RE-AGRO-BUILDING

Urban Agriculture

TORINO

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POLITECNICO
DI TORINO

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Master Course in Architecture for sustainable design

Thesis Green Deal: urban agriculture

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CONTENT

ABSTRACT

I started final thesis project in unusual situation - Covid-19 lockdown 2020 - and it makes you think of what's important in your life. During the lockdown few stores were open: farmacies and supermarkets. Food is essential part of a human life and yet most of it's production stays away and remains invisible to a regular city dweller, being grown sometimes thousand kilometers away. Climate change implies that unsustainable relationship between city and field will need to be reconsidered. Cities can not fully depend on self-subsistence today, but they can increase the share of self-production at urban level, integrating into urban tissue and leting farm function in collaboration with other activities.

Current thesis develops a project that builds relationship between student living, studying areas (student dormitory) and indoor urban farm. This design proposes a solution of how to integrate innovative urban agriculture center in student space so it would be not separate, invisible part of the building but could be a source of inpiration for young people that witness new ways in agriculture. Project designed also to be a place that encourage students/graduates to participate in project, become more interested in what we consume and more educated on food influence on the planet.

Cantine is a natural meeting point between farm and people, in this case would be also an experimental laboratory where people could try new sorts of vegatables and give immediate feedback to research part of the farm, also contributing to the project by buying fresh and local meals.

This project is meant to be circully connected place, where students and agriculture workers constantly exchange ideas, work closely together, being a source of innovative ideas and methods in this new, growing branch of urban agriculture.

In the first part of the thesis I describe what are current problems with sustainability in modern approach to agriculture today.

Overpopulation in the world means need to feed 3 billion more people by 2050, while 70 percent of them would be living not in the rural traditional agricultural areas but in cities, applying more pressure on current food distribution.[1]

"Food miles" that are words that describe road food makes from fiels to table and nowadays it's longer than ever. It contributes to oil-based use that spent on extensive ways of growing food, keeping it fresh and delivering from one point of the globe to another. Placing agriculture in the place of consumption would be one way of adressing the problem.

Therefore, indoor farms located in post-industrial/abandoned buildings in city could be one of the design options. In the first part of the thesis I would want to present some study cases related to urban agriculture, that study how different ways of joining urban agriculture with different acivities as office, residence, park, retirement center, hotel.

With this thesis I would like to propose indoor urban farm co-existing with student dormitory, that is a way to rethink relationship between city and agriculture, renew connections between young generation and sustainable food production, estimate food produced and energy spent as well as to take into consideration intangible social benefits of indoor urban farm open to students.

Indoor urban farm project involves hydroponic leed lightning system that uses energy of roof located solar panels.

Second part of the Thesis shows project location in urban scale, shows analysis of location, mobility, climate, geography and society. This part of the project includes review of already existing structure on via Nizza 10 and proposal for renewal that includes interior changes in order to reuse old building that was designed as Post office (Palazzo delle Poste) and breath new life into it as mix-use building with indoor urban farm in connection with cantine, student dormitory and ground level retail space (retail includes caffes, restorant, local food shop).

INRODUCTION

This thesis propose reuse of abandoned building for creation of student dormitory combined with commercial and non-profit urban farms.
Benefits of indoor plants in cohabitants with students presented in:

- ability of plants to absorb CO2 and produce O2
- hyperlocal production of food for dormitory and locals (in radius of 3 km)
- creation of part-time jobs for students
- positive effects on concentration, overall health and level of stress

Indoor plants are known to confer significant psychological and physical benefits to individuals living/working in environments where they are present [e.g., reduced stress, increased task performance, and decreased symptoms of ill health (Bringslimark et al., 2007; Son, 2004). Based on this and other studies, plants also have the potential to significantly improve the quality of indoor air.

Much of the literature on indoor plants treats their benefits as outcomes of psychological restoration. Restoration processes involve the renewal of psychological and physiological resources that normally become depleted in meeting ordinary demands (Hartig, 2004). The two restoration processes commonly cited in the literature on indoor plants concern recovery from an inability to concentrate characteristic of attentional fatigue (Kaplan, 1995) and recovery from the elevated physiological arousal and negative emotions characteristic of acute stress (Ulrich et al., 1991). In these processes, indoor plants are seen as features of the indoor environment that attract attention without effort and evoke positive emotions that can respectively promote renewal of the capacity to concentrate and interrupt the stress process. Note that attentional fatigue may contribute to stress; the person cannot concentrate well enough to meet demands, which the person then experiences as excessive and more stressful (Kaplan, 1995). It follows that directed attention restoration might play a role in reducing stress. Previous

experimental studies suggest that the effects of plants are greater for those who have relatively high levels of stress (e.g., Kim and Mattson, 2002).[2]

- ability to absorb VOC (volatile organic compounds) therefore lovering level of pollution
al., 1997; Orwell et al., 2006). Plants remove VOCs from indoor air through stomatal uptake, absorption, and adsorption to plant surfaces (Beattie and Seibel, 2007; Korte et al., 2000; Sandhu et al., 2007).

The importance of indoor air quality to human health has become of increasing interest in developed countries where inhabitants often spend over 90% of their time indoors (Jenkins et al., 1992; Snyder, 1990). Indoor air has been reported to be as much as 12 times more polluted than that outdoors (Ingrosso, 2002; Orwell et al., 2004; Zabiega1a, 2006). Indoor air pollutants primarily originate from building product emissions, human activities inside the building, and infiltration of outdoor air (Wolkoff and Nielsen, 2001; Zabiega1a, 2006) and have increased as a result of the lower gas exchange rates of newer, more energy-efficient buildings (Cohen, 1996). Indoor air pollutants include volatile organic compounds (VOCs), particulate matter, ozone, radon, lead, and biological contaminants (Destaillats et al., 2008). Exposure can cause acute illnesses (e.g., asthma, nausea) and chronic diseases (e.g., cancer, immunologic, neurologic, reproductive, developmental, and respiratory disorders) (Suh et al., 2000).[3]

- increasing quality of rest in resting areas

Aim of this project is to propose design solution in combining productive green spaces with student dormitory and overall combining commercial urban farm, retail area and student dormitory in already existing structure in centre of Turin, Italy, calculating outcomes in amounts of food produces, number of job created, CO2 absorbed. Design includes analysis part in urban scale analysing strenghs, weaknesses, opportunities and threads in chosen cite and analysis of existing or temporary existed case studies for indoor urban farm, student dormitory and office building that allowed co-existing of production and work areas.

Project of requalification of existing structure on via Nizza 10 into mixed-use building with student dormitory, urban farm, retail area on ground floor and solar panels on top of the building. Concept incllude schemes of indoor hydroponic production, local distribution in areas inside the radius not further than 3 km to restaurants, grocery shops, caffes and other dormitories and student cantines. Combination of production of greens inside student dormitory will support biofilic approach of design. Calculation of CO2 reduced and O2 released would support idea of benefits of combination two areas in one building. Reduction of pollution. How many kg of production, energy estimation and absorbtion of CO2

Expo Milano 2015, Milan's recently opened World's Fair, showcases the future of sustainable agriculture with a fully functioning 9,250 square-foot vertical farm. In 1991, Dickson Despommier, Emeritus Professor of Microbiology and Public Health at Columbia University, ingeniously identified vertical farming as a solution for food and space shortages in urban areas. Vertical farming proves more environmentally conscious and spatially viable than traditional farming techniques, cementing its functionality as the population exceeds nine billion in 2050. Further confirming the essentialness of modernizing agriculture, the United Nations predicts a mandatory 70% increase of food production in the next 35 years to accommodate a growing population. [4]

Globalisation has revolutionized food production and consumption in recent decades, and cultivation has become more efficient As a result, diets have diversified and food availability has increased in around the globe. However, it has also led to a situation where the majority of the world's population lives in countries that are dependent on, at least partially, imported food. This can intensify vulnerabilities during any kind of global crisis, such as the current COVID-19 pandemic, as global food supply chains are disrupted.

Aalto University dissertation researcher Pekka Kinnunen

says, “There are big differences between different areas and the local foliage. For example, in Europe and North America, temperate crops, such as wheat, can be obtained mostly within a radius of 500 kilometers. In comparison, the global average is about 3,800 kilometers.”
“The ongoing COVID-19 epidemic emphasizes the importance of self-sufficiency and local food production. It would be important also to assess the risks that dependence on imported agricultural inputs such as animal feed proteins, fertilizers and energy, might cause,” says Kummu.[5]

Integrating food production into the built environment—from community gardens on empty lots to rooftop hydroponic greenhouses and aquaponics—offers an opportunity to reduce the energy intensity of our food system.Local food production also affords what could prove to be a critically important level of self-sufficiency in an uncertain world. Just as the issue of passive survivability (see EBN Vol. 17, No. 4) addressed why and how to create buildings that will maintain livable conditions in the event of extended loss of power or heating fuel or shortages of water, producing more of our food locally offers a level of security we don’t have today. Hopefully, this won’t become necessary, but the chance that it might should be a strong incentive to move in this direction.[6]
Under the approach of our electric future that has been gaining more and more attention over the last decades, traditional production is evolving following alternative paths. Indoor farming has started leaving its mark. Farmers initiated examining alternative ways that could assist them to produce in a relatively isolated environment, controlling growth conditions, and avoid tares or other exogenous ground factors that influence productivity.

Hydroponics is a method of growing plants using direct feeding of nutrients, light, water solutions, often in a soilless environment. The immediate social impact out of this, is that consumers have easy access to fresh vegetables produced locally, throughout the year,
avoiding transportation – and therefore CO2 emissions – from distant areas (Ohyama et al., 2008). Indoor farming units, promote also food supply security in cities and achieve optimization of resources utilization contributing to the prosperous smart cities concept.[7]

Trends in the marketplace show that urban dwellers are increasingly supporting locally produced foods. This thesis argues for an architecture that responds to our cultures consumptive behaviors.[8]

GENERAL OVERVIEW

Sustainable Development Goals

In 2015 was adopted by world leaders The 2030 Agenda for Sustainable Development. This 17 Sustainable Development Goals (SDGs) is an urgent call to gather all countries regardless of economical development to help each other reach balance. Existing world problems as ending poverty, fighting inequality, improvement of education and health would aline with new sustainable strategies for tacking climate change and keeping ecosystems of forests and oceans. [9] While using clean energy for buildings and decreasing use of water and electricity architecture can evolve buildings into more self-sufficient state of being by implementing urban agriculture that answers to the goals of Sustainable development.

1. The 17 Sustainable Development Goals (SDGs)

Urban agriculture is addressing to 6 of them.

2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture.

Placement of urban farm into mixed-use building with student dormitory with use of hydroponics increases agricultural productivity several times and provides part-time work opportunities to students living in dormitory. It implements resilient agricultural practice by significant reduction of water use, pesticide use and natural independence from weather conditions. Small scale urban farm helps preserve genetic diversity of plants in comparison to large-scale monoculture agriculture methods of industrial farming. Position of urban farm helps prevents food shortages or food price anomalies during extreme situations.

3. Ensure healthy lives and promote well-being for all at all ages

In 2015, a total of 40 million deaths due to non-communicable diseases (NCDs) occurred (70% of the global total of 56 million deaths). The majority were caused by the four main NCDs: 17.7 million were from cardiovascular diseases, 8.8 million from cancers, 3.9 million from chronic respiratory diseases, and 1.6 million from diabetes.[10] Healthy diet can prevent NC diseases and social impact of urban farmers as members of community increases awareness as well as social contribution of urban farm itself.

11. Sustainable cities and communities

Including green spaces into student dormitory increases air quality and reduces pollution. It also provides recreational place. By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.

12. Responsible consumption and production.

Closeness farm to city shortens consumption chain therefore reducing need in additional packaging, refrigeration and gasoline spent. Closeness and client-orientation may help reduces excessive production and food waste.

13. Climate action

The leading sources of the greenhouse gas savings that

countries need to focus on in order to realize their commitments under the Paris Agreement are switching fuels to renewable energy and enhancing end-use energy efficiency. Building energy-efficiently dormitory include use of natural ventilation and solar shading instead of mechanical ventilation and air-conditioning, green roof to reduce urban heat island effect, solar panels to provide clean energy.

15. Life on land

To combat biodiversity loss one of the strategies could be insertion of small islands of greens with diverse plants and grass for insects and birds. For example green roof islands would be part of it.

What is Urban Agriculture?

Urban agriculture is defined as growing food within cities.[11] 1000 years ago differentiation of labour types created a distinction between human inhabitants. Rural and urban settlements were organised. Generally speaking, urban area defied by activities as commerce, finance, education, administrative tasks, holy activities, politics. Rural was defined by production of primary products, mostly agricultural. In contrast, the rural is a setting of primary production, notably of agricultural products. Though this division never meant that agriculture could not take place in the city itself or on its borders. On the contrary, proximity and abundance of agricultural lands were defining success of early cities. [12]

Nowadays, urban agriculture develops from traditional soil-based open air methods to soilles solution sometimes without natural light and automated care.

In this project is used hydroponics method of cultivation partly using natural light and partly supported by LED lightning inside the building.

Why Urban Agriculture now?

The COVID-19 emergency has pointed problems that cities face in times of global crises. Long quarantines led us to realise our dependance of the availability of food in cities and importance of its for life.The combination of border closure and movement restrictions enlarged food losses and export costs, especially for fresh produce exposing countries that

2.Urban farm project on the rooftops of the Palais des Expositions in Paris

heavely rely on imported production.Urban agriculture was the answer to global crises in past, but instead of a temporaty solution with nowaday technologies and new more efficient practices such as vertical farming, hydroponics, aeroponic, aquaponic and rooftop greenhouses we can make it permanent part of cities to increase its self-sufficiency. It should not get in a way to traditional farming and just take extra pressure of existing system, specializing in fast-spoiled, expensive, nutrient-rich produce. And in case of global crises it could be a key solution for citizens in need of fresh locally grown production, that doesn't get affected by border closure. This way it can lower effects of global risks. Apart from global issues, in large cities, urban planning and food systems should work together and implement in new city arrangements in spacial management of food production within city borders. Recently interest in urban agriculture notably increased among developed countries and Covid-19 pandemic just spurred interest and need in self-production of vegetables in fruits in urban allotments. The main issue that came in sight with ongoing pandemic is if it would be possible to scale-up the urban farming effec-

tively so it could shorten food supply chains, food-miles and food deserts to increase reachability and resilience of city production.[13]

Recently due to small scale, adjustability, its focus on healthy whole food, food security, community building and employment possibilities urban agriculture became especcialy relevant as part of food system.

With abundance of abandoned or unused unusual places inside the city as rooftops, tarraces, balconies, even basements, urban agriculture can become a tool of urban revitalization. [14] Feeding urban areas has been important in urban planning until the mechanisation of the city, the green revolution in agriculture, and the rise of the supermarket deluded that urban food supply was de-facto solved (Barles, 2014 and Steel, 2013), but global crises like global pandemic showed how fragile the nowaday urban food supply system can be.[15]

Synthesis of urban spaces and foor production benefitial for resiliency of urban food supply systems because of these four points:

1.Transportation and storage infrastructures are the most fragile part in the relationship between city and agrucultural sector. Urban agriculture minimises the dependence on this infrastructure.

2. Shortening of supply chain and transportation distance allows less food waste and fresher food.

3. Placement of agriculture near customer make it more responsive to his needs, allowing more flexibility and quick responsiveness in business of growing and selling food. Products can be pre-ordered limiting food waste.

4. Urban agriculture in many cases allows to grow food whole year lond and increase number of hasvests, allowing foster the development of culture-adapted breeds. Direct feedback between consumers and farmers could benefit both.[16]

Among benefits of urban agriculture are also community engagement, environmental awareness, consumers health, food education and training, and job creation.[17]

Why Turin?

Europe is one of the most densely urbanized continents on the globe, with the highest share of land (up to 80%) used for settlements, production systems (including agriculture and forestry) and infrastructure. Every year, more than 1000 km2 of land is transformed into housing, industry, roads or recreational uses.

Meanwhile many cities in Europe have lack of green space per citizen according to the standarts of World Health Organisation. The share of green space in Europe changes from 1.9% in Reggio Calabria, Italy (i.e., 3–4 m2 of green space per person), to 46% in countries which have more than 300 m2 of green space per person (e.g., Liège in Belgium, Oulu in Finland and Valenciennes in France) [18]

In Italy, a few years later than in other countries, the problems of rething placement of food and the agrofood chain increases interest, for example in city like Pisa, with development of Local Plan of Food (Di Iacovo et al,. 2013), and Palermo, where new strategic food plan promote and precerve urban agriculture, and Milan, where they develop new food strategies.

In this directions, Turin started to construct new integrated governance of the territorial food systmem under guide of the municipality of Turin and the metropolitan area.

Turin is the fourth biggest Italian city for population. Its located in the Northwest of Italy, the city has a population of 900.000 (almost 2,3 million if we consider the Città Metropolitana). In the last decades, Turin has experienced one of a dramatic transformation, reflecting changes not only

in the city but in the world. Closed factories left empty areas in the middle of the city that then were developed into brand new spaces.This went along with remarkable process by redefining city again, that had a pivotal point in 2006 with city hosting Winter Olympic Games.
Turin has a rich history of traditional relationships with food production. City is a part of a territorial system where food is a important social, cultural and economic asset that contributes to economy with high-quality food production (famous wines, chocolate, cheese, nuts etc.), wine and agro-tourism, which slowly takes place left by factories. Food takes part in city's new direction, starts to represent it.

Strong relationship with food industry and influence of strong and active stakeholders like Slow Food, Eataly resulted in oraganization of many initiatives and advertising events as Salone del Gusto, Terra Madre, Cioccolato that purpose to promote and protect traditional food production of Turin, that happens to be recognized as national "capital of food". Italy is famous by its relationship with food, and Turin is not an exception. People of Turin support big ammount of food markets (45) held in the city everyday. In most of them, farmers bring everyday their fresh products, from the agrictulture area around Turin. In Italy, these markets are not a new wave or new tendency as it became in many countries but just a usual way for people to purchase their groceries. These markets hardly can be defined as "alternative food networks", as they are not expression of practices against the globalized unsustainable and detached food chain.

At the same time, Turin's deep history and long-established relationship with food production oppose to the new ways of production, such as solidarity purchasing groups, urban gardens, small urban farms, farmers' market and others. This is a clue of the twist of Italian food system, where the obstacles are quite different by the ones experienced by food plans of Canadian, American of British cities. This could suggest that there could be an "Italian way" to food planning.

In the past years, however, several strategic processes related to the food system took place. Three of these might be able to create positive influence in terms of urban food governance:

- The European project Food Smart Cities for Development, that wants to create new Food Policy Council, funded by the Development Education and Awareness Raising (DEAR) of the European Commission.

- " Torino Capitale del Cibo" (Torino Food Capital) that defines future strategies and vision of Turin Metropolitan area, which is organized by Torino Strategica7, within the third Strategic Plan "Torino Metropoli 2025". One of the influencial objectives in plans is creation of Food commission for the growth and managent of food system with more quality and that would be more sustainable, fair, competitive and stress-resilient.

- "Nutrire Torino Metropolitana" (Feeding Metropolitan Turin) the participatory process with pursuit to attract actors of the food system to construct local food agenda that would be lead towards launch of a food strategy for this area, led by the Città Metropolitana (the former Province of Turin) and the University of Turin.

History

Turin has a long and rich history as a military base and center of trade. Since the 14th century city served as an important political centre and later transformed into one of the most major industrial bases in Italy.

The city inherited its rectangular grid of straigh roads from its primary funtion as a military camp established by the Romans in the 1st century A.D. The Emperor Augustus had Turin built for the military groups he sent for protection of the Roman's borders on the north. Reason for chosing Turin's location is its geographical position down the Alpine

paths that lead to Western and Central Europe with crossing point on the river Po. [19]

City layout, a classic Roman "castrum" with square layout, remained almost unchanged, surrounded by ancient walls, for centuries, and survived both during the rule of the lombards and later the Franks, middle ages with domination of the Church until period of municipal autonomy arrived before the rise and consolidation of power over the city by the Acaja.

In the fifteenth century Dukedom of the Savoy unificated politically and administratively various provinces of Piedmont region and declared Turin their official residence, giving the city its importance.

In 1559 Turin became new capital under the Savoy rule. In the late 17th-early 18th century city experience expantion among lines imposed by urban planning.
After unification of Italy, Turin was declared its capital. Growth of industry and commerce of new nation required new ways of transportation and distribution of raw resourses and final products. The railway system was build and accelerated urbanisation and growth of economy.[20]By 1861, this railway system made up 40% of the entire Italian network.[21]

3. Map of Italy

In1865 capital status was transferred to Florence and caused change in economical, political and cultural life of the city. [22] Many wealthy political families left the city as well as other ambitious citizens. Torino lost its prestigious political status as well as job positions and wealth and it had a damaging effect from economical point of view as well as political. The population of city in 1864 was 220,000 and it fell to 191,500 in 1868. Change of status spurred unemployment to the rate over 20%. Decline in agricultural, commercial and banking areas in the latest years of the 19th century caused mass unemployment. In face of economic breakdown, city was forsed to look for a new identity, new niche for itself. [23]

4. Map of Piedmont

In 1880s first great foundries, steel and textile factories were opened ans gave new breath to the city's economy. [24]
In the 1870s a collaboration of municipal leaders, university professors and local businessmen joined forces to give a new direction to Turin's future. City became a center of applied research and great progress was made in branches of engineering and electricity. Economic development inspired demographic growth and between years 1864 and 1881 population increased to 14%. In the decade to 1881 manufacturing jobs grew by 44%. The city's well-developed banking sector evolved from the downturn with several new banks, that includes the Bank of Torino (Banca di Torino), securing city's position as nation's financial center.

The outbreak of World War I and the attendant rise in demand for military equipment fuelled the city's industrial development, with Fiat as the main beneficiary.[25] Fiat expanded so quickly so its employee numbers rose from 4.00 in 1914 to 40.000 in 1918.[26] The city's population expanded from 500,000 in 1921 to almost 700,000 by 1939, with Fiat employing a third of the industry.[27]
The Second World War left Turin in desperate state, fighting against hunger, poverty, unemployment and the devastating effects of bombing. In the hard task of reconstruction it was Fiat factory that guided the economy of the city and transformed it into the industrial capital of the nation.
From the 1950s and on, Turin's engineering industry was on the rise, both in the Italy and on the global market

Crisis

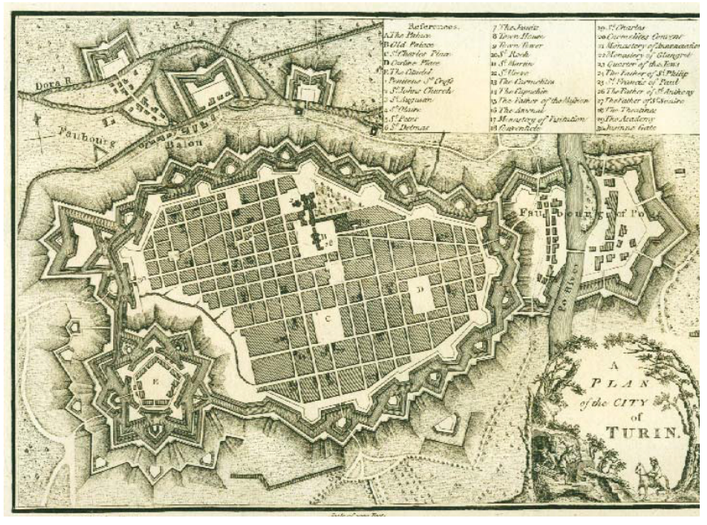
The 1770s were worrying time for Italy. It was time of terrorism and extreme left and right wing subversion.[28] The global oil crisis of 1973 brought Turin's economic miracle of the previous twenty years to a decline. In 1975 population grew to 1.2 million just before a long decline in the manufacturing industry (IRES 2006). Fiat factory fired 23 thousand people from its Turin's plants in the hardest year for italian industrial economy 1980. During that decade Torino's metropolitan area lost roughly 100,000 industrial jobs, most of them based in the city itself (Maggi and Piperno 1999). In

the decade between 1986 and 1996 decline continues and Fiat cut workforce in Piedmont from 92 thousands to 47 thousands. (Rosso, 2004)

Slow-burning nature of Fiat's decline gave its many local suppliers the necessary warning time to plan for diversification into new international markets, which they did with impressive efficiency (Whitford and Enrietti, 2005).[29]

Recovery actions

In 1995 Turin ratified new Urban Masterplan, that redustributed land use and changed infrastructure planning to bring physical renewal.
Winter games 2006 promoted Torino's new 'post-industrial' identity to the world and in Italy. It spurred physical renewal plans and aided public-private collaboration capacity in Turin.
The Urban Masterplan Plan itself is set along six 'lines of action', each broken down into more detailed points, which are set out below:
1. "Integrate the metropolitan area into the international system"
2. "Construct a metropolitan government" in the province;



5. Map of Torino in 1800

3. "Develop training, research and strategic resources", turning the city into a centre of research and education;
4. "Promote enterprise and employment", supporting entrepreneurship and innovation while tackling unemployment;
5. "Promote Torino as a city of culture, tourism, commerce and sports";
6. "Improve urban quality by upgrading the environment and urban areas",

As part of the Plan, to promote quality of the city's higher education, were given proposals to buildi new university buildings in four new locations and to increase the size of the Polytechnic's university's campus in two times.[30]
Nowadays city has changed and showed progress in recent years and is no longer solely industrial-oriented: city became a renowned centre of excellence in science research, engineering technology and innovation, also internationally accredited in academic circles. The city has successfully moved towards a services-oriented economy and it also hosts many companies listed in the Italian stock exchange. The last decade have seen a spurring incline in the sector of other investments: healthcare, student housing, RSA and innovative residential formats are increasingly interesting among international investors looking for an asset class that explores new areas other than major italian cities, keeping lower risk levels and steady returns.[31]

Student housing

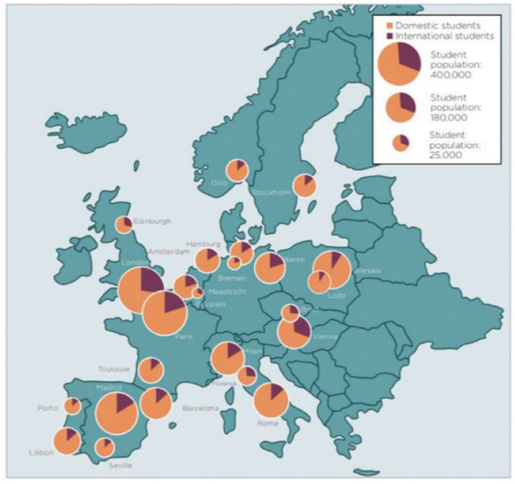
Education sector became an international level business, and in it student housing had fast growth in last couple of decades. In this market outstanding universities of Italy, as well as comparatively low cost of life and low tuition fees and high quality of life made it globally attractive destination not just for great number of tourists but students from all different countries.[32]

In Europe Student Housing is an already consolidated business segment, while in Italy it still has promising growth potential. The European housing market, while showing

different statistics from country to country, is defined by an offer of beds for students overall not sufficient: the majority of the places is still controlled directly by universities or religious representatives and, for this, it is necessary to change the attitude to this type of market, and to propose a more adequate student housing management.[33] The offer of university housing in Turin consists of system in charge of specialized groups as Camplus (Lingotto, Carlo Mollino, Cesare Codegone) and Sharing (Campus San Paolo), private student housing (Fondazione Einaudi) and residences run by public regional entities (EDISU Piemonte) and religious representatives.[34]

In the present-time world, education centers have become major drivers of economic developement. Universities are connected directly to the local and international business world (providing talent, skills and research) and are significant centers attracting young people, professors and post-graduate researchers locally and internationally, who contribute greatly to the cultural and commercial parts of the city's community, giving a boost to its international recognition and leading it directly to become a society rooted on the educational economy.
Competition at the local and world levels involves majorly the attractiveness of universities and the quality of teaching and research standards. Surrounding location and community can add to attractiveness by desiding to increase the level of services that are offered to students and professors and assistants, including the quality of reception and image of place in common and financial support given into innovation and research facilities.

