"IN-NOVA SCHOLA" - Concorso di progettazione in due gradi per la realizzazione del polo scolastico di Gignano - Torreta - Sant' Elia, L'Aquila

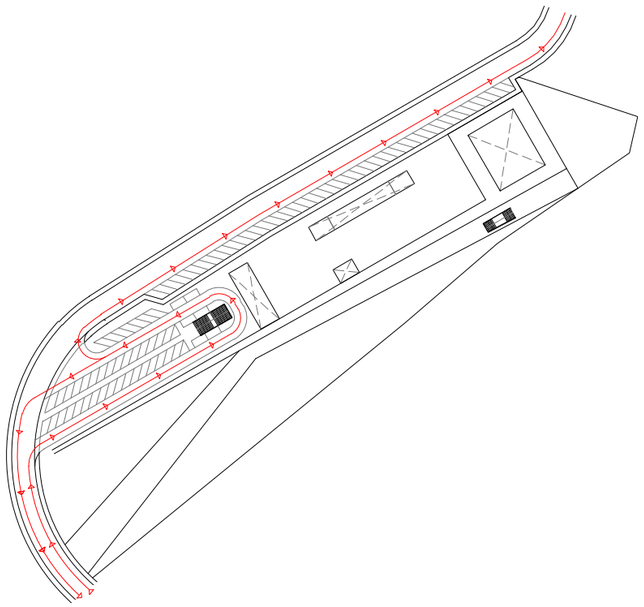
17 pages

Located in the Southeast of L'Aquila city centre completely immersed in the valley, the plot enjoys privileged views and a unique sun exposure. It is flanked on the one side by “Monte Velino” and “Monte Sirente”, on the other by “Monti della Laga” and “Gran Sasso d'Italia”.

Its immediate neighbors are a small water line to the north and “Via Manieri” that flanks it to the southeast.

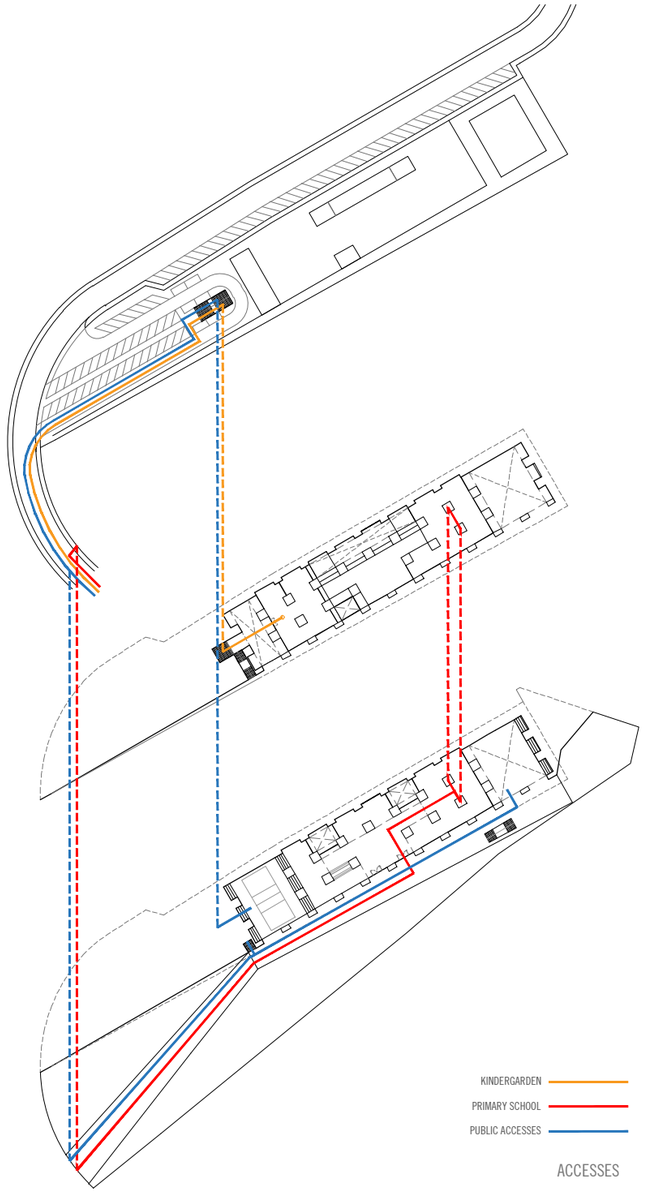
The school building is the first public equipment with which the learner contacts as a user, hence a first educational experience lies within the framework of respect for a collective good, an object with rules of coexistence and use that must endure throughout the life as citizens. And also, the community owes to the school building an equal attitude of appreciation and affection for what it represents as an initiatory and symbolic pole of citizenship and personal accomplishment.

It is also an importante premisse to seek conscious enviromental choices when designing such a building. Therefore, the project seeks to induce a recharge of groundwater through strategies of water fixation in soils that go from the maximization of the permeable areas occupied by arboreal, shrub and herbaceous vegetation; to the use of porous floors. These are the key issues for the prevention of soil erosion, which in this case are extremely vulnerable to the steep slopes of the hill.



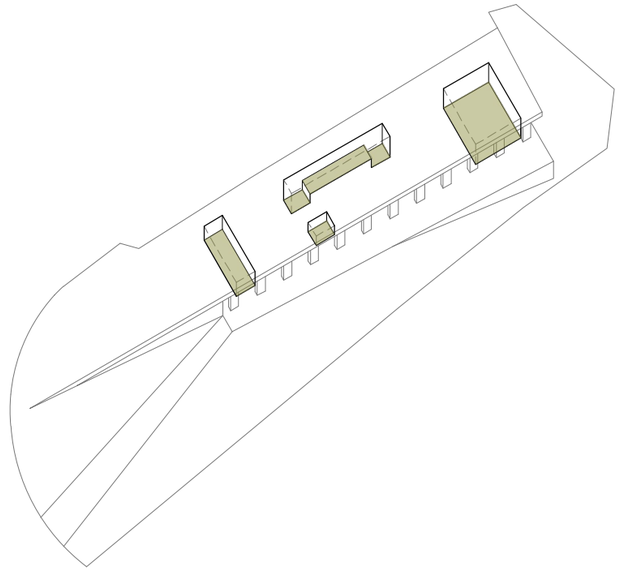
OUTDOOR TRAFFIC CIRCULATION

The idea that a “school building” has the characteristics normally required of a teacher, seems at first sight, illogical. Its architecture is supposed to be silent, unchanging and at the same time capable of surviving its use, for a definite or undetermined time. However, a building is able to communicate ideas, perceptions and knowledge as well as a teacher.



ACCESSES

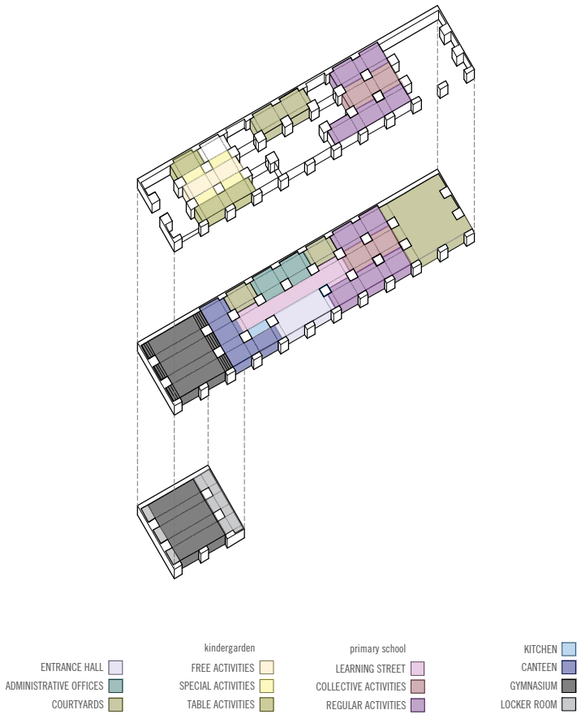
It is from this concept of an anonymous container, of an assembly space, of "Agora", that the project for the School Campus of Gignano - Torretta - S.Elia in L'Aquila is born.



