

PREVIOUS STUDY AND REHABILITATION OF A BUILDING

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1- INTRODUCTION

Jennifer Aroca Alarcón, student of Building Engineering at the Polytechnic University of Valencia and as Erasmus student at Silesian University of Technology, Politechnika Śląska is going to be the author of this project of rehabilitation of a building.

To perform a restore a building and know all their deficiencies is requires a prior study in all aspects of construction, structural, functional, etc..This study must be the first part of this project.

The rehabilitation of buildings by recovering its functions through various actions on those elements that have lost their constructive function, or have suffered a deterioration in its entirety or in appearance.

Once we understand the building we can make depth study of the current state of it.

2- AIM OF THE PROJECT

This objective is achieved by developing the points contained in this project. First it will develop solutions adopted in the realization of this building. Secondly, it will be analyzed by a study that contains building deficiencies or pathologies detected. Finally, it will present a proposal for intervention to identified weaknesses possible solutions. This project will also include the location of the building plans, lifting and constructive analysis of the same.

To achieve this aim It has been necessary:

- Collect data and information of the building.
- Perform data collection "in situ"
- Take a photographic data of the building, both inside and outside.
- Description graphically the building by planes.
- Analysis of materials used for construction and building systems.
- Study of existing pathologies
- Establish proposals for intervention for those building deficiencies.

3- PRELIMINARY INVESTIGATION

3.1 SCOPE AND METHODOLOGY.

In order to perform a detailed analysis of the building, the different phases of this study are:

Survey metric descriptive

Is the main phase of data collection, as it allows more direct knowledge of the qualities of the building construction. This is the graphic representation of the constructed reality as precisely as possible.

It has performed the lifting all plants of the building and have traced many transverse and longitudinal sections as deemed necessary.

Photografic Survey

Is a survey conducted by means of photographs. But in this previous study It wasn't necessary photographic lifting. It has been enough a good photographic memory of the entire building.

Study materials and construction

Is necessary to know all the materials that have been made the building and building systems that were used for its construction.

Study pathologies of materials

This study aims to identify the existing pathologies in the building, in order to know it better and to intervene later.

Study of material damage

More detailed study of the damage that have suffered the materials with which it was built initially.

Functional study

Appropriate conduct a study of the historical role of the building that is intended to take account rehabilitate afterwards.

3.2 INFORMATION OF THE BUILDING

3.2.1 Location of the building

The building, object of studio was built in 1973. It is situated in Gliwice, Silesia City, in Poland. It is located within the complex of The Silesian University of Technology "Politechnika Slaska" and specifically is the laboratory of Construction of Civil Engineering Department, situated in B. Krzywoustego 7 Gliwice. It hasn't adjacent buildings, so its 4 sides are relapsers to different streets, one of these Sklodowskiej Marii-Curie.

This building was built on a rectangular solar plant with an area of approximately 2.644m².

It has two pedestrian accesses from the outside by the north facade, and another pedestrian access from the building of the civil engineering faculty. This connection is located on the first floor. It also has a main vehicle access by the east façade with a ramp, as well as others through the west front.

3.2.2 Location of the building

- **Building environment**

About the state of the building is not well maintained:

- In a perimeter around 4m of the building the pavement is up and is disrepair.
- There are sewers and vents rusted
- In some parts of the perimeter there are earths and stones
- Lack cleaning and maintenance throughout the area



3.2.3 Description

The building consists of basement, ground floor and four heights.

Basement

This plant has access from the two main pedestrian entries situated in the north facade of the building.

This plant has a longitudinal corridor which distributes to the different rooms, one of which is a laboratory building that occupies practically the entire basement.

Ground floor

The ground floor distribution is similar to other plants, because it has a corridor that runs through the building longitudinally leaving aside offices, and classes for teaching and in the other side, a large open space that is used for construction lab, where is the machinery, materials for tests ... etc.. This plant has

access by the two main pedestrian entries, and by the driveway located on the east façade.

First, second, third and fourth floor

Besides having access by the two main entrances mentioned above, has direct access from the building of the civil engineering faculty through a connection between the two. This plant is intended for educational classrooms, laboratories, offices and offices.

Second, third and fourth floor have access by the two main entrances. These plants are the 3 smaller than the others plants areas. Its distribution is similar to the rest, because a longitudinal corridor of the building is the one that gives access to the various rooms. And all, consist of offices, lecture theaters and laboratories

3.3 DESCRIPTIVE REPORT ACCORDING CURRENT SITUATION BUILDING.

3.1.1 Building systems and material used.

To know and understand the building is due to perform a study of the materials and construction systems that were used in its construction.

Foundation

Because of absence of information provided and taking into account that it is a final degree project in which we can't do tastings. For this reason It has been impossible to define exactly the condition or type of it.

Enclosure

It has three different types:

- **Brick cladding**: It is located in the lower part of the facade that surrounds the perimeter of the building. It is made with brick building from 9cm, polyurethane foam, stabilizing role spacer and Facing clinker brick 13cm.



Photography 1

- Enclosure finished with fibre corrugated plates: large part of the façade is made with this kind. It is comprised of Aerated concrete block 24 cm, 10cm mineral wool, fiber cement plates 125 x 250 x 0,6 cm on wood slats with cross section 5 x 6cm. and protective varnish finish



Photography 2

- Enclosure finish with smooth plates bolted: Part of the facade and the facade of the staircase is made with this type. The layers that comprise this kind is the same as above constructive solution but the finish is solved with smooth panels.



Photography 3

Pillars

All the pillars are made with reinforced concrete. Nevertheless in the ground floor and first floor we can find different kind of pillars (*photography 4 and 5*)



Photography 4



Photography 5



Photography 6

Partitions

The partitions are made with bricks. The brick used is hollow brick 9. The brick is received with cement mortar and subsequent with application of lime and finished with painting application of various shades, depending on the plant in question. (*photography 6*)

Partitions of wetlands are solved in the same way but with ceramic tiles finish (*Photography 7*)

In addition the top of the partitions is covered with plasterboard panels for passing installations.



Photography 6. Corridor of second floor.



Photography 7. Ceramic tiles of a wetland

Wrought

Floor slabs are precast hollow core reinforced concrete slabs. It works unidirectionally.

The wrought is composed of reinforced concrete beam where support the alveolar plates. The alveolar plates are prefabricated elements and with them can be made floor slabs with light forged between supports larger. It has the main reinforcement and secondary reinforcement and the top slab is poured "in situ".

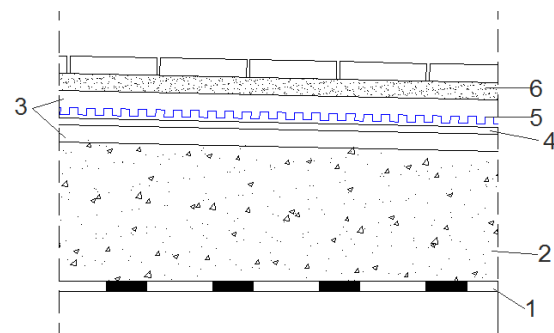
Deck

The building has two cover types:

- Passable cover:

Its sequence constructive consists in:

Steam cut sheet (1) cellular lightening concrete for formation of slope (2) regularization mortar (3), sheet waterproofing (4), geotextile separator layer (5), , gripping mortar for tiles (6) and finish with ceramic tiles.



It has access from the first floor. The evacuation of water in this deck is solved by sinks. One specifically located in the center of the cover with cloths inclined towards the sink.

I don't have access to this part of the building.

- Not passable cover:

Is finish with film anti-UV treatment. And it hasn't direct access, only has the possibility of access for maintenance.

This kind of deck is situated on the second floor and the fourth floor.

It is a sloping roof. Water evacuation is solved by a hidden gutter that runs the entire length (the longer side) of the deck. (Photography 9)



Photography 9. Photo of second floor

Finishes

- Walls:

The coating is executed with mortar which constitutes the binder is cement or a mixture of cement and lime.

The plastering is executed with lime and cement paste from various applications of successive layers to achieve a uniform and smooth.

The lining of wetlands is solved with rectangular ceramic tiles received with a thick layer of mortar grip.

Pavement

- Terrazzo

The majority of the pavement in this building is terrazzo. (concrete mixture with marble grits). This pavement gets executed in situ. The advantage

is that It can be made on site and it doesn't have a factory preset shape. It Can be adapted to any area. (Photography 9)



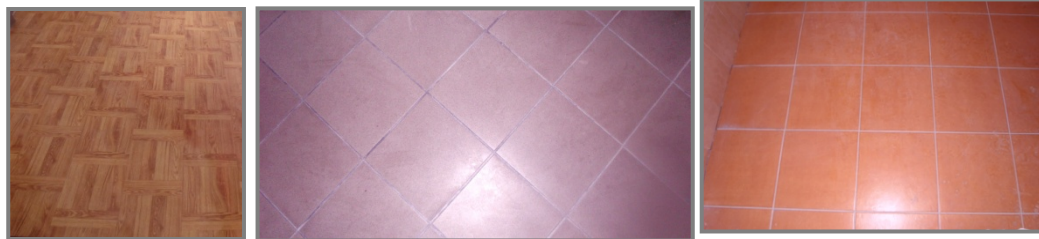
Photography 10.
Photo corridor of
first floor

- Ceramic Pavement

This kind of pavement is situated in wetlands. Ceramic tile is squared, but it isn't equal in all wet areas of the building, since the color is different. Photography 11,12

- Parquet flooring

It can be found in specific areas of the building very reduced, like the building reception or some offices. Photography 13



Photography 13

Photography 11

Photography 12

Window frames

- Indoor: the doors are made of wood, but we can classify into several types:

- Wooden brown door, photography 14
- Wooden door with glazed, photography 15
- Wooden white door, photography 16
- Metal door, photography 17
- Glass door, photography 18
- Elevator door, photography 19



Photography 14

Photography 15

Photography 16

Photography 17



Photography 18

Photography 19

- Outdoor: The windows are mostly wood, except for the stairwell, that are large single glazed steel windows. Photography 20
The doors in technology areas and garage are of stainless. Photography 21



Photography 20

Photography 21

3.4 BUILDING COMMUNICATION

Exterior

The building has two main pedestrian entrances located on the north elevation. Is an access by stairs leading to a reception hall, located on the mezzanine floor (between basement and ground floor). *Photography 22.*

The building also has access from the building of civil engineering faculty on the first floor. is a connection between both to create a shortcut. *Photography 23,24*

Vehicle access is located on the west elevation ascending a ramp, leading to the ground floor. *Photography 25.*

The building has also several steel doors located in the north and east elevation providing direct access to the basement. *Photography 26, 27, 28.*

Interior

All floors of the building are connected by two stairways that run full height and two lifts for the transport of materials. *Photography 29.*



Photography 22

Photography 23



Photography 24

Photography 25. Ramp.



Photography 26. North elevation.

Photography 27. East elevation.



Photography 28. North elevation

Photography 29. Interior stairs.

4- DETAILED INVESTIGATION

4.1 INTRODUCTION

The purpose of this separated is to give a glimpse of the current building condition, as well as the study of deficiencies found in it. Overall the condition of the building is a little flawed. It presents several pathologies that affect functional and constructive terms.

4.2 DOCUMENTATION AND LOCATION OF THE PATHOLOGIES.

Enclosure

Humidity the outside wall

Observed wet stains on the bottom of the facade, as well as loss of tone color face bricks. (*Pathology 3*)

This deficiency can be detected in the north elevation of the building. This kind of moistures are due to rising moisture, as the water rises from the found through the building foundation which are in contact with the ground and transmitted through the pores of the material to reach to areas above grade. It can manifests as spots, chipping, fading in the color finish.. The severity of moisture depends on:

- The amount of water contained in the subsoil water level effects.
- Saturation of rainwater field is not as evacuate.
- By breaking conveying water underground installations.
- The material which transmits moisture.
- Moisture from building.
- Thickness of the wall, as the wider is its most high amounts water

Also it can be observed humidity caused by water leakage caused by downpipes that are poorly executed and water flowing directly from the vertical face of the façade. (*Pathology 4*)

Breakage façade

In some areas of the facade shows the absence of the final finish, as well as in other areas where the finish is bad condition. (*Pathology 5*)

In one of the pedestrian access can be seen breaking a partition formed by exposed bricks. This is due to anchorage of the banister on the wall, since the wall thickness is not sufficient for anchoring. Therefore, there has been a handover of the anchoring element. (*Pathology 16*)

Failure to comply with the thermal conditions

The facade, according Polish regulations (5) (6) does not comply with the thermal conditions. (*Pathology 5*)
The constructive section of the facade not comply with the thermal conditions of b because it leads to excessive global warming front.

The thermal transmittance data are reflected in the relevant tab of pathology 5. The solution has been performed to comply with the regulations is the increased thickness of the insulation. In the case of the facade finished with fibre corrugated plates (*photography 2*) and with smooth plates bolted (*photography 3*), increase the thickness of rockwool.

In the façade of the basement finished with brick cladding (*photography 1*) increase the thickness of polyurethane foam.

Lack of coating

The parapet in some areas doesn't have the finished, like the rest of the façade. (*Pathology 8*).

Disaggregation of the concrete

At some concrete elements of the façade there are humidity and peeling, rust problems, disaggregation of concrete and efflorescences.

Is the case of the access ramp to the building (*Pathology 12*) or stairs located on the north elevation of the building to give pedestrian access to it

(Pathology 7) .

Moreover the outgoing located in the south elevation (Pathology 10).

All these pathologies are resolved with similar way according to Concrete Repair and Protection Sopros(8).

cracks in the brick facing

There is a vertical crack in the lower part of the facade in the south. The crack has broken the finishing material, in this case the brick. This type of crack probably not significantly affected the building as it is usual in this type of pathology finished facades with brickwork. (pathology 17)

Window frames

Interiors

The interior woodwork, in this case the interior doors are in perfect condition,

Exteriors

The main problem is that the windows are in poor condition and its metal anchoring elements are oxidized. (Pathology 2)

The exit doors of the garage and technology rooms are steel gates and have some small minor rust. But the problem is overheating by them. (pathology 19)

Deck

Heating in the deck

Both the passable cover as not passable cover doesn't comply with thermal conditions according Polish regulations. The main cause is it hasn't enough thickness isolation.

Leaks in the deck

The problem lies in the passable cover there is insufficient sinks. It doesn't comply with the regulations (1). In the not passable cover the meetings with

skylights are poorly resolved so water can filter through these areas. In some areas there is no cover minimum elevation vertical waterproofing membrane on the upstream. (1) (pathology 1)

Installations

Downpipes

Poor execution of water pipes. The connections are not suitable and when it rains the water the water flows directly from the front of the facade. The clamps are rusted and some are loose. (Pathology 4)

Water evacuation floor level

In some areas of the perimeter of the building there are accumulation of lands which are causing this problem. When it rains the water is absorbed for land, making this wet and causing moisture in the enclosure. For the evacuation water there is a roof garden sump type, but it isn't enough. When it rains the entire width of the street is water logged. (Pathology 11)

Installations

Some installations ducts are not protected suitably. They have been viewed, and haven't a protection coating(2). (Pathology 18)
Observed spots on the face of the wall in the basement, and Grommets break installations.

Interior coatings

Partitions

Partitions are generally in good condition, except for some small crack that can be seen in the finish.

In some wet areas the ceramic tiles have fallen and have left the mortar seen. (Pathology 6)

Pavement

In many areas of high pedestrian traffic, like corridors, there are cracks and fissures in several directions in the terrazzo floor. (Pathology 15)

Also on the stairs that connect all the building look finish material detachment. This may be due to the intensive foot traffic or the finishing material which have suffered strokes. (Pathology 14)

Expansion joint

Is dirty and has moisture around. It has also lost the sealant in most of its entire length, so it is exposed to the weather. Inside the building in the basement is also seen without sealant. It has irregularities in placement rockwool. (Pathology 9)

Expansion joint is an element very important in the buildings, because It allows relative movements between two parts of a structure or between structure and others with which it works, so it has to be in perfect condition and be well maintained to prevent deterioration.

Oxidized elements

Inside the building, specifically the ground floor where the materials laboratory, there is a lane beam to transport materials around the room. All elements are of steel, and in particular has one entire surface oxidation. However it has been chosen to carry out a repair method and healthy since no decrease in their section. (Pathology 13)

5- STUDY BUILDING. FLOORPLANS

5.1 LIFTING METRIC-DESCRIPTIVE

5.1.1 Site plan

5.1.2 Floor plants

- Basement
- Ground floor
- First floor
- Second floor
- Third floor
- Fourth floor
- Deck

5.1.3 Elevations

- North
- South
- East
- West

5.1.4 Sections

- Section A-A´
- Section B-B´
- Section C-C´

5.1.5 Structure plans

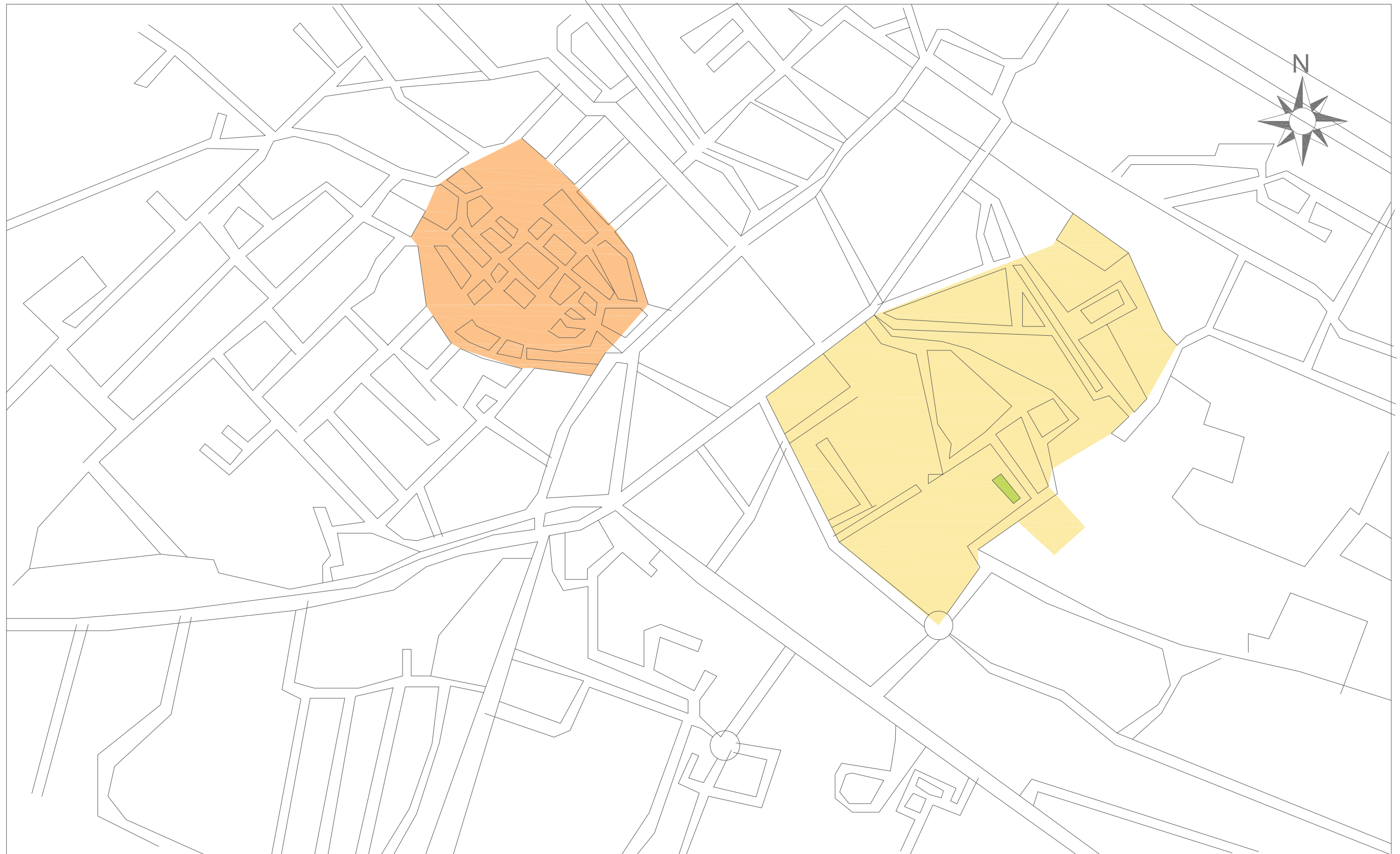
- Basement
- Ground floor
- First floor
- Second floor
- Third floor
- Fourth floor
- Detail structure

