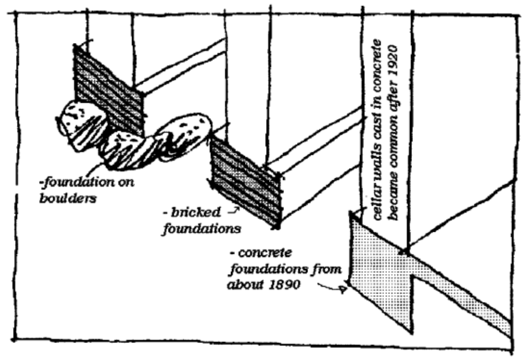
Urban (Dwelling) Renewal Project – Danebrosgade 4, Arhus

Description of the existing conditions

01. Foundation

Description

Cast in situ concrete foundation.
Dimensions of the foundation are 800 mm in width and 300 mm in depth.
The use of asphalt or slate bricked into the foundation walls, to stop the rising damp. (Reference BPS 100, pg. 7).



Structure analysis

The foundation takes the vertical and horizontal forces coming from the roof, walls and floors.
There are no cracks in the basement walls, which mean that the foundation is in good condition.

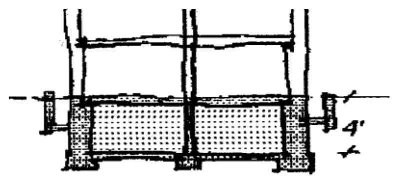
Proposals

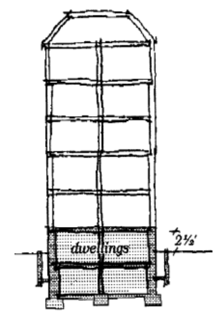
Insulate the foundation to prevent the rising damp.

02. Basement / cellar

Description

Used for laundry, technical and storage purposes.
Depth of 4’ (1.20 m).
Height above the ground level approx. $2\frac{1}{2}$ ‘ (0.75 m)
Drainage under the floor leading to a sewer in the street. (Ref.BPS 100, pg. 6)



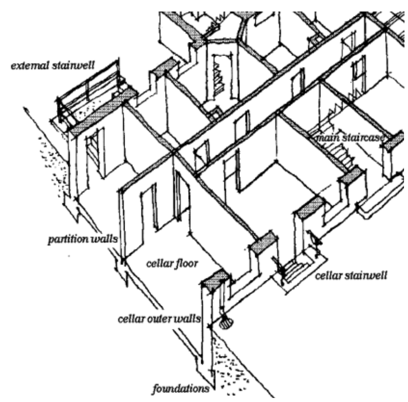


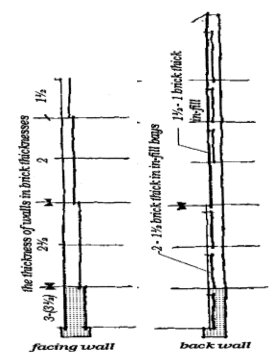
Structure analysis

The outer walls are load bearing walls made of brickwork with a thickness of 3-$3\frac{1}{2}$ bricks.
There are no cracks in the walls.

Proposals

Steel plates could be used to prevent the rising damp.
Change the pipes in the basement floor.
Organize storage rooms for all apartments.
Common room for different activities.
New laundry.



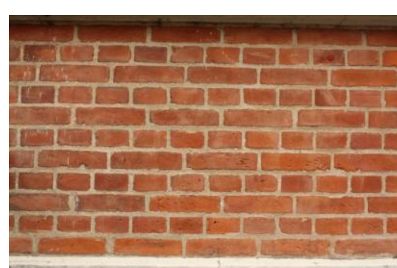


03. Façades

Description

The street façade is made of red brickwork, generally in good condition. It appears deteriorated in the lower part of the façade – presence of cracks, moisture stains and scratched surfaces.
The plinth is a plastered painted surface, with cracks and small damaged areas in the plaster.
Hairline cracks in the plastered cornices.

The courtyard façade comprises yellow brickwork with horizontal two course-high bands of red brick, over and under the windows.
The brickwork shows cracks, poor joints and moisture



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stains.
Whitewashed plinth, with small cracks and uneven surface.
Plants hanging up on the façade.
Parabolic antenna, telephone and antenna cables mounted.

Street façade

Courtyard façade

Structure analysis

The façades are load bearing.
No signs of damages due to subsidence, therefore, they are in good condition.

Proposal

Reparation of the brickwork as we move down the façade.
Plastering or repairing cracks on the plinth in courtyard façade.
Remove the cables and the parabolic antenna and the plants from the façade.

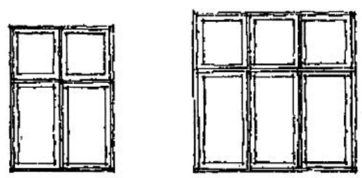
03.01. Windows

Description

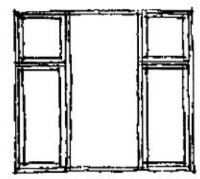
Usage of different types of double glazed windows: Dannebrogs windows at dormers and both façades, some Frederiksberg windows on the street façade and casement windows at the cellar.
Generally, the pinewood windows are in good condition: casement with intact paint-work, corners fittings with intact painted surfaces.
Some of the windows show:

- flaking paint-work;
- worn-out wood with cracks;
- corner fitting with rust stains.

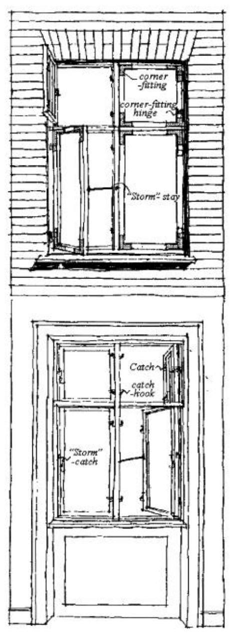
New sills made of aluminum.
There are no ventilation valves.
The joint around the windows are about 12 mm and they are packed with tarred stuffing and finished with a mortar joint.
The joints between the sill and frame are executed flushed with the frame, and therefore, there is no drip.
The 3-rd sectioned window on the street side and dormers is in accordance with requirements for rescue openings.
Several panes are punctured.
Cracks in the plastered borders of the windows.

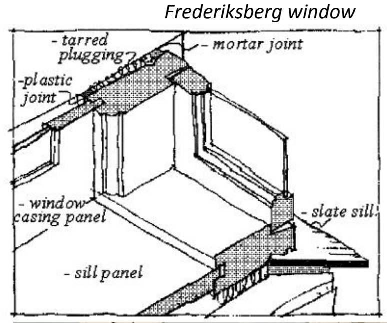


Dannebrogs windows



Frederiksberg window

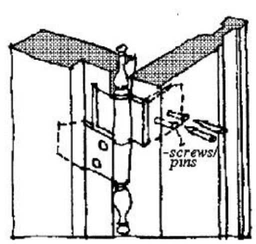




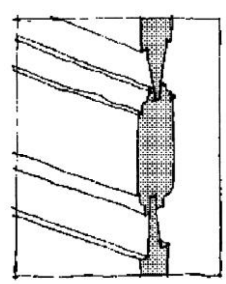
Cracks in the borders of the windows

Proposal

Repair and repaint windows.
Replace punctured panels.



"Dutch" butt-hinge



Paneled door

03.02. External doors

Description

Double leafed, painted, panel doors with glazed top panel.

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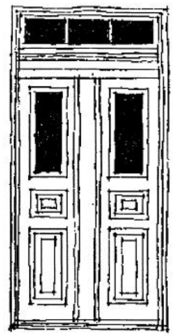
Flaking of the painted wood on all external doors.
Metal handle doors, in very good condition.
Hinged with “Dutch” hinge.
The “fixed leaf” of the door is fixed to the door frame with a sliding bolt.



The existing door

Proposal

Changing of both external doors from the street façade – main and cellar doors.

03.03. Gates

There are no gates on the property.

03.04. Decorative elements

Arches in good condition.
Cracks in the plastered borders of the windows.

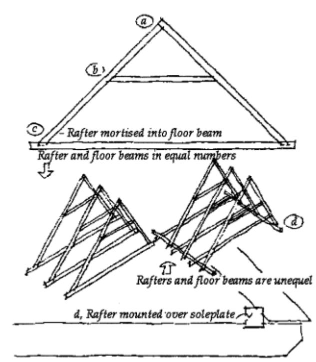
04. Roof

Description

Collar tie rafter roof construction clad with TENO sarking felt and red-brown concrete roof tiles.
No insulation in the attic.
100 mm insulation under the sarking felt without ventilated cavity on top of the insulation.
No drip flashing at the foot of the sarking felt.
Worn out flashings.
The fire parapet capped with red-brown concrete roof tiles is partly broken down due to age.
There are zinc roof gutters with gutter iron.
Timber floor board.
There are 3 dormers facing the courtyard and 3 facing the street.

Structure analysis

Collar ties rafter roof construction.
The collar tie was used to stiffen the rafters and the whole structure was stiffened in the longitudinal direction by a stud wall on either side.
(Ref. BPS 103, pg. 8)
Concrete roof tiles.



Proposal

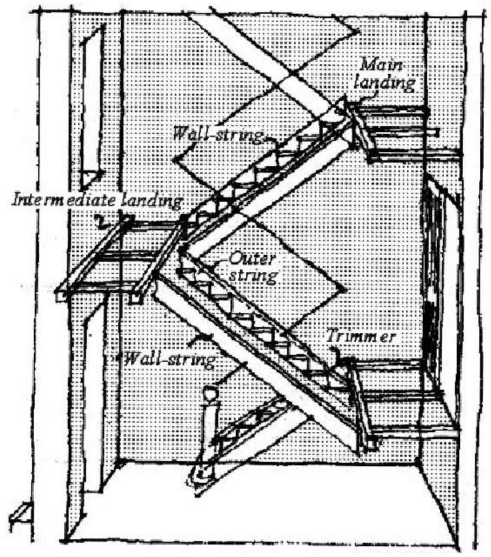
Insulate the attic.
Ventilate cavity on top of existing insulation.
Place drip flashing on the foot of sarking felt.
Change fire parapet, roof gutters and roof surface.
Analyze the roof structure and renovate the damaged rafters.

05. Staircases

Description

The width of every tread is 1.00 m.
Wooden construction.

Treads and landings are covered with linoleum.
Walls and the soffits of the treads and landings are covered with fire protecting gypsum boards.



Structure analysis

The dead load of the staircase as well as the imposed load of the residents and their guests on it is transferred to the surrounding internal walls on the sides of the stairs.

Proposal

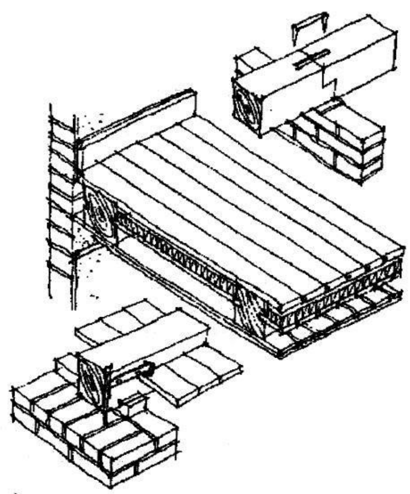
Extend the main staircase to the basement via an airlock.
Meet all fire demands for staircases.
Meet all acoustic demands for staircases (reverberation time).
Demolish the rear staircase and install new electrical installations.
Renew the linoleum on treads and landings.
Renovate and paint the surfaces of the staircase walls.

BR
One hand rail is sufficient if the width of the stairs < 1.1m (pg. 53).
Building element no less than EI60 dividing cellar/gr. floor (pg. 188).
The door in this element has to be EI2 30-C (BD30 door).

06. Storey partitions (floors, ceilings)

Description

Timber joist 225 x 225mm cc/900mm
Pegging board 25mm
Clay pegging 60mm
Pine floor boards 32mm (directly on the joist)
Stucco on the ceilings



Structure analysis

Every third joist is anchored to the external wall.
The joists are also carried by the center wall in the longitudinal direction.

Proposal

Change the floor partition with respect to sound, fire and installations.
Reduce the distance between the joists by adding new ones.
The stucco must be sacrificed to meet the demands.
Sand down the floor boards thoroughly.

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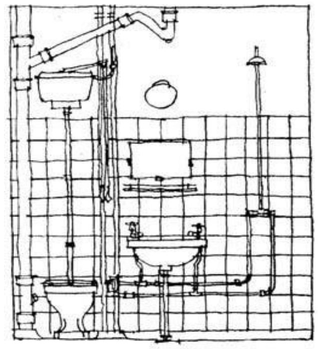
07. Bathrooms and kitchens

07.01. Bathrooms

Description

The 2 apartments on each floor have a common toilet.
These toilets don't have a wash basin.
The floors in the toilet are made from wood.
The form of ventilation is natural.
The pipes are visible in these toilets.
The conditions are obsolete and worn out.
There's no heating system in the toilet.



E.g. of visible pipes in the bathroom

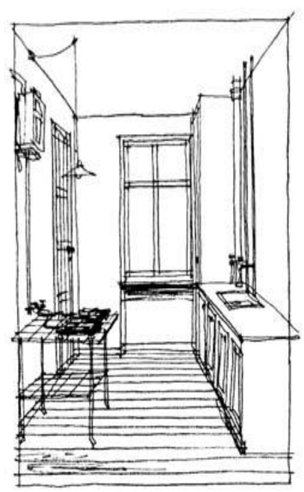
Proposal

1. In order to provide privacy, each apartment must have a separate bathroom, equipped with toilet bowl, washbasin and shower.
2. The bathrooms have to have mechanical ventilation.
3. There should be no visible pipes in the toilets.
4. Incorporate heating system.

07.02. Kitchens

Description

The kitchen is made in the old style with frame-cupboards.
The pipes in the kitchen are visible.
There is no heating system.
Disarranged worn out fixed furniture.
The floors are made of wood.

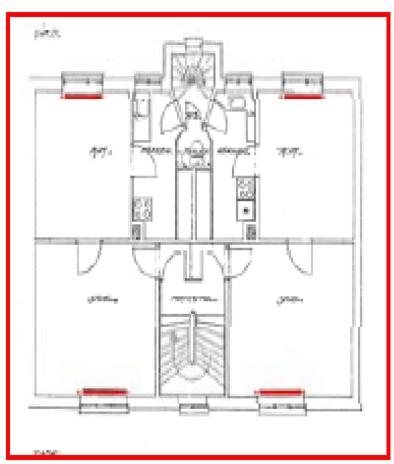


Proposal

1. Proper arrangement of kitchen should be done.
2. Provide proper heating and mechanical ventilation.
3. Hide pipe installations.
4. New appliances.

08. Installations

08.01. Heat installations



Description

1. The building is heated by district heating.
2. All the installations are placed in the cellar.
3. Lack of automatic valves to regulate pressure in the heating system.
4. Cast-iron radiators with thermostat valves are placed under the windows in the living room.
5. In general heating installations are in good conditions.

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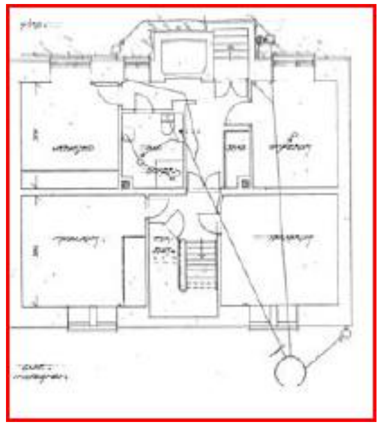
Proposal
Reusing the heating pipes.
Possibility of installing automatic valves.
Heating pipes could be taken to the shaft and properly distributed.

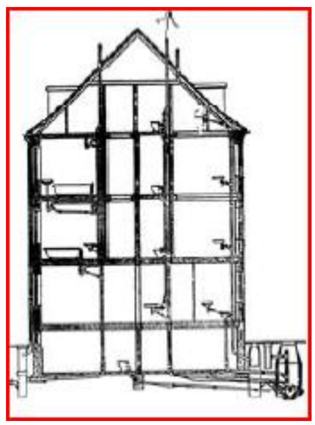
08.02. Sewer installations



Description
There is a combined system where the sewer pipes are connected to the rain water.
The pipes are made of glazed clay.
In general, the sewer system is in good condition.

Proposal
Replace the combined system with a separate system for rain and waste water.
All sewer pipes must be replaced and taken to the shafts.

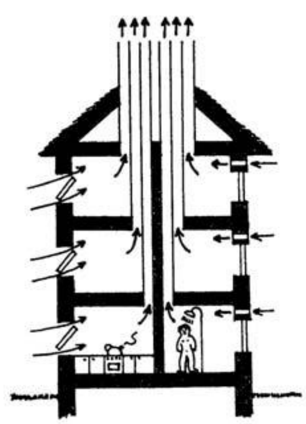
08.03. Water installations



Description
The water in the two tanks placed in the basement is heated by district heating.
The hot and cold water are galvanized steel pipes that are visible.

Proposals
The water installation should be taken to a shaft.
The pipes should be running through walls or floors so that they are not visible.
Old pipes should be replaced.
There should be an adequate amount of hot water supply for the new kitchens and bathrooms – e.g.: reconsider the hot water tank solution.

08.04. Ventilation installations



Description
There is natural ventilation through windows.
No mechanical ventilation in kitchen and bathrooms.

Proposal
Provide mechanical ventilation so that fresh air is adequately brought into the house and stale air is taken away.

08.05. Electrical installations

Description
All electric installation must be removed as they are worn out and replaced with new installations.

Item	Registration of existing condition of building – *with subsequent alterations*.	Scheme Design Proposal – *with subsequent alterations*	Unit	Amount	Price	Improve-ment	Quality / Operation
(12)	**FOUNDATION**						
12.01	CONDITION OF FOUNDATION Cast in situ concrete foundation. Dimensions of the foundation are 800 mm in width and 300 mm in depth. The use of asphalt or slate, bricked into the foundation walls, to stop the rising damp. (Reference BPS 100, pg. 7).						
12.02	STRUCTURE ANALYSIS The foundation takes the vertical and horizontal forces coming from the roof, walls and floors. There are no cracks in the basement walls, which mean that the foundation is in good condition.						
(29)	**BASEMENT / CELLAR**						
29.01	CONDITION OF BASEMENT Used for laundry, technical and storage purposes. Depth of 4' (1.20 m). Height above the ground level approx. 0.75 m. Drainage under the floor leading to a sewer in the street. (Ref.BPS 100, pg. 6)						
29.02	STRUCTURE ANALYSIS The outer walls are load bearing walls made of						

Item	Registration of existing condition of building *– with subsequent alterations.*	Scheme Design Proposal – *with subsequent alterations*	Unit	Amount	Price	Improve-ment	Quality / Operation

brickwork with a thickness of 3-31/2 bricks.
There are no cracks in the walls.

(21) FAÇADES

21.01 CONDITION OF FAÇADES

The street façade is made of red brickwork, generally in good condition. It appears deteriorated in the lower part of the façade – presence of cracks, moisture stains and scratched surfaces.
The plinth is a plastered painted surface, with cracks and small damaged areas in the plaster.
Hairline cracks in the plastered cornices.

The courtyard façade comprises yellow brickwork with horizontal two course-high bands of red brick, over and under the windows.
The brickwork shows cracks, poor joints and moisture stains.
Whitewashed plinth, with small cracks and uneven surface.
Plants hanging up on the façade.
Parabolic antenna, telephone and antenna cables mounted.

21.02 STRUCTURE ANALYSIS

The façades are load bearing.
No signs of damages due to subsidence, therefore, they are in good condition.

(39) WINDOWS

39.01 CONDITION OF WINDOWS

Usage of different types of double glazed windows: Dannebrogs windows at dormers and both façades, some Frederiksberg windows on the

Item	Registration of existing condition of building – *with subsequent alterations*.	Scheme Design Proposal – *with subsequent alterations*	Unit	Amount	Price	Improve-ment	Quality / Operation

street façade and casement windows at the cellar.
Generally, the pinewood windows are in good condition: casement with intact paint-work, corners fittings with intact painted surfaces.
Some of the windows show:

- flaking paint-work;
- worn-out wood with cracks;
- corner fitting with rust stains.

New sills made of aluminum.
There are no ventilation valves.
The joint around the windows are about 12 mm and they are packed with tarred stuffing and finished with a mortar joint.
The joints between the sill and frame are executed flushed with the frame, and therefore, there is no drip.
The 3-rd sectioned window on the street side and dormers is in accordance with requirements for rescue openings.
Several panes are punctured.
Cracks in the plastered borders of the windows.
Skylights are in good condition.

(31) EXTERNAL DOORS

31.01 CONDITION OF EXTERNAL DOORS
Double leafed, painted, panel doors with glazed top panel.
Flaking of the painted wood on all external doors.
Metal handle doors, in very good condition.
Hinged with “Dutch” hinge.
The “fixed leaf” of the door is fixed to the door frame with a sliding bolt.

(31) GATES

There are no gates on the property.

(41) DECORATIVE ELEMENTS

Arches in good condition.
Cracks in the plastered borders of the windows.

(27) ROOF

27.01 CONDITION OF ROOF
Collar tie rafter roof construction clad with TENO sarking felt and red-brown concrete roof tiles.
No insulation in the attic.
100 mm insulation under the sarking felt without ventilated cavity on top of the insulation.
No drip flashing at the foot of the sarking felt.
Worn out flashings.
The fire parapet capped with red-brown concrete roof tiles is partly broken down due to age.
There are zinc roof gutters with gutter iron.
Timber floor board.
There are 3 dormers facing the courtyard and 3 facing the street.

27.02 STRUCTURE ANALYSIS
Collar ties rafter roof construction.
The collar tie was used to stiffen the rafters and the whole structure was stiffened in the longitudinal direction by a stud wall on either side.
(Ref. BPS 103, pg. 8)
Concrete roof tiles.

(24) STAIRCASE

Item	Registration of existing condition of building – *with subsequent alterations.*	Scheme Design Proposal – *with subsequent alterations*	Unit	Amount	Price	Improve-ment	Quality / Operation

24.01 CONDITION OF STAIRCASE
The width of every tread is 1.00 m.
Wooden construction.
Treads and landings are covered with linoleum.
Walls and the soffits of the treads and landings are covered with fire protecting gypsum boards.

24.02 STRUCTURE ANALYSIS
The dead load of the staircase as well as the imposed load of the residents and their guests on it is transferred to the surrounding internal walls on the sides of the stairs.

(23) STOREY PARTITIONS

23.01 CONDITION OF STOREY PARTITIONS
Timber joist 225 x 225mm cc/900mm
Pugging board 25mm
Clay pugging 60mm
Pine floor boards 32mm (directly on the joist)
Stucco on the ceilings

23.02 STRUCTURE ANALYSIS
Every third joist is anchored to the external wall. The joists are also carried by the center wall in the longitudinal direction.

(74) BATHROOMS

74.01 CONDITION OF BATHROOMS
The 2 apartments on each floor have a common toilet.
These toilets don’t have a wash basin.
The floors in the toilet are made from wood.
The form of ventilation is natural.
The pipes are visible in these toilets.

Item	Registration of existing condition of building – *with subsequent alterations.*	Scheme Design Proposal – *with subsequent alterations*	Unit	Amount	Price	Improve-ment	Quality / Operation

The conditions are obsolete and worn out.
There's no heating system in the toilet.

(79) KITCHENS

79.01 CONDITION OF KITCHENS
The kitchen is made in the old style with frame-cupboards.
The pipes in the kitchen are visible.
There is no heating system.
Disarranged worn out fixed furniture.
The floors are made of wood.

(56) HEAT INSTALLATIONS

56.01 CONDITION OF HEAT INSTALLATIONS
The building is heated by district heating.
All the installations are placed in the cellar.
Lack of automatic valves to regulate pressure in the heating system.
Cast-iron radiators with thermostat valves are placed under the windows in the living room.
In general heating installations are in good conditions.

(52) SEWER INSTALLATIONS

52.01 CONDITION OF SEWER INSTALLATIONS
There is a combined system where the sewer pipes are connected to the rain water.
The pipes are made of glazed clay.
In general, the sewer system is in good condition.

(53) WATER INSTALLATIONS

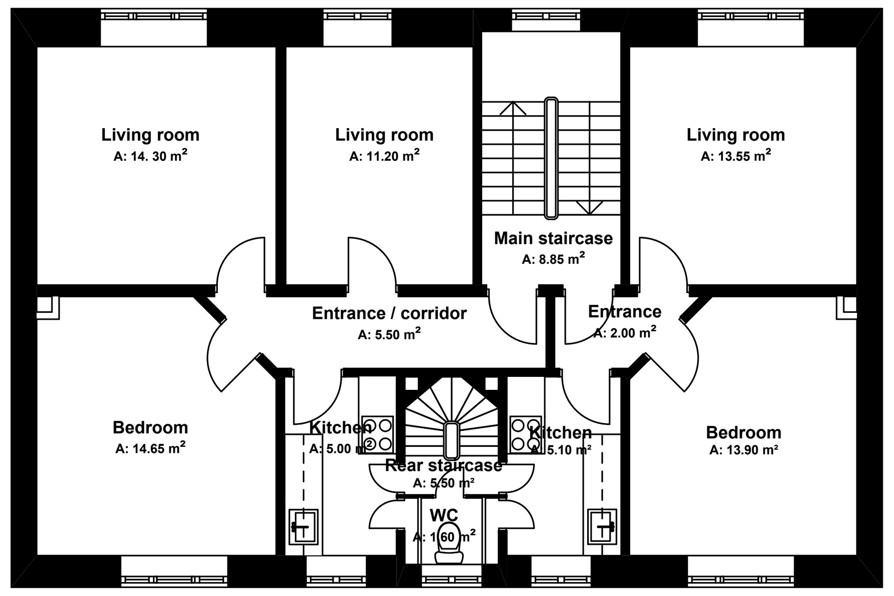
Item	Registration of existing condition of building – *with subsequent alterations.*	Scheme Design Proposal – *with subsequent alterations*	Unit	Amount	Price	Improvement	Quality / Operation
53.01	CONDITION OF WATER INSTALLATIONS The water in the two tanks placed in the basement is heated by district heating. The hot and cold water are galvanized steel pipes that are visible.						
(57)	**VENTILATION INSTALLATIONS**						
57.01	CONDITION OF VENTILATION INSTALLATIONS There is natural ventilation through windows. There is no mechanical ventilation in kitchen and bathrooms.						
(69)	**ELECTRICAL INSTALLATIONS**						
69.01	CONDITION OF ELECTRICAL INSTALLATIONS All electric installation must be removed as they are worn out and replaced with new installations.						

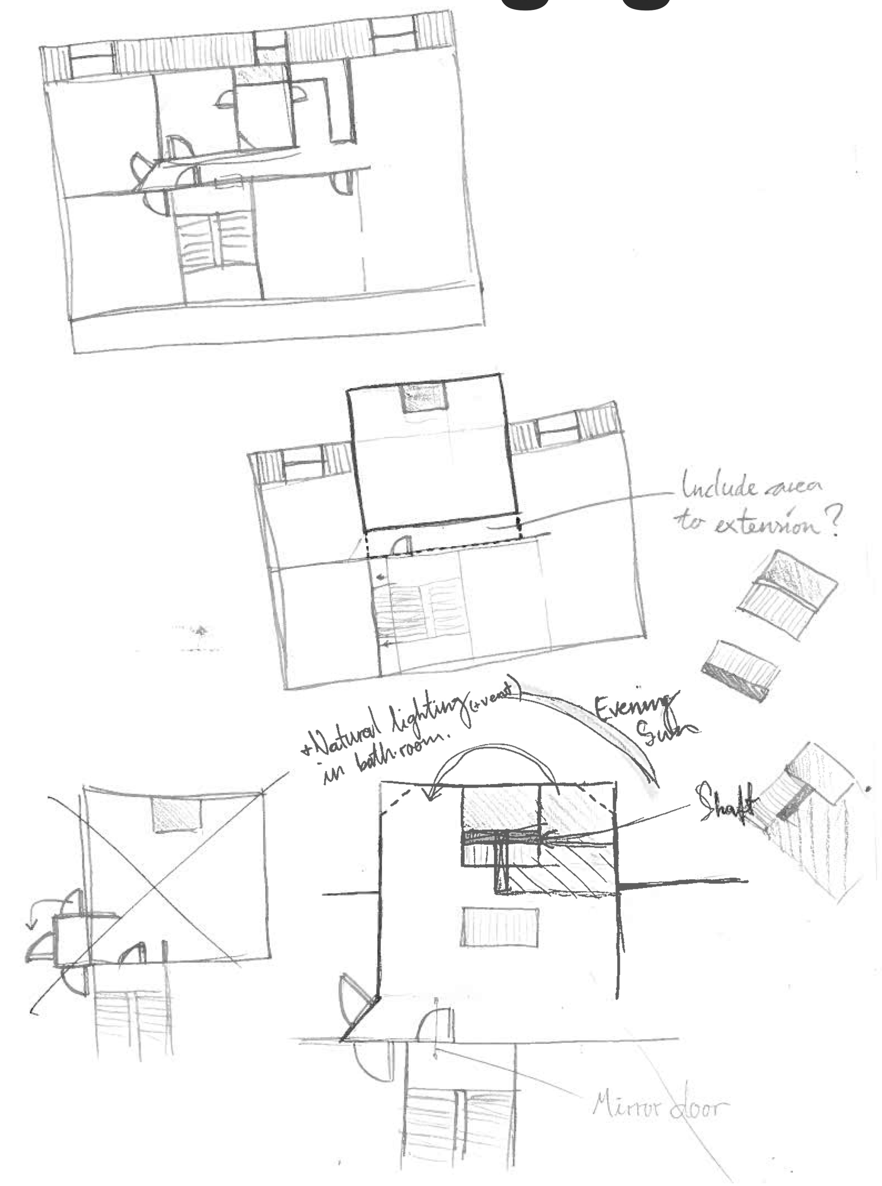
Proposal Sketches for Apartment Floors - Dannebrogsgade 4, Aarhus

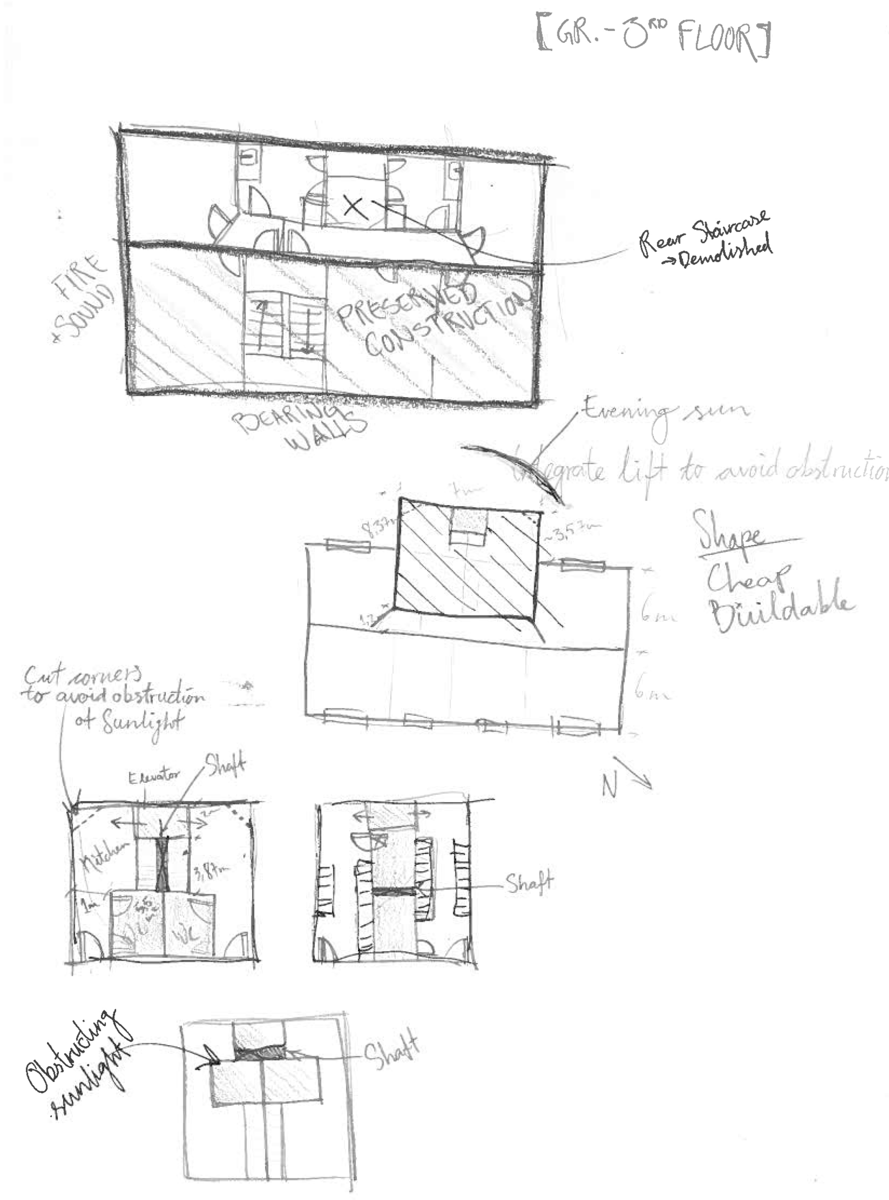
Existing apartment plan

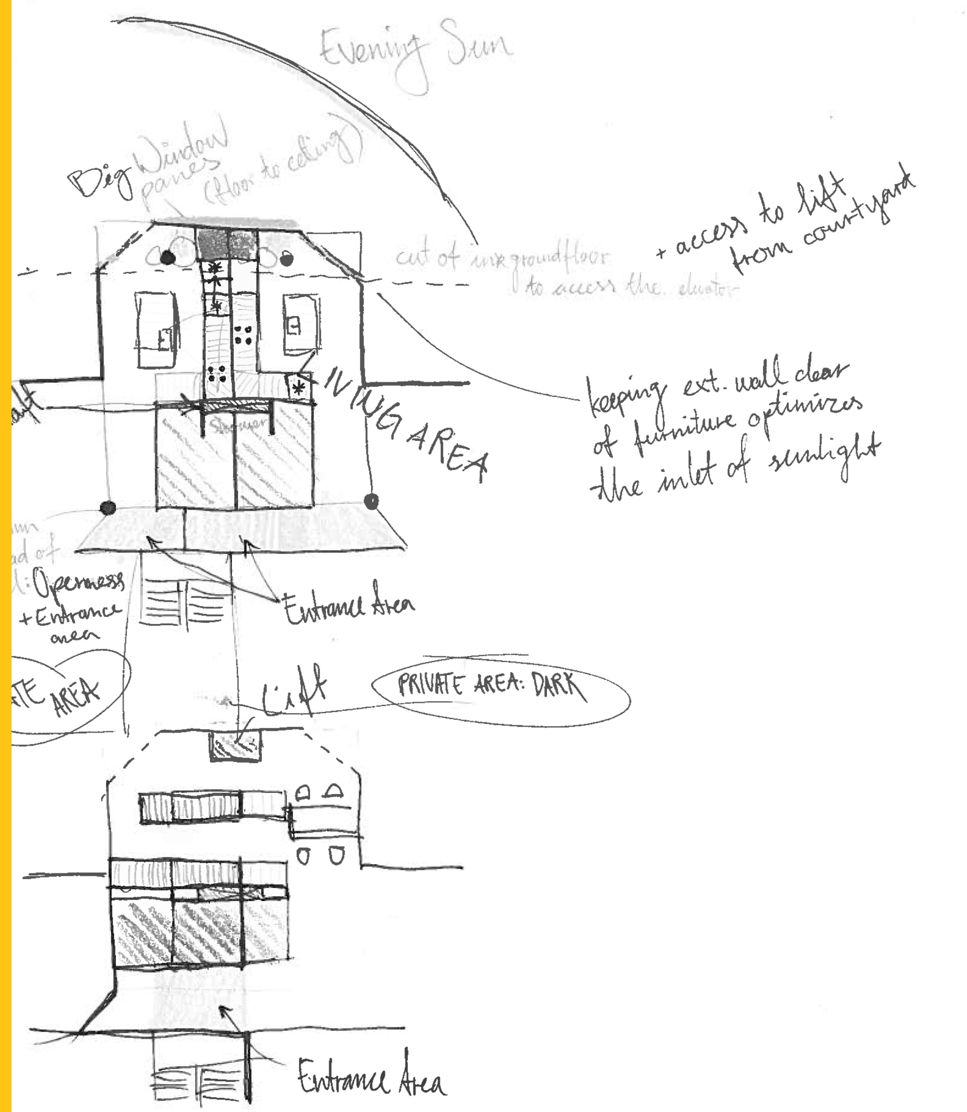
Proposals:
- lift;
- different entrances in the apartments;
- separate bathrooms;
- demolishing of the rear staircase;

Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- good flow of light;
- accesible shaft, placed near the kitchen and bathrooms.



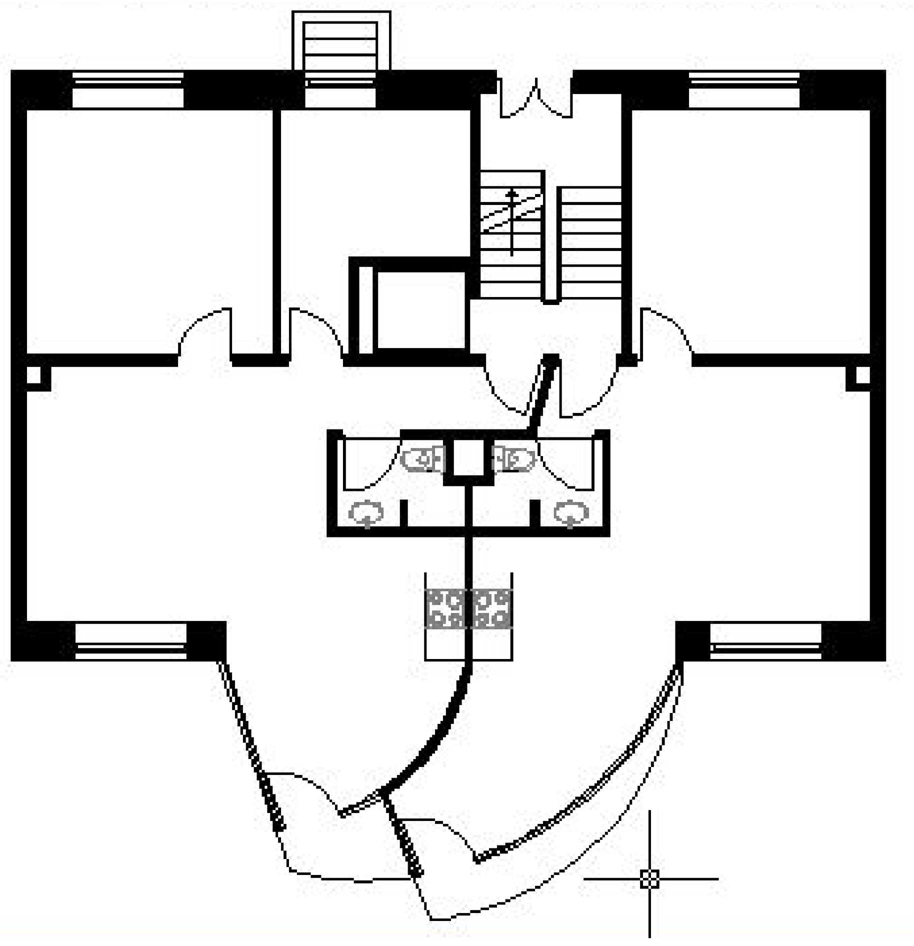






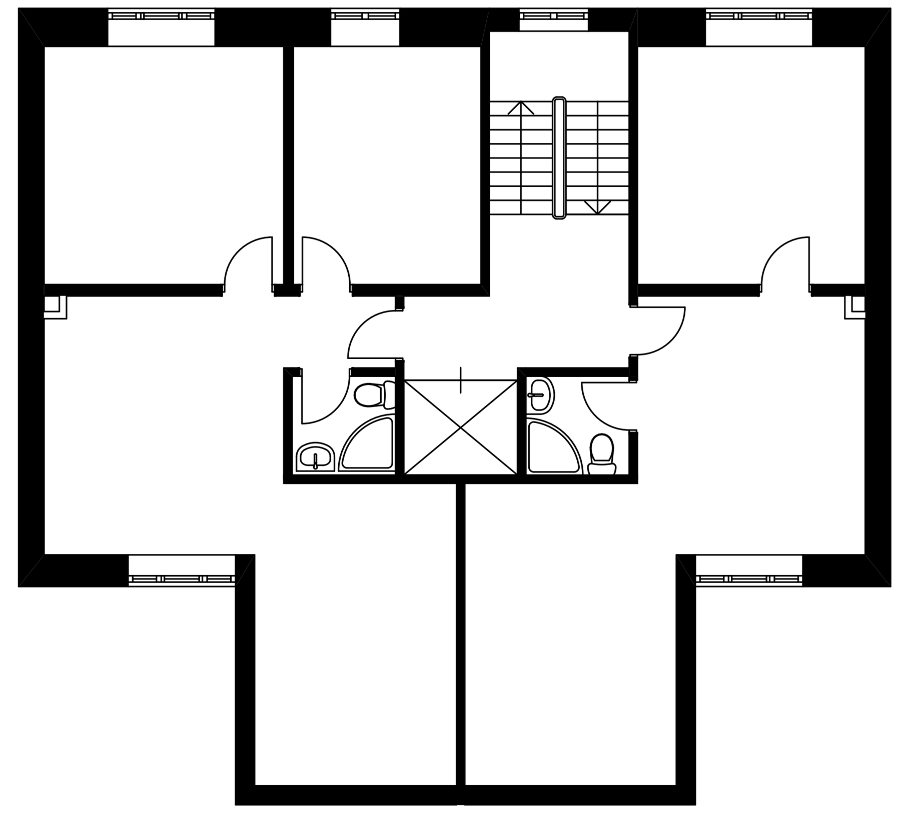
Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- good flow of light;
- accesible shaft, placed near the kitchen and bathrooms.

Disadvantages:
- limited entrance area in the apartments;
- one hole in the slab;
- common shaft.



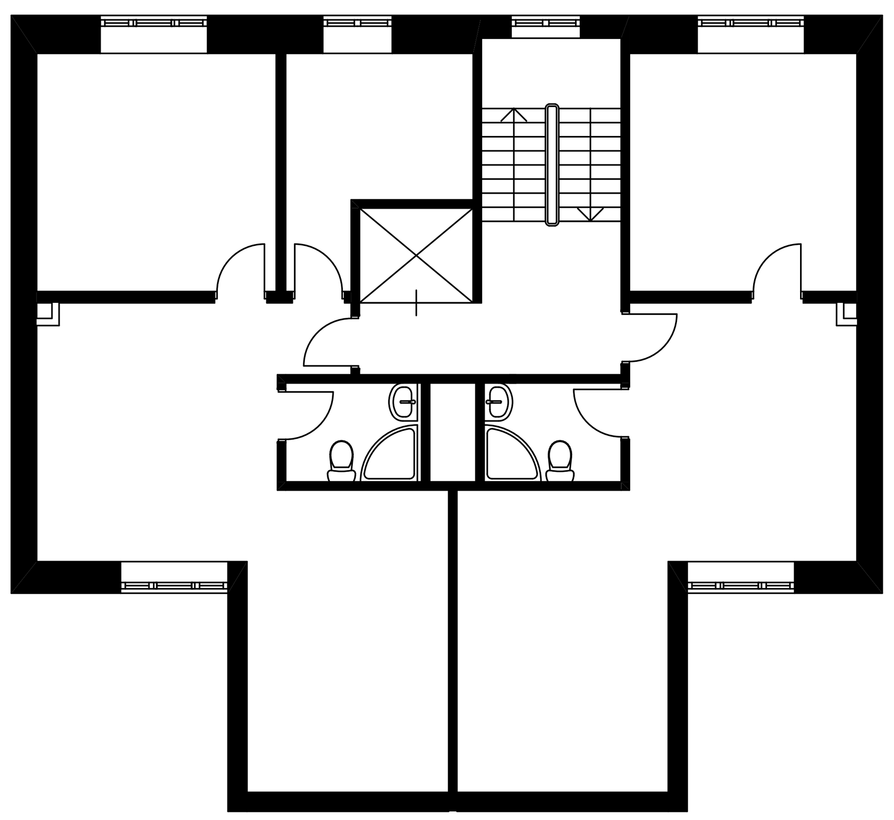
Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- good flow of light;
- elevator placed in the rear staircase's hole.

Disadvantages:
- limited entrance area in the apartments;
- no shafts placed on plan;
- bathroom doors opening to the living room.



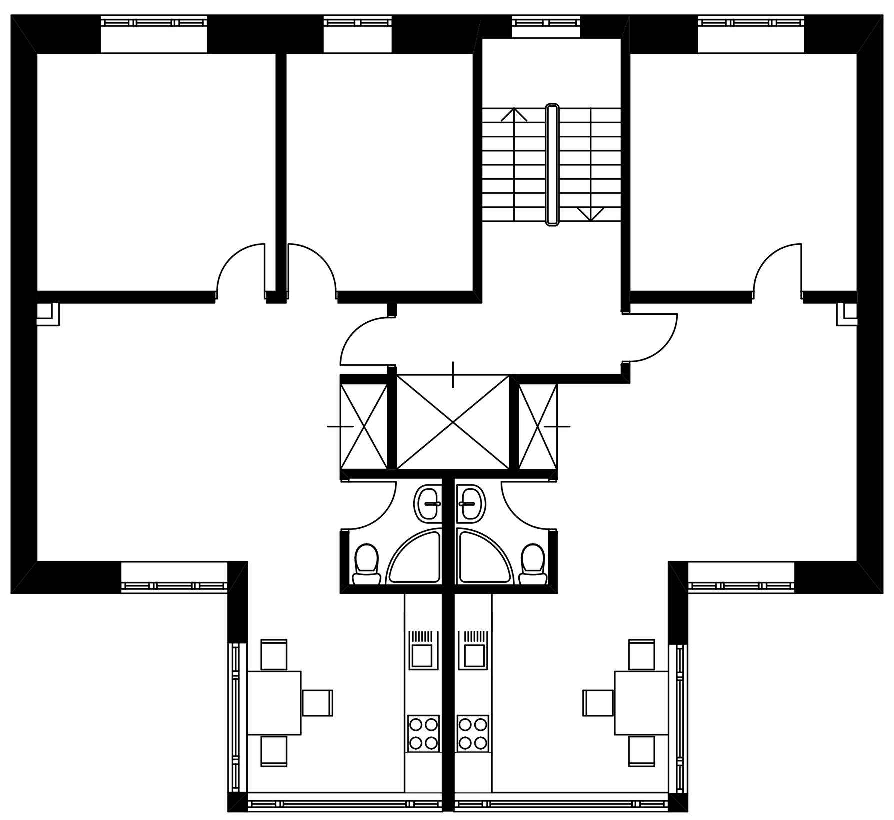
Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- good flow of light;
- accesible shaft, placed near the kitchen and bathrooms.

Disadvantages:
- limited entrance area in the apartments;
- one hole in the slab;
- common shaft;
- bathroom doors opening to the living room.



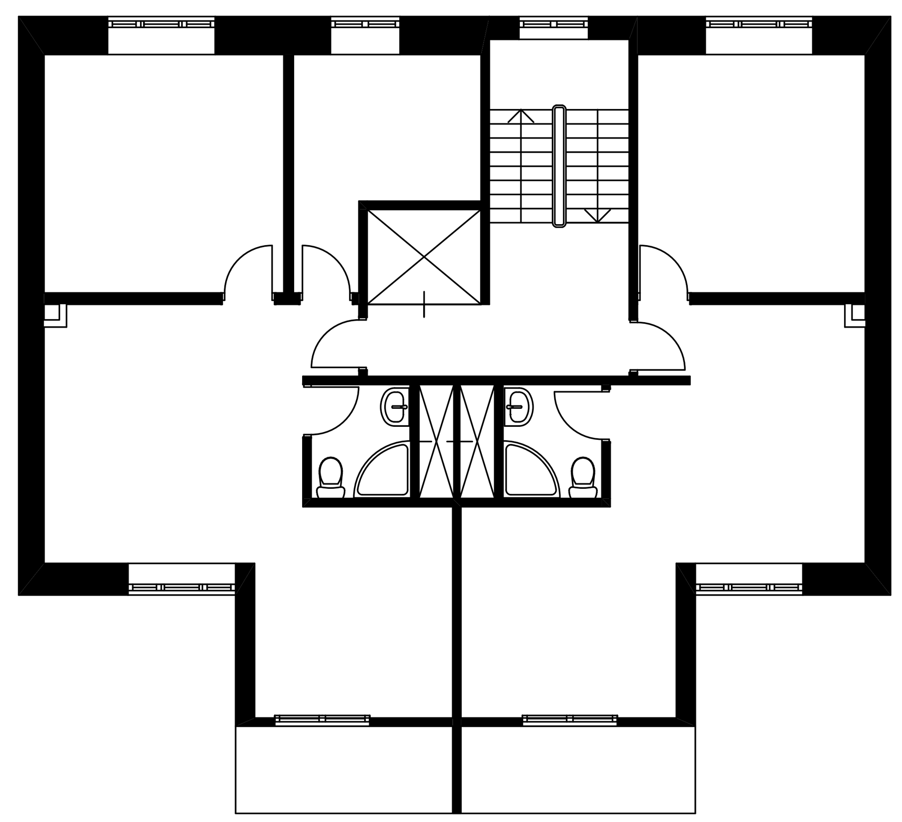
Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- good flow of light;
- elevator placed in the rear staircase's hole.

Disadvantages:
- limited entrance area in the apartments;
- shafts placed away from the kitchen;
- 2 holes in the slab for shafts;
- bathroom doors opening to the living room.



Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- good flow of light;
- accesible shaft, placed near the kitchen and bathrooms;
- shafts placed in the rear staircase's hole.

Disadvantages:
- limited entrance area in the apartments;
- one hole in the slab for elevator;
- bathroom doors opening to the living room.



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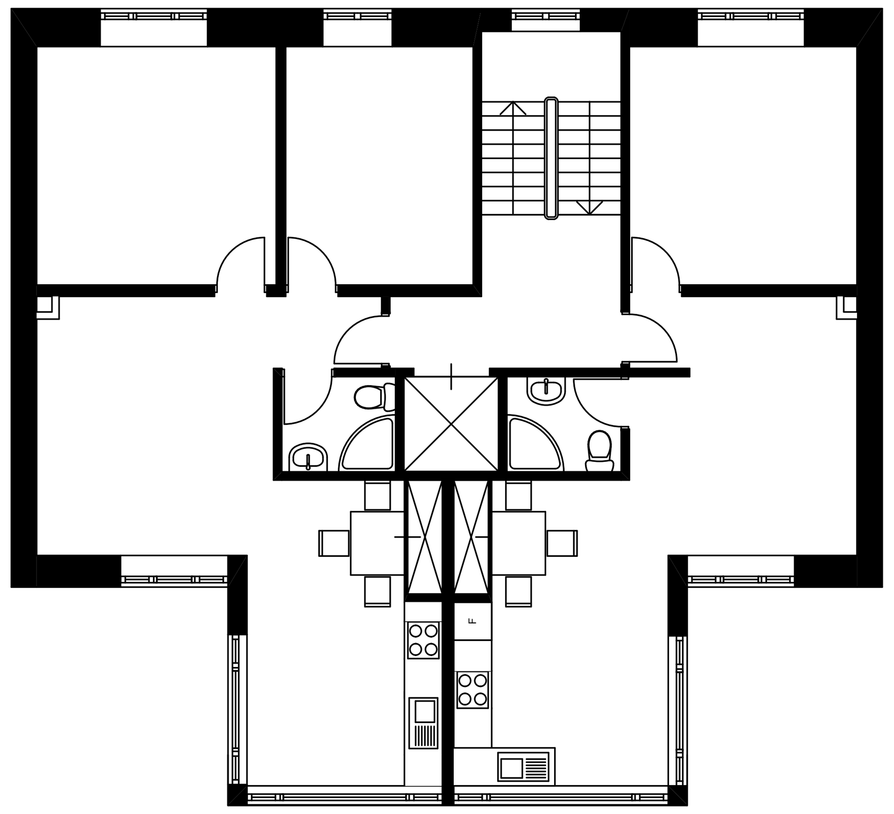
Proposal Sketches for Apartment Floors - Dannebrogsgade 4, Aarhus

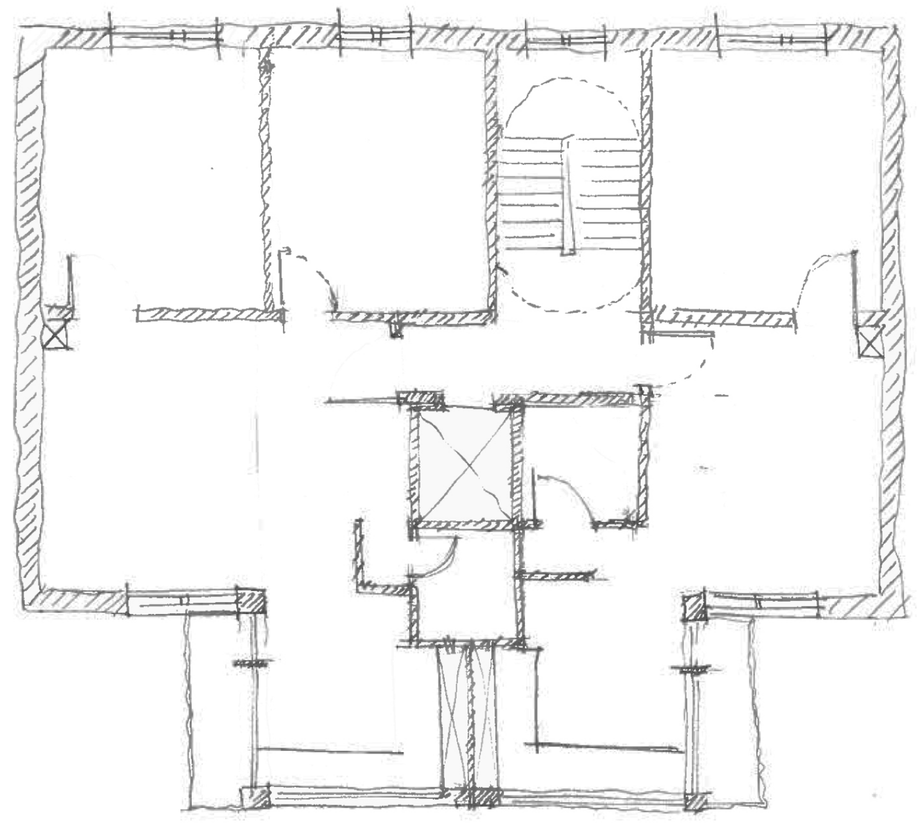
Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- good flow of light;
- accesible shaft, placed near the kitchen and bathrooms.

Disadvantages:
- limited entrance area in the apartments;
- one hole in the slab for shafts;
- bathroom doors opening to the living room;
- organization of the kitchen.



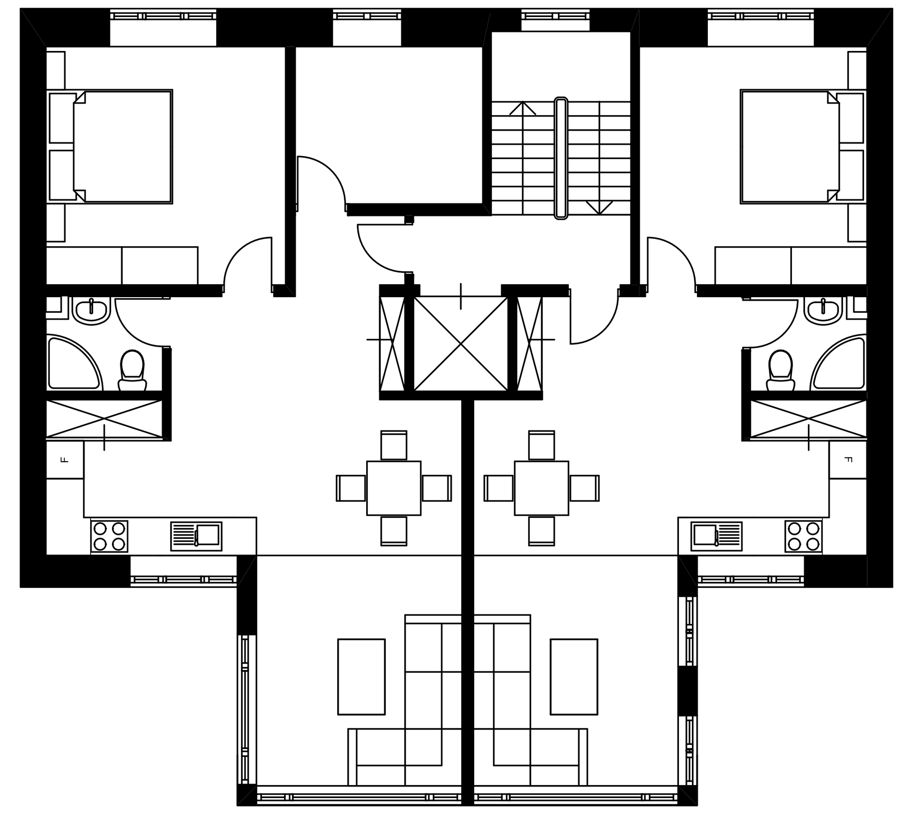
Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- good flow of light;
- accesible shafts, placed near the kitchens and one of the bathrooms;
- lift placed in the rear staircase's hole;
- no holes in the slab;
- hidden bathroom doors.

Disadvantages:
- limited entrance area in the apartments;
- labyrinthical layout in the apartments;
- one of the bathrooms is not connected to the shaft;
- the placement of the doors on the longitudinal bearing wall limits the possibilities for furnishing.



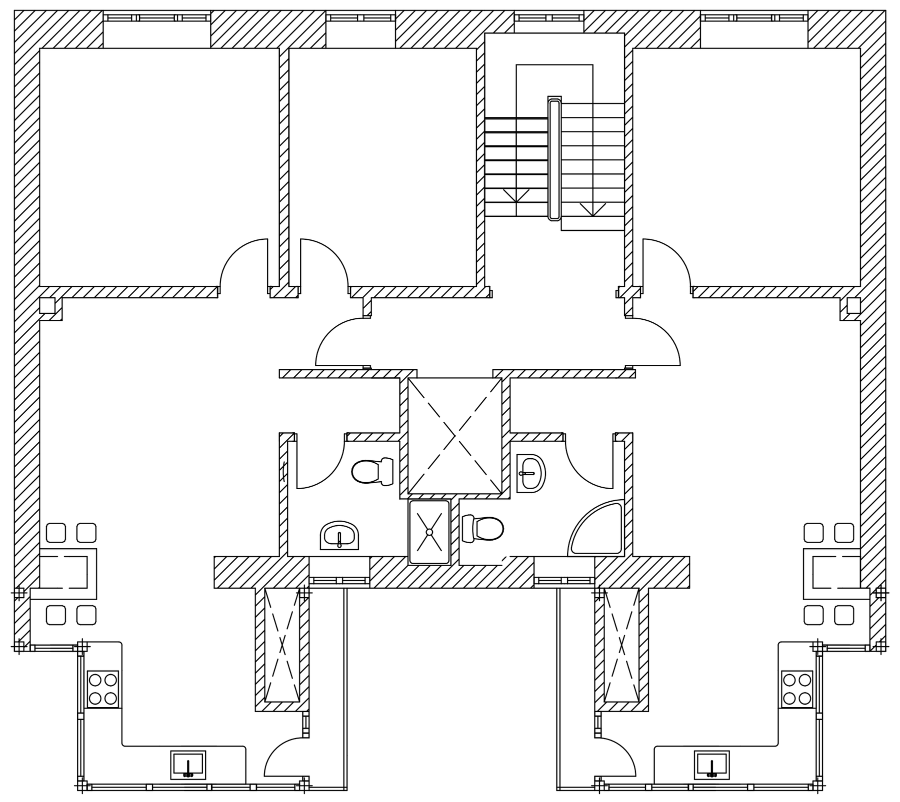
Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- good flow of light;
- elevator placed in the rear staircase's hole
- generous entrance area in the apartments;
- accesible shafts, placed near the kitchens and the bathrooms;
- living room placed in the extension: the space benefits of sunlight and expanding views;
- possibility of using the old chimneys holes.

Disadvantages:
- not enough sunlight in the dining room;
- no good flow - you have to cross throw dining and kitchen to get to the living room;
- 2 holes in the slab for the shafts.



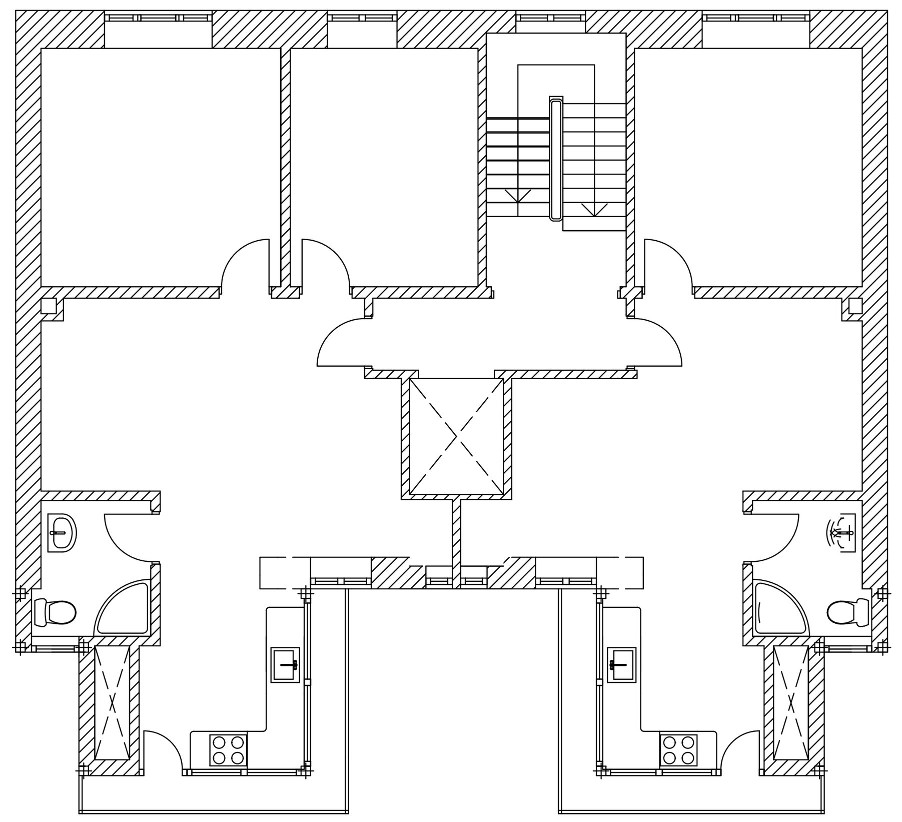
Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- accesible shafts, placed near the kitchens and the bathrooms;
- lift placed in the rear staircase's hole;
- no holes in the slab;
- natural light and ventilation in the bathrooms;
- hidden bathroom doors.

Disadvantages:
- limited entrance area in the apartments;
- facing balconies;
- not enough sunlight in the living room;
- too close to the neighbour's boundary.



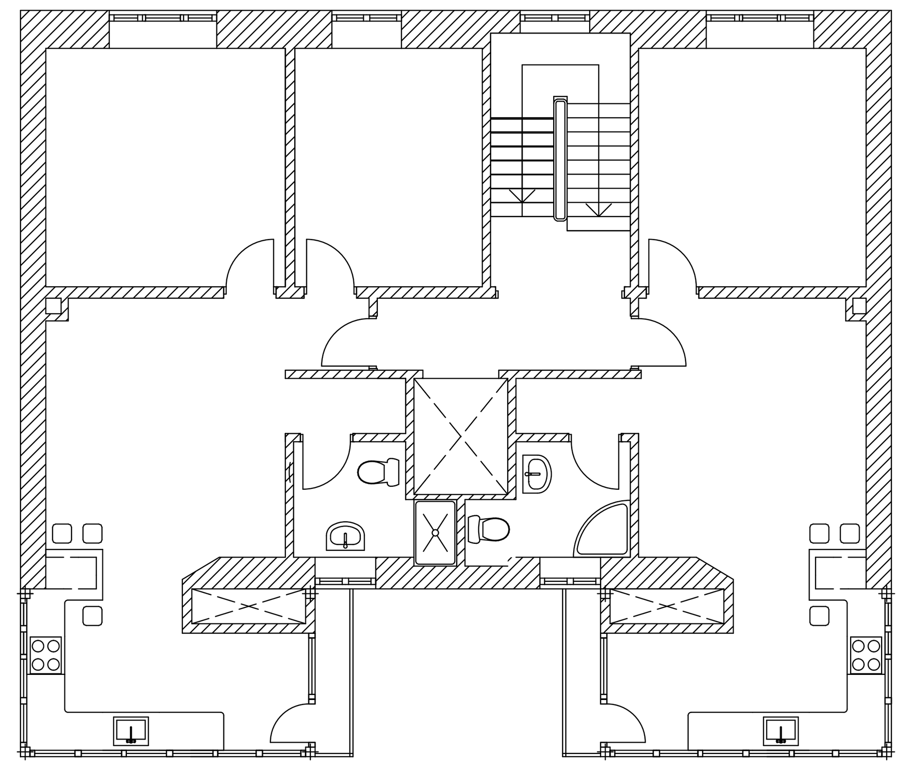
Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- accesible shafts, placed near the kitchens and the bathrooms;
- lift placed in the rear staircase's hole;
- no holes in the slab;
- natural light and ventilation in the bathrooms.

Disadvantages:
- limited entrance area in the apartments;
- facing balconies;
- not enough sunlight in the living room;
- no clear area for the living room;
- too close to the neighbour's boundary.



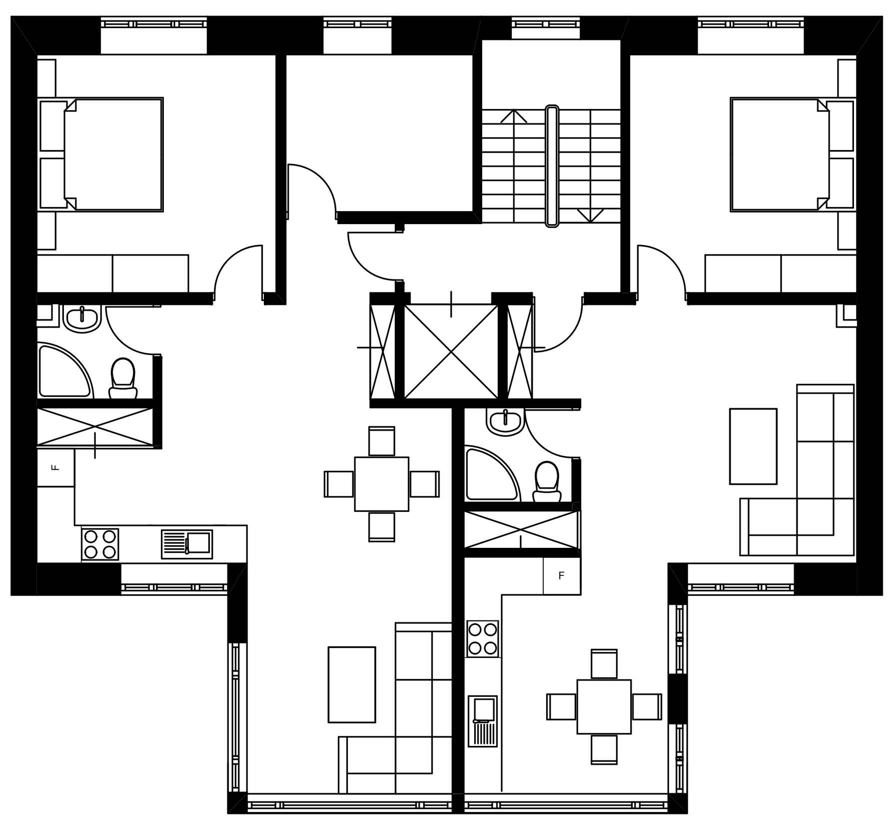
Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- accesible shafts, placed near the kitchens and the bathrooms;
- lift placed in the rear staircase's hole;
- no holes in the slab;
- natural light and ventilation in the bathrooms;
- hidden bathroom doors.

Disadvantages:
- limited entrance area in the apartments;
- facing balconies;
- not enough sunlight in the living room;
- too close to the neighbour's boundary.



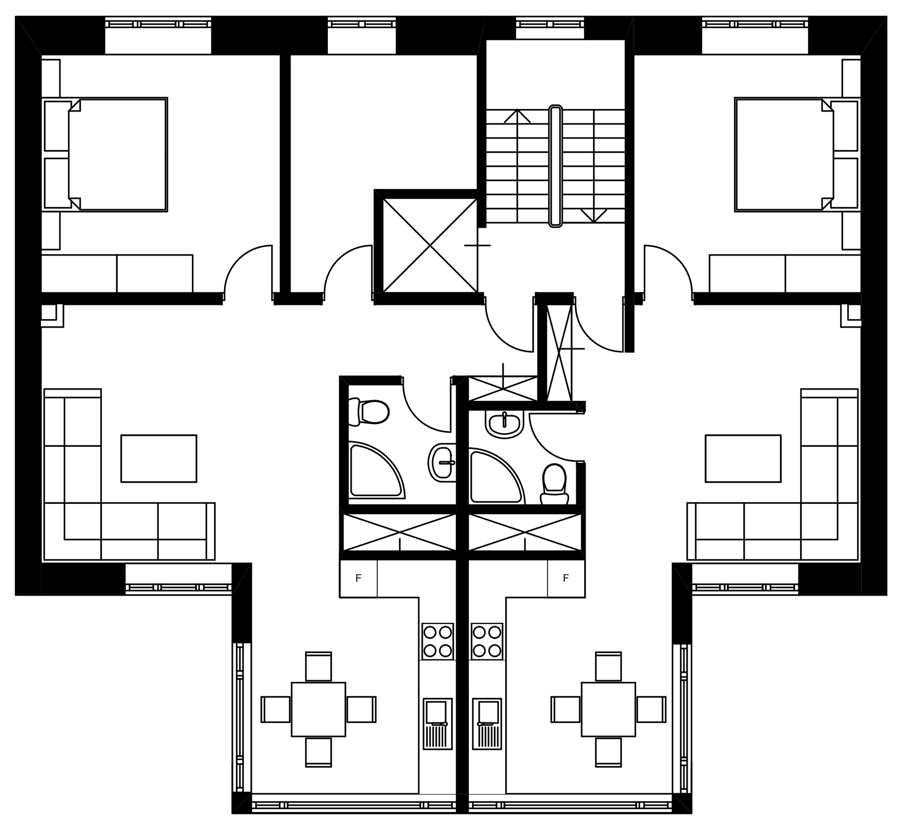
Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- good flow of light;
- accesible shafts, placed near the kitchens and one of the bathrooms;
- lift placed in the rear staircase's hole;
- no limited entrance area in the apartments;
- different arrangement of the apartments.

Disadvantages:
- 2 holes in the slab for elevator and shafts;
- small dining area.



Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- good flow of light;
- accesible shafts, placed near the kitchens and one of the bathrooms;
- no limited entrance area in the apartments;
- open space.

Disadvantages:
- 2 holes in the slab for elevator and shafts;
- small dining area;
- one of the bathrooms doors from one apartment opens to the living room.



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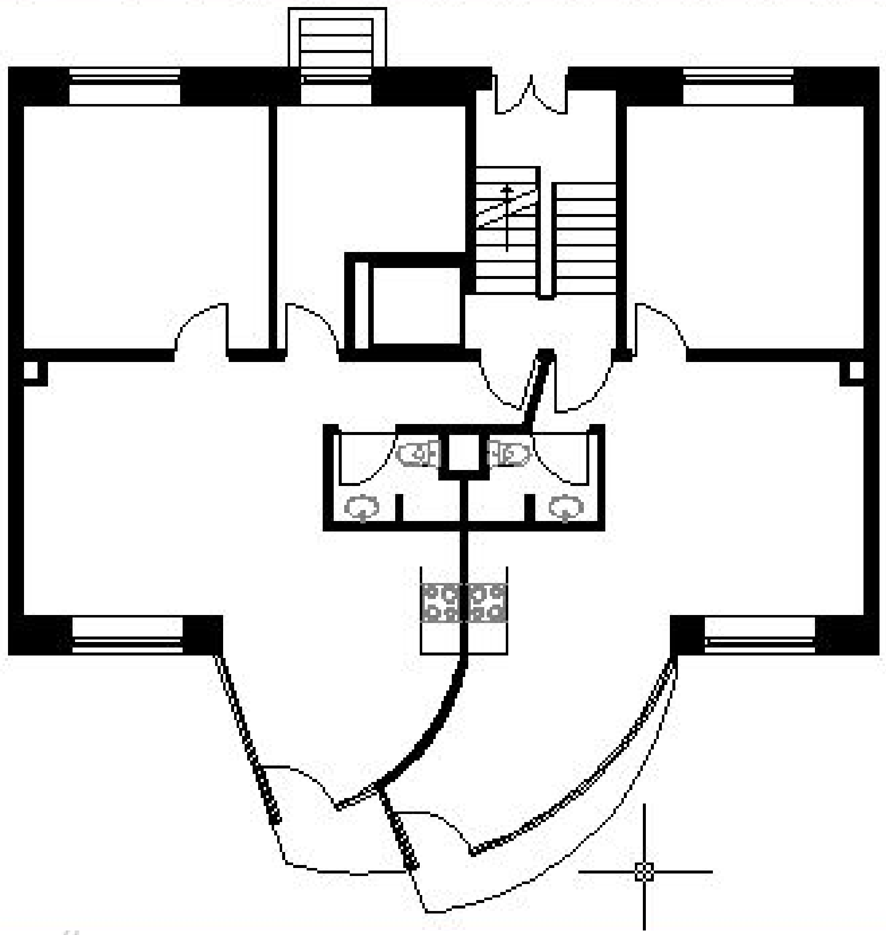
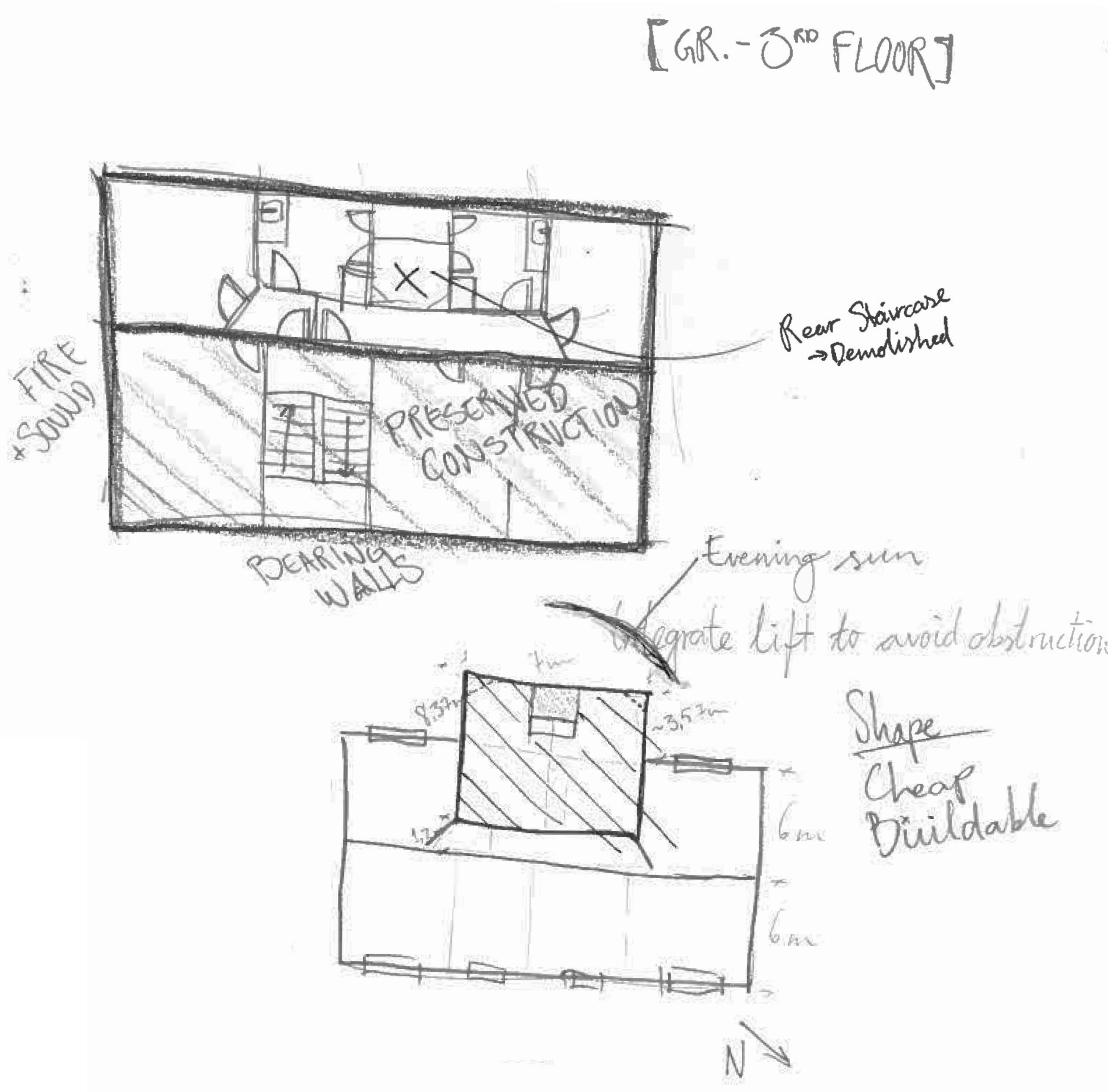
Working Process

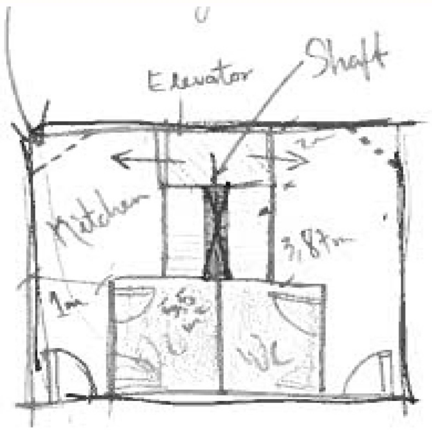
Sketches for apartment floors

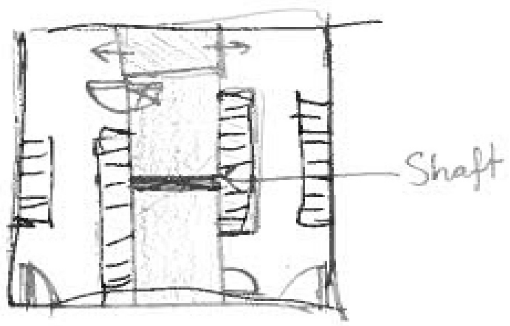
Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- good flow of light;
- accesible shaft, placed near the kitchen and bathrooms.

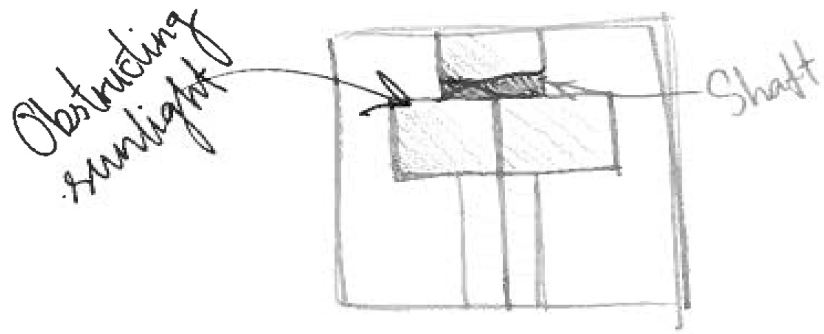
Disadvantages:
- limited entrance area in the apartments;
- one hole in the slab;
- common shaft.











Proposals:

- providing new bathrooms and kitchens to each dwelling;
- all floors connected by a lift;
- demolishing of the rear staircase;
- new installation shafts;
- balcony to each apartment;
- open living area.

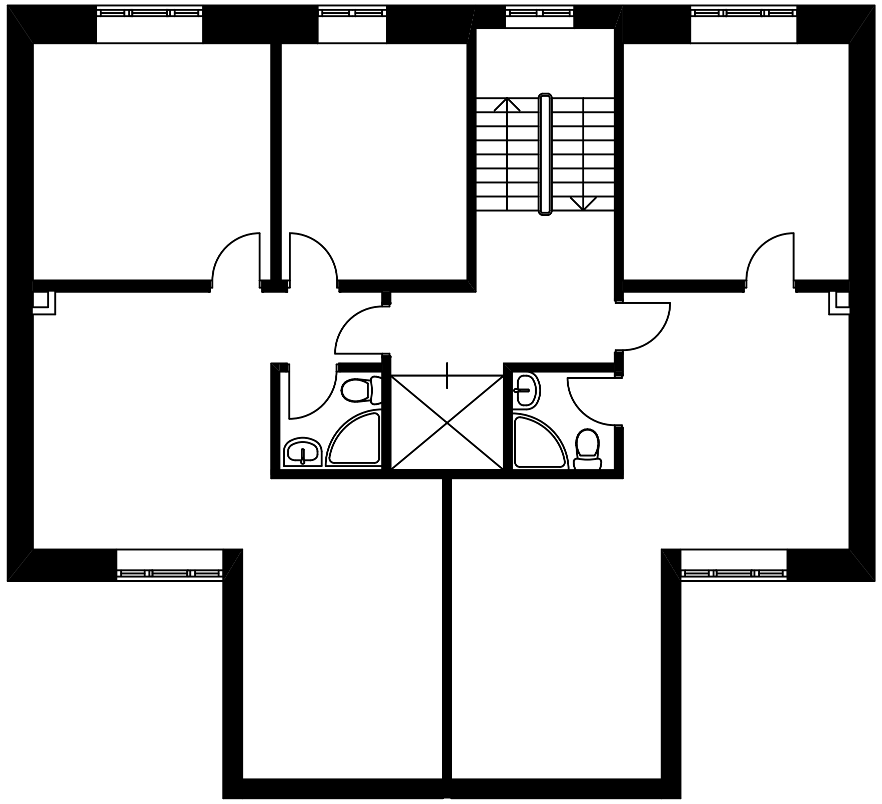
Working

Process

Sketches for apartment floors --- Advantages / Disadvantages

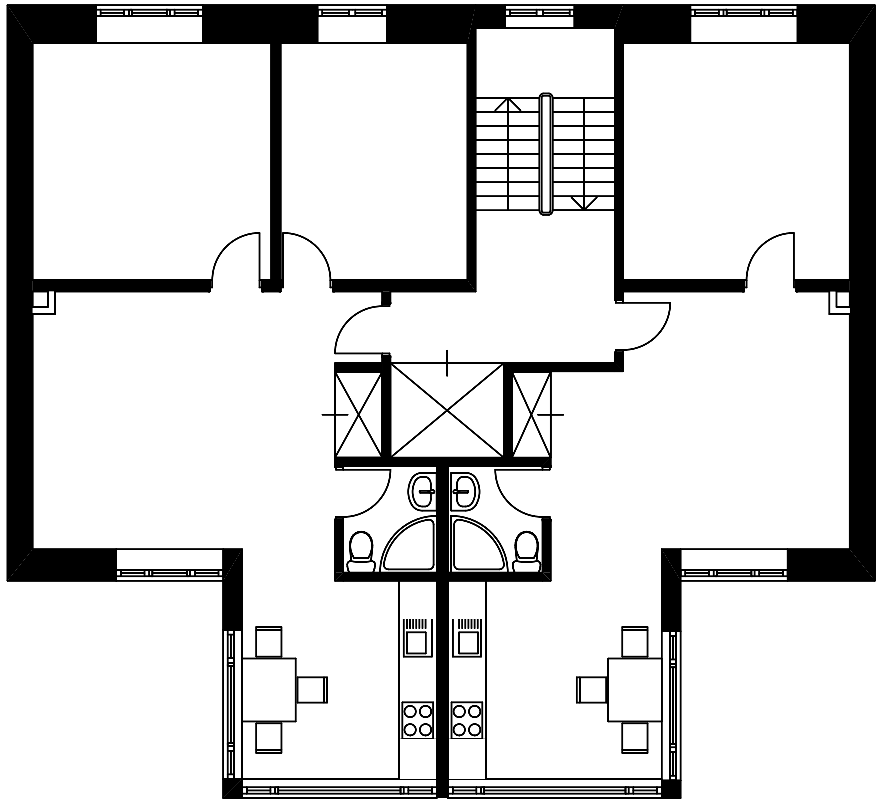
Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- good flow of light;
- elevator placed in the rear staircase's hole.

Disadvantages:
- limited entrance area in the apartments;
- shafts placed away from the kitchen;
- 2 holes in the slab for shafts;
- bathroom doors opening to the living room;
- organization of the kitchen.



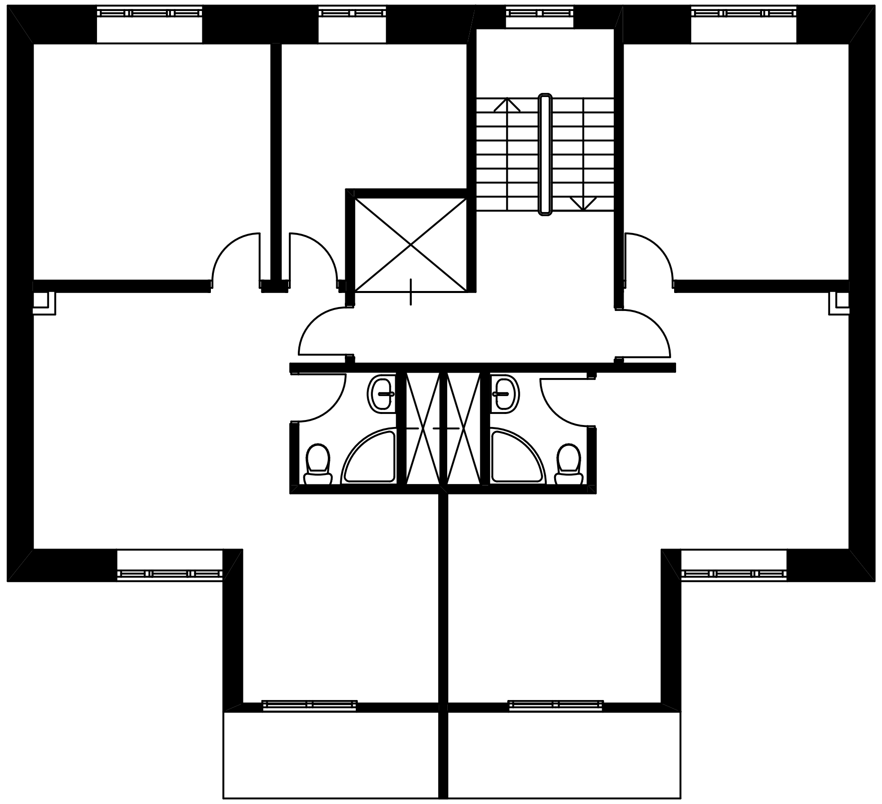
Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- good flow of light;
- elevator placed in the rear staircase's hole.

Disadvantages:
- limited entrance area in the apartments;
- shafts placed away from the kitchen;
- 2 holes in the slab for shafts;
- bathroom doors opening to the living room.



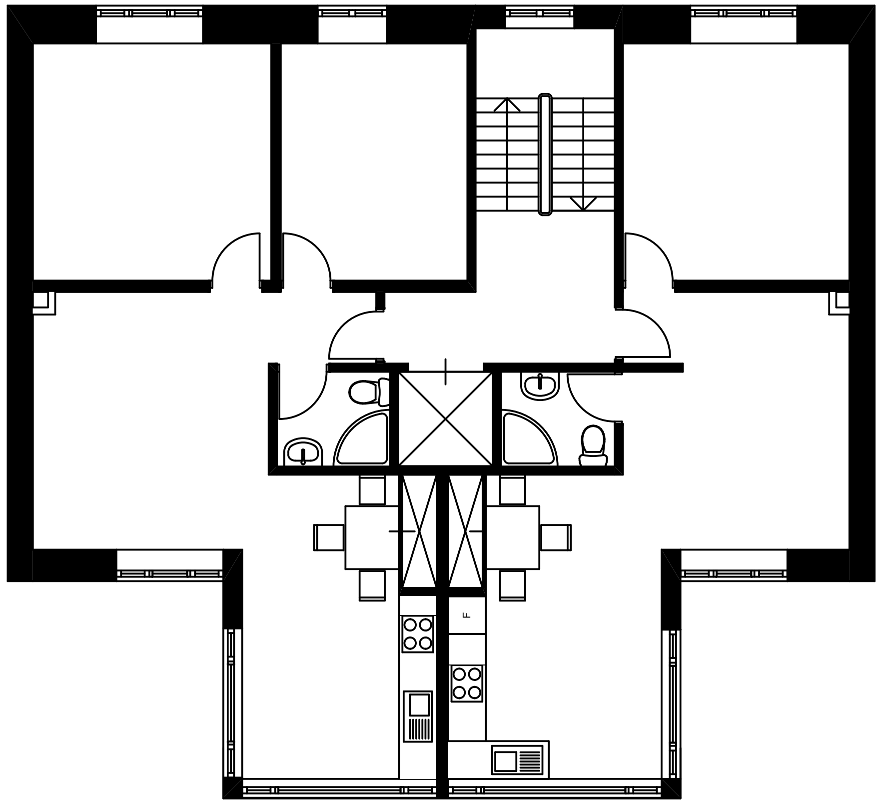
Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- good flow of light;
- accesible shaft, placed near the kitchen and bathrooms;
- shafts placed in the rear staircase's hole.

Disadvantages:
- limited entrance area in the apartments;
- one hole in the slab for elevator;
- bathroom doors opening to the living room.



Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- good flow of light;
- accesible shaft, placed near the kitchen and bathrooms.

Disadvantages:
- limited entrance area in the apartments;
- one hole in the slab for shafts;
- bathroom doors opening to the living room;
- organization of the kitchen.



