

The background of the entire page is an aerial photograph of a city, specifically Turin, Italy. The image is overlaid with a light gray grid. Numerous small, blue, stylized icons of buildings are scattered across the map, primarily concentrated in the central and lower-left areas. The text is overlaid on this background.

Design Strategies to Regenerate Outdoor Spaces In High School Buildings

A Transformative Model for the
Post-pandemic City,
based on the Case Study of Turin



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**Design Strategies to Regenerate Outdoor Spaces
In High School Buildings**

-
**A Transformative Model for the Post-pandemic City,
based on the Case Study of Turin**

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"Ideas take life in the least expected places"

John Seabrook, "Has the Pandemic Transformed the Office Forever?", The New Yorker, February 2021.

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ABSTRACT



High schools, high potential for contemporary cities

Moving from the study of international experiences in the field of high schools' outdoor space renovation and then focusing on the case study of the city Turin, the research presented in this document aims at identifying design strategies for the sustainable regeneration of the city's high school building infrastructure.

The research will focus on outdoor spaces (open spaces, courts, building envelop, accessibility...), identifying recurring typologies by measuring the territorial and architectural characteristics of the high schools' infrastructures.

This analysis is followed by the selection of three representative high schools examples in Turin, suitable for hosting potentials of transformation at the urban and architectural scales, proposing tools and devices that could allow the reproducibility of the interventions in similar schools, in Turin and other contexts.

The tools will therefore be collected in a "Spatial Toolkit", with the proposed goal to easily "find" the correct device for solving any critical issues identified during analysis phases or to boost potential opportunities. The objective of this thesis concerns the study and re-design of some of the outdoor school spaces of the city of Turin, conceiving some renovation projects in the case studies that might accommodate it, improving their outdoor space to create a new way of teaching and learning.

INTRODUCTION

Outdoor education: an opportunity for teaching

The birth of outdoor education is much more distant in time than we could think: in fact, despite the modern and friendly name that characterizes it, the first experiences are proposed already at the beginning of the last century, on the wave of a series of cultural movements that propose the reform of the traditional school model, revisiting the ordinary "classroom organization" according to which the students, sitting behind their school desks, receive notions from the teachers.

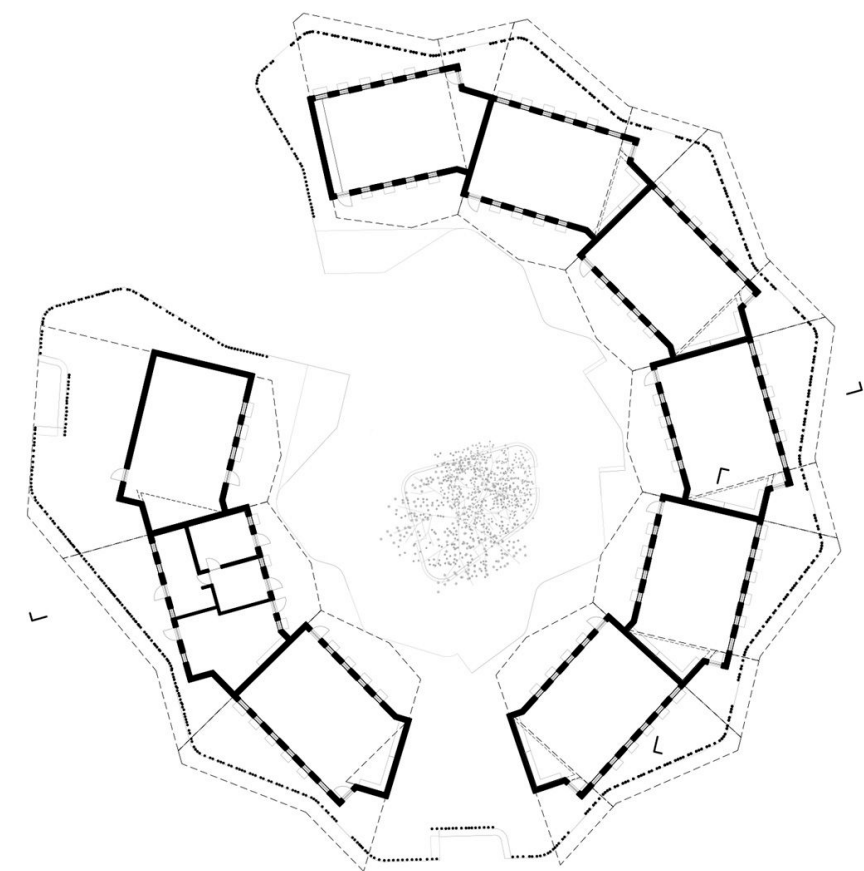
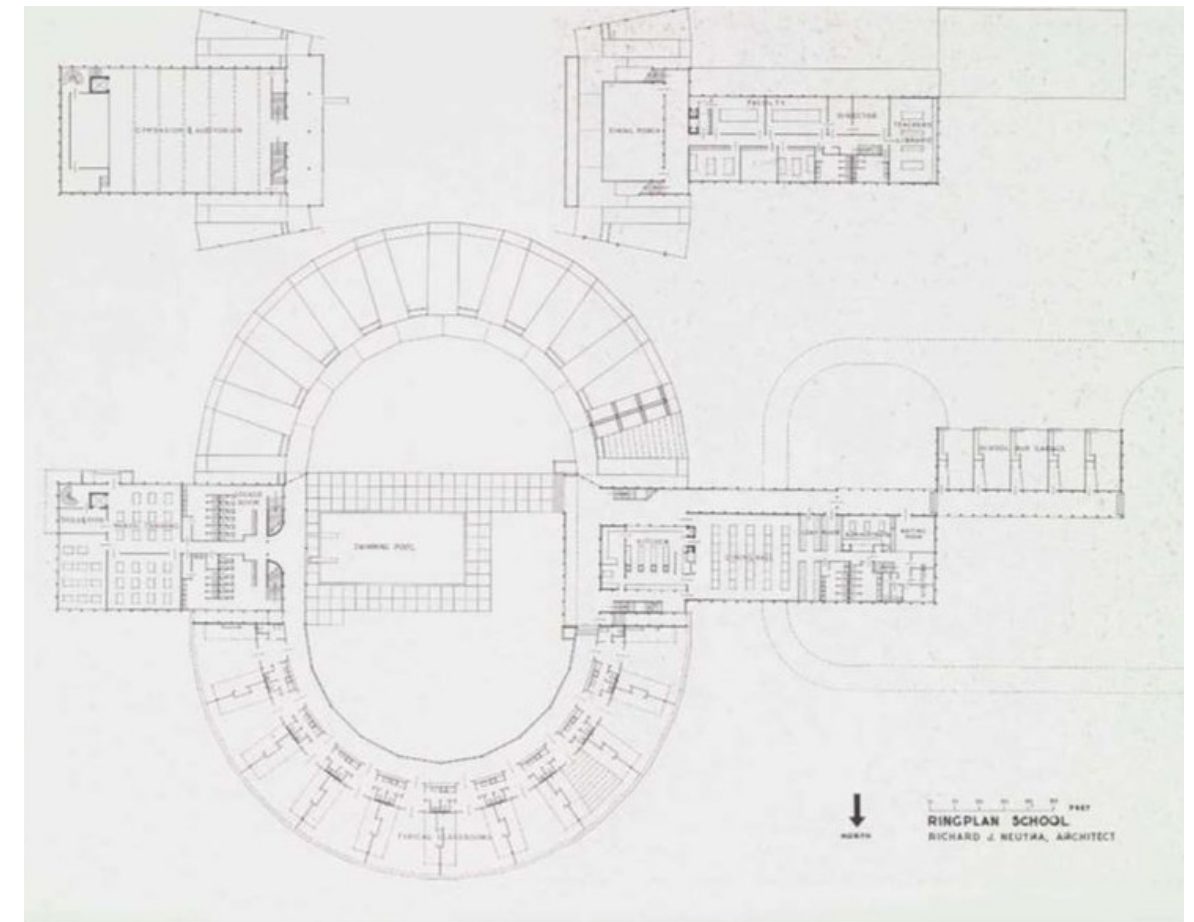
This last scheme has been theorized by one of the greatest American pedagogist, John Dewey, that in one of his school dedicated essays distinguished between the "listening school" and the "activity school"¹. According to the description provided by the author, the "listening school" is "based on the teacher and book authority, on the silence of the students and mnemonic learning" while, the "activity school" is founded on "the teacher and students collaboration, on the student-student collaboration and the habit of building comparison phases and the development of the critical sense".

Another example of critique formulated by Dewey concerns the student-desk dimensions, unsuitable for any crafting activity, and designed only to contain books and pencils.

Finally, the emptiness of the classroom environment and geometrical disposition of student-desk allows the only activity of passive learning, shaping minds often not able to think critically and independently.

The founding principles of the new "active school" model will be deepened in the following pages, but we can anticipate that some of these innovative teaching proposals came also from Italian educators and pedagogists, such as Giuseppina Pizzigoni, Loris Malaguzzi and Maria Montessori.

On the following page, first picture from above: Richard Neutra, Ring Plan School, 1926, image source: are.na. Bottom image: Kere Architecture, Ring-shaped Lycée Schorge Secondary School, 2016.



¹ Dewey John (1859-1952), *Scuola e società*, Firenze, La Nuova Italia, 1967, pp. 21-22.

Synthetically, the proposed teaching reform invites to build stronger links between students and the workplace, making them more performing in terms of an experimental learning, where they can come into contact with the natural elements and build links with it. Obviously, from the design point of view, it is clear that the designers were asked to ensure greater continuity between internal and external teaching space, and even better, more possibilities for students to access the outdoor areas directly from their classrooms.

These principles are fortunately accepted immediately, and the search for new forms that guarantee the most performing connection between inside and outside will practically never end, even to the present day. As we will see, in fact, the idea of "outdoor learning" is no longer enclosed within the boundaries of the school, but it is extended to the neighbourhood where the school is located, involving students to become an active part active part in the community wealth growth.

The benefits of outdoor education have been thoroughly documented in hundreds of researches that from the 1980s to the present day. The advantages are many and, besides guaranteeing a higher performance during the students' studies, in terms of results achieved, involvement during teaching activities and improving cultural luggage, they allow the personal growth of the individual by favoring relational and problem-solving skills as well as a better attitude towards physical disciplines and competitions.

Outdoor learning is also an opportunity for development and learning towards the principles of sustainability and participation in the social activity of the community, offering the opportunity to operate on real case studies. High school students, almost all teenagers, find themselves in the age group (15-19 years) in which they begin to understand their role in society: a school that does not teach almost anything about it, limiting her influence to just provide general cultural notions risks not to give its students the tools for fully understand it, lacking in the principles aimed at respect for the community and the surrounding environment. Respect for others can take place by accelerating the process of introducing students into society, by allowing them to have a direct confrontation with it, for example performing extracurricular cultural activities (organization of exhibitions, talks, debates, sports competitions) able to transform the school space into a

second "home", and therefore influencing the school opening hours outside the normal school activity hours (usually organized between 08:00 AM and 03:00 PM). Consequently, the regeneration of school spaces, aimed towards a greater respect for the surrounding environment, requires to consider outdoor spaces as a place where to gain experience and in which it is possible to develop one's skills through singular and group activities.

How is this possible? The internal courtyards of the schools, as well as the paved entrance spaces and the gardens where present, can implement new learning activities, even accommodating hypotheses of transformation able of adapting them to host cultural events and alternative teaching methods: cinema sessions, talks between students, sports competitions, moments of self-exhibition in which students can show their research and application results in the case, for example,



Natural Element Outdoor Lecture in the Scandinavian woods.
Image source: natureschool.ie

of artistic high schools, professional technical institutes, tourism and cooperative promotion.

Moreover, as we said, moving beyond the schools wall perimeter means to propose solutions for a new way of teaching that flows through the communities forming a unique neighbourhood, an urban reality, a society. The final focus of this thesis will try to understand if it is possible to propose an alternative to the actual "classical teaching", outside from the physical barrier of schools walls and classrooms, giving the students the opportunity to gain new learning spaces, demonstrating the possibility of this intention even in the most difficult city environment, in most cases full of noise and traffic.

This new conception of "outdoor learning" has been already experimented in different countries all over Europe, especially in those ones where the presence of extensive natural environments is stronger. In the Scandinavian context², for example, the term "outdoor education" most often involves school-based learning outside of the classroom, in the nearby natural or cultural landscape or on school grounds, properly provided with natural elements and often with a cross-curricular approach. In this context, students have the opportunity to learn in woodland environments different subjects, like English, Mathematics and Science. In this vision, became important the schools surroundings, intended like some sort of "arenas", or better, like knowledge's sources: students can learn from the phenomena and relationships that happen in there.

The "context" of this thesis is far away from the northern European woods, since the location our research work will be a metropolitan city, where facing the theme of outdoor space renovation in high schools could appear more difficult. Most of the high schools buildings have been built in the proximity of a urban environment and this brings us to make some considerations, like the lack available un-built ground, which if present, includes urban parks or public gardens. So, taking into account the difficulties of a city environment, the outdoor space has to answer new questions: how can we imagine outdoor learning spaces inserted in our consolidated cities, far away from natural aspect? What can students actu-

² Fägerstam Emilia, *High school teachers' experience of the educational potential of outdoor teaching and learning*, Journal of Adventure Education and Outdoor Learning, 2013,

ally learn from our cities, instead of being just neutral citizens? Are contemporary cities capable to teach them something? Thus, the attention, more than into the cities countryside, has to be moved to the high school buildings, the plots and the available surfaces of our cities, that have been shaped for education throughout the years. Therefore, the city is the place where human trades and connections happens, and more than a fraction of time in which learn notions and tools for future life, we can imagine the actual five years that italian high school students spend in high schools as an occasion to improve social interactions over the everyday classroom environment. In the future, the outdoor teaching system could promote the acting together of students and local communities to increase their welfare and well-being through social activities and collaborations with the local activities actors. More, it became an opportunity to strengthen the student's



High school students in front of a Milan High School, waiting for the bus in a busy public sidewalk.
Image source: Wired.it

link with their living environment, looking at the district and the street in a deeper perspective: if now the presence of a high school has a quite neutral impact in the life of a neighbourhood (in some cases also negative due to the amount of vehicular traffic that students contribute to generate during entrance and exit hours, using personal scooters and cars to reach the high school building), educating students to the respect of surrounding areas and even leading them to the choice of sustainable lifestyles could improve the general quality of life of it.

The role of the Covid-19 pandemic in boosting outdoor education

The Covid-19 pandemic that began during March 2020 has emptied our cities, forcing citizens and students inside their homes, observing the world from an un-imaginable distance. This temporary distancing from the street and from the living outside our own home allowed us to observe them from a new perspective, allowing ourselves to act better and for the community, with the common objective to return as soon as possible to a normal life. The pandemic situation compromised in fact the possibility of any normal relationship, preventing the normal school group activities, not even normal classrooms, since there was no possibility to guarantee the safety of any public place. The student community of all educational levels (primary and secondary cycle) soon asked the pandemic scientists experts for a safe and secondary solution to "distance learning", a way in which the student can attend classroom from home, avoiding the contact with classmates and teachers, that could bring to possible infections. Although the distance learning solution represents an innovative fall-back, which transfers the learning space into a manageable and transportable tool like a computer, on the other hand the space of the high school building cannot be destined to remain closed, failing in the building of that relationship that raise between students and teachers, in a space totally dedicated to discussion and comparison, where ideas are forged and built. During two years of pandemic situation, and neither during the developing of this document (that happened from March 2021 to February 2022) any solution has been totally safely implemented since with the possibility of vaccinations and the emerging of a new Covid-related variant almost every three months, rules for entering in public spaces have been modified and strengthened

fast and almost every month. The problem of accessing to normal school activities is still being studied across the entire world education community, due to the wholeness of the problem.

Goals and objectives

The first part of this work has very questioned the city and its high schools buildings, trying to understand how many of them have been built over the time and how the city has growth throughout the years. The second part will be more focused on the proposal of strategies for spreading the regenerative process of school's outdoor space through the city. The city growth has generated different type of urban fabric, with specific features and ways to link building heritage to the ground: it is in this space high schools buildings have to fit within the school property plot and have to deal with other existing buildings.

This has modelled over the time multiple way of building high schools, that have produced mistakes, then solved in the following years; in other cases smart choices have been carried out, re-using un-used existing buildings where, due to the high density of the urban grid, demolishing and build a new building was simply un-imaginable. The order of the actions that have been followed during the presented process include data research moments and their management to gain final result in the form of "school dimensions"; each passage previously mentioned will be thoroughly discussed in the dedicated paragraphs. The obtained dimensions presented us important information regarding general dimensions of the plot and later, since the methodology chosen for this work is the one about "classifications according to different categories", this information has been classified under certain typologies according to similar features. Features that included the shape of the school building and its positioning within the plot, together with the connection of the school lot with the urban city fabric. Such classifications are useful to identify recurrent typologies in the urban fabric that are suitable for regenerative projects. Finally, after the selection of the devices that built the projects, came the "collection moment", in which they have been included in a "spatial toolkit" completely aimed to the free use of designers that decide to face regeneration projects.

PART 1

**High school buildings current
status: history of teaching ways,
designing methods and real life
examples**

The italian high schools: brief social and political history

The history of high school education in Italy has been subject of study and discussion on various features, raising questions about the educational offer of the high school system, which, especially in the first decades of twentieth century has lagged behind the quantitative and qualitative demand for educational contents and spaces dedicated to teaching.

A 1976 report pointed out that "the emerging needs of the school are not of mere building needs, but of new educational content, credibility in certifications and management of the social function of the school"¹. This sentence can help us understand how, already in the mid 1970s there seem not to be any particular problem in the design of schools buildings and educational spaces in Italy, but rather, it's necessary to point out the short comings on the contents of the study programs. But why? Over the last ten years Italy was part of the most industrialized European countries, and it was becoming common the awareness about the development of new technologies in support of teaching and labour market. Such changes led to deep changes in the society, and required to train minds able to understand the scientific transformations taking place, with a cultural background substantially renewed compared to the past, more loaded with technical and scientific notions.

In other words, "to force the school to develop new models of cultural formation so that we can create the basis for overcoming the social and technical division of labour"². A school that, according to the digital changes that were running during that time, can take into account scientific and technological evolution and transformations even in social life, so that students can be formed capable of mastering different and updated notions compared to the older generations (such as foreign languages and computer science) in order to own useful tools for practical life and insertion into the labour market. We'll soon see that it was not just

¹ Guiducci Roberto, Guiducci Giuliano, Minoli Lorenza, *La scuola superiore in Italia: problematica e fabbisogni nella prospettiva di sviluppo e di riforma*, Milano, ISEDI, 1976

² Anna Laura Fadiga Zanatta, *Il sistema scolastico italiano*, Bologna, Mulino, 1971

a problem regarding subjects to be taught or technologies to be implemented: something was missing in the relationship between the different grades of italian education school system and even the links with university offer. Suffice to say that until 1969 the only requirement to access university courses was the posses of a classical high school diploma. Having attended any other type of high school in previous years would be enough to deny access to university courses. After 1969 the access was extended to all the high school graduates. Easing the continuation of studies from high schools to university studies appeared to be a major priority compared to the past, when these systems appeared "sectoralized"³, inserted in a process that was dating back to the first reforms of the 1920s for which was popular the form "to every social class, its school"⁴, defining schools dedicated to the working class, the middle-classes and the noble classes. A situation, the latter, generating social discomfort for which, also thanks to the difficult transition between one school address and another if not after passing complex exams, once taken a certain educational "path" the fate and social position of the student were almost marked for life. It seems clear that the society of the time has deepened and raised questions about the training and higher education of Italian students: we'll shortly begin to see a radical change in the subjects and on the two main groups that shape the school-organ: students and teachers. Nowadays, through years, high school system has been extensively reformed: collecting the most important changes soon after the Second World War: these reforms will provide some important changes in the high school organization, continuing to extend the access to courses to more people, the mandatory school time and renewing the educational offer. The renovation of educational offer was highly requested from both university and high schools students, demanding new selecting criteria for the access to second cycle studies, new evaluation systems and a better integration in the school management decisions. This happened especially during the 1960s and 1970s, when the country was invested by a vibrant political situation, call to act in favour of better workers rights, in which also students felt involved, since their nation and their own future needed to be brought up to par with the

³ Riccardo Massa, *Cambiare la scuola. Educare o istruire?*, Bari, Laterza, 1997

⁴ Henri Janne, Lucien Geminard, *Rapporto sulla scuola secondaria superiore*, Roma, Armando, 1974

fast technological and social progress that was investing the world at that time. Most of biggest Italian cities were invested by protests, high school and university building occupations, often suppressed by live arrests and military interventions, but we'll just need to wait the 1970s to see a radical change and adaptation of school systems to modern society models and flexibility in curricular choices and teaching methods. Those reforms started to build the scratch for the modern high school system⁵. Nowadays high schools students attend high schools for five years, divided in a "2+3" combination in which for the first two years they receive equal training, without differentiations among all the high schools addresses. In the next and last three years they are free to choose the subject and the best "growth path" according to their interests.

According to the definition available in the Education and Research Ministry website "today high schools provide the student with the cultural and methodological tools for understanding the surrounding reality, so that he poses with a rational, creative, design and critical attitude, in front of situations, phenomena and problems, acquiring knowledge, skills and competences consistent with personal skills and choices, appropriate to the continuation of higher education, integration into social life and the work market"⁶.

The next paragraph will focus more on the school construction ways evolution over time, and how the architecture has responded to such changes.

⁵ The reference in particular is intended towards the Decreti Delegati of 1976 that presented for the first time the active and democratic participation of students and students' parents in the school and classroom life, with the intention to help school staff (principal, teachers, administrative, technical and auxiliary staff, the latter better known as "ATA") in the general management of the school. From the '80 to the '90 the most of the reforms invest school teaching programs (Brocca programs, 1988) and re-organization of professional colleges, introducing in 1997 for the first time the double cycle system. Other changes will invest even the final exam organization and access to university studies. From the beginning of 2000 we see multiple reforms (Berlinguer, Moratti, Gelmini, Renzi's Buona Scuola) propose changes on the school different addresses, improving the educational offer of the high schools. The first two reforms in the order will remain effectively un-implemented, except for the professional opportunities that students can gain obtaining the diploma; Gelmini and Renzi, as mentioned, will implement high school education offer and in particular the Renzi's Buona Scuola will allow students to customize their own study curriculum and to apply for the "Alternanza Scuola-Lavoro" (Legge 107/2015), providing the implementation of hours to be spent in job practical applications.

⁶ Ministero dell'Istruzione Ministero dell'Università e della Ricerca, *Scuola secondaria di secondo grado*, <https://www.miur.gov.it/scuola-secondaria-di-secondo-grado>, accessed on 25/11/2021



High school students during a school rights protest, 1968
Image source: storiaverita.it

Methods and ways to think schools open space: from the early twentieth century to the second post-war period

The previous chapter introduced an historical framework on the reasons that brought Italian high schools of the twentieth century to feel the need for a radical change in the methods, contents, and ways of teaching. Parallel to a political research asset on the preparation of new training courses, we begin to understand the value of all the participants that take part in the "didactic action" (students and teachers), starting from the awareness that designers of teaching spaces already contribute, while thinking and drawing, to the success of a good apparatus/educational system. In fact, the contribution of schools design for the realization of good educational environments is indeed recognized in the pedagogical and architectural field since the end of the twentieth century, thanks to the work that successful pedagogists such as John Dewey (1859-1952) and Maria Montessori (1870-1952) (both creators of the homonym pedagogical methods). This acknowledgment is linked to the work that have been successfully developed during their studies in the early 1900s and also thanks to the experimental schools built to put them into practice. The principles carried out by those pedagogists and in particular from Maria Montessori, involve all the group ages, trying to bring a renovation in all school cycles, from elementary to the high schools and in particular in the last case, fighting the idea of a school aimed only to shape adult minds, increasing the complexity of educational contents and expected results, to build a "school of social life experiences" that could help teenagers towards the economic independence and insertion in the labour market. All those principles have been expressed from Montessori in multiple essays, of which the most famous is really dedicated to the reform of second cycle schools (middle school and high schools), where adolescents start to get an education¹.

The studies carried out make real the idea of enhancing outdoor spaces, thinking of them as educational places where students can be in contact with the

¹ Maria Montessori, *The Erdkinder (i fanciulli della terra) - Schema per una riforma della scuola secondaria*, 1939. Essay available on <https://www.operanazionalemontessori.it>, accessed on 28/01/2022.

surrounding reality of natural elements in a way to find a good "focus on study and work"². Later, they turned into the need for coordinated architectural and design solutions, such as the interior and furnishings, the layout of the spaces and the tools that the students have to their disposal to put in practice what they learn. All the pedagogical methods born in the first years of 1900s seem to share common proposals: everything might be studied and designed according to the students' needs and dimensions, producing large desks specially designed on the proportions of each age group, from elementary to medium school. Moreover, they promoted the expressive freedom for the students, avoiding, at least for the first school years, the rigidly structured programs, preferring opportunities for group integration and, above all, the accentuation of contact with the outdoor environment. These new methods, starting from the years after the Second World



Students attend algebra and mathematics class at an outdoor 'forest school' in Toronto's High Park on July 29, 1913. Image source: cbc.ca

² Ibidem

War, represent the idea of a school that is no longer based on "passive listening", filling student's minds with fresh notions, but instead on the proposal of a school in which they can move and have the possibility to build a more direct relationship between classmates and teachers.

By this way to give a shape to this "new school" it is considered necessary a renewal of the concepts underlying school construction by developing the need for new architectural solutions. In the first place, the change involves the dimensional aspects: the old building distribution schemes start to be discussed, together with the environments' dimensions, their layout, and spatial distribution into the architecture plan, the connection between indoor and outdoor space. All the experiences and theories developed by Montessori really took applications in some architectural experiments outside Italy³, starting from 1930s with primary and elementary school examples, but then moved to higher education grades, like middle and high school only after the Second world war⁴.

³ The didactic experiences inspired by Montessori design theories found great luck in the Netherlands, more specifically in Amsterdam, where from 1945 are continuing to operate more than 20 schools of all educational grades. In the USA since 2018 operated the Montessori High School, then closed for financial problems, but nowadays remain active the experience of the Montessori Adolescent Consortium founded in the USA the first years of 1950's and that collect more than 50 high schools carrying on educational activities inspired by the Montessori theories, properly revisited from modern pedagogist and adapted to contemporary time.

⁴ Nowadays those didactic experiences find applications in the Montessori Lyceum Amsterdam that educate 1600 students every year. This didactic experience is very interesting because, due to the high number of students and the aim of the school to dedicate itself to the education of each student with personalized growth paths, it is spreaded in the city through other littler "member-schools" that host 150-students groups with their own teachers and tutors team.

Finally, still in Amsterdam, we find the Montessori College Oost (MCO), founded in 2001 and designed by Herman Hertzberger, one of the greatest dutch school designers. The MCO high school is considered an architecturally revolutionary school structure, as a space designed to promote both social cohesion and the development of the individual's educational path. The building is provided with classroom, laboratories, main halls and, especially, a huge amount of open space and common areas where students can move around and are moreover invited to stay thanks to the ergonomic furniture, high amount supply of natural-light and movement freedom. Pictures of architectural plans and section of the MCO are provided at page 35.

The 1960s and first building design theories

During the 1960's in front of the success, even if limited in the application principles due to the poor interaction between the legislative and administrative system, that the XII Triennale di Milano of 1960 brought in the field of the relationship between architecture and pedagogy, the design experimentations on school design continued to be carried out. Indeed, not for nothing, the title of the exhibition of that time was "The house and the school", welcoming with joy the announced reform proposal of the national school system, which will begin to take its first steps two years later, in 1968 (accomplice of the dynamic state influenced by the student movements of the same year) for the second cycle schools and for the universities.

The reform will be concluded in 1969 with the extension of university access to all the high schools addresses; together with the starting of politics promoting



Volleyball match in the open courtyard sporting of a high school. Mid 1960's
Image source: curiosando708090.altervista.org

literacy⁵ through the population, this significantly increased the amount of students that could access to high school studies, generating much more demand for classrooms and didactic environments. Therefore, the question that, maybe for the first time in the history of Italian school, was asked among designers was "are there enough schools for so many students"⁶? "How many school buildings are there in Italy?". Those are all questions that, indirectly, asked for a general survey of the conservation status of school buildings and their spaces, outdoor and indoor. Nevertheless, the features that were considered to propose school catalogue where not very significative, as they only illustrated construction years and original intention of the school building design⁷. The survey took into consideration a total of 3.009 school buildings for the school year 1960/61 and was led by ISTAT. The final result of the survey previously mentioned highlighted a general status of classrooms overcrowding in the 1960's: counting the number of total high school classrooms and the number of students attending the secondary cycle schools in the entire school set that was considered, it emerged that an hypothetical average of 67 students (without counting the missed data provided by regional offices) were allocated in each classroom⁸. According to these data, the number of classrooms suitable for Italian students was low and the need to build more schools was becoming evident. This last aspect led, during the years of the well known "boom" that invested construction field, to build new schools that would have to follow new design theories on the wave of well known pedagogists theories mentioned in the previous paragraph. In 1960 Aldo

5 Together with the birth of the Italian Republic in 1946, Constitution forced the application of article no. 34 that made mandatory the elementary and professional school education (for a total of 8 years) starting to reduce the illiteracy rate. In 1962, with the birth of middle school, the access to high schools has been extended to everyone: the illiteracy rate reached the minimum rate of the time, thanks also to the television technology.

6 Isabella Ferdinando, *L'edilizia scolastica in Italia. Precedenti e prospettive*, La Nuova Italia, Firenze, 1965

7 The Isabella's essay has reported the three classification ways adopted such as "designed to host didactic activities", "adapted to host didactic activities" and "emergency ones". They all describe respectively, in other words, buildings effectively designed to be schools, buildings originally designed for other activities and now fully adapted to host school activities and finally un-completed conversion projects of existing buildings with different functions to host didactic activities even with the effective inclusion and starting of the educational activities in it.

8 Isabella Ferdinando, *L'edilizia scolastica in Italia. Precedenti e prospettive*, op. cit.

Visalberghi remarked again the educational aspects of school environments that "for the educative functions need to provide their own space both physical, psychological appropriately designed"⁹. Gradually, the role of designers and technical experts became more important, no more intended just as executors in the definition of the quality environment. The responsibilities of these actors and their true involvement in the didactic process will become more clear in the following years, thanks to the regulations implemented by the State in the schools building process and the birth of "participatory planning" that will involve users in the project design phase. The union of those visions (designers and users) starts to be theorized already now, merging technicians skills with others of a different kind that will implement school building design with new notions, like communicative, research, education and socialization aspects. Quality of didactic activities is intended "as more qualitatively high as more appropriate is the space that they have at their disposal"¹⁰: designers refine their skills in schools spaces design continuing to make more project and gaining experience from the relationship with various types of users). So, what can we understand? Spaces want attention, any kind of space, even outdoor and indoor is part of the educational process of students, from elementary to high school.

As we see, the general interest in school building design arises during these years: there have been published multiple essays that provide a personal read of school reports, theories, ideas and reflections on the design of all schools spaces. But most of them concord on a school intended as a "system", where the "pedagogical cells"¹¹ (classrooms) and the environments supporting didactic action (like the corridors, common rooms, canteens and outdoor spaces) start to coexist together, inviting to think experimentally of the design of a school plan not as the sequence of several environments, in which a gap, a door, a window are not only intended as functional outlets, but also as parts integrated with the others (from a well-placed window I can see a forest or a open courtyard, a garden,

9 Visalberghi Aldo, *Apertura del dibattito; per una pedagogia dell'ambiente*, Casabella n.245, nov. 1960

10 Magnaghi Alberto, *Programmazione per l'edilizia scolastica: indicazioni tipologiche, tecnologiche e procedurali per la formulazione di un capitolato prestazionale nella scuola secondaria superiore*, Milano, Franco Angeli, 1983

11 Luigi Romanini, *Costruire scuole. Esigenze pedagogiche nell'edilizia scolastica*, Milano, Garzanti, 1962.

greenery; from the passage in the wall of a classroom I access to another classroom, promoting cooperation between several groups of classes; the existence of a common open classroom that allows the building to accommodate guests, parents and promote shared events such as lectures, exhibitions, dance essays). The school design consideration of the pedagogical-didactic opportunities of spaces indirectly lead to the development of more articulated architectural plans, looking at the courtyards, the greenery, and the land outside the building as essential school spaces: a school cannot be built without giving its students the opportunity to move in the green and spend recreation and socialization time in a garden, looking in the reformed classrooms, innovative environments, but still "artificial, unnatural"¹². The green must be inviting and stimulate the imagination of the students, hosting activities related to it (gardening, horticulture) and making it suitable thanks to dedicated furnitures and architectural elements like gradients and/or slopes, therefore improving buildings accessibility to all and a better flows management.

The courtyards derived by the own building's shape and design can be taken into account as outdoor gyms, "marking" them to be suitable for sports games.

These notions and reflections on the architecture translation of ideas and proposals that come from the reform of educational programs and from the renovated way of building schools, as well as a first reference to its urban planning and the context in which it is inserted, also highlighting the common problem of urban inclusion in the city fabric. In fact, if on the one hand the newly designed schools are large, capacious in terms of available space, and therefore susceptible to experimenting with the new building and pedagogical principles, on the other hand they are often located in the peripheral areas of the cities, where there is more space than in the consolidated historic center. In these areas the transport system can struggle to arrive, and a bad road system could make innovation not within everyone's reachability, favouring on the one hand the development of communities and local contexts, but on the other making it necessary to build more schools and therefore increase the consumption of public land.

¹² Ibidem.

The 1970s and the technological innovation on school design

Starting from the 1970's, accomplices of the pedagogical studies mentioned above and the first critical thoughts on building schools, the outdoor space designing and its context finally fall into the ordinary process of school design. More schools are starting to being built paying more attention in the outdoor design, while some proposes the creation of schools within existing parks and green areas¹³.

Concerning the technological aspects, the 1970s are years of great changes, that tried to quickly answer to the demand of schools spaces in the years of construction boom. It's a fraction of time rich of new design and shaping school building ways, influenced largely by new building technologies and materials that will completely change criteria of school buildings regulations.

It's the emerging of prefabrication solutions (or "building industrialization"¹⁴): the rapid availability with which it was possible to obtain the construction panels and the versatility in being able to find the most different shapes according to the needs meant that the designers could dedicate the same amount of time to the buildings design and to the open space organisation, in some cases even enhancing it, with the intention of proposing it as the "first educational place", in line with the principles prosed by Maria Montessori a few decades earlier.

At the national level, one of the organizations that, in these years, is most interested in use of prefabrication also in educational buildings is the "Italian Prefabrication Association", which "try to arrive at a deeper knowledge of building prefabrication, believing that its use can be a solution to the problem of the shortage of

¹³ Piero Fumo, *I padiglioni scolastici nei parchi: trasformazioni tecnologiche e nuove tipologie*, UniRoma Sapienza, <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiF3abtx-9b1AhXJQvEDHYKsBmEQFnoEAcQAQ&url=https%3A%2F%2Fweb.uniroma1.it%2Farchiscuole%2Fsites%2Fdefault%2Ffiles%2FfumoII.pdf&usg=AOvVawoL-Wv9Buzp3DlxNMbelKke>, accessed on 06/11/2021.

¹⁴ Magnaghi Alberto, *Programmazione per l' edilizia scolastica: indicazioni tipologiche, tecnologiche e procedurali per la formulazione di un capitolato prestazionale nella scuola secondaria superiore*, Milano, Franco Angeli, 1983, pp. 139-142.

homes and schools"¹⁵.

This deep change in the building design way (regarding all the positive aspects of prefabrication) made it necessary an adaptation of national buildings construction regulations, evolving the existing ones¹⁶ to the D.M. 18.12.1975, that publish the general indications for school design, of each order and educational grade. Indications provide requirements for almost every aspect of design: the "features of spaces related to pedagogical utility" chapter contains indications for adaptation of open spaces to the new outdoor sporting activities and the necessity of continuous contact between classrooms and outdoor space¹⁷.

Speaking about the continuity mentioned in the law, the prefabrication has indeed opened the possibility of "playing" with the transparent openings, improving their versatility concerning positioning and dimensions, according to the amount of light requested than in traditional masonry building. This was possible by the structures with retracted pillars from to the elevation plans that, increasingly, became home to large and bright ribbon windows for the benefit of the views and lighting of the outdoor spaces, emphasizing even more the link between indoor and outdoor space.

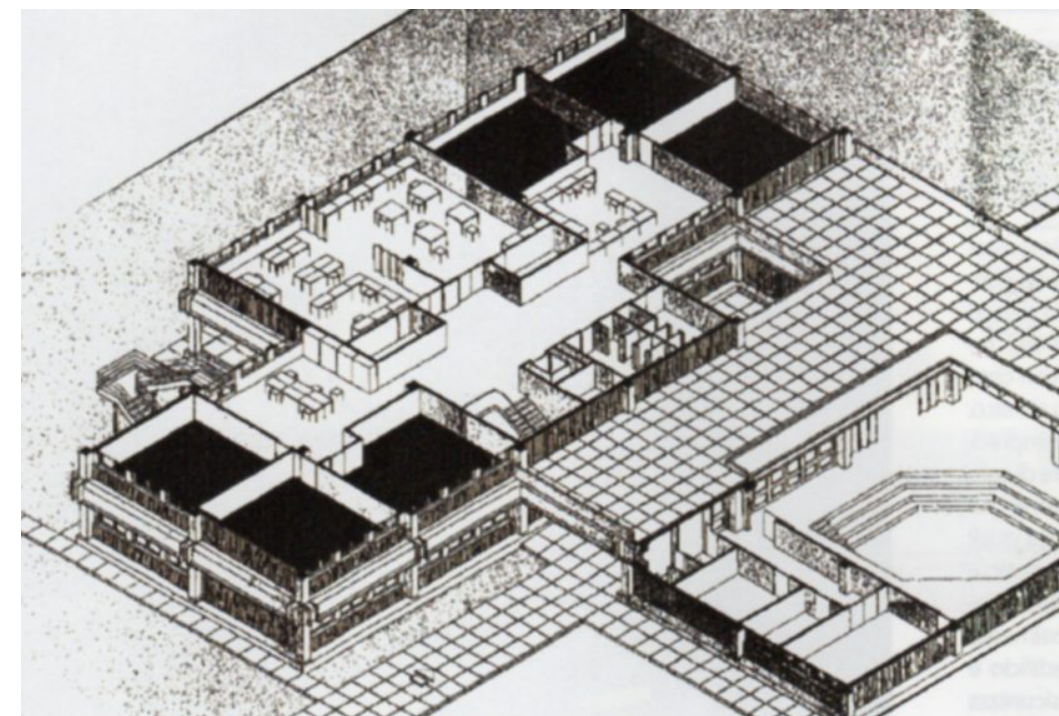
The natural environment and the relationship with the surrounding space start to increase the amount of possibilities of outdoor education, making users of school spaces much more demanding in terms of activities (and spaces to carry out those activities¹⁸). The concept of architectural plan is involved in a deep change: every type of didactic activities should be potentially viable everywhere in the building, increasing the demand for qualified spaces, "without precluding other

15 Elisa Negro (tesista), Maria Barelli (relatrice), *Edilizia scolastica prefabbricata in Italia nella seconda metà del '900: il dibattito, i sistemi costruttivi e alcuni casi piemontesi*, Politecnico di Torino, Corso di Laurea Magistrale in Architettura Per Il Progetto Sostenibile, 2016.

16 The Legge 641/67 "Nuove norme per l'edilizia scolastica e universitaria e piano finanziario dello intervento per il quinquennio 1967-1971", was the current regulation until 1975.

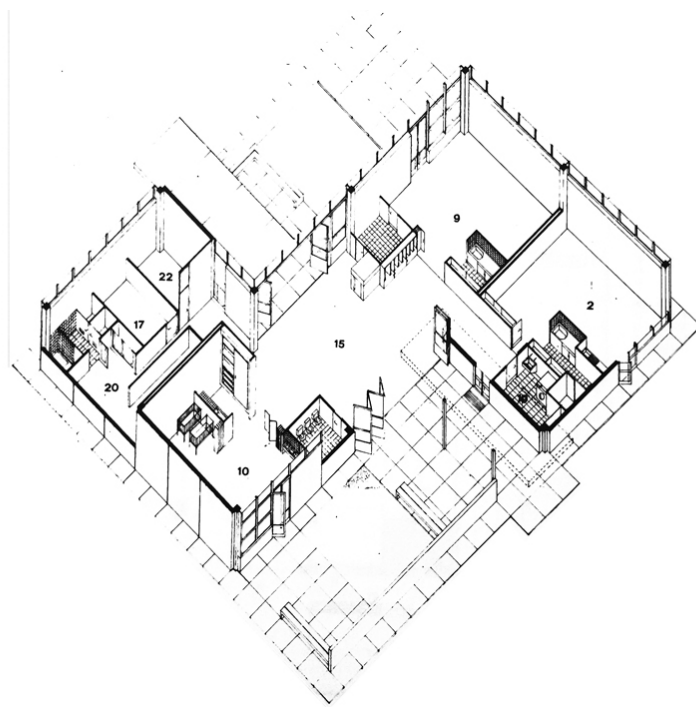
17 D.m. 18.12.1975, "Norme tecniche aggiornate relative all'edilizia scolastica - Characteristics of spaces related to pedagogical utility".

18 Magnaghi Alberto, *op. cit.*, pp. 139-140.



Istituto d'Istruzione Superiore Antonio Meucci in Carpi (MO) built with a complete modular and prefabricated scheme between 1974 and 1975. Images source: cbc-spa.it

functions"¹⁹ and avoiding to condition users' activities from spaces dimension (this passage is also highlighted on the New Building School Regulation Code. The text explain that "each pedagogic unit must guarantee a level of flexibility such to allow activities for both individual and medium-sized group activities" in addition "to the need of transformation of the unit from a regular one to a special²⁰ one"). First experiments of prefabrication where already been developed in the early 1900s²¹, while between the 1960's and the 1970's are reached very extensive levels of



Prefabricated nursery project in the Parma's province. Mid '70
Image source: quarryandconstructionweb.it

¹⁹ See note no. 17.

²⁰ With "special" classroom are intended units where it is possible to carry out laboratories, and experimental activities that can involve even outdoor spaces.

²¹ We see a preliminar application in 1911 at the Gianicolo in Rome where the first open-air school entirely prefabricated with wooden modules was built, equipped with every type of service even subsequently integrated with masonry additions.

freedom to architects who joined this technique. Plans, according to the users requests mentioned before, started to be shaped with removal elements (like internal/external walls, curtains, furnitures) allowing the possibility to transform classrooms and the integration with other school indoor and outdoor environments²²). Those features start to make real the idea of school communities, so much discussed in the previous years. But except for the ease of finding materials, placing windows and design school plans, what was the real gain in terms of spaces? Prefabricated buildings made it possible to conceive extensive buildings adaptable to the different ground conditions, landing on the slopes and allowing to aggregate prefabricated units (pavilions) even complex around a "common" pivotal environment, such as an entrance hall or a covered courtyard.

At the architectural level, the enthusiasm for designing with prefabricated elements produce multiple reference models that, on the city scale, will produce a plurality of building interventions that will continue to improve the theme of the indoor-outdoor relationship spaces, in some cases proposing the total opening of the ground floor to completely move the educational activities to the upper floors.

The 1980s and the participatory planning: a neighbourhood school

In the didactic literature of the last century, a model of formative interaction between teachers, students and local communities has been proposed, beginning to be part of an elaborate mechanism that, at the dawn of the first experiences of "participatory design" has shown many difficulties. The theory of participatory design had already been promoted by the architect Giancarlo De Carlo when, in 1973, citing his most famous aphorism "architecture is too important to be left to

²² The D.M. 18.12.1975 published those design disposals for the middle schools although, due to the absence of a second cycle didactic reform, the text order to follow the same disposal even for the high schools. The design disposals are published at the article 3.1.3, comma 1, 2 and 3.

architects²³ implies the weak point of a designing way that, at the time, failed to take into account the opinions and needs of future users of our architectures. De Carlo was one of the first European architects to involve users as an active part in the decision-making process, limiting the architect's role to the translation of a functional, economic and aesthetically well-made technical result. The participatory model, with a view to a general reorganization, was then theorized in the early 1980s with the name of "didactic triangle"²⁴ and is defined as the representation of the didactic action, based on the established relationship between the teacher, the student and the "cultural content" of the teaching.

In other words, teaching doesn't involve anymore just people, but also the "tools" that students and teachers have at their disposal to make the didactic action. It's starting to be more and more common to think over the idea of students seated behind a school desk, listening passively to the teacher for many hours per day, expecting to assimilate notions; the tools provided from the environment can make the learning more fun, more interesting, more engaging.