SITE PLAN



 Laboratory of Construction

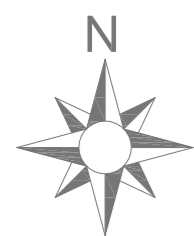
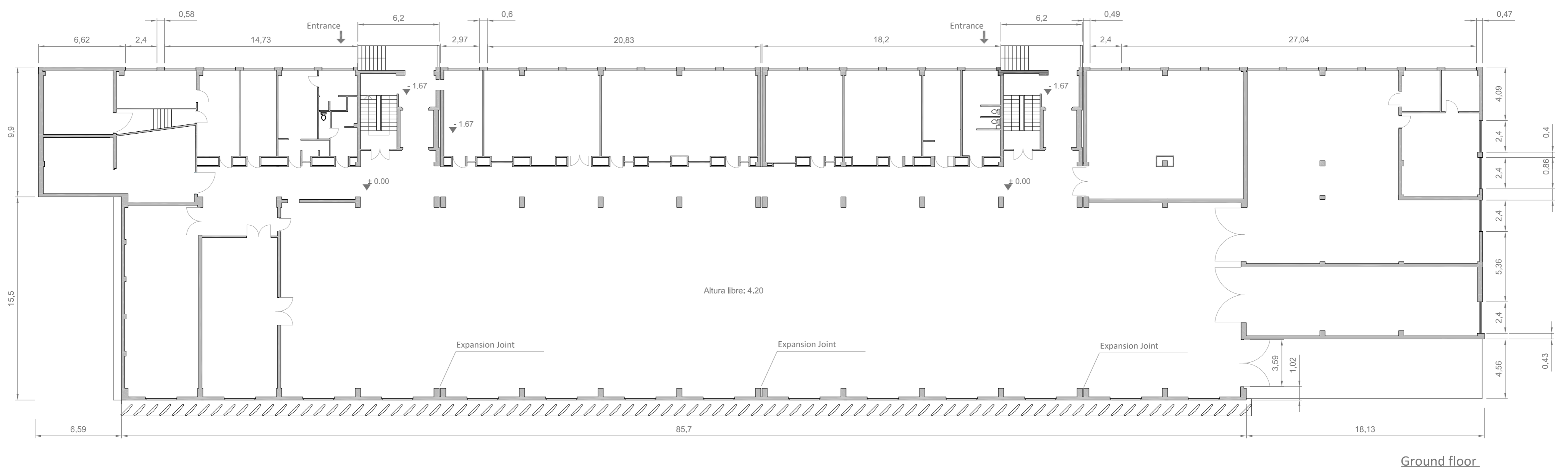
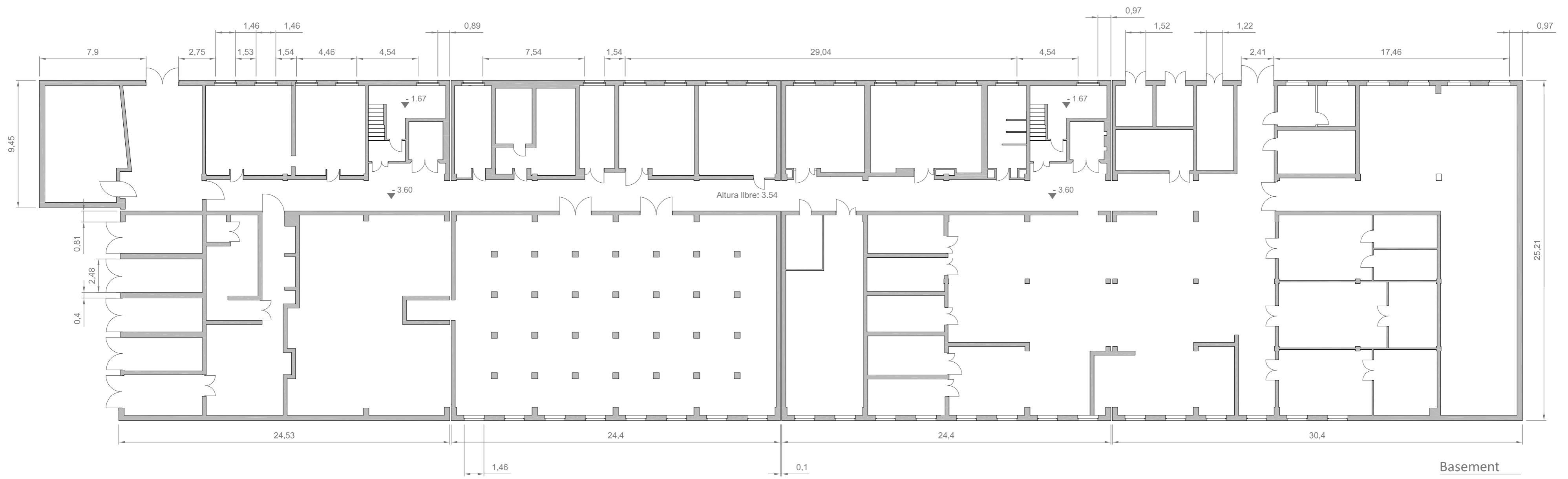
 Faculty of Civil Engineering

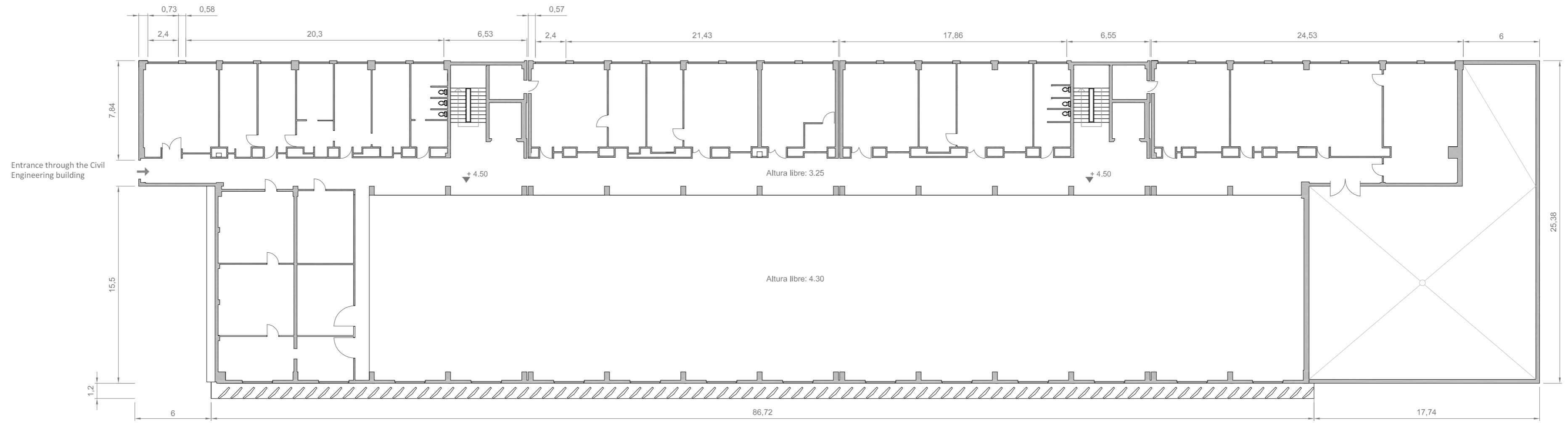


City centre

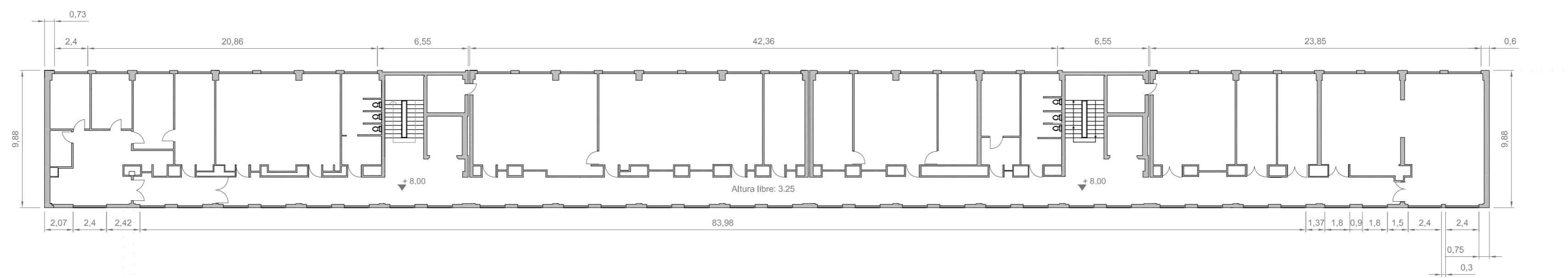
Academic district "Politechnika Śląska"

Laboratory of Construction

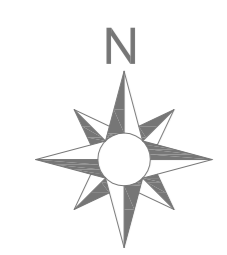


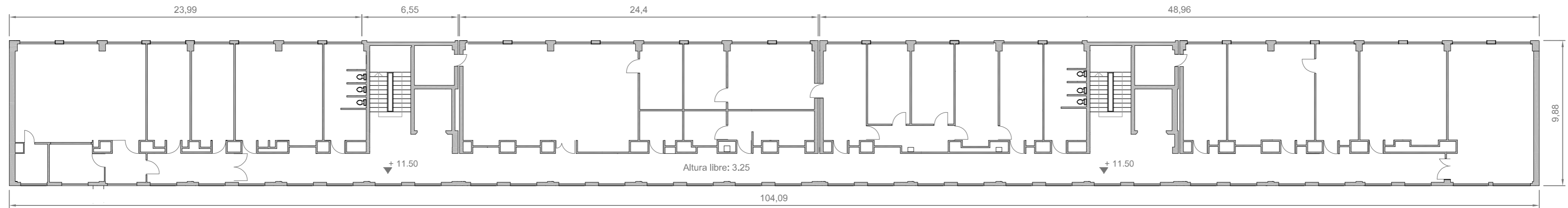


First floor

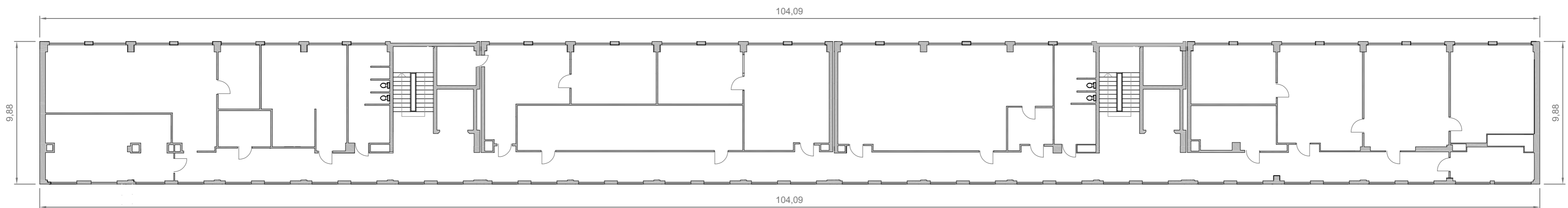


Second floor

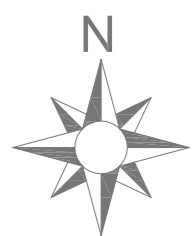


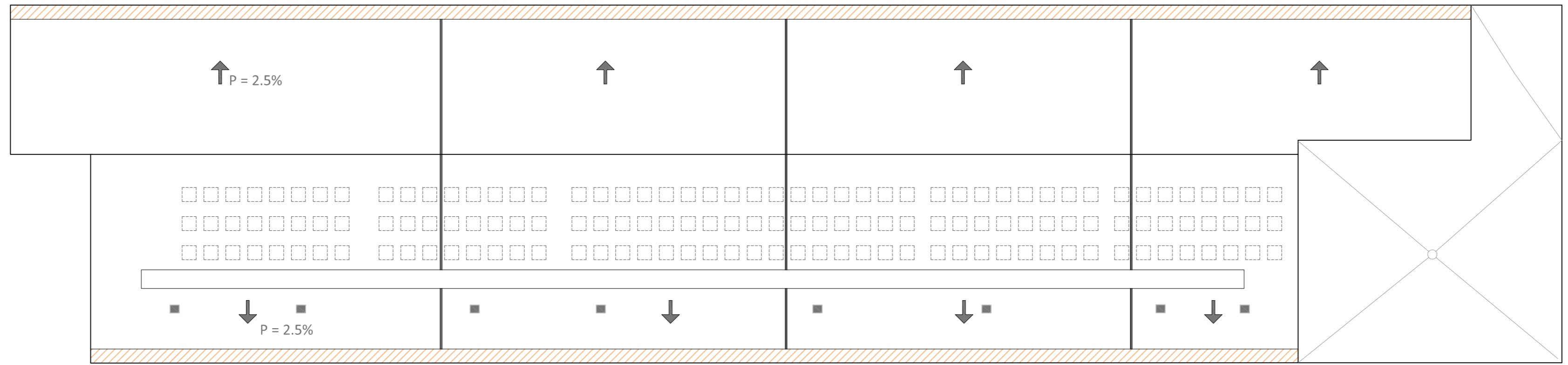


Third floor

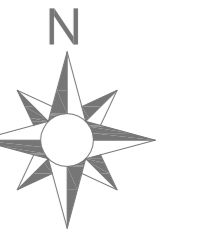


Fourth floor








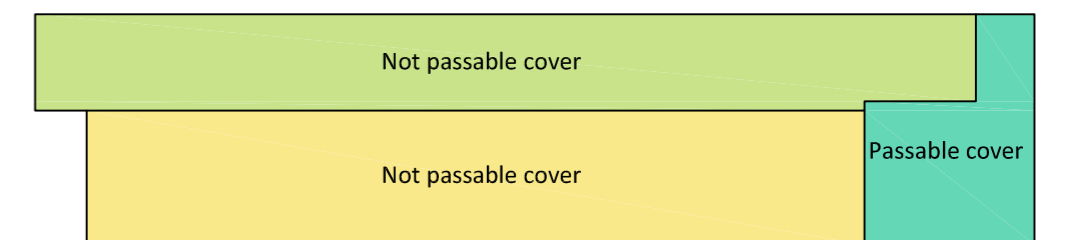
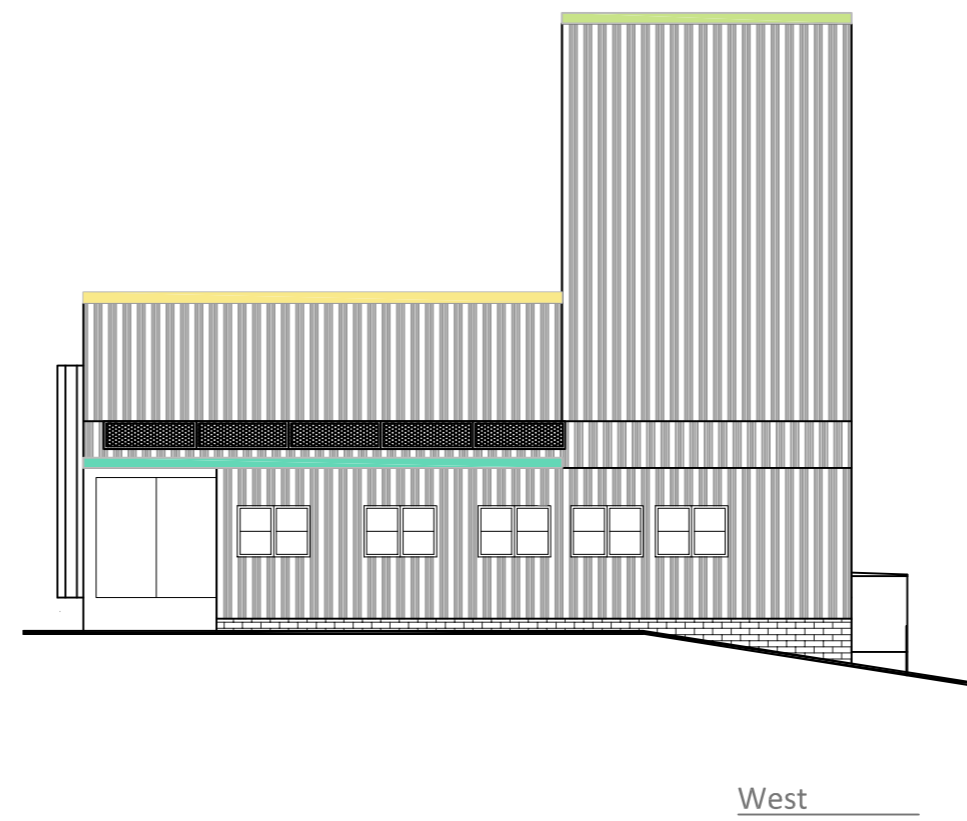


Deck floor

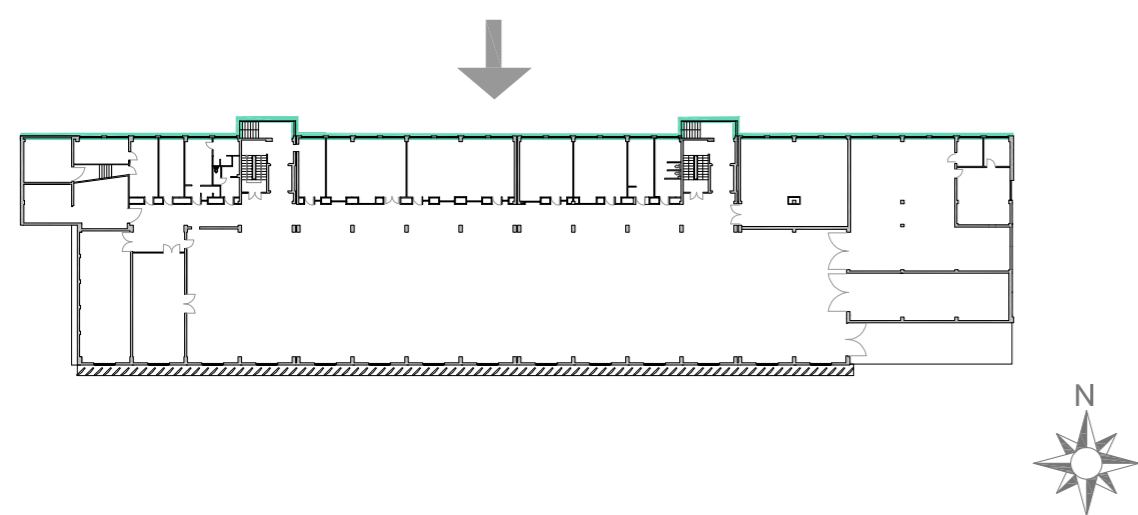
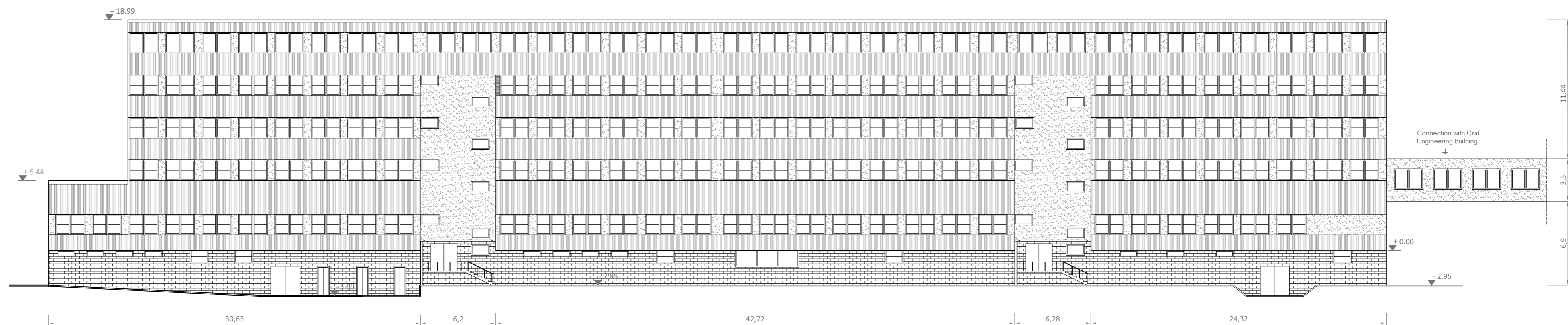


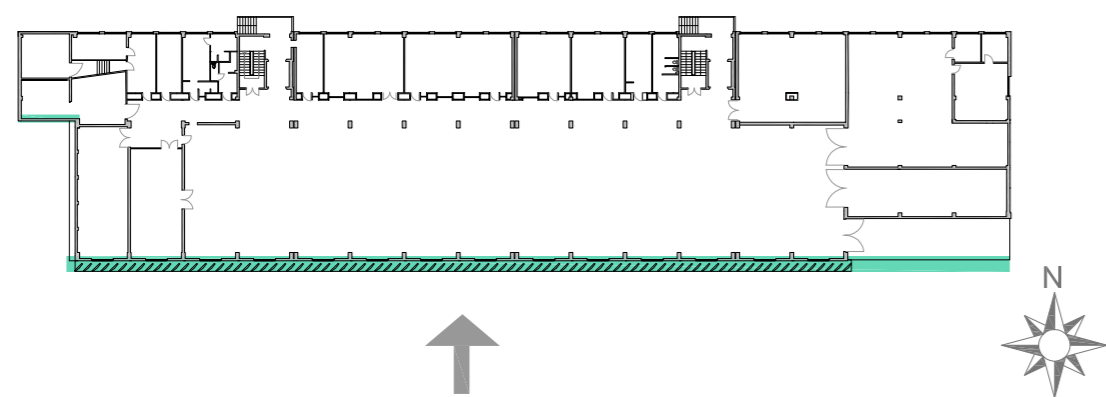
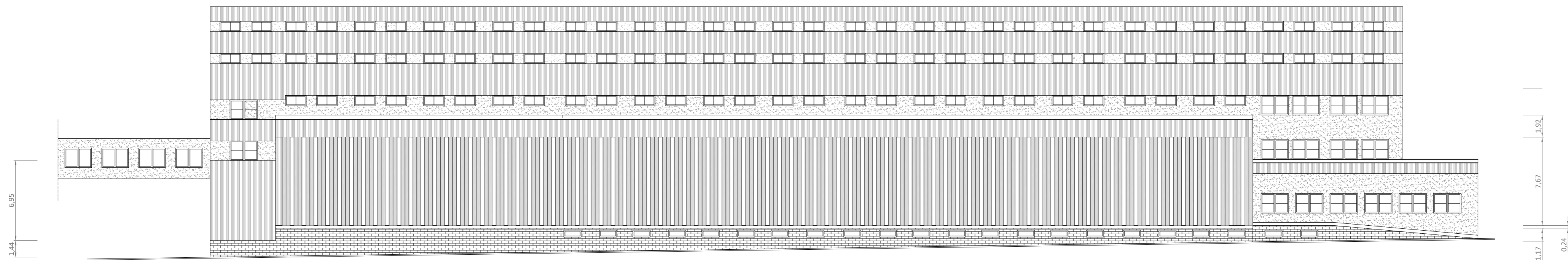
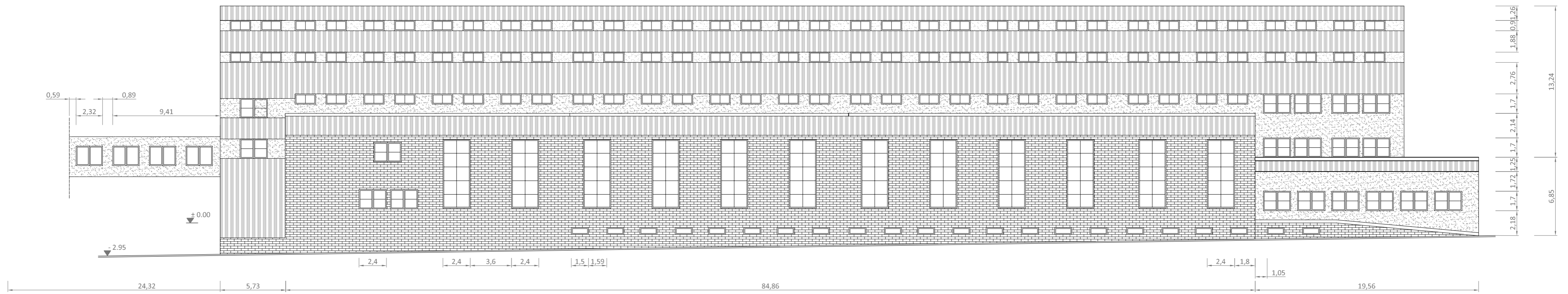
LEGEND