COURTYARDS

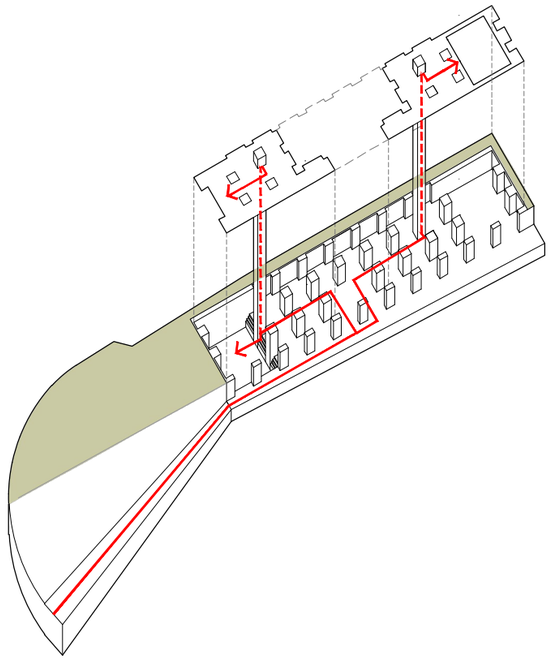
The design promotes the idea of a unitary space, socially inclusive and programmatically open that develops and articulates with the exterior spaces. It is a volume that raises from the different altimetric dimensions and topography of the lot, like a belvedere.

VIEW OF THE INTERIOR | FUNCTIONAL PROGRAM



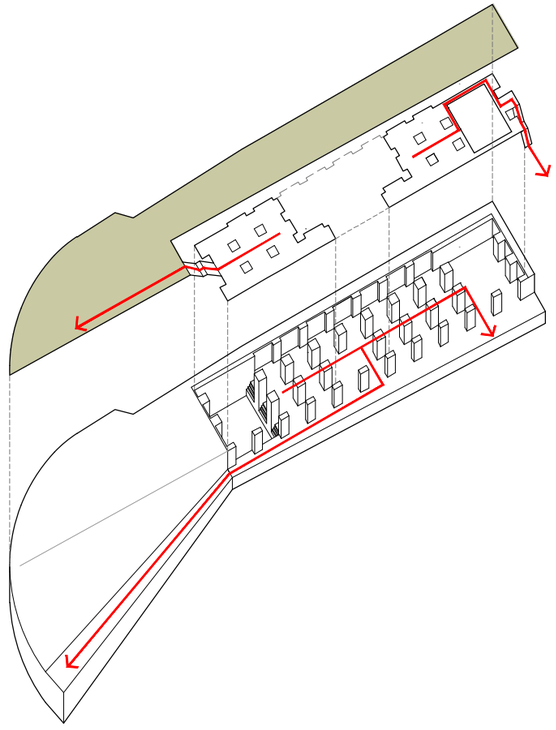
PROGRAM

Given the Northern orientation of the lot (whose light is considered exceptional for school and work spaces), the rooftop garden is marked by the presence of several courtyards that will complement with natural lighting from the South and create outer spaces more sheltered from the dominant winds.



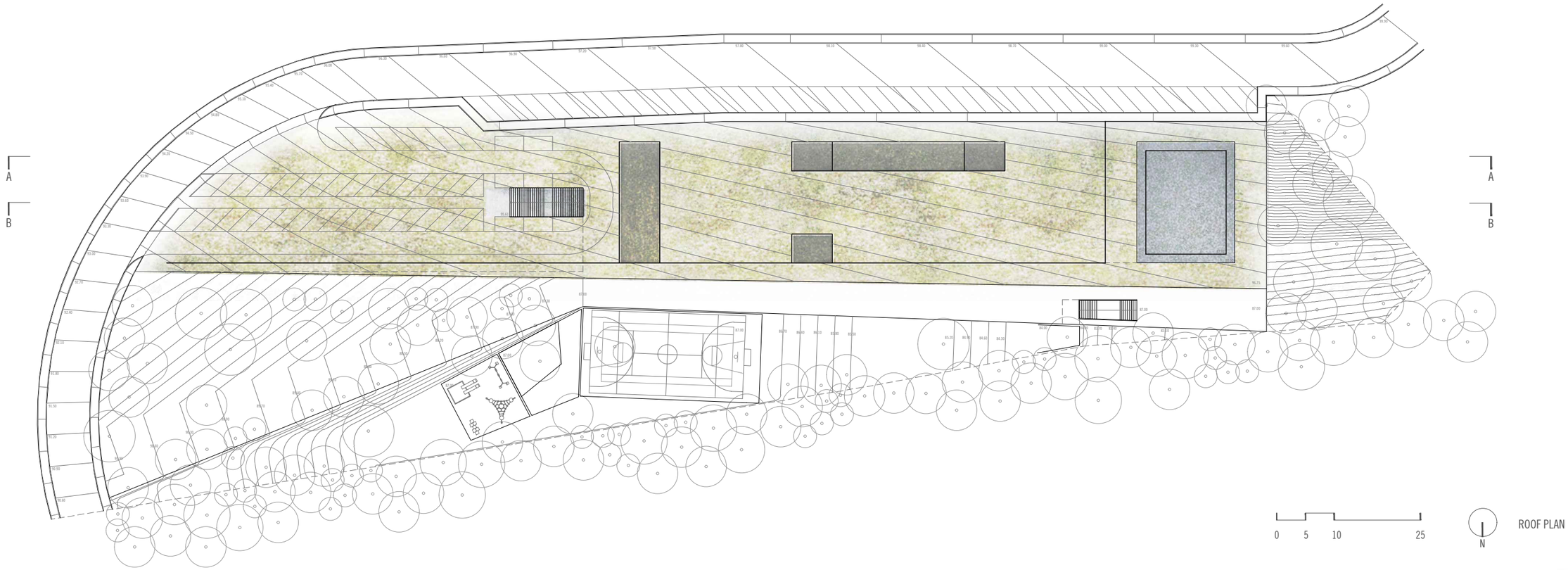
ACCESSIBILITIES

The institutional entrance of the school is done by the most favourable area of the lot to the East. A walking path unfolds in a “central atrium” with a double height ceiling, where the administrative core is located.. It is from this “atrium” that a “Learning Street” is created to where the whole program of the schools turns to, connecting the Gymnasium to a more informal playground to the West.