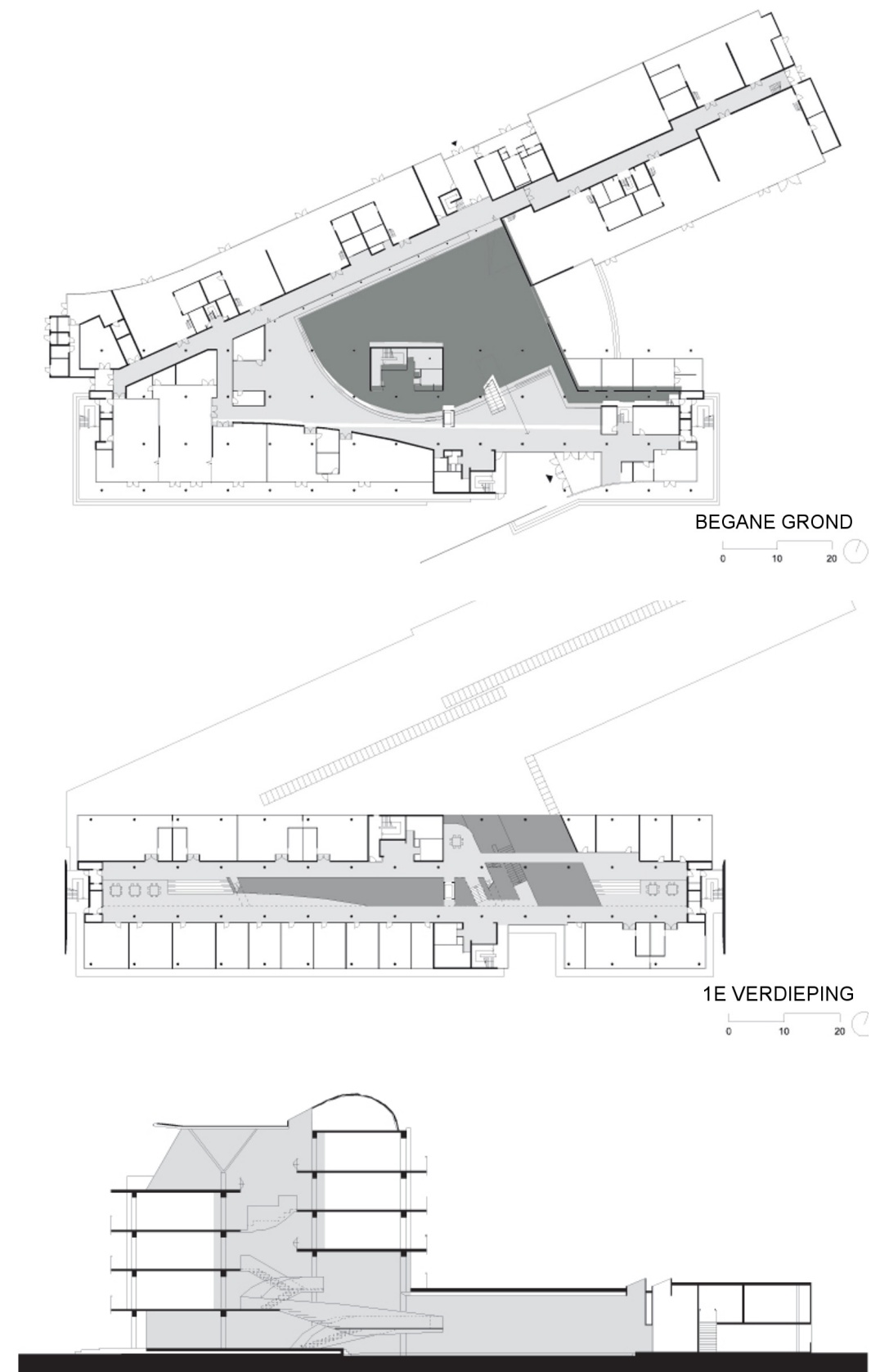
The didactic triangle identifies three main dimensions from which it is possible to observe the educational event as a whole: if the first two focus more on the relationship established between teacher and student, investigating mainly the relational-communicative and methodological-didactic relationship (that is, respectively, the quality of communications between teacher-student and the tools that teachers offer to students to explain and allow them to learn their subject) the last of the three dimensions is the "organizational" one, and attention is paid to the preparation of the teaching set: classrooms and school environments.

How is the classroom environment structured? Which tools are accessible to students? Which are the other environments with which students are in contact?

The classroom environment, the open space in which it is inserted, and the urban context are definitively intrinsic parts of the training process of students.

²³ Weyland Beate, *Progettare scuole insieme: strategie e processi tra spazi e didattiche*, in Attia Sandy, Weyland Beate, Prey Kuno, *Progettare scuole insieme. Tra pedagogia architettura design*, Edizioni Guerini, Milano, 2018, pp. 45-46.

²⁴ Castoldi Mario, *Ripensare la scuola: un'esperienza di progettazione partecipata*, Form@re Open Journal per la formazione in rete, 2017,



From above: Montessori College Oost, Amsterdam (1993-2000), ground, first floor plan and transversal section. Image source: <https://www.ahh.nl/index.php/en/projects2/9-onderwijs/55-montessori-college-oost-amsterdam>, accessed on 28/01/2022.

Therefore it changes the meaning of "context": it starts to become more active, without considering only the physical built surroundings, but embracing the community, promoting an active involvement of families and the creation of forms of mutual exchange between school and territorial community.

Since in this essay we're analysing the story behind the design of schools outdoor space (and the consequent benefits that involve the learning methods) therefore we can say that the schools outdoor space is starting to go over the physical limits of the plot, including the neighbourhood community, in which the students can train to learn more than classic subjects, extending their knowledge and experience in life.

This process of involvement will in fact take shape, a few years later, under the



High schools students involved into community activities during Service Learning hours. USA, 2020. Image source: edutopia.org

name of "Service Learning"²⁵ and is currently in use in the educational programs of many schools in Spain, the United Kingdom and Germany.

The definition of Service Learning recognized by the National Research Council (1999) wants it to mean "an idea of civic school that stands as a meeting place between formal and informal knowledge and that proposes innovative ways of integration between school, territory, local authorities and the work market"²⁶. Another definition from Vanderbilt University (Nashville, Tennessee), defined it as "a form of experiential education where learning occurs through a cycle of action and reflection as students seek to achieve real objectives for the community and deeper understanding and skills for themselves."²⁷

According to these principles, the school community is increasingly open to dialogue with the various actors present in the area: families, local authorities, the productive world, volunteering. We are facing a sort of exchange of favours, because, if on the one hand the school is intended as a resource for the territory and an opportunity for development since it intervenes directly by providing the educational bases for future citizens, on the other hand the presence of Associations in the territory can provide support and stimulus, providing structures, materials and activities that offer students important opportunities to recognize themselves²⁸ as active at community level, enclosing key skills of discipline and citizenship.

In sum, this process has primarily involved a change in didactic curriculum rather

²⁵ Giunti, C., Orlandini, L., Tortoli, L. et al. (a cura di), *Avanguardie educative. Linee guida per l'implementazione dell'idea "Dentro/fuori la scuola - Service Learning"*, Indire, Firenze, 2018.

²⁶ Giunti, C., Orlandini, L., Tortoli, *op. cit.*

²⁷ Wolpert-Gawron Heather, *What the Heck Is Service Learning?*, in Edutopia, <https://www.edutopia.org/blog/what-heck-service-learning-heather-wolpert-gawron>, accessed on 23/12/2021.

²⁸ The benefits of Service Learning didn't stopped even during Covid-19 pandemia, when worldwide student community shared cases of anxiety, depression and mental health issues due to the home isolation, quarantine and social distancing. Even if schools system well reacted to the first and more difficult days of pandemia, in March-May 2020, re-organizing the didactic activities online, there were still some students quite reluctant to return to in-person learning. The Service Learning hours have helped those students to partially solve their personal and social difficulties, meeting other people and build relationship, feeling again as part of the community even after the schools hours, when some of them become to be active part of volunteering activities and social services.

than in the way schools are designed. However, it should be considered fundamental for having pushed architects and school designers towards a more open vision of such buildings, which can accommodate and facilitate the stay not only of regular users (like students and teachers), but also external users, such as community people and external actors that can contribute to the schooling and social growth of students.

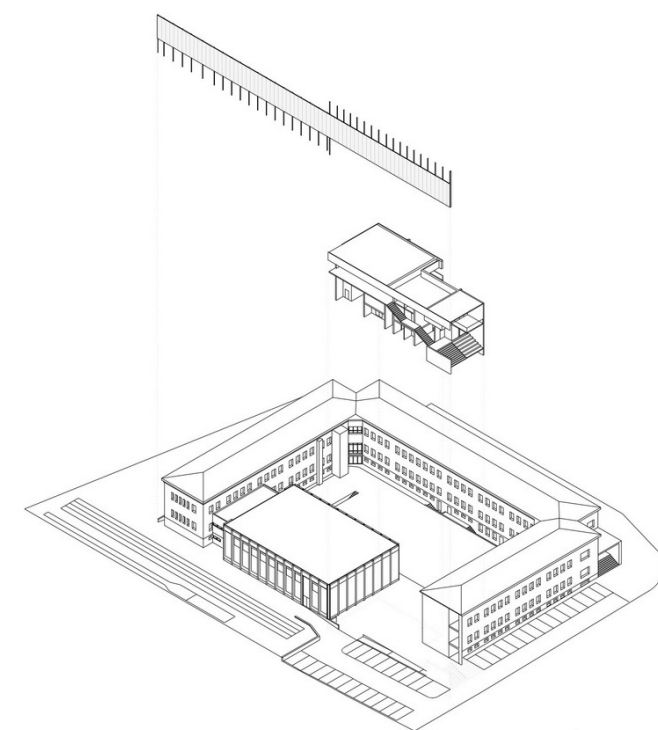
From 1990s to current time: the need of renovation

At the end of the 1990s, a drastic loss of interest in the debate on the design of schools appears, as we observe a decrease in the need for the construction of new schools and the emergence of the problems of the school heritage built during previous years. Indeed, although the design process was well permeated by the theoretical development methods, in parallel, rarely the projects have ended up reflecting them well even on a practical level. The problems ranged from the design phase to the management of the construction sites: there were occasions in which the comparison with future customers was missing, generating changes and transformations of the interior spaces, ignoring how the success or failure of innovative proposals depending on the appreciation degree of users and on the correspondence between hypothesized and actual use of spaces and equipment. And in the general disorder there were also the construction companies: taking into account the most cheapness of the intervention in the face of the gain, they hardly refer to the text of the new Technical Standards of School Building published in December 1975, with the consequent reduction of investments, expansion of project times, and inadequacy in the preparation of the site. This leads us to intervene on the existing heritage that, in a big percentage, is today demanding for energy efficiency and structural interventions. Nowadays, fortunately, many territorial realities which are promoting a general schools renovation, decide to directly involve them in the functional recovery project by proposing “a significant relationship between architectural project and educational project”²⁹. The

29 Fianchini Maria, *Progettare scuole in scenari innovativi*, TECHNE 21 | 2021, Firenze University Press

objective is therefore reversed if compared to the past: although before the focus was on the good design of a school, now it is necessary to understand how to recover them. In addition to the care of the school recovery project (as well as moments of participate meetings with future users and feedbacks collections on the recovery projects progress), moments of architectural analysis of the artefacts are needed, to better understand original designers intention and propose the best recovery plan. Design choices are therefore oriented into the energy performance and the psycho-physical satisfaction of the users.

On the one hand it is possible to intervene directly on the internal partitions of the school buildings if they are mobile or partially removable and on the other, by



Giulia de Appolonia - Officina Di Architettura, Renovation and Extension E. Fermi High School in Palazzolo sull'Oglio, 2020. Image source: ArchDaily.

30 Progetto Torino fa scuola, <https://www.torinofascuola.it/>, accessed on 12/06/2021.

31 *Concorso di progettazione per la ristrutturazione e la riorganizzazione della Scuola Secondaria di I grado Enrico Fermi di Torino*, Competition Document, 2016, available on <http://concorsotorinofascuolafermi.concorrimi.it/>

32 Ibidem.



high school buildings current status: history of teaching ways, designing methods and real life examples

the 1960s and 1970s (39.8%)³³ and does not possess any of the nowadays mandatory certifications³⁴.

However, good news follows, such as the increasing commitment of municipalities to protect their school heritage through the establishment of regional funds dedicated to this emergency. It should also be emphasized the commitment of the State that through several projects³⁵ on the national territory, has begun to allocate large funds for the protection of the school heritage, divided among the regions through participation competitions. In more recent times, starting from 2020, due to the Covid 19 pandemic, the need for school regeneration interventions has increasingly become a necessity, since the safe learning spaces require the application of important hygienic-sanitary regulations.

Teams of scientists and pedagogues from all over the world have studied the most effective methods to make schools safe, often proposing the creation of new furnishing objects as a solution to guarantee the correct distance between students and teachers. But the desire to regain possession of their school spaces has also manifested itself among the students, who already during the summer of 2020 have reorganized themselves through their student associations, creating events and discussion spaces to understand and face together the theme of the reopening of schools. often also involving the community of the neighbourhood. In Turin, for example, the project "Re-Opening: a neighbourhood school"³⁶ was

33 Legambiente, *"XXI Rapporto sulla qualità dell'edilizia scolastica e dei servizi"*.

34 The data are collected by the Italian association Legambiente, and explain how, in 2021, about 60% of the school heritage lack static testing tests; 42.2% of a fire prevention plan and 71.9% of the sanitary viability.

On the other hand, 98% of the structures are located in an area prone to seismic vulnerability and do not have certificates of protection from events of this magnitude.

35 Since 2015, the commitment of the ItaliaSiCura project has been significant: thanks to this project, over 300 new buildings have been built and 2100 regeneration interventions have been carried out in 15 different Italian regions.

In total, almost two billion euros were spent, divided to ensure renewable energy improvement interventions, seismic improvement and adaptation, energy efficiency and functional integrations to existing buildings. In the following years governments have taken up the symbolic legacy of this project, continuing to invest in the interest of school regeneration even during the Covid-19 pandemic that occurred starting from February 2020.

36 "Re-Opening - Una scuola di quartiere" project, promoted by ACMOS association, in <https://acmos.net/scuoladiquartiere>, accessed on 09/02/2022.

launched, and the first edition was hosted by the Albert Einstein High School. It underlined the concept of an "educating community" formed firstly by the students, and of a school more focused on the promotion of self-expression spaces and students cooperation: outdoor spaces are highly candidate to perform this objective.

Examples of outdoor space design in high schools: experiments between indoor and outdoor environments

The following pages from 48 to 61 are going to present an overview relating to the design of contemporary school building around the world. The examples are intended as well made projects, in which it's possible to appreciate what today means designing high school spaces and deal with the different modern contexts. Some of them show in fact multiple ways to approach the outdoor design, not only intended as a space itself, but like the continuation of the indoor one, proposing multiple connection between the two worlds, in a physical, visual and material way. This means that the outdoor design directly influences the architectural plan design, such as floor plan altitudes, vertical and environments distribution, windowed surfaces and entrance gates.

Planimetrical distribution of building bodies, divided by didactic activities hosted is even influenced by outdoor space design, modelling the building itself in articulated shapes, all depending on outdoor-indoor relationship. Great attention is paid towards the furniture, not only intended for the sitting and relax of students, but providing tools for carrying out experimental, sporting and sensorial activities, while in other cases the design moves towards the way in which the school building and the plot link to the urban fabric, with the aim of a better welcoming image directed to the students and the citizens, improving school image in the neighbourhood.

Design examples of schools outdoor space reported in the following pages came from five different countries and explanatory sheets are organized providing a general description always wrote by their designers, together with schemes and project drawing and pictures of indoor and outdoor environments.



Piedmont Hills
High School

Animo
High School

Gjerdrum
High School

Ørestad Gymnasium

ICS Milan International

Sassa School Complex

Marryatville
High School

Ørestad Gymnasium

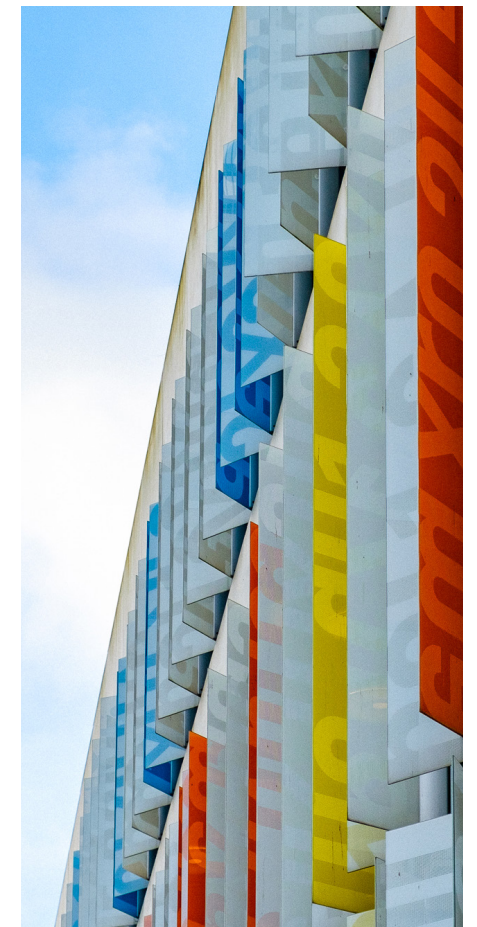
Location: Copenhagen, Denmark

Construction year: 2006

Design studio: 3XN Architects

The Ørestad College has been the first Denmark High School to fulfil new educational visions regarding subjects, organisation and teaching systems. Communication, interaction and synergy has been key issues for this purpose stimulating a new way of learning promoting study groups, classes and assemblies, reflecting international tendencies aiming at achieving a more dynamic and life-like studying environment. The intention is also to enforce the students' abilities gradually to take responsibility for own learning, being able to work in teams as well as working individually.

The project displays a visionary interpretation of openness and flexibility spaces since, The building is in fact interconnected vertically and horizontally. Four boomerang shaped floor plans are rotated to create the powerful super structure which forms the over-all frame of the building. Four study zones occupy one floor plan each. Avoiding floor altitude jumps, the organisational flexibility enables the different teaching and learning spaces to overlap and interact with no distinct borders. The rotation opens a part of each floor to the vertical tall central atrium and forms a zone that provides community and expresses the college's ambition for interdisciplinary education.



Here above and right page, pictures of the Ørestad Gymnasium. Indoor and outdoor spaces.
Image and text description source: Designboom.com, text provided by the architects)



Piedmont Hills High School

Location: San Jose, USA

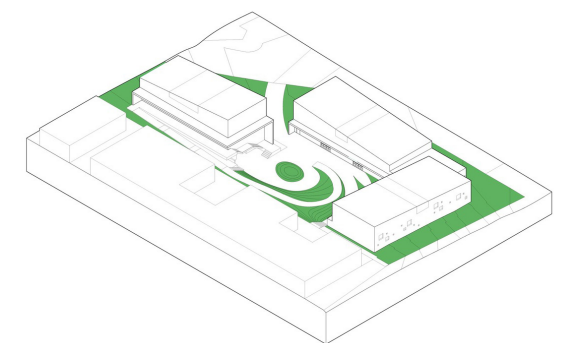
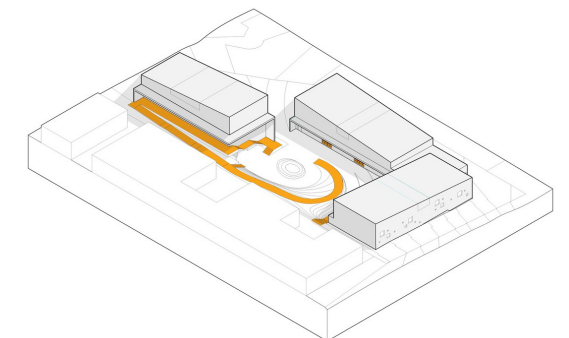
Construction year: 2018

Design studio: LPA Architects

The design for the Piedmont Hills High School Science and Life Skills Complex overcomes the challenges of a difficult site to create a modern, cost-effective, energy-efficient facility focused on indoor-outdoor learning environments, making science teaching fun and more integrative. Moreover, the new facility creates a gateway to the campus and introduces indoor-outdoor learning opportunities, setting a new standard for the future design of learning spaces at the school. The existing site topography was used to connect the upper and lower floors with ramps that promote active design. Overhead doors face classrooms to the lively sloping courtyard which creates a new identity to the campus-based on the natural setting. The design utilizes an all-wood frame construction, reducing the number of trades and significantly lowering costs and construction time while the exterior shell, shear walls, and openings were carefully integrated early in design to maximize the limitations of the construction type. The quantity, size, and placement of windows were carefully designed to increase controlled daylight while maintaining the integrity of the wood-framed shear wall. This collaborative effort between architects and structural engineers resulted in an efficient cost-effective structure with a playful layout that challenges the norm.



Here above and on the right page, pictures of the Piedmont Hill High School complex outdoor spaces. Images and description text source: ArchDaily (text description provided by the architects)



Marryatville High School

Location: Adelaide, Australia

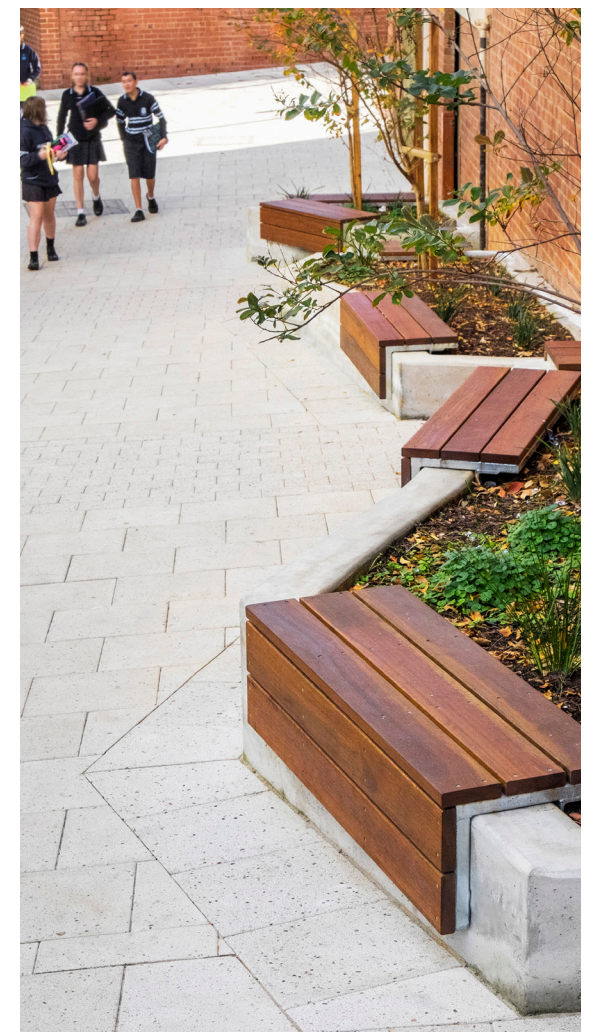
Construction time: 2013

Design studio: JPE Design Studio

The Marryatville High School is located in the center of the Marryatville District of Adelaide, Australia. The project for revisiting some of the buildings of the complex, along with the renovation of open space, has been promoted by the JPE Design Studio in two different steps. The first part brought to the complex new science laboratories, classrooms and informal indoor and outdoor learning areas. Inspired by the view and access to the site's natural features, the new systemation re-wrote the relation between design and learning. Encouraging open plan teaching and outdoor learning in a technology and resource rich environment which is linked to the natural setting of First Creek Park and the new student plaza. A textured and expressive palette of materials creates robust and refined interior spaces which are transformed by the colour of natural environment, reinforcing the connection between outside and inside areas. The second stage of works includes the refurbishment of two existing buildings, along with the landscape works to the school's central circulation spine and northern entry. These works have been carefully designed to ensure their better insertion into the school's existing built form, as well as a seamless integration of the landscape work made during step 1. The second step work improve the school connectivity and accessibility whilst continuing to maintain the open, tree-filled landscape character. The revitalised indoor and outdoor spaces provide a much needed functional overlay while expressing a 21st century learning experience.



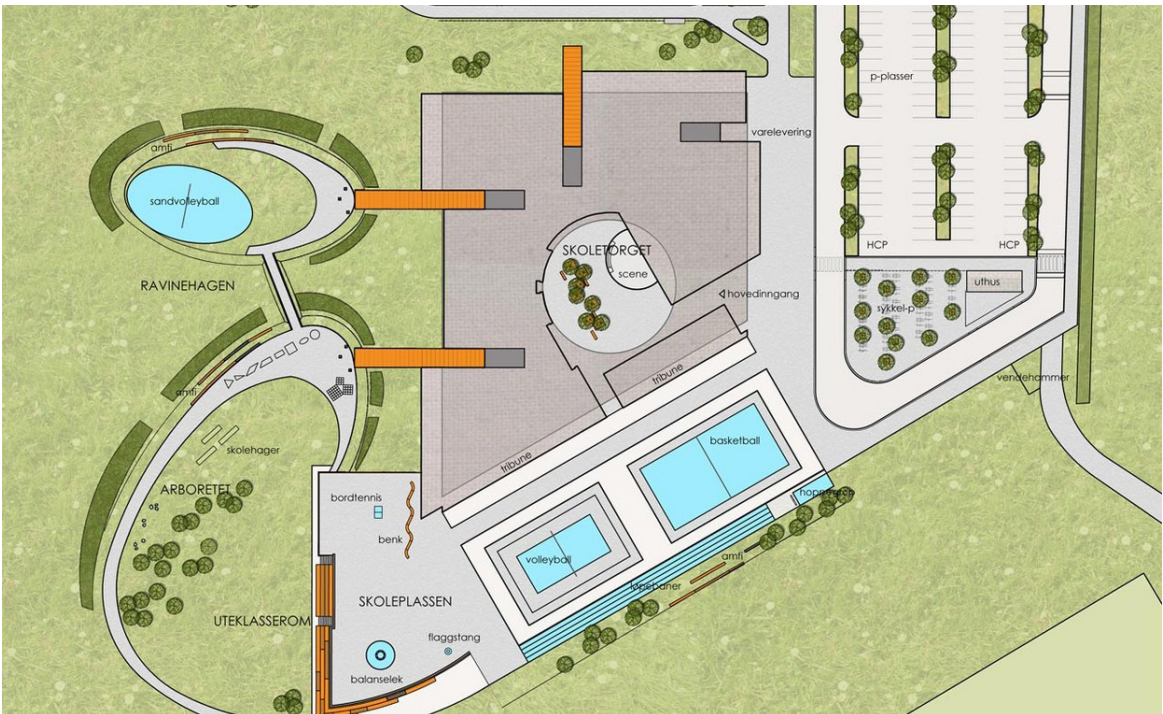
Here above and on the right page, pictures of the Marryatville campus outdoor spaces. Images and description text source: JPE Design Studio (text description provided by the architects)



Gjerdrum High School

Location: Gjerdrum, Norway
Construction year: 2009
Design studio: Østengen & Bergo AS

The Gjerdrum High school is located in a gently sloping terrain towards the south west zone of the namesake city, with traces of past ravines. The landscape for this school was designed by the same architects, leaving the back of the building, facing the north, open against the sports facilities and the hills while the central school-yard is developed around a central zone at the south of the building. To the west, you can find a garden formed as stylized ravines, linked to the building with wooden piers, including various learning activities. Along the south wall of the building is an activity area with basketball court, volleyball court, running track, jumping pits for long jump and table tennis. The area will also serve as a great gathering place for the school: in fact, the design admitted several possibilities for outdoor classrooms; the inner courtyard is a quiet, shielded room, tribuness southwest of the school can take many students. The seating on the south wall of the building invites to sit down and rest, but can also be used as an outdoor classroom. The asphalt on the ground, that characterizes the principal material of this area is painted with geometric shapes, allowing to create different learning place for multiple outdoor lectures at the same time. The outdoor areas are designed with accessibility for everyone. In addition there are smaller gathering places with a few steps, so that facilities for teaching in both large and small groups are present. The ravine in the south has a sunbathing lawn, and nature trail leading to the arboretum with all the Norwegian trees. Car and bicycle parking has a plot of vegetation, both trees, shrubs and perennials.



Here above and on the right page, pictures of the Gjerdrum High School. Images and description text source: ArchDaily (text description provided by the architects)



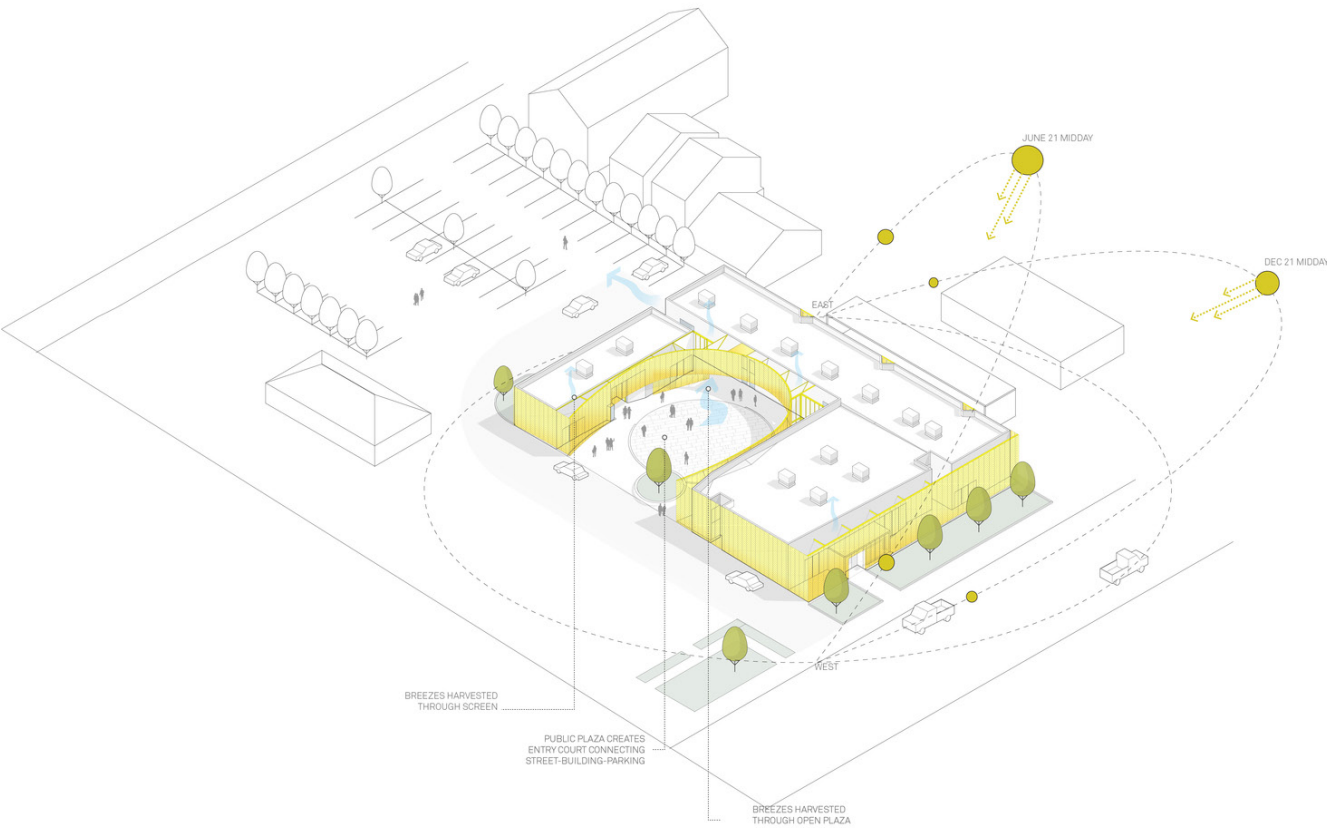
Animo South Los Angeles High School

Location: Los Angeles, USA
Construction year: 2015
Design studio: BROOKS + CARLO SCARPA

The new Animo school is located in one of the toughest areas in South Central Los Angeles hosting 630 students. This building is an addition to the 1950's campus, creating a flexible teaching environment that supports significant parental involvement and puts student life at the center of the school and unites the campus community. Designed on an extremely limited budget, simple cost effective gestures were deployed in the use of cladding, fenestration, colour and transparency to create a memorable sense of richness, providing a bright moment in an extremely tough inner city community. The South Los Angeles High School building is surrounded by a 20 foot high perforated bullet resistant metal walls, creating light filled courtyards for outside activity that is connected directly to classroom activities. This arrangement of courtyard design allows the building to breathe fresh air and daylight while providing a safe and secure environment for learning and social engagement. More, the result of the positioning of the perforated wall shape the curved outdoor space, leaving it free for the welcome of students and guest, creating a open-air light-filled halls and classrooms, as well as the building transparency, express the school's values and provide a healthy, sustainable learning environment. Unlike most school that are enclosed by a property line security fence, the presence of the bullet resistant material itself guaranteed the un-necessity of a fence, leaving the space from the street free to stripes of dry green plants, typical of the Los Angeles environment.



Here above and on the right page, pictures of the Animo High School. Images and description text source: ArchDaily (text description provided by the architects)



ICS Milan International

Location: Milan, Italy

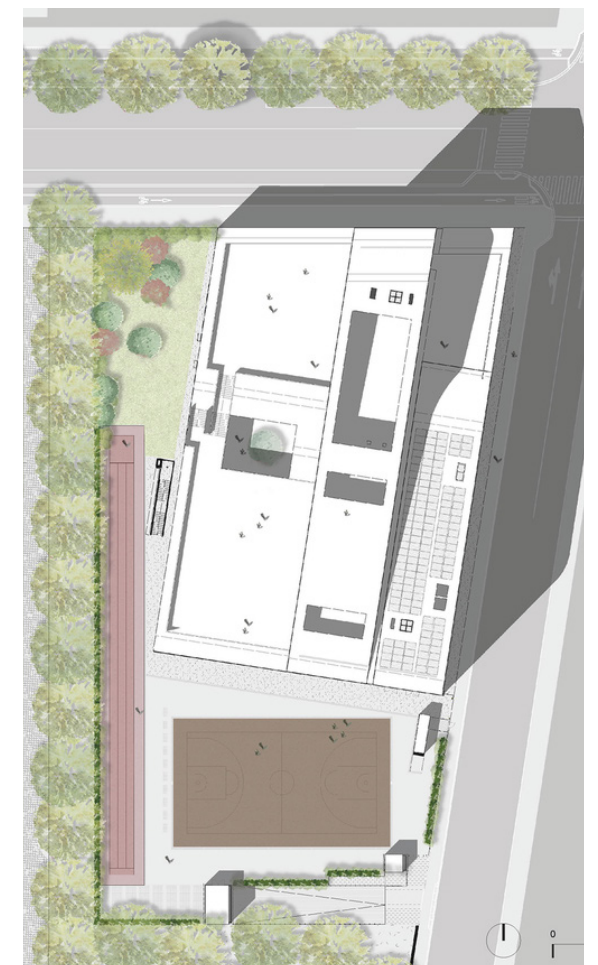
Construction year: 2020

Design studio: Barreca & La Varra

Campus Symbiosis of ICS Milan International School is part of Area Symbiosis, the Covivio Business District in Porta Romana in Milan. The building has a very recognisable shape wrapped in a fluid system of curves that envelops the whole. The plot on which it stands is not large, so the project has compressed the volumes and spaces as much as possible, generating a “vertical school” in which interior spaces of double and triple heights and outdoor spaces such as terraces and loggias follow one after the other, “climbing” the building. Students from Milan’s high schools participated in the shaping process towards multiple workshops that led to stimulating contamination of design ideas, responding to the needs of the building’s future users. The results produces a large ground floor, where the indoor collective activities (canteen, gym, swimming pool, and auditorium) open up to the city and to the large outdoor playground equipped for outdoor activities (athletics track and multifunctional sports field). The strong internal verticality guarantee a continuous connection to the top of the building. Speaking about the shape, particular importance invests the role of the roofs, which is used as an auditorium or recreational area in continuity with the interior spaces, with a covered part that allows shelter from the rain. This terrace is also connected to the one on the first floor (the roof of the indoor sports areas in connection with the canteen), which in turn is connected by a monumental staircase to the outdoor playground. The two terraces are connected both visually and materially by the shell, which near the opening on the ground floor between the auditorium and the gymnasium is interrupted to create an open-air space, a patio with a tree, which increases the amount of light and air entering the ground floor.



Here above and on the right page, pictures of the ICS Campus. Images and description text source: ArchDaily (text description provided by the architects)



Sassa School Complex (Primary + Secondary)

Location: Sessa, Italy

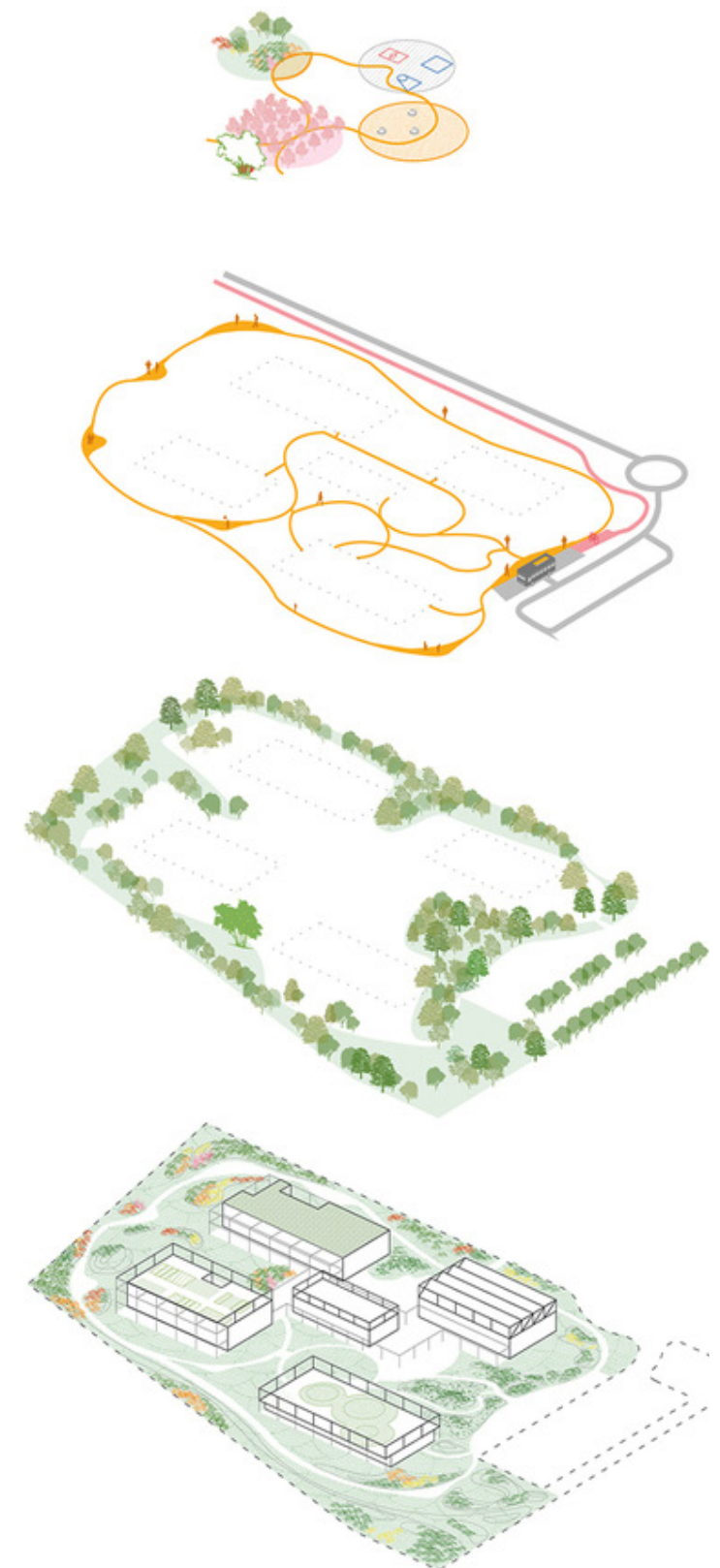
Construction year: 2016

Design studio: SET Architects

The project of the Sessa school complex is a multifunctional building, conceived as a civic center that integrates school activities into one large number of services open to the community in which students, parents and citizens have a chance to become active protagonists. The aim is to create a space with complementary activity in a unique school complex: the buildings' ground floor level presents mostly glass façades which give value to the visual transparency of the School Complex: thanks to the glass façades, all the classrooms have a strong relation between indoor and outdoor spaces, with the opportunity during summer time, to enlarge their spaces outside, working and studying under the porch. The project brings nature into the building thanks to the windows opened to the surrounding landscape. In addition, the outdoor spaces of the school complex are designed as a theme park where students can experience directly the variety of plants species and to study their life cycle. The outdoor park project plays a primary role in the redefining the natural space as a place of learning full of incitement and fun. Several circles become generators of the landscape project, in which the walk continues to crown the school complex and it is enriched with activities and equipment along the way. In addition to the external ring, it is designed another level of paths, linked with gardens and squares, each one with its proper elements and identities. The outdoor classroom is a space suitable for conducting open-air educational activities in which the green and its various forms are a predominant element, but they can also be used for play or as a small stage for school performances during the warmer season.



Here above and on the right page, pictures of the Sassa School Complex. Images and description text source: ArchDaily (text description provided by the architects)



PART 2

**Exploring Turin high school
buildings infrastructure**

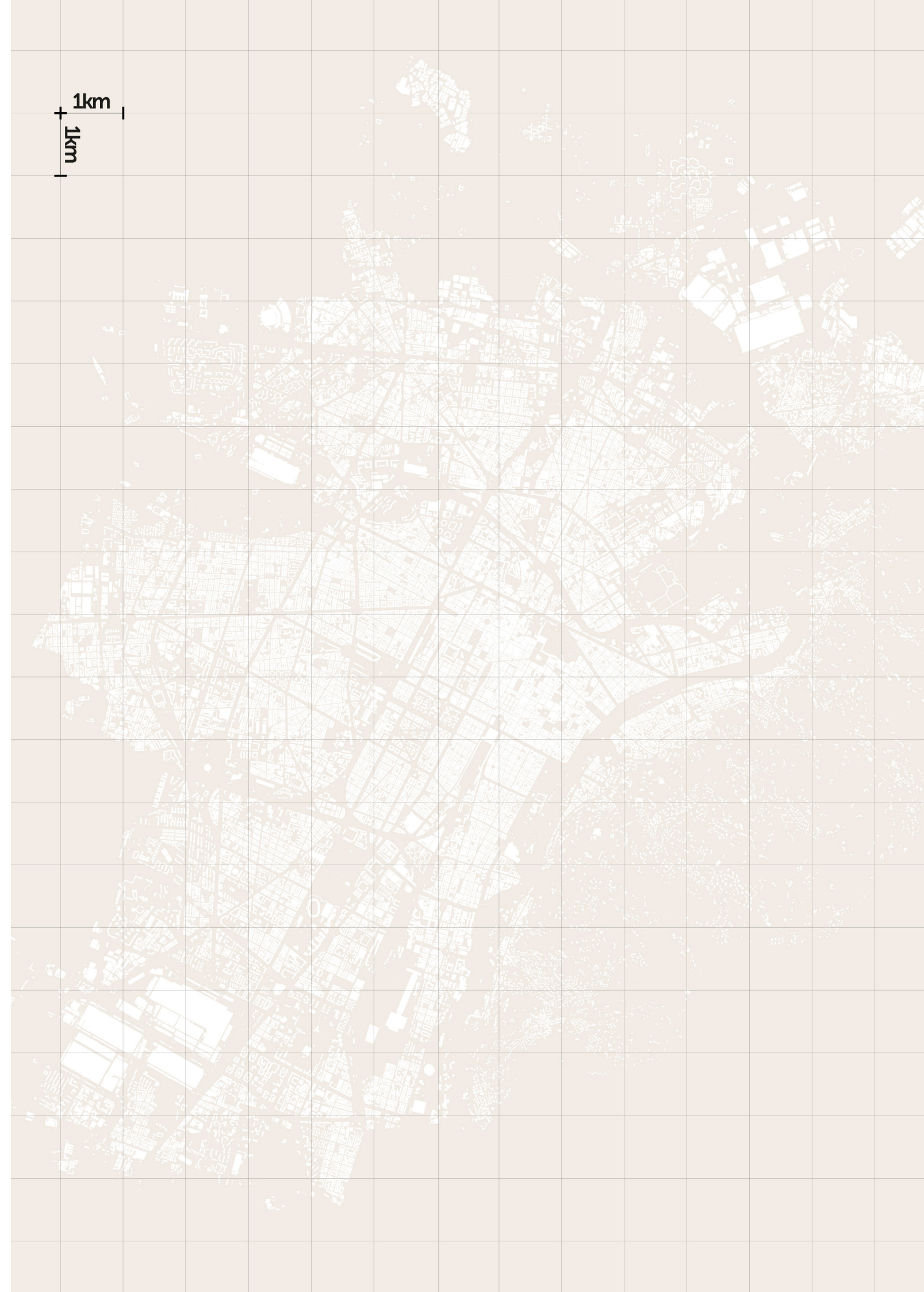
An italian vibrating laboratory: Turin

After the short introduction on the Italian history of designing outdoor spaces in high schools comes now the time to get closer to downsize the aim of this thesis to a real case of study, joining Turin as a research field where to get some results available to be applied into real high school's buildings. To give you a dimensional idea of the city, according to the latest data available from the ISTAT website, referring to the year 2014, Piedmont was the eighth region in Italy for number of students with a total of 168.439¹ in all the territory. Moreover, Turin among all the cities of Piedmont, hosts the largest number of secondary schools, for a total of 92 high schools, hosted in almost 80 different buildings. The city is characterized by variable density area that like usual in big urban realities, decrease in the most peripherals areas. This leads us to think about multiple ways to optimize and improve the current school building system, rethinking architecture buildings even from the social, sustainable and urban point of view.