City of Turin bceome very interested and invested in the sector of education and research. Fresh university facilities have been built (lecture halls, student housing and cantines); promising new sectors of research have been supported; important policy directions have been started to stimulate exchange programmes and bring international students ;[35]
Turin is at the moment one of the main education centres in Italy. In 2017 / 2018 academic year, greeted over 100,000 university students (up by 4% over the previous year) and was ranked 4th in nation by university population. Turin is an increasingly popular target for students from Erasmus exchange program also, counting around 1,500 students arrivals.[36]

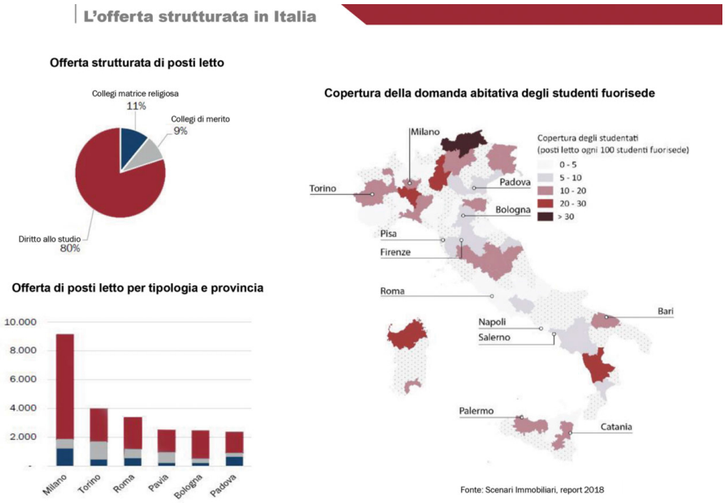


6, Student populations in key European cities

An education market of 4.5 million students, with a growth percentage of over 500% compared to 1975, and that in Italy sees 94 thousand foreign students, 675 thousand applications for accomodatio, a demand that has grown 20% from 2017 to now. The bedroom space available in university student residences for off-site students cover, in Italy, less than 10% of what is the potential ask, comparing to a European average of 20%, with as much as 30% in Ireland.[37] Taking in consideration out-of-town Italian students, international students accounted in the campuses of Turin and also those studying ouside of Italy, there is an counted possible market for beds of around 40,000, much higher than the today's availability of 5,000 places (beds accredited by MIUR, Ministero dell'Istruzione dell'Università della Ricerca).[38]

Adaptive reuse

"For the purpose of sustainable urban development there is no alternative to a thrifty way of dealing with resources which include the stock of industrial areas and buildings. For us, the existing building stock must therefore be regarded not merely as a material and economic resource but also as an important component that makes the city itself into a source of new developments and new life styles....If the existing buildings are appropriately converted, they can remain as an active part of the urban structure and as a node in the network of relationship, interlacing and movement in the urban space. These location thus also have a relational value."[39]
Conversion into residential accomodation could be a way of adapting and reusing underused or abandoned office buildings. Many previous researches has researched possibilities for this way of conversion, and has given tools for deciding the reuse potential of vacant offices.



7. Student housing demand

Owners of buildings have four likable ways for dealing with underused commercial buildings: consolidation, renovation, tearing down and building new, and conversion to new use.

Most owners choose consolidation, to keep the property's status quo, look for new residents and wait for better economical opportunities. Putting it on sale is sometimes not an option. The market price of commercial buildings is calculated and depends on the potential rental income and therefore the sale of a emptied property yields less than its real value, which signify financial loss for the owners. At the same time, new investments are hard to justify to investors who already lost money on a building. A second way is renovation or adaptation for other commercial market segments. Though smaller refurbishments are performed every 5 years (Vijverberg 2001; Douglas 2006) at some point the property is in need of major renovation (Wilkinson and Remøy 2011). Nevertheless, in markets with high vacancy percentage, there is a possibility that the income of renovation will be less than the refurbishment spending. Demolition and new-build on the other hand creates ways for a better fit with current and potential users' needs. At the same time, redevelopment is time-consuming and causes income delay. If the property is structurally in a proper state, new built is a waste of time, energy and material and conflicts with international goals for sustainable development. Conversion to new use is the fourth strategy. Conversion keeps a beneficial and durable use of the position and building, implies less investment need than redevelopment and can have higher social and financial benefits. Conversion into a well-functioning building has researched to ameliorate the view of the environment and lower risks of vandalism and increase level of safety around it.

Commercial spaces are build to bear more weight than residential housing. In most cases, additionally build floors could be beared by the already existing frame.(In offices 300kg/sq.m, in housing 175kg/sq.m)

Making the comparison between the sustainability of rehabilitation to demolish and new-build, the expected life-span of the new or to be reused property has a major impact on which way is the most sustainable; if new building is calculated to have a much longer life span than rehabilitation it is likely to be more sustainable. At the same time, in uncertain economical environment, where the expected lifespan of new-build is anticipated to be shorter, conversion will be more sustainable (Jansz 2012).[40]

URBAN ANALYSIS

TORINO

City context

Turin, Italian Torino, Latin Augusta Taurinorum, city, capital of Torino province and of Piedmont (Piedmont) region, north-western Italy.[41] Turin is an important cultural and business hub in North Italy. City is surrounded on the western and northern sides by the Alp mountains and on the eastern border by a high hills that is the prolongation of Monferrato hills.[42] It is located on the Po River near its junction with the Sangone, Dora Riparia, and Stura di Lanzo rivers[43] and below Susa Valley.[44]

Turin is an important educational center. It's oldes university,The University of Turin, was founded in 1404. Other educational institutions are the Turin Polytechnic (1859), the Institute of Business and Industrial Organization Studies (1935), the Gallery of the Albertina Academy (1652), the Giuseppe Verdi State Musical Conservatory (1867), and the University Institute of European Studies (1952).[45]

Turin is composed of 8 boroughs (circosrizione).

San Salvario borough

Area: 130 km²
Population : 870952 p.
Density: 6,691/km²
Elevation: 239 m

San Salvario (San Salvari in Piedmontese) is a historic district of the 8th boroughs of Turin, located south-east of the historic centre part of the city. In this district are located many landmarks and the most famoust city park, Parco del Valentino is located along the left side of the river Po, on the east edge of the district.[46] This district differentiate from others with its increasing immigrants' community, cultural integration of people with different backgrounds.It also famous among students for night-life after the opening of several low-cost bars, restaurants and caffes.[47]

It is delimited:

to the north, from Corso Vittorio Emanuele II (border with the Borgo Nuovo del Centro)
to the east, by the Po river
to the west, from the Turin-Genoa railway line (border with Crocetta)
to the south, from Corso Bramante - Ponte Franco Balbis (border with Nizza Millefonti)[48]

It is one of the greenest central districts of Turin mostly because of Valentino park, public park, full of pedestrian paths, clubs and clubs, it also hosts the castle of the same name, now the seat of the Faculty of Architecture of the Polytechnic of Turin, plus the touristic medieval village. The other part, from west composed of narrow streets and historical palazzos, beside via Madama Cristina-via Nizza and the railway part of the Porta Nuova station.

Nowadays borough consists various cultural, craft and tertiary activities in general. Night life developed in this region in the end of the twentieth century in the streets between via Madama Christina and via Nizza. Summary of the establishments of many ethnic backgrounds, bars, restaurants,pubs, rhumerie, bistros, and takeaways of all types and ethnic groups have been added. In the borough there are two markets with fresh vegetables and fruits from local producers, one in Piazza Madama Cristina and the other in Piazza Nizza.

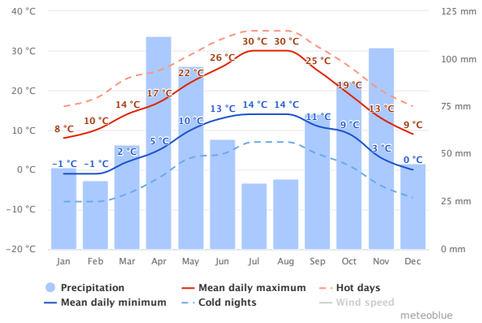
In the 1930s, the borough saw the beggining of many of multi-ethnic socio-cultural associations, which still exist today and which, in 2003, joined into one non-profit company for local development. The company opened its headquarters at the Casa del Quartiere in via Morgari, as a recreational, cultural and multi-ethnic headquarters in the 2010.[49]

Population

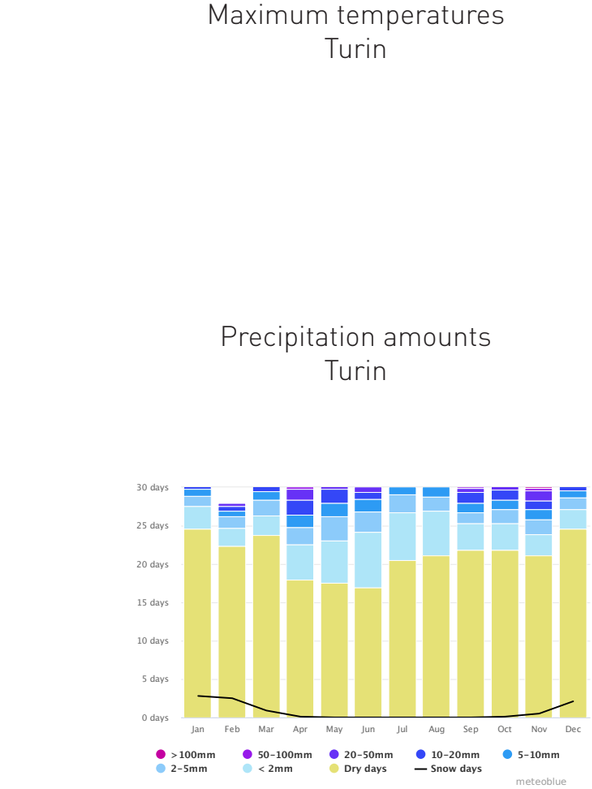
Total population of Turin on 1st January 2020 was 870,952 people, ranking 4th in Italy, showing a small change: -0.02%/year from 2011 to 2020 spread over an area of 130 square kilometres in the north of Italy, Piedmont. The Turin metropolitan area has a population of 2.2 million citizens. The average age is 43.7

Around 15 per cent (132800) of the population is counted of non-italians, the main numbers showing from Romania, Morocco, Albania, China, and Moldova.

Like many Northern Italian cities, there is a large proportion of older citizens in comparison to young group. Approximately 15 percent of the population is under 18 years of age, while 25.8 percent is over 65.[50]



Average temperatures and precipitation Turin



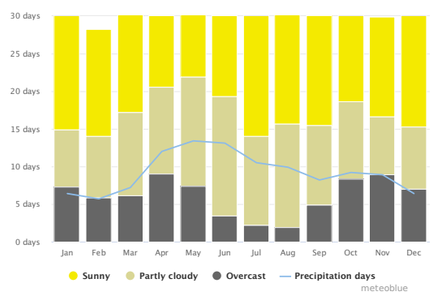
Maximum temperatures Turin

Climate

Turin has a European-humid subtropical type of climate, as well as majority of North of Italy.

Winter months are mildly cold and non-humid, summer months are mild in the hills and quite hot in the plains. Rain anticipated mostly during spring and autumn; during the hottest months, otherwise, rains are less frequent but heavier (thunderstorms are frequent). During the winter and autumn months banks of fog, which are sometimes very thick, form in the plains[51] but rarely on the city because of its location at the end of the Susa Valley. Its position on the east side of the Alps makes the weather drier than on the west side because of the föhn wind effect.

The highest temperature ever recorded was 37.1 °C (98.8 °F), and the lowest was −21.8 °C (−7.2 °F).[52]



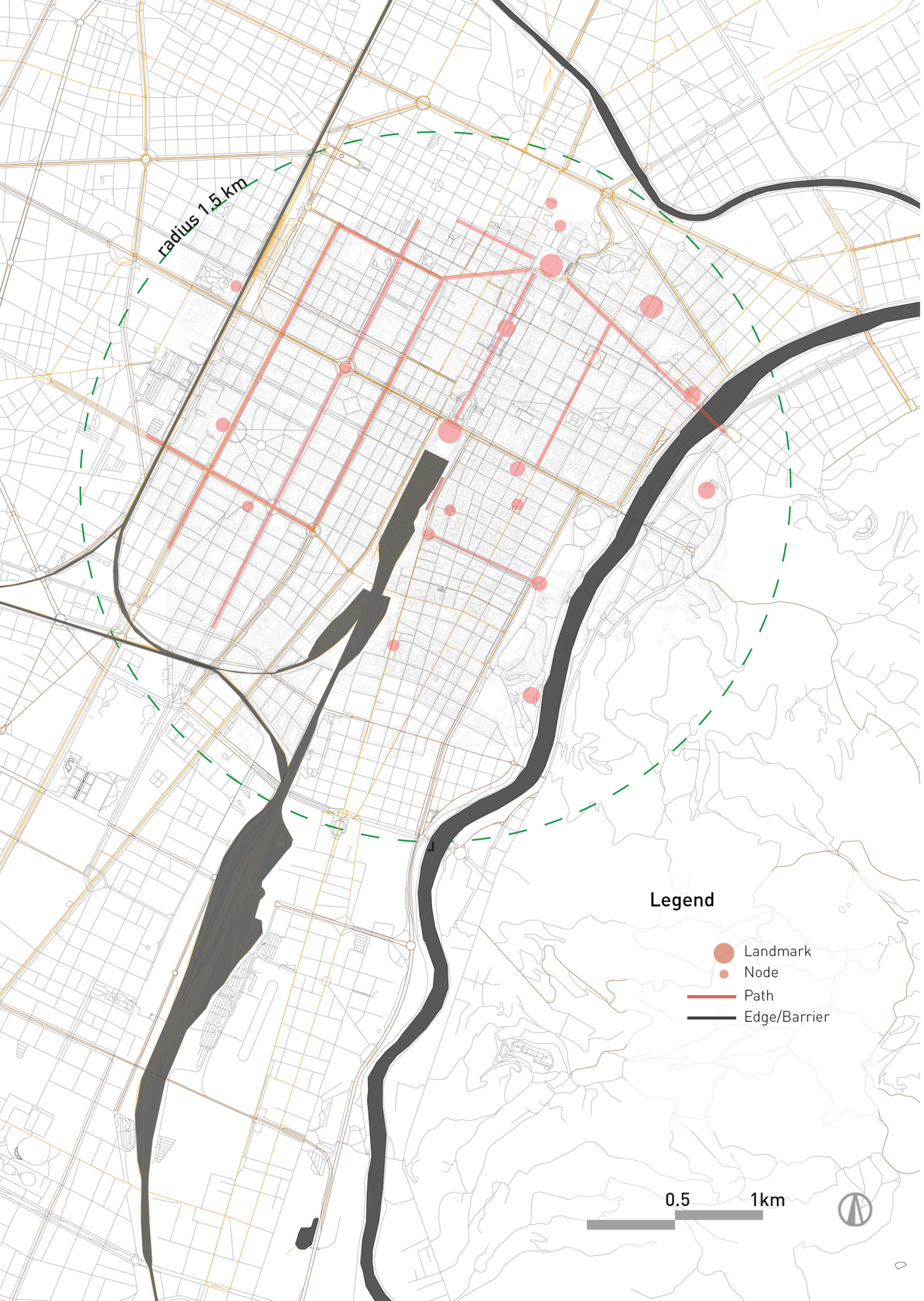
Cloudy, sunny, and precipitation days Turin

Precipitation amounts Turin

Rebaudengo
Borgo Vittoria
Reggio Parco
Barriera di Milano
Campidoglio
Aurora
Parella
CIT Turin
Quadrilatero
Vanchiglia
Pozzo Strada
Cenisia
Centro
Crocetta
Santa Rita
San Salvario
Mirafiori Nord
Filadelfia
Borgo Po
Lingotto
Nizza Millefonti
Mirafiori Sud
Cavoretto

Legend
railroad
highway
main road
road
metropoliten
bus/tram way
water
green
university
metro stop

0.5 1 2 km



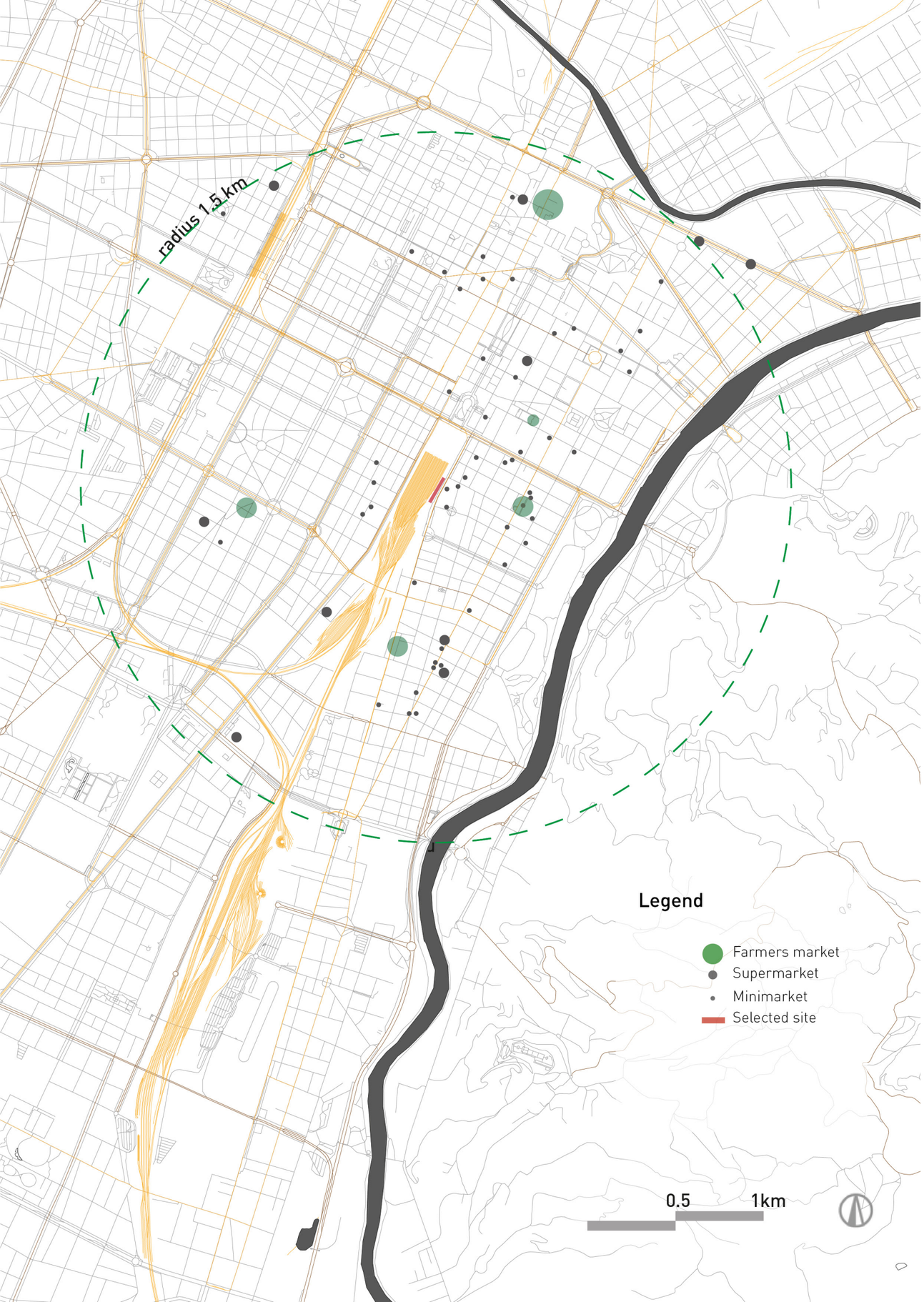
Lynch analysis

Project is located near visible Turin's landmark Porta Nuova train station in a difined district.
Also it's located along the barrier created by train tracks.
Location on the edge of a district and near the barrier gives project isolated position, but closeness to Porta Nuova landmark makes it more popular by pedestrians.

There's a nodes made by Marconi and Puorta Nuova metro station.
Also in the area of the project there's few smaller landmarks: protestant church, catholic church and biggest synagoge in Turin.

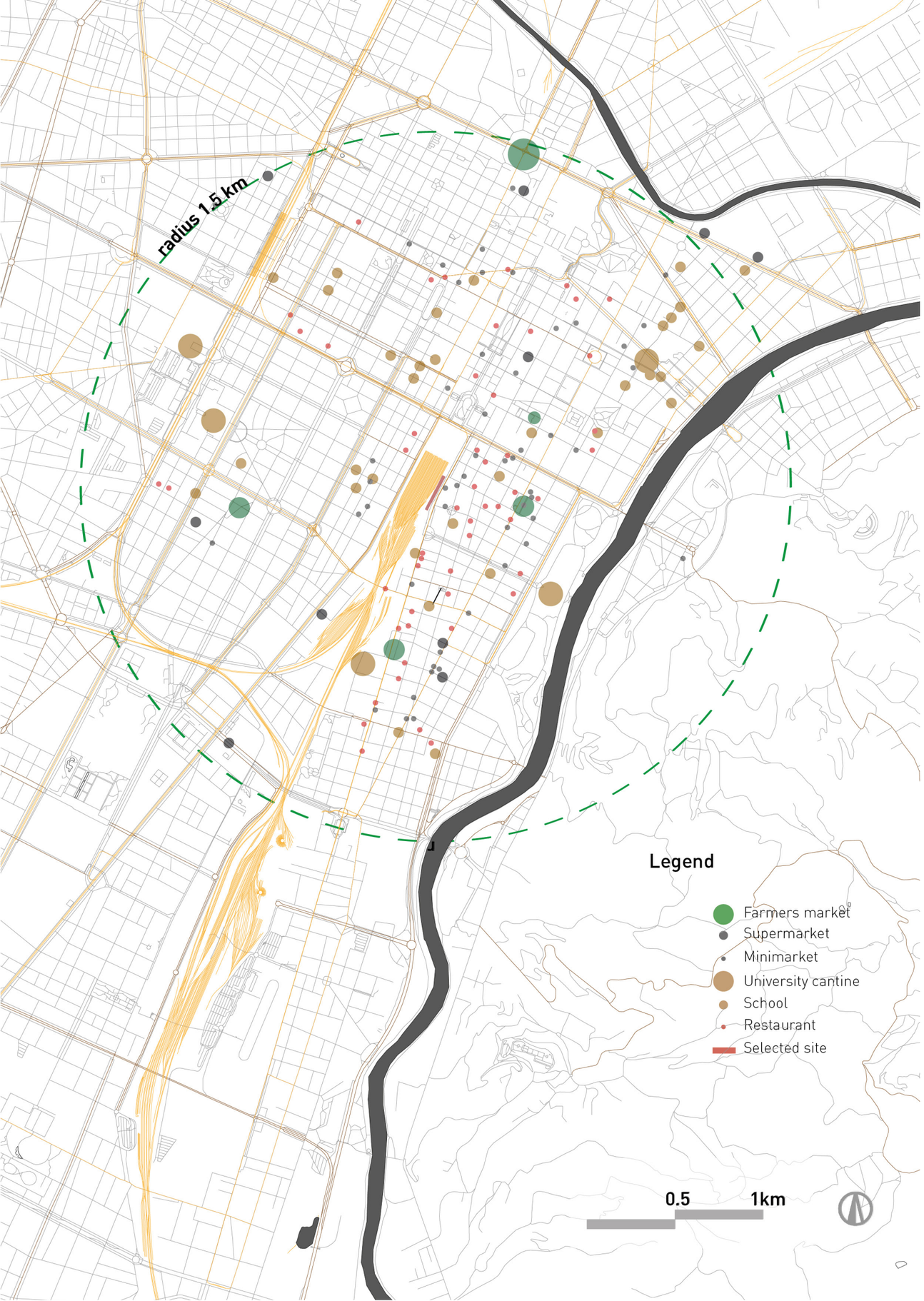
One of the most notable landmarks composed by Valentino Castle and Medieval Village in Valentino Park.

There's a distinctive path traditionally made by San Salvario church and Castle Valentino. Now it's also a path between Marconi metro station and Castle Valentino.



Fresh products availability analysis

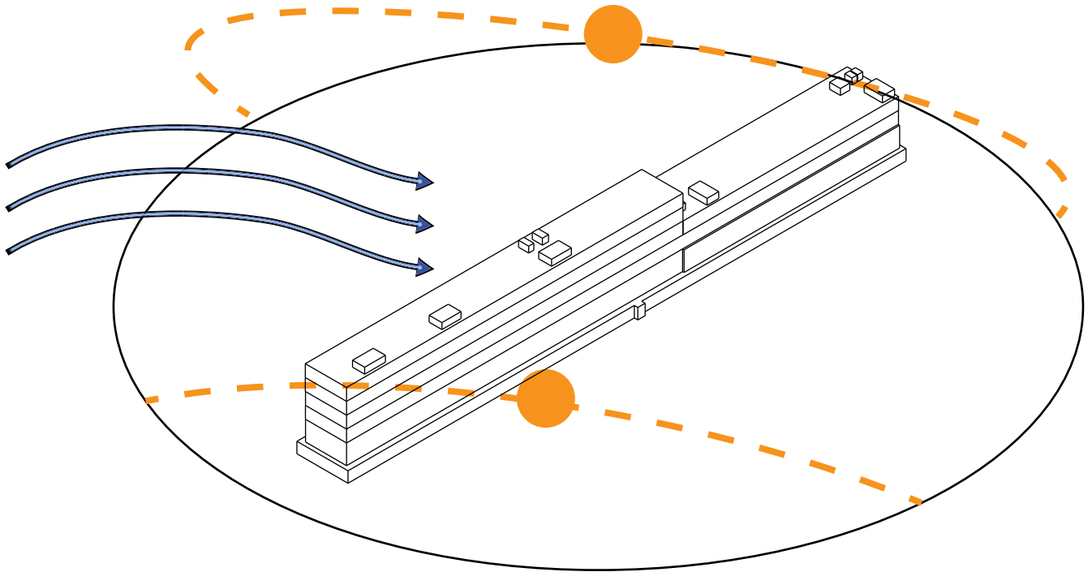
Here's an analysis of local points available for public to buy fresh product. I took into analysis all usual sources for students as farmer's markets, supermarkets, minimarkets. Being student myself I know that for everyday meals we don't usually consider restaurants or caffes so I didn't include them into analysis.
Chosen radius of 1.5 km is explained by distance that could be considered comfortable for a student on a bike. Universities and private companies offer affordable solutions for students. City is building more bicycle paths recently, for example path in front of selected building is part of recent renovations.