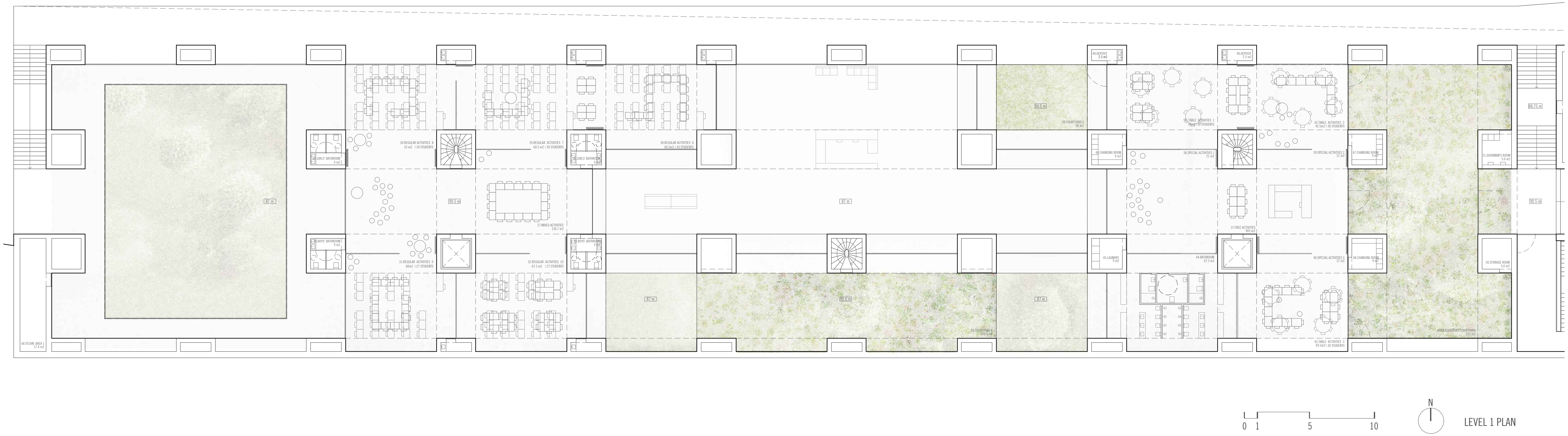


EVACUATION

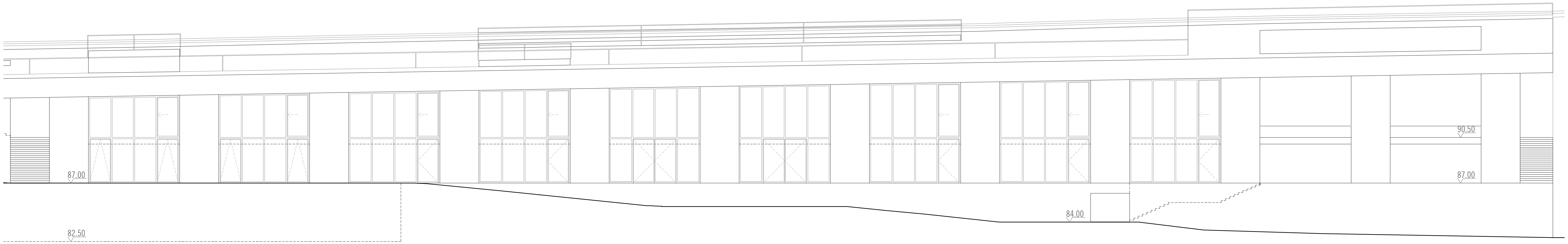
Programmatic “pillars" allow you to collect acoustic partitions, and thus adopt traditional or more innovative learning occupancy postures simultaneously.