Talking about the entire schools and education sector in the building construction, Turin has approximatively a total of 330 schools and that constitutes a real widespread infrastructure. Currently, changes at the urban level have become an important factor in rethinking those school buildings and their relationship with the built space.



¹ ISTAT, *Scuola Secondaria di secondo grado*, http://dati.istat.it/Index.aspx?DataSetCode=DCIS_SCUOLESECONDO2#, accessed on 31/05/2021



Moreover, time have changed, and a general renovation of building regulations² made existing school buildings un-suitable for the regular and safe use. Therefore, they were necessary adaptation works that, in many cases, led to the verification of structural requirements and existing installations, the latter in most of the cases very dated and not suitable for the modern space thermal comfort regulation. Due to the varied buildings age, dating back from the mid-nineteenth century to the most recent ones built in the early 2000s, the school have been subject of functional recovery and energy-environmental improvement interventions, spending about 13.000.000 Euros between 2019 and 2020³. The interventions involved 30 completed intervention plus 8 renovation projects to the year 2020 and were completely financed by the Metropolitan City, that took care of student and parent demands for comfort and safety in public school. The city has therefore showed interests in the school heritage, that has been explored and studied

² We refer in particular to the regulatory framework published after the Legge 373/1976 which although it regulated the thermal insulation characteristics of buildings and the design of new installations, remained very arbitrary in the field of renovation of existing buildings, leaving the mayor and the building commission to decide on the rules effective application. The regulations after 1976 give clearer indications in terms of environmental and installation design of newly design and existing buildings, by introducing the concepts of energy, environmental and installation performance certifications (Legge 10/91). The overcoming of the Legge 10/1991 will take place with the European Directive 2002/91/EC which will make similar the European Union members regulations regarding actions on energy saving, pressing, above all, towards the implementation of the energy certification of buildings, a methodology for calculating energy performance and periodic inspection of boilers and air conditioning systems, as well as an energetic expertise of the buildings with more than 15 years of service. The European Community will issue further in 2006 (Directive 2006/32/EC) indications on energy efficiency and end-uses of resources, providing guidance on the application of energy efficiency criteria, energy requalification and users information campaigns. In Italy this directive will be transposed through the Decreto Legislativo 115/2008 which "in order to contribute to the improvement of the security of energy supply and environmental protection through the reduction of greenhouse gases, establishes a framework of measures aimed to the improve of energy efficiency in terms of cost-benefit analysis". Finally, the regulations issued between 2005 and 2009 (195/2005, 311/2006, 59/2009) respectively promote environmental protection actions, made mandatory energy certifications, indicate the criteria of minimum requirements relating to seasonal air conditioning, lighting and provide updated calculation methods. The decree D.M 26/06/2009 will subsequently publish the national guidelines for energy certification and the technical standards of reference while.

³ Città Metropolitana di Torino, "Edilizia scolastica: massimo impegno e attenzione alla sicurezza", in <http://www.cittametropolitana.torino.it/cms/comunicati/edilizia-scolastica/edilizia-scolastica-la-citta-metropolitana-conferma-il-massimo-impegno-e-l-attenzione-alla-sicurez>, accessed on 29/01/2022



High School Students in front of the main entrance to Liceo Massimo D'azeglio. 1970. Image Source: archivi.polodel900.it

far and wide. A good distribution in the urban neighbourhoods distinguishes high school's buildings for a good accessibility by the public transport system that can reach almost each zone of the city, integrating buses and tramway lines.

Turin student community

The Turin student community is strong and active and, as we said before, share opinions and needs to the Municipal school management, as well as taking part in different social occasions such as the recent environmental strikes, or social demonstrations. The active participation of Turin student community in the social aspects of the nation has ever been historically strong, never failing to show their support to their own and workers rights demonstrations. Nowadays, like in most of Italian cities, student community is formed by several organizations, providing orientation activities, seminars and socializing moments. Turin's students, in some way were, the first at the end of the hardest months of the pandemic to request a return to in-presence didactic activities, but updated with the new principles that Covid-19 pandemic has taught us, namely social cooperation, respect for the environment and awareness for a better future. In recent times, for example, due to the Covid-19 pandemic, a lot have been the requests of the students to the Municipal Education Office, asking for a general renovation of educational programs, to make them more compatible with the Distance Learning, asking moreover for more affordable subscriptions to the public transportation and, last but not least, a renovation of the school spaces, indoor and outdoor both⁴.

The renovation of school spaces and didactic can guarantee firstly the healthiness of school spaces and secondly a learning way updated and closer to a lifestyle more aware of its impact in terms of resource consumption and pollution.

Is here that high school buildings and linked outdoor space come into play, suitable to host new didactic activities, new subjects and new ways to approach the learning of scientific and humanistic topics.

The first reinterpretation that we, as architects, can propose is precisely on outdoor spaces, since at the moment the indoor environments are the most analysed and revisited for a safe return to normal didactic activities.

⁴ Marco Beton, *Dad, trasporti e sicurezza sanitaria: la rabbia degli studenti sfilava in piazza a Torino*, in <https://www.torinoggi.it/2021/01/29/amp/argomenti/scuola-e-lavoro/articolo/dad-trasporti-e-sicurezza-sanitaria-la-rabbia-degli-studenti-sfila-in-piazza-a-torino-foto.html>, accessed on 25/01/2022.



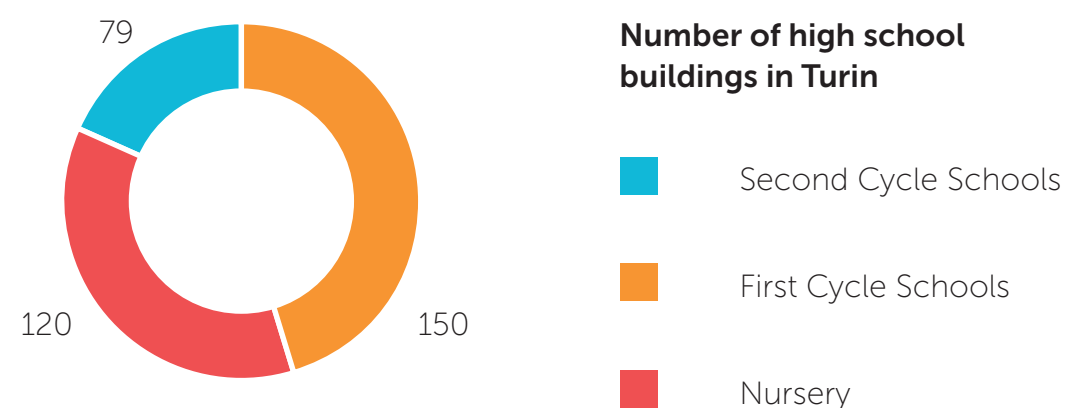
Technical college students protest over the extension for admission to university courses in Turin City Centre, 03/03/1961. Image Source: archivi.polodel900.it



High School Student Protest against online didactic activities in Turin City Centre, 07/01/2021. Image Source: torinoggi.it

Collecting data on main school building infrastructure

The first step to start the research and design phase was to understand where to find the sources and data necessary for a first analysis of the high school buildings numbers and quantities. At the national level, the main data collections about the school come from two main sources: ISTAT web data sources and the collections available on the Ministry of Education website, which includes a "School Data Portal" and a freely available section relating to data and informations on schools construction date. ISTAT data present the numbers relating to the total population of students, teachers, and the number of total classes carried out for each academic year, dividing them province by province. The most recent data date back to the 2019 academic year, and show a growth trend that in the last three years has seen the student population growing: 633.006 in 2017, 637.518 in 2018, 640.096 in 2019. The data of the Education's Ministry collect information on school buildings, such as, for example, their location, functional areas, reachability, buildings original use and construction year, open and built surfaces, etc. Moreover, it is important to point out that in a city not always the number of high school institutions is the same of the school buildings; in some cases they could be different, since a single building complex can host more than one school, dividing the architectural plan in two half, sometimes communicating and in others not. In other cases a school can have multiple branches, due to the high number of students and the few spaces available in main buildings. If two schools are hosted in a single building, usually main entrances are separated: this means that addresses for each school are different, since the civic numbers are not the same and often entrance gates are not located in the same building side. So, by this way, it is clear how to differentiate the school institutions if more than one is hosted in a single building complex. Regarding the branches located in other buildings,



they appear as additional addresses to the list, since in most of the cases, branches occupy entire new buildings. It's up to the researcher to understand to which main high school the branch belongs and if it is useful to know or not¹. The high school numbers collected from the data analysis are showed in the pie-graph on the previous page highlighting the division according to the "cycle of studies", in the City of Turin. With "cycle of studies" is generally meant the way students are divided according to their age: the kindergarten, between 3 and 6 years, first cycle (elementary and medium school) between 6 and 14 years, second cycle (high schools, professional schools) between 14 and 19 years. The study cycle of Italian students end usually with the university studies or the starting of a work right after the high school studies.

Working method and data processing

The measurement and observation work on high school buildings began with the data analysis from the School Data Portal available from the website of the Ministry of Public Education, University and Research. The open data available on the website are updated to the school year 2018/19 and are collected in several spreadsheets. The tables are divided into main topics. The ones resulting useful for the elaborations done for a first study of the data (and both downloadable from the website of the Schools Portal) are those called "List and location of active school buildings" and "Surfaces and volumes of buildings" (sqm / mc); both lists contain information on all the high schools present on the Italian territory and share some common data relating to the school buildings' construction year, the building "anagraphic" and "mechanographic"² codes used to identify the schools and institutes located on the Italian territory.

The table relating to the "List and location of active school buildings" shows the Municipality data regarding the school location (code, description, initials), the road address complete with site and name, the civic number, the postal zip code and the current state of the building (if active or not). The second table relates to the surfaces and volumes of the buildings, reporting in addition to those in common with the previous table and described above, the data regarding the "plot surface" (total area) on which the school is stationed, the "open area" (as known as un-built) and the built volume.

Having obtained these two tables, the first step was to merge them using the

¹ For the aim of this research, it was not necessary to know the location of the schools branches (if they were provided). Regarding the multi-institution school complexes, we referred to the data reported on the Ministry's lists for every single school address, without consider the open square meters measurable on the parcel shared between them.

² Those codes are useful to identify every school and institution in the city and Italian territory.

common data relating to the mechanographic code, which for buildings located in the Turin' municipality begins with the pair of letters "TO". This allowed us to extrapolate, from each list, the data relating to the high schools present in the territory of Turin. The recovered data were then collected into a single spreadsheet. The next step was to differentiate the school grades between kindergartens, the first cycle (primary, elementary, middle schools) and the second cycle (high schools and professional schools).

Since none of the lists available from the School Data Portal differentiated the schools according to cycles information, it has been referred to the data available on the website of the Database Registry of School Building and the Information System of the Educational Sector of the Municipality of Turin, from which it was possible to obtain data lists containing the classification of school buildings according to the cycle to which they belong, as well as the schools' street addresses, the zip code and the name of the school institution.

Then, by filtering the list of the Database Registry of School Buildings so that it showed only the high schools and the related street addresses, through the coincidence of the latter with the information coming from the unified tables of the School Data Portal lists, we were able to obtain the information we needed to perform future surveys on outdoor spaces: a complete list of high schools, complete with street addresses, name of the institution and measurements relating to open spaces and the plot on which the school is located.

Following obtaining the list and size of each school building we began to perform a spatialized study of the data, graphically locating them in the city map and observing the relationship with the built environment. The result of this operation is a collection of maps that will be shown in the following pages, while the map from pages 78 to 81 represents all the Turin's high school buildings and related standing surfaces. This map has been used as base for following studies.

The school buildings location phase is followed by the construction of a high schools abacus that collect the information for each high school plot. For the abacus making we made use of the open-use cadastral parcels digital archive available from Turin's Geoportal³. The Geoportal allowed us to download a .DWG format file editable with Autodesk AutoCAD collecting city blocks and city building shapes, including schools.

In this way, we had the opportunity to verify the coincidence between the measurements collected by the School's Data Portal and the ones from the Geoportal: at the end of this process, obvious discrepancies were noticed. The errors found

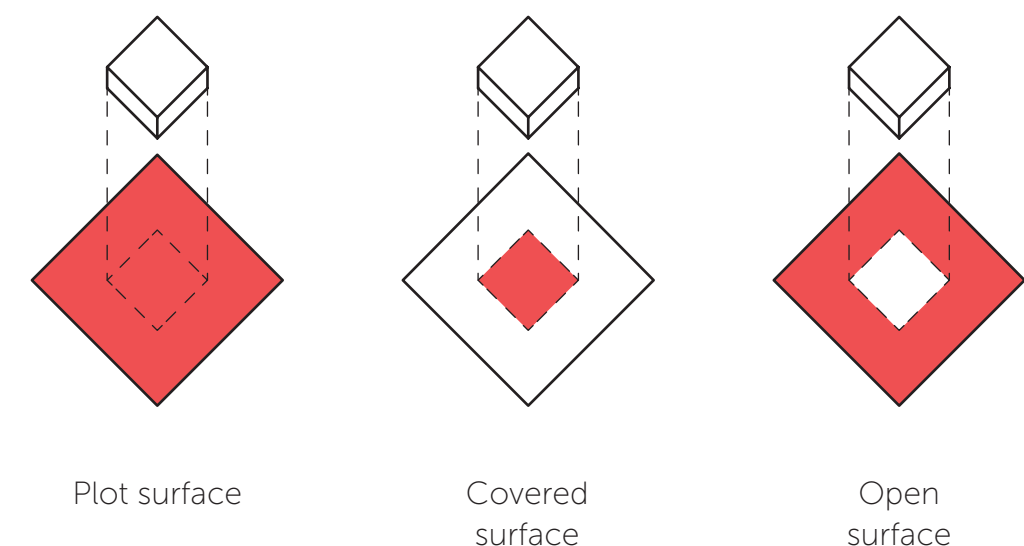
were in a range between 500 and 2000 m² of difference: considering the cadastral archive as the most updated source we had between it and the Ministry measurements, the incorrect Ministry's informations have been replaced with the measures reported by the cadastral archive.

The high schools abacus









































As mentioned in the previous chapter, the construction of the high schools abacus made use of the surface measurements obtained from the Ministry's data and cadastral parcels collection processing.

The data presented by the abacus take into account, in addition to the school name, the "Plot Surface" of each school, also known as the total size of the plot on which the school building is located. Finally, it's included the "Open Surface", meaning the free area in the building surroundings as the result of the subtraction between the school building footprint area (Covered Surface) and the Plot Surface.

Each of these surfaces are expressed in the relative meter squares values, and reported in a graphic format that shows each of the school cadastral parcels extensions and the building shapes standing on them. The abacus presents, in ascending order, all the city high schools according to the open surface dimension values. Here below is an example scheme of the three surfaces types in which plots can be expressed and that were taken into account during the abacus processing that follows from pages 74 to 77.



³ Geoportale della Città di Torino, <http://geoportale.comune.torino.it/web/>, accessed on 05/05/2021

									
"Liceo Classico Gioberti" Plot Surface: 8.731,00 Open Surface: 0,00	"I.I.S. "C.I. Giulio" Plot Surface: 683,00 Open Surface: 0,00	"Liceo Germana Erba" Plot Surface: 1.652,00 Open Surface: 0,00	"Istituto Internazionale" Plot Surface: 473,00 Open Surface: 49,00	"Liceo Scientifico Cairoli" Plot Surface: 1.485,00 Open Surface: 431,00	"I.I.S. Luigi Lagrange" Plot Surface: 2.791,00 Open Surface: 1324,00	"Scuola Superiore per Mediatori Linguistici" Plot Surface: 4.608,00 Open Surface: 1350,00	"Istituti Professionali Valentino Bosso" Plot Surface: 3.800,00 Open Surface: 1365,00	"Liceo Statale Regina Margherita" Plot Surface: 3.820,00 Open Surface: 1450,00	"Liceo Classico e Musicale Cavour - Succursale" Plot Surface: 4.641,00 Open Surface: 1473,00
									
"Istituto di Istruzione Superiore Giovanni Giolitti" Plot Surface: 1.360,00 Open Surface: 435,00	"Liceo Scientifico Statale A.Volta" Plot Surface: 1.795,00 Open Surface: 524,00	"Liceo Classico Statale "Massimo D'Azeglio" Plot Surface: 1.880,00 Open Surface: 600,00	"I.P.S.I.A. Dalmazio Birago" Plot Surface: 2.624,00 Open Surface: 618,00	"Liceo Artistico "A. Passoni" Plot Surface: 1.767,00 Open Surface: 637,00	"Convitto Nazionale Umberto I" Plot Surface: 2.325,00 Open Surface: 1607,00	"Istituto Per Il Commercio Paolo Boselli" Plot Surface: 3.205,00 Open Surface: 1690,00	"Istituto Istruzione Superiore Santorre Di Santarosa" Plot Surface: 3.250,00 Open Surface: 1815,00	"IIS Plana" Plot Surface: 10.947,00 Open Surface: 1815,00	"Istituto Carlo Levi" Plot Surface: 11.672,00 Open Surface: 2000,00
									
"Liceo Statale Bosso-Monti" Plot Surface: 2.290,00 Open Surface: 640,00	"ITGS Guarino Guarini" Plot Surface: 2.506,00 Open Surface: 750,00	"Liceo Domenico Berti" Plot Surface: 7.137,00 Open Surface: 800,00	"Istituto Maria Ausiliatrice" Plot Surface: 1.911,00 Open Surface: 820,00	"Istituto Flora - Liceo Economico Sociale" Plot Surface: 1.652,00 Open Surface: 897,00	"Liceo Colombatto" Plot Surface: 3.566,00 Open Surface: 2128,00	"Istituto Boselli" Plot Surface: 5.689,00 Open Surface: 2191,00	"Liceo Classico Vittorio Alfieri" Plot Surface: 5089,00 Open Surface: 2.244,00	"Istituto Paritario Sant'Anna": 5.726,00 Open Surface: 2.253,00	I.I.S. E. Majorana" Plot Surface: 6.300,00 Open Surface: 2.393,00
									
"Istituto Pietro Gobetti" Plot Surface: 1.996,00 Open Surface: 983,00	"Liceo Scientifico Carlo Cattaneo (Succursale)" Plot Surface: 2.511,00 Open Surface: 1079,00	"Liceo Artistico Aldo Passoni" Plot Surface: 2.762,00 Open Surface: 1083,00	"Istituto d'Istruzione Superiore "Bosso - Monti" Plot Surface: 4.291,00 Open Surface: 1294,00	"Istituto di Istruzione Superiore "Giuseppe Peano" Plot Surface: 4.514,00 Open Surface: 1320,00	"Istituto Russell-Moro-Guarini" Plot Surface: 4.194,00 Open Surface: 2432,00	"ISS "A. Magarotto" Plot Surface: 3197,00 Open Surface: 2605,00	"Liceo D'Assisi" Plot Surface: 1.652,00 Open Surface: 2.725,00	"Istituto Tecnico Industriale Statale L. Casale" Plot Surface: 5.400,00 Open Surface: 2808,00	"Istituto Pietro Gobetti" Plot Surface: 28.481,00 Open Surface: 2868,00



Other buildings sharing the same plot space



"Scuole Pubbliche
Via Braccini"
Plot Surface:
5.200,00
Open Surface:
2920,00



"Istituto Geometri
Alvar Aalto"
Plot Surface:
5.469,00
Open Surface:
2986,00



"Liceo Classico e
Musicale Cavour -
Sede centrale"
Plot Surface:
4.175,00
Open Surface:
3009,00



"Istituto Paolo
Boselli"
Plot Surface:
3.264,00
Open Surface:
3037,00



"I.I.S. J. Beccari"
Plot Surface:
4.314,00
Open Surface:
3134,00



"Istituto Pietro
Gobetti"
Plot Surface:
3.000,00
Open Surface:
6457,00



"Primo Liceo Artistico
Statale"
Plot Surface:
15.365,00
Open Surface:
6463,00



"Liceo Artistico St. R.
Cottini"
Plot Surface:
9.187,00
Open Surface:
6632,00



"IIS Bodoni-Paravia"
Plot Surface:
10.356,00
Open Surface:
7147,00



"Istituto Superiore di
Istruzione Majorana"
Plot Surface:
2725,60
Open Surface:
7447,00



"Istituto Tecnico
Sommeiller/Liceo
Scientifico Ferraris"
Plot Surface:
9.660,00
Open Surface:
3140,00



"Istituto Enzo Ferrari"
Plot Surface:
6.300,00
Open Surface:
3417,00



"Scuola Paritaria
Mazzarello"
Plot Surface:
8.220,00
Open Surface:
3458,00



"Istituto di Istruzione
Superiore Romolo
Zerboni"
Plot Surface:
2.035,00
Open Surface:
3772,00



"Liceo delle Scienze
Umane Regina
Margherita"
Plot Surface:
5.080,00
Open Surface:
3840,00



"Lycée Français
International Jean
Giono Turin"
Plot Surface:
9.995,00
Open Surface:
8017,00



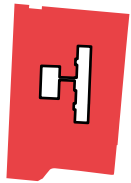
"Liceo Giordano
Bruno"
Plot Surface:
14.622,00
Open Surface:
9776,00



"Istituto Superiore
Santarosa"
Plot Surface:
12.296,00
Open Surface:
10762,00



"Liceo Altiero
Spinelli"
Plot Surface:
15.720,00
Open Surface:
11305,00



"Liceo Scientifico
Carlo Cattaneo"
Plot Surface:
15.000,00
Open Surface:
12913,00



"I.P.S.I.A. Dalmazio
Birago"
Plot Surface:
5.662,00
Open Surface:
4291,00



"Istituto delle Arti e
dei Mestieri"
Plot Surface:
6821,00
Open Surface:
4440,00



"Istituto Istruzione
Superiore Statale
Galilei-Ferrari"
Plot Surface:
6.141,00
Open Surface:
4637,00



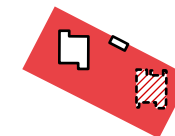
"Liceo Linguistico
Albert Einstein"
Plot Surface:
5.823,00
Open Surface:
4938,00



"Liceo Scientifico
Statale Gino Segrè"
Plot Surface:
6.800,00
Open Surface:
5200,00



"Liceo Scientifico
Valsalice"
Plot Surface:
18.778,00
Open Surface:
13048,00



"Istituto Magistrale
Regina Margherita"
Plot Surface:
17.870,00
Open Surface:
15094,00



"ITTS Carlo Grassi"
Plot Surface:
21.310,00
Open Surface:
15098,00



"Istituto Internaziona-
le Agnelli"
Plot Surface:
35.394,00
Open Surface:
17870,00



"IIS Primo Levi"
Plot Surface:
33.562,00
Open Surface:
18679,00



"Liceo Artistico
Statale Renato
Cottini Succursale"
Plot Surface:
8.330,00
Open Surface:
5270,00



"IPS J. B. Beccari -
Istituto Alberghiero
Tecnico"
Plot Surface:
10.420,00
Open Surface:
5465,00



"I.I.S. J. Beccari"
Plot Surface:
7.215,00
Open Surface:
5480,00



"IIS Albert Einstein"
Plot Surface:
8.660,00
Open Surface:
5789,00



"Istituto Scolastico
Sacra Famiglia"
Plot Surface:
8.631,00
Open Surface:
6008,00



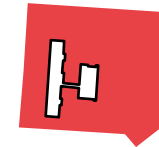
"Istituto Professionale
Statale Colombatto"
Plot Surface:
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Open Surface:
19626,00



"Istituto Sociale"
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26.309,00
Open Surface:
19981,00



"IIS Copernico-Lu-
xemburg"
Plot Surface:
25.966,00
Open Surface:
20218,00



"IIS Russell - Moro -
Guarini"
Plot Surface:
28.377,00
Open Surface:
25102,00

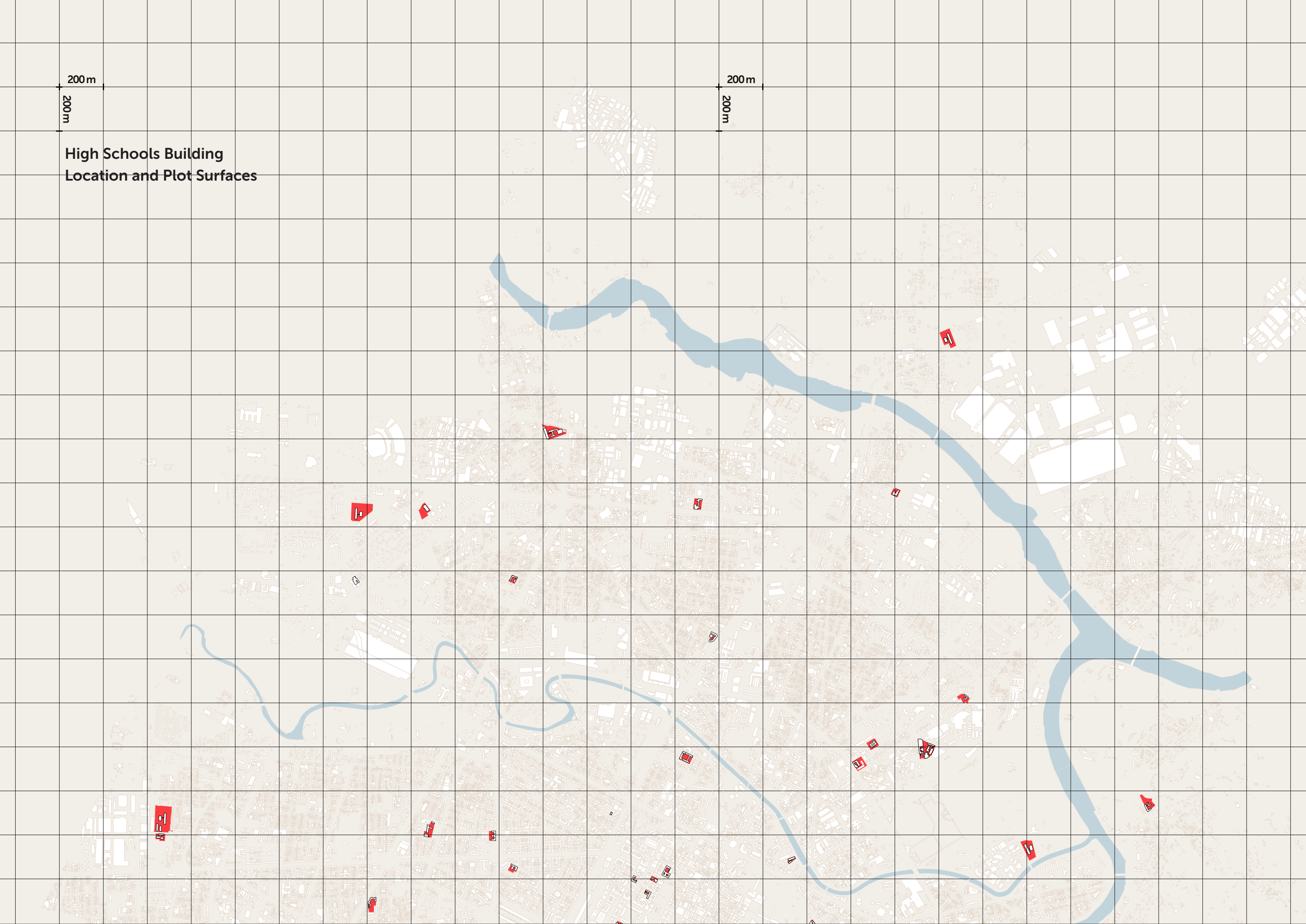


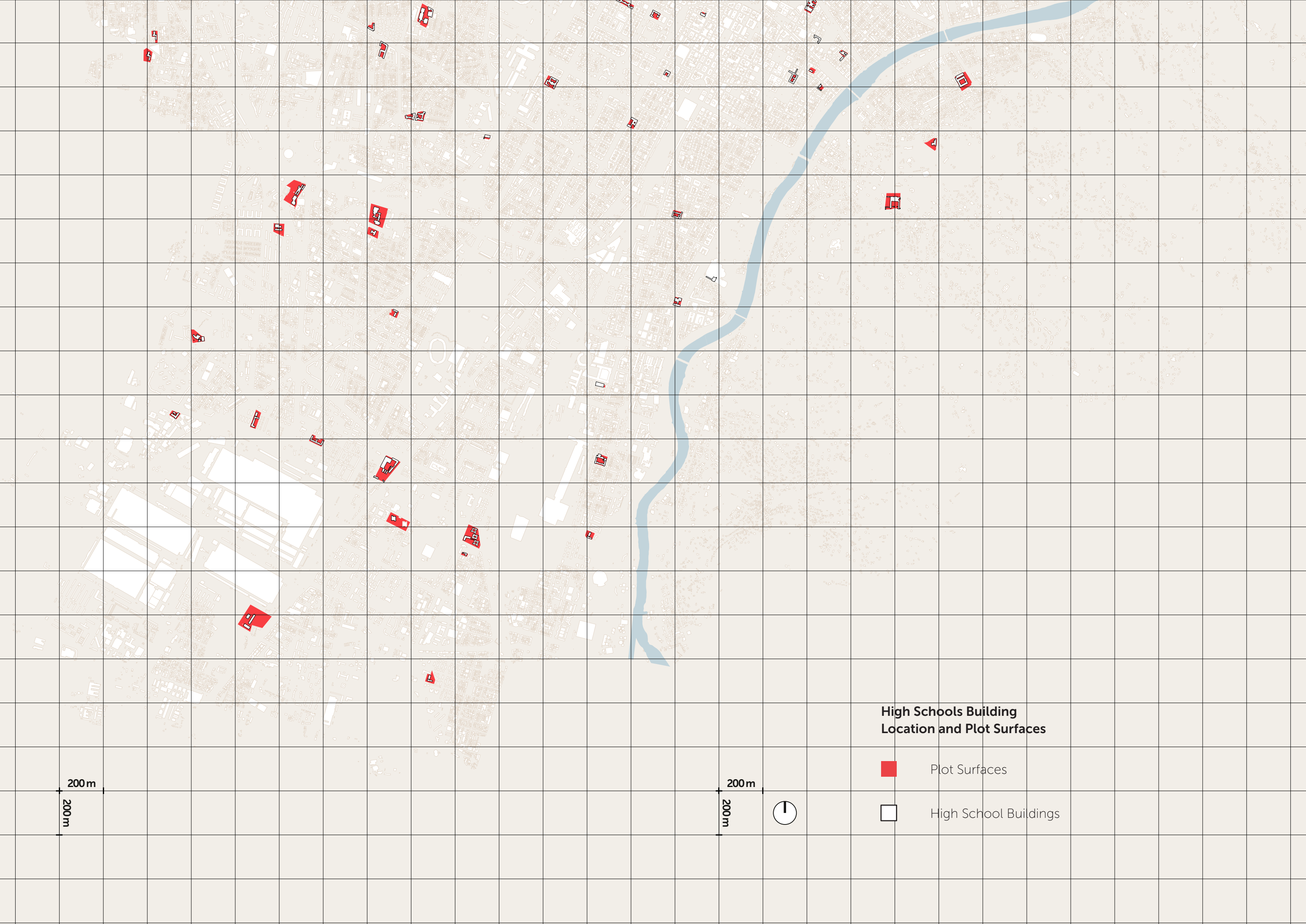
Other buildings sharing
the same plot space

200 m
200 m

200 m
200 m

High Schools Building Location and Plot Surfaces





**High Schools Building
Location and Plot Surfaces**



Plot Surfaces



High School Buildings

200m

200m

200m

200m



Observations about previous measurements: there's space for everyone!

Working at different scales, we looked at the collected high school data to build an idea of the kind of spaces that a morphologically well-defined city like Turin could host. The data collected show that of the total school size of the city, equal to **1,672,448** square meters, less than half concerns high schools: 656,904.00 m2, equal to 39,3%).

To get an idea of this size you could think of a total of 92 regular football fields, whose dimensions range from 105 metres in size to 68 in width.

As for the open space, out of a total of **1,672,007** square meters, the 19,19 % (320,962 sqm) concerns high schools. In this case, always keeping in mind our regular football fields, we could put 45 in a row.

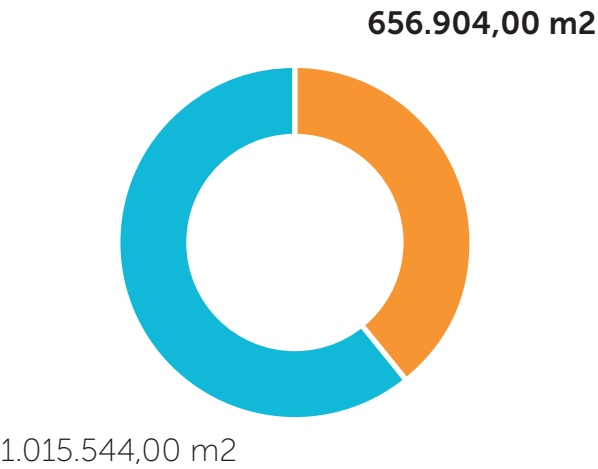
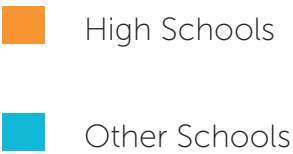
From these numbers we can imagine how in the city of Turin the potential for transforming the high school's open space is innumerable, being able to give students opportunities for develop and improve their high school as a place of life, leisure and entertainment.

And let's not forget how, with a view to participatory design, such projects can be transformed into an opportunity for local communities and inhabitants to gain new urban space, opening new courtyards to the public, gardens and sports fields to anyone in the city.



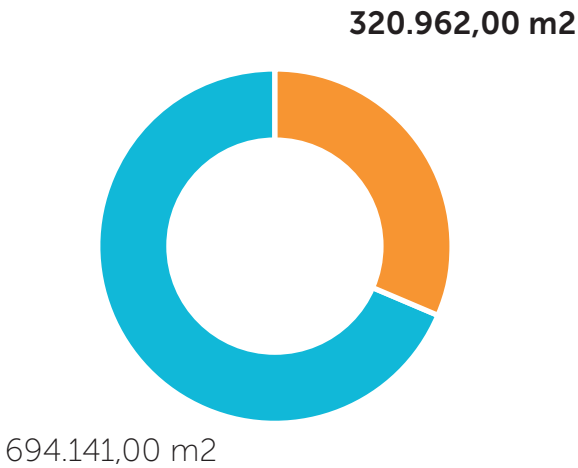
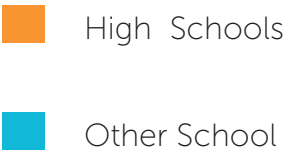
Total High School Plot Surfaces

656.904,00 m2



Total High School Open Surfaces

320.962,00 m2



The Ratio between plot surface and open surface

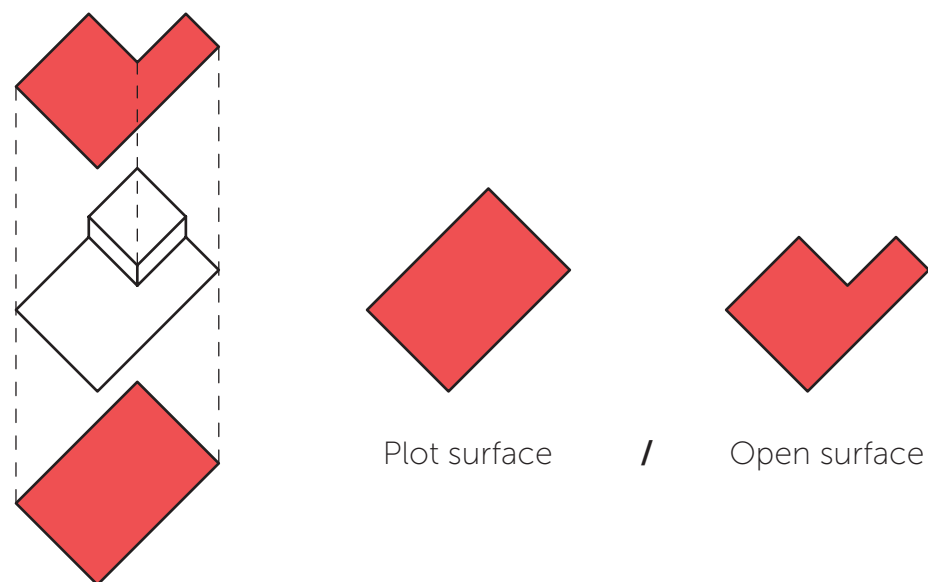
The next step after obtaining the high schools dimensions lists, and identifying them in the city map, has been the calculation of the ratio between the plot and open surfaces. The result of this operation is a number that can be equal to or higher than 1.

From this calculation it's easy to understand which are the high schools that occupy almost all the open available space, in fact, the closer the values will be to the value of 1, the more open space will be inside the plot. The ratio calculus provide also a general overview of the potential offered by the high school plots, and if it is worth thinking about the regeneration of schools open spaces.

To get a clearer idea, let's imagine a high school whose plot measures in total 1000 m². If we imagine the open space available in the plot equal to the exact half of it (500 m²), we will get a value of 2 as a Ratio. If, on the other hand, we approach values closer to 1000 m² (for example 850 m²) we will obtain Ratio values below 2 (in the 850 m² case will be equal to 1.18).

With higher Ratio values, the possibility of working on the free space of the plot is not excluded, but the project operations can become increasingly difficult due to the lack of available space.

The calculation of the Ratio is performed by dividing the plot total surface by the internal open surface, and it was calculated (as you can see in the graph on the following page) that in Turin most schools have Ratio values between 1 and 2.



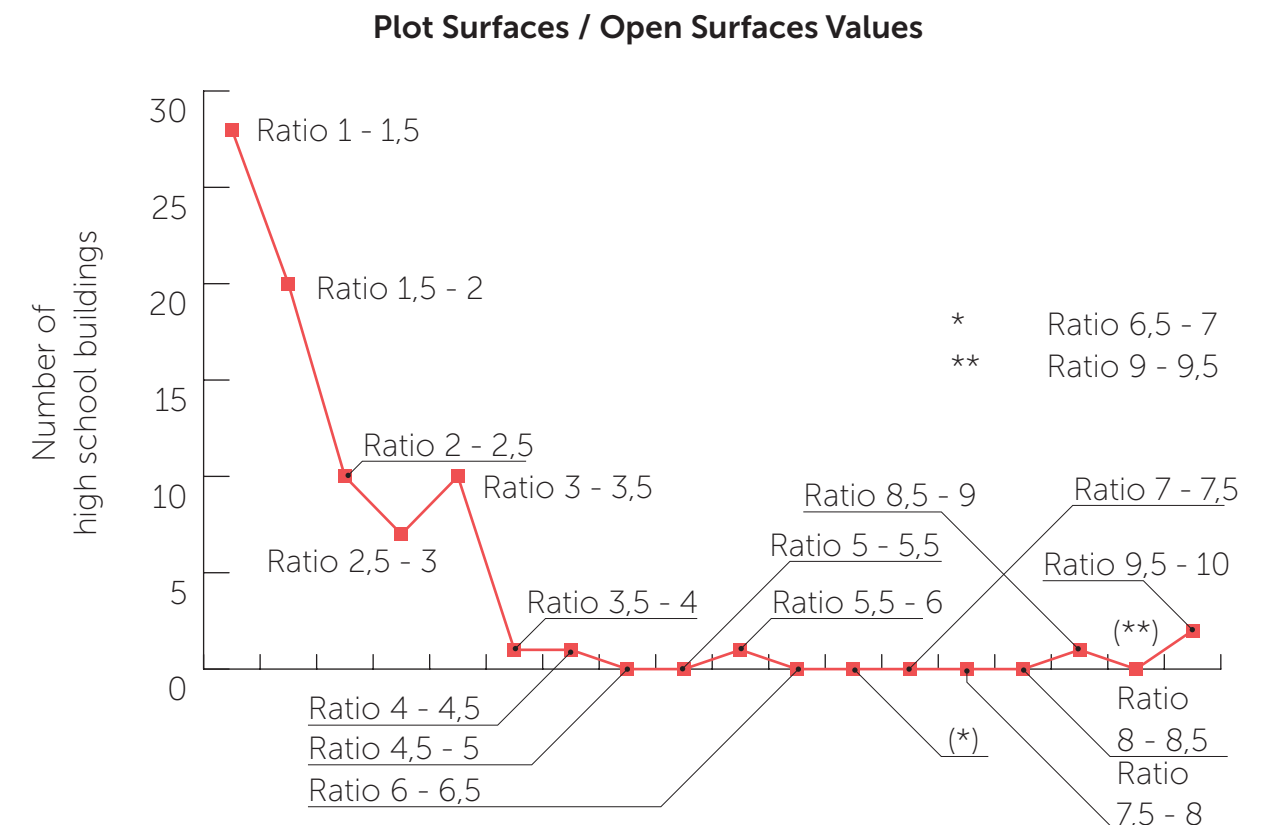
A value of 2 means that the exact half of the plot is free to accommodate interventions in the open space, so just over half of the schools in the city are well suited to hosting interventions of this type.

This data partially supports the result of the research on page 83, where according to the data, the Open Surface of Turin high school turns out to be just under half of the sum of the surfaces of the plots.

Schools with a Ratio value of more than 2, for which the available outdoor space is gradually reduced, can be invested by redevelopment works not necessarily within the plot, but in the nearby public spaces, such as streets, squares, or parks adjacent to it.

The possibility of intervention must then be evaluated on a case-by-case basis and for any high school is excluded: the value of the Ratio between Plot Surface and Open Surface can help in advance to identify the amount of open space available, and where to carry out the redevelopment works of the outdoor space. It does not have to be intended as a green light for the possibility of interventions or not. We repeat: interventions are possible everywhere, after a case-to-case study.

Here below you can observe a graphical representation of the relationship between the number of high schools and Ratio ranges.



High schools dimensions evolution over time

Once the abacus of the city's high schools had been realized all the open surface measurements have been divided into 3 ranges:

- Small (0 - 1500 square meters)
- Medium (1500-5200 square meters)
- Large (> 5200 square meters)

The result of this search is shown on the map "School dimensions and age relationship" on pages 88 to 91. The map has been realized taking into account the over mentioned cataloged ranges; in addition, a research on each high school age (construction time) was carried on, to understand the relationship that runs between the period of construction of the high school buildings and their plot dimension. In other words, the map tries to verify if it is true that, with the advance of years larger and larger high schools have been built. The result shows how the peripheral spaces of the city, less characterized by a consolidated and historical fabric, present larger plots (and much more open space).

On the contrary, the historical fabric of the city, in the most central area, houses the cases of the smallest high schools, often housed in historic buildings and with plot extensions that must follow the rules of the rigid urban checker-board mesh that defines this part of the city.

However, there are exceptions of high schools housed in spacious buildings such as old military barracks, former convents and colleges. These facilities, already by their default design, boast large paved courtyards, gyms, and cloisters that, for high schools that have now taken place of the ancient functions, represent an already given outdoor space facility, often with good dimension for hosting sports fields, open gyms or space for personal studies.

At the same time, the schools built in the most peripheral spaces of the city and built on a more recent date, have larger and open spaces of a different kind, since we find more availability of greenery, lawns, gardens, and spaces available to guarantee the presence of sports equipment such as playgrounds and athletics tracks. The relationship between the age of the buildings and the size of the lots has been represented in the graph on the following page.

The graph shows the trend followed by the size of school projects over time, di-

viding the buildings by categories, starting from those built before 1800 up to the structures built after 1975.

