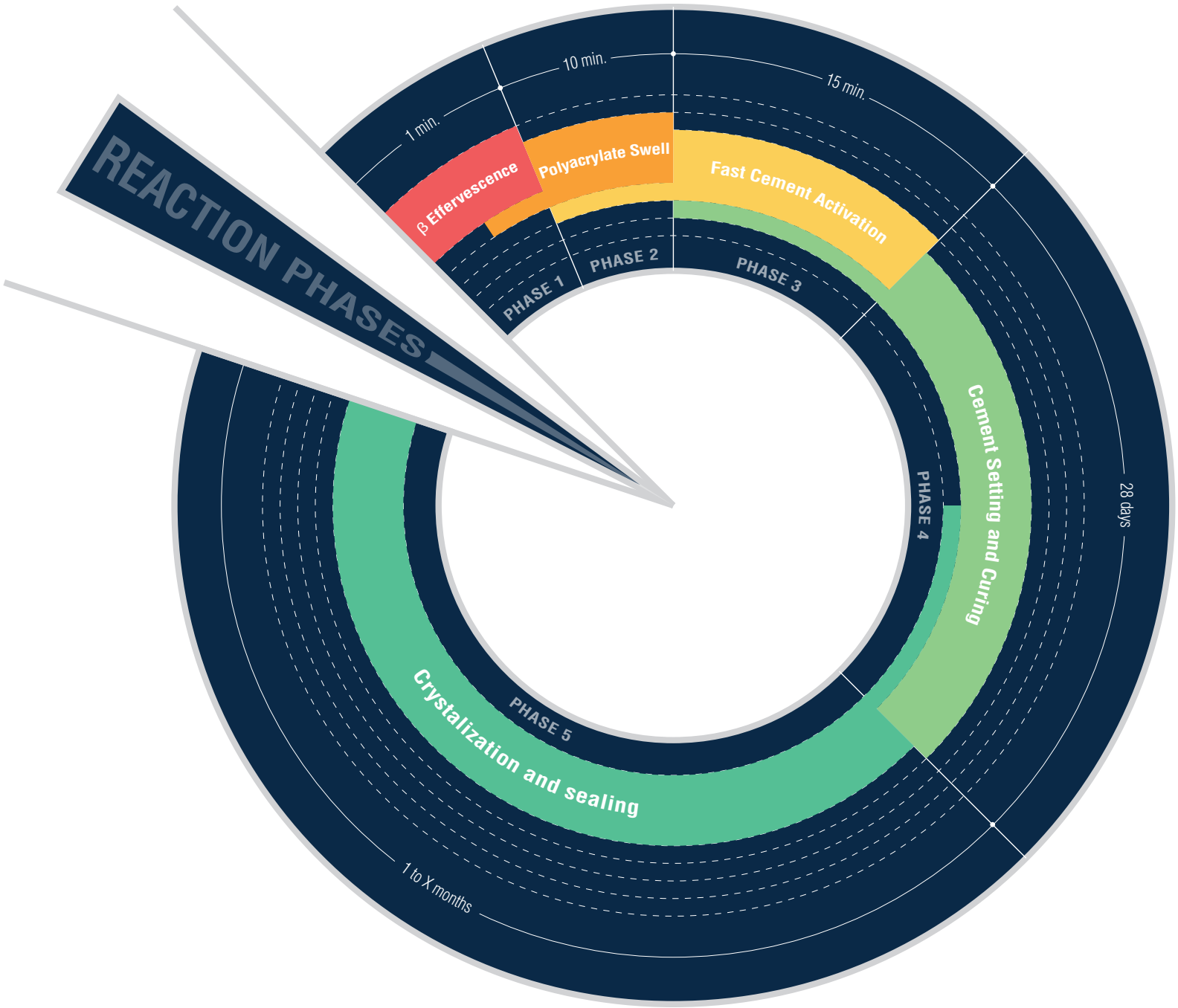
One of the longest stages such as the cement hardening and curing occurs (by facing the evolution explained before in the section "3.1.1.2.1 Alpha Component – Fast Hardening Malta").

At least 10 days to ensure a correct curing execution and a lasting solidification of the material are required.

5-. Chrystal sealing: fissure healing:

This step was not predicted during the theoretical approach, it was identified during the development of the experimental phase, and is included in this section as an introduction of this phenomenon, for preserving the order of ideas (this part is more detailed in the chapter 4, tests results).

This particular effect consists in the generation of fractal growing and extending minerals, along the inner surfaces of the fissure where mesh of material that matches both of the sides in the crack and re–unifying the surface is generated. This process occurs after one month, approximately, of curing by the prisms immersion on water. This crystallization or mineral formations could possibly be a long term solution for a better quality sealing.


REACTION PHASES
1 min.
10 min.
15 min.
28 days
1 to X months
β Effervescence
Polyacrylate Swell
Fast Cement Activation
Cement Setting and Curing
Crystalization and sealing
PHASE 1
PHASE 2
PHASE 3
PHASE 4
PHASE 5

Once known the components for the healing agent, the determination of proportional amounts of each one is required, in order to obtain the expected results (explained in the previous sections).

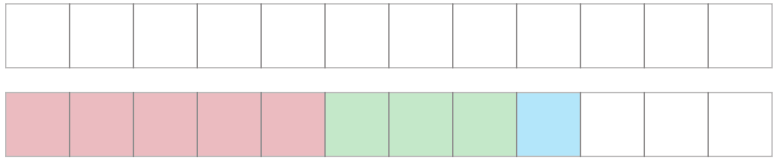
As there are thousands of possible combinations, a methodology to estimate the quantities for each component and reduce the spectrum must be determined.

Moving on with this idea, and basing in combinatorial theory concepts, a total number of parts is established (as if it were hypothetical containers that would be filled with each substance), registering the different amounts and combinations.

This combining procedure is represented with linear graphs, to understand the specific variation in unitary quantities for each component and study its changes by modifying the values. These units of materials chosen represents the proportion.

For example if a universe of 12 available total units is considered (like 10 empty containers), and the units chosen for every component are: Alpha= 5, Beta= 3, Gamma= 1; the final proportion will be 5:3:1, it means 5 parts of alpha by every 3 of beta and 1 of gamma. A relation of 9/12 meaning that 9 of the 12 possible units were used, (a convention for preserving proportion in whole numbers, to avoid decimals).

Once obtained the proportion (in volume), the final volume required to be prepared must be determined (the volume of a capsule for example, or a specific amount for a test), a rule of three can be used to convert the mixture design proportion into an effective value.



12 total units

5 units alpha - 3 units beta - 1 unit gamma
9 units used of 12 = 9/12

GRAPHIC EXAMPLE OF UNITS SELECTION FOR PROPORTIONAL COMBINATIONS

Legend:

Alpha Beta Gamma

For example, it is required to determine the volume of alpha, beta and gamma in a preparation of 100ml of healing agent using the numbers in the previous example (Alpha = 5, Beta = 3, Gamma = 1). Applying the rule of three, if 100ml are equivalent to 9 total parts, how many milliliters of alpha (or beta, or gamma) are required?

100ml ——————— 9 units

X ——————— 5 units(α)

It means α_{vol}= (5*100)/9 = 55.55 ml of alpha.

For beta will be 3.33 ml, and gamma equals to 11.11 ml. Now, considering that these components are solid and in a powdered presentation, the best measuring procedure to manage quantities during the elaboration are weight units (grams), so is necessary to convert from volume to mass.

For this procedure is important to know the density of every component (in this case densities were verified in the laboratory to increase precision). Alpha density = 1.45 gr/ml; Beta density = 1.42 gr/ml, and gamma density = 1.22gr/ml.

Finally in this example, to obtain the quantity in grams for the preparation, will be multiplied:

$$\alpha_{mass} = \alpha_{vol} * \rho\alpha$$

Alpha in mass = 55.55 ml *1.45 gr/ml= 80.54gr
Beta = 4.72 gr, gamma = 13.55 gr.

This calculation for preparing 100 ml is used in all of the graphic intersections (all the mix designs) and then are represented in a pie chart to visually show the proportion changes in the effective results for every combination and compare them.

The estimative procedure can not be repeated for the entire universe of combinations, it is necessary to filter them by considering the expected effects based in a specific premise.

This premise establishes that: "alpha is the main component; gamma and beta are its complements".

The reasons for these conditions are:

1—. Alpha, as the binding element, is required to be on a higher quantity, in order to unify both fissure sides and the sodium polyacrylate crystals.

2—. Beta and gamma components are much more reactive and presents a higher purity condition (an elevated potential capacity for producing a determined effect), so a minor amount of these elements will be required. For example, sodium polyacrylate is able to increase from 50 to 500 times its size by water osmosis absorption, so the quantity must be much more reduced compared to alpha.

The following graphs are theoretical representations of different proportions; developed to save time and material by filtering many of

the clearly non useful combinations, and to study the evolution of the reasoning by variating the quantities. This system operates with 3 Graphics by combination, following this logics:

1st graph: variation of beta and gamma from minimum to maximum values, keeping alpha (the binder) constant, understanding the effects of each complementary component;

2nd graph: variation of the binder proportions from the highest to lowest to highest value (HLH) to understand how proportions change by variating alpha on extreme quantities while complements also variate in the same time;

3rd graph: variation of the binder proportions in the opposite way, lowest—highest—lowest (LHL), also variating its complements.

In this way is illustrated how the mixture changes by having more cement, sodium polyacrylate, or acid base.

In "graph 1 (G1)", very uniform distributions of these 3 parts are represented, also there are cases where the binder is not present at all and makes the mix useless for the purpose required, (and can be discarded).

Having equal quantities of every component is considered senseless; the lack of enough binder to keep elements in place, an excess of acid—base and polyacrylate quantities that could produce contrary effects into the fissure; capsule

internal waste of space (considering that presents very reduced dimensions to be practical on many applications), and very poor effectiveness.

Taking into consideration these conditions (from graphic 2 to graphic 5), in order to give it more space into the capsule and increase it hierarchy into the reaction binder quantities are increased, thinking also on a long term healing effect, because beta and gamma are short term solutions for reducing the concrete and steel deterioration by water as soon as possible, then the binder will progressively block the fissure.

Number of units used of each component (quantity of α, β, ɣ).
red = alpha, green = beta, blue = gamma

Relation of parts used: The mix design proportion is stimated with a maximun of N parts that could be used. M are the effective parts of N (the total) used for a specific mix.

Identification code: G= graphic, X = number of the graphic group; Y= number of the intersection in the graphic

Number of units used of each component (quantity of α, β, ɣ)

Total parts= sumatory of all of the component's units involved

Mass of each other of the components: if the units are considered in volume, it can be multiplied by each material density to obtain its mass in grams

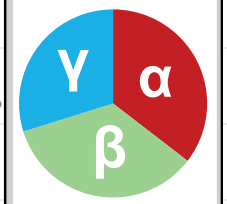
Referential calculation: it's been taken a volume of 100ml as a reference for ilustrating the calculation and its effective proportions

Proportional Volume: original units must be distributed into the total volume required, it means that A+B+C must be = 100ml

Proportional mass: once known the effective volume rispect to the reference of 100ml, it can be multiplied by its particular dfensity to obtain the effective mass

Resultant Graphic of proportions: this is a visual comparison of how much mass of material is involved in a particular mixture design, to notice the hierarchy between all of the components and compare the variations of mixes in different graphics, supporting the selection process

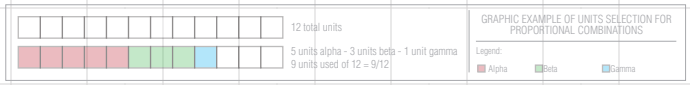
A	E	I
M		
N		
GXX -		Y
α	β	ɣ
PARTS E/O		
A	E	I
TOT PARTS		
A+E+I		
MASS E/O		
B	F	J
IN 100ML		
VOL. PROP		
C	G	K
MASS PROP		
D	H	L



CALCULATIONS PROCEEDMENTS

Total parts = A+B+I. Sumatory of the used units involved

Total units = Sumatory of the total available units.



example: A= quantity, units of alpha involved

example: A+E+I = units of α + units of β + units of ɣ

example: B= Vα*ρα = A* 1.45
example: F= Vβ*ρβ = A* 1.42
example: J= Vɣ*ρɣ = A* 1.22

example: A+B+C=100ml. By using the rule of three, if A+B+C is equal to 100ml , How much is the value of A in ml?
Cvol= (A*100) / (A+B+C)

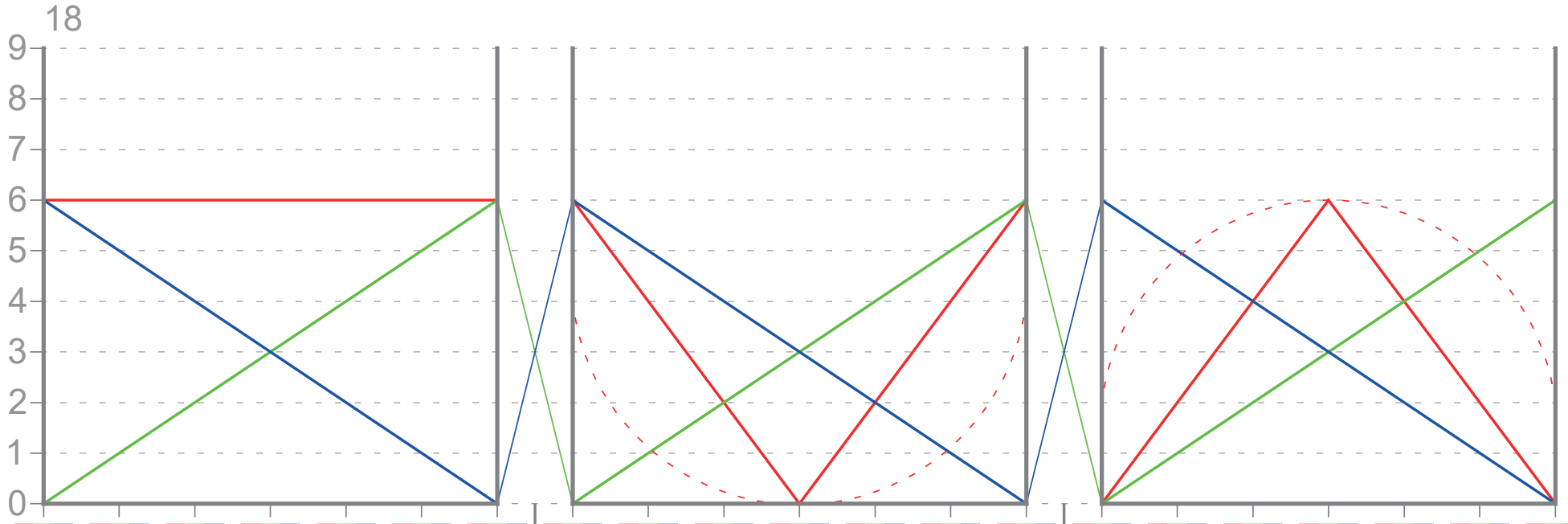
example: D= Cvol*ρα = C* 1.45
example: H= Gvol*ρβ = G* 1.42
example: L= Kvol*ɣ = K* 1.22

GRAPHICS LEGEND AND CALCULATION PROCEEDMENT

Used for estimating the ammounts of materials and graphically illustrate proportions between them. Used to discard theoretically the irelevant mixes before the physical test.

3.3.1.5.A Graphic 1

3.3.1.5 Mixture Design



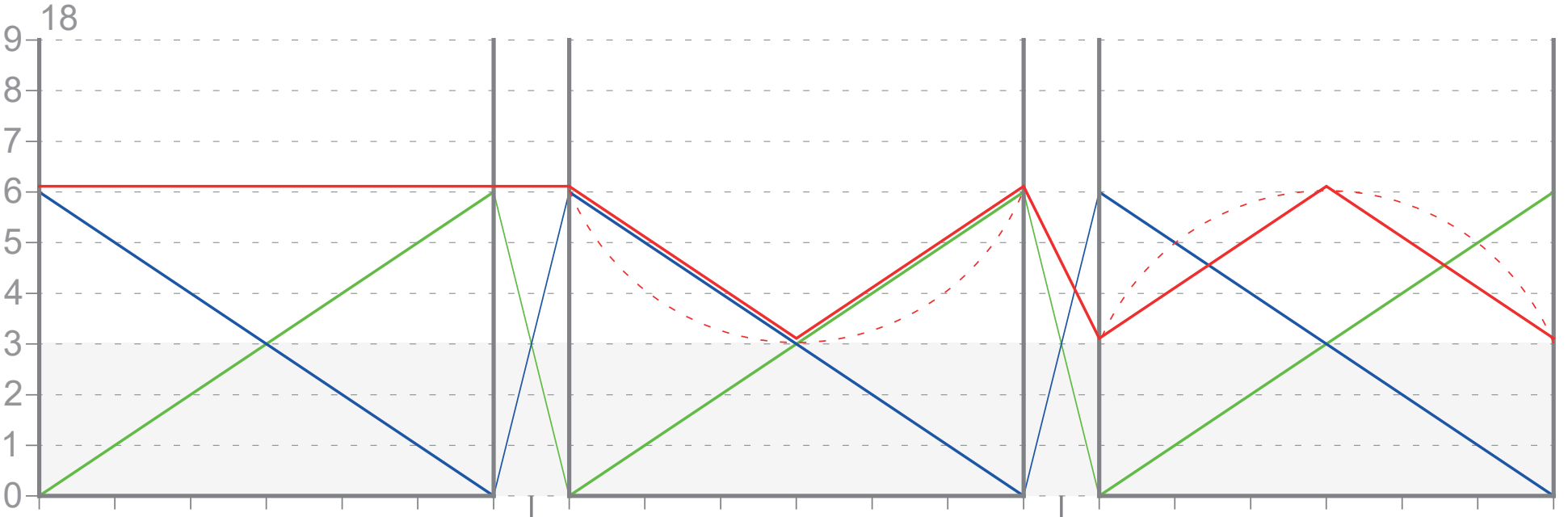
	G1 - 1	G1 - 2	G1 - 3	G1 - 4	G1 - 5	G1 - 6	G1 - 7
	6 0 6 / 12 / 27	6 1 5 / 12 / 27	6 2 4 / 12 / 27	6 3 3 / 12 / 27	6 4 2 / 12 / 27	6 5 1 / 12 / 27	6 6 0 / 12 / 27
	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ
PARTS E/O	6 0 6	6 1 5	6 2 4	6 3 3	6 4 2	6 5 1	6 6 0
TOT PARTS	12	12	12	12	12	12	12
MASS E/O	9 0 7	9 1 6	9 3 5	9 4 4	9 6 2	9 7 1	9 9 0
IN 100ML							
VOL. PROP	50 0 50	50 8 42	50 17 33	50 25 25	50 33 17	50 42 8	50 50 0
MASS PROP	73 0 61	73 12 51	73 24 41	73 36 31	73 47 20	73 59 10	73 71 0

	G1 - 8	G1 - 9	G1 - 10	G1 - 11	G1 - 12	G1 - 13	G1 - 14
	6 0 6 / 12 / 27	4 1 5 / 10 / 27	2 0 4 / 6 / 27	0 3 3 / 6 / 27	2 4 2 / 8 / 27	4 5 1 / 10 / 27	6 6 0 / 12 / 27
	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ
PARTS E/O	6 0 6	4 1 5	2 2 4	0 3 3	2 4 2	4 5 1	6 6 0
TOT PARTS	12	10	8	6	8	10	12
MASS E/O	9 0 7	6 1 6	3 3 5	0 4 4	3 6 2	6 7 1	9 9 0
IN 100ML							
VOL. PROP	50 0 50	40 10 50	25 25 50	0 50 50	25 50 25	40 50 10	50 50 0
MASS PROP	73 0 61	58 14 61	36 36 61	0 71 61	36 71 31	58 71 12	73 71 0

	G1 - 15	G1 - 16	G1 - 17	G1 - 18	G1 - 19	G1 - 20	G1 - 21
	0 0 6 / 6 / 27	2 1 5 / 8 / 27	4 2 4 / 10 / 27	6 3 3 / 12 / 27	4 4 2 / 10 / 27	2 5 1 / 8 / 27	0 6 0 / 6 / 27
	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ
PARTS E/O	0 0 6	2 1 5	11 4 4	6 3 3	4 4 2	2 5 1	0 6 0
TOT PARTS	6	8	19	12	10	8	6
MASS E/O	0 0 7	3 1 6	16 6 5	9 4 4	6 6 2	3 7 1	0 9 0
IN 100ML							
VOL. PROP	0 0 ##	25 13 63	58 21 21	50 25 25	40 40 20	25 63 13	0 ## 0
MASS PROP	0 0 ##	36 18 76	84 30 26	73 36 31	58 57 24	36 89 15	0 ## 0

3.3.1.5.A Graphic 2

3.3.1.5 Mixture Design



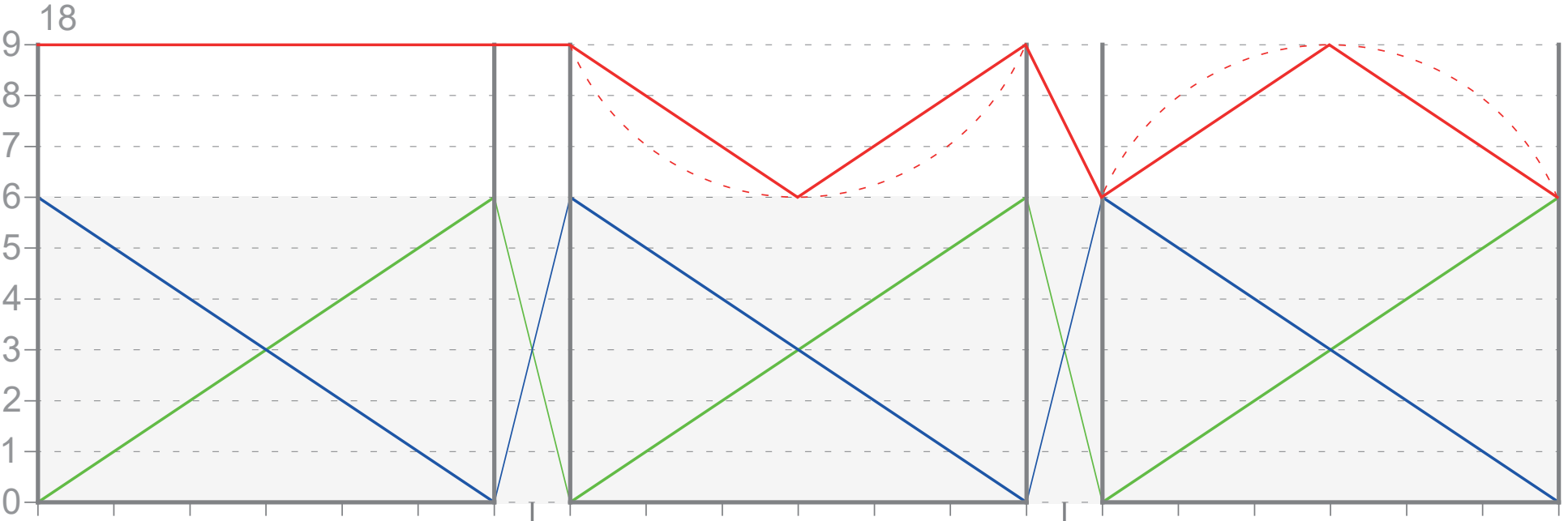
	G2 - 1	G2 - 2	G2 - 3	G2 - 4	G2 - 5	G2 - 6	G2 - 7
	6 0 6 / 12 / 27	6 1 5 / 12 / 27	6 2 4 / 12 / 27	6 3 3 / 12 / 27	6 4 2 / 12 / 27	6 5 1 / 12 / 27	6 6 0 / 12 / 27
α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ
PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O
6 0 6	6 1 5	6 2 4	6 3 3	6 4 2	6 5 1	6 6 0	
TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	
12	12	12	12	12	12	12	
MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	
9 0 7	9 1 6	9 3 5	9 4 4	9 6 2	9 7 1	9 9 0	
IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	
VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	
50 0 50	50 8 42	50 17 33	50 25 25	50 33 17	50 42 8	50 50 0	
MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	
73 0 61	73 12 51	73 24 41	73 36 31	73 47 20	73 59 10	73 71 0	

	G2 - 8	G2 - 9	G2 - 10	G2 - 11	G2 - 12	G2 - 13	G2 - 14
	6 0 6 / 12 / 27	5 1 5 / 11 / 27	4 2 4 / 10 / 27	3 3 3 / 9 / 27	4 4 2 / 10 / 27	5 5 1 / 11 / 27	6 6 0 / 12 / 27
α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ
PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O
6 0 6	5 1 5	4 2 4	3 3 3	4 4 2	5 5 1	6 6 0	
TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	
12	11	10	9	10	11	12	
MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	
9 0 7	7 1 6	6 3 5	4 4 4	6 6 2	7 7 1	9 9 0	
IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	
VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	
50 0 50	45 9 45	40 20 40	33 33 33	40 40 20	45 45 9	50 50 0	
MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	
73 0 61	66 13 55	58 28 49	48 47 41	58 57 24	66 65 11	73 71 0	

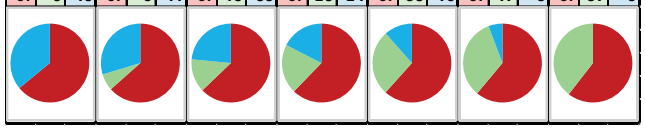
	G2 - 15	G2 - 16	G2 - 17	G2 - 18	G2 - 19	G2 - 20	G2 - 21
	3 6 0 / 9 / 27	4 5 1 / 10 / 27	5 4 2 / 11 / 27	6 3 3 / 12 / 27	5 2 4 / 11 / 27	4 1 5 / 10 / 27	3 0 6 / 9 / 27
α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ
PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O
3 0 6	4 1 5	5 4 4	6 3 3	5 4 2	4 5 1	3 6 0	
TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	
9	10	13	12	11	10	9	
MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	
4 0 7	6 1 6	7 6 5	9 4 4	7 6 2	6 7 1	4 9 0	
IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	
VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	
33 0 67	40 10 50	38 31 31	50 25 25	45 36 18	40 50 10	33 67 0	
MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	
48 0 81	58 14 61	56 44 38	73 36 31	66 52 22	58 71 12	48 95 0	

3.3.1.5.A Graphic 3

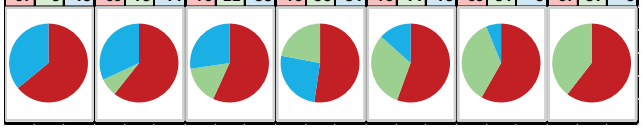
3.3.1.5 Mixture Design



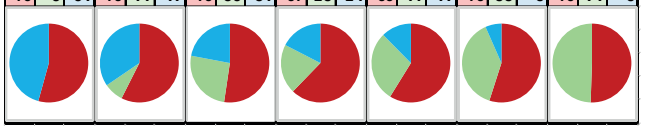
	G3 - 1	G3 - 2	G3 - 3	G3 - 4	G3 - 5	G3 - 6	G3 - 7
	9 0 6	9 1 5	9 2 4	9 3 3	9 4 2	9 5 1	9 6 0
	15 / 27	15 / 27	15 / 27	15 / 27	15 / 27	15 / 27	15 / 27
α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ
PARTS E/0	PARTS E/0	PARTS E/0	PARTS E/0	PARTS E/0	PARTS E/0	PARTS E/0	PARTS E/0
9 0 6	9 1 5	9 2 4	9 3 3	9 4 2	9 5 1	9 6 0	
TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	
15	15	15	15	15	15	15	
MASS E/0	MASS E/0	MASS E/0	MASS E/0	MASS E/0	MASS E/0	MASS E/0	
13 0 7	13 1 6	13 3 5	13 4 4	13 6 2	13 7 1	13 9 0	
IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	
VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	
60 0 40	60 7 33	60 13 27	60 20 20	60 27 13	60 33 7	60 40 0	
MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	
87 0 49	87 9 41	87 19 33	87 28 24	87 38 16	87 47 8	87 57 0	



	G3 - 8	G3 - 9	G3 - 10	G3 - 11	G3 - 12	G3 - 13	G3 - 14
	9 0 6	8 1 5	7 2 4	6 3 3	7 4 2	8 5 1	9 6 0
	15 / 27	14 / 27	13 / 27	12 / 27	13 / 27	14 / 27	15 / 27
α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ
PARTS E/0	PARTS E/0	PARTS E/0	PARTS E/0	PARTS E/0	PARTS E/0	PARTS E/0	PARTS E/0
9 0 6	8 1 5	7 2 4	6 3 3	7 4 2	8 5 1	9 6 0	
TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	
15	14	13	12	13	14	15	
MASS E/0	MASS E/0	MASS E/0	MASS E/0	MASS E/0	MASS E/0	MASS E/0	
13 0 7	12 1 6	10 3 5	9 4 4	10 6 2	12 7 1	13 9 0	
IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	
VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	
60 0 40	57 7 36	54 15 31	50 25 25	54 31 15	57 36 7	60 40 0	
MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	
87 0 49	83 10 44	78 22 38	73 36 31	78 44 19	83 51 9	87 57 0	

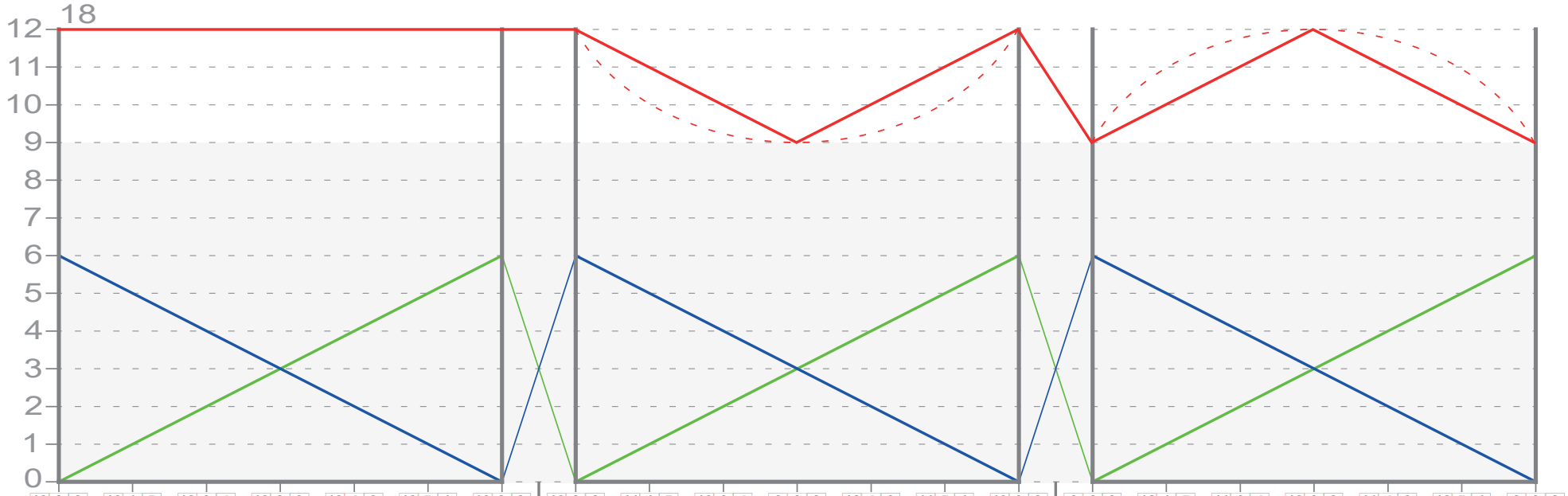


	G3 - 15	G3 - 16	G3 - 17	G3 - 18	G3 - 19	G3 - 20	G3 - 21
	6 0 6	7 1 5	8 2 4	9 3 3	8 4 2	7 5 1	6 6 0
	12 / 27	13 / 27	14 / 27	15 / 27	14 / 27	13 / 27	12 / 27
α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ
PARTS E/0	PARTS E/0	PARTS E/0	PARTS E/0	PARTS E/0	PARTS E/0	PARTS E/0	PARTS E/0
6 0 6	7 1 5	8 4 4	9 3 3	8 4 2	7 5 1	6 6 0	
TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	
12	13	16	15	14	13	12	
MASS E/0	MASS E/0	MASS E/0	MASS E/0	MASS E/0	MASS E/0	MASS E/0	
9 0 7	10 1 6	12 6 5	13 4 4	12 6 2	10 7 1	9 9 0	
IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	
VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	
50 0 50	54 8 38	50 25 25	60 20 20	57 29 14	54 38 8	50 50 0	
MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	
73 0 61	78 11 47	73 36 31	87 28 24	83 41 17	78 55 9	73 71 0	



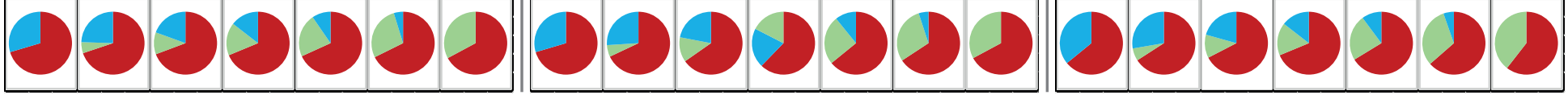
3.3.1.5.A Graphic 4

3.3.1.5 Mixture Design



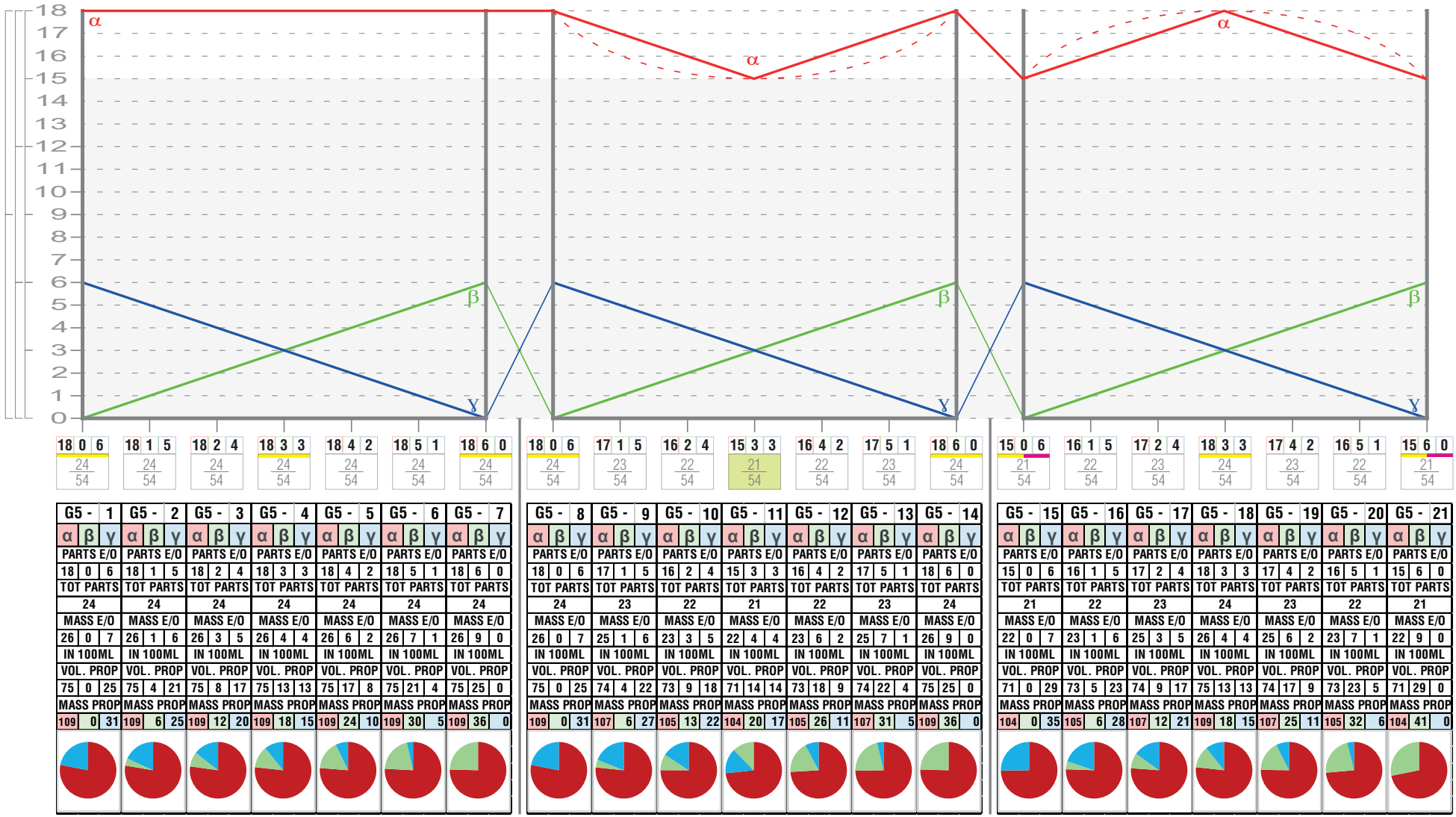
12 0 6	12 1 5	12 2 4	12 3 3	12 4 2	12 5 1	12 6 0	12 0 6	11 1 5	10 2 4	9 3 3	10 4 2	11 5 1	12 6 0	9 0 6	10 1 5	11 2 4	12 3 3	11 4 2	10 5 1	9 6 0
18 / 36	18 / 36	18 / 36	18 / 36	18 / 36	18 / 36	18 / 36	18 / 36	17 / 36	16 / 36	15 / 36	16 / 36	617 / 36	18 / 36	15 / 36	16 / 36	17 / 36	18 / 36	17 / 36	16 / 36	15 / 36

G4 - 1	G4 - 2	G4 - 3	G4 - 4	G4 - 5	G4 - 6	G4 - 7	G4 - 8	G4 - 9	G4 - 10	G4 - 11	G4 - 12	G4 - 13	G4 - 14	G4 - 15	G4 - 16	G4 - 17	G4 - 18	G4 - 19	G4 - 20	G4 - 21
α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ
PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O
12 0 6	12 1 5	12 2 4	12 3 3	12 4 2	12 5 1	12 6 0	12 0 6	11 1 5	10 2 4	9 3 3	10 4 2	11 5 1	12 6 0	9 0 6	10 1 5	11 2 4	12 3 3	11 4 2	10 5 1	9 6 0
TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS
18	18	18	18	18	18	18	18	17	16	15	16	17	18	15	16	17	18	17	16	15
MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O
17 0 7	17 1 6	17 3 5	17 4 4	17 6 2	17 7 1	17 9 0	17 0 7	16 1 6	15 3 5	13 4 4	15 6 2	16 7 1	17 9 0	13 0 7	15 1 6	16 3 5	17 4 4	16 6 2	15 7 1	13 9 0
IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML
VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP
67 0 33	67 6 28	67 11 22	67 17 17	67 22 11	67 28 6	67 33 0	67 0 33	65 6 29	63 13 25	60 20 20	63 25 13	65 29 6	67 33 0	60 0 40	63 6 31	65 12 24	67 17 17	65 24 12	63 31 6	60 40 0
MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP
97 0 41	97 8 34	97 16 27	97 24 20	97 32 14	97 39 7	97 47 0	97 0 41	94 8 36	91 18 31	87 28 24	91 36 15	94 42 7	97 47 0	87 0 49	91 9 38	94 17 29	97 24 20	94 33 14	91 44 8	87 57 0



3.3.1.5.A Graphic 5

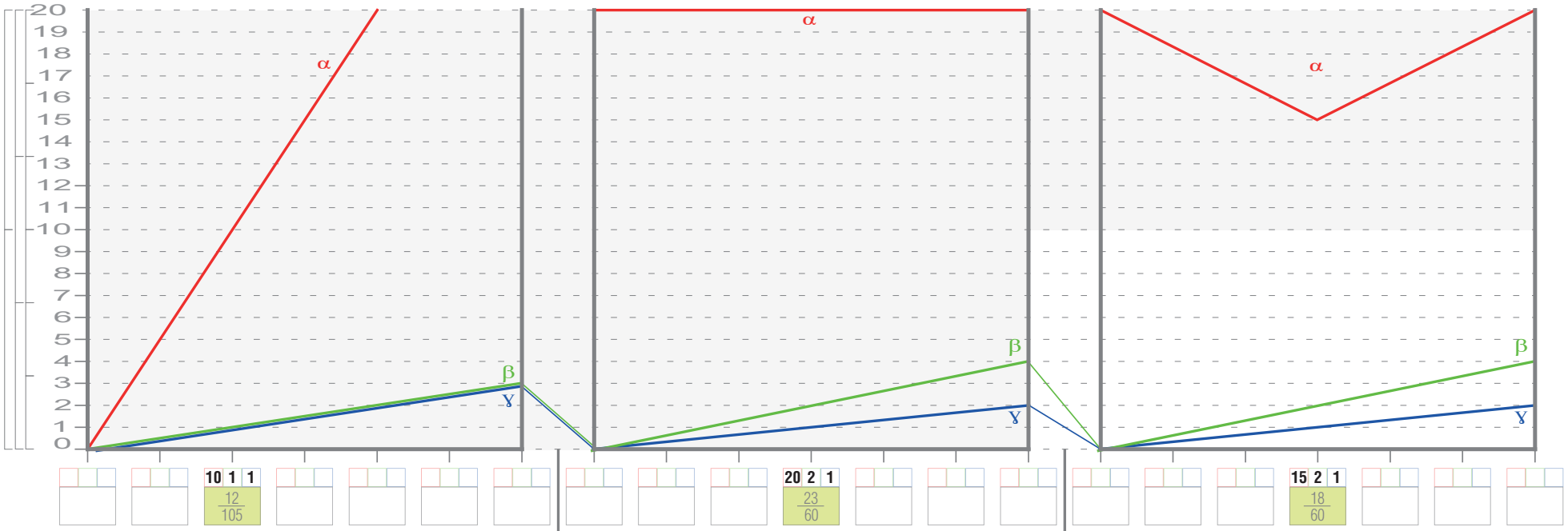
3.3.1.5 Mixture Design



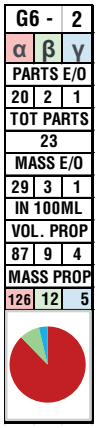
18 0 6	18 1 5	18 2 4	18 3 3	18 4 2	18 5 1	18 6 0	18 0 6	17 1 5	16 2 4	15 3 3	16 4 2	17 5 1	18 6 0	15 0 6	16 1 5	17 2 4	18 3 3	17 4 2	16 5 1	15 6 0
24 / 54	24 / 54	24 / 54	24 / 54	24 / 54	24 / 54	24 / 54	24 / 54	23 / 54	22 / 54	21 / 54	22 / 54	23 / 54	24 / 54	21 / 54	22 / 54	23 / 54	24 / 54	23 / 54	22 / 54	21 / 54

G5 - 1	G5 - 2	G5 - 3	G5 - 4	G5 - 5	G5 - 6	G5 - 7	G5 - 8	G5 - 9	G5 - 10	G5 - 11	G5 - 12	G5 - 13	G5 - 14	G5 - 15	G5 - 16	G5 - 17	G5 - 18	G5 - 19	G5 - 20	G5 - 21
α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ	α β γ
PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O	PARTS E/O
18 0 6	18 1 5	18 2 4	18 3 3	18 4 2	18 5 1	18 6 0	18 0 6	17 1 5	16 2 4	15 3 3	16 4 2	17 5 1	18 6 0	15 0 6	16 1 5	17 2 4	18 3 3	17 4 2	16 5 1	15 6 0
TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS	TOT PARTS
24	24	24	24	24	24	24	24	23	22	21	22	23	24	21	22	23	24	23	22	21
MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O	MASS E/O
26 0 7	26 1 6	26 3 5	26 4 4	26 6 2	26 7 1	26 9 0	26 0 7	25 1 6	23 3 5	22 4 4	23 6 2	25 7 1	26 9 0	22 0 7	23 1 6	25 3 5	26 4 4	25 6 2	23 7 1	22 9 0
IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML	IN 100ML
VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP	VOL. PROP
75 0 25	75 4 21	75 8 17	75 13 13	75 17 8	75 21 4	75 25 0	75 0 25	74 4 22	73 9 18	71 14 14	73 18 9	74 22 4	75 25 0	71 0 29	73 5 23	74 9 17	75 13 13	74 17 9	73 23 5	71 29 0
MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP	MASS PROP
109 0 31	109 6 25	109 12 20	109 18 15	109 24 10	109 30 5	109 36 0	109 0 31	107 6 27	105 13 22	104 20 17	105 26 11	107 31 5	109 36 0	104 0 35	105 6 28	107 12 21	109 18 15	107 25 11	105 32 6	104 41 0

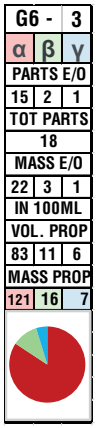
3.3.1.5.A Graphic 6
3.3.1.5 Mixture Design



G6 - 1		
α	β	γ
PARTS E/O		
10	1	1
TOT PARTS		
12		
MASS E/O		
15	1	1
IN 100ML		
VOL. PROP		
83	8	8
MASS PROP		
121	12	10



G6 - 2		
α	β	γ
PARTS E/O		
20	2	1
TOT PARTS		
23		
MASS E/O		
29	3	1
IN 100ML		
VOL. PROP		
87	9	4
MASS PROP		
126	12	5



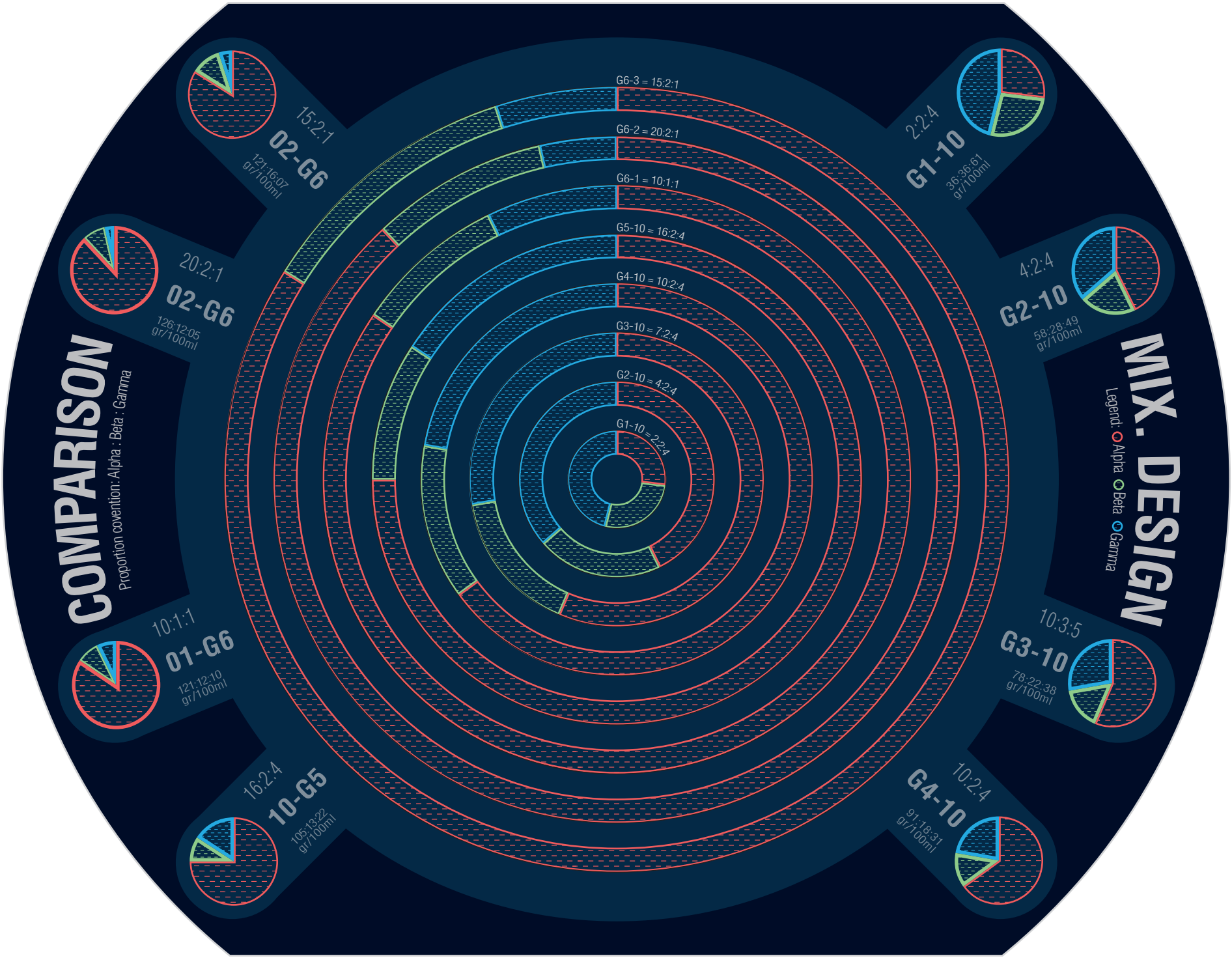
G6 - 3		
α	β	γ
PARTS E/O		
15	2	1
TOT PARTS		
18		
MASS E/O		
22	3	1
IN 100ML		
VOL. PROP		
83	11	6
MASS PROP		
121	16	7

Once developed the different relevant theoretical tests and graphics following the established criterion, it is possible to compare how much the quantities change for each material. The selection of the representative mix designs in order to illustrate the differences are shown in the following figure; it has been chosen the G1–10, G2–10, G3–10, G4–10, G5–10, and the most accurate mixes: G6–01, G6–02, G6–03.

The evolution in the adjustment of every part quantities are notable in the graph; in G1–10, the proportion is 2:2:4, and colors in the graphics are distributed very uniformly (meaning that alpha, beta and gamma presents very equitable quantities), but there is a very reduced amount of cement compared to the expressed in the general criterion, expecting it to be less cohesive. Polyacrylate crystals are excessive and effervescence will be very violent but with very few material to mix.

In the other hand, G6–01, 02 and 03, has an important presence of cement, that could guarantee the adhesion of the components; beta and gamma are in a regulated quantity, enough to produce the required effects.

For these reasons, the selected mixture designs for the physical test necessary to precisely measure its resistance and behavior, are the G6 group: G6–01, G6–02 and G6–03; in the following section will be presented this test and the final selection for this research (this mixes, could variate depending on the specific conditions and results desired, the filtering process here developed is related to this particular research).


COMPARISON
Proportion covention: Alpha : Beta : Gamma
MIX. DESIGN
Legend: Alpha Beta Gamma
G6-3 = 15:2:1
G6-2 = 20:2:1
G6-1 = 10:1:1
G5-10 = 16:2:4
G4-10 = 10:2:4
G3-10 = 7:2:4
G2-10 = 4:2:4
G1-10 = 2:2:4
15:2:1
02-G6
121:16:07 gr/100ml
20:2:1
02-G6
126:12:05 gr/100ml
10:1:1
01-G6
121:12:10 gr/100ml
16:2:4
10-G5
105:13:22 gr/100ml
2:2:4
G1-10
36:36:61 gr/100ml
4:2:4
G2-10
58:28:49 gr/100ml
10:3:5
G3-10
78:22:38 gr/100ml
10:2:4
G4-10
91:18:31 gr/100ml

3.3.1.6 Relevant Mixture Proportion Tests

3.3.1 Solid healing powder composition:

3.3. Solid healing agent development:

The mixture designs able to fulfill the requirements expressed in the previous sections are the: G6–1 = 10:1:1; G6–2 = 20:2:1 and G6–3 = 15:2:1. To understand now which of all these combinations is ideal to obtain the expected effects is necessary to develop some physical tests.

"Concrete cracks early in its loading history. Most cracks are a result of the following actions to which concrete can be subjected:

1. Volumetric change caused by drying shrinkage, creep under sustained load, thermal stresses including elevated temperatures, and chemical incompatibility of concrete components.

2. Direct stress caused by applied loads or reactions or internal stress caused by continuity, reversible fatigue load, long-term deflection, camber in prestressed systems, and environmental effects including differential movement in structural systems.

3. Flexural stress caused by bending. (...)

External load results in direct and bending stresses, causing flexural, bond, and diagonal tension cracks. Immediately after the tensile stress in the concrete exceeds its tensile strength, internal microcracks form. These cracks generate into macrocracks propagating to the external fiber zones of the element.

Immediately after the full development of the first crack in a reinforced-concrete element, the stress in the concrete at the cracking zone is reduced to zero and is assumed by the reinforcement" (Nawy,E. 1968)

References:

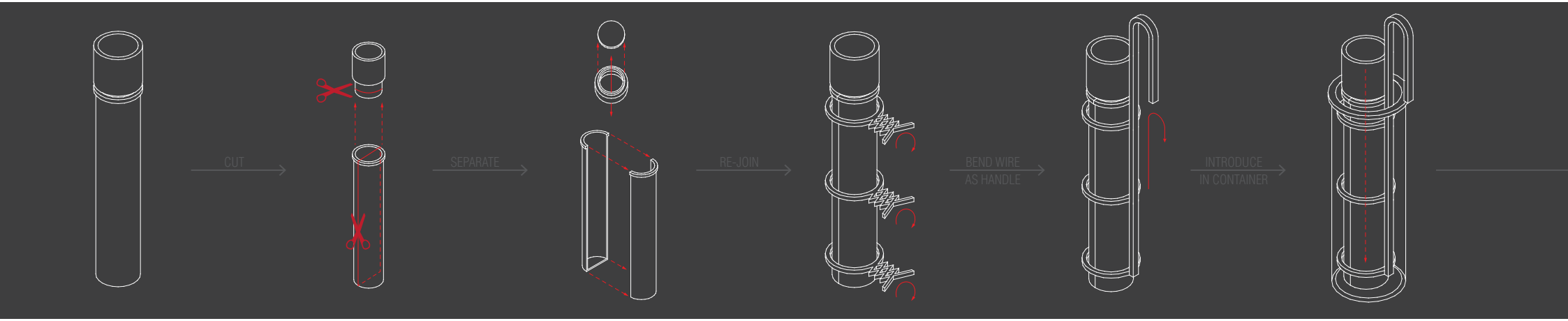
-Nawy, E., 1968. Crack Control in Reinforced Concrete Structures. Journal Proceedings, [online] 65(10), pp.825-836. Available at: <https://onlinepubs.trb.org/Onlinepubs/trr/1991/1301/1301-005.pdf> [Accessed 15 December 2021].

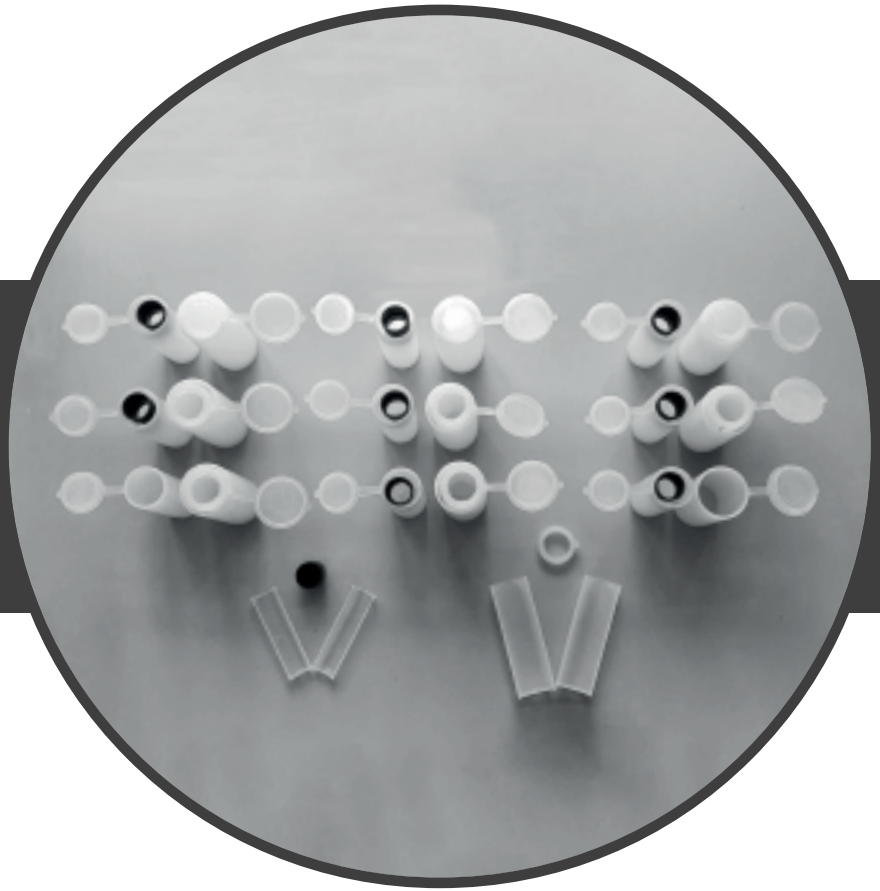
Cracks on concrete are formed by different conditions as expressed in the previous citation, due to changes on concrete setting, moisture, quick shrinkage dry, and by some efforts such as tensile – traction stresses; for this reason the mixture designs already hardened in presence of this stress require to be tested, to obtain a preliminary approach and select the combination with the best behavior for meeting the aims of this research.

The "Brazilian test" or " Splitting Tensile Strength Test" is the selected procedure to evaluate these mixtures, where a cylinder made of the hardened healing agent will be compressed on its longitudinal sides to produce internal tensile/ traction efforts, and quantify the maximum load in newtons this material is able to resist before cracking or disaggregating.

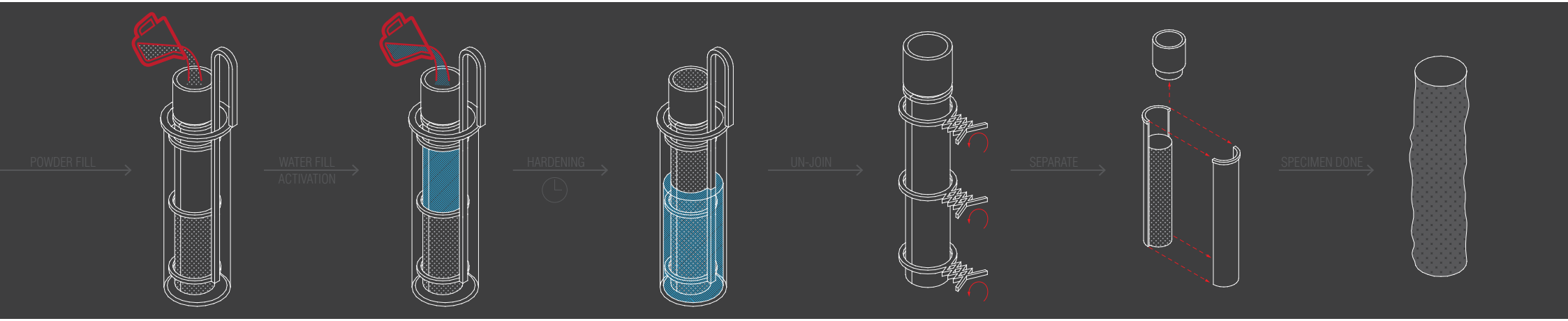
Also, cylinders must be prepared on a mold that could guarantee uniformity on all the specimens to reduce the error, taking into consideration that is partially composed by polyacrylate crystals that will be retired before the stress application. In this case, due to its uniformity and measures that matches very well with the required for the press used, "Falcon" plastic containers were chosen as molds. For supporting the dis–molding process these were longitudinally sectioned in two parts, and then re–joined with steel wire to maintain it in position, to be finally introduced in a major size falcon before the inclusion of the healing powder and its hydration, to avoid water looses in the joints.

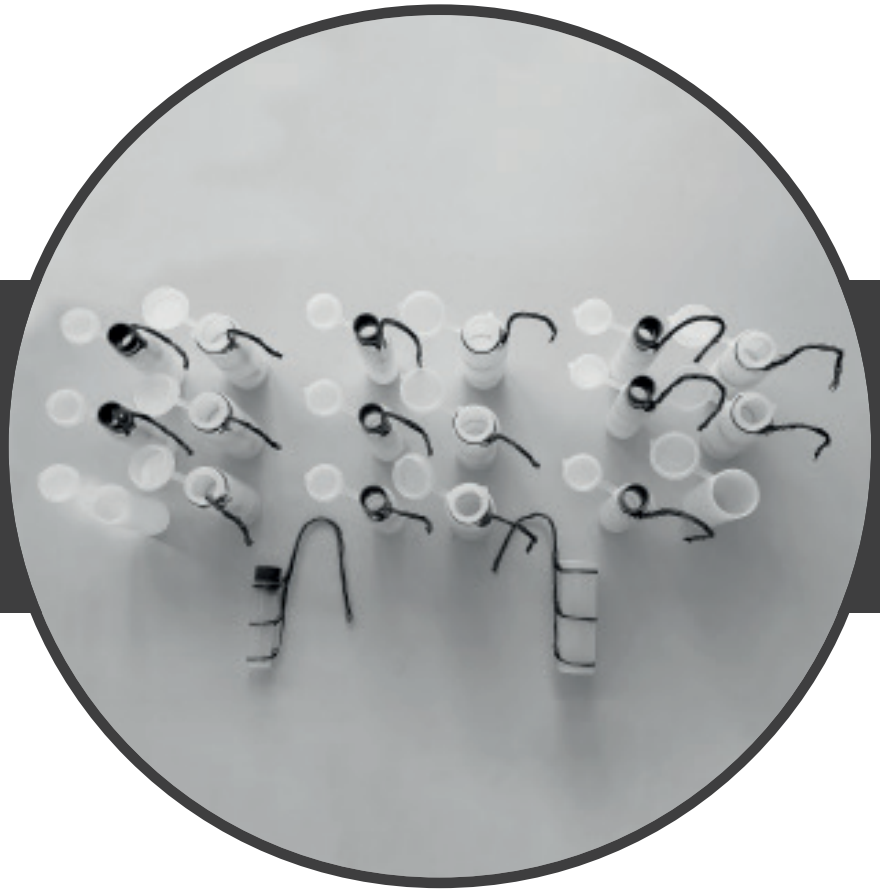
All the process is illustrated in the following figure:

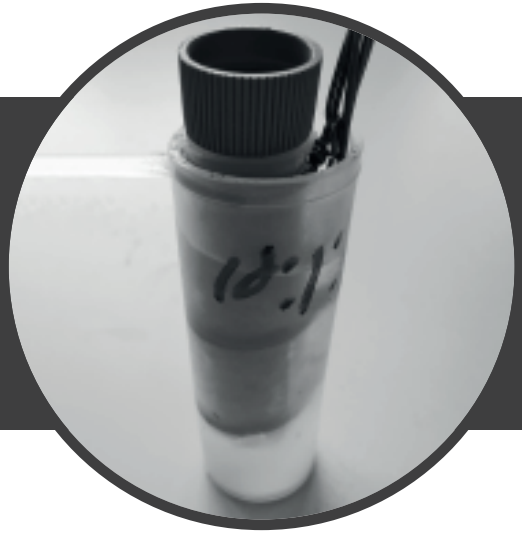

CUT
SEPARATE
RE-JOIN
BEND WIRE
AS HANDLE
INTRODUCE
IN CONTAINER






POWDER FILL
WATER FILL
ACTIVATION
HARDENING
UN-JOIN
SEPARATE
SPECIMEN DONE





As seen before, two types of cylinders were used as molds, one of 10 ml (diameter=1,5 cm, height 6 cm) and the other 34 ml (diameter= 2,5 ml, height 7 cm). In the case it would be necessary, the 34 ml mold was developed, preventing further tests or substitution (it was discarded by the reason that the 10 ml specimen presents more accurate measures and width/height relation for the press used).

For the 10 ml mold, taking advantage of the container precise standard graduation, it was considered a volume of 5,6 ml, reserving a void section for the size increase when activated.

It were include 12 total parts proportionally on 5,6ml for the 10:1:1 mixture preparation, and by applying the rule of three as explained in the section 3.1.2, the volume of each component is: alpha = 4,6 ml, beta = 0,46ml, gamma = 0,46 ml.

Calculating the mass of each component:

$$\alpha_{mass} = 4{,}6ml * 1{,}45\ gr/ml$$

$$\alpha_{mass} = 6{,}67\ gr$$

$$\beta_{mass} = 0{,}46\ ml * 1{,}42\ gr/ml$$

$$\beta_{mass} = 0{,}65\ gr$$

$$\gamma_{mass} = 0{,}46\ ml * 1{,}22\ gr/ml$$

$$\gamma_{mass} = 0{,}56\ gr/ml$$

For the mixture 20:2:1, 23 total parts to be included proportionally into 5,6 ml were required; applying the rule of three as explained in the section 3.1.2, the volume of each component is: alpha = 4,86 ml, beta = 0,48 ml, gamma = 0,24 ml.

Calculating the mass of each component:

$$\alpha_{mass} = 4{,}86 \text{ ml} * 1{,}45 \text{ gr/ml}$$

$$\alpha_{mass} = 7{,}07 \text{ gr}$$

$$\beta_{mass} = 0{,}48 \text{ ml} * 1{,}42 \text{ gr/ml}$$

$$\beta_{mass} = 0{,}68 \text{ gr}$$

$$\gamma_{mass} = 0{,}24 \text{ ml} * 1{,}22 \text{ gr/ml}$$

$$\gamma_{mass} = 0{,}29 \text{ gr/ml}$$

The preparation for the mixture 15:2:1 required 18 total parts to be included proportionally into 5,6 ml; applying the rule of three as explained in the section 3.1.2, the volume of each component is: alpha = 4,66 ml, beta = 0,62 ml, gamma = 0,31 ml.

Calculating the mass of each component:

$$\alpha_{mass} = 4{,}66 \text{ ml} * 1{,}45 \text{ gr/ml}$$

$$\alpha_{mass} = 6{,}75 \text{ gr}$$

$$\beta_{mass} = 0{,}62 \text{ ml} * 1{,}42 \text{ gr/ml}$$

$$\beta_{mass} = 0{,}88 \text{ gr}$$

$$\gamma_{mass} = 0{,}31 \text{ ml} * 1{,}22 \text{ gr/ml}$$

$$\gamma_{mass} = 0{,}37 \text{ gr/ml}$$

For all these mixtures, 4 ml of water were directly added into the mold, and the external container was made up to the top for 10 minutes until all the mixture hydration was completed, for preventing liquid spills and shrinkage loose. Then the samples containing water absorbed by sodium polyacrylate crystals, were let set for a 15 days curing period (three specimens by mixture type for testing were produced).

After 15 days of hardening, all the specimens are dis–molded and placed in the servo hydraulic device for measuring its tensile resistance by applying an uniformly increasing load (measured in newtons). The displacement of the cross–head was also registered for further calculations.

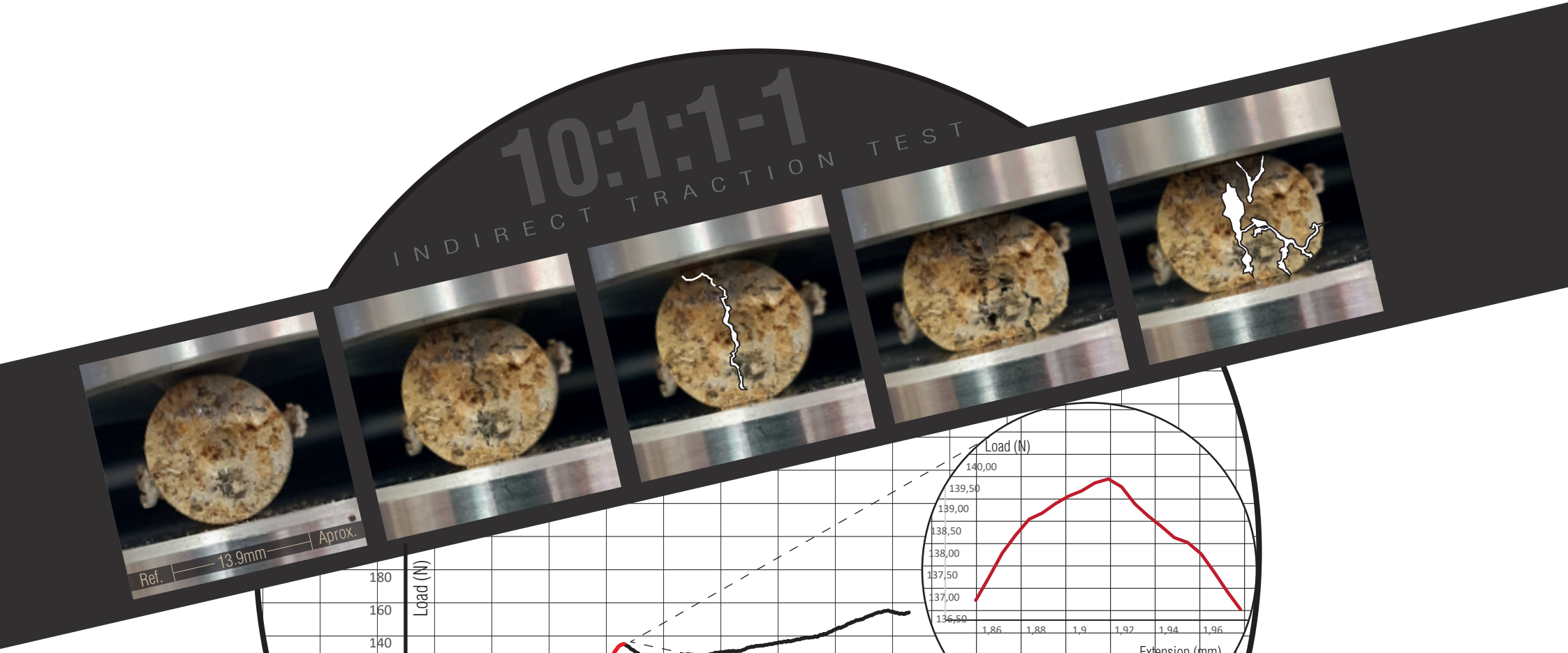
In the following section, by the use of a graphic relating the load (N) by the vertical cross–head displacement (mm), these results are illustrated. The first cracking point where the forces decrease due to the segregation of material, is considered as the maximum load resisted, and is zoomed in the graphic to make further comparisons between all the samples. (The data tables used to develop these graphics are available in annexes 3.2.1–A to P).

The load registered for this critic point is divided by the cross section area (the product of the diameter of the circular base by the height of the cylinder), obtaining the force in mega pascal (newtons of force by mm2) of tensile stress required to disaggregate the material or loose its resistance.

Then, the results of every groups of tests by mixture design are averaged to obtain a final value and compare the behavior of each combination.

10:1:1-1

INDIRECT TRACTION TEST



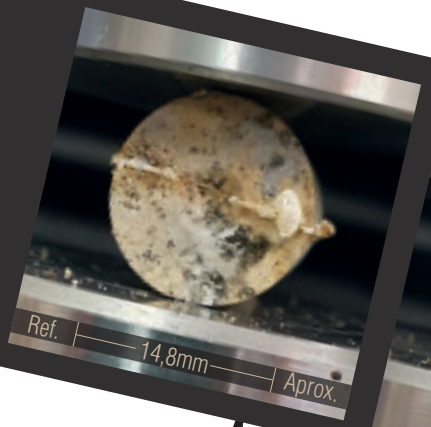
MAX. TRACTION RES.
0.36 MPa

Test at 15 days of hardening, max load = 139,7 N. Cilinder measures: Diameter = 13,9 mm; Height = 27,8 mm. Detailed tables on Anexes 3.3.1.6-A.

Elaboration by author: Panza, A. (2021)

10:1:1-2

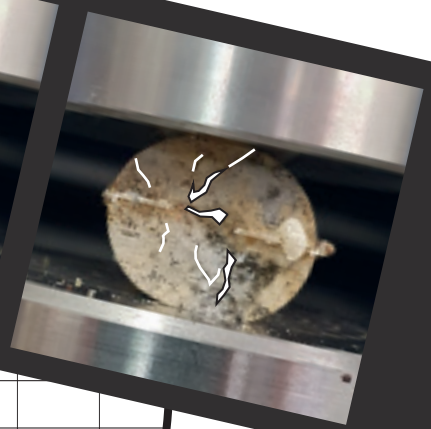
INDIRECT TRACTION TEST

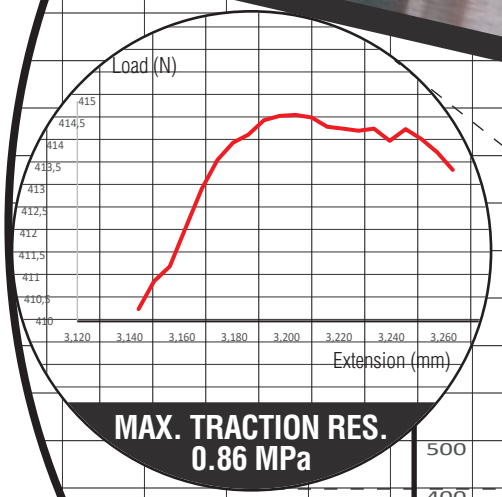




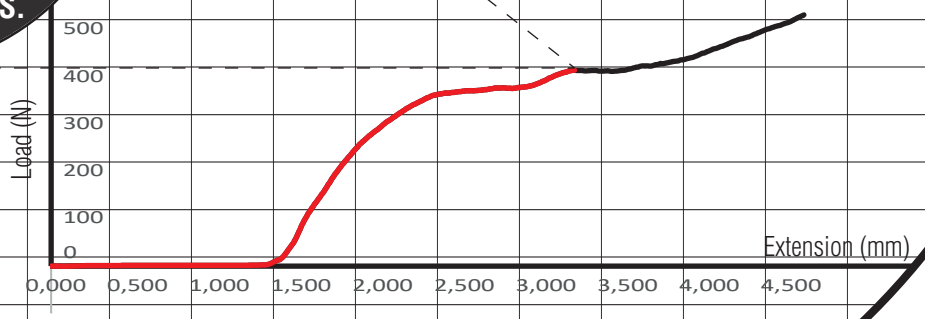








MAX. TRACTION RES.
0.86 MPa

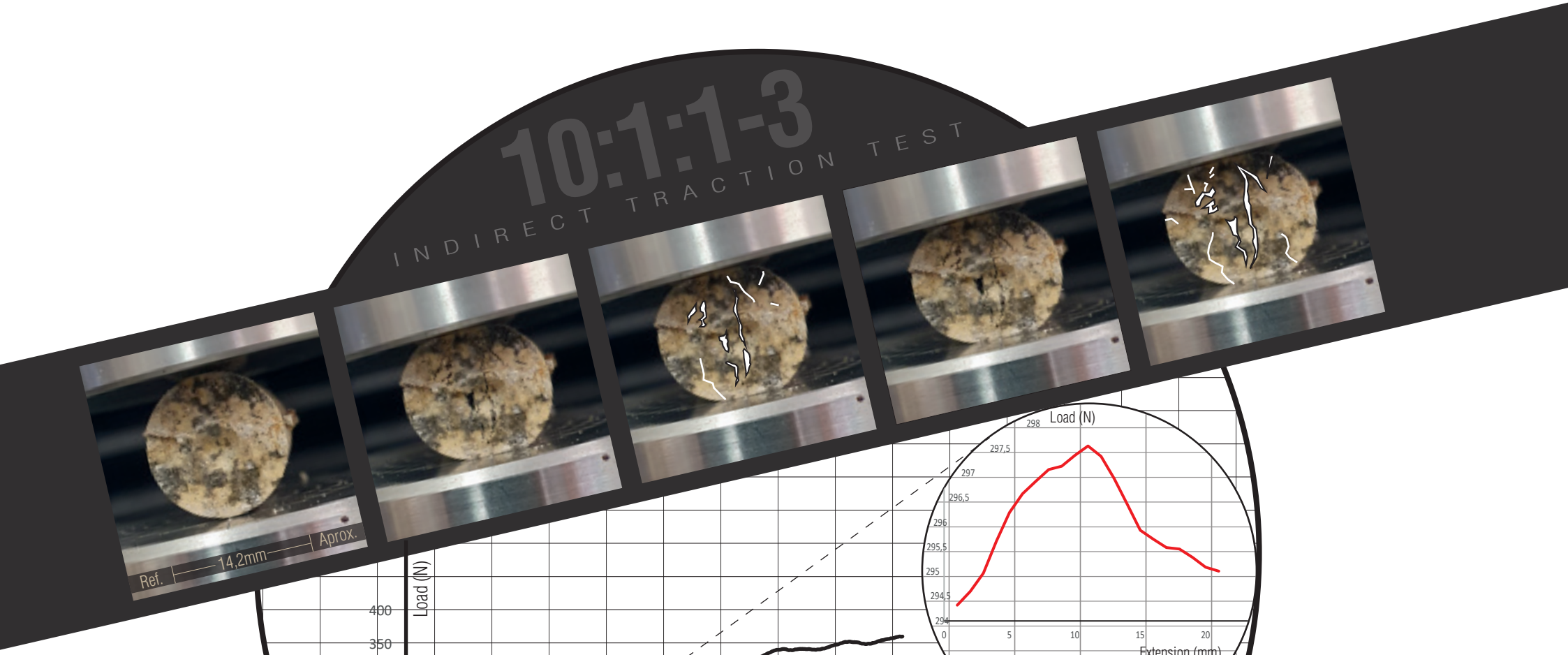


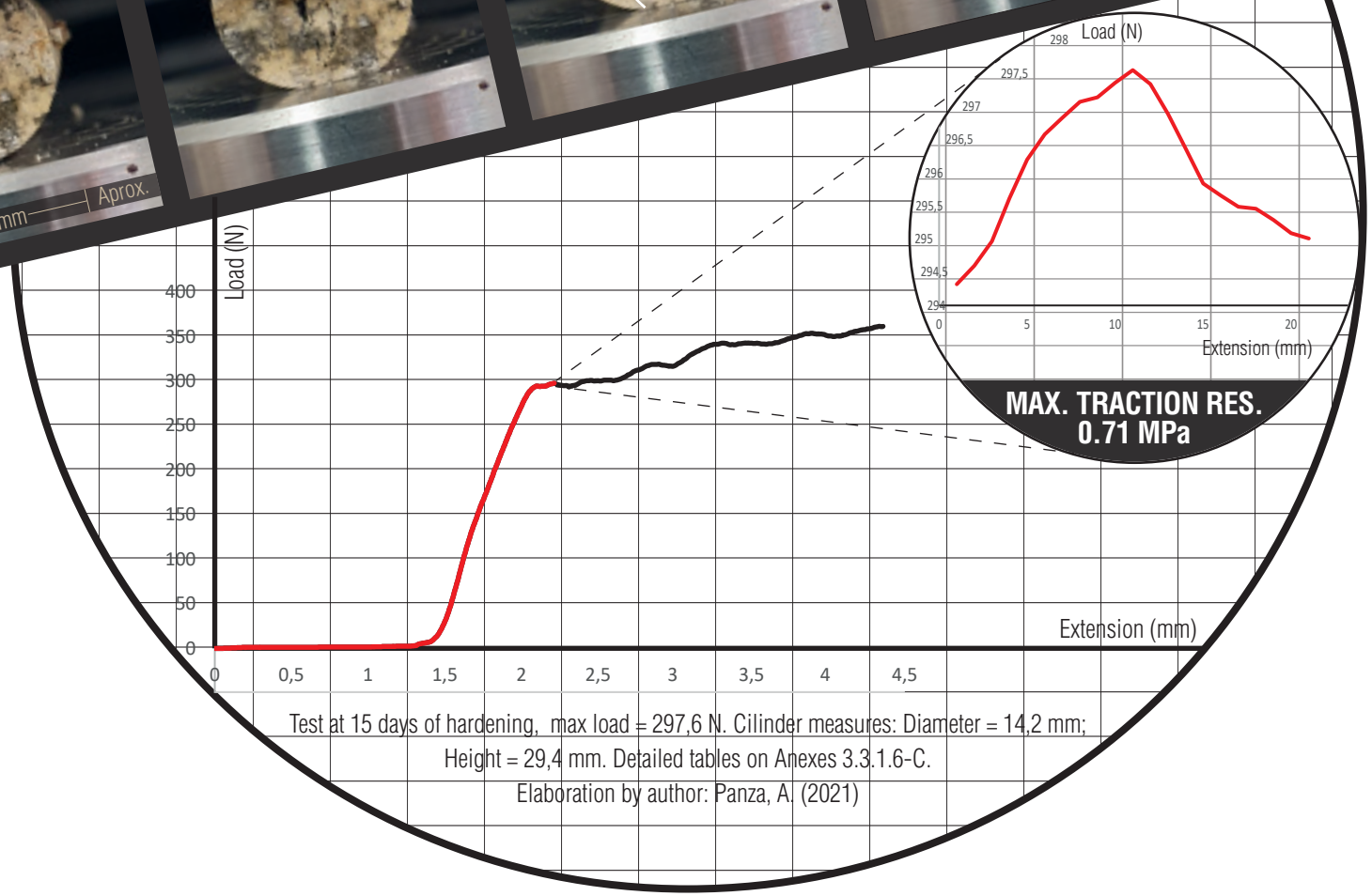
Test at 15 days of hardening, max load = 414,7 N. Cilinder measures: Diameter = 14,8 mm; Height = 32,5 mm. Detailed tables on Anexes 3.3.1.6-B.

Elaboration by author: Panza, A. (2021)

10:1:1-3

INDIRECT TRACTION TEST





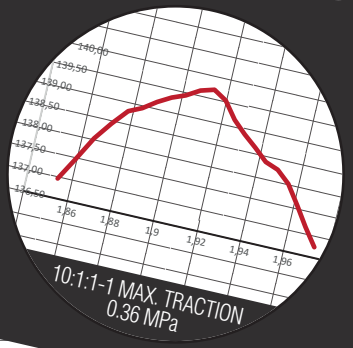
Test at 15 days of hardening, max load = 297,6 N. Cilinder measures: Diameter = 14,2 mm; Height = 29,4 mm. Detailed tables on Anexes 3.3.1.6-C.

Elaboration by author: Panza, A. (2021)

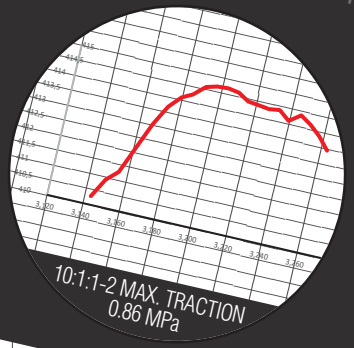
AVERAGE

10:1:1-Av

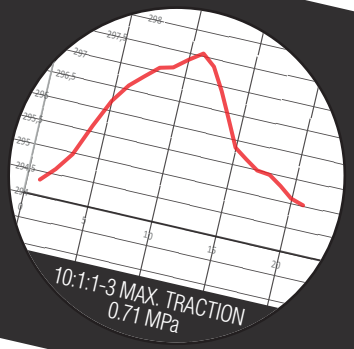
INDIRECT TRACTION TEST

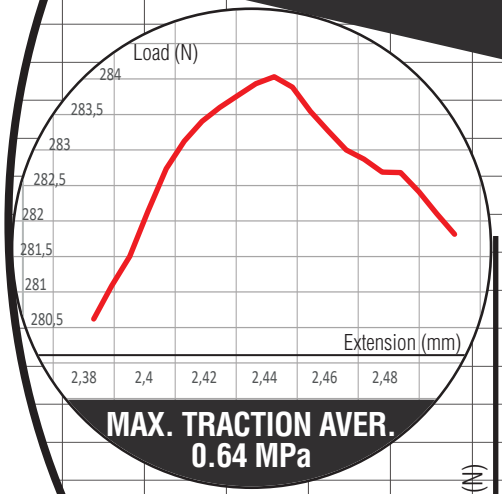


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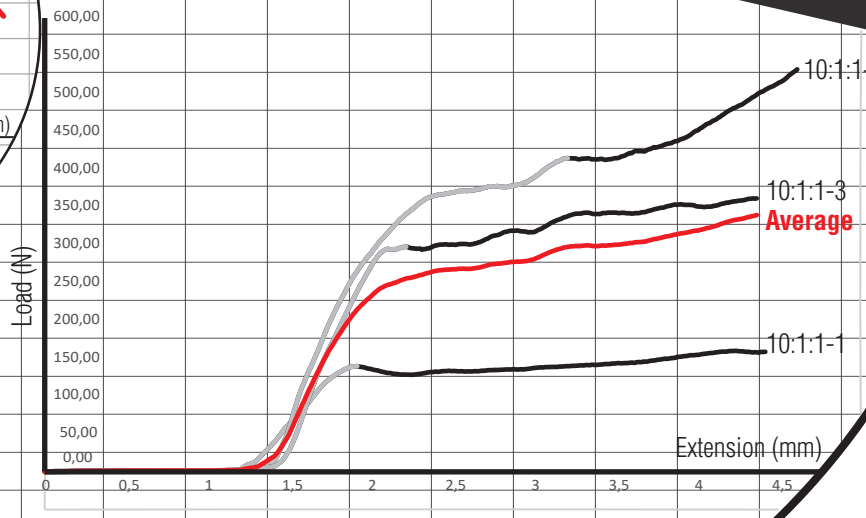


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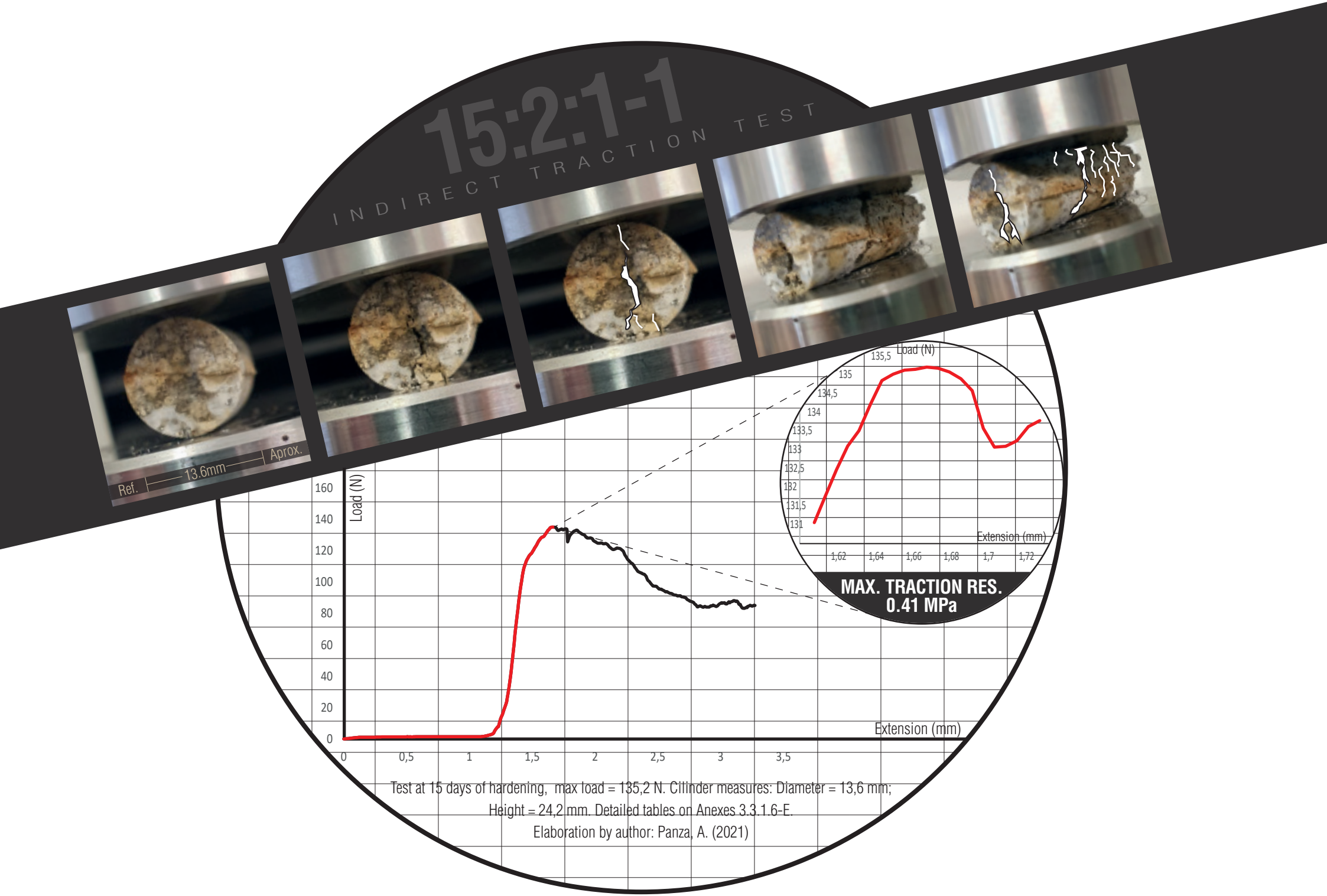




MAX. TRACTION AVER.
0.64 MPa



Test at 15 days of hardening, max average load = 284 N.
Detailed tables on Anexes 3.3.1.6-D.
Elaboration by author: Panza, A. (2021)



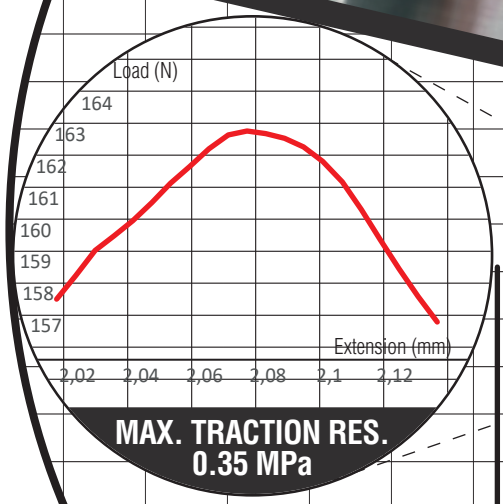
Test at 15 days of hardening, max load = 135,2 N. Cilinder measures: Diameter = 13,6 mm; Height = 24,2 mm. Detailed tables on Anexes 3.3.1.6-E.

Elaboration by author: Panza, A. (2021)

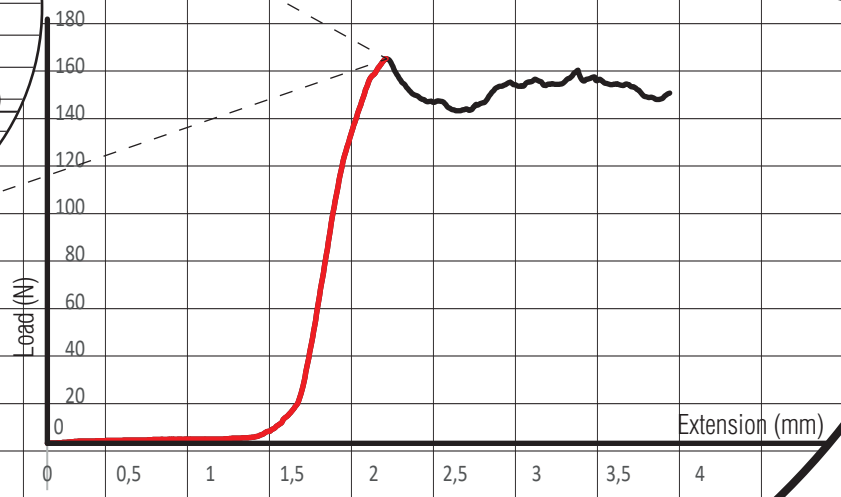
15:2:1-2

INDIRECT TRACTION TEST

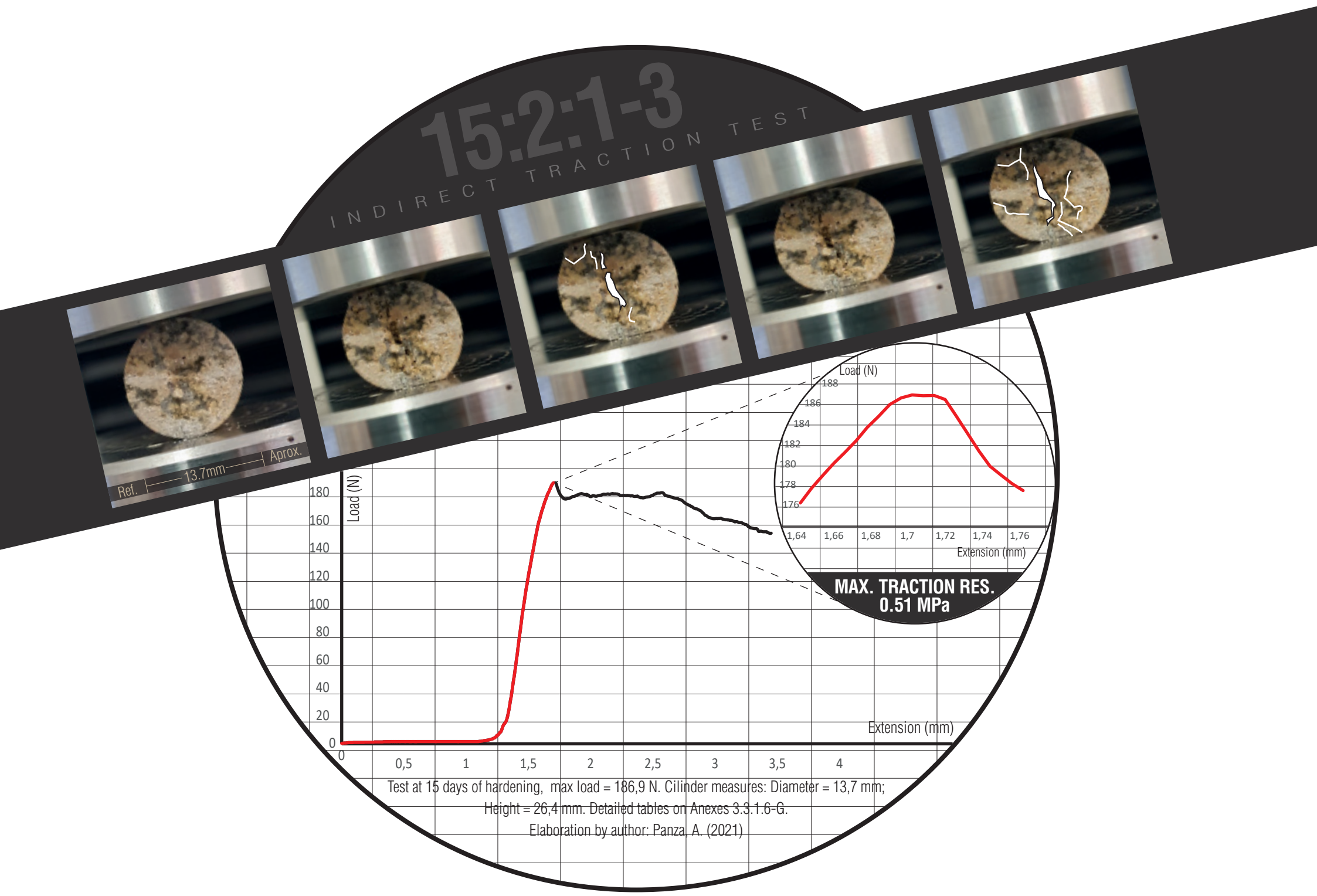




MAX. TRACTION RES.
0.35 MPa



Test at 15 days of hardening, max load = 163,2 N. Cilinder measures: Diameter = 13,9 mm;
Height = 33,4 mm. Detailed tables on Anexes 3.3.1.6-F.
Elaboration by author: Panza, A. (2021)



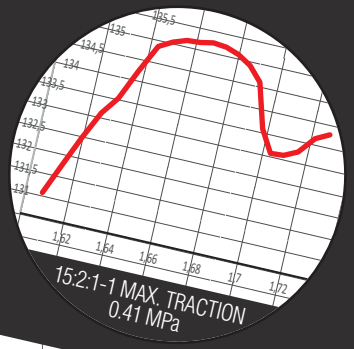
Test at 15 days of hardening, max load = 186,9 N. Cilinder measures: Diameter = 13,7 mm; Height = 26,4 mm. Detailed tables on Anexes 3.3.1.6-G.

Elaboration by author: Panza, A. (2021)

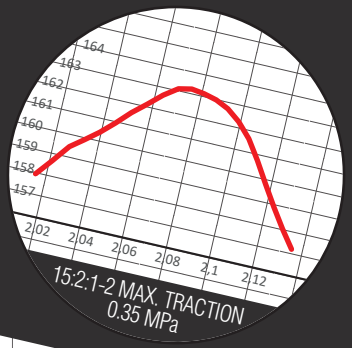
AVERAGE

15:2:1-Av

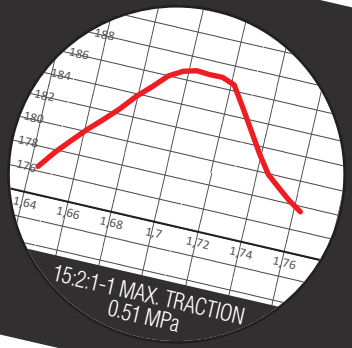
INDIRECT TRACTION TEST

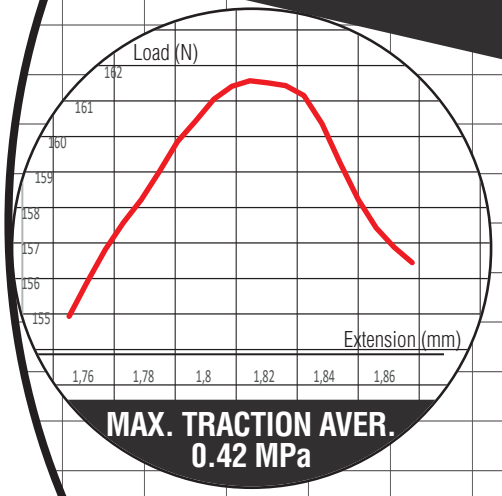


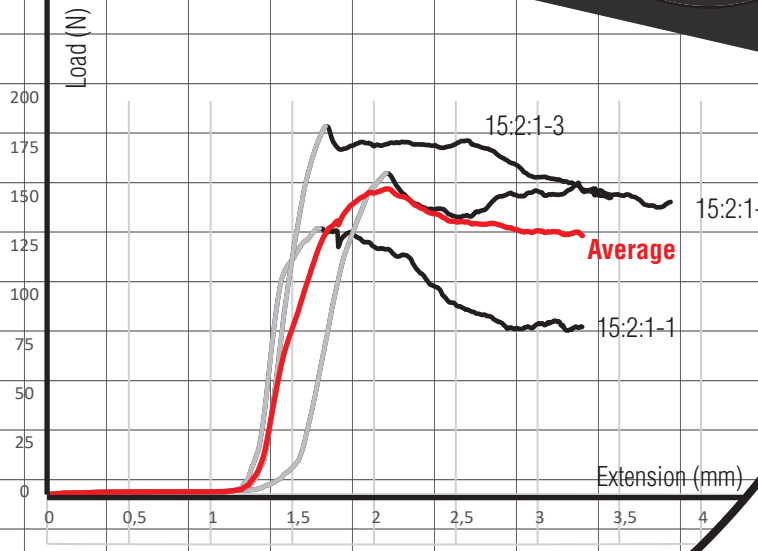
+



+







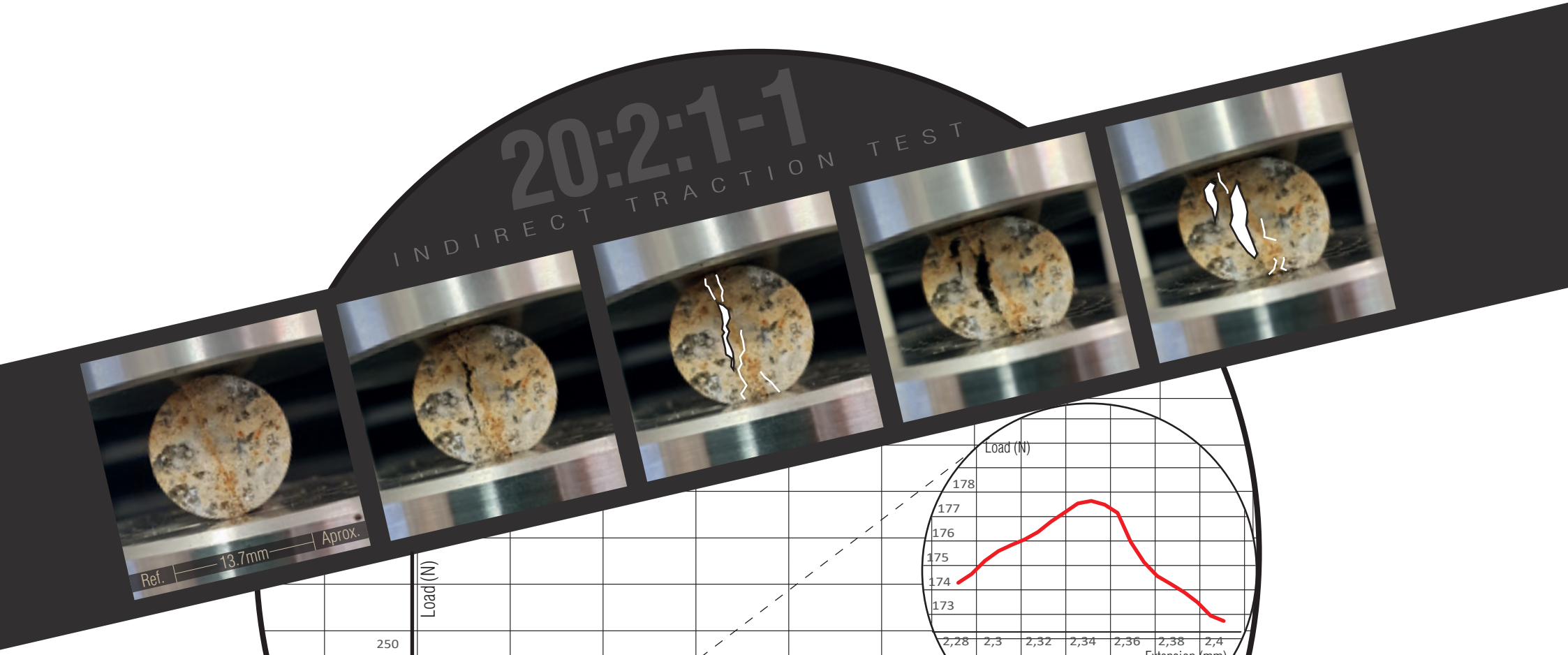
Test at 15 days of hardening, max average load = 161,8 N.

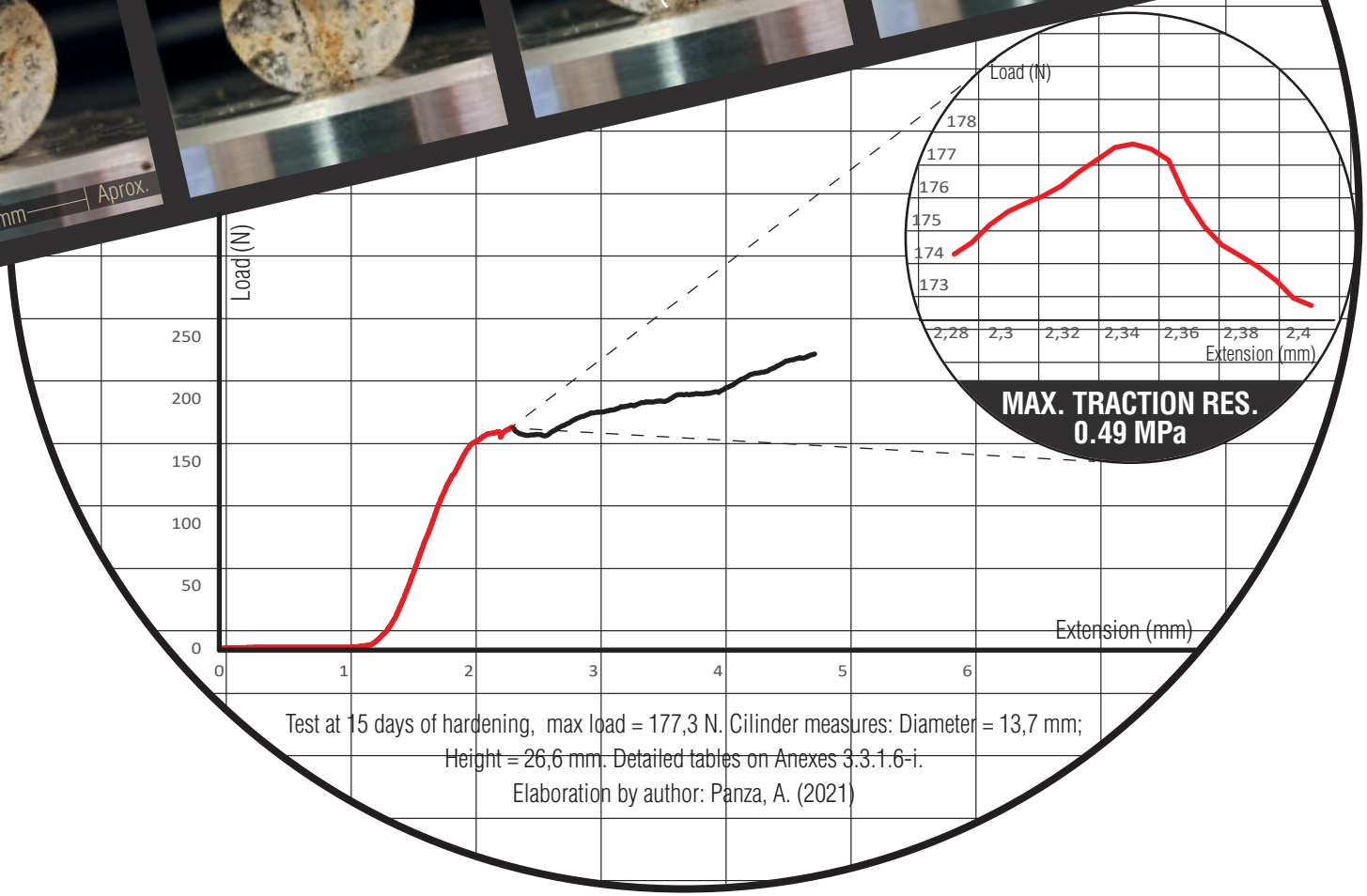
Detailed tables on Anexes 3.3.1.6-H.

Elaboration by author: Panza, A. (2021)

20:2:1-1

INDIRECT TRACTION TEST



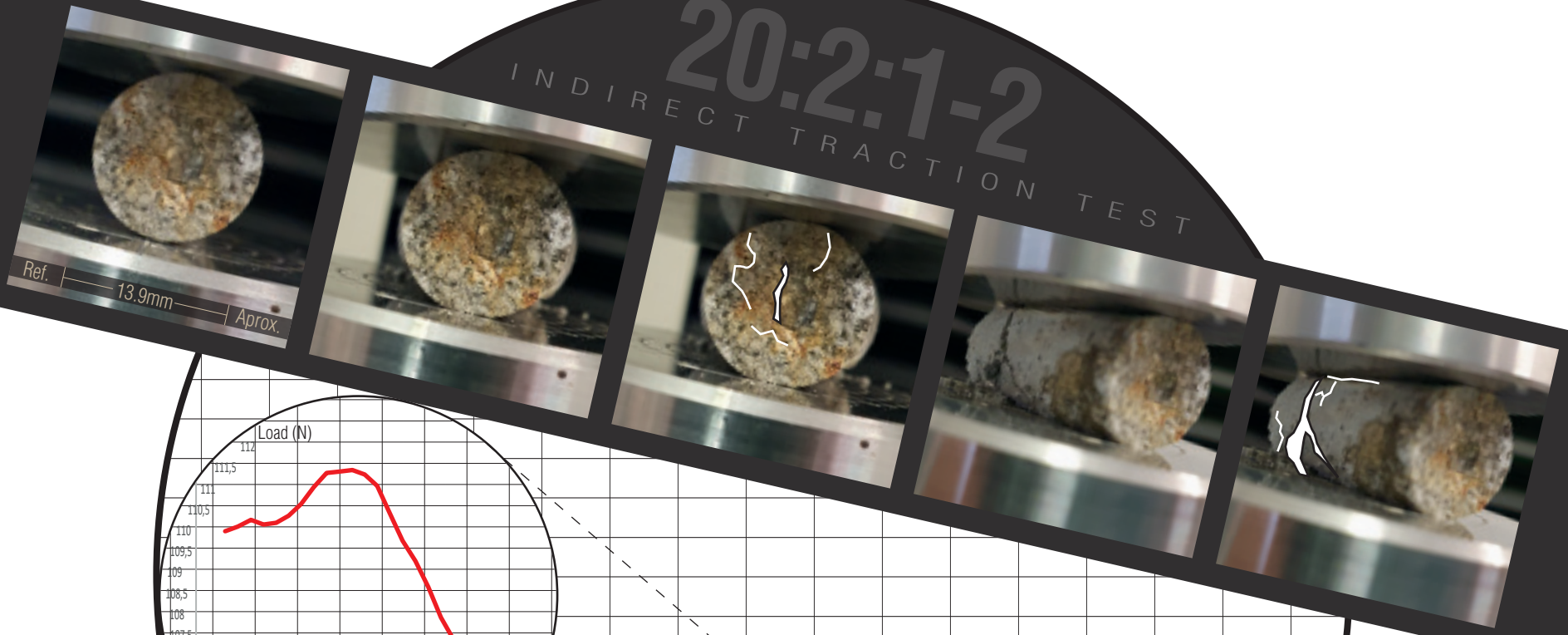


Test at 15 days of hardening, max load = 177,3 N. Cilinder measures: Diameter = 13,7 mm; Height = 26,6 mm. Detailed tables on Anexes 3.3.1.6-i.

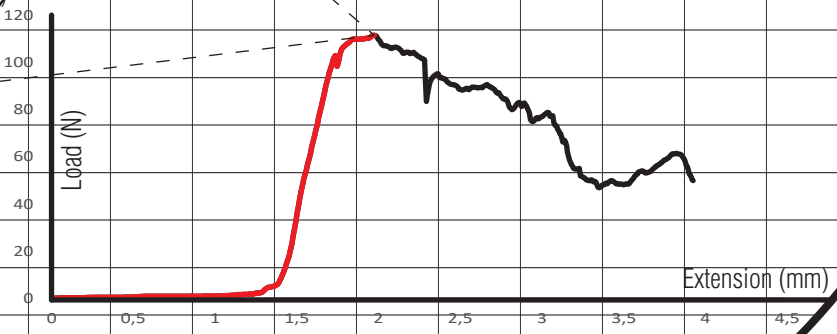
Elaboration by author: Panza, A. (2021)

20:2:1-2

INDIRECT TRACTION TEST



MAX. TRACTION RES.
0.37 MPa

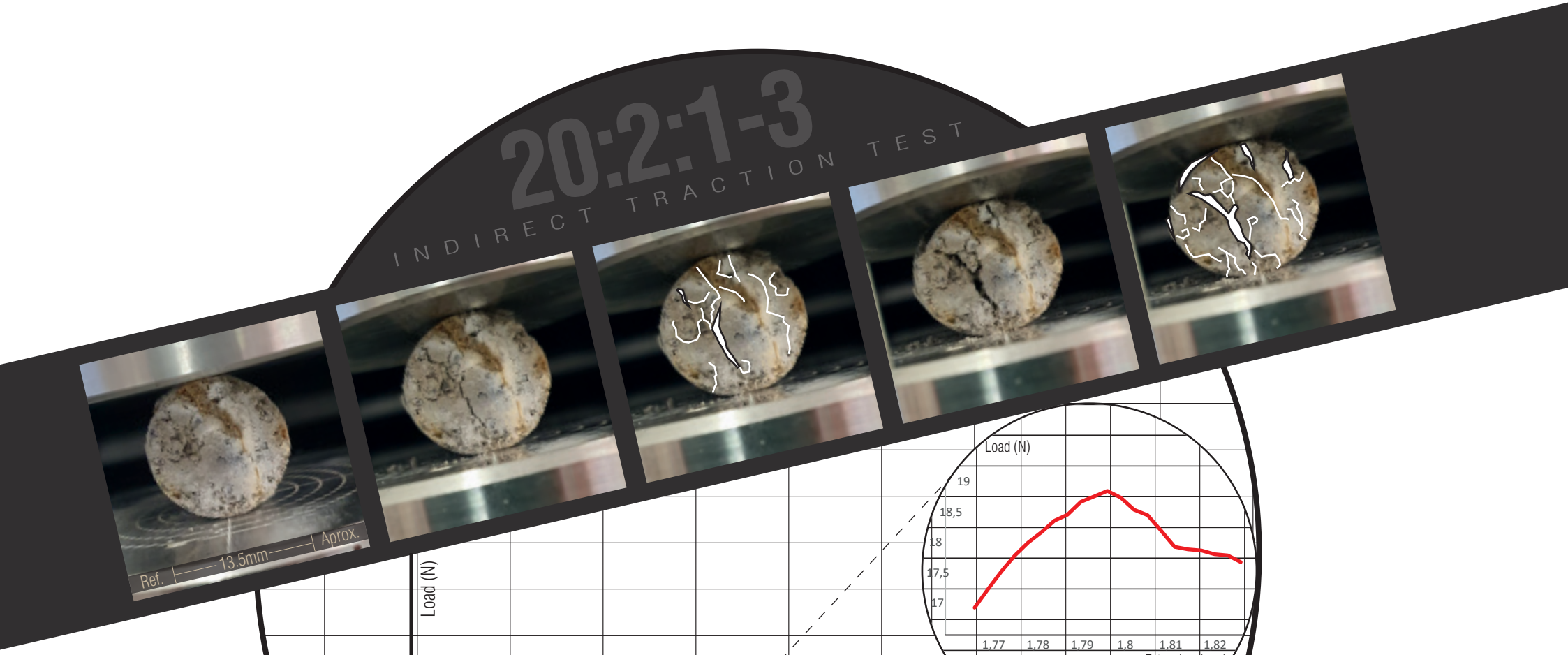


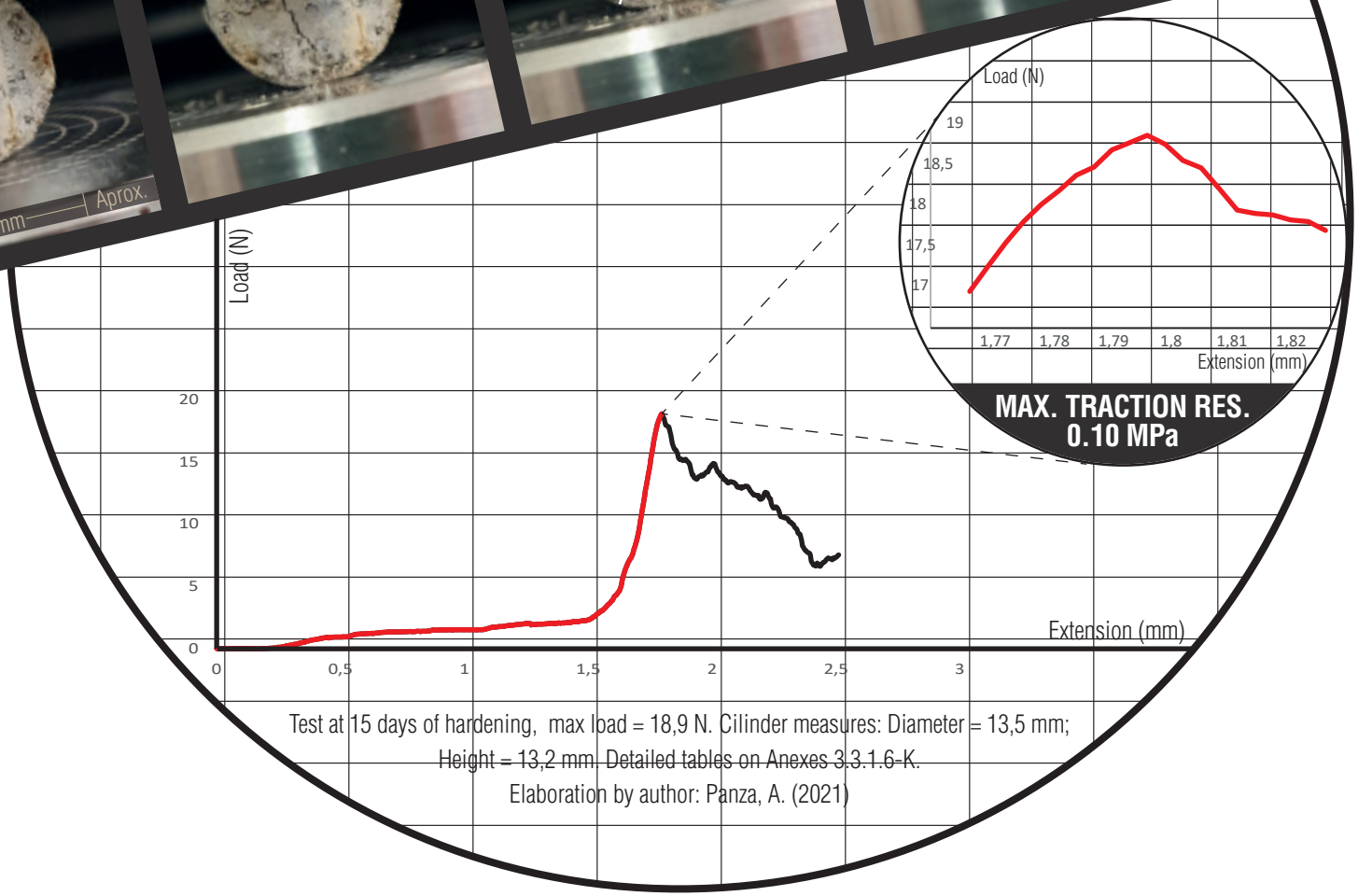
Test at 15 days of hardening, max load = 111,5 N. Cilinder measures: Diameter = 13,9 mm; Height = 21,8 mm. Detailed tables on Anexes 3.3.1.6-J.

Elaboration by author: Panza, A. (2021)

20:2:1-3

INDIRECT TRACTION TEST





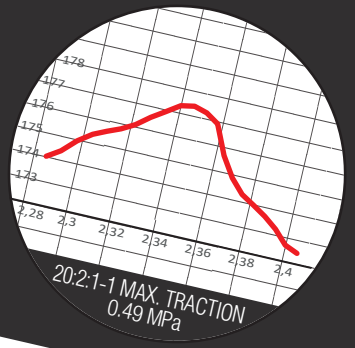
Test at 15 days of hardening, max load = 18,9 N. Cilinder measures: Diameter = 13,5 mm; Height = 13,2 mm. Detailed tables on Anexes 3.3.1.6-K.

Elaboration by author: Panza, A. (2021)

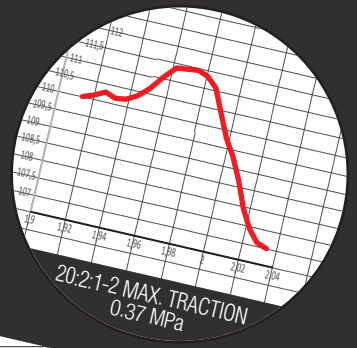
AVERAGE

20:2:1-Av

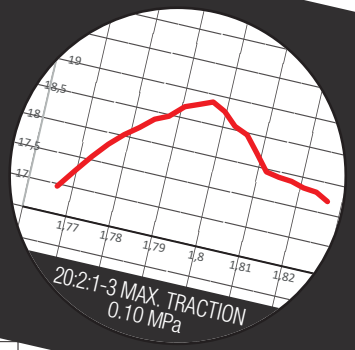
INDIRECT TRACTION TEST

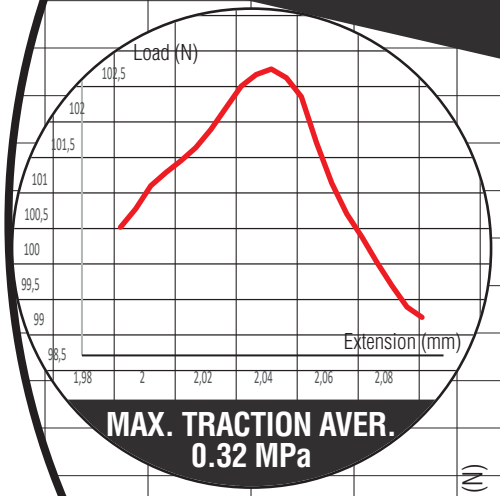


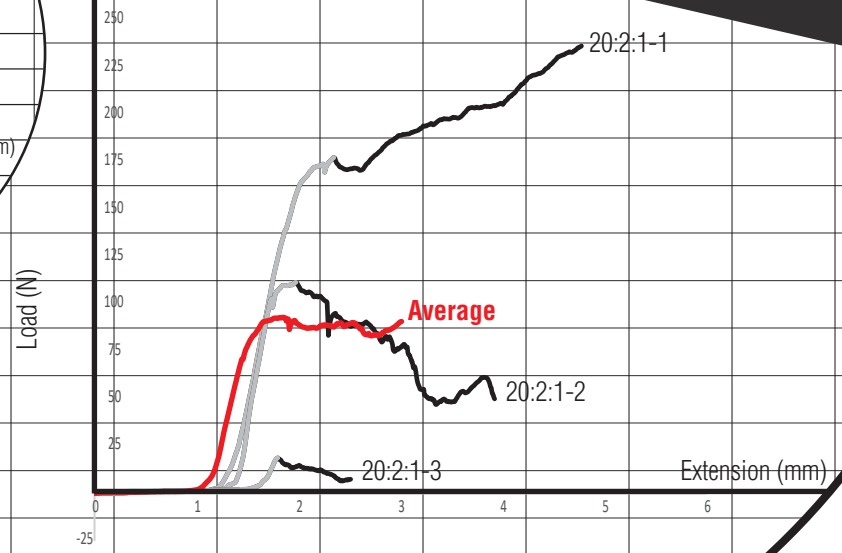
+



+



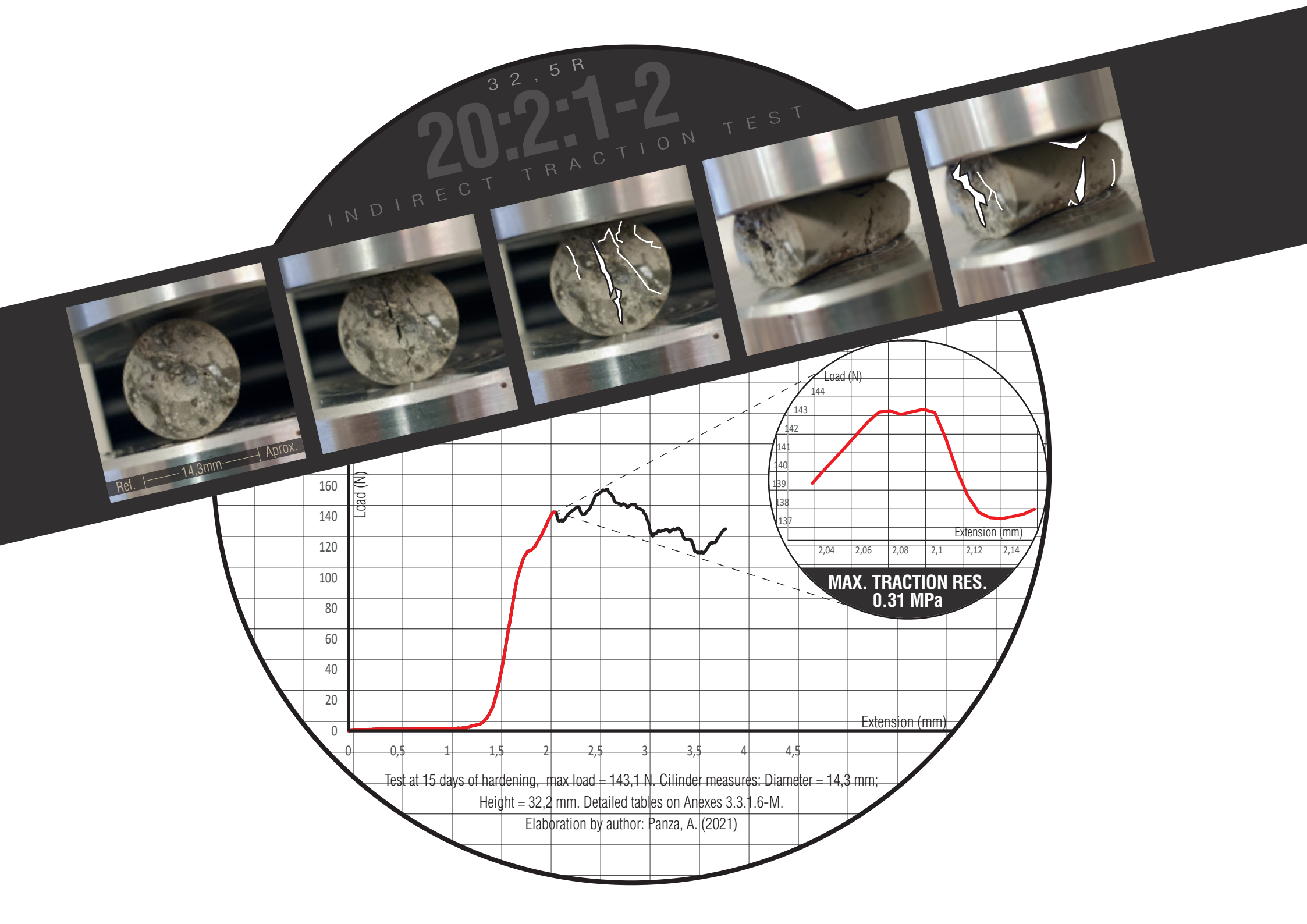




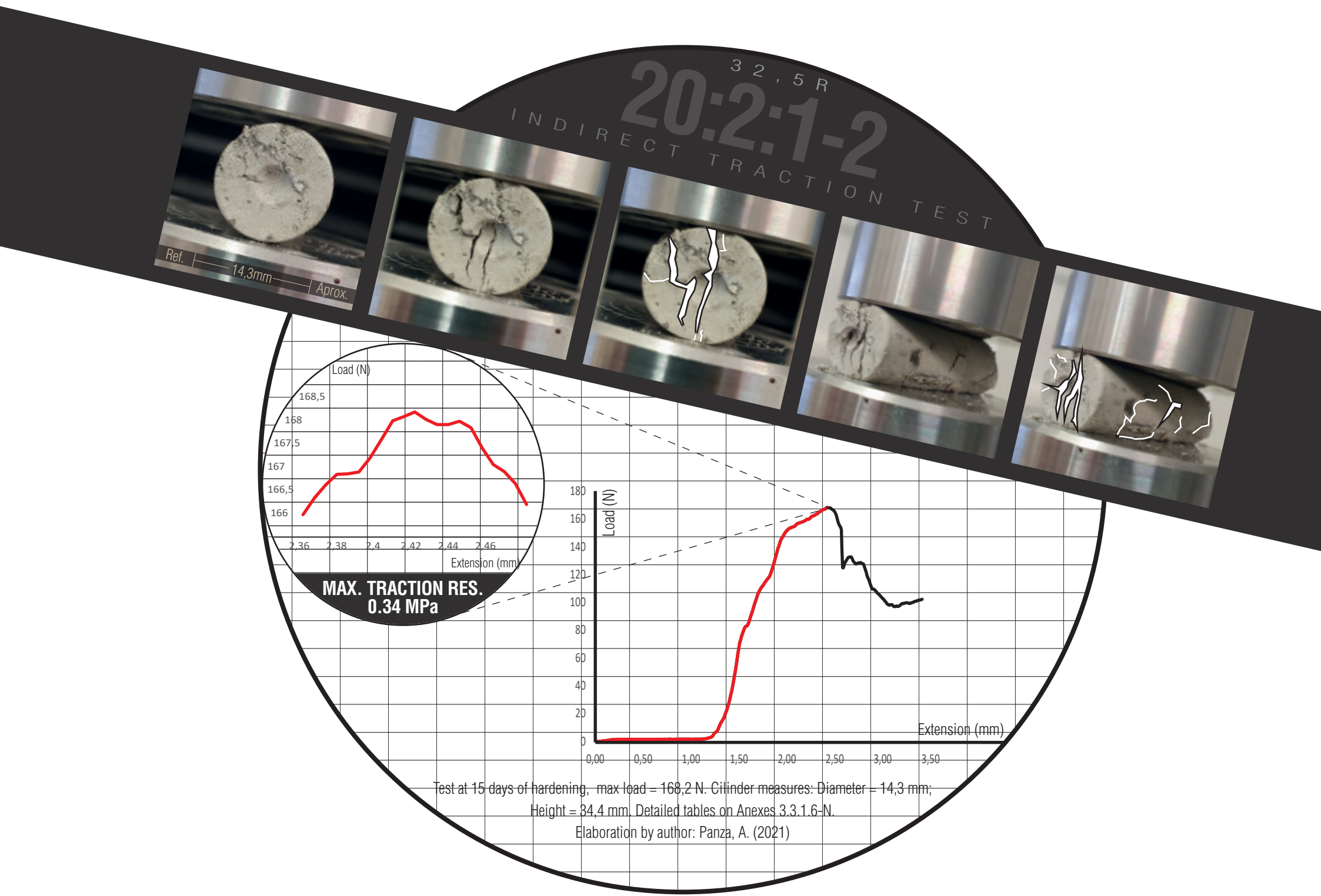
Test at 15 days of hardening, max average load = 102,6 N.

Detailed tables on Anexes 3.3.1.6-L.

Elaboration by author: Panza, A. (2021)



Test at 15 days of hardening, max load = 143,1 N. Cilinder measures: Diameter = 14,3 mm;
Height = 32,2 mm. Detailed tables on Anexes 3.3.1.6-M.
Elaboration by author: Panza, A. (2021)



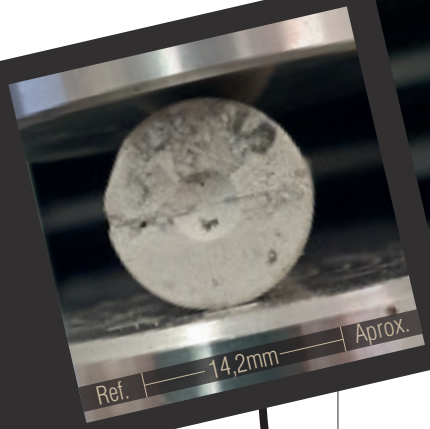
Test at 15 days of hardening, max load = 168,2 N. Cilinder measures: Diameter = 14,3 mm; Height = 34,4 mm. Detailed tables on Anexes 3.3.1.6-N.

Elaboration by author: Panza, A. (2021)

32,5R

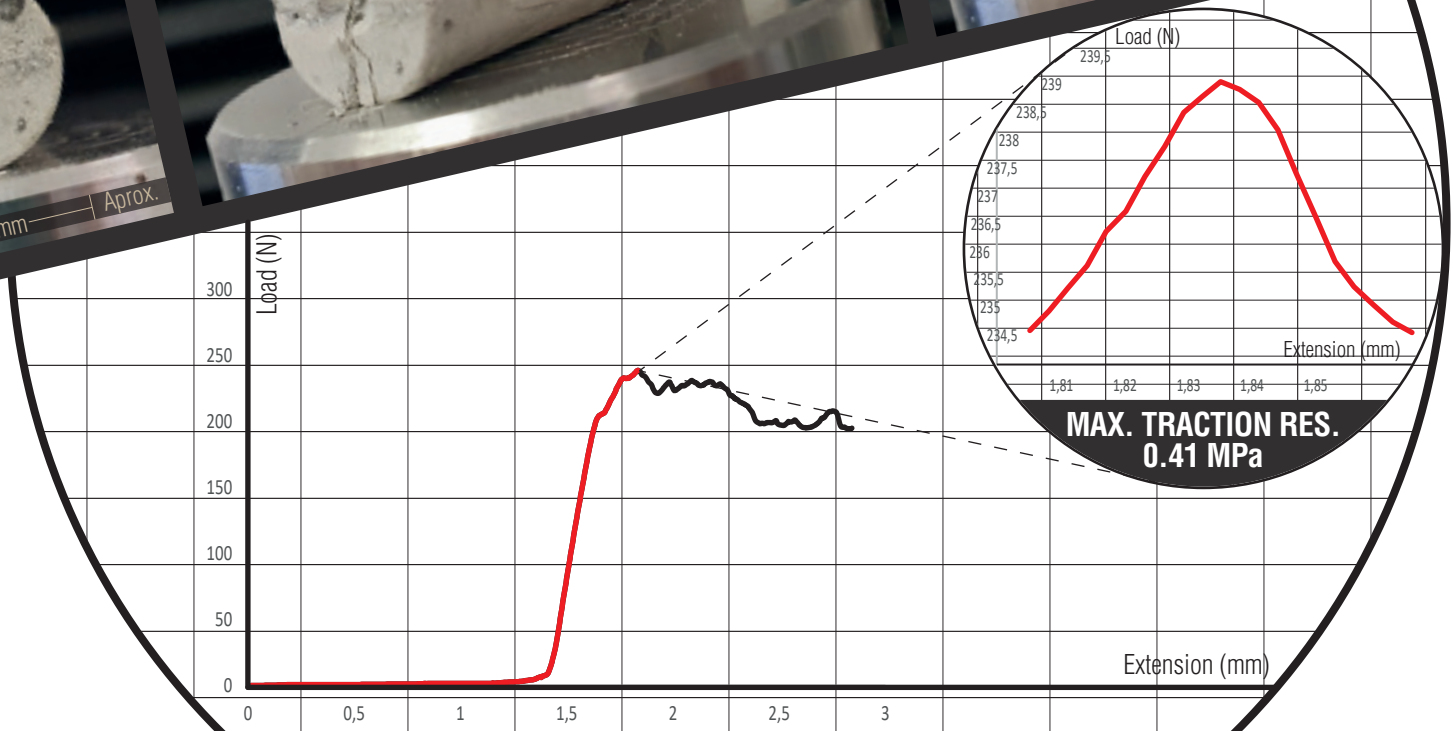
20:2:1-3

INDIRECT TRACTION TEST



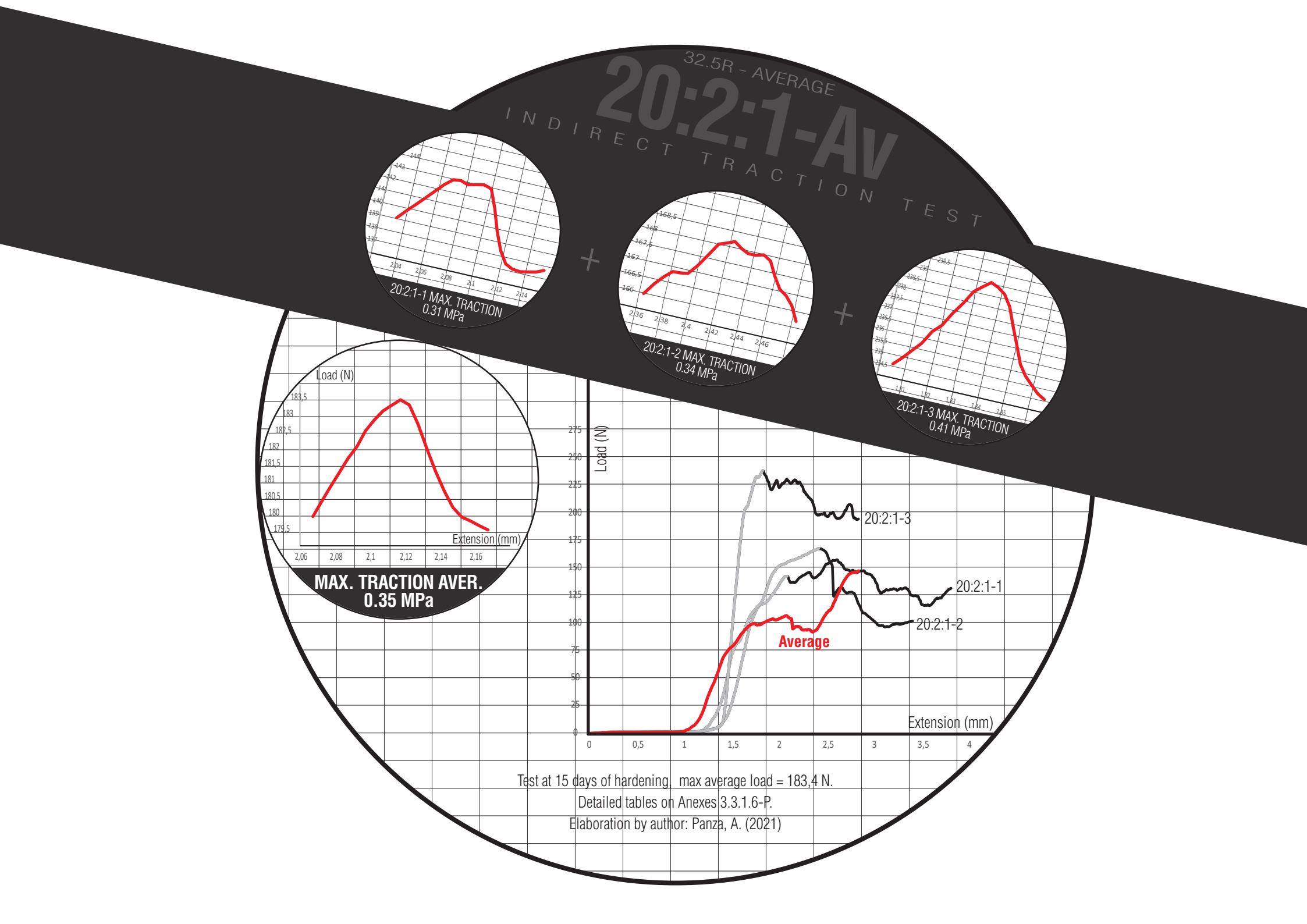






Test at 15 days of hardening, max load = 239 N. Cilinder measures: Diameter = 14,2 mm; Height = 40,5 mm. Detailed tables on Anexes 3.3.1.6-O.

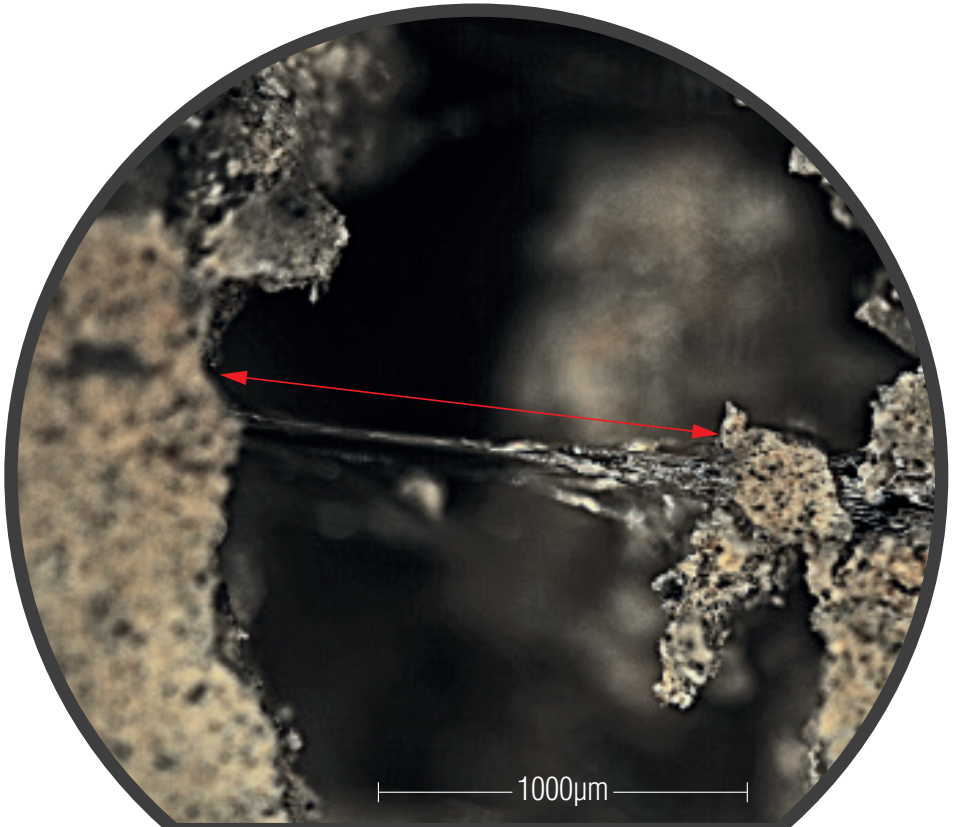
Elaboration by author: Panza, A. (2021)


32.5R - AVERAGE
20:2:1-Av
INDIRECT TRACTION TEST
20:2:1-1 MAX. TRACTION
0.31 MPa
20:2:1-2 MAX. TRACTION
0.34 MPa
20:2:1-3 MAX. TRACTION
0.41 MPa
Load (N)
Extension (mm)
MAX. TRACTION AVER.
0.35 MPa
Load (N)
Extension (mm)
20:2:1-3
20:2:1-1
20:2:1-2
Average
Test at 15 days of hardening, max average load = 183,4 N.
Detailed tables on Anexes 3.3.1.6-P.
Elaboration by author: Panza, A. (2021)

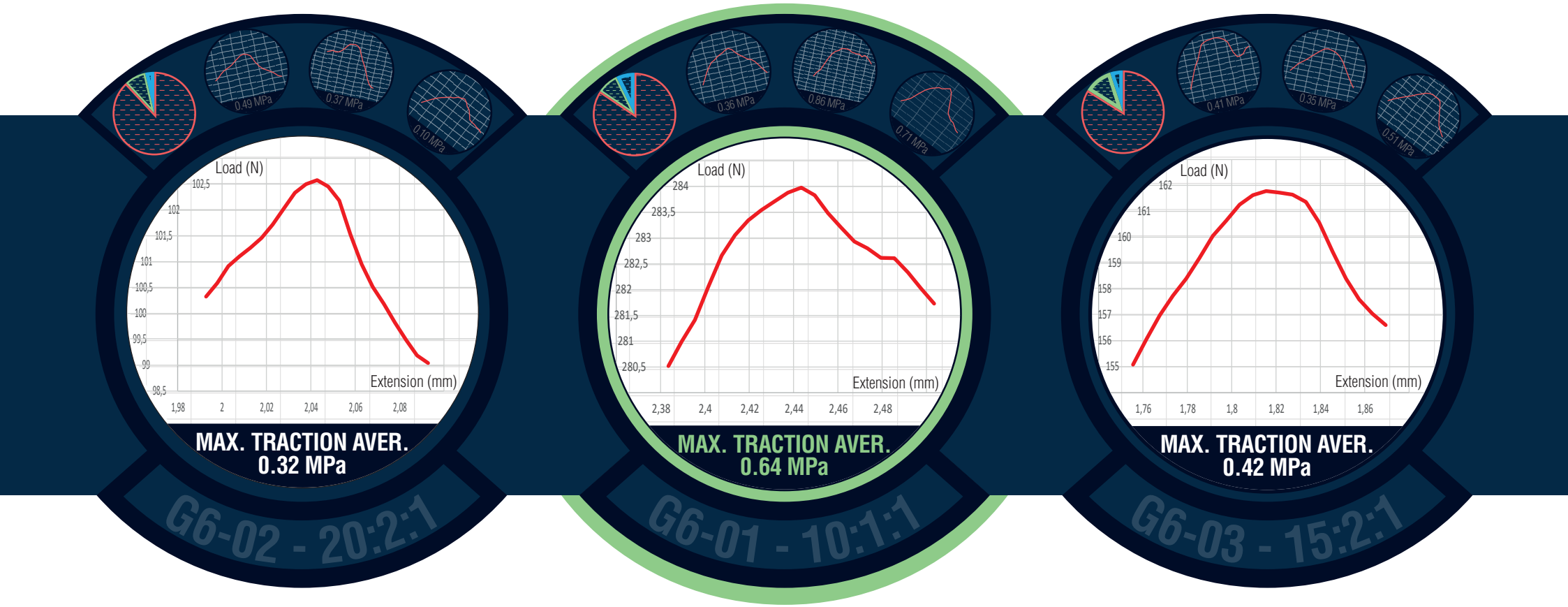
After finishing the tests for all of the specimens, it is notable a better performance in the mixture 10:1:1, presenting the highest indirect traction resistance with values of: 0.36, 0.86 and 0.71 MPa, and an average of 0.64 MPa; higher than the 0.42 and 0.32 MPa registered in the mixtures 15:1:1 and 20:1:1 respectively.

The reason for this notable performances could be: the malt composition and its resistance in very few time; and possibly the presence of polyacrylate crystals that acts as very small elastomer fibers embed in the mixture supporting the tensile strengths and preventing the disaggregation of the material (figure in this page).

Considering this information, the chosen mixture design for the following tests will be 10:1:1 (graphic in next page).



Microscope view of a polyacrylate chrystal acting as a fiber joining cement


0.49 MPa
0.37 MPa
0.10 MPa
Load (N)
102,5
102
101,5
101
100,5
100
99,5
99
98,5
Extension (mm)
1,98
2
2,02
2,04
2,06
2,08
MAX. TRACTION AVER.
0.32 MPa
G6-02 - 20:2:1
0.36 MPa
0.86 MPa
0.71 MPa
Load (N)
284
283,5
283
282,5
282
281,5
281
280,5
Extension (mm)
2,38
2,4
2,42
2,44
2,46
2,48
MAX. TRACTION AVER.
0.64 MPa
G6-01 - 10:1:1
0.41 MPa
0.35 MPa
0.51 MPa
Load (N)
162
161
160
159
158
157
156
155
Extension (mm)
1,76
1,78
1,8
1,82
1,84
1,86
MAX. TRACTION AVER.
0.42 MPa
G6-03 - 15:2:1

3.4. Virtual Capsule:

After the selection of an effective powder healing agent, the production of a solid cylindric mass by the application of different physical – chemical procedures is possible, this material presents a shape retention with the correct treatment, that will only require the waterproofing layer to protect it from the moisture and early activations. That is to say it will avoid the necessity of a physical container to preserve the healing agent before its epoxy sealing, reducing steps and material to conform the final product.

As seen in the previous section, a solid powdered mixture of substances based in cement, acid–base, and sodium polyacrylate was developed, also it is notable that this agent, by being produced in a powdered presentation, can be compacted, creating conglomerated masses (similar to the effect of cement or sugar lumps when preserved into containers, tends to create grains accumulations).

Based on this effect and using the principles of sedimentary and metamorphic rocks formations, is originated the idea of producing a mass of this healing agent compacted for obtaining a cylindrical shape core that will be insulated in epoxy. This is the definition of Virtual Capsule: a capsule self healing technique that does not require a physical container to preserve its shape (the solid agent can do it itself; in other words, is only healing powder and waterproofing layer, considering it virtual due to the lack of a hard container or "shield").

For making it possible and considering the powder as a sediments association, some geology principles are used; the concepts of cohesion, lithification and metamorphosis in rocks were useful to produce a consolidated mass of material with an specific shape and volume without disaggregating.

Bibliographic references:
-Panchuk, K. and Earle, S., 2019. Physical geology. 1st ed. University of Saskatchewan, pp.1-544. Available at: https://openpress.usask.ca/physicalgeology/front-matter/physical-geology/
-USDA, 2008. National soil survey handbook. Washington, D.C.: U.S. Dept. of Agriculture, Soil Conservation Service, pp.Part 269: 1-128. Available at: https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/16/nrcs143_020629.pdf

" Weathering and erosion (Chapter 8) are the first two steps in the transformation of per-existing rocks into sedimentary rocks. The remaining steps in the formation of sedimentary rocks are transportation, deposition, burial, and lithification.(...) Lithification is the process of converting sediments into solid rock. Compaction is the first step. Sediments that have been deposited are buried when more and more sediments accumulate above them. The weight of the overlying sediments pushes the clasts together, closing up some of the pore spaces (the gaps between grains) and forcing them together. Pore spaces often contain water (although they can also contain air or even hydrocarbons), so the water is squeezed out." (Panchuk, K. 2019)

"Lithification - The conversion of unconsolidated sediment into a coherent and solid rock, involving processes such as cementation, compaction, desiccation, crystallization, recrystallization, and compression. It may occur concurrently with, shortly after, or long after deposition." (National Soil Survey Handbook (NSSH). USDA 2008)

Lithification is the conformation of a solid mass by the use of high pressures over an amount of granular material (sediments) until removing all of the air between the grains, compacting it into a single final material, such as explained in the previous citation. That is to say high pressure to compress all of the components together is one of the principles for obtaining the desired results.

"The word "Metamorphism" comes from the Greek: meta = after, morph = form, so metamorphism means the after form. In geology this refers to the changes in mineral assemblage and texture that result from subjecting a rock to pressures and temperatures different from those under which the rock originally formed.

The original rock that has undergone metamorphism is called the protolith. Protolith can be any type of rock and sometimes the changes in texture and mineralogy are so dramatic that is difficult to distinguish what the protolith was. (...)

During metamorphism the protolith undergoes changes in texture of the rock and the mineral make up of the rock. These changes take place mostly in the solid state and are caused by changes in physical or chemical conditions, which in turn can be caused by such things as burial, tectonic stress, heating by magma or interactions with fluids. (...)

Bibliographic references:
-Nelson, S., 2017. Metamorphism and Metamorphic Rocks. [ebook] Louisiana, USA: Tulane University, pp.1-13. Available at: <https://www.tulane.edu/~sanelson/eens1110/metamorphic.pdf> [Accessed 10 January 2022].

Metamorphism occurs because rocks undergo changes in temperature and pressure and may be subjected to differential stress and hydrothermal fluids. Metamorphism occurs because some minerals are stable only under certain conditions of pressure and temperature." (Nelson, S. 2017).

Complementing the lithification principle (in order to reduce the huge amount of time it requires in nature), are taking into consideration also the metamorphic rocks generation concepts; where high pressures combined with high temperatures supports the mineral assemblage behavior.

For supporting this process, the mass workability, and obtaining a more accurate and clean shape; a liquid media to produce a fluid mixture able to contain all of the components well combined must be incorporated, avoiding the precipitation of the bigger grains, preventing looses by manipulation (considering it is a powder and its components can be dispersed in air); also for preventing air voids that could produce weak points or cracks; and to take advantage of the cohesion principle, present in wet sand for example:

"Adding a small amount of liquid to granular matter transforms its properties in practical ways. Wet sand can be easily sculpted grain segregation can be prevented and particle agglomeration can be manipulated making it an important phenomenon in industrial processes.

On the other hand, landslides can occur when the ground becomes saturated with rain. Liquid in the interstitial space initially collects near points of contact between grains, because it is drawn there by surface tension. The curvature of the liquid interface leads to low pressure in the liquid phase causing a force of attraction between grains.

Remarkably, the static mechanical properties resulting from this cohesion is insensitive to the actual liquid content over a wide range.

When a liquid is added to granular matter, a three-phase system is formed, composed of liquid, solid and interstitial fluid. Interfaces exist between liquid and solid, and liquid and displaced interstitial fluid (Fig. 1a). The cohesive strength between grains initially increases sharply for very small volumes of liquid because of the roughness of the grains.

Bibliographic and image references:
-Kudrolli, A., 2008. GRANULAR MATTER Sticky sand. nature materials, NEWS & VIEWS, Vol 7, [online] pp.174-175. Available at: <https://home.agh.edu.pl/~kozlow/fizyka/Fizyka%20zamkow%20z%20piasku/Sticky%20sand_nmat2008.pdf> [Accessed 10 January 2022].

After this increase, however, the cohesivity is effectively constant until the liquid saturates the space between the grains and cohesion decreases to zero, just as when the grains are completely dry.

It is well known1,7 that for a perfectly wetting liquid bridge between spherical grains in contact with each other, the strength of the cohesive force is independent of the volume of liquid and approaches $2\pi\gamma R$*, where* γ *is the surface tension of the liquid and R is the radius of the grain (Fig. 1b). This occurs because the increase in liquid bridge size is balanced by the decrease in its curvature." (Kudrolli, A. 2008).*

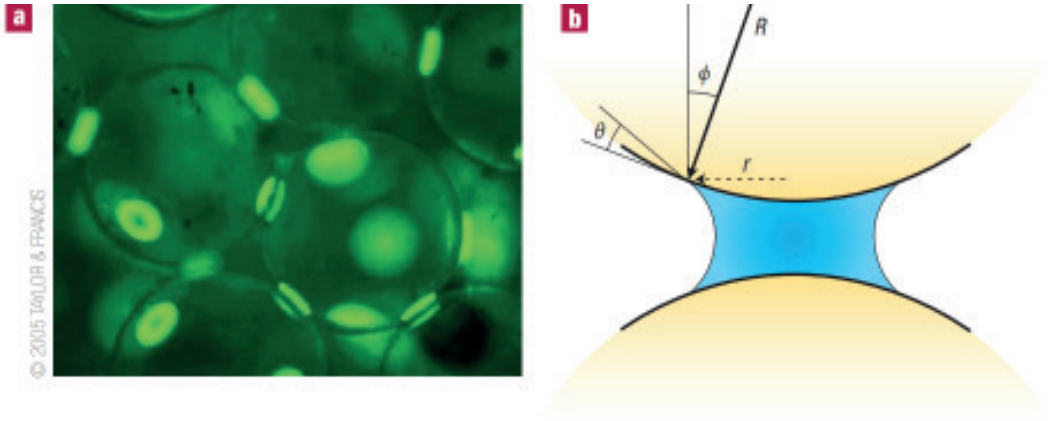


Figure 1 Liquid bridges form at the point of contact between grains, as a result of surface tension. **a**, Fluorescence microscopy image of liquid bridges between 375-μm-diameter glass beads[5]. **b**, Schematic of a liquid bridge (blue) between spherical surfaces (yellow). θ is the liquid–solid contact angle, ϕ is the half-filling angle, defined as $\phi = \tan^{-1}(r/R)$, where r is the radius of the liquid bridge, and R is the radius of the grain.

A liquid media between a granular mater amount can support the attraction due to the superficial tension of water, such as explained in the previous citation, creating a network between the contact points, and reducing the pressure by producing curvatures in the fluid, originating an attraction effect, conforming an unified mix.

As it is not possible to use water and not activate the healing agent and harden it before its use, it is necessary to study other liquid substances. One alternative considered was high purity alcohol, but it can always contain water; also could produce volatile and health hazardous gases by heating it; also implicates high costs for its use including specialized installations and personal protection implements.

Oil was another substance considered, but as it produces many harmful gases, its evaporation is difficult to manage; it can also contaminate cement producing some healing agent activation problems.

Propylene glycol is the best performance substance selected, considering the following reasons:

Technical data sheet references:
-DOW™, n.d. DOW™ Propylene Glycol, Industrial Grade. Form No. 812-00307-0415BBI. [online] Dow, pp.1-2. Available at: <https://www.dow.com/content/dam/dcc/documents/en-us/productdatasheet/812/812-00307-01-dow-propylene-glycol-industrial-grade-tds.pdf?iframe=true> [Accessed 10 January 2022].

Property	Typical Value
Molecular weight (g/mol)	76.10
Boiling point, 101.3 kPa (1 atm)	187.4°C (369.3°F)
Distillation range, 101.3 kPa (1 atm)	186-189°C (367°F-372°F)
Vapor pressure 20°C (68°F) 25°C (77°F)	 0.011 kPa (0.08 mm Hg) 0.017 kPa (0.13 mm Hg)
Freezing point	Supercools
Pour point	< -57°C (-71°F)
Specific gravity 20/20°C (68/68°F) 25/4°C (77/39°F) 60/4°C (140/39°F)	 1.038 1.033 1.007
Refractive index n20/D, 20°C (68°F)	1.4310-1.4330
Viscosity, 25°C (77°F) 60°C (140°F)	48.6 centipoise (mPa.s) 8.42 centipoise (mPa.s)
Specific heat, 25°C (77°F) Surface tension, 25°C (77°F)	2.51 J/(g°K) (0.60 Btu/lb/°F) 36 mN/m (36 dynes/cm)
Flash point, Pensky-Martens Closed Cup	104°C (220°F)
Autoignition temperature	371°C (700°F)
Thermal conductivity, 25°C (77°F)	0.2061 W/(m°K) (0.1191 Btu $hr^{1}ft^{-1}°F^{-1}$)
Electrical conductivity, 25°C (77°F)	10 micro S/m (0.1 * 10-7 mhos/cm)
Heat of formation	-422 kJ/mol (-101 Kcal/g-mol)
Heat of vaporization, 25°C (77°F)	67 kJ/mol (379 Btu/lb)

> *"is a high purity material produced by the high temperature and high pressure hydrolysis of propylene oxide (PO) with excess water. PGI is a distilled product with a purity specification of minimum 99.5% and is available from The Dow Chemical Company in drum, IBC and bulk quantities. PGI is a colorless, water soluble, hygroscopic liquid with a characteristic glycol odor, medium viscosity, low vapor pressure and low toxicity." (DOW™, n.d.)*

The non toxicity, relative low cost, the possibility of be manipulated by any person without too many strict safety rules or equipment, makes of propylene glycol the ideal substance for this process. It also presents a very low amount of water permitted (0.05% H2O maximum permitted), difficulting the healing agent's involuntary activation.

It is a viscose substance with a texture similar to oil, ideal in molds manipulation and for giving the agent an specific shape; furthermore, this viscosity variates with temperature, when increased becomes more liquid and workable.

One of the most important features is the facility PPG presents to begin its evaporation (almost at room temperature), requiring only 25C° to intensify it. This substance releases non toxic water vapors when exposed to heat, less pollutant and non health hazardous.

This liquid is also easily hydro—soluble, it can be quickly dissolved and does not produce water alterations, allowing cement and the other components to react normally.

Bibliographic references:
-DOW™, n.d. DOW™ Propylene Glycol, Industrial Grade. Form No. 812-00307-0415BBI. [online] Dow, pp.1-2. Available at: <https://www.dow.com/content/dam/dcc/documents/en-us/productdatasheet/812/812-00307-01-dow-propylene-glycol-industrial-grade-tds.pdf?iframe=true> [Accessed 10 January 2022].

Knowing the requirements to obtain the desired product, a mold is developed following this principles:

1-.Pressure resistance:

Internal forces for compacting the substances will occur into the mold, that is to say it must be made of a material with closing systems able to resist these stresses without breaking, opening or producing deformations that could affect the final shape.

2-. Heat resistance:

For time periods from 10 to 30 minutes at 200–250C° the mold will be heated; it is important a correct material selection in order to avoid undesired melting effects or weak points generation producing deformations (considering this, thin thermoplastics are discarded).

4-. Easily dis-molding:

As capsules must present very reduced dimensions, the final product will be extremely delicate until the epoxy layer application; for this reason, the dis–molding process must be the most quick and easy possible, without producing efforts in the compact substance that could generate fissures or disintegration.

5-. Be reusable:

For reducing waste and increasing the production of capsules respect to the mold restitutions and make it sustainable, the mold must be able to be re–used and made of a

resistant material. If one mold could only produce one capsule, it makes no sense trying to save in a container for the powder contention.

Before producing the final mold design, different configurations were tested; one was as an extrusion process of the material, passing through a thin metallic pipe and then heated. This one presented very poor results due to the lack of compression of the material in a closed chamber when applying the heating treatment, obtaining a cracked product.

Also was tried a mechanic press for compacting the material in fluid state, to be then extracted and heated. Here the results were better, presenting a more compact mass. Anyway, were still very brittle; so these methods were discarded.

The material presenting the best performance used for this research was the bamboo: Fargesia nítida:

> *"Bamboo is a diverse plant that easily adopts to different climate and landscape condition. It can grow in a wide variety of soil types, different temperatures and humidity conditions. For Poland's climate, there are dozens of varieties of cold hardy bamboo to consider. Most of them belong to either the Phyllostachys or the Fargesia group (genus) of bamboo." (F. BOROWSKI, P., 2019)*

Bamboo, due to the compressive and tensile strength resistance (that is similar to the ones present in steel), its vegetal origin, its renew—ability as natural source (easily reproducible in many different climatic conditions), its biodegradability, compost—ability and non toxicity, makes of it an excellent choice for this molds.

Table 1. Mechanical properties of bamboo, spruce wood and steel

Properties [kN/cm^2]	Bamboo	Spruce wood	Steel
Modulus of elasticity	2000	1100	21000
Compressive strength	6.2–9.5	4.3	14.0
Tension strength	14.8–38.4	8.9	16.0
Bending strength	7.6–27.6	6.8	14.0
Shear strength	2.0	0.7	9.2

Source: GUTU, T. A study on the mechanical strength properties of bamboo to enhance its diversification on its utilization. *International Journal of Innovative Technology and Exploring Engineering*, 2013, 2.5: 314–319.

This material is also an advantage for the mold production due to the following facts:

1-. Cylindrical Shape:

This particular specie of bamboo presents very uniform cylindrical sections and a straight shape, ideal to form the healing agents cores.

Bibliographic references:
-F. BOROWSKI, P., 2019. Bamboo as an innovative material for many branches of world industry. Annals of WULS, Forestry and Wood Technology, [online] 107, pp.13-18. Available at: <https://www.researchgate.net/profile/Piotr-Borowski-2/publication/338839252_Bamboo_as_an_innovative_material_for_many_branches_of_world_industry/links/5e3d36c4a6fdccd9658e751b/Bamboo-as-an-innovative-material-for-many-branches-of-world-industry.pdf>.

2-. Easily sectioning:

This material, is composed of cellulose conducts, that can be easily sectioned by cutting following the grain direction, separating the fibers joints, without loosing material and producing deformations.

3-. Thermal Conductivity:

In the case of the thermal conductivity, and to avoid fissures due to abrupt temperature changes it is recommended to permit a slow cooling process; so bamboo (respect to steel for example) because of its thermal insulation behavior is also convenient:

"The estimated (...)thermal conductivity of the bamboo cell wall material was k fll = 0.55-0.59 W/m K."(Shah,D.2016)

Bamboo thermal conductivity is approximately 0.55 to 0.59 W/m*K, while steel is around 13 or 14 W/m*K (it variates depending on the steel composition), presenting a better thermal insulation in comparison.

4-. Heat resistance range:

Bamboo burnout temperature is from 456 C° to 520 C°, that is higher than 230C°(that is the temperature used for the capsules heat treatment in this research)

Ignition and burnout temperatures of bamboo and sugarcane bagasse at five heating rates. Lu, J. and Chen, W., 2015. - table 4

Material	Heating rate (°C min^{-1})				
	5	10	20	30	40
	Burnout temperature (T_b, °C)				
IM	456	470	492	501	512
CM[c]	460	484	500	510	520

-Shah, D., Bock, M., Mulligan, H. and Ramage, M., 2016. Thermal conductivity of engineered bamboo composites. Journal of Materials Science, [online] 51(6), pp.2991-3002. Available at: <https://link.springer.com/article/10.1007/s10853-015-9610-z#citeas>.
Bamboo Table references:
-Lu, J. and Chen, W., 2015. Investigation on the ignition and burnout temperatures of bamboo and sugarcane bagasse by thermogravimetric analysis. Applied Energy, [online] 160, pp.49-57. Available at: <https://www.sciencedirect.com/science/article/pii/S030626191501096X>.

Once selected the material in order to obtain the final mold, it is necessary to process it respecting the following steps:

1-. Bamboo Segment selection:

Selecting the piece of bamboo is one of the most important steps to obtain a mold, it is necessary to choose one straight segment, with no longitudinal curvatures, fissures, or holes that could affect the uniformity of the final result.

The cross section diameter of the segment presenting the desired dimensions for the capsule's core, discounting 2 or 3 millimeters of the epoxy coating, must be the one considered in this selection phase.

2-. Chamber cleaning:

Once selected and cut the bamboo segment required for the mold, it is important to clean the inner side, the internal surface must be continuous (with no pores or imperfections), normally in bamboo lacuna can be found rests of the endodermis and septa (internal layer and node), that must be removed using a pipe brush until obtaining an inner soft surface that will conform the chamber where the healing paste will be introduced.

3-. Longitudinal section:

As the mold is required to be easily disassembled, the best solution for extracting the baked paste, is to develop a longitudinal cut, separating the cylinder into two equal parts.

It is necessary to place a blade along the

diameter of the circular base and hit it until introducing it 1cm in the bamboo pipe; then by slightly turning the blade as a lever, the fibers will begin to detach, producing a clean sectioning.

The initial cut must be very well located, the blade should be perpendicular to the surface and passing across the entire diameter in order to separate both sides in the same time.

4-. Closing System:

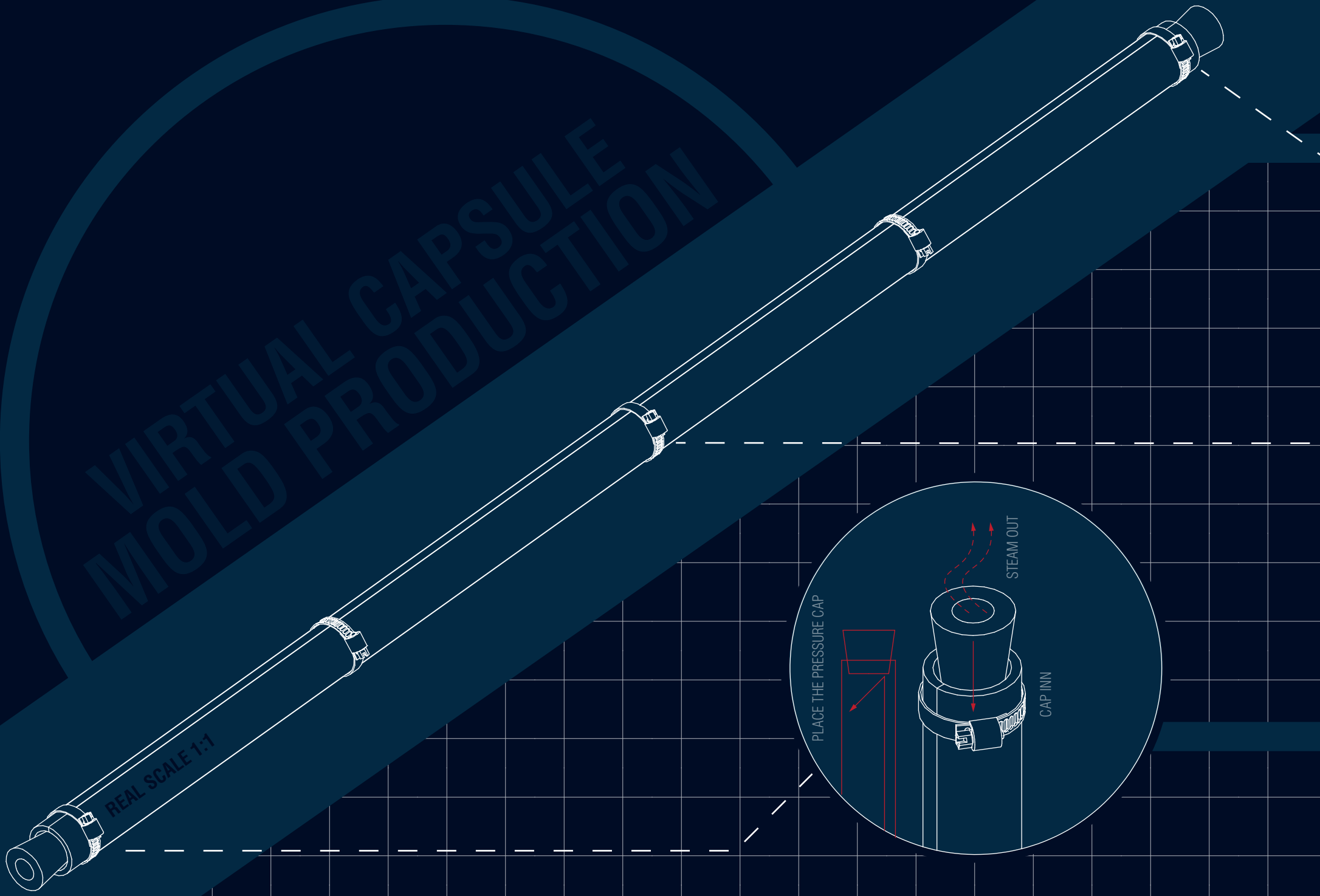
Once obtained two equal matching parts, it is necessary to re—join and keep them in place for a correct functioning; for this reason, are used "W2 Metal Clamps" that are metallic stripes with threaded segments mechanisms, received by a screw in the other edge, closing it in a circular position to constrain the bamboo cylinder and keep it still in position.

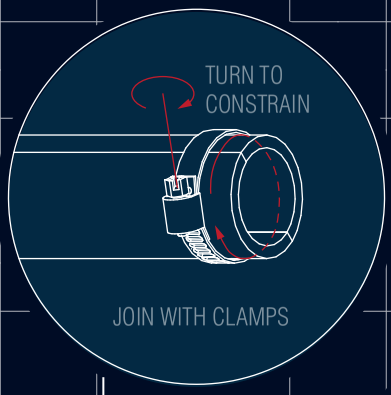
For a piece of 30cm length 5 clamps are used, interleaving the orientation and constrain effect producing an equilibrium and avoiding the bamboo pieces rotation.

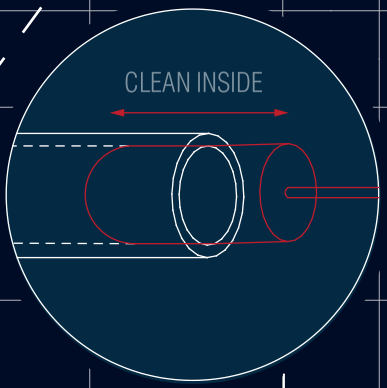
5-. Pressure caps:

Considering that cylinders ends are opened, due to the high pressure an extrusion effect could occur, releasing the paste out of the mold; for this reason, two metallic caps with small perforations were the vapor can be released are placed, preventing the material leaking and increasing the paste pressure into the chamber.

VIRTUAL CAPSULE MOLD PRODUCTION

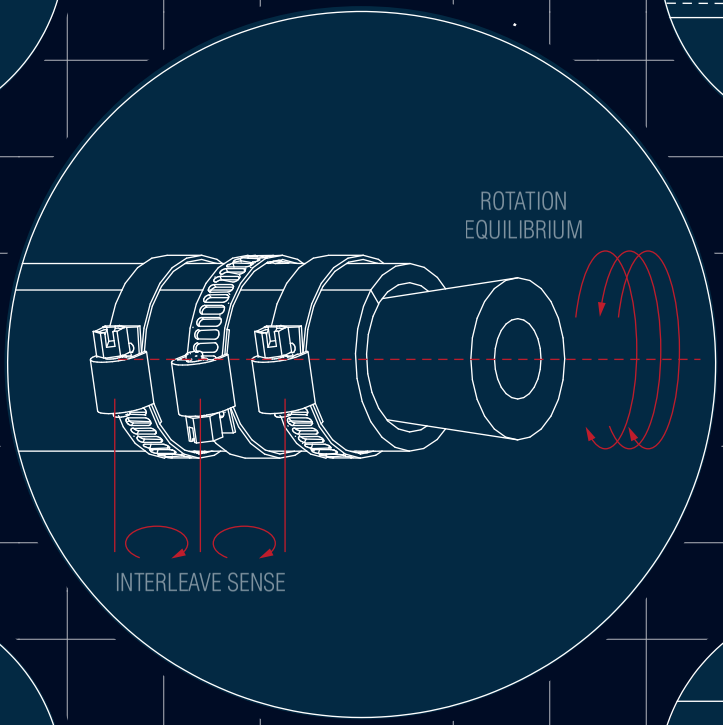


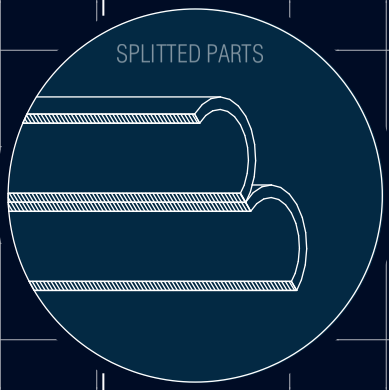


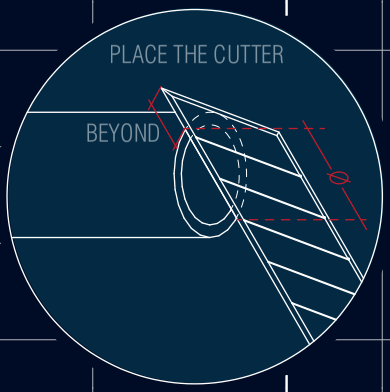


MOLD JOINING

MOLD SECTIONING



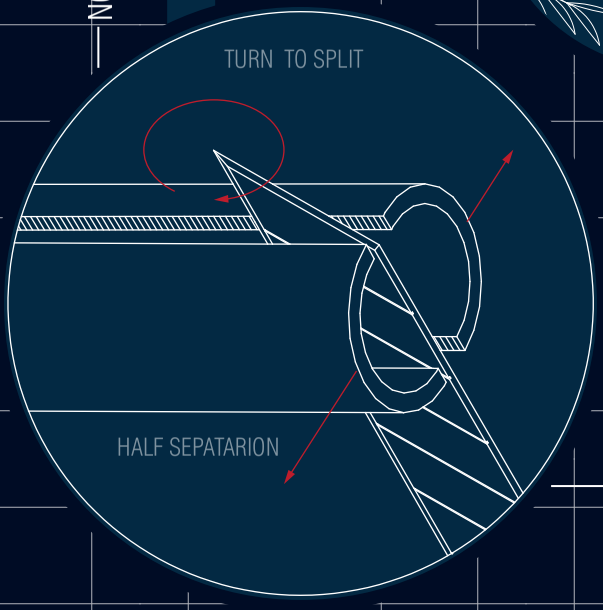


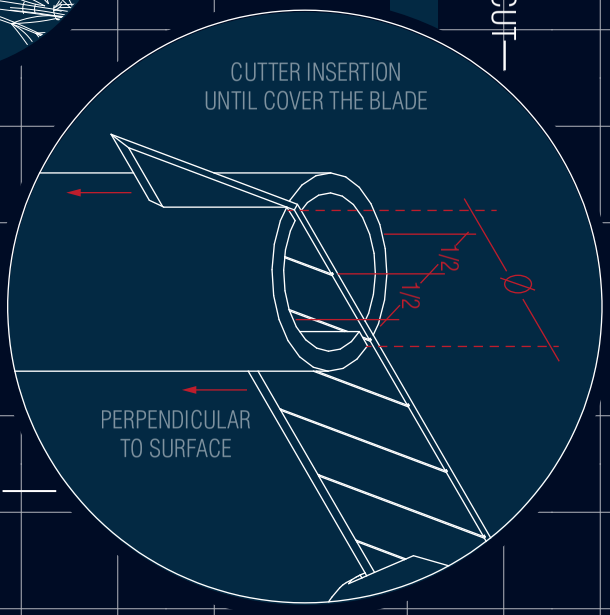


SECTION

INITIAL CUT







SPLITTING

Once understood the principles and concepts necessary to develop a compressed mass of powdered materials; to produce the healing powder compact cylinder, it is necessary to apply these ideas; the process occurs in the following steps:

1-. Healing powder preparation:

The first step is to prepare the healing powder by combining alpha, beta and gamma components in proportions 10:1:1 (as explained in section 3.1.2 and 3.1.2.1).

2-. Propylene Glycol mixture:

Then is necessary to create the solution of PPG and healing powder, this procedure require the addition of small quantities of PPG and keep on mixing. Initially the substance will turn into a very cohesive element, producing practically a ball shape (with a similar texture to play dough or clay); after obtaining this result, another very small quantity of PPG will be necessary in order to obtain a very dense non Newtonian fluid.

It is important to keep mixing and adding PPG in very small quantities, the temperature increase generated by the particles friction produces viscosity alterations. It must be taken into consideration that the result could be more liquid than the one desired If the entire amount of PPG is added in the initial moment (the fluid behavior tent to change depending on the mixing velocity, room temperature, and other factors).

The following proportions are only referential, it is difficult to establish very specific quantities when many environmental and human action

variables can affect the result. It is possible to use the following figures as a reference.

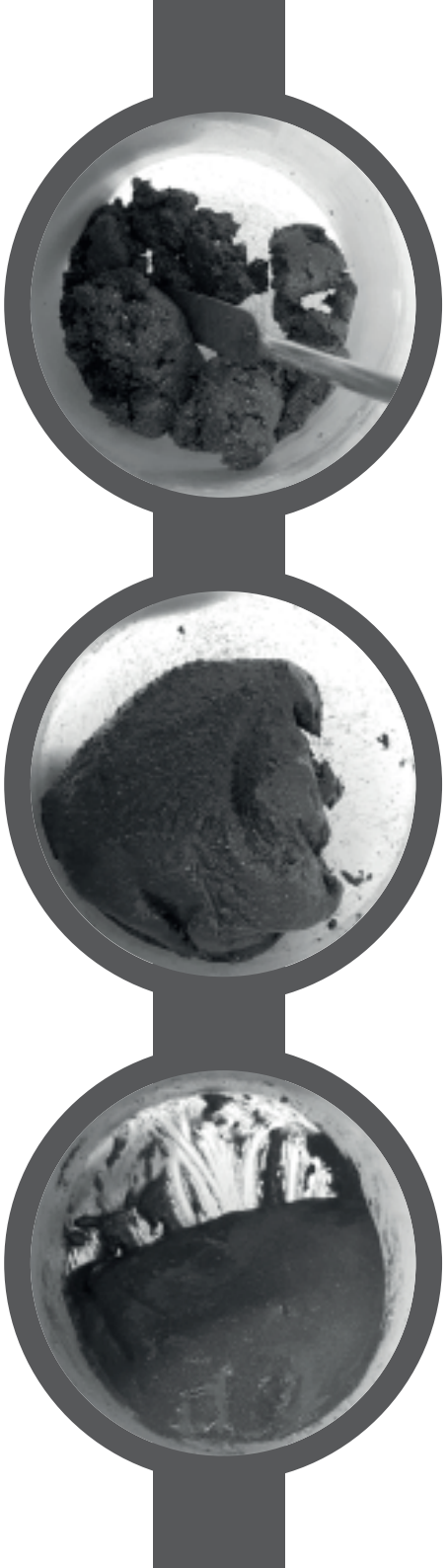
The proportion used in the experimental phase is:

For 28.554 gr of mix 10:1:1, PPG = 8,00 gr (PPG relation = 0.28 gr PPG/gr HP10:1:1)

For 42.9 gr of mix 10:1:1, PPG = 13.6 gr (PPG relation = 0.32 gr PPG/gr HP10:1:1)

For 85.7 gr of mix 10:1:1, PPG = 22.35 gr (PPG relation = 0.26 gr PPG/gr HP10:1:1)

It can be estimated an amount of between 0.26 and 0.32 grams of PPG by 1 gram of mix 10:1:1 of the healing powder.



3-. Insert into a mold:

Then is necessary to insert the mixture into a cylindric mold to keep the shape; to avoid the mixture to stick inside it must include a transfer material (oven paper for example). To avoid producing efforts and cracks in the final product (as shown in the previous section 3.2.2) the mold must open and close easily.

4-. Heat Application:

In order to produce the size increase that will generate the inner pressure and PPG evaporation for stopping the reaction and drying the material, it is necessary to apply heat.

In this case a laboratory oven with inner ventilation to extract the vapor, guarantying the drying of the substance is used; the temperature must be of 230C°, to evaporate the PPG in the less time possible (without being so violent to produce cracks, but not too soft to dry only the exterior layers and keep the core humid). Also it is important to avoid for safety reasons to reach the 370C° (temperature that could produce the ignition of PPG in a closed pressurized chamber).