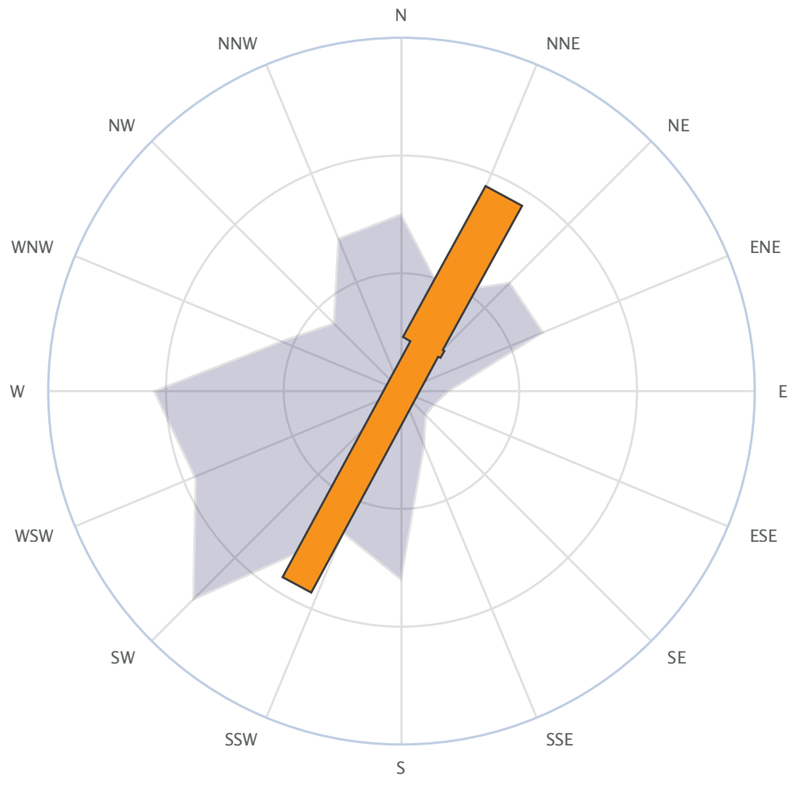
Supply chain analysis

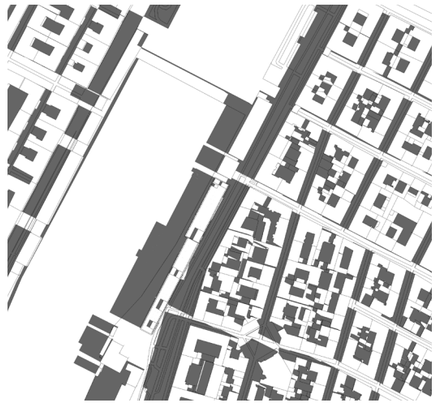
Here's an analysis of supply points available for urban farm on selected site to deliver their product. I took into analysis points as farmer's markets, supermarkets, minimarkets, university cantines, schools and restaurants. From my experience in Turin I noticed that salads or vegetable products are not often guests in caffeterias so I didn't include them into analysis. Chosen radius of 1.5 km is explained by distance that could be considered comfortable for a delivery on a bike to make production even more environmentally friendly.

SUNSHINE
+ MAIN WIND



WIND





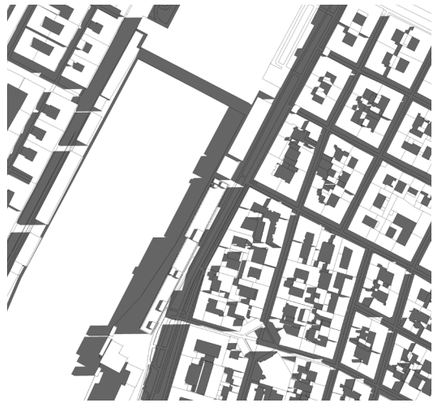
December 21
9 am

December 21
2 pm

December 21
6 pm

TORINO
site solar analysis
december 21

N



March 21
9 am

March 21
2 pm

March 21
6 pm

TORINO
site solar analysis
march 21

N

June 20
9 am

June 20
2 pm

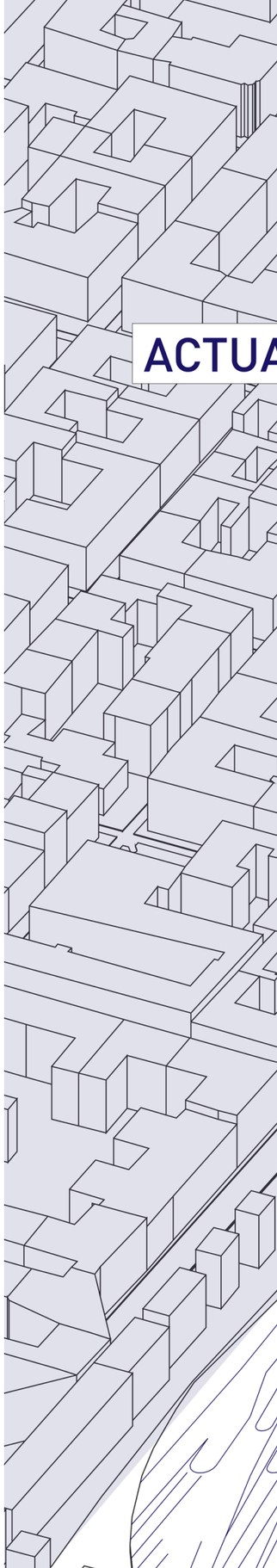
June 20
6 pm

TORINO
site solar analysis
june 20

N

Solar analysis in chosen site in Turin, Italy. Analysis shows that west facade would need additional shading in summer.

Ex-palazzo delle Poste is a part of buildings, that surround railroad station Porta Nuova in San Salvario borough, dynamic part of Turin, filled by students, with a lot of bars, caffes and restaurants. It's south to the main Turin urban road Victtorio Emanuele II. West facade facing railroads. Building located between two metro stations, Marconi metro station and Porta Nuova metro stations. It's also close to the one of the main train stations in Turin, Porta Nuova train station.



AL STATE

METRO

PORTA NUOVA
train station

MAIN ROAD

CENTRO

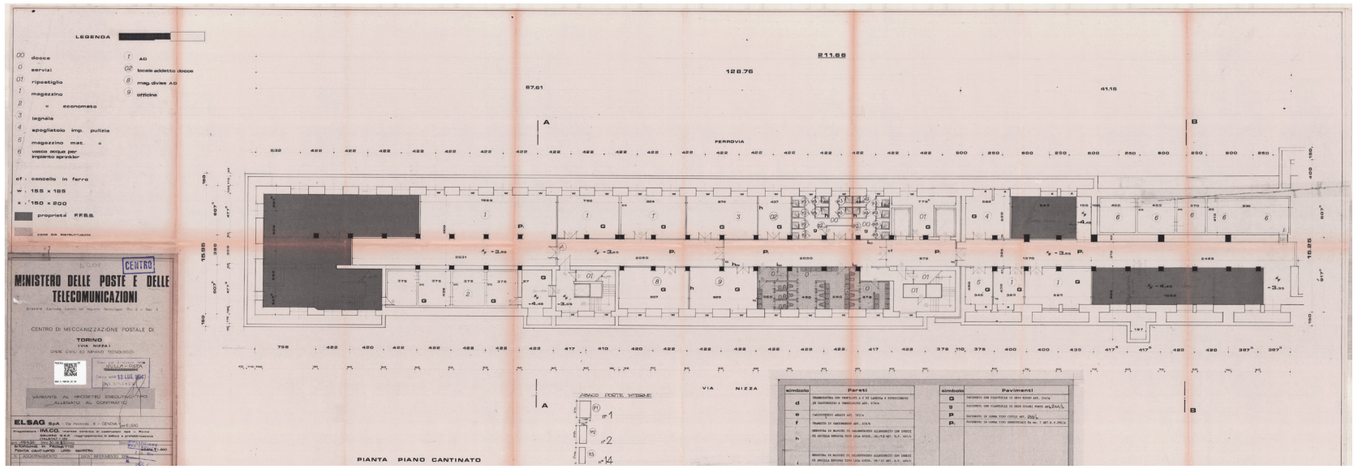
METRO

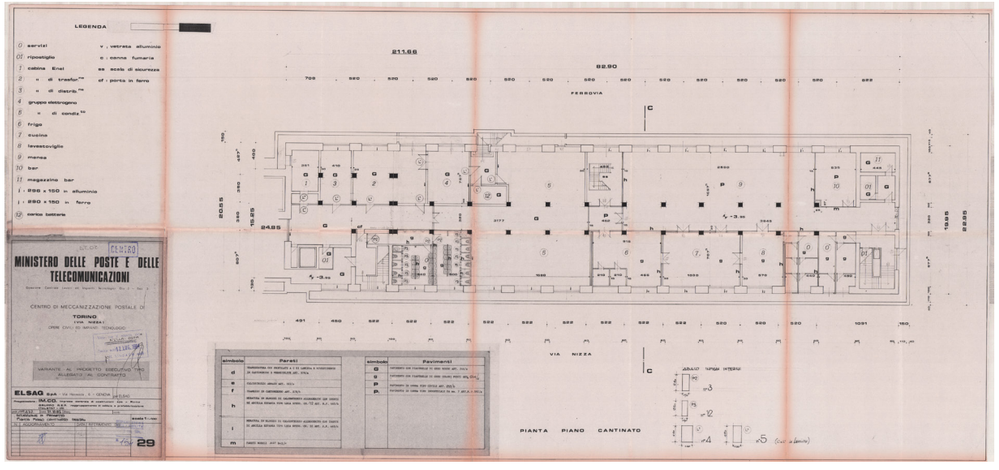
Piazza Saluzzo/cultural hub

ROAD TO VALENTINO CASTLE

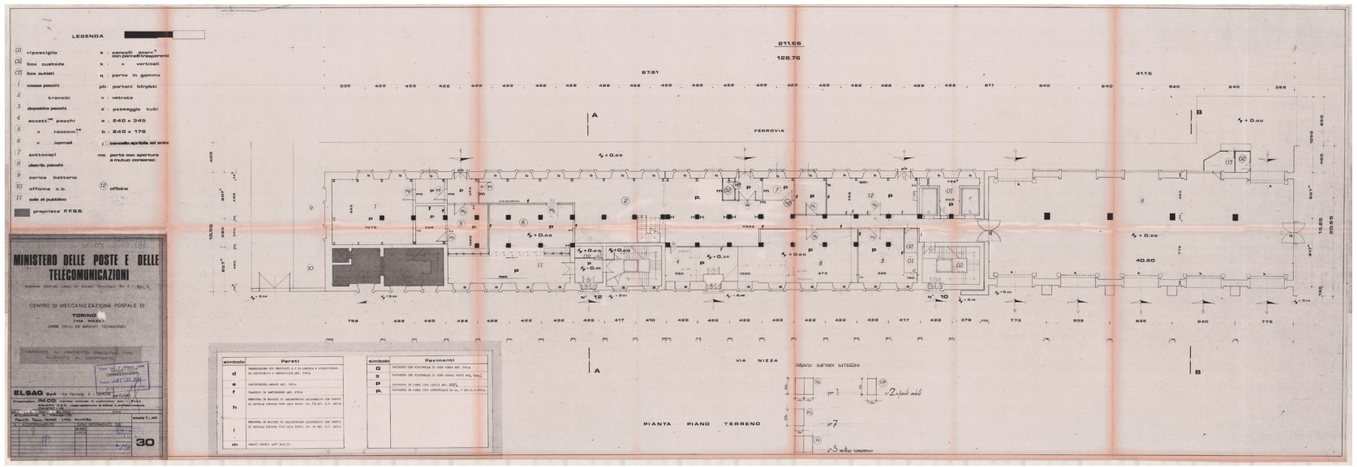
Ex-palazzo delle Poste, view from via Nizza, east-facade,
view from the south point

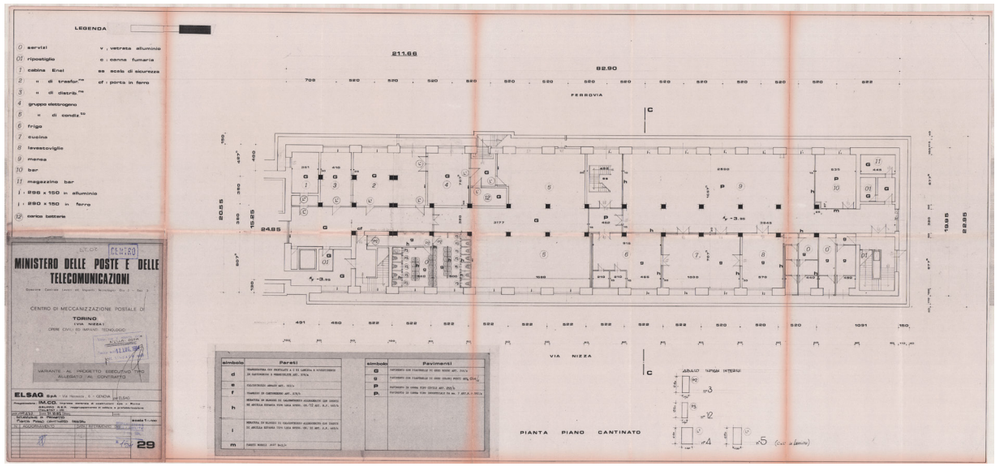
Ex-palazzo delle Poste, view from via Nizza, east-facade,
view from the north point



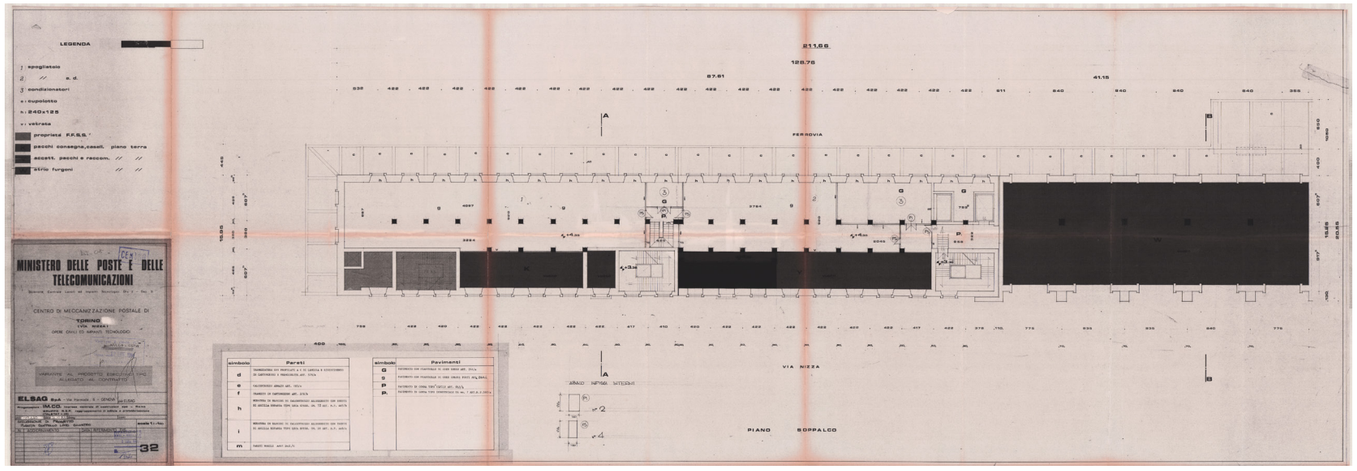


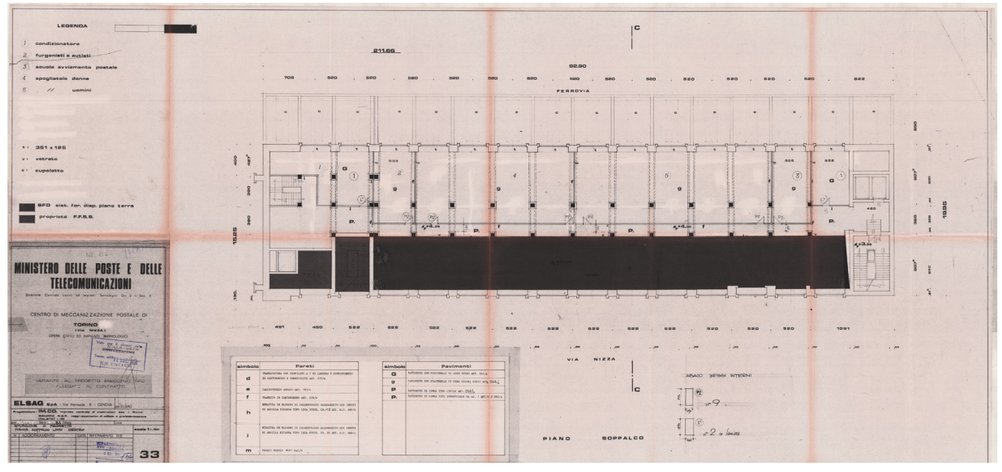
Ex-palazzo delle Poste, basement



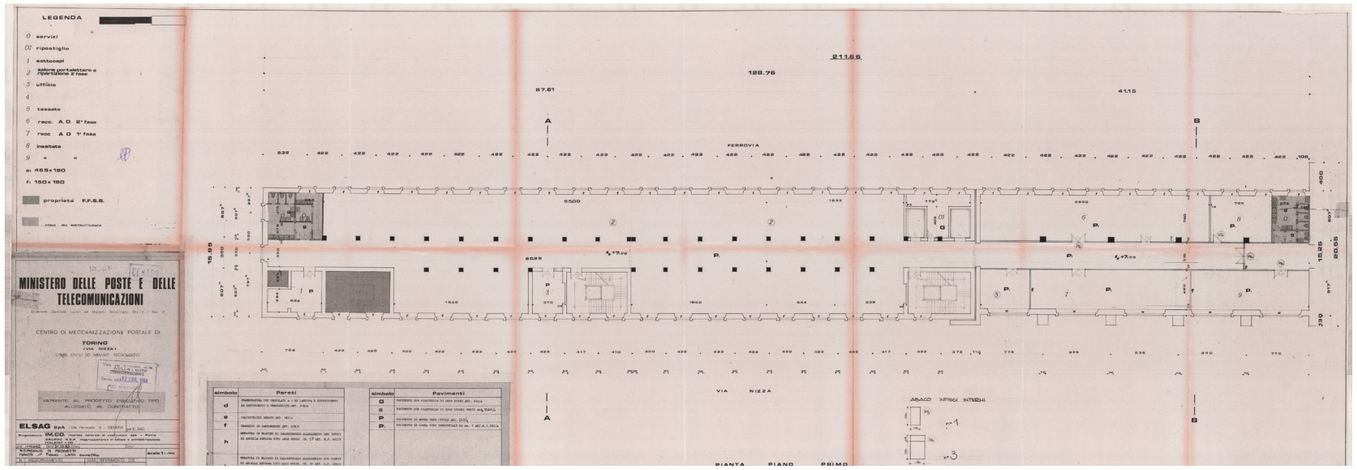


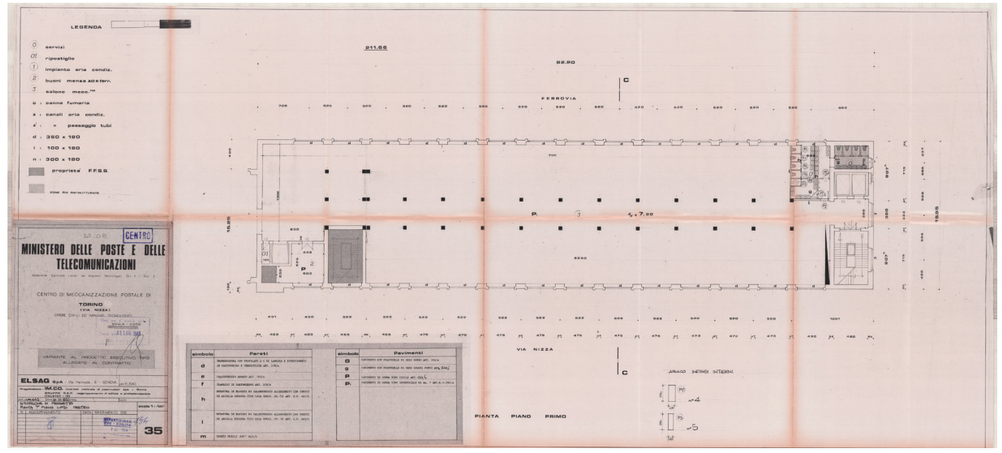
Ex-palazzo delle Poste, ground floor plan