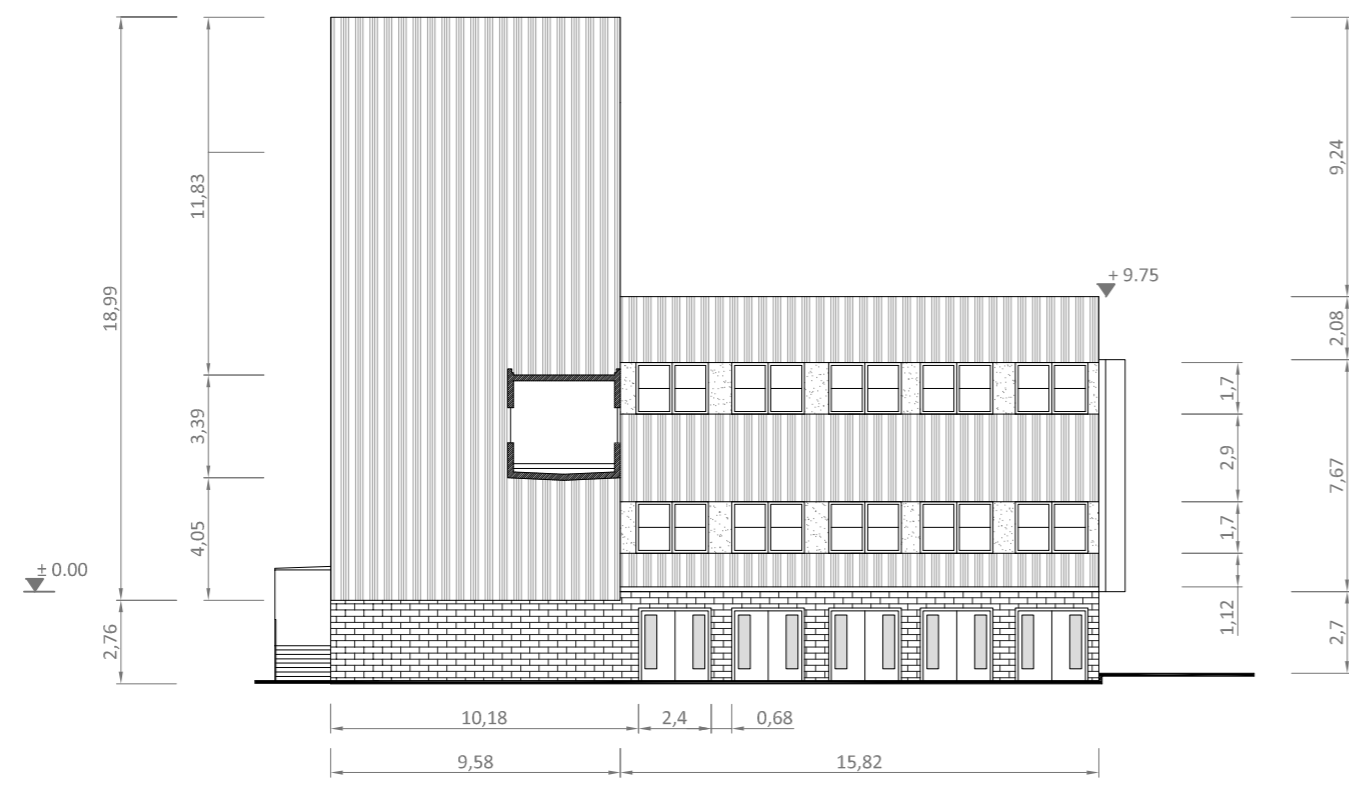
-  Skylights
-  Vent fireplaces
-  Direction of the slope
-  Sink
-  Hidden gutter



ELEVATIONS



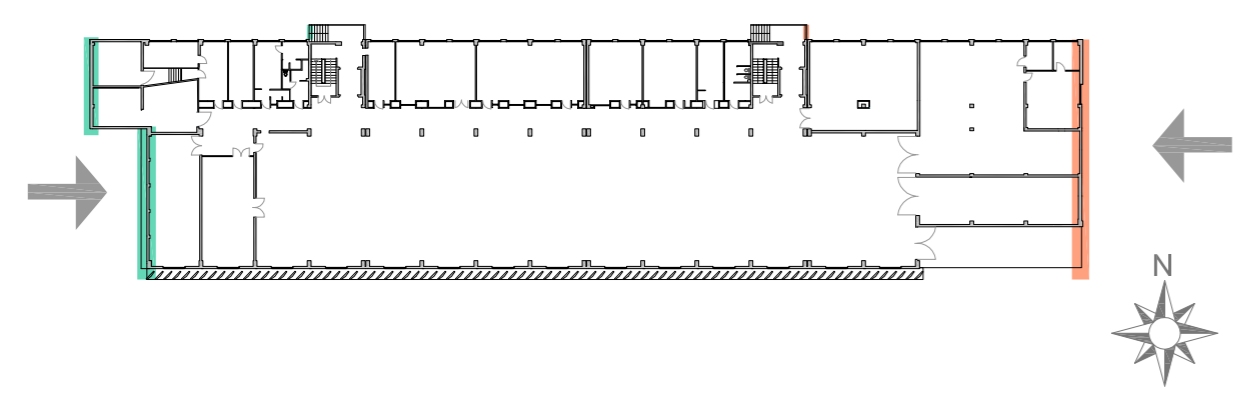


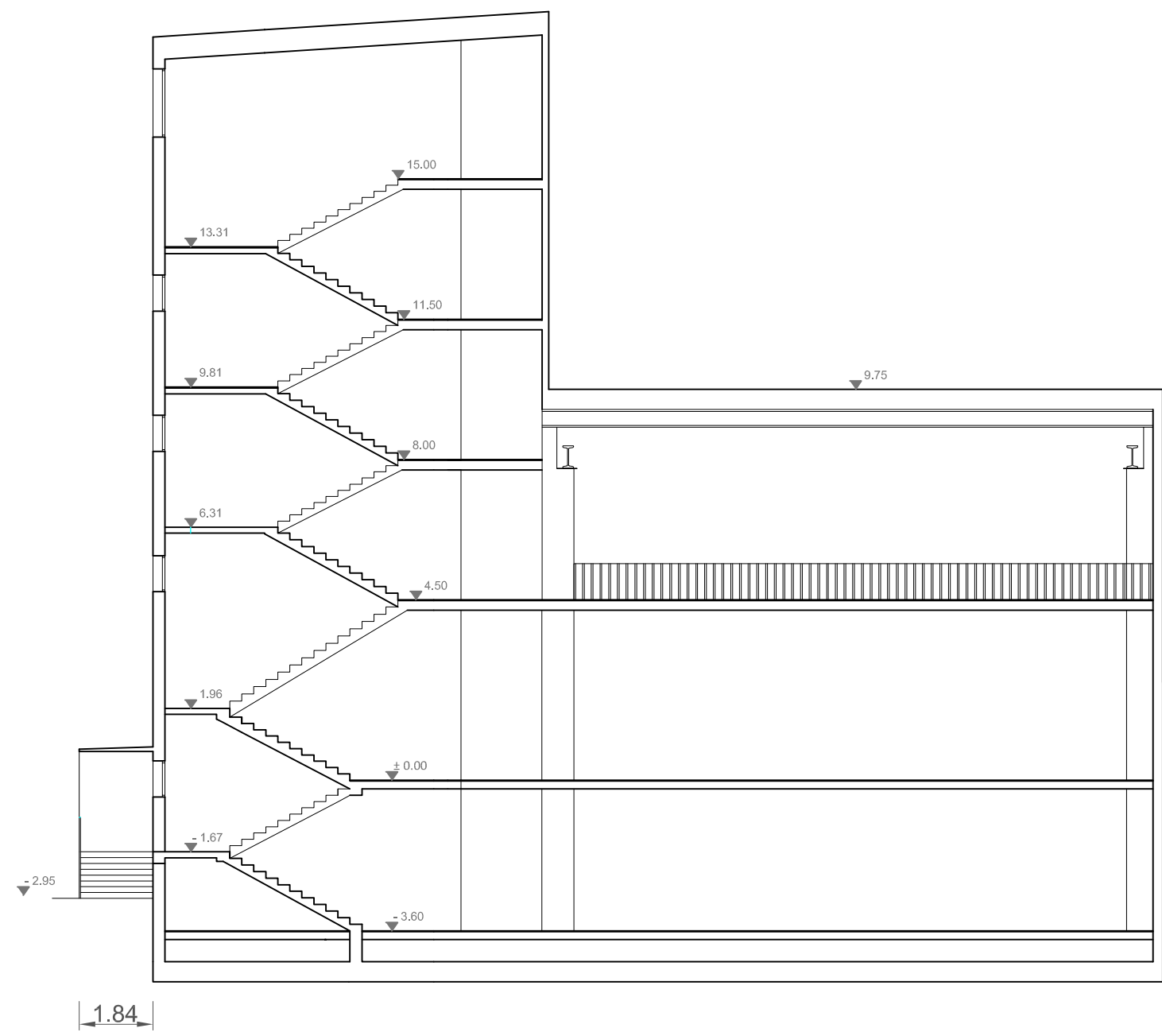
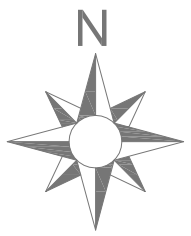
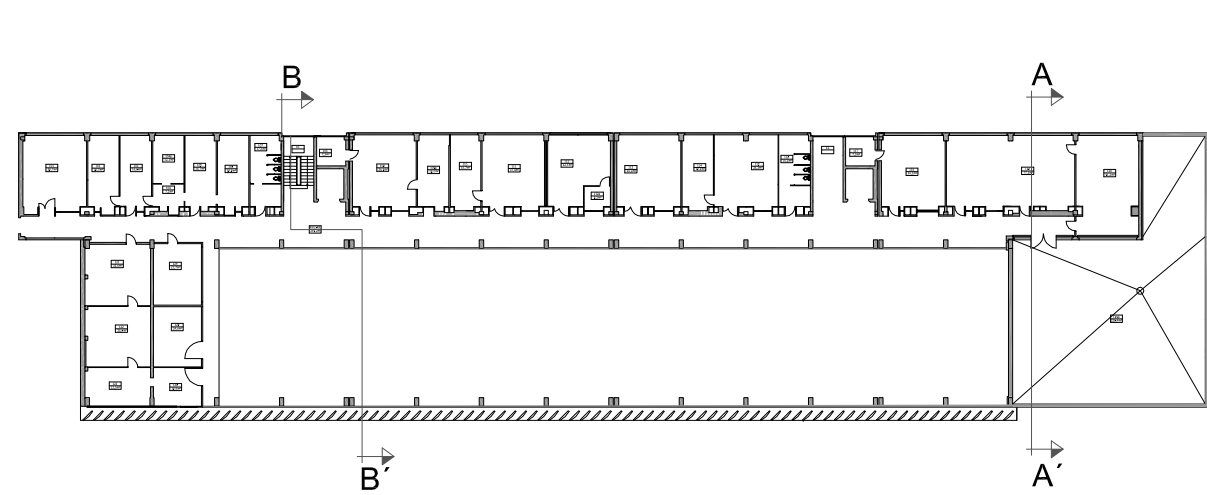


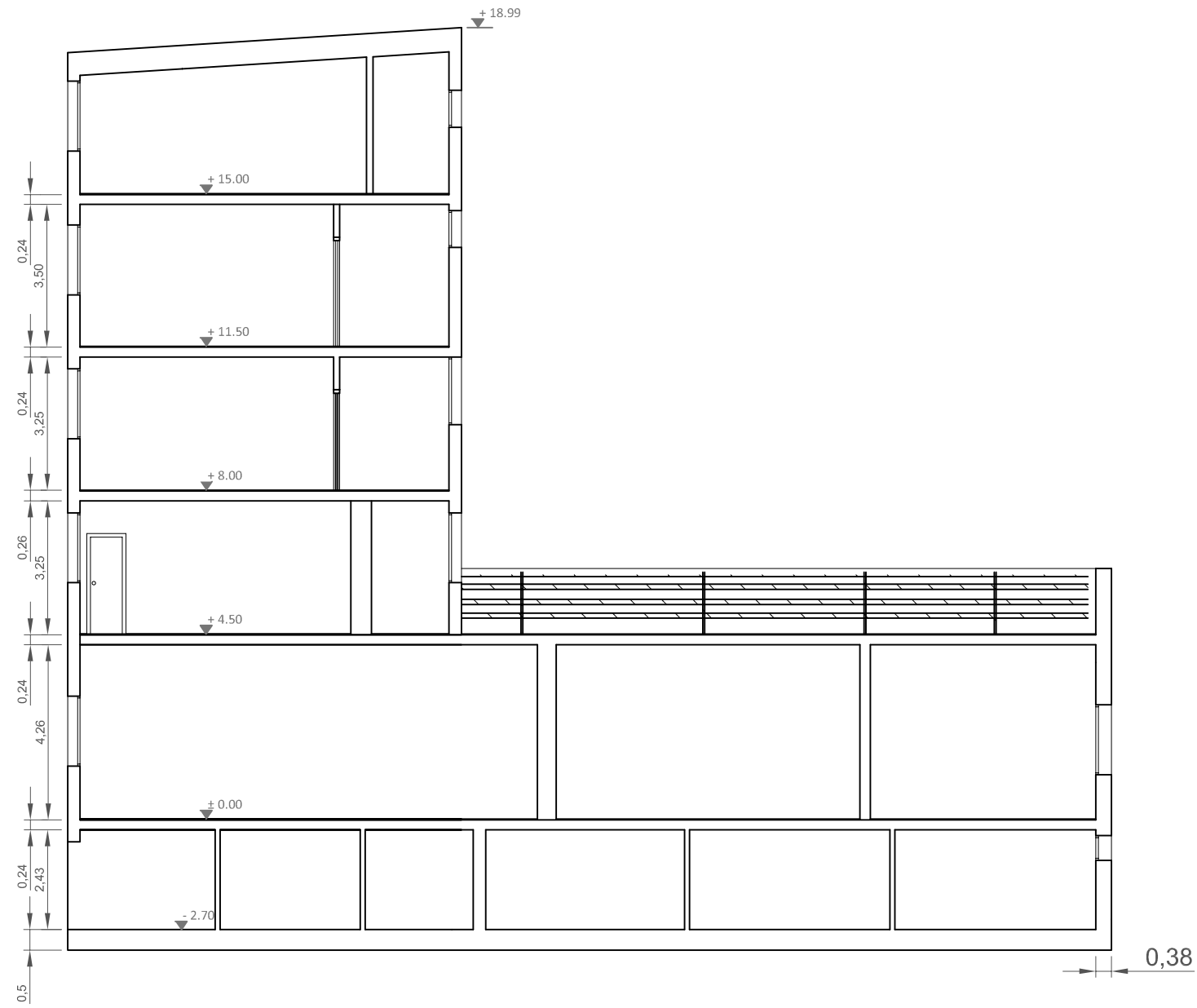
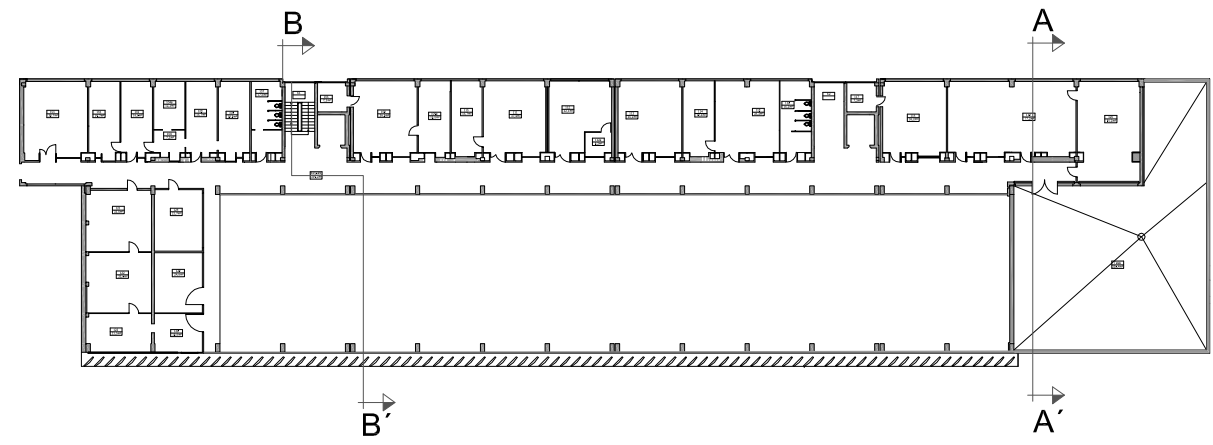
East

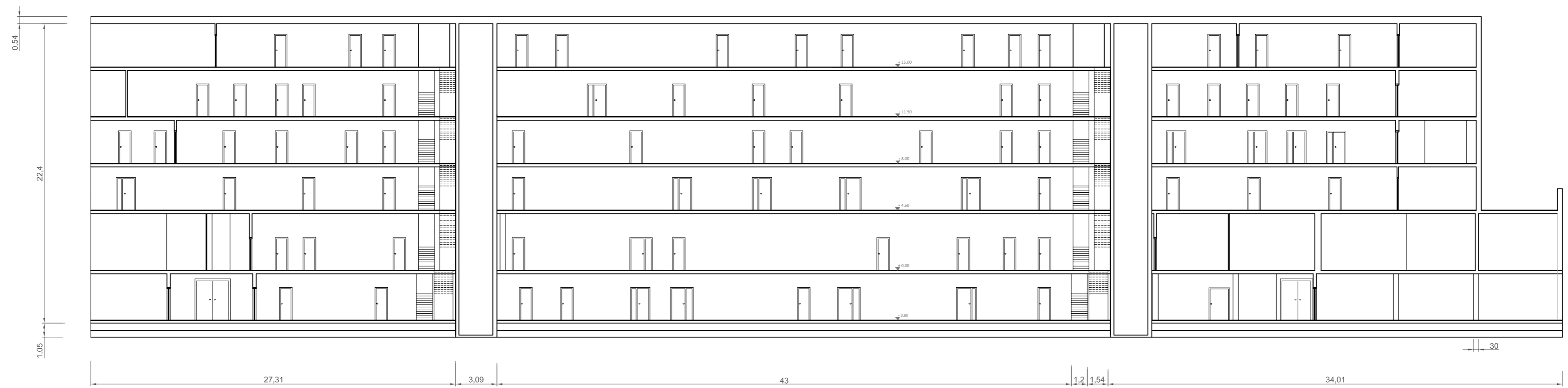
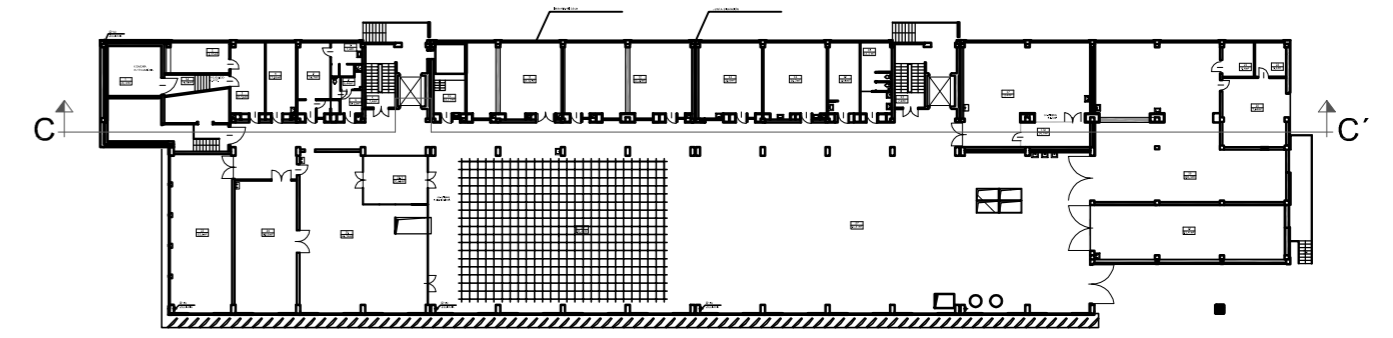


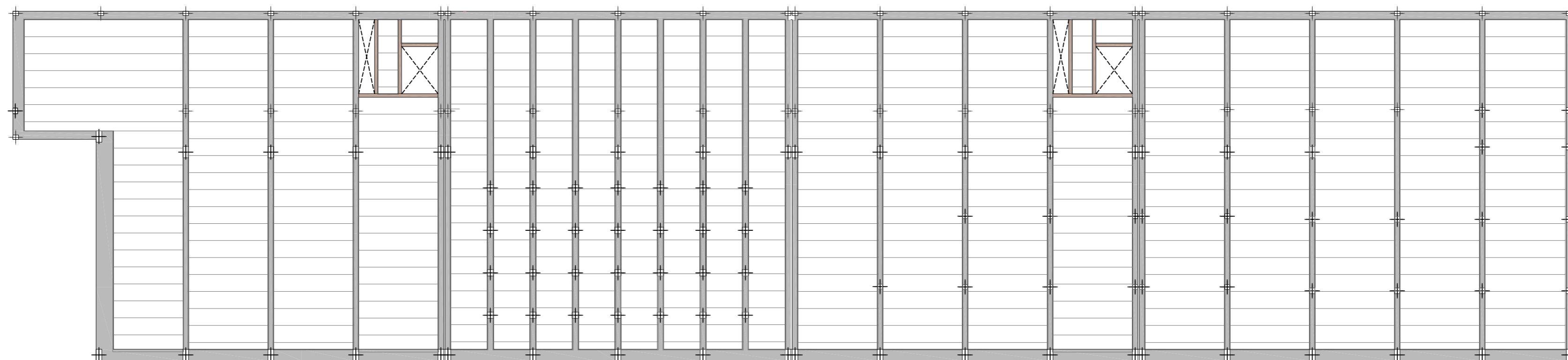
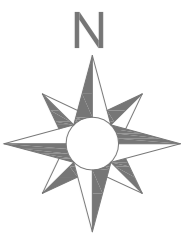
West