A small quantity of CO_2 is produced from the acid base in a very slow chemical reaction when PPG is mixed with the healing agent (due to the 0.05% of water contained), this gas tent to increase the pressure forming a very dense foam. Then, the combination of the CO_2 release with the mold resistance when heat is applied produces inner compressive strengths compacting the material. Heat quickly evaporates the PPG stopping the reaction, preserving a significant amount of acid–base necessary for the healing effect when activated.

By an experimental method, the temperature and the exposition time were determined, it required to be tested and adjusted until obtaining the desired

results. With temperatures lower than 230C°, the evaporation time increases, the external layer tent to dry and crack while the core is still wet and keeps reacting producing CO_2, so the final result is not a solid cylinder because the core is still brittle. If the temperature is higher than 230C° and is exposed to heat for too much time, the material tent to dry very quickly, producing cracks in the material and its disaggregation.

For a bamboo mold with a radius of 0.75 cm, a length of 30 cm, and a volume of 53 cc; using 72.5 gr alpha; 7.1 gr of Beta; 6.1 gr of gamma; and 22.35 gr of PPG; are required 27 minutes exposed to a heat of 230C°.

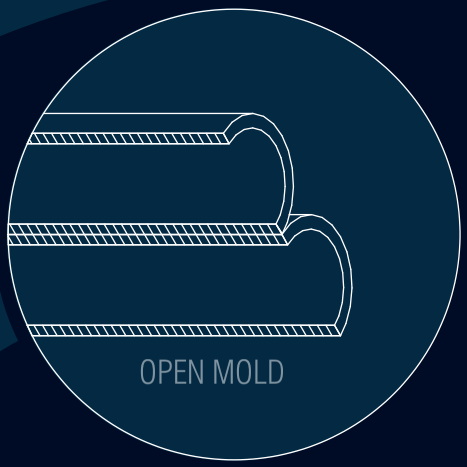
For a bamboo mold with a radius of 0.3 cm, a length of 30 cm, and a volume of 8.5 cc; using 12 gr alpha; 1.18 gr of Beta; 1.01 gr of gamma; and 8.13 gr of PPG; are required 17 minutes exposed to a heat of 230C°.

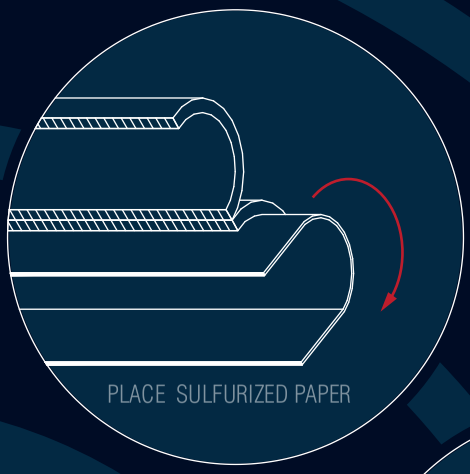
5-. Dis-molding:

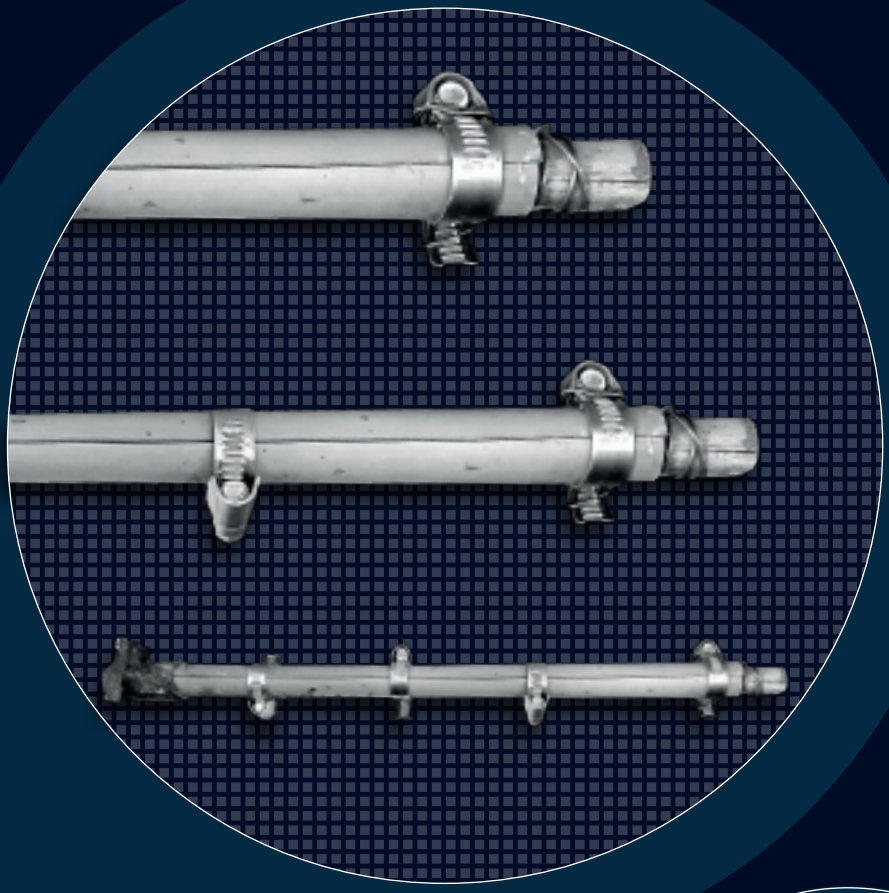
After heating the material and evaporating the Propylene Glycol, to avoid excessive fissures generation when the material is setting, it is necessary to let it cool down slowly until achieving the room temperature, once finished this period, the mold can be opened carefully and extract the material that will separated in pieces.

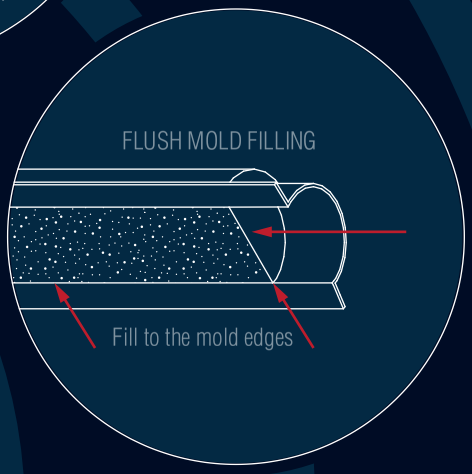
6-. Waterproofing layer:

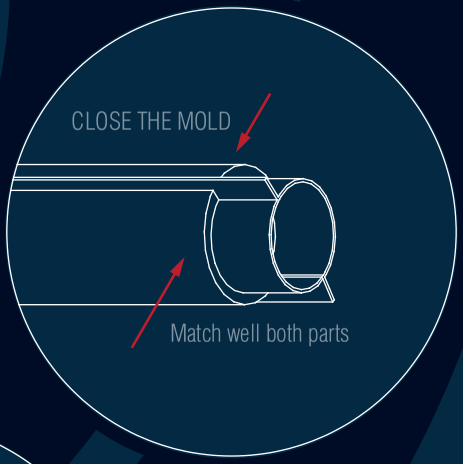
The last step consists on carefully tying a thread around the compacted material cylinder, and apply the epoxy insulating layer, in this case has been used the commercial product "Plastigel 3220 Sigillante brand API (technical data on annexes 3.2.3).

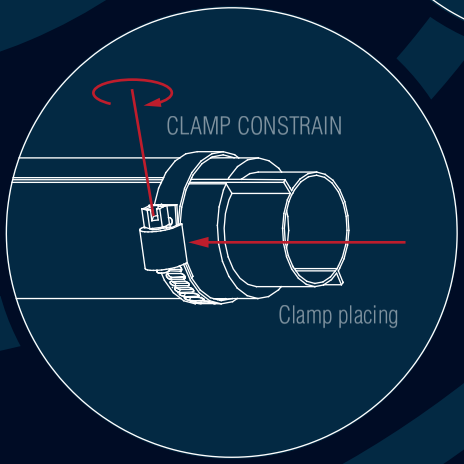

OPEN MOLD

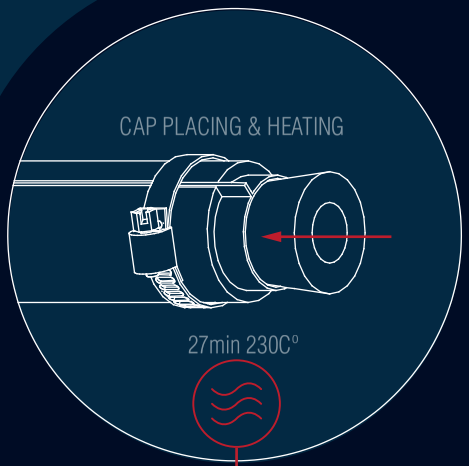

PLACE SULFURIZED PAPER

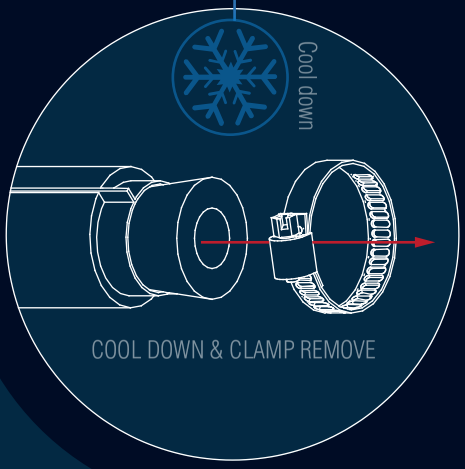


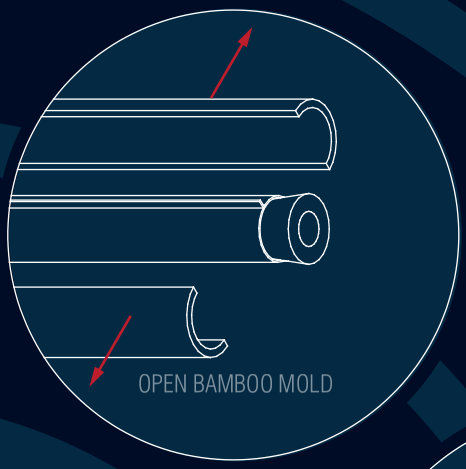

FLUSH MOLD FILLING
Fill to the mold edges

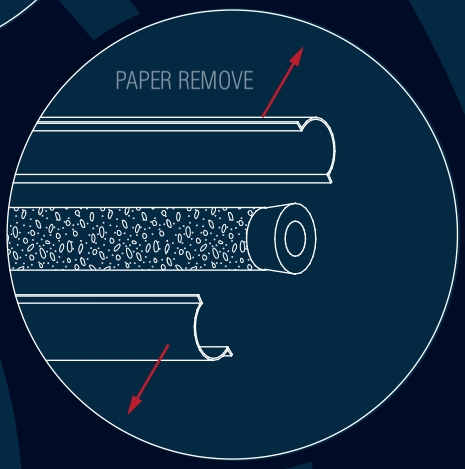

CLOSE THE MOLD
Match well both parts

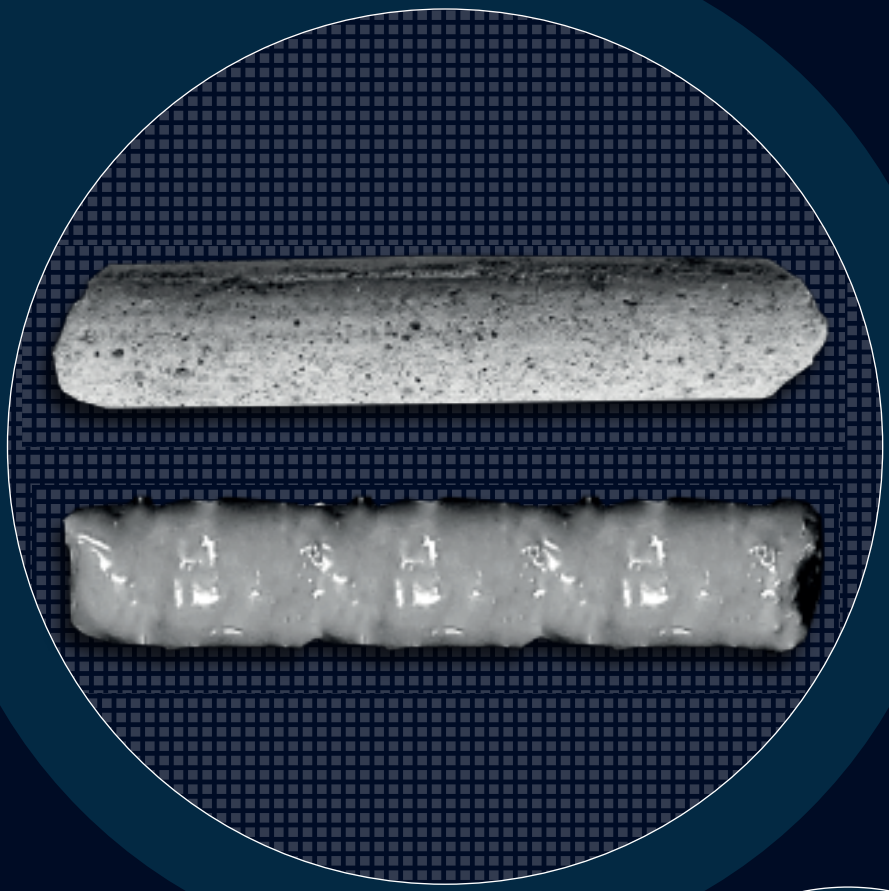

CLAMP CONSTRAIN
Clamp placing

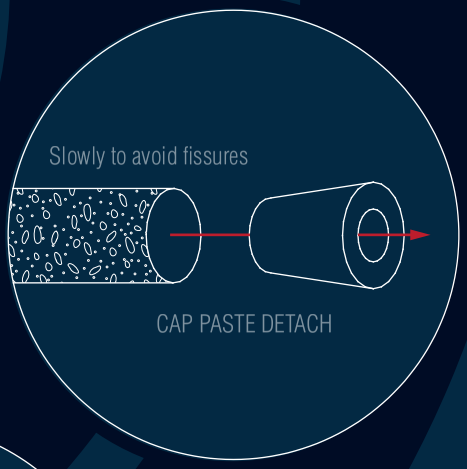

CAP PLACING & HEATING
27min 230C°


Cool down
COOL DOWN & CLAMP REMOVE

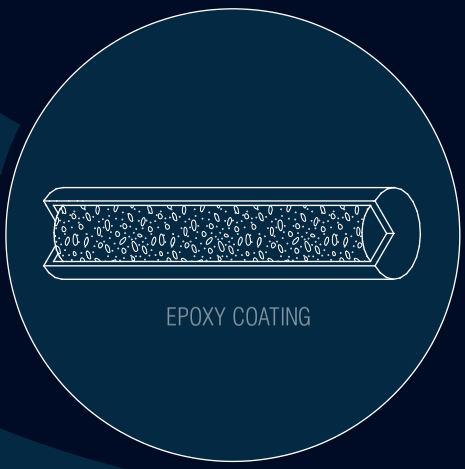

OPEN BAMBOO MOLD


PAPER REMOVE




Slowly to avoid fissures
CAP PASTE DETACH


HARD HEALING PASTE


EPOXY COATING

3.5. PLA Solid Core Capsule

3.0 subsection of chapter: 3 Solid healing agents

Another possibility, considering the solid healing agent as a substance requiring a very reduced amount of space to be stored, is the use of PLA 3D printed capsules (presented in chapter 2), to be filled with the healing powder and waterproofed by using the same procedure described for the polyurethane filled ones; by being the powdered agent less reactive and humidity sensitive, is perfectly feasible to be used in this type of PLA containers.

The PLA capsule for the solid healing agent is perfectly compatible and the filling methodology is easier, by being a powder not very sensitive to environmental humidity, it can be introduced and closed without presenting an early violent activation (in spite of the polyurethane case) because it does not require the cap elastomeric paste for sealing; .

Taking into consideration that a PLA capsule designed for this research presents a total chamber volume of 4 cc, are only required 5,7 grams of healing agent powder. For the volumes required of each component calculation, with a 10:1:1 mixture proportion: Alpha = 3.33 cc; Beta = 0.335 cc; Gamma = 0.335 cc.

Calculating the mass of each component:

$$\alpha_{mass} = 3.33 \text{ ml} * 1{,}45 \text{ gr/ml}$$

$$\alpha_{mass} = 4.8 \text{ gr}$$

$$\beta_{mass} = 0.335 \text{ gr} * 1{,}42 \text{ gr/ml}$$

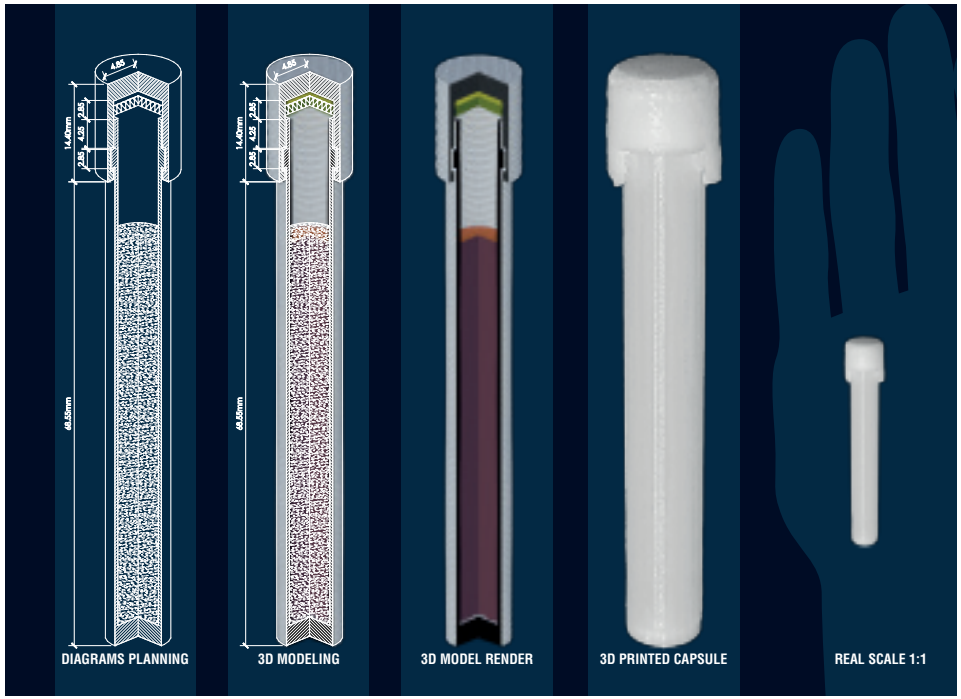
$$\beta_{mass} = 0{,}5 \text{ gr}$$

$$\gamma_{mass} = 0{,}335 \text{ ml} * 1{,}22 \text{ gr/ml}$$

$$\gamma_{mass} = 0{,}40 \text{ gr/ml}$$

While filling the capsule with the solid agent, it is important to vibrate it to remove the most of the air possible; by being a conduct with very small dimensions, it presents complications in the insertion without two or three active and effective vibration periods; once the material is compacted inside, the cap is placed, the cylinder insulated in epoxy and ready to use.

This capsule is also very convenient for the healing powder because, as is not necessary to mix it with Propylene Glycol, there is not a partial activation and stop of the acid—base components reaction, preserving it on its pure state (That is to say the chemical reaction in contact with water is more violent in therms of effervescence that the virtual capsule).



4

EXPERIMENTAL PHASE



4.1 Introduction

4. Chapter 4: Experimental phase

Once developed new capsules designs; selected, combined, tested the solid components for the powder healing agent and created new compacted capsuled with it. The next step, and one of the most important to confirm if it is effectively able to produce a self healing effect, as the theoretical approaches hypothesizes, is to test the different configurations.

For making this possible, in this chapter will be developed two experiments that include a total of three tests and the respective comparisons:

1–. The first experiment is the "3D printed capsule leak tightness"; that includes the use of the 3D printed PLA capsules, filled with Polyurethane, and testing the healing agent leaking.

2–. The second experiment is the " Powder agent's healing capacity": in this case by the usage of 3D printed powder filled, and virtual capsules, embedded in malt prisms that will be cracked for the development of two different tests:

2.1–. waterproofing test: to verify the crack blocking condition.

2.2–. Mechanical recovery test: to verify if some resistance can be restored.

4.2. Experiment 1 - 3D printed capsule leak tightness

In this section a test for verifying the capacity of the capsule for containing moisture sensitive healing agents will be developed (such as "Carbo stop U" polyurethane, detailed in section 2.1.1), for the time necessary to apply the epoxy waterproofing layer without leaking the PU from pores; with the aim of comparing it to the version presented in Carillo 2017 research (detailed in the section 1.2.4), to verify if the new technology, design, and procedures had produced positive changes in this field. This are tested with polymeric foam in stead of water due to the CO_2 pressure released by the PU healing agent, supporting the resin licking (that will be the real use of the capsule). In this case the effectiveness of PU for self healing wont be tested, because its healing abilities were already confirmed in other researches in concrete, the innovation in this case is the insulating capacity of the container or "shield".

Necessary resources for the test:

—2 gr PLA filament for each capsule, including the cap.

—2000 Watt of electric energy for producing each capsule, including the cap. The 3D printer consumes 0.7 Kw/h when nozzle is heated at 210C°, and bed at 60C°; producing the capsule and cap takes 3 hours.

—4 ml of "Carbo stop U" polyurethane foam making resin for each capsule.

—7.5 gr of epoxy resin for waterproofing layer for each capsule.

Procedure:

For this test, it is necessary to print the capsules and caps, filling all of them with the polyurethane resin, then close carefully the cap and secure it, apply the epoxy resin and see the results.

Preliminary results:

From a total of 8 capsules, 7 presented cap outflow; 3 of them presented polyurethane leaking, passing through the epoxy resin, and permitting the contact of the healing agent with the exterior.

Only one capsule was perfectly insulated, without presenting any leaks, in this case the resin was barely hardened when applied and the capsule was not filled to the edge of the container.

These leaks could possibly occur by four factors:

1-. Capsule over filling:

Waterproofing problems producing cap leaking occurs due to the introduction of high amounts of material and filling it to the edges (or overpassing them).

2-. Epoxy resin hardening time:

If the epoxy resin require more time, or if it is mixed with an insufficient amount of catalysts, could not insulate the cap fast enough to prevent the foam leaking.

3-. High PU reactivity:

Another problem tat is common, not only for this research, also in other previous experiences, is that "Carbostop U" is very sensitive to moisture, and can react with the minimum environmental humidity.

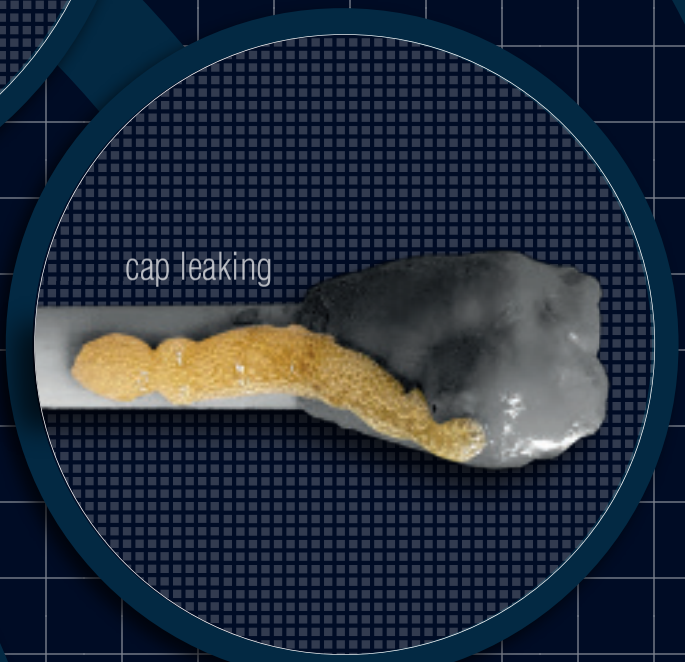
4-. High environmental moisture:

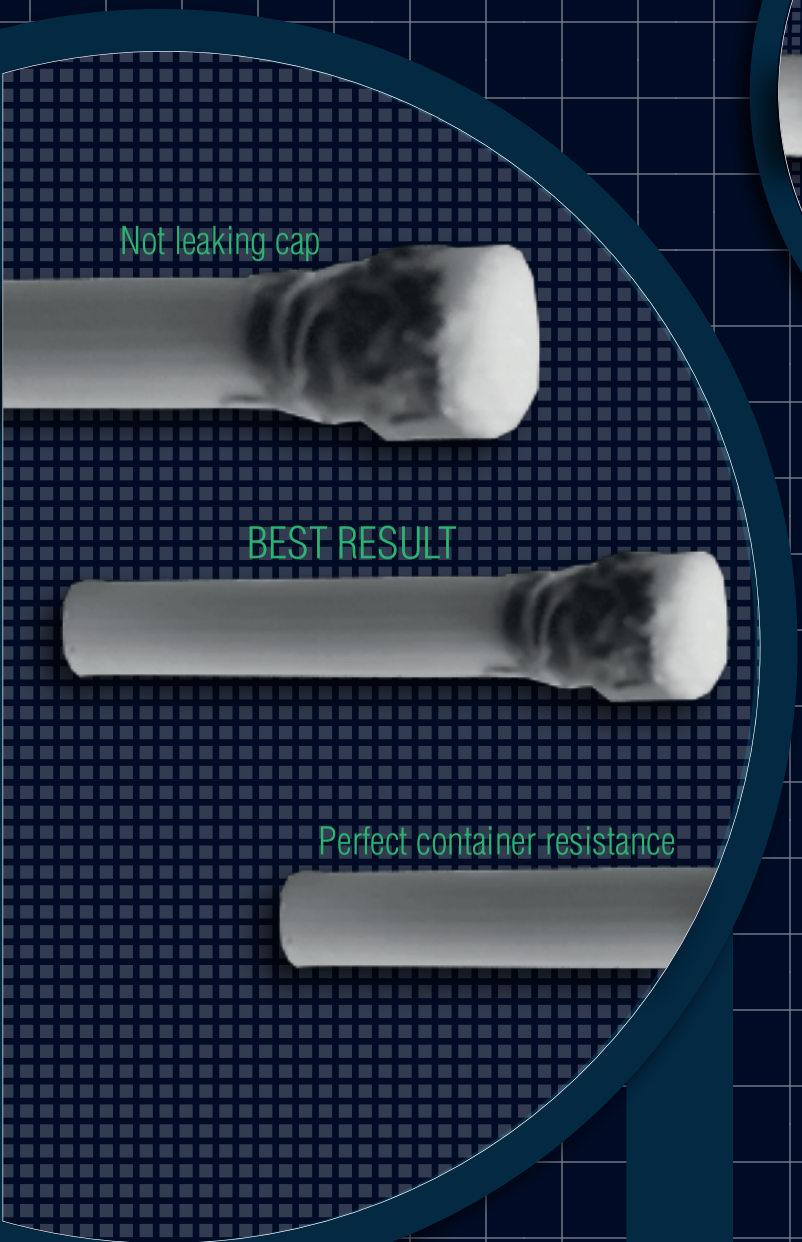
The premature polyurethane activation could be due to the capsules filling in a non humidity controlled environment.

Anyway; is possible to notice a good resistance in the capsule container, that, in spite of the pressure and activation of PU, did not present pores leaking or breaking points.

PU CAPSULE
LEAKING TEST RESULTS

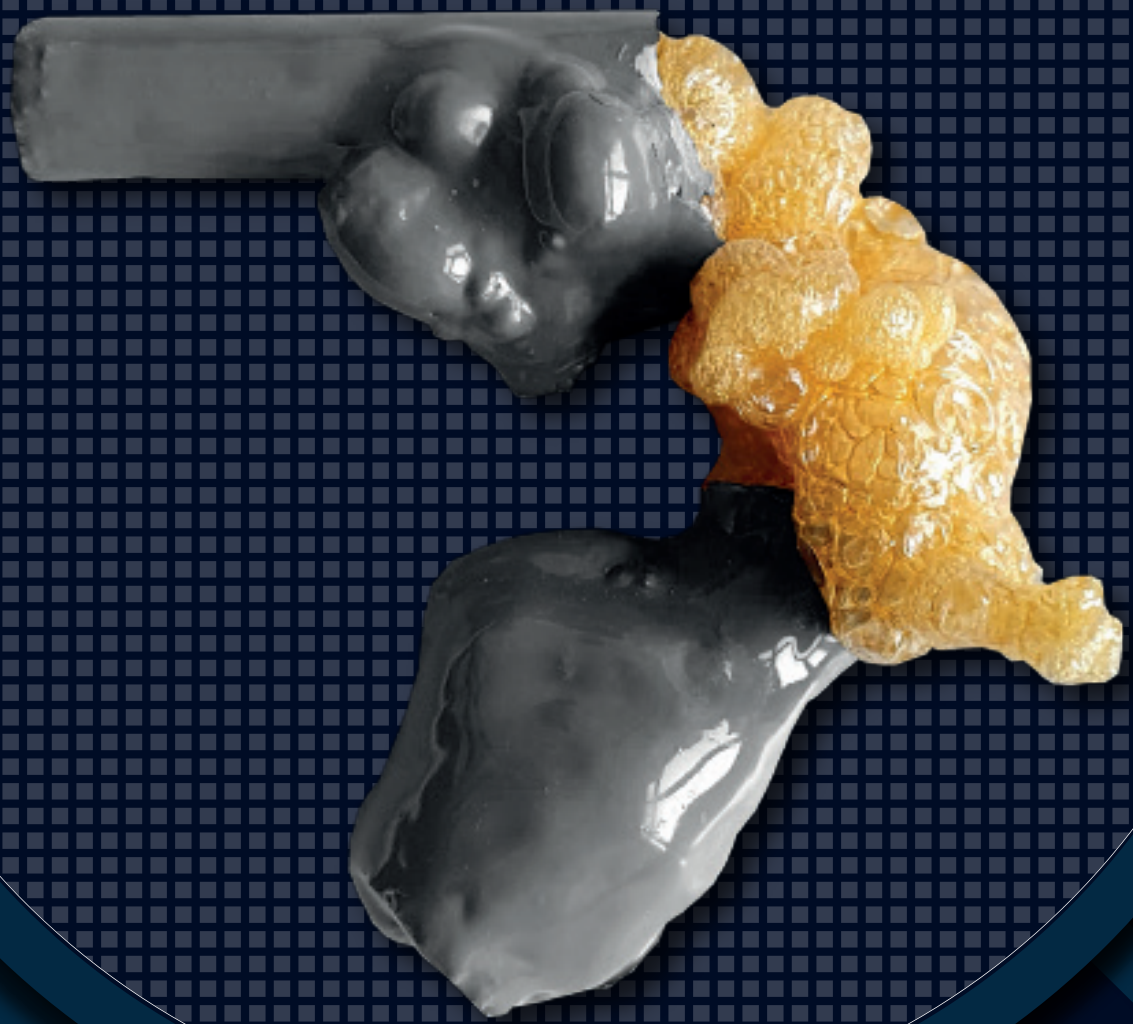








PU has been preserved in
spite of leaking, still reacts at 15 days



CAPSULE ACTIVATED AT 15 DAYS - PU STILL REACTIVE

Due to the previous results where the healing agent leaks through the cap joints, a fast hardening epoxy in the cap chamber, (as described in the design phase, section 2.2.2) was included as a barrier, that could present resistance to PU leaking in a very brief period.

The epoxy resin used is a commercial product called "Acciaio Rapido" from the brand "Bostik", that contains Bisphenol A epichlorohydrin polymer, 2—Propenoic acid, dipentaerythritol, epichlorohydrin bisphenol F.

These test has been developed by introducing the epoxy mix resin in the cap, filling the container with polyurethane resin, closing it, and then surrounding the joint with the same epoxy to prevent moisture inns and PU leaking.

The cap resisted the pressure better than the previous test, without foaming generation under the epoxy layer, as seen in the next page figure; It is notable that the bottom presented pores or imperfection, that allowed the material licking (something that did not happen in previous tests, this can be solved by increasing the bottom thickness).

Anyway, the PU used in this case is very sensitive and the capsule must be filled in a humidity controlled space, because in stead of insulating, the epoxy resin is used to resist the PU pressure due to early activations (even sealing it perfectly, will harden inside of the capsule due to an already started catalysis effect).

It is important to mention that this epoxy could be used in further studies to block pores and imperfections in other types of capsules, reducing the waste due to the samples rejection because of leaking. (Technical data on annexes 4.2.2)

Next page figure references:
-Bostik, n.d. Acciaio Rapido® Adesivo (epossidico) bicomponente di color metallo ed extra-forte... [ebook] Milan, Italy: Boostik. Available at: <https://www.bostik.it/prodotti/bostik-acciaio-rapido?gclid=Cj0KCQiAuv0PBhDXARIsAKzLQ8HDnCBXNiMydFSa2sy68SgoeWFePPI470vlVYboJcNxKFHamigWfgYaAs46EALw_wcB> [Accessed 5 February 2022].

ACCIAIO RAPIDO®

ADESIVO (EPOSSIDICO) BICOMPONENTE DI COLOR METALLO ED EXTRA-FORTE.



DESCRIZIONE PRODOTTO

Adesivo (epossidico) bicomponente di color metallo ed extra-forte.

CAMPI DI APPLICAZIONE

Riparazioni molto resistenti di oggetti in metallo che devono resistere a condizioni difficili (sforzi, vibrazioni), come utensili, componenti automobilistici, motori, ciclomotori, biciclette, cancellate (di giardini) o posate. Idoneo anche per stuccare piccoli fori nel radiatore.

Perfetto per l'incollaggio di praticamente tutti i metalli, come acciaio (inossidabile), alluminio, ferro, rame e zinco. Adatto anche per l'incollaggio di metallo combinato a pietra, legno, calcestruzzo e materiali sintetici come formica, poliestere e resina. Non indicato per Polietilene (PE), polipropilene (PP), PTFE e gomma siliconica.

PROPRIETÀ

· Extra-forte
· Di color metallo
· Resistente a condizioni difficili
· Riempitivo
· Resistente all'acqua (di mare)
· Ottima resistenza alle sostanze chimiche
· Dopo l'indurimento può essere smerigliato, carteggiato, levigato e verniciato

PREPARAZIONE

Condizioni di utilizzo: Applicare solo a temperature comprese fra +5°C e +35°C. Il prodotto polimerizza miscelando resina e induritore.
Protezione personale: È consigliabile indossare guanti protettivi.
Requisiti delle superfici: I materiali da incollare devono essere puliti, asciutti e privi di grasso e polvere.
Trattamento preliminare delle superfici: Sgrassare le parti da unire con acetone. Irruvidire le superfici lisce (carta vetrata).
Utensili: Miscelare i componenti utilizzando il bicchiere e la spatola in dotazione.

APPLICAZIONI

Rapporto di miscelazione: 1:1
Resa: 1 ml = circa 1 cm^2 con uno spessore dello strato di 1 mm
Modalità di utilizzo:
Stendere una quantità uniforme di adesivo da entrambi i tubetti nella scodella fornita. Mescolare le due parti uguali con una spatoletta in plastica fino ad ottenere un composto di colore omogeneo. Applicare uno strato sottile del composto, che può essere utilizzato a temperatura ambiente (+20°C) per circa 45 minuti, su uno dei materiali. Unire i materiali e tenerli fermi per 10 ore. Fare attenzione che le parti non si spostino prima che l'adesivo si indurisca. Richiudere i tubetti dopo l'utilizzo. Resina e indurente non possono venire a contatto tra loro al di fuori dell'utilizzo.
Tempo aperto: 45 minuti
Macchie/Residui: Rimuovere immediatamente i residui ancora umidi con acqua calda e sapone. I residui di adesivo indurito possono essere rimossi solo con azione meccanica.
Consigli: Alcuni tipi di materiali sintetici, come ad esempio polietilene e polipropilene, non possono essere incollati con l'adesivo. È possibile effettuare un test del materiale appoggiando un filo di rame incandescente contro il materiale sintetico. Si avverte odore di cera? In tal caso non sarà possibile incollare il materiale.
Utilizzare uno spezzone di nastro adesivo per tenere in posizione le parti mentre l'adesivo indurisce.
Punti di attenzione: Chiudere bene dopo l'uso. Per prestazioni ottimali, è importante produrre una quantità superiore di adesivo miscelando bene. Il tempo di polimerizzazione dipende dalla temperatura. L'adesivo non polimerizza a temperature inferiori a +5°C.

TEMPI DI ESSICCAZIONE*

Tempo di utilizzo: ca. 10 ore
Tempo di asciugatura/polimerizzazione: ca. 24 ore. L'indurimento resiste più a lungo a temperature basse e di meno a temperature elevate.

*** Il tempo di essiccazione può variare per il tipo di superficie, per la quantità di prodotto utilizzata, per la temperatura dell'aria o per l'umidità.**

CARATTERISTICHE TECNICHE

Resistenza all'umidità: Buona
Resistenza all'acqua: Buona
Resistenza alle temperature: Da -40°C a +60°C.
Resistenza alle sostanze chimiche: Molto buona
Verniciabilità: Buona
Potere riempitivo: Buona

SPECIFICHE TECNICHE

Base chimica: Resina: resina epossidica, Indurente: amido modificato.
Colore: Grigio

Le nostre istruzioni sono basate su indagini approfondite e sull'esperienza. In considerazione dell'ampia varietà di materiali e di condizioni nelle quali i nostri prodotti vengono applicati, non possiamo assumerci alcuna responsabilità per i risultati ottenuti e/o per eventuali danni causati dall'uso del prodotto. I nostri Uffici Assistenza sono tuttavia a disposizione per fornirvi qualsiasi consiglio di cui abbiate bisogno.

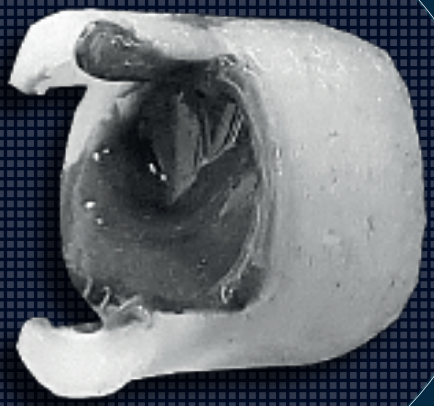

BOTTOM
PORE AT TIME 0
SEALED CAP AT
TIME 0
BOTTOM
PORE AT 10 MIN
SEALED CAP AT
10 MINUTES
BOTTOM
PORE AT 15 MIN
SEALED CAP AT
15 MINUTES

3D PRINTED CAP SEALING TEST WITH PU AND FAST EPOXY

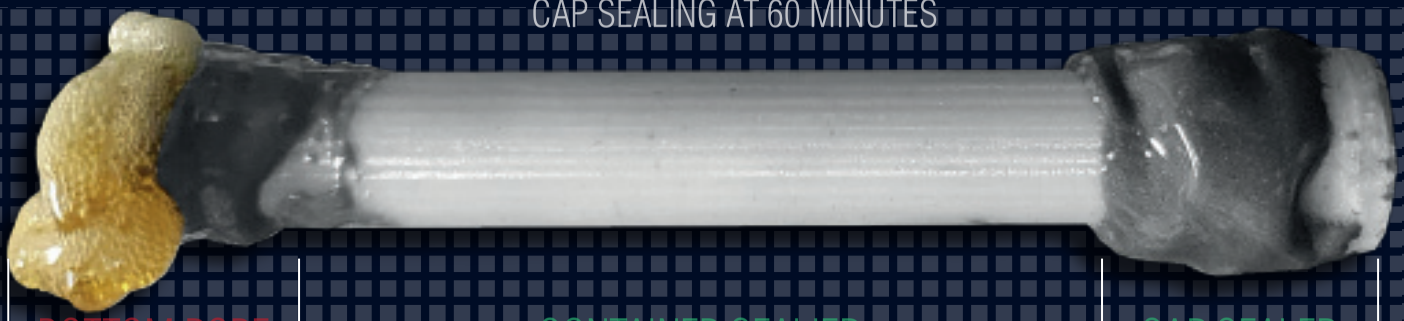
CAP BEFORE
(PREVIOUS TEST)



CAP INNER EPOXY FILLING



CAP SEALING AT 60 MINUTES



BOTTOM PORE — CONTAINER SEALIED — CAP SEALED

PU EARLY ACTIVATED DUE TO MOISTURE CATALYST DURING THE FILLING PROCESS - PRODUCES EXCESS OF PRESSURE
- FILL IN A HUMIDITY CONTROLLED AREA -
- EVENTUAL PORES CAN BE SEALIED BY APPLYING ANOTHER FAST HARD. EPOXY LAYER-

4.3. Experiment 2 - Powder agent's healing capacity

This second part is about testing the capacity of the powdered agent to produce a self healing effect in malt prisms. In this case, 8 units of 3D printed capsules (placed in couples for each sample), 4 units of Virtual capsules, and 4 reference prisms (that will not contain capsule for comparing) were produced. After making the malt prisms, these will be exposed to tensile/flexural strengths, in order to produce a crack in the phase called "Pre-fissuring", with this procedure, the capsules will be activated by placing the prisms under water.

After two weeks, by running water into an existing conduct in the malt prisms, the first waterproofing test will be executed, with the aim of evaluating the crack permeability or blocking. This procedure will be repeated after other two weeks.

The last procedure will be the application, again of tensile strength on the prisms, one month after the pre-fissuring day; measuring the resistant to these efforts the sample has before cracking again. This will be useful to know if the healing agent is able to re-join both parts and recover the strength.

Capsule's necessary resources and preparation:

The first step for this procedure is the preparation of the capsules that will be used, and require the following materials

-For producing 8 PLA Capsules:

—16 gr of PLA, 2 gr of filament for each capsule, including the cap.

—16000 Watt of electric energy for producing each capsule, including the cap. The 3D printer consumes 0.7 Kw/h when nozzle is heated at 210C°, and bed at 60C°; producing the capsule and cap takes 3 hours.

—9.6 gr of fast hardening cement (as explained in the section 3.1.1)

—1 gr of acid base mixture (tartaric acid, malic acid, sodium bicarbonate)

—0.8 gr of sodium polyacrylate

—180 gr of epoxy resin for waterproofing layer for each capsule.

Procedure:

After the 3D printing process of all the capsules and caps, these are filled with the mixture of healing powder in the quantities previously indicated. Sets of mixture for two capsules each time will be prepared and placed maintaining the couple together (in the same concrete prism), this will support the homogeneity on the mixture, grains and capsules.

While filling the containers, in order to remove the air and introduce the entire amount of material, it is necessary to vibrate them correctly. Once finished this step and closed the cap, the capsule is insulated with the epoxy resin.

-For producing 4 virtual capsules:

—One bamboo mold of radius 0.75 cm and length 30 cm (as explained in section 3.2.3)

—72.5 gr of fast hardening cement (as explained in the section 3.1.1)

—7.1 gr of acid base mixture (tartaric acid, malic acid, sodium bicarbonate)

—6.1 gr of sodium polyacrylate

—22.35 gr of Propylene Glycol

— 1100 watt electric energy. The device memmet UNE200 used for the test consumes 1.1 kw/h, for 1 hour usage (taking into consideration the pre—heating time)

Procedure:

This procedure requires the healing agent mixing (powders and PPG), then an opened mold preparation (as explained in the section 3.2.3), the tracing paper placing, the mix collocation into each mold half, then the mold closing and clamps securing, caps placing, and heating in the "memmet" oven for 27 minutes at 230C°; then cooled down, the material is extracted, divided in 4 pieces (capsule's cores), and finally insulated in epoxy resin.

Necessary materials for 12 prisms:

—4 steel form—works, containing 3 molds for 3 prisms production of 40 mm x 40 mm x 160 mm each other.

—Lubricant mineral oil for dis—molding.

—1800 gr of cement C1 — 42.5, are required 900gr for every 6 samples.

—5400 gr of standard sand CEN, EN 196—1, conform with ISO 6979:2009; of 2mm maximum aggregate size. Are required 2700gr for every 6 prisms.

—900 gr water, potable and free of contaminants. 450 gr every 6 prisms.

Mixing and paste-mold placing Procedure:

For a correct production of the malt paste, it is necessary to use a mixing machine, and follow this procedure:

1—. With the machine stopped, pour the water and cement in.

2—. activate the machine in low velocity for 30 seconds

3—. without stopping the machine, sand is pour gradually in a total time of 30 seconds.

4—. turn the machine to high velocity for 30 seconds.

5—.Stop the machine and remove the paste from the walls joining all the mixture together.

6—. Let the paste rest with the machine stop for 1 minute and 30 seconds, keeping it covered with a clean fabric piece.

7—. Activate again the machine in high velocity for 1 minute

8—. Stop the machine and the paste is ready to use.

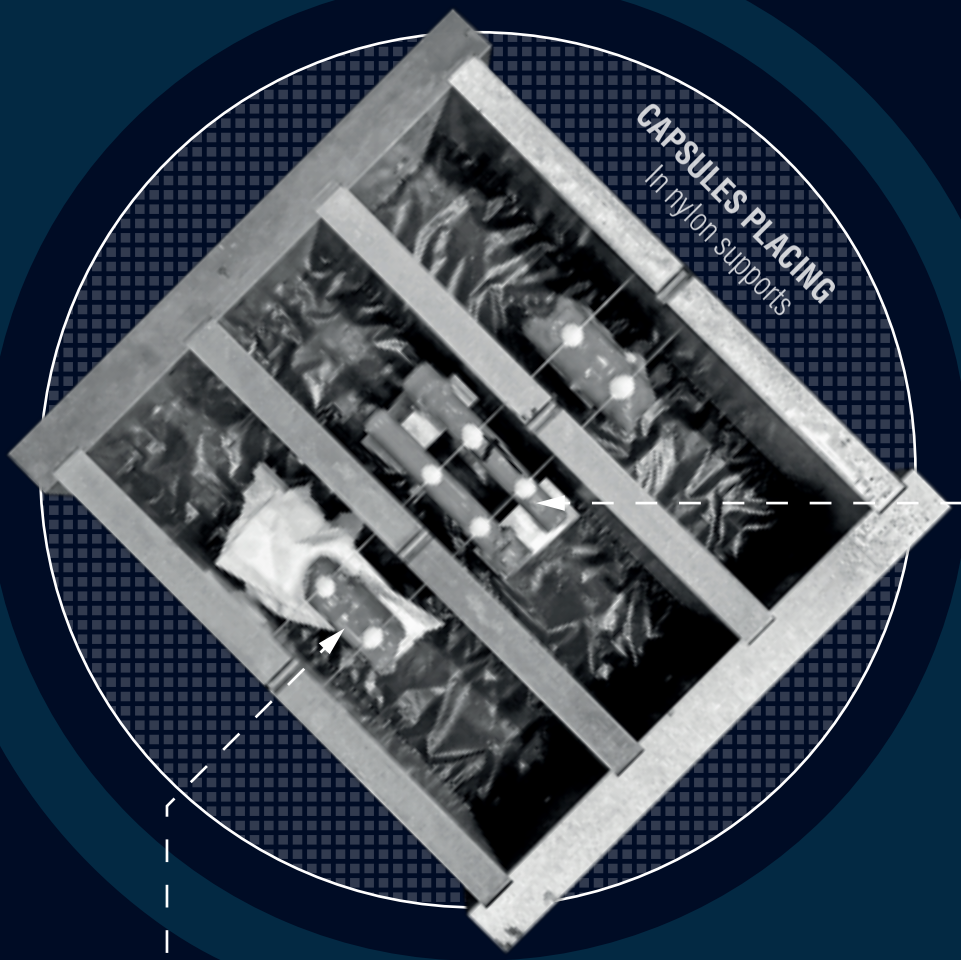
Form-work preparation and paste placing:

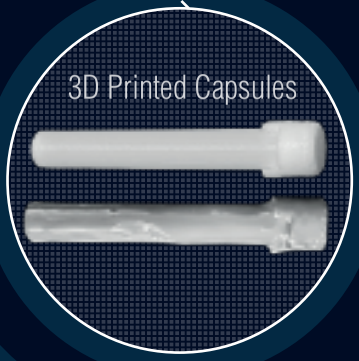
Before the paste placing:

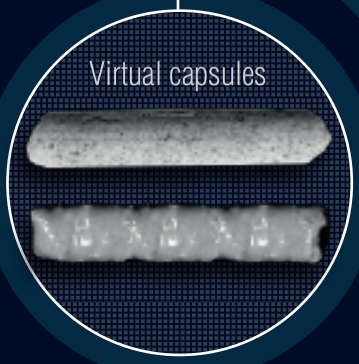
—Clean the form—work pieces
—Assemble the form—work
—Place the nylon guides to maintain the capsules in the center of the prism
—Attach the capsules to the nylon with bi component epoxy resin
—Lubricate the mold with mineral oil

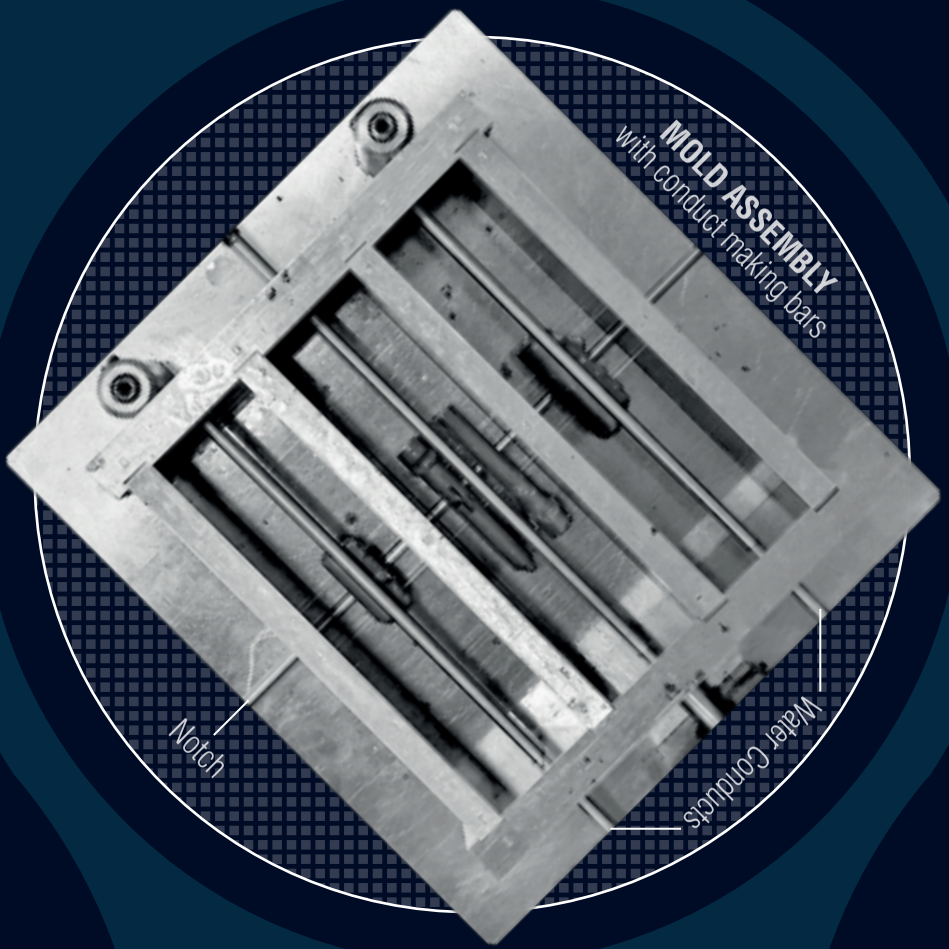
Paste placing: is placed in two half

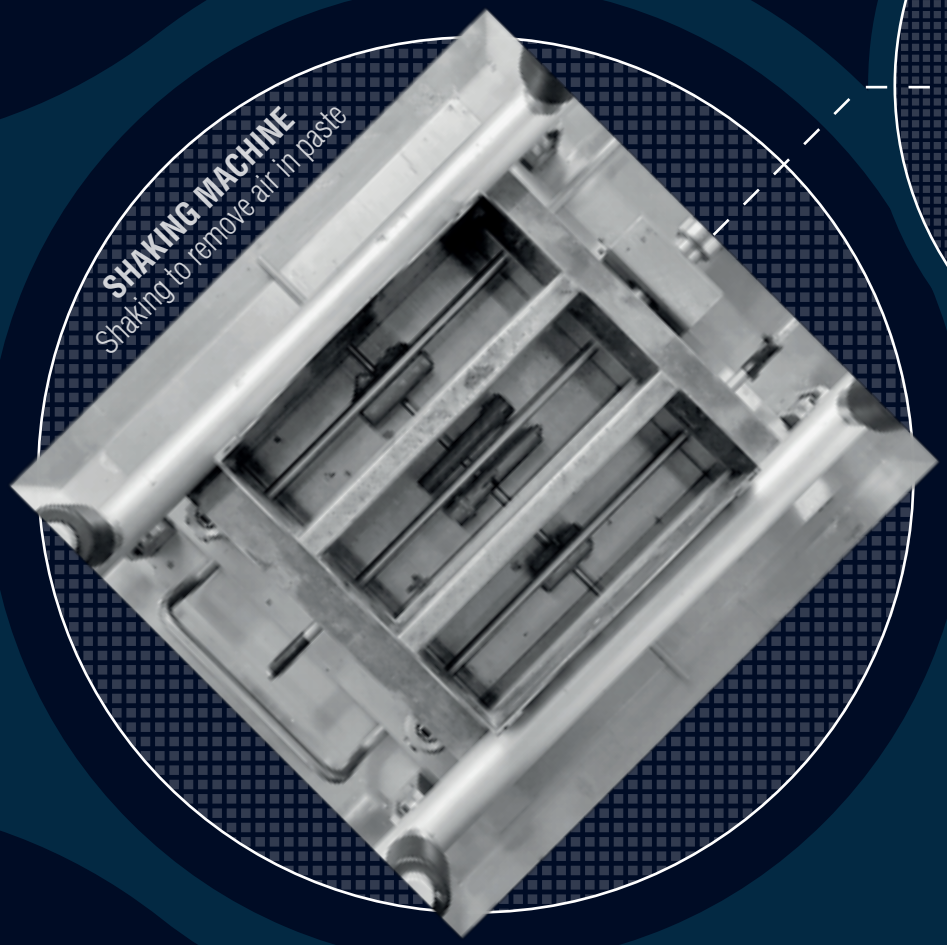
—Place the paste until filling the first half (20mm bottom—top height).
—Place the half filled mold in a shaking machine that will remove the air from the paste.
—Apply 60 hits on the machine.
—Place the rest of the paste until matching the edge of the form—work.
—Apply 60 more heats for removing the rest of the air.
—Take the form—work out of the shaking machine
—Place an acetate layer to avoid water evaporation and shrinkage cracking; let the malt set and harden.
—Dis—mold after 48 hours.
—Preserve the prisms covered with plastic to avoid moisture looses for 15 days.
—Prisms are ready for the pre—fissuring procedure.


CAPSULES PLACING
In nylon supports

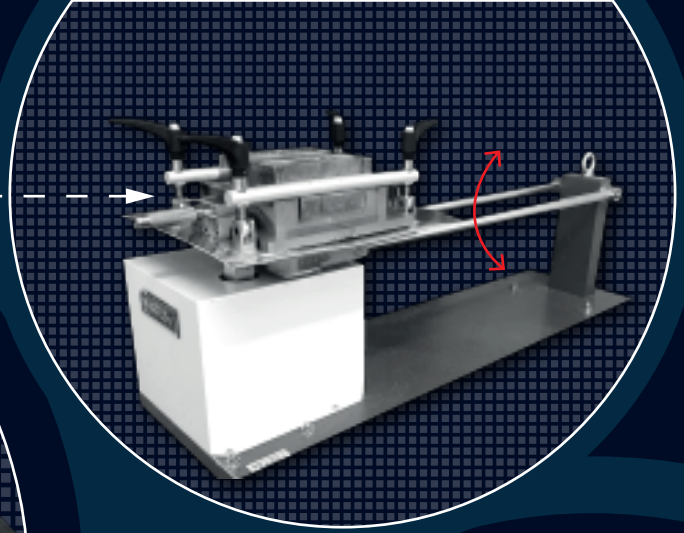

3D Printed Capsules

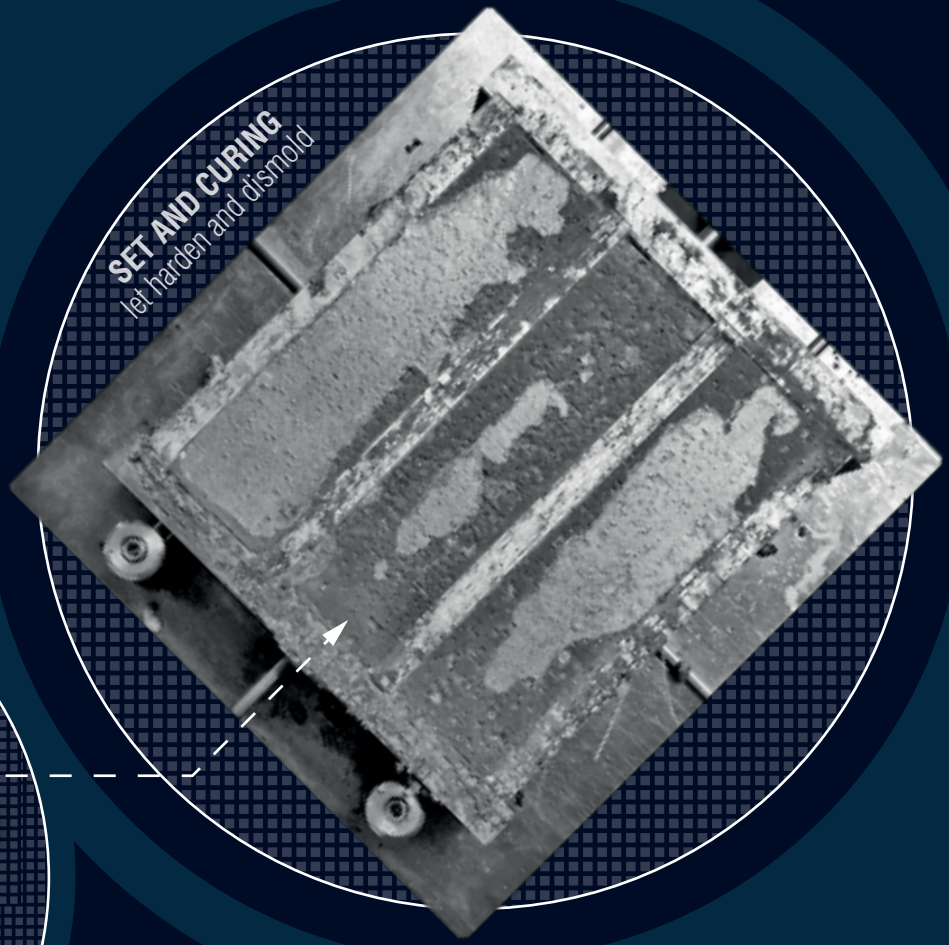

Virtual capsules


MOLD ASSEMBLY
with conduct making bars
Notch
Water Conducts



SHAKING MACHINE
Shaking to remove air in paste





SET AND CURING
let harden and dismold



Dismolded and cured prism

Once produced the prisms, and let them cure for 15 days, it is necessary to submit them to a "3 point flexural test" to produce the capsules activating crack, breaking the insulating layer and the container.

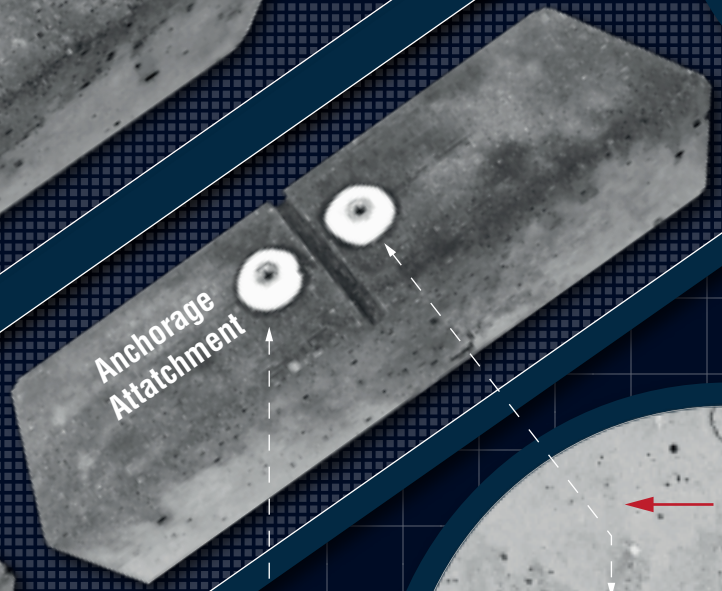
This procedure is done by placing the prism with the notch (a carved guide made in one of the faces to produced a controlled cracks) facing down and contacting the 3 supports on the machine (two of them for the bottom face, and one on the top).

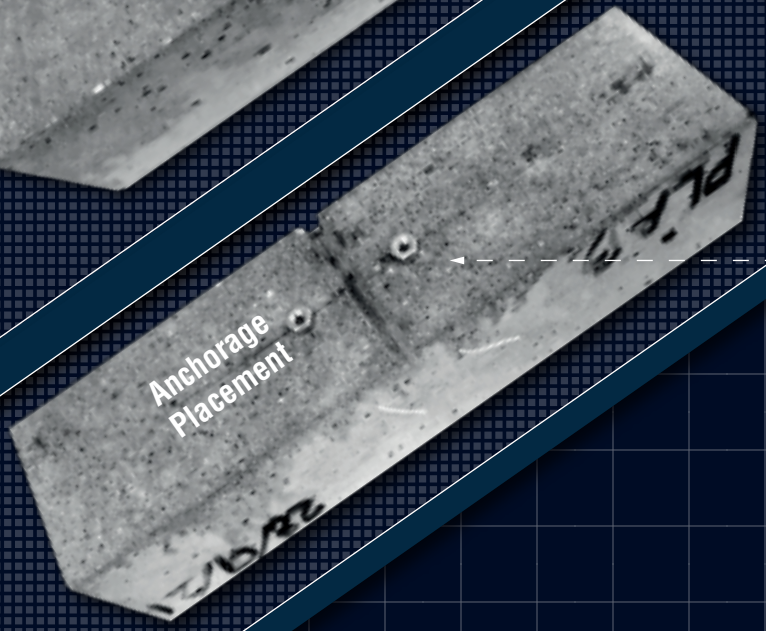
Then a horizontal displacement sensor contacting both sides separated by the notch is attached (to previously glued metallic anchorage points in the notch face) to measure the displacement of both fissure parts while applying the load, registering the data, controlling the forces and stopping the test before breaking the prism.

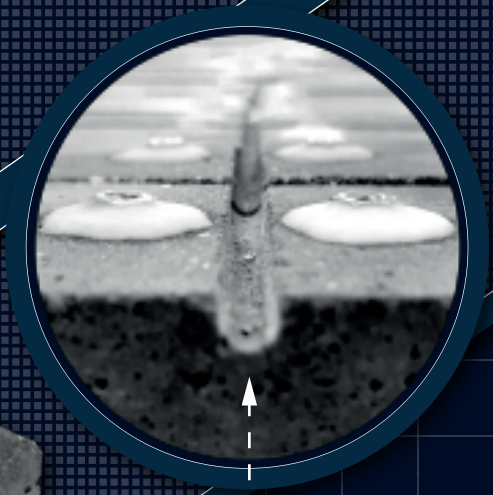
The information of strength, vertical displacement, and horizontal displacement is registered to produce a graph showing the initial resistance behavior. This graph, after activating the healing agent and its hardening will be then compared (repeating the test to register and verify if has effectively recovered some of the original strength or even overpass it). In this case, for a better comprehension of the results, the graphic will be shown in the section 4.3.5 mechanical recovery comparing the pre—fissuring with the self healing agent influence data.

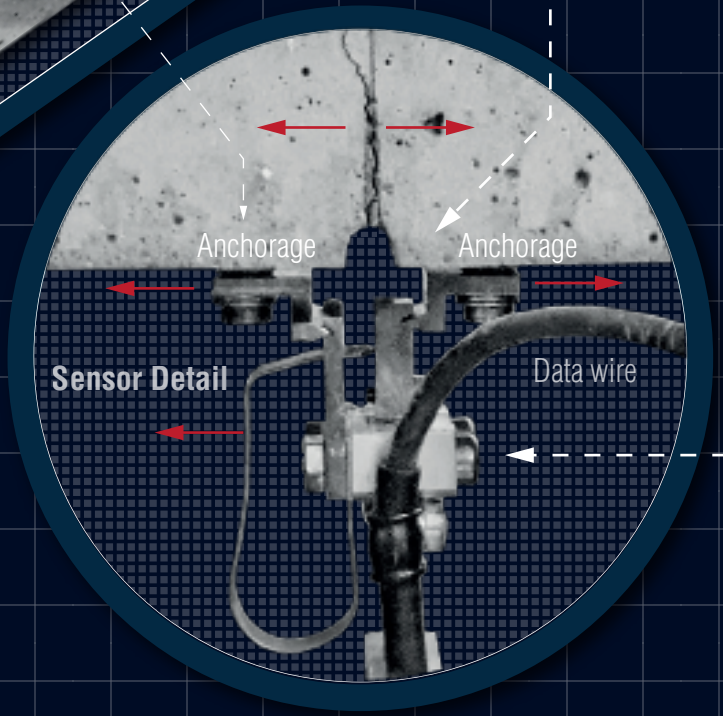
PRE-FISSURING TEST












FLEXURAL TEST
RY
Support C
28/9/21
PLAH
Horizontal
Displacement
Support A
Support B
Horizontal
Displacement
Sensor
FY
FY

After producing the initial fissure, the prisms are left underwater to activate the healing agent, for 8 days, from October 12th 2021 (the pre-fissuring day) to October 20th 2021.

For the development of this test, it was necessary to introduce a nylon pipe in the water conduct left on the prism, insulated with silicone paste to avoid water looses, also sealing the bottom to leave only one way out that is through the fissure.

To allow the water falling, the prism is placed still on a horizontal frame with a void in the center; the pipe is connected to a container (placed 50cm above the prism conduct level) and the liquid fall by gravity with a pressure of 50MPa, (the container is constantly refilled to keep always the same height and force).

Under the sample, for registering the grams of water passing through, an electronic weight is placed, this device is connected to a computer software that registers the variation of weight by time.

The total test for each sample is 7 minutes; ignoring the first minute where data could present alterations for remaining air in the conduct, or falling drops from the immersion period remaining moisture; so the effective measuring time is 6 minutes.

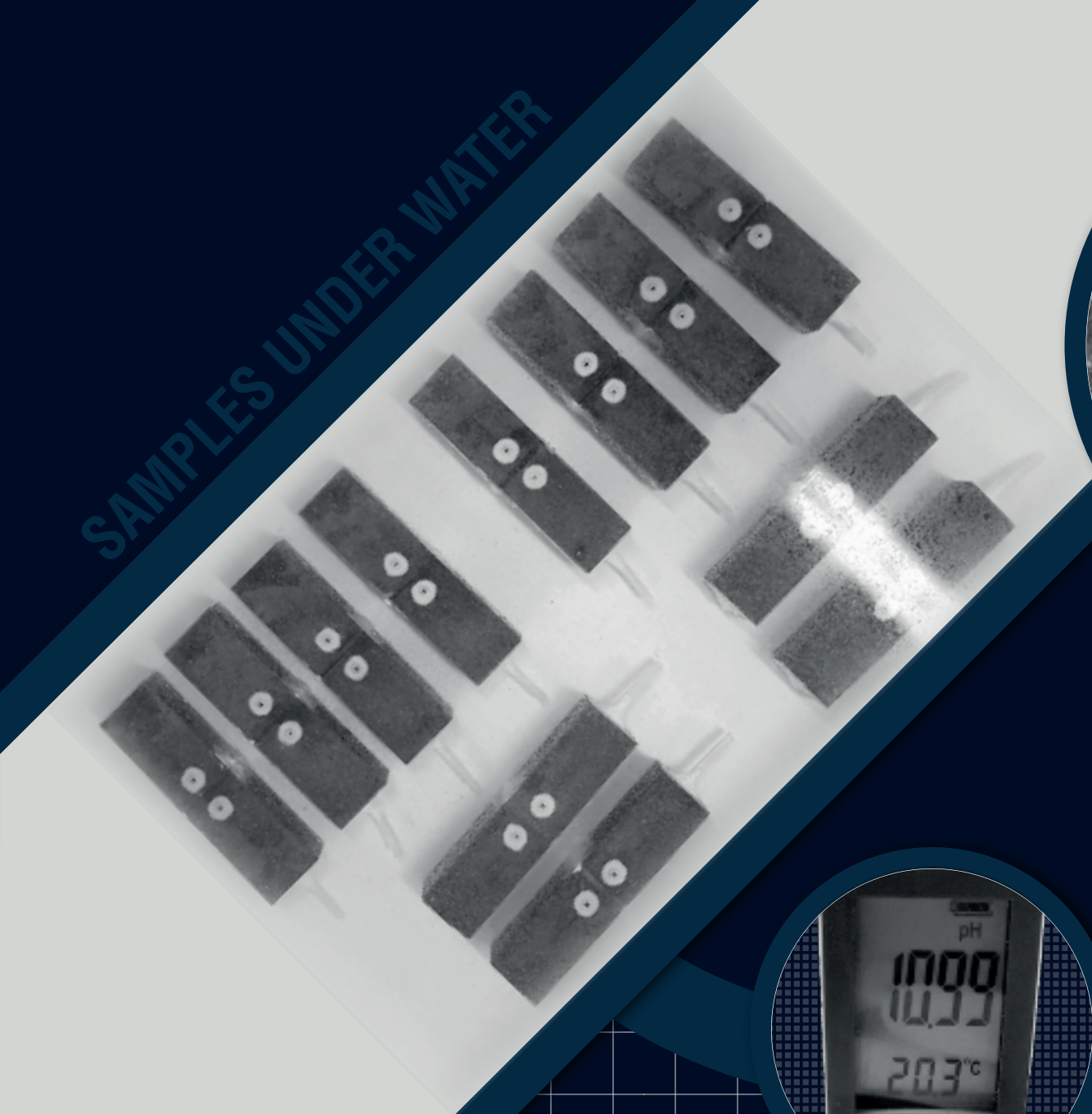
Using these data, the tables presented in the following pages are developed, and is calculated the water flow (WF), as the variation in mass of water released divided by the variation of time.

Then by dividing the difference between the water-flows from the reference prisms and the capsule samples, by the reference prism water-flow again, the sealing effectiveness (SE) is calculated (this amount is in percentage).

$$WF = \frac{\Delta m}{\Delta t} \qquad [g/min]$$

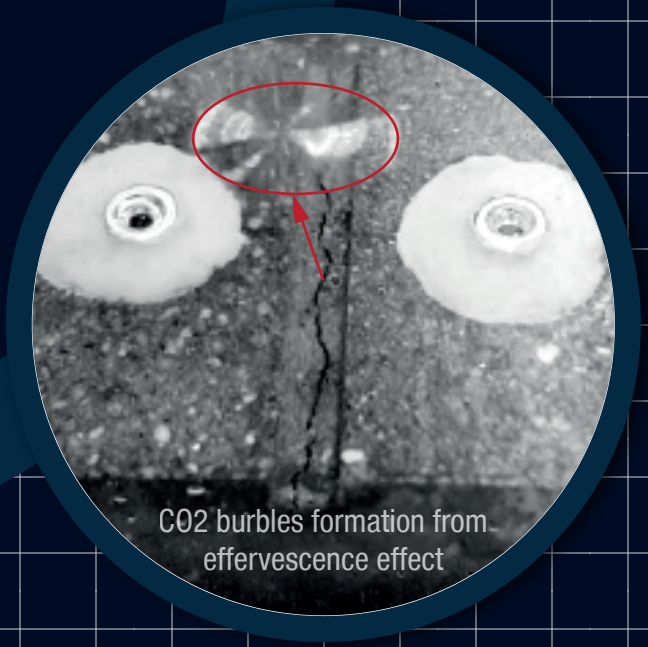
$$SE = \frac{WF_{ref} - WF_{caps}}{WF_{ref}} \qquad [\%]$$

SAMPLES UNDER WATER



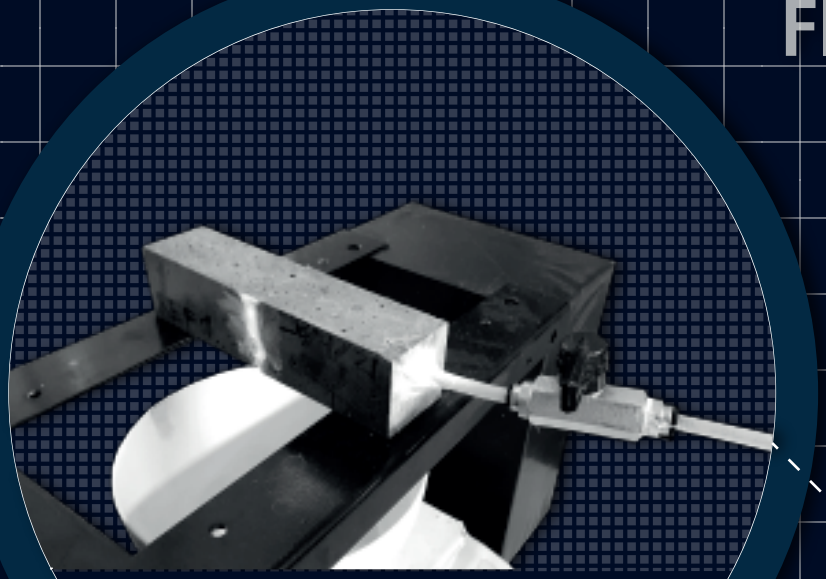


CO2 burbles formation from effervescence effect



CO2 burbles formation from effervescence effect

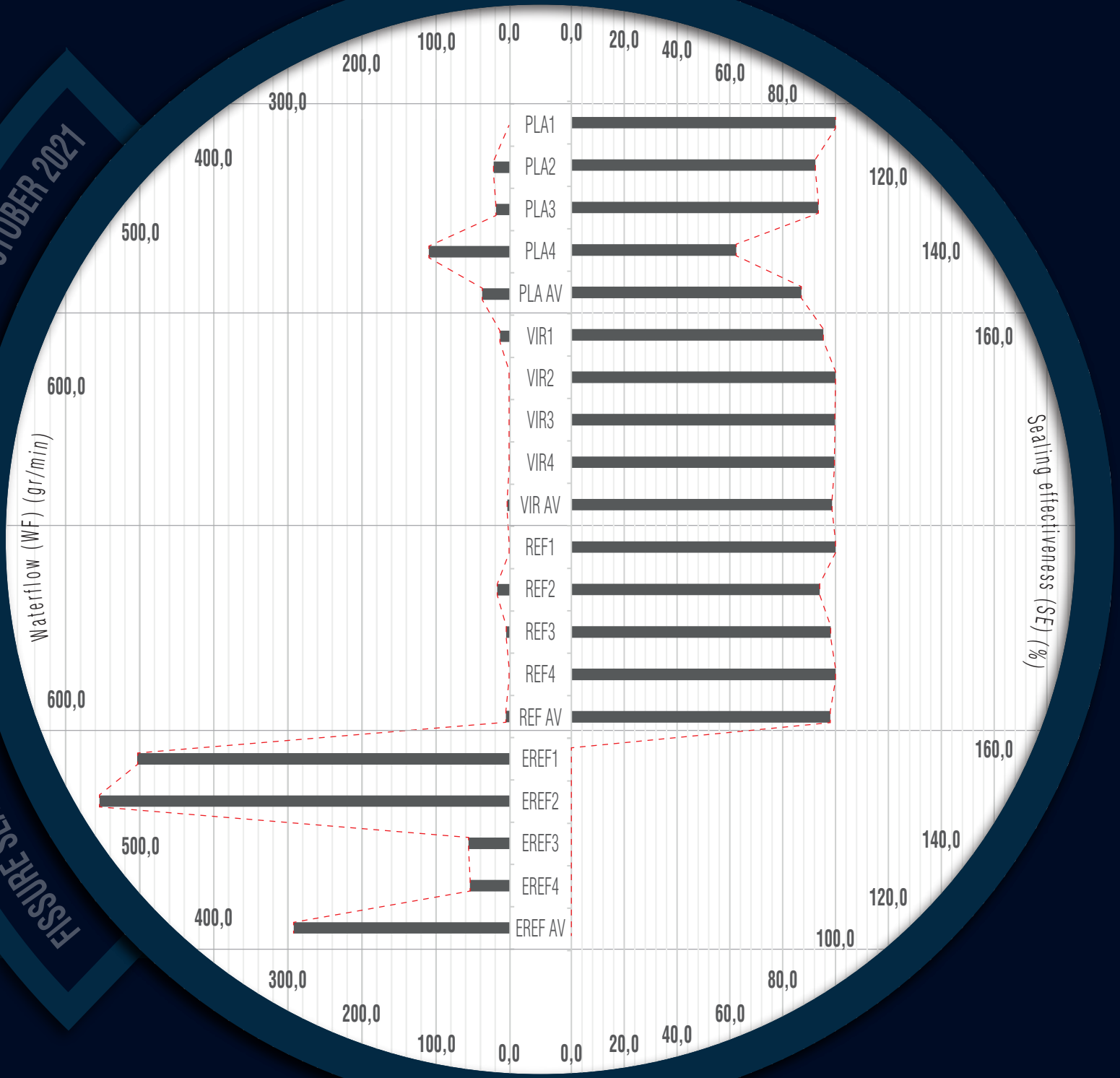
FISSURE SEALING TEST



Healing agent waterproofing test. Water connection from 50cm height for 50MPa constant pressure.

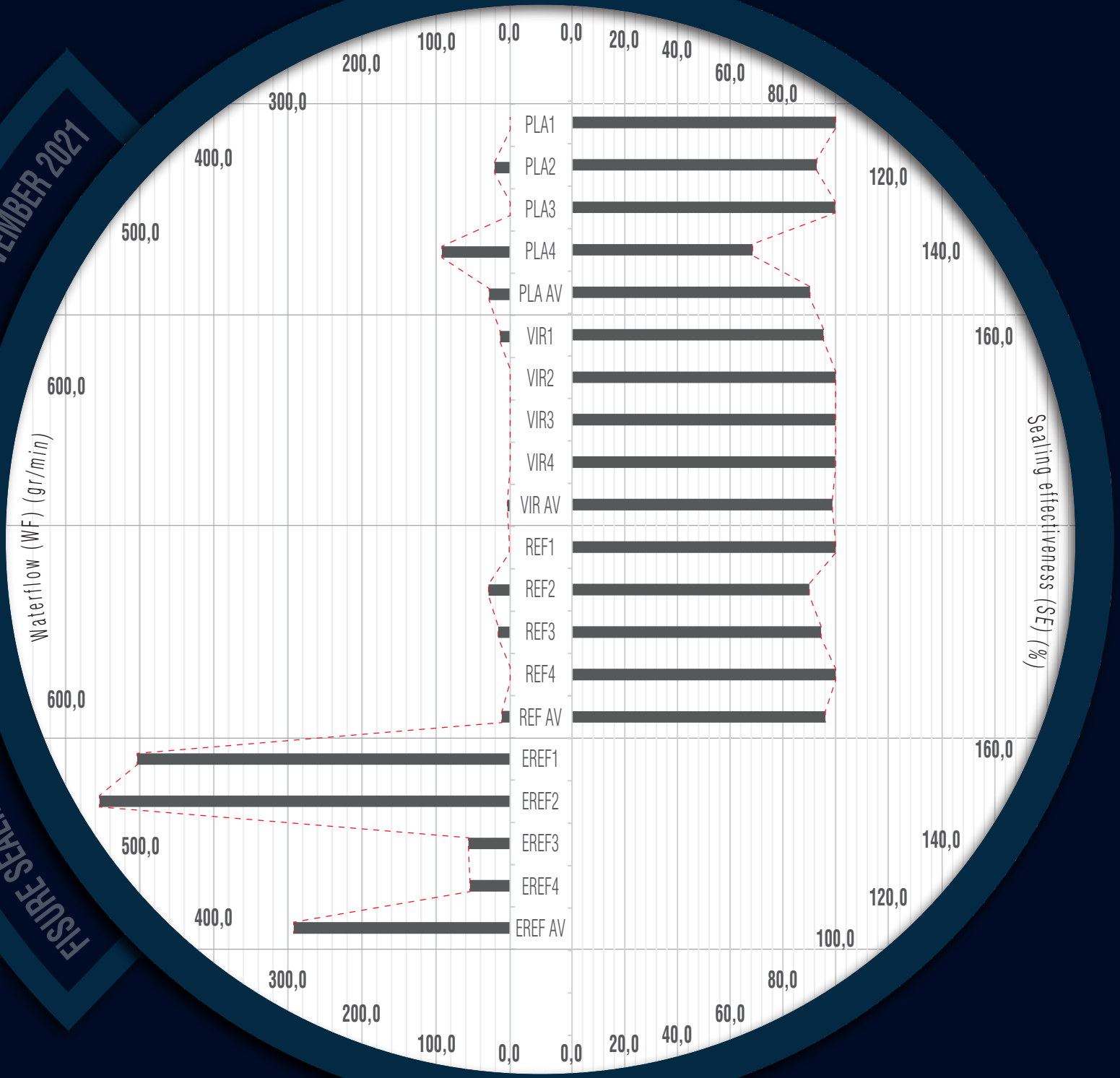
TYPE	INITIAL TIME (HH.MM.SS)	INITIAL MASS (gr.)	FINAL TIME (HH.MM.SS)	FINAL MASS (gr.)	ΔTIME (minutes)	ΔTIME (seconds)	Δ MASS (gr.)	WF (gr/min)	SE USING REF (%)	SE USING EREF (%)
TESTING DATE: OCTOBER 12TH 2021										
3D PRINTED (PLA) SOLID HEALING AGENT CAPSULES										
PLA1	12:38:00	0,00	12:44:00	0,00	6	360	0,00	0,0	100,0	100,00
PLA2	12:48:15	30,50	12:54:15	163,6	6	360	133,10	22,2	-289,5	92,40
PLA3	12:57:36	21,70	13:03:36	134,9	6	360	113,20	18,9	-231,2	93,54
PLA4	14:54:32	99,60	15:00:32	758,5	6	360	658,90	109,8	-1828,0	62,40
PLA AV	13:19:36	37,95	13:25:36	264,25	6	360	226,30	37,7	-562,2	87,09
VIRTUAL SOLID HEALING AGENT CAPSULE (VIR)										
VIR1	15:05:28	16,50	15:11:28	97,20	6	360	80,70	13,5	-136,1	95,39
VIR2	16:49:08	0,30	16:55:08	0,60	6	360	0,30	0,1	99,1	99,98
VIR3	15:25:14	5,80	15:31:14	9,30	6	360	3,50	0,6	89,8	99,80
VIR4	15:34:35	7,50	15:40:35	14,90	6	360	7,40	1,2	78,3	99,58
VIR AV	15:43:36	7,53	15:49:36	30,50	6	360	22,98	3,8	32,8	98,69
REFERENCE PRISMS DEVELOPED ON THIS EXPERIMENT										
REF1	11:59:13	0,00	12:05:13	0,00	6	360	0,00	0,0	-	100,00
REF2	12:08:14	28,70	12:14:14	133,30	6	360	104,60	17,4	-	94,03
REF3	12:18:57	16,70	12:24:57	48,80	6	360	32,10	5,4	-	98,17
REF4	12:28:10	0,00	12:34:10	0,00	6	360	0,00	0,0	-	100,00
REF AV	12:13:39	11,35	12:19:38	45,53	6	360	34,18	5,7	-	98,05
EXTERNAL REFERENCE PRISMS FROM THE RESEARCH OF AAMER,W 2021										
EREF1	13:29:00	436,2	13:35:00	3457,1	6	360	3020,90	503,5	-	-
EREF2	12:54:00	1019,4	13:00:00	4346,2	6	360	3326,80	554,5	-	-
EREF3	12:01:00	74,8	12:07:00	411,4	6	360	336,60	56,1	-	-
EREF4	13:17:00	68,6	13:23:00	393,9	6	360	325,30	54,2	-	-
EREF AV	12:55:15	399,75	13:01:15	2152,15	6	360	1752,40	292,1	-	-

FISSURE SEALING TEST AT 8 DAYS FROM PRE-FISSURING - OCTOBER 2021



TYPE	INITIAL TIME (HH.MM.SS)	INITIAL MASS (gr.)	FINAL TIME (HH.MM.SS)	FINAL MASS (gr.)	ΔTIME (minutes)	ΔTIME (seconds)	Δ MASS (gr.)	WF (gr/min)	SE USING REF (%)	SE USING EREF (%)
TESTING DATE: NOVEMBER 8TH 2021										
3D PRINTED (PLA) SOLID HEALING AGENT CAPSULES										
PLA1	12:12:12	1,6	12:18:12	1,7	6	360	0,10	0,0	99,7	100,0
PLA2	12:21:12	24,8	12:27:12	149,7	6	360	124,90	20,8	-265,5	92,9
PLA3	12:30:00	3,4	12:36:00	6,5	6	360	3,10	0,5	90,9	99,8
PLA4	12:39:06	91,4	12:45:06	643,6	6	360	552,20	92,0	-1515,8	68,5
PLA AV	12:25:38	30,30	12:31:37	200,38	6	360	170,08	28,3	-397,7	90,3
VIRTUAL SOLID HEALING AGENT CAPSULE (VIR)										
VIR1	12:47:49	13,3	12:53:49	93,9	6	360	80,60	13,4	-135,8	95,40
VIR2	12:57:01	0,2	13:03:01	0,3	6	360	0,10	0,0	99,7	99,99
VIR3	13:05:40	2,7	13:11:40	4,6	6	360	1,90	0,3	94,4	99,89
VIR4	13:14:27	3,6	13:20:27	5,9	6	360	2,30	0,4	93,3	99,87
VIR AV	13:01:14	4,95	13:07:14	26,18	6	360	21,23	3,5	37,9	98,79
REFERENCE PRISMS DEVELOPED ON THIS EXPERIMENT										
REF1	12:03:01	0	12:09:01	0,1	6	360	0,10	0,0	99,7	99,99
REF2	11:35:35	34,9	11:41:35	209,3	6	360	174,40	29,1	-410,3	90,05
REF3	11:44:39	17,9	11:50:39	114,1	6	360	96,20	16,0	-181,5	94,51
REF4	11:53:38	0	11:59:38	0	6	360	0,00	0,0	100,0	100,00
REF AV	11:49:13	13,20	11:55:13	80,88	6	360	67,68	11,3	-98,0	96,14
EXTERNAL REFERENCE PRISMS FROM THE RESEARCH OF AAMER,W 2021										
EREF1	13:29:00	436,2	13:35:00	3457,1	6	360	3020,90	503,5	-	-
EREF2	12:54:00	1019,4	13:00:00	4346,2	6	360	3326,80	554,5	-	-
EREF3	12:01:00	74,8	12:07:00	411,4	6	360	336,60	56,1	-	-
EREF4	13:17:00	68,6	13:23:00	393,9	6	360	325,30	54,2	-	-
EREF AV	12:55:15	399,75	13:01:15	2152,15	6	360	1752,40	292,1	-	-

FISURE SEALING TEST AT 18 DAYS FROM PRE-FISSURING - NOVEMBER 2021



GENERAL DATA			TEST AT 8 DAYS (OCTOBER 12TH 2021)				TEST AT 18 DAYS (NOVEMBER 8TH 2021)			
TYPE	ΔTIME (minutes)	ΔTIME (seconds)	Δ MASS (gr.)	WF (gr/min)	SE USING REF (%)	SE USING EREF (%)	Δ MASS (gr.)	WF (gr/min)	SE USING REF (%)	SE USING EREF (%)
3D PRINTED (PLA) SOLID HEALING AGENT CAPSULES										
PLA1	6	360	0,00	0,0	100,0	100,00	0,10	0,0	99,7	100,0
PLA2	6	360	133,10	22,2	-289,5	92,40	124,90	20,8	-265,5	92,9
PLA3	6	360	113,20	18,9	-231,2	93,54	3,10	0,5	90,9	99,8
PLA4	6	360	658,90	109,8	-1828,0	62,40	552,20	92,0	-1515,8	68,5
PLA AV	6	360	226,30	37,7	-562,2	87,09	170,08	28,3	-397,7	90,3
VIRTUAL SOLID HEALING AGENT CAPSULE (VIR)										
VIR1	6	360	80,70	13,5	-136,1	95,39	80,60	13,4	-135,8	95,40
VIR2	6	360	0,30	0,1	99,1	99,98	0,10	0,0	99,7	99,99
VIR3	6	360	3,50	0,6	89,8	99,80	1,90	0,3	94,4	99,89
VIR4	6	360	7,40	1,2	78,3	99,58	2,30	0,4	93,3	99,87
VIR AV	6	360	22,98	3,8	32,8	98,69	21,23	3,5	37,9	98,79
REFERENCE PRISMS DEVELOPED ON THIS EXPERIMENT										
REF1	6	360	0,00	0,0	-	100,00	0,10	0,0	99,7	99,99
REF2	6	360	104,60	17,4	-	94,03	174,40	29,1	-410,3	90,05
REF3	6	360	32,10	5,4	-	98,17	96,20	16,0	-181,5	94,51
REF4	6	360	0,00	0,0	-	100,00	0,00	0,0	100,0	100,00
REF AV	6	360	34,18	5,7	-	98,05	67,68	11,3	-98,0	96,14
EXTERNAL REFERENCE PRISMS FROM THE RESEARCH OF AAMER,W 2021										
EREF1	6	360	3020,90	503,5	-	-	3020,90	503,5	-	-
EREF2	6	360	3326,80	554,5	-	-	3326,80	554,5	-	-
EREF3	6	360	336,60	56,1	-	-	336,60	56,1	-	-
EREF4	6	360	325,30	54,2	-	-	325,30	54,2	-	-
EREF AV	6	360	1752,40	292,1	-	-	1752,40	292,1	-	-

FISSURE SEALING TEST COMPARISON AT 8 & 18 DAYS FROM PRE-FISSURING

As seen in the previous graphic, all the data was collected, and as explained in the beginning of this section, were calculated the water flow and the sealing effectiveness.

For the data analysis, an external reference was included, taken from the research of Aamer, W. 2021. Which prisms were developed in the same conditions, dimension, molds and fissured with the same machine used on this research; so it is compatible and used as a point of comparison in this test.

External reference are necessary due to some alterations occurred with the ones developed for this thesis. One of the reasons is that, the fissure aperture in this research references are very reduced; so the crack, without having any support to keep it open, tent to re—join and close.

Another reason is, that the reference prisms were placed in the same water container as the capsules including ones, and due to the effervescence effect the powder was released from the capsules to the water (that was particularly full of these grains and solids in suspension), so this supported the autogenous self healing process on the malt, closing the crack.

Another reason, that more than being considered a drawback is an advantage, because it could mean that the powder released into the water, in contact with smaller cracks, can indirectly support the autogenous concrete self healing effect, helping them close without the presence of embedded capsules in minimum fissures.

Bibliographic references:
-Aamer, W., 2021. Materiali cementizi auto-riparanti: Valutazione dell'efficienza di riparazione di capsule cementizie e in PET riciclato. Turin, Italy: Politecnico di Torino, pp.1-110.

In the previous tables and graphs, for the 8 days test, a reduced water flow for the prisms with embedded capsules notable; PLA1 directly presents a total fissure blocking, and PLA average is 37.7 gr/min of water passing through, that is notably smaller than the 292.1 gr/min in the external reference average.

For the same date, virtual capsules presents the best performance, with an average water flow of only 3.8 gr/ml and a sealing effectiveness of 98.69%, that means almost a total sealing of the crack.

Even in this research references prisms, the average waterfowl is 31.18 gr/min, presenting the REF1 and 4 a total closure, being just barely superior to the 3D printed capsule's prisms.

For the test at 18 days, it is possible to see an evolution of the sealing process, with a PLA capsule prism water flow average of 28.3 gr/ml, minor than the 37.7 gr/ml, and a 90% effectiveness.

For the virtual capsules prisms, a water flow average of 3.5 gr/min was obtained, minor than the previous 3.8 gr/ml; and an effectiveness of 98.79%, meaning a practically total sealing.

In general terms, the sealing condition occurs and is very effective; it is also notable that the longer the time, the better the performance (reducing the water flow with the days).

Once finished the sealing tests, and considering that the fissures were not totally closed, the prisms were immersed again in water for 10 more days, completing also the 28 days curing period.

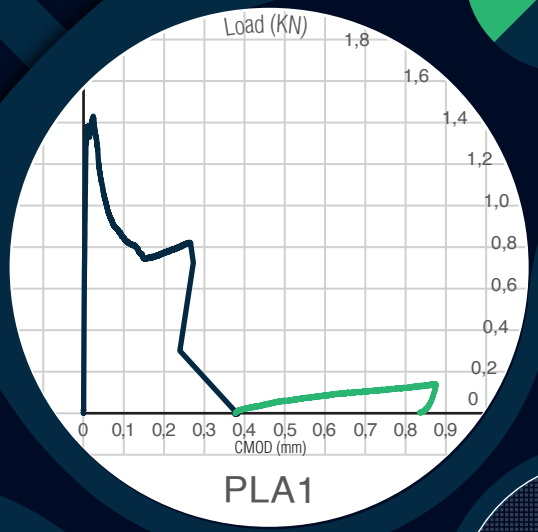
The samples are then extracted from water and is developed another flexural resistance test, following the same procedure of the pre-fissuring section (explained before), but testing now if the healing agent recovered part of the initial tensile strength.

In the following section, the comparison of the graphs developed with the registration of vertical load, vertical displacement, and horizontal displacement, recovered from the sensors will be presented.

In these graphs, are compared the initial values from the pre-fissuring test, and the final values from the current procedure (where the samples are finally broken).

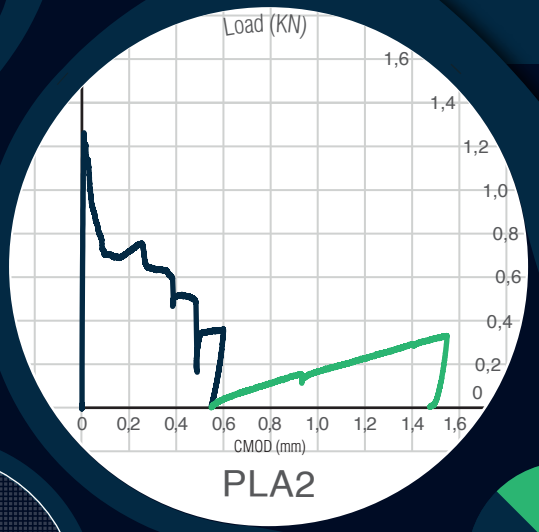

FLEXURAL TEST
RY
Support C
28/9/21
PLA 1
Horizontal
Displacement
Horizontal
Displacement
Support A
Support B
FY
Horizontal
Displacement
Sensor
FY

PRE-FISSURING VS STRENGTH RECOVERY TEST - 3DP PLA CAP. AT 28 D.



PLA1

10% recovered
1,4 vs 0.14kN

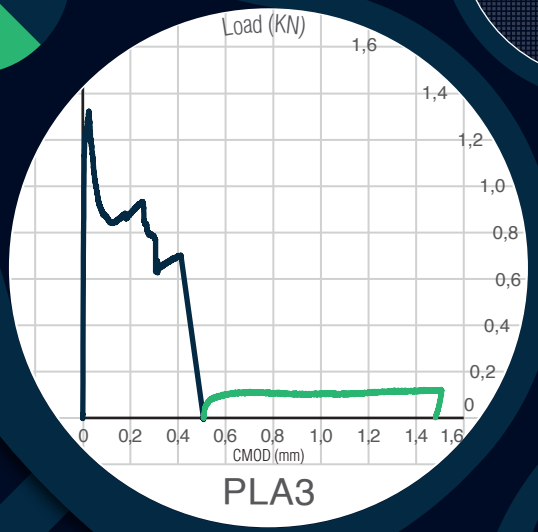


PLA2

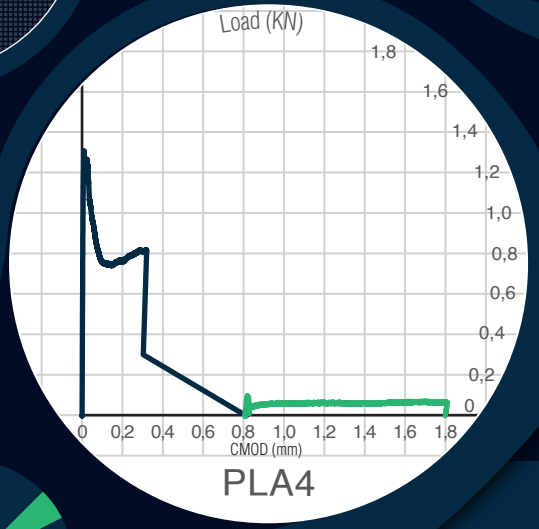
1,26 vs 0.33kN recovered
26%



9,3% recovered
1,3 vs 0.12kN



PLA3

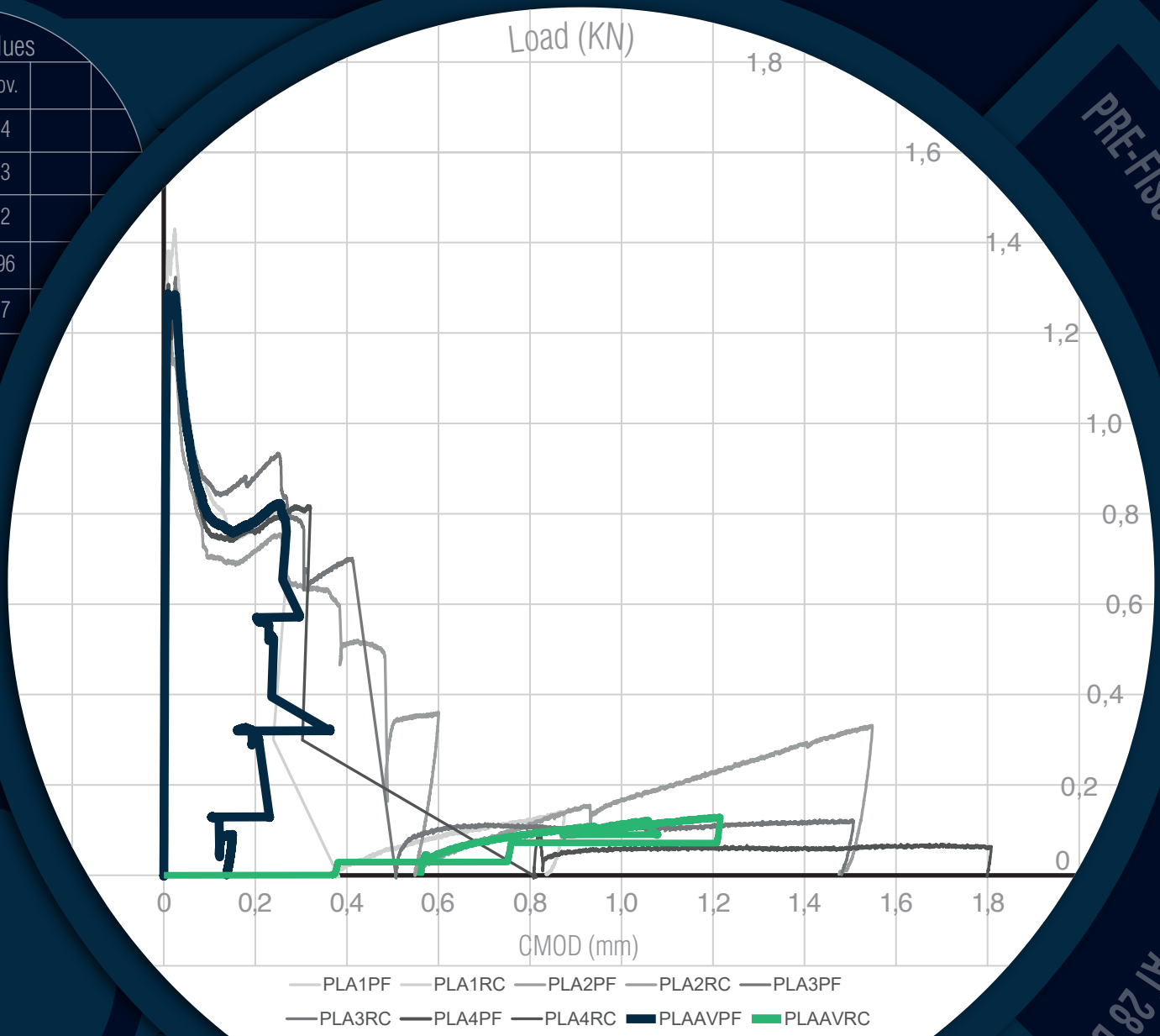


PLA4

1,3 vs 0.096kN recovered
5.3%

Maximum values

Type	Pre-fis.	Recov.
PLA1	1.43	0.14
PLA2	1.26	0.33
PLA3	1.32	0.12
PLA4	1.30	0.096
PLAAV	1.33	0.17



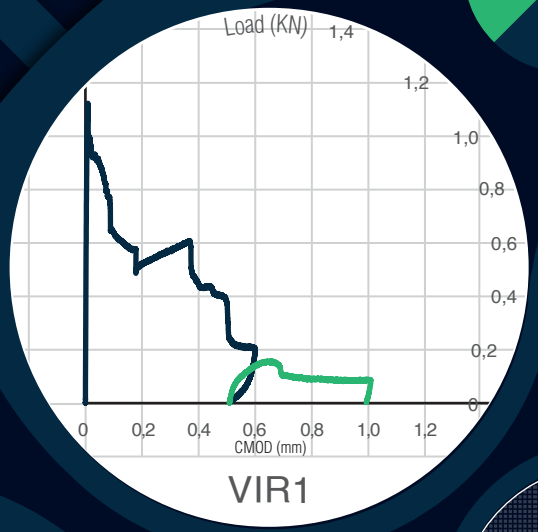
PLA AVERAGE

PRE-FISS. VS STR. RECOVERY TEST - 3DP PLA CAP. AVERAGE AT 28 D.

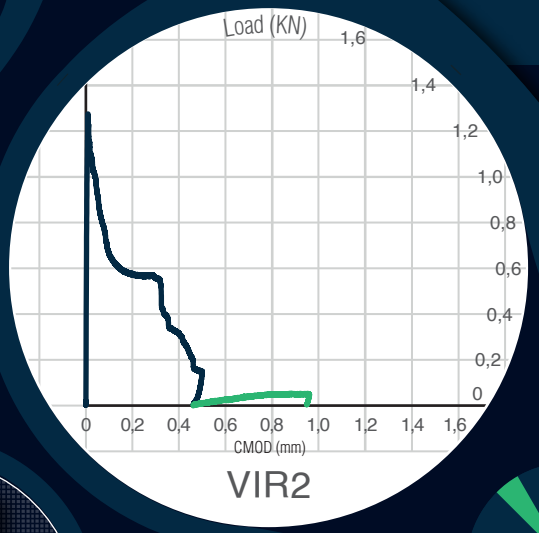


PRE-FISSURING VS STRENGTH RECOVERY TEST - VIRTUAL CAP. AT 28 D.

14%
recovered
1,12 vs 0.15kN



VIR1

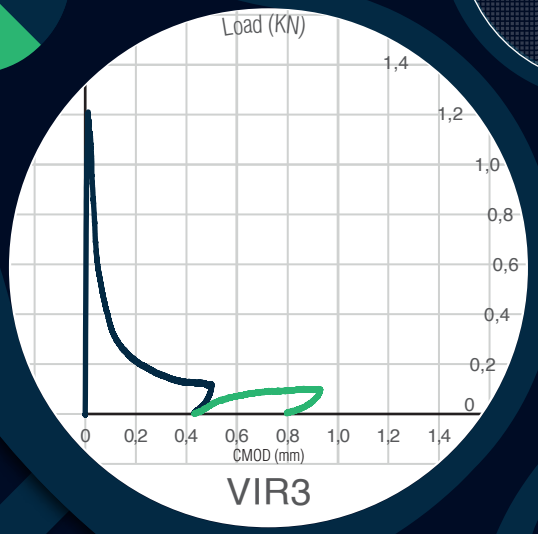


VIR2

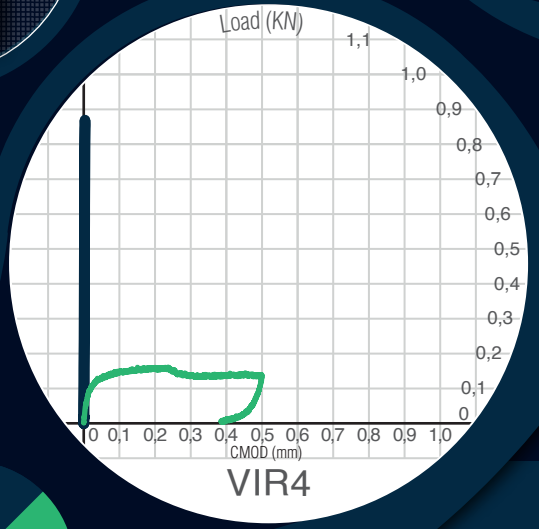
1,27 vs 0.054kN
recovered
4.25%



8.26%
recovered
1,21 vs 0.10kN



VIR3



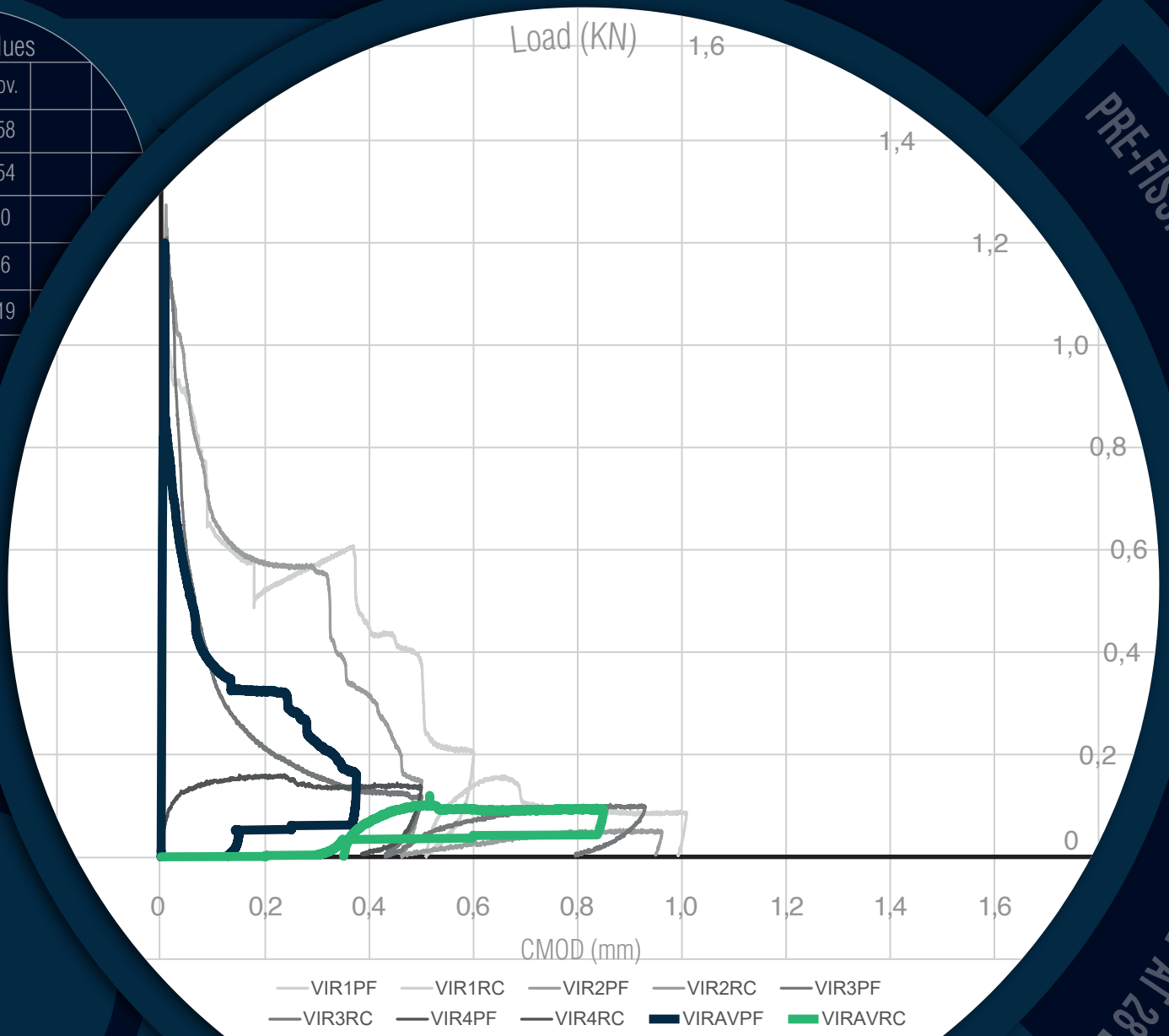
VIR4

0.86 vs 0.16kN
recovered
18.6%

Maximum values

Type	Pre-fis.	Recov.
VIR1	1.12	0.158
VIR2	1.27	0.054
VIR3	1.21	0.10
VIR4	0.86	0.16
VIRAV	1.12	0.119



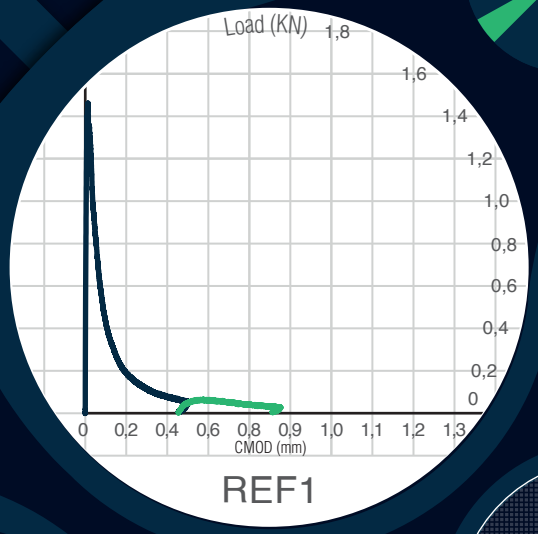


VIR AVERAGE

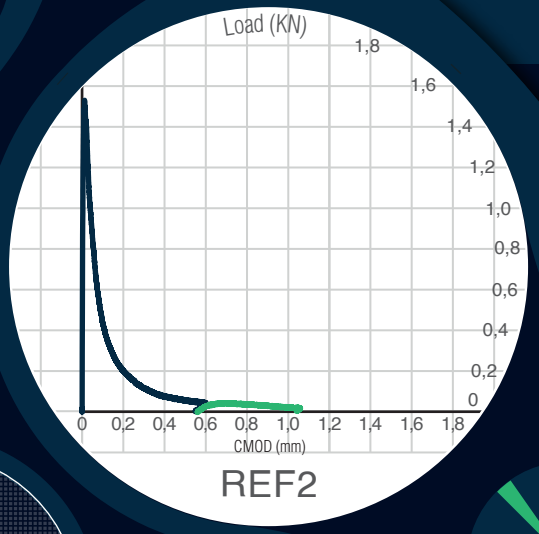
PRE-FISS. VS STR. RECOVERY TEST - VIRTUAL CAP. AVERAGE AT 28 D.

PRE-FISSURING VS STRENGTH RECOVERY TEST - REFERENCE AT 28 D.

4.5%
recovered
1.46 vs 0.066kN



REF1

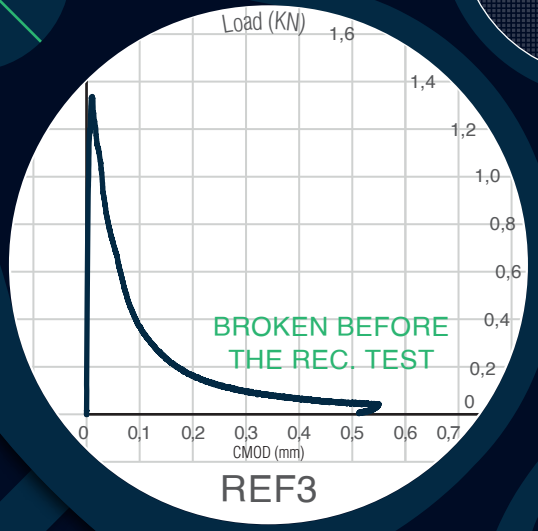


REF2

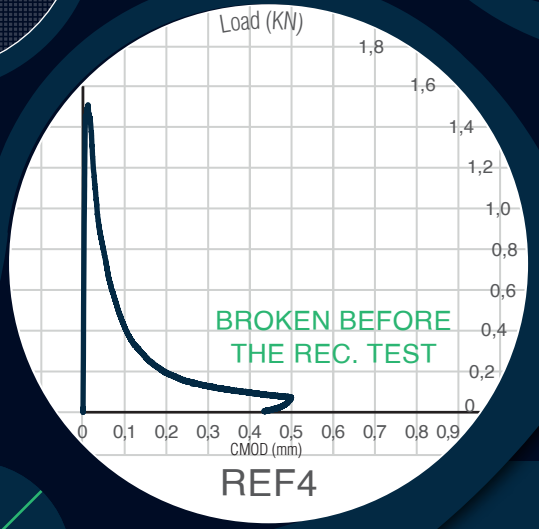
1.53 vs 0.044kN
recovered
2.87%

?
Broken before
the recov. test





REF3



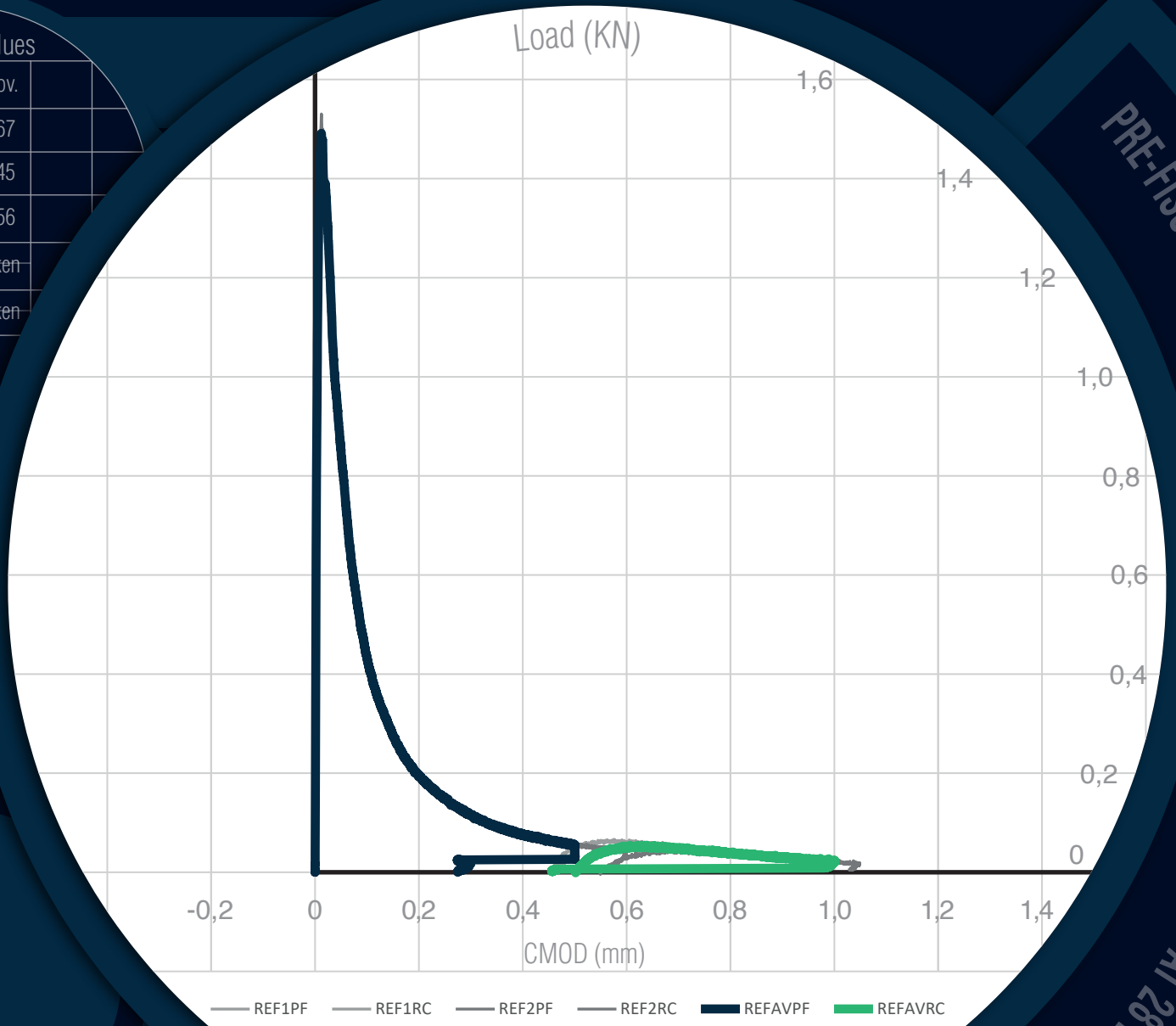
REF4

Broken before
the recov test
?

PRE-FISS. VS STR. RECOVERY TEST - REFERENCE AVERAGE AT 28 D.

Maximum values

Type	Pre-fis.	Recov.
REF1	1.46	0.067
REF2	1.53	0.045
REF AV	1.49	0.056
REF3	1.33	Broken
REF4	1.50	Broken



REF AVERAGE

Average REF strength recovered 3.74%

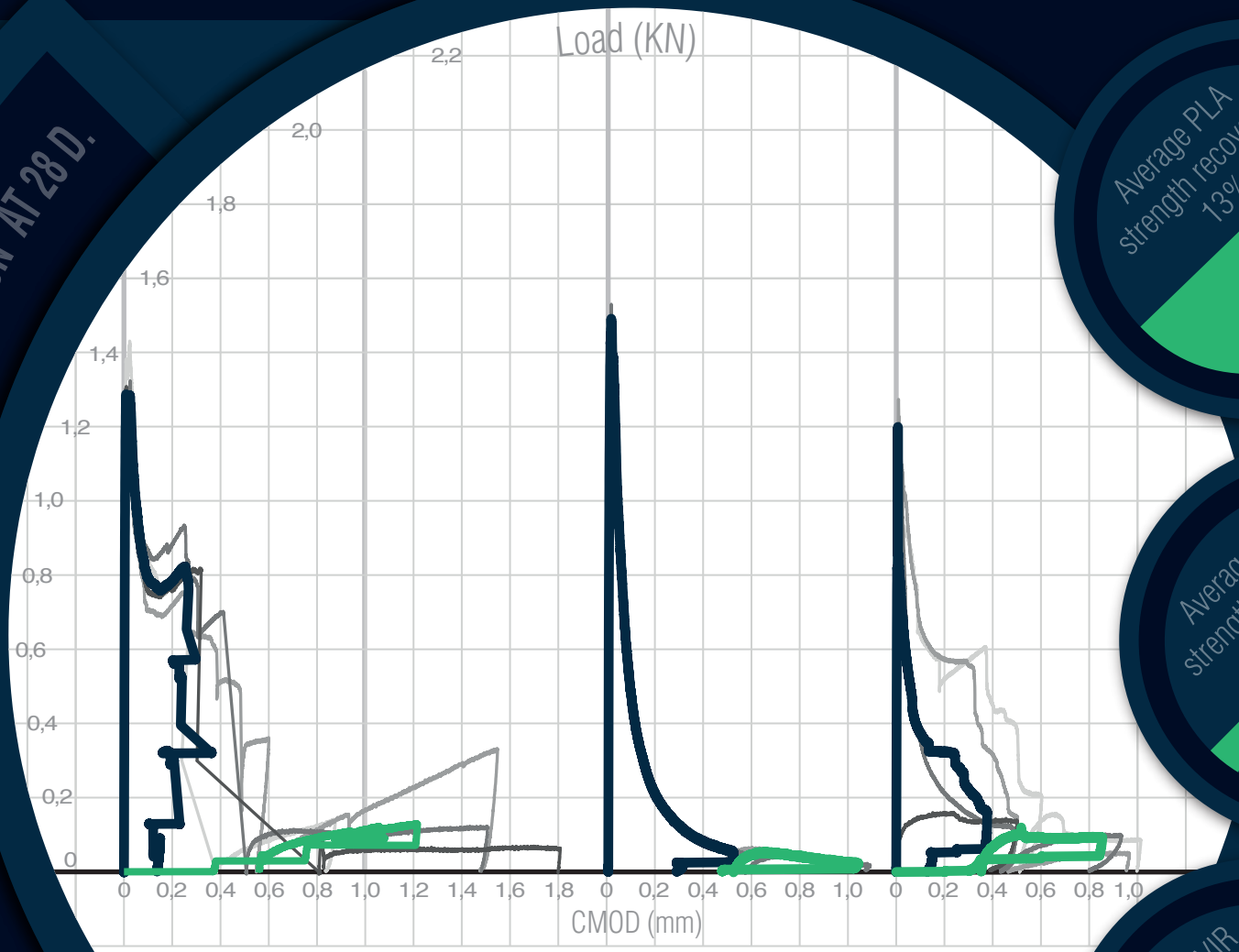
The data obtained in graphs has two curves, one in dark blue and one in green, the blue curve refers to the pre-fissuring tests, where is expressed in the X axis the CMOD (or horizontal displacement) in millimeters (from the sensor placed in the notch, as explained in the section 4.3.3); and the Y axis refers to the load in kilo newtons applied to produce the tensile stress and generate the crack.

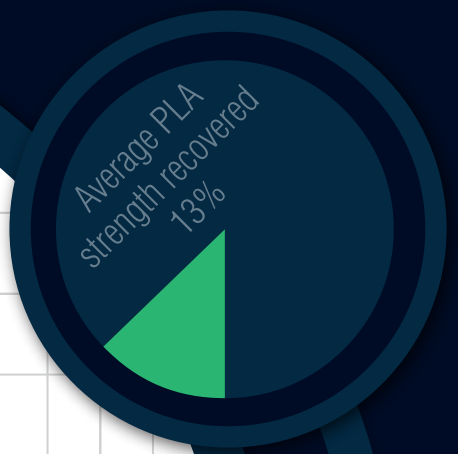
With this information, a maximum point in the Y axis, that is the heaviest load resisted by the sample before cracking is identified, and will be the reference point to compare the healing agent behavior and effectiveness in mechanical terms.

The green curve, represents the second test developed after the healing agent activation and hardening; in this case, the highest point in the curve for the Y axis must be equal to the highest point presented in the blue curve for considering a 100% of tensile strength recovery. In other words, for an ideal mechanical healing effect, the resistance of the healing agent to tensile strengths, must be equal or superior to the one obtained in the pre-fissuring test.

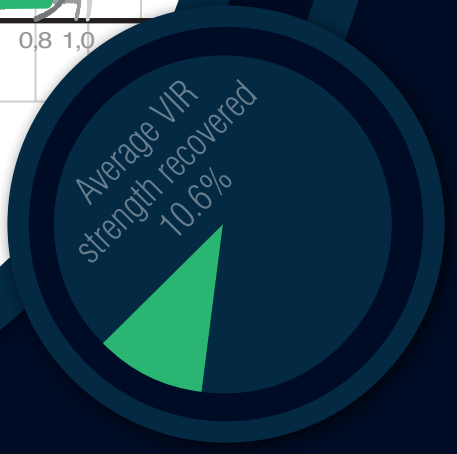
A regular flexural test curve in concrete normally presents the appearance shown in the references cases, but, due to the differences on materials behaviors of the capsule containing prisms, a different pattern of forces and reactions occurs, producing variations in the curves (this is the reason why some graphics presents regularities in the load and CMOD progression).

PRE-FISS. VS STR. RECOVERY TEST - AVERAGE COMPARISSON AT 28 D.









PLA1PF PLA1RC PLA2PF PLA2RC PLA3PF PLA3RC PLA4PF
PLA4RC PLAAVPF PLAAVRC REF1PF REF1RC REF2PF REF2RC
REFAVPF REFAVRC VIR1PF VIR1RC VIR2PF VIR2RC
VIR3PF VIR3RC VIR4PF VIR4RC VIRAVPF VIRAVRC

As seen in the previous figures, the prisms containing 3D printed PLA powder core capsules, presented a strength recovery of 10%, 9.3%, 5%, and even 26%; also, the samples containing virtual capsules (with powder core) presented 14%, 8.26%, 18%, and 4.25%.

These results compared to the ones obtained in the reference prisms, that are 4.5% and 2.87%; are equal or superior by the double amount (also some of the reference presented such a brittle and fragile condition that didn't resist the manipulation before the test).

From all the previous graphics and data obtained, average curves and maximum points to obtain a final amount for comparing every solution were developed.

In the immediately previous figure, the average results are presented and contrasted together, obtaining from the reference samples a 3.74% of recovery; is to say from a maximum average load of 1.49 KN resisted during the pre-fissuring test (that is the 100%), were reached 0.056KN after the healing period, this amount represent in comparison a 3.74% (of the total 1.49KN).

In the case of the reference prisms, is totally normal to present low recoveries due to the lack of capsules or healing agents embedded.

The PLA average results presents a 13% of strength recovered, obtaining a maximum load value of 0.17 KN form a pre–fissuring value of 1.33 KN, three times superior to the one obtained in the reference average.

Evaluating the virtual capsules, the average recovery obtained is a 10.6%, registering an amount of 0.11 KN from a maximum pre–fissuring value of 1.12 KN, that is still more than the double of the values presented in the references.

The difference between the virtual and the 3D printed capsules effectiveness could be that the powdered agent (in the case of the PLA capsules) didn't present any treatment, and was not mixed with propylene glycol, so its purity, in spite of the virtual capsules, could be considered higher. Anyway, it is important to remember that virtual capsules presented a higher waterproofing effectiveness in previous tests.

Also, it is possible that PLA capsules presented some alterations in the test (specifically the PLA2 of 26%) because of the presence of a thicker capsule respect to virtual, and a non total breaking of the shield and waterproofing layer during the pre–fissuring, that, supported by the healing effect, could create the illusion of a higher strength.

Anyway, both capsule's results are a sign of good potential; with a 10% of strength recovery after one month, using only salts and minerals, without depending of complex polymeric or epoxy substances; it could possibly recover a higher amount with a longer curing and activation period for properly producing the mineral structures and chemical reactions.

The microscopic view, is another important part of the experiment, because the evolution of the healing process and fissures widths can be observed in detail; for these reasons were registered the images in two moments, one after the pre-fissuring test (to register the initial aspect of the crack, before acting any healing agent) and another after the healing period (and just before the recovery test when is broken).

In the following figures, the fissures in three stages are shown, one before the healing process, that is just after the pre-fissuring test; another after the 28 days healing period; and a comparison view, composed of a background and a mask of yellow points corresponding to the areas occupied by new minerals formation as a consequence of the healing process.

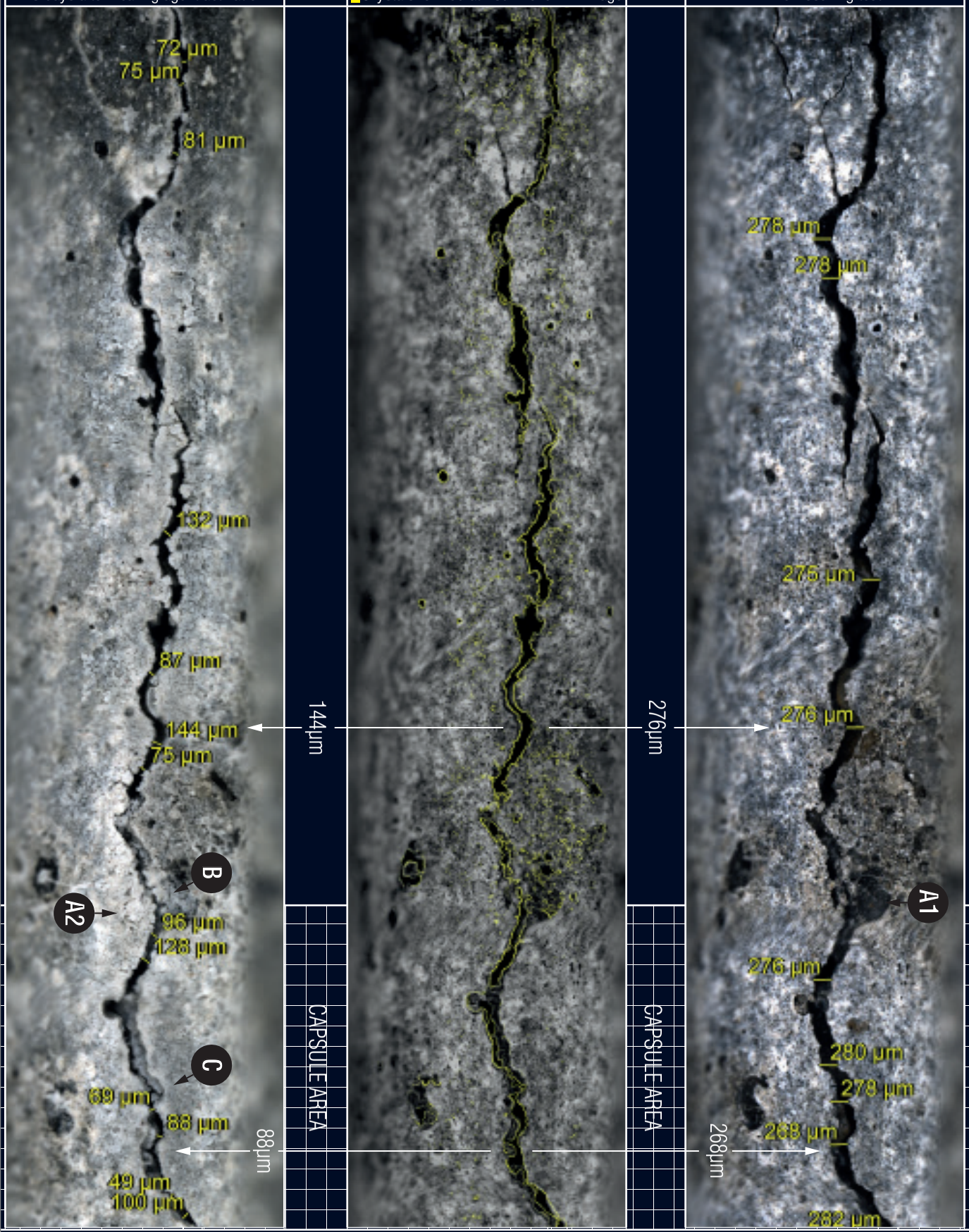
The pre-fissuring microscope view is used as the background for this figure, to understand where the minerals are located compared to the moment before the healing action.

For developing the yellow mask, as the light is reflexed in a more intense way than the normal cement paste, is possible to filter them and highlight its area, then apply yellow as a high contrast color, and is finally placed removing the rest of the image to fit in the pre-fissuring crack, and notice the changes.

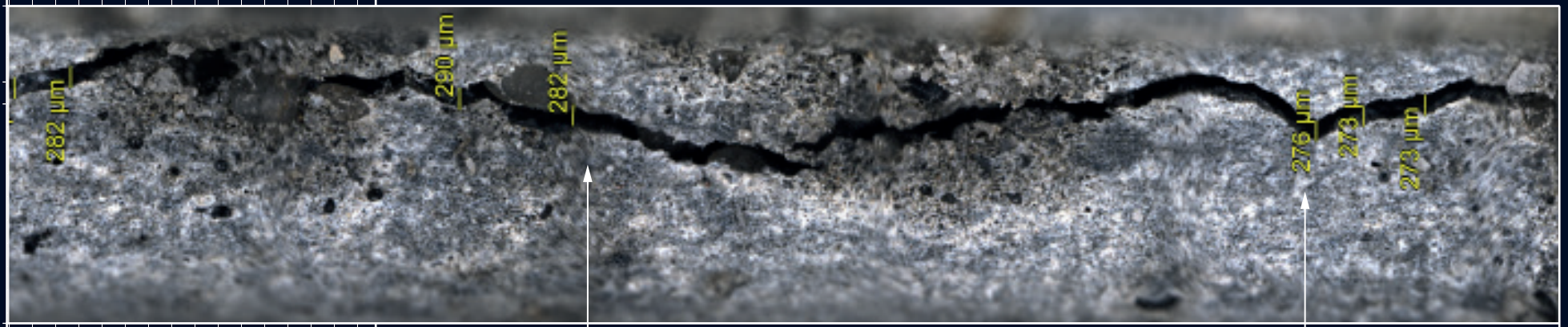
Due to the notable difference of quality in the results, it has been divided the information in two groups, one called "high relevance results", showing the notably superior effectiveness of the healing agent where was also obtained more information and views of minerals formation; and another section with the rest of the results.

Anyway, in both cases are shown the fissures comparison, not only in visual terms, also in measures. It is complemented with a detailed view of three relevant points with mineral formation to understand how the reaction and healing agent works.

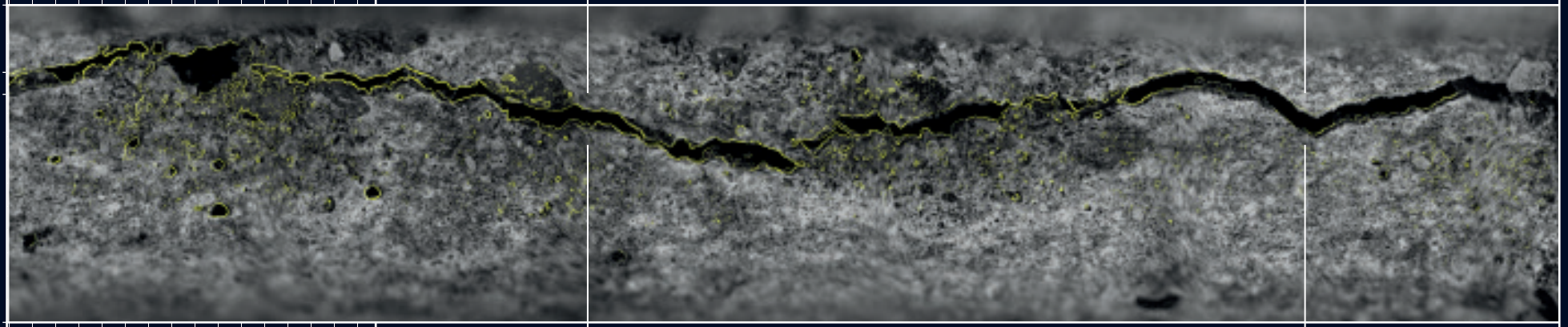
PLA1 MICROSCOPE VIEWS COMPARISON FROM PF. TO 28 D.ACTIVATED



321



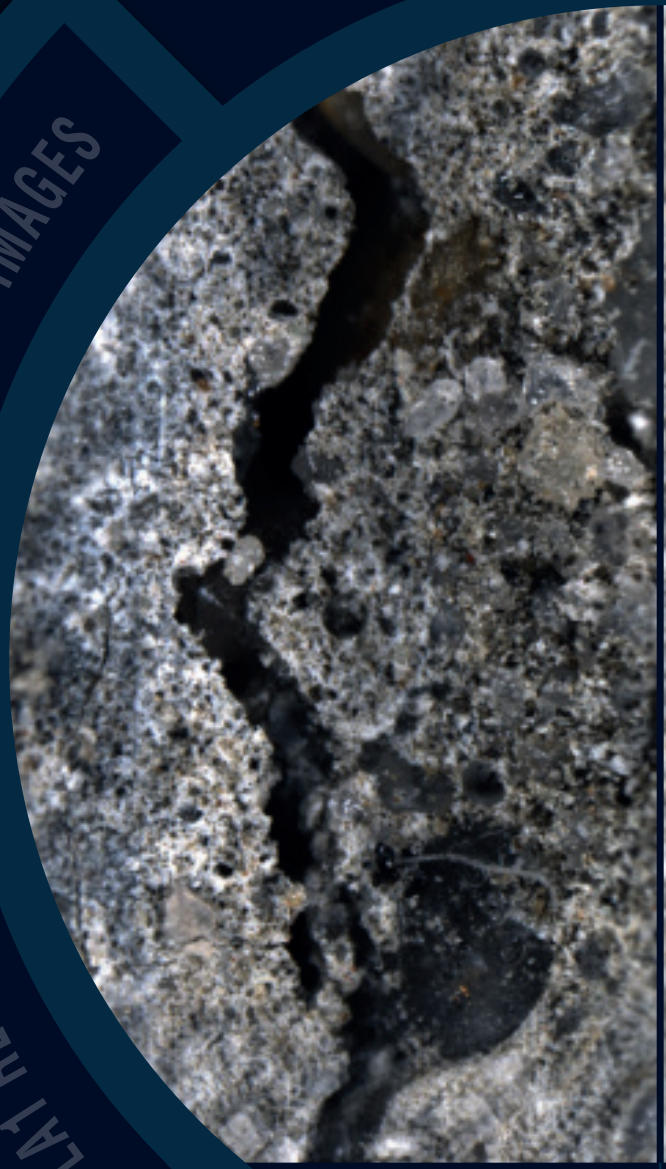
CAPSULE AREA 282µm 276µm



CAPSULE AREA 167µm 249µm



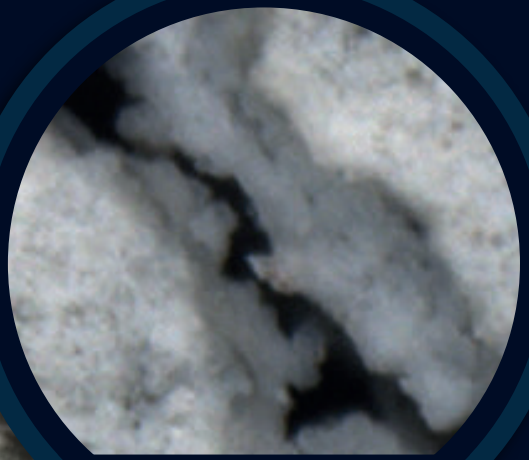
PLA1 RELEVANT MICROSCOPE DETAILED IMAGES



BEFORE (A1)



AFTER (A2)

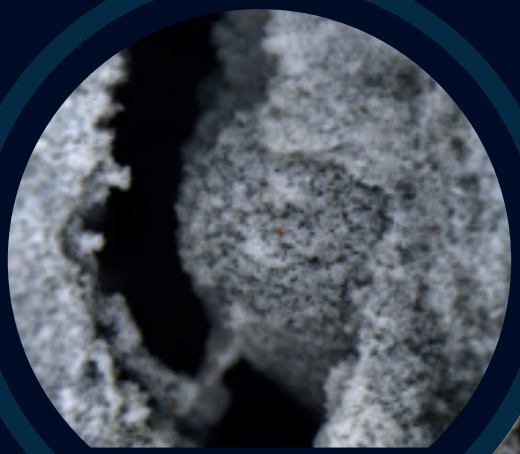


DETAIL B



DETAIL C

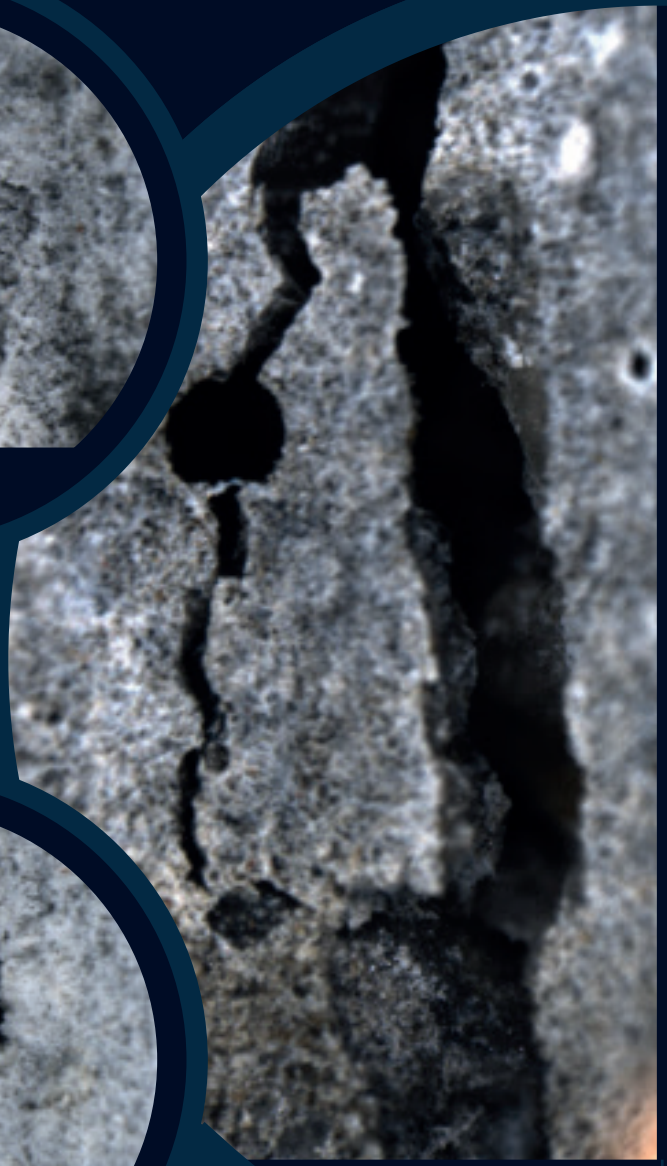
PLA4 RELEVANT MICROSCOPE DETAILED IMAGES



DETAIL B



DETAIL C

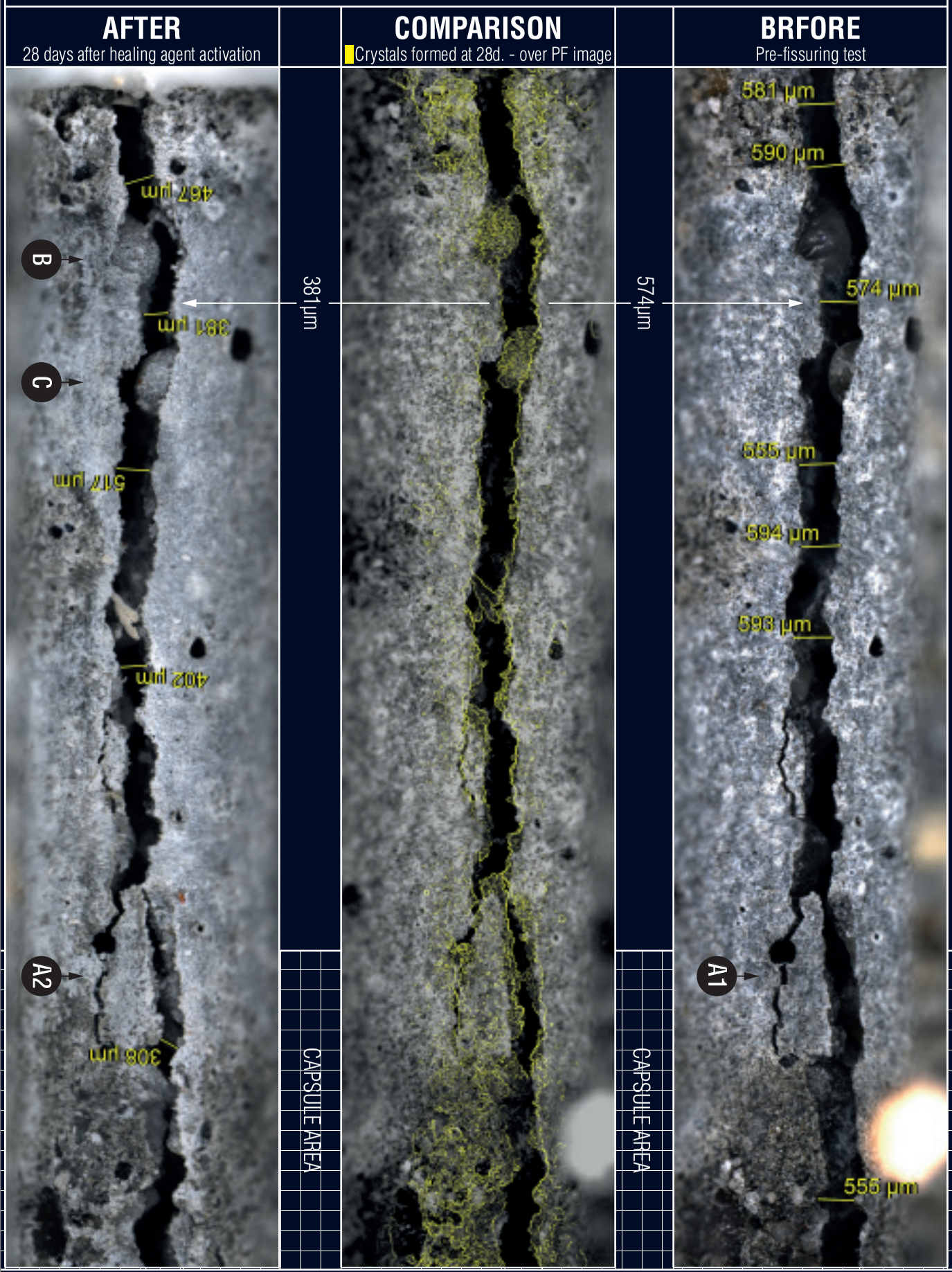


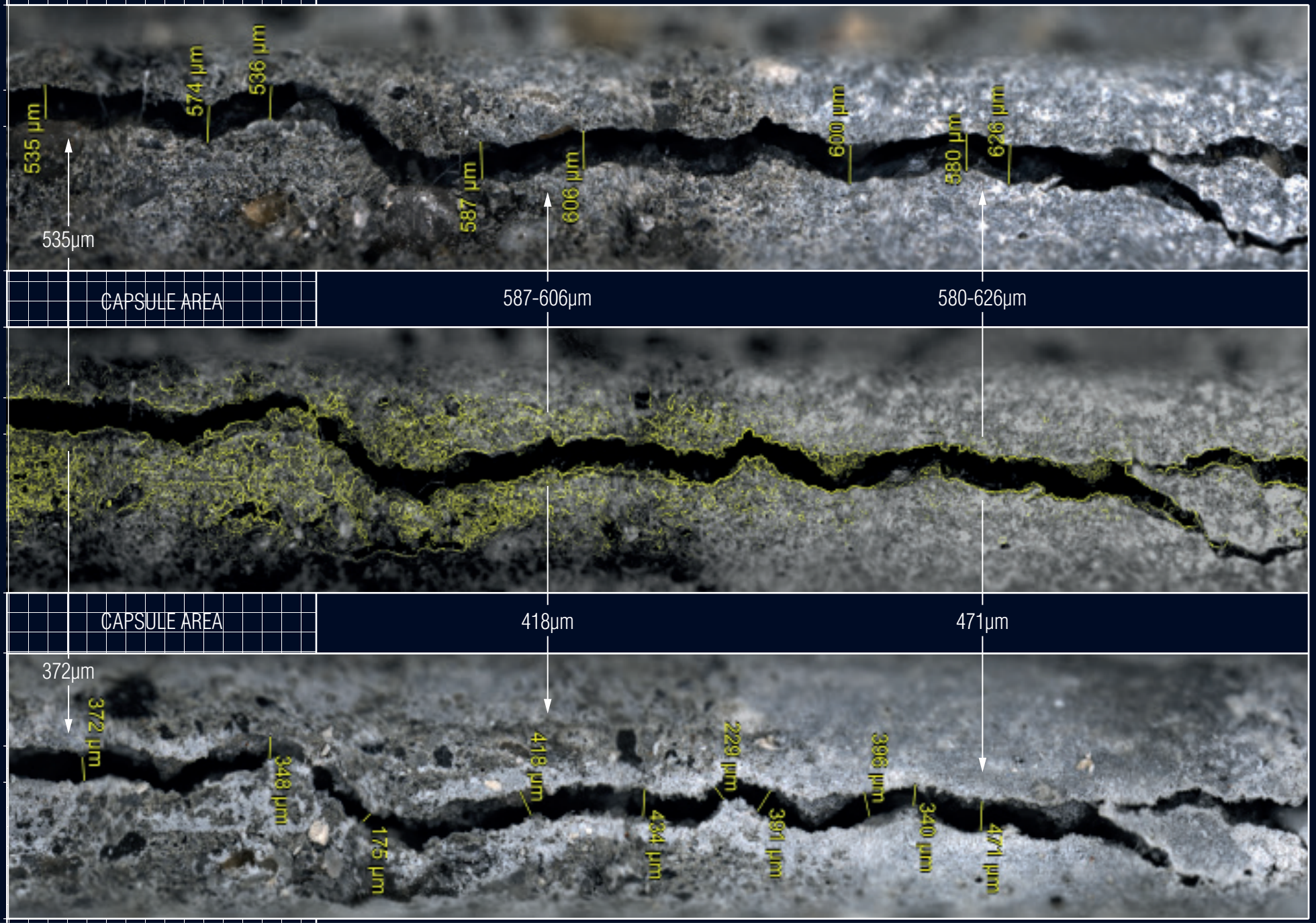
BEFORE (A1)



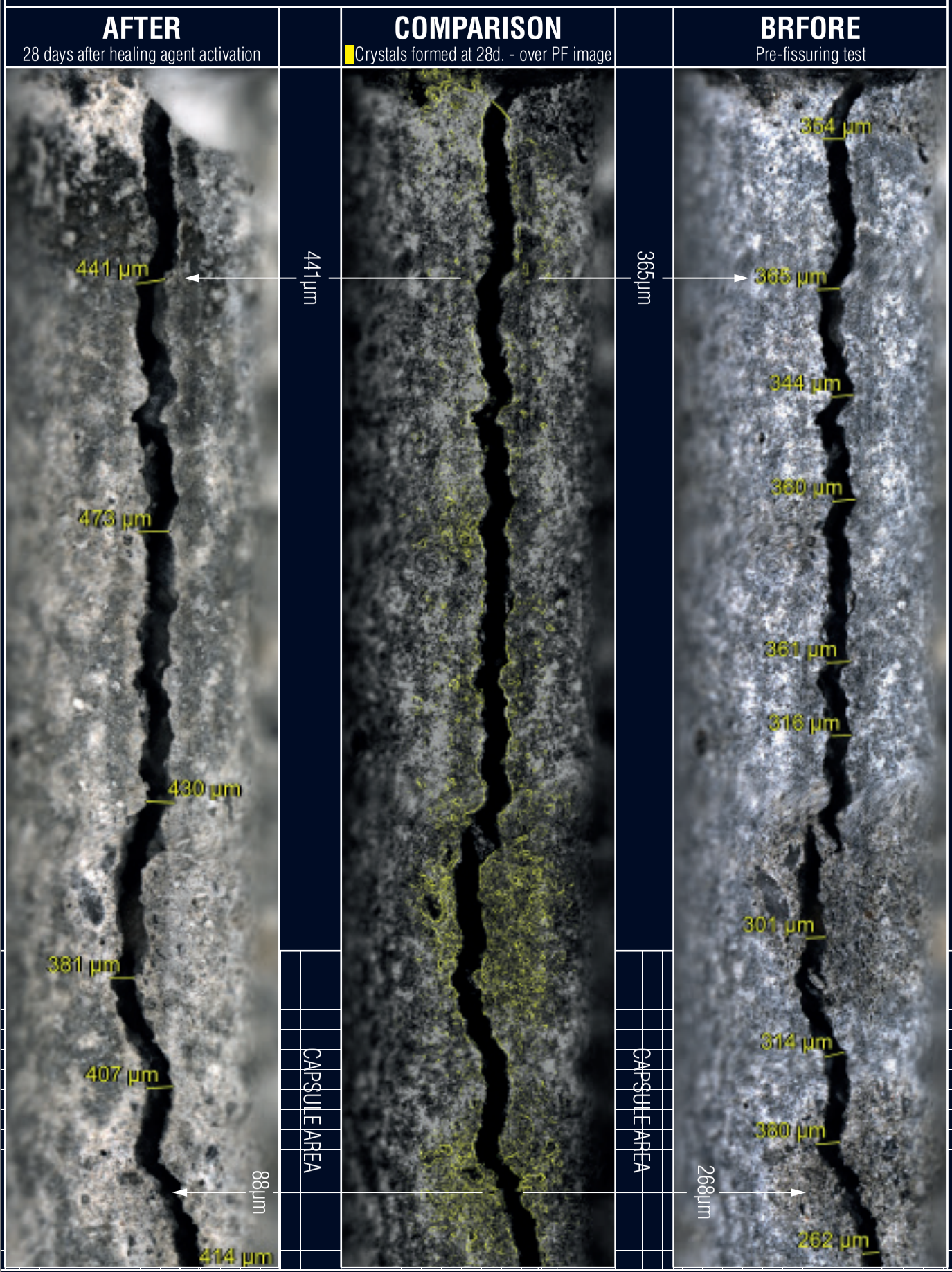
AFTER (A2)

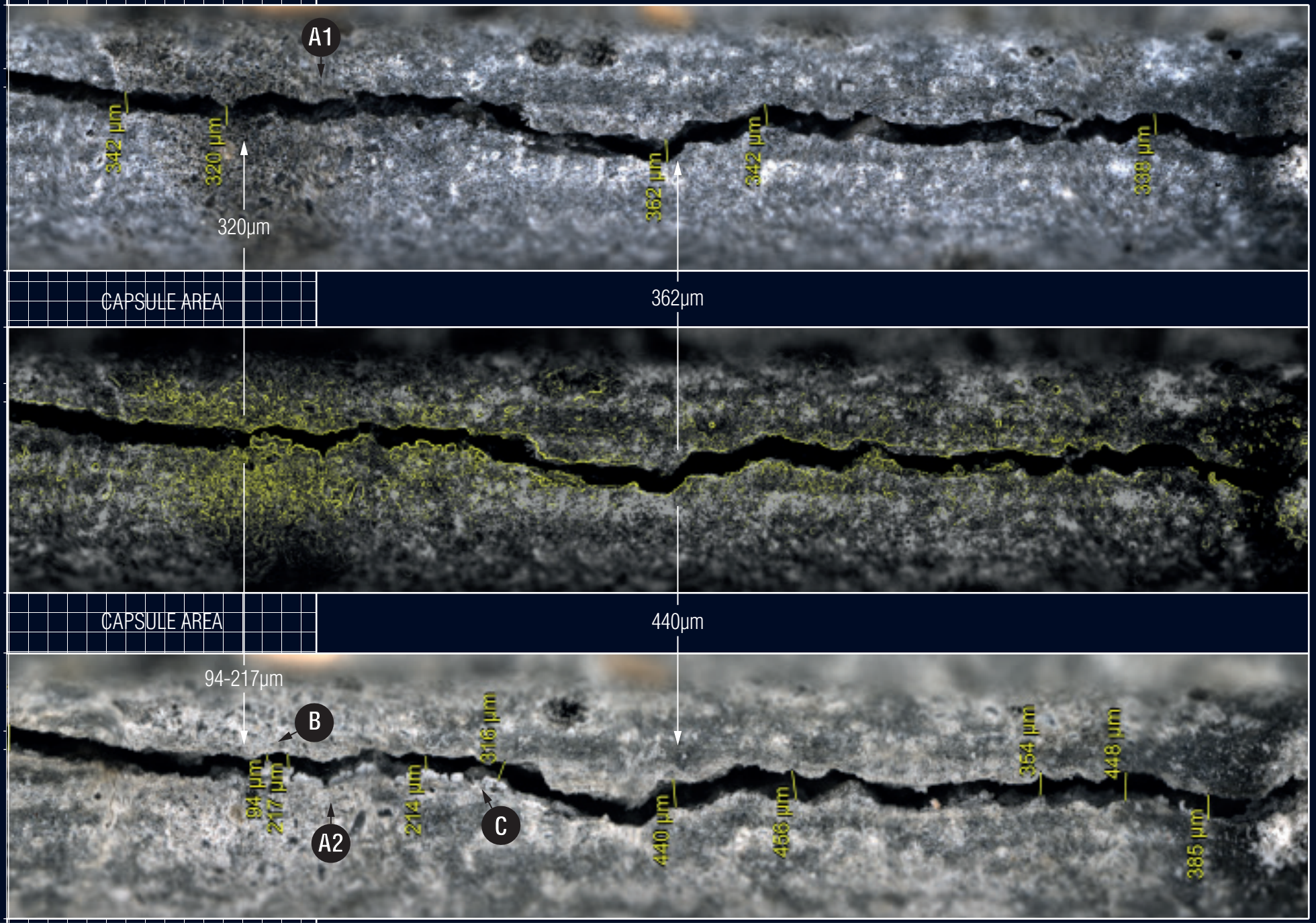
PLA4 MICROSCOPE VIEWS COMPARISON FROM PF. TO 28 D.ACTIVATED



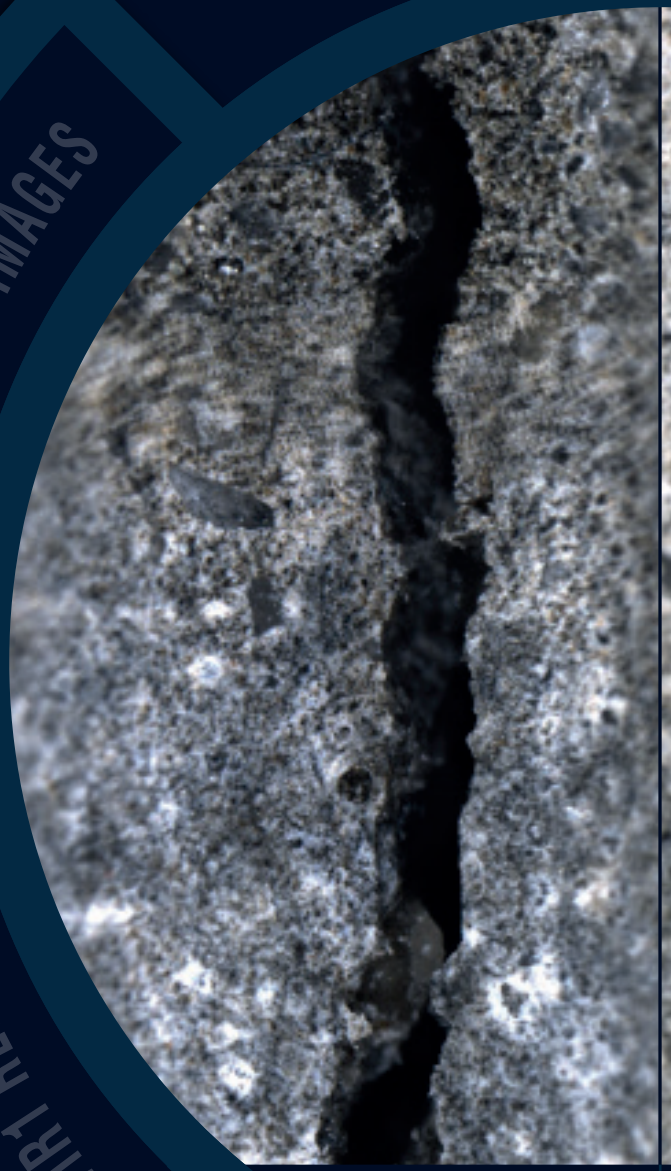

535 µm
574 µm
536 µm
587 µm
606 µm
600 µm
580 µm
626 µm
535µm
CAPSULE AREA
587-606µm
580-626µm
CAPSULE AREA
418µm
471µm
372µm
372 µm
348 µm
175 µm
418 µm
434 µm
229 µm
391 µm
396 µm
340 µm
471 µm

VIR1 MICROSCOPE VIEWS COMPARISON FROM PF. TO 28 D.ACTIVATED

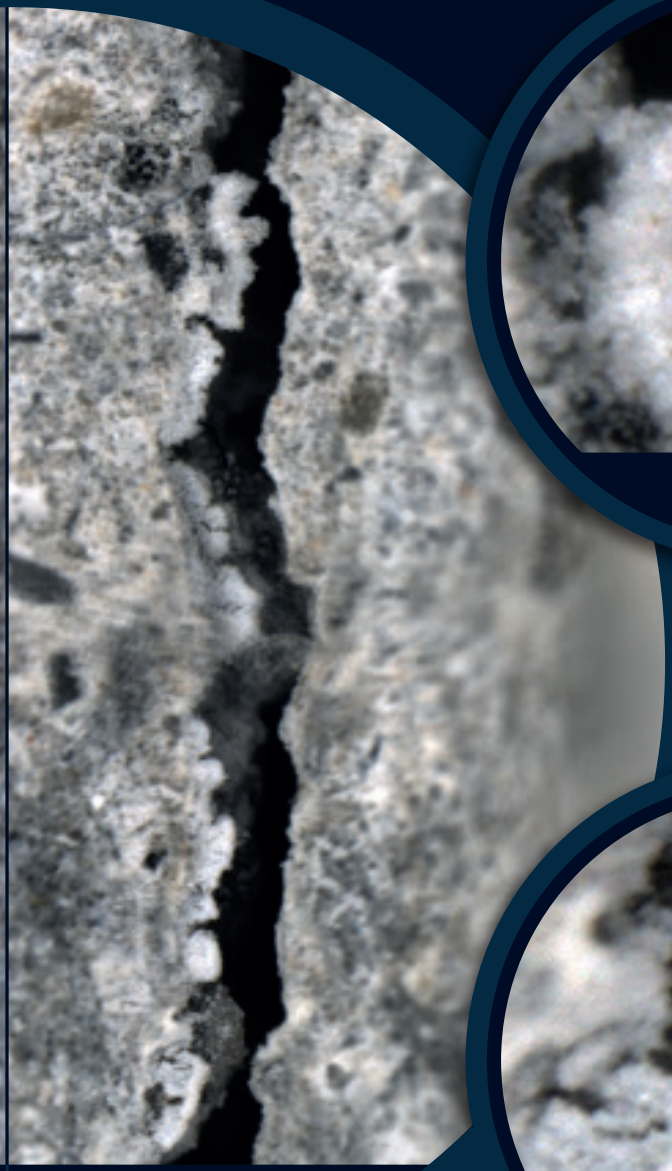



A1
342 µm
320 µm
320µm
362 µm
342 µm
338 µm
CAPSULE AREA
362µm
CAPSULE AREA
440µm
94-217µm
B
94 µm
217 µm
214 µm
316 µm
A2
C
440 µm
456 µm
354 µm
448 µm
385 µm

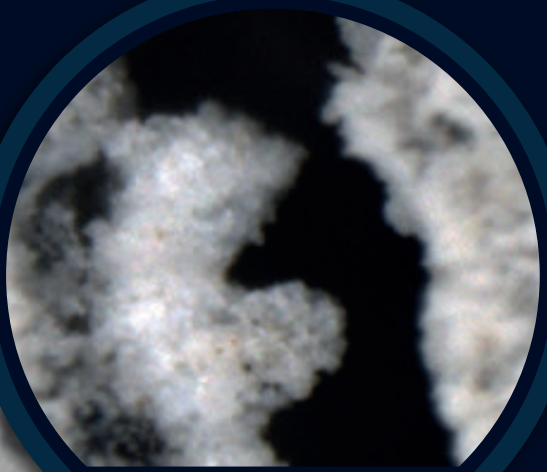
VIR1 RELEVANT MICROSCOPE DETAILED IMAGES



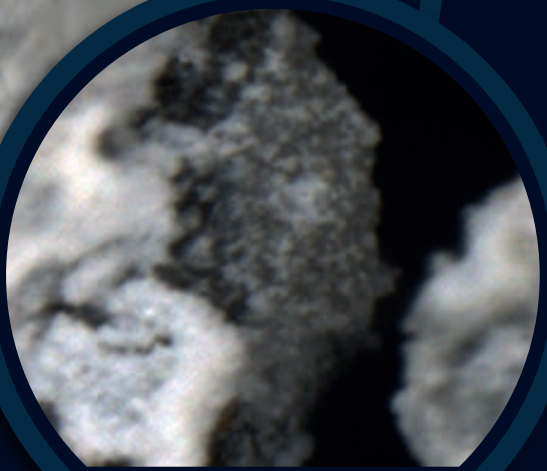
BEFORE (A1)



AFTER (A2)

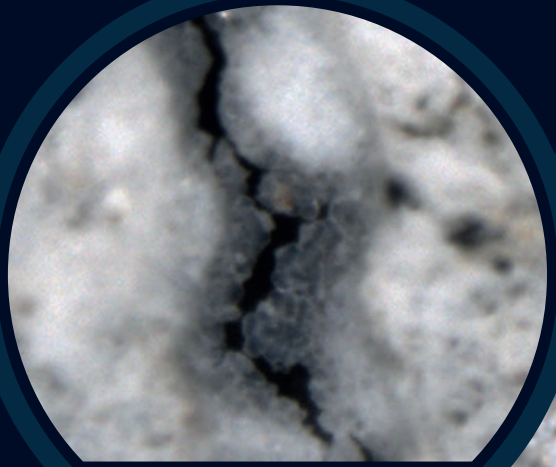


DETAIL B

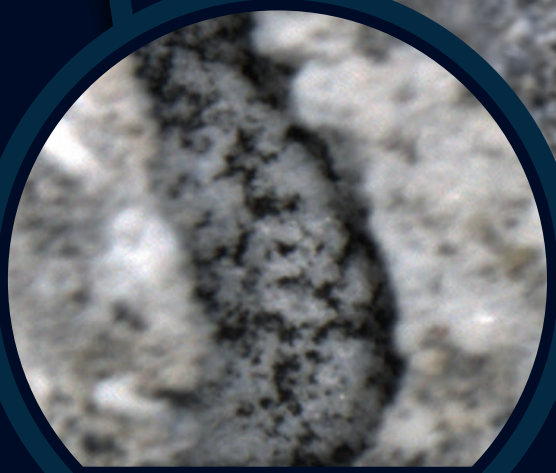


DETAIL C

VIR2 RELEVANT MICROSCOPE DETAILED IMAGES



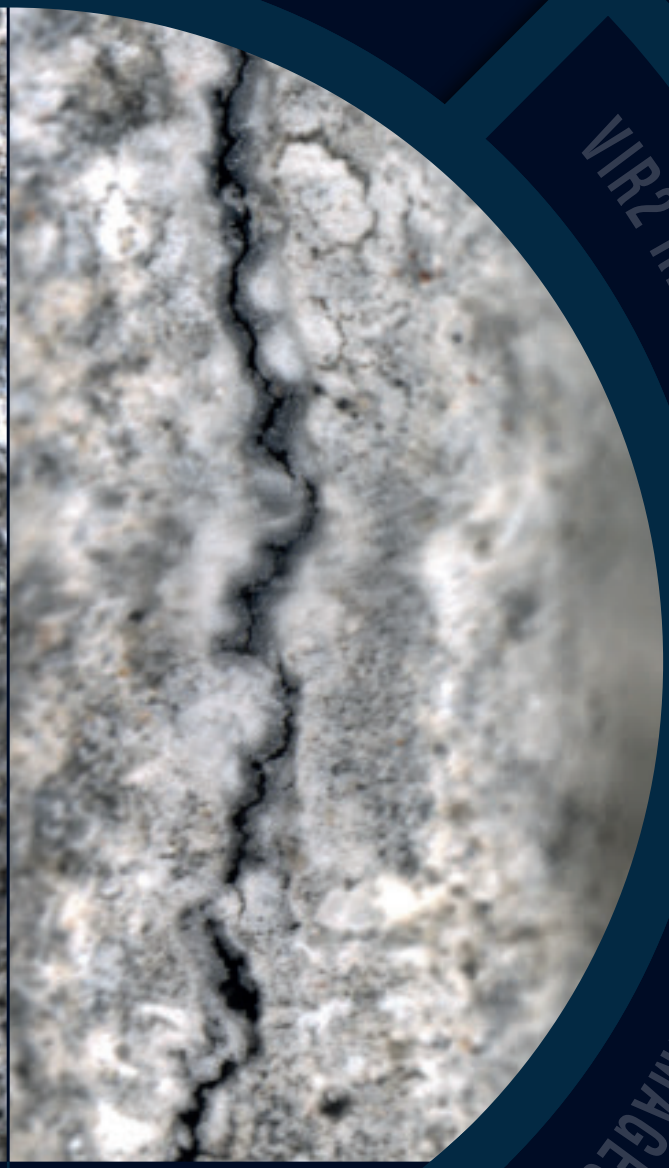
DETAIL B



DETAIL C

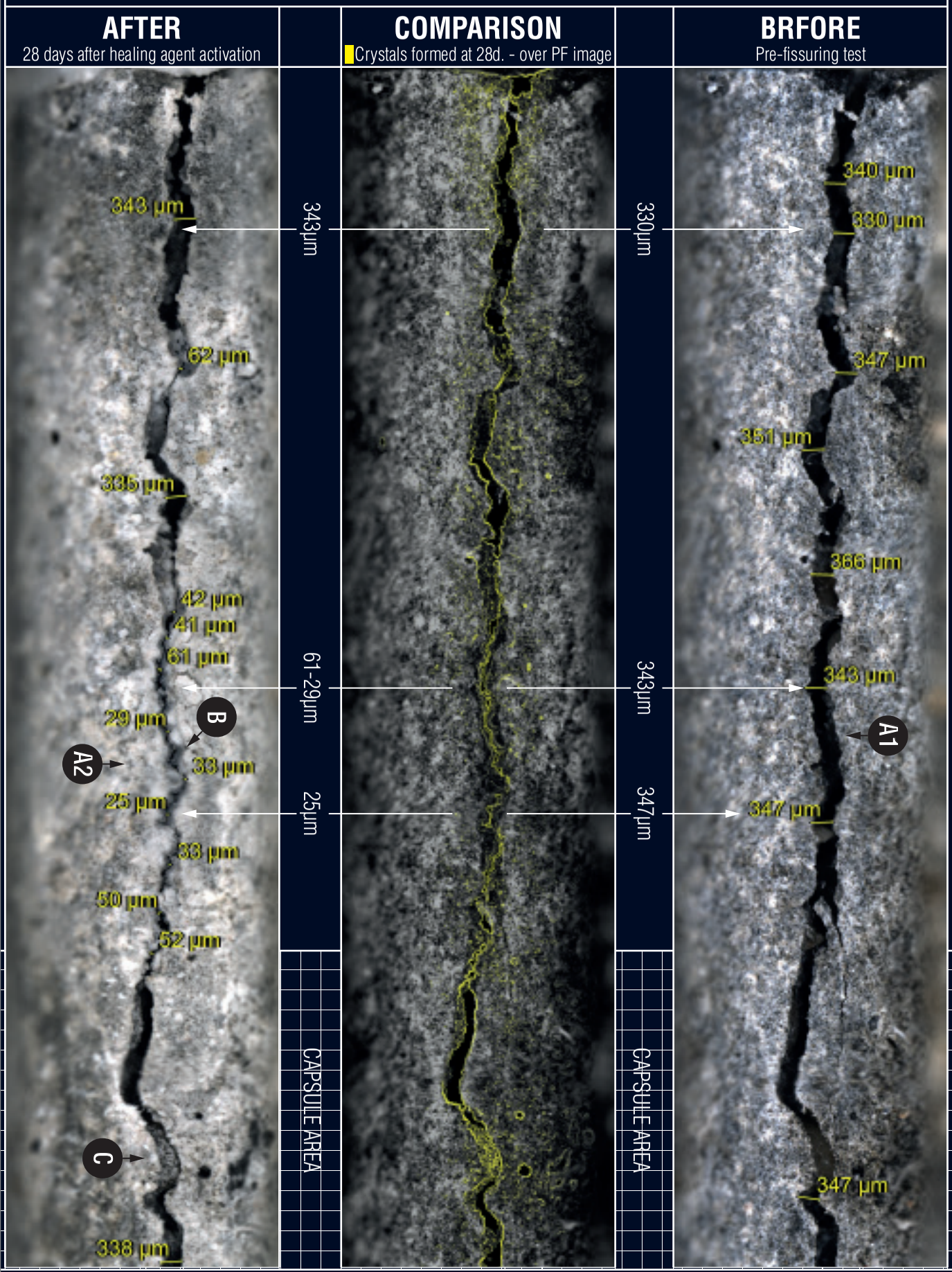


BEFORE (A1)

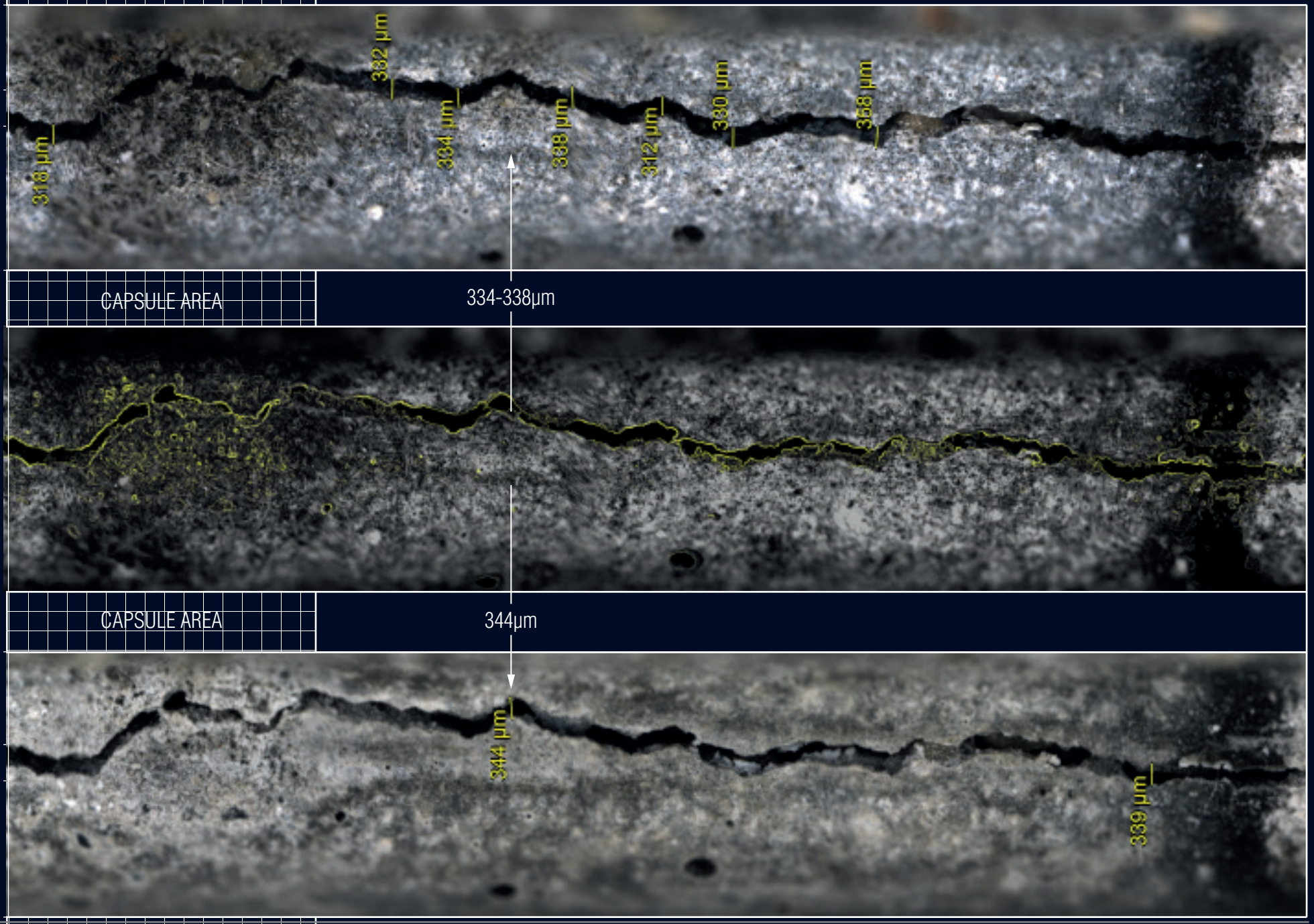


AFTER (A2)

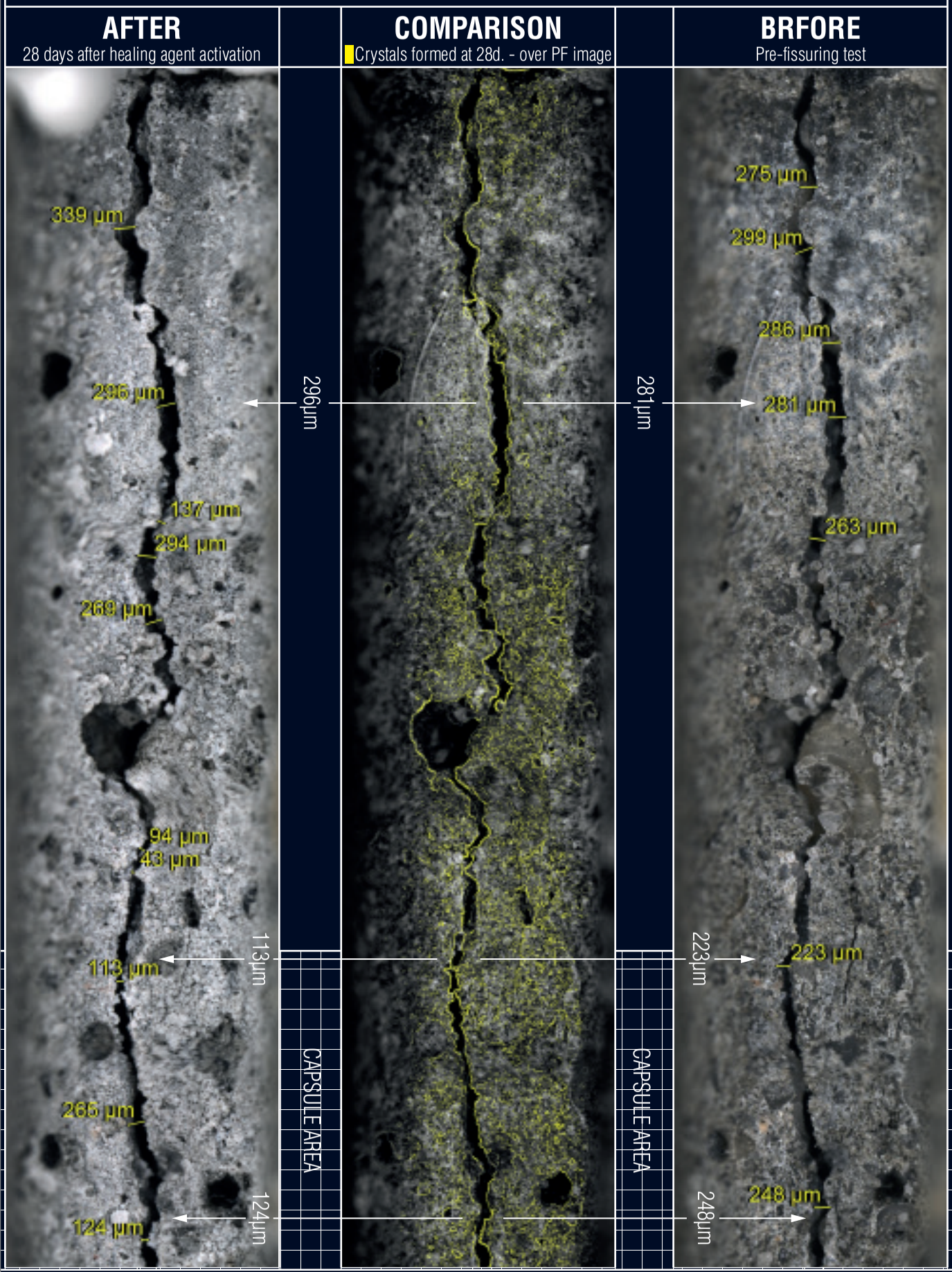
VIR2 MICROSCOPE VIEWS COMPARISON FROM PF. TO 28 D.ACTIVATED