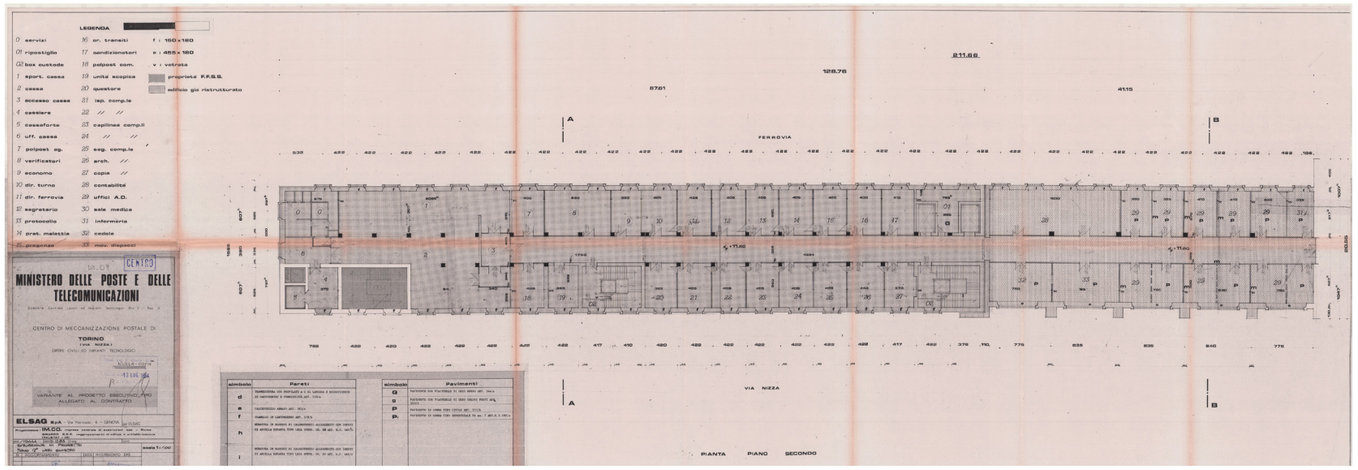


Ex-palazzo delle Poste, ground floor plan, second floor

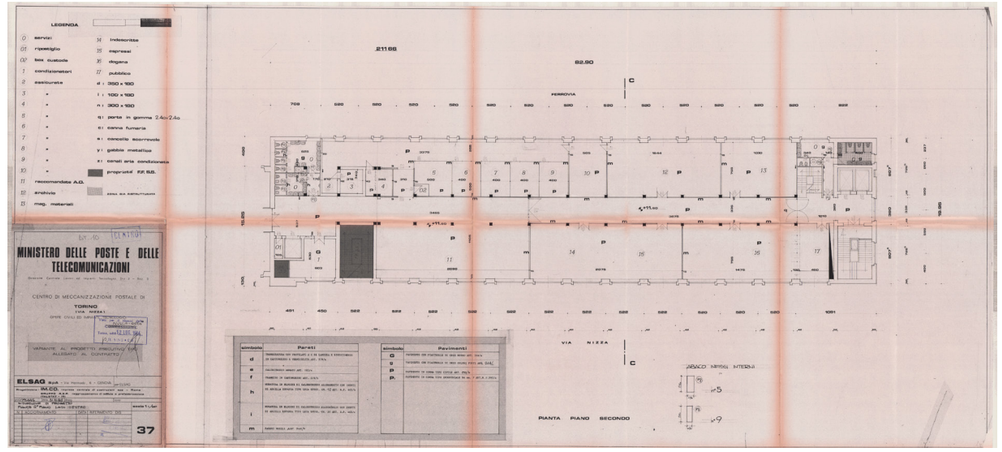


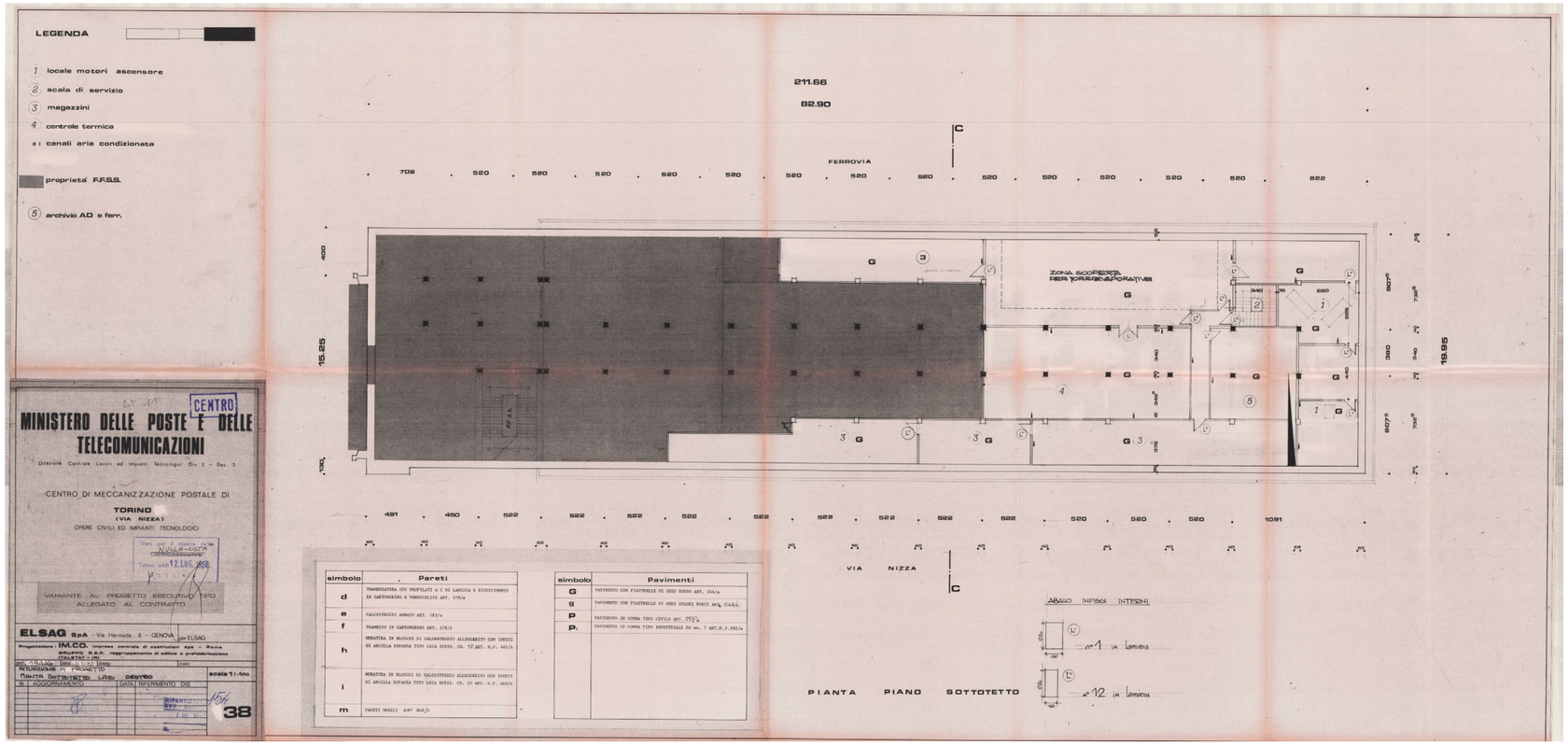


Ex-palazzo delle Poste, ground floor plan

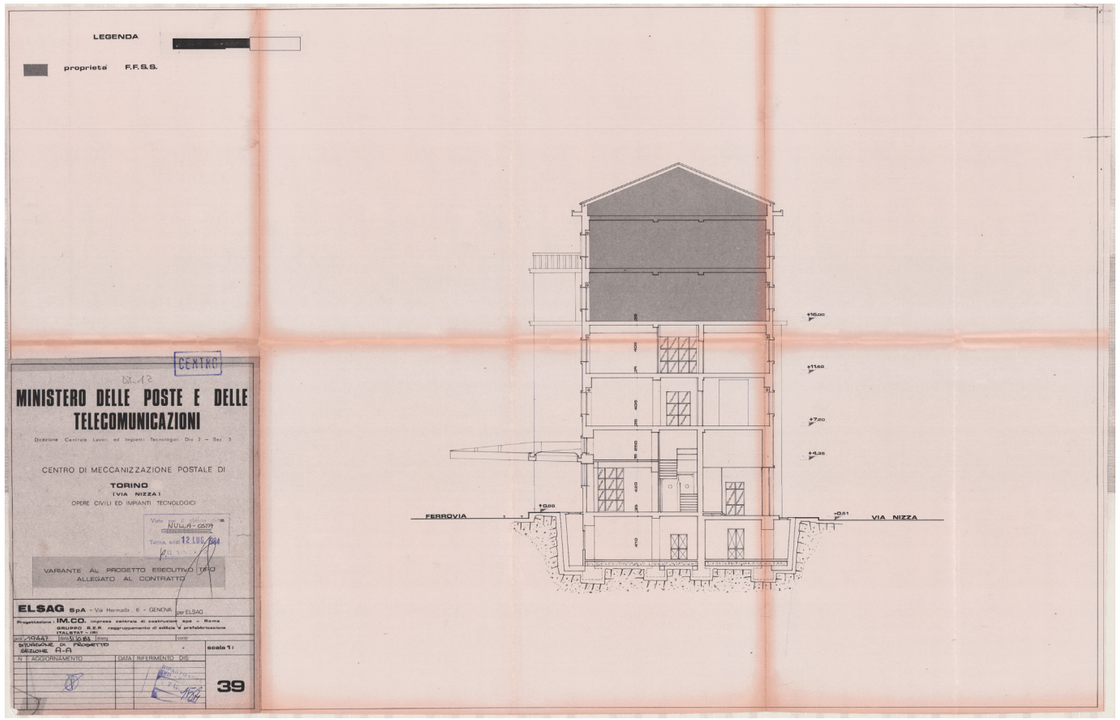


Ex-palazzo delle Poste, first floor plan

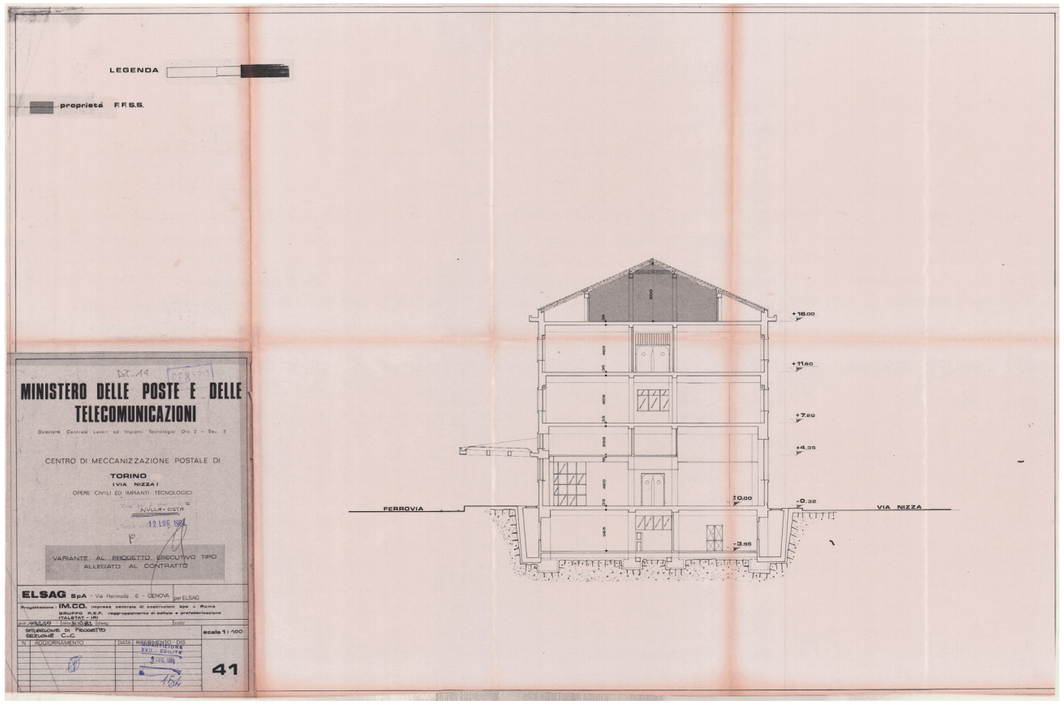




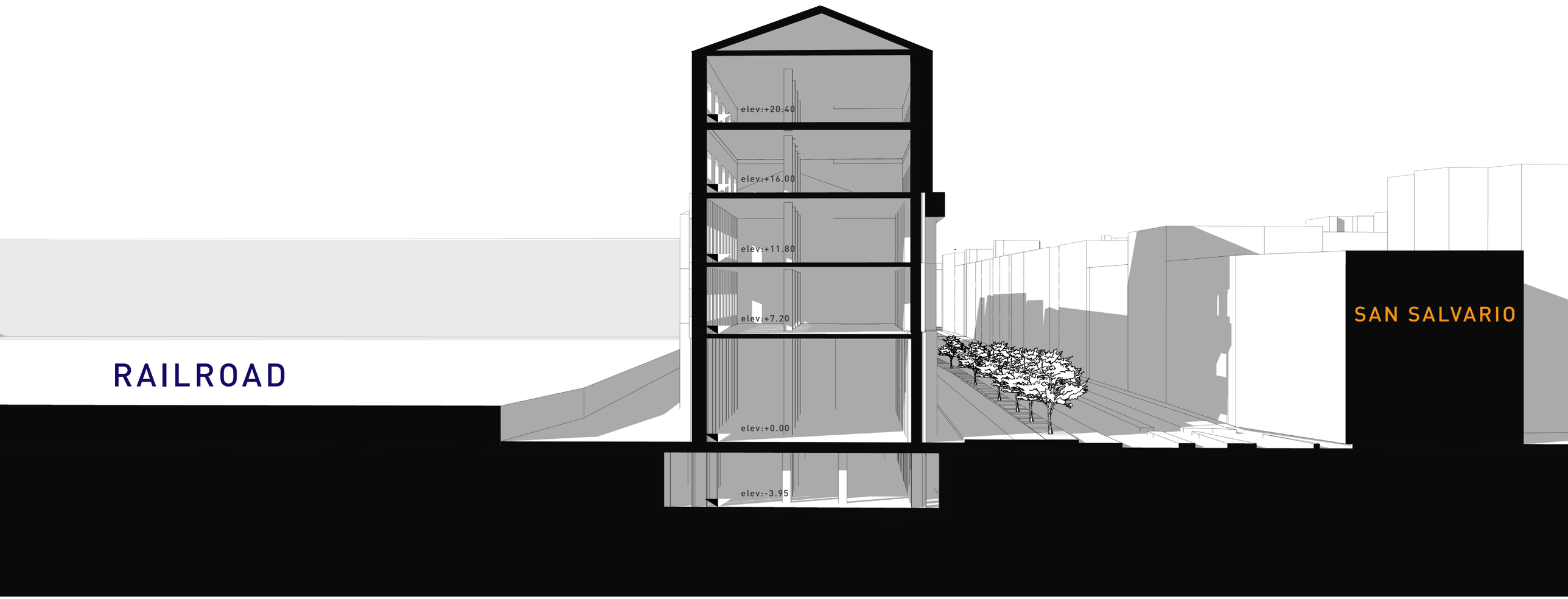
Ex-palazzo delle Poste, second floor plan



Ex-palazzo delle Poste, south section



Ex-palazzo delle Poste, north section


elev:+20.40
elev:+16.00
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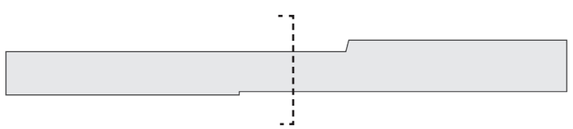
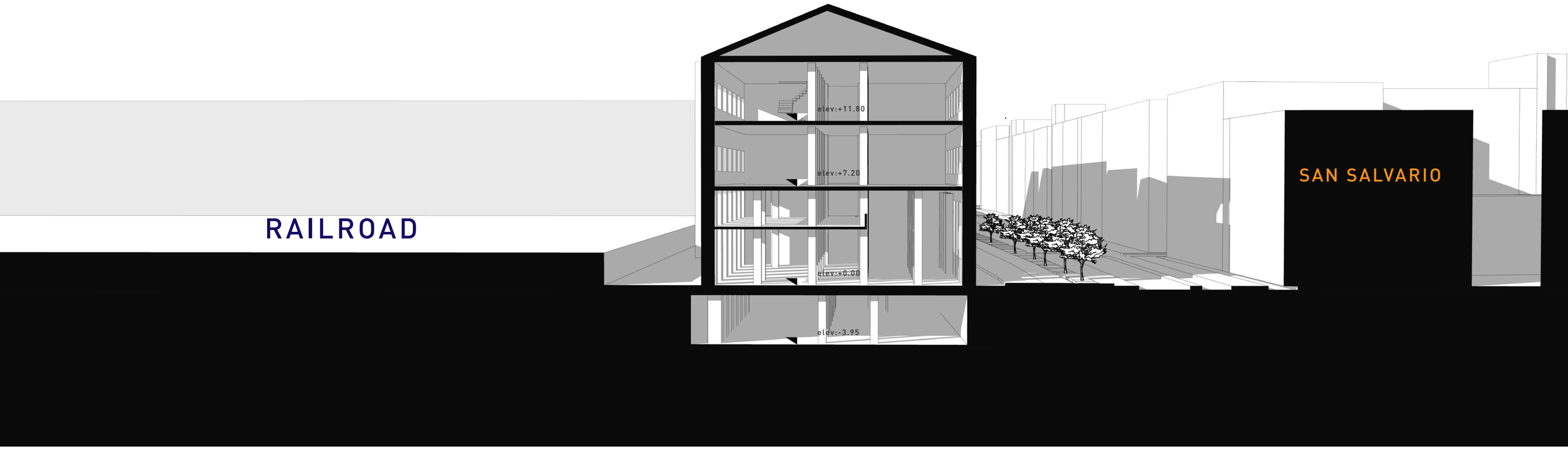
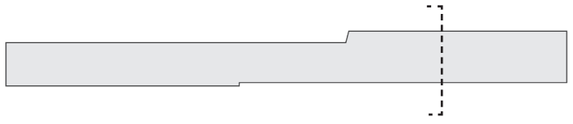
elev:+0.00
elev:-3.95
RAILROAD
SAN SALVARIO

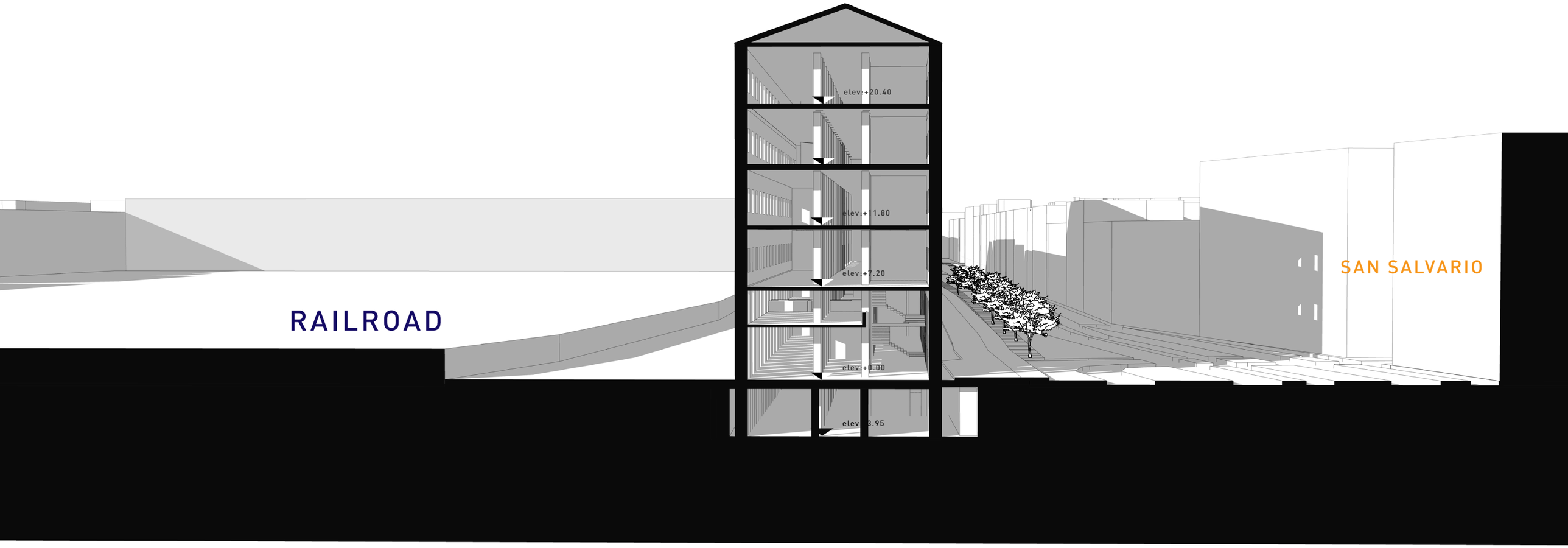
SECTION B-B





SECTION A-A




RAILROAD
elev.+20.40
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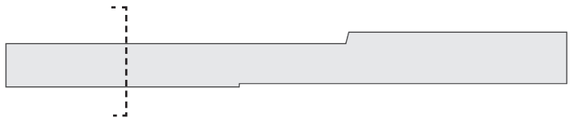
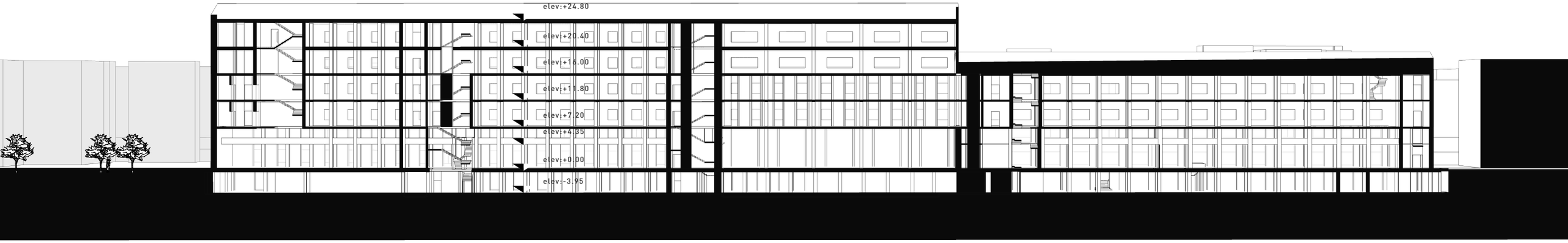
elev.-0.95
SAN SALVARIO

SECTION A-A

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elev:+16.00
elev:+11.80
elev:+7.20
elev:+4.35
elev:+0.00
elev:-3.95

SECTION D-D

CASE STUDIES

CASE STUDY A

VERTICAL HARVEST, JACKSON, USA

To study work of hydroponic commercial farm as one of case studies was chosen Vertical Harvest urban farm in Jackson, Wyoming, USA.

Size: 9,144 x 45,72 m plot, 3 stories high
Founders: Nona Yehia and Penny McBride
Design: E/Ye Design
Production:
Greens: 16782,918 kg per year
Herbs: 1995,80 kg per year
Tomatoes: 19958,064 kg per year

8. Vertical Harvest view

Jackson is located at 43°2831N 110°469W (43.475, –110.769), at an elevation of 6,237 feet (1,901 m) above sea level. According to the United States Census Bureau, the town has a total area of 2.95 square miles (7.64 km2), of which 2.91 square miles (7.54 km2) is land and 0.04 square miles (0.10 km2) is water.[53]

Due to its location in a very narrow river valley, Jackson experience a unique micro-climate that gets considerably more precipitation than the majority of Wyoming and has high humidity during most of the year. Its elevation (almost 1km above sea level) is also responsible for extreme differences between day and night temperatures, which makes the climate very close to being classified as subarctic (Köppen Dfc). Extreme temperatures range from –46 °C on January 1, 1979, to 37 °C on August 19, 1981, and on average 249.7 mornings fall below freezing and 41.2 of these below –18 °C;[54]

Town's location means there is not a lot of space and welcoming weather for farmers to grow fresh produce for the touristic town. The Vertical Harvest farm takes plot of unused city land that sits next to a parking lot in Jackson, Wyoming. Through an efficient building design, and the use of hydroponic farming techniques, the 1371,6 sq.m. footprint will have 5486,4 sq.m. of growing area. Within this area, the farm will produce over 38736,788 kg in year for town of 9577 people. All of the produce grown is distributed to 40 local restaurants and four grocery stores. [55]

Jackson's climate allows traditional farming method to grow during 4 months, but this project lengthens this for whole year and small town even in the harshest winter has access to locally-grown fresh greens. Located one mile above sea level, the town is covered with snow for long months and is therefore depends on imported fresh produce. Developers chose not to compete with local farms, thereby helping small local businesses and chose to grow produce that is currently imported, by this action they scaling down food chains in town, reducing transportation.

9. Vertical Harvest. Indoor space

Building combines uses of artificial natural lights for their hydroponic production. The 45 meters-long greenhouse facade of the building let in natural light, which both improves photosynthesis and cuts down on energy costs for the facility. When days shortens and it's impossible to use just natural light only, led-lighting help to ensure that farm meets it's production goals.

Although the grow lights will require a certain amount of energy, Vertical Harvest founders have stated that it still constitutes net energy savings over imported produce, and while HPS (High Pressure Sodium) bulbs will be used for the tomatoes, LEDs will be utilized for the "lettuce varietals, microgreen and propagation areas."

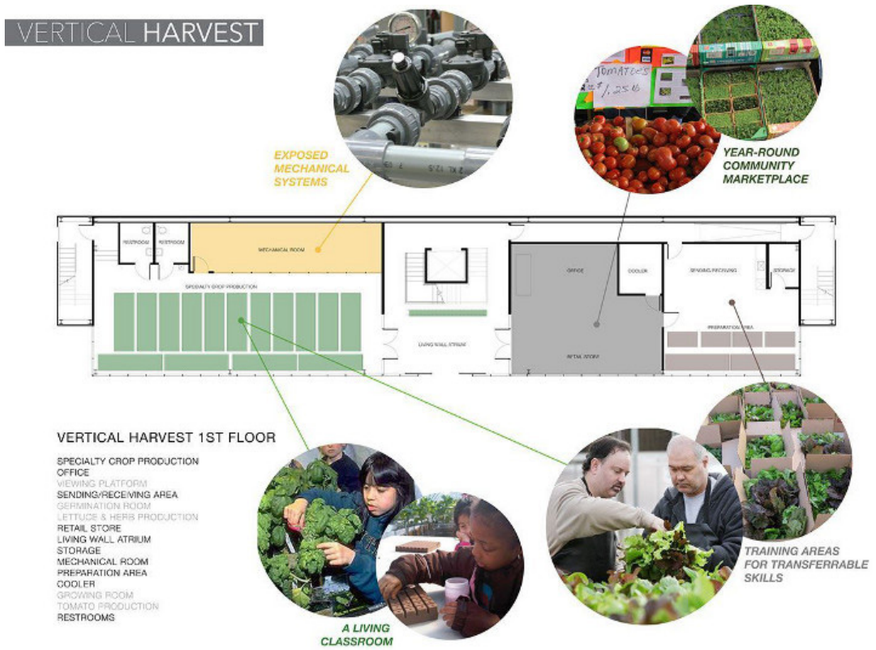
Vertical Harvest farm in Jackson will also serve as an educational facility for community, with a "small but functional 'living classroom'" and allow visitors learn about indoor urban farming without contamination of crops.

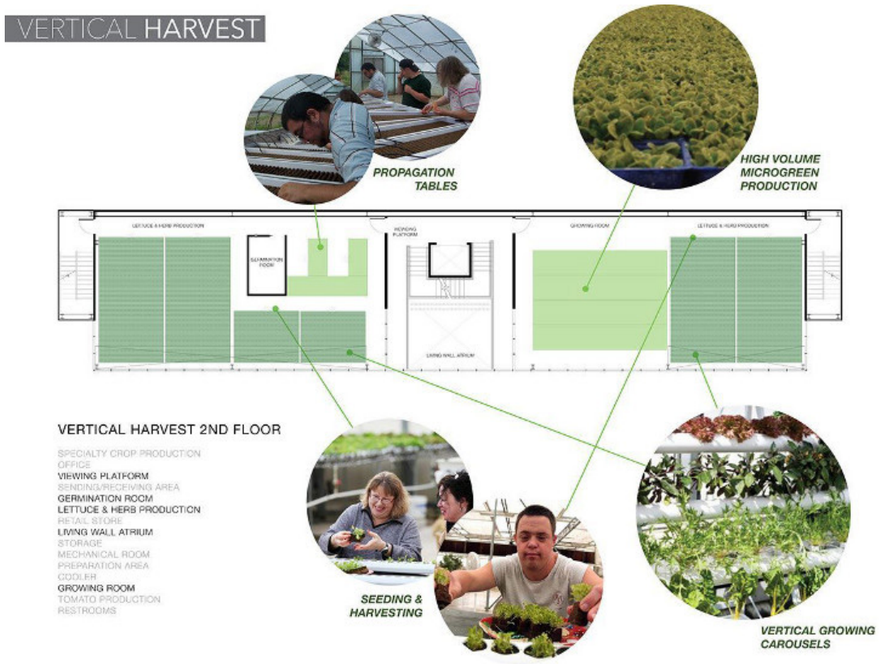
Half of Vertical Harvest's workers have physical or intellectual disabilities and farm environment is also specifically designed to provide a safe and meaningful work environment for adults with developmental disabilities, the employee base of Vertical Harvest.

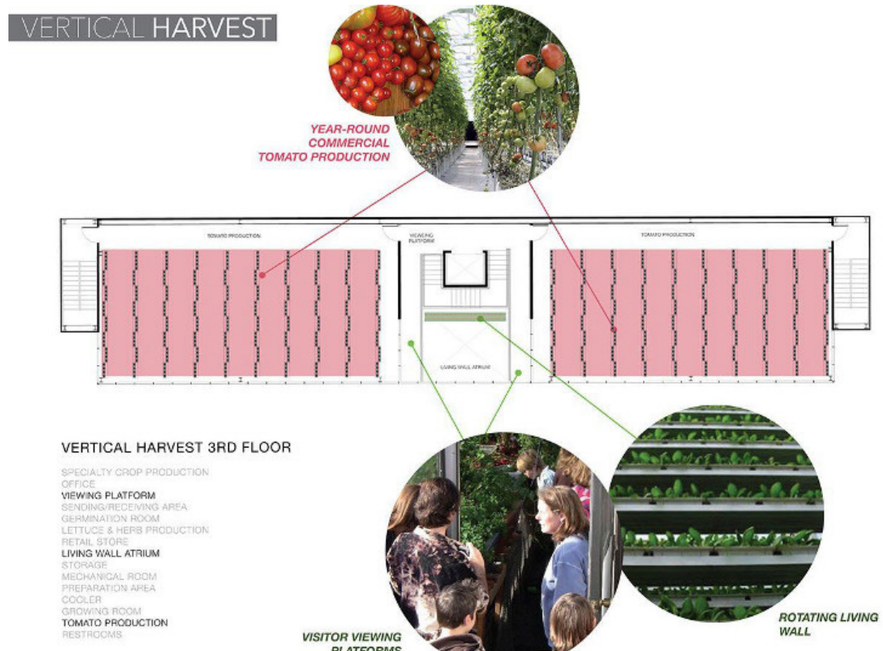
10. Street view

"Covid has shined a spotlight on what we knew ten years ago when we were looking at this vertical model: We have a centralized food system and it's kept us from getting fresh, local, good-tasting food. I think Covid-19 has forced people to ask why that is and how they now can get locally-grown food they like in the summertime and get it year-round. It's exactly what Vertical Harvest is about." - words of co-founder Nona Yehia.