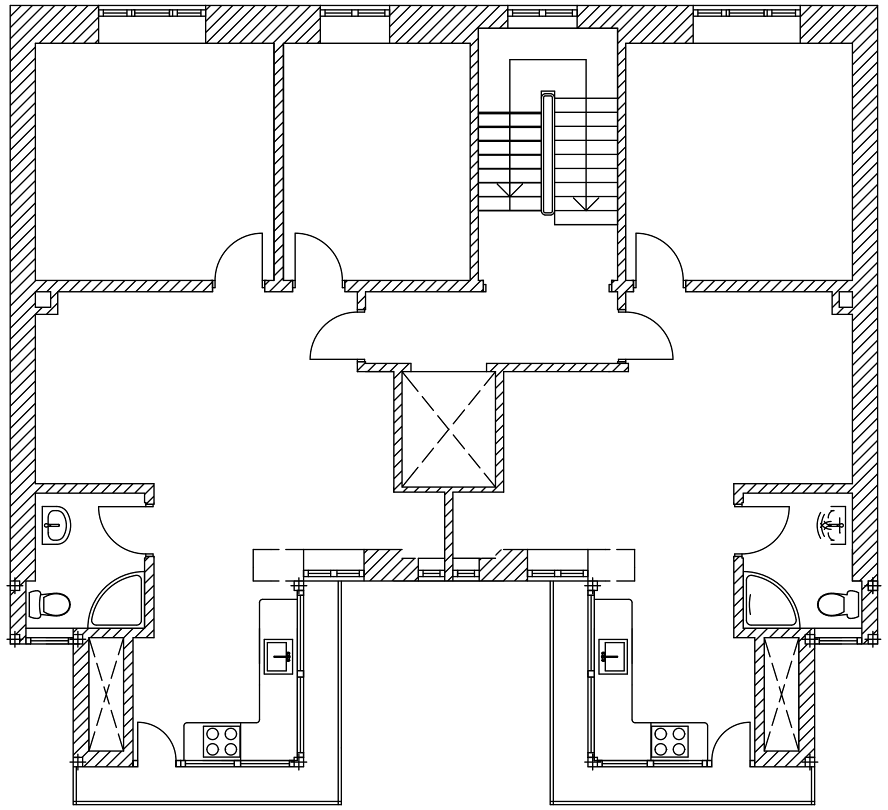
Working

Process

Sketches for apartment floors --- Advantages / Disadvantages

Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- accesible shafts, placed near the kitchens and the bathrooms;
- lift placed in the rear staircase's hole;
- no holes in the slab;
- natural light and ventilation in the bathrooms.

Disadvantages:
- limited entrance area in the apartments;
- facing balconies;
- not enough sunlight in the living room;
- no clear area for the living room;
- too close to the neighbour's boundary.



Advantages:
- good position of lift;
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- natural light and ventilation in the bathrooms;
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Disadvantages:
- limited entrance area in the apartments;
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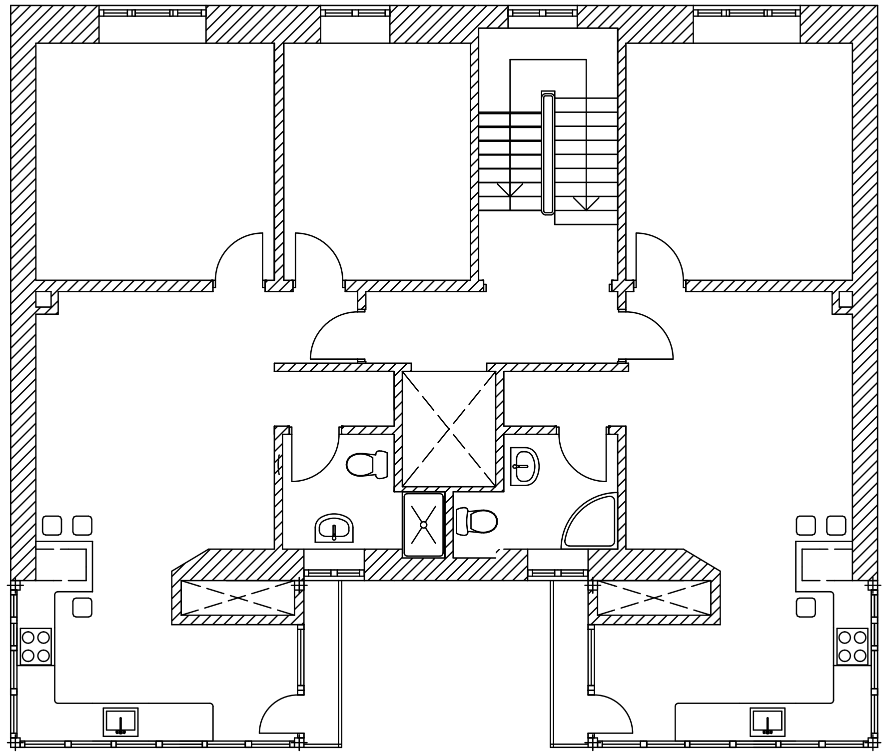
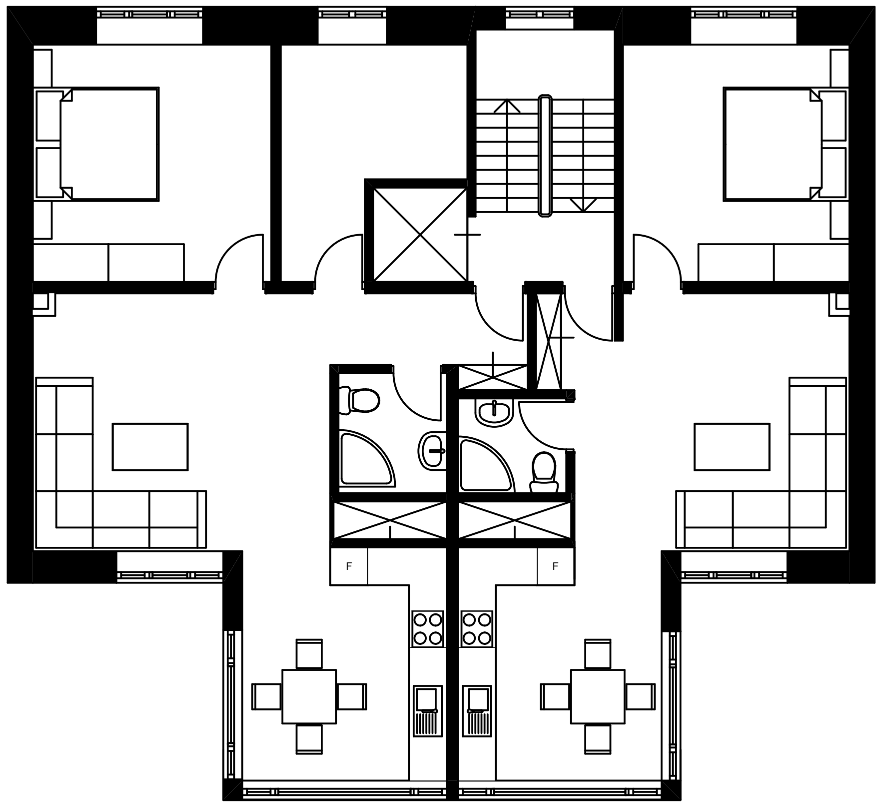


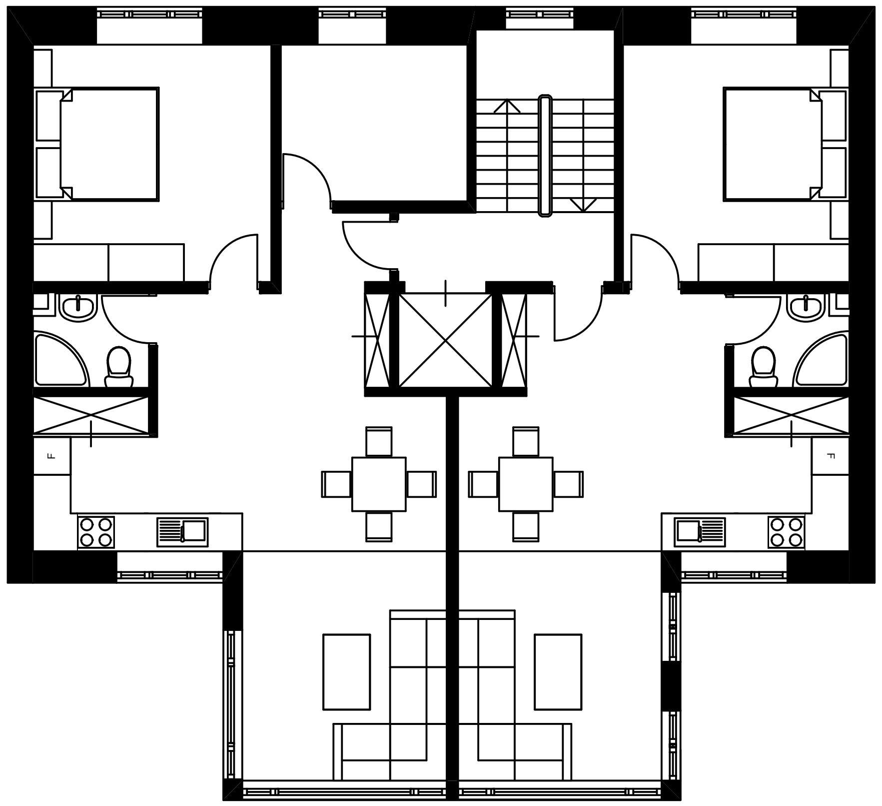
Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- good flow of light;
- accesible shafts, placed near the kitchens and one of the bathrooms;
- no limited entrance area in the apartments;
- open space.

Disadvantages:
- 2 holes in the slab for elevator and shafts;
- small dining area;
- one of the bathrooms doors from one apartment opens to the living room.



Advantages:
- good position of lift;
- good circulation from stairs to apartments and lift;
- good flow of light;
- elevator placed in the rear staircase's hole
- generous entrance area in the apartments;
- accesible shafts, placed near the kitchens and the bathrooms;
- living room placed in the extension: the space benefits of sunlight and expanding views;
- possibility of using the old chimneys holes.

Disadvantages:
- not enough sunlight in the dining room;
- no good flow - you have to cross throw dining and kitchen to get to the living room;
- 2 holes in the slab for the shafts.



Working Process

Sketches for basement --- Advantages / Disadvantages

Advantages:
- natural light and ventilation in the common area.

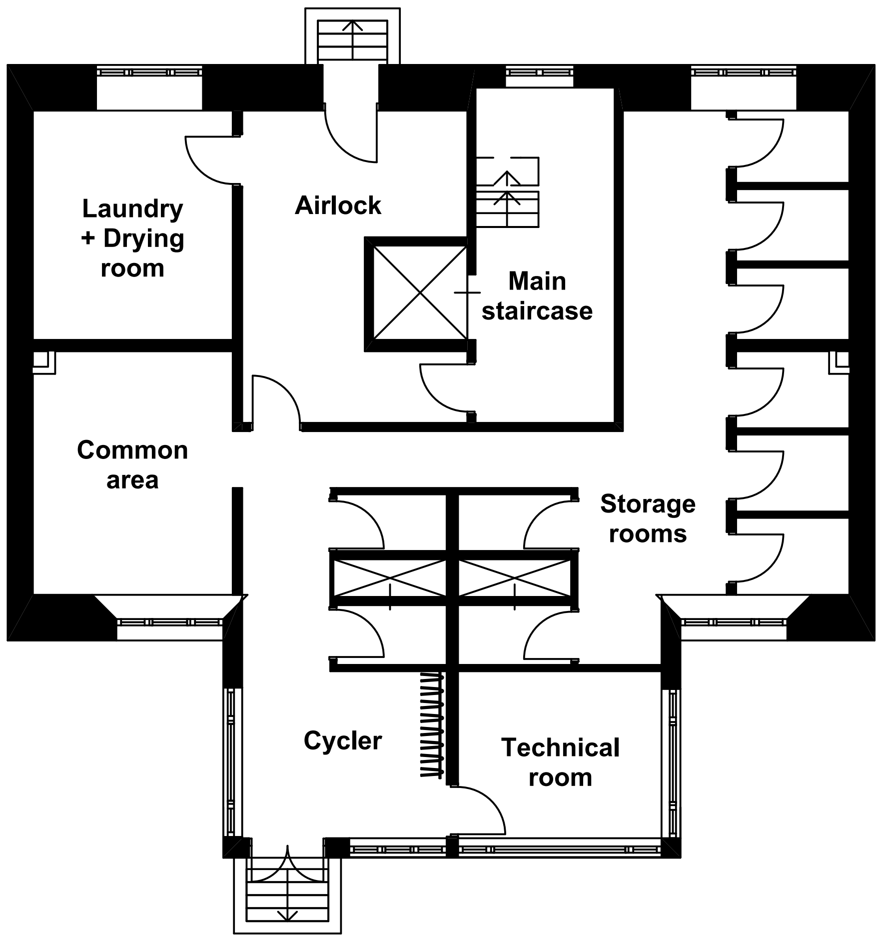
Disadvantages:
- cycler placed away from the street access;
- demands for designing the airlock are not fulfilled;
- technical room far from shafts.

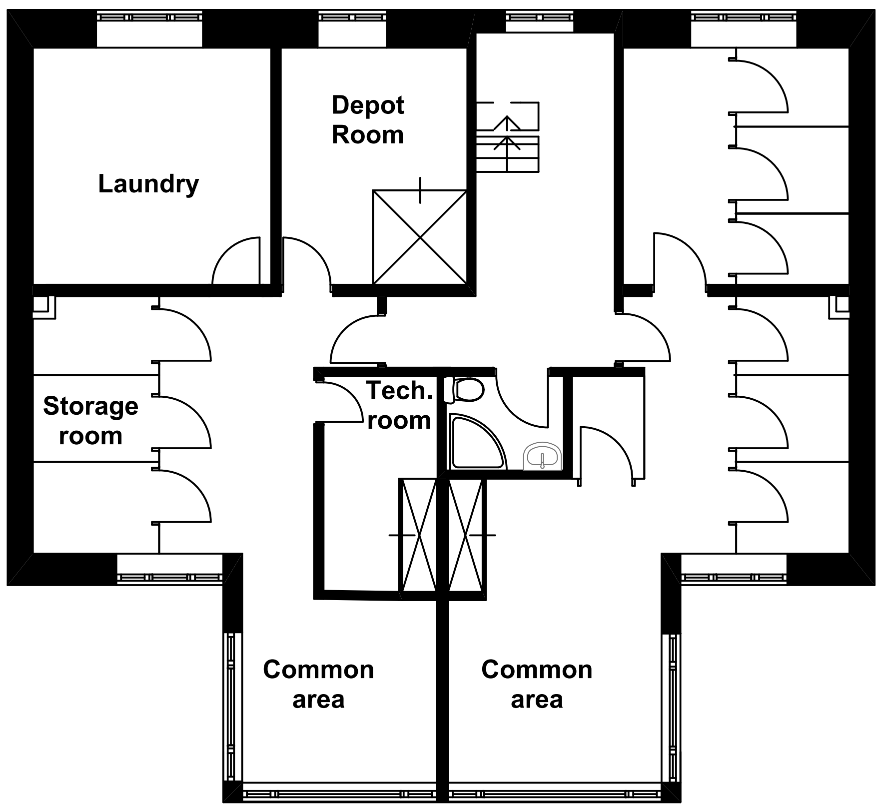
Proposals:

- extend the main staircase to the basement via an airlock;
- new laundry and drying area;
- 10 storage rooms for each dwelling disposal;
- new installation rooms;
- acces to the basement available from the courtyard;
- demolishing and removing the existing stairway to the terrain in the courtyard.

Advantages:
- suitable storage rooms;
- natural light and ventilation in the common area.

Disadvantages:
- no airlock provided;
- no access to the courtyard;
- lift placed in direct connection with the depot room;
- no space for drying.





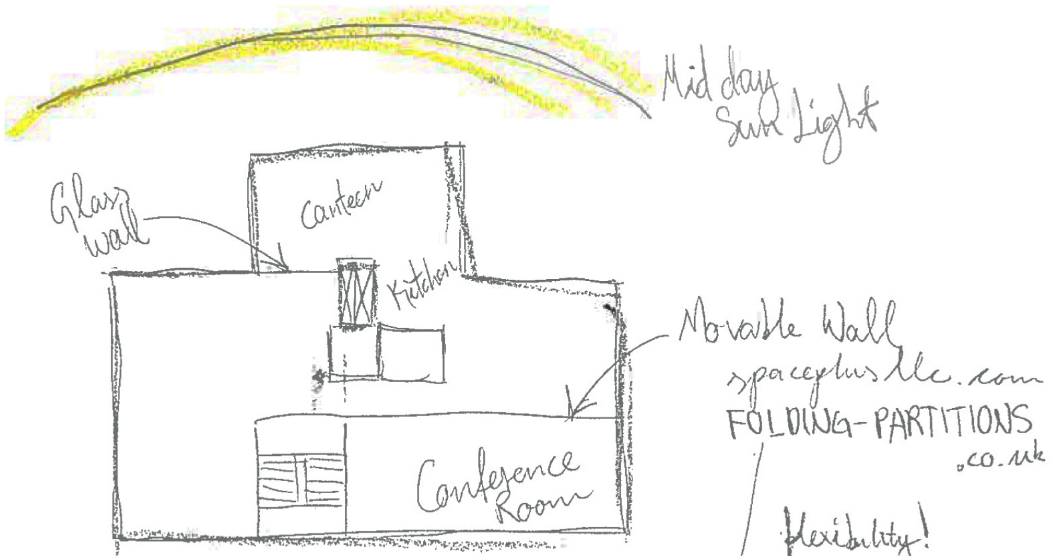
Working Process

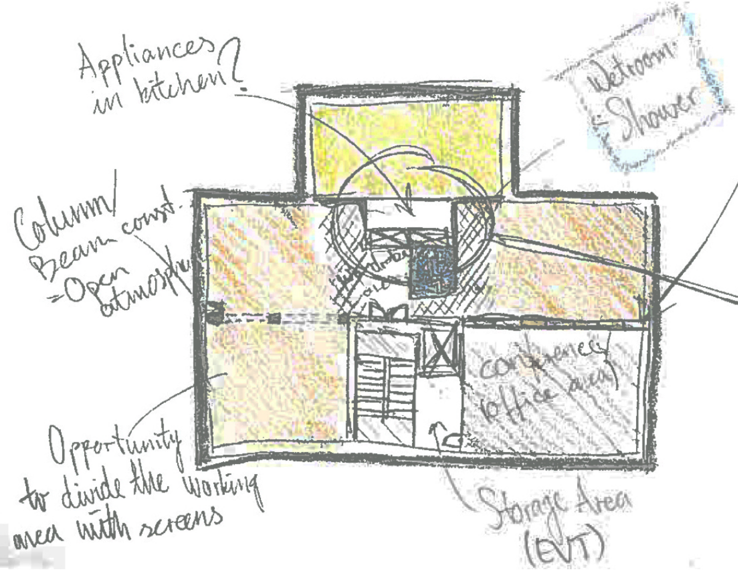
Sketches for ground floor

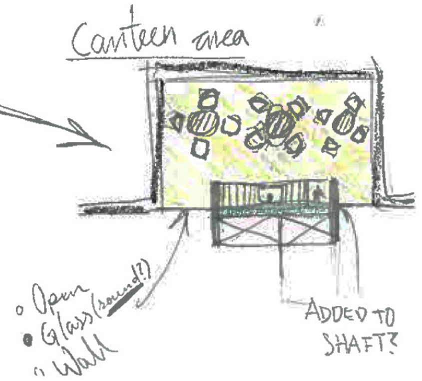
[Office in the ground floor]

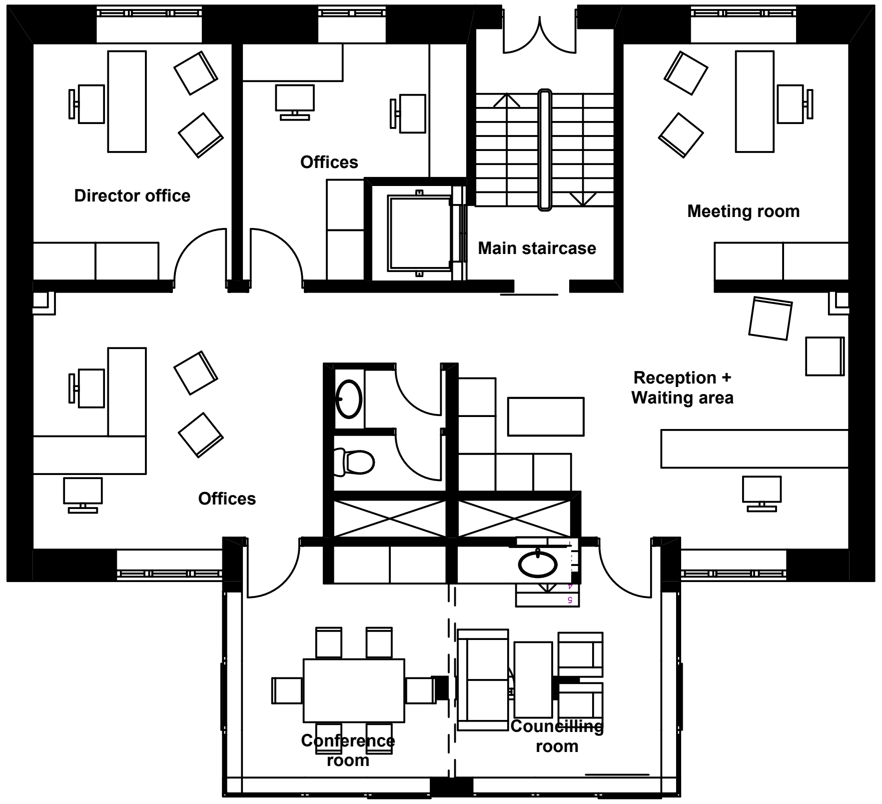
- Conference room
- Working area
- Kitchen (small)
- Canteen/Lunch area

* Movable walls to maximize flexibility



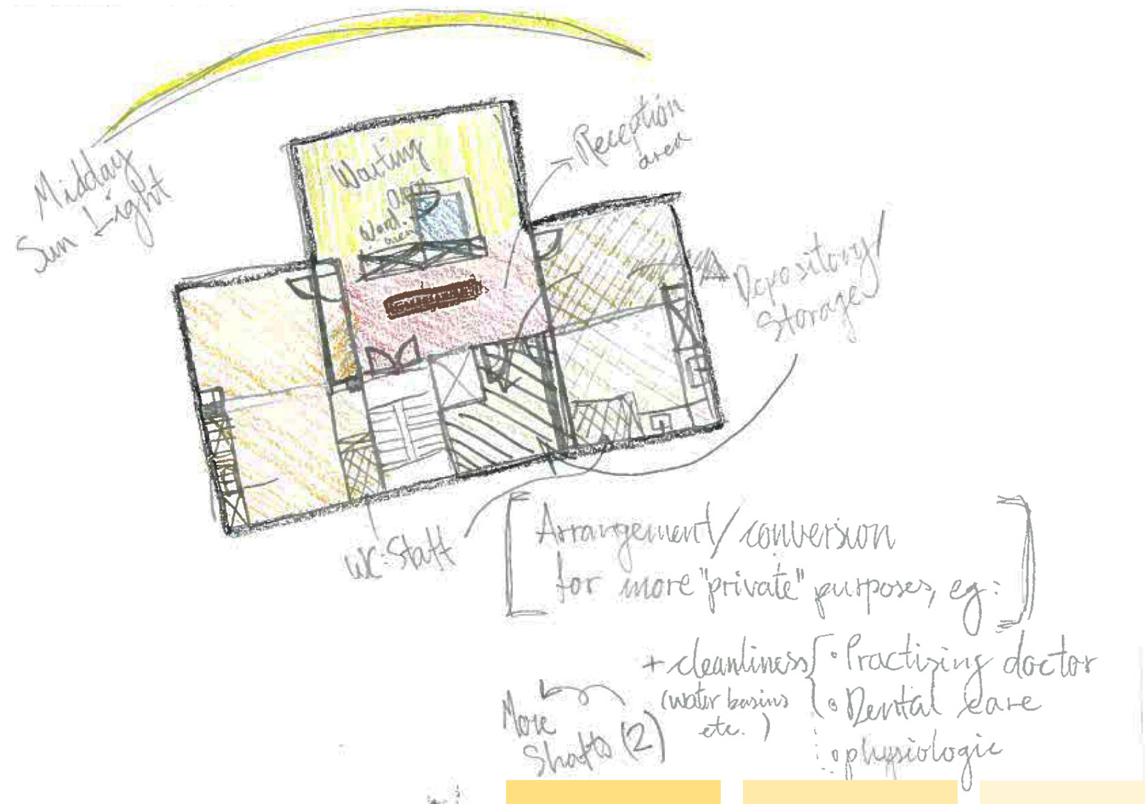






Proposals:

- extend the main staircase to the basement via an airlock;
- demolishing the rear staircase;
- change the 2 flats into offices.



Working Process

Sketches for penthouse apartment --- Advantages / Disadvantages

Advantages:
- good circulation in the apartment;
- dressing room and personal bathroom for the main bedroom;
- good flow of light.

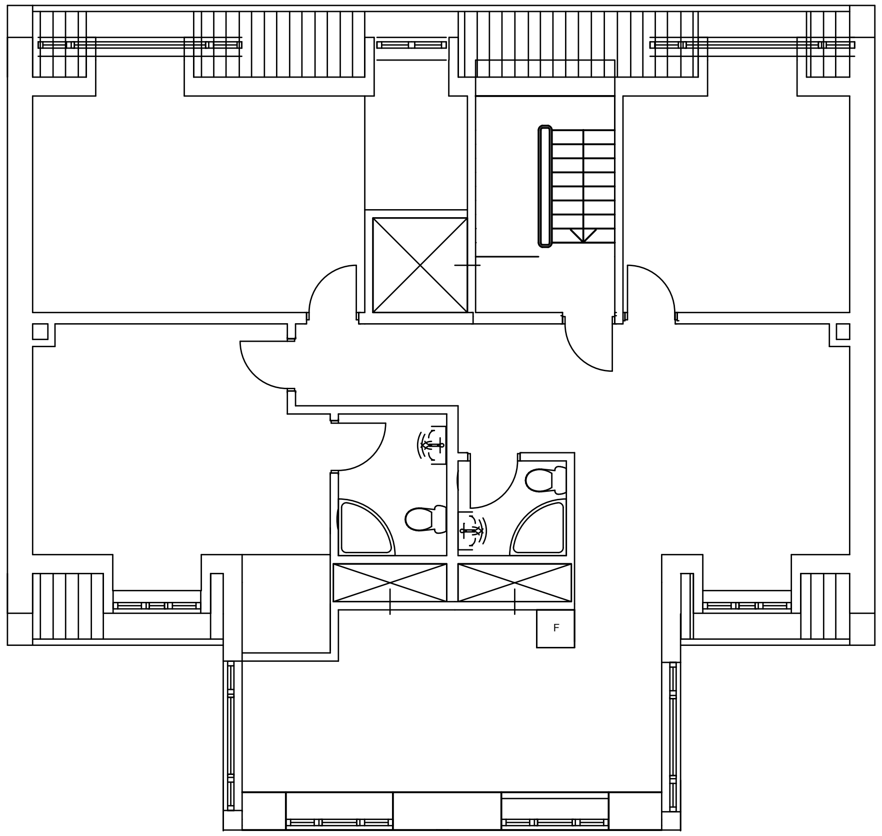
Disadvantages:
- small apartment bathroom;
- no roof terrace;
- lost space by keeping the both shafts.

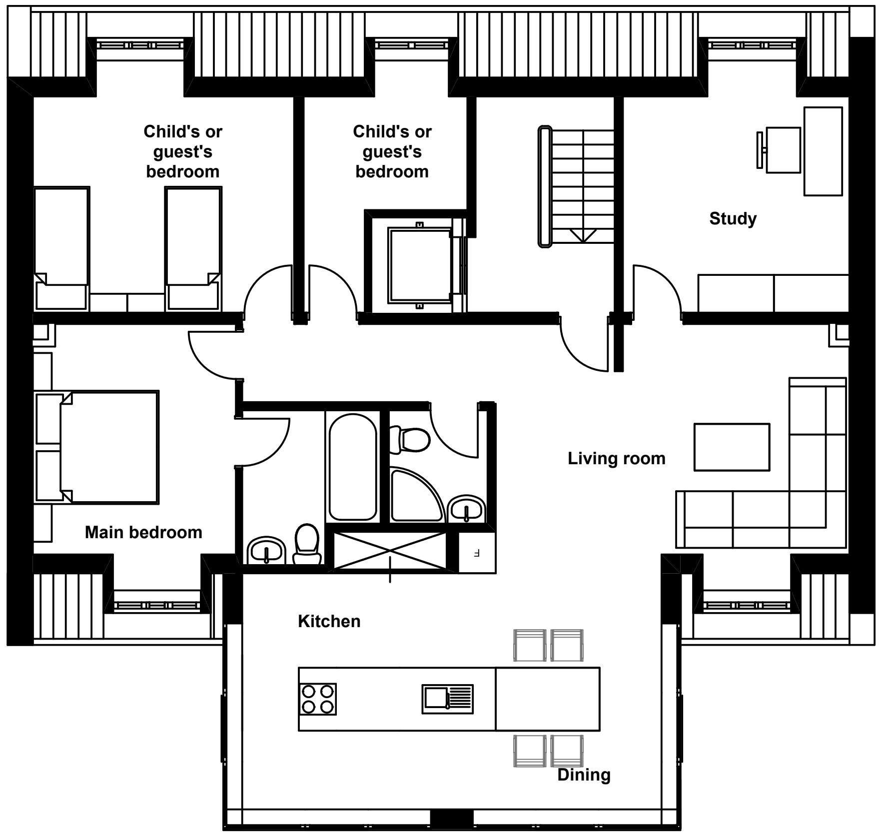
Proposals:

- change the 2 existing flats into a penthouse;
- provide a roof terrace;
- separate the private areas from the common ones;
- open living area;
- study room for family members;
- expanding views.

Advantages:
- good circulation in the apartment;
- personal bathroom for the main bedroom;
- good flow of light.

Disadvantages:
- small apartment bathroom;
- no roof terrace;
- no dressing for the main bedroom;
- no space for ventilation pipes from the covered shaft.





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- Building site include scaffolding.
- Demolition
- Primary Element
- Completion
- Finishes
- Building Services
- Fit and Furniture
- Miscellaneous / General Fit other

Building Element — Cupboards

List Content

- Introduction
- Reparation
- Demolition
- Shoring
- Steel work

- Demolition
- Remove Roof Surface
- Demolition existing walls exterior
- Demolition interior walls
- Demolition of old storey partition

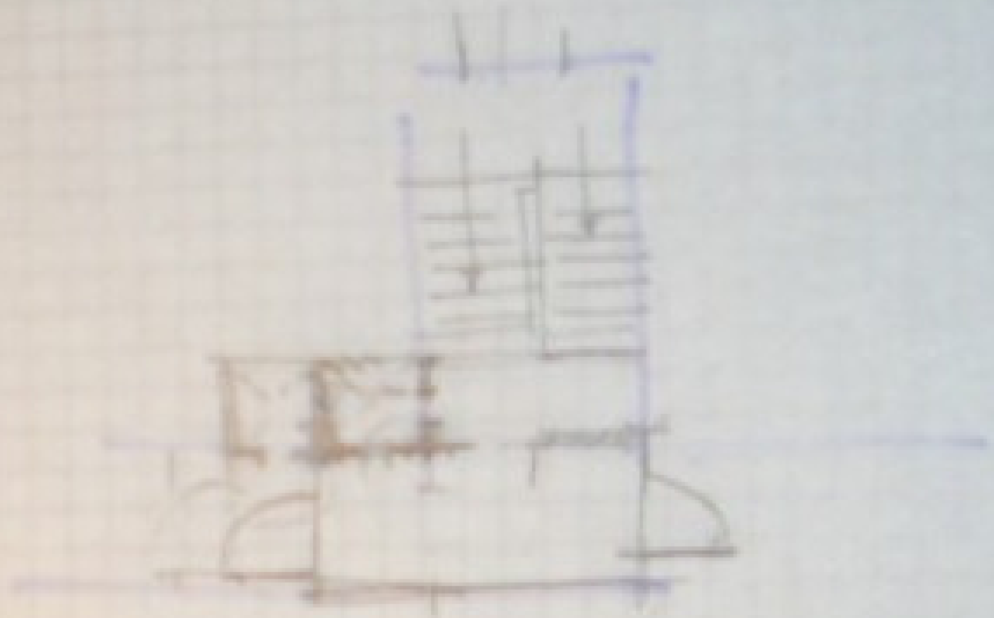
(1) Foundation

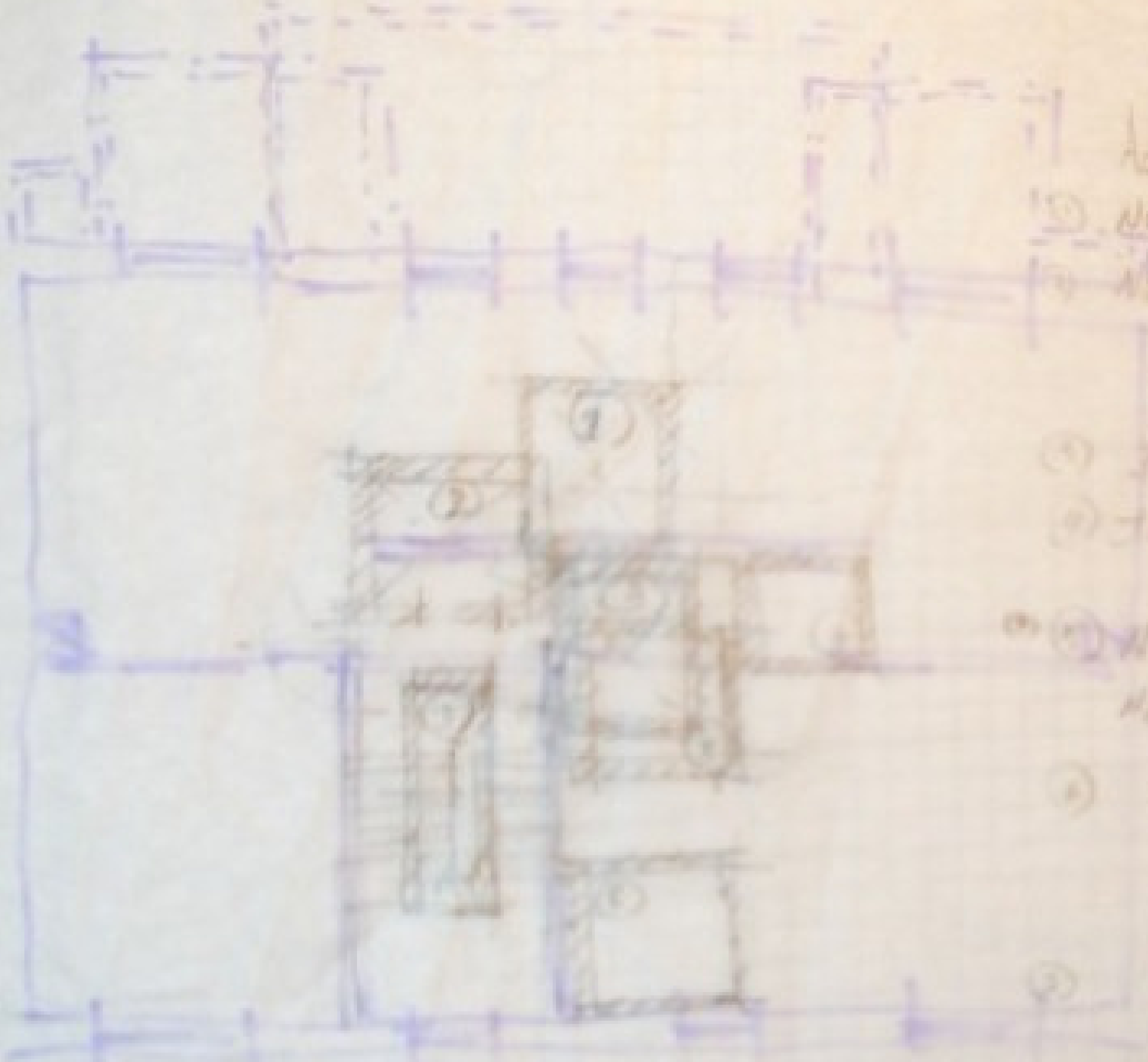
Demolition ... guide

Hand over

Building Process

Demolition Primary

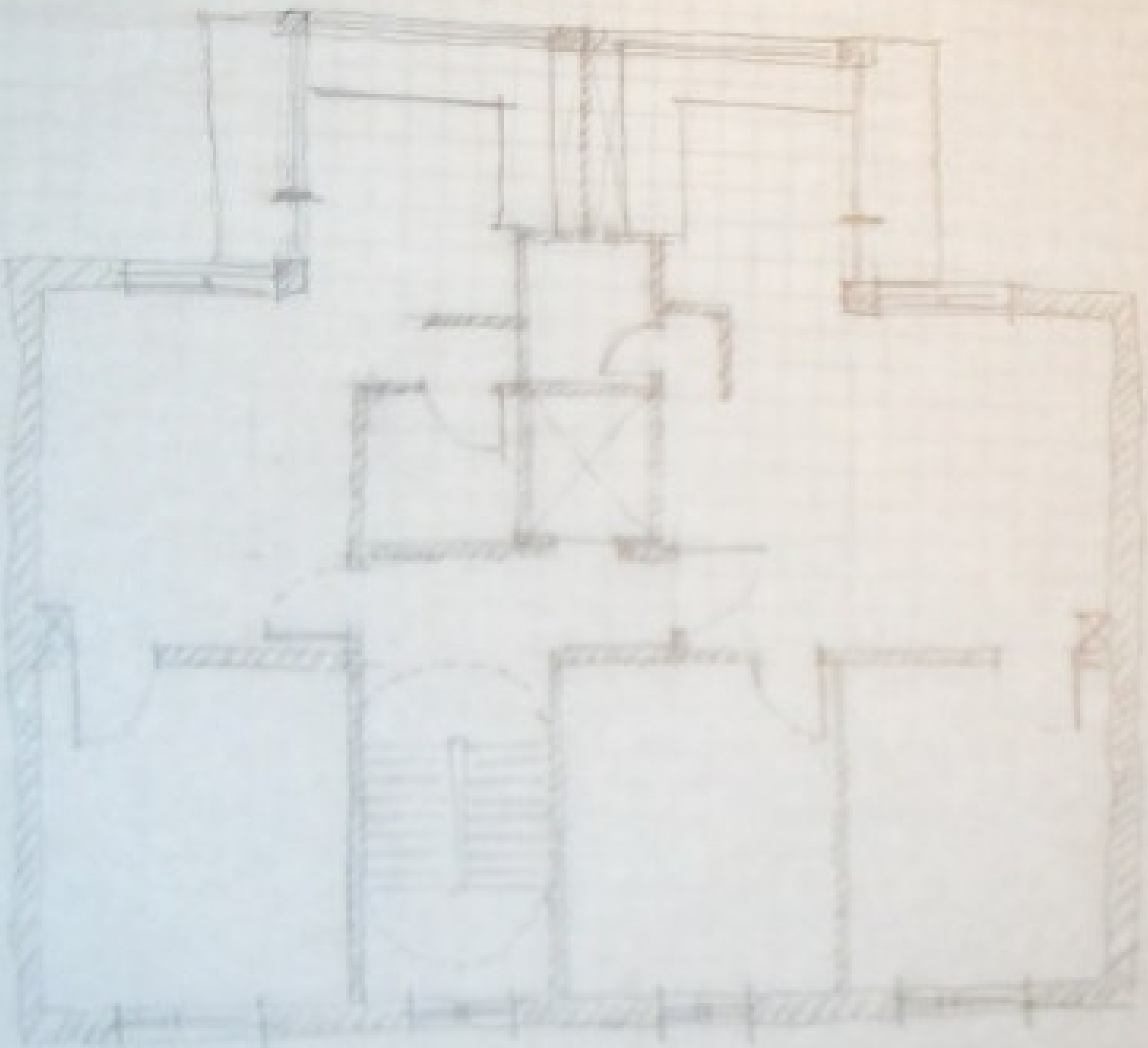




Elevator Placements

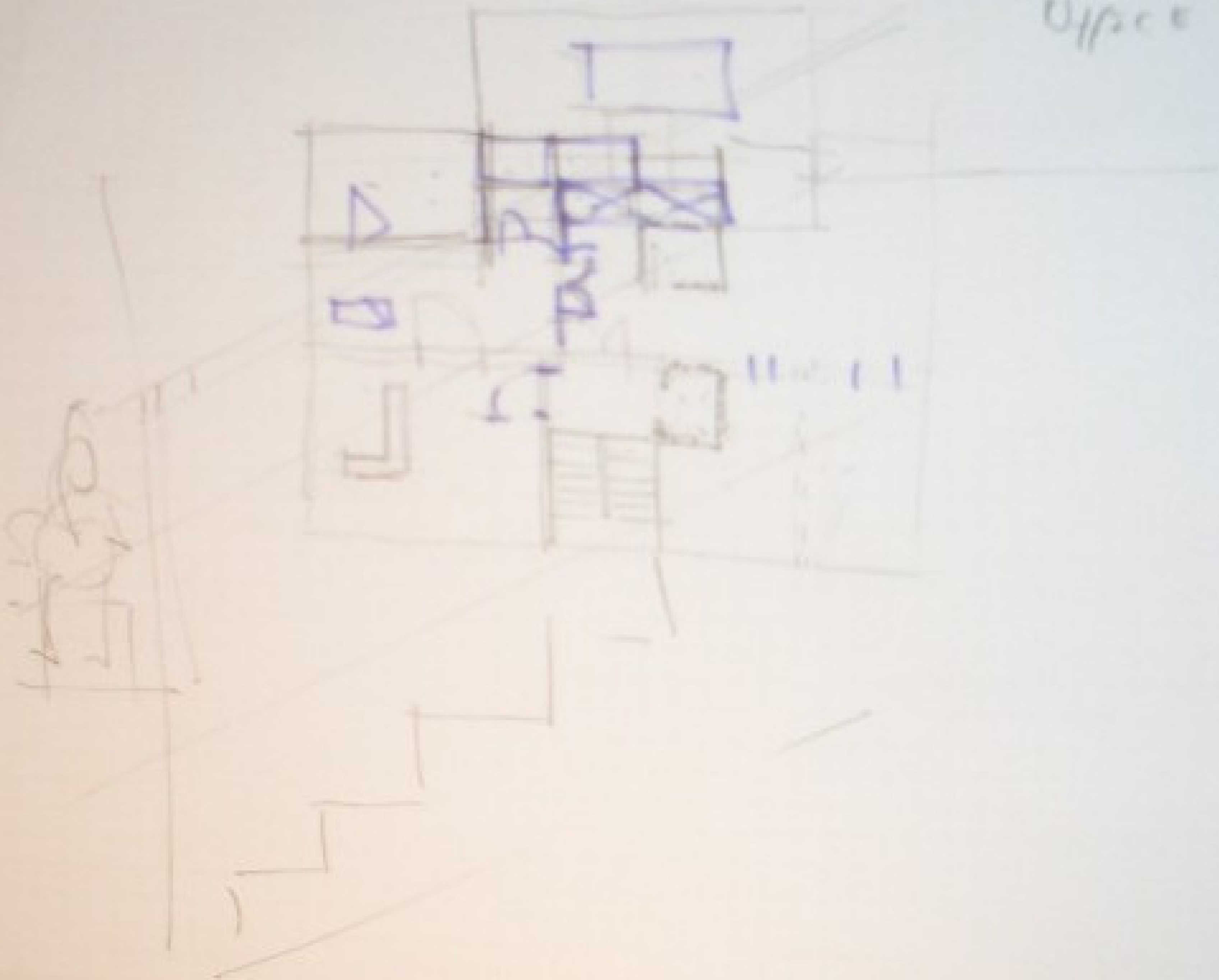
	Advantages	Disadvantages
(1)	No Slab Hole / No Corridor	Long Corridor / New Slab Hole / Cut Bearing Walls / Cut Joists and Beams
(2)	Idem (5)	
(3)	Idem (4)	
(4)	No Slab Hole / No Corridor	Decrease Stair Width
(6)	——	New Slab Hole / Long Corridor / Cut Joists and Beams
(7)		

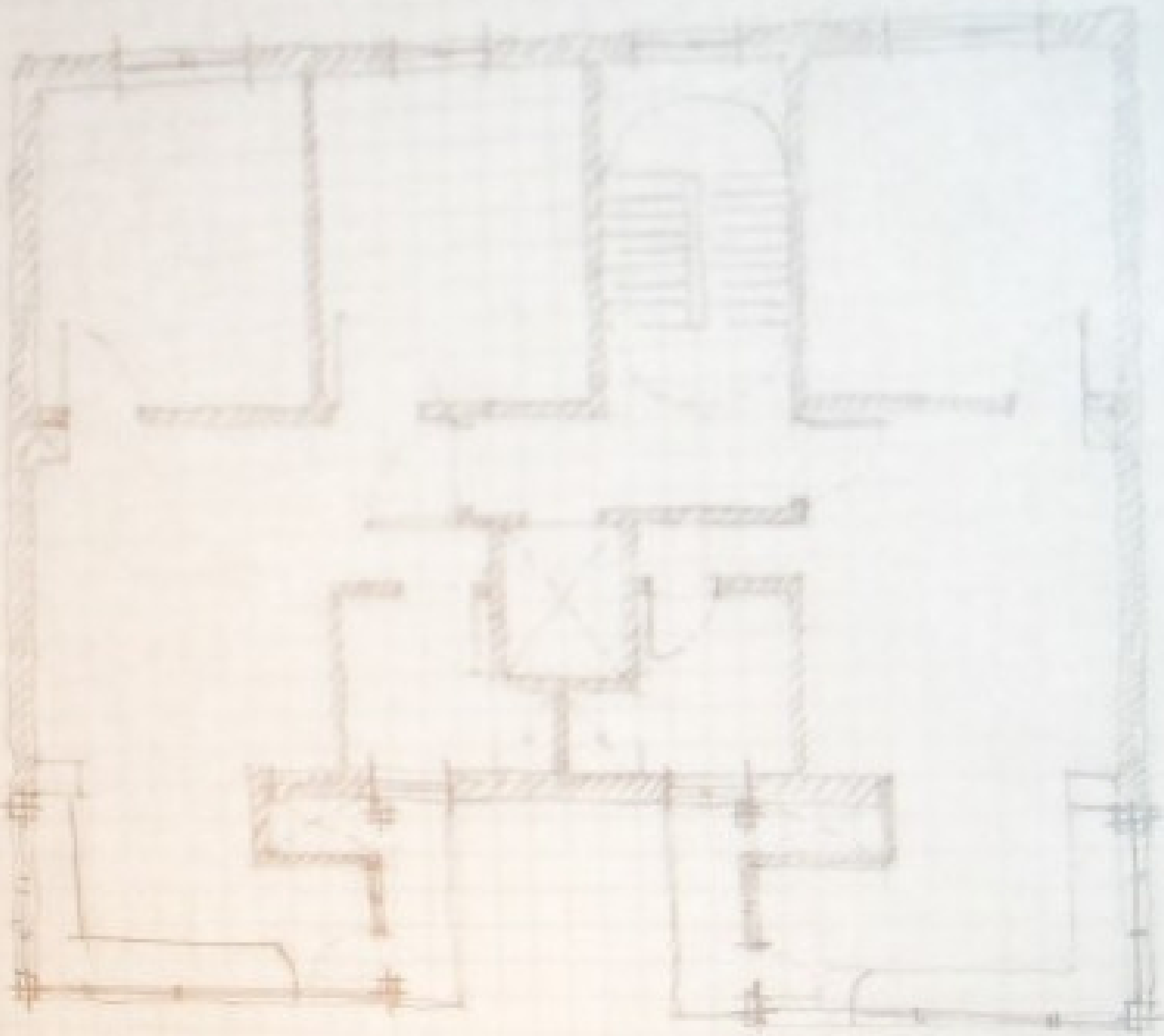
* Special Elevator w/ Motor Machine

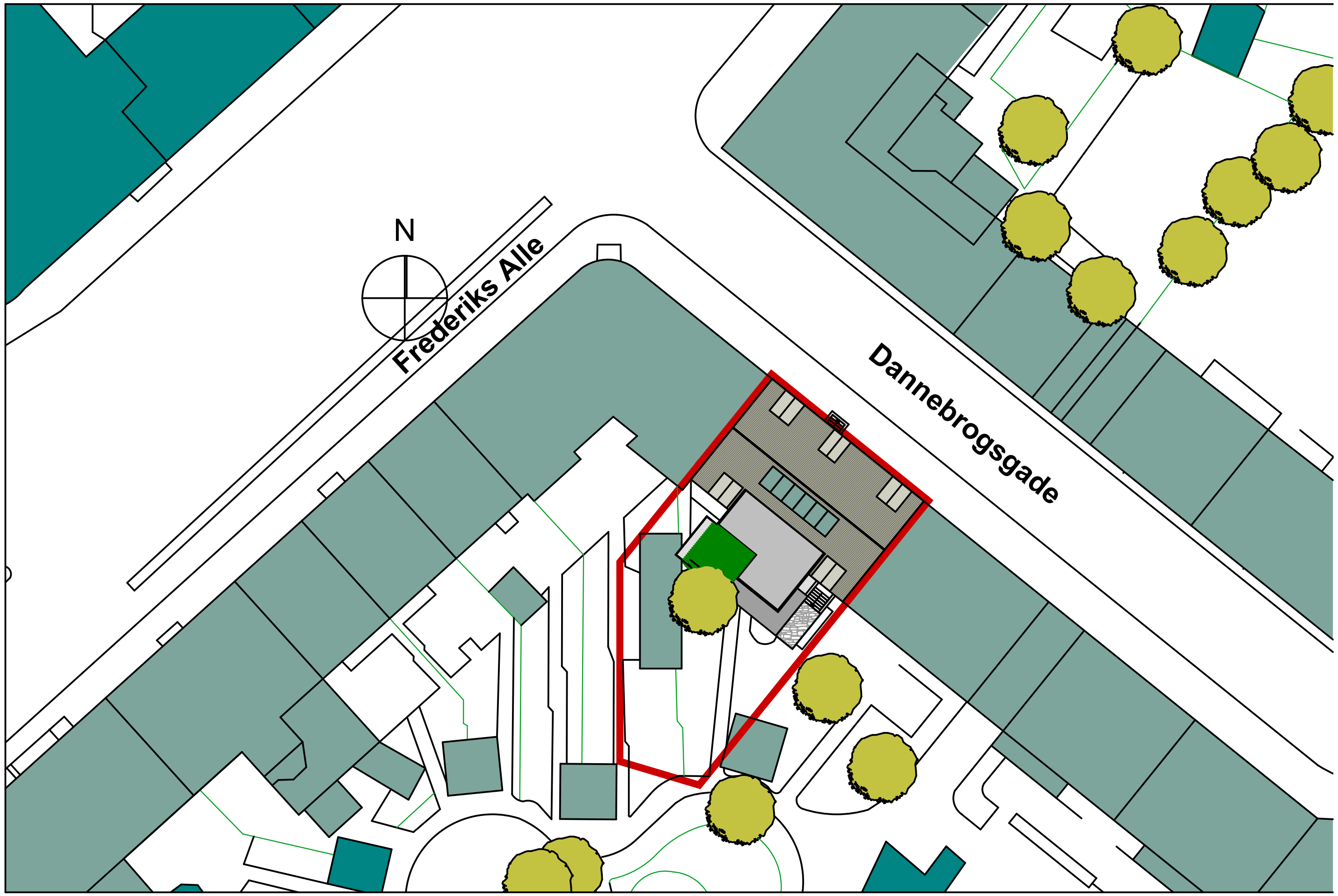


Ground Floor

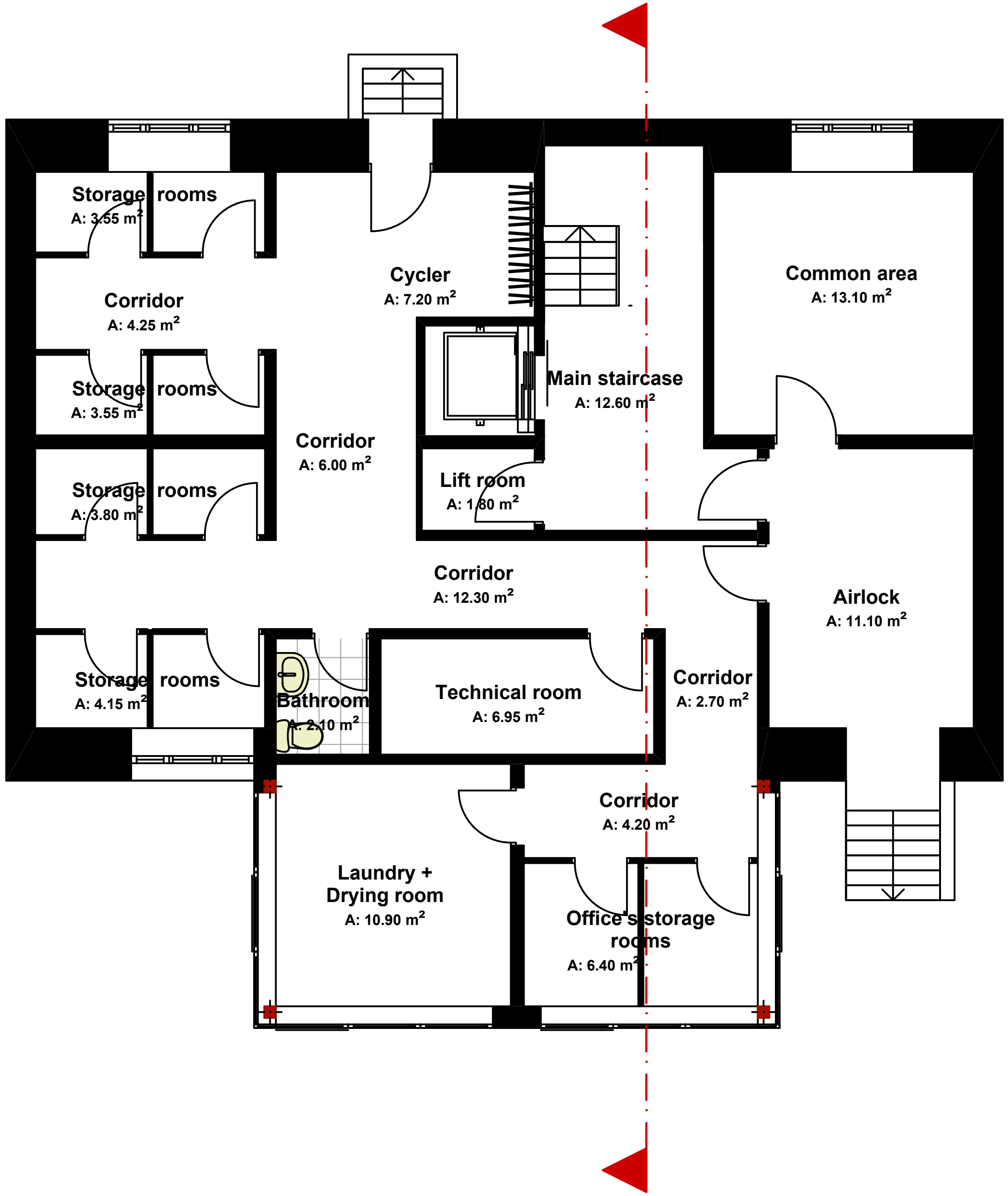
Office Proposal



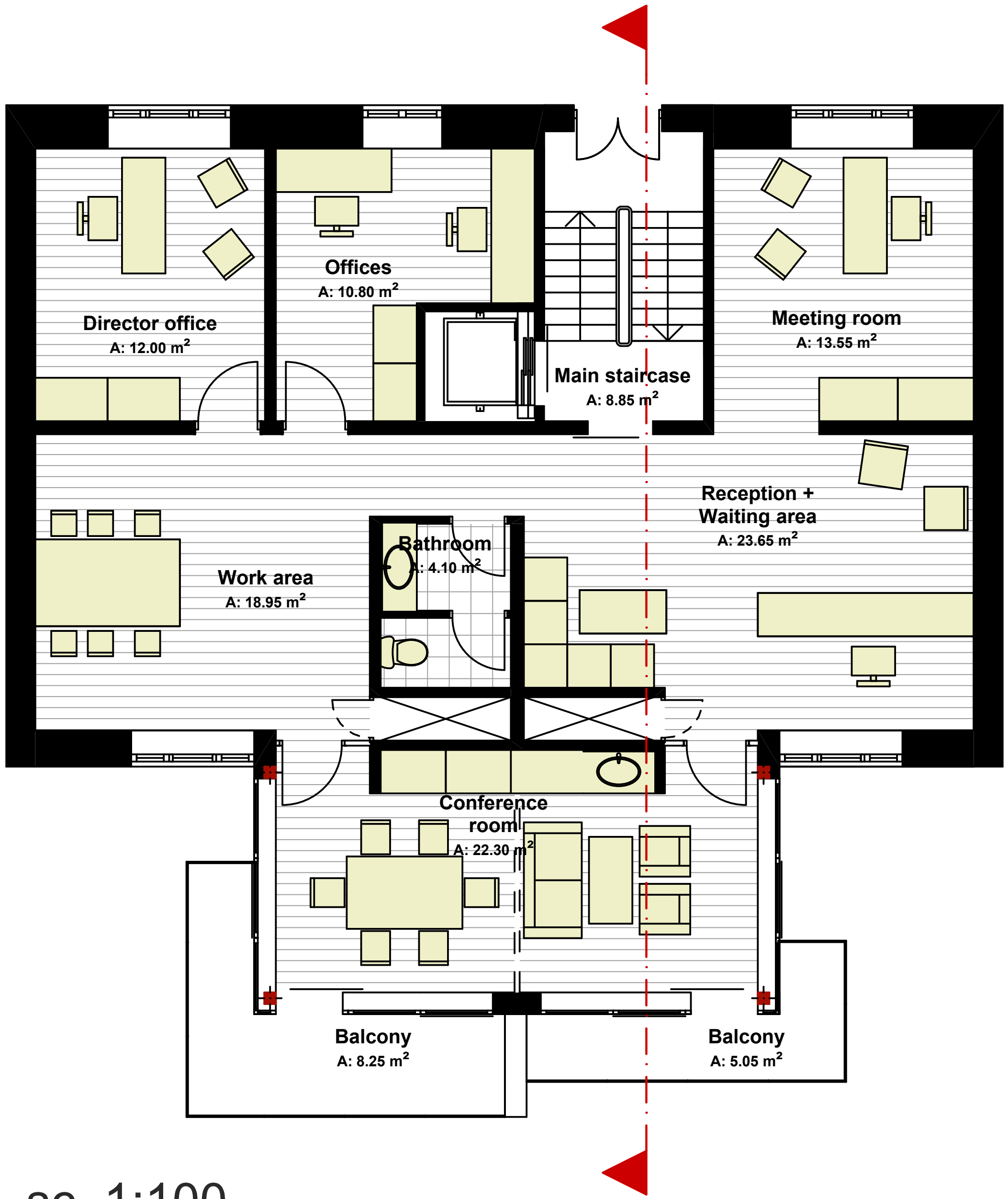




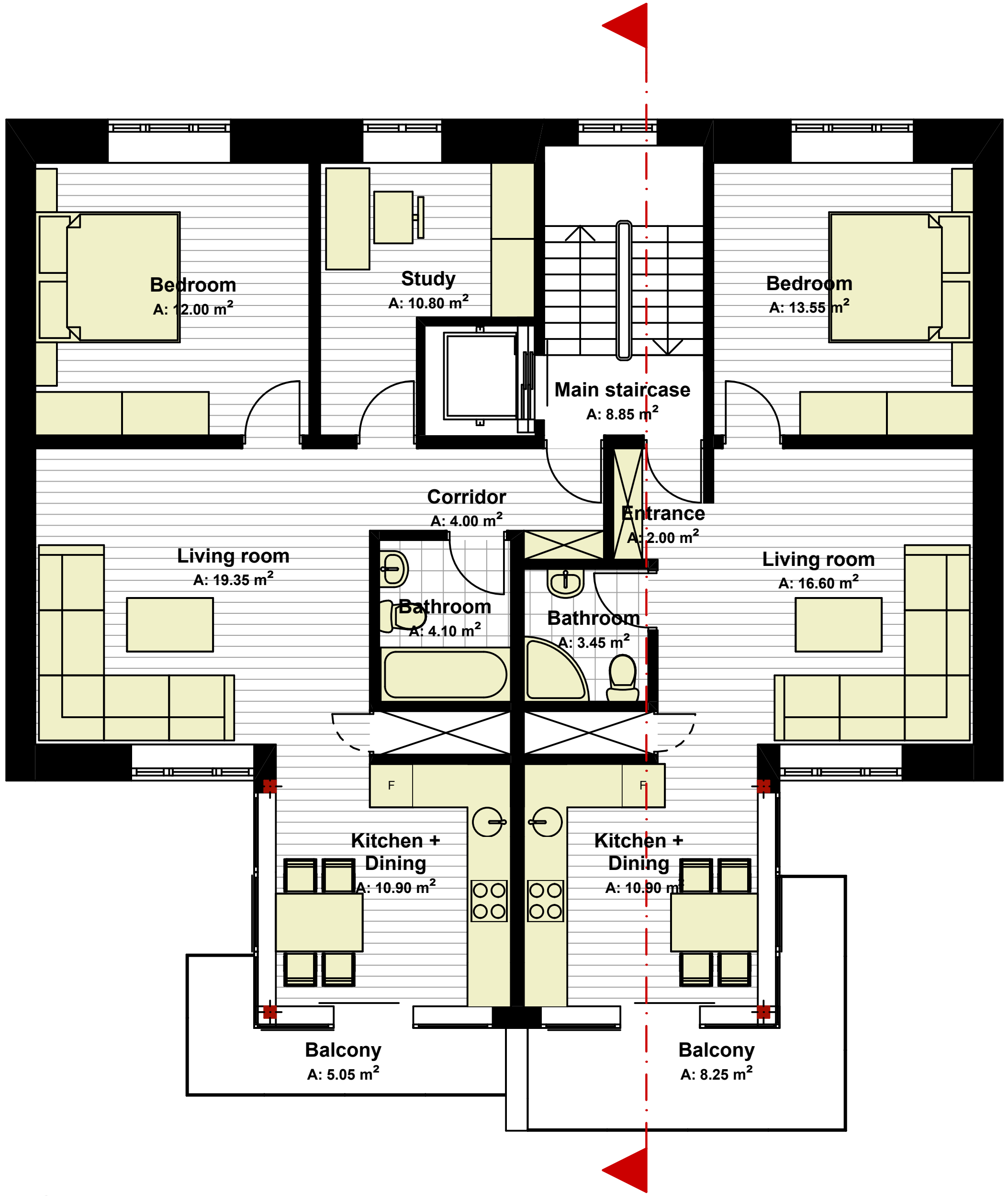
Location plan, sc. 1:500



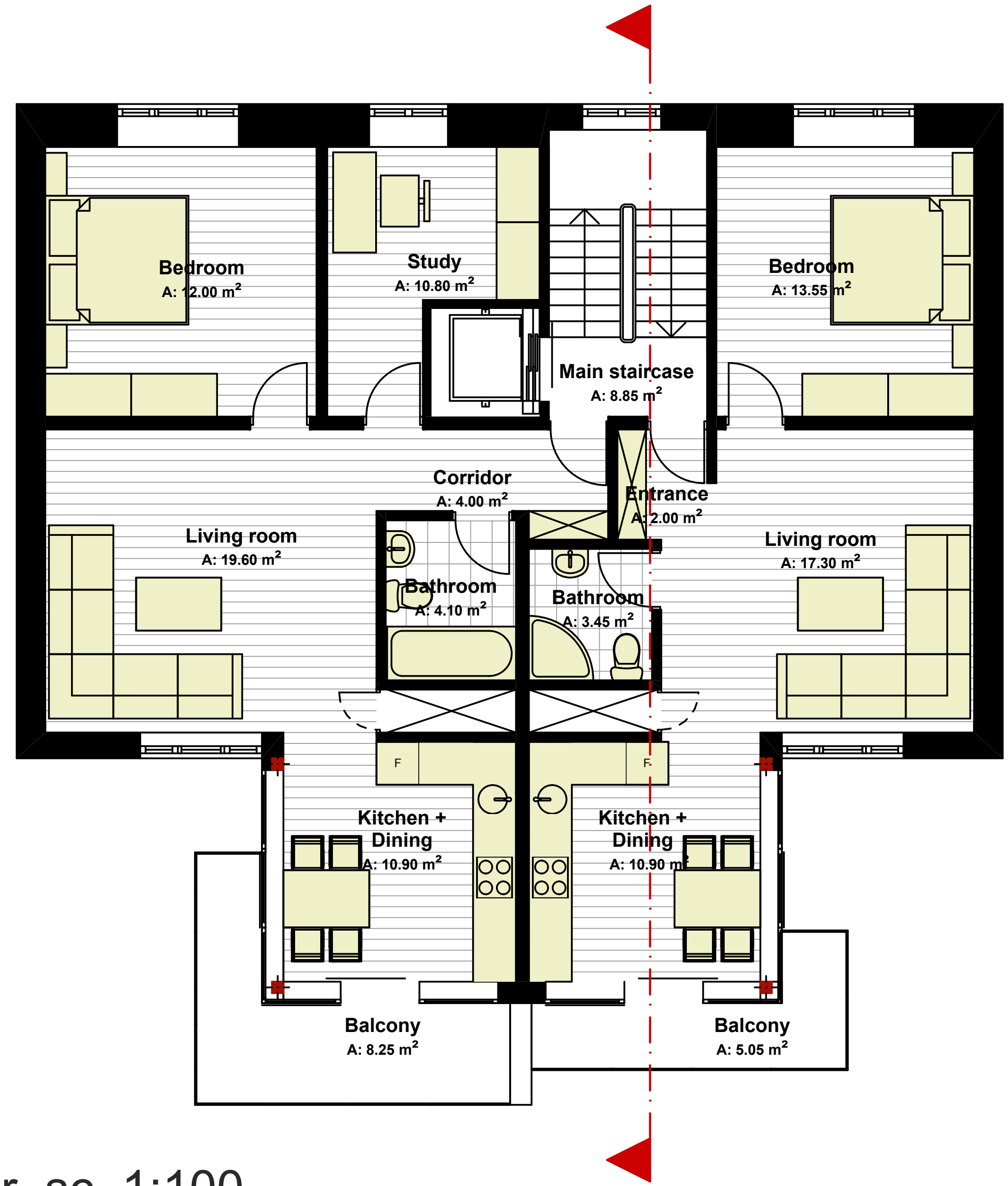
Plan of basement, sc. 1:100



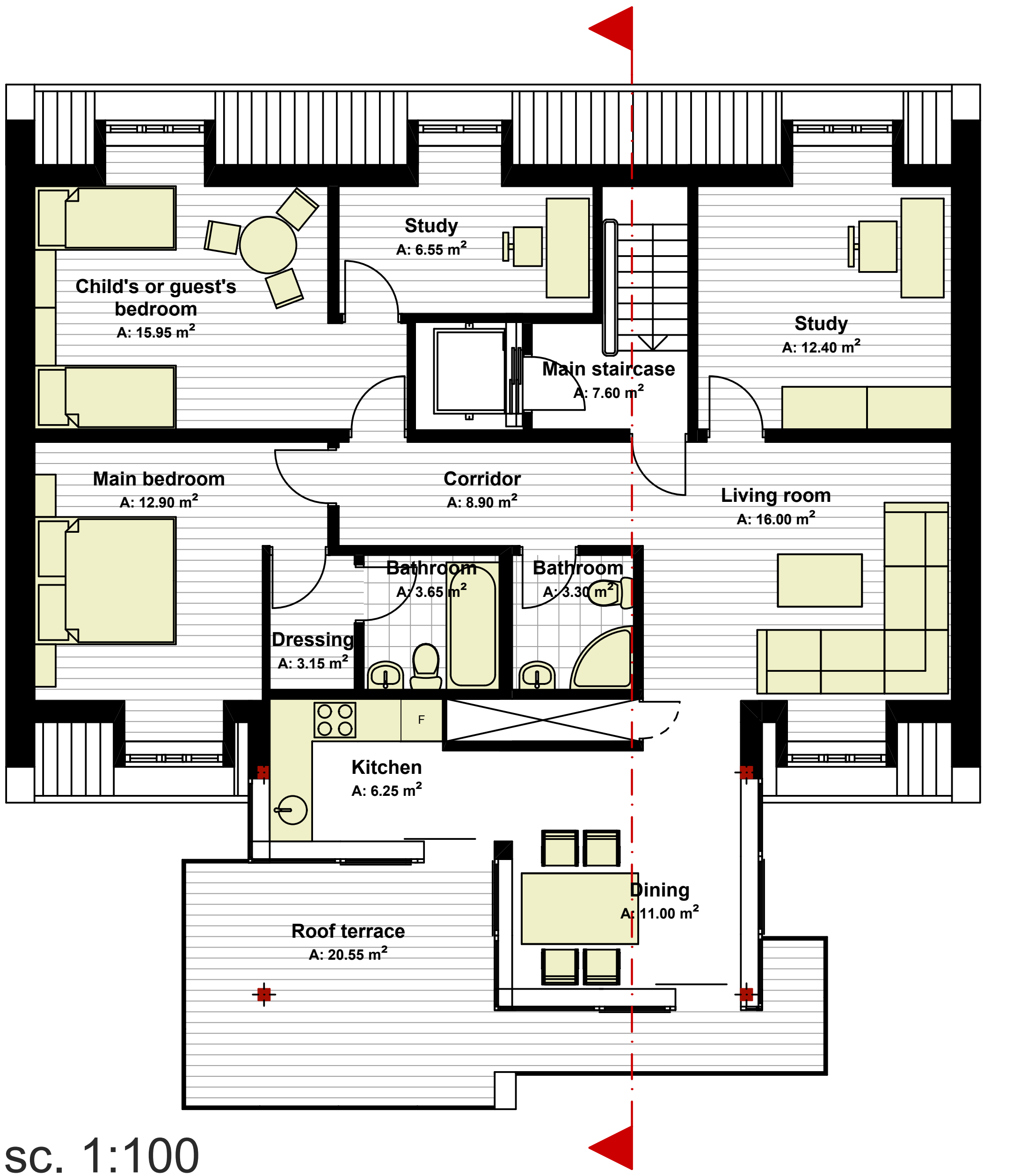
Plan of ground floor, sc. 1:100



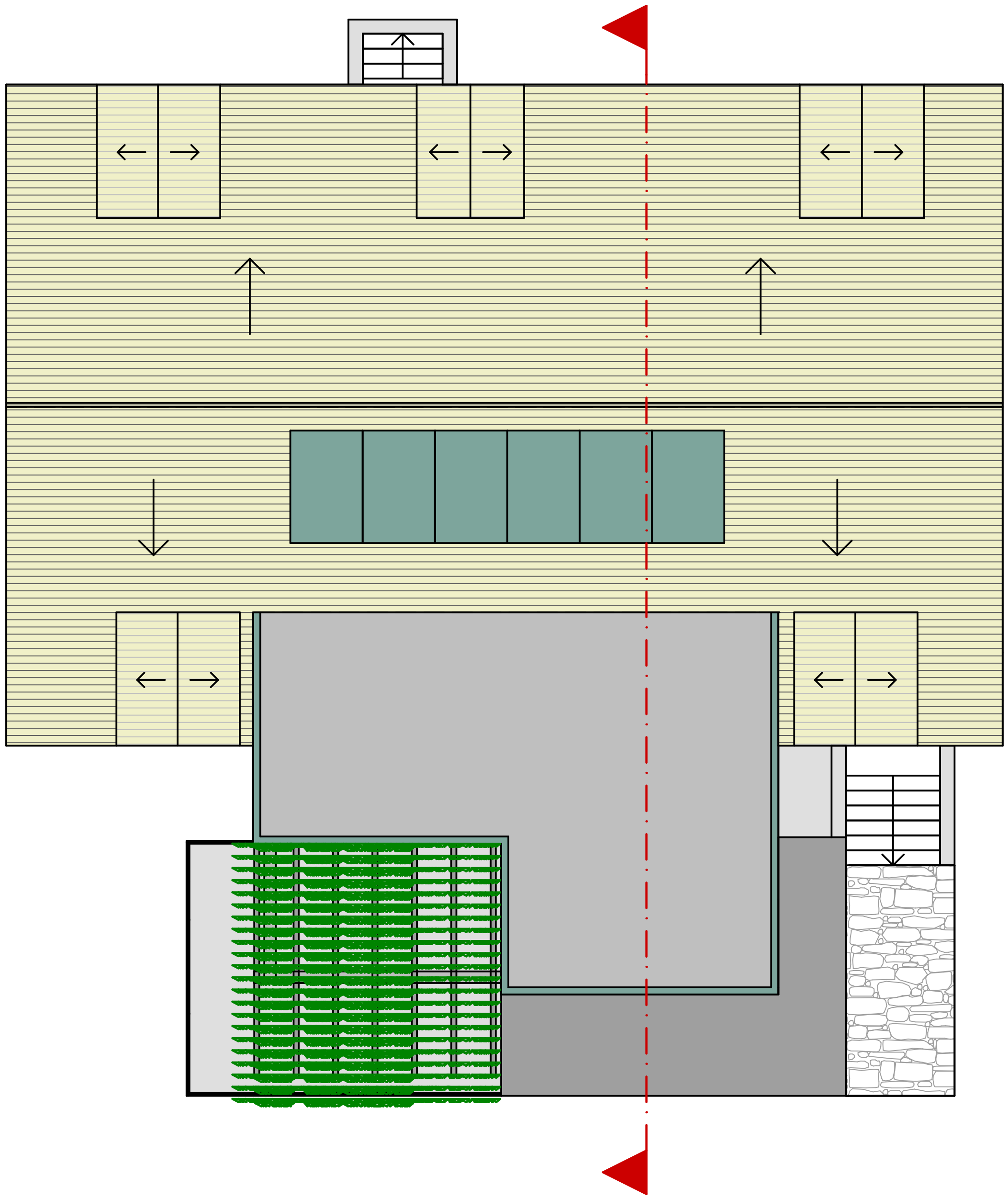
Plan of first and third floors, sc. 1:100



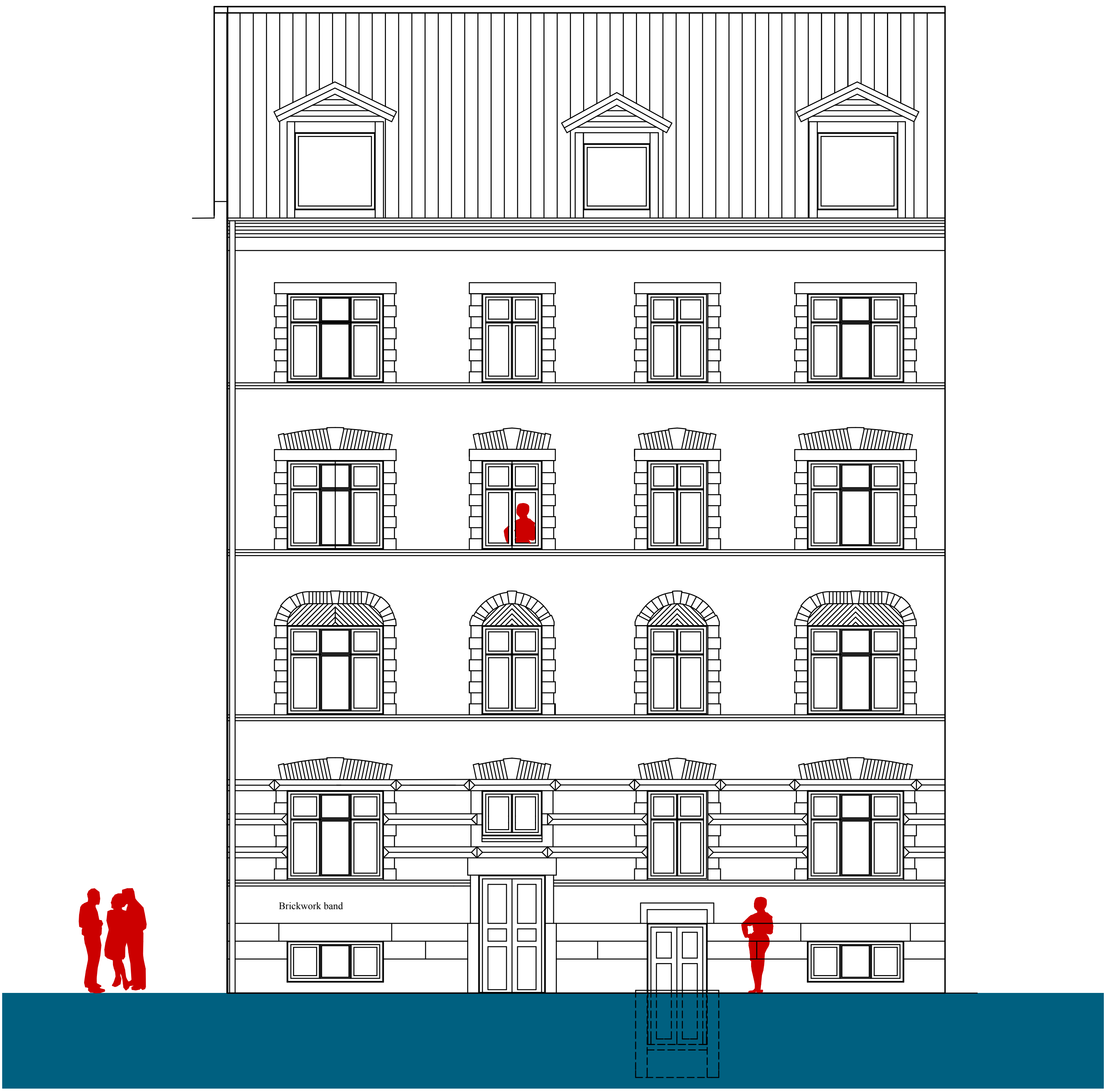
Plan of second floor, sc. 1:100



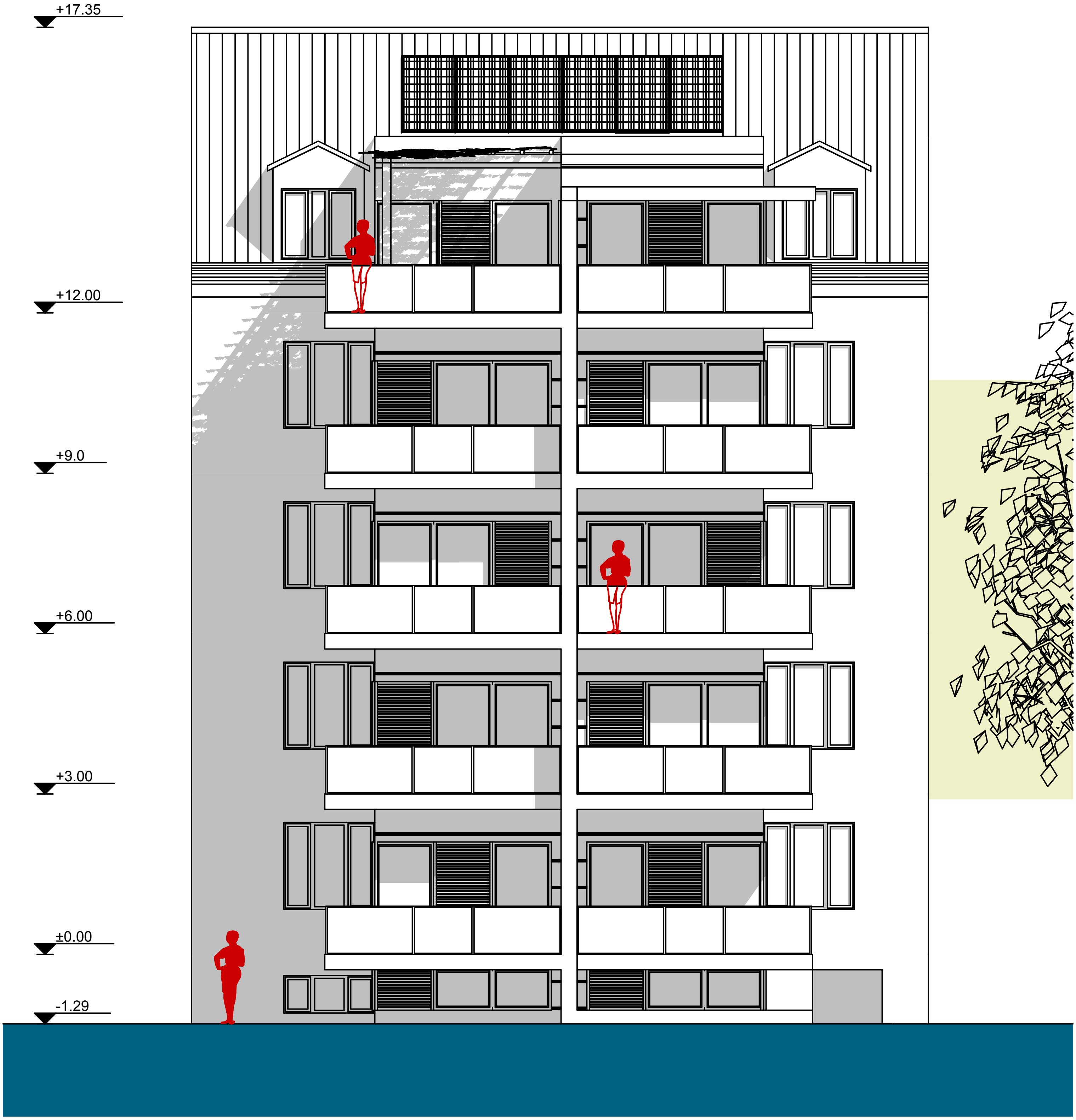
Plan of roof storey, sc. 1:100



Top view, sc. 1:100

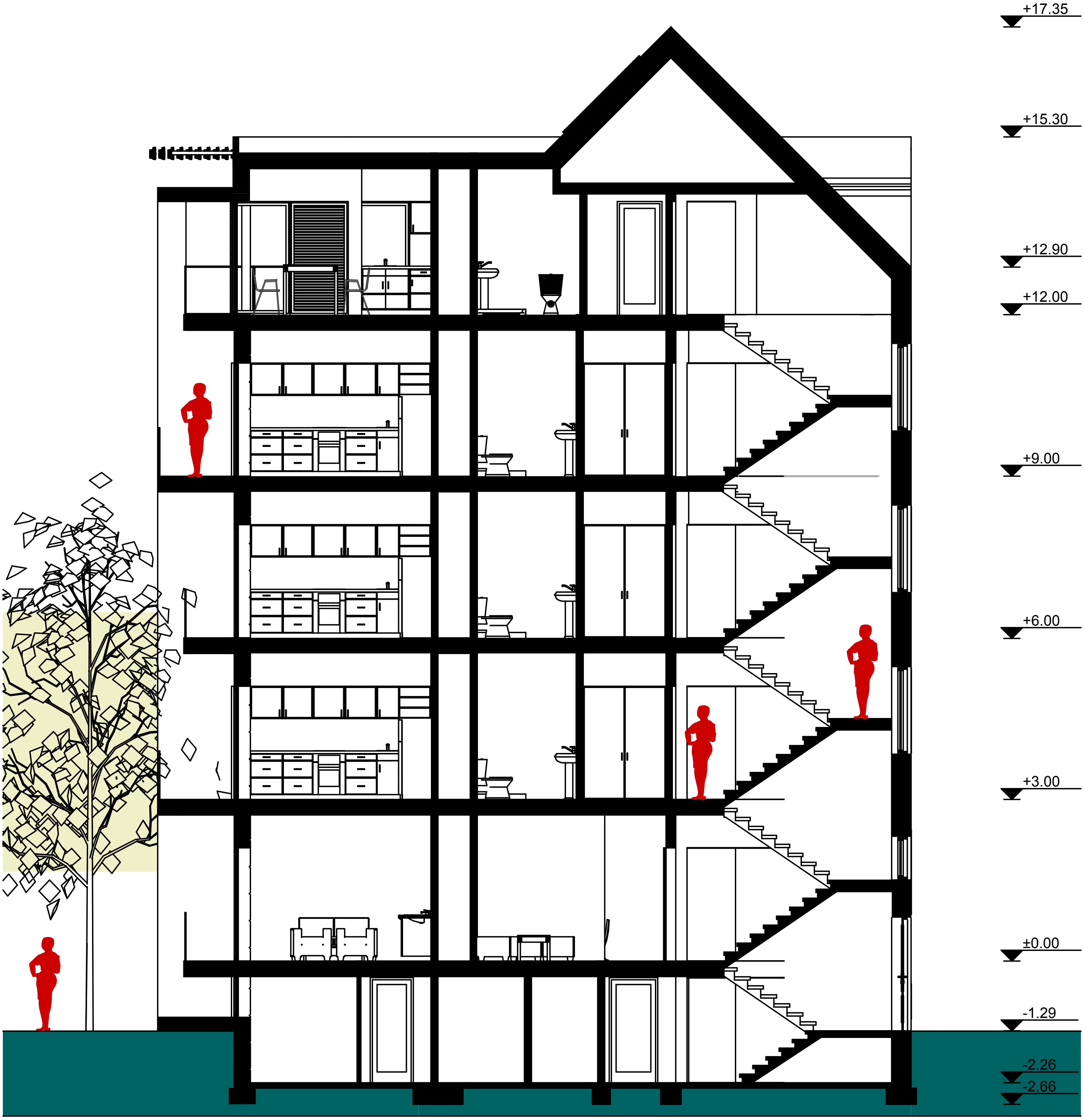


Street façade, sc. 1:100



Courtyard façade, sc. 1:100

Lateral view of the courtyard façade, sc. 1:100



Section, sc. 1:100

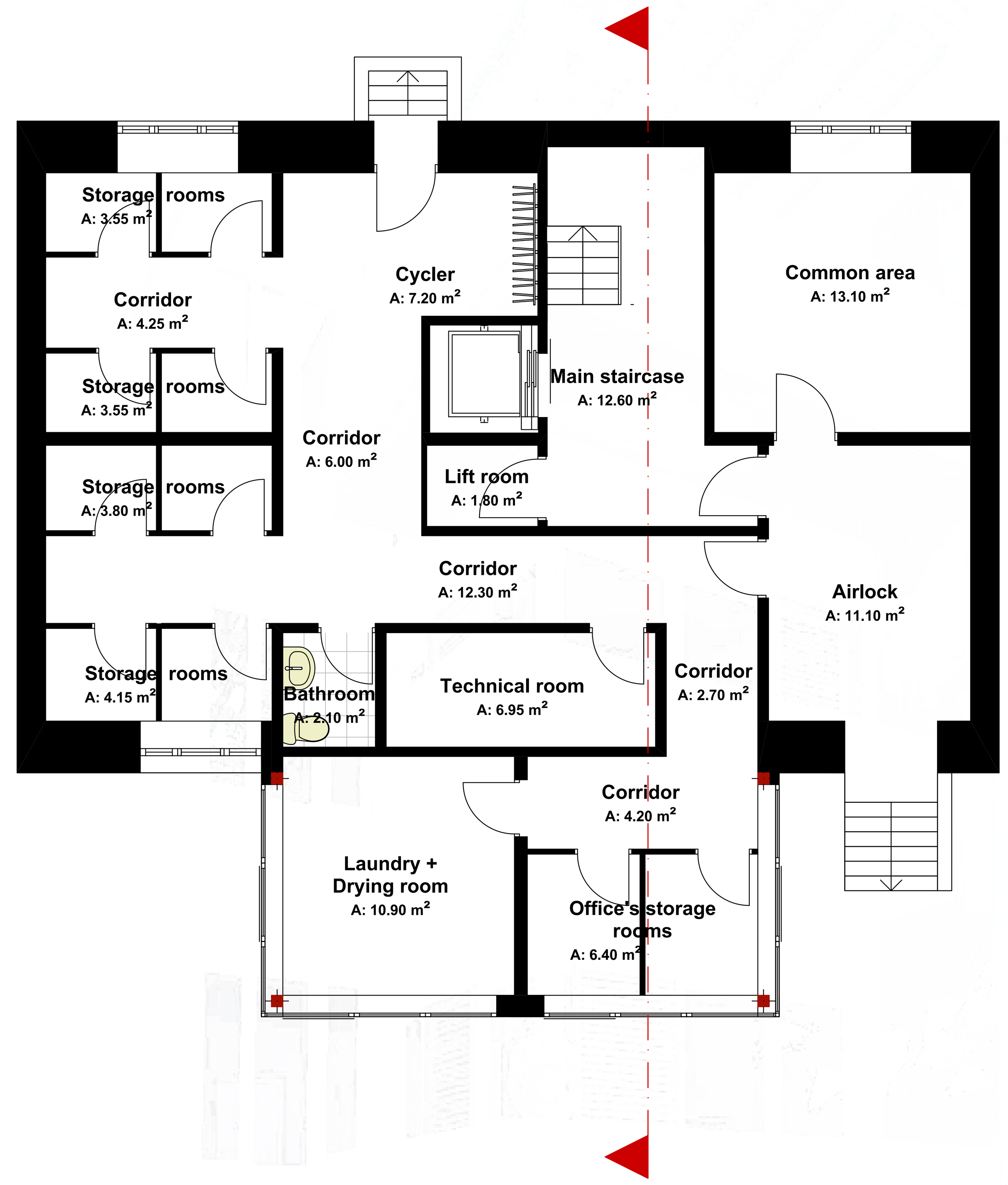
Urban Renewal Project - Dannebrogsgade 4, Aarhus

Concept - a mixed reality of old and new

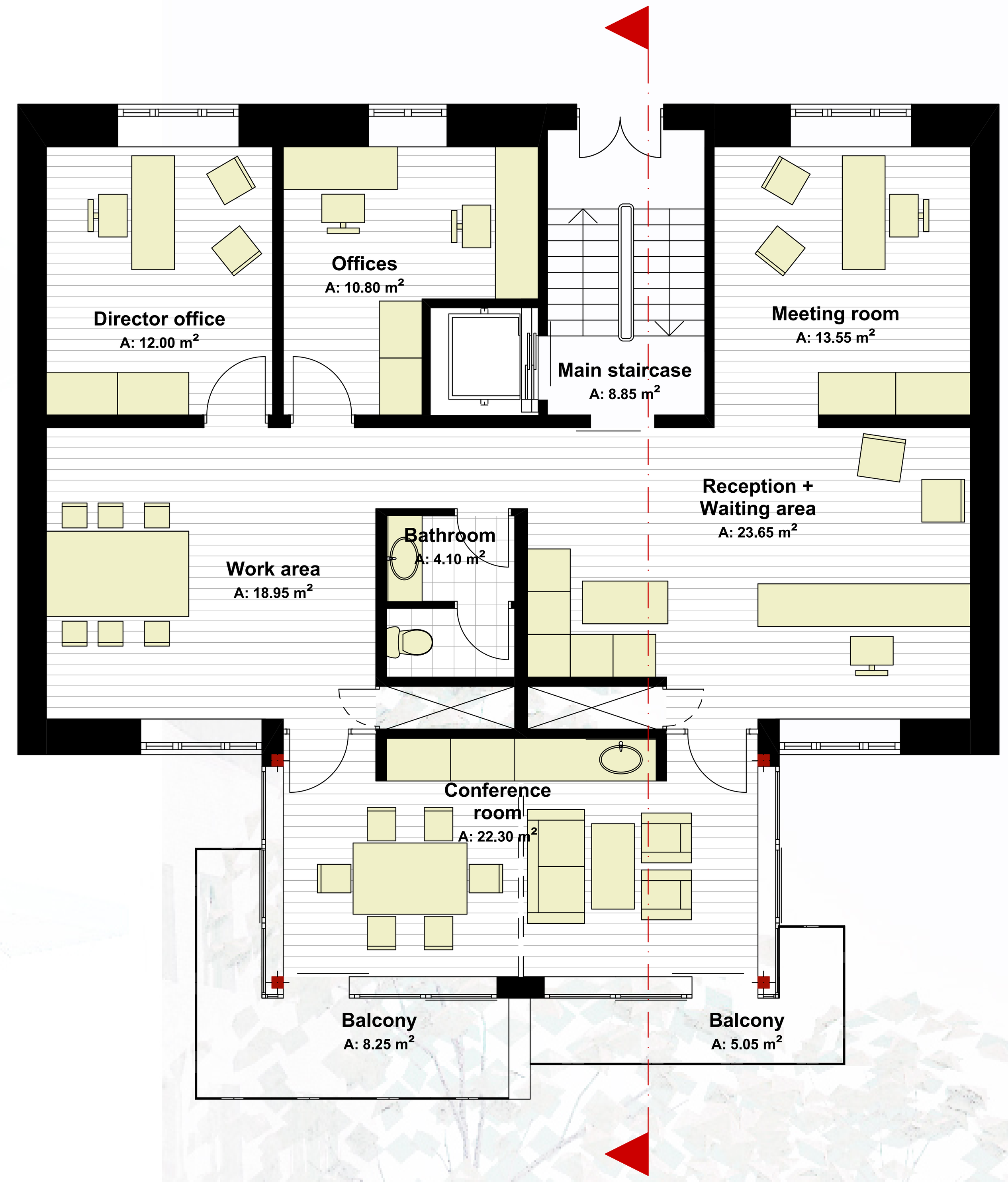
The idea was to integrate the new extension in the existing context by combining the old brickwork with the new materials: aluminum cladding on the façade, metal frames and wood shutters for windows. Transparency of the glass emphasizes the visual connection between the interior and the exterior, opening the space within and expanding the view.