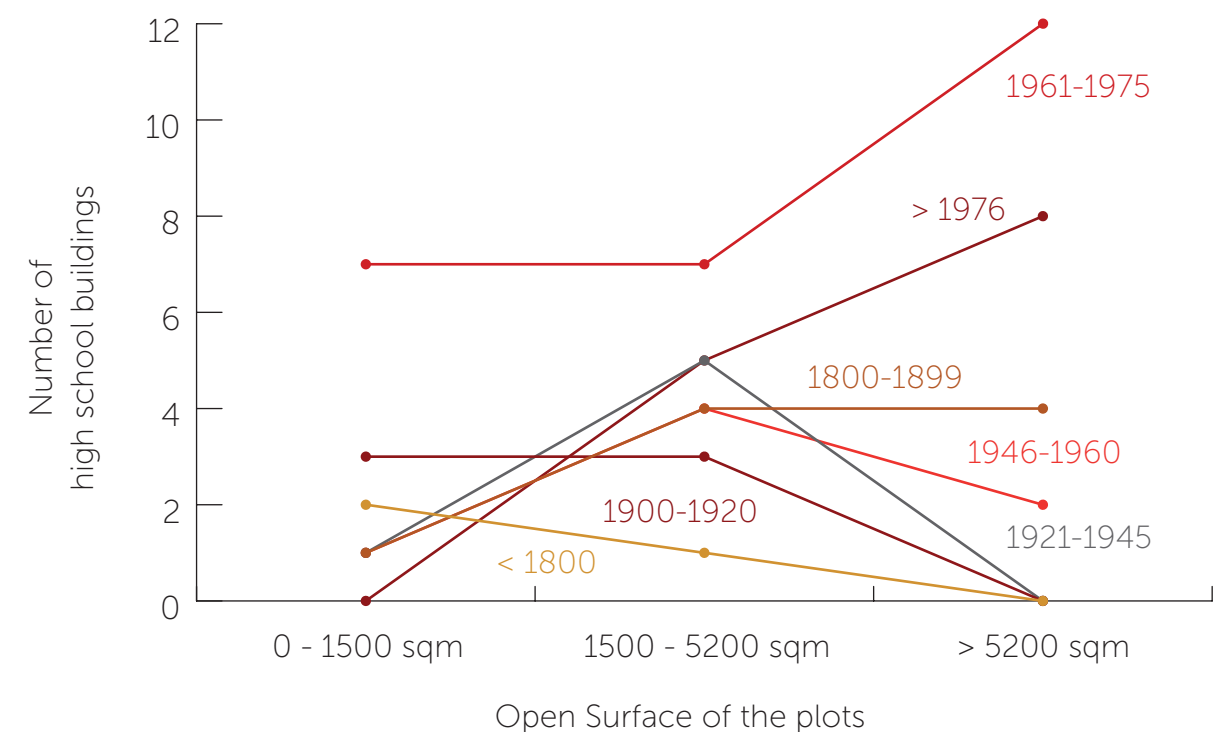
The trend of the graph shows how the years between 1961 and 1975 are full of experiments and new large-scale building constructions, as in total 20 high schools were built with a total 5200 m2 of Plot Surface, in addition to 7 up to 1500 m2 and the range 1500-5200 m2.

After 1976, however, the number of school constructions above 5200 m2 remains high.

In the first sixty years of the last century, fewer large schools were built than in the following years, but it's this the period to which most of the high school buildings up to 5200 square meters of the city were built, creating just a few above 5200 square meters.

In the nineteenth century, 9 of the city's high schools were built, while 3 buildings before 1800, with a maximum size up to 5200 square meters.

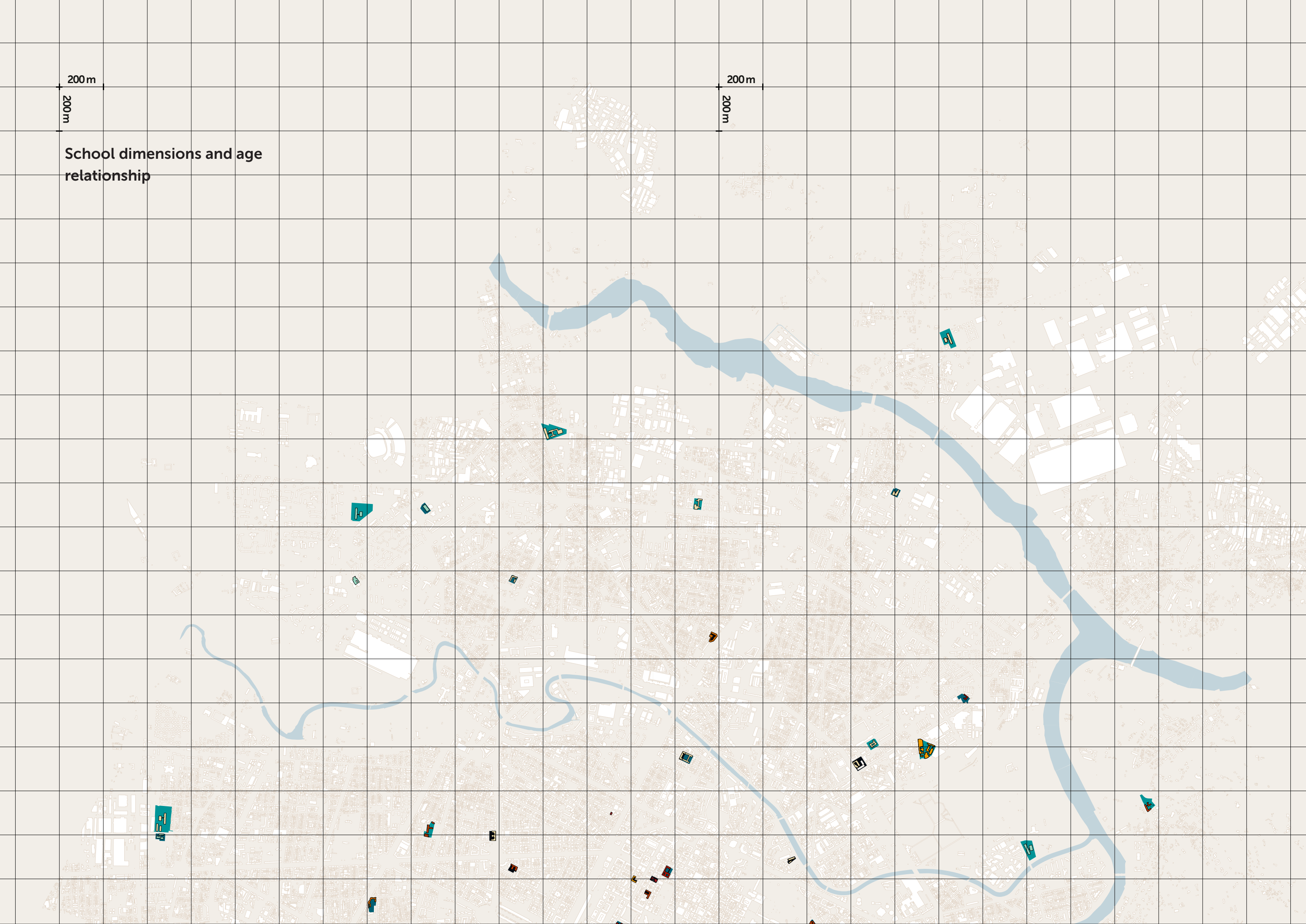
Change in dimensions school plots over time

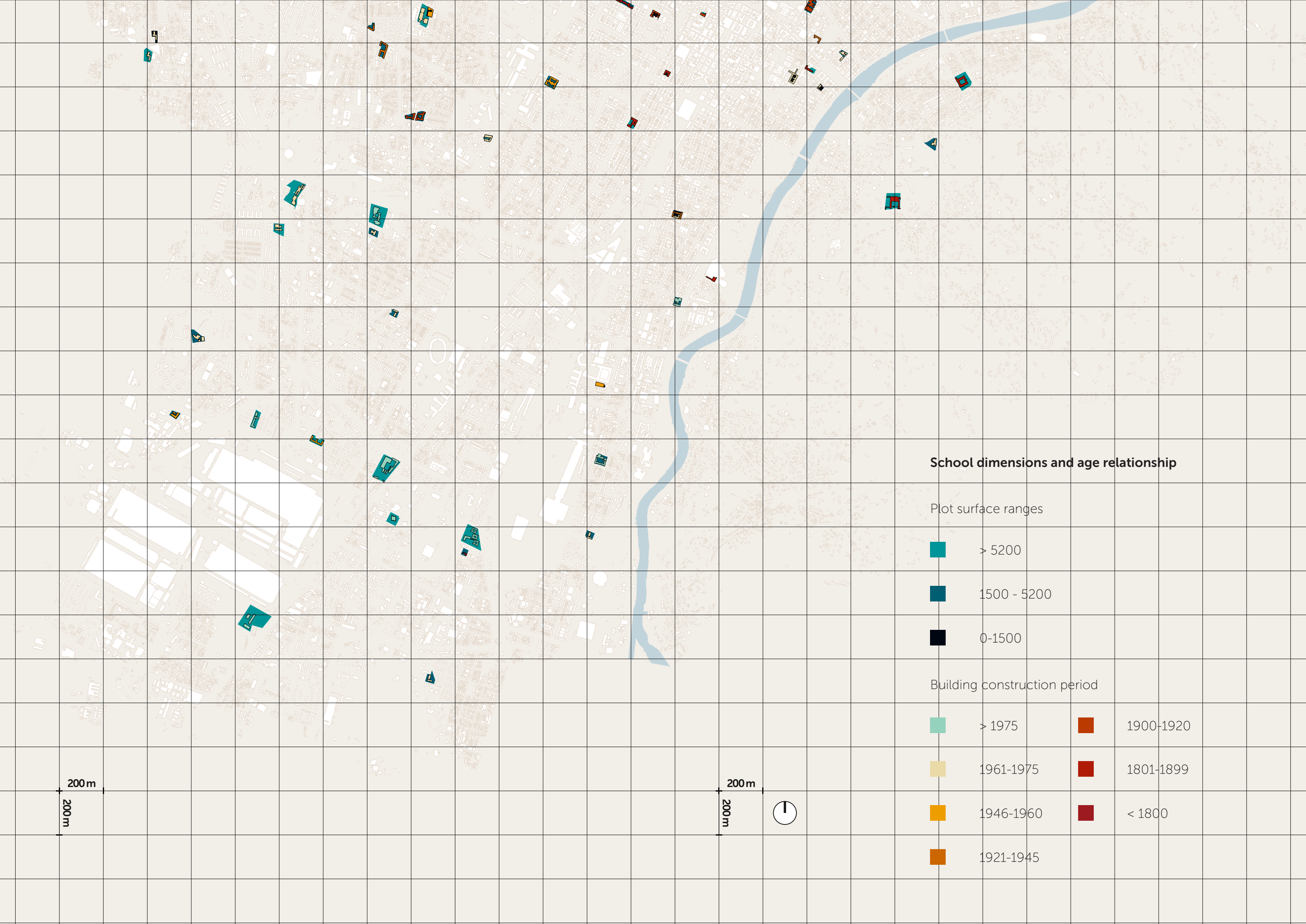


200 m
200 m

School dimensions and age relationship

200 m
200 m





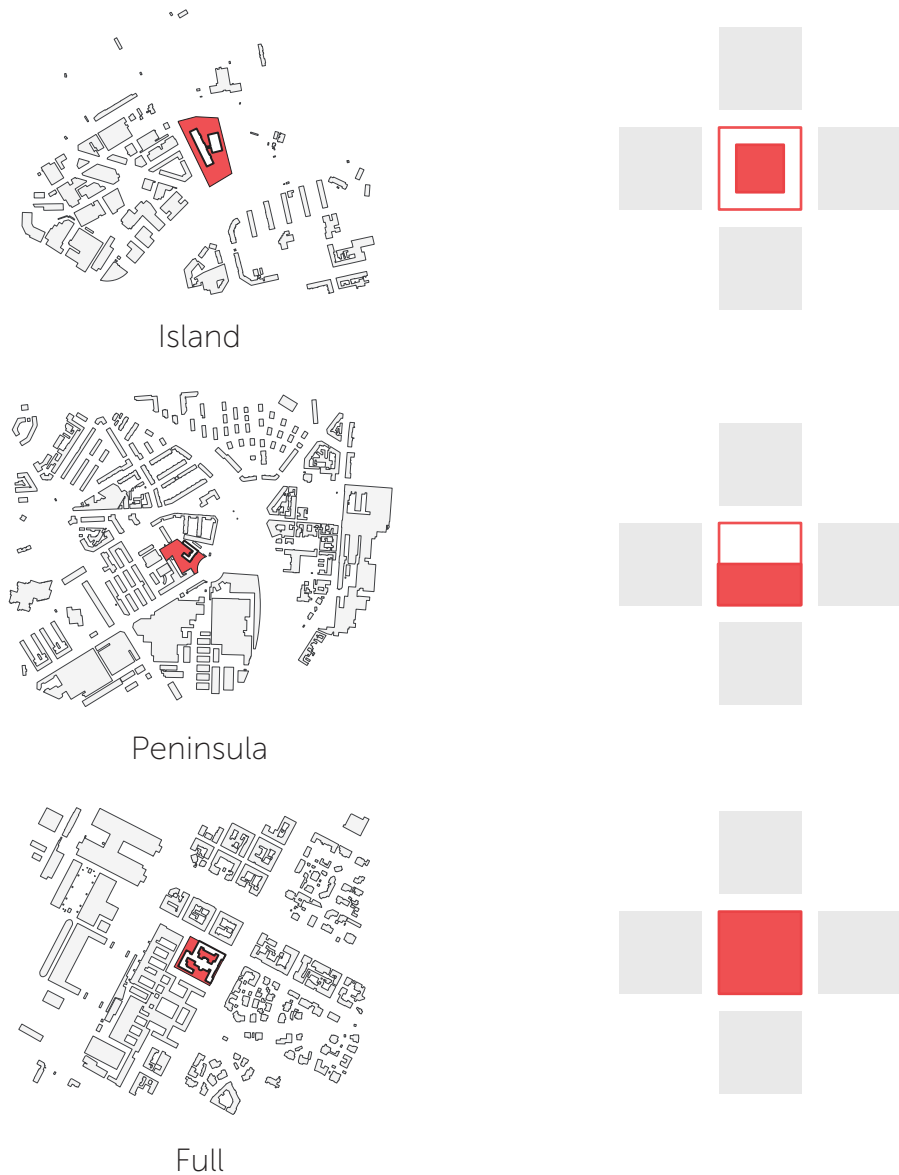
Urban typologies: a way for classifying high schools buildings

Once completed the surfaces measurements collection and the relationship between plot size and construction year, the second phase of the data analysis required to investigate the relationship that runs between plots size and the generating elements of external space: the buildings. There have been choose two classifications to proceed on the collection of the previous mentioned required informations.

The first classification, regarding the collection of plot informations, works according to the position of the building in the plot space, considering the relation between the built elements and the open space. It is divided into:

- Islands, in alternative identified as "isolated buildings",
- Peninsulas, as "perimeter buildings"
- Fulls as "completed".

Here below are provided some examples for each classification to give you a clearer idea. Pages from 94 to 99 present you the union between the classifica-



tion according to the building position in the plot in relationship with the building shape typologies, that are going to be presented in the following paragraph.

Building shape typologies

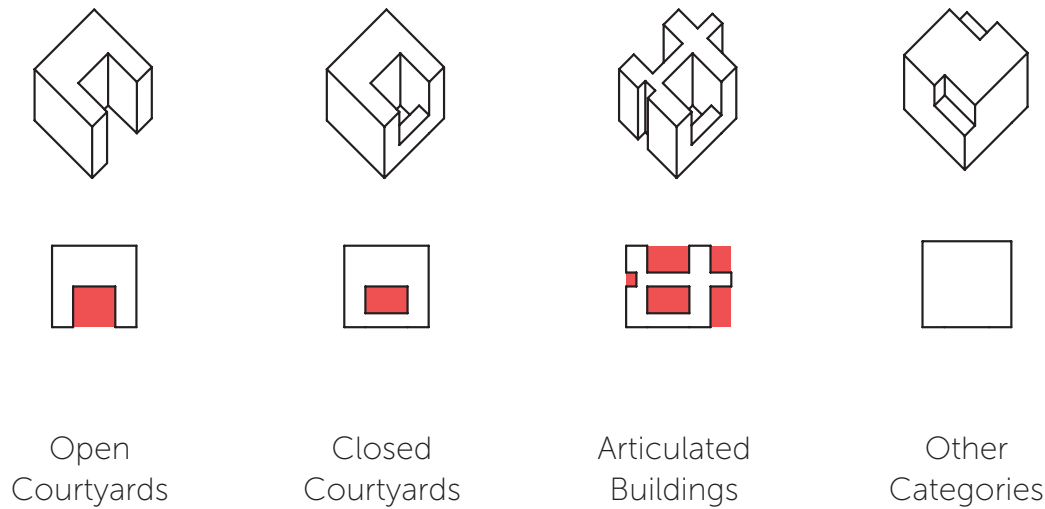
In the second classification work we identify four typologies that describe the way in which the building affect the open space and the morphology of the urban block, so that became significant the relationship between "voids" and "built" volumes. We identify three main categories:

- Open Courtyards,
- Close Courtyards,
- Articulated Buildings
- Other Categories.

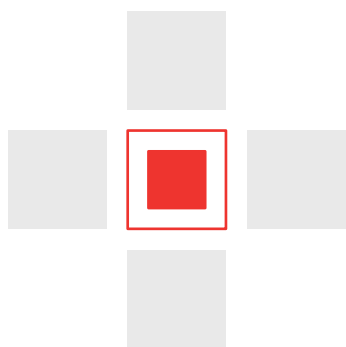
With open and close courtyards we obviously mean building with internal paved surfaces often open to the air, enclosed around four sides in the open cases and at least three in the closed ones.

The articulated building often present multiple branches in which it find it's shape. The different branches host usually architectural plan ambient with similar functions, connected to a main body that host staircases and elevation systems to connect them all. Articulated buildings typology is also the generator of multiple open spaces around the plot, all of a different kind: some of them could touch directly the perimeter of the plot facing the road, others can involve multiple indoor courtyard according to the building design.

Moreover, you can easily imagine articulated buildings as an human body, where the branches are your arms, legs and head, while instead the main body is the chest. The last building's category represents all the other building categories not falling in any of the previous three typologies, collecting shapes as cubes, slats, or other building portions.

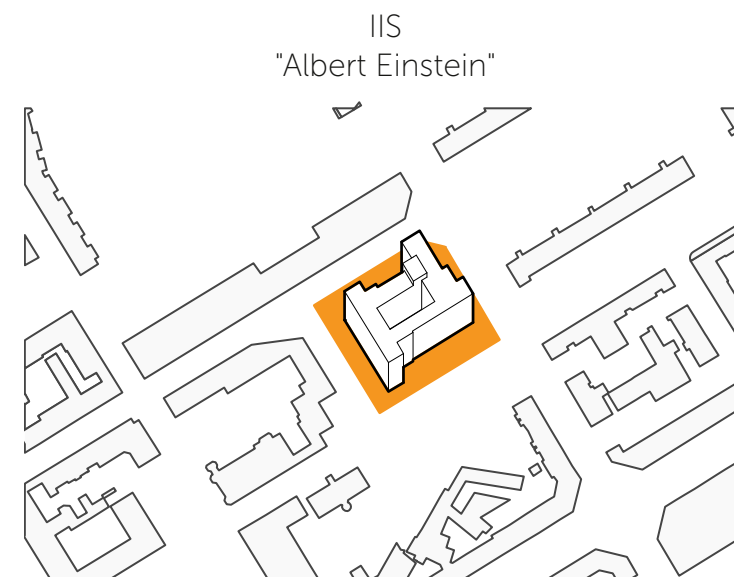


Islands

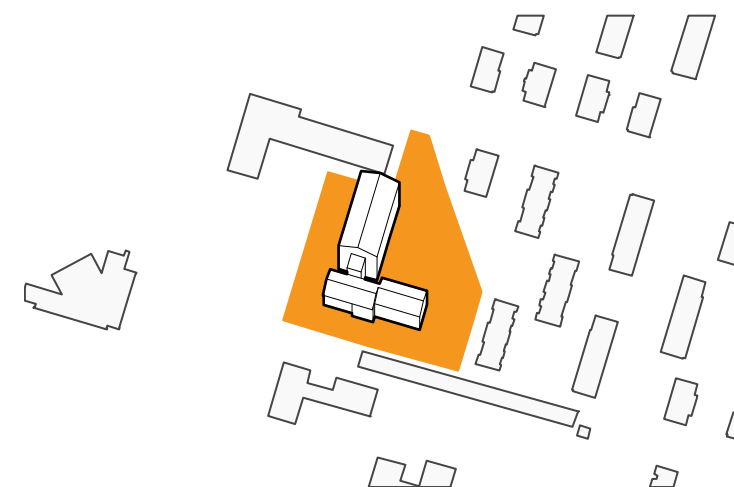


The Island classification identifies the high school buildings completely isolated within the plot, without touching its boundaries and leaving a free open perimeter around it.

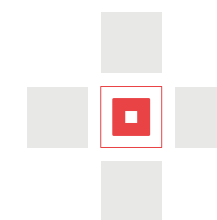
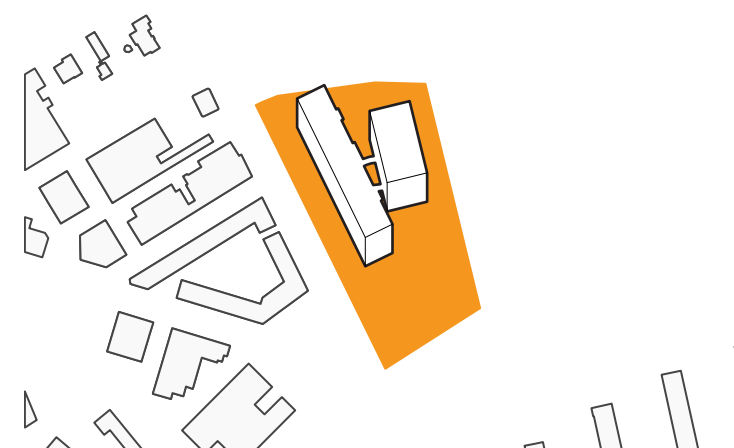
This perimeter can be considered as a full potential of transformation, since it maintains a strong relationship with the building and allows a dialogue with the context. In other words, the transformation potential of this classification identifies in the perfect circularity around the building a strong point, allowing in some cases the designer to invent new methods of managing the flows around or through the building, involving existing patios or courtyards in the design solutions (but always needing to pay attention to the respect of distances with other properties, according to the Building Construction Regulation Code).



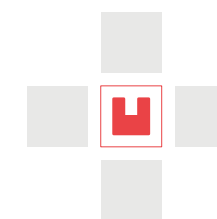
IIS
"Albert Einstein"



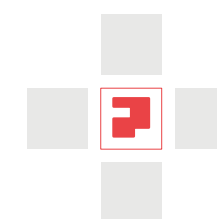
I.P.S.I.A.
Dalmazio Birago



closed courtyards

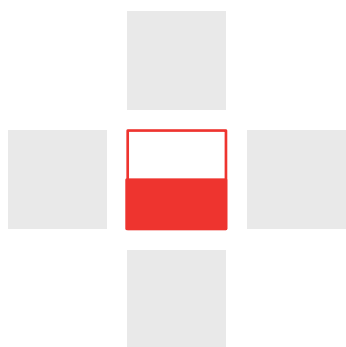


open courtyards



articulated building

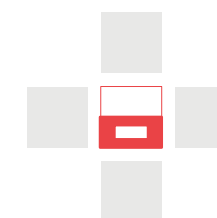
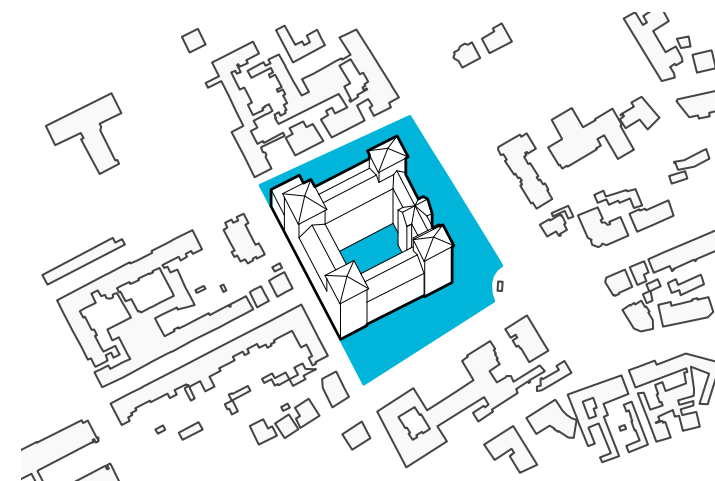
Peninsulas



The classification named as "Peninsulas" collects all the plots hosting school buildings with at least one side touching the perimeter, in any position, but not entirely. This is also the first classification where a building elevation is called to face directly the public space. The open surface is thereby divided in multiple areas all around the building: in that way, the school building finds its relationship with the open space only across the gates that connect them each-other. The designer has to provide a good response to the flows and space management since the division between an "open" and "closed" environment can lead to sectorialize the spaces lacking in a sense of architectural continuity.

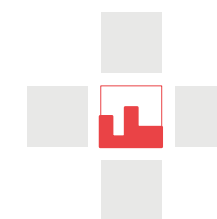
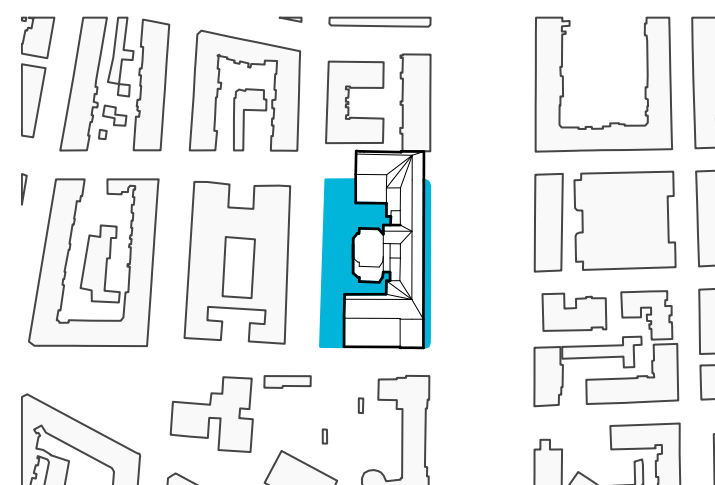
Otherwise, the building faces the context in one or two sides of the plot; therefore it is really important to know the elevation design, to follow the urban criteria of a good architectural new design in the event of an elevation rethinking dictated by project needs.

Istituto di Istruzione Superiore
Gobetti Marchesini Casale Arduino



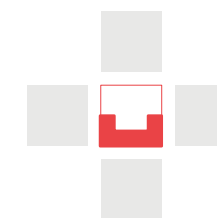
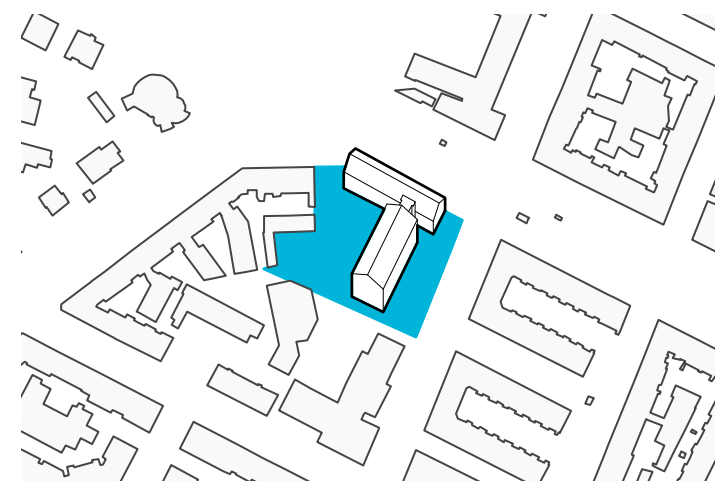
closed courtyards

Liceo Classico e
Musicale "Cavour" - Succursale



articulated building

Liceo Classico e Musicale "Cavour" -
Sede Centrale



open courtyards

Fulls

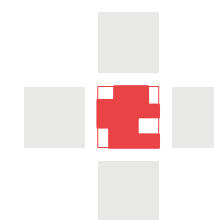
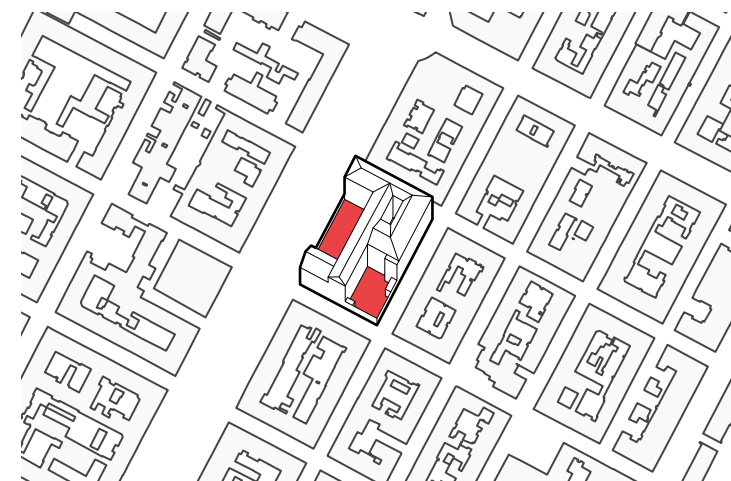


The last macro classification that has named as "Full" makes reference to the plot surface that have been almost entirely built and in which the school building touch everywhere the plot perimeter, in all the sides.

In other words, the construction capacity reach almost the maximum permitted, often over 70%, to fill the entire work area. The goal of the designer must be to locate the presence (and currently) use of the internal courtyards or ventilated spaces in the architectural plan, since such massive buildings often seem to be missing in being provided with them. Ventilated spaces of this type are often also identified in the presence of open-air skylights, running from the ground floor to the rooftop.

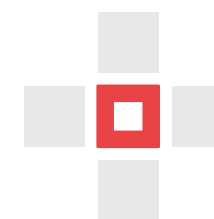
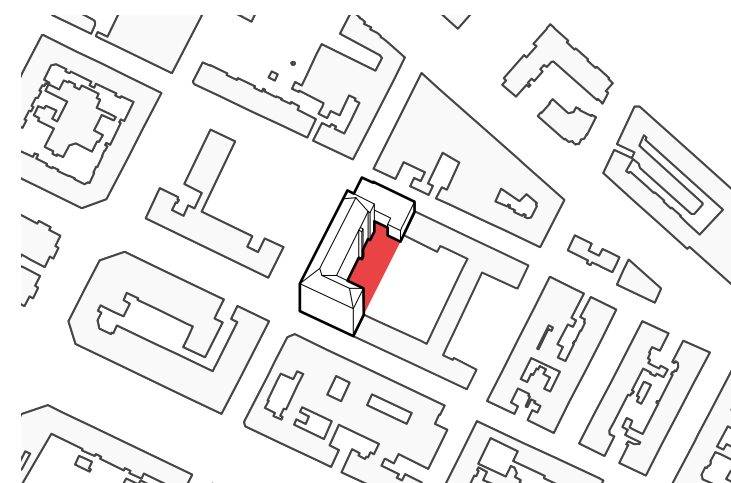
Finally, this typology require a careful look to the close context of the school building, that can deny the possibility to extend the constructed spaces with new design structures.

Istituto Paritario
Sant'Anna



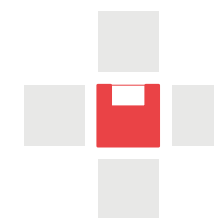
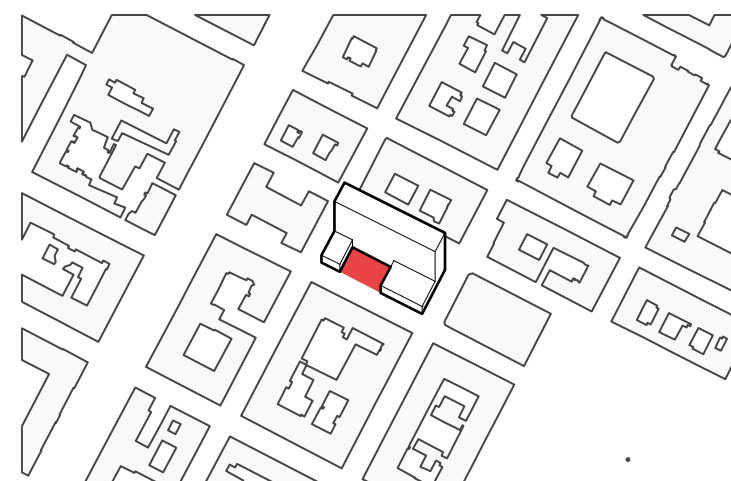
articulated building

ITGS
Guarino Guarini



closed courtyards

Liceo Artistico "A. Passoni"

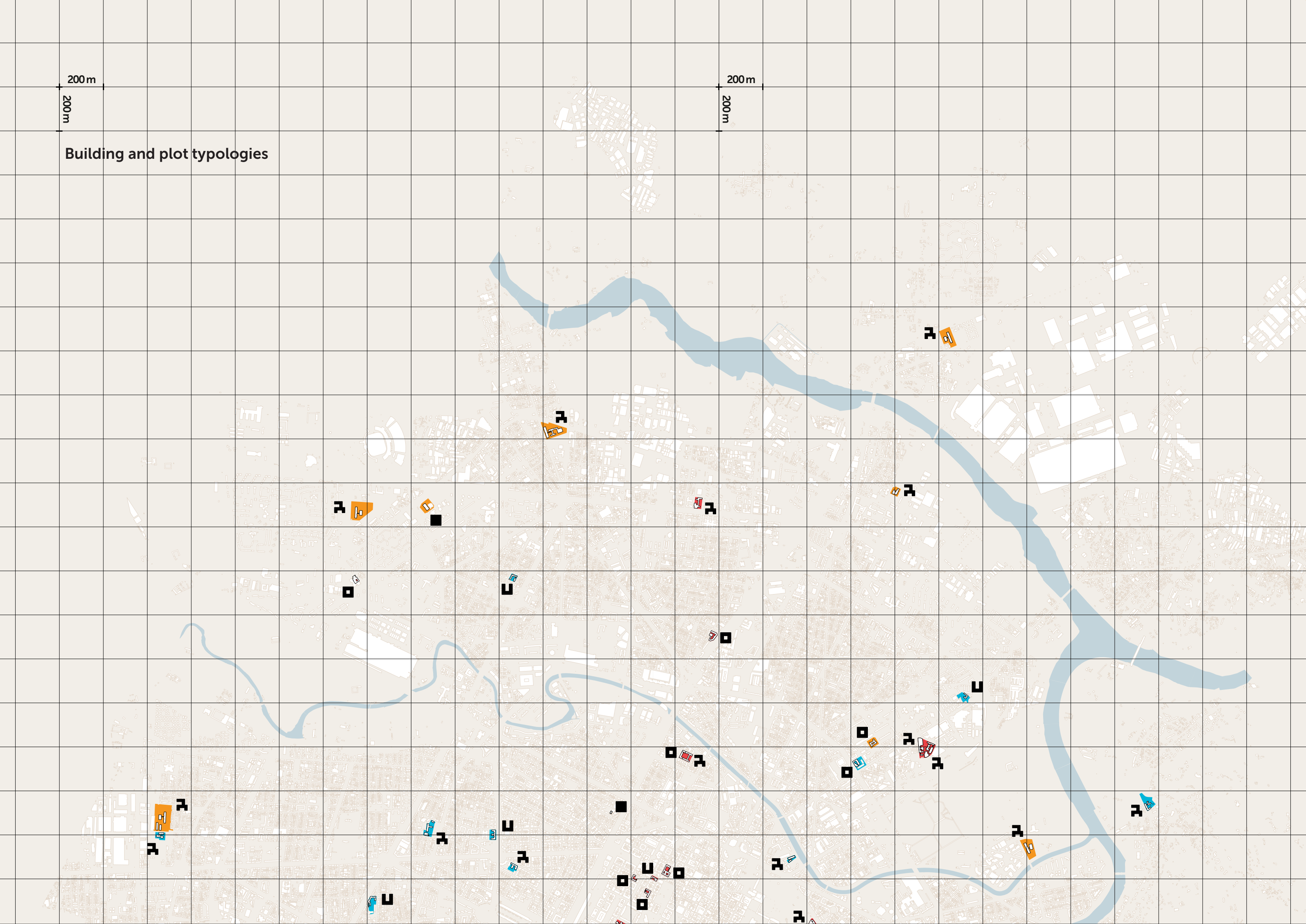


open courtyard

200 m
200 m

200 m
200 m

Building and plot typologies



Urban typologies: classification results

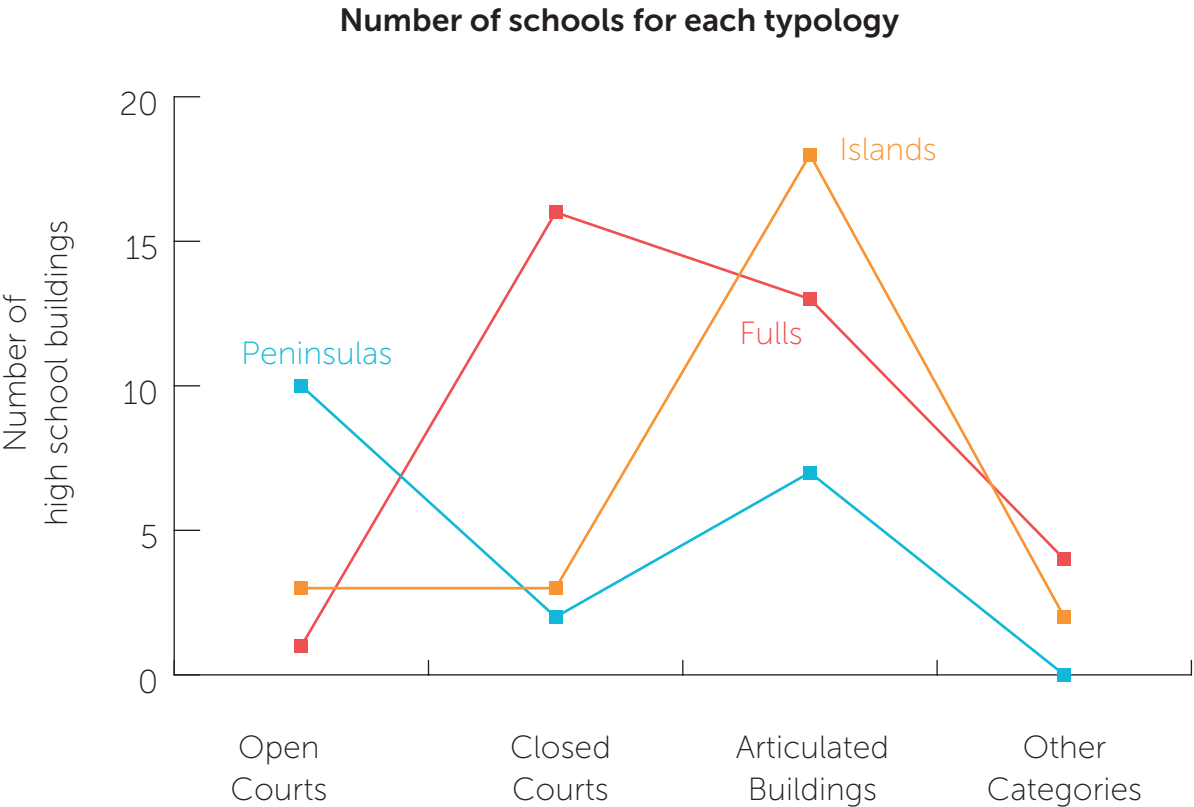
The matrix table below mixes together buildings typologies and plots classifications, showing the relative units numbers for each possible combination. On the other hand, and in terms of "surface quantities", we measure the amount of area that corresponds to each plot typology in the city of Turin using the matrix as an analysis that provides us relevant useful data at the moment of intervention, to choose the most recurrent plot classification and building typologies in the city suitable for hosting regenerative interventions. The intervention principal aim is to generate a proposal/discussion on how all those categories can influence the regeneration of high school buildings in terms of open spaces, creating social, natural, architectural, and urban strategies to improve the ways of "listening learning" to a more experimental one. The linear graph on the following page shows the values contained in the matrix below, comparing the distribution of buildings and the respective urban classification categories: the comparative reading highlight the values for the "Island" (26, equal to 33%) "Peninsula" (19, equal to 23%) and "Fulls" (34, equal to 44%). This means that, in the 44% of the cases, a open space redevelopment project must deal with a plot almost entirely built while in the last 56% it share one or more sides with public space, like a street, a square, a private property, or an already existing structure, forcing to follow safety distancing regulations, provided by the City Building Regulation Code¹ or applying the needed consent declarations from other properties. In any case, the opportunity arises to reflect on the way to link the school with the urban fabric, enhancing an elevation or a side of the building, allowing the design hypothesis to carry out reflections also concerned with the architecture. From pages 100 to 103 we have shown the result of the "Urban typologies" map, showing the total classification works of Turin high school's according to the plot's and building's categories described on page 93.

	Open Courts	Closed Courts	Articulated Buildings	Other Categories
Islands	3*	3*	18*	2*
Peninsulas	9*	3*	7*	0*
Fulls	1*	16*	13*	4*
TOTAL	14*	21*	38*	6*

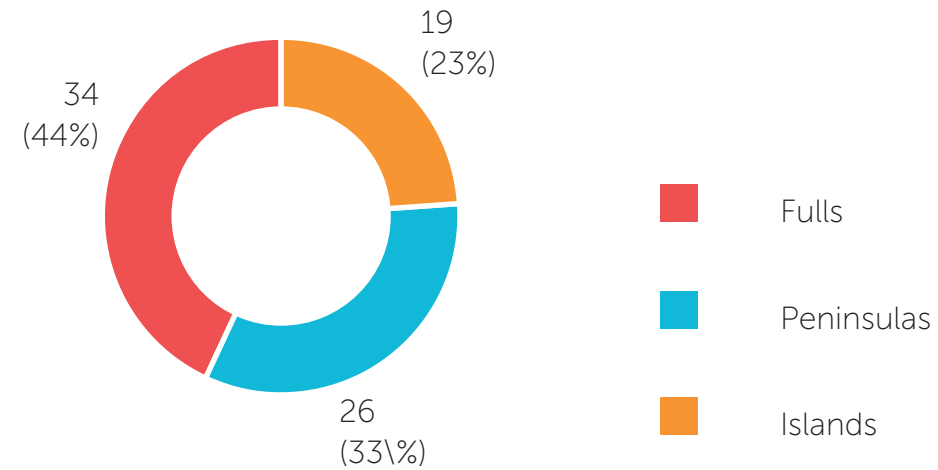
* number of school buildings

¹ Città Di Torino, Servizio Centrale Consiglio Comunale, Raccolta Dei Regolamenti Municipali, Regolamento Edilizio, <http://www.comune.torino.it/regolamenti/302/302.htm#art36b>, accessed on 08/11/2021.

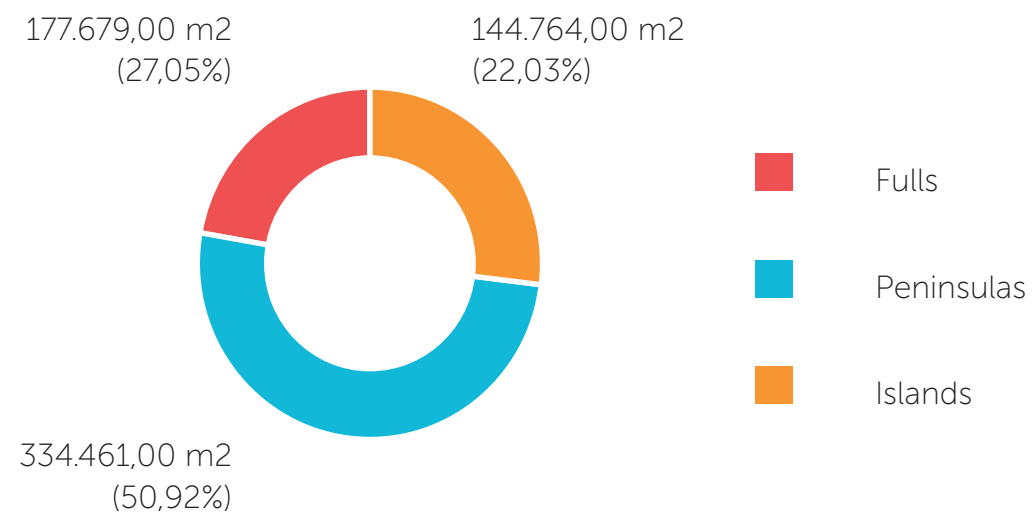
The measurements carried out are shown in the pie charts on page 106. They give us a transversal one offered by the pie graph "Total Open Surface" that shows for the Peninsulas category the possibility to work on an area of 183,487.00 square meters, equal to 57.16% of the total Open space and potentially significant to contribute to the improvement of the high school outdoor spaces of the city. In order, follow the buildings that fall into the category of the Islands, which more than all the others, invite to reflect also on development in the overall surroundings of the high school plot, proposing a project vision closer to the connection with the city fabric. For this category, the space concerns 59,066.00 square meters. Finally, the Fulls are excellent opportunities to explore at closer scale the design solutions that require an in-depth study of the building architecture, studying the articulation of empty and built spaces, as in most of the examples of this category it's necessary to deal with courtyards, both open and closed, and how they communicate with the rest of the plot space. For this category, that is the most widespread in the city, the total square meters are 78,409.00, less than the ones related to the other categories due to the higher space consumption. The data here collected will aim to make help us do a better choice regarding significant case studies as experimental fields where to design and propose solutions for the improvement of outdoor space. They will also try to guarantee the spread through the city school infrastructure, trying to reach as many buildings as possible. For both aims, it will be considered the numbers obtained according to each possible combination between plot classifications and building categories.