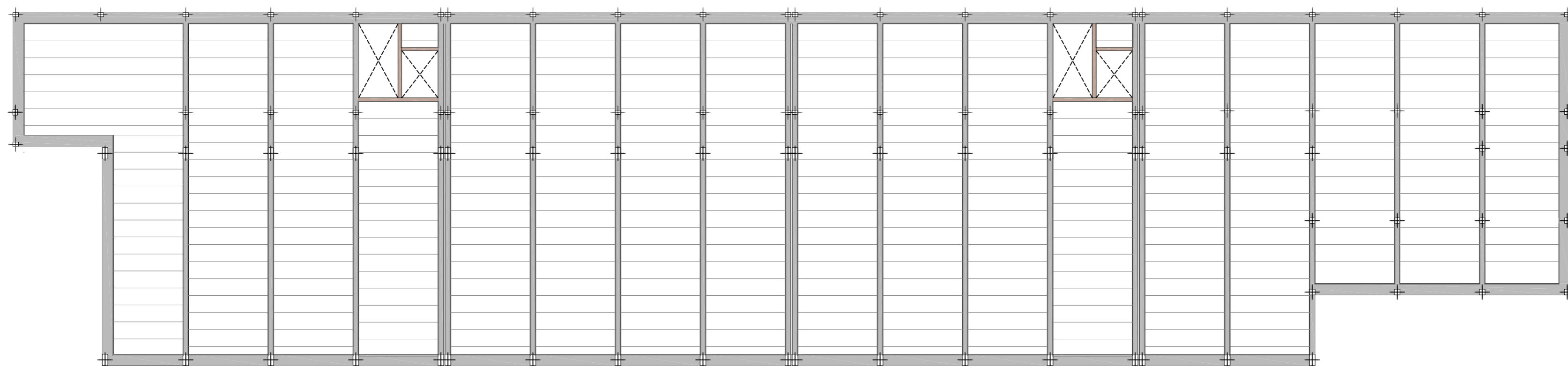




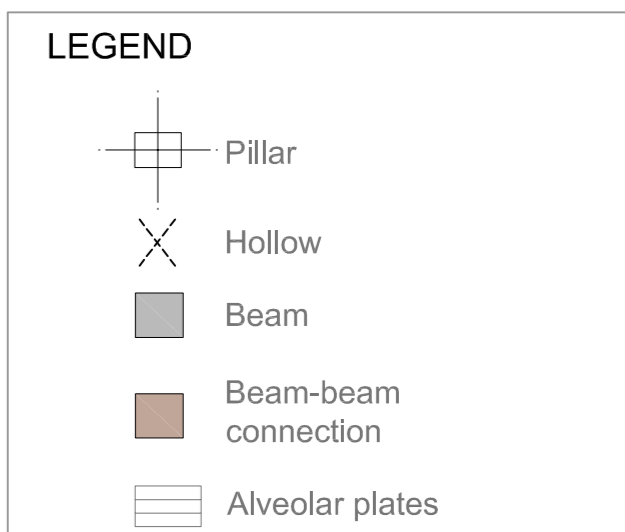


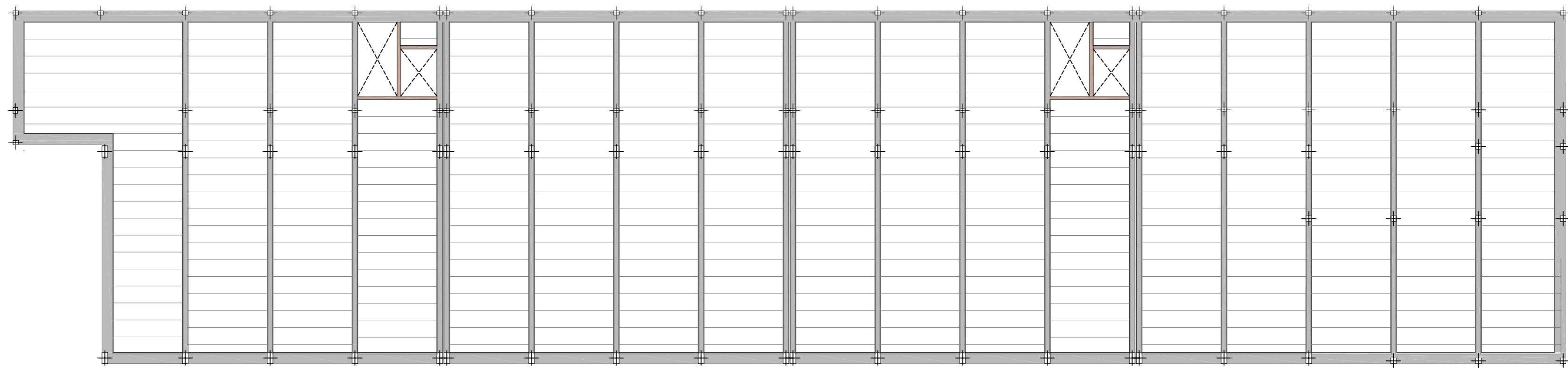
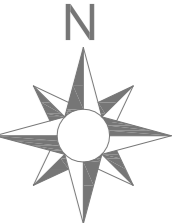


Basement

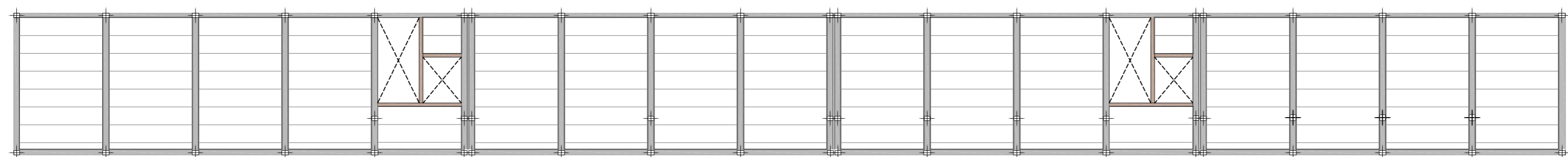


Ground floor



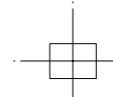






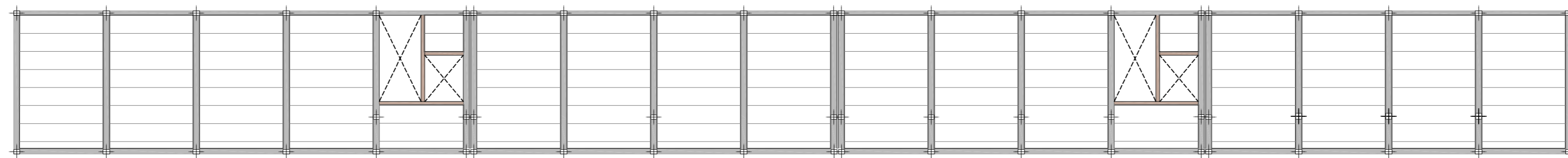
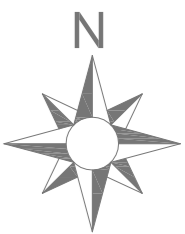
First floor



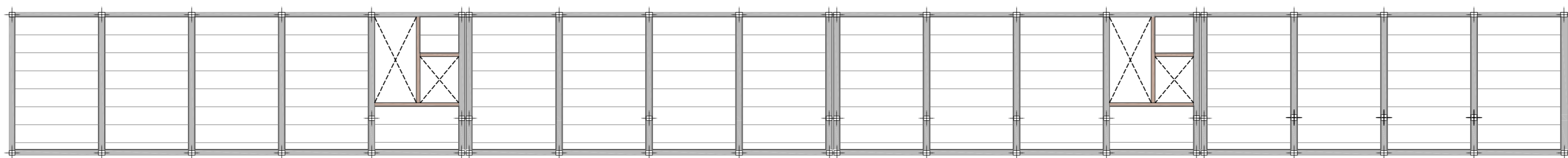
Second floor

LEGEND

-  Pillar
-  Hollow
-  Beam
-  Beam-beam connection
-  Alveolar plates








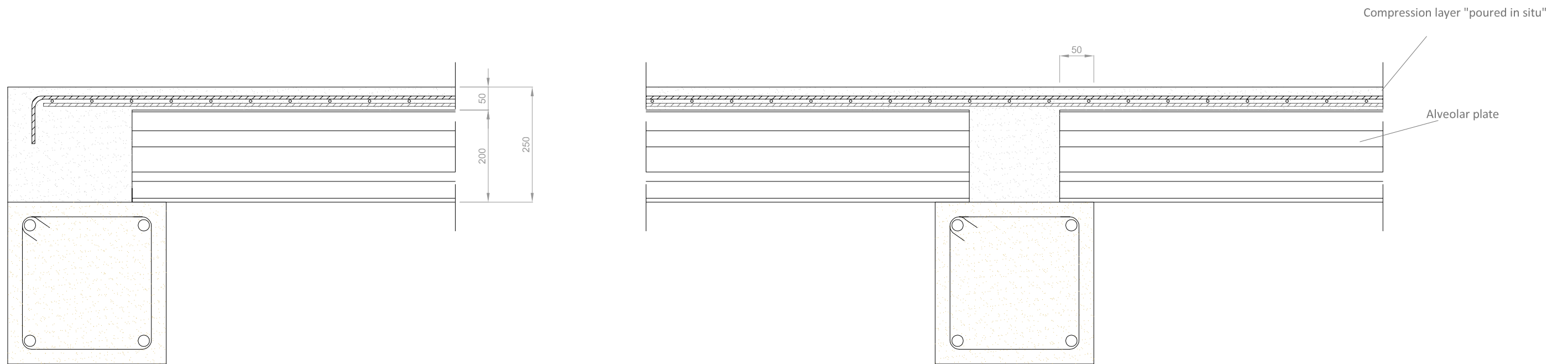
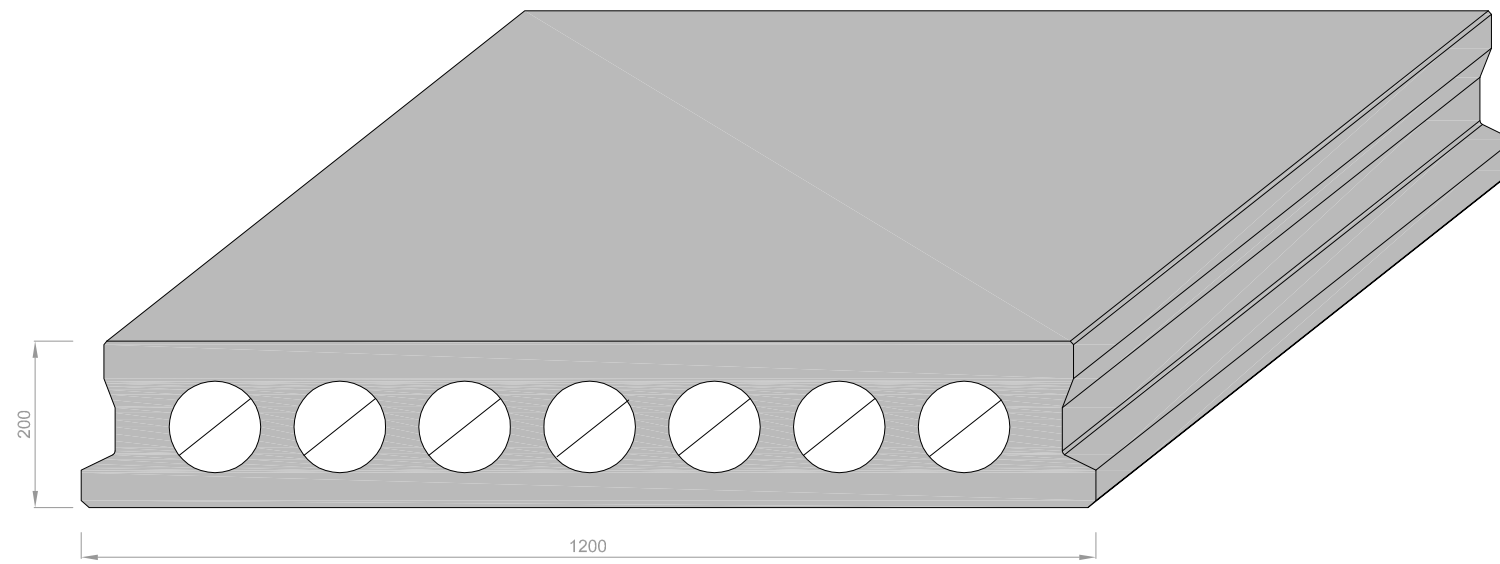
Third floor



Fourth floor

LEGEND

-  Pillar
-  Hollow
-  Beam
-  Beam-beam connection
-  Alveolar plates



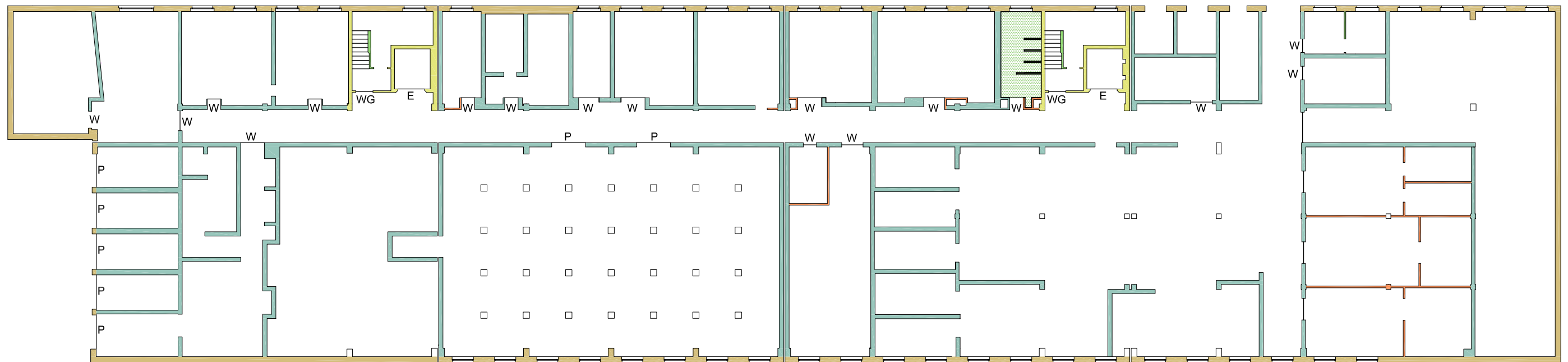
6- FLOORPLANS STUDY MATERIALS AND CONSTRUCTIVE

6.1 FLOOR PLANTS












- Basement
- Ground floor
- First floor
- Second floor
- Third floor
- Fourth floor

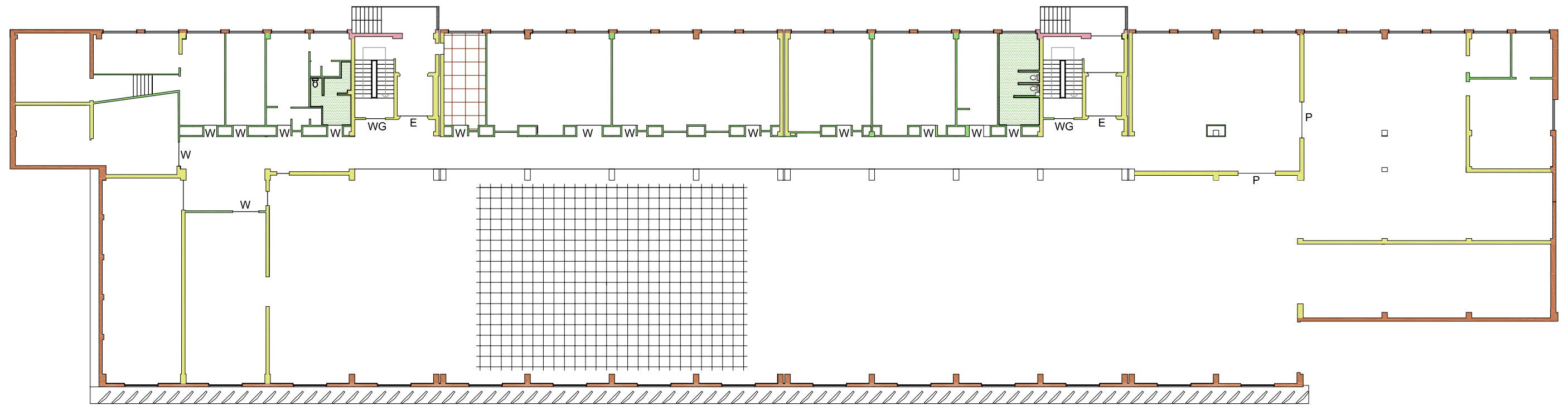
6.2 ELEVATIONS

- North
- South
- East
- West














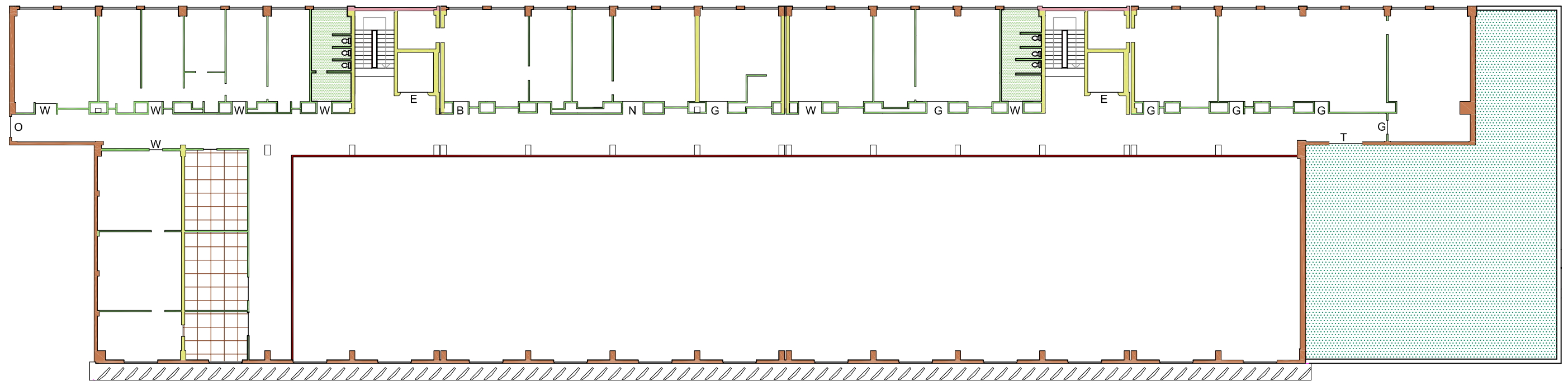
Basement

LEGEND		Material doors				
	Cellular concrete brick 30 cm		Cellular concrete brick 24 cm, finish with smooth plates bolted	M = Metal door		Porcelain stoneware floor
	Klinker 13 cm, rigid polyurethane foam and brick facing		Cellular concrete brick 24 cm	W= Wooden door		Parquet flooring
	Cellular concrete brick 24 cm, 14 cm rockwool, and corrugated plates mounted on wooden slats, with protective varnish finish.		Bricks with cement-and-lime plaster.	A= Red wooden door		Banister
			Finished with ceramic tile	B= Brown wooden door		Outdoor ceramic tiles
				P= Tailgate		
				C= Glass door		
				G= Door with glazed		
				E= Elevator door		
				O= Building exit(conexion Eng. Civil)		
				N= Door covered		
				T= Terrace door		














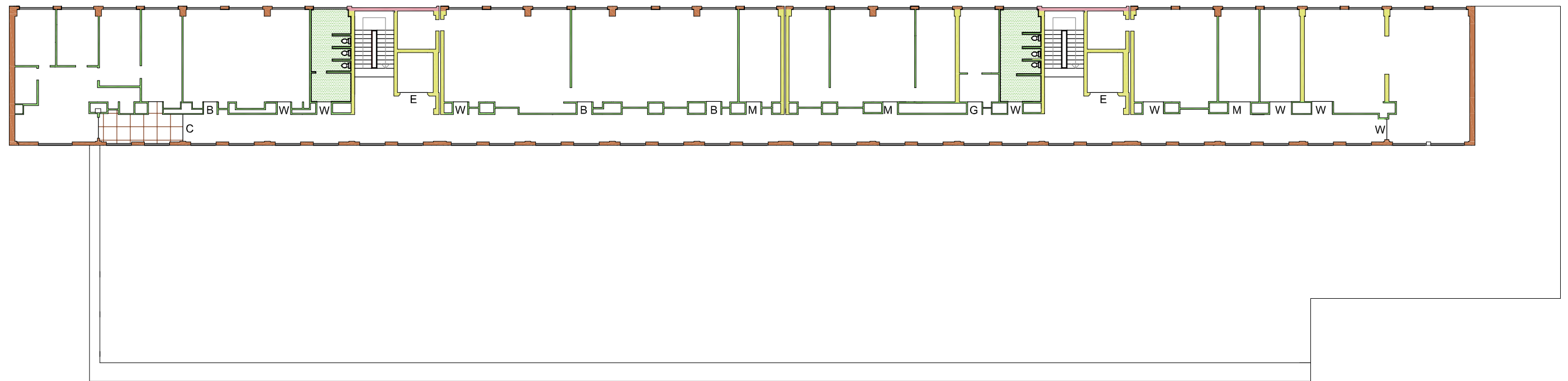
Ground floor

LEGEND		Material doors	
	Cellular concrete brick 30 cm		Cellular concrete brick 24 cm, finish with smooth plates bolted
	Klinker 13 cm, rigid polyurethane foam and brick facing		Cellular concrete brick 24 cm
	Cellular concrete brick 24 cm, 14 cm rockwool, and corrugated plates mounted on wooden slats, with protective varnish finish.		Bricks with cement-and-lime plaster.
			Finished with ceramic tile
		M = Metal door	 Porcelain stoneware floor
		W= Wooden door	 Parquet flooring
		A= Red wooden door	 Banister
		B= Brown wooden door	 Outdoor ceramic tiles
		P= Tailgate	
		C= Glass door	
		G= Door with glazed	
		E= Elevator door	
		O= Building exit(conexion Eng. Civil	
		N= Door covered	
		T= Terrace door	