A narrow strip was designed to sustain the visual continuity of the building, as a whole. The band is used as an enclosure of the extension, treated as a wall, ceiling and floor for the proposed balconies, emphasizing the verticality of the building. Attached to the façade plan, it integrates the concept of sustainability, by providing shading in the warm seasons.

Interior features such as the ceiling system are line up with the building's façade for a united visual effect from interior to exterior. Material colors are dense at the extension's walls and graduate from darker to lighter colors. The result is a building that resonates with transparency and elegant simplicity inside and out.

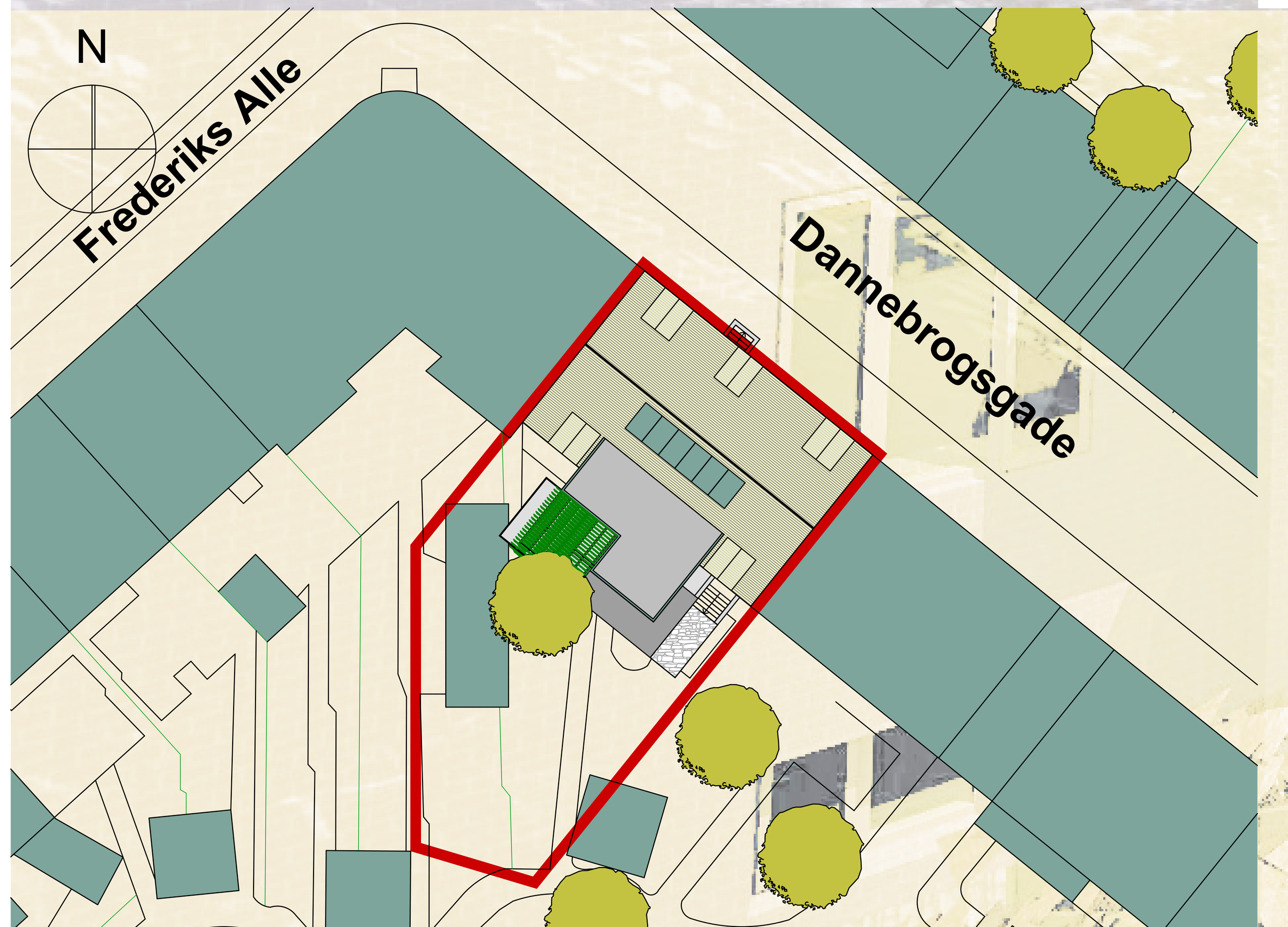


Plan of Basement, sc. 1:50



Plan of Ground Floor, sc. 1:50

In the ground floor there will be offices for a small Design company. The idea is to emphasize the interaction and flexibility through features such as: a transparent, open workspace, a layout that encourages circulation and a meeting space for collaborative work. The location of the conference room creates an unobstructed perimeter that allows all occupants to enjoy abundant daylight. Glass fronts to offices further the experience of connectivity and accessibility throughout the interior space. The automated lighting, dimming, and shading systems maximize daylight while managing glare and solar heat gain.



Location Plan, sc. 1:200

Section, sc. 1:100

Lateral view of courtyard façade, sc. 1:100

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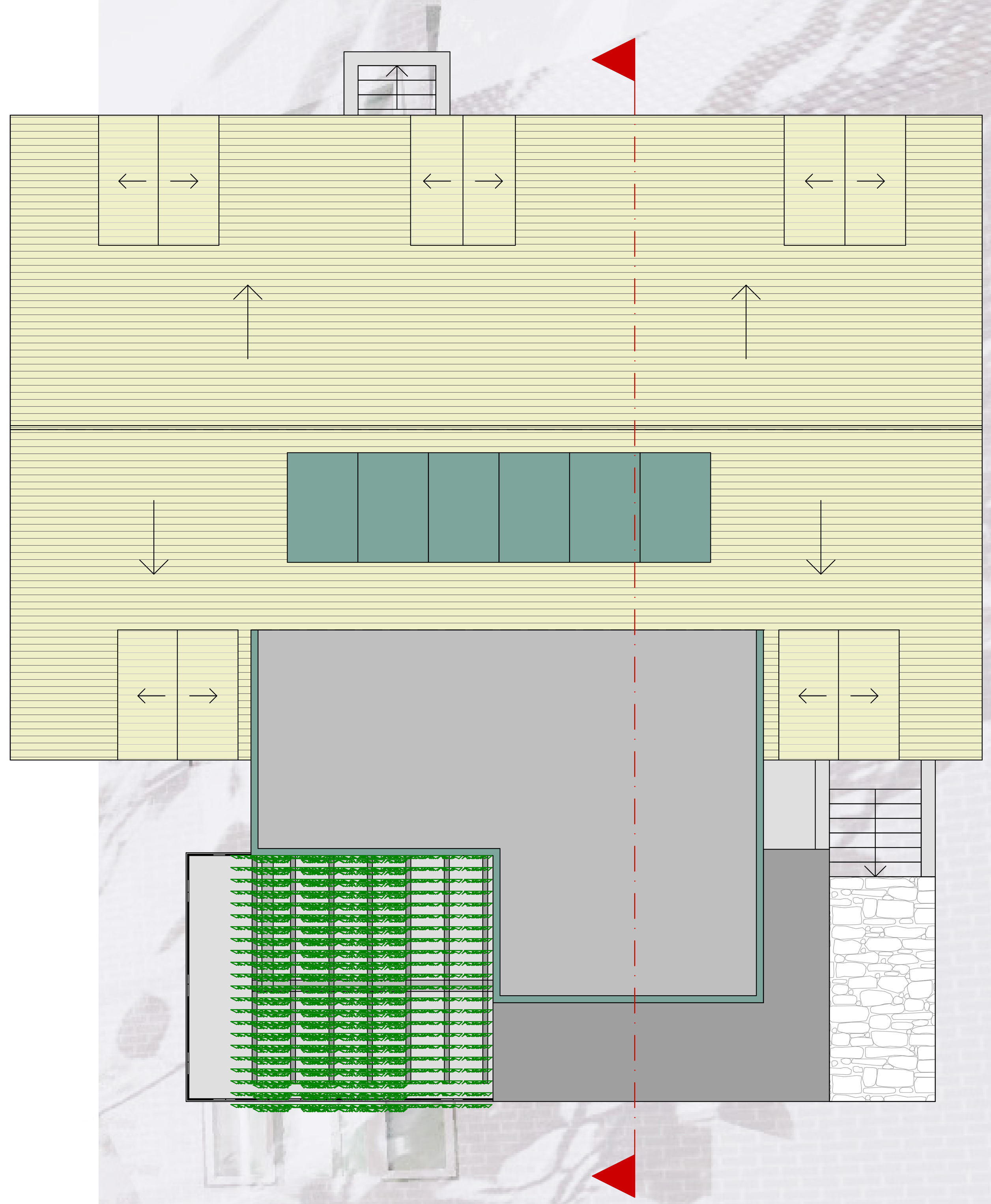
Urban Renewal Project - Dannebrogsgade 4, Aarhus

Plan of 1st and 3rd Floors, sc. 1:50

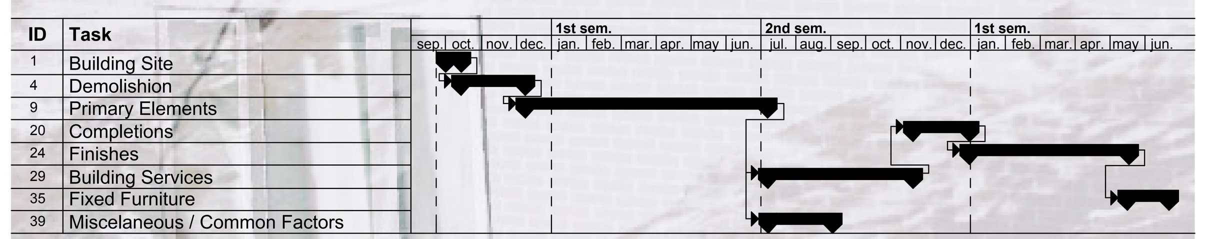
Plan of Penthouse, sc. 1:50



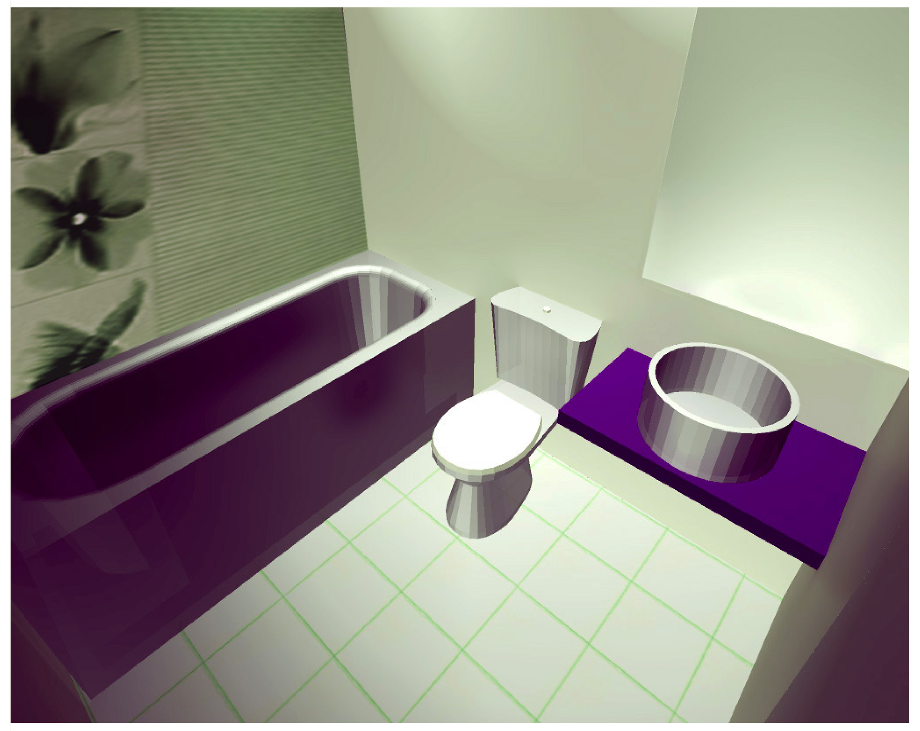
Top View, sc. 1:50

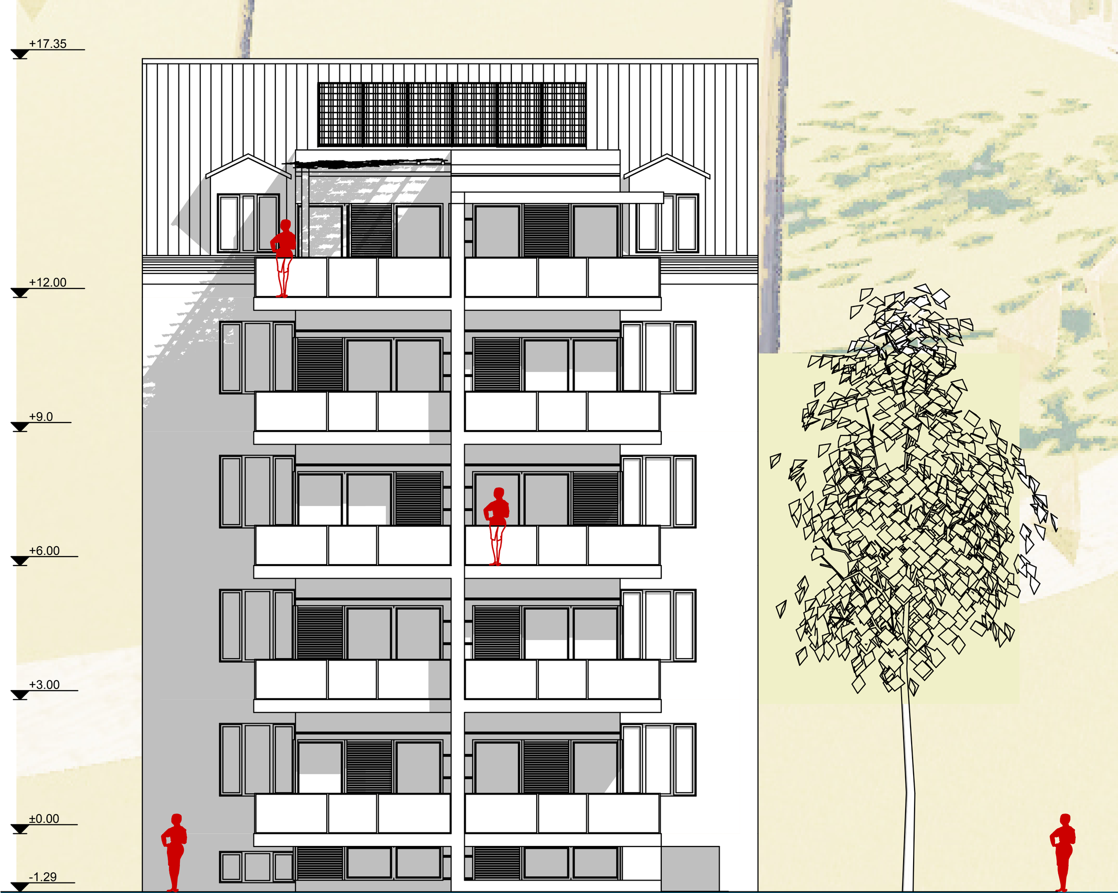
The concept of opened space has been taken further to the flats, by connecting the living room with dining and kitchen, and leaving privacy only for the bedrooms. Placing the living room towards the courtyard creates an illuminated indoor climate.

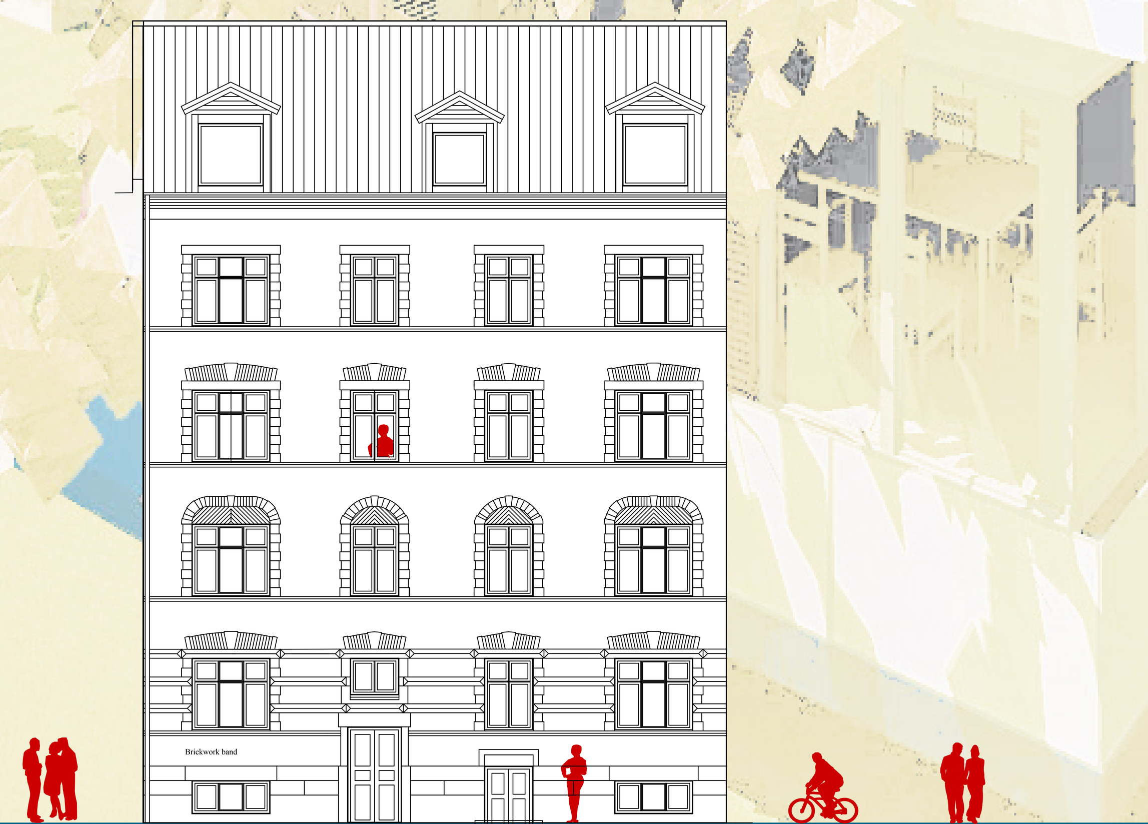
At the roof storey, the existing flats have been converted into a penthouse, an apartment designed to give to a family the necessary space for common areas - living, dining, kitchen, and the private ones - bedroom and study rooms. It's provided with a roof terrace that captures expansive views, protected for sun by its horizontal garden elements placed on the top, as an overhang.

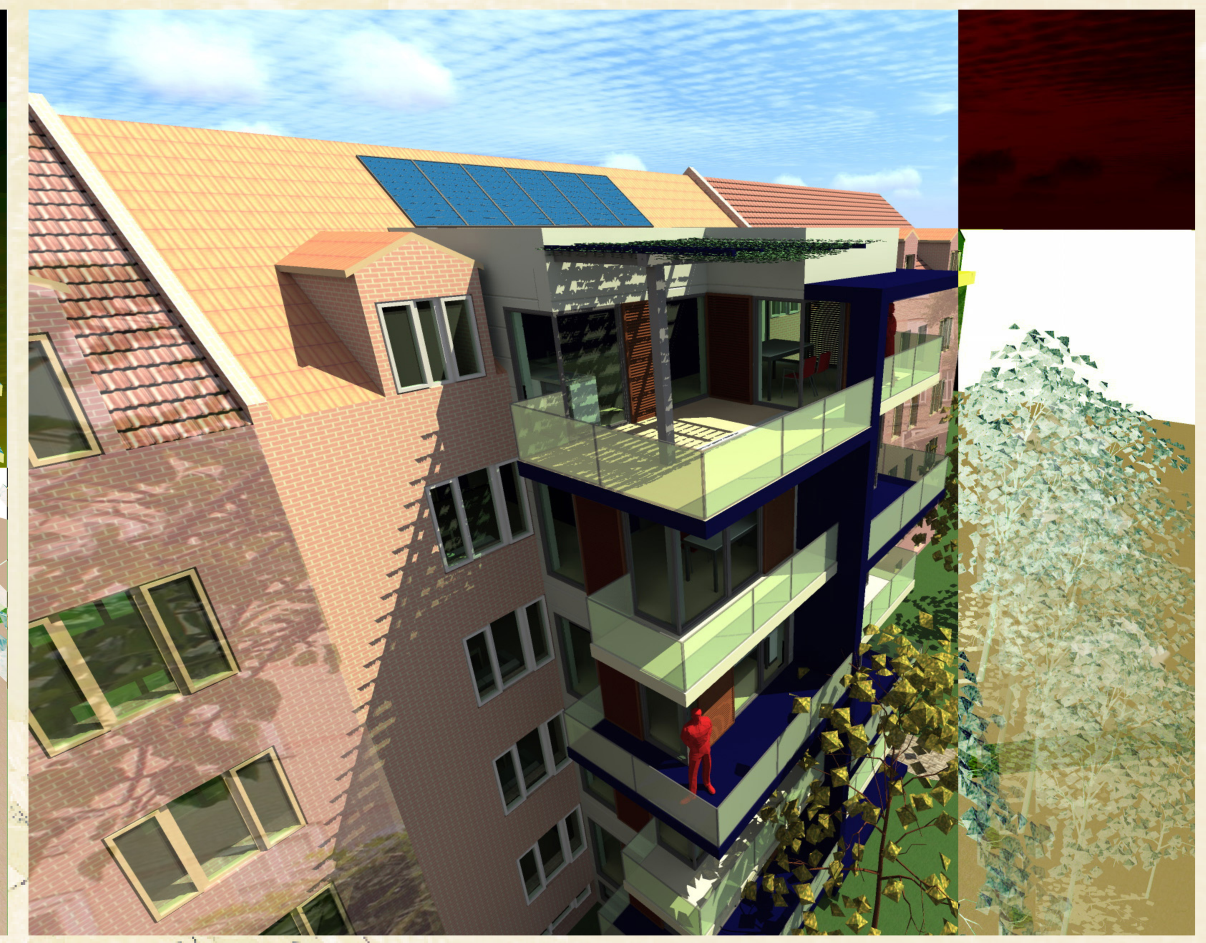


Construction Time Planning









Courtyard façade, sc. 1:100

Street façade, sc. 1:100

Hiren Anantray Bhatt • Valentina Adriana Buz • Arnaldo Taborga Landivar • Frederik Kromann Laursen • Group 01 • BK52E

Concept – a mixed reality of old and new.

The idea was to integrate the new extension in the existing context by combining the old brickwork with the new materials: aluminum cladding on the façade, metal frames and wood shutters for windows. Transparency of the glass emphasizes the visual connection between the interior and the exterior, opening the space within and expanding the view.

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Interior features such as the ceiling system are line up with the building's façade for a united visual effect from interior to exterior. Material colors are dense at the extension’s walls and graduate from darker to lighter colors. The result is a building that resonates with transparency and elegant simplicity inside and out.

The building has been modernized with an elevator that serves all floors.

Ground Floor – Design Office

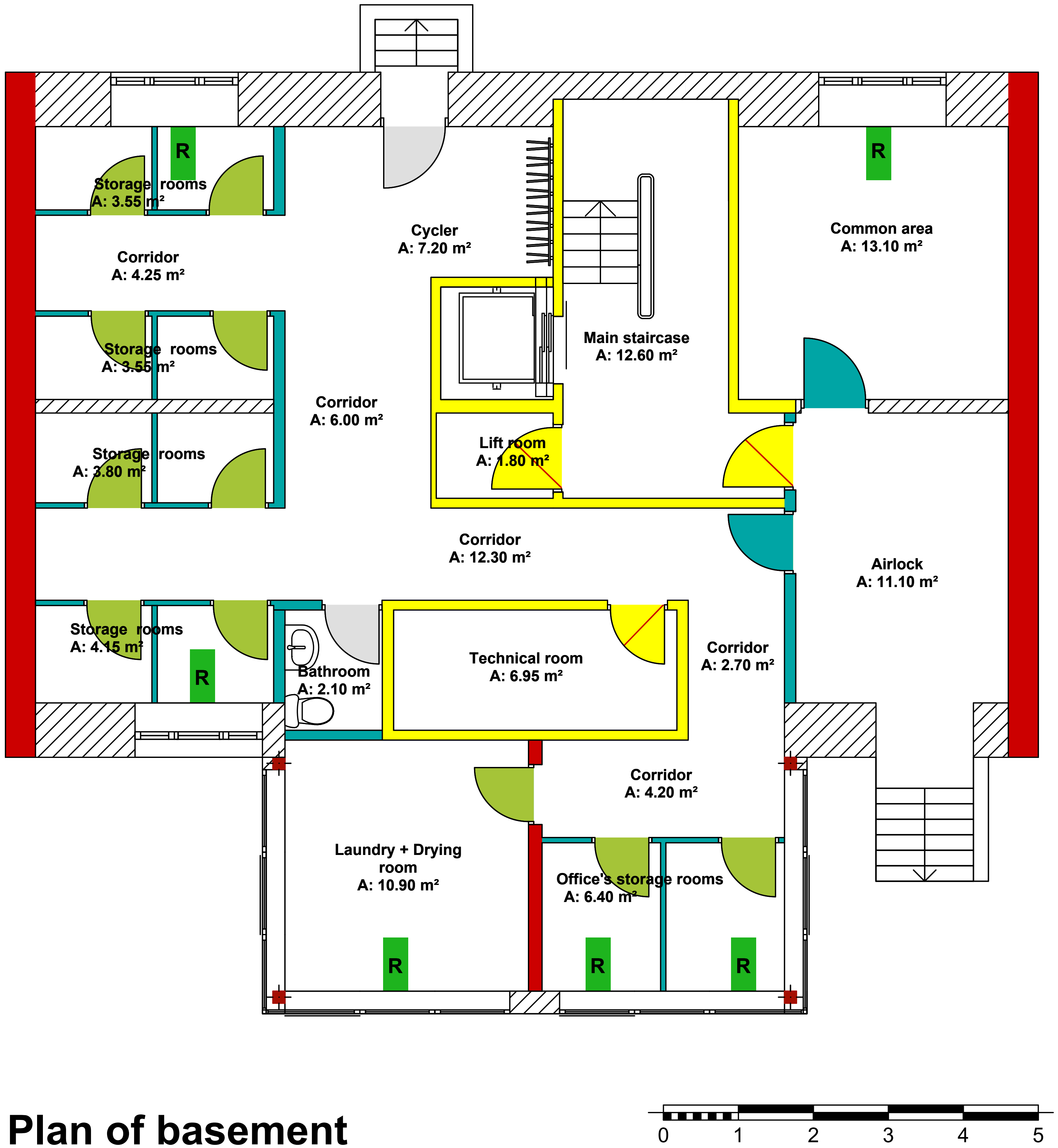
In the ground floor there will be offices for a small Design company. The idea is to emphasize the interaction and flexibility through features such as: a transparent, open workspace, a layout that encourages circulation and a meeting space for collaborative work. The location of the conference room creates an unobstructed perimeter that allows all occupants to enjoy abundant daylight. Glass fronts to offices further the experience of connectivity and accessibility throughout the interior space. The automated lighting, dimming, and shading systems maximize daylight while managing glare and solar heat gain.

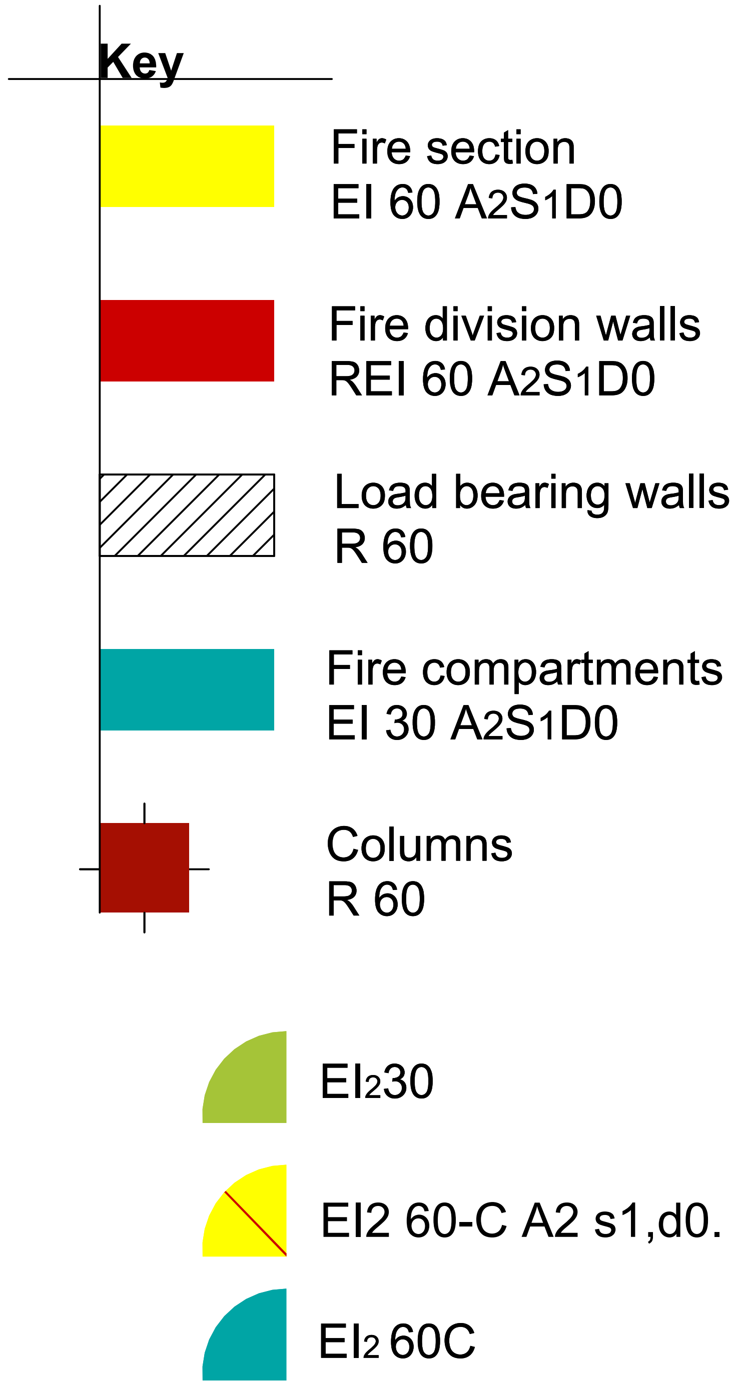
First, Second and Third Floors

The concept of opened space has been taken further to the flats, by connecting the living room with dining and kitchen, and leaving privacy only for the bedrooms. Placing the living room towards the courtyard creates an illuminated indoor climate, needed more than the privacy of the bedrooms.

At the roof storey, the existing flats have been converted into a penthouse, an apartment designed to give to a family the necessary space for common areas – living, dining, kitchen, and the private ones – bedroom and study rooms. It’s provided with a roof terrace that captures expansive views, protected for sun by its horizontal garden elements placed on the top, as an overhang.

Fire Analysis

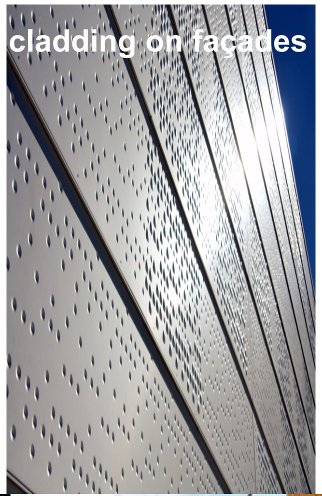




Plan of basement

Materials

stainless steel for structure



aluminum cladding on facades

metal frame for windows

Resistance

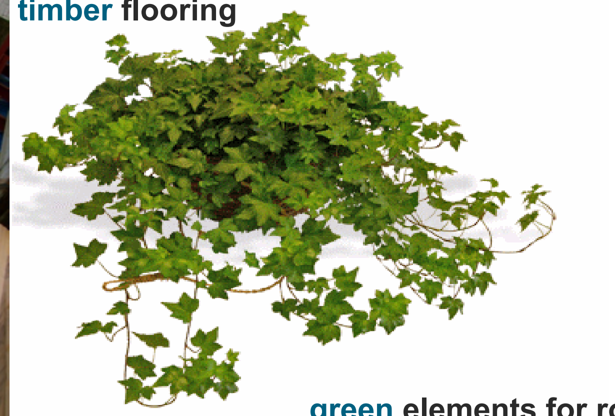
load
strenght
durability
low maintainance

Organic

appealing
eco-friendlly

mahogany wood for windows shutters

timber flooring



green elements for roof terrace

Vision

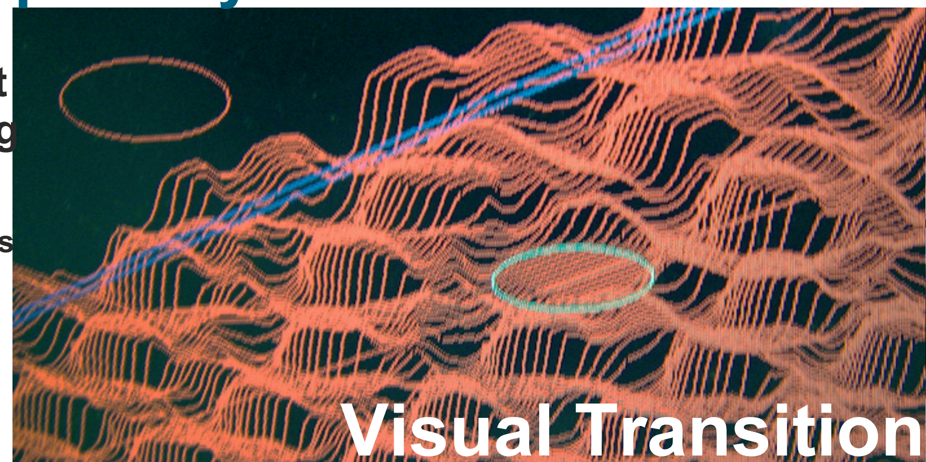
mirrored glass for balconies railings

transparent glass for windows

treated glass in certain areas

Transparency

view
sunlight
blending



Visual Transition

similar ceiling light fittings (for offices)

coloured paint walls on inside

florescent light for flat's rooms

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Wellbeing Concept

Indoor air quality---

Good air quality, fundamental to health is provided by natural ventilation from windows and mechanical ventilation.

Good light ---

Sunlight spreads during daytime in large areas thanks to the expanding windows on the façades, while in the evening skillful lightning adds special atmosphere to the white space that vibrates in effects of reverberation and shading.

Controlling excessive light ---

External wooden shutters.
The distance between the fins may be varied to achieve the required shade angle or to allow more natural daylight into the apartment interior.

Control over comfort ---

Thermal comfort already provided by insulating the external walls and the storey partitions is increased by personal control on heating (thermostats valves mounted on radiators).

Required floor surfaces---

Used in the penthouse, the polished concrete floor fits with the spaces for which has been designed for - kitchen and dining. Gives a pleasant background.
Easy cleaning and maintainance.

Fluidity ---

The Office area is designed as a fluid, dynamic space, in which life is combined with work. Less furniture and light colors dilates the concept of wellbeing.

Flexibility ---

Folding walls in the conference room offer the possibility to modulate the interior. You can benefit of the entire space or split it into small consultation rooms.

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Existing Condition

The property was built in 1899 by Master Mason J. Jensen. The building is 4½ storeys and originally had 10 apartments, but today it has 9 apartments because the 2 on the top floor were amalgamated into one.

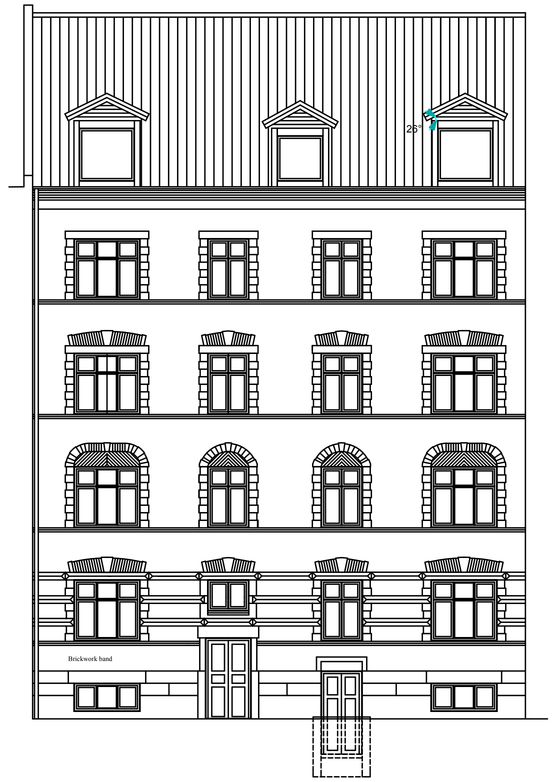
Façades

The street façade is made of red brickwork, generally in good condition. It appears deteriorated in the lower part of the façade - presence of cracks, moisture stains and scratched surfaces.
The plinth is a plastered painted surface, with cracks and small damaged areas in the plaster.
There are some hairline cracks in the plastered borders of the windows and cornices.

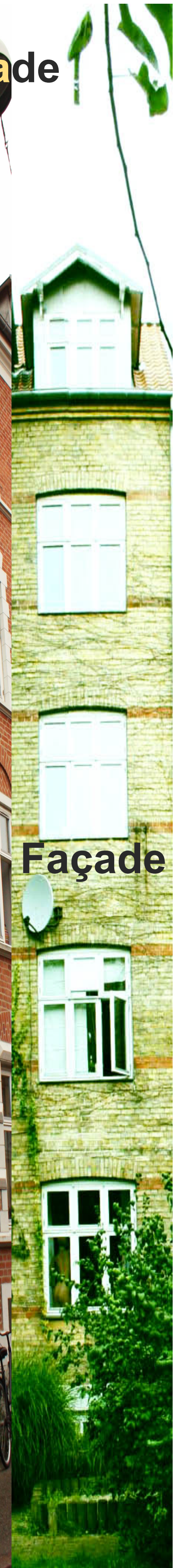
The courtyard façade comprises yellow brickwork with horizontal two course-high bands of red brick, over and under the windows.
The brickwork shows cracks, poor joints and moisture stains.
Whitewashed plinth, with small cracks and uneven surface.
Plants hanging up on the façade.
Parabolic antenna, telephone and antenna cables mounted.

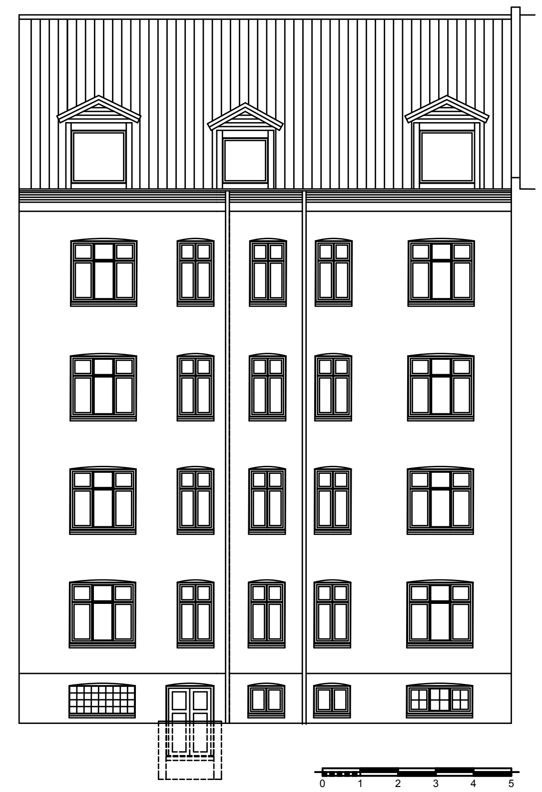
Existing materials

Street Façade



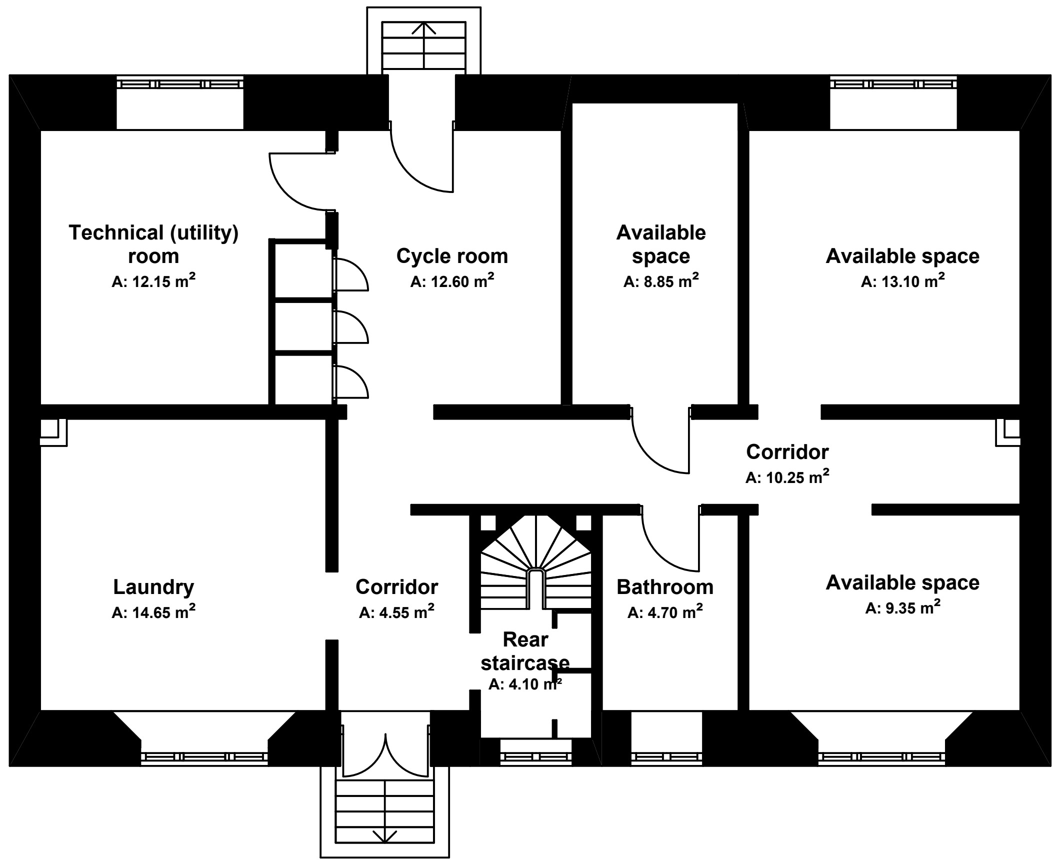
Courtyard Façade



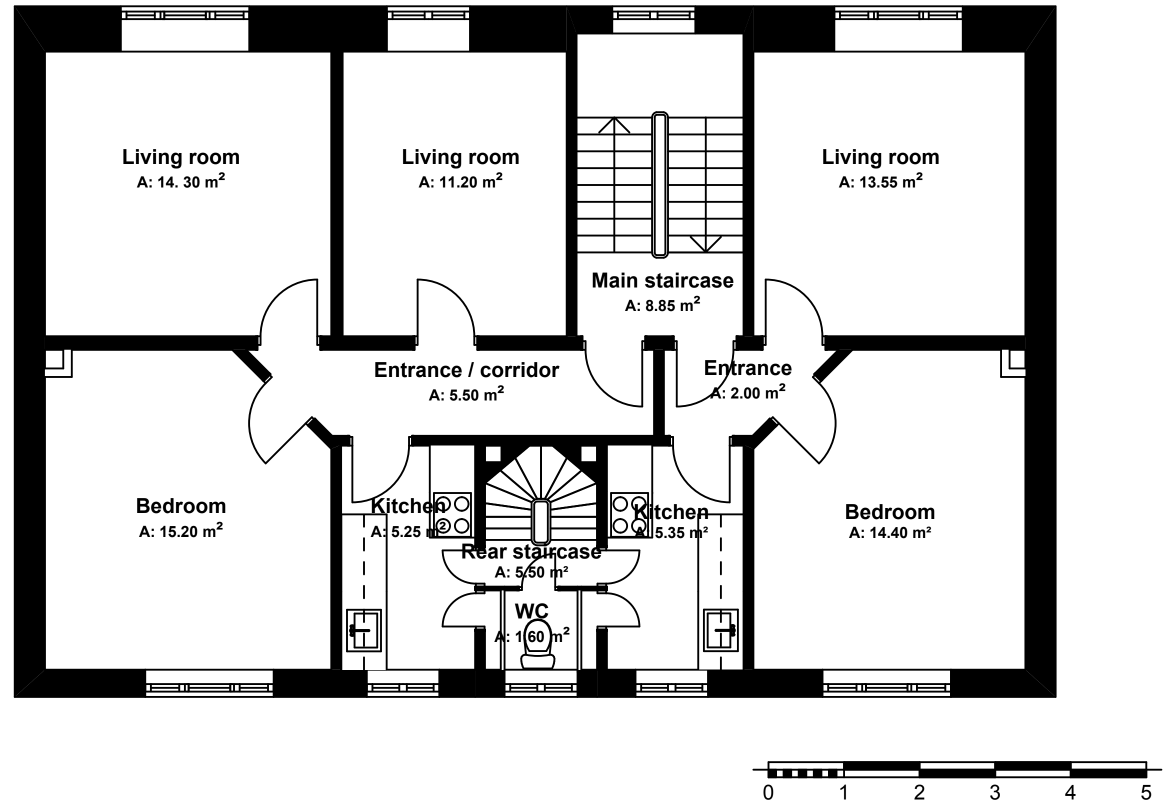


Building Design

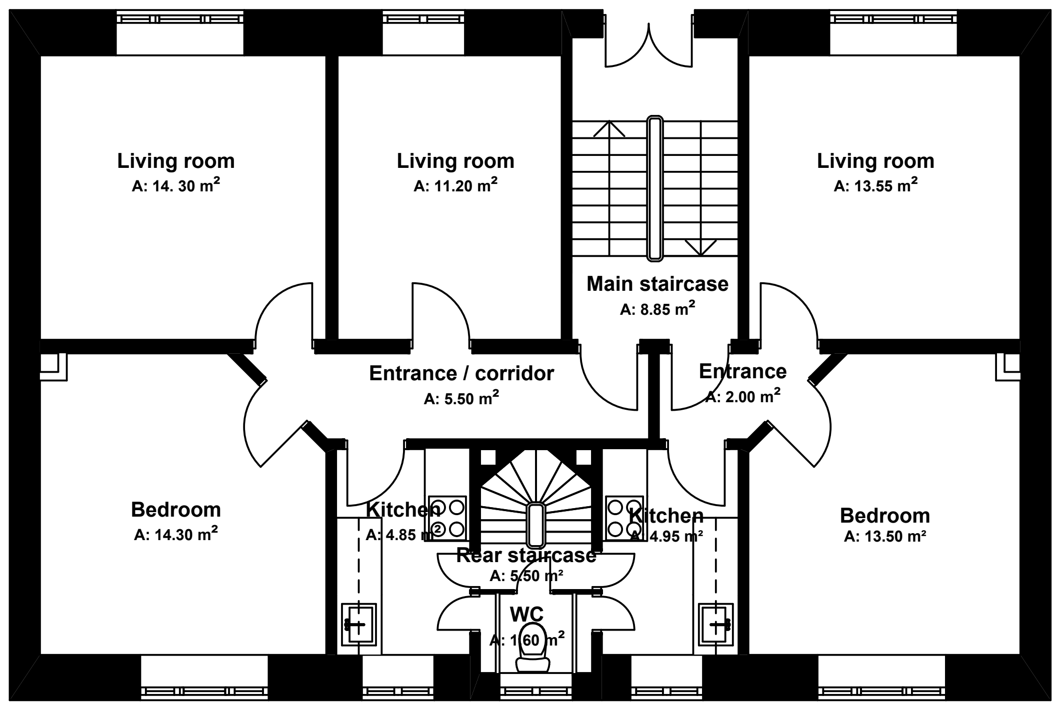
Plan of basement



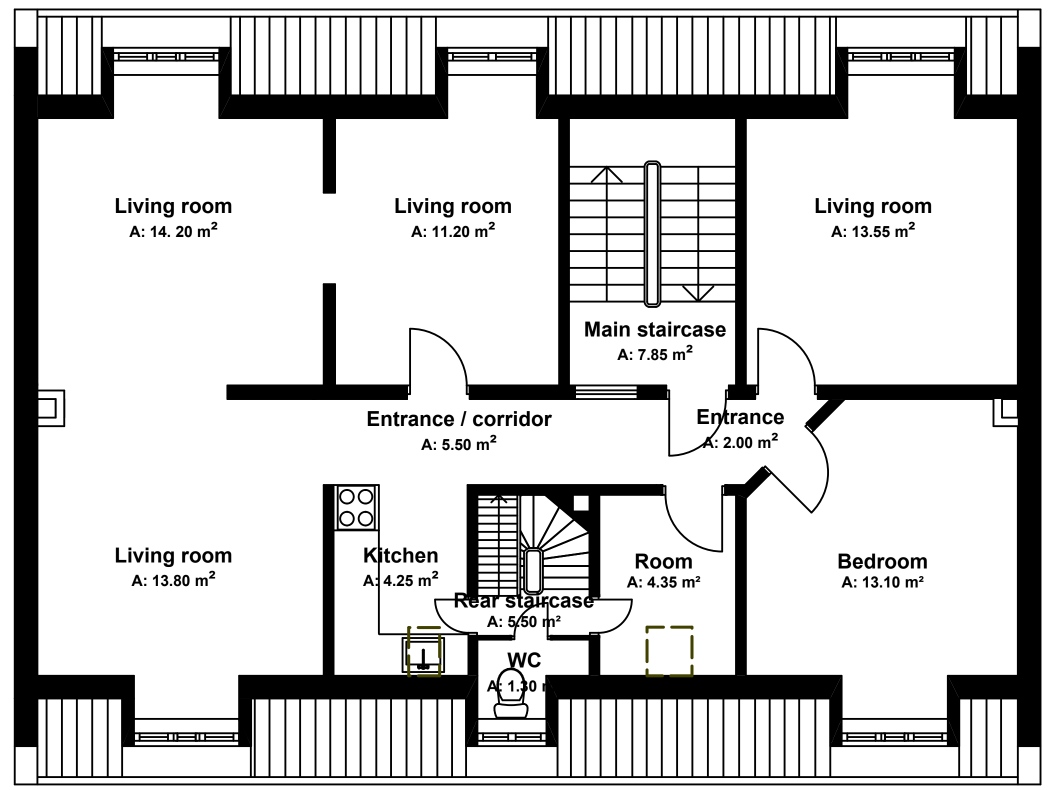
Plan of first, second and third floors

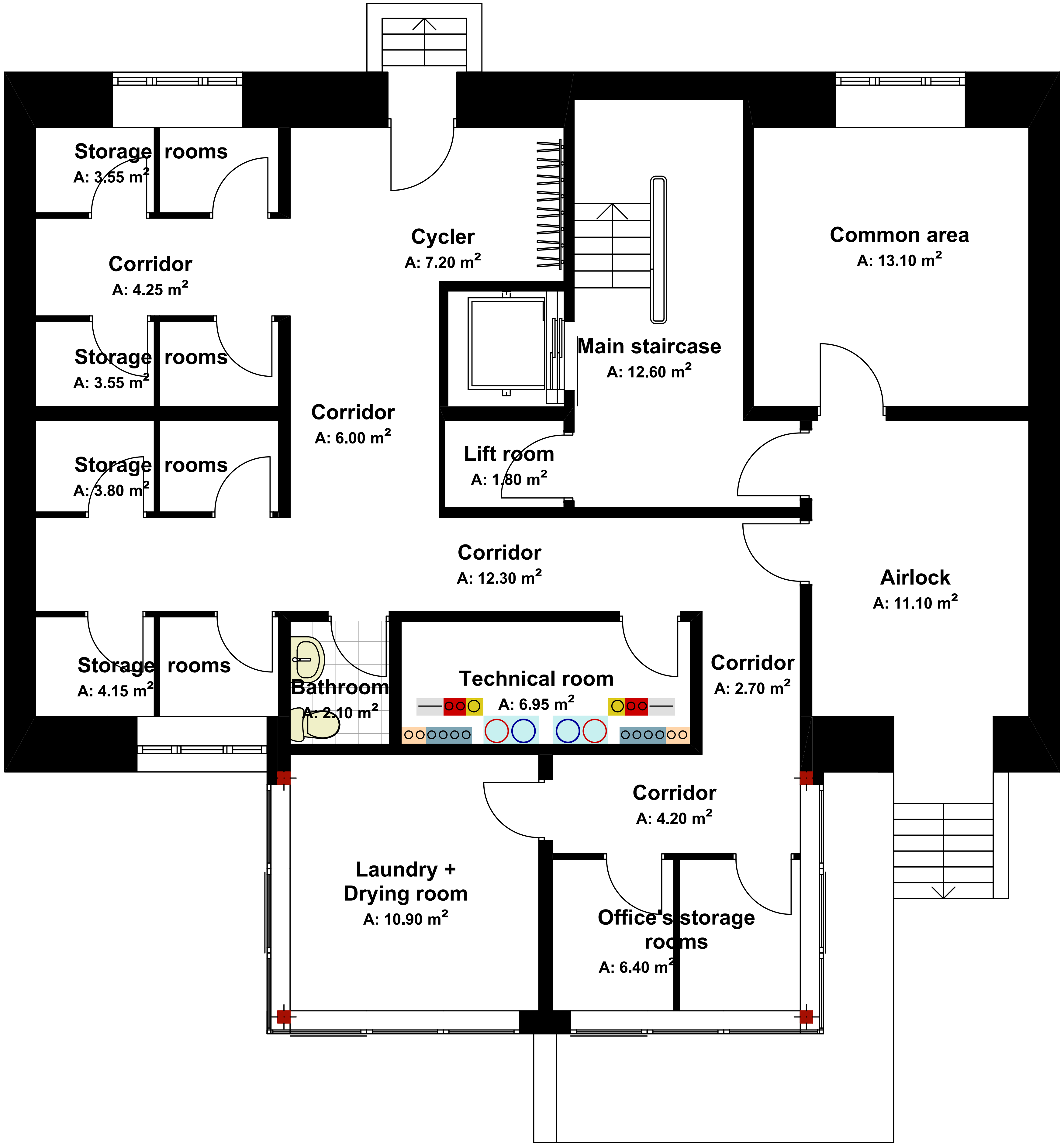


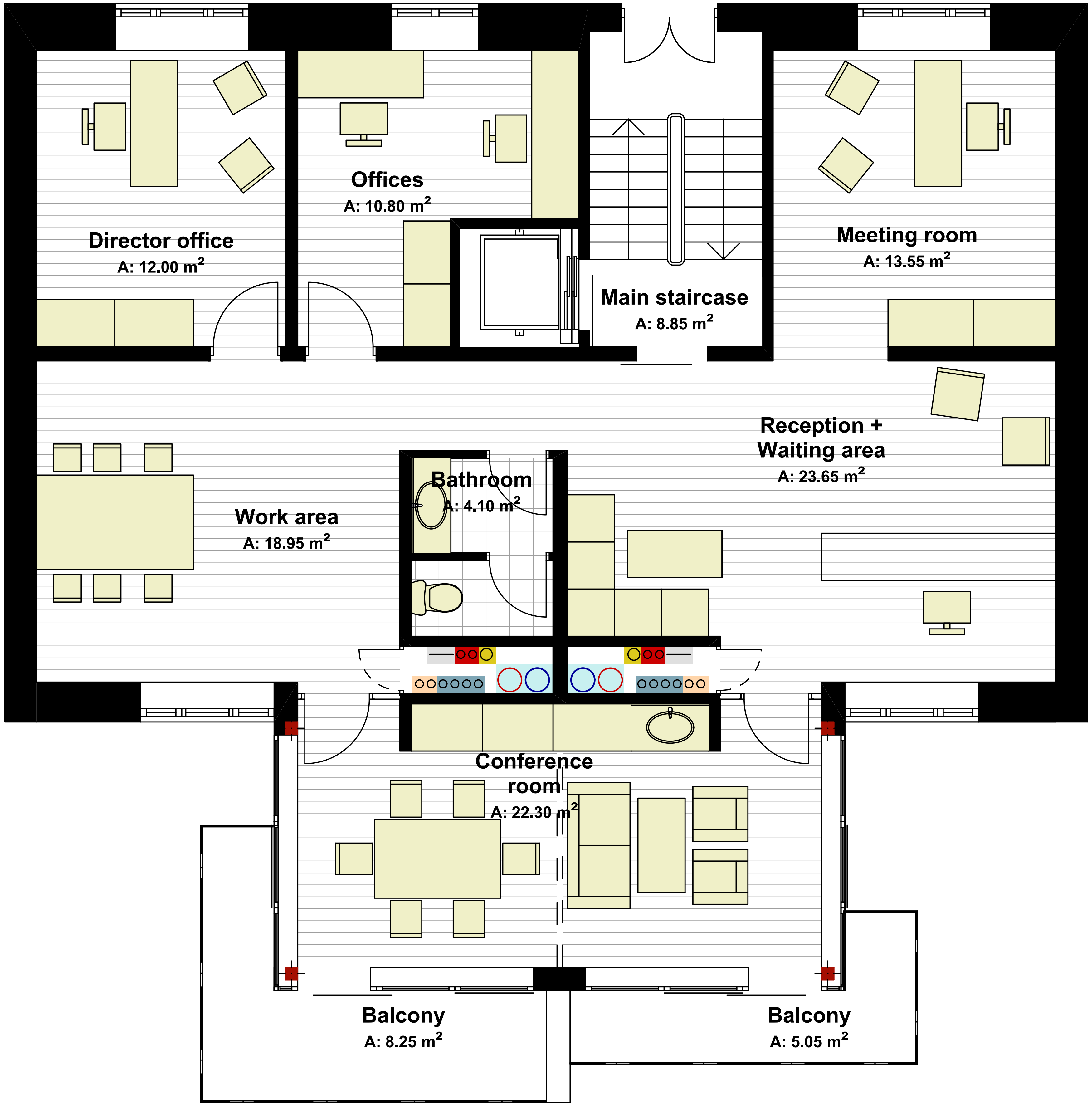
Plan of ground floor



Plan of roof storey




Storage rooms
A: 3.55 m2
Corridor
A: 4.25 m2
Cycler
A: 7.20 m2
Common area
A: 13.10 m2
Storage rooms
A: 3.55 m2
Main staircase
A: 12.60 m2
Corridor
A: 6.00 m2
Storage rooms
A: 3.80 m2
Lift room
A: 1.80 m2
Corridor
A: 12.30 m2
Airlock
A: 11.10 m2
Storage rooms
A: 4.15 m2
Bathroom
A: 2.10 m2
Technical room
A: 6.95 m2
Corridor
A: 2.70 m2
Corridor
A: 4.20 m2
Laundry +
Drying room
A: 10.90 m2
Office's storage
rooms
A: 6.40 m2


Director office
A: 12.00 m^2
Offices
A: 10.80 m^2
Main staircase
A: 8.85 m^2
Meeting room
A: 13.55 m^2
Reception +
Waiting area
A: 23.65 m^2
Bathroom
A: 4.10 m^2
Work area
A: 18.95 m^2
Conference
room
A: 22.30 m^2
Balcony
A: 8.25 m^2
Balcony
A: 5.05 m^2

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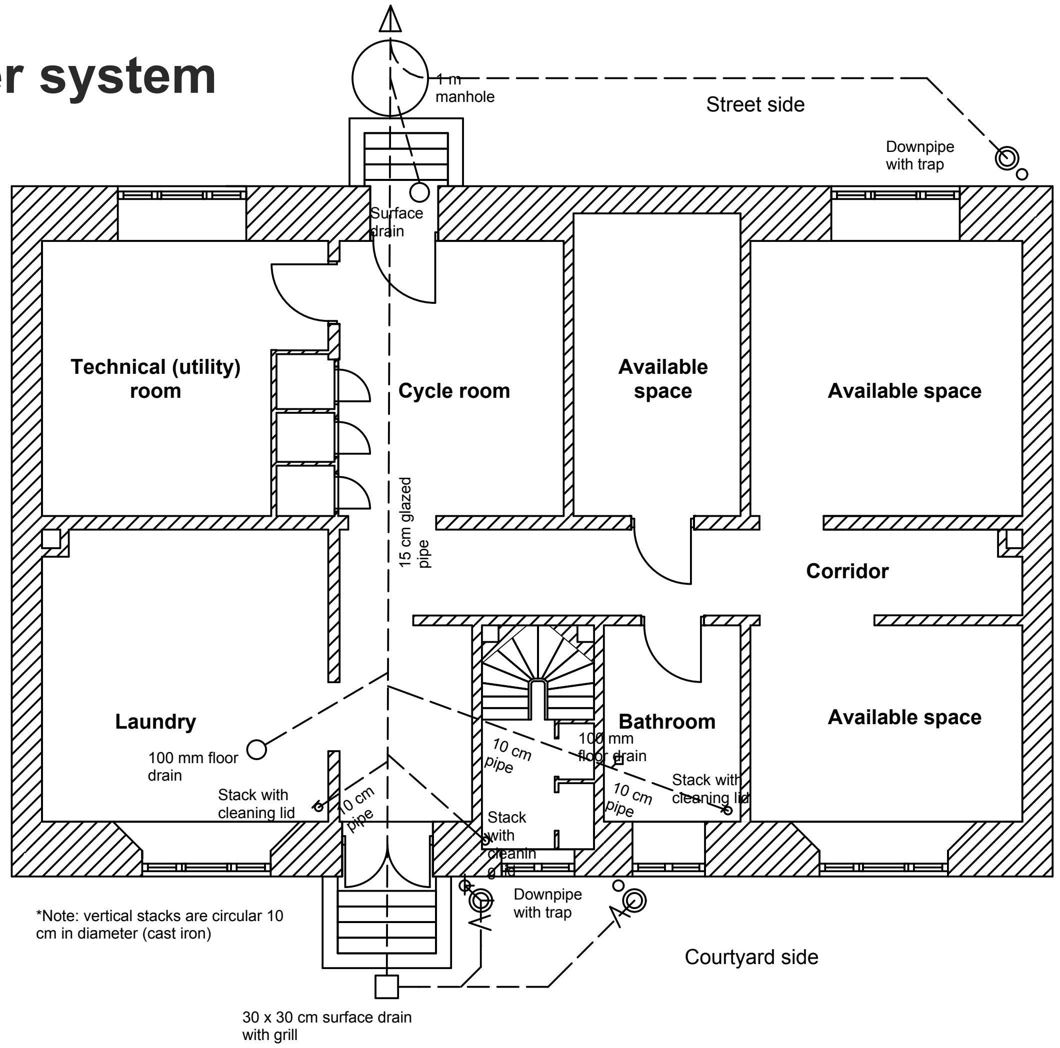
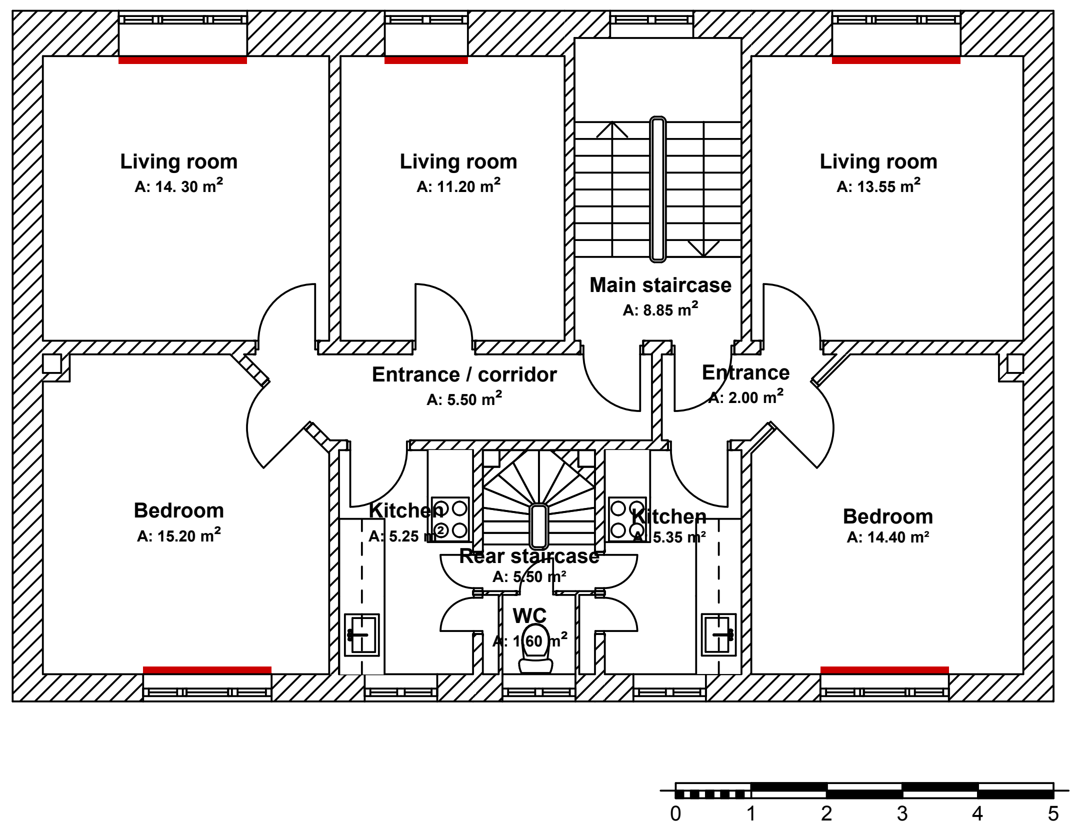
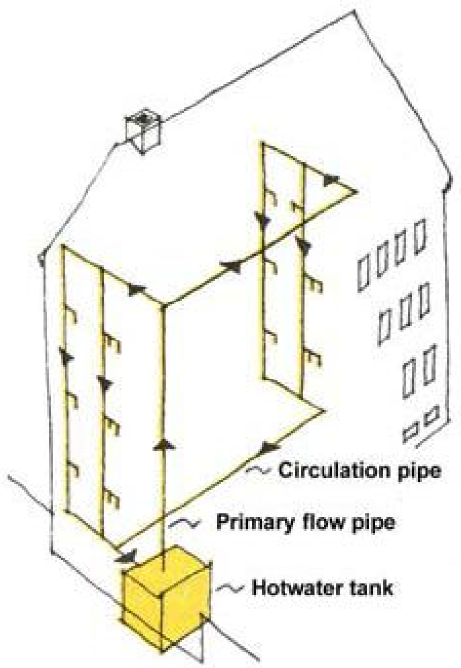
Sewer system



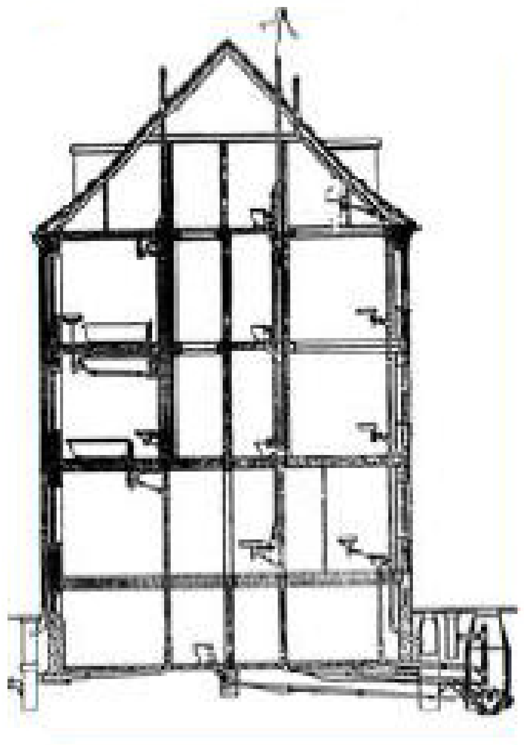
Heating



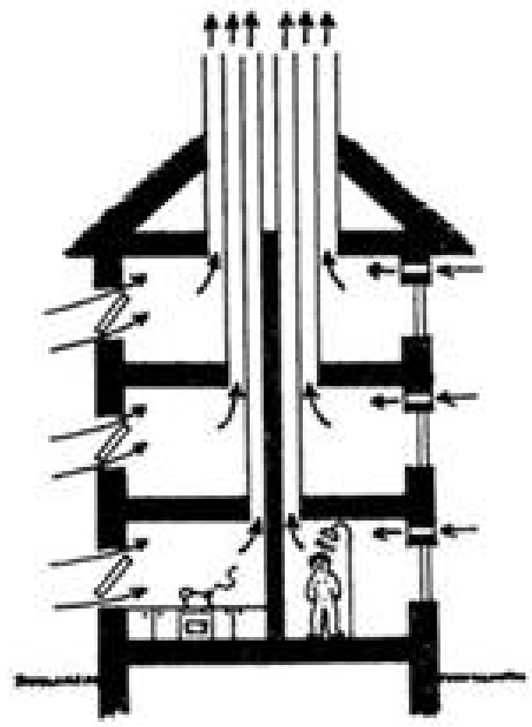
Water system



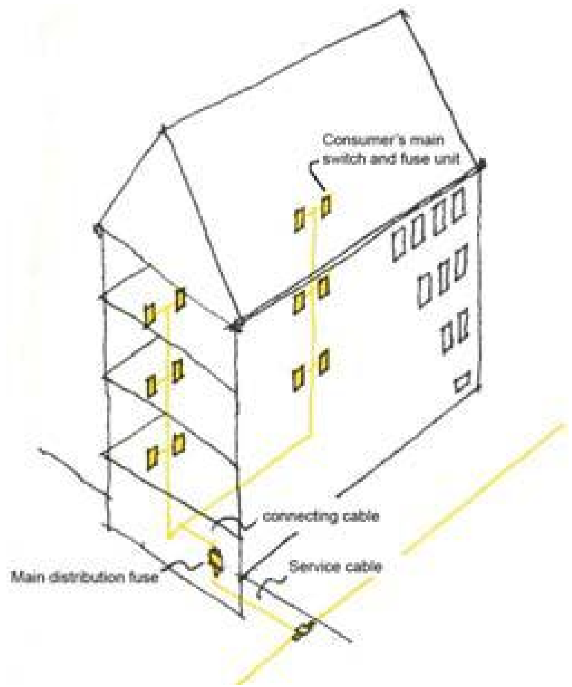
Internal drain system



Ventilation

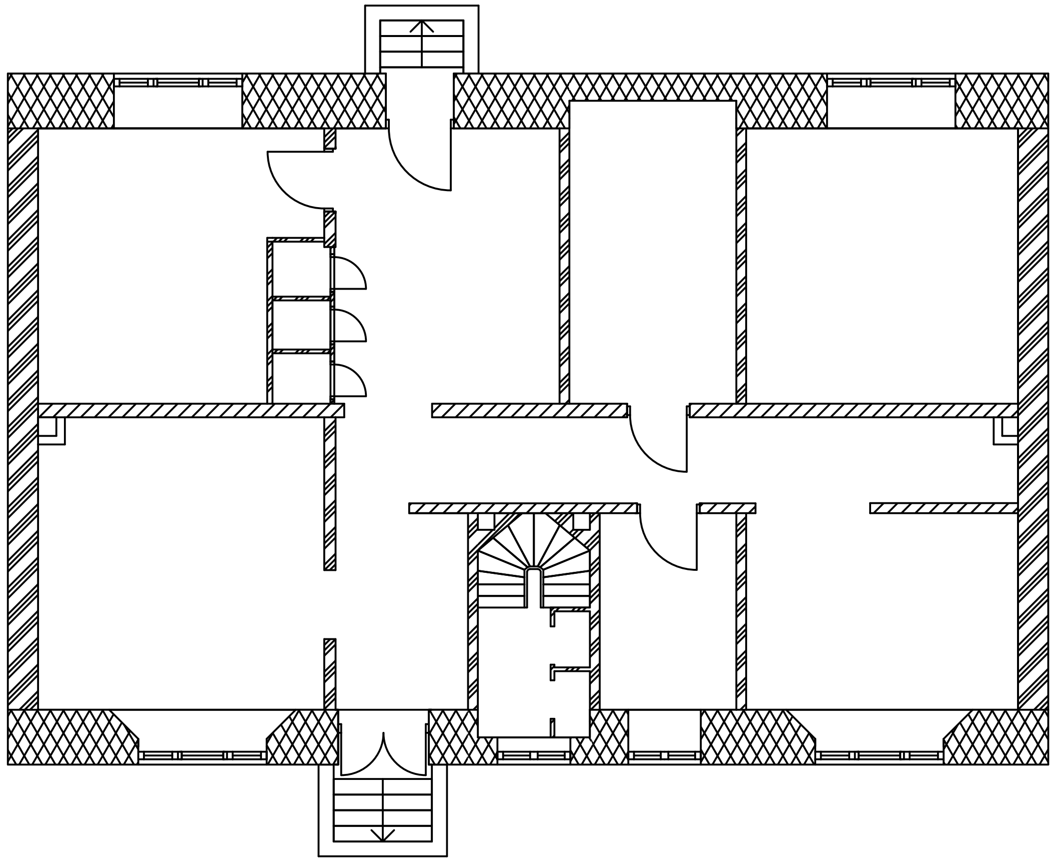


Electricity

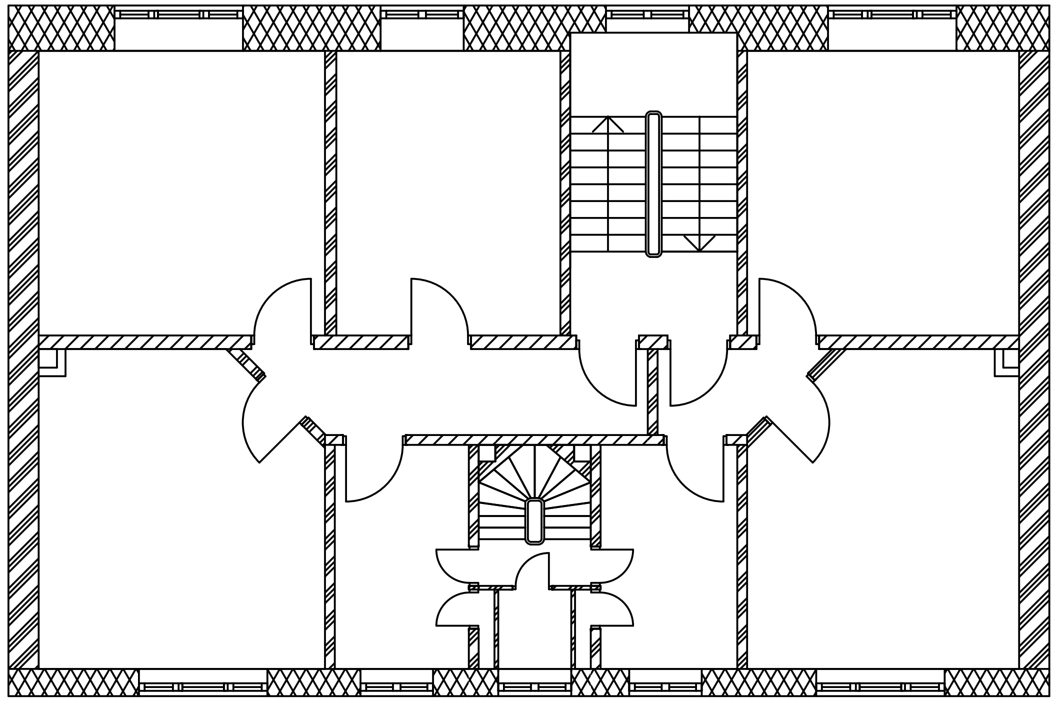


Statical Analysis

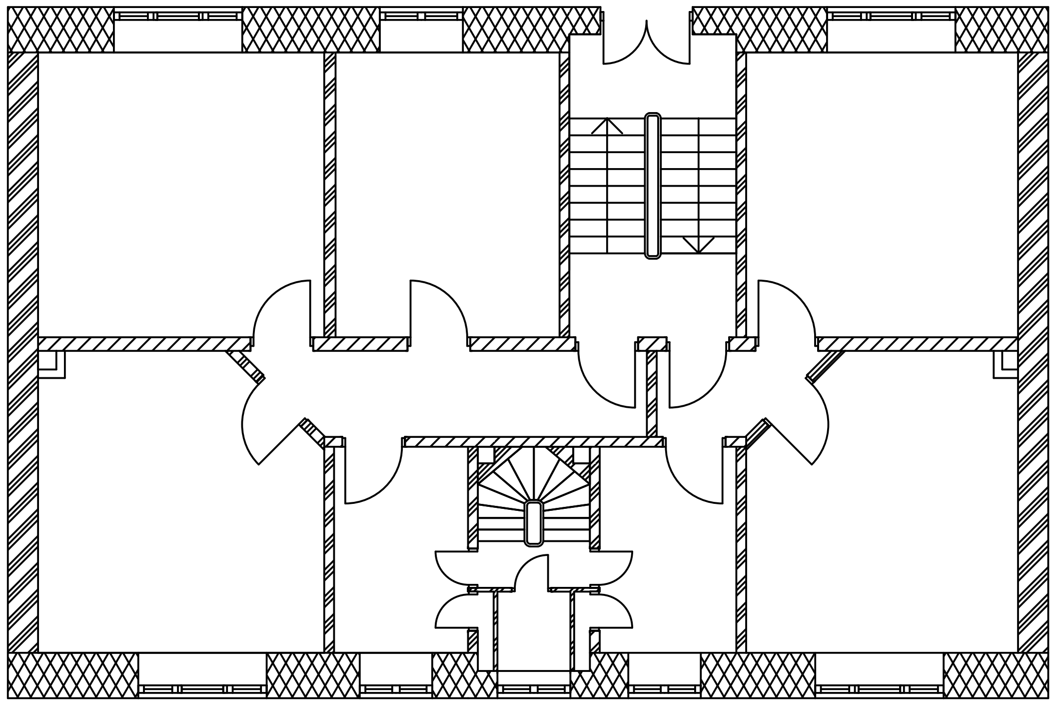
Basement



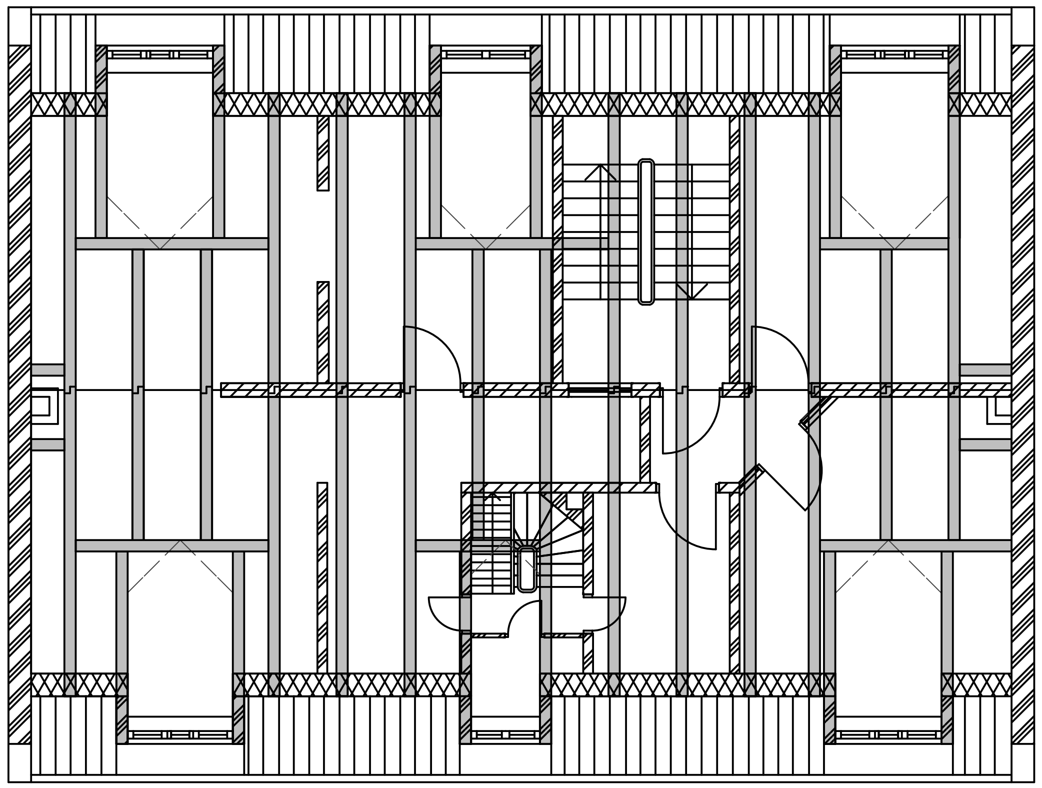
First, second and third floors



Ground floor



Roof storey



Key

Roof / joist / façade / wind
Vertical loads coming from the roof, joists and façade walls
Wind forces on the façade walls

Roof / joist / wall
Vertical loads coming from the roof, joists and walls

Joist / wall
Vertical loads coming from the joists and walls

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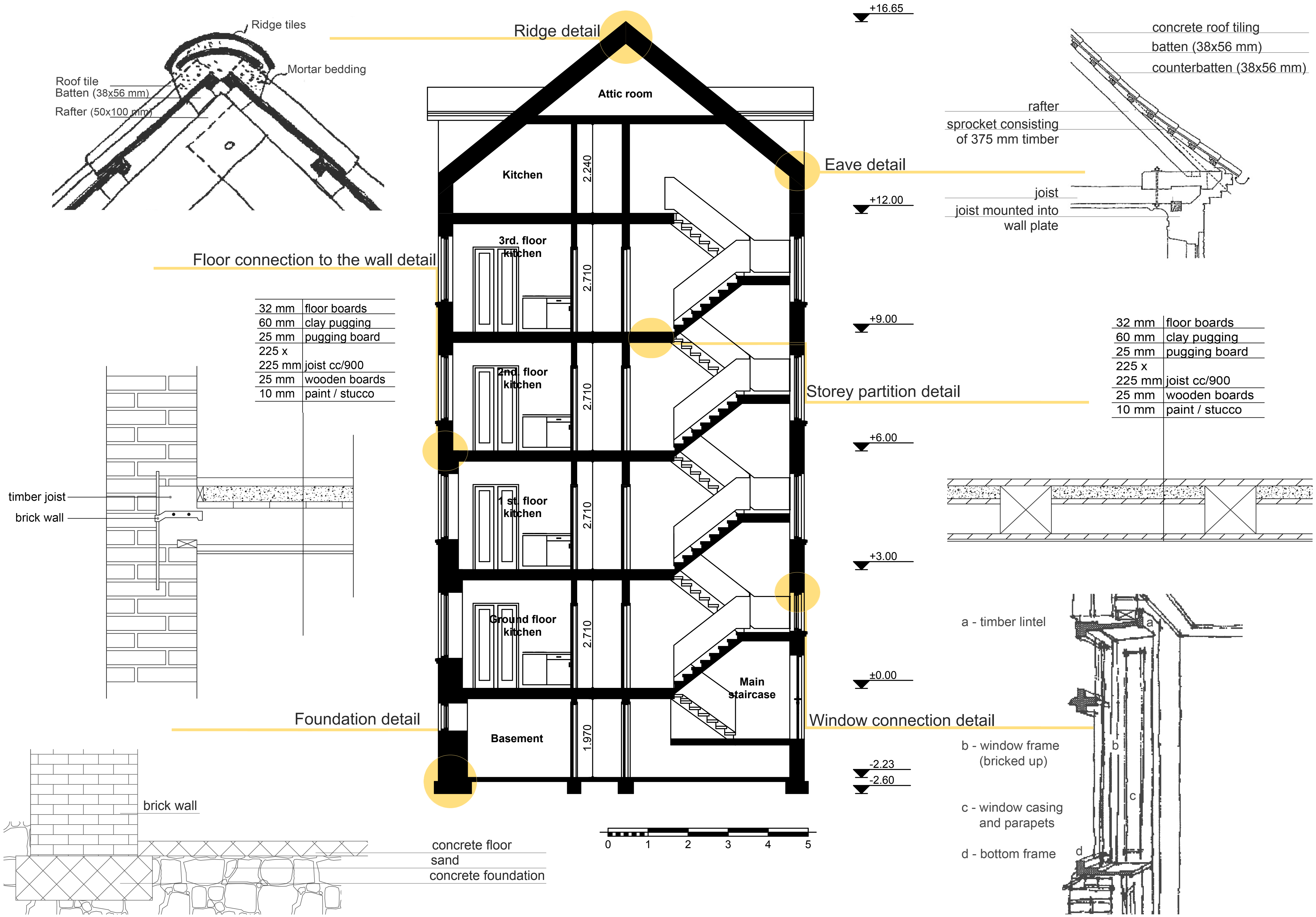
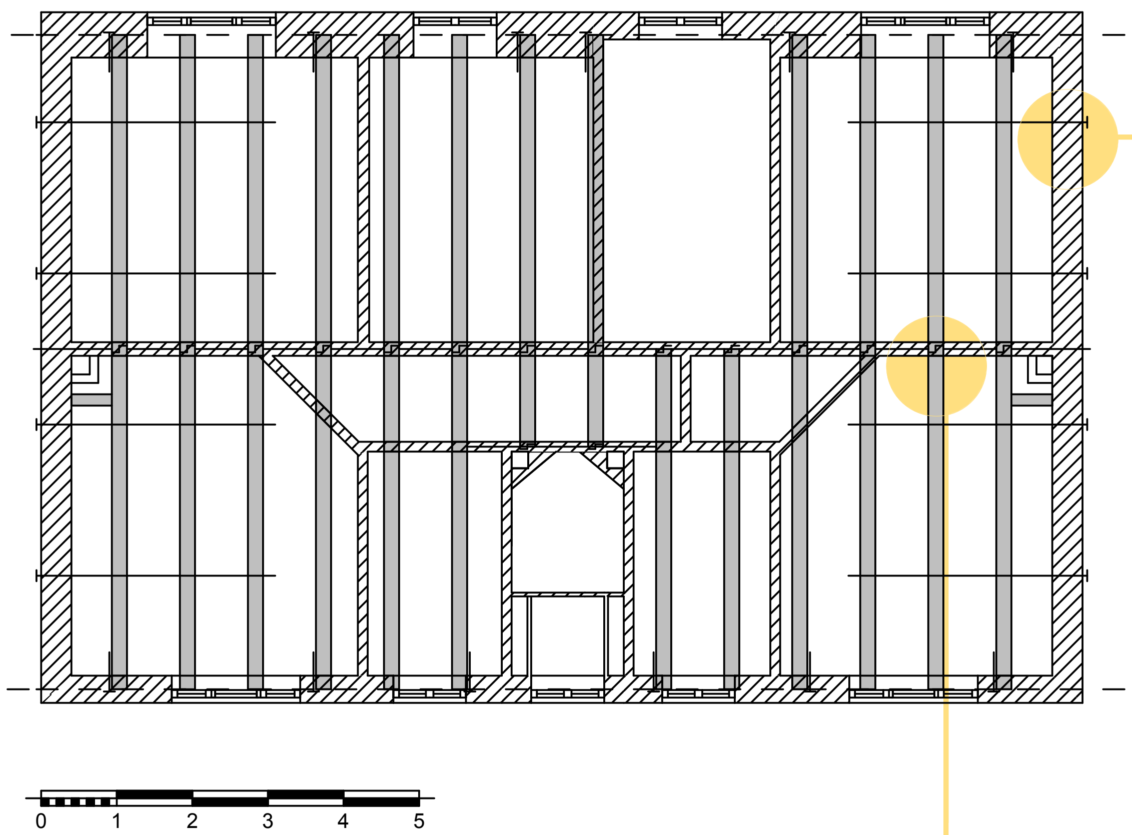
Structure Overview