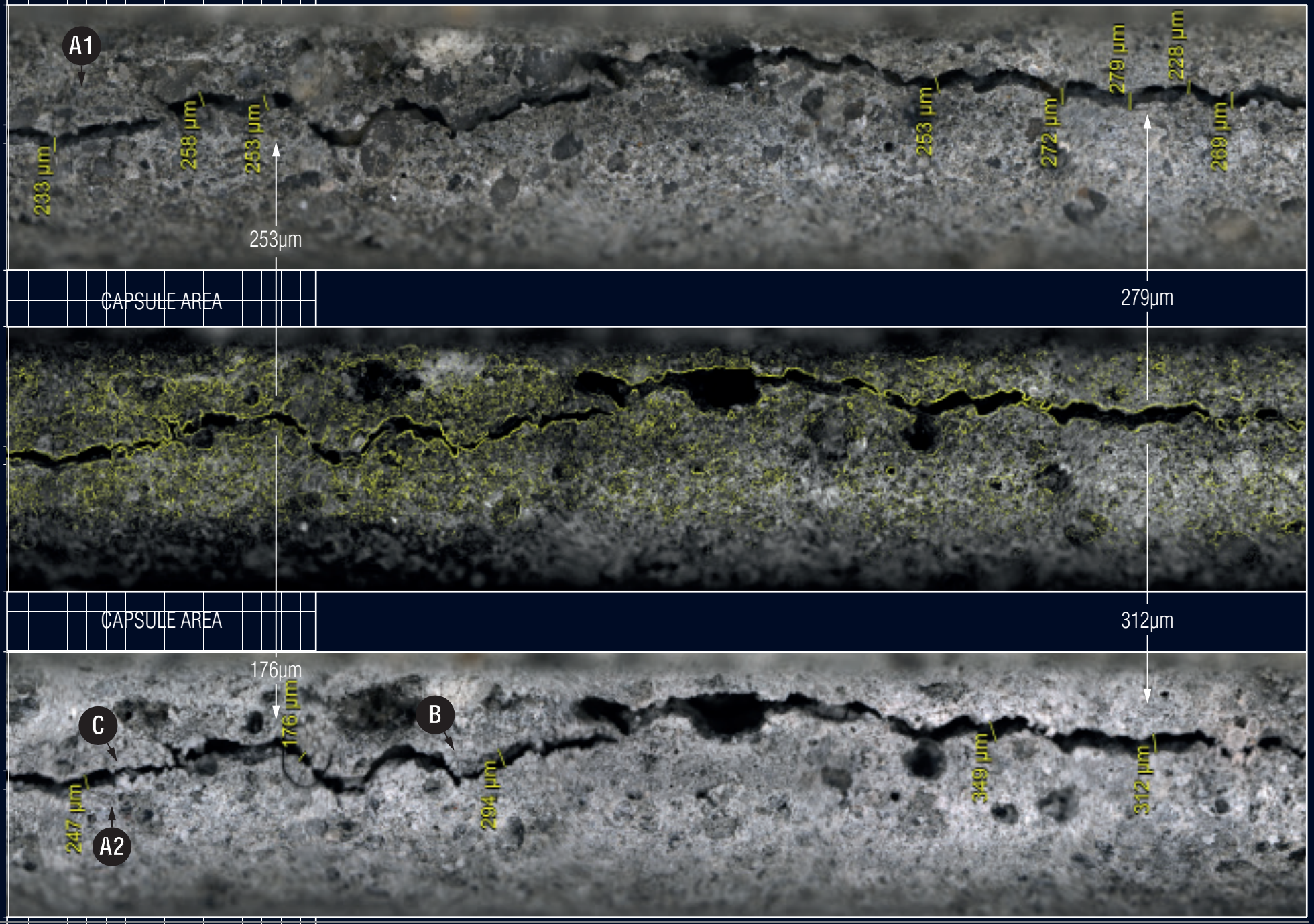


331

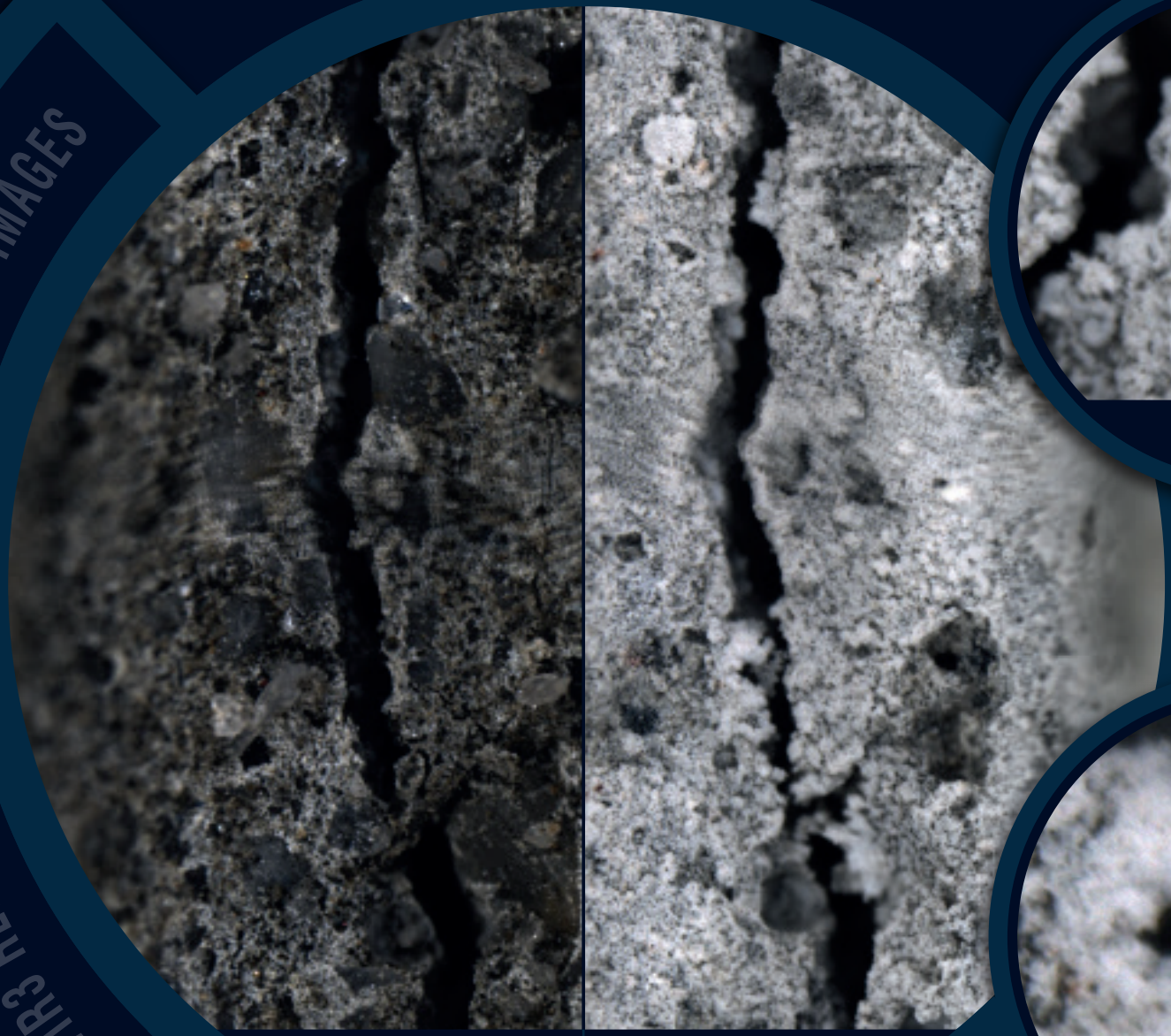

318 µm
332 µm
334 µm
388 µm
312 µm
330 µm
358 µm
CAPSULE AREA
334-338µm
CAPSULE AREA
344µm
344 µm
339 µm

VIR3 MICROSCOPE VIEWS COMPARISON FROM PF. TO 28 D.ACTIVATED




A1
233 µm
258 µm
253 µm
253µm
253 µm
272 µm
279 µm
228 µm
269 µm
CAPSULE AREA
279µm
CAPSULE AREA
312µm
176µm
C
176 µm
B
247 µm
A2
294 µm
349 µm
312 µm

VIR3 RELEVANT MICROSCOPE DETAILED IMAGES

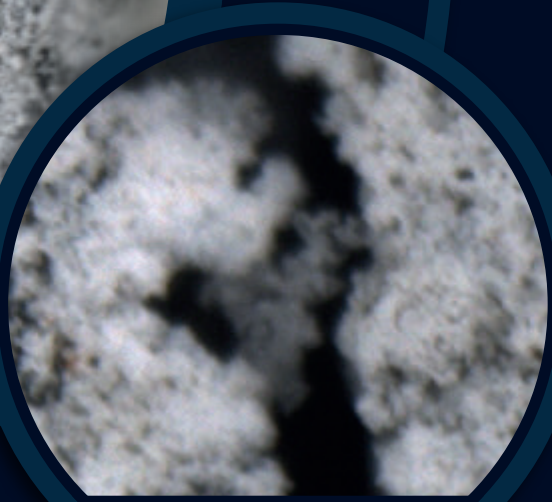


BEFORE (A1)

AFTER (A2)

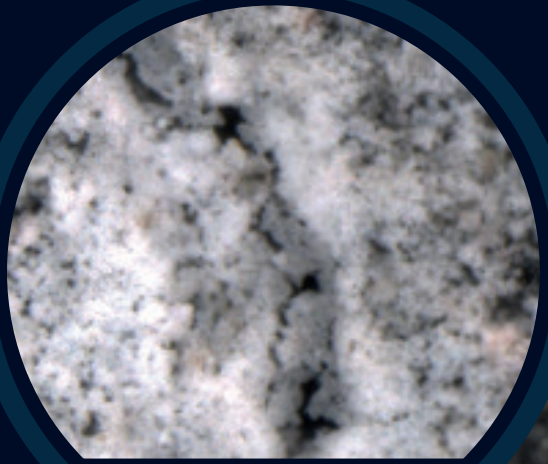


DETAIL B

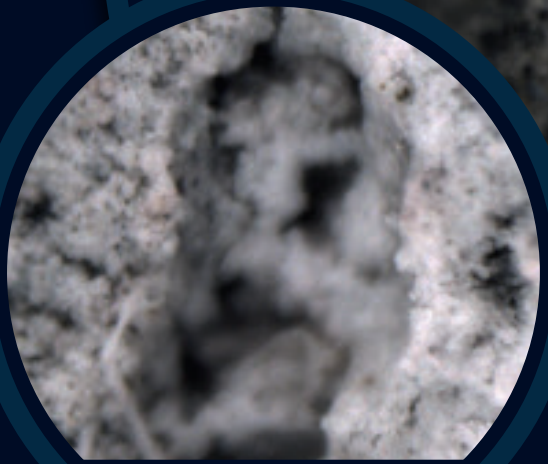


DETAIL C

VIR4 RELEVANT MICROSCOPE DETAILED IMAGES



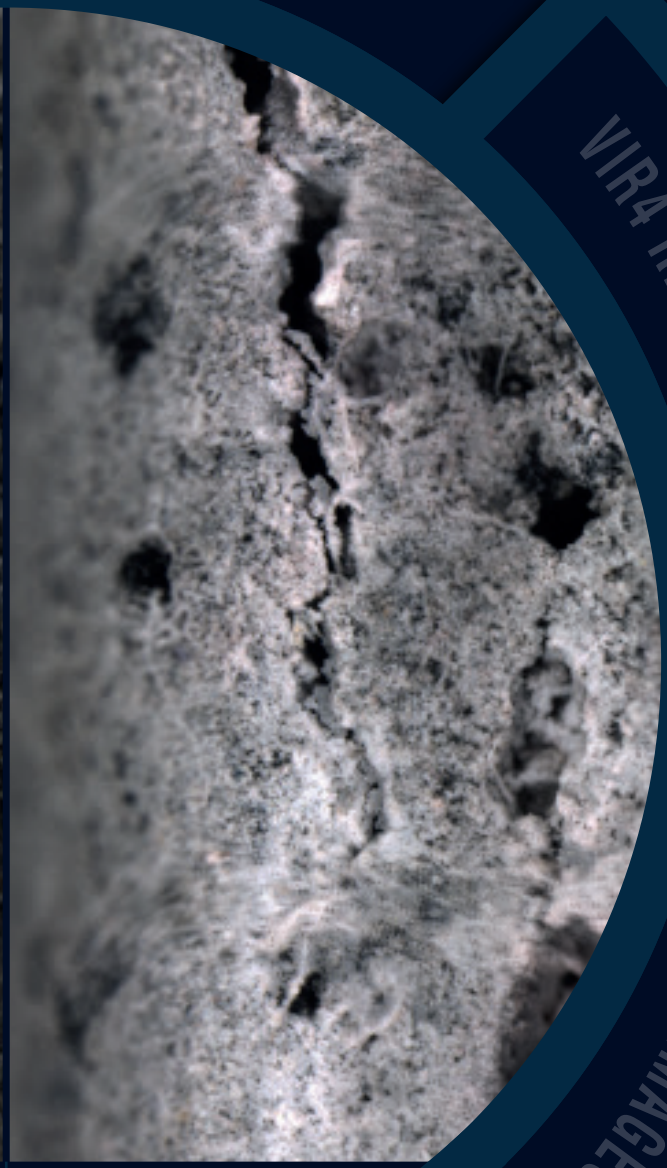
DETAIL B



DETAIL C



BEFORE (A1)



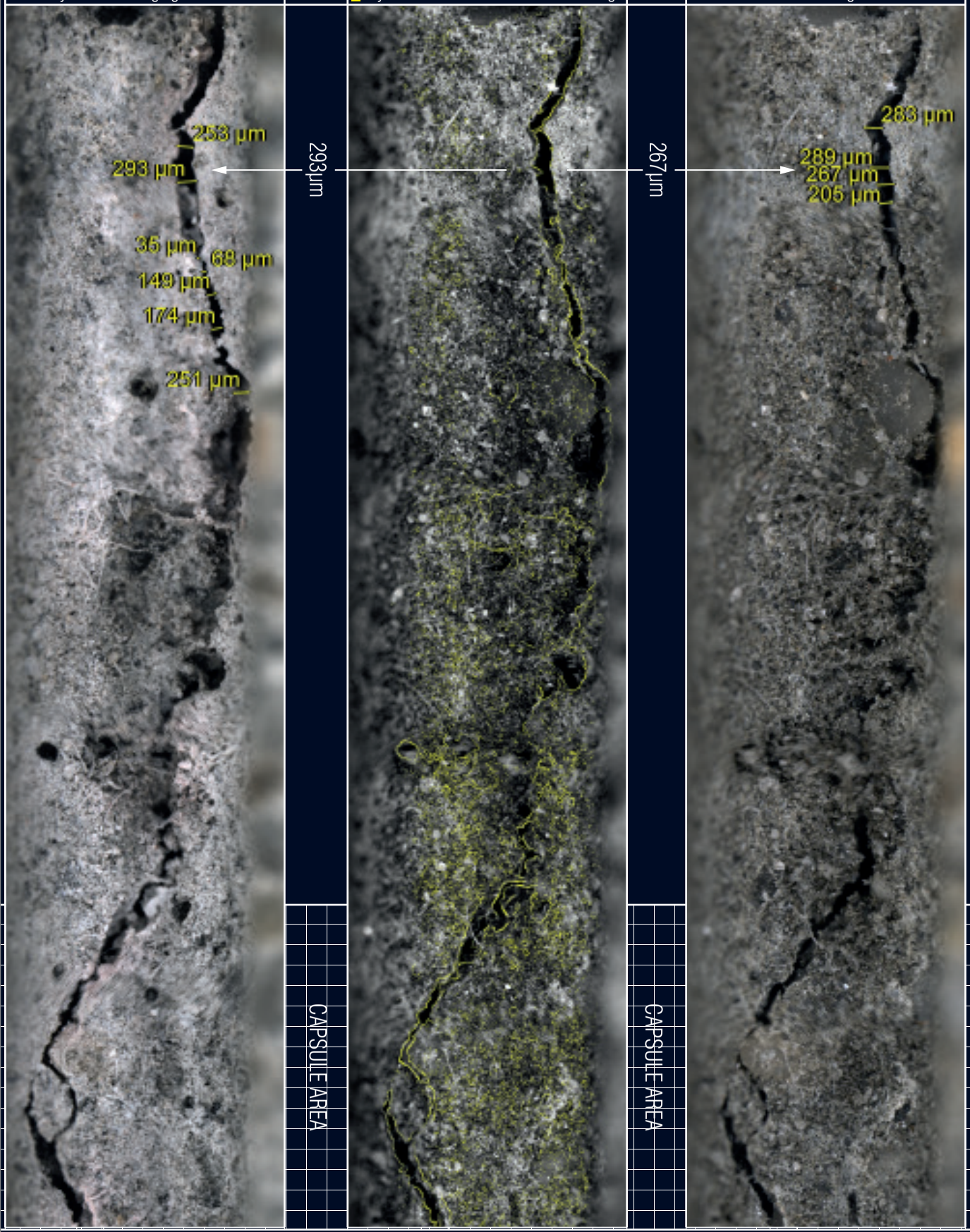
AFTER (A2)

VIR4 MICROSCOPE VIEWS COMPARISON FROM PF. TO 28 D.ACTIVATED

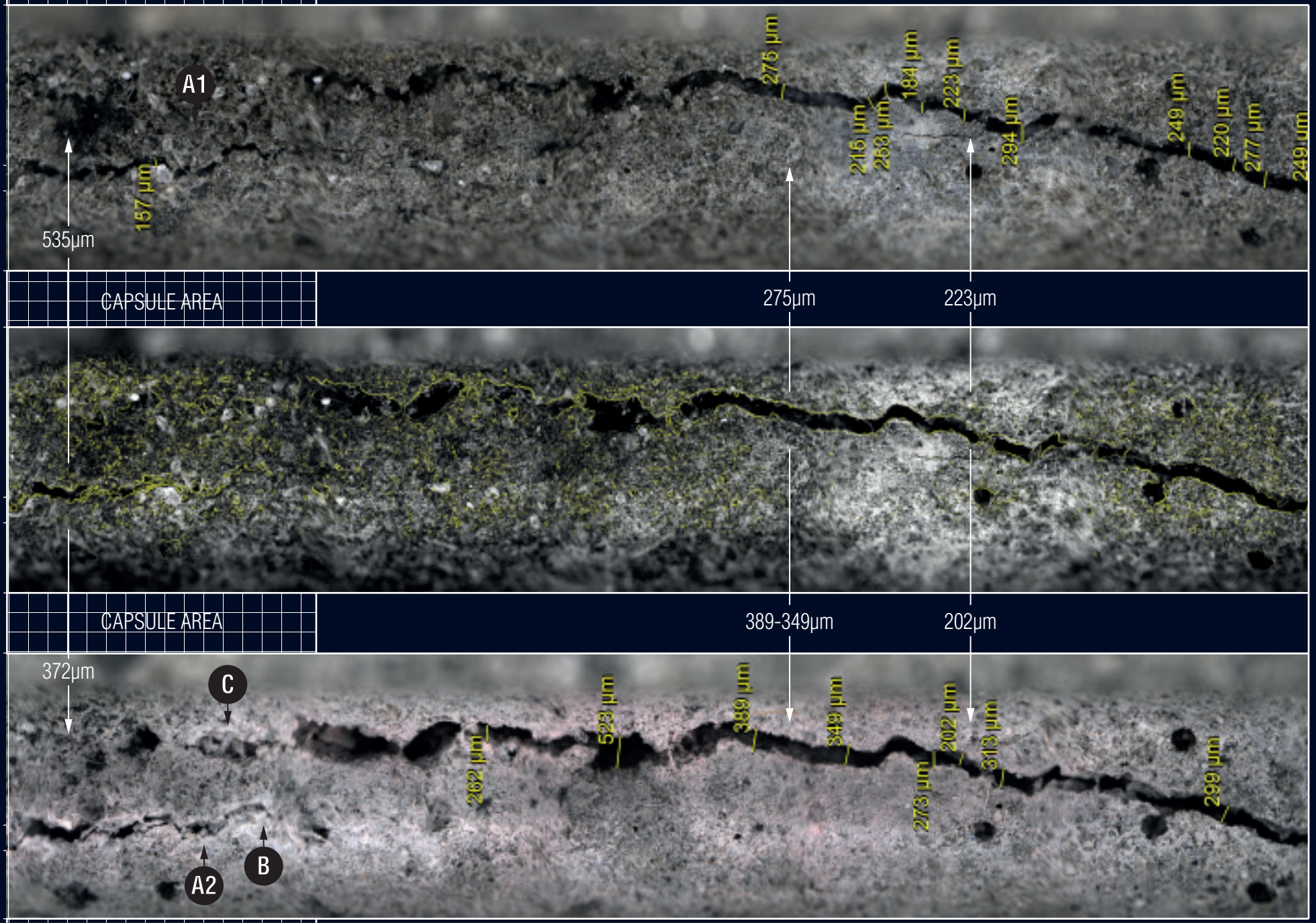
AFTER
28 days after healing agent activation

COMPARISON
Crystals formed at 28d. - over PF image

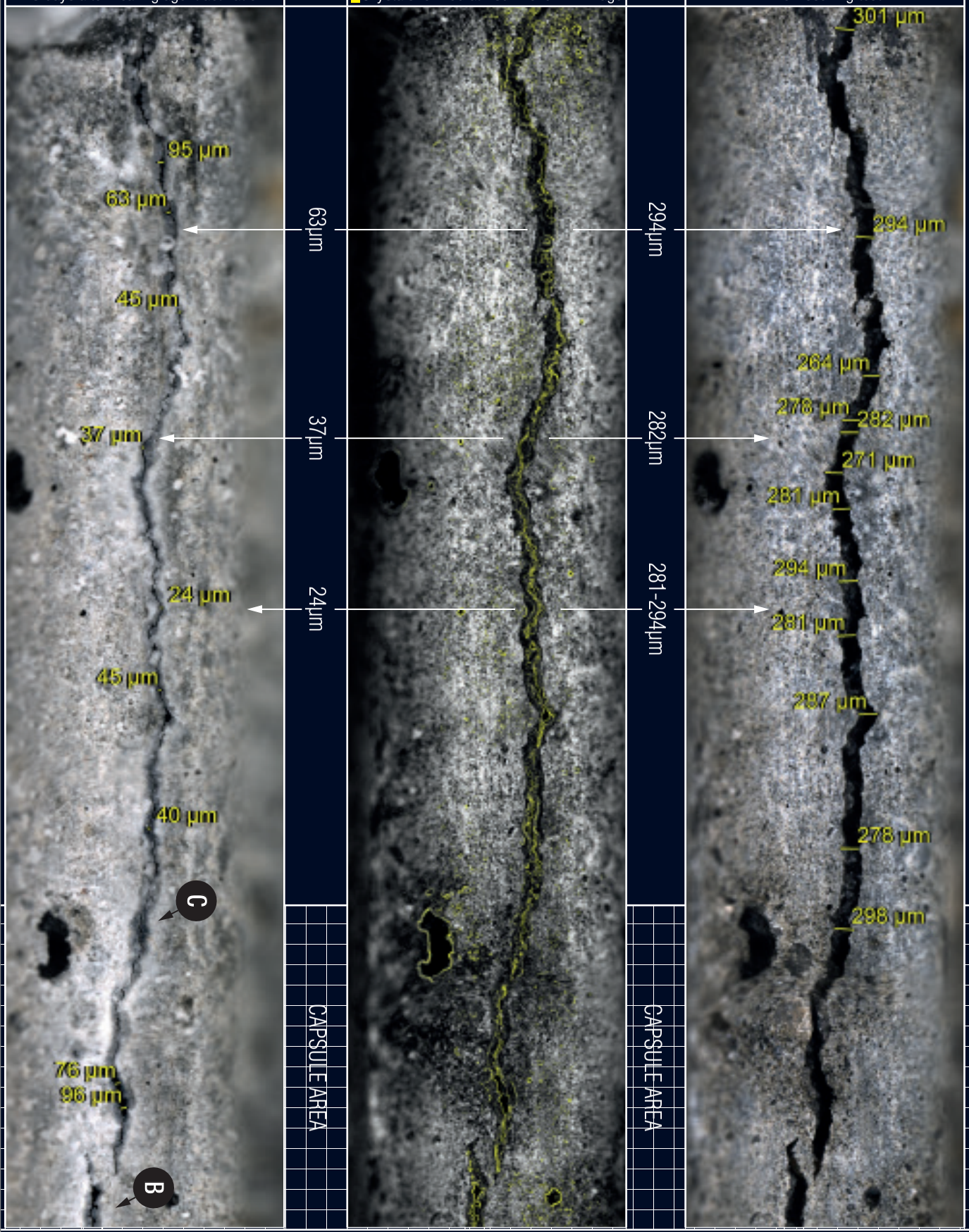
BRFORE
Pre-fissuring test



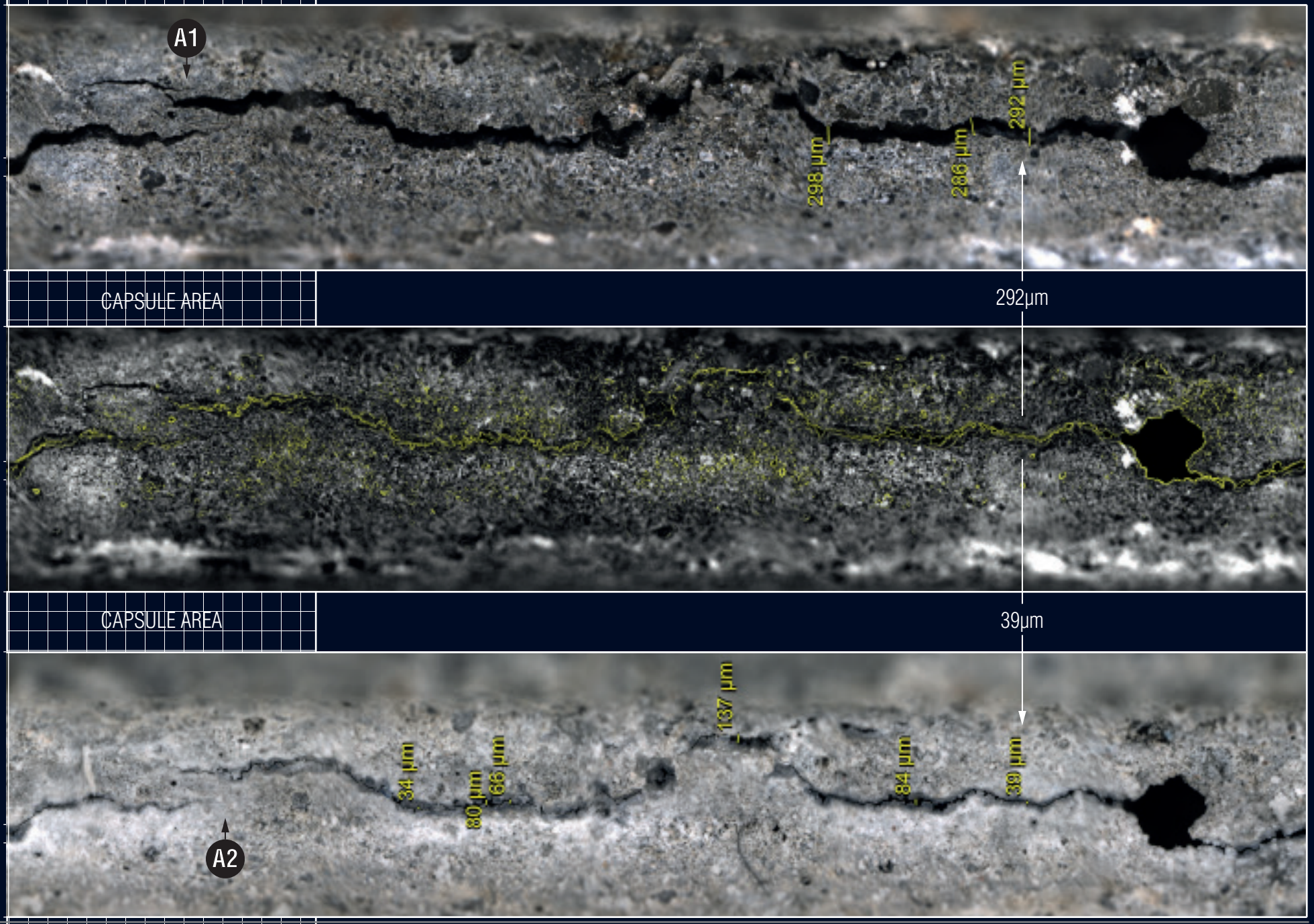
337


A1
157 µm
535µm
275 µm
215 µm
253 µm
184 µm
223 µm
294 µm
249 µm
220 µm
277 µm
249 µm
CAPSULE AREA
275µm
223µm
CAPSULE AREA
389-349µm
202µm
372µm
C
262 µm
523 µm
389 µm
349 µm
273 µm
202 µm
313 µm
299 µm
A2
B

REF1 MICROSCOPE VIEWS COMPARISON FROM PF. TO 28 D.ACTIVATED



339


A1
298 µm
286 µm
292 µm
292µm
CAPSULE AREA
CAPSULE AREA
39µm
34 µm
80 µm
66 µm
137 µm
84 µm
39 µm
A2

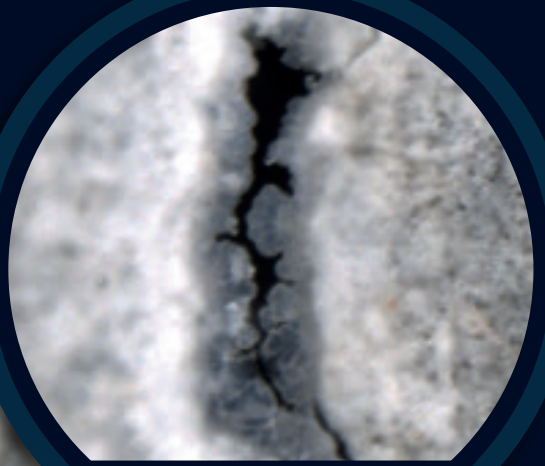
REF1 RELEVANT MICROSCOPE DETAILED IMAGES



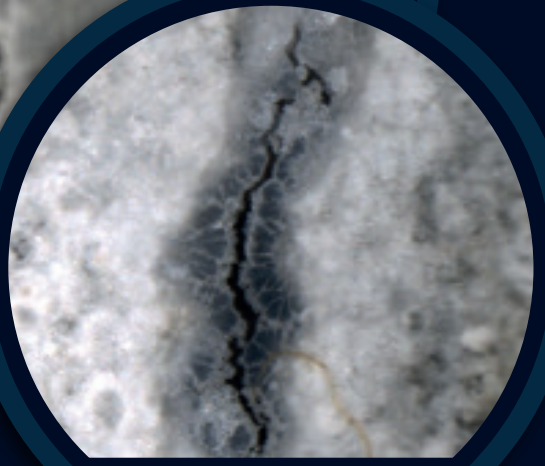
BEFORE (A1)



AFTER (A2)

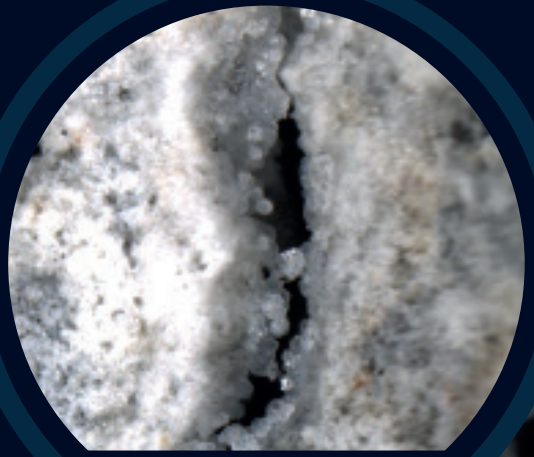


DETAIL B

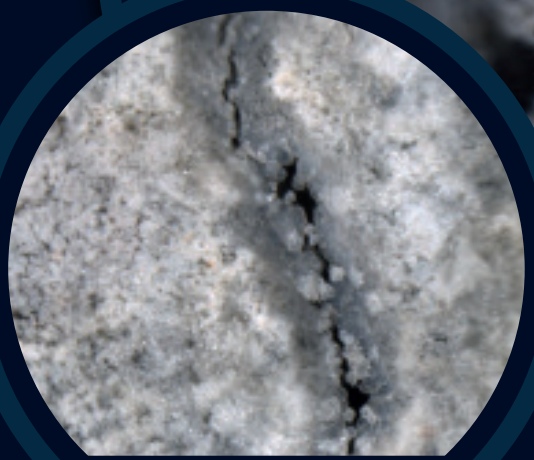


DETAIL C

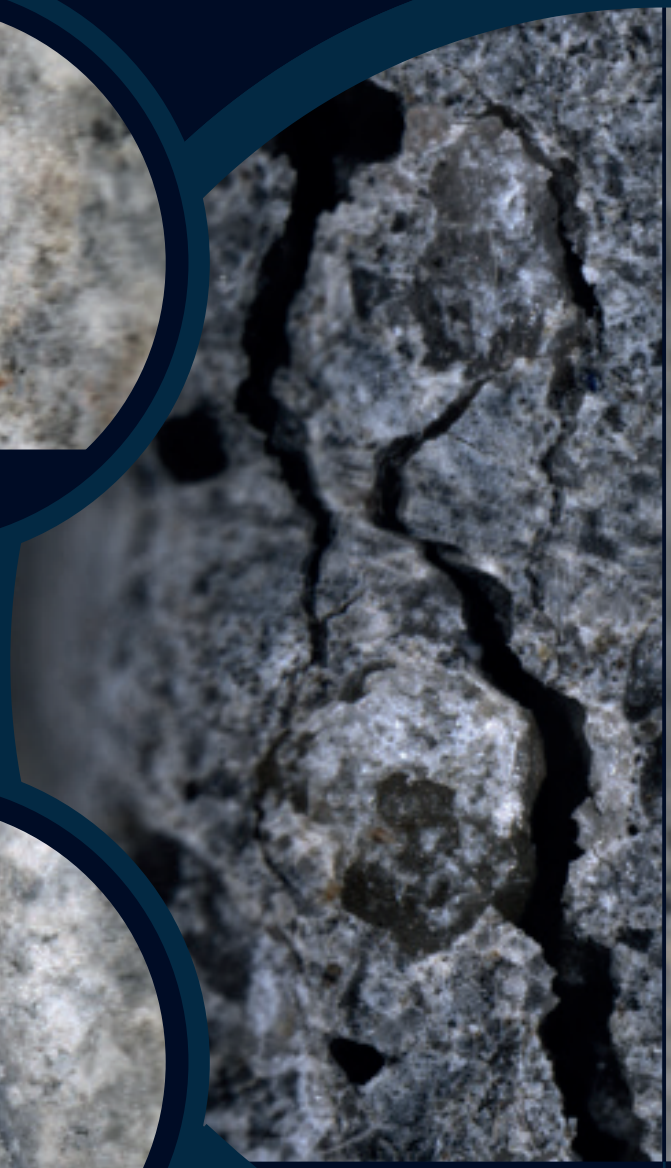
REF2 RELEVANT MICROSCOPE DETAILED IMAGES



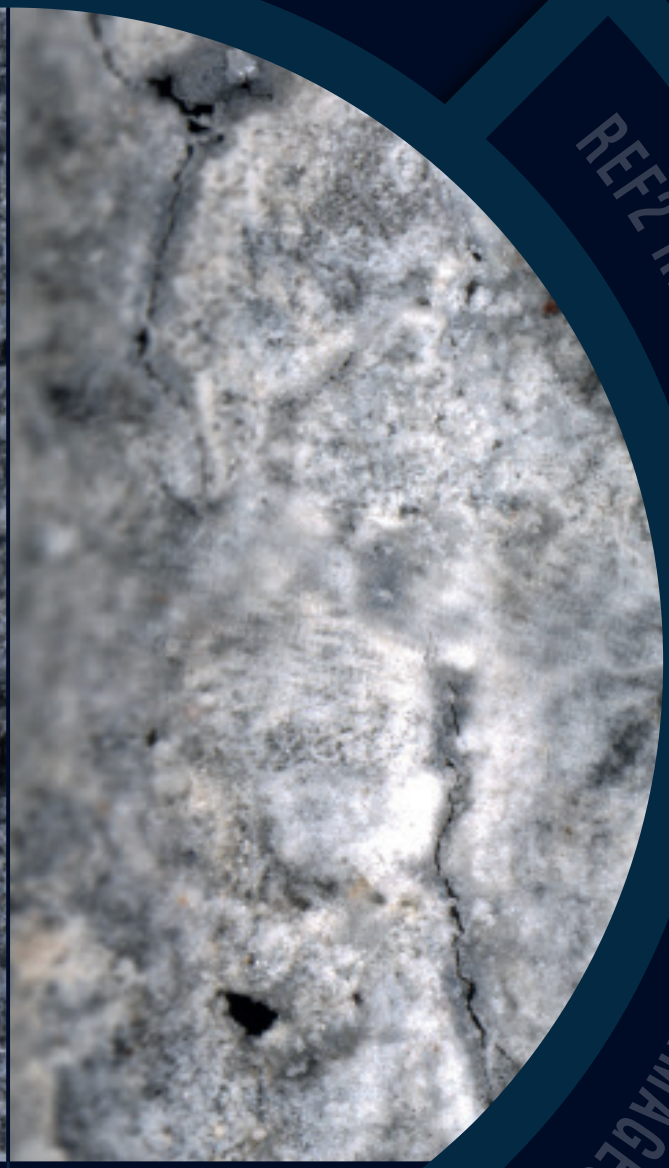
DETAIL B



DETAIL C



BEFORE (A1)



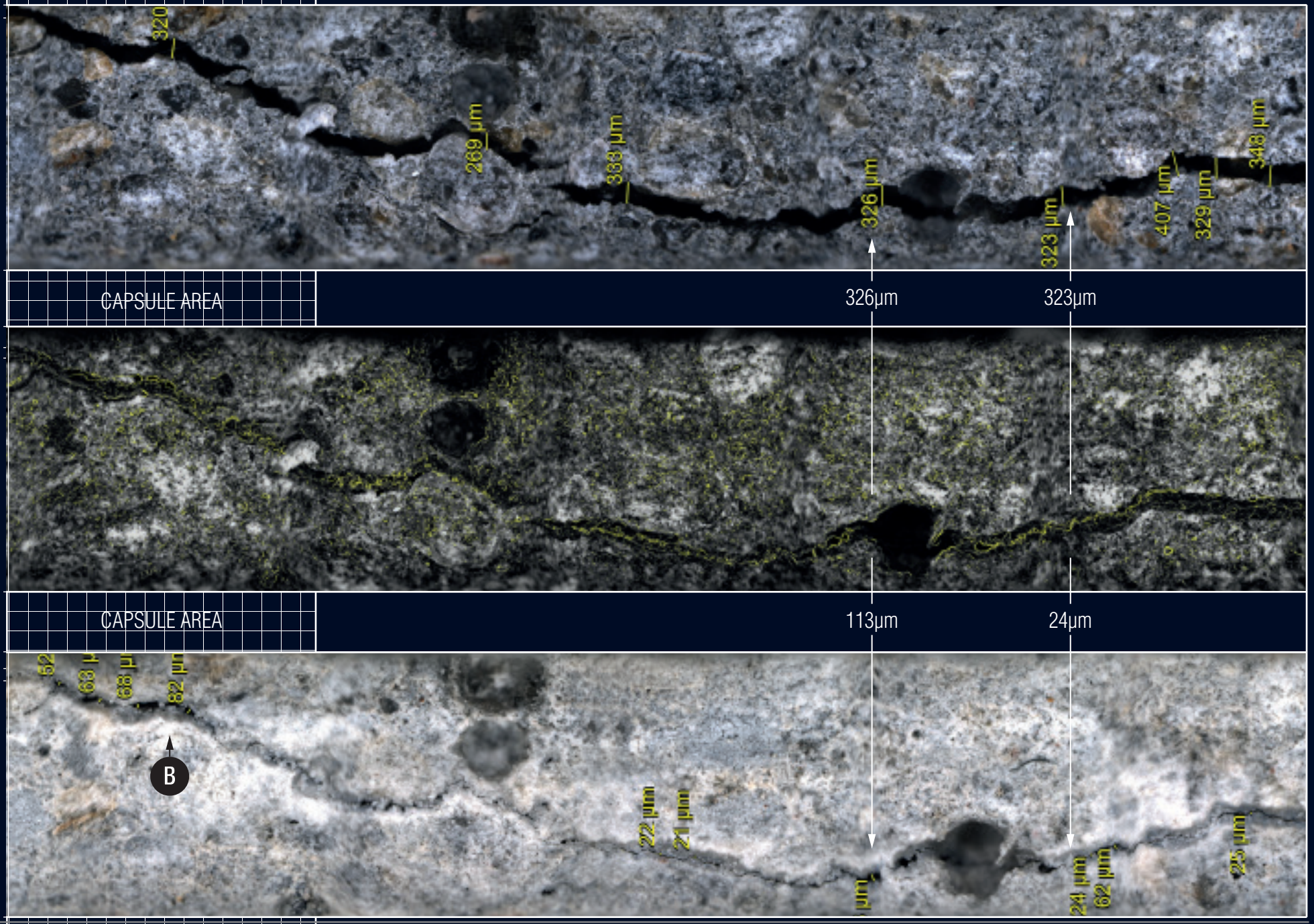
AFTER (A2)

REF2 MICROSCOPE VIEWS COMPARISON FROM PF. TO 28 D.ACTIVATED

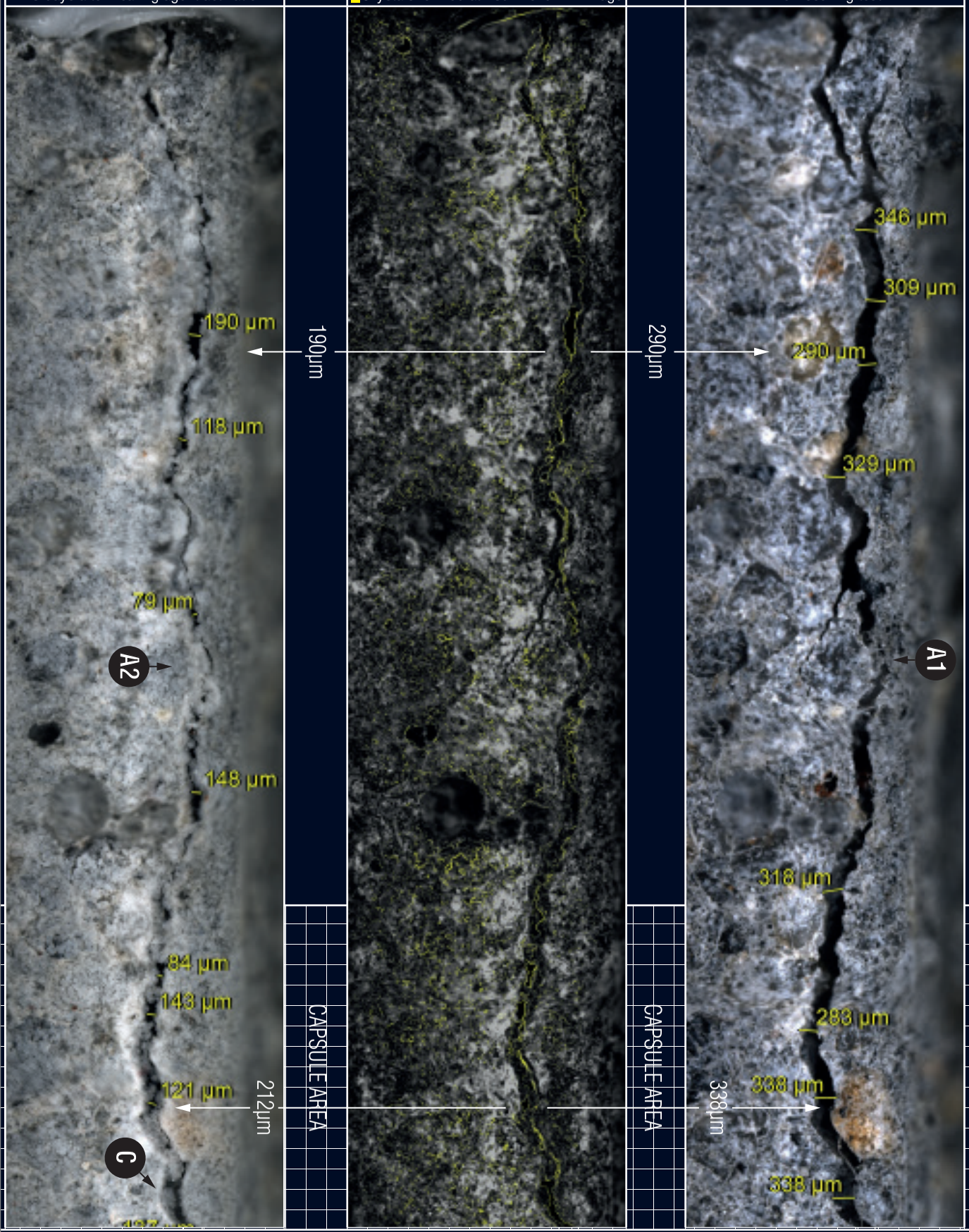
BRFORE
Pre-fissuring test

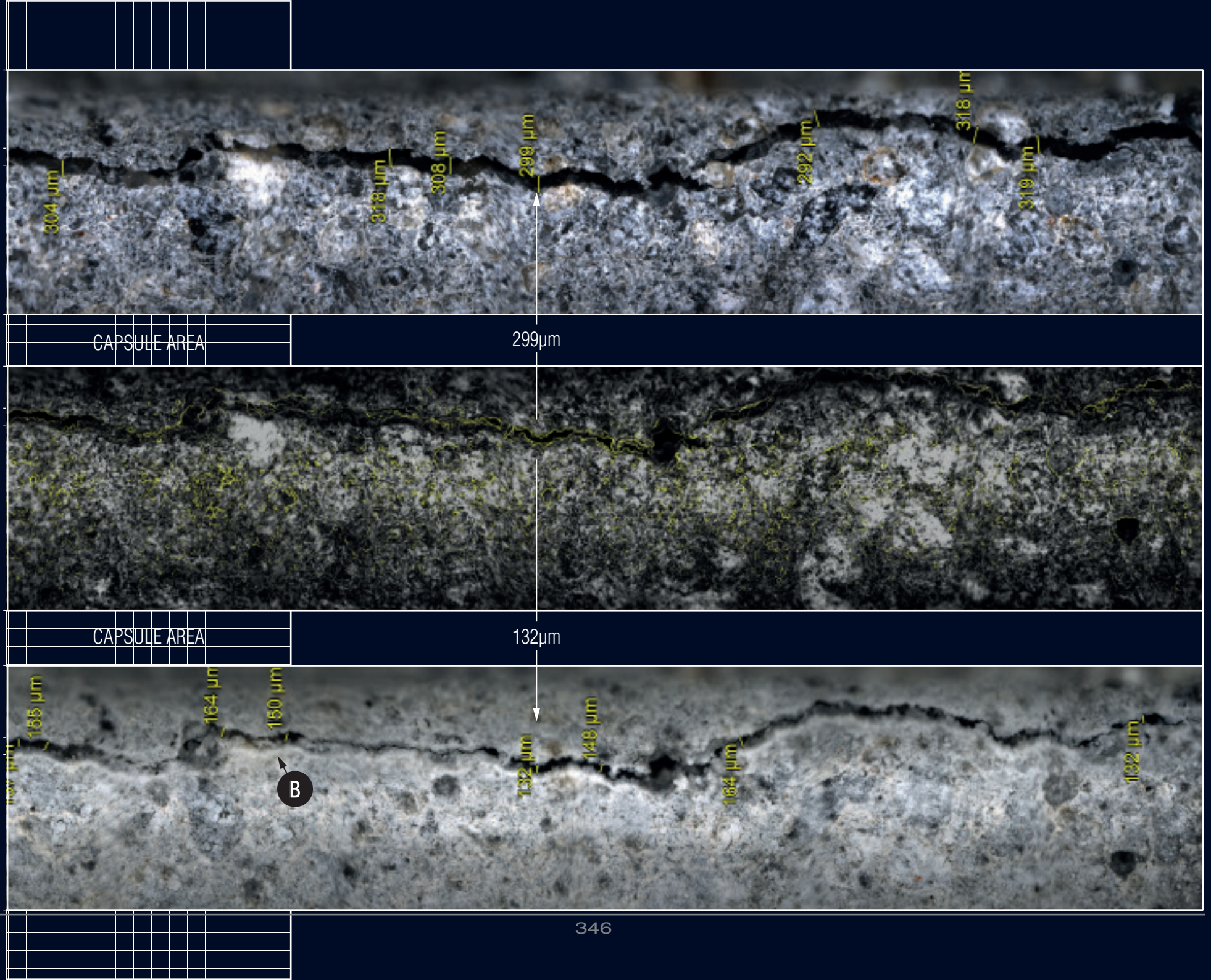
COMPARISON
Crystals formed at 28d. - over PF image

AFTER
28 days after healing agent activation

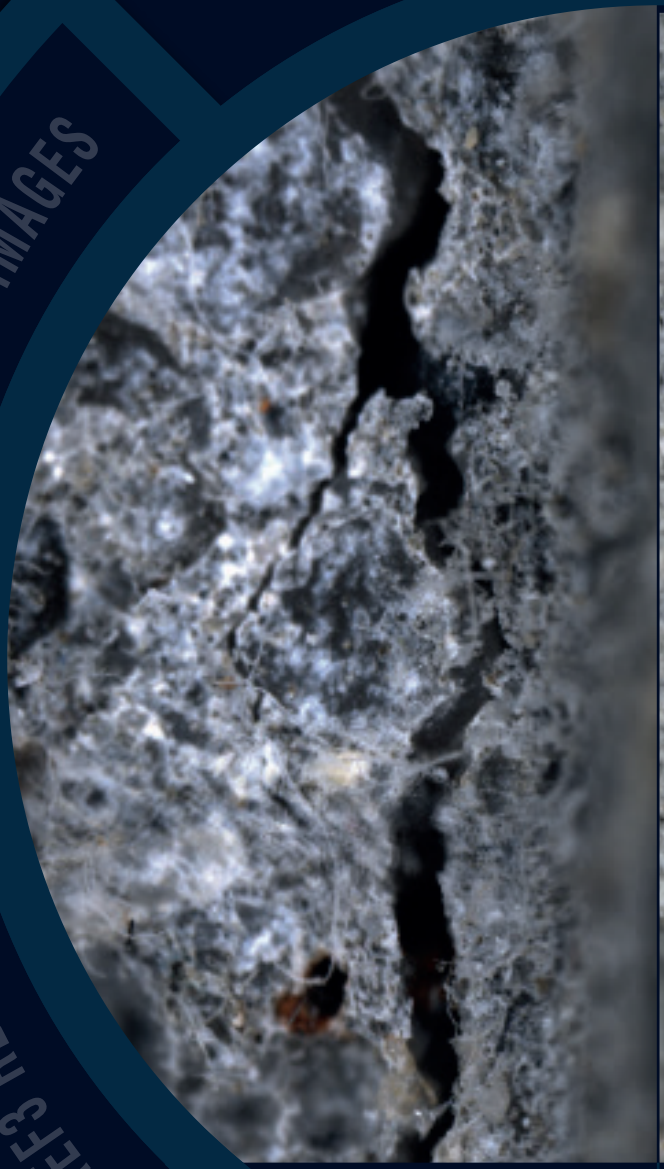

320
269 µm
383 µm
326 µm
323 µm
407 µm
329 µm
348 µm
CAPSULE AREA
326µm
323µm
CAPSULE AREA
113µm
24µm
52
68 µ
68 µ
82 µm
B
22 µm
21 µm
µm
24 µm
62 µm
25 µm

REF3 MICROSCOPE VIEWS COMPARISON FROM PF. TO 28 D.ACTIVATED

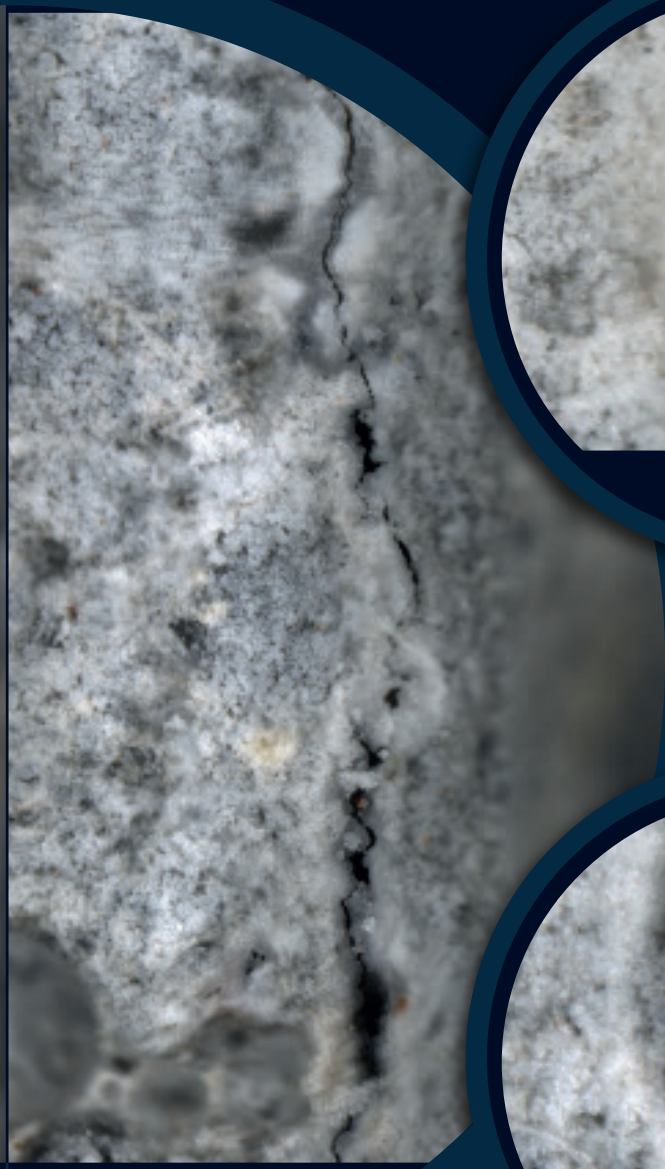



304 µm
318 µm
308 µm
299 µm
292 µm
318 µm
319 µm
CAPSULE AREA
299µm
CAPSULE AREA
132µm
155 µm
164 µm
150 µm
B
132 µm
148 µm
164 µm
132 µm

REF3 RELEVANT MICROSCOPE DETAILED IMAGES



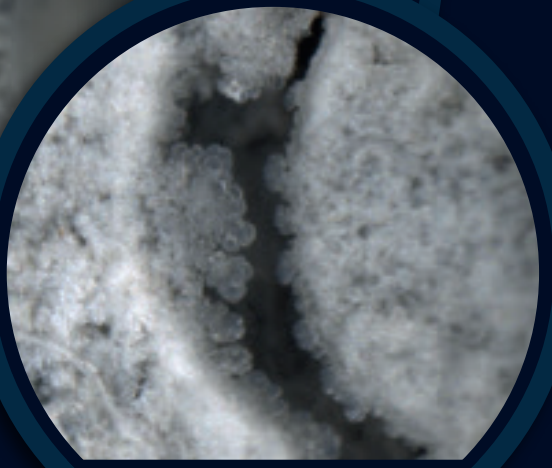
BEFORE (A1)



AFTER (A2)

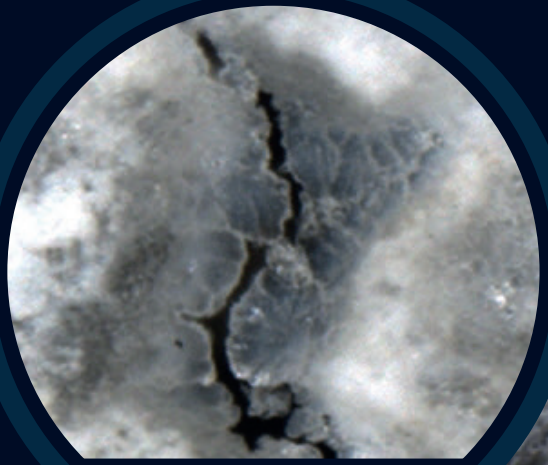


DETAIL B

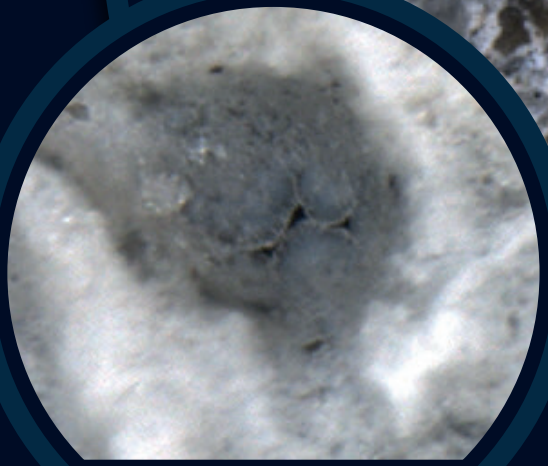


DETAIL C

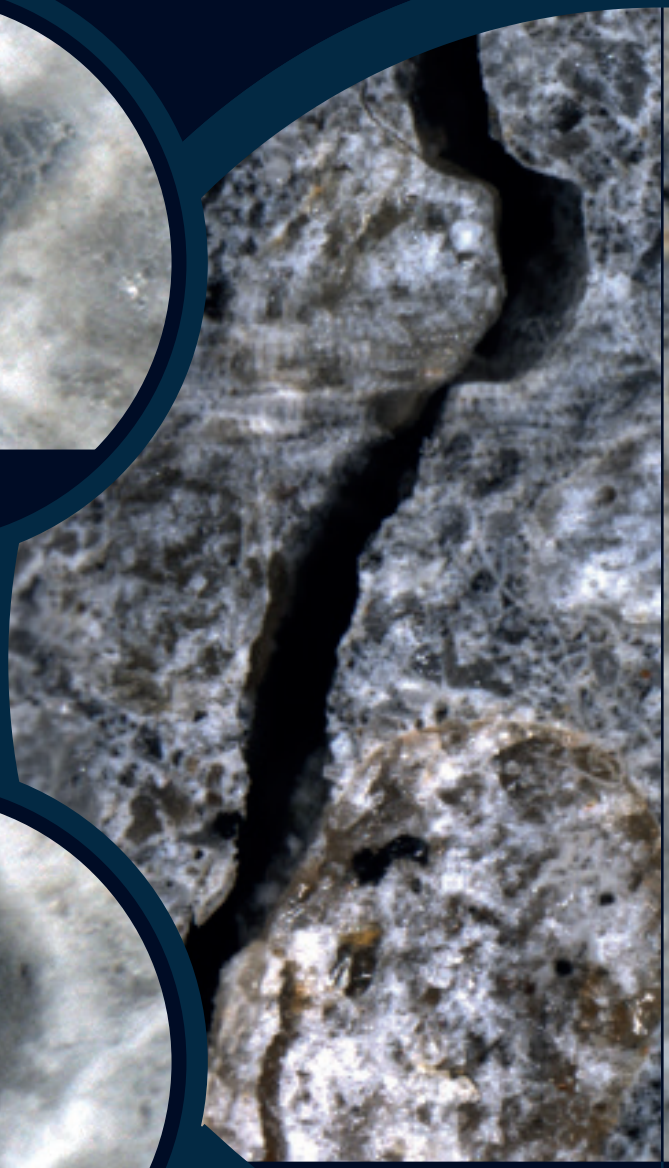
REF4 RELEVANT MICROSCOPE DETAILED IMAGES



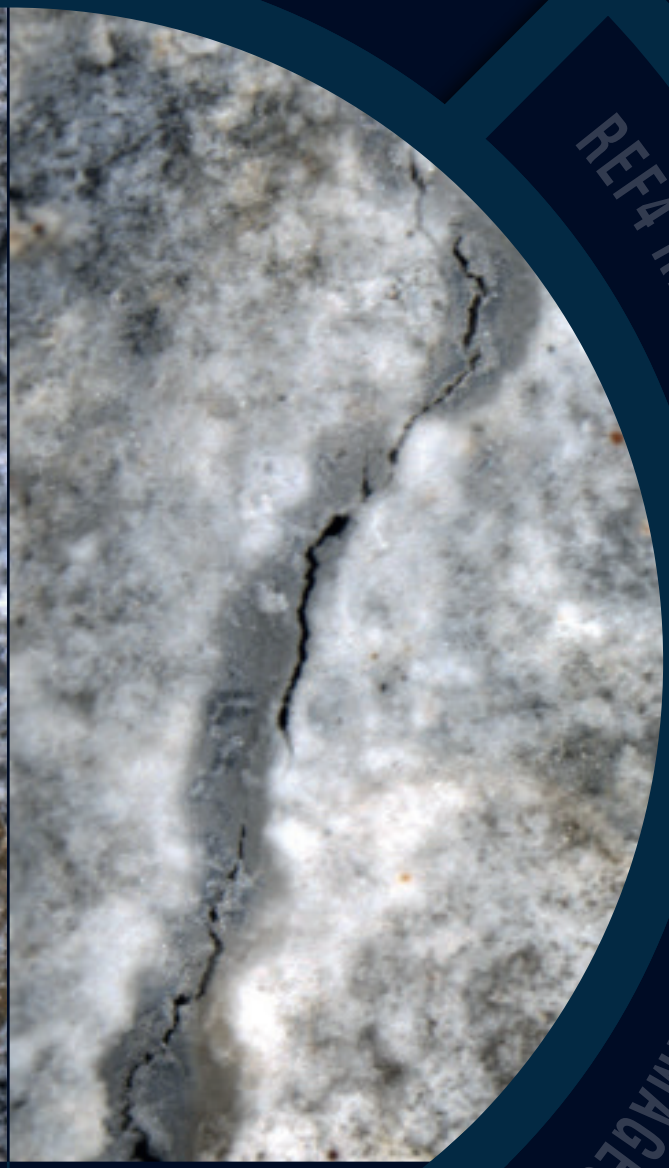
DETAIL B



DETAIL C

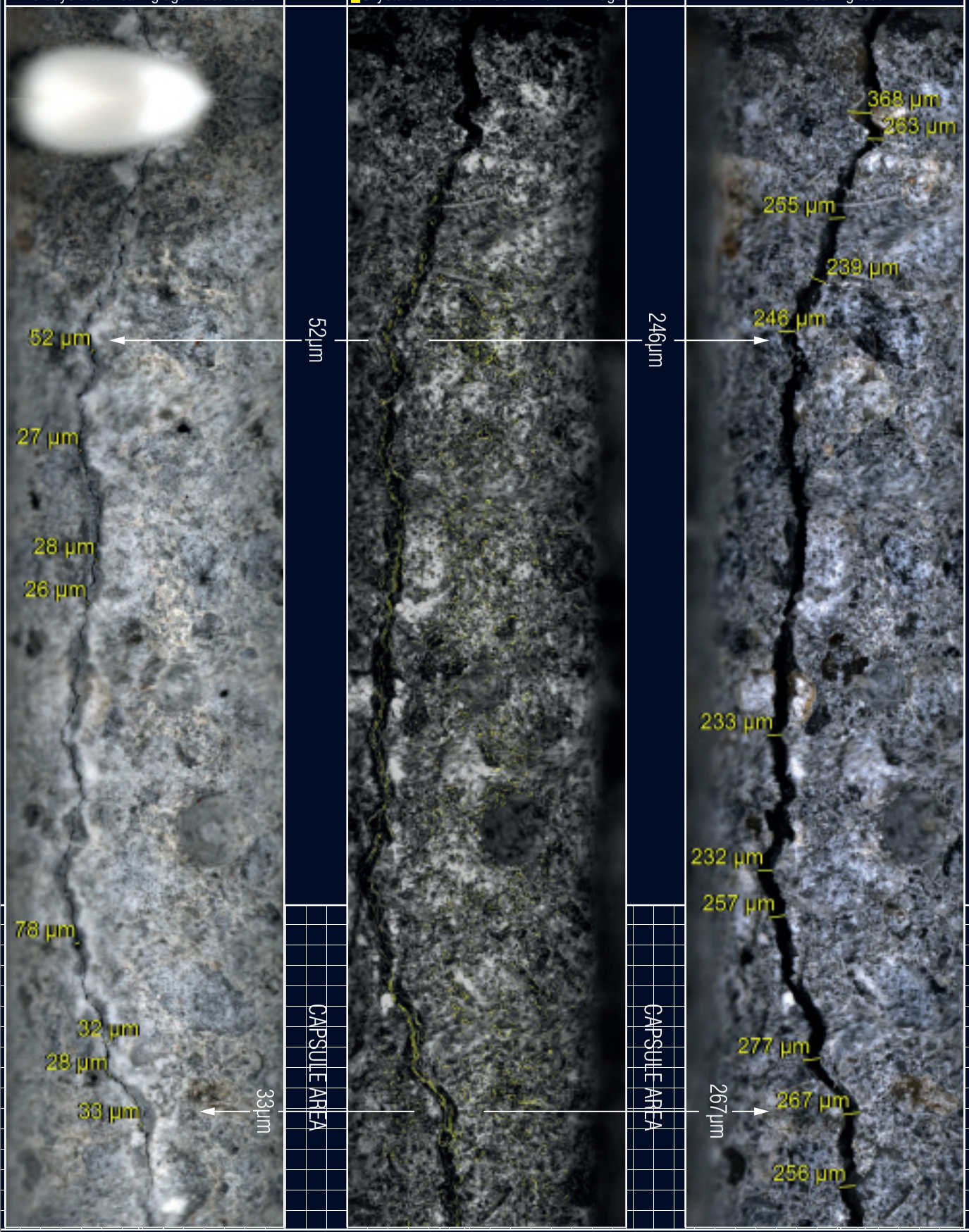


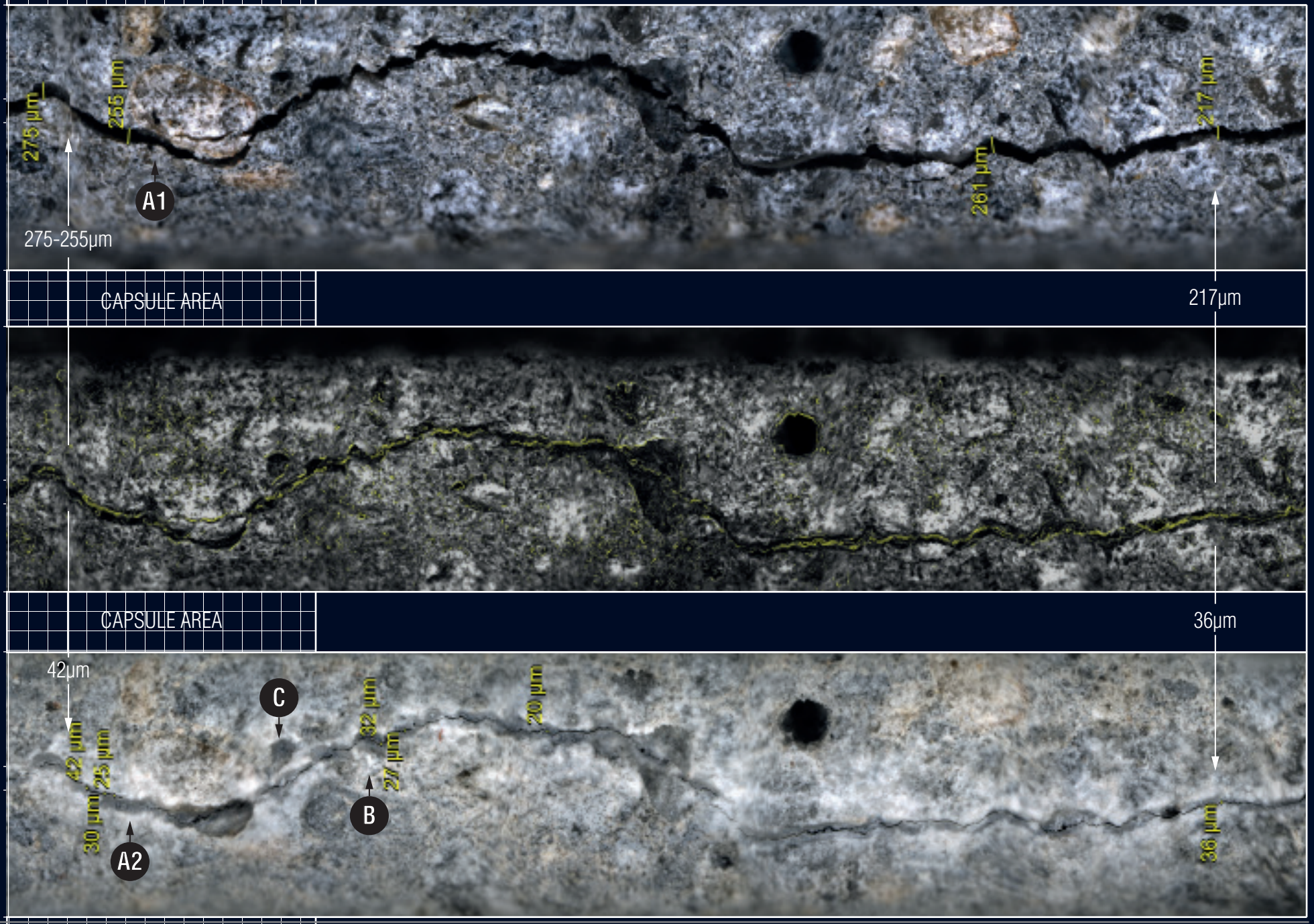
BEFORE (A1)



AFTER (A2)

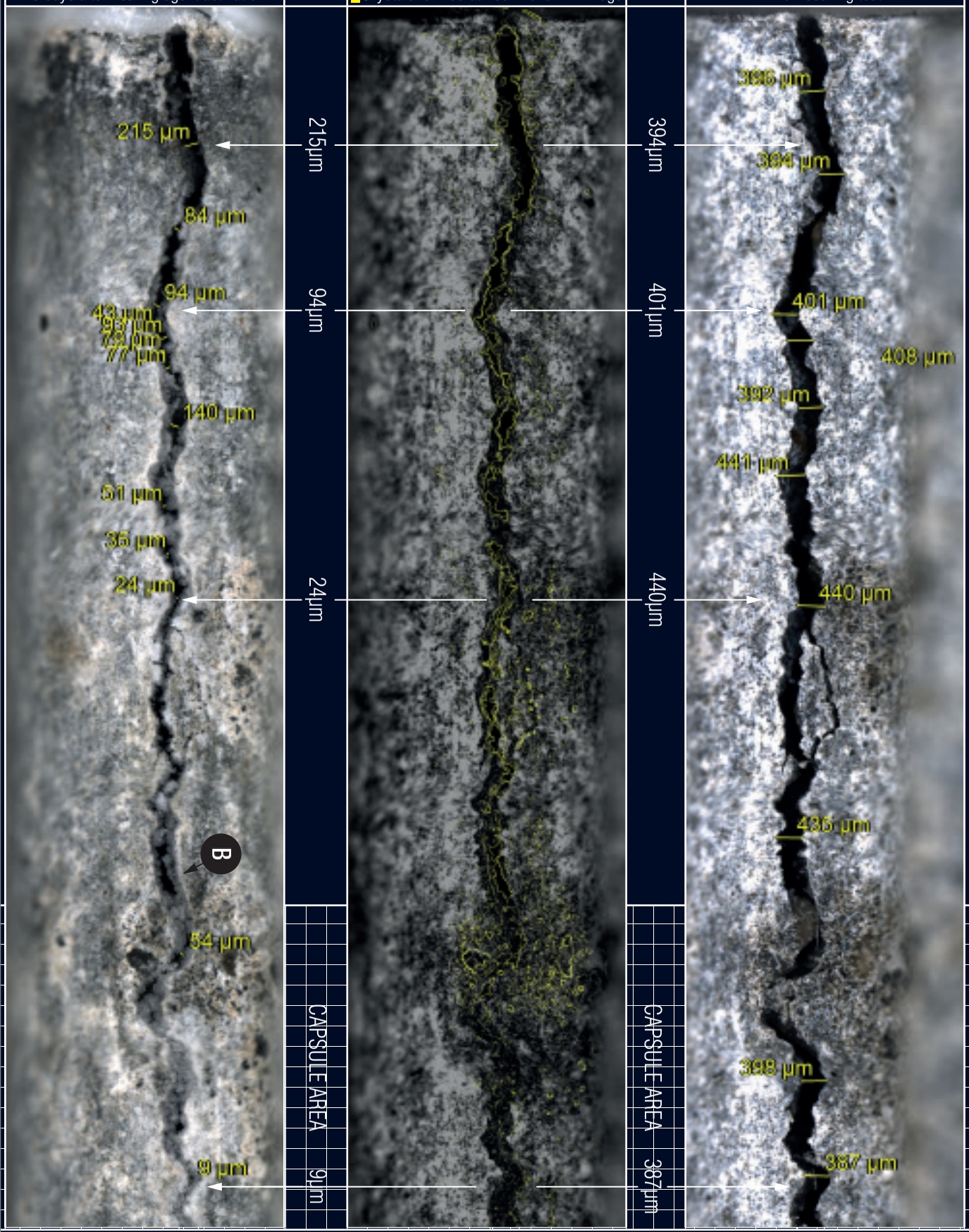
REF4 MICROSCOPE VIEWS COMPARISON FROM PF. TO 28 D.ACTIVATED

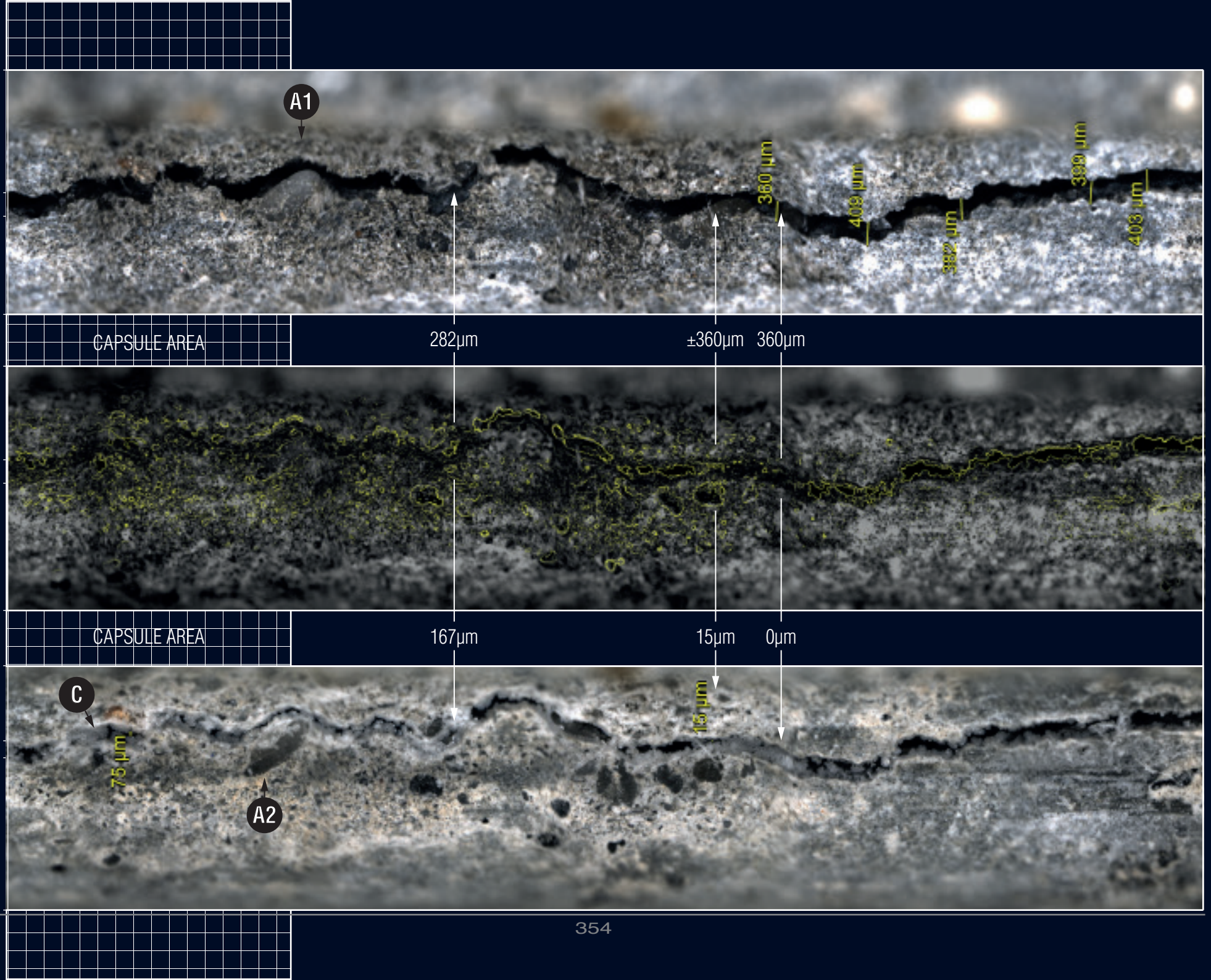



275 µm
255 µm
A1
275-255µm
261 µm
217 µm
CAPSULE AREA
217µm
CAPSULE AREA
36µm
42µm
42 µm
25 µm
30 µm
A2
C
32 µm
27 µm
B
20 µm
36 µm

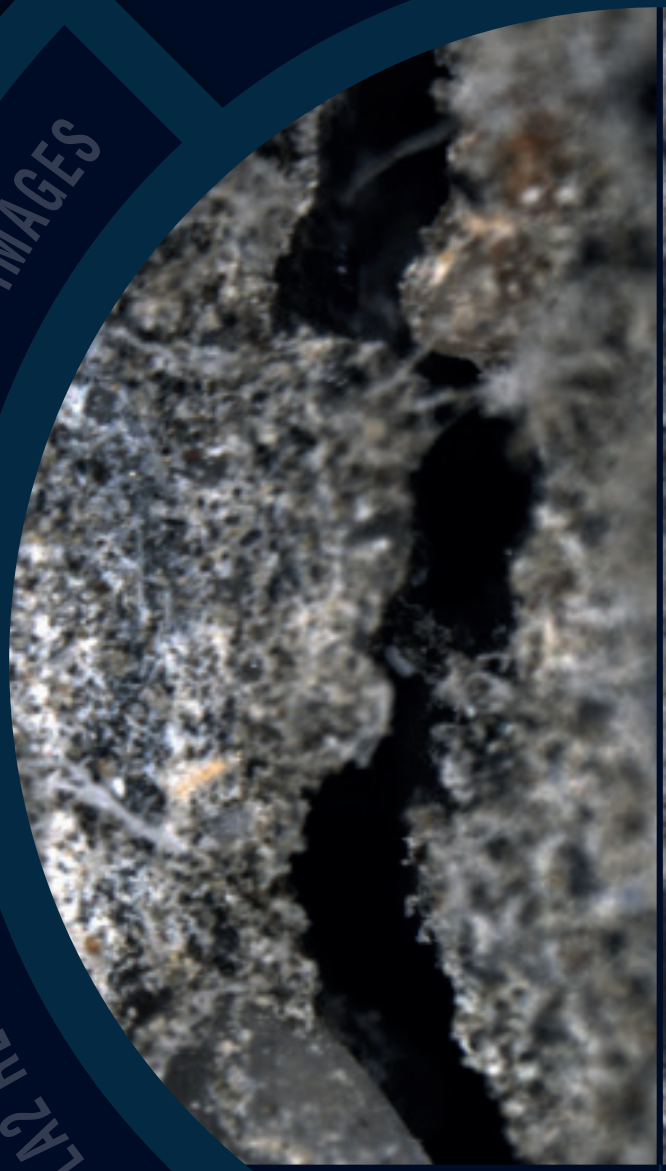
High Relevance Results:

PLA2 MICROSCOPE VIEWS COMPARISON FROM PF. TO 28 D.ACTIVATED

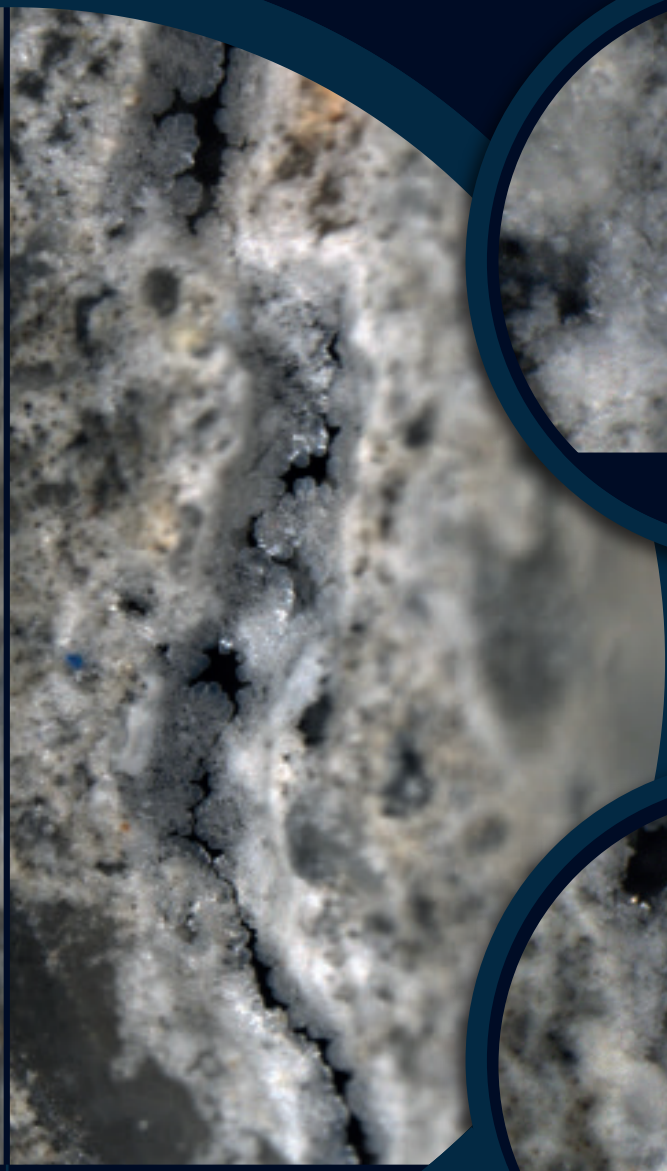



A1
360 µm
409 µm
382 µm
399 µm
403 µm
CAPSULE AREA
282µm
±360µm
360µm
CAPSULE AREA
167µm
15µm
0µm
C
75 µm
A2
15 µm

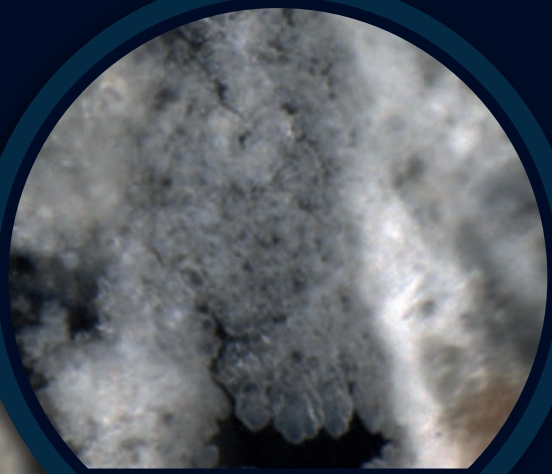
PLA2 RELEVANT MICROSCOPE DETAILED IMAGES



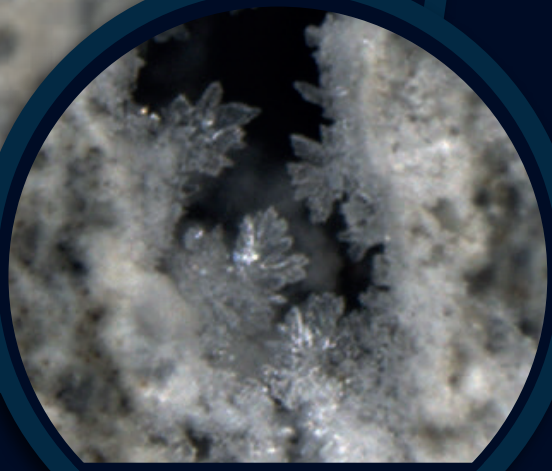
BEFORE (A1)



AFTER (A2)

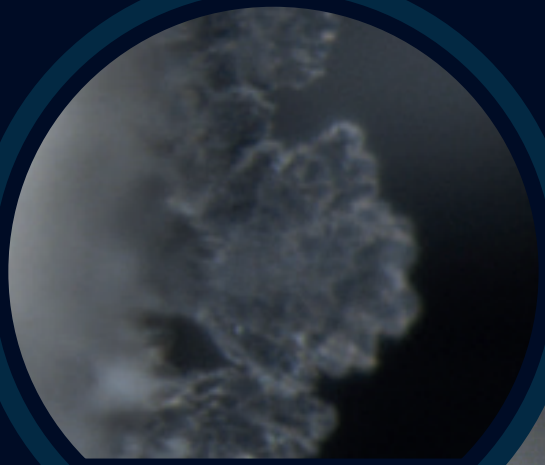


DETAIL B

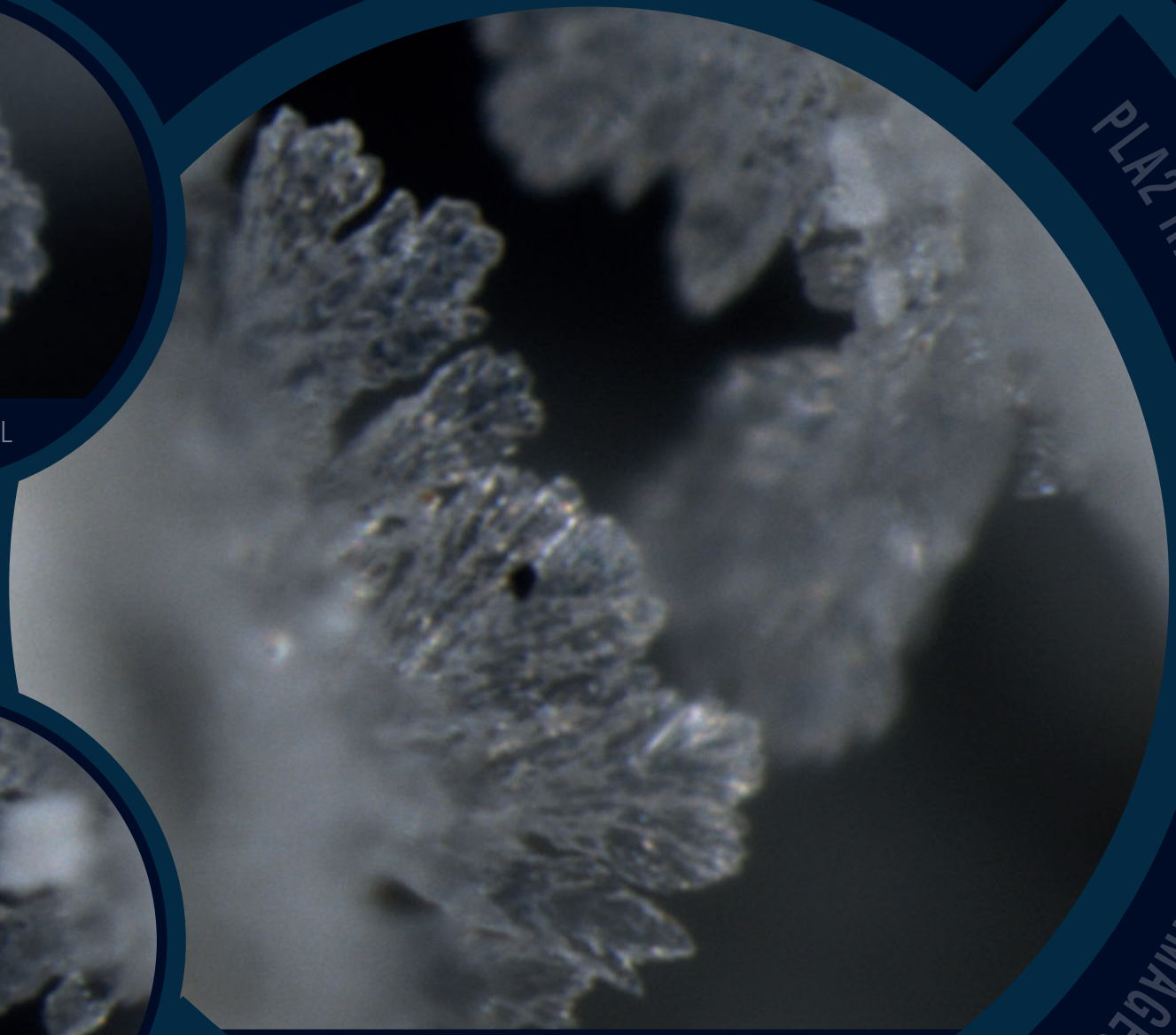


DETAIL C

PLA2 RELEVANT MICROSCOPE DETAILED IMAGES

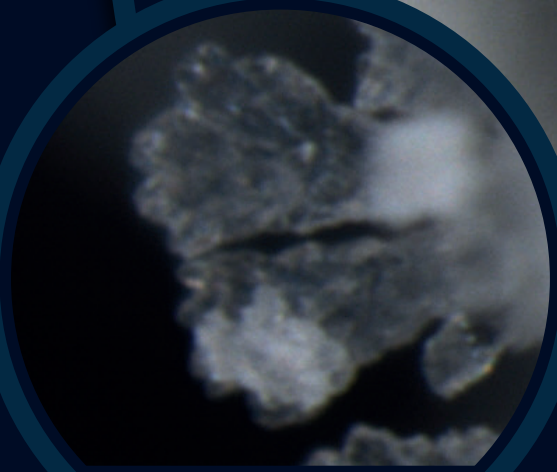


CHRYSTAL DETAIL



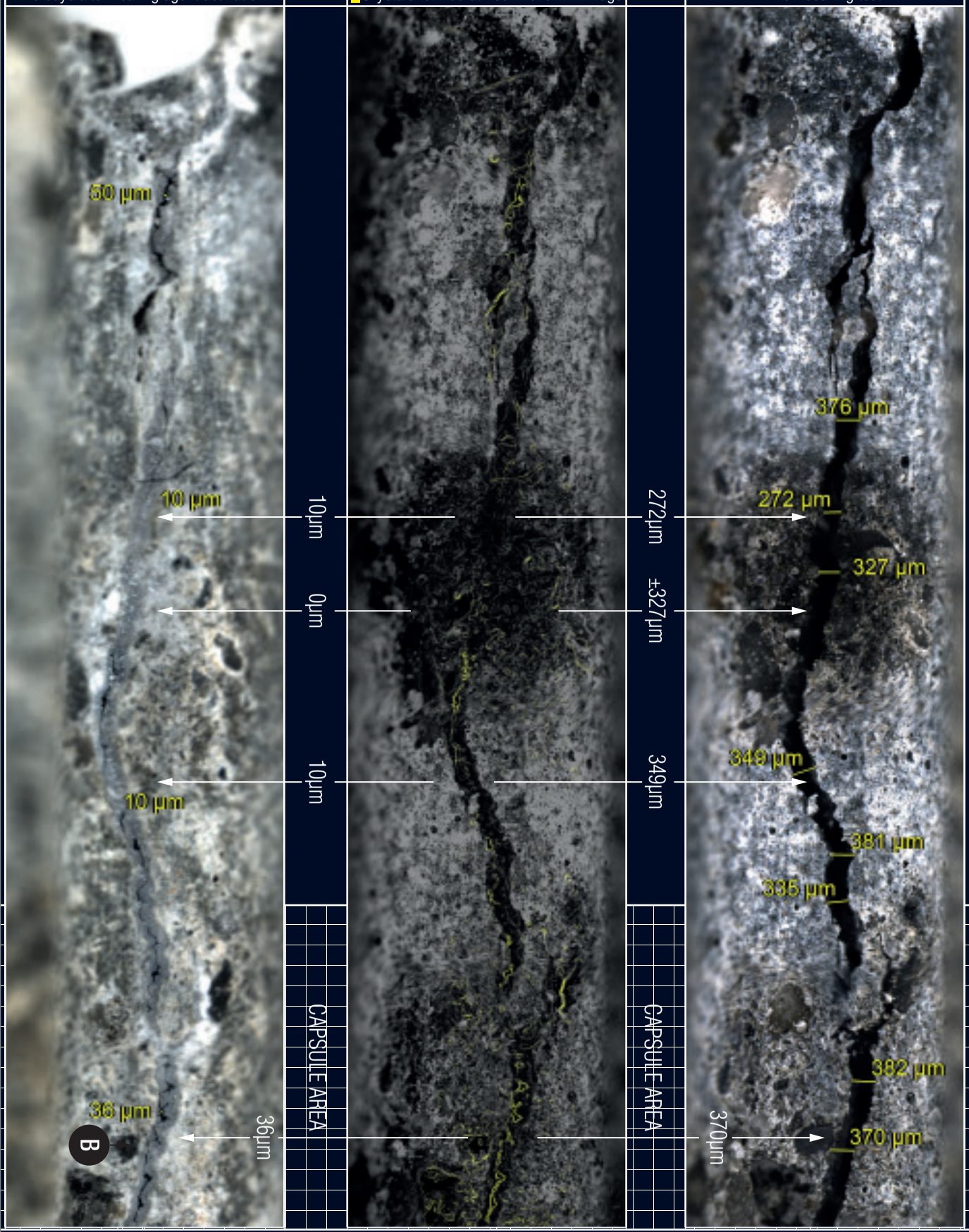
100 µm

CRISTALS DETAILED VIEW

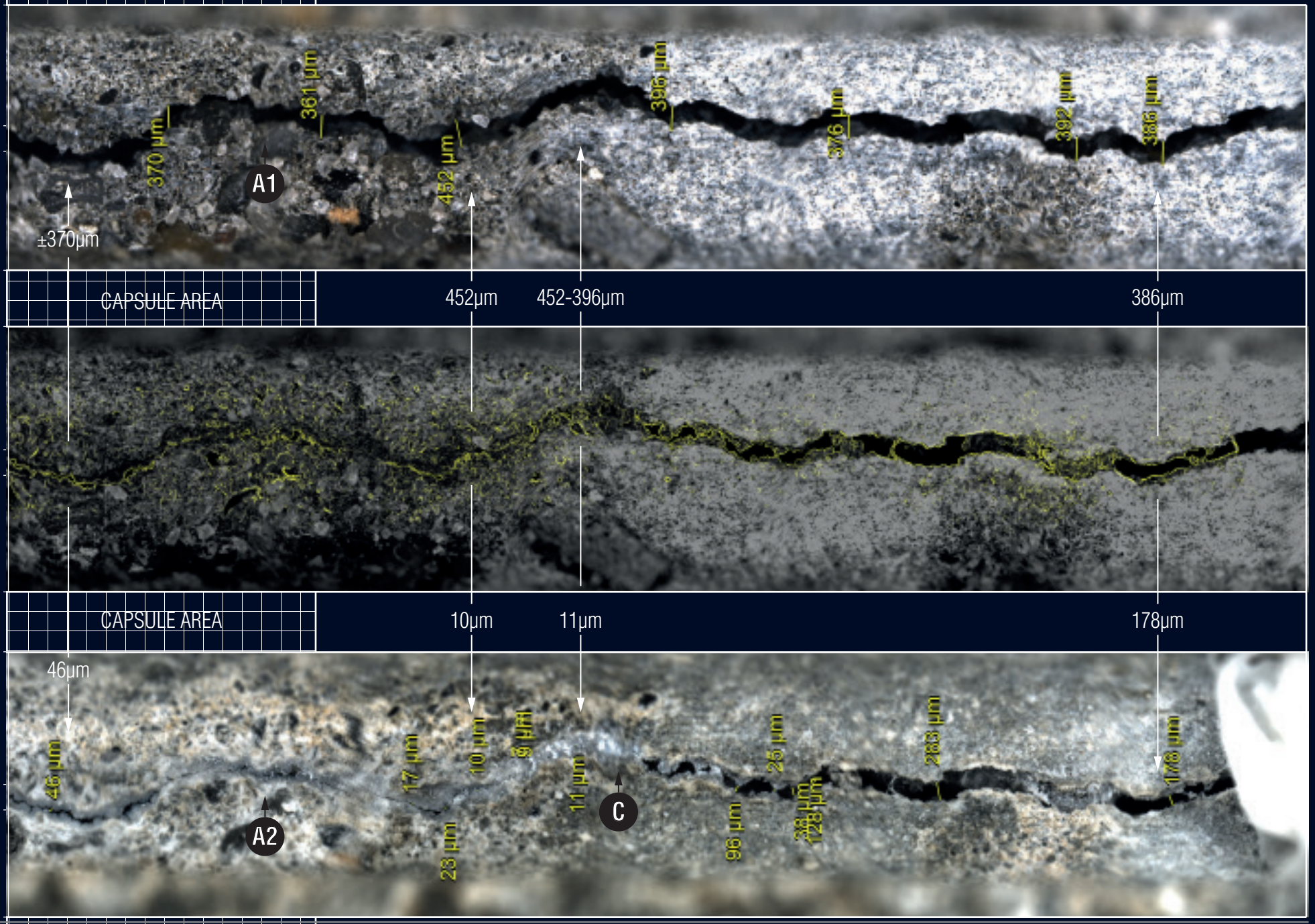


CHRYSTAL DETAIL

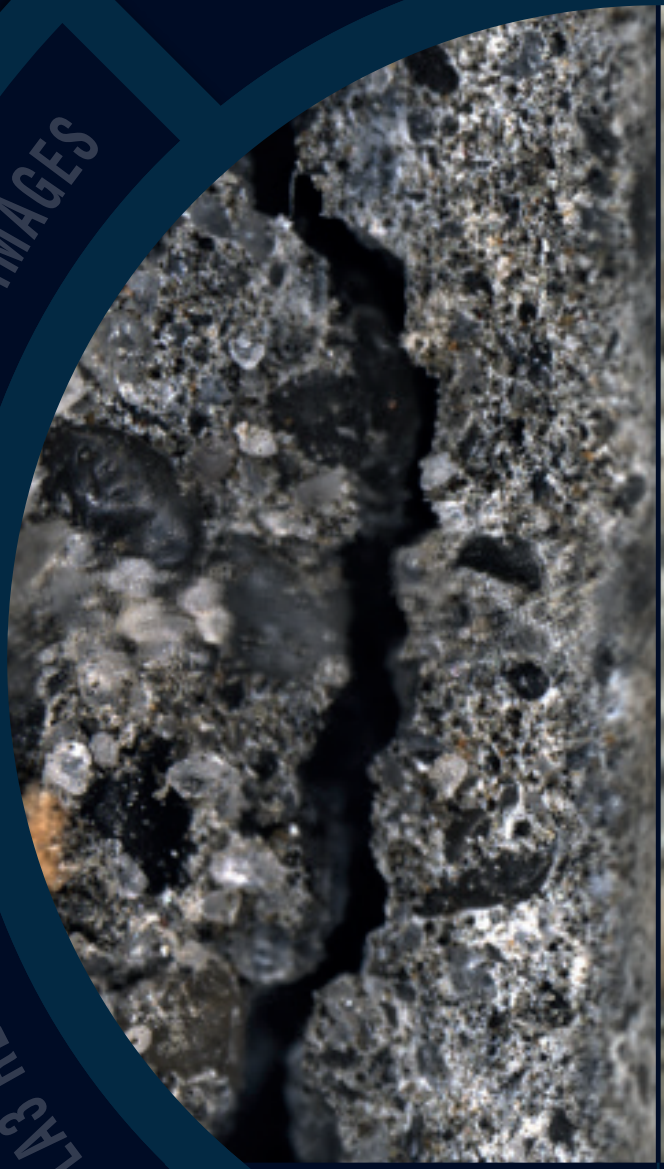
PLA3 MICROSCOPE VIEWS COMPARISON FROM PF. TO 28 D.ACTIVATED



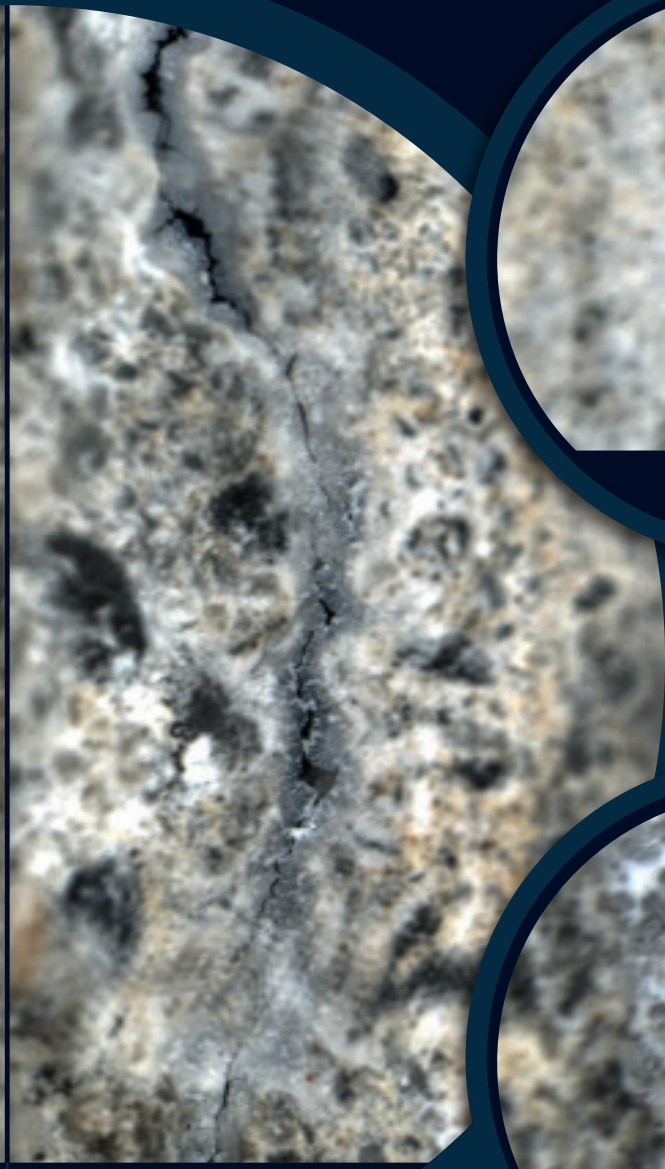
357


370 µm
361 µm
452 µm
396 µm
376 µm
392 µm
386 µm
A1
±370µm
CAPSULE AREA
452µm
452-396µm
386µm
CAPSULE AREA
10µm
11µm
178µm
46µm
46 µm
17 µm
10 µm
9 µm
11 µm
C
25 µm
263 µm
178 µm
A2
23 µm
96 µm
28 µm
128 µm

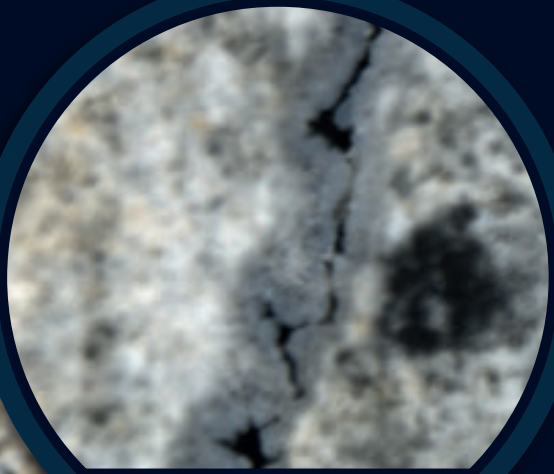
PLA3 RELEVANT MICROSCOPE DETAILED IMAGES



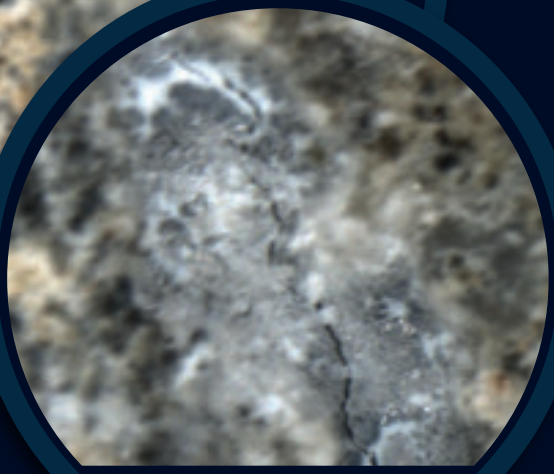
BEFORE (A1)



AFTER (A2)

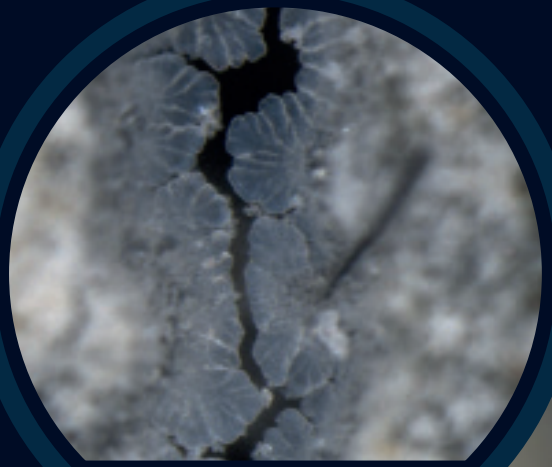


DETAIL B

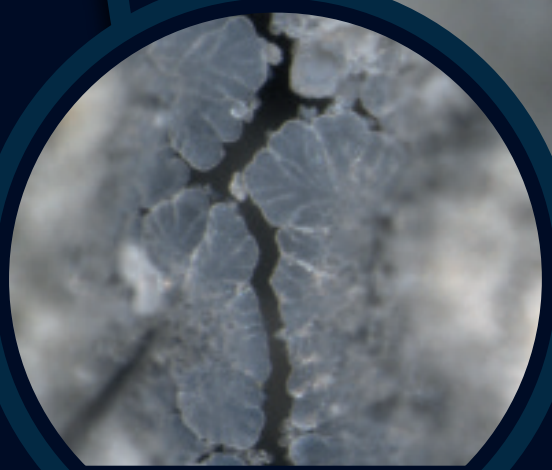


DETAIL C

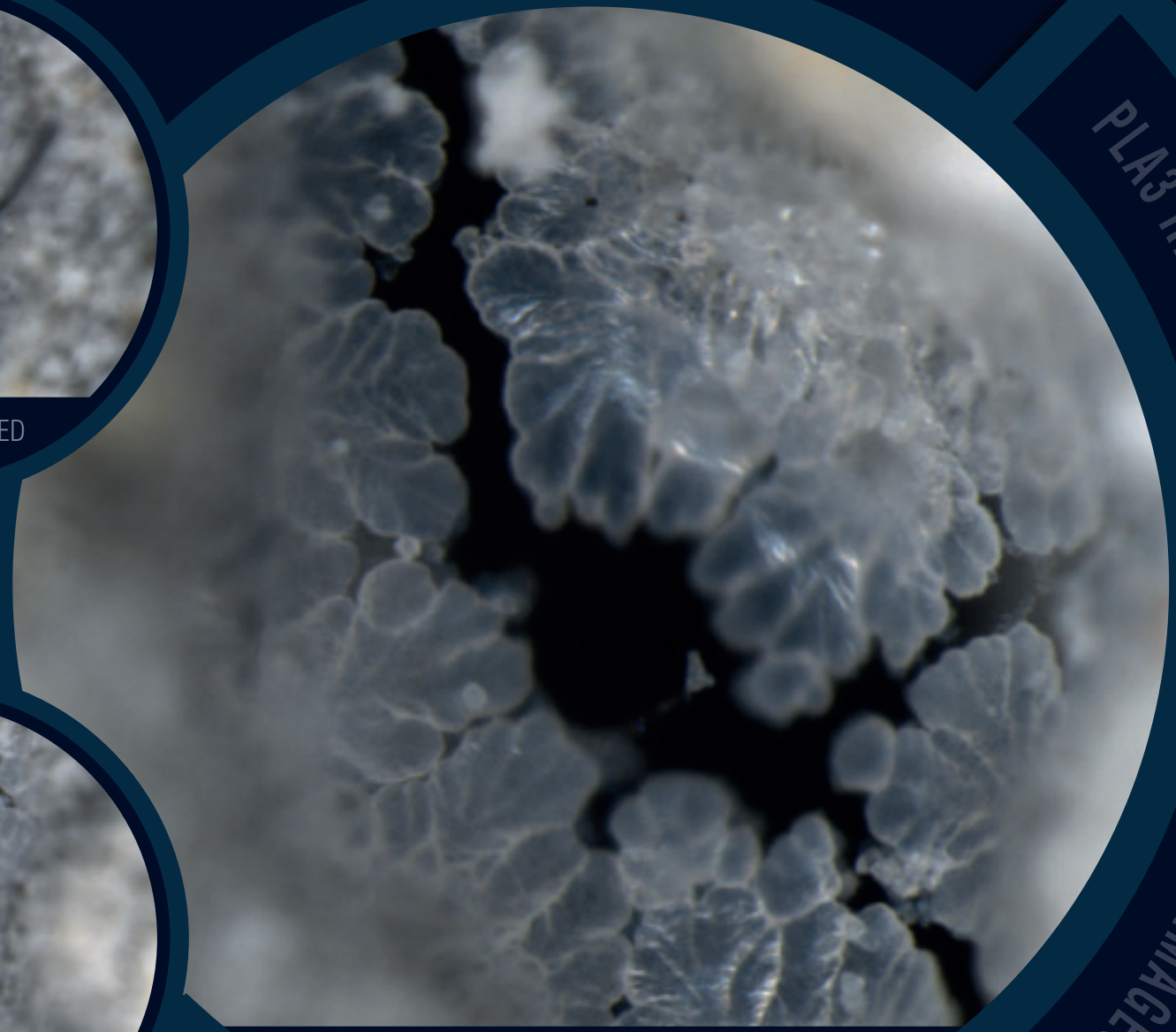
PLA3 RELEVANT MICROSCOPE DETAILED IMAGES



MINERALS FORMED



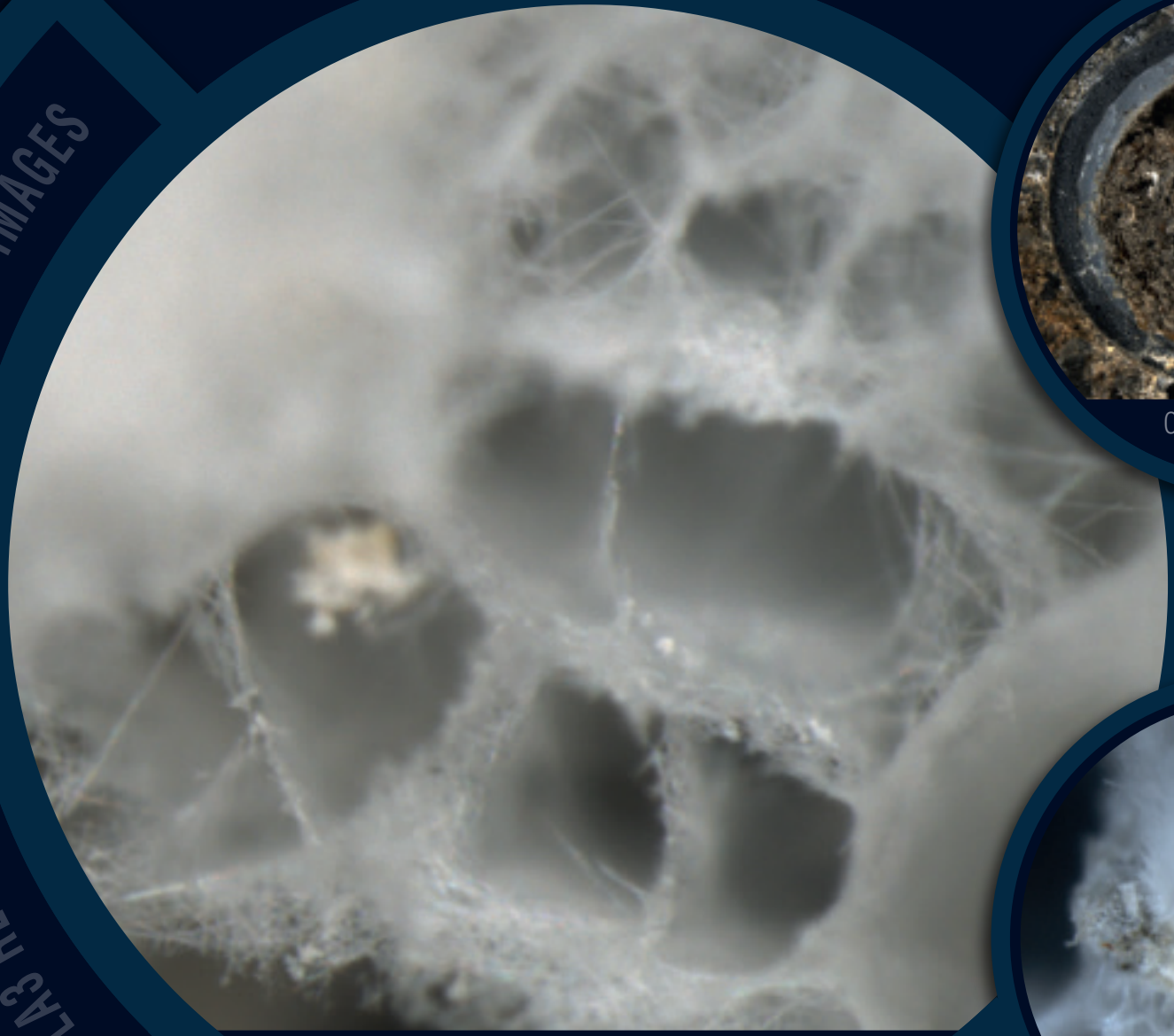
MINERALS FORMED



MINERALS FORMED IN THE FISSURE

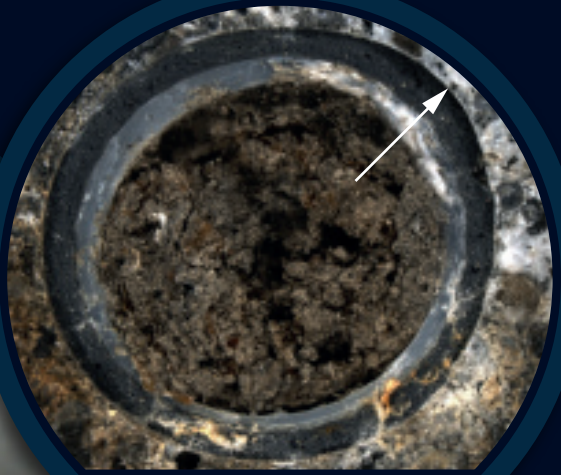
100µm

PLA3 RELEVANT MICROSCOPE DETAILED IMAGES



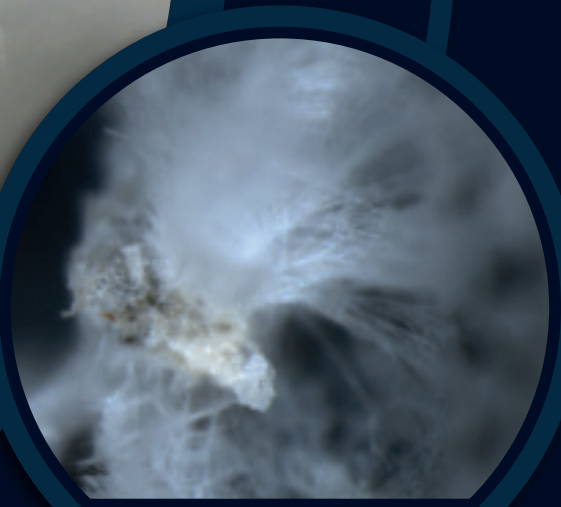
MINERALS FORMED AROUND THE CAPSULE AREA

100µm



CAPSULE BROKEN

1000µm



NEEDLE SHAPE

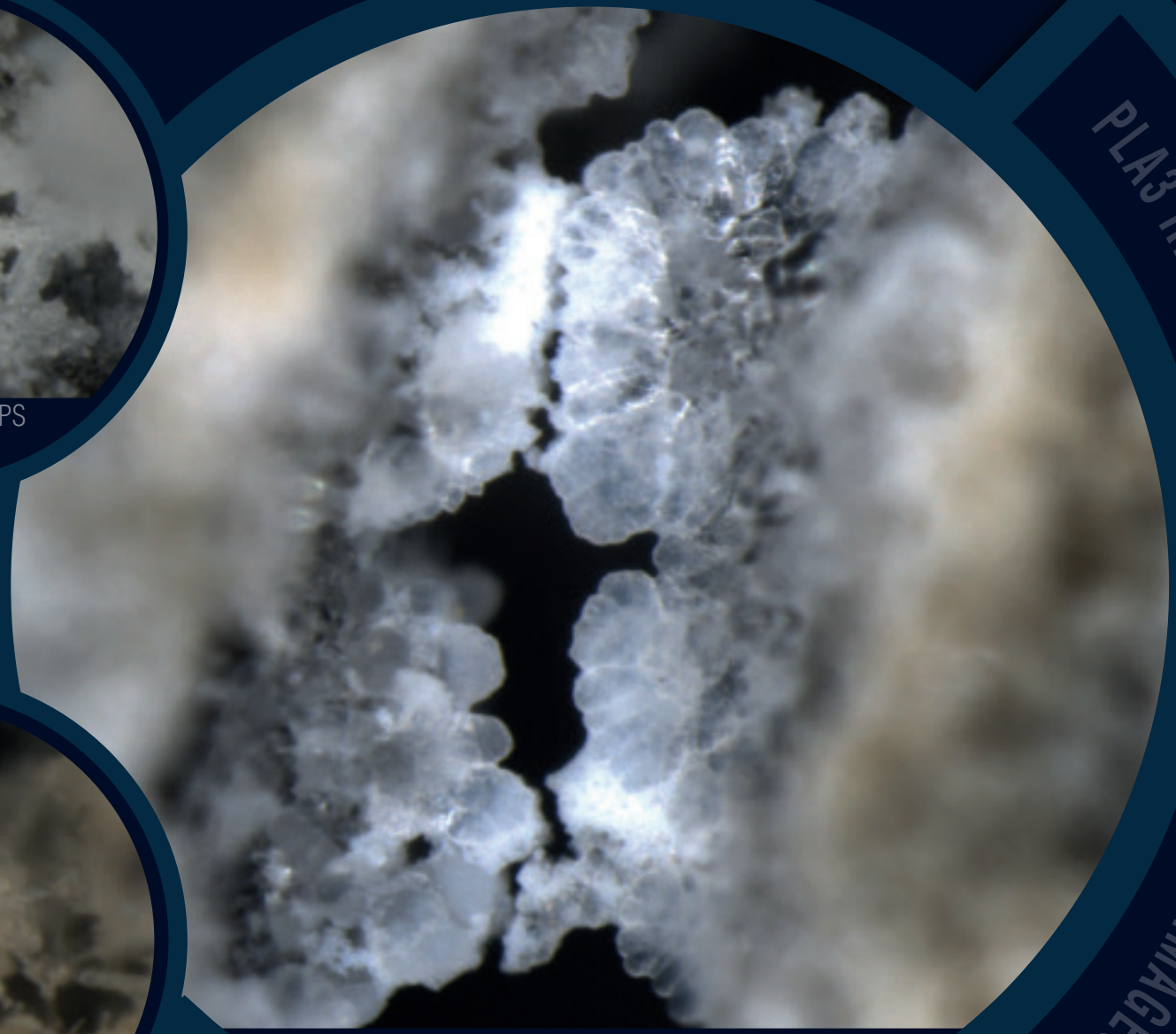
50µm

PLA3 RELEVANT MICROSCOPE DETAILED IMAGES



GRANULAR GROUPS

50µm



MINERALS FORMED IN THE FISSURE

100µm



NEEDLE SHAPE

50µm

As seen in the previous images all of the samples, after the healing period, presented a formation of mineralogical structures along the fissure, and variations in the crack width, each case will be discussed one by one (with exception of PLA2 and PLA3 that will be explained separately):

PLA1 observations:

Visually comparing the before and after images, mineral formation along the edge of the crack are observed, without covering the entire void. It is also presenting fissure width variations of: 276 to 144, 268 to 88, 282 to 167, and 276 to 249 micron; around a 50% of reduction in the surface.

PLA4 observations:

For PLA4, there is also mineral presence in the fissure edges, but not enough to cover the fissure void. The width has variations of: 574 to 381, 587–606 to 418, and 580–626 to 471 microns, presenting some reductions, but not a notable change.

VIR1 observations:

It is also notable a mineral formation in the edges and a more dense presence in the capsule's area, that covers better the void left by the fissure. The crack width variations are: 365 to 441, and 362 to 440 in the borders of the prism; in the capsule's area are 268 to 88, and 320 to 94–271 micron. Being the presence of the capsule a positive influence for its healing effect.

VIR2 observations:

In this case is possible to see near the capsule zone a well covered area, where minerals begin to fill the crack. The width variation in the border areas are 365 to 441, and 362 to 440; while, in the capsule's closer areas are 343 to 61–29, and 347 to 25 micron. So is, again, a notable change in the parts where the healing material is present.

VIR3 Observations:

It is notable the presence of white mineral grains accumulation (but again, is better in the capsule area). The width variations are: 281–296, and 279 to 312 microns in the farther areas, and 223 to 113, 248 to 124, and 253 to 176 microns in the capsule area.

VIR4 observations:

In this case was found a more important presence of mineral grains along the crack and a dense group formation covering the void in the fissure, presenting a better result. The width variations are: 267 to 293, 275 to 389, 223 to 202 in the farther areas, and 535 to 272 in the capsule's zone

REF 1 to 4 observations:

For the references, is possible to see, mineral groups along the crack and also covering it very well, almost closing it in a superficial level, the result seems to be due to precipitation of the powder suspended in water, its pH change, and the normal autogenous malt healing effect.

For the relevant cases, such as PLA2 and PLA3, a superior quality in the results was observed, probably due to the presence of pure powder (without any alteration), in spite of the virtual capsules (where the material is mixed with PPG and heated). It is possible that due to this condition, it has developed more mature mineral structures in lower time.

PLA2 observations:

In this case, the minerals covers the most of the fissure area, presenting some crack widths lower than 9 microns; or a total combination of these mineral structures from both sides, turning into a one solid and continuous surface.

The crack widths variations are: 394 to 215, 461 to 94, 440 to 24, 387 to 9, 282 to 167, 360 to 15, and even 360 to 0 microns. Its is possible to see in the detail images, a very particular translucent mineral formation fixed to the cement surface of the crack.

PLA3 observations:

This is the higher quality result in terms of superficial crack covering, where different mineralogical formations that creates a network of material are observed, it is able to sustain its own weight, and grow enough to match the other side formation and combine.

The fissure's widths are: 272 to 10, 327 to 0, 349 to 10, 370 to 36, 374 to 46, 452 to 10, 396 to 11, and 386 to 178; so is notable that

some areas present a total closure of the surface.

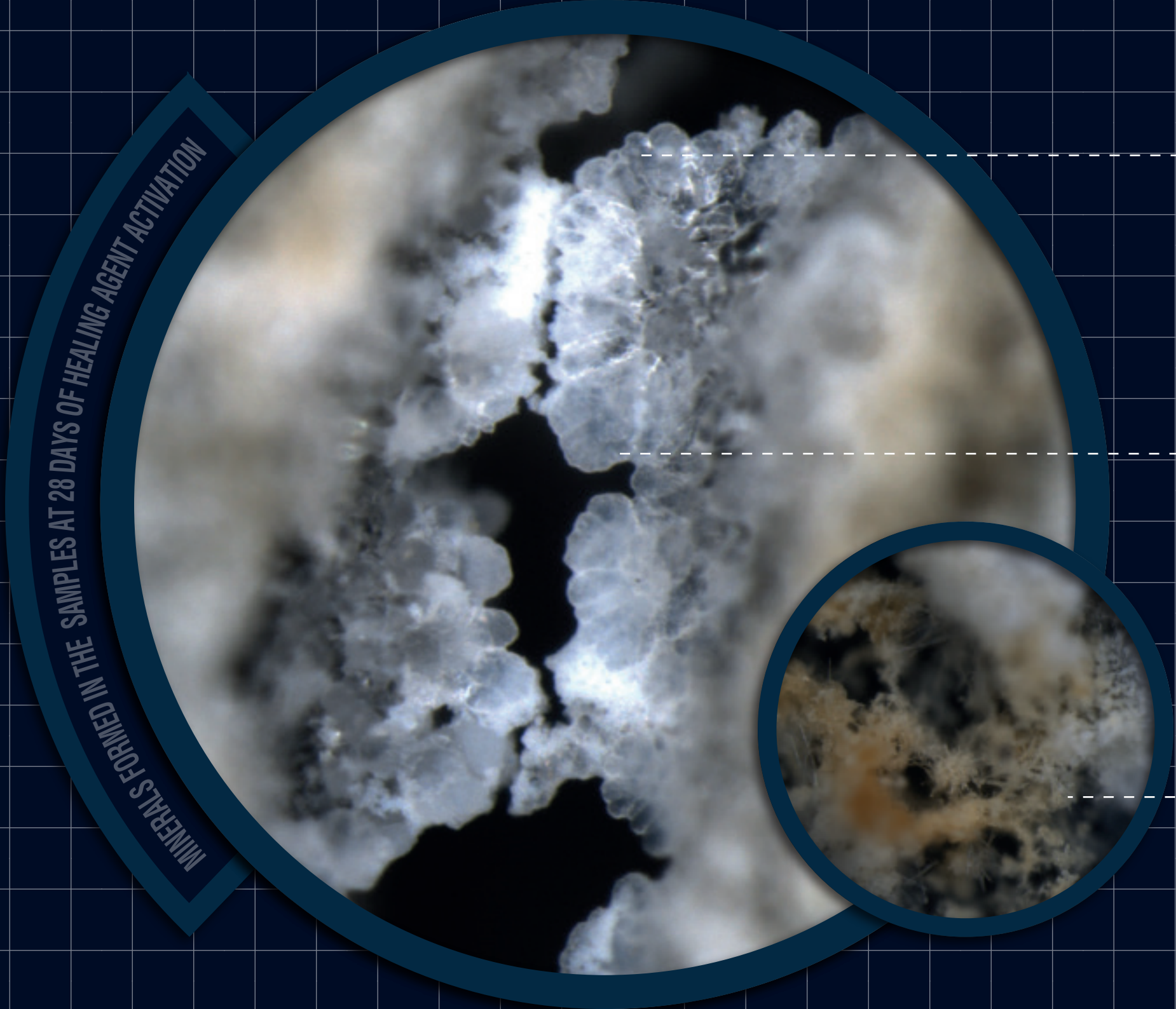
In the detail images of PLA3, the different minerals formed are shown, some of them presenting a needle shape mesh, that could possibly be ettringite, derivatives from the silicates or aluminate present in cement. Some others are white grains grouped conforming star shape structures; many of them found in the capsule's surroundings. As shown in the figures, by registering them through the electronic microscope after the fissuring test and both parts separation for evaluating the inner section as well.

The most visible mineral present, able to fill the fissure void is the translucent crystal formation shown in the last figure. Considering its shape, and knowing that is originated from cement powder, could possibly be Tobermorite (that is normally formed by the hydration of calcium silicate by reacting with water, producing mineral and calcium hydroxide).

This mineral is also called C SH in nomenclature; and, as explained in the section 1.2.2, is the responsible of the adhesive effect with aggregates, and the resistance of concrete.

It is, for sure, necessary to repeat the experiment including longer periods of time and more control phases with microscope views, to develop again this material and chemically analyze it to confirm this hypothesis in further studies (in the next page is presented a comparative figure of both minerals).

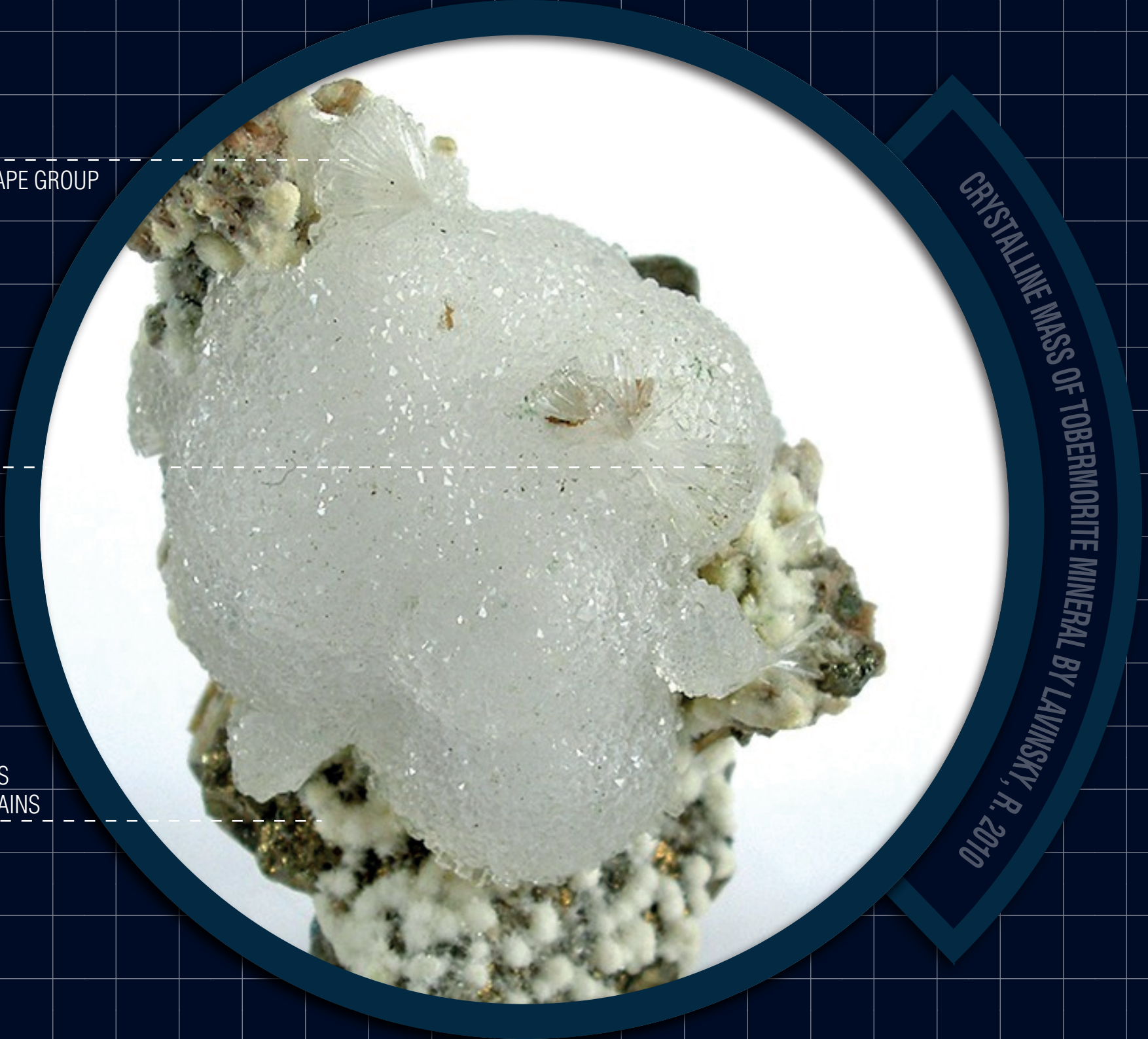
Next page figure "Crystalline mass of tobermorite" references:
-Lavinsky, R. And Wikipedia, 2010. Crystalline mass of tobermorite. [image] Available at: <https://en.wikipedia.org/wiki/File:Tobermorite-t08-76a.jpg> [Accessed 30 January 2022].


MINERALS FORMED IN THE SAMPLES AT 28 DAYS OF HEALING AGENT ACTIVATION

FAN SHAPE GROUP

TRANS-
LUCENT

NEEDLES
AND GRAINS

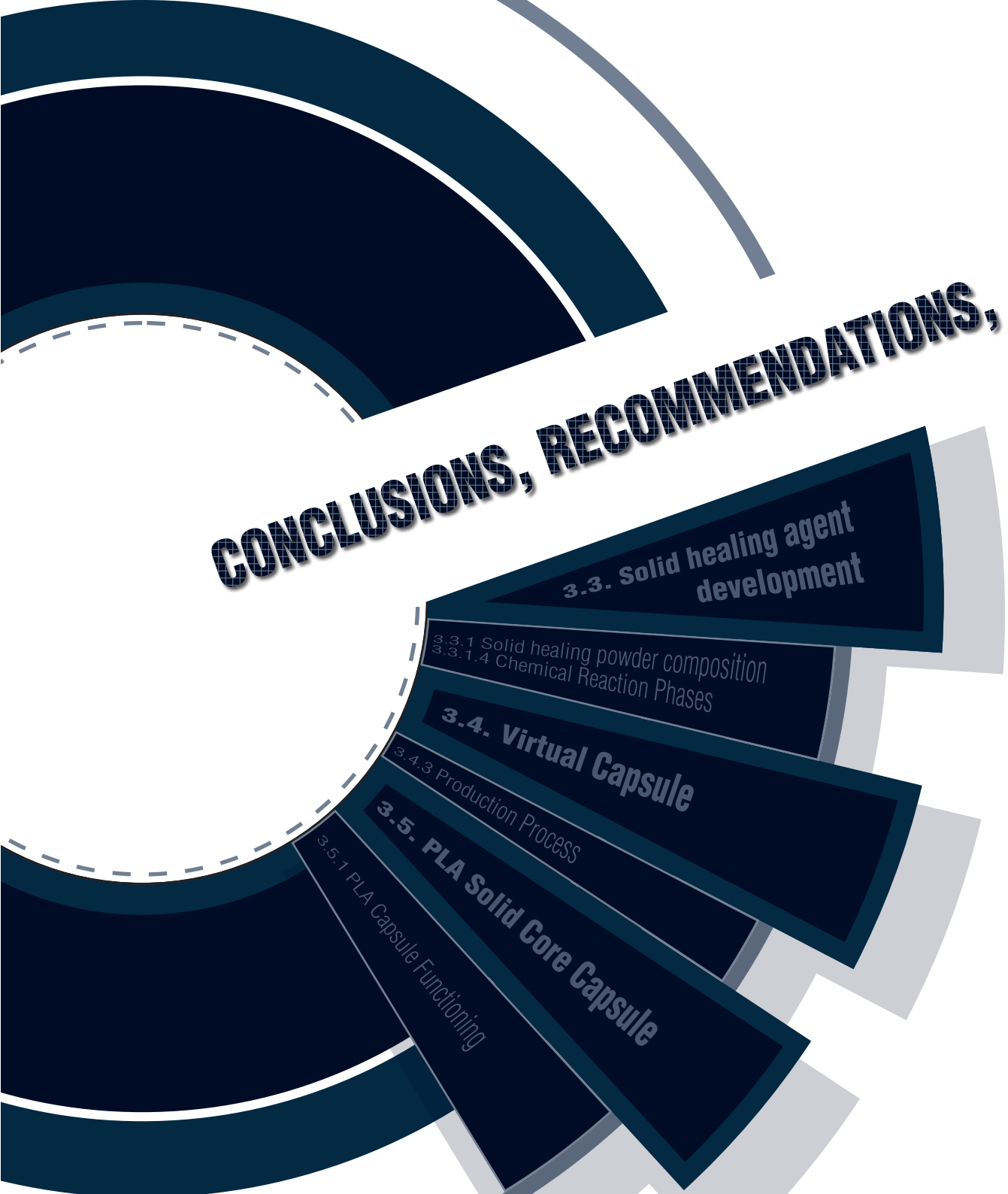


CRYSTALLINE MASS OF TOBERMORITE MINERAL BY LAVINSKY, R. 2010

Lavinsky, R. And Wikipedia, 2010. Crystalline mass of tobermorite. [image] Available at: <https://en.wikipedia.org/wiki/File:Tobermorite-108-76a.-jpg> [Accessed 30 January 2022].

5

CONCLUSIONS, RECOMMENDATIONS, AND POSSIBLE APPLICATIONS



5.1 Introduction

5. Chapter 5: Conclusions...

As seen in the previous chapter, the 3D printed capsule design, in terms of porosity reduction and PU waterproofing, was improved, obtaining also one good result without any outcomes or leaking, (that was also activated after the 15 days period with the PU perfectly reactive and functional).

Furthermore, the healing powder, in terms of fissure sealing (avoiding the water passage with effectiveness of 98 to 100%) presented very good results, tat is to say the most important aim of blocking the water passage to protect the steel reinforcement can be considered fulfilled.

In the case of the mechanical strength, around 10% of the material resistance in one month was recovered, so possibly in a longer time test this condition could be improved.

Taking into consideration all this information, the capsules and healing agent are viable, presenting an important potential and contribution for the concrete self healing field. In this chapter some conclusions from this results will be established. Also, its features in terms of sustainability (comparing it with previous techniques as a reference)will be evaluated, and some possible applications in the field of construction will be presented.

The results from experiment two, using 3D printed and virtual powder healing agent core capsules, are very interesting due to a summary of factors identified in the different stages, that are the following:

1-. Fissure sealing:

In the case of this test, the passage of water flow from an external reference prism group with no capsule included was used as a comparison point; where is notable the capacity of the healing powder to block the liquid passage. In part due to the presence of the polyacrylate crystals, that were identified in a size increased condition (after breaking the prism to study the inner malt conditions).

Then the surface mineral formations and in parts of the prism's core, supported importantly this process; this can be verified by the water flow change between the first test and the second one.

It must be considered that one of the main aims of concrete self healing, that is the blocking of water passages into the concrete elements to avoid the steel reinforcement degradations was fulfilled, taking into consideration the results from this test of 98 to 100% of crack sealing (specially in the virtual capsule's data).

2-. Mechanical recovery:

The results seems to be not so dramatic as the obtained in the fissure sealing; but is important to say that compared to the reference prisms (that also presented mineral formations in the surface), the capsule containing samples presented at least the double of resistance recovered.

It is important to say, that the sample's healing agent were reacted for only one month, and mineral formations could take more time than this; also, the water pressure applied in the container (where the prims were located) was minimum, so the moisture did not reach to activate the entire amount of powder. It could be interesting to test this healing agent again in containers which height could be from around 1 meter or similar, to verify if the pressure increase can support the healing agent hydration (and not only depend on the capillarity effect, as happened in this experiment).

Anyway, for all the effects and advantages explained before, the formation of this mineral is very positive, and could be interesting the development of a longer term test.

3-. Microscope mineral observation:

With this experience, has been possible to appreciate the different mineralogical formations present in the prism and capsule, many of them normal on cement hydration. But some particular structures, as shown in the end of chapter 4, were observed and must be analyzed carefully to understand its potential; because, by being tobermorite, it could mean the possible formation of a resistant network of minerals to seal the crack and recover the most of the resistance (or even the total amount).

Anyway, the fissure closure effect was notable due to these formations; in the following tables are shown the variations of measures before and after the healing effect applications (ref available on annexes 5.2). In some cases the average value importantly variates, and in others, modifies the standard deviation (that is related to how different are the widths respect to each other), a larger value means a dramatic difference between them, highlighting the presence of very reduced distances in specific points.

PLA FISSURE WIDTHS

PLA1		PLA2		PLA3		PLA4	
Crack width [µm] on 12/10/2021	Crack width [µm] on 18/11/2021	Crack width [µm] on 12/10/2021	Crack width [µm] on 18/11/2021	Crack width [µm] on 12/10/2021	Crack width [µm] on 18/11/2021	Crack width [µm] on 12/10/2021	Crack width [µm] on 18/11/2021
278	72	396	215	376	178	581	471
278	75	394	84	272	283	590	391
275	81	401	94	327	38	574	434
276	132	408	43	349	128	555	418
276	87	392	93	381	25	594	372
280	75	441	79	335	96	593	402
278	144	440	77	382	7	555	517
268	96	435	140	370	9	535	381
282	128	398	51	370	11	574	467
282	69	387	35	361	10	536	308
290	88	360	24	452	23	587	340
282	100	409	54	396	17	606	396
276	49	382	9	376	46	600	229
273	167	399	75	392	36	580	175
273	249	403	15	386	50	526	348
Mean		Mean		Mean		Mean	
277,8	**107,5**	**403,0**	72,5	368,3	63,8	572,4	376,6
Standard deviation		Standard deviation		Standard deviation		Standard deviation	
5,1	50,6	21,9	52,6	39,3	78,1	25,2	89,6

VIR FISSURE WIDTHS

VIR1		VIR2		VIR3		VIR4	
Crack width [µm] on 12/10/2021	Crack width [µm] on 18/11/2021	Crack width [µm] on 12/10/2021	Crack width [µm] on 18/11/2021	Crack width [µm] on 12/10/2021	Crack width [µm] on 18/11/2021	Crack width [µm] on 12/10/2021	Crack width [µm] on 18/11/2021
354	441	340	343	275	339	283	339
365	473	330	62	299	296	289	296
344	430	347	335	286	137	157	137
360	381	351	42	281	294	253	294
361	407	366	41	263	269	184	269
316	414	343	61	223	94	223	94
301	94	347	29	248	43	294	43
314	217	347	33	233	113	220	113
380	214	318	25	258	265	249	265
262	316	332	33	253	124	275	124
342	440	334	50	272	247	267	247
320	456	338	52	228	176	205	176
362	354	312	338	269	294	277	294
342	448	330	344	279	349	249	349
338	385	358	339	253	312	215	312
Mean		Mean		Mean		Mean	
336,2	**359,2**	**339,5**	127,4	260,4	215,2	239,8	215,2
Standard deviation		Standard deviation		Standard deviation		Standard deviation	
31,2	111,5	14,8	139,3	22,5	97,4	40,7	97,4

For these analysis, the necessary steps, abilities, materials and resources, required for the production of self healing capsules were taken into consideration. Comparing this research with the case study of Carrillo, S. and Paganelli, G., 2017. And Wael Aamer 2021.

Carrillo and Paganelli cement capsule production process:

In this case, the capsules production require different steps:

1—. Cement mixture and paste production for the container making.

2—. Extrusion of the paste into a machine to obtain cement cylinders.

3—. Cement hardening period required to use the cylinders.

4—. Primer application for waterproofing layer.

5—. production of bottom and top cap.

6—. Application of the bottom cap and sealing with epoxy resin.

7—. Capsule filling with the healing agent.

8—. top cap placing and capsule sealing with epoxy resin.

Wael Aamer CEM capsule production process:

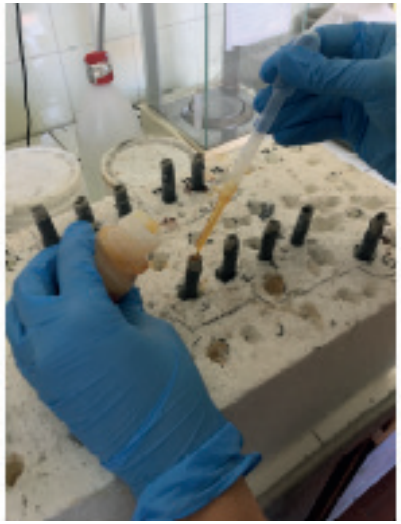
1—. Cement mixture and paste production.

Results and images extracted from:
-Carrillo, S. and Paganelli, G., 2017. Sviluppo di nuove capsule polimeriche per materiali cementizi autoriparanti. Turin, Italy: Politecnico di Torino, pp.1-378.











Carrillo, S. and Paganelli, G., 2017

2–. Paste manipulation, using a plastic straw as a mold or guide, where the paste must be warped around to obtain a cylinder.

3–. Cutting the long cylinder in smaller pieces.

4–. Cylinders hardening period 3–4 days.

5–. Cylinders coating with waterproofing primer.

6–. Top and Bottom cap production.

7–. Bottom cap placing with epoxy resin.

8–. Epoxy resin hardening period.

9–. Capsule filling.

10–. Top cap placing and epoxy waterproofing.

This research's 3d Printed PLA capsules production:

1–. Capsule and cap 3d printing (3 hours by capsule and cap).

2–. Healing agent preparation.

3–. Capsule filling.

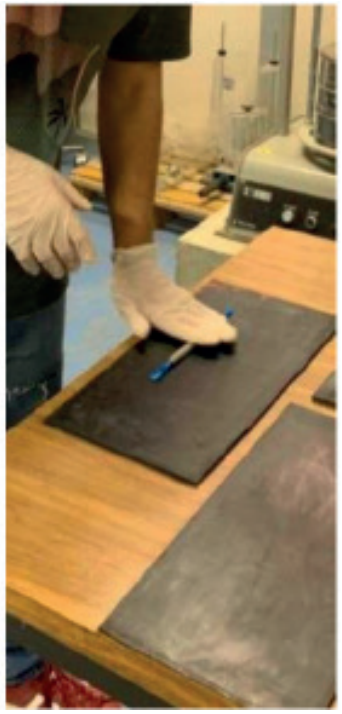
4–. Cap sealing and closure.

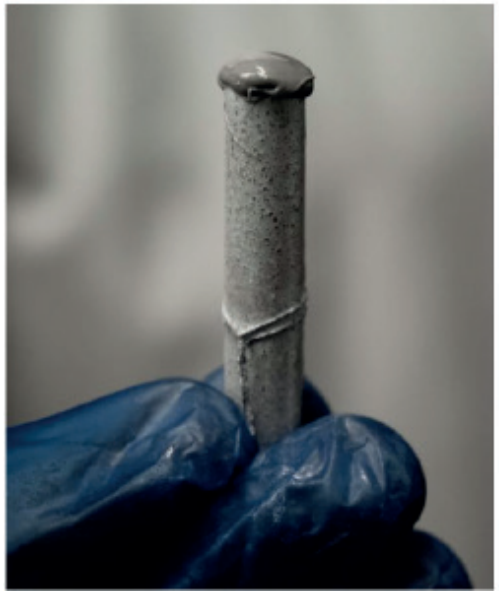
5–. Epoxy coating application for waterproofing.

This research's virtual capsules production:

1–. Solid healing agent paste mixing.

Results and images extracted from:
-Wael Aamer, 2021. Materiali cementizi auto-riparanti: Valutazione dell'efficienza di riparazione di capsule cementizie e in PET riciclato. Turin, Italy: Politecnico di Torino, pp.1-110.



Wael Aamer, 2021

2—. Mold preparation with baking paper.

3—. Mold filling and closing.

4—. Heating period (30 minutes).

5—. Cooling down period (30 minutes).

6—. Compact powder cylinders mold extraction.

7—. Epoxy resin coating for waterproofing.

Comparison:

As seen in the previous sections, the production processes from external experiences present a higher amount of steps and hardening periods to produce the capsules; this, compared to the PLA 3D Printed capsules process developed on this research is very different, for these type of healing technique are only required four steps; where, the 3d printing can be done by a non specialized person (by just uploading the gcode in the machine memory and clicking print), facilitating the container production and making it more universal and accessible; requiring only to be filled, closed and insulated (this last step require more specialized personal and self protection equipment).

In the case of the virtual capsules, 8 steps are required, executed by specialized personal; but the use of oil derivate materials and dangerous substances is reduced.

AAMER WAEL 2021 SELF HEALING CEM CAPSULES PRODUCTION PROCESS

10 STEPS



CARRILLO & PAGANELLI 2021 SELF HEALING CEM CAPSULES PRODUCTION PROCESS

9 STEPS



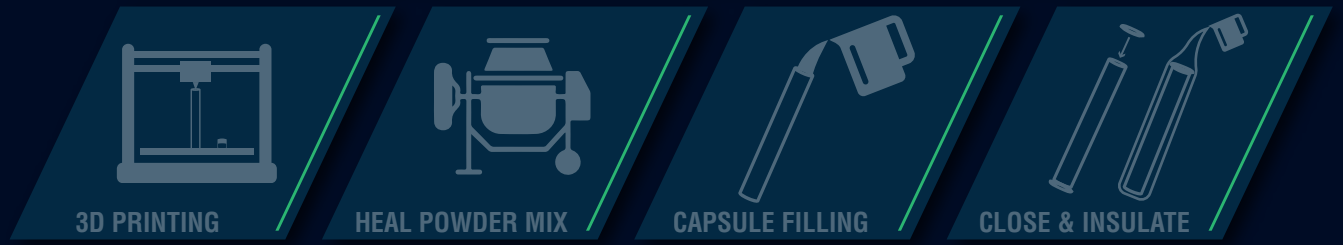
PANZA A. 2022 SELF HEALING VIRTUAL CAPSULES PRODUCTION PROCESS

7 STEPS

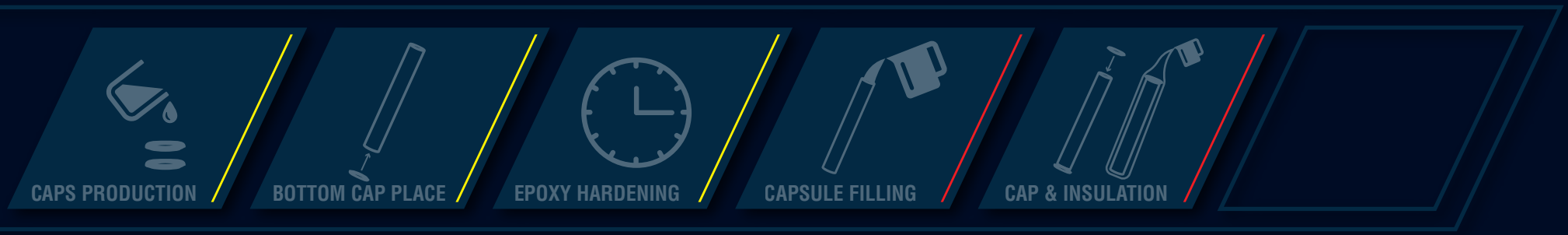


PANZA A. 2022 SELF HEALING 3D PRINTED CAPSULES PRODUCTION PROCESS

4 STEPS




PRIMER LAYER
CAPS PRODUCTION
BOTTOM CAP PLACE
EPOXY HARDENING
CAPSULE FILLING
CAP & INSULATION


CAPS PRODUCTION
BOTTOM CAP PLACE
EPOXY HARDENING
CAPSULE FILLING
CAP & INSULATION


COOLING PERIOD
x4 pcs
DIS-MOLDING
INSULATION

Sustainable criteria evaluation:

The main aim of the self healing field of study is the reduction of impact, emissions, waste generation and non biodegradable materials for construction, by enlarging the lifespan of concrete elements, considering its excellent behavior as an structural material; so it is important to reduce the pollutant materials, embodied energy and emissions associated to self healing capsules (to not produce more negative effects with these solutions than the concrete industry).

Taking into consideration these ideas, and the production processes from the Aamel and Paganelli cement capsules; in both cases the presence of oil derivate epoxy resins and primers is notable to make functional containers (this conforms the internal coating, external waterproofing, and both caps).

The container is made of cement, that require the clinker production using kilns at very high temperatures, and extraction of minerals form natural formations. The healing agent is composed of polyurethane (again oil derivate products and hardly biodegradable).

Also, all of the products used in these processes are health hazardous, toxic or requires to be manipulated following strict personal protection rules and equipment.

PLA 3D printed capsules sustainable criteria:

In the case of the capsules developed on this research, these are made of PLA, a polymer made of food wastes and recycled organic substances, that is biodegradable without the necessity of enzymes or catalysts (as explained in the section 2.2.2.1); this material is used on a 3D printer, where can be produced in any part of the world without requiring specialized personal.

From the 7 total materials, 5 of them (that are PLA, sodium polyacrylate, sodium bicarbonate, malic acid, and tartaric acid) are non toxic and biodegradable; some of this even at alimentary degree, it can be consumed or manipulated by a person without risks of toxicity or health hazard.

In the case of cement and the epoxy resin that are still necessary for these type of capsules, the amount of them (respect to the external researches mentioned) has been reduced, also the resin could be changed for biodegradable polymers in future researches.

For these reasons, the environmental impact in this case can be notably reduced, with a lower dependence of oil derivate resources and mineral extracted from nature.

Virtual capsules sustainable criteria:

In the case of virtual capsules, these are again produced with the same non oil derivate products as PLA capsules (with the exception of PLA for sure), and has been also removed the necessity of producing a container, replacing it with a re—usable bamboo mold, that is still a natural biodegradable material from a fast growing or considered plague vegetal specie, so in a controlled production of this material, non deforestation is required.

The use of these molds can save around 40 PLA containers by bamboo piece used, or even more, and the baking paper for its dis—molding is perfectly biodegradable, even more after being heated.

The propylene glycol used for making the cement paste is non toxic, can be manipulated without very strict personal protection protocols, is easily evaporating, and the gas emissions released are water vapors, so the air pollution impact is very low, and the inhalation of these gases is barely or not dangerous.

Again, here he epoxy resins has been reduced, and the cement consumption is lower than the external researches presented; also, has been demonstrated in the experiment 2 section that this capsule presented an excellent fissure sealing effect to avoid the water passage.



CEMENT POWDER | POLYURETHANE | LIQUID PRIMER | EPOXY RESIN

CEMENT - PU - EPOXY CAPSULES

Reduced Amount

CEMENT POWDER | Na POLY-ACRILATE | MALIC ACID | TARTARIC ACID | Na BICAR-BONATE | BAMBOO PIECES | PROPYLE-NEGLYCOL | Reduced Amount EPOXY RESIN



VIRTUAL - POWDER - CAPSULES



Reduced Amount CEMENT POWDER | Na POLY-ACRILATE | MALIC ACID | TARTARIC ACID | Na BICAR-BONATE | PLA POLYMER | Reduced Amount EPOXY RESIN

3D PRINTED POWDER CAPSULES

As seen in the entire process, these type of powder healing capsules are made of substances that require water to be activated (but also, are made to stop the water flow into the concrete structures), so the ambit of application must be related to concrete elements in contact with this liquid.

One possible case could be the concrete roofing surfaces, that in countries as Venezuela, which constructions are mainly developed using this material; and also presents long rainy periods (with buildings drains obstruction); water tent to accumulate in these areas, permeating concrete pores and small fissures until reaching the steel reinforcement, (producing oxidation and other effects; also, by leaving the fissures opened, vegetal species can accumulate and develop roosts thats keeps on increasing the crack size) producing in very few time an important deterioration of these structures.

Other cases could be in lakes bridges columns foundations, that are normally in contact with water and are very difficult for maintenance and inspection in case of cracks. Even when are made using waterproofing admixtures, fisures are produced anyway (as explained in the section 1.2.2).

Vibrations and other efforts could produce them, and could be very helpful to have self healing capsules to contain the water damage and give time for inspection and corrective maintenance.

Images extracted from:
-Reyes, I and Efecto Tocuyo, 2021. La UCV resiste entre filtraciones de agua y abandono. [image] Available at: <https://efectococuyo.com/la-humanidad/la-ucv-resiste-entre-filtraciones-de-agua-y-abandono/> [Accessed 31 January 2022].



Images of roofs affected by water filtration compromising the structural resistance in the UCV, Caracas, Venezuela (Reyes, I and Efecto Tocuyo, 2021)

As shown in the following figure, moisture and water effects are some of the main responsible for producing soil setting, originating structural failures and fissuring, exposing steel to external conditions.

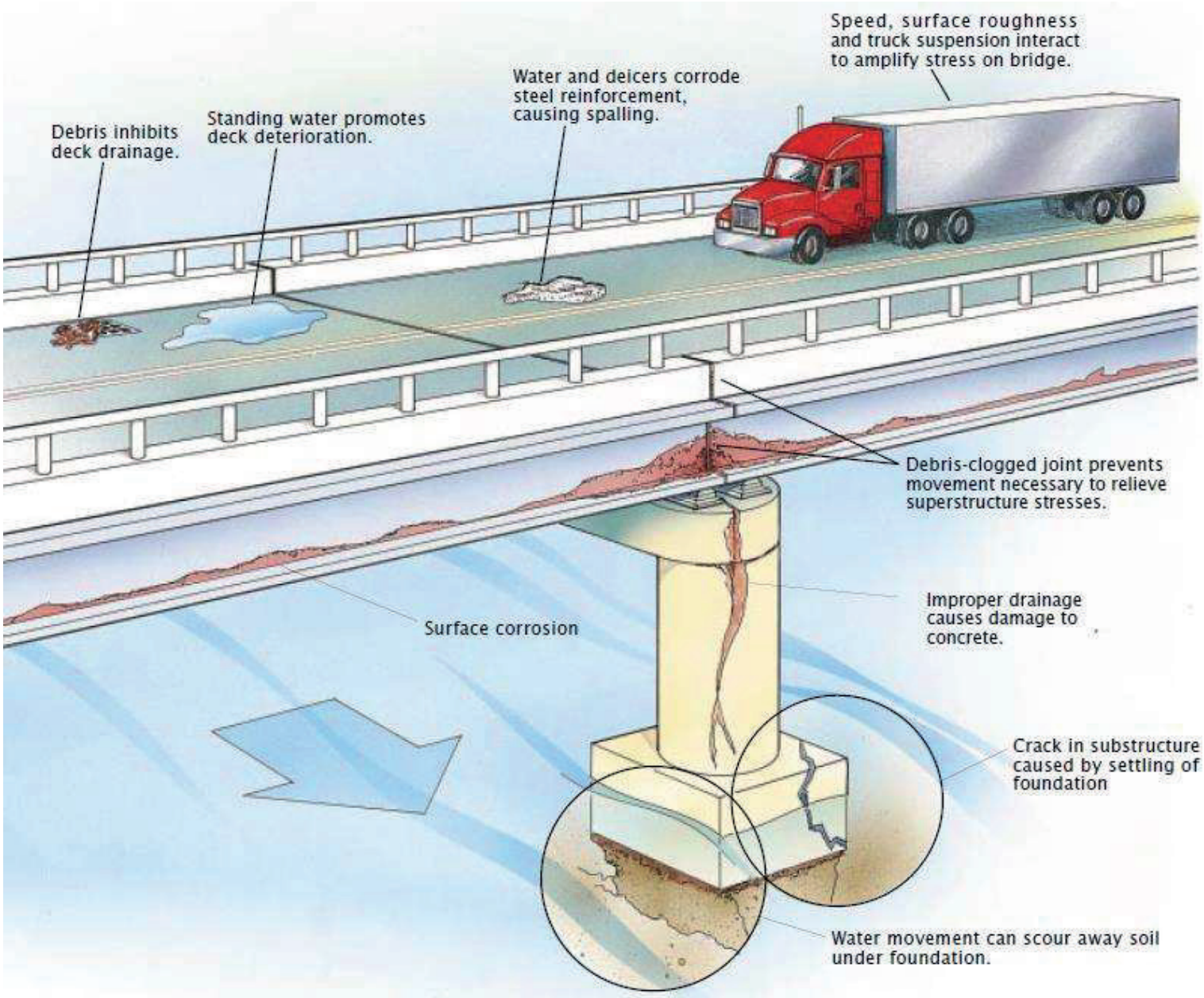
Another possible use are the water tanks, artificial ponds, basement retaining walls and foundations located in soils with high phreatic (or groundwater levels), where important amounts of moisture can be found, affecting regularly these structures with important difficulties for its maintenance considering is underground and normally non visitable.

For the application of this technique, could be done attaching the capsules to a plastic mesh that can be introduced in concrete form—works, at the most external position from the steel reinforcement core of the structural element, so the capsules could be maintained on its position, and concrete can be placed or vibrated without the problem of affecting the capsule's location.

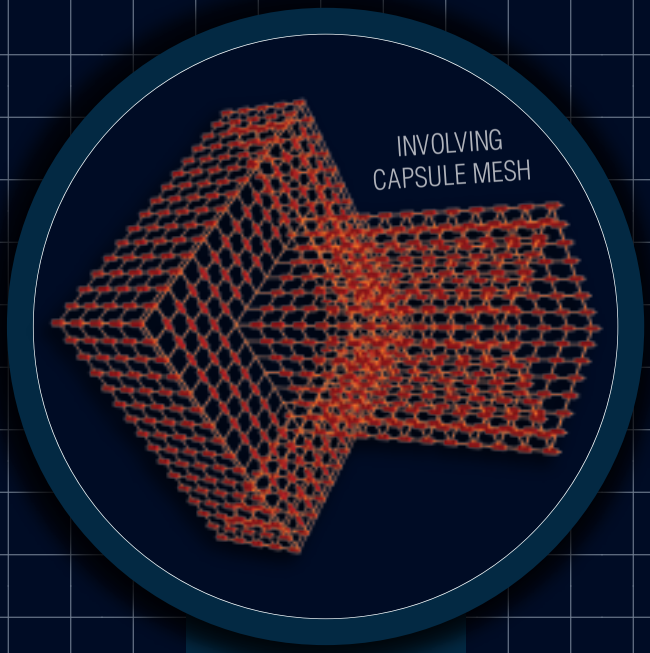
By being in the most external points, always leaving space for the finished layer of concrete, when fissures are formed, the material has enough margin for the capsule activation and healing effect development before contacting the water with the steel.

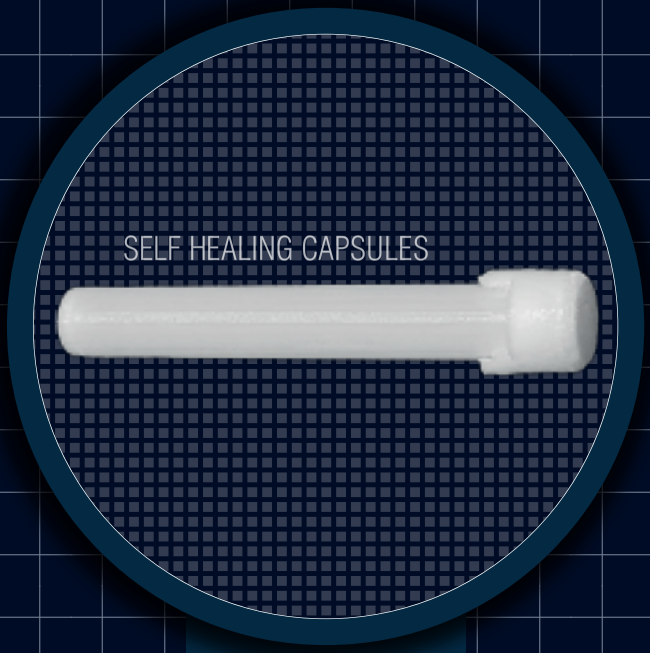
In the case of water pressure in lakes and ponds, this could be an advantage for the powder capsules, due to the positive pressure of the liquid that could hydrate the entire mixture and allow the minerals generation and correct polyacrylate size increase for blocking it.

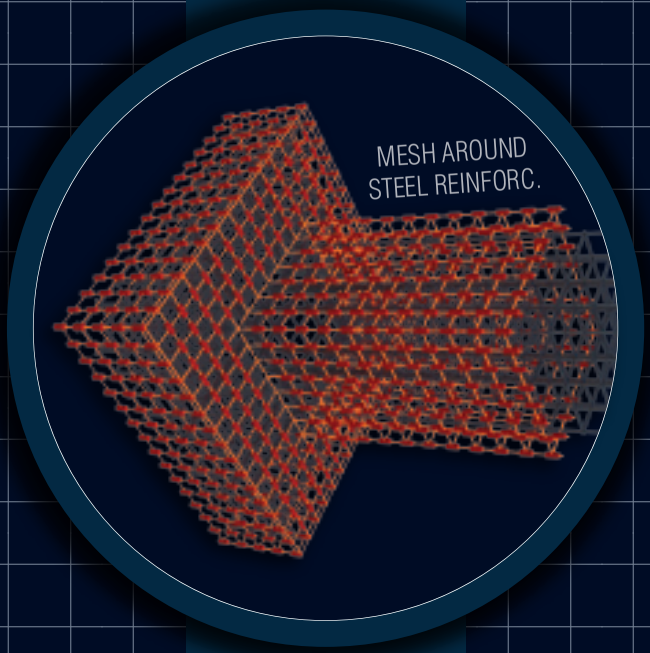
Images extracted from:
-Wibowo, H. and Sritharan, S., 2018. Use of Ultra-High-Performance Concrete for Bridge Deck Overlays. [ebook] Iowa, USA: Iowa State University, p.17. Available at: <http://publications.iowa.gov/27040/1/TR-683%20Final%20Report%20Use%20of%20Ultra-High-Performance%20Concrete%20for%20Bridge%20Deck%20Overlays.pdf> [Accessed 31 January 2022].

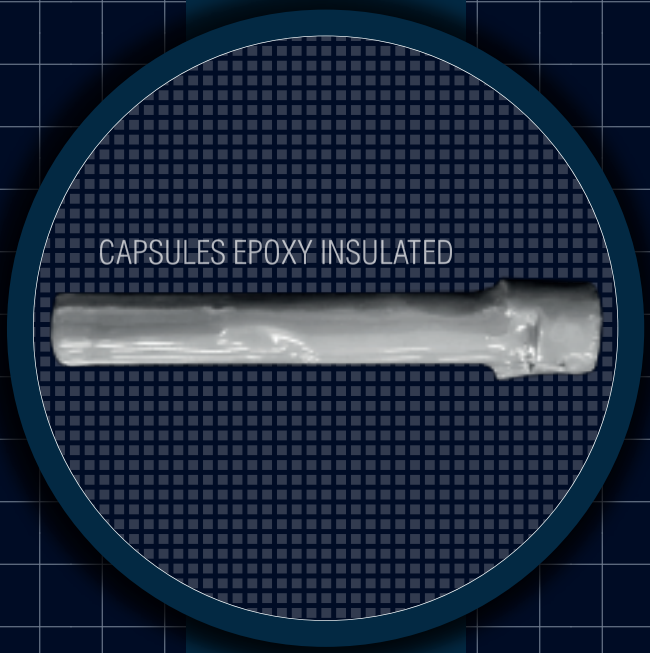


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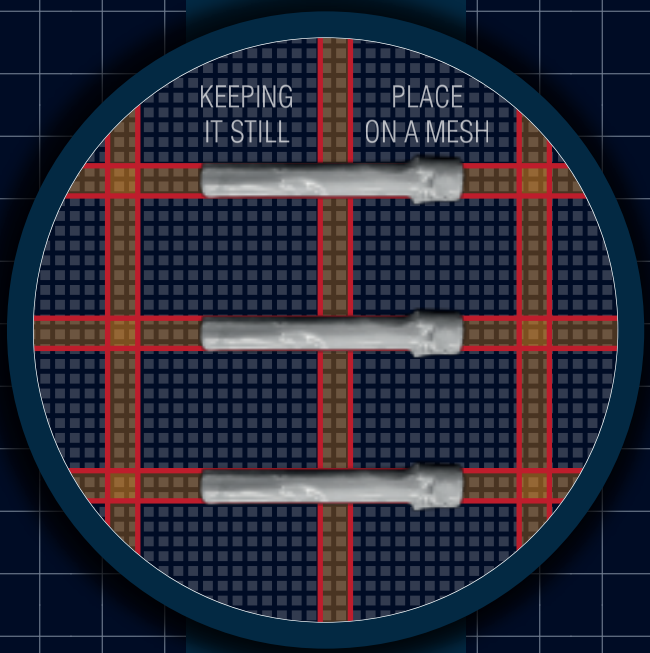

INVOLVING
CAPSULE MESH


SELF HEALING CAPSULES


MESH AROUND
STEEL REINFORC.


CAPSULES EPOXY INSULATED


FINAL
STRUCTURE


KEEPING
IT STILL
PLACE
ON A MESH

POSSIBLE APPLICATION IN HARD MAINTENANCE STRUCTURES

In this research has been shown the entire process for the production of feasible capsules with the use of 3D printing techniques, and the development of a powder healing agent as an alternative to the liquid less lasting components used nowadays; as seen in the results, the potential of these capsules is very interesting for this field of study; for sure, further studies are required, but this initial information obtained, crates new possibilities; also, has been done an effort for a more sustainable production of these capsules, as a contribution to the reduction in the environmental impact.

It is important to mention some other possible alternatives for developing other classes of powder, to be investigated further in future researches:

Sodium Per-carbonate and citric acid for capsules in water containing organic matter:

For the cases where the concrete is exposed to water with an important amount of organic mater, the use of Sodium Per—carbonate could produce hydrogen peroxide, that could reduce the effect of it in the normal cement reaction; also, by reacting with citric acid, produces again the effervescence effect, substituting the combination of malic acid, tartaric acid and sodium bicarbonate from this research powder mix.

Calcium chloride addition to capture air humidity and not depend on direct water action:

One of the possible interrogants lefts is, what could be the powder solution for capsules in concrete that are not directly in contact with water; in this case, a possible solution is the addition of Calcium Chloride into the powder mix, due to the excellent capacity of this substance to capture the environmental humidity to the point of presenting a liquid state due to water accumulation; this water can be used to activate the rest of the components and proceed to its normal functioning. It is important to study the possible alterations that calcium chloride could do to cement reaction and concrete.

Use of Luminescent powder for facilitating the visual detection of capsules activations:

As these capsules are also designed to be placed on difficult maintenance areas, such as foundations and underwater structures; it could be useful to include this type of luminescent pigments that normally presents some light emittance cells that load when exposed to environmental light; when capsules are activated, the ejection of these powders due to positive pressure or water currents could occur, spreading them over the surface if the structure, and be highlighted due to its luminescence effect, so it could be easily seen during a preventive maintenance or inspection, to correct the problem and evaluate the sealing effect to protect the steel reinforcement.

6

ANNEXES

CarboStop U

Monocomponente!
Pronto all'uso senza miscelazione

Descrizione

Resina poliuretanica monocomponente, reattiva all´acqua, esente da CFC e plastificanti. Pronta all'uso senza miscelazione.
Viene utilizzato per:

- blocco di trasudamenti d'acqua, anche marina, in fessure
- sigillatura in galleria
- consolidamento di sabbia ghiaiosa
- sigillatura di fori

Applicabile a temperature ambiente comprese tra 0 e 40 °C.
CarboStop U è approvato sulla base della normativa tedesca ZTV-RISS come presigillante per la sigillatura di strutture in calcestruzzo.

Caratteristiche Tecniche

I dati di seguito elencati sono relativi a valori ottenuti in laboratorio in reazione non contrastata. Nella messa in opera in cantiere essi possono subire variazioni dovute a scambi di calore fra la resina e l´ambiente circostante, in funzione delle caratteristiche della roccia o del terreno, dell´umidità, della pressione e di altri fattori.

Dati dei Componenti

		CarboStop U
Densità a 25 °C	kg/m³	1100 -1140
Colore		marrone
Punto di Infiammabilità	°C	> 100
Viscosità a 5 °C	mPa*s	2500 - 6000
Viscosità a 10 °C	mPa*s	1900 - 4500
Viscosità a 15 °C	mPa*s	1100 - 2500
Viscosità a 25 °C	mPa*s	270 - 1000

Dati della miscela

Temperatura	5 °C	10 °C	15 °C	20 °C	25 °C	
Inizio	27”	26”	24”	22”	20”	± 5”
Fine	4’20”	3’20”	2’50”	2’20’’	2’00”	± 15”
Fattore di schiumatura	30 - 60				30 - 50	

La reazione avviene con l'aggiunta del 10% di acqua alla miscela appena preparata
Se necessario la reazione può essere accelerata con CarboAdd X.

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CarboStop U

Composizione e Caratteristiche

Componenti

CarboStop U è composto da isocianati modificati con plastificanti e additivi.

Sistema

CarboStop U reagisce a contatto con l'acqua creando una schiuma poliuretanica/poliurea. Il tasso di espansione della schiuma dipende in primo luogo dalla pressione di ritorno provocata dalla propagazione della resina nella struttura da sigillare, perciò fessure ampie o ghiaia daranno luogo a un elevato fattore di schiumatura, mentre fessure strette o sabbia fine daranno luogo a un basso fattore di espansione e ad un'elevata resistenza meccanica.

Prodotto Finale

CarboStop U ferma venute d'acqua e fornisce una sigillatura temporanea, che spesso è sufficiente per la sigillatura di scavi durante i lavori di costruzione. CarboStop U è usato anche come presigillante secondo la normativa tedesca ZTV-ING (sigillatura e giuntura estendibile di fessure in cemento armato). Dopo l'iniezione di CarboStop U, iniettare CarboCrackSeal H nella schiuma non ancora completamente indurita. 2,3

Il CarboStop U indurito non si restringe né si gonfia a contatto con l'acqua.

CarboStop U è stato testato in merito alla compatibilità con acqua di falda secondo le direttive ufficiali dell'Istituto Tedesco per la Tecnologia di Costruzione (DIBt); è stata rilevata solo una minima alterazione della qualità dell'acqua.[1]

Messa in opera

CarboStop U reagisce a contatto con l'acqua. È quindi possibile che si formi una pellicola sulla superficie del liquido a causa della reazione con l'umidità presente nell'aria; questo, tuttavia, non ha nessuna influenza negativa sulla pompabilità della miscela stessa.

La miscela CarboStop/CarboAdd viene convogliata analogamente a un materiale monocomponente, con pompa a mano o meccanica, e iniettata tramite packer all´interno della zona da trattare. La miscela aumenta di volume (schiumatura) al contatto con l´acqua e indurisce.

Nel caso all´interno della zona iniettata non esistesse acqua in quantità sufficiente, questa può essere immessa posteriormente all´iniezione del CarboStop/CarboAdd. Contrariamente ai sistemi bicomponenti, CarboStop U non indurisce all´interno dei tubi di caricamento una volta che la sua reazione dipende dal contatto con l´acqua nella zona iniettata.

Subito dopo il termine dell'attività di iniezione sciacquare la pompa con CarboSolv D, per prevenire la formazione di ostruzioni. In seguito a periodi di pausa della durata superiore a un giorno, riempire la pompa con CarboSolv S.

Avvertenze

Prima della messa in opera si raccomanda di conservare i prodotti per almeno 12 ore ad una temperatura minima di 15°C, in modo da ottenere la temperatura di lavorazione ideale (fra 15 e 30 °C). Nel riscaldare evitare assolutamente l'impiego di fiamma diretta sui contenitori.

Indicazioni di Sicurezza e Manipolazione per l'Impiego di CarboStop U

Osservare le regole generali di sicurezza mentre si manipolano i prodotti chimici.

CarboStop U

CarboStop U
Simbolo: Xn (nocivo).
R20 Nocivo per inalazione. R36/37/38 Irritante per gli occhi, le vie respiratorie e la pelle. R42/43 Può provocare sensibilizzazione per inalazione e contatto con la pelle. R48/20 Nocivo: pericolo di gravi danni alla salute in caso di esposizione prolungata per inalazione.
S9 Conservare il recipiente in luogo ben ventilato. S23 Non respirare i fumi/aerosol. S26 In caso di contatto con gli occhi, lavare immediatamene e abbondantemente con acqua e consultare il medico. S36/37 Usare indumenti protettivi e guanti adatti. S45 In caso di incidente o di malessere consultare immediatamente il medico. S60 Questo materiale e il suo contenitore devono essere smaltiti come rifiuti pericolosi.
Z1 Contiene isocianati: vedi informazioni fornite dal produttore

Ulteriori informazioni sulle schede di sicurezza fornite dl produttore.

Imballi
5,5 kg in latte metalliche
22 kg in latte metalliche

Altri imballi su richiesta.

Stoccaggio e Conservazione
Almeno 6 mesi dalla data di consegna o 12 mesi dalla data di produzione se conservati in ambiento asciutto fra 10 °C e 30 °C. In questo periodo è possibile che la viscosità aumenti di circa 100%; questo non influisce sulla messa in funzione del prodotto. Le condizioni legali di stoccaggio devono essere osservate. Nell'impiego di prodotti stoccati a lungo, prima della messa in opera, si consiglia di verificare presso la Minova CarboTech le effettive caratteristiche del prodotto come da specifica.

Smaltimento
Vedere le normative locali. I prodotti liquidi possono essere smaltiti presso un impianto inceneritore (codice UE 080501).
Il CarboStop U indurito può essere smaltito come rifiuto urbano (codice UE 200139).