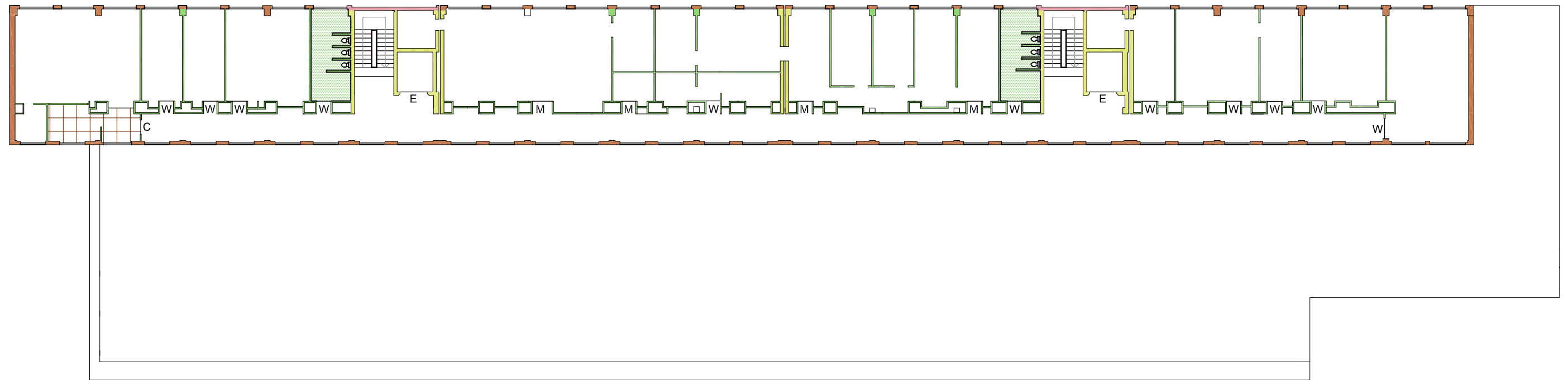
First floor

LEGEND		Material doors	
	Cellular concrete brick 30 cm		Cellular concrete brick 24 cm, finish with smooth plates bolted
	Klinker 13 cm, rigid polyurethane foam and brick facing		Cellular concrete brick 24 cm
	Cellular concrete brick 24 cm, 14 cm rockwool, and corrugated plates mounted on wooden slats, with protective varnish finish.		Bricks with cement-and-lime plaster.
			Finished with ceramic tile
		M = Metal door	 Porcelain stoneware floor
		W= Wooden door	 Parquet flooring
		A= Red wooden door	 Banister
		B= Brown wooden door	 Outdoor ceramic tiles
		P= Tailgate	
		C= Glass door	
		G= Door with glazed	
		E= Elevator door	
		O= Building exit(conexion Eng. Civil)	
		N= Door covered	
		T= Terrace door	














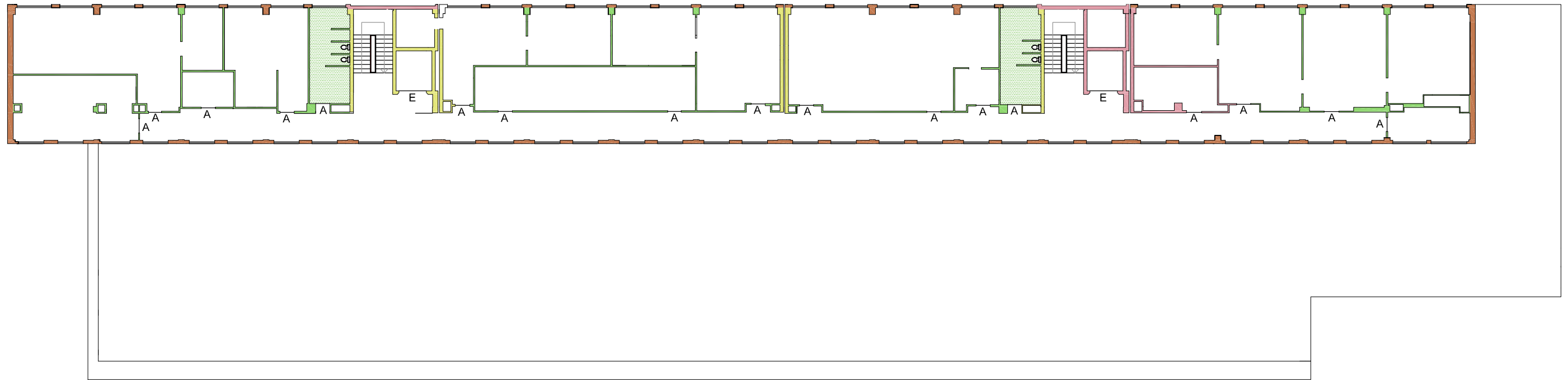
Second floor

LEGEND		Material doors		
	Cellular concrete brick 30 cm		Cellular concrete brick 24 cm, finish with smooth plates bolted	
	Klinker 13 cm, rigid polyurethane foam and brick facing		Cellular concrete brick 24 cm	
	Cellular concrete brick 24 cm, 14 cm rockwool, and corrugated plates mounted on wooden slats, with protective varnish finish.		Bricks with cement-and-lime plaster.	
			Finished with ceramic tile	
		M = Metal door		Porcelain stoneware floor
		W= Wooden door		Parquet flooring
		A= Red wooden door		Banister
		B= Brown wooden door		Outdoor ceramic tiles
		P= Tailgate		
		C= Glass door		
		G= Door with glazed		
		E= Elevator door		
		O= Building exit(conexion Eng. Civil)		
		N= Door covered		
		T= Terrace door		














Third floor

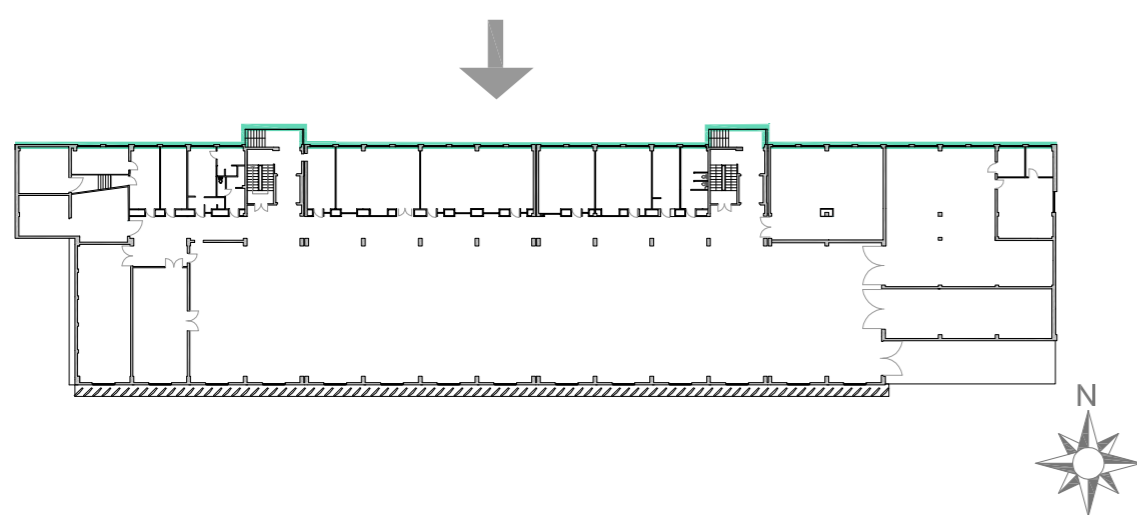
LEGEND		Material doors			
	Cellular concrete brick 30 cm		Cellular concrete brick 24 cm, finish with smooth plates bolted		
	Klinker 13 cm, rigid polyurethane foam and brick facing		Cellular concrete brick 24 cm		
	Cellular concrete brick 24 cm, 14 cm rockwool, and corrugated plates mounted on wooden slats, with protective varnish finish.		Bricks with cement-and-lime plaster.		
			Finished with ceramic tile		
		M = Metal door		Porcelain stoneware floor	
		W= Wooden door		Parquet flooring	
		A= Red wooden door		Banister	
		B= Brown wooden door			Outdoor ceramic tiles
		P= Tailgate			
		C= Glass door			
		G= Door with glazed			
		E= Elevator door			
		O= Building exit(conexion Eng. Civil)			
		N= Door covered			
		T= Terrace door			









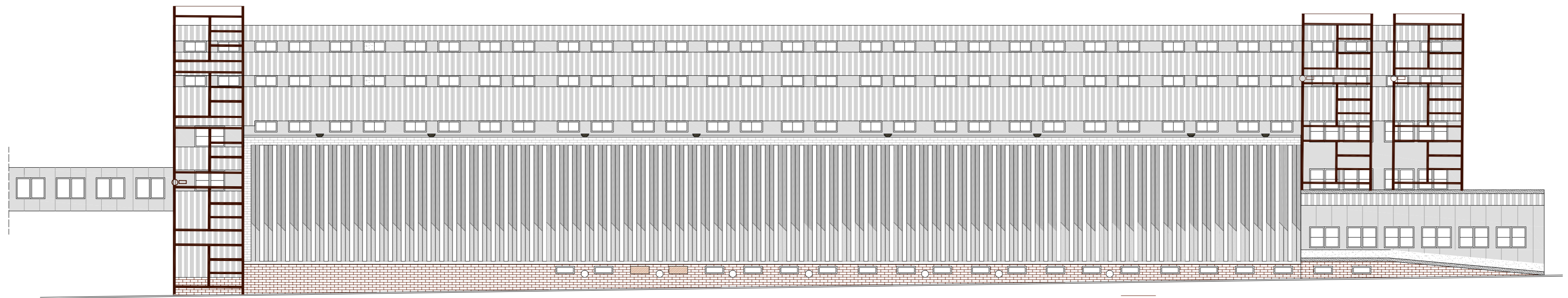
Fourth floor





LEGEND		Material doors	
	Cellular concrete brick 30 cm		Cellular concrete brick 24 cm, finish with smooth plates bolted
	Klinker 13 cm, rigid polyurethane foam and brick facing		Cellular concrete brick 24 cm
	Cellular concrete brick 24 cm, 14 cm rockwool, and corrugated plates mounted on wooden slats, with protective varnish finish.		Bricks with cement-and-lime plaster.
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		C= Glass door	
		G= Door with glazed	
		E= Elevator door	
		O= Building exit(conexion Eng. Civil)	
		N= Door covered	
		T= Terrace door	

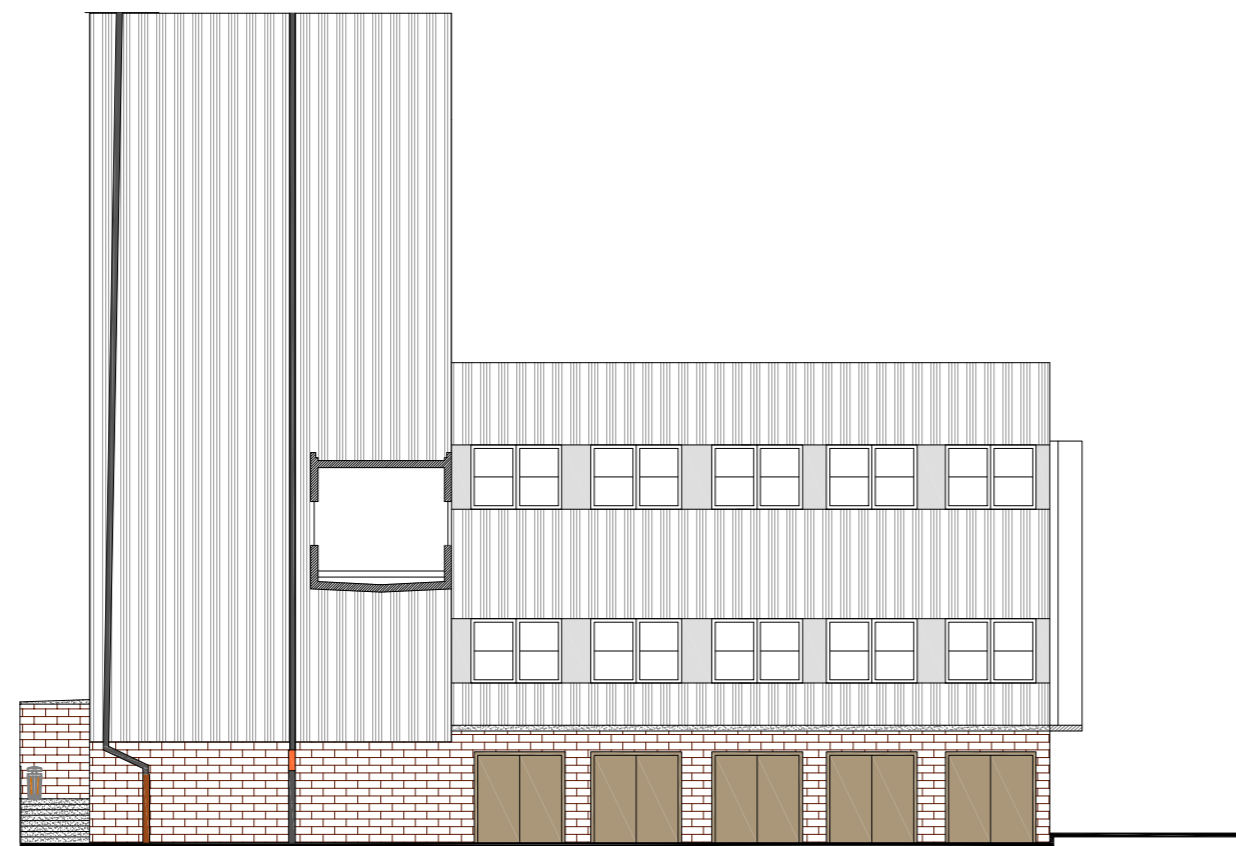
ELEVATIONS



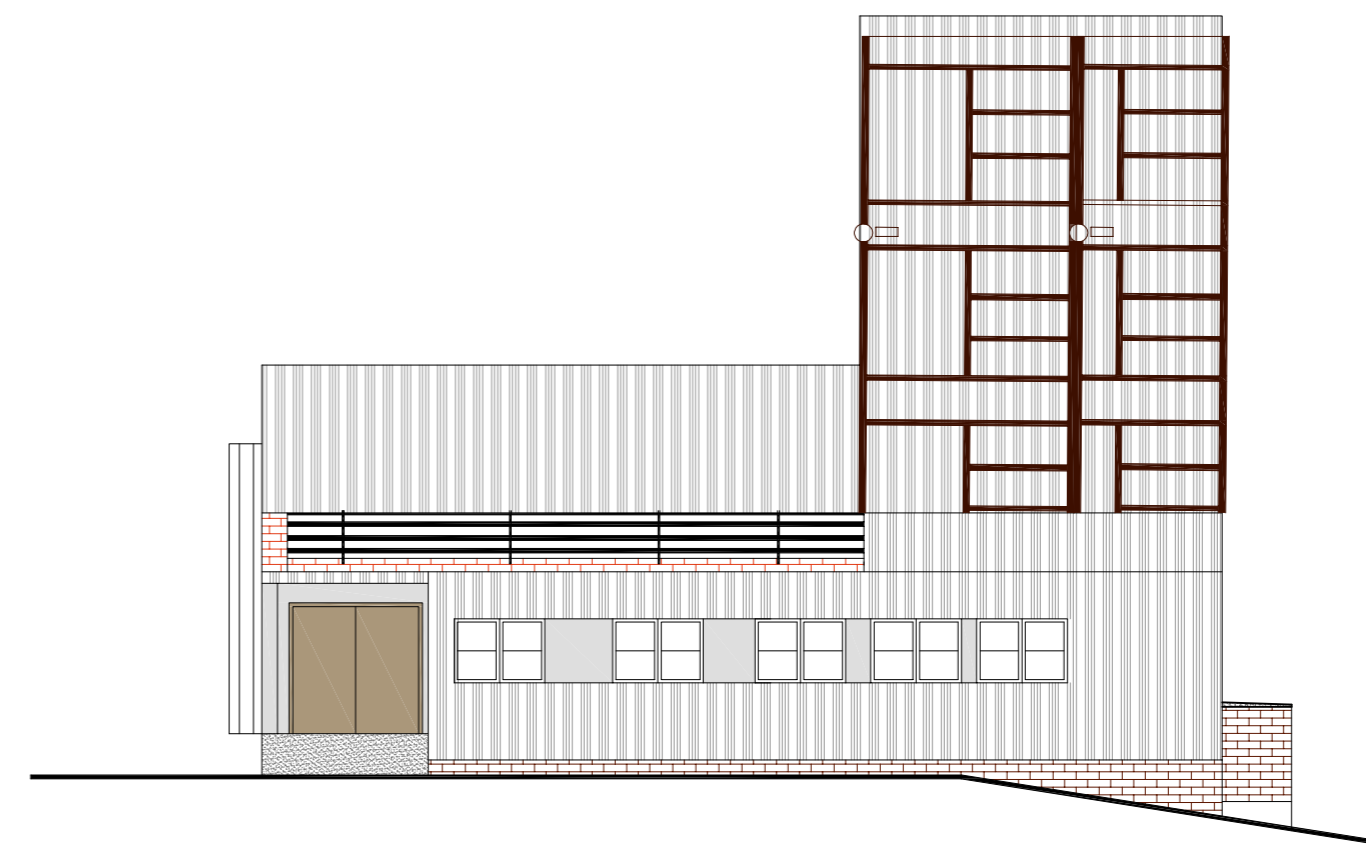
LEGEND			
	Painted brick facing		Deteriorated concrete construction elements
	Facade without finished of fibre corrugated plates		Humidity
	Fibre corrugated plates with dirt and color fading		Currently façade rehabilitation



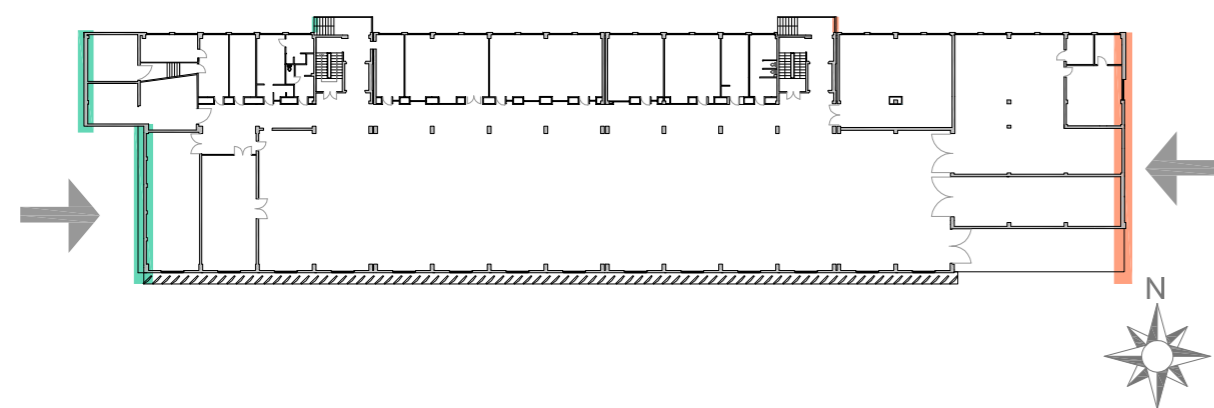
LEGEND	
	Facade without finished of fibre corrugated plates
	Blind windows
	Painted plates
	Currently façade rehabilitation



East



West



LEGEND	
	Facade without finished of fibre corrugated plates
	Currently façade rehabilitation
	Deteriorated concrete construction elements

7- FIELD OBSERVATIONS AND EVALUATION OF THE PATHOLOGIES

7.1 PATHOLOGICAL TABS

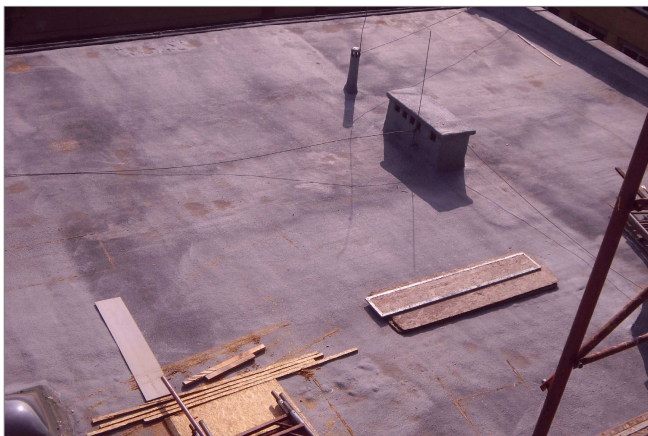
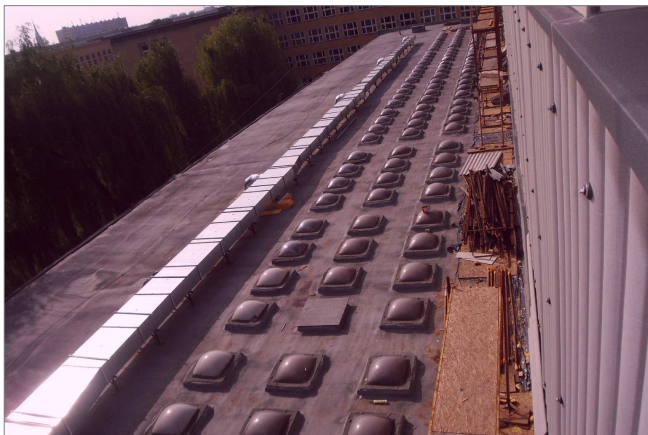
- Description (situation, photos...)
- Possible causes.
- Evaluation of rehabilitation alternatives (interventions)
- Propose solution.
- Details.