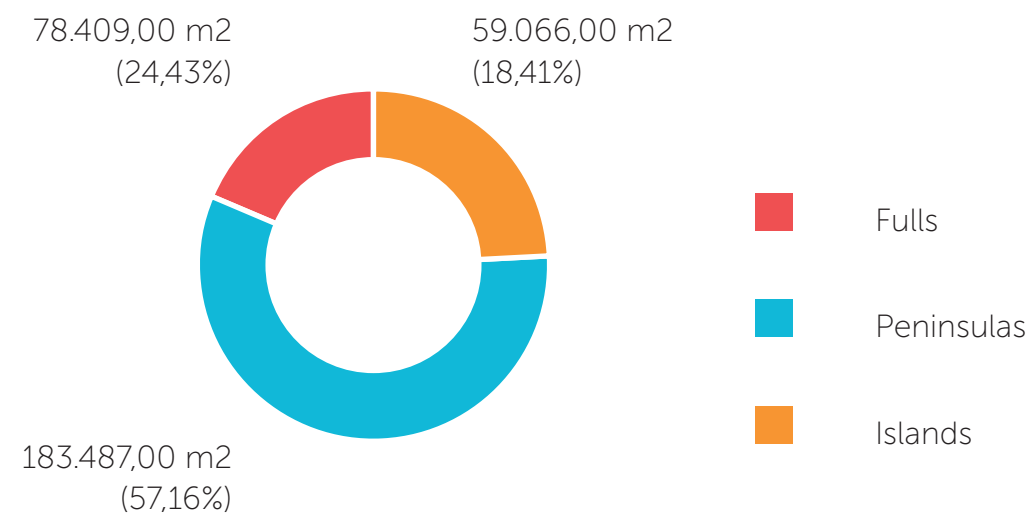
Urban typologies



Total Plot Surface



Total Open Surface



Classifying school buildings urban fabric

The research work has then moved to identify a relationship between plot surfaces and the urban fabric of the city. If during the previous classifications work the catalogue was limited to the boundaries of high school plots area, this second classification help us to give a broader idea of how these schools fit into the urban fabric of the city.

The existing high school case studies are different, and Turin over time has seen the urban mesh expand with different solutions, very heterogeneous among them. The classification of the high schools in relationship with the urban fabric that we will propose has therefore started from an in-depth analysis of the city urban fabric, defining different "types" of cities that have been overwritten, expanded and added over time. In this urban fabric classification we, therefore, propose a first distinction of four different fabric classifications:

- Compact Urban fabric,
- Open plan urban fabric,
- Fragmented city,
- Garden city,
- Rural fabric.

Before going to a closer look at each classification we can generally give a large-scale view of the city and its neighbourhoods. The historical areas of the city are characterized by a regular urban mesh in different directions, with streets perpendicular to each other and closed courtyard buildings that speak a heterogeneous language in the design of the elevations.

This is the principal characteristic of the city centre, while the residential neighbourhoods built during the first industrial development of the city mostly follow another type of grid with long and narrow urban blocks in which the buildings tend to thicken on the boundaries of the urban block, leaving the central space

for the courtyards and garages.

In the city centre, the urban grid is often characterized by rectangular blocks placed to form a perfect “chessboard”. In the outer areas, however, the most recent development of residential neighbourhood construction from the 1980s to the 1990s appears as self-organized, with an internal system of routes and services.

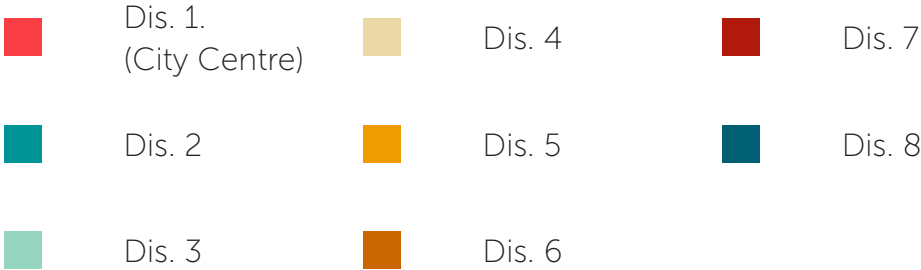
It happens sometimes to find a mixture of residential areas and service lands (like big store buildings and office business centers but also little parks and small gardens) where any self-organization is prevalent on the others and each property takes its own space in the general layout.

In the classification of the urban fabric, park and industrial areas that remain within the municipal boundaries have been included. The area of the hill of Turin, east of the River Po, contains its logic of development with low and medium density buildings, constituting the last border of the city before entering others municipalities like Chieri or Alessandria.

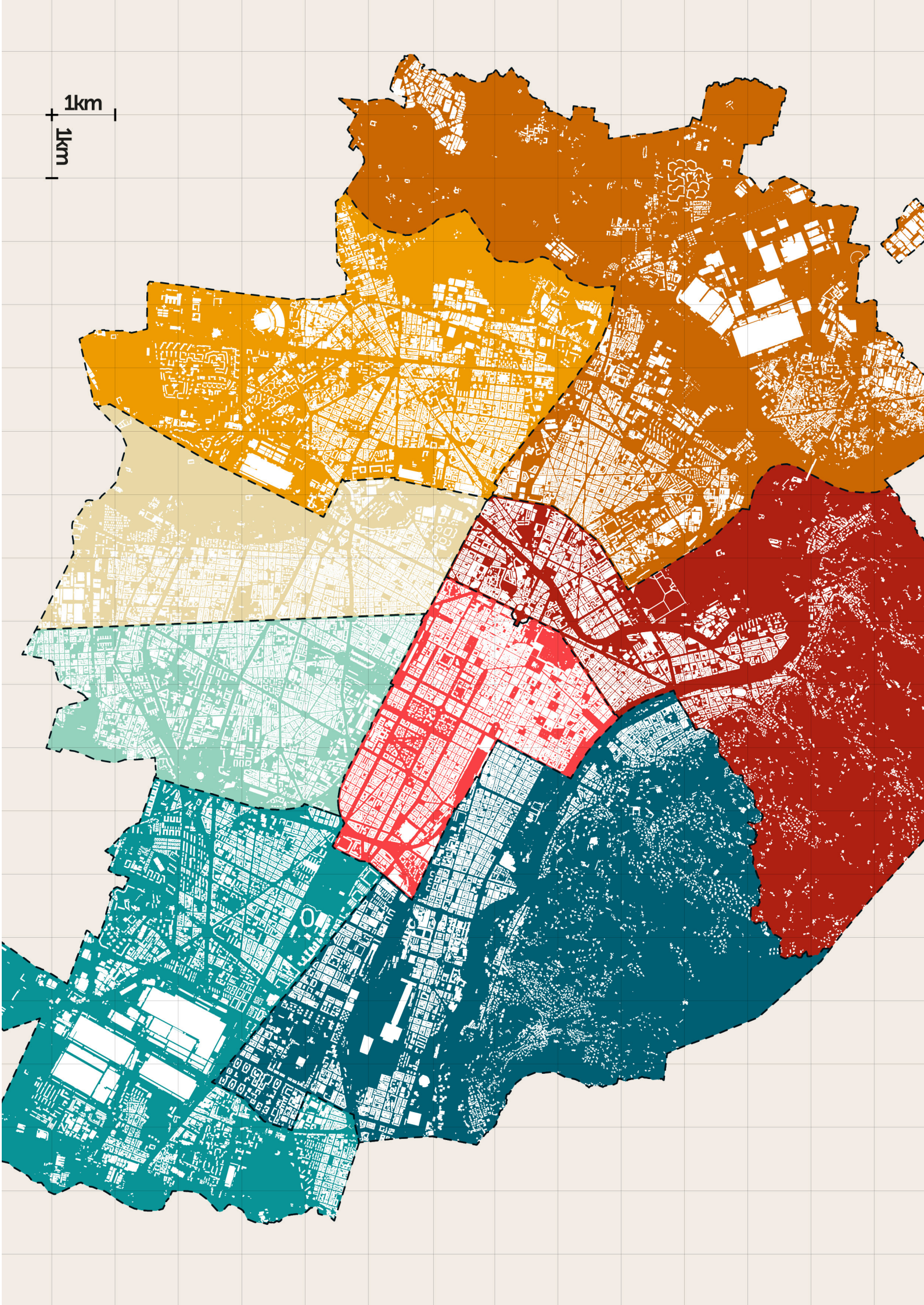
It is in this varied urban fabric that high schools are placed, dialoguing with the built volume and with the urban mesh in different ways, which constitute the basis of the building classification that has followed after the city urban fabric classification.

The city urban fabric classification has taken the basics from a previous study developed by the Turin’s Polytechnic and commissioned by the Turin’s Municipality in the framework of peripheral research for the PRG between 1991 and 1995¹.

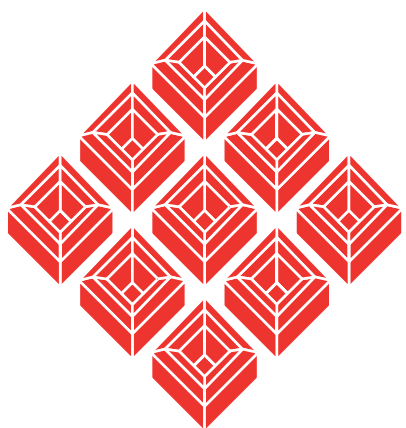
Of course, since 1995, portions of the city have changed their morphology, some industrial areas have been dismissed and transformed into other different urban realities. The purpose of our research was not limited to update the 1995 base-map, but also to reviewing and updating the current morphology according to a more simplified classification. The map that follows from pages 120 to 123 shows the classification work of Turin’s city fabric while a closer description of each fabric is provided on the pages from 110 to 119. On the next page is presented the general districts division of the city that can start to identify where is expected to identify a certain grid type instead of another one.



¹ Indagine sulla morfologia urbana di Torino, *Caratteri dell'indagine sulla morfologia del tessuto urbano*, in <https://www.landscapefor.eu/component/k2/60-sul-campo-per-piani/108-l%E2%80%99indagine-sulla-morfologia-urbana-nel-quadro-della-ricerca-sulle-periferie-per-il-prg-di-torino?Itemid=121&limit=1&start=1>, accessed on 20/05/2021



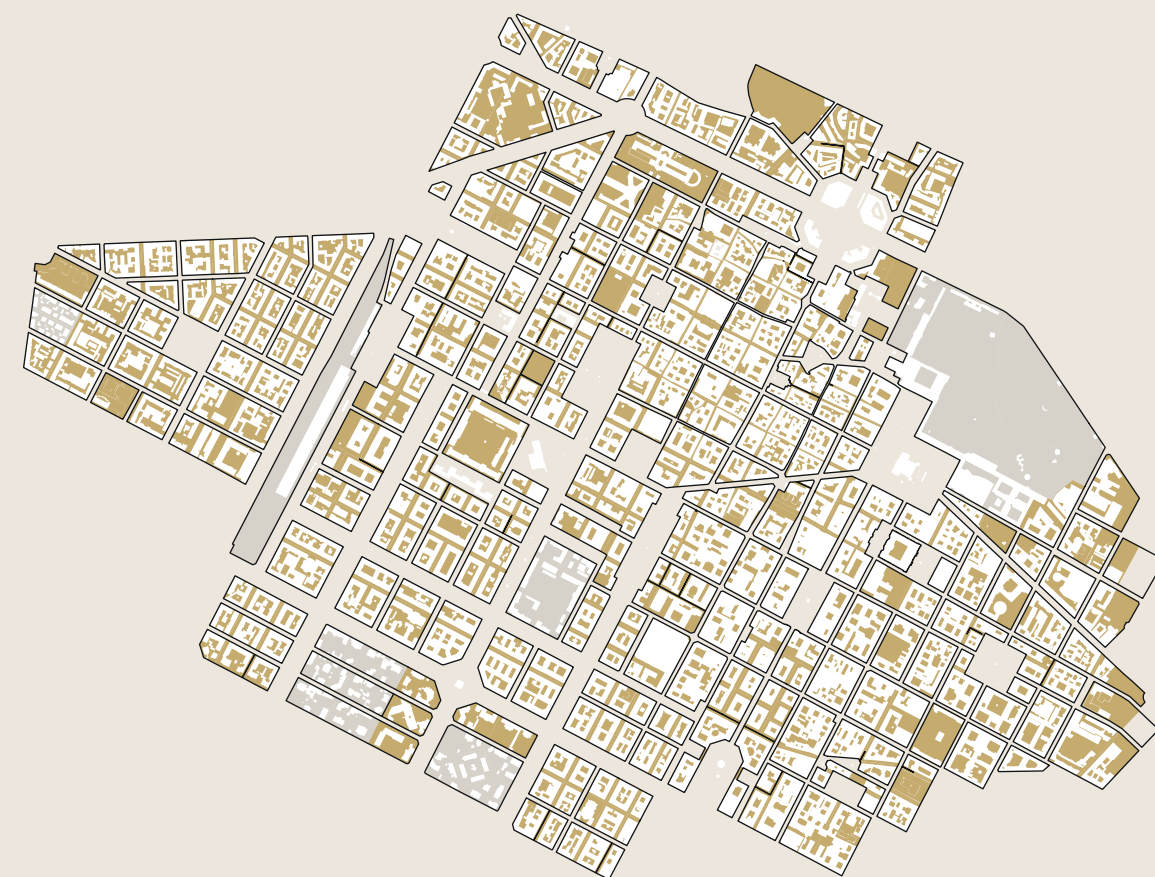
Compact urban fabric



The first item that appears in the fabric classification proposes the definition of "Compact Urban Fabric". This is the most diffuse fabric classification of the city and use to collect urban blocks groups characterized by a well recognizable urban form. The feature that distinguishes this category from the others is the perfect graft of the urban block within the urban grid, surrounded, in most cases, by four streets.

In other words, the urban fabric generate a kind of curtain around the plot, creating a very orderly and reticular morphology. The grafting of the plots into the urban grid often guarantees diversified entrances from several points making the designer deal with differentiated building's accesses that, indirectly, allow a better management of flows.

To a first look at this type of urban fabric, in terms of open space, we may think that it doesn't collect enough space to create outdoor learning spaces for experimentations, since it could appear very dense. This could be solved turning our attention to the interior open spaces of the architectural plan, looking at the internal courtyards or voids in the volume.



Open plan urban fabric



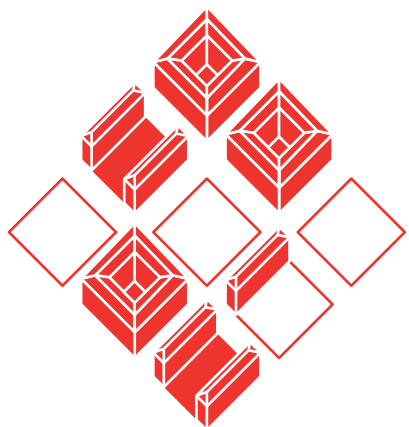
The second fabric classification proposed is the “Open plan urban fabric”. This classification concerns the public open spaces that manage to merge with the private ones of the urban plots, generating almost a single one, divided only by the separation fences between private property and public space.

There is no shortage of cases in which school’s plots are bordering parks and public areas (such as squares and pedestrian paths), which enrich high schools surroundings with a greater amount of open space and design hypotheses.

This fabric classification also identifies the city of expansion, that has a larger amount of usable free space, and that can be modified in the future, growing exponentially. Regarding the plots internal open spaces, since the parcels are bigger than in the consolidated grids, designers provided the school buildings with higher amounts of open areas. Instead, regarding the building typologies, in general, closed courtyard buildings are located in compact urban fabrics as they complete the urban block in a reticular way: it we’ll be difficult to find this architectural typology in this fabric while instead the other three (open courtyards, articulated and other categories) are more common.



Fragmented areas

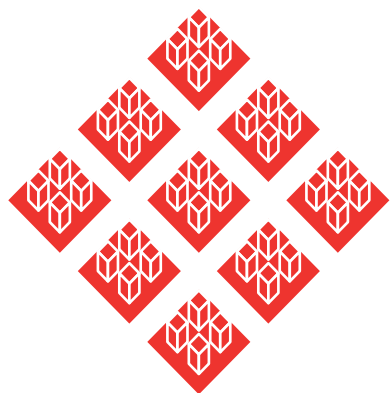


The third fabric classification collects the "Fragmented areas", those that stand out in the urban grid, breaking up with the regular division of the urban blocks, providing a mix between the open plan or compact fabric without a specific order. In these urban areas, the school plots are inserted between the roads and the properties without a precise rule but respecting the distance from the adjacent buildings. This fabric doesn't show any specific grid distribution or any is definable. This is partially true due to the presence of multiple voids (often plazas), while regarding the built environment, it can be well-known as fragmented or discontinuous.

The multiplicity of accesses that characterize the school buildings plots located on this fabric guarantees a good distribution of flows while, instead, the buildings ways to interact with surroundings are not ordinary, creating less geometrically defined spaces but more articulated: it's possible to feel and touch the urban void as it becomes a generator of space, that can deal with private spaces to create great opportunities for the regenerative process, involving community and neighbourhood. Take into account that this fabric depends a lot on the directions of the streets: the road distribution can be intended as an additional open space generator element since it can provide different ways to distribute the open spaces near to the schools plots, involving new citizen interaction and connection ways with the project.



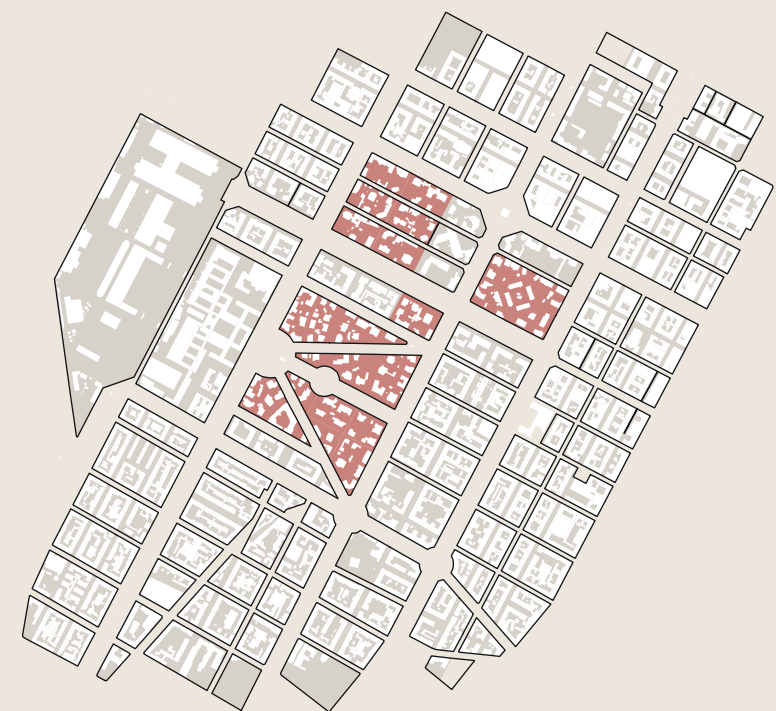
Garden City



The garden city fabric classification is characterized by private residential open spaces provided with nature, greenery and gardens. It's the less diffuse classification in the urban fabric.

Mostly of the buildings that falls into this category can be low or medium density primary residences that, starting from a model or a design module, use to repeat many times. The same applies to the building style, since not ever what's repeating concerns a physic "module".

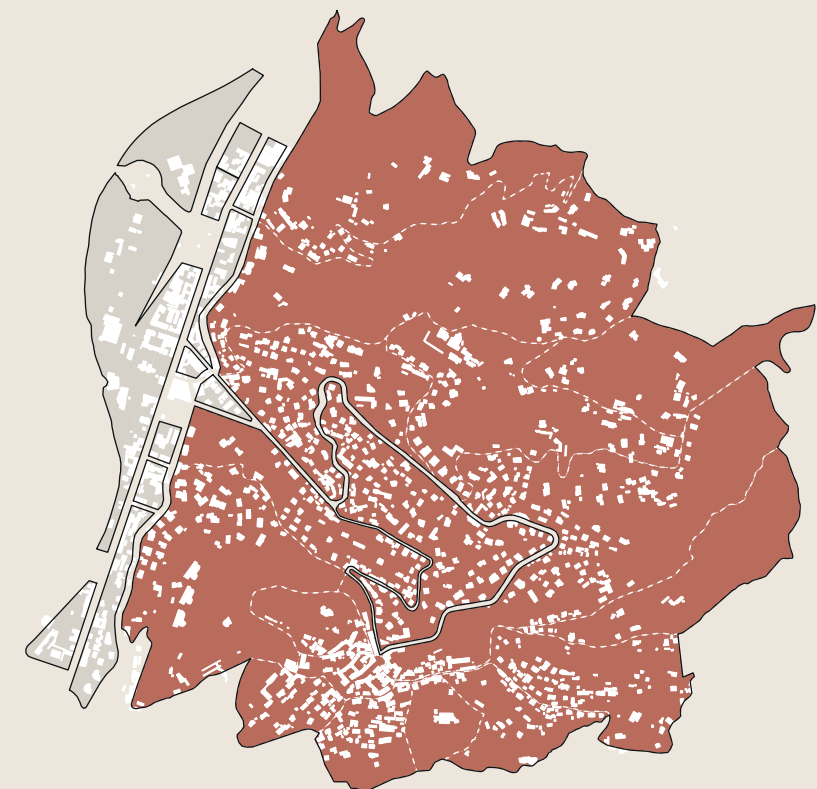
This typology does not house any educational building due to the low diffusion; however it is worth highlighting it to understand how those areas and green spaces, that are generally seen on the map, can be classified as they are not parks or public areas.



Rural fabric



The rural urban fabric is a very recurrent typology in the eastern part of the city of Turin, in correspondence with the hilly areas. We can consider it morphologically very similar to the garden city described earlier, but it has a significant difference: if in the garden city we can still recognize a well-defined grid by the distribution of the urban blocks, this type of fabric is characterized by a general disorder due firstly by the morphology of the hilly terrain and secondly by the arrangement of private properties, whose parcels are jagged and do not recognize clean geometric shapes. The road is therefore predominantly the only linear reference to which properties locate their main entrance. The schools in this fabric are very few, with varied plot shapes and variable building sizes. Among them, however, there are many simple architectural typologies, such as the internal and closed courtyards.

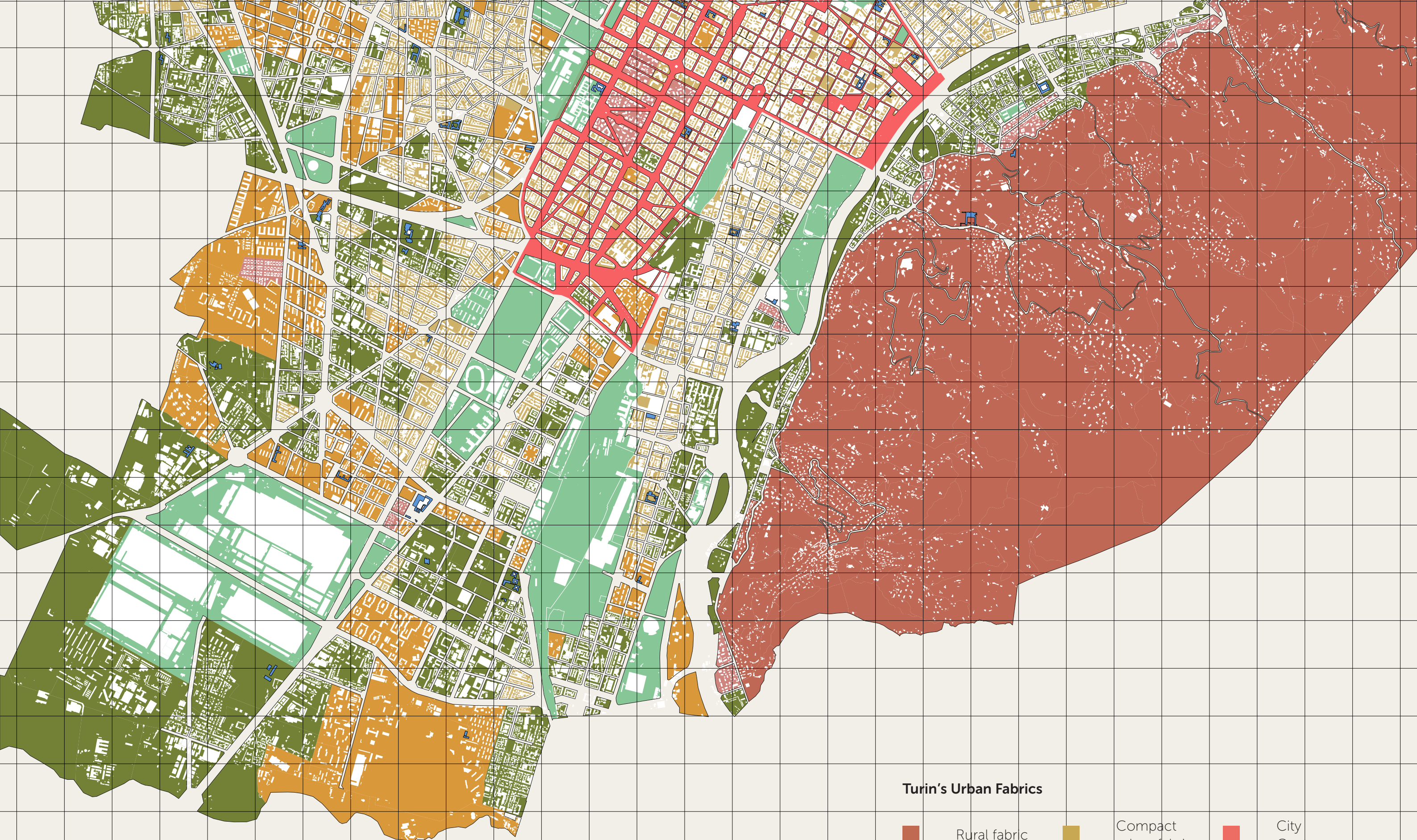


200 m
200 m

Turin's Urban Fabrics

200 m
200 m













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Turin's Urban Fabrics

- | | | | | | |
|---|-----------------------------|---|------------------------|---|-----------------------|
|  | Rural fabric |  | Compact urban fabric |  | City Centre |
|  | Garden city |  | Open plan urban fabric |  | High School Buildings |
|  | Service and Industrial area |  | Fragmented urban areas | | |

Relationships between the urban fabric and the high school buildings

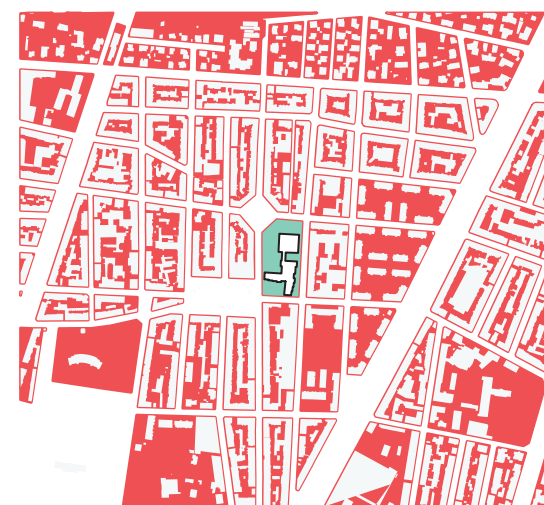
The high school classification developed according to the link with Turin's urban fabric wants to investigate how schools are grafted onto the urban grid through the areas of relevance and the method of construction of school buildings.

It is easy to imagine how, in the various eras until the second half of the last century, the city was planned and designed to develop in a certain way. The planners who drew the maps have identified precise spaces where to build schools of any kind and place city services, like pieces of a bigger puzzle. We, therefore, find service buildings well inserted in the urban mesh, appropriately provided with entrances from the streets, building a relationship with the city and open areas, filling the space as a result of the subtraction between built area and plot extensions.

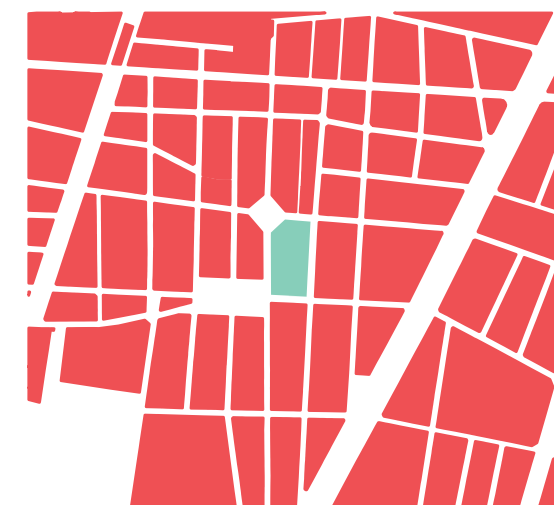
We are now going to present the result of our research to classify how school plot surfaces and buildings are linked with the city and the next built environment. You will find three categories: firstly we meet the "Urban Blocks", namely those plots that fit perfectly with the urban grid, with a complete urban block dedicated to the school function (you can find a graphical explanation in the first line from the top of the next page).

In the historic center more than in the suburbs, school buildings enjoy less open space, relegating it more easily towards the interior of the plot, as they are often leaning against other buildings whose priority is the continuation of the elevation wire, making the elevations language similar everywhere in the heights of the interplane and decorations.

This leads us to the Partial Urban Blocks classification type, where the schools plot is in a way forced to share the urban blocks space together with other urban properties. In the recently built suburban schools, as anticipated, the high schools are much more detached from following a common language with the neighboring buildings, having a bigger amount of open space, capable of accommodating more open activities devices like playgrounds, gyms and gardens. The difference lies in the way in which the designers of the past and the more recent ones intended the way to design schools' open space. The classification finally ends with the "Irregular Urban Blocks", those high school plots whose urban conformation does not reflect any grid in particular, grafting within the built space without a rule, often going to intercept roads on opposite sides to the main one, to gain an extra entry. Usually, this level of classification belongs to huge buildings, that host more than one schools kind inside of them.



Urban Blocks



School urban block
Other urban blocks



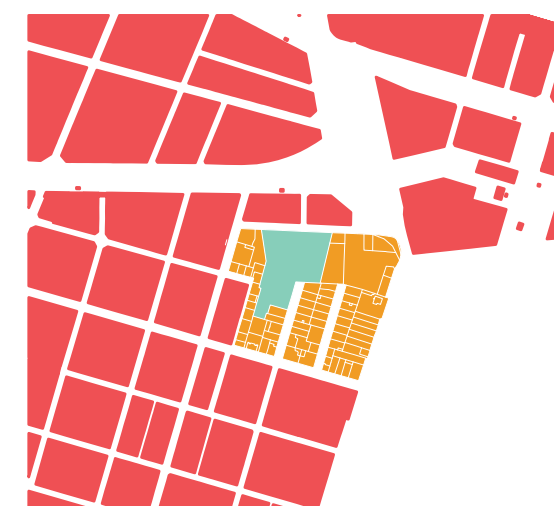
Partial Urban Blocks



Other urban blocks' properties
Other urban blocks
School urban block

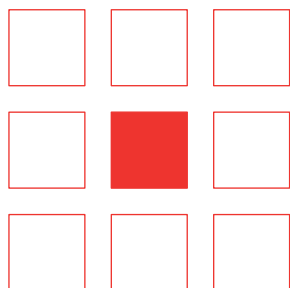


Irregular Urban Blocks

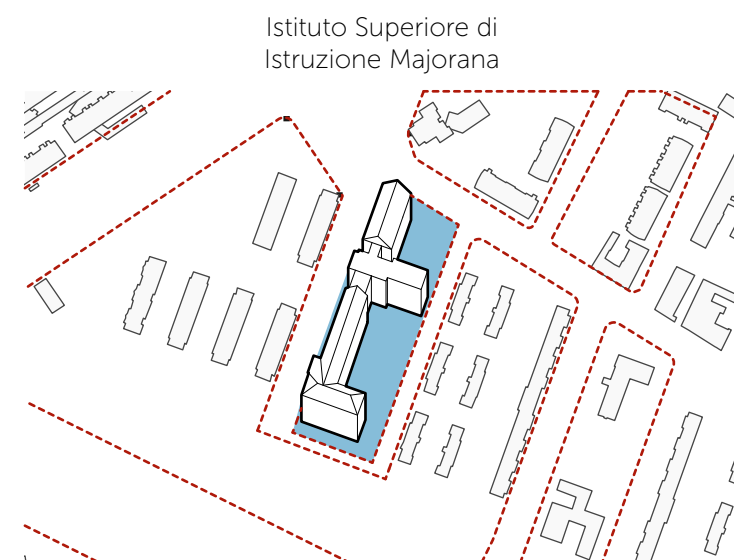


Other urban block's properties
Other urban blocks
School urban block

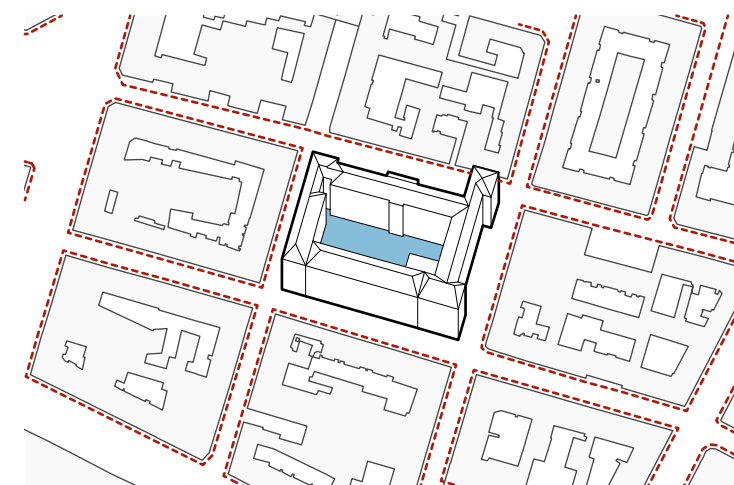
Urban Blocks



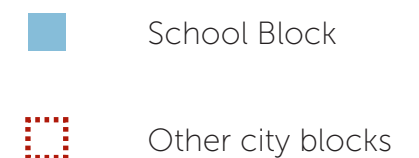
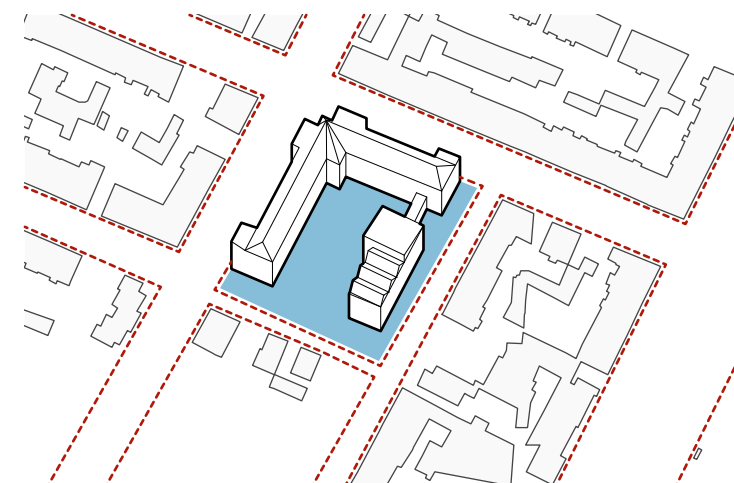
The first item to appear in the classification of school areas on the urban fabric proposes the definition of the “Urban Blocks”. The feature that distinguishes this category from the others is the perfect graft of the plot within the urban grid, surrounded, in most cases, by 4 streets, thus generating an urban block completely dedicated to the school function only. The grafting of the area into the urban grid in this way guarantees firstly diversified accesses from several points and secondly provides the school with a greater amount of open space. The greater freedom offered by the plot structure/shape provides designers with multiple project opportunities such as better flows managements and the un-necessity to deal with existing or neighbouring buildings. You will find all the building typologies mentioned before: open courtyards, closed courtyards and articulated buildings. About the articulated buildings, it is quite common to find them divided into different school kinds, as the differentiated accesses allow better management of flows, but there are also exceptional cases of structures conceived with the same features even in the historic center.



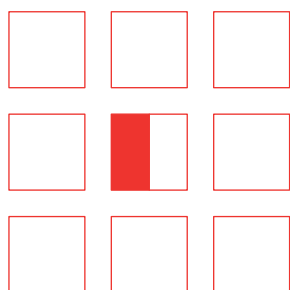
Liceo Statale Regina Margherita



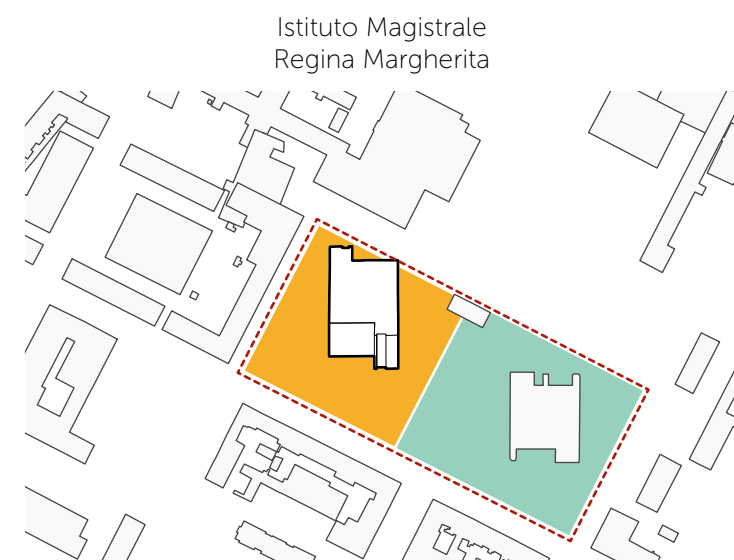
Istituto Per Il Commercio Paolo Boselli



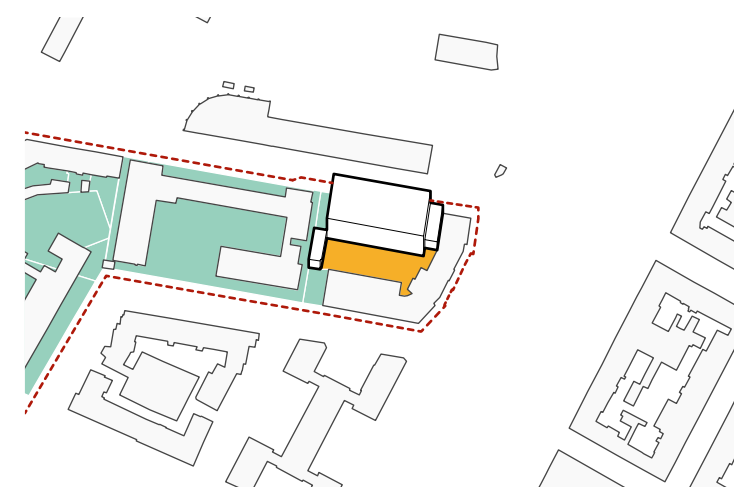
Partial Urban Blocks



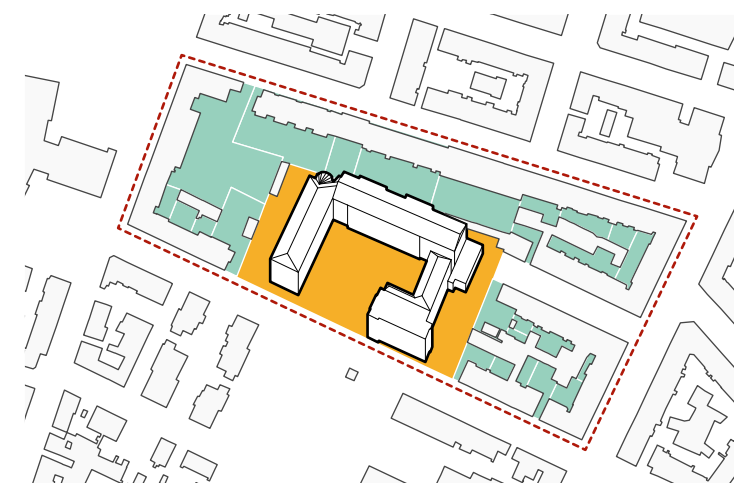
The second classification adopted is the one called "Partial Urban Blocks". This solution concerns those schools' plots inserted within the urban grid, coexisting with other adjacent structures. In other words: the school area is not free on four sides, but borders in several points with other properties, which may be residential buildings, commercial and productive activities. Sometimes all three sides can be occupied, leaving only one open to the street, where the main entrance is located. The buildings within the plot may or may not enjoy a good amount of open space, although often, due to the very nature of the plot, they will find themselves sharing a closed side with that of another building. There is no shortage of cases in which, school buildings border with parks and public areas such as squares and pedestrian paths, which enrich schools of a greater amount of open space, suitable for additional design hypotheses. In some of the Partial Urban Blocks cases where the connection with the city is weak, making design hypotheses on the external public space became the only way to guarantee a better relationship with it and therefore a more welcoming environment for high school users.



Istituto Superiore Geometri Alvar Aalto

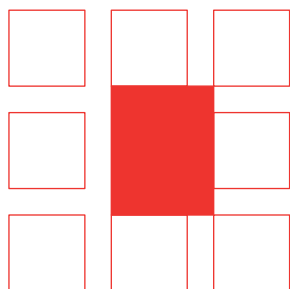


Istituto Paritario Maria Consolatrice



- ⋄ Block extensions
- School property
- Adjacent properties

Irregular Urban Blocks

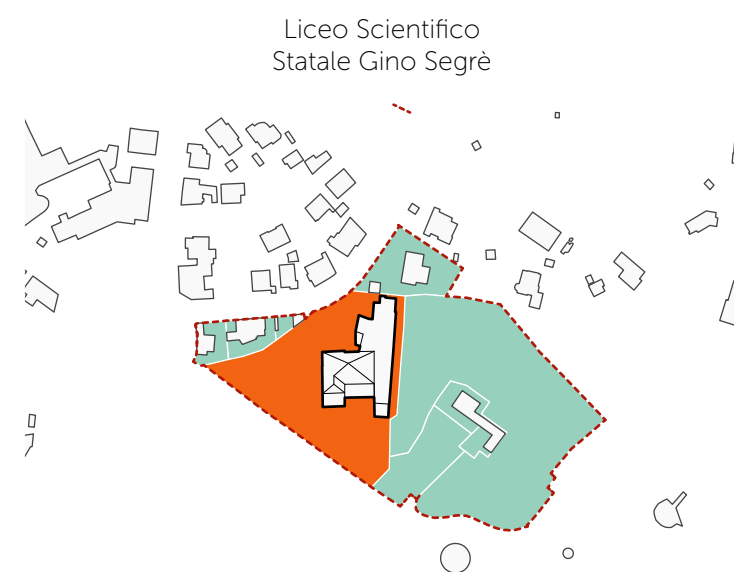
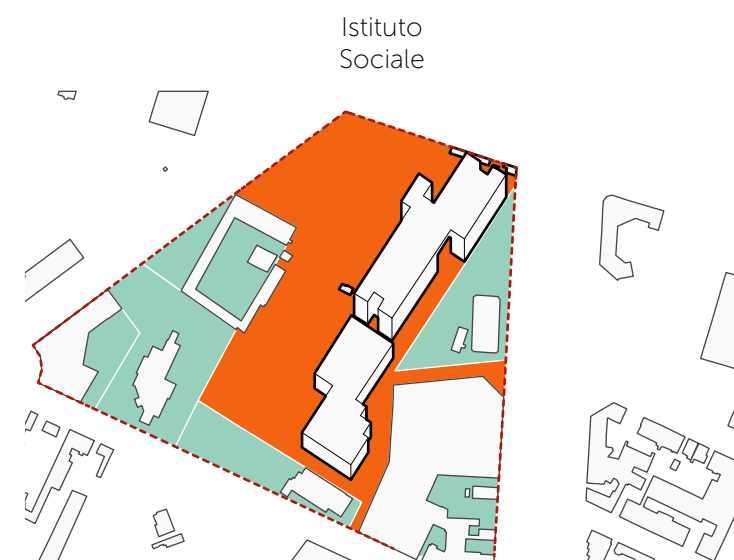


The third and final classification is named as the "Irregular Urban Blocks", meaning those that stand out in the urban grid, breaking up the regular subdivision of the urban blocks.

The school's plots are inserted between the roads and the properties without a precise rule but respecting the distance from the adjacent buildings.

These areas have multiple access points, and the buildings standing in the plot can be more than one, hosting different school functions.

The multiplicity of accesses means a more complex flows distribution. The building shape grafted into this type of classification is very particular, and the way they interact with their surroundings creates multiple open areas and an evident difference on the regular grid of the urban blocks.