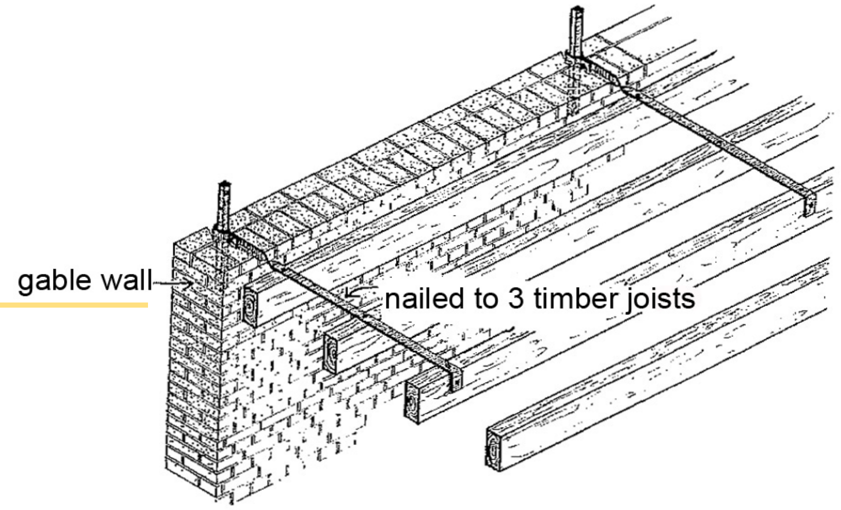
Principal section

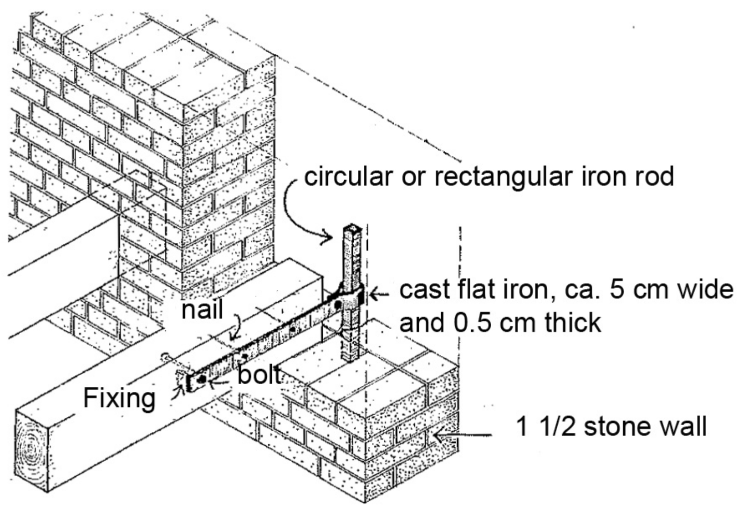


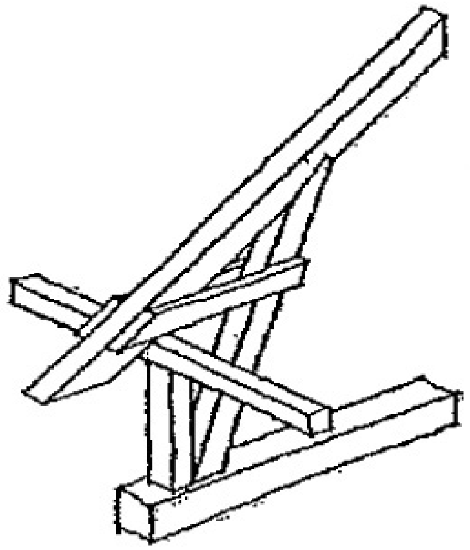
Structure Overview

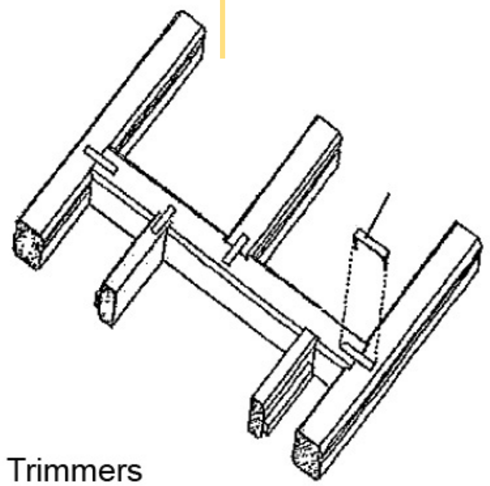
Joist plan



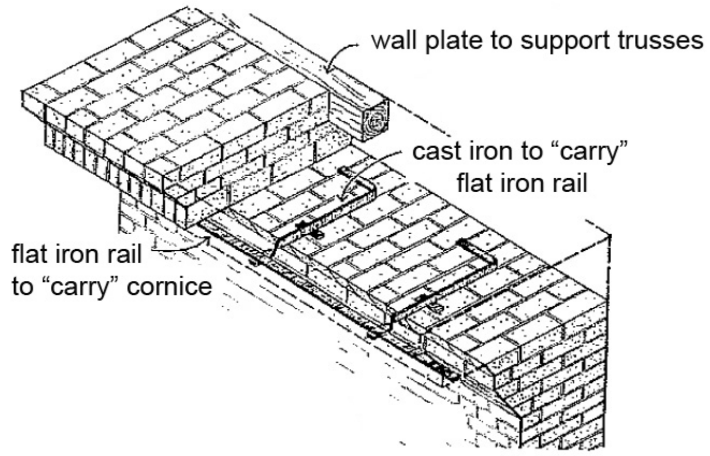








Trimmers



ID	Detail name	Components	Thickness (mm)
1.	**Floor**		
	Extension	Wooden floor	15
		Aluminum heat transfer plate with joist trak panels	17
		Plaster board	12.5
		Plaster board	12.5
		Trapezoidal plate	20
		Textile membrane	1
		C Profile	200 x 63.5 x 2 (cc/ 600)
		Insulation	100
		Acoustic profile	25
		Fire plaster board	15
		Plaster board	13
		Total thickness	330
	Existing building	Wooden floor	15
		Aluminum heat transfer plate with joist trak panels	17
		Plaster board	12.5
		Plaster board	12.5
		Trapezoidal plate	20
		Textile membrane	1
		Wood joist	225 x 225 (cc/ 900)
		Insulation	100
		Fire plaster board	15
		Plaster board	13
		Total thickness	330
	Wet room with suspended ceiling (Existing building)	Tiles	400 x 400 x 6
		Screed (for slope)	35
		Waterproof membrane	2
		Lightweight concrete (reinforced with 6mm round steel laid in a grid with 100 mm grid distance and with heating pipes)	60
		2 layers of polyethylene foil	2 x 0.15
		Plywood placed between the joists	22
		Wood strip (nailed to the side of the joists)	50 x 50
		Wood joist	225 x 225 (cc/ 900)
		Insulation	100
		Fire plasterboard	15
		Plaster board	12.5
		Suspended ceiling	280
		Total thickness	635

	Basement floor	Linoleum finish	3
		Concrete slab	100
		Polystyrene insulation	200
		Total thickness	303
2.	**Wall**		
	Exterior wall	Painting	
		Plaster board	12.5
		Plaster board	12.5
		C-profile	250 x 70 x 2 (cc/ 600)
		Damp proof membrane	2
		Insulation	250
		Wind board	13
		Ventilated cavity	30
		Distance battens	30 x 30 (cc/ 350)
		Oak wood cladding	16
			336
	Common wall (shaft)	Painting	
		Plaster board	12.5
		Plaster board	12.5
		C-profile	150 x 50 x1.5 (cc/ 600)
		Insulation	100
		Plaster board	12.5
		Plaster board	12.5
		Painting	
		Total thickness	200
	Common wall (kitchen)	Tiles	6
		Tiles fixing	3
		Plaster board	12.5
		Plaster board	12.5
		C-profile	150 x 50 x1.5 (cc/ 600)
		Insulation	100
		Plaster board	12.5
		Plaster board	12.5
		Tiles fixing	3
		Tiles	6
		Total thickness	218
	Interior wall (laundry wall)	Painting	
		Plaster board	12.5
		C-profile	100 x 50 x1.5 (cc/ 450)
		Plaster board	12.5
		Painting	
		Total thickness	125
	Interior wall	Painting	

	(storage rooms)	Plaster board	12.5
		C-profile	50 x 15 x1 (cc/ 450)
		Plaster board	12.5
		Painting	
		Total thickness	75
	Interior wall (technical room)	Painting	
		Plaster board	12.5
		Plaster board	12.5
		C-profile	100 x 50 x1.5 (cc/ 450)
		Plaster board	12.5
		Plaster board	12.5
		Painting	
		Total thickness	150
	Interior wall (elevator shaft walls)	Painting	
		Plaster board	12.5
		Plaster board	12.5
		C-profile	100 x 50 x1.5 (cc/ 450)
		Insulation	100
		Plaster board	12.5
		Plaster board	12.5
		Painting	
		Total thickness	150
	Basement wall	Painting	
		Plaster board	12.5
		Plaster board	12.5
		C-profile	200 x 70 x 2.5 (cc/ 600)
		Insulation	200
		Damp proof membrane	2
		Reinforced concrete	400
		Polystyrene insulation	200
		Drainage membrane	2
		Total thickness	830
3.	**Roof**		
	Existing building	Tiles	60
		Tiles fixing	
		Roof batten	38 x 56
		Pressure impregnated batten	30 x 45
		Wooden board	21 x 110
		Ventilation cavity	50
		Trusses	150 x 180
		Batten	50 x 50
		Mineral wool	50
		Damp proof membrane	2
		Batten	50 x 50

		Mineral wool	50
		Gypsum board	13
		Gypsum board	13
	Extension	Vegetal layer	
		Soil	125
		Root membrane	2
		Gravel	40
		Textile membrane	2
		Extruded polystyrene	30
		Bitumen membrane (2 layers)	4
		Lightweight concrete (slope for drainage)	100
		Trapezoidal plate	20
		C Profile	200 x 63.5 x 2 (cc/ 600)
		Insulation	200
		HEB Steel beam	160 x 160
		Fire board	15
		Plaster board	12.5
		Painting	
		Total thickness (without vegetation)	575.5
4.	**Balcony**		
		Balcony deck	25
		Batten	10 x 50 (cc/600)
		Batten	25 x 40 (cc/400)
		HEB profile	120 x 120 (cc/ 900)
		Balcony deck	25
5.	**Roof terrace**		
		Terrace deck	25
		High regulations (brackets)	37.5
		Textile membrane	
		Extruded polystyrene	30
		Lightweight concrete (slope for drainage)	100 – 120
		Trapezoidal plate	20
		C Profile	200 x 63.5 x 2 (cc/ 600)
		Insulation	100 – 140
		HEB Steel beam	160 x 160
		Fire board	15

PROJECT Renovation Multistorey house, Aarhus
PHASE Scheme Design
DATE

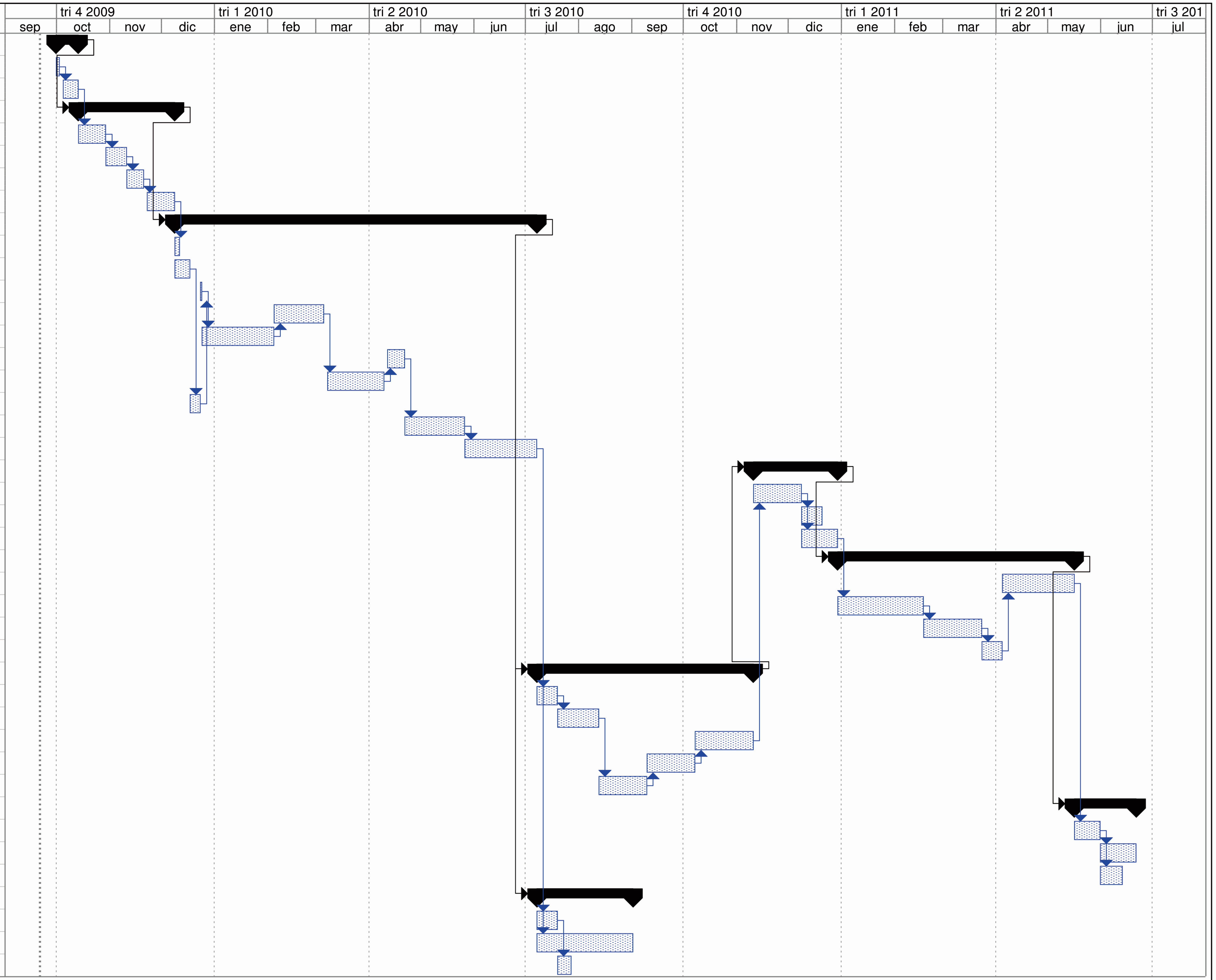
ITEM	PROBLEM	CONSEQUENCES	REMARKS	FOLLOW UP INSPECTION
Elevator	Affecting dwelling layout	Reduced dwelling floor areas	Position attached interior bearing wall	Placed near staircase
	Sound Insulation	Uncomfortable indoor climate	Identify sound demands	Using leads sheets
	Connection to floors	Destabilization of existing floors	Stabalize floors	Shaft stabalizes the old floors
	Support and roof connection	Changing the roof or the basement construction	Identify shaft height	Hidraulic Elevator
	Shaft Dimensions	Will the elevator fit ?	Find elevator external dimensions	Necessary dimensions for the shaft
Service shafts	Inadequate dimensions	Shaft won´t contain all pipes	Alteration of plans to facilitate the shaft	Found new pipe solution
	Layout-Pipes and Manifolds	Inaccesability to pipes	Analyse the shaft and the requirements	Pipes fits in the shaft
	Uncomfortable access to shaft	Dificulties in inspection	Solution exists	50 mm distance between each pipe in shaft
Room layouts	Size problems rooms close to the elevator	No tennants	Analyse and change the use	New rooms (studies and dressing rooms)
	Inadequate sound protection	End users uncomfortable	Check sound demands	New walls fullfill demands
External walls	Heat loss	Cold indoor climate	Improve insulation	Extension biult with low energy class
Staircase	Not fire protection	No other access route during fire	Fire- proof staircase	Dual gypsum Fire-board under landing
	Noaccess to attic	Attic will be inaccesible	Create a hatch- an opening	Hatch created
	Access to airlock	Rearrangement of the basement	Identify airlock, make a fire analysis	The airlock fullfill the minimun requirements
Balconies	Connection to extension	Redesign structure for stability	Research details from supplier	Connected to the steel beams/columns
	Rain water affecting railings	Rust	Retain original design with solutions	Stainless railings connected on top of the surface
Technical room	Inadequate space for all of the services	Rearrangement of the basement	Identify the sizes of the machinery and pipes	Enough space is provided to accommodate them
Storey partitions	Connection to old floor	Bad fire protection if done incorrectly	Fire- proof both floors	Both are fire-proofed
	Different levels	Aestheticly displeasing	Match floor level, celling only in bathrooms and kitchens	Floor levels are the same everywhere
Roof	Supporting altered rafters	Roof can collapse	Place a beam at the base for support	Beam in place
	Connecting old roof to new roof	Cold bridge and instability	Fully insulate andd support beam	Beam in place, and wooden studs bolted to rafters
	Refurbishing dormers	Won´t match old design if done wrong	Make sure they match with the new design	Replacing cladding and adding flashing
Steel beam/Columns	Fire Hazard	Won´t be able to carry the extension	Fire-proof the beams and columns	All beams/columns are fire-proofed
	Hazardous wall connection	Wind may pull the extension away	Make a static analysis	The existing wall is able to support them
Airlock	There is no airlock	Check the building regulations	A new space is required	The basic requirements fullfilled

Criteria of Analysis			Materials											
			Wood		Metal cladding		Ceramics		Fiber cement		Stone		Clay bricks	
Importance / Grade / Total (I x G)		I	G	T	G	T	G	T	G	T	G	T	G	T
Density		2	1	2	2	4	2	4	2	4	3	6	3	6
Durability		1	2	2	1	1	1	1	1	1	1	1	1	1
Mounting		3	1	3	2	6	2	6	1	3	3	9	1	3
Price		2	2	4	1	2	2	4	2	4	3	6	2	4
Construction time														
Life cycle	By-products / emissions (Production)	3	1	3	3	9	3	9	2	6	1	3	1	3
	Recycling	2	1	2	1	2	3	6	3	6	1	2	1	2
	Waste disposal	2	1	2	2	4	2	4	2	4	1	2	1	2
Regulations	Thermal performance	1	1	1	3	3	1	1	3	3	3	3	3	3
	Fire resistance	2	3	6	2	4	1	2	2	4	1	2	1	2
	Moisture resistance	1	3	3	1	1	2	2	2	2	2	2	2	2
	Sound reduction	2	3	6	3	6	2	4	3	6	1	2	2	4
Maintenance		2	3	6	2	4	1	2	1	2	1	2	1	2
Impact resistance		2	3	6	1	2	2	4	3	6	3	6	3	6
Result				46		48		49		51		46		40

Criteria of Analysis		Grade		
		1	2	3
Density		Light	Medium	Dense
Durability		> 20 years	10 - 20	< 10 years
Mounting		Easy	Moderate	Hard
Price		Low	Acceptable	High
Construction time				
Life cycle	By-products / emissions (Production)	Low	Medium	High
	Recycling	Totally	Partly	No recycling
	Waste disposal	Organic	Neutral	Toxic
Regulations	Thermal performance	Low U-value	Medium U-value	High U-value
	Fire resistance	Non combustible	Non combustible with bad performance to fire	Combustible
	Moisture resistance	Impermeable	Absorb moisture – Small damages	Absorb moisture – Risk of corrosion, rot
	Sound reduction	High	Medium	Low
Maintenance		Low	Medium	High
Impact resistance		High	Medium	Low

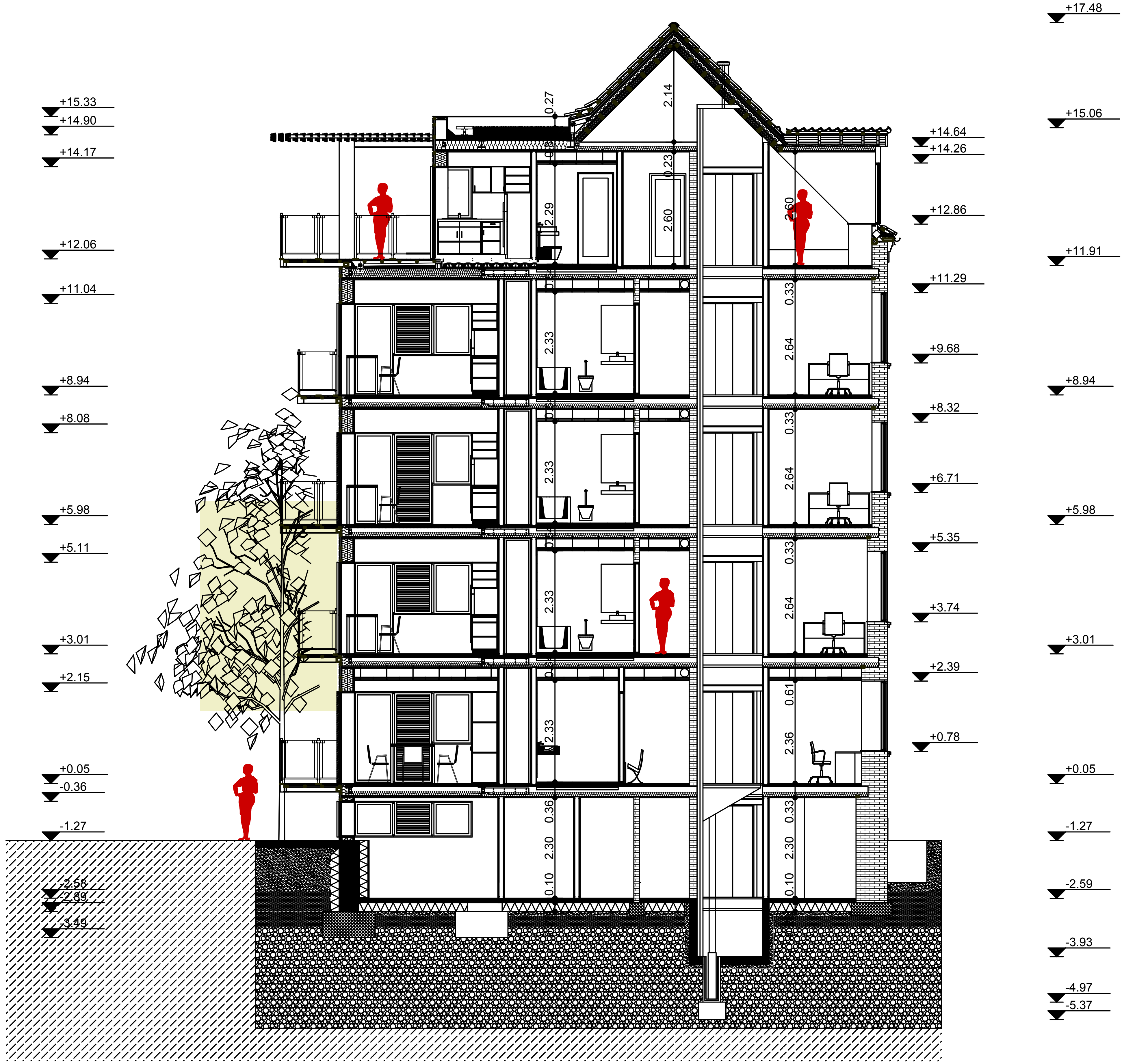
http://www.level.org.nz/material-use/choosing-materials/

Id		Nombre de tarea
1		**BUILDING SITE**
2		Site containers and equipment
3		Scafolding
4		**DEMOLISHION**
5		Remove Roof Surface
6		Demolishion courtyard Bearing walls
7		Demolishion interior walls
8		Demolish storey partition / new holes
9		**PRIMARY ELEMENTS**
10		Foudation
11		Steel structure
12		Steel fire proof
13		Storey partition Extension
14		Storey partition
15		Roof Extension
16		Roof
17		Balconies
18		External walls
19		Internal walls
20		**COMPLETIONS**
21		Suspended ceilings
22		Windows
23		Doors
24		**FINISHES**
25		Painting
26		Tiles
27		Wood boarding
28		Linoleum
29		**BUILDING SERVICES**
30		Sewer
31		Water
32		Electricity
33		Ventilation
34		Heating
35		**FIXED FURNITURE**
36		Sanitary elements
37		Cupboards
38		Kitchens cupboards
39		**MISCELLANEOUS /COMMOM FACTORS**
40		Staircase
41		Elevator
42		Ornamental Decoration

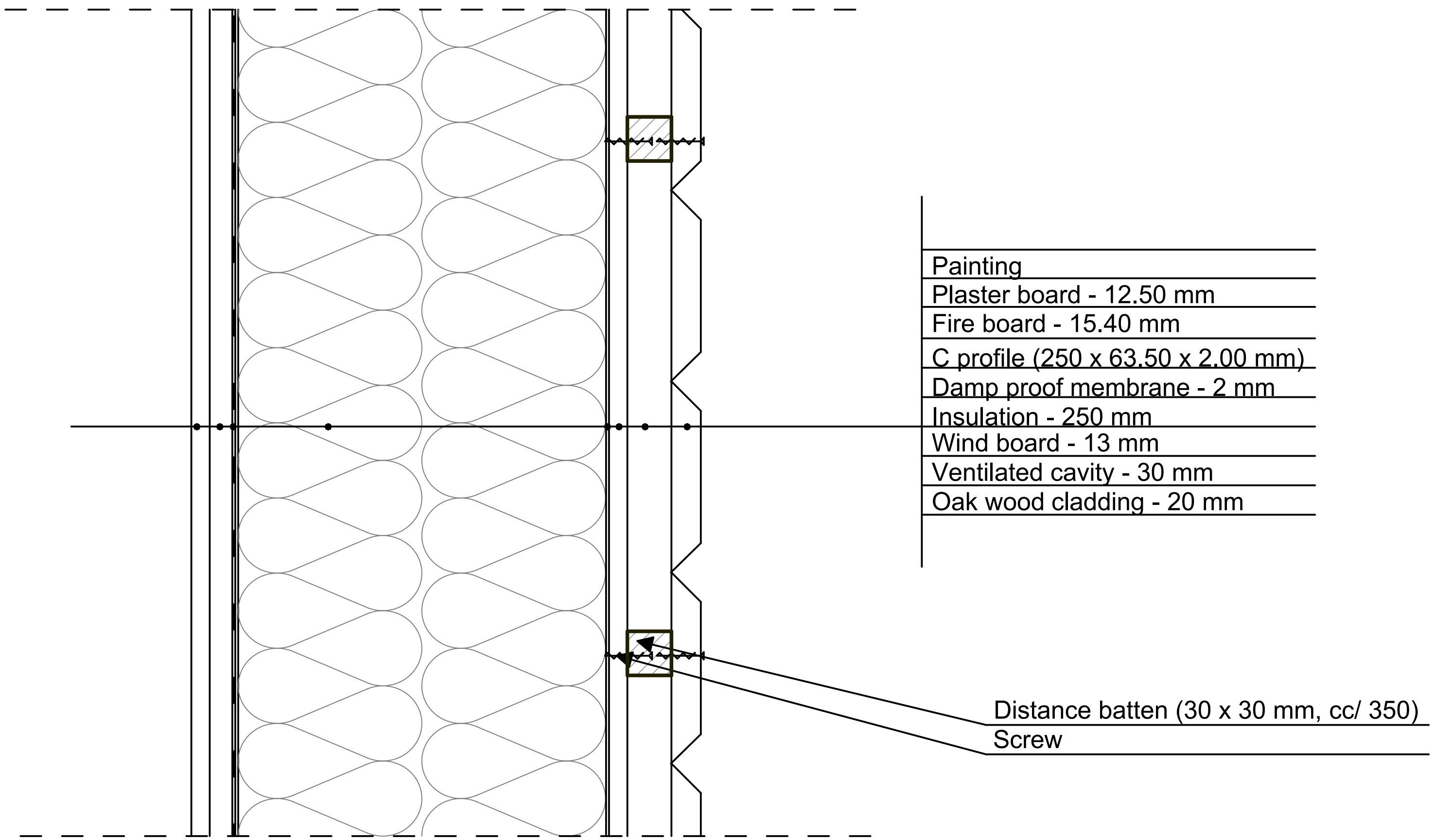


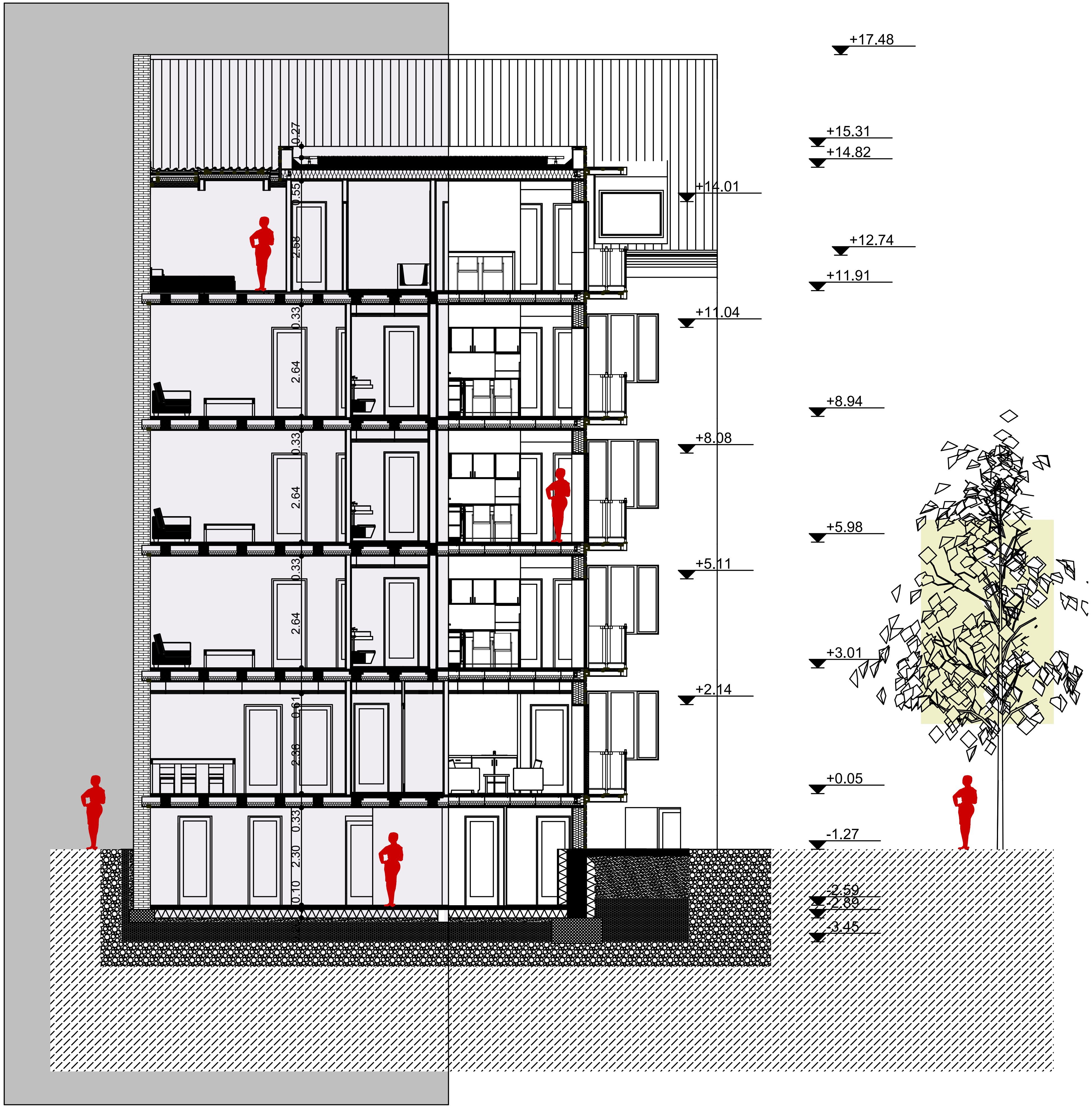
Proyecto: Planning_Dannebrogsg
Fecha: lun 21/09/09

Tarea		Progreso		Resumen		Tareas externas		Fecha límite	
División		Hito		Resumen del proyecto		Hito externo			

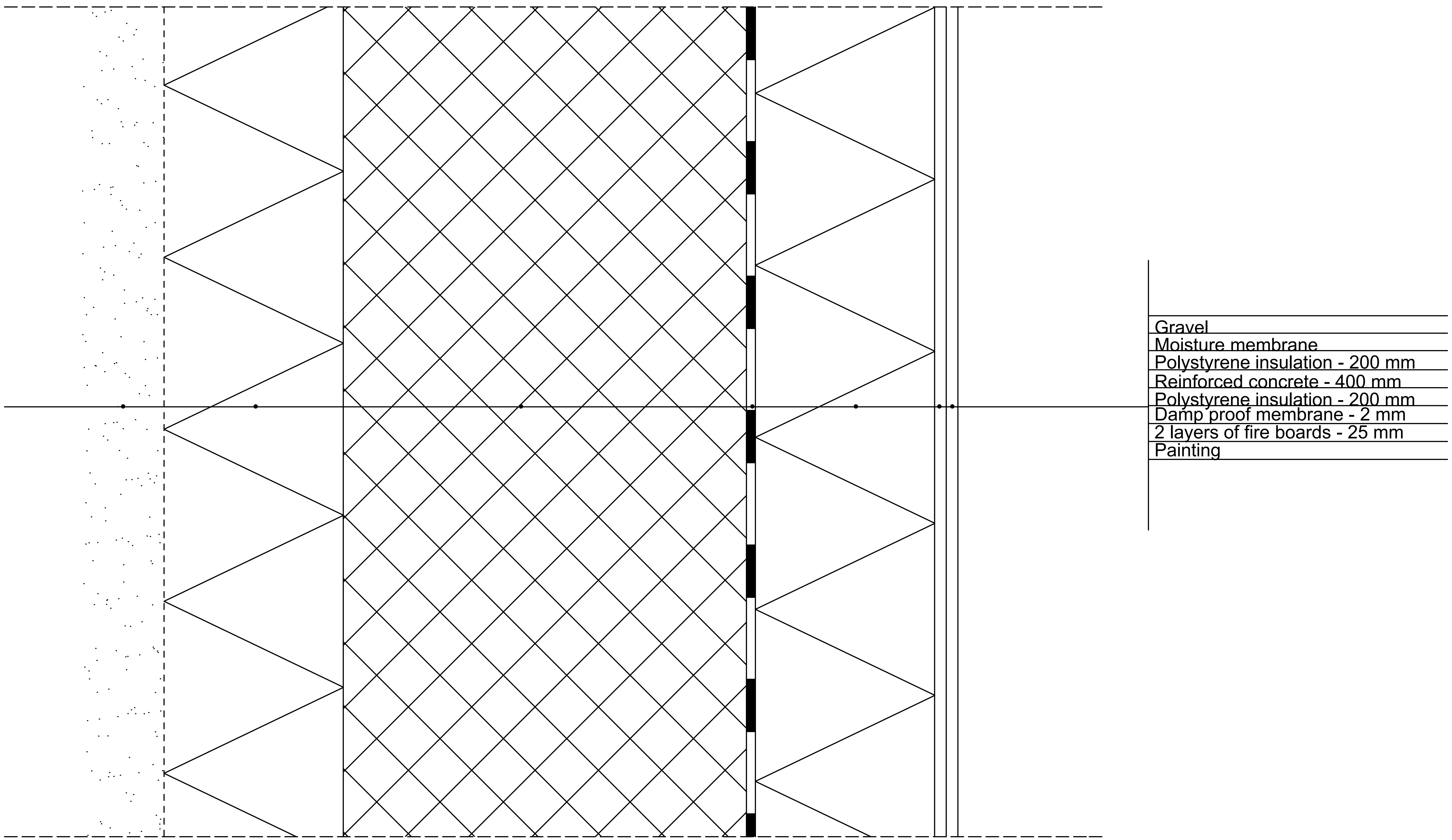

+17.48
+15.33
+15.06
+14.90
+14.64
+14.26
+14.17
+12.86
+12.06
+11.91
+11.29
+11.04
+9.68
+8.94
+8.32
+8.08
+6.71
+5.98
+5.35
+5.11
+3.74
+3.01
+2.39
+2.15
+0.78
+0.05
-0.36
-1.27
-2.58
-2.59
-2.89
-3.49
-3.93
-4.97
-5.37
0.27
2.14
0.23
2.29
2.60
2.60
0.33
2.33
2.64
0.61
2.36
0.36
2.30
0.10

Exterior wall (vertical section)
sc. 1:5

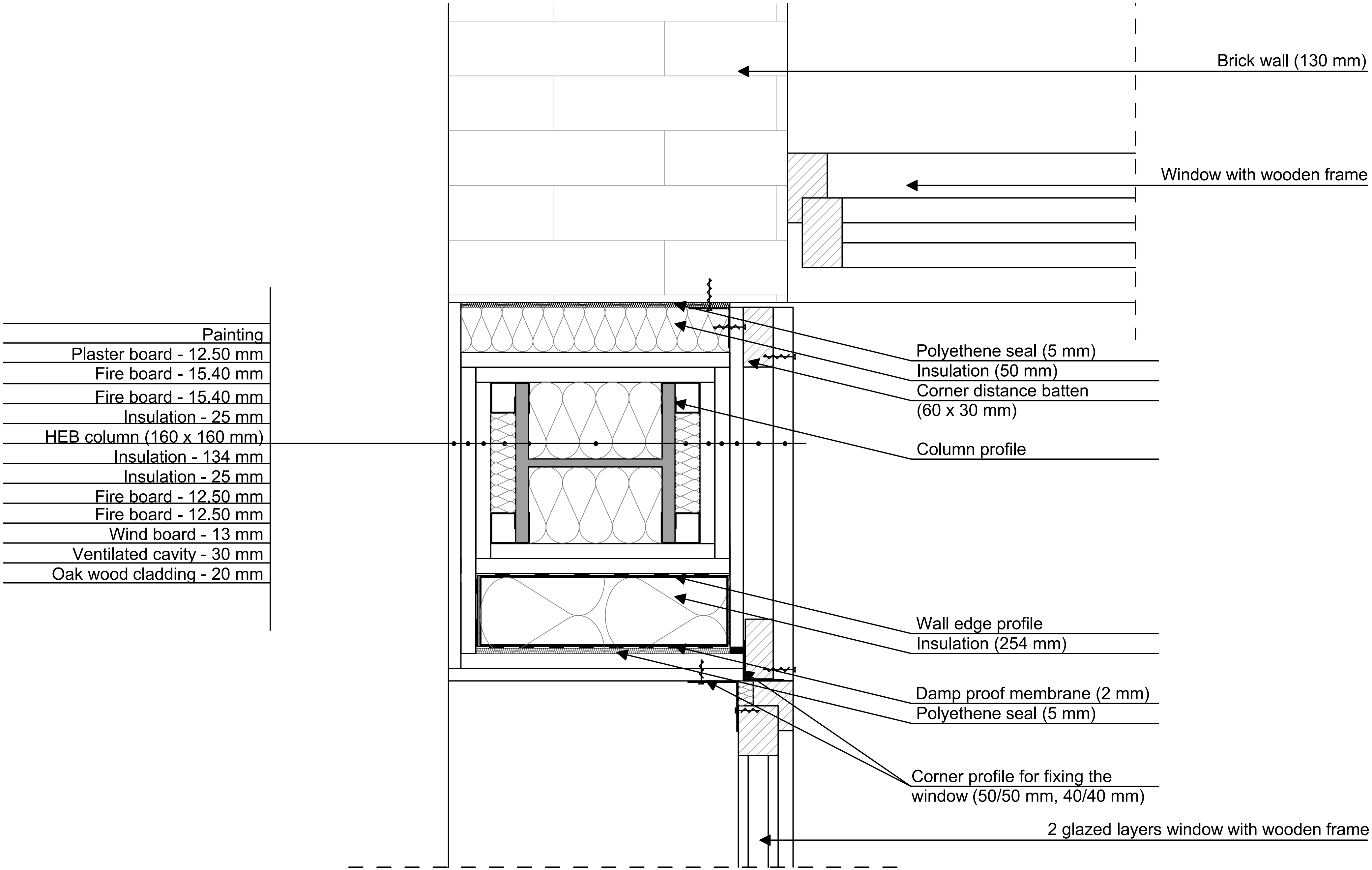



+17.48
+15.31
+14.82
+14.01
+12.74
+11.91
+11.04
+8.94
+8.08
+5.98
+5.11
+3.01
+2.14
+0.05
-1.27
-2.59
-2.89
-3.45

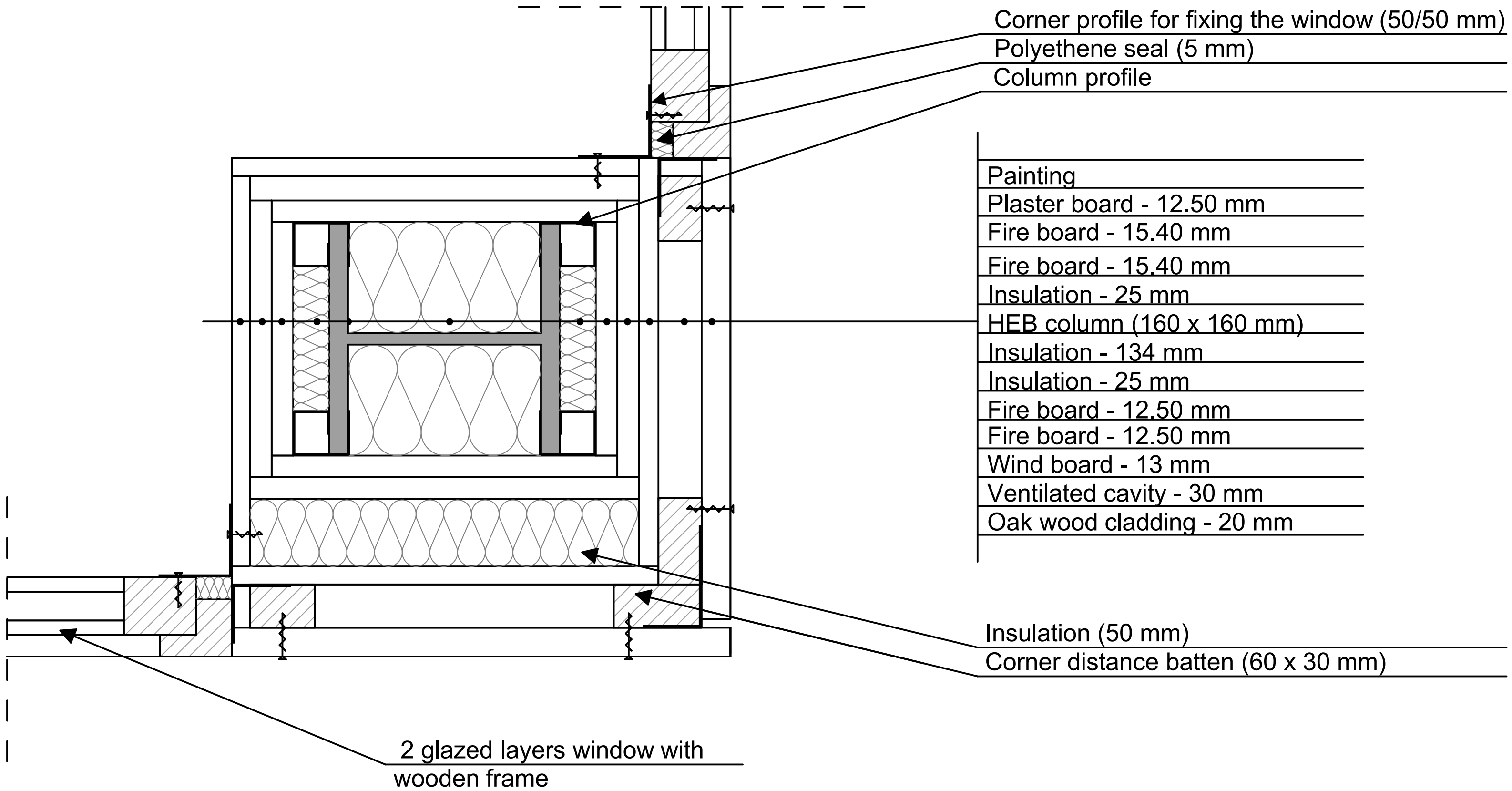
Basement wall
sc. 1:5



Exterior wall - connection with the existing brick wall (horizontal section), sc. 1:5



Exterior wall - corner (horizontal section)
sc. 1:5



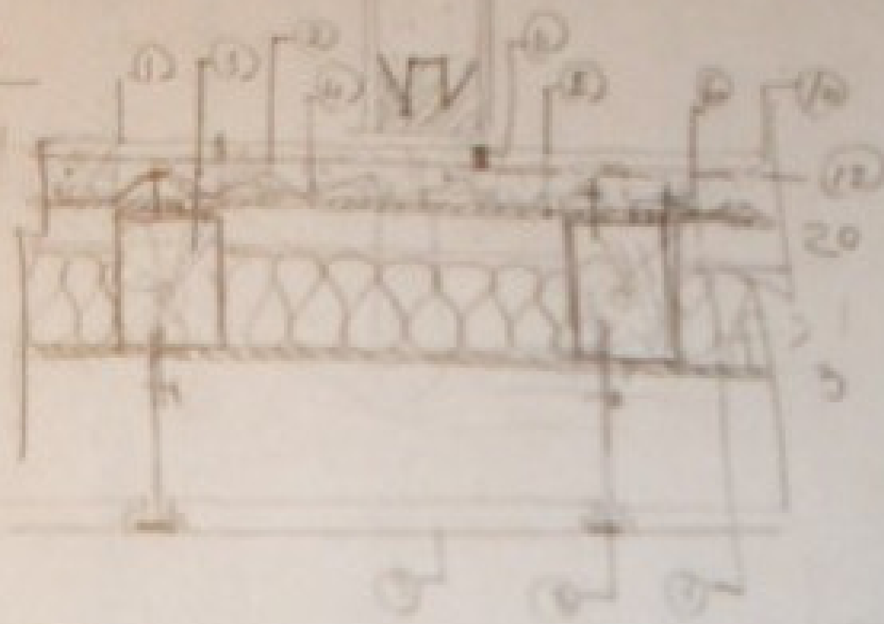
Arcilla expandida (conductividad) térmica 0'12 W/m°K

expanded clay

↳ LECA light expanded clay gravel

① SOLUTION

- Sound
- Fires
- Hanging ceiling
- Moisture
- Uponor



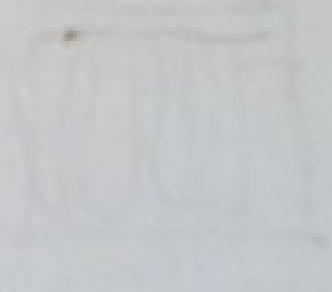
Pavimento de madera – wood flooring

Tarima de madera – wood flooring

KITCHEN CEILING

① Pavimento Cerámico tomado con pasta cola = tile flooring laid with adhesive

② Sobre losa con tolita [illegible] tomado con mallazo = LECA concrete bed



③ Vigas de Madera = Wood Beams

④ Chapa grecada = steel profile [illegible] panel

⑤ Tablero de madera = wood board

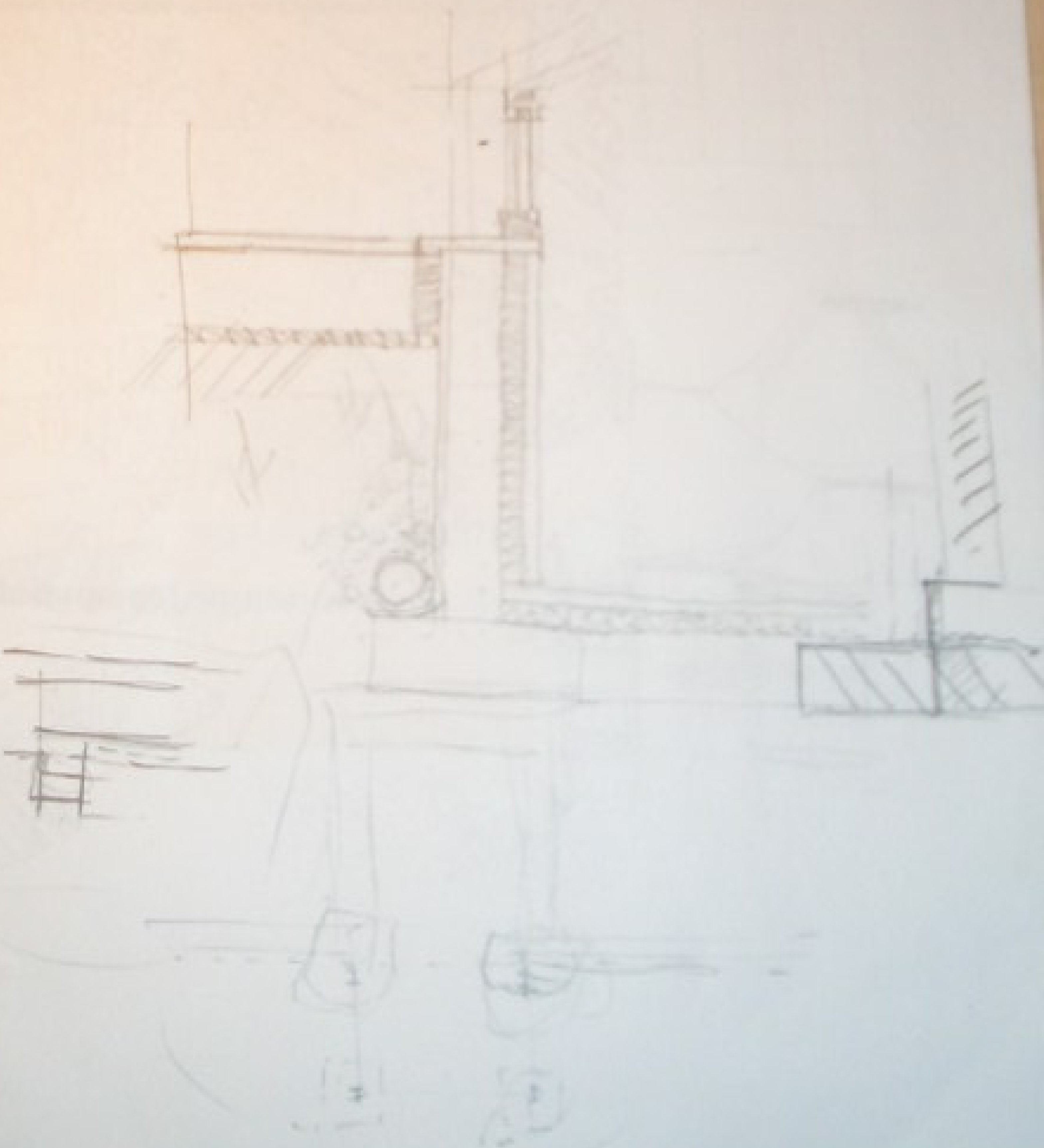
⑥ Fijación mecánica de chapa sobre tablero + viga = fixing steel screws

⑦ Aislamiento térmico y acústico = Insulation (thermal and acoustic)

⑧ Tirantes = fixing stud

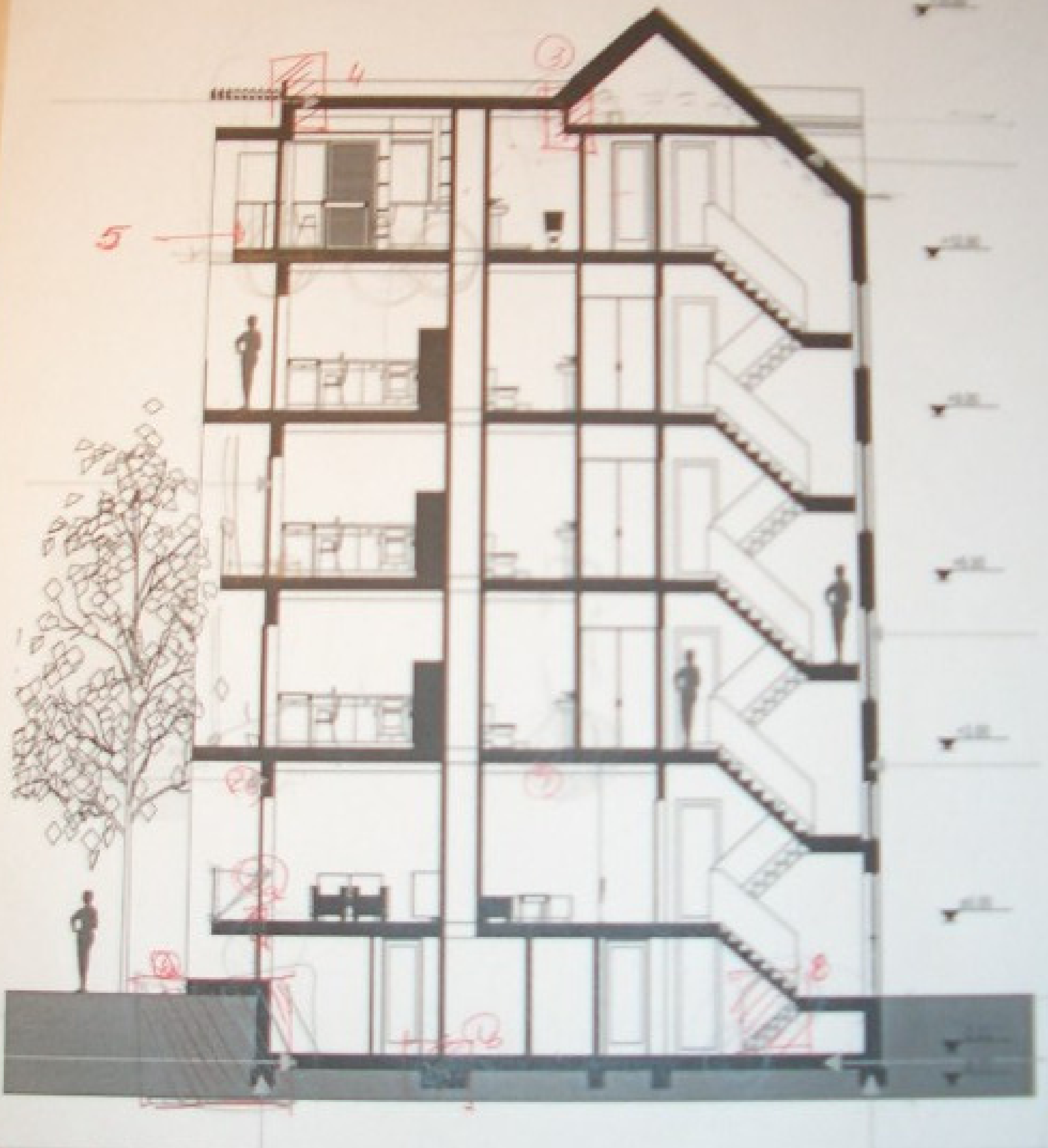
⑨ Placa techo = Plaster board

- Green Roof
- connection old/New Roof
- connection New wall/old
- Ext. / Int wall



(8) Stair Detail

(9) Floor Partition + Ceiling + Wet Rooms



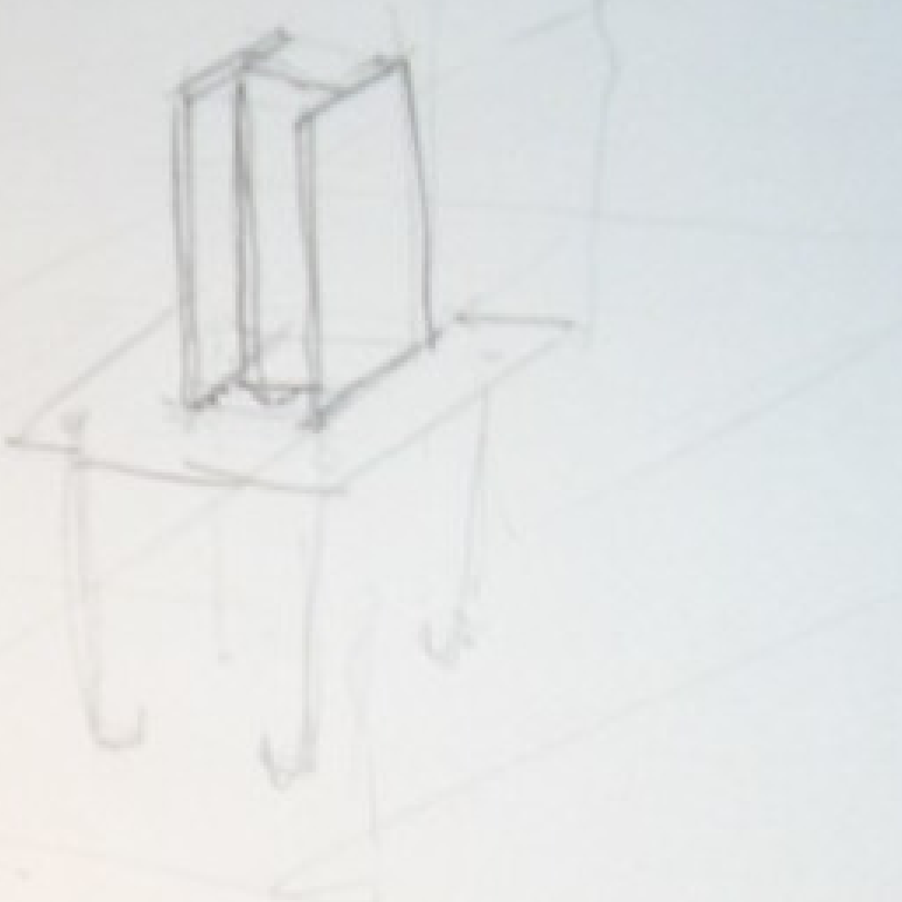
(1) Stability New Extension

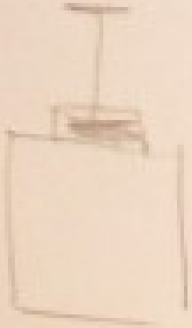
(2) Balconies: Thermal Breaking – Design – Overhang

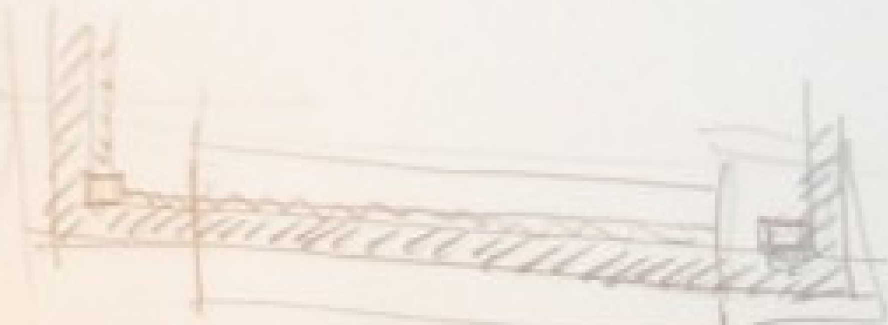
(3) Roof Extension + Existing Roofing Collar Tie + Stability of roof parts

(4) Connection Roof Extension + External Wall

(5) Roof Terrace in the Penthouse Floor







14.861
641

14.500

4535

2451

146

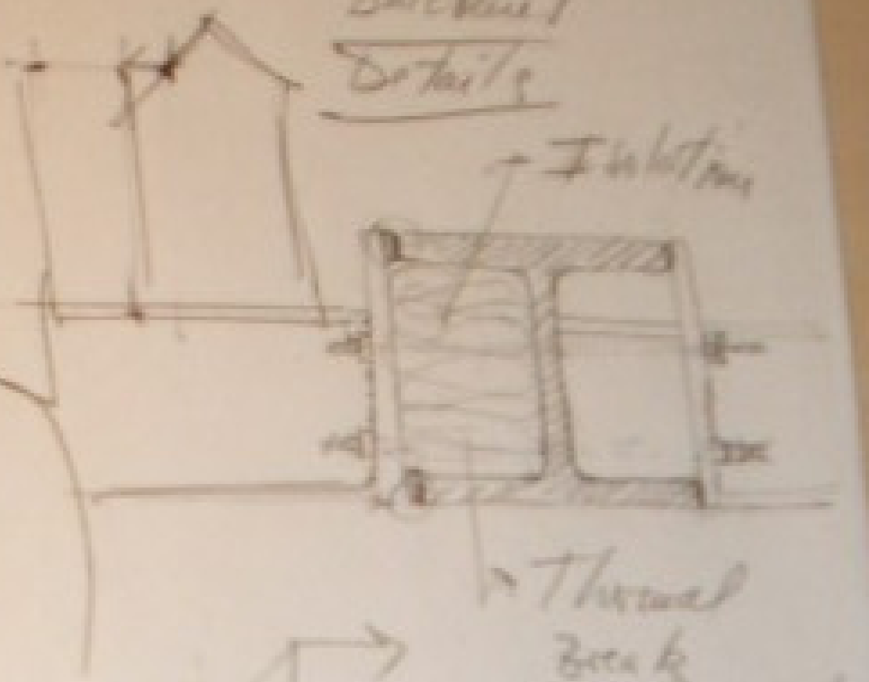
5.871

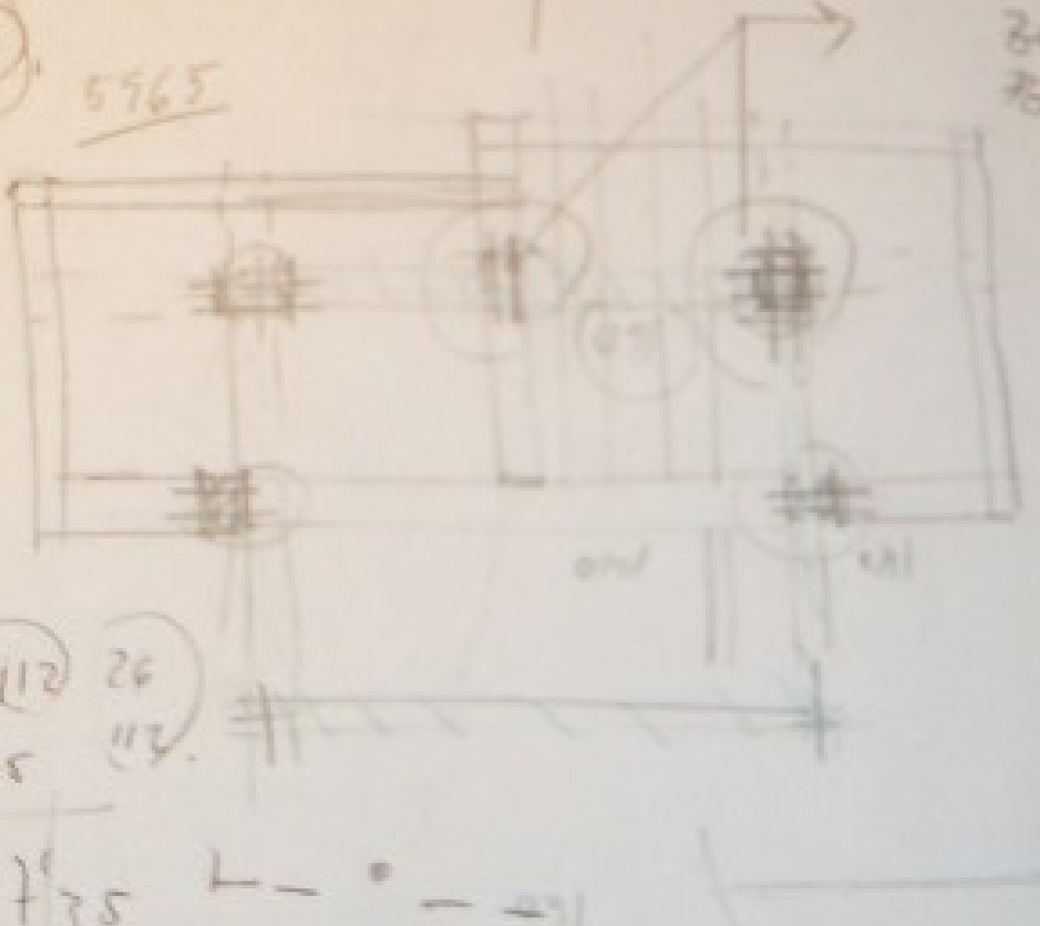
2601 2585

220

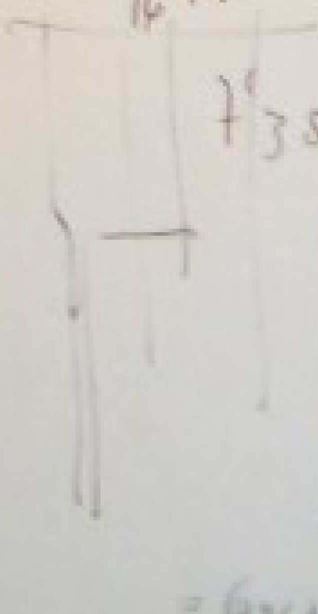
5565

2108



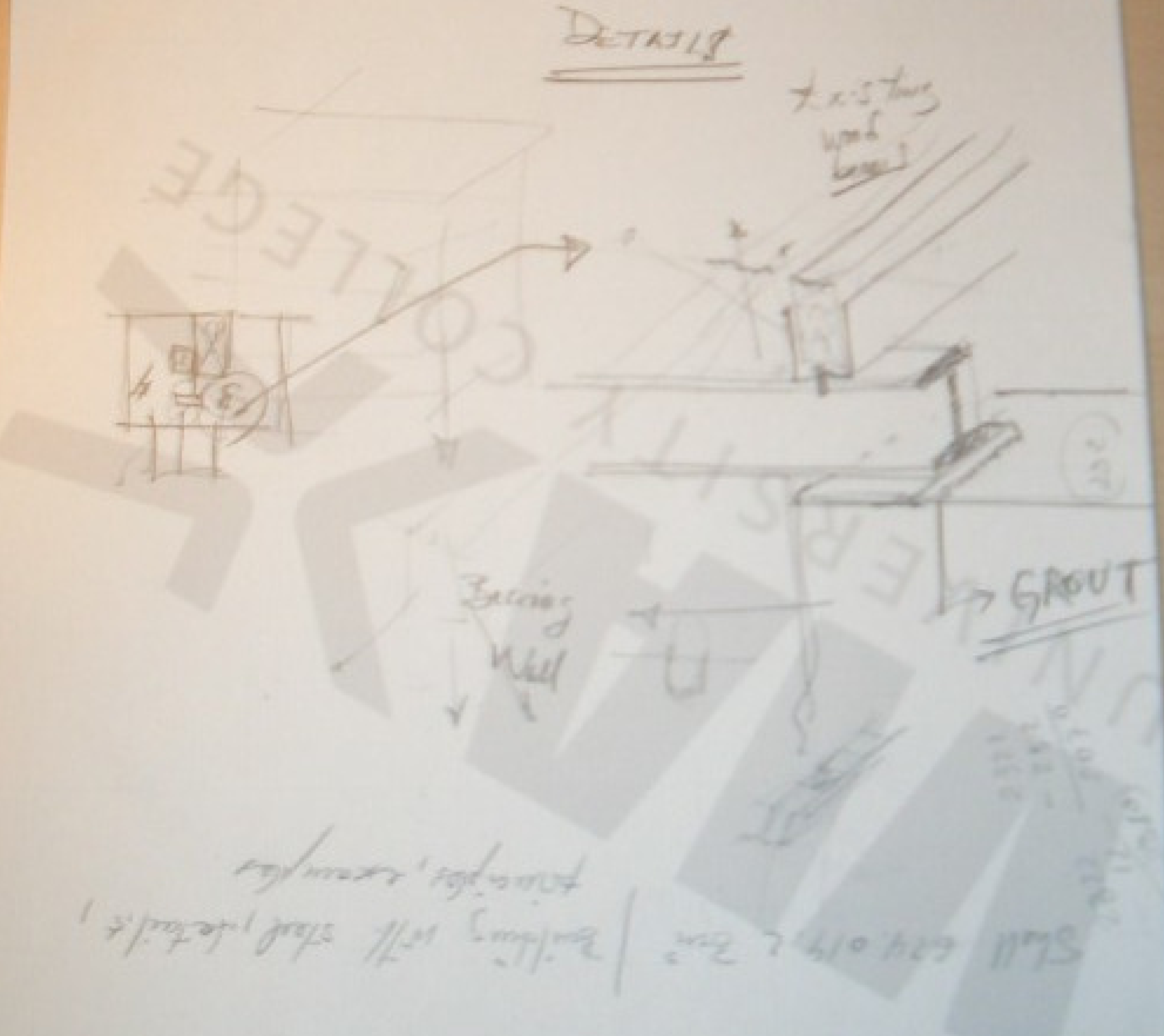


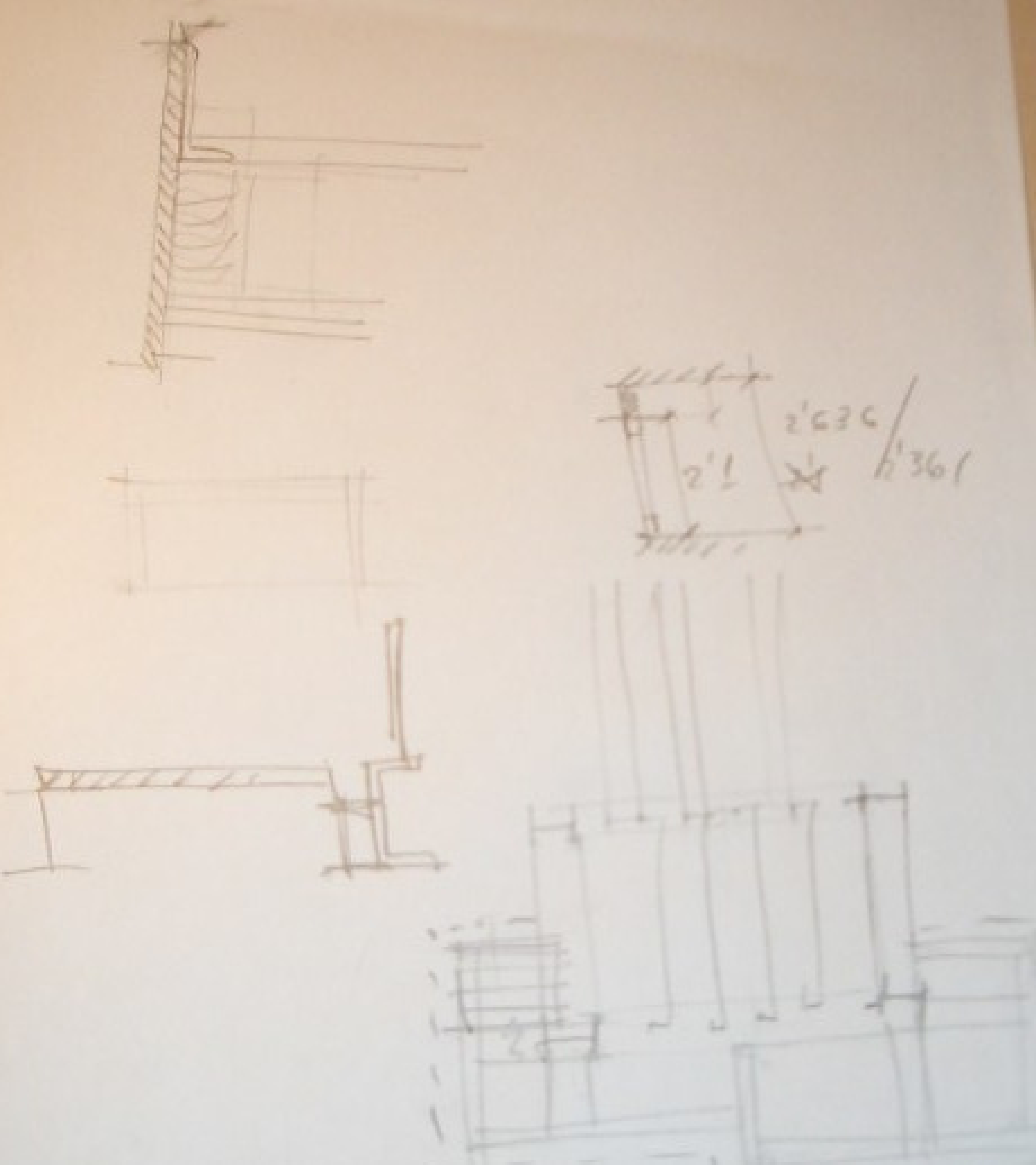
112 26
2585 1645 112



7'35

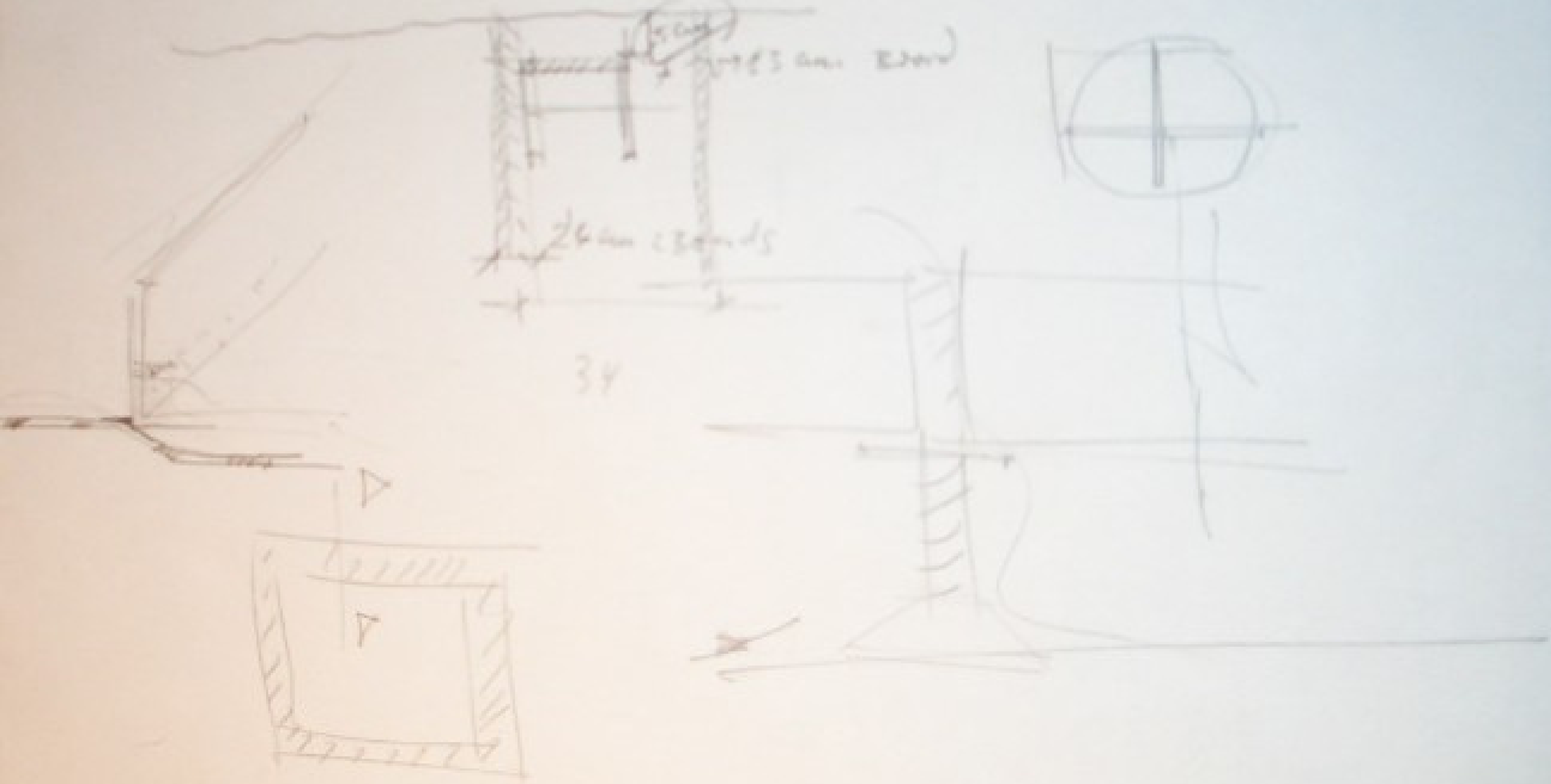
Ilirian Tanitoney Bhat
Valentina Afiana Bay
Arnaldo Landirer Taburga
Fredrik Kramer Lawson
= 641 + CN
Group 01. BK52E

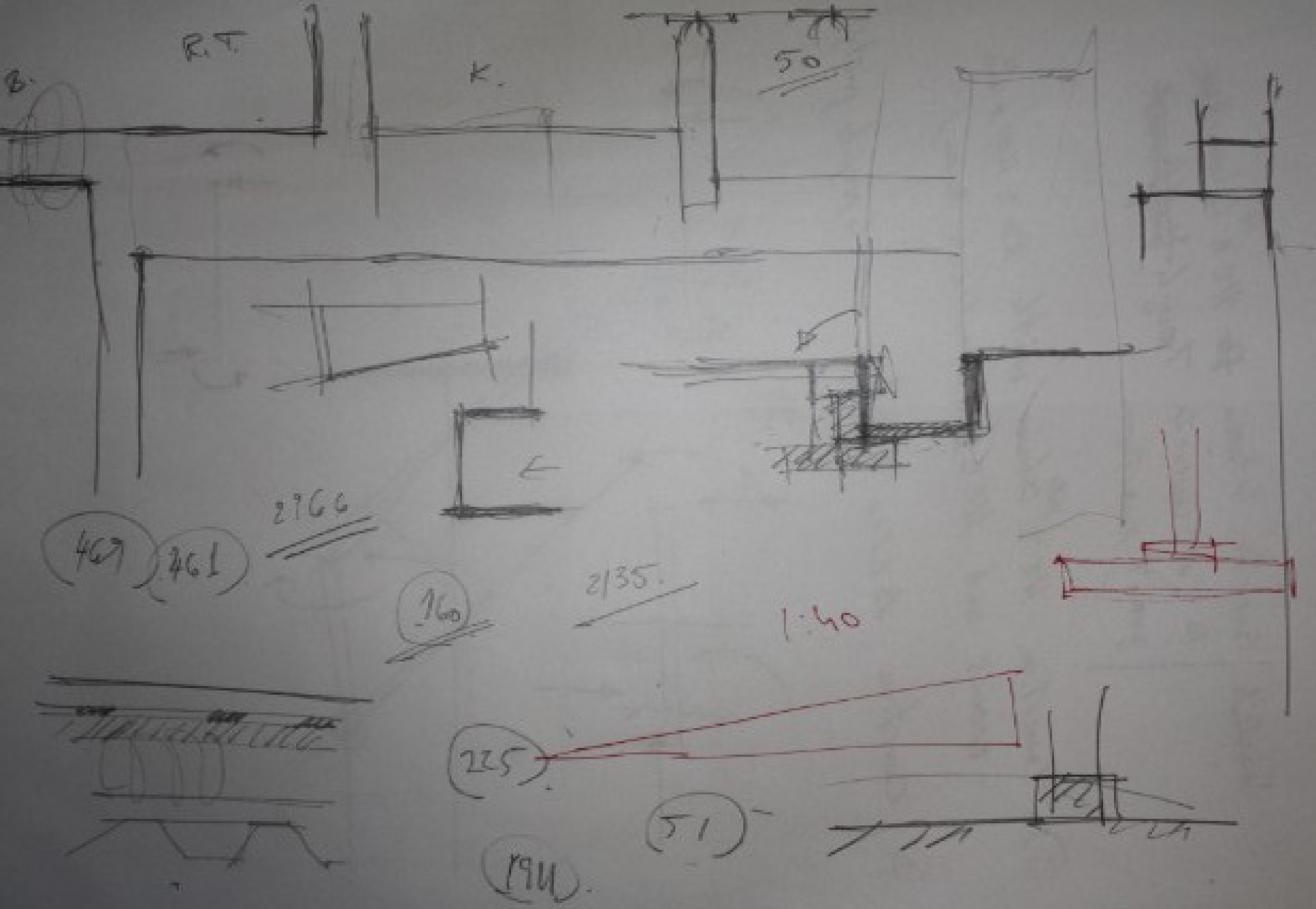

DETAILS
GROUT
Bearing Wall


2'636
1'361
2'1

H150 ... Column and Timber Beams

Velfac (Velux)

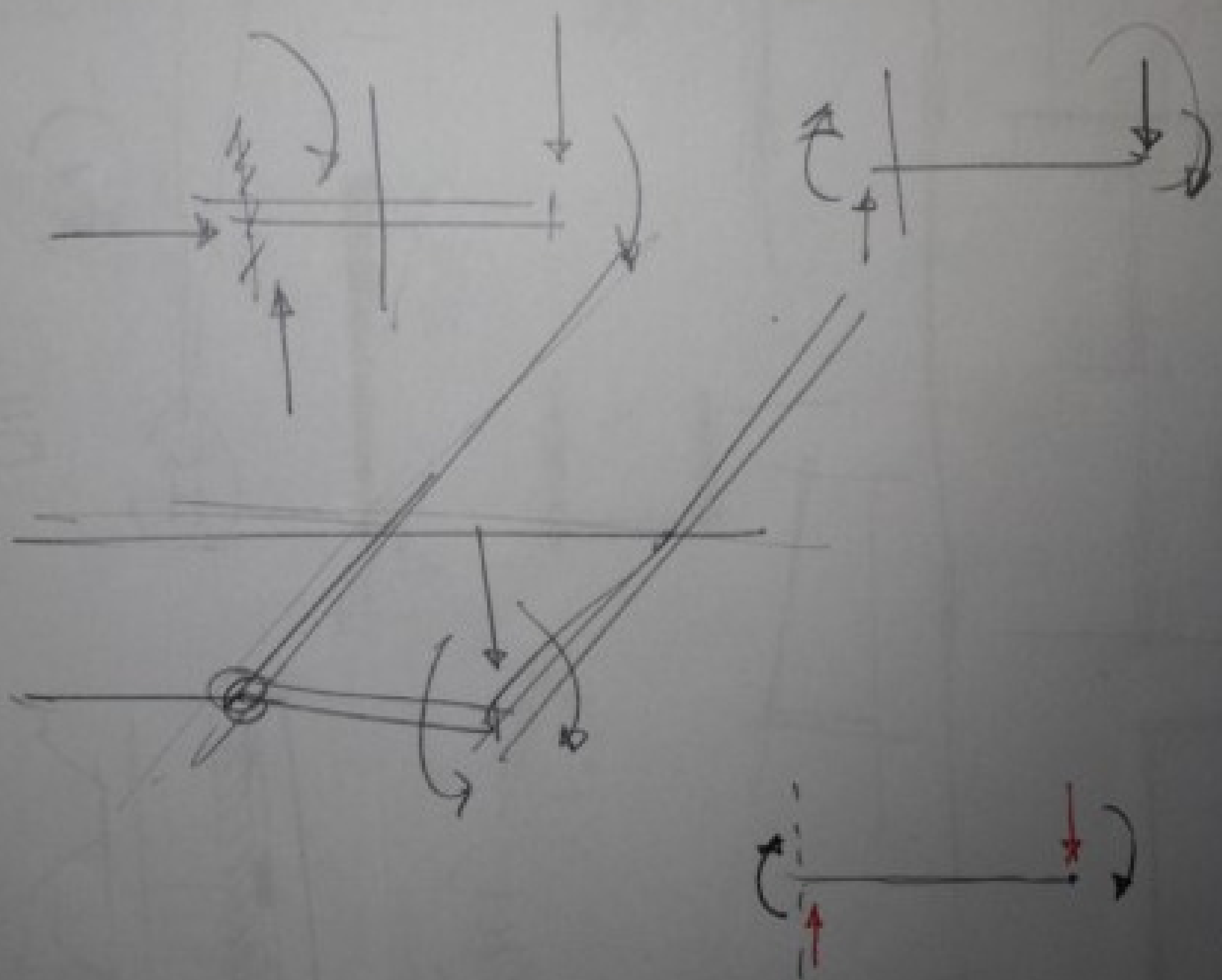


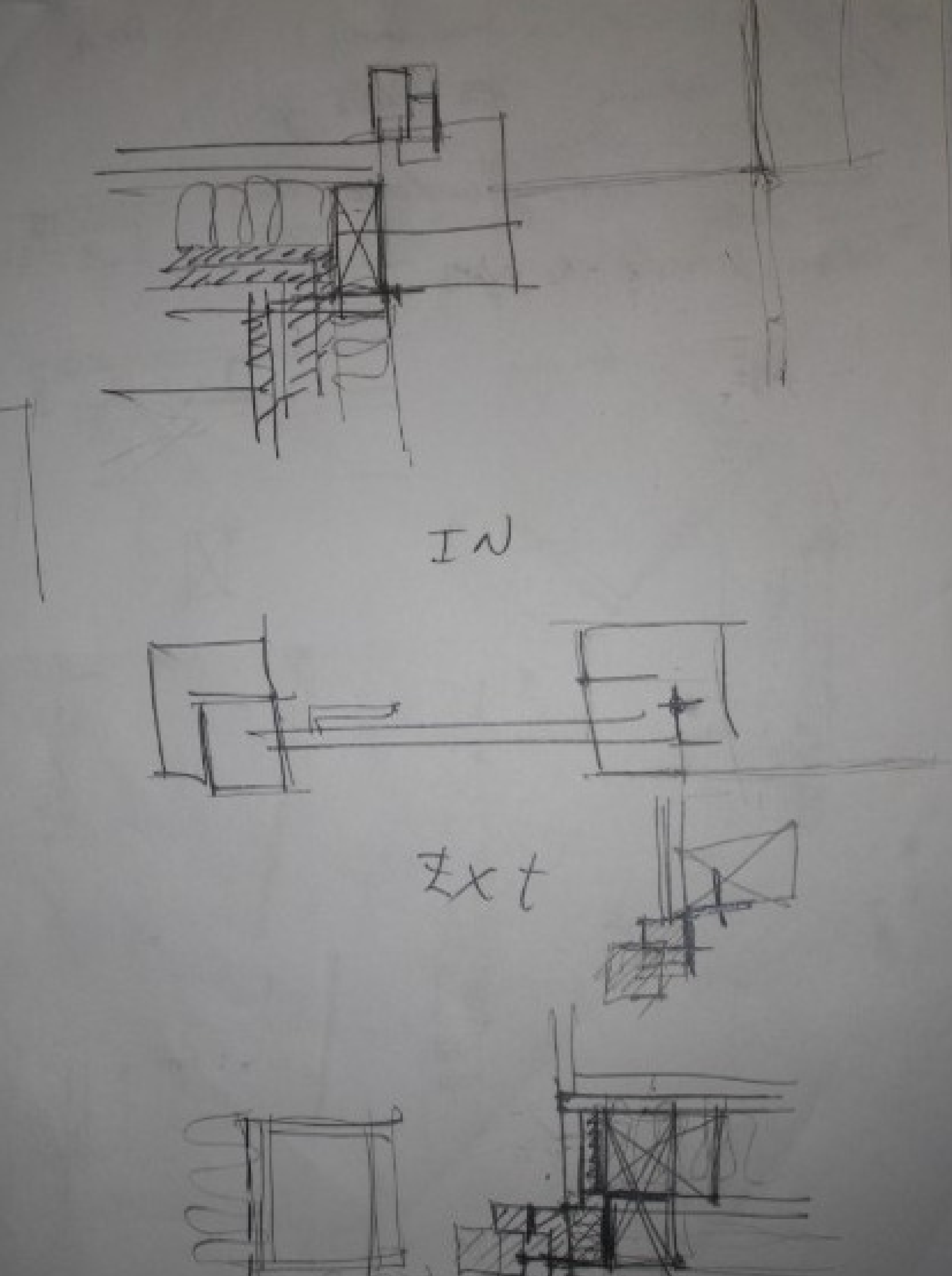

B.
R.T.
K.
50
2966
469
461
160
2135.
1:40
225
51
194

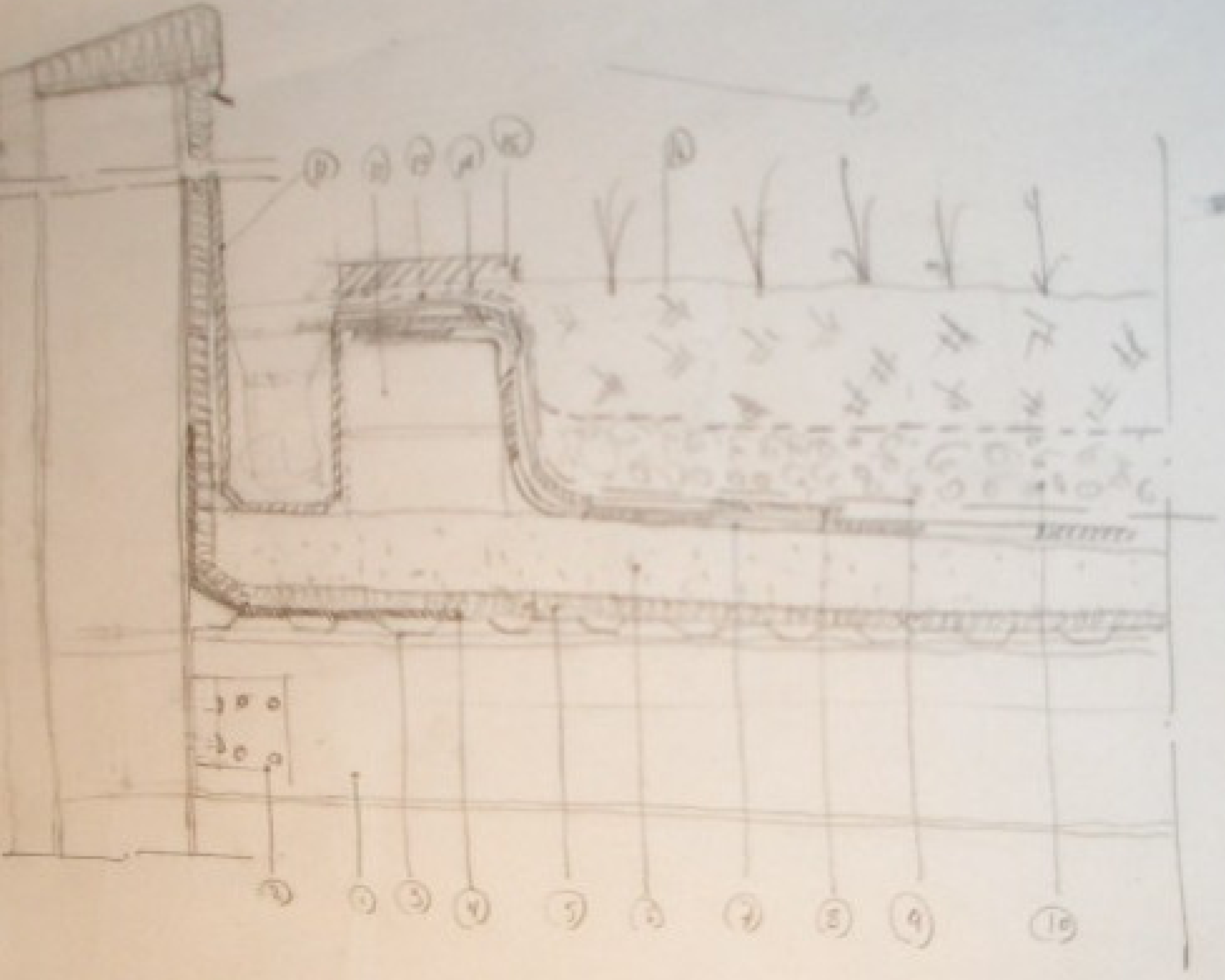
(1) ~~[illegible]~~ | Conection between ~~[illegible]~~ HEB 160 Column ~~[illegible]~~ to cast concrete Trough ~~[illegible]~~ grout mortar

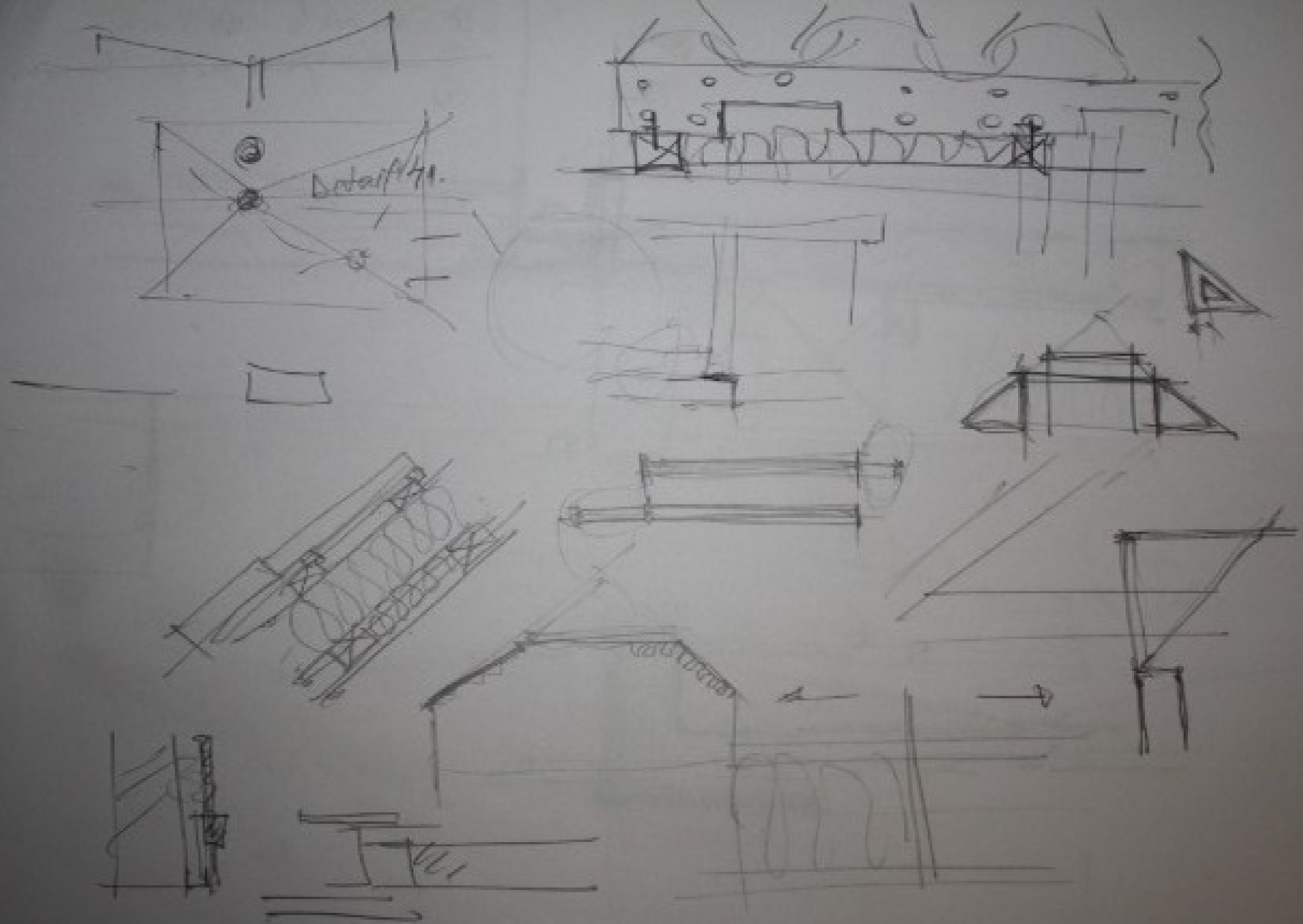
(2) Conection HEB 160 column with HEB 160 main beams and HEB 120 cantilever beams.