7.2 OVERVIEW PATHOLOGIES

- 1- Leaks on deck
- 2- Windows frames
- 3- Humidity in the outside wall
- 4- Downpipes
- 5- Breakage façade
- 6- Fall of tiles
- 7- Deteriorated external stairs
- 8- Uncoated ledge
- 9- Dirt expansion strip
- 10- Oxidation and external moisture
- 11- Incorrect water evacuation
- 12- Ramp in poor condition
- 13- Oxidation profiles
- 14- Cracks in interior stairs
- 15- Pavement crack
- 16- Simple brick breakage
- 17- Crack in brick facing
- 18- Installation
- 19- Overheating trough outside doorframes

DESCRIPTION: Humidity in two different areas on the top floor of the building. Heating in the deck, It doesn't comply with thermal conditions

PHOTOGRAPHS:



POSSIBLE CAUSES:

Not passable cover

- Drains with insufficient slope or diameter
- No maintenance of drainage pipes
- Enough deck slope.
- encounters with skylights poorly resolved
- The outer perimeter of the cover does not have a minimum vertical extension waterproofing layer on the vertical surface (in some parts there is not forechest)

Passable cover

- Poor quality pavement material that absorbs too much water because of a high porosity.
- Lack of sufficient sumps
- Cloths deck with insufficient slope

General causes

- Waterproofing layer poor placement or absence of this.
- Insufficient insulation thickness. Cover warming

INTERVENTION:

1. The steps to intervene successfully on this pathology are:

Not passable cover

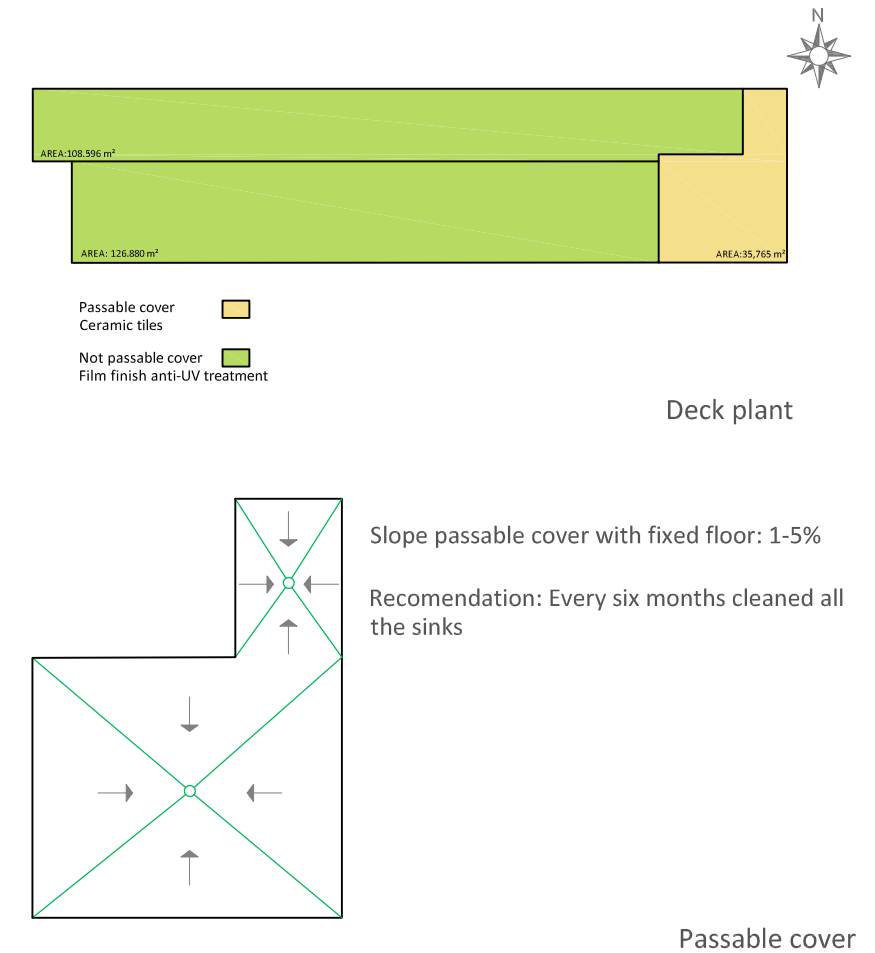
Not passable cover 11cm increasing insulation (currently 7 cm)

THERMAL TRANSMITTANCE

Regulation $U = 0,25 \text{ W / m}^2 \text{ K}$

Increasing the thickness of polyurethane insulation 10cm $U = 0,23 \text{ W / m}^2 \text{ K}$

LOCATION:



Passable cover

- Remove layers from the deck to reach the wrought
- Rerunning all the layers (detail 1) placing another sump.

- Placing the covering layers, increasing the thickness of the insulation

CTE DB-H1 Table 4.6 number of sinks depending on the deck area.
For areas less than 100m², 2 sinks

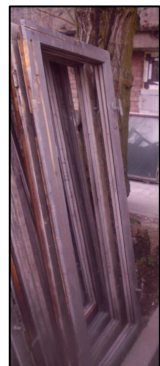
THERMAL TRANSMITTANCE

Regulation: $U = 0,50 \text{ W / m}^2 \text{ K}$

Increasing the thickness of polyurethane foam ($\lambda = 0,025$) insulation 10cm $U = 0,46 \text{ W / m}^2 \text{ K}$

DESCRIPTION: Most of window frames is deteriorated. The window fittings are rusted. The windows of the staircase are made of steel and are oxidized.

PHOTOGRAPHS:



POSSIBLE CAUSES:

Because of the weather ,they are continuously exposed to rain, snow ..

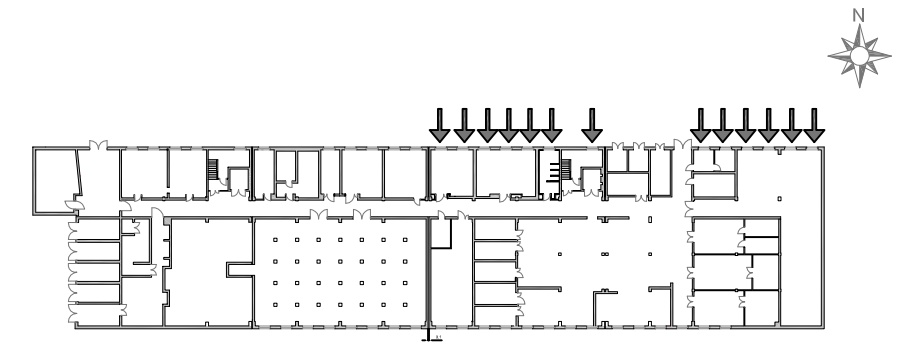
INTERVENTION:

Change affected window frames and replace PVC windows and change the window sill too.

By aesthetics of the building and to avoid future problems with window frames, recommended to change all the woodwork of the building

The windows will be of PVC material and soundproofing of 40 dB

LOCATION:

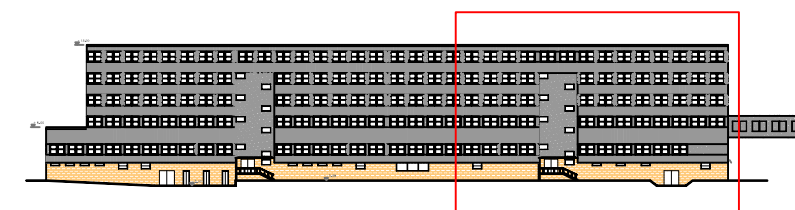


➔ Rusty windows

basement

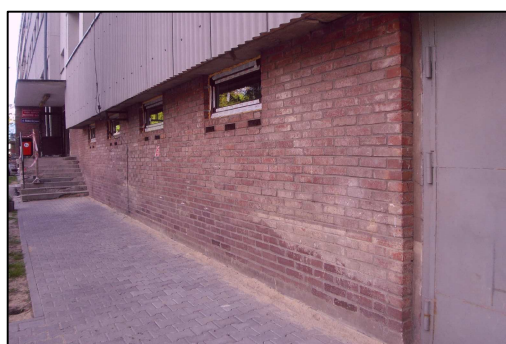
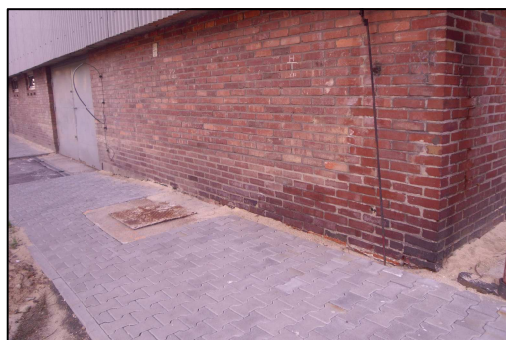
DESCRIPTION: Damp in most of the facade of the building, at the bottom. observed deterioration of elements, efflorescences and coatings

LOCATION:



North

PHOTOGRAPHS:

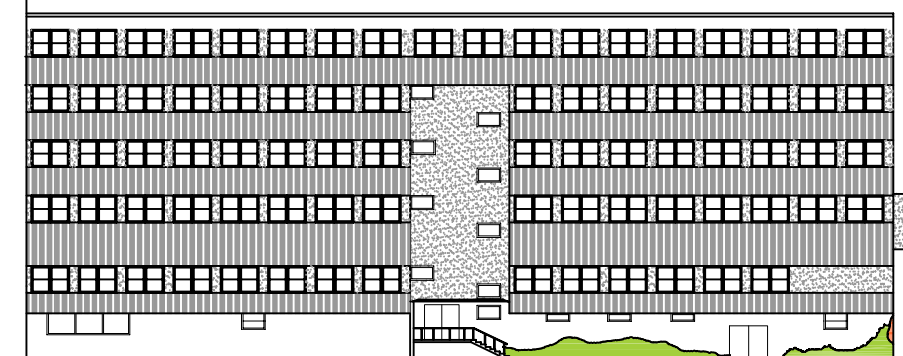




POSSIBLE CAUSES:

- Very porous wall material
- Too much water in the subsoil because of ground water table
- Saturation field rainwater
- Water facilities breakage or deteriorated (pathology 4)

INTERVENTION:

1. The steps to intervene successfully on this pathology are:
 - Remove of the whole coating by chopping the entire affected area.
 - Clean all the support by sandblasting.
 - Be placed on electro-osmosis system by pulses of resonance.
 - Coat the entire surface with a special mortar microporous
 - Take the initial state of the facade.



-  Damp by capillarity
-  Water filtration because of poor design of the pipe (pathology 4)

DESCRIPTION: Poor execution of water pipes. Pipes are poorly subject, and are oxidized. The connetions are not suitable. When there are heavy rains the water don't run through the pipes. The water fall directly to the ground.

PHOTOGRAPHS:



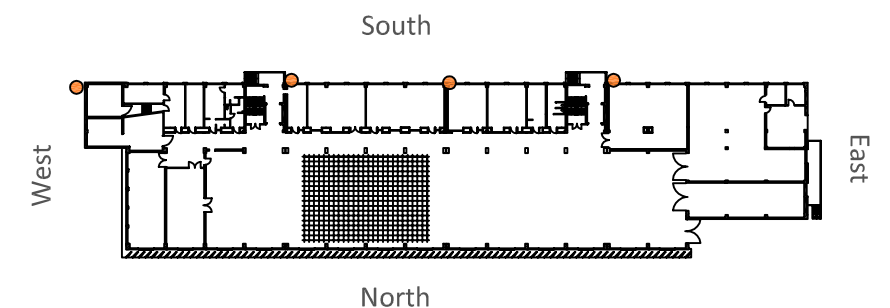
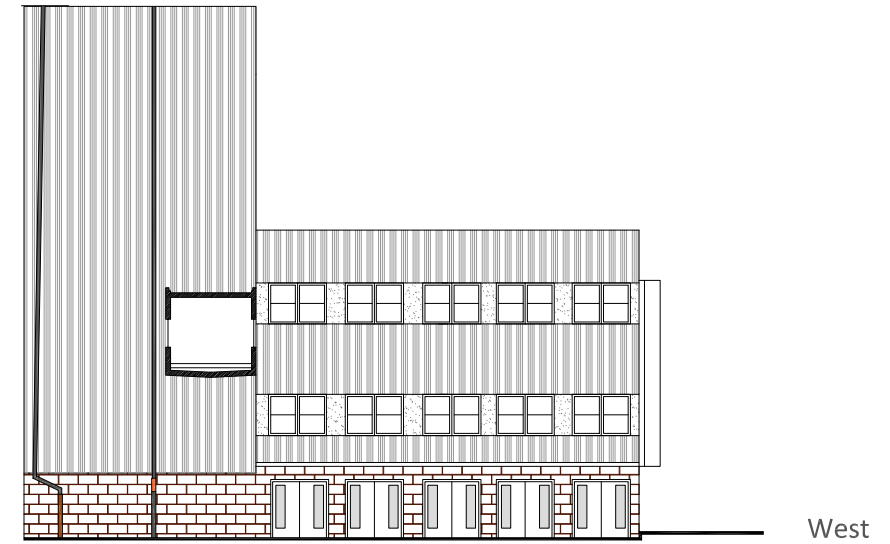
POSSIBLE CAUSES:

- Poor design of the pipes
- there is slack between the splices of the pipes

INTERVENTION:

Change all downpipes and replace the entire system

LOCATION:



● Situation of pipes

DESCRIPTION: With step the years cement fibre corrugated plates have been deteriorated, leaving the interior discovered. Also all the facade does not comply with the thermal conditions. Global warming.

LOCATION:

PHOTOGRAPHS:



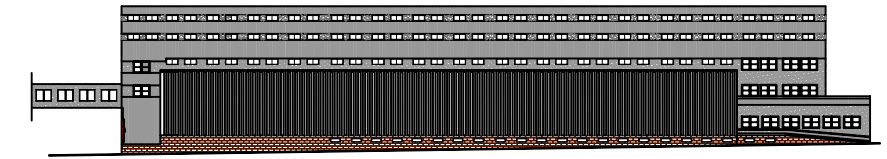
POSSIBLE CAUSES:

Breakage facade

- Because of the weather: rain and snow
- Acts of vandalism

warming of the facade

- Insufficient rockwool thickness (insulation)



 Breakage facade

South

INTERVENTION:

Given that the facade finished with fibre corrugated plates and with smooth plates bolted does not meet regulations regarding thermal transmittance and is generally in very poor condition. The recommendation would be to change the entire facade increased insulation rockwool and complying with:

Brick cladding (Basement floor)

Existing wall $U = 2,33 \text{ W / K}$ -- > no cumple con la normativa

Regulation: $U = 0,90 \text{ W / K}$

Increasing the thickness of polyurethane insulation 5cm $U = 0,41 \text{ W / m}^2 \text{ K}$

Enclosure finish with smooth plates bolted :

Existing wall: $U = 4,55 \text{ W / m}^2$

Regulation: $U = 0,65 \text{ W / m}^2 \text{ K}$ para $t \leq 16 \text{ }^\circ \text{C}$

Increasing the thickness of rockwool 14cm $U = 0,50 \text{ W / m}^2 \text{ K}$

Enclosure finished with fibre corrugated plates:

Existing wall: $U = 1,49$

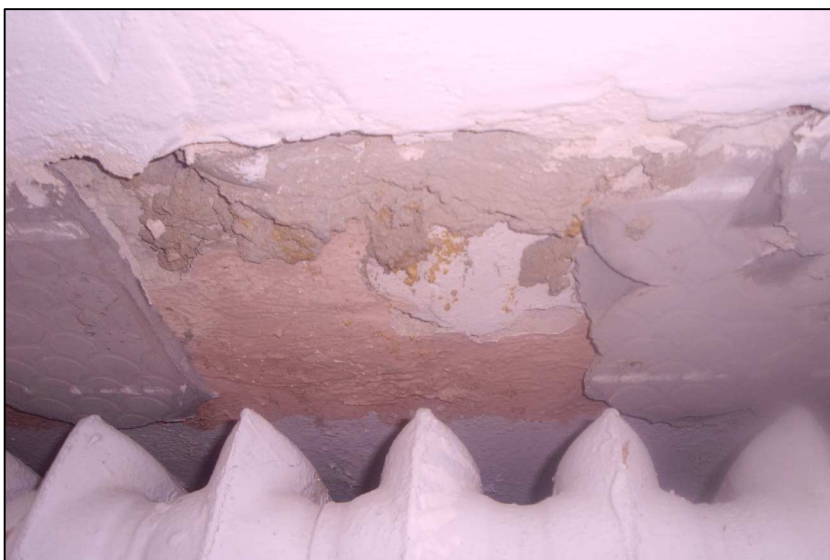
Regulation: $U = 0,30 \text{ W / m}^2$

Increasing the thickness of rockwool 14cm $U = 0,29 \text{ W / m}^2 \text{ K}$



DESCRIPTION: Some tiles have fallen and others are bulging. The pathology is in a wet area of the building

PHOTOGRAPHS:



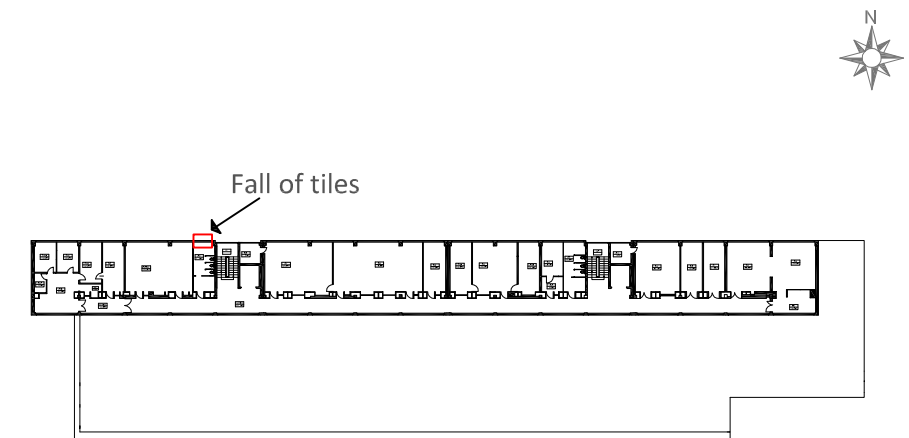
POSSIBLE CAUSES:

- Moisture
- Poor quality plaster
- Tile placement without prior wetting
- Insufficient plaster layer
- Exposure to high temperatures because there are close to a radiator

INTERVENTION:

1. The steps to intervene successfully on this pathology are:
 - Removing the tiles bulging
 - Remove the layer of plaster
 - Clean the surface
 - Applying plaster of good quality
 - Placement the tiles wetting

LOCATION:

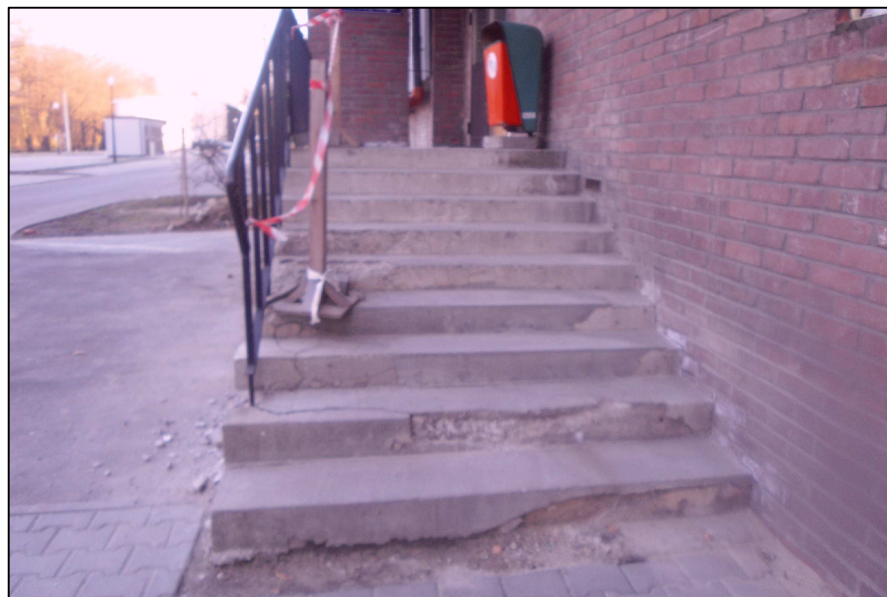


DESCRIPTION: Stairs deteriorated by weatherproof. Observe detachment of concrete remaining sight and rusty armour

LOCATION:

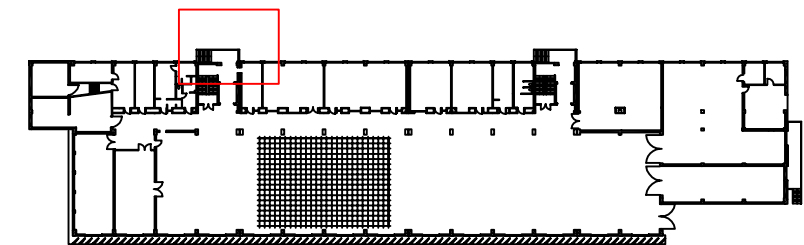


PHOTOGRAPHS:



POSSIBLE CAUSES:

- Missing armor coating
- Lack of maintenance of concrete
- Corrosion of reinforcements
- Concrete surface without treatment. Observed pilling and oxidized armor in sight
- Abruption of concrete (coating)
- Insufficient vibrated concrete which has produced voids and detachments
- Elevated foot traffic
- Impact on the steps
- Use low strength concrete.