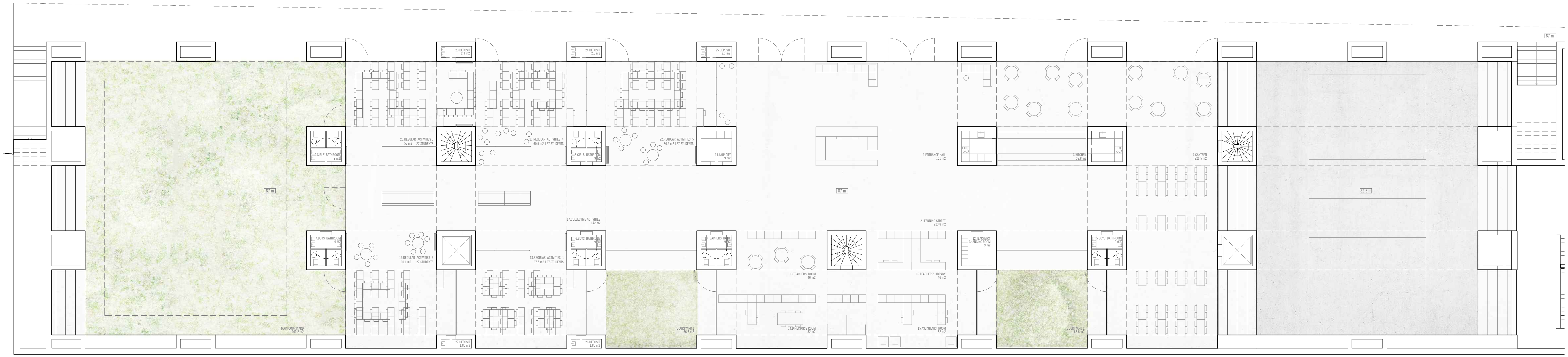
ROOF PLAN



LEVEL 1 PLAN



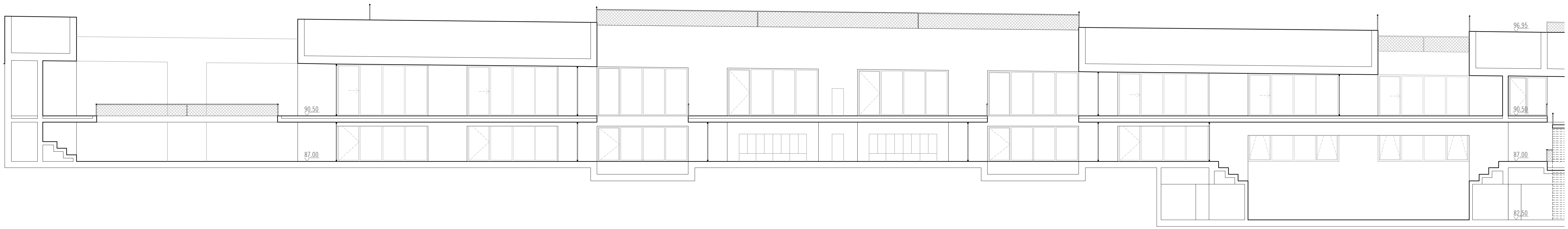
NORTH FACADE



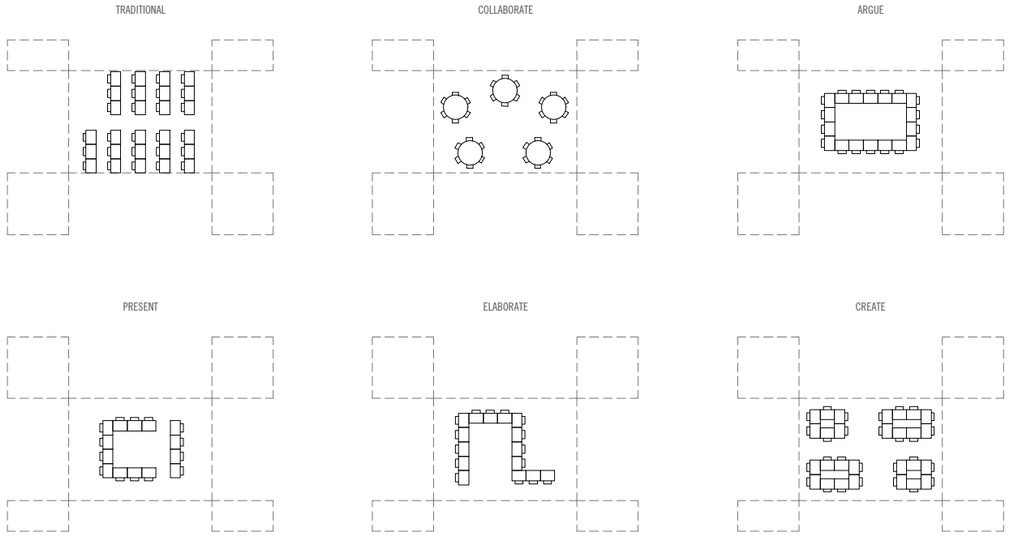
0 1 5 10

N

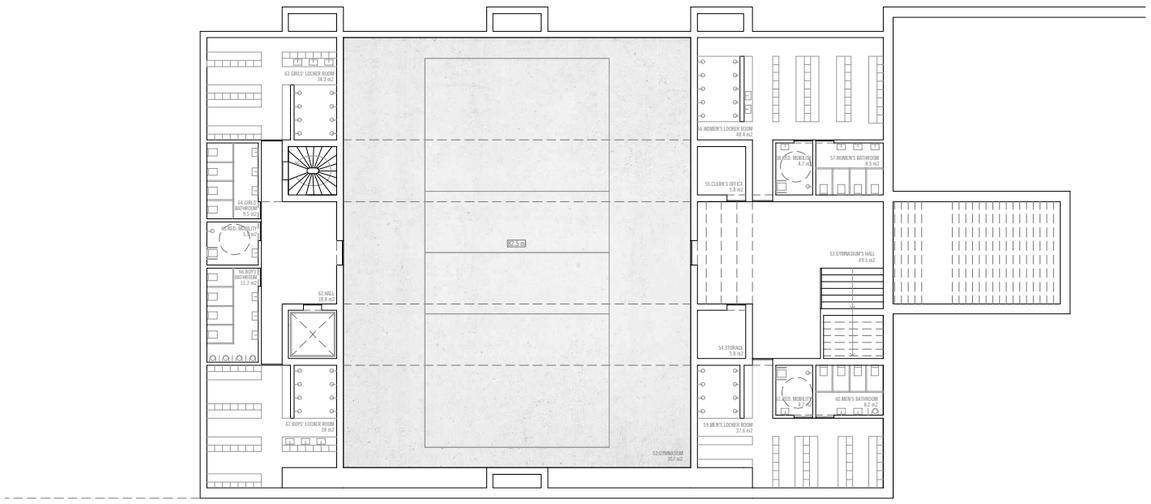
GROUNDFLOOR PLAN

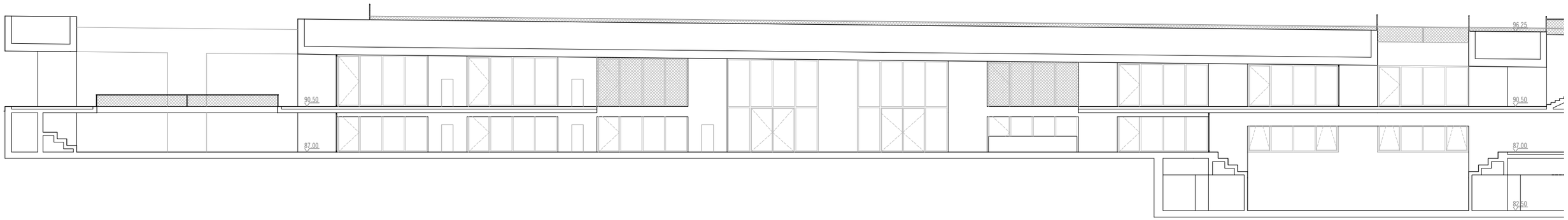


SECTION A

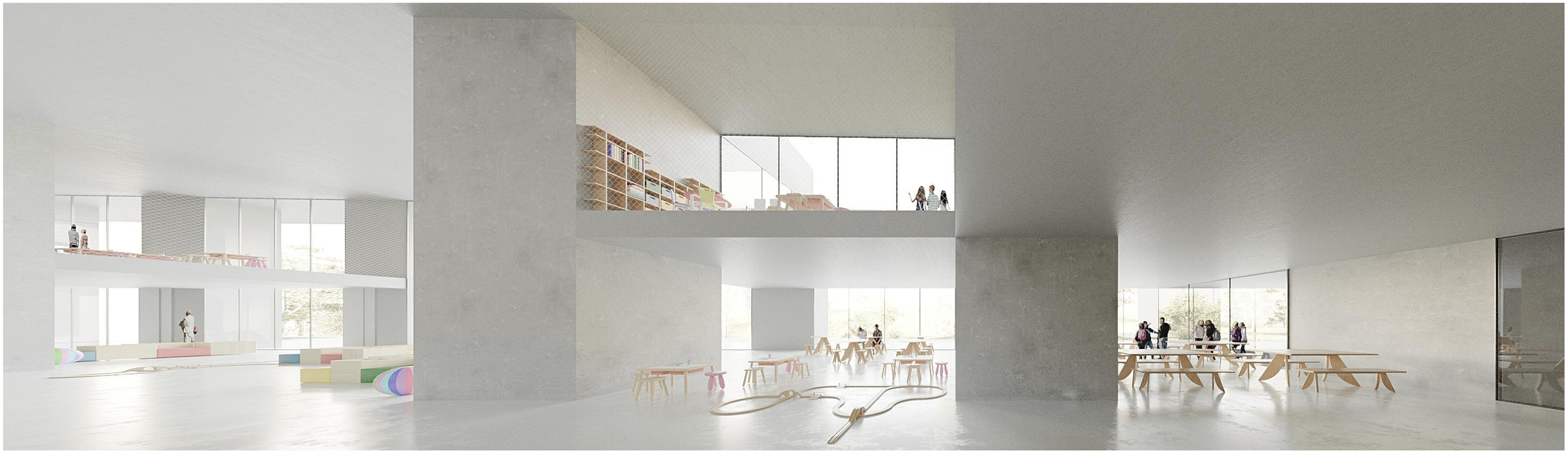


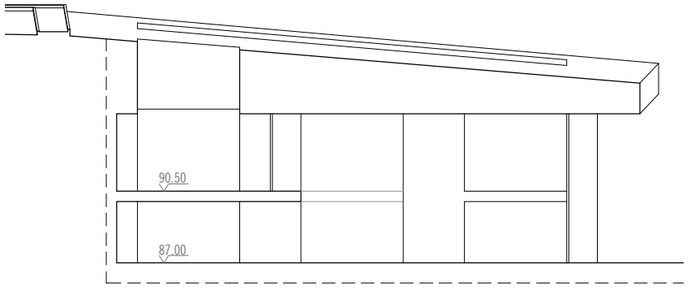
FLEXIBLE CLASSROOM ARRANGMENT FOR DIFFERENT ACTIVITIES



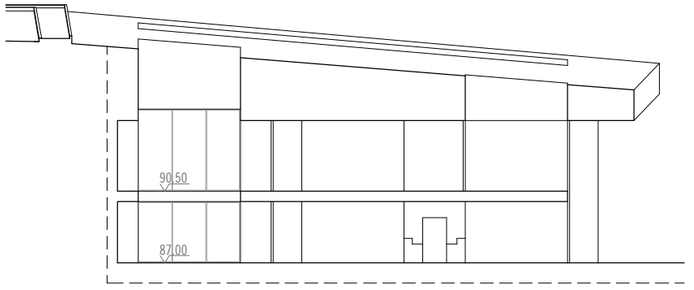


SECTION B

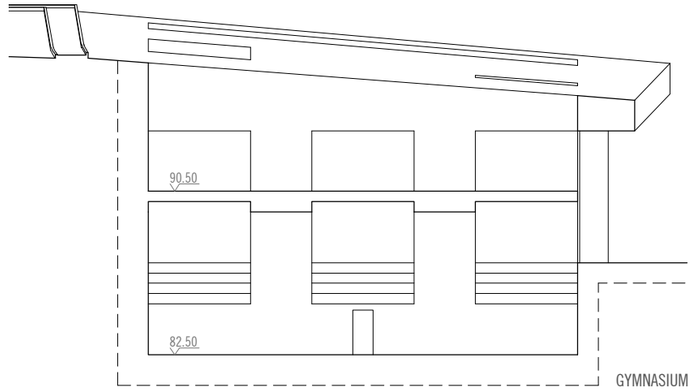




TEACHERS' COURTYARD



SOCIAL AREAS



GYMNASIUM

The objective of respecting environmental components is pursued through a design strategy that is translated into precise choices such as:

- Construction of a building distributed in only 2 levels, easily accessible from the natural dimensions of the lot to minimise the impact of the volumetric masses.

- Use of prefabricated concrete elements, widely recyclable, environmentally friendly and aesthetically sensible.

- Use of dry technologies and elements to reduce the impact of construction site, accelerate construction, ensure a high level of ease of maintenance and easy replacement of components.

- Maximum performance, correct room orientation, balanced ratio of empty and full spaces, only natural light inlet and protection systems for the most exposed fronts.

- Simple geometries and in harmony with the surroundings , reserving the role of building recognition as an important public garrison for some elements such as the "Agora" gallery.

- Maximum opening for the community at all times, designing a typo-logically distributed building, in order to guarantee the separation of the parts in physical and technological terms.

VIEW OF THE NORTH FACADE I SUSTAINABLE AND TECHNOLOGICAL SOLUTIONS

Prunus Avium
(CILIEGIO SILVATICO)

Sorbus Aria
(SORBO MONTANO)

Fraxinus Excelsior
(FRASSINO MAGGIORE)