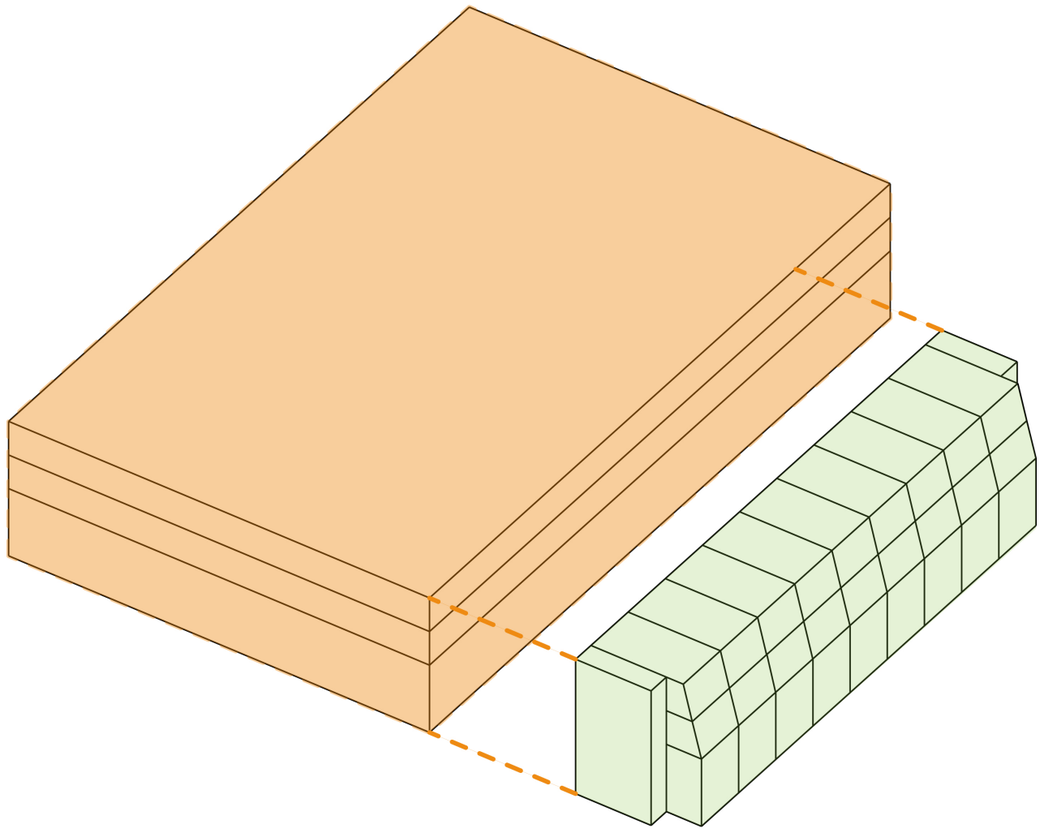
11. Before and after construction







18. Plans and diagrams of urban farm



GREENHOUSE

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PARKING

CASE STUDY B

PASONA GROUP, JAPAN

To study work of combined function of office and urban agriculture as one of case studies was chosen Pasona Group in Tokyo, Japan that temporarily had urban farm in office areas.

Size: 2700 sq.m plot, 9 floors
Designation: Pasona Group Urban Farm
Author: KONO Designs
Function: Office + Urban Farm
Number of users: ~ 2000 employees
Green space: 4 000 m2
Plants: 200 species

12. Pasona Group Headquarters
Tokyo. Street view

Pasona HQ, Japanese recruitment company, located in downtown Tokyo, Japan in a nine story corporate building. Design decision was to renovate existing 50 years old building and to keep existing superstructure and envelope.[56] New York firm Kono Designs created the urban farm in 2010 to allow employees to grow and harvest their own food at work.[57] The project consists of a double-skin green facade, offices, an auditorium, cafeterias, a rooftop garden and (temporarily) urban farming facilities integrated within the building.[58] It is the largest and most direct farm-to-table of its kind ever realized inside an office building in Japan.[59]

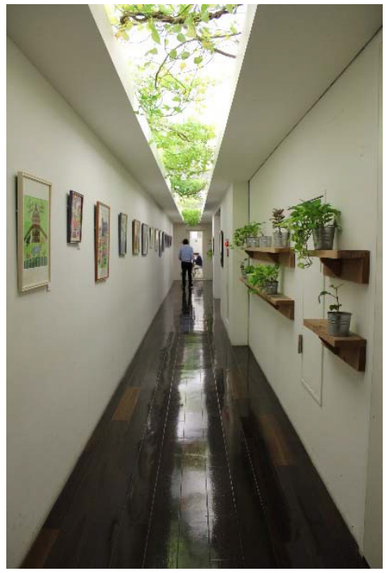
All of the food is harvested, prepared and served on-site in the cafeterias - making Pasona's Urban Farm the largest farm-to-table office scheme in Japan.

13.Rice harvest

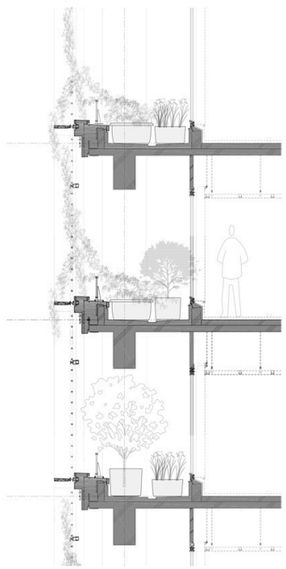
Pasona employees are encourage to maintain and harvest the crops and are supported by a team of agricultural specialists. "One way to encourage this is to not just tell urban communities about farms and plants, but to actively engage with them through both a visual intervention in their busy lifestyle and educational programs focusing on farming methods and practices that are common in Japan"- comments company principal Yoshimi Kono.[60]

14.Pasona HQ
Partitions

Double facade of the building was an important decision in design, cutting off space available for office and instead putting it off for flowers and orange trees on balconies. This balconies provide shading and additional insulation for interior, reducing heating and cooling loads of the building. This green wall gives certain identity for building in public's eye. Facade presents itself is a grid system that adds additional depth to the facade. One of the smartest design solutions came from using unused places, for example space above conference table, to suspend tomatoes above. Traditional partitions in conference rooms were replaced by lemon and passion fruit trees. Salad leaves are grown inside seminar rooms and bean sprouts are grown under benches.[61] These crops are equipped with metal halide, HEFL, fluorescent and LED lamps and an automatic irrigation system. An intelligent climate control system monitors humidity, temperature and breeze to balance human comfort during office hours and optimize crop growth during after hours.[62] Ducts, pipes and vertical shafts were rerouted to the perimeter of the building to allow for maximum height ceilings and a climate control system is used to monitor humidity, temperature and air flow in the building to ensure it is safe for the employees and suitable for the farm.[63] Pasona focuses on educating and cultivating next generation of farmers by offering public seminars, lectures and internship programs, to promote both traditional and urban farming as lucrative professions and business opportunities.[64] "It is important to note that this is not a passive building with plants on the walls, this is an actively growing building, with plantings used for educational workshops where Pasona employees and outside community members can come in and learn farming practices."[65]



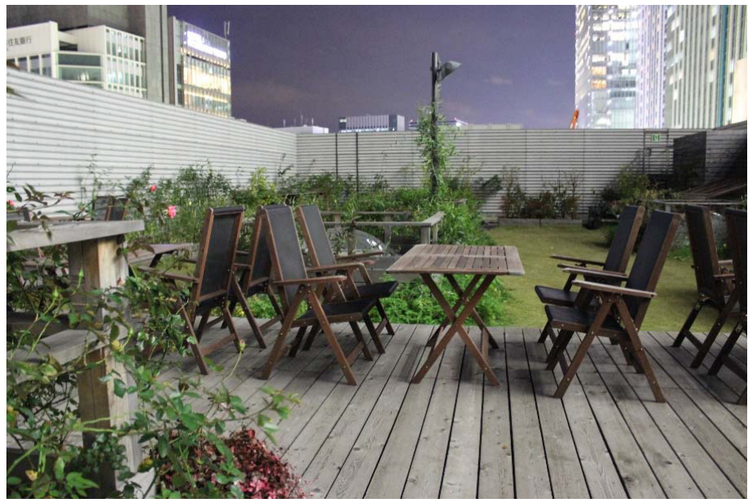
15. Pasona HQ
Rice paddy entrance



16. Pasona HQ
Typical balcony section

As the crops harvested in Pasona HQ are served within the building cafeterias, it highlights 'zero food mileage' concept of a more sustainable food distribution system that reduces energy and transportation cost.

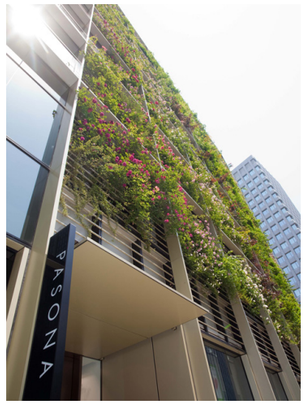
The project believes in the long term benefits and sustainability in recruiting new urban farmers to practice alternative food distribution despite the increased energy required in the upkeep of the plants. Crops and office workers share a common space using soil based farming as well as hydroponics.



17. Pasona HQ
Green rooftop with leisure areas

A sampling on the air at Pasona HQ have shown reduction of carbon dioxide where plants are abundant. Such air quality increases productivity at work by 12%, reduce symptoms of discomfort and ailments at work by 23%, absenteeism and staff turnover cost.
Employees are encourages to participate in the maintenance and harvesting of crops with the help of agriculture specialists. This encouraging awareness of food security and social interactions betweens workers.
Pasona Urban Farm is a unique workplace environment that promotes higher work efficiency, social interaction,

future sustainability and engages the wider community of Tokyo by showcasing the benefits and technology of urban agriculture.[66]



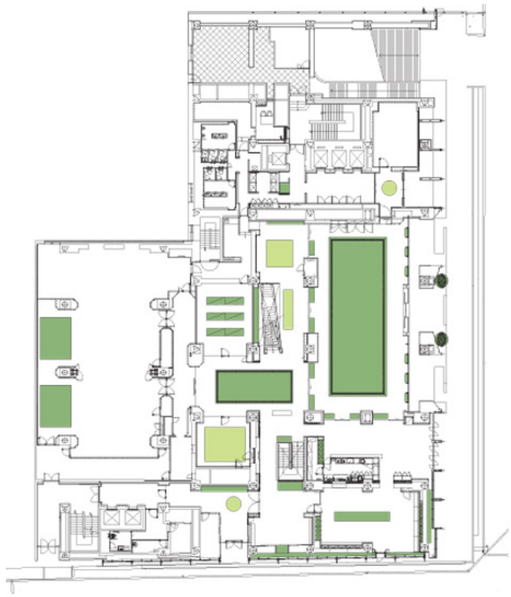
18. Pasona HQ
Green facade

green/farm space

green/farm ceiling

Pasona HQ
Ground floor, Lobby

Pasona HQ
Typical office floor plan



CASE STUDY C

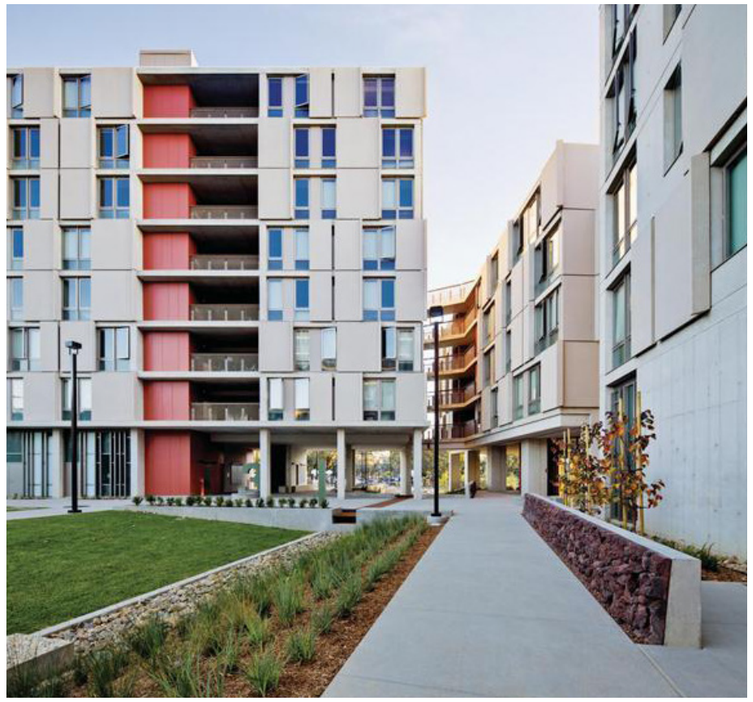
CHARLES DAVID KEELING APARTMENTS

To study student dormitory as one of case studies was chosen Charles David Keeling Apartments in San Diego, California, USA.

Area: 13656,7 sq.m
Client: University of California, San Diego
Architect: KieranTimberlake
Construction Manager: Swinerton Builders
Landscape Architect: Spurlock Poirier
Structural Engineer: John A. Martin & Associates
Electrical Engineer: Sparling
Mechanical, Plumbing & Fire Protection: IBE Consulting Engineers
Civil Engineer: Nasland Engineering
Environmental Consultant: Atelier Ten
Lighting Consultant: Candela
Cost Estimating: International Consultants, Inc.
Specifications Consultant: Technical Resources Consultant Inc. (TRC)
Program:85 6-person apartments with bath and kitchen, 2 two-story lounges, green roof terrace, courtyard with multiple use areas, basketball courts, and barbecue area

The Keeling Apartments are named after Charles David Keeling, a former professor at the Scripps Institution of Oceanography whose measuring of carbon dioxide first brought the idea of the "greenhouse effect" and global warning to the international scientific community. (33) From his research came the Keeling Curve, which first alerted the world to the possibility of global warming. He conducted his research at the Mauna Loa Observatory on the big island of Hawaii, that explains why eight communities in the Keeling Apartments are named after the eight Hawaiian Islands.[67]

The project also extended the life of a neighbouring building slated for demolition. Careful planning for the new complex spared the cost and environmental impact of replacing the lost housing elsewhere.[68]



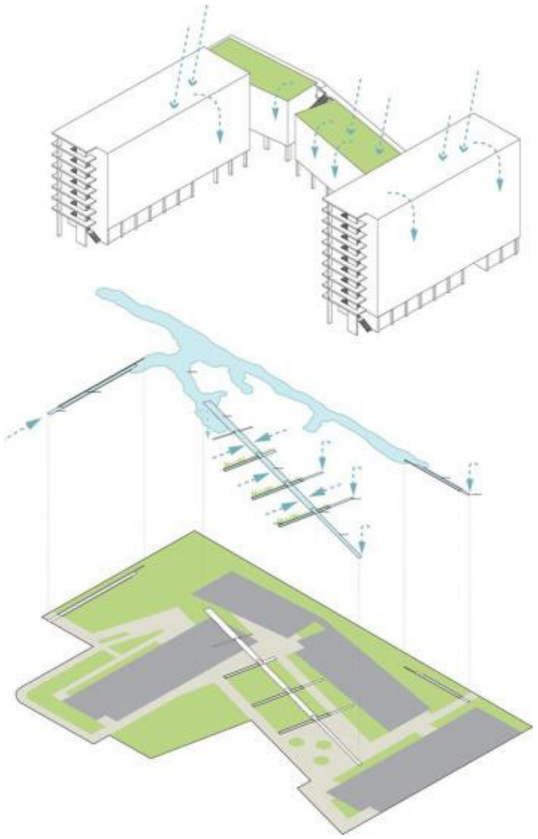
19. The 17 Sustainable Development Goals (SDGs)

At one point in the project the budget was reduced, but the same number of students needed to be accommodated. In addition, the cost estimate had to be reduced by 25%, while maintaining same level of high performance and quality living spaces. Natural ventilation was found to cause a 38.3% reduction in energy consumption. The photovoltanics were afforded because of a lease program with SDG&E, otherwise they would not have been within the budget.

The prohibitive cost for water transport and sewage fees was a major motivation for on-site water recycling. The fiberglass sunshade material met the design objectives, with the added benefit of being inexpensive, durable, and long-lasting. This project increases the density of the site and has both a cultural and fiscal benefit for the campus.[69]

"We hope it serves as a model for environmentally responsible student housing not only for the UC system, but for colleges and universities across the country," says James Timberlake.[70]

It's an example of a relatively large scale student dorm that had an opportunity to really break some important ground in terms of water performance and has an on-site black



20. Charles David Keeling Apartments
Rainwater mitigation

and grey water treatment facility.[71]

It managed to naturally ventilate the apartments even though it is pretty far south in San Diego. So the avoidance of the systems through the design of the façade and considering what was actually needed.

That was amplified by the single loaded corridor, which (I would say) is moving away from a standard design plan.

The project also had a clear approach to solar orientation that came through in the development of the different elevations which was pretty strong.[72]

And beginning to cast the trajectory in a way that is responding to some significant regional and global challenges, in this case is water. So water in a way was a really prominent story and that was buttressed in this case with having a business case showing that the cost of doing this on-site black and grey water treatment was actually less expensive than the conventional approach to plug into the grid.

One of the strategies for sustainability is to use natural ventilation for cooling, embrace ocean breezes and do not install mechanical system of cooling, that results in significant reduction of energy. Computational fluid dynamics (CFD) used to verify effectiveness of the building shape and ability to use natural ventilation. To make sure that the windows were right size and unit design would ensure comfort for students without mechanical system of cooling wind tunnel testing was used.

There are nine or ten operable windows within each apartment, which are single-loaded to offer the occupants ample flow-through natural ventilation and daylight. Each apartment has both an ocean side and a courtyard view. The shading devices and railings have a permeable design to maintain views while minimizing the effect of solar radiation.[73]

In addition to several sustainable building features, the Keeling Apartments have a 49 kilowatt rooftop solar array.[74] The PV system is the first at UC San Diego to be funded through San Diego Gas and Electrics innovative lease program. On-site renewable energy comes from a rooftop photovoltaic array. On-site PV arrays supplies 6% of the building's total energy.[75]

Heating efficiencies are achieved by thermal mass, and

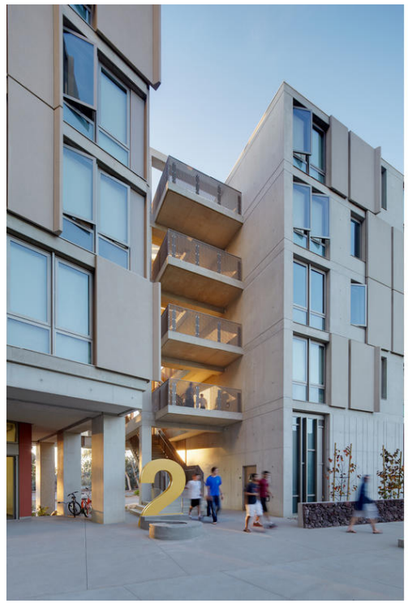
by an innovative backward-constructed rain-screen and air barrier exterior wall that reduces heat loss and water vapour infiltration. Any necessary mechanical heating is provided by a localized arrangement of individually controlled radiant panels. Lighting energy demand is largely met by daylighting and is complemented in public spaces with occupancy-controlled lighting systems.[76]

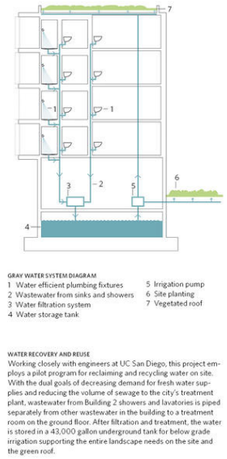
Water conservation was a top priority for this project, as it is both a scarce resource in Southern California and requires a significant amount of energy to transport from its distant source. The design response was two-fold, first focusing on conservation, and second on recycling. The conservation measures included water-efficient landscaping and a full suite of efficient plumbing fixtures, such as low-flow toilets.[77] Storm-water flow into the Pacific Ocean is re-mediated with a system of landscape bioswales and retention basins that reduce storm-water quantity, delay peak water flow, and control flooding in this region of the campus, with the added benefit of reducing erosion of fragile coastal scrub arroyos, a particularly threatened ecosystem.[78] Recycled water, while regionally available and used elsewhere at UC San Diego, was not available on this end of the campus and the cost to extend the system was prohibitive. Instead, the project incorporates its own wastewater recycling system to provide landscape irrigation water at grade at for the green roof. The integration of on-site water recycling was a pilot project for the UC system, providing a legal and technical template for future projects to follow.[79]

"We were all challenged by UC San Diego leadership to use the campus as a 'planet first' climate research tool, to translate theory into remarkable spaces," says Martin Poirier, FASLA, the principal designer with Spurlock Poirier Landscape Architects.

Materials used in the building are robust and long-lasting, with an 80-year life span. In addition, most surfaces are unfinished, eliminating the need for carpet, vinyl tile, or mastics.

As the exterior and interior walls, floors, and ceilings are exposed concrete, a high level of care was taken to generate the most aesthetic concrete with intense focus on batch composition, form-work, and craft. To withstand the salt air,





21. Charles David Keeling Apartments Rainwater mitigation

the project incorporates aluminium windows and doors and stainless steel hardware for exposed elements. An innovative architectural use of industrial fiberglass grating for sunshades and railing systems was specified for its durability in marine environments.

The long-term benefit of these material selections will be less maintenance and longer replacement intervals, resulting in reduced costs and associated energy. Environmental considerations were carefully examined with regard to the use of concrete, and particularly fly ash additive. The team carefully reviewed the scientific literature about the health aspects of the latter concluding that fly ash is not an issue in either the short term or the very long term. Fly ash was incorporated primarily in the foundations where colour was not an issue. In addition, all of the concrete wood form-work

was recycled after use.[80]

Before the Keeling Apartments were completed, second-year students were housed in two separate locations, removed from Revelle College. This discouraged students from using the main dining and other facilities, or attending extra-curricular events which required a long trek across campus. With the project's completion, second year students relocated to Revelle College, where they now engage the greater college community.

The higher density that results from this project—and the benefit of attractive housing, views, and location—has the additional benefit of enabling students who would otherwise live off-campus to reside on-campus, further solidifying the campus community and reducing the vehicle miles driven by commuter students.

Estimated percent of occupants using public transit, cycling or walking: 100% [81]

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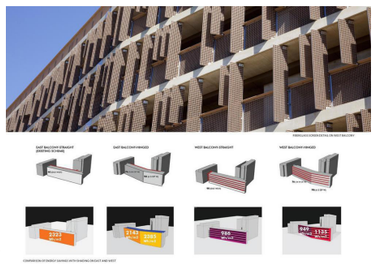
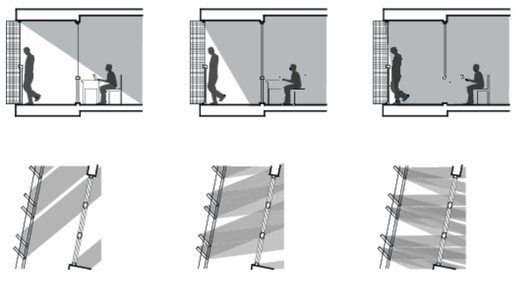
"We hope it serves as a model for environmentally responsible student housing not only for the UC system, but for colleges and universities across the country,"



22. Charles David Keeling Apartments
Solar analysis
Shading devices



23. Charles David Keeling Apartments
Solar analysis

says James Timberlake.[83]

It's an example of a relatively large scale student dorm that had an opportunity to really break some important ground in terms of water performance and has an on-site black and grey water treatment facility.[84]

It managed to naturally ventilate the apartments even though it is pretty far south in San Diego. So the avoidance of the systems through the design of the façade and considering what was actually needed.

That was amplified by the single loaded corridor, which (I would say) is moving away from a standard design plan.

The project also had a clear approach to solar orientation that came through in the development of the different elevations which was pretty strong.[85]
And beginning to cast the trajectory in a way that is responding to some significant regional and global challenges, in this case is water. So water in a way was a really prominent story and that was buttressed in this case with having a business case showing that the cost of doing this on-site black and grey water treatment was actually less expensive than the conventional approach to plug into the grid.

The roof of Keeling Apartments borders the highly landscaped campus, surrounded by eucalyptus trees, and the coastal boulevard that follows the La Jolla cliffs. With the ocean nearby to the west, the roof is highly exposed to wind, salt, and humidity.

The green roof covers roughly 464,5 sq. m. and is divided into two distinct sections by an exterior stair and patio. It can be characterized as an intensive green roof, planted with temperate succulents and drought-tolerant grasses. This roof is formal in composition and is planted in a series of subdivided beds, separated by a perforated edge retainer that limits root movement between zones. The green roof assembly has an overall depth that fluctuates from 25 to

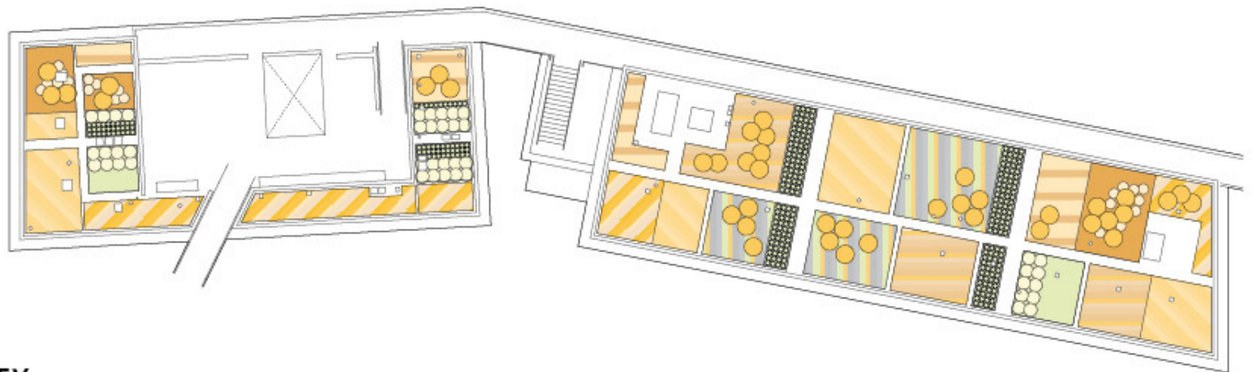
45,7 cm. Since the roof insulation slopes, while the finish level of the roof deck is flat, green roof media makes up the difference in grade. It is watered using a drip irrigation system fed by reclaimed and recycled water tied to cisterns located at grade and fed through a pressurized pump.[86] Since opening in 2011, the project has been recognized with an Award from the American Society of Civil Engineers for its water conservation and treatment systems, and was named Project of the Year by the American Public Works Association.

The Charles David Keeling Apartments at UC San Diego have been awarded LEED-NC (Leadership in Energy and Environmental Design for New Construction) Platinum certification from the United States Green Building Council. The building the first LEED Platinum student housing in the University of California system. It is also the first new building at UC San Diego to receive a Platinum rating—the highest LEED certification level that can be achieved. Keeling Apartments also won COTE Top Ten Green Award (30) `The project also extended the life of a neighbouring building slated for demolition. Careful planning for the new complex spared the cost and environmental impact of replacing the lost housing elsewhere.[87]

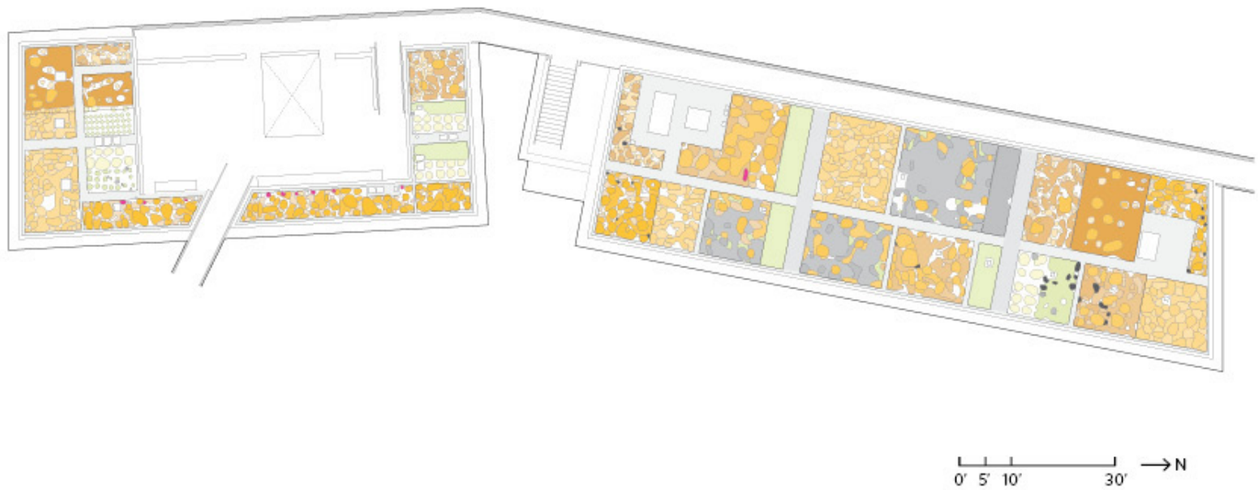
25.Charles David Keeling Apartments

24. Charles David Keeling Apartments

2011 PLANTING PLAN



2012 SURVEY



CASE STUDY D

URBAN DENVER BUILDING BY TRES BIRDS HOUSES

A JAPANESE RESTAURANT AND AEROPONIC GREENHOUSE

Size: 650-square-metre, 2 floors
Design: Tres Birds Workshop
Location: Denver, CO
Completed: Fall 2018

26. Facade of Uchi restaurant

When the James Beard Award-winning Japanese restaurant Uchi came calling in Denver, tres birds workshop was selected to provide full service sustainable architecture, general contracting, and interior design. The full square block mixed-use living and urban agriculture development designed by tbw, Tres Birds Workshop, the Austin-based restaurant group looked to the space's creator to provide an elevated aesthetic for the chic restaurant.[88]

The building is located within a block-long, mixed-use development called S*Park, short for Sustainability Park.