Certificazioni Disponibili
1. Valutazione d'igiene nel rispetto dell'acqua di falda (Istituto di Igiene, Gelsenkirchen, 2006)
2. Relazione su iniezioni di CarboCrackSeal H / CarboStop U in base alla normativa ZTV-RISS (Institut für Massivbau, Essen, 2003)
3. Certificato di conformità Ü-399 (ibac Aachen, 2011)
4. Numero di registrazione KR07-887 (Registro dei prodotti, Svezia 2008)
5. Certificato conforme alle direttive KTW (LADR GmbH, 2010)

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CarboStop U

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2.2.2.2.1 Final Gcode for 3D Printing

[profile]
layer_height = 0.095
wall_thickness = 0.8
retraction_enable = True
solid_layer_thickness = .2
fill_density = 15
print_speed = 10
print_temperature = 220
print_temperature2 = 0
print_temperature3 = 0
print_temperature4 = 0
print_temperature5 = 0
print_bed_temperature = 60
support = None
platform_adhesion = None
support_dual_extrusion = Both
wipe_tower = False
wipe_tower_volume = 15
ooze_shield = False
filament_diameter = 1.75
filament_diameter2 = 0
filament_diameter3 = 0
filament_diameter4 = 0
filament_diameter5 = 0
filament_flow = 100.0
nozzle_size = 0.1
retraction_speed = 60
retraction_amount = 6.0
retraction_dual_amount = 16.5
retraction_min_travel = 1.5
retraction_combing = No Skin
retraction_minimal_extrusion = 0.02
retraction_hop = 0.0075
bottom_thickness = 0.3
layer0_width_factor = 130
object_sink = 0.0
overlap_dual = 0.15
travel_speed = 60
bottom_layer_speed = 30
infill_speed = 0.1
solidarea_speed = 30
inset0_speed = 10
insetx_speed = 10
cool_min_layer_time = 3
fan_enabled = True
skirt_line_count = 1
skirt_gap = 3.0
skirt_minimal_length = 150.0
fan_full_height = 0.5
fan_speed = 100
fan_speed_max = 100
cool_min_feedrate = 10
cool_head_lift = False
solid_top = True
solid_bottom = True
fill_overlap = 1
perimeter_before_infill = True
support_type = Grid
support_angle = 60
support_fill_rate = 30
support_xy_distance = 0.5
support_z_distance = 0.15
spiralize = False
simple_mode = False
brim_line_count = 20
raft_margin = 5.0
raft_line_spacing = 3.0
raft_base_thickness = 0.3
raft_base_linewidth = 1.0
raft_interface_thickness = 0.27
raft_interface_linewidth = 0.4
raft_airgap_all = 0.0
raft_airgap = 0.22
raft_surface_layers = 2
raft_surface_thickness = 0.27
raft_surface_linewidth = 0.4
fix_horrible_union_all_type_a = True
fix_horrible_union_all_type_b = False

```
fix_horrible_use_open_bits = False
fix_horrible_extensive_stitching = True
plugin_config =
object_center_x = -1
object_center_y = -1

[alterations]
start.gcode = ;Sliced at: {day} {date} {time}
        ;Basic settings: Layer height: {layer_height} Walls: {wall_thickness} Fill: {fill_density}
        ;Print time: {print_time}
        ;Filament used: {filament_amount}m {filament_weight}g
        ;Filament cost: {filament_cost}
        ;M190 S{print_bed_temperature} ;Uncomment to add your own bed temperature line
        ;M109 S{print_temperature} ;Uncomment to add your own temperature line
        G21        ;metric values
        G90        ;absolute positioning
        M82        ;set extruder to absolute mode
        M107       ;start with the fan off
        G28 X0 Y0  ;move X/Y to min endstops
        G28 Z0     ;move Z to min endstops
        G1 Z15.0 F{travel_speed} ;move the platform down 15mm
        G92 E0                   ;zero the extruded length
        G1 F200 E3               ;extrude 3mm of feed stock
        G92 E0                   ;zero the extruded length again
        G1 F{travel_speed}
        ;Put printing message on LCD screen
        M117 Printing...
end.gcode = ;End GCode
        M104 S0                  ;extruder heater off
        M140 S0                  ;heated bed heater off (if you have it)
        G91                      ;relative positioning
        G1 E-1 F300              ;retract the filament a bit before lifting the nozzle, to release some of the pressure
        G1 Z+0.5 E-5 X-20 Y-20 F{travel_speed} ;move Z up a bit and retract filament even more
        G28 X0 Y0                ;move X/Y to min endstops, so the head is out of the way
        M84                      ;steppers off
        G90                      ;absolute positioning
        ;{profile_string}
start2.gcode = ;Sliced at: {day} {date} {time}
        ;Basic settings: Layer height: {layer_height} Walls: {wall_thickness} Fill: {fill_density}
        ;Print time: {print_time}
        ;Filament used: {filament_amount}m {filament_weight}g
        ;Filament cost: {filament_cost}
        ;M190 S{print_bed_temperature} ;Uncomment to add your own bed temperature line
        ;M104 S{print_temperature} ;Uncomment to add your own temperature line
        ;M109 T1 S{print_temperature2} ;Uncomment to add your own temperature line
        ;M109 T0 S{print_temperature} ;Uncomment to add your own temperature line
        G21        ;metric values
        G90        ;absolute positioning
        M107       ;start with the fan off
        G28 X0 Y0  ;move X/Y to min endstops
        G28 Z0     ;move Z to min endstops
        G1 Z15.0 F{travel_speed} ;move the platform down 15mm
        T1                       ;Switch to the 2nd extruder
        G92 E0                   ;zero the extruded length
        G1 F200 E10              ;extrude 10mm of feed stock
        G92 E0                   ;zero the extruded length again
        G1 F200 E-{retraction_dual_amount}
        T0                       ;Switch to the first extruder
        G92 E0                   ;zero the extruded length
        G1 F200 E10              ;extrude 10mm of feed stock
        G92 E0                   ;zero the extruded length again
        G1 F{travel_speed}
        ;Put printing message on LCD screen
        M117 Printing...
end2.gcode = ;End GCode
        M104 T0 S0               ;extruder heater off
        M104 T1 S0               ;extruder heater off
```

```
        M140 S0                 ;heated bed heater off (if you have it)
        G91                     ;relative positioning
        G1 E-1 F300             ;retract the filament a bit before lifting the
nozzle, to release some of the pressure
        G1 Z+0.5 E-5 X-20 Y-20 F{travel_speed} ;move Z up a bit and retract
filament even more
        G28 X0 Y0               ;move X/Y to min endstops, so the head is out
of the way
        M84                     ;steppers off
        G90                     ;absolute positioning
        ;{profile_string}
start3.gcode = ;Sliced at: {day} {date} {time}
        ;Basic settings: Layer height: {layer_height} Walls: {wall_thickness} Fill:
{fill_density}
        ;Print time: {print_time}
        ;Filament used: {filament_amount}m {filament_weight}g
        ;Filament cost: {filament_cost}
        ;M190 S{print_bed_temperature} ;Uncomment to add your own bed
temperature line
        ;M104 S{print_temperature} ;Uncomment to add your own temperature
line
        ;M109 T1 S{print_temperature2} ;Uncomment to add your own temperature
line
        ;M109 T0 S{print_temperature} ;Uncomment to add your own temperature
line
        G21       ;metric values
        G90       ;absolute positioning
        M107      ;start with the fan off
        G28 X0 Y0  ;move X/Y to min endstops
        G28 Z0     ;move Z to min endstops
        G1 Z15.0 F{travel_speed} ;move the platform down 15mm
        T2                  ;Switch to the 3rd extruder
        G92 E0              ;zero the extruded length
        G1 F200 E10         ;extrude 10mm of feed stock
        G92 E0              ;zero the extruded length again
        G1 F200 E-{retraction_dual_amount}
        T1                  ;Switch to the 2nd extruder
        G92 E0              ;zero the extruded length
        G1 F200 E10         ;extrude 10mm of feed stock
        G92 E0              ;zero the extruded length again
        G1 F200 E-{retraction_dual_amount}
        T0                  ;Switch to the first extruder
        G92 E0              ;zero the extruded length
        G1 F200 E10         ;extrude 10mm of feed stock
        G92 E0              ;zero the extruded length again
        G1 F{travel_speed}
        ;Put printing message on LCD screen
        M117 Printing...
end3.gcode = ;End GCode
        M104 T0 S0              ;extruder heater off
        M104 T1 S0              ;extruder heater off
        M104 T2 S0              ;extruder heater off
        M140 S0                 ;heated bed heater off (if you have it)
        G91                     ;relative positioning
        G1 E-1 F300             ;retract the filament a bit before lifting the
nozzle, to release some of the pressure
        G1 Z+0.5 E-5 X-20 Y-20 F{travel_speed} ;move Z up a bit and retract
filament even more
        G28 X0 Y0               ;move X/Y to min endstops, so the head is out
of the way
        M84                     ;steppers off
        G90                     ;absolute positioning
        ;{profile_string}
start4.gcode = ;Sliced at: {day} {date} {time}
        ;Basic settings: Layer height: {layer_height} Walls: {wall_thickness} Fill:
{fill_density}
        ;Print time: {print_time}
        ;Filament used: {filament_amount}m {filament_weight}g
        ;Filament cost: {filament_cost}
        ;M190 S{print_bed_temperature} ;Uncomment to add your own bed
temperature line
        ;M104 S{print_temperature} ;Uncomment to add your own temperature
line
        ;M109 T2 S{print_temperature2} ;Uncomment to add your own temperature
line
        ;M109 T1 S{print_temperature2} ;Uncomment to add your own temperature
line
        ;M109 T0 S{print_temperature} ;Uncomment to add your own temperature
line
        G21       ;metric values
        G90       ;absolute positioning
        M107      ;start with the fan off
        G28 X0 Y0  ;move X/Y to min endstops
        G28 Z0     ;move Z to min endstops
```

```
        G1 Z15.0 F{travel_speed} ;move the platform down 15mm
        T3                  ;Switch to the 4th extruder
        G92 E0                ;zero the extruded length
        G1 F200 E10             ;extrude 10mm of feed stock
        G92 E0                ;zero the extruded length again
        G1 F200 E-{retraction_dual_amount}
        T2                  ;Switch to the 3rd extruder
        G92 E0                ;zero the extruded length
        G1 F200 E10             ;extrude 10mm of feed stock
        G92 E0                ;zero the extruded length again
        G1 F200 E-{retraction_dual_amount}
        T1                  ;Switch to the 2nd extruder
        G92 E0                ;zero the extruded length
        G1 F200 E10             ;extrude 10mm of feed stock
        G92 E0                ;zero the extruded length again
        G1 F200 E-{retraction_dual_amount}
        T0                  ;Switch to the first extruder
        G92 E0                ;zero the extruded length
        G1 F200 E10             ;extrude 10mm of feed stock
        G92 E0                ;zero the extruded length again
        G1 F{travel_speed}
        ;Put printing message on LCD screen
        M117 Printing...
end4.gcode = ;End GCode
        M104 T0 S0                  ;extruder heater off
        M104 T1 S0                  ;extruder heater off
        M104 T2 S0                  ;extruder heater off
        M104 T3 S0                  ;extruder heater off
        M140 S0                 ;heated bed heater off (if you have it)
        G91                         ;relative positioning
        G1 E-1 F300                         ;retract the filament a bit before lifting the
nozzle, to release some of the pressure
        G1 Z+0.5 E-5 X-20 Y-20 F{travel_speed} ;move Z up a bit and retract
filament even more
        G28 X0 Y0                       ;move X/Y to min endstops, so the head is out
of the way
        M84                 ;steppers off
        G90                 ;absolute positioning
        ;{profile_string}
support_start.gcode =
support_end.gcode =
cool_start.gcode =
cool_end.gcode =
replace.csv =
preswitchextruder.gcode = ;Switch between the current extruder and the next
extruder, when printing with multiple extruders.
        ;This code is added before the T(n)
postswitchextruder.gcode = ;Switch between the current extruder and the next
extruder, when printing with multiple extruders.
        ;This code is added after the T(n)
```

3.3.1.1.A RASSASIE RAPID CEMENT

Technical data for Rassasie "cemento rapido" the rapid cement used for the powder healing agent mixture design.

RASSASIE. Codice Fiscale: 00627720378. Partita Iva: 00519761209, 2021. SCHEDA TECNICA Prodotto : CEMENTO RAPIDO. [online] Bologna, Italy. Available at: <https://www.rassasie.com/prodotti/cementi/cemento-rapido.html> [Accessed 10 November 2021].

RASSASIE. Codice Fiscale: 00627720378. Partita Iva: 00519761209, 2021. Scheda di sicurezza del 25/11/2019, revisione 3. [online] Bologna, Italy. Available at: <https://www.rassasie.com/prodotti/cementi/cemento-rapido.html> [Accessed 10 November 2021].

RASSASIE S.R.L.
Via A. Labriola, 4
40010 Sala Bolognese (Bo)
Codice Fiscale: 00627720378
Partita Iva: 00519761209

SCHEDA TECNICA

Prodotto : CEMENTO RAPIDO

CARATTERISTICHE TECNICHE: Il cemento rapido e' una miscela di cementi grigi, inerti quarziferi e additivi speciali in grado di sviluppare resistenze meccaniche elevate in intervalli di tempo molto brevi e con minimi ritiri.

CAMPI DI APPLICAZIONE:

- Bloccaggio senza armature di telai, infissi, pali, tubazioni, prese e cavi elettrici all'interno e all'esterno;
- Rapide riparazioni di murature degradate;
- Stuccatura di fessure o crepe negli intonaci;
- Come accellerante di presa per le normali malte di cantiere quando c'e' pericolo di gelo.

MODALITA' D'USO E CONTROINDICAZIONI: pulire la superficie d'aggancio da eventuali detriti mal fissati ed eliminare per quanto possibile corpi autoadesivi; bagnare leggermente e uniformemente le parti polverose.

PREPARAZIONE DELL'IMPASTO: Mescolare il cemento rapido con 23-25% di acqua fresca e pulita calcolato il peso sulla polvere, avendo cura di versare sempre la polvere in acqua e non il contrario, fino ad ottenere una pasta priva di grumi. Si consiglia di impastare la quantita' di prodotto che si e' certi di utilizzare nei 2-3 minuti successivi in quanto, una volta cominciata la presa, il prodotto non e' piu' utilizzabile.

APPLICAZIONE: applicare il prodotto con cazzuola da muratore o spatola liscia metallica; dopo la presa lisciare la superficie con gommapiuma umida, come per un normale intonaco cementizio. In presenza di temperature molto elevate, bagnare il prodotto nei primi minuti dopo la presa.

PULIZIA: la pulizia degli attrezzi e delle mani va effettuata con acqua abbondante, non appena possibile.

FORNITURA

- Sacchi e/o scatole da Kg. 5
- Scatole da Kg. 1

DATI TECNICI DEL PRODOTTO:

Consistenza:	molto pastoso
Colore:	grigio
Conservazione:	15 mesi in luogo fresco e asciutto in assenza di ventilazione ad imballo integro.
Infiammabilita'	NO
Rapporto d'impasto	23-25 parti d'acqua con 100 parti di polvere
Temperatura di applicazione	da +5° a +35°
Tempo di vita dell'impasto (Pot life)	2 minuti
Tempo aperto a 23° e 50% di umidita'	20 minuti
PRESTAZIONI FINALI	
Resistenza alla compressione a 15 minuti	6 N/mm^2
Resistenza alla compressione a 1 ora	9 N/mm^2
Resistenza alla compressione a 3 ore	15 N/mm^2
Resistenza alla compressione a 3 giorni	25 N/mm^2
Resistenza alla compressione a 28 gg.	40,5 N/mm^2
Resistenza alla temperatura	da -30°C a +90°C

N.B. i dati e le informazioni contenuti in questa scheda, dettati dalla nostra migliore esperienza, sono puramente indicativi e devono essere verificati dall'utilizzatore del prodotto che si assume comunque tutte le responsabilita' derivanti dall'uso.

Data di revisione: 11/09/2017

Scheda di sicurezza del 25/11/2019, revisione 3

SEZIONE 1: identificazione della sostanza/miscela e della società/impresa

1.1. Identificatore del prodotto

Identificazione della miscela:

Nome commerciale: CEMENTO RAPIDO

Codice commerciale: XXXXX

1.2. Usi identificati pertinenti della sostanza o della miscela e usi sconsigliati

Uso raccomandato:

Legante idraulico a presa ultrarapida.

USO CONSUMATORE

USO PROFESSIONALE

Usi sconsigliati:

Non utilizzare per usi diversi da quelli indicati.

1.3. Informazioni sul fornitore della scheda di dati di sicurezza

Fornitore:

Rassasie S.r.l.

Via Labriola, 4

40010 Sala Bolognese (BO) – ITALIA

Tel. 051 6814417 - Fax 0516814620

Persona competente responsabile della scheda di sicurezza:

info@rassasie.com

1.4. Numero telefonico di emergenza

Per informazioni urgenti (h24) rivolgersi ai seguenti Centri Antiveleni (CAV):

Ospedale Niguarda Ca' Granda di Milano Tel. +39 02 66101029.

Ospedale Pediatrico Bambino Gesù di Roma Tel. +39 06 68593726

Az. Osp. Univ. Di Foggia Tel. +39 0881 732326

Az. Osp. A. Cardarelli di Napoli Tel. +39 081 7472870

Policlinico Umberto I di Roma Tel. +39 06 49978000

Policlinico A. Gemelli di Roma Tel. +39 06 3054343

Az. Osp. Careggi U.O. Tossicologia Medica di Firenze Tel. +39 055 7947819

Centro Nazionale di Informazione Tossicologica di Pavia Tel. +39 0382 24444

Azienda Ospedaliera Papa Giovanni XXII di Bergamo Tel. +39 800883300

SEZIONE 2: identificazione dei pericoli

2.1. Classificazione della sostanza o della miscela

Criteri Regolamento CE 1272/2008 (CLP):

Skin Irrit. 2, H315 Provoca irritazione cutanea.

Eye Dam. 1, H318 Provoca gravi lesioni oculari.

Skin Sens. 1B, H317 Può provocare una reazione allergica cutanea.

STOT SE 3, H335 Può irritare le vie respiratorie.

Effetti fisico-chimici dannosi alla salute umana e all'ambiente:

Nessun altro pericolo

2.2. Elementi dell'etichetta

Pittogrammi di pericolo:



Pericolo

Indicazioni di pericolo:

H315 Provoca irritazione cutanea.

H318 Provoca gravi lesioni oculari.

H317 Può provocare una reazione allergica cutanea.

H335 Può irritare le vie respiratorie.

Consigli di prudenza:

P101 In caso di consultazione di un medico, tenere a disposizione il contenitore o l'etichetta del prodotto.

P102 Tenere fuori dalla portata dei bambini.

P103 Leggere l'etichetta prima dell'uso.

P261 Evitare di respirare la polvere.

P271 Utilizzare soltanto all'aperto o in luogo ben ventilato.

P280 Indossare guanti e indumenti protettivi. Proteggere gli occhi e il viso.

P302+P352 IN CASO DI CONTATTO CON LA PELLE: lavare abbondantemente con acqua e sapone.

P332+P313 In caso di irritazione della pelle: consultare un medico.

P304+P340 IN CASO DI INALAZIONE: trasportare l'infortunato all'aria aperta e mantenerlo a riposo in posizione che favorisca la respirazione.

P312 Contattare un CENTRO ANTIVELENI o un medico in caso di malessere.

P305+P351+P338 IN CASO DI CONTATTO CON GLI OCCHI: sciacquare accuratamente per parecchi minuti. Togliere le eventuali lenti a contatto se è agevole farlo. Continuare a sciacquare.

P310 Contattare immediatamente un CENTRO ANTIVELENI o un medico.

P362+P364 Togliere tutti gli indumenti contaminati e lavarli prima di indossarli nuovamente.

P403+P233 Tenere il recipiente ben chiuso e in luogo ben ventilato.

P405 Conservare sotto chiave.

P501 Smaltire il prodotto/recipiente in conformità alla regolamentazione.

Disposizioni speciali:

Nessuna

Contiene

CLINKER DI CEMENTO PORTLAND

Disposizioni speciali in base all'Allegato XVII del REACH e successivi adeguamenti:

Nessuna

2.3. Altri pericoli

Sostanze vPvB: Nessuna - Sostanze PBT: Nessuna

Altri pericoli:

Il cemento bianco, in presenza di acqua, per esempio nella produzione di calcestruzzo o malta, o quando si bagna, produce una soluzione fortemente alcalina (pH elevato a causa della formazione degli idrossidi di calcio, sodio e potassio).

Il cemento bianco, può irritare gli occhi, le mucose, la gola ed il sistema respiratorio e provocare tosse. L'inalazione ripetuta della polvere di cemento bianco per un lungo periodo di tempo aumenta il rischio di insorgenza di malattie polmonari.

Il contatto ripetuto e prolungato del cemento sulla pelle umida, a causa della traspirazione o dell'umidità, può provocare irritazione e/o dermatiti.

Sia il cemento bianco che i suoi impasti, in caso di contatto prolungato con la pelle, possono provocare sensibilizzazione (a causa della presenza in tracce di sali di cromo VI).

In caso di ingestione significativa, il cemento può provocare ulcerazioni all'apparato digerente.

La miscela ha un basso contenuto di cromati. Nella forma pronta all'uso dopo l'aggiunta di acqua il contenuto di cromo (VI) solubile è al massimo di 2 mg/kg sul secco. Condizione indispensabile per un basso contenuto di cromati è in ogni caso uno stoccaggio corretto, all'asciutto, e rispettando i termini massimi di conservazione previsti.

La percentuale di ossido di silicio cristallino respirabile è inferiore all' 1%. Pertanto il prodotto non è soggetto ad obbligo di identificazione. Tuttavia è consigliabile l'impiego di una protezione delle vie respiratorie.

SEZIONE 3: composizione/informazioni sugli ingredienti

3.1. Sostanze

Non applicabile

3.2. Miscele

Componenti pericolosi ai sensi del Regolamento CLP e relativa classificazione:

Qtà	Nome	Numero d'identif.		Classificazione
50 - 100 %	CALCIO CARBONATO	CAS: EC:	1317-65-3 215-279-6	Sostanza con un limite di esposizione sul posto di lavoro fissato a livello dell'Unione.
25 - 35 %	CLINKER DI CEMENTO PORTLAND	CAS: EC:	65997-15-1 266-043-4	3.2/2 Skin Irrit. 2 H315 3.3/1 Eye Dam. 1 H318 3.4.2/1B Skin Sens. 1B H317 3.8/3 STOT SE 3 H335

3 - 6 %	CALCE IDRATA; CALCIO DIIDROSSIDO	CAS: EC: REACH No.:	1305-62-0 215-137-3 01-2119475151-45	3.2/2 Skin Irrit. 2 H315 3.3/1 Eye Dam. 1 H318 3.8/3 STOT SE 3 H335

SEZIONE 4: misure di primo soccorso

4.1. Descrizione delle misure di primo soccorso

In caso di contatto con la pelle:

Per la miscela asciutta, rimuovere e sciacquare abbondantemente con acqua. Per la miscela bagnata/umida, lavare la pelle con molta acqua e sapone a pH neutro o adeguato detergente leggero. Togliere gli indumenti contaminati, le scarpe, gli occhiali e pulirli completamente prima di riusarli. Consultare un medico in tutti i casi di irritazione o ustione.

In caso di contatto con gli occhi:

Non strofinare gli occhi per evitare possibili danni corneali causati dallo sfregamento. Se presenti, rimuovere le lenti a contatto. Inclinare le testa nella direzione dell'occhio colpito, aprire bene le palpebre e risciacquare con abbondante acqua per almeno 20 minuti per rimuovere tutti i residui. Se possibile, usare acqua isotonica (0.9% NaCl). Contattare uno specialista della medicina del lavoro o un oculista.

In caso di ingestione:

Non provocare assolutamente vomito. Se la persona è cosciente, lavare la bocca con acqua e far bere molta acqua.

RICORRERE IMMEDIATAMENTE A VISITA MEDICA.

In caso di inalazione:

Portare la persona all'aria aperta. La polvere in gola e nelle narici dovrebbe pulirsi naturalmente. Contattare un medico se persiste l'irritazione, o se si manifesta più avanti o se si hanno fastidi, tosse o persistono altri sintomi.

4.2. Principali sintomi ed effetti, sia acuti che ritardati

Nessun dato disponibile per la miscela. Per sintomi ed effetti dovuti alle sostanze contenute, vedere il cap. 11.

4.3. Indicazione dell'eventuale necessità di consultare immediatamente un medico e di trattamenti speciali

In caso d'incidente o malessere consultare immediatamente un medico (se possibile mostrare le istruzioni per l'uso o la scheda di sicurezza).

Trattamento:

Trattamento sintomatico.

SEZIONE 5: misure antincendio

5.1. Mezzi di estinzione

Mezzi di estinzione idonei:

Acqua nebulizzata, anidride carbonica (CO2), polvere, schiuma.

Mezzi di estinzione che non devono essere utilizzati per ragioni di sicurezza:

Getti d'acqua diretti.

5.2. Pericoli speciali derivanti dalla sostanza o dalla miscela

Il prodotto non è combustibile, né esplosivo. Non facilita, né alimenta la combustione di altri materiali.

5.3. Raccomandazioni per gli addetti all'estinzione degli incendi

Impiegare apparecchiature respiratorie adeguate.

Raccogliere separatamente l'acqua contaminata utilizzata per estinguere l'incendio. Non scaricarla nella rete fognaria.

Se fattibile sotto il profilo della sicurezza, spostare dall'area di immediato pericolo i contenitori non danneggiati.

SEZIONE 6: misure in caso di rilascio accidentale

6.1. Precauzioni personali, dispositivi di protezione e procedure in caso di emergenza

Indossare i dispositivi di protezione individuale.

Se esposti a polveri indossare apparecchiature respiratorie.

Fornire un'adeguata ventilazione.

Utilizzare una protezione respiratoria adeguata.

Consultare le misure protettive esposte al punto 7 e 8.

6.2. Precauzioni ambientali

Impedire la penetrazione nel suolo/sottosuolo. Impedire il deflusso nelle acque superficiali o nella rete fognaria.

Trattenere l'acqua di lavaggio contaminata ed eliminarla.

6.3. Metodi e materiali per il contenimento e per la bonifica

Per la bonifica:

Raccogliere il prodotto fuoriuscito ed inserirlo in contenitori per il recupero o lo smaltimento. Eliminare il residuo con getti d'acqua se non ci sono controindicazioni.

Provvedere ad una sufficiente areazione del luogo interessato dalla perdita. Valutare la compatibilita` del recipiente da utilizzare con il prodotto, verificando la sezione 10. Lo smaltimento del materiale contaminato deve essere effettuato conformemente alle disposizioni del punto 13.

6.4. Riferimento ad altre sezioni

Vedi anche paragrafo 8 e 13

SEZIONE 7: manipolazione e immagazzinamento

7.1. Precauzioni per la manipolazione sicura

Evitare il contatto con la pelle e gli occhi, l'inalazione di polvere.

Utilizzare il sistema di ventilazione localizzato.

Non utilizzare contenitori vuoti prima che siano stati puliti.

Prima delle operazioni di trasferimento assicurarsi che nei contenitori non vi siano materiali incompatibili residui.

Si rimanda anche al paragrafo 8 per i dispositivi di protezione raccomandati.

Raccomandazioni generali sull'igiene del lavoro:

Gli indumenti contaminati devono essere sostituiti prima di accedere alle aree da pranzo.

Durante il lavoro non mangiare né bere.

7.2. Condizioni per lo stoccaggio sicuro, comprese eventuali incompatibilità

Conservare solo nel contenitore originale. Conservare i recipienti chiusi, in luogo ben ventilato, al riparo dai raggi solari diretti. Conservare i contenitori lontano da eventuali materiali incompatibili, verificando la sezione 10.

Conservare in ambienti sempre ben areati.

Tenere lontano da cibi, bevande e mangimi.

Materie incompatibili:

Nessuna in particolare.

Indicazione per i locali:

Freschi ed adeguatamente areati.

7.3. Usi finali particolari

Vedi punto 1.2 della presente scheda.

SEZIONE 8: controllo dell'esposizione/protezione individuale

8.1. Parametri di controllo

CALCIO CARBONATO - CAS: 1317-65-3

- Tipo OEL: VME - TWA: 10 mg/m3 - Note: Germania (polvere totale)
- Tipo OEL: VME - TWA: 3 mg/m3 - Note: Svizzera (polvere respirabile)
- Tipo OEL: DFG - TWA(8h): 4 mg/m3 - Note: USA (polvere totale)
- Tipo OEL: WEL - TWA: 4 mg/m3 - Note: Regno Unito (polvere respirabile)
- Tipo OEL: VLA-ED - TWA: 10 mg/m3 - Note: Irlanda (polvere respirabile)
- Tipo OEL: MAC TWA - TWA: 10 mg/m3 - Note: Spagna (polvere totale)
- Tipo OEL: VME - TWA: 10 mg/m3 - Note: Olanda (polvere totale)
- Tipo OEL: VME - TWA: 10 mg/m3 - Note: Francia (polvere totale)
- Tipo OEL: TLV - TWA: 10 mg/m3 - Note: Belgio
- Tipo OEL: WEL - TWA: 10 mg/m3 - Note: Regno Unito (polvere inalabile)

TLV TWA - ACGIH: 10 mg/m3 (frazione inalabile)

CLINKER DI CEMENTO PORTLAND - CAS: 65997-15-1

- Tipo OEL: TLV-ACGIH - TWA(8h): 1 mg/m3 - Note: frazione respirabile
- Tipo OEL: ACGIH - TWA(8h): 1 mg/m3

CALCIO DIIDROSSIDO (calce idrata) - CAS: 1305-62-0

- Tipo OEL: REL-NIOSH - TWA: 5 mg/m3
- Tipo OEL: PEL-OSHA - TWA: 15 mg/m3 - Note: polvere totale
- Tipo OEL: PEL-OSHA - TWA: 5 mg/m3 - Note: frazione respirabile
- Tipo OEL: UE - TWA(8h): 1 mg/m3 - STEL: 4 mg/m3
- Tipo OEL: ACGIH - TWA(8h): 5 mg/m3

Valori limite di esposizione DNEL

CLINKER DI CEMENTO PORTLAND - CAS: 65997-15-1

Lavoratore industriale: 1 mg/m3

CALCIO DIIDROSSIDO (calce idrata) - CAS: 1305-62-0

Lavoratore industriale: 1 mg/m3 - Consumatore: 1 mg/m3 - Esposizione: Inalazione Umana - Frequenza: Lungo termine, effetti locali

Lavoratore industriale: 4 mg/m3 - Consumatore: 4 mg/m3 - Esposizione: Inalazione Umana - Frequenza: Breve termine (acuta)

Valori limite di esposizione PNEC

CALCIO DIIDROSSIDO (calce idrata) - CAS: 1305-62-0

Bersaglio: Acqua dolce - Valore: 0.49 mg/l

Bersaglio: Acqua di mare - Valore: 0.32 mg/l

Bersaglio: Emissione saltuaria - Valore: 0.49 mg/l

Bersaglio: Impianto di trattamento delle acque reflue - Valore: 3 mg/l

Bersaglio: Suolo - Valore: 1080 mg/kg

8.2. Controlli dell'esposizione

Protezione degli occhi:

Indossare occhiali con protezioni laterali (EN 166).

Protezione della pelle:

Indossare abiti da lavoro con maniche lunghe e calzature di sicurezza per uso professionale di categoria II (rif. norma EN 344). Lavarsi con acqua e sapone dopo aver rimosso gli indumenti protettivi.

Protezione delle mani:

In caso sia previsto un contatto prolungato con il prodotto, si consiglia di proteggere le mani con guanti da lavoro resistenti alla penetrazione (rif. norma EN 374). Per la scelta definitiva del materiale dei guanti da lavoro si deve valutare anche il processo di utilizzo del prodotto e gli eventuali ulteriori prodotti che ne derivano. Si rammenta inoltre che i guanti in lattice possono dare origine a fenomeni di sensibilizzazione.

Protezione respiratoria:

Si consiglia l'utilizzo di una mascherina facciale filtrante di tipo P (rif. norma EN 149), o dispositivo equivalente, la cui classe (1, 2 o 3) dovrà essere scelta in relazione alla concentrazione limite di utilizzo.

Rischi termici:

Nessuno

Controlli dell'esposizione ambientale:

Vedere sezione 7 e 13.

Controlli tecnici idonei:

Nessuno

SEZIONE 9: proprietà fisiche e chimiche

9.1. Informazioni sulle proprietà fisiche e chimiche fondamentali

Proprietà	Valore	Metodo:	Note
Aspetto e colore:	polvere grigia	--	--
Odore:	inodore	--	--
Soglia di odore:	Non Rilevante	--	--
pH:	12	--	--
Punto di fusione/congelamento:	Non Rilevante	--	--
Punto di ebollizione iniziale e intervallo di ebollizione:	Non applicabile	--	--
Punto di infiammabilità:	Non applicabile	--	--
Velocità di evaporazione:	Non applicabile	--	--
Infiammabilità solidi/gas:	non infiammabile	--	--
Limite superiore/inferiore d'infiammabilità o esplosione:	Non applicabile	--	--
Pressione di vapore:	Non applicabile	--	--
Densità dei vapori:	Non applicabile	--	--
Densità relativa:	1.2 Kg/l	--	--
Idrosolubilità:	Parzialmente solubile	--	--
Solubilità in olio:	Non Rilevante	--	--
Coefficiente di ripartizione (n-ottanolo/acqua):	Non Rilevante	--	--
Temperatura di autoaccensione:	Non applicabile	--	--
Temperatura di decomposizione:	Non Rilevante	--	--
Viscosità:	Non applicabile	--	--
Proprietà esplosive:	non esplosivo sulla base della composizione	--	--

Proprietà ossidanti:	non ossidante sulla base della composizione	--	--

9.2. Altre informazioni

Proprietà	Valore	Metodo:	Note
Miscibilità:	Non Rilevante	--	--
Liposolubilità:	Non Rilevante	--	--

SEZIONE 10: stabilità e reattività

10.1. Reattività

Quando miscelato con acqua, il cemento e le miscele contenenti cemento induriscono formando un massa stabile che non reagisce con l'ambiente.

10.2. Stabilità chimica

Il cemento a contatto con l'acido idrofluoridrico si decompone producendo gas tetrafluoruro di silicio corrosivo. Il cemento reagisce con acqua e forma silicati e idrossido di calcio. I silicati nel cemento reagiscono con potenti ossidanti come fluoro, trifluoruro di boro, trifluoruro di cloro, trifluoruro di manganese e bifluoruro di ossigeno.

10.3. Possibilità di reazioni pericolose

In condizioni di uso e stoccaggio normali non sono prevedibili reazioni pericolose. Evitare comunque il contatto con materiali incompatibili.

CALCE IDRATA

Sviluppa idrogeno a contatto con: alluminio, ottone, umidità. Reagisce con diossido di carbonio.

10.4. Condizioni da evitare

Evitare l'umidità.

Evitare l'accumulo di polveri nell'ambiente.

10.5. Materiali incompatibili

Il cemento e le miscele contenenti cemento umido sono alcalini ed incompatibili con gli acidi, con i sali di ammonio, con l'alluminio e con altri metalli non nobili. A contatto con le polveri di alluminio il cemento e le miscele contenenti cemento umido provocano la formazione di idrogeno.

10.6. Prodotti di decomposizione pericolosi

Ossidi di calcio, ossidi di carbonio.

Idrogeno.

SEZIONE 11: informazioni tossicologiche

11.1. Informazioni sugli effetti tossicologici

Informazioni tossicologiche riguardanti il prodotto:

a) tossicità acuta

Non classificato

Sulla base dei dati disponibili, i criteri di classificazione non sono soddisfatti.

b) corrosione/irritazione cutanea

Il prodotto è classificato: Skin Irrit. 2 H315

c) lesioni oculari gravi/irritazioni oculari gravi

Il prodotto è classificato: Eye Dam. 1 H318

d) sensibilizzazione respiratoria o cutanea

Il prodotto è classificato: Skin Sens. 1B H317

e) mutagenicità delle cellule germinali

Non classificato

Sulla base dei dati disponibili, i criteri di classificazione non sono soddisfatti.

f) cancerogenicità

Non classificato

Sulla base dei dati disponibili, i criteri di classificazione non sono soddisfatti.

g) tossicità per la riproduzione

Non classificato

Sulla base dei dati disponibili, i criteri di classificazione non sono soddisfatti.

h) tossicità specifica per organi bersaglio (STOT) — esposizione singola

Il prodotto è classificato: STOT SE 3 H335

i) tossicità specifica per organi bersaglio (STOT) — esposizione ripetuta

Non classificato

Sulla base dei dati disponibili, i criteri di classificazione non sono soddisfatti.

j) pericolo in caso di aspirazione

Non classificato

Sulla base dei dati disponibili, i criteri di classificazione non sono soddisfatti.

Informazioni tossicologiche riguardanti le principali sostanze presenti nel prodotto:

CALCIO CARBONATO - CAS: 1317-65-3

a) tossicità acuta:

Test: LD50 - Via: Orale - Specie: Ratto > 2000 mg/kg

CLINKER DI CEMENTO PORTLAND - CAS: 65997-15-1

a) tossicità acuta:

Test: LD50 - Via: Pelle - Specie: Coniglio = 2000 mg/kg

Via: Inalazione Negativo

Via: Orale Negativo

b) corrosione/irritazione cutanea:

Test: Irritante per la pelle - Via: Pelle Positivo - Fonte: Esperienze sull'uomo - Note: Il cemento a contatto con la pelle umida può causare ispessimenti, screpolature e spaccature della pelle. Il contatto prolungato in combinazione con abrasioni esistenti può causare gravi ustioni.

c) lesioni oculari gravi/irritazioni oculari gravi:

Test: Corrosivo per gli occhi - Via: Occhi Positivo - Note: Il clinker ha causato un insieme di effetti eterogenei sulla cornea e l'indice di irritazione calcolato è stato pari a 128.

Ilcontatto diretto con il cemento può causare lesioni corneali per sollecitazione meccanica, irritazione o infiammazione immediata o ritardata. Il contatto diretto con grandi quantità di cemento asciutto o con proiezioni di cemento umido può causare effettiche variano dall'irritazione oculare moderata (ad es. congiuntivite o blefarite) alle ustioni chimiche e cecità.

d) sensibilizzazione respiratoria o cutanea:

Test: Sensibilizzazione della pelle - Via: Pelle Positivo - Note: Alcuni individui possono sviluppare eczema a seguito dell'esposizione alla polvere di cemento umido, causato sia dall'elevato pH, che induce dermatiti da contatto irritanti dopo un contatto prolungato, sia da una reazione immunologica al Cr (VI) solubile che provoca dermatiti allergiche da contatto. La risposta può apparire in una varietà di forme che possono andare da una lieve eruzione cutanea a gravi dermatiti ed è una combinazione di questi due meccanismi sopra menzionati. Non si prevede effetto di sensibilizzazione se il cemento contiene un agente riducente del Cr (VI) idrosolubile finchè non è superato il periodo indicato di efficacia di tale agente riducente.

Test: Sensibilizzazione per inalazione Negativo

e) mutagenicità delle cellule germinali:

Negativo

f) cancerogenicità:

Negativo - Note: Nessuna associazione causale è stata stabilita tra l'esposizione al cemento Portland ed il cancro.

La letteratura epidemiologica non supporta l'identificazione del cemento Portland come sospetto cancerogeno per l'uomo.

Il cemento Portland non è classificabile come cancerogeno per l'uomo (ai sensi dell'ACGIH A4: agenti che causano preoccupazione sulla possibilità di essere cancerogeni per l'uomo ma che non possono essere valutati definitivamente a causa della mancanza di dati. Studi in vitro o su animali non forniscono indicazioni di cancerogenicità che siano sufficienti a classificare l'agente con una delle altre notazioni).

g) tossicità per la riproduzione:

Negativo - Fonte: Esperienze sull'uomo

h) tossicità specifica per organi bersaglio (STOT) — esposizione singola:

Positivo - Note: La polvere di cemento può irritare la gola e l'apparato respiratorio. Tosse, starnuti e fiatone possono verificarsi a seguito di esposizioni al di sopra dei limiti d'esposizione professionale.

Nel complesso, gli elementi raccolti indicano chiaramente chel'esposizione professionale alla polvere di cemento ha prodotto deficit nella funzione respiratoria. Comunque, le prove disponibili al momento sono insufficienti per stabilire con certezza la relazione dose-risposta per questi effetti.

i) tossicità specifica per organi bersaglio (STOT) — esposizione ripetuta:

Negativo - Note: C'è un'indicazione di COPD. Gli effetti sono acuti e dovuti alle elevate esposizioni. Non sono stati osservati effetti cronici o effetti a bassa concentrazione.

j) pericolo in caso di aspirazione:

Non applicabile.

CALCIO DIIDROSSIDO (calce idrata) - CAS: 1305-62-0

a) tossicità acuta:

Test: LD50 - Via: Orale - Specie: Ratto > 2000 mg/kg

Test: LD50 - Via: Pelle - Specie: Coniglio > 2500 mg/kg

b) corrosione/irritazione cutanea:

Test: Irritante per la pelle - Specie: Coniglio No

c) lesioni oculari gravi/irritazioni oculari gravi:

Test: Irritante per gli occhi - Specie: Coniglio Sì

SEZIONE 12: informazioni ecologiche

12.1. Tossicità

Utilizzare secondo le buone pratiche lavorative, evitando di disperdere il prodotto nell'ambiente.

Non classificato per i pericoli per l'ambiente

Sulla base dei dati disponibili, i criteri di classificazione non sono soddisfatti.

CALCIO CARBONATO - CAS: 1317-65-3

a) Tossicità acquatica acuta:

Endpoint: LC50 - Specie: Pesci > 10000 mg/l - Durata h: 96

Endpoint: EC50 - Specie: Alghe > 200 mg/l - Durata h: 72

Endpoint: EC50 - Specie: Dafnie > 1000 mg/l - Durata h: 48

CLINKER DI CEMENTO PORTLAND - CAS: 65997-15-1

a) Tossicità acquatica acuta:

Endpoint: LC50 0 - Note: Il cemento non è pericoloso per l'ambiente. I test di ecotossicità con il cemento Portland su Daphnia magna e Selenastrum coli hanno dimostrato un piccolo impatto tossicologico. Quindi i valori LC50 e EC50 non possono essere determinati. Non ci sono indicazioni di tossicità in fase sedimentaria. L'aggiunta di grandi quantità di cemento all'acqua può, comunque, causare un aumento del pH e può, quindi, risultare tossico per la vita acquatica in determinate circostanze.

CALCIO DIIDROSSIDO (calce idrata) - CAS: 1305-62-0

a) Tossicità acquatica acuta:

Endpoint: LC50 - Specie: Pesci d'acqua marina = 457 mg/l - Durata h: 96

Endpoint: LC50 - Specie: Crostacei d'acqua marina = 158 mg/l - Durata h: 96

Endpoint: EC50 - Specie: Crostacei d'acqua dolce = 49.1 mg/l - Durata h: 48

Endpoint: EC50 - Specie: Alghe d'acqua dolce = 184.57 mg/l - Durata h: 72

Endpoint: LC50 - Specie: Pesci d'acqua dolce = 50.6 mg/l - Durata h: 96

Endpoint: NOEC - Specie: Piante acquatiche (Selenatrum capricornutum) = 48 mg/l - Durata h: 72

b) Tossicità acquatica cronica:

Endpoint: NOEC - Specie: Crostacei d'acqua marina = 32 mg/l - Durata h: 336

c) Tossicità per i batteri:

Endpoint: EC50 - Specie: Microrganismi = 300.4 mg/l - Durata h: 3

12.2. Persistenza e degradabilità

CALCIO CARBONATO - CAS: 1317-65-3

Note: Questi minerali non sono biodegradabili.

CLINKER DI CEMENTO PORTLAND - CAS: 65997-15-1

Biodegradabilità: Non attinente, poiché il cemento è un materiale inorganico. Dopo l'indurimento, il cemento non presenta rischi di tossicità.

12.3. Potenziale di bioaccumulo

CLINKER DI CEMENTO PORTLAND - CAS: 65997-15-1

Non attinente, poiché il cemento è un materiale inorganico. Dopo l'indurimento, il cemento non presenta rischi di tossicità.

12.4. Mobilità nel suolo

CLINKER DI CEMENTO PORTLAND - CAS: 65997-15-1

Non attinente, poiché il cemento è un materiale inorganico. Dopo l'indurimento, il cemento non presenta rischi di tossicità.

12.5. Risultati della valutazione PBT e vPvB

Sostanze vPvB: Nessuna - Sostanze PBT: Nessuna

12.6. Altri effetti avversi

Nessuno

SEZIONE 13: considerazioni sullo smaltimento

13.1. Metodi di trattamento dei rifiuti

Recuperare se possibile. Inviare ad impianti di smaltimento autorizzati o ad incenerimento in condizioni controllate. Operare secondo le vigenti disposizioni locali e nazionali.

SEZIONE 14: informazioni sul trasporto

14.1. Numero ONU

Merce non pericolosa ai sensi delle norme sul trasporto.

14.2. Nome di spedizione dell'ONU

Non applicabile

14.3. Classi di pericolo connesso al trasporto

Non applicabile

14.4. Gruppo di imballaggio

Non applicabile

14.5. Pericoli per l'ambiente

ADR-Inquinante ambientale: No

IMDG-Marine pollutant: No

14.6. Precauzioni speciali per gli utilizzatori

Non applicabile

14.7. Trasporto di rinfuse secondo l'allegato II di MARPOL ed il codice IBC

Non applicabile

SEZIONE 15: informazioni sulla regolamentazione

15.1. Disposizioni legislative e regolamentari su salute, sicurezza e ambiente specifiche per la sostanza o la miscela

D.Lgs. 9/4/2008 n. 81

D.M. Lavoro 26/02/2004 (Limiti di esposizione professionali)

Regolamento (CE) n. 1907/2006 (REACH)

Regolamento (CE) n. 1272/2008 (CLP)

Regolamento (CE) n. 790/2009 (ATP 1 CLP) e (UE) n. 758/2013

Regolamento (UE) 2015/830

Regolamento (UE) n. 286/2011 (ATP 2 CLP)

Regolamento (UE) n. 618/2012 (ATP 3 CLP)

Regolamento (UE) n. 487/2013 (ATP 4 CLP)

Regolamento (UE) n. 944/2013 (ATP 5 CLP)

Regolamento (UE) n. 605/2014 (ATP 6 CLP)

Regolamento (UE) n. 2015/1221 (ATP 7 CLP)

Regolamento (UE) n. 2016/918 (ATP 8 CLP)

Regolamento (UE) n. 2016/1179 (ATP 9 CLP)

Regolamento (UE) n. 2017/776 (ATP 10 CLP)

Restrizioni relative al prodotto o alle sostanze contenute in base all'Allegato XVII del Regolamento (CE) 1907/2006 (REACH) e successivi adeguamenti:

Restrizioni relative al prodotto:

Nessuna restrizione.

Restrizioni relative alle sostanze contenute:

Nessuna restrizione.

Ove applicabili, si faccia riferimento alle seguenti normative:

Circolari ministeriali 46 e 61 (Ammine aromatiche).

Direttiva 2012/18/EU (Seveso III)

Regolamento 648/2004/CE (Detergenti).

D.L. 3/4/2006 n. 152 Norme in materia ambientale

Dir. 2004/42/CE (Direttiva COV)

Disposizioni relative alla direttiva EU 2012/18 (Seveso III):

Categoria Seveso III in accordo all'Allegato 1, parte 1

Nessuno

15.2. Valutazione della sicurezza chimica

Non è stata effettuata una valutazione della sicurezza chimica per la miscela

Sostanze per le quali è stata effettuata una valutazione della sicurezza chimica:

CALCIO DIIDROSSIDO (calce idrata)

SEZIONE 16: altre informazioni

Testo delle frasi utilizzate nel paragrafo 3:

H315 Provoca irritazione cutanea.

H318 Provoca gravi lesioni oculari.

H317 Può provocare una reazione allergica cutanea.

H335 Può irritare le vie respiratorie.

Classe e categoria di pericolo	Codice	Descrizione
Skin Irrit. 2	3.2/2	Irritazione cutanea, Categoria 2
Eye Dam. 1	3.3/1	Gravi lesioni oculari, Categoria 1
Skin Sens. 1B	3.4.2/1B	Sensibilizzazione della pelle, Categoria 1B
STOT SE 3	3.8/3	Tossicità specifica per organi bersaglio — esposizione singola, Categoria 3

Paragrafi modificati rispetto alla precedente revisione:

SEZIONE 1: identificazione della sostanza/miscela e della società/impresa
SEZIONE 2: identificazione dei pericoli
SEZIONE 3: composizione/informazioni sugli ingredienti
SEZIONE 5: misure antincendio
SEZIONE 6: misure in caso di rilascio accidentale
SEZIONE 7: manipolazione e immagazzinamento
SEZIONE 8: controllo dell'esposizione/protezione individuale
SEZIONE 9: proprietà fisiche e chimiche
SEZIONE 10: stabilità e reattività
SEZIONE 11: informazioni tossicologiche
SEZIONE 12: informazioni ecologiche
SEZIONE 15: informazioni sulla regolamentazione
SEZIONE 16: altre informazioni

Classificazione e procedura utilizzata per derivarla a norma del regolamento (CE)1272/2008 [CLP] in relazione alle miscele:

Classificazione a norma del regolamento (CE) n. 1272/2008	Procedura di classificazione
Skin Irrit. 2, H315	Metodo di calcolo
Eye Dam. 1, H318	Metodo di calcolo
Skin Sens. 1B, H317	Metodo di calcolo
STOT SE 3, H335	Metodo di calcolo

Questo documento e' stato redatto da un tecnico competente in materia di SDS e che ha ricevuto formazione adeguata.

Principali fonti bibliografiche:

Sito web ECHA: https://echa.europa.eu

ECDIN - Environmental Chemicals Data and Information Network - Joint Research Centre, Commission of the European Communities

SAX's DANGEROUS PROPERTIES OF INDUSTRIAL MATERIALS - Eight Edition - Van Nostrand Reinold

Istituto Superiore di Sanità - Inventario Nazionale Sostanze Chimiche

Le informazioni ivi contenute si basano sulle nostre conoscenze alla data sopra riportata. Sono riferite unicamente al prodotto indicato e non costituiscono garanzia di particolari qualità.

L'utilizzatore è tenuto ad assicurarsi della idoneità e completezza di tali informazioni in relazione all'utilizzo specifico che ne deve fare.

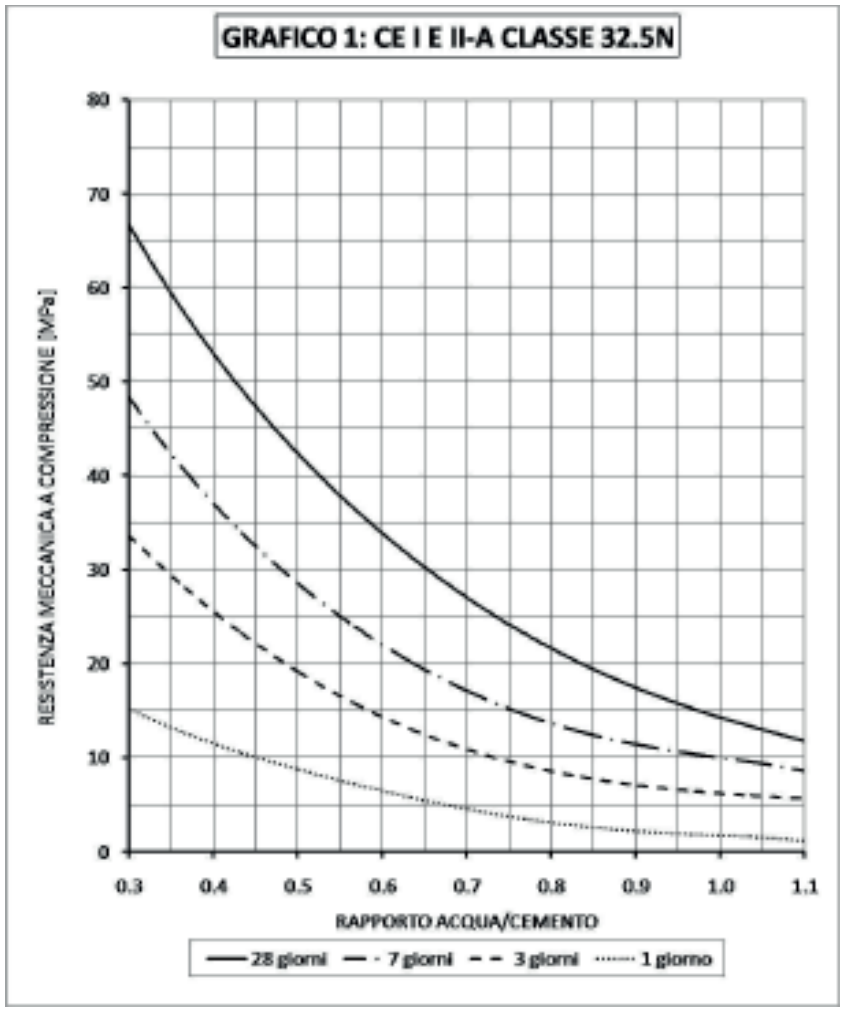
Questa scheda annulla e sostituisce ogni edizione precedente.

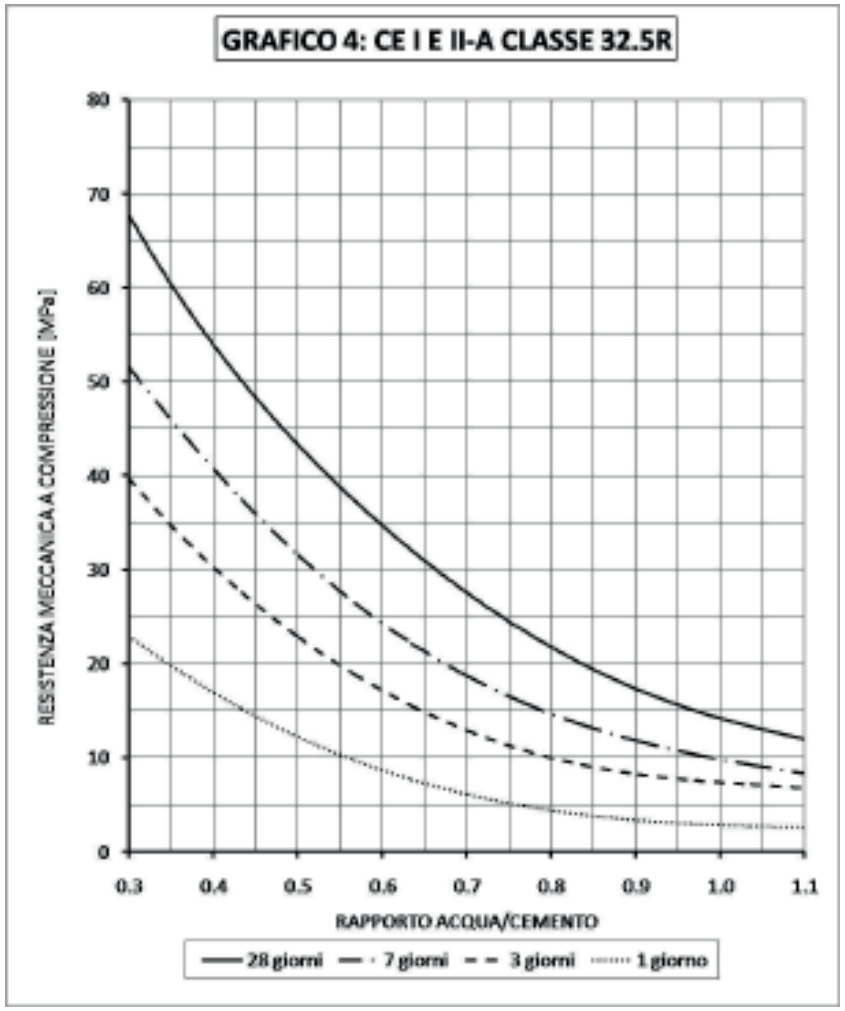
ADR:	Accordo europeo relativo al trasporto internazionale stradale di merci pericolose.
CAS:	Chemical Abstracts Service (divisione della American Chemical Society).
CLP:	Classificazione, Etichettatura, Imballaggio.
DNEL:	Livello derivato senza effetto.
EINECS:	Inventario europeo delle sostanze chimiche europee esistenti in commercio.
GefStoffVO:	Ordinanza sulle sostanze pericolose in Germania.
GHS:	Sistema globale armonizzato di classificazione e di etichettatura dei prodotti chimici.
IATA:	Associazione per il trasporto aereo internazionale.
IATA-DGR:	Regolamento sulle merci pericolose della "Associazione per il trasporto aereo internazionale" (IATA).
ICAO:	Organizzazione internazionale per l'aviazione civile.
ICAO-TI:	Istruzioni tecniche della "Organizzazione internazionale per l'aviazione civile" (ICAO).
IMDG:	Codice marittimo internazionale per le merci pericolose.

INCI:	Nomenclatura internazionale degli ingredienti cosmetici.
KSt:	Coefficiente d'esplosione.
LC50:	Concentrazione letale per il 50 per cento della popolazione di test.
LD50:	Dose letale per il 50 per cento della popolazione di test.
PNEC:	Concentrazione prevista senza effetto.
RID:	Regolamento riguardante il trasporto internazionale di merci pericolose per via ferroviaria.
STA:	Stima della tossicità acuta
STAmix:	Stima della tossicità acuta (Miscele)
STEL:	Limite d'esposizione a corto termine.
STOT:	Tossicità organo-specifica.
TLV:	Valore limite di soglia.
TWA:	Media ponderata nel tempo
WGK:	Classe di pericolo per le acque (Germania).



3.3.1.1.B Cement 32.5 N and R mechanical Strength by Curing Time Graphics

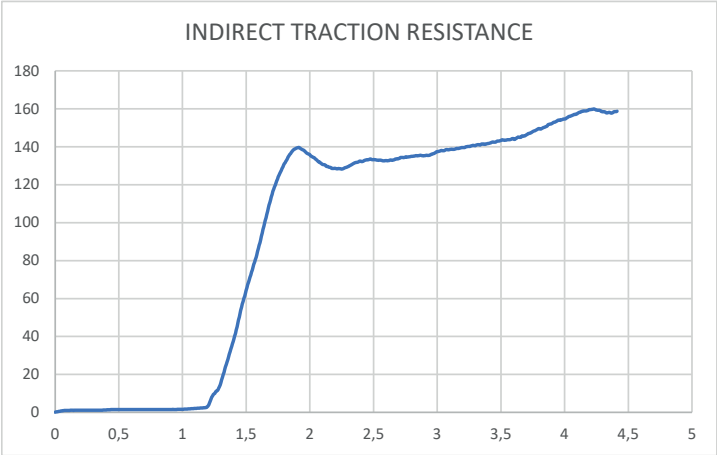


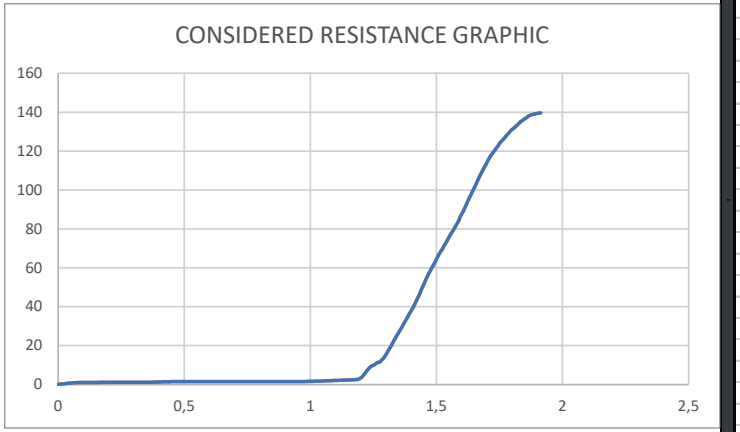


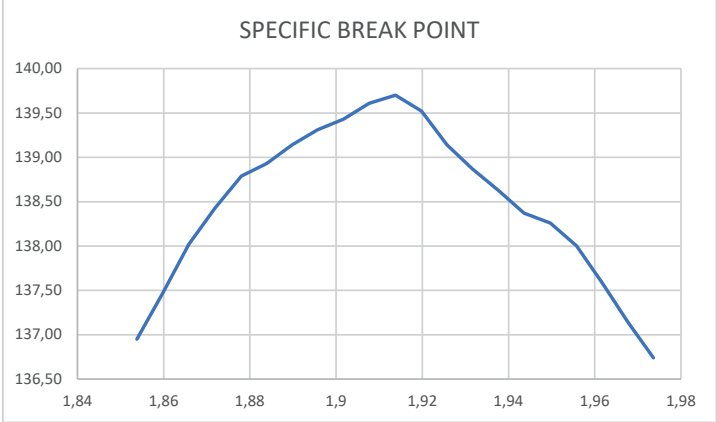
Images references:

-Coppola, L., Buoso, A., Crippa, E. and Lorenzi, S., 2015. STRUCTURAL MATERIALS EXERCISES HANDBOOK APPENDICI A - B. [ebook] pp.1-40. Available at: <http://www00.unibg.it/dati/corsi/20057/71243-Appendici%20A%20e%20B_rev2015.pdf> [Accessed 22 November 2021].

3.3.1.6-A Mix. Proportion Tests
10:1:1 - 1







LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
0,11	1,2	-1,27341	0	13,9	27,8	386,42	0,0003
0,18	1,6	-1,26751	0,0059	13,9	27,8	386,42	0,0005
0,25	2	-1,26161	0,0118	13,9	27,8	386,42	0,0006
0,32	2,4	-1,25571	0,0177	13,9	27,8	386,42	0,0008
0,41	2,8	-1,24981	0,0236	13,9	27,8	386,42	0,0011
0,49	3,2	-1,24371	0,0297	13,9	27,8	386,42	0,0013
0,59	3,6	-1,23761	0,0358	13,9	27,8	386,42	0,0015
0,66	4	-1,23161	0,0418	13,9	27,8	386,42	0,0017
0,73	4,4	-1,22571	0,0477	13,9	27,8	386,42	0,0019
0,78	4,8	-1,21981	0,0536	13,9	27,8	386,42	0,0020
0,85	5,2	-1,21381	0,0596	13,9	27,8	386,42	0,0022
0,91	5,6	-1,20781	0,0656	13,9	27,8	386,42	0,0024
0,96	6	-1,20171	0,0717	13,9	27,8	386,42	0,0025
1,01	6,4	-1,19561	0,0778	13,9	27,8	386,42	0,0026
1,05	6,8	-1,18971	0,0837	13,9	27,8	386,42	0,0027
1,06	7,2	-1,18381	0,0896	13,9	27,8	386,42	0,0027
1,07	7,6	-1,17781	0,0956	13,9	27,8	386,42	0,0028
1,06	8	-1,17181	0,1016	13,9	27,8	386,42	0,0027
1,07	8,4	-1,16581	0,1076	13,9	27,8	386,42	0,0028
1,07	8,8	-1,15961	0,1138	13,9	27,8	386,42	0,0028
1,08	9,2	-1,15351	0,1199	13,9	27,8	386,42	0,0028
1,09	9,6	-1,14761	0,1258	13,9	27,8	386,42	0,0028
1,09	10	-1,14171	0,1317	13,9	27,8	386,42	0,0028
1,08	10,4	-1,13571	0,1377	13,9	27,8	386,42	0,0028
1,07	10,8	-1,12971	0,1437	13,9	27,8	386,42	0,0028
1,09	11,2	-1,12361	0,1498	13,9	27,8	386,42	0,0028
1,08	11,6	-1,11741	0,156	13,9	27,8	386,42	0,0028
1,11	12	-1,11141	0,162	13,9	27,8	386,42	0,0029
1,10	12,4	-1,10551	0,1679	13,9	27,8	386,42	0,0028
1,11	12,8	-1,09951	0,1739	13,9	27,8	386,42	0,0029
1,11	13,2	-1,09361	0,1798	13,9	27,8	386,42	0,0029
1,11	13,6	-1,08751	0,1859	13,9	27,8	386,42	0,0029
1,10	14	-1,08141	0,192	13,9	27,8	386,42	0,0028
1,11	14,4	-1,07531	0,1981	13,9	27,8	386,42	0,0029
1,11	14,8	-1,06941	0,204	13,9	27,8	386,42	0,0029
1,11	15,2	-1,06341	0,21	13,9	27,8	386,42	0,0029
1,13	15,6	-1,05751	0,2159	13,9	27,8	386,42	0,0029
1,13	16	-1,05151	0,2219	13,9	27,8	386,42	0,0029
1,12	16,4	-1,04541	0,228	13,9	27,8	386,42	0,0029
1,12	16,8	-1,03931	0,2341	13,9	27,8	386,42	0,0029
1,12	17,2	-1,03331	0,2401	13,9	27,8	386,42	0,0029
1,12	17,6	-1,02731	0,2461	13,9	27,8	386,42	0,0029
1,13	18	-1,02141	0,252	13,9	27,8	386,42	0,0029
1,13	18,4	-1,01541	0,258	13,9	27,8	386,42	0,0029
1,13	18,8	-1,00951	0,2639	13,9	27,8	386,42	0,0029
1,15	19,2	-1,00341	0,27	13,9	27,8	386,42	0,0030
1,14	19,6	-0,99731	0,2761	13,9	27,8	386,42	0,0030
1,14	20	-0,99131	0,2821	13,9	27,8	386,42	0,0030
1,13	20,4	-0,98531	0,2881	13,9	27,8	386,42	0,0029
1,15	20,8	-0,97941	0,294	13,9	27,8	386,42	0,0030
1,14	21,2	-0,97341	0,3	13,9	27,8	386,42	0,0030
1,15	21,6	-0,96741	0,306	13,9	27,8	386,42	0,0030
1,12	22	-0,96141	0,312	13,9	27,8	386,42	0,0029
1,15	22,4	-0,95531	0,3181	13,9	27,8	386,42	0,0030
1,14	22,8	-0,94931	0,3241	13,9	27,8	386,42	0,0030
1,15	23,2	-0,94341	0,33	13,9	27,8	386,42	0,0030
1,16	23,6	-0,93741	0,336	13,9	27,8	386,42	0,0030
1,16	24	-0,93151	0,3419	13,9	27,8	386,42	0,0030
1,17	24,4	-0,92541	0,348	13,9	27,8	386,42	0,0030
1,16	24,8	-0,91931	0,3541	13,9	27,8	386,42	0,0030
1,15	25,2	-0,91331	0,3601	13,9	27,8	386,42	0,0030

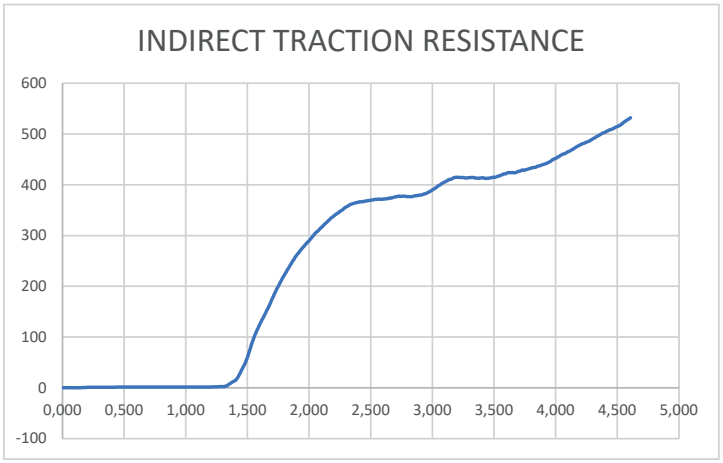
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
1,16	25,6	-0,90731	0,3661	13,9	27,8	386,42	0,0030	1,51	50	-0,54141	0,732	13,9	27,8	386,42	0,0039	2,08	74,4	-0,17551	1,0979	13,9	27,8	386,42	0,0054
1,17	26	-0,90141	0,372	13,9	27,8	386,42	0,0030	1,51	50,4	-0,53551	0,7379	13,9	27,8	386,42	0,0039	2,11	74,8	-0,16961	1,1038	13,9	27,8	386,42	0,0055
1,23	26,4	-0,89551	0,3779	13,9	27,8	386,42	0,0032	1,51	50,8	-0,52941	0,744	13,9	27,8	386,42	0,0039	2,14	75,2	-0,16351	1,1099	13,9	27,8	386,42	0,0055
1,22	26,8	-0,88951	0,3839	13,9	27,8	386,42	0,0032	1,50	51,2	-0,52331	0,7501	13,9	27,8	386,42	0,0039	2,17	75,6	-0,15731	1,1161	13,9	27,8	386,42	0,0056
1,27	27,2	-0,88341	0,39	13,9	27,8	386,42	0,0033	1,51	51,6	-0,51721	0,7562	13,9	27,8	386,42	0,0039	2,20	76	-0,15131	1,1221	13,9	27,8	386,42	0,0057
1,27	27,6	-0,87731	0,3961	13,9	27,8	386,42	0,0033	1,49	52	-0,51121	0,7622	13,9	27,8	386,42	0,0039	2,20	76,4	-0,14541	1,128	13,9	27,8	386,42	0,0057
1,30	28	-0,87131	0,4021	13,9	27,8	386,42	0,0034	1,51	52,4	-0,50531	0,7681	13,9	27,8	386,42	0,0039	2,24	76,8	-0,13951	1,1339	13,9	27,8	386,42	0,0058
1,33	28,4	-0,86541	0,408	13,9	27,8	386,42	0,0034	1,50	52,8	-0,49931	0,7741	13,9	27,8	386,42	0,0039	2,27	77,2	-0,13351	1,1399	13,9	27,8	386,42	0,0059
1,35	28,8	-0,85951	0,4139	13,9	27,8	386,42	0,0035	1,50	53,2	-0,49341	0,78	13,9	27,8	386,42	0,0039	2,29	77,6	-0,12741	1,146	13,9	27,8	386,42	0,0059
1,37	29,2	-0,85351	0,4199	13,9	27,8	386,42	0,0035	1,49	53,6	-0,48741	0,786	13,9	27,8	386,42	0,0039	2,29	78	-0,12131	1,1521	13,9	27,8	386,42	0,0059
1,38	29,6	-0,84751	0,4259	13,9	27,8	386,42	0,0036	1,50	54	-0,48121	0,7922	13,9	27,8	386,42	0,0039	2,36	78,4	-0,11531	1,1581	13,9	27,8	386,42	0,0061
1,40	30	-0,84141	0,432	13,9	27,8	386,42	0,0036	1,51	54,4	-0,47511	0,7983	13,9	27,8	386,42	0,0039	2,38	78,8	-0,10931	1,1641	13,9	27,8	386,42	0,0062
1,44	30,4	-0,83531	0,4381	13,9	27,8	386,42	0,0037	1,53	54,8	-0,46921	0,8042	13,9	27,8	386,42	0,0040	2,43	79,2	-0,10341	1,17	13,9	27,8	386,42	0,0063
1,45	30,8	-0,82941	0,444	13,9	27,8	386,42	0,0038	1,51	55,2	-0,46321	0,8102	13,9	27,8	386,42	0,0039	2,47	79,6	-0,09751	1,1759	13,9	27,8	386,42	0,0064
1,49	31,2	-0,82341	0,45	13,9	27,8	386,42	0,0039	1,52	55,6	-0,45731	0,8161	13,9	27,8	386,42	0,0039	2,51	80	-0,09151	1,1819	13,9	27,8	386,42	0,0065
1,50	31,6	-0,81751	0,4559	13,9	27,8	386,42	0,0039	1,52	56	-0,45131	0,8221	13,9	27,8	386,42	0,0039	2,53	80,4	-0,08541	1,188	13,9	27,8	386,42	0,0065
1,50	32	-0,81151	0,4619	13,9	27,8	386,42	0,0039	1,52	56,4	-0,44531	0,8281	13,9	27,8	386,42	0,0039	2,90	80,8	-0,07931	1,1941	13,9	27,8	386,42	0,0075
1,51	32,4	-0,80551	0,4679	13,9	27,8	386,42	0,0039	1,53	56,8	-0,43921	0,8342	13,9	27,8	386,42	0,0040	3,32	81,2	-0,07331	1,2001	13,9	27,8	386,42	0,0086
1,51	32,8	-0,79931	0,4741	13,9	27,8	386,42	0,0039	1,54	57,2	-0,43311	0,8403	13,9	27,8	386,42	0,0040	4,02	81,6	-0,06741	1,206	13,9	27,8	386,42	0,0104
1,50	33,2	-0,79331	0,4801	13,9	27,8	386,42	0,0039	1,52	57,6	-0,42731	0,8461	13,9	27,8	386,42	0,0039	4,88	82	-0,06151	1,2119	13,9	27,8	386,42	0,0126
1,50	33,6	-0,78741	0,486	13,9	27,8	386,42	0,0039	1,53	58	-0,42131	0,8521	13,9	27,8	386,42	0,0040	6,07	82,4	-0,05551	1,2179	13,9	27,8	386,42	0,0157
1,53	34	-0,78151	0,4919	13,9	27,8	386,42	0,0040	1,53	58,4	-0,41541	0,858	13,9	27,8	386,42	0,0040	7,07	82,8	-0,04961	1,2238	13,9	27,8	386,42	0,0183
1,52	34,4	-0,77551	0,4979	13,9	27,8	386,42	0,0039	1,54	58,8	-0,40941	0,864	13,9	27,8	386,42	0,0040	7,98	83,2	-0,04351	1,2299	13,9	27,8	386,42	0,0207
1,51	34,8	-0,76951	0,5039	13,9	27,8	386,42	0,0039	1,55	59,2	-0,40331	0,8701	13,9	27,8	386,42	0,0040	8,75	83,6	-0,03741	1,236	13,9	27,8	386,42	0,0226
1,53	35,2	-0,76351	0,5099	13,9	27,8	386,42	0,0040	1,53	59,6	-0,39721	0,8762	13,9	27,8	386,42	0,0040	9,40	84	-0,03141	1,242	13,9	27,8	386,42	0,0243
1,52	35,6	-0,75741	0,516	13,9	27,8	386,42	0,0039	1,55	60	-0,39121	0,8822	13,9	27,8	386,42	0,0040	9,79	84,4	-0,02551	1,2479	13,9	27,8	386,42	0,0253
1,51	36	-0,75141	0,522	13,9	27,8	386,42	0,0039	1,52	60,4	-0,38531	0,8881	13,9	27,8	386,42	0,0039	10,04	84,8	-0,01961	1,2538	13,9	27,8	386,42	0,0260
1,51	36,4	-0,74551	0,5279	13,9	27,8	386,42	0,0039	1,54	60,8	-0,37941	0,894	13,9	27,8	386,42	0,0040	10,74	85,2	-0,01361	1,2598	13,9	27,8	386,42	0,0278
1,52	36,8	-0,73951	0,5339	13,9	27,8	386,42	0,0039	1,53	61,2	-0,37341	0,9	13,9	27,8	386,42	0,0040	11,38	85,6	-0,00761	1,2658	13,9	27,8	386,42	0,0294
1,52	37,2	-0,73361	0,5398	13,9	27,8	386,42	0,0039	1,54	61,6	-0,36741	0,906	13,9	27,8	386,42	0,0040	11,35	86	-0,00151	1,2719	13,9	27,8	386,42	0,0294
1,52	37,6	-0,72751	0,5459	13,9	27,8	386,42	0,0039	1,53	62	-0,36131	0,9121	13,9	27,8	386,42	0,0040	11,86	86,4	0,00459	1,278	13,9	27,8	386,42	0,0307
1,51	38	-0,72151	0,5519	13,9	27,8	386,42	0,0039	1,55	62,4	-0,35521	0,9182	13,9	27,8	386,42	0,0040	12,73	86,8	0,01049	1,2839	13,9	27,8	386,42	0,0329
1,51	38,4	-0,71541	0,558	13,9	27,8	386,42	0,0039	1,56	62,8	-0,34931	0,9241	13,9	27,8	386,42	0,0040	13,44	87,2	0,01639	1,2898	13,9	27,8	386,42	0,0348
1,52	38,8	-0,70941	0,564	13,9	27,8	386,42	0,0039	1,54	63,2	-0,34341	0,93	13,9	27,8	386,42	0,0040	14,47	87,6	0,02229	1,2957	13,9	27,8	386,42	0,0374
1,50	39,2	-0,70351	0,5699	13,9	27,8	386,42	0,0039	1,53	63,6	-0,33741	0,936	13,9	27,8	386,42	0,0040	15,76	88	0,02829	1,3017	13,9	27,8	386,42	0,0408
1,53	39,6	-0,69751	0,5759	13,9	27,8	386,42	0,0040	1,54	64	-0,33151	0,9419	13,9	27,8	386,42	0,0040	17,14	88,4	0,03439	1,3078	13,9	27,8	386,42	0,0444
1,51	40	-0,69161	0,5818	13,9	27,8	386,42	0,0039	1,55	64,4	-0,32541	0,948	13,9	27,8	386,42	0,0040	18,49	88,8	0,04049	1,3139	13,9	27,8	386,42	0,0478
1,50	40,4	-0,68551	0,5879	13,9	27,8	386,42	0,0039	1,54	64,8	-0,31931	0,9541	13,9	27,8	386,42	0,0040	19,82	89,2	0,04649	1,3199	13,9	27,8	386,42	0,0513
1,51	40,8	-0,67941	0,594	13,9	27,8	386,42	0,0039	1,56	65,2	-0,31331	0,9601	13,9	27,8	386,42	0,0040	21,18	89,6	0,05249	1,3259	13,9	27,8	386,42	0,0548
1,52	41,2	-0,67331	0,6001	13,9	27,8	386,42	0,0039	1,56	65,6	-0,30741	0,966	13,9	27,8	386,42	0,0040	22,64	90	0,05839	1,3318	13,9	27,8	386,42	0,0586
1,51	41,6	-0,66741	0,606	13,9	27,8	386,42	0,0039	1,56	66	-0,30151	0,9719	13,9	27,8	386,42	0,0040	24,02	90,4	0,06429	1,3377	13,9	27,8	386,42	0,0622
1,52	42	-0,66151	0,6119	13,9	27,8	386,42	0,0039	1,56	66,4	-0,29561	0,9778	13,9	27,8	386,42	0,0040	25,28	90,8	0,07029	1,3437	13,9	27,8	386,42	0,0654
1,51	42,4	-0,65551	0,6179	13,9	27,8	386,42	0,0039	1,57	66,8	-0,28961	0,9838	13,9	27,8	386,42	0,0041	26,54	91,2	0,07639	1,3498	13,9	27,8	386,42	0,0687
1,52	42,8	-0,64961	0,6238	13,9	27,8	386,42	0,0039	1,58	67,2	-0,28351	0,9899	13,9	27,8	386,42	0,0041	27,95	91,6	0,08259	1,356	13,9	27,8	386,42	0,0723
1,52	43,2	-0,64351	0,6299	13,9	27,8	386,42	0,0039	1,61	67,6	-0,27741	0,996	13,9	27,8	386,42	0,0042	29,26	92	0,08849	1,3619	13,9	27,8	386,42	0,0757
1,52	43,6	-0,63741	0,636	13,9	27,8	386,42	0,0039	1,63	68	-0,27141	1,002	13,9	27,8	386,42	0,0042	30,66	92,4	0,09439	1,3678	13,9	27,8	386,42	0,0793
1,52	44	-0,63141	0,642	13,9	27,8	386,42	0,0039	1,64	68,4	-0,26551	1,0079	13,9	27,8	386,42	0,0042	32,04	92,8	0,10039	1,3738	13,9	27,8	386,42	0,0829
1,50	44,4	-0,62541	0,648	13,9	27,8	386,42	0,0039	1,68	68,8	-0,25961	1,0138	13,9	27,8	386,42	0,0043	33,38	93,2	0,10639	1,3798	13,9	27,8	386,42	0,0864
1,50	44,8	-0,61951	0,6539	13,9	27,8	386,42	0,0039	1,70	69,2	-0,25361	1,0198	13,9	27,8	386,42	0,0044	34,73	93,6	0,11239	1,3858	13,9	27,8	386,42	0,0899
1,50	45,2	-0,61351	0,6599	13,9	27,8	386,42	0,0039	1,72	69,6	-0,24761	1,0258	13,9	27,8	386,42	0,0045	36,11	94	0,11849	1,3919	13,9	27,8	386,42	0,0934
1,52	45,6	-0,60751	0,6659	13,9	27,8	386,42	0,0039	1,77	70	-0,24151	1,0319	13,9	27,8	386,42	0,0046	37,49	94,4	0,12459	1,398	13,9	27,8	386,42	0,0970
1,52	46	-0,60141	0,672	13,9	27,8	386,42	0,0039	1,78	70,4	-0,23541	1,038	13,9	27,8	386,42	0,0046	38,83	94,8	0,13059	1,404	13,9	27,8	386,42	0,1005
1,51	46,4	-0,59531	0,6781	13,9	27,8	386,42	0,0039	1,80	70,8	-0,22951	1,0439	13,9	27,8	386,42	0,0047	40,28	95,2	0,13649	1,4099	13,9	27,8	386,42	0,1042
1,52	46,8	-0,58941	0,684	13,9	27,8	386,42	0,0039	1,82	71,2	-0,22351	1,0499	13,9	27,8	386,42	0,0047	41,69	95,6	0,14239	1,4158	13,9	27,8	386,42	0,1079
1,52	47,2	-0,58341	0,69	13,9	27,8	386,42	0,0039	1,85	71,6	-0,21761	1,0558	13,9	27,8	386,42	0,0048	43,39	96	0,14839	1,4218	13,9	27,8	386,42	0,1123
1,51	47,6	-0,57751	0,6959	13,9	27,8	386,42	0,0039	1,89	72	-0,21161	1,0618	13,9	27,8	386,42	0,0049	45,10	96,4	0,15449	1,4279	13,9	27,8	386,42	0,1167
1,51	48	-0,57151	0,7019	13,9	27,8	386,42	0,0039	1,93	72,4	-0,20561	1,0678	13,9	27,8	386,42	0,0050	46,85	96,8	0,16059	1,434	13,9	27,8	386,42	0,1212
1,52	48,4	-0,56551	0,7079	13,9	27,8	386,42	0,0039	1,97	72,8	-0,19951	1,0739	13,9	27,8	386,42	0,0051	48,61	97,2	0,16659	1,44	13,9	27,8	386,42	0,1258
1,51	48,8	-0,55931	0,7141	13,9	27,8	386,42	0,0039	1,99	73,2	-0,19341	1,08	13,9	27,8	386,42	0,0051	50,35	97,6	0,17259	1,446	13,9	27,8	386,42	0,1303
1,52	49,2	-0,55331	0,7201	13,9	27,8	386,42	0,0039	2,02	73,6	-0,18741	1,086	13,9	27,8	386,42	0,0052	52,06	98	0,17849	1,4519	13,9	27,8	386,42	0,1347
1,51	49,6	-0,54741	0,726	13,9	27,8	386,42	0,0039	2,06	74	-0,18151	1,0919	13,9	27,8	386,42	0,0053	53,82	98,4	0,18439	1,4578	13,9	27,8	386,42	0,1393

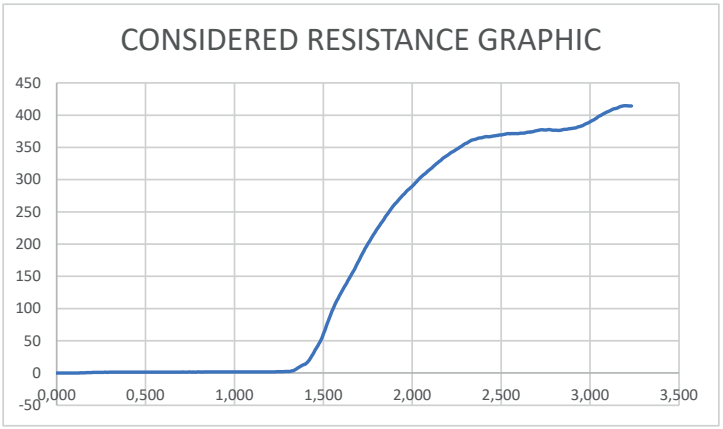
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
55,49	98,8	0,19039	1,4638	13,9	27,8	386,42	0,1436	134,61	123,2	0,55649	1,8299	13,9	27,8	386,42	0,3484	128,65	147,6	0,92259	2,196	13,9	27,8	386,42	0,3329
57,15	99,2	0,19649	1,4699	13,9	27,8	386,42	0,1479	135,34	123,6	0,56259	1,836	13,9	27,8	386,42	0,3502	128,56	148	0,92859	2,202	13,9	27,8	386,42	0,3327
58,61	99,6	0,20259	1,476	13,9	27,8	386,42	0,1517	135,91	124	0,56859	1,842	13,9	27,8	386,42	0,3517	128,45	148,4	0,93449	2,2079	13,9	27,8	386,42	0,3324
60,02	100	0,20859	1,482	13,9	27,8	386,42	0,1553	136,39	124,4	0,57449	1,8479	13,9	27,8	386,42	0,3530	128,36	148,8	0,94049	2,2139	13,9	27,8	386,42	0,3322
61,33	100,4	0,21449	1,4879	13,9	27,8	386,42	0,1587	136,95	124,8	0,58039	1,8538	13,9	27,8	386,42	0,3544	128,48	149,2	0,94639	2,2198	13,9	27,8	386,42	0,3325
62,72	100,8	0,22049	1,4939	13,9	27,8	386,42	0,1623	137,47	125,2	0,58639	1,8598	13,9	27,8	386,42	0,3558	128,54	149,6	0,95249	2,2259	13,9	27,8	386,42	0,3326
64,26	101,2	0,22639	1,4998	13,9	27,8	386,42	0,1663	138,02	125,6	0,59239	1,8658	13,9	27,8	386,42	0,3572	128,47	150	0,95859	2,232	13,9	27,8	386,42	0,3325
65,83	101,6	0,23239	1,5058	13,9	27,8	386,42	0,1704	138,43	126	0,59849	1,8719	13,9	27,8	386,42	0,3582	128,48	150,4	0,96459	2,238	13,9	27,8	386,42	0,3325
67,36	102	0,23849	1,5119	13,9	27,8	386,42	0,1743	138,79	126,4	0,60459	1,878	13,9	27,8	386,42	0,3592	128,34	150,8	0,97059	2,244	13,9	27,8	386,42	0,3321
68,65	102,4	0,24469	1,5181	13,9	27,8	386,42	0,1777	138,93	126,8	0,61049	1,8839	13,9	27,8	386,42	0,3595	128,29	151,2	0,97639	2,2498	13,9	27,8	386,42	0,3320
69,83	102,8	0,25059	1,524	13,9	27,8	386,42	0,1807	139,14	127,2	0,61639	1,8898	13,9	27,8	386,42	0,3601	128,37	151,6	0,98239	2,2558	13,9	27,8	386,42	0,3322
71,13	103,2	0,25649	1,5299	13,9	27,8	386,42	0,1841	139,31	127,6	0,62229	1,8957	13,9	27,8	386,42	0,3605	128,47	152	0,98839	2,2618	13,9	27,8	386,42	0,3325
72,45	103,6	0,26249	1,5359	13,9	27,8	386,42	0,1875	139,43	128	0,62829	1,9017	13,9	27,8	386,42	0,3608	128,69	152,4	0,99439	2,2678	13,9	27,8	386,42	0,3330
73,84	104	0,26839	1,5418	13,9	27,8	386,42	0,1911	139,61	128,4	0,63429	1,9077	13,9	27,8	386,42	0,3613	128,92	152,8	1,00049	2,2739	13,9	27,8	386,42	0,3336
75,21	104,4	0,27449	1,5479	13,9	27,8	386,42	0,1946	139,70	128,8	0,64039	1,9138	13,9	27,8	386,42	0,3615	129,02	153,2	1,00659	2,28	13,9	27,8	386,42	0,3339
76,59	104,8	0,28059	1,554	13,9	27,8	386,42	0,1982	139,52	129,2	0,64639	1,9198	13,9	27,8	386,42	0,3611	129,12	153,6	1,01249	2,2859	13,9	27,8	386,42	0,3341
77,96	105,2	0,28659	1,56	13,9	27,8	386,42	0,2017	139,14	129,6	0,65229	1,9257	13,9	27,8	386,42	0,3601	129,32	154	1,01839	2,2918	13,9	27,8	386,42	0,3347
79,19	105,6	0,29249	1,5659	13,9	27,8	386,42	0,2049	138,87	130	0,65819	1,9316	13,9	27,8	386,42	0,3594	129,52	154,4	1,02429	2,2977	13,9	27,8	386,42	0,3352
80,46	106	0,29849	1,5719	13,9	27,8	386,42	0,2082	138,63	130,4	0,66419	1,9376	13,9	27,8	386,42	0,3588	129,63	154,8	1,03029	2,3037	13,9	27,8	386,42	0,3355
81,76	106,4	0,30439	1,5778	13,9	27,8	386,42	0,2116	138,37	130,8	0,67019	1,9436	13,9	27,8	386,42	0,3581	129,96	155,2	1,03649	2,3099	13,9	27,8	386,42	0,3363
83,21	106,8	0,31039	1,5838	13,9	27,8	386,42	0,2153	138,26	131,2	0,67629	1,9497	13,9	27,8	386,42	0,3578	130,15	155,6	1,04249	2,3159	13,9	27,8	386,42	0,3368
84,83	107,2	0,31649	1,5899	13,9	27,8	386,42	0,2195	138,00	131,6	0,68239	1,9558	13,9	27,8	386,42	0,3571	130,34	156	1,04849	2,3219	13,9	27,8	386,42	0,3373
86,59	107,6	0,32259	1,596	13,9	27,8	386,42	0,2241	137,58	132	0,68839	1,9618	13,9	27,8	386,42	0,3560	130,61	156,4	1,05439	2,3278	13,9	27,8	386,42	0,3380
88,05	108	0,32859	1,602	13,9	27,8	386,42	0,2279	137,14	132,4	0,69429	1,9677	13,9	27,8	386,42	0,3549	130,79	156,8	1,06029	2,3337	13,9	27,8	386,42	0,3385
89,47	108,4	0,33449	1,6079	13,9	27,8	386,42	0,2315	136,74	132,8	0,70019	1,9736	13,9	27,8	386,42	0,3539	131,04	157,2	1,06629	2,3397	13,9	27,8	386,42	0,3391
91,09	108,8	0,34039	1,6138	13,9	27,8	386,42	0,2357	136,47	133,2	0,70619	1,9796	13,9	27,8	386,42	0,3532	131,30	157,6	1,07229	2,3457	13,9	27,8	386,42	0,3398
92,87	109,2	0,34639	1,6198	13,9	27,8	386,42	0,2403	136,29	133,6	0,71219	1,9856	13,9	27,8	386,42	0,3527	131,57	158	1,07839	2,3518	13,9	27,8	386,42	0,3405
94,59	109,6	0,35239	1,6258	13,9	27,8	386,42	0,2448	136,14	134	0,71829	1,9917	13,9	27,8	386,42	0,3523	131,63	158,4	1,08449	2,3579	13,9	27,8	386,42	0,3406
96,32	110	0,35849	1,6319	13,9	27,8	386,42	0,2493	135,94	134,4	0,72439	1,9978	13,9	27,8	386,42	0,3518	131,84	158,8	1,09039	2,3638	13,9	27,8	386,42	0,3412
97,98	110,4	0,36459	1,638	13,9	27,8	386,42	0,2536	135,49	134,8	0,73029	2,0037	13,9	27,8	386,42	0,3506	131,80	159,2	1,09629	2,3697	13,9	27,8	386,42	0,3411
99,51	110,8	0,37049	1,6439	13,9	27,8	386,42	0,2575	135,11	135,2	0,73619	2,0096	13,9	27,8	386,42	0,3496	131,92	159,6	1,10229	2,3757	13,9	27,8	386,42	0,3414
101,09	111,2	0,37639	1,6498	13,9	27,8	386,42	0,2616	134,84	135,6	0,74219	2,0156	13,9	27,8	386,42	0,3489	131,98	160	1,10829	2,3817	13,9	27,8	386,42	0,3415
102,67	111,6	0,38239	1,6558	13,9	27,8	386,42	0,2657	134,61	136	0,74819	2,0216	13,9	27,8	386,42	0,3484	132,35	160,4	1,11429	2,3877	13,9	27,8	386,42	0,3425
104,33	112	0,38829	1,6617	13,9	27,8	386,42	0,2700	134,37	136,4	0,75429	2,0277	13,9	27,8	386,42	0,3477	132,44	160,8	1,12049	2,3939	13,9	27,8	386,42	0,3427
106,11	112,4	0,39439	1,6678	13,9	27,8	386,42	0,2746	134,25	136,8	0,76039	2,0338	13,9	27,8	386,42	0,3474	132,33	161,2	1,12649	2,3999	13,9	27,8	386,42	0,3425
107,74	112,8	0,40049	1,6739	13,9	27,8	386,42	0,2788	133,93	137,2	0,76639	2,0398	13,9	27,8	386,42	0,3466	132,16	161,6	1,13239	2,4058	13,9	27,8	386,42	0,3420
109,28	113,2	0,40649	1,6799	13,9	27,8	386,42	0,2828	133,47	137,6	0,77229	2,0457	13,9	27,8	386,42	0,3454	132,30	162	1,13829	2,4117	13,9	27,8	386,42	0,3424
110,66	113,6	0,41239	1,6858	13,9	27,8	386,42	0,2864	133,15	138	0,77829	2,0517	13,9	27,8	386,42	0,3446	132,38	162,4	1,14429	2,4177	13,9	27,8	386,42	0,3426
112,06	114	0,41839	1,6918	13,9	27,8	386,42	0,2900	132,71	138,4	0,78429	2,0577	13,9	27,8	386,42	0,3434	132,66	162,8	1,15029	2,4237	13,9	27,8	386,42	0,3433
113,53	114,4	0,42429	1,6977	13,9	27,8	386,42	0,2938	132,42	138,8	0,79029	2,0637	13,9	27,8	386,42	0,3427	132,90	163,2	1,15639	2,4298	13,9	27,8	386,42	0,3439
114,96	114,8	0,43029	1,7037	13,9	27,8	386,42	0,2975	132,07	139,2	0,79649	2,0699	13,9	27,8	386,42	0,3418	132,98	163,6	1,16249	2,4359	13,9	27,8	386,42	0,3441
116,46	115,2	0,43639	1,7098	13,9	27,8	386,42	0,3014	132,00	139,6	0,80249	2,0759	13,9	27,8	386,42	0,3416	133,08	164	1,16849	2,4419	13,9	27,8	386,42	0,3444
117,72	115,6	0,44249	1,7159	13,9	27,8	386,42	0,3046	131,59	140	0,80849	2,0819	13,9	27,8	386,42	0,3405	133,18	164,4	1,17439	2,4478	13,9	27,8	386,42	0,3447
118,80	116	0,44849	1,7219	13,9	27,8	386,42	0,3074	131,27	140,4	0,81439	2,0878	13,9	27,8	386,42	0,3397	133,10	164,8	1,18029	2,4537	13,9	27,8	386,42	0,3444
119,82	116,4	0,45439	1,7278	13,9	27,8	386,42	0,3101	130,98	140,8	0,82039	2,0938	13,9	27,8	386,42	0,3390	133,22	165,2	1,18629	2,4597	13,9	27,8	386,42	0,3448
120,86	116,8	0,46039	1,7338	13,9	27,8	386,42	0,3128	130,74	141,2	0,82639	2,0998	13,9	27,8	386,42	0,3383	133,34	165,6	1,19239	2,4658	13,9	27,8	386,42	0,3451
121,95	117,2	0,46639	1,7398	13,9	27,8	386,42	0,3156	130,64	141,6	0,83239	2,1058	13,9	27,8	386,42	0,3381	133,53	166	1,19849	2,4719	13,9	27,8	386,42	0,3456
123,07	117,6	0,47239	1,7458	13,9	27,8	386,42	0,3185	130,64	142	0,83849	2,1119	13,9	27,8	386,42	0,3381	133,56	166,4	1,20449	2,4779	13,9	27,8	386,42	0,3456
124,21	118	0,47849	1,7519	13,9	27,8	386,42	0,3214	130,52	142,4	0,84459	2,118	13,9	27,8	386,42	0,3378	133,29	166,8	1,21039	2,4838	13,9	27,8	386,42	0,3449
125,16	118,4	0,48459	1,758	13,9	27,8	386,42	0,3239	130,17	142,8	0,85049	2,1239	13,9	27,8	386,42	0,3369	133,22	167,2	1,21639	2,4898	13,9	27,8	386,42	0,3448
125,93	118,8	0,49049	1,7639	13,9	27,8	386,42	0,3259	129,71	143,2	0,85649	2,1299	13,9	27,8	386,42	0,3357	133,19	167,6	1,22229	2,4957	13,9	27,8	386,42	0,3447
126,71	119,2	0,49649	1,7699	13,9	27,8	386,42	0,3279	129,71	143,6	0,86239	2,1358	13,9	27,8	386,42	0,3357	133,28	168	1,22829	2,5017	13,9	27,8	386,42	0,3449
127,63	119,6	0,50239	1,7758	13,9	27,8	386,42	0,3303	129,65	144	0,86839	2,1418	13,9	27,8	386,42	0,3355	133,26	168,4	1,23439	2,5078	13,9	27,8	386,42	0,3449
128,55	120	0,50839	1,7818	13,9	27,8	386,42	0,3327	129,35	144,4	0,87449	2,1479	13,9	27,8	386,42	0,3347	133,24	168,8	1,24049	2,5139	13,9	27,8	386,42	0,3448
129,46	120,4	0,51449	1,7879	13,9	27,8	386,42	0,3350	129,23	144,8	0,88059	2,154	13,9	27,8	386,42	0,3344	133,09	169,2	1,24649	2,5199	13,9	27,8	386,42	0,3444
130,37	120,8	0,52059	1,794	13,9	27,8	386,42	0,3374	129,21	145,2	0,88659	2,16	13,9	27,8	386,42	0,3344	132,92	169,6	1,25239	2,5258	13,9	27,8	386,42	0,3440
131,07	121,2	0,52659	1,8	13,9	27,8	386,42	0,3392	128,96	145,6	0,89249	2,1659	13,9	27,8	386,42	0,3337	132,91	170	1,25839	2,5318	13,9	27,8	386,42	0,3440
131,72	121,6	0,53249	1,8059	13,9	27,8	386,42	0,3409	128,62	146	0,89839	2,1718	13,9	27,8	386,42	0,3329	132,83	170,4	1,26429	2,5377	13,9	27,8	386,42	0,3437
132,41	122	0,53839	1,8118	13,9	27,8	386,42	0,3427	128,54	146,4	0,90439	2,1778	13,9	27,8	386,42	0,3326	132,91	170,8	1,27029	2,5437	13,9	27,8	386,42	0,3440
133,12	122,4	0,54439	1,8178	13,9	27,8	386,42	0,3445	128,57	146,8	0,91039	2,1838	13,9	27,8	386,42	0,3327	132,93	171,2	1,27649	2,5499	13,9	27,8	386,42	0,3440
133,81	122,8	0,55039	1,8238	13,9	27,8	386,42	0,3463	128,57	147,2	0,91649	2,1899	13,9	27,8	386,42	0,3327	132,99	171,6	1,28249	2,5559	13,9	27,8	386,42	0,3442

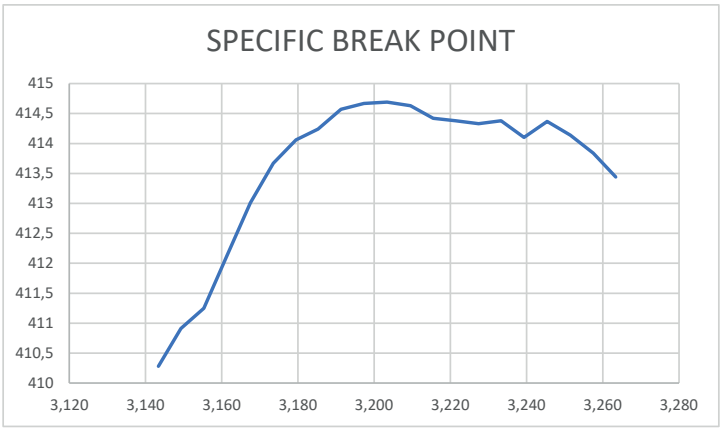
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
132,83	172	1,28849	2,5619	13,9	27,8	386,42	0,3437	135,44	196,4	1,65429	2,9277	13,9	27,8	386,42	0,3505	140,69	220,8	2,02009	3,2935	13,9	27,8	386,42	0,3641
132,74	172,4	1,29439	2,5678	13,9	27,8	386,42	0,3435	135,45	196,8	1,66029	2,9337	13,9	27,8	386,42	0,3505	140,56	221,2	2,02609	3,2995	13,9	27,8	386,42	0,3637
132,60	172,8	1,30029	2,5737	13,9	27,8	386,42	0,3431	135,53	197,2	1,66629	2,9397	13,9	27,8	386,42	0,3507	140,88	221,6	2,03219	3,3056	13,9	27,8	386,42	0,3646
132,61	173,2	1,30629	2,5797	13,9	27,8	386,42	0,3432	135,71	197,6	1,67229	2,9457	13,9	27,8	386,42	0,3512	141,05	222	2,03829	3,3117	13,9	27,8	386,42	0,3650
132,65	173,6	1,31239	2,5858	13,9	27,8	386,42	0,3433	135,99	198	1,67849	2,9519	13,9	27,8	386,42	0,3519	141,15	222,4	2,04439	3,3178	13,9	27,8	386,42	0,3653
132,76	174	1,31849	2,5919	13,9	27,8	386,42	0,3436	136,10	198,4	1,68449	2,9579	13,9	27,8	386,42	0,3522	141,15	222,8	2,05029	3,3237	13,9	27,8	386,42	0,3653
132,68	174,4	1,32449	2,5979	13,9	27,8	386,42	0,3434	136,23	198,8	1,69039	2,9638	13,9	27,8	386,42	0,3525	141,10	223,2	2,05619	3,3296	13,9	27,8	386,42	0,3651
132,68	174,8	1,33039	2,6038	13,9	27,8	386,42	0,3434	136,36	199,2	1,69629	2,9697	13,9	27,8	386,42	0,3529	140,92	223,6	2,06219	3,3356	13,9	27,8	386,42	0,3647
132,57	175,2	1,33629	2,6097	13,9	27,8	386,42	0,3431	136,52	199,6	1,70229	2,9757	13,9	27,8	386,42	0,3533	141,11	224	2,06819	3,3416	13,9	27,8	386,42	0,3652
132,70	175,6	1,34229	2,6157	13,9	27,8	386,42	0,3434	136,78	200	1,70829	2,9817	13,9	27,8	386,42	0,3540	141,48	224,4	2,07429	3,3477	13,9	27,8	386,42	0,3661
132,69	176	1,34829	2,6217	13,9	27,8	386,42	0,3434	137,05	200,4	1,71439	2,9878	13,9	27,8	386,42	0,3547	141,51	224,8	2,08039	3,3538	13,9	27,8	386,42	0,3662
133,02	176,4	1,35439	2,6278	13,9	27,8	386,42	0,3442	137,30	200,8	1,72049	2,9939	13,9	27,8	386,42	0,3553	141,53	225,2	2,08629	3,3597	13,9	27,8	386,42	0,3663
133,09	176,8	1,36049	2,6339	13,9	27,8	386,42	0,3444	137,43	201,2	1,72649	2,9999	13,9	27,8	386,42	0,3556	141,30	225,6	2,09229	3,3657	13,9	27,8	386,42	0,3657
132,96	177,2	1,36649	2,6399	13,9	27,8	386,42	0,3441	137,51	201,6	1,73239	3,0058	13,9	27,8	386,42	0,3559	141,32	226	2,09819	3,3716	13,9	27,8	386,42	0,3657
132,88	177,6	1,37229	2,6457	13,9	27,8	386,42	0,3439	137,62	202	1,73829	3,0117	13,9	27,8	386,42	0,3561	141,29	226,4	2,10419	3,3776	13,9	27,8	386,42	0,3656
132,96	178	1,37829	2,6517	13,9	27,8	386,42	0,3441	137,71	202,4	1,74429	3,0177	13,9	27,8	386,42	0,3564	141,44	226,8	2,11019	3,3836	13,9	27,8	386,42	0,3660
133,04	178,4	1,38429	2,6577	13,9	27,8	386,42	0,3443	137,83	202,8	1,75029	3,0237	13,9	27,8	386,42	0,3567	141,62	227,2	2,11629	3,3897	13,9	27,8	386,42	0,3665
133,21	178,8	1,39029	2,6637	13,9	27,8	386,42	0,3447	138,06	203,2	1,75649	3,0299	13,9	27,8	386,42	0,3573	141,77	227,6	2,12239	3,3958	13,9	27,8	386,42	0,3669
133,57	179,2	1,39639	2,6698	13,9	27,8	386,42	0,3457	138,03	203,6	1,76249	3,0359	13,9	27,8	386,42	0,3572	141,74	228	2,12839	3,4018	13,9	27,8	386,42	0,3668
133,60	179,6	1,40249	2,6759	13,9	27,8	386,42	0,3457	137,96	204	1,76849	3,0419	13,9	27,8	386,42	0,3570	141,85	228,4	2,13429	3,4077	13,9	27,8	386,42	0,3671
133,66	180	1,40839	2,6818	13,9	27,8	386,42	0,3459	137,90	204,4	1,77429	3,0477	13,9	27,8	386,42	0,3569	142,02	228,8	2,14029	3,4137	13,9	27,8	386,42	0,3675
133,62	180,4	1,41439	2,6878	13,9	27,8	386,42	0,3458	137,99	204,8	1,78029	3,0537	13,9	27,8	386,42	0,3571	142,14	229,2	2,14619	3,4196	13,9	27,8	386,42	0,3678
133,77	180,8	1,42029	2,6937	13,9	27,8	386,42	0,3462	138,16	205,2	1,78629	3,0597	13,9	27,8	386,42	0,3575	142,31	229,6	2,15229	3,4257	13,9	27,8	386,42	0,3683
133,82	181,2	1,42629	2,6997	13,9	27,8	386,42	0,3463	138,41	205,6	1,79239	3,0658	13,9	27,8	386,42	0,3582	142,46	230	2,15839	3,4318	13,9	27,8	386,42	0,3687
134,02	181,6	1,43229	2,7057	13,9	27,8	386,42	0,3468	138,53	206	1,79849	3,0719	13,9	27,8	386,42	0,3585	142,51	230,4	2,16449	3,4379	13,9	27,8	386,42	0,3688
134,34	182	1,43849	2,7119	13,9	27,8	386,42	0,3477	138,50	206,4	1,80449	3,0779	13,9	27,8	386,42	0,3584	142,41	230,8	2,17039	3,4438	13,9	27,8	386,42	0,3685
134,43	182,4	1,44449	2,7179	13,9	27,8	386,42	0,3479	138,44	206,8	1,81039	3,0838	13,9	27,8	386,42	0,3583	142,47	231,2	2,17629	3,4497	13,9	27,8	386,42	0,3687
134,40	182,8	1,45039	2,7238	13,9	27,8	386,42	0,3478	138,47	207,2	1,81629	3,0897	13,9	27,8	386,42	0,3583	142,44	231,6	2,18229	3,4557	13,9	27,8	386,42	0,3686
134,35	183,2	1,45629	2,7297	13,9	27,8	386,42	0,3477	138,58	207,6	1,82229	3,0957	13,9	27,8	386,42	0,3586	142,62	232	2,18829	3,4617	13,9	27,8	386,42	0,3691
134,29	183,6	1,46229	2,7357	13,9	27,8	386,42	0,3475	138,64	208	1,82829	3,1017	13,9	27,8	386,42	0,3588	142,90	232,4	2,19439	3,4678	13,9	27,8	386,42	0,3698
134,34	184	1,46829	2,7417	13,9	27,8	386,42	0,3477	138,70	208,4	1,83439	3,1078	13,9	27,8	386,42	0,3589	143,06	232,8	2,20049	3,4739	13,9	27,8	386,42	0,3702
134,54	184,4	1,47439	2,7478	13,9	27,8	386,42	0,3482	138,76	208,8	1,84049	3,1139	13,9	27,8	386,42	0,3591	143,03	233,2	2,20649	3,4799	13,9	27,8	386,42	0,3701
134,72	184,8	1,48049	2,7539	13,9	27,8	386,42	0,3486	138,70	209,2	1,84639	3,1198	13,9	27,8	386,42	0,3589	143,09	233,6	2,21239	3,4858	13,9	27,8	386,42	0,3703
134,47	185,2	1,48639	2,7598	13,9	27,8	386,42	0,3480	138,65	209,6	1,85229	3,1257	13,9	27,8	386,42	0,3588	143,20	234	2,21839	3,4918	13,9	27,8	386,42	0,3706
134,63	185,6	1,49239	2,7658	13,9	27,8	386,42	0,3484	138,67	210	1,85819	3,1316	13,9	27,8	386,42	0,3589	143,26	234,4	2,22429	3,4977	13,9	27,8	386,42	0,3707
134,65	186	1,49829	2,7717	13,9	27,8	386,42	0,3485	138,74	210,4	1,86419	3,1376	13,9	27,8	386,42	0,3590	143,50	234,8	2,23039	3,5038	13,9	27,8	386,42	0,3714
134,71	186,4	1,50429	2,7777	13,9	27,8	386,42	0,3486	138,88	210,8	1,87029	3,1437	13,9	27,8	386,42	0,3594	143,70	235,2	2,23649	3,5099	13,9	27,8	386,42	0,3719
134,80	186,8	1,51029	2,7837	13,9	27,8	386,42	0,3488	139,11	211,2	1,87639	3,1498	13,9	27,8	386,42	0,3600	143,68	235,6	2,24259	3,516	13,9	27,8	386,42	0,3718
134,83	187,2	1,51639	2,7898	13,9	27,8	386,42	0,3489	139,18	211,6	1,88239	3,1558	13,9	27,8	386,42	0,3602	143,56	236	2,24849	3,5219	13,9	27,8	386,42	0,3715
134,97	187,6	1,52249	2,7959	13,9	27,8	386,42	0,3493	139,07	212	1,88839	3,1618	13,9	27,8	386,42	0,3599	143,40	236,4	2,25439	3,5278	13,9	27,8	386,42	0,3711
135,04	188	1,52839	2,8018	13,9	27,8	386,42	0,3495	139,17	212,4	1,89429	3,1677	13,9	27,8	386,42	0,3602	143,49	236,8	2,26029	3,5337	13,9	27,8	386,42	0,3713
135,01	188,4	1,53429	2,8077	13,9	27,8	386,42	0,3494	139,30	212,8	1,90019	3,1736	13,9	27,8	386,42	0,3605	143,46	237,2	2,26629	3,5397	13,9	27,8	386,42	0,3713
135,12	188,8	1,54029	2,8137	13,9	27,8	386,42	0,3497	139,41	213,2	1,90619	3,1796	13,9	27,8	386,42	0,3608	143,65	237,6	2,27239	3,5458	13,9	27,8	386,42	0,3717
135,14	189,2	1,54629	2,8197	13,9	27,8	386,42	0,3497	139,54	213,6	1,91219	3,1856	13,9	27,8	386,42	0,3611	143,74	238	2,27849	3,5519	13,9	27,8	386,42	0,3720
135,23	189,6	1,55229	2,8257	13,9	27,8	386,42	0,3500	139,58	214	1,91829	3,1917	13,9	27,8	386,42	0,3612	143,78	238,4	2,28449	3,5579	13,9	27,8	386,42	0,3721
135,35	190	1,55839	2,8318	13,9	27,8	386,42	0,3503	139,59	214,4	1,92429	3,1977	13,9	27,8	386,42	0,3612	143,70	238,8	2,29049	3,5639	13,9	27,8	386,42	0,3719
135,36	190,4	1,56449	2,8379	13,9	27,8	386,42	0,3503	139,60	214,8	1,93029	3,2037	13,9	27,8	386,42	0,3613	143,70	239,2	2,29629	3,5697	13,9	27,8	386,42	0,3719
135,24	190,8	1,57039	2,8438	13,9	27,8	386,42	0,3500	139,59	215,2	1,93619	3,2096	13,9	27,8	386,42	0,3612	143,87	239,6	2,30229	3,5757	13,9	27,8	386,42	0,3723
135,28	191,2	1,57629	2,8497	13,9	27,8	386,42	0,3501	139,64	215,6	1,94219	3,2156	13,9	27,8	386,42	0,3614	143,98	240	2,30829	3,5817	13,9	27,8	386,42	0,3726
135,32	191,6	1,58229	2,8557	13,9	27,8	386,42	0,3502	139,81	216	1,94819	3,2216	13,9	27,8	386,42	0,3618	144,30	240,4	2,31439	3,5878	13,9	27,8	386,42	0,3734
135,42	192	1,58829	2,8617	13,9	27,8	386,42	0,3504	140,02	216,4	1,95419	3,2276	13,9	27,8	386,42	0,3624	144,29	240,8	2,32039	3,5938	13,9	27,8	386,42	0,3734
135,57	192,4	1,59439	2,8678	13,9	27,8	386,42	0,3508	140,10	216,8	1,96029	3,2337	13,9	27,8	386,42	0,3626	144,32	241,2	2,32639	3,5998	13,9	27,8	386,42	0,3735
135,50	192,8	1,60049	2,8739	13,9	27,8	386,42	0,3507	140,15	217,2	1,96629	3,2397	13,9	27,8	386,42	0,3627	143,88	241,6	2,33229	3,6057	13,9	27,8	386,42	0,3723
135,37	193,2	1,60649	2,8799	13,9	27,8	386,42	0,3503	140,15	217,6	1,97219	3,2456	13,9	27,8	386,42	0,3627	144,19	242	2,33829	3,6117	13,9	27,8	386,42	0,3731
135,32	193,6	1,61239	2,8858	13,9	27,8	386,42	0,3502	140,21	218	1,97819	3,2516	13,9	27,8	386,42	0,3628	144,18	242,4	2,34419	3,6176	13,9	27,8	386,42	0,3731
135,24	194	1,61829	2,8917	13,9	27,8	386,42	0,3500	140,21	218,4	1,98409	3,2575	13,9	27,8	386,42	0,3628	144,72	242,8	2,35019	3,6236	13,9	27,8	386,42	0,3745
135,28	194,4	1,62429	2,8977	13,9	27,8	386,42	0,3501	140,39	218,8	1,99009	3,2635	13,9	27,8	386,42	0,3633	144,97	243,2	2,35639	3,6298	13,9	27,8	386,42	0,3752
135,31	194,8	1,63029	2,9037	13,9	27,8	386,42	0,3502	140,51	219,2	1,99629	3,2697	13,9	27,8	386,42	0,3636	145,21	243,6	2,36239	3,6358	13,9	27,8	386,42	0,3758
135,46	195,2	1,63649	2,9099	13,9	27,8	386,42	0,3506	140,69	219,6	2,00229	3,2757	13,9	27,8	386,42	0,3641	144,96	244	2,36839	3,6418	13,9	27,8	386,42	0,3751
135,55	195,6	1,64249	2,9159	13,9	27,8	386,42	0,3508	140,73	220	2,00819	3,2816	13,9	27,8	386,42	0,3642	145,08	244,4	2,37429	3,6477	13,9	27,8	386,42	0,3754
135,50	196	1,64849	2,9219	13,9	27,8	386,42	0,3507	140,68	220,4	2,01409	3,2875	13,9	27,8	386,42	0,3641	144,99	244,8	2,38019	3,6536	13,9	27,8	386,42	0,3752

LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
145,17	245,2	2,38629	3,6597	13,9	27,8	386,42	0,3757	155,55	269,6	2,75239	4,0258	13,9	27,8	386,42	0,4025	158,52	294	3,11859	4,392	13,9	27,8	386,42	0,4102
145,80	245,6	2,39229	3,6657	13,9	27,8	386,42	0,3773	155,89	270	2,75849	4,0319	13,9	27,8	386,42	0,4034	158,51	294,4	3,12459	4,398	13,9	27,8	386,42	0,4102
145,69	246	2,39839	3,6718	13,9	27,8	386,42	0,3770	156,06	270,4	2,76449	4,0379	13,9	27,8	386,42	0,4039	158,50	294,8	3,13049	4,4039	13,9	27,8	386,42	0,4102
145,72	246,4	2,40439	3,6778	13,9	27,8	386,42	0,3771	156,06	270,8	2,77049	4,0439	13,9	27,8	386,42	0,4039	158,65	295,2	3,13639	4,4098	13,9	27,8	386,42	0,4106
145,69	246,8	2,41029	3,6837	13,9	27,8	386,42	0,3770	156,25	271,2	2,77639	4,0498	13,9	27,8	386,42	0,4044	158,77	295,34	3,13849	4,4119	13,9	27,8	386,42	0,4109
145,88	247,2	2,41629	3,6897	13,9	27,8	386,42	0,3775	156,42	271,6	2,78229	4,0557	13,9	27,8	386,42	0,4048								
146,07	247,6	2,42219	3,6956	13,9	27,8	386,42	0,3780	156,60	272	2,78839	4,0618	13,9	27,8	386,42	0,4053								
146,32	248	2,42819	3,7016	13,9	27,8	386,42	0,3787	156,82	272,4	2,79449	4,0679	13,9	27,8	386,42	0,4058								
146,64	248,4	2,43429	3,7077	13,9	27,8	386,42	0,3795	157,05	272,8	2,80049	4,0739	13,9	27,8	386,42	0,4064								
146,96	248,8	2,44039	3,7138	13,9	27,8	386,42	0,3803	157,13	273,2	2,80659	4,08	13,9	27,8	386,42	0,4066								
147,04	249,2	2,44639	3,7198	13,9	27,8	386,42	0,3805	157,03	273,6	2,81249	4,0859	13,9	27,8	386,42	0,4064								
147,10	249,6	2,45229	3,7257	13,9	27,8	386,42	0,3807	157,21	274	2,81839	4,0918	13,9	27,8	386,42	0,4068								
147,25	250	2,45819	3,7316	13,9	27,8	386,42	0,3811	157,38	274,4	2,82439	4,0978	13,9	27,8	386,42	0,4073								
147,42	250,4	2,46419	3,7376	13,9	27,8	386,42	0,3815	157,68	274,8	2,83039	4,1038	13,9	27,8	386,42	0,4081								
147,72	250,8	2,47019	3,7436	13,9	27,8	386,42	0,3823	157,96	275,2	2,83649	4,1099	13,9	27,8	386,42	0,4088								
148,02	251,2	2,47629	3,7497	13,9	27,8	386,42	0,3831	158,14	275,6	2,84259	4,116	13,9	27,8	386,42	0,4092								
148,26	251,6	2,48239	3,7558	13,9	27,8	386,42	0,3837	158,16	276	2,84849	4,1219	13,9	27,8	386,42	0,4093								
148,32	252	2,48829	3,7617	13,9	27,8	386,42	0,3838	158,41	276,4	2,85449	4,1279	13,9	27,8	386,42	0,4099								
148,54	252,4	2,49429	3,7677	13,9	27,8	386,42	0,3844	158,63	276,8	2,86039	4,1338	13,9	27,8	386,42	0,4105								
148,69	252,8	2,50019	3,7736	13,9	27,8	386,42	0,3848	158,64	277,2	2,86639	4,1398	13,9	27,8	386,42	0,4105								
148,90	253,2	2,50619	3,7796	13,9	27,8	386,42	0,3853	158,89	277,6	2,87239	4,1458	13,9	27,8	386,42	0,4112								
149,15	253,6	2,51229	3,7857	13,9	27,8	386,42	0,3860	158,90	278	2,87849	4,1519	13,9	27,8	386,42	0,4112								
149,38	254	2,51829	3,7917	13,9	27,8	386,42	0,3866	158,87	278,4	2,88459	4,158	13,9	27,8	386,42	0,4111								
149,71	254,4	2,52439	3,7978	13,9	27,8	386,42	0,3874	158,87	278,8	2,89039	4,1638	13,9	27,8	386,42	0,4111								
149,56	254,8	2,53029	3,8037	13,9	27,8	386,42	0,3870	158,86	279,2	2,89629	4,1697	13,9	27,8	386,42	0,4111								
149,30	255,2	2,53619	3,8096	13,9	27,8	386,42	0,3864	159,01	279,6	2,90229	4,1757	13,9	27,8	386,42	0,4115								
149,46	255,6	2,54219	3,8156	13,9	27,8	386,42	0,3868	159,18	280	2,90829	4,1817	13,9	27,8	386,42	0,4119								
149,67	256	2,54819	3,8216	13,9	27,8	386,42	0,3873	159,44	280,4	2,91439	4,1878	13,9	27,8	386,42	0,4126								
149,88	256,4	2,55429	3,8277	13,9	27,8	386,42	0,3879	159,64	280,8	2,92049	4,1939	13,9	27,8	386,42	0,4131								
150,20	256,8	2,56039	3,8338	13,9	27,8	386,42	0,3887	159,64	281,2	2,92649	4,1999	13,9	27,8	386,42	0,4131								
150,30	257,2	2,56629	3,8397	13,9	27,8	386,42	0,3890	159,67	281,6	2,93229	4,2057	13,9	27,8	386,42	0,4132								
150,39	257,6	2,57229	3,8457	13,9	27,8	386,42	0,3892	159,71	282	2,93829	4,2117	13,9	27,8	386,42	0,4133								
150,61	258	2,57819	3,8516	13,9	27,8	386,42	0,3898	159,79	282,4	2,94419	4,2176	13,9	27,8	386,42	0,4135								
150,74	258,4	2,58419	3,8576	13,9	27,8	386,42	0,3901	159,85	282,8	2,95029	4,2237	13,9	27,8	386,42	0,4137								
150,95	258,8	2,59019	3,8636	13,9	27,8	386,42	0,3906	160,00	283,2	2,95639	4,2298	13,9	27,8	386,42	0,4141								
151,65	259,2	2,59629	3,8697	13,9	27,8	386,42	0,3924	159,90	283,6	2,96249	4,2359	13,9	27,8	386,42	0,4138								
151,86	259,6	2,60239	3,8758	13,9	27,8	386,42	0,3930	159,62	284	2,96839	4,2418	13,9	27,8	386,42	0,4131								
151,93	260	2,60829	3,8817	13,9	27,8	386,42	0,3932	159,42	284,4	2,97429	4,2477	13,9	27,8	386,42	0,4126								
152,06	260,4	2,61429	3,8877	13,9	27,8	386,42	0,3935	159,33	284,8	2,98029	4,2537	13,9	27,8	386,42	0,4123								
152,06	260,8	2,62019	3,8936	13,9	27,8	386,42	0,3935	159,23	285,2	2,98629	4,2597	13,9	27,8	386,42	0,4121								
152,28	261,2	2,62619	3,8996	13,9	27,8	386,42	0,3941	159,28	285,6	2,99229	4,2657	13,9	27,8	386,42	0,4122								
152,50	261,6	2,63229	3,9057	13,9	27,8	386,42	0,3946	159,28	286	2,99849	4,2719	13,9	27,8	386,42	0,4122								
152,89	262	2,63839	3,9118	13,9	27,8	386,42	0,3957	159,09	286,4	3,00449	4,2779	13,9	27,8	386,42	0,4117								
152,97	262,4	2,64439	3,9178	13,9	27,8	386,42	0,3959	158,85	286,8	3,01039	4,2838	13,9	27,8	386,42	0,4111								
152,98	262,8	2,65029	3,9237	13,9	27,8	386,42	0,3959	158,60	287,2	3,01629	4,2897	13,9	27,8	386,42	0,4104								
153,18	263,2	2,65619	3,9296	13,9	27,8	386,42	0,3964	158,66	287,6	3,02229	4,2957	13,9	27,8	386,42	0,4106								
153,42	263,6	2,66219	3,9356	13,9	27,8	386,42	0,3970	158,47	288	3,02829	4,3017	13,9	27,8	386,42	0,4101								
153,62	264	2,66819	3,9416	13,9	27,8	386,42	0,3975	158,58	288,4	3,03449	4,3079	13,9	27,8	386,42	0,4104								
154,04	264,4	2,67439	3,9478	13,9	27,8	386,42	0,3986	158,47	288,8	3,04059	4,314	13,9	27,8	386,42	0,4101								
154,11	264,8	2,68039	3,9538	13,9	27,8	386,42	0,3988	158,30	289,2	3,04649	4,3199	13,9	27,8	386,42	0,4097								
154,12	265,2	2,68639	3,9598	13,9	27,8	386,42	0,3988	158,01	289,6	3,05249	4,3259	13,9	27,8	386,42	0,4089								
153,98	265,6	2,69229	3,9657	13,9	27,8	386,42	0,3985	157,89	290	3,05839	4,3318	13,9	27,8	386,42	0,4086								
154,14	266	2,69829	3,9717	13,9	27,8	386,42	0,3989	157,93	290,4	3,06439	4,3378	13,9	27,8	386,42	0,4087								
154,27	266,4	2,70429	3,9777	13,9	27,8	386,42	0,3992	158,06	290,8	3,07049	4,3439	13,9	27,8	386,42	0,4090								
154,38	266,8	2,71029	3,9837	13,9	27,8	386,42	0,3995	158,16	291,2	3,07659	4,35	13,9	27,8	386,42	0,4093								
154,65	267,2	2,71649	3,9899	13,9	27,8	386,42	0,4002	158,07	291,6	3,08259	4,356	13,9	27,8	386,42	0,4091								
154,66	267,6	2,72249	3,9959	13,9	27,8	386,42	0,4002	157,83	292	3,08859	4,362	13,9	27,8	386,42	0,4084								
154,65	268	2,72849	4,0019	13,9	27,8	386,42	0,4002	157,71	292,4	3,09449	4,3679	13,9	27,8	386,42	0,4081								
154,72	268,4	2,73439	4,0078	13,9	27,8	386,42	0,4004	157,89	292,8	3,10039	4,3738	13,9	27,8	386,42	0,4086								
155,10	268,8	2,74029	4,0137	13,9	27,8	386,42	0,4014	158,03	293,2	3,10639	4,3798	13,9	27,8	386,42	0,4090								
155,31	269,2	2,74629	4,0197	13,9	27,8	386,42	0,4019	158,39	293,6	3,11249	4,3859	13,9	27,8	386,42	0,4099								

3.3.1.6-B Mix. Proportion Tests
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LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
0,00	1,2	-1,39835	0	14,8	32,5	481	0,0000
0,01	1,6	-1,39235	0,006	14,8	32,5	481	0,0000
0,00	2	-1,38625	0,0121	14,8	32,5	481	0,0000
0,01	2,4	-1,38015	0,0182	14,8	32,5	481	0,0000
0,01	2,8	-1,37425	0,0241	14,8	32,5	481	0,0000
0,00	3,2	-1,36835	0,03	14,8	32,5	481	0,0000
0,00	3,6	-1,36235	0,036	14,8	32,5	481	0,0000
0,00	4	-1,35645	0,0419	14,8	32,5	481	0,0000
0,01	4,4	-1,35035	0,048	14,8	32,5	481	0,0000
0,01	4,8	-1,34425	0,0541	14,8	32,5	481	0,0000
-0,01	5,2	-1,33825	0,0601	14,8	32,5	481	0,0000
0,00	5,6	-1,33235	0,066	14,8	32,5	481	0,0000
0,00	6	-1,32635	0,072	14,8	32,5	481	0,0000
0,00	6,4	-1,32045	0,0779	14,8	32,5	481	0,0000
0,00	6,8	-1,31455	0,0838	14,8	32,5	481	0,0000
-0,02	7,2	-1,30835	0,09	14,8	32,5	481	0,0000
-0,01	7,6	-1,30235	0,096	14,8	32,5	481	0,0000
0,00	8	-1,29635	0,102	14,8	32,5	481	0,0000
0,03	8,4	-1,29045	0,1079	14,8	32,5	481	0,0001
0,01	8,8	-1,28455	0,1138	14,8	32,5	481	0,0000
-0,06	9,2	-1,27865	0,1197	14,8	32,5	481	-0,0001
0,02	9,6	-1,27265	0,1257	14,8	32,5	481	0,0000
0,15	10	-1,26655	0,1318	14,8	32,5	481	0,0003
0,20	10,4	-1,26045	0,1379	14,8	32,5	481	0,0004
0,25	10,8	-1,25455	0,1438	14,8	32,5	481	0,0005
0,30	11,2	-1,24865	0,1497	14,8	32,5	481	0,0006
0,32	11,6	-1,24275	0,1556	14,8	32,5	481	0,0007
0,42	12	-1,23675	0,1616	14,8	32,5	481	0,0009
0,52	12,4	-1,23075	0,1676	14,8	32,5	481	0,0011
0,61	12,8	-1,22465	0,1737	14,8	32,5	481	0,0013
0,69	13,2	-1,21865	0,1797	14,8	32,5	481	0,0014
0,67	13,6	-1,21265	0,1857	14,8	32,5	481	0,0014
0,75	14	-1,20675	0,1916	14,8	32,5	481	0,0016
0,83	14,4	-1,20085	0,1975	14,8	32,5	481	0,0017
0,87	14,8	-1,19485	0,2035	14,8	32,5	481	0,0018
0,92	15,2	-1,18875	0,2096	14,8	32,5	481	0,0019
0,98	15,6	-1,18265	0,2157	14,8	32,5	481	0,0020
1,00	16	-1,17665	0,2217	14,8	32,5	481	0,0021
1,07	16,4	-1,17075	0,2276	14,8	32,5	481	0,0022
1,12	16,8	-1,16485	0,2335	14,8	32,5	481	0,0023
1,17	17,2	-1,15885	0,2395	14,8	32,5	481	0,0024
1,16	17,6	-1,15285	0,2455	14,8	32,5	481	0,0024
1,17	18	-1,14665	0,2517	14,8	32,5	481	0,0024
1,18	18,4	-1,14065	0,2577	14,8	32,5	481	0,0025
1,18	18,8	-1,13475	0,2636	14,8	32,5	481	0,0025
1,19	19,2	-1,12875	0,2696	14,8	32,5	481	0,0025
1,20	19,6	-1,12285	0,2755	14,8	32,5	481	0,0025
1,18	20	-1,11685	0,2815	14,8	32,5	481	0,0025
1,15	20,4	-1,11075	0,2876	14,8	32,5	481	0,0024
1,20	20,8	-1,10465	0,2937	14,8	32,5	481	0,0025
1,20	21,2	-1,09855	0,2998	14,8	32,5	481	0,0025
1,19	21,6	-1,09265	0,3057	14,8	32,5	481	0,0025
1,19	22	-1,08675	0,3116	14,8	32,5	481	0,0025
1,19	22,4	-1,08075	0,3176	14,8	32,5	481	0,0025
1,19	22,8	-1,07475	0,3236	14,8	32,5	481	0,0025
1,22	23,2	-1,06855	0,3298	14,8	32,5	481	0,0025
1,21	23,6	-1,06245	0,3359	14,8	32,5	481	0,0025
1,20	24	-1,05645	0,3419	14,8	32,5	481	0,0025
1,22	24,4	-1,05055	0,3478	14,8	32,5	481	0,0025
1,23	24,8	-1,04455	0,3538	14,8	32,5	481	0,0026
1,21	25,2	-1,03855	0,3598	14,8	32,5	481	0,0025

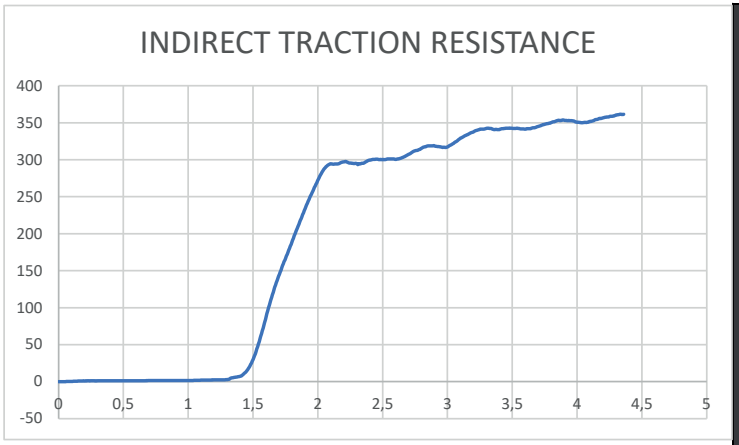
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
1,24	25,6	-1,03255	0,3658	14,8	32,5	481	0,0026	1,51	50	-0,66645	0,7319	14,8	32,5	481	0,0031	1,61	74,4	-0,30025	1,0981	14,8	32,5	481	0,0033
1,20	26	-1,02645	0,3719	14,8	32,5	481	0,0025	1,52	50,4	-0,66045	0,7379	14,8	32,5	481	0,0032	1,60	74,8	-0,29435	1,104	14,8	32,5	481	0,0033
1,26	26,4	-1,02035	0,378	14,8	32,5	481	0,0026	1,55	50,8	-0,65445	0,7439	14,8	32,5	481	0,0032	1,58	75,2	-0,28835	1,11	14,8	32,5	481	0,0033
1,27	26,8	-1,01445	0,3839	14,8	32,5	481	0,0026	1,54	51,2	-0,64855	0,7498	14,8	32,5	481	0,0032	1,60	75,6	-0,28245	1,1159	14,8	32,5	481	0,0033
1,26	27,2	-1,00845	0,3899	14,8	32,5	481	0,0026	1,53	51,6	-0,64255	0,7558	14,8	32,5	481	0,0032	1,56	76	-0,27655	1,1218	14,8	32,5	481	0,0032
1,19	27,6	-1,00255	0,3958	14,8	32,5	481	0,0025	1,53	52	-0,63655	0,7618	14,8	32,5	481	0,0032	1,56	76,4	-0,27045	1,1279	14,8	32,5	481	0,0032
1,24	28	-0,99655	0,4018	14,8	32,5	481	0,0026	1,57	52,4	-0,63055	0,7678	14,8	32,5	481	0,0033	1,56	76,8	-0,26435	1,134	14,8	32,5	481	0,0032
1,20	28,4	-0,99045	0,4079	14,8	32,5	481	0,0025	1,50	52,8	-0,62445	0,7739	14,8	32,5	481	0,0031	1,54	77,2	-0,25835	1,14	14,8	32,5	481	0,0032
1,28	28,8	-0,98435	0,414	14,8	32,5	481	0,0027	1,50	53,2	-0,61845	0,7799	14,8	32,5	481	0,0031	1,59	77,6	-0,25245	1,1459	14,8	32,5	481	0,0033
1,28	29,2	-0,97835	0,42	14,8	32,5	481	0,0027	1,53	53,6	-0,61245	0,7859	14,8	32,5	481	0,0032	1,59	78	-0,24655	1,1518	14,8	32,5	481	0,0033
1,30	29,6	-0,97235	0,426	14,8	32,5	481	0,0027	1,54	54	-0,60655	0,7918	14,8	32,5	481	0,0032	1,59	78,4	-0,24065	1,1577	14,8	32,5	481	0,0033
1,34	30	-0,96645	0,4319	14,8	32,5	481	0,0028	1,58	54,4	-0,60065	0,7977	14,8	32,5	481	0,0033	1,59	78,8	-0,23465	1,1637	14,8	32,5	481	0,0033
1,36	30,4	-0,96045	0,4379	14,8	32,5	481	0,0028	1,55	54,8	-0,59465	0,8037	14,8	32,5	481	0,0032	1,59	79,2	-0,22855	1,1698	14,8	32,5	481	0,0033
1,38	30,8	-0,95445	0,4439	14,8	32,5	481	0,0029	1,50	55,2	-0,58845	0,8099	14,8	32,5	481	0,0031	1,57	79,6	-0,22245	1,1759	14,8	32,5	481	0,0033
1,42	31,2	-0,94835	0,45	14,8	32,5	481	0,0030	1,54	55,6	-0,58245	0,8159	14,8	32,5	481	0,0032	1,62	80	-0,21645	1,1819	14,8	32,5	481	0,0034
1,44	31,6	-0,94225	0,4561	14,8	32,5	481	0,0030	1,52	56	-0,57645	0,8219	14,8	32,5	481	0,0032	1,58	80,4	-0,21055	1,1878	14,8	32,5	481	0,0033
1,49	32	-0,93625	0,4621	14,8	32,5	481	0,0031	1,54	56,4	-0,57055	0,8278	14,8	32,5	481	0,0032	1,63	80,8	-0,20465	1,1937	14,8	32,5	481	0,0034
1,47	32,4	-0,93035	0,468	14,8	32,5	481	0,0031	1,55	56,8	-0,56455	0,8338	14,8	32,5	481	0,0032	1,67	81,2	-0,19865	1,1997	14,8	32,5	481	0,0035
1,52	32,8	-0,92445	0,4739	14,8	32,5	481	0,0032	1,55	57,2	-0,55855	0,8398	14,8	32,5	481	0,0032	1,70	81,6	-0,19265	1,2057	14,8	32,5	481	0,0035
1,48	33,2	-0,91845	0,4799	14,8	32,5	481	0,0031	1,56	57,6	-0,55255	0,8458	14,8	32,5	481	0,0032	1,81	82	-0,18655	1,2118	14,8	32,5	481	0,0038
1,50	33,6	-0,91245	0,4859	14,8	32,5	481	0,0031	1,56	58	-0,54645	0,8519	14,8	32,5	481	0,0032	1,77	82,4	-0,18045	1,2179	14,8	32,5	481	0,0037
1,52	34	-0,90635	0,492	14,8	32,5	481	0,0032	1,54	58,4	-0,54035	0,858	14,8	32,5	481	0,0032	1,84	82,8	-0,17455	1,2238	14,8	32,5	481	0,0038
1,46	34,4	-0,90025	0,4981	14,8	32,5	481	0,0030	1,57	58,8	-0,53445	0,8639	14,8	32,5	481	0,0033	1,88	83,2	-0,16865	1,2297	14,8	32,5	481	0,0039
1,49	34,8	-0,89435	0,504	14,8	32,5	481	0,0031	1,55	59,2	-0,52845	0,8699	14,8	32,5	481	0,0032	1,91	83,6	-0,16265	1,2357	14,8	32,5	481	0,0040
1,48	35,2	-0,88845	0,5099	14,8	32,5	481	0,0031	1,56	59,6	-0,52255	0,8758	14,8	32,5	481	0,0032	1,96	84	-0,15665	1,2417	14,8	32,5	481	0,0041
1,49	35,6	-0,88245	0,5159	14,8	32,5	481	0,0031	1,56	60	-0,51655	0,8818	14,8	32,5	481	0,0032	2,06	84,4	-0,15055	1,2478	14,8	32,5	481	0,0043
1,48	36	-0,87645	0,5219	14,8	32,5	481	0,0031	1,58	60,4	-0,51045	0,8879	14,8	32,5	481	0,0033	2,08	84,8	-0,14445	1,2539	14,8	32,5	481	0,0043
1,48	36,4	-0,87045	0,5279	14,8	32,5	481	0,0031	1,58	60,8	-0,50435	0,894	14,8	32,5	481	0,0033	2,08	85,2	-0,13845	1,2599	14,8	32,5	481	0,0043
1,48	36,8	-0,86435	0,534	14,8	32,5	481	0,0031	1,56	61,2	-0,49835	0,9	14,8	32,5	481	0,0032	2,19	85,6	-0,13255	1,2658	14,8	32,5	481	0,0046
1,48	37,2	-0,85835	0,54	14,8	32,5	481	0,0031	1,54	61,6	-0,49245	0,9059	14,8	32,5	481	0,0032	2,21	86	-0,12655	1,2718	14,8	32,5	481	0,0046
1,47	37,6	-0,85245	0,5459	14,8	32,5	481	0,0031	1,56	62	-0,48645	0,9119	14,8	32,5	481	0,0032	2,22	86,4	-0,12065	1,2777	14,8	32,5	481	0,0046
1,48	38	-0,84645	0,5519	14,8	32,5	481	0,0031	1,56	62,4	-0,48055	0,9178	14,8	32,5	481	0,0032	2,27	86,8	-0,11455	1,2838	14,8	32,5	481	0,0047
1,50	38,4	-0,84055	0,5578	14,8	32,5	481	0,0031	1,56	62,8	-0,47445	0,9239	14,8	32,5	481	0,0032	2,24	87,2	-0,10845	1,2899	14,8	32,5	481	0,0047
1,46	38,8	-0,83455	0,5638	14,8	32,5	481	0,0030	1,55	63,2	-0,46835	0,93	14,8	32,5	481	0,0032	2,25	87,6	-0,10235	1,296	14,8	32,5	481	0,0047
1,48	39,2	-0,82845	0,5699	14,8	32,5	481	0,0031	1,55	63,6	-0,46225	0,9361	14,8	32,5	481	0,0032	2,32	88	-0,09635	1,302	14,8	32,5	481	0,0048
1,50	39,6	-0,82235	0,576	14,8	32,5	481	0,0031	1,60	64	-0,45635	0,942	14,8	32,5	481	0,0033	2,41	88,4	-0,09045	1,3079	14,8	32,5	481	0,0050
1,48	40	-0,81635	0,582	14,8	32,5	481	0,0031	1,56	64,4	-0,45035	0,948	14,8	32,5	481	0,0032	2,52	88,8	-0,08455	1,3138	14,8	32,5	481	0,0052
1,49	40,4	-0,81045	0,5879	14,8	32,5	481	0,0031	1,58	64,8	-0,44435	0,954	14,8	32,5	481	0,0033	3,18	89,2	-0,07855	1,3198	14,8	32,5	481	0,0066
1,49	40,8	-0,80455	0,5938	14,8	32,5	481	0,0031	1,57	65,2	-0,43845	0,9599	14,8	32,5	481	0,0033	3,32	89,6	-0,07255	1,3258	14,8	32,5	481	0,0069
1,46	41,2	-0,79855	0,5998	14,8	32,5	481	0,0030	1,55	65,6	-0,43235	0,966	14,8	32,5	481	0,0032	3,90	90	-0,06635	1,332	14,8	32,5	481	0,0081
1,49	41,6	-0,79255	0,6058	14,8	32,5	481	0,0031	1,55	66	-0,42625	0,9721	14,8	32,5	481	0,0032	4,49	90,4	-0,06035	1,338	14,8	32,5	481	0,0093
1,48	42	-0,78645	0,6119	14,8	32,5	481	0,0031	1,57	66,4	-0,42015	0,9782	14,8	32,5	481	0,0033	5,47	90,8	-0,05435	1,344	14,8	32,5	481	0,0114
1,48	42,4	-0,78035	0,618	14,8	32,5	481	0,0031	1,54	66,8	-0,41415	0,9842	14,8	32,5	481	0,0032	6,63	91,2	-0,04845	1,3499	14,8	32,5	481	0,0138
1,50	42,8	-0,77445	0,6239	14,8	32,5	481	0,0031	1,57	67,2	-0,40835	0,99	14,8	32,5	481	0,0033	7,59	91,6	-0,04255	1,3558	14,8	32,5	481	0,0158
1,46	43,2	-0,76855	0,6298	14,8	32,5	481	0,0030	1,57	67,6	-0,40235	0,996	14,8	32,5	481	0,0033	8,51	92	-0,03655	1,3618	14,8	32,5	481	0,0177
1,49	43,6	-0,76255	0,6358	14,8	32,5	481	0,0031	1,57	68	-0,39635	1,002	14,8	32,5	481	0,0033	9,58	92,4	-0,03045	1,3679	14,8	32,5	481	0,0199
1,47	44	-0,75655	0,6418	14,8	32,5	481	0,0031	1,58	68,4	-0,39025	1,0081	14,8	32,5	481	0,0033	10,78	92,8	-0,02435	1,374	14,8	32,5	481	0,0224
1,53	44,4	-0,75045	0,6479	14,8	32,5	481	0,0032	1,62	68,8	-0,38425	1,0141	14,8	32,5	481	0,0034	11,76	93,2	-0,01835	1,38	14,8	32,5	481	0,0244
1,51	44,8	-0,74435	0,654	14,8	32,5	481	0,0031	1,57	69,2	-0,37825	1,0201	14,8	32,5	481	0,0033	12,44	93,6	-0,01245	1,3859	14,8	32,5	481	0,0259
1,48	45,2	-0,73835	0,66	14,8	32,5	481	0,0031	1,58	69,6	-0,37235	1,026	14,8	32,5	481	0,0033	13,09	94	-0,00655	1,3918	14,8	32,5	481	0,0272
1,53	45,6	-0,73245	0,6659	14,8	32,5	481	0,0032	1,59	70	-0,36635	1,032	14,8	32,5	481	0,0033	13,69	94,4	-0,00055	1,3978	14,8	32,5	481	0,0285
1,50	46	-0,72645	0,6719	14,8	32,5	481	0,0031	1,59	70,4	-0,36045	1,0379	14,8	32,5	481	0,0033	14,94	94,8	0,00545	1,4038	14,8	32,5	481	0,0311
1,51	46,4	-0,72055	0,6778	14,8	32,5	481	0,0031	1,56	70,8	-0,35445	1,0439	14,8	32,5	481	0,0032	16,51	95,2	0,01155	1,4099	14,8	32,5	481	0,0343
1,51	46,8	-0,71455	0,6838	14,8	32,5	481	0,0031	1,57	71,2	-0,34835	1,05	14,8	32,5	481	0,0033	18,43	95,6	0,01765	1,416	14,8	32,5	481	0,0383
1,51	47,2	-0,70845	0,6899	14,8	32,5	481	0,0031	1,56	71,6	-0,34225	1,0561	14,8	32,5	481	0,0032	20,50	96	0,02355	1,4219	14,8	32,5	481	0,0426
1,51	47,6	-0,70235	0,696	14,8	32,5	481	0,0031	1,58	72	-0,33625	1,0621	14,8	32,5	481	0,0033	22,88	96,4	0,02945	1,4278	14,8	32,5	481	0,0476
1,52	48	-0,69645	0,7019	14,8	32,5	481	0,0032	1,58	72,4	-0,33035	1,068	14,8	32,5	481	0,0033	25,66	96,8	0,03535	1,4337	14,8	32,5	481	0,0533
1,55	48,4	-0,69055	0,7078	14,8	32,5	481	0,0032	1,55	72,8	-0,32445	1,0739	14,8	32,5	481	0,0032	28,40	97,2	0,04135	1,4397	14,8	32,5	481	0,0590
1,51	48,8	-0,68455	0,7138	14,8	32,5	481	0,0031	1,58	73,2	-0,31845	1,0799	14,8	32,5	481	0,0033	31,29	97,6	0,04735	1,4457	14,8	32,5	481	0,0651
1,52	49,2	-0,67855	0,7198	14,8	32,5	481	0,0032	1,58	73,6	-0,31245	1,0859	14,8	32,5	481	0,0033	34,32	98	0,05355	1,4519	14,8	32,5	481	0,0714
1,50	49,6	-0,67255	0,7258	14,8	32,5	481	0,0031	1,57	74	-0,30635	1,092	14,8	32,5	481	0,0033	37,27	98,4	0,05955	1,4579	14,8	32,5	481	0,0775

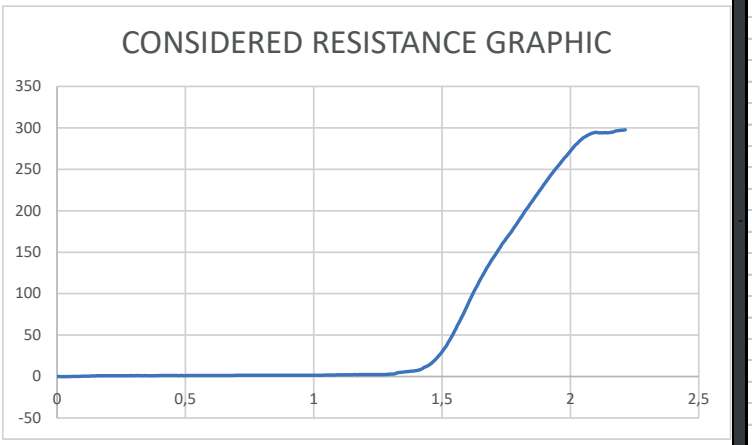
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
40,03	98,8	0,06555	1,4639	14,8	32,5	481	0,0832	234,06	123,2	0,43115	1,8295	14,8	32,5	481	0,4866	337,24	147,6	0,79685	2,1952	14,8	32,5	481	0,7011
42,92	99,2	0,07135	1,4697	14,8	32,5	481	0,0892	236,51	123,6	0,43715	1,8355	14,8	32,5	481	0,4917	338,38	148	0,80285	2,2012	14,8	32,5	481	0,7035
45,59	99,6	0,07735	1,4757	14,8	32,5	481	0,0948	238,96	124	0,44315	1,8415	14,8	32,5	481	0,4968	339,80	148,4	0,80895	2,2073	14,8	32,5	481	0,7064
48,58	100	0,08335	1,4817	14,8	32,5	481	0,1010	241,52	124,4	0,44915	1,8475	14,8	32,5	481	0,5021	341,02	148,8	0,81505	2,2134	14,8	32,5	481	0,7090
51,81	100,4	0,08945	1,4878	14,8	32,5	481	0,1077	244,10	124,8	0,45525	1,8536	14,8	32,5	481	0,5075	341,98	149,2	0,82105	2,2194	14,8	32,5	481	0,7110
55,76	100,8	0,09555	1,4939	14,8	32,5	481	0,1159	246,36	125,2	0,46125	1,8596	14,8	32,5	481	0,5122	342,94	149,6	0,82695	2,2253	14,8	32,5	481	0,7130
59,98	101,2	0,10145	1,4998	14,8	32,5	481	0,1247	248,65	125,6	0,46715	1,8655	14,8	32,5	481	0,5169	343,84	150	0,83295	2,2313	14,8	32,5	481	0,7148
64,29	101,6	0,10745	1,5058	14,8	32,5	481	0,1337	250,91	126	0,47315	1,8715	14,8	32,5	481	0,5216	344,87	150,4	0,83895	2,2373	14,8	32,5	481	0,7170
68,57	102	0,11335	1,5117	14,8	32,5	481	0,1426	253,20	126,4	0,47905	1,8774	14,8	32,5	481	0,5264	345,91	150,8	0,84495	2,2433	14,8	32,5	481	0,7191
73,04	102,4	0,11925	1,5176	14,8	32,5	481	0,1519	255,58	126,8	0,48515	1,8835	14,8	32,5	481	0,5314	347,08	151,2	0,85105	2,2494	14,8	32,5	481	0,7216
77,65	102,8	0,12525	1,5236	14,8	32,5	481	0,1614	257,91	127,2	0,49125	1,8896	14,8	32,5	481	0,5362	348,16	151,6	0,85715	2,2555	14,8	32,5	481	0,7238
82,38	103,2	0,13145	1,5298	14,8	32,5	481	0,1713	259,97	127,6	0,49725	1,8956	14,8	32,5	481	0,5405	349,17	152	0,86315	2,2615	14,8	32,5	481	0,7259
86,97	103,6	0,13745	1,5358	14,8	32,5	481	0,1808	261,73	128	0,50325	1,9016	14,8	32,5	481	0,5441	350,02	152,4	0,86905	2,2674	14,8	32,5	481	0,7277
91,24	104	0,14345	1,5418	14,8	32,5	481	0,1897	263,58	128,4	0,50915	1,9075	14,8	32,5	481	0,5480	351,17	152,8	0,87505	2,2734	14,8	32,5	481	0,7301
95,23	104,4	0,14935	1,5477	14,8	32,5	481	0,1980	265,46	128,8	0,51515	1,9135	14,8	32,5	481	0,5519	352,27	153,2	0,88105	2,2794	14,8	32,5	481	0,7324
99,15	104,8	0,15525	1,5536	14,8	32,5	481	0,2061	267,30	129,2	0,52115	1,9195	14,8	32,5	481	0,5557	353,51	153,6	0,88705	2,2854	14,8	32,5	481	0,7349
102,84	105,2	0,16125	1,5596	14,8	32,5	481	0,2138	269,22	129,6	0,52715	1,9255	14,8	32,5	481	0,5597	354,74	154	0,89315	2,2915	14,8	32,5	481	0,7375
106,45	105,6	0,16725	1,5656	14,8	32,5	481	0,2213	271,33	130	0,53325	1,9316	14,8	32,5	481	0,5641	355,73	154,4	0,89925	2,2976	14,8	32,5	481	0,7396
109,91	106	0,17345	1,5718	14,8	32,5	481	0,2285	273,11	130,4	0,53935	1,9377	14,8	32,5	481	0,5678	356,49	154,8	0,90515	2,3035	14,8	32,5	481	0,7411
113,20	106,4	0,17945	1,5778	14,8	32,5	481	0,2353	274,85	130,8	0,54525	1,9436	14,8	32,5	481	0,5714	357,25	155,2	0,91115	2,3095	14,8	32,5	481	0,7427
116,27	106,8	0,18535	1,5837	14,8	32,5	481	0,2417	276,43	131,2	0,55125	1,9496	14,8	32,5	481	0,5747	358,16	155,6	0,91705	2,3154	14,8	32,5	481	0,7446
119,27	107,2	0,19125	1,5896	14,8	32,5	481	0,2480	278,07	131,6	0,55725	1,9556	14,8	32,5	481	0,5781	359,06	156	0,92315	2,3215	14,8	32,5	481	0,7465
122,39	107,6	0,19725	1,5956	14,8	32,5	481	0,2544	279,73	132	0,56315	1,9615	14,8	32,5	481	0,5816	360,15	156,4	0,92915	2,3275	14,8	32,5	481	0,7488
125,46	108	0,20325	1,6016	14,8	32,5	481	0,2608	281,61	132,4	0,56925	1,9676	14,8	32,5	481	0,5855	361,14	156,8	0,93525	2,3336	14,8	32,5	481	0,7508
128,54	108,4	0,20935	1,6077	14,8	32,5	481	0,2672	283,36	132,8	0,57535	1,9737	14,8	32,5	481	0,5891	361,67	157,2	0,94125	2,3396	14,8	32,5	481	0,7519
131,67	108,8	0,21545	1,6138	14,8	32,5	481	0,2737	284,86	133,2	0,58135	1,9797	14,8	32,5	481	0,5922	362,07	157,6	0,94715	2,3455	14,8	32,5	481	0,7527
134,41	109,2	0,22145	1,6198	14,8	32,5	481	0,2794	286,25	133,6	0,58725	1,9856	14,8	32,5	481	0,5951	362,29	158	0,95315	2,3515	14,8	32,5	481	0,7532
137,03	109,6	0,22735	1,6257	14,8	32,5	481	0,2849	287,55	134	0,59325	1,9916	14,8	32,5	481	0,5978	362,76	158,4	0,95905	2,3574	14,8	32,5	481	0,7542
139,91	110	0,23325	1,6316	14,8	32,5	481	0,2909	289,02	134,4	0,59915	1,9975	14,8	32,5	481	0,6009	363,37	158,8	0,96515	2,3635	14,8	32,5	481	0,7554
142,88	110,4	0,23925	1,6376	14,8	32,5	481	0,2970	290,83	134,8	0,60525	2,0036	14,8	32,5	481	0,6046	363,95	159,2	0,97115	2,3695	14,8	32,5	481	0,7567
145,69	110,8	0,24525	1,6436	14,8	32,5	481	0,3029	292,68	135,2	0,61135	2,0097	14,8	32,5	481	0,6085	364,44	159,6	0,97725	2,3756	14,8	32,5	481	0,7577
148,74	111,2	0,25135	1,6497	14,8	32,5	481	0,3092	294,44	135,6	0,61735	2,0157	14,8	32,5	481	0,6121	364,68	160	0,98325	2,3816	14,8	32,5	481	0,7582
151,61	111,6	0,25745	1,6558	14,8	32,5	481	0,3152	296,08	136	0,62335	2,0217	14,8	32,5	481	0,6156	364,91	160,4	0,98915	2,3875	14,8	32,5	481	0,7586
154,31	112	0,26345	1,6618	14,8	32,5	481	0,3208	297,73	136,4	0,62925	2,0276	14,8	32,5	481	0,6190	365,23	160,8	0,99515	2,3935	14,8	32,5	481	0,7593
157,17	112,4	0,26925	1,6676	14,8	32,5	481	0,3268	299,44	136,8	0,63515	2,0335	14,8	32,5	481	0,6225	365,67	161,2	1,00115	2,3995	14,8	32,5	481	0,7602
160,22	112,8	0,27525	1,6736	14,8	32,5	481	0,3331	301,20	137,2	0,64115	2,0395	14,8	32,5	481	0,6262	366,10	161,6	1,00715	2,4055	14,8	32,5	481	0,7611
163,38	113,2	0,28125	1,6796	14,8	32,5	481	0,3397	303,08	137,6	0,64715	2,0455	14,8	32,5	481	0,6301	366,64	162	1,01325	2,4116	14,8	32,5	481	0,7622
166,81	113,6	0,28725	1,6856	14,8	32,5	481	0,3468	304,73	138	0,65325	2,0516	14,8	32,5	481	0,6335	366,72	162,4	1,01925	2,4176	14,8	32,5	481	0,7624
170,17	114	0,29335	1,6917	14,8	32,5	481	0,3538	306,11	138,4	0,65935	2,0577	14,8	32,5	481	0,6364	366,53	162,8	1,02525	2,4236	14,8	32,5	481	0,7620
173,43	114,4	0,29945	1,6978	14,8	32,5	481	0,3606	307,43	138,8	0,66525	2,0636	14,8	32,5	481	0,6391	366,55	163,2	1,03115	2,4295	14,8	32,5	481	0,7621
176,44	114,8	0,30535	1,7037	14,8	32,5	481	0,3668	308,63	139,2	0,67115	2,0695	14,8	32,5	481	0,6416	366,65	163,6	1,03705	2,4354	14,8	32,5	481	0,7623
179,62	115,2	0,31125	1,7096	14,8	32,5	481	0,3734	309,98	139,6	0,67705	2,0754	14,8	32,5	481	0,6444	366,75	164	1,04305	2,4414	14,8	32,5	481	0,7625
182,91	115,6	0,31725	1,7156	14,8	32,5	481	0,3803	311,53	140	0,68305	2,0814	14,8	32,5	481	0,6477	367,22	164,4	1,04915	2,4475	14,8	32,5	481	0,7635
186,15	116	0,32325	1,7216	14,8	32,5	481	0,3870	313,05	140,4	0,68915	2,0875	14,8	32,5	481	0,6508	367,69	164,8	1,05525	2,4536	14,8	32,5	481	0,7644
189,43	116,4	0,32925	1,7276	14,8	32,5	481	0,3938	314,47	140,8	0,69515	2,0935	14,8	32,5	481	0,6538	367,93	165,2	1,06125	2,4596	14,8	32,5	481	0,7649
192,58	116,8	0,33545	1,7338	14,8	32,5	481	0,4004	315,89	141,2	0,70115	2,0995	14,8	32,5	481	0,6567	368,01	165,6	1,06705	2,4654	14,8	32,5	481	0,7651
195,42	117,2	0,34145	1,7398	14,8	32,5	481	0,4063	317,06	141,6	0,70705	2,1054	14,8	32,5	481	0,6592	368,20	166	1,07305	2,4714	14,8	32,5	481	0,7655
198,12	117,6	0,34735	1,7457	14,8	32,5	481	0,4119	318,56	142	0,71295	2,1113	14,8	32,5	481	0,6623	368,51	166,4	1,07905	2,4774	14,8	32,5	481	0,7661
200,69	118	0,35325	1,7516	14,8	32,5	481	0,4172	320,03	142,4	0,71895	2,1173	14,8	32,5	481	0,6653	368,76	166,8	1,08505	2,4834	14,8	32,5	481	0,7667
203,34	118,4	0,35925	1,7576	14,8	32,5	481	0,4227	321,55	142,8	0,72495	2,1233	14,8	32,5	481	0,6685	369,31	167,2	1,09115	2,4895	14,8	32,5	481	0,7678
206,20	118,8	0,36525	1,7636	14,8	32,5	481	0,4287	322,96	143,2	0,73105	2,1294	14,8	32,5	481	0,6714	369,48	167,6	1,09725	2,4956	14,8	32,5	481	0,7681
209,12	119,2	0,37135	1,7697	14,8	32,5	481	0,4348	324,51	143,6	0,73715	2,1355	14,8	32,5	481	0,6747	369,50	168	1,10315	2,5015	14,8	32,5	481	0,7682
212,01	119,6	0,37735	1,7757	14,8	32,5	481	0,4408	325,78	144	0,74305	2,1414	14,8	32,5	481	0,6773	369,72	168,4	1,10905	2,5074	14,8	32,5	481	0,7686
214,52	120	0,38335	1,7817	14,8	32,5	481	0,4460	327,10	144,4	0,74895	2,1473	14,8	32,5	481	0,6800	369,93	168,8	1,11505	2,5134	14,8	32,5	481	0,7691
217,04	120,4	0,38925	1,7876	14,8	32,5	481	0,4512	328,48	144,8	0,75485	2,1532	14,8	32,5	481	0,6829	370,29	169,2	1,12095	2,5193	14,8	32,5	481	0,7698
219,60	120,8	0,39515	1,7935	14,8	32,5	481	0,4565	329,69	145,2	0,76085	2,1592	14,8	32,5	481	0,6854	370,61	169,6	1,12705	2,5254	14,8	32,5	481	0,7705
221,97	121,2	0,40115	1,7995	14,8	32,5	481	0,4615	331,21	145,6	0,76685	2,1652	14,8	32,5	481	0,6886	371,09	170	1,13315	2,5315	14,8	32,5	481	0,7715
224,50	121,6	0,40725	1,8056	14,8	32,5	481	0,4667	332,68	146	0,77295	2,1713	14,8	32,5	481	0,6916	371,37	170,4	1,13915	2,5375	14,8	32,5	481	0,7721
227,03	122	0,41335	1,8117	14,8	32,5	481	0,4720	334,07	146,4	0,77905	2,1774	14,8	32,5	481	0,6945	371,34	170,8	1,14505	2,5434	14,8	32,5	481	0,7720
229,49	122,4	0,41935	1,8177	14,8	32,5	481	0,4771	335,06	146,8	0,78495	2,1833	14,8	32,5	481	0,6966	371,21	171,2	1,15095	2,5493	14,8	32,5	481	0,7717
231,74	122,8	0,42525	1,8236	14,8	32,5	481	0,4818	336,18	147,2	0,79085	2,1892	14,8	32,5	481	0,6989	371,31	171,6	1,15695	2,5553	14,8	32,5	481	0,7720

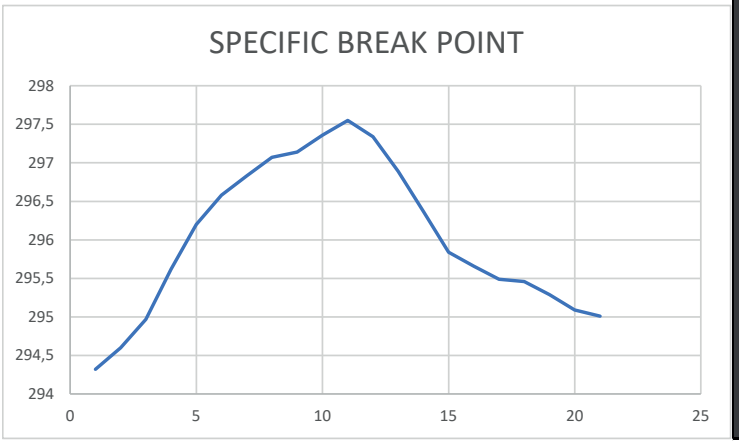
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
371,41	172	1,16295	2,5613	14,8	32,5	481	0,7722	381,31	196,4	1,52905	2,9274	14,8	32,5	481	0,7927	413,96	220,8	1,89505	3,2934	14,8	32,5	481	0,8606
371,59	172,4	1,16905	2,5674	14,8	32,5	481	0,7725	381,81	196,8	1,53515	2,9335	14,8	32,5	481	0,7938	413,93	221,2	1,90105	3,2994	14,8	32,5	481	0,8606
371,56	172,8	1,17515	2,5735	14,8	32,5	481	0,7725	382,17	197,2	1,54105	2,9394	14,8	32,5	481	0,7945	414,09	221,6	1,90695	3,3053	14,8	32,5	481	0,8609
371,50	173,2	1,18115	2,5795	14,8	32,5	481	0,7723	382,59	197,6	1,54705	2,9454	14,8	32,5	481	0,7954	414,24	222	1,91295	3,3113	14,8	32,5	481	0,8612
371,31	173,6	1,18705	2,5854	14,8	32,5	481	0,7720	383,17	198	1,55295	2,9513	14,8	32,5	481	0,7966	414,22	222,4	1,91895	3,3173	14,8	32,5	481	0,8612
371,42	174	1,19305	2,5914	14,8	32,5	481	0,7722	383,75	198,4	1,55895	2,9573	14,8	32,5	481	0,7978	414,34	222,8	1,92495	3,3233	14,8	32,5	481	0,8614
371,59	174,4	1,19905	2,5974	14,8	32,5	481	0,7725	384,60	198,8	1,56495	2,9633	14,8	32,5	481	0,7996	414,45	223,2	1,93105	3,3294	14,8	32,5	481	0,8616
371,78	174,8	1,20505	2,6034	14,8	32,5	481	0,7729	385,55	199,2	1,57105	2,9694	14,8	32,5	481	0,8016	414,18	223,6	1,93705	3,3354	14,8	32,5	481	0,8611
371,97	175,2	1,21115	2,6095	14,8	32,5	481	0,7733	386,34	199,6	1,57715	2,9755	14,8	32,5	481	0,8032	413,85	224	1,94295	3,3413	14,8	32,5	481	0,8604
372,02	175,6	1,21725	2,6156	14,8	32,5	481	0,7734	386,96	200	1,58305	2,9814	14,8	32,5	481	0,8045	413,26	224,4	1,94885	3,3472	14,8	32,5	481	0,8592
372,27	176	1,22315	2,6215	14,8	32,5	481	0,7740	387,76	200,4	1,58895	2,9873	14,8	32,5	481	0,8062	413,10	224,8	1,95485	3,3532	14,8	32,5	481	0,8588
372,06	176,4	1,22905	2,6274	14,8	32,5	481	0,7735	388,64	200,8	1,59495	2,9933	14,8	32,5	481	0,8080	413,08	225,2	1,96085	3,3592	14,8	32,5	481	0,8588
372,47	176,8	1,23505	2,6334	14,8	32,5	481	0,7744	389,46	201,2	1,60095	2,9993	14,8	32,5	481	0,8097	413,09	225,6	1,96695	3,3653	14,8	32,5	481	0,8588
372,84	177,2	1,24105	2,6394	14,8	32,5	481	0,7751	390,63	201,6	1,60705	3,0054	14,8	32,5	481	0,8121	413,15	226	1,97305	3,3714	14,8	32,5	481	0,8589
373,35	177,6	1,24705	2,6454	14,8	32,5	481	0,7762	391,64	202	1,61315	3,0115	14,8	32,5	481	0,8142	412,98	226,4	1,97905	3,3774	14,8	32,5	481	0,8586
373,67	178	1,25315	2,6515	14,8	32,5	481	0,7769	392,18	202,4	1,61915	3,0175	14,8	32,5	481	0,8153	412,98	226,8	1,98495	3,3833	14,8	32,5	481	0,8586
373,82	178,4	1,25915	2,6575	14,8	32,5	481	0,7772	393,21	202,8	1,62505	3,0234	14,8	32,5	481	0,8175	413,23	227,2	1,99085	3,3892	14,8	32,5	481	0,8591
373,61	178,8	1,26505	2,6634	14,8	32,5	481	0,7767	394,38	203,2	1,63095	3,0293	14,8	32,5	481	0,8199	413,44	227,6	1,99685	3,3952	14,8	32,5	481	0,8595
374,08	179,2	1,27105	2,6694	14,8	32,5	481	0,7777	395,19	203,6	1,63695	3,0353	14,8	32,5	481	0,8216	413,55	228	2,00285	3,4012	14,8	32,5	481	0,8598
374,32	179,6	1,27705	2,6754	14,8	32,5	481	0,7782	396,49	204	1,64295	3,0413	14,8	32,5	481	0,8243	413,73	228,4	2,00895	3,4073	14,8	32,5	481	0,8601
374,73	180	1,28305	2,6814	14,8	32,5	481	0,7791	397,93	204,4	1,64905	3,0474	14,8	32,5	481	0,8273	413,59	228,8	2,01505	3,4134	14,8	32,5	481	0,8599
375,34	180,4	1,28915	2,6875	14,8	32,5	481	0,7803	398,80	204,8	1,65515	3,0535	14,8	32,5	481	0,8291	413,18	229,2	2,02095	3,4193	14,8	32,5	481	0,8590
375,76	180,8	1,29515	2,6935	14,8	32,5	481	0,7812	399,33	205,2	1,66115	3,0595	14,8	32,5	481	0,8302	412,66	229,6	2,02685	3,4252	14,8	32,5	481	0,8579
375,99	181,2	1,30115	2,6995	14,8	32,5	481	0,7817	400,30	205,6	1,66705	3,0654	14,8	32,5	481	0,8322	412,39	230	2,03285	3,4312	14,8	32,5	481	0,8574
376,16	181,6	1,30705	2,7054	14,8	32,5	481	0,7820	401,26	206	1,67295	3,0713	14,8	32,5	481	0,8342	412,48	230,4	2,03875	3,4371	14,8	32,5	481	0,8575
376,64	182	1,31305	2,7114	14,8	32,5	481	0,7830	402,29	206,4	1,67895	3,0773	14,8	32,5	481	0,8364	412,67	230,8	2,04485	3,4432	14,8	32,5	481	0,8579
376,95	182,4	1,31905	2,7174	14,8	32,5	481	0,7837	403,28	206,8	1,68505	3,0834	14,8	32,5	481	0,8384	412,90	231,2	2,05095	3,4493	14,8	32,5	481	0,8584
377,41	182,8	1,32505	2,7234	14,8	32,5	481	0,7846	404,20	207,2	1,69105	3,0894	14,8	32,5	481	0,8403	413,10	231,6	2,05695	3,4553	14,8	32,5	481	0,8588
377,27	183,2	1,33115	2,7295	14,8	32,5	481	0,7843	404,90	207,6	1,69715	3,0955	14,8	32,5	481	0,8418	413,12	232	2,06285	3,4612	14,8	32,5	481	0,8589
377,32	183,6	1,33715	2,7355	14,8	32,5	481	0,7844	405,52	208	1,70305	3,1014	14,8	32,5	481	0,8431	413,31	232,4	2,06885	3,4672	14,8	32,5	481	0,8593
377,14	184	1,34315	2,7415	14,8	32,5	481	0,7841	406,19	208,4	1,70895	3,1073	14,8	32,5	481	0,8445	413,59	232,8	2,07475	3,4731	14,8	32,5	481	0,8599
377,07	184,4	1,34905	2,7474	14,8	32,5	481	0,7839	407,06	208,8	1,71495	3,1133	14,8	32,5	481	0,8463	413,92	233,2	2,08075	3,4791	14,8	32,5	481	0,8605
377,16	184,8	1,35505	2,7534	14,8	32,5	481	0,7841	407,88	209,2	1,72095	3,1193	14,8	32,5	481	0,8480	414,35	233,6	2,08685	3,4852	14,8	32,5	481	0,8614
377,33	185,2	1,36105	2,7594	14,8	32,5	481	0,7845	408,73	209,6	1,72705	3,1254	14,8	32,5	481	0,8498	414,58	234	2,09295	3,4913	14,8	32,5	481	0,8619
377,64	185,6	1,36705	2,7654	14,8	32,5	481	0,7851	409,93	210	1,73315	3,1315	14,8	32,5	481	0,8522	414,50	234,4	2,09895	3,4973	14,8	32,5	481	0,8617
377,70	186	1,37315	2,7715	14,8	32,5	481	0,7852	410,08	210,4	1,73915	3,1375	14,8	32,5	481	0,8526	414,59	234,8	2,10485	3,5032	14,8	32,5	481	0,8619
377,51	186,4	1,37915	2,7775	14,8	32,5	481	0,7848	410,28	210,8	1,74505	3,1434	14,8	32,5	481	0,8530	414,84	235,2	2,11085	3,5092	14,8	32,5	481	0,8625
376,97	186,8	1,38505	2,7834	14,8	32,5	481	0,7837	410,91	211,2	1,75095	3,1493	14,8	32,5	481	0,8543	415,22	235,6	2,11675	3,5151	14,8	32,5	481	0,8632
376,80	187,2	1,39105	2,7894	14,8	32,5	481	0,7834	411,25	211,6	1,75695	3,1553	14,8	32,5	481	0,8550	415,76	236	2,12285	3,5212	14,8	32,5	481	0,8644
376,79	187,6	1,39705	2,7954	14,8	32,5	481	0,7833	412,12	212	1,76295	3,1613	14,8	32,5	481	0,8568	416,41	236,4	2,12895	3,5273	14,8	32,5	481	0,8657
376,68	188	1,40305	2,8014	14,8	32,5	481	0,7831	413,01	212,4	1,76915	3,1675	14,8	32,5	481	0,8586	417,06	236,8	2,13505	3,5334	14,8	32,5	481	0,8671
376,53	188,4	1,40905	2,8074	14,8	32,5	481	0,7828	413,67	212,8	1,77515	3,1735	14,8	32,5	481	0,8600	417,26	237,2	2,14095	3,5393	14,8	32,5	481	0,8675
376,69	188,8	1,41515	2,8135	14,8	32,5	481	0,7831	414,06	213,2	1,78115	3,1795	14,8	32,5	481	0,8608	417,59	237,6	2,14685	3,5452	14,8	32,5	481	0,8682
376,44	189,2	1,42115	2,8195	14,8	32,5	481	0,7826	414,24	213,6	1,78695	3,1853	14,8	32,5	481	0,8612	418,13	238	2,15285	3,5512	14,8	32,5	481	0,8693
376,37	189,6	1,42705	2,8254	14,8	32,5	481	0,7825	414,57	214	1,79295	3,1913	14,8	32,5	481	0,8619	418,61	238,4	2,15885	3,5572	14,8	32,5	481	0,8703
376,51	190	1,43305	2,8314	14,8	32,5	481	0,7828	414,67	214,4	1,79895	3,1973	14,8	32,5	481	0,8621	419,45	238,8	2,16485	3,5632	14,8	32,5	481	0,8720
376,78	190,4	1,43895	2,8373	14,8	32,5	481	0,7833	414,69	214,8	1,80505	3,2034	14,8	32,5	481	0,8621	420,12	239,2	2,17105	3,5694	14,8	32,5	481	0,8734
377,25	190,8	1,44505	2,8434	14,8	32,5	481	0,7843	414,63	215,2	1,81115	3,2095	14,8	32,5	481	0,8620	420,71	239,6	2,17705	3,5754	14,8	32,5	481	0,8747
377,68	191,2	1,45115	2,8495	14,8	32,5	481	0,7852	414,42	215,6	1,81715	3,2155	14,8	32,5	481	0,8616	421,49	240	2,18305	3,5814	14,8	32,5	481	0,8763
378,13	191,6	1,45715	2,8555	14,8	32,5	481	0,7861	414,38	216	1,82305	3,2214	14,8	32,5	481	0,8615	421,31	240,4	2,18895	3,5873	14,8	32,5	481	0,8759
378,22	192	1,46315	2,8615	14,8	32,5	481	0,7863	414,33	216,4	1,82905	3,2274	14,8	32,5	481	0,8614	421,18	240,8	2,19495	3,5933	14,8	32,5	481	0,8756
378,21	192,4	1,46905	2,8674	14,8	32,5	481	0,7863	414,38	216,8	1,83495	3,2333	14,8	32,5	481	0,8615	422,12	241,2	2,20095	3,5993	14,8	32,5	481	0,8776
378,40	192,8	1,47505	2,8734	14,8	32,5	481	0,7867	414,10	217,2	1,84095	3,2393	14,8	32,5	481	0,8609	422,99	241,6	2,20705	3,6054	14,8	32,5	481	0,8794
378,71	193,2	1,48095	2,8793	14,8	32,5	481	0,7873	414,37	217,6	1,84705	3,2454	14,8	32,5	481	0,8615	423,79	242	2,21315	3,6115	14,8	32,5	481	0,8811
378,99	193,6	1,48705	2,8854	14,8	32,5	481	0,7879	414,14	218	1,85315	3,2515	14,8	32,5	481	0,8610	424,18	242,4	2,21915	3,6175	14,8	32,5	481	0,8819
379,25	194	1,49315	2,8915	14,8	32,5	481	0,7885	413,84	218,4	1,85915	3,2575	14,8	32,5	481	0,8604	423,95	242,8	2,22505	3,6234	14,8	32,5	481	0,8814
379,52	194,4	1,49915	2,8975	14,8	32,5	481	0,7890	413,44	218,8	1,86505	3,2634	14,8	32,5	481	0,8595	424,00	243,2	2,23095	3,6293	14,8	32,5	481	0,8815
379,63	194,8	1,50505	2,9034	14,8	32,5	481	0,7893	413,22	219,2	1,87095	3,2693	14,8	32,5	481	0,8591	423,75	243,6	2,23695	3,6353	14,8	32,5	481	0,8810
379,95	195,2	1,51105	2,9094	14,8	32,5	481	0,7899	413,23	219,6	1,87695	3,2753	14,8	32,5	481	0,8591	423,89	244	2,24295	3,6413	14,8	32,5	481	0,8813
380,30	195,6	1,51695	2,9153	14,8	32,5	481	0,7906	413,47	220	1,88295	3,2813	14,8	32,5	481	0,8596	424,04	244,4	2,24915	3,6475	14,8	32,5	481	0,8816
380,64	196	1,52295	2,9213	14,8	32,5	481	0,7914	413,75	220,4	1,88905	3,2874	14,8	32,5	481	0,8602	423,93	244,8	2,25515	3,6535	14,8	32,5	481	0,8814

LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
423,78	245,2	2,26115	3,6595	14,8	32,5	481	0,8810	455,30	269,6	2,62685	4,0252	14,8	32,5	481	0,9466	502,31	294	2,99285	4,3912	14,8	32,5	481	1,0443
423,64	245,6	2,26705	3,6654	14,8	32,5	481	0,8807	456,28	270	2,63285	4,0312	14,8	32,5	481	0,9486	502,98	294,4	2,99875	4,3971	14,8	32,5	481	1,0457
423,59	246	2,27295	3,6713	14,8	32,5	481	0,8806	457,23	270,4	2,63875	4,0371	14,8	32,5	481	0,9506	503,74	294,8	3,00485	4,4032	14,8	32,5	481	1,0473
424,01	246,4	2,27895	3,6773	14,8	32,5	481	0,8815	458,15	270,8	2,64485	4,0432	14,8	32,5	481	0,9525	504,65	295,2	3,01095	4,4093	14,8	32,5	481	1,0492
424,71	246,8	2,28505	3,6834	14,8	32,5	481	0,8830	459,28	271,2	2,65095	4,0493	14,8	32,5	481	0,9548	505,49	295,6	3,01705	4,4154	14,8	32,5	481	1,0509
425,38	247,2	2,29115	3,6895	14,8	32,5	481	0,8844	459,90	271,6	2,65705	4,0554	14,8	32,5	481	0,9561	505,98	296	3,02295	4,4213	14,8	32,5	481	1,0519
426,25	247,6	2,29715	3,6955	14,8	32,5	481	0,8862	460,38	272	2,66295	4,0613	14,8	32,5	481	0,9571	506,69	296,4	3,02885	4,4272	14,8	32,5	481	1,0534
426,58	248	2,30305	3,7014	14,8	32,5	481	0,8869	460,77	272,4	2,66885	4,0672	14,8	32,5	481	0,9579	507,51	296,8	3,03485	4,4332	14,8	32,5	481	1,0551
426,69	248,4	2,30895	3,7073	14,8	32,5	481	0,8871	461,33	272,8	2,67475	4,0731	14,8	32,5	481	0,9591	508,04	297,2	3,04085	4,4392	14,8	32,5	481	1,0562
427,28	248,8	2,31495	3,7133	14,8	32,5	481	0,8883	462,21	273,2	2,68085	4,0792	14,8	32,5	481	0,9609	508,65	297,6	3,04695	4,4453	14,8	32,5	481	1,0575
427,81	249,2	2,32095	3,7193	14,8	32,5	481	0,8894	463,12	273,6	2,68685	4,0852	14,8	32,5	481	0,9628	509,25	298	3,05305	4,4514	14,8	32,5	481	1,0587
428,63	249,6	2,32705	3,7254	14,8	32,5	481	0,8911	464,02	274	2,69305	4,0914	14,8	32,5	481	0,9647	509,66	298,4	3,05905	4,4574	14,8	32,5	481	1,0596
429,26	250	2,33315	3,7315	14,8	32,5	481	0,8924	464,62	274,4	2,69905	4,0974	14,8	32,5	481	0,9659	510,18	298,8	3,06495	4,4633	14,8	32,5	481	1,0607
428,40	250,4	2,33915	3,7375	14,8	32,5	481	0,8906	465,06	274,8	2,70495	4,1033	14,8	32,5	481	0,9669	510,95	299,2	3,07085	4,4692	14,8	32,5	481	1,0623
428,62	250,8	2,34505	3,7434	14,8	32,5	481	0,8911	465,58	275,2	2,71085	4,1092	14,8	32,5	481	0,9679	511,79	299,6	3,07685	4,4752	14,8	32,5	481	1,0640
429,00	251,2	2,35095	3,7493	14,8	32,5	481	0,8919	466,46	275,6	2,71685	4,1152	14,8	32,5	481	0,9698	512,62	300	3,08285	4,4812	14,8	32,5	481	1,0657
429,36	251,6	2,35695	3,7553	14,8	32,5	481	0,8926	467,47	276	2,72285	4,1212	14,8	32,5	481	0,9719	513,36	300,4	3,08905	4,4874	14,8	32,5	481	1,0673
429,75	252	2,36295	3,7613	14,8	32,5	481	0,8935	468,45	276,4	2,72905	4,1274	14,8	32,5	481	0,9739	514,14	300,8	3,09505	4,4934	14,8	32,5	481	1,0689
430,24	252,4	2,36905	3,7674	14,8	32,5	481	0,8945	469,15	276,8	2,73505	4,1334	14,8	32,5	481	0,9754	514,78	301,2	3,10105	4,4994	14,8	32,5	481	1,0702
430,72	252,8	2,37505	3,7734	14,8	32,5	481	0,8955	469,84	277,2	2,74105	4,1394	14,8	32,5	481	0,9768	515,20	301,6	3,10695	4,5053	14,8	32,5	481	1,0711
431,03	253,2	2,38105	3,7794	14,8	32,5	481	0,8961	471,08	277,6	2,74685	4,1452	14,8	32,5	481	0,9794	515,85	302	3,11285	4,5112	14,8	32,5	481	1,0725
431,51	253,6	2,38695	3,7853	14,8	32,5	481	0,8971	471,83	278	2,75285	4,1512	14,8	32,5	481	0,9809	516,62	302,4	3,11885	4,5172	14,8	32,5	481	1,0741
432,18	254	2,39285	3,7912	14,8	32,5	481	0,8985	472,68	278,4	2,75885	4,1572	14,8	32,5	481	0,9827	517,52	302,8	3,12495	4,5233	14,8	32,5	481	1,0759
432,65	254,4	2,39885	3,7972	14,8	32,5	481	0,8995	473,56	278,8	2,76485	4,1632	14,8	32,5	481	0,9845	518,45	303,2	3,13105	4,5294	14,8	32,5	481	1,0779
433,23	254,8	2,40495	3,8033	14,8	32,5	481	0,9007	474,80	279,2	2,77105	4,1694	14,8	32,5	481	0,9871	519,55	303,6	3,13705	4,5354	14,8	32,5	481	1,0801
433,41	255,2	2,41105	3,8094	14,8	32,5	481	0,9011	475,60	279,6	2,77715	4,1755	14,8	32,5	481	0,9888	520,63	304	3,14295	4,5413	14,8	32,5	481	1,0824
433,78	255,6	2,41705	3,8154	14,8	32,5	481	0,9018	476,42	280	2,78295	4,1813	14,8	32,5	481	0,9905	521,82	304,4	3,14895	4,5473	14,8	32,5	481	1,0849
433,90	256	2,42295	3,8213	14,8	32,5	481	0,9021	477,05	280,4	2,78895	4,1873	14,8	32,5	481	0,9918	523,03	304,8	3,15485	4,5532	14,8	32,5	481	1,0874
434,13	256,4	2,42895	3,8273	14,8	32,5	481	0,9026	477,84	280,8	2,79495	4,1933	14,8	32,5	481	0,9934	524,19	305,2	3,16085	4,5592	14,8	32,5	481	1,0898
434,40	256,8	2,43485	3,8332	14,8	32,5	481	0,9031	478,55	281,2	2,80095	4,1993	14,8	32,5	481	0,9949	525,21	305,6	3,16695	4,5653	14,8	32,5	481	1,0919
434,75	257,2	2,44085	3,8392	14,8	32,5	481	0,9038	479,19	281,6	2,80705	4,2054	14,8	32,5	481	0,9962	526,28	306	3,17305	4,5714	14,8	32,5	481	1,0941
435,71	257,6	2,44695	3,8453	14,8	32,5	481	0,9058	480,24	282	2,81305	4,2114	14,8	32,5	481	0,9984	527,30	306,4	3,17905	4,5774	14,8	32,5	481	1,0963
436,23	258	2,45305	3,8514	14,8	32,5	481	0,9069	480,72	282,4	2,81905	4,2174	14,8	32,5	481	0,9994	528,11	306,8	3,18485	4,5832	14,8	32,5	481	1,0979
436,71	258,4	2,45905	3,8574	14,8	32,5	481	0,9079	481,08	282,8	2,82495	4,2233	14,8	32,5	481	1,0002	528,99	307,2	3,19085	4,5892	14,8	32,5	481	1,0998
436,98	258,8	2,46485	3,8632	14,8	32,5	481	0,9085	481,58	283,2	2,83095	4,2293	14,8	32,5	481	1,0012	529,96	307,6	3,19685	4,5952	14,8	32,5	481	1,1018
437,11	259,2	2,47085	3,8692	14,8	32,5	481	0,9088	482,28	283,6	2,83685	4,2352	14,8	32,5	481	1,0027	530,90	308	3,20285	4,6012	14,8	32,5	481	1,1037
437,54	259,6	2,47685	3,8752	14,8	32,5	481	0,9096	483,06	284	2,84295	4,2413	14,8	32,5	481	1,0043	531,97	308,4	3,20885	4,6072	14,8	32,5	481	1,1060
438,24	260	2,48285	3,8812	14,8	32,5	481	0,9111	483,61	284,4	2,84905	4,2474	14,8	32,5	481	1,0054	532,09	308,45	3,20965	4,608	14,8	32,5	481	1,1062
438,88	260,4	2,48905	3,8874	14,8	32,5	481	0,9124	484,36	284,8	2,85505	4,2534	14,8	32,5	481	1,0070								
439,51	260,8	2,49505	3,8934	14,8	32,5	481	0,9137	484,72	285,2	2,86105	4,2594	14,8	32,5	481	1,0077								
439,90	261,2	2,50095	3,8993	14,8	32,5	481	0,9146	485,17	285,6	2,86695	4,2653	14,8	32,5	481	1,0087								
440,34	261,6	2,50685	3,9052	14,8	32,5	481	0,9155	485,83	286	2,87295	4,2713	14,8	32,5	481	1,0100								
440,77	262	2,51285	3,9112	14,8	32,5	481	0,9164	486,67	286,4	2,87895	4,2773	14,8	32,5	481	1,0118								
441,18	262,4	2,51885	3,9172	14,8	32,5	481	0,9172	487,60	286,8	2,88495	4,2833	14,8	32,5	481	1,0137								
441,87	262,8	2,52485	3,9232	14,8	32,5	481	0,9186	488,44	287,2	2,89105	4,2894	14,8	32,5	481	1,0155								
442,41	263,2	2,53095	3,9293	14,8	32,5	481	0,9198	489,52	287,6	2,89715	4,2955	14,8	32,5	481	1,0177								
443,03	263,6	2,53695	3,9353	14,8	32,5	481	0,9211	490,28	288	2,90305	4,3014	14,8	32,5	481	1,0193								
443,79	264	2,54285	3,9412	14,8	32,5	481	0,9226	491,18	288,4	2,90895	4,3073	14,8	32,5	481	1,0212								
444,66	264,4	2,54885	3,9472	14,8	32,5	481	0,9244	491,97	288,8	2,91495	4,3133	14,8	32,5	481	1,0228								
445,44	264,8	2,55485	3,9532	14,8	32,5	481	0,9261	492,79	289,2	2,92095	4,3193	14,8	32,5	481	1,0245								
446,25	265,2	2,56075	3,9591	14,8	32,5	481	0,9278	493,85	289,6	2,92705	4,3254	14,8	32,5	481	1,0267								
447,60	265,6	2,56685	3,9652	14,8	32,5	481	0,9306	494,67	290	2,93305	4,3314	14,8	32,5	481	1,0284								
448,61	266	2,57295	3,9713	14,8	32,5	481	0,9327	495,43	290,4	2,93905	4,3374	14,8	32,5	481	1,0300								
449,32	266,4	2,57895	3,9773	14,8	32,5	481	0,9341	496,04	290,8	2,94495	4,3433	14,8	32,5	481	1,0313								
450,42	266,8	2,58485	3,9832	14,8	32,5	481	0,9364	496,93	291,2	2,95085	4,3492	14,8	32,5	481	1,0331								
450,94	267,2	2,59085	3,9892	14,8	32,5	481	0,9375	497,86	291,6	2,95685	4,3552	14,8	32,5	481	1,0351								
450,96	267,6	2,59685	3,9952	14,8	32,5	481	0,9375	498,85	292	2,96285	4,3612	14,8	32,5	481	1,0371								
451,82	268	2,60285	4,0012	14,8	32,5	481	0,9393	499,89	292,4	2,96895	4,3673	14,8	32,5	481	1,0393								
452,93	268,4	2,60895	4,0073	14,8	32,5	481	0,9416	500,77	292,8	2,97505	4,3734	14,8	32,5	481	1,0411								
454,07	268,8	2,61495	4,0133	14,8	32,5	481	0,9440	501,48	293,2	2,98095	4,3793	14,8	32,5	481	1,0426								
454,53	269,2	2,62095	4,0193	14,8	32,5	481	0,9450	502,14	293,6	2,98685	4,3852	14,8	32,5	481	1,0440								

3.3.1.6-C Mix. Proportion Tests
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LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
-0,01	1,2	-1,46066	0	14,2	29,4	417,48	0,0000
0,03	1,6	-1,45476	0,0059	14,2	29,4	417,48	0,0001
-0,01	2	-1,44876	0,0119	14,2	29,4	417,48	0,0000
0,00	2,4	-1,44266	0,018	14,2	29,4	417,48	0,0000
0,01	2,8	-1,43656	0,0241	14,2	29,4	417,48	0,0000
-0,03	3,2	-1,43066	0,03	14,2	29,4	417,48	-0,0001
0,02	3,6	-1,42476	0,0359	14,2	29,4	417,48	0,0000
0,00	4	-1,41876	0,0419	14,2	29,4	417,48	0,0000
0,04	4,4	-1,41286	0,0478	14,2	29,4	417,48	0,0001
0,01	4,8	-1,40676	0,0539	14,2	29,4	417,48	0,0000
0,14	5,2	-1,40066	0,06	14,2	29,4	417,48	0,0003
0,14	5,6	-1,39466	0,066	14,2	29,4	417,48	0,0003
0,17	6	-1,38876	0,0719	14,2	29,4	417,48	0,0004
0,17	6,4	-1,38276	0,0779	14,2	29,4	417,48	0,0004
0,24	6,8	-1,37676	0,0839	14,2	29,4	417,48	0,0006
0,26	7,2	-1,37076	0,0899	14,2	29,4	417,48	0,0006
0,30	7,6	-1,36466	0,096	14,2	29,4	417,48	0,0007
0,40	8	-1,35856	0,1021	14,2	29,4	417,48	0,0010
0,41	8,4	-1,35266	0,108	14,2	29,4	417,48	0,0010
0,45	8,8	-1,34676	0,1139	14,2	29,4	417,48	0,0011
0,47	9,2	-1,34076	0,1199	14,2	29,4	417,48	0,0011
0,54	9,6	-1,33486	0,1258	14,2	29,4	417,48	0,0013
0,67	10	-1,32876	0,1319	14,2	29,4	417,48	0,0016
0,67	10,4	-1,32266	0,138	14,2	29,4	417,48	0,0016
0,72	10,8	-1,31666	0,144	14,2	29,4	417,48	0,0017
0,78	11,2	-1,31066	0,15	14,2	29,4	417,48	0,0019
0,90	11,6	-1,30476	0,1559	14,2	29,4	417,48	0,0022
0,91	12	-1,29886	0,1618	14,2	29,4	417,48	0,0022
0,93	12,4	-1,29286	0,1678	14,2	29,4	417,48	0,0022
1,01	12,8	-1,28676	0,1739	14,2	29,4	417,48	0,0024
1,04	13,2	-1,28066	0,18	14,2	29,4	417,48	0,0025
1,04	13,6	-1,27476	0,1859	14,2	29,4	417,48	0,0025
1,05	14	-1,26886	0,1918	14,2	29,4	417,48	0,0025
1,02	14,4	-1,26296	0,1977	14,2	29,4	417,48	0,0024
1,04	14,8	-1,25696	0,2037	14,2	29,4	417,48	0,0025
1,05	15,2	-1,25096	0,2097	14,2	29,4	417,48	0,0025
1,03	15,6	-1,24486	0,2158	14,2	29,4	417,48	0,0025
1,05	16	-1,23876	0,2219	14,2	29,4	417,48	0,0025
1,07	16,4	-1,23286	0,2278	14,2	29,4	417,48	0,0026
1,08	16,8	-1,22696	0,2337	14,2	29,4	417,48	0,0026
1,04	17,2	-1,22096	0,2397	14,2	29,4	417,48	0,0025
1,07	17,6	-1,21506	0,2456	14,2	29,4	417,48	0,0026
1,07	18	-1,20906	0,2516	14,2	29,4	417,48	0,0026
1,09	18,4	-1,20296	0,2577	14,2	29,4	417,48	0,0026
1,08	18,8	-1,19686	0,2638	14,2	29,4	417,48	0,0026
1,07	19,2	-1,19096	0,2697	14,2	29,4	417,48	0,0026
1,10	19,6	-1,18506	0,2756	14,2	29,4	417,48	0,0026
1,03	20	-1,17906	0,2816	14,2	29,4	417,48	0,0025
1,14	20,4	-1,17306	0,2876	14,2	29,4	417,48	0,0027
1,02	20,8	-1,16706	0,2936	14,2	29,4	417,48	0,0024
1,12	21,2	-1,16096	0,2997	14,2	29,4	417,48	0,0027
1,07	21,6	-1,15496	0,3057	14,2	29,4	417,48	0,0026
1,13	22	-1,14906	0,3116	14,2	29,4	417,48	0,0027
1,12	22,4	-1,14316	0,3175	14,2	29,4	417,48	0,0027
1,15	22,8	-1,13716	0,3235	14,2	29,4	417,48	0,0028
1,10	23,2	-1,13116	0,3295	14,2	29,4	417,48	0,0026
1,11	23,6	-1,12496	0,3357	14,2	29,4	417,48	0,0027
1,16	24	-1,11896	0,3417	14,2	29,4	417,48	0,0028
1,06	24,4	-1,11296	0,3477	14,2	29,4	417,48	0,0025
1,12	24,8	-1,10706	0,3536	14,2	29,4	417,48	0,0027
1,11	25,2	-1,10106	0,3596	14,2	29,4	417,48	0,0027

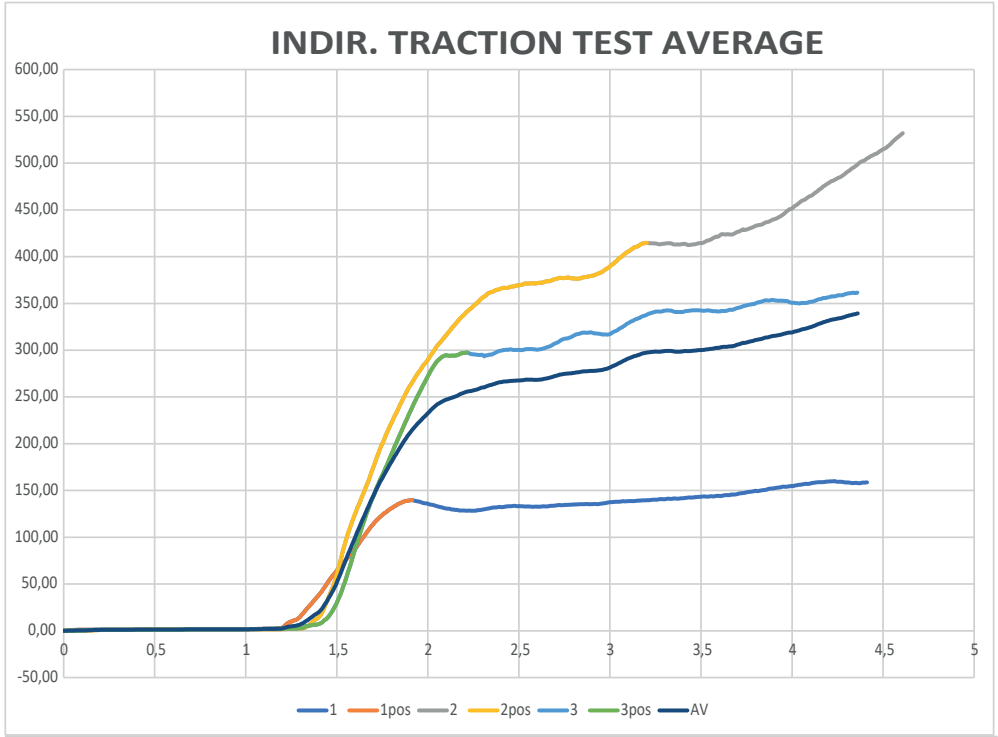
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
1,12	25,6	-1,09516	0,3655	14,2	29,4	417,48	0,0027	1,52	50	-0,72886	0,7318	14,2	29,4	417,48	0,0036	1,99	74,4	-0,36256	1,0981	14,2	29,4	417,48	0,0048
1,12	26	-1,08906	0,3716	14,2	29,4	417,48	0,0027	1,53	50,4	-0,72266	0,738	14,2	29,4	417,48	0,0037	1,98	74,8	-0,35656	1,1041	14,2	29,4	417,48	0,0047
1,12	26,4	-1,08286	0,3778	14,2	29,4	417,48	0,0027	1,53	50,8	-0,71666	0,744	14,2	29,4	417,48	0,0037	2,05	75,2	-0,35066	1,11	14,2	29,4	417,48	0,0049
1,12	26,8	-1,07686	0,3838	14,2	29,4	417,48	0,0027	1,53	51,2	-0,71076	0,7499	14,2	29,4	417,48	0,0037	2,07	75,6	-0,34476	1,1159	14,2	29,4	417,48	0,0050
1,14	27,2	-1,07086	0,3898	14,2	29,4	417,48	0,0027	1,53	51,6	-0,70486	0,7558	14,2	29,4	417,48	0,0037	2,11	76	-0,33876	1,1219	14,2	29,4	417,48	0,0051
1,12	27,6	-1,06496	0,3957	14,2	29,4	417,48	0,0027	1,53	52	-0,69886	0,7618	14,2	29,4	417,48	0,0037	2,11	76,4	-0,33276	1,1279	14,2	29,4	417,48	0,0051
1,16	28	-1,05896	0,4017	14,2	29,4	417,48	0,0028	1,53	52,4	-0,69286	0,7678	14,2	29,4	417,48	0,0037	2,16	76,8	-0,32666	1,134	14,2	29,4	417,48	0,0052
1,16	28,4	-1,05296	0,4077	14,2	29,4	417,48	0,0028	1,51	52,8	-0,68676	0,7739	14,2	29,4	417,48	0,0036	2,19	77,2	-0,32056	1,1401	14,2	29,4	417,48	0,0052
1,17	28,8	-1,04686	0,4138	14,2	29,4	417,48	0,0028	1,52	53,2	-0,68066	0,78	14,2	29,4	417,48	0,0036	2,19	77,6	-0,31456	1,1461	14,2	29,4	417,48	0,0052
1,17	29,2	-1,04076	0,4199	14,2	29,4	417,48	0,0028	1,58	53,6	-0,67466	0,786	14,2	29,4	417,48	0,0038	2,21	78	-0,30866	1,152	14,2	29,4	417,48	0,0053
1,14	29,6	-1,03476	0,4259	14,2	29,4	417,48	0,0027	1,53	54	-0,66876	0,7919	14,2	29,4	417,48	0,0037	2,25	78,4	-0,30276	1,1579	14,2	29,4	417,48	0,0054
1,14	30	-1,02886	0,4318	14,2	29,4	417,48	0,0027	1,52	54,4	-0,66286	0,7978	14,2	29,4	417,48	0,0036	2,26	78,8	-0,29676	1,1639	14,2	29,4	417,48	0,0054
1,14	30,4	-1,02286	0,4378	14,2	29,4	417,48	0,0027	1,54	54,8	-0,65696	0,8037	14,2	29,4	417,48	0,0037	2,22	79,2	-0,29076	1,1699	14,2	29,4	417,48	0,0053
1,14	30,8	-1,01686	0,4438	14,2	29,4	417,48	0,0027	1,53	55,2	-0,65086	0,8098	14,2	29,4	417,48	0,0037	2,25	79,6	-0,28466	1,176	14,2	29,4	417,48	0,0054
1,13	31,2	-1,01086	0,4498	14,2	29,4	417,48	0,0027	1,53	55,6	-0,64476	0,8159	14,2	29,4	417,48	0,0037	2,28	80	-0,27856	1,1821	14,2	29,4	417,48	0,0055
1,14	31,6	-1,00476	0,4559	14,2	29,4	417,48	0,0027	1,56	56	-0,63876	0,8219	14,2	29,4	417,48	0,0037	2,27	80,4	-0,27266	1,188	14,2	29,4	417,48	0,0054
1,14	32	-0,99866	0,462	14,2	29,4	417,48	0,0027	1,55	56,4	-0,63276	0,8279	14,2	29,4	417,48	0,0037	2,30	80,8	-0,26676	1,1939	14,2	29,4	417,48	0,0055
1,15	32,4	-0,99266	0,468	14,2	29,4	417,48	0,0028	1,53	56,8	-0,62686	0,8338	14,2	29,4	417,48	0,0037	2,30	81,2	-0,26086	1,1998	14,2	29,4	417,48	0,0055
1,12	32,8	-0,98676	0,4739	14,2	29,4	417,48	0,0027	1,53	57,2	-0,62086	0,8398	14,2	29,4	417,48	0,0037	2,33	81,6	-0,25486	1,2058	14,2	29,4	417,48	0,0056
1,13	33,2	-0,98086	0,4798	14,2	29,4	417,48	0,0027	1,53	57,6	-0,61486	0,8458	14,2	29,4	417,48	0,0037	2,34	82	-0,24886	1,2118	14,2	29,4	417,48	0,0056
1,13	33,6	-0,97486	0,4858	14,2	29,4	417,48	0,0027	1,52	58	-0,60886	0,8518	14,2	29,4	417,48	0,0036	2,36	82,4	-0,24276	1,2179	14,2	29,4	417,48	0,0057
1,12	34	-0,96876	0,4919	14,2	29,4	417,48	0,0027	1,54	58,4	-0,60276	0,8579	14,2	29,4	417,48	0,0037	2,38	82,8	-0,23666	1,224	14,2	29,4	417,48	0,0057
1,12	34,4	-0,96266	0,498	14,2	29,4	417,48	0,0027	1,53	58,8	-0,59676	0,8639	14,2	29,4	417,48	0,0037	2,38	83,2	-0,23076	1,2299	14,2	29,4	417,48	0,0057
1,16	34,8	-0,95656	0,5041	14,2	29,4	417,48	0,0028	1,54	59,2	-0,59076	0,8699	14,2	29,4	417,48	0,0037	2,42	83,6	-0,22496	1,2357	14,2	29,4	417,48	0,0058
1,16	35,2	-0,95066	0,51	14,2	29,4	417,48	0,0028	1,53	59,6	-0,58486	0,8758	14,2	29,4	417,48	0,0037	2,34	84	-0,21896	1,2417	14,2	29,4	417,48	0,0056
1,15	35,6	-0,94476	0,5159	14,2	29,4	417,48	0,0028	1,53	60	-0,57886	0,8818	14,2	29,4	417,48	0,0037	2,38	84,4	-0,21296	1,2477	14,2	29,4	417,48	0,0057
1,14	36	-0,93876	0,5219	14,2	29,4	417,48	0,0027	1,54	60,4	-0,57296	0,8877	14,2	29,4	417,48	0,0037	2,38	84,8	-0,20686	1,2538	14,2	29,4	417,48	0,0057
1,14	36,4	-0,93276	0,5279	14,2	29,4	417,48	0,0027	1,53	60,8	-0,56686	0,8938	14,2	29,4	417,48	0,0037	2,39	85,2	-0,20086	1,2598	14,2	29,4	417,48	0,0057
1,15	36,8	-0,92666	0,534	14,2	29,4	417,48	0,0028	1,54	61,2	-0,56066	0,9	14,2	29,4	417,48	0,0037	2,42	85,6	-0,19476	1,2659	14,2	29,4	417,48	0,0058
1,16	37,2	-0,92056	0,5401	14,2	29,4	417,48	0,0028	1,55	61,6	-0,55476	0,9059	14,2	29,4	417,48	0,0037	2,48	86	-0,18886	1,2718	14,2	29,4	417,48	0,0059
1,16	37,6	-0,91456	0,5461	14,2	29,4	417,48	0,0028	1,55	62	-0,54886	0,9118	14,2	29,4	417,48	0,0037	2,51	86,4	-0,18296	1,2777	14,2	29,4	417,48	0,0060
1,16	38	-0,90866	0,552	14,2	29,4	417,48	0,0028	1,52	62,4	-0,54286	0,9178	14,2	29,4	417,48	0,0036	2,57	86,8	-0,17696	1,2837	14,2	29,4	417,48	0,0062
1,15	38,4	-0,90276	0,5579	14,2	29,4	417,48	0,0028	1,53	62,8	-0,53696	0,9237	14,2	29,4	417,48	0,0037	2,60	87,2	-0,17096	1,2897	14,2	29,4	417,48	0,0062
1,15	38,8	-0,89676	0,5639	14,2	29,4	417,48	0,0028	1,52	63,2	-0,53086	0,9298	14,2	29,4	417,48	0,0036	2,80	87,6	-0,16486	1,2958	14,2	29,4	417,48	0,0067
1,16	39,2	-0,89076	0,5699	14,2	29,4	417,48	0,0028	1,54	63,6	-0,52476	0,9359	14,2	29,4	417,48	0,0037	2,89	88	-0,15876	1,3019	14,2	29,4	417,48	0,0069
1,16	39,6	-0,88466	0,576	14,2	29,4	417,48	0,0028	1,55	64	-0,51866	0,942	14,2	29,4	417,48	0,0037	3,04	88,4	-0,15286	1,3078	14,2	29,4	417,48	0,0073
1,18	40	-0,87856	0,5821	14,2	29,4	417,48	0,0028	1,55	64,4	-0,51276	0,9479	14,2	29,4	417,48	0,0037	3,10	88,8	-0,14696	1,3137	14,2	29,4	417,48	0,0074
1,16	40,4	-0,87256	0,5881	14,2	29,4	417,48	0,0028	1,50	64,8	-0,50676	0,9539	14,2	29,4	417,48	0,0036	3,64	89,2	-0,14096	1,3197	14,2	29,4	417,48	0,0087
1,16	40,8	-0,86666	0,594	14,2	29,4	417,48	0,0028	1,57	65,2	-0,50086	0,9598	14,2	29,4	417,48	0,0038	4,56	89,6	-0,13496	1,3257	14,2	29,4	417,48	0,0109
1,16	41,2	-0,86076	0,5999	14,2	29,4	417,48	0,0028	1,52	65,6	-0,49496	0,9657	14,2	29,4	417,48	0,0036	5,00	90	-0,12896	1,3317	14,2	29,4	417,48	0,0120
1,18	41,6	-0,85476	0,6059	14,2	29,4	417,48	0,0028	1,54	66	-0,48886	0,9718	14,2	29,4	417,48	0,0037	5,10	90,4	-0,12286	1,3378	14,2	29,4	417,48	0,0122
1,16	42	-0,84876	0,6119	14,2	29,4	417,48	0,0028	1,54	66,4	-0,48266	0,978	14,2	29,4	417,48	0,0037	5,24	90,8	-0,11676	1,3439	14,2	29,4	417,48	0,0126
1,20	42,4	-0,84266	0,618	14,2	29,4	417,48	0,0029	1,56	66,8	-0,47666	0,984	14,2	29,4	417,48	0,0037	5,49	91,2	-0,11086	1,3498	14,2	29,4	417,48	0,0132
1,19	42,8	-0,83656	0,6241	14,2	29,4	417,48	0,0029	1,56	67,2	-0,47076	0,9899	14,2	29,4	417,48	0,0037	5,74	91,6	-0,10496	1,3557	14,2	29,4	417,48	0,0137
1,18	43,2	-0,83066	0,63	14,2	29,4	417,48	0,0028	1,55	67,6	-0,46486	0,9958	14,2	29,4	417,48	0,0037	5,90	92	-0,09896	1,3617	14,2	29,4	417,48	0,0141
1,19	43,6	-0,82476	0,6359	14,2	29,4	417,48	0,0029	1,55	68	-0,45886	1,0018	14,2	29,4	417,48	0,0037	6,03	92,4	-0,09286	1,3678	14,2	29,4	417,48	0,0144
1,20	44	-0,81886	0,6418	14,2	29,4	417,48	0,0029	1,60	68,4	-0,45286	1,0078	14,2	29,4	417,48	0,0038	6,23	92,8	-0,08676	1,3739	14,2	29,4	417,48	0,0149
1,22	44,4	-0,81286	0,6478	14,2	29,4	417,48	0,0029	1,62	68,8	-0,44676	1,0139	14,2	29,4	417,48	0,0039	6,45	93,2	-0,08066	1,38	14,2	29,4	417,48	0,0154
1,25	44,8	-0,80676	0,6539	14,2	29,4	417,48	0,0030	1,62	69,2	-0,44056	1,0201	14,2	29,4	417,48	0,0039	6,62	93,6	-0,07466	1,386	14,2	29,4	417,48	0,0159
1,27	45,2	-0,80066	0,66	14,2	29,4	417,48	0,0030	1,66	69,6	-0,43456	1,0261	14,2	29,4	417,48	0,0040	6,86	94	-0,06876	1,3919	14,2	29,4	417,48	0,0164
1,28	45,6	-0,79466	0,666	14,2	29,4	417,48	0,0031	1,66	70	-0,42866	1,032	14,2	29,4	417,48	0,0040	7,07	94,4	-0,06286	1,3978	14,2	29,4	417,48	0,0169
1,30	46	-0,78876	0,6719	14,2	29,4	417,48	0,0031	1,64	70,4	-0,42266	1,038	14,2	29,4	417,48	0,0039	7,34	94,8	-0,05686	1,4038	14,2	29,4	417,48	0,0176
1,36	46,4	-0,78286	0,6778	14,2	29,4	417,48	0,0033	1,74	70,8	-0,41676	1,0439	14,2	29,4	417,48	0,0042	7,80	95,2	-0,05086	1,4098	14,2	29,4	417,48	0,0187
1,35	46,8	-0,77686	0,6838	14,2	29,4	417,48	0,0032	1,78	71,2	-0,41076	1,0499	14,2	29,4	417,48	0,0043	8,54	95,6	-0,04466	1,416	14,2	29,4	417,48	0,0205
1,36	47,2	-0,77086	0,6898	14,2	29,4	417,48	0,0033	1,79	71,6	-0,40456	1,0561	14,2	29,4	417,48	0,0043	9,31	96	-0,03866	1,422	14,2	29,4	417,48	0,0223
1,41	47,6	-0,76466	0,696	14,2	29,4	417,48	0,0034	1,81	72	-0,39846	1,0622	14,2	29,4	417,48	0,0043	10,54	96,4	-0,03266	1,428	14,2	29,4	417,48	0,0252
1,44	48	-0,75866	0,702	14,2	29,4	417,48	0,0034	1,85	72,4	-0,39256	1,0681	14,2	29,4	417,48	0,0044	11,55	96,8	-0,02676	1,4339	14,2	29,4	417,48	0,0277
1,46	48,4	-0,75266	0,708	14,2	29,4	417,48	0,0035	1,88	72,8	-0,38666	1,074	14,2	29,4	417,48	0,0045	12,31	97,2	-0,02086	1,4398	14,2	29,4	417,48	0,0295
1,46	48,8	-0,74676	0,7139	14,2	29,4	417,48	0,0035	1,92	73,2	-0,38066	1,08	14,2	29,4	417,48	0,0046	13,20	97,6	-0,01486	1,4458	14,2	29,4	417,48	0,0316
1,49	49,2	-0,74086	0,7198	14,2	29,4	417,48	0,0036	1,94	73,6	-0,37466	1,086	14,2	29,4	417,48	0,0046	14,45	98	-0,00886	1,4518	14,2	29,4	417,48	0,0346
1,51	49,6	-0,73486	0,7258	14,2	29,4	417,48	0,0036	1,96	74	-0,36866	1,092	14,2	29,4	417,48	0,0047	15,99	98,4	-0,00266	1,458	14,2	29,4	417,48	0,0383

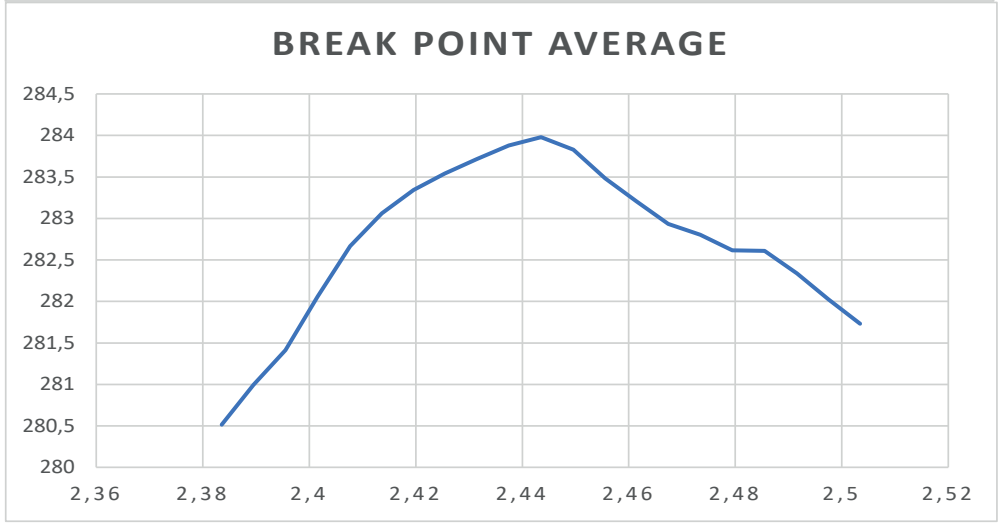
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
17,60	98,8	0,00324	1,4639	14,2	29,4	417,48	0,0422	202,25	123,2	0,36904	1,8297	14,2	29,4	417,48	0,4845	297,07	147,6	0,73464	2,1953	14,2	29,4	417,48	0,7116
19,34	99,2	0,00924	1,4699	14,2	29,4	417,48	0,0463	204,85	123,6	0,37494	1,8356	14,2	29,4	417,48	0,4907	297,14	148	0,74064	2,2013	14,2	29,4	417,48	0,7117
21,16	99,6	0,01514	1,4758	14,2	29,4	417,48	0,0507	207,44	124	0,38094	1,8416	14,2	29,4	417,48	0,4969	297,36	148,4	0,74664	2,2073	14,2	29,4	417,48	0,7123
23,08	100	0,02104	1,4817	14,2	29,4	417,48	0,0553	210,14	124,4	0,38684	1,8475	14,2	29,4	417,48	0,5034	297,55	148,8	0,75274	2,2134	14,2	29,4	417,48	0,7127
25,19	100,4	0,02704	1,4877	14,2	29,4	417,48	0,0603	212,86	124,8	0,39294	1,8536	14,2	29,4	417,48	0,5099	297,34	149,2	0,75884	2,2195	14,2	29,4	417,48	0,7122
27,54	100,8	0,03314	1,4938	14,2	29,4	417,48	0,0660	215,58	125,2	0,39904	1,8597	14,2	29,4	417,48	0,5164	296,89	149,6	0,76474	2,2254	14,2	29,4	417,48	0,7111
29,90	101,2	0,03924	1,4999	14,2	29,4	417,48	0,0716	218,04	125,6	0,40504	1,8657	14,2	29,4	417,48	0,5223	296,37	150	0,77064	2,2313	14,2	29,4	417,48	0,7099
32,42	101,6	0,04524	1,5059	14,2	29,4	417,48	0,0777	220,54	126	0,41094	1,8716	14,2	29,4	417,48	0,5283	295,84	150,4	0,77664	2,2373	14,2	29,4	417,48	0,7086
35,04	102	0,05114	1,5118	14,2	29,4	417,48	0,0839	223,14	126,4	0,41684	1,8775	14,2	29,4	417,48	0,5345	295,66	150,8	0,78264	2,2433	14,2	29,4	417,48	0,7082
37,86	102,4	0,05704	1,5177	14,2	29,4	417,48	0,0907	225,74	126,8	0,42284	1,8835	14,2	29,4	417,48	0,5407	295,49	151,2	0,78864	2,2493	14,2	29,4	417,48	0,7078
40,98	102,8	0,06304	1,5237	14,2	29,4	417,48	0,0982	228,40	127,2	0,42884	1,8895	14,2	29,4	417,48	0,5471	295,46	151,6	0,79474	2,2554	14,2	29,4	417,48	0,7077
44,11	103,2	0,06904	1,5297	14,2	29,4	417,48	0,1057	231,18	127,6	0,43494	1,8956	14,2	29,4	417,48	0,5538	295,29	152	0,80084	2,2615	14,2	29,4	417,48	0,7073
47,45	103,6	0,07514	1,5358	14,2	29,4	417,48	0,1137	233,84	128	0,44104	1,9017	14,2	29,4	417,48	0,5601	295,09	152,4	0,80674	2,2674	14,2	29,4	417,48	0,7068
50,86	104	0,08114	1,5418	14,2	29,4	417,48	0,1218	236,36	128,4	0,44694	1,9076	14,2	29,4	417,48	0,5662	295,01	152,8	0,81264	2,2733	14,2	29,4	417,48	0,7066
54,25	104,4	0,08714	1,5478	14,2	29,4	417,48	0,1299	238,72	128,8	0,45284	1,9135	14,2	29,4	417,48	0,5718	294,97	153,2	0,81864	2,2793	14,2	29,4	417,48	0,7065
57,77	104,8	0,09304	1,5537	14,2	29,4	417,48	0,1384	241,16	129,2	0,45874	1,9194	14,2	29,4	417,48	0,5777	294,95	153,6	0,82464	2,2853	14,2	29,4	417,48	0,7065
61,44	105,2	0,09894	1,5596	14,2	29,4	417,48	0,1472	243,74	129,6	0,46474	1,9254	14,2	29,4	417,48	0,5838	295,10	154	0,83074	2,2914	14,2	29,4	417,48	0,7069
64,97	105,6	0,10494	1,5656	14,2	29,4	417,48	0,1556	246,25	130	0,47084	1,9315	14,2	29,4	417,48	0,5898	295,03	154,4	0,83684	2,2975	14,2	29,4	417,48	0,7067
68,68	106	0,11094	1,5716	14,2	29,4	417,48	0,1645	248,73	130,4	0,47694	1,9376	14,2	29,4	417,48	0,5958	294,60	154,8	0,84284	2,3035	14,2	29,4	417,48	0,7057
72,51	106,4	0,11714	1,5778	14,2	29,4	417,48	0,1737	250,94	130,8	0,48294	1,9436	14,2	29,4	417,48	0,6011	293,43	155,2	0,84874	2,3094	14,2	29,4	417,48	0,7029
76,30	106,8	0,12314	1,5838	14,2	29,4	417,48	0,1828	253,05	131,2	0,48884	1,9495	14,2	29,4	417,48	0,6061	294,19	155,6	0,85474	2,3154	14,2	29,4	417,48	0,7047
80,00	107,2	0,12904	1,5897	14,2	29,4	417,48	0,1916	255,29	131,6	0,49474	1,9554	14,2	29,4	417,48	0,6115	294,57	156	0,86074	2,3214	14,2	29,4	417,48	0,7056
83,87	107,6	0,13494	1,5956	14,2	29,4	417,48	0,2009	257,63	132	0,50074	1,9614	14,2	29,4	417,48	0,6171	294,39	156,4	0,86674	2,3274	14,2	29,4	417,48	0,7052
87,87	108	0,14094	1,6016	14,2	29,4	417,48	0,2105	260,01	132,4	0,50674	1,9674	14,2	29,4	417,48	0,6228	294,78	156,8	0,87294	2,3336	14,2	29,4	417,48	0,7061
91,92	108,4	0,14694	1,6076	14,2	29,4	417,48	0,2202	262,48	132,8	0,51284	1,9735	14,2	29,4	417,48	0,6287	295,23	157,2	0,87894	2,3396	14,2	29,4	417,48	0,7072
95,87	108,8	0,15304	1,6137	14,2	29,4	417,48	0,2296	264,68	133,2	0,51894	1,9796	14,2	29,4	417,48	0,6340	295,22	157,6	0,88494	2,3456	14,2	29,4	417,48	0,7071
99,85	109,2	0,15904	1,6197	14,2	29,4	417,48	0,2392	266,81	133,6	0,52494	1,9856	14,2	29,4	417,48	0,6391	295,25	158	0,89084	2,3515	14,2	29,4	417,48	0,7072
103,40	109,6	0,16504	1,6257	14,2	29,4	417,48	0,2477	268,90	134	0,53084	1,9915	14,2	29,4	417,48	0,6441	295,88	158,4	0,89674	2,3574	14,2	29,4	417,48	0,7087
106,90	110	0,17094	1,6316	14,2	29,4	417,48	0,2561	271,21	134,4	0,53674	1,9974	14,2	29,4	417,48	0,6496	296,54	158,8	0,90274	2,3634	14,2	29,4	417,48	0,7103
110,33	110,4	0,17694	1,6376	14,2	29,4	417,48	0,2643	273,30	134,8	0,54274	2,0034	14,2	29,4	417,48	0,6546	296,98	159,2	0,90884	2,3695	14,2	29,4	417,48	0,7114
113,87	110,8	0,18284	1,6435	14,2	29,4	417,48	0,2728	275,68	135,2	0,54884	2,0095	14,2	29,4	417,48	0,6603	297,81	159,6	0,91494	2,3756	14,2	29,4	417,48	0,7134
117,30	111,2	0,18894	1,6496	14,2	29,4	417,48	0,2810	277,92	135,6	0,55494	2,0156	14,2	29,4	417,48	0,6657	298,42	160	0,92104	2,3817	14,2	29,4	417,48	0,7148
120,72	111,6	0,19504	1,6557	14,2	29,4	417,48	0,2892	279,90	136	0,56094	2,0216	14,2	29,4	417,48	0,6705	298,84	160,4	0,92694	2,3876	14,2	29,4	417,48	0,7158
124,15	112	0,20114	1,6618	14,2	29,4	417,48	0,2974	281,65	136,4	0,56694	2,0276	14,2	29,4	417,48	0,6746	299,22	160,8	0,93284	2,3935	14,2	29,4	417,48	0,7167
127,49	112,4	0,20704	1,6677	14,2	29,4	417,48	0,3054	283,49	136,8	0,57284	2,0335	14,2	29,4	417,48	0,6791	299,46	161,2	0,93884	2,3995	14,2	29,4	417,48	0,7173
130,65	112,8	0,21294	1,6736	14,2	29,4	417,48	0,3129	285,35	137,2	0,57884	2,0395	14,2	29,4	417,48	0,6835	299,59	161,6	0,94474	2,4054	14,2	29,4	417,48	0,7176
133,78	113,2	0,21894	1,6796	14,2	29,4	417,48	0,3204	286,80	137,6	0,58484	2,0455	14,2	29,4	417,48	0,6870	299,95	162	0,95094	2,4116	14,2	29,4	417,48	0,7185
136,77	113,6	0,22494	1,6856	14,2	29,4	417,48	0,3276	288,28	138	0,59094	2,0516	14,2	29,4	417,48	0,6905	300,24	162,4	0,95694	2,4176	14,2	29,4	417,48	0,7192
139,72	114	0,23094	1,6916	14,2	29,4	417,48	0,3347	289,43	138,4	0,59694	2,0576	14,2	29,4	417,48	0,6933	300,41	162,8	0,96294	2,4236	14,2	29,4	417,48	0,7196
142,43	114,4	0,23704	1,6977	14,2	29,4	417,48	0,3412	290,57	138,8	0,60304	2,0637	14,2	29,4	417,48	0,6960	300,40	163,2	0,96884	2,4295	14,2	29,4	417,48	0,7196
145,21	114,8	0,24314	1,7038	14,2	29,4	417,48	0,3478	291,45	139,2	0,60894	2,0696	14,2	29,4	417,48	0,6981	300,49	163,6	0,97484	2,4355	14,2	29,4	417,48	0,7198
148,05	115,2	0,24904	1,7097	14,2	29,4	417,48	0,3546	292,40	139,6	0,61484	2,0755	14,2	29,4	417,48	0,7004	300,43	164	0,98084	2,4415	14,2	29,4	417,48	0,7196
150,98	115,6	0,25494	1,7156	14,2	29,4	417,48	0,3616	293,17	140	0,62084	2,0815	14,2	29,4	417,48	0,7022	300,72	164,4	0,98684	2,4475	14,2	29,4	417,48	0,7203
153,88	116	0,26094	1,7216	14,2	29,4	417,48	0,3686	293,73	140,4	0,62684	2,0875	14,2	29,4	417,48	0,7036	300,92	164,8	0,99294	2,4536	14,2	29,4	417,48	0,7208
156,74	116,4	0,26694	1,7276	14,2	29,4	417,48	0,3754	294,35	140,8	0,63294	2,0936	14,2	29,4	417,48	0,7051	300,72	165,2	0,99904	2,4597	14,2	29,4	417,48	0,7203
159,57	116,8	0,27304	1,7337	14,2	29,4	417,48	0,3822	294,64	141,2	0,63904	2,0997	14,2	29,4	417,48	0,7058	300,39	165,6	1,00494	2,4656	14,2	29,4	417,48	0,7195
162,23	117,2	0,27914	1,7398	14,2	29,4	417,48	0,3886	294,40	141,6	0,64494	2,1056	14,2	29,4	417,48	0,7052	300,29	166	1,01094	2,4716	14,2	29,4	417,48	0,7193
164,62	117,6	0,28504	1,7457	14,2	29,4	417,48	0,3943	294,16	142	0,65084	2,1115	14,2	29,4	417,48	0,7046	300,21	166,4	1,01684	2,4775	14,2	29,4	417,48	0,7191
167,06	118	0,29094	1,7516	14,2	29,4	417,48	0,4002	294,09	142,4	0,65684	2,1175	14,2	29,4	417,48	0,7044	300,36	166,8	1,02284	2,4835	14,2	29,4	417,48	0,7195
169,66	118,4	0,29694	1,7576	14,2	29,4	417,48	0,4064	294,06	142,8	0,66284	2,1235	14,2	29,4	417,48	0,7044	300,26	167,2	1,02894	2,4896	14,2	29,4	417,48	0,7192
172,15	118,8	0,30294	1,7636	14,2	29,4	417,48	0,4124	294,17	143,2	0,66884	2,1295	14,2	29,4	417,48	0,7046	300,32	167,6	1,03504	2,4957	14,2	29,4	417,48	0,7194
174,75	119,2	0,30894	1,7696	14,2	29,4	417,48	0,4186	294,29	143,6	0,67494	2,1356	14,2	29,4	417,48	0,7049	300,36	168	1,04104	2,5017	14,2	29,4	417,48	0,7195
177,47	119,6	0,31504	1,7757	14,2	29,4	417,48	0,4251	294,18	144	0,68094	2,1416	14,2	29,4	417,48	0,7047	300,21	168,4	1,04694	2,5076	14,2	29,4	417,48	0,7191
180,29	120	0,32104	1,7817	14,2	29,4	417,48	0,4319	294,20	144,4	0,68694	2,1476	14,2	29,4	417,48	0,7047	300,10	168,8	1,05284	2,5135	14,2	29,4	417,48	0,7188
182,94	120,4	0,32704	1,7877	14,2	29,4	417,48	0,4382	294,32	144,8	0,69274	2,1534	14,2	29,4	417,48	0,7050	300,15	169,2	1,05884	2,5195	14,2	29,4	417,48	0,7190
185,66	120,8	0,33294	1,7936	14,2	29,4	417,48	0,4447	294,60	145,2	0,69874	2,1594	14,2	29,4	417,48	0,7057	300,47	169,6	1,06484	2,5255	14,2	29,4	417,48	0,7197
188,36	121,2	0,33894	1,7996	14,2	29,4	417,48	0,4512	294,97	145,6	0,70474	2,1654	14,2	29,4	417,48	0,7065	300,83	170	1,07094	2,5316	14,2	29,4	417,48	0,7206
191,16	121,6	0,34484	1,8055	14,2	29,4	417,48	0,4579	295,62	146	0,71074	2,1714	14,2	29,4	417,48	0,7081	301,05	170,4	1,07694	2,5376	14,2	29,4	417,48	0,7211
194,03	122	0,35094	1,8116	14,2	29,4	417,48	0,4648	296,20	146,4	0,71684	2,1775	14,2	29,4	417,48	0,7095	301,19	170,8	1,08294	2,5436	14,2	29,4	417,48	0,7214
196,96	122,4	0,35704	1,8177	14,2	29,4	417,48	0,4718	296,58	146,8	0,72284	2,1835	14,2	29,4	417,48	0,7104	301,20	171,2	1,08884	2,5495	14,2	29,4	417,48	0,7215
199,66	122,8	0,36304	1,8237	14,2	29,4	417,48	0,4783	296,83	147,2	0,72874	2,1894	14,2	29,4	417,48	0,7110	301,11	171,6	1,09474	2,5554	14,2	29,4	417,48	0,7213

LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
301,17	172	1,10074	2,5614	14,2	29,4	417,48	0,7214	317,78	196,4	1,46674	2,9274	14,2	29,4	417,48	0,7612	342,12	220,8	1,83284	3,2935	14,2	29,4	417,48	0,8195
301,19	172,4	1,10674	2,5674	14,2	29,4	417,48	0,7214	317,76	196,8	1,47284	2,9335	14,2	29,4	417,48	0,7611	342,26	221,2	1,83894	3,2996	14,2	29,4	417,48	0,8198
301,17	172,8	1,11284	2,5735	14,2	29,4	417,48	0,7214	317,62	197,2	1,47884	2,9395	14,2	29,4	417,48	0,7608	342,47	221,6	1,84484	3,3055	14,2	29,4	417,48	0,8203
301,03	173,2	1,11894	2,5796	14,2	29,4	417,48	0,7211	317,49	197,6	1,48484	2,9455	14,2	29,4	417,48	0,7605	342,55	222	1,85074	3,3114	14,2	29,4	417,48	0,8205
301,08	173,6	1,12484	2,5855	14,2	29,4	417,48	0,7212	317,11	198	1,49074	2,9514	14,2	29,4	417,48	0,7596	342,62	222,4	1,85674	3,3174	14,2	29,4	417,48	0,8207
300,75	174	1,13074	2,5914	14,2	29,4	417,48	0,7204	316,82	198,4	1,49674	2,9574	14,2	29,4	417,48	0,7589	342,44	222,8	1,86274	3,3234	14,2	29,4	417,48	0,8203
300,59	174,4	1,13674	2,5974	14,2	29,4	417,48	0,7200	316,61	198,8	1,50274	2,9634	14,2	29,4	417,48	0,7584	342,43	223,2	1,86884	3,3295	14,2	29,4	417,48	0,8202
300,50	174,8	1,14274	2,6034	14,2	29,4	417,48	0,7198	316,83	199,2	1,50874	2,9694	14,2	29,4	417,48	0,7589	342,31	223,6	1,87494	3,3356	14,2	29,4	417,48	0,8199
300,67	175,2	1,14874	2,6094	14,2	29,4	417,48	0,7202	316,90	199,6	1,51494	2,9756	14,2	29,4	417,48	0,7591	341,98	224	1,88084	3,3415	14,2	29,4	417,48	0,8192
300,98	175,6	1,15484	2,6155	14,2	29,4	417,48	0,7209	316,68	200	1,52094	2,9816	14,2	29,4	417,48	0,7586	341,47	224,4	1,88674	3,3474	14,2	29,4	417,48	0,8179
301,11	176	1,16094	2,6216	14,2	29,4	417,48	0,7213	316,72	200,4	1,52684	2,9875	14,2	29,4	417,48	0,7586	341,07	224,8	1,89274	3,3534	14,2	29,4	417,48	0,8170
301,36	176,4	1,16684	2,6275	14,2	29,4	417,48	0,7219	316,87	200,8	1,53274	2,9934	14,2	29,4	417,48	0,7590	340,78	225,2	1,89864	3,3593	14,2	29,4	417,48	0,8163
301,77	176,8	1,17274	2,6334	14,2	29,4	417,48	0,7228	317,18	201,2	1,53874	2,9994	14,2	29,4	417,48	0,7597	340,76	225,6	1,90474	3,3654	14,2	29,4	417,48	0,8162
302,09	177,2	1,17874	2,6394	14,2	29,4	417,48	0,7236	317,78	201,6	1,54474	3,0054	14,2	29,4	417,48	0,7612	340,93	226	1,91074	3,3714	14,2	29,4	417,48	0,8166
302,42	177,6	1,18474	2,6454	14,2	29,4	417,48	0,7244	318,54	202	1,55074	3,0114	14,2	29,4	417,48	0,7630	340,91	226,4	1,91684	3,3775	14,2	29,4	417,48	0,8166
302,96	178	1,19084	2,6515	14,2	29,4	417,48	0,7257	319,29	202,4	1,55694	3,0176	14,2	29,4	417,48	0,7648	340,77	226,8	1,92284	3,3835	14,2	29,4	417,48	0,8163
303,40	178,4	1,19694	2,6576	14,2	29,4	417,48	0,7267	319,84	202,8	1,56284	3,0235	14,2	29,4	417,48	0,7661	340,77	227,2	1,92874	3,3894	14,2	29,4	417,48	0,8163
303,75	178,8	1,20294	2,6636	14,2	29,4	417,48	0,7276	320,35	203,2	1,56874	3,0294	14,2	29,4	417,48	0,7673	340,81	227,6	1,93464	3,3953	14,2	29,4	417,48	0,8164
304,12	179,2	1,20884	2,6695	14,2	29,4	417,48	0,7285	320,83	203,6	1,57474	3,0354	14,2	29,4	417,48	0,7685	340,90	228	1,94064	3,4013	14,2	29,4	417,48	0,8166
304,67	179,6	1,21474	2,6754	14,2	29,4	417,48	0,7298	321,42	204	1,58074	3,0414	14,2	29,4	417,48	0,7699	341,27	228,4	1,94664	3,4073	14,2	29,4	417,48	0,8175
305,37	180	1,22074	2,6814	14,2	29,4	417,48	0,7315	322,27	204,4	1,58674	3,0474	14,2	29,4	417,48	0,7719	341,82	228,8	1,95274	3,4134	14,2	29,4	417,48	0,8188
306,00	180,4	1,22674	2,6874	14,2	29,4	417,48	0,7330	323,15	204,8	1,59284	3,0535	14,2	29,4	417,48	0,7740	342,04	229,2	1,95884	3,4195	14,2	29,4	417,48	0,8193
306,82	180,8	1,23284	2,6935	14,2	29,4	417,48	0,7349	323,90	205,2	1,59894	3,0596	14,2	29,4	417,48	0,7758	342,03	229,6	1,96474	3,4254	14,2	29,4	417,48	0,8193
307,38	181,2	1,23894	2,6996	14,2	29,4	417,48	0,7363	324,40	205,6	1,60484	3,0655	14,2	29,4	417,48	0,7770	342,11	230	1,97064	3,4313	14,2	29,4	417,48	0,8195
307,69	181,6	1,24484	2,7055	14,2	29,4	417,48	0,7370	325,07	206	1,61074	3,0714	14,2	29,4	417,48	0,7786	342,24	230,4	1,97664	3,4373	14,2	29,4	417,48	0,8198
308,21	182	1,25074	2,7114	14,2	29,4	417,48	0,7383	325,87	206,4	1,61674	3,0774	14,2	29,4	417,48	0,7806	342,35	230,8	1,98264	3,4433	14,2	29,4	417,48	0,8200
308,82	182,4	1,25674	2,7174	14,2	29,4	417,48	0,7397	326,70	206,8	1,62274	3,0834	14,2	29,4	417,48	0,7826	342,66	231,2	1,98874	3,4494	14,2	29,4	417,48	0,8208
309,76	182,8	1,26274	2,7234	14,2	29,4	417,48	0,7420	327,68	207,2	1,62874	3,0894	14,2	29,4	417,48	0,7849	342,69	231,6	1,99474	3,4554	14,2	29,4	417,48	0,8209
310,54	183,2	1,26874	2,7294	14,2	29,4	417,48	0,7438	328,50	207,6	1,63494	3,0956	14,2	29,4	417,48	0,7869	342,75	232	2,00074	3,4614	14,2	29,4	417,48	0,8210
311,13	183,6	1,27494	2,7356	14,2	29,4	417,48	0,7453	329,15	208	1,64094	3,1016	14,2	29,4	417,48	0,7884	342,58	232,4	2,00664	3,4673	14,2	29,4	417,48	0,8206
311,69	184	1,28094	2,7416	14,2	29,4	417,48	0,7466	329,74	208,4	1,64674	3,1074	14,2	29,4	417,48	0,7898	342,60	232,8	2,01264	3,4733	14,2	29,4	417,48	0,8206
311,99	184,4	1,28684	2,7475	14,2	29,4	417,48	0,7473	330,31	208,8	1,65274	3,1134	14,2	29,4	417,48	0,7912	342,77	233,2	2,01854	3,4792	14,2	29,4	417,48	0,8210
312,29	184,8	1,29274	2,7534	14,2	29,4	417,48	0,7480	330,98	209,2	1,65874	3,1194	14,2	29,4	417,48	0,7928	342,66	233,6	2,02454	3,4852	14,2	29,4	417,48	0,8208
312,50	185,2	1,29874	2,7594	14,2	29,4	417,48	0,7485	331,38	209,6	1,66474	3,1254	14,2	29,4	417,48	0,7938	342,57	234	2,03064	3,4913	14,2	29,4	417,48	0,8206
312,58	185,6	1,30474	2,7654	14,2	29,4	417,48	0,7487	332,15	210	1,67084	3,1315	14,2	29,4	417,48	0,7956	342,66	234,4	2,03674	3,4974	14,2	29,4	417,48	0,8208
312,89	186	1,31074	2,7714	14,2	29,4	417,48	0,7495	332,76	210,4	1,67694	3,1376	14,2	29,4	417,48	0,7971	342,44	234,8	2,04264	3,5033	14,2	29,4	417,48	0,8203
313,37	186,4	1,31684	2,7775	14,2	29,4	417,48	0,7506	333,15	210,8	1,68284	3,1435	14,2	29,4	417,48	0,7980	342,16	235,2	2,04854	3,5092	14,2	29,4	417,48	0,8196
313,75	186,8	1,32274	2,7834	14,2	29,4	417,48	0,7515	333,54	211,2	1,68874	3,1494	14,2	29,4	417,48	0,7989	342,16	235,6	2,05454	3,5152	14,2	29,4	417,48	0,8196
314,26	187,2	1,32864	2,7893	14,2	29,4	417,48	0,7528	334,07	211,6	1,69474	3,1554	14,2	29,4	417,48	0,8002	342,17	236	2,06054	3,5212	14,2	29,4	417,48	0,8196
315,02	187,6	1,33464	2,7953	14,2	29,4	417,48	0,7546	334,42	212	1,70064	3,1613	14,2	29,4	417,48	0,8010	342,34	236,4	2,06654	3,5272	14,2	29,4	417,48	0,8200
315,63	188	1,34064	2,8013	14,2	29,4	417,48	0,7560	335,15	212,4	1,70674	3,1674	14,2	29,4	417,48	0,8028	342,58	236,8	2,07264	3,5333	14,2	29,4	417,48	0,8206
316,31	188,4	1,34664	2,8073	14,2	29,4	417,48	0,7577	335,76	212,8	1,71284	3,1735	14,2	29,4	417,48	0,8043	342,50	237,2	2,07874	3,5394	14,2	29,4	417,48	0,8204
316,83	188,8	1,35274	2,8134	14,2	29,4	417,48	0,7589	336,31	213,2	1,71884	3,1795	14,2	29,4	417,48	0,8056	342,33	237,6	2,08464	3,5453	14,2	29,4	417,48	0,8200
317,16	189,2	1,35884	2,8195	14,2	29,4	417,48	0,7597	336,62	213,6	1,72484	3,1855	14,2	29,4	417,48	0,8063	342,25	238	2,09054	3,5512	14,2	29,4	417,48	0,8198
317,43	189,6	1,36474	2,8254	14,2	29,4	417,48	0,7603	336,97	214	1,73074	3,1914	14,2	29,4	417,48	0,8072	342,07	238,4	2,09654	3,5572	14,2	29,4	417,48	0,8194
317,59	190	1,37064	2,8313	14,2	29,4	417,48	0,7607	337,44	214,4	1,73664	3,1973	14,2	29,4	417,48	0,8083	341,80	238,8	2,10254	3,5632	14,2	29,4	417,48	0,8187
318,00	190,4	1,37664	2,8373	14,2	29,4	417,48	0,7617	338,02	214,8	1,74264	3,2033	14,2	29,4	417,48	0,8097	341,70	239,2	2,10864	3,5693	14,2	29,4	417,48	0,8185
318,34	190,8	1,38264	2,8433	14,2	29,4	417,48	0,7625	338,64	215,2	1,74874	3,2094	14,2	29,4	417,48	0,8112	341,81	239,6	2,11474	3,5754	14,2	29,4	417,48	0,8187
318,66	191,2	1,38864	2,8493	14,2	29,4	417,48	0,7633	339,08	215,6	1,75484	3,2155	14,2	29,4	417,48	0,8122	341,79	240	2,12074	3,5814	14,2	29,4	417,48	0,8187
318,88	191,6	1,39474	2,8554	14,2	29,4	417,48	0,7638	339,45	216	1,76084	3,2215	14,2	29,4	417,48	0,8131	341,61	240,4	2,12664	3,5873	14,2	29,4	417,48	0,8183
318,85	192	1,40084	2,8615	14,2	29,4	417,48	0,7637	339,79	216,4	1,76674	3,2274	14,2	29,4	417,48	0,8139	341,35	240,8	2,13264	3,5933	14,2	29,4	417,48	0,8176
318,73	192,4	1,40674	2,8674	14,2	29,4	417,48	0,7635	340,27	216,8	1,77274	3,2334	14,2	29,4	417,48	0,8151	341,44	241,2	2,13854	3,5992	14,2	29,4	417,48	0,8179
318,62	192,8	1,41264	2,8733	14,2	29,4	417,48	0,7632	340,56	217,2	1,77864	3,2393	14,2	29,4	417,48	0,8158	341,52	241,6	2,14454	3,6052	14,2	29,4	417,48	0,8181
318,70	193,2	1,41864	2,8793	14,2	29,4	417,48	0,7634	340,87	217,6	1,78474	3,2454	14,2	29,4	417,48	0,8165	341,98	242	2,15074	3,6114	14,2	29,4	417,48	0,8192
318,84	193,6	1,42464	2,8853	14,2	29,4	417,48	0,7637	341,25	218	1,79084	3,2515	14,2	29,4	417,48	0,8174	342,05	242,4	2,15674	3,6174	14,2	29,4	417,48	0,8193
319,09	194	1,43074	2,8914	14,2	29,4	417,48	0,7643	341,25	218,4	1,79694	3,2576	14,2	29,4	417,48	0,8174	341,97	242,8	2,16274	3,6234	14,2	29,4	417,48	0,8191
319,08	194,4	1,43684	2,8975	14,2	29,4	417,48	0,7643	341,26	218,8	1,80284	3,2635	14,2	29,4	417,48	0,8174	341,94	243,2	2,16864	3,6293	14,2	29,4	417,48	0,8191
318,59	194,8	1,44284	2,9035	14,2	29,4	417,48	0,7631	341,26	219,2	1,80874	3,2694	14,2	29,4	417,48	0,8174	342,03	243,6	2,17464	3,6353	14,2	29,4	417,48	0,8193
318,20	195,2	1,44874	2,9094	14,2	29,4	417,48	0,7622	341,40	219,6	1,81474	3,2754	14,2	29,4	417,48	0,8178	342,13	244	2,18064	3,6413	14,2	29,4	417,48	0,8195
318,04	195,6	1,45474	2,9154	14,2	29,4	417,48	0,7618	341,37	220	1,82074	3,2814	14,2	29,4	417,48	0,8177	342,54	244,4	2,18664	3,6473	14,2	29,4	417,48	0,8205
317,89	196	1,46074	2,9214	14,2	29,4	417,48	0,7614	341,57	220,4	1,82674	3,2874	14,2	29,4	417,48	0,8182	343,06	244,8	2,19284	3,6535	14,2	29,4	417,48	0,8217

LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
343,19	245,2	2,19884	3,6595	14,2	29,4	417,48	0,8221	350,32	269,6	2,56474	4,0254	14,2	29,4	417,48	0,8391
343,23	245,6	2,20474	3,6654	14,2	29,4	417,48	0,8221	350,17	270	2,57064	4,0313	14,2	29,4	417,48	0,8388
343,12	246	2,21074	3,6714	14,2	29,4	417,48	0,8219	350,02	270,4	2,57664	4,0373	14,2	29,4	417,48	0,8384
343,51	246,4	2,21664	3,6773	14,2	29,4	417,48	0,8228	350,00	270,8	2,58264	4,0433	14,2	29,4	417,48	0,8384
343,93	246,8	2,22264	3,6833	14,2	29,4	417,48	0,8238	350,37	271,2	2,58874	4,0494	14,2	29,4	417,48	0,8392
344,40	247,2	2,22874	3,6894	14,2	29,4	417,48	0,8249	350,51	271,6	2,59474	4,0554	14,2	29,4	417,48	0,8396
344,91	247,6	2,23484	3,6955	14,2	29,4	417,48	0,8262	350,64	272	2,60084	4,0615	14,2	29,4	417,48	0,8399
345,16	248	2,24094	3,7016	14,2	29,4	417,48	0,8268	350,50	272,4	2,60674	4,0674	14,2	29,4	417,48	0,8396
345,40	248,4	2,24684	3,7075	14,2	29,4	417,48	0,8273	350,47	272,8	2,61264	4,0733	14,2	29,4	417,48	0,8395
345,69	248,8	2,25274	3,7134	14,2	29,4	417,48	0,8280	350,74	273,2	2,61864	4,0793	14,2	29,4	417,48	0,8401
346,09	249,2	2,25874	3,7194	14,2	29,4	417,48	0,8290	350,76	273,6	2,62464	4,0853	14,2	29,4	417,48	0,8402
346,53	249,6	2,26474	3,7254	14,2	29,4	417,48	0,8301	351,31	274	2,63074	4,0914	14,2	29,4	417,48	0,8415
347,03	250	2,27084	3,7315	14,2	29,4	417,48	0,8312	351,83	274,4	2,63684	4,0975	14,2	29,4	417,48	0,8427
347,48	250,4	2,27694	3,7376	14,2	29,4	417,48	0,8323	351,65	274,8	2,64274	4,1034	14,2	29,4	417,48	0,8423
347,59	250,8	2,28294	3,7436	14,2	29,4	417,48	0,8326	351,79	275,2	2,64864	4,1093	14,2	29,4	417,48	0,8427
347,80	251,2	2,28884	3,7495	14,2	29,4	417,48	0,8331	352,11	275,6	2,65464	4,1153	14,2	29,4	417,48	0,8434
348,19	251,6	2,29474	3,7554	14,2	29,4	417,48	0,8340	352,45	276	2,66064	4,1213	14,2	29,4	417,48	0,8442
348,49	252	2,30074	3,7614	14,2	29,4	417,48	0,8347	352,82	276,4	2,66664	4,1273	14,2	29,4	417,48	0,8451
348,78	252,4	2,30684	3,7675	14,2	29,4	417,48	0,8354	353,45	276,8	2,67274	4,1334	14,2	29,4	417,48	0,8466
348,96	252,8	2,31294	3,7736	14,2	29,4	417,48	0,8359	354,02	277,2	2,67874	4,1394	14,2	29,4	417,48	0,8480
349,23	253,2	2,31894	3,7796	14,2	29,4	417,48	0,8365	354,32	277,6	2,68474	4,1454	14,2	29,4	417,48	0,8487
349,30	253,6	2,32484	3,7855	14,2	29,4	417,48	0,8367	354,53	278	2,69064	4,1513	14,2	29,4	417,48	0,8492
349,45	254	2,33084	3,7915	14,2	29,4	417,48	0,8370	354,83	278,4	2,69664	4,1573	14,2	29,4	417,48	0,8499
349,95	254,4	2,33674	3,7974	14,2	29,4	417,48	0,8382	355,04	278,8	2,70264	4,1633	14,2	29,4	417,48	0,8504
350,42	254,8	2,34274	3,8034	14,2	29,4	417,48	0,8394	355,59	279,2	2,70874	4,1694	14,2	29,4	417,48	0,8518
350,93	255,2	2,34884	3,8095	14,2	29,4	417,48	0,8406	355,94	279,6	2,71484	4,1755	14,2	29,4	417,48	0,8526
351,27	255,6	2,35494	3,8156	14,2	29,4	417,48	0,8414	355,72	280	2,72084	4,1815	14,2	29,4	417,48	0,8521
351,42	256	2,36094	3,8216	14,2	29,4	417,48	0,8418	355,87	280,4	2,72674	4,1874	14,2	29,4	417,48	0,8524
351,71	256,4	2,36684	3,8275	14,2	29,4	417,48	0,8425	356,31	280,8	2,73264	4,1933	14,2	29,4	417,48	0,8535
351,99	256,8	2,37274	3,8334	14,2	29,4	417,48	0,8431	356,49	281,2	2,73864	4,1993	14,2	29,4	417,48	0,8539
352,46	257,2	2,37864	3,8393	14,2	29,4	417,48	0,8443	356,77	281,6	2,74464	4,2053	14,2	29,4	417,48	0,8546
352,76	257,6	2,38474	3,8454	14,2	29,4	417,48	0,8450	357,15	282	2,75074	4,2114	14,2	29,4	417,48	0,8555
353,19	258	2,39084	3,8515	14,2	29,4	417,48	0,8460	357,55	282,4	2,75684	4,2175	14,2	29,4	417,48	0,8564
353,39	258,4	2,39684	3,8575	14,2	29,4	417,48	0,8465	357,46	282,8	2,76274	4,2234	14,2	29,4	417,48	0,8562
353,23	258,8	2,40284	3,8635	14,2	29,4	417,48	0,8461	357,65	283,2	2,76874	4,2294	14,2	29,4	417,48	0,8567
352,99	259,2	2,40874	3,8694	14,2	29,4	417,48	0,8455	357,72	283,6	2,77464	4,2353	14,2	29,4	417,48	0,8569
353,12	259,6	2,41474	3,8754	14,2	29,4	417,48	0,8458	357,92	284	2,78064	4,2413	14,2	29,4	417,48	0,8573
353,29	260	2,42064	3,8813	14,2	29,4	417,48	0,8462	358,20	284,4	2,78674	4,2474	14,2	29,4	417,48	0,8580
353,62	260,4	2,42674	3,8874	14,2	29,4	417,48	0,8470	358,64	284,8	2,79284	4,2535	14,2	29,4	417,48	0,8591
353,71	260,8	2,43284	3,8935	14,2	29,4	417,48	0,8473	358,63	285,2	2,79894	4,2596	14,2	29,4	417,48	0,8590
353,61	261,2	2,43884	3,8995	14,2	29,4	417,48	0,8470	358,66	285,6	2,80484	4,2655	14,2	29,4	417,48	0,8591
353,29	261,6	2,44474	3,9054	14,2	29,4	417,48	0,8462	358,75	286	2,81074	4,2714	14,2	29,4	417,48	0,8593
353,06	262	2,45074	3,9114	14,2	29,4	417,48	0,8457	358,95	286,4	2,81674	4,2774	14,2	29,4	417,48	0,8598
353,01	262,4	2,45664	3,9173	14,2	29,4	417,48	0,8456	359,16	286,8	2,82274	4,2834	14,2	29,4	417,48	0,8603
352,94	262,8	2,46264	3,9233	14,2	29,4	417,48	0,8454	359,72	287,2	2,82884	4,2895	14,2	29,4	417,48	0,8616
352,92	263,2	2,46874	3,9294	14,2	29,4	417,48	0,8454	360,06	287,6	2,83494	4,2956	14,2	29,4	417,48	0,8625
353,00	263,6	2,47484	3,9355	14,2	29,4	417,48	0,8455	360,49	288	2,84094	4,3016	14,2	29,4	417,48	0,8635
352,90	264	2,48084	3,9415	14,2	29,4	417,48	0,8453	360,66	288,4	2,84684	4,3075	14,2	29,4	417,48	0,8639
352,81	264,4	2,48674	3,9474	14,2	29,4	417,48	0,8451	360,85	288,8	2,85274	4,3134	14,2	29,4	417,48	0,8644
352,82	264,8	2,49264	3,9533	14,2	29,4	417,48	0,8451	360,98	289,2	2,85874	4,3194	14,2	29,4	417,48	0,8647
352,71	265,2	2,49864	3,9593	14,2	29,4	417,48	0,8449	361,12	289,6	2,86484	4,3255	14,2	29,4	417,48	0,8650
352,57	265,6	2,50474	3,9654	14,2	29,4	417,48	0,8445	361,38	290	2,87094	4,3316	14,2	29,4	417,48	0,8656
352,53	266	2,51074	3,9714	14,2	29,4	417,48	0,8444	361,48	290,4	2,87694	4,3376	14,2	29,4	417,48	0,8659
352,26	266,4	2,51684	3,9775	14,2	29,4	417,48	0,8438	361,20	290,8	2,88294	4,3436	14,2	29,4	417,48	0,8652
351,53	266,8	2,52274	3,9834	14,2	29,4	417,48	0,8420	361,11	291,2	2,88884	4,3495	14,2	29,4	417,48	0,8650
351,12	267,2	2,52874	3,9894	14,2	29,4	417,48	0,8410	361,32	291,6	2,89474	4,3554	14,2	29,4	417,48	0,8655
350,92	267,6	2,53464	3,9953	14,2	29,4	417,48	0,8406	361,55	291,84	2,89834	4,359	14,2	29,4	417,48	0,8660
350,58	268	2,54064	4,0013	14,2	29,4	417,48	0,8398								
350,69	268,4	2,54664	4,0073	14,2	29,4	417,48	0,8400								
350,66	268,8	2,55284	4,0135	14,2	29,4	417,48	0,8399								
350,50	269,2	2,55884	4,0195	14,2	29,4	417,48	0,8396								

3.3.1.6-D Mix. Proportion Tests
10:1:1 - Average



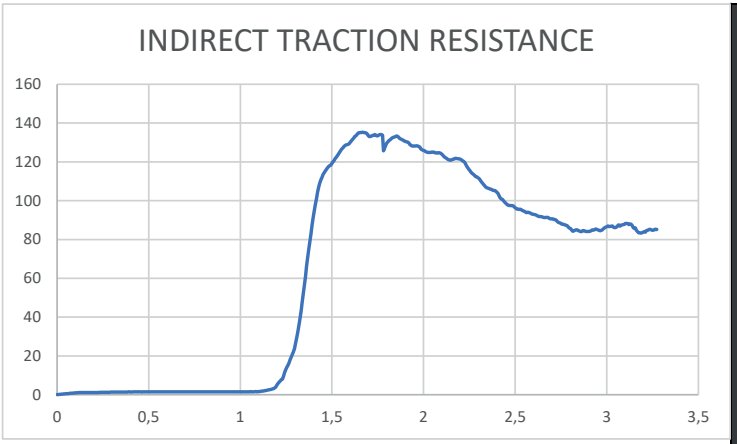


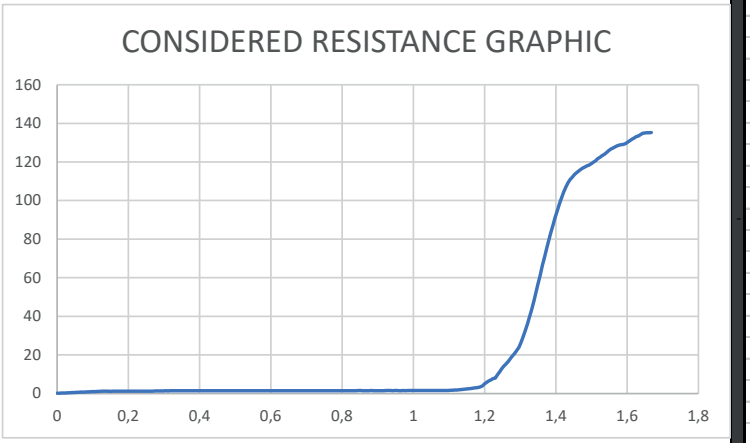
BREAK POINTS AVERAGE		INDIREC TRACTION TEST AVERAGE	
LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)
280,5167	2,383533333	0,033333	0
280,9933	2,3895	0,073333	0,005933333
281,4133	2,3955	0,08	0,011933333
282,0567	2,401533333	0,11	0,017966667
282,6667	2,407666667	0,143333	0,023933333
283,06	2,413633333	0,153333	0,0299
283,3433	2,419566667	0,203333	0,0359
283,54	2,425433333	0,22	0,041866667
283,7133	2,431433333	0,26	0,047833333
283,88	2,437433333	0,266667	0,053866667
283,98	2,443533333	0,326667	0,0599
283,83	2,4496	0,35	0,065866667
283,4833	2,455533333	0,376667	0,071866667
283,2067	2,461433333	0,393333	0,077866667
282,9333	2,467433333	0,43	0,0838
282,8033	2,4734	0,433333	0,089833333
282,6167	2,479433333	0,453333	0,095866667
282,61	2,485533333	0,486667	0,1019
282,3367	2,4916	0,503333	0,107833333
282,0233	2,497533333	0,51	0,113833333
281,73	2,503433333	0,496667	0,119833333
		0,55	0,125766667
		0,636667	0,1318
		0,65	0,137866667
		0,68	0,143833333
		0,723333	0,149833333
		0,766667	0,155833333
		0,813333	0,1618
		0,85	0,167766667
		0,91	0,173833333
		0,946667	0,179833333
		0,94	0,185833333
		0,966667	0,1918
		0,986667	0,197766667
		1,006667	0,203733333
		1,026667	0,209766667
		1,046667	0,2158
		1,06	0,221833333
		1,086667	0,2278
		1,106667	0,233766667
		1,11	0,239766667
		1,116667	0,245733333
		1,123333	0,251766667
		1,133333	0,2578
		1,13	0,263766667
		1,136667	0,269766667
		1,146667	0,275733333
		1,116667	0,281733333
		1,14	0,287766667
		1,123333	0,293766667
		1,153333	0,299833333
		1,136667	0,3058
		1,146667	0,311733333
		1,153333	0,317733333
		1,16	0,323733333
		1,156667	0,329766667
		1,16	0,335866667
		1,173333	0,341833333
		1,15	0,347833333
		1,17	0,353833333

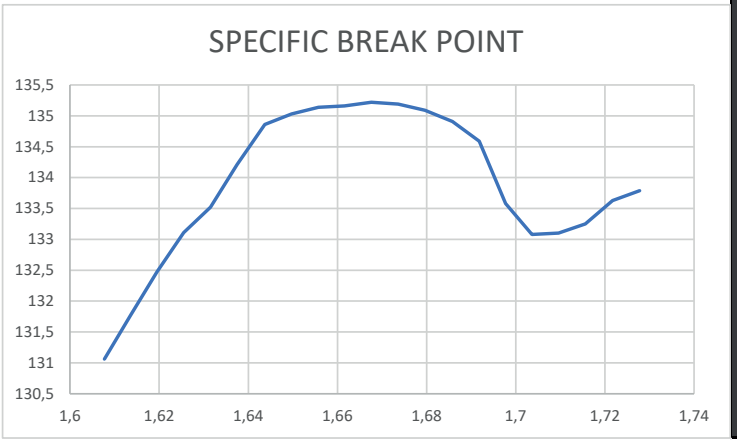
INDIREC TRACTION TEST AVERAGE		INDIREC TRACTION TEST AVERAGE		INDIREC TRACTION TEST AVERAGE		INDIREC TRACTION TEST AVERAGE		INDIREC TRACTION TEST AVERAGE		INDIREC TRACTION TEST AVERAGE		INDIREC TRACTION TEST AVERAGE		INDIREC TRACTION TEST AVERAGE	
LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)
1,156667	0,359833333	1,51	0,7199	1,83	1,079966667	29,77333	1,439833333	180,4667	1,7997	251,1667	2,159533333	267,8433	2,519566667	277,5933	2,8795
1,173333	0,3658	1,506667	0,725866667	1,846667	1,085966667	31,61333	1,445833333	182,46	1,805666667	251,7133	2,1655	268	2,525566667	277,7167	2,8855
1,163333	0,371833333	1,513333	0,7319	1,863333	1,091966667	33,61	1,451866667	184,49	1,8117	252,3067	2,1715	268,2767	2,531633333	277,86	2,891533333
1,203333	0,3779	1,52	0,737933333	1,893333	1,098033333	35,69333	1,4579	186,5233	1,817733333	252,9367	2,177566667	268,4167	2,5376	277,96	2,897566667
1,203333	0,383866667	1,53	0,743966667	1,896667	1,103966667	37,70667	1,463866667	188,4033	1,8237	253,4033	2,183533333	268,48	2,543566667	277,8433	2,903533333
1,223333	0,3899	1,523333	0,749933333	1,923333	1,109966667	39,80333	1,469833333	190,3067	1,8297	253,86	2,1895	268,4467	2,549566667	277,87	2,909566667
1,193333	0,395866667	1,523333	0,755933333	1,946667	1,115966667	41,78667	1,475833333	192,2333	1,8357	254,32	2,1955	268,47	2,555533333	277,9633	2,915533333
1,233333	0,401866667	1,516667	0,761933333	1,956667	1,121933333	43,89333	1,4818	194,1033	1,8417	254,6933	2,2015	268,47	2,561533333	278,01	2,921533333
1,23	0,407866667	1,536667	0,7679	1,956667	1,127933333	46,11	1,4878	196,0167	1,847633333	255,2033	2,2075	268,5067	2,567533333	278,1767	2,9275
1,266667	0,4139	1,503333	0,773966667	1,986667	1,133966667	48,67333	1,493866667	197,97	1,853666667	255,6433	2,213566667	268,4433	2,573566667	278,34	2,933566667
1,273333	0,419933333	1,506667	0,779966667	2	1,14	51,38	1,499833333	199,8033	1,8597	255,9333	2,219566667	268,38	2,5796	278,44	2,939533333
1,273333	0,425933333	1,533333	0,785966667	2,023333	1,146	54,18	1,505833333	201,57	1,865666667	256,1233	2,225533333	268,3467	2,585566667	278,5967	2,945533333
1,293333	0,4319	1,523333	0,791966667	2,03	1,151966667	56,99	1,5118	203,2933	1,871666667	256,2267	2,231533333	268,31	2,591566667	278,7567	2,951533333
1,313333	0,437933333	1,536667	0,797933333	2,066667	1,1579	59,85	1,5178	205,0433	1,877633333	256,3967	2,237533333	268,2867	2,597566667	278,89	2,957533333
1,323333	0,4439	1,54	0,803866667	2,076667	1,1639	62,82	1,523766667	206,75	1,883633333	256,6367	2,243533333	268,32	2,603533333	279,1467	2,9635
1,346667	0,449933333	1,513333	0,809966667	2,08	1,1699	65,87333	1,5298	208,4833	1,889633333	256,9533	2,2495	268,4033	2,609533333	279,58	2,9695
1,36	0,455966667	1,53	0,815966667	2,096667	1,175933333	68,95667	1,535833333	210,1533	1,895633333	257,33	2,255566667	268,5667	2,6156	279,92	2,9756
1,376667	0,462	1,533333	0,821966667	2,136667	1,181966667	71,98	1,5418	211,6667	1,901666667	257,6433	2,2616	268,69	2,6216	280,14	2,981566667
1,376667	0,467966667	1,536667	0,827933333	2,126667	1,187933333	74,89667	1,5478	213,1833	1,9076	257,9333	2,267533333	268,8133	2,627566667	280,51	2,987533333
1,383333	0,473966667	1,536667	0,833933333	2,276667	1,1939	77,83667	1,553766667	214,6267	1,9136	258,3667	2,273533333	269,11	2,633566667	280,9367	2,993533333
1,37	0,479933333	1,54	0,839966667	2,43	1,199866667	80,74667	1,559733333	215,9933	1,919566667	258,7533	2,279566667	269,2967	2,639566667	281,3567	2,999533333
1,376667	0,4859	1,536667	0,8459	2,683333	1,205833333	83,53667	1,5657	217,3667	1,925533333	259,1933	2,285533333	269,55	2,6455	281,9733	3,005533333
1,39	0,491933333	1,536667	0,851933333	3,01	1,211833333	86,35	1,571766667	218,8167	1,931566667	259,72	2,291566667	269,8633	2,651566667	282,6	3,011533333
1,366667	0,498	1,536667	0,857966667	3,4	1,2179	89,15667	1,5778	220,1567	1,937633333	260,0933	2,2976	270,0867	2,6576	283,06	3,0176
1,386667	0,504	1,546667	0,863933333	3,763333	1,223866667	91,92667	1,583766667	221,3867	1,9436	260,24	2,303566667	270,19	2,663566667	283,6267	3,023533333
1,39	0,509933333	1,546667	0,869966667	4,08	1,229833333	94,7	1,589733333	222,58	1,9496	260,2133	2,3096	270,59	2,669566667	284,2633	3,029533333
1,386667	0,515933333	1,54	0,875933333	4,36	1,2358	97,61667	1,595733333	223,7867	1,9556	260,8333	2,315566667	270,8633	2,675566667	284,6833	3,035533333
1,376667	0,521933333	1,546667	0,881933333	4,566667	1,2418	100,46	1,601733333	224,98	1,961566667	261,3233	2,3216	271,2533	2,681533333	285,29	3,041533333
1,376667	0,5279	1,546667	0,8879	4,743333	1,2478	103,31	1,607733333	226,2533	1,967566667	261,7167	2,327566667	271,6533	2,687566667	286,0333	3,0475
1,383333	0,533966667	1,55	0,893933333	4,833333	1,253833333	106,21	1,613766667	227,5267	1,9736	262,2367	2,333633333	272,1167	2,693566667	286,6467	3,053566667
1,386667	0,539966667	1,543333	0,9	5,07	1,259833333	109,0433	1,619766667	228,67	1,979633333	262,6467	2,339633333	272,3967	2,6996	287,13	3,0596
1,383333	0,545966667	1,543333	0,905933333	5,33	1,265833333	111,6733	1,625733333	229,7833	1,9856	262,8633	2,3456	272,6233	2,705533333	287,7033	3,065566667
1,383333	0,551933333	1,546667	0,911933333	5,346667	1,271833333	114,3767	1,6317	230,8633	1,9916	263,0367	2,3516	273,0633	2,711566667	288,2867	3,071533333
1,386667	0,5579	1,543333	0,917933333	5,53	1,2778	117,0633	1,637733333	232,0567	1,997566667	263,4233	2,357566667	273,4	2,717566667	288,8867	3,077533333
1,376667	0,5639	1,55	0,9239	5,856667	1,2838	119,69	1,643666667	233,2067	2,003566667	263,9167	2,363566667	273,8567	2,723533333	289,4733	3,083533333
1,38	0,5699	1,536667	0,929933333	6,093333	1,2898	122,3767	1,6497	234,49	2,0096	264,2433	2,369566667	274,0533	2,729533333	290,1167	3,0895
1,396667	0,575966667	1,54	0,936	6,506667	1,295833333	125	1,655766667	235,7333	2,015633333	264,7233	2,375633333	274,2467	2,7356	290,66	3,0956
1,39	0,581966667	1,563333	0,941966667	6,99	1,301866667	127,5967	1,661766667	236,8633	2,021633333	265,0267	2,381666667	274,39	2,7416	291,1033	3,101566667
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1,38	0,599933333	1,566667	0,959933333	8,88	1,3198	135,48	1,6797	240,16	2,0396	265,82	2,399633333	274,7667	2,759533333	292,52	3,1195
1,393333	0,6059	1,543333	0,9659	9,686667	1,3258	138,08	1,685666667	241,1167	2,045566667	265,95	2,405566667	274,95	2,765533333	292,92	3,1255
1,386667	0,6119	1,55	0,971933333	10,51333	1,331833333	140,65	1,6917	242,0533	2,051633333	266,2967	2,411633333	275,08	2,771533333	293,5833	3,131533333
1,396667	0,617966667	1,556667	0,978	11,20333	1,337833333	143,13	1,697733333	242,75	2,057666667	266,4467	2,417633333	275,1967	2,777566667	293,86	3,137566667
1,403333	0,623933333	1,556667	0,984	11,99667	1,343866667	145,5367	1,703733333	243,4733	2,063666667	266,5333	2,423633333	275,1733	2,7835	294,1033	3,143533333
1,386667	0,6299	1,57	0,989933333	12,88667	1,349833333	148,0433	1,7097	244,05	2,069666667	266,6167	2,4296	275,2967	2,7895	294,52	3,1495
1,4	0,6359	1,576667	0,995933333	13,76	1,355833333	150,5367	1,7157	244,7933	2,0756	266,7067	2,4356	275,5933	2,795533333	294,8333	3,1555
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1,416667	0,6479	1,606667	1,007933333	15,42333	1,367833333	155,33	1,727666667	246,0167	2,0876	267,04	2,4476	275,95	2,807466667	295,7767	3,167533333
1,42	0,653933333	1,64	1,013933333	16,35	1,3739	157,67	1,733766667	246,6	2,093633333	267,2367	2,453633333	276,2133	2,813533333	296,2433	3,173533333
1,416667	0,659966667	1,63	1,02	17,19667	1,379933333	159,8667	1,7398	247,09	2,099666667	267,29	2,459666667	276,2467	2,819566667	296,5933	3,179533333
1,443333	0,665933333	1,653333	1,025966667	17,93	1,3859	161,9367	1,745733333	247,3667	2,1056	267,2467	2,4656	276,3433	2,8255	296,8	3,185466667
1,44	0,671933333	1,673333	1,031966667	18,68667	1,391866667	163,9867	1,7517	247,7867	2,111566667	267,34	2,471633333	276,4833	2,8315	297,04	3,191466667
1,46	0,6779	1,67	1,037966667	19,41667	1,397866667	166,0533	1,757733333	248,2133	2,1176	267,4267	2,4776	276,7133	2,8375	297,2333	3,197433333
1,46	0,683866667	1,7	1,0439	20,37	1,403866667	168,0933	1,7637	248,5933	2,123566667	267,47	2,483566667	276,9433	2,8435	297,4367	3,203466667
1,463333	0,6899	1,723333	1,049933333	21,53	1,409866667	170,1933	1,769733333	248,9467	2,1296	267,5967	2,489633333	277,2067	2,8495	297,62	3,2095
1,476667	0,695966667	1,733333	1,056	22,88667	1,415933333	172,37	1,775733333	249,5033	2,135633333	267,6633	2,495666667	277,4433	2,855533333	297,7133	3,215533333
1,49	0,701933333	1,76	1,062033333	24,4	1,4219	174,4533	1,781733333	249,87	2,1416	267,7133	2,501633333	277,4967	2,861566667	297,88	3,2215
1,51	0,7079	1,786667	1,067966667	26,17333	1,4279	176,48	1,787733333	250,2167	2,1476	267,73	2,5076	277,5033	2,867533333	298,0467	3,227466667
1,493333	0,713933333	1,8	1,073933333	28,02	1,433866667	178,5433	1,7937	250,6767	2,153533333	267,7567	2,5136	277,5067	2,873533333	298,25	3,233466667

INDIREC TRACTION TEST AVERAGE		INDIREC TRACTION TEST AVERAGE		INDIREC TRACTION TEST AVERAGE		INDIREC TRACTION TEST AVERAGE	
LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)
298,27	3,239433333	302,6267	3,599433333	317,6933	3,9594	337,3567	4,319533333
298,4633	3,245466667	302,7967	3,605433333	318,05	3,965433333	337,66	4,3256
298,5333	3,251533333	303,32	3,611533333	318,4267	3,971466667	337,98	4,3316
298,4333	3,257533333	303,47	3,6175	318,6167	3,9775	338,28	4,3376
298,3633	3,263466667	303,5467	3,623466667	318,7767	3,983433333	338,4333	4,3436
298,33	3,269466667	303,6367	3,629466667	318,9033	3,9895	338,7333	4,349566667
298,44	3,275466667	303,6633	3,635466667	318,8467	3,995466667	339,0833	4,355533333
298,5233	3,281433333	303,66	3,641466667	319,0167	4,001466667	339,41	4,360733333
298,6667	3,287433333	303,8867	3,6475	319,4467	4,007466667		
298,9233	3,293466667	303,9933	3,653533333	319,9433	4,0135		
298,9167	3,2995	304,0467	3,659566667	320,1133	4,0195		
299,1467	3,305466667	304,2233	3,6655	320,39	4,025466667		
299,28	3,311466667	304,1333	3,6715	320,78	4,031466667		
299,33	3,3175	304,4133	3,677466667	321,1033	4,037433333		
299,31	3,323466667	304,7767	3,683466667	321,4033	4,043466667		
299,3267	3,3295	305,22	3,689533333	321,9667	4,0495		
299,1367	3,335533333	305,7433	3,695533333	322,2767	4,0555		
298,98	3,341466667	306,02	3,701533333	322,54	4,061533333		
298,7367	3,347433333	306,2433	3,7075	322,6967	4,0675		
298,56	3,353466667	306,6433	3,7135	322,95	4,073433333		
298,4633	3,3594	306,98	3,7195	323,36	4,0795		
298,3833	3,365466667	307,42	3,7255	323,6367	4,085466667		
298,4667	3,371466667	307,8467	3,731533333	324,18	4,091533333		
298,3933	3,3775	307,7667	3,737566667	324,61	4,097566667		
298,3967	3,383466667	307,9767	3,743533333	324,7967	4,1035		
298,54	3,389433333	308,2733	3,7495	325,11	4,109466667		
298,6733	3,395433333	308,6033	3,7555	325,57	4,1155		
298,73	3,401433333	308,8533	3,761466667	326,0267	4,121466667		
298,95	3,407433333	309,1867	3,767533333	326,56	4,127533333		
299,1433	3,4135	309,4567	3,773533333	327,0767	4,133533333		
299,12	3,419466667	309,72	3,779533333	327,5	4,139533333		
299	3,425433333	309,9867	3,7855	328,0967	4,145466667		
298,9867	3,431433333	310,3367	3,791466667	328,42	4,151466667		
299,0767	3,437433333	310,77	3,797466667	328,7933	4,1575		
299,1433	3,443433333	311,07	3,803466667	329,1567	4,163433333		
299,3433	3,449466667	311,2133	3,8095	329,75	4,1695		
299,41	3,455466667	311,5033	3,815533333	330,1833	4,175566667		
299,4967	3,461433333	311,6633	3,8215	330,44	4,1815		
299,5967	3,467433333	311,9067	3,8275	330,7867	4,1875		
299,75	3,473433333	312,1967	3,833466667	331,2633	4,1935		
299,9067	3,4794	312,5033	3,8394	331,56	4,1995		
300,0333	3,4854	312,9533	3,845466667	331,8767	4,205466667		
300,1167	3,491466667	313,3433	3,8515	332,3667	4,2115		
300,14	3,497466667	313,6133	3,8575	332,6867	4,2175		
300,1767	3,503433333	313,72	3,863433333	332,7967	4,223466667		
300,2333	3,509433333	313,9167	3,869433333	333,0767	4,2295		
300,3533	3,515433333	314,1733	3,875466667	333,3	4,235466667		
300,4967	3,521433333	314,4867	3,8814	333,5333	4,241466667		
300,7167	3,527433333	314,8533	3,8875	333,7433	4,2475		
301,0433	3,533466667	315,0933	3,8935	334,11	4,253533333		
301,0733	3,539466667	315,2633	3,899466667	334,1933	4,259566667		
301,19	3,545433333	315,3767	3,905433333	334,37	4,2655		
301,3733	3,551433333	315,5733	3,911466667	334,62	4,271533333		
301,4867	3,557433333	315,72	3,917433333	334,9033	4,277533333		
301,65	3,563433333	315,93	3,9234	335,2033	4,2835		
301,84	3,569466667	316,17	3,929433333	335,5867	4,289533333		
302,13	3,5755	316,4833	3,935466667	336,08	4,2956		
302,42	3,5815	316,77	3,941433333	336,4133	4,301566667		
302,4067	3,587466667	317,17	3,947466667	336,8067	4,307566667		
302,2733	3,593466667	317,4567	3,953433333	337,0967	4,313566667		

3.3.1.6-E Mix. Proportion Tests
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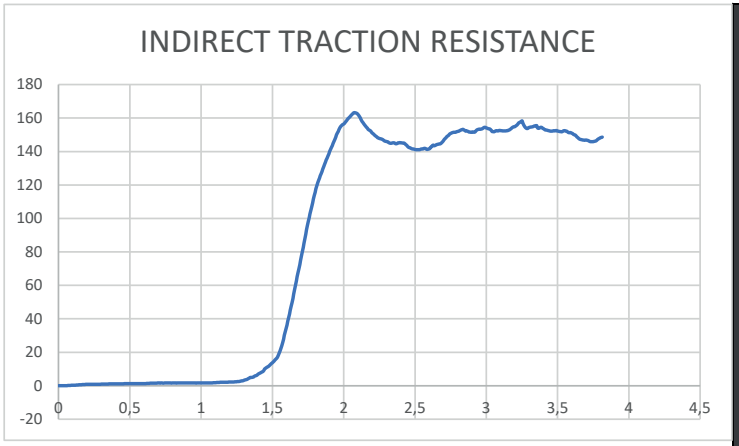
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
0,08	1,2	-1,27544	0	13,6	24,2	329,12	0,0002
0,12	1,6	-1,26934	0,0061	13,6	24,2	329,12	0,0004
0,19	2	-1,26334	0,0121	13,6	24,2	329,12	0,0006
0,23	2,4	-1,25744	0,018	13,6	24,2	329,12	0,0007
0,28	2,8	-1,25154	0,0239	13,6	24,2	329,12	0,0009
0,32	3,2	-1,24554	0,0299	13,6	24,2	329,12	0,0010
0,38	3,6	-1,23954	0,0359	13,6	24,2	329,12	0,0012
0,44	4	-1,23354	0,0419	13,6	24,2	329,12	0,0013
0,50	4,4	-1,22744	0,048	13,6	24,2	329,12	0,0015
0,55	4,8	-1,22144	0,054	13,6	24,2	329,12	0,0017
0,59	5,2	-1,21554	0,0599	13,6	24,2	329,12	0,0018
0,67	5,6	-1,20964	0,0658	13,6	24,2	329,12	0,0020
0,72	6	-1,20364	0,0718	13,6	24,2	329,12	0,0022
0,77	6,4	-1,19764	0,0778	13,6	24,2	329,12	0,0023
0,83	6,8	-1,19154	0,0839	13,6	24,2	329,12	0,0025
0,86	7,2	-1,18554	0,0899	13,6	24,2	329,12	0,0026
0,91	7,6	-1,17954	0,0959	13,6	24,2	329,12	0,0028
0,96	8	-1,17364	0,1018	13,6	24,2	329,12	0,0029
1,01	8,4	-1,16764	0,1078	13,6	24,2	329,12	0,0031
1,05	8,8	-1,16174	0,1137	13,6	24,2	329,12	0,0032
1,10	9,2	-1,15574	0,1197	13,6	24,2	329,12	0,0033
1,14	9,6	-1,14964	0,1258	13,6	24,2	329,12	0,0035
1,14	10	-1,14364	0,1318	13,6	24,2	329,12	0,0035
1,15	10,4	-1,13774	0,1377	13,6	24,2	329,12	0,0035
1,14	10,8	-1,13174	0,1437	13,6	24,2	329,12	0,0035
1,13	11,2	-1,12584	0,1496	13,6	24,2	329,12	0,0034
1,14	11,6	-1,11984	0,1556	13,6	24,2	329,12	0,0035
1,15	12	-1,11374	0,1617	13,6	24,2	329,12	0,0035
1,15	12,4	-1,10764	0,1678	13,6	24,2	329,12	0,0035
1,15	12,8	-1,10164	0,1738	13,6	24,2	329,12	0,0035
1,14	13,2	-1,09574	0,1797	13,6	24,2	329,12	0,0035
1,14	13,6	-1,08984	0,1856	13,6	24,2	329,12	0,0035
1,15	14	-1,08384	0,1916	13,6	24,2	329,12	0,0035
1,15	14,4	-1,07784	0,1976	13,6	24,2	329,12	0,0035
1,16	14,8	-1,07174	0,2037	13,6	24,2	329,12	0,0035
1,17	15,2	-1,06564	0,2098	13,6	24,2	329,12	0,0036
1,18	15,6	-1,05974	0,2157	13,6	24,2	329,12	0,0036
1,19	16	-1,05374	0,2217	13,6	24,2	329,12	0,0036
1,19	16,4	-1,04784	0,2276	13,6	24,2	329,12	0,0036
1,20	16,8	-1,04184	0,2336	13,6	24,2	329,12	0,0036
1,20	17,2	-1,03584	0,2396	13,6	24,2	329,12	0,0036
1,21	17,6	-1,02974	0,2457	13,6	24,2	329,12	0,0037
1,22	18	-1,02364	0,2518	13,6	24,2	329,12	0,0037
1,22	18,4	-1,01774	0,2577	13,6	24,2	329,12	0,0037
1,24	18,8	-1,01174	0,2637	13,6	24,2	329,12	0,0038
1,24	19,2	-1,00584	0,2696	13,6	24,2	329,12	0,0038
1,27	19,6	-0,99984	0,2756	13,6	24,2	329,12	0,0039
1,28	20	-0,99374	0,2817	13,6	24,2	329,12	0,0039
1,28	20,4	-0,98764	0,2878	13,6	24,2	329,12	0,0039
1,31	20,8	-0,98154	0,2939	13,6	24,2	329,12	0,0040
1,34	21,2	-0,97564	0,2998	13,6	24,2	329,12	0,0041
1,38	21,6	-0,96974	0,3057	13,6	24,2	329,12	0,0042
1,37	22	-0,96374	0,3117	13,6	24,2	329,12	0,0042
1,38	22,4	-0,95774	0,3177	13,6	24,2	329,12	0,0042
1,40	22,8	-0,95154	0,3239	13,6	24,2	329,12	0,0043
1,41	23,2	-0,94544	0,33	13,6	24,2	329,12	0,0043
1,40	23,6	-0,93954	0,3359	13,6	24,2	329,12	0,0043
1,40	24	-0,93354	0,3419	13,6	24,2	329,12	0,0043
1,42	24,4	-0,92764	0,3478	13,6	24,2	329,12	0,0043
1,41	24,8	-0,92164	0,3538	13,6	24,2	329,12	0,0043
1,40	25,2	-0,91554	0,3599	13,6	24,2	329,12	0,0043

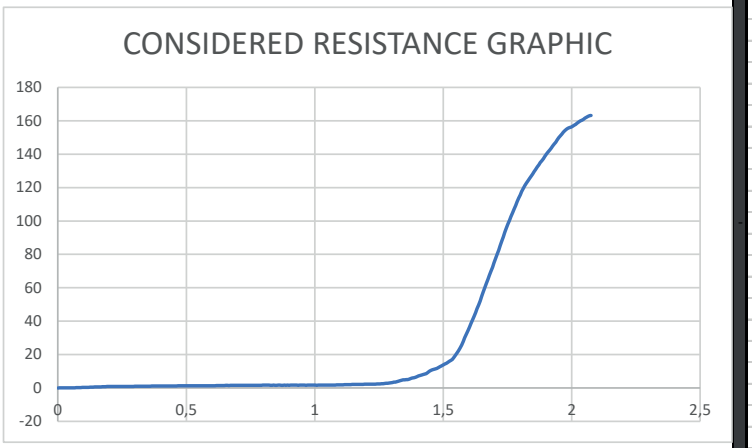
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
1,41	25,6	-0,90944	0,366	13,6	24,2	329,12	0,0043	1,46	50	-0,54354	0,7319	13,6	24,2	329,12	0,0044	1,60	74,4	-0,17754	1,0979	13,6	24,2	329,12	0,0049
1,42	26	-0,90334	0,3721	13,6	24,2	329,12	0,0043	1,46	50,4	-0,53754	0,7379	13,6	24,2	329,12	0,0044	1,64	74,8	-0,17164	1,1038	13,6	24,2	329,12	0,0050
1,41	26,4	-0,89744	0,378	13,6	24,2	329,12	0,0043	1,48	50,8	-0,53164	0,7438	13,6	24,2	329,12	0,0045	1,71	75,2	-0,16564	1,1098	13,6	24,2	329,12	0,0052
1,41	26,8	-0,89154	0,3839	13,6	24,2	329,12	0,0043	1,48	51,2	-0,52564	0,7498	13,6	24,2	329,12	0,0045	1,79	75,6	-0,15974	1,1157	13,6	24,2	329,12	0,0054
1,43	27,2	-0,88554	0,3899	13,6	24,2	329,12	0,0043	1,47	51,6	-0,51974	0,7557	13,6	24,2	329,12	0,0045	1,85	76	-0,15364	1,1218	13,6	24,2	329,12	0,0056
1,43	27,6	-0,87964	0,3958	13,6	24,2	329,12	0,0043	1,46	52	-0,51364	0,7618	13,6	24,2	329,12	0,0044	1,94	76,4	-0,14754	1,1279	13,6	24,2	329,12	0,0059
1,41	28	-0,87354	0,4019	13,6	24,2	329,12	0,0043	1,46	52,4	-0,50754	0,7679	13,6	24,2	329,12	0,0044	2,03	76,8	-0,14154	1,1339	13,6	24,2	329,12	0,0062
1,41	28,4	-0,86744	0,408	13,6	24,2	329,12	0,0043	1,47	52,8	-0,50154	0,7739	13,6	24,2	329,12	0,0045	2,17	77,2	-0,13564	1,1398	13,6	24,2	329,12	0,0066
1,43	28,8	-0,86144	0,414	13,6	24,2	329,12	0,0043	1,48	53,2	-0,49564	0,7798	13,6	24,2	329,12	0,0045	2,26	77,6	-0,12964	1,1458	13,6	24,2	329,12	0,0069
1,43	29,2	-0,85554	0,4199	13,6	24,2	329,12	0,0043	1,46	53,6	-0,48974	0,7857	13,6	24,2	329,12	0,0044	2,42	78	-0,12374	1,1517	13,6	24,2	329,12	0,0074
1,43	29,6	-0,84954	0,4259	13,6	24,2	329,12	0,0043	1,47	54	-0,48374	0,7917	13,6	24,2	329,12	0,0045	2,52	78,4	-0,11764	1,1578	13,6	24,2	329,12	0,0077
1,43	30	-0,84364	0,4318	13,6	24,2	329,12	0,0043	1,48	54,4	-0,47774	0,7977	13,6	24,2	329,12	0,0045	2,65	78,8	-0,11154	1,1639	13,6	24,2	329,12	0,0081
1,44	30,4	-0,83764	0,4378	13,6	24,2	329,12	0,0044	1,49	54,8	-0,47164	0,8038	13,6	24,2	329,12	0,0045	2,83	79,2	-0,10554	1,1699	13,6	24,2	329,12	0,0086
1,44	30,8	-0,83154	0,4439	13,6	24,2	329,12	0,0044	1,46	55,2	-0,46554	0,8099	13,6	24,2	329,12	0,0044	3,01	79,6	-0,09954	1,1759	13,6	24,2	329,12	0,0091
1,43	31,2	-0,82544	0,45	13,6	24,2	329,12	0,0043	1,48	55,6	-0,45964	0,8158	13,6	24,2	329,12	0,0045	3,15	80	-0,09364	1,1818	13,6	24,2	329,12	0,0096
1,44	31,6	-0,81944	0,456	13,6	24,2	329,12	0,0044	1,47	56	-0,45374	0,8217	13,6	24,2	329,12	0,0045	3,45	80,4	-0,08764	1,1878	13,6	24,2	329,12	0,0105
1,42	32	-0,81354	0,4619	13,6	24,2	329,12	0,0043	1,47	56,4	-0,44784	0,8276	13,6	24,2	329,12	0,0045	3,95	80,8	-0,08174	1,1937	13,6	24,2	329,12	0,0120
1,44	32,4	-0,80764	0,4678	13,6	24,2	329,12	0,0044	1,48	56,8	-0,44184	0,8336	13,6	24,2	329,12	0,0045	5,02	81,2	-0,07564	1,1998	13,6	24,2	329,12	0,0153
1,43	32,8	-0,80164	0,4738	13,6	24,2	329,12	0,0043	1,49	57,2	-0,43584	0,8396	13,6	24,2	329,12	0,0045	5,85	81,6	-0,06954	1,2059	13,6	24,2	329,12	0,0178
1,44	33,2	-0,79564	0,4798	13,6	24,2	329,12	0,0044	1,50	57,6	-0,42964	0,8458	13,6	24,2	329,12	0,0046	6,57	82	-0,06354	1,2119	13,6	24,2	329,12	0,0200
1,43	33,6	-0,78954	0,4859	13,6	24,2	329,12	0,0043	1,50	58	-0,42364	0,8518	13,6	24,2	329,12	0,0046	7,00	82,4	-0,05764	1,2178	13,6	24,2	329,12	0,0213
1,44	34	-0,78344	0,492	13,6	24,2	329,12	0,0044	1,48	58,4	-0,41774	0,8577	13,6	24,2	329,12	0,0045	7,76	82,8	-0,05174	1,2237	13,6	24,2	329,12	0,0236
1,44	34,4	-0,77754	0,4979	13,6	24,2	329,12	0,0044	1,47	58,8	-0,41184	0,8636	13,6	24,2	329,12	0,0045	7,93	83,2	-0,04574	1,2297	13,6	24,2	329,12	0,0241
1,45	34,8	-0,77164	0,5038	13,6	24,2	329,12	0,0044	1,48	59,2	-0,40584	0,8696	13,6	24,2	329,12	0,0045	9,58	83,6	-0,03974	1,2357	13,6	24,2	329,12	0,0291
1,45	35,2	-0,76564	0,5098	13,6	24,2	329,12	0,0044	1,48	59,6	-0,39984	0,8756	13,6	24,2	329,12	0,0045	11,23	84	-0,03364	1,2418	13,6	24,2	329,12	0,0341
1,43	35,6	-0,75974	0,5157	13,6	24,2	329,12	0,0043	1,50	60	-0,39374	0,8817	13,6	24,2	329,12	0,0046	12,80	84,4	-0,02754	1,2479	13,6	24,2	329,12	0,0389
1,44	36	-0,75364	0,5218	13,6	24,2	329,12	0,0044	1,49	60,4	-0,38764	0,8878	13,6	24,2	329,12	0,0045	14,11	84,8	-0,02164	1,2538	13,6	24,2	329,12	0,0429
1,46	36,4	-0,74764	0,5278	13,6	24,2	329,12	0,0044	1,48	60,8	-0,38174	0,8937	13,6	24,2	329,12	0,0045	15,20	85,2	-0,01574	1,2597	13,6	24,2	329,12	0,0462
1,43	36,8	-0,74154	0,5339	13,6	24,2	329,12	0,0043	1,49	61,2	-0,37574	0,8997	13,6	24,2	329,12	0,0045	16,47	85,6	-0,00974	1,2657	13,6	24,2	329,12	0,0500
1,44	37,2	-0,73574	0,5397	13,6	24,2	329,12	0,0044	1,49	61,6	-0,36984	0,9056	13,6	24,2	329,12	0,0045	17,91	86	-0,00374	1,2717	13,6	24,2	329,12	0,0544
1,44	37,6	-0,72974	0,5457	13,6	24,2	329,12	0,0044	1,48	62	-0,36384	0,9116	13,6	24,2	329,12	0,0045	19,33	86,4	0,00226	1,2777	13,6	24,2	329,12	0,0587
1,44	38	-0,72384	0,5516	13,6	24,2	329,12	0,0044	1,49	62,4	-0,35784	0,9176	13,6	24,2	329,12	0,0045	20,73	86,8	0,00836	1,2838	13,6	24,2	329,12	0,0630
1,46	38,4	-0,71784	0,5576	13,6	24,2	329,12	0,0044	1,50	62,8	-0,35174	0,9237	13,6	24,2	329,12	0,0046	22,19	87,2	0,01436	1,2898	13,6	24,2	329,12	0,0674
1,43	38,8	-0,71174	0,5637	13,6	24,2	329,12	0,0043	1,51	63,2	-0,34564	0,9298	13,6	24,2	329,12	0,0046	23,88	87,6	0,02036	1,2958	13,6	24,2	329,12	0,0726
1,45	39,2	-0,70564	0,5698	13,6	24,2	329,12	0,0044	1,51	63,6	-0,33974	0,9357	13,6	24,2	329,12	0,0046	26,40	88	0,02636	1,3018	13,6	24,2	329,12	0,0802
1,45	39,6	-0,69964	0,5758	13,6	24,2	329,12	0,0044	1,49	64	-0,33374	0,9417	13,6	24,2	329,12	0,0045	29,24	88,4	0,03226	1,3077	13,6	24,2	329,12	0,0888
1,45	40	-0,69374	0,5817	13,6	24,2	329,12	0,0044	1,50	64,4	-0,32784	0,9476	13,6	24,2	329,12	0,0046	32,35	88,8	0,03826	1,3137	13,6	24,2	329,12	0,0983
1,46	40,4	-0,68784	0,5876	13,6	24,2	329,12	0,0044	1,50	64,8	-0,32184	0,9536	13,6	24,2	329,12	0,0046	35,84	89,2	0,04436	1,3198	13,6	24,2	329,12	0,1089
1,46	40,8	-0,68184	0,5936	13,6	24,2	329,12	0,0044	1,48	65,2	-0,31574	0,9597	13,6	24,2	329,12	0,0045	39,54	89,6	0,05046	1,3259	13,6	24,2	329,12	0,1201
1,46	41,2	-0,67574	0,5997	13,6	24,2	329,12	0,0044	1,48	65,6	-0,30964	0,9658	13,6	24,2	329,12	0,0045	43,54	90	0,05646	1,3319	13,6	24,2	329,12	0,1323
1,46	41,6	-0,66964	0,6058	13,6	24,2	329,12	0,0044	1,50	66	-0,30364	0,9718	13,6	24,2	329,12	0,0046	47,68	90,4	0,06236	1,3378	13,6	24,2	329,12	0,1449
1,46	42	-0,66364	0,6118	13,6	24,2	329,12	0,0044	1,49	66,4	-0,29764	0,9778	13,6	24,2	329,12	0,0045	52,09	90,8	0,06836	1,3438	13,6	24,2	329,12	0,1583
1,46	42,4	-0,65774	0,6177	13,6	24,2	329,12	0,0044	1,50	66,8	-0,29174	0,9837	13,6	24,2	329,12	0,0046	56,65	91,2	0,07426	1,3497	13,6	24,2	329,12	0,1721
1,47	42,8	-0,65174	0,6237	13,6	24,2	329,12	0,0045	1,51	67,2	-0,28574	0,9897	13,6	24,2	329,12	0,0046	61,29	91,6	0,08026	1,3557	13,6	24,2	329,12	0,1862
1,49	43,2	-0,64584	0,6296	13,6	24,2	329,12	0,0045	1,51	67,6	-0,27984	0,9956	13,6	24,2	329,12	0,0046	66,12	92	0,08636	1,3618	13,6	24,2	329,12	0,2009
1,47	43,6	-0,63984	0,6356	13,6	24,2	329,12	0,0045	1,50	68	-0,27364	1,0018	13,6	24,2	329,12	0,0046	70,70	92,4	0,09246	1,3679	13,6	24,2	329,12	0,2148
1,46	44	-0,63374	0,6417	13,6	24,2	329,12	0,0044	1,50	68,4	-0,26764	1,0078	13,6	24,2	329,12	0,0046	75,04	92,8	0,09846	1,3739	13,6	24,2	329,12	0,2280
1,47	44,4	-0,62764	0,6478	13,6	24,2	329,12	0,0045	1,51	68,8	-0,26154	1,0139	13,6	24,2	329,12	0,0046	79,22	93,2	0,10436	1,3798	13,6	24,2	329,12	0,2407
1,45	44,8	-0,62164	0,6538	13,6	24,2	329,12	0,0044	1,50	69,2	-0,25564	1,0198	13,6	24,2	329,12	0,0046	83,27	93,6	0,11026	1,3857	13,6	24,2	329,12	0,2530
1,46	45,2	-0,61574	0,6597	13,6	24,2	329,12	0,0044	1,51	69,6	-0,24974	1,0257	13,6	24,2	329,12	0,0046	87,26	94	0,11626	1,3917	13,6	24,2	329,12	0,2651
1,47	45,6	-0,60974	0,6657	13,6	24,2	329,12	0,0045	1,52	70	-0,24374	1,0317	13,6	24,2	329,12	0,0046	91,17	94,4	0,12226	1,3977	13,6	24,2	329,12	0,2770
1,47	46	-0,60374	0,6717	13,6	24,2	329,12	0,0045	1,54	70,4	-0,23774	1,0377	13,6	24,2	329,12	0,0047	94,87	94,8	0,12836	1,4038	13,6	24,2	329,12	0,2883
1,48	46,4	-0,59774	0,6777	13,6	24,2	329,12	0,0045	1,52	70,8	-0,23164	1,0438	13,6	24,2	329,12	0,0046	98,32	95,2	0,13436	1,4098	13,6	24,2	329,12	0,2987
1,48	46,8	-0,59164	0,6838	13,6	24,2	329,12	0,0045	1,52	71,2	-0,22554	1,0499	13,6	24,2	329,12	0,0046	101,32	95,6	0,14036	1,4158	13,6	24,2	329,12	0,3079
1,47	47,2	-0,58554	0,6899	13,6	24,2	329,12	0,0045	1,55	71,6	-0,21964	1,0558	13,6	24,2	329,12	0,0047	104,26	96	0,14626	1,4217	13,6	24,2	329,12	0,3168
1,46	47,6	-0,57954	0,6959	13,6	24,2	329,12	0,0044	1,52	72	-0,21364	1,0618	13,6	24,2	329,12	0,0046	106,96	96,4	0,15226	1,4277	13,6	24,2	329,12	0,3250
1,47	48	-0,57364	0,7018	13,6	24,2	329,12	0,0045	1,52	72,4	-0,20774	1,0677	13,6	24,2	329,12	0,0046	109,16	96,8	0,15816	1,4336	13,6	24,2	329,12	0,3317
1,47	48,4	-0,56764	0,7078	13,6	24,2	329,12	0,0045	1,54	72,8	-0,20174	1,0737	13,6	24,2	329,12	0,0047	110,78	97,2	0,16426	1,4397	13,6	24,2	329,12	0,3366
1,48	48,8	-0,56174	0,7137	13,6	24,2	329,12	0,0045	1,55	73,2	-0,19564	1,0798	13,6	24,2	329,12	0,0047	112,08	97,6	0,17036	1,4458	13,6	24,2	329,12	0,3405
1,48	49,2	-0,55564	0,7198	13,6	24,2	329,12	0,0045	1,55	73,6	-0,18954	1,0859	13,6	24,2	329,12	0,0047	113,37	98	0,17636	1,4518	13,6	24,2	329,12	0,3445
1,47	49,6	-0,54954	0,7259	13,6	24,2	329,12	0,0045	1,54	74	-0,18354	1,0919	13,6	24,2	329,12	0,0047	114,36	98,4	0,18226	1,4577	13,6	24,2	329,12	0,3475

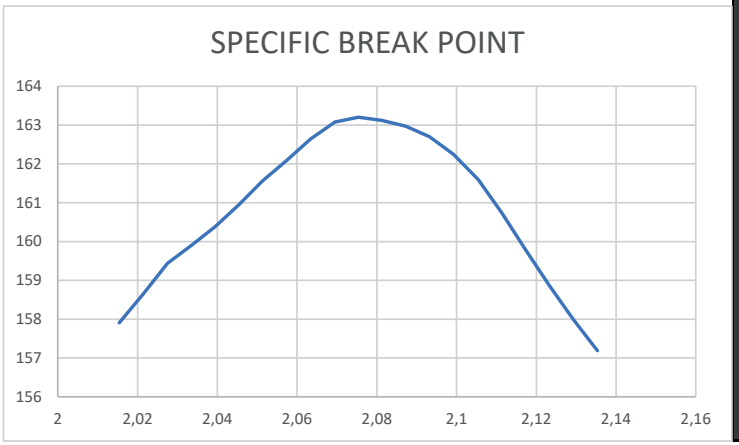
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
115,26	98,8	0,18816	1,4636	13,6	24,2	329,12	0,3502	132,46	123,2	0,55416	1,8296	13,6	24,2	329,12	0,4025	121,62	147,6	0,92006	2,1955	13,6	24,2	329,12	0,3695
116,12	99,2	0,19406	1,4695	13,6	24,2	329,12	0,3528	132,64	123,6	0,56016	1,8356	13,6	24,2	329,12	0,4030	121,38	148	0,92626	2,2017	13,6	24,2	329,12	0,3688
116,87	99,6	0,20006	1,4755	13,6	24,2	329,12	0,3551	132,84	124	0,56626	1,8417	13,6	24,2	329,12	0,4036	121,02	148,4	0,93236	2,2078	13,6	24,2	329,12	0,3677
117,50	100	0,20616	1,4816	13,6	24,2	329,12	0,3570	133,20	124,4	0,57226	1,8477	13,6	24,2	329,12	0,4047	120,54	148,8	0,93826	2,2137	13,6	24,2	329,12	0,3662
118,08	100,4	0,21226	1,4877	13,6	24,2	329,12	0,3588	133,33	124,8	0,57826	1,8537	13,6	24,2	329,12	0,4051	120,14	149,2	0,94416	2,2196	13,6	24,2	329,12	0,3650
118,42	100,8	0,21816	1,4936	13,6	24,2	329,12	0,3598	133,01	125,2	0,58426	1,8597	13,6	24,2	329,12	0,4041	119,72	149,6	0,95006	2,2255	13,6	24,2	329,12	0,3638
119,17	101,2	0,22406	1,4995	13,6	24,2	329,12	0,3621	132,61	125,6	0,59006	1,8655	13,6	24,2	329,12	0,4029	118,53	150	0,95606	2,2315	13,6	24,2	329,12	0,3601
119,89	101,6	0,23006	1,5055	13,6	24,2	329,12	0,3643	132,00	126	0,59606	1,8715	13,6	24,2	329,12	0,4011	117,38	150,4	0,96216	2,2376	13,6	24,2	329,12	0,3566
120,60	102	0,23596	1,5114	13,6	24,2	329,12	0,3664	131,76	126,4	0,60216	1,8776	13,6	24,2	329,12	0,4003	116,62	150,8	0,96826	2,2437	13,6	24,2	329,12	0,3543
121,69	102,4	0,24206	1,5175	13,6	24,2	329,12	0,3697	131,38	126,8	0,60826	1,8837	13,6	24,2	329,12	0,3992	115,80	151,2	0,97426	2,2497	13,6	24,2	329,12	0,3518
122,45	102,8	0,24816	1,5236	13,6	24,2	329,12	0,3721	131,16	127,2	0,61436	1,8898	13,6	24,2	329,12	0,3985	115,14	151,6	0,98026	2,2557	13,6	24,2	329,12	0,3498
123,24	103,2	0,25416	1,5296	13,6	24,2	329,12	0,3745	130,72	127,6	0,62026	1,8957	13,6	24,2	329,12	0,3972	114,41	152	0,98616	2,2616	13,6	24,2	329,12	0,3476
123,89	103,6	0,26006	1,5355	13,6	24,2	329,12	0,3764	130,56	128	0,62606	1,9015	13,6	24,2	329,12	0,3967	113,93	152,4	0,99206	2,2675	13,6	24,2	329,12	0,3462
124,86	104	0,26606	1,5415	13,6	24,2	329,12	0,3794	130,29	128,4	0,63206	1,9075	13,6	24,2	329,12	0,3959	113,45	152,8	0,99806	2,2735	13,6	24,2	329,12	0,3447
125,82	104,4	0,27196	1,5474	13,6	24,2	329,12	0,3823	130,18	128,8	0,63806	1,9135	13,6	24,2	329,12	0,3955	112,81	153,2	1,00416	2,2796	13,6	24,2	329,12	0,3428
126,65	104,8	0,27796	1,5534	13,6	24,2	329,12	0,3848	129,70	129,2	0,64406	1,9195	13,6	24,2	329,12	0,3941	112,39	153,6	1,01026	2,2857	13,6	24,2	329,12	0,3415
127,23	105,2	0,28406	1,5595	13,6	24,2	329,12	0,3866	129,03	129,6	0,65016	1,9256	13,6	24,2	329,12	0,3920	112,19	154	1,01626	2,2917	13,6	24,2	329,12	0,3409
127,79	105,6	0,29016	1,5656	13,6	24,2	329,12	0,3883	128,59	130	0,65616	1,9316	13,6	24,2	329,12	0,3907	111,78	154,4	1,02216	2,2976	13,6	24,2	329,12	0,3396
128,37	106	0,29616	1,5716	13,6	24,2	329,12	0,3900	128,19	130,4	0,66206	1,9375	13,6	24,2	329,12	0,3895	111,24	154,8	1,02816	2,3036	13,6	24,2	329,12	0,3380
128,76	106,4	0,30206	1,5775	13,6	24,2	329,12	0,3912	128,17	130,8	0,66806	1,9435	13,6	24,2	329,12	0,3894	110,51	155,2	1,03406	2,3095	13,6	24,2	329,12	0,3358
128,93	106,8	0,30796	1,5834	13,6	24,2	329,12	0,3917	128,22	131,2	0,67406	1,9495	13,6	24,2	329,12	0,3896	109,72	155,6	1,04006	2,3155	13,6	24,2	329,12	0,3334
129,12	107,2	0,31396	1,5894	13,6	24,2	329,12	0,3923	128,18	131,6	0,68006	1,9555	13,6	24,2	329,12	0,3895	109,02	156	1,04626	2,3217	13,6	24,2	329,12	0,3312
129,51	107,6	0,31996	1,5954	13,6	24,2	329,12	0,3935	128,27	132	0,68616	1,9616	13,6	24,2	329,12	0,3897	108,31	156,4	1,05226	2,3277	13,6	24,2	329,12	0,3291
130,33	108	0,32606	1,6015	13,6	24,2	329,12	0,3960	128,16	132,4	0,69226	1,9677	13,6	24,2	329,12	0,3894	107,69	156,8	1,05826	2,3337	13,6	24,2	329,12	0,3272
131,06	108,4	0,33226	1,6077	13,6	24,2	329,12	0,3982	127,98	132,8	0,69816	1,9736	13,6	24,2	329,12	0,3889	106,94	157,2	1,06416	2,3396	13,6	24,2	329,12	0,3249
131,77	108,8	0,33816	1,6136	13,6	24,2	329,12	0,4004	127,61	133,2	0,70406	1,9795	13,6	24,2	329,12	0,3877	106,66	157,6	1,07006	2,3455	13,6	24,2	329,12	0,3241
132,47	109,2	0,34406	1,6195	13,6	24,2	329,12	0,4025	126,69	133,6	0,71006	1,9855	13,6	24,2	329,12	0,3849	106,42	158	1,07606	2,3515	13,6	24,2	329,12	0,3233
133,11	109,6	0,35006	1,6255	13,6	24,2	329,12	0,4044	126,32	134	0,71606	1,9915	13,6	24,2	329,12	0,3838	106,28	158,4	1,08216	2,3576	13,6	24,2	329,12	0,3229
133,52	110	0,35606	1,6315	13,6	24,2	329,12	0,4057	125,96	134,4	0,72206	1,9975	13,6	24,2	329,12	0,3827	105,99	158,8	1,08826	2,3637	13,6	24,2	329,12	0,3220
134,21	110,4	0,36206	1,6375	13,6	24,2	329,12	0,4078	125,82	134,8	0,72826	2,0037	13,6	24,2	329,12	0,3823	105,85	159,2	1,09426	2,3697	13,6	24,2	329,12	0,3216
134,86	110,8	0,36826	1,6437	13,6	24,2	329,12	0,4098	125,35	135,2	0,73426	2,0097	13,6	24,2	329,12	0,3809	105,50	159,6	1,10026	2,3757	13,6	24,2	329,12	0,3206
135,03	111,2	0,37426	1,6497	13,6	24,2	329,12	0,4103	125,08	135,6	0,74026	2,0157	13,6	24,2	329,12	0,3800	105,28	160	1,10616	2,3816	13,6	24,2	329,12	0,3199
135,14	111,6	0,38026	1,6557	13,6	24,2	329,12	0,4106	124,91	136	0,74616	2,0216	13,6	24,2	329,12	0,3795	105,22	160,4	1,11206	2,3875	13,6	24,2	329,12	0,3197
135,16	112	0,38616	1,6616	13,6	24,2	329,12	0,4107	124,87	136,4	0,75206	2,0275	13,6	24,2	329,12	0,3794	104,90	160,8	1,11816	2,3936	13,6	24,2	329,12	0,3187
135,22	112,4	0,39216	1,6676	13,6	24,2	329,12	0,4109	124,93	136,8	0,75806	2,0335	13,6	24,2	329,12	0,3796	104,38	161,2	1,12416	2,3996	13,6	24,2	329,12	0,3171
135,19	112,8	0,39816	1,6736	13,6	24,2	329,12	0,4108	124,84	137,2	0,76416	2,0396	13,6	24,2	329,12	0,3793	103,80	161,6	1,13036	2,4058	13,6	24,2	329,12	0,3154
135,09	113,2	0,40416	1,6796	13,6	24,2	329,12	0,4105	125,14	137,6	0,77026	2,0457	13,6	24,2	329,12	0,3802	102,66	162	1,13636	2,4118	13,6	24,2	329,12	0,3119
134,91	113,6	0,41036	1,6858	13,6	24,2	329,12	0,4099	125,00	138	0,77626	2,0517	13,6	24,2	329,12	0,3798	101,51	162,4	1,14226	2,4177	13,6	24,2	329,12	0,3084
134,59	114	0,41636	1,6918	13,6	24,2	329,12	0,4089	124,95	138,4	0,78216	2,0576	13,6	24,2	329,12	0,3796	100,96	162,8	1,14816	2,4236	13,6	24,2	329,12	0,3068
133,58	114,4	0,42226	1,6977	13,6	24,2	329,12	0,4059	124,60	138,8	0,78816	2,0636	13,6	24,2	329,12	0,3786	100,63	163,2	1,15416	2,4296	13,6	24,2	329,12	0,3058
133,08	114,8	0,42816	1,7036	13,6	24,2	329,12	0,4044	124,60	139,2	0,79416	2,0696	13,6	24,2	329,12	0,3786	100,11	163,6	1,16016	2,4356	13,6	24,2	329,12	0,3042
133,10	115,2	0,43416	1,7096	13,6	24,2	329,12	0,4044	124,58	139,6	0,80016	2,0756	13,6	24,2	329,12	0,3785	99,37	164	1,16626	2,4417	13,6	24,2	329,12	0,3019
133,25	115,6	0,44016	1,7156	13,6	24,2	329,12	0,4049	124,72	140	0,80626	2,0817	13,6	24,2	329,12	0,3789	98,78	164,4	1,17236	2,4478	13,6	24,2	329,12	0,3001
133,63	116	0,44626	1,7217	13,6	24,2	329,12	0,4060	124,67	140,4	0,81236	2,0878	13,6	24,2	329,12	0,3788	98,16	164,8	1,17836	2,4538	13,6	24,2	329,12	0,2982
133,79	116,4	0,45236	1,7278	13,6	24,2	329,12	0,4065	124,35	140,8	0,81826	2,0937	13,6	24,2	329,12	0,3778	97,67	165,2	1,18426	2,4597	13,6	24,2	329,12	0,2968
134,03	116,8	0,45836	1,7338	13,6	24,2	329,12	0,4072	123,99	141,2	0,82426	2,0997	13,6	24,2	329,12	0,3767	97,59	165,6	1,19016	2,4656	13,6	24,2	329,12	0,2965
133,79	117,2	0,46426	1,7397	13,6	24,2	329,12	0,4065	123,47	141,6	0,83016	2,1056	13,6	24,2	329,12	0,3752	97,48	166	1,19616	2,4716	13,6	24,2	329,12	0,2962
133,38	117,6	0,47016	1,7456	13,6	24,2	329,12	0,4053	122,80	142	0,83616	2,1116	13,6	24,2	329,12	0,3731	97,50	166,4	1,20216	2,4776	13,6	24,2	329,12	0,2962
133,53	118	0,47616	1,7516	13,6	24,2	329,12	0,4057	122,26	142,4	0,84216	2,1176	13,6	24,2	329,12	0,3715	97,54	166,8	1,20836	2,4838	13,6	24,2	329,12	0,2964
133,94	118,4	0,48216	1,7576	13,6	24,2	329,12	0,4070	121,90	142,8	0,84826	2,1237	13,6	24,2	329,12	0,3704	97,28	167,2	1,21436	2,4898	13,6	24,2	329,12	0,2956
134,08	118,8	0,48826	1,7637	13,6	24,2	329,12	0,4074	121,42	143,2	0,85436	2,1298	13,6	24,2	329,12	0,3689	96,81	167,6	1,22026	2,4957	13,6	24,2	329,12	0,2941
134,14	119,2	0,49436	1,7698	13,6	24,2	329,12	0,4076	121,08	143,6	0,86026	2,1357	13,6	24,2	329,12	0,3679	96,31	168	1,22616	2,5016	13,6	24,2	329,12	0,2926
133,75	119,6	0,50036	1,7758	13,6	24,2	329,12	0,4064	120,93	144	0,86616	2,1416	13,6	24,2	329,12	0,3674	95,77	168,4	1,23216	2,5076	13,6	24,2	329,12	0,2910
125,74	120	0,50626	1,7817	13,6	24,2	329,12	0,3820	120,88	144,4	0,87216	2,1476	13,6	24,2	329,12	0,3673	95,70	168,8	1,23816	2,5136	13,6	24,2	329,12	0,2908
127,09	120,4	0,51216	1,7876	13,6	24,2	329,12	0,3862	121,05	144,8	0,87816	2,1536	13,6	24,2	329,12	0,3678	95,51	169,2	1,24426	2,5197	13,6	24,2	329,12	0,2902
128,62	120,8	0,51816	1,7936	13,6	24,2	329,12	0,3908	121,28	145,2	0,88426	2,1597	13,6	24,2	329,12	0,3685	95,63	169,6	1,25036	2,5258	13,6	24,2	329,12	0,2906
129,81	121,2	0,52426	1,7997	13,6	24,2	329,12	0,3944	121,43	145,6	0,89026	2,1657	13,6	24,2	329,12	0,3690	95,43	170	1,25636	2,5318	13,6	24,2	329,12	0,2900
130,45	121,6	0,53036	1,8058	13,6	24,2	329,12	0,3964	121,80	146	0,89626	2,1717	13,6	24,2	329,12	0,3701	94,99	170,4	1,26226	2,5377	13,6	24,2	329,12	0,2886
131,07	122	0,53636	1,8118	13,6	24,2	329,12	0,3982	121,84	146,4	0,90216	2,1776	13,6	24,2	329,12	0,3702	94,80	170,8	1,26816	2,5436	13,6	24,2	329,12	0,2880
131,38	122,4	0,54226	1,8177	13,6	24,2	329,12	0,3992	121,71	146,8	0,90816	2,1836	13,6	24,2	329,12	0,3698	94,55	171,2	1,27416	2,5496	13,6	24,2	329,12	0,2873
131,97	122,8	0,54816	1,8236	13,6	24,2	329,12	0,4010	121,62	147,2	0,91406	2,1895	13,6	24,2	329,12	0,3695	94,17	171,6	1,28016	2,5556	13,6	24,2	329,12	0,2861

LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
93,87	172	1,28626	2,5617	13,6	24,2	329,12	0,2852	84,83	196,4	1,65226	2,9277	13,6	24,2	329,12	0,2577
94,02	172,4	1,29236	2,5678	13,6	24,2	329,12	0,2857	85,13	196,8	1,65816	2,9336	13,6	24,2	329,12	0,2587
93,95	172,8	1,29836	2,5738	13,6	24,2	329,12	0,2855	85,40	197,2	1,66406	2,9395	13,6	24,2	329,12	0,2595
93,66	173,2	1,30426	2,5797	13,6	24,2	329,12	0,2846	85,22	197,6	1,67006	2,9455	13,6	24,2	329,12	0,2589
93,42	173,6	1,31016	2,5856	13,6	24,2	329,12	0,2838	84,94	198	1,67606	2,9515	13,6	24,2	329,12	0,2581
93,12	174	1,31616	2,5916	13,6	24,2	329,12	0,2829	84,75	198,4	1,68206	2,9575	13,6	24,2	329,12	0,2575
92,94	174,4	1,32226	2,5977	13,6	24,2	329,12	0,2824	84,51	198,8	1,68826	2,9637	13,6	24,2	329,12	0,2568
92,85	174,8	1,32836	2,6038	13,6	24,2	329,12	0,2821	84,70	199,2	1,69436	2,9698	13,6	24,2	329,12	0,2574
92,74	175,2	1,33436	2,6098	13,6	24,2	329,12	0,2818	85,00	199,6	1,70016	2,9756	13,6	24,2	329,12	0,2583
92,53	175,6	1,34026	2,6157	13,6	24,2	329,12	0,2811	85,61	200	1,70616	2,9816	13,6	24,2	329,12	0,2601
92,14	176	1,34626	2,6217	13,6	24,2	329,12	0,2800	86,06	200,4	1,71216	2,9876	13,6	24,2	329,12	0,2615
91,92	176,4	1,35216	2,6276	13,6	24,2	329,12	0,2793	86,38	200,8	1,71816	2,9936	13,6	24,2	329,12	0,2625
91,84	176,8	1,35816	2,6336	13,6	24,2	329,12	0,2790	86,67	201,2	1,72426	2,9997	13,6	24,2	329,12	0,2633
91,85	177,2	1,36426	2,6397	13,6	24,2	329,12	0,2791	87,02	201,6	1,73036	3,0058	13,6	24,2	329,12	0,2644
91,72	177,6	1,37036	2,6458	13,6	24,2	329,12	0,2787	86,62	202	1,73636	3,0118	13,6	24,2	329,12	0,2632
91,45	178	1,37636	2,6518	13,6	24,2	329,12	0,2779	86,77	202,4	1,74226	3,0177	13,6	24,2	329,12	0,2636
91,29	178,4	1,38226	2,6577	13,6	24,2	329,12	0,2774	86,89	202,8	1,74816	3,0236	13,6	24,2	329,12	0,2640
91,34	178,8	1,38816	2,6636	13,6	24,2	329,12	0,2775	87,02	203,2	1,75416	3,0296	13,6	24,2	329,12	0,2644
91,35	179,2	1,39416	2,6696	13,6	24,2	329,12	0,2776	86,40	203,6	1,76016	3,0356	13,6	24,2	329,12	0,2625
91,50	179,6	1,40016	2,6756	13,6	24,2	329,12	0,2780	86,14	204	1,76636	3,0418	13,6	24,2	329,12	0,2617
91,23	180	1,40626	2,6817	13,6	24,2	329,12	0,2772	86,14	204,4	1,77236	3,0478	13,6	24,2	329,12	0,2617
90,75	180,4	1,41236	2,6878	13,6	24,2	329,12	0,2757	86,56	204,8	1,77836	3,0538	13,6	24,2	329,12	0,2630
90,68	180,8	1,41826	2,6937	13,6	24,2	329,12	0,2755	87,23	205,2	1,78426	3,0597	13,6	24,2	329,12	0,2650
90,69	181,2	1,42416	2,6996	13,6	24,2	329,12	0,2756	87,55	205,6	1,79026	3,0657	13,6	24,2	329,12	0,2660
90,63	181,6	1,43006	2,7055	13,6	24,2	329,12	0,2754	86,91	206	1,79616	3,0716	13,6	24,2	329,12	0,2641
90,31	182	1,43606	2,7115	13,6	24,2	329,12	0,2744	87,31	206,4	1,80226	3,0777	13,6	24,2	329,12	0,2653
90,32	182,4	1,44216	2,7176	13,6	24,2	329,12	0,2744	87,59	206,8	1,80836	3,0838	13,6	24,2	329,12	0,2661
89,89	182,8	1,44826	2,7237	13,6	24,2	329,12	0,2731	87,69	207,2	1,81436	3,0898	13,6	24,2	329,12	0,2664
89,25	183,2	1,45426	2,7297	13,6	24,2	329,12	0,2712	87,83	207,6	1,82026	3,0957	13,6	24,2	329,12	0,2669
88,89	183,6	1,46016	2,7356	13,6	24,2	329,12	0,2701	88,30	208	1,82616	3,1016	13,6	24,2	329,12	0,2683
88,66	184	1,46606	2,7415	13,6	24,2	329,12	0,2694	88,33	208,4	1,83216	3,1076	13,6	24,2	329,12	0,2684
88,36	184,4	1,47206	2,7475	13,6	24,2	329,12	0,2685	88,16	208,8	1,83816	3,1136	13,6	24,2	329,12	0,2679
87,96	184,8	1,47806	2,7535	13,6	24,2	329,12	0,2673	87,74	209,2	1,84426	3,1197	13,6	24,2	329,12	0,2666
87,91	185,2	1,48416	2,7596	13,6	24,2	329,12	0,2671	88,09	209,6	1,85036	3,1258	13,6	24,2	329,12	0,2677
87,66	185,6	1,49026	2,7657	13,6	24,2	329,12	0,2663	87,96	210	1,85636	3,1318	13,6	24,2	329,12	0,2673
87,57	186	1,49626	2,7717	13,6	24,2	329,12	0,2661	87,27	210,4	1,86226	3,1377	13,6	24,2	329,12	0,2652
87,30	186,4	1,50216	2,7776	13,6	24,2	329,12	0,2653	86,09	210,8	1,86816	3,1436	13,6	24,2	329,12	0,2616
87,09	186,8	1,50806	2,7835	13,6	24,2	329,12	0,2646	85,69	211,2	1,87416	3,1496	13,6	24,2	329,12	0,2604
86,54	187,2	1,51406	2,7895	13,6	24,2	329,12	0,2629	85,99	211,6	1,88016	3,1556	13,6	24,2	329,12	0,2613
85,95	187,6	1,52006	2,7955	13,6	24,2	329,12	0,2612	84,71	212	1,88626	3,1617	13,6	24,2	329,12	0,2574
85,66	188	1,52616	2,8016	13,6	24,2	329,12	0,2603	83,98	212,4	1,89236	3,1678	13,6	24,2	329,12	0,2552
84,99	188,4	1,53216	2,8076	13,6	24,2	329,12	0,2582	83,40	212,8	1,89826	3,1737	13,6	24,2	329,12	0,2534
84,30	188,8	1,53816	2,8136	13,6	24,2	329,12	0,2561	83,44	213,2	1,90416	3,1796	13,6	24,2	329,12	0,2535
84,32	189,2	1,54406	2,8195	13,6	24,2	329,12	0,2562	83,35	213,6	1,91016	3,1856	13,6	24,2	329,12	0,2533
84,70	189,6	1,54996	2,8254	13,6	24,2	329,12	0,2574	83,47	214	1,91606	3,1915	13,6	24,2	329,12	0,2536
84,92	190	1,55596	2,8314	13,6	24,2	329,12	0,2580	83,73	214,4	1,92216	3,1976	13,6	24,2	329,12	0,2544
84,93	190,4	1,56206	2,8375	13,6	24,2	329,12	0,2581	84,01	214,8	1,92826	3,2037	13,6	24,2	329,12	0,2553
84,62	190,8	1,56816	2,8436	13,6	24,2	329,12	0,2571	83,76	215,2	1,93426	3,2097	13,6	24,2	329,12	0,2545
84,35	191,2	1,57416	2,8496	13,6	24,2	329,12	0,2563	84,64	215,6	1,94026	3,2157	13,6	24,2	329,12	0,2572
84,11	191,6	1,58006	2,8555	13,6	24,2	329,12	0,2556	84,77	216	1,94616	3,2216	13,6	24,2	329,12	0,2576
84,04	192	1,58596	2,8614	13,6	24,2	329,12	0,2553	85,02	216,4	1,95206	3,2275	13,6	24,2	329,12	0,2583
84,44	192,4	1,59196	2,8674	13,6	24,2	329,12	0,2566	85,36	216,8	1,95816	3,2336	13,6	24,2	329,12	0,2594
84,62	192,8	1,59796	2,8734	13,6	24,2	329,12	0,2571	85,13	217,2	1,96426	3,2397	13,6	24,2	329,12	0,2587
84,37	193,2	1,60406	2,8795	13,6	24,2	329,12	0,2564	84,85	217,6	1,97026	3,2457	13,6	24,2	329,12	0,2578
84,16	193,6	1,61016	2,8856	13,6	24,2	329,12	0,2557	84,73	218	1,97626	3,2517	13,6	24,2	329,12	0,2574
84,15	194	1,61616	2,8916	13,6	24,2	329,12	0,2557	84,94	218,4	1,98216	3,2576	13,6	24,2	329,12	0,2581
84,15	194,4	1,62206	2,8975	13,6	24,2	329,12	0,2557	85,34	218,8	1,98816	3,2636	13,6	24,2	329,12	0,2593
84,15	194,8	1,62796	2,9034	13,6	24,2	329,12	0,2557	85,08	219,2	1,99406	3,2695	13,6	24,2	329,12	0,2585
84,20	195,2	1,63396	2,9094	13,6	24,2	329,12	0,2558	85,20	219,44	1,99776	3,2732	13,6	24,2	329,12	0,2589
84,61	195,6	1,64006	2,9155	13,6	24,2	329,12	0,2571								
84,96	196	1,64616	2,9216	13,6	24,2	329,12	0,2581								

3.3.1.6-F Mix. Proportion Tests
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LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
-0,02	1,2	-1,52212	0	13,9	33,4	464,26	0,0000
-0,01	1,6	-1,51632	0,0058	13,9	33,4	464,26	0,0000
0,00	2	-1,51042	0,0117	13,9	33,4	464,26	0,0000
0,02	2,4	-1,50442	0,0177	13,9	33,4	464,26	0,0000
0,05	2,8	-1,49842	0,0237	13,9	33,4	464,26	0,0001
0,05	3,2	-1,49232	0,0298	13,9	33,4	464,26	0,0001
0,03	3,6	-1,48642	0,0357	13,9	33,4	464,26	0,0001
0,06	4	-1,48052	0,0416	13,9	33,4	464,26	0,0001
0,06	4,4	-1,47452	0,0476	13,9	33,4	464,26	0,0001
0,07	4,8	-1,46852	0,0536	13,9	33,4	464,26	0,0002
0,08	5,2	-1,46262	0,0595	13,9	33,4	464,26	0,0002
0,12	5,6	-1,45652	0,0656	13,9	33,4	464,26	0,0003
0,16	6	-1,45042	0,0717	13,9	33,4	464,26	0,0003
0,18	6,4	-1,44452	0,0776	13,9	33,4	464,26	0,0004
0,23	6,8	-1,43862	0,0835	13,9	33,4	464,26	0,0005
0,25	7,2	-1,43272	0,0894	13,9	33,4	464,26	0,0005
0,26	7,6	-1,42672	0,0954	13,9	33,4	464,26	0,0006
0,29	8	-1,42072	0,1014	13,9	33,4	464,26	0,0006
0,34	8,4	-1,41462	0,1075	13,9	33,4	464,26	0,0007
0,35	8,8	-1,40852	0,1136	13,9	33,4	464,26	0,0008
0,38	9,2	-1,40262	0,1195	13,9	33,4	464,26	0,0008
0,41	9,6	-1,39672	0,1254	13,9	33,4	464,26	0,0009
0,45	10	-1,39072	0,1314	13,9	33,4	464,26	0,0010
0,49	10,4	-1,38472	0,1374	13,9	33,4	464,26	0,0011
0,54	10,8	-1,37872	0,1434	13,9	33,4	464,26	0,0012
0,57	11,2	-1,37252	0,1496	13,9	33,4	464,26	0,0012
0,60	11,6	-1,36652	0,1556	13,9	33,4	464,26	0,0013
0,63	12	-1,36072	0,1614	13,9	33,4	464,26	0,0014
0,67	12,4	-1,35472	0,1674	13,9	33,4	464,26	0,0014
0,71	12,8	-1,34872	0,1734	13,9	33,4	464,26	0,0015
0,73	13,2	-1,34272	0,1794	13,9	33,4	464,26	0,0016
0,77	13,6	-1,33662	0,1855	13,9	33,4	464,26	0,0017
0,81	14	-1,33052	0,1916	13,9	33,4	464,26	0,0017
0,82	14,4	-1,32452	0,1976	13,9	33,4	464,26	0,0018
0,81	14,8	-1,31862	0,2035	13,9	33,4	464,26	0,0017
0,82	15,2	-1,31262	0,2095	13,9	33,4	464,26	0,0018
0,82	15,6	-1,30672	0,2154	13,9	33,4	464,26	0,0018
0,83	16	-1,30062	0,2215	13,9	33,4	464,26	0,0018
0,82	16,4	-1,29442	0,2277	13,9	33,4	464,26	0,0018
0,83	16,8	-1,28842	0,2337	13,9	33,4	464,26	0,0018
0,83	17,2	-1,28242	0,2397	13,9	33,4	464,26	0,0018
0,85	17,6	-1,27652	0,2456	13,9	33,4	464,26	0,0018
0,84	18	-1,27052	0,2516	13,9	33,4	464,26	0,0018
0,86	18,4	-1,26452	0,2576	13,9	33,4	464,26	0,0019
0,86	18,8	-1,25842	0,2637	13,9	33,4	464,26	0,0019
0,88	19,2	-1,25232	0,2698	13,9	33,4	464,26	0,0019
0,87	19,6	-1,24632	0,2758	13,9	33,4	464,26	0,0019
0,91	20	-1,24042	0,2817	13,9	33,4	464,26	0,0020
0,91	20,4	-1,23442	0,2877	13,9	33,4	464,26	0,0020
0,92	20,8	-1,22842	0,2937	13,9	33,4	464,26	0,0020
0,95	21,2	-1,22242	0,2997	13,9	33,4	464,26	0,0020
0,95	21,6	-1,21632	0,3058	13,9	33,4	464,26	0,0020
0,96	22	-1,21022	0,3119	13,9	33,4	464,26	0,0021
0,97	22,4	-1,20422	0,3179	13,9	33,4	464,26	0,0021
1,00	22,8	-1,19832	0,3238	13,9	33,4	464,26	0,0022
1,00	23,2	-1,19232	0,3298	13,9	33,4	464,26	0,0022
1,02	23,6	-1,18642	0,3357	13,9	33,4	464,26	0,0022
1,05	24	-1,18032	0,3418	13,9	33,4	464,26	0,0023
1,06	24,4	-1,17422	0,3479	13,9	33,4	464,26	0,0023
1,07	24,8	-1,16812	0,354	13,9	33,4	464,26	0,0023
1,08	25,2	-1,16222	0,3599	13,9	33,4	464,26	0,0023

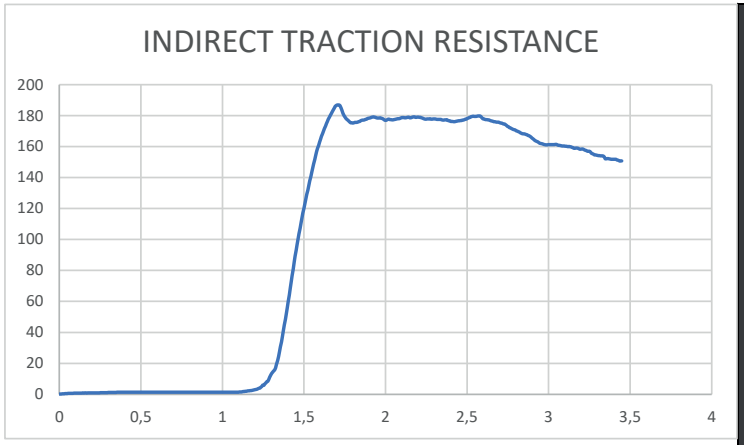
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
1,09	25,6	-1,15632	0,3658	13,9	33,4	464,26	0,0023	1,61	50	-0,79052	0,7316	13,9	33,4	464,26	0,0035	1,84	74,4	-0,42452	1,0976	13,9	33,4	464,26	0,0040
1,10	26	-1,15032	0,3718	13,9	33,4	464,26	0,0024	1,61	50,4	-0,78462	0,7375	13,9	33,4	464,26	0,0035	1,86	74,8	-0,41852	1,1036	13,9	33,4	464,26	0,0040
1,13	26,4	-1,14432	0,3778	13,9	33,4	464,26	0,0024	1,63	50,8	-0,77842	0,7437	13,9	33,4	464,26	0,0035	1,89	75,2	-0,41232	1,1098	13,9	33,4	464,26	0,0041
1,12	26,8	-1,13822	0,3839	13,9	33,4	464,26	0,0024	1,62	51,2	-0,77242	0,7497	13,9	33,4	464,26	0,0035	1,93	75,6	-0,40632	1,1158	13,9	33,4	464,26	0,0042
1,13	27,2	-1,13212	0,39	13,9	33,4	464,26	0,0024	1,63	51,6	-0,76642	0,7557	13,9	33,4	464,26	0,0035	1,98	76	-0,40052	1,1216	13,9	33,4	464,26	0,0043
1,14	27,6	-1,12612	0,396	13,9	33,4	464,26	0,0025	1,62	52	-0,76052	0,7616	13,9	33,4	464,26	0,0035	2,01	76,4	-0,39452	1,1276	13,9	33,4	464,26	0,0043
1,14	28	-1,12022	0,4019	13,9	33,4	464,26	0,0025	1,63	52,4	-0,75452	0,7676	13,9	33,4	464,26	0,0035	2,04	76,8	-0,38852	1,1336	13,9	33,4	464,26	0,0044
1,14	28,4	-1,11432	0,4078	13,9	33,4	464,26	0,0025	1,62	52,8	-0,74862	0,7735	13,9	33,4	464,26	0,0035	2,04	77,2	-0,38252	1,1396	13,9	33,4	464,26	0,0044
1,13	28,8	-1,10832	0,4138	13,9	33,4	464,26	0,0024	1,63	53,2	-0,74252	0,7796	13,9	33,4	464,26	0,0035	2,07	77,6	-0,37642	1,1457	13,9	33,4	464,26	0,0045
1,16	29,2	-1,10232	0,4198	13,9	33,4	464,26	0,0025	1,62	53,6	-0,73642	0,7857	13,9	33,4	464,26	0,0035	2,07	78	-0,37032	1,1518	13,9	33,4	464,26	0,0045
1,14	29,6	-1,09622	0,4259	13,9	33,4	464,26	0,0025	1,61	54	-0,73032	0,7918	13,9	33,4	464,26	0,0035	2,09	78,4	-0,36442	1,1577	13,9	33,4	464,26	0,0045
1,16	30	-1,09012	0,432	13,9	33,4	464,26	0,0025	1,64	54,4	-0,72442	0,7977	13,9	33,4	464,26	0,0035	2,11	78,8	-0,35852	1,1636	13,9	33,4	464,26	0,0045
1,16	30,4	-1,08412	0,438	13,9	33,4	464,26	0,0025	1,70	54,8	-0,71842	0,8037	13,9	33,4	464,26	0,0037	2,13	79,2	-0,35252	1,1696	13,9	33,4	464,26	0,0046
1,17	30,8	-1,07822	0,4439	13,9	33,4	464,26	0,0025	1,66	55,2	-0,71252	0,8096	13,9	33,4	464,26	0,0036	2,15	79,6	-0,34652	1,1756	13,9	33,4	464,26	0,0046
1,18	31,2	-1,07232	0,4498	13,9	33,4	464,26	0,0025	1,67	55,6	-0,70652	0,8156	13,9	33,4	464,26	0,0036	2,16	80	-0,34052	1,1816	13,9	33,4	464,26	0,0047
1,20	31,6	-1,06632	0,4558	13,9	33,4	464,26	0,0026	1,64	56	-0,70052	0,8216	13,9	33,4	464,26	0,0035	2,16	80,4	-0,33442	1,1877	13,9	33,4	464,26	0,0047
1,21	32	-1,06032	0,4618	13,9	33,4	464,26	0,0026	1,61	56,4	-0,69432	0,8278	13,9	33,4	464,26	0,0035	2,19	80,8	-0,32832	1,1938	13,9	33,4	464,26	0,0047
1,23	32,4	-1,05412	0,468	13,9	33,4	464,26	0,0026	1,62	56,8	-0,68832	0,8338	13,9	33,4	464,26	0,0035	2,21	81,2	-0,32242	1,1997	13,9	33,4	464,26	0,0048
1,23	32,8	-1,04812	0,474	13,9	33,4	464,26	0,0026	1,67	57,2	-0,68232	0,8398	13,9	33,4	464,26	0,0036	2,23	81,6	-0,31642	1,2057	13,9	33,4	464,26	0,0048
1,22	33,2	-1,04212	0,48	13,9	33,4	464,26	0,0026	1,63	57,6	-0,67642	0,8457	13,9	33,4	464,26	0,0035	2,24	82	-0,31052	1,2116	13,9	33,4	464,26	0,0048
1,25	33,6	-1,03632	0,4858	13,9	33,4	464,26	0,0027	1,62	58	-0,67042	0,8517	13,9	33,4	464,26	0,0035	2,25	82,4	-0,30442	1,2177	13,9	33,4	464,26	0,0048
1,24	34	-1,03032	0,4918	13,9	33,4	464,26	0,0027	1,64	58,4	-0,66442	0,8577	13,9	33,4	464,26	0,0035	2,27	82,8	-0,29832	1,2238	13,9	33,4	464,26	0,0049
1,25	34,4	-1,02432	0,4978	13,9	33,4	464,26	0,0027	1,64	58,8	-0,65832	0,8638	13,9	33,4	464,26	0,0035	2,28	83,2	-0,29232	1,2298	13,9	33,4	464,26	0,0049
1,25	34,8	-1,01832	0,5038	13,9	33,4	464,26	0,0027	1,63	59,2	-0,65222	0,8699	13,9	33,4	464,26	0,0035	2,31	83,6	-0,28622	1,2359	13,9	33,4	464,26	0,0050
1,25	35,2	-1,01212	0,51	13,9	33,4	464,26	0,0027	1,62	59,6	-0,64622	0,8759	13,9	33,4	464,26	0,0035	2,38	84	-0,28042	1,2417	13,9	33,4	464,26	0,0051
1,25	35,6	-1,00612	0,516	13,9	33,4	464,26	0,0027	1,64	60	-0,64032	0,8818	13,9	33,4	464,26	0,0035	2,37	84,4	-0,27442	1,2477	13,9	33,4	464,26	0,0051
1,25	36	-1,00022	0,5219	13,9	33,4	464,26	0,0027	1,63	60,4	-0,63432	0,8878	13,9	33,4	464,26	0,0035	2,45	84,8	-0,26842	1,2537	13,9	33,4	464,26	0,0053
1,26	36,4	-0,99432	0,5278	13,9	33,4	464,26	0,0027	1,64	60,8	-0,62832	0,8938	13,9	33,4	464,26	0,0035	2,53	85,2	-0,26242	1,2597	13,9	33,4	464,26	0,0054
1,28	36,8	-0,98842	0,5337	13,9	33,4	464,26	0,0028	1,63	61,2	-0,62232	0,8998	13,9	33,4	464,26	0,0035	2,56	85,6	-0,25632	1,2658	13,9	33,4	464,26	0,0055
1,28	37,2	-0,98232	0,5398	13,9	33,4	464,26	0,0028	1,64	61,6	-0,61622	0,9059	13,9	33,4	464,26	0,0035	2,64	86	-0,25022	1,2719	13,9	33,4	464,26	0,0057
1,29	37,6	-0,97622	0,5459	13,9	33,4	464,26	0,0028	1,64	62	-0,61012	0,912	13,9	33,4	464,26	0,0035	2,73	86,4	-0,24432	1,2778	13,9	33,4	464,26	0,0059
1,27	38	-0,97022	0,5519	13,9	33,4	464,26	0,0027	1,64	62,4	-0,60412	0,918	13,9	33,4	464,26	0,0035	2,85	86,8	-0,23842	1,2837	13,9	33,4	464,26	0,0061
1,27	38,4	-0,96422	0,5579	13,9	33,4	464,26	0,0027	1,65	62,8	-0,59822	0,9239	13,9	33,4	464,26	0,0036	2,97	87,2	-0,23242	1,2897	13,9	33,4	464,26	0,0064
1,29	38,8	-0,95832	0,5638	13,9	33,4	464,26	0,0028	1,64	63,2	-0,59232	0,9298	13,9	33,4	464,26	0,0035	3,11	87,6	-0,22652	1,2956	13,9	33,4	464,26	0,0067
1,29	39,2	-0,95232	0,5698	13,9	33,4	464,26	0,0028	1,63	63,6	-0,58632	0,9358	13,9	33,4	464,26	0,0035	3,27	88	-0,22042	1,3017	13,9	33,4	464,26	0,0070
1,31	39,6	-0,94642	0,5757	13,9	33,4	464,26	0,0028	1,64	64	-0,58032	0,9418	13,9	33,4	464,26	0,0035	3,43	88,4	-0,21432	1,3078	13,9	33,4	464,26	0,0074
1,31	40	-0,94032	0,5818	13,9	33,4	464,26	0,0028	1,64	64,4	-0,57422	0,9479	13,9	33,4	464,26	0,0035	3,54	88,8	-0,20832	1,3138	13,9	33,4	464,26	0,0076
1,31	40,4	-0,93432	0,5878	13,9	33,4	464,26	0,0028	1,65	64,8	-0,56812	0,954	13,9	33,4	464,26	0,0036	3,71	89,2	-0,20242	1,3197	13,9	33,4	464,26	0,0080
1,32	40,8	-0,92822	0,5939	13,9	33,4	464,26	0,0028	1,65	65,2	-0,56222	0,9599	13,9	33,4	464,26	0,0036	4,00	89,6	-0,19652	1,3256	13,9	33,4	464,26	0,0086
1,33	41,2	-0,92222	0,5999	13,9	33,4	464,26	0,0029	1,61	65,6	-0,55632	0,9658	13,9	33,4	464,26	0,0035	4,34	90	-0,19052	1,3316	13,9	33,4	464,26	0,0093
1,34	41,6	-0,91632	0,6058	13,9	33,4	464,26	0,0029	1,64	66	-0,55032	0,9718	13,9	33,4	464,26	0,0035	4,58	90,4	-0,18452	1,3376	13,9	33,4	464,26	0,0099
1,34	42	-0,91042	0,6117	13,9	33,4	464,26	0,0029	1,65	66,4	-0,54442	0,9777	13,9	33,4	464,26	0,0036	4,90	90,8	-0,17842	1,3437	13,9	33,4	464,26	0,0106
1,38	42,4	-0,90442	0,6177	13,9	33,4	464,26	0,0030	1,64	66,8	-0,53832	0,9838	13,9	33,4	464,26	0,0035	4,91	91,2	-0,17232	1,3498	13,9	33,4	464,26	0,0106
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1,44	43,2	-0,89222	0,6299	13,9	33,4	464,26	0,0031	1,66	67,6	-0,52622	0,9959	13,9	33,4	464,26	0,0036	5,04	92	-0,16052	1,3616	13,9	33,4	464,26	0,0109
1,47	43,6	-0,88622	0,6359	13,9	33,4	464,26	0,0032	1,64	68	-0,52032	1,0018	13,9	33,4	464,26	0,0035	5,30	92,4	-0,15452	1,3676	13,9	33,4	464,26	0,0114
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1,49	44,4	-0,87442	0,6477	13,9	33,4	464,26	0,0032	1,65	68,8	-0,50842	1,0137	13,9	33,4	464,26	0,0036	5,94	93,2	-0,14252	1,3796	13,9	33,4	464,26	0,0128
1,53	44,8	-0,86842	0,6537	13,9	33,4	464,26	0,0033	1,65	69,2	-0,50232	1,0198	13,9	33,4	464,26	0,0036	6,10	93,6	-0,13642	1,3857	13,9	33,4	464,26	0,0131
1,50	45,2	-0,86252	0,6596	13,9	33,4	464,26	0,0032	1,65	69,6	-0,49632	1,0258	13,9	33,4	464,26	0,0036	6,31	94	-0,13032	1,3918	13,9	33,4	464,26	0,0136
1,49	45,6	-0,85642	0,6657	13,9	33,4	464,26	0,0032	1,66	70	-0,49022	1,0319	13,9	33,4	464,26	0,0036	6,75	94,4	-0,12442	1,3977	13,9	33,4	464,26	0,0145
1,51	46	-0,85032	0,6718	13,9	33,4	464,26	0,0033	1,67	70,4	-0,48422	1,0379	13,9	33,4	464,26	0,0036	7,12	94,8	-0,11852	1,4036	13,9	33,4	464,26	0,0153
1,57	46,4	-0,84442	0,6777	13,9	33,4	464,26	0,0034	1,66	70,8	-0,47832	1,0438	13,9	33,4	464,26	0,0036	7,41	95,2	-0,11252	1,4096	13,9	33,4	464,26	0,0160
1,61	46,8	-0,83852	0,6836	13,9	33,4	464,26	0,0035	1,66	71,2	-0,47242	1,0497	13,9	33,4	464,26	0,0036	7,68	95,6	-0,10652	1,4156	13,9	33,4	464,26	0,0165
1,61	47,2	-0,83252	0,6896	13,9	33,4	464,26	0,0035	1,69	71,6	-0,46652	1,0556	13,9	33,4	464,26	0,0036	7,94	96	-0,10052	1,4216	13,9	33,4	464,26	0,0171
1,62	47,6	-0,82652	0,6956	13,9	33,4	464,26	0,0035	1,68	72	-0,46042	1,0617	13,9	33,4	464,26	0,0036	8,23	96,4	-0,09442	1,4277	13,9	33,4	464,26	0,0177
1,63	48	-0,82052	0,7016	13,9	33,4	464,26	0,0035	1,70	72,4	-0,45432	1,0678	13,9	33,4	464,26	0,0037	8,53	96,8	-0,08842	1,4337	13,9	33,4	464,26	0,0184
1,62	48,4	-0,81442	0,7077	13,9	33,4	464,26	0,0035	1,73	72,8	-0,44832	1,0738	13,9	33,4	464,26	0,0037	9,18	97,2	-0,08242	1,4397	13,9	33,4	464,26	0,0198
1,61	48,8	-0,80832	0,7138	13,9	33,4	464,26	0,0035	1,73	73,2	-0,44242	1,0797	13,9	33,4	464,26	0,0037	9,97	97,6	-0,07652	1,4456	13,9	33,4	464,26	0,0215
1,62	49,2	-0,80242	0,7197	13,9	33,4	464,26	0,0035	1,77	73,6	-0,43652	1,0856	13,9	33,4	464,26	0,0038	10,46	98	-0,07062	1,4515	13,9	33,4	464,26	0,0225
1,62	49,6	-0,79652	0,7256	13,9	33,4	464,26	0,0035	1,80	74	-0,43052	1,0916	13,9	33,4	464,26	0,0039	10,83	98,4	-0,06462	1,4575	13,9	33,4	464,26	0,0233

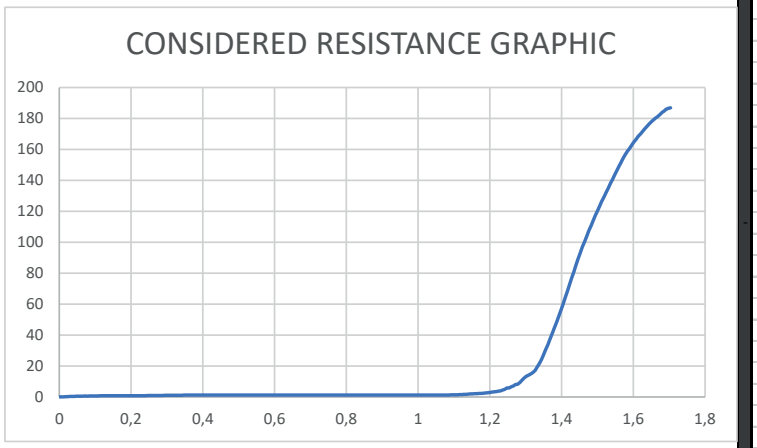
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
11,14	98,8	-0,05852	1,4636	13,9	33,4	464,26	0,0240	124,11	123,2	0,30758	1,8297	13,9	33,4	464,26	0,2673	151,55	147,6	0,67348	2,1956	13,9	33,4	464,26	0,3264
11,39	99,2	-0,05232	1,4698	13,9	33,4	464,26	0,0245	125,44	123,6	0,31358	1,8357	13,9	33,4	464,26	0,2702	150,96	148	0,67938	2,2015	13,9	33,4	464,26	0,3252
11,77	99,6	-0,04642	1,4757	13,9	33,4	464,26	0,0254	126,74	124	0,31948	1,8416	13,9	33,4	464,26	0,2730	150,58	148,4	0,68538	2,2075	13,9	33,4	464,26	0,3243
12,31	100	-0,04052	1,4816	13,9	33,4	464,26	0,0265	128,09	124,4	0,32548	1,8476	13,9	33,4	464,26	0,2759	150,03	148,8	0,69138	2,2135	13,9	33,4	464,26	0,3232
12,81	100,4	-0,03452	1,4876	13,9	33,4	464,26	0,0276	129,44	124,8	0,33138	1,8535	13,9	33,4	464,26	0,2788	149,52	149,2	0,69738	2,2195	13,9	33,4	464,26	0,3221
13,25	100,8	-0,02852	1,4936	13,9	33,4	464,26	0,0285	130,87	125,2	0,33748	1,8596	13,9	33,4	464,26	0,2819	149,17	149,6	0,70348	2,2256	13,9	33,4	464,26	0,3213
13,72	101,2	-0,02252	1,4996	13,9	33,4	464,26	0,0296	132,33	125,6	0,34358	1,8657	13,9	33,4	464,26	0,2850	148,69	150	0,70958	2,2317	13,9	33,4	464,26	0,3203
14,27	101,6	-0,01642	1,5057	13,9	33,4	464,26	0,0307	133,67	126	0,34968	1,8718	13,9	33,4	464,26	0,2879	148,26	150,4	0,71548	2,2376	13,9	33,4	464,26	0,3193
14,78	102	-0,01032	1,5118	13,9	33,4	464,26	0,0318	134,93	126,4	0,35558	1,8777	13,9	33,4	464,26	0,2906	148,08	150,8	0,72138	2,2435	13,9	33,4	464,26	0,3190
15,34	102,4	-0,00432	1,5178	13,9	33,4	464,26	0,0330	136,08	126,8	0,36148	1,8836	13,9	33,4	464,26	0,2931	147,80	151,2	0,72738	2,2495	13,9	33,4	464,26	0,3184
15,93	102,8	0,00158	1,5237	13,9	33,4	464,26	0,0343	137,36	127,2	0,36748	1,8896	13,9	33,4	464,26	0,2959	147,68	151,6	0,73338	2,2555	13,9	33,4	464,26	0,3181
16,51	103,2	0,00748	1,5296	13,9	33,4	464,26	0,0356	138,68	127,6	0,37348	1,8956	13,9	33,4	464,26	0,2987	147,58	152	0,73948	2,2616	13,9	33,4	464,26	0,3179
17,00	103,6	0,01348	1,5356	13,9	33,4	464,26	0,0366	140,06	128	0,37948	1,9016	13,9	33,4	464,26	0,3017	147,44	152,4	0,74558	2,2677	13,9	33,4	464,26	0,3176
18,27	104	0,01958	1,5417	13,9	33,4	464,26	0,0394	141,30	128,4	0,38558	1,9077	13,9	33,4	464,26	0,3044	147,09	152,8	0,75158	2,2737	13,9	33,4	464,26	0,3168
19,67	104,4	0,02568	1,5478	13,9	33,4	464,26	0,0424	142,45	128,8	0,39168	1,9138	13,9	33,4	464,26	0,3068	146,71	153,2	0,75748	2,2796	13,9	33,4	464,26	0,3160
20,98	104,8	0,03168	1,5538	13,9	33,4	464,26	0,0452	143,58	129,2	0,39758	1,9197	13,9	33,4	464,26	0,3093	146,36	153,6	0,76348	2,2856	13,9	33,4	464,26	0,3153
22,24	105,2	0,03758	1,5597	13,9	33,4	464,26	0,0479	144,81	129,6	0,40348	1,9256	13,9	33,4	464,26	0,3119	146,14	154	0,76948	2,2916	13,9	33,4	464,26	0,3148
23,86	105,6	0,04348	1,5656	13,9	33,4	464,26	0,0514	146,06	130	0,40948	1,9316	13,9	33,4	464,26	0,3146	145,96	154,4	0,77548	2,2976	13,9	33,4	464,26	0,3144
25,76	106	0,04948	1,5716	13,9	33,4	464,26	0,0555	147,22	130,4	0,41548	1,9376	13,9	33,4	464,26	0,3171	145,86	154,8	0,78158	2,3037	13,9	33,4	464,26	0,3142
27,86	106,4	0,05548	1,5776	13,9	33,4	464,26	0,0600	148,60	130,8	0,42158	1,9437	13,9	33,4	464,26	0,3201	145,71	155,2	0,78768	2,3098	13,9	33,4	464,26	0,3139
30,08	106,8	0,06158	1,5837	13,9	33,4	464,26	0,0648	149,93	131,2	0,42758	1,9497	13,9	33,4	464,26	0,3229	145,37	155,6	0,79358	2,3157	13,9	33,4	464,26	0,3131
32,18	107,2	0,06768	1,5898	13,9	33,4	464,26	0,0693	151,02	131,6	0,43358	1,9557	13,9	33,4	464,26	0,3253	145,01	156	0,79958	2,3217	13,9	33,4	464,26	0,3123
34,22	107,6	0,07368	1,5958	13,9	33,4	464,26	0,0737	152,06	132	0,43948	1,9616	13,9	33,4	464,26	0,3275	144,96	156,4	0,80548	2,3276	13,9	33,4	464,26	0,3122
36,36	108	0,07958	1,6017	13,9	33,4	464,26	0,0783	153,17	132,4	0,44548	1,9676	13,9	33,4	464,26	0,3299	144,92	156,8	0,81148	2,3336	13,9	33,4	464,26	0,3122
38,49	108,4	0,08558	1,6077	13,9	33,4	464,26	0,0829	154,18	132,8	0,45148	1,9736	13,9	33,4	464,26	0,3321	145,04	157,2	0,81748	2,3396	13,9	33,4	464,26	0,3124
40,66	108,8	0,09148	1,6136	13,9	33,4	464,26	0,0876	155,00	133,2	0,45738	1,9795	13,9	33,4	464,26	0,3339	145,14	157,6	0,82358	2,3457	13,9	33,4	464,26	0,3126
42,86	109,2	0,09748	1,6196	13,9	33,4	464,26	0,0923	155,58	133,6	0,46348	1,9856	13,9	33,4	464,26	0,3351	145,19	158	0,82968	2,3518	13,9	33,4	464,26	0,3127
45,17	109,6	0,10358	1,6257	13,9	33,4	464,26	0,0973	156,02	134	0,46948	1,9916	13,9	33,4	464,26	0,3361	145,00	158,4	0,83558	2,3577	13,9	33,4	464,26	0,3123
47,45	110	0,10968	1,6318	13,9	33,4	464,26	0,1022	156,30	134,4	0,47548	1,9976	13,9	33,4	464,26	0,3367	144,71	158,8	0,84148	2,3636	13,9	33,4	464,26	0,3117
49,68	110,4	0,11568	1,6378	13,9	33,4	464,26	0,1070	156,73	134,8	0,48138	2,0035	13,9	33,4	464,26	0,3376	144,60	159,2	0,84738	2,3695	13,9	33,4	464,26	0,3115
52,14	110,8	0,12158	1,6437	13,9	33,4	464,26	0,1123	157,29	135,2	0,48728	2,0094	13,9	33,4	464,26	0,3388	144,80	159,6	0,85328	2,3754	13,9	33,4	464,26	0,3119
54,76	111,2	0,12748	1,6496	13,9	33,4	464,26	0,1180	157,91	135,6	0,49328	2,0154	13,9	33,4	464,26	0,3401	145,14	160	0,85938	2,3815	13,9	33,4	464,26	0,3126
57,49	111,6	0,13348	1,6556	13,9	33,4	464,26	0,1238	158,65	136	0,49928	2,0214	13,9	33,4	464,26	0,3417	145,24	160,4	0,86548	2,3876	13,9	33,4	464,26	0,3128
60,07	112	0,13958	1,6617	13,9	33,4	464,26	0,1294	159,44	136,4	0,50538	2,0275	13,9	33,4	464,26	0,3434	145,28	160,8	0,87148	2,3936	13,9	33,4	464,26	0,3129
62,68	112,4	0,14568	1,6678	13,9	33,4	464,26	0,1350	159,90	136,8	0,51138	2,0335	13,9	33,4	464,26	0,3444	145,21	161,2	0,87738	2,3995	13,9	33,4	464,26	0,3128
65,14	112,8	0,15168	1,6738	13,9	33,4	464,26	0,1403	160,38	137,2	0,51728	2,0394	13,9	33,4	464,26	0,3455	145,21	161,6	0,88338	2,4055	13,9	33,4	464,26	0,3128
67,58	113,2	0,15758	1,6797	13,9	33,4	464,26	0,1456	160,95	137,6	0,52328	2,0454	13,9	33,4	464,26	0,3467	145,12	162	0,88928	2,4114	13,9	33,4	464,26	0,3126
70,01	113,6	0,16358	1,6857	13,9	33,4	464,26	0,1508	161,56	138	0,52918	2,0513	13,9	33,4	464,26	0,3480	145,03	162,4	0,89528	2,4174	13,9	33,4	464,26	0,3124
72,37	114	0,16948	1,6916	13,9	33,4	464,26	0,1559	162,08	138,4	0,53518	2,0573	13,9	33,4	464,26	0,3491	145,00	162,8	0,90138	2,4235	13,9	33,4	464,26	0,3123
74,91	114,4	0,17548	1,6976	13,9	33,4	464,26	0,1614	162,64	138,8	0,54128	2,0634	13,9	33,4	464,26	0,3503	144,66	163,2	0,90748	2,4296	13,9	33,4	464,26	0,3116
77,57	114,8	0,18158	1,7037	13,9	33,4	464,26	0,1671	163,08	139,2	0,54738	2,0695	13,9	33,4	464,26	0,3513	144,07	163,6	0,91348	2,4356	13,9	33,4	464,26	0,3103
80,17	115,2	0,18768	1,7098	13,9	33,4	464,26	0,1727	163,20	139,6	0,55328	2,0754	13,9	33,4	464,26	0,3515	143,66	164	0,91928	2,4414	13,9	33,4	464,26	0,3094
82,61	115,6	0,19368	1,7158	13,9	33,4	464,26	0,1779	163,12	140	0,55918	2,0813	13,9	33,4	464,26	0,3514	143,19	164,4	0,92528	2,4474	13,9	33,4	464,26	0,3084
85,19	116	0,19958	1,7217	13,9	33,4	464,26	0,1835	162,97	140,4	0,56508	2,0872	13,9	33,4	464,26	0,3510	142,61	164,8	0,93128	2,4534	13,9	33,4	464,26	0,3072
87,89	116,4	0,20548	1,7276	13,9	33,4	464,26	0,1893	162,70	140,8	0,57108	2,0932	13,9	33,4	464,26	0,3505	142,38	165,2	0,93728	2,4594	13,9	33,4	464,26	0,3067
90,60	116,8	0,21148	1,7336	13,9	33,4	464,26	0,1951	162,25	141,2	0,57708	2,0992	13,9	33,4	464,26	0,3495	142,21	165,6	0,94338	2,4655	13,9	33,4	464,26	0,3063
93,20	117,2	0,21748	1,7396	13,9	33,4	464,26	0,2007	161,60	141,6	0,58328	2,1054	13,9	33,4	464,26	0,3481	141,92	166	0,94948	2,4716	13,9	33,4	464,26	0,3057
95,76	117,6	0,22358	1,7457	13,9	33,4	464,26	0,2063	160,73	142	0,58928	2,1114	13,9	33,4	464,26	0,3462	141,64	166,4	0,95538	2,4775	13,9	33,4	464,26	0,3051
98,24	118	0,22968	1,7518	13,9	33,4	464,26	0,2116	159,79	142,4	0,59518	2,1173	13,9	33,4	464,26	0,3442	141,53	166,8	0,96138	2,4835	13,9	33,4	464,26	0,3049
100,47	118,4	0,23558	1,7577	13,9	33,4	464,26	0,2164	158,86	142,8	0,60118	2,1233	13,9	33,4	464,26	0,3422	141,46	167,2	0,96728	2,4894	13,9	33,4	464,26	0,3047
102,69	118,8	0,24148	1,7636	13,9	33,4	464,26	0,2212	157,99	143,2	0,60718	2,1293	13,9	33,4	464,26	0,3403	141,32	167,6	0,97328	2,4954	13,9	33,4	464,26	0,3044
104,88	119,2	0,24738	1,7695	13,9	33,4	464,26	0,2259	157,19	143,6	0,61318	2,1353	13,9	33,4	464,26	0,3386	141,16	168	0,97938	2,5015	13,9	33,4	464,26	0,3041
107,09	119,6	0,25338	1,7755	13,9	33,4	464,26	0,2307	156,46	144	0,61918	2,1413	13,9	33,4	464,26	0,3370	141,05	168,4	0,98548	2,5076	13,9	33,4	464,26	0,3038
109,30	120	0,25948	1,7816	13,9	33,4	464,26	0,2354	155,92	144,4	0,62538	2,1475	13,9	33,4	464,26	0,3358	141,04	168,8	0,99148	2,5136	13,9	33,4	464,26	0,3038
111,57	120,4	0,26558	1,7877	13,9	33,4	464,26	0,2403	155,21	144,8	0,63138	2,1535	13,9	33,4	464,26	0,3343	141,07	169,2	0,99738	2,5195	13,9	33,4	464,26	0,3039
113,71	120,8	0,27158	1,7937	13,9	33,4	464,26	0,2449	154,55	145,2	0,63738	2,1595	13,9	33,4	464,26	0,3329	141,05	169,6	1,00338	2,5255	13,9	33,4	464,26	0,3038
115,70	121,2	0,27748	1,7996	13,9	33,4	464,26	0,2492	153,97	145,6	0,64328	2,1654	13,9	33,4	464,26	0,3316	141,04	170	1,00938	2,5315	13,9	33,4	464,26	0,3038
117,70	121,6	0,28338	1,8055	13,9	33,4	464,26	0,2535	153,34	146	0,64928	2,1714	13,9	33,4	464,26	0,3303	141,26	170,4	1,01538	2,5375	13,9	33,4	464,26	0,3043
119,53	122	0,28938	1,8115	13,9	33,4	464,26	0,2575	152,91	146,4	0,65528	2,1774	13,9	33,4	464,26	0,3294	141,49	170,8	1,02148	2,5436	13,9	33,4	464,26	0,3048
121,25	122,4	0,29538	1,8175	13,9	33,4	464,26	0,2612	152,57	146,8	0,66148	2,1836	13,9	33,4	464,26	0,3286	141,49	171,2	1,02748	2,5496	13,9	33,4	464,26	0,3048
122,74	122,8	0,30148	1,8236	13,9	33,4	464,26	0,2644	152,16	147,2	0,66758	2,1897	13,9	33,4	464,26	0,3277	141,57	171,6	1,03348	2,5556	13,9	33,4	464,26	0,3049