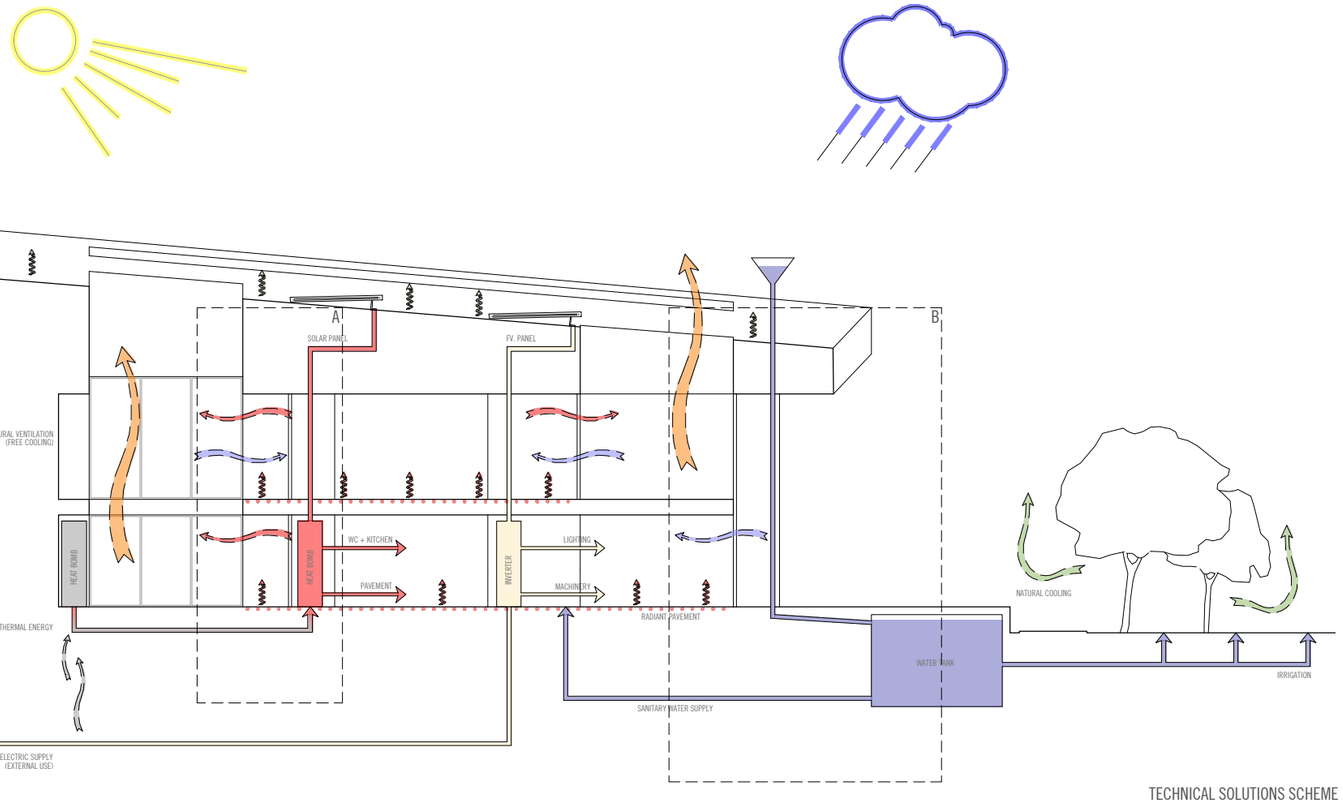
Fagus Sylvatica
(FAGGIO)

Quercus Cerris
(CERRO)

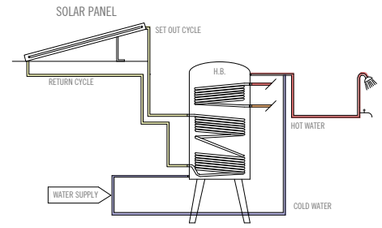
Quercus Pubescens
(ROVARELLA)

Populus Nigra
(PIOPPO NERO)

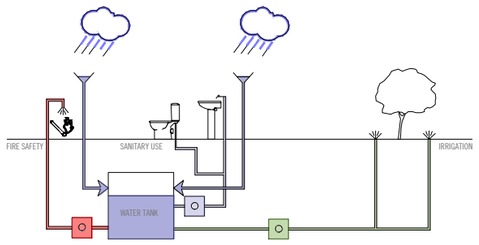
Ostrya Carpinifolia
(CARPINO NERO)



TECHNICAL SOLUTIONS SCHEME



A. HEATING SYSTEM POWERED BY SOLAR ENERGY

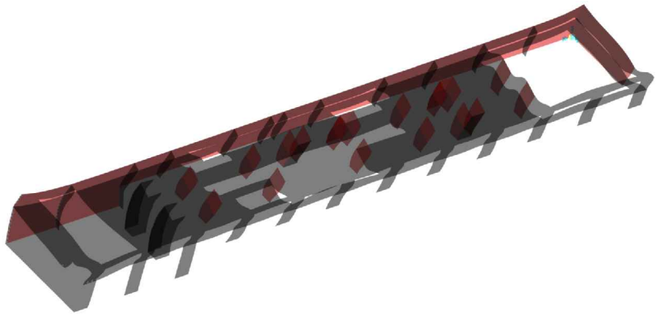


B. RAINWATER HARVESTING SYSTEM

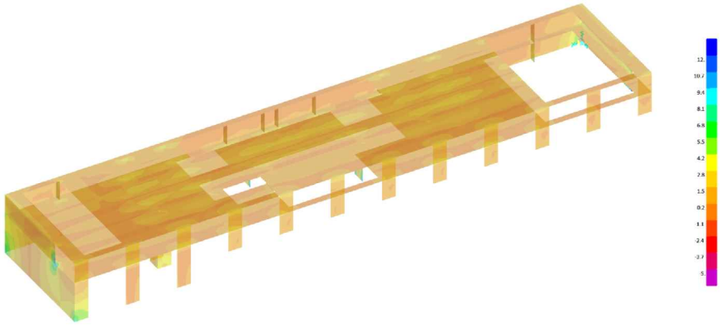
The project aims to guarantee the conservation of the habitats present in the area also through the use of native, tree and shrub species. The function of absorbing pollutants in the atmosphere and the regulation of the micro-climate through the use of vegetation were taken into account. For the most part, indigenous species have been introduced and / or compatible with the characteristics of the environment and also guarantee less maintenance. In order to minimise water and energy consumption, an automatic drip irrigation system (with water from rainwater collection tanks), powered by renewable energy sources, will be provided.

The construction phase is acritical time that affects the environmental components. The main disadvantages are related to noise levels, air pollution, vehicle circulation, the presence of airborne dust, the presence of waste and processing residues ,the separation of materials and the analyses required for the identification of any harmful materials will be provided, for the other aspects we intend to implement a series of simple measures to mitigate the impact.
The proposed design adopts as a starting point compliance with the current regulations on the use of renewable sources, and then follow the necessary requirementsto reach the level of a building with almost zero emissions.

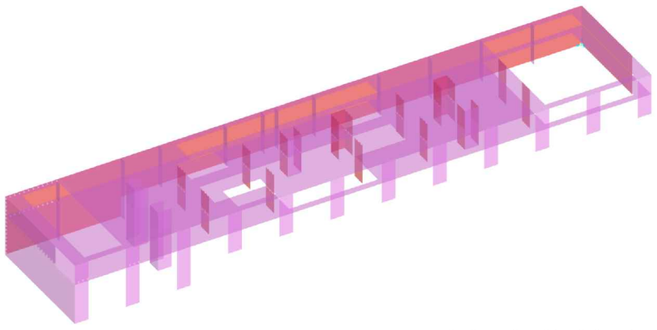
Consequently, the following is foreseen:
- The installation of solar thermal panels alongside a geothermal system ,producing the hot fluid for the sanitary hot water and for the heating system , with a very high efficiency, adequately sized to avoid overload in the summer.
- The installation of photo-voltaic panels according to its orientation, of very high performance , capable of producing the electricity necessary for the cooling and lighting systems, and also electric supply for external use on public areas
- Elimination of air pollution: planned systems using air-cooled heat pumps that do not include the use of fossil fuels
- Rainwater collection systems will also channel the water collection shell and a good part of the impermeable surfaces not subject to polluting factors towards a storage tank, from which it will draw the irrigation of green areas and, WC waste water.



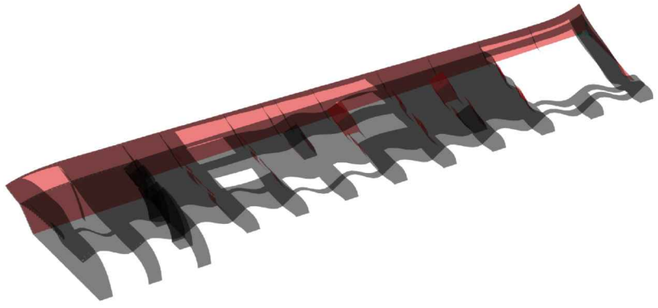
FIRST VIBRATION MODEL F= 6.3 Hz



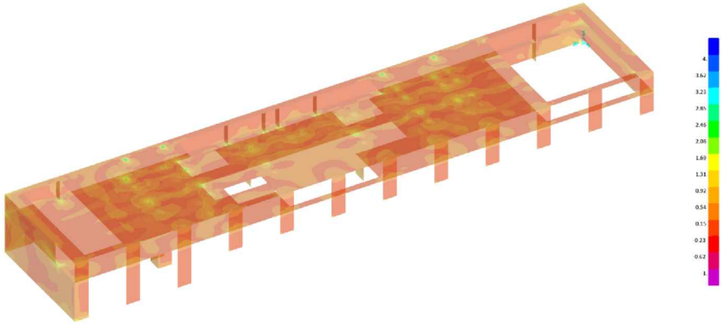
VERTICAL STRESSES (MPa)