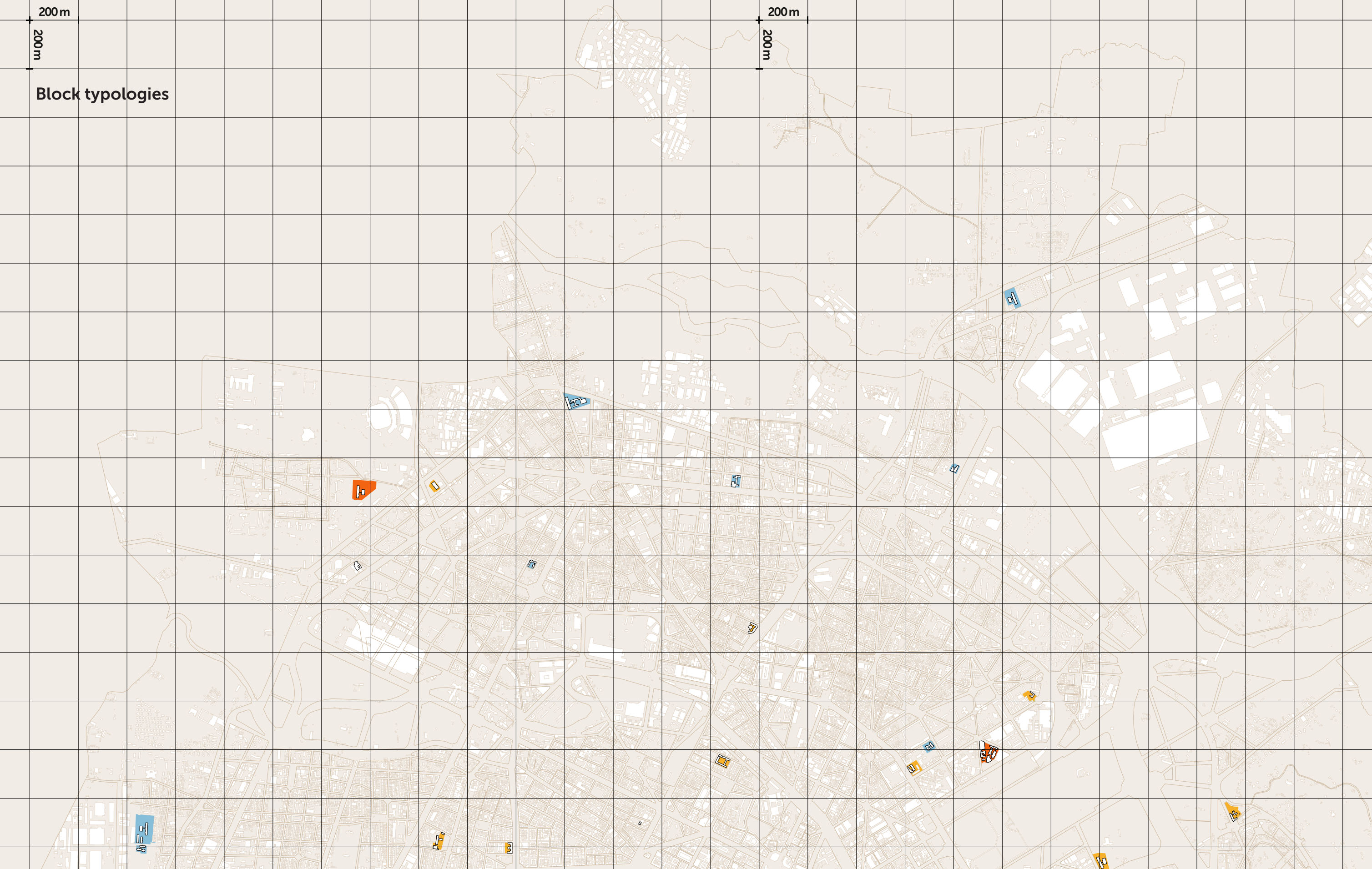


- Block extensions
- School property
- Adjacent properties

200 m
200 m

Block typologies

200 m
200 m





200 m

200 m

200 m

200 m



Block typologies

- Urban Blocks
- Irregular Urban Blocks
- Partial Urban Blocks

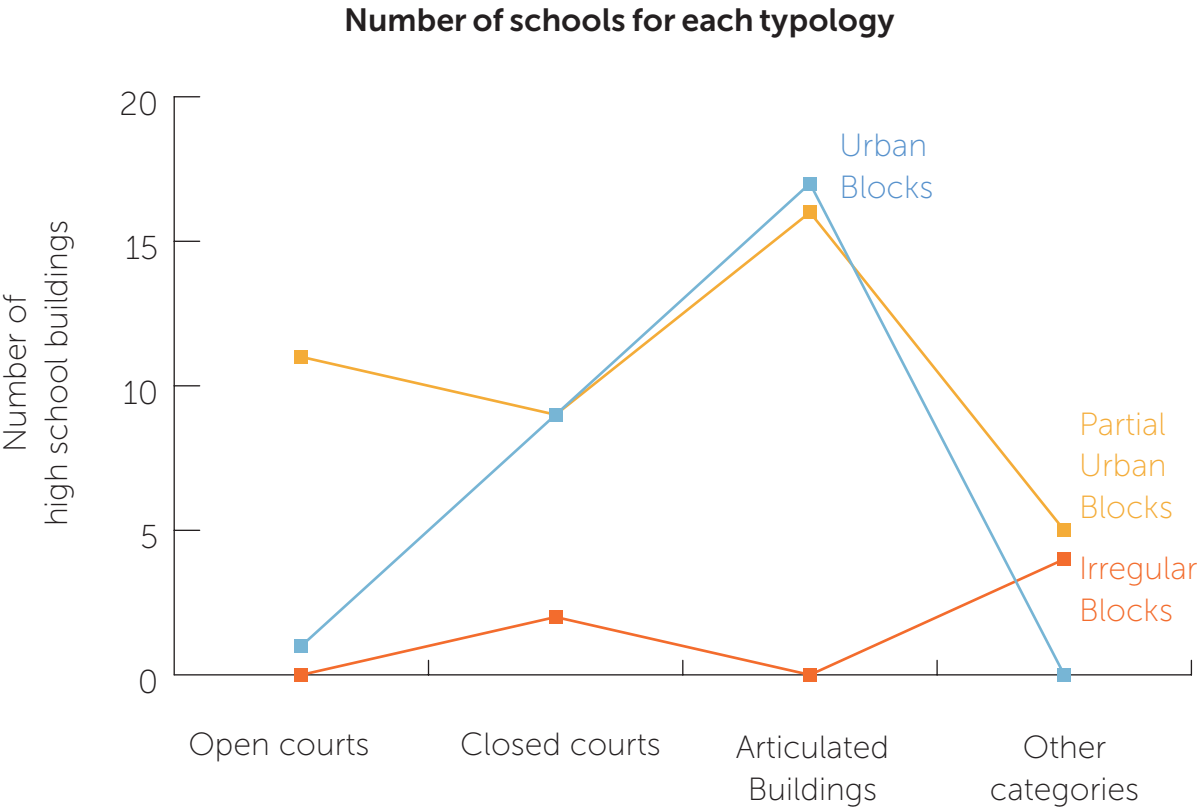
Considerations on the relationships between city fabric and high schools: outdoor spaces as an active part for neighbourhoods regeneration

The matrix and the bar graph on the following page illustrate the results of the previous classification according to the urban fabric. Following the latter, in the city of Turin, high schools that belong to the Partial Urban Blocks classification are very common (44): it is not a completely unexpected result, since, for a city with a stratified fabric like Turin it could be very easy to find historical buildings used as schools or portions of them bordering other housing units. The city center hosts at least eight of those cases. But there are also many cases of more recent design in which the plot chosen to host the school is equipped with one side confined to another property, especially outside the city center. In Partial Urban Blocks it will always be appropriate to analyze the context, and have clear what are the surrounding "elements": residential buildings, commercial activities, parks and public areas have different needs and provide different opportunities, which is a designers task to identify and take advantage. The potential of the project intended to implement Partial Urban Blocks open space could be intended as the expansion of the offer of public areas for leisure, entertainment and even for public events since in most predominantly residential areas, the number of such spaces could be not enough while instead schools have a large amount of open space. Even school plots facing existing parks can offer ideas for outdoor teaching or urban views, involving existing green space to attract new visitors without strong efforts. Of particular interest is also the data regarding the Regular Blocks, which makes us understand that as many as 29 of the high schools of the city, most of them of recent design, present an urban plot entirely dedicated to itself, free from obstructions and potentially characterized by high quantities of open space. Even the city center has some, for a total of at least six high schools buildings hosted inside structures designed originally for hosting different functions. Case studies belonging to the Regular Blocks classification are in the most favourable design condition, being generally equipped with greater quantities of open space: in these cases the designer can integrate the space of the street and sidewalk into the regeneration project, conceiving a sort of whole in favour of a better distribution of user flows. Moreover, the opportunity offered from renovation solutions (if they concern works in the surrounding streets) can improve the safety and healthiness of the schools, making them as little urban islands distant from traffic noise and pollution. Finally, only six schools fall into the Irregular Urban Blocks classification for the most part concerning large buildings and located in the most peripheral areas of the city. In Irregular Urban Blocks, the location of the accesses should be evaluated immediately since, often, the schools' plots are very large and could extend from one part of the block to another, including one or more separate entrances and, therefore, a more complex flow system. The opportunity offered is similar to Partial Urban Blocks, since

the two classifications are very similar, but in the Irregular Urban Blocks case the reachability of proposed open space addition can involve multiple urban blocks (by the very nature of the classification itself to be in contact with multiple urban blocks), spreading the new aggregated space to much more people.

	Urban Blocks	Partial Urban Blocks	Irregular Urban Blocks
Compact urban fabric	13*	18*	0*
Open urban fabric	2*	8*	2*
Fragmented urban fabric	14*	17*	3*
Garden city	0*	0*	0*
Rural urban fabric	0*	1*	1*
TOTAL	29*	44*	6*

*number of school buildings



PART 3

From design to transformation strategies

Three projects for replicable strategies

The third chapter of this thesis introduces some design considerations carried out according to the city's school building heritage analysis, to propose some design strategies that can be applied in recurrent situations which characterize the school infrastructure for the benefits of users and activities hosted. The main recurrent situation identified by this work, as we said, is the non-use of outdoor spaces as a space for teaching, learning and carrying out sports activities, the latter all being activities that could easily be implemented since at the moment the most of meter squares are un-used or dedicated to parking.

Regenerating outdoor spaces doesn't have to necessarily mean "only" them, since the fields that can take advantage of the regenerative process are multiple, starting from the circulation system (allowing the passage from areas often forgotten by the school community), to the organization of new spaces and sporting devices. The improvement solutions that we are going to present in the next pages aim to transform schools open surfaces into platforms where to learn and to experiment with new forms of outdoor teaching. Moreover, the design solutions include opening the courtyards to the community and citizens to make them suitable for hosting small and large-scale events such as sports meetings or stages were to exhibit festivals or film screenings. In cases where the school is the only neighborhood space able to accommodate the public and sports equipment to host events, it can raise itself to a community pole, keeping a supervised outdoor space even outside of class hours. The classification work carried out in the previous part two has identified some common building's characteristics, such as their shape, summarized in the four main categories (open, closed court, articulated buildings, and other); how the building is placed in the space of the lot and therefore the ability to generate open spaces by subtraction and finally the relationship with the city fabric. Given these premises, it should be stated that the approach to the design of the high schools' open space redevelopment must be analysed on a case-by-case basis since, according to the building shape typologies, buildings can be shaped in multiple ways. The analysis of an open court case study must be approached differently from that of a closed courtyard or an articulated

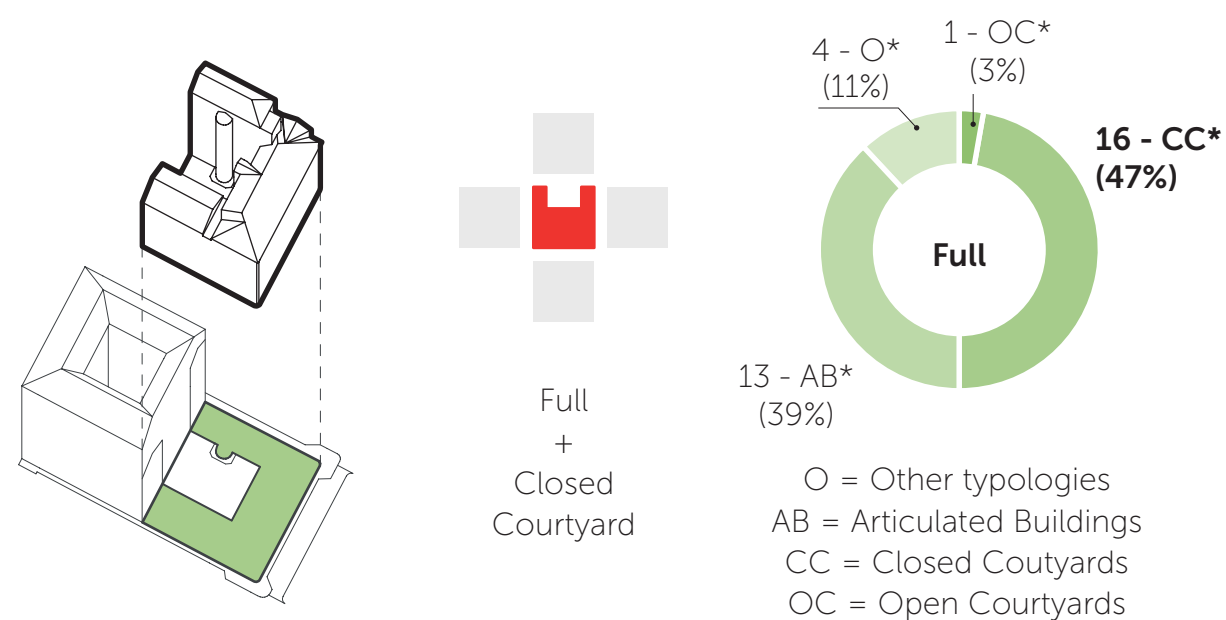
building: the difference stands in the architectural plan, that can generate multiple open spaces (and connection ways between them), plus a more complex flow management system and spatial organization. The goal we set ourselves and that is the task of this chapter, is to extrapolate three case studies from the school classification work made during the city analysis of Part 2 and summarized in the two matrices of pages 104 and 137. The three case studies will host some projects known as "replicable strategies": in a first moment, they will face the critical issues and opportunities of existing spaces found during the current state analysis phase, while in a second moment they will serve as a basis for the approach of design in similar case studies, implementing a "regenerative sprawl" process through the city.

Case studies selection

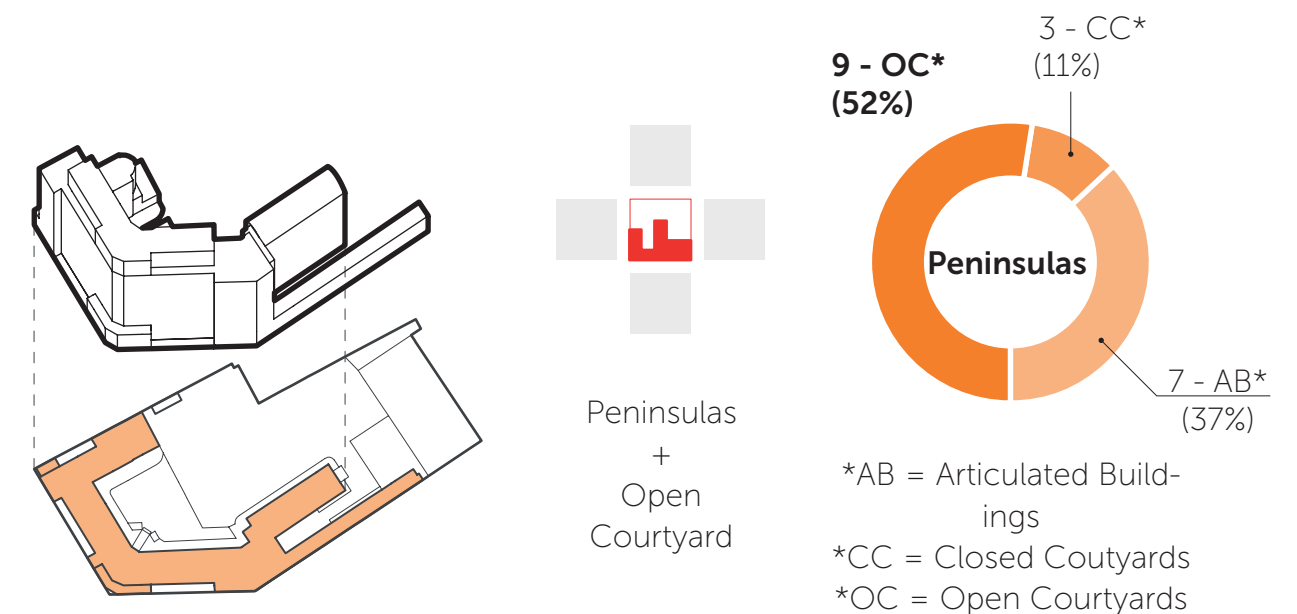
The three significant school buildings chosen according to the past analysis can host significant typologies of replicable interventions to be implemented in similar cases all around Turin's territory. The three schools, in order of building's construction time are the Liceo Massimo D'Azeglio, the Liceo Privato Cairoli and the Primo Liceo Artistico. Before discussing the numerical reasons behind the choice of those schools, we provide a short description of the buildings' potential in terms of the regenerative process. The Liceo Massimo D'Azeglio is an old high school building, whose construction dates back to the years of the unification of Italy, well inserted in the historical fabric of the city. The age of the building makes it a relevant example to demonstrate the adaptability of projects interventions even in the oldest structures, where it is harder to imagine a capacity for transformation. The Cairoli's High School Building was built in the early twenties of the past century. This building was immediately imagined to house several school grades, from the elementary to the professional multiple discipline school (that at the time were equal to the actual high school). For this reason, the result of the design is a massive building, equipped with necessary laboratories, classrooms, and an excellent distribution system, but lacking in the design and invention of the outdoor space, today mainly home to a large parking area, and a small green area

dimensionally un-suitable to provide leisure and relaxing spaces for the students of the 3 institutes that in the meantime have occupied the building. The Primo Liceo Artistico is an artistic high school, built at the turn of the sixties and seventies, dimensionally and functionally equipped with all the characteristics suitable for this kind of school, including art laboratories and a huge sporting area with an internal gym, the latter housed in a different parallel structure than the main building. This building is particular as it's part of a recurring architectural model, replicated in just under a dozen specimens, all hosting a different type of school, from scientific to linguistic high school, inserted in different contexts, located almost in the opposite areas of the city.

The choice of the above case studies took into account the intrinsic typological characteristics of each building, representing a significant survey sample among all the schools' infrastructure. The choice of schools has considered all the urban classifications identified (Islands, Peninsulas, Fulls and connected building typologies) without focusing only on one classification, to consider the most recurrent "combinations" of classifications and typologies in the city urban fabric, making the regenerative sprawl as more widespread as possible. Following the presentation order of the case studies, we see the Liceo Classico Massimo D'azeglio as a representative example of the "Full - Closed Courtyard" classifications combina-

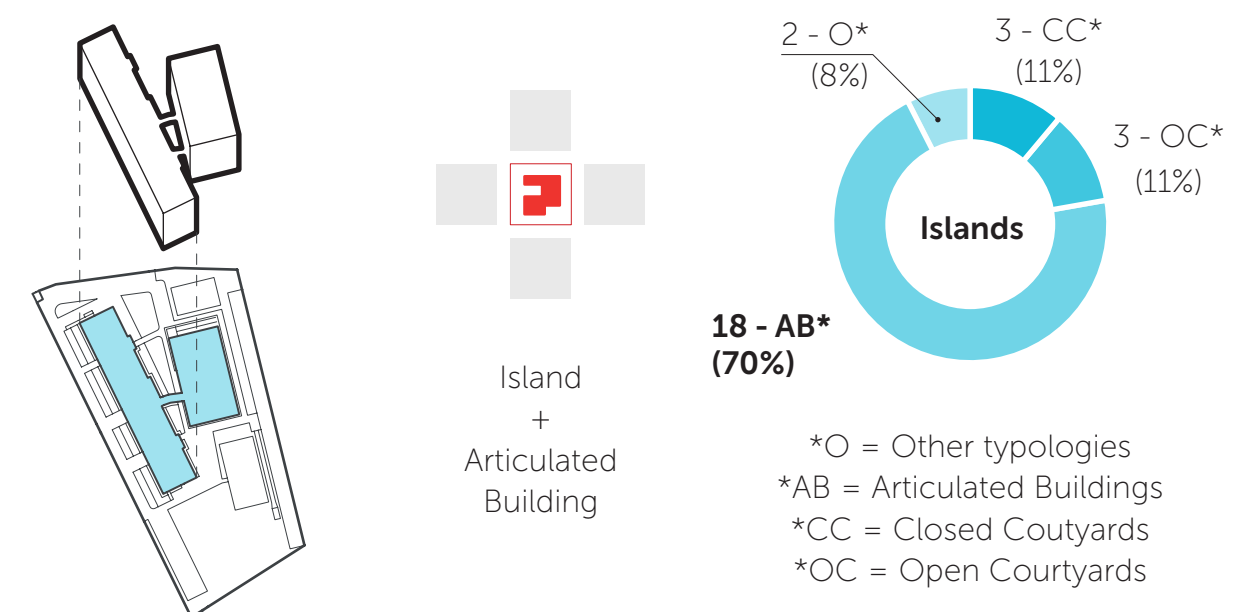


tion, which together with the Articulated Buildings (7) has a more diffuse number in the city than the other architectural categories, counting 8 similar buildings on the total of 20 "Full" overall.



The Liceo Cairoli becomes representative of the "Peninsulas" - "Open Courtyards" classifications combination that among the case studies falling into this category counts 14 case studies out of the total of 32 present on city fabric.

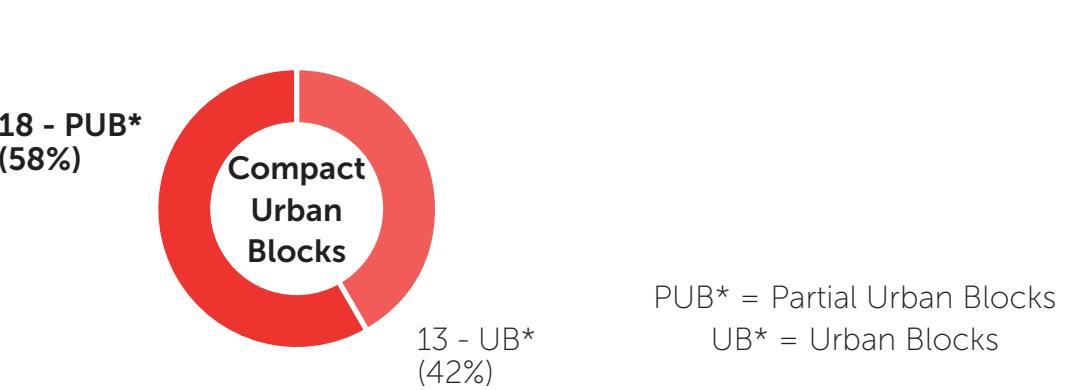
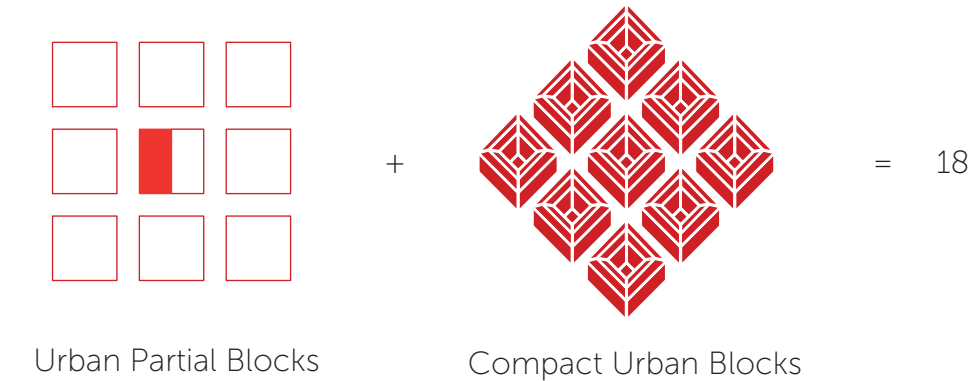
As we can be seen from the pie chart below, another most recurrent combination collects together the Articulated Buildings and the Island Classification, making it more suitable for the expansion of a widespread redevelopment project through the school building classification that does not touch the plot perimeter.



The Primo Liceo Artistico well responds to the combination of these features, that counts as many as 19 school buildings out of a total of 27 in the city fabric that can take inspiration from the design solutions applied on this case study.

In addition, the building that houses the First Art School is part of a series of "model" buildings replicated in several specimens within the city; 5 different schools are housed in as many buildings with shape, architectural plan and elevations very similar to each other, making the design considerations applied on this case study immediately applicable also on the other similar built school buildings.

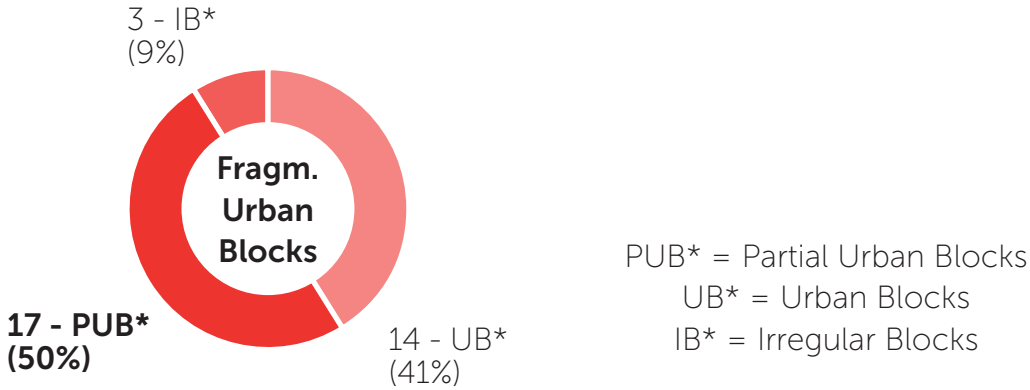
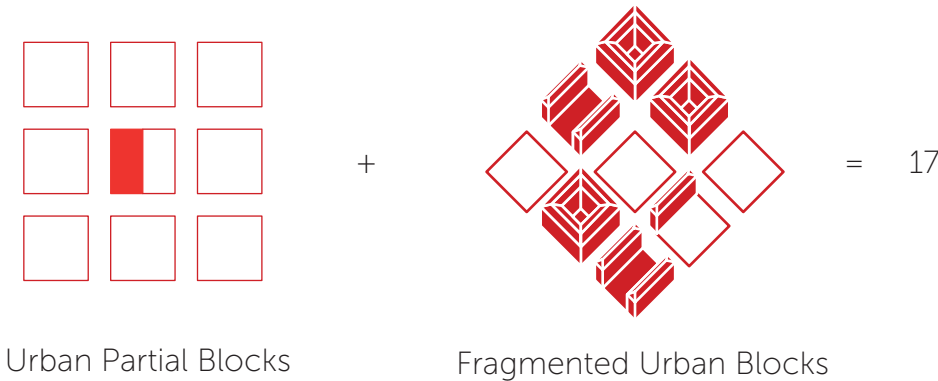
Following the classification according to the link with the urban fabric, the previously described schools all fall within the "Urban Partial Blocks" classification,



which within the urban fabric is the most widespread type (see the matrix at page 134) and the one that more specifically requires the implementation of interventions on the architectural and urban scale. This feature has made it the main study object for design reflections that propose replicable architectural and urban solutions on all high school buildings belonging to this category. The total number of

high schools that fall into this category is 44; most of them are collocated into the "Compact Urban Fabric" classification for a total of 19 schools.

The Liceo Cairoli and The Liceo Classico Massimo D'Azeglio find their location in the Compact Urban Fabric, falling within the 19 school buildings collected while the Primo Liceo Artistico even belongs to the "Partial Urban Block" classification, but find itself in the "Fragmented Urban Blocks" area, that locates 17 schools through the city. The type of "Regular Blocks" is perhaps the most fortunate of the three classifications identified, because the very conformation of the urban block offers a greater amount of open space to work on since there is no other property that insists on its boundaries. In case you decide to implement urban

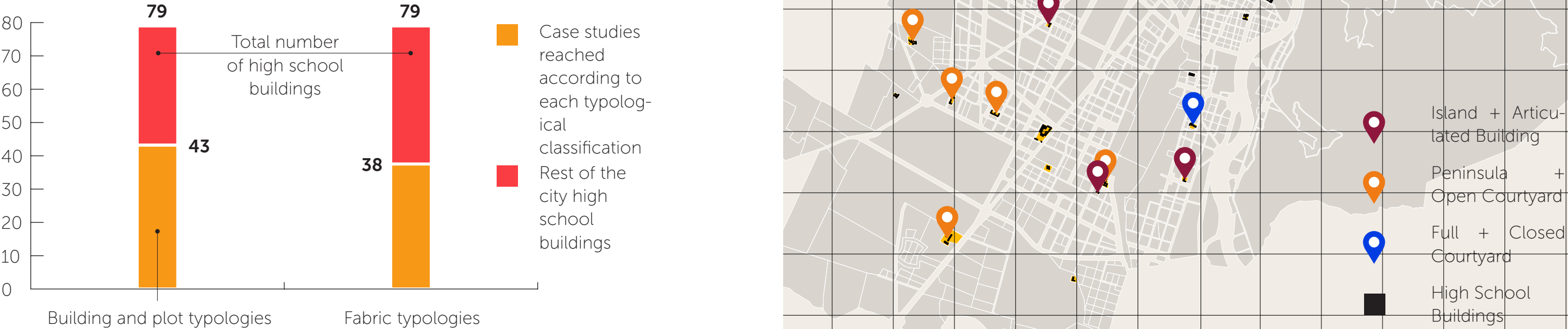


interventions on the street, the non-presence of other properties that insist on the school plot perimeter does not represent a problem, as the street surrounds all sides of the property and therefore interventions improvements on the sidewalks can qualitatively raise the surrounding space a plot. The schools belonging to the category of "Irregular Urban Blocks" are in a much lower number than

the other two classifications and the types of intervention to be applied must be studied on a case-by-case basis as they often have to deal with large dimensional plot extensions, that means interfacing with different properties and actors. The reason why no case studies belonging to this category have not been explored is precisely their low diffusion on the urban fabric that makes them case studies whose interventions should be considered taking into account the dimensional characteristics of each one. Regarding the urban classification, as we said, all the school buildings identified all belong to the typologies identified on pages 94, 96 and 98. Those typologies, which have more to deal with the building architecture, have been deliberately explored in all three variants, to make each of the design solutions adopted as more widespread as possible. These solutions aim at the common goal of strengthening the existing link between outdoor space and existing indoor spaces. The indoor spaces have been intentionally involved in participating in the regenerative process, transforming them into an active part of the projects, opting for a total improvement of the space and quality of life of these school buildings.

How many buildings can be reached by replicable strategies?

The map on the following page collects the case studies of high schools similar to the combinations highlighted from the analysis work, to show how far the principles of “replicable strategies” can extend within the number of high schools in the city: the total of schools that could be renewed is 43 units out of the 79 located in the city territory. The map on the following page works as a useful navigator for future designers to identify the next educational urban regeneration case studies that can fit with our proposals or, on the contrary, to identify and operate on the case studies where our intervention proposals cannot arrive.





Liceo Massimo
D'Azeglio



Liceo Privato
Cairoli



Primo
Liceo Artistico

Data collection and projects processing

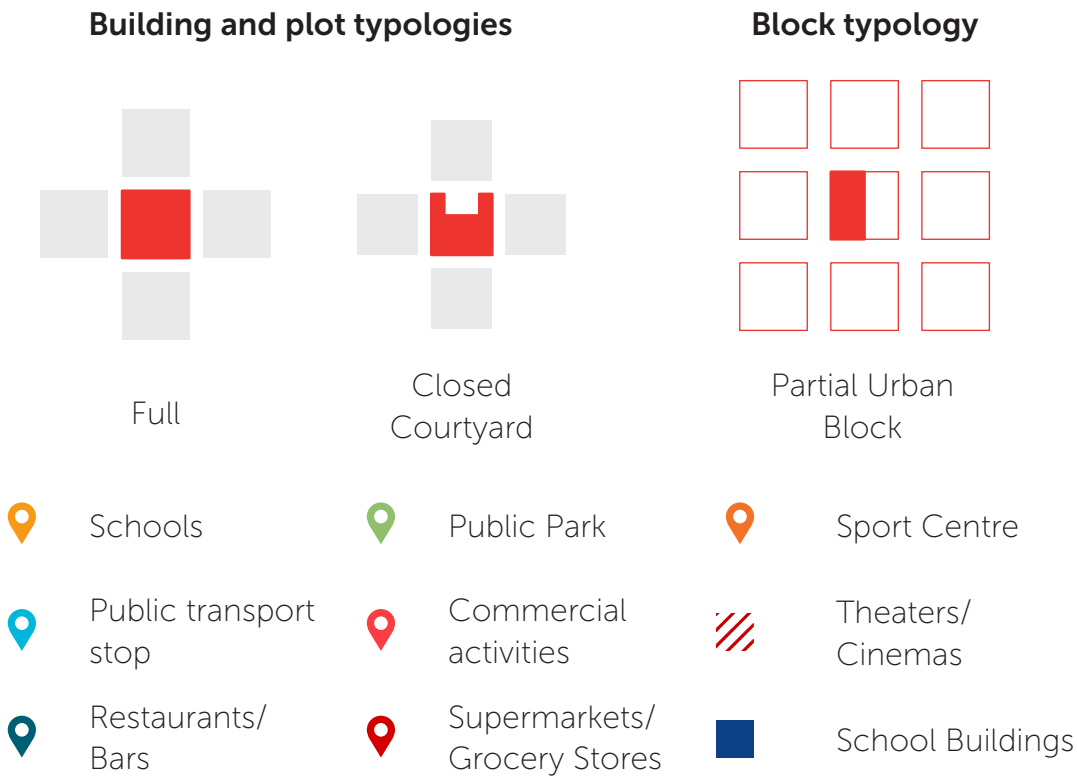
The next step following the identification of relevant case studies was to collect the existing buildings documentation. The drawings collected for the Liceo D'Azeglio and Primo Liceo Artistico, including plans, sections and elevations, were provided by the Database Anagrafe dell'Edilizia Scolastica of Turin Municipality, while the drawings for the Liceo Cairoli were provided by the professionals of Studio Pirera in Turin, who during 2019 carried out a detailed survey of the entire building. So, the work continued with the analysis of the context of each school within a radius of about 730x730 meters, identifying commercial and leisure activities such as sports spaces, cinemas, theaters and green areas in addition to the connection offered by the public transport system.

On each lot, the identification and measurement of the criticality / opportunities provided by the morphological characteristics of the external space was then followed to by the preliminary and definitive design phases. Each project collects the results of the design phases in 2 axonometric drawings, both identical in inclination and observation point, which respectively show the current and project status of the building as well as specific focus on areas of intervention that can accommodate multiple functions, showing the versatility of the space in hosting different activities.

Finally, each board contains the current and project measurements for paved and green surfaces, together with the building footprint, comparing them to demonstrate, where possible, the benefits that the hypotheses of improvement can bring.

LICEO CLASSICO MASSIMO D'AZEGLIO

The Liceo Massimo D’Azeglio is one of the historical high schools of the city. The institution has its roots in the ancient “College of Porta Nuova”, established in 1831 and initially housed in the surrounding area, but elsewhere. Only in 1860 it found its place in the current location of Via S. Quintino, a few urban blocks from the Porta Nuova area, and took the name of “Liceo D’Azeglio”. Some of the wealthiest Italian intellectuals have studied here, including Primo Levi, Cesare Pavese, and Giulio Einaudi. The building dates back to the 60s of the nineteenth century, and has been expanded twice. The sleeve on the east side is the highest body of the complex: presenting a total height of almost 15 meters and 4 floors above ground was probably built at the beginning of the twentieth century, connoting an architectural design different from the main, cleaner and poorly marked. The main longitudinal body of the west side consists of 3 floors above ground, with the main entrance located on Via Parini and dates back to 1860. The elevation is regular and punctuated by large windows framed and interrupted with a series of fake pilasters. Last in chronological order is the west 3 floor extension overlooking Via Melchiorre, and which was designed to house a large gym in the basement, as well as additional classrooms and laboratories. The elevation design is very different from the historical ones, so that we can define as “prefabricated” and “industrial”. The school complex is shaped as a closed internal courtyard; the rest of the urban block is occupied by a historic residential building characterizing the historical fabric where the school stands, but decidedly higher. The extremities of the roads are occupied by areas intended for car parking and an ecological area for waste collection, so certainly nothing valuable and, in particular, harmful to the image of the school. The interventions will try to improve the ground floor circulation inside the building, since at the moment the only entrance is located in Via Parini.



Green area
1745 m²

Paved area
485 m²

Boundary wall
667 m²

Boundary blind wall
Opportunity element,
suitable for improving
image interventions of the
school

Main entrance
The sidewalk that surrounds the building
is narrow, and in the minutes just before
the first hour lecture ring bell in the
morning, students crowd it before
entering school, exposing themselves to
the danger of stopping on the road and
traffic

Public Trashbins Area and parking lots
Could be removed from here, to allow
the building gain a better image from
the street and for the neighborhood

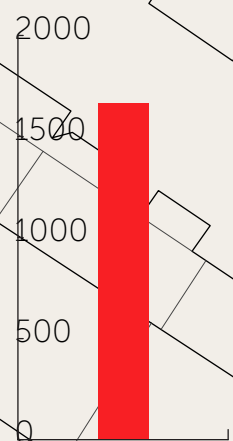
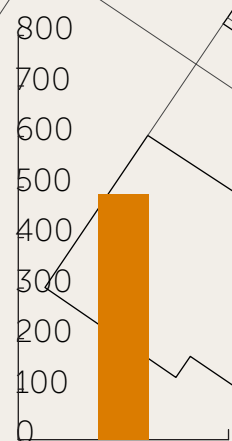
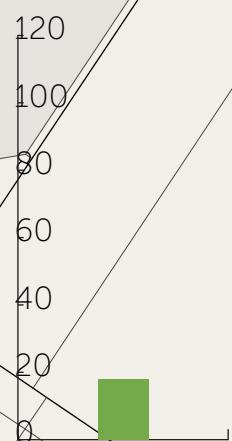
Internal un-used courtyard
Currently it looks like an
unused paved open space,
suitable for hosting improving
interventions for new activities
that can attract new people in
the building, except for
students, teachers and school
staffs, transforming it as a
landmark space for the neigh-
borhood

Internal trench
The internal trench used as a
space for the ventilation of
underground gym. It is suitable
for interventions that can
better connect the gym to the
internal courtyard (and there-
fore to the ground floor), since
the it is currently accessible
only from the underground
floor plan. The trench is in fact
large enough to host a new
staircase and for interventions
that can improve the view
from the underground floor.

**Current greens
urface**

**Current paved
surface**

**Current covered
surface**



**Un-allowed
entrances**

 **Critical Areas**
 **Improvement
areas**



Festivals!

During school closure periods, the small internal courtyard may be suitable for hosting cultural events and talks. By mounting a removable stage and placing seats in the playing field, the space lends itself well to hosting history and art lectures, cultural debates and temporary exhibitions. Moreover, the free background wall, can act as a projective screen, transforming the space into an outdoor cinema room, usable by students for assembly meetings and during film and theater lessons

New courtyard

The dimensions of the internal courtyard of the high school, currently unused, are suitable to accommodate a mixed sports garment, which can be used safely as an alternative to the current indoor gym, during the hot hours and on days of clear skies. The current concrete flooring can serve as the basis for a new plastic layer, suitable for playgrounds, and painted in different colors to generate shapes and patterns on the ground

Open air permanent exhibition of art.

The boundary wall of the adjacent property can be used as a new space for street art, dedicated to celebrating urban art, becoming a permanent urban work of art.

Envelope rethinking

The widening of the windows that illuminate the building ground floor, allow a greater amount of natural light to enter, as well as ensuring a better visual relationship between indoor and outdoor spaces.

Slow!

Via San Quintino, the road facing the North façade of the Liceo D'azeglio is a secondary road fortunately not too busy, and therefore does not need a permanent closure. However, to make the area facing the school less dangerous, the road will be elevated via a wooden bump, as long as the length of the segment in front of the school, helping to reduce the speed of motorists and make the area safer for students to transit. Moreover, this intervention could help to upgrade the connection between the school and the city fabric.

First floor plan

1 FLOOR

project flows

existing flows

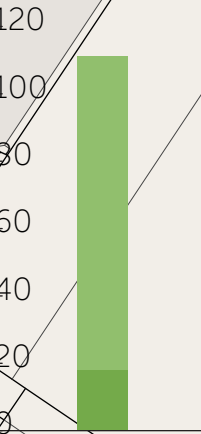
Indoor spaces extension

The extension of existing spaces through the addition of balconies or external elements allows an improvement in spaces accessibility, as well as providing better hypotheses of connection between indoor and outdoor spaces. In this case, the balcony added as an extension of the conference room on the first floor of the eastern block of the building allows to add a space from which you can watch the events that will be held in the inner courtyard of the building. It works also as a direct connection with the outdoor space, linking ground floor and then first floor through the proposed stair system that connects also the basement floor.

Take a seat!

On the external sidewalk will be mounted a new permanent wooden structure, with a constant section, which will act as a barrier to the driveway and as a permanent seat. The path will be done in such a way as to create rest and groping areas for students on the road where they can wait to enter the school. The structure will also be equipped with small planters and earthen pots towards the street, which will increase the presence of greenery in the lot, that at the moment is quite low.