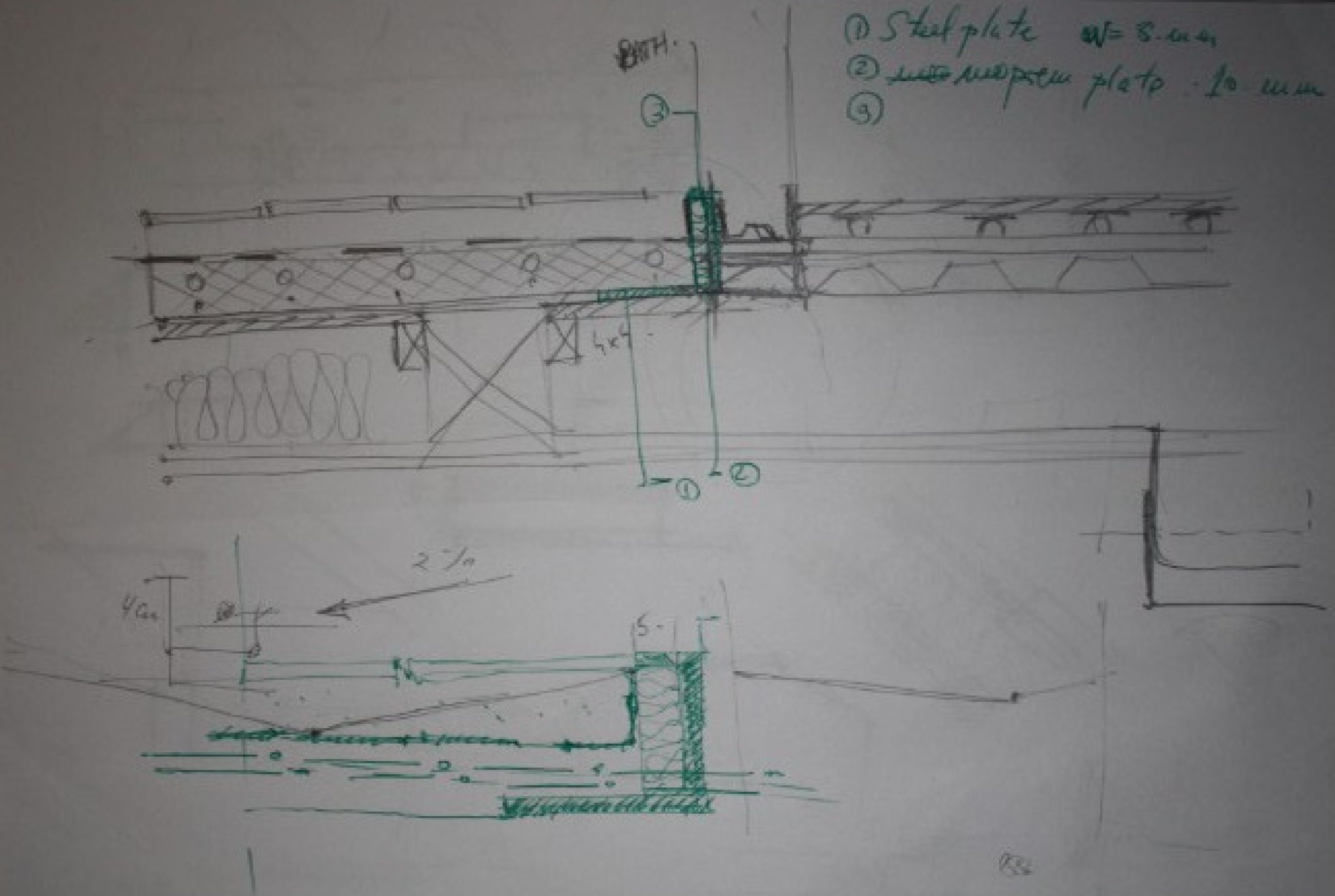
(3) Conection HEB 120 cantilever and C profile joint

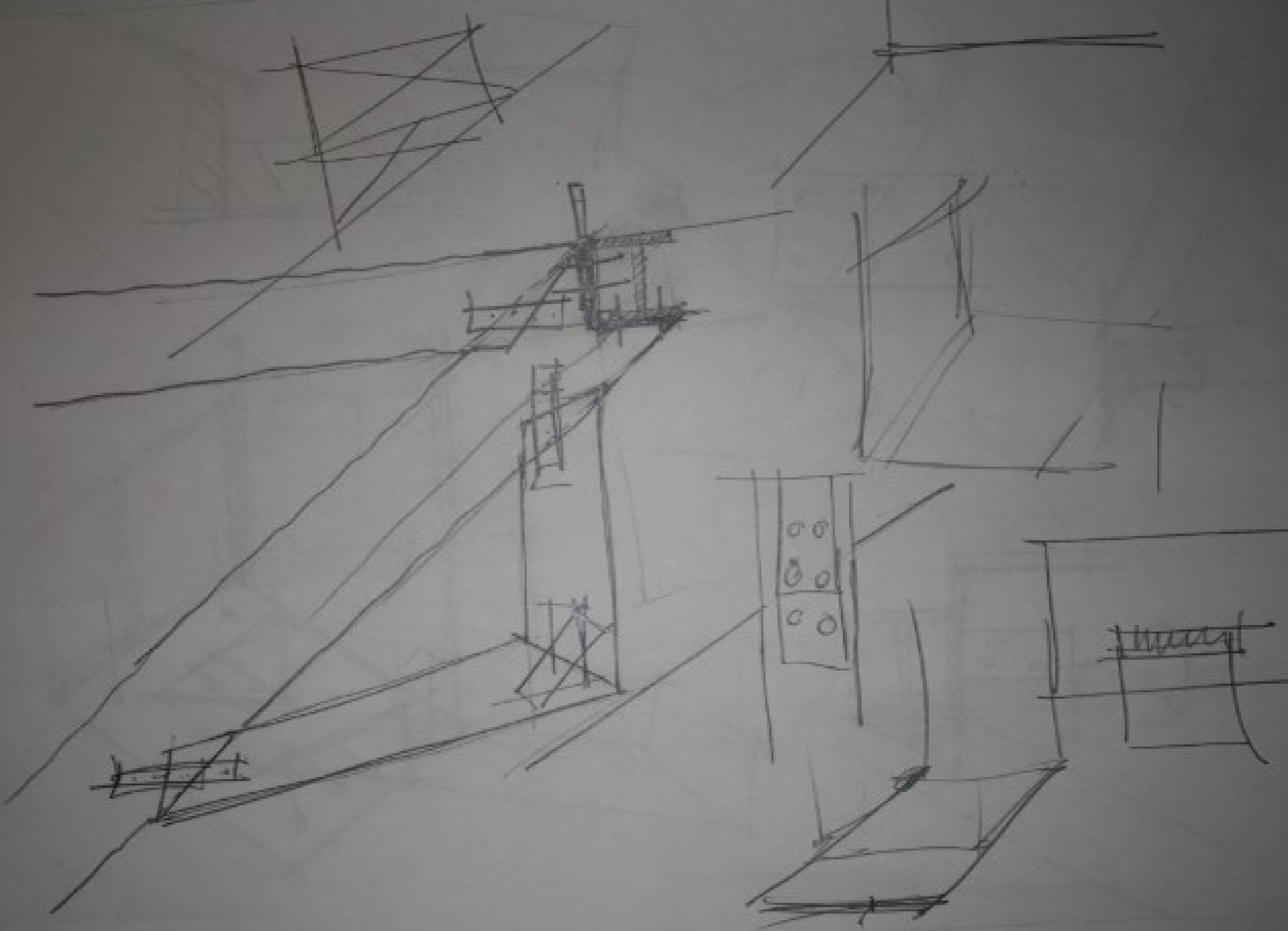


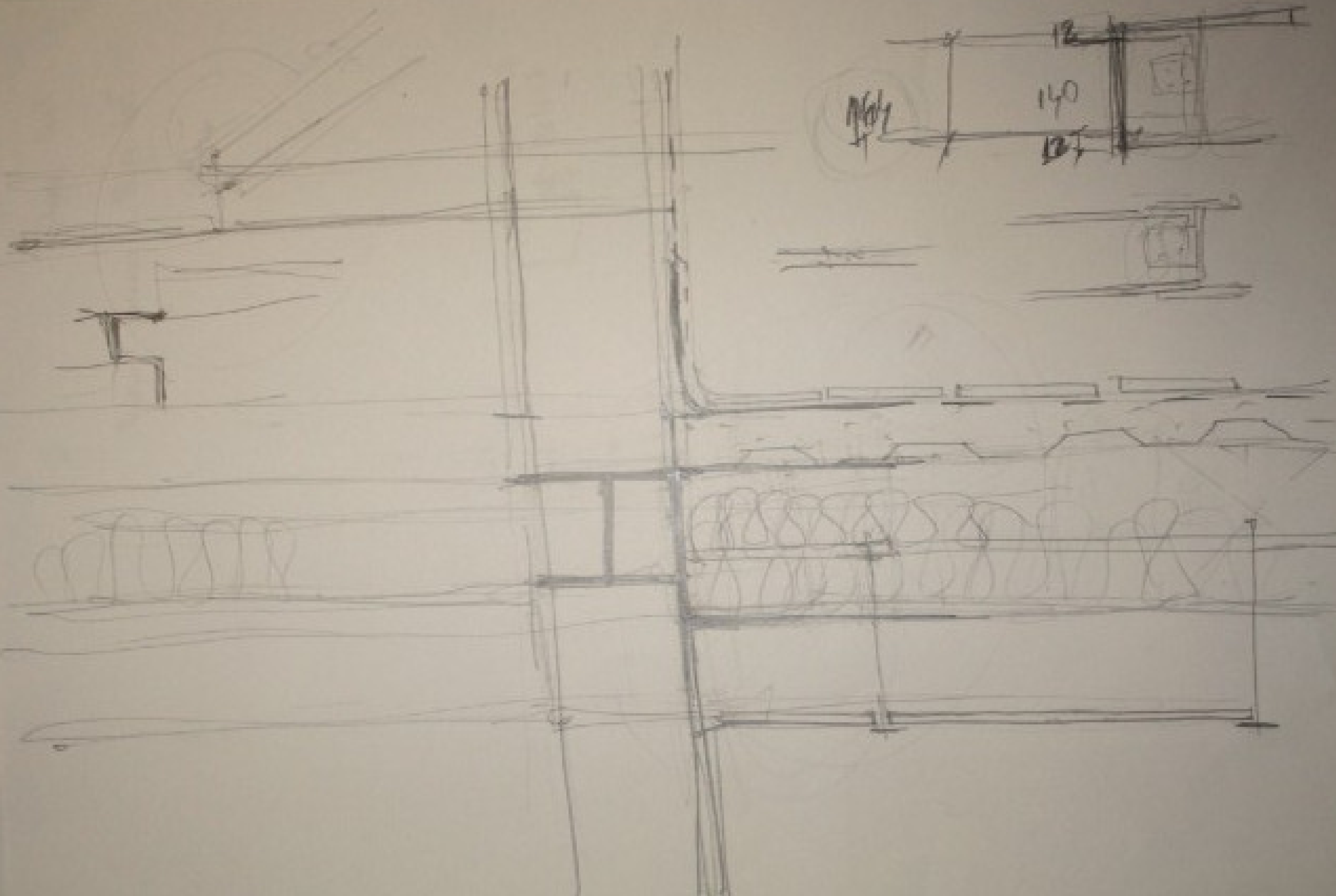

IN
Ext


2
1
3
4
5
6
7
8
9
10

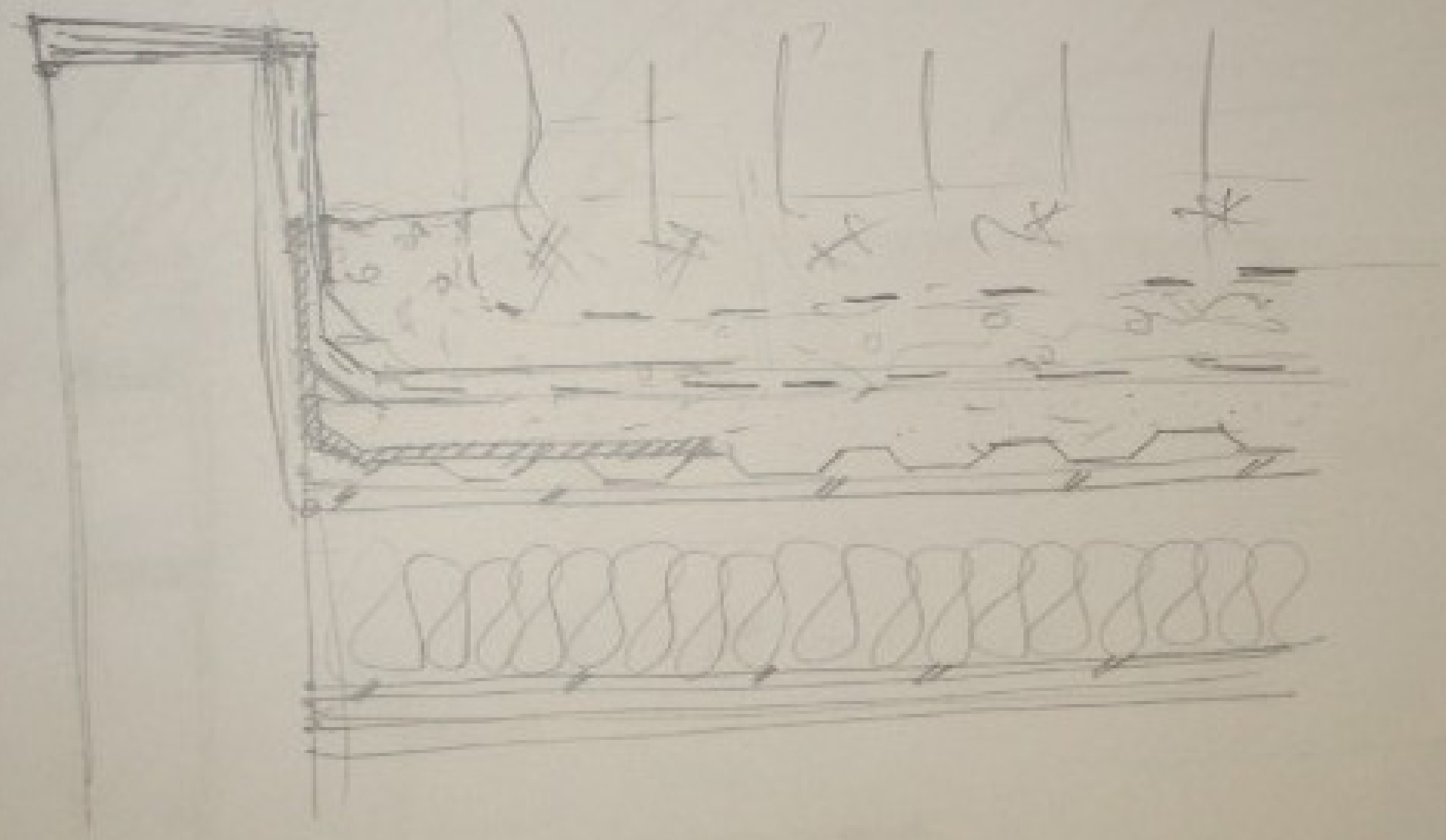


Detail 1/1.


① Steel plate W= 8. mm
② plate · 10. mm
③
BATH.
4x4
2%
4cm
5.



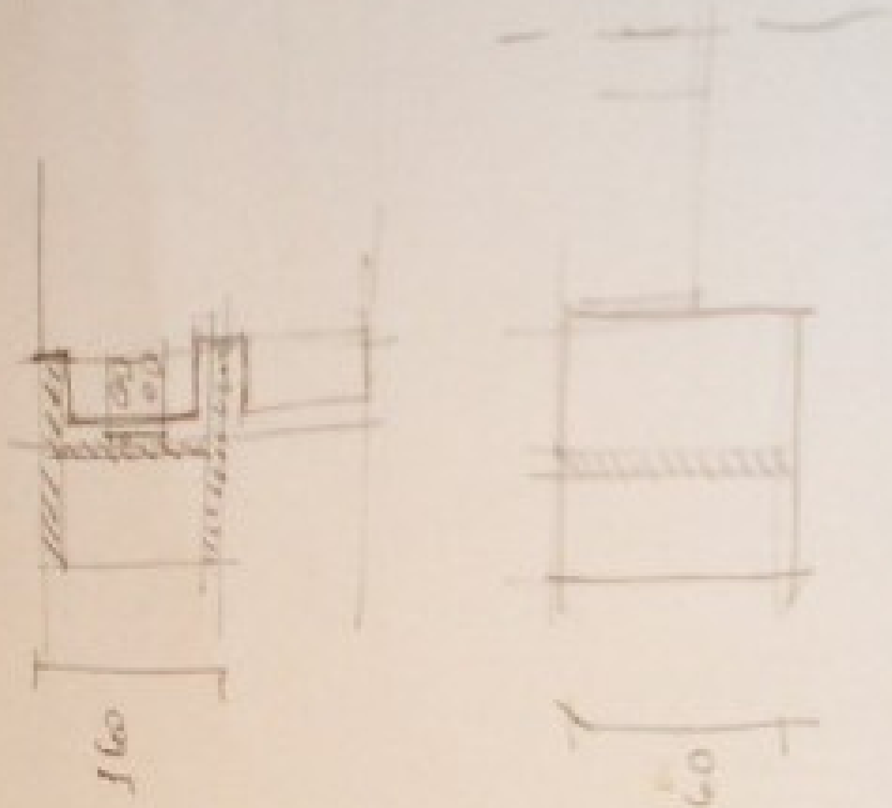

140

EINDHOVEN 权



Leca
cladding
walls
windows

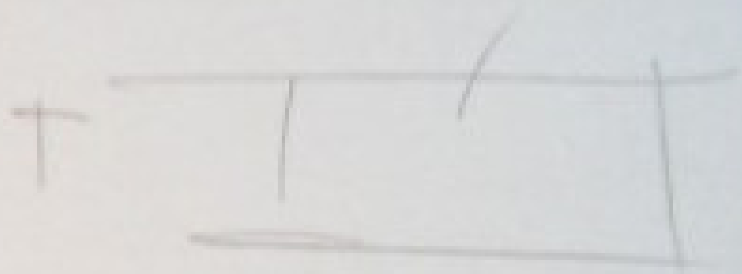
250



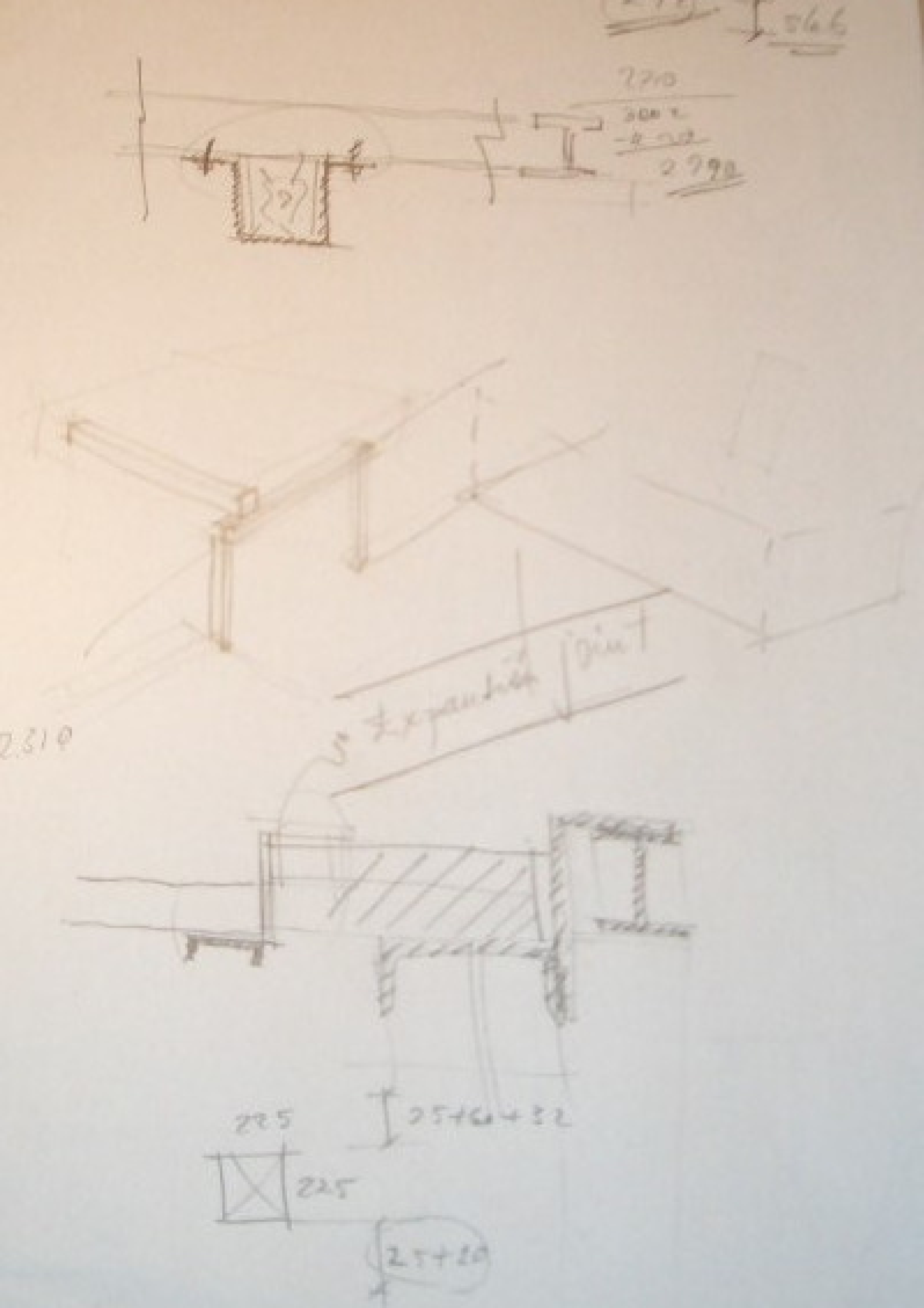
Building
① Time planning

① Scaffolding
② Building site
③ statical analysis

22



draft 18
17


2790
Expansion joint
225
225
25+20

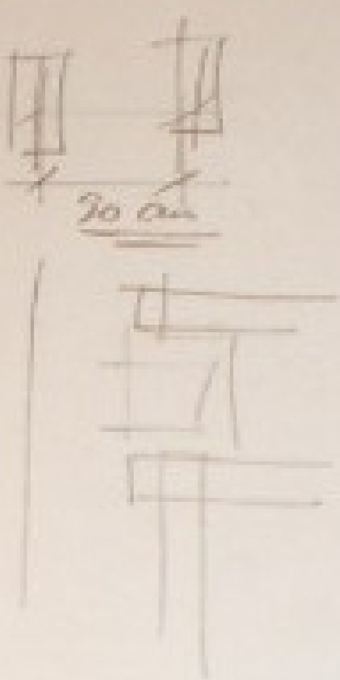
1 inch = 25'4 mm

9' = 9x25'4 = 228'6 mm ≈ 22'86 cm

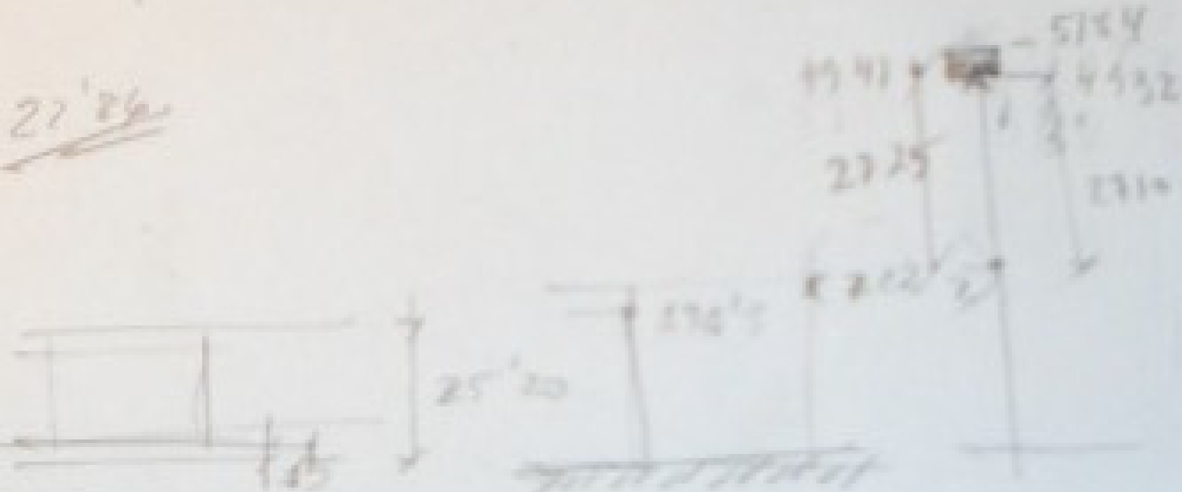
and 5 cm of lenght

22'86 → 228'6 mm

11'43 → 114'3 mm



22'86



H+15

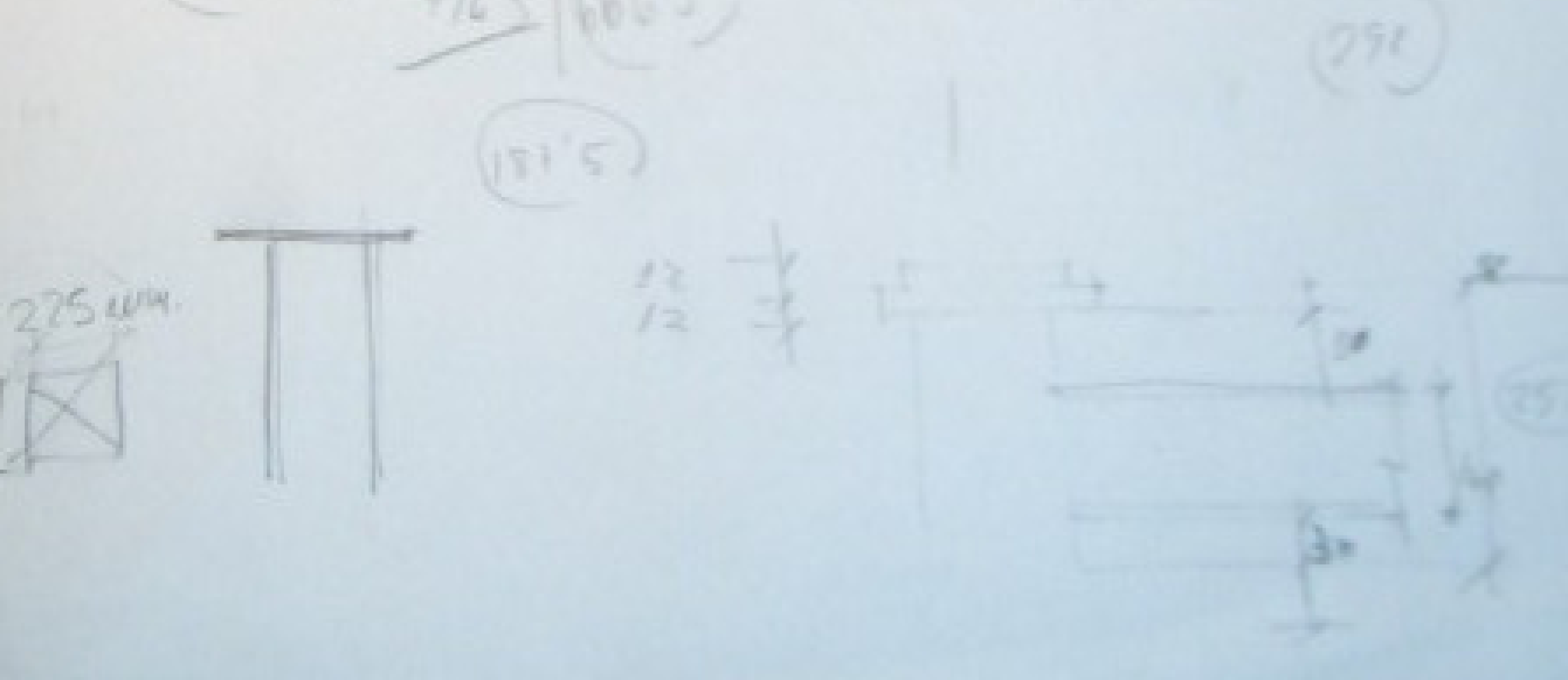
7163 | 6663

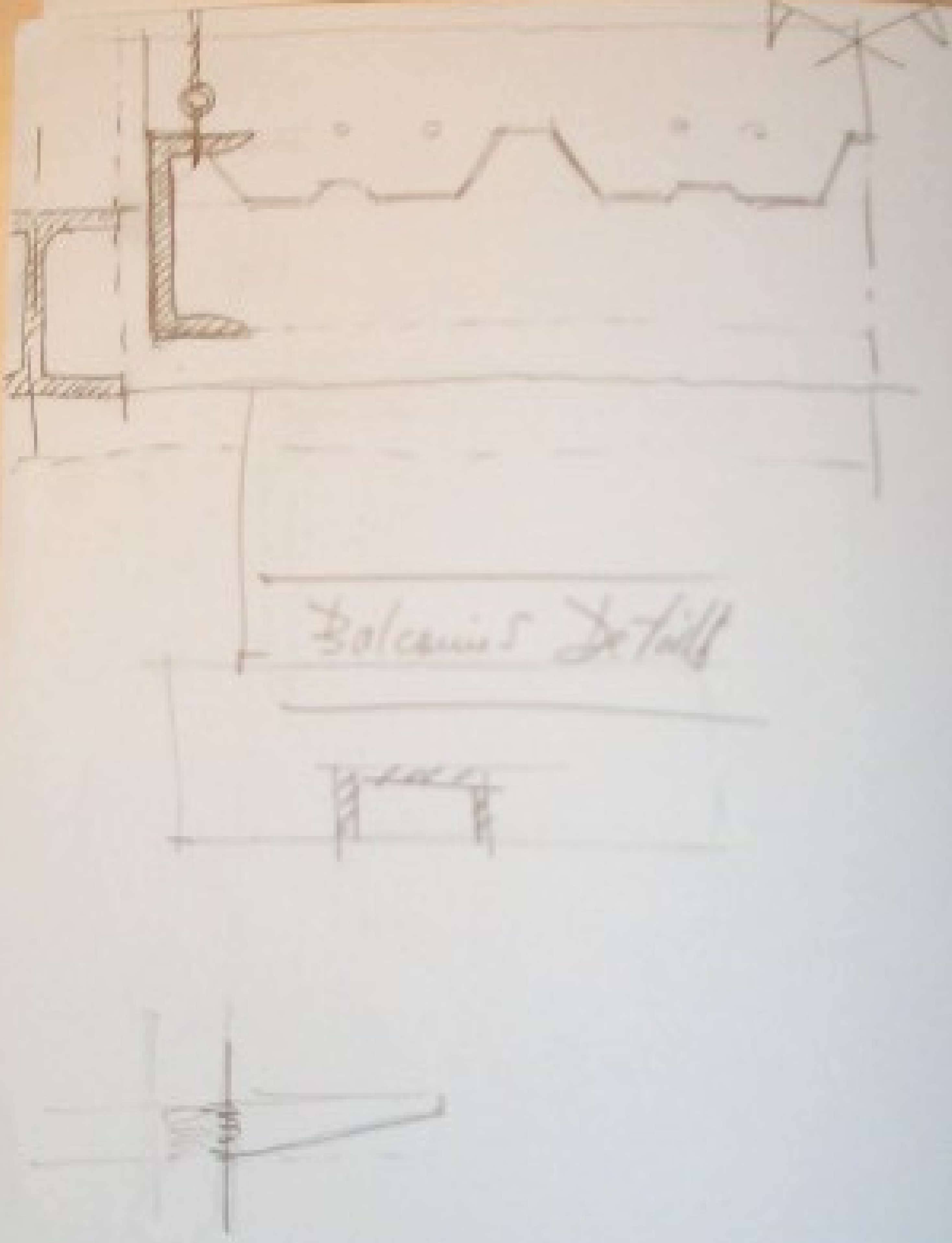
360

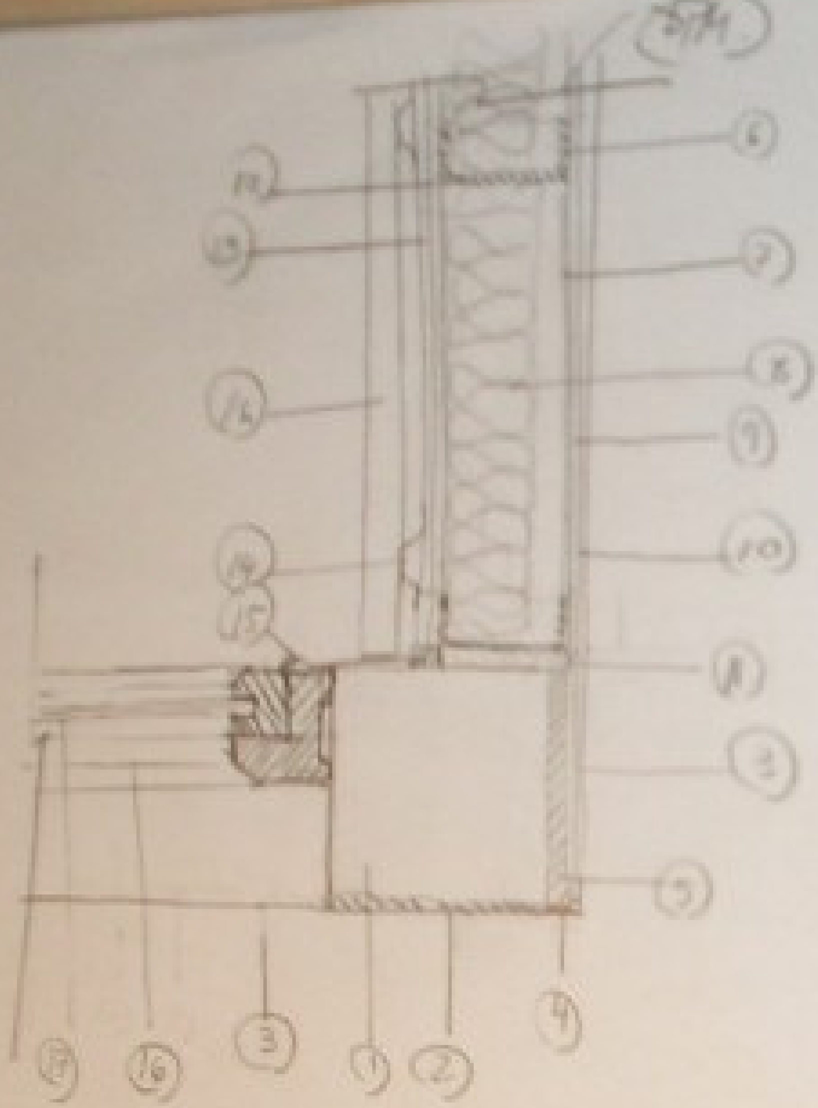
187'5

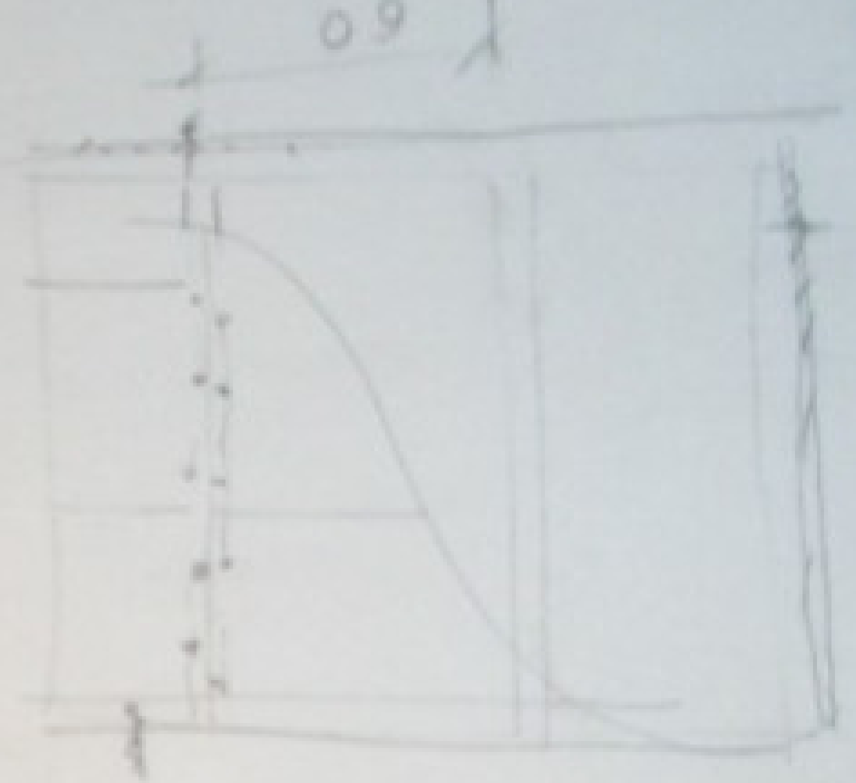
252

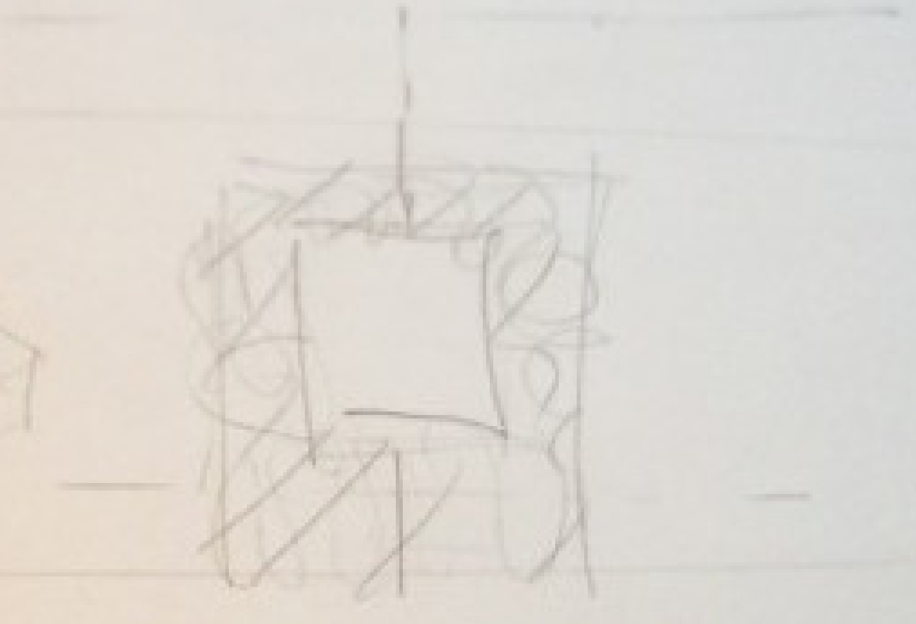
225 mm.

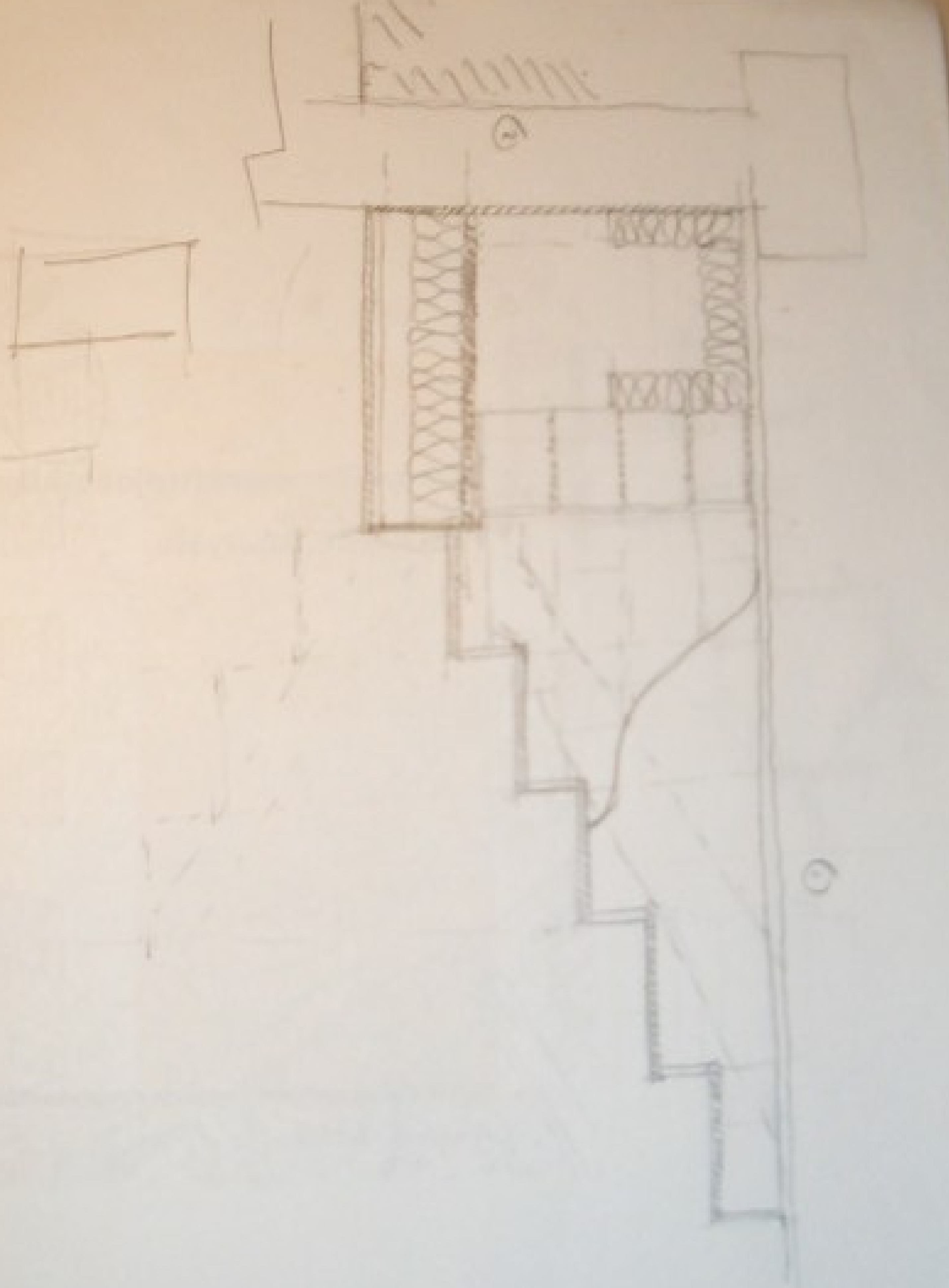



Balconies Detail

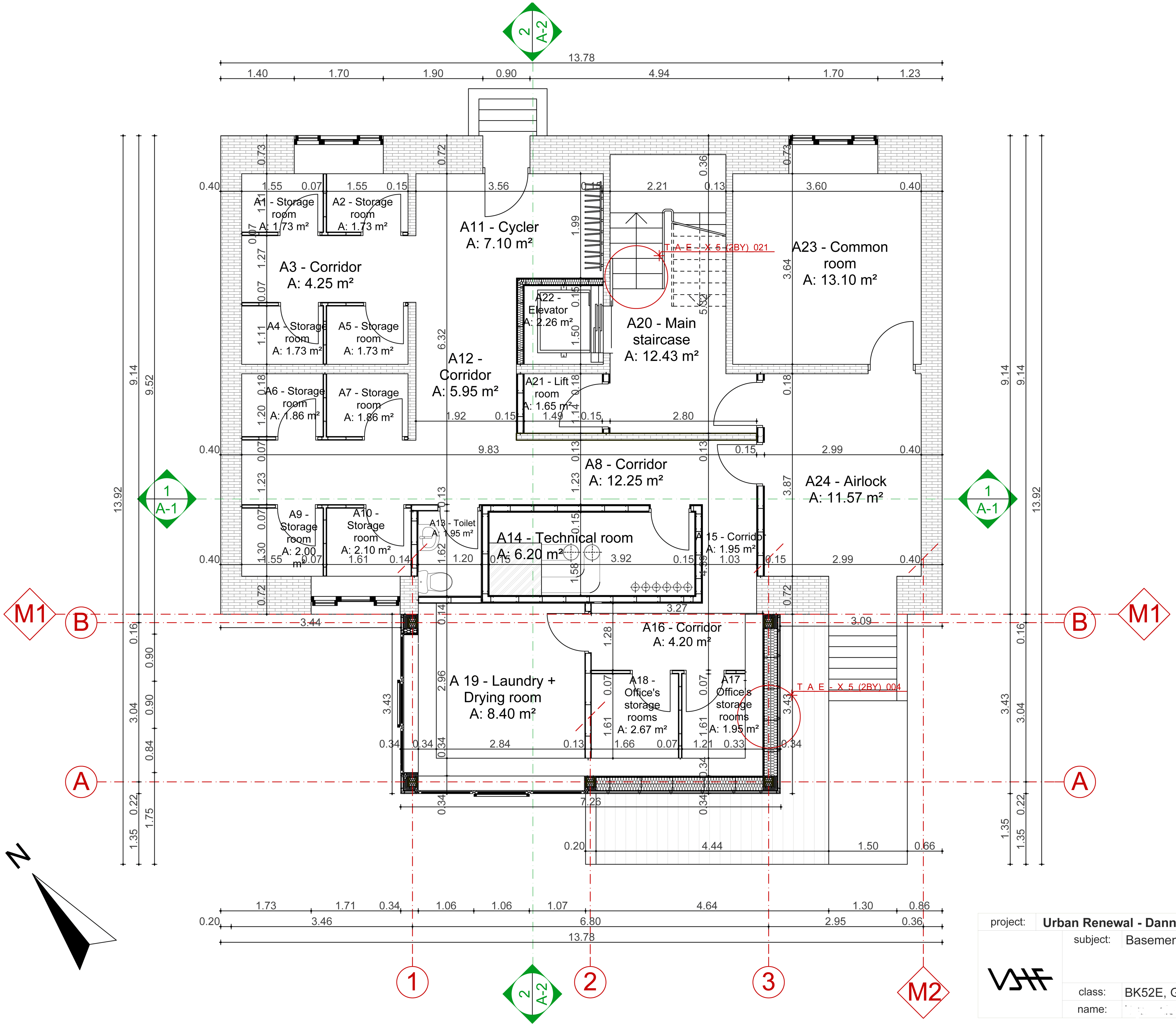








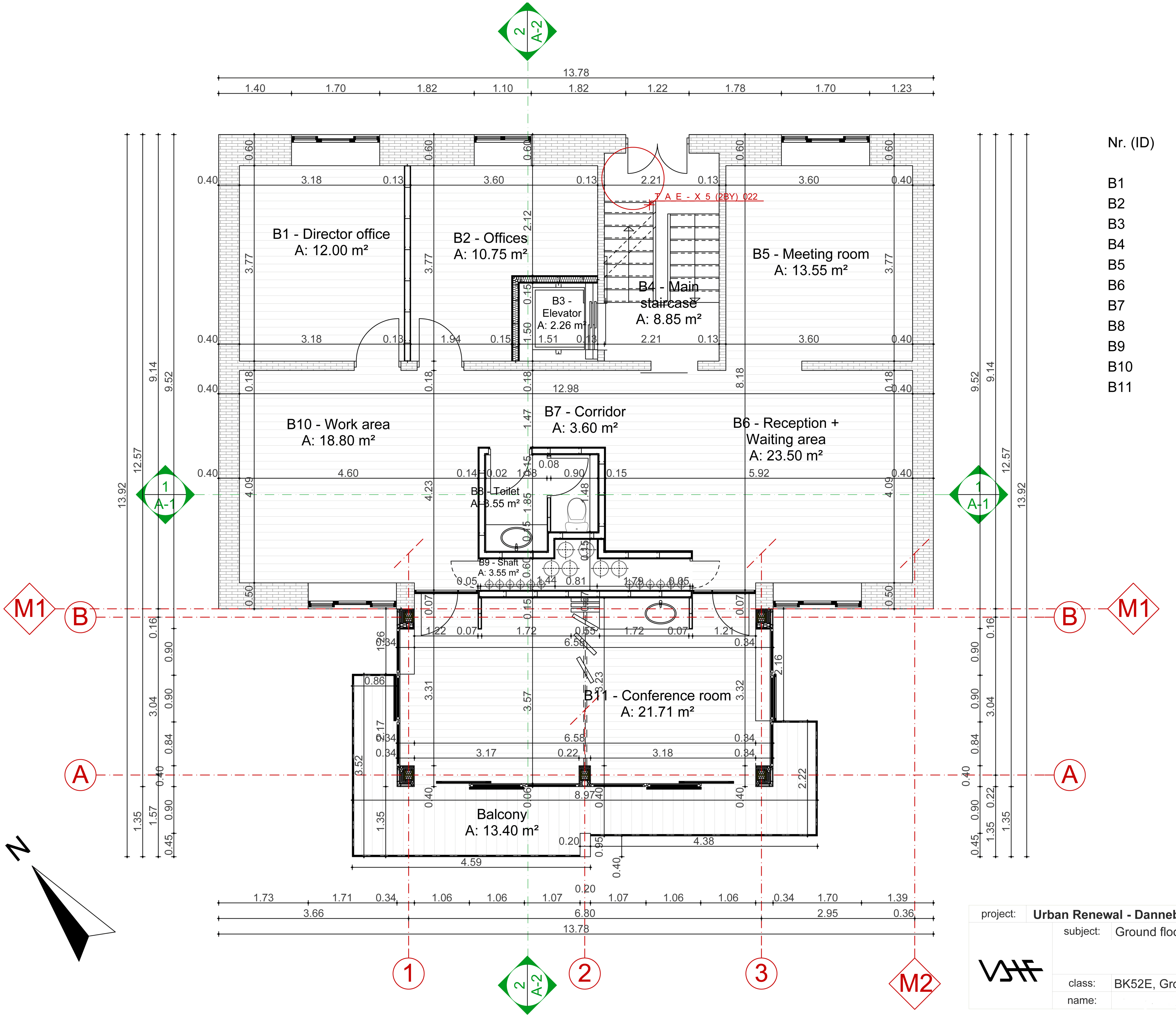
825 / 905



Nr. (ID)	Name of the room	Area (m²)
A1	Storage room	1.73
A2	Storage room	1.73
A3	Corridor	4.25
A4	Storage room	1.73
A5	Storage room	1.73
A6	Storage room	1.86
A7	Storage room	1.86
A8	Corridor	12.25
A9	Storage room	2.00
A10	Storage room	2.10
A11	Cycler	7.10
A12	Corridor	5.95
A13	Toilet	1.95
A14	Technical room	6.20
A15	Corridor	1.95
A16	Corridor	4.20
A17	Office storage room	1.95
A18	Office storage room	2.67
A19	Laundry and Drying room	8.40
A20	Main staircase	12.43
A21	Lift room	1.65
A22	Elevator	2.26
A23	Common room	13.10
A24	Airlock	11.57
	Total	112.62

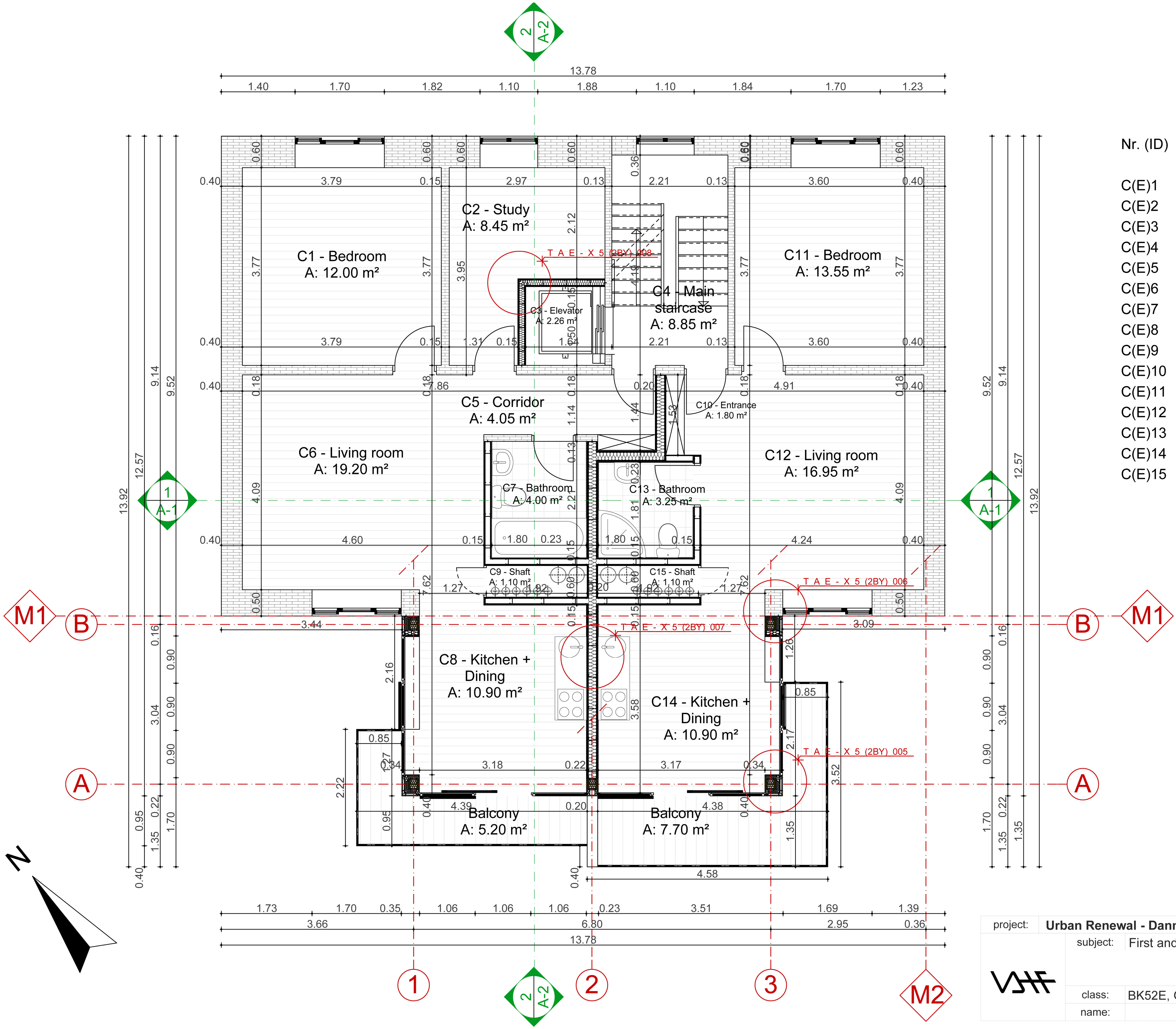
project: **Urban Renewal - Dannebrogsgade 4, Aarhus**
subject: Basement plan
class: BK52E, Group 01
name:

date: 03.12.2009
scale: 1:50
phase: **Scheme Design**
drawing number: T_A_E_-_X_1_(2BY)_001



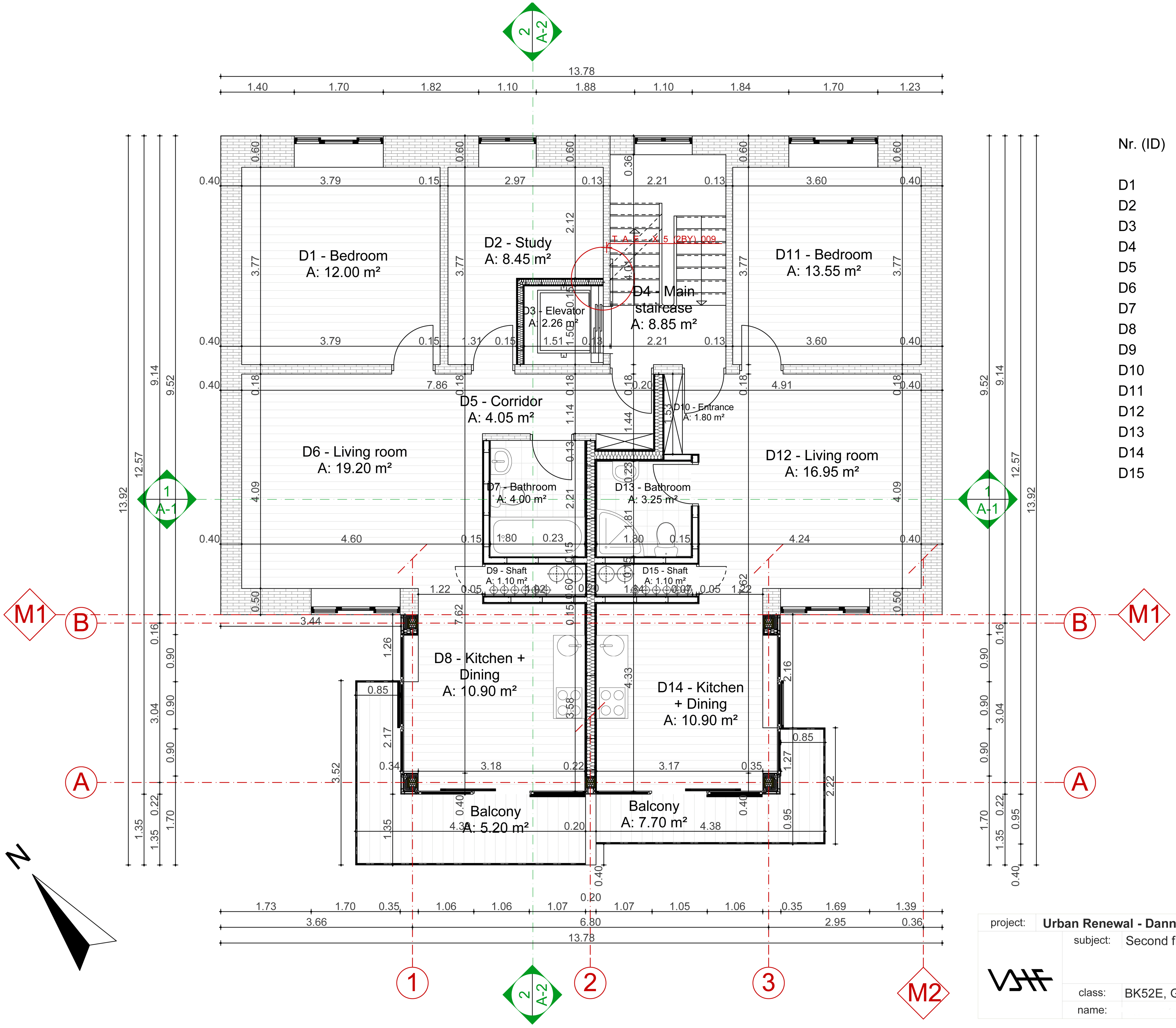
Nr. (ID)	Name of the room	Area (m²)
B1	Director office	12.00
B2	Offices	10.75
B3	Elevator	2.26
B4	Main staircase	8.85
B5	Meeting room	13.55
B6	Reception + Waiting area	23.50
B7	Corridor	3.60
B8	Toilet	3.55
B9	Shaft	2.73
B10	Work room	18.80
B11	Conference room	21.71
	Total	121.23

project:	**Urban Renewal - Dannebrogsgade 4, Aarhus**	date:	03.12.2009
subject:	Ground floor plan	scale:	1:50
		phase:	**Scheme Design**
class:	BK52E, Group 01	drawing number:	T_A_E_-_X_1_(2BY)_002
name:			



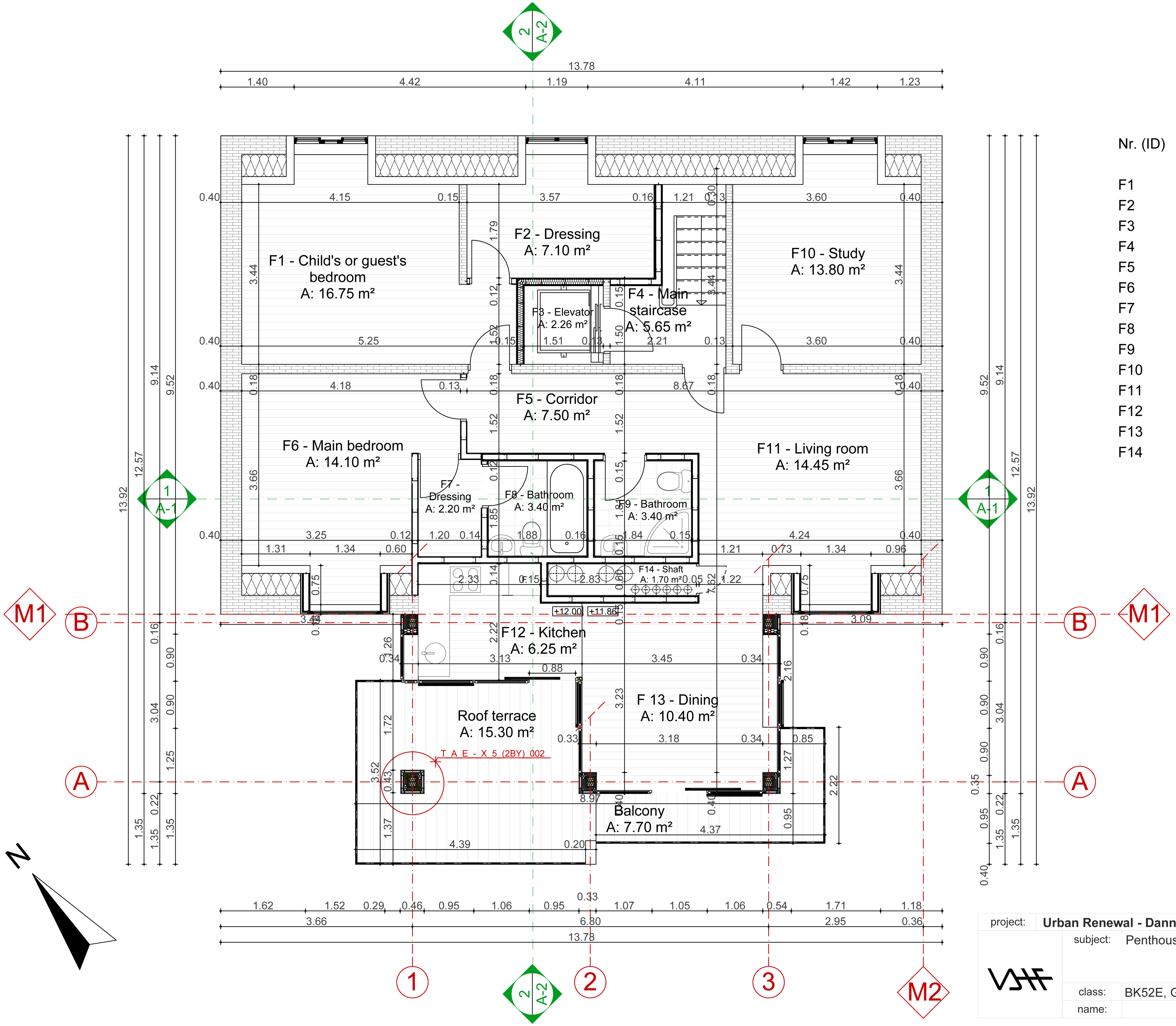
Nr. (ID)	Name of the room	Area (m²)
C(E)1	Bedroom	12.00
C(E)2	Study	8.45
C(E)3	Elevator	2.26
C(E)4	Main staircase	8.85
C(E)5	Corridor	4.05
C(E)6	Living room	19.20
C(E)7	Bathroom	4.00
C(E)8	Kitchen + Dining room	10.90
C(E)9	Shaft	1.10
C(E)10	Entrance	1.80
C(E)11	Bedroom	13.55
C(E)12	Living room	16.95
C(E)13	Bathroom	3.25
C(E)14	Kitchen + Dining room	10.90
C(E)15	Shaft	1.10
	Total	118.36

project:	Urban Renewal - Dannebrogsgade 4, Aarhus	date:	03.12.2009
subject:	First and third floors plan	scale:	1:50
		phase:	**Scheme Design**
class:	BK52E, Group 01	drawing number:	T_A_E_-_X_1_(2BY)_003
name:			



Nr. (ID)	Name of the room	Area (m²)
D1	Bedroom	12.00
D2	Study	8.45
D3	Elevator	2.26
D4	Main staircase	8.85
D5	Corridor	4.05
D6	Living room	19.20
D7	Bathroom	4.00
D8	Kitchen + Dining room	10.90
D9	Shaft	1.10
D10	Entrance	1.80
D11	Bedroom	13.55
D12	Living room	16.95
D13	Bathroom	3.25
D14	Kitchen + Dining room	10.90
D15	Shaft	1.10
	Total	118.36

project:	**Urban Renewal - Dannebrogsgade 4, Aarhus**	date:	03.12.2009
subject:	Second floor plan	scale:	1:50
		phase:	**Scheme Design**
class:	BK52E, Group 01	drawing number:	T_A_E_-_X_1_(2BY)_004
name:			



Nr. (ID)	Name of the room	Area (m²)
F1	Child's or guest's bedroom	16.75
F2	Dressing	7.10
F3	Elevator	2.26
F4	Main staircase	8.85
F5	Corridor	7.50
F6	Main bedroom	14.10
F7	Dressing	2.20
F8	Bathroom	3.40
F9	Bathroom	3.40
F10	Study	13.80
F11	Living room	14.45
F12	Kitchen	6.25
F13	Dining room	10.40
F14	Shaft	1.70
	Total	112.16

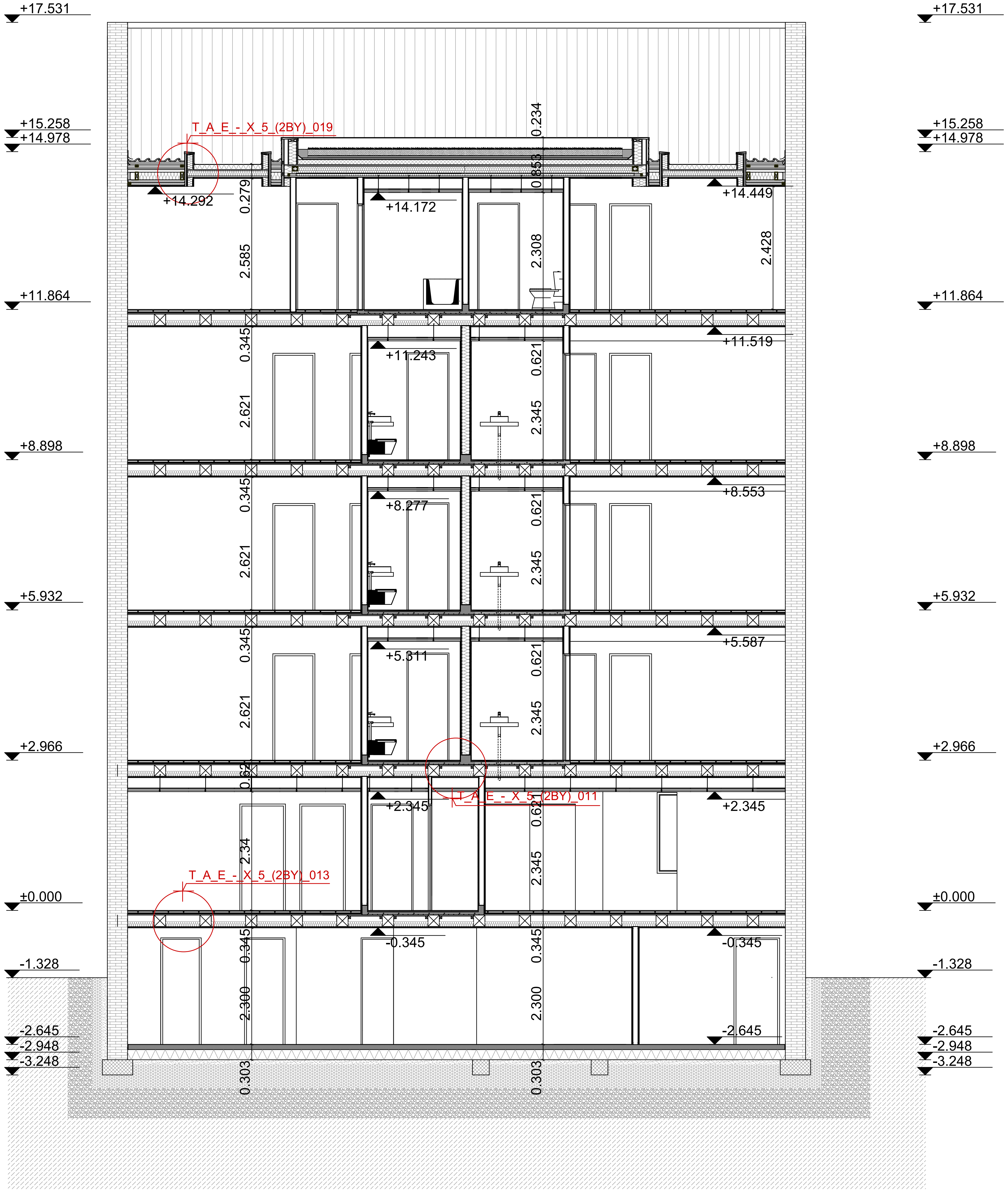
project: **Urban Renewal - Dannebrogsgade 4, Aarhus**
subject: Penthouse plan
class: BK52E, Group 01
name:
date: 04.12.2009
scale: 1:50
phase: **Scheme Design**
drawing number: T_A_E_-_X_1_(2BY)_005

Roof construction
Roof U= 0.17
Pitch 45°
Red pan tiles
Tiles fixing
Roof batten 38 x 56 mm
Pressure impregnated batten 30 x 45 mm
Wooden board 21 x 110 mm
Ventilation cavity 50 mm
Trusses 150 x 180 mm
Batten 50 x 50 mm
Damp proof membrane 2 mm
Batten 50 x 50
2 layers of mineral wool (2 x 50 mm)
2 layers of gypsum board (2 x 13 mm)

Dormer roof
2 sealing layers 4 mm
Rigid foam thermal insulation 100 mm
Vapour barrier 2 mm
Trapezoidal plate 20 mm
C-Profile 100 x 50 x 1.5 mm (cc/ 450)
Insulation 100 mm
Acoustic profile 25 mm
Fire board 15 mm
Plaster board 13 mm

Dormer wall
Fibre cement cladding 8 mm
Vertical wooden batten 25 x 35 mm
2 layers of plaster board 25 mm
C-Profile 100 x 50 x 1.5 mm (cc/ 450)
Insulation 100 mm
Damp proof membrane 2 mm
2 layers of plaster board 25 mm

Apartments floor
Wooden floor 15 mm
Aluminum heat transfer plate with joist trak panels 32 mm
2 layers of plaster board 25mm
Trapezoidal plate 20 mm
Textile membrane 1 mm
Wood joist 225 x 225 mm (cc/ 900)
Insulation 100 mm
Fire board 15 mm
Plaster board 13 mm



Wet room floor
Tiles 400 x 400 x 6 mm
Screed (for slope) 20 mm
Waterproof membrane 2 mm
Lightweight concrete (reinforced with 6mm round steel laid in a grid with 100 mm grid distance and with heating pipes) 60 mm
2 layers of polyethylene foil 0.3 mm
Plywood placed between the joists 22 mm
Wood strip (nailed to the side of the joists) 50 x 50 mm
Wood joist 225 x 225 mm (cc/ 900)
Insulation 100 mm
Fire board 15 mm
Plaster board 12.5 mm
Suspended ceiling 280 mm

Basement floor
Linoleum finish 3 mm
Concrete slab 100 mm
Polystyrene insulation 200 mm

project:	Urban Renewal - Dannebrogsgade 4, Aarhus	date:	05.12.2009
subject:	Section A1-1	scale:	1:50
		phase:	Scheme Design
class:	BK52E, Group 01	drawing number:	T_A_E_-_X_3_(2BY)_001
name:			

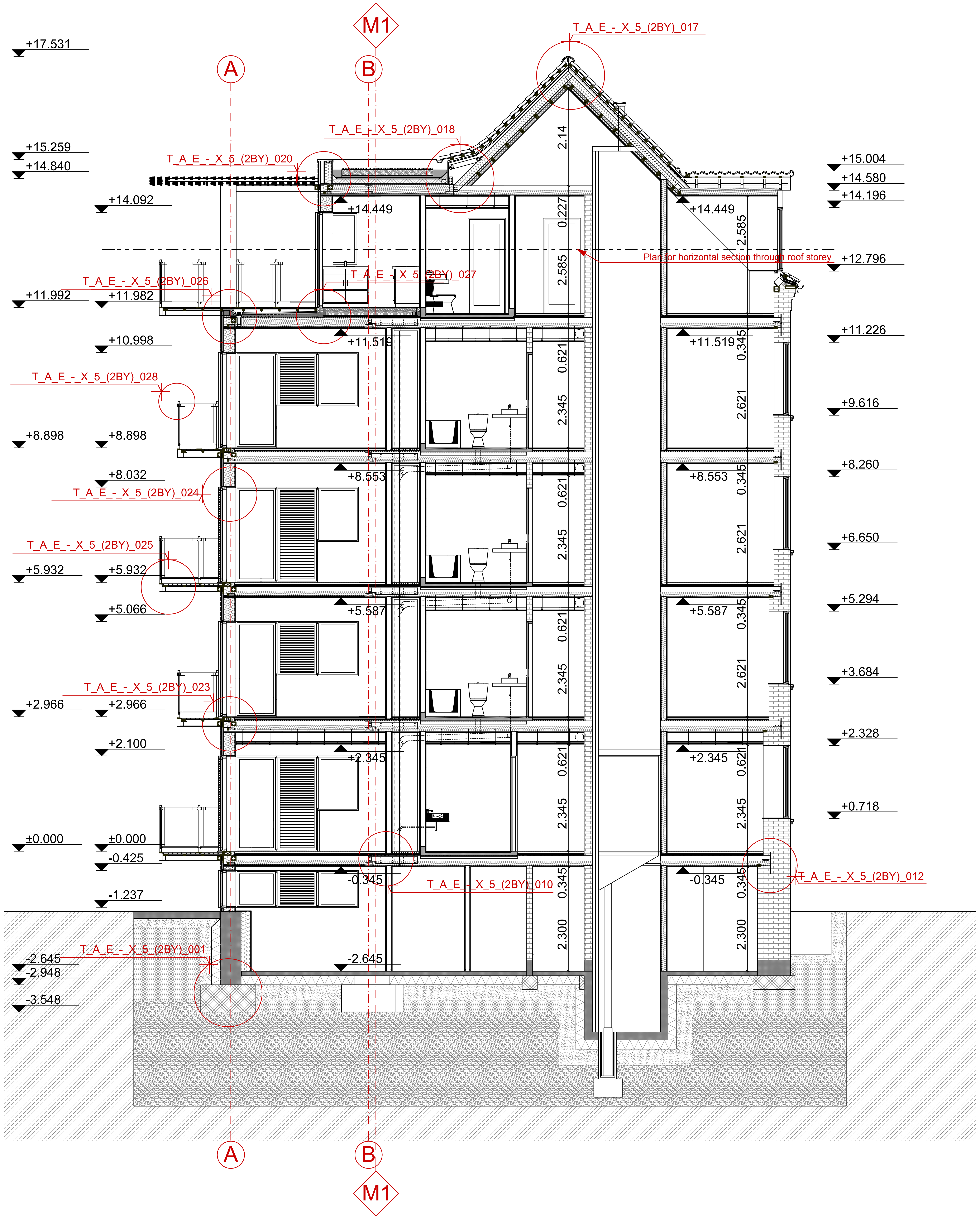
Green roof construction
Slope 2.5%
Vegetal layer
Soil 125 mm
Root membrane 2 mm
Gravel 40 mm
Textile membrane 2 mm
Extruded polystyrene 30 mm
Bitumen membrane (2 layers) 4 mm
Lightweight concrete (slope for drainage) 100 mm
Trapezoidal plate 20 mm
C Profile 200 x 63.5 x 2 mm (cc/ 600)
Insulation 200 mm
Fire board 15 mm
Plaster board 12.5 mm

Roof terrace deck
Terrace deck 25 mm
Batten 10 x 50 mm
Batten 25 x 40 mm
High regulations (brackets) 37.5 mm
Protect mortar 20 mm
Extruded polystyrene 30 mm
Textile membrane
Lightweight concrete (slope for drainage) 100 - 120 mm
Steel trapezoidal plate 20 mm
C Profile 200 x 63.5 x 2 mm (cc/ 600)
Insulation 200 mm
Acoustic profile 25 mm
Fire board 15 mm
Plaster board 12.5 mm

Balcony deck
Balcony deck 25 mm
Batten 10 x 50 mm (cc/600)
Batten 25 x 40 mm (cc/400)
HEB steel beam 120 x 120 mm

Penthouse kitchen floor
Cast polish concrete (lightweight) 80 mm
Heat transfer pipes
Cupolex system
2 layers of plaster board 25mm
C Profile 200 x 63.5 x 2 mm (cc/ 600)
Insulation 200 mm
Acoustic profile 25 mm
Fire board 15 mm
Plaster board 13 mm

Extension floor
Wooden floor 15 mm
Aluminum heat transfer plate with joist trak panels 32 mm
2 layers of plaster board 25mm
Trapezoidal plate 20 mm
Textile membrane 1 mm
C Profile 200 x 63.5 x 2 mm (cc/ 600)
Insulation 100 mm
Acoustic profile 25 mm
Fire board 15 mm
Plaster board 13 mm



Roof construction
Roof U= 0.17
Pitch 45°
Red pan tiles
Tiles fixing
Roof batten 38 x 56 mm
Pressure impregnated batten 30 x 45 mm
Wooden board 21 x 110 mm
Ventilation cavity 50 mm
Trusses 150 x 180 mm
Batten 50 x 50 mm
Damp proof membrane 2 mm
Batten 50 x 50
2 layers of mineral wool (2 x 50 mm)
2 layers of gypsum board (2 x 13 mm)

External wall
2 layers of plaster board
C-profile 250 x 70 x 2 mm (cc/ 600)
Damp proof membrane 2mm
Insulation 250 mm
Wind board 13 mm
Ventilated cavity 50 mm
Distance battens 30 x 30 mm (cc/ 350)
Oak wood cladding 16 mm

Existing building floor
Wooden floor 15 mm
Aluminum heat transfer plate with joist trak panels 32 mm
2 layers of plaster board 25mm
Trapezoidal plate 20 mm
Textile membrane 1 mm
Wood joist 225 x 225 mm (cc/ 900)
Insulation 100 mm
Fire board 15 mm
Plaster board 13 mm

Basement floor
Linoleum finish 3 mm
Concrete slab 100 mm
Polystyrene insulation 200 mm

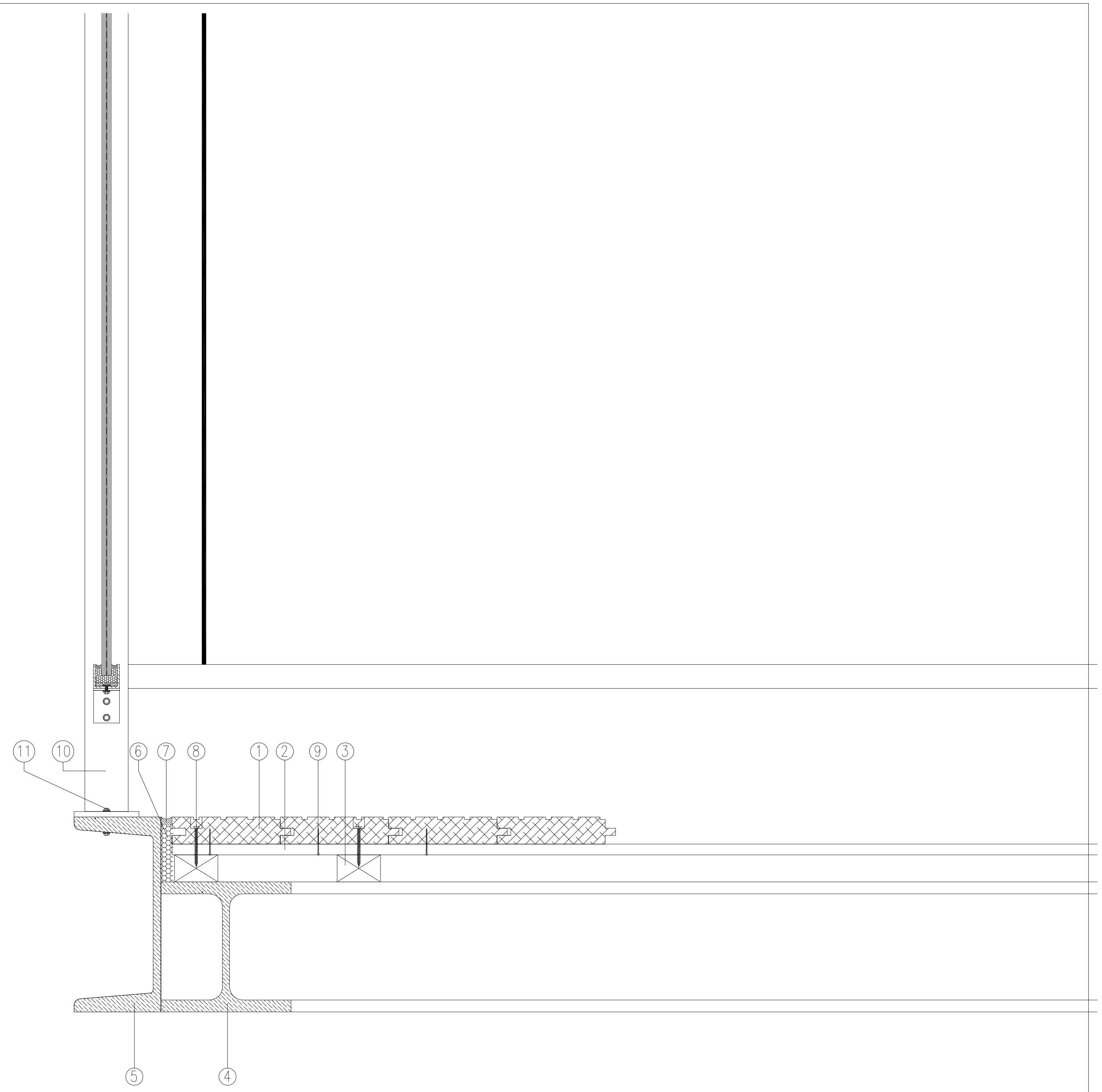
Basement wall
2 layers of plaster board 25 mm
C-profile 200 x 70 x 2.5 mm (cc/ 600)
Insulation 200 mm
Reinforced concrete 450 mm
Polystyrene insulation 200 mm
Drainage membrane 2 mm

project:	Urban Renewal - Dannebrogsgade 4, Aarhus	date:	04.12.2009
subject:	Section A2-2	scale:	1:50
		phase:	Scheme Design
		drawing number:	T_A_E_-_X_3_(2BY)_002
class:	BK52E, Group 01		
name:			

Balcony-balcony ends

(vertical section) Sc 1:5

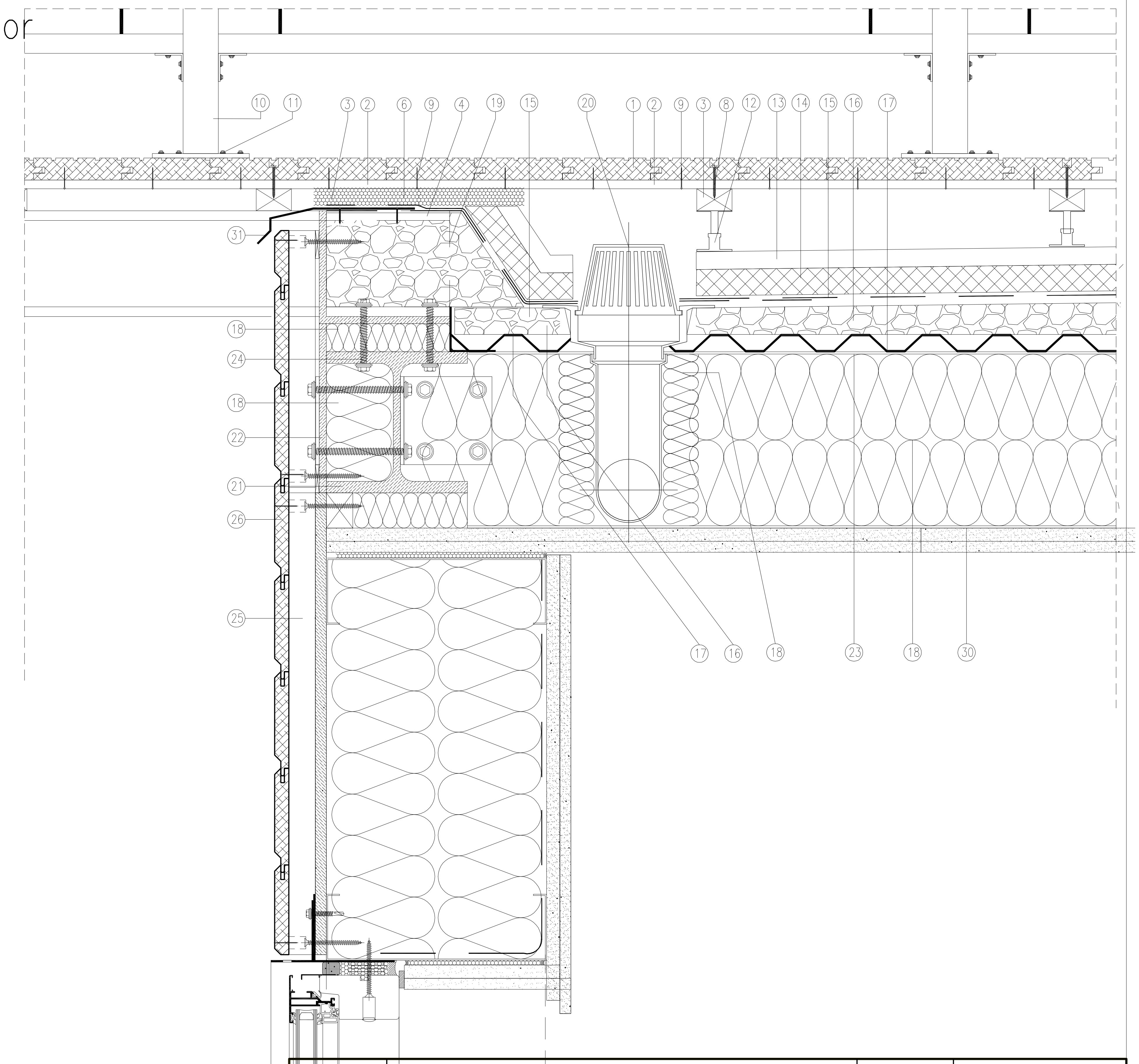
1. Balcony deck - 25 mm
2. Batten - 10x50 mm (cc/600 mm)
3. Batten - 25x40 mm (cc/900 mm)
4. HEB Steel beam - 120 mm
5. UPN Steel beam - 180 mm
6. Neopren Strip
7. Seal
8. Screw fixing balcony deck-batten
9. Nail fixing battens
10. Railing - 40x40 mm
11. Screw fixing railing-UPN



project:	Urban Renewal - Dannebrogsgade 4, Aarhus		date:	17.01.2010
	subject:	Balcony ends detail	scale:	1:5
			phase:	**Scheme Design**
			drawing number:	
	class:	BK52E, Group 01		
	name:	Landivar Taborga, Arnaldo		