CALCULATION MODEL GEOMETRY



SECOND VIBRATION MODEL F= 10.5 Hz



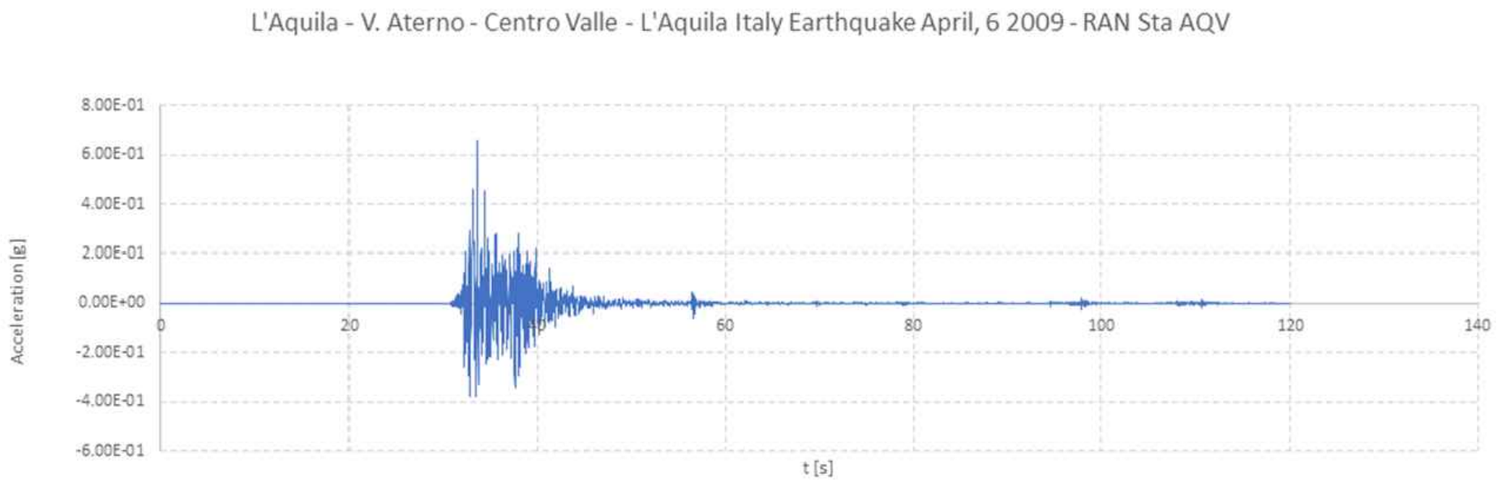
HORIZONTAL STRESSES (MPa)

The devastating and tragic L'Aquila earthquake of 6th April 2009 was a precious opportunity to learn how a moderate to strong magnitude earthquake can inflict severe damages in different types of building structures.
Site effects, combined with small focal depths and fault proximity, triggered a earthquake with a maximum recorded PGA of 0.676g which, in many cases, was very destructive for structures that were either poorly designed, had construction problems or were outdated.

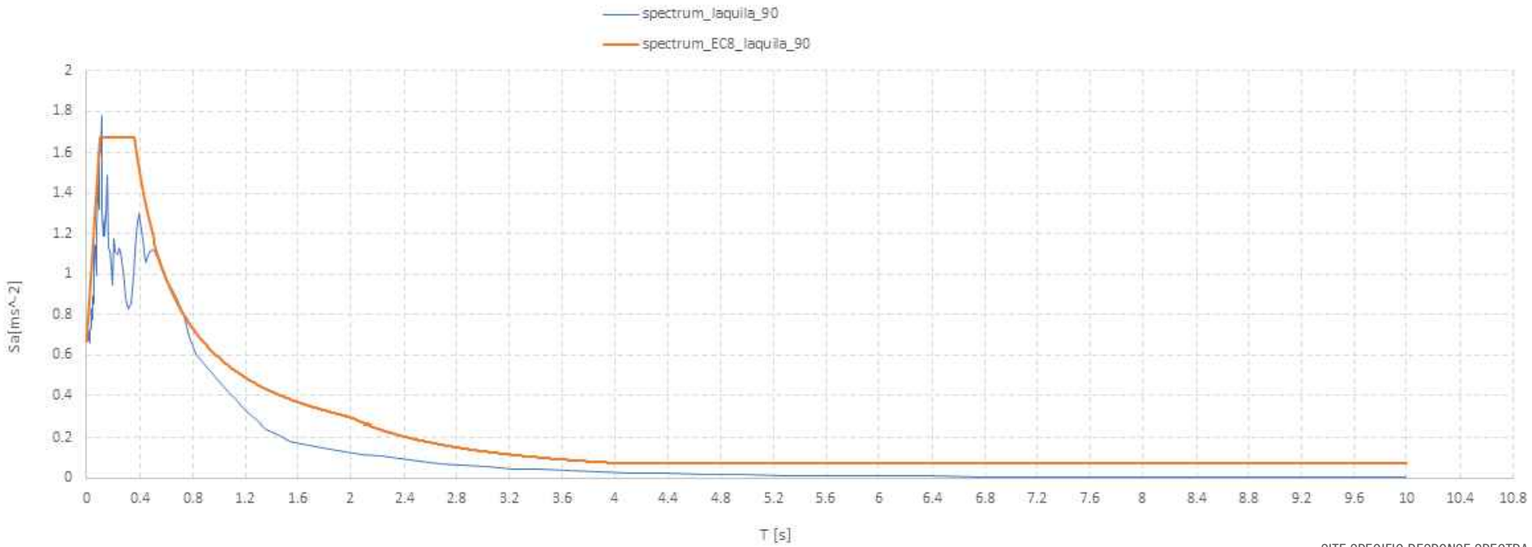
The proposed design for the new L'Aquila school respects all the principles that are key to a good performance of structures in seismic areas:

-structural simplicity;
-uniformity, symmetry and redundancy;
-bi-directional resistance and stiffness;
-torsional resistance and stiffness;
-diaphragmatic behaviour at storey level;
-adequate foundation.

The primary elements for seismic resistance are all the shear walls, both internal and peripheric. To reduce the eccentricities between the shear centre and mass (inertia) centre, shear walls with longitudinal orientation were provided along the building's main facade.
Capacity design principles according to EC8 are used for the calculation of all the walls, and internal forces and moments include the effects of accidental eccentricity, tension shift and increase in shear due to plasticity of the base of the wall.



ACCELERATION TIME HISTORY



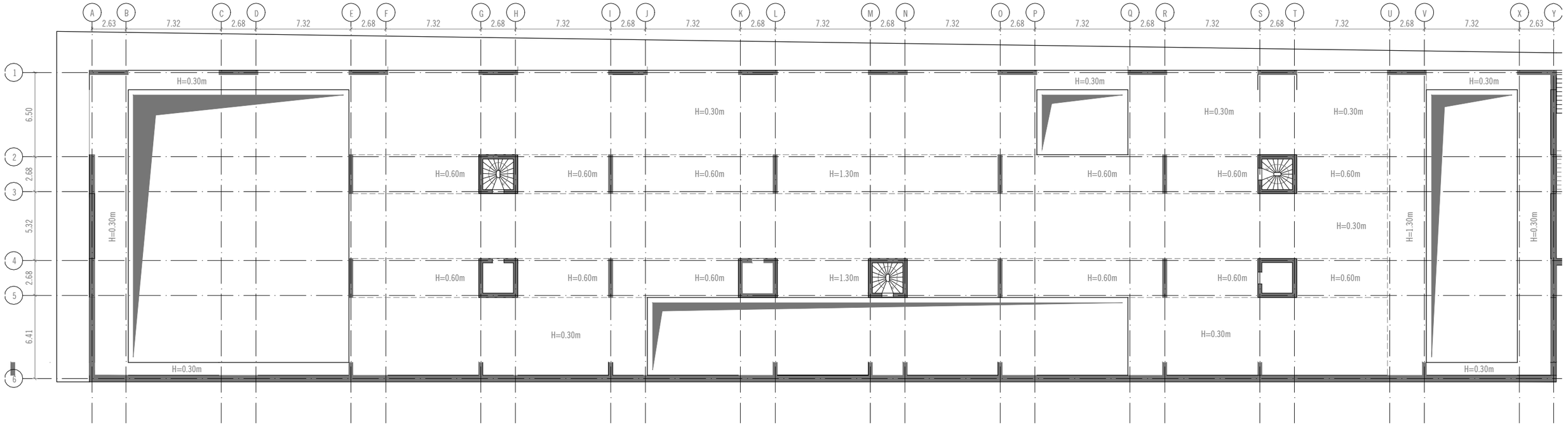
SITE SPECIFIC RESPONSE SPECTRA

Due to the sensible location of the building and taking into account that it belongs to importance class IV, after analysing the document *Relazione geologica sulle indagini, caratterizzazione e modellazione geologica, geotecnica e sismica "realizzazione del nuovo polo scolastico di gignano, torretta-sant'elia"*, special measures will be applied to assure proper behaviour under seismic loading. These special measures include the use of damping elements such as buckling restrained axial dampers.