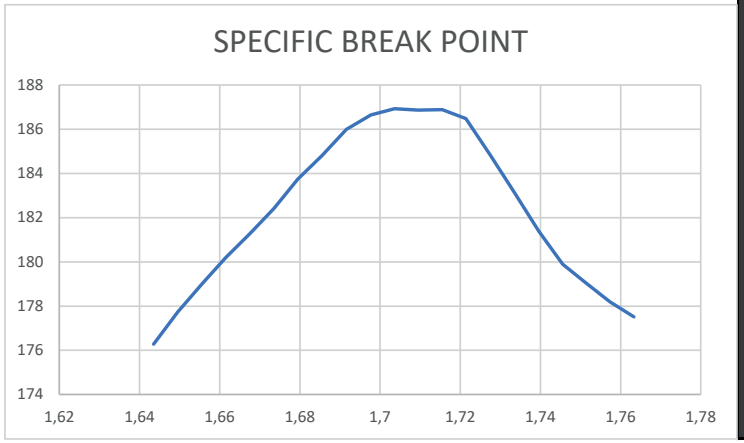
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
141,74	172	1,03938	2,5615	13,9	33,4	464,26	0,3053	152,29	196,4	1,40538	2,9275	13,9	33,4	464,26	0,3280	153,89	220,8	1,77128	3,2934	13,9	33,4	464,26	0,3315
141,90	172,4	1,04538	2,5675	13,9	33,4	464,26	0,3056	152,86	196,8	1,41128	2,9334	13,9	33,4	464,26	0,3293	154,35	221,2	1,77728	3,2994	13,9	33,4	464,26	0,3325
141,73	172,8	1,05138	2,5735	13,9	33,4	464,26	0,3053	153,09	197,2	1,41738	2,9395	13,9	33,4	464,26	0,3298	154,55	221,6	1,78338	3,3055	13,9	33,4	464,26	0,3329
141,41	173,2	1,05738	2,5795	13,9	33,4	464,26	0,3046	153,34	197,6	1,42348	2,9456	13,9	33,4	464,26	0,3303	154,58	222	1,78948	3,3116	13,9	33,4	464,26	0,3330
141,25	173,6	1,06348	2,5856	13,9	33,4	464,26	0,3042	153,37	198	1,42958	2,9517	13,9	33,4	464,26	0,3304	154,61	222,4	1,79528	3,3174	13,9	33,4	464,26	0,3330
141,33	174	1,06958	2,5917	13,9	33,4	464,26	0,3044	153,33	198,4	1,43548	2,9576	13,9	33,4	464,26	0,3303	154,84	222,8	1,80128	3,3234	13,9	33,4	464,26	0,3335
141,46	174,4	1,07548	2,5976	13,9	33,4	464,26	0,3047	153,42	198,8	1,44138	2,9635	13,9	33,4	464,26	0,3305	154,94	223,2	1,80718	3,3293	13,9	33,4	464,26	0,3337
141,80	174,8	1,08138	2,6035	13,9	33,4	464,26	0,3054	153,60	199,2	1,44738	2,9695	13,9	33,4	464,26	0,3308	155,21	223,6	1,81318	3,3353	13,9	33,4	464,26	0,3343
142,64	175,2	1,08738	2,6095	13,9	33,4	464,26	0,3072	153,85	199,6	1,45338	2,9755	13,9	33,4	464,26	0,3314	155,39	224	1,81928	3,3414	13,9	33,4	464,26	0,3347
142,75	175,6	1,09338	2,6155	13,9	33,4	464,26	0,3075	154,21	200	1,45948	2,9816	13,9	33,4	464,26	0,3322	155,44	224,4	1,82538	3,3475	13,9	33,4	464,26	0,3348
143,54	176	1,09948	2,6216	13,9	33,4	464,26	0,3092	154,50	200,4	1,46558	2,9877	13,9	33,4	464,26	0,3328	155,44	224,8	1,83138	3,3535	13,9	33,4	464,26	0,3348
143,81	176,4	1,10558	2,6277	13,9	33,4	464,26	0,3098	154,38	200,8	1,47158	2,9937	13,9	33,4	464,26	0,3325	154,04	225,2	1,83728	3,3594	13,9	33,4	464,26	0,3318
143,47	176,8	1,11158	2,6337	13,9	33,4	464,26	0,3090	154,13	201,2	1,47748	2,9996	13,9	33,4	464,26	0,3320	153,85	225,6	1,84318	3,3653	13,9	33,4	464,26	0,3314
143,58	177,2	1,11748	2,6396	13,9	33,4	464,26	0,3093	153,90	201,6	1,48338	3,0055	13,9	33,4	464,26	0,3315	154,02	226	1,84918	3,3713	13,9	33,4	464,26	0,3318
143,82	177,6	1,12338	2,6455	13,9	33,4	464,26	0,3098	153,69	202	1,48938	3,0115	13,9	33,4	464,26	0,3310	154,36	226,4	1,85518	3,3773	13,9	33,4	464,26	0,3325
144,14	178	1,12938	2,6515	13,9	33,4	464,26	0,3105	153,53	202,4	1,49538	3,0175	13,9	33,4	464,26	0,3307	154,55	226,8	1,86128	3,3834	13,9	33,4	464,26	0,3329
144,22	178,4	1,13538	2,6575	13,9	33,4	464,26	0,3106	153,58	202,8	1,50148	3,0236	13,9	33,4	464,26	0,3308	154,43	227,2	1,86738	3,3895	13,9	33,4	464,26	0,3326
144,38	178,8	1,14148	2,6636	13,9	33,4	464,26	0,3110	153,20	203,2	1,50758	3,0297	13,9	33,4	464,26	0,3300	153,87	227,6	1,87328	3,3954	13,9	33,4	464,26	0,3314
144,50	179,2	1,14758	2,6697	13,9	33,4	464,26	0,3112	152,39	203,6	1,51348	3,0356	13,9	33,4	464,26	0,3282	153,70	228	1,87918	3,4013	13,9	33,4	464,26	0,3311
144,52	179,6	1,15348	2,6756	13,9	33,4	464,26	0,3113	151,89	204	1,51938	3,0415	13,9	33,4	464,26	0,3272	153,33	228,4	1,88518	3,4073	13,9	33,4	464,26	0,3303
144,81	180	1,15938	2,6815	13,9	33,4	464,26	0,3119	151,96	204,4	1,52538	3,0475	13,9	33,4	464,26	0,3273	152,92	228,8	1,89118	3,4133	13,9	33,4	464,26	0,3294
145,38	180,4	1,16538	2,6875	13,9	33,4	464,26	0,3131	151,80	204,8	1,53138	3,0535	13,9	33,4	464,26	0,3270	152,80	229,2	1,89728	3,4194	13,9	33,4	464,26	0,3291
145,84	180,8	1,17128	2,6934	13,9	33,4	464,26	0,3141	152,06	205,2	1,53738	3,0595	13,9	33,4	464,26	0,3275	152,73	229,6	1,90338	3,4255	13,9	33,4	464,26	0,3290
146,50	181,2	1,17738	2,6995	13,9	33,4	464,26	0,3156	152,38	205,6	1,54348	3,0656	13,9	33,4	464,26	0,3282	152,58	230	1,90938	3,4315	13,9	33,4	464,26	0,3287
147,20	181,6	1,18348	2,7056	13,9	33,4	464,26	0,3171	152,50	206	1,54958	3,0717	13,9	33,4	464,26	0,3285	152,43	230,4	1,91528	3,4374	13,9	33,4	464,26	0,3283
147,82	182	1,18958	2,7117	13,9	33,4	464,26	0,3184	152,34	206,4	1,55548	3,0776	13,9	33,4	464,26	0,3281	152,31	230,8	1,92118	3,4433	13,9	33,4	464,26	0,3281
148,35	182,4	1,19548	2,7176	13,9	33,4	464,26	0,3195	152,31	206,8	1,56148	3,0836	13,9	33,4	464,26	0,3281	152,22	231,2	1,92718	3,4493	13,9	33,4	464,26	0,3279
148,84	182,8	1,20138	2,7235	13,9	33,4	464,26	0,3206	152,63	207,2	1,56738	3,0895	13,9	33,4	464,26	0,3288	152,13	231,6	1,93318	3,4553	13,9	33,4	464,26	0,3277
149,33	183,2	1,20738	2,7295	13,9	33,4	464,26	0,3217	152,56	207,6	1,57338	3,0955	13,9	33,4	464,26	0,3286	152,22	232	1,93928	3,4614	13,9	33,4	464,26	0,3279
149,76	183,6	1,21338	2,7355	13,9	33,4	464,26	0,3226	152,49	208	1,57948	3,1016	13,9	33,4	464,26	0,3285	152,35	232,4	1,94548	3,4676	13,9	33,4	464,26	0,3282
150,34	184	1,21948	2,7416	13,9	33,4	464,26	0,3238	152,39	208,4	1,58558	3,1077	13,9	33,4	464,26	0,3282	152,45	232,8	1,95138	3,4735	13,9	33,4	464,26	0,3284
150,72	184,4	1,22558	2,7477	13,9	33,4	464,26	0,3246	152,26	208,8	1,59158	3,1137	13,9	33,4	464,26	0,3280	152,36	233,2	1,95728	3,4794	13,9	33,4	464,26	0,3282
150,99	184,8	1,23148	2,7536	13,9	33,4	464,26	0,3252	152,36	209,2	1,59748	3,1196	13,9	33,4	464,26	0,3282	152,44	233,6	1,96328	3,4854	13,9	33,4	464,26	0,3284
151,16	185,2	1,23738	2,7595	13,9	33,4	464,26	0,3256	152,31	209,6	1,60338	3,1255	13,9	33,4	464,26	0,3281	152,56	234	1,96928	3,4914	13,9	33,4	464,26	0,3286
151,42	185,6	1,24338	2,7655	13,9	33,4	464,26	0,3262	152,27	210	1,60938	3,1315	13,9	33,4	464,26	0,3280	152,34	234,4	1,97528	3,4974	13,9	33,4	464,26	0,3281
151,45	186	1,24928	2,7714	13,9	33,4	464,26	0,3262	152,37	210,4	1,61538	3,1375	13,9	33,4	464,26	0,3282	152,13	234,8	1,98148	3,5036	13,9	33,4	464,26	0,3277
151,46	186,4	1,25528	2,7774	13,9	33,4	464,26	0,3262	152,49	210,8	1,62148	3,1436	13,9	33,4	464,26	0,3285	152,05	235,2	1,98748	3,5096	13,9	33,4	464,26	0,3275
151,48	186,8	1,26148	2,7836	13,9	33,4	464,26	0,3263	152,51	211,2	1,62758	3,1497	13,9	33,4	464,26	0,3285	151,87	235,6	1,99348	3,5156	13,9	33,4	464,26	0,3271
151,70	187,2	1,26758	2,7897	13,9	33,4	464,26	0,3268	152,66	211,6	1,63348	3,1556	13,9	33,4	464,26	0,3288	151,85	236	1,99938	3,5215	13,9	33,4	464,26	0,3271
151,85	187,6	1,27348	2,7956	13,9	33,4	464,26	0,3271	152,92	212	1,63948	3,1616	13,9	33,4	464,26	0,3294	151,77	236,4	2,00538	3,5275	13,9	33,4	464,26	0,3269
152,03	188	1,27938	2,8015	13,9	33,4	464,26	0,3275	153,24	212,4	1,64538	3,1675	13,9	33,4	464,26	0,3301	151,90	236,8	2,01128	3,5334	13,9	33,4	464,26	0,3272
152,21	188,4	1,28538	2,8075	13,9	33,4	464,26	0,3279	153,68	212,8	1,65138	3,1735	13,9	33,4	464,26	0,3310	152,31	237,2	2,01738	3,5395	13,9	33,4	464,26	0,3281
152,44	188,8	1,29128	2,8134	13,9	33,4	464,26	0,3284	154,12	213,2	1,65748	3,1796	13,9	33,4	464,26	0,3320	152,43	237,6	2,02348	3,5456	13,9	33,4	464,26	0,3283
152,73	189,2	1,29738	2,8195	13,9	33,4	464,26	0,3290	154,52	213,6	1,66348	3,1856	13,9	33,4	464,26	0,3328	152,42	238	2,02958	3,5517	13,9	33,4	464,26	0,3283
152,94	189,6	1,30348	2,8256	13,9	33,4	464,26	0,3294	154,73	214	1,66958	3,1917	13,9	33,4	464,26	0,3333	152,23	238,4	2,03548	3,5576	13,9	33,4	464,26	0,3279
153,15	190	1,30948	2,8316	13,9	33,4	464,26	0,3299	154,80	214,4	1,67548	3,1976	13,9	33,4	464,26	0,3334	152,19	238,8	2,04138	3,5635	13,9	33,4	464,26	0,3278
153,26	190,4	1,31538	2,8375	13,9	33,4	464,26	0,3301	155,09	214,8	1,68138	3,2035	13,9	33,4	464,26	0,3341	151,75	239,2	2,04738	3,5695	13,9	33,4	464,26	0,3269
152,81	190,8	1,32128	2,8434	13,9	33,4	464,26	0,3291	155,47	215,2	1,68728	3,2094	13,9	33,4	464,26	0,3349	151,38	239,6	2,05338	3,5755	13,9	33,4	464,26	0,3261
152,56	191,2	1,32728	2,8494	13,9	33,4	464,26	0,3286	155,88	215,6	1,69338	3,2155	13,9	33,4	464,26	0,3358	151,26	240	2,05948	3,5816	13,9	33,4	464,26	0,3258
152,18	191,6	1,33328	2,8554	13,9	33,4	464,26	0,3278	156,53	216	1,69948	3,2216	13,9	33,4	464,26	0,3372	151,30	240,4	2,06558	3,5877	13,9	33,4	464,26	0,3259
152,25	192	1,33938	2,8615	13,9	33,4	464,26	0,3279	157,09	216,4	1,70548	3,2276	13,9	33,4	464,26	0,3384	151,18	240,8	2,07158	3,5937	13,9	33,4	464,26	0,3256
152,18	192,4	1,34548	2,8676	13,9	33,4	464,26	0,3278	157,43	216,8	1,71148	3,2336	13,9	33,4	464,26	0,3391	150,94	241,2	2,07748	3,5996	13,9	33,4	464,26	0,3251
151,95	192,8	1,35148	2,8736	13,9	33,4	464,26	0,3273	157,68	217,2	1,71738	3,2395	13,9	33,4	464,26	0,3396	150,65	241,6	2,08348	3,6056	13,9	33,4	464,26	0,3245
151,65	193,2	1,35738	2,8795	13,9	33,4	464,26	0,3266	158,03	217,6	1,72328	3,2454	13,9	33,4	464,26	0,3404	150,29	242	2,08938	3,6115	13,9	33,4	464,26	0,3237
151,57	193,6	1,36328	2,8854	13,9	33,4	464,26	0,3265	158,38	218	1,72928	3,2514	13,9	33,4	464,26	0,3411	150,01	242,4	2,09548	3,6176	13,9	33,4	464,26	0,3231
151,54	194	1,36928	2,8914	13,9	33,4	464,26	0,3264	156,75	218,4	1,73528	3,2574	13,9	33,4	464,26	0,3376	149,82	242,8	2,10158	3,6237	13,9	33,4	464,26	0,3227
151,56	194,4	1,37528	2,8974	13,9	33,4	464,26	0,3265	155,63	218,8	1,74138	3,2635	13,9	33,4	464,26	0,3352	149,35	243,2	2,10758	3,6297	13,9	33,4	464,26	0,3217
151,78	194,8	1,38148	2,9036	13,9	33,4	464,26	0,3269	154,93	219,2	1,74748	3,2696	13,9	33,4	464,26	0,3337	148,74	243,6	2,11358	3,6357	13,9	33,4	464,26	0,3204
151,62	195,2	1,38748	2,9096	13,9	33,4	464,26	0,3266	154,26	219,6	1,75338	3,2755	13,9	33,4	464,26	0,3323	148,30	244	2,11948	3,6416	13,9	33,4	464,26	0,3194
151,51	195,6	1,39348	2,9156	13,9	33,4	464,26	0,3263	153,85	220	1,75928	3,2814	13,9	33,4	464,26	0,3314	147,75	244,4	2,12548	3,6476	13,9	33,4	464,26	0,3182
151,78	196	1,39938	2,9215	13,9	33,4	464,26	0,3269	153,70	220,4	1,76528	3,2874	13,9	33,4	464,26	0,3311	147,35	244,8	2,13138	3,6535	13,9	33,4	464,26	0,3174

LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
147,19	245,2	2,13748	3,6596	13,9	33,4	464,26	0,3170
147,15	245,6	2,14358	3,6657	13,9	33,4	464,26	0,3170
146,94	246	2,14958	3,6717	13,9	33,4	464,26	0,3165
146,79	246,4	2,15548	3,6776	13,9	33,4	464,26	0,3162
146,78	246,8	2,16138	3,6835	13,9	33,4	464,26	0,3162
146,77	247,2	2,16738	3,6895	13,9	33,4	464,26	0,3161
146,86	247,6	2,17338	3,6955	13,9	33,4	464,26	0,3163
146,82	248	2,17948	3,7016	13,9	33,4	464,26	0,3162
146,76	248,4	2,18548	3,7076	13,9	33,4	464,26	0,3161
146,63	248,8	2,19148	3,7136	13,9	33,4	464,26	0,3158
146,26	249,2	2,19738	3,7195	13,9	33,4	464,26	0,3150
145,97	249,6	2,20328	3,7254	13,9	33,4	464,26	0,3144
145,85	250	2,20928	3,7314	13,9	33,4	464,26	0,3142
145,92	250,4	2,21528	3,7374	13,9	33,4	464,26	0,3143
145,94	250,8	2,22148	3,7436	13,9	33,4	464,26	0,3143
145,93	251,2	2,22748	3,7496	13,9	33,4	464,26	0,3143
146,00	251,6	2,23348	3,7556	13,9	33,4	464,26	0,3145
146,11	252	2,23938	3,7615	13,9	33,4	464,26	0,3147
146,34	252,4	2,24528	3,7674	13,9	33,4	464,26	0,3152
146,58	252,8	2,25128	3,7734	13,9	33,4	464,26	0,3157
147,09	253,2	2,25738	3,7795	13,9	33,4	464,26	0,3168
147,54	253,6	2,26348	3,7856	13,9	33,4	464,26	0,3178
147,77	254	2,26948	3,7916	13,9	33,4	464,26	0,3183
148,10	254,4	2,27538	3,7975	13,9	33,4	464,26	0,3190
148,39	254,8	2,28128	3,8034	13,9	33,4	464,26	0,3196
148,49	255,2	2,28728	3,8094	13,9	33,4	464,26	0,3198
148,62	255,48	2,29148	3,8136	13,9	33,4	464,26	0,3201

3.3.1.6-G Mix. Proportion Tests
15:2:1 - 3







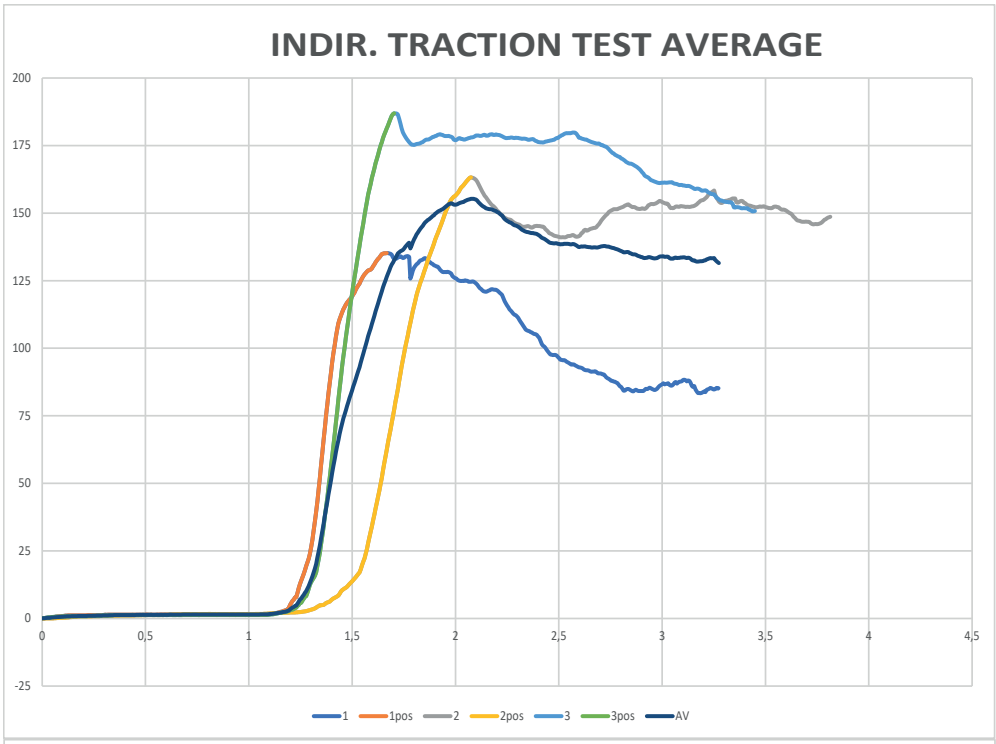
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
0,11	1,2	-1,31649	0	13,7	26,4	361,68	0,0003
0,15	1,6	-1,31069	0,0058	13,7	26,4	361,68	0,0004
0,21	2	-1,30459	0,0119	13,7	26,4	361,68	0,0006
0,28	2,4	-1,29859	0,0179	13,7	26,4	361,68	0,0008
0,33	2,8	-1,29259	0,0239	13,7	26,4	361,68	0,0009
0,38	3,2	-1,28669	0,0298	13,7	26,4	361,68	0,0011
0,41	3,6	-1,28079	0,0357	13,7	26,4	361,68	0,0011
0,46	4	-1,27479	0,0417	13,7	26,4	361,68	0,0013
0,52	4,4	-1,26889	0,0476	13,7	26,4	361,68	0,0014
0,57	4,8	-1,26269	0,0538	13,7	26,4	361,68	0,0016
0,62	5,2	-1,25659	0,0599	13,7	26,4	361,68	0,0017
0,64	5,6	-1,25079	0,0657	13,7	26,4	361,68	0,0018
0,66	6	-1,24479	0,0717	13,7	26,4	361,68	0,0018
0,63	6,4	-1,23879	0,0777	13,7	26,4	361,68	0,0017
0,68	6,8	-1,23289	0,0836	13,7	26,4	361,68	0,0019
0,71	7,2	-1,22679	0,0897	13,7	26,4	361,68	0,0020
0,75	7,6	-1,22069	0,0958	13,7	26,4	361,68	0,0021
0,78	8	-1,21469	0,1018	13,7	26,4	361,68	0,0022
0,79	8,4	-1,20869	0,1078	13,7	26,4	361,68	0,0022
0,81	8,8	-1,20279	0,1137	13,7	26,4	361,68	0,0022
0,83	9,2	-1,19679	0,1197	13,7	26,4	361,68	0,0023
0,81	9,6	-1,19079	0,1257	13,7	26,4	361,68	0,0022
0,83	10	-1,18469	0,1318	13,7	26,4	361,68	0,0023
0,84	10,4	-1,17859	0,1379	13,7	26,4	361,68	0,0023
0,85	10,8	-1,17259	0,1439	13,7	26,4	361,68	0,0024
0,83	11,2	-1,16669	0,1498	13,7	26,4	361,68	0,0023
0,85	11,6	-1,16079	0,1557	13,7	26,4	361,68	0,0024
0,85	12	-1,15479	0,1617	13,7	26,4	361,68	0,0024
0,84	12,4	-1,14879	0,1677	13,7	26,4	361,68	0,0023
0,86	12,8	-1,14269	0,1738	13,7	26,4	361,68	0,0024
0,86	13,2	-1,13659	0,1799	13,7	26,4	361,68	0,0024
0,87	13,6	-1,13059	0,1859	13,7	26,4	361,68	0,0024
0,87	14	-1,12479	0,1917	13,7	26,4	361,68	0,0024
0,88	14,4	-1,11879	0,1977	13,7	26,4	361,68	0,0024
0,88	14,8	-1,11279	0,2037	13,7	26,4	361,68	0,0024
0,88	15,2	-1,10679	0,2097	13,7	26,4	361,68	0,0024
0,89	15,6	-1,10059	0,2159	13,7	26,4	361,68	0,0025
0,92	16	-1,09459	0,2219	13,7	26,4	361,68	0,0025
0,92	16,4	-1,08869	0,2278	13,7	26,4	361,68	0,0025
0,94	16,8	-1,08279	0,2337	13,7	26,4	361,68	0,0026
0,95	17,2	-1,07679	0,2397	13,7	26,4	361,68	0,0026
0,98	17,6	-1,07079	0,2457	13,7	26,4	361,68	0,0027
0,99	18	-1,06469	0,2518	13,7	26,4	361,68	0,0027
1,01	18,4	-1,05859	0,2579	13,7	26,4	361,68	0,0028
1,03	18,8	-1,05269	0,2638	13,7	26,4	361,68	0,0028
1,05	19,2	-1,04679	0,2697	13,7	26,4	361,68	0,0029
1,07	19,6	-1,04079	0,2757	13,7	26,4	361,68	0,0030
1,07	20	-1,03479	0,2817	13,7	26,4	361,68	0,0030
1,09	20,4	-1,02879	0,2877	13,7	26,4	361,68	0,0030
1,12	20,8	-1,02269	0,2938	13,7	26,4	361,68	0,0031
1,14	21,2	-1,01659	0,2999	13,7	26,4	361,68	0,0032
1,14	21,6	-1,01069	0,3058	13,7	26,4	361,68	0,0032
1,14	22	-1,00479	0,3117	13,7	26,4	361,68	0,0032
1,15	22,4	-0,99879	0,3177	13,7	26,4	361,68	0,0032
1,14	22,8	-0,99279	0,3237	13,7	26,4	361,68	0,0032
1,15	23,2	-0,98679	0,3297	13,7	26,4	361,68	0,0032
1,19	23,6	-0,98069	0,3358	13,7	26,4	361,68	0,0033
1,24	24	-0,97469	0,3418	13,7	26,4	361,68	0,0034
1,26	24,4	-0,96869	0,3478	13,7	26,4	361,68	0,0035
1,30	24,8	-0,96279	0,3537	13,7	26,4	361,68	0,0036
1,31	25,2	-0,95689	0,3596	13,7	26,4	361,68	0,0036

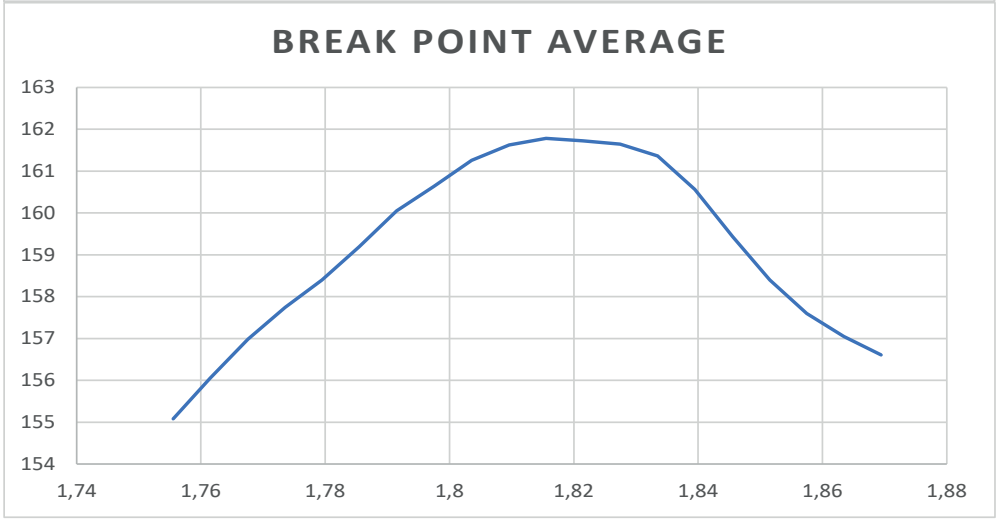
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
1,30	25,6	-0,95089	0,3656	13,7	26,4	361,68	0,0036	1,33	50	-0,58469	0,7318	13,7	26,4	361,68	0,0037	1,43	74,4	-0,21879	1,0977	13,7	26,4	361,68	0,0040
1,29	26	-0,94479	0,3717	13,7	26,4	361,68	0,0036	1,32	50,4	-0,57859	0,7379	13,7	26,4	361,68	0,0036	1,48	74,8	-0,21279	1,1037	13,7	26,4	361,68	0,0041
1,31	26,4	-0,93869	0,3778	13,7	26,4	361,68	0,0036	1,33	50,8	-0,57259	0,7439	13,7	26,4	361,68	0,0037	1,54	75,2	-0,20689	1,1096	13,7	26,4	361,68	0,0043
1,30	26,8	-0,93269	0,3838	13,7	26,4	361,68	0,0036	1,33	51,2	-0,56669	0,7498	13,7	26,4	361,68	0,0037	1,57	75,6	-0,20089	1,1156	13,7	26,4	361,68	0,0043
1,29	27,2	-0,92679	0,3897	13,7	26,4	361,68	0,0036	1,30	51,6	-0,56079	0,7557	13,7	26,4	361,68	0,0036	1,65	76	-0,19499	1,1215	13,7	26,4	361,68	0,0046
1,31	27,6	-0,92089	0,3956	13,7	26,4	361,68	0,0036	1,31	52	-0,55479	0,7617	13,7	26,4	361,68	0,0036	1,73	76,4	-0,18899	1,1275	13,7	26,4	361,68	0,0048
1,31	28	-0,91499	0,4015	13,7	26,4	361,68	0,0036	1,33	52,4	-0,54879	0,7677	13,7	26,4	361,68	0,0037	1,81	76,8	-0,18279	1,1337	13,7	26,4	361,68	0,0050
1,30	28,4	-0,90899	0,4075	13,7	26,4	361,68	0,0036	1,32	52,8	-0,54269	0,7738	13,7	26,4	361,68	0,0036	1,91	77,2	-0,17679	1,1397	13,7	26,4	361,68	0,0053
1,31	28,8	-0,90279	0,4137	13,7	26,4	361,68	0,0036	1,32	53,2	-0,53659	0,7799	13,7	26,4	361,68	0,0036	2,00	77,6	-0,17089	1,1456	13,7	26,4	361,68	0,0055
1,31	29,2	-0,89679	0,4197	13,7	26,4	361,68	0,0036	1,32	53,6	-0,53069	0,7858	13,7	26,4	361,68	0,0036	2,10	78	-0,16489	1,1516	13,7	26,4	361,68	0,0058
1,29	29,6	-0,89079	0,4257	13,7	26,4	361,68	0,0036	1,33	54	-0,52479	0,7917	13,7	26,4	361,68	0,0037	2,18	78,4	-0,15899	1,1575	13,7	26,4	361,68	0,0060
1,31	30	-0,88489	0,4316	13,7	26,4	361,68	0,0036	1,32	54,4	-0,51889	0,7976	13,7	26,4	361,68	0,0036	2,28	78,8	-0,15299	1,1635	13,7	26,4	361,68	0,0063
1,32	30,4	-0,87899	0,4375	13,7	26,4	361,68	0,0036	1,32	54,8	-0,51289	0,8036	13,7	26,4	361,68	0,0036	2,39	79,2	-0,14689	1,1696	13,7	26,4	361,68	0,0066
1,30	30,8	-0,87299	0,4435	13,7	26,4	361,68	0,0036	1,32	55,2	-0,50689	0,8096	13,7	26,4	361,68	0,0036	2,38	79,6	-0,14079	1,1757	13,7	26,4	361,68	0,0066
1,31	31,2	-0,86689	0,4496	13,7	26,4	361,68	0,0036	1,33	55,6	-0,50079	0,8157	13,7	26,4	361,68	0,0037	2,53	80	-0,13479	1,1817	13,7	26,4	361,68	0,0070
1,31	31,6	-0,86079	0,4557	13,7	26,4	361,68	0,0036	1,32	56	-0,49469	0,8218	13,7	26,4	361,68	0,0036	2,65	80,4	-0,12889	1,1876	13,7	26,4	361,68	0,0073
1,31	32	-0,85479	0,4617	13,7	26,4	361,68	0,0036	1,33	56,4	-0,48879	0,8277	13,7	26,4	361,68	0,0037	2,81	80,8	-0,12299	1,1935	13,7	26,4	361,68	0,0078
1,30	32,4	-0,84889	0,4676	13,7	26,4	361,68	0,0036	1,33	56,8	-0,48289	0,8336	13,7	26,4	361,68	0,0037	2,96	81,2	-0,11699	1,1995	13,7	26,4	361,68	0,0082
1,32	32,8	-0,84299	0,4735	13,7	26,4	361,68	0,0036	1,32	57,2	-0,47699	0,8395	13,7	26,4	361,68	0,0036	3,18	81,6	-0,11099	1,2055	13,7	26,4	361,68	0,0088
1,31	33,2	-0,83699	0,4795	13,7	26,4	361,68	0,0036	1,31	57,6	-0,47099	0,8455	13,7	26,4	361,68	0,0036	3,35	82	-0,10489	1,2116	13,7	26,4	361,68	0,0093
1,32	33,6	-0,83099	0,4855	13,7	26,4	361,68	0,0036	1,32	58	-0,46489	0,8516	13,7	26,4	361,68	0,0036	3,57	82,4	-0,09879	1,2177	13,7	26,4	361,68	0,0099
1,32	34	-0,82489	0,4916	13,7	26,4	361,68	0,0036	1,33	58,4	-0,45879	0,8577	13,7	26,4	361,68	0,0037	3,90	82,8	-0,09279	1,2237	13,7	26,4	361,68	0,0108
1,31	34,4	-0,81879	0,4977	13,7	26,4	361,68	0,0036	1,33	58,8	-0,45279	0,8637	13,7	26,4	361,68	0,0037	4,03	83,2	-0,08689	1,2296	13,7	26,4	361,68	0,0111
1,31	34,8	-0,81279	0,5037	13,7	26,4	361,68	0,0036	1,32	59,2	-0,44689	0,8696	13,7	26,4	361,68	0,0036	4,64	83,6	-0,08099	1,2355	13,7	26,4	361,68	0,0128
1,30	35,2	-0,80689	0,5096	13,7	26,4	361,68	0,0036	1,32	59,6	-0,44089	0,8756	13,7	26,4	361,68	0,0036	5,00	84	-0,07499	1,2415	13,7	26,4	361,68	0,0138
1,32	35,6	-0,80089	0,5156	13,7	26,4	361,68	0,0036	1,32	60	-0,43499	0,8815	13,7	26,4	361,68	0,0036	5,89	84,4	-0,06889	1,2476	13,7	26,4	361,68	0,0163
1,32	36	-0,79499	0,5215	13,7	26,4	361,68	0,0036	1,32	60,4	-0,42899	0,8875	13,7	26,4	361,68	0,0036	5,86	84,8	-0,06279	1,2537	13,7	26,4	361,68	0,0162
1,32	36,4	-0,78899	0,5275	13,7	26,4	361,68	0,0036	1,32	60,8	-0,42279	0,8937	13,7	26,4	361,68	0,0036	6,63	85,2	-0,05679	1,2597	13,7	26,4	361,68	0,0183
1,31	36,8	-0,78279	0,5337	13,7	26,4	361,68	0,0036	1,32	61,2	-0,41679	0,8997	13,7	26,4	361,68	0,0036	7,28	85,6	-0,05079	1,2657	13,7	26,4	361,68	0,0201
1,31	37,2	-0,77669	0,5398	13,7	26,4	361,68	0,0036	1,31	61,6	-0,41079	0,9057	13,7	26,4	361,68	0,0036	8,11	86	-0,04489	1,2716	13,7	26,4	361,68	0,0224
1,30	37,6	-0,77079	0,5457	13,7	26,4	361,68	0,0036	1,33	62	-0,40489	0,9116	13,7	26,4	361,68	0,0037	8,26	86,4	-0,03889	1,2776	13,7	26,4	361,68	0,0228
1,32	38	-0,76489	0,5516	13,7	26,4	361,68	0,0036	1,33	62,4	-0,39899	0,9175	13,7	26,4	361,68	0,0037	9,54	86,8	-0,03289	1,2836	13,7	26,4	361,68	0,0264
1,30	38,4	-0,75889	0,5576	13,7	26,4	361,68	0,0036	1,33	62,8	-0,39299	0,9235	13,7	26,4	361,68	0,0037	10,98	87,2	-0,02689	1,2896	13,7	26,4	361,68	0,0304
1,31	38,8	-0,75289	0,5636	13,7	26,4	361,68	0,0036	1,33	63,2	-0,38689	0,9296	13,7	26,4	361,68	0,0037	12,45	87,6	-0,02079	1,2957	13,7	26,4	361,68	0,0344
1,31	39,2	-0,74689	0,5696	13,7	26,4	361,68	0,0036	1,30	63,6	-0,38079	0,9357	13,7	26,4	361,68	0,0036	13,48	88	-0,01479	1,3017	13,7	26,4	361,68	0,0373
1,32	39,6	-0,74069	0,5758	13,7	26,4	361,68	0,0036	1,32	64	-0,37469	0,9418	13,7	26,4	361,68	0,0036	14,27	88,4	-0,00879	1,3077	13,7	26,4	361,68	0,0395
1,31	40	-0,73469	0,5818	13,7	26,4	361,68	0,0036	1,32	64,4	-0,36879	0,9477	13,7	26,4	361,68	0,0036	14,95	88,8	-0,00289	1,3136	13,7	26,4	361,68	0,0413
1,30	40,4	-0,72879	0,5877	13,7	26,4	361,68	0,0036	1,32	64,8	-0,36279	0,9537	13,7	26,4	361,68	0,0036	15,78	89,2	0,00311	1,3196	13,7	26,4	361,68	0,0436
1,32	40,8	-0,72279	0,5937	13,7	26,4	361,68	0,0036	1,32	65,2	-0,35689	0,9596	13,7	26,4	361,68	0,0036	17,11	89,6	0,00911	1,3256	13,7	26,4	361,68	0,0473
1,30	41,2	-0,71689	0,5996	13,7	26,4	361,68	0,0036	1,33	65,6	-0,35089	0,9656	13,7	26,4	361,68	0,0037	19,39	90	0,01521	1,3317	13,7	26,4	361,68	0,0536
1,31	41,6	-0,71089	0,6056	13,7	26,4	361,68	0,0036	1,32	66	-0,34479	0,9717	13,7	26,4	361,68	0,0036	21,76	90,4	0,02131	1,3378	13,7	26,4	361,68	0,0602
1,33	42	-0,70469	0,6118	13,7	26,4	361,68	0,0037	1,32	66,4	-0,33869	0,9778	13,7	26,4	361,68	0,0036	24,34	90,8	0,02731	1,3438	13,7	26,4	361,68	0,0673
1,32	42,4	-0,69859	0,6179	13,7	26,4	361,68	0,0036	1,31	66,8	-0,33269	0,9838	13,7	26,4	361,68	0,0036	27,43	91,2	0,03321	1,3497	13,7	26,4	361,68	0,0758
1,34	42,8	-0,69259	0,6239	13,7	26,4	361,68	0,0037	1,32	67,2	-0,32679	0,9897	13,7	26,4	361,68	0,0036	30,66	91,6	0,03911	1,3556	13,7	26,4	361,68	0,0848
1,31	43,2	-0,68669	0,6298	13,7	26,4	361,68	0,0036	1,33	67,6	-0,32079	0,9957	13,7	26,4	361,68	0,0037	33,97	92	0,04511	1,3616	13,7	26,4	361,68	0,0939
1,31	43,6	-0,68069	0,6358	13,7	26,4	361,68	0,0036	1,34	68	-0,31489	1,0016	13,7	26,4	361,68	0,0037	37,50	92,4	0,05111	1,3676	13,7	26,4	361,68	0,1037
1,31	44	-0,67479	0,6417	13,7	26,4	361,68	0,0036	1,33	68,4	-0,30879	1,0077	13,7	26,4	361,68	0,0037	41,16	92,8	0,05721	1,3737	13,7	26,4	361,68	0,1138
1,31	44,4	-0,66869	0,6478	13,7	26,4	361,68	0,0036	1,34	68,8	-0,30269	1,0138	13,7	26,4	361,68	0,0037	44,72	93,2	0,06321	1,3797	13,7	26,4	361,68	0,1236
1,32	44,8	-0,66259	0,6539	13,7	26,4	361,68	0,0036	1,35	69,2	-0,29669	1,0198	13,7	26,4	361,68	0,0037	48,40	93,6	0,06921	1,3857	13,7	26,4	361,68	0,1338
1,31	45,2	-0,65649	0,66	13,7	26,4	361,68	0,0036	1,33	69,6	-0,29079	1,0257	13,7	26,4	361,68	0,0037	52,16	94	0,07511	1,3916	13,7	26,4	361,68	0,1442
1,31	45,6	-0,65059	0,6659	13,7	26,4	361,68	0,0036	1,33	70	-0,28479	1,0317	13,7	26,4	361,68	0,0037	55,87	94,4	0,08101	1,3975	13,7	26,4	361,68	0,1545
1,31	46	-0,64469	0,6718	13,7	26,4	361,68	0,0036	1,33	70,4	-0,27889	1,0376	13,7	26,4	361,68	0,0037	59,89	94,8	0,08711	1,4036	13,7	26,4	361,68	0,1656
1,31	46,4	-0,63869	0,6778	13,7	26,4	361,68	0,0036	1,32	70,8	-0,27289	1,0436	13,7	26,4	361,68	0,0036	64,18	95,2	0,09311	1,4096	13,7	26,4	361,68	0,1774
1,32	46,8	-0,63279	0,6837	13,7	26,4	361,68	0,0036	1,35	71,2	-0,26679	1,0497	13,7	26,4	361,68	0,0037	68,39	95,6	0,09921	1,4157	13,7	26,4	361,68	0,1891
1,32	47,2	-0,62669	0,6898	13,7	26,4	361,68	0,0036	1,34	71,6	-0,26069	1,0558	13,7	26,4	361,68	0,0037	72,50	96	0,10521	1,4217	13,7	26,4	361,68	0,2005
1,34	47,6	-0,62059	0,6959	13,7	26,4	361,68	0,0037	1,36	72	-0,25479	1,0617	13,7	26,4	361,68	0,0038	76,63	96,4	0,11111	1,4276	13,7	26,4	361,68	0,2119
1,33	48	-0,61459	0,7019	13,7	26,4	361,68	0,0037	1,35	72,4	-0,24879	1,0677	13,7	26,4	361,68	0,0037	80,86	96,8	0,11711	1,4336	13,7	26,4	361,68	0,2236
1,32	48,4	-0,60859	0,7079	13,7	26,4	361,68	0,0036	1,36	72,8	-0,24289	1,0736	13,7	26,4	361,68	0,0038	85,10	97,2	0,12301	1,4395	13,7	26,4	361,68	0,2353
1,33	48,8	-0,60269	0,7138	13,7	26,4	361,68	0,0037	1,34	73,2	-0,23699	1,0795	13,7	26,4	361,68	0,0037	89,14	97,6	0,12901	1,4455	13,7	26,4	361,68	0,2465
1,31	49,2	-0,59679	0,7197	13,7	26,4	361,68	0,0036	1,37	73,6	-0,23089	1,0856	13,7	26,4	361,68	0,0038	93,13	98	0,13511	1,4516	13,7	26,4	361,68	0,2575
1,33	49,6	-0,59079	0,7257	13,7	26,4	361,68	0,0037	1,40	74	-0,22489	1,0916	13,7	26,4	361,68	0,0039	96,91	98,4	0,14121	1,4577	13,7	26,4	361,68	0,2679

LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
100,32	98,8	0,14721	1,4637	13,7	26,4	361,68	0,2774	175,81	123,2	0,51281	1,8293	13,7	26,4	361,68	0,4861	179,11	147,6	0,87891	2,1954	13,7	26,4	361,68	0,4952
103,74	99,2	0,15311	1,4696	13,7	26,4	361,68	0,2868	176,13	123,6	0,51871	1,8352	13,7	26,4	361,68	0,4870	178,99	148	0,88491	2,2014	13,7	26,4	361,68	0,4949
107,28	99,6	0,15901	1,4755	13,7	26,4	361,68	0,2966	176,24	124	0,52481	1,8413	13,7	26,4	361,68	0,4873	178,94	148,4	0,89091	2,2074	13,7	26,4	361,68	0,4947
110,64	100	0,16501	1,4815	13,7	26,4	361,68	0,3059	176,65	124,4	0,53081	1,8473	13,7	26,4	361,68	0,4884	178,88	148,8	0,89701	2,2135	13,7	26,4	361,68	0,4946
113,86	100,4	0,17101	1,4875	13,7	26,4	361,68	0,3148	177,00	124,8	0,53691	1,8534	13,7	26,4	361,68	0,4894	178,63	149,2	0,90301	2,2195	13,7	26,4	361,68	0,4939
117,12	100,8	0,17711	1,4936	13,7	26,4	361,68	0,3238	177,18	125,2	0,54291	1,8594	13,7	26,4	361,68	0,4899	178,44	149,6	0,90901	2,2255	13,7	26,4	361,68	0,4934
120,20	101,2	0,18311	1,4996	13,7	26,4	361,68	0,3323	177,19	125,6	0,54881	1,8653	13,7	26,4	361,68	0,4899	178,18	150	0,91491	2,2314	13,7	26,4	361,68	0,4926
123,20	101,6	0,18911	1,5056	13,7	26,4	361,68	0,3406	177,30	126	0,55481	1,8713	13,7	26,4	361,68	0,4902	177,94	150,4	0,92091	2,2374	13,7	26,4	361,68	0,4920
126,23	102	0,19501	1,5115	13,7	26,4	361,68	0,3490	177,58	126,4	0,56071	1,8772	13,7	26,4	361,68	0,4910	177,78	150,8	0,92691	2,2434	13,7	26,4	361,68	0,4915
129,08	102,4	0,20091	1,5174	13,7	26,4	361,68	0,3569	177,79	126,8	0,56681	1,8833	13,7	26,4	361,68	0,4916	177,78	151,2	0,93301	2,2495	13,7	26,4	361,68	0,4915
131,90	102,8	0,20691	1,5234	13,7	26,4	361,68	0,3647	178,14	127,2	0,57291	1,8894	13,7	26,4	361,68	0,4925	177,84	151,6	0,93911	2,2556	13,7	26,4	361,68	0,4917
134,95	103,2	0,21301	1,5295	13,7	26,4	361,68	0,3731	178,26	127,6	0,57901	1,8955	13,7	26,4	361,68	0,4929	177,80	152	0,94501	2,2615	13,7	26,4	361,68	0,4916
137,86	103,6	0,21911	1,5356	13,7	26,4	361,68	0,3812	178,52	128	0,58501	1,9015	13,7	26,4	361,68	0,4936	177,94	152,4	0,95101	2,2675	13,7	26,4	361,68	0,4920
140,67	104	0,22511	1,5416	13,7	26,4	361,68	0,3889	178,60	128,4	0,59101	1,9075	13,7	26,4	361,68	0,4938	177,95	152,8	0,95691	2,2734	13,7	26,4	361,68	0,4920
143,45	104,4	0,23101	1,5475	13,7	26,4	361,68	0,3966	178,91	128,8	0,59691	1,9134	13,7	26,4	361,68	0,4947	177,79	153,2	0,96291	2,2794	13,7	26,4	361,68	0,4916
146,13	104,8	0,23691	1,5534	13,7	26,4	361,68	0,4040	179,04	129,2	0,60291	1,9194	13,7	26,4	361,68	0,4950	177,75	153,6	0,96891	2,2854	13,7	26,4	361,68	0,4915
148,83	105,2	0,24291	1,5594	13,7	26,4	361,68	0,4115	179,16	129,6	0,60891	1,9254	13,7	26,4	361,68	0,4954	177,88	154	0,97501	2,2915	13,7	26,4	361,68	0,4918
151,67	105,6	0,24891	1,5654	13,7	26,4	361,68	0,4193	179,01	130	0,61501	1,9315	13,7	26,4	361,68	0,4949	177,83	154,4	0,98111	2,2976	13,7	26,4	361,68	0,4917
154,35	106	0,25501	1,5715	13,7	26,4	361,68	0,4268	178,90	130,4	0,62111	1,9376	13,7	26,4	361,68	0,4946	177,80	154,8	0,98701	2,3035	13,7	26,4	361,68	0,4916
156,80	106,4	0,26111	1,5776	13,7	26,4	361,68	0,4335	178,67	130,8	0,62711	1,9436	13,7	26,4	361,68	0,4940	177,70	155,2	0,99291	2,3094	13,7	26,4	361,68	0,4913
158,87	106,8	0,26711	1,5836	13,7	26,4	361,68	0,4393	178,48	131,2	0,63301	1,9495	13,7	26,4	361,68	0,4935	177,61	155,6	0,99891	2,3154	13,7	26,4	361,68	0,4911
160,82	107,2	0,27301	1,5895	13,7	26,4	361,68	0,4446	178,50	131,6	0,63901	1,9555	13,7	26,4	361,68	0,4935	177,51	156	1,00491	2,3214	13,7	26,4	361,68	0,4908
162,94	107,6	0,27901	1,5955	13,7	26,4	361,68	0,4505	178,48	132	0,64491	1,9614	13,7	26,4	361,68	0,4935	177,55	156,4	1,01101	2,3275	13,7	26,4	361,68	0,4909
164,75	108	0,28501	1,6015	13,7	26,4	361,68	0,4555	178,61	132,4	0,65101	1,9675	13,7	26,4	361,68	0,4938	177,56	156,8	1,01711	2,3336	13,7	26,4	361,68	0,4909
166,57	108,4	0,29101	1,6075	13,7	26,4	361,68	0,4605	178,34	132,8	0,65711	1,9736	13,7	26,4	361,68	0,4931	177,50	157,2	1,02311	2,3396	13,7	26,4	361,68	0,4908
168,43	108,8	0,29711	1,6136	13,7	26,4	361,68	0,4657	178,23	133,2	0,66311	1,9796	13,7	26,4	361,68	0,4928	177,32	157,6	1,02901	2,3455	13,7	26,4	361,68	0,4903
170,00	109,2	0,30321	1,6197	13,7	26,4	361,68	0,4700	177,94	133,6	0,66911	1,9856	13,7	26,4	361,68	0,4920	177,16	158	1,03501	2,3515	13,7	26,4	361,68	0,4898
171,64	109,6	0,30911	1,6256	13,7	26,4	361,68	0,4746	177,22	134	0,67501	1,9915	13,7	26,4	361,68	0,4900	177,15	158,4	1,04091	2,3574	13,7	26,4	361,68	0,4898
173,29	110	0,31501	1,6315	13,7	26,4	361,68	0,4791	177,00	134,4	0,68101	1,9975	13,7	26,4	361,68	0,4894	177,27	158,8	1,04691	2,3634	13,7	26,4	361,68	0,4901
174,93	110,4	0,32101	1,6375	13,7	26,4	361,68	0,4837	176,99	134,8	0,68701	2,0035	13,7	26,4	361,68	0,4894	177,35	159,2	1,05311	2,3696	13,7	26,4	361,68	0,4904
176,28	110,8	0,32701	1,6435	13,7	26,4	361,68	0,4874	177,35	135,2	0,69301	2,0095	13,7	26,4	361,68	0,4904	177,44	159,6	1,05911	2,3756	13,7	26,4	361,68	0,4906
177,73	111,2	0,33301	1,6495	13,7	26,4	361,68	0,4914	177,69	135,6	0,69911	2,0156	13,7	26,4	361,68	0,4913	177,05	160	1,06511	2,3816	13,7	26,4	361,68	0,4895
179,03	111,6	0,33921	1,6557	13,7	26,4	361,68	0,4950	177,76	136	0,70511	2,0216	13,7	26,4	361,68	0,4915	176,73	160,4	1,07101	2,3875	13,7	26,4	361,68	0,4886
180,21	112	0,34511	1,6616	13,7	26,4	361,68	0,4983	177,41	136,4	0,71111	2,0276	13,7	26,4	361,68	0,4905	176,62	160,8	1,07701	2,3935	13,7	26,4	361,68	0,4883
181,29	112,4	0,35111	1,6676	13,7	26,4	361,68	0,5012	177,40	136,8	0,71701	2,0335	13,7	26,4	361,68	0,4905	176,30	161,2	1,08291	2,3994	13,7	26,4	361,68	0,4874
182,42	112,8	0,35701	1,6735	13,7	26,4	361,68	0,5044	177,23	137,2	0,72301	2,0395	13,7	26,4	361,68	0,4900	176,24	161,6	1,08901	2,4055	13,7	26,4	361,68	0,4873
183,74	113,2	0,36301	1,6795	13,7	26,4	361,68	0,5080	177,23	137,6	0,72901	2,0455	13,7	26,4	361,68	0,4900	176,20	162	1,09511	2,4116	13,7	26,4	361,68	0,4872
184,80	113,6	0,36901	1,6855	13,7	26,4	361,68	0,5109	177,38	138	0,73511	2,0516	13,7	26,4	361,68	0,4904	176,16	162,4	1,10111	2,4176	13,7	26,4	361,68	0,4871
185,99	114	0,37511	1,6916	13,7	26,4	361,68	0,5142	177,57	138,4	0,74121	2,0577	13,7	26,4	361,68	0,4910	176,14	162,8	1,10711	2,4236	13,7	26,4	361,68	0,4870
186,64	114,4	0,38121	1,6977	13,7	26,4	361,68	0,5160	177,72	138,8	0,74721	2,0637	13,7	26,4	361,68	0,4914	176,22	163,2	1,11301	2,4295	13,7	26,4	361,68	0,4872
186,93	114,8	0,38711	1,7036	13,7	26,4	361,68	0,5168	177,85	139,2	0,75311	2,0696	13,7	26,4	361,68	0,4917	176,44	163,6	1,11901	2,4355	13,7	26,4	361,68	0,4878
186,86	115,2	0,39301	1,7095	13,7	26,4	361,68	0,5166	178,02	139,6	0,75901	2,0755	13,7	26,4	361,68	0,4922	176,54	164	1,12491	2,4414	13,7	26,4	361,68	0,4881
186,88	115,6	0,39901	1,7155	13,7	26,4	361,68	0,5167	178,05	140	0,76501	2,0815	13,7	26,4	361,68	0,4923	176,67	164,4	1,13101	2,4475	13,7	26,4	361,68	0,4885
186,48	116	0,40491	1,7214	13,7	26,4	361,68	0,5156	178,14	140,4	0,77101	2,0875	13,7	26,4	361,68	0,4925	176,75	164,8	1,13711	2,4536	13,7	26,4	361,68	0,4887
184,85	116,4	0,41091	1,7274	13,7	26,4	361,68	0,5111	178,43	140,8	0,77711	2,0936	13,7	26,4	361,68	0,4933	176,86	165,2	1,14311	2,4596	13,7	26,4	361,68	0,4890
183,13	116,8	0,41701	1,7335	13,7	26,4	361,68	0,5063	178,69	141,2	0,78321	2,0997	13,7	26,4	361,68	0,4941	176,90	165,6	1,14901	2,4655	13,7	26,4	361,68	0,4891
181,39	117,2	0,42311	1,7396	13,7	26,4	361,68	0,5015	178,74	141,6	0,78911	2,1056	13,7	26,4	361,68	0,4942	177,07	166	1,15491	2,4714	13,7	26,4	361,68	0,4896
179,90	117,6	0,42901	1,7455	13,7	26,4	361,68	0,4974	178,69	142	0,79501	2,1115	13,7	26,4	361,68	0,4941	177,17	166,4	1,16091	2,4774	13,7	26,4	361,68	0,4899
179,04	118	0,43491	1,7514	13,7	26,4	361,68	0,4950	178,56	142,4	0,80101	2,1175	13,7	26,4	361,68	0,4937	177,47	166,8	1,16691	2,4834	13,7	26,4	361,68	0,4907
178,20	118,4	0,44081	1,7573	13,7	26,4	361,68	0,4927	178,56	142,8	0,80701	2,1235	13,7	26,4	361,68	0,4937	177,72	167,2	1,17301	2,4895	13,7	26,4	361,68	0,4914
177,51	118,8	0,44681	1,7633	13,7	26,4	361,68	0,4908	178,72	143,2	0,81311	2,1296	13,7	26,4	361,68	0,4941	177,78	167,6	1,17901	2,4955	13,7	26,4	361,68	0,4915
176,93	119,2	0,45291	1,7694	13,7	26,4	361,68	0,4892	178,89	143,6	0,81911	2,1356	13,7	26,4	361,68	0,4946	178,21	168	1,18501	2,5015	13,7	26,4	361,68	0,4927
176,32	119,6	0,45901	1,7755	13,7	26,4	361,68	0,4875	178,98	144	0,82511	2,1416	13,7	26,4	361,68	0,4949	178,44	168,4	1,19091	2,5074	13,7	26,4	361,68	0,4934
175,76	120	0,46501	1,7815	13,7	26,4	361,68	0,4860	178,64	144,4	0,83101	2,1475	13,7	26,4	361,68	0,4939	178,81	168,8	1,19691	2,5134	13,7	26,4	361,68	0,4944
175,36	120,4	0,47091	1,7874	13,7	26,4	361,68	0,4848	178,66	144,8	0,83691	2,1534	13,7	26,4	361,68	0,4940	178,91	169,2	1,20281	2,5193	13,7	26,4	361,68	0,4947
175,31	120,8	0,47681	1,7933	13,7	26,4	361,68	0,4847	178,74	145,2	0,84291	2,1594	13,7	26,4	361,68	0,4942	179,29	169,6	1,20891	2,5254	13,7	26,4	361,68	0,4957
175,25	121,2	0,48281	1,7993	13,7	26,4	361,68	0,4845	179,04	145,6	0,84891	2,1654	13,7	26,4	361,68	0,4950	179,49	170	1,21501	2,5315	13,7	26,4	361,68	0,4963
175,36	121,6	0,48881	1,8053	13,7	26,4	361,68	0,4848	179,15	146	0,85511	2,1716	13,7	26,4	361,68	0,4953	179,59	170,4	1,22101	2,5375	13,7	26,4	361,68	0,4965
175,58	122	0,49491	1,8114	13,7	26,4	361,68	0,4855	179,18	146,4	0,86111	2,1776	13,7	26,4	361,68	0,4954	179,55	170,8	1,22701	2,5435	13,7	26,4	361,68	0,4964
175,65	122,4	0,50101	1,8175	13,7	26,4	361,68	0,4857	178,95	146,8	0,86701	2,1835	13,7	26,4	361,68	0,4948	179,57	171,2	1,23291	2,5494	13,7	26,4	361,68	0,4965
175,69	122,8	0,50691	1,8234	13,7	26,4	361,68	0,4858	178,93	147,2	0,87291	2,1894	13,7	26,4	361,68	0,4947	179,55	171,6	1,23891	2,5554	13,7	26,4	361,68	0,4964

LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
179,69	172	1,24481	2,5613	13,7	26,4	361,68	0,4968	163,36	196,4	1,61101	2,9275	13,7	26,4	361,68	0,4517	154,46	220,8	1,97711	3,2936	13,7	26,4	361,68	0,4271
179,83	172,4	1,25091	2,5674	13,7	26,4	361,68	0,4972	163,08	196,8	1,61711	2,9336	13,7	26,4	361,68	0,4509	154,29	221,2	1,98311	3,2996	13,7	26,4	361,68	0,4266
179,81	172,8	1,25701	2,5735	13,7	26,4	361,68	0,4972	162,66	197,2	1,62311	2,9396	13,7	26,4	361,68	0,4497	154,17	221,6	1,98901	3,3055	13,7	26,4	361,68	0,4263
179,74	173,2	1,26301	2,5795	13,7	26,4	361,68	0,4970	162,23	197,6	1,62901	2,9455	13,7	26,4	361,68	0,4485	154,12	222	1,99501	3,3115	13,7	26,4	361,68	0,4261
179,34	173,6	1,26891	2,5854	13,7	26,4	361,68	0,4959	162,06	198	1,63491	2,9514	13,7	26,4	361,68	0,4481	154,10	222,4	2,00091	3,3174	13,7	26,4	361,68	0,4261
178,68	174	1,27491	2,5914	13,7	26,4	361,68	0,4940	161,86	198,4	1,64091	2,9574	13,7	26,4	361,68	0,4475	153,98	222,8	2,00691	3,3234	13,7	26,4	361,68	0,4257
177,86	174,4	1,28091	2,5974	13,7	26,4	361,68	0,4918	161,68	198,8	1,64691	2,9634	13,7	26,4	361,68	0,4470	154,02	223,2	2,01311	3,3296	13,7	26,4	361,68	0,4258
177,91	174,8	1,28681	2,6033	13,7	26,4	361,68	0,4919	161,49	199,2	1,65301	2,9695	13,7	26,4	361,68	0,4465	153,88	223,6	2,01921	3,3357	13,7	26,4	361,68	0,4255
177,64	175,2	1,29291	2,6094	13,7	26,4	361,68	0,4912	161,30	199,6	1,65911	2,9756	13,7	26,4	361,68	0,4460	153,30	224	2,02511	3,3416	13,7	26,4	361,68	0,4239
177,48	175,6	1,29901	2,6155	13,7	26,4	361,68	0,4907	161,17	200	1,66501	2,9815	13,7	26,4	361,68	0,4456	152,15	224,4	2,03101	3,3475	13,7	26,4	361,68	0,4207
177,36	176	1,30501	2,6215	13,7	26,4	361,68	0,4904	161,11	200,4	1,67091	2,9874	13,7	26,4	361,68	0,4454	152,05	224,8	2,03701	3,3535	13,7	26,4	361,68	0,4204
177,24	176,4	1,31091	2,6274	13,7	26,4	361,68	0,4900	161,15	200,8	1,67681	2,9933	13,7	26,4	361,68	0,4456	152,19	225,2	2,04301	3,3595	13,7	26,4	361,68	0,4208
177,21	176,8	1,31681	2,6333	13,7	26,4	361,68	0,4900	161,21	201,2	1,68281	2,9993	13,7	26,4	361,68	0,4457	152,23	225,6	2,04901	3,3655	13,7	26,4	361,68	0,4209
176,95	177,2	1,32281	2,6393	13,7	26,4	361,68	0,4892	161,26	201,6	1,68891	3,0054	13,7	26,4	361,68	0,4459	152,16	226	2,05511	3,3716	13,7	26,4	361,68	0,4207
176,72	177,6	1,32891	2,6454	13,7	26,4	361,68	0,4886	161,28	202	1,69501	3,0115	13,7	26,4	361,68	0,4459	152,00	226,4	2,06121	3,3777	13,7	26,4	361,68	0,4203
176,54	178	1,33501	2,6515	13,7	26,4	361,68	0,4881	161,21	202,4	1,70111	3,0176	13,7	26,4	361,68	0,4457	151,80	226,8	2,06711	3,3836	13,7	26,4	361,68	0,4197
176,34	178,4	1,34101	2,6575	13,7	26,4	361,68	0,4876	161,26	202,8	1,70701	3,0235	13,7	26,4	361,68	0,4459	151,80	227,2	2,07301	3,3895	13,7	26,4	361,68	0,4197
176,16	178,8	1,34701	2,6635	13,7	26,4	361,68	0,4871	161,31	203,2	1,71291	3,0294	13,7	26,4	361,68	0,4460	151,87	227,6	2,07901	3,3955	13,7	26,4	361,68	0,4199
176,05	179,2	1,35291	2,6694	13,7	26,4	361,68	0,4868	161,35	203,6	1,71881	3,0353	13,7	26,4	361,68	0,4461	151,78	228	2,08491	3,4014	13,7	26,4	361,68	0,4197
175,92	179,6	1,35891	2,6754	13,7	26,4	361,68	0,4864	161,40	204	1,72481	3,0413	13,7	26,4	361,68	0,4463	151,82	228,4	2,09101	3,4075	13,7	26,4	361,68	0,4198
175,80	180	1,36491	2,6814	13,7	26,4	361,68	0,4861	161,46	204,4	1,73091	3,0474	13,7	26,4	361,68	0,4464	151,76	228,8	2,09711	3,4136	13,7	26,4	361,68	0,4196
175,73	180,4	1,37101	2,6875	13,7	26,4	361,68	0,4859	161,13	204,8	1,73701	3,0535	13,7	26,4	361,68	0,4455	151,30	229,2	2,10311	3,4196	13,7	26,4	361,68	0,4183
175,79	180,8	1,37711	2,6936	13,7	26,4	361,68	0,4860	160,90	205,2	1,74301	3,0595	13,7	26,4	361,68	0,4449	151,15	229,6	2,10901	3,4255	13,7	26,4	361,68	0,4179
175,51	181,2	1,38311	2,6996	13,7	26,4	361,68	0,4853	160,85	205,6	1,74881	3,0653	13,7	26,4	361,68	0,4447	150,90	230	2,11491	3,4314	13,7	26,4	361,68	0,4172
175,16	181,6	1,38901	2,7055	13,7	26,4	361,68	0,4843	160,73	206	1,75481	3,0713	13,7	26,4	361,68	0,4444	150,65	230,4	2,12091	3,4374	13,7	26,4	361,68	0,4165
175,15	182	1,39491	2,7114	13,7	26,4	361,68	0,4843	160,55	206,4	1,76071	3,0772	13,7	26,4	361,68	0,4439	150,70	230,8	2,12691	3,4434	13,7	26,4	361,68	0,4167
174,86	182,4	1,40091	2,7174	13,7	26,4	361,68	0,4835	160,35	206,8	1,76681	3,0833	13,7	26,4	361,68	0,4433	150,77	231,16	2,13241	3,4489	13,7	26,4	361,68	0,4169
174,65	182,8	1,40691	2,7234	13,7	26,4	361,68	0,4829	160,39	207,2	1,77291	3,0894	13,7	26,4	361,68	0,4435								
174,55	183,2	1,41301	2,7295	13,7	26,4	361,68	0,4826	160,39	207,6	1,77891	3,0954	13,7	26,4	361,68	0,4435								
174,15	183,6	1,41921	2,7357	13,7	26,4	361,68	0,4815	160,20	208	1,78491	3,1014	13,7	26,4	361,68	0,4429								
173,74	184	1,42511	2,7416	13,7	26,4	361,68	0,4804	160,21	208,4	1,79081	3,1073	13,7	26,4	361,68	0,4430								
173,17	184,4	1,43101	2,7475	13,7	26,4	361,68	0,4788	160,08	208,8	1,79681	3,1133	13,7	26,4	361,68	0,4426								
172,77	184,8	1,43691	2,7534	13,7	26,4	361,68	0,4777	159,98	209,2	1,80271	3,1192	13,7	26,4	361,68	0,4423								
172,30	185,2	1,44291	2,7594	13,7	26,4	361,68	0,4764	160,05	209,6	1,80871	3,1252	13,7	26,4	361,68	0,4425								
172,04	185,6	1,44901	2,7655	13,7	26,4	361,68	0,4757	160,02	210	1,81491	3,1314	13,7	26,4	361,68	0,4424								
171,62	186	1,45511	2,7716	13,7	26,4	361,68	0,4745	159,79	210,4	1,82091	3,1374	13,7	26,4	361,68	0,4418								
171,35	186,4	1,46111	2,7776	13,7	26,4	361,68	0,4738	159,50	210,8	1,82691	3,1434	13,7	26,4	361,68	0,4410								
171,08	186,8	1,46711	2,7836	13,7	26,4	361,68	0,4730	159,31	211,2	1,83281	3,1493	13,7	26,4	361,68	0,4405								
170,87	187,2	1,47301	2,7895	13,7	26,4	361,68	0,4724	158,95	211,6	1,83871	3,1552	13,7	26,4	361,68	0,4395								
170,74	187,6	1,47891	2,7954	13,7	26,4	361,68	0,4721	158,91	212	1,84471	3,1612	13,7	26,4	361,68	0,4394								
170,23	188	1,48491	2,8014	13,7	26,4	361,68	0,4707	159,04	212,4	1,85081	3,1673	13,7	26,4	361,68	0,4397								
170,08	188,4	1,49101	2,8075	13,7	26,4	361,68	0,4702	159,05	212,8	1,85691	3,1734	13,7	26,4	361,68	0,4398								
169,76	188,8	1,49711	2,8136	13,7	26,4	361,68	0,4694	158,88	213,2	1,86291	3,1794	13,7	26,4	361,68	0,4393								
169,39	189,2	1,50311	2,8196	13,7	26,4	361,68	0,4683	158,63	213,6	1,86881	3,1853	13,7	26,4	361,68	0,4386								
169,00	189,6	1,50901	2,8255	13,7	26,4	361,68	0,4673	158,33	214	1,87481	3,1913	13,7	26,4	361,68	0,4378								
168,71	190	1,51501	2,8315	13,7	26,4	361,68	0,4665	158,32	214,4	1,88081	3,1973	13,7	26,4	361,68	0,4377								
168,46	190,4	1,52091	2,8374	13,7	26,4	361,68	0,4658	158,40	214,8	1,88681	3,2033	13,7	26,4	361,68	0,4380								
168,27	190,8	1,52691	2,8434	13,7	26,4	361,68	0,4652	158,41	215,2	1,89291	3,2094	13,7	26,4	361,68	0,4380								
168,27	191,2	1,53301	2,8495	13,7	26,4	361,68	0,4652	158,22	215,6	1,89901	3,2155	13,7	26,4	361,68	0,4375								
168,09	191,6	1,53911	2,8556	13,7	26,4	361,68	0,4647	157,77	216	1,90501	3,2215	13,7	26,4	361,68	0,4362								
167,83	192	1,54511	2,8616	13,7	26,4	361,68	0,4640	157,55	216,4	1,91091	3,2274	13,7	26,4	361,68	0,4356								
167,58	192,4	1,55101	2,8675	13,7	26,4	361,68	0,4633	157,25	216,8	1,91681	3,2333	13,7	26,4	361,68	0,4348								
167,24	192,8	1,55701	2,8735	13,7	26,4	361,68	0,4624	157,05	217,2	1,92281	3,2393	13,7	26,4	361,68	0,4342								
167,03	193,2	1,56291	2,8794	13,7	26,4	361,68	0,4618	156,98	217,6	1,92891	3,2454	13,7	26,4	361,68	0,4340								
166,59	193,6	1,56901	2,8855	13,7	26,4	361,68	0,4606	156,92	218	1,93501	3,2515	13,7	26,4	361,68	0,4339								
166,16	194	1,57511	2,8916	13,7	26,4	361,68	0,4594	156,38	218,4	1,94111	3,2576	13,7	26,4	361,68	0,4324								
165,63	194,4	1,58111	2,8976	13,7	26,4	361,68	0,4579	155,71	218,8	1,94701	3,2635	13,7	26,4	361,68	0,4305								
165,11	194,8	1,58711	2,9036	13,7	26,4	361,68	0,4565	155,42	219,2	1,95301	3,2695	13,7	26,4	361,68	0,4297								
164,57	195,2	1,59301	2,9095	13,7	26,4	361,68	0,4550	155,03	219,6	1,95891	3,2754	13,7	26,4	361,68	0,4286								
163,91	195,6	1,59891	2,9154	13,7	26,4	361,68	0,4532	154,69	220	1,96491	3,2814	13,7	26,4	361,68	0,4277								
163,59	196	1,60491	2,9214	13,7	26,4	361,68	0,4523	154,68	220,4	1,97101	3,2875	13,7	26,4	361,68	0,4277								

3.3.1.6-H Mix. Proportion Tests
15:2:1 - Average

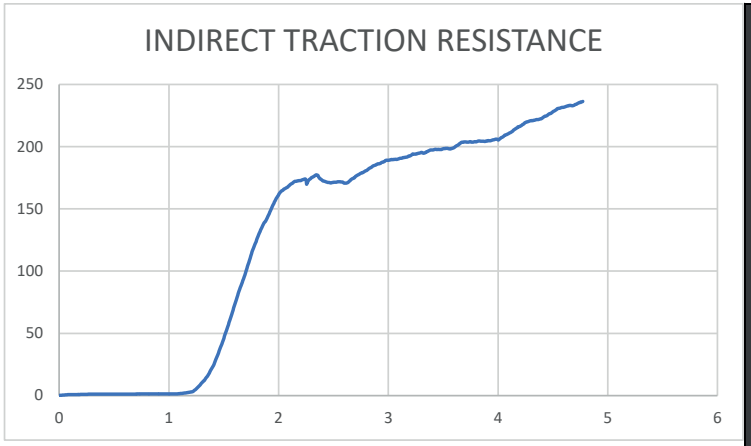


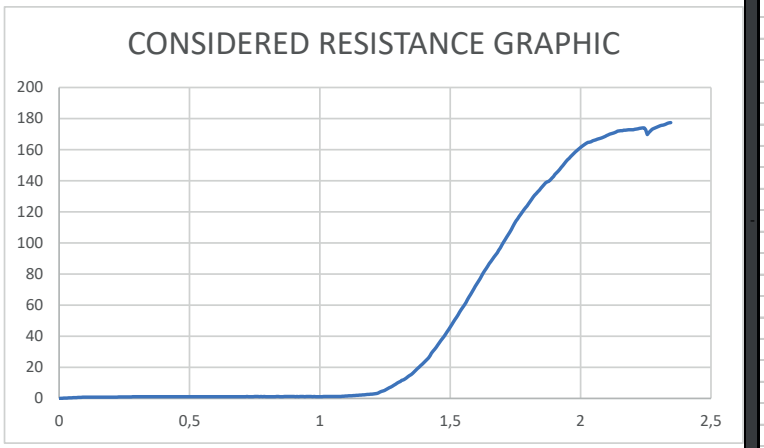


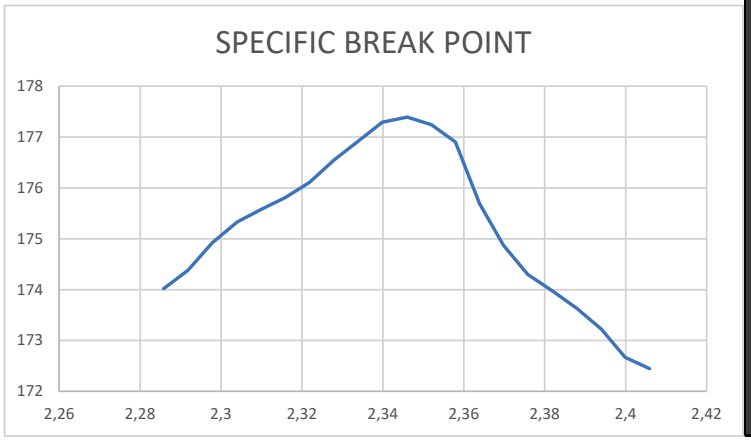
BREAK POINTS		INDIREC TRACTION	
LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)
100,3267	1,9928	0,036667	0
100,5867	1,997833333	0,07	0,005
100,9167	2,002833333	0,113333	0,010033333
101,1033	2,007866667	0,14	0,014966667
101,27	2,012833333	0,163333	0,020033333
101,46	2,0178	0,176667	0,025033333
101,7167	2,0228	0,213333	0,030033333
102,0267	2,0278	0,236667	0,035
102,3333	2,032833333	0,243333	0,04
102,5	2,037833333	0,276667	0,045
102,5767	2,042833333	0,283333	0,05
102,4533	2,047833333	0,306667	0,055
102,1833	2,0528	0,323333	0,059966667
101,53	2,057866667	0,343333	0,064966667
100,9533	2,0629	0,363333	0,069966667
100,5167	2,0679	0,383333	0,074966667
100,1867	2,072933333	0,383333	0,080033333
99,82333	2,0779	0,393333	0,085066667
99,49333	2,0829	0,396667	0,0901
99,19	2,087866667	0,4	0,095066667
99,04333	2,092866667	0,403333	0,100033333
		0,4	0,105066667
		0,403333	0,110066667
		0,406667	0,115066667
		0,41	0,120033333
		0,403333	0,125066667
		0,41	0,13
		0,403333	0,135
		0,396667	0,140033333
		0,41	0,145066667
		0,403333	0,150066667
		0,406667	0,1551
		0,423333	0,160166667
		0,43	0,1651
		0,436667	0,170066667
		0,46	0,1751
		0,466667	0,180066667
		0,486667	0,185033333
		0,496667	0,1901
		0,496667	0,195066667
		0,496667	0,200033333
		0,51	0,205033333
		0,506667	0,210033333
		0,513333	0,2151
		0,54	0,220066667
		0,54	0,2251
		0,543333	0,230133333
		0,543333	0,235066667
		0,556667	0,240066667
		0,563333	0,245066667
		0,57	0,250033333
		0,57	0,255033333
		0,58	0,260066667
		0,573333	0,265033333
		0,576667	0,269966667
		0,576667	0,275
		0,573333	0,280033333
		0,57	0,285033333
		0,58	0,290033333
		0,58	0,295033333

INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION	
LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)
1,263333	0,3598	1,47	0,719733333	1,54	1,079666667	68,35333	1,439633333	140,2533	1,799533333	151,5233	2,159533333	138,4967	2,5195	134,35	2,879466667	133,2867	3,2395
1,266667	0,3658	1,473333	0,725733333	1,563333	1,0857	70,39667	1,445633333	141,17	1,805533333	151,48	2,1655	138,6567	2,525566667	134,1067	2,8855	133,2867	3,2455
1,27	0,371866667	1,466667	0,731766667	1,58	1,0917	72,32	1,451633333	142,06	1,811566667	151,43	2,171566667	138,6533	2,5316	133,95	2,891533333	133,3433	3,251533333
1,283333	0,377866667	1,463333	0,737766667	1,623333	1,097733333	74,03333	1,457633333	142,76	1,817566667	151,31	2,177533333	138,6133	2,537566667	133,78	2,8975	132,69	3,257533333
1,276667	0,383866667	1,48	0,7438	1,66	1,1037	75,57333	1,463633333	143,4667	1,823533333	151,0767	2,183566667	138,6133	2,543566667	133,68	2,903533333	132,2267	3,263533333
1,283333	0,389866667	1,476667	0,749766667	1,713333	1,109733333	77,08333	1,469633333	144,1267	1,829533333	150,9033	2,189533333	138,5367	2,549533333	133,4633	2,9095	131,81	3,269533333
1,293333	0,3958	1,466667	0,7557	1,763333	1,1157	78,64	1,475566667	144,7367	1,8355	150,76	2,1955	138,43	2,555533333	133,3433	2,9155	131,4967	3,2747
1,286667	0,401766667	1,463333	0,7617	1,826667	1,121633333	80,15	1,481566667	145,2733	1,841533333	150,4433	2,201533333	138,4333	2,5615	133,4433	2,9215		
1,283333	0,407766667	1,473333	0,767733333	1,893333	1,127666667	81,58333	1,4876	145,98	1,847533333	150,18	2,207566667	138,5833	2,567566667	133,4933	2,927566667		
1,29	0,413833333	1,47	0,773733333	1,96	1,133733333	82,93	1,4936	146,59	1,853533333	149,8167	2,213566667	138,4967	2,5736	133,69	2,933533333		
1,3	0,4198	1,476667	0,779766667	2,04	1,1397	84,36333	1,499566667	147,02	1,859566667	149,43	2,219533333	138,27	2,579566667	133,7167	2,939533333		
1,286667	0,425833333	1,466667	0,785733333	2,11	1,1457	85,78667	1,5056	147,3767	1,8655	149,11	2,225533333	138,0033	2,585533333	133,5967	2,945533333		
1,3	0,4318	1,47	0,791733333	2,196667	1,1517	87,20333	1,511566667	147,6567	1,871533333	148,4667	2,231533333	137,71	2,591566667	133,4567	2,951533333		
1,306667	0,437766667	1,48	0,797666667	2,263333	1,157666667	88,70333	1,517566667	148,09	1,8775	147,86	2,237533333	137,42	2,597566667	133,3133	2,9575		
1,303333	0,443766667	1,503333	0,8037	2,346667	1,163666667	90,09333	1,523566667	148,4167	1,883533333	147,4933	2,243533333	137,52	2,603533333	133,2033	2,963533333		
1,306667	0,4498	1,48	0,8097	2,45	1,1697	91,56667	1,529566667	148,8867	1,8896	147,1267	2,249566667	137,6733	2,609566667	133,2633	2,9696		
1,316667	0,455833333	1,493333	0,8157	2,513333	1,175733333	92,91667	1,535566667	149,22	1,8956	146,8867	2,2556	137,5867	2,615566667	133,3833	2,975566667		
1,313333	0,4618	1,476667	0,8217	2,613333	1,1817	94,6	1,5416	149,7133	1,901533333	146,5967	2,261566667	137,68	2,6216	133,6633	2,981566667		
1,323333	0,4678	1,47	0,8277	2,753333	1,1877	96,31333	1,547566667	150,0633	1,907566667	146,4367	2,267566667	137,6567	2,627566667	133,89	2,987566667		
1,326667	0,473766667	1,476667	0,833666667	2,983333	1,193666667	97,92	1,553533333	150,5133	1,913566667	146,1633	2,273533333	137,5067	2,633533333	133,97	2,993533333		
1,323333	0,479766667	1,493333	0,839633333	3,396667	1,199666667	99,43333	1,559533333	150,7733	1,919533333	145,77	2,279533333	137,46	2,639533333	134,0033	2,999533333		
1,333333	0,485733333	1,48	0,845666667	3,753333	1,2057	101,1067	1,565533333	151	1,925533333	145,5	2,285566667	137,42	2,645566667	134,06	3,005566667		
1,333333	0,4918	1,48	0,8517	4,053333	1,2117	102,8267	1,571566667	151,22	1,931566667	145,4033	2,2916	137,3767	2,6516	133,8633	3,0116		
1,333333	0,4978	1,483333	0,8577	4,273333	1,217733333	104,4733	1,577566667	151,4367	1,937566667	145,19	2,2976	137,2833	2,657566667	133,8367	3,0176		
1,336667	0,503766667	1,48	0,8637	4,643333	1,223733333	105,96	1,583566667	151,8133	1,9436	144,9667	2,3036	137,2933	2,663566667	133,91	3,023566667		
1,333333	0,5098	1,476667	0,8697	4,746667	1,2297	107,3733	1,589566667	152,21	1,949566667	144,64	2,309566667	137,3	2,669566667	133,8433	3,029566667		
1,333333	0,515766667	1,473333	0,8757	5,51	1,2357	108,89	1,595566667	152,5667	1,955566667	144,2333	2,315533333	137,3133	2,675533333	133,38	3,0355		
1,336667	0,521733333	1,486667	0,881666667	6,203333	1,241666667	110,48	1,601566667	152,9367	1,961533333	143,8467	2,3216	137,28	2,681533333	133,1433	3,041533333		
1,346667	0,5277	1,48	0,8877	7,02	1,247733333	112,04	1,607633333	153,3133	1,9676	143,6067	2,3276	137,2867	2,6876	133,1867	3,047566667		
1,34	0,533766667	1,48	0,893733333	7,473333	1,253733333	113,62	1,6136	153,5	1,9736	143,39	2,333633333	137,4367	2,693566667	133,1633	3,0536		
1,343333	0,539766667	1,48	0,899733333	8,12	1,2597	115,11	1,6196	153,6133	1,979533333	143,16	2,3396	137,5667	2,699566667	133,3967	3,059566667		
1,343333	0,545766667	1,48	0,905733333	8,77	1,265733333	116,64	1,6256	153,4033	1,985566667	143,04	2,345566667	137,6633	2,705533333	133,5933	3,065533333		
1,343333	0,5517	1,483333	0,911733333	9,553333	1,271733333	118,0867	1,6316	153,1867	1,991533333	142,9233	2,3516	137,76	2,711533333	133,38	3,071533333		
1,343333	0,5577	1,486667	0,9177	10,10667	1,2777	119,6067	1,6376	153,0867	1,997533333	142,81	2,357566667	137,8433	2,717533333	133,4	3,0775		
1,343333	0,5637	1,493333	0,9237	11,04	1,2837	121,0933	1,643633333	153,18	2,003566667	142,6567	2,363566667	137,7933	2,723533333	133,4167	3,083566667		
1,35	0,569733333	1,493333	0,929733333	12,04667	1,2897	122,5067	1,6496	153,33	2,009533333	142,6	2,3696	137,71	2,729566667	133,57	3,089566667		
1,36	0,575766667	1,48	0,935733333	13,14667	1,2957	123,8867	1,655666667	153,56	2,015566667	142,58	2,375566667	137,6	2,7356	133,5933	3,095533333		
1,356667	0,581766667	1,483333	0,941766667	14,38333	1,301733333	125,1467	1,661633333	153,7733	2,021533333	142,49	2,381566667	137,58	2,741566667	133,6633	3,101533333		
1,356667	0,5877	1,486667	0,947733333	15,64667	1,307733333	126,3967	1,667666667	153,9067	2,027533333	142,3967	2,387533333	137,4167	2,747566667	133,6433	3,107533333		
1,366667	0,593733333	1,49	0,953766667	16,94667	1,3137	127,5833	1,673633333	154,0767	2,0335	142,2667	2,393566667	137,24	2,7535	133,5	3,113533333		
1,363333	0,599733333	1,483333	0,959733333	18,44333	1,3197	128,8033	1,6796	154,15	2,0395	141,9633	2,3995	137,1233	2,7595	133,36	3,1195		
1,37	0,605733333	1,473333	0,965733333	20,21667	1,3257	129,9067	1,685666667	154,44	2,045533333	141,75	2,4056	137,04	2,765566667	133,4833	3,1255		
1,376667	0,611766667	1,486667	0,971766667	22,42333	1,331733333	130,9833	1,691666667	154,6467	2,051533333	141,3267	2,4116	136,88	2,771566667	133,4167	3,131566667		
1,386667	0,617766667	1,486667	0,977766667	24,67333	1,337733333	131,71	1,697666667	154,8667	2,057533333	140,9	2,417566667	136,7033	2,777533333	133,1433	3,137533333		
1,403333	0,6238	1,483333	0,983766667	27,11	1,343766667	132,5267	1,703633333	154,9867	2,063566667	140,7	2,423566667	136,55	2,783566667	132,6933	3,143533333		
1,413333	0,629766667	1,493333	0,9898	29,66333	1,349733333	133,3767	1,709633333	155,1767	2,069566667	140,5033	2,429566667	136,37	2,789566667	132,5033	3,149533333		
1,416667	0,635766667	1,5	0,995733333	32,30667	1,3557	134,2467	1,715633333	155,2667	2,0755	140,2067	2,435566667	136,18	2,7955	132,5333	3,155466667		
1,416667	0,641733333	1,493333	1,001733333	35,04333	1,361666667	135,1	1,7216	155,2967	2,0815	139,8567	2,4415	135,9733	2,8015	132,18	3,1615		
1,423333	0,647766667	1,486667	1,007766667	37,83333	1,3677	135,51	1,7276	155,26	2,0875	139,5467	2,447566667	135,76	2,807533333	132,0867	3,167533333		
1,433333	0,6538	1,5	1,0138	40,63333	1,373733333	135,92	1,733633333	155,16	2,0935	139,1733	2,4536	135,5	2,813533333	132,0433	3,173533333		
1,423333	0,659766667	1,5	1,0198	43,29333	1,3797	136,1267	1,739633333	154,9767	2,099533333	138,97	2,459566667	135,48	2,819533333	132,1467	3,179533333		
1,423333	0,665766667	1,496667	1,025733333	45,92333	1,3857	136,3467	1,7456	154,6033	2,105533333	138,9	2,465533333	135,5467	2,8255	132,1667	3,1855		
1,43	0,671766667	1,503333	1,031766667	48,57667	1,3917	136,9367	1,7516	154,0733	2,1115	138,8233	2,471533333	135,5933	2,8315	132,1767	3,1915		
1,453333	0,677733333	1,513333	1,037733333	51,26333	1,397633333	137,5367	1,757533333	153,5367	2,117466667	138,77	2,4775	135,55	2,837466667	132,2833	3,1975		
1,47	0,6837	1,5	1,043733333	53,96	1,403666667	138,0933	1,763533333	153,1067	2,1235	138,8467	2,483566667	135,2333	2,843466667	132,5	3,2035		
1,466667	0,689766667	1,51	1,049766667	56,63667	1,409666667	138,65	1,769566667	152,71	2,129566667	138,82	2,489566667	135,06	2,8495	132,5467	3,2095		
1,473333	0,6958	1,526667	1,055733333	59,13	1,4157	139,0533	1,7756	152,3867	2,135533333	138,6367	2,495533333	134,7933	2,8555	132,9133	3,215566667		
1,476667	0,701766667	1,52	1,061733333	61,56667	1,421666667	136,9333	1,7816	152,1233	2,1415	138,56	2,501533333	134,7067	2,8615	133,0233	3,221566667		
1,47	0,7078	1,523333	1,067733333	63,94	1,427666667	138,0067	1,787566667	151,8133	2,147533333	138,42	2,507533333	134,7333	2,8675	133,22	3,2275		
1,473333	0,713766667	1,543333	1,0737	66,18333	1,433633333	139,2133	1,793533333	151,64	2,1535	138,5167	2,513533333	134,6033	2,8735	133,3467	3,2335		

3.3.1.6-i Mix. Proportion Tests
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LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
0,06	1,2	-1,3315	0	13,75	26,6	365,75	0,0002
0,13	1,6	-1,3255	0,006	13,75	26,6	365,75	0,0004
0,18	2	-1,3196	0,0119	13,75	26,6	365,75	0,0005
0,23	2,4	-1,3136	0,0179	13,75	26,6	365,75	0,0006
0,28	2,8	-1,3075	0,024	13,75	26,6	365,75	0,0008
0,32	3,2	-1,3014	0,0301	13,75	26,6	365,75	0,0009
0,38	3,6	-1,2954	0,0361	13,75	26,6	365,75	0,0010
0,44	4	-1,2895	0,042	13,75	26,6	365,75	0,0012
0,47	4,4	-1,2836	0,0479	13,75	26,6	365,75	0,0013
0,52	4,8	-1,2776	0,0539	13,75	26,6	365,75	0,0014
0,58	5,2	-1,2715	0,06	13,75	26,6	365,75	0,0016
0,63	5,6	-1,2654	0,0661	13,75	26,6	365,75	0,0017
0,67	6	-1,2594	0,0721	13,75	26,6	365,75	0,0018
0,73	6,4	-1,2534	0,0781	13,75	26,6	365,75	0,0020
0,79	6,8	-1,2475	0,084	13,75	26,6	365,75	0,0022
0,83	7,2	-1,2415	0,09	13,75	26,6	365,75	0,0023
0,82	7,6	-1,2355	0,096	13,75	26,6	365,75	0,0022
0,83	8	-1,2294	0,1021	13,75	26,6	365,75	0,0023
0,83	8,4	-1,2233	0,1082	13,75	26,6	365,75	0,0023
0,85	8,8	-1,2173	0,1142	13,75	26,6	365,75	0,0023
0,84	9,2	-1,2114	0,1201	13,75	26,6	365,75	0,0023
0,86	9,6	-1,2054	0,1261	13,75	26,6	365,75	0,0024
0,84	10	-1,1994	0,1321	13,75	26,6	365,75	0,0023
0,86	10,4	-1,1934	0,1381	13,75	26,6	365,75	0,0024
0,85	10,8	-1,1873	0,1442	13,75	26,6	365,75	0,0023
0,85	11,2	-1,1812	0,1503	13,75	26,6	365,75	0,0023
0,86	11,6	-1,1753	0,1562	13,75	26,6	365,75	0,0024
0,85	12	-1,1693	0,1622	13,75	26,6	365,75	0,0023
0,84	12,4	-1,1634	0,1681	13,75	26,6	365,75	0,0023
0,87	12,8	-1,1574	0,1741	13,75	26,6	365,75	0,0024
0,86	13,2	-1,1514	0,1801	13,75	26,6	365,75	0,0024
0,85	13,6	-1,1452	0,1863	13,75	26,6	365,75	0,0023
0,89	14	-1,1391	0,1924	13,75	26,6	365,75	0,0024
0,88	14,4	-1,1332	0,1983	13,75	26,6	365,75	0,0024
0,88	14,8	-1,1273	0,2042	13,75	26,6	365,75	0,0024
0,90	15,2	-1,1213	0,2102	13,75	26,6	365,75	0,0025
0,91	15,6	-1,1153	0,2162	13,75	26,6	365,75	0,0025
0,94	16	-1,1093	0,2222	13,75	26,6	365,75	0,0026
0,96	16,4	-1,1031	0,2284	13,75	26,6	365,75	0,0026
0,97	16,8	-1,0971	0,2344	13,75	26,6	365,75	0,0027
0,98	17,2	-1,0912	0,2403	13,75	26,6	365,75	0,0027
1,00	17,6	-1,0853	0,2462	13,75	26,6	365,75	0,0027
1,01	18	-1,0793	0,2522	13,75	26,6	365,75	0,0028
1,03	18,4	-1,0733	0,2582	13,75	26,6	365,75	0,0028
1,07	18,8	-1,0672	0,2643	13,75	26,6	365,75	0,0029
1,08	19,2	-1,0611	0,2704	13,75	26,6	365,75	0,0030
1,09	19,6	-1,0551	0,2764	13,75	26,6	365,75	0,0030
1,11	20	-1,0492	0,2823	13,75	26,6	365,75	0,0030
1,13	20,4	-1,0433	0,2882	13,75	26,6	365,75	0,0031
1,14	20,8	-1,0373	0,2942	13,75	26,6	365,75	0,0031
1,16	21,2	-1,0313	0,3002	13,75	26,6	365,75	0,0032
1,16	21,6	-1,0252	0,3063	13,75	26,6	365,75	0,0032
1,19	22	-1,0191	0,3124	13,75	26,6	365,75	0,0033
1,17	22,4	-1,0131	0,3184	13,75	26,6	365,75	0,0032
1,18	22,8	-1,0073	0,3242	13,75	26,6	365,75	0,0032
1,19	23,2	-1,0013	0,3302	13,75	26,6	365,75	0,0033
1,18	23,6	-0,9953	0,3362	13,75	26,6	365,75	0,0032
1,17	24	-0,9893	0,3422	13,75	26,6	365,75	0,0032
1,19	24,4	-0,9832	0,3483	13,75	26,6	365,75	0,0033
1,19	24,8	-0,9772	0,3543	13,75	26,6	365,75	0,0033
1,18	25,2	-0,9713	0,3602	13,75	26,6	365,75	0,0032

LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
1,18	25,6	-0,9653	0,3662	13,75	26,6	365,75	0,0032	1,23	50	-0,5993	0,7322	13,75	26,6	365,75	0,0034	1,57	74,4	-0,2334	1,0981	13,75	26,6	365,75	0,0043
1,19	26	-0,9594	0,3721	13,75	26,6	365,75	0,0033	1,24	50,4	-0,5933	0,7382	13,75	26,6	365,75	0,0034	1,62	74,8	-0,2273	1,1042	13,75	26,6	365,75	0,0044
1,20	26,4	-0,9534	0,3781	13,75	26,6	365,75	0,0033	1,24	50,8	-0,5872	0,7443	13,75	26,6	365,75	0,0034	1,72	75,2	-0,2212	1,1103	13,75	26,6	365,75	0,0047
1,18	26,8	-0,9473	0,3842	13,75	26,6	365,75	0,0032	1,25	51,2	-0,5811	0,7504	13,75	26,6	365,75	0,0034	1,70	75,6	-0,2153	1,1162	13,75	26,6	365,75	0,0046
1,19	27,2	-0,9412	0,3903	13,75	26,6	365,75	0,0033	1,25	51,6	-0,5752	0,7563	13,75	26,6	365,75	0,0034	1,77	76	-0,2094	1,1221	13,75	26,6	365,75	0,0048
1,20	27,6	-0,9352	0,3963	13,75	26,6	365,75	0,0033	1,25	52	-0,5692	0,7623	13,75	26,6	365,75	0,0034	1,85	76,4	-0,2034	1,1281	13,75	26,6	365,75	0,0051
1,18	28	-0,9293	0,4022	13,75	26,6	365,75	0,0032	1,24	52,4	-0,5633	0,7682	13,75	26,6	365,75	0,0034	1,94	76,8	-0,1975	1,134	13,75	26,6	365,75	0,0053
1,21	28,4	-0,9233	0,4082	13,75	26,6	365,75	0,0033	1,25	52,8	-0,5573	0,7742	13,75	26,6	365,75	0,0034	2,00	77,2	-0,1914	1,1401	13,75	26,6	365,75	0,0055
1,19	28,8	-0,9174	0,4141	13,75	26,6	365,75	0,0033	1,24	53,2	-0,5513	0,7802	13,75	26,6	365,75	0,0034	2,07	77,6	-0,1853	1,1462	13,75	26,6	365,75	0,0057
1,20	29,2	-0,9113	0,4202	13,75	26,6	365,75	0,0033	1,25	53,6	-0,5452	0,7863	13,75	26,6	365,75	0,0034	2,15	78	-0,1793	1,1522	13,75	26,6	365,75	0,0059
1,20	29,6	-0,9052	0,4263	13,75	26,6	365,75	0,0033	1,24	54	-0,5391	0,7924	13,75	26,6	365,75	0,0034	2,24	78,4	-0,1734	1,1581	13,75	26,6	365,75	0,0061
1,20	30	-0,8992	0,4323	13,75	26,6	365,75	0,0033	1,24	54,4	-0,5332	0,7983	13,75	26,6	365,75	0,0034	2,31	78,8	-0,1675	1,164	13,75	26,6	365,75	0,0063
1,20	30,4	-0,8933	0,4382	13,75	26,6	365,75	0,0033	1,24	54,8	-0,5273	0,8042	13,75	26,6	365,75	0,0034	2,42	79,2	-0,1615	1,17	13,75	26,6	365,75	0,0066
1,19	30,8	-0,8874	0,4441	13,75	26,6	365,75	0,0033	1,24	55,2	-0,5213	0,8102	13,75	26,6	365,75	0,0034	2,47	79,6	-0,1555	1,176	13,75	26,6	365,75	0,0068
1,18	31,2	-0,8814	0,4501	13,75	26,6	365,75	0,0032	1,23	55,6	-0,5153	0,8162	13,75	26,6	365,75	0,0034	2,59	80	-0,1494	1,1821	13,75	26,6	365,75	0,0071
1,19	31,6	-0,8754	0,4561	13,75	26,6	365,75	0,0033	1,24	56	-0,5092	0,8223	13,75	26,6	365,75	0,0034	2,67	80,4	-0,1434	1,1881	13,75	26,6	365,75	0,0073
1,17	32	-0,8693	0,4622	13,75	26,6	365,75	0,0032	1,24	56,4	-0,5031	0,8284	13,75	26,6	365,75	0,0034	2,77	80,8	-0,1373	1,1942	13,75	26,6	365,75	0,0076
1,20	32,4	-0,8633	0,4682	13,75	26,6	365,75	0,0033	1,25	56,8	-0,4971	0,8344	13,75	26,6	365,75	0,0034	2,87	81,2	-0,1314	1,2001	13,75	26,6	365,75	0,0078
1,20	32,8	-0,8573	0,4742	13,75	26,6	365,75	0,0033	1,25	57,2	-0,4912	0,8403	13,75	26,6	365,75	0,0034	2,96	81,6	-0,1255	1,206	13,75	26,6	365,75	0,0081
1,19	33,2	-0,8514	0,4801	13,75	26,6	365,75	0,0033	1,24	57,6	-0,4853	0,8462	13,75	26,6	365,75	0,0034	3,05	82	-0,1195	1,212	13,75	26,6	365,75	0,0083
1,18	33,6	-0,8454	0,4861	13,75	26,6	365,75	0,0032	1,24	58	-0,4794	0,8521	13,75	26,6	365,75	0,0034	3,24	82,4	-0,1135	1,218	13,75	26,6	365,75	0,0089
1,20	34	-0,8395	0,492	13,75	26,6	365,75	0,0033	1,24	58,4	-0,4733	0,8582	13,75	26,6	365,75	0,0034	3,55	82,8	-0,1074	1,2241	13,75	26,6	365,75	0,0097
1,20	34,4	-0,8335	0,498	13,75	26,6	365,75	0,0033	1,25	58,8	-0,4673	0,8642	13,75	26,6	365,75	0,0034	4,12	83,2	-0,1013	1,2302	13,75	26,6	365,75	0,0113
1,20	34,8	-0,8274	0,5041	13,75	26,6	365,75	0,0033	1,25	59,2	-0,4612	0,8703	13,75	26,6	365,75	0,0034	4,52	83,6	-0,0954	1,2361	13,75	26,6	365,75	0,0124
1,20	35,2	-0,8213	0,5102	13,75	26,6	365,75	0,0033	1,25	59,6	-0,4553	0,8762	13,75	26,6	365,75	0,0034	4,91	84	-0,0895	1,242	13,75	26,6	365,75	0,0134
1,19	35,6	-0,8153	0,5162	13,75	26,6	365,75	0,0033	1,25	60	-0,4493	0,8822	13,75	26,6	365,75	0,0034	5,20	84,4	-0,0836	1,2479	13,75	26,6	365,75	0,0142
1,21	36	-0,8094	0,5221	13,75	26,6	365,75	0,0033	1,25	60,4	-0,4434	0,8881	13,75	26,6	365,75	0,0034	5,71	84,8	-0,0776	1,2539	13,75	26,6	365,75	0,0156
1,20	36,4	-0,8035	0,528	13,75	26,6	365,75	0,0033	1,25	60,8	-0,4375	0,894	13,75	26,6	365,75	0,0034	6,33	85,2	-0,0715	1,26	13,75	26,6	365,75	0,0173
1,21	36,8	-0,7975	0,534	13,75	26,6	365,75	0,0033	1,26	61,2	-0,4314	0,9001	13,75	26,6	365,75	0,0034	6,89	85,6	-0,0654	1,2661	13,75	26,6	365,75	0,0188
1,20	37,2	-0,7914	0,5401	13,75	26,6	365,75	0,0033	1,23	61,6	-0,4253	0,9062	13,75	26,6	365,75	0,0034	7,35	86	-0,0594	1,2721	13,75	26,6	365,75	0,0201
1,20	37,6	-0,7853	0,5462	13,75	26,6	365,75	0,0033	1,25	62	-0,4193	0,9122	13,75	26,6	365,75	0,0034	7,97	86,4	-0,0534	1,2781	13,75	26,6	365,75	0,0218
1,20	38	-0,7793	0,5522	13,75	26,6	365,75	0,0033	1,24	62,4	-0,4134	0,9181	13,75	26,6	365,75	0,0034	8,55	86,8	-0,0475	1,284	13,75	26,6	365,75	0,0234
1,20	38,4	-0,7734	0,5581	13,75	26,6	365,75	0,0033	1,26	62,8	-0,4075	0,924	13,75	26,6	365,75	0,0034	9,18	87,2	-0,0415	1,29	13,75	26,6	365,75	0,0251
1,20	38,8	-0,7674	0,5641	13,75	26,6	365,75	0,0033	1,25	63,2	-0,4015	0,93	13,75	26,6	365,75	0,0034	9,86	87,6	-0,0355	1,296	13,75	26,6	365,75	0,0270
1,20	39,2	-0,7615	0,57	13,75	26,6	365,75	0,0033	1,25	63,6	-0,3955	0,936	13,75	26,6	365,75	0,0034	10,46	88	-0,0295	1,302	13,75	26,6	365,75	0,0286
1,21	39,6	-0,7555	0,576	13,75	26,6	365,75	0,0033	1,24	64	-0,3894	0,9421	13,75	26,6	365,75	0,0034	10,92	88,4	-0,0233	1,3082	13,75	26,6	365,75	0,0299
1,19	40	-0,7494	0,5821	13,75	26,6	365,75	0,0033	1,25	64,4	-0,3833	0,9482	13,75	26,6	365,75	0,0034	11,62	88,8	-0,0173	1,3142	13,75	26,6	365,75	0,0318
1,19	40,4	-0,7433	0,5882	13,75	26,6	365,75	0,0033	1,25	64,8	-0,3773	0,9542	13,75	26,6	365,75	0,0034	11,94	89,2	-0,0114	1,3201	13,75	26,6	365,75	0,0326
1,18	40,8	-0,7373	0,5942	13,75	26,6	365,75	0,0032	1,25	65,2	-0,3714	0,9601	13,75	26,6	365,75	0,0034	12,61	89,6	-0,0055	1,326	13,75	26,6	365,75	0,0345
1,19	41,2	-0,7314	0,6001	13,75	26,6	365,75	0,0033	1,25	65,6	-0,3654	0,9661	13,75	26,6	365,75	0,0034	13,31	90	0,0005	1,332	13,75	26,6	365,75	0,0364
1,19	41,6	-0,7255	0,606	13,75	26,6	365,75	0,0033	1,24	66	-0,3595	0,972	13,75	26,6	365,75	0,0034	14,03	90,4	0,0065	1,338	13,75	26,6	365,75	0,0384
1,21	42	-0,7195	0,612	13,75	26,6	365,75	0,0033	1,25	66,4	-0,3535	0,978	13,75	26,6	365,75	0,0034	14,75	90,8	0,0126	1,3441	13,75	26,6	365,75	0,0403
1,20	42,4	-0,7135	0,618	13,75	26,6	365,75	0,0033	1,24	66,8	-0,3473	0,9842	13,75	26,6	365,75	0,0034	15,36	91,2	0,0187	1,3502	13,75	26,6	365,75	0,0420
1,20	42,8	-0,7074	0,6241	13,75	26,6	365,75	0,0033	1,24	67,2	-0,3413	0,9902	13,75	26,6	365,75	0,0034	16,31	91,6	0,0246	1,3561	13,75	26,6	365,75	0,0446
1,20	43,2	-0,7013	0,6302	13,75	26,6	365,75	0,0033	1,24	67,6	-0,3353	0,9962	13,75	26,6	365,75	0,0034	17,29	92	0,0306	1,3621	13,75	26,6	365,75	0,0473
1,20	43,6	-0,6953	0,6362	13,75	26,6	365,75	0,0033	1,23	68	-0,3294	1,0021	13,75	26,6	365,75	0,0034	18,25	92,4	0,0365	1,368	13,75	26,6	365,75	0,0499
1,21	44	-0,6894	0,6421	13,75	26,6	365,75	0,0033	1,24	68,4	-0,3235	1,008	13,75	26,6	365,75	0,0034	19,18	92,8	0,0424	1,3739	13,75	26,6	365,75	0,0524
1,20	44,4	-0,6834	0,6481	13,75	26,6	365,75	0,0033	1,25	68,8	-0,3175	1,014	13,75	26,6	365,75	0,0034	20,13	93,2	0,0485	1,38	13,75	26,6	365,75	0,0550
1,21	44,8	-0,6774	0,6541	13,75	26,6	365,75	0,0033	1,25	69,2	-0,3114	1,0201	13,75	26,6	365,75	0,0034	21,12	93,6	0,0546	1,3861	13,75	26,6	365,75	0,0577
1,19	45,2	-0,6714	0,6601	13,75	26,6	365,75	0,0033	1,25	69,6	-0,3053	1,0262	13,75	26,6	365,75	0,0034	22,05	94	0,0607	1,3922	13,75	26,6	365,75	0,0603
1,21	45,6	-0,6653	0,6662	13,75	26,6	365,75	0,0033	1,25	70	-0,2992	1,0323	13,75	26,6	365,75	0,0034	22,94	94,4	0,0666	1,3981	13,75	26,6	365,75	0,0627
1,21	46	-0,6592	0,6723	13,75	26,6	365,75	0,0033	1,25	70,4	-0,2933	1,0382	13,75	26,6	365,75	0,0034	23,95	94,8	0,0725	1,404	13,75	26,6	365,75	0,0655
1,22	46,4	-0,6533	0,6782	13,75	26,6	365,75	0,0033	1,26	70,8	-0,2874	1,0441	13,75	26,6	365,75	0,0034	24,95	95,2	0,0785	1,41	13,75	26,6	365,75	0,0682
1,21	46,8	-0,6474	0,6841	13,75	26,6	365,75	0,0033	1,27	71,2	-0,2814	1,0501	13,75	26,6	365,75	0,0035	26,06	95,6	0,0845	1,416	13,75	26,6	365,75	0,0713
1,22	47,2	-0,6414	0,6901	13,75	26,6	365,75	0,0033	1,29	71,6	-0,2754	1,0561	13,75	26,6	365,75	0,0035	27,56	96	0,0906	1,4221	13,75	26,6	365,75	0,0754
1,22	47,6	-0,6354	0,6961	13,75	26,6	365,75	0,0033	1,32	72	-0,2693	1,0622	13,75	26,6	365,75	0,0036	29,11	96,4	0,0967	1,4282	13,75	26,6	365,75	0,0796
1,24	48	-0,6293	0,7022	13,75	26,6	365,75	0,0034	1,37	72,4	-0,2632	1,0683	13,75	26,6	365,75	0,0037	30,43	96,8	0,1027	1,4342	13,75	26,6	365,75	0,0832
1,23	48,4	-0,6231	0,7084	13,75	26,6	365,75	0,0034	1,39	72,8	-0,2572	1,0743	13,75	26,6	365,75	0,0038	31,75	97,2	0,1086	1,4401	13,75	26,6	365,75	0,0868
1,24	48,8	-0,6171	0,7144	13,75	26,6	365,75	0,0034	1,38	73,2	-0,2513	1,0802	13,75	26,6	365,75	0,0038	33,07	97,6	0,1146	1,4461	13,75	26,6	365,75	0,0904
1,25	49,2	-0,6112	0,7203	13,75	26,6	365,75	0,0034	1,44	73,6	-0,2454	1,0861	13,75	26,6	365,75	0,0039	34,38	98	0,1205	1,452	13,75	26,6	365,75	0,0940
1,24	49,6	-0,6053	0,7262	13,75	26,6	365,75	0,0034	1,49	74	-0,2394	1,0921	13,75	26,6	365,75	0,0041	35,81	98,4	0,1265	1,458	13,75	26,6	365,75	0,0979

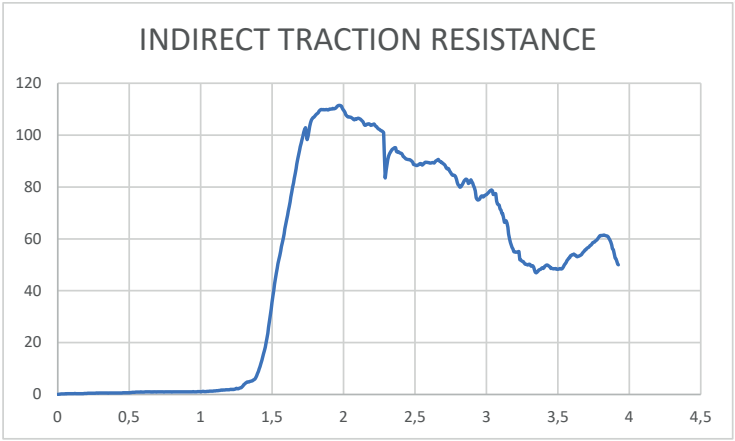
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
37,24	98,8	0,1326	1,4641	13,75	26,6	365,75	0,1018	131,85	123,2	0,4985	1,83	13,75	26,6	365,75	0,3605	172,76	147,6	0,8645	2,196	13,75	26,6	365,75	0,4723
38,64	99,2	0,1387	1,4702	13,75	26,6	365,75	0,1056	132,89	123,6	0,5044	1,8359	13,75	26,6	365,75	0,3633	172,77	148	0,8704	2,2019	13,75	26,6	365,75	0,4724
39,97	99,6	0,1446	1,4761	13,75	26,6	365,75	0,1093	133,97	124	0,5103	1,8418	13,75	26,6	365,75	0,3663	173,05	148,4	0,8763	2,2078	13,75	26,6	365,75	0,4731
41,37	100	0,1506	1,4821	13,75	26,6	365,75	0,1131	135,15	124,4	0,5163	1,8478	13,75	26,6	365,75	0,3695	173,22	148,8	0,8823	2,2138	13,75	26,6	365,75	0,4736
42,92	100,4	0,1565	1,488	13,75	26,6	365,75	0,1173	136,36	124,8	0,5223	1,8538	13,75	26,6	365,75	0,3728	173,45	149,2	0,8884	2,2199	13,75	26,6	365,75	0,4742
44,45	100,8	0,1625	1,494	13,75	26,6	365,75	0,1215	137,52	125,2	0,5283	1,8598	13,75	26,6	365,75	0,3760	173,73	149,6	0,8945	2,226	13,75	26,6	365,75	0,4750
46,03	101,2	0,1686	1,5001	13,75	26,6	365,75	0,1259	138,74	125,6	0,5344	1,8659	13,75	26,6	365,75	0,3793	173,87	150	0,9005	2,232	13,75	26,6	365,75	0,4754
47,69	101,6	0,1747	1,5062	13,75	26,6	365,75	0,1304	139,32	126	0,5404	1,8719	13,75	26,6	365,75	0,3809	173,94	150,4	0,9064	2,2379	13,75	26,6	365,75	0,4756
49,22	102	0,1807	1,5122	13,75	26,6	365,75	0,1346	139,59	126,4	0,5463	1,8778	13,75	26,6	365,75	0,3817	173,95	150,8	0,9123	2,2438	13,75	26,6	365,75	0,4756
50,72	102,4	0,1867	1,5182	13,75	26,6	365,75	0,1387	140,51	126,8	0,5523	1,8838	13,75	26,6	365,75	0,3842	172,84	151,2	0,9183	2,2498	13,75	26,6	365,75	0,4726
52,24	102,8	0,1926	1,5241	13,75	26,6	365,75	0,1428	141,71	127,2	0,5583	1,8898	13,75	26,6	365,75	0,3875	169,68	151,6	0,9243	2,2558	13,75	26,6	365,75	0,4639
53,87	103,2	0,1986	1,5301	13,75	26,6	365,75	0,1473	142,77	127,6	0,5643	1,8958	13,75	26,6	365,75	0,3903	170,98	152	0,9305	2,262	13,75	26,6	365,75	0,4675
55,51	103,6	0,2045	1,536	13,75	26,6	365,75	0,1518	144,02	128	0,5703	1,9018	13,75	26,6	365,75	0,3938	172,13	152,4	0,9365	2,268	13,75	26,6	365,75	0,4706
57,09	104	0,2106	1,5421	13,75	26,6	365,75	0,1561	145,13	128,4	0,5764	1,9079	13,75	26,6	365,75	0,3968	173,02	152,8	0,9425	2,274	13,75	26,6	365,75	0,4731
58,63	104,4	0,2167	1,5482	13,75	26,6	365,75	0,1603	146,18	128,8	0,5824	1,9139	13,75	26,6	365,75	0,3997	173,59	153,2	0,9484	2,2799	13,75	26,6	365,75	0,4746
60,17	104,8	0,2227	1,5542	13,75	26,6	365,75	0,1645	147,31	129,2	0,5883	1,9198	13,75	26,6	365,75	0,4028	174,02	153,6	0,9543	2,2858	13,75	26,6	365,75	0,4758
61,80	105,2	0,2286	1,5601	13,75	26,6	365,75	0,1690	148,52	129,6	0,5942	1,9257	13,75	26,6	365,75	0,4061	174,38	154	0,9603	2,2918	13,75	26,6	365,75	0,4768
63,55	105,6	0,2346	1,5661	13,75	26,6	365,75	0,1738	149,75	130	0,6002	1,9317	13,75	26,6	365,75	0,4094	174,92	154,4	0,9663	2,2978	13,75	26,6	365,75	0,4783
65,27	106	0,2405	1,572	13,75	26,6	365,75	0,1785	151,03	130,4	0,6062	1,9377	13,75	26,6	365,75	0,4129	175,33	154,8	0,9725	2,304	13,75	26,6	365,75	0,4794
66,97	106,4	0,2465	1,578	13,75	26,6	365,75	0,1831	152,35	130,8	0,6123	1,9438	13,75	26,6	365,75	0,4165	175,58	155,2	0,9785	2,31	13,75	26,6	365,75	0,4801
68,77	106,8	0,2526	1,5841	13,75	26,6	365,75	0,1880	153,52	131,2	0,6184	1,9499	13,75	26,6	365,75	0,4197	175,81	155,6	0,9844	2,3159	13,75	26,6	365,75	0,4807
70,43	107,2	0,2587	1,5902	13,75	26,6	365,75	0,1926	154,46	131,6	0,6244	1,9559	13,75	26,6	365,75	0,4223	176,11	156	0,9904	2,3219	13,75	26,6	365,75	0,4815
72,08	107,6	0,2646	1,5961	13,75	26,6	365,75	0,1971	155,52	132	0,6303	1,9618	13,75	26,6	365,75	0,4252	176,54	156,4	0,9963	2,3278	13,75	26,6	365,75	0,4827
73,69	108	0,2705	1,602	13,75	26,6	365,75	0,2015	156,53	132,4	0,6362	1,9677	13,75	26,6	365,75	0,4280	176,91	156,8	1,0023	2,3338	13,75	26,6	365,75	0,4837
75,35	108,4	0,2765	1,608	13,75	26,6	365,75	0,2060	157,49	132,8	0,6423	1,9738	13,75	26,6	365,75	0,4306	177,29	157,2	1,0084	2,3399	13,75	26,6	365,75	0,4847
77,05	108,8	0,2825	1,614	13,75	26,6	365,75	0,2107	158,61	133,2	0,6484	1,9799	13,75	26,6	365,75	0,4337	177,39	157,6	1,0145	2,346	13,75	26,6	365,75	0,4850
78,87	109,2	0,2885	1,62	13,75	26,6	365,75	0,2156	159,46	133,6	0,6545	1,986	13,75	26,6	365,75	0,4360	177,24	158	1,0205	2,352	13,75	26,6	365,75	0,4846
80,58	109,6	0,2946	1,6261	13,75	26,6	365,75	0,2203	160,29	134	0,6605	1,992	13,75	26,6	365,75	0,4383	176,90	158,4	1,0264	2,3579	13,75	26,6	365,75	0,4837
82,12	110	0,3007	1,6322	13,75	26,6	365,75	0,2245	161,10	134,4	0,6664	1,9979	13,75	26,6	365,75	0,4405	175,69	158,8	1,0324	2,3639	13,75	26,6	365,75	0,4804
83,62	110,4	0,3066	1,6381	13,75	26,6	365,75	0,2286	161,99	134,8	0,6724	2,0039	13,75	26,6	365,75	0,4429	174,87	159,2	1,0383	2,3698	13,75	26,6	365,75	0,4781
85,22	110,8	0,3125	1,644	13,75	26,6	365,75	0,2330	162,73	135,2	0,6784	2,0099	13,75	26,6	365,75	0,4449	174,30	159,6	1,0443	2,3758	13,75	26,6	365,75	0,4766
86,76	111,2	0,3185	1,65	13,75	26,6	365,75	0,2372	163,53	135,6	0,6844	2,0159	13,75	26,6	365,75	0,4471	173,97	160	1,0505	2,382	13,75	26,6	365,75	0,4757
88,10	111,6	0,3245	1,656	13,75	26,6	365,75	0,2409	164,10	136	0,6905	2,022	13,75	26,6	365,75	0,4487	173,63	160,4	1,0565	2,388	13,75	26,6	365,75	0,4747
89,55	112	0,3306	1,6621	13,75	26,6	365,75	0,2448	164,67	136,4	0,6966	2,0281	13,75	26,6	365,75	0,4502	173,22	160,8	1,0625	2,394	13,75	26,6	365,75	0,4736
91,02	112,4	0,3366	1,6681	13,75	26,6	365,75	0,2489	164,77	136,8	0,7025	2,034	13,75	26,6	365,75	0,4505	172,67	161,2	1,0684	2,3999	13,75	26,6	365,75	0,4721
92,32	112,8	0,3426	1,6741	13,75	26,6	365,75	0,2524	165,16	137,2	0,7085	2,04	13,75	26,6	365,75	0,4516	172,45	161,6	1,0744	2,4059	13,75	26,6	365,75	0,4715
93,73	113,2	0,3486	1,6801	13,75	26,6	365,75	0,2563	165,67	137,6	0,7144	2,0459	13,75	26,6	365,75	0,4530	172,29	162	1,0804	2,4119	13,75	26,6	365,75	0,4711
95,29	113,6	0,3545	1,686	13,75	26,6	365,75	0,2605	165,98	138	0,7204	2,0519	13,75	26,6	365,75	0,4538	172,25	162,4	1,0864	2,4179	13,75	26,6	365,75	0,4710
96,90	114	0,3605	1,692	13,75	26,6	365,75	0,2649	166,33	138,4	0,7264	2,0579	13,75	26,6	365,75	0,4548	172,07	162,8	1,0925	2,424	13,75	26,6	365,75	0,4705
98,75	114,4	0,3665	1,698	13,75	26,6	365,75	0,2700	166,70	138,8	0,7326	2,0641	13,75	26,6	365,75	0,4558	171,85	163,2	1,0985	2,43	13,75	26,6	365,75	0,4699
100,54	114,8	0,3727	1,7042	13,75	26,6	365,75	0,2749	166,98	139,2	0,7386	2,0701	13,75	26,6	365,75	0,4565	171,67	163,6	1,1045	2,436	13,75	26,6	365,75	0,4694
102,19	115,2	0,3787	1,7102	13,75	26,6	365,75	0,2794	167,25	139,6	0,7445	2,076	13,75	26,6	365,75	0,4573	171,45	164	1,1104	2,4419	13,75	26,6	365,75	0,4688
103,71	115,6	0,3846	1,7161	13,75	26,6	365,75	0,2836	167,62	140	0,7505	2,082	13,75	26,6	365,75	0,4583	171,30	164,4	1,1164	2,4479	13,75	26,6	365,75	0,4684
105,30	116	0,3906	1,7221	13,75	26,6	365,75	0,2879	168,01	140,4	0,7564	2,0879	13,75	26,6	365,75	0,4594	171,17	164,8	1,1224	2,4539	13,75	26,6	365,75	0,4680
106,90	116,4	0,3965	1,728	13,75	26,6	365,75	0,2923	168,50	140,8	0,7624	2,0939	13,75	26,6	365,75	0,4607	171,21	165,2	1,1285	2,46	13,75	26,6	365,75	0,4681
108,62	116,8	0,4025	1,734	13,75	26,6	365,75	0,2970	169,03	141,2	0,7685	2,1	13,75	26,6	365,75	0,4621	171,04	165,6	1,1345	2,466	13,75	26,6	365,75	0,4676
110,44	117,2	0,4086	1,7401	13,75	26,6	365,75	0,3020	169,55	141,6	0,7746	2,1061	13,75	26,6	365,75	0,4636	170,93	166	1,1405	2,472	13,75	26,6	365,75	0,4673
112,38	117,6	0,4147	1,7462	13,75	26,6	365,75	0,3073	169,99	142	0,7806	2,1121	13,75	26,6	365,75	0,4648	170,93	166,4	1,1465	2,478	13,75	26,6	365,75	0,4673
114,09	118	0,4207	1,7522	13,75	26,6	365,75	0,3119	170,31	142,4	0,7865	2,118	13,75	26,6	365,75	0,4656	171,01	166,8	1,1524	2,4839	13,75	26,6	365,75	0,4676
115,55	118,4	0,4266	1,7581	13,75	26,6	365,75	0,3159	170,58	142,8	0,7924	2,1239	13,75	26,6	365,75	0,4664	171,19	167,2	1,1584	2,4899	13,75	26,6	365,75	0,4681
117,09	118,8	0,4326	1,7641	13,75	26,6	365,75	0,3201	170,90	143,2	0,7983	2,1298	13,75	26,6	365,75	0,4673	171,25	167,6	1,1644	2,4959	13,75	26,6	365,75	0,4682
118,36	119,2	0,4385	1,77	13,75	26,6	365,75	0,3236	171,35	143,6	0,8044	2,1359	13,75	26,6	365,75	0,4685	171,40	168	1,1705	2,502	13,75	26,6	365,75	0,4686
119,80	119,6	0,4445	1,776	13,75	26,6	365,75	0,3275	171,86	144	0,8105	2,142	13,75	26,6	365,75	0,4699	171,46	168,4	1,1766	2,5081	13,75	26,6	365,75	0,4688
121,21	120	0,4506	1,7821	13,75	26,6	365,75	0,3314	172,10	144,4	0,8166	2,1481	13,75	26,6	365,75	0,4705	171,40	168,8	1,1825	2,514	13,75	26,6	365,75	0,4686
122,53	120,4	0,4566	1,7881	13,75	26,6	365,75	0,3350	172,20	144,8	0,8226	2,1541	13,75	26,6	365,75	0,4708	171,50	169,2	1,1884	2,5199	13,75	26,6	365,75	0,4689
123,77	120,8	0,4626	1,7941	13,75	26,6	365,75	0,3384	172,25	145,2	0,8285	2,16	13,75	26,6	365,75	0,4710	171,41	169,6	1,1943	2,5258	13,75	26,6	365,75	0,4687
125,12	121,2	0,4685	1,8	13,75	26,6	365,75	0,3421	172,43	145,6	0,8344	2,1659	13,75	26,6	365,75	0,4714	171,53	170	1,2003	2,5318	13,75	26,6	365,75	0,4690
126,66	121,6	0,4745	1,806	13,75	26,6	365,75	0,3463	172,51	146	0,8404	2,1719	13,75	26,6	365,75	0,4717	171,77	170,4	1,2064	2,5379	13,75	26,6	365,75	0,4696
128,02	122	0,4804	1,8119	13,75	26,6	365,75	0,3500	172,63	146,4	0,8464	2,1779	13,75	26,6	365,75	0,4720	171,85	170,8	1,2125	2,544	13,75	26,6	365,75	0,4699
129,35	122,4	0,4864	1,8179	13,75	26,6	365,75	0,3537	172,77	146,8	0,8525	2,184	13,75	26,6	365,75	0,4724	171,87	171,2	1,2185	2,55	13,75	26,6	365,75	0,4699
130,73	122,8	0,4925	1,824	13,75	26,6	365,75	0,3574	172,81	147,2	0,8585	2,19	13,75	26,6	365,75	0,4725	171,88	171,6	1,2244	2,5559	13,75	26,6	365,75	0,4699

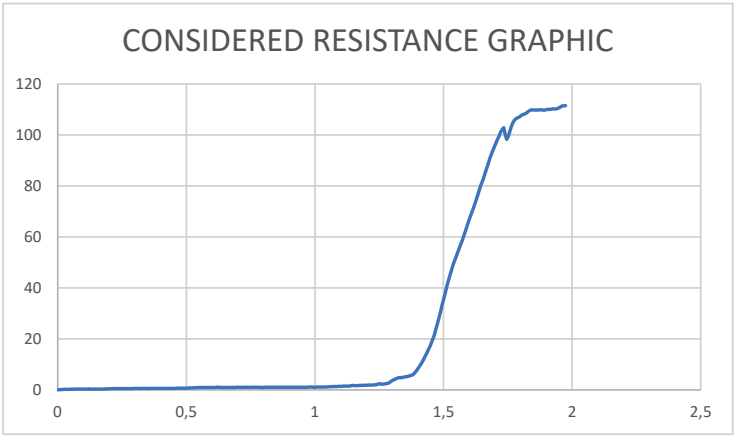
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
171,78	172	1,2303	2,5618	13,75	26,6	365,75	0,4697	186,64	196,4	1,5963	2,9278	13,75	26,6	365,75	0,5103	195,15	220,8	1,9622	3,2937	13,75	26,6	365,75	0,5336
171,59	172,4	1,2363	2,5678	13,75	26,6	365,75	0,4691	186,95	196,8	1,6023	2,9338	13,75	26,6	365,75	0,5111	195,46	221,2	1,9683	3,2998	13,75	26,6	365,75	0,5344
171,65	172,8	1,2423	2,5738	13,75	26,6	365,75	0,4693	187,41	197,2	1,6084	2,9399	13,75	26,6	365,75	0,5124	195,28	221,6	1,9744	3,3059	13,75	26,6	365,75	0,5339
171,59	173,2	1,2484	2,5799	13,75	26,6	365,75	0,4691	187,62	197,6	1,6145	2,946	13,75	26,6	365,75	0,5130	195,04	222	1,9804	3,3119	13,75	26,6	365,75	0,5333
171,40	173,6	1,2545	2,586	13,75	26,6	365,75	0,4686	187,60	198	1,6205	2,952	13,75	26,6	365,75	0,5129	194,69	222,4	1,9863	3,3178	13,75	26,6	365,75	0,5323
170,95	174	1,2605	2,592	13,75	26,6	365,75	0,4674	187,86	198,4	1,6264	2,9579	13,75	26,6	365,75	0,5136	194,72	222,8	1,9922	3,3237	13,75	26,6	365,75	0,5324
170,66	174,4	1,2664	2,5979	13,75	26,6	365,75	0,4666	188,09	198,8	1,6324	2,9639	13,75	26,6	365,75	0,5143	195,02	223,2	1,9982	3,3297	13,75	26,6	365,75	0,5332
170,62	174,8	1,2723	2,6038	13,75	26,6	365,75	0,4665	188,56	199,2	1,6384	2,9699	13,75	26,6	365,75	0,5155	195,18	223,6	2,0043	3,3358	13,75	26,6	365,75	0,5336
170,75	175,2	1,2783	2,6098	13,75	26,6	365,75	0,4668	188,93	199,6	1,6444	2,9759	13,75	26,6	365,75	0,5166	195,60	224	2,0104	3,3419	13,75	26,6	365,75	0,5348
170,75	175,6	1,2843	2,6158	13,75	26,6	365,75	0,4668	189,06	200	1,6505	2,982	13,75	26,6	365,75	0,5169	195,77	224,4	2,0165	3,348	13,75	26,6	365,75	0,5353
170,92	176	1,2904	2,6219	13,75	26,6	365,75	0,4673	189,15	200,4	1,6565	2,988	13,75	26,6	365,75	0,5172	195,99	224,8	2,0224	3,3539	13,75	26,6	365,75	0,5359
171,03	176,4	1,2965	2,628	13,75	26,6	365,75	0,4676	189,07	200,8	1,6624	2,9939	13,75	26,6	365,75	0,5169	196,26	225,2	2,0283	3,3598	13,75	26,6	365,75	0,5366
171,39	176,8	1,3025	2,634	13,75	26,6	365,75	0,4686	189,07	201,2	1,6684	2,9999	13,75	26,6	365,75	0,5169	196,61	225,6	2,0343	3,3658	13,75	26,6	365,75	0,5376
171,78	177,2	1,3083	2,6398	13,75	26,6	365,75	0,4697	189,13	201,6	1,6743	3,0058	13,75	26,6	365,75	0,5171	196,80	226	2,0403	3,3718	13,75	26,6	365,75	0,5381
172,43	177,6	1,3143	2,6458	13,75	26,6	365,75	0,4714	189,23	202	1,6803	3,0118	13,75	26,6	365,75	0,5174	197,08	226,4	2,0464	3,3779	13,75	26,6	365,75	0,5388
172,78	178	1,3202	2,6517	13,75	26,6	365,75	0,4724	189,45	202,4	1,6864	3,0179	13,75	26,6	365,75	0,5180	197,30	226,8	2,0525	3,384	13,75	26,6	365,75	0,5394
173,55	178,4	1,3263	2,6578	13,75	26,6	365,75	0,4745	189,64	202,8	1,6925	3,024	13,75	26,6	365,75	0,5185	197,44	227,2	2,0585	3,39	13,75	26,6	365,75	0,5398
173,77	178,8	1,3324	2,6639	13,75	26,6	365,75	0,4751	189,69	203,2	1,6985	3,03	13,75	26,6	365,75	0,5186	197,32	227,6	2,0644	3,3959	13,75	26,6	365,75	0,5395
174,19	179,2	1,3385	2,67	13,75	26,6	365,75	0,4763	189,60	203,6	1,7044	3,0359	13,75	26,6	365,75	0,5184	197,40	228	2,0704	3,4019	13,75	26,6	365,75	0,5397
174,39	179,6	1,3444	2,6759	13,75	26,6	365,75	0,4768	189,59	204	1,7103	3,0418	13,75	26,6	365,75	0,5184	197,40	228,4	2,0764	3,4079	13,75	26,6	365,75	0,5397
174,72	180	1,3503	2,6818	13,75	26,6	365,75	0,4777	189,69	204,4	1,7163	3,0478	13,75	26,6	365,75	0,5186	197,57	228,8	2,0823	3,4138	13,75	26,6	365,75	0,5402
174,81	180,4	1,3563	2,6878	13,75	26,6	365,75	0,4779	189,68	204,8	1,7223	3,0538	13,75	26,6	365,75	0,5186	197,81	229,2	2,0885	3,42	13,75	26,6	365,75	0,5408
175,37	180,8	1,3623	2,6938	13,75	26,6	365,75	0,4795	189,78	205,2	1,7284	3,0599	13,75	26,6	365,75	0,5189	197,99	229,6	2,0946	3,4261	13,75	26,6	365,75	0,5413
175,98	181,2	1,3684	2,6999	13,75	26,6	365,75	0,4811	189,86	205,6	1,7344	3,0659	13,75	26,6	365,75	0,5191	197,96	230	2,1005	3,432	13,75	26,6	365,75	0,5412
176,38	181,6	1,3745	2,706	13,75	26,6	365,75	0,4822	189,81	206	1,7404	3,0719	13,75	26,6	365,75	0,5190	197,79	230,4	2,1064	3,4379	13,75	26,6	365,75	0,5408
176,81	182	1,3804	2,7119	13,75	26,6	365,75	0,4834	189,81	206,4	1,7463	3,0778	13,75	26,6	365,75	0,5190	197,78	230,8	2,1124	3,4439	13,75	26,6	365,75	0,5408
176,96	182,4	1,3863	2,7178	13,75	26,6	365,75	0,4838	189,94	206,8	1,7523	3,0838	13,75	26,6	365,75	0,5193	197,81	231,2	2,1184	3,4499	13,75	26,6	365,75	0,5408
177,27	182,8	1,3923	2,7238	13,75	26,6	365,75	0,4847	190,04	207,2	1,7582	3,0897	13,75	26,6	365,75	0,5196	197,83	231,6	2,1244	3,4559	13,75	26,6	365,75	0,5409
177,54	183,2	1,3983	2,7298	13,75	26,6	365,75	0,4854	190,30	207,6	1,7643	3,0958	13,75	26,6	365,75	0,5203	197,78	232	2,1305	3,462	13,75	26,6	365,75	0,5408
177,89	183,6	1,4043	2,7358	13,75	26,6	365,75	0,4864	190,58	208	1,7704	3,1019	13,75	26,6	365,75	0,5211	197,68	232,4	2,1366	3,4681	13,75	26,6	365,75	0,5405
178,26	184	1,4104	2,7419	13,75	26,6	365,75	0,4874	190,75	208,4	1,7764	3,1079	13,75	26,6	365,75	0,5215	197,71	232,8	2,1425	3,474	13,75	26,6	365,75	0,5406
178,57	184,4	1,4165	2,748	13,75	26,6	365,75	0,4882	190,66	208,8	1,7823	3,1138	13,75	26,6	365,75	0,5213	197,70	233,2	2,1484	3,4799	13,75	26,6	365,75	0,5405
178,78	184,8	1,4224	2,7539	13,75	26,6	365,75	0,4888	190,67	209,2	1,7883	3,1198	13,75	26,6	365,75	0,5213	197,80	233,6	2,1544	3,4859	13,75	26,6	365,75	0,5408
178,80	185,2	1,4283	2,7598	13,75	26,6	365,75	0,4889	190,96	209,6	1,7942	3,1257	13,75	26,6	365,75	0,5221	198,05	234	2,1603	3,4918	13,75	26,6	365,75	0,5415
179,14	185,6	1,4343	2,7658	13,75	26,6	365,75	0,4898	191,16	210	1,8002	3,1317	13,75	26,6	365,75	0,5227	198,20	234,4	2,1664	3,4979	13,75	26,6	365,75	0,5419
179,45	186	1,4403	2,7718	13,75	26,6	365,75	0,4906	191,32	210,4	1,8063	3,1378	13,75	26,6	365,75	0,5231	198,46	234,8	2,1725	3,504	13,75	26,6	365,75	0,5426
179,77	186,4	1,4464	2,7779	13,75	26,6	365,75	0,4915	191,21	210,8	1,8123	3,1438	13,75	26,6	365,75	0,5228	198,51	235,2	2,1785	3,51	13,75	26,6	365,75	0,5427
180,17	186,8	1,4525	2,784	13,75	26,6	365,75	0,4926	191,36	211,2	1,8184	3,1499	13,75	26,6	365,75	0,5232	198,37	235,6	2,1845	3,516	13,75	26,6	365,75	0,5424
180,48	187,2	1,4586	2,7901	13,75	26,6	365,75	0,4935	191,42	211,6	1,8243	3,1558	13,75	26,6	365,75	0,5234	198,57	236	2,1904	3,5219	13,75	26,6	365,75	0,5429
180,66	187,6	1,4645	2,796	13,75	26,6	365,75	0,4939	191,55	212	1,8302	3,1617	13,75	26,6	365,75	0,5237	198,59	236,4	2,1964	3,5279	13,75	26,6	365,75	0,5430
180,84	188	1,4704	2,8019	13,75	26,6	365,75	0,4944	191,68	212,4	1,8362	3,1677	13,75	26,6	365,75	0,5241	198,62	236,8	2,2023	3,5338	13,75	26,6	365,75	0,5430
181,22	188,4	1,4764	2,8079	13,75	26,6	365,75	0,4955	191,79	212,8	1,8422	3,1737	13,75	26,6	365,75	0,5244	198,59	237,2	2,2084	3,5399	13,75	26,6	365,75	0,5430
181,55	188,8	1,4824	2,8139	13,75	26,6	365,75	0,4964	192,15	213,2	1,8483	3,1798	13,75	26,6	365,75	0,5254	198,43	237,6	2,2145	3,546	13,75	26,6	365,75	0,5425
182,08	189,2	1,4885	2,82	13,75	26,6	365,75	0,4978	192,56	213,6	1,8543	3,1858	13,75	26,6	365,75	0,5265	198,36	238	2,2205	3,552	13,75	26,6	365,75	0,5423
182,61	189,6	1,4946	2,8261	13,75	26,6	365,75	0,4993	192,58	214	1,8603	3,1918	13,75	26,6	365,75	0,5265	198,20	238,4	2,2264	3,5579	13,75	26,6	365,75	0,5419
182,87	190	1,5005	2,832	13,75	26,6	365,75	0,5000	192,57	214,4	1,8662	3,1977	13,75	26,6	365,75	0,5265	198,17	238,8	2,2323	3,5638	13,75	26,6	365,75	0,5418
183,12	190,4	1,5064	2,8379	13,75	26,6	365,75	0,5007	192,98	214,8	1,8721	3,2036	13,75	26,6	365,75	0,5276	198,27	239,2	2,2384	3,5699	13,75	26,6	365,75	0,5421
183,48	190,8	1,5124	2,8439	13,75	26,6	365,75	0,5017	193,29	215,2	1,8781	3,2096	13,75	26,6	365,75	0,5285	198,46	239,6	2,2444	3,5759	13,75	26,6	365,75	0,5426
183,74	191,2	1,5183	2,8498	13,75	26,6	365,75	0,5024	193,65	215,6	1,8842	3,2157	13,75	26,6	365,75	0,5295	198,69	240	2,2505	3,582	13,75	26,6	365,75	0,5432
184,17	191,6	1,5244	2,8559	13,75	26,6	365,75	0,5035	194,13	216	1,8903	3,2218	13,75	26,6	365,75	0,5308	198,81	240,4	2,2565	3,588	13,75	26,6	365,75	0,5436
184,58	192	1,5305	2,862	13,75	26,6	365,75	0,5047	194,09	216,4	1,8963	3,2278	13,75	26,6	365,75	0,5307	199,08	240,8	2,2625	3,594	13,75	26,6	365,75	0,5443
184,78	192,4	1,5366	2,8681	13,75	26,6	365,75	0,5052	193,93	216,8	1,9023	3,2338	13,75	26,6	365,75	0,5302	199,40	241,2	2,2684	3,5999	13,75	26,6	365,75	0,5452
184,93	192,8	1,5425	2,874	13,75	26,6	365,75	0,5056	193,96	217,2	1,9082	3,2397	13,75	26,6	365,75	0,5303	199,72	241,6	2,2744	3,6059	13,75	26,6	365,75	0,5461
185,11	193,2	1,5484	2,8799	13,75	26,6	365,75	0,5061	193,98	217,6	1,9141	3,2456	13,75	26,6	365,75	0,5304	200,05	242	2,2803	3,6118	13,75	26,6	365,75	0,5470
185,32	193,6	1,5544	2,8859	13,75	26,6	365,75	0,5067	194,04	218	1,9201	3,2516	13,75	26,6	365,75	0,5305	200,50	242,4	2,2864	3,6179	13,75	26,6	365,75	0,5482
185,68	194	1,5603	2,8918	13,75	26,6	365,75	0,5077	194,35	218,4	1,9262	3,2577	13,75	26,6	365,75	0,5314	200,86	242,8	2,2925	3,624	13,75	26,6	365,75	0,5492
185,94	194,4	1,5664	2,8979	13,75	26,6	365,75	0,5084	194,46	218,8	1,9323	3,2638	13,75	26,6	365,75	0,5317	201,13	243,2	2,2985	3,63	13,75	26,6	365,75	0,5499
186,20	194,8	1,5725	2,904	13,75	26,6	365,75	0,5091	194,61	219,2	1,9383	3,2698	13,75	26,6	365,75	0,5321	201,40	243,6	2,3044	3,6359	13,75	26,6	365,75	0,5506
186,25	195,2	1,5785	2,91	13,75	26,6	365,75	0,5092	194,77	219,6	1,9443	3,2758	13,75	26,6	365,75	0,5325	201,87	244	2,3104	3,6419	13,75	26,6	365,75	0,5519
186,16	195,6	1,5845	2,916	13,75	26,6	365,75	0,5090	194,78	220	1,9502	3,2817	13,75	26,6	365,75	0,5325	202,30	244,4	2,3163	3,6478	13,75	26,6	365,75	0,5531
186,35	196	1,5904	2,9219	13,75	26,6	365,75	0,5095	194,91	220,4	1,9562	3,2877	13,75	26,6	365,75	0,5329	202,61	244,8	2,3224	3,6539	13,75	26,6	365,75	0,5540

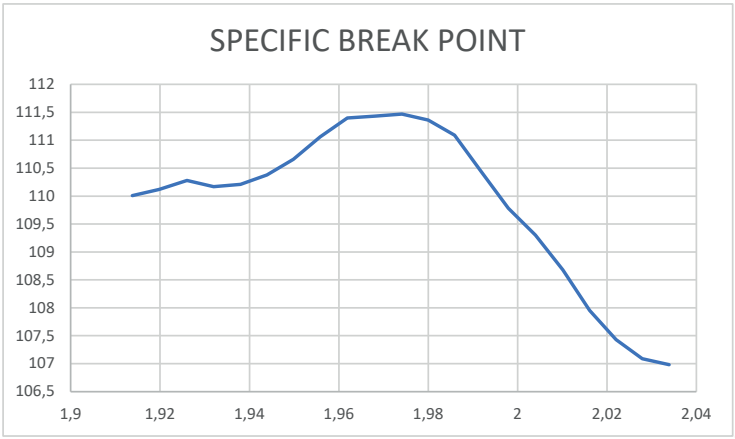
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
203,05	245,2	2,3285	3,66	13,75	26,6	365,75	0,5552	207,18	269,6	2,6946	4,0261	13,75	26,6	365,75	0,5665	222,42	294	3,0603	4,3918	13,75	26,6	365,75	0,6081
203,39	245,6	2,3345	3,666	13,75	26,6	365,75	0,5561	207,33	270	2,7005	4,032	13,75	26,6	365,75	0,5669	222,71	294,4	3,0663	4,3978	13,75	26,6	365,75	0,6089
203,56	246	2,3405	3,672	13,75	26,6	365,75	0,5566	207,58	270,4	2,7064	4,0379	13,75	26,6	365,75	0,5675	223,09	294,8	3,0722	4,4037	13,75	26,6	365,75	0,6100
203,49	246,4	2,3464	3,6779	13,75	26,6	365,75	0,5564	207,91	270,8	2,7124	4,0439	13,75	26,6	365,75	0,5684	223,49	295,2	3,0782	4,4097	13,75	26,6	365,75	0,6110
203,58	246,8	2,3523	3,6838	13,75	26,6	365,75	0,5566	208,30	271,2	2,7183	4,0498	13,75	26,6	365,75	0,5695	223,86	295,6	3,0842	4,4157	13,75	26,6	365,75	0,6121
203,75	247,2	2,3583	3,6898	13,75	26,6	365,75	0,5571	208,86	271,6	2,7244	4,0559	13,75	26,6	365,75	0,5710	224,18	296	3,0903	4,4218	13,75	26,6	365,75	0,6129
203,81	247,6	2,3643	3,6958	13,75	26,6	365,75	0,5572	209,31	272	2,7305	4,062	13,75	26,6	365,75	0,5723	224,52	296,4	3,0963	4,4278	13,75	26,6	365,75	0,6139
203,86	248	2,3704	3,7019	13,75	26,6	365,75	0,5574	209,35	272,4	2,7366	4,0681	13,75	26,6	365,75	0,5724	224,60	296,8	3,1022	4,4337	13,75	26,6	365,75	0,6141
203,80	248,4	2,3765	3,708	13,75	26,6	365,75	0,5572	209,59	272,8	2,7425	4,074	13,75	26,6	365,75	0,5730	224,73	297,2	3,1081	4,4396	13,75	26,6	365,75	0,6144
203,68	248,8	2,3824	3,7139	13,75	26,6	365,75	0,5569	209,75	273,2	2,7484	4,0799	13,75	26,6	365,75	0,5735	225,01	297,6	3,1141	4,4456	13,75	26,6	365,75	0,6152
203,58	249,2	2,3883	3,7198	13,75	26,6	365,75	0,5566	210,16	273,6	2,7543	4,0858	13,75	26,6	365,75	0,5746	225,31	298	3,1201	4,4516	13,75	26,6	365,75	0,6160
203,55	249,6	2,3943	3,7258	13,75	26,6	365,75	0,5565	210,24	274	2,7603	4,0918	13,75	26,6	365,75	0,5748	225,85	298,4	3,1262	4,4577	13,75	26,6	365,75	0,6175
203,62	250	2,4003	3,7318	13,75	26,6	365,75	0,5567	210,71	274,4	2,7664	4,0979	13,75	26,6	365,75	0,5761	226,17	298,8	3,1323	4,4638	13,75	26,6	365,75	0,6184
203,81	250,4	2,4063	3,7378	13,75	26,6	365,75	0,5572	210,96	274,8	2,7725	4,104	13,75	26,6	365,75	0,5768	226,52	299,2	3,1383	4,4698	13,75	26,6	365,75	0,6193
204,02	250,8	2,4124	3,7439	13,75	26,6	365,75	0,5578	211,26	275,2	2,7785	4,11	13,75	26,6	365,75	0,5776	226,67	299,6	3,1441	4,4756	13,75	26,6	365,75	0,6197
203,98	251,2	2,4184	3,7499	13,75	26,6	365,75	0,5577	211,38	275,6	2,7844	4,1159	13,75	26,6	365,75	0,5779	226,86	300	3,1501	4,4816	13,75	26,6	365,75	0,6203
203,72	251,6	2,4243	3,7558	13,75	26,6	365,75	0,5570	211,81	276	2,7903	4,1218	13,75	26,6	365,75	0,5791	227,21	300,4	3,156	4,4875	13,75	26,6	365,75	0,6212
203,64	252	2,4302	3,7617	13,75	26,6	365,75	0,5568	212,15	276,4	2,7963	4,1278	13,75	26,6	365,75	0,5800	227,57	300,8	3,1621	4,4936	13,75	26,6	365,75	0,6222
203,58	252,4	2,4362	3,7677	13,75	26,6	365,75	0,5566	212,61	276,8	2,8023	4,1338	13,75	26,6	365,75	0,5813	228,05	301,2	3,1682	4,4997	13,75	26,6	365,75	0,6235
203,62	252,8	2,4421	3,7736	13,75	26,6	365,75	0,5567	213,20	277,2	2,8085	4,14	13,75	26,6	365,75	0,5829	228,37	301,6	3,1742	4,5057	13,75	26,6	365,75	0,6244
203,77	253,2	2,4482	3,7797	13,75	26,6	365,75	0,5571	213,60	277,6	2,8145	4,146	13,75	26,6	365,75	0,5840	228,63	302	3,1802	4,5117	13,75	26,6	365,75	0,6251
203,93	253,6	2,4543	3,7858	13,75	26,6	365,75	0,5576	213,94	278	2,8205	4,152	13,75	26,6	365,75	0,5849	228,91	302,4	3,1861	4,5176	13,75	26,6	365,75	0,6259
203,99	254	2,4603	3,7918	13,75	26,6	365,75	0,5577	214,26	278,4	2,8264	4,1579	13,75	26,6	365,75	0,5858	229,35	302,8	3,1921	4,5236	13,75	26,6	365,75	0,6271
203,77	254,4	2,4662	3,7977	13,75	26,6	365,75	0,5571	214,69	278,8	2,8323	4,1638	13,75	26,6	365,75	0,5870	229,61	303,2	3,198	4,5295	13,75	26,6	365,75	0,6278
204,00	254,8	2,4721	3,8036	13,75	26,6	365,75	0,5578	214,99	279,2	2,8383	4,1698	13,75	26,6	365,75	0,5878	230,13	303,6	3,2041	4,5356	13,75	26,6	365,75	0,6292
204,16	255,2	2,4781	3,8096	13,75	26,6	365,75	0,5582	215,34	279,6	2,8444	4,1759	13,75	26,6	365,75	0,5888	230,61	304	3,2102	4,5417	13,75	26,6	365,75	0,6305
204,33	255,6	2,4842	3,8157	13,75	26,6	365,75	0,5587	216,00	280	2,8505	4,182	13,75	26,6	365,75	0,5906	230,65	304,4	3,2163	4,5478	13,75	26,6	365,75	0,6306
204,48	256	2,4903	3,8218	13,75	26,6	365,75	0,5591	216,13	280,4	2,8565	4,188	13,75	26,6	365,75	0,5909	230,76	304,8	3,2222	4,5537	13,75	26,6	365,75	0,6309
204,61	256,4	2,4963	3,8278	13,75	26,6	365,75	0,5594	216,10	280,8	2,8625	4,194	13,75	26,6	365,75	0,5908	230,84	305,2	3,2281	4,5596	13,75	26,6	365,75	0,6311
204,50	256,8	2,5022	3,8337	13,75	26,6	365,75	0,5591	216,41	281,2	2,8684	4,1999	13,75	26,6	365,75	0,5917	231,05	305,6	3,2341	4,5656	13,75	26,6	365,75	0,6317
204,31	257,2	2,5082	3,8397	13,75	26,6	365,75	0,5586	216,66	281,6	2,8744	4,2059	13,75	26,6	365,75	0,5924	231,14	306	3,2401	4,5716	13,75	26,6	365,75	0,6320
204,33	257,6	2,5141	3,8456	13,75	26,6	365,75	0,5587	216,94	282	2,8803	4,2118	13,75	26,6	365,75	0,5931	231,35	306,4	3,2462	4,5777	13,75	26,6	365,75	0,6325
204,31	258	2,5201	3,8516	13,75	26,6	365,75	0,5586	217,42	282,4	2,8864	4,2179	13,75	26,6	365,75	0,5944	231,50	306,8	3,2523	4,5838	13,75	26,6	365,75	0,6329
204,38	258,4	2,5262	3,8577	13,75	26,6	365,75	0,5588	217,81	282,8	2,8925	4,224	13,75	26,6	365,75	0,5955	231,56	307,2	3,2583	4,5898	13,75	26,6	365,75	0,6331
204,41	258,8	2,5323	3,8638	13,75	26,6	365,75	0,5589	218,01	283,2	2,8985	4,23	13,75	26,6	365,75	0,5961	231,58	307,6	3,2642	4,5957	13,75	26,6	365,75	0,6332
204,33	259,2	2,5383	3,8698	13,75	26,6	365,75	0,5587	218,42	283,6	2,9045	4,236	13,75	26,6	365,75	0,5972	231,76	308	3,2702	4,6017	13,75	26,6	365,75	0,6337
204,17	259,6	2,5442	3,8757	13,75	26,6	365,75	0,5582	218,98	284	2,9104	4,2419	13,75	26,6	365,75	0,5987	231,92	308,4	3,2762	4,6077	13,75	26,6	365,75	0,6341
204,26	260	2,5502	3,8817	13,75	26,6	365,75	0,5585	219,38	284,4	2,9164	4,2479	13,75	26,6	365,75	0,5998	232,12	308,8	3,2822	4,6137	13,75	26,6	365,75	0,6346
204,44	260,4	2,5561	3,8876	13,75	26,6	365,75	0,5590	219,59	284,8	2,9224	4,2539	13,75	26,6	365,75	0,6004	232,38	309,2	3,2883	4,6198	13,75	26,6	365,75	0,6354
204,47	260,8	2,5622	3,8937	13,75	26,6	365,75	0,5590	219,84	285,2	2,9285	4,26	13,75	26,6	365,75	0,6011	232,56	309,6	3,2944	4,6259	13,75	26,6	365,75	0,6358
204,71	261,2	2,5683	3,8998	13,75	26,6	365,75	0,5597	220,01	285,6	2,9346	4,2661	13,75	26,6	365,75	0,6015	232,63	310	3,3003	4,6318	13,75	26,6	365,75	0,6360
204,73	261,6	2,5744	3,9059	13,75	26,6	365,75	0,5598	220,06	286	2,9405	4,272	13,75	26,6	365,75	0,6017	232,75	310,4	3,3063	4,6378	13,75	26,6	365,75	0,6364
204,92	262	2,5804	3,9119	13,75	26,6	365,75	0,5603	220,26	286,4	2,9465	4,278	13,75	26,6	365,75	0,6022	232,99	310,8	3,3123	4,6438	13,75	26,6	365,75	0,6370
204,78	262,4	2,5863	3,9178	13,75	26,6	365,75	0,5599	220,49	286,8	2,9524	4,2839	13,75	26,6	365,75	0,6028	233,15	311,2	3,3183	4,6498	13,75	26,6	365,75	0,6375
204,70	262,8	2,5923	3,9238	13,75	26,6	365,75	0,5597	220,73	287,2	2,9584	4,2899	13,75	26,6	365,75	0,6035	233,29	311,6	3,3243	4,6558	13,75	26,6	365,75	0,6378
204,80	263,2	2,5983	3,9298	13,75	26,6	365,75	0,5599	220,83	287,6	2,9644	4,2959	13,75	26,6	365,75	0,6038	233,03	312	3,3305	4,662	13,75	26,6	365,75	0,6371
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205,12	264	2,6104	3,9419	13,75	26,6	365,75	0,5608	220,98	288,4	2,9766	4,3081	13,75	26,6	365,75	0,6042	232,95	312,8	3,3424	4,6739	13,75	26,6	365,75	0,6369
205,30	264,4	2,6165	3,948	13,75	26,6	365,75	0,5613	220,93	288,8	2,9825	4,314	13,75	26,6	365,75	0,6040	232,91	313,2	3,3483	4,6798	13,75	26,6	365,75	0,6368
205,44	264,8	2,6225	3,954	13,75	26,6	365,75	0,5617	221,04	289,2	2,9884	4,3199	13,75	26,6	365,75	0,6043	233,05	313,6	3,3543	4,6858	13,75	26,6	365,75	0,6372
205,46	265,2	2,6283	3,9598	13,75	26,6	365,75	0,5617	221,18	289,6	2,9943	4,3258	13,75	26,6	365,75	0,6047	233,28	314	3,3604	4,6919	13,75	26,6	365,75	0,6378
205,67	265,6	2,6343	3,9658	13,75	26,6	365,75	0,5623	221,24	290	3,0004	4,3319	13,75	26,6	365,75	0,6049	233,64	314,4	3,3665	4,698	13,75	26,6	365,75	0,6388
205,80	266	2,6403	3,9718	13,75	26,6	365,75	0,5627	221,38	290,4	3,0065	4,338	13,75	26,6	365,75	0,6053	233,96	314,8	3,3725	4,704	13,75	26,6	365,75	0,6397
206,02	266,4	2,6464	3,9779	13,75	26,6	365,75	0,5633	221,59	290,8	3,0125	4,344	13,75	26,6	365,75	0,6059	233,94	315,2	3,3785	4,71	13,75	26,6	365,75	0,6396
206,11	266,8	2,6525	3,984	13,75	26,6	365,75	0,5635	221,77	291,2	3,0185	4,35	13,75	26,6	365,75	0,6063	234,12	315,6	3,3844	4,7159	13,75	26,6	365,75	0,6401
205,99	267,2	2,6585	3,99	13,75	26,6	365,75	0,5632	221,80	291,6	3,0244	4,3559	13,75	26,6	365,75	0,6064	234,46	316	3,3903	4,7218	13,75	26,6	365,75	0,6410
205,88	267,6	2,6644	3,9959	13,75	26,6	365,75	0,5629	221,69	292	3,0303	4,3618	13,75	26,6	365,75	0,6061	234,84	316,4	3,3963	4,7278	13,75	26,6	365,75	0,6421
205,37	268	2,6704	4,0019	13,75	26,6	365,75	0,5615	221,80	292,4	3,0363	4,3678	13,75	26,6	365,75	0,6064	235,02	316,8	3,4023	4,7338	13,75	26,6	365,75	0,6426
205,73	268,4	2,6763	4,0078	13,75	26,6	365,75	0,5625	221,98	292,8	3,0423	4,3738	13,75	26,6	365,75	0,6069	235,42	317,2	3,4084	4,7399	13,75	26,6	365,75	0,6437
206,15	268,8	2,6823	4,0138	13,75	26,6	365,75	0,5636	222,22	293,2	3,0484	4,3799	13,75	26,6	365,75	0,6076	235,58	317,6	3,4145	4,746	13,75	26,6	365,75	0,6441
206,68	269,2	2,6885	4,02	13,75	26,6	365,75	0,5651	222,40	293,6	3,0544	4,3859	13,75	26,6	365,75	0,6081	235,56	318	3,4204	4,7519	13,75	26,6	365,75	0,6440

LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
235,77	318,4	3,4263	4,7578	13,75	26,6	365,75	0,6446
235,96	318,8	3,4323	4,7638	13,75	26,6	365,75	0,6451
236,15	319,2	3,4382	4,7697	13,75	26,6	365,75	0,6457
236,35	319,4	3,4413	4,7728	13,75	26,6	365,75	0,6462
0,00	0	0	0	0	0	0	0,0000

3.3.1.6-J Mix. Proportion Tests
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LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
0,04	1,2	-1,4092	0	13,85	21,75	301,2375	0,0001
0,08	1,6	-1,4031	0,0061	13,85	21,75	301,2375	0,0003
0,14	2	-1,397	0,0122	13,85	21,75	301,2375	0,0005
0,18	2,4	-1,3911	0,0181	13,85	21,75	301,2375	0,0006
0,21	2,8	-1,3851	0,0241	13,85	21,75	301,2375	0,0007
0,23	3,2	-1,3792	0,03	13,85	21,75	301,2375	0,0008
0,25	3,6	-1,3732	0,036	13,85	21,75	301,2375	0,0008
0,27	4	-1,3672	0,042	13,85	21,75	301,2375	0,0009
0,26	4,4	-1,3611	0,0481	13,85	21,75	301,2375	0,0009
0,30	4,8	-1,355	0,0542	13,85	21,75	301,2375	0,0010
0,27	5,2	-1,3491	0,0601	13,85	21,75	301,2375	0,0009
0,28	5,6	-1,3432	0,066	13,85	21,75	301,2375	0,0009
0,31	6	-1,3372	0,072	13,85	21,75	301,2375	0,0010
0,30	6,4	-1,3312	0,078	13,85	21,75	301,2375	0,0010
0,31	6,8	-1,3251	0,0841	13,85	21,75	301,2375	0,0010
0,32	7,2	-1,3191	0,0901	13,85	21,75	301,2375	0,0011
0,33	7,6	-1,313	0,0962	13,85	21,75	301,2375	0,0011
0,35	8	-1,3071	0,1021	13,85	21,75	301,2375	0,0012
0,36	8,4	-1,3011	0,1081	13,85	21,75	301,2375	0,0012
0,36	8,8	-1,2952	0,114	13,85	21,75	301,2375	0,0012
0,37	9,2	-1,2892	0,12	13,85	21,75	301,2375	0,0012
0,36	9,6	-1,2831	0,1261	13,85	21,75	301,2375	0,0012
0,36	10	-1,277	0,1322	13,85	21,75	301,2375	0,0012
0,36	10,4	-1,271	0,1382	13,85	21,75	301,2375	0,0012
0,36	10,8	-1,2651	0,1441	13,85	21,75	301,2375	0,0012
0,34	11,2	-1,2591	0,1501	13,85	21,75	301,2375	0,0011
0,36	11,6	-1,2532	0,156	13,85	21,75	301,2375	0,0012
0,36	12	-1,2472	0,162	13,85	21,75	301,2375	0,0012
0,35	12,4	-1,241	0,1682	13,85	21,75	301,2375	0,0012
0,35	12,8	-1,235	0,1742	13,85	21,75	301,2375	0,0012
0,36	13,2	-1,229	0,1802	13,85	21,75	301,2375	0,0012
0,37	13,6	-1,2231	0,1861	13,85	21,75	301,2375	0,0012
0,38	14	-1,2171	0,1921	13,85	21,75	301,2375	0,0013
0,40	14,4	-1,2112	0,198	13,85	21,75	301,2375	0,0013
0,42	14,8	-1,2051	0,2041	13,85	21,75	301,2375	0,0014
0,47	15,2	-1,199	0,2102	13,85	21,75	301,2375	0,0016
0,49	15,6	-1,193	0,2162	13,85	21,75	301,2375	0,0016
0,51	16	-1,1871	0,2221	13,85	21,75	301,2375	0,0017
0,52	16,4	-1,1811	0,2281	13,85	21,75	301,2375	0,0017
0,51	16,8	-1,1752	0,234	13,85	21,75	301,2375	0,0017
0,50	17,2	-1,1692	0,24	13,85	21,75	301,2375	0,0017
0,53	17,6	-1,1631	0,2461	13,85	21,75	301,2375	0,0018
0,50	18	-1,1571	0,2521	13,85	21,75	301,2375	0,0017
0,52	18,4	-1,151	0,2582	13,85	21,75	301,2375	0,0017
0,53	18,8	-1,1452	0,264	13,85	21,75	301,2375	0,0018
0,54	19,2	-1,1392	0,27	13,85	21,75	301,2375	0,0018
0,54	19,6	-1,1332	0,276	13,85	21,75	301,2375	0,0018
0,53	20	-1,1272	0,282	13,85	21,75	301,2375	0,0018
0,54	20,4	-1,1211	0,2881	13,85	21,75	301,2375	0,0018
0,54	20,8	-1,1151	0,2941	13,85	21,75	301,2375	0,0018
0,55	21,2	-1,1091	0,3001	13,85	21,75	301,2375	0,0018
0,55	21,6	-1,1032	0,306	13,85	21,75	301,2375	0,0018
0,55	22	-1,0972	0,312	13,85	21,75	301,2375	0,0018
0,54	22,4	-1,0913	0,3179	13,85	21,75	301,2375	0,0018
0,55	22,8	-1,0852	0,324	13,85	21,75	301,2375	0,0018
0,55	23,2	-1,0792	0,33	13,85	21,75	301,2375	0,0018
0,55	23,6	-1,0731	0,3361	13,85	21,75	301,2375	0,0018
0,55	24	-1,0672	0,342	13,85	21,75	301,2375	0,0018
0,55	24,4	-1,0613	0,3479	13,85	21,75	301,2375	0,0018
0,53	24,8	-1,0553	0,3539	13,85	21,75	301,2375	0,0018
0,55	25,2	-1,0493	0,3599	13,85	21,75	301,2375	0,0018

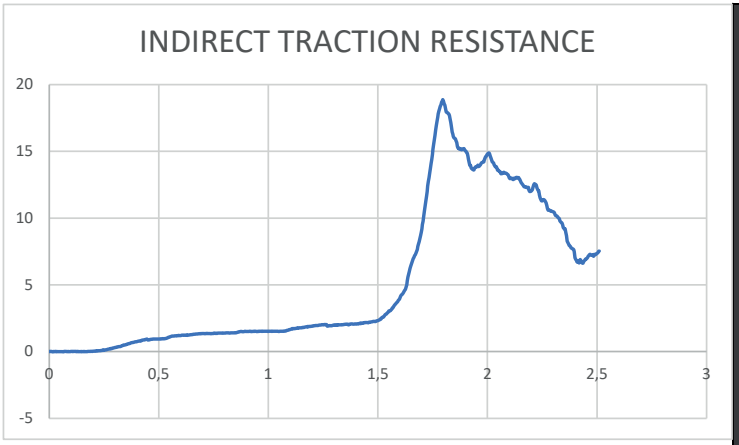
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
0,56	25,6	-1,0432	0,366	13,85	21,75	301,2375	0,0019	1,00	50	-0,677	0,7322	13,85	21,75	301,2375	0,0033	1,38	74,4	-0,3112	1,098	13,85	21,75	301,2375	0,0046
0,56	26	-1,0371	0,3721	13,85	21,75	301,2375	0,0019	1,00	50,4	-0,6711	0,7381	13,85	21,75	301,2375	0,0033	1,42	74,8	-0,3053	1,1039	13,85	21,75	301,2375	0,0047
0,57	26,4	-1,0312	0,378	13,85	21,75	301,2375	0,0019	0,98	50,8	-0,6652	0,744	13,85	21,75	301,2375	0,0033	1,46	75,2	-0,2993	1,1099	13,85	21,75	301,2375	0,0048
0,56	26,8	-1,0252	0,384	13,85	21,75	301,2375	0,0019	1,02	51,2	-0,6593	0,7499	13,85	21,75	301,2375	0,0034	1,47	75,6	-0,2934	1,1158	13,85	21,75	301,2375	0,0049
0,57	27,2	-1,0193	0,3899	13,85	21,75	301,2375	0,0019	1,01	51,6	-0,6533	0,7559	13,85	21,75	301,2375	0,0034	1,49	76	-0,2873	1,1219	13,85	21,75	301,2375	0,0049
0,58	27,6	-1,0133	0,3959	13,85	21,75	301,2375	0,0019	1,01	52	-0,6473	0,7619	13,85	21,75	301,2375	0,0034	1,53	76,4	-0,2812	1,128	13,85	21,75	301,2375	0,0051
0,57	28	-1,0073	0,4019	13,85	21,75	301,2375	0,0019	1,00	52,4	-0,6412	0,768	13,85	21,75	301,2375	0,0033	1,54	76,8	-0,2752	1,134	13,85	21,75	301,2375	0,0051
0,58	28,4	-1,0012	0,408	13,85	21,75	301,2375	0,0019	1,03	52,8	-0,6351	0,7741	13,85	21,75	301,2375	0,0034	1,69	77,2	-0,2692	1,14	13,85	21,75	301,2375	0,0056
0,58	28,8	-0,9951	0,4141	13,85	21,75	301,2375	0,0019	1,04	53,2	-0,6292	0,78	13,85	21,75	301,2375	0,0035	1,73	77,6	-0,2633	1,1459	13,85	21,75	301,2375	0,0057
0,59	29,2	-0,9892	0,42	13,85	21,75	301,2375	0,0020	1,01	53,6	-0,6233	0,7859	13,85	21,75	301,2375	0,0034	1,64	78	-0,2573	1,1519	13,85	21,75	301,2375	0,0054
0,60	29,6	-0,9833	0,4259	13,85	21,75	301,2375	0,0020	0,99	54	-0,6173	0,7919	13,85	21,75	301,2375	0,0033	1,70	78,4	-0,2514	1,1578	13,85	21,75	301,2375	0,0056
0,59	30	-0,9773	0,4319	13,85	21,75	301,2375	0,0020	0,98	54,4	-0,6113	0,7979	13,85	21,75	301,2375	0,0033	1,71	78,8	-0,2453	1,1639	13,85	21,75	301,2375	0,0057
0,59	30,4	-0,9714	0,4378	13,85	21,75	301,2375	0,0020	1,01	54,8	-0,6052	0,804	13,85	21,75	301,2375	0,0034	1,77	79,2	-0,2392	1,17	13,85	21,75	301,2375	0,0059
0,61	30,8	-0,9652	0,444	13,85	21,75	301,2375	0,0020	1,02	55,2	-0,5991	0,8101	13,85	21,75	301,2375	0,0034	1,78	79,6	-0,2332	1,176	13,85	21,75	301,2375	0,0059
0,62	31,2	-0,9591	0,4501	13,85	21,75	301,2375	0,0021	1,03	55,6	-0,5931	0,8161	13,85	21,75	301,2375	0,0034	1,78	80	-0,2272	1,182	13,85	21,75	301,2375	0,0059
0,63	31,6	-0,9531	0,4561	13,85	21,75	301,2375	0,0021	1,04	56	-0,5872	0,822	13,85	21,75	301,2375	0,0035	1,85	80,4	-0,2213	1,1879	13,85	21,75	301,2375	0,0061
0,65	32	-0,9472	0,462	13,85	21,75	301,2375	0,0022	1,01	56,4	-0,5813	0,8279	13,85	21,75	301,2375	0,0034	1,81	80,8	-0,2153	1,1939	13,85	21,75	301,2375	0,0060
0,64	32,4	-0,9413	0,4679	13,85	21,75	301,2375	0,0021	1,02	56,8	-0,5753	0,8339	13,85	21,75	301,2375	0,0034	1,85	81,2	-0,2093	1,1999	13,85	21,75	301,2375	0,0061
0,65	32,8	-0,9353	0,4739	13,85	21,75	301,2375	0,0022	1,00	57,2	-0,5693	0,8399	13,85	21,75	301,2375	0,0033	1,88	81,6	-0,2032	1,206	13,85	21,75	301,2375	0,0062
0,64	33,2	-0,9293	0,4799	13,85	21,75	301,2375	0,0021	1,00	57,6	-0,5632	0,846	13,85	21,75	301,2375	0,0033	1,96	82	-0,1971	1,2121	13,85	21,75	301,2375	0,0065
0,66	33,6	-0,9232	0,486	13,85	21,75	301,2375	0,0022	1,06	58	-0,5571	0,8521	13,85	21,75	301,2375	0,0035	1,88	82,4	-0,1912	1,218	13,85	21,75	301,2375	0,0062
0,67	34	-0,9171	0,4921	13,85	21,75	301,2375	0,0022	1,03	58,4	-0,5512	0,858	13,85	21,75	301,2375	0,0034	1,99	82,8	-0,1852	1,224	13,85	21,75	301,2375	0,0066
0,68	34,4	-0,9111	0,4981	13,85	21,75	301,2375	0,0023	1,05	58,8	-0,5452	0,864	13,85	21,75	301,2375	0,0035	1,93	83,2	-0,1793	1,2299	13,85	21,75	301,2375	0,0064
0,71	34,8	-0,9052	0,504	13,85	21,75	301,2375	0,0024	1,01	59,2	-0,5393	0,8699	13,85	21,75	301,2375	0,0034	2,00	83,6	-0,1733	1,2359	13,85	21,75	301,2375	0,0066
0,75	35,2	-0,8992	0,51	13,85	21,75	301,2375	0,0025	1,01	59,6	-0,5333	0,8759	13,85	21,75	301,2375	0,0034	2,13	84	-0,1673	1,2419	13,85	21,75	301,2375	0,0071
0,77	35,6	-0,8932	0,516	13,85	21,75	301,2375	0,0026	1,02	60	-0,5272	0,882	13,85	21,75	301,2375	0,0034	2,38	84,4	-0,1612	1,248	13,85	21,75	301,2375	0,0079
0,81	36	-0,8872	0,522	13,85	21,75	301,2375	0,0027	1,04	60,4	-0,5211	0,8881	13,85	21,75	301,2375	0,0035	2,39	84,8	-0,1551	1,2541	13,85	21,75	301,2375	0,0079
0,82	36,4	-0,8811	0,5281	13,85	21,75	301,2375	0,0027	1,03	60,8	-0,5151	0,8941	13,85	21,75	301,2375	0,0034	2,18	85,2	-0,1491	1,2601	13,85	21,75	301,2375	0,0072
0,87	36,8	-0,8751	0,5341	13,85	21,75	301,2375	0,0029	1,03	61,2	-0,5091	0,9001	13,85	21,75	301,2375	0,0034	2,30	85,6	-0,1432	1,266	13,85	21,75	301,2375	0,0076
0,89	37,2	-0,8691	0,5401	13,85	21,75	301,2375	0,0030	1,05	61,6	-0,5032	0,906	13,85	21,75	301,2375	0,0035	2,42	86	-0,1373	1,2719	13,85	21,75	301,2375	0,0080
0,92	37,6	-0,8631	0,5461	13,85	21,75	301,2375	0,0031	1,05	62	-0,4972	0,912	13,85	21,75	301,2375	0,0035	2,50	86,4	-0,1313	1,2779	13,85	21,75	301,2375	0,0083
0,95	38	-0,8572	0,552	13,85	21,75	301,2375	0,0032	1,05	62,4	-0,4912	0,918	13,85	21,75	301,2375	0,0035	2,62	86,8	-0,1252	1,284	13,85	21,75	301,2375	0,0087
0,96	38,4	-0,8512	0,558	13,85	21,75	301,2375	0,0032	1,06	62,8	-0,4851	0,9241	13,85	21,75	301,2375	0,0035	2,94	87,2	-0,1191	1,2901	13,85	21,75	301,2375	0,0098
0,97	38,8	-0,8451	0,5641	13,85	21,75	301,2375	0,0032	1,07	63,2	-0,479	0,9302	13,85	21,75	301,2375	0,0036	3,36	87,6	-0,1131	1,2961	13,85	21,75	301,2375	0,0112
0,97	39,2	-0,839	0,5702	13,85	21,75	301,2375	0,0032	1,07	63,6	-0,473	0,9362	13,85	21,75	301,2375	0,0036	3,73	88	-0,1072	1,302	13,85	21,75	301,2375	0,0124
0,98	39,6	-0,833	0,5762	13,85	21,75	301,2375	0,0033	1,07	64	-0,4671	0,9421	13,85	21,75	301,2375	0,0036	4,00	88,4	-0,1012	1,308	13,85	21,75	301,2375	0,0133
0,99	40	-0,827	0,5822	13,85	21,75	301,2375	0,0033	1,08	64,4	-0,4612	0,948	13,85	21,75	301,2375	0,0036	4,37	88,8	-0,0952	1,314	13,85	21,75	301,2375	0,0145
0,98	40,4	-0,8211	0,5881	13,85	21,75	301,2375	0,0033	1,06	64,8	-0,4552	0,954	13,85	21,75	301,2375	0,0035	4,57	89,2	-0,0893	1,3199	13,85	21,75	301,2375	0,0152
0,98	40,8	-0,8151	0,5941	13,85	21,75	301,2375	0,0033	1,05	65,2	-0,4492	0,96	13,85	21,75	301,2375	0,0035	4,87	89,6	-0,0831	1,3261	13,85	21,75	301,2375	0,0162
0,98	41,2	-0,8091	0,6001	13,85	21,75	301,2375	0,0033	1,06	65,6	-0,4431	0,9661	13,85	21,75	301,2375	0,0035	4,80	90	-0,0771	1,3321	13,85	21,75	301,2375	0,0159
0,98	41,6	-0,803	0,6062	13,85	21,75	301,2375	0,0033	1,06	66	-0,4371	0,9721	13,85	21,75	301,2375	0,0035	4,87	90,4	-0,0711	1,3381	13,85	21,75	301,2375	0,0162
0,99	42	-0,797	0,6122	13,85	21,75	301,2375	0,0033	1,09	66,4	-0,4311	0,9781	13,85	21,75	301,2375	0,0036	4,97	90,8	-0,0652	1,344	13,85	21,75	301,2375	0,0165
1,00	42,4	-0,791	0,6182	13,85	21,75	301,2375	0,0033	1,09	66,8	-0,4252	0,984	13,85	21,75	301,2375	0,0036	5,06	91,2	-0,0592	1,35	13,85	21,75	301,2375	0,0168
1,03	42,8	-0,7851	0,6241	13,85	21,75	301,2375	0,0034	1,09	67,2	-0,4193	0,9899	13,85	21,75	301,2375	0,0036	5,20	91,6	-0,0533	1,3559	13,85	21,75	301,2375	0,0173
1,00	43,2	-0,7791	0,6301	13,85	21,75	301,2375	0,0033	1,08	67,6	-0,4133	0,9959	13,85	21,75	301,2375	0,0036	5,31	92	-0,0472	1,362	13,85	21,75	301,2375	0,0176
0,99	43,6	-0,7732	0,636	13,85	21,75	301,2375	0,0033	1,07	68	-0,4072	1,002	13,85	21,75	301,2375	0,0036	5,52	92,4	-0,0411	1,3681	13,85	21,75	301,2375	0,0183
0,99	44	-0,7671	0,6421	13,85	21,75	301,2375	0,0033	1,10	68,4	-0,4011	1,0081	13,85	21,75	301,2375	0,0037	5,73	92,8	-0,0351	1,3741	13,85	21,75	301,2375	0,0190
0,99	44,4	-0,7611	0,6481	13,85	21,75	301,2375	0,0033	1,16	68,8	-0,3951	1,0141	13,85	21,75	301,2375	0,0039	5,95	93,2	-0,0291	1,3801	13,85	21,75	301,2375	0,0198
0,98	44,8	-0,755	0,6542	13,85	21,75	301,2375	0,0033	1,16	69,2	-0,3892	1,02	13,85	21,75	301,2375	0,0039	6,45	93,6	-0,0232	1,386	13,85	21,75	301,2375	0,0214
0,99	45,2	-0,749	0,6602	13,85	21,75	301,2375	0,0033	1,14	69,6	-0,3833	1,0259	13,85	21,75	301,2375	0,0038	7,18	94	-0,0172	1,392	13,85	21,75	301,2375	0,0238
0,98	45,6	-0,7431	0,6661	13,85	21,75	301,2375	0,0033	1,13	70	-0,3773	1,0319	13,85	21,75	301,2375	0,0038	8,07	94,4	-0,0112	1,398	13,85	21,75	301,2375	0,0268
0,99	46	-0,7371	0,6721	13,85	21,75	301,2375	0,0033	1,14	70,4	-0,3713	1,0379	13,85	21,75	301,2375	0,0038	8,93	94,8	-0,0051	1,4041	13,85	21,75	301,2375	0,0296
1,00	46,4	-0,7312	0,678	13,85	21,75	301,2375	0,0033	1,16	70,8	-0,3653	1,0439	13,85	21,75	301,2375	0,0039	9,79	95,2	0,001	1,4102	13,85	21,75	301,2375	0,0325
0,99	46,8	-0,7251	0,6841	13,85	21,75	301,2375	0,0033	1,21	71,2	-0,3591	1,0501	13,85	21,75	301,2375	0,0040	10,76	95,6	0,007	1,4162	13,85	21,75	301,2375	0,0357
0,97	47,2	-0,719	0,6902	13,85	21,75	301,2375	0,0032	1,22	71,6	-0,3532	1,056	13,85	21,75	301,2375	0,0040	11,99	96	0,0129	1,4221	13,85	21,75	301,2375	0,0398
1,01	47,6	-0,713	0,6962	13,85	21,75	301,2375	0,0034	1,26	72	-0,3472	1,062	13,85	21,75	301,2375	0,0042	13,13	96,4	0,0188	1,428	13,85	21,75	301,2375	0,0436
1,02	48	-0,7071	0,7021	13,85	21,75	301,2375	0,0034	1,28	72,4	-0,3413	1,0679	13,85	21,75	301,2375	0,0042	14,22	96,8	0,0248	1,434	13,85	21,75	301,2375	0,0472
1,01	48,4	-0,7011	0,7081	13,85	21,75	301,2375	0,0034	1,30	72,8	-0,3354	1,0738	13,85	21,75	301,2375	0,0043	15,63	97,2	0,0307	1,4399	13,85	21,75	301,2375	0,0519
0,99	48,8	-0,6952	0,714	13,85	21,75	301,2375	0,0033	1,28	73,2	-0,3294	1,0798	13,85	21,75	301,2375	0,0042	16,86	97,6	0,0369	1,4461	13,85	21,75	301,2375	0,0560
1,00	49,2	-0,6892	0,72	13,85	21,75	301,2375	0,0033	1,32	73,6	-0,3232	1,086	13,85	21,75	301,2375	0,0044	18,26	98	0,0429	1,4521	13,85	21,75	301,2375	0,0606
1,00	49,6	-0,6831	0,7261	13,85	21,75	301,2375	0,0033	1,37	74	-0,3172	1,092	13,85	21,75	301,2375	0,0045	19,83	98,4	0,0489	1,4581	13,85	21,75	301,2375	0,0658