Balcony–connection with roof terrace floor (vertical section) Sc 1:5

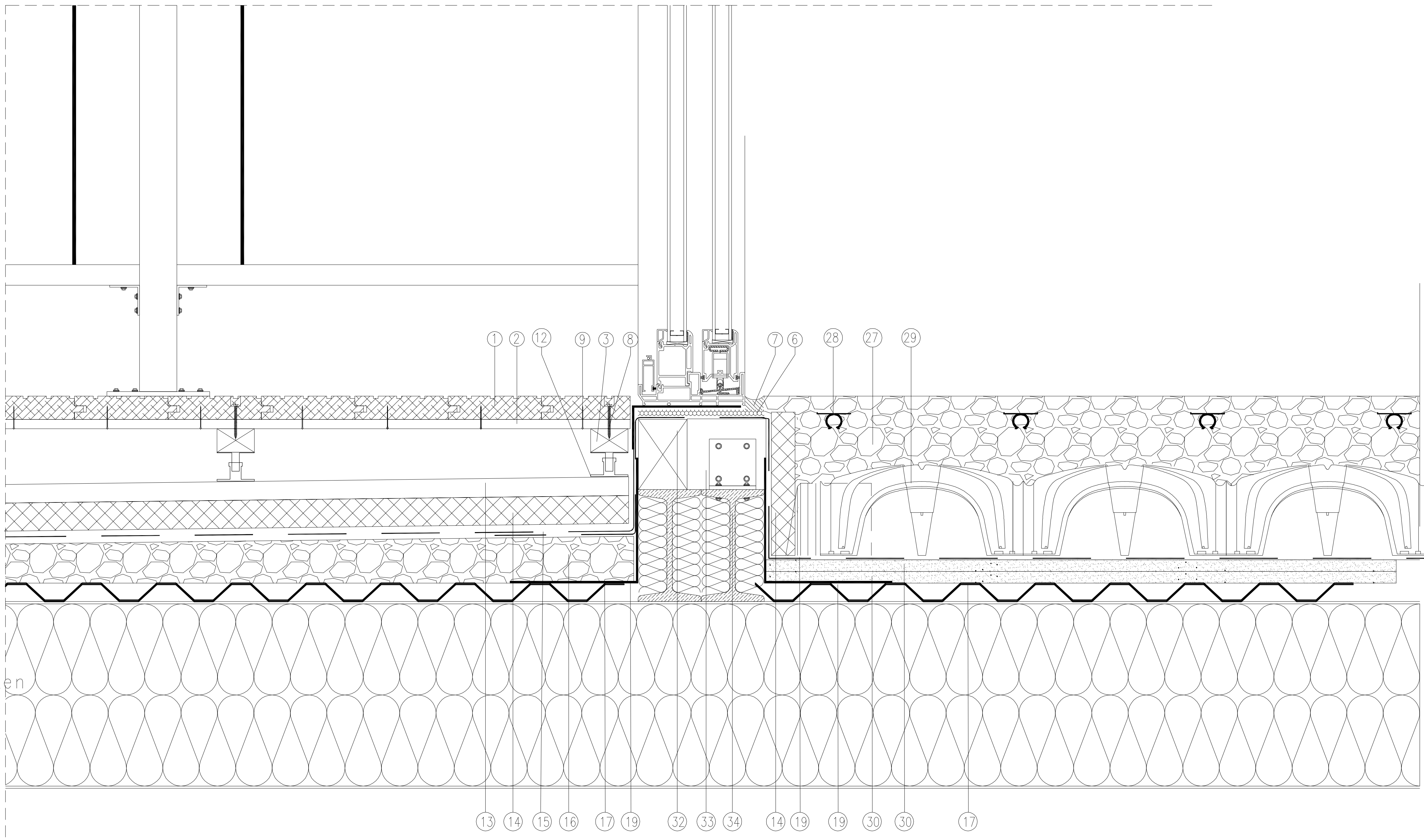
1. Balcony/Terrace deck – 25 mm
2. Batten – 10x50 mm (cc/600 mm)
3. Batten – 25x40 mm (cc/900 mm)
4. HEB Steel beam – 120 mm
5. UPN Steel beam – 180 mm
6. Neopren Strip
7. Seal
8. Screw fixing balcony deck–batten
9. Nail fixing battens
10. Railing – 40x40 mm
11. Screw fixing railing–UPN
12. High Regulations 37,5 mm
13. Mortar – 20 mm
14. XPD – Extruded polyestiren 30 mm
15. Bituminen membrane (2 layers)
16. Lightweight concrete (slope drainage 100–120 mm)
17. Steel Trapezoidal plate 20 mm
18. Insulation
19. Steel edge angle plate
20. Drainage
21. HEB Steel beam – 160 mm
22. Steel plate Lx200x8 mm
23. C–profile
24. Bold connection
25. Vertical Ventilated cavity 30 mm(Batten 40x30 mm)
26. Oak wood cladding 20 mm
27. Light weight polish concrete
28. Heat transfer pipes
29. Cupolex System
30. Plaster Board
31. Zinc Profile
32. Wooden beam Lx52x75
33. Wooden beam 84x52x75 (CC 600mm)
34. IPN Steel beam–140 mm



project:	Urban Renewal - Dannebrogsgade 4, Aarhus	date:	17.01.2010
	subject: Roof terrace detail	scale:	1:5
		phase:	**Scheme Design**
		drawing number:	
	class: BK52E, Group 01		
	name: Landivar Taborga, Arnaldo		

Roof terrace floor–connection with kitchen floor (vertical section) Sc 1:5

1. Balcony/Terrace deck – 25 mm
2. Batten – 10x50 mm (cc/600 mm)
3. Batten – 25x40 mm (cc/900 mm)
4. HEB Steel beam – 120 mm
5. UPN Steel beam – 180 mm
6. Neopren Strip
7. Seal
8. Screw fixing balcony deck–batten
9. Nail fixing battens
10. Railing – 40x40 mm
11. Screw fixing railing–UPN
12. High Regulations 37,5 mm
13. Mortar – 20 mm
14. XPD – Extruded polyestiren 30 mm
15. Bituminen membrane (2 layers)
16. Lightweight concrete (slope drainage 100–120 mm)
17. Steel Trapezoidal plate 20 mm
18. Insulation
19. Steel edge angle plate
20. Drainage
21. HEB Steel beam – 160 mm
22. Steel plate Lx200x8 mm
23. C–profile
24. Bold connection
25. Vertical Ventilated cavity 30 mm(Batten 40x30 mm)
26. Oak wood cladding 20 mm
27. Light weight polish concrete
28. Heat transfer pipes
29. Cupolex System
30. Plaster Board
31. Zinc Profile
32. Wooden beam Lx52x75
33. Wooden beam 84x52x75 (CC 600mm)
34. IPN Steel beam–140 mm

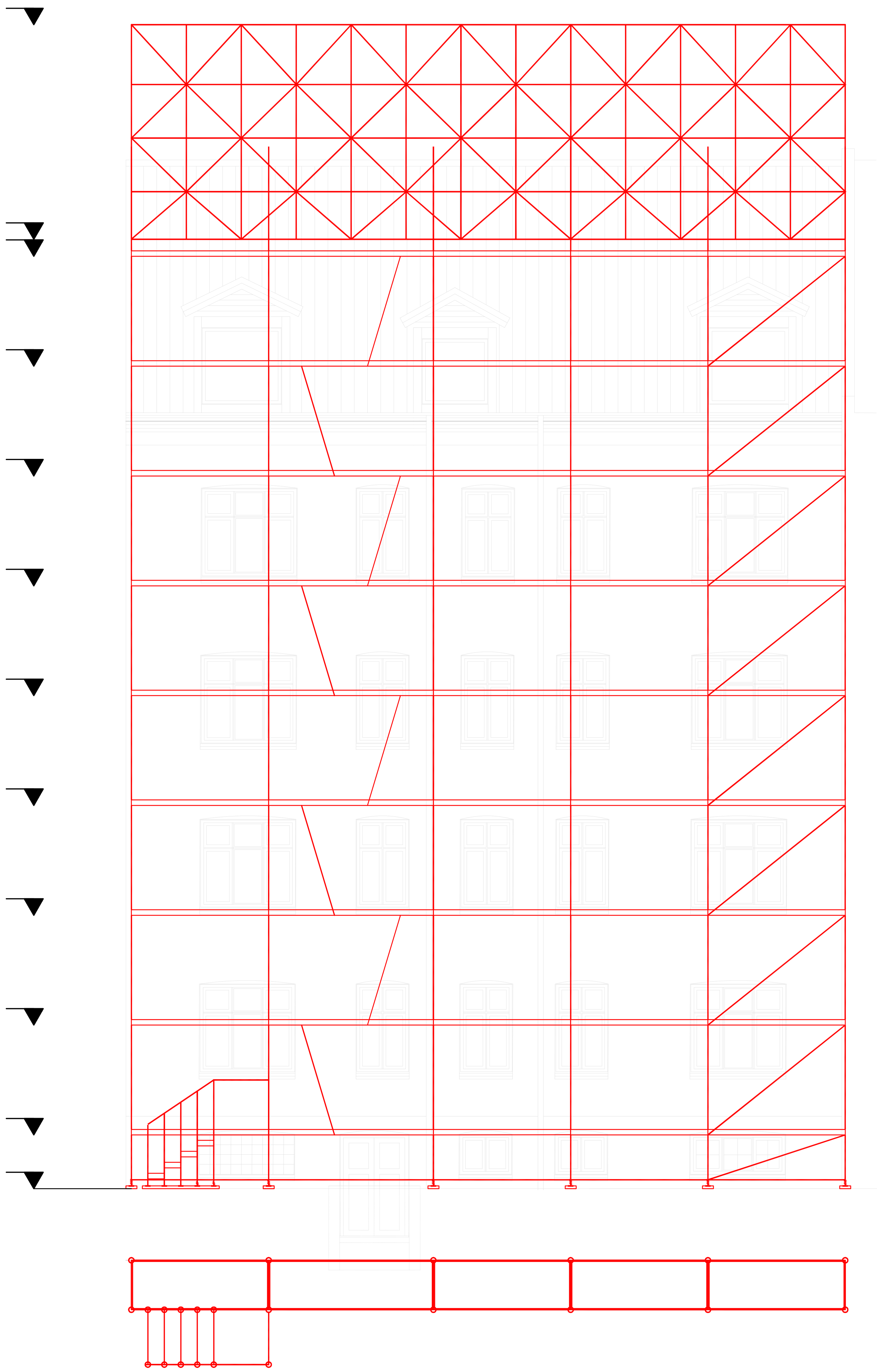


project:	Urban Renewal - Dannebrogsgade 4, Aarhus	date:	17.01.2010
subject:	Roof terrace floor detail and Penthouse kitchen floor detail	scale:	1:5
		phase:	**Scheme Design**
class:	BK52E, Group 01	drawing number:	
name:	Landivar Taborga, Arnaldo		

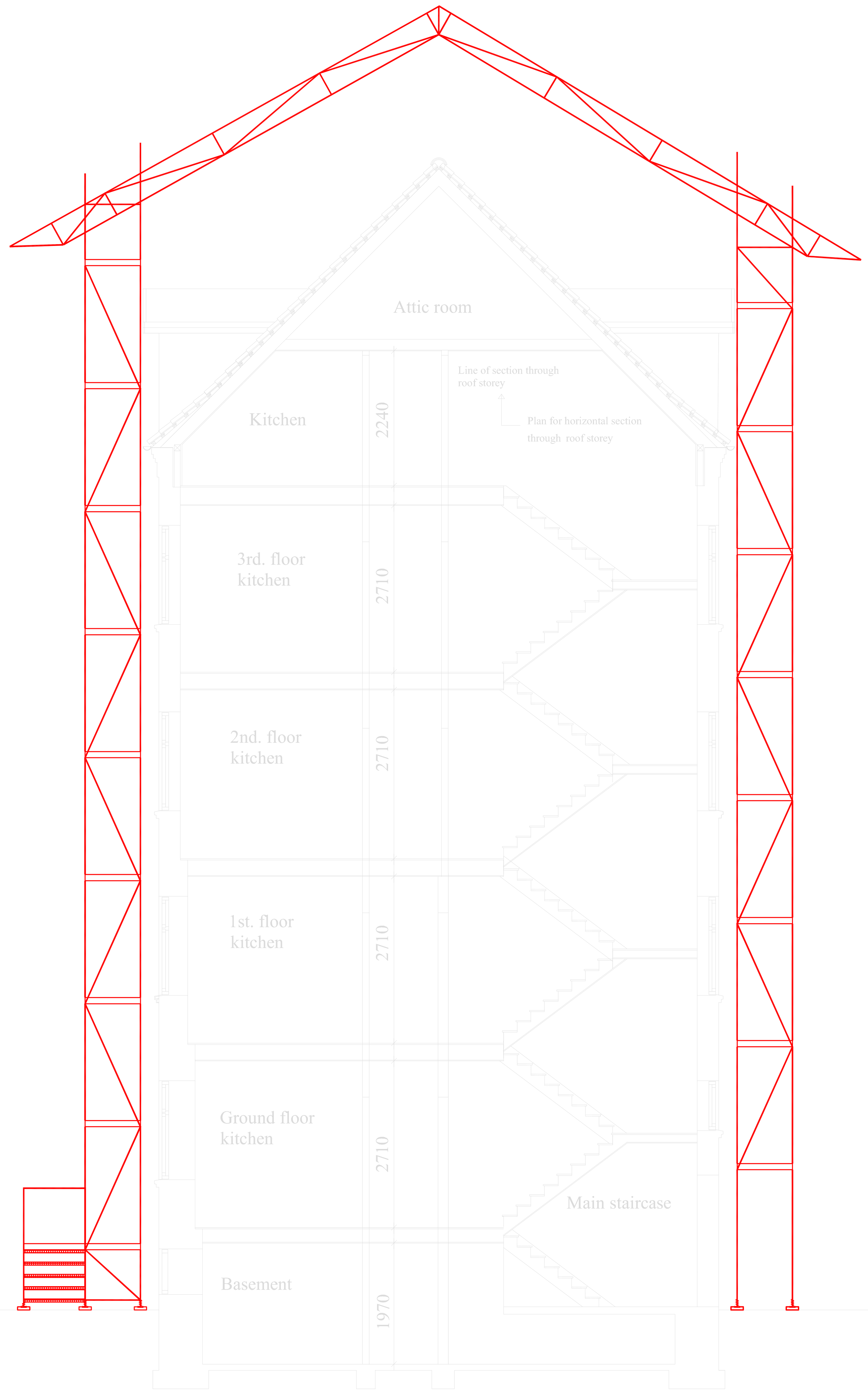
LEGEND

- Proposed trees
- Existing trees
- Vegetation (shrubs and small plants)
- Grass
- Small rocks and sand
- Paved pedestrian path
- Playgroung area
- Sitting area with benches
- Waste area

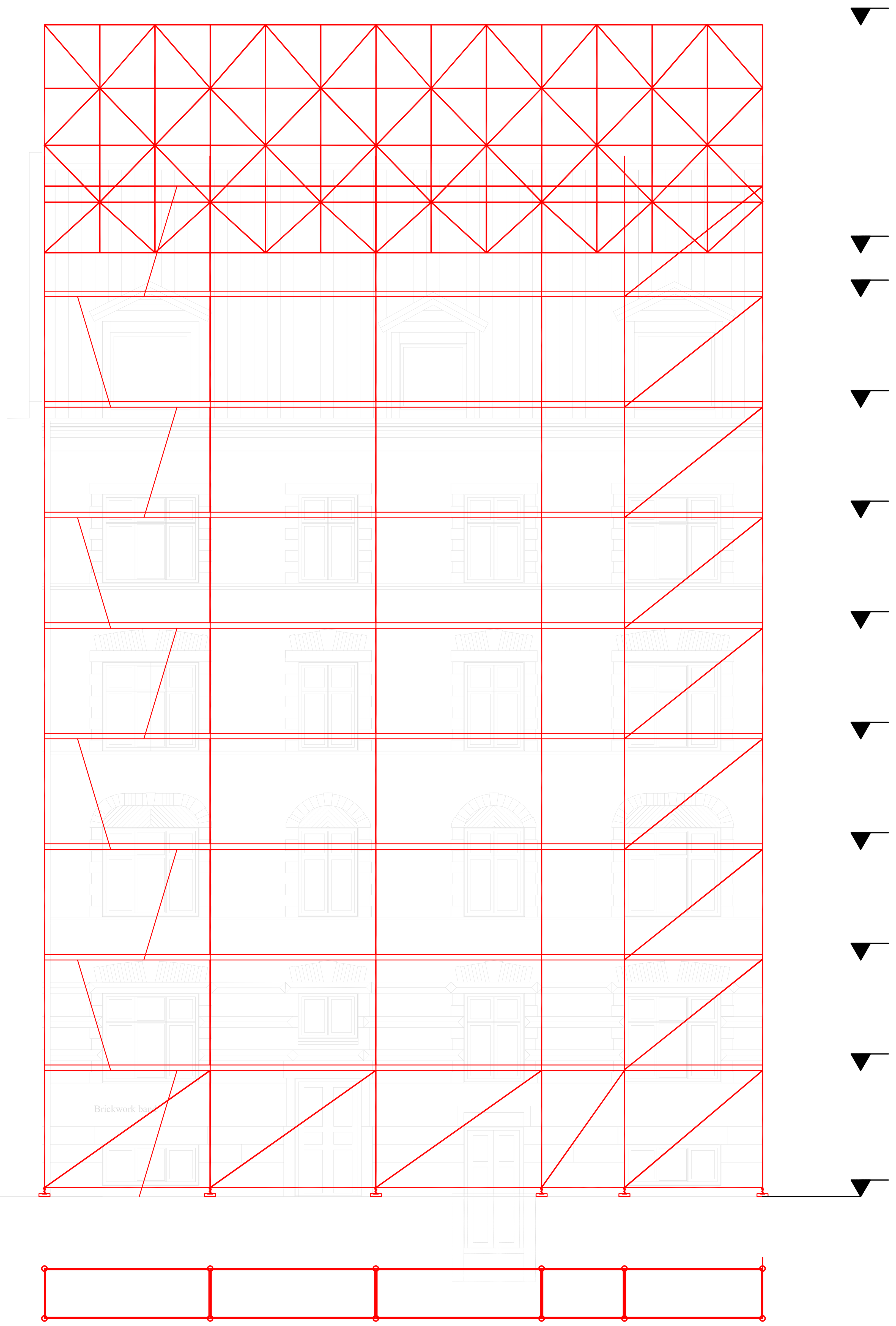
project:	Urban Renewal - Dannebrogsgade 4, Aarhus	date:	
subject:	Location plan	scale:	1:200
		phase:	**Scheme Design**
class:	BK52E, Group 01	drawing number:	T_A_E_-_X_1_(2BE)_001
name:			



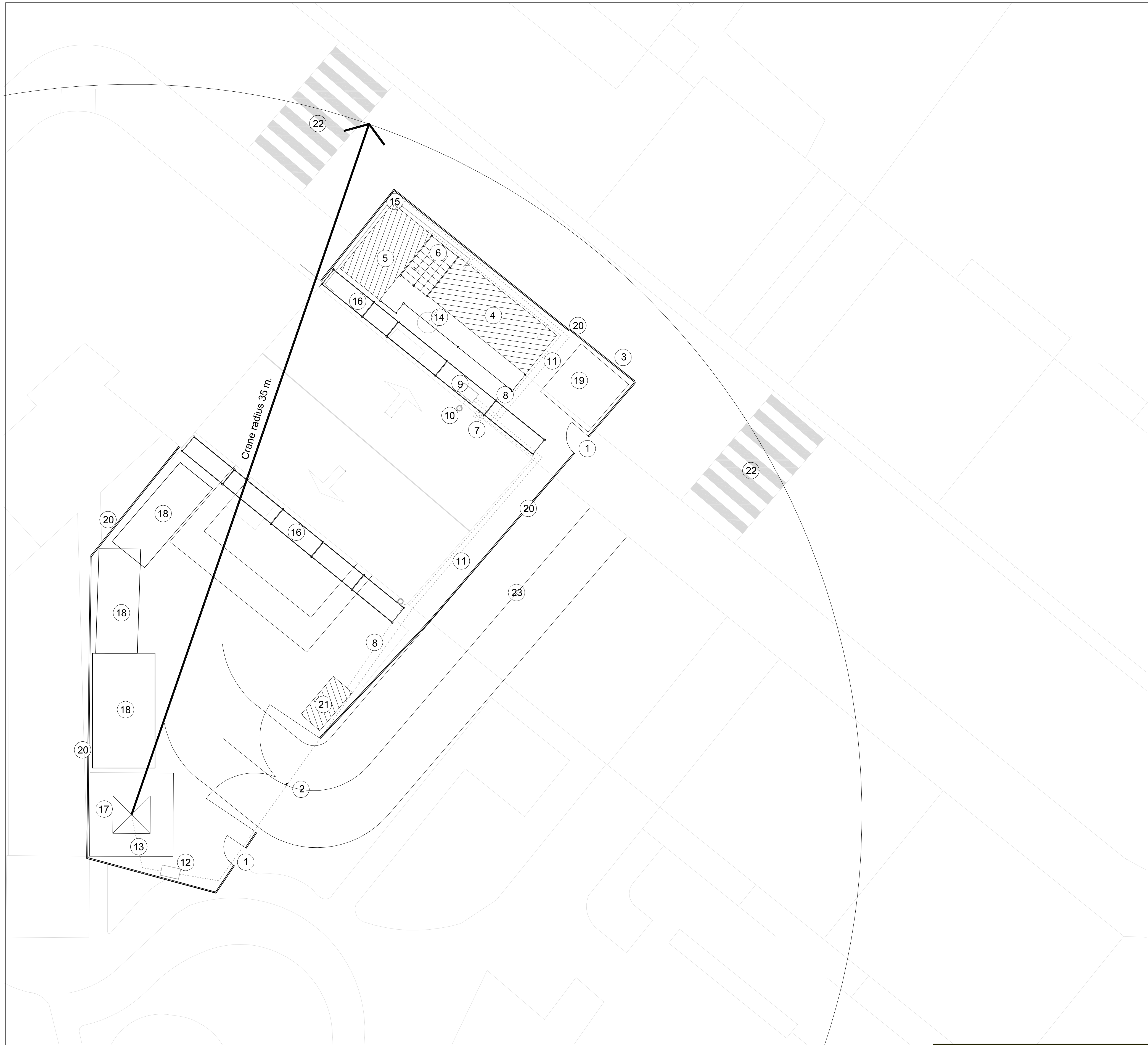
Elevation towards courtyard (before refurbishment)

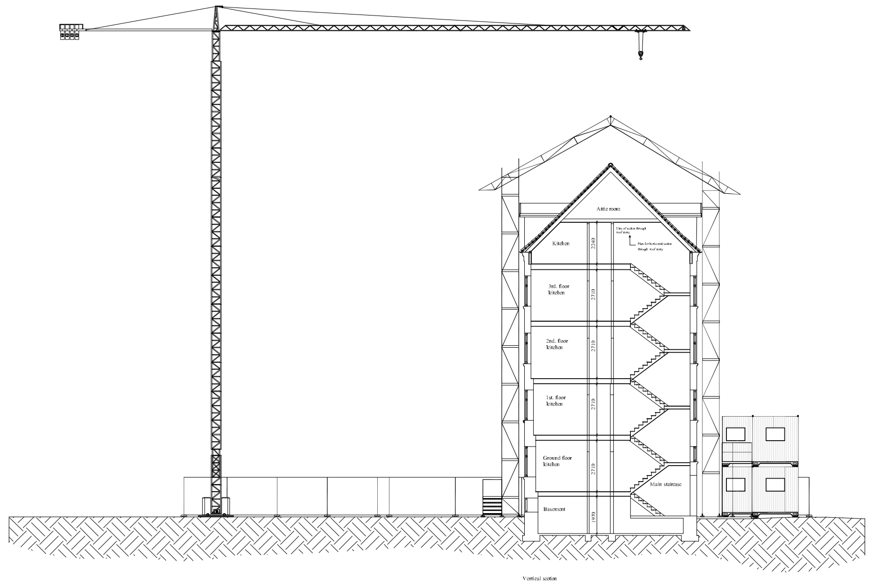


Vertical section



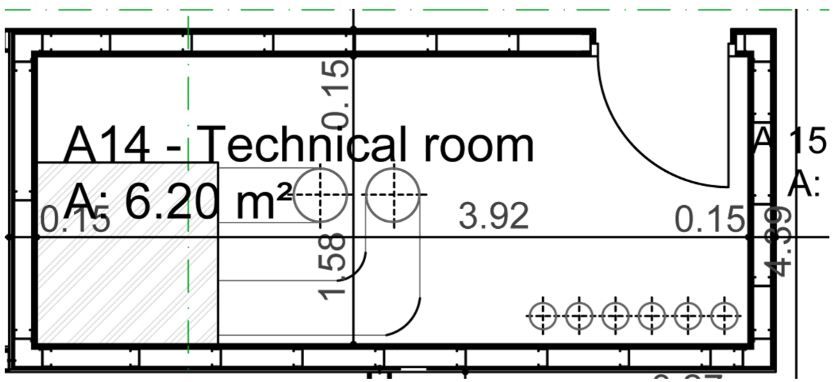
Elevation towards the street (before refurbishment)



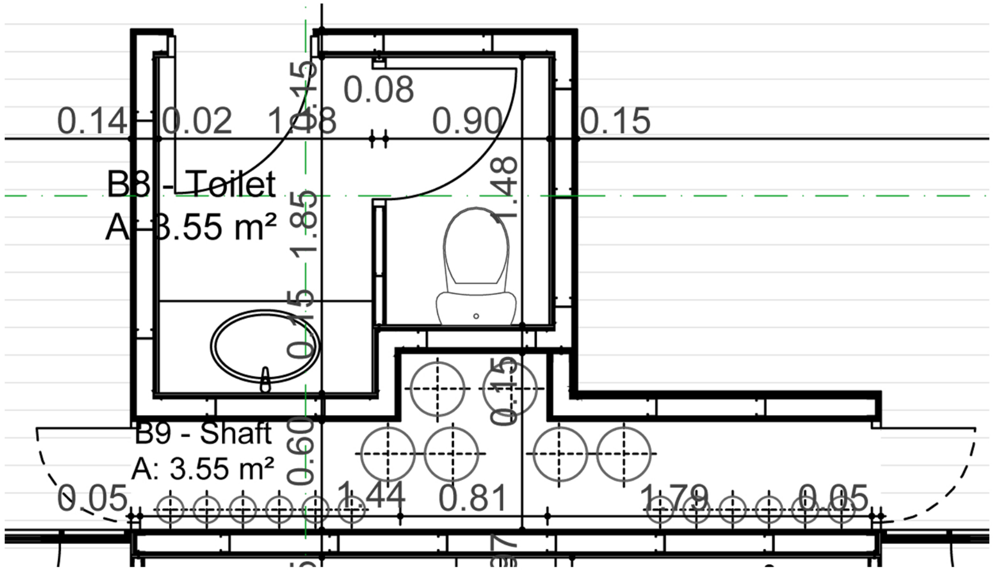


1. Pedestrian access door
2. Vehicles access door
3. Vehicles access slide-door
4. Cabins 1L Office / 2L Changing
5. Cabis 1L Meeting / 2L Dinning
6. Temporary stairs access 2L cabins
7. Site water meter
8. Site water line
9. Site electricity meter & principal board
10. Site electricity line through each storey & secondary board
11. Site electricity line
12. Court yard electricity secondary board
13. Site electricity tower crane line
14. Site sewer conected to Main hole
15. Site telephone line
16. Scaffolding
17. Tower Crane
18. Storage areas
19. Waste area for containers
20. Perimetral Fence
21. Chemical toilet
22. Temporary pedestrian crossing
23. Temporary road access to the Site

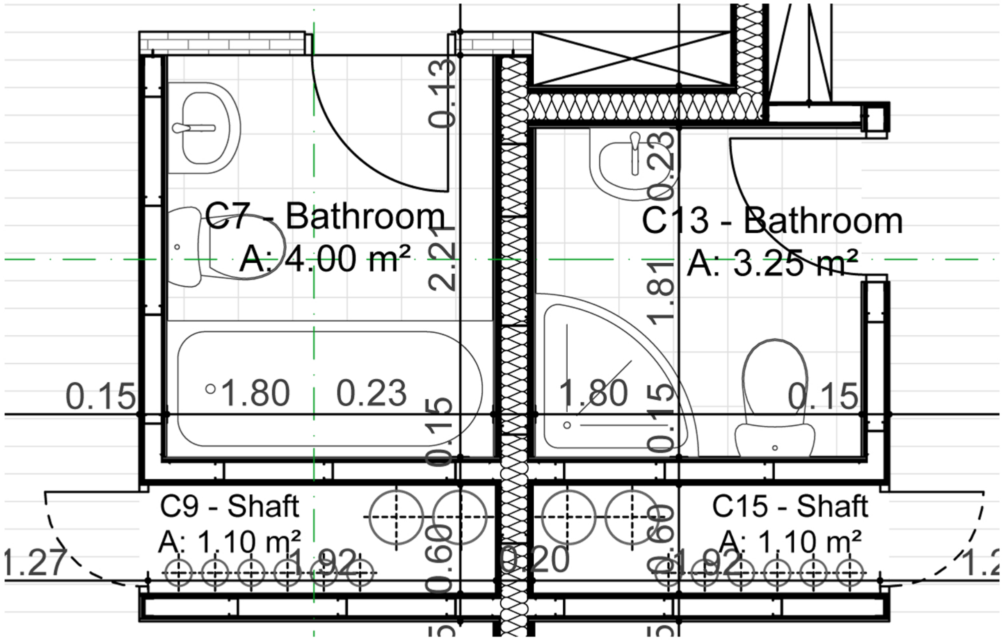
project:	**Urban Renewal - Dannebrogsgade 4, Aarhus**	date:	17.01.2010
subject:	Site Plan	scale:	1:200
		phase:	**Scheme Design**
		drawing number:	
class:	BK52E, Group 01		
name:	Landivar Taborga, Arnaldo		



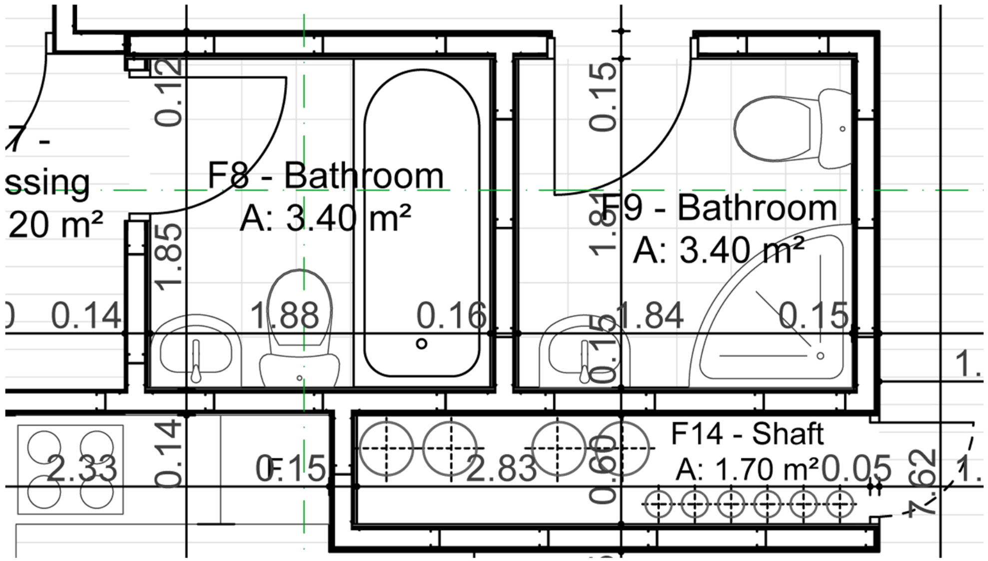
Basement - Technical room



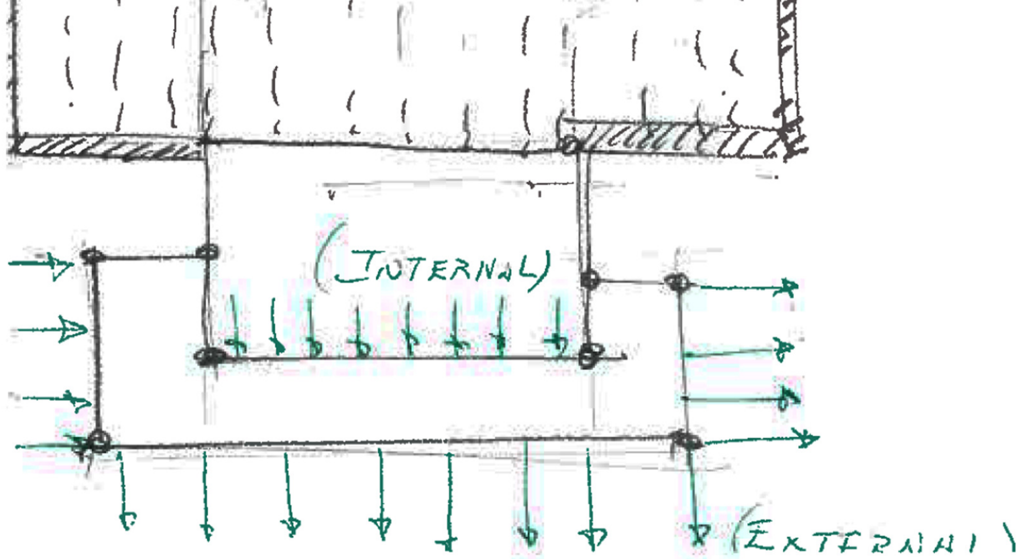
Ground floor - Arrangements of pipes in the shaft



Appartments - Arrangements of pipes in the shaft



Penthouse - Arrangements of pipes in the shaft

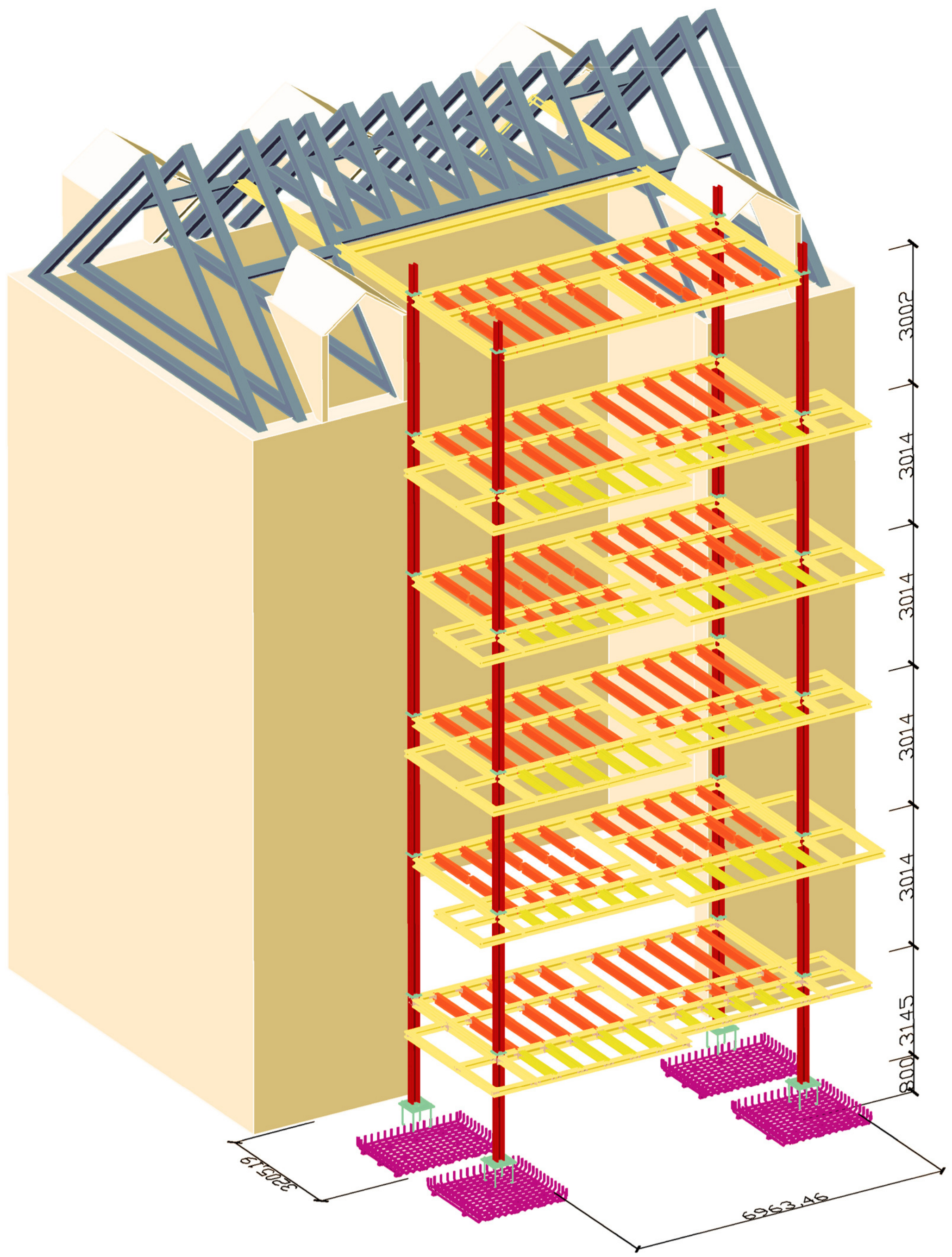


RH → Horizontal Reactions
V → Vertical Reactions
RW → Reaction Wall
↑→ Reactions

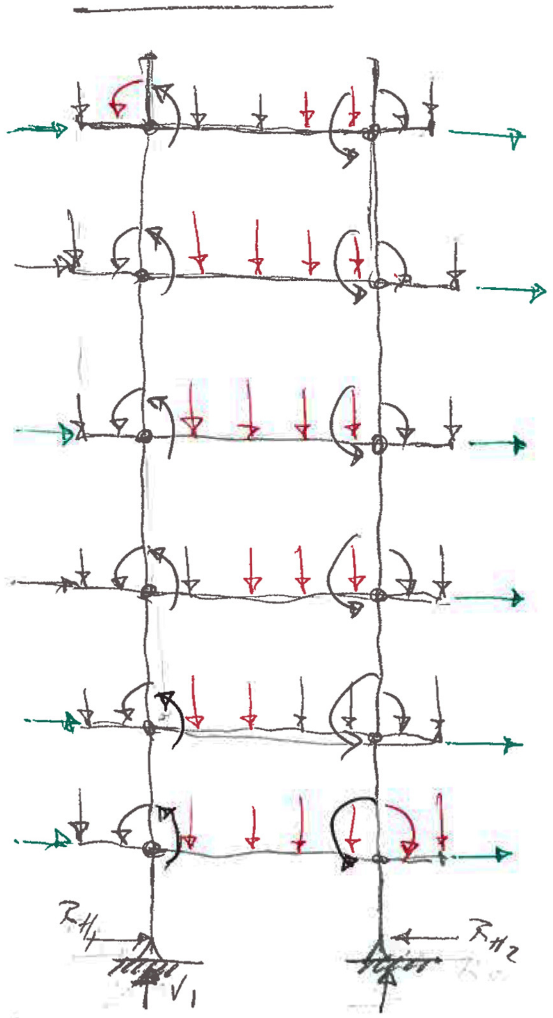
↓↑→ Wind loads
↓↓↓↓ Wind loads

↓↓ VERTICAL LOADS
⇒ WIND LOADS
BENDING MOMENTS

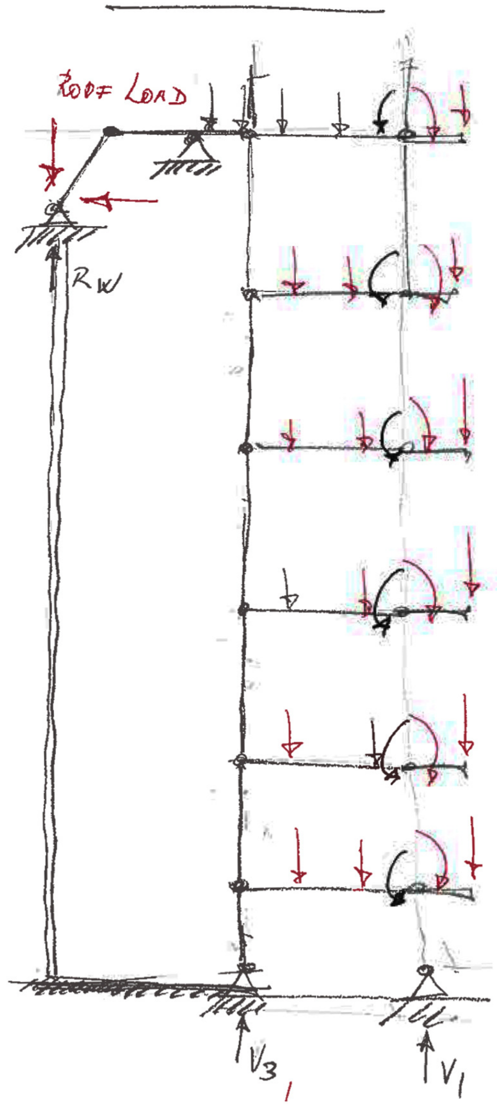
Static Analysis



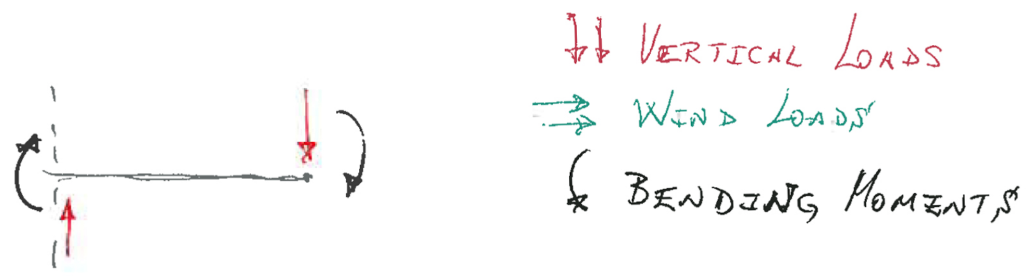
FRONT ELEVATION

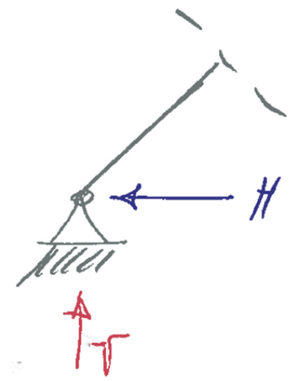


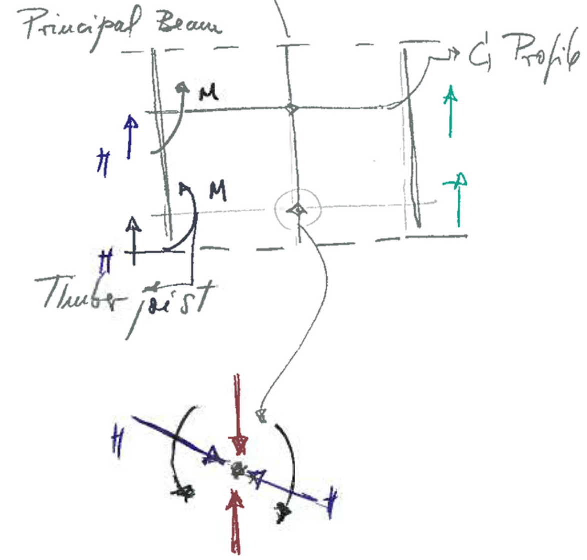
SIDE ELEVATION

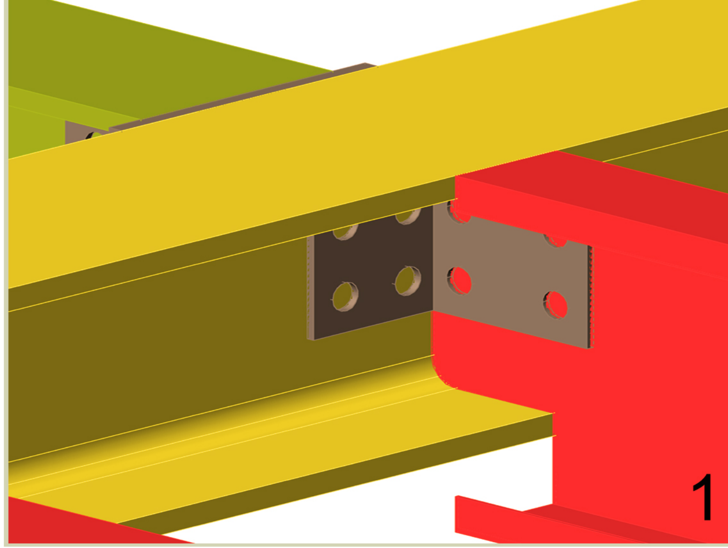


→ Principal plan
→ Key
→ System (3D model)
→ Front Elevation
→ Side Elevation



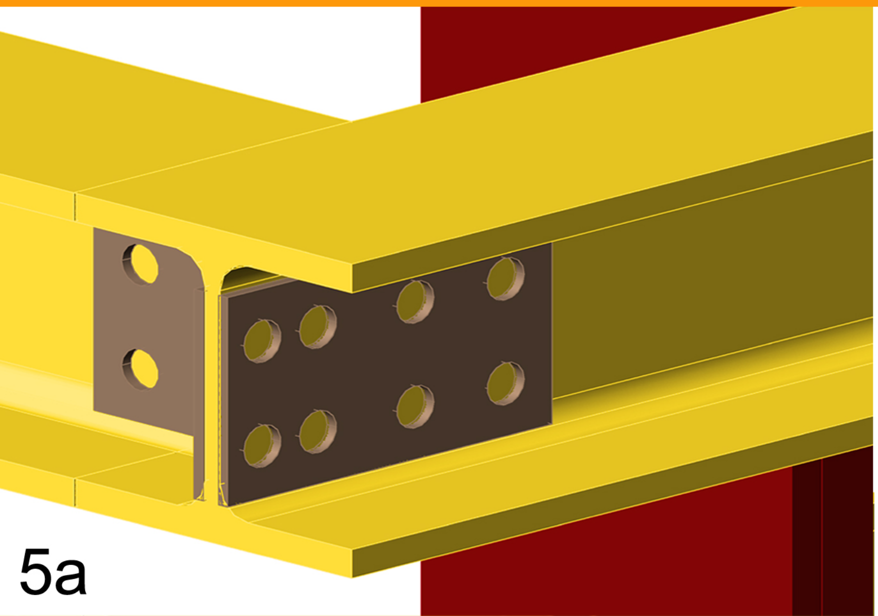






1

Static Analysis



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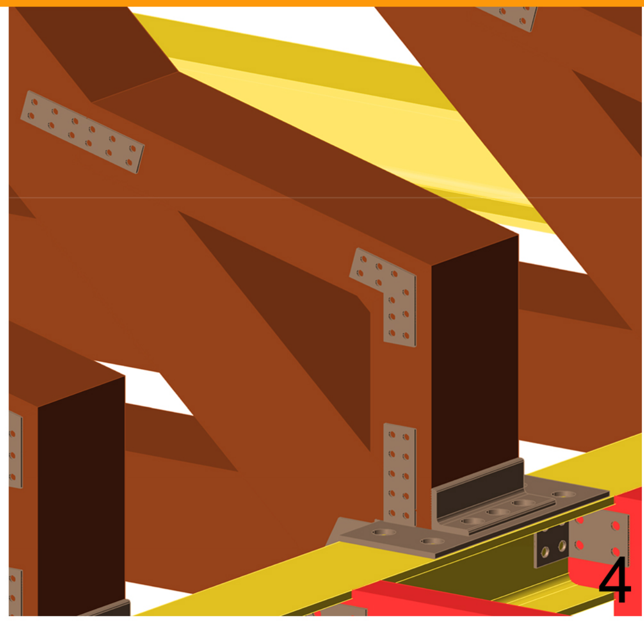

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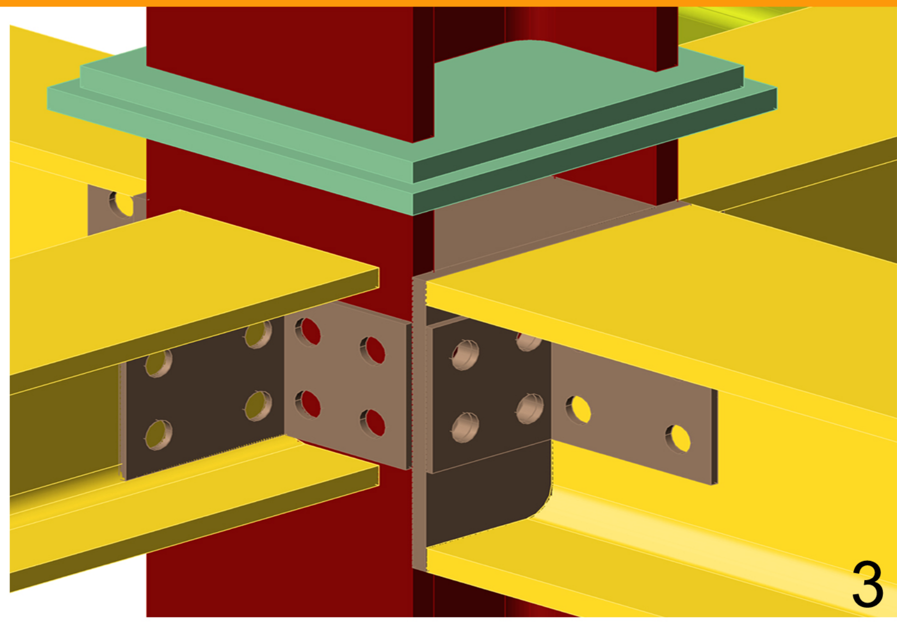

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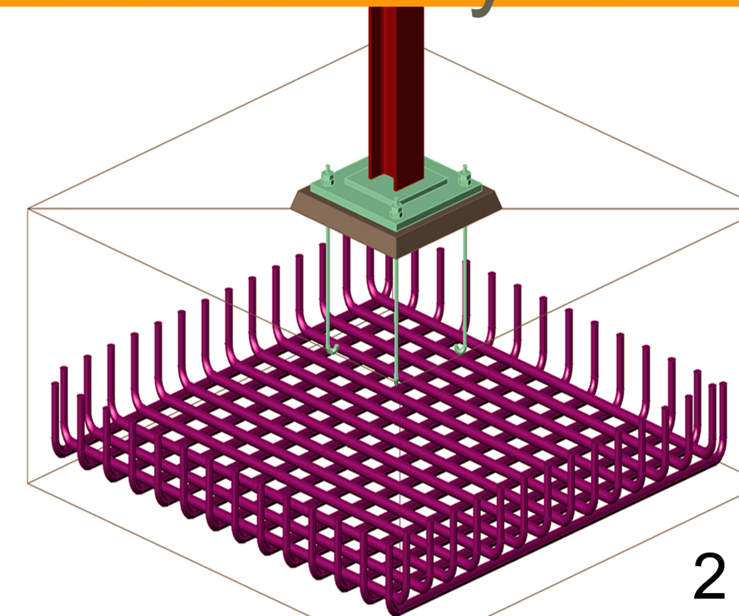

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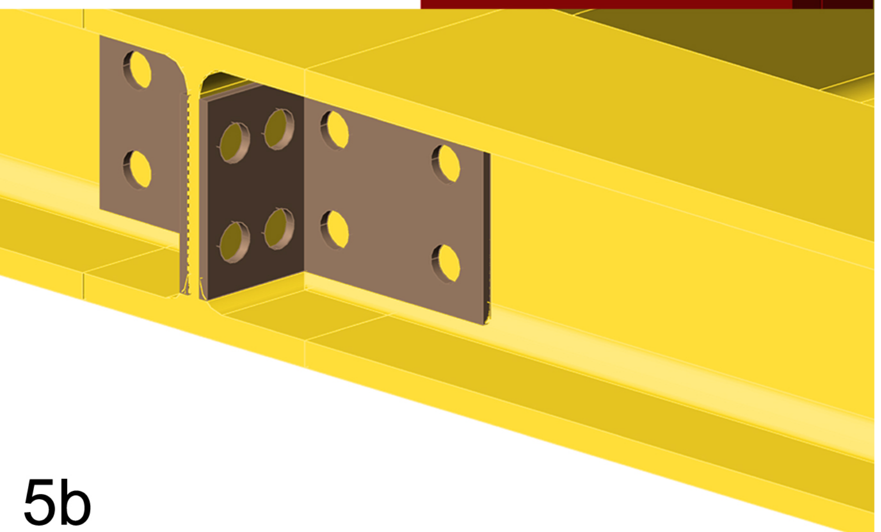

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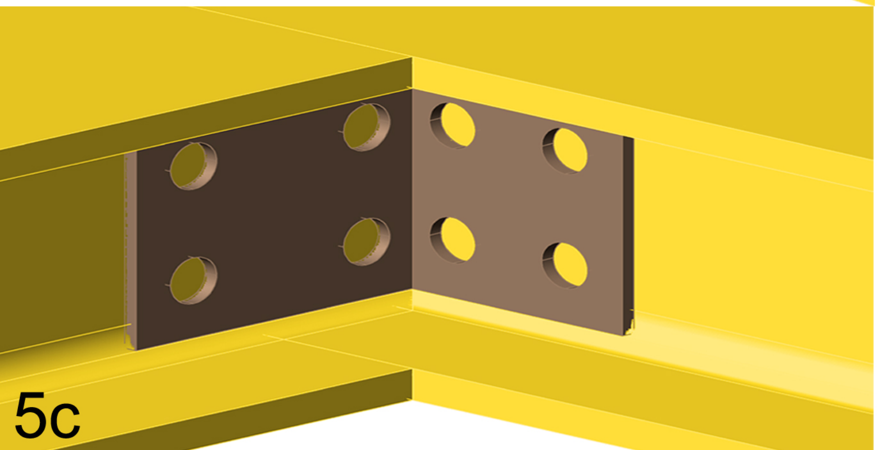

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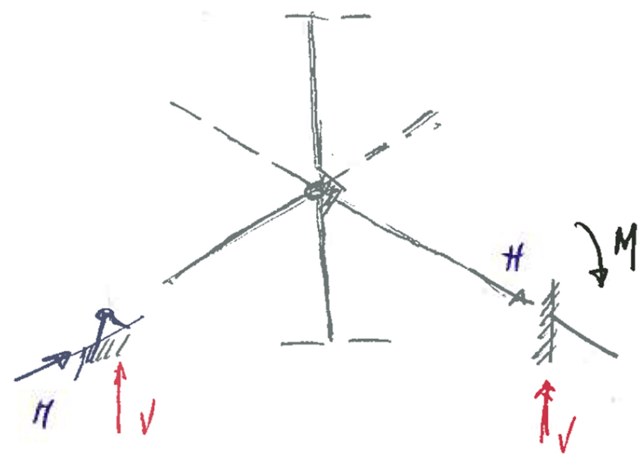

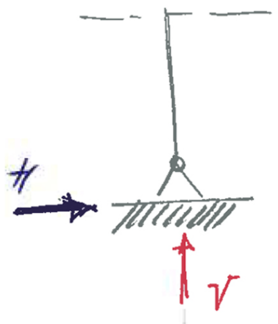

Analysis of some main force transmitting joints

→ Support types and connection principals

1 - HEB beam with C profile
2 - column to foundation
3 - beams to column
4 - roof connection
5 - beam to beam

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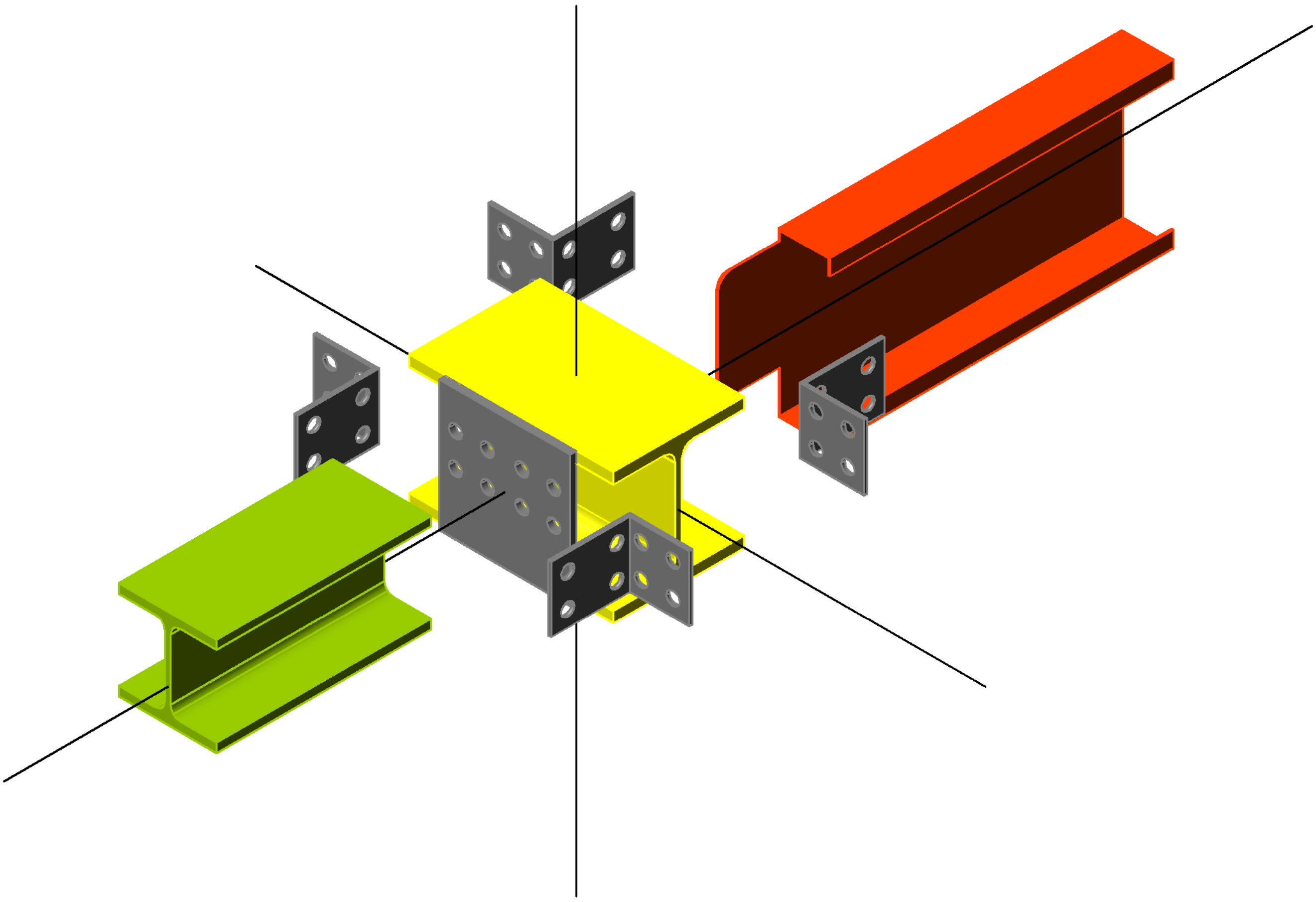
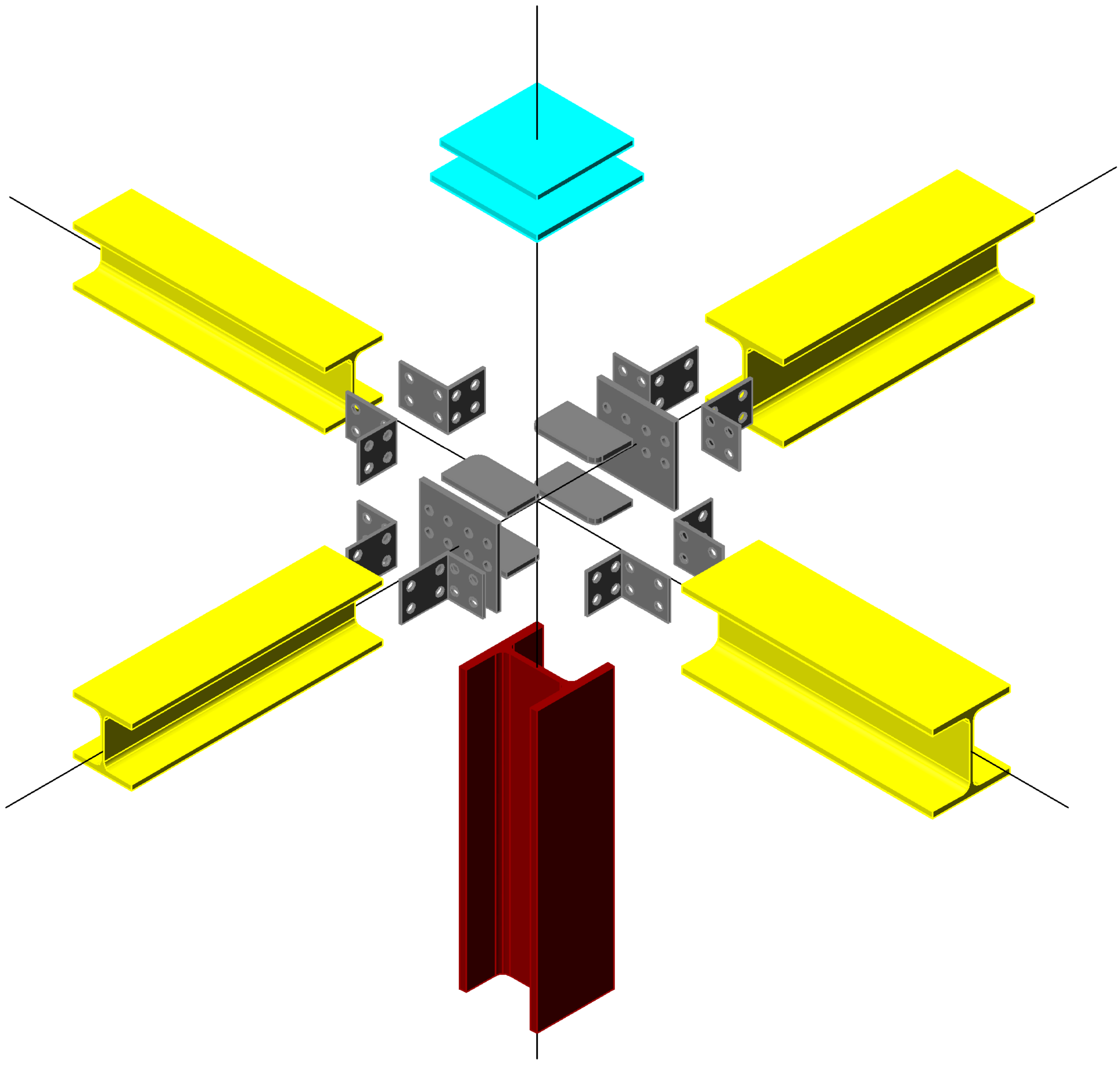
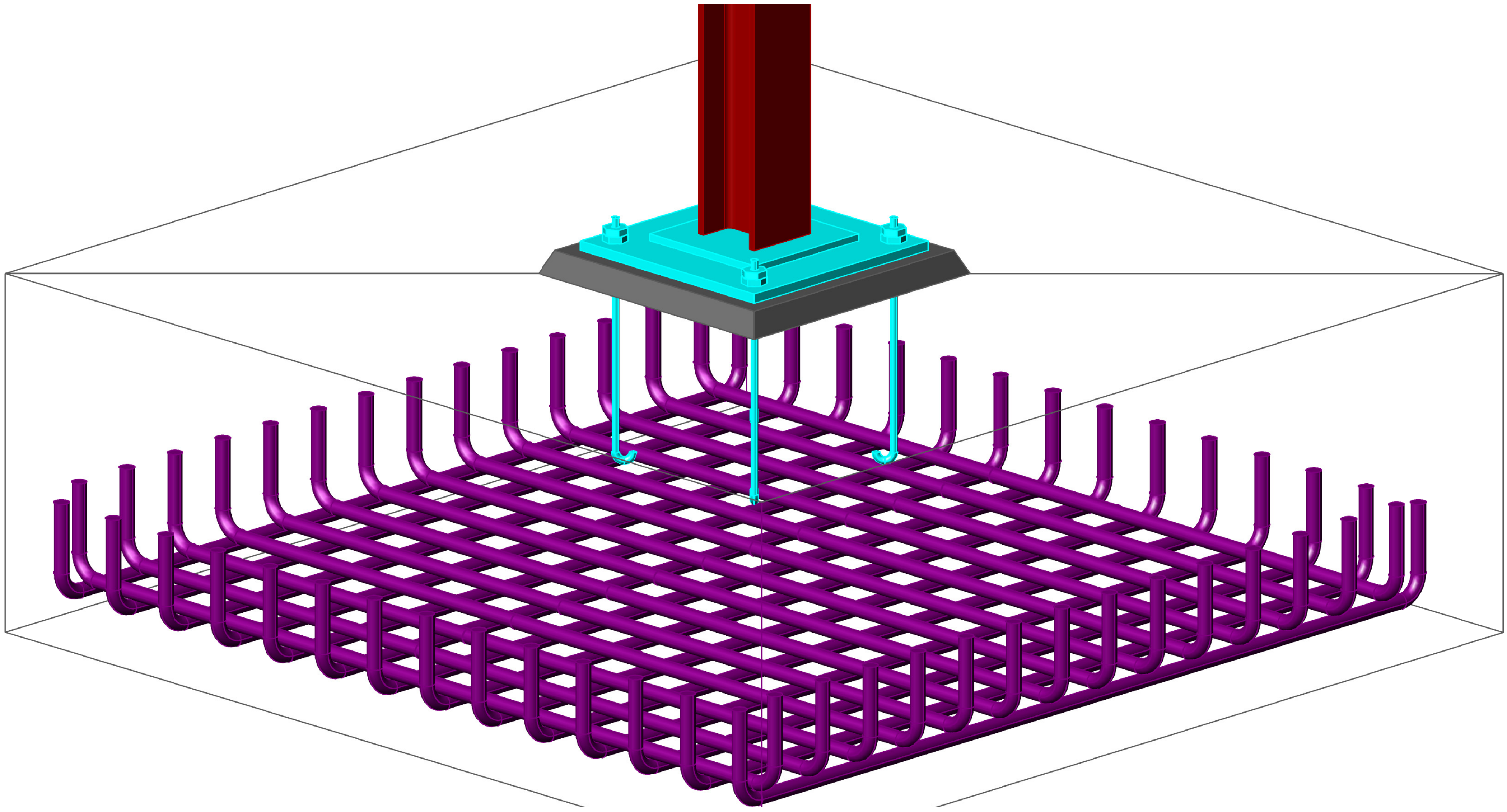
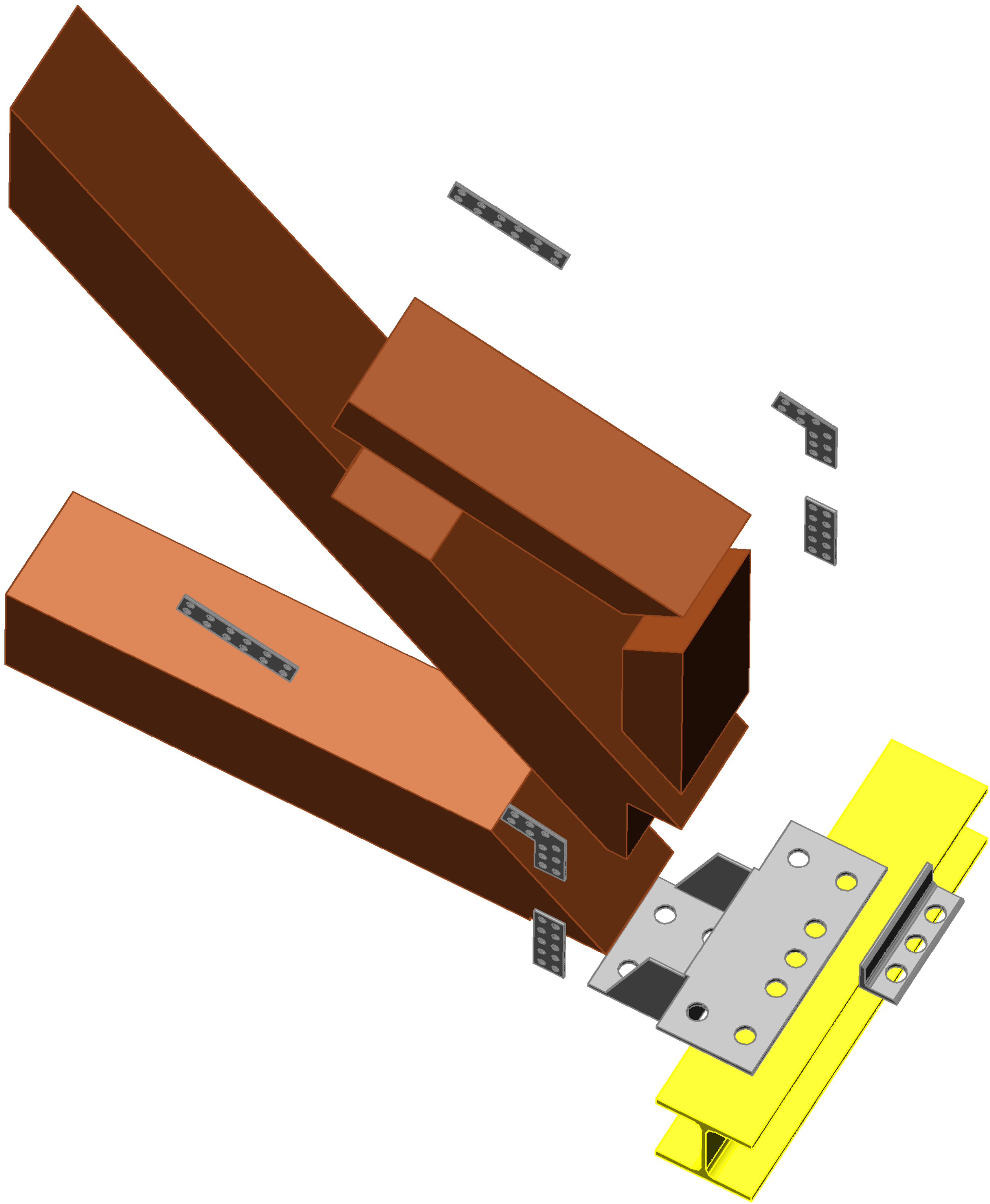
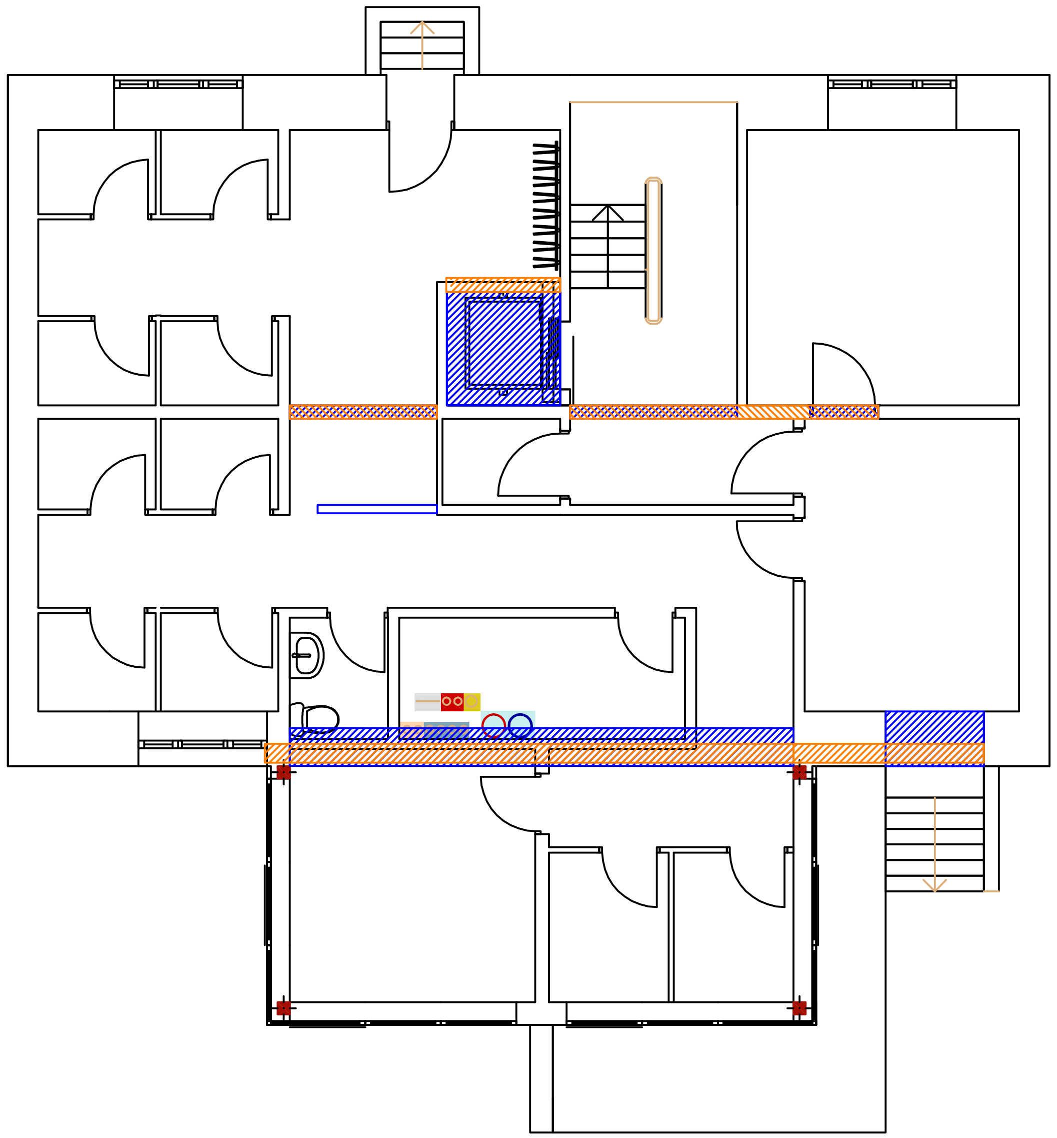


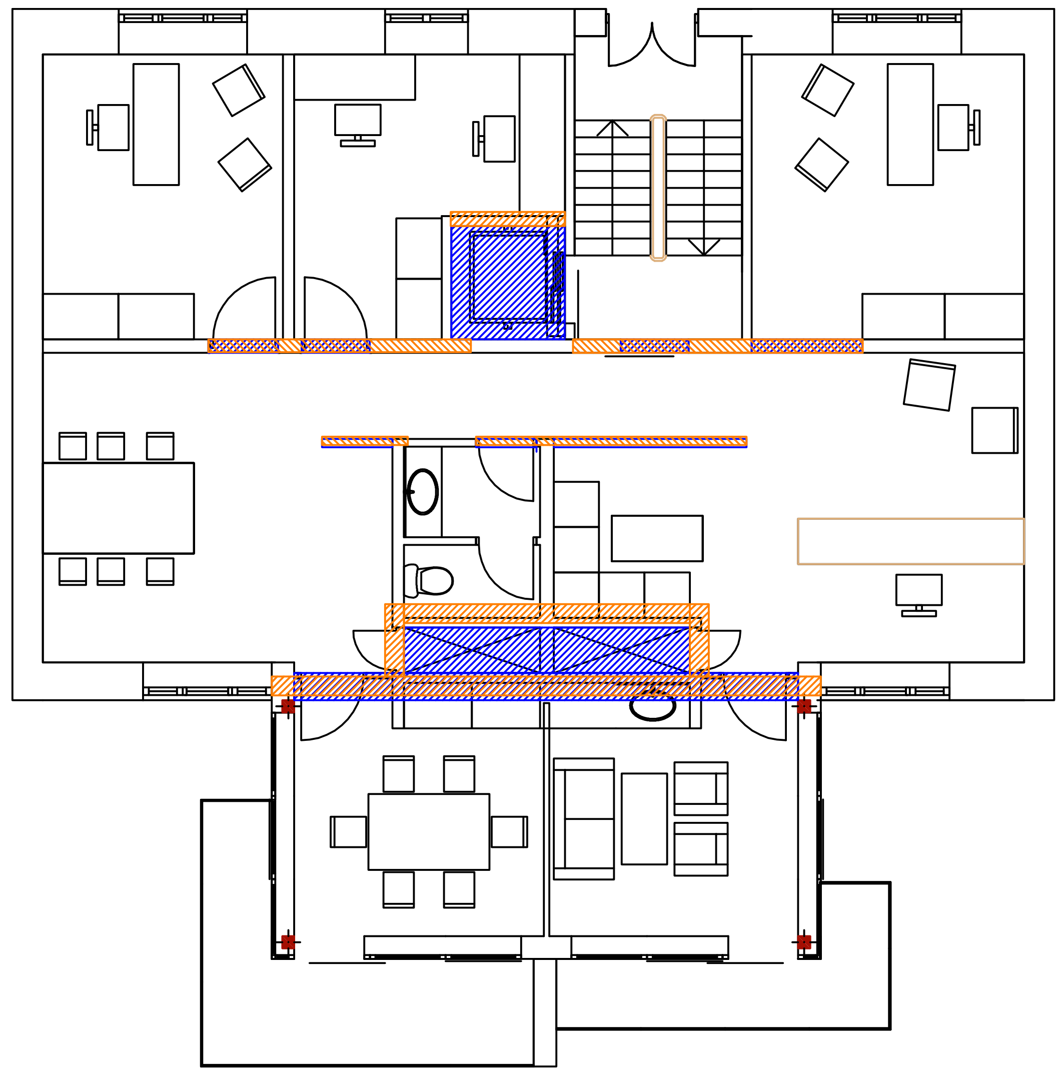








Plan of basement



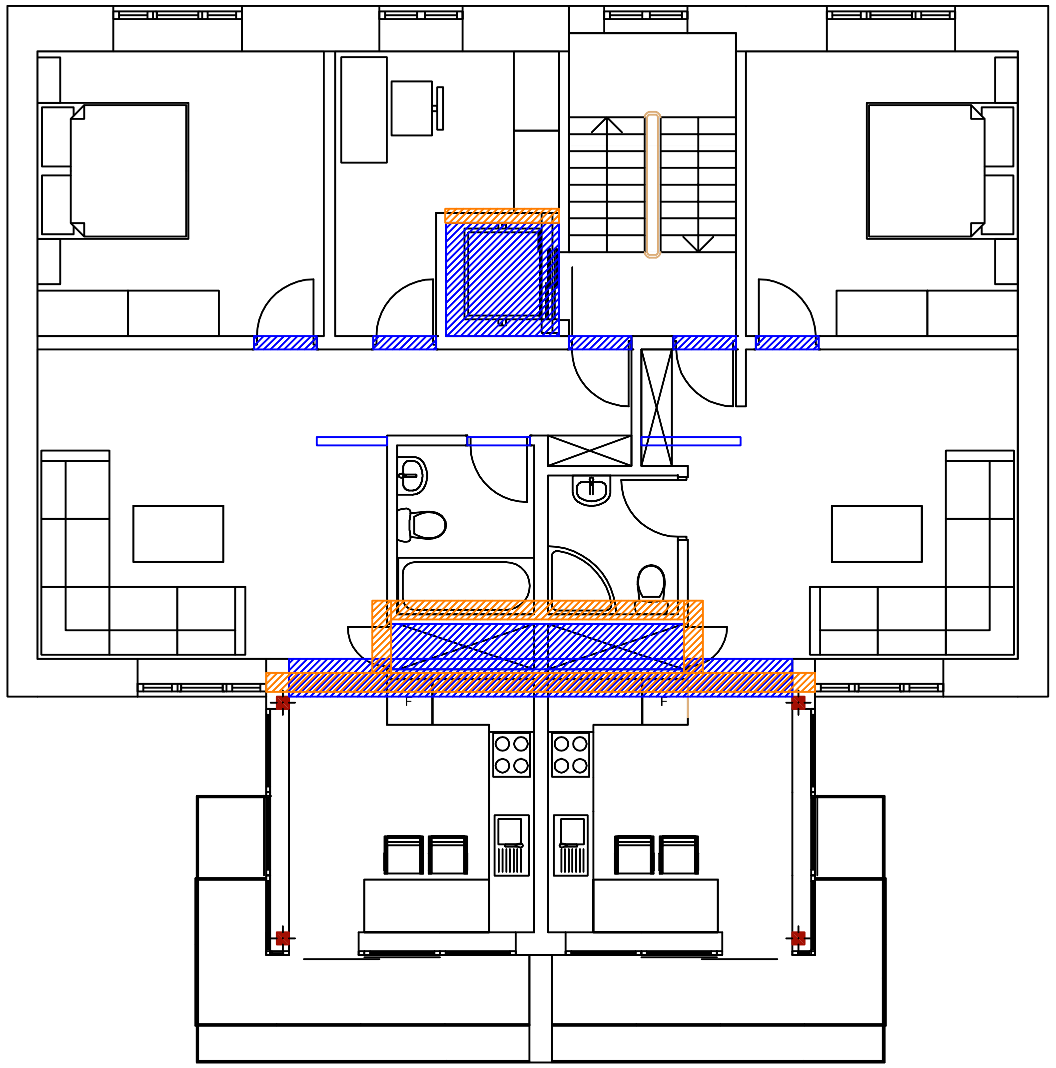
Plan of ground floor

Floor beams

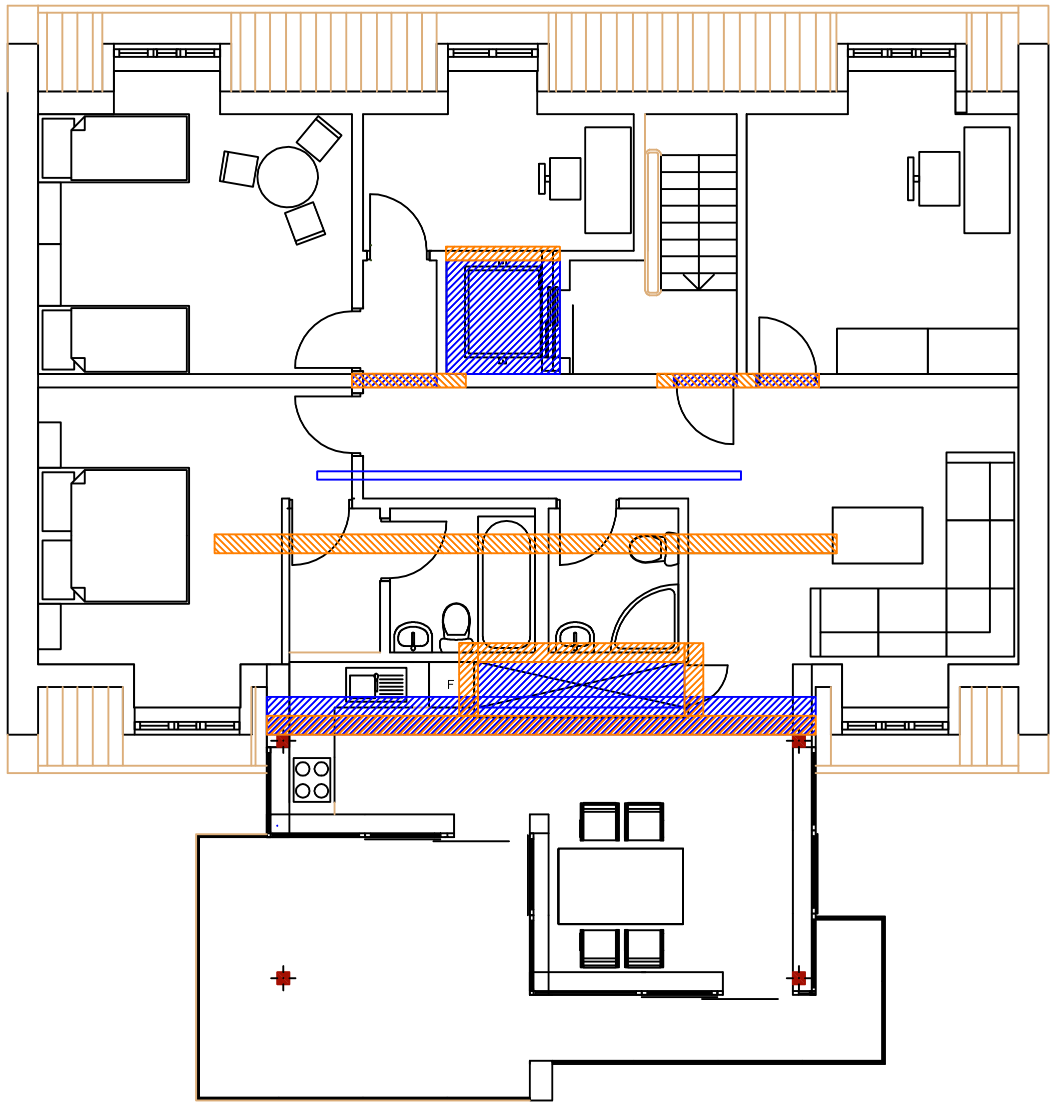
Wall beams

New vertical and horizontal holes

project:	Urban Renewal - Dannebrogsgade 4, Aarhus	date:	
subject:	Beams and holes part 1	scale:	1:100
		phase:	**Outline**
		drawing number:	
class:	BK52E, Group 01		
name:	Landivar Taborga, Arnaldo		