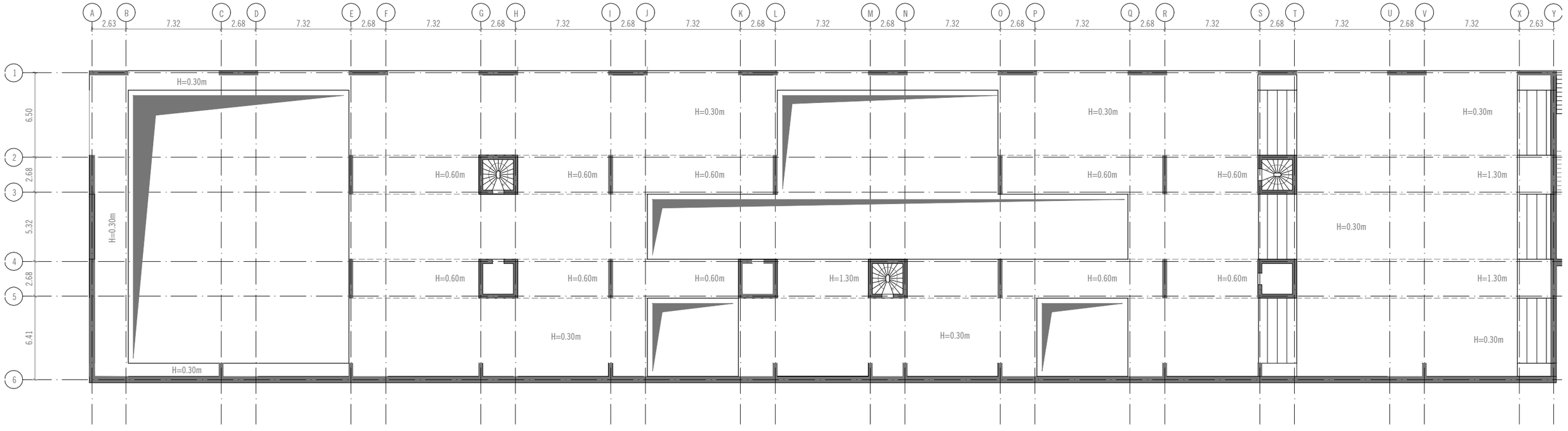
The proposed conceptual design is structurally safe when excited by the Eurocode 8 compatible earthquake defined in the previously mentioned document, but the damping elements are needed assure proper behaviour for damage limitation requirement, human lives protection requirement and no collapse requirement.

The concrete slabs have thicknesses ranging from 0.30m to 0.60m, and beams with total height of 1.30m were adopted for the longer spans.
Prefabricated concrete elements can be used in the beams, ensuring a low environmental impact solution for this concrete structure.

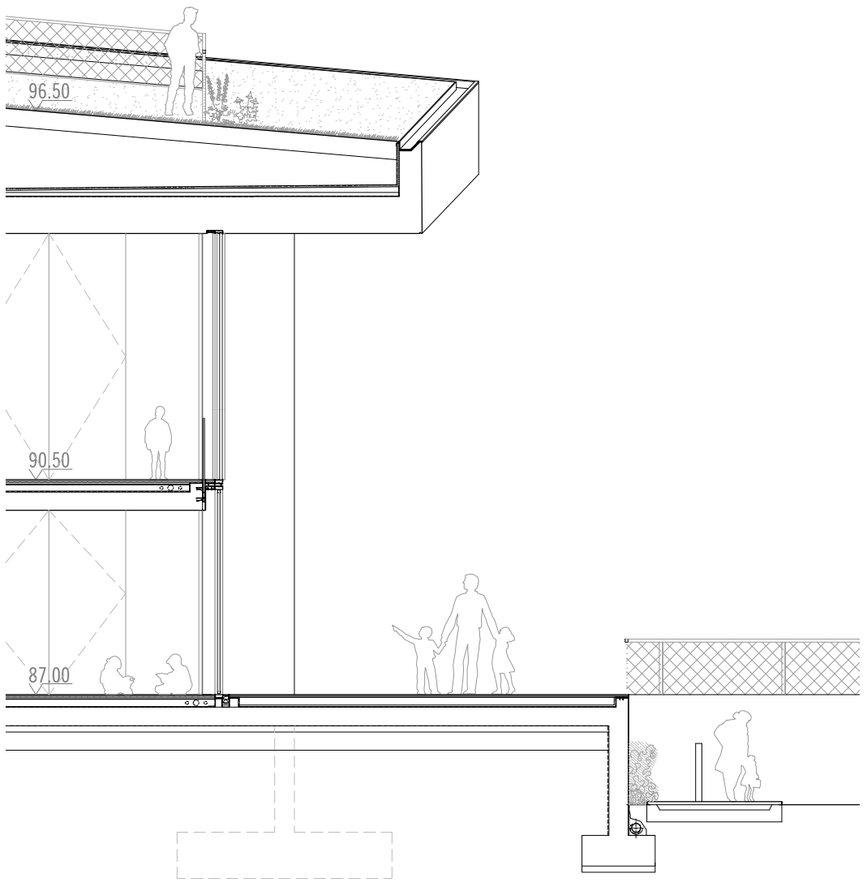
The choice of steel hysteretic dampers is justified by its relatively low cost in comparison with other alternatives such as fluid viscous dampers or base isolation, guaranteeing at the same time high energy dissipation concentrated in these elements.