INTERVENTION:

1. The steps to intervene successfully on this pathology are:

Down the stairs and remake it, would be a very expensive process is better to perform the following process

- 1- Substrate preparation: for the corrosion steel, clean it with sandblasted
 - 2- Corrosion protection for exposed reinforcement: it comes to apply a dry mortan, comprising high-grade cement, aggregate plus additives, mixed with water. It provides durable protection against corrosion
 - 3- Application of bonding layer: The cementitious Sopro Repadur mortar bonding layer
 - 4- Ensures good adhesion : Apply cementitious, fibre-reinforced. The repair mortar is applied wet-on-wet to the slurry in 1 to 5cm thick coat.
 - 5- Final surface finishing: Sopro Repadur 5 fine PCC concrete filler is used to fill pores and blowholes and to prepare substrate for paint systems or other coatings. The filler may be applied in coats up to 5 mm thick.
- Following post the whole staircase formwork
 - Return to be concreted the areas where lost concrete section

DESCRIPTION: Part of the facade without a coating (cement fibre corrugated plates) . Railings in disrepair, it doesn't comply safety conditions. It is made with painted wood and steel. The steel has oxidized some parts. Cover water flows directly by the facade causing leaks

PHOTOGRAPHS:



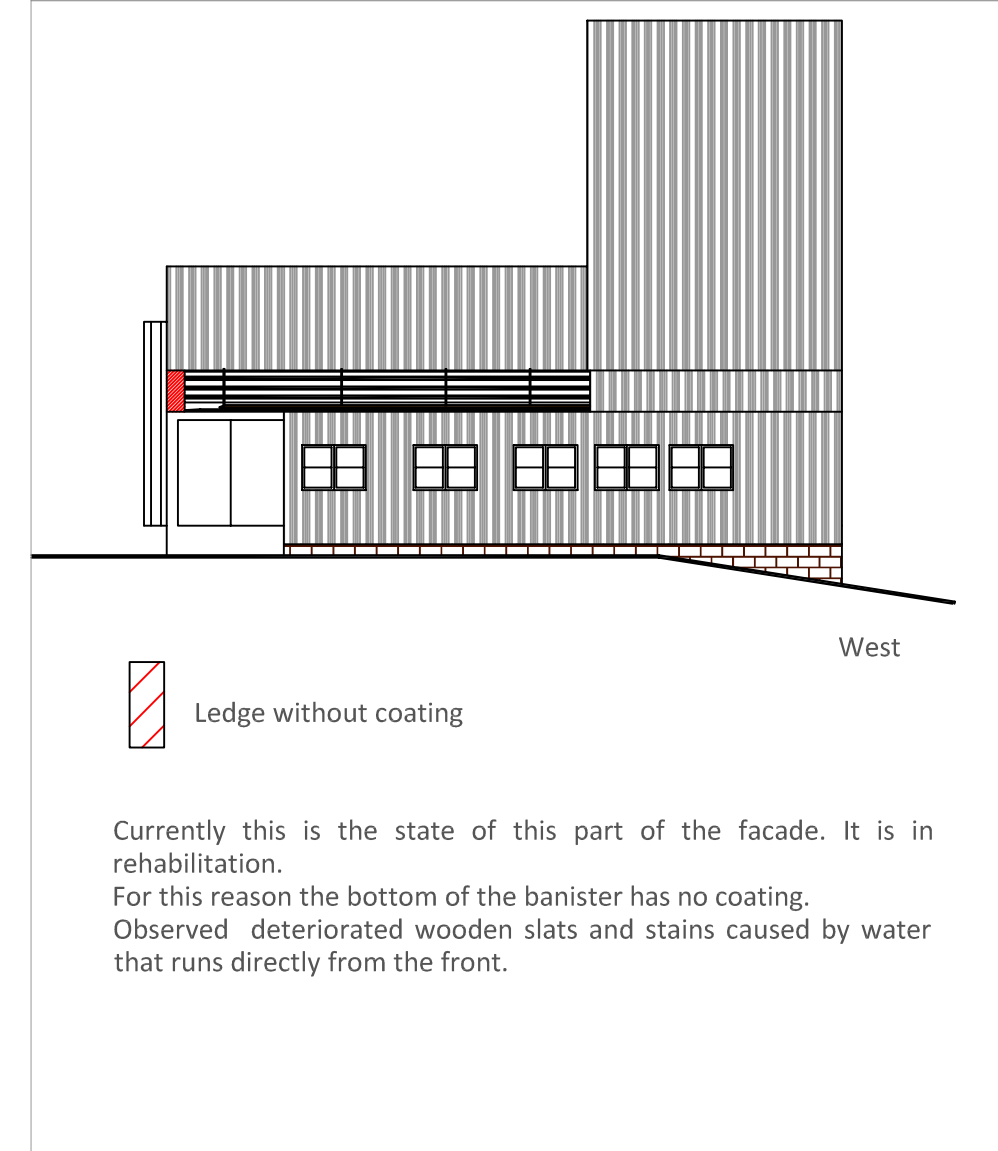
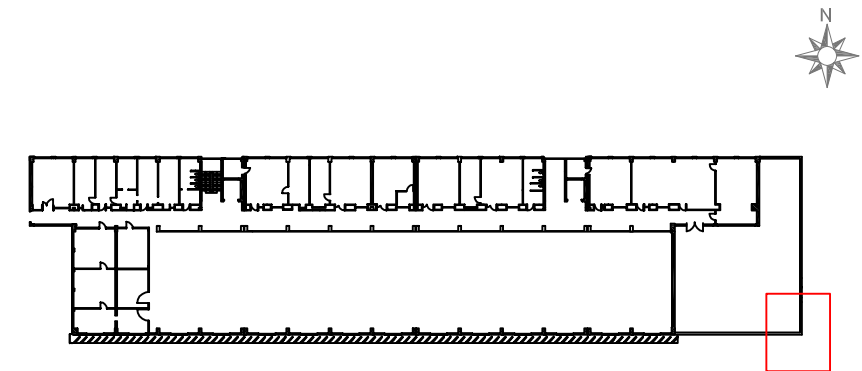
POSSIBLE CAUSES:

- Probably the cement fibre corrugated plates has been withdrawn for safety reasons (perhaps was loose)
- On the other hand, the cover hasn't vertical height and don't formed ledge so for this reason the water falls directly from the front facade and producing by filtration humidities

INTERVENTION:

1. The steps to intervene successfully on this pathology are:
 - Remove cement fibre corrugated plates affected and the rockwool.
- * According with the intervention performed in the pathology 5

LOCATION:



DESCRIPTION: Expansion joint is dirty and has moisture around. The mineral wool also is not constant along its length. It hasn't sealant, so air and moisture can enter into the joint.

PHOTOGRAPHS:



POSSIBLE CAUSES:

- Lack of maintenance and cleaning of the expansion joint
- Meteorological agents

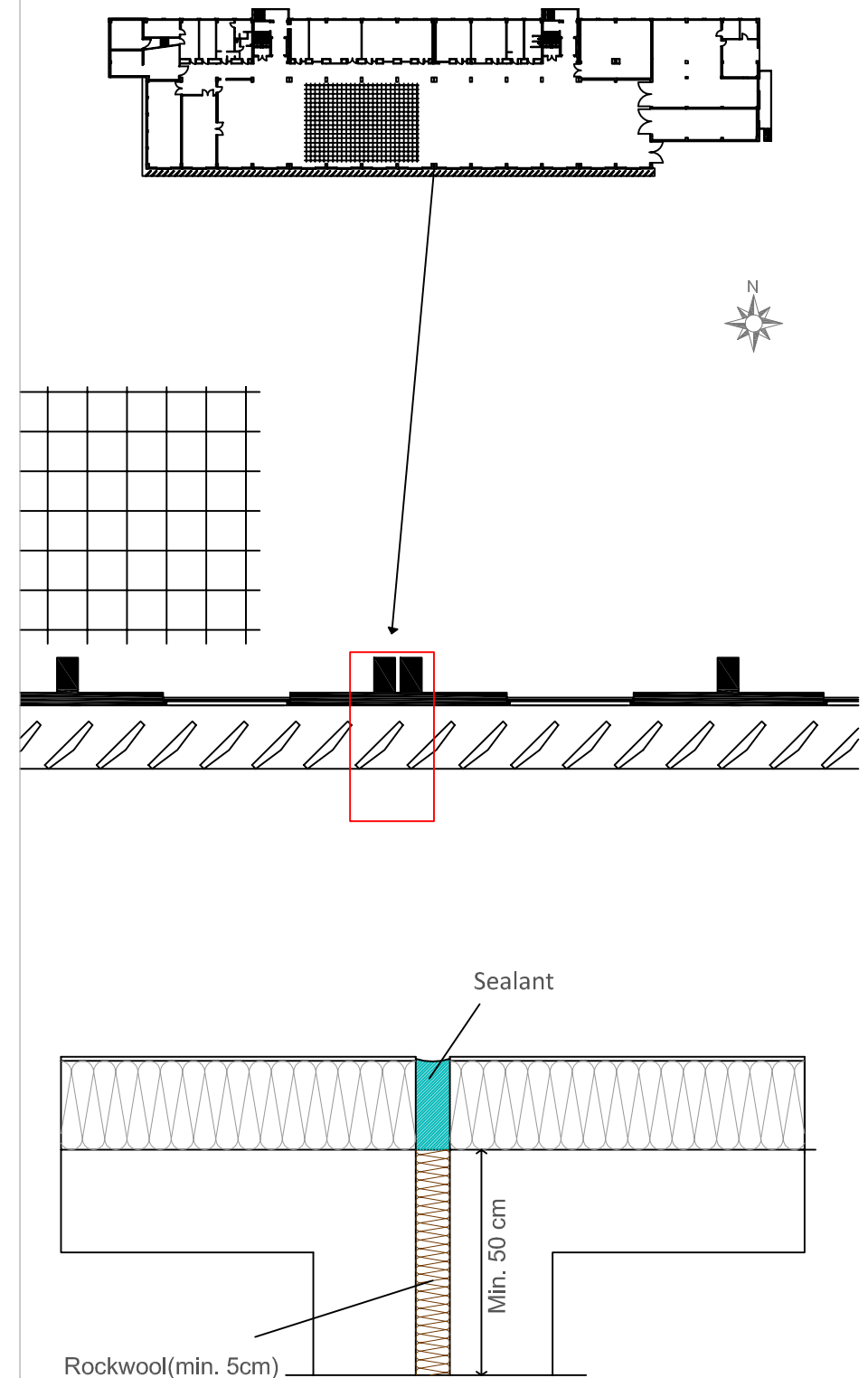
INTERVENTION:

1. The steps to intervene successfully on this pathology are:

- Clean the entire length of the joint
- Removing rockwool
- Refit rockwool. Minimum depth of rockwool 1cm

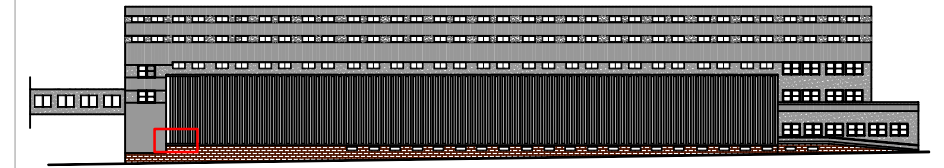
The expansion joint aims to absorb the movements of expansion or contraction due to temperature variations. It should be sealed with elastic fillers that are resistant to mechanical damage and chemical products. It must be impermeable and resistant to atmospheric agents.

LOCATION:

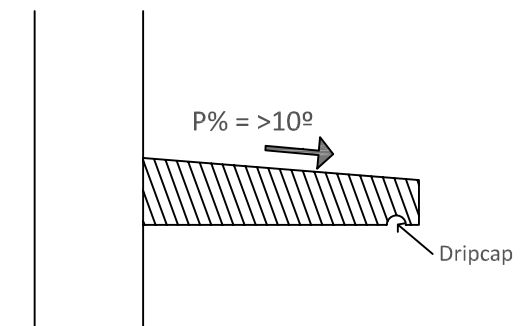


DESCRIPTION: Concrete facade outgoing where there are water stains, chipping, concrete disintegrations even formation of mold on the surface.

LOCATION:



South



PHOTOGRAPHS:



POSSIBLE CAUSES:

- Water stagnates resulting moisture and oxidation.
- No dripcap at the bottom, which causes the water to run directly by the slab
- Concrete surface without treatment. Observed pilling
- Insufficient vibrated concrete which has produced voids and detachments
- Lack of maintenance of concrete
- Slope insufficient outward which causes the water is stagnant

INTERVENTION:

1. The steps to intervene successfully on this pathology are:

- Clean the entire surface
- check the slope. Minimum slope has to be 10 °.

- Put formwork and concreting again

It has to be waterproof or have the top face protected by a impermeable barrier to prevent water from seeping through them.

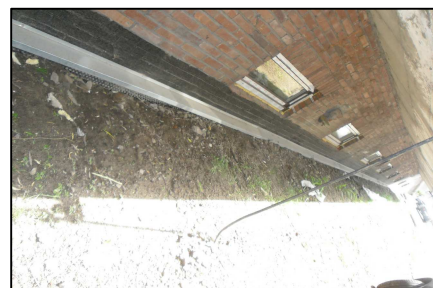
In the vertical face encounter with the elements must have an element protection up at least 15 cm

Do a dripcap on the outer edge of the lower face to prevent rainwater evacuated reaches the facade immediately inferior to it.

Expansion joints should be arranged every two pieces when they are stone or prefabricated and every 2 m when they are ceramic. The joints between the copings must be such that they are impermeable with proper sealing.

DESCRIPTION: Poor choice of water drainage method. placing a sink for landscaped deck with holes to evacuate water from the perforations in the sump. But when it rains the water is not drained properly and remains in the ground causing it to be wet. That moisture passes into producing more moisture facade.

PHOTOGRAPHS:



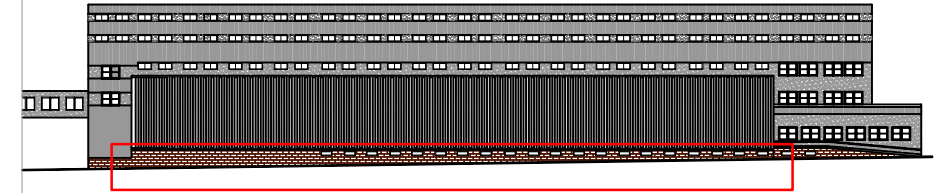
POSSIBLE CAUSES:

- Drainage method poorly executed.
- Land obstructing water drainage

INTERVENTION:

1. The steps to intervene successfully on this pathology are:
 - Remove all lands that are observed.
 - Change the drainage method.
 - Place a water collection gutter in the middle of the street with a slope to evacuate the water and it doesn't touch the front of the building

LOCATION:



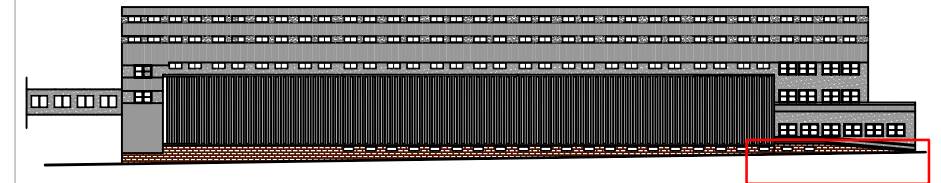
PHOTOGRAPHS:



Photography of www.arquetasprefabricadas.com

DESCRIPTION: There are lack of uniformity in rolling layer and there is a layer slip. It can be observed rust problems, disaggregation of concrete and efflorescences

LOCATION:



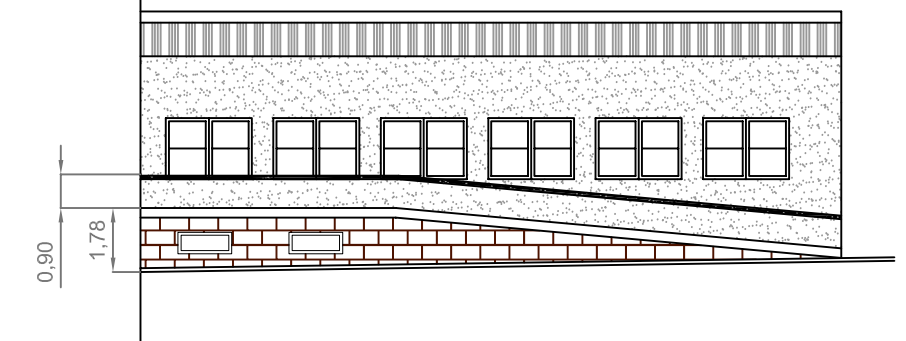
PHOTOGRAPHS:



POSSIBLE CAUSES:

- The surface wear is produced by mechanical action due to foot traffic, ordinary vehicles, commercial vehicles and the water that carries suspended particles. Observed disaggregation of the concrete
- Small differential settlement
- Lack of maintenance of concrete
- Concrete surface without treatment. Observed pilling and oxidized armor in sight
- Abruption of concrete (coating)
- Insufficient vibrated concrete which has produced voids and detachments
- Use low strength concrete.

The entire length of the ramp there aren't banister. Place it, with a height of 0.90m.



INTERVENTION:

The steps to intervene successfully on this pathology are similar to the intervention of the pathology 7:

First removing layers of the ramp:

- 1- Substrate preparation: for the corrosion steel, clean it with sandblasted
 - 2- Corrosion protection for exposed reinforcement: it comes to apply a dry mortar, comprising high-grade cement, aggregate plus additives, mixed with water. It provides durable protection against corrosion
 - 3- Application of bonding layer: The cementitious Sopro Repadur mortar bonding layer
 - 4- Ensures good adhesion : Apply cementitious, fibre-reinforced. The repair mortar is applied wet-on-wet to the slurry in 1 to 5cm thick coat.
 - 5- Final surface finishing: Sopro Repadur 5 fine PCC concrete filler is used to fill pores and blowholes and to prepare substrate for paint systems or other coatings. The filler may be applied in coats up to 5 mm thick.
- Following post the whole staircase formwork
 - Return to be concreted all the ramp. The running surface on the ramps must be adherent. To avoid scuffing of the ramps will be applied, at least in the tread portion, a coating layer of concrete

DESCRIPTION: Metal profiles that are inside the building, are oxidized.

PHOTOGRAPHS:



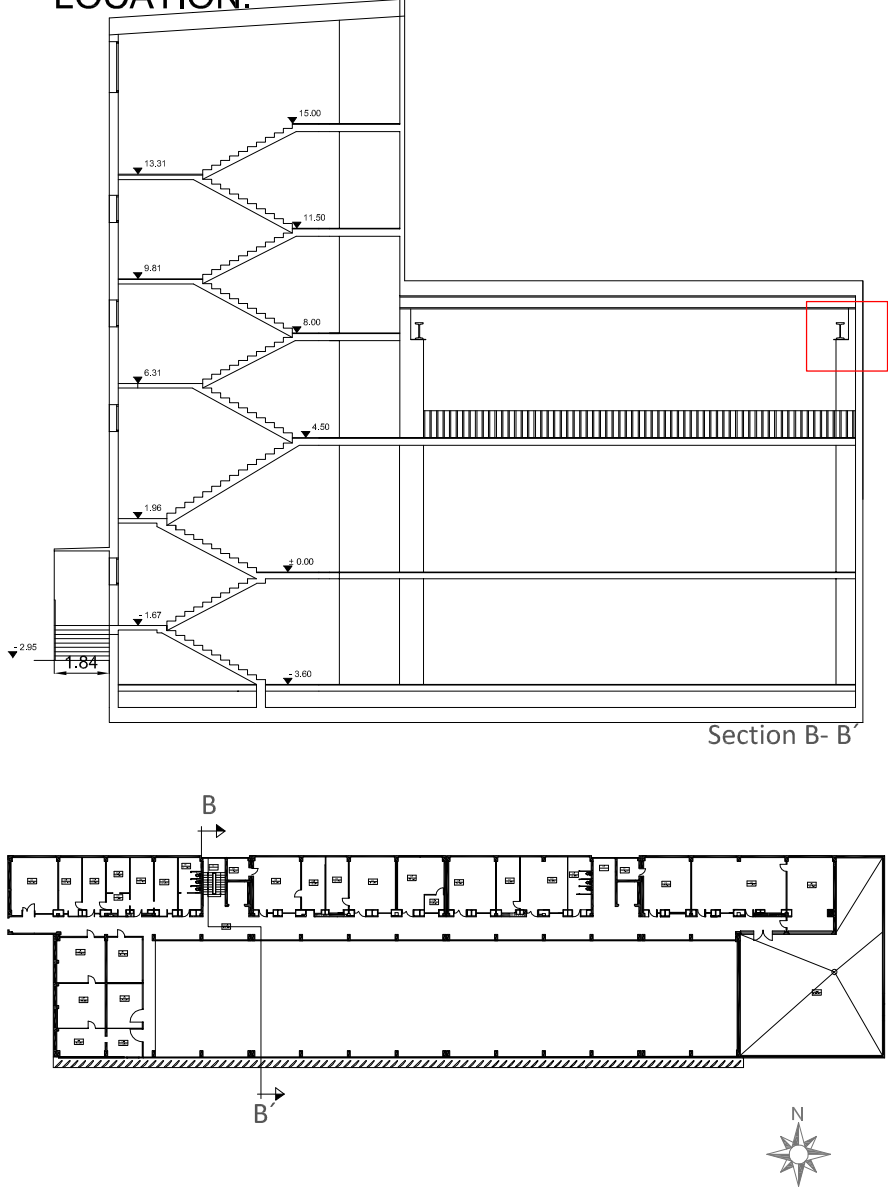
POSSIBLE CAUSES:

- It isn't made galvanized steel
- Because of the moisture

INTERVENTION:

- The steps to intervene successfully on this pathology are:
 - Perform a cleaning of the profiles by sandblasting and following do a quick drying
 - profile must be free of dust, dirt, oil, grease, oxide or other contaminants
 - passivation of the whole area: after performing cleaning steel, give a coat of epoxy to facilitate bonding with the repair material and protect the steel.
 - Protection: Cover the elements with anticorrosive coating

LOCATION:



DESCRIPTION: Fissures are observed at the beginning of the stairs.

Also breakage of parts of the steps

PHOTOGRAPHS:



POSSIBLE CAUSES:

- Breakage of the steps may be due to high pedestrian traffic or hard hits to the stairs
- Horizontal fissure on the stairs due to poor execution of the ladder. Maybe because of insufficient splicing of reinforcements of the slab with the ladder

INTERVENTION:

This pathology is mild

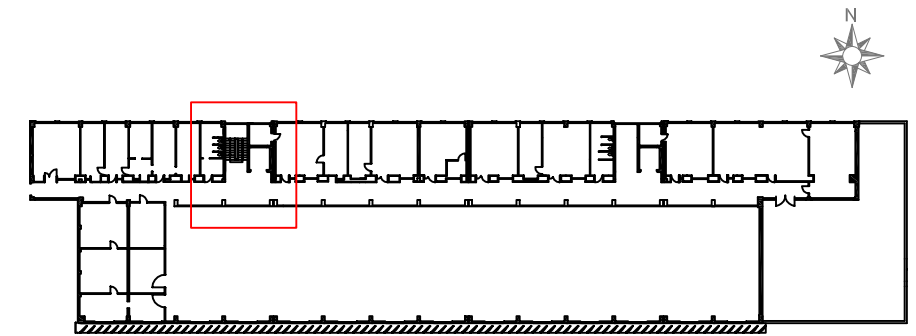
- The breakage of steps only causes aesthetic problems:

- Application of bonding layer: The cementitious Sopro Repadur mortar bonding layer
- Ensures good adhesion : Apply cementitious, fibre-reinforced. The repair mortar is applied wet-on-wet to the slurry in 1 to 5cm thick coat.
- Final surface finishing: Sopro Repadur 5 fine PCC concrete filler is used to fill pores and blowholes.