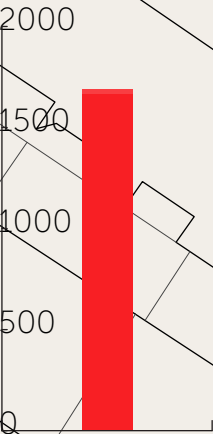
Project green-surface increase



Project paved surface increase



Project covered surface increase

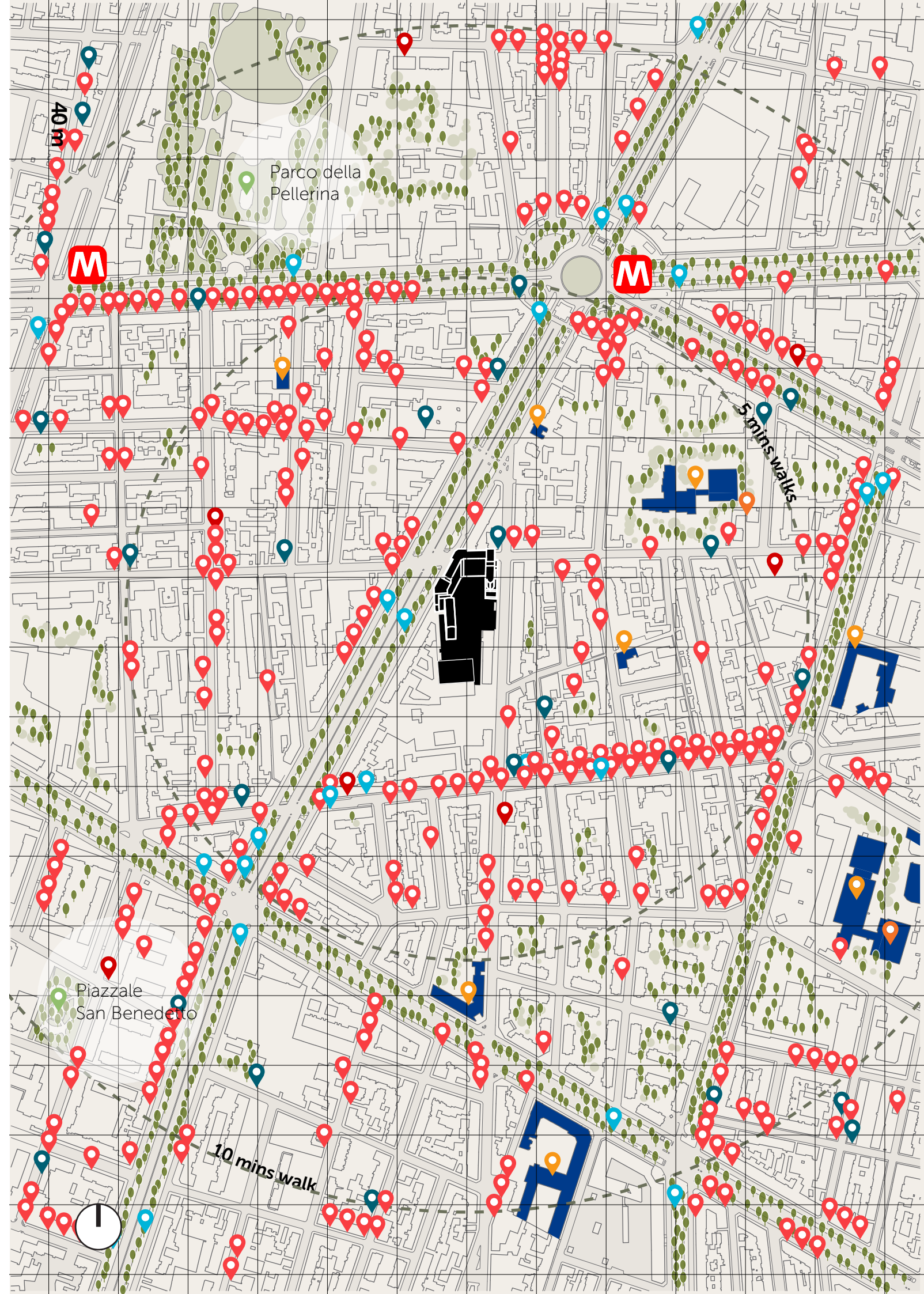
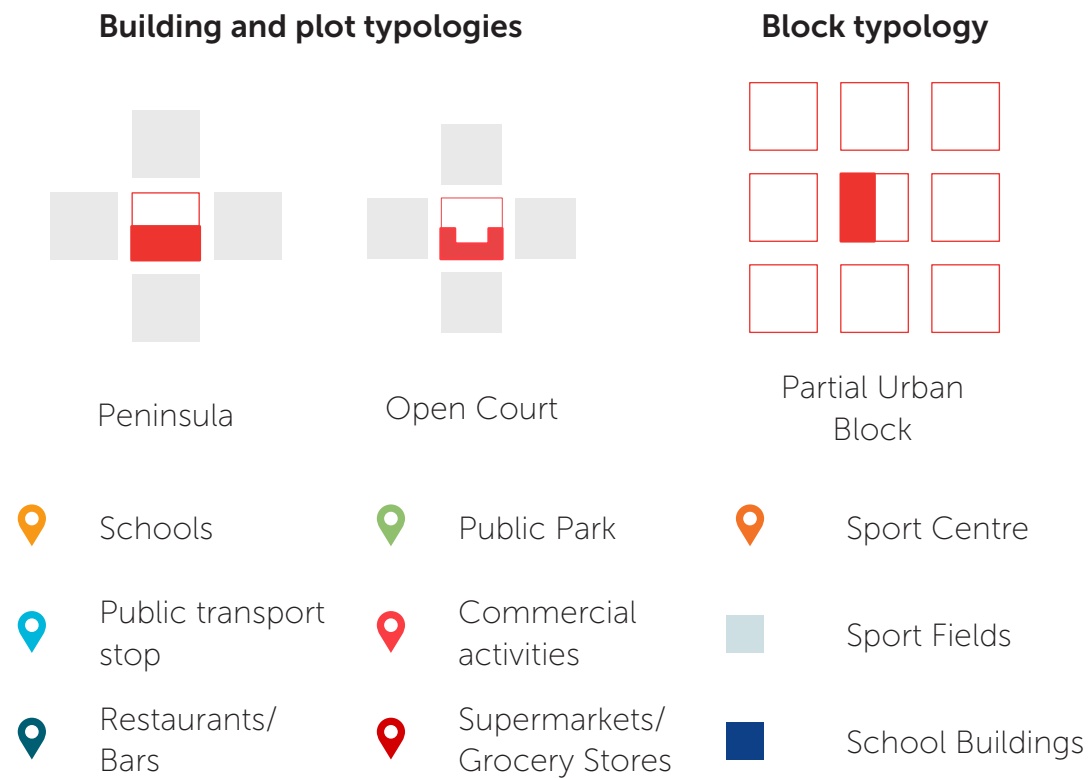


New Pavement

Replacing the existing flooring with the plastic material provided outside increases the sense of circularity of the space and clearly defines the spaces for movement

ISTITUTO ARTI E MESTIERI / LICEO PRIVATO CAIROLI

The building that today stands in Via Trapani 25, on the corner with Via Bardonecchia was born immediately to host the school function. The structure dates back to 1935 with three original school grades to be hosted that where elementary, middle and technique schools for specializations in carpentry and mechanics. Precisely because of the multiplicity of functions housed in it, the building is very extensive, coming to occupy a total area of more than 2500 square meters. The main body that houses the classrooms of the institutes located in it is spread over 6 floors above ground plus one for access on the roof and extends over the entire perimeter overlooking Corso Trapani and Via Bardonecchia. On the western wing, a barrel-vaulted body houses some classrooms and laboratories. On the eastern side the building turns to follow Via Luigi Capriolo with a 2-floors body above the ground, hosting an internal chapel. The plot borders to the south with other properties which consists of a production low building and a 7-floor medical polyclinic. At the centre of the plot there is a large paved area intended for parking, as well as a regular football field on the south side. It is worth mentioning the elevation of the structure (and presumably of the parking plot), as the building is surrounded by an open and walk-able trench: the entrance to the building from the internal courtyard is through stairways that cross the same. Since the building was designed with all the spaces, equipment and distribution such as to ensure easy use for schools function there are no serious critical issues on it. The re-generative process can work on the complete rethinking of the plaza behind the main building, as being a very large space that can accommodate new activities for students and the community that lives in the surrounding residential area. The rethinking of the plaza can also help to improve the appearance of the building, adding more green areas to the ones already existing. Finally, flat roofs are suitable for interventions that can add new activities and spaces to the users.



Green sport areas
1040 m²

Green areas
406 m²

Paved surfaces
2156 m²

Flat Roofs

Those surfaces are suitable for improving outdoor space interventions since at the moment they are used as normal terraces

Existing Garden

The existing small garden helps to bring some green space in the court, but can be implemented in dimensions and "utility" for the didactic activities

Internal courtyard

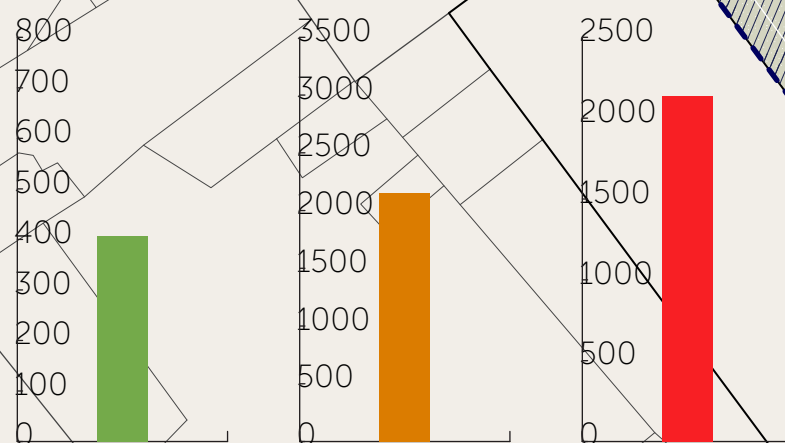
Currently used as a paved parking lot for teachers and school staff, it's a large space for hosting new construction interventions and use transformations experiments

Paved roofs
673 m²

Current greens surface

Current paved surface

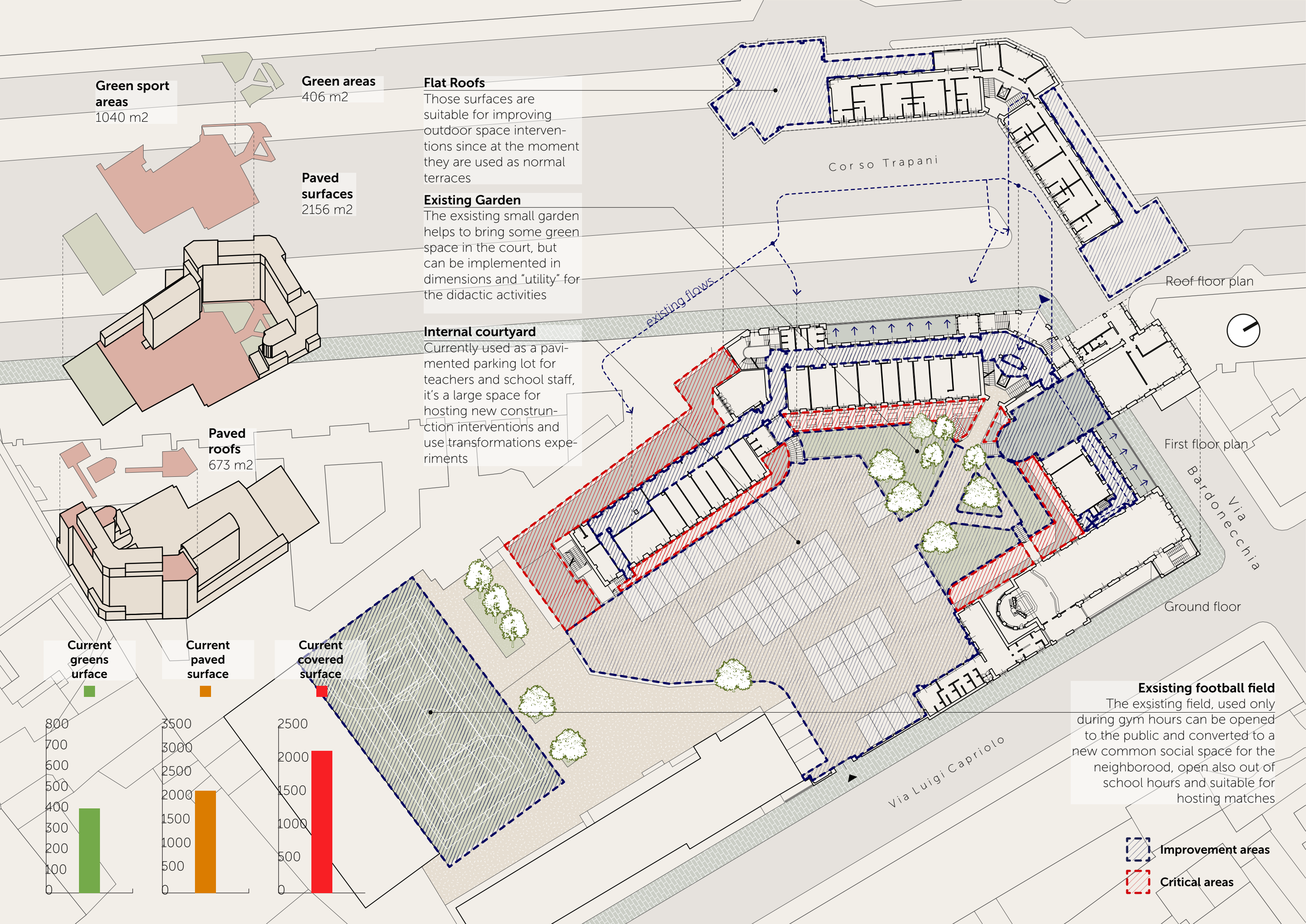
Current covered surface



Existing football field

The existing field, used only during gym hours can be opened to the public and converted to a new common social space for the neighborhood, open also out of school hours and suitable for hosting matches

Improvement areas
 Critical areas



Tower of stairs!

The new staircase tower structure beyond the trench allows access to the second floor directly from the ground floor as well as to the tennis court located on the rooftop of the chapel

Tennis time!

Parking lots in the internal court turn into tennis fields when school tennis cup takes part (out of school hours)

Agriculture farm classroom

New Connections

The continuing elevated bridge connects the multiple spaces of the plot and ambients of the ground floor plan

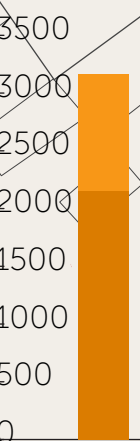
Shared sporting area between high school and neighborhood community

During gym hours, the existing multi-use field can be use for several training sessions in different sports. The space is even open for the local football teams to have a match, tranforming the area to a community space

Project green-surface increase



Project paved surface increase



Project covered surface increase

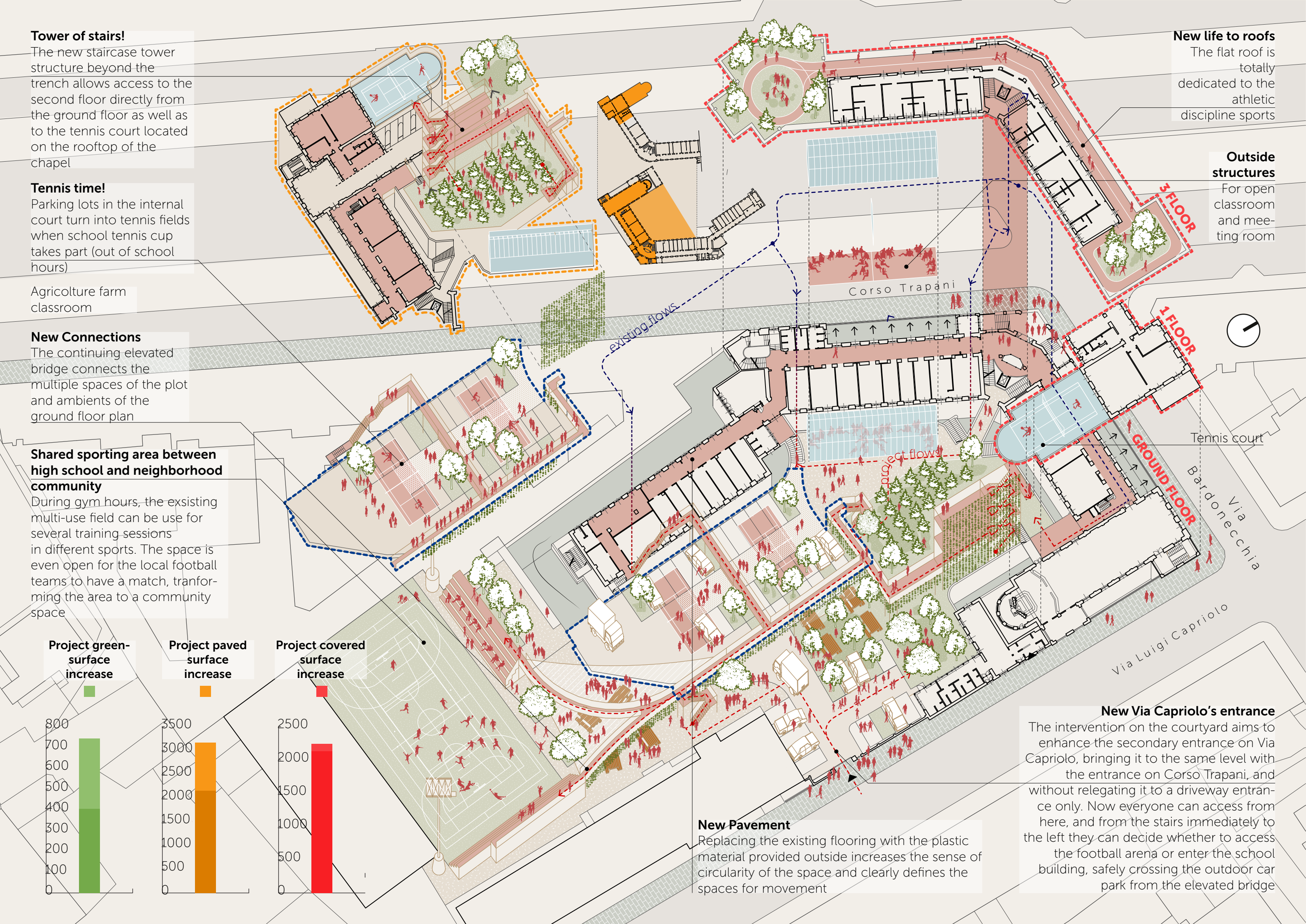


New life to roofs

The flat roof is totally dedicated to the athletic discipline sports

Outside structures

For open classroom and meeting room



Corso Trapani

3 FLOOR

1 FLOOR

Tennis court

GROUND FLOOR

Via Bardonecchia

Via Luigi Capriolo

New Pavement

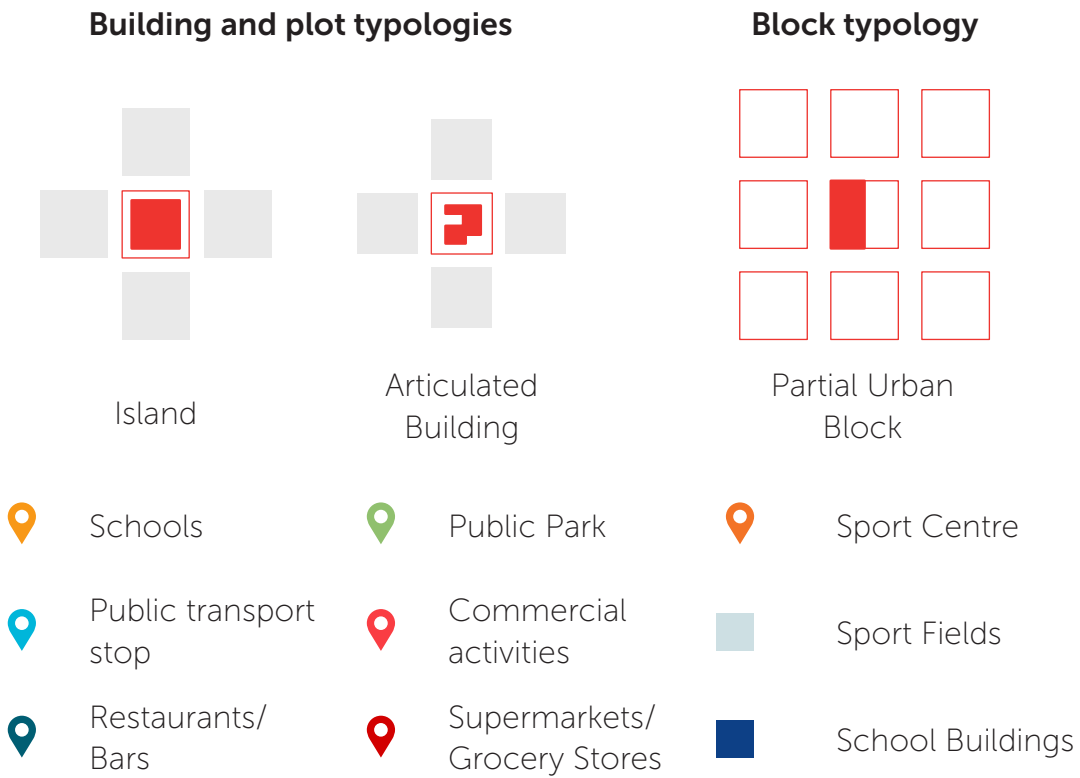
Replacing the existing flooring with the plastic material provided outside increases the sense of circularity of the space and clearly defines the spaces for movement

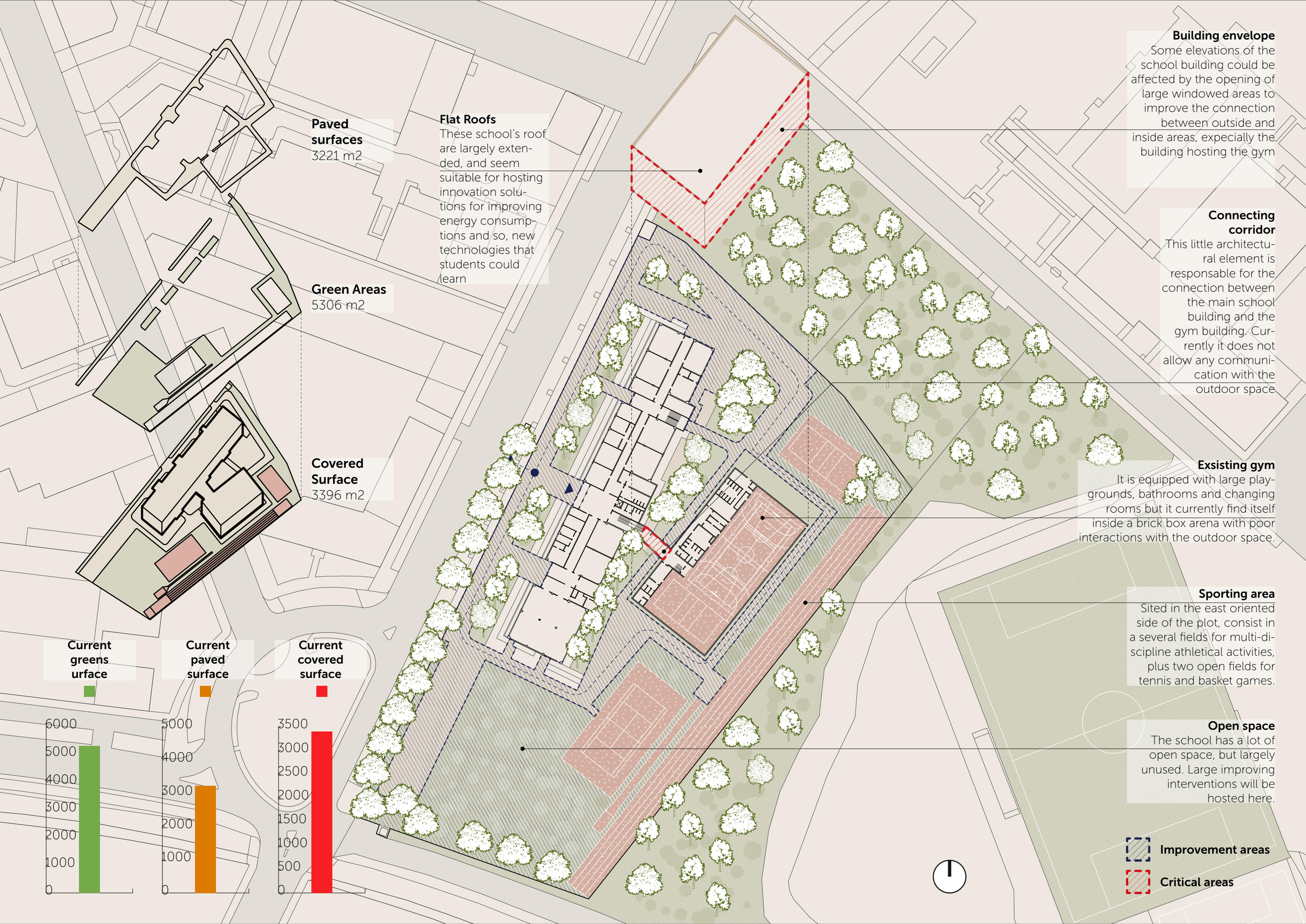
New Via Capriolo's entrance

The intervention on the courtyard aims to enhance the secondary entrance on Via Capriolo, bringing it to the same level with the entrance on Corso Trapani, and without relegating it to a driveway entrance only. Now everyone can access from here, and from the stairs immediately to the left they can decide whether to access the football arena or enter the school building, safely crossing the outdoor car park from the elevated bridge

PRIMO LICEO ARTISTICO STATALE

The Primo Liceo Artistico is located in the Vanchigliette district, a suburban area of the bottom west Turin and located along the river bank of the Po. Above the school plot, a hundred meters further following the Carcano Avenue where the school finds its address we can find one of the main entrances to the Monumetal Cemetery of the city. The area is clearly different from those we have seen where the Cairoli High School and the D’Azeglio are located, and is characterized by the massive presence of vegetation due to the Crescenzio and Colletta Park that entirely surrounds the plot on which the school building stands. The residential areas are located on the opposite bank of the river, while in front of the building there is a small commercial and productive area. The building that houses the First Art School is part of a series of replicable three floors buildings above ground that have found great success in the city since the second half of the 1960s of the last century. In fact, there are five structures similar to this one. The architectural plan is characterized by 3 entrances on the ground floor, of which the central one that gives access to the main distribution atrium. On the sides of the atrium branch off two distribution corridors with classrooms and laboratories on the right and left; the corridor on the right ends towards a conference room. In front of the atrium it is possible to access the stairwell towards the last first and second floor and a further corridor that directs towards the covered gym building, detached from the main one and also with a flat roof. The outdoor space is essentially empty excluding the area to the east towards the river, which includes an athletics track, a track for long jumping and two courts for the game of tennis and basketball: the enhancement of the outdoor space of this high school will start from this portion of the plot, well stocked regarding sporting facilities and therefore suitable for hosting competitions between several schools or companies, promoting the high school as one of the major sports centres in the neighbourhood.





Building envelope

Some elevations of the school building could be affected by the opening of large windowed areas to improve the connection between outside and inside areas, especially the building hosting the gym

Connecting corridor

This little architectural element is responsible for the connection between the main school building and the gym building. Currently it does not allow any communication with the outdoor space

Existing gym

It is equipped with large playgrounds, bathrooms and changing rooms but it currently find itself inside a brick box arena with poor interactions with the outdoor space.

Sporting area

Sited in the east oriented side of the plot, consist in a several fields for multi-discipline athletical activities, plus two open fields for tennis and basket games.

Open space

The school has a lot of open space, but largely unused. Large improving interventions will be hosted here.

Flat Roofs

These school's roof are largely extended, and seem suitable for hosting innovation solutions for improving energy consumptions and so, new technologies that students could learn

Paved surfaces

3221 m2

Green Areas

5306 m2

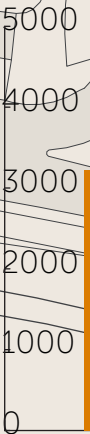
Covered Surface

3396 m2

Current greens surface



Current paved surface



Current covered surface



- Improvement areas
- Critical areas



Energy roofs

The installation of solar panels and wind turbines on the flat roofs of buildings will allow in part to make them self-sufficient from an energy point of view and make them, in the eyes of the students, a concrete example of environmental sustainability, studying and monitoring their operation.

New pavement

Replacing the existing flooring with the plastic material provided outside increases the sense of circularity of the space and clearly defines the spaces for movement

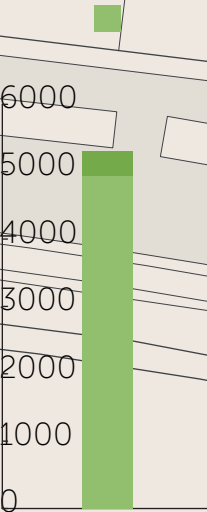
Outside structures.

Removable structures for storing drawing and sculpting tools for open air lectures, but also for protection from sun, rain, and studying in the outdoor

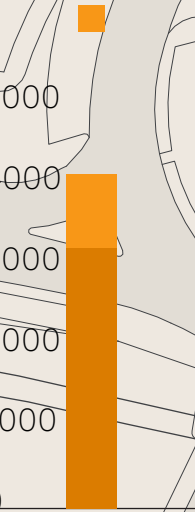
Market area:

Open to the public on Saturdays and Sundays, highlights student work in art subjects. The workbenches can also be used to organize afternoon courses and workshops during times of self-management between students and teachers.

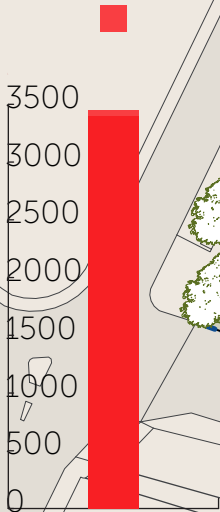
Project green-surface decrease



Project paved surface increase



Project covered surface increase



Open air exhibition!

Here we show the best results of students competition in drawings and painting (but also some famous artworks that you will probably know). This is possible thanks to the steel structure with mullions and transoms that surrounds the facades, and that also allow the grow of vertical vegetation

Open facades!

The wall of the school gym is currently opaque, and the only windows for light are located very high. A new glass wall can allow to put this existing environment in contact with the sports area immediately behind and thus unify the spaces dedicated to movement, improving circulation between them.

Sport days

The area behind the lot, well equipped with regard to spaces and playgrounds, can host competitions between schools and students in the neighborhood. There is no shortage of spaces for the public and.. may the best win!

Panoramic platform

Here you can enjoy a wonderful view towards the Superga and Turin Hill!

PART 4

The regenerative toolkit for open spaces

An early spatial toolkit

Having investigated the three case studies reported in the previous chapter and later identified the basic research fields where to develop the best devices for each case study, led us to carry out a series of "actions" on the schools plots that in some cases involved the addition of new structures and in others the complete rethinking of the usage of basic building architectural elements like roofs, both with the aim of the improvement of existing outdoor school spaces.

Illustrating how each of the interventions proposed in the previous projects was conceived is the objective of this final chapter, to help those who approach the theme of the school open space redevelopment to identify a step by step path, starting from a detailed analysis of the actual state of each case study to the development of the best actions to be taken.

Each of these actions are collected within the toolkit that is presented in the following pages and wants to be intended as a "manual" for every professional who, even after the conclusion of this research work, approaches the redevelopment of the open space of school buildings, with the same objectives and parameters that we have planned to achieve since the first chapter. The toolkit tries to collect all the actions that have been carried out in the projects, assigning them unique properties and applications that the professional can choose to apply based on the weaknesses/opportunities identified after the current state analysis conclusion.

The properties differentiate the type of user to whom the intervention is addressed, and the possibility of performing one or more functions in the same. But in the same way, it also identifies the more "physical" characteristics of the newly built objects, such as the position compared to the main high school building or the type of coverage that it offers.

Each of the projects considered in the previous chapter are immersed in an urban context that help us to consider each project as an intervention for the city too: a project capable of generating spaces not only for its usual school users but also for citizens, who will be able to freely access them during public events or opening hours.

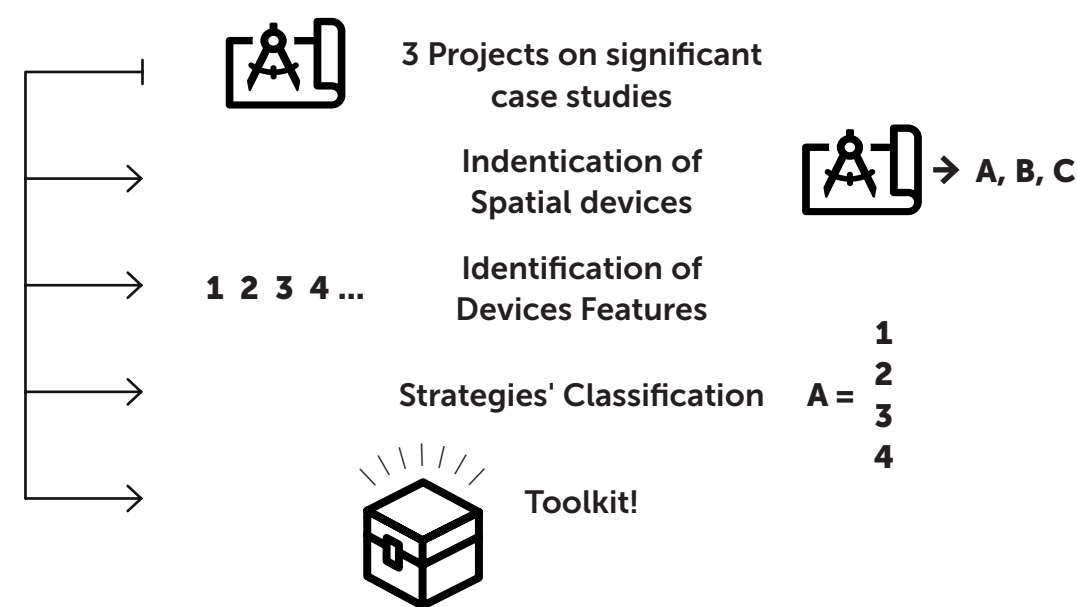
The intervention strategies collected in the toolkit are the result of the synthesis of the operations carried out step by step in the development of the three previous projects and that we can illustrate as:

- the review of what is being done with the open space that belongs to the city on the main street, considering it as a management resource for the entry and exit flows of students, avoiding the accumulation of people in the same space.
- the review of what can be done with the internal space or patio of the school that lends itself to the development of educational activities, whether experimental, sports, or cultural learning that can be developed temporarily, generating flexibility and achieving that at certain times the students can be divided between these internal and external spaces.
- the check of the relationship between the interior and exterior circulation of the building and the open spaces, both stairs and corridors, as these are the meeting points and the greatest pedestrian flow.

The toolkit contains those strategies or points in common that solve a problem, that strengthen an opportunity, that solve variables and determinants of place, climate, comfort, in the case of schools of education and that seek to improve spatial quality transcending the thought of a closed space full of people to a flexible space that can be converted into a multi-purpose space and that promotes culture, art, sports, and sustainable education.

Toolkit structure

The toolkit is structured to present the projects' most useful intervention "ways" divided into ten main strategies to which every professional can refer while designing the renovation of the school outdoor space. Each strategy has been considered useful when "replicable"; in other words: when it can help to spread the regenerative process through the city. Here before you can find a short scheme that, starting from the completion of each project, introduces the toolkit step and its consecutive actions.



The index aim is to presents each device according to the field of intervention, distinguishing those on constructed buildings, on outdoor areas and on the public space outside the plot.

The main reason the spatial devices are classified following these criteria brings us to the second level of this toolkit's structure exploration: to know where and how it is possible to apply them, the strategies are provided with unique features that will be deeper explored in the following section.

Each feature helps to make strategies comparable along with the other similar in each of their fields of application. For example, the interventions attached to school buildings modify different architectural aspects and elements of the existing structures, and they could be the walls, floors, roofs, or windowed surfaces (including interventions that propose the addition of new architectural elements such as double façades, devices for the energy efficiency of buildings or extension of interior spaces). It's up to the designer to define the best intervention to apply but, at least, a priori classification may help him to discard otherwise useless devices, non regarding the fields in which he wants to take action.

More, interventions that take care of the outdoor space enclose the operations that modify its design, starting from the functions hosted, the materials used and the spatial additions, depending on the type of usage wished to be implemented. Finally, the interventions on the open space outside the plot include the operations that modify the design of the urban public space, rethinking the function of the simple road to improve accessibility to the school and the flows of its users, even considering the surrounding community, providing spaces for relaxing and green spaces in the city areas where they are most lacking.

Strategies features

As mentioned in the previous paragraph, each of the categories presented in the short index has intrinsic and unique properties that allow them to respond effectively to the critical issues/opportunities identified.

We, therefore, distinguish four different types of properties:

- Proximity,
- Structure,
- Activities hosted,
- Intensity.

A closer description for each feature is provided on the following pages from 174 to 177.

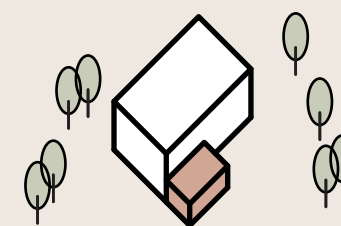
Proximity

With the title of Proximity, it is intended the feature that explains the position of the device in relationship with the main school building. We find three different possible positions: the devices could be totally "dependent" on the building structure; in other words they are the ones that, in a way, are attached to the architectural plan/elevation, being forced to follow the dimensions of the portion of given space in which are inserted. Therefore, for example, we can find such devices inside the buildings, or outside, like additional balconies or roof extensions.

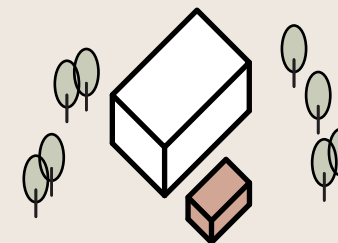
With "independent" devices we intend the ones without any physical contact with the main building, or in a totally different position in the plot. Devices "outside school perimeter" are the ones that could have contact with the main school building, but standing outside the school property, like in the public sidewalk or the street, providing solutions to architectural and urban issues, for example improving the accessibility to the school building.

Structure

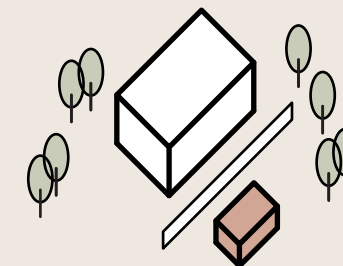
Classifying the spatial devices according to the structure's typology is the aim of the structure feature. It pays particular attention to the outdoor or covered-heated spaces, making it easy to identify which strategies to use for the outdoor areas and the activity to implement in the device. Also, climate comfort is a crucial point that needs to be considered, applicable worldwide and valuable in all seasons of the year: thanks to the flexibility of the spatial devices they can be fully or partially covered by an opaque or transparent skin, provided with heating or cooling systems according to the usage. In other cases they don't provide any coverage for users, being usable only during certain weather conditions and for limited activities.



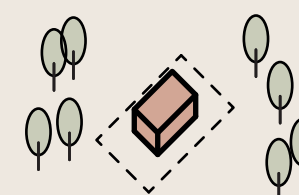
Dependent devices



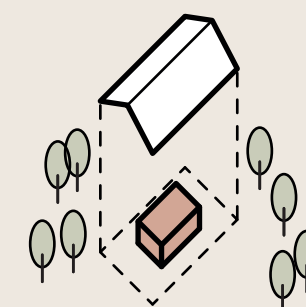
Independent devices



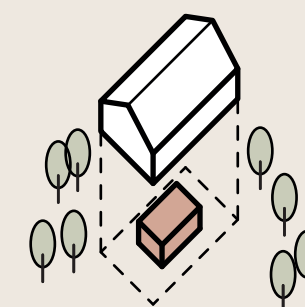
Outside school perimeter



outdoor - non covered



outdoor - partially covered



outdoor - covered/heated

Activities Hosted

This feature indicate the activities emerged in the cases related to the learning process and that can be separate between “socio-motor activities” (like sport, walks, etc.), the “teaching and learning activities” (educational greenhouses, educational gardens), the “movements activities” dedicated only to improve the connection between spaces, “socializations activities” that can happen almost everywhere but more particularly during public events and last “relaxing” activities that everyone can carry out.

We have transformed such activities into features, so that it's possible to clearly understand which one is more indicated for the device.

Intensity

This feature collects the many uses a device can host in is provided space and “how many” of them at the same time. We distinguish in fact “single ones” devices, that can host just one activity at a time, and others than can host multiples at the same (multiple use).

Moreover some of them are proposed to support a “plurality of usages”, which means that the space is designed (during different hours) to allow it's use from more than one activity (and users kind), which can be teaching, learning, studying, sport, socialization and relax.



Spaces for study



Spaces for connections



Spaces for teaching



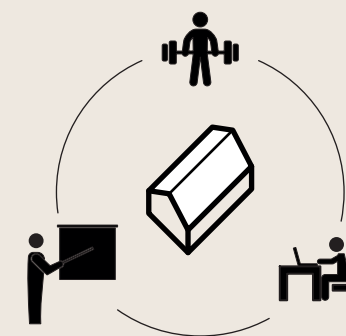
Spaces for socialization



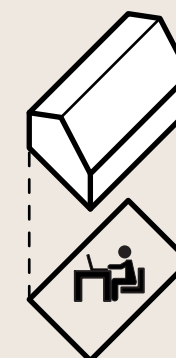
Socio-motor experiences



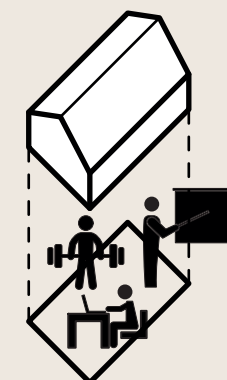
Spaces for relax



plurality of uses



single use one

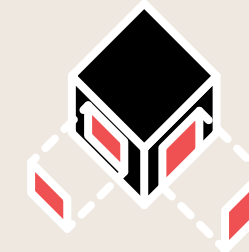


multiple use at the same time

Strategie's index



Ground use
rethinking and
replacement



Windowed
surfaces imple-
mentation



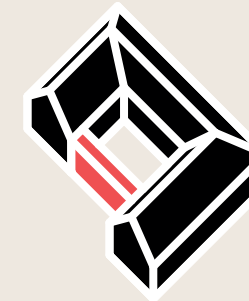
Envelope skin
replacement



Roof use
rethinking and
replacement



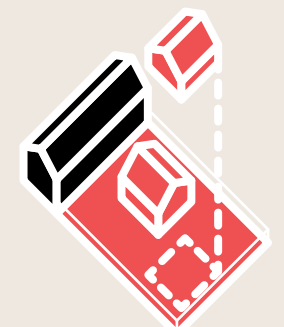
Extension of
indoor
enviroments



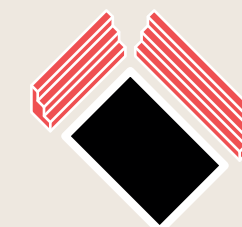
Addition of new
connection
spaces



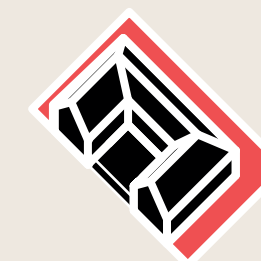
Circulation
network
improvement



Addition of new
outdoor
structures



Adaptability of
existing spaces
to new
functions



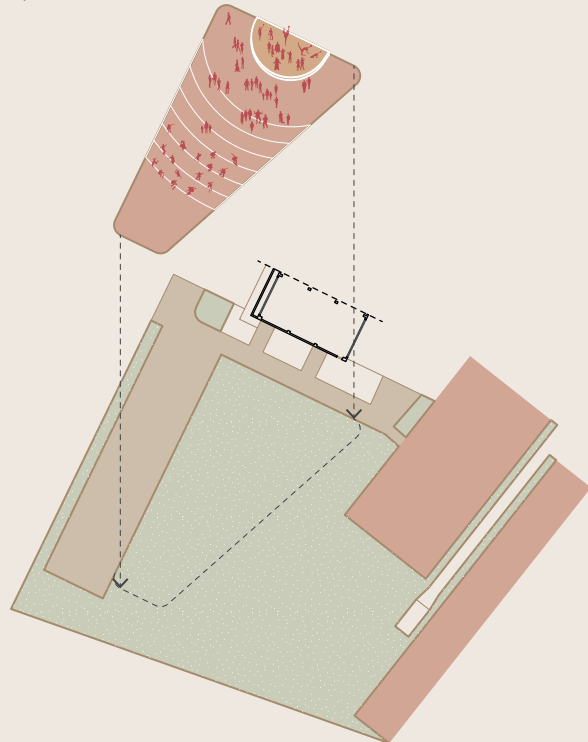
Public space
image and
function
improvement

Collection of strategies

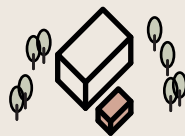
The following pages from 180 to 189 are going to presents the project devices applied in the regeneration project processed and previously illustrated in Part 3. The reader and designer can refer to the early index on next page to find the needed device for it's project research, since the exhibition follows the index order. The index is structured with schematic icons for each device: they may help in advance to understand the application field for each one.

The devices presentation is divided by sections and structured to present a hypothetical use of them, extracted from one of the project discussed before, to provide the reader/designer an application example; together with the use, a brief description of featured properties is provided suggesting, moreover, users and activities that can be involved or implemented in each device or space's transformation provided.

Strategy
application
example



Proximity



Structure



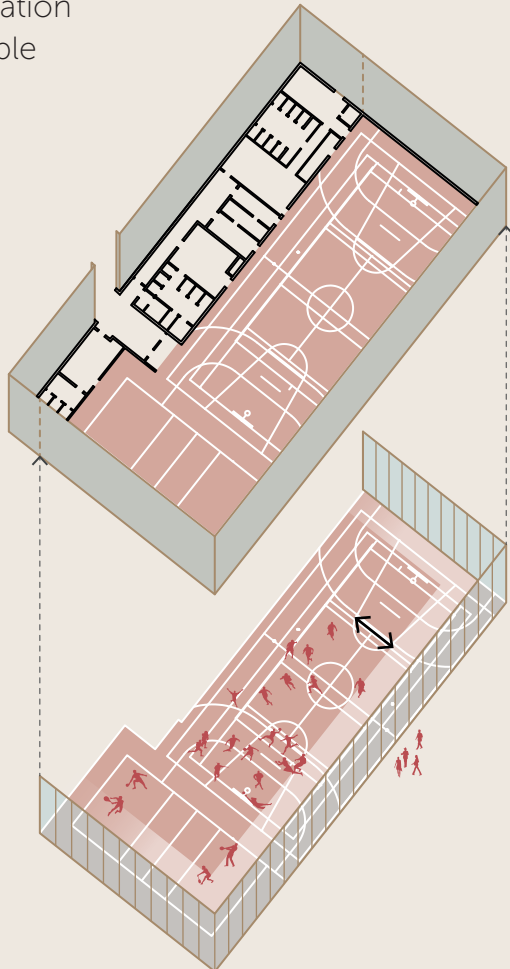
Activities hosted



Intensity



Strategy
application
example



Proximity



Structure



Activities hosted



Intensity



Ground use rethinking and replacement



With the identification of unused paved or natural surfaces within the property, it is possible implementing a transformation that, starting from the improvement of the existing base material (concrete, ceramic flooring, uncultivated lawns, etc.) through the overlapping of new fabrics with the design or colour that you want, can guarantee the installation of new activities and functions, improving them qualitatively, in terms of appearance. This makes these surfaces suitable for the use of multiple functions, without necessarily blocking the original one: this transformation can include parking plot areas which, after the transformation of the pavement, the relocation of the stalls and the insertion of new activities, can alternate the two functions using them at different times when one cannot disturb the other. The new activities for which such spaces can be conceived are many, starting from spaces for sports, outdoor lecture spaces, relax/study spaces and greenery.

Windowed surfaces implementation



The enlargement of the existing windowed surfaces where possible allows a greater supply of light and air inside the rooms, ensuring also a better relationship between indoor and outdoor space. Interventions of this type can highly modify the external appearance of the buildings, and must be evaluated according to the results of structural and landscape studies. Transformations of this type are highly recommended in environments that host gyms, or meeting rooms, where the involvement of a natural outdoor environment and the presence of natural light make the stay in these environments more pleasant and guarantee a better quality to the functions hosted in them.