The ground level was designed for Uchi, an award-winning restaurant that serves up a range of Japanese fare, from wagyu beef and oak-grilled fish to sushi and sashimi. Its first location opened in 2003 in Austin, Texas. Rectangular in plan, the building consists of a relatively solid base made of brick and concrete. Up above, a fully glazed volume is topped with a multi-gable roof, giving the building a distinctive look.[89]

Using tbw's experience in Japan (with completed projects in Tokyo and Osaka) as a foundation, the firm was able to bring Japanese sensibilities to the table while incorporating that which makes Denver unique. Native lumber and reclaimed materials were used throughout the restaurant, like the massive Douglas fir door that's accented with utilitarian steel.[90]

The southern wall grabs the immediate attention of the guest after passing through the entry. A tbw innovation, the wall is a composite of red and crystal bricks that refract the light as it streams into the dining room. As the sun sets, one can peer out from the inside to see the Denver skyline.

The balance of light and dark makes the space compelling -- the raw lumber ceiling (which doubles its duty as sound-dampening) contrasts with the black accents around the room. Shoji screens provide a lightness while the boldness of the Austin restaurant's iconic red flowered paper makes a statement. A 70-foot white marble sushi bar serves as a connection between the two dining rooms, and large parties can dine under a magnificent eight-foot oculus with views up to the delicate vines of the greenhouse above.[91]

Furniture was designed especially for Uchi, and manufactured by Denver-based House Fish.[92]

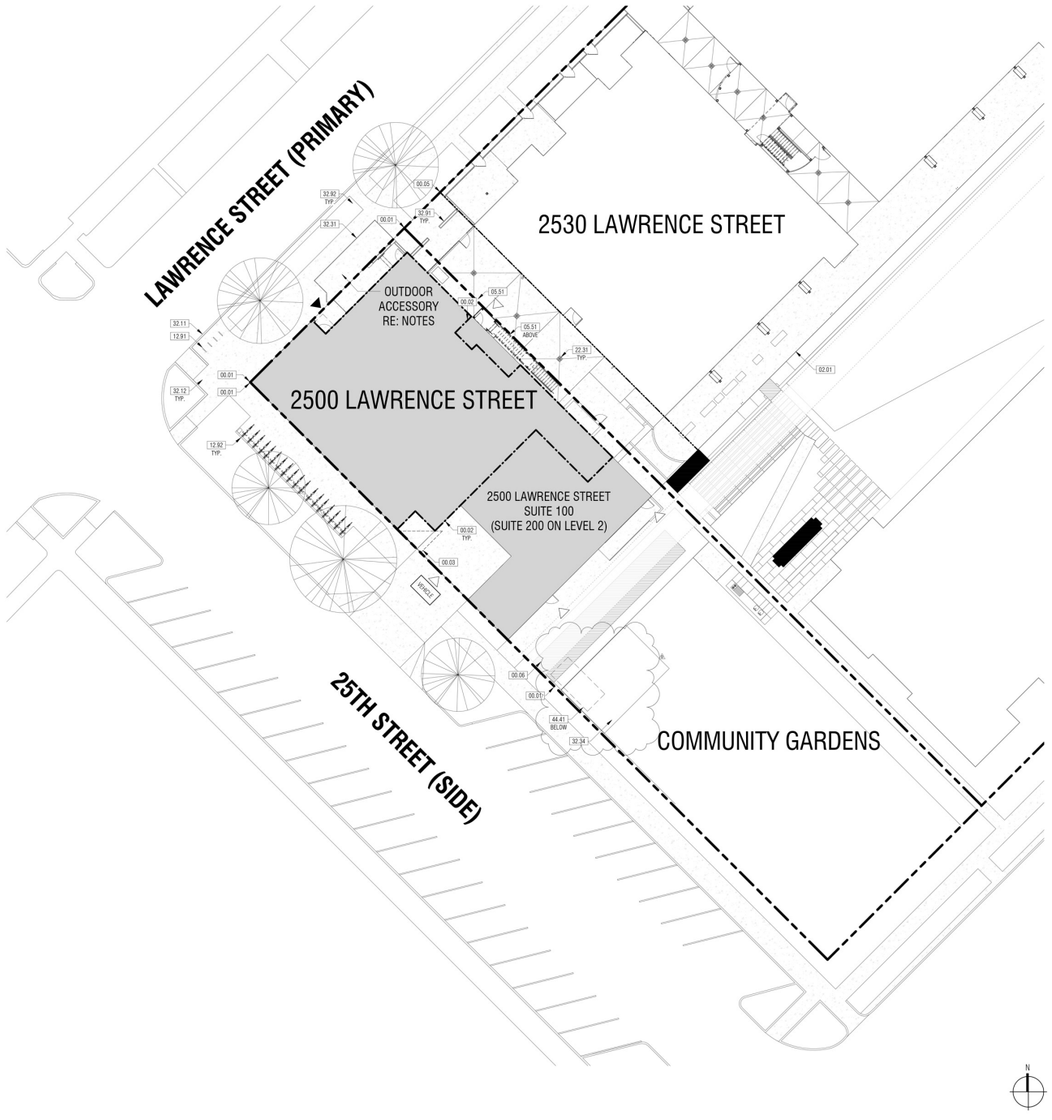
Up above, the team created a 650-square-metre greenhouse that "supplies the kitchen with the freshest organic greens available throughout the year".

Managed by Altius Farms, the growing area features white, aeroponic towers that require no soil.

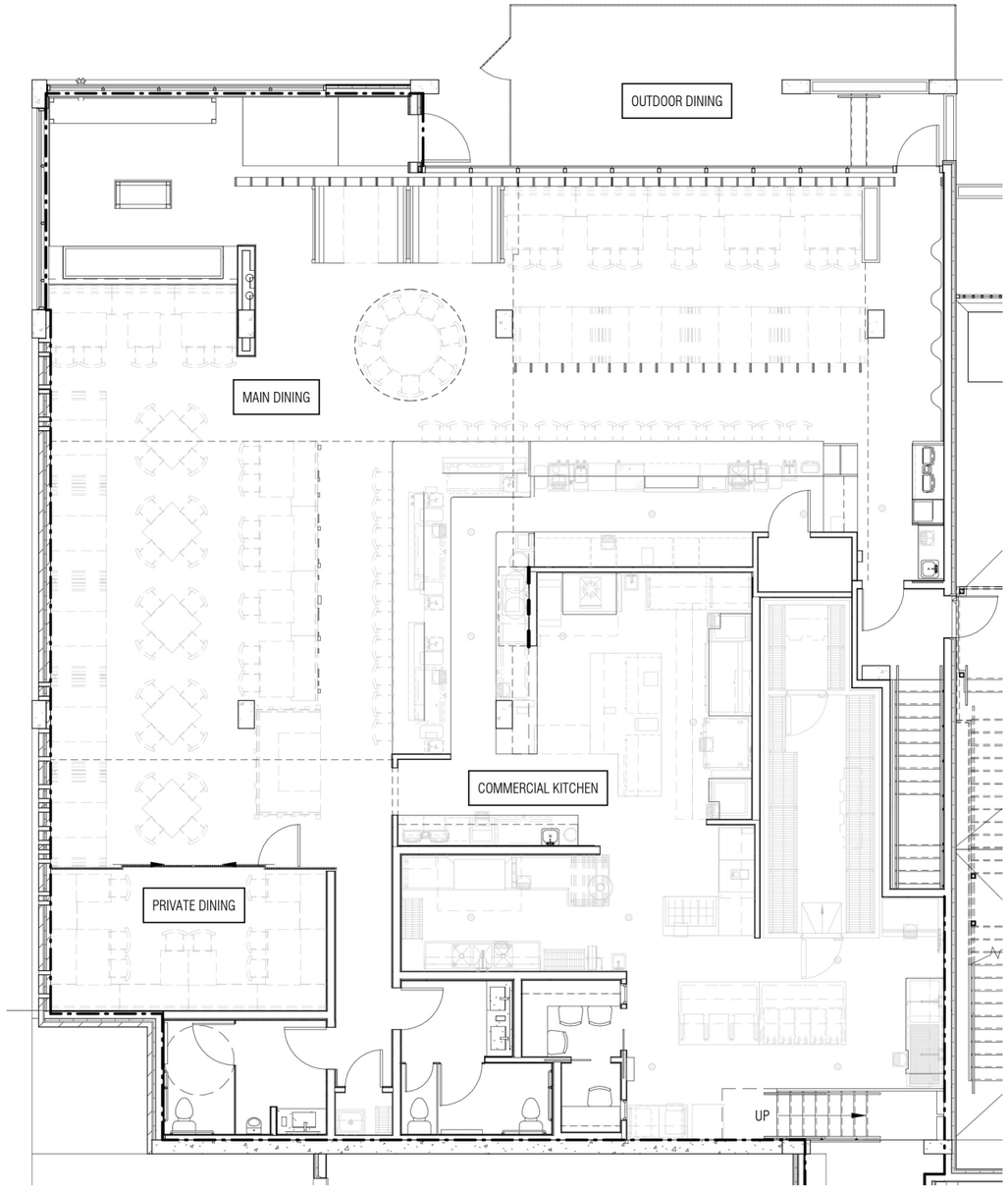
The plants – which include lettuce, herbs and edible flowers – are regularly misted with nutrient-laden water.

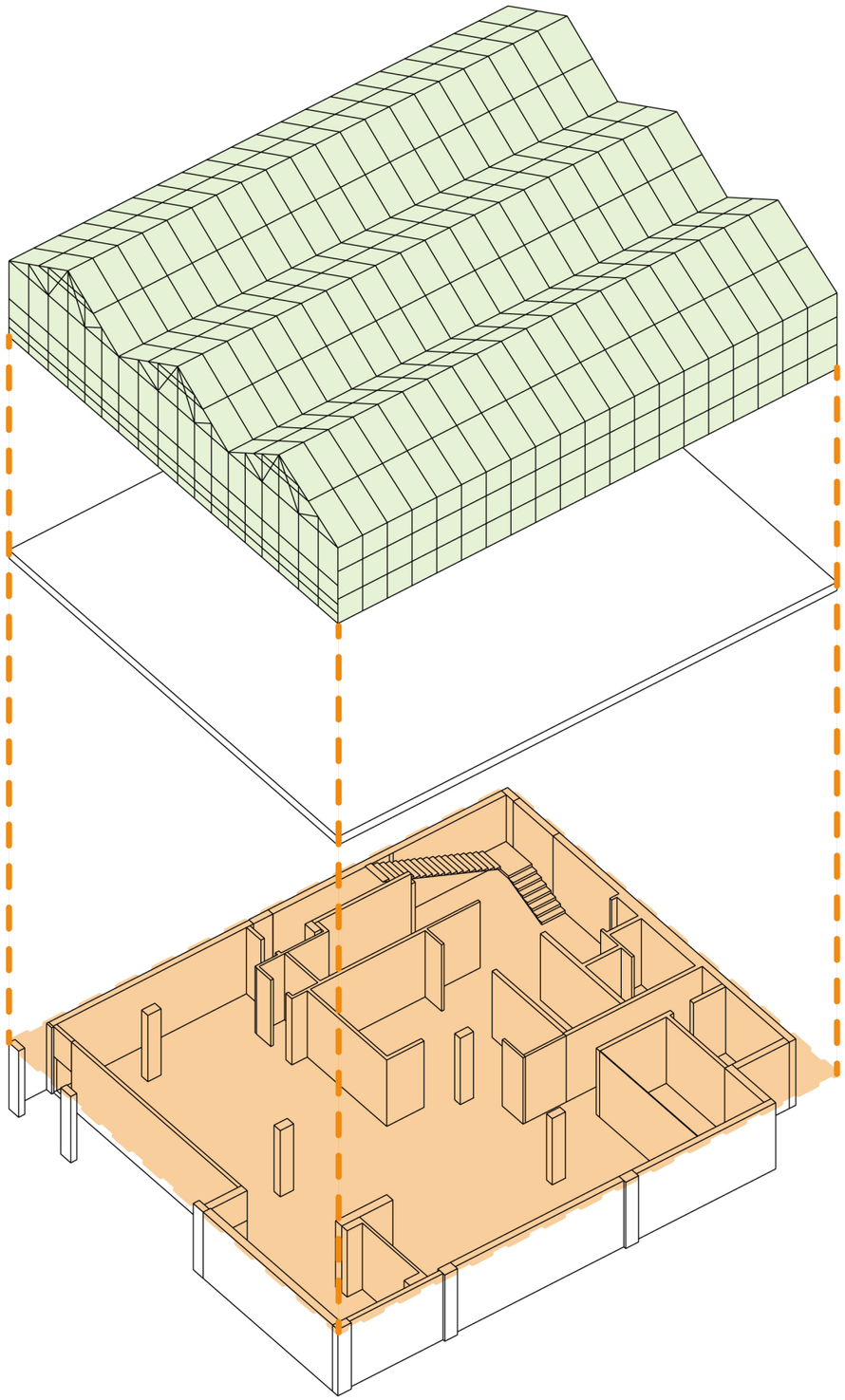
The greenhouse conditions are monitored by sensors that help control heating and cooling and cue the opening of roof and side vents, according to Denver's 303 Magazine. In addition to Uchi, the urban farm provides leafy greens for a number of local restaurants and markets.[93]

27. UCHI restaurant



28. UCHI restaurant
Ground floor plan





GREENHOUSE

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RESTAURANT

CASE STUDY E

TRUSSARDI DEHORS – THE UNEXPECTED GARDEN

To study strategies of reuse of historical building to new functions was chosen Trussardi Cafe, located in the ground floor of the headquarters of the fashion house in Piazza della Scala, Milan.

Area: 100 sq.m
Client:Trussardi
Architect: Carlo Ratti e Associati
Team: Carlo Ratti, Walter Nicolino
Structure: Polar Glass System
Vertical greenery: Patrick Blanc
Interior design: David Drago
Lighting: Artemide

On the occasion of the Salone del Mobile, the completely renovated Cafè Trussardi in Milan reopens with a permanent terrace overlooking Piazzetta Ferrari. The dehors was born from the collaboration of the Carlo Ratti e Associati studio and the artist-botanist Patrick Blanc and was conceived as a glass case surmounted by a vertical garden of 100 square meters, a real 'Unexpected garden' suspended in the void.[94] More than 120 different plant species are placed on the thin support structure, creating the effect of a green cloud floating in space.[95]

An eco-sustainable element, the vertical garden is able to improve thermal insulation of the building and better quality of air space by filtering pollutants and producing oxygen. Also it works as shade in summer days.

Trussardi presents a project aimed at enhancing the historic center of Milan. Project readjust an urban space, relationship between a square, a pedestrian area and a new meeting point. The project also provides 5 square meters of green for each car present in the square before the intervention.[96]

With the use of a living element as the building material the entire structure can be interpreted as an organism with its own metabolism.[97]

29.View from square, Trussardi cafe, Piazza della Scala, Milan.

30.View from square, Trussardi cafe, Piazza della Scala, Milan.

CASE STUDY F

FABBRICA DELL'ARIA

Size: 650-square-metre, 2 floors
Design: Tres Birds Workshop
Location: Florence, Italy
Completed: 2019
Client: B9
Project idea: Stefano Mancuso
Project development: Arch. Michele Giombini (Developer)
Architecture & Interior Design: Studio Q-Bic
Research & Sustainable Design: Studio PNAT

31.Former tobacco factory.

In Italy, Florence city, team of architects and biologists collaborated to rethink old tobacco factory. Industrial building (Manifattura Tabacchi) was shut down in 2001. Developers chose to requalify it and rebuild as big multi-purpose center. New name of "Fabbrica dell'Aria" (Air Fabric) was chosen for it.

What makes this project special is unique collaboration of biology and architecture. They chose to insert into facade greenhouse, that is able with help of newest technologies to purify 5 000 cubic meters of indoor air in an hour. It's considered to be a model for a filter that can be replicable and used inside any building, commercial or residencial. It's an innovative solution to air pollution in cities.[98]

Plants that were used in model can be characrerized by big area of leaves that influence level of area purification: bigger the leaves, more efficient the process. Banana tree, flint and ficus are one some examples of broad-leaves plants.

32.Indoor greenhouse.

Pnat is a creative group of designers and plant scientists with the aim of conceiving creative solutions based on facts. Pnat uses observation of plant behaviors to give thouht to new design solutions.

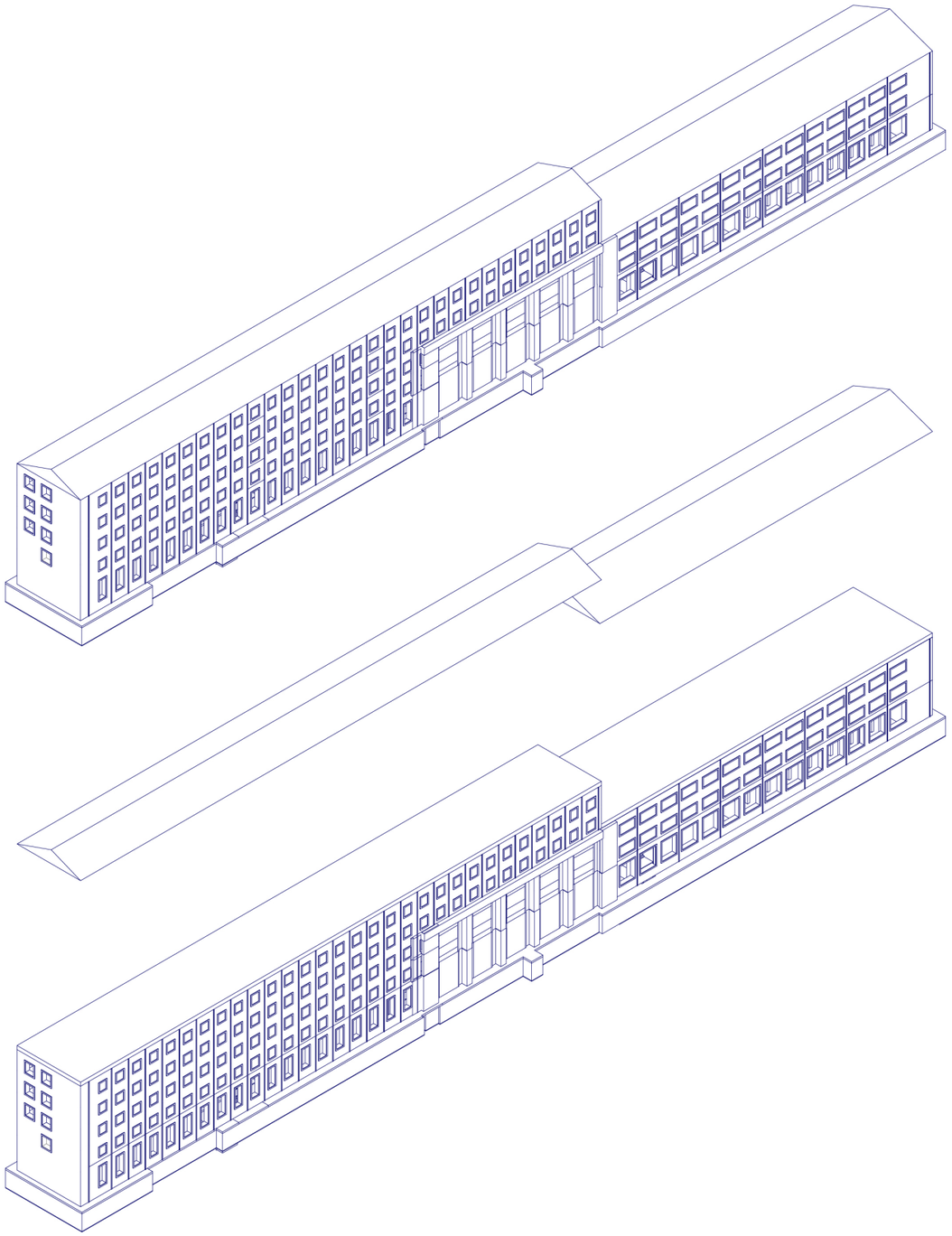
In this project, fact was that plants have a natural ability to absorb and degrade atmospheric pollutants but the problem has always been the huge amounts required. PNAT created a technology that increases this capacity. So just a few plants are now required to clean a huge volumes of indoor air with high velocity.

98% decrease of the air pollutants was shown in the LINV laboratory in Florence where measurement of purification was made.[99] Additionally, plants were examined to reduce temperature and regulate humidity without any external control.[100]

This innovative method makes Air Fabric a new model that can be scaled and replicated in old and new buildings to increase quality of life of users.

33. Indoor greenhouse.

CHANGE



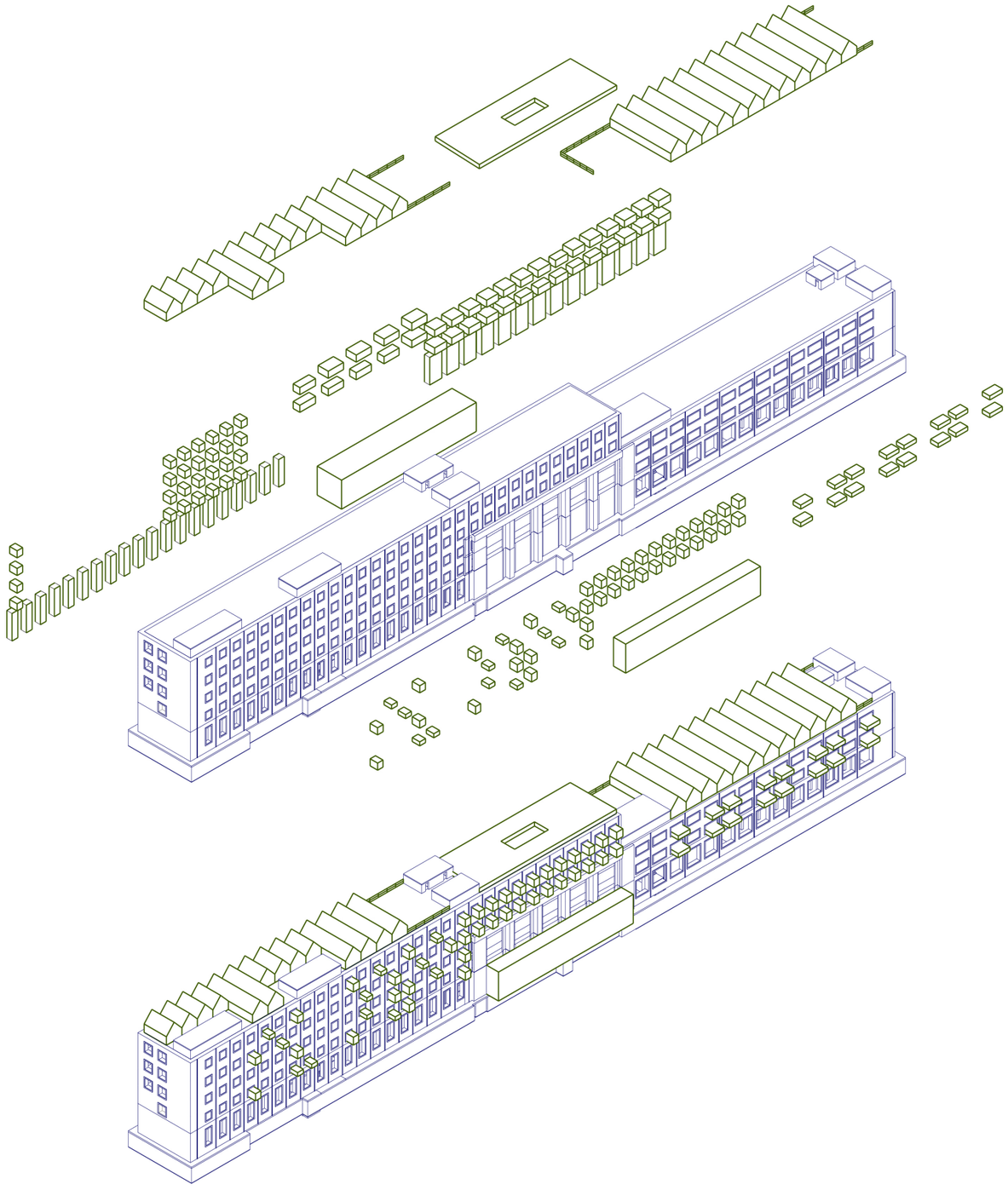
ACTUAL STATE

Ex-palazzo delle Poste, or in other words Ex-post office building once was serving as an office space, now is underused. This project aims to give it a new breath in a post-industrial era with change of orientation from manufacturing to service-related industries.

Current building has cultural significance to the city and it's facade and main structure is under protection. It leaves it difficult to propose major interventions.

Though it has it's advantages. Due to rational and effective office planning, building is easily dividable by units and gives base for design of student accomodation.

One of the first strategies for this building would be more efficient and productive use of a vast space - it's roof. Currently it's slightly sloped and little to no-used.
It would add 2480 square meters area.