Plan of first floor, second and third floors

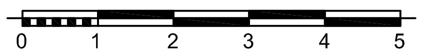


Plan of roof storey

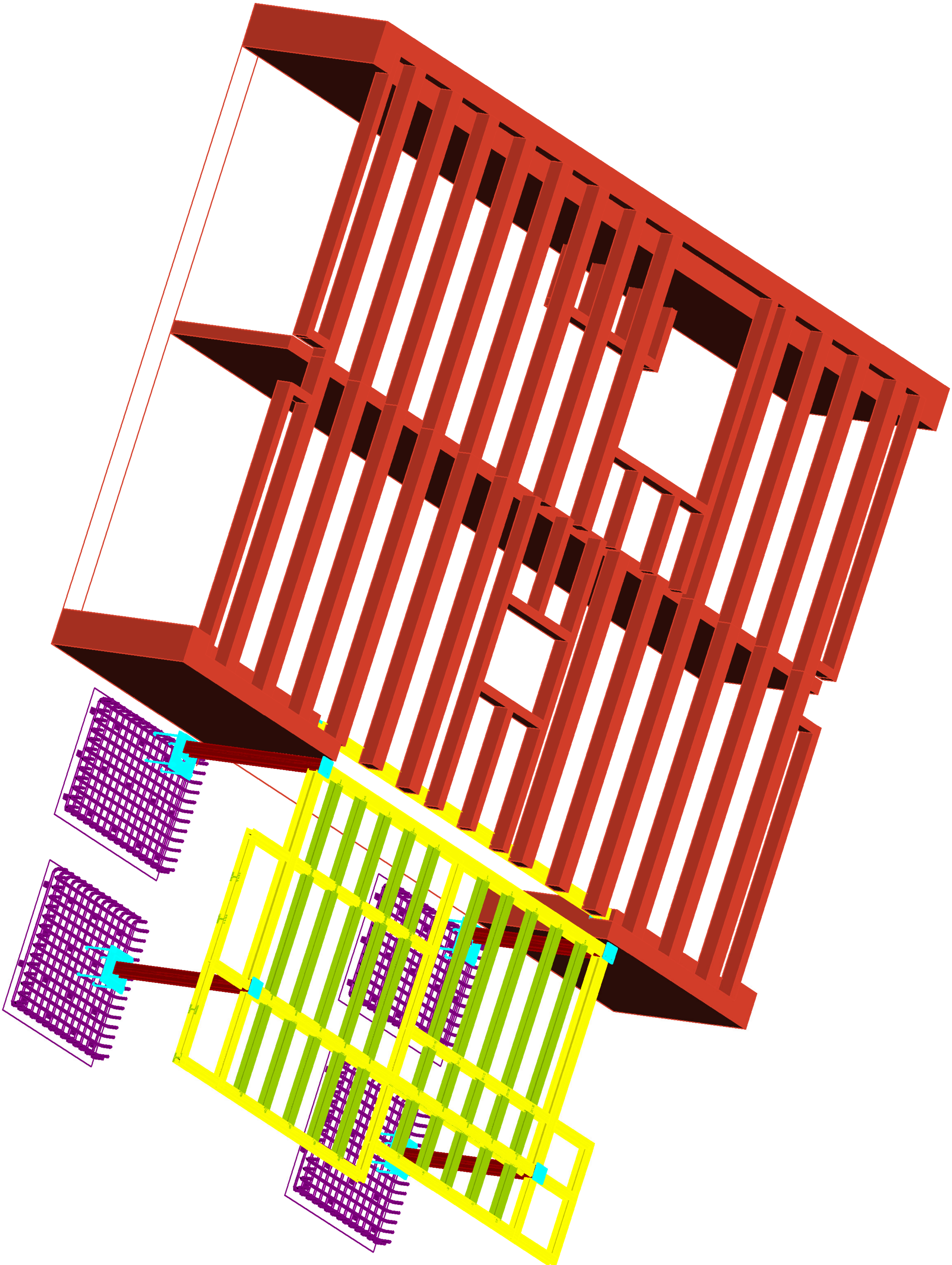
Floor beams

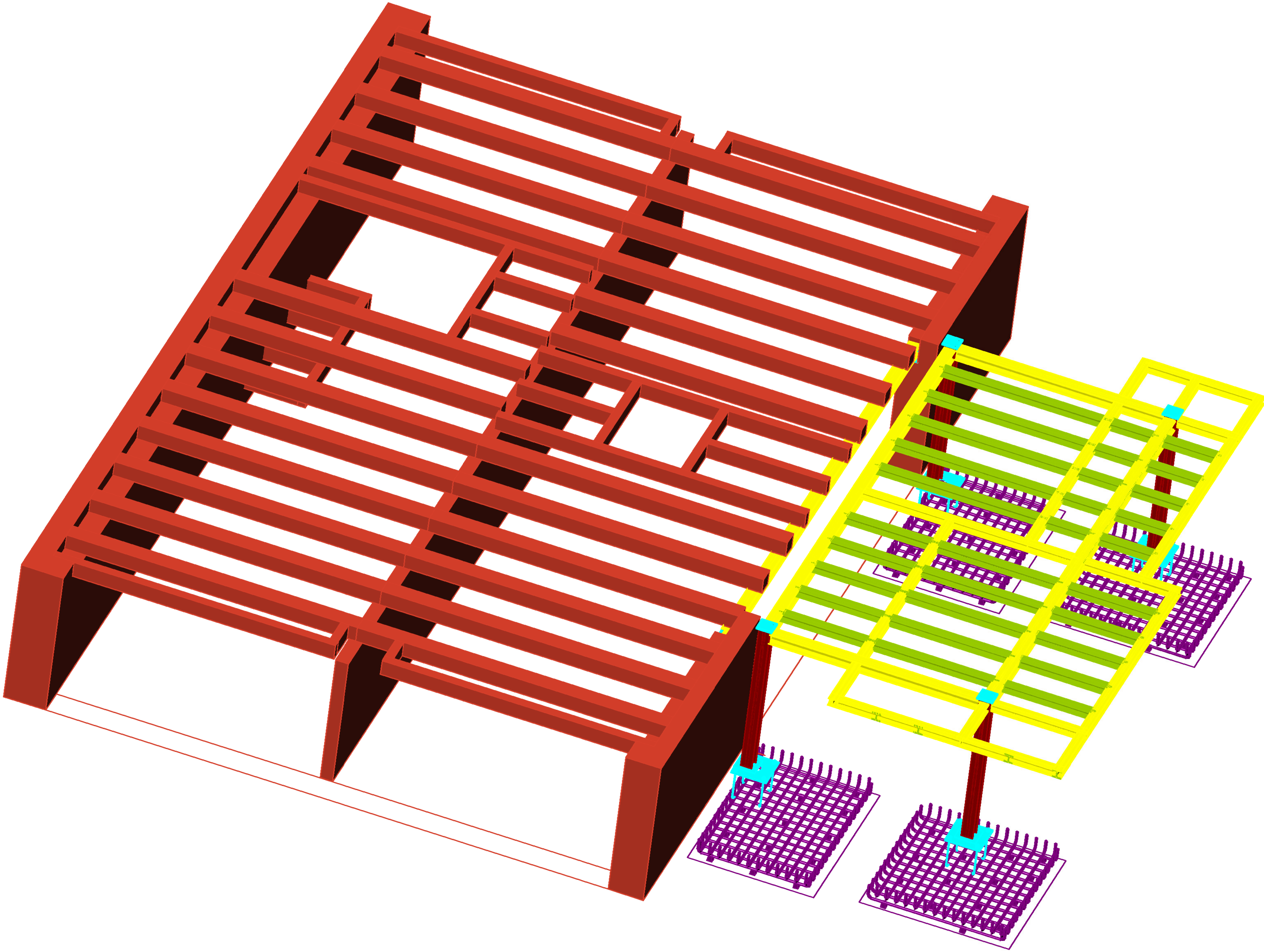
Wall beams

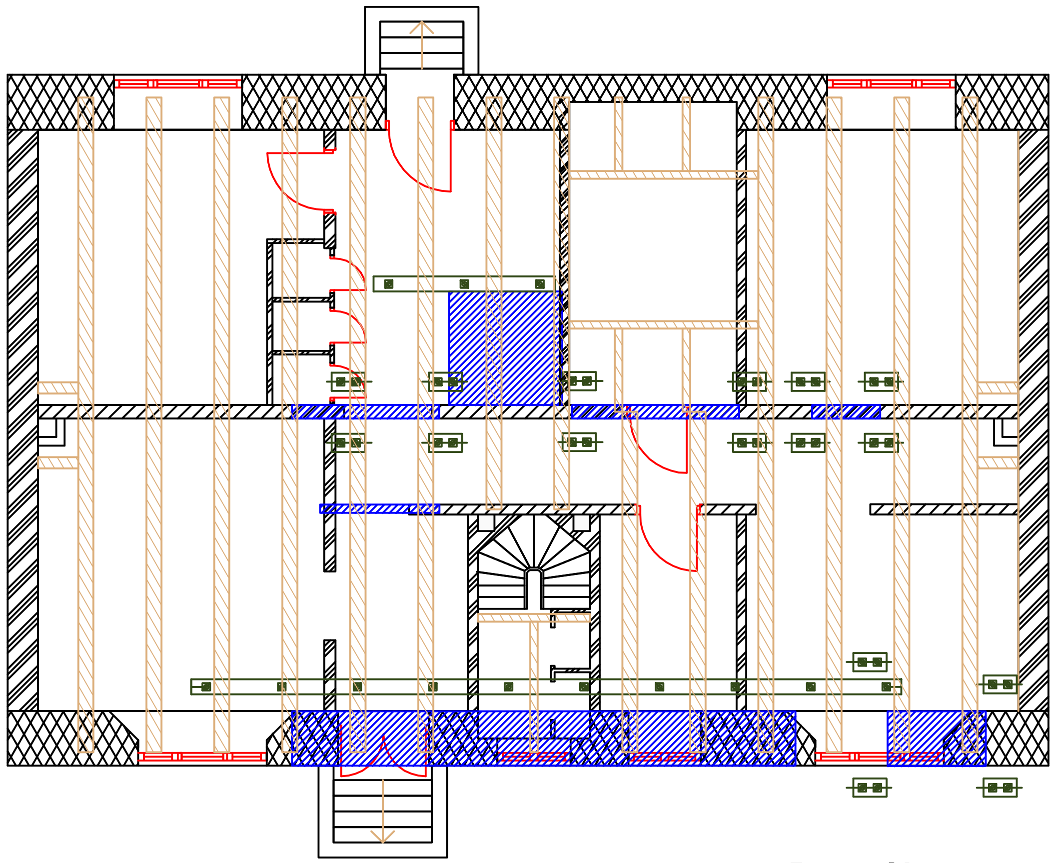
New vertical and horizontal holes



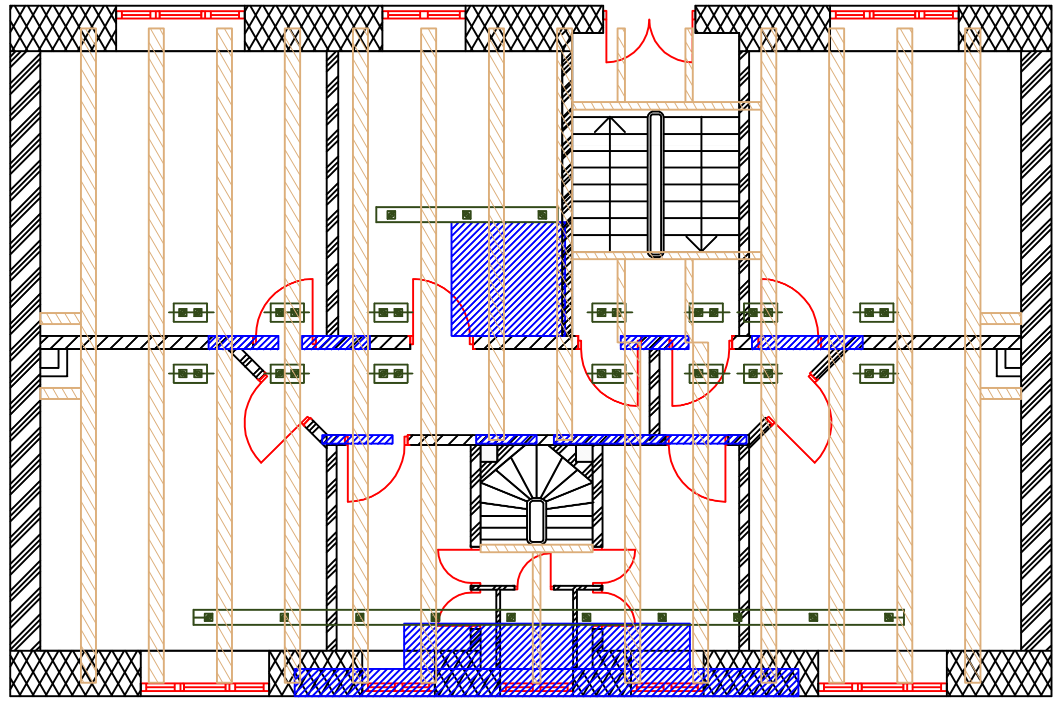
project:	Urban Renewal - Dannebrogsgade 4, Aarhus	date:	
subject:	Beams and holes part 2	scale:	1:100
		phase:	**Outline**
		drawing number:	
class:	BK52E, Group 01		
name:	Landivar Taborga, Arnaldo		







Plan of basement



Plan of ground floor

Roof / joist / façade / wind
Vertical loads coming from the roof, joists and façade walls Wind forces on the façade walls

Roof / joist / wall
Vertical loads coming from the roof, joists and walls

Joist / wall
Vertical loads coming from the joists and walls

Joists / trusses

Existing holes

New vertical and horizontal holes

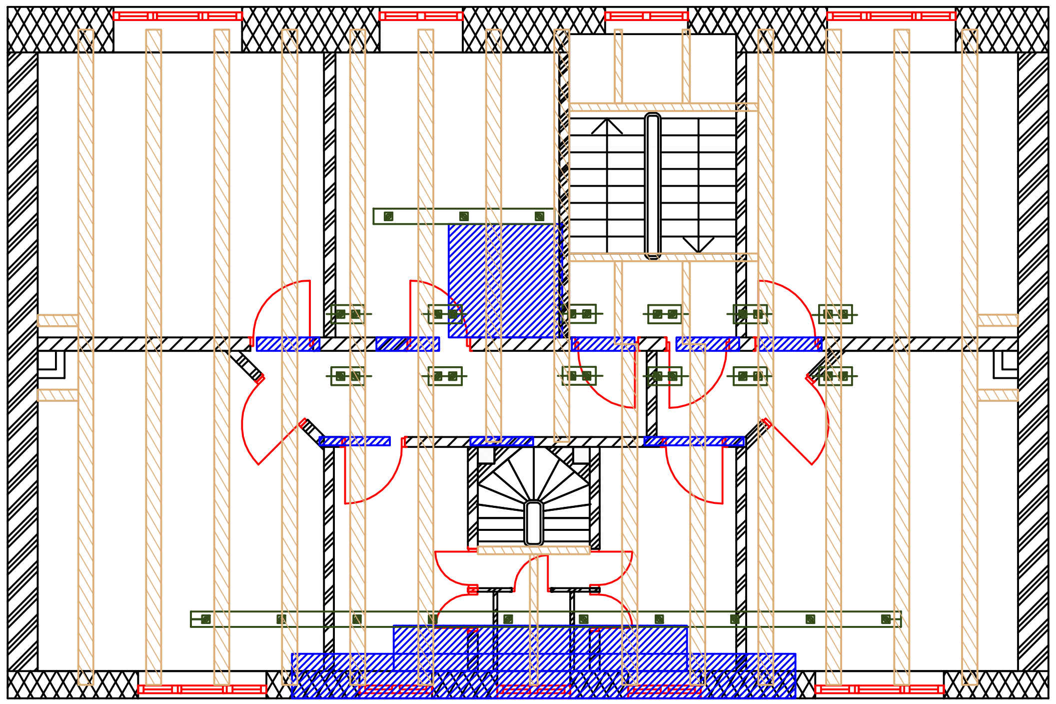
Floor shoring+wood soles

Dead shore+wood soles

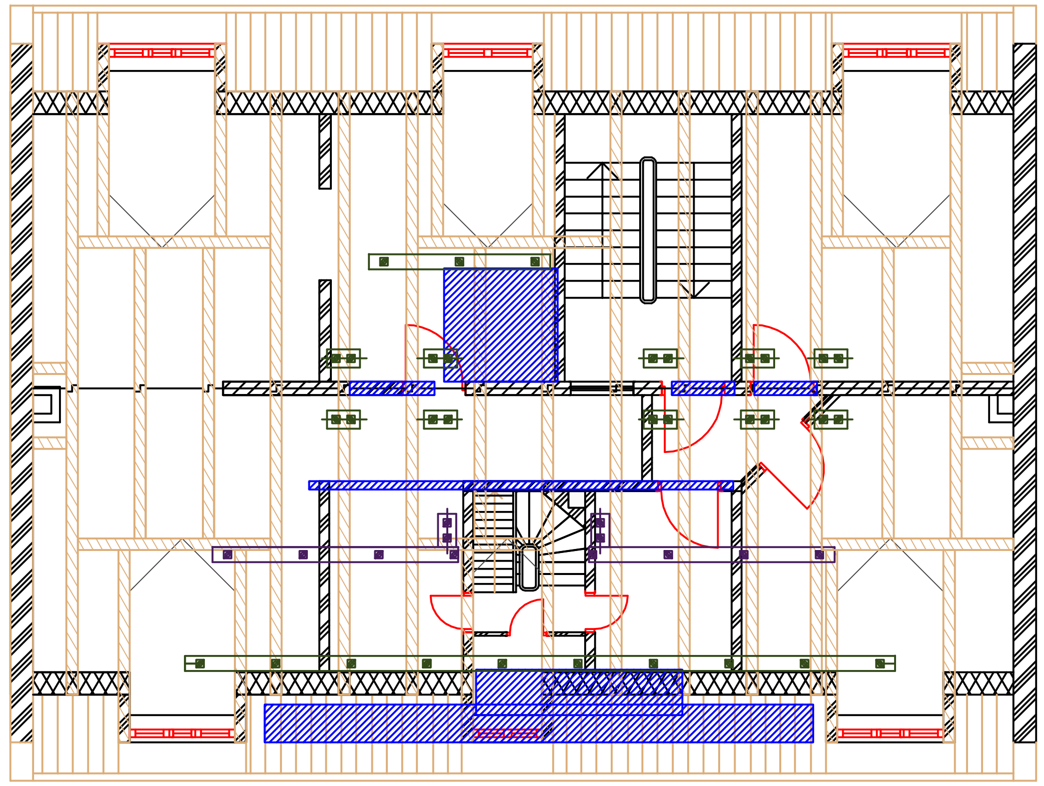
Roof shoring+ wood soles

Roof dead shore+ wood soles

project:	**Urban Renewal - Dannebrogsgade 4, Aarhus**	date:	
subject:	Shoring part 1	scale:	1:100
		phase:	**Outline**
class:	BK52E, Group 01	drawing number:	
name:	Landivar Taborga, Arnaldo		



Plan of first floor, second and third floors



Plan of roof storey

Roof / joist / façade / wind
Vertical loads coming from the roof, joists and façade walls
Wind forces on the façade walls

Roof / joist / wall
Vertical loads coming from the roof, joists and walls

Joist / wall
Vertical loads coming from the joists and walls

Joists / trusses

Existing holes

New vertical and horizontal holes

Floor shoring+wood soles

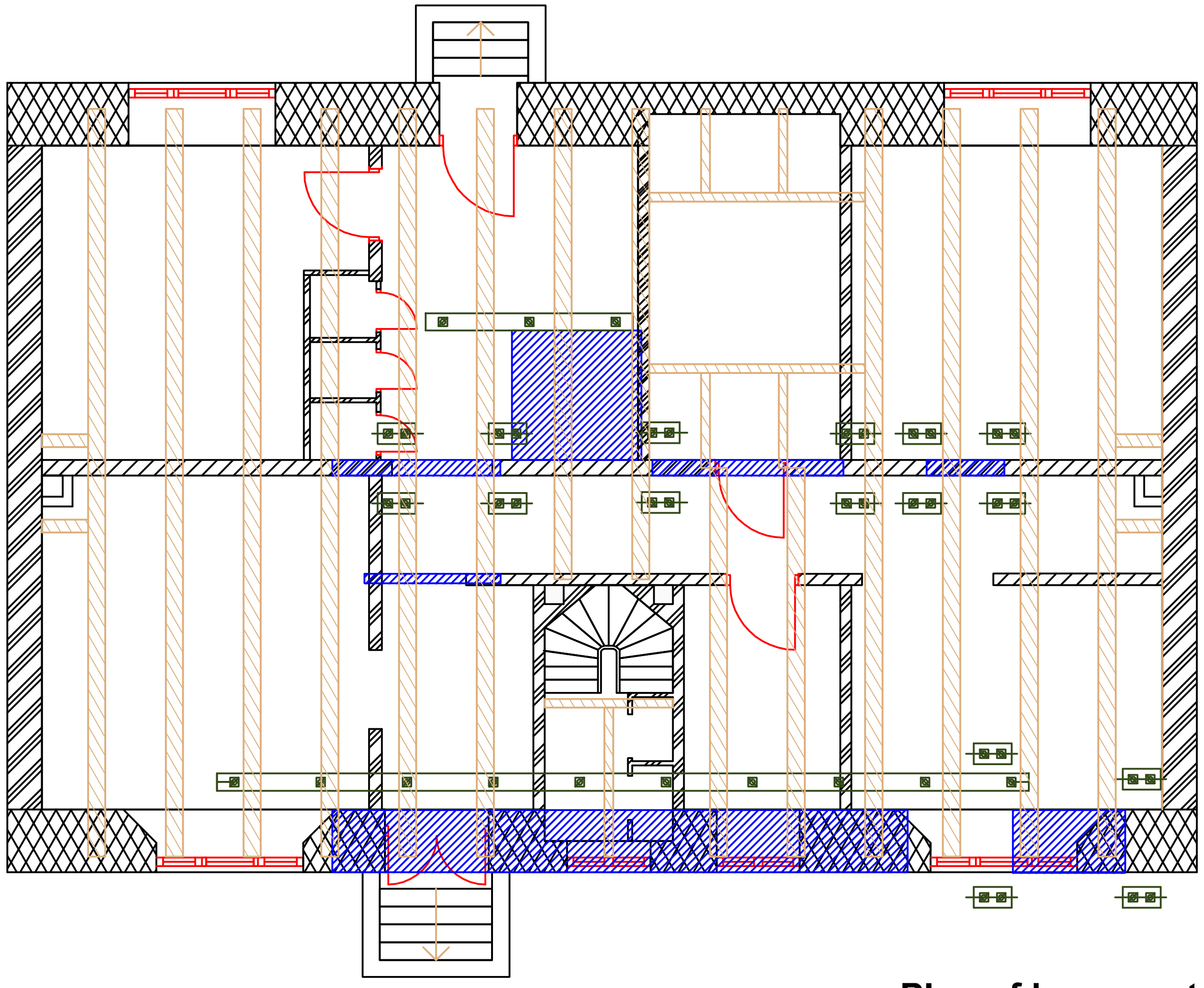
Dead shore+wood soles

Roof shoring+ wood soles

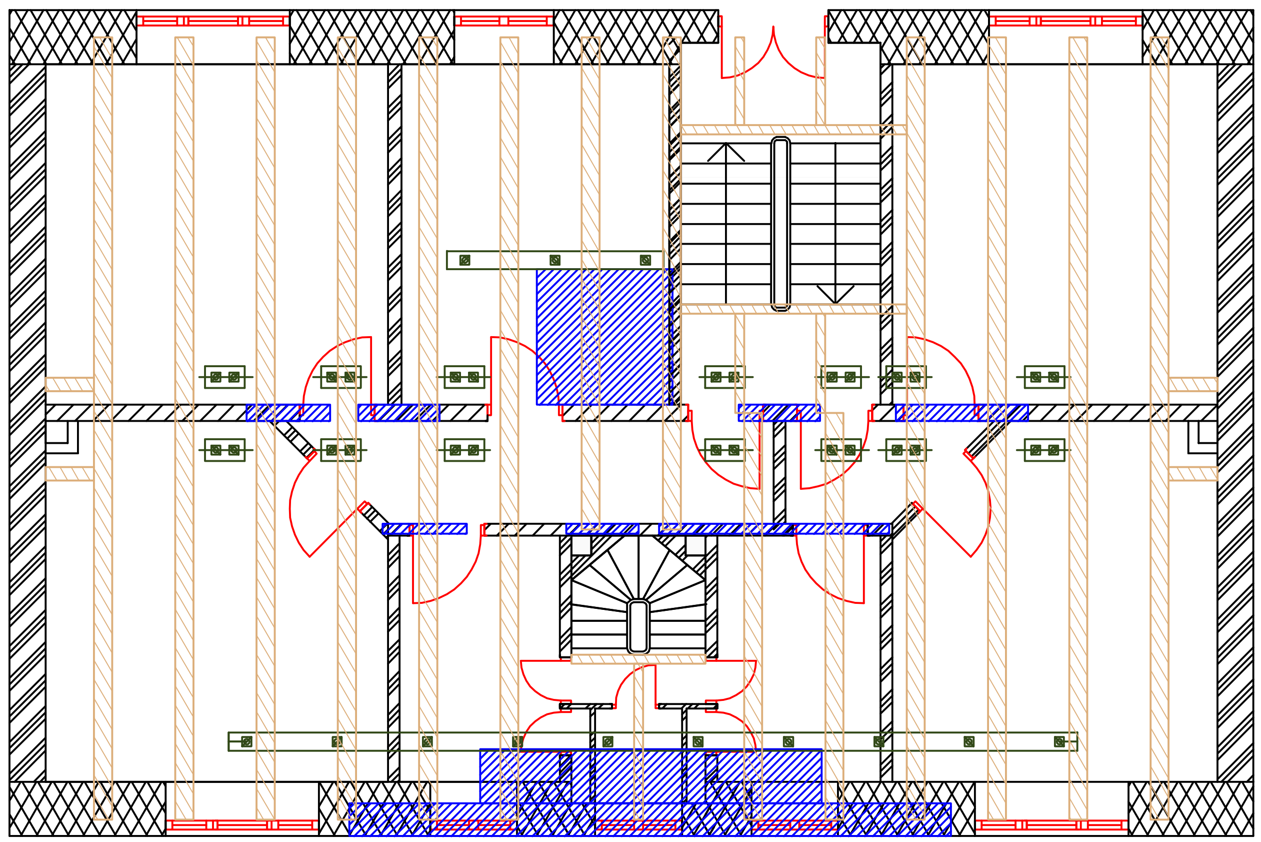
Roof dead shore+ wood soles

0 1 2 3 4 5

project:	**Urban Renewal - Dannebrogsgade 4, Aarhus**	date:	
subject:	Shoring part 2	scale:	1:100
		phase:	**Outline**
		drawing number:	
class:	BK52E, Group 01		
name:	Landivar TAborga, Arnaldo		



Plan of basement



Plan of ground floor

Roof / joist / façade / wind
Vertical loads coming from the roof, joists and façade walls
Wind forces on the façade walls

Roof / joist / wall
Vertical loads coming from the roof, joists and walls

Joist / wall
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New vertical and horizontal holes

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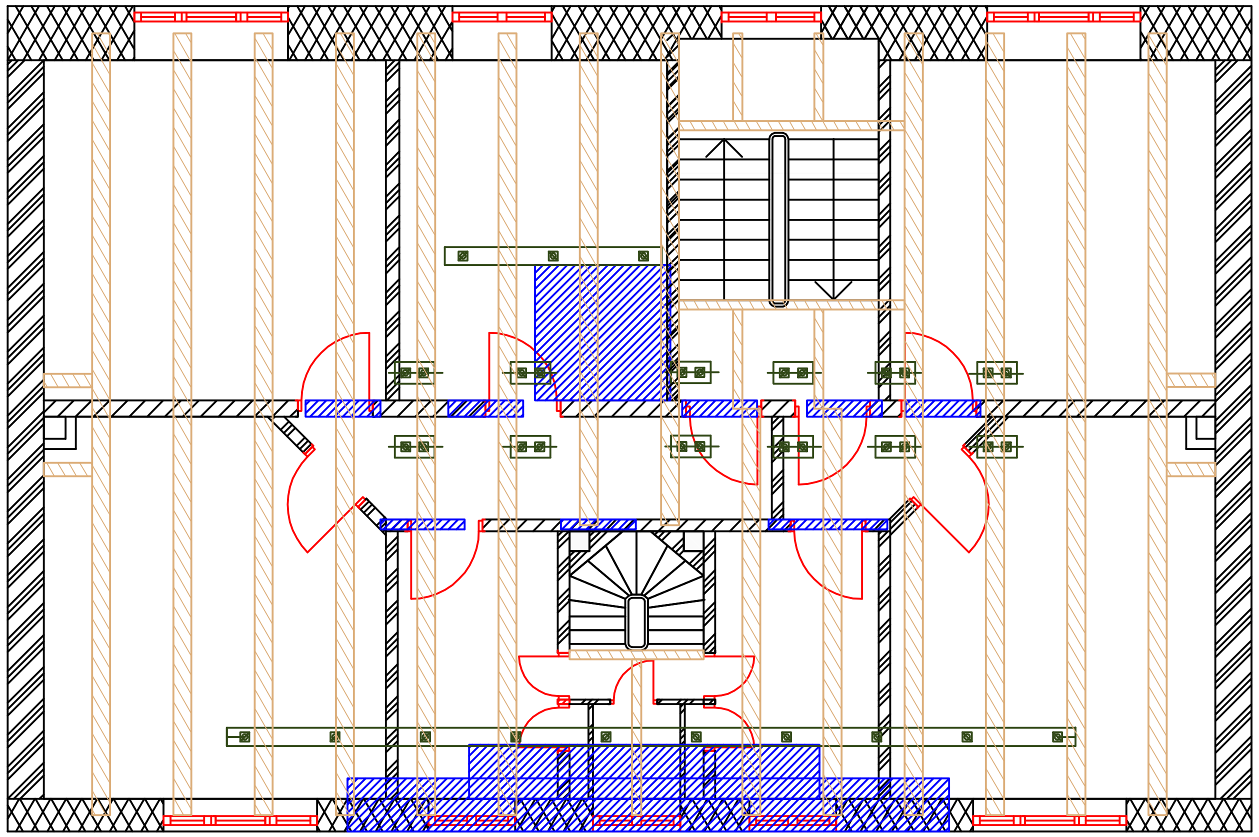
Joists / trusses

0 1 2 3 4 5



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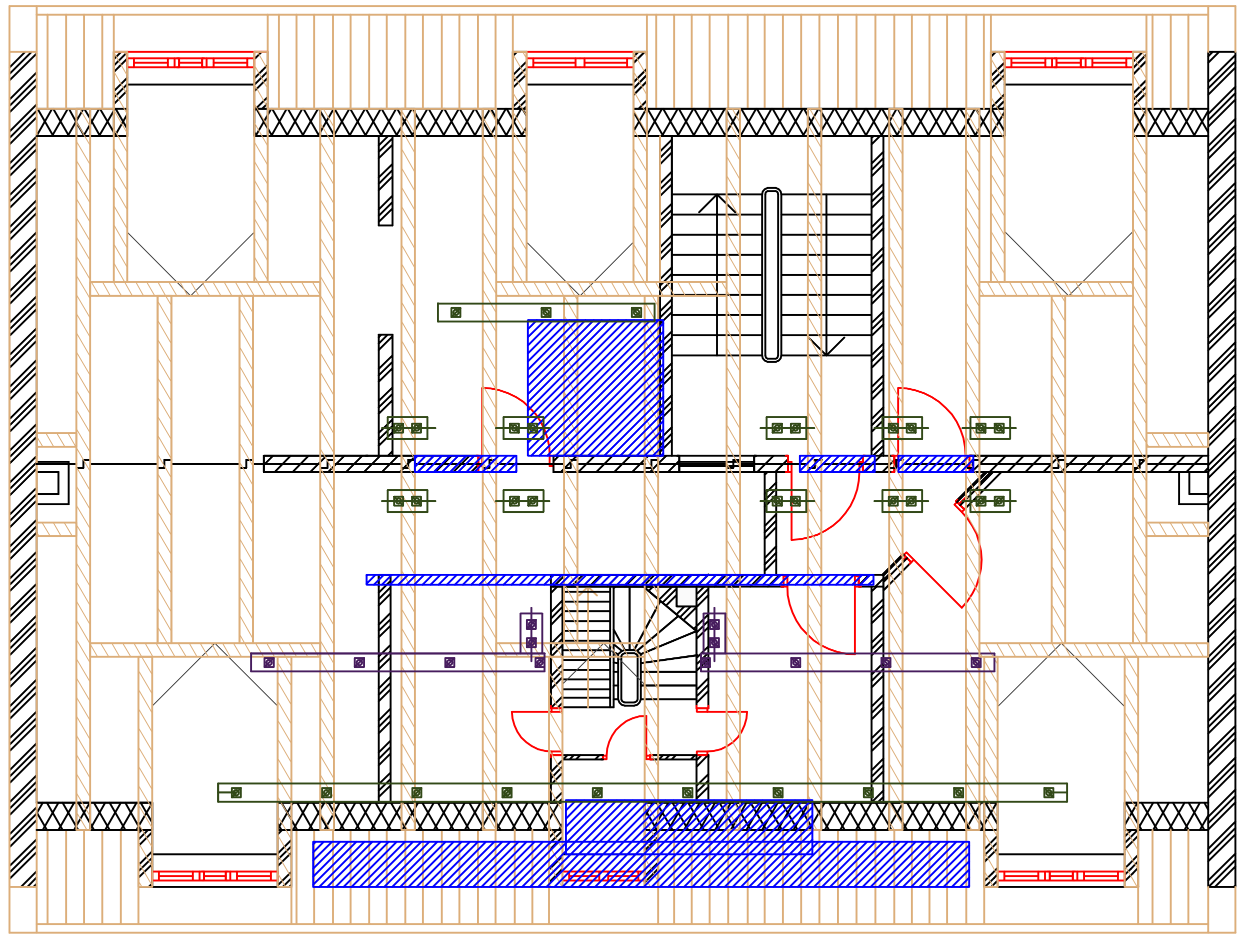

Plan of roof storey

Roof / joist / façade / wind
Vertical loads coming from the roof, joists and façade walls
Wind forces on the façade walls

Roof / joist / wall
Vertical loads coming from the roof, joists and walls

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Vertical loads coming from the joists and walls

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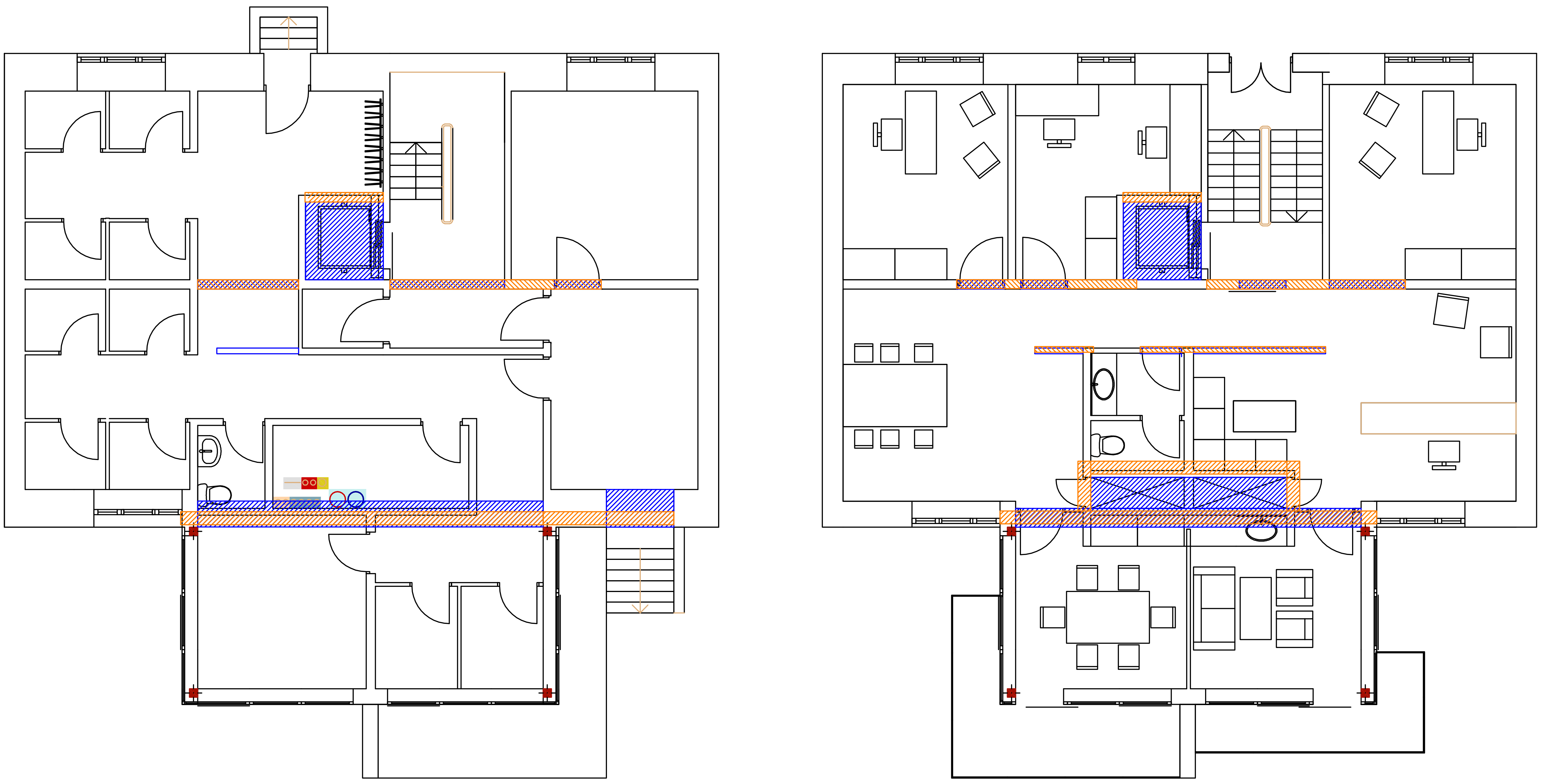
Joists / trusses

0 1 2 3 4 5



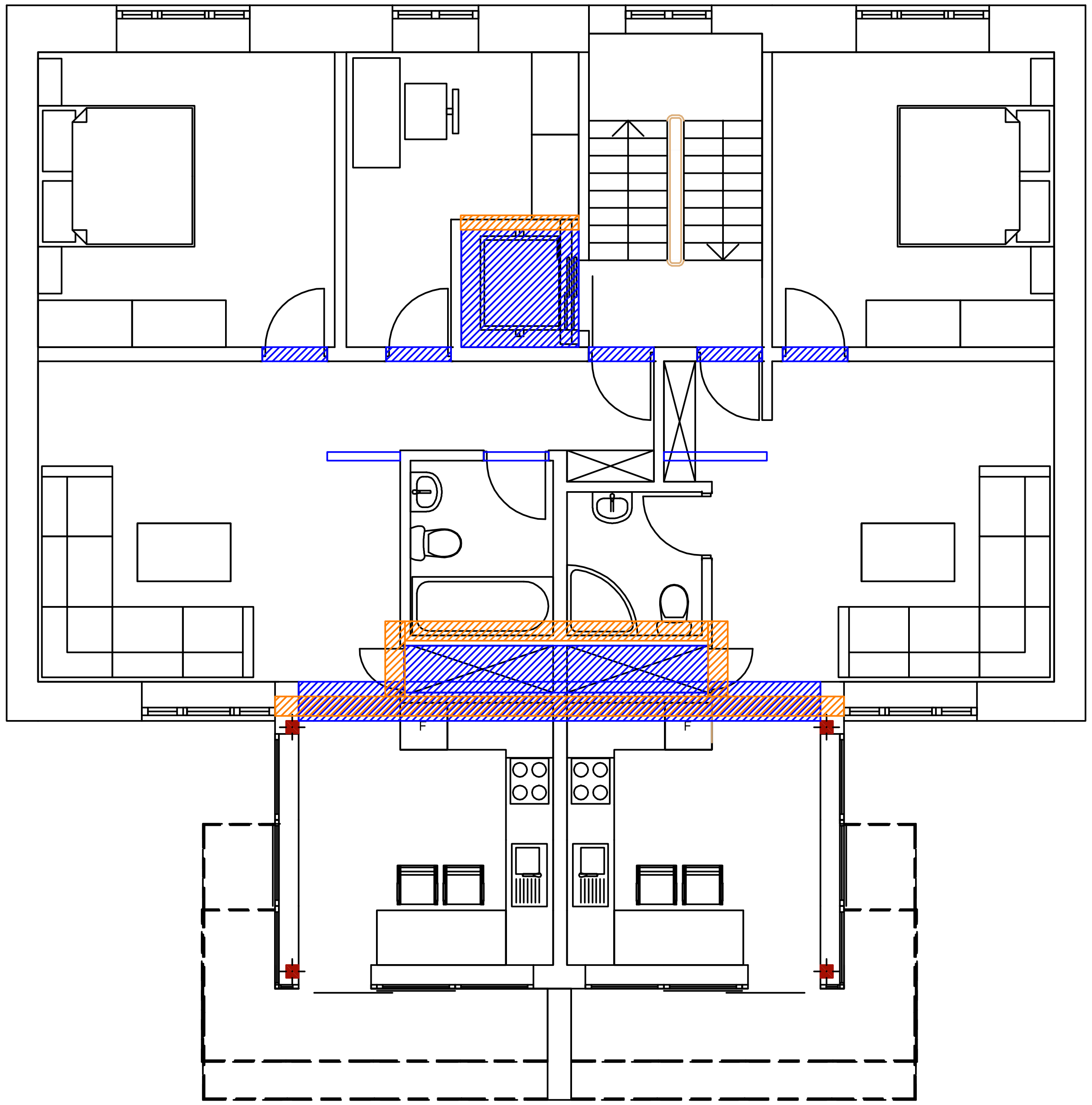
Plan of basement

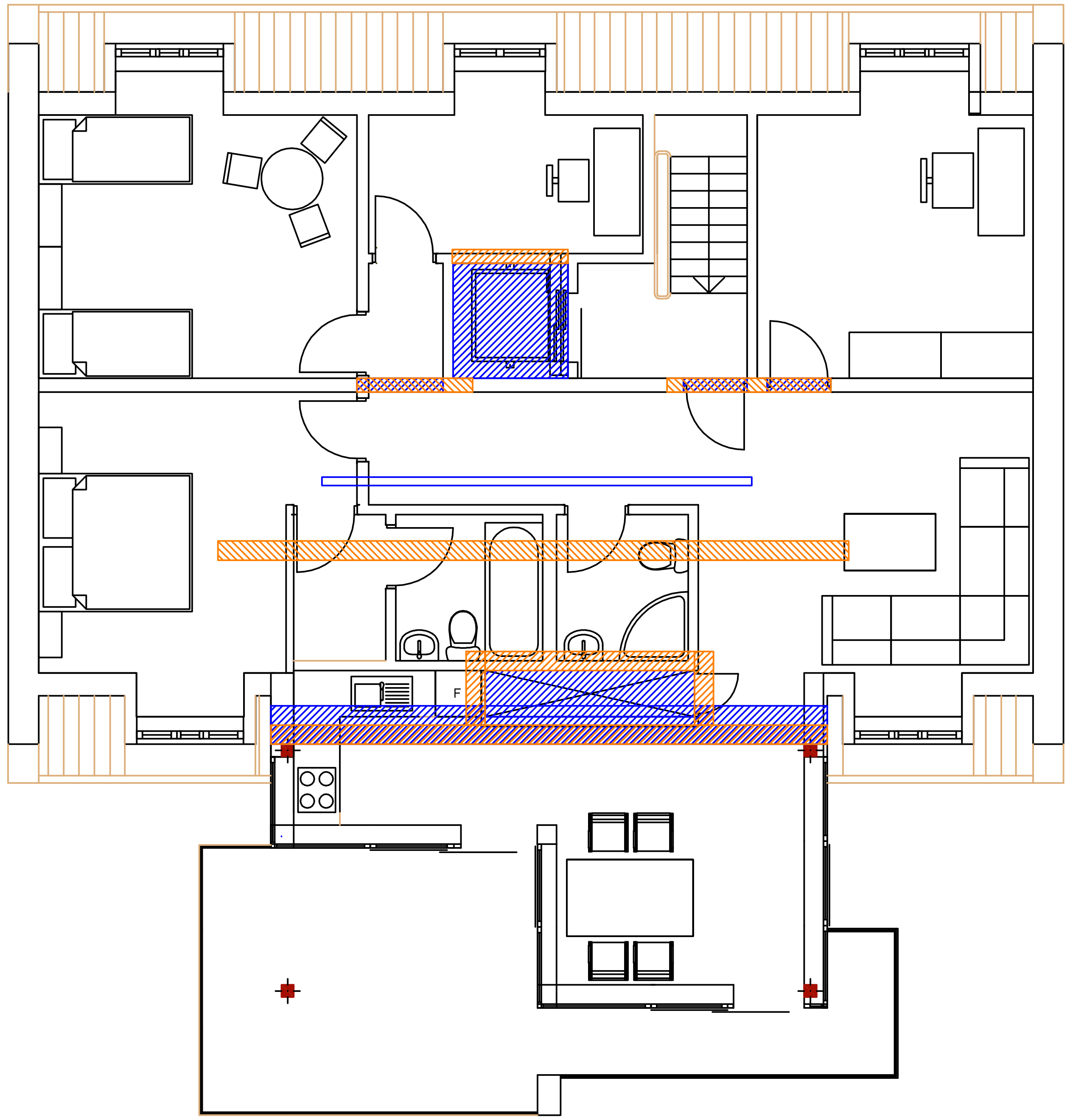
Plan of ground floor

Floor beams

New vertical and horizontal holes

Wall beams





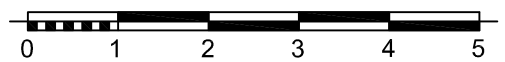
Plan of first floor, second and third floors

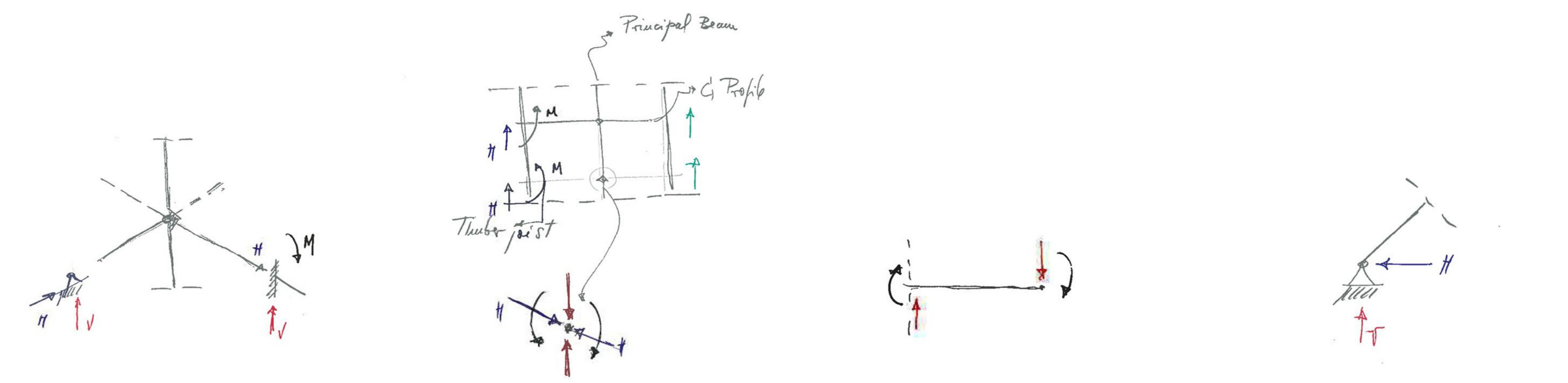
Plan of roof storey

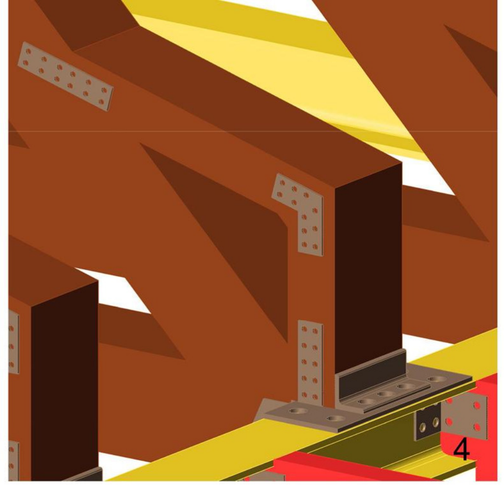
Floor beams

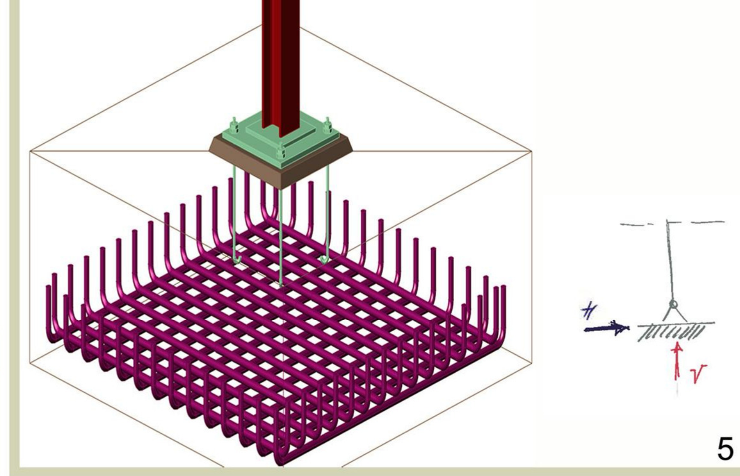
New vertical and horizontal holes

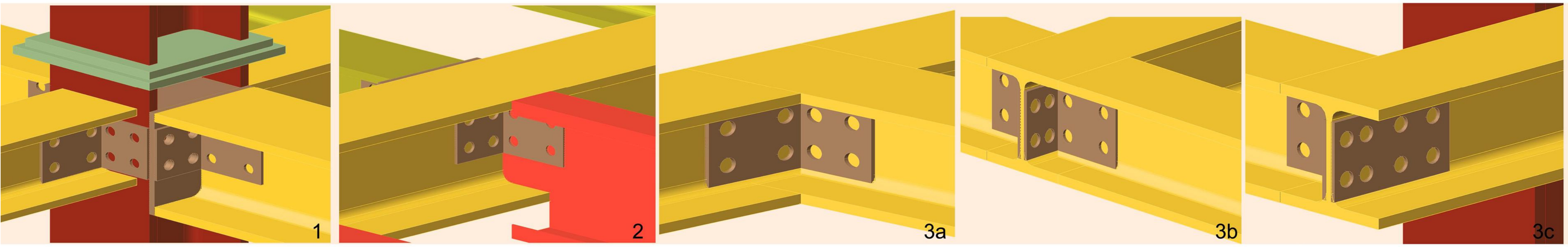
Wall beams









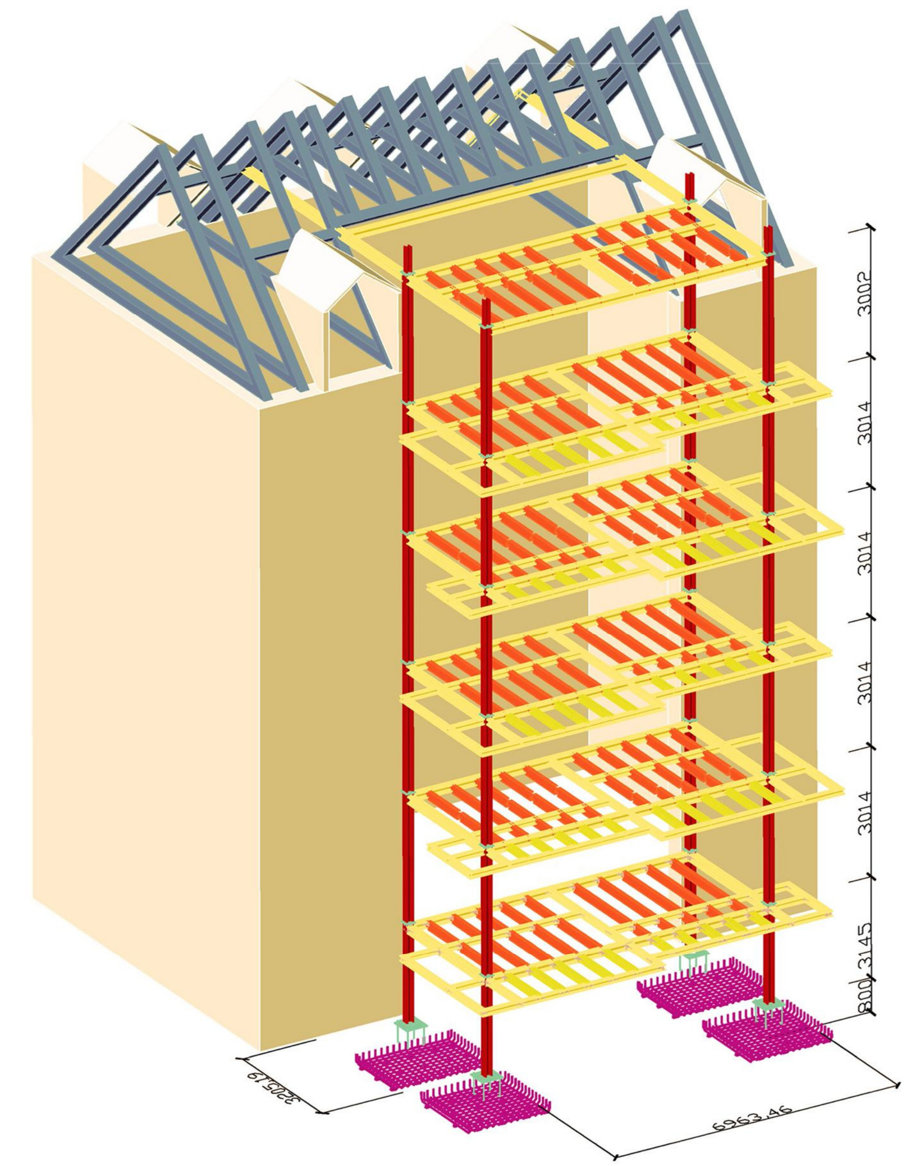


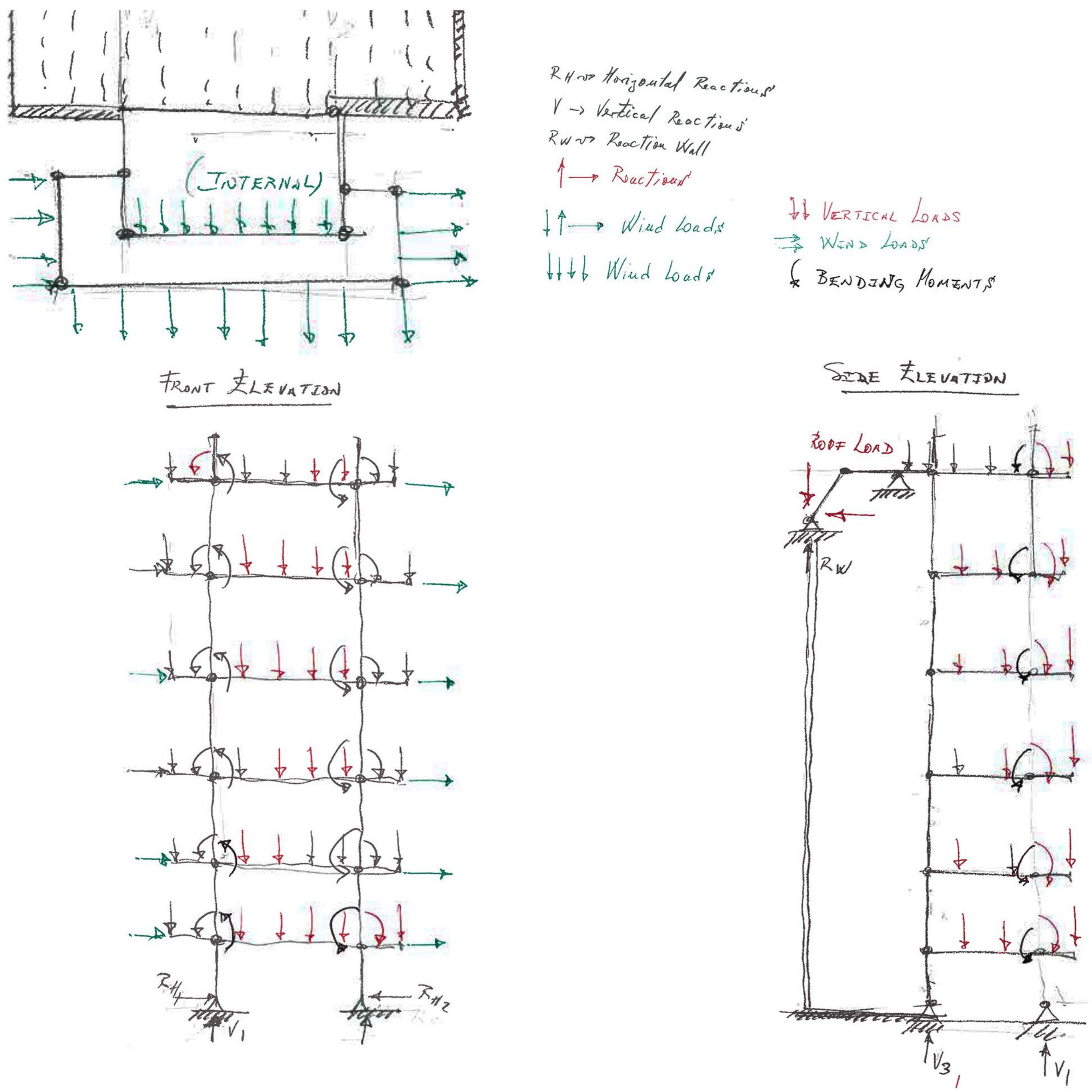
Static Analysis

Analysis of some main force transmitting joints

→ Support types and connection principals

1 - beams to column
2 - HEB beam with C profile
3 - beam to beam
4 - roof connection
5 - column to foundation





→ System (3D model)
→ Principal plan
→ Key
→ Front Elevation
→ Side Elevation

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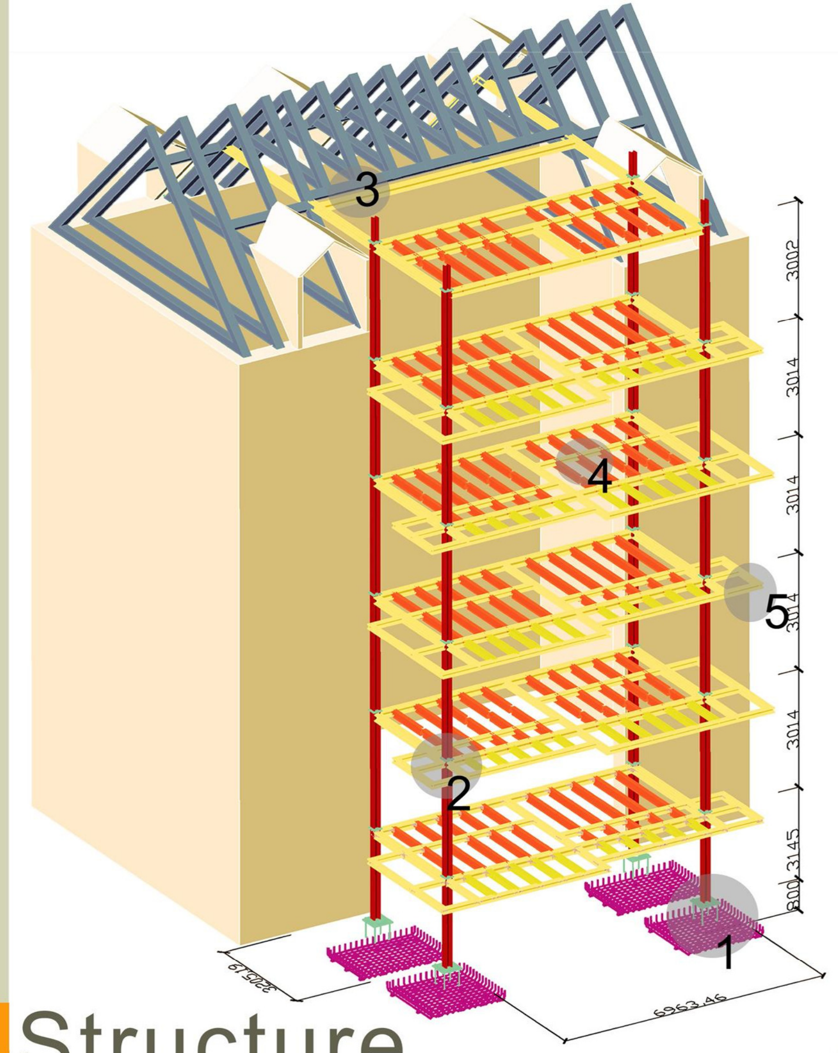
Steel structure comprising:

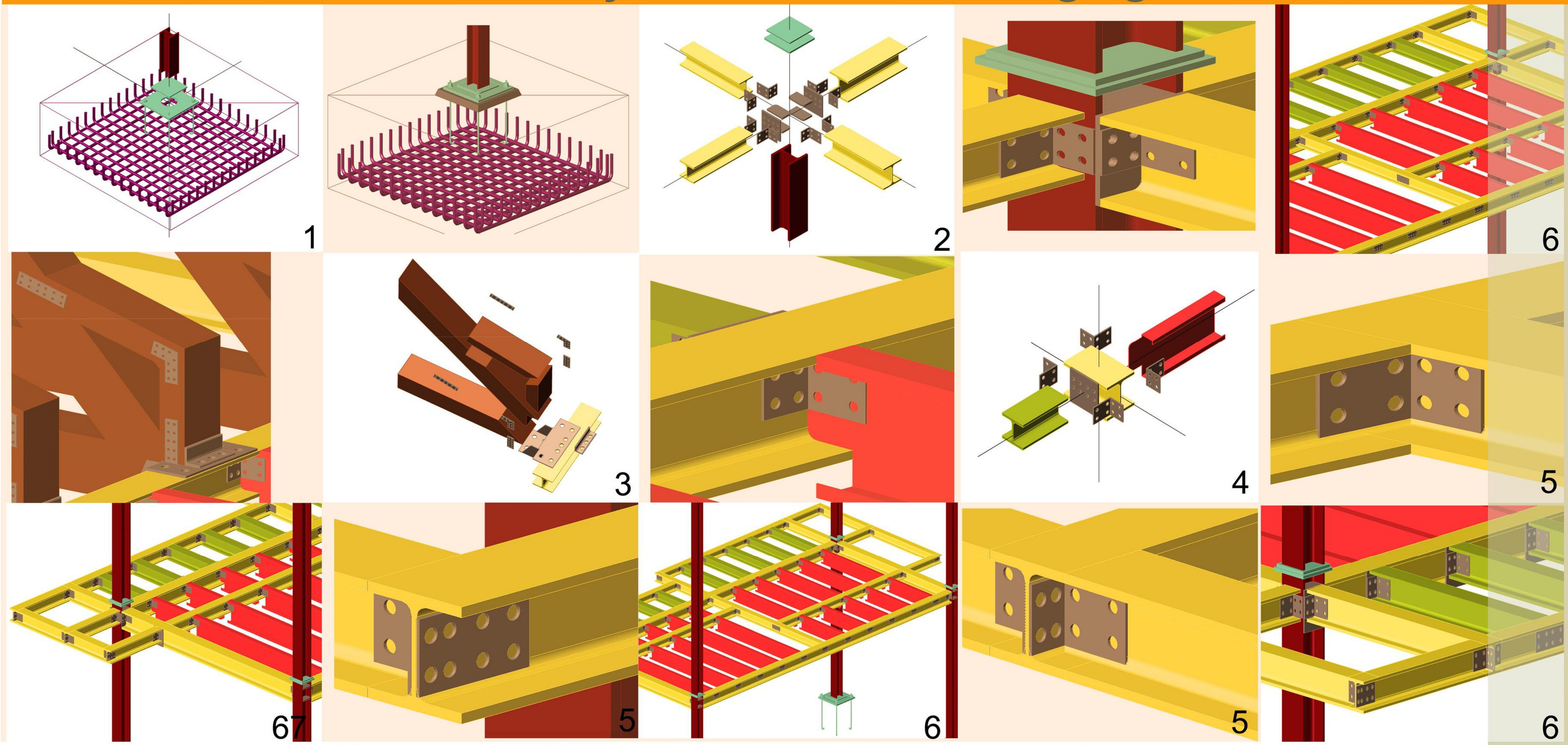
- 4 x 160 HEB columns
- 4 x reinforced concrete spot footing
- 5 x 160 HEB beams (principal beams, connecting the columns) on each storey
- 1 x 160 HEB beam, in the roof structure
- 10 x C profiles (250 x 63.50 x 2.50 mm) on each storey
- 10 x 120 HEB beams, for the cantilever balconies

1 - HEB 160 column connected to cast concrete foundation through grout mortar and fixed with a plate with anchorages
2 - Connection of HEB 160 main beams and HEB 120 cantilever beam (from the balcony) with the HEB 160 column: bolted connection
3 - Connection between the two roofs: steel angle bolted to the HEB beams and to the trusses; attached wooden beams to the original trusses
4 - Connection between C-Profile (200 x 63.50 x 2.50 mm) and the HEB 120 cantilever beam, bolted to the main beam HEB 160
5 - Connection between the cantilever beams HEB 120, from the balcony (end connections)
6 - Views of structure connections



Urban Renewal Project - Dannebrogsgade 4, Aarhus

Structure



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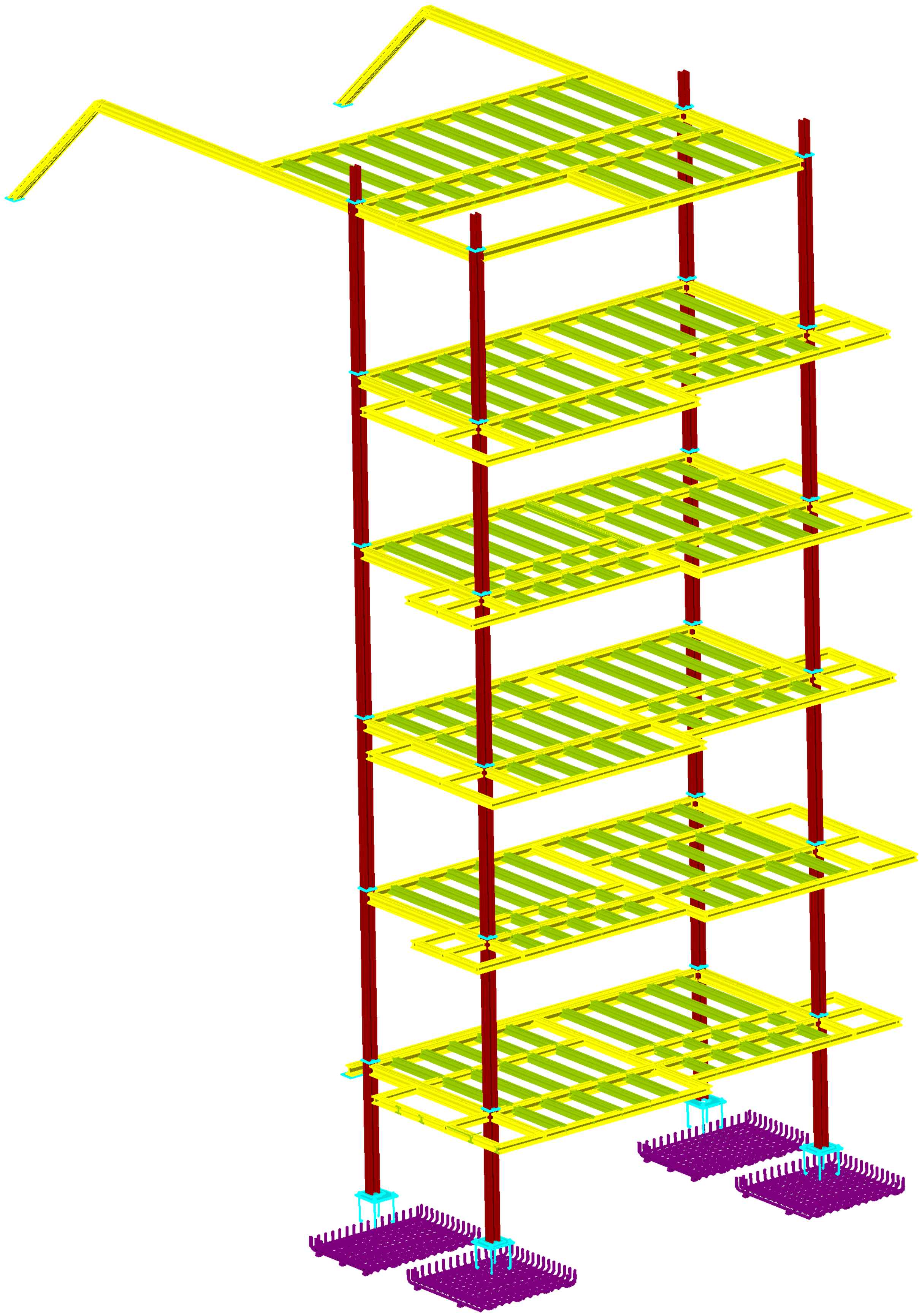
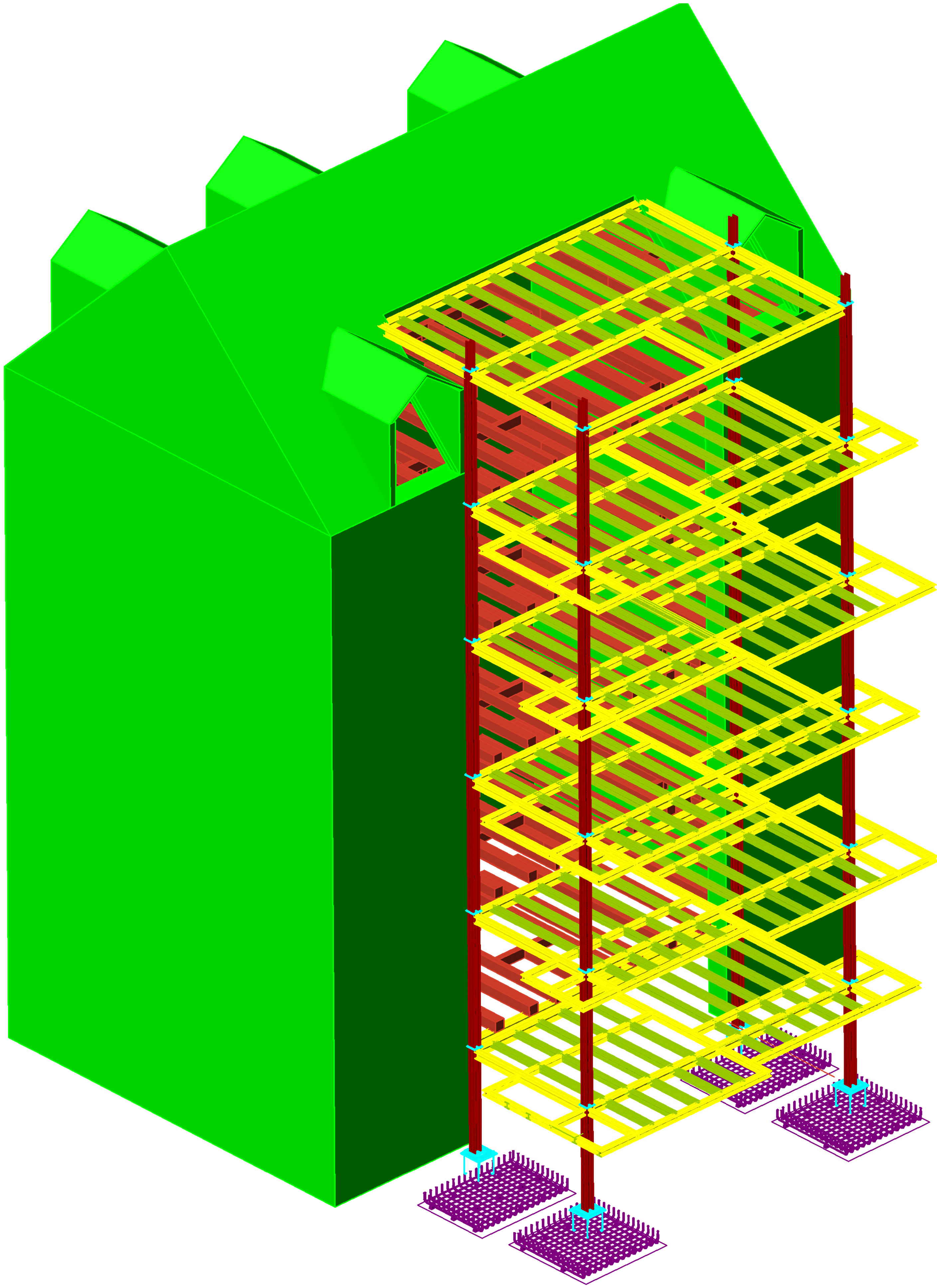
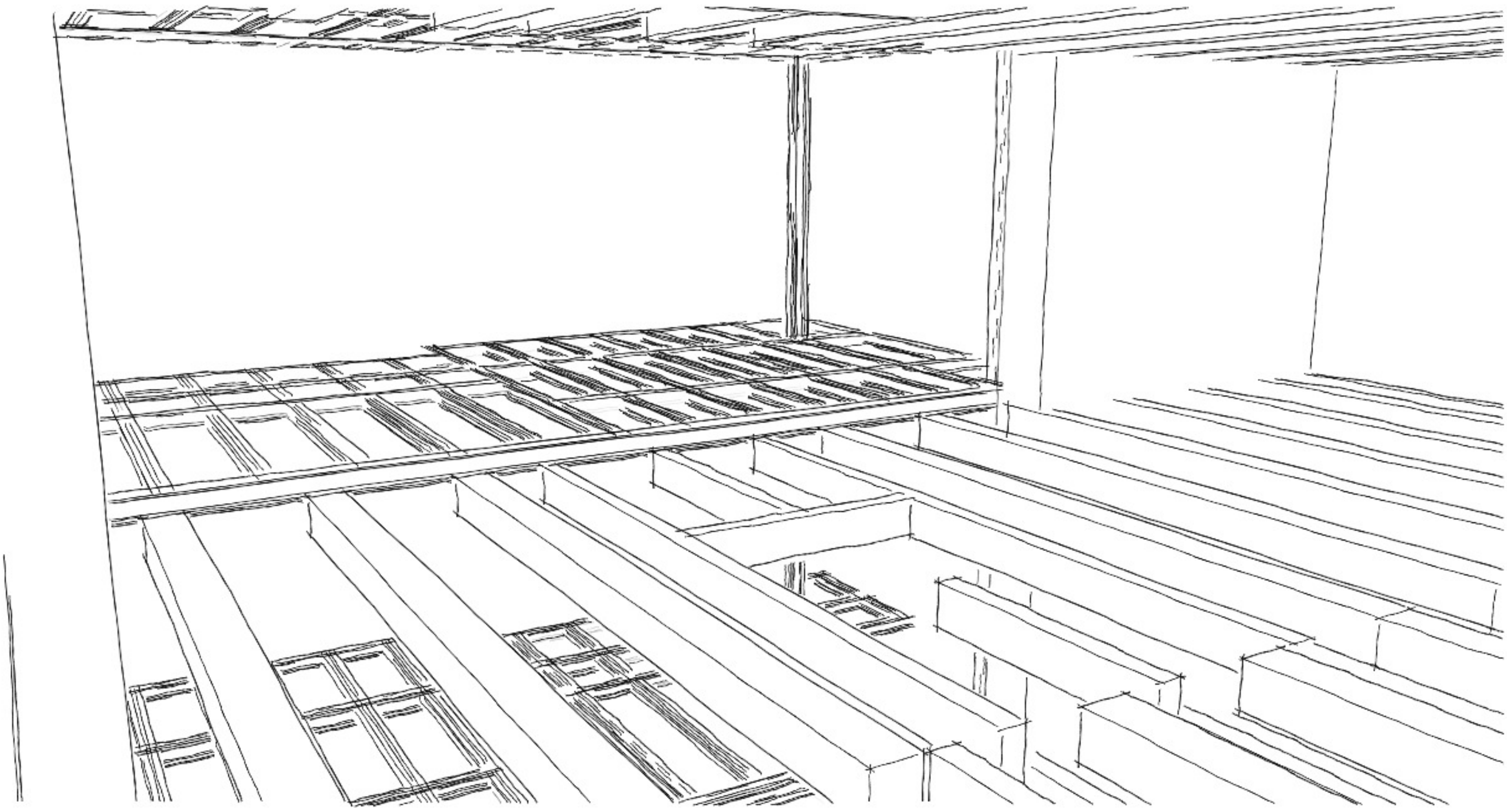
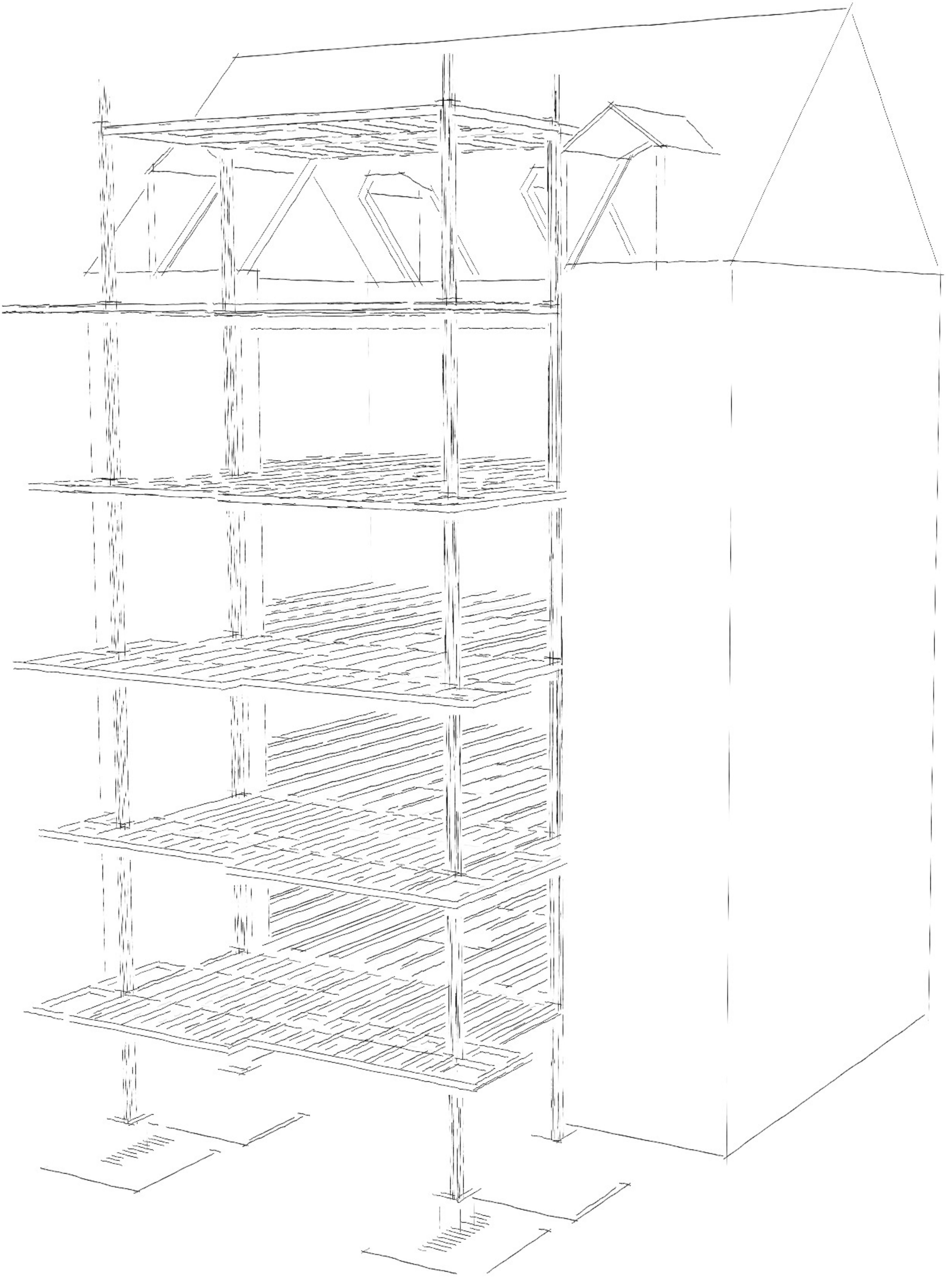
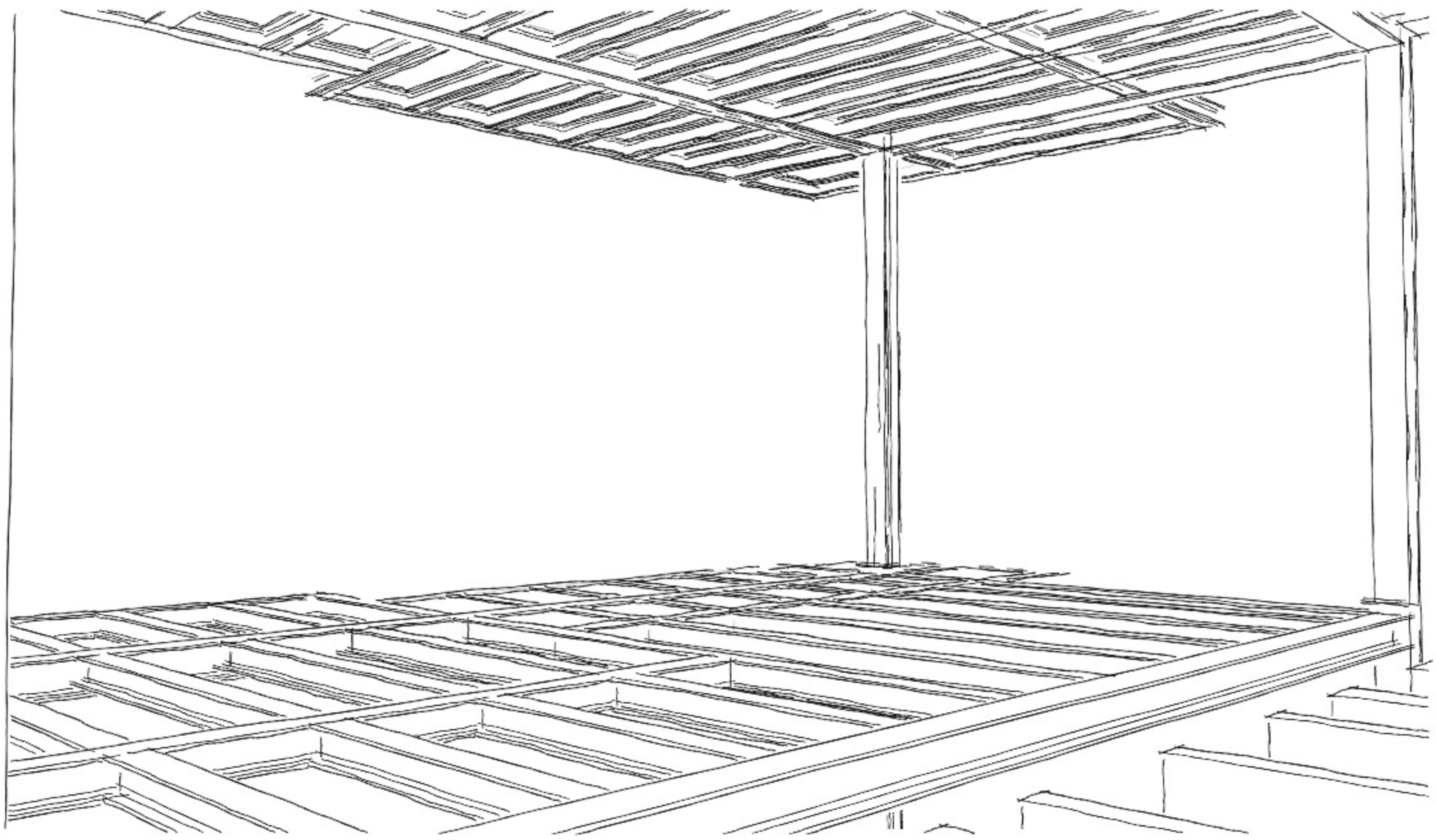
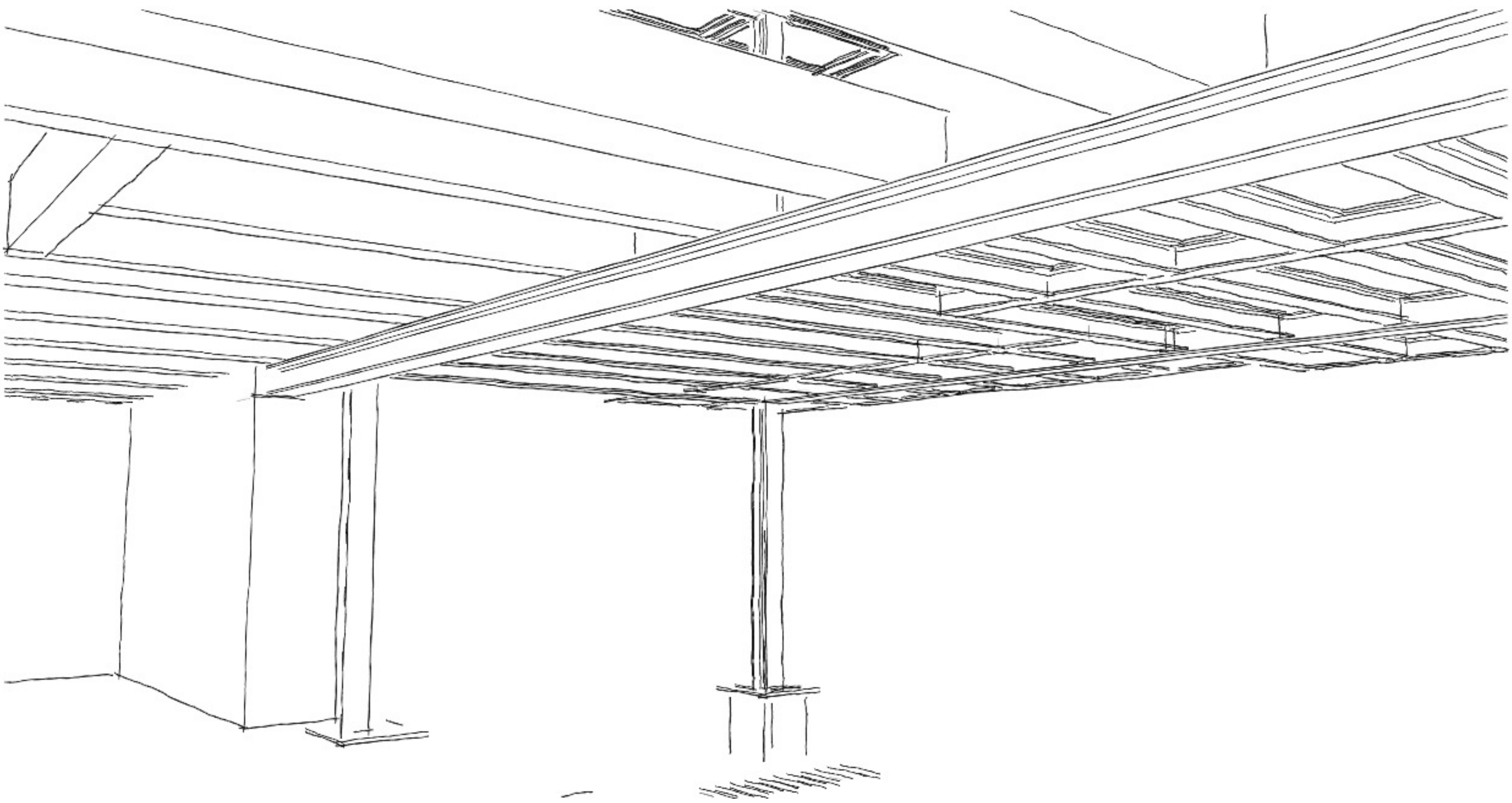


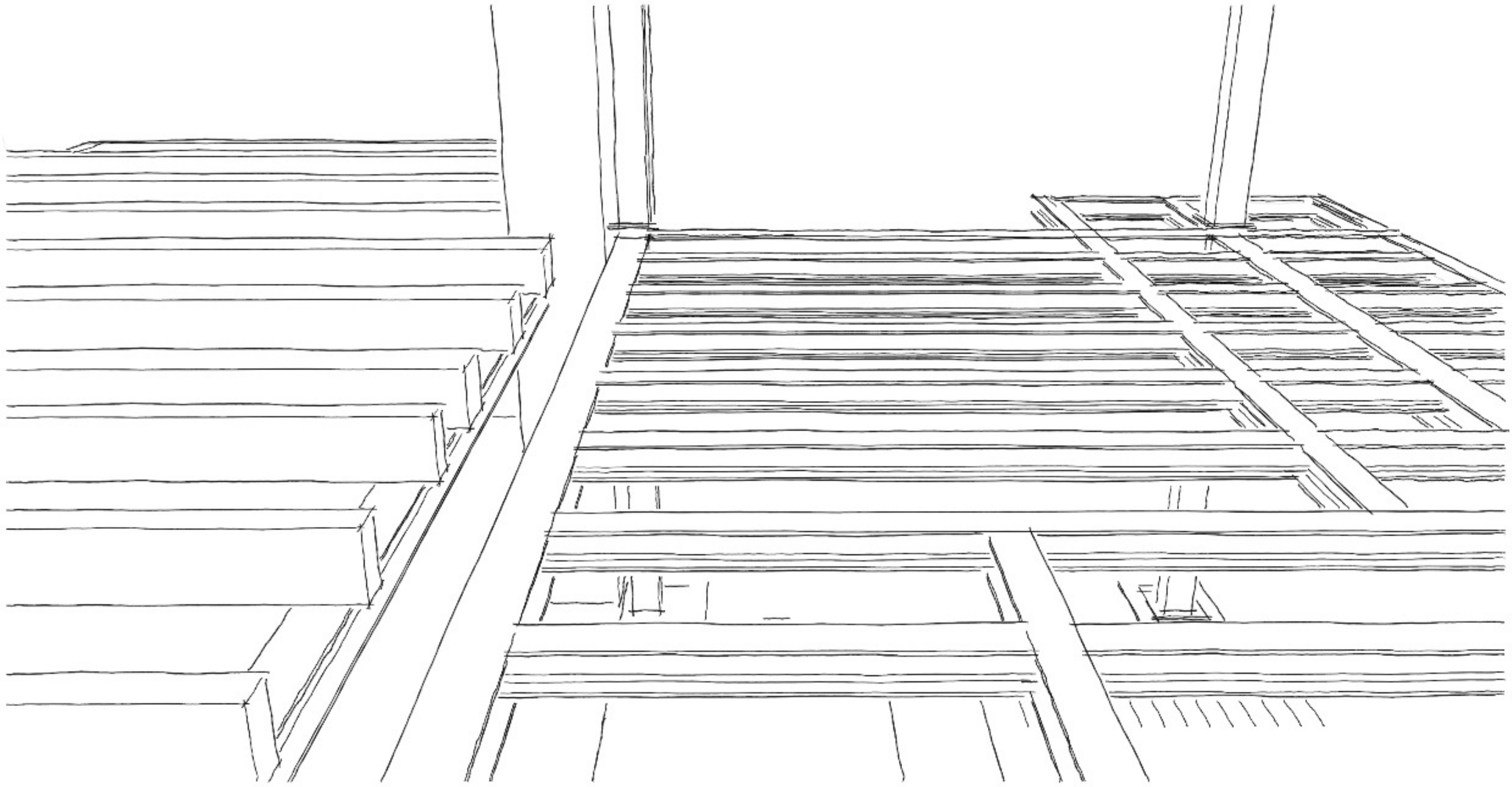


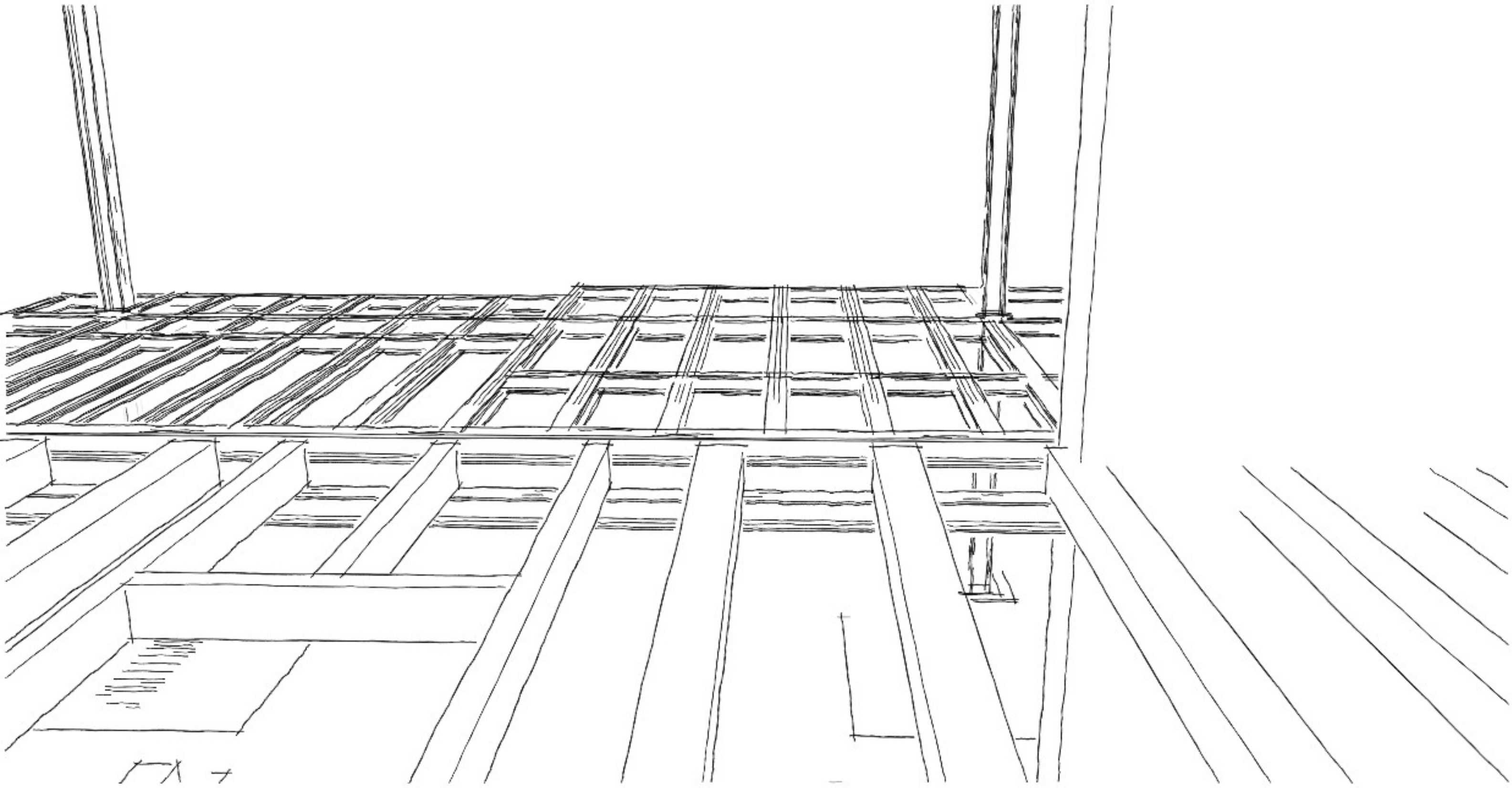












1 Tender Invitation

Invitation

Case:
Renovation at Dannebrogsgade 4
8000 Aarhus

Client:
Carpenter Main Contractor A/S

Contract:
Soil and Concrete works

You are cordially invited to tender for the Soil and Concrete works Subcontractor position for Refurbishment of residential building from 1889 and extension at Dannebrogsgade 4, Aarhus. The total area for the apartments before renovation is 614 m^2 and after refurbishment will be 738 m^2.