- The fissure of the stairs, still is not a crack

Recommended observe the crack for a given time and if it increases the thickness or depth and it would be a crack. We will have to take action

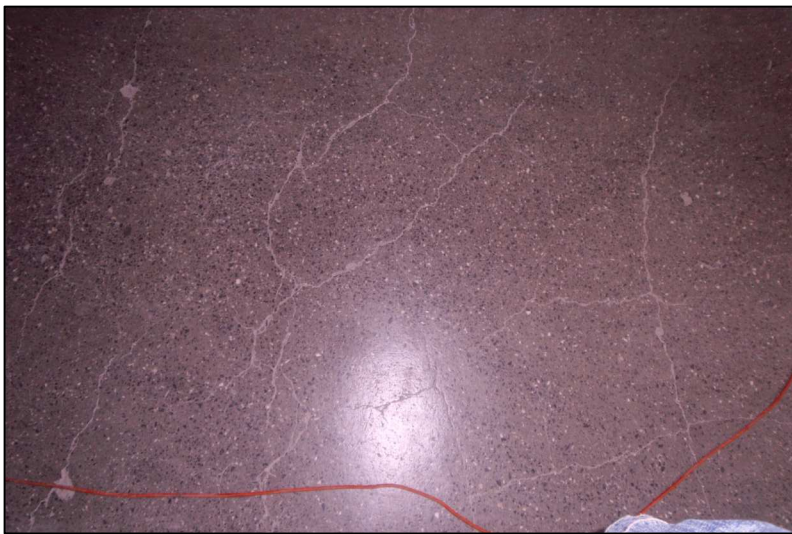
LOCATION:



First Floor

DESCRIPTION: Observed fissures and cracks in different directions of the pavement. Terrazzo is positioned "in site" It isn't made up of tiles of a given size. They are unspecified dimensions plates with joints therebetween

PHOTOGRAPHS:



POSSIBLE CAUSES:

- Absence of dosing mortar 1:6 that makes sharing mortar in order to distribute pressures and level the ground
- Joints insufficient or excessive plate dimensions
- Weakness of the flooring material.
- Errors in adherence with the support.
- Insufficient flexural strength of the tiles (not to be less than 150kp/cm²)
- Lack of continuity and strength of the layer.
- Uneven distribution layer.
- Mechanical erosions produced by the friction of use, since the pavement is in an area of passage and very busy.
- Linear cracks caused by tensile stresses to shrink the pavement.

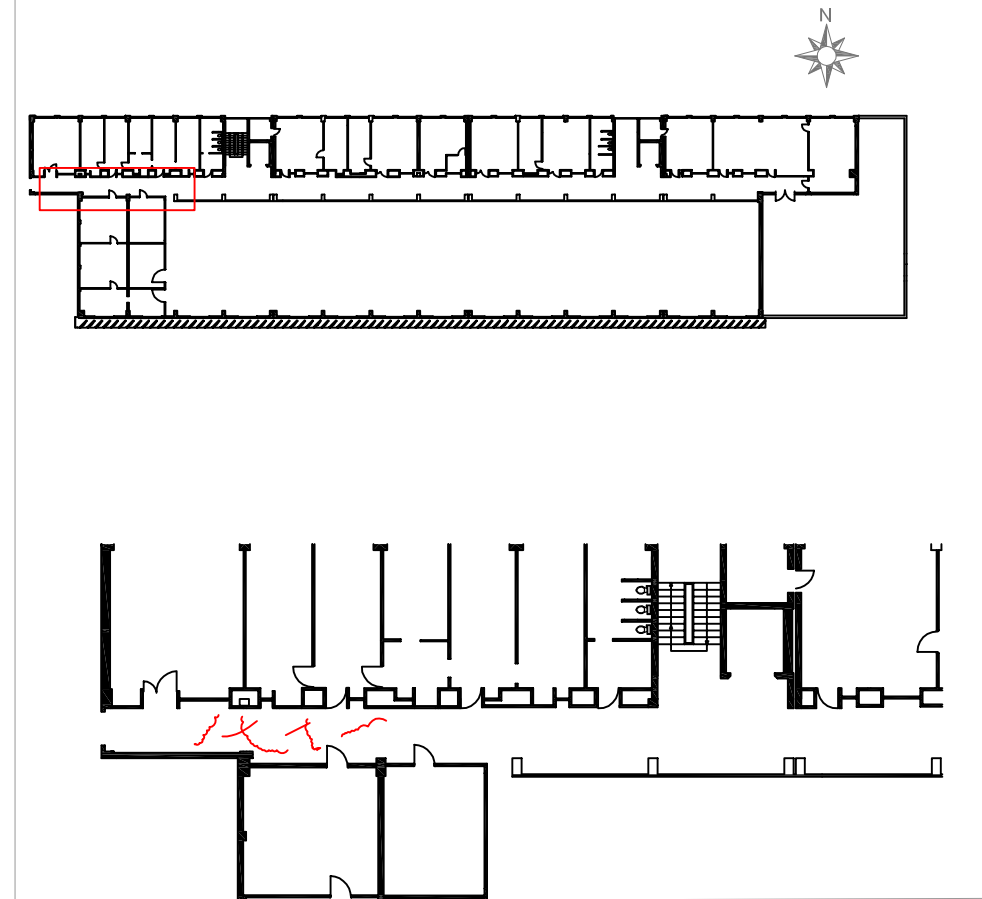
INTERVENTION:

At the moment is not very serious pathologies, but if the cracks increase the best solution would be the removal of all the affected flooring and replace it by taking various precautions:

pose the possibility of placing terrazzo tiles

- Lift the entire affected and corresponding pavement layers up to the slab.
- Resume all layers.
- Placement Print impact resistant
- Placing concrete leveling for surface leveling.
- 2cm of crushed sand.
- Mortar cement terrazzo gripping.
- Placement terrazzo pavement, paying extreme care to the execution of the joints. The marble floor has to be special for high traffic.

LOCATION:



DESCRIPTION: Outer wall made of brick 7. Insufficient wall thickness and the anchoring of the banister has perforated the brick and leaving a completely portion of a brick

PHOTOGRAPHS:



POSSIBLE CAUSES:

- Placement of a brick thick inadequate

INTERVENTION:

1. The steps to intervene successfully on this pathology are:
 - Withdraw the banister and one of this option:
 - 1- Perform the anchoring banister in a different way and repair the broken brick
 - 2- Increase the width of the wall. realizing it again with thicker brick

LOCATION:



North

DESCRIPTION: Observed vertical crack in the exposed brick in the bottom of the façade

LOCATION:



PHOTOGRAPHS:



POSSIBLE CAUSES:

- Overloads. Unexpected overloads or higher than expected.
- Differential settlement of the foundation or ground. Minimal drop in level of a portion of the work as a consequence of compression of the material used or the area where support stabilization
- Lack of adhesion between brick and mortar
- By lack of wetting of the brick in its placement
- Vertical thrust

INTERVENTION:

The steps to intervene successfully on this pathology are: Description of the method outside (façade):

To the following repair consider the crack has not affected to the structure beyond repair. Then we have to know if this crack is stable or not.:

- 1-Place testimonials to detect if the crack is stable or not. Once satisfied that the crack is stabilized proceed to put together the two parts of the façade improving continuity.
- 2 - Clean up and peel the crack by escarpment and hammer. Following removed the stones have been broken.
- 3- Observe the size of the crack:
 - If the crack is not big: Fill a mortar without retractions slightly expansive.
 - If the crack is large: stone is placed(same type as the façade) filling with non-shrink mortar.
- 4- Finally plaister the affected area in the time to proceed to coating of all the exterior walls.

DESCRIPTION: On the ground floor partitions where it runs the facilities, moisture and stains are observed on the wall. The tubes that protect installations are damaged and broken. Even ducts there are sections that haven't protection. The installations clamps are rusted. On the fourth floor It can be observed a similar problem as the pipe is exposed unprotected one hand.

PHOTOGRAPHS:



Basement



Third fourth floor

POSSIBLE CAUSES:

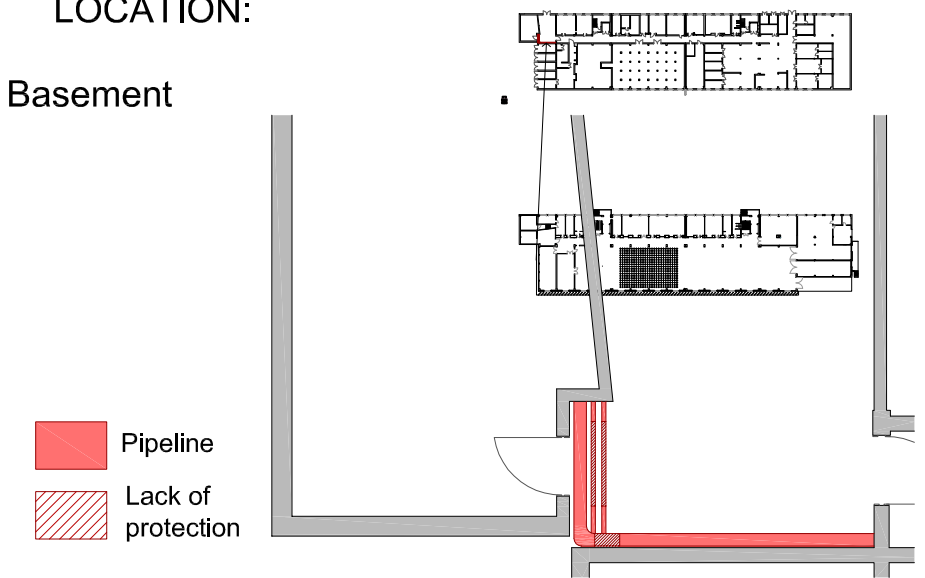
- Indoor humidity
- Leaks in water pipes
- Lack of care and maintenance
- protection tubes are unsuitable materials

INTERVENTION:

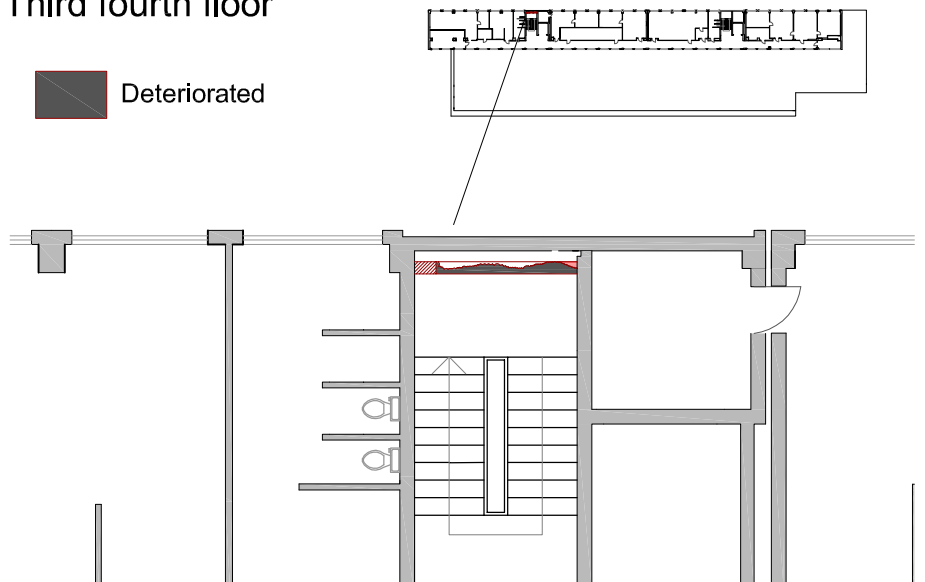
1. The steps to intervene successfully on this pathology are:
 - Check the operation of the facilities is correct by testing, to see that the stains don't come from a leak.
 - Remove the damaged parts, as well as protection tubes and clamps rusted
 - Cleaning the surface of the wall
 - Replacing tubes pipes protection of a suitable material must be insulating.

LOCATION:

Basement



Third fourth floor



Passing ducts

- 1 - The tube feedthrough shall be arranged that between them and the ducts. This is a clearance allowing tolerances execution and possible differential movements between the wall and the duct.
- 2 -Ducts must be fixed to the wall with flexible elements.
- 3 - Should be available waterproofing between the wall and the tube feedthrough and later It must be sealed the clearance between them and the duct with an expanding profile mastic or elastic compression resistant

DESCRIPTION: Exit doors of the garage and technology rooms are steel. Through them excessive heating is produced, they don't present any type of insulation.

PHOTOGRAPHS:



POSSIBLE CAUSES:

- The doors do not have insulation.

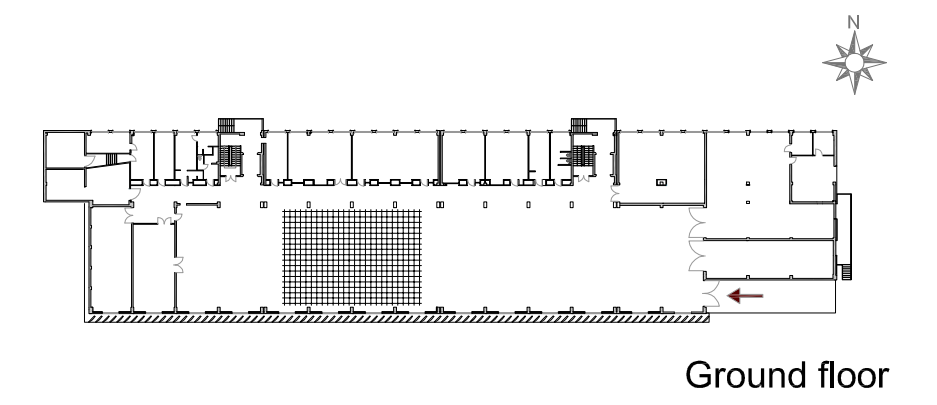
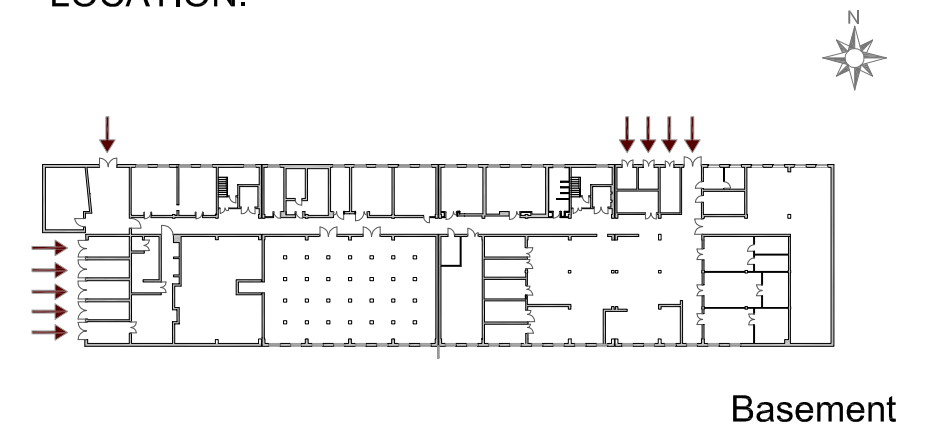
INTERVENTION:

1. The steps to intervene successfully on this pathology are:

- From inside placed an insulator to the entire surface of polystyrene 5cm.
- Covered with plates protected 0.75mm
- To protect the door from the outside give it an anticorrosion alkyd paint film:

Before applying the paint previous surface preparation:
The surface must be clean, dry, free of dust, grease, soap, mushrooms before any application.

LOCATION:



→ Doors to put the insulation

THERMAL TRANSMITTANCE

Regulation: $U = 0,90 \text{ W / m}^2 \text{ K}$
 Door with polystyrene insulation 5cm $U = 0,86 \text{ W / m}^2 \text{ K}$



North elevation



North elevation



West elevation



South and East elevation





P= Tailgate



C= Glass door



O= Buildingexit
(conexion Eng. Civil)



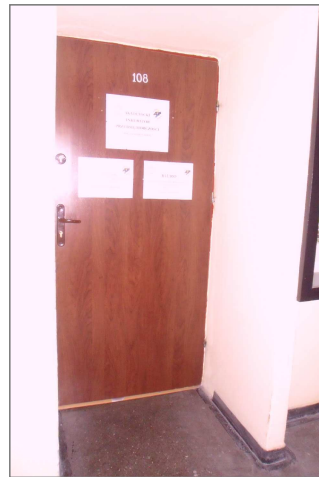
T= Terrace door



M = Metal door



W= Wooden door



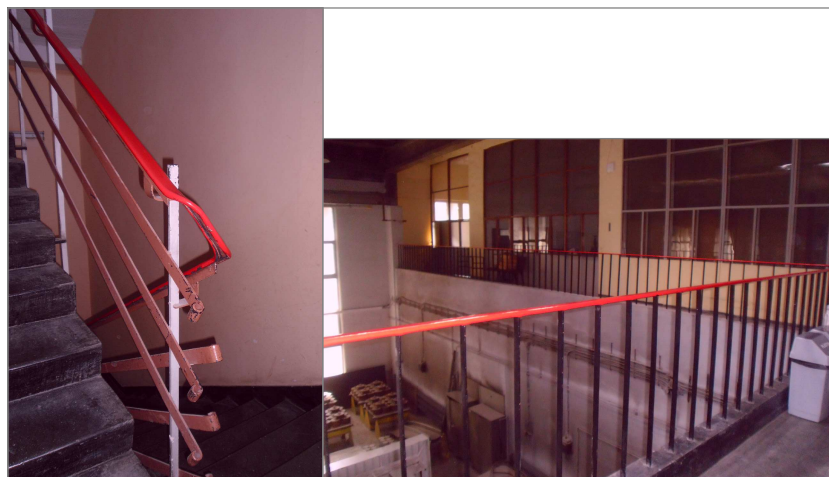
B= Brown wooden door



A= Red wooden door



E= Elevator door



Banister



G= Door with glazed



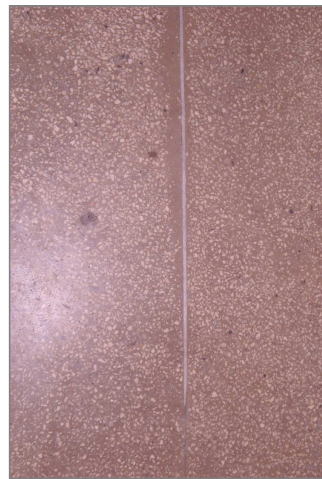
Basement floor



Ground floor



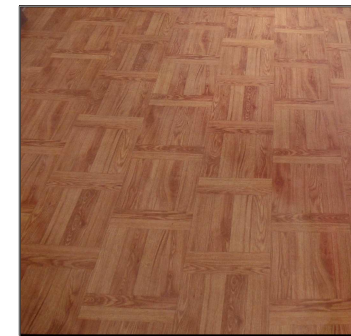
First floor



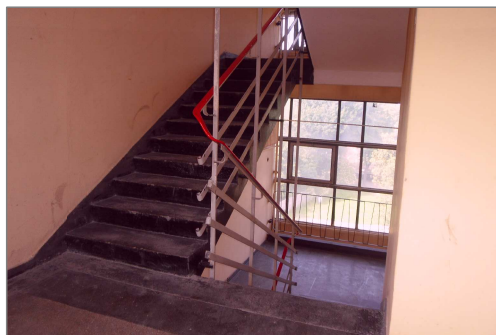
second, third and fourth floor



Porcelain stoneware floor



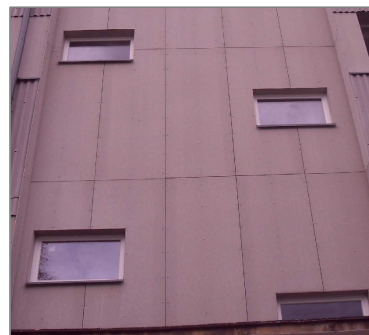
Parquet flooring



E= Stairs floor



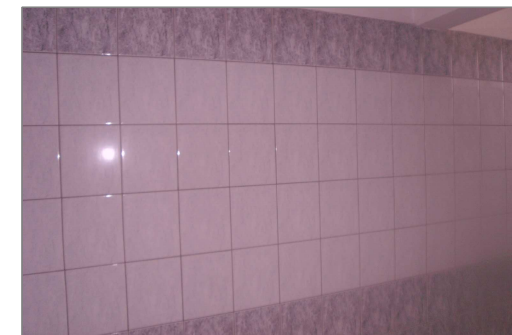
Corrugated plates
125 x 250 x 0,6 cm



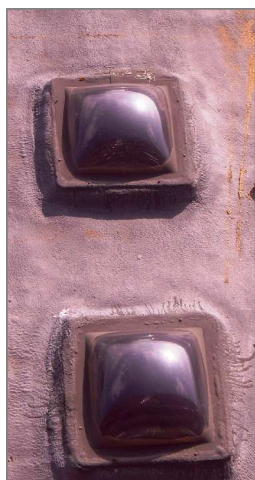
Smooth plates bolted



Brick facing



Finished with ceramic tile



Skylights

9- FINAL REPORT

8.1 OBSERVATIONS

An important remark to perform is that this building for a month is in the process of rehabilitation.

They are doing the exterior rehabilitation and conditioning of the environment around the building.

Are also removing all the exterior woodwork and changing it by PVC (like the proposal I made in intervention pathology number 2)

8.2 CONCLUSIONS

The main conclusions that I have drawn from this project are summarized in the following paragraphs:

The building, object of study in general has several indoor and outdoor pathologies. Many of them are the result of lack of maintenance and other construction defects, some of which arise because this building was built in 1973 so construction methods were much older now and less advanced.

Therefore the recommendation is to conduct the proposed interventions and subsequently perform proper maintenance and building state newspaper.

Not all serious damage are found. For example an important issue to treat would be receiving thermal heating the building, adding that does not comply with the regulations and the status of the main entrances to the building, including ramps and stairs. On the other hand also treat the whole issue of water drainage systems and moisture produced in parts of the facade.

In implementing the project I have put into practice the knowledge acquired over the years, for the making of a building study, diagnostic, and architectural survey constructive intervention study.

This, along with the search for information collection, the study of the building and the current regulations when making interventions and continuous progress of the project, I have acquired the necessary knowledge.

I think the goals I had originally proposed for this project I have kept almost entirely and that the effort was worth it.

8.3 BIBLIOGRAPHY

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RAMIREZ WHITE, M. J. "Intervention techniques in architectural heritage". UPV. 2007.

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Notes

Course notes CONSTRUCTION MATERIALS II Engineering building.

Course notes CONSTRUCTION MATERIALS III Engineering building.

Course notes CONSTRUCTION Engineering Building V.

Course notes CONSTRUCTION Engineering Building VI.

Regulations:

Technical Building Code (CTE) DB SE - AE Structural Safety: Basis of Calculation and Action in the Building

Technical Building Code (CTE) HS DB Health (2)

Technical Building Code (CTE) DB-HE Energy Savings (1)

Technical Building Code (CTE) DB-SUA and Safety in use accessibility

EHE 2008 Instrucción de Hormigón Estructural

ACI 364.1 R-94 - American Concrete Institute. Guide for Evaluation of Concrete Structures Prior to Rehabilitation (Reapproved 1999) (5)

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Webs

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Others

Concrete repair nad protection SOPRO (8)