CHANGE

Opening up the roof, we give ourselves a possibility for implementing green spaces in it. Three different types of use proposed:

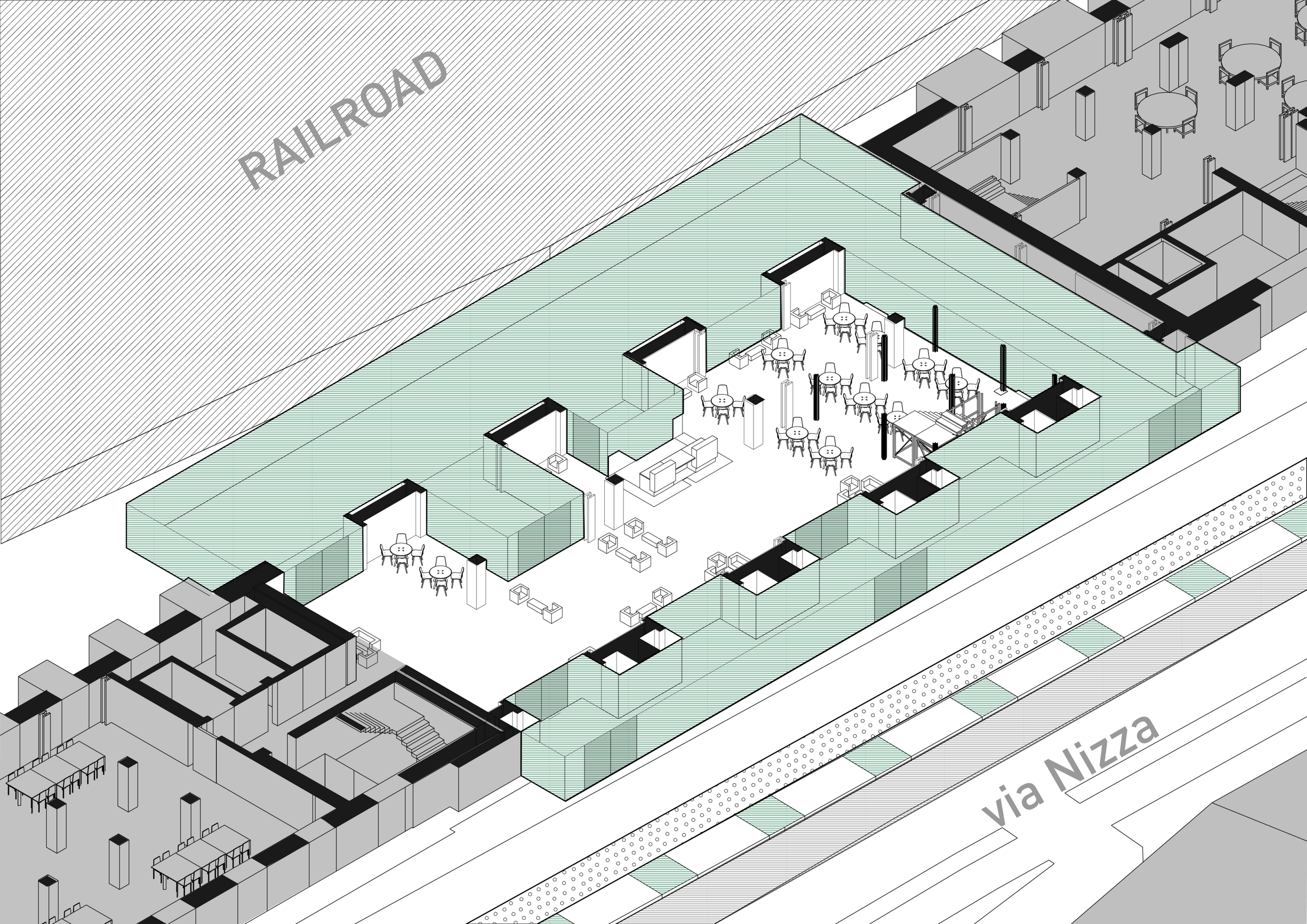
1. Traditional green roof for students to spend time outdoors.

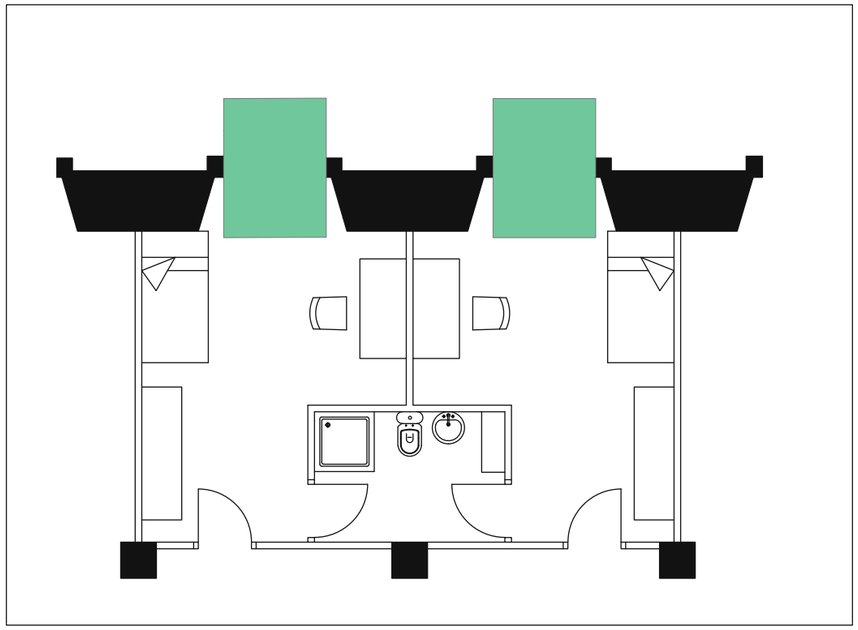
2. Greenhouse spaces for winter and rainy days, where all types of plants can be grown

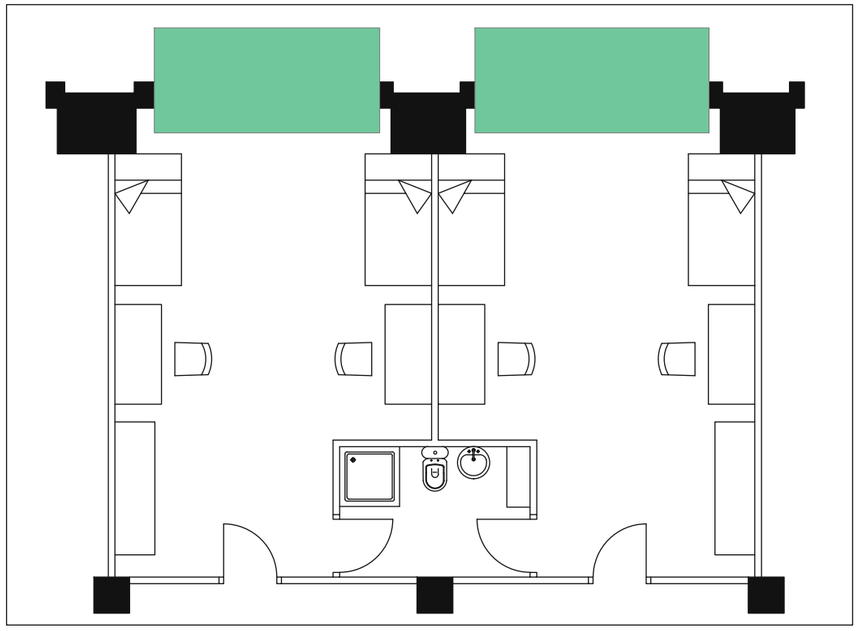
3. North part of the roof designed as a part of urban farm, for it's future growth. With posiiblity to expand.

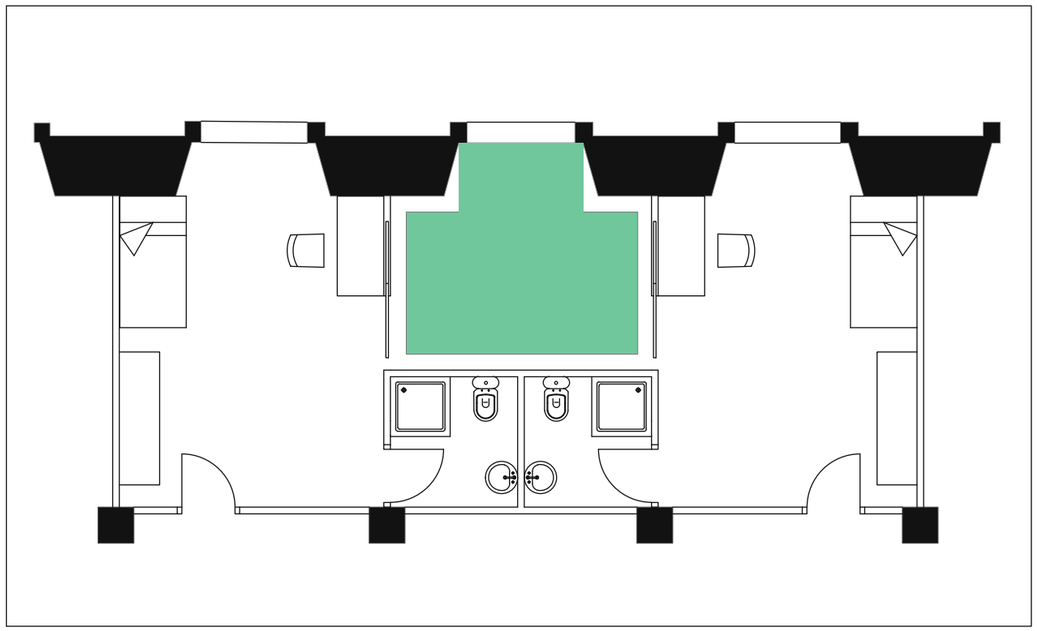
Additionaly to underline it's new use and highlight main entrace, proposed metal framed glass canape that imitate greenhouse irregular rooftop.

Benefiting individual space, addition to facade would be green island for every student, expanding outdoors.


RAILROAD
via Nizza

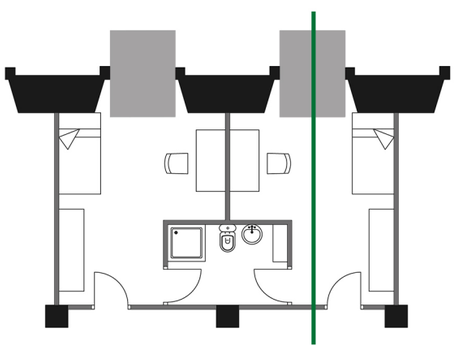


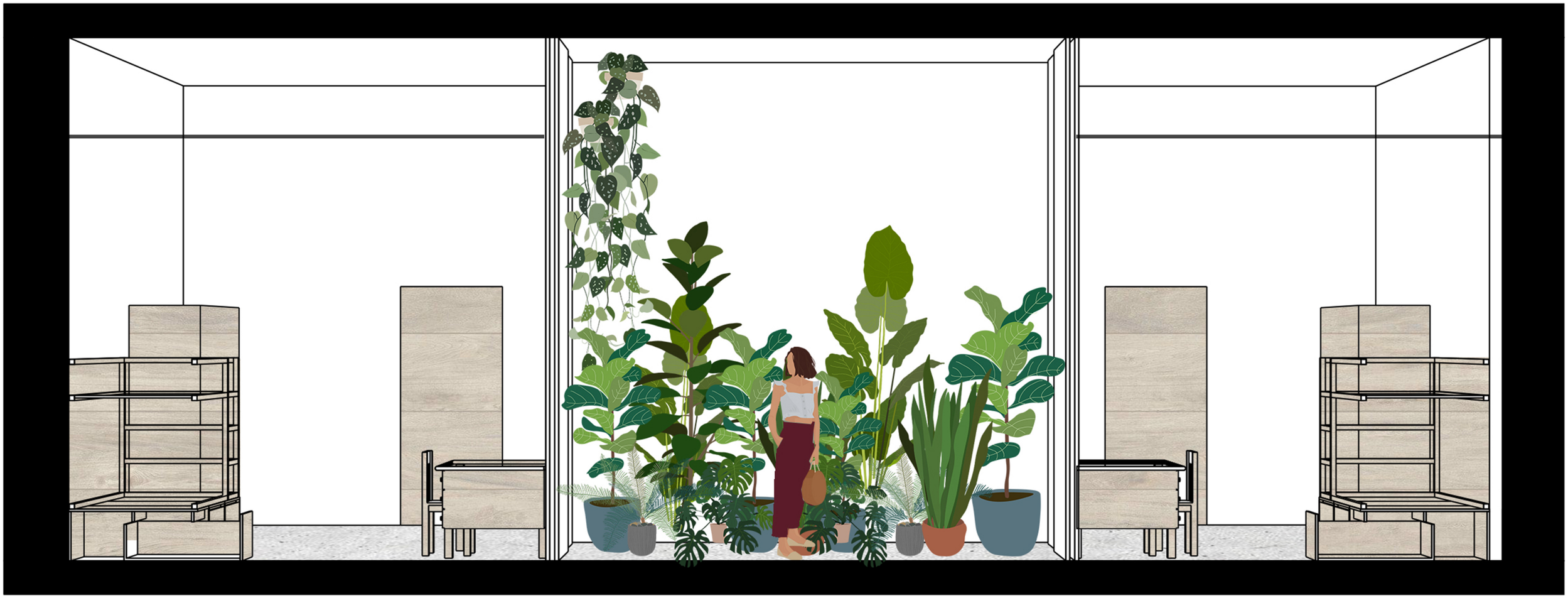


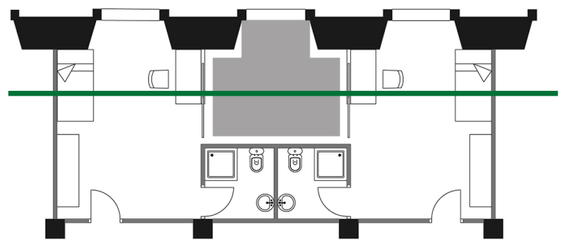


Green spaces in student dormitories

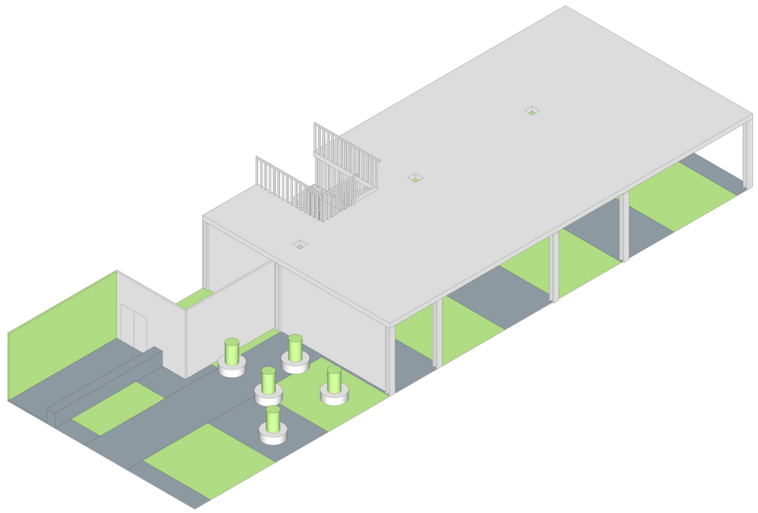
As a part of facade greenery
As common room between rooms



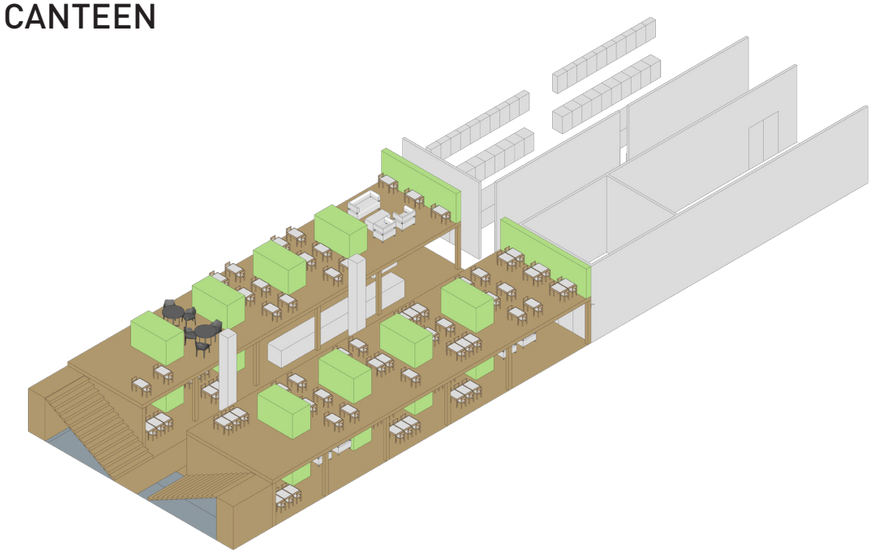




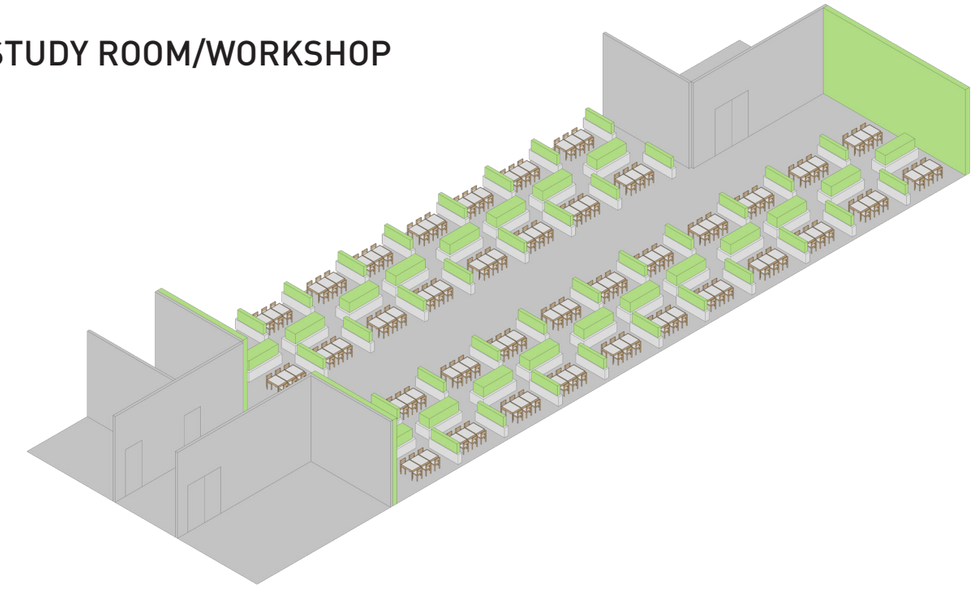
HALL



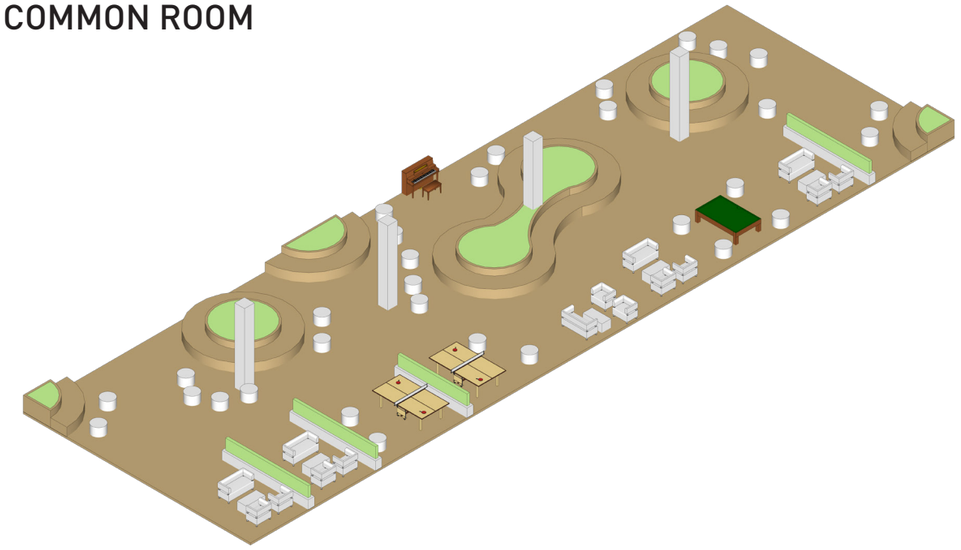
CANTEEN



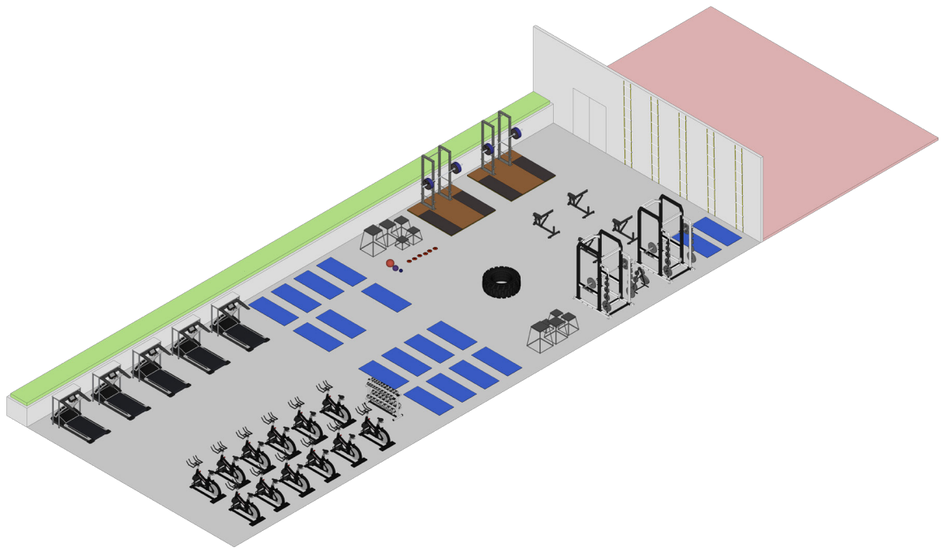
STUDY ROOM/WORKSHOP



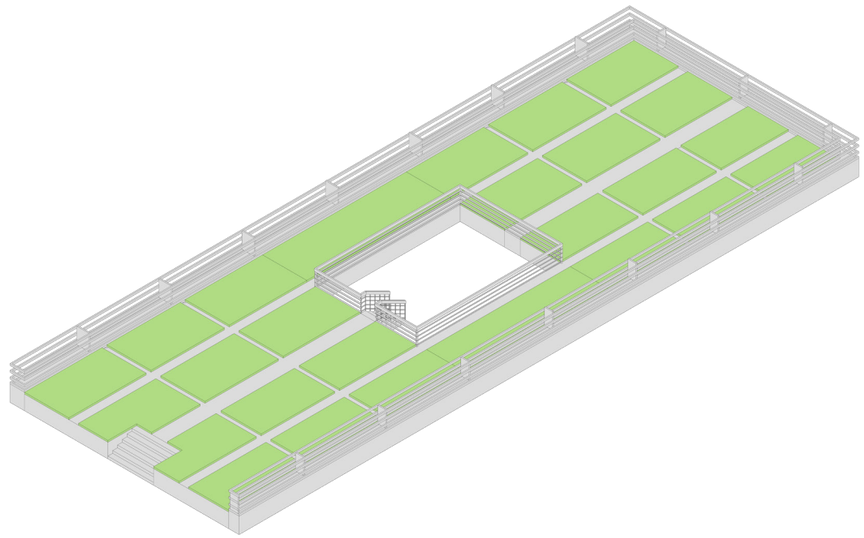
COMMON ROOM



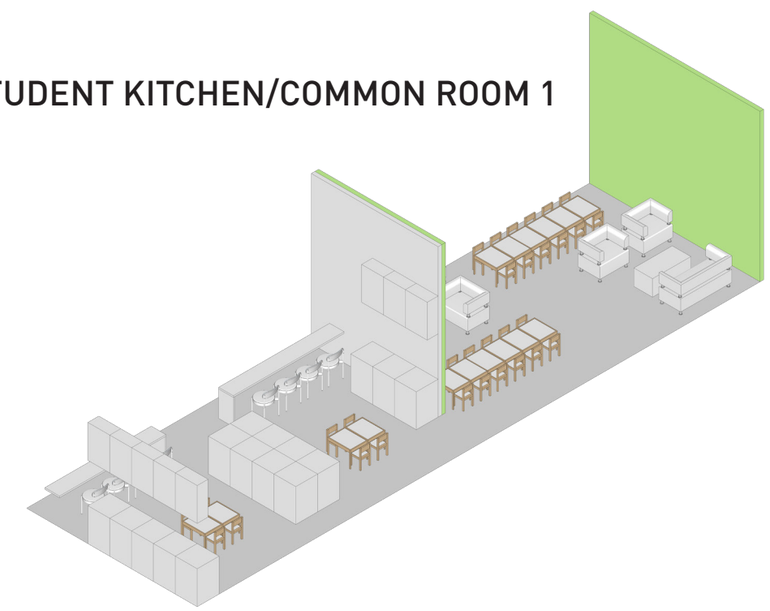
GYM



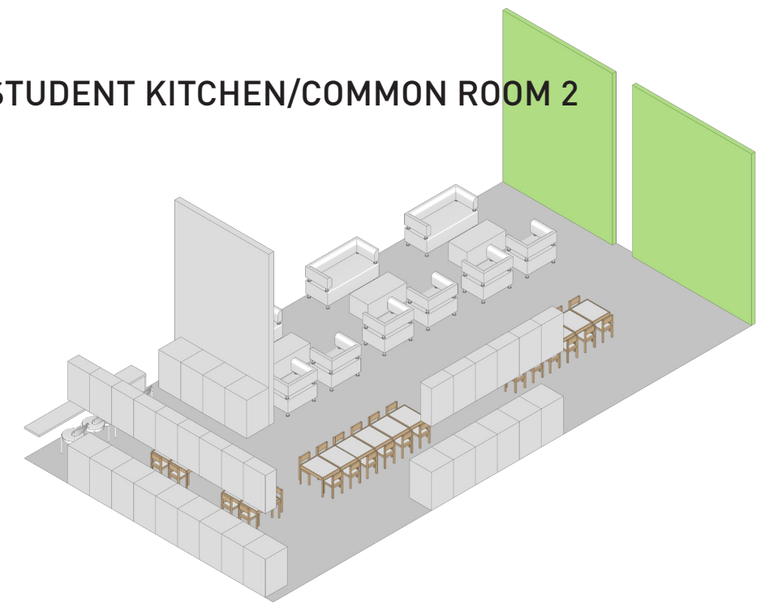
GREEN ROOF



STUDENT KITCHEN/COMMON ROOM 1

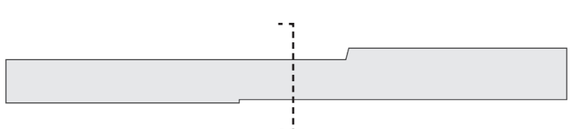


STUDENT KITCHEN/COMMON ROOM 2




RAILROAD
SAN SALVARIO
elev.:+24.80
elev.:+19.40
elev.:+16.00
elev.:+11.80
elev.:+7.20
elev.:+0.00
elev.:-3.95