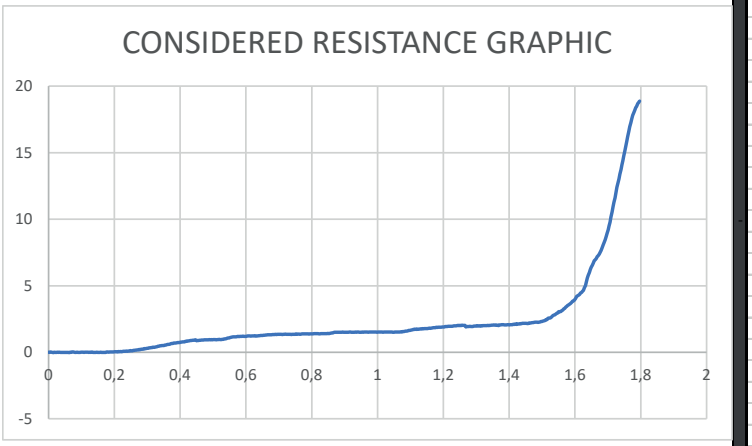
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
21,63	98,8	0,0548	1,464	13,85	21,75	301,2375	0,0718	109,23	123,2	0,4205	1,8297	13,85	21,75	301,2375	0,3626	103,84	147,6	0,7866	2,1958	13,85	21,75	301,2375	0,3447
23,65	99,2	0,0607	1,4699	13,85	21,75	301,2375	0,0785	109,63	123,6	0,4265	1,8357	13,85	21,75	301,2375	0,3639	103,92	148	0,7927	2,2019	13,85	21,75	301,2375	0,3450
25,93	99,6	0,0667	1,4759	13,85	21,75	301,2375	0,0861	109,86	124	0,4326	1,8418	13,85	21,75	301,2375	0,3647	104,17	148,4	0,7988	2,208	13,85	21,75	301,2375	0,3458
28,28	100	0,0728	1,482	13,85	21,75	301,2375	0,0939	109,82	124,4	0,4388	1,848	13,85	21,75	301,2375	0,3646	104,29	148,8	0,8048	2,214	13,85	21,75	301,2375	0,3462
30,71	100,4	0,0789	1,4881	13,85	21,75	301,2375	0,1019	109,77	124,8	0,4448	1,854	13,85	21,75	301,2375	0,3644	103,85	149,2	0,8107	2,2199	13,85	21,75	301,2375	0,3447
33,13	100,8	0,0849	1,4941	13,85	21,75	301,2375	0,1100	109,82	125,2	0,4507	1,8599	13,85	21,75	301,2375	0,3646	103,40	149,6	0,8166	2,2258	13,85	21,75	301,2375	0,3433
35,49	101,2	0,0908	1,5	13,85	21,75	301,2375	0,1178	109,81	125,6	0,4566	1,8658	13,85	21,75	301,2375	0,3645	103,21	150	0,8226	2,2318	13,85	21,75	301,2375	0,3426
37,93	101,6	0,0967	1,5059	13,85	21,75	301,2375	0,1259	109,78	126	0,4626	1,8718	13,85	21,75	301,2375	0,3644	102,78	150,4	0,8286	2,2378	13,85	21,75	301,2375	0,3412
40,24	102	0,1027	1,5119	13,85	21,75	301,2375	0,1336	109,84	126,4	0,4686	1,8778	13,85	21,75	301,2375	0,3646	102,43	150,8	0,8347	2,2439	13,85	21,75	301,2375	0,3400
42,45	102,4	0,1087	1,5179	13,85	21,75	301,2375	0,1409	109,82	126,8	0,4747	1,8839	13,85	21,75	301,2375	0,3646	102,28	151,2	0,8408	2,25	13,85	21,75	301,2375	0,3395
44,71	102,8	0,1148	1,524	13,85	21,75	301,2375	0,1484	109,73	127,2	0,4808	1,89	13,85	21,75	301,2375	0,3643	101,95	151,6	0,8468	2,256	13,85	21,75	301,2375	0,3384
46,82	103,2	0,1209	1,5301	13,85	21,75	301,2375	0,1554	109,79	127,6	0,4868	1,896	13,85	21,75	301,2375	0,3645	101,68	152	0,8527	2,2619	13,85	21,75	301,2375	0,3375
48,73	103,6	0,1269	1,5361	13,85	21,75	301,2375	0,1618	110,00	128	0,4927	1,9019	13,85	21,75	301,2375	0,3652	101,62	152,4	0,8587	2,2679	13,85	21,75	301,2375	0,3373
50,47	104	0,1328	1,542	13,85	21,75	301,2375	0,1675	110,03	128,4	0,4987	1,9079	13,85	21,75	301,2375	0,3653	101,39	152,8	0,8646	2,2738	13,85	21,75	301,2375	0,3366
52,01	104,4	0,1388	1,548	13,85	21,75	301,2375	0,1727	110,01	128,8	0,5046	1,9138	13,85	21,75	301,2375	0,3652	101,02	153,2	0,8707	2,2799	13,85	21,75	301,2375	0,3354
53,56	104,8	0,1447	1,5539	13,85	21,75	301,2375	0,1778	110,12	129,2	0,5106	1,9198	13,85	21,75	301,2375	0,3656	92,97	153,6	0,8768	2,286	13,85	21,75	301,2375	0,3086
55,28	105,2	0,1507	1,5599	13,85	21,75	301,2375	0,1835	110,28	129,6	0,5168	1,926	13,85	21,75	301,2375	0,3661	83,50	154	0,8829	2,2921	13,85	21,75	301,2375	0,2772
56,96	105,6	0,1569	1,5661	13,85	21,75	301,2375	0,1891	110,17	130	0,5228	1,932	13,85	21,75	301,2375	0,3657	86,51	154,4	0,8888	2,298	13,85	21,75	301,2375	0,2872
58,49	106	0,1629	1,5721	13,85	21,75	301,2375	0,1942	110,21	130,4	0,5288	1,938	13,85	21,75	301,2375	0,3659	88,75	154,8	0,8947	2,3039	13,85	21,75	301,2375	0,2946
60,12	106,4	0,1689	1,5781	13,85	21,75	301,2375	0,1996	110,38	130,8	0,5347	1,9439	13,85	21,75	301,2375	0,3664	90,57	155,2	0,9007	2,3099	13,85	21,75	301,2375	0,3007
61,97	106,8	0,1748	1,584	13,85	21,75	301,2375	0,2057	110,66	131,2	0,5406	1,9498	13,85	21,75	301,2375	0,3674	91,95	155,6	0,9066	2,3158	13,85	21,75	301,2375	0,3052
63,93	107,2	0,1808	1,59	13,85	21,75	301,2375	0,2122	111,06	131,6	0,5466	1,9558	13,85	21,75	301,2375	0,3687	92,87	156	0,9127	2,3219	13,85	21,75	301,2375	0,3083
65,67	107,6	0,1868	1,596	13,85	21,75	301,2375	0,2180	111,40	132	0,5527	1,9619	13,85	21,75	301,2375	0,3698	93,51	156,4	0,9188	2,328	13,85	21,75	301,2375	0,3104
67,45	108	0,1928	1,602	13,85	21,75	301,2375	0,2239	111,43	132,4	0,5588	1,968	13,85	21,75	301,2375	0,3699	93,96	156,8	0,9248	2,334	13,85	21,75	301,2375	0,3119
69,17	108,4	0,1989	1,6081	13,85	21,75	301,2375	0,2296	111,47	132,8	0,5649	1,9741	13,85	21,75	301,2375	0,3700	94,42	157,2	0,9307	2,3399	13,85	21,75	301,2375	0,3134
70,75	108,8	0,2049	1,6141	13,85	21,75	301,2375	0,2349	111,36	133,2	0,5708	1,98	13,85	21,75	301,2375	0,3697	94,69	157,6	0,9367	2,3459	13,85	21,75	301,2375	0,3143
72,44	109,2	0,2109	1,6201	13,85	21,75	301,2375	0,2405	111,09	133,6	0,5767	1,9859	13,85	21,75	301,2375	0,3688	94,90	158	0,9427	2,3519	13,85	21,75	301,2375	0,3150
74,26	109,6	0,2168	1,626	13,85	21,75	301,2375	0,2465	110,43	134	0,5827	1,9919	13,85	21,75	301,2375	0,3666	95,19	158,4	0,9486	2,3578	13,85	21,75	301,2375	0,3160
76,16	110	0,2227	1,6319	13,85	21,75	301,2375	0,2528	109,78	134,4	0,5887	1,9979	13,85	21,75	301,2375	0,3644	95,20	158,8	0,9548	2,364	13,85	21,75	301,2375	0,3160
78,00	110,4	0,2287	1,6379	13,85	21,75	301,2375	0,2589	109,30	134,8	0,5948	2,004	13,85	21,75	301,2375	0,3628	93,64	159,2	0,9608	2,37	13,85	21,75	301,2375	0,3109
79,99	110,8	0,2348	1,644	13,85	21,75	301,2375	0,2655	108,68	135,2	0,6009	2,0101	13,85	21,75	301,2375	0,3608	93,47	159,6	0,9668	2,376	13,85	21,75	301,2375	0,3103
81,58	111,2	0,2409	1,6501	13,85	21,75	301,2375	0,2708	107,95	135,6	0,6069	2,0161	13,85	21,75	301,2375	0,3584	93,64	160	0,9727	2,3819	13,85	21,75	301,2375	0,3109
83,27	111,6	0,2469	1,6561	13,85	21,75	301,2375	0,2764	107,43	136	0,6128	2,022	13,85	21,75	301,2375	0,3566	93,37	160,4	0,9786	2,3878	13,85	21,75	301,2375	0,3100
85,11	112	0,2527	1,6619	13,85	21,75	301,2375	0,2825	107,09	136,4	0,6187	2,0279	13,85	21,75	301,2375	0,3555	93,15	160,8	0,9846	2,3938	13,85	21,75	301,2375	0,3092
87,02	112,4	0,2587	1,6679	13,85	21,75	301,2375	0,2889	106,98	136,8	0,6247	2,0339	13,85	21,75	301,2375	0,3551	93,02	161,2	0,9907	2,3999	13,85	21,75	301,2375	0,3088
88,86	112,8	0,2646	1,6738	13,85	21,75	301,2375	0,2950	107,05	137,2	0,6307	2,0399	13,85	21,75	301,2375	0,3554	92,93	161,6	0,9968	2,406	13,85	21,75	301,2375	0,3085
90,71	113,2	0,2706	1,6798	13,85	21,75	301,2375	0,3011	106,98	137,6	0,6368	2,046	13,85	21,75	301,2375	0,3551	92,41	162	1,0028	2,412	13,85	21,75	301,2375	0,3068
92,44	113,6	0,2767	1,6859	13,85	21,75	301,2375	0,3069	106,83	138	0,6429	2,0521	13,85	21,75	301,2375	0,3546	91,83	162,4	1,0087	2,4179	13,85	21,75	301,2375	0,3048
94,06	114	0,2828	1,692	13,85	21,75	301,2375	0,3122	106,62	138,4	0,6488	2,058	13,85	21,75	301,2375	0,3539	91,53	162,8	1,0146	2,4238	13,85	21,75	301,2375	0,3038
95,52	114,4	0,2887	1,6979	13,85	21,75	301,2375	0,3171	106,44	138,8	0,6547	2,0639	13,85	21,75	301,2375	0,3533	91,18	163,2	1,0206	2,4298	13,85	21,75	301,2375	0,3027
96,86	114,8	0,2946	1,7038	13,85	21,75	301,2375	0,3215	106,07	139,2	0,6607	2,0699	13,85	21,75	301,2375	0,3521	90,85	163,6	1,0266	2,4358	13,85	21,75	301,2375	0,3016
98,32	115,2	0,3006	1,7098	13,85	21,75	301,2375	0,3264	105,84	139,6	0,6666	2,0758	13,85	21,75	301,2375	0,3514	90,73	164	1,0327	2,4419	13,85	21,75	301,2375	0,3012
99,64	115,6	0,3065	1,7157	13,85	21,75	301,2375	0,3308	106,24	140	0,6728	2,082	13,85	21,75	301,2375	0,3527	90,65	164,4	1,0388	2,448	13,85	21,75	301,2375	0,3009
101,02	116	0,3126	1,7218	13,85	21,75	301,2375	0,3354	106,10	140,4	0,6788	2,088	13,85	21,75	301,2375	0,3522	90,60	164,8	1,0448	2,454	13,85	21,75	301,2375	0,3008
102,13	116,4	0,3187	1,7279	13,85	21,75	301,2375	0,3390	106,30	140,8	0,6848	2,094	13,85	21,75	301,2375	0,3529	90,52	165,2	1,0507	2,4599	13,85	21,75	301,2375	0,3005
102,87	116,8	0,3247	1,7339	13,85	21,75	301,2375	0,3415	106,48	141,2	0,6908	2,1	13,85	21,75	301,2375	0,3535	90,44	165,6	1,0566	2,4658	13,85	21,75	301,2375	0,3002
100,22	117,2	0,3306	1,7398	13,85	21,75	301,2375	0,3327	106,47	141,6	0,6967	2,1059	13,85	21,75	301,2375	0,3534	90,17	166	1,0626	2,4718	13,85	21,75	301,2375	0,2993
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99,54	118	0,3425	1,7517	13,85	21,75	301,2375	0,3304	106,13	142,4	0,7086	2,1178	13,85	21,75	301,2375	0,3523	89,50	166,8	1,0747	2,4839	13,85	21,75	301,2375	0,2971
101,63	118,4	0,3485	1,7577	13,85	21,75	301,2375	0,3374	105,83	142,8	0,7147	2,1239	13,85	21,75	301,2375	0,3513	88,68	167,2	1,0808	2,49	13,85	21,75	301,2375	0,2944
103,35	118,8	0,3546	1,7638	13,85	21,75	301,2375	0,3431	105,52	143,2	0,7208	2,13	13,85	21,75	301,2375	0,3503	88,59	167,6	1,0868	2,496	13,85	21,75	301,2375	0,2941
104,80	119,2	0,3606	1,7698	13,85	21,75	301,2375	0,3479	105,15	143,6	0,7268	2,136	13,85	21,75	301,2375	0,3491	88,40	168	1,0927	2,5019	13,85	21,75	301,2375	0,2935
105,87	119,6	0,3666	1,7758	13,85	21,75	301,2375	0,3515	104,49	144	0,7326	2,1418	13,85	21,75	301,2375	0,3469	88,38	168,4	1,0986	2,5078	13,85	21,75	301,2375	0,2934
106,38	120	0,3725	1,7817	13,85	21,75	301,2375	0,3531	103,88	144,4	0,7386	2,1478	13,85	21,75	301,2375	0,3448	88,23	168,8	1,1046	2,5138	13,85	21,75	301,2375	0,2929
106,73	120,4	0,3784	1,7876	13,85	21,75	301,2375	0,3543	103,79	144,8	0,7446	2,1538	13,85	21,75	301,2375	0,3445	88,42	169,2	1,1107	2,5199	13,85	21,75	301,2375	0,2935
106,96	120,8	0,3844	1,7936	13,85	21,75	301,2375	0,3551	104,01	145,2	0,7506	2,1598	13,85	21,75	301,2375	0,3453	88,65	169,6	1,1168	2,526	13,85	21,75	301,2375	0,2943
107,41	121,2	0,3905	1,7997	13,85	21,75	301,2375	0,3566	104,27	145,6	0,7567	2,1659	13,85	21,75	301,2375	0,3461	88,88	170	1,1228	2,532	13,85	21,75	301,2375	0,2950
107,86	121,6	0,3966	1,8058	13,85	21,75	301,2375	0,3581	104,32	146	0,7628	2,172	13,85	21,75	301,2375	0,3463	89,08	170,4	1,1287	2,5379	13,85	21,75	301,2375	0,2957
108,06	122	0,4026	1,8118	13,85	21,75	301,2375	0,3587	104,36	146,4	0,7687	2,1779	13,85	21,75	301,2375	0,3464	88,92	170,8	1,1346	2,5438	13,85	21,75	301,2375	0,2952
108,37	122,4	0,4086	1,8178	13,85	21,75	301,2375	0,3597	104,22	146,8	0,7747	2,1839	13,85	21,75	301,2375	0,3460	88,43	171,2	1,1406	2,5498	13,85	21,75	301,2375	0,2936
108,74	122,8	0,4145	1,8237	13,85	21,75	301,2375	0,3610	103,74	147,2	0,7806	2,1898	13,85	21,75	301,2375	0,3444	88,70	171,6	1,1466	2,5558	13,85	21,75	301,2375	0,2945

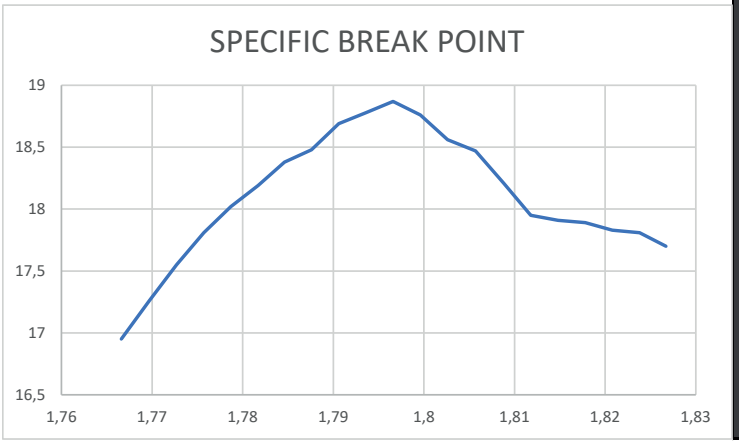
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
88,94	172	1,1527	2,5619	13,85	21,75	301,2375	0,2952	75,85	196,4	1,5188	2,928	13,85	21,75	301,2375	0,2518	50,09	220,8	1,8849	3,2941	13,85	21,75	301,2375	0,1663
89,37	172,4	1,1588	2,568	13,85	21,75	301,2375	0,2967	75,35	196,8	1,5247	2,9339	13,85	21,75	301,2375	0,2501	50,29	221,2	1,8908	3,3	13,85	21,75	301,2375	0,1669
89,56	172,8	1,1648	2,574	13,85	21,75	301,2375	0,2973	74,93	197,2	1,5306	2,9398	13,85	21,75	301,2375	0,2487	50,13	221,6	1,8968	3,306	13,85	21,75	301,2375	0,1664
89,53	173,2	1,1707	2,5799	13,85	21,75	301,2375	0,2972	75,06	197,6	1,5366	2,9458	13,85	21,75	301,2375	0,2492	49,46	222	1,9027	3,3119	13,85	21,75	301,2375	0,1642
89,48	173,6	1,1766	2,5858	13,85	21,75	301,2375	0,2970	75,34	198	1,5425	2,9517	13,85	21,75	301,2375	0,2501	49,64	222,4	1,9087	3,3179	13,85	21,75	301,2375	0,1648
89,42	174	1,1826	2,5918	13,85	21,75	301,2375	0,2968	75,92	198,4	1,5486	2,9578	13,85	21,75	301,2375	0,2520	49,63	222,8	1,9148	3,324	13,85	21,75	301,2375	0,1648
89,38	174,4	1,1886	2,5978	13,85	21,75	301,2375	0,2967	76,50	198,8	1,5547	2,9639	13,85	21,75	301,2375	0,2540	49,14	223,2	1,9209	3,3301	13,85	21,75	301,2375	0,1631
89,20	174,8	1,1947	2,6039	13,85	21,75	301,2375	0,2961	76,61	199,2	1,5607	2,9699	13,85	21,75	301,2375	0,2543	47,95	223,6	1,9268	3,336	13,85	21,75	301,2375	0,1592
89,26	175,2	1,2008	2,61	13,85	21,75	301,2375	0,2963	76,12	199,6	1,5667	2,9759	13,85	21,75	301,2375	0,2527	47,16	224	1,9327	3,3419	13,85	21,75	301,2375	0,1566
89,30	175,6	1,2068	2,616	13,85	21,75	301,2375	0,2964	76,30	200	1,5726	2,9818	13,85	21,75	301,2375	0,2533	46,93	224,4	1,9387	3,3479	13,85	21,75	301,2375	0,1558
89,41	176	1,2126	2,6218	13,85	21,75	301,2375	0,2968	76,73	200,4	1,5785	2,9877	13,85	21,75	301,2375	0,2547	47,14	224,8	1,9447	3,3539	13,85	21,75	301,2375	0,1565
89,45	176,4	1,2186	2,6278	13,85	21,75	301,2375	0,2969	76,95	200,8	1,5845	2,9937	13,85	21,75	301,2375	0,2554	47,50	225,2	1,9507	3,3599	13,85	21,75	301,2375	0,1577
89,24	176,8	1,2246	2,6338	13,85	21,75	301,2375	0,2962	76,98	201,2	1,5906	2,9998	13,85	21,75	301,2375	0,2555	47,99	225,6	1,9568	3,366	13,85	21,75	301,2375	0,1593
89,62	177,2	1,2306	2,6398	13,85	21,75	301,2375	0,2975	77,32	201,6	1,5966	3,0058	13,85	21,75	301,2375	0,2567	48,13	226	1,9629	3,3721	13,85	21,75	301,2375	0,1598
90,02	177,6	1,2368	2,646	13,85	21,75	301,2375	0,2988	77,73	202	1,6027	3,0119	13,85	21,75	301,2375	0,2580	48,23	226,4	1,9688	3,378	13,85	21,75	301,2375	0,1601
90,17	178	1,2428	2,652	13,85	21,75	301,2375	0,2993	78,11	202,4	1,6086	3,0178	13,85	21,75	301,2375	0,2593	48,53	226,8	1,9747	3,3839	13,85	21,75	301,2375	0,1611
90,51	178,4	1,2487	2,6579	13,85	21,75	301,2375	0,3005	78,40	202,8	1,6145	3,0237	13,85	21,75	301,2375	0,2603	48,86	227,2	1,9806	3,3898	13,85	21,75	301,2375	0,1622
90,66	178,8	1,2547	2,6639	13,85	21,75	301,2375	0,3010	78,72	203,2	1,6205	3,0297	13,85	21,75	301,2375	0,2613	48,55	227,6	1,9866	3,3958	13,85	21,75	301,2375	0,1612
90,14	179,2	1,2606	2,6698	13,85	21,75	301,2375	0,2992	78,84	203,6	1,6264	3,0356	13,85	21,75	301,2375	0,2617	48,88	228	1,9927	3,4019	13,85	21,75	301,2375	0,1623
89,80	179,6	1,2666	2,6758	13,85	21,75	301,2375	0,2981	78,49	204	1,6325	3,0417	13,85	21,75	301,2375	0,2606	49,35	228,4	1,9988	3,408	13,85	21,75	301,2375	0,1638
89,75	180	1,2727	2,6819	13,85	21,75	301,2375	0,2979	77,11	204,4	1,6386	3,0478	13,85	21,75	301,2375	0,2560	49,63	228,8	2,0048	3,414	13,85	21,75	301,2375	0,1648
89,36	180,4	1,2788	2,688	13,85	21,75	301,2375	0,2966	77,27	204,8	1,6446	3,0538	13,85	21,75	301,2375	0,2565	49,94	229,2	2,0107	3,4199	13,85	21,75	301,2375	0,1658
89,19	180,8	1,2848	2,694	13,85	21,75	301,2375	0,2961	77,45	205,2	1,6505	3,0597	13,85	21,75	301,2375	0,2571	49,94	229,6	2,0167	3,4259	13,85	21,75	301,2375	0,1658
88,91	181,2	1,2907	2,6999	13,85	21,75	301,2375	0,2951	77,41	205,6	1,6564	3,0656	13,85	21,75	301,2375	0,2570	49,75	230	2,0226	3,4318	13,85	21,75	301,2375	0,1652
88,59	181,6	1,2967	2,7059	13,85	21,75	301,2375	0,2941	74,49	206	1,6624	3,0716	13,85	21,75	301,2375	0,2473	49,51	230,4	2,0286	3,4378	13,85	21,75	301,2375	0,1644
88,24	182	1,3026	2,7118	13,85	21,75	301,2375	0,2929	73,40	206,4	1,6684	3,0776	13,85	21,75	301,2375	0,2437	49,17	230,8	2,0348	3,444	13,85	21,75	301,2375	0,1632
87,47	182,4	1,3086	2,7178	13,85	21,75	301,2375	0,2904	73,23	206,8	1,6745	3,0837	13,85	21,75	301,2375	0,2431	48,62	231,2	2,0408	3,45	13,85	21,75	301,2375	0,1614
87,04	182,8	1,3148	2,724	13,85	21,75	301,2375	0,2889	73,00	207,2	1,6806	3,0898	13,85	21,75	301,2375	0,2423	48,68	231,6	2,0468	3,456	13,85	21,75	301,2375	0,1616
87,23	183,2	1,3208	2,73	13,85	21,75	301,2375	0,2896	71,54	207,6	1,6866	3,0958	13,85	21,75	301,2375	0,2375	48,57	232	2,0527	3,4619	13,85	21,75	301,2375	0,1612
87,06	183,6	1,3268	2,736	13,85	21,75	301,2375	0,2890	71,05	208	1,6925	3,1017	13,85	21,75	301,2375	0,2359	48,40	232,4	2,0587	3,4679	13,85	21,75	301,2375	0,1607
86,26	184	1,3327	2,7419	13,85	21,75	301,2375	0,2864	69,76	208,4	1,6984	3,1076	13,85	21,75	301,2375	0,2316	48,50	232,8	2,0646	3,4738	13,85	21,75	301,2375	0,1610
85,71	184,4	1,3386	2,7478	13,85	21,75	301,2375	0,2845	69,75	208,8	1,7044	3,1136	13,85	21,75	301,2375	0,2315	48,50	233,2	2,0707	3,4799	13,85	21,75	301,2375	0,1610
85,21	184,8	1,3446	2,7538	13,85	21,75	301,2375	0,2829	68,18	209,2	1,7105	3,1197	13,85	21,75	301,2375	0,2263	48,55	233,6	2,0768	3,486	13,85	21,75	301,2375	0,1612
84,70	185,2	1,3507	2,7599	13,85	21,75	301,2375	0,2812	66,35	209,6	1,7166	3,1258	13,85	21,75	301,2375	0,2203	48,29	234	2,0828	3,492	13,85	21,75	301,2375	0,1603
84,46	185,6	1,3568	2,766	13,85	21,75	301,2375	0,2804	66,40	210	1,7226	3,1318	13,85	21,75	301,2375	0,2204	48,20	234,4	2,0888	3,498	13,85	21,75	301,2375	0,1600
84,58	186	1,3628	2,772	13,85	21,75	301,2375	0,2808	67,03	210,4	1,7286	3,1378	13,85	21,75	301,2375	0,2225	48,33	234,8	2,0947	3,5039	13,85	21,75	301,2375	0,1604
84,43	186,4	1,3687	2,7779	13,85	21,75	301,2375	0,2803	66,15	210,8	1,7345	3,1437	13,85	21,75	301,2375	0,2196	48,53	235,2	2,1007	3,5099	13,85	21,75	301,2375	0,1611
83,99	186,8	1,3747	2,7839	13,85	21,75	301,2375	0,2788	64,41	211,2	1,7405	3,1497	13,85	21,75	301,2375	0,2138	48,60	235,6	2,1066	3,5158	13,85	21,75	301,2375	0,1613
83,06	187,2	1,3806	2,7898	13,85	21,75	301,2375	0,2757	61,86	211,6	1,7465	3,1557	13,85	21,75	301,2375	0,2054	48,44	236	2,1127	3,5219	13,85	21,75	301,2375	0,1608
81,60	187,6	1,3866	2,7958	13,85	21,75	301,2375	0,2709	60,07	212	1,7526	3,1618	13,85	21,75	301,2375	0,1994	48,44	236,4	2,1188	3,528	13,85	21,75	301,2375	0,1608
80,91	188	1,3927	2,8019	13,85	21,75	301,2375	0,2686	58,59	212,4	1,7587	3,1679	13,85	21,75	301,2375	0,1945	48,88	236,8	2,1248	3,534	13,85	21,75	301,2375	0,1623
80,51	188,4	1,3988	2,808	13,85	21,75	301,2375	0,2673	57,52	212,8	1,7647	3,1739	13,85	21,75	301,2375	0,1909	49,31	237,2	2,1307	3,5399	13,85	21,75	301,2375	0,1637
79,95	188,8	1,4048	2,814	13,85	21,75	301,2375	0,2654	56,72	213,2	1,7706	3,1798	13,85	21,75	301,2375	0,1883	49,98	237,6	2,1366	3,5458	13,85	21,75	301,2375	0,1659
80,04	189,2	1,4107	2,8199	13,85	21,75	301,2375	0,2657	56,09	213,6	1,7766	3,1858	13,85	21,75	301,2375	0,1862	50,42	238	2,1426	3,5518	13,85	21,75	301,2375	0,1674
80,45	189,6	1,4167	2,8259	13,85	21,75	301,2375	0,2671	55,08	214	1,7826	3,1918	13,85	21,75	301,2375	0,1828	50,93	238,4	2,1486	3,5578	13,85	21,75	301,2375	0,1691
81,01	190	1,4226	2,8318	13,85	21,75	301,2375	0,2689	54,98	214,4	1,7886	3,1978	13,85	21,75	301,2375	0,1825	51,59	238,8	2,1547	3,5639	13,85	21,75	301,2375	0,1713
81,69	190,4	1,4286	2,8378	13,85	21,75	301,2375	0,2712	54,85	214,8	1,7947	3,2039	13,85	21,75	301,2375	0,1821	52,02	239,2	2,1608	3,57	13,85	21,75	301,2375	0,1727
82,43	190,8	1,4348	2,844	13,85	21,75	301,2375	0,2736	54,89	215,2	1,8008	3,21	13,85	21,75	301,2375	0,1822	52,53	239,6	2,1668	3,576	13,85	21,75	301,2375	0,1744
82,64	191,2	1,4408	2,85	13,85	21,75	301,2375	0,2743	54,95	215,6	1,8068	3,216	13,85	21,75	301,2375	0,1824	52,76	240	2,1726	3,5818	13,85	21,75	301,2375	0,1751
82,99	191,6	1,4468	2,856	13,85	21,75	301,2375	0,2755	55,01	216	1,8127	3,2219	13,85	21,75	301,2375	0,1826	53,49	240,4	2,1786	3,5878	13,85	21,75	301,2375	0,1776
82,97	192	1,4527	2,8619	13,85	21,75	301,2375	0,2754	55,11	216,4	1,8186	3,2278	13,85	21,75	301,2375	0,1829	53,66	240,8	2,1846	3,5938	13,85	21,75	301,2375	0,1781
82,47	192,4	1,4586	2,8678	13,85	21,75	301,2375	0,2738	51,96	216,8	1,8246	3,2338	13,85	21,75	301,2375	0,1725	53,89	241,2	2,1906	3,5998	13,85	21,75	301,2375	0,1789
81,32	192,8	1,4646	2,8738	13,85	21,75	301,2375	0,2700	51,83	217,2	1,8307	3,2399	13,85	21,75	301,2375	0,1721	53,89	241,6	2,1967	3,6059	13,85	21,75	301,2375	0,1789
81,61	193,2	1,4707	2,8799	13,85	21,75	301,2375	0,2709	51,54	217,6	1,8368	3,246	13,85	21,75	301,2375	0,1711	54,12	242	2,2027	3,6119	13,85	21,75	301,2375	0,1797
82,26	193,6	1,4768	2,886	13,85	21,75	301,2375	0,2731	51,29	218	1,8429	3,2521	13,85	21,75	301,2375	0,1703	53,82	242,4	2,2086	3,6178	13,85	21,75	301,2375	0,1787
82,80	194	1,4828	2,892	13,85	21,75	301,2375	0,2749	51,21	218,4	1,8488	3,258	13,85	21,75	301,2375	0,1700	53,74	242,8	2,2145	3,6237	13,85	21,75	301,2375	0,1784
82,10	194,4	1,4887	2,8979	13,85	21,75	301,2375	0,2725	50,68	218,8	1,8547	3,2639	13,85	21,75	301,2375	0,1682	53,24	243,2	2,2205	3,6297	13,85	21,75	301,2375	0,1767
81,46	194,8	1,4946	2,9038	13,85	21,75	301,2375	0,2704	50,24	219,2	1,8607	3,2699	13,85	21,75	301,2375	0,1668	53,12	243,6	2,2265	3,6357	13,85	21,75	301,2375	0,1763
80,58	195,2	1,5006	2,9098	13,85	21,75	301,2375	0,2675	50,16	219,6	1,8667	3,2759	13,85	21,75	301,2375	0,1665	53,24	244	2,2326	3,6418	13,85	21,75	301,2375	0,1767
79,72	195,6	1,5066	2,9158	13,85	21,75	301,2375	0,2646	50,18	220	1,8728	3,282	13,85	21,75	301,2375	0,1666	53,39	244,4	2,2387	3,6479	13,85	21,75	301,2375	0,1772
78,55	196	1,5126	2,9218	13,85	21,75	301,2375	0,2608	49,91	220,4	1,8789	3,2881	13,85	21,75	301,2375	0,1657	53,57	244,8	2,2447	3,6539	13,85	21,75	301,2375	0,1778

LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
53,69	245,2	2,2506	3,6598	13,85	21,75	301,2375	0,1782
54,01	245,6	2,2565	3,6657	13,85	21,75	301,2375	0,1793
54,40	246	2,2625	3,6717	13,85	21,75	301,2375	0,1806
54,87	246,4	2,2685	3,6777	13,85	21,75	301,2375	0,1821
55,24	246,8	2,2746	3,6838	13,85	21,75	301,2375	0,1834
55,75	247,2	2,2807	3,6899	13,85	21,75	301,2375	0,1851
55,86	247,6	2,2867	3,6959	13,85	21,75	301,2375	0,1854
56,26	248	2,2926	3,7018	13,85	21,75	301,2375	0,1868
56,54	248,4	2,2985	3,7077	13,85	21,75	301,2375	0,1877
56,73	248,8	2,3045	3,7137	13,85	21,75	301,2375	0,1883
56,99	249,2	2,3106	3,7198	13,85	21,75	301,2375	0,1892
57,43	249,6	2,3167	3,7259	13,85	21,75	301,2375	0,1906
57,63	250	2,3227	3,7319	13,85	21,75	301,2375	0,1913
58,10	250,4	2,3286	3,7378	13,85	21,75	301,2375	0,1929
58,48	250,8	2,3346	3,7438	13,85	21,75	301,2375	0,1941
58,67	251,2	2,3405	3,7497	13,85	21,75	301,2375	0,1948
58,81	251,6	2,3465	3,7557	13,85	21,75	301,2375	0,1952
59,18	252	2,3527	3,7619	13,85	21,75	301,2375	0,1965
59,41	252,4	2,3588	3,768	13,85	21,75	301,2375	0,1972
59,69	252,8	2,3648	3,774	13,85	21,75	301,2375	0,1981
60,17	253,2	2,3707	3,7799	13,85	21,75	301,2375	0,1997
60,50	253,6	2,3766	3,7858	13,85	21,75	301,2375	0,2008
61,07	254	2,3826	3,7918	13,85	21,75	301,2375	0,2027
61,36	254,4	2,3886	3,7978	13,85	21,75	301,2375	0,2037
61,22	254,8	2,3948	3,804	13,85	21,75	301,2375	0,2032
61,32	255,2	2,4008	3,81	13,85	21,75	301,2375	0,2036
61,37	255,6	2,4068	3,816	13,85	21,75	301,2375	0,2037
61,48	256	2,4127	3,8219	13,85	21,75	301,2375	0,2041
61,34	256,4	2,4187	3,8279	13,85	21,75	301,2375	0,2036
61,29	256,8	2,4246	3,8338	13,85	21,75	301,2375	0,2035
61,15	257,2	2,4307	3,8399	13,85	21,75	301,2375	0,2030
61,06	257,6	2,4368	3,846	13,85	21,75	301,2375	0,2027
60,74	258	2,4429	3,8521	13,85	21,75	301,2375	0,2016
60,19	258,4	2,4488	3,858	13,85	21,75	301,2375	0,1998
59,55	258,8	2,4547	3,8639	13,85	21,75	301,2375	0,1977
58,81	259,2	2,4607	3,8699	13,85	21,75	301,2375	0,1952
57,60	259,6	2,4667	3,8759	13,85	21,75	301,2375	0,1912
56,23	260	2,4728	3,882	13,85	21,75	301,2375	0,1867
55,86	260,4	2,4789	3,8881	13,85	21,75	301,2375	0,1854
54,29	260,8	2,4849	3,8941	13,85	21,75	301,2375	0,1802
52,61	261,2	2,4908	3,9	13,85	21,75	301,2375	0,1746
52,40	261,6	2,4967	3,9059	13,85	21,75	301,2375	0,1739
51,41	262	2,5027	3,9119	13,85	21,75	301,2375	0,1707
50,26	262,4	2,5088	3,918	13,85	21,75	301,2375	0,1668
50,00	262,7	2,5133	3,9225	13,85	21,75	301,2375	0,1660

3.3.1.6-K Mix. Proportion Tests
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LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
0,01	1	-1,62435	0	13,5	13,2	178,2	0,0001
0,00	1,2	-1,62145	0,0029	13,5	13,2	178,2	0,0000
0,02	1,4	-1,61835	0,006	13,5	13,2	178,2	0,0001
0,01	1,6	-1,61545	0,0089	13,5	13,2	178,2	0,0001
0,00	1,8	-1,61235	0,012	13,5	13,2	178,2	0,0000
-0,02	2	-1,60935	0,015	13,5	13,2	178,2	-0,0001
0,01	2,2	-1,60635	0,018	13,5	13,2	178,2	0,0001
0,00	2,4	-1,60335	0,021	13,5	13,2	178,2	0,0000
0,00	2,6	-1,60035	0,024	13,5	13,2	178,2	0,0000
0,01	2,8	-1,59745	0,0269	13,5	13,2	178,2	0,0001
0,00	3	-1,59445	0,0299	13,5	13,2	178,2	0,0000
0,01	3,2	-1,59145	0,0329	13,5	13,2	178,2	0,0001
-0,01	3,4	-1,58855	0,0358	13,5	13,2	178,2	-0,0001
0,00	3,6	-1,58555	0,0388	13,5	13,2	178,2	0,0000
-0,01	3,8	-1,58255	0,0418	13,5	13,2	178,2	-0,0001
0,00	4	-1,57955	0,0448	13,5	13,2	178,2	0,0000
0,00	4,2	-1,57645	0,0479	13,5	13,2	178,2	0,0000
0,00	4,4	-1,57335	0,051	13,5	13,2	178,2	0,0000
0,00	4,6	-1,57035	0,054	13,5	13,2	178,2	0,0000
-0,01	4,8	-1,56735	0,057	13,5	13,2	178,2	-0,0001
0,00	5	-1,56435	0,06	13,5	13,2	178,2	0,0000
-0,02	5,2	-1,56135	0,063	13,5	13,2	178,2	-0,0001
0,01	5,4	-1,55845	0,0659	13,5	13,2	178,2	0,0001
0,00	5,6	-1,55545	0,0689	13,5	13,2	178,2	0,0000
0,02	5,8	-1,55255	0,0718	13,5	13,2	178,2	0,0001
0,02	6	-1,54955	0,0748	13,5	13,2	178,2	0,0001
0,01	6,2	-1,54655	0,0778	13,5	13,2	178,2	0,0001
0,00	6,4	-1,54355	0,0808	13,5	13,2	178,2	0,0000
0,00	6,6	-1,54055	0,0838	13,5	13,2	178,2	0,0000
0,01	6,8	-1,53745	0,0869	13,5	13,2	178,2	0,0001
-0,01	7	-1,53445	0,0899	13,5	13,2	178,2	-0,0001
0,00	7,2	-1,53145	0,0929	13,5	13,2	178,2	0,0000
0,00	7,4	-1,52835	0,096	13,5	13,2	178,2	0,0000
0,01	7,6	-1,52535	0,099	13,5	13,2	178,2	0,0001
0,01	7,8	-1,52245	0,1019	13,5	13,2	178,2	0,0001
0,01	8	-1,51945	0,1049	13,5	13,2	178,2	0,0001
0,00	8,2	-1,51655	0,1078	13,5	13,2	178,2	0,0000
0,01	8,4	-1,51355	0,1108	13,5	13,2	178,2	0,0001
0,01	8,6	-1,51055	0,1138	13,5	13,2	178,2	0,0001
0,01	8,8	-1,50755	0,1168	13,5	13,2	178,2	0,0001
0,01	9	-1,50455	0,1198	13,5	13,2	178,2	0,0001
0,00	9,2	-1,50155	0,1228	13,5	13,2	178,2	0,0000
0,01	9,4	-1,49855	0,1258	13,5	13,2	178,2	0,0001
-0,01	9,6	-1,49545	0,1289	13,5	13,2	178,2	-0,0001
0,02	9,8	-1,49245	0,1319	13,5	13,2	178,2	0,0001
0,00	10	-1,48945	0,1349	13,5	13,2	178,2	0,0000
0,00	10,2	-1,48635	0,138	13,5	13,2	178,2	0,0000
-0,01	10,4	-1,48345	0,1409	13,5	13,2	178,2	-0,0001
0,00	10,6	-1,48045	0,1439	13,5	13,2	178,2	0,0000
0,01	10,8	-1,47745	0,1469	13,5	13,2	178,2	0,0001
0,00	11	-1,47455	0,1498	13,5	13,2	178,2	0,0000
0,00	11,2	-1,47155	0,1528	13,5	13,2	178,2	0,0000
0,00	11,4	-1,46855	0,1558	13,5	13,2	178,2	0,0000
0,01	11,6	-1,46555	0,1588	13,5	13,2	178,2	0,0001
0,00	11,8	-1,46265	0,1617	13,5	13,2	178,2	0,0000
-0,01	12	-1,45955	0,1648	13,5	13,2	178,2	-0,0001
-0,01	12,2	-1,45655	0,1678	13,5	13,2	178,2	-0,0001
-0,01	12,4	-1,45345	0,1709	13,5	13,2	178,2	-0,0001
0,00	12,6	-1,45045	0,1739	13,5	13,2	178,2	0,0000
0,02	12,8	-1,44745	0,1769	13,5	13,2	178,2	0,0001
0,02	13	-1,44445	0,1799	13,5	13,2	178,2	0,0001

LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
0,01	13,2	-1,44155	0,1828	13,5	13,2	178,2	0,0001	0,60	25,4	-1,25865	0,3657	13,5	13,2	178,2	0,0034	1,08	37,6	-1,07545	0,5489	13,5	13,2	178,2	0,0061
0,02	13,4	-1,43855	0,1858	13,5	13,2	178,2	0,0001	0,62	25,6	-1,25565	0,3687	13,5	13,2	178,2	0,0035	1,11	37,8	-1,07255	0,5518	13,5	13,2	178,2	0,0062
0,02	13,6	-1,43555	0,1888	13,5	13,2	178,2	0,0001	0,65	25,8	-1,25255	0,3718	13,5	13,2	178,2	0,0036	1,13	38	-1,06955	0,5548	13,5	13,2	178,2	0,0063
0,03	13,8	-1,43255	0,1918	13,5	13,2	178,2	0,0002	0,66	26	-1,24955	0,3748	13,5	13,2	178,2	0,0037	1,14	38,2	-1,06655	0,5578	13,5	13,2	178,2	0,0064
0,02	14	-1,42965	0,1947	13,5	13,2	178,2	0,0001	0,67	26,2	-1,24655	0,3778	13,5	13,2	178,2	0,0038	1,16	38,4	-1,06355	0,5608	13,5	13,2	178,2	0,0065
0,02	14,2	-1,42665	0,1977	13,5	13,2	178,2	0,0001	0,69	26,4	-1,24355	0,3808	13,5	13,2	178,2	0,0039	1,16	38,6	-1,06055	0,5638	13,5	13,2	178,2	0,0065
0,04	14,4	-1,42365	0,2007	13,5	13,2	178,2	0,0002	0,69	26,6	-1,24055	0,3838	13,5	13,2	178,2	0,0039	1,16	38,8	-1,05755	0,5668	13,5	13,2	178,2	0,0065
0,04	14,6	-1,42065	0,2037	13,5	13,2	178,2	0,0002	0,70	26,8	-1,23765	0,3867	13,5	13,2	178,2	0,0039	1,17	39	-1,05445	0,5699	13,5	13,2	178,2	0,0066
0,04	14,8	-1,41755	0,2068	13,5	13,2	178,2	0,0002	0,72	27	-1,23465	0,3897	13,5	13,2	178,2	0,0040	1,18	39,2	-1,05135	0,573	13,5	13,2	178,2	0,0066
0,03	15	-1,41455	0,2098	13,5	13,2	178,2	0,0002	0,73	27,2	-1,23165	0,3927	13,5	13,2	178,2	0,0041	1,19	39,4	-1,04835	0,576	13,5	13,2	178,2	0,0067
0,06	15,2	-1,41155	0,2128	13,5	13,2	178,2	0,0003	0,74	27,4	-1,22865	0,3957	13,5	13,2	178,2	0,0042	1,18	39,6	-1,04535	0,579	13,5	13,2	178,2	0,0066
0,05	15,4	-1,40845	0,2159	13,5	13,2	178,2	0,0003	0,74	27,6	-1,22575	0,3986	13,5	13,2	178,2	0,0042	1,20	39,8	-1,04235	0,582	13,5	13,2	178,2	0,0067
0,06	15,6	-1,40545	0,2189	13,5	13,2	178,2	0,0003	0,76	27,8	-1,22275	0,4016	13,5	13,2	178,2	0,0043	1,19	40	-1,03945	0,5849	13,5	13,2	178,2	0,0067
0,05	15,8	-1,40245	0,2219	13,5	13,2	178,2	0,0003	0,77	28	-1,21965	0,4047	13,5	13,2	178,2	0,0043	1,20	40,2	-1,03645	0,5879	13,5	13,2	178,2	0,0067
0,06	16	-1,39955	0,2248	13,5	13,2	178,2	0,0003	0,78	28,2	-1,21665	0,4077	13,5	13,2	178,2	0,0044	1,21	40,4	-1,03355	0,5908	13,5	13,2	178,2	0,0068
0,07	16,2	-1,39655	0,2278	13,5	13,2	178,2	0,0004	0,79	28,4	-1,21355	0,4108	13,5	13,2	178,2	0,0044	1,20	40,6	-1,03055	0,5938	13,5	13,2	178,2	0,0067
0,07	16,4	-1,39355	0,2308	13,5	13,2	178,2	0,0004	0,79	28,6	-1,21055	0,4138	13,5	13,2	178,2	0,0044	1,20	40,8	-1,02755	0,5968	13,5	13,2	178,2	0,0067
0,07	16,6	-1,39065	0,2337	13,5	13,2	178,2	0,0004	0,83	28,8	-1,20755	0,4168	13,5	13,2	178,2	0,0047	1,20	41	-1,02455	0,5998	13,5	13,2	178,2	0,0067
0,09	16,8	-1,38765	0,2367	13,5	13,2	178,2	0,0005	0,81	29	-1,20455	0,4198	13,5	13,2	178,2	0,0045	1,21	41,2	-1,02155	0,6028	13,5	13,2	178,2	0,0068
0,08	17	-1,38465	0,2397	13,5	13,2	178,2	0,0004	0,85	29,2	-1,20155	0,4228	13,5	13,2	178,2	0,0048	1,23	41,4	-1,01855	0,6058	13,5	13,2	178,2	0,0069
0,10	17,2	-1,38165	0,2427	13,5	13,2	178,2	0,0006	0,85	29,4	-1,19865	0,4257	13,5	13,2	178,2	0,0048	1,23	41,6	-1,01545	0,6089	13,5	13,2	178,2	0,0069
0,09	17,4	-1,37865	0,2457	13,5	13,2	178,2	0,0005	0,87	29,6	-1,19565	0,4287	13,5	13,2	178,2	0,0049	1,23	41,8	-1,01235	0,612	13,5	13,2	178,2	0,0069
0,13	17,6	-1,37555	0,2488	13,5	13,2	178,2	0,0007	0,88	29,8	-1,19265	0,4317	13,5	13,2	178,2	0,0049	1,22	42	-1,00935	0,615	13,5	13,2	178,2	0,0068
0,11	17,8	-1,37245	0,2519	13,5	13,2	178,2	0,0006	0,88	30	-1,18965	0,4347	13,5	13,2	178,2	0,0049	1,23	42,2	-1,00635	0,618	13,5	13,2	178,2	0,0069
0,12	18	-1,36945	0,2549	13,5	13,2	178,2	0,0007	0,90	30,2	-1,18665	0,4377	13,5	13,2	178,2	0,0051	1,23	42,4	-1,00335	0,621	13,5	13,2	178,2	0,0069
0,14	18,2	-1,36645	0,2579	13,5	13,2	178,2	0,0008	0,91	30,4	-1,18365	0,4407	13,5	13,2	178,2	0,0051	1,23	42,6	-1,00045	0,6239	13,5	13,2	178,2	0,0069
0,14	18,4	-1,36355	0,2608	13,5	13,2	178,2	0,0008	0,92	30,6	-1,18065	0,4437	13,5	13,2	178,2	0,0052	1,25	42,8	-0,99745	0,6269	13,5	13,2	178,2	0,0070
0,16	18,6	-1,36055	0,2638	13,5	13,2	178,2	0,0009	0,94	30,8	-1,17765	0,4467	13,5	13,2	178,2	0,0053	1,22	43	-0,99455	0,6298	13,5	13,2	178,2	0,0068
0,17	18,8	-1,35755	0,2668	13,5	13,2	178,2	0,0010	0,87	31	-1,17455	0,4498	13,5	13,2	178,2	0,0049	1,24	43,2	-0,99155	0,6328	13,5	13,2	178,2	0,0070
0,19	19	-1,35465	0,2697	13,5	13,2	178,2	0,0011	0,88	31,2	-1,17145	0,4529	13,5	13,2	178,2	0,0049	1,24	43,4	-0,98855	0,6358	13,5	13,2	178,2	0,0070
0,18	19,2	-1,35165	0,2727	13,5	13,2	178,2	0,0010	0,88	31,4	-1,16845	0,4559	13,5	13,2	178,2	0,0049	1,25	43,6	-0,98555	0,6388	13,5	13,2	178,2	0,0070
0,21	19,4	-1,34865	0,2757	13,5	13,2	178,2	0,0012	0,91	31,6	-1,16545	0,4589	13,5	13,2	178,2	0,0051	1,25	43,8	-0,98255	0,6418	13,5	13,2	178,2	0,0070
0,20	19,6	-1,34565	0,2787	13,5	13,2	178,2	0,0011	0,91	31,8	-1,16255	0,4618	13,5	13,2	178,2	0,0051	1,27	44	-0,97955	0,6448	13,5	13,2	178,2	0,0071
0,24	19,8	-1,34275	0,2816	13,5	13,2	178,2	0,0013	0,93	32	-1,15955	0,4648	13,5	13,2	178,2	0,0052	1,27	44,2	-0,97655	0,6478	13,5	13,2	178,2	0,0071
0,23	20	-1,33965	0,2847	13,5	13,2	178,2	0,0013	0,93	32,2	-1,15655	0,4678	13,5	13,2	178,2	0,0052	1,27	44,4	-0,97345	0,6509	13,5	13,2	178,2	0,0071
0,24	20,2	-1,33665	0,2877	13,5	13,2	178,2	0,0013	0,93	32,4	-1,15365	0,4707	13,5	13,2	178,2	0,0052	1,29	44,6	-0,97045	0,6539	13,5	13,2	178,2	0,0072
0,28	20,4	-1,33355	0,2908	13,5	13,2	178,2	0,0016	0,94	32,6	-1,15065	0,4737	13,5	13,2	178,2	0,0053	1,29	44,8	-0,96735	0,657	13,5	13,2	178,2	0,0072
0,27	20,6	-1,33055	0,2938	13,5	13,2	178,2	0,0015	0,94	32,8	-1,14765	0,4767	13,5	13,2	178,2	0,0053	1,30	45	-0,96445	0,6599	13,5	13,2	178,2	0,0073
0,29	20,8	-1,32755	0,2968	13,5	13,2	178,2	0,0016	0,94	33	-1,14465	0,4797	13,5	13,2	178,2	0,0053	1,30	45,2	-0,96145	0,6629	13,5	13,2	178,2	0,0073
0,30	21	-1,32455	0,2998	13,5	13,2	178,2	0,0017	0,94	33,2	-1,14165	0,4827	13,5	13,2	178,2	0,0053	1,31	45,4	-0,95855	0,6658	13,5	13,2	178,2	0,0074
0,31	21,2	-1,32155	0,3028	13,5	13,2	178,2	0,0017	0,94	33,4	-1,13855	0,4858	13,5	13,2	178,2	0,0053	1,32	45,6	-0,95555	0,6688	13,5	13,2	178,2	0,0074
0,33	21,4	-1,31865	0,3057	13,5	13,2	178,2	0,0019	0,95	33,6	-1,13555	0,4888	13,5	13,2	178,2	0,0053	1,32	45,8	-0,95255	0,6718	13,5	13,2	178,2	0,0074
0,33	21,6	-1,31565	0,3087	13,5	13,2	178,2	0,0019	0,94	33,8	-1,13245	0,4919	13,5	13,2	178,2	0,0053	1,32	46	-0,94965	0,6747	13,5	13,2	178,2	0,0074
0,36	21,8	-1,31275	0,3116	13,5	13,2	178,2	0,0020	0,95	34	-1,12945	0,4949	13,5	13,2	178,2	0,0053	1,32	46,2	-0,94665	0,6777	13,5	13,2	178,2	0,0074
0,36	22	-1,30975	0,3146	13,5	13,2	178,2	0,0020	0,94	34,2	-1,12635	0,498	13,5	13,2	178,2	0,0053	1,34	46,4	-0,94365	0,6807	13,5	13,2	178,2	0,0075
0,38	22,2	-1,30675	0,3176	13,5	13,2	178,2	0,0021	0,95	34,4	-1,12345	0,5009	13,5	13,2	178,2	0,0053	1,33	46,6	-0,94065	0,6837	13,5	13,2	178,2	0,0075
0,37	22,4	-1,30375	0,3206	13,5	13,2	178,2	0,0021	0,95	34,6	-1,12045	0,5039	13,5	13,2	178,2	0,0053	1,34	46,8	-0,93755	0,6868	13,5	13,2	178,2	0,0075
0,38	22,6	-1,30065	0,3237	13,5	13,2	178,2	0,0021	0,96	34,8	-1,11755	0,5068	13,5	13,2	178,2	0,0054	1,35	47	-0,93455	0,6898	13,5	13,2	178,2	0,0076
0,40	22,8	-1,29765	0,3267	13,5	13,2	178,2	0,0022	0,94	35	-1,11455	0,5098	13,5	13,2	178,2	0,0053	1,34	47,2	-0,93155	0,6928	13,5	13,2	178,2	0,0075
0,42	23	-1,29455	0,3298	13,5	13,2	178,2	0,0024	0,96	35,2	-1,11155	0,5128	13,5	13,2	178,2	0,0054	1,35	47,4	-0,92845	0,6959	13,5	13,2	178,2	0,0076
0,45	23,2	-1,29155	0,3328	13,5	13,2	178,2	0,0025	0,96	35,4	-1,10855	0,5158	13,5	13,2	178,2	0,0054	1,36	47,6	-0,92555	0,6988	13,5	13,2	178,2	0,0076
0,45	23,4	-1,28855	0,3358	13,5	13,2	178,2	0,0025	0,97	35,6	-1,10565	0,5187	13,5	13,2	178,2	0,0054	1,35	47,8	-0,92255	0,7018	13,5	13,2	178,2	0,0076
0,49	23,6	-1,28555	0,3388	13,5	13,2	178,2	0,0027	0,96	35,8	-1,10255	0,5218	13,5	13,2	178,2	0,0054	1,35	48	-0,91955	0,7048	13,5	13,2	178,2	0,0076
0,49	23,8	-1,28255	0,3418	13,5	13,2	178,2	0,0027	0,96	36	-1,09955	0,5248	13,5	13,2	178,2	0,0054	1,36	48,2	-0,91665	0,7077	13,5	13,2	178,2	0,0076
0,50	24	-1,27965	0,3447	13,5	13,2	178,2	0,0028	0,97	36,2	-1,09645	0,5279	13,5	13,2	178,2	0,0054	1,34	48,4	-0,91365	0,7107	13,5	13,2	178,2	0,0075
0,51	24,2	-1,27665	0,3477	13,5	13,2	178,2	0,0029	0,98	36,4	-1,09345	0,5309	13,5	13,2	178,2	0,0055	1,36	48,6	-0,91065	0,7137	13,5	13,2	178,2	0,0076
0,51	24,4	-1,27365	0,3507	13,5	13,2	178,2	0,0029	1,00	36,6	-1,09035	0,534	13,5	13,2	178,2	0,0056	1,35	48,8	-0,90765	0,7167	13,5	13,2	178,2	0,0076
0,55	24,6	-1,27065	0,3537	13,5	13,2	178,2	0,0031	1,01	36,8	-1,08735	0,537	13,5	13,2	178,2	0,0057	1,37	49	-0,90465	0,7197	13,5	13,2	178,2	0,0077
0,54	24,8	-1,26775	0,3566	13,5	13,2	178,2	0,0030	1,03	37	-1,08435	0,54	13,5	13,2	178,2	0,0058	1,35	49,2	-0,90165	0,7227	13,5	13,2	178,2	0,0076
0,58	25	-1,26475	0,3596	13,5	13,2	178,2	0,0033	1,06	37,2	-1,08135	0,543	13,5	13,2	178,2	0,0059	1,36	49,4	-0,89865	0,7257	13,5	13,2	178,2	0,0076
0,60	25,2	-1,26175	0,3626	13,5	13,2	178,2	0,0034	1,08	37,4	-1,07845	0,5459	13,5	13,2	178,2	0,0061	1,36	49,6	-0,89555	0,7288	13,5	13,2	178,2	0,0076

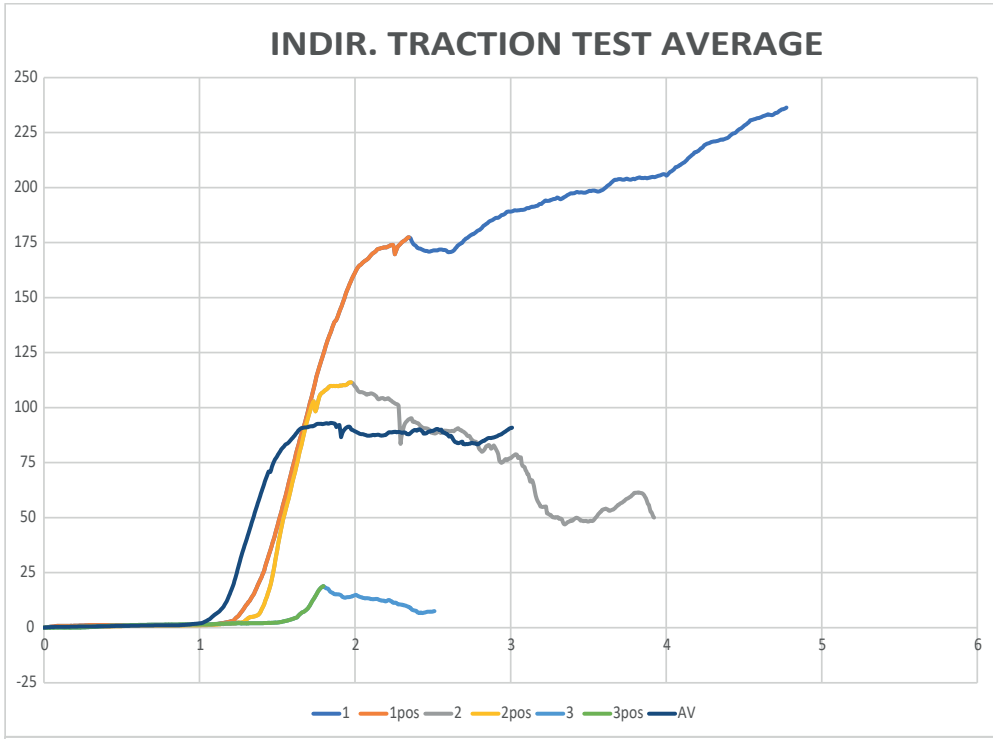
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
1,35	49,8	-0,89255	0,7318	13,5	13,2	178,2	0,0076	1,52	62	-0,70965	0,9147	13,5	13,2	178,2	0,0085	1,65	74,2	-0,52655	1,0978	13,5	13,2	178,2	0,0093
1,36	50	-0,88945	0,7349	13,5	13,2	178,2	0,0076	1,52	62,2	-0,70665	0,9177	13,5	13,2	178,2	0,0085	1,67	74,4	-0,52355	1,1008	13,5	13,2	178,2	0,0094
1,34	50,2	-0,88655	0,7378	13,5	13,2	178,2	0,0075	1,50	62,4	-0,70365	0,9207	13,5	13,2	178,2	0,0084	1,68	74,6	-0,52065	1,1037	13,5	13,2	178,2	0,0094
1,36	50,4	-0,88355	0,7408	13,5	13,2	178,2	0,0076	1,51	62,6	-0,70065	0,9237	13,5	13,2	178,2	0,0085	1,70	74,8	-0,51765	1,1067	13,5	13,2	178,2	0,0095
1,36	50,6	-0,88055	0,7438	13,5	13,2	178,2	0,0076	1,51	62,8	-0,69765	0,9267	13,5	13,2	178,2	0,0085	1,73	75	-0,51465	1,1097	13,5	13,2	178,2	0,0097
1,36	50,8	-0,87755	0,7468	13,5	13,2	178,2	0,0076	1,51	63	-0,69455	0,9298	13,5	13,2	178,2	0,0085	1,71	75,2	-0,51175	1,1126	13,5	13,2	178,2	0,0096
1,35	51	-0,87465	0,7497	13,5	13,2	178,2	0,0076	1,53	63,2	-0,69145	0,9329	13,5	13,2	178,2	0,0086	1,74	75,4	-0,50875	1,1156	13,5	13,2	178,2	0,0098
1,38	51,2	-0,87165	0,7527	13,5	13,2	178,2	0,0077	1,51	63,4	-0,68855	0,9358	13,5	13,2	178,2	0,0085	1,72	75,6	-0,50575	1,1186	13,5	13,2	178,2	0,0097
1,36	51,4	-0,86865	0,7557	13,5	13,2	178,2	0,0076	1,53	63,6	-0,68555	0,9388	13,5	13,2	178,2	0,0086	1,74	75,8	-0,50275	1,1216	13,5	13,2	178,2	0,0098
1,37	51,6	-0,86565	0,7587	13,5	13,2	178,2	0,0077	1,53	63,8	-0,68265	0,9417	13,5	13,2	178,2	0,0086	1,73	76	-0,49975	1,1246	13,5	13,2	178,2	0,0097
1,37	51,8	-0,86265	0,7617	13,5	13,2	178,2	0,0077	1,51	64	-0,67965	0,9447	13,5	13,2	178,2	0,0085	1,75	76,2	-0,49665	1,1277	13,5	13,2	178,2	0,0098
1,36	52	-0,85965	0,7647	13,5	13,2	178,2	0,0076	1,51	64,2	-0,67665	0,9477	13,5	13,2	178,2	0,0085	1,76	76,4	-0,49355	1,1308	13,5	13,2	178,2	0,0099
1,37	52,2	-0,85655	0,7678	13,5	13,2	178,2	0,0077	1,50	64,4	-0,67365	0,9507	13,5	13,2	178,2	0,0084	1,75	76,6	-0,49055	1,1338	13,5	13,2	178,2	0,0098
1,38	52,4	-0,85345	0,7709	13,5	13,2	178,2	0,0077	1,53	64,6	-0,67065	0,9537	13,5	13,2	178,2	0,0086	1,78	76,8	-0,48755	1,1368	13,5	13,2	178,2	0,0100
1,38	52,6	-0,85045	0,7739	13,5	13,2	178,2	0,0077	1,51	64,8	-0,66775	0,9566	13,5	13,2	178,2	0,0085	1,77	77	-0,48455	1,1398	13,5	13,2	178,2	0,0099
1,39	52,8	-0,84745	0,7769	13,5	13,2	178,2	0,0078	1,52	65	-0,66475	0,9596	13,5	13,2	178,2	0,0085	1,78	77,2	-0,48165	1,1427	13,5	13,2	178,2	0,0100
1,39	53	-0,84445	0,7799	13,5	13,2	178,2	0,0078	1,52	65,2	-0,66175	0,9626	13,5	13,2	178,2	0,0085	1,78	77,4	-0,47865	1,1457	13,5	13,2	178,2	0,0100
1,39	53,2	-0,84155	0,7828	13,5	13,2	178,2	0,0078	1,52	65,4	-0,65865	0,9657	13,5	13,2	178,2	0,0085	1,78	77,6	-0,47575	1,1486	13,5	13,2	178,2	0,0100
1,38	53,4	-0,83855	0,7858	13,5	13,2	178,2	0,0077	1,52	65,6	-0,65565	0,9687	13,5	13,2	178,2	0,0085	1,78	77,8	-0,47275	1,1516	13,5	13,2	178,2	0,0100
1,39	53,6	-0,83555	0,7888	13,5	13,2	178,2	0,0078	1,51	65,8	-0,65255	0,9718	13,5	13,2	178,2	0,0085	1,80	78	-0,46975	1,1546	13,5	13,2	178,2	0,0101
1,37	53,8	-0,83265	0,7917	13,5	13,2	178,2	0,0077	1,52	66	-0,64955	0,9748	13,5	13,2	178,2	0,0085	1,81	78,2	-0,46675	1,1576	13,5	13,2	178,2	0,0102
1,38	54	-0,82965	0,7947	13,5	13,2	178,2	0,0077	1,52	66,2	-0,64655	0,9778	13,5	13,2	178,2	0,0085	1,80	78,4	-0,46375	1,1606	13,5	13,2	178,2	0,0101
1,39	54,2	-0,82665	0,7977	13,5	13,2	178,2	0,0078	1,52	66,4	-0,64365	0,9807	13,5	13,2	178,2	0,0085	1,82	78,6	-0,46075	1,1636	13,5	13,2	178,2	0,0102
1,38	54,4	-0,82365	0,8007	13,5	13,2	178,2	0,0077	1,52	66,6	-0,64065	0,9837	13,5	13,2	178,2	0,0085	1,83	78,8	-0,45765	1,1667	13,5	13,2	178,2	0,0103
1,39	54,6	-0,82065	0,8037	13,5	13,2	178,2	0,0078	1,52	66,8	-0,63775	0,9866	13,5	13,2	178,2	0,0085	1,85	79	-0,45455	1,1698	13,5	13,2	178,2	0,0104
1,41	54,8	-0,81755	0,8068	13,5	13,2	178,2	0,0079	1,53	67	-0,63475	0,9896	13,5	13,2	178,2	0,0086	1,85	79,2	-0,45155	1,1728	13,5	13,2	178,2	0,0104
1,41	55	-0,81455	0,8098	13,5	13,2	178,2	0,0079	1,52	67,2	-0,63175	0,9926	13,5	13,2	178,2	0,0085	1,85	79,4	-0,44855	1,1758	13,5	13,2	178,2	0,0104
1,41	55,2	-0,81145	0,8129	13,5	13,2	178,2	0,0079	1,53	67,4	-0,62875	0,9956	13,5	13,2	178,2	0,0086	1,88	79,6	-0,44555	1,1788	13,5	13,2	178,2	0,0105
1,41	55,4	-0,80845	0,8159	13,5	13,2	178,2	0,0079	1,51	67,6	-0,62575	0,9986	13,5	13,2	178,2	0,0085	1,86	79,8	-0,44255	1,1818	13,5	13,2	178,2	0,0104
1,40	55,6	-0,80545	0,8189	13,5	13,2	178,2	0,0079	1,52	67,8	-0,62275	1,0016	13,5	13,2	178,2	0,0085	1,89	80	-0,43965	1,1847	13,5	13,2	178,2	0,0106
1,38	55,8	-0,80245	0,8219	13,5	13,2	178,2	0,0077	1,52	68	-0,61975	1,0046	13,5	13,2	178,2	0,0085	1,88	80,2	-0,43665	1,1877	13,5	13,2	178,2	0,0105
1,39	56	-0,79955	0,8248	13,5	13,2	178,2	0,0078	1,52	68,2	-0,61665	1,0077	13,5	13,2	178,2	0,0085	1,88	80,4	-0,43365	1,1907	13,5	13,2	178,2	0,0105
1,40	56,2	-0,79655	0,8278	13,5	13,2	178,2	0,0079	1,52	68,4	-0,61365	1,0107	13,5	13,2	178,2	0,0085	1,89	80,6	-0,43075	1,1936	13,5	13,2	178,2	0,0106
1,40	56,4	-0,79355	0,8308	13,5	13,2	178,2	0,0079	1,52	68,6	-0,61055	1,0138	13,5	13,2	178,2	0,0085	1,90	80,8	-0,42775	1,1966	13,5	13,2	178,2	0,0107
1,41	56,6	-0,79055	0,8338	13,5	13,2	178,2	0,0079	1,51	68,8	-0,60755	1,0168	13,5	13,2	178,2	0,0085	1,90	81	-0,42465	1,1997	13,5	13,2	178,2	0,0107
1,40	56,8	-0,78765	0,8367	13,5	13,2	178,2	0,0079	1,52	69	-0,60465	1,0197	13,5	13,2	178,2	0,0085	1,91	81,2	-0,42175	1,2026	13,5	13,2	178,2	0,0107
1,41	57	-0,78465	0,8397	13,5	13,2	178,2	0,0079	1,53	69,2	-0,60165	1,0227	13,5	13,2	178,2	0,0086	1,94	81,4	-0,41865	1,2057	13,5	13,2	178,2	0,0109
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1,41	57,4	-0,77855	0,8458	13,5	13,2	178,2	0,0079	1,52	69,6	-0,59575	1,0286	13,5	13,2	178,2	0,0085	1,94	81,8	-0,41255	1,2118	13,5	13,2	178,2	0,0109
1,42	57,6	-0,77545	0,8489	13,5	13,2	178,2	0,0080	1,52	69,8	-0,59275	1,0316	13,5	13,2	178,2	0,0085	1,95	82	-0,40955	1,2148	13,5	13,2	178,2	0,0109
1,40	57,8	-0,77245	0,8519	13,5	13,2	178,2	0,0079	1,52	70	-0,58975	1,0346	13,5	13,2	178,2	0,0085	1,95	82,2	-0,40655	1,2178	13,5	13,2	178,2	0,0109
1,42	58	-0,76945	0,8549	13,5	13,2	178,2	0,0080	1,53	70,2	-0,58675	1,0376	13,5	13,2	178,2	0,0086	1,96	82,4	-0,40355	1,2208	13,5	13,2	178,2	0,0110
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1,51	59,4	-0,74855	0,8758	13,5	13,2	178,2	0,0085	1,53	71,6	-0,56555	1,0588	13,5	13,2	178,2	0,0086	2,01	83,8	-0,38265	1,2417	13,5	13,2	178,2	0,0113
1,51	59,6	-0,74555	0,8788	13,5	13,2	178,2	0,0085	1,53	71,8	-0,56265	1,0617	13,5	13,2	178,2	0,0086	2,02	84	-0,37965	1,2447	13,5	13,2	178,2	0,0113
1,50	59,8	-0,74265	0,8817	13,5	13,2	178,2	0,0084	1,52	72	-0,55975	1,0646	13,5	13,2	178,2	0,0085	2,00	84,2	-0,37655	1,2478	13,5	13,2	178,2	0,0112
1,50	60	-0,73955	0,8848	13,5	13,2	178,2	0,0084	1,53	72,2	-0,55675	1,0676	13,5	13,2	178,2	0,0086	2,02	84,4	-0,37355	1,2508	13,5	13,2	178,2	0,0113
1,50	60,2	-0,73655	0,8878	13,5	13,2	178,2	0,0084	1,54	72,4	-0,55375	1,0706	13,5	13,2	178,2	0,0086	2,01	84,6	-0,37045	1,2539	13,5	13,2	178,2	0,0113
1,51	60,4	-0,73345	0,8909	13,5	13,2	178,2	0,0085	1,53	72,6	-0,55075	1,0736	13,5	13,2	178,2	0,0086	2,04	84,8	-0,36745	1,2569	13,5	13,2	178,2	0,0114
1,52	60,6	-0,73045	0,8939	13,5	13,2	178,2	0,0085	1,55	72,8	-0,54775	1,0766	13,5	13,2	178,2	0,0087	2,03	85	-0,36455	1,2598	13,5	13,2	178,2	0,0114
1,51	60,8	-0,72745	0,8969	13,5	13,2	178,2	0,0085	1,55	73	-0,54475	1,0796	13,5	13,2	178,2	0,0087	2,03	85,2	-0,36155	1,2628	13,5	13,2	178,2	0,0114
1,51	61	-0,72445	0,8999	13,5	13,2	178,2	0,0085	1,57	73,2	-0,54175	1,0826	13,5	13,2	178,2	0,0088	2,02	85,4	-0,35865	1,2657	13,5	13,2	178,2	0,0113
1,51	61,2	-0,72155	0,9028	13,5	13,2	178,2	0,0085	1,59	73,4	-0,53865	1,0857	13,5	13,2	178,2	0,0089	1,91	85,6	-0,35565	1,2687	13,5	13,2	178,2	0,0107
1,51	61,4	-0,71855	0,9058	13,5	13,2	178,2	0,0085	1,59	73,6	-0,53565	1,0887	13,5	13,2	178,2	0,0089	1,94	85,8	-0,35265	1,2717	13,5	13,2	178,2	0,0109
1,51	61,6	-0,71555	0,9088	13,5	13,2	178,2	0,0085	1,61	73,8	-0,53255	1,0918	13,5	13,2	178,2	0,0090	1,94	86	-0,34965	1,2747	13,5	13,2	178,2	0,0109
1,51	61,8	-0,71265	0,9117	13,5	13,2	178,2	0,0085	1,64	74	-0,52955	1,0948	13,5	13,2	178,2	0,0092	1,94	86,2	-0,34665	1,2777	13,5	13,2	178,2	0,0109

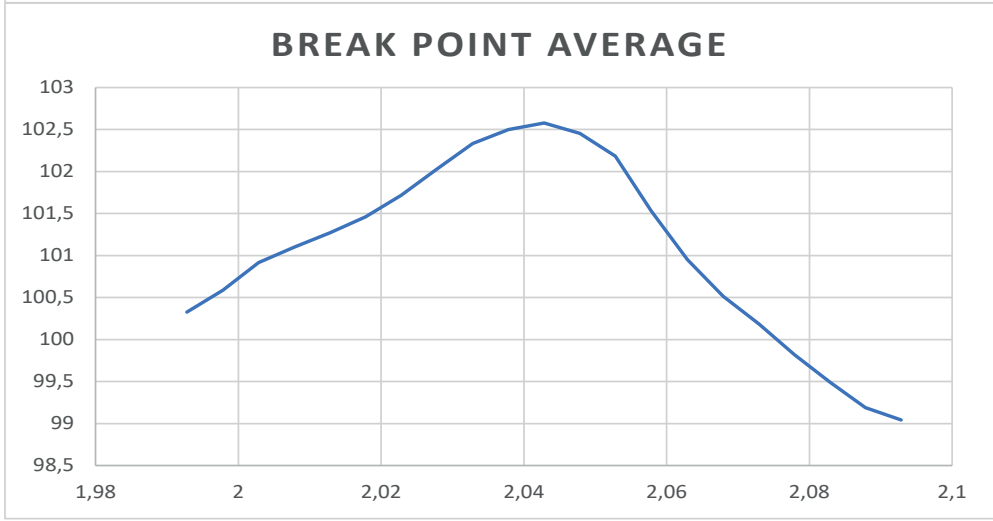
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
1,95	86,4	-0,34365	1,2807	13,5	13,2	178,2	0,0109	2,20	98,6	-0,16055	1,4638	13,5	13,2	178,2	0,0123	6,22	110,8	0,02235	1,6467	13,5	13,2	178,2	0,0349
1,94	86,6	-0,34065	1,2837	13,5	13,2	178,2	0,0109	2,22	98,8	-0,15755	1,4668	13,5	13,2	178,2	0,0125	6,40	111	0,02545	1,6498	13,5	13,2	178,2	0,0359
1,94	86,8	-0,33755	1,2868	13,5	13,2	178,2	0,0109	2,23	99	-0,15465	1,4697	13,5	13,2	178,2	0,0125	6,55	111,2	0,02845	1,6528	13,5	13,2	178,2	0,0368
1,94	87	-0,33455	1,2898	13,5	13,2	178,2	0,0109	2,23	99,2	-0,15165	1,4727	13,5	13,2	178,2	0,0125	6,71	111,4	0,03145	1,6558	13,5	13,2	178,2	0,0377
1,97	87,2	-0,33155	1,2928	13,5	13,2	178,2	0,0111	2,24	99,4	-0,14865	1,4757	13,5	13,2	178,2	0,0126	6,87	111,6	0,03445	1,6588	13,5	13,2	178,2	0,0386
1,97	87,4	-0,32855	1,2958	13,5	13,2	178,2	0,0111	2,27	99,6	-0,14565	1,4787	13,5	13,2	178,2	0,0127	6,96	111,8	0,03735	1,6617	13,5	13,2	178,2	0,0391
1,98	87,6	-0,32555	1,2988	13,5	13,2	178,2	0,0111	2,27	99,8	-0,14265	1,4817	13,5	13,2	178,2	0,0127	7,05	112	0,04035	1,6647	13,5	13,2	178,2	0,0396
2,00	87,8	-0,32255	1,3018	13,5	13,2	178,2	0,0112	2,26	100	-0,13955	1,4848	13,5	13,2	178,2	0,0127	7,19	112,2	0,04335	1,6677	13,5	13,2	178,2	0,0403
1,98	88	-0,31955	1,3048	13,5	13,2	178,2	0,0111	2,25	100,2	-0,13655	1,4878	13,5	13,2	178,2	0,0126	7,25	112,4	0,04625	1,6706	13,5	13,2	178,2	0,0407
1,99	88,2	-0,31665	1,3077	13,5	13,2	178,2	0,0112	2,26	100,4	-0,13345	1,4909	13,5	13,2	178,2	0,0127	7,37	112,6	0,04925	1,6736	13,5	13,2	178,2	0,0414
1,98	88,4	-0,31355	1,3108	13,5	13,2	178,2	0,0111	2,29	100,6	-0,13045	1,4939	13,5	13,2	178,2	0,0129	7,52	112,8	0,05225	1,6766	13,5	13,2	178,2	0,0422
2,00	88,6	-0,31065	1,3137	13,5	13,2	178,2	0,0112	2,31	100,8	-0,12745	1,4969	13,5	13,2	178,2	0,0130	7,65	113	0,05525	1,6796	13,5	13,2	178,2	0,0429
1,97	88,8	-0,30765	1,3167	13,5	13,2	178,2	0,0111	2,31	101	-0,12445	1,4999	13,5	13,2	178,2	0,0130	7,87	113,2	0,05825	1,6826	13,5	13,2	178,2	0,0442
2,00	89	-0,30465	1,3197	13,5	13,2	178,2	0,0112	2,35	101,2	-0,12145	1,5029	13,5	13,2	178,2	0,0132	8,06	113,4	0,06135	1,6857	13,5	13,2	178,2	0,0452
2,00	89,2	-0,30165	1,3227	13,5	13,2	178,2	0,0112	2,36	101,4	-0,11855	1,5058	13,5	13,2	178,2	0,0132	8,24	113,6	0,06435	1,6887	13,5	13,2	178,2	0,0462
2,01	89,4	-0,29855	1,3258	13,5	13,2	178,2	0,0113	2,38	101,6	-0,11555	1,5088	13,5	13,2	178,2	0,0134	8,46	113,8	0,06745	1,6918	13,5	13,2	178,2	0,0475
2,00	89,6	-0,29555	1,3288	13,5	13,2	178,2	0,0112	2,45	101,8	-0,11255	1,5118	13,5	13,2	178,2	0,0137	8,68	114	0,07045	1,6948	13,5	13,2	178,2	0,0487
2,00	89,8	-0,29245	1,3319	13,5	13,2	178,2	0,0112	2,45	102	-0,10955	1,5148	13,5	13,2	178,2	0,0137	8,93	114,2	0,07345	1,6978	13,5	13,2	178,2	0,0501
2,02	90	-0,28945	1,3349	13,5	13,2	178,2	0,0113	2,56	102,2	-0,10655	1,5178	13,5	13,2	178,2	0,0144	9,20	114,4	0,07635	1,7007	13,5	13,2	178,2	0,0516
2,01	90,2	-0,28645	1,3379	13,5	13,2	178,2	0,0113	2,57	102,4	-0,10355	1,5208	13,5	13,2	178,2	0,0144	9,52	114,6	0,07925	1,7036	13,5	13,2	178,2	0,0534
2,02	90,4	-0,28345	1,3409	13,5	13,2	178,2	0,0113	2,58	102,6	-0,10055	1,5238	13,5	13,2	178,2	0,0145	9,77	114,8	0,08225	1,7066	13,5	13,2	178,2	0,0548
2,02	90,6	-0,28055	1,3438	13,5	13,2	178,2	0,0113	2,60	102,8	-0,09755	1,5268	13,5	13,2	178,2	0,0146	10,17	115	0,08525	1,7096	13,5	13,2	178,2	0,0571
2,04	90,8	-0,27755	1,3468	13,5	13,2	178,2	0,0114	2,67	103	-0,09445	1,5299	13,5	13,2	178,2	0,0150	10,55	115,2	0,08825	1,7126	13,5	13,2	178,2	0,0592
2,04	91	-0,27455	1,3498	13,5	13,2	178,2	0,0114	2,76	103,2	-0,09145	1,5329	13,5	13,2	178,2	0,0155	10,92	115,4	0,09125	1,7156	13,5	13,2	178,2	0,0613
2,05	91,2	-0,27155	1,3528	13,5	13,2	178,2	0,0115	2,79	103,4	-0,08835	1,536	13,5	13,2	178,2	0,0157	11,27	115,6	0,09415	1,7185	13,5	13,2	178,2	0,0632
2,04	91,4	-0,26855	1,3558	13,5	13,2	178,2	0,0114	2,81	103,6	-0,08545	1,5389	13,5	13,2	178,2	0,0158	11,62	115,8	0,09725	1,7216	13,5	13,2	178,2	0,0652
2,06	91,6	-0,26555	1,3588	13,5	13,2	178,2	0,0116	2,89	103,8	-0,08245	1,5419	13,5	13,2	178,2	0,0162	12,00	116	0,10025	1,7246	13,5	13,2	178,2	0,0673
2,03	91,8	-0,26255	1,3618	13,5	13,2	178,2	0,0114	2,93	104	-0,07955	1,5448	13,5	13,2	178,2	0,0164	12,41	116,2	0,10325	1,7276	13,5	13,2	178,2	0,0696
2,04	92	-0,25955	1,3648	13,5	13,2	178,2	0,0114	2,95	104,2	-0,07655	1,5478	13,5	13,2	178,2	0,0166	12,75	116,4	0,10635	1,7307	13,5	13,2	178,2	0,0715
2,01	92,2	-0,25655	1,3678	13,5	13,2	178,2	0,0113	3,05	104,4	-0,07355	1,5508	13,5	13,2	178,2	0,0171	13,02	116,6	0,10935	1,7337	13,5	13,2	178,2	0,0731
2,05	92,4	-0,25345	1,3709	13,5	13,2	178,2	0,0115	3,05	104,6	-0,07055	1,5538	13,5	13,2	178,2	0,0171	13,39	116,8	0,11235	1,7367	13,5	13,2	178,2	0,0751
2,05	92,6	-0,25045	1,3739	13,5	13,2	178,2	0,0115	3,05	104,8	-0,06755	1,5568	13,5	13,2	178,2	0,0171	13,73	117	0,11535	1,7397	13,5	13,2	178,2	0,0770
2,08	92,8	-0,24735	1,377	13,5	13,2	178,2	0,0117	3,13	105	-0,06455	1,5598	13,5	13,2	178,2	0,0176	14,09	117,2	0,11825	1,7426	13,5	13,2	178,2	0,0791
2,07	93	-0,24445	1,3799	13,5	13,2	178,2	0,0116	3,18	105,2	-0,06155	1,5628	13,5	13,2	178,2	0,0178	14,40	117,4	0,12125	1,7456	13,5	13,2	178,2	0,0808
2,07	93,2	-0,24155	1,3828	13,5	13,2	178,2	0,0116	3,27	105,4	-0,05855	1,5658	13,5	13,2	178,2	0,0184	14,77	117,6	0,12425	1,7486	13,5	13,2	178,2	0,0829
2,05	93,4	-0,23855	1,3858	13,5	13,2	178,2	0,0115	3,30	105,6	-0,05545	1,5689	13,5	13,2	178,2	0,0185	15,16	117,8	0,12715	1,7515	13,5	13,2	178,2	0,0851
2,06	93,6	-0,23555	1,3888	13,5	13,2	178,2	0,0116	3,40	105,8	-0,05235	1,572	13,5	13,2	178,2	0,0191	15,51	118	0,13015	1,7545	13,5	13,2	178,2	0,0870
2,06	93,8	-0,23255	1,3918	13,5	13,2	178,2	0,0116	3,45	106	-0,04935	1,575	13,5	13,2	178,2	0,0194	15,85	118,2	0,13315	1,7575	13,5	13,2	178,2	0,0889
2,07	94	-0,22965	1,3947	13,5	13,2	178,2	0,0116	3,52	106,2	-0,04635	1,578	13,5	13,2	178,2	0,0198	16,20	118,4	0,13615	1,7605	13,5	13,2	178,2	0,0909
2,07	94,2	-0,22665	1,3977	13,5	13,2	178,2	0,0116	3,57	106,4	-0,04345	1,5809	13,5	13,2	178,2	0,0200	16,61	118,6	0,13925	1,7636	13,5	13,2	178,2	0,0932
2,06	94,4	-0,22365	1,4007	13,5	13,2	178,2	0,0116	3,63	106,6	-0,04045	1,5839	13,5	13,2	178,2	0,0204	16,95	118,8	0,14225	1,7666	13,5	13,2	178,2	0,0951
2,07	94,6	-0,22055	1,4038	13,5	13,2	178,2	0,0116	3,68	106,8	-0,03755	1,5868	13,5	13,2	178,2	0,0207	17,26	119	0,14535	1,7697	13,5	13,2	178,2	0,0969
2,08	94,8	-0,21755	1,4068	13,5	13,2	178,2	0,0117	3,74	107	-0,03455	1,5898	13,5	13,2	178,2	0,0210	17,55	119,2	0,14835	1,7727	13,5	13,2	178,2	0,0985
2,08	95	-0,21455	1,4098	13,5	13,2	178,2	0,0117	3,84	107,2	-0,03155	1,5928	13,5	13,2	178,2	0,0215	17,81	119,4	0,15135	1,7757	13,5	13,2	178,2	0,0999
2,11	95,2	-0,21145	1,4129	13,5	13,2	178,2	0,0118	3,87	107,4	-0,02855	1,5958	13,5	13,2	178,2	0,0217	18,02	119,6	0,15435	1,7787	13,5	13,2	178,2	0,1011
2,10	95,4	-0,20845	1,4159	13,5	13,2	178,2	0,0118	3,93	107,6	-0,02555	1,5988	13,5	13,2	178,2	0,0221	18,19	119,8	0,15735	1,7817	13,5	13,2	178,2	0,1021
2,12	95,6	-0,20545	1,4189	13,5	13,2	178,2	0,0119	4,06	107,8	-0,02255	1,6018	13,5	13,2	178,2	0,0228	18,38	120	0,16025	1,7846	13,5	13,2	178,2	0,1031
2,10	95,8	-0,20245	1,4219	13,5	13,2	178,2	0,0118	4,19	108	-0,01955	1,6048	13,5	13,2	178,2	0,0235	18,48	120,2	0,16325	1,7876	13,5	13,2	178,2	0,1037
2,14	96	-0,19955	1,4248	13,5	13,2	178,2	0,0120	4,25	108,2	-0,01645	1,6079	13,5	13,2	178,2	0,0238	18,69	120,4	0,16625	1,7906	13,5	13,2	178,2	0,1049
2,12	96,2	-0,19655	1,4278	13,5	13,2	178,2	0,0119	4,29	108,4	-0,01345	1,6109	13,5	13,2	178,2	0,0241	18,78	120,6	0,16925	1,7936	13,5	13,2	178,2	0,1054
2,12	96,4	-0,19365	1,4307	13,5	13,2	178,2	0,0119	4,35	108,6	-0,01045	1,6139	13,5	13,2	178,2	0,0244	18,87	120,8	0,17225	1,7966	13,5	13,2	178,2	0,1059
2,16	96,6	-0,19065	1,4337	13,5	13,2	178,2	0,0121	4,45	108,8	-0,00745	1,6169	13,5	13,2	178,2	0,0250	18,76	121	0,17525	1,7996	13,5	13,2	178,2	0,1053
2,15	96,8	-0,18765	1,4367	13,5	13,2	178,2	0,0121	4,51	109	-0,00445	1,6199	13,5	13,2	178,2	0,0253	18,56	121,2	0,17825	1,8026	13,5	13,2	178,2	0,1042
2,18	97	-0,18465	1,4397	13,5	13,2	178,2	0,0122	4,59	109,2	-0,00155	1,6228	13,5	13,2	178,2	0,0258	18,47	121,4	0,18135	1,8057	13,5	13,2	178,2	0,1036
2,18	97,2	-0,18165	1,4427	13,5	13,2	178,2	0,0122	4,66	109,4	0,00145	1,6258	13,5	13,2	178,2	0,0262	18,21	121,6	0,18445	1,8088	13,5	13,2	178,2	0,1022
2,17	97,4	-0,17855	1,4458	13,5	13,2	178,2	0,0122	4,84	109,6	0,00435	1,6287	13,5	13,2	178,2	0,0272	17,95	121,8	0,18745	1,8118	13,5	13,2	178,2	0,1007
2,18	97,6	-0,17555	1,4488	13,5	13,2	178,2	0,0122	5,01	109,8	0,00735	1,6317	13,5	13,2	178,2	0,0281	17,91	122	0,19045	1,8148	13,5	13,2	178,2	0,1005
2,18	97,8	-0,17245	1,4519	13,5	13,2	178,2	0,0122	5,31	110	0,01025	1,6346	13,5	13,2	178,2	0,0298	17,89	122,2	0,19345	1,8178	13,5	13,2	178,2	0,1004
2,16	98	-0,16945	1,4549	13,5	13,2	178,2	0,0121	5,59	110,2	0,01325	1,6376	13,5	13,2	178,2	0,0314	17,83	122,4	0,19645	1,8208	13,5	13,2	178,2	0,1001
2,16	98,2	-0,16645	1,4579	13,5	13,2	178,2	0,0121	5,80	110,4	0,01625	1,6406	13,5	13,2	178,2	0,0325	17,81	122,6	0,19945	1,8238	13,5	13,2	178,2	0,0999
2,21	98,4	-0,16355	1,4608	13,5	13,2	178,2	0,0124	6,00	110,6	0,01935	1,6437	13,5	13,2	178,2	0,0337	17,70	122,8	0,20235	1,8267	13,5	13,2	178,2	0,0993

LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
17,41	123	0,20535	1,8297	13,5	13,2	178,2	0,0977	14,66	135,2	0,38865	2,013	13,5	13,2	178,2	0,0823	11,99	147,4	0,57135	2,1957	13,5	13,2	178,2	0,0673
17,16	123,2	0,20835	1,8327	13,5	13,2	178,2	0,0963	14,51	135,4	0,39165	2,016	13,5	13,2	178,2	0,0814	12,02	147,6	0,57435	2,1987	13,5	13,2	178,2	0,0675
16,81	123,4	0,21135	1,8357	13,5	13,2	178,2	0,0943	14,36	135,6	0,39455	2,0189	13,5	13,2	178,2	0,0806	12,06	147,8	0,57735	2,2017	13,5	13,2	178,2	0,0677
16,46	123,6	0,21435	1,8387	13,5	13,2	178,2	0,0924	14,20	135,8	0,39755	2,0219	13,5	13,2	178,2	0,0797	12,13	148	0,58045	2,2048	13,5	13,2	178,2	0,0681
16,29	123,8	0,21735	1,8417	13,5	13,2	178,2	0,0914	14,18	136	0,40045	2,0248	13,5	13,2	178,2	0,0796	12,32	148,2	0,58345	2,2078	13,5	13,2	178,2	0,0691
16,11	124	0,22035	1,8447	13,5	13,2	178,2	0,0904	14,13	136,2	0,40345	2,0278	13,5	13,2	178,2	0,0793	12,49	148,4	0,58655	2,2109	13,5	13,2	178,2	0,0701
16,01	124,2	0,22345	1,8478	13,5	13,2	178,2	0,0898	14,01	136,4	0,40645	2,0308	13,5	13,2	178,2	0,0786	12,57	148,6	0,58955	2,2139	13,5	13,2	178,2	0,0705
15,98	124,4	0,22655	1,8509	13,5	13,2	178,2	0,0897	13,91	136,6	0,40945	2,0338	13,5	13,2	178,2	0,0781	12,54	148,8	0,59255	2,2169	13,5	13,2	178,2	0,0704
15,94	124,6	0,22945	1,8538	13,5	13,2	178,2	0,0895	13,83	136,8	0,41245	2,0368	13,5	13,2	178,2	0,0776	12,53	149	0,59545	2,2198	13,5	13,2	178,2	0,0703
15,79	124,8	0,23255	1,8569	13,5	13,2	178,2	0,0886	13,87	137	0,41535	2,0397	13,5	13,2	178,2	0,0778	12,47	149,2	0,59845	2,2228	13,5	13,2	178,2	0,0700
15,66	125	0,23555	1,8599	13,5	13,2	178,2	0,0879	13,77	137,2	0,41845	2,0428	13,5	13,2	178,2	0,0773	12,27	149,4	0,60145	2,2258	13,5	13,2	178,2	0,0689
15,36	125,2	0,23845	1,8628	13,5	13,2	178,2	0,0862	13,59	137,4	0,42145	2,0458	13,5	13,2	178,2	0,0763	12,15	149,6	0,60435	2,2287	13,5	13,2	178,2	0,0682
15,24	125,4	0,24145	1,8658	13,5	13,2	178,2	0,0855	13,61	137,6	0,42455	2,0489	13,5	13,2	178,2	0,0764	12,04	149,8	0,60735	2,2317	13,5	13,2	178,2	0,0676
15,25	125,6	0,24445	1,8688	13,5	13,2	178,2	0,0856	13,53	137,8	0,42755	2,0519	13,5	13,2	178,2	0,0759	12,04	150	0,61035	2,2347	13,5	13,2	178,2	0,0676
15,17	125,8	0,24735	1,8717	13,5	13,2	178,2	0,0851	13,50	138	0,43055	2,0549	13,5	13,2	178,2	0,0758	11,72	150,2	0,61335	2,2377	13,5	13,2	178,2	0,0658
15,20	126	0,25035	1,8747	13,5	13,2	178,2	0,0853	13,49	138,2	0,43355	2,0579	13,5	13,2	178,2	0,0757	11,51	150,4	0,61635	2,2407	13,5	13,2	178,2	0,0646
15,20	126,2	0,25335	1,8777	13,5	13,2	178,2	0,0853	13,34	138,4	0,43655	2,0609	13,5	13,2	178,2	0,0749	11,40	150,6	0,61935	2,2437	13,5	13,2	178,2	0,0640
15,11	126,4	0,25635	1,8807	13,5	13,2	178,2	0,0848	13,31	138,6	0,43945	2,0638	13,5	13,2	178,2	0,0747	11,29	150,8	0,62245	2,2468	13,5	13,2	178,2	0,0634
15,14	126,6	0,25945	1,8838	13,5	13,2	178,2	0,0850	13,35	138,8	0,44245	2,0668	13,5	13,2	178,2	0,0749	11,32	151	0,62555	2,2499	13,5	13,2	178,2	0,0635
15,14	126,8	0,26245	1,8868	13,5	13,2	178,2	0,0850	13,35	139	0,44535	2,0697	13,5	13,2	178,2	0,0749	11,31	151,2	0,62855	2,2529	13,5	13,2	178,2	0,0635
15,20	127	0,26545	1,8898	13,5	13,2	178,2	0,0853	13,42	139,2	0,44835	2,0727	13,5	13,2	178,2	0,0753	11,39	151,4	0,63155	2,2559	13,5	13,2	178,2	0,0639
15,21	127,2	0,26855	1,8929	13,5	13,2	178,2	0,0854	13,43	139,4	0,45135	2,0757	13,5	13,2	178,2	0,0754	11,36	151,6	0,63455	2,2589	13,5	13,2	178,2	0,0637
15,11	127,4	0,27155	1,8959	13,5	13,2	178,2	0,0848	13,39	139,6	0,45435	2,0787	13,5	13,2	178,2	0,0751	11,33	151,8	0,63745	2,2618	13,5	13,2	178,2	0,0636
15,05	127,6	0,27455	1,8989	13,5	13,2	178,2	0,0845	13,37	139,8	0,45735	2,0817	13,5	13,2	178,2	0,0750	11,24	152	0,64045	2,2648	13,5	13,2	178,2	0,0631
15,01	127,8	0,27745	1,9018	13,5	13,2	178,2	0,0842	13,37	140	0,46045	2,0848	13,5	13,2	178,2	0,0750	11,13	152,2	0,64345	2,2678	13,5	13,2	178,2	0,0625
14,91	128	0,28045	1,9048	13,5	13,2	178,2	0,0837	13,33	140,2	0,46345	2,0878	13,5	13,2	178,2	0,0748	10,95	152,4	0,64635	2,2707	13,5	13,2	178,2	0,0614
14,86	128,2	0,28345	1,9078	13,5	13,2	178,2	0,0834	13,28	140,4	0,46655	2,0909	13,5	13,2	178,2	0,0745	10,70	152,6	0,64935	2,2737	13,5	13,2	178,2	0,0600
14,62	128,4	0,28635	1,9107	13,5	13,2	178,2	0,0820	13,24	140,6	0,46955	2,0939	13,5	13,2	178,2	0,0743	10,59	152,8	0,65235	2,2767	13,5	13,2	178,2	0,0594
14,42	128,6	0,28935	1,9137	13,5	13,2	178,2	0,0809	13,13	140,8	0,47255	2,0969	13,5	13,2	178,2	0,0737	10,61	153	0,65535	2,2797	13,5	13,2	178,2	0,0595
14,17	128,8	0,29235	1,9167	13,5	13,2	178,2	0,0795	13,03	141	0,47545	2,0998	13,5	13,2	178,2	0,0731	10,61	153,2	0,65835	2,2827	13,5	13,2	178,2	0,0595
13,95	129	0,29535	1,9197	13,5	13,2	178,2	0,0783	12,96	141,2	0,47845	2,1028	13,5	13,2	178,2	0,0727	10,57	153,4	0,66145	2,2858	13,5	13,2	178,2	0,0593
13,95	129,2	0,29835	1,9227	13,5	13,2	178,2	0,0783	12,98	141,4	0,48135	2,1057	13,5	13,2	178,2	0,0728	10,52	153,6	0,66455	2,2889	13,5	13,2	178,2	0,0590
13,76	129,4	0,30145	1,9258	13,5	13,2	178,2	0,0772	13,01	141,6	0,48435	2,1087	13,5	13,2	178,2	0,0730	10,54	153,8	0,66755	2,2919	13,5	13,2	178,2	0,0591
13,70	129,6	0,30455	1,9289	13,5	13,2	178,2	0,0769	12,98	141,8	0,48735	2,1117	13,5	13,2	178,2	0,0728	10,51	154	0,67055	2,2949	13,5	13,2	178,2	0,0590
13,67	129,8	0,30755	1,9319	13,5	13,2	178,2	0,0767	12,90	142	0,49035	2,1147	13,5	13,2	178,2	0,0724	10,49	154,2	0,67355	2,2979	13,5	13,2	178,2	0,0589
13,61	130	0,31055	1,9349	13,5	13,2	178,2	0,0764	12,88	142,2	0,49335	2,1177	13,5	13,2	178,2	0,0723	10,47	154,4	0,67645	2,3008	13,5	13,2	178,2	0,0588
13,61	130,2	0,31355	1,9379	13,5	13,2	178,2	0,0764	12,99	142,4	0,49635	2,1207	13,5	13,2	178,2	0,0729	10,43	154,6	0,67945	2,3038	13,5	13,2	178,2	0,0585
13,71	130,4	0,31655	1,9409	13,5	13,2	178,2	0,0769	12,99	142,6	0,49935	2,1237	13,5	13,2	178,2	0,0729	10,36	154,8	0,68245	2,3068	13,5	13,2	178,2	0,0581
13,79	130,6	0,31945	1,9438	13,5	13,2	178,2	0,0774	12,96	142,8	0,50245	2,1268	13,5	13,2	178,2	0,0727	10,23	155	0,68535	2,3097	13,5	13,2	178,2	0,0574
13,84	130,8	0,32245	1,9468	13,5	13,2	178,2	0,0777	13,01	143	0,50545	2,1298	13,5	13,2	178,2	0,0730	10,18	155,2	0,68835	2,3127	13,5	13,2	178,2	0,0571
13,83	131	0,32545	1,9498	13,5	13,2	178,2	0,0776	13,06	143,2	0,50855	2,1329	13,5	13,2	178,2	0,0733	10,17	155,4	0,69135	2,3157	13,5	13,2	178,2	0,0571
13,87	131,2	0,32845	1,9528	13,5	13,2	178,2	0,0778	13,04	143,4	0,51155	2,1359	13,5	13,2	178,2	0,0732	10,13	155,6	0,69435	2,3187	13,5	13,2	178,2	0,0568
13,96	131,4	0,33135	1,9557	13,5	13,2	178,2	0,0783	13,03	143,6	0,51445	2,1388	13,5	13,2	178,2	0,0731	10,03	155,8	0,69735	2,3217	13,5	13,2	178,2	0,0563
13,87	131,6	0,33445	1,9588	13,5	13,2	178,2	0,0778	13,04	143,8	0,51745	2,1418	13,5	13,2	178,2	0,0732	10,01	156	0,70045	2,3248	13,5	13,2	178,2	0,0562
13,87	131,8	0,33745	1,9618	13,5	13,2	178,2	0,0778	12,94	144	0,52045	2,1448	13,5	13,2	178,2	0,0726	9,95	156,2	0,70345	2,3278	13,5	13,2	178,2	0,0558
13,93	132	0,34045	1,9648	13,5	13,2	178,2	0,0782	12,91	144,2	0,52335	2,1477	13,5	13,2	178,2	0,0724	9,80	156,4	0,70655	2,3309	13,5	13,2	178,2	0,0550
13,98	132,2	0,34355	1,9679	13,5	13,2	178,2	0,0785	12,78	144,4	0,52635	2,1507	13,5	13,2	178,2	0,0717	9,73	156,6	0,70955	2,3339	13,5	13,2	178,2	0,0546
14,08	132,4	0,34655	1,9709	13,5	13,2	178,2	0,0790	12,67	144,6	0,52935	2,1537	13,5	13,2	178,2	0,0711	9,68	156,8	0,71245	2,3368	13,5	13,2	178,2	0,0543
14,15	132,6	0,34965	1,974	13,5	13,2	178,2	0,0794	12,60	144,8	0,53235	2,1567	13,5	13,2	178,2	0,0707	9,64	157	0,71545	2,3398	13,5	13,2	178,2	0,0541
14,17	132,8	0,35265	1,977	13,5	13,2	178,2	0,0795	12,53	145	0,53535	2,1597	13,5	13,2	178,2	0,0703	9,51	157,2	0,71845	2,3428	13,5	13,2	178,2	0,0534
14,19	133	0,35565	1,98	13,5	13,2	178,2	0,0796	12,45	145,2	0,53835	2,1627	13,5	13,2	178,2	0,0699	9,29	157,4	0,72135	2,3457	13,5	13,2	178,2	0,0521
14,20	133,2	0,35855	1,9829	13,5	13,2	178,2	0,0797	12,37	145,4	0,54145	2,1658	13,5	13,2	178,2	0,0694	9,25	157,6	0,72435	2,3487	13,5	13,2	178,2	0,0519
14,35	133,4	0,36145	1,9858	13,5	13,2	178,2	0,0805	12,33	145,6	0,54445	2,1688	13,5	13,2	178,2	0,0692	9,18	157,8	0,72735	2,3517	13,5	13,2	178,2	0,0515
14,48	133,6	0,36445	1,9888	13,5	13,2	178,2	0,0813	12,36	145,8	0,54755	2,1719	13,5	13,2	178,2	0,0694	9,19	158	0,73035	2,3547	13,5	13,2	178,2	0,0516
14,60	133,8	0,36745	1,9918	13,5	13,2	178,2	0,0819	12,34	146	0,55055	2,1749	13,5	13,2	178,2	0,0692	8,93	158,2	0,73335	2,3577	13,5	13,2	178,2	0,0501
14,63	134	0,37045	1,9948	13,5	13,2	178,2	0,0821	12,29	146,2	0,55345	2,1778	13,5	13,2	178,2	0,0690	8,69	158,4	0,73635	2,3607	13,5	13,2	178,2	0,0488
14,76	134,2	0,37345	1,9978	13,5	13,2	178,2	0,0828	12,30	146,4	0,55645	2,1808	13,5	13,2	178,2	0,0690	8,27	158,6	0,73935	2,3637	13,5	13,2	178,2	0,0464
14,81	134,4	0,37645	2,0008	13,5	13,2	178,2	0,0831	12,30	146,6	0,55945	2,1838	13,5	13,2	178,2	0,0690	8,17	158,8	0,74245	2,3668	13,5	13,2	178,2	0,0458
14,88	134,6	0,37945	2,0038	13,5	13,2	178,2	0,0835	12,31	146,8	0,56235	2,1867	13,5	13,2	178,2	0,0691	8,06	159	0,74545	2,3698	13,5	13,2	178,2	0,0452
14,87	134,8	0,38255	2,0069	13,5	13,2	178,2	0,0834	12,09	147	0,56535	2,1897	13,5	13,2	178,2	0,0678	7,94	159,2	0,74855	2,3729	13,5	13,2	178,2	0,0446
14,83	135	0,38555	2,0099	13,5	13,2	178,2	0,0832	11,99	147,2	0,56835	2,1927	13,5	13,2	178,2	0,0673	7,92	159,4	0,75145	2,3758	13,5	13,2	178,2	0,0444

LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
7,88	159,6	0,75445	2,3788	13,5	13,2	178,2	0,0442
7,78	159,8	0,75745	2,3818	13,5	13,2	178,2	0,0437
7,74	160	0,76045	2,3848	13,5	13,2	178,2	0,0434
7,70	160,2	0,76335	2,3877	13,5	13,2	178,2	0,0432
7,69	160,4	0,76635	2,3907	13,5	13,2	178,2	0,0432
7,62	160,6	0,76935	2,3937	13,5	13,2	178,2	0,0428
7,47	160,8	0,77225	2,3966	13,5	13,2	178,2	0,0419
7,04	161	0,77525	2,3996	13,5	13,2	178,2	0,0395
6,91	161,2	0,77835	2,4027	13,5	13,2	178,2	0,0388
6,84	161,4	0,78135	2,4057	13,5	13,2	178,2	0,0384
6,71	161,6	0,78445	2,4088	13,5	13,2	178,2	0,0377
6,69	161,8	0,78745	2,4118	13,5	13,2	178,2	0,0375
6,78	162	0,79045	2,4148	13,5	13,2	178,2	0,0380
6,64	162,2	0,79345	2,4178	13,5	13,2	178,2	0,0373
6,82	162,4	0,79645	2,4208	13,5	13,2	178,2	0,0383
6,89	162,6	0,79935	2,4237	13,5	13,2	178,2	0,0387
6,81	162,8	0,80235	2,4267	13,5	13,2	178,2	0,0382
6,70	163	0,80525	2,4296	13,5	13,2	178,2	0,0376
6,63	163,2	0,80825	2,4326	13,5	13,2	178,2	0,0372
6,63	163,4	0,81125	2,4356	13,5	13,2	178,2	0,0372
6,71	163,6	0,81425	2,4386	13,5	13,2	178,2	0,0377
6,79	163,8	0,81725	2,4416	13,5	13,2	178,2	0,0381
6,85	164	0,82035	2,4447	13,5	13,2	178,2	0,0384
6,94	164,2	0,82335	2,4477	13,5	13,2	178,2	0,0389
6,94	164,4	0,82645	2,4508	13,5	13,2	178,2	0,0389
6,99	164,6	0,82945	2,4538	13,5	13,2	178,2	0,0392
7,06	164,8	0,83245	2,4568	13,5	13,2	178,2	0,0396
7,15	165	0,83545	2,4598	13,5	13,2	178,2	0,0401
7,20	165,2	0,83835	2,4627	13,5	13,2	178,2	0,0404
7,26	165,4	0,84135	2,4657	13,5	13,2	178,2	0,0407
7,30	165,6	0,84425	2,4686	13,5	13,2	178,2	0,0410
7,26	165,8	0,84725	2,4716	13,5	13,2	178,2	0,0407
7,23	166	0,85025	2,4746	13,5	13,2	178,2	0,0406
7,23	166,2	0,85325	2,4776	13,5	13,2	178,2	0,0406
7,24	166,4	0,85625	2,4806	13,5	13,2	178,2	0,0406
7,14	166,6	0,85925	2,4836	13,5	13,2	178,2	0,0401
7,28	166,8	0,86235	2,4867	13,5	13,2	178,2	0,0409
7,29	167	0,86545	2,4898	13,5	13,2	178,2	0,0409
7,25	167,2	0,86845	2,4928	13,5	13,2	178,2	0,0407
7,29	167,4	0,87145	2,4958	13,5	13,2	178,2	0,0409
7,35	167,6	0,87435	2,4987	13,5	13,2	178,2	0,0412
7,37	167,8	0,87735	2,5017	13,5	13,2	178,2	0,0414
7,43	168	0,88035	2,5047	13,5	13,2	178,2	0,0417
7,52	168,2	0,88325	2,5076	13,5	13,2	178,2	0,0422
7,54	168,36	0,88565	2,51	13,5	13,2	178,2	0,0423
0,00	0	0	0	0	0	0	0,0000

3.3.1.6-L Mix. Proportion Tests
20:2:1 - Average



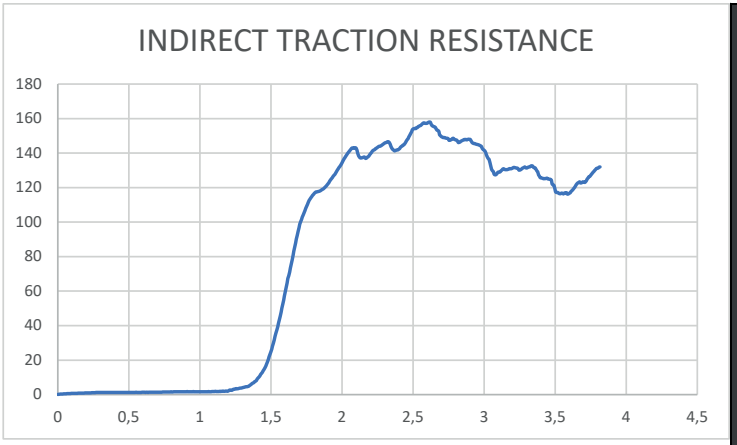


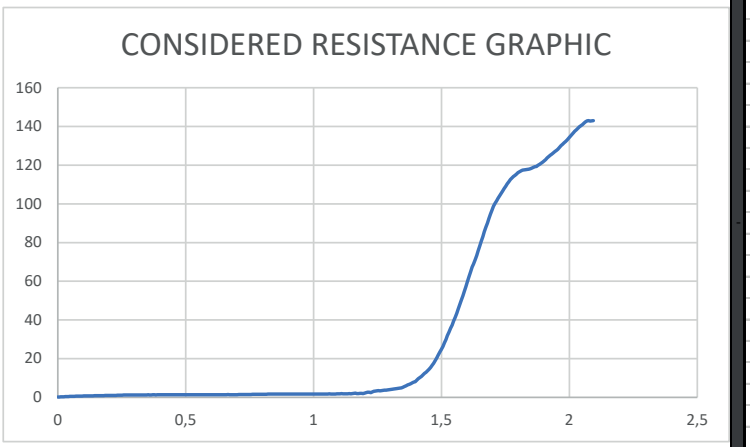
BREAK POINTS		INDIREC TRACTION	
LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)
155,0833	1,755533333	0,036667	0
156,05	1,7615	0,07	0,005
156,98	1,767566667	0,113333	0,010033333
157,74	1,773533333	0,14	0,014966667
158,3967	1,7795	0,163333	0,020033333
159,1933	1,785466667	0,176667	0,025033333
160,0533	1,7915	0,213333	0,030033333
160,6367	1,7975	0,236667	0,035
161,2567	1,803566667	0,243333	0,04
161,6267	1,8096	0,276667	0,045
161,7833	1,815533333	0,283333	0,05
161,7233	1,821466667	0,306667	0,055
161,6467	1,827433333	0,323333	0,059966667
161,3633	1,833466667	0,343333	0,064966667
160,5633	1,839466667	0,363333	0,069966667
159,4367	1,845533333	0,383333	0,074966667
158,4	1,851533333	0,383333	0,080033333
157,5967	1,857466667	0,393333	0,085066667
157,05	1,863433333	0,396667	0,0901
156,6067	1,869433333	0,4	0,095066667
156,1633	1,875466667	0,403333	0,100033333
		0,4	0,105066667
		0,403333	0,110066667
		0,406667	0,115066667
		0,41	0,120033333
		0,403333	0,125066667
		0,41	0,13
		0,403333	0,135
		0,396667	0,140033333
		0,41	0,145066667
		0,403333	0,150066667
		0,406667	0,1551
		0,423333	0,160166667
		0,43	0,1651
		0,436667	0,170066667
		0,46	0,1751
		0,466667	0,180066667
		0,486667	0,185033333
		0,496667	0,1901
		0,496667	0,195066667
		0,496667	0,200033333
		0,51	0,205033333
		0,506667	0,210033333
		0,513333	0,2151
		0,54	0,220066667
		0,54	0,2251
		0,543333	0,230133333
		0,543333	0,235066667
		0,556667	0,240066667
		0,563333	0,245066667
		0,57	0,250033333
		0,57	0,255033333
		0,58	0,260066667
		0,573333	0,265033333
		0,576667	0,269966667
		0,576667	0,275
		0,573333	0,280033333
		0,57	0,285033333
		0,58	0,290033333
		0,58	0,295033333

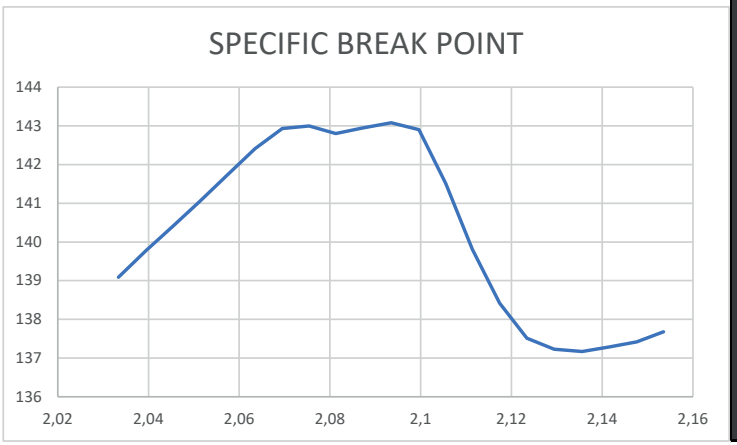
INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION	
LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)
0,583333	0,3	0,943333	0,599966667	1,23	0,9	16,25	1,1999	78,01333	1,499866667	92,60333	1,7998	87,31667	2,099866667	89,63333	2,399833333	83,43333	2,699833333
0,583333	0,305	0,946667	0,604966667	1,273333	0,905033333	17,09333	1,204966667	78,67667	1,504866667	92,75667	1,8048	87,36333	2,104866667	89,92	2,404866667	83,37	2,7048
0,59	0,31	0,943333	0,610033333	1,313333	0,91	18	1,209933333	79,19667	1,509833333	92,80667	1,809866667	87,47667	2,109833333	90,21667	2,409866667	83,33	2,709833333
0,596667	0,314966667	0,953333	0,615	1,343333	0,915	19	1,214966667	79,74333	1,514833333	92,86	1,814833333	87,58667	2,114833333	90,07333	2,414866667	83,46667	2,7148
0,59	0,32	0,956667	0,620033333	1,383333	0,919966667	20,07333	1,219966667	80,32667	1,5198	92,86667	1,8199	87,57	2,119833333	89,94667	2,4199	83,38333	2,7198
0,593333	0,324966667	0,976667	0,625033333	1,436667	0,925	21,21667	1,225	80,86667	1,5248	92,73	1,824866667	87,41333	2,124833333	89,66333	2,4249	83,38667	2,724766667
0,6	0,329966667	0,976667	0,63	1,436667	0,929933333	22,41333	1,229933333	81,34667	1,529766667	92,75	1,829866667	87,50667	2,1298	89,34667	2,4299	83,50667	2,729766667
0,596667	0,334933333	0,983333	0,635	1,473333	0,934933333	23,67	1,234966667	81,77667	1,534766667	92,78667	1,834866667	87,55667	2,1348	89,03667	2,434833333	83,58667	2,734766667
0,61	0,339966667	0,976667	0,64	1,513333	0,939966667	24,99667	1,239966667	82,16	1,539833333	92,96667	1,839833333	87,63333	2,139833333	88,23	2,439866667	83,60667	2,739833333
0,603333	0,345	0,993333	0,645	1,546667	0,944933333	26,31333	1,244966667	82,54667	1,544833333	93,07	1,844833333	87,71667	2,144866667	88,17333	2,444833333	83,82	2,744833333
0,606667	0,35	1	0,649966667	1,62	0,95	27,62333	1,249933333	82,95	1,549833333	93,01	1,849833333	87,68667	2,149866667	88,19	2,4498	84,05	2,749866667
0,62	0,355	0,996667	0,654966667	1,66	0,955033333	29	1,254933333	83,36	1,554866667	92,94667	1,8548	87,61667	2,154866667	88,30333	2,454833333	83,98667	2,7549
0,613333	0,360033333	0,99	0,66	1,66	0,960033333	30,27333	1,259933333	83,53667	1,559833333	92,94	1,8598	87,44667	2,159866667	88,39333	2,4598	83,73667	2,759866667
0,616667	0,364966667	0,986667	0,664933333	1,706667	0,964966667	31,51333	1,264933333	83,65333	1,5648	92,81333	1,864766667	87,34	2,164833333	88,68333	2,4648	83,73333	2,764833333
0,616667	0,37	1,003333	0,669933333	1,74	0,969966667	32,77333	1,269933333	83,95333	1,5698	92,70667	1,869766667	87,27333	2,169833333	88,95333	2,469833333	83,77	2,7698
0,62	0,375	1,01	0,675	1,793333	0,974966667	34,01667	1,274966667	84,31667	1,574833333	92,28333	1,8748	87,33	2,174866667	89,14333	2,474866667	83,73667	2,774833333
0,63	0,38	1,013333	0,68	1,816667	0,979966667	35,20333	1,279966667	84,69	1,579833333	91,12667	1,879833333	87,34667	2,179833333	89,1	2,479866667	83,44	2,779833333
0,63	0,385	1,023333	0,685033333	1,86	0,984966667	36,31333	1,285	85,17333	1,5848	91,47333	1,8849	87,43667	2,184833333	89,20667	2,4849	83,33667	2,7848
0,636667	0,389933333	1,013333	0,690033333	1,906667	0,989933333	37,34	1,290033333	85,56333	1,589833333	91,83333	1,8899	87,49333	2,189833333	89,39	2,489866667	83,35667	2,789833333
0,646667	0,394933333	1,033333	0,695033333	1,926667	0,994966667	38,37333	1,295	85,9	1,594766667	92,06333	1,894866667	87,53333	2,194833333	89,44333	2,494833333	83,55	2,7948
0,636667	0,3999	1,02	0,7	1,973333	0,999933333	39,49	1,299966667	86,31667	1,599733333	92,12667	1,899866667	87,8	2,199766667	89,45333	2,499866667	83,80333	2,799766667
0,646667	0,404933333	1,03	0,705	2,016667	1,004933333	40,63333	1,305	86,77333	1,604766667	89,59	1,904833333	88,15	2,204833333	89,6	2,504833333	84,15667	2,8048
0,653333	0,409933333	1,05	0,709966667	2,08	1,009966667	41,71333	1,309966667	87,14667	1,6098	86,55333	1,909866667	88,32	2,209833333	89,77333	2,509833333	84,33	2,809866667
0,67	0,414966667	1,046667	0,714966667	2,116667	1,014966667	42,82667	1,314966667	87,58667	1,6148	87,73667	1,9148	88,68667	2,214833333	89,98	2,514833333	84,51667	2,814866667
0,673333	0,42	1,06	0,719966667	2,256667	1,020033333	44,03667	1,319933333	88,08	1,619833333	88,62	1,919833333	88,81	2,2199	90,16333	2,519833333	84,76333	2,8199
0,69	0,425033333	1,046667	0,724966667	2,423333	1,025033333	45,24667	1,324966667	88,56667	1,624833333	89,31667	1,924833333	88,78333	2,2249	90,28667	2,524833333	84,99333	2,824866667
0,7	0,430033333	1,053333	0,729933333	2,583333	1,03	46,38	1,329933333	89,01333	1,629833333	89,85667	1,929766667	88,73333	2,229866667	90,33333	2,529766667	84,93333	2,829833333
0,72	0,434966667	1,06	0,734966667	2,756667	1,034966667	47,50667	1,3349	89,48	1,6348	90,26	1,9348	88,83	2,234866667	90,21667	2,534766667	85,16	2,834833333
0,726667	0,439966667	1,07	0,739966667	2,936667	1,039933333	48,63667	1,339933333	89,82667	1,6398	90,62333	1,9398	88,73	2,239866667	89,79333	2,5398	85,42333	2,839833333
0,75	0,444966667	1,073333	0,744933333	3,116667	1,044966667	49,73667	1,344966667	90,16	1,644833333	90,9	1,944833333	88,86667	2,244866667	89,85	2,5448	85,65667	2,8448
0,76	0,449966667	1,053333	0,75	3,243333	1,049966667	50,90667	1,349966667	90,5	1,649833333	91,18667	1,949866667	88,97667	2,249866667	89,96667	2,549833333	85,97333	2,849833333
0,766667	0,455	1,053333	0,755033333	3,476667	1,054966667	52,08333	1,355	90,69	1,654833333	91,31	1,9549	89,00667	2,2549	90,01	2,5548	86,16	2,854866667
0,786667	0,459966667	1,06	0,760033333	3,67	1,059933333	53,23	1,36	90,75	1,659833333	91,33	1,9599	89,03	2,259833333	89,03	2,559833333	86,21	2,8598
0,786667	0,464933333	1,066667	0,765	3,906667	1,064933333	54,34	1,364966667	90,79667	1,6648	91,32333	1,964833333	88,83	2,2648	88,67333	2,564766667	86,19	2,864733333
0,803333	0,469933333	1,076667	0,769966667	4,14	1,069933333	55,53	1,369966667	90,93667	1,669833333	90,91667	1,9699	88,78	2,269866667	88,68667	2,5698	86,19	2,869833333
0,8	0,474966667	1,083333	0,775	4,463333	1,074966667	56,57667	1,374966667	90,97667	1,674866667	90,13333	1,974833333	88,93667	2,274866667	88,65667	2,574766667	86,14333	2,874833333
0,81	0,479966667	1,083333	0,78	4,83	1,079966667	57,59	1,379966667	91	1,6799	89,88333	1,979833333	88,98667	2,279866667	88,26333	2,5798	86,30667	2,879833333
0,82	0,485033333	1,08	0,784966667	5,153333	1,084966667	58,68667	1,384933333	91,01667	1,6849	89,83	1,984866667	88,85667	2,2849	88,22667	2,5848	86,36667	2,884866667
0,813333	0,490033333	1,09	0,789966667	5,403333	1,090033333	59,81667	1,389933333	91,09333	1,689933333	89,63	1,9898	88,77667	2,2899	87,85333	2,589766667	86,36667	2,8899
0,816667	0,495033333	1,083333	0,794966667	5,76	1,095066667	60,86	1,394866667	91,08667	1,6949	89,42333	1,9948	88,69	2,2949	87,82	2,594733333	86,53333	2,894833333
0,823333	0,5	1,08	0,799933333	5,936667	1,099966667	61,95	1,399866667	91,24333	1,699866667	89,19667	1,999833333	88,52333	2,299866667	87,32667	2,599766667	86,64333	2,899833333
0,826667	0,505	1,083333	0,804966667	6,26	1,105	63,04667	1,404866667	91,39333	1,704866667	89,09667	2,004833333	88,55667	2,304866667	86,83	2,604766667	86,81333	2,904833333
0,843333	0,509966667	1,08	0,809966667	6,473333	1,109966667	64,12333	1,409933333	91,44667	1,709866667	88,88	2,009866667	88,69333	2,309866667	86,94333	2,609766667	86,91333	2,9098
0,843333	0,514966667	1,096667	0,814966667	6,74	1,114966667	65,23	1,414933333	91,49	1,714833333	88,67	2,014866667	88,75333	2,314866667	87,21667	2,614833333	87,05667	2,914833333
0,863333	0,519933333	1,09	0,820033333	7,013333	1,119966667	66,26667	1,419966667	91,55333	1,719866667	88,51333	2,019866667	88,74	2,3199	86,92	2,619833333	87,31667	2,9198
0,853333	0,524966667	1,093333	0,825	7,246667	1,124966667	67,31	1,424966667	91,52333	1,724866667	88,32667	2,024866667	88,53667	2,324866667	86,40667	2,624866667	87,51667	2,9248
0,856667	0,529933333	1,086667	0,830033333	7,61	1,1299	68,26333	1,4299	91,54	1,7298	88,15667	2,029866667	88,11	2,329833333	85,6	2,629833333	87,60667	2,929766667
0,856667	0,534933333	1,083333	0,835	7,98	1,134933333	69,25667	1,434933333	91,79333	1,734866667	88,04667	2,034866667	87,93667	2,334833333	85,06333	2,6348	87,73667	2,934766667
0,856667	0,539966667	1,096667	0,84	8,366667	1,139933333	70,16	1,4399	91,87667	1,739833333	87,97	2,0399	87,93333	2,3399	84,63333	2,639833333	87,88	2,939833333
0,863333	0,545	1,123333	0,844966667	8,75	1,144933333	70,99333	1,4449	92,10333	1,744833333	87,91	2,044866667	87,86	2,3449	84,33	2,6448	88,15	2,9448
0,866667	0,550033333	1,116667	0,849966667	9,143333	1,149966667	70,72	1,4499	92,34	1,7499	87,90333	2,049866667	88,06667	2,3499	84,20333	2,6498	88,38667	2,949833333
0,88	0,555033333	1,116667	0,854966667	9,636667	1,154966667	70,72	1,4549	92,51333	1,7549	87,82333	2,054833333	88,39	2,354966667	84,16333	2,6548	88,65333	2,954833333
0,883333	0,560066667	1,113333	0,86	10,19333	1,160033333	71,71333	1,4599	92,6	1,7599	87,69667	2,059833333	88,66	2,3599	83,84333	2,6598	88,86333	2,959833333
0,903333	0,565	1,12	0,864933333	10,79	1,164966667	72,89667	1,464866667	92,65667	1,764866667	87,61	2,064833333	88,97667	2,364866667	83,82667	2,664766667	89,05	2,9648
0,896667	0,57	1,126667	0,869933333	11,41	1,169966667	73,98	1,469866667	92,64667	1,769833333	87,50667	2,069833333	89,33667	2,369933333	83,96333	2,669766667	89,31667	2,9698
0,896667	0,575	1,146667	0,875	12,03	1,175	74,88667	1,474866667	92,64667	1,7748	87,29667	2,074866667	89,50667	2,374866667	84,12333	2,6748	89,55667	2,974833333
0,913333	0,58	1,16	0,88	12,72667	1,179966667	75,72333	1,479866667	92,67667	1,779833333	87,28	2,0799	89,76	2,3799	84,28333	2,679866667	89,82333	2,979833333
0,923333	0,585	1,186667	0,885033333	13,63	1,184966667	76,36667	1,4849	92,63	1,7848	87,27333	2,0849	89,89	2,384866667	84,47667	2,684866667	90,04667	2,9848
0,93	0,590066667	1,216667	0,890066667	14,53333	1,189966667	76,92667	1,489866667	92,50333	1,789833333	87,28333	2,089933333	89,80333	2,389866667	84,51667	2,689833333	90,36	2,9898
0,923333	0,595	1,233333	0,895033333	15,33333	1,194966667	77,41333	1,494866667	92,51333	1,794833333	87,22333	2,0949	89,46667	2,394833333	83,44667	2,694833333	90,53667	2,9948

INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION	
LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)
90,68333	2,999766667	73,21667	1,979933333	77,85667	2,159866667	80,85	2,339866667
90,72333	3,0048	73,29	1,9829	77,87667	2,162833333	80,85333	2,342866667
90,88	3,0098	73,38333	1,985866667	77,87	2,1659	80,85667	2,345866667
90,84333	3,014833333	73,5	1,9889	77,90333	2,168933333	80,96333	2,3489
90,85	3,019833333	73,57	1,991933333	77,98333	2,171966667	81,04667	2,3519
90,76	3,024833333	73,54	1,994933333	78,03667	2,174966667	81,04333	2,3549
90,80333	3,0298	73,54667	1,9979	78,03	2,1779	81,01667	2,357866667
90,98	3,034833333	73,39333	2,0009	77,99667	2,180866667	81,05	2,360833333
91,16667	3,039833333	73,53667	2,003866667	78,03333	2,183866667	81,03667	2,363833333
91,29333	3,044833333	73,67333	2,0069	78,09667	2,186833333	81,06333	2,366866667
91,38333	3,049833333	73,83667	2,009966667	78,10333	2,189866667	81,16	2,3699
91,52	3,0548	73,94667	2,013033333	78,13	2,192866667	81,17333	2,372966667
91,59	3,0598	73,94667	2,016	78,13667	2,195833333	81,16	2,3759
91,60667	3,064766667	73,98	2,018933333	78,24333	2,198833333	81,21667	2,378866667
91,70333	3,069766667	74,03667	2,021933333	78,38333	2,2018	81,24667	2,381866667
91,87	3,0748	74,16	2,024866667	78,54	2,204833333	81,29667	2,384833333
91,89333	3,079833333	74,33	2,0279	78,72667	2,207833333	81,35	2,386833333
92,03333	3,084866667	74,44	2,030933333	78,89	2,2109	2,563333	0,7969
92,09333	3,089833333	74,42	2,033966667	79,03	2,2139	2,54	0,7979
92,06667	3,094833333	74,47333	2,036933333	79,04667	2,216866667	2,49	0,798866667
92,07667	3,099833333	74,54	2,039866667	79,08667	2,2198	2,346667	0,799866667
92,11333	3,104833333	74,64333	2,042866667	79,16	2,2228	2,303333	0,8009
92,16333	3,109833333	74,61	2,045866667	79,19333	2,2258	2,28	0,8019
92,38667	3,1148	74,77333	2,048933333	79,33333	2,2288	2,236667	0,802933333
92,55667	3,1198	74,83	2,051966667	79,40333	2,231833333	2,23	0,803933333
92,61667	3,124766667	74,92	2,054966667	79,52	2,234833333	2,26	0,804933333
92,57667	3,129733333	74,95667	2,057933333	79,46333	2,237766667	2,213333	0,805933333
92,64333	3,134766667	75,05	2,0609	79,45667	2,240766667	2,273333	0,806933333
92,71	3,139833333	75,15333	2,063866667	79,53667	2,243733333	2,296667	0,8079
92,81667	3,1448	75,32	2,066866667	79,62	2,2468	2,27	0,8089
93,04667	3,1498	75,51667	2,0699	79,79	2,249866667	2,233333	0,809866667
93,21333	3,154833333	75,67333	2,0729	79,89333	2,252866667	2,21	0,810866667
93,39	3,159833333	75,79	2,0759	80,00667	2,255866667	2,21	0,811866667
93,39333	3,1648	75,88333	2,078866667	80,09	2,258833333	2,236667	0,812866667
93,41	3,1698	76,02	2,081833333	80,22667	2,2618	2,263333	0,813866667
93,46333	3,1748	76,12	2,084866667	80,28333	2,264766667	2,283333	0,8149
93,52	3,179833333	76,22333	2,0879	80,42	2,2678	2,313333	0,8159
93,52667	3,1848	76,42667	2,090966667	80,52	2,2708	2,313333	0,816933333
93,45667	3,1898	76,45667	2,093966667	80,45	2,273833333	2,33	0,817933333
93,32	3,194733333	76,41	2,096966667	80,45	2,2768	2,353333	0,818933333
93,13667	3,199766667	76,48	2,0999	80,48333	2,279766667	2,383333	0,819933333
93,11333	3,204766667	76,54	2,1029	80,55333	2,282766667	2,4	0,8209
92,93667	3,209833333	76,64	2,105833333	80,57	2,2858	2,42	0,8219
92,75667	3,214866667	76,81	2,108866667	80,62333	2,288866667	2,433333	0,822866667
92,54333	3,219866667	76,93	2,1119	80,68	2,2919	2,42	0,823866667
92,25	3,224866667	76,97	2,1149	80,69	2,2949	2,41	0,824866667
91,79333	3,229833333	77,1	2,1179	80,69	2,297866667	2,41	0,825866667
91,4	3,234866667	77,32333	2,120866667	80,74333	2,300833333	2,413333	0,826866667
91,36333	3,239833333	77,45667	2,123866667	80,78333	2,303833333	2,38	0,827866667
90,86667	3,244866667	77,51667	2,1269	80,82667	2,306833333	2,426667	0,8289
90,38333	3,249866667	77,61667	2,129933333	80,87	2,309833333	2,43	0,829933333
90,33333	3,254866667	77,69	2,133	80,91333	2,312866667	2,416667	0,830933333
90,09667	3,259833333	77,7	2,135966667	80,93333	2,315833333	2,43	0,831933333
89,63667	3,264866667	77,76333	2,138933333	80,96	2,318833333	2,45	0,8329
89,52333	3,269366667	77,84333	2,1419	81,00667	2,321833333	2,456667	0,8339
72,91	1,964866667	77,89	2,1449	81,05333	2,324866667	2,476667	0,8349
72,97333	1,9679	77,91333	2,147866667	81,08	2,327866667	2,506667	0,835866667
73,06667	1,970933333	77,88667	2,1509	80,94333	2,330966667	2,513333	0,836666667
73,15	1,974	77,88333	2,153933333	80,93	2,333966667	0	0
73,20333	1,977	77,84333	2,1569	80,87667	2,3369	0	0

3.3.1.6-M Mix. Proportion Tests
32.5R - 20:2:1 - 1







LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
0,14	1	-1,44778	0	14,3	32,2	460,46	0,0003
0,20	1,4	-1,44198	0,0058	14,3	32,2	460,46	0,0004
0,23	1,8	-1,43598	0,0118	14,3	32,2	460,46	0,0005
0,29	2,2	-1,42998	0,0178	14,3	32,2	460,46	0,0006
0,31	2,6	-1,42388	0,0239	14,3	32,2	460,46	0,0007
0,37	3	-1,41798	0,0298	14,3	32,2	460,46	0,0008
0,39	3,4	-1,41218	0,0356	14,3	32,2	460,46	0,0008
0,43	3,8	-1,40618	0,0416	14,3	32,2	460,46	0,0009
0,46	4,2	-1,40028	0,0475	14,3	32,2	460,46	0,0010
0,50	4,6	-1,39418	0,0536	14,3	32,2	460,46	0,0011
0,54	5	-1,38808	0,0597	14,3	32,2	460,46	0,0012
0,56	5,4	-1,38208	0,0657	14,3	32,2	460,46	0,0012
0,58	5,8	-1,37608	0,0717	14,3	32,2	460,46	0,0013
0,60	6,2	-1,37018	0,0776	14,3	32,2	460,46	0,0013
0,62	6,6	-1,36418	0,0836	14,3	32,2	460,46	0,0013
0,67	7	-1,35818	0,0896	14,3	32,2	460,46	0,0015
0,69	7,4	-1,35208	0,0957	14,3	32,2	460,46	0,0015
0,71	7,8	-1,34598	0,1018	14,3	32,2	460,46	0,0015
0,73	8,2	-1,33998	0,1078	14,3	32,2	460,46	0,0016
0,76	8,6	-1,33408	0,1137	14,3	32,2	460,46	0,0017
0,77	9	-1,32818	0,1196	14,3	32,2	460,46	0,0017
0,77	9,4	-1,32218	0,1256	14,3	32,2	460,46	0,0017
0,79	9,8	-1,31618	0,1316	14,3	32,2	460,46	0,0017
0,80	10,2	-1,30998	0,1378	14,3	32,2	460,46	0,0017
0,82	10,6	-1,30398	0,1438	14,3	32,2	460,46	0,0018
0,84	11	-1,29798	0,1498	14,3	32,2	460,46	0,0018
0,86	11,4	-1,29208	0,1557	14,3	32,2	460,46	0,0019
0,87	11,8	-1,28618	0,1616	14,3	32,2	460,46	0,0019
0,88	12,2	-1,28018	0,1676	14,3	32,2	460,46	0,0019
0,89	12,6	-1,27408	0,1737	14,3	32,2	460,46	0,0019
0,91	13	-1,26798	0,1798	14,3	32,2	460,46	0,0020
0,94	13,4	-1,26198	0,1858	14,3	32,2	460,46	0,0020
0,95	13,8	-1,25598	0,1918	14,3	32,2	460,46	0,0021
0,97	14,2	-1,25008	0,1977	14,3	32,2	460,46	0,0021
0,99	14,6	-1,24408	0,2037	14,3	32,2	460,46	0,0022
1,01	15	-1,23808	0,2097	14,3	32,2	460,46	0,0022
1,02	15,4	-1,23198	0,2158	14,3	32,2	460,46	0,0022
1,01	15,8	-1,22598	0,2218	14,3	32,2	460,46	0,0022
1,03	16,2	-1,21998	0,2278	14,3	32,2	460,46	0,0022
1,07	16,6	-1,21398	0,2338	14,3	32,2	460,46	0,0023
1,09	17	-1,20808	0,2397	14,3	32,2	460,46	0,0024
1,13	17,4	-1,20208	0,2457	14,3	32,2	460,46	0,0025
1,14	17,8	-1,19608	0,2517	14,3	32,2	460,46	0,0025
1,18	18,2	-1,18998	0,2578	14,3	32,2	460,46	0,0026
1,20	18,6	-1,18388	0,2639	14,3	32,2	460,46	0,0026
1,22	19	-1,17798	0,2698	14,3	32,2	460,46	0,0026
1,24	19,4	-1,17208	0,2757	14,3	32,2	460,46	0,0027
1,26	19,8	-1,16608	0,2817	14,3	32,2	460,46	0,0027
1,26	20,2	-1,16018	0,2876	14,3	32,2	460,46	0,0027
1,26	20,6	-1,15408	0,2937	14,3	32,2	460,46	0,0027
1,27	21	-1,14798	0,2998	14,3	32,2	460,46	0,0028
1,25	21,4	-1,14198	0,3058	14,3	32,2	460,46	0,0027
1,26	21,8	-1,13598	0,3118	14,3	32,2	460,46	0,0027
1,25	22,2	-1,13018	0,3176	14,3	32,2	460,46	0,0027
1,26	22,6	-1,12418	0,3236	14,3	32,2	460,46	0,0027
1,27	23	-1,11818	0,3296	14,3	32,2	460,46	0,0028
1,28	23,4	-1,11208	0,3357	14,3	32,2	460,46	0,0028
1,27	23,8	-1,10598	0,3418	14,3	32,2	460,46	0,0028
1,27	24,2	-1,09998	0,3478	14,3	32,2	460,46	0,0028
1,29	24,6	-1,09408	0,3537	14,3	32,2	460,46	0,0028
1,28	25	-1,08818	0,3596	14,3	32,2	460,46	0,0028

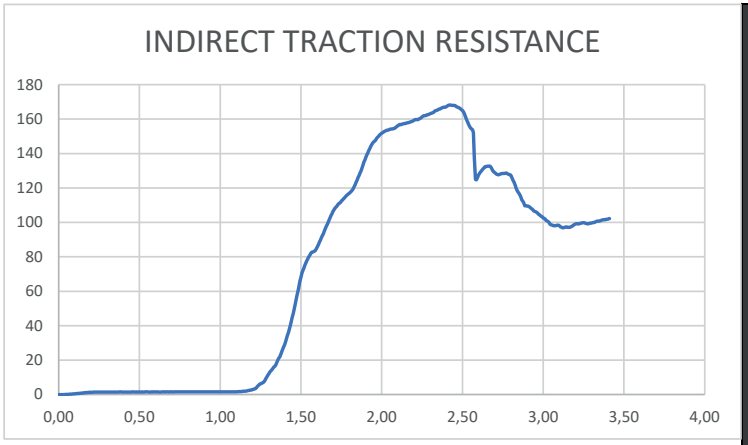
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
1,27	25,4	-1,08218	0,3656	14,3	32,2	460,46	0,0028	1,46	49,8	-0,71618	0,7316	14,3	32,2	460,46	0,0032	1,84	74,2	-0,35018	1,0976	14,3	32,2	460,46	0,0040
1,29	25,8	-1,07608	0,3717	14,3	32,2	460,46	0,0028	1,48	50,2	-0,71008	0,7377	14,3	32,2	460,46	0,0032	1,86	74,6	-0,34418	1,1036	14,3	32,2	460,46	0,0040
1,29	26,2	-1,06998	0,3778	14,3	32,2	460,46	0,0028	1,49	50,6	-0,70398	0,7438	14,3	32,2	460,46	0,0032	1,92	75	-0,33828	1,1095	14,3	32,2	460,46	0,0042
1,28	26,6	-1,06398	0,3838	14,3	32,2	460,46	0,0028	1,50	51	-0,69808	0,7497	14,3	32,2	460,46	0,0033	1,79	75,4	-0,33228	1,1155	14,3	32,2	460,46	0,0039
1,30	27	-1,05798	0,3898	14,3	32,2	460,46	0,0028	1,50	51,4	-0,69218	0,7556	14,3	32,2	460,46	0,0033	1,79	75,8	-0,32638	1,1214	14,3	32,2	460,46	0,0039
1,30	27,4	-1,05218	0,3956	14,3	32,2	460,46	0,0028	1,53	51,8	-0,68618	0,7616	14,3	32,2	460,46	0,0033	1,82	76,2	-0,32038	1,1274	14,3	32,2	460,46	0,0040
1,31	27,8	-1,04618	0,4016	14,3	32,2	460,46	0,0028	1,56	52,2	-0,68018	0,7676	14,3	32,2	460,46	0,0034	1,86	76,6	-0,31428	1,1335	14,3	32,2	460,46	0,0040
1,29	28,2	-1,04018	0,4076	14,3	32,2	460,46	0,0028	1,56	52,6	-0,67408	0,7737	14,3	32,2	460,46	0,0034	1,89	77	-0,30818	1,1396	14,3	32,2	460,46	0,0041
1,30	28,6	-1,03408	0,4137	14,3	32,2	460,46	0,0028	1,58	53	-0,66798	0,7798	14,3	32,2	460,46	0,0034	1,87	77,4	-0,30218	1,1456	14,3	32,2	460,46	0,0041
1,30	29	-1,02798	0,4198	14,3	32,2	460,46	0,0028	1,60	53,4	-0,66198	0,7858	14,3	32,2	460,46	0,0035	1,90	77,8	-0,29628	1,1515	14,3	32,2	460,46	0,0041
1,30	29,4	-1,02208	0,4257	14,3	32,2	460,46	0,0028	1,60	53,8	-0,65608	0,7917	14,3	32,2	460,46	0,0035	2,00	78,2	-0,29028	1,1575	14,3	32,2	460,46	0,0043
1,29	29,8	-1,01608	0,4317	14,3	32,2	460,46	0,0028	1,61	54,2	-0,65018	0,7976	14,3	32,2	460,46	0,0035	2,13	78,6	-0,28438	1,1634	14,3	32,2	460,46	0,0046
1,31	30,2	-1,01018	0,4376	14,3	32,2	460,46	0,0028	1,60	54,6	-0,64418	0,8036	14,3	32,2	460,46	0,0035	1,94	79	-0,27828	1,1695	14,3	32,2	460,46	0,0042
1,29	30,6	-1,00428	0,4435	14,3	32,2	460,46	0,0028	1,60	55	-0,63818	0,8096	14,3	32,2	460,46	0,0035	1,92	79,4	-0,27218	1,1756	14,3	32,2	460,46	0,0042
1,31	31	-0,99828	0,4495	14,3	32,2	460,46	0,0028	1,62	55,4	-0,63198	0,8158	14,3	32,2	460,46	0,0035	2,05	79,8	-0,26618	1,1816	14,3	32,2	460,46	0,0045
1,30	31,4	-0,99218	0,4556	14,3	32,2	460,46	0,0028	1,65	55,8	-0,62598	0,8218	14,3	32,2	460,46	0,0036	2,06	80,2	-0,26018	1,1876	14,3	32,2	460,46	0,0045
1,29	31,8	-0,98608	0,4617	14,3	32,2	460,46	0,0028	1,66	56,2	-0,61998	0,8278	14,3	32,2	460,46	0,0036	1,95	80,6	-0,25428	1,1935	14,3	32,2	460,46	0,0042
1,30	32,2	-0,98018	0,4676	14,3	32,2	460,46	0,0028	1,64	56,6	-0,61408	0,8337	14,3	32,2	460,46	0,0036	2,13	81	-0,24828	1,1995	14,3	32,2	460,46	0,0046
1,31	32,6	-0,97428	0,4735	14,3	32,2	460,46	0,0028	1,64	57	-0,60808	0,8397	14,3	32,2	460,46	0,0036	2,44	81,4	-0,24238	1,2054	14,3	32,2	460,46	0,0053
1,30	33	-0,96828	0,4795	14,3	32,2	460,46	0,0028	1,66	57,4	-0,60208	0,8457	14,3	32,2	460,46	0,0036	2,67	81,8	-0,23628	1,2115	14,3	32,2	460,46	0,0058
1,31	33,4	-0,96228	0,4855	14,3	32,2	460,46	0,0028	1,66	57,8	-0,59608	0,8517	14,3	32,2	460,46	0,0036	2,60	82,2	-0,23018	1,2176	14,3	32,2	460,46	0,0056
1,31	33,8	-0,95628	0,4915	14,3	32,2	460,46	0,0028	1,68	58,2	-0,58998	0,8578	14,3	32,2	460,46	0,0036	2,42	82,6	-0,22408	1,2237	14,3	32,2	460,46	0,0053
1,31	34,2	-0,95018	0,4976	14,3	32,2	460,46	0,0028	1,68	58,6	-0,58388	0,8639	14,3	32,2	460,46	0,0036	2,79	83	-0,21818	1,2296	14,3	32,2	460,46	0,0061
1,32	34,6	-0,94418	0,5036	14,3	32,2	460,46	0,0029	1,66	59	-0,57798	0,8698	14,3	32,2	460,46	0,0036	3,15	83,4	-0,21228	1,2355	14,3	32,2	460,46	0,0068
1,31	35	-0,93828	0,5095	14,3	32,2	460,46	0,0028	1,67	59,4	-0,57198	0,8758	14,3	32,2	460,46	0,0036	3,20	83,8	-0,20628	1,2415	14,3	32,2	460,46	0,0069
1,33	35,4	-0,93238	0,5154	14,3	32,2	460,46	0,0029	1,65	59,8	-0,56608	0,8817	14,3	32,2	460,46	0,0036	3,31	84,2	-0,20028	1,2475	14,3	32,2	460,46	0,0072
1,32	35,8	-0,92638	0,5214	14,3	32,2	460,46	0,0029	1,69	60,2	-0,56008	0,8877	14,3	32,2	460,46	0,0037	3,52	84,6	-0,19418	1,2536	14,3	32,2	460,46	0,0076
1,32	36,2	-0,92038	0,5274	14,3	32,2	460,46	0,0029	1,69	60,6	-0,55398	0,8938	14,3	32,2	460,46	0,0037	3,37	85	-0,18808	1,2597	14,3	32,2	460,46	0,0073
1,32	36,6	-0,91428	0,5335	14,3	32,2	460,46	0,0029	1,72	61	-0,54788	0,8999	14,3	32,2	460,46	0,0037	3,43	85,4	-0,18208	1,2657	14,3	32,2	460,46	0,0074
1,33	37	-0,90818	0,5396	14,3	32,2	460,46	0,0029	1,71	61,4	-0,54188	0,9059	14,3	32,2	460,46	0,0037	3,54	85,8	-0,17618	1,2716	14,3	32,2	460,46	0,0077
1,33	37,4	-0,90228	0,5455	14,3	32,2	460,46	0,0029	1,74	61,8	-0,53598	0,9118	14,3	32,2	460,46	0,0038	3,66	86,2	-0,17018	1,2776	14,3	32,2	460,46	0,0079
1,35	37,8	-0,89638	0,5514	14,3	32,2	460,46	0,0029	1,73	62,2	-0,52998	0,9178	14,3	32,2	460,46	0,0038	3,76	86,6	-0,16428	1,2835	14,3	32,2	460,46	0,0082
1,34	38,2	-0,89038	0,5574	14,3	32,2	460,46	0,0029	1,71	62,6	-0,52398	0,9238	14,3	32,2	460,46	0,0037	3,85	87	-0,15818	1,2896	14,3	32,2	460,46	0,0084
1,33	38,6	-0,88438	0,5634	14,3	32,2	460,46	0,0029	1,69	63	-0,51798	0,9298	14,3	32,2	460,46	0,0037	3,94	87,4	-0,15208	1,2957	14,3	32,2	460,46	0,0086
1,34	39	-0,87838	0,5694	14,3	32,2	460,46	0,0029	1,71	63,4	-0,51188	0,9359	14,3	32,2	460,46	0,0037	4,08	87,8	-0,14598	1,3018	14,3	32,2	460,46	0,0089
1,33	39,4	-0,87228	0,5755	14,3	32,2	460,46	0,0029	1,71	63,8	-0,50588	0,9419	14,3	32,2	460,46	0,0037	4,20	88,2	-0,13998	1,3078	14,3	32,2	460,46	0,0091
1,34	39,8	-0,86618	0,5816	14,3	32,2	460,46	0,0029	1,73	64,2	-0,49988	0,9479	14,3	32,2	460,46	0,0038	4,30	88,6	-0,13408	1,3137	14,3	32,2	460,46	0,0093
1,34	40,2	-0,86028	0,5875	14,3	32,2	460,46	0,0029	1,75	64,6	-0,49398	0,9538	14,3	32,2	460,46	0,0038	4,41	89	-0,12818	1,3196	14,3	32,2	460,46	0,0096
1,35	40,6	-0,85438	0,5934	14,3	32,2	460,46	0,0029	1,69	65	-0,48808	0,9597	14,3	32,2	460,46	0,0037	4,53	89,4	-0,12218	1,3256	14,3	32,2	460,46	0,0098
1,36	41	-0,84838	0,5994	14,3	32,2	460,46	0,0030	1,69	65,4	-0,48208	0,9657	14,3	32,2	460,46	0,0037	4,62	89,8	-0,11608	1,3317	14,3	32,2	460,46	0,0100
1,35	41,4	-0,84238	0,6054	14,3	32,2	460,46	0,0029	1,71	65,8	-0,47608	0,9717	14,3	32,2	460,46	0,0037	4,77	90,2	-0,10998	1,3378	14,3	32,2	460,46	0,0104
1,36	41,8	-0,83638	0,6114	14,3	32,2	460,46	0,0030	1,69	66,2	-0,46998	0,9778	14,3	32,2	460,46	0,0037	4,90	90,6	-0,10398	1,3438	14,3	32,2	460,46	0,0106
1,33	42,2	-0,83028	0,6175	14,3	32,2	460,46	0,0029	1,69	66,6	-0,46388	0,9839	14,3	32,2	460,46	0,0037	5,24	91	-0,09798	1,3498	14,3	32,2	460,46	0,0114
1,35	42,6	-0,82418	0,6236	14,3	32,2	460,46	0,0029	1,71	67	-0,45798	0,9898	14,3	32,2	460,46	0,0037	5,62	91,4	-0,09208	1,3557	14,3	32,2	460,46	0,0122
1,36	43	-0,81828	0,6295	14,3	32,2	460,46	0,0030	1,71	67,4	-0,45208	0,9957	14,3	32,2	460,46	0,0037	5,98	91,8	-0,08608	1,3617	14,3	32,2	460,46	0,0130
1,34	43,4	-0,81238	0,6354	14,3	32,2	460,46	0,0029	1,68	67,8	-0,44618	1,0016	14,3	32,2	460,46	0,0036	6,39	92,2	-0,08008	1,3677	14,3	32,2	460,46	0,0139
1,36	43,8	-0,80638	0,6414	14,3	32,2	460,46	0,0030	1,65	68,2	-0,44018	1,0076	14,3	32,2	460,46	0,0036	6,71	92,6	-0,07408	1,3737	14,3	32,2	460,46	0,0146
1,37	44,2	-0,80038	0,6474	14,3	32,2	460,46	0,0030	1,68	68,6	-0,43408	1,0137	14,3	32,2	460,46	0,0036	7,02	93	-0,06798	1,3798	14,3	32,2	460,46	0,0152
1,39	44,6	-0,79428	0,6535	14,3	32,2	460,46	0,0030	1,70	69	-0,42798	1,0198	14,3	32,2	460,46	0,0037	7,52	93,4	-0,06198	1,3858	14,3	32,2	460,46	0,0163
1,38	45	-0,78818	0,6596	14,3	32,2	460,46	0,0030	1,73	69,4	-0,42198	1,0258	14,3	32,2	460,46	0,0038	7,80	93,8	-0,05608	1,3917	14,3	32,2	460,46	0,0169
1,41	45,4	-0,78218	0,6656	14,3	32,2	460,46	0,0031	1,69	69,8	-0,41608	1,0317	14,3	32,2	460,46	0,0037	8,13	94,2	-0,05008	1,3977	14,3	32,2	460,46	0,0177
1,37	45,8	-0,77628	0,6715	14,3	32,2	460,46	0,0030	1,67	70,2	-0,41018	1,0376	14,3	32,2	460,46	0,0036	8,93	94,6	-0,04418	1,4036	14,3	32,2	460,46	0,0194
1,38	46,2	-0,77028	0,6775	14,3	32,2	460,46	0,0030	1,69	70,6	-0,40418	1,0436	14,3	32,2	460,46	0,0037	9,68	95	-0,03818	1,4096	14,3	32,2	460,46	0,0210
1,38	46,6	-0,76428	0,6835	14,3	32,2	460,46	0,0030	1,71	71	-0,39818	1,0496	14,3	32,2	460,46	0,0037	10,24	95,4	-0,03198	1,4158	14,3	32,2	460,46	0,0222
1,39	47	-0,75828	0,6895	14,3	32,2	460,46	0,0030	1,71	71,4	-0,39208	1,0557	14,3	32,2	460,46	0,0037	10,87	95,8	-0,02598	1,4218	14,3	32,2	460,46	0,0236
1,40	47,4	-0,75218	0,6956	14,3	32,2	460,46	0,0030	1,76	71,8	-0,38608	1,0617	14,3	32,2	460,46	0,0038	11,61	96,2	-0,01998	1,4278	14,3	32,2	460,46	0,0252
1,40	47,8	-0,74608	0,7017	14,3	32,2	460,46	0,0030	1,72	72,2	-0,38018	1,0676	14,3	32,2	460,46	0,0037	12,33	96,6	-0,01408	1,4337	14,3	32,2	460,46	0,0268
1,42	48,2	-0,74018	0,7076	14,3	32,2	460,46	0,0031	1,70	72,6	-0,37428	1,0735	14,3	32,2	460,46	0,0037	13,00	97	-0,00818	1,4396	14,3	32,2	460,46	0,0282
1,42	48,6	-0,73418	0,7136	14,3	32,2	460,46	0,0031	1,70	73	-0,36828	1,0795	14,3	32,2	460,46	0,0037	13,77	97,4	-0,00218	1,4456	14,3	32,2	460,46	0,0299
1,43	49	-0,72818	0,7196	14,3	32,2	460,46	0,0031	1,74	73,4	-0,36228	1,0855	14,3	32,2	460,46	0,0038	14,54	97,8	0,00392	1,4517	14,3	32,2	460,46	0,0316
1,46	49,4	-0,72228	0,7255	14,3	32,2	460,46	0,0032	1,76	73,8	-0,35628	1,0915	14,3	32,2	460,46	0,0038	15,50	98,2	0,01002	1,4578	14,3	32,2	460,46	0,0337

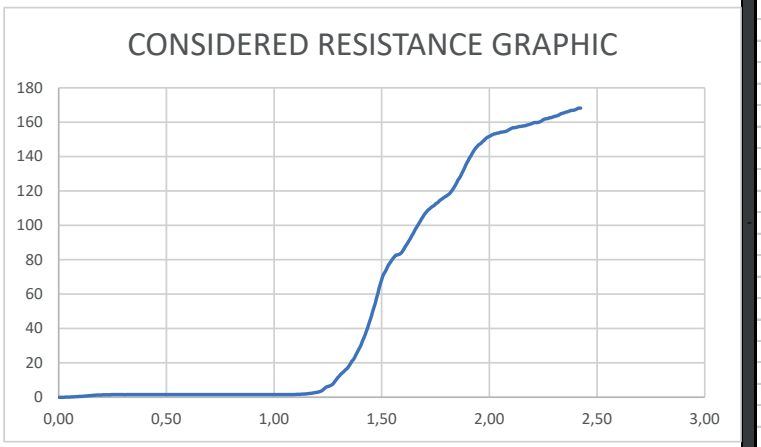
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
16,58	98,6	0,01602	1,4638	14,3	32,2	460,46	0,0360	117,69	123	0,38162	1,8294	14,3	32,2	460,46	0,2556	139,02	147,4	0,74772	2,1955	14,3	32,2	460,46	0,3019
17,63	99	0,02192	1,4697	14,3	32,2	460,46	0,0383	117,78	123,4	0,38752	1,8353	14,3	32,2	460,46	0,2558	139,72	147,8	0,75362	2,2014	14,3	32,2	460,46	0,3034
18,96	99,4	0,02782	1,4756	14,3	32,2	460,46	0,0412	117,96	123,8	0,39352	1,8413	14,3	32,2	460,46	0,2562	140,32	148,2	0,75962	2,2074	14,3	32,2	460,46	0,3047
20,37	99,8	0,03372	1,4815	14,3	32,2	460,46	0,0442	118,14	124,2	0,39952	1,8473	14,3	32,2	460,46	0,2566	141,10	148,6	0,76572	2,2135	14,3	32,2	460,46	0,3064
21,89	100,2	0,03972	1,4875	14,3	32,2	460,46	0,0475	118,47	124,6	0,40562	1,8534	14,3	32,2	460,46	0,2573	141,53	149	0,77182	2,2196	14,3	32,2	460,46	0,3074
23,39	100,6	0,04582	1,4936	14,3	32,2	460,46	0,0508	118,85	125	0,41172	1,8595	14,3	32,2	460,46	0,2581	141,84	149,4	0,77772	2,2255	14,3	32,2	460,46	0,3080
24,85	101	0,05192	1,4997	14,3	32,2	460,46	0,0540	119,16	125,4	0,41772	1,8655	14,3	32,2	460,46	0,2588	142,08	149,8	0,78372	2,2315	14,3	32,2	460,46	0,3086
26,39	101,4	0,05792	1,5057	14,3	32,2	460,46	0,0573	119,39	125,8	0,42362	1,8714	14,3	32,2	460,46	0,2593	142,55	150,2	0,78962	2,2374	14,3	32,2	460,46	0,3096
28,09	101,8	0,06382	1,5116	14,3	32,2	460,46	0,0610	119,93	126,2	0,42952	1,8773	14,3	32,2	460,46	0,2605	142,86	150,6	0,79562	2,2434	14,3	32,2	460,46	0,3103
29,90	102,2	0,06972	1,5175	14,3	32,2	460,46	0,0649	120,39	126,6	0,43552	1,8833	14,3	32,2	460,46	0,2615	143,23	151	0,80162	2,2494	14,3	32,2	460,46	0,3111
31,86	102,6	0,07572	1,5235	14,3	32,2	460,46	0,0692	120,94	127	0,44152	1,8893	14,3	32,2	460,46	0,2627	143,64	151,4	0,80772	2,2555	14,3	32,2	460,46	0,3119
33,73	103	0,08172	1,5295	14,3	32,2	460,46	0,0733	121,54	127,4	0,44762	1,8954	14,3	32,2	460,46	0,2640	143,93	151,8	0,81382	2,2616	14,3	32,2	460,46	0,3126
35,65	103,4	0,08782	1,5356	14,3	32,2	460,46	0,0774	122,17	127,8	0,45372	1,9015	14,3	32,2	460,46	0,2653	144,00	152,2	0,81972	2,2675	14,3	32,2	460,46	0,3127
37,41	103,8	0,09382	1,5416	14,3	32,2	460,46	0,0812	122,86	128,2	0,45962	1,9074	14,3	32,2	460,46	0,2668	144,18	152,6	0,82562	2,2734	14,3	32,2	460,46	0,3131
39,33	104,2	0,09982	1,5476	14,3	32,2	460,46	0,0854	123,66	128,6	0,46552	1,9133	14,3	32,2	460,46	0,2686	144,48	153	0,83162	2,2794	14,3	32,2	460,46	0,3138
41,28	104,6	0,10572	1,5535	14,3	32,2	460,46	0,0896	124,39	129	0,47152	1,9193	14,3	32,2	460,46	0,2701	144,86	153,4	0,83762	2,2854	14,3	32,2	460,46	0,3146
43,41	105	0,11172	1,5595	14,3	32,2	460,46	0,0943	125,09	129,4	0,47752	1,9253	14,3	32,2	460,46	0,2717	145,27	153,8	0,84372	2,2915	14,3	32,2	460,46	0,3155
45,55	105,4	0,11772	1,5655	14,3	32,2	460,46	0,0989	125,75	129,8	0,48362	1,9314	14,3	32,2	460,46	0,2731	145,73	154,2	0,84982	2,2976	14,3	32,2	460,46	0,3165
47,91	105,8	0,12372	1,5715	14,3	32,2	460,46	0,1040	126,35	130,2	0,48972	1,9375	14,3	32,2	460,46	0,2744	145,98	154,6	0,85582	2,3036	14,3	32,2	460,46	0,3170
50,22	106,2	0,12982	1,5776	14,3	32,2	460,46	0,1091	127,02	130,6	0,49572	1,9435	14,3	32,2	460,46	0,2759	146,12	155	0,86172	2,3095	14,3	32,2	460,46	0,3173
52,48	106,6	0,13582	1,5836	14,3	32,2	460,46	0,1140	127,57	131	0,50162	1,9494	14,3	32,2	460,46	0,2770	146,38	155,4	0,86762	2,3154	14,3	32,2	460,46	0,3179
54,82	107	0,14172	1,5895	14,3	32,2	460,46	0,1191	128,24	131,4	0,50752	1,9553	14,3	32,2	460,46	0,2785	146,64	155,8	0,87362	2,3214	14,3	32,2	460,46	0,3185
57,24	107,4	0,14762	1,5954	14,3	32,2	460,46	0,1243	129,15	131,8	0,51352	1,9613	14,3	32,2	460,46	0,2805	146,63	156,2	0,87962	2,3274	14,3	32,2	460,46	0,3184
59,67	107,8	0,15362	1,6014	14,3	32,2	460,46	0,1296	130,06	132,2	0,51952	1,9673	14,3	32,2	460,46	0,2825	146,06	156,6	0,88582	2,3336	14,3	32,2	460,46	0,3172
62,20	108,2	0,15962	1,6074	14,3	32,2	460,46	0,1351	130,86	132,6	0,52562	1,9734	14,3	32,2	460,46	0,2842	145,04	157	0,89182	2,3396	14,3	32,2	460,46	0,3150
64,77	108,6	0,16572	1,6135	14,3	32,2	460,46	0,1407	131,57	133	0,53172	1,9795	14,3	32,2	460,46	0,2857	143,75	157,4	0,89782	2,3456	14,3	32,2	460,46	0,3122
67,29	109	0,17182	1,6196	14,3	32,2	460,46	0,1461	132,29	133,4	0,53772	1,9855	14,3	32,2	460,46	0,2873	142,76	157,8	0,90372	2,3515	14,3	32,2	460,46	0,3100
68,85	109,4	0,17782	1,6256	14,3	32,2	460,46	0,1495	133,08	133,8	0,54362	1,9914	14,3	32,2	460,46	0,2890	142,12	158,2	0,90972	2,3575	14,3	32,2	460,46	0,3086
71,00	109,8	0,18372	1,6315	14,3	32,2	460,46	0,1542	133,96	134,2	0,54952	1,9973	14,3	32,2	460,46	0,2909	141,66	158,6	0,91562	2,3634	14,3	32,2	460,46	0,3076
73,27	110,2	0,18972	1,6375	14,3	32,2	460,46	0,1591	134,81	134,6	0,55552	2,0033	14,3	32,2	460,46	0,2928	141,32	159	0,92172	2,3695	14,3	32,2	460,46	0,3069
75,65	110,6	0,19562	1,6434	14,3	32,2	460,46	0,1643	135,82	135	0,56152	2,0093	14,3	32,2	460,46	0,2950	141,44	159,4	0,92772	2,3755	14,3	32,2	460,46	0,3072
78,07	111	0,20172	1,6495	14,3	32,2	460,46	0,1695	136,77	135,4	0,56772	2,0155	14,3	32,2	460,46	0,2970	141,66	159,8	0,93382	2,3816	14,3	32,2	460,46	0,3076
80,70	111,4	0,20782	1,6556	14,3	32,2	460,46	0,1753	137,62	135,8	0,57372	2,0215	14,3	32,2	460,46	0,2989	141,80	160,2	0,93972	2,3875	14,3	32,2	460,46	0,3080
83,07	111,8	0,21392	1,6617	14,3	32,2	460,46	0,1804	138,29	136,2	0,57972	2,0275	14,3	32,2	460,46	0,3003	141,83	160,6	0,94562	2,3934	14,3	32,2	460,46	0,3080
85,53	112,2	0,21982	1,6676	14,3	32,2	460,46	0,1857	139,09	136,6	0,58562	2,0334	14,3	32,2	460,46	0,3021	142,26	161	0,95162	2,3994	14,3	32,2	460,46	0,3090
87,91	112,6	0,22572	1,6735	14,3	32,2	460,46	0,1909	139,77	137	0,59162	2,0394	14,3	32,2	460,46	0,3035	142,65	161,4	0,95762	2,4054	14,3	32,2	460,46	0,3098
90,12	113	0,23172	1,6795	14,3	32,2	460,46	0,1957	140,41	137,4	0,59762	2,0454	14,3	32,2	460,46	0,3049	143,24	161,8	0,96372	2,4115	14,3	32,2	460,46	0,3111
92,31	113,4	0,23772	1,6855	14,3	32,2	460,46	0,2005	141,06	137,8	0,60362	2,0514	14,3	32,2	460,46	0,3063	143,77	162,2	0,96972	2,4175	14,3	32,2	460,46	0,3122
94,64	113,8	0,24372	1,6915	14,3	32,2	460,46	0,2055	141,74	138,2	0,60972	2,0575	14,3	32,2	460,46	0,3078	144,12	162,6	0,97572	2,4235	14,3	32,2	460,46	0,3130
96,82	114,2	0,24982	1,6976	14,3	32,2	460,46	0,2103	142,41	138,6	0,61572	2,0635	14,3	32,2	460,46	0,3093	144,64	163	0,98162	2,4294	14,3	32,2	460,46	0,3141
98,72	114,6	0,25582	1,7036	14,3	32,2	460,46	0,2144	142,93	139	0,62172	2,0695	14,3	32,2	460,46	0,3104	144,80	163,4	0,98752	2,4353	14,3	32,2	460,46	0,3145
100,25	115	0,26172	1,7095	14,3	32,2	460,46	0,2177	143,00	139,4	0,62762	2,0754	14,3	32,2	460,46	0,3106	145,35	163,8	0,99352	2,4413	14,3	32,2	460,46	0,3157
101,62	115,4	0,26772	1,7155	14,3	32,2	460,46	0,2207	142,80	139,8	0,63352	2,0813	14,3	32,2	460,46	0,3101	146,18	164,2	0,99952	2,4473	14,3	32,2	460,46	0,3175
102,90	115,8	0,27362	1,7214	14,3	32,2	460,46	0,2235	142,95	140,2	0,63962	2,0874	14,3	32,2	460,46	0,3105	146,98	164,6	1,00562	2,4534	14,3	32,2	460,46	0,3192
104,11	116,2	0,27962	1,7274	14,3	32,2	460,46	0,2261	143,08	140,6	0,64572	2,0935	14,3	32,2	460,46	0,3107	147,78	165	1,01172	2,4595	14,3	32,2	460,46	0,3209
105,43	116,6	0,28572	1,7335	14,3	32,2	460,46	0,2290	142,90	141	0,65182	2,0996	14,3	32,2	460,46	0,3103	148,50	165,4	1,01762	2,4654	14,3	32,2	460,46	0,3225
106,72	117	0,29182	1,7396	14,3	32,2	460,46	0,2318	141,51	141,4	0,65772	2,1055	14,3	32,2	460,46	0,3073	149,38	165,8	1,02352	2,4713	14,3	32,2	460,46	0,3244
107,91	117,4	0,29772	1,7455	14,3	32,2	460,46	0,2344	139,81	141,8	0,66362	2,1114	14,3	32,2	460,46	0,3036	150,32	166,2	1,02942	2,4772	14,3	32,2	460,46	0,3265
109,09	117,8	0,30372	1,7515	14,3	32,2	460,46	0,2369	138,42	142,2	0,66962	2,1174	14,3	32,2	460,46	0,3006	151,36	166,6	1,03542	2,4832	14,3	32,2	460,46	0,3287
110,30	118,2	0,30962	1,7574	14,3	32,2	460,46	0,2395	137,51	142,6	0,67562	2,1234	14,3	32,2	460,46	0,2986	152,37	167	1,04142	2,4892	14,3	32,2	460,46	0,3309
111,41	118,6	0,31562	1,7634	14,3	32,2	460,46	0,2420	137,23	143	0,68162	2,1294	14,3	32,2	460,46	0,2980	153,45	167,4	1,04762	2,4954	14,3	32,2	460,46	0,3333
112,54	119	0,32162	1,7694	14,3	32,2	460,46	0,2444	137,17	143,4	0,68782	2,1356	14,3	32,2	460,46	0,2979	154,02	167,8	1,05362	2,5014	14,3	32,2	460,46	0,3345
113,45	119,4	0,32772	1,7755	14,3	32,2	460,46	0,2464	137,29	143,8	0,69382	2,1416	14,3	32,2	460,46	0,2982	154,17	168,2	1,05952	2,5073	14,3	32,2	460,46	0,3348
114,17	119,8	0,33372	1,7815	14,3	32,2	460,46	0,2479	137,42	144,2	0,69982	2,1476	14,3	32,2	460,46	0,2984	154,29	168,6	1,06542	2,5132	14,3	32,2	460,46	0,3351
114,75	120,2	0,33962	1,7874	14,3	32,2	460,46	0,2492	137,68	144,6	0,70572	2,1535	14,3	32,2	460,46	0,2990	154,17	169	1,07142	2,5192	14,3	32,2	460,46	0,3348
115,47	120,6	0,34562	1,7934	14,3	32,2	460,46	0,2508	137,75	145	0,71172	2,1595	14,3	32,2	460,46	0,2992	154,75	169,4	1,07742	2,5252	14,3	32,2	460,46	0,3361
116,10	121	0,35152	1,7993	14,3	32,2	460,46	0,2521	136,96	145,4	0,71762	2,1654	14,3	32,2	460,46	0,2974	154,86	169,8	1,08352	2,5313	14,3	32,2	460,46	0,3363
116,62	121,4	0,35752	1,8053	14,3	32,2	460,46	0,2533	137,04	145,8	0,72372	2,1715	14,3	32,2	460,46	0,2976	155,41	170,2	1,08962	2,5374	14,3	32,2	460,46	0,3375
117,11	121,8	0,36362	1,8114	14,3	32,2	460,46	0,2543	137,50	146,2	0,72982	2,1776	14,3	32,2	460,46	0,2986	155,68	170,6	1,09562	2,5434	14,3	32,2	460,46	0,3381
117,48	122,2	0,36962	1,8174	14,3	32,2	460,46	0,2551	137,84	146,6	0,73582	2,1836	14,3	32,2	460,46	0,2994	155,87	171	1,10142	2,5492	14,3	32,2	460,46	0,3385
117,57	122,6	0,37572	1,8235	14,3	32,2	460,46	0,2553	138,36	147	0,74172	2,1895	14,3	32,2	460,46	0,3005	156,08	171,4	1,10742	2,5552	14,3	32,2	460,46	0,3390