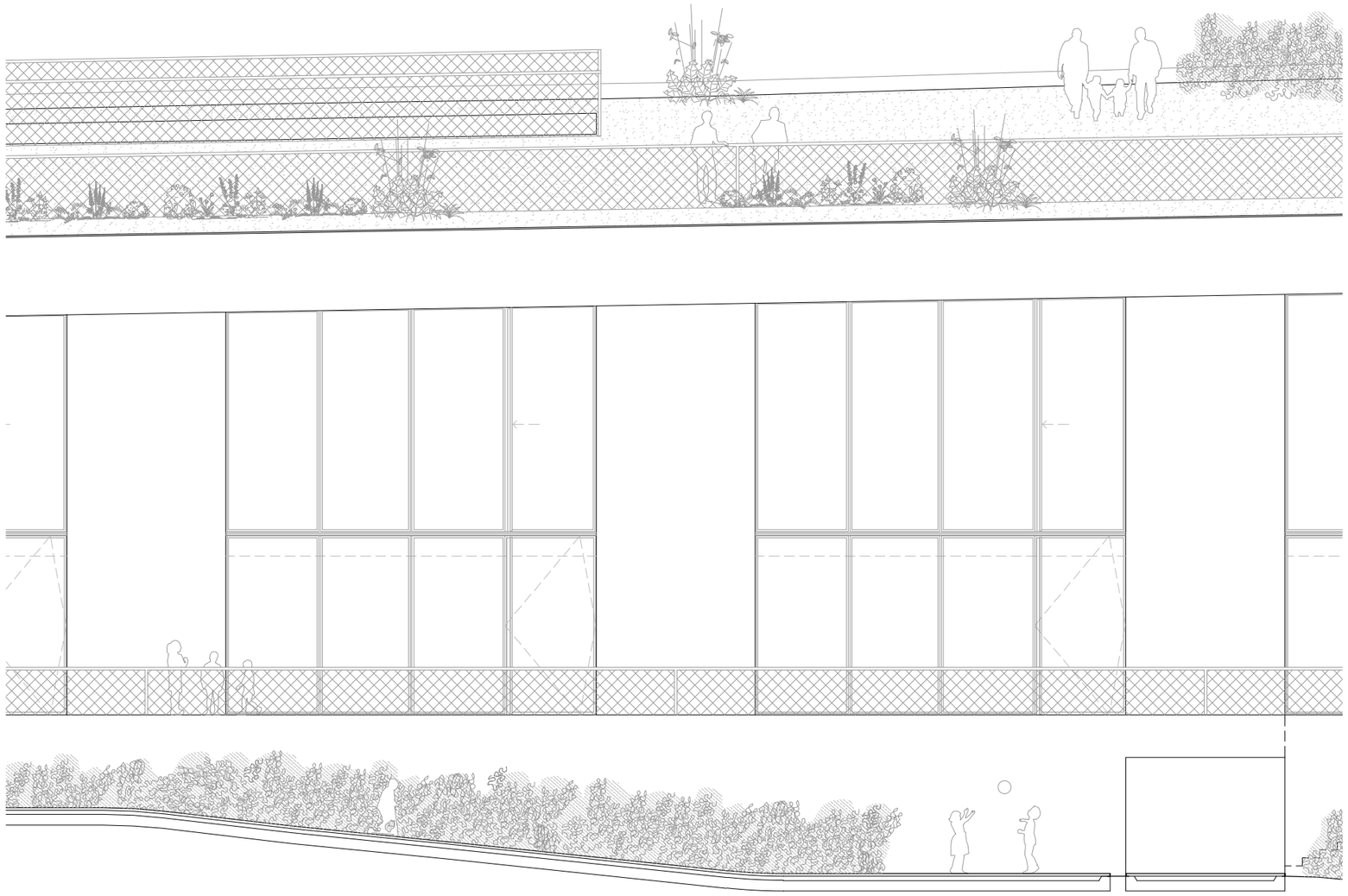
LEVEL 1 STRUCTURAL PLAN



GROUNDFLOOR STRUCTURAL PLAN



CONSTRUCTIVE DETAIL



0 1 2 5

NORTH FACADE

GENERAL INFORMATION

LOT AREA		11 073,00m^2
ROOF PLAN SURFACE		2 868,2 m^2
DEPLOYMENT AREA ABOVE THE SURFACE		2 937,6 m^2
DEPLOYMENT AREA BELOW THE SURFACE		773,6 m^2
CONSTRUCTION AREA ABOVE THE SURFACE		3 633,6 m^2
Uf = Su/Sf	Uf = 2 868,2/9 057,19 = 0,31 < 60 (verified)	0,31

ENTRANCE LEVEL		87 m
TOTAL HEIGHT		11,6 m
NUMBER OF LEVELS BELOW THE SURFACE		1
NUMBER OF LEVELS ABOVE THE SURFACE		2

CALCULATION OF THE SURFACES

Nº	GROUNDFLOOR PROGRAMME	GROSS AREA (m^2)	USABLE AREA (m^2)
1	ENTRANCE HALL	154,1	151
2	LEARNING STREET	228,17	223,8
3	KITCHEN	36,27	32,9
4	CANTEEN	236,27	226,5
5,6,7	BOYS' BATHROOM	23,66	27
8,9	GIRLS' BATHROOM	15,7	18
10	TEACHER'S BATHROOM	7,62	9
11	LAUNDRY	7,18	9
12	CHANGING ROOM	7,62	9
13	TEACHER'S ROOM	41,37	46
14	DIRECTOR'S ROOM	49,96	32
15	ASSISTENT'S ROOM	42,59	32
16	TEACHER'S LIBRARY	41,46	46
17	COLLECTIVE ACTIVITIES	146,14	142
18	REGULAR ACTIVITIES 1	73,14	67,2
19	REGULAR ACTIVITIES 2	65,36	60,1
20	REGULAR ACTIVITIES 3	54,77	53
21	REGULAR ACTIVITIES 4	62,51	60,5
22	REGULAR ACTIVITIES 5	62,49	60,5
23,24,25,26	DEPOSIT	10,6	36
70	TECHNICAL AREAS	24,7	24,7
	CIRCULATION (STAIRCASES + LIFTS)	35,9	29

Nº	UNDERGROUND PROGRAMME	GROSS AREA (m^2)	USABLE AREA (m^2)
52	GYMNASIUM	394,5	440,6
53	GYMNASIUM'S HALL	70,6	49,5
54	STORAGE	7,2	5,8
55	CLERK'S OFFICE	7,2	5,8
56	WOMEN'S LOCKER ROOM	56,4	48,4
57	WOMEN'S BATHROOM	10,8	8,5
58	REDUCED MOBILITY BATHROOM	5,4	4,7
59	MEN'S LOCKER ROOM	49,3	37,6
60	MEN'S BATHROOM	10,4	8,2
	REDUCED MOBILITY BATHROOM	5,2	4,7
62	HALL	27,7	18,8
63	GIRLS' LOCKER ROOM	37,1	34,3
64	GIRLS' BATHROOM	11,3	9,5
65	REDUCED MOBILITY BATHROOM	6,6	5,5
66	BOYS' BATHROOM	13,9	11,7
67	BOYS' LOCKER ROOM	45,1	38
	CIRCULATION (STAIRCASES + LIFTS)	11,6	14

Nº	LEVEL 1 PROGRAMME	GROSS AREA (m^2)	USABLE AREA (m^2)
27	COLLECTIVE ACTIVITIES	140,61	136,7
28	REGULAR ACTIVITIES 6	62,82	60,5
29	REGULAR ACTIVITIES 7	62,51	60,5
30	REGULAR ACTIVITIES 8	54,57	53
31	REGULAR ACTIVITIES 9	65,34	60
32	REGULAR ACTIVITIES 10	73,14	67,5
33,34	BOYS' BATHROOM	16,52	18
35,36	GIRLS' BATHROOM	16,07	18
37	FREE ACTIVITIES	105,15	103
38	SPECIAL ACTIVITIES 1	21,96	21
39	SPECIAL ACTIVITIES 2	21,96	21
40	SPECIAL ACTIVITIES 3	21,96	21
41	TABLE ACTIVITIES 1	50,9	42,5
42	TABLE ACTIVITIES 2	49,31	50
43	TABLE ACTIVITIES 3	53,94	49,5
44	CHILDREN'S BATHROOM	72,7	67,3
45	LAUNDRY	8,08	9
46,47	CHANGING ROOM	25,12	27
48,49	DEPOSIT	4,6	13,5
50	STORAGE ROOM	9	5,6
51	DOORMAN'S ROOM	9	5,6
68,69	TECHNICAL AREAS	34,8	34,8
	CIRCULATION (STAIRCASES + LIFTS)	35,9	29
TOTAL			3041,6

CALCULATION OF THE EXPENDITURE

FIELD OF EXPERTISE	AREA	EUR/m^2	SUBTOTAL	TOTAL (EUR)
ARCHITECTURE				
GYMNASIUM	770,3	600,00	462.180,00	
GROUND FLOOR	1402,88	620,00	869.785,60	
UPPER FLOOR	975,16	620,00	604.599,20	
				1.936.564,80
LANDSCAPE				
ROOFPLAN SURFACE	2868,2	25,00	71.705,00	
GROUNDFLOOR SURFACE	8204,8	20,00	164.096,00	
				235.801,00
STRUCTURAL				
GYMNASIUM	770,3	310,00	238.793,00	
GROUND FLOOR	1402,88	290,00	406.835,20	
UPPER FLOOR	975,16	290,00	282.796,40	
				928.424,70
HYDRAULICS				
GYMNASIUM	770,3	15,00	11.554,50	
GROUND FLOOR	1402,88	30,00	42.086,40	
UPPER FLOOR	975,16	30,00	29.254,80	
				82.895,70
ELECTRICAL & FIRESAFETY ENGINEERING				
GYMNASIUM	770,3	40,00	30.812,00	
GROUND FLOOR	1402,88	70,00	98.201,60	
UPPER FLOOR	975,16	70,00	68.261,20	
				197.274,80
TELECOMUNICATIONS				
GYMNASIUM	770,3	5,00	3.851,50	
GROUND FLOOR	1402,88	15,00	21.043,20	
UPPER FLOOR	975,16	15,00	14.627,40	
				39.552,10
HEATING, VENTILATION AND AIR CONDITIONING & SMOKE EHAUSTION				
GYMNASIUM	770,3	40,00	30.812,00	
GROUND FLOOR	1402,88	95,00	133.273,60	
UPPER FLOOR	975,16	95,00	92.640,20	
				256.725,80
TOTAL				3.677.208,80