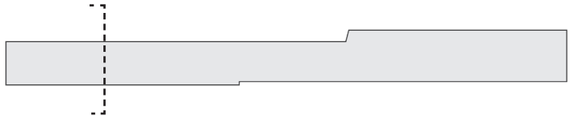
SECTION B-B



RAILROAD

SAN SALVARIO

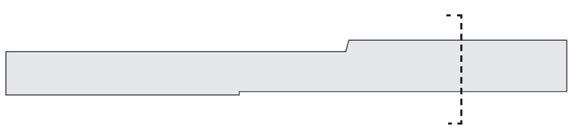
SECTION A-A

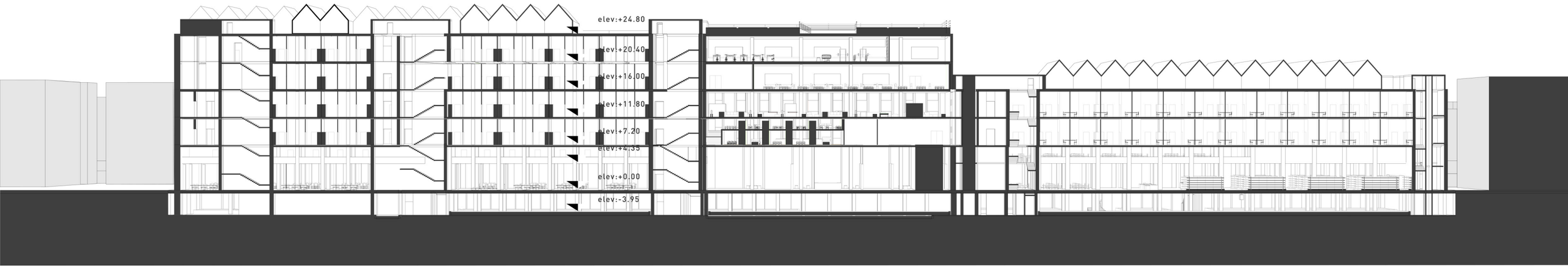


RAILROAD

SAN SALVARIO

SECTION A-A

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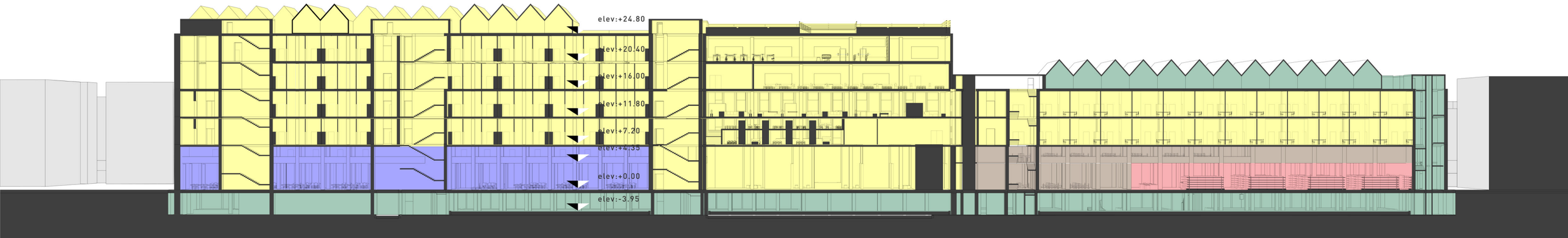
elev:+4.35
elev:+0.00
elev:-3.95

SECTION D-D

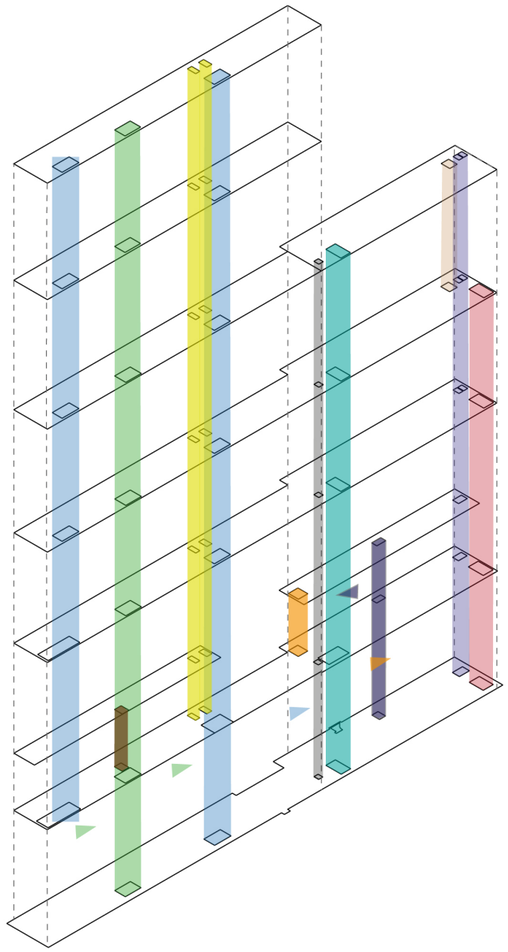


SECTION D-D

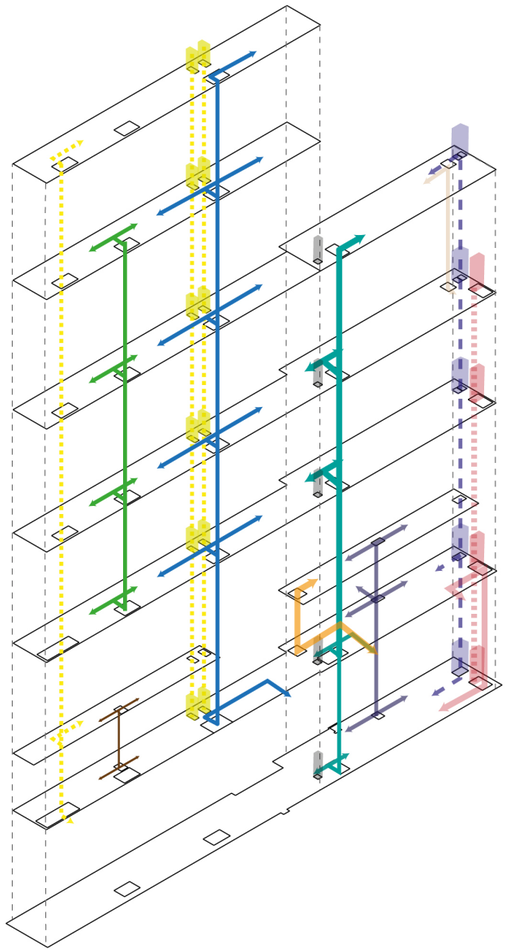
Legend:

- Office
- Restaurant/caffe
- Groceries
- Urban farm
- Dormitory

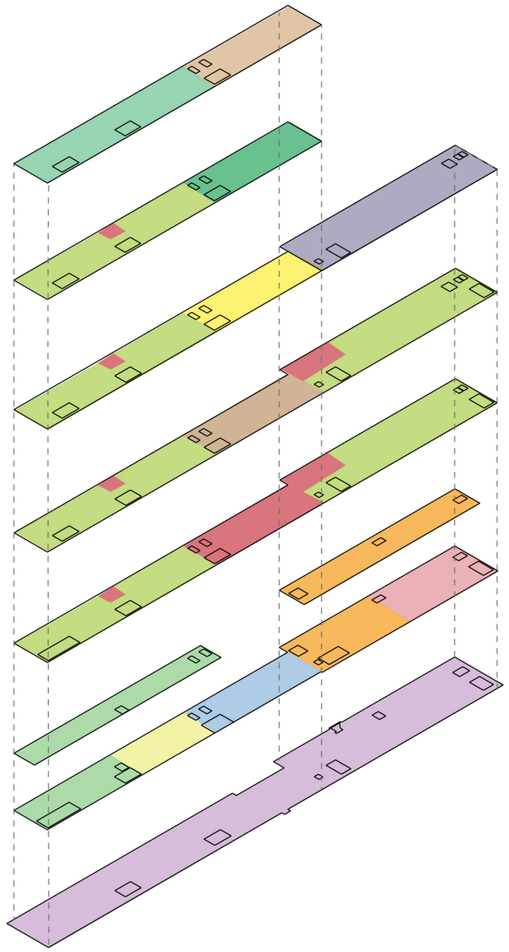
1. Vertical connections



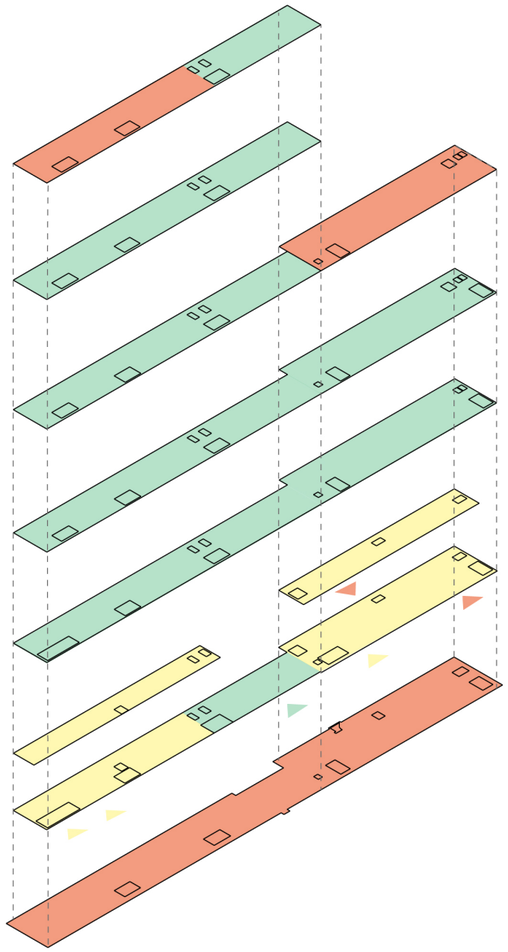
2. Circulation



3. Functions



4. Access



Legend

1. Vertical connections

- stairs for students
- elevator for students
- stairs for students
- stairs for restaurant
- elevator shared
- stairs shared
- stairs urban farm
- elevator urban farm
- stairs and elevatro urban farm
- stairs urban farm
- stairs offices

2. Circulation

- office workers
- students
- students
- restaurant stuff, visitors
- students, urban farm workers
- urban farm workers
- urban farm workers
- urban farm workers

3. Functions

- urban farm
- offices
- workshop
- dormitory hall
- restaurant and caffe
- urban farm shop
- dormitoriy's room, coridor
- cantine, kitchen
- common room
- study room
- sport center
- rooftop garden
- student greenhouse

4.Access

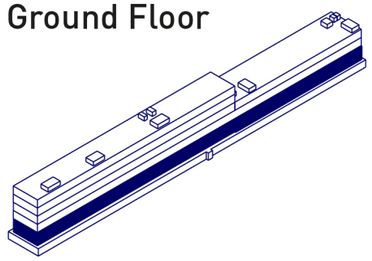
- private
- students
- public
- private access
- public access
- student access

GROUND FLOOR

Legend:

1. reception
2. restaurant/caffe
3. groceries
4. offices
5. retail

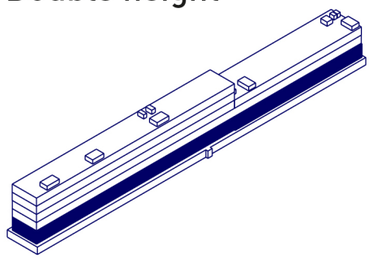
Ground Floor



Legend

1	Dormitory hall
2	Reception
3	Workshop space
4	Office space/ coworking
5	Fresh groceries shop
6	Cafe
7	Restaurant

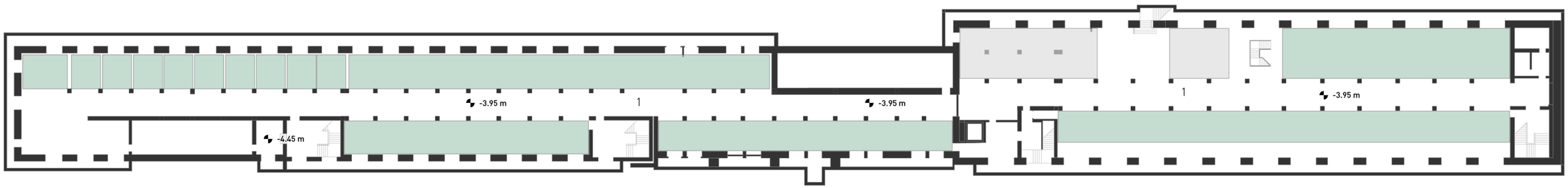
Ground Floor
Double height



Legend

1 Dormitory hall
2 Reception
3 Office space
4 Office space/coworking
5 Fresh groceries shop
6 Cafe
7 Restaurant
8 Restaurant kitchen
9 Storage

BASEMENT



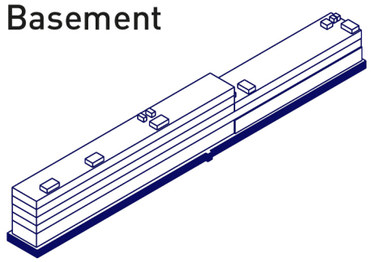
Legend:

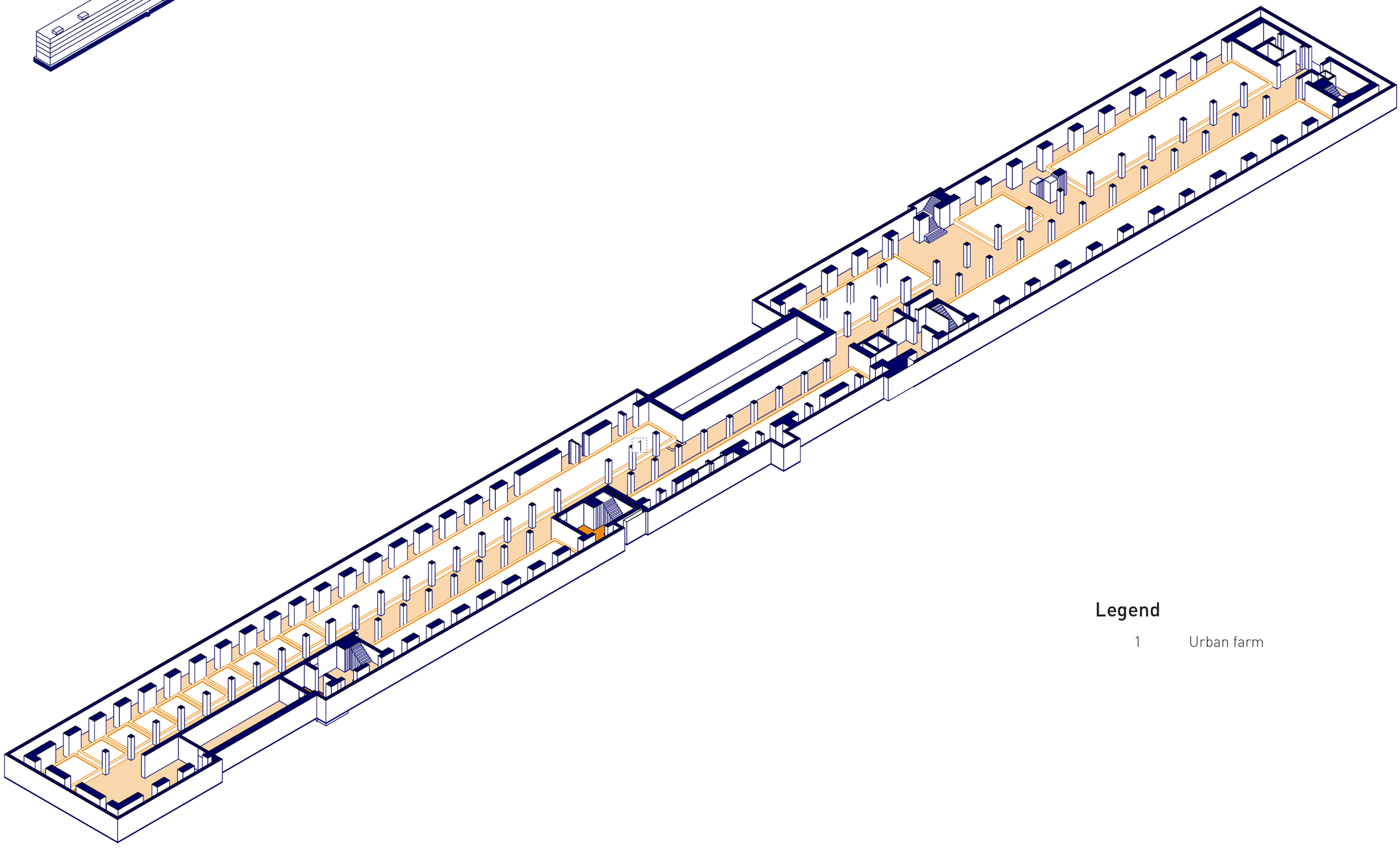
1. urban farm

via Nizza

1m 5m 10 m

Basement

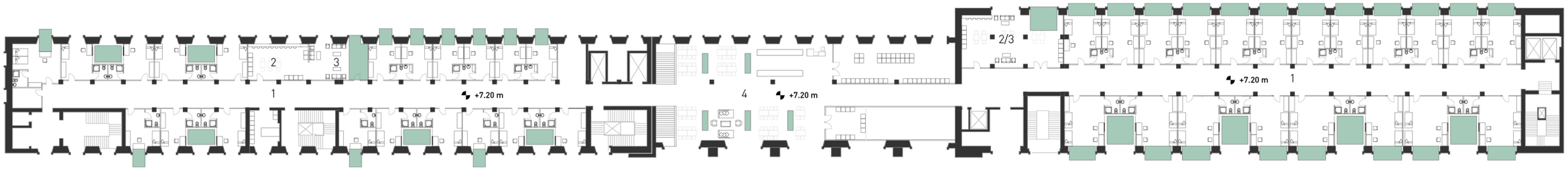




Legend

1 Urban farm

FIRST FLOOR

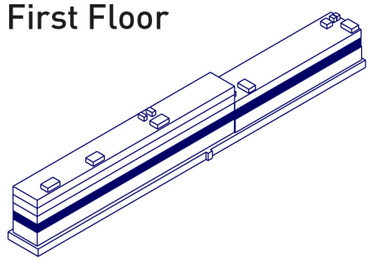


Legend:

1. dormitory
2. kitchen
3. common room
4. cantine

via Nizza

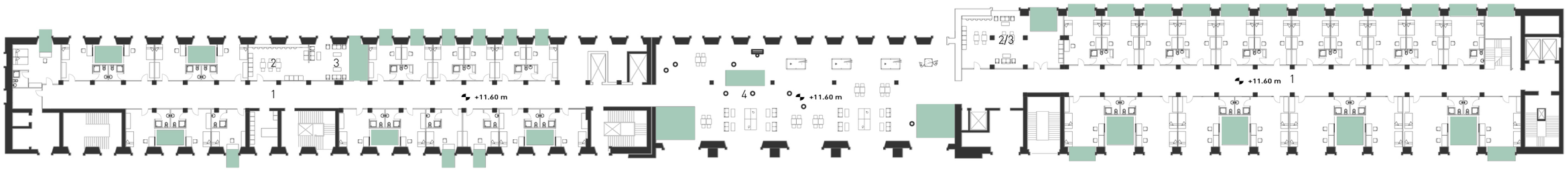
First Floor



Legend

1	Dormitory
2	Students kitchen/common space
3	Canteen
4	Composting
5	Canteen kitchen
6	Technical space

SECOND FLOOR



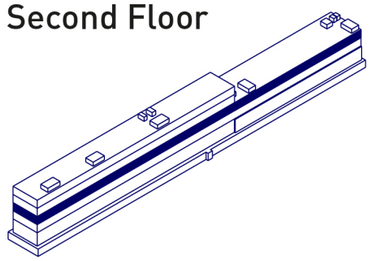
Legend:

1. dormitory
2. kitchen
3. common room
4. living room

1m 5m 10 m NORD

via Nizza

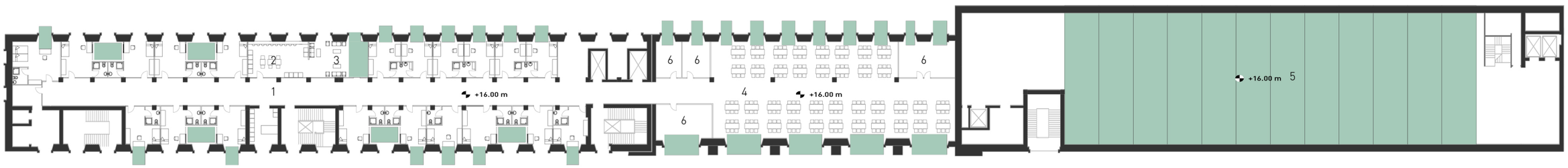
Second Floor



Legend

1	Dormitory
2	Students kitchen/common space
3	Common room
4	Technical room

THIRD FLOOR

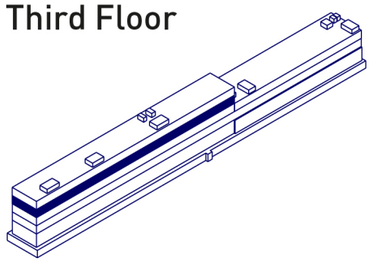


Legend:

1. dormitory
2. kitchen
3. common room
4. study room
5. greenhouse
6. workshop space

via Nizza

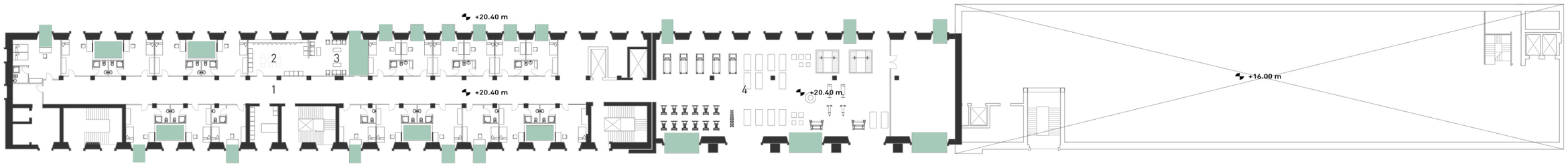
Third Floor



Legend

1	Dormitory
2	Students kitchen/common space
3	Study room
4	Technical room
5	Workshop
6	Greenhouse

FORTH FLOOR

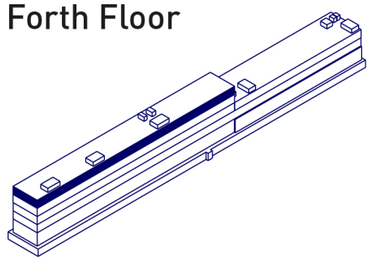


Legend:

1. dormitory
2. kitchen
3. common room
4. training room

via Nizza

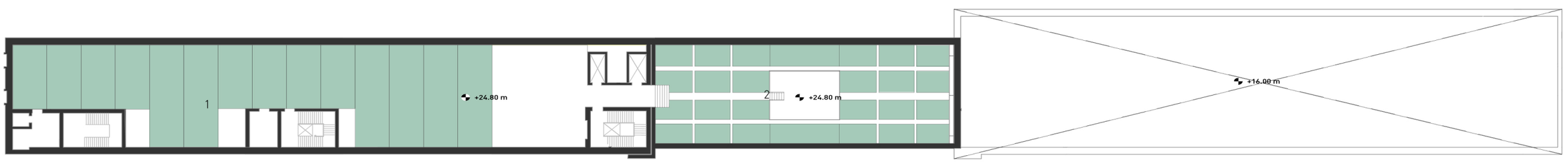
Forth Floor



Legend

1	Dormitory
2	Students kitchen/common space
3	Gym
4	Technical room
5	Exercise room
6	Greenhouse

ROOF



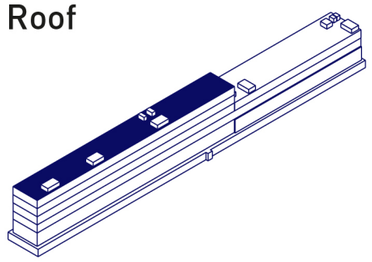
Legend:

1. greenhouse
2. green roof

1m 5m 10 m

via Nizza

Roof



1
2
3

Legend

1 Solar panels
2 Green roof
3 Greenhouse

ENDNOTES

1 http://www.verticalfarm.com
2 Psychological Benefits of Indoor Plants in Workplaces: Putting Experimental Results into Context Tina Bringslimark1 Department of Plant and Environmental Sciences, Norwegian University of Life Sciences, Box 5003, N-1432 A°s, Norway Terry Hartig2 Institute for Housing and Urban Research, Uppsala University, Box 785, SE-80129 G¨ avle, Sweden Grete Grindal Patil Department of Plant and Environmental Sciences, Norwegian University of Life Sciences, Box 5003, N-1432 A°s, Norway
3 Screening Indoor Plants for Volatile Organic Pollutant Removal Efficiency Dong Sik Yang Department of Horticulture, University of Georgia, Athens, GA 30602-7273 Svoboda V. Pennisi Department of Horticulture, University of Georgia, Griffin, GA 30223 Ki-Cheol Son Department of Environmental Science, Konkuk University, Seoul 143-701, Korea Stanley J. Kays1 The Plant Center, Department of Horticulture, University of Georgia, 1111 Plant Science Building, Athens, GA 30602-7273
4 https://web.archive.org/web/20150613165717/http://agritecture.com/
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8 PROGRESSIVE CONSUMPTION: STRATEGIC SUSTAINABLE EXCESS by Daniel J Bonham B.F.A. ARCHITECTURE MASSACHUSETTS COLLEGE OF ART 2003
9 https://sdgs.un.org/goals
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11 The Potential for Urban Agriculture in New York City Growing Capacity, Food Security, & Green Infrastructure prepared by Kubi Ackerman and Project Team: Richard Plunz, Michael Conard,Ruth Katz, Eric Dahlgren,for Sustainable Energy, Patricia Culligan
12 https://web.archive.org/web/20070818061240/http://www.comune.torino.it/canaleturismo/en/history.htm
13 Food First: COVID-19 Outbreak and Cities Lockdown a Booster for a Wider Vision on Urban Agriculture Giuseppe Pulighe * and Flavio Lupia
14 Towards Regenerated and Productive Vacant Areas through Urban Horticulture: Lessons from Bologna, Italy Daniela Gasperi 1,†, Giuseppina Pennisi 1,2,†, Niccolò Rizzati 1, Francesca Magrefi 3, Giovanni Bazzocchi 1, Umberto Mezzacapo 4, Monique Centrone Stefani 5, Esther Sanyé-Mengual 1,†, Francesco Orsini 1,†,* and Giorgio Gianquinto 1
15 Supra
16 Alexander Gogl "Cultivating Urbanism A strategy for the cultivation of urbanism in Berlin"
17 Supra
18 Supra
19 Torino city report, Astrid Winkler
20 https://web.archive.org/web/20070818061240/http://www.comune.torino.it/canaleturismo/en/history.htm
21 Supra
22 Supra
23 Supra
24 Supra
25 Supra
26 Supra
27 Supra
28 Supra
29 Supra
30 Supra
31 Torino Urban Profile 2019, JLL
32 Ibid
33 Student housing. A cura di Elena Colopardi e Maria Grazia Nurra
34 Supra

35 http://www.torinostrategica.it/en/torino-universita/
36 Supra
37 Supra
38 Supra
39 Baum M. (2013), City as Loft. Adaptive Reuse as a Resource for Sustainable Urban Development, Gta Verlag
40 Remoy, HT., & van der Voordt, DJM. (2014). Adaptive reuse of office buildings into housing: Opportunities and risks . Building Research and Information: the international journal of research, development and demonstration, 42(3), 381-390. https://doi.org/10.1080/09613218.2014.865922
41 https://www.britannica.com/place/Turin-Italy
42 https://en.wikipedia.org/wiki/Turin
43 Supra
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