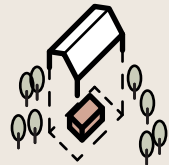
Strategy application example



Proximity



Structure



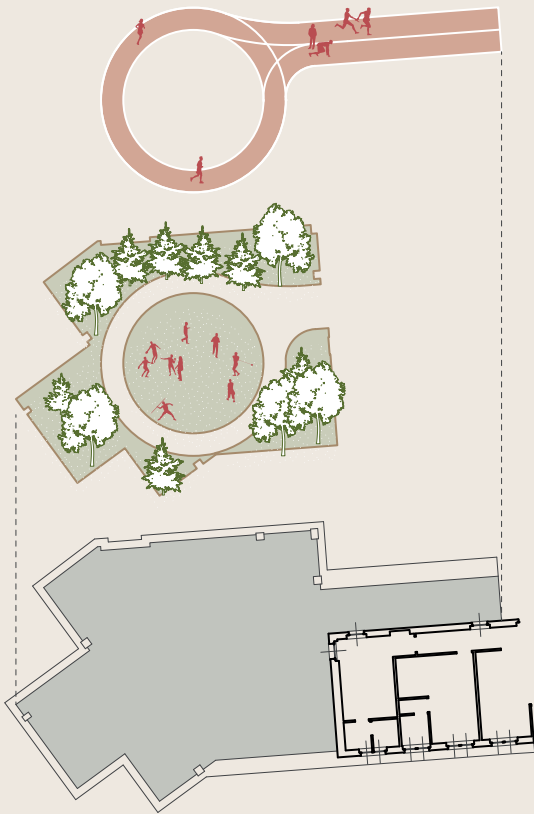
Activities hosted



Intensity



Strategy application example



Proximity



Structure



Activities hosted



Intensity



Envelope skin replacement



The architectural transformation of the elevations can include the placing of new wooden structures right in front of the existing building, allowing the growth of vertical climbing plants that could bring the green even to the highest floors of the school buildings, where the redevelopment of the outdoor spaces seems not able to arrive.

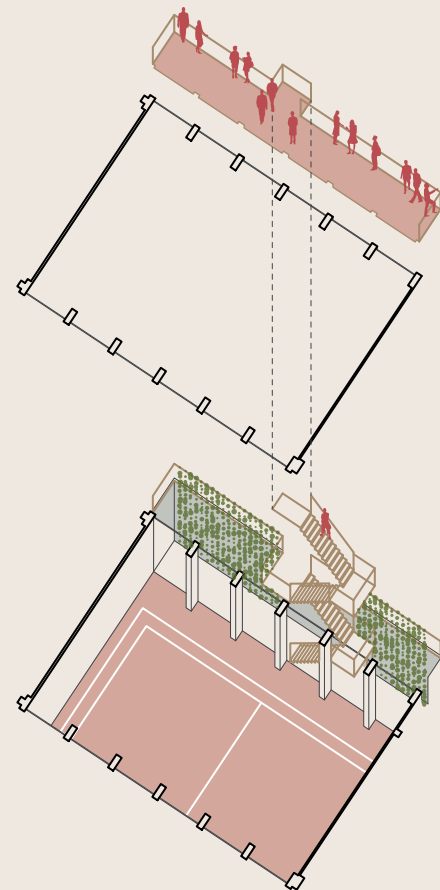
These structures, in addition to acting as a vertical framework for the climbing plants housed in it, can also act as an open-air exhibition space, placing artworks or coloured curtains that involve improvements to the aesthetic appearance of the structure and parametric solar shading systems if needed.

Roof use rethinking



The flat roofs of school buildings are most of the time unused horizontal surfaces, attractive to a functional transformation that, through the improvement of the existing basic material (in a way similar to the soil transformation on the ground floor), would allow the installation of new activities mostly related to sports areas, measuring the size of existing surfaces and adapting the best playing field to them. Access to them can take place through the existing vertical distribution system, or through the addition of external distribution structures that rise from the ground floor to the desired altitude, when it is not too high. Roofs can also be conceived as another completely open floor, if not even another surface, conceiving an entire additional “school departments”, adding new modular structures (for examples recycling naval containers) to host new classrooms and laboratories spaces as to create completely independent areas that can be connected to existing electrical and water systems, or provide the necessary energy by themselves thanks to solar panels, wind turbines or other sustainable devices. Interventions like this must be evaluated according to structural and landscape studies.

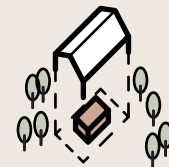
Strategy
application
example



Proximity



Structure



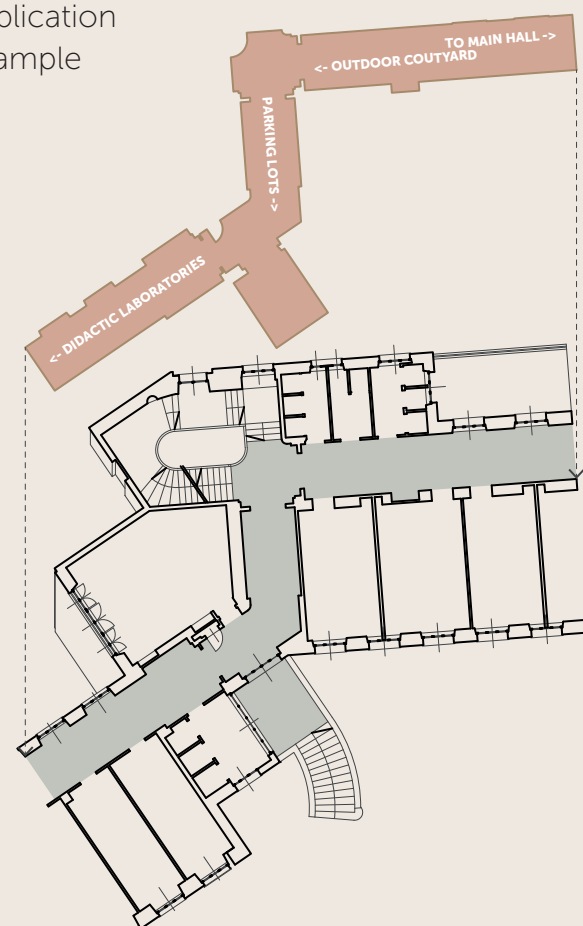
Activities hosted



Intensity



Strategy
application
example



Proximity



Structure



Activities hosted



Intensity



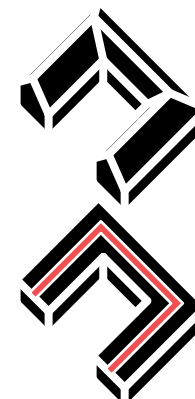
Extension of indoor environment



The extension of existing spaces can be provided with the additional or further dimension alteration of windowed surfaces on the upper floors (above the ground floor), opening the existing indoor spaces to external views so that the students and users can relax on the terraces breathing some fresh air or, in some cases, standing towards the internal courtyard below them, in the event of sporting matches or public talks.

The functionality of such spaces is better if they can enjoy additional access directly from the outside, so as to improve the connectivity of spaces.

Circulation network improvement

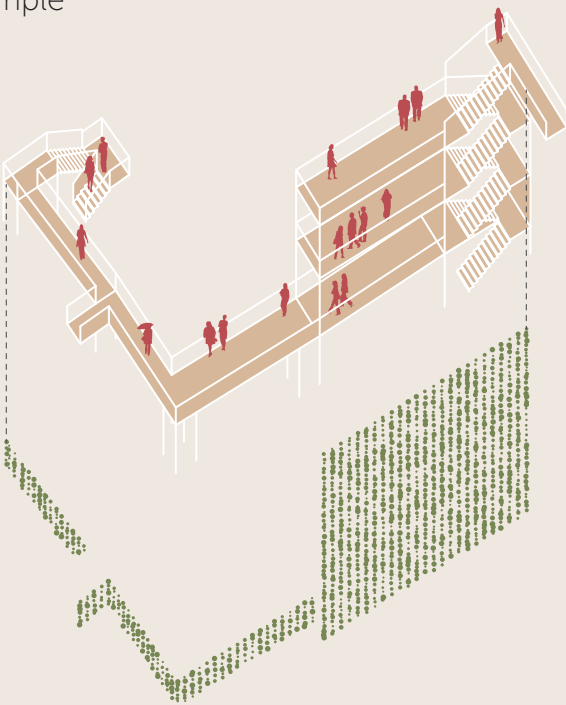


This type of intervention involves the replacement of the existing flooring with a similar material to the one that used for external pavements if not, where possible, the same.

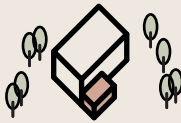
By this way, in order to ensure the complete circularity of the intervention, it is possible to well differentiate which will be the spaces for movement and which ones for school activities, both internal and external.

The floors will also be equipped with suitable signatures, identifying the direction for each environment, such as laboratories, classrooms, playgrounds and safety exits.

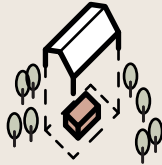
Strategy application example



Proximity



Structure



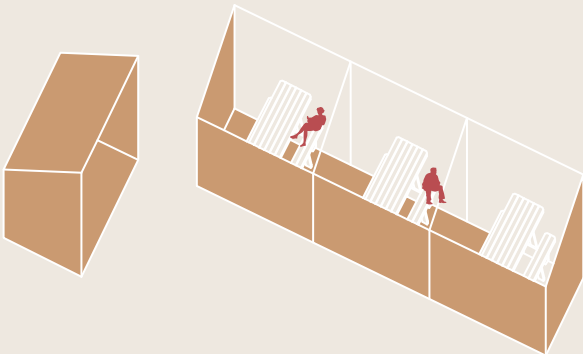
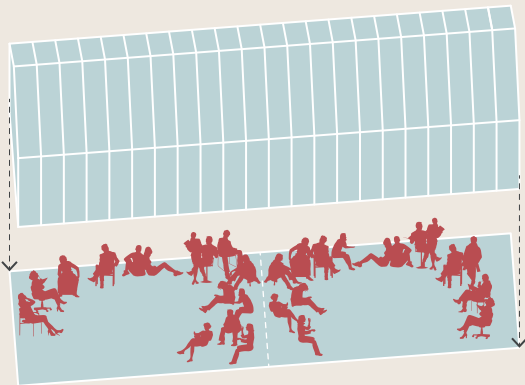
Activities hosted



Intensity



Strategy application examples



Proximity



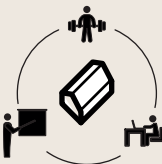
Structure



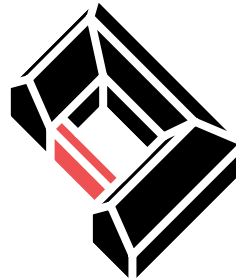
Activities hosted



Intensity

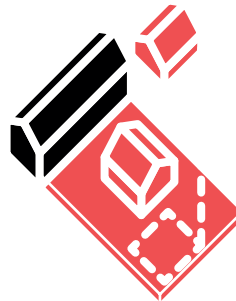


Addition of new connection spaces



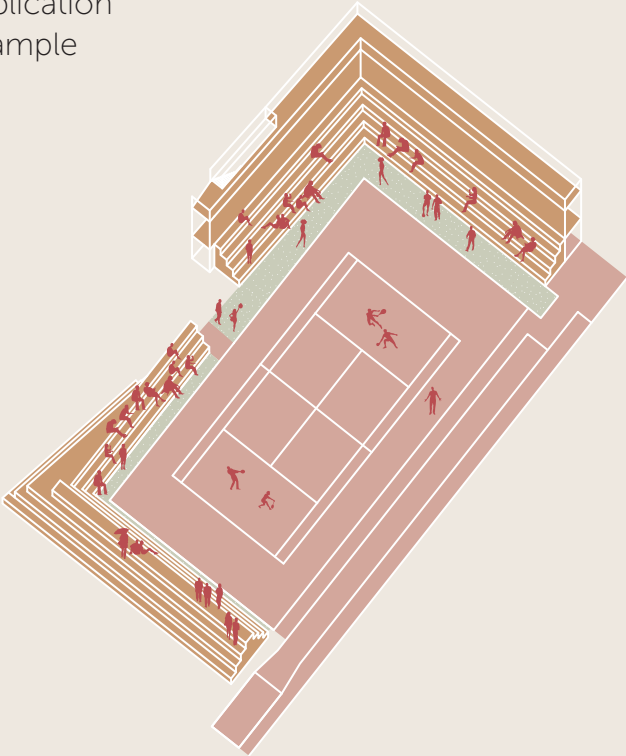
Light metal structures of this type, 1.20m wide, can help to improve the connectivity of school buildings, especially if they own complex architectural plants, making it easier to move within the plot. In cases where the space proposed for the installation of these structures is also crossed by vehicular traffic, they allow to separate the flows of pedestrians and cars, making the space safer. These structures can also promote (if needed) new forms of vertical distribution from the ground to the upper floors of the building, as we mentioned earlier in the alternative connection that the redeveloped roofs can enjoy.

Addition of new outdoor structures

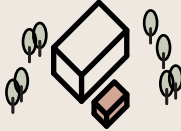


The addition of removable external structures in the inner courtyards allows to guarantee additional spaces to those provided by the existing buildings. These structures, which can be equipped with all the required thermal comforts but also possess removable walls, are open to the internal courtyard and can host lectures on subjects not necessarily "ordinary" (such as mathematics or literature), but more practical, such as biology and agriculture. By this way those spaces are able to guarantee the true instant application of the concepts learn during lecture hours, carrying out didactic experiments right outside after they come to and end. Some of these structures are also designed to act as "external warehouses", where it's possible to collect and store tools for outdoor teaching and practical activities, in order to facilitate their use and avoid transportation from inside to outside. Subjects that can gain benefits from such structures are live drawing, sculpture, dance, free gymnastics, theatre, cinematography and other practical arts.

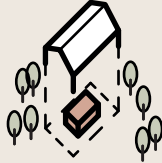
Strategy
application
example



Proximity



Structure



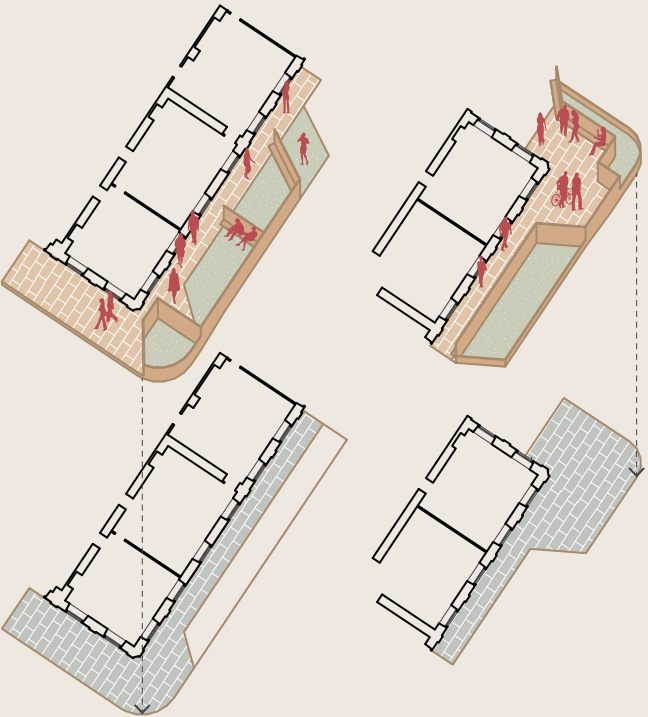
Activities hosted



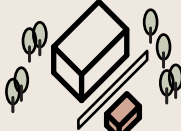
Intensity



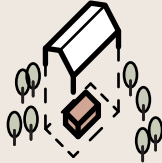
Strategy
application
example



Proximity



Structure



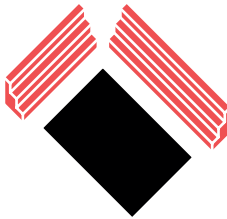
Activities hosted



Intensity



Adaptability of existing spaces to new functions



Stage structures of this type can transform the spaces of a school into meeting places. Classrooms and community people can use them socializing or attending meetings and competitions in the occasions the high school outdoor areas are opened to host sporting and public cultural events.

Another benefit: the presence of such structures facilities provides the spaces to be more welcoming, allowing the practice of completely different functions from the original one: a playing field can easily become a sort of "stage" for theatre performances, but also music lessons, open readings and public talks.

Public space image and function improvement



In the event that the urban conditions around the school are suitable, redevelopment interventions can be carried out on the outdoor public space close to the building, adding permanent structures with seats and public green dedicated to the rest of students and teachers, but also citizens.

In the first case, students can stop to wait on the sidewalks to enter the school building before the first lecture hour ring bell: standing on the space of the road can be dangerous, due to the presence of cars and the high volumes of traffic in the first hours of morning.

In the second case, citizens can benefit from the presence of these small areas isolated from urban traffic and surrounded by greenery, resting and socializing.

Conclusions: a practical step by step “modus operandi” for urban regeneration projects through the city

For the conclusion of this research work we believe that the precious result of all this document is what we can call as the “modus operandi” followed during the work's developing time, and that can serve as a basis for approaching any urban regeneration project.

Those kind of projects do not necessarily have to be linked to the theme of high schools, for which this work has shown this “modus operandi” adaptability, but can also fall within the field of redevelopment of public greenery, abandoned industrial buildings and degraded urban areas that, nowadays, are recurring themes in our cities.

We can say that, regardless of the usefulness that the designers will draw from the final toolkit produced by this research, the modus operandi followed taught us to discretize any case study into a smaller series of critical issues and opportunities to be downsized and solved.

A new way of approaching design, because, when facing an area that need to be regenerated, depending on whether it is rather large or not, we soon try to solve everything, and it is easy to make wrong choices, which can be good for one portion of the area but not for another. We don't criticize a way of operating that focuses on the homogeneity of the project, on the common language that each of its parts must have. Even dividing the intervention area into all its smaller components (green areas, built-up areas, paved areas) it is possible to operate different tools that share construction materials, techniques and the common goal of ensuring the best usability of the environments. The redevelopment project it's complete if each of the strategies adopted responds to the demand for functional improvement and new quality spaces supply.

The case of Turin high school buildings provided us with a concrete case study, especially due to the Covid-19 pandemic, which has definitively pushed us to rethink the design of public spaces, no matter if they are indoor or outdoor. The American journalist John Seabrook of The New Yorker, in an article published on February 2021 questioned what the function of an office was, highlighting how

“the digital resources that now allow many workers to do their jobs from home had made it possible to come into the office and spend all day online¹”. So he was asking “what is the utility of an office if all the work can be done from home? Is it possible to completely rethink the way they are designed today? The answer to the question is simpler than expected, but in addition to point out problems of a personal nature such as the increased pressure that resides in working from home and the vulnerability of information that travels on the web (for which the walls of an office archive can be an impregnable stronghold), offices are also made of the energy that is established among colleagues, in the informal meetings, between desks: “ideas take place in the least expected places”. The discourse can apply to school in the same way: the months of pandemic have shown us that distance learning can be easily done. So why keep talking about schools? What are they for?

This text repeated several times that good teaching and the quality of studies are consequent to the good relationship that grows between students-teachers-places of learning. School students will certainly not have had the opportunity to read Seanrook's article to understand the importance of the relationship between human beings: they understood this already a few months later, when the worst months of the pandemic were over and governments opted for a return to the classroom. And Seabrook's article had not yet been published.

The confused response of the institutions (which seems for the moment to dwell on a safe return only inside the school buildings) has pushed us to act, to rethink the external spaces of the school from the beginning, to provide a less risky alternative to traditional teaching inside the classrooms.

The demonstration that this text has provided regarding the adaptability of school outdoor spaces to carry out teaching activities, even if apparently inadequate to host it, makes us understand how powerful the tool for analysing the opportunities / weaknesses of public spaces is. And moreover, it teach how the conception of a new type of use for the school outdoor spaces could offer new opportunities even in neighbourhoods where they are not very present due to the high build-

¹ Seabrook John, *Has the Pandemic Transformed the Office Forever?*, in *The New Yorker*, in <https://www.newyorker.com/magazine/2021/02/01/has-the-pandemic-transformed-the-office-forever>, accessed on 05/11/2021.

ing density. The analysis has also demonstrated far and wide the potential of the school external spaces as suitable places to implement a new type of teaching and, even if minimally, also how the discretization of the parts can be applied to the buildings themselves, working on their components (internal dividers, exteriors, roofs, floors). It is possible to regenerate the components opting for the search of a common language, to be found in the materials, in the approach techniques and in the purpose that each of the proposals conceived would have. The work done is valuable in two aspects, since on the one hand it encourages research in the true sense of the word, studying the city and questioning it to find every possible case study or people community that needs it, and secondly it proposes concrete ideas, without focusing only to “document facts”.

At the end of the work it therefore seems right to dwell on the reached steps, to offer an useful overview to those who decide to continue the work documented here but also to those who will have the opportunity to deal with a urban regeneration project in the future.

Data collection, management and interpretation

The research work starts with the available data collection, searching for them in digital and non-digital archives, and then moving towards a more personal way of processing them, through an individual interpretation key.

This is useful to boost up the achievement of a result, interpretation or deduction. For some, the reorganization of data means translating them into graphic form (for the urban planner or architect the language of “maps” is almost the rule), but it also means building abacus, enclosing quantities in graphs, schemes and matrices. Everything can be useful. Just collect your data!

Recurrent typologies: spreading regeneration ideas

Keeping the archives at hand and exposing them to a critical review, prepares the mind to operate the next step of cataloguing data in order to identify categories of recurring objects, similar in shape and characteristics: the categories of recurring

objects collect groups objects that in the future can be “treated” in a similar way, applying the same design principles.

It is a useful work of discretization, which in the case of the work carried out for this thesis, has identified “types” of recurrent schools within the city urban fabric, similar in shape, insertion in the urban grid and relationship with the surrounding built environment.

This allowed us to significantly resize the regeneration work we had in mind, making us realize that, actually, it would have been enough to operate on the most recurrent types, better if representative of all the identified categories, to guarantee the maximum spread to the regeneration intervention.

In fact, on a total of 79 schools in Turin, it was enough to identify three case studies to ensure that the regeneration work reached 41 case studies on a total of almost 80 buildings, 42% of the total.

The typologies would certainly not have covered all the schools in the city, since in that case it would have been more convenient to work on more categories of objects and the time available would certainly not have been enough. But we consider the 42% achieved is suitable to provide a good example, a “modus operandi” for those who will continue this work after its conclusion and can apply it to other studies, or even just to complete the work done to the rest of the city’s high schools.

Regeneration projects: rethinking architecture rules

After the end of analysis and cataloguing work comes the designing phase itself, which will aim to propose concrete ideas for representative case studies. In this phase, a role of great importance will derive from the analysis of the existing spaces, the flows and the circularity that the current high school architecture building can offer. It is necessary to approach the plot to a smaller scale, proposing solutions to the critical issues recounted, without necessarily arriving at the definition of technical details. It is a first step where, basically, we can get rid of the rigid design rules, to produce ideas, find new tools and, perhaps, to find new criteria for the regeneration of any kind of spaces, either indoor or outdoor.

Regeneration today for tomorrow: a spatial toolkit through time

The work's goal, as we wrote right away, was to catalogue and collect information and, to approach the end of this work, it's in the same way that we want to conclude the last step of the "modus operandi": the toolkit collect practical ideas, such as (to name a few previously exposed in the document) the re-paving of interiors, the reuse of the roofs or the general rethinking of building elements like roofs, façades, windows.

What we propose to do is to collect ideas, identificate the "strategies" and devices that make them alive, and at the end collect them in a "toolkit" to hand.

The toolkit can be considered as a collection from which you (and the ones after you can) can draw solutions to be applied to case studies and spread the work of regeneration.

Regeneration projects results

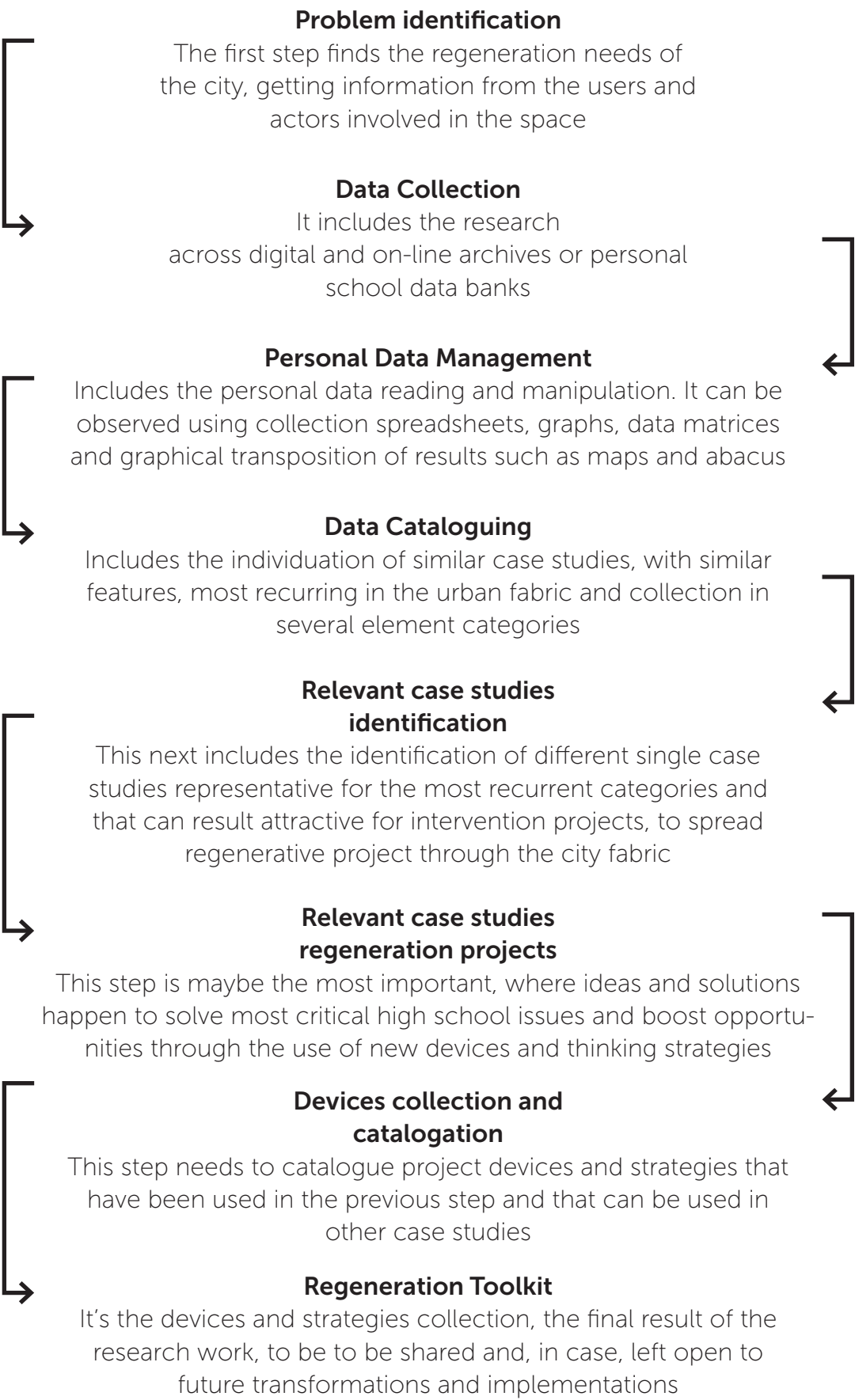
Urban regeneration projects never end with the achievement of pure redevelopment of spaces, repainting rusty buildings or adding greenery in areas once mainly paved. In fact, even if regeneration project are very attractive from the aesthetics point of view (and pay attention, the aesthetics of the project isn't a component to not examine) a good work of regeneration can be considered complete when it proposes new alternative spaces to the communities, which can be used in addition to the ones already existing in the areas, even better if they make accessible areas once private or considered un-accessible.

In the presented projects we have often imagined an alternative use of outdoor spaces, trying to go beyond the stationary way of intending them: is it possible to rethink schools beyond educational functions? We could answer yes, but only after a case-by-case analysis: the didactic functions can be integrated with other forms of teaching, making students understand that you do not necessarily learn (and grow) behind a desk and in front of a school chair, but also at the cinema, festivals, sporting events, public talks.

Will the users of the school spaces necessarily be teachers, students and school

staff? A school space is practiced by parents, while school conferences and assemblies also welcome other users, who do not necessarily attend school building every day. So the question may become: is it possible to make the stay of temporary users more enjoyable? Could the school for our students and it's normal users can be more than a stationary place that you reach in the morning and leave in the early afternoon? To answer those questions, that involve both users and building architecture, analysing the existing distribution and evaluating new plans for the relocation (if necessary) of functions, we may evaluate new teaching ways and involve areas until now apparently excluded or considered unsuitable. Areas that, if the school is implemented with new activities, must be suitable to host them.

Brief summary of high school regenerative process



Bibliography

- Secchi L. Luigi, "Edifici scolastici italiani primari e secondari: norme tecnico- igieniche per lo studio dei progetti", Milano, Hoepli , 1927,
- Sitte Camillo, Dodi Luigi, "L'arte di costruire le città", Milano, Vallardi, 1953
- Dewey John, "Scuola e società", Firenze, La Nuova Italia, 1967, pp. 21-22,
- Merle R ; Landes, Jack L, "Planning functional school buildings", New York, Harper, 1957,
- Visalberghi Aldo, "Apertura del dibattito; per una pedagogia dell'ambiente", Casabella n.245, nov. 1960
- Romanini Luigi, "Costruire scuole. Esigenze pedagogiche nell'edilizia scolastica", Milano, Garzanti, 1962,
- Isabella Ferdinando, "L'edilizia scolastica in Italia. Precedenti e prospettive", La Nuova Italia, Firenze, 1965
- Anna Laura Fadiga Zanatta, "Il sistema scolastico italiano", Bologna, Mulino, 1971,
- Gozzer Giovanni, "Rapporto sulla secondaria: la riforma degli istituti secondari superiori nel dibattito politico e culturale dal 1950 al 1973", Roma, Coines, 1973,
- Oddo Biasini, "Scuola secondaria superiore: ipotesi di riforma" (prefazione di Giovanni Spadolini), Roma, Ed. della Voce, 1973, pp. 83-87,
- Henri Janne, Lucien Geminard, "Rapporto sulla scuola secondaria superiore", Roma, Armando, 1974,

- Telmon Vittorio, "La scuola secondaria superiore", Firenze, La Nuova Italia, 1975,
- Guiducci Roberto, Guiducci Giuliano, Minoli Lorenza, "La scuola superiore in Italia: problematica e fabbisogni nella prospettiva di sviluppo e di riforma", Milano, ISEDI, 1976,
- Remine Nicola, Buscemi Giuseppe, "L'edilizia scolastica: problemi, prospettive, legislazione", Firenze, Le Monnier, 1976,
- Magnaghi Alberto, "Programmazione per l' edilizia scolastica: indicazioni tipologiche, tecnologiche e procedurali per la formulazione di un capitolato prestazionale nella scuola secondaria superiore", Milano, Franco Angeli, 1983,
- Maddalena Benzi, "Un sistema edilizio per la scuola secondaria superiore", Bologna, Parma, 1980,
- Daprà Mario, "La fondazione dell' edilizia scolastica in Italia", Firenze, Le Monnier, 1987,
- Sole Maurizio, "Manuale di edilizia scolastica", NIS Italia Scientifica, Roma, 1995,
- Massa Riccardo, "Cambiare la scuola: educare o istruire?", Bari, Laterza, 1997,
- Turri Eugenio, "Il paesaggio come teatro: dal territorio vissuto al territorio rappresentato", Venezia, Marsilio, 1998,
- Koolhaas Rem, Mau Bruce, Werlemann Hans, Sigler Jennifer, "S, M, L, XL: Office for Metropolitan Architecture", OMA firm, New York, The Monacelli press, 1998,
- Bongiovanni Bruno, "Il Sessantotto studentesco e operaio", in Nicola Tranfaglia (a cura di), "Storia di Torino. Gli anni della Repubblica", Vol. IX, Einaudi, Torino

1999,

- Dudek Mark, "Architecture of schools: the new learning environments", Oxford, Architectural Press, 2000,
- Adams Nicholas, "Skidmore, Owings & Merrill: SOM dal 1936", Milano, Electa, 2006,
- Ford Alan, "Designing the sustainable school", Mulgrave, Victoria, Images Pub, 2007,
- Hertzberger Herman, "Space and Learning: Lessons in Architecture. 010 Publisher, Rotterdam, 2008
- Giangrande Alessandro, Guidetti Gabriella, Mortola Elena, "Spazi didattici all'aperto: un processo di progettazione partecipata", Roma, Gangemi Editore, 2009,
- Tedesco Silvia, "Riqualificazione energetico ambientale del costruito: edifici scolastici", Alinea Editrice, Firenze, 2010,
- BIG, Bjarke Ingels Group, "Yes is more, un archi-fumetto sull'evoluzione dell'architettura", Köln, Taschen, 2011,
- Guglielmi Laura, Petrangeli Maurizio, "Scuole: secondarie superiori - ME Architectural Book and Review", Roma, Mancosu, 2011,
- Pezzetti Laura Anna, "Architettura per la scuola. Impianto, forma, idea", Napoli, Clean, 2012,
- Campioli Andrea, Lavagna Monica, "Tecniche e architettura", Torino, Città Studi, 2013,
- Fägerstam Emilia, "High school teachers' experience of the educational po-

tential of outdoor teaching and learning", Journal of Adventure Education and Outdoor Learning, 2013,

- Pepe Domenico., Rossetti Massimo., "La riqualificazione energetico-ambientale degli edifici scolastici", Maggioli, Santarcangelo di Romagna, 2014,
- Crespi Manuela, Sole Maurizio, "Edilizia scolastica", Dei Tipografia del Genio CiCivile, Roma, 2014
- Campobenedetto Daniele, "Dall'aula al paesaggio educativo: ipotesi sulle trasformazioni e le potenzialità del patrimonio edilizio scolastico in Italia.", contributo per il rapporto della Fondazione Agnelli dedicato all'architettura scolastica, 2015,
- Borri Stefano, "Spazi educativi e architetture scolastiche: linee e indirizzi internazionali", Indire, Firenze, 2016,
- Negro Elisa (tesista), Barelli Maria (relatrice), "Edilizia scolastica prefabbricata in Italia nella seconda metà del '900: il dibattito, i sistemi costruttivi e alcuni casi piemontesi", Politecnico di Torino, Corso di Laurea Magistrale in Architettura Per Il Progetto Sostenibile, 2016,
- Concorso di progettazione per la ristrutturazione e la riorganizzazione della Scuola Secondaria di I grado Enrico Fermi di Torino, bando di concorso, 2016,
- Gregory Paola, "Nuovo realismo, postmodernismo: dibattito aperto fra architettura e filosofia", Roma, Officina, 2016,
- Castoldi Mario, "Ripensare la scuola: un'esperienza di progettazione partecipata", Form@re Open Journal per la formazione in rete, 2017,
- Weyland Beate, "Progettare scuole insieme: strategie e processi tra spazi e didattiche", in Attia Sandy, Weyland Beate, Prey Kuno, "Progettare scuole insieme.

Tra pedagogia architettura design", Edizioni Guerini, Milano, 2018,

- Giunti Chiara, Orlandini Lorenza, Laura Tortoli (a cura di), "Avanguardie educative". Linee guida per l'implementazione dell'idea "Dentro/fuori la scuola - Service Learning", Indire, Firenze, 2018,
- Barelli Maria, Gregory Paola, "Qui abito. A partire dalla scuola: storie di famiglie e di quartiere per immaginare il futuro della comunità": Progetto vincente del Bando pubblico "AxTO" (Azioni per le periferie torinesi), 2018,
- Caruso Maria Girolama, Cerbara Loredana, Menniti Adele, Misiti Maura, Tintori Antonio, "Sport e integrazione sociale. Indagine sulle scuole secondarie di secondo grado in Italia", Roma - Consiglio Nazionale delle Ricerche - Istituto di Ricerche sulla Popolazione e le Politiche Sociali. (IRPPS Working papers n. 108/2018), 2018,
- Hofmeister Sandra, "School buildings: spaces for learning and the community", München Detail; 2021,
- Robiglio Matteo, "Re-USA: 20 American Stories of Adaptive Reuse: A Toolkit for Post-Industrial Cities", Jovis Editorial, 2020,
- Legambiente, "XXI Rapporto sulla qualità dell'edilizia scolastica e dei servizi",
- ENEA, "Rapporto Annuale Efficienza Energetica 2020",
- Fondazione Giovanni Agnelli, "Rapporto sull'edilizia scolastica", Laterza, Roma, 2020,
- Fondazione Giovanni Agnelli, Full Polito, "Fare spazio. Idee progettuali per riaprire le scuole in sicurezza.", Torino, 2020,
- Berghauser Pont Meta, Haupt Per, "Meta Spacematrix: space, density and urban

form", Rotterdam: nai010, 2021,

- Fianchini Maria, "Progettare scuole in scenari innovativi", TECHNE 21 | 2021, Firenze University Press.

Sitography

- Anagrafe dell'Edilizia Scolastica, <https://www.regione.piemonte.it/web/temi/istruzione-formazione-lavoro/edilizia-scolastica/anagrafe-edilizia-scolastica>, accessed on 15/08/2021,
- Ministero dell'Istruzione Ministero dell'Università e della Ricerca Portale Unico dei Dati della Scuola, <https://dati.istruzione.it/opendata/>, accessed on 05/05/2021,
- Ministero dell'Istruzione Ministero dell'Università e della Ricerca, Portale Scuola in Chiaro, <https://www.miur.gov.it/-/scuola-in-chiaro>, accessed on 20/07/2021
- Geoportale della Città di Torino, <http://geoportale.comune.torino.it/web/>, accessed on 05/05/2021,
- Geo-Piemonte, Geoportale della Regione Piemonte, <https://www.geoportale.piemonte.it/cms/>, accessed on 23/09/2021,
- Piano Attuativo #Italiasicura, <http://mappa.italiasicura.gov.it/#/home>, accessed on 07/06/2021, accessed on 31/11/2021
- Indagine sulla morfologia urbana di Torino, Caratteri dell'indagine sulla morfologia del tessuto urbano, in <https://www.landscapefor.eu/component/k2/60-sul-campo-per-piani/108-l%E2%80%99indagine-sulla-morfologia-urbana-nel-quadro-della-ricerca-sulle-periferie-per-il-prg-di-torino?Itemid=121-&limit=1&start=1>, accessed on 20/05/2021,
- Archivio Storico della Città di Torino, <http://www.comune.torino.it/archivios-torico/>, accessed on 16/07/2021,
- MuseoTorino, <https://www.museotorino.it/site>, accessed on 10/08/2021,

- Citta' Di Torino, Servizio Centrale Consiglio Comunale, Raccolta Dei Regolamenti Municipali, Regolamento Edilizio, <http://www.comune.torino.it/regolamenti/302/302.htm#art36b>, accessed on 08/11/2021,
- Nierenberg Amelia, "Classrooms Without Walls, and Hopefully Covid. 4 Examples of successful outdoor teaching environments", in The New York Times, <https://www.nytimes.com/2020/10/27/us/outdoor-classroom-design.html?smid=wa-share>, November 2020, accessed on 11/07/2021,
- Hayhurst Chris, "Successful Examples of Higher and Outdoor Learning Spaces", EdTech Magazine, <https://edtechmagazine.com/higher/article/2021/01/successful-examples-higher-ed-outdoor-learning-spaces-perfcon>, accessed on 15/07/2021,
- Pezzetti Laura Anna, Khanamiryan Helen, "Accelerating Innovations, Wellbeing and Regualification of School Buildings after the Pandemic. Towards a "New Extraordinary", in Magazine del Festival dell'Architettura, <https://www.famagazine.it/index.php/famagazine/article/view/490/1414>, accessed on 25/10/2021,
- PLANT EN HOUTGOED, Landscape Design Studio, <https://www.plantenhoutgoed.be/>, accessed on 29/11/2021,
- Brady Becky, "The Value of Outdoor Environments to K-12 Learning, Health, and Student Safety", in Clarknexsen, <https://www.clarknexsen.com/blog-value-of-outdoor-environments-to-k-12-learning-health-and-student-safety/>, accessed on 15/10/2021,
- Atelier di progettazione, Spazi innovativi: ambienti per la didattica, mense e cortili sono i tre temi progettuali al centro del workshop di progettazione applicato a 4 scuole torinesi, in Fondazione per l'architettura, <https://www.fondazione-perlarchitettura.it/processi-di-qualita/atelier-progettazione/spazi-innovativi-apprendimento/>, accessed on 14/09/2021.

- Ørestad High School (Ørestad Gymnasium), <https://oerestadgym.dk/>, accessed on 01/11/2021,
- Piedmont Hills High School Science and Life Skills Complex / LPA Architects, https://www.archdaily.com/969697/piedmont-hills-high-school-science-and-life-skills-complex-lpa?ad_medium=gallery, accessed on 01/11/2021,
- JPE Design Studio, Marryatville High School Learning Centre, <https://www.jpe.com.au/projects/marryatville-high-school-learning-centre>, accessed on 01/11/2021,
- Gjerdrum High School / Østengen & Bergo AS, <https://www.archdaily.com/131182/gjerdrum-high-school-%25c3%25b8stengen-bergo-as>, accessed on 02/11/2021,
- Animo South Los Angeles High School / BROOKS + SCARPA, https://www.archdaily.com/895565/animo-south-los-angeles-high-school-brooks-plus-scarpa?ad_medium=gallery, accessed on 02/11/2021,
- Campus Symbiosis ICS Milan International School / Barreca & La Varra, https://www.archdaily.com/970897/campus-symbiosis-ics-milan-international-school-barreca-and-la-varra?ad_medium=gallery, accessed on 05/11/2021,
- SET Architects' Climbing-Frame Inspired Sassa School Prioritizes Adaptability, https://www.archdaily.com/910101/set-architects-climbing-frame-inspired-sassa-school-prioritizes-adaptability?ad_medium=gallery, accessed on 09/11/2021,
- Città metropolitana di Torino, "Edilizia scolastica: massimo impegno e attenzione alla sicurezza", in <http://www.cittametropolitana.torino.it/cms/comunicati/edilizia-scolastica/edilizia-scolastica-la-citta-metropolitana-conferma-il-massimo-impegno-e-l-attenzione-alla-sicurez>, accessed on 24/01/2022,

- Marco Beton, "Dad, trasporti e sicurezza sanitaria: la rabbia degli studenti sfila in piazza a Torino", in <https://www.torinoggi.it/2021/01/29/amp/argomenti/scuola-e-lavoro/articolo/dad-trasporti-e-sicurezza-sanitaria-la-rabbia-degli-studenti-sfila-in-piazza-a-torino-foto.html>, accessed on 03/04/2021,
- John Seabrook, "Has the Pandemic Transformed the Office Forever?", in The New Yorker, in <https://www.newyorker.com/magazine/2021/02/01/has-the-pandemic-transformed-the-office-forever>, accessed on 05/11/2021,
- Fumo Piero, "I padiglioni scolastici nei parchi: trasformazioni tecnologiche e nuove tipologie", UniRoma Sapienza, <https://www.google.com/url?sa=t&rct=-j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwi-F3abtx9b1AhXJQvEDHYKsBmEQFnoECACQAQ&url=https%3A%2F%2Fweb.uniroma1.it%2Farchiscuole%2Fsites%2Fdefault%2Ffiles%2Ffumoll.pdf&usg=AOvVaw0L-Wv9Buzp3DlxNMbelKke>, accessed on 06/11/2021,
- L'adolescente Montessori, in <https://www.montessorinet.it/adolescenza/l-adolescente-montessori.html>, accessed on 28/01/2022,
- Buschi Alessandra, "Le Principali Riforme Della Scuola Italiana", in <https://tracedistudio.it/5663/riforme-della-scuola.html>, accessed on 21/01/2022,
- De Pasquale Dario, "Le riforme scolastiche degli anni '60 - '70 - '80 - '90", in <https://dariodepasquale.it/la-scuola-italiana-nella-storia-le-riforme-scolastiche-degli-anni-70-90/>, accessed on 21/01/2022,
- Archivi Polo del '900, <https://archivi.polodel900.it/>, accessed on 28/01/2022.
- Decreto ministeriale (Ministero dei lavori pubblici) 18-12-1975, in <https://www.indicenormativa.it/norma/urn%3Anir%3Aministero.lavori.pubblici%3Adecreto%3A1975-12-18>, accessed on 23/01/2021

- Tola Elisabetta, "La lunga marcia dell'alfabetizzazione", <https://archivoscienzescuola.zanichelli.it/diamo-i-numeri/2012/09/24/la-lunga-marcia-dellalfabetizzazione/>, accessed on 23/01/2022,
- "Re-Opening - Una scuola di quartiere" project, promoted by ACMOS association, in <https://acmos.net/scuoladiquartiere>, accessed on 09/02/2022.

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