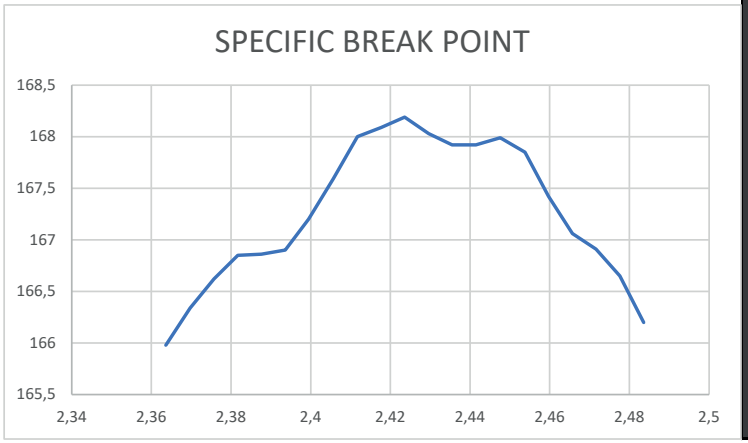
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
156,59	171,8	1,11342	2,5612	14,3	32,2	460,46	0,3401	145,56	196,2	1,47952	2,9273	14,3	32,2	460,46	0,3161	131,46	220,6	1,84562	3,2934	14,3	32,2	460,46	0,2855
157,03	172,2	1,11942	2,5672	14,3	32,2	460,46	0,3410	145,54	196,6	1,48572	2,9335	14,3	32,2	460,46	0,3161	131,28	221	1,85172	3,2995	14,3	32,2	460,46	0,2851
157,50	172,6	1,12552	2,5733	14,3	32,2	460,46	0,3420	145,27	197	1,49172	2,9395	14,3	32,2	460,46	0,3155	131,57	221,4	1,85762	3,3054	14,3	32,2	460,46	0,2857
157,49	173	1,13162	2,5794	14,3	32,2	460,46	0,3420	145,08	197,4	1,49772	2,9455	14,3	32,2	460,46	0,3151	131,80	221,8	1,86352	3,3113	14,3	32,2	460,46	0,2862
157,19	173,4	1,13762	2,5854	14,3	32,2	460,46	0,3414	144,96	197,8	1,50362	2,9514	14,3	32,2	460,46	0,3148	132,03	222,2	1,86942	3,3172	14,3	32,2	460,46	0,2867
157,17	173,8	1,14352	2,5913	14,3	32,2	460,46	0,3413	144,89	198,2	1,50962	2,9574	14,3	32,2	460,46	0,3147	132,03	222,6	1,87552	3,3233	14,3	32,2	460,46	0,2867
157,25	174,2	1,14952	2,5973	14,3	32,2	460,46	0,3415	144,70	198,6	1,51552	2,9633	14,3	32,2	460,46	0,3143	132,52	223	1,88152	3,3293	14,3	32,2	460,46	0,2878
157,49	174,6	1,15542	2,6032	14,3	32,2	460,46	0,3420	144,41	199	1,52162	2,9694	14,3	32,2	460,46	0,3136	132,62	223,4	1,88772	3,3355	14,3	32,2	460,46	0,2880
157,85	175	1,16152	2,6093	14,3	32,2	460,46	0,3428	144,20	199,4	1,52772	2,9755	14,3	32,2	460,46	0,3132	132,51	223,8	1,89372	3,3415	14,3	32,2	460,46	0,2878
158,04	175,4	1,16762	2,6154	14,3	32,2	460,46	0,3432	143,76	199,8	1,53372	2,9815	14,3	32,2	460,46	0,3122	131,66	224,2	1,89962	3,3474	14,3	32,2	460,46	0,2859
157,88	175,8	1,17372	2,6215	14,3	32,2	460,46	0,3429	142,76	200,2	1,53962	2,9874	14,3	32,2	460,46	0,3100	131,46	224,6	1,90552	3,3533	14,3	32,2	460,46	0,2855
156,87	176,2	1,17962	2,6274	14,3	32,2	460,46	0,3407	142,07	200,6	1,54562	2,9934	14,3	32,2	460,46	0,3085	131,47	225	1,91152	3,3593	14,3	32,2	460,46	0,2855
155,93	176,6	1,18552	2,6333	14,3	32,2	460,46	0,3386	141,65	201	1,55162	2,9994	14,3	32,2	460,46	0,3076	130,53	225,4	1,91752	3,3653	14,3	32,2	460,46	0,2835
155,63	177	1,19152	2,6393	14,3	32,2	460,46	0,3380	141,13	201,4	1,55762	3,0054	14,3	32,2	460,46	0,3065	129,63	225,8	1,92362	3,3714	14,3	32,2	460,46	0,2815
155,30	177,4	1,19742	2,6452	14,3	32,2	460,46	0,3373	140,40	201,8	1,56372	3,0115	14,3	32,2	460,46	0,3049	129,16	226,2	1,92972	3,3775	14,3	32,2	460,46	0,2805
155,25	177,8	1,20362	2,6514	14,3	32,2	460,46	0,3372	138,79	202,2	1,56982	3,0176	14,3	32,2	460,46	0,3014	127,35	226,6	1,93572	3,3835	14,3	32,2	460,46	0,2766
154,85	178,2	1,20972	2,6575	14,3	32,2	460,46	0,3363	137,60	202,6	1,57582	3,0236	14,3	32,2	460,46	0,2988	126,48	227	1,94162	3,3894	14,3	32,2	460,46	0,2747
153,77	178,6	1,21572	2,6635	14,3	32,2	460,46	0,3339	136,87	203	1,58162	3,0294	14,3	32,2	460,46	0,2972	125,70	227,4	1,94762	3,3954	14,3	32,2	460,46	0,2730
153,27	179	1,22162	2,6694	14,3	32,2	460,46	0,3329	136,34	203,4	1,58762	3,0354	14,3	32,2	460,46	0,2961	125,56	227,8	1,95362	3,4014	14,3	32,2	460,46	0,2727
153,07	179,4	1,22762	2,6754	14,3	32,2	460,46	0,3324	134,34	203,8	1,59362	3,0414	14,3	32,2	460,46	0,2918	125,51	228,2	1,95962	3,4074	14,3	32,2	460,46	0,2726
152,58	179,8	1,23352	2,6813	14,3	32,2	460,46	0,3314	132,06	204,2	1,59962	3,0474	14,3	32,2	460,46	0,2868	125,28	228,6	1,96572	3,4135	14,3	32,2	460,46	0,2721
150,59	180,2	1,23952	2,6873	14,3	32,2	460,46	0,3270	130,54	204,6	1,60572	3,0535	14,3	32,2	460,46	0,2835	125,07	229	1,97182	3,4196	14,3	32,2	460,46	0,2716
150,02	180,6	1,24572	2,6935	14,3	32,2	460,46	0,3258	129,68	205	1,61182	3,0596	14,3	32,2	460,46	0,2816	125,17	229,4	1,97772	3,4255	14,3	32,2	460,46	0,2718
149,53	181	1,25172	2,6995	14,3	32,2	460,46	0,3247	129,21	205,4	1,61772	3,0655	14,3	32,2	460,46	0,2806	125,23	229,8	1,98372	3,4315	14,3	32,2	460,46	0,2720
149,20	181,4	1,25772	2,7055	14,3	32,2	460,46	0,3240	127,73	205,8	1,62362	3,0714	14,3	32,2	460,46	0,2774	125,37	230,2	1,98962	3,4374	14,3	32,2	460,46	0,2723
149,05	181,8	1,26362	2,7114	14,3	32,2	460,46	0,3237	127,30	206,2	1,62962	3,0774	14,3	32,2	460,46	0,2765	125,42	230,6	1,99562	3,4434	14,3	32,2	460,46	0,2724
149,02	182,2	1,26962	2,7174	14,3	32,2	460,46	0,3236	127,49	206,6	1,63562	3,0834	14,3	32,2	460,46	0,2769	124,97	231	2,00172	3,4495	14,3	32,2	460,46	0,2714
148,96	182,6	1,27552	2,7233	14,3	32,2	460,46	0,3235	128,02	207	1,64172	3,0895	14,3	32,2	460,46	0,2780	124,96	231,4	2,00782	3,4556	14,3	32,2	460,46	0,2714
148,77	183	1,28162	2,7294	14,3	32,2	460,46	0,3231	128,63	207,4	1,64782	3,0956	14,3	32,2	460,46	0,2794	124,84	231,8	2,01382	3,4616	14,3	32,2	460,46	0,2711
148,60	183,4	1,28772	2,7355	14,3	32,2	460,46	0,3227	129,08	207,8	1,65382	3,1016	14,3	32,2	460,46	0,2803	124,87	232,2	2,01972	3,4675	14,3	32,2	460,46	0,2712
148,53	183,8	1,29382	2,7416	14,3	32,2	460,46	0,3226	128,95	208,2	1,65972	3,1075	14,3	32,2	460,46	0,2800	124,27	232,6	2,02572	3,4735	14,3	32,2	460,46	0,2699
148,29	184,2	1,29972	2,7475	14,3	32,2	460,46	0,3220	129,13	208,6	1,66562	3,1134	14,3	32,2	460,46	0,2804	122,01	233	2,03162	3,4794	14,3	32,2	460,46	0,2650
147,46	184,6	1,30572	2,7535	14,3	32,2	460,46	0,3202	129,74	209	1,67162	3,1194	14,3	32,2	460,46	0,2818	121,69	233,4	2,03762	3,4854	14,3	32,2	460,46	0,2643
147,43	185	1,31162	2,7594	14,3	32,2	460,46	0,3202	130,17	209,4	1,67762	3,1254	14,3	32,2	460,46	0,2827	121,37	233,8	2,04372	3,4915	14,3	32,2	460,46	0,2636
147,63	185,4	1,31762	2,7654	14,3	32,2	460,46	0,3206	130,74	209,8	1,68372	3,1315	14,3	32,2	460,46	0,2839	119,32	234,2	2,04982	3,4976	14,3	32,2	460,46	0,2591
147,97	185,8	1,32372	2,7715	14,3	32,2	460,46	0,3214	130,89	210,2	1,68982	3,1376	14,3	32,2	460,46	0,2843	117,51	234,6	2,05582	3,5036	14,3	32,2	460,46	0,2552
148,40	186,2	1,32982	2,7776	14,3	32,2	460,46	0,3223	130,49	210,6	1,69572	3,1435	14,3	32,2	460,46	0,2834	117,17	235	2,06172	3,5095	14,3	32,2	460,46	0,2545
148,53	186,6	1,33582	2,7836	14,3	32,2	460,46	0,3226	130,37	211	1,70162	3,1494	14,3	32,2	460,46	0,2831	117,21	235,4	2,06762	3,5154	14,3	32,2	460,46	0,2545
148,05	187	1,34172	2,7895	14,3	32,2	460,46	0,3215	130,37	211,4	1,70762	3,1554	14,3	32,2	460,46	0,2831	116,96	235,8	2,07362	3,5214	14,3	32,2	460,46	0,2540
147,77	187,4	1,34772	2,7955	14,3	32,2	460,46	0,3209	130,39	211,8	1,71362	3,1614	14,3	32,2	460,46	0,2832	116,57	236,2	2,07962	3,5274	14,3	32,2	460,46	0,2532
147,65	187,8	1,35362	2,8014	14,3	32,2	460,46	0,3207	130,53	212,2	1,71962	3,1674	14,3	32,2	460,46	0,2835	116,41	236,6	2,08582	3,5336	14,3	32,2	460,46	0,2528
147,53	188,2	1,35972	2,8075	14,3	32,2	460,46	0,3204	130,84	212,6	1,72572	3,1735	14,3	32,2	460,46	0,2842	116,42	237	2,09182	3,5396	14,3	32,2	460,46	0,2528
146,67	188,6	1,36582	2,8136	14,3	32,2	460,46	0,3185	131,05	213	1,73182	3,1796	14,3	32,2	460,46	0,2846	116,80	237,4	2,09772	3,5455	14,3	32,2	460,46	0,2537
146,05	189	1,37182	2,8196	14,3	32,2	460,46	0,3172	130,96	213,4	1,73772	3,1855	14,3	32,2	460,46	0,2844	116,72	237,8	2,10372	3,5515	14,3	32,2	460,46	0,2535
146,21	189,4	1,37782	2,8256	14,3	32,2	460,46	0,3175	130,92	213,8	1,74362	3,1914	14,3	32,2	460,46	0,2843	116,33	238,2	2,10962	3,5574	14,3	32,2	460,46	0,2526
146,45	189,8	1,38372	2,8315	14,3	32,2	460,46	0,3181	131,17	214,2	1,74952	3,1973	14,3	32,2	460,46	0,2849	116,71	238,6	2,11562	3,5634	14,3	32,2	460,46	0,2535
146,81	190,2	1,38972	2,8375	14,3	32,2	460,46	0,3188	131,47	214,6	1,75552	3,2033	14,3	32,2	460,46	0,2855	117,02	239	2,12172	3,5695	14,3	32,2	460,46	0,2541
147,07	190,6	1,39562	2,8434	14,3	32,2	460,46	0,3194	131,67	215	1,76162	3,2094	14,3	32,2	460,46	0,2860	116,53	239,4	2,12782	3,5756	14,3	32,2	460,46	0,2531
147,37	191	1,40172	2,8495	14,3	32,2	460,46	0,3200	131,60	215,4	1,76772	3,2155	14,3	32,2	460,46	0,2858	116,91	239,8	2,13382	3,5816	14,3	32,2	460,46	0,2539
147,71	191,4	1,40772	2,8555	14,3	32,2	460,46	0,3208	131,44	215,8	1,77372	3,2215	14,3	32,2	460,46	0,2855	116,21	240,2	2,13972	3,5875	14,3	32,2	460,46	0,2524
147,95	191,8	1,41382	2,8616	14,3	32,2	460,46	0,3213	131,34	216,2	1,77962	3,2274	14,3	32,2	460,46	0,2852	116,35	240,6	2,14562	3,5934	14,3	32,2	460,46	0,2527
147,78	192,2	1,41972	2,8675	14,3	32,2	460,46	0,3209	131,38	216,6	1,78552	3,2333	14,3	32,2	460,46	0,2853	116,69	241	2,15162	3,5994	14,3	32,2	460,46	0,2534
147,90	192,6	1,42562	2,8734	14,3	32,2	460,46	0,3212	130,93	217	1,79152	3,2393	14,3	32,2	460,46	0,2843	117,01	241,4	2,15762	3,6054	14,3	32,2	460,46	0,2541
147,67	193	1,43152	2,8793	14,3	32,2	460,46	0,3207	130,17	217,4	1,79752	3,2453	14,3	32,2	460,46	0,2827	117,60	241,8	2,16372	3,6115	14,3	32,2	460,46	0,2554
147,89	193,4	1,43762	2,8854	14,3	32,2	460,46	0,3212	130,13	217,8	1,80362	3,2514	14,3	32,2	460,46	0,2826	118,21	242,2	2,16982	3,6176	14,3	32,2	460,46	0,2567
148,12	193,8	1,44362	2,8914	14,3	32,2	460,46	0,3217	130,42	218,2	1,80972	3,2575	14,3	32,2	460,46	0,2832	118,76	242,6	2,17572	3,6235	14,3	32,2	460,46	0,2579
147,99	194,2	1,44972	2,8975	14,3	32,2	460,46	0,3214	130,78	218,6	1,81562	3,2634	14,3	32,2	460,46	0,2840	119,22	243	2,18162	3,6294	14,3	32,2	460,46	0,2589
147,94	194,6	1,45572	2,9035	14,3	32,2	460,46	0,3213	131,15	219	1,82162	3,2694	14,3	32,2	460,46	0,2848	119,92	243,4	2,18762	3,6354	14,3	32,2	460,46	0,2604
146,99	195	1,46162	2,9094	14,3	32,2	460,46	0,3192	131,45	219,4	1,82752	3,2753	14,3	32,2	460,46	0,2855	120,64	243,8	2,19362	3,6414	14,3	32,2	460,46	0,2620
146,03	195,4	1,46752	2,9153	14,3	32,2	460,46	0,3171	131,77	219,8	1,83342	3,2812	14,3	32,2	460,46	0,2862	121,66	244,2	2,19962	3,6474	14,3	32,2	460,46	0,2642
145,81	195,8	1,47352	2,9213	14,3	32,2	460,46	0,3167	131,97	220,2	1,83952	3,2873	14,3	32,2	460,46	0,2866	122,13	244,6	2,20572	3,6535	14,3	32,2	460,46	0,2652

LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
122,66	245	2,21172	3,6595	14,3	32,2	460,46	0,2664
123,00	245,4	2,21762	3,6654	14,3	32,2	460,46	0,2671
123,30	245,8	2,22362	3,6714	14,3	32,2	460,46	0,2678
122,66	246,2	2,22952	3,6773	14,3	32,2	460,46	0,2664
122,71	246,6	2,23552	3,6833	14,3	32,2	460,46	0,2665
122,98	247	2,24162	3,6894	14,3	32,2	460,46	0,2671
123,39	247,4	2,24772	3,6955	14,3	32,2	460,46	0,2680
123,26	247,8	2,25372	3,7015	14,3	32,2	460,46	0,2677
123,00	248,2	2,25962	3,7074	14,3	32,2	460,46	0,2671
123,24	248,6	2,26552	3,7133	14,3	32,2	460,46	0,2676
123,84	249	2,27152	3,7193	14,3	32,2	460,46	0,2689
124,95	249,4	2,27752	3,7253	14,3	32,2	460,46	0,2714
125,66	249,8	2,28362	3,7314	14,3	32,2	460,46	0,2729
126,25	250,2	2,28972	3,7375	14,3	32,2	460,46	0,2742
126,44	250,6	2,29562	3,7434	14,3	32,2	460,46	0,2746
127,05	251	2,30152	3,7493	14,3	32,2	460,46	0,2759
127,66	251,4	2,30742	3,7552	14,3	32,2	460,46	0,2772
128,31	251,8	2,31342	3,7612	14,3	32,2	460,46	0,2787
128,87	252,2	2,31942	3,7672	14,3	32,2	460,46	0,2799
129,42	252,6	2,32552	3,7733	14,3	32,2	460,46	0,2811
130,05	253	2,33162	3,7794	14,3	32,2	460,46	0,2824
130,46	253,4	2,33752	3,7853	14,3	32,2	460,46	0,2833
131,18	253,8	2,34342	3,7912	14,3	32,2	460,46	0,2849
131,20	254,2	2,34942	3,7972	14,3	32,2	460,46	0,2849
131,33	254,6	2,35532	3,8031	14,3	32,2	460,46	0,2852
131,91	255	2,36142	3,8092	14,3	32,2	460,46	0,2865
132,04	255,4	2,36752	3,8153	14,3	32,2	460,46	0,2868
132,04	255,42	2,36782	3,8156	14,3	32,2	460,46	0,2868

3.3.1.6-N Mix. Proportion Tests
32.5R - 20:2:1 - 2







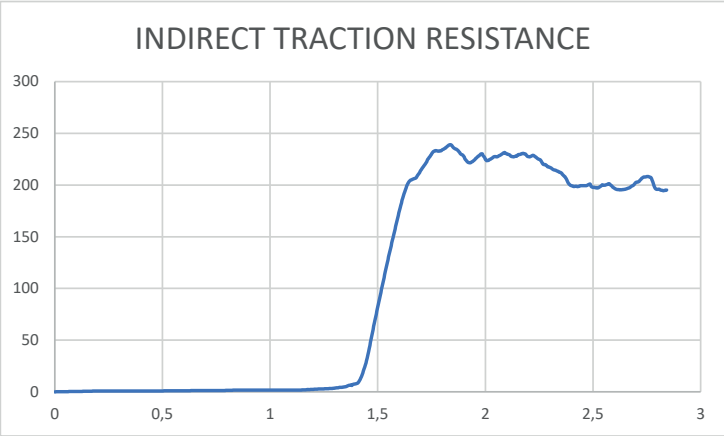
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
0,01	1	-1,33957	0	14,3	34,4	491,92	0,0000
0,02	1,4	-1,33367	0,0059	14,3	34,4	491,92	0,0000
0,02	1,8	-1,32757	0,012	14,3	34,4	491,92	0,0000
0,01	2,2	-1,32147	0,0181	14,3	34,4	491,92	0,0000
0,01	2,6	-1,31557	0,024	14,3	34,4	491,92	0,0000
0,03	3	-1,30957	0,03	14,3	34,4	491,92	0,0001
0,06	3,4	-1,30367	0,0359	14,3	34,4	491,92	0,0001
0,10	3,8	-1,29767	0,0419	14,3	34,4	491,92	0,0002
0,10	4,2	-1,29167	0,0479	14,3	34,4	491,92	0,0002
0,13	4,6	-1,28557	0,054	14,3	34,4	491,92	0,0003
0,19	5	-1,27947	0,0601	14,3	34,4	491,92	0,0004
0,22	5,4	-1,27357	0,066	14,3	34,4	491,92	0,0004
0,28	5,8	-1,26767	0,0719	14,3	34,4	491,92	0,0006
0,32	6,2	-1,26167	0,0779	14,3	34,4	491,92	0,0007
0,37	6,6	-1,25567	0,0839	14,3	34,4	491,92	0,0008
0,42	7	-1,24967	0,0899	14,3	34,4	491,92	0,0009
0,46	7,4	-1,24357	0,096	14,3	34,4	491,92	0,0009
0,50	7,8	-1,23747	0,1021	14,3	34,4	491,92	0,0010
0,56	8,2	-1,23157	0,108	14,3	34,4	491,92	0,0011
0,62	8,6	-1,22567	0,1139	14,3	34,4	491,92	0,0013
0,67	9	-1,21967	0,1199	14,3	34,4	491,92	0,0014
0,72	9,4	-1,21367	0,1259	14,3	34,4	491,92	0,0015
0,78	9,8	-1,20757	0,132	14,3	34,4	491,92	0,0016
0,85	10,2	-1,20147	0,1381	14,3	34,4	491,92	0,0017
0,91	10,6	-1,19557	0,144	14,3	34,4	491,92	0,0018
0,98	11	-1,18957	0,15	14,3	34,4	491,92	0,0020
1,04	11,4	-1,18367	0,1559	14,3	34,4	491,92	0,0021
1,10	11,8	-1,17767	0,1619	14,3	34,4	491,92	0,0022
1,17	12,2	-1,17167	0,1679	14,3	34,4	491,92	0,0024
1,23	12,6	-1,16557	0,174	14,3	34,4	491,92	0,0025
1,25	13	-1,15947	0,1801	14,3	34,4	491,92	0,0025
1,29	13,4	-1,15357	0,186	14,3	34,4	491,92	0,0026
1,32	13,8	-1,14757	0,192	14,3	34,4	491,92	0,0027
1,33	14,2	-1,14167	0,1979	14,3	34,4	491,92	0,0027
1,37	14,6	-1,13567	0,2039	14,3	34,4	491,92	0,0028
1,39	15	-1,12957	0,21	14,3	34,4	491,92	0,0028
1,40	15,4	-1,12357	0,216	14,3	34,4	491,92	0,0028
1,43	15,8	-1,11747	0,2221	14,3	34,4	491,92	0,0029
1,45	16,2	-1,11157	0,228	14,3	34,4	491,92	0,0029
1,47	16,6	-1,10567	0,2339	14,3	34,4	491,92	0,0030
1,48	17	-1,09967	0,2399	14,3	34,4	491,92	0,0030
1,50	17,4	-1,09367	0,2459	14,3	34,4	491,92	0,0030
1,51	17,8	-1,08757	0,252	14,3	34,4	491,92	0,0031
1,52	18,2	-1,08147	0,2581	14,3	34,4	491,92	0,0031
1,50	18,6	-1,07557	0,264	14,3	34,4	491,92	0,0030
1,52	19	-1,06957	0,27	14,3	34,4	491,92	0,0031
1,51	19,4	-1,06367	0,2759	14,3	34,4	491,92	0,0031
1,52	19,8	-1,05767	0,2819	14,3	34,4	491,92	0,0031
1,50	20,2	-1,05167	0,2879	14,3	34,4	491,92	0,0030
1,51	20,6	-1,04557	0,294	14,3	34,4	491,92	0,0031
1,51	21	-1,03947	0,3001	14,3	34,4	491,92	0,0031
1,49	21,4	-1,03357	0,306	14,3	34,4	491,92	0,0030
1,50	21,8	-1,02767	0,3119	14,3	34,4	491,92	0,0030
1,50	22,2	-1,02177	0,3178	14,3	34,4	491,92	0,0030
1,51	22,6	-1,01577	0,3238	14,3	34,4	491,92	0,0031
1,52	23	-1,00967	0,3299	14,3	34,4	491,92	0,0031
1,50	23,4	-1,00357	0,336	14,3	34,4	491,92	0,0030
1,51	23,8	-0,99767	0,3419	14,3	34,4	491,92	0,0031
1,52	24,2	-0,99167	0,3479	14,3	34,4	491,92	0,0031
1,52	24,6	-0,98577	0,3538	14,3	34,4	491,92	0,0031
1,50	25	-0,97987	0,3597	14,3	34,4	491,92	0,0030

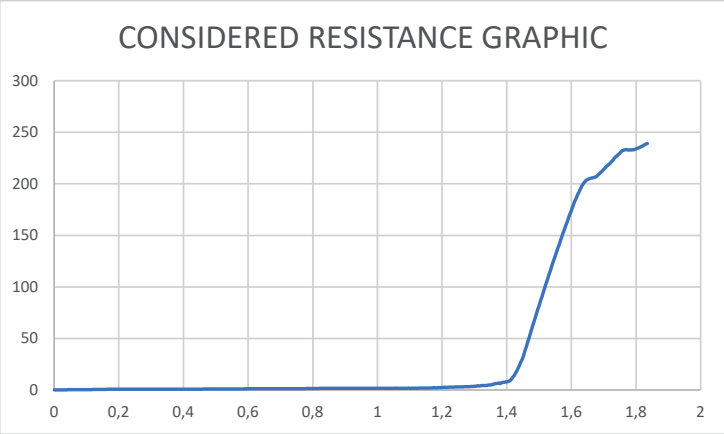
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
1,51	25,4	-0,97387	0,3657	14,3	34,4	491,92	0,0031	1,53	49,8	-0,60747	0,7321	14,3	34,4	491,92	0,0031	1,61	74,2	-0,24157	1,098	14,3	34,4	491,92	0,0033
1,52	25,8	-0,96767	0,3719	14,3	34,4	491,92	0,0031	1,53	50,2	-0,60137	0,7382	14,3	34,4	491,92	0,0031	1,65	74,6	-0,23567	1,1039	14,3	34,4	491,92	0,0034
1,53	26,2	-0,96167	0,3779	14,3	34,4	491,92	0,0031	1,54	50,6	-0,59537	0,7442	14,3	34,4	491,92	0,0031	1,67	75	-0,22967	1,1099	14,3	34,4	491,92	0,0034
1,53	26,6	-0,95577	0,3838	14,3	34,4	491,92	0,0031	1,53	51	-0,58947	0,7501	14,3	34,4	491,92	0,0031	1,69	75,4	-0,22377	1,1158	14,3	34,4	491,92	0,0034
1,51	27	-0,94987	0,3897	14,3	34,4	491,92	0,0031	1,54	51,4	-0,58347	0,7561	14,3	34,4	491,92	0,0031	1,74	75,8	-0,21777	1,1218	14,3	34,4	491,92	0,0035
1,51	27,4	-0,94387	0,3957	14,3	34,4	491,92	0,0031	1,56	51,8	-0,57757	0,762	14,3	34,4	491,92	0,0032	1,78	76,2	-0,21167	1,1279	14,3	34,4	491,92	0,0036
1,52	27,8	-0,93787	0,4017	14,3	34,4	491,92	0,0031	1,55	52,2	-0,57147	0,7681	14,3	34,4	491,92	0,0032	1,80	76,6	-0,20557	1,134	14,3	34,4	491,92	0,0037
1,52	28,2	-0,93187	0,4077	14,3	34,4	491,92	0,0031	1,55	52,6	-0,56537	0,7742	14,3	34,4	491,92	0,0032	1,84	77	-0,19957	1,14	14,3	34,4	491,92	0,0037
1,51	28,6	-0,92577	0,4138	14,3	34,4	491,92	0,0031	1,55	53	-0,55937	0,7802	14,3	34,4	491,92	0,0032	1,93	77,4	-0,19357	1,146	14,3	34,4	491,92	0,0039
1,51	29	-0,91967	0,4199	14,3	34,4	491,92	0,0031	1,55	53,4	-0,55337	0,7862	14,3	34,4	491,92	0,0032	1,97	77,8	-0,18767	1,1519	14,3	34,4	491,92	0,0040
1,51	29,4	-0,91377	0,4258	14,3	34,4	491,92	0,0031	1,54	53,8	-0,54747	0,7921	14,3	34,4	491,92	0,0031	2,03	78,2	-0,18167	1,1579	14,3	34,4	491,92	0,0041
1,52	29,8	-0,90787	0,4317	14,3	34,4	491,92	0,0031	1,54	54,2	-0,54157	0,798	14,3	34,4	491,92	0,0031	2,17	78,6	-0,17567	1,1639	14,3	34,4	491,92	0,0044
1,51	30,2	-0,90187	0,4377	14,3	34,4	491,92	0,0031	1,54	54,6	-0,53557	0,804	14,3	34,4	491,92	0,0031	2,29	79	-0,16957	1,17	14,3	34,4	491,92	0,0047
1,52	30,6	-0,89597	0,4436	14,3	34,4	491,92	0,0031	1,54	55	-0,52947	0,8101	14,3	34,4	491,92	0,0031	2,34	79,4	-0,16347	1,1761	14,3	34,4	491,92	0,0048
1,52	31	-0,88987	0,4497	14,3	34,4	491,92	0,0031	1,54	55,4	-0,52337	0,8162	14,3	34,4	491,92	0,0031	2,49	79,8	-0,15747	1,1821	14,3	34,4	491,92	0,0051
1,53	31,4	-0,88377	0,4558	14,3	34,4	491,92	0,0031	1,54	55,8	-0,51737	0,8222	14,3	34,4	491,92	0,0031	2,65	80,2	-0,15157	1,188	14,3	34,4	491,92	0,0054
1,53	31,8	-0,87777	0,4618	14,3	34,4	491,92	0,0031	1,54	56,2	-0,51147	0,8281	14,3	34,4	491,92	0,0031	2,71	80,6	-0,14557	1,194	14,3	34,4	491,92	0,0055
1,51	32,2	-0,87187	0,4677	14,3	34,4	491,92	0,0031	1,55	56,6	-0,50557	0,834	14,3	34,4	491,92	0,0032	2,93	81	-0,13967	1,1999	14,3	34,4	491,92	0,0060
1,52	32,6	-0,86587	0,4737	14,3	34,4	491,92	0,0031	1,56	57	-0,49957	0,84	14,3	34,4	491,92	0,0032	3,01	81,4	-0,13357	1,206	14,3	34,4	491,92	0,0061
1,53	33	-0,85987	0,4797	14,3	34,4	491,92	0,0031	1,53	57,4	-0,49357	0,846	14,3	34,4	491,92	0,0031	3,26	81,8	-0,12747	1,2121	14,3	34,4	491,92	0,0066
1,52	33,4	-0,85387	0,4857	14,3	34,4	491,92	0,0031	1,54	57,8	-0,48747	0,8521	14,3	34,4	491,92	0,0031	3,51	82,2	-0,12137	1,2182	14,3	34,4	491,92	0,0071
1,52	33,8	-0,84777	0,4918	14,3	34,4	491,92	0,0031	1,53	58,2	-0,48147	0,8581	14,3	34,4	491,92	0,0031	3,93	82,6	-0,11547	1,2241	14,3	34,4	491,92	0,0080
1,53	34,2	-0,84167	0,4979	14,3	34,4	491,92	0,0031	1,56	58,6	-0,47547	0,8641	14,3	34,4	491,92	0,0032	4,59	83	-0,10957	1,23	14,3	34,4	491,92	0,0093
1,51	34,6	-0,83577	0,5038	14,3	34,4	491,92	0,0031	1,56	59	-0,46957	0,87	14,3	34,4	491,92	0,0032	5,27	83,4	-0,10357	1,236	14,3	34,4	491,92	0,0107
1,52	35	-0,82987	0,5097	14,3	34,4	491,92	0,0031	1,54	59,4	-0,46357	0,876	14,3	34,4	491,92	0,0031	5,88	83,8	-0,09767	1,2419	14,3	34,4	491,92	0,0120
1,54	35,4	-0,82387	0,5157	14,3	34,4	491,92	0,0031	1,55	59,8	-0,45767	0,8819	14,3	34,4	491,92	0,0032	6,25	84,2	-0,09157	1,248	14,3	34,4	491,92	0,0127
1,52	35,8	-0,81787	0,5217	14,3	34,4	491,92	0,0031	1,55	60,2	-0,45157	0,888	14,3	34,4	491,92	0,0032	6,42	84,6	-0,08547	1,2541	14,3	34,4	491,92	0,0131
1,51	36,2	-0,81187	0,5277	14,3	34,4	491,92	0,0031	1,54	60,6	-0,44547	0,8941	14,3	34,4	491,92	0,0031	6,80	85	-0,07947	1,2601	14,3	34,4	491,92	0,0138
1,54	36,6	-0,80567	0,5339	14,3	34,4	491,92	0,0031	1,55	61	-0,43947	0,9001	14,3	34,4	491,92	0,0032	7,06	85,4	-0,07347	1,2661	14,3	34,4	491,92	0,0144
1,54	37	-0,79967	0,5399	14,3	34,4	491,92	0,0031	1,54	61,4	-0,43357	0,906	14,3	34,4	491,92	0,0031	7,62	85,8	-0,06757	1,272	14,3	34,4	491,92	0,0155
1,53	37,4	-0,79377	0,5458	14,3	34,4	491,92	0,0031	1,55	61,8	-0,42767	0,9119	14,3	34,4	491,92	0,0032	8,41	86,2	-0,06157	1,278	14,3	34,4	491,92	0,0171
1,53	37,8	-0,78777	0,5518	14,3	34,4	491,92	0,0031	1,56	62,2	-0,42167	0,9179	14,3	34,4	491,92	0,0032	9,40	86,6	-0,05567	1,2839	14,3	34,4	491,92	0,0191
1,52	38,2	-0,78177	0,5578	14,3	34,4	491,92	0,0031	1,56	62,6	-0,41567	0,9239	14,3	34,4	491,92	0,0032	10,45	87	-0,04957	1,29	14,3	34,4	491,92	0,0212
1,52	38,6	-0,77587	0,5637	14,3	34,4	491,92	0,0031	1,56	63	-0,40967	0,9299	14,3	34,4	491,92	0,0032	11,38	87,4	-0,04347	1,2961	14,3	34,4	491,92	0,0231
1,52	39	-0,76967	0,5699	14,3	34,4	491,92	0,0031	1,55	63,4	-0,40357	0,936	14,3	34,4	491,92	0,0032	12,28	87,8	-0,03747	1,3021	14,3	34,4	491,92	0,0250
1,53	39,4	-0,76357	0,576	14,3	34,4	491,92	0,0031	1,54	63,8	-0,39757	0,942	14,3	34,4	491,92	0,0031	13,11	88,2	-0,03157	1,308	14,3	34,4	491,92	0,0267
1,52	39,8	-0,75757	0,582	14,3	34,4	491,92	0,0031	1,55	64,2	-0,39167	0,9479	14,3	34,4	491,92	0,0032	13,82	88,6	-0,02557	1,314	14,3	34,4	491,92	0,0281
1,54	40,2	-0,75167	0,5879	14,3	34,4	491,92	0,0031	1,55	64,6	-0,38577	0,9538	14,3	34,4	491,92	0,0032	14,48	89	-0,01957	1,32	14,3	34,4	491,92	0,0294
1,53	40,6	-0,74567	0,5939	14,3	34,4	491,92	0,0031	1,56	65	-0,37977	0,9598	14,3	34,4	491,92	0,0032	15,20	89,4	-0,01357	1,326	14,3	34,4	491,92	0,0309
1,52	41	-0,73977	0,5998	14,3	34,4	491,92	0,0031	1,56	65,4	-0,37377	0,9658	14,3	34,4	491,92	0,0032	15,92	89,8	-0,00747	1,3321	14,3	34,4	491,92	0,0324
1,54	41,4	-0,73367	0,6059	14,3	34,4	491,92	0,0031	1,56	65,8	-0,36767	0,9719	14,3	34,4	491,92	0,0032	16,56	90,2	-0,00147	1,3381	14,3	34,4	491,92	0,0337
1,53	41,8	-0,72757	0,612	14,3	34,4	491,92	0,0031	1,54	66,2	-0,36157	0,978	14,3	34,4	491,92	0,0031	17,32	90,6	0,00443	1,344	14,3	34,4	491,92	0,0352
1,52	42,2	-0,72147	0,6181	14,3	34,4	491,92	0,0031	1,56	66,6	-0,35567	0,9839	14,3	34,4	491,92	0,0032	18,61	91	0,01033	1,3499	14,3	34,4	491,92	0,0378
1,52	42,6	-0,71557	0,624	14,3	34,4	491,92	0,0031	1,56	67	-0,34977	0,9898	14,3	34,4	491,92	0,0032	19,88	91,4	0,01633	1,3559	14,3	34,4	491,92	0,0404
1,52	43	-0,70967	0,6299	14,3	34,4	491,92	0,0031	1,55	67,4	-0,34387	0,9957	14,3	34,4	491,92	0,0032	21,01	91,8	0,02223	1,3618	14,3	34,4	491,92	0,0427
1,52	43,4	-0,70367	0,6359	14,3	34,4	491,92	0,0031	1,54	67,8	-0,33777	1,0018	14,3	34,4	491,92	0,0031	21,88	92,2	0,02833	1,3679	14,3	34,4	491,92	0,0445
1,53	43,8	-0,69767	0,6419	14,3	34,4	491,92	0,0031	1,54	68,2	-0,33177	1,0078	14,3	34,4	491,92	0,0031	23,10	92,6	0,03443	1,374	14,3	34,4	491,92	0,0470
1,53	44,2	-0,69157	0,648	14,3	34,4	491,92	0,0031	1,54	68,6	-0,32567	1,0139	14,3	34,4	491,92	0,0031	24,65	93	0,04043	1,38	14,3	34,4	491,92	0,0501
1,53	44,6	-0,68557	0,654	14,3	34,4	491,92	0,0031	1,54	69	-0,31957	1,02	14,3	34,4	491,92	0,0031	26,05	93,4	0,04633	1,3859	14,3	34,4	491,92	0,0530
1,51	45	-0,67947	0,6601	14,3	34,4	491,92	0,0031	1,55	69,4	-0,31367	1,0259	14,3	34,4	491,92	0,0032	27,35	93,8	0,05223	1,3918	14,3	34,4	491,92	0,0556
1,53	45,4	-0,67357	0,666	14,3	34,4	491,92	0,0031	1,56	69,8	-0,30777	1,0318	14,3	34,4	491,92	0,0032	28,84	94,2	0,05823	1,3978	14,3	34,4	491,92	0,0586
1,54	45,8	-0,66757	0,672	14,3	34,4	491,92	0,0031	1,55	70,2	-0,30177	1,0378	14,3	34,4	491,92	0,0032	30,44	94,6	0,06423	1,4038	14,3	34,4	491,92	0,0619
1,54	46,2	-0,66167	0,6779	14,3	34,4	491,92	0,0031	1,55	70,6	-0,29577	1,0438	14,3	34,4	491,92	0,0032	32,35	95	0,07033	1,4099	14,3	34,4	491,92	0,0658
1,52	46,6	-0,65567	0,6839	14,3	34,4	491,92	0,0031	1,56	71	-0,28967	1,0499	14,3	34,4	491,92	0,0032	34,17	95,4	0,07643	1,416	14,3	34,4	491,92	0,0695
1,53	47	-0,64957	0,69	14,3	34,4	491,92	0,0031	1,57	71,4	-0,28357	1,056	14,3	34,4	491,92	0,0032	36,05	95,8	0,08233	1,4219	14,3	34,4	491,92	0,0733
1,53	47,4	-0,64347	0,6961	14,3	34,4	491,92	0,0031	1,57	71,8	-0,27757	1,062	14,3	34,4	491,92	0,0032	38,09	96,2	0,08833	1,4279	14,3	34,4	491,92	0,0774
1,53	47,8	-0,63747	0,7021	14,3	34,4	491,92	0,0031	1,56	72,2	-0,27167	1,0679	14,3	34,4	491,92	0,0032	40,12	96,6	0,09423	1,4338	14,3	34,4	491,92	0,0816
1,52	48,2	-0,63147	0,7081	14,3	34,4	491,92	0,0031	1,56	72,6	-0,26577	1,0738	14,3	34,4	491,92	0,0032	42,31	97	0,10023	1,4398	14,3	34,4	491,92	0,0860
1,53	48,6	-0,62557	0,714	14,3	34,4	491,92	0,0031	1,56	73	-0,25977	1,0798	14,3	34,4	491,92	0,0032	44,68	97,4	0,10623	1,4458	14,3	34,4	491,92	0,0908
1,56	49	-0,61967	0,7199	14,3	34,4	491,92	0,0032	1,57	73,4	-0,25377	1,0858	14,3	34,4	491,92	0,0032	47,17	97,8	0,11233	1,4519	14,3	34,4	491,92	0,0959
1,53	49,4	-0,61357	0,726	14,3	34,4	491,92	0,0031	1,60	73,8	-0,24767	1,0919	14,3	34,4	491,92	0,0033	49,69	98,2	0,11843	1,458	14,3	34,4	491,92	0,1010

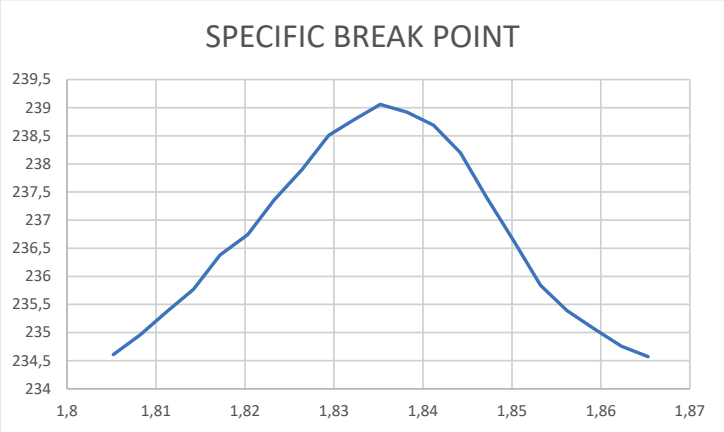
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
52,21	98,6	0,12433	1,4639	14,3	34,4	491,92	0,1061	120,78	123	0,49023	1,8298	14,3	34,4	491,92	0,2455	159,10	147,4	0,85613	2,1957	14,3	34,4	491,92	0,3234
54,78	99	0,13023	1,4698	14,3	34,4	491,92	0,1114	121,86	123,4	0,49613	1,8357	14,3	34,4	491,92	0,2477	159,40	147,8	0,86213	2,2017	14,3	34,4	491,92	0,3240
57,47	99,4	0,13613	1,4757	14,3	34,4	491,92	0,1168	123,18	123,8	0,50213	1,8417	14,3	34,4	491,92	0,2504	159,73	148,2	0,86833	2,2079	14,3	34,4	491,92	0,3247
60,24	99,8	0,14213	1,4817	14,3	34,4	491,92	0,1225	124,65	124,2	0,50823	1,8478	14,3	34,4	491,92	0,2534	159,70	148,6	0,87433	2,2139	14,3	34,4	491,92	0,3246
63,13	100,2	0,14823	1,4878	14,3	34,4	491,92	0,1283	126,11	124,6	0,51433	1,8539	14,3	34,4	491,92	0,2564	159,71	149	0,88033	2,2199	14,3	34,4	491,92	0,3247
65,87	100,6	0,15433	1,4939	14,3	34,4	491,92	0,1339	127,28	125	0,52033	1,8599	14,3	34,4	491,92	0,2587	159,75	149,4	0,88623	2,2258	14,3	34,4	491,92	0,3247
68,40	101	0,16033	1,4999	14,3	34,4	491,92	0,1390	128,55	125,4	0,52623	1,8658	14,3	34,4	491,92	0,2613	160,06	149,8	0,89223	2,2318	14,3	34,4	491,92	0,3254
70,64	101,4	0,16633	1,5059	14,3	34,4	491,92	0,1436	130,04	125,8	0,53223	1,8718	14,3	34,4	491,92	0,2644	160,35	150,2	0,89813	2,2377	14,3	34,4	491,92	0,3260
72,13	101,8	0,17223	1,5118	14,3	34,4	491,92	0,1466	131,64	126,2	0,53813	1,8777	14,3	34,4	491,92	0,2676	160,82	150,6	0,90423	2,2438	14,3	34,4	491,92	0,3269
73,38	102,2	0,17823	1,5178	14,3	34,4	491,92	0,1492	133,21	126,6	0,54423	1,8838	14,3	34,4	491,92	0,2708	161,33	151	0,91033	2,2499	14,3	34,4	491,92	0,3280
74,92	102,6	0,18423	1,5238	14,3	34,4	491,92	0,1523	134,89	127	0,55033	1,8899	14,3	34,4	491,92	0,2742	161,77	151,4	0,91633	2,2559	14,3	34,4	491,92	0,3289
76,54	103	0,19033	1,5299	14,3	34,4	491,92	0,1556	136,37	127,4	0,55633	1,8959	14,3	34,4	491,92	0,2772	161,92	151,8	0,92233	2,2619	14,3	34,4	491,92	0,3292
77,73	103,4	0,19643	1,536	14,3	34,4	491,92	0,1580	137,83	127,8	0,56233	1,9019	14,3	34,4	491,92	0,2802	161,98	152,2	0,92823	2,2678	14,3	34,4	491,92	0,3293
78,78	103,8	0,20233	1,5419	14,3	34,4	491,92	0,1601	139,19	128,2	0,56823	1,9078	14,3	34,4	491,92	0,2830	162,17	152,6	0,93413	2,2737	14,3	34,4	491,92	0,3297
79,91	104,2	0,20833	1,5479	14,3	34,4	491,92	0,1624	140,34	128,6	0,57423	1,9138	14,3	34,4	491,92	0,2853	162,53	153	0,94013	2,2797	14,3	34,4	491,92	0,3304
80,90	104,6	0,21423	1,5538	14,3	34,4	491,92	0,1645	141,67	129	0,58013	1,9197	14,3	34,4	491,92	0,2880	162,56	153,4	0,94623	2,2858	14,3	34,4	491,92	0,3305
81,81	105	0,22023	1,5598	14,3	34,4	491,92	0,1663	142,90	129,4	0,58623	1,9258	14,3	34,4	491,92	0,2905	162,81	153,8	0,95223	2,2918	14,3	34,4	491,92	0,3310
82,70	105,4	0,22623	1,5658	14,3	34,4	491,92	0,1681	144,11	129,8	0,59233	1,9319	14,3	34,4	491,92	0,2930	163,08	154,2	0,95823	2,2978	14,3	34,4	491,92	0,3315
82,75	105,8	0,23233	1,5719	14,3	34,4	491,92	0,1682	145,05	130,2	0,59833	1,9379	14,3	34,4	491,92	0,2949	163,30	154,6	0,96413	2,3037	14,3	34,4	491,92	0,3320
82,98	106,2	0,23833	1,5779	14,3	34,4	491,92	0,1687	145,94	130,6	0,60433	1,9439	14,3	34,4	491,92	0,2967	163,50	155	0,97013	2,3097	14,3	34,4	491,92	0,3324
83,25	106,6	0,24433	1,5839	14,3	34,4	491,92	0,1692	146,66	131	0,61013	1,9497	14,3	34,4	491,92	0,2981	163,70	155,4	0,97603	2,3156	14,3	34,4	491,92	0,3328
83,80	107	0,25023	1,5898	14,3	34,4	491,92	0,1704	147,16	131,4	0,61613	1,9557	14,3	34,4	491,92	0,2992	164,03	155,8	0,98203	2,3216	14,3	34,4	491,92	0,3334
84,73	107,4	0,25613	1,5957	14,3	34,4	491,92	0,1722	147,78	131,8	0,62213	1,9617	14,3	34,4	491,92	0,3004	164,58	156,2	0,98813	2,3277	14,3	34,4	491,92	0,3346
85,79	107,8	0,26213	1,6017	14,3	34,4	491,92	0,1744	148,62	132,2	0,62813	1,9677	14,3	34,4	491,92	0,3021	164,90	156,6	0,99413	2,3337	14,3	34,4	491,92	0,3352
87,19	108,2	0,26823	1,6078	14,3	34,4	491,92	0,1772	149,29	132,6	0,63423	1,9738	14,3	34,4	491,92	0,3035	165,08	157	1,00013	2,3397	14,3	34,4	491,92	0,3356
88,44	108,6	0,27433	1,6139	14,3	34,4	491,92	0,1798	150,00	133	0,64023	1,9798	14,3	34,4	491,92	0,3049	165,35	157,4	1,00613	2,3457	14,3	34,4	491,92	0,3361
89,62	109	0,28033	1,6199	14,3	34,4	491,92	0,1822	150,64	133,4	0,64613	1,9857	14,3	34,4	491,92	0,3062	165,65	157,8	1,01203	2,3516	14,3	34,4	491,92	0,3367
90,84	109,4	0,28623	1,6258	14,3	34,4	491,92	0,1847	151,23	133,8	0,65213	1,9917	14,3	34,4	491,92	0,3074	165,89	158,2	1,01803	2,3576	14,3	34,4	491,92	0,3372
92,08	109,8	0,29213	1,6317	14,3	34,4	491,92	0,1872	151,63	134,2	0,65813	1,9977	14,3	34,4	491,92	0,3082	165,98	158,6	1,02403	2,3636	14,3	34,4	491,92	0,3374
93,33	110,2	0,29813	1,6377	14,3	34,4	491,92	0,1897	151,94	134,6	0,66403	2,0036	14,3	34,4	491,92	0,3089	166,34	159	1,03013	2,3697	14,3	34,4	491,92	0,3381
94,72	110,6	0,30413	1,6437	14,3	34,4	491,92	0,1926	152,41	135	0,67023	2,0098	14,3	34,4	491,92	0,3098	166,62	159,4	1,03613	2,3757	14,3	34,4	491,92	0,3387
96,14	111	0,31023	1,6498	14,3	34,4	491,92	0,1954	152,82	135,4	0,67623	2,0158	14,3	34,4	491,92	0,3107	166,85	159,8	1,04213	2,3817	14,3	34,4	491,92	0,3392
97,47	111,4	0,31633	1,6559	14,3	34,4	491,92	0,1981	153,09	135,8	0,68223	2,0218	14,3	34,4	491,92	0,3112	166,86	160,2	1,04803	2,3876	14,3	34,4	491,92	0,3392
98,79	111,8	0,32223	1,6618	14,3	34,4	491,92	0,2008	153,26	136,2	0,68813	2,0277	14,3	34,4	491,92	0,3116	166,90	160,6	1,05403	2,3936	14,3	34,4	491,92	0,3393
99,98	112,2	0,32813	1,6677	14,3	34,4	491,92	0,2032	153,55	136,6	0,69413	2,0337	14,3	34,4	491,92	0,3121	167,20	161	1,05993	2,3995	14,3	34,4	491,92	0,3399
101,25	112,6	0,33413	1,6737	14,3	34,4	491,92	0,2058	153,57	137	0,70013	2,0397	14,3	34,4	491,92	0,3122	167,59	161,4	1,06603	2,4056	14,3	34,4	491,92	0,3407
102,52	113	0,34013	1,6797	14,3	34,4	491,92	0,2084	153,80	137,4	0,70613	2,0457	14,3	34,4	491,92	0,3127	168,00	161,8	1,07213	2,4117	14,3	34,4	491,92	0,3415
103,82	113,4	0,34613	1,6857	14,3	34,4	491,92	0,2111	154,12	137,8	0,71223	2,0518	14,3	34,4	491,92	0,3133	168,09	162,2	1,07813	2,4177	14,3	34,4	491,92	0,3417
105,04	113,8	0,35223	1,6918	14,3	34,4	491,92	0,2135	154,20	138,2	0,71833	2,0579	14,3	34,4	491,92	0,3135	168,19	162,6	1,08403	2,4236	14,3	34,4	491,92	0,3419
106,28	114,2	0,35823	1,6978	14,3	34,4	491,92	0,2161	154,23	138,6	0,72423	2,0638	14,3	34,4	491,92	0,3135	168,03	163	1,09003	2,4296	14,3	34,4	491,92	0,3416
107,14	114,6	0,36423	1,7038	14,3	34,4	491,92	0,2178	154,41	139	0,73013	2,0697	14,3	34,4	491,92	0,3139	167,92	163,4	1,09593	2,4355	14,3	34,4	491,92	0,3414
108,06	115	0,37013	1,7097	14,3	34,4	491,92	0,2197	154,51	139,4	0,73613	2,0757	14,3	34,4	491,92	0,3141	167,92	163,8	1,10193	2,4415	14,3	34,4	491,92	0,3414
108,82	115,4	0,37603	1,7156	14,3	34,4	491,92	0,2212	154,80	139,8	0,74213	2,0817	14,3	34,4	491,92	0,3147	167,99	164,2	1,10803	2,4476	14,3	34,4	491,92	0,3415
109,45	115,8	0,38203	1,7216	14,3	34,4	491,92	0,2225	155,29	140,2	0,74813	2,0877	14,3	34,4	491,92	0,3157	167,85	164,6	1,11423	2,4538	14,3	34,4	491,92	0,3412
110,17	116,2	0,38813	1,7277	14,3	34,4	491,92	0,2240	155,73	140,6	0,75423	2,0938	14,3	34,4	491,92	0,3166	167,42	165	1,12013	2,4597	14,3	34,4	491,92	0,3403
110,82	116,6	0,39423	1,7338	14,3	34,4	491,92	0,2253	156,13	141	0,76023	2,0998	14,3	34,4	491,92	0,3174	167,06	165,4	1,12613	2,4657	14,3	34,4	491,92	0,3396
111,27	117	0,40023	1,7398	14,3	34,4	491,92	0,2262	156,52	141,4	0,76613	2,1057	14,3	34,4	491,92	0,3182	166,91	165,8	1,13203	2,4716	14,3	34,4	491,92	0,3393
111,79	117,4	0,40613	1,7457	14,3	34,4	491,92	0,2273	156,86	141,8	0,77213	2,1117	14,3	34,4	491,92	0,3189	166,65	166,2	1,13803	2,4776	14,3	34,4	491,92	0,3388
112,54	117,8	0,41213	1,7517	14,3	34,4	491,92	0,2288	156,75	142,2	0,77803	2,1176	14,3	34,4	491,92	0,3186	166,20	166,6	1,14403	2,4836	14,3	34,4	491,92	0,3379
113,03	118,2	0,41803	1,7576	14,3	34,4	491,92	0,2298	156,97	142,6	0,78413	2,1237	14,3	34,4	491,92	0,3191	165,84	167	1,15023	2,4898	14,3	34,4	491,92	0,3371
113,67	118,6	0,42413	1,7637	14,3	34,4	491,92	0,2311	157,15	143	0,79023	2,1298	14,3	34,4	491,92	0,3195	165,33	167,4	1,15633	2,4959	14,3	34,4	491,92	0,3361
114,39	119	0,43023	1,7698	14,3	34,4	491,92	0,2325	157,34	143,4	0,79623	2,1358	14,3	34,4	491,92	0,3198	164,74	167,8	1,16223	2,5018	14,3	34,4	491,92	0,3349
114,93	119,4	0,43633	1,7759	14,3	34,4	491,92	0,2336	157,47	143,8	0,80223	2,1418	14,3	34,4	491,92	0,3201	163,83	168,2	1,16813	2,5077	14,3	34,4	491,92	0,3330
115,52	119,8	0,44233	1,7819	14,3	34,4	491,92	0,2348	157,50	144,2	0,80813	2,1477	14,3	34,4	491,92	0,3202	162,60	168,6	1,17413	2,5137	14,3	34,4	491,92	0,3305
116,01	120,2	0,44823	1,7878	14,3	34,4	491,92	0,2358	157,70	144,6	0,81413	2,1537	14,3	34,4	491,92	0,3206	161,21	169	1,18013	2,5197	14,3	34,4	491,92	0,3277
116,55	120,6	0,45413	1,7937	14,3	34,4	491,92	0,2369	157,81	145	0,82003	2,1596	14,3	34,4	491,92	0,3208	159,73	169,4	1,18613	2,5257	14,3	34,4	491,92	0,3247
117,01	121	0,46013	1,7997	14,3	34,4	491,92	0,2379	157,95	145,4	0,82613	2,1657	14,3	34,4	491,92	0,3211	158,18	169,8	1,19223	2,5318	14,3	34,4	491,92	0,3216
117,49	121,4	0,46613	1,8057	14,3	34,4	491,92	0,2388	158,16	145,8	0,83223	2,1718	14,3	34,4	491,92	0,3215	156,85	170,2	1,19833	2,5379	14,3	34,4	491,92	0,3189
118,08	121,8	0,47233	1,8119	14,3	34,4	491,92	0,2400	158,37	146,2	0,83833	2,1779	14,3	34,4	491,92	0,3219	155,86	170,6	1,20423	2,5438	14,3	34,4	491,92	0,3168
118,81	122,2	0,47833	1,8179	14,3	34,4	491,92	0,2415	158,55	146,6	0,84423	2,1838	14,3	34,4	491,92	0,3223	154,94	171	1,21013	2,5497	14,3	34,4	491,92	0,3150
119,71	122,6	0,48433	1,8239	14,3	34,4	491,92	0,2434	158,80	147	0,85013	2,1897	14,3	34,4	491,92	0,3228	154,40	171,4	1,21613	2,5557	14,3	34,4	491,92	0,3139

LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
153,79	171,8	1,22213	2,5617	14,3	34,4	491,92	0,3126	107,92	196,2	1,58833	2,9279	14,3	34,4	491,92	0,2194	99,50	220,6	1,95443	3,294	14,3	34,4	491,92	0,2023
152,08	172,2	1,22823	2,5678	14,3	34,4	491,92	0,3092	107,55	196,6	1,59433	2,9339	14,3	34,4	491,92	0,2186	99,70	221	1,96043	3,3	14,3	34,4	491,92	0,2027
137,44	172,6	1,23433	2,5739	14,3	34,4	491,92	0,2794	106,93	197	1,60033	2,9399	14,3	34,4	491,92	0,2174	99,85	221,4	1,96633	3,3059	14,3	34,4	491,92	0,2030
124,94	173	1,24033	2,5799	14,3	34,4	491,92	0,2540	106,44	197,4	1,60623	2,9458	14,3	34,4	491,92	0,2164	99,92	221,8	1,97223	3,3118	14,3	34,4	491,92	0,2031
124,77	173,4	1,24623	2,5858	14,3	34,4	491,92	0,2536	106,15	197,8	1,61223	2,9518	14,3	34,4	491,92	0,2158	100,01	222,2	1,97823	3,3178	14,3	34,4	491,92	0,2033
125,81	173,8	1,25223	2,5918	14,3	34,4	491,92	0,2558	105,92	198,2	1,61823	2,9578	14,3	34,4	491,92	0,2153	100,35	222,6	1,98423	3,3238	14,3	34,4	491,92	0,2040
127,04	174,2	1,25813	2,5977	14,3	34,4	491,92	0,2583	105,53	198,6	1,62423	2,9638	14,3	34,4	491,92	0,2145	100,60	223	1,99033	3,3299	14,3	34,4	491,92	0,2045
128,16	174,6	1,26413	2,6037	14,3	34,4	491,92	0,2605	104,91	199	1,63033	2,9699	14,3	34,4	491,92	0,2133	100,72	223,4	1,99643	3,336	14,3	34,4	491,92	0,2047
129,11	175	1,27033	2,6099	14,3	34,4	491,92	0,2625	104,45	199,4	1,63643	2,976	14,3	34,4	491,92	0,2123	100,77	223,8	2,00233	3,3419	14,3	34,4	491,92	0,2049
129,74	175,4	1,27633	2,6159	14,3	34,4	491,92	0,2637	103,92	199,8	1,64233	2,9819	14,3	34,4	491,92	0,2113	100,80	224,2	2,00823	3,3478	14,3	34,4	491,92	0,2049
130,45	175,8	1,28233	2,6219	14,3	34,4	491,92	0,2652	103,58	200,2	1,64823	2,9878	14,3	34,4	491,92	0,2106	101,00	224,6	2,01423	3,3538	14,3	34,4	491,92	0,2053
131,06	176,2	1,28833	2,6279	14,3	34,4	491,92	0,2664	103,30	200,6	1,65423	2,9938	14,3	34,4	491,92	0,2100	101,12	225	2,02023	3,3598	14,3	34,4	491,92	0,2056
131,80	176,6	1,29423	2,6338	14,3	34,4	491,92	0,2679	102,65	201	1,66013	2,9997	14,3	34,4	491,92	0,2087	101,43	225,4	2,02633	3,3659	14,3	34,4	491,92	0,2062
132,36	177	1,30023	2,6398	14,3	34,4	491,92	0,2691	102,31	201,4	1,66623	3,0058	14,3	34,4	491,92	0,2080	101,58	225,8	2,03243	3,372	14,3	34,4	491,92	0,2065
132,38	177,4	1,30623	2,6458	14,3	34,4	491,92	0,2691	101,95	201,8	1,67233	3,0119	14,3	34,4	491,92	0,2072	101,60	226,2	2,03843	3,378	14,3	34,4	491,92	0,2065
132,56	177,8	1,31233	2,6519	14,3	34,4	491,92	0,2695	101,15	202,2	1,67833	3,0179	14,3	34,4	491,92	0,2056	101,60	226,6	2,04433	3,3839	14,3	34,4	491,92	0,2065
132,75	178,2	1,31843	2,658	14,3	34,4	491,92	0,2699	100,85	202,6	1,68423	3,0238	14,3	34,4	491,92	0,2050	101,80	227	2,05023	3,3898	14,3	34,4	491,92	0,2069
132,68	178,6	1,32433	2,6639	14,3	34,4	491,92	0,2697	100,43	203	1,69023	3,0298	14,3	34,4	491,92	0,2042	101,81	227,4	2,05623	3,3958	14,3	34,4	491,92	0,2070
132,66	179	1,33023	2,6698	14,3	34,4	491,92	0,2697	100,00	203,4	1,69613	3,0357	14,3	34,4	491,92	0,2033	101,96	227,8	2,06223	3,4018	14,3	34,4	491,92	0,2073
132,21	179,4	1,33623	2,6758	14,3	34,4	491,92	0,2688	99,03	203,8	1,70213	3,0417	14,3	34,4	491,92	0,2013	102,23	228,2	2,06833	3,4079	14,3	34,4	491,92	0,2078
131,19	179,8	1,34223	2,6818	14,3	34,4	491,92	0,2667	98,66	204,2	1,70823	3,0478	14,3	34,4	491,92	0,2006	102,27	228,37	2,07093	3,4105	14,3	34,4	491,92	0,2079
129,94	180,2	1,34833	2,6879	14,3	34,4	491,92	0,2641	98,48	204,6	1,71433	3,0539	14,3	34,4	491,92	0,2002								
129,39	180,6	1,35443	2,694	14,3	34,4	491,92	0,2630	98,27	205	1,72033	3,0599	14,3	34,4	491,92	0,1998								
129,01	181	1,36043	2,7	14,3	34,4	491,92	0,2623	98,03	205,4	1,72623	3,0658	14,3	34,4	491,92	0,1993								
128,40	181,4	1,36633	2,7059	14,3	34,4	491,92	0,2610	98,05	205,8	1,73213	3,0717	14,3	34,4	491,92	0,1993								
127,98	181,8	1,37223	2,7118	14,3	34,4	491,92	0,2602	98,15	206,2	1,73813	3,0777	14,3	34,4	491,92	0,1995								
127,70	182,2	1,37823	2,7178	14,3	34,4	491,92	0,2596	98,32	206,6	1,74413	3,0837	14,3	34,4	491,92	0,1999								
127,61	182,6	1,38423	2,7238	14,3	34,4	491,92	0,2594	98,38	207	1,75033	3,0899	14,3	34,4	491,92	0,2000								
127,88	183	1,39033	2,7299	14,3	34,4	491,92	0,2600	98,35	207,4	1,75633	3,0959	14,3	34,4	491,92	0,1999								
128,11	183,4	1,39643	2,736	14,3	34,4	491,92	0,2604	97,96	207,8	1,76223	3,1018	14,3	34,4	491,92	0,1991								
128,33	183,8	1,40233	2,7419	14,3	34,4	491,92	0,2609	97,45	208,2	1,76813	3,1077	14,3	34,4	491,92	0,1981								
128,48	184,2	1,40823	2,7478	14,3	34,4	491,92	0,2612	97,09	208,6	1,77413	3,1137	14,3	34,4	491,92	0,1974								
128,38	184,6	1,41413	2,7537	14,3	34,4	491,92	0,2610	96,85	209	1,78013	3,1197	14,3	34,4	491,92	0,1969								
128,44	185	1,42013	2,7597	14,3	34,4	491,92	0,2611	96,91	209,4	1,78613	3,1257	14,3	34,4	491,92	0,1970								
128,60	185,4	1,42613	2,7657	14,3	34,4	491,92	0,2614	97,12	209,8	1,79233	3,1319	14,3	34,4	491,92	0,1974								
128,64	185,8	1,43233	2,7719	14,3	34,4	491,92	0,2615	97,31	210,2	1,79833	3,1379	14,3	34,4	491,92	0,1978								
128,25	186,2	1,43833	2,7779	14,3	34,4	491,92	0,2607	97,41	210,6	1,80423	3,1438	14,3	34,4	491,92	0,1980								
128,07	186,6	1,44423	2,7838	14,3	34,4	491,92	0,2603	97,20	211	1,81013	3,1497	14,3	34,4	491,92	0,1976								
127,74	187	1,45013	2,7897	14,3	34,4	491,92	0,2597	97,10	211,4	1,81603	3,1556	14,3	34,4	491,92	0,1974								
127,61	187,4	1,45613	2,7957	14,3	34,4	491,92	0,2594	97,10	211,8	1,82203	3,1616	14,3	34,4	491,92	0,1974								
127,02	187,8	1,46213	2,8017	14,3	34,4	491,92	0,2582	97,29	212,2	1,82823	3,1678	14,3	34,4	491,92	0,1978								
125,59	188,2	1,46823	2,8078	14,3	34,4	491,92	0,2553	97,54	212,6	1,83433	3,1739	14,3	34,4	491,92	0,1983								
124,47	188,6	1,47433	2,8139	14,3	34,4	491,92	0,2530	97,80	213	1,84023	3,1798	14,3	34,4	491,92	0,1988								
123,15	189	1,48023	2,8198	14,3	34,4	491,92	0,2503	98,20	213,4	1,84613	3,1857	14,3	34,4	491,92	0,1996								
121,75	189,4	1,48623	2,8258	14,3	34,4	491,92	0,2475	98,71	213,8	1,85213	3,1917	14,3	34,4	491,92	0,2007								
120,11	189,8	1,49213	2,8317	14,3	34,4	491,92	0,2442	99,02	214,2	1,85813	3,1977	14,3	34,4	491,92	0,2013								
118,67	190,2	1,49813	2,8377	14,3	34,4	491,92	0,2412	99,09	214,6	1,86413	3,2037	14,3	34,4	491,92	0,2014								
117,79	190,6	1,50413	2,8437	14,3	34,4	491,92	0,2394	99,29	215	1,87023	3,2098	14,3	34,4	491,92	0,2018								
116,81	191	1,51033	2,8499	14,3	34,4	491,92	0,2375	99,09	215,4	1,87633	3,2159	14,3	34,4	491,92	0,2014								
115,88	191,4	1,51633	2,8559	14,3	34,4	491,92	0,2356	99,21	215,8	1,88223	3,2218	14,3	34,4	491,92	0,2017								
114,77	191,8	1,52233	2,8619	14,3	34,4	491,92	0,2333	99,46	216,2	1,88813	3,2277	14,3	34,4	491,92	0,2022								
113,19	192,2	1,52823	2,8678	14,3	34,4	491,92	0,2301	99,58	216,6	1,89413	3,2337	14,3	34,4	491,92	0,2024								
112,15	192,6	1,53423	2,8738	14,3	34,4	491,92	0,2280	99,71	217	1,90013	3,2397	14,3	34,4	491,92	0,2027								
111,23	193	1,54013	2,8797	14,3	34,4	491,92	0,2261	99,76	217,4	1,90623	3,2458	14,3	34,4	491,92	0,2028								
109,73	193,4	1,54623	2,8858	14,3	34,4	491,92	0,2231	99,76	217,8	1,91233	3,2519	14,3	34,4	491,92	0,2028								
109,63	193,8	1,55233	2,8919	14,3	34,4	491,92	0,2229	99,72	218,2	1,91833	3,2579	14,3	34,4	491,92	0,2027								
109,50	194,2	1,55843	2,898	14,3	34,4	491,92	0,2226	99,43	218,6	1,92423	3,2638	14,3	34,4	491,92	0,2021								
109,52	194,6	1,56433	2,9039	14,3	34,4	491,92	0,2226	99,30	219	1,93023	3,2698	14,3	34,4	491,92	0,2019								
109,28	195	1,57023	2,9098	14,3	34,4	491,92	0,2221	99,18	219,4	1,93613	3,2757	14,3	34,4	491,92	0,2016								
109,02	195,4	1,57623	2,9158	14,3	34,4	491,92	0,2216	99,26	219,8	1,94223	3,2818	14,3	34,4	491,92	0,2018								
108,43	195,8	1,58223	2,9218	14,3	34,4	491,92	0,2204	99,54	220,2	1,94833	3,2879	14,3	34,4	491,92	0,2023								

3.3.1.6-0 Mix. Proportion Tests
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LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
0,00	1	-1,41902	0	14,2	40,5	575,1	0,0000
0,02	1,2	-1,41612	0,0029	14,2	40,5	575,1	0,0000
0,03	1,4	-1,41322	0,0058	14,2	40,5	575,1	0,0001
0,03	1,6	-1,41032	0,0087	14,2	40,5	575,1	0,0001
0,04	1,8	-1,40732	0,0117	14,2	40,5	575,1	0,0001
0,06	2	-1,40442	0,0146	14,2	40,5	575,1	0,0001
0,08	2,2	-1,40142	0,0176	14,2	40,5	575,1	0,0001
0,11	2,4	-1,39832	0,0207	14,2	40,5	575,1	0,0002
0,13	2,6	-1,39532	0,0237	14,2	40,5	575,1	0,0002
0,14	2,8	-1,39232	0,0267	14,2	40,5	575,1	0,0002
0,16	3	-1,38932	0,0297	14,2	40,5	575,1	0,0003
0,18	3,2	-1,38642	0,0326	14,2	40,5	575,1	0,0003
0,18	3,4	-1,38342	0,0356	14,2	40,5	575,1	0,0003
0,17	3,6	-1,38052	0,0385	14,2	40,5	575,1	0,0003
0,20	3,8	-1,37762	0,0414	14,2	40,5	575,1	0,0003
0,19	4	-1,37462	0,0444	14,2	40,5	575,1	0,0003
0,20	4,2	-1,37162	0,0474	14,2	40,5	575,1	0,0003
0,21	4,4	-1,36862	0,0504	14,2	40,5	575,1	0,0004
0,22	4,6	-1,36562	0,0534	14,2	40,5	575,1	0,0004
0,22	4,8	-1,36262	0,0564	14,2	40,5	575,1	0,0004
0,24	5	-1,35962	0,0594	14,2	40,5	575,1	0,0004
0,23	5,2	-1,35652	0,0625	14,2	40,5	575,1	0,0004
0,25	5,4	-1,35352	0,0655	14,2	40,5	575,1	0,0004
0,26	5,6	-1,35052	0,0685	14,2	40,5	575,1	0,0005
0,26	5,8	-1,34752	0,0715	14,2	40,5	575,1	0,0005
0,27	6	-1,34452	0,0745	14,2	40,5	575,1	0,0005
0,27	6,2	-1,34162	0,0774	14,2	40,5	575,1	0,0005
0,29	6,4	-1,33862	0,0804	14,2	40,5	575,1	0,0005
0,30	6,6	-1,33562	0,0834	14,2	40,5	575,1	0,0005
0,32	6,8	-1,33272	0,0863	14,2	40,5	575,1	0,0006
0,32	7	-1,32972	0,0893	14,2	40,5	575,1	0,0006
0,34	7,2	-1,32672	0,0923	14,2	40,5	575,1	0,0006
0,33	7,4	-1,32372	0,0953	14,2	40,5	575,1	0,0006
0,35	7,6	-1,32072	0,0983	14,2	40,5	575,1	0,0006
0,36	7,8	-1,31762	0,1014	14,2	40,5	575,1	0,0006
0,38	8	-1,31462	0,1044	14,2	40,5	575,1	0,0007
0,39	8,2	-1,31152	0,1075	14,2	40,5	575,1	0,0007
0,40	8,4	-1,30862	0,1104	14,2	40,5	575,1	0,0007
0,40	8,6	-1,30562	0,1134	14,2	40,5	575,1	0,0007
0,40	8,8	-1,30262	0,1164	14,2	40,5	575,1	0,0007
0,42	9	-1,29972	0,1193	14,2	40,5	575,1	0,0007
0,45	9,2	-1,29672	0,1223	14,2	40,5	575,1	0,0008
0,44	9,4	-1,29382	0,1252	14,2	40,5	575,1	0,0008
0,46	9,6	-1,29082	0,1282	14,2	40,5	575,1	0,0008
0,47	9,8	-1,28782	0,1312	14,2	40,5	575,1	0,0008
0,48	10	-1,28482	0,1342	14,2	40,5	575,1	0,0008
0,49	10,2	-1,28182	0,1372	14,2	40,5	575,1	0,0009
0,52	10,4	-1,27872	0,1403	14,2	40,5	575,1	0,0009
0,53	10,6	-1,27562	0,1434	14,2	40,5	575,1	0,0009
0,54	10,8	-1,27262	0,1464	14,2	40,5	575,1	0,0009
0,55	11	-1,26962	0,1494	14,2	40,5	575,1	0,0010
0,58	11,2	-1,26662	0,1524	14,2	40,5	575,1	0,0010
0,59	11,4	-1,26362	0,1554	14,2	40,5	575,1	0,0010
0,60	11,6	-1,26072	0,1583	14,2	40,5	575,1	0,0010
0,62	11,8	-1,25772	0,1613	14,2	40,5	575,1	0,0011
0,64	12	-1,25472	0,1643	14,2	40,5	575,1	0,0011
0,64	12,2	-1,25172	0,1673	14,2	40,5	575,1	0,0011
0,68	12,4	-1,24882	0,1702	14,2	40,5	575,1	0,0012
0,67	12,6	-1,24582	0,1732	14,2	40,5	575,1	0,0012
0,71	12,8	-1,24282	0,1762	14,2	40,5	575,1	0,0012
0,72	13	-1,23972	0,1793	14,2	40,5	575,1	0,0013

LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
0,75	13,2	-1,23672	0,1823	14,2	40,5	575,1	0,0013	0,81	25,4	-1,05352	0,3655	14,2	40,5	575,1	0,0014	0,99	37,6	-0,87022	0,5488	14,2	40,5	575,1	0,0017
0,73	13,4	-1,23362	0,1854	14,2	40,5	575,1	0,0013	0,81	25,6	-1,05052	0,3685	14,2	40,5	575,1	0,0014	1,00	37,8	-0,86722	0,5518	14,2	40,5	575,1	0,0017
0,74	13,6	-1,23062	0,1884	14,2	40,5	575,1	0,0013	0,82	25,8	-1,04752	0,3715	14,2	40,5	575,1	0,0014	1,01	38	-0,86432	0,5547	14,2	40,5	575,1	0,0018
0,77	13,8	-1,22762	0,1914	14,2	40,5	575,1	0,0013	0,82	26	-1,04452	0,3745	14,2	40,5	575,1	0,0014	1,01	38,2	-0,86132	0,5577	14,2	40,5	575,1	0,0018
0,75	14	-1,22462	0,1944	14,2	40,5	575,1	0,0013	0,82	26,2	-1,04152	0,3775	14,2	40,5	575,1	0,0014	1,03	38,4	-0,85842	0,5606	14,2	40,5	575,1	0,0018
0,77	14,2	-1,22172	0,1973	14,2	40,5	575,1	0,0013	0,83	26,4	-1,03842	0,3806	14,2	40,5	575,1	0,0014	1,03	38,6	-0,85542	0,5636	14,2	40,5	575,1	0,0018
0,77	14,4	-1,21872	0,2003	14,2	40,5	575,1	0,0013	0,82	26,6	-1,03542	0,3836	14,2	40,5	575,1	0,0014	1,03	38,8	-0,85242	0,5666	14,2	40,5	575,1	0,0018
0,76	14,6	-1,21572	0,2033	14,2	40,5	575,1	0,0013	0,83	26,8	-1,03232	0,3867	14,2	40,5	575,1	0,0014	1,03	39	-0,84942	0,5696	14,2	40,5	575,1	0,0018
0,76	14,8	-1,21272	0,2063	14,2	40,5	575,1	0,0013	0,83	27	-1,02932	0,3897	14,2	40,5	575,1	0,0014	1,04	39,2	-0,84642	0,5726	14,2	40,5	575,1	0,0018
0,77	15	-1,20982	0,2092	14,2	40,5	575,1	0,0013	0,82	27,2	-1,02632	0,3927	14,2	40,5	575,1	0,0014	1,06	39,4	-0,84342	0,5756	14,2	40,5	575,1	0,0018
0,75	15,2	-1,20682	0,2122	14,2	40,5	575,1	0,0013	0,80	27,4	-1,02342	0,3956	14,2	40,5	575,1	0,0014	1,07	39,6	-0,84042	0,5786	14,2	40,5	575,1	0,0019
0,77	15,4	-1,20372	0,2153	14,2	40,5	575,1	0,0013	0,82	27,6	-1,02042	0,3986	14,2	40,5	575,1	0,0014	1,05	39,8	-0,83732	0,5817	14,2	40,5	575,1	0,0018
0,78	15,6	-1,20072	0,2183	14,2	40,5	575,1	0,0014	0,82	27,8	-1,01752	0,4015	14,2	40,5	575,1	0,0014	1,07	40	-0,83432	0,5847	14,2	40,5	575,1	0,0019
0,78	15,8	-1,19762	0,2214	14,2	40,5	575,1	0,0014	0,83	28	-1,01452	0,4045	14,2	40,5	575,1	0,0014	1,07	40,2	-0,83132	0,5877	14,2	40,5	575,1	0,0019
0,77	16	-1,19462	0,2244	14,2	40,5	575,1	0,0013	0,82	28,2	-1,01152	0,4075	14,2	40,5	575,1	0,0014	1,08	40,4	-0,82832	0,5907	14,2	40,5	575,1	0,0019
0,77	16,2	-1,19152	0,2275	14,2	40,5	575,1	0,0013	0,82	28,4	-1,00852	0,4105	14,2	40,5	575,1	0,0014	1,07	40,6	-0,82532	0,5937	14,2	40,5	575,1	0,0019
0,77	16,4	-1,18862	0,2304	14,2	40,5	575,1	0,0013	0,83	28,6	-1,00552	0,4135	14,2	40,5	575,1	0,0014	1,09	40,8	-0,82232	0,5967	14,2	40,5	575,1	0,0019
0,78	16,6	-1,18552	0,2335	14,2	40,5	575,1	0,0014	0,82	28,8	-1,00252	0,4165	14,2	40,5	575,1	0,0014	1,09	41	-0,81942	0,5996	14,2	40,5	575,1	0,0019
0,78	16,8	-1,18262	0,2364	14,2	40,5	575,1	0,0014	0,82	29	-0,99942	0,4196	14,2	40,5	575,1	0,0014	1,09	41,2	-0,81642	0,6026	14,2	40,5	575,1	0,0019
0,79	17	-1,17962	0,2394	14,2	40,5	575,1	0,0014	0,82	29,2	-0,99632	0,4227	14,2	40,5	575,1	0,0014	1,09	41,4	-0,81352	0,6055	14,2	40,5	575,1	0,0019
0,78	17,2	-1,17672	0,2423	14,2	40,5	575,1	0,0014	0,82	29,4	-0,99332	0,4257	14,2	40,5	575,1	0,0014	1,09	41,6	-0,81052	0,6085	14,2	40,5	575,1	0,0019
0,78	17,4	-1,17372	0,2453	14,2	40,5	575,1	0,0014	0,83	29,6	-0,99032	0,4287	14,2	40,5	575,1	0,0014	1,09	41,8	-0,80752	0,6115	14,2	40,5	575,1	0,0019
0,80	17,6	-1,17072	0,2483	14,2	40,5	575,1	0,0014	0,83	29,8	-0,98732	0,4317	14,2	40,5	575,1	0,0014	1,08	42	-0,80452	0,6145	14,2	40,5	575,1	0,0019
0,78	17,8	-1,16772	0,2513	14,2	40,5	575,1	0,0014	0,83	30	-0,98432	0,4347	14,2	40,5	575,1	0,0014	1,09	42,2	-0,80152	0,6175	14,2	40,5	575,1	0,0019
0,78	18	-1,16472	0,2543	14,2	40,5	575,1	0,0014	0,82	30,2	-0,98132	0,4377	14,2	40,5	575,1	0,0014	1,10	42,4	-0,79842	0,6206	14,2	40,5	575,1	0,0019
0,79	18,2	-1,16172	0,2573	14,2	40,5	575,1	0,0014	0,84	30,4	-0,97842	0,4406	14,2	40,5	575,1	0,0015	1,09	42,6	-0,79542	0,6236	14,2	40,5	575,1	0,0019
0,78	18,4	-1,15862	0,2604	14,2	40,5	575,1	0,0014	0,84	30,6	-0,97542	0,4436	14,2	40,5	575,1	0,0015	1,09	42,8	-0,79232	0,6267	14,2	40,5	575,1	0,0019
0,78	18,6	-1,15552	0,2635	14,2	40,5	575,1	0,0014	0,84	30,8	-0,97242	0,4466	14,2	40,5	575,1	0,0015	1,11	43	-0,78932	0,6297	14,2	40,5	575,1	0,0019
0,78	18,8	-1,15252	0,2665	14,2	40,5	575,1	0,0014	0,83	31	-0,96942	0,4496	14,2	40,5	575,1	0,0014	1,13	43,2	-0,78642	0,6326	14,2	40,5	575,1	0,0020
0,80	19	-1,14952	0,2695	14,2	40,5	575,1	0,0014	0,84	31,2	-0,96642	0,4526	14,2	40,5	575,1	0,0015	1,13	43,4	-0,78342	0,6356	14,2	40,5	575,1	0,0020
0,79	19,2	-1,14652	0,2725	14,2	40,5	575,1	0,0014	0,85	31,4	-0,96342	0,4556	14,2	40,5	575,1	0,0015	1,16	43,6	-0,78042	0,6386	14,2	40,5	575,1	0,0020
0,79	19,4	-1,14362	0,2754	14,2	40,5	575,1	0,0014	0,85	31,6	-0,96042	0,4586	14,2	40,5	575,1	0,0015	1,15	43,8	-0,77752	0,6415	14,2	40,5	575,1	0,0020
0,77	19,6	-1,14062	0,2784	14,2	40,5	575,1	0,0013	0,86	31,8	-0,95732	0,4617	14,2	40,5	575,1	0,0015	1,14	44	-0,77452	0,6445	14,2	40,5	575,1	0,0020
0,79	19,8	-1,13762	0,2814	14,2	40,5	575,1	0,0014	0,86	32	-0,95422	0,4648	14,2	40,5	575,1	0,0015	1,16	44,2	-0,77152	0,6475	14,2	40,5	575,1	0,0020
0,79	20	-1,13462	0,2844	14,2	40,5	575,1	0,0014	0,87	32,2	-0,95122	0,4678	14,2	40,5	575,1	0,0015	1,16	44,4	-0,76862	0,6504	14,2	40,5	575,1	0,0020
0,80	20,2	-1,13162	0,2874	14,2	40,5	575,1	0,0014	0,86	32,4	-0,94822	0,4708	14,2	40,5	575,1	0,0015	1,17	44,6	-0,76562	0,6534	14,2	40,5	575,1	0,0020
0,79	20,4	-1,12872	0,2903	14,2	40,5	575,1	0,0014	0,86	32,6	-0,94522	0,4738	14,2	40,5	575,1	0,0015	1,18	44,8	-0,76252	0,6565	14,2	40,5	575,1	0,0021
0,79	20,6	-1,12562	0,2934	14,2	40,5	575,1	0,0014	0,86	32,8	-0,94232	0,4767	14,2	40,5	575,1	0,0015	1,18	45	-0,75952	0,6595	14,2	40,5	575,1	0,0021
0,81	20,8	-1,12262	0,2964	14,2	40,5	575,1	0,0014	0,87	33	-0,93932	0,4797	14,2	40,5	575,1	0,0015	1,20	45,2	-0,75642	0,6626	14,2	40,5	575,1	0,0021
0,79	21	-1,11952	0,2995	14,2	40,5	575,1	0,0014	0,89	33,2	-0,93632	0,4827	14,2	40,5	575,1	0,0015	1,19	45,4	-0,75352	0,6655	14,2	40,5	575,1	0,0021
0,79	21,2	-1,11652	0,3025	14,2	40,5	575,1	0,0014	0,88	33,4	-0,93342	0,4856	14,2	40,5	575,1	0,0015	1,19	45,6	-0,75042	0,6686	14,2	40,5	575,1	0,0021
0,80	21,4	-1,11342	0,3056	14,2	40,5	575,1	0,0014	0,87	33,6	-0,93042	0,4886	14,2	40,5	575,1	0,0015	1,19	45,8	-0,74742	0,6716	14,2	40,5	575,1	0,0021
0,80	21,6	-1,11042	0,3086	14,2	40,5	575,1	0,0014	0,86	33,8	-0,92742	0,4916	14,2	40,5	575,1	0,0015	1,20	46	-0,74452	0,6745	14,2	40,5	575,1	0,0021
0,80	21,8	-1,10742	0,3116	14,2	40,5	575,1	0,0014	0,89	34	-0,92442	0,4946	14,2	40,5	575,1	0,0015	1,20	46,2	-0,74152	0,6775	14,2	40,5	575,1	0,0021
0,81	22	-1,10442	0,3146	14,2	40,5	575,1	0,0014	0,89	34,2	-0,92142	0,4976	14,2	40,5	575,1	0,0015	1,20	46,4	-0,73862	0,6804	14,2	40,5	575,1	0,0021
0,81	22,2	-1,10152	0,3175	14,2	40,5	575,1	0,0014	0,88	34,4	-0,91832	0,5007	14,2	40,5	575,1	0,0015	1,20	46,6	-0,73562	0,6834	14,2	40,5	575,1	0,0021
0,80	22,4	-1,09852	0,3205	14,2	40,5	575,1	0,0014	0,89	34,6	-0,91522	0,5038	14,2	40,5	575,1	0,0015	1,21	46,8	-0,73262	0,6864	14,2	40,5	575,1	0,0021
0,81	22,6	-1,09552	0,3235	14,2	40,5	575,1	0,0014	0,91	34,8	-0,91222	0,5068	14,2	40,5	575,1	0,0016	1,21	47	-0,72962	0,6894	14,2	40,5	575,1	0,0021
0,81	22,8	-1,09262	0,3264	14,2	40,5	575,1	0,0014	0,92	35	-0,90922	0,5098	14,2	40,5	575,1	0,0016	1,21	47,2	-0,72672	0,6923	14,2	40,5	575,1	0,0021
0,81	23	-1,08952	0,3295	14,2	40,5	575,1	0,0014	0,91	35,2	-0,90622	0,5128	14,2	40,5	575,1	0,0016	1,22	47,4	-0,72362	0,6954	14,2	40,5	575,1	0,0021
0,80	23,2	-1,08662	0,3324	14,2	40,5	575,1	0,0014	0,93	35,4	-0,90322	0,5158	14,2	40,5	575,1	0,0016	1,20	47,6	-0,72062	0,6984	14,2	40,5	575,1	0,0021
0,80	23,4	-1,08362	0,3354	14,2	40,5	575,1	0,0014	0,93	35,6	-0,90032	0,5187	14,2	40,5	575,1	0,0016	1,22	47,8	-0,71752	0,7015	14,2	40,5	575,1	0,0021
0,81	23,6	-1,08062	0,3384	14,2	40,5	575,1	0,0014	0,93	35,8	-0,89742	0,5216	14,2	40,5	575,1	0,0016	1,23	48	-0,71442	0,7046	14,2	40,5	575,1	0,0021
0,80	23,8	-1,07752	0,3415	14,2	40,5	575,1	0,0014	0,94	36	-0,89432	0,5247	14,2	40,5	575,1	0,0016	1,21	48,2	-0,71152	0,7075	14,2	40,5	575,1	0,0021
0,81	24	-1,07442	0,3446	14,2	40,5	575,1	0,0014	0,94	36,2	-0,89142	0,5276	14,2	40,5	575,1	0,0016	1,21	48,4	-0,70842	0,7106	14,2	40,5	575,1	0,0021
0,83	24,2	-1,07142	0,3476	14,2	40,5	575,1	0,0014	0,93	36,4	-0,88842	0,5306	14,2	40,5	575,1	0,0016	1,22	48,6	-0,70552	0,7135	14,2	40,5	575,1	0,0021
0,81	24,4	-1,06832	0,3507	14,2	40,5	575,1	0,0014	0,96	36,6	-0,88542	0,5336	14,2	40,5	575,1	0,0017	1,23	48,8	-0,70252	0,7165	14,2	40,5	575,1	0,0021
0,82	24,6	-1,06542	0,3536	14,2	40,5	575,1	0,0014	0,97	36,8	-0,88242	0,5366	14,2	40,5	575,1	0,0017	1,25	49	-0,69962	0,7194	14,2	40,5	575,1	0,0022
0,80	24,8	-1,06252	0,3565	14,2	40,5	575,1	0,0014	0,97	37	-0,87932	0,5397	14,2	40,5	575,1	0,0017	1,24	49,2	-0,69662	0,7224	14,2	40,5	575,1	0,0022
0,81	25	-1,05952	0,3595	14,2	40,5	575,1	0,0014	0,99	37,2	-0,87632	0,5427	14,2	40,5	575,1	0,0017	1,23	49,4	-0,69362	0,7254	14,2	40,5	575,1	0,0021
0,80	25,2	-1,05652	0,3625	14,2	40,5	575,1	0,0014	0,98	37,4	-0,87332	0,5457	14,2	40,5	575,1	0,0017	1,24	49,6	-0,69062	0,7284	14,2	40,5	575,1	0,0022

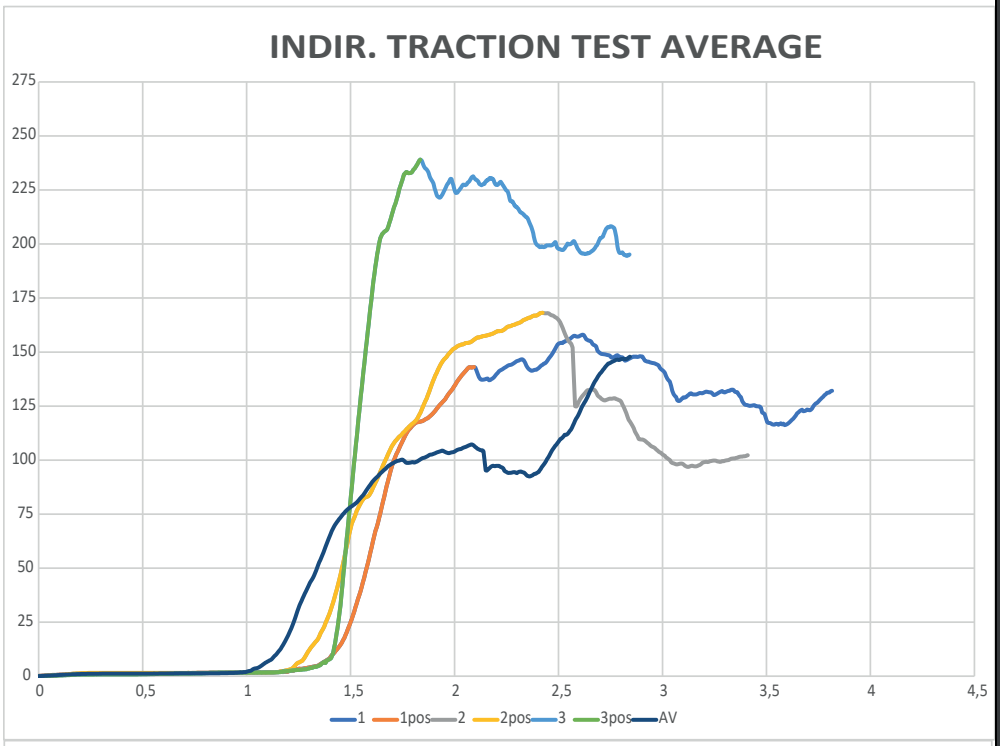
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
1,26	49,8	-0,68762	0,7314	14,2	40,5	575,1	0,0022	1,67	62	-0,50442	0,9146	14,2	40,5	575,1	0,0029	1,76	74,2	-0,32152	1,0975	14,2	40,5	575,1	0,0031
1,24	50	-0,68462	0,7344	14,2	40,5	575,1	0,0022	1,61	62,2	-0,50142	0,9176	14,2	40,5	575,1	0,0028	1,74	74,4	-0,31852	1,1005	14,2	40,5	575,1	0,0030
1,25	50,2	-0,68162	0,7374	14,2	40,5	575,1	0,0022	1,63	62,4	-0,49842	0,9206	14,2	40,5	575,1	0,0028	1,74	74,6	-0,31542	1,1036	14,2	40,5	575,1	0,0030
1,24	50,4	-0,67852	0,7405	14,2	40,5	575,1	0,0022	1,65	62,6	-0,49552	0,9235	14,2	40,5	575,1	0,0029	1,73	74,8	-0,31242	1,1066	14,2	40,5	575,1	0,0030
1,25	50,6	-0,67552	0,7435	14,2	40,5	575,1	0,0022	1,65	62,8	-0,49252	0,9265	14,2	40,5	575,1	0,0029	1,75	75	-0,30942	1,1096	14,2	40,5	575,1	0,0030
1,26	50,8	-0,67242	0,7466	14,2	40,5	575,1	0,0022	1,67	63	-0,48952	0,9295	14,2	40,5	575,1	0,0029	1,74	75,2	-0,30642	1,1126	14,2	40,5	575,1	0,0030
1,24	51	-0,66952	0,7495	14,2	40,5	575,1	0,0022	1,66	63,2	-0,48652	0,9325	14,2	40,5	575,1	0,0029	1,73	75,4	-0,30352	1,1155	14,2	40,5	575,1	0,0030
1,26	51,2	-0,66652	0,7525	14,2	40,5	575,1	0,0022	1,62	63,4	-0,48352	0,9355	14,2	40,5	575,1	0,0028	1,75	75,6	-0,30052	1,1185	14,2	40,5	575,1	0,0030
1,26	51,4	-0,66352	0,7555	14,2	40,5	575,1	0,0022	1,68	63,6	-0,48042	0,9386	14,2	40,5	575,1	0,0029	1,74	75,8	-0,29752	1,1215	14,2	40,5	575,1	0,0030
1,28	51,6	-0,66062	0,7584	14,2	40,5	575,1	0,0022	1,68	63,8	-0,47742	0,9416	14,2	40,5	575,1	0,0029	1,74	76	-0,29462	1,1244	14,2	40,5	575,1	0,0030
1,28	51,8	-0,65762	0,7614	14,2	40,5	575,1	0,0022	1,66	64	-0,47432	0,9447	14,2	40,5	575,1	0,0029	1,75	76,2	-0,29162	1,1274	14,2	40,5	575,1	0,0030
1,28	52	-0,65462	0,7644	14,2	40,5	575,1	0,0022	1,66	64,2	-0,47132	0,9477	14,2	40,5	575,1	0,0029	1,75	76,4	-0,28862	1,1304	14,2	40,5	575,1	0,0030
1,28	52,2	-0,65162	0,7674	14,2	40,5	575,1	0,0022	1,64	64,4	-0,46832	0,9507	14,2	40,5	575,1	0,0029	1,76	76,6	-0,28562	1,1334	14,2	40,5	575,1	0,0031
1,28	52,4	-0,64872	0,7703	14,2	40,5	575,1	0,0022	1,63	64,6	-0,46532	0,9537	14,2	40,5	575,1	0,0028	1,77	76,8	-0,28262	1,1364	14,2	40,5	575,1	0,0031
1,27	52,6	-0,64562	0,7734	14,2	40,5	575,1	0,0022	1,64	64,8	-0,46242	0,9566	14,2	40,5	575,1	0,0029	1,79	77	-0,27952	1,1395	14,2	40,5	575,1	0,0031
1,28	52,8	-0,64262	0,7764	14,2	40,5	575,1	0,0022	1,64	65	-0,45942	0,9596	14,2	40,5	575,1	0,0029	1,79	77,2	-0,27642	1,1426	14,2	40,5	575,1	0,0031
1,30	53	-0,63952	0,7795	14,2	40,5	575,1	0,0023	1,63	65,2	-0,45642	0,9626	14,2	40,5	575,1	0,0028	1,79	77,4	-0,27342	1,1456	14,2	40,5	575,1	0,0031
1,31	53,2	-0,63652	0,7825	14,2	40,5	575,1	0,0023	1,69	65,4	-0,45352	0,9655	14,2	40,5	575,1	0,0029	1,83	77,6	-0,27042	1,1486	14,2	40,5	575,1	0,0032
1,32	53,4	-0,63352	0,7855	14,2	40,5	575,1	0,0023	1,66	65,6	-0,45052	0,9685	14,2	40,5	575,1	0,0029	1,82	77,8	-0,26742	1,1516	14,2	40,5	575,1	0,0032
1,34	53,6	-0,63042	0,7886	14,2	40,5	575,1	0,0023	1,64	65,8	-0,44752	0,9715	14,2	40,5	575,1	0,0029	1,85	78	-0,26442	1,1546	14,2	40,5	575,1	0,0032
1,33	53,8	-0,62742	0,7916	14,2	40,5	575,1	0,0023	1,67	66	-0,44452	0,9745	14,2	40,5	575,1	0,0029	1,90	78,2	-0,26152	1,1575	14,2	40,5	575,1	0,0033
1,35	54	-0,62452	0,7945	14,2	40,5	575,1	0,0023	1,70	66,2	-0,44142	0,9776	14,2	40,5	575,1	0,0030	1,90	78,4	-0,25852	1,1605	14,2	40,5	575,1	0,0033
1,37	54,2	-0,62152	0,7975	14,2	40,5	575,1	0,0024	1,68	66,4	-0,43842	0,9806	14,2	40,5	575,1	0,0029	1,90	78,6	-0,25552	1,1635	14,2	40,5	575,1	0,0033
1,39	54,4	-0,61862	0,8004	14,2	40,5	575,1	0,0024	1,70	66,6	-0,43542	0,9836	14,2	40,5	575,1	0,0030	1,95	78,8	-0,25252	1,1665	14,2	40,5	575,1	0,0034
1,40	54,6	-0,61562	0,8034	14,2	40,5	575,1	0,0024	1,71	66,8	-0,43232	0,9867	14,2	40,5	575,1	0,0030	2,02	79	-0,24962	1,1694	14,2	40,5	575,1	0,0035
1,44	54,8	-0,61262	0,8064	14,2	40,5	575,1	0,0025	1,67	67	-0,42932	0,9897	14,2	40,5	575,1	0,0029	2,14	79,2	-0,24662	1,1724	14,2	40,5	575,1	0,0037
1,45	55	-0,60962	0,8094	14,2	40,5	575,1	0,0025	1,65	67,2	-0,42632	0,9927	14,2	40,5	575,1	0,0029	2,27	79,4	-0,24352	1,1755	14,2	40,5	575,1	0,0039
1,44	55,2	-0,60662	0,8124	14,2	40,5	575,1	0,0025	1,65	67,4	-0,42342	0,9956	14,2	40,5	575,1	0,0029	2,15	79,6	-0,24052	1,1785	14,2	40,5	575,1	0,0037
1,47	55,4	-0,60362	0,8154	14,2	40,5	575,1	0,0026	1,66	67,6	-0,42042	0,9986	14,2	40,5	575,1	0,0029	2,17	79,8	-0,23742	1,1816	14,2	40,5	575,1	0,0038
1,50	55,6	-0,60062	0,8184	14,2	40,5	575,1	0,0026	1,65	67,8	-0,41752	1,0015	14,2	40,5	575,1	0,0029	2,18	80	-0,23442	1,1846	14,2	40,5	575,1	0,0038
1,53	55,8	-0,59752	0,8215	14,2	40,5	575,1	0,0027	1,68	68	-0,41452	1,0045	14,2	40,5	575,1	0,0029	2,24	80,2	-0,23142	1,1876	14,2	40,5	575,1	0,0039
1,56	56	-0,59442	0,8246	14,2	40,5	575,1	0,0027	1,70	68,2	-0,41152	1,0075	14,2	40,5	575,1	0,0030	2,25	80,4	-0,22842	1,1906	14,2	40,5	575,1	0,0039
1,62	56,2	-0,59142	0,8276	14,2	40,5	575,1	0,0028	1,68	68,4	-0,40852	1,0105	14,2	40,5	575,1	0,0029	2,30	80,6	-0,22542	1,1936	14,2	40,5	575,1	0,0040
1,62	56,4	-0,58842	0,8306	14,2	40,5	575,1	0,0028	1,64	68,6	-0,40552	1,0135	14,2	40,5	575,1	0,0029	2,32	80,8	-0,22252	1,1965	14,2	40,5	575,1	0,0040
1,62	56,6	-0,58552	0,8335	14,2	40,5	575,1	0,0028	1,71	68,8	-0,40242	1,0166	14,2	40,5	575,1	0,0030	2,37	81	-0,21952	1,1995	14,2	40,5	575,1	0,0041
1,62	56,8	-0,58252	0,8365	14,2	40,5	575,1	0,0028	1,70	69	-0,39942	1,0196	14,2	40,5	575,1	0,0030	2,45	81,2	-0,21652	1,2025	14,2	40,5	575,1	0,0043
1,60	57	-0,57952	0,8395	14,2	40,5	575,1	0,0028	1,71	69,2	-0,39632	1,0227	14,2	40,5	575,1	0,0030	2,50	81,4	-0,21352	1,2055	14,2	40,5	575,1	0,0043
1,60	57,2	-0,57662	0,8424	14,2	40,5	575,1	0,0028	1,71	69,4	-0,39332	1,0257	14,2	40,5	575,1	0,0030	2,51	81,6	-0,21062	1,2084	14,2	40,5	575,1	0,0044
1,61	57,4	-0,57362	0,8454	14,2	40,5	575,1	0,0028	1,69	69,6	-0,39032	1,0287	14,2	40,5	575,1	0,0029	2,54	81,8	-0,20762	1,2114	14,2	40,5	575,1	0,0044
1,62	57,6	-0,57062	0,8484	14,2	40,5	575,1	0,0028	1,66	69,8	-0,38732	1,0317	14,2	40,5	575,1	0,0029	2,60	82	-0,20462	1,2144	14,2	40,5	575,1	0,0045
1,62	57,8	-0,56762	0,8514	14,2	40,5	575,1	0,0028	1,68	70	-0,38432	1,0347	14,2	40,5	575,1	0,0029	2,60	82,2	-0,20152	1,2175	14,2	40,5	575,1	0,0045
1,62	58	-0,56462	0,8544	14,2	40,5	575,1	0,0028	1,67	70,2	-0,38142	1,0376	14,2	40,5	575,1	0,0029	2,65	82,4	-0,19842	1,2206	14,2	40,5	575,1	0,0046
1,61	58,2	-0,56152	0,8575	14,2	40,5	575,1	0,0028	1,68	70,4	-0,37842	1,0406	14,2	40,5	575,1	0,0029	2,69	82,6	-0,19542	1,2236	14,2	40,5	575,1	0,0047
1,62	58,4	-0,55842	0,8606	14,2	40,5	575,1	0,0028	1,72	70,6	-0,37542	1,0436	14,2	40,5	575,1	0,0030	2,76	82,8	-0,19242	1,2266	14,2	40,5	575,1	0,0048
1,64	58,6	-0,55542	0,8636	14,2	40,5	575,1	0,0029	1,73	70,8	-0,37252	1,0465	14,2	40,5	575,1	0,0030	2,76	83	-0,18942	1,2296	14,2	40,5	575,1	0,0048
1,71	58,8	-0,55242	0,8666	14,2	40,5	575,1	0,0030	1,68	71	-0,36952	1,0495	14,2	40,5	575,1	0,0029	2,80	83,2	-0,18642	1,2326	14,2	40,5	575,1	0,0049
1,67	59	-0,54942	0,8696	14,2	40,5	575,1	0,0029	1,65	71,2	-0,36652	1,0525	14,2	40,5	575,1	0,0029	2,81	83,4	-0,18342	1,2356	14,2	40,5	575,1	0,0049
1,67	59,2	-0,54642	0,8726	14,2	40,5	575,1	0,0029	1,72	71,4	-0,36352	1,0555	14,2	40,5	575,1	0,0030	2,82	83,6	-0,18042	1,2386	14,2	40,5	575,1	0,0049
1,67	59,4	-0,54342	0,8756	14,2	40,5	575,1	0,0029	1,76	71,6	-0,36052	1,0585	14,2	40,5	575,1	0,0031	2,87	83,8	-0,17752	1,2415	14,2	40,5	575,1	0,0050
1,65	59,6	-0,54052	0,8785	14,2	40,5	575,1	0,0029	1,73	71,8	-0,35742	1,0616	14,2	40,5	575,1	0,0030	2,87	84	-0,17452	1,2445	14,2	40,5	575,1	0,0050
1,64	59,8	-0,53752	0,8815	14,2	40,5	575,1	0,0029	1,72	72	-0,35442	1,0646	14,2	40,5	575,1	0,0030	2,87	84,2	-0,17152	1,2475	14,2	40,5	575,1	0,0050
1,62	60	-0,53452	0,8845	14,2	40,5	575,1	0,0028	1,72	72,2	-0,35142	1,0676	14,2	40,5	575,1	0,0030	2,88	84,4	-0,16852	1,2505	14,2	40,5	575,1	0,0050
1,65	60,2	-0,53152	0,8875	14,2	40,5	575,1	0,0029	1,69	72,4	-0,34842	1,0706	14,2	40,5	575,1	0,0029	2,92	84,6	-0,16552	1,2535	14,2	40,5	575,1	0,0051
1,66	60,4	-0,52862	0,8904	14,2	40,5	575,1	0,0029	1,70	72,6	-0,34542	1,0736	14,2	40,5	575,1	0,0030	2,94	84,8	-0,16252	1,2565	14,2	40,5	575,1	0,0051
1,65	60,6	-0,52562	0,8934	14,2	40,5	575,1	0,0029	1,73	72,8	-0,34252	1,0765	14,2	40,5	575,1	0,0030	2,95	85	-0,15942	1,2596	14,2	40,5	575,1	0,0051
1,65	60,8	-0,52252	0,8965	14,2	40,5	575,1	0,0029	1,74	73	-0,33952	1,0795	14,2	40,5	575,1	0,0030	2,94	85,2	-0,15642	1,2626	14,2	40,5	575,1	0,0051
1,65	61	-0,51942	0,8996	14,2	40,5	575,1	0,0029	1,71	73,2	-0,33652	1,0825	14,2	40,5	575,1	0,0030	3,01	85,4	-0,15332	1,2657	14,2	40,5	575,1	0,0052
1,65	61,2	-0,51642	0,9026	14,2	40,5	575,1	0,0029	1,71	73,4	-0,33362	1,0854	14,2	40,5	575,1	0,0030	3,08	85,6	-0,15032	1,2687	14,2	40,5	575,1	0,0054
1,69	61,4	-0,51342	0,9056	14,2	40,5	575,1	0,0029	1,71	73,6	-0,33062	1,0884	14,2	40,5	575,1	0,0030	3,12	85,8	-0,14742	1,2716	14,2	40,5	575,1	0,0054
1,69	61,6	-0,51032	0,9087	14,2	40,5	575,1	0,0029	1,70	73,8	-0,32762	1,0914	14,2	40,5	575,1	0,0030	3,14	86	-0,14442	1,2746	14,2	40,5	575,1	0,0055
1,69	61,8	-0,50732	0,9117	14,2	40,5	575,1	0,0029	1,71	74	-0,32462	1,0944	14,2	40,5	575,1	0,0030	3,16	86,2	-0,14152	1,2775	14,2	40,5	575,1	0,0055

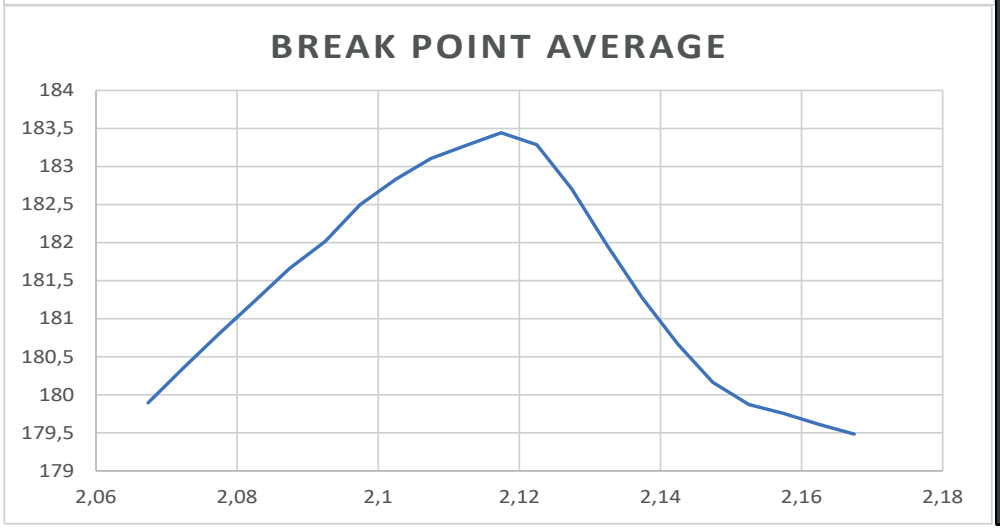
LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
3,20	86,4	-0,13842	1,2806	14,2	40,5	575,1	0,0056	44,96	98,6	0,04448	1,4635	14,2	40,5	575,1	0,0782	203,44	110,8	0,22718	1,6462	14,2	40,5	575,1	0,3537
3,20	86,6	-0,13552	1,2835	14,2	40,5	575,1	0,0056	48,06	98,8	0,04748	1,4665	14,2	40,5	575,1	0,0836	204,07	111	0,23018	1,6492	14,2	40,5	575,1	0,3548
3,22	86,8	-0,13262	1,2864	14,2	40,5	575,1	0,0056	51,11	99	0,05048	1,4695	14,2	40,5	575,1	0,0889	204,63	111,2	0,23318	1,6522	14,2	40,5	575,1	0,3558
3,30	87	-0,12962	1,2894	14,2	40,5	575,1	0,0057	54,18	99,2	0,05338	1,4724	14,2	40,5	575,1	0,0942	204,93	111,4	0,23618	1,6552	14,2	40,5	575,1	0,3563
3,46	87,2	-0,12662	1,2924	14,2	40,5	575,1	0,0060	57,16	99,4	0,05638	1,4754	14,2	40,5	575,1	0,0994	205,25	111,6	0,23928	1,6583	14,2	40,5	575,1	0,3569
3,49	87,4	-0,12352	1,2955	14,2	40,5	575,1	0,0061	60,32	99,6	0,05928	1,4783	14,2	40,5	575,1	0,1049	205,59	111,8	0,24228	1,6613	14,2	40,5	575,1	0,3575
3,51	87,6	-0,12052	1,2985	14,2	40,5	575,1	0,0061	63,35	99,8	0,06228	1,4813	14,2	40,5	575,1	0,1102	205,81	112	0,24528	1,6643	14,2	40,5	575,1	0,3579
3,60	87,8	-0,11742	1,3016	14,2	40,5	575,1	0,0063	66,39	100	0,06528	1,4843	14,2	40,5	575,1	0,1154	206,06	112,2	0,24838	1,6674	14,2	40,5	575,1	0,3583
3,72	88	-0,11442	1,3046	14,2	40,5	575,1	0,0065	69,38	100,2	0,06828	1,4873	14,2	40,5	575,1	0,1206	206,17	112,4	0,25128	1,6703	14,2	40,5	575,1	0,3585
3,85	88,2	-0,11142	1,3076	14,2	40,5	575,1	0,0067	72,29	100,4	0,07128	1,4903	14,2	40,5	575,1	0,1257	206,43	112,6	0,25428	1,6733	14,2	40,5	575,1	0,3589
3,97	88,4	-0,10842	1,3106	14,2	40,5	575,1	0,0069	75,22	100,6	0,07428	1,4933	14,2	40,5	575,1	0,1308	206,76	112,8	0,25728	1,6763	14,2	40,5	575,1	0,3595
3,88	88,6	-0,10542	1,3136	14,2	40,5	575,1	0,0067	78,17	100,8	0,07728	1,4963	14,2	40,5	575,1	0,1359	207,43	113	0,26018	1,6792	14,2	40,5	575,1	0,3607
3,90	88,8	-0,10252	1,3165	14,2	40,5	575,1	0,0068	81,12	101	0,08038	1,4994	14,2	40,5	575,1	0,1411	208,33	113,2	0,26318	1,6822	14,2	40,5	575,1	0,3623
4,05	89	-0,09952	1,3195	14,2	40,5	575,1	0,0070	84,09	101,2	0,08338	1,5024	14,2	40,5	575,1	0,1462	209,32	113,4	0,26618	1,6852	14,2	40,5	575,1	0,3640
4,24	89,2	-0,09662	1,3224	14,2	40,5	575,1	0,0074	87,13	101,4	0,08648	1,5055	14,2	40,5	575,1	0,1515	210,15	113,6	0,26918	1,6882	14,2	40,5	575,1	0,3654
4,29	89,4	-0,09362	1,3254	14,2	40,5	575,1	0,0075	90,10	101,6	0,08948	1,5085	14,2	40,5	575,1	0,1567	211,22	113,8	0,27218	1,6912	14,2	40,5	575,1	0,3673
4,34	89,6	-0,09062	1,3284	14,2	40,5	575,1	0,0075	93,10	101,8	0,09238	1,5114	14,2	40,5	575,1	0,1619	212,08	114	0,27518	1,6942	14,2	40,5	575,1	0,3688
4,33	89,8	-0,08762	1,3314	14,2	40,5	575,1	0,0075	96,00	102	0,09538	1,5144	14,2	40,5	575,1	0,1669	213,10	114,2	0,27818	1,6972	14,2	40,5	575,1	0,3705
4,31	90	-0,08462	1,3344	14,2	40,5	575,1	0,0075	98,85	102,2	0,09828	1,5173	14,2	40,5	575,1	0,1719	214,13	114,4	0,28128	1,7003	14,2	40,5	575,1	0,3723
4,45	90,2	-0,08152	1,3375	14,2	40,5	575,1	0,0077	101,77	102,4	0,10128	1,5203	14,2	40,5	575,1	0,1770	215,15	114,6	0,28428	1,7033	14,2	40,5	575,1	0,3741
4,57	90,4	-0,07842	1,3406	14,2	40,5	575,1	0,0079	104,70	102,6	0,10428	1,5233	14,2	40,5	575,1	0,1821	216,14	114,8	0,28728	1,7063	14,2	40,5	575,1	0,3758
4,68	90,6	-0,07552	1,3435	14,2	40,5	575,1	0,0081	107,59	102,8	0,10728	1,5263	14,2	40,5	575,1	0,1871	217,07	115	0,29028	1,7093	14,2	40,5	575,1	0,3774
4,79	90,8	-0,07242	1,3466	14,2	40,5	575,1	0,0083	110,44	103	0,11028	1,5293	14,2	40,5	575,1	0,1920	217,94	115,2	0,29328	1,7123	14,2	40,5	575,1	0,3790
4,92	91	-0,06942	1,3496	14,2	40,5	575,1	0,0086	113,31	103,2	0,11328	1,5323	14,2	40,5	575,1	0,1970	218,62	115,4	0,29628	1,7153	14,2	40,5	575,1	0,3801
5,01	91,2	-0,06652	1,3525	14,2	40,5	575,1	0,0087	116,35	103,4	0,11628	1,5353	14,2	40,5	575,1	0,2023	219,45	115,6	0,29918	1,7182	14,2	40,5	575,1	0,3816
5,21	91,4	-0,06352	1,3555	14,2	40,5	575,1	0,0091	119,25	103,6	0,11928	1,5383	14,2	40,5	575,1	0,2074	220,49	115,8	0,30218	1,7212	14,2	40,5	575,1	0,3834
5,59	91,6	-0,06062	1,3584	14,2	40,5	575,1	0,0097	122,16	103,8	0,12238	1,5414	14,2	40,5	575,1	0,2124	221,43	116	0,30518	1,7242	14,2	40,5	575,1	0,3850
5,85	91,8	-0,05762	1,3614	14,2	40,5	575,1	0,0102	125,00	104	0,12538	1,5444	14,2	40,5	575,1	0,2174	222,47	116,2	0,30818	1,7272	14,2	40,5	575,1	0,3868
6,05	92	-0,05462	1,3644	14,2	40,5	575,1	0,0105	127,72	104,2	0,12838	1,5474	14,2	40,5	575,1	0,2221	223,65	116,4	0,31118	1,7302	14,2	40,5	575,1	0,3889
6,25	92,2	-0,05162	1,3674	14,2	40,5	575,1	0,0109	130,45	104,4	0,13138	1,5504	14,2	40,5	575,1	0,2268	225,01	116,6	0,31418	1,7332	14,2	40,5	575,1	0,3913
6,38	92,4	-0,04862	1,3704	14,2	40,5	575,1	0,0111	133,12	104,6	0,13438	1,5534	14,2	40,5	575,1	0,2315	225,83	116,8	0,31718	1,7362	14,2	40,5	575,1	0,3927
6,56	92,6	-0,04562	1,3734	14,2	40,5	575,1	0,0114	135,88	104,8	0,13728	1,5563	14,2	40,5	575,1	0,2363	226,81	117	0,32018	1,7392	14,2	40,5	575,1	0,3944
6,71	92,8	-0,04262	1,3764	14,2	40,5	575,1	0,0117	138,56	105	0,14028	1,5593	14,2	40,5	575,1	0,2409	227,59	117,2	0,32328	1,7423	14,2	40,5	575,1	0,3957
6,11	93	-0,03952	1,3795	14,2	40,5	575,1	0,0106	141,23	105,2	0,14328	1,5623	14,2	40,5	575,1	0,2456	228,72	117,4	0,32638	1,7454	14,2	40,5	575,1	0,3977
6,75	93,2	-0,03652	1,3825	14,2	40,5	575,1	0,0117	144,05	105,4	0,14618	1,5652	14,2	40,5	575,1	0,2505	229,39	117,6	0,32938	1,7484	14,2	40,5	575,1	0,3989
7,20	93,4	-0,03352	1,3855	14,2	40,5	575,1	0,0125	146,61	105,6	0,14918	1,5682	14,2	40,5	575,1	0,2549	230,39	117,8	0,33238	1,7514	14,2	40,5	575,1	0,4006
7,35	93,6	-0,03042	1,3886	14,2	40,5	575,1	0,0128	149,24	105,8	0,15218	1,5712	14,2	40,5	575,1	0,2595	231,34	118	0,33528	1,7543	14,2	40,5	575,1	0,4023
7,50	93,8	-0,02752	1,3915	14,2	40,5	575,1	0,0130	151,99	106	0,15518	1,5742	14,2	40,5	575,1	0,2643	232,24	118,2	0,33828	1,7573	14,2	40,5	575,1	0,4038
7,62	94	-0,02452	1,3945	14,2	40,5	575,1	0,0132	154,68	106,2	0,15828	1,5773	14,2	40,5	575,1	0,2690	232,50	118,4	0,34128	1,7603	14,2	40,5	575,1	0,4043
7,76	94,2	-0,02162	1,3974	14,2	40,5	575,1	0,0135	157,33	106,4	0,16128	1,5803	14,2	40,5	575,1	0,2736	232,89	118,6	0,34428	1,7633	14,2	40,5	575,1	0,4050
7,92	94,4	-0,01862	1,4004	14,2	40,5	575,1	0,0138	159,89	106,6	0,16438	1,5834	14,2	40,5	575,1	0,2780	233,18	118,8	0,34718	1,7662	14,2	40,5	575,1	0,4055
8,09	94,6	-0,01562	1,4034	14,2	40,5	575,1	0,0141	162,59	106,8	0,16738	1,5864	14,2	40,5	575,1	0,2827	233,34	119	0,35018	1,7692	14,2	40,5	575,1	0,4057
8,38	94,8	-0,01262	1,4064	14,2	40,5	575,1	0,0146	165,25	107	0,17038	1,5894	14,2	40,5	575,1	0,2873	233,18	119,2	0,35318	1,7722	14,2	40,5	575,1	0,4055
8,99	95	-0,00962	1,4094	14,2	40,5	575,1	0,0156	167,91	107,2	0,17338	1,5924	14,2	40,5	575,1	0,2920	232,94	119,4	0,35618	1,7752	14,2	40,5	575,1	0,4050
9,70	95,2	-0,00672	1,4123	14,2	40,5	575,1	0,0169	170,51	107,4	0,17628	1,5953	14,2	40,5	575,1	0,2965	232,79	119,6	0,35928	1,7783	14,2	40,5	575,1	0,4048
10,67	95,4	-0,00362	1,4154	14,2	40,5	575,1	0,0186	172,98	107,6	0,17928	1,5983	14,2	40,5	575,1	0,3008	232,80	119,8	0,36228	1,7813	14,2	40,5	575,1	0,4048
11,96	95,6	-0,00062	1,4184	14,2	40,5	575,1	0,0208	175,49	107,8	0,18218	1,6012	14,2	40,5	575,1	0,3051	232,97	120	0,36538	1,7844	14,2	40,5	575,1	0,4051
13,37	95,8	0,00248	1,4215	14,2	40,5	575,1	0,0232	178,02	108	0,18518	1,6042	14,2	40,5	575,1	0,3095	232,84	120,2	0,36838	1,7874	14,2	40,5	575,1	0,4049
14,84	96	0,00548	1,4245	14,2	40,5	575,1	0,0258	180,53	108,2	0,18818	1,6072	14,2	40,5	575,1	0,3139	232,97	120,4	0,37138	1,7904	14,2	40,5	575,1	0,4051
16,50	96,2	0,00858	1,4276	14,2	40,5	575,1	0,0287	182,88	108,4	0,19118	1,6102	14,2	40,5	575,1	0,3180	233,08	120,6	0,37428	1,7933	14,2	40,5	575,1	0,4053
18,19	96,4	0,01148	1,4305	14,2	40,5	575,1	0,0316	185,21	108,6	0,19418	1,6132	14,2	40,5	575,1	0,3220	233,43	120,8	0,37728	1,7963	14,2	40,5	575,1	0,4059
20,07	96,6	0,01448	1,4335	14,2	40,5	575,1	0,0349	187,18	108,8	0,19728	1,6163	14,2	40,5	575,1	0,3255	233,85	121	0,38018	1,7992	14,2	40,5	575,1	0,4066
21,94	96,8	0,01738	1,4364	14,2	40,5	575,1	0,0381	189,48	109	0,20028	1,6193	14,2	40,5	575,1	0,3295	234,38	121,2	0,38318	1,8022	14,2	40,5	575,1	0,4075
23,91	97	0,02038	1,4394	14,2	40,5	575,1	0,0416	191,56	109,2	0,20338	1,6224	14,2	40,5	575,1	0,3331	234,61	121,4	0,38618	1,8052	14,2	40,5	575,1	0,4079
25,97	97,2	0,02328	1,4423	14,2	40,5	575,1	0,0452	193,43	109,4	0,20638	1,6254	14,2	40,5	575,1	0,3363	234,96	121,6	0,38918	1,8082	14,2	40,5	575,1	0,4086
28,04	97,4	0,02628	1,4453	14,2	40,5	575,1	0,0488	195,41	109,6	0,20938	1,6284	14,2	40,5	575,1	0,3398	235,37	121,8	0,39218	1,8112	14,2	40,5	575,1	0,4093
30,16	97,6	0,02928	1,4483	14,2	40,5	575,1	0,0524	197,09	109,8	0,21238	1,6314	14,2	40,5	575,1	0,3427	235,77	122	0,39518	1,8142	14,2	40,5	575,1	0,4100
32,68	97,8	0,03228	1,4513	14,2	40,5	575,1	0,0568	198,78	110	0,21528	1,6343	14,2	40,5	575,1	0,3456	236,38	122,2	0,39818	1,8172	14,2	40,5	575,1	0,4110
35,72	98	0,03528	1,4543	14,2	40,5	575,1	0,0621	200,33	110,2	0,21828	1,6373	14,2	40,5	575,1	0,3483	236,74	122,4	0,40128	1,8203	14,2	40,5	575,1	0,4117
38,71	98,2	0,03828	1,4573	14,2	40,5	575,1	0,0673	201,56	110,4	0,22128	1,6403	14,2	40,5	575,1	0,3505	237,36	122,6	0,40428	1,8233	14,2	40,5	575,1	0,4127
41,90	98,4	0,04138	1,4604	14,2	40,5	575,1	0,0729	202,73	110,6	0,22418	1,6432	14,2	40,5	575,1	0,3525	237,90	122,8	0,40738	1,8264	14,2	40,5	575,1	0,4137

LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
238,51	123	0,41038	1,8294	14,2	40,5	575,1	0,4147	223,67	135,2	0,59318	2,0122	14,2	40,5	575,1	0,3889	227,81	147,4	0,77618	2,1952	14,2	40,5	575,1	0,3961
238,79	123,2	0,41328	1,8323	14,2	40,5	575,1	0,4152	223,96	135,4	0,59618	2,0152	14,2	40,5	575,1	0,3894	227,47	147,6	0,77918	2,1982	14,2	40,5	575,1	0,3955
239,06	123,4	0,41618	1,8352	14,2	40,5	575,1	0,4157	224,45	135,6	0,59918	2,0182	14,2	40,5	575,1	0,3903	227,40	147,8	0,78208	2,2011	14,2	40,5	575,1	0,3954
238,92	123,6	0,41918	1,8382	14,2	40,5	575,1	0,4154	224,79	135,8	0,60228	2,0213	14,2	40,5	575,1	0,3909	227,25	148	0,78508	2,2041	14,2	40,5	575,1	0,3951
238,69	123,8	0,42218	1,8412	14,2	40,5	575,1	0,4150	225,12	136	0,60528	2,0243	14,2	40,5	575,1	0,3914	227,33	148,2	0,78808	2,2071	14,2	40,5	575,1	0,3953
238,20	124	0,42518	1,8442	14,2	40,5	575,1	0,4142	225,62	136,2	0,60828	2,0273	14,2	40,5	575,1	0,3923	227,66	148,4	0,79108	2,2101	14,2	40,5	575,1	0,3959
237,42	124,2	0,42808	1,8471	14,2	40,5	575,1	0,4128	225,88	136,4	0,61128	2,0303	14,2	40,5	575,1	0,3928	227,99	148,6	0,79408	2,2131	14,2	40,5	575,1	0,3964
236,63	124,4	0,43118	1,8502	14,2	40,5	575,1	0,4115	226,35	136,6	0,61418	2,0332	14,2	40,5	575,1	0,3936	228,34	148,8	0,79718	2,2162	14,2	40,5	575,1	0,3970
235,84	124,6	0,43418	1,8532	14,2	40,5	575,1	0,4101	226,86	136,8	0,61718	2,0362	14,2	40,5	575,1	0,3945	228,68	149	0,80018	2,2192	14,2	40,5	575,1	0,3976
235,39	124,8	0,43718	1,8562	14,2	40,5	575,1	0,4093	227,30	137	0,62008	2,0391	14,2	40,5	575,1	0,3952	228,79	149,2	0,80328	2,2223	14,2	40,5	575,1	0,3978
235,06	125	0,44028	1,8593	14,2	40,5	575,1	0,4087	227,51	137,2	0,62308	2,0421	14,2	40,5	575,1	0,3956	228,39	149,4	0,80628	2,2253	14,2	40,5	575,1	0,3971
234,76	125,2	0,44328	1,8623	14,2	40,5	575,1	0,4082	227,47	137,4	0,62608	2,0451	14,2	40,5	575,1	0,3955	227,89	149,6	0,80928	2,2283	14,2	40,5	575,1	0,3963
234,57	125,4	0,44628	1,8653	14,2	40,5	575,1	0,4079	227,47	137,6	0,62908	2,0481	14,2	40,5	575,1	0,3955	227,38	149,8	0,81228	2,2313	14,2	40,5	575,1	0,3954
234,15	125,6	0,44938	1,8684	14,2	40,5	575,1	0,4071	227,19	137,8	0,63208	2,0511	14,2	40,5	575,1	0,3950	227,08	150	0,81518	2,2342	14,2	40,5	575,1	0,3949
233,81	125,8	0,45228	1,8713	14,2	40,5	575,1	0,4066	227,35	138	0,63508	2,0541	14,2	40,5	575,1	0,3953	226,56	150,2	0,81818	2,2372	14,2	40,5	575,1	0,3939
233,11	126	0,45528	1,8743	14,2	40,5	575,1	0,4053	227,52	138,2	0,63818	2,0572	14,2	40,5	575,1	0,3956	226,02	150,4	0,82118	2,2402	14,2	40,5	575,1	0,3930
232,23	126,2	0,45818	1,8772	14,2	40,5	575,1	0,4038	227,94	138,4	0,64118	2,0602	14,2	40,5	575,1	0,3963	225,60	150,6	0,82418	2,2432	14,2	40,5	575,1	0,3923
231,38	126,4	0,46118	1,8802	14,2	40,5	575,1	0,4023	228,41	138,6	0,64428	2,0633	14,2	40,5	575,1	0,3972	225,16	150,8	0,82718	2,2462	14,2	40,5	575,1	0,3915
230,64	126,6	0,46418	1,8832	14,2	40,5	575,1	0,4010	228,61	138,8	0,64728	2,0663	14,2	40,5	575,1	0,3975	224,80	151	0,83008	2,2491	14,2	40,5	575,1	0,3909
230,04	126,8	0,46718	1,8862	14,2	40,5	575,1	0,4000	228,89	139	0,65028	2,0693	14,2	40,5	575,1	0,3980	224,60	151,2	0,83318	2,2522	14,2	40,5	575,1	0,3905
229,58	127	0,47018	1,8892	14,2	40,5	575,1	0,3992	229,20	139,2	0,65318	2,0722	14,2	40,5	575,1	0,3985	224,37	151,4	0,83618	2,2552	14,2	40,5	575,1	0,3901
229,19	127,2	0,47318	1,8922	14,2	40,5	575,1	0,3985	229,72	139,4	0,65618	2,0752	14,2	40,5	575,1	0,3994	223,61	151,6	0,83928	2,2583	14,2	40,5	575,1	0,3888
228,75	127,4	0,47618	1,8952	14,2	40,5	575,1	0,3978	230,11	139,6	0,65908	2,0781	14,2	40,5	575,1	0,4001	222,48	151,8	0,84228	2,2613	14,2	40,5	575,1	0,3869
228,05	127,6	0,47928	1,8983	14,2	40,5	575,1	0,3965	230,64	139,8	0,66208	2,0811	14,2	40,5	575,1	0,4010	221,12	152	0,84538	2,2644	14,2	40,5	575,1	0,3845
226,95	127,8	0,48238	1,9014	14,2	40,5	575,1	0,3946	231,03	140	0,66508	2,0841	14,2	40,5	575,1	0,4017	220,18	152,2	0,84838	2,2674	14,2	40,5	575,1	0,3829
225,73	128	0,48538	1,9044	14,2	40,5	575,1	0,3925	231,20	140,2	0,66808	2,0871	14,2	40,5	575,1	0,4020	219,75	152,4	0,85128	2,2703	14,2	40,5	575,1	0,3821
224,73	128,2	0,48838	1,9074	14,2	40,5	575,1	0,3908	231,38	140,4	0,67098	2,09	14,2	40,5	575,1	0,4023	219,91	152,6	0,85428	2,2733	14,2	40,5	575,1	0,3824
223,87	128,4	0,49138	1,9104	14,2	40,5	575,1	0,3893	230,73	140,6	0,67408	2,0931	14,2	40,5	575,1	0,4012	219,70	152,8	0,85728	2,2763	14,2	40,5	575,1	0,3820
222,99	128,6	0,49428	1,9133	14,2	40,5	575,1	0,3877	230,41	140,8	0,67708	2,0961	14,2	40,5	575,1	0,4006	219,71	153	0,86018	2,2792	14,2	40,5	575,1	0,3820
222,31	128,8	0,49728	1,9163	14,2	40,5	575,1	0,3866	230,12	141	0,68018	2,0992	14,2	40,5	575,1	0,4001	219,16	153,2	0,86318	2,2822	14,2	40,5	575,1	0,3811
221,90	129	0,50028	1,9193	14,2	40,5	575,1	0,3858	229,76	141,2	0,68318	2,1022	14,2	40,5	575,1	0,3995	218,63	153,4	0,86618	2,2852	14,2	40,5	575,1	0,3802
221,74	129,2	0,50318	1,9222	14,2	40,5	575,1	0,3856	229,66	141,4	0,68618	2,1052	14,2	40,5	575,1	0,3993	217,84	153,6	0,86918	2,2882	14,2	40,5	575,1	0,3788
221,56	129,4	0,50628	1,9253	14,2	40,5	575,1	0,3853	229,48	141,6	0,68918	2,1082	14,2	40,5	575,1	0,3990	217,80	153,8	0,87218	2,2912	14,2	40,5	575,1	0,3787
221,47	129,6	0,50918	1,9282	14,2	40,5	575,1	0,3851	229,20	141,8	0,69218	2,1112	14,2	40,5	575,1	0,3985	217,22	154	0,87528	2,2943	14,2	40,5	575,1	0,3777
221,55	129,8	0,51218	1,9312	14,2	40,5	575,1	0,3852	228,92	142	0,69518	2,1142	14,2	40,5	575,1	0,3981	217,25	154,2	0,87828	2,2973	14,2	40,5	575,1	0,3778
221,86	130	0,51518	1,9342	14,2	40,5	575,1	0,3858	228,16	142,2	0,69808	2,1171	14,2	40,5	575,1	0,3967	216,98	154,4	0,88128	2,3003	14,2	40,5	575,1	0,3773
222,32	130,2	0,51828	1,9373	14,2	40,5	575,1	0,3866	227,74	142,4	0,70108	2,1201	14,2	40,5	575,1	0,3960	216,65	154,6	0,88438	2,3034	14,2	40,5	575,1	0,3767
222,72	130,4	0,52138	1,9404	14,2	40,5	575,1	0,3873	227,59	142,6	0,70408	2,1231	14,2	40,5	575,1	0,3957	216,34	154,8	0,88738	2,3064	14,2	40,5	575,1	0,3762
223,27	130,6	0,52438	1,9434	14,2	40,5	575,1	0,3882	227,43	142,8	0,70698	2,126	14,2	40,5	575,1	0,3955	215,76	155	0,89038	2,3094	14,2	40,5	575,1	0,3752
223,83	130,8	0,52738	1,9464	14,2	40,5	575,1	0,3892	227,22	143	0,71008	2,1291	14,2	40,5	575,1	0,3951	215,33	155,2	0,89338	2,3124	14,2	40,5	575,1	0,3744
224,42	131	0,53038	1,9494	14,2	40,5	575,1	0,3902	227,34	143,2	0,71298	2,132	14,2	40,5	575,1	0,3953	214,87	155,4	0,89628	2,3153	14,2	40,5	575,1	0,3736
225,08	131,2	0,53338	1,9524	14,2	40,5	575,1	0,3914	227,53	143,4	0,71608	2,1351	14,2	40,5	575,1	0,3956	214,59	155,6	0,89928	2,3183	14,2	40,5	575,1	0,3731
225,70	131,4	0,53628	1,9553	14,2	40,5	575,1	0,3925	227,66	143,6	0,71908	2,1381	14,2	40,5	575,1	0,3959	214,54	155,8	0,90228	2,3213	14,2	40,5	575,1	0,3730
226,19	131,6	0,53928	1,9583	14,2	40,5	575,1	0,3933	227,88	143,8	0,72218	2,1412	14,2	40,5	575,1	0,3962	214,34	156	0,90528	2,3243	14,2	40,5	575,1	0,3727
226,91	131,8	0,54218	1,9612	14,2	40,5	575,1	0,3946	227,81	144	0,72518	2,1442	14,2	40,5	575,1	0,3961	214,20	156,2	0,90818	2,3272	14,2	40,5	575,1	0,3725
227,43	132	0,54518	1,9642	14,2	40,5	575,1	0,3955	228,58	144,2	0,72818	2,1472	14,2	40,5	575,1	0,3975	213,79	156,4	0,91128	2,3303	14,2	40,5	575,1	0,3717
227,94	132,2	0,54818	1,9672	14,2	40,5	575,1	0,3963	228,91	144,4	0,73118	2,1502	14,2	40,5	575,1	0,3980	213,63	156,6	0,91418	2,3332	14,2	40,5	575,1	0,3715
228,16	132,4	0,55118	1,9702	14,2	40,5	575,1	0,3967	229,39	144,6	0,73408	2,1531	14,2	40,5	575,1	0,3989	213,13	156,8	0,91728	2,3363	14,2	40,5	575,1	0,3706
228,78	132,6	0,55418	1,9732	14,2	40,5	575,1	0,3978	229,47	144,8	0,73708	2,1561	14,2	40,5	575,1	0,3990	213,04	157	0,92038	2,3394	14,2	40,5	575,1	0,3704
229,46	132,8	0,55728	1,9763	14,2	40,5	575,1	0,3990	229,45	145	0,74008	2,1591	14,2	40,5	575,1	0,3990	212,66	157,2	0,92338	2,3424	14,2	40,5	575,1	0,3698
230,05	133	0,56028	1,9793	14,2	40,5	575,1	0,4000	229,82	145,2	0,74298	2,162	14,2	40,5	575,1	0,3996	212,33	157,4	0,92648	2,3455	14,2	40,5	575,1	0,3692
230,20	133,2	0,56338	1,9824	14,2	40,5	575,1	0,4003	229,97	145,4	0,74608	2,1651	14,2	40,5	575,1	0,3999	212,33	157,6	0,92948	2,3485	14,2	40,5	575,1	0,3692
230,05	133,4	0,56638	1,9854	14,2	40,5	575,1	0,4000	230,49	145,6	0,74908	2,1681	14,2	40,5	575,1	0,4008	211,85	157,8	0,93248	2,3515	14,2	40,5	575,1	0,3684
228,87	133,6	0,56938	1,9884	14,2	40,5	575,1	0,3980	230,32	145,8	0,75208	2,1711	14,2	40,5	575,1	0,4005	211,28	158	0,93538	2,3544	14,2	40,5	575,1	0,3674
228,01	133,8	0,57238	1,9914	14,2	40,5	575,1	0,3965	230,57	146	0,75508	2,1741	14,2	40,5	575,1	0,4009	210,55	158,2	0,93828	2,3573	14,2	40,5	575,1	0,3661
227,28	134	0,57528	1,9943	14,2	40,5	575,1	0,3952	230,51	146,2	0,75818	2,1772	14,2	40,5	575,1	0,4008	209,88	158,4	0,94128	2,3603	14,2	40,5	575,1	0,3649
226,08	134,2	0,57828	1,9973	14,2	40,5	575,1	0,3931	230,14	146,4	0,76118	2,1802	14,2	40,5	575,1	0,4002	209,23	158,6	0,94428	2,3633	14,2	40,5	575,1	0,3638
224,85	134,4	0,58118	2,0002	14,2	40,5	575,1	0,3910	230,22	146,6	0,76428	2,1833	14,2	40,5	575,1	0,4003	208,53	158,8	0,94728	2,3663	14,2	40,5	575,1	0,3626
224,12	134,6	0,58418	2,0032	14,2	40,5	575,1	0,3897	229,92	146,8	0,76728	2,1863	14,2	40,5	575,1	0,3998	207,91	159	0,95028	2,3693	14,2	40,5	575,1	0,3615
223,62	134,8	0,58718	2,0062	14,2	40,5	575,1	0,3888	229,26	147	0,77028	2,1893	14,2	40,5	575,1	0,3986	207,07	159,2	0,95328	2,3723	14,2	40,5	575,1	0,3601
223,70	135	0,59018	2,0092	14,2	40,5	575,1	0,3890	228,40	147,2	0,77328	2,1923	14,2	40,5	575,1	0,3971	206,23	159,4	0,95628	2,3753	14,2	40,5	575,1	0,3586

LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)	LOAD (N)	TIME (s)	EXTENSION (mm)	EXTENTION POSITIVE (mm)	BASE (mm)	HEIGHT (mm)	AREA (mm^2)	STRESS (Mpa)
204,95	159,6	0,95938	2,3784	14,2	40,5	575,1	0,3564	200,19	171,8	1,14218	2,5612	14,2	40,5	575,1	0,3481	207,81	184	1,32538	2,7444	14,2	40,5	575,1	0,3613
203,44	159,8	0,96238	2,3814	14,2	40,5	575,1	0,3537	200,41	172	1,14518	2,5642	14,2	40,5	575,1	0,3485	208,08	184,2	1,32838	2,7474	14,2	40,5	575,1	0,3618
202,04	160	0,96548	2,3845	14,2	40,5	575,1	0,3513	200,80	172,2	1,14818	2,5672	14,2	40,5	575,1	0,3492	208,24	184,4	1,33128	2,7503	14,2	40,5	575,1	0,3621
201,07	160,2	0,96848	2,3875	14,2	40,5	575,1	0,3496	201,14	172,4	1,15118	2,5702	14,2	40,5	575,1	0,3497	208,17	184,6	1,33428	2,7533	14,2	40,5	575,1	0,3620
200,40	160,4	0,97148	2,3905	14,2	40,5	575,1	0,3485	201,35	172,6	1,15418	2,5732	14,2	40,5	575,1	0,3501	208,14	184,8	1,33718	2,7562	14,2	40,5	575,1	0,3619
200,00	160,6	0,97448	2,3935	14,2	40,5	575,1	0,3478	201,18	172,8	1,15728	2,5763	14,2	40,5	575,1	0,3498	208,00	185	1,34018	2,7592	14,2	40,5	575,1	0,3617
199,64	160,8	0,97738	2,3964	14,2	40,5	575,1	0,3471	200,55	173	1,16028	2,5793	14,2	40,5	575,1	0,3487	207,75	185,2	1,34318	2,7622	14,2	40,5	575,1	0,3612
199,34	161	0,98038	2,3994	14,2	40,5	575,1	0,3466	199,90	173,2	1,16328	2,5823	14,2	40,5	575,1	0,3476	207,64	185,4	1,34618	2,7652	14,2	40,5	575,1	0,3611
199,24	161,2	0,98338	2,4024	14,2	40,5	575,1	0,3464	199,35	173,4	1,16638	2,5854	14,2	40,5	575,1	0,3466	207,29	185,6	1,34918	2,7682	14,2	40,5	575,1	0,3604
199,07	161,4	0,98628	2,4053	14,2	40,5	575,1	0,3461	198,70	173,6	1,16938	2,5884	14,2	40,5	575,1	0,3455	206,31	185,8	1,35218	2,7712	14,2	40,5	575,1	0,3587
198,62	161,6	0,98928	2,4083	14,2	40,5	575,1	0,3454	198,06	173,8	1,17228	2,5913	14,2	40,5	575,1	0,3444	204,95	186	1,35518	2,7742	14,2	40,5	575,1	0,3564
198,53	161,8	0,99228	2,4113	14,2	40,5	575,1	0,3452	197,53	174	1,17528	2,5943	14,2	40,5	575,1	0,3435	203,40	186,2	1,35828	2,7773	14,2	40,5	575,1	0,3537
198,69	162	0,99528	2,4143	14,2	40,5	575,1	0,3455	197,21	174,2	1,17818	2,5972	14,2	40,5	575,1	0,3429	201,33	186,4	1,36128	2,7803	14,2	40,5	575,1	0,3501
198,82	162,2	0,99838	2,4174	14,2	40,5	575,1	0,3457	196,79	174,4	1,18128	2,6003	14,2	40,5	575,1	0,3422	199,10	186,6	1,36438	2,7834	14,2	40,5	575,1	0,3462
198,92	162,4	1,00138	2,4204	14,2	40,5	575,1	0,3459	196,38	174,6	1,18418	2,6032	14,2	40,5	575,1	0,3415	197,68	186,8	1,36728	2,7863	14,2	40,5	575,1	0,3437
198,67	162,6	1,00448	2,4235	14,2	40,5	575,1	0,3455	196,00	174,8	1,18718	2,6062	14,2	40,5	575,1	0,3408	196,60	187	1,37028	2,7893	14,2	40,5	575,1	0,3419
198,59	162,8	1,00748	2,4265	14,2	40,5	575,1	0,3453	195,83	175	1,19018	2,6092	14,2	40,5	575,1	0,3405	196,02	187,2	1,37328	2,7923	14,2	40,5	575,1	0,3408
198,57	163	1,01048	2,4295	14,2	40,5	575,1	0,3453	195,61	175,2	1,19318	2,6122	14,2	40,5	575,1	0,3401	195,87	187,4	1,37618	2,7952	14,2	40,5	575,1	0,3406
198,68	163,2	1,01348	2,4325	14,2	40,5	575,1	0,3455	195,59	175,4	1,19628	2,6153	14,2	40,5	575,1	0,3401	195,85	187,6	1,37918	2,7982	14,2	40,5	575,1	0,3405
198,68	163,4	1,01638	2,4354	14,2	40,5	575,1	0,3455	195,62	175,6	1,19938	2,6184	14,2	40,5	575,1	0,3401	195,86	187,8	1,38218	2,8012	14,2	40,5	575,1	0,3406
199,09	163,6	1,01938	2,4384	14,2	40,5	575,1	0,3462	195,43	175,8	1,20238	2,6214	14,2	40,5	575,1	0,3398	195,92	188	1,38518	2,8042	14,2	40,5	575,1	0,3407
199,34	163,8	1,02238	2,4414	14,2	40,5	575,1	0,3466	195,57	176	1,20538	2,6244	14,2	40,5	575,1	0,3401	196,12	188,2	1,38808	2,8071	14,2	40,5	575,1	0,3410
199,37	164	1,02528	2,4443	14,2	40,5	575,1	0,3467	195,39	176,2	1,20838	2,6274	14,2	40,5	575,1	0,3397	195,69	188,4	1,39118	2,8102	14,2	40,5	575,1	0,3403
199,40	164,2	1,02828	2,4473	14,2	40,5	575,1	0,3467	195,38	176,4	1,21138	2,6304	14,2	40,5	575,1	0,3397	195,19	188,6	1,39418	2,8132	14,2	40,5	575,1	0,3394
199,37	164,4	1,03128	2,4503	14,2	40,5	575,1	0,3467	195,49	176,6	1,21428	2,6333	14,2	40,5	575,1	0,3399	194,96	188,8	1,39718	2,8162	14,2	40,5	575,1	0,3390
199,41	164,6	1,03428	2,4533	14,2	40,5	575,1	0,3467	195,68	176,8	1,21728	2,6363	14,2	40,5	575,1	0,3403	195,01	189	1,40028	2,8193	14,2	40,5	575,1	0,3391
199,47	164,8	1,03728	2,4563	14,2	40,5	575,1	0,3468	195,73	177	1,22028	2,6393	14,2	40,5	575,1	0,3403	194,72	189,2	1,40328	2,8223	14,2	40,5	575,1	0,3386
199,38	165	1,04038	2,4594	14,2	40,5	575,1	0,3467	195,61	177,2	1,22318	2,6422	14,2	40,5	575,1	0,3401	194,61	189,4	1,40628	2,8253	14,2	40,5	575,1	0,3384
199,30	165,2	1,04338	2,4624	14,2	40,5	575,1	0,3465	195,82	177,4	1,22618	2,6452	14,2	40,5	575,1	0,3405	194,44	189,6	1,40928	2,8283	14,2	40,5	575,1	0,3381
199,39	165,4	1,04648	2,4655	14,2	40,5	575,1	0,3467	195,86	177,6	1,22918	2,6482	14,2	40,5	575,1	0,3406	194,70	189,8	1,41218	2,8312	14,2	40,5	575,1	0,3385
199,49	165,6	1,04938	2,4684	14,2	40,5	575,1	0,3469	195,98	177,8	1,23218	2,6512	14,2	40,5	575,1	0,3408	194,88	190	1,41518	2,8342	14,2	40,5	575,1	0,3389
199,63	165,8	1,05238	2,4714	14,2	40,5	575,1	0,3471	196,29	178	1,23528	2,6543	14,2	40,5	575,1	0,3413	194,78	190,2	1,41808	2,8371	14,2	40,5	575,1	0,3387
199,88	166	1,05528	2,4743	14,2	40,5	575,1	0,3476	196,46	178,2	1,23828	2,6573	14,2	40,5	575,1	0,3416	195,06	190,4	1,42108	2,8401	14,2	40,5	575,1	0,3392
200,23	166,2	1,05828	2,4773	14,2	40,5	575,1	0,3482	196,82	178,4	1,24138	2,6604	14,2	40,5	575,1	0,3422	195,16	190,49	1,42248	2,8415	14,2	40,5	575,1	0,3393
200,44	166,4	1,06128	2,4803	14,2	40,5	575,1	0,3485	196,88	178,6	1,24438	2,6634	14,2	40,5	575,1	0,3423								
200,90	166,6	1,06418	2,4832	14,2	40,5	575,1	0,3493	197,17	178,8	1,24738	2,6664	14,2	40,5	575,1	0,3428								
200,83	166,8	1,06718	2,4862	14,2	40,5	575,1	0,3492	197,41	179	1,25038	2,6694	14,2	40,5	575,1	0,3433								
199,87	167	1,07018	2,4892	14,2	40,5	575,1	0,3475	197,79	179,2	1,25328	2,6723	14,2	40,5	575,1	0,3439								
198,56	167,2	1,07318	2,4922	14,2	40,5	575,1	0,3453	198,17	179,4	1,25628	2,6753	14,2	40,5	575,1	0,3446								
198,16	167,4	1,07628	2,4953	14,2	40,5	575,1	0,3446	198,66	179,6	1,25928	2,6783	14,2	40,5	575,1	0,3454								
197,89	167,6	1,07928	2,4983	14,2	40,5	575,1	0,3441	199,06	179,8	1,26228	2,6813	14,2	40,5	575,1	0,3461								
197,72	167,8	1,08238	2,5014	14,2	40,5	575,1	0,3438	199,40	180	1,26528	2,6843	14,2	40,5	575,1	0,3467								
197,73	168	1,08538	2,5044	14,2	40,5	575,1	0,3438	199,91	180,2	1,26818	2,6872	14,2	40,5	575,1	0,3476								
197,51	168,2	1,08838	2,5074	14,2	40,5	575,1	0,3434	200,42	180,4	1,27128	2,6903	14,2	40,5	575,1	0,3485								
197,45	168,4	1,09138	2,5104	14,2	40,5	575,1	0,3433	201,18	180,6	1,27428	2,6933	14,2	40,5	575,1	0,3498								
197,33	168,6	1,09428	2,5133	14,2	40,5	575,1	0,3431	201,93	180,8	1,27728	2,6963	14,2	40,5	575,1	0,3511								
197,26	168,8	1,09728	2,5163	14,2	40,5	575,1	0,3430	202,70	181	1,28038	2,6994	14,2	40,5	575,1	0,3525								
197,31	169	1,10018	2,5192	14,2	40,5	575,1	0,3431	202,61	181,2	1,28338	2,7024	14,2	40,5	575,1	0,3523								
197,24	169,2	1,10318	2,5222	14,2	40,5	575,1	0,3430	202,88	181,4	1,28638	2,7054	14,2	40,5	575,1	0,3528								
197,50	169,4	1,10618	2,5252	14,2	40,5	575,1	0,3434	203,02	181,6	1,28938	2,7084	14,2	40,5	575,1	0,3530								
197,85	169,6	1,10918	2,5282	14,2	40,5	575,1	0,3440	203,25	181,8	1,29238	2,7114	14,2	40,5	575,1	0,3534								
198,26	169,8	1,11218	2,5312	14,2	40,5	575,1	0,3447	203,52	182	1,29528	2,7143	14,2	40,5	575,1	0,3539								
198,77	170	1,11518	2,5342	14,2	40,5	575,1	0,3456	204,43	182,2	1,29828	2,7173	14,2	40,5	575,1	0,3555								
199,16	170,2	1,11828	2,5373	14,2	40,5	575,1	0,3463	205,15	182,4	1,30118	2,7202	14,2	40,5	575,1	0,3567								
199,51	170,4	1,12128	2,5403	14,2	40,5	575,1	0,3469	205,87	182,6	1,30418	2,7232	14,2	40,5	575,1	0,3580								
200,22	170,6	1,12428	2,5433	14,2	40,5	575,1	0,3481	206,46	182,8	1,30718	2,7262	14,2	40,5	575,1	0,3590								
200,04	170,8	1,12738	2,5464	14,2	40,5	575,1	0,3478	207,01	183	1,31018	2,7292	14,2	40,5	575,1	0,3600								
199,90	171	1,13038	2,5494	14,2	40,5	575,1	0,3476	207,32	183,2	1,31318	2,7322	14,2	40,5	575,1	0,3605								
199,86	171,2	1,13328	2,5523	14,2	40,5	575,1	0,3475	207,73	183,4	1,31618	2,7352	14,2	40,5	575,1	0,3612								
199,90	171,4	1,13628	2,5553	14,2	40,5	575,1	0,3476	207,88	183,6	1,31928	2,7383	14,2	40,5	575,1	0,3615								
199,96	171,6	1,13918	2,5582	14,2	40,5	575,1	0,3477	207,70	183,8	1,32228	2,7413	14,2	40,5	575,1	0,3612								

3.3.1.6-P Mix. Proportion Tests
32.5R - 20:2:1 - Average





BREAK POINTS		INDIREC TRACTION	
LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)
179,8933	2,0674	0,05	0
180,3567	2,072433333	0,08	0,004866667
180,8	2,077433333	0,093333	0,009866667
181,2267	2,082433333	0,11	0,014866667
181,66	2,087433333	0,12	0,019866667
182,0167	2,092466667	0,153333	0,0248
182,4967	2,097433333	0,176667	0,0297
182,83	2,102466667	0,213333	0,034733333
183,1033	2,107466667	0,23	0,0397
183,2767	2,112466667	0,256667	0,044766667
183,4433	2,117433333	0,296667	0,049833333
183,2833	2,122466667	0,32	0,054766667
182,7067	2,1274	0,346667	0,059733333
181,9767	2,132366667	0,363333	0,064666667
181,2767	2,137366667	0,396667	0,069633333
180,6633	2,142466667	0,426667	0,074633333
180,1633	2,147433333	0,45	0,0797
179,8733	2,1525	0,473333	0,084766667
179,7533	2,1575	0,503333	0,089733333
179,61	2,1625	0,533333	0,094666667
179,4833	2,167466667	0,56	0,099633333
		0,573333	0,104666667
		0,606667	0,1097
		0,636667	0,1148
		0,663333	0,119766667
		0,696667	0,124766667
		0,723333	0,129666667
		0,753333	0,134633333
		0,783333	0,139633333
		0,813333	0,144666667
		0,826667	0,149733333
		0,856667	0,1547
		0,866667	0,1597
		0,883333	0,164633333
		0,906667	0,169666667
		0,926667	0,1747
		0,936667	0,179766667
		0,946667	0,184766667
		0,96	0,189733333
		0,98	0,1947
		0,996667	0,199633333
		1,026667	0,204633333
		1,03	0,209633333
		1,053333	0,2147
		1,056667	0,2197
		1,073333	0,224666667
		1,08	0,2296
		1,1	0,234633333
		1,096667	0,239633333
		1,103333	0,2447
		1,11	0,249766667
		1,106667	0,254733333
		1,116667	0,2597
		1,116667	0,264566667
		1,13	0,269566667
		1,143333	0,2746
		1,14	0,279666667
		1,153333	0,284633333
		1,153333	0,289633333
		1,173333	0,294566667

INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION		INDIREC TRACTION	
LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)	LOAD (N)	EXTENTION POSITIVE (mm)
1,166667	0,299533333	1,266667	0,599666667	1,41	0,899666667	18,85333	1,1996	78,25333	1,499533333	99,1	1,799533333	106,11	2,0995	94,27	2,399466667	140,04	2,699433333
1,176667	0,304533333	1,263333	0,604666667	1,433333	0,904666667	19,89667	1,2046	78,58667	1,504533333	98,87333	1,804533333	105,8067	2,1045	94,53	2,4045	140,4967	2,7045
1,18	0,309666667	1,266667	0,609733333	1,446667	0,9097	20,98	1,209666667	78,96	1,509633333	98,97	1,809566667	105,35	2,1096	95,26333	2,409533333	141,1067	2,709566667
1,186667	0,3147	1,273333	0,6148	1,48	0,9148	22,14333	1,214733333	79,32667	1,514666667	99,19333	1,814633333	105,1133	2,114666667	95,88333	2,4146	141,85	2,7146
1,193333	0,319666667	1,283333	0,619833333	1,503333	0,919766667	23,35	1,2197	79,65667	1,5197	99,36333	1,8196	104,8867	2,1196	96,71333	2,419566667	142,4333	2,719533333
1,186667	0,324633333	1,283333	0,624766667	1,533333	0,9247	24,55	1,224633333	80,04667	1,5246	99,62333	1,824533333	104,65	2,1245	97,33	2,4245	143,0767	2,7245
1,193333	0,329533333	1,286667	0,629733333	1,496667	0,929666667	25,89333	1,229566667	80,41667	1,529533333	99,96	1,829566667	104,5467	2,129466667	97,92	2,429466667	143,6533	2,729433333
1,2	0,334533333	1,306667	0,634733333	1,52	0,9346	27,28333	1,234566667	80,92333	1,534533333	100,2867	1,834533333	104,5267	2,1345	98,71333	2,4345	144,1967	2,734433333
1,19	0,339533333	1,31	0,639766667	1,543333	0,939633333	28,75667	1,2396	81,48	1,539533333	100,5967	1,839633333	104,1033	2,1395	99,48	2,439566667	144,7467	2,739466667
1,19	0,3446	1,313333	0,644866667	1,563333	0,9447	30,17333	1,2447	82,07667	1,5446	100,8433	1,844666667	99,38667	2,144533333	100,3833	2,444633333	144,8	2,744533333
1,193333	0,349633333	1,32	0,6499	1,586667	0,949733333	31,49667	1,2497	82,6	1,549633333	100,9967	1,8497	95,24333	2,149566667	101,1033	2,449633333	145,0167	2,749566667
1,186667	0,354566667	1,323333	0,6549	1,613333	0,954733333	32,76333	1,2547	83,12333	1,5546	101,11	1,854633333	95,14	2,154533333	101,9	2,454566667	145,35	2,7545
1,193333	0,359566667	1,313333	0,6598	1,643333	0,959666667	33,82667	1,259633333	83,68333	1,559566667	101,29	1,8596	95,49	2,159533333	102,7567	2,459533333	145,55	2,759433333
1,2	0,364533333	1,323333	0,664733333	1,7	0,964666667	34,85333	1,264566667	84,41667	1,564533333	101,55	1,864533333	95,93333	2,1645	103,71	2,4645	145,7633	2,764433333
1,196667	0,3695	1,32	0,6697	1,783333	0,969666667	36,02	1,269566667	85,09333	1,569566667	101,8067	1,869566667	96,41667	2,1695	104,5267	2,469466667	145,99	2,769466667
1,2	0,374533333	1,323333	0,674733333	1,766667	0,974733333	37,18333	1,2746	85,83	1,574633333	102,1	1,874566667	96,89333	2,1746	105,2367	2,474533333	146,31	2,7745
1,2	0,379633333	1,326667	0,679833333	1,776667	0,9798	38,22	1,279666667	86,52333	1,579666667	102,3867	1,8796	97,21	2,179633333	106,01	2,4796	146,4667	2,779633333
1,196667	0,384633333	1,336667	0,684833333	1,873333	0,9848	39,15667	1,2846	87,21333	1,5847	102,5333	1,884633333	97,43333	2,184666667	106,6567	2,484566667	146,4833	2,784566667
1,196667	0,3896	1,343333	0,6898	1,926667	0,989766667	40,17	1,289633333	87,89333	1,589633333	102,58	1,889566667	97,27	2,189633333	107,1867	2,4895	146,2967	2,7895
1,203333	0,394533333	1,336667	0,694733333	1,916667	0,994733333	41,15333	1,294566667	88,54667	1,594566667	102,7067	1,8945	97,21	2,194533333	107,8467	2,4945	146,4067	2,794466667
1,206667	0,399533333	1,34	0,699766667	2,05	0,999666667	42,17333	1,2996	89,23333	1,599533333	102,9333	1,899533333	97,34667	2,199533333	108,4733	2,4995	146,6733	2,799433333
1,203333	0,4045	1,336667	0,7048	2,18	1,004666667	43,18667	1,3046	89,87333	1,604566667	103,07	1,9046	97,30667	2,204666667	109,1767	2,504533333	146,7633	2,804466667
1,203333	0,409533333	1,34	0,709833333	2,34	1,0097	43,99333	1,309633333	90,51667	1,6096	103,29	1,909633333	97,36667	2,209566667	109,8267	2,509633333	146,8433	2,809533333
1,213333	0,4146	1,346667	0,714866667	2,4	1,014766667	44,84667	1,3147	91,02	1,614633333	103,5467	1,914666667	97,31333	2,214633333	110,0133	2,514666667	146,97	2,814566667
1,203333	0,419566667	1,356667	0,7199	2,48	1,019766667	45,68667	1,3197	91,53333	1,619633333	103,7	1,919633333	96,92667	2,2196	110,5167	2,5196	146,7233	2,819533333
1,203333	0,4245	1,35	0,724833333	2,82	1,0247	46,65667	1,3246	91,96667	1,624533333	103,8233	1,9246	96,74667	2,224533333	111,1	2,524533333	146,7867	2,824466667
1,22	0,429466667	1,343333	0,729833333	3,17	1,029666667	47,78	1,329533333	92,36667	1,629533333	103,9933	1,9295	96,57667	2,229566667	111,73	2,529466667	146,87	2,829466667
1,206667	0,4345	1,346667	0,734733333	3,393333	1,034666667	48,95	1,3345	92,87	1,634533333	104,19	1,9345	96,11333	2,234566667	111,7133	2,534466667	147,2167	2,8345
1,203333	0,439533333	1,36	0,739766667	3,55	1,0397	50,26333	1,339533333	93,46	1,639533333	104,37	1,939533333	95,07	2,239566667	111,8067	2,5395	147,63	2,839533333
1,213333	0,444633333	1,356667	0,744833333	3,676667	1,0448	51,55	1,3446	93,95333	1,644633333	104,3033	1,9446	94,73333	2,2447	112,2033	2,544566667	147,8967	2,843433333
1,223333	0,449666667	1,366667	0,749866667	3,76	1,049833333	52,78667	1,349633333	94,41333	1,649666667	104,0467	1,949566667	94,48667	2,2497	112,7967	2,5496		
1,216667	0,4546	1,363333	0,754833333	3,873333	1,0548	53,71	1,3546	94,86	1,654633333	103,7467	1,954566667	94,20333	2,254633333	113,5167	2,554533333		
1,223333	0,459533333	1,38	0,759766667	4,096667	1,059733333	54,85	1,359533333	95,32	1,659566667	103,56	1,959533333	94,08	2,259566667	114,0433	2,559466667		
1,21	0,464533333	1,38	0,764766667	4,41	1,064733333	56,03333	1,364533333	95,75	1,664533333	103,3867	1,964533333	94,10333	2,264533333	114,9	2,564466667		
1,213333	0,4695	1,376667	0,7698	4,77	1,069633333	57,3	1,369533333	96,13333	1,669466667	103,27	1,969533333	94,14	2,2695	115,99	2,5695		
1,216667	0,474566667	1,37	0,774833333	5,146667	1,0747	58,59	1,374633333	96,63667	1,674533333	103,28	1,9746	94,23333	2,274566667	117,1333	2,5746		
1,22	0,479633333	1,376667	0,7799	5,493333	1,079766667	59,93	1,3797	97,09667	1,6796	103,4333	1,9796	94,32	2,279633333	118,2333	2,579633333		
1,216667	0,484633333	1,37	0,7849	5,84	1,084766667	61,16	1,3847	97,46333	1,6846	103,5867	1,984633333	94,41333	2,284633333	119,1633	2,5846		
1,223333	0,4896	1,38	0,789866667	6,16	1,089733333	62,37667	1,3896	97,73	1,689566667	103,6533	1,989566667	94,44333	2,289566667	119,84	2,589533333		
1,23	0,494566667	1,386667	0,794766667	6,433333	1,094733333	63,59333	1,394566667	98,11667	1,694566667	103,6833	1,9945	94,18333	2,294533333	120,7	2,594466667		
1,223333	0,499566667	1,373333	0,799733333	6,69	1,0997	64,74667	1,399566667	98,34667	1,699566667	103,9433	1,999466667	93,99333	2,299533333	121,7167	2,599466667		
1,226667	0,5046	1,38	0,804733333	6,976667	1,104733333	65,91	1,404533333	98,64	1,7046	104,23	2,0045	94,32667	2,304533333	122,77	2,604466667		
1,23	0,509666667	1,383333	0,809733333	7,243333	1,109766667	67,09667	1,409566667	98,96333	1,709633333	104,58	2,009566667	94,60333	2,309633333	123,97	2,609533333		
1,216667	0,514733333	1,366667	0,8148	7,506667	1,114833333	68,24	1,4146	99,21	1,7147	104,79	2,014533333	94,66667	2,3147	124,9367	2,614566667		
1,223333	0,519733333	1,37	0,8198	7,803333	1,1198	69,16	1,4196	99,43333	1,719666667	104,95	2,0195	94,7	2,319633333	125,7133	2,6195		
1,23	0,524666667	1,386667	0,824733333	8,35	1,124733333	69,97667	1,424533333	99,67333	1,724633333	105,09	2,024466667	94,47	2,324566667	126,52	2,624433333		
1,223333	0,5296	1,383333	0,829666667	8,9	1,1297	70,68333	1,429533333	99,72667	1,729566667	105,1067	2,029433333	94,38	2,329533333	127,3833	2,629433333		
1,23	0,5346	1,366667	0,8347	9,396667	1,134633333	71,32333	1,434533333	99,76	1,734533333	105,3067	2,034466667	94,19667	2,3345	128,2733	2,634433333		
1,236667	0,539633333	1,36	0,839733333	9,823333	1,139666667	71,97333	1,439566667	99,98667	1,739566667	105,62	2,0395	93,73667	2,339566667	129,2367	2,639533333		
1,243333	0,544633333	1,376667	0,8448	10,34	1,1447	72,65333	1,444633333	100,18	1,7446	105,8633	2,0446	93,17333	2,344633333	130,3233	2,6446		
1,233333	0,549733333	1,386667	0,849866667	10,96	1,149733333	73,22	1,449666667	100,2367	1,749633333	105,9867	2,0496	92,73	2,3496	131,3667	2,6496		
1,246667	0,554666667	1,396667	0,854833333	11,59333	1,154666667	73,79	1,4546	99,89333	1,754566667	106,12	2,054566667	92,55333	2,354566667	132,3567	2,654533333		
1,236667	0,559633333	1,393333	0,859766667	12,12333	1,159633333	74,43333	1,4596	99,46333	1,759533333	106,3667	2,0595	92,41	2,359533333	133,38	2,659466667		
1,243333	0,5646	1,383333	0,8647	12,72333	1,164633333	74,99333	1,4645	98,97667	1,7645	106,5967	2,064466667	92,48	2,364533333	134,39	2,664433333		
1,233333	0,569633333	1,39	0,869666667	13,53	1,169633333	75,57333	1,469533333	98,73667	1,769566667	106,81	2,069433333	92,74333	2,369533333	135,35	2,6694		
1,243333	0,5747	1,403333	0,874733333	14,42	1,1747	76,18333	1,474566667	98,7	1,7746	107,0267	2,0745	93,00667	2,374633333	136,3267	2,674466667		
1,253333	0,579766667	1,406667	0,879766667	15,20667	1,179766667	76,67667	1,479633333	98,74333	1,779666667	107,2167	2,0796	93,36333	2,379666667	137,0733	2,679533333		
1,246667	0,584833333	1,42	0,884766667	16,04333	1,184766667	77,11667	1,4846	98,81667	1,784666667	107,2133	2,084566667	93,63667	2,384666667	137,8433	2,6845		
1,253333	0,589766667	1,413333	0,8897	16,97333	1,189733333	77,47	1,489533333	98,87333	1,789633333	106,9733	2,0895	93,68	2,3896	138,67	2,689433333		
1,25	0,5947	1,41	0,894633333	17,89333	1,194666667	77,89	1,494533333	99,03667	1,794566667	106,61	2,094466667	93,99667	2,394533333	139,38	2,694433333		

5.2 Reference Fissure Widths

REF FISSURE WIDTHS

REF1		REF2		REF3		REF4	
Crack width [µm] on 12/10/2021	Crack width [µm] on 18/11/2021	Crack width [µm] on 12/10/2021	Crack width [µm] on 18/11/2021	Crack width [µm] on 12/10/2021	Crack width [µm] on 18/11/2021	Crack width [µm] on 12/10/2021	Crack width [µm] on 18/11/2021
301	95	359	63	346	190	368	52
294	63	296	26	309	118	263	27
264	45	347	25	290	79	255	28
278	37	231	24	329	148	239	26
282	24	263	21	318	84	246	78
271	45	330	22	283	143	233	32
281	40	357	82	338	121	232	28
294	76	320	68	338	137	257	33
281	96	269	52	304	155	277	42
287	34	333	7	318	164	267	30
278	80	326	29	308	150	256	25
298	66	323	14	299	132	275	32
298	137	407	57	292	148	255	27
286	84	329	113	318	164	261	20
292	39	348	62	319	132	217	36
Mean		Mean		Mean		Mean	
285,7	**64,1**	**319,9**	43,0	311,6	133,9	252,4	33,1
Standard deviation		Standard deviation		Standard deviation		Standard deviation	
10,6	30,8	44,0	30,3	17,1	26,2	17,2	13,9

Scheda di dati di sicurezza
ai sensi del regolamento 1907/2006/CE, Articolo 31

Stampato il: 03.05.2020 Numero versione 36 Revisione: 30.04.2020

SEZIONE 1: Identificazione della sostanza o della miscela e della società/ impresa

· **1.1 Identificatore del prodotto**

· **Denominazione commerciale:** BK ACCRAP FPB 2X15ML A1*12 IT
· **1.2 Usi identificati pertinenti della sostanza o della miscela e usi sconsigliati**
Non sono disponibili altre informazioni.
· **Utilizzazione della Sostanza / del Preparato** Adesivo

· **1.3 Informazioni sul fornitore della scheda di dati di sicurezza**
· **Produttore/fornitore:**
Bison International
Dr.A.F.Philipsstraat 9
NL-4462 EW Goes
PO Box 160
NL-4460 AD Goes
tel. +31 88 3235700
fax. +31 88 3235800
e mail: sds@boltonadhesives.com

UHU BOSTIK S.p.A. - Via G.B. Pirelli, 19 - 20124 Milano
Tel. +39.02.6775.08 Fax +39.02.6775.481
mail@uhubostik.it

· **Informazioni fornite da:** Marketing UHU BOSTIK
· **1.4 Numero telefonico di emergenza:** Centro Antiveleni di Milano: 0266101029

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SEZIONE 2: Identificazione dei pericoli

· **2.1 Classificazione della sostanza o della miscela**
· **Classificazione secondo il regolamento (CE) n. 1272/2008**


GHS09 ambiente

Aquatic Chronic 2 H411 Tossico per gli organismi acquatici con effetti di lunga durata.


GHS07

Skin Irrit. 2	H315 Provoca irritazione cutanea.
Eye Irrit. 2	H319 Provoca grave irritazione oculare.
Skin Sens. 1	H317 Può provocare una reazione allergica cutanea.

· **2.2 Elementi dell'etichetta**
· **Etichettatura secondo il regolamento (CE) n. 1272/2008**
Il prodotto è classificato ed etichettato conformemente al regolamento CLP.
· **Pittogrammi di pericolo**


GHS07 GHS09

(continua a pagina 2)

References
-Bostik, n.d. Acciaio Rapido® Adesivo (epossidico) bicomponente di color metallo ed extra-forte. [ebook] Milan, Italy: Bostik. Available at: <https://www.bostik.it/prodotti/bostik-acciaio-rapido?gclid=CjwKCAiAuvOPBhBXARIsAKzLQ8HDnCBXNiMydFSa2sy68SgoeWFePPl470vlVYboJcNxKFHamigWfgYaAs46EALw_wcB> [Accessed 5 February 2022].

Scheda di dati di sicurezza
ai sensi del regolamento 1907/2006/CE, Articolo 31

Stampato il: 03.05.2020 Numero versione 36 Revisione: 30.04.2020

Denominazione commerciale: BK ACCRAP FPB 2X15ML A1*12 IT

(Segue da pagina 1)

· **Avvertenza** Attenzione

· **Componenti pericolosi che ne determinano l'etichettatura:**
prodotto di reazione: bisfenolo-A-epicloridrina resine epossidiche (peso molecolare medio ≤ 700)
2-Propenoic acid, reaction products with dipentaerythritol
prodotto di reazione: bisfenolo-F-epicloridrina resine epossidiche (peso molecolare medio ≤ 700)
· **Indicazioni di pericolo**
H315 Provoca irritazione cutanea.
H319 Provoca grave irritazione oculare.
H317 Può provocare una reazione allergica cutanea.
H411 Tossico per gli organismi acquatici con effetti di lunga durata.
· **Consigli di prudenza**

P101	In caso di consultazione di un medico, tenere a disposizione il contenitore o l'etichetta del prodotto.
P102	Tenere fuori dalla portata dei bambini.
P261	Evitare di respirare i vapori.
P280	Indossare guanti di protezione / occhiali di protezione.
P302+P352	IN CASO DI CONTATTO CON LA PELLE: Lavare abbondantemente con acqua e sapone.
P305+P351+P338	IN CASO DI CONTATTO CON GLI OCCHI: sciacquare accuratamente per parecchi minuti. Togliere le eventuali lenti a contatto se è agevole farlo. Continuare a sciacquare.
P501	Smaltire il prodotto/recipiente in conformità con le disposizioni nazionali.

· **Ulteriori dati:**
Contiene componenti epossidici. Può provocare una reazione allergica.
· **Etichettatura di imballaggi che non contengono una quantità superiore a 125 ml**
· **Pittogrammi di pericolo**



GHS07 GHS09

· **Avvertenza** Attenzione

· **Componenti pericolosi che ne determinano l'etichettatura:**
prodotto di reazione: bisfenolo-A-epicloridrina resine epossidiche (peso molecolare medio ≤ 700)
2-Propenoic acid, reaction products with dipentaerythritol
prodotto di reazione: bisfenolo-F-epicloridrina resine epossidiche (peso molecolare medio ≤ 700)
· **Indicazioni di pericolo**
H317 Può provocare una reazione allergica cutanea.
· **Consigli di prudenza**

P101	In caso di consultazione di un medico, tenere a disposizione il contenitore o l'etichetta del prodotto.
P102	Tenere fuori dalla portata dei bambini.
P261	Evitare di respirare i vapori.
P280	Indossare guanti di protezione / occhiali di protezione.
P302+P352	IN CASO DI CONTATTO CON LA PELLE: Lavare abbondantemente con acqua e sapone.
P305+P351+P338	IN CASO DI CONTATTO CON GLI OCCHI: sciacquare accuratamente per parecchi minuti. Togliere le eventuali lenti a contatto se è agevole farlo. Continuare a sciacquare.

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Scheda di dati di sicurezza
ai sensi del regolamento 1907/2006/CE, Articolo 31

Stampato il: 03.05.2020 Numero versione 36 Revisione: 30.04.2020

Denominazione commerciale: BK ACCRAP FPB 2X15ML A1*12 IT

(Segue da pagina 2)

P501 Smaltire il prodotto/recipiente in conformità con le disposizioni nazionali.
· **2.3 Altri pericoli**
· **Risultati della valutazione PBT e vPvB**
· **PBT:** Non applicabile.
· **vPvB:** Non applicabile.

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SEZIONE 3: Composizione/informazioni sugli ingredienti

· **3.2 Miscele**
· **Descrizione:**
Miscela delle seguenti sostanze con additivi non pericolosi.
Adesivo

· **Sostanze pericolose:**

CAS: 25068-38-6 NLP: 500-033-5 Numero indice: 603-074-00-8 Reg.nr.: 01-2119456619-26-XXXX	prodotto di reazione: bisfenolo-A-epicloridrina resine epossidiche (peso molecolare medio ≤ 700) Aquatic Chronic 2, H411; Skin Irrit. 2, H315; Eye Irrit. 2, H319; Skin Sens. 1, H317	25-50%
CAS: 1384855-91-7 Numeri CE: 800-838-4	2-Propenoic acid, reaction products with dipentaerythritol Eye Irrit. 2, H319; Skin Sens. 1A, H317; Aquatic Chronic 3, H412	25-50%
CAS: 9003-36-5 NLP: 500-006-8 Reg.nr.: 01-2119454392-40-xxxx	prodotto di reazione: bisfenolo-F-epicloridrina resine epossidiche (peso molecolare medio ≤ 700) Aquatic Chronic 2, H411; Skin Irrit. 2, H315; Skin Sens. 1, H317	10-25%

· **Ulteriori indicazioni:** Il testo dell'avvertenza dei pericoli citati può essere appreso dal capitolo 16

SEZIONE 4: Misure di primo soccorso

· **4.1 Descrizione delle misure di primo soccorso**
· **Indicazioni generali:** Non sono necessari provvedimenti specifici.
· **Inalazione:**
Portare il soggetto in zona molto ben areata e per sicurezza consultare un medico.
Se il soggetto è svenuto provvedere a tenerlo durante il trasporto in posizione stabile su un fianco.
· **Contatto con la pelle:** Lavare immediatamente con acqua e sapone sciacquando accuratamente.
· **Contatto con gli occhi:**
Lavare con acqua corrente per diversi minuti tenendo le palpebre ben aperte Se persiste il dolore consultare il medico.
· **Ingestione:** Se il dolore persiste consultare il medico.
· **4.2 Principali sintomi ed effetti, sia acuti che ritardati** Non sono disponibili altre informazioni.
· **4.3 Indicazione dell'eventuale necessità di consultare immediatamente un medico e di trattamenti speciali**
Non sono disponibili altre informazioni.

IT-IT

(continua a pagina 4)

Scheda di dati di sicurezza
ai sensi del regolamento 1907/2006/CE, Articolo 31

Stampato il: 03.05.2020 Numero versione 36 Revisione: 30.04.2020

Denominazione commerciale: BK ACCRAP FPB 2X15ML A1*12 IT

(Segue da pagina 3)

SEZIONE 5: Misure antincendio

· **5.1 Mezzi di estinzione**
· **Mezzi di estinzione idonei:** Adottare provvedimenti antiincendio nei dintorni della zona colpita.
· **5.2 Pericoli speciali derivanti dalla sostanza o dalla miscela**
Non sono disponibili altre informazioni.
· **5.3 Raccomandazioni per gli addetti all'estinzione degli incendi**
· **Mezzi protettivi specifici:** Non sono richiesti provvedimenti particolari.

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SEZIONE 6: Misure in caso di rilascio accidentale

· **6.1 Precauzioni personali, dispositivi di protezione e procedure in caso di emergenza**
Non necessario.
· **6.2 Precauzioni ambientali:**
In caso di infiltrazione nei corpi d'acqua o nelle fognature avvertire le autorità competenti.
Impedire infiltrazioni nella fognatura/nelle acque superficiali/nelle acque freatiche.
· **6.3 Metodi e materiali per il contenimento e per la bonifica:**
Effettuare il recupero o lo smaltimento in appositi serbatoi.
Raccogliere il liquido con materiale assorbente (sabbia, tripoli, legante di acidi, legante universale, segatura).
Provvedere ad una sufficiente areazione.
· **6.4 Riferimento ad altre sezioni**
Per informazioni relative ad un manipolazione sicura, vedere capitolo 7.
Per informazioni relative all'equipaggiamento protettivo ad uso personale vedere Capitolo 8.
Per informazioni relative allo smaltimento vedere Capitolo 13.

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SEZIONE 7: Manipolazione e immagazzinamento

· **7.1 Precauzioni per la manipolazione sicura**
Accurata ventilazione/aspirazione nei luoghi di lavoro.
Evitare la formazione di aerosol.
· **Indicazioni in caso di incendio ed esplosione:** Non sono richiesti provvedimenti particolari.

· **7.2 Condizioni per lo stoccaggio sicuro, comprese eventuali incompatibilità**
· **Stoccaggio:**
· **Requisiti dei magazzini e dei recipienti:** Non sono richiesti requisiti particolari.
· **Indicazioni sullo stoccaggio misto:** Non necessario.
· **Ulteriori indicazioni relative alle condizioni di immagazzinamento:**
Mantenere i recipienti ermeticamente chiusi.
· **Classe di stoccaggio:** 10
· **7.3 Usi finali particolari** Non sono disponibili altre informazioni.

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SEZIONE 8: Controllo dell'esposizione/protezione individuale

· **Ulteriori indicazioni sulla struttura di impianti tecnici:** Nessun dato ulteriore, vedere punto 7.

(continua a pagina 5)