The renovation of the building implies the extension of each floor with 24.80 m^2. The back staircase is removed and each apartment is provided with its own kitchen and bathroom. The two flats from the ground floor are changed into an office for a design company, while those from the upper floor are converted into a penthouse. An elevator which serves all floors including the basement will be established.

Form of tender:
It is the restricted tender which follows GC92, where all main criteria are described.

List of tender material:
- Content of tender material
- General building drawings
- Detail drawings
- Case specifications
- Work specifications
- Building component specifications

Last respite to ask questions:
27th November 2009

Letter of correction:
The last correction can be made till December the 4th and each correction indicates a letter with information to the contractor

Contact Person:

Valentina Buz e-mail: 2037284@viauc.dk
Hiren Bhatt e-mail: 2037284@viauc.dk

Time and place of tender
The closing date for tenders to be received is on December the 7th at 10:00 am.
Place for receiving tenders is Hotel Guldsmeden, conference room Helgolandsgade 7-11 Kobenhavn.

Return of the tender materials:

Deposit of 5.000,00 DKK for the tender material is required and it will returned 7 working days after all material are given back to the design office.

Reservations:

All reservations have to be price included and stated in the appropriate space on tender form.

The contractor which is not going to prepare an offer, is kindly asked to give tender material back in 5 days after receiving it from the Design office.

Yours faithfully,

Design Office

Contractors

checklist

for recieved tender material.

The checklist can be used for the first scrutinity of the recieved material, but also for the more detailed scrutinity during the bidding phase.

The completed checklist can be a good help in the preparation to a pre-tender meeting, or by a later hand over to a colleague.

The checklist is elaborated
by BYG Cph.. and rev.
july 2002/nst

2 Scrutiny Tender Material

1. Overview of the recieved material (letter of tender)

			Remarks/ references
1.1	Client:	Carpenter Main Contractor Amaliagade, 8700 Horsens	
1.2	Tenderer:	Works with Concrete A/S Olof Palme Alle, 8200 Aarhus	
1.3	Building case:	Refurbishment of residential building and extension.	
1.4	Trade form:	Ind. Trade form.: [ ] Subcontractor.: [X] Main contractor.: [ ]	
1.5	Tender form:	Public: [ ] Selected: [ ] Private bid: [X]	
1.6	Tender time:	Date: 07 12 Time: 10:0 0	
1.7	Place for tender /adress:		
1.8	Are any documents, (drawings, pages in specification etc.) missing, and what:		
1.9	Closing time for quistions regarding the tender material.	Date: 27 11	
1.10	Closing time for revisions.	Date:	
1.11	Other specific conditions mentioned in the tender letter for the buildingcase:		

2. Overview of the building case:

			Remarks/reference Drawing no. Specification pos..
2.1	Short description of the building case:	The renovation of the building implies the extension of each floor.The back staircase is removed and each apartment is provided with its own kitchen and bathroom. The two flats from GF are changed into and office.The upper floor is converted into a penthouse. An elevator which serves all floors will be established(basement included)	**Case specifications**
2.1.1	and volume	m2 total floor area	**Plan**
2.2	Location of the building site:	Dannebrogsgade 4 8000 Aarhus	**Plan**

Who is responsible for:

2.3.	Administration of the building case:	Damien Crosse Users of the building: Housing Association and tenants from the Aarhus Commune	**Case Specification**
2.4	Site management:	Carpenter Main Contractor	**Case Specification**
2.5	Trade supervision in the building case:		

Time schedule for the building case:

2.6	Expected start of the case:	Date:23 / 02 / 10	**Time schedule**
2.7	Expected handover of the case:	Date:18 / 01 /11	
2.8	Expected start of **this trade**:	Date:02 /04 / 10	**Time schedule**
2.9	Expected handover of **this trade**:	Date:25 / 05 /10	**Time schedule**

2.10	**Building in wintertime:**	Yes:	No: X	**Case specification**

3. Common conditions and Special conditions:

Remarks/reference
Drawing no.
Specification pos..

Pay specific attention to additions and deviations to GC 92 and "normal practice"!

3.1	**The projectmaterial;** -is it stated, that the contractor have to read through the complete material (**NB! AB 92 § 2 is in force**) (work, which is not clearly drawn, specified or eventually ref. to in another trade)	Yes:	X	No:		**Case specifications**
3.2	Are alternative bid desirable:	Yes:	X	No:		
3.3	Are the standardreservations rekognized, e.g. BYG's as a part of the bid?	Yes:	X	No:		
3.4	Does the client reserve his position to have a free choice amongst the received bids:	Yes:	X	No:		
3.5	Binding time of bid:			No. of weeks:	5	
3.6	**Price and time (fixed):**	Yes:	X	No:		
3.6.1	Are there deviations from price and time cirkular of 10 oct. 1991, Incl. a.o. fixed price (max in 12 mth.)	Yes:	X	No:		
3.6.2	**Which deviations?**	Steel price				
3.7	**Contractors security bond**	15%	Date for release: 18 /01 / 11			**Case specifications**
3.8	**Is it released on demand?**	Yes:		No:	X	
3.9	**Does the client provide security?**	Yes:	X	No:		
3.10	**Form of payment:**			Phaseplan:		
3.10.1				Interim certificate:		

3. Common conditions and Special conditions - continued:

Remarks/reference

No.	Item	Yes	No	Drawing no. Specification pos..
3.11	**Payment; -** are conditions for payment of the contractsum specified?	X		**Case specifications**
3.12	**Payment; -** are rules for payment of extra work and omissions specified?		X	**Case specifications**
3.13	Are demarcations for projectdeviations set, acc. to AB 92 § 14		X	
3.13.1	What demarcations?			
3.14	**Hand over; -** are there specific conditions for handing over the trade?		X	**Case specifications**
3.15 A	**Withhold;** 15 % security, 0% withhold? GC 92 legislation.			
3.15 B	**Withhold;** 10 % security, 5 % withhold - not part of GC 92			
3.16	**Release of security bond; -** are there specific conditions for release of eventually **security bond?**		X	
3.17	**Sanctions;**			
3.17.1	Day fine (per. calendarday or workday (**should be workday**):	0,2% Contract Sum Kr. per. day:		**Case specifications**
3.18	Are there a description of the rules for calculation of and release of day fines?		X	
3.19	**Waste days estimation; -** are there description of how kind of and volume of waste days are estimated? (including definition of bad weather)		X	
3.20	**Formal demands regarding respite acc. To AB 92 § 24**	X		**Case specifications**
3.21	**Time limits regarding compensation from contractor to client acc. to** AB 92 § 25	X		**Case specifications**
3.22	**Is AB 92 § 35 stk 2 deviated. Pay attention to compensation related to Operation And Maintenance expenses.**		X	

3. Common conditions and Special conditions - continued:

No.	Question	Yes	No	Remarks/reference Drawing no. Specification pos..
3.23	**Is the 5 years guarantee acc. to GC 92 deviated? (not recommended.)**	Yes:	No: X	
3.24	**Is demand regarding 5 years suppliers Guarantee deviated? (should follow contractors guarantee)**	Yes:	No: X	
3.25	Are there demand for specific Insurances.	Yes:	No: X	
3.25.1	Which?			
3.26.1	**Do the client have all-risk insurance?**	Yes: X	No:	
3.26.2	**Own risk?, if yes, how much?**	Yes:	No:	
3.27	Has the client taken a policy for storm and fire?	Yes: X	No:	
3,27.1	are the contractor included?	Yes: X	No:	
3.28	**Meetings:** -are there a demand for participation in meetings beyond the usual site meetings?	Yes: X	No:	**Case specifications**
3.29.1	Time limits for objections to minutes acc. to AB 92 § 19	Yes:	No: X	
3.29.2	Which other meetings?			

Is it marked clearly, who is responsible for:

No.	Question	Yes	No	Remarks/reference Drawing no. Specification pos..
3.30	-the common buildingsitearrangement maintenance/cleaning of common areas.	Yes: X	No:	**Case specifications**
3.31	-Who will pay for usage of electricity, Telephone and water?	Yes: X	No:	**Case specifications**
3.32	-weatherprovisions in common areas	Yes: X	No:	**Case specifications**
3.33	- securityprovisions in common areas	Yes: X	No:	**Case specifications**

4. Are there particular specifications on the tender form:

						remarks/reference drawing no. Specification pos..
4.1	Unitprices:	Yes:	X	No:		
4.2	Alternative unitprices:	Yes:		No:	X	
4.3	Special prices for weatherprovisions (winterpricelist)	Yes:		No:	X	
4.4	Special prices for safetyprovisions	Yes:		No:	X	
4.5	Information regarding cabin needs:	Yes:		No:	X	
4.6	Information regarding man-days:	Yes:		No:	X	
4.7	Information regarding storage needs:	Yes:		No:	X	
4.8	Are samples of material or other particular samples requested?	Yes:		No:	X	
4.8.1	Which?					

5. Overview of the trade:

		Yes	No	Remarks/reference drawing no. Specification pos..
5.1	**Extent of the trade: -** do the drawinglist contain a clear indication of the drawings, attached to the trade?		X	
5.2	Is it evident which constructionworks is included in the trade?		X	
5.3	**Worksiteplanning;** - are there a clear specification of the demands for the contractors workplanning, including detailing and demands for updating?	X		
5.4	**Supervision:** - are particular conditions for supervision stated from:			
5.4.1	Authorities?			
5.4.2	Client?			
5.4.3	Contractor?	X		

5.5 Specific remarks:

6. Quality Assurance:

Remarks/reference
Drawing no.
Specification pos..

6.1 Quality Assurance: - are there demand for Quality assurance cf. departmental order no. 202 of 23.03.2000? Yes: No:

6.2 Are participation in projectscrutinity-meeting(s) requested? Yes: No:

6.3 Are a controlplan included in the projectmaterial? Yes: No:

6.4 Are there special demands for delivery control? Yes: No:

6.4.1 What special demands?

6.5 Are there special demands for process control? Yes: No:

6.5.1 What special demands?

6.6 Are special tests needed? Yes: No:

6.6.1 What special tests?

6.7 Are there demand for Q.A.-documentation? Yes: No:

6.7.1 What special demands?

6.8 Are information regarding individual materials and building components certificates, guaranties and Operation and Maintenance requested? Yes: No:

6.8.1 What materials and building components?

7. Overview of the work of the individual profession:

7.1 Extent:

The best way to determine the extent is done by measuring and pricing of the individual building components
(partworks /activities)

Other works in the form of : e.g.
- **test of materials**
- **design**
- **arrangement of building site**
- **operation of building site**
- **weatherprecautions**
- **safetyprecautions**
- **quality-management**

Are determined during the bidding phase as well.

7.2 Directions:

				Remarks/reference Drawing no. Specification pos..
7.2.1	**-are there references to norms and technical provisions, which have to be followed?**	Yes: X	No:	
7.2.2	Which norms and technical provisions?	DS 401 Dansk Ingeniørforenings norm for sand-, gravel- and stone aggregate, 1992 DS 409 Norm for Health and Safety Provisions for Constructions, 1999 DS 410 Norm for Loads on Constructions, 1998 DS 411 Norm for Concrete Constructions, 1999 DS 415 Norm for Founding, 1998 DS 423 Norm for Concrete Testing, 1984 DS 427 Cement. Composition, Demands for Characteristics and Approval Criteria, Part 1: Standard Cements, 1995 DS 481 Norm for Concrete Aggregate, 1999 DS 482 Norm for the Execution of Concrete Constructions, 1999 Dansk Standards Catalogue Update, current edition Building Regulations, 1. April 1995 incl. current enclosures		
7.2.3	**-is it stated which certificates, declarations etc. are requested?**	Yes:	No:	
7.2.4	Which certificates and declarations?			

7.2.5	**-are preconditions for execution of the work stated, like tolerances at previous work/trade**	Yes:		No:	X
7.2.6	Which tolerances?				

8. Considerations: -should bid be given respecting Conditions in tender material?

Remarks/reference
Drawing no.
Specification pos..

8.1	-are there conditions and requirements stated in: **"1. Overview of recieved material (letter of tender) "** which cannot be accepted?	Yes:		No: X	
8.1.1	Which conditions or requirements cannot be accepted **(state pos. and remarks)**				
8.2	-are there conditions and requirements stated in **"2. Overview of the building case:"** which cannot be accepted?	Yes:		No: X	
8.2.1	Which conditions or requirements cannot be accepted **(state pos. and remarks)**				
8.3	- are there conditions and requirements stated in **"3. Common conditions and specific conditions:"** which cannot be accepted?	Yes:		No: X	
8.3.1	Which conditions or requirements cannot be accepted **(state pos. and remarks)**				
8.4	- are there conditions and requirements stated in **"4. Are there particular specifications on the tenderform:"** which cannot be accepted?	Yes:		No: X	
8.4.1	Which conditions or requirements cannot be accepted **(state pos. and remarks)**				

8. Considerations: -should bid be given respecting Conditions in tender material? - continued

Remarks/reference
Drawing no.
Specification pos..

		Yes:	No:	Remarks/reference
8.5	- are there conditions and requirements stated in "**5. Overview of the trade:**" which cannot be accepted?		X	
8.5.1	Which conditions or requirements cannot be accepted **(state pos. and remarks)**			
8.6	- are there conditions and requirements stated in "**6. Quality-assurance; "** which cannot be accepted?		X	
8.6.1	Which conditions or requirements cannot be accepted **(state pos. and remarks)**			
8.7	- are there conditions and requirements stated in "**7. Overview of work for the individual trade:"** which cannot be accepted?		X	
8.7.1	Which conditions or requirements cannot be accepted **(state pos. and remarks)**			

9. Should bid be given ?

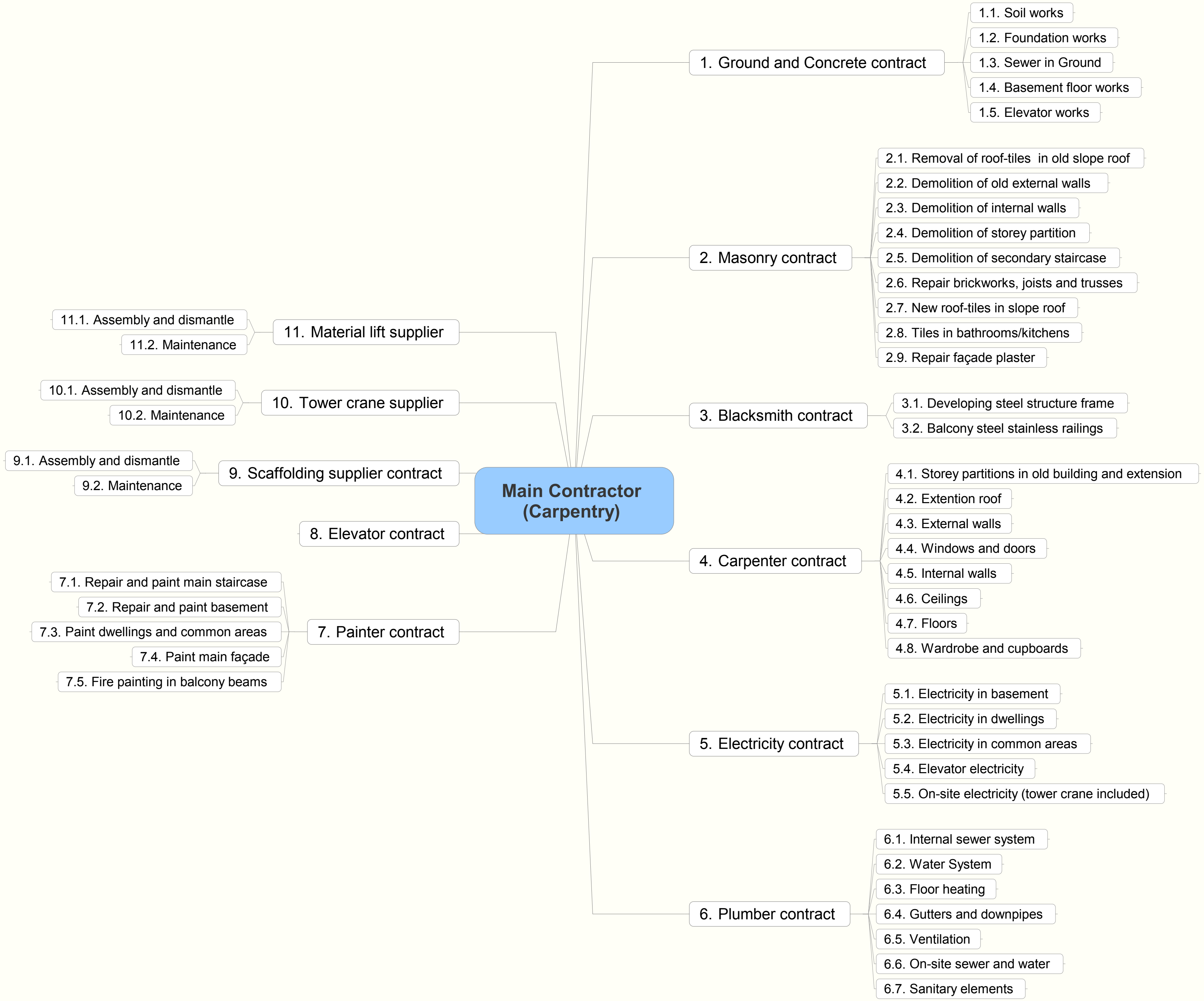
Remarks/reference
Drawing no.
Specification pos..

9.1	**Are reservations beyond the standardreservations needed against some of the conditions, stated in the tender material**	Yes:	No: X	
9.2	Which reservations are needed beyond standardreservations **(refer to which pos. no the reservation is taken)**			
9.3	**-are there other conditions and works where special attention is needed?**	Yes: X	No:	
9.4	Which reservations are needed beyond the standardreservations **(refer to which pos. no the reservation is taken)**	Sewer works and underpinning works		
9.5	**Are we giving a bid on above mentioned requirements, incl. the stated reservations?**	Yes: X	No:	
9.6	**Are we deviating from above mentioned reservations, if we are invited to negotiate after the tender?**	Yes:	No: X	
9.7	**Which reservations are completely unchangeable?**	Underpinning works		

Tender conditions have been looked through and assessed by:

Date:____________________

Employee: ______________________ Manager: ______________________


Main Contractor (Carpentry)
1. Ground and Concrete contract
1.1. Soil works
1.2. Foundation works
1.3. Sewer in Ground
1.4. Basement floor works
1.5. Elevator works
2. Masonry contract
2.1. Removal of roof-tiles in old slope roof
2.2. Demolition of old external walls
2.3. Demolition of internal walls
2.4. Demolition of storey partition
2.5. Demolition of secondary staircase
2.6. Repair brickworks, joists and trusses
2.7. New roof-tiles in slope roof
2.8. Tiles in bathrooms/kitchens
2.9. Repair façade plaster
3. Blacksmith contract
3.1. Developing steel structure frame
3.2. Balcony steel stainless railings
4. Carpenter contract
4.1. Storey partitions in old building and extension
4.2. Extention roof
4.3. External walls
4.4. Windows and doors
4.5. Internal walls
4.6. Ceilings
4.7. Floors
4.8. Wardrobe and cupboards
5. Electricity contract
5.1. Electricity in basement
5.2. Electricity in dwellings
5.3. Electricity in common areas
5.4. Elevator electricity
5.5. On-site electricity (tower crane included)
6. Plumber contract
6.1. Internal sewer system
6.2. Water System
6.3. Floor heating
6.4. Gutters and downpipes
6.5. Ventilation
6.6. On-site sewer and water
6.7. Sanitary elements
7. Painter contract
7.1. Repair and paint main staircase
7.2. Repair and paint basement
7.3. Paint dwellings and common areas
7.4. Paint main façade
7.5. Fire painting in balcony beams
8. Elevator contract
9. Scaffolding supplier contract
9.1. Assembly and dismantle
9.2. Maintenance
10. Tower crane supplier
10.1. Assembly and dismantle
10.2. Maintenance
11. Material lift supplier
11.1. Assembly and dismantle
11.2. Maintenance

1 Tender form

Project:
Soil and Concrete trade
Renovation at Dannebrogsgade 4
8000 Aarhus

Client:
Carpenter Main Contractor A/S

The undersigned would hereby, and in accordance with:

The specifications and drawings of the tender-documents of 30.10 2009

Offer to execute the aforementioned Trade-contract to fixed price and time for the following sum, exclusive VAT:

DKK: *274.377,00 .-* **EXCL.VAT.**
WRITE: *Two hundred seventy four thousend three hundred seventy seven$^{00}/_{100}$*

Reservations:
Ground sewer works are not included
Underpinning works are not included

Date: 04.*Dec.2009*

Name: *Representative Carpenter Main Contractor*

Address: *Ameliagalde 12, Horsens*

Phone: *+45 52805964*

Contractors stamp:

Contractors signature:

2 Tender form

Applicable for Soil and Concrete contract:

Total price of bid without VAT shall be transferred to page 1.

1.	Soil works	**DKK:** *100.753,00.-*
2.	Concrete works	**DKK:** *173.624,00.-*

TOTAL PRICE.

DKK: *274.377,00.-*

Date: *04.Dec.2009*

Contractors stamp:

Name: *Representative Carpenter Main Contractor*

Address: *Amaliegalde 12, Horsens*

Contractors signature:

Phone: *+45 52805964*

Case Specifications

1. Table of Contents (continued)

Project Specific Specifications

Table of Contents

2. Orientation
- 2.1. General
- 2.2. The Project Background
- 2.3. Summary of Contracts/Works
- 2.4. Project Documents
- 2.5. Project Organisation

3. GC 92
- A. Contractual basis
- B. Performance bond and insurance
- C. Performance of the contract
- D. The employer's obligation to pay
- E. Extension of time limits and delay
- F. Handing-over of the work
- G. Defects
- H. 1-and 5-year inspections
- I. Special provisions on determination
- J. Disputes'

4. The building site
- 4.1. General
- 4.2. Stipulations
    - 4.2.1 Directions from local authorities
    - 4.2.2 Permits and reports to authorities
    - 4.2.3 Other stipulations

- 4.3. Handover of building
- 4.4. Existing conditions
- 4.5. The Client's setting-out of the building
- 4.6. Establishment of the building site
    - 4.6.1 Site plan
    - 4.6.2 Demarcation of the building site
    - 4.6.3 Fencing in the building site
    - 4.6.4 Closing off
    - 4.6.5 Security
    - 4.6.6 Security against theft
    - 4.6.7 Signposting
    - 4.6.8 Screening off/blocking off against 3rd person.

- 4.7 The Site's infrastructure
    - 4.7.1 Parking
    - 4.7.2 External road and path system
    - 4.7.3 Traffic system within the building
    - 4.7.4 Sealing off of rebates and holes in traffic areas.

4.7.5 Establishing barriers in traffic areas
4.7.6 Lighting up traffic areas
4.7.7 Provisions for shielding against inclement weather in traffic areas.
4.7.8 Clearing and cleaning traffic areas.
4.8 Portable site cabins and storage areas
4.8.1 Conditions for Cabins
4.8.2 Storage space
4.8.3 Tent workshops
4.8.4 Skips and refuse
4.8.5 Lighting of cabin area and storage space
4.8.6 Provisions for inclement weather in Cabin/storage area.
4.8.7 Clearing and cleaning of cabin and storage area
4.8.9 First aid post
4.8.9 Fire extinguishing materials
4.9 Work areas
4.9.1 Closing off rebates and holes in work areas
4.9.2 Establishing barriers in work areas
4.9.3 Lighting work areas
4.9.4 Provisions against inclement weather in work areas
4.9.5 Clearing and cleaning work areas
4.10 Technical installations
4.10.1 Cranes and building material lifts
4.10.2 Personnel elevators
4.10.3 Scaffolding
4.11 Site utilities
4.11.1 Water, sewer and drainage
4.11.2 Electricity
4.11.3 Telephone
4.12 Special provisions for buildings in use
4.12.1 General work conditions
4.12.2 Information to tenants

5. Health and Safety
5.1 General
5.1.1 Organisation
5.1.2 Safety meetings
5.2 Health and Safety Plan
5.3 The work environment
5.1.3 Safety meetings
5.1.4 Limiting noise
5.1.5 Limiting damage and adverse effects of vibration
5.1.6 Limiting the adverse effects of dust
5.1.7 Limiting adverse ergonomic effects
5.4 Provisions for dangerous works

6. The surrounding environment
6.1 General
6.2 Noise
6.3 Vibration
6.4 Dust
6.5 Emission to the atmosphere

7. Quality Assurance
7.1 General
7.2 Project management
7.2.1 Site meetings
7.2.2 Kick off meetings
7.3 Quality Plan
7.4 Contractor's quality control and documentation
7.4.1 General
7.4.2 Quality control documentation
7.4.3 Operational & Maintenance documentation
7.4.5 Filing QA-documents
7.5 Handing over procedure (project preview)
7.6 Local authority inspections
7.7 Guarantee/warrantee documents
7.8 Handing over
7.9 Quality assurance after handing over

8. Scheduling
8.1 General
8.2 Time Schedules
8.3 Inclement weather days

Basis Specification (right page)

2. Orientation

2.1 General
The directions in the Works Specification have priority over the stipulations in the Case Specifications

In the case of the Work Specification, the Building Component Specifications (Chapter 4) and drawings have priority over the Work Specifications' Chapter 3.

2.2 The Project Background

2.3 Summary of Contracts/Works

2.4 Project Documents
The project documents are structured in accordance with *BPS Structure for Specifications*, *edition 2001-08-06*

Project Specific Specification (left page)

2. Orientation

2.1 General
BPS Basis Specifications – The Building Case, publication B201, edition 2001-08-06 is, together with this project specific specification, valid for this particular project. The project specific stipulations have priority over the Basis Specifications.

2.2 The Project Background

Refurbishment of residential building from 1889 and extension at Dannebrogsgade 4, Aarhus. The total area for the apartments before renovation is 614 m² and after refurbishment will be 738 m².

The renovation of the building implies the extension of each floor with 24.80 m². The back staircase is removed and each apartment is provided with its own kitchen and bathroom. The two flats from the ground floor are changed into an office for a design company, while those from the upper floor are converted into a penthouse. An elevator which serves all floors including the basement will be established.

The extension will be built as lightweight and steel construction.

2. 3 Summary of Contracts/Works

01.-Ground and Concrete Contract

- Soil works
- Foundation works
- Sewer in ground
- Floor in basement
- Elevator works

02.-Mansonry Contract

- Removal of roof-tiles in old slope roof
- Demolition of old external walls
- Demolition of internal walls
- Demolition of storey partition
- Demolition of secondary staircase
- Repare brickworks, joists and trusses
- New roof-tiles in slope roof
- Tiles in bathrooms/kitchen

- Repair façades plaster

03.-Blacksmith Contract

- Developing the steel structure frame
- Balcony steel stainless railings

04.-Carpenter Contract

- Storey partitions in old building and extension
- Extension roof
- External walls
- Windows and doors
- Internal walls
- Ceilings
- Floors
- Wardrobes and cupboards

05.-Electrician Contract

- Electricity in basement
- Electricity in dwellings
- Electricity in common areas
- Electricity in Elevator
- On-Site electricity(tower crane included)

06.-Plumber Contract

- Internal sewer system
- Water system
- Floor heating
- Gutters and downpipes
- Ventilation
- On-Site water and sewer
- Sanitary elements

07.-Painter Contract

- Repair and paint main staircase
- Repair and paint basement
- Paint dwellings and common areas
- Paint main façade
- Fire paint in balcony beams

08.-Elevator Contract

09.-Scaffolder supplier Contract

- Assembly and dismantle
- Maintenance

10.-Tower crane supplier Contract

- Assembly and dismantle
- Maintenance

2.4 Project Documents

Drawings

Basis Specification
Plan Drawings
Sewer Plan
Cross sections
Elevations

2.5 Project Organisation

Tender material
Tender documents
Quality assurance
Health and safety assurance
Case specifications
Work specifications
Building component specifications

2.5 Project Organisation

Client: Damien Crosse
Users of the building: Housing Association and tenants from the Aarhus commune
Site address: Dannebrogsgade 4, 8000 Aarhus

Consultant: Group 1, BK52E

Designers: Valentina Buz
e-mail: 2037284@viauc.dk

Hiren Bhatt
e-mail: 2037284@viauc.dk

Frederik Kromann
e-mail: 2037284@viau.dk

Project manager: Arnaldo Landivar
e-mail: 2037323@viauc.dk

Site manager: Main contractor
Site inspection: Group 1, BK52E
Health and safety organisation: Main contractor

Address: VIA University College
Chr. M. Østergårdsvej, 8700 Horsens

Contact person: Arnaldo Landivar
Tel./fax: 55217899
e-mail: 2037323@viauc.dk

3. GC 92

A. Contractual basis

General conditions
§ 1. The present general conditions shall apply to contracts for the provision of works and supplies within building and engineering.

Subs. 2. In relation to supplies the term 'employer'

3. GC 92

A. Contractual basis

General conditions
§ 1.

shall be defined as the buyer and 'contractor' as the vendor. In relation to sub-contracts the term 'employer' shall be defined as the main contractor and 'contractor' as the sub-contractor.

Subs. 3. Deviations from the general conditions shall be valid only when it is clearly and explicitly stated in which respects such deviations are to be made.

Subs. 4. Unless otherwise provided the amounts stated shall not include value-added tax (VAT).

Subs. 5. Unless otherwise provided the term 'workday' shall be defined as all such weekdays from Monday through to Friday as are not official public holidays.

Subs. 6. All documents shall be drafted in Danish and all indications of currency, measures and weight shall be Danish indications. Negotiations, including site meetings, shall be conducted in Danish. If documents are also drafted in another language and in the event that discrepancies appear between the foreign-language version and the Danish text, the Danish text shall prevail.

Subs. 6. The initial AutoCAD drawings and the documents available for this project are in English. Therefore, in the documents translated from English to Danish, English text shall prevail.

Subs. 7. The legal relationship between the parties shall in all respects be treated in accordance with Danish Law.

The employer's invitation to tender

§2. 'Tender' shall be defined as the employer's invitation for bids.

The employer's invitation to tender

§2.

Subs. 2. Bids shall be made on the basis of the information contained in the tender documents. The contents of these documents must be unambiguous and presented so as to make quite clear the extent and nature of the services to be provided.

Subs. 3. The tender documents must stipulate a time schedule.

Subs. 4. The tender documents must inform of the existence on the site of any ancient monuments, cf. §

16.

Subs. 5. If a fee is charged for the tender documents to ensure their return, this must appear from the invitation to tender. The fee shall be refunded immediately upon the return within a reasonable time of a complete and undamaged set of tender documents, irrespective of whether the person returning the documents has submitted a bid or not.

Subs. 6. With a view to the evaluation of the bids received, the employer may in the tender documents set conditions for the form in which bids are to be submitted, including one which requires bids to be drafted with a reasonable specification of the bid price on tender lists made available for that purpose.

Subs. 7. If the bid or parts thereof, is to be made in the form of unit prices, the employer must stipulate the weight given to the individual unit prices in the evaluation of the total bid.

The contractor's bid

§3. Where several tenders in unison submit a bid, they shall all be jointly and severally bound by it.

Subs. 2. If, in an invitation for tenders, tenders are requested to stipulate a price not only for the work as a whole, but also for parts of the work, the prices quoted for the individual parts may be considered as distinct bids only when this has been explicitly stated in the tender documents or in connection with the submission o the bid.

Subs. 3. If, in addition to an overall bid price, a bid is to contain unit prices, both types of prices shall be binding upon the tender. Unit prices shall be applied in case of adjustments of payment occasioned by services being of different extent than stated by the employer in the tender documents. The internal sequence of bids shall be determined on the basis of the total bids only.

Subs. 4. The bid shall cover only those services which are indicated as belonging under the contract

The contractor's bid

§3.

on drawings given to the contractor to use as a basis for the bid or which are mentioned in those sections of the work description which apply to the contract in question.

Subs. 5. Bids shall be open for acceptance for a period of 20 workdays from the closing date. Other bids in writing shall be open for acceptance for a period of 20 workdays from the date of the bid.

Subs. 6. Bidders whose bids are not accepted may demand that their own bid, drawings, calculations and descriptions be returned to them.

Subs. 7. The employer must promptly notify unsuccessful bidders of the result of the tender.

Subs. 7. Unsuccessful bidders will be notified within 5 working days after acceptance of any bid.

The contract

§4. An agreement for the performance of work or the provision of supplies shall be made by acceptance in writing of the bid submitted or by a special document. Reference may be made to the documents upon which the contract is based.

Subs. 2. Any stamp duty must be paid by the employer.

The contract

§4.

Assignment of rights and obligations, etc.

§ 5. The parties may assign their rights under the contract.

Subs. 2. If the contractor assigns claims under the agreements that are not due for payment, those assigned claims, which relate to the performance of the work, shall have priority over other assigned claims.

Subs. 3. Neither party may transfer his obligations to a third party without prior consent from the other party.

Subs. 4. The contractor may sub-let unto others the performance of the work to the extent that it is customary or natural for such work to be performed under a sub-contractor.

Assignment of rights and obligations, etc.

§ 5.

Subs. 5. Where it has been proved that a claim against the contractor concerning defects cannot, or can only with the greatest difficulty be successful, the employer shall be entitled to put forward the claim directly against the contractor's sub-contractors and suppliers, cf. 10, *Subs.*4.

B. Performance bond and insurance

The provision by the contractor of a performance bond

§6. Unless otherwise provided in the tender documents, the contractor must within a period of 8 workdays of the conclusion of the contract provide security for the due performance of his obligations towards the employer. The bond may be in the form of an adequate guarantee from a bank or a savings bank, an insurance guarantee or other adequate types of security.

Subs. 2. Until the handing-over of the work, the bond provided must correspond to 15% of the contract sum. After handing-over the bond must correspond to 10% of the contract sum.

Subs. 3. The bond provided for supplies delivered completely finished in instalments must correspond to 10% of the contract sum.

Subs. 4. One year after handing-over the bond must be reduced, however cf. §36, subs.3.(1) , to 2% of the contract sum, unless prior claim for the rectification of defects has been put forward in writing by the employer, in which case the bond shall be reduced when such rectification has been effected.

Subs. 5. The bond shall cease 5 years after handing – over, however cf. §36.(1), unless a prior claim for rectification has been put forward in writing by the employer, in which case the bond shall cease when such rectification has been effected.

Subs. 6. Proportional release of the bond shall be made in case of sectional completion, cf.§ 28, subs.4, last full stop.

Subs. 7. If the employer requests payment under the bond provided, such request must be made in writing and notified simultaneously to the contractor and the guarantor, with an exact indication of the nature and extent of the alleged breach as well as the magnitude

B. Performance bond and insurance

The provision by the contractor of a performance bond

§6.

of the amount claimed. The amount shall be payable to the employer within 10 workdays of receipt of the above notification, unless the contractor has filed a prior request with the Court of Arbitration asking for an order on the specific question whether the payment claim of the employer is justified, in which case the provisions of § 46 shall apply.

Subs. 8. The purpose of the bond shall be to satisfy all claims which the employer may have under the contract, including such claims as relate to any extra work and the recovery of too large payments already made under the contract.

The provision by the employer of a performance bond

§7. If the contractor so requires, the employer under a private contract shall provide a performance bond for the due performance of his pecuniary obligations towards the contractor within 8 days of a demand therefore. The bond shall be provided in the form of an adequate guarantee from a bank, an insurance-guarantee or other adequate types of security.

Subs. 2. The bond shall correspond to the average payment for a three-month period, however with a minimum of 10% of the contract cum, so calculated that the contract sum is divided evenly on the number of months stipulated in the contract for the performance of the work. Where the contract is extended to include extra work under §14, the contractor may claim the bond to be increased if the payment for the totality of such extras – to the exclusion of extra work for which payment has already been effected – exceeds half of the average payment for one month under the original contract.

Subs. 3. If the contractor requests payment under the bond provided, such request must be made in writing and notified simultaneously to the employer and guarantor, with an exact indication of the magnitude of the amount claimed. The amount shall be payable to the contractor within 10 workdays of receipt of the above notification, unless the employer has failed a prior request with the Court of Arbitration asking for an order on the specific question whether the payment claim of the contractor is justified, in which case the provisions of § 46 shall apply.

Subs. 4. The purpose of the bond shall be to satisfy all claims which the contractor may have under the

The provision by the employer of a performance bond

§7.

contract, including such claims as relate to any extra work.

Insurance

§8. The employer shall take out and pay for the usual fire and storm and tempest insurance from the commencement of the work and until any defects established in connection with the handing-over have been rectified. At the request of the contractor, the contractor and any sub-contractor shall be included as insured under the insurance policy. The insurance must provide cover for the work of all contractors on the building or engineering work under the contract. For building alterations or additions the insurance must provide cover for damage to the work and the building or engineering work on which alterations or additions are being made.

Subs. 2. Public-sector employers may claim acceptance as self-insurers.

Subs. 3. The contractor and any sub-contractors must be covered by the usual liability insurance in relation to injury or damage for which they may incur liability under the general provisions of Danish legislation. Upon request the contractor must furnish documentation of such insurance being in force.

Insurance

§8.

C. Performance of the contract

Working schedule and measurements

§9. The contractor must as soon as possible, and in cooperation with the employer, prepare a working schedule.

Subs. 2. The setting out of the main grid lines and heights (levels) shall be the responsibility of the employer, with all other setting out being undertaken by the contractor.

C. Performance of the contract

Working schedule and measurements

§9. The working schedule is included in the tender documents (the handed out material).

Services provided by the contractor

§10. The work must be performed in accordance with the provisions of the contract, with due professional care and skill or in accordance with any instructions given by the employer under §15. To the extent that no special descriptions are made of the materials, they must be of general good quality.

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Services provided by the contractor

§10.

Subs. 2. The contractor shall supply all materials and perform all secondary services required for the completion of the work.

Subs. 3. Materials and other supplies intended for incorporation in the work must be supplied by the contractor without any right of lien. Once the specific objects have been delivered at the site they become the property of the employer.

Subs. 4. Materials and other supplies for the work must be supplied with a 5-year suppliers' liability for defects. The liability period shall commence upon the handling-over of the work and shall be limited to a maximum of 6 years from delivery to stock or for resale. Moreover, the supplier must have accepted partly that claims of defects under the circumstances mentioned in § 5, *Subs.* 5, can be made directly against the supplier, partly that disputes concerning defective supplies can brought before the Building and Construction Arbitration Court.

Subs. 5. The contractor may refrain from complying with the provisions of subs. 4 above if such compliance will cause him considerable additional expense or substantially delay the work or if, in the case of small supplies, control of compliance with that provision will be too burdensome. In the case of large supplies, the employer must be informed of such omission.

Project conferences, documentation and tests

§11. In the tender documents, the employer may provide that the contractor is to participate in project conferences. Provisions may also be made for the nature and extent of samplings and the kind of documentation to be furnished by the contractor in relation to the performance of the work, constructions made, the origin and properties of the materials used and the samplings made. Such provisions may be contained in a tender control plan. Participation in project conferences and the furnishing of documentation and tests form part of the service to be provided by the contractor.

Subs. 2. During the performance of the work and upon handing-over, the employer may demand that further tests be made. In this case too, the contractor

Project conferences, documentation and tests

§11.

must make available the necessary staff for tests and test analyses. If such further tests show that the services provided are up to contract, the employer must be charged with the cost thereof as for extra work. Otherwise the contractor shall pay for the costs incurred by the employer.

Subs. 3. The contractor shall allow access for the employer and his supervisors to the building and production sites where the work is being carried out. Moreover, the employer may claim that such information be furnished as is necessary to evaluate the service.

Subs. 4. During the performance of the work, the employer and his supervisors may reject work or materials that are not up to contract. Such rejection must be made at the earliest possible time.

Subs. 5. The contractor must arrange for regular tidying-up and clearing-away and for the immediate removal of rejected materials from the building site.

Clearance regarding sweeping the pavement (carpentry) and vacuum cleaning (concrete, masonry, carpentry) is made every day. A general clearance is taken on Fridays by everyone.

Deterioration of the work etc. Maintenance

§12. If the work, or part thereof, is deteriorated, destroyed or lost before handing-over, the contractors shall arrange for and defray all expenses arising out of the provision of a service which is up to contract, unless the occurrence was caused by the employer. If the employer delivers materials to the work done by the contractor, the same rule shall apply to these materials in the time from the receipt by the contractor thereof and until the handing-over of the work.

Subs. 2. The employer shall not be liable for damage caused by contractors to the work, materials and equipment of other contractors.

Subs. 3. The contractor shall maintain the work performed until handing-over.

Subs. 4. If works or parts thereof are put to use prior to handing-over, the provisions of subs. 1-3 above shall apply in the period until such works are put to use.

Deterioration of the work etc. Maintenance

§12.

Relations to public authorities

§13. The employer shall arrange for the necessary

Relations to public authorities

§13.

planning permission for the project and shall defray all expenses thereby incurred.

Subs. 2. The contractor shall arrange for notifications, applications for licences, requests for inspections and such certificates as relate to the execution of the work itself and shall defray all expenses thereby incurred.

Alterations in the work

§14. The employer may demand that alterations be made in the nature and extent of the work where such alterations are naturally linked to the services agreed upon. The contractor shall be entitled to undertake such alterations, unless the employer points out special conditions which justify that the performance of the work be undertaken by others.
The employer may demand that alterations be made in the nature and extent of the work where such alterations are naturally linked to the services agreed upon. The contractor shall be entitled to undertake such alterations, unless the employer points out special conditions which justify that the performance of the work be undertaken by others.

Subs. 2. The employer's demands for alternations shall be made in writing. The same shall apply to any demands by the parties for alterations in the contract in respect of price, time and performance bond because of such alteration. An additional contract for the alteration shall be made as soon as possible, and negotiations thereon must not lead to a delay in the performance of the work under the contract.

Subs. 3. Where such alterations relate to work for which unit prices apply, the agreed contact sum shall be adjusted accordingly, unless the parties agree otherwise, cf. subs. 2.
However, adjustments in accordance with unit prices may be made only within +/- 15% of the contract sum and within +/- 100% of the individual items in the tender list.

Subs. 4. Payment for alterations other than those provided for in subs. 3 shall be by account rendered unless otherwise agreed by the parties.

Subs. 5. In case of reductions in the extent of the work, the contractor shall give the employer the benefit for any costs for which savings are, or ought to have been obtained. However, where the reduction

Alterations in the work

§14.

Any alteration or modification of the original project shall be made in writing.

concerns work for which unit prices apply, cf. subs. 3, this may be done only to the extent that the reduction in work leads to a reduction of the contract sum of more than 15%.

Lack of clarity, obstructions or similar matters

§15. The contractor shall consult with the employer if the contract and its basis do not provide sufficient guidelines for the performance of the work.

Subs. 2. Where the contractor finds that the work cannot be performed in accordance with the contract entered into, he shall immediately inform the employer thereof and follow the latter's instructions.

Subs. 3. The contractor shall immediately inform the employer of the occurrence of any events which obstruct work or render work difficult or due to which the employer is likely to suffer inconvenience or loss, including cases in which the employer will incur liability towards third parties. If there is no time to receive instructions from the employer, the contractor must take the best possible measures for the purpose of avoiding losses being suffered by the employer in return for being granted the necessary extension of time limit and against payment.

Subs. 4. The tender documents must contain information on any analyses made of groundwater and soil conditions, contamination or other obstructions. To the extent that the tender documents do not contain exhaustive information on such obstructions, measures aimed at eliminating them and the resulting inconvenience shall be paid as extras.

Subs. 5. If, despite the undertaking of such preliminary analyses as are reasonable or usual considering the character, location and prior use of the site, unforeseen matters arise which lead to orders or bans being imposed by public authorities which prevent continuation of the work or render them unreasonably burdensome for the employer, the latter may annul the contract against payment of compensation to the contractor. Such compensation shall not cover the loss of profit suffered by the contractor by not completing the work but only such other losses as the contractor may suffer.

Lack of clarity, obstructions or similar matters

§15.

8. Scheduling

Ancient monuments

§16. The contractor shall see to it that no in situ ancient monuments are damaged, altered or moved.

Subs. 2. The contractor shall immediately notify the discovery of ancient monuments to the Keeper of National Antiquities and the employer, and work must be suspended to the extent that it affects the ancient monument.

*Subs.*3. The contractor shall see to it that all objects found in the course of work are handed over to the employer.

Subs. 4. The provisions of subs. 1-3 above shall also apply to wrecks and in situ ancient monuments found on the sea bed.

Ancient monuments

§16.

The contractor shall immediately notify the employer and no-one else. The employer then takes the case further.

The employer's supervisors

§17. The employer's supervisors shall be defined as his superintending officers, professional supervisors or other supervisors especially appointed by him.

Subs. 2. The employer or his supervisors must be present at the site or be on call.

Subs. 3. The employer's supervisors represent the employer towards the contractor in relation to the organisation and performance of the work. The supervisors may deliver and receive information concerning the work, approve or reject materials or work and issue instructions for the organisation of the work performed by the different contractors with a view to their interrelations.

Subs. 4. Supervision by the employer does not relieve the contractor of undertaking a control of his own.

The employer's supervisors

§17.

The employer or his supervisors can be called if not present at the site, but only during the working hours.

Work management by the contractor

§18. The contractor shall manage the work either in person or through an agent who acts as his representative towards the employer and the supervisors in relation to the organisation and performance of the work.

Subs. 2. The contractor or his agent shall be present at the site or be on call.

Work management by the contractor

§18.

8. Scheduling

Site meetings

§19. Site meetings shall be convened by the employer or his supervisors who shall also prepare minutes from the meetings to be sent as soon as possible to the contractors with whom the employer has concluded contracts.

Subs. 2 The contractor himself or his agent shall attend all site meetings.

Subs. 3. At all site meetings statements shall be made of the number of workdays – days lost – on which work has been wholly or partially at a standstill, with indication of the reasons.

Site meetings

§19. Site meetings shall be held every Friday every week at 10:00 in the meeting cabin. The first thing to do on a meeting is to sign the minutes from last meeting.

If a contractor doesn´t attend site meetings he can be released from his contract.

Collaboration with other contractors

§20. The contractor shall collaborate with other contractors at the site and shall negotiate with the supervisors in due time for errors and delays caused by insufficient inter-contractor collaboration to be avoided.

Collaboration with other contractors

§20. See §19. Site meetings. Site meetings are considered to be in collaboration with other contractors as well as normal interaction on building site. In case of constant lack of collaboration on the behalf of one or more contractors he / they can be released from the contract.

Calling-in of employer and contractor Parties residing abroad

§21. The employer and the contractor shall each provide the other with an address and telephone number to which communications are to be made and from where the employer and his supervisors, respectively the contractor or his agent, can be called in.

Subs. 2. If either contractual party resides abroad or takes up residence abroad after the conclusion of the contract, said party shall appoint a person with an address or domicile in this country who is authorised to enter into financially binding commitments on his behalf, against whom legal action can be taken on behalf of said party and with whom all negotiations on behalf of said party can be pursued with binding effect.

Calling-in of employer and contractor Parties residing abroad

§21.

D. The employer's obligation to pay

Payment

§22. Upon written request to the employer, the contractor shall be entitled to receive payment once a month for work performed, etc. Within 15 days of receipt of such request, cf. Subs. 11, the employer

D. The employer's obligation to pay

Payment

§22. Upon written request to the employer, the contractor shall be entitled to receive payment once a month for work performed, etc. Within 10 days of receipt of such request, cf. Subs. 11.

shall effect payment of the amount for which works and materials in accordance with the contract have been provided on the site.

All the materials wich have been provided on the site shall not be entitled to receive payment till they will be placed on the building.

The due date for contractor´s payment request shall be on 25th of every month.

Subs. 2. Subject to the same rules as under subs. 1, the contractor may also demand payment for any off-site materials, etc., purchased by him and not yet delivered. If the employer so demands, the contractor shall provide a performance bond for delivery in accordance with the contract, cf.§ 6. The size of such bond shall correspond to the payment demanded for non-delivered materials, inclusive of VAT.

Subs. 3. Requests for payment for materials, etc., made more than 20 workdays prior to the application thereof on the site shall be conditional upon provisions to the effect in the bid.

Subs. 4. Instead of payment under subs. 1, the parties may agree on payment being effected in accordance with a payment schedule that follows the time schedule and stipulates at which times the contract sum or parts thereof are to be paid. Alternatively, the payment schedule may stipulate the stages at which specified amounts, be they in the contract sum or parts thereof, have to be paid.
Payment must be made at the agreed times, etc., conditional upon the completed performance of the work to which the payment is related.

Subs. 5. If, in the case of extra work, no agreements have been made on the time of payment thereof, payment may be demanded as provided by subs.1.

Subs. 6. If the contract provides for adjustment of the contract sum in cases of changes of index, wages under collective wage agreements, prices of material, etc., shall be adjusted in connection with the payment for such parts of the work as are affected by the change. Adjustment is to be based on a documented statement provided by the contractor.

Subs. 7. Upon handing over, the contractor shall submit a final and exhaustive account, including one indicating amounts due for all extras. Once the employer has received such account, the contractor may advance no further claims, to the exception of such claims for which reservations have been specifically made in the final account.

Subs. 8. For building works, including site development works, the final account must be submitted to the employer within 25 workdays of the handing over, however, for main contracts within 35 workdays thereof. For engineering works, apart from those mentioned in § 36, subs.1, the time limit for submission of the final account shall be 60 workdays.

Subs. 9. If the employer is not in receipt of the final account at the expiry of the period provided in subs.8, he may submit a written demand requiring the account t be forwarded within 10 workdays. If the contractor fails to submit the account to the employer within this period, he shall forfeit his claim for payment for extra work performed on an account-rendered basis as well as for reimbursement for wage and price increases.

*Subs.*10. Payment of the amount stated in the contractor's final account shall be affected within 15 days of receipt thereof.

Subs. 11. Amounts due to the contractor shall carry an interest from the due date as provided by the Danish Interest Rate Act. The time limit provided in *Subs.*1 is days of grace.

*Subs.*12. Where the contractor finds the amount for which payment has been claimed has not been paid, he shall immediately notify the employer thereof in writing.

*Subs.*13. In case of dispute between the parties concerning an account, the employer shall effect payment of all undisputed amounts due.

Subs. 14. If the parties disagree on the employer's right to hold back payments or effect set-offs against the claim of the contractor, the provisions of §46 shall apply at the request of either party.

Subs. 15. Whenever necessary in order to prevent work standstills, the employer may at the expense of the contractor effect payment of wages due to the employees of the contractor.

The right of the contractor to stop work
§23. If the employer fails to effect payment within the above time limits of amounts due, the contractor may stop work with a written notice of 5 workdays.

The right of the contractor to stop work
§23.

Subs. 2. Moreover, the contractor may stop work immediately upon the employer's bankruptcy or suspension of payments, or if negotiations are initiated on enforced composition, or if the general financial situation of the employer proves to be such that it must be assumed that he is unable to fulfil his obligations under the contract. However, the above shall not apply where the employer has provided, or does so at the request of the contractor, adequate security for the performance of his obligations under the remaining part of the contract.

E. Extension of time limits and delays

The contractor's right to extension of time limits.

§24. The contractor shall be entitled to extensions of time limits in case of delay of the work caused by
(1) Alterations in the nature and extent of the work ordered by the employer cf. 14.
(2) Circumstances relating to the employer or delay on the part of another contractor,
(3) Circumstance for which the contractor cannot be blamed and which are outside his control, e.g. war, unusual natural events, fire, strikes, lock-out or vandalism,
(4) The occurrence of precipitation, low temperature, strong winds or other weather conditions which prevent or delay the work because they are essentially greater than what is usual for the season and region concerned, or
(5) Public orders or bans which were not issued because of the contractor's own situation.

Subs. 2. However, the contractor must endeavour to avoid or limit the extent of delays by means of such measures as can reasonably be required.

Subs. 3. Where the contractor feels entitled to an extension of a time limit he must inform the employer thereof in writing without delay. The contractor must, upon request, substantiate that the delay was caused by the circumstances relied upon by him.

The contractor's liability in case of delays
§25. Delays, which do not entitle the contractor to an extension of time limits, shall be considered the liability of the contractor.

Subs. 2. Where provisions have been made for

E. Extension of time limits and delays

The contractor's right to extension of time limits.

§24. Delays caused by weather are only accepted if there are unusual conditions. The normal conditions are those published by DMI.

The contractor's liability in case of delays
§25. Day penalty is set to 2‰ of the contract sum per day.

liquidated damages or other special penalties, no additional claims arising out of delays can be made in excess thereof.

Subs. 3. Where no provisions have been made for liquidated damages or other special penalties, the loss suffered by the employer shall be assessed in accordance with the general provisions of Danish legislation on compensation.

The employer's right to extension of time limits

§26. The employer shall be entitled to extensions of time limits in case of such delays of the work as are caused by the exposure of the employer or another contractor to the circumstances mentioned in §24, subs. 1(3), (4) and (5). The employer shall be vested with the same right in relation to alterations as mentioned in §24, subs. 1(1).

Subs. 2. However, the employer shall endeavour to avoid or limit the extent of the delay by means of such measures as can reasonably be required.

Subs. 3. Where the employer feels entitled to an extension of a time limit, he must inform the contractor thereof in writing without delay. The employer must, upon request, substantiate that the delay was caused by the circumstances relied upon by him.

The employer's right to extension of time limits

§26.

The employer's liability in case of delay

§27. The contractor shall be entitled to compensation for losses suffered because of delays caused by
(1) circumstances relation to the employer, cf. §24, subs. 1(2), and where he is guilty of any errors or neglect, or
(2) liability-entailing delays by other contractors, cf. § 25, subs. 1, or liability-entailing delays on the part of other contractual parties.

Subs. 2. The contractor shall be entitled to indemnity if the cause of the delay falls under
(1) §24, Subs. 1(1) and § 24, subs. 1(5), or
(2) §24, subs. 1(2), however, without falling under subs. 1 or subs. 3 of the present section.
The indemnity shall amount to the loss sustained by the contractor, however, to the exclusion of any loss of profit sustained by him by not being able to perform other works for the duration of the delay or similar consequential losses.

The employer's liability in case of delay

§27.

*Subs.*3. If the cause of the delay falls under §24, subs. 1(3) or §24, subs. 1(4), the contractor shall be entitled to neither indemnity nor compensation.

F. Handing over of the work

Handing over meeting

§28. Just before completion of the work, the contractor must inform the employer in writing of the time of completion (completion notice). The employer shall then convene the contractor to a handing over meeting to take place within 10 workdays of the time indicated, however, cf. Subs. 4.

Subs. 2. The work shall be taken to be handed over to the employer upon the conclusion of the handing over meeting - - unless material defects were discovered in the course thereof, in which case a new handing over meeting shall be arranged to be held when the contractor has informed the employer in writing that rectification has taken place, cf. Subs. 1.

Subs. 3. If the employer does not convene a handing over meeting as provided in subs. 1, the work shall be taken to have been handed over 10 workdays after the stated time of completion. The same shall apply in relation to new handing over meeting as provided in subs. 2, 2nd full stop.

Subs. 4. Where the work comprises several contracts, the employer must await the completion of all contracts before convening the handing over meeting. However, it may have been provided for in the contract or appear from the circumstances that contracts, or parts thereof, are to be handed over at different times or that building sections are to be handed over separately.

Subs. 5. For engineering works, apart form those mentioned i §36, subs. 1, the individual contracts shall be handed over separately, unless otherwise agreed or indicated by the circumstances.

F. Handing over of the work

Handing over meeting

§28. Handing over of the work for each contractor will be according to a time schedule.

Handing Over Protocol

§29. During the handing over meeting, a document shall be drafted (the handing over protocol) in which shall be listed any claims for defective work and any other circumstances pointed out by the employer in addition to any comments made by the contractor thereon. It must appear from the document whether the parties consider the work as having been handed

Handing Over Protocol

§29.

over or not.

Subs. 2. The document shall be signed by the employer and the contractor.

Subs. 3. If either party is unrepresented at the handing over meeting, the meeting may proceed without the representation of the said party. The party present must, as soon as possible, inform the other party in writing of the proceedings of the handing over meeting and of the contents of the handing over protocol.

G. Defects

The concept of defects

§30. If the work has not been performed in accordance with the contract, with due professional care and skill or in accordance with any instructions given by the employer under § 15, it shall be deemed to be defective. The same shall apply whenever the contractor has failed to provide other services agreed upon in relation to the work.

Subs. 2. If the materials are not the agreed materials or are not of a general good quality, cf. § 10, subs. 1, they shall be taken to be defective. However, this provision shall not apply.

(1) where, in case of a free choice of materials, the contractor substantiates that the materials stipulated in the contract do not exist or are not procurable because of war, import bans, etc., or
2)where, in case the employer has ordered the use of specific materials, the contractor substantiates that, it is impossible to procure such materials in the stipulated condition due to circumstances which, at the conclusion of the contract, the contractor ought not to have foreseen.

In case of (1) and (2), the contractor must as soon as possible notify the employer of the actual or possible occurrence of obstacles, cf. §15.

*Subs.*3. The work must in any case possess such properties as are guaranteed by the contract.

Subs. 4. The time of handing-over shall be decisive for the establishment of defective work, whether the defects can be established at this point or are hidden.

G. Defects

The concept of defects

§30.

Defects established during handing over

§31. The contractor shall have an obligation and a right to rectify any defects discovered during handing over.

Subs. 2. The employer must stipulate in writing a time limit for the rectification of defects discovered. The duration of such limit shall be fixed on the basis of the nature and extent of the defects and the circumstances in general. The contractor shall notify the employer in writing when rectification has taken place.

Subs. 3. If, upon the expiry of the time limit mentioned in subs.2, or after having received a notice from the contractor to the effect that rectification has taken place, the employer is of the opinion that the defects have not been rectified, he must inform the contractor in writing of any defects within 10 working days.

Subs. 4. If the contractor does not proceed immediately to rectify said defects, the employer shall be entitled to have them rectified at the expense of the contractor or demand a reduction of the contract sum, cf. §34.

Defects established during handing over

§31.

Defects established after handing over

§32. For the period of 5 years after handing over, the contractor shall have an obligation and a right to rectify defects established after handing over, however cf. §36, subs. 3(3).

Subs. 2. Such defects may be relied upon by the employer only if the contractor was notified thereof in writing within a reasonable period of the time when the defects were, or ought to have been, discovered. However, this provision shall not apply where the contractor is guilty of gross recklessness.

Subs. 3. The employer must stipulate in writing a time limit for the rectification of defects established. The duration of such limit shall be fixed on the basis of the nature and extent of the defects and the circumstances in general. The contractor shall notify the employer in writing when rectification has taken place. Rectification of a defect may be postponed in order for it to be effected together with the rectification of any defects established during the 1-year inspection, provided that such postponement

Defects established after handing over

§32.

does not cause the defect to aggravate and does not cause any inconvenience to the employer.

Subs. 4. If the contractor fails to rectify the defects established within the limit provided in subs. 3, the employer shall be entitled to arrange for rectification and charge the contractor with the cost thereof or demand a reduction of the contract sum, cf. §34.

Subs. 5. The employer may have defects rectified at the expense of the contractor where such rectification is urgent and the contractor is not capable of effecting rectification immediately. The same shall apply where the employer has reason to believe that the contractor will not effect rectification in the proper manner or without delay.

Lapse the contractor's obligation to rectify, etc.

Lapse the contractor's obligation to rectify, etc.

§33. The contractor's obligation to rectify and the employer's access to effecting rectification at the expense of the contractor, cf. §§ 31 and 32, shall lapse if the costs of rectification are disproportionately large. In the assessment thereof, consideration must be given to the employer's interest in fulfilment of the contract.
However, the employer shall in any case preserve his right to a reduction, cf. §34.

§33.

The employer's right to a reduction of the contract sum

The employer's right to a reduction of the contract sum

§34. If the contractor fails to rectify defects as provided by §31, subs. 4 and §32, subs, 4, the employer may choose not to have the defects rectified at the expense of the contractor but, instead, to claim a reduction of the contract sum. Moreover, the employer shall be entitled to a reduction of the contract sum if rectification proves impossible and under the circumstances mentioned in §33.

§34.

Subs. 2. The calculation of the reduction shall be based upon the amount payable for such rectification had it actually taken place.

Subs. 3. Where rectification of defects proves impossible or gives rise to disproportionately large costs, the employer may choose whether the reduction is to be fixed by estimate or in one of the following ways:

(1) either as the difference between the contract sum agreed upon and the contract sum which the

parties presumably would have agreed upon had a contract been concluded for the work in its present condition,

2) or as the difference between the value of the work as provided under the contract without defects and the value of the work in its present condition.

Subs. 4. The employer's right to annul the contract because of defects shall follow the rules provided in § 40.

The contractor's liability for consequential damage

§35. The contractor shall be liable for compensation for losses suffered due to defects in the work, where such defects are caused by errors or negligence on the part of the contractor, or where they relate to properties, the presence of which has been guaranteed in the contract.

Subs. 2. The contractor shall not be liable for operational losses, loss of profit or other indirect losses.

The contractor's liability for consequential damage

§35.

Cessation of the liability for defects

§36. In connection with building works and attendant engineering works, the employer's claim against the contractor for defects shall be put forward within 5 years of the handing over of the work. After this period, the employer may not put forward any claims against the contractor. The provisions of Act no. 274 of December 22, 1908, on time barring of certain claims, shall not apply to these cases.

Subs. 2. However, the claim of the employer shall continue to exist in relation to those sections of the work to which it applies that:

(1) the contractor has undertaken to extend the period of his liability,

(2) it is established during handing over that agreed quality assurance measures have failed materially, or

(3) the contractor has acted in gross recklessness.

Subs. 3. For engineering works, apart from such as are mentioned in subs.1, the liability for defects shall cease as provided by the General Conditions of Danish Legislation, the following shall apply:

Cessation of the liability for defects

§36.

Subs. 3. Sewer works in the ground and the foundation works require 15 years liability.

(1) The rule in §6, subs. 4, on the reduction of the performance bond, shall be changed to the effect that the bond shall cease.
(2) The contractor may refrain from fulfilling the provision of §10, subs. 4 on supplier liability.
(3) The time limit for rectification rights and obligations cf. §32, subs.1 shall be changed to 1 year.
(4) The provision in §38 on 5-year inspections shall not apply.

H. 1st-and 5th -year inspections

H. 1st-and 5th -year inspections

1st year inspection

1st year inspection

§37. The employer shall convene the contractor to an inspection of the work to take place within one year of the handing over.

.

§37.

5th year inspection

5th year inspection

§38. The employer shall convene the contractor to a final inspection of the work to take place not later than 30 workdays prior to the expiry of a 5-year period after handing over, however cf. §36, subs.3 (4).

Subs. 2. If the employer fails to convene an inspection as provided by subs. 1, the contractor may convene the employer to the inspection. Such convening must be made in writing with a minimum notice of 10 workdays

§38.

Joint inspection rules

Joint inspection rules

§39. The convening of inspections under §§37 and 38, subs.1, must be made in writing with a notice of maximum 60 and minimum 15 workdays - however, for main contracts minimum 20 workdays.

.

Subs. 2. In connection with the inspection, a document shall be drafted (the inspection protocol) in which shall be listed any claims for defective work and any other circumstances pointed out by the employer in addition to any comments made by the contractor thereon.

Subs. 3. The employer and the contractor shall sign the document.

§39.

Subs. 4. If either party is not represented at the inspection, the meeting may proceed without the representation of said party. The party present must as soon as possible inform the other party in writing of the proceedings of the inspection and of the contents of the inspection protocol.

I. Special provisions on annulment

The employer's right to annul the contract

§40. Following the submission to the contractor of a written notice thereof, the employer may annul the contract:

(1) if, without entitling him to an extension of time limits, the contractor is the cause of material delay in the performance of the work, and where such delay causes considerable inconvenience to the employer, or
(2) if the contractor is otherwise the cause of material delay in respect of matters of decisive importance to the employer, unless the interests of the latter have been sufficiently safeguarded in another way, e.g. by the possibility of discontinuing payments or by the provision of security, or
if the quality of the work performed is such that the employer has reason to believe that the contractor will not be able to complete the work without material defects. tilstrækkeligt tilgodeset på anden måde, f.eks. gennem adgangen til at standse udbetalingerne eller ved stillet sikkerhed, eller
3) hvis det udførte arbejde er af en sådan kvalitet, at bygherren har grund til at antage, at entreprenøren ikke vil være i stand til at fuldføre arbejdet uden væsentlige mangler.

I. Special provisions on annulment

The employer's right to annul the contract

§40.

The contractor's right to annul the contract

§41. In case of material delay, the contractor may, upon submission to the employer of a written notice thereof, annul the contract under such circumstances as are mentioned in §24, subs. 1(2) if the employer does not demonstrate reasonable endeavours for the purpose of furthering work as much as possible.

Subs. 2. Moreover, the contractor may, upon submission to the employer of a written notice thereof, annul the contract if the employer is the cause of material delay in respect of matters of

The contractor's right to annul the contract

§41.

decisive interest to the contractor. However, the contract cannot be annulled if the contractor's interests have been sufficiently safeguarded in another way, e.g., by his possibility of stopping work or by the provision of security.

Bankruptcy, suspension of payments, composition, etc.
§42. In the event of the bankruptcy of a party under a contract, and to the extent that nothing in the provisions of the Danish Bankruptcy Act prevents it, the other party may annul the contract immediately.

Subs. 2. If, under the provisions of the Danish Bankruptcy Act, the estate is entitled to enter into the contract, it shall within a period of 5 workdays of a request thereon inform of its intentions in that respect.

Subs. 3. The provision of subs. 1 shall also apply in the case of the suspending of payments by a party under the contract, if negotiations are initiated on a composition scheme, or if the general financial situation of said party proves to be such that it must be assumed that he is unable to fulfil his obligations under the contract. However, the right to determine shall be conditional upon said party not having provided, or not providing, at the request of the other party adequate security for the performance of his obligations under the contract, cf.§§6 and 7.

Subs. 4. If a party is a limited company or a private company, the other party may annul the contact in case a claim for the dissolution of such company is put forward by the Danish Commerce and Companies Agency. The provision shall not apply if, within 10 workdays of receipt of a claim from the other party, said party furnishes documentation which substantiates that the conditions for a dissolution of the company are non-existing, or if said party provides full security for the fulfilment of his obligations under the contract.

Subs. 5. In case of determination, the provisions of §§ 44 shall apply.

Bankruptcy, suspension of payments, composition, etc.
§42.

Death of a party

§43. In the event that a party dies and the debt of the deceased is disclaimed by the estate, the provisions of § 42, subs. 1 and 2 shall apply.

Death of a party

§43.

*Subs.*2. Where the administration of the estate is different from the method mentioned in subs.1, the estate and the heirs shall be entitled to enter into the contract, however cf. Subs. 3. The same shall apply to the spouse of the deceased if said spouse retains undivided precession of the estate.
The right of entry shall be conditional upon the provision of adequate security for the fulfilment of the obligations under the contract, cf. §§ 6 and 7.

Subs. 3. Upon the death of the contractor, a further condition for a right of entry shall be the appointment of a manager for the work against whom the employer has no legitimate objections. Where the nature of the work is special to the point where, after the contractor's death, it cannot be expected to be duly completed, there shall be no entry.

Subs. 4. In case of determination, the provisions of §§44 shall apply.

Joint rules on annulment

§44. Annulment shall be made in writing.

Subs. 2. Concurrent with the annulment, the annulling party shall arrange for the convening in writing of a registration meeting (status meeting) to take place as soon as possible. However, unless the parties agree otherwise, the registration meeting shall be held 1 workday upon receipt of the convening notice at the earliest.

Subs. 3. During the registration meeting, a document shall be drafted (the registration protocol) which shall describe the extent and quality of the work performed. All parties shall sign the document unless an expert, appointed by the Board of Arbitration, cf. § 45, undertakes registration.

Subs. 4. If, despite receipt of a convening notice, a party is not represented at the registration meeting, the meeting may proceed without the representation of said party. The party present must as soon as possible inform the other party in writing of the proceedings of the registration and of the contents of the registration protocol.

Subs. 5. In case of annulment by the employer, the employer or the person charged with completion of the work on his behalf shall be entitled to use such materials and equipment of the contractor as are

Joint rules on annulment

§44.

present on the site, if removal thereof before completion of the work will cause the employer to suffer losses. The payment for the uses thereof shall follow the usual rates.

Subs. 6. In case of annulment by either party, the other party shall be liable for the loss suffered, in accordance with the General Conditions of Danish Legislation.

J. Disputes

Inspection and survey by experts

§45. If, in the case of disputes between the parties or in order to establish proof of a matter, there is a wish for inspection and survey by an appointed expert, a request thereon shall be submitted to the Building and Construction Board of Arbitration in Copenhagen.

Subs. 2. Such request must be accompanied by
(1) information on the parties involved, their addresses and telephone numbers,
(2) a written statement containing a brief description of the case and a list of the questions to be answered by the expert (the matter of issue),
(3) all relevant documents,
(4) an indication, if appropriate, of the technical qualifications to be possessed by the expert, and
(5) an indication of whether the inspection and survey is to be treated as urgent, in which case a special fee is payable.

Subs. 3. As a general rule, one expert shall be appointed. Where the Board of Arbitration finds it appropriate, it may appoint two experts or, where special circumstances so require, more than two. In its decision thereon, the Board of Arbitration shall consider any wishes of the parties.

Subs. 4. Another inspection and survey by a different expert may be made only where considered appropriate by the Board of Arbitration. If the dispute has already been referred to arbitration, cf. 47, the Court of Arbitration shall consider requests made for a supplementary inspection and survey or another inspection and survey by the same or different expert.

Subs. 5. The person, or persons, who have requested the expert inspection and survey shall be liable for the costs arising there from, including the fee to the

J. Disputes

Inspection and survey by experts

§45.

expert as fixed by the Board of Arbitration. If the dispute or part thereof is referred to the Court of Arbitration, the costs and the necessity thereof shall be considered in the fixing of arbitration costs. In such case, the Court of Arbitration shall fix the fee payable to the expert.

Subs. 6. Where the present general conditions apply to the relationship between the employer and several parties (contractors, suppliers), the provisions of subs. 1-5 shall apply to the interrelations between such parties.

Subs. 7. The Building and Construction Board of Arbitration shall fix the rules applying to an expert inspection and survey.

Expert opinions on security provided, etc.

§46. At the request of a party, the Board of Arbitration may appoint an expert who shall be asked to give an opinion on the release of security provided, cf. §6, subs. 7, and §7, subs. 3, and on the justification of holding back payments or making set-offs in case of disagreements between the parties as described in § 22, subs.14.

Subs. 2. Depending upon the nature of the dispute, the Board of Arbitration may decide that such opinion is to be given by several experts.

Subs. 3. The request must contain such information, etc., as is listed in §45, subs.2. A copy of the request shall at the same time be sent to the other party under the contract.

Subs. 4. The Board of Arbitration shall stipulate a short period within which the opponent may file a statement. Under special circumstances, the expert may allow the parties to file one more statements within a short period fixed by the expert. Upon the expiry of such period, the expert will as soon as possible and within 15 workdays decide to what extent the request for payment is seen to be justified and award costs, including the fee payable to the expert. The Board of Arbitration shall fix the size of such a fee.

Subs. 5. Under special circumstances, it may be decided that payments to private employers and to contractors are to be conditional upon the provision of security, in which case the expert shall stipulate the type and magnitude of such security as well as the

Expert opinions on security provided, etc.

§46.

conditions applying to payments under it or its cessation.
In case of requests for payment under security provided by the employer, the expert may under special circumstances also refer the contractor to bring the matter before the Court of Arbitration under § 47.

Subs. 6. Under very special circumstances, the Board of Arbitration may extend the time limits provided in subs.4 by up to 10 workdays.

Subs. 7. The payment of amounts under a decision on the payment of security provided shall be effected within 3 workdays of the day when the parties and the guarantor receive notice in writing thereof.

Arbitration

Arbitration

§47. The Building and Construction Court of Arbitration in Copenhagen shall decide disputes between the parties, whose awards shall settle matters finally and conclusively

§47.

Subs.2. Matters shall be brought before the Court of Arbitration by the submission of a statement of claim addressed to the Board of Arbitration.

Subs. 3. Such statement of claim must contain
(1) information on the parties involved, their addresses and telephone numbers,
(2) the claim of the applicant containing a brief description of the facts upon which the claim is based, and
(3) indication of such documents and other pieces of evidence as the applicant intends to rely upon. The documents must be enclosed.

Subs. 4. The Court of Arbitration shall, however cf. Subs. 5 and 6, consist of 1 member of the Court's Presidium and 2 experts to be appointed by the Board of Arbitration on a case-by-case basis, depending upon the nature of the dispute. The Chairman of the Presidium may decide that one of its deputy members is to be President of the Court of Arbitration.

Subs.5. At the request of either party, the court shall be extended to include 2 more members or deputy members of the Presidium. The additional costs thereby incurred shall be awarded in connection with the Court of Arbitration's decision on the general arbitration costs. It may be decided that, where the court finds the extension of the court to be insufficiently justified, such costs as follow from the extension of the court are to be defrayed by the party requesting it.

Subs. 6. Where the parties so agree, the Court of Arbitration may have 1 member only.

Subs. 7. The procedure to be followed by the Court of Arbitration in the settlement of the disputes shall follow the rules fixed by the Building and Construction Board of Arbitration.
Otherwise the Danish Arbitration Act shall apply.

Subs. 8. Where the present general conditions apply to the relationship between the employer and several parties (contractors, suppliers), the provisions of subs. 1-7 shall also apply to the interrelations between such parties.

4. Building Site

4. Building Site
Dannebrogsgade 4
8000 Aarhus. C, Denmark

4.1. General

4.1. General
Apart from stipulations about the building site, this chapter gives information of an informative nature about who implements the various site provisions. The services in connection with the different site provisions are stated in the relevant work specifications.

The specification of services will normally be given in the work specifications but reference can also be made to, for example, the Case Specifications or the drawings.

4.2 Stipulations

4.2 Stipulations
Work involving the danger of fire or sparks (so-called “hot works”, eg. asphalt roofing or angle grinding, etc.) must be implemented by observing the “Directions for Fire Safety no. 10a and 10b of 10 April, 1994, issued by The Danish Institute of Fire Safety.

4.2.1. Local authority regulations

4.2.1. Local authority regulations
Guidelines for taking down back stairs Aarhus kommune
Guidelines for dormers Aarhus kommune

4.2.2. Planning Permission and notification to the

4.2.2. Planning Permission and notification to the

authorities.

4.2.3. Other stipulations

4.3. Transfer and handing over

4.4. Existing conditions

Buildings, crossings, pavements, roads, masts, piping and conduits, courtyards, fences, signposts, trees and bushes, must not be damaged.

The necessary provisions must be taken to maintain plants. The cutting and trimming of trees and bushes must not be done without the prior permission of the project management.

It is the duty of the contractor to notify the owner of conduits, pipes and cables (public authorities, companies and private persons) of works and conduct the work in accordance with their directions.

Before excavation near existing piping, the owner must be summoned by the contractor to show the

authorities.

Main contractor is applying for:

1) Permission for closing half of Dannebrogsgade for during the 12 month building period.

2) Permission for using street for digging work during sewer installation and electric installation.

4.2.3. Other stipulations

4.3. Transfer and handing over

Contractor Arnaldo Landivar must convene a meeting, with the participation of the project management and the road authorities, to examine the road network before the start of works.

The contractor must make a registration of existing building components bordering up to the work area. Any damage to the aforementioned structures must be noted before work begins.

The localities are taken-over in a condition cleared of loose items and furnishings. Respective contractors, to the extent it is stated in the work specifications, must remove fixed furniture and equipment.

Each contractor is responsible for the materials he is using all the time.

It is the duty of the contractor to re-establish the areas that are not part of the finished works, but which the contractor uses in connection with the completion of works, so that they appear as they did when the contract was awarded – but only to the extent that this does not conflict with the General Conditions of Danish Liability Legislation.

4.4. Existing conditions

The existing conditions on site are shown on drawing number <x>.

Contractor "Carpenter Main Contractor" must come up with the following information about cable, pipes and conduits:

- Distance from the façades
- Depth from walkway pavement
- Crossing installations

Buildings, crossings, pavements, roads, masts, piping and conduits, courtyards, fences, signposts, trees and bushes, must not be damaged.

The necessary provisions must be taken to maintain location of said piping, etc.

If gas, water, sewer- and other piping is to be severed from the main pipe, it will be done at the contractor's arrangement and at his/her expense and liability.

plants. The cutting and trimming of trees and bushes must not be done without the prior permission of the project management.

It is the duty of the contractor to notify the owner of conduits, pipes and cables (public authorities, companies and private persons) of works and conduct the work in accordance with their directions.

Before excavation near existing piping, the owner must be summoned by the contractor to show the location of said piping, etc.

If gas, water, sewer- and other piping is to be severed from the main pipe, it will be done at the contractor's arrangement and at his/her expense

4.5. Marking out by the employer
The expense for any marking out above and beyond that of the employer's marking out must be included in the individual contracts.

4.5. Marking out by the employer
The employer marks out, once and for all, <x> nos. main reference lines and <x> nos. reference levels as stated in drawing <x>. Carpenter Main Contractor is responsible for maintaining these settlings and levels. Carpenter Main Contractor marks-off and maintains <x> nos. fixed level settings for other contractors use, as describe in drawing no. <x>

4.6. Organisation of the building site
4.6.1. Site drawing
The Health and Safety coordinator updates the site plan, for example, as part of the completing and revising the Plan for Health and Safety.

4.6. Organisation of the building site
4.6.1. Site drawing
See drawing no

4.6.2 The building site boundaries
The boundaries of the site are shown on the site plan. If a contractor wishes to extend the site area beyond the boundaries shown, he/she must secure the necessary permission for this after prior agreement with the project management.

4.6.2 The building site boundaries.
The site boundaries are shown on site plan no. <x>.

4.6.3. Fencing-in the building site

4.6.3. Fencing-in the building site
Contractor "Carpenter Main Contractor" establishes moves, maintains, and removes the temporary site fencing. The scope of the building site fencing is shown on drawing no. <x>.
The boundary fence has a height of 2.00 m. The material used for the fence is galvanised steel with rubber or concrete feet. The time for establishing the fence is stated in the tender time schedule.

4.6.4. Closing-off

4.6.4. Closing-off
Contractor "Carpenter Main Contractor" must establish, maintain and take down any interim

covering/protection to the building. Holes for windows must be closed-off with wooden frames clad with plastic foil. Door openings must be closed-off with interim wooden doorplates with a lock system.

Contractor "Carpenter Main Contractor" must ensure daily opening at 8:00 o'clock and closing at 18:00 o'clock of the building site.

4.6.5 Security guard

4.6.5 Security guard
The employer does establish the security guard system.
The system must be started in the completion phase until the handing over.
The security system is managed by KS Vagt and comprises a daily night site guard from 18: 00 until 8:00, including weekends.

4.6.6. Security against theft form the site

4.6.6. Security against theft form the site
The employer does establish the security system against theft from the site.
The security system against theft from the site is managed by the above mention company.

4.6.7. Signposts
Each individual contractor is responsible for signposting the door of own portable site cabins.

Each individual contractor is responsible for signposting own site work areas.

4.6.7. Signposts
Contractor "Carpenter Main Contractor" delivers and sets-up the following signs in the common traffic and work areas at the beginning of construction on site and removes them after the completion of construction:

- 8 nos. sign board with the text "Mandatory helmet area"
- 2 nos. sign board with the text " No trespassing"
- 1 nos. sign board with the text "speed limit 20Km/h"

Furthermore the Contractor must be following the signals that were located in Safe and Health plans.

4.6.8 Screening off /cordoning off of 3rd person.
It is the responsibility of each individual contractor to secure that traffic around buildings and roads/pathways are screen off and secured against falling building materials and other objects from the site.

4.6.8 Screening off /cordoning off of 3rd person
Contractor "Scaffolding Supplier" establishes, maintains and removes screens and other provisions towards streets, around buildings, etc that are set-up in the interest of public safety. The screening is minimum 2.4 m high and made in waterproof canvas placed on the scaffolding.

If the scaffolding faces the street a covered walkway must be provided following the measurements at the Health and safety Plan.

4.7. Building site traffic areas
4.7.1. Parking

4.7.2. Outdoors traffic areas
The outdoor traffic areas are shown on the site drawing.
The site roads can be used by heavy lorries and trailers, e.g., element trailers, earth dumpsters, and mobile concrete mixers. All roads are drained and secured against the weather conditions. Outdoor traffic area may, under no circumstances be partly or wholly blocked off with the permission of the project management

4.7.3. Traffic areas inside the building
Traffic areas and corridors must under no circumstances be blocked off wholly or partly without the permission of the project management.

4.7.4 The covering of holes and rebates in the traffic areas.
Holes, such as light-shafts, wells, etc, in traffic areas is to be covered with boarding or lids that are fixed.

The responsibility for covering holes and keeping them covered is that of the contractor who makes the holes.

The aforementioned contractor does any temporary removal, screening off and re-establishing of these covers during construction.

4.7.5. Establishing of railings in traffic areas
Guard railings must be set-up along all traffic areas where there is a level jump of more that 2 metres. Any temporary removal of railings because of a contractor's work must be re-established by the same contractor after the work is completed. During the

4.7. Building site traffic areas
4.7.1. Parking
Private parking is not provided.

4.7.2. Outdoors traffic areas
Contractor "Carpenter Main Contractor" establishes, maintains, secures against weather conditions, relays and removes building site roads, crossings in accordance with the Tender time schedule and the building site drawing no. <x>.

4.7.3. Traffic areas inside the building
Common traffic areas in the building or building excavation is to comprise:
- 1 nos. interim staircases;
- 3 nos. Interim gangways;

and areas which, after the completion of the building, will constitute internal corridors, passages, staircases, etc.

Contractor "Carpenter Main Contractor" will deliver, set-up, maintaing, move and remove the interim staircases and gangways, etc, following and adjusting them at the different execution phases shown at the Health and Safety plans.

Staircases and gangways can be given a load of up to 300 kg/sq.m. The interim staircases and gangways will, during the course of construction, be replaced by permanent ones.

4.7.4 The covering of holes and rebates in the traffic areas

4.7.5. Establishing of railings in traffic areas
Contractor "Carpenter Main Contractor" sets-up, maintains and removes the railings along common traffic areas as shown on building site drawing no. <x>.

work, the contractor must take measures to prevent accidents until the railings are re-established.

In case of any difference between the drawing plans and the Health and Safety plans, the second ones prevail over the first ones above mentioned.

Likewise, the Safety coordinator would make modifications over the above mention plans if he considers necessary in order to prevent risk areas.

4.7.6. Lighting of traffic areas
The extent of the lighting is shown on the building site plan.

4.7.6. Lighting of traffic areas
Contractor "Electricity Contractor" establishs´ maintains and removes lighting in traffic areas.

Lights in building site traffic areas are mounted on light-masts.

Traffic areas in buildings are lit with orientation lights with a minimum strength of 25 lux. This is done with light-chains.

The regular and interim staircases in the building are lit with a minimum strength of 100 lux.

Building site lights are controlled using "twilight relays" with a switching on clock device with 24-hour and week programme, except the staircases lights, which would be switched on 24-hour a day.

The employer pays for the cost of lighting common traffic areas included regular and interim staircases.

4.7.7. Provisions for inclement weather in traffic areas
Inclement weather provisions are planned and set in action in good time and to such a degree that they are able to ward off the adverse effects on time schedules and quality of work.

Clearing of snow and similar work must be, as far as possible, done in the period before normal work starts.

4.7.7. Provisions for inclement weather in traffic areas.
Contractor "Carpenter Main Contractor" is responsible for providing inclement weather provisions in common traffic areas of the building site.

4.7.8. Clearing and cleaning common traffic areas
The contractor must constantly participate in keeping the traffic areas cleared and cleaned.

4.7.8. Clearing and cleaning common traffic areas
Contractor "Carpenter Main Contractor" cleans and clears the common traffic areas in the building for dust and the like, which cannot be identified to a specific contractor.

The abovementioned works must be done every day at the end of the working day, giving special attention for regular and interim staircases.

4.8. Portable cabins and storage areas

4.8.1. Portable site cabin conditions

The location of portable cabins is given on the site plan.
The situation of the individual contractors' site cabins must be agreed with the project management if it is not stated on drawings.

4.8. Portable cabins and storage areas

4.8.1. Portable site cabin conditions

Contractor "Carpenter Main Contractor" must follow the instructions established on the Health and safety plan in order to place, run, maintain and remove the following cabins, which are at the disposition of all contractors during the course of construction :

- Portable cabin for 20 persons with shower, washbasin and locker facilities, and dining room;
- 2 Portable chemical toilet cabins for 20 persons;
- 1Portable dining cabins for 10 persons;
- Meeting and office facilities for holding site meetings, etc. The cabin contains a meeting room for 10 persons and 2 separate offices with 2 office stations. The cabin is fitted with toilet and washbasin.

Contractor "Carpenter Main Contractor" must take care of daily cleaning of the cabins and ensure the supply of soap, toilet paper and paper towels.

Re-establishing of the terrain after the portable cabins is to be done by contractor Landscape including the demolition of the provisional concrete bed for the storage areas.

4.8.2. Storage areas/ Storage yard

The location of storage areas is on the building site drawing.

The storage space for individual contractors within the total site storage area must be agreed with the management. Storage of materials in traffic areas is strictly prohibited.

4.8.2. Storage areas/ Storage yard

Contractors "Carpenter Main Contractor", "Masonry Subcontractor", "Concrete and Soil works Subcontractor", and "Blacksmith Subcontractor" establish´, maintain, secure against inclement weather and re-establish the storage areas shown on site plan <x>.
The paving on site storage areas is 100 mm poor concrete bed.

Storage rooms in the basement, inside the building, will provide for Electric, Plumber, Windows supplier, Doors supplier and for Sanitary supplier.

4.8.3. Tent workshops

Tent workshops can only be established by individual contractors to the extent shown on the site drawing.

4.8.3. Tent workshops

Tent workshops are not allowed on-site.

4.8.4. Handling of refuse and refuse containers

4.8.4. Handling of refuse and refuse containers

The individual contractors is obligated to remove his refuse from work sites and storage depots and deposit them in containers and skips or remove them from the site completely, on a regular basis.

All contractors must sort and handle building refuse in accordance with the council's regulations in this area.

Containers and skips are placed in accordance with the building site drawing.

Contractor "Masonry Subcotractor" must establish, mark and empty the refuse containers during the course of the demolition period and remove them once the demolition period is finished.

Demolition-refuse must be sorted in the following fractions:

- Organic refuse
- Non organic refuse
- Steel

Contractor "Concrete and Soil works Subcontractor" must establish, mark and empty the refuse containers during the course of the ground and concrete works period and remove them once that works period is finished.

Soil and concrete-refuse must be sorted in the following fractions:

- Soil refuse
- Concrete refuse
- Steel
- Chemical products refuse

Contractor "Carpenter Main Contractor" must establish, mark and empty the refuse containers during the course of the construction period and remove them once the construction period is finished.

Building-refuse must be sorted in the following fractions:

- Organic refuse
- Non organic refuse
- Steel
- Chemical products refuse

Packaging, etc., must be wrapped up and placed in the skip so that it takes up as little space as possible.

All costs in connection with removal of refuse from the containers and skips, including environmental and refuse surcharges, are to be borne by the employer based on documentation of these costs.

4.8.5. Lighting of portable cabin area and storage areas

4.8.5. Lighting of portable cabin area and storage areas

Contractor "Electricity Contractor" establishs, maintains and removes lighting appliances in accordance with the building site drawing using minimum 25 lux light strength in common traffic areas, in portable cabin and storage areas.

4.8.6. Provisions against inclement weather in the

4.8.6. Provisions against inclement weather in the

portable cabin and storage areas
Inclement weather provisions are planned ahead of time and set into action so as to ward off the negative effects of the weather on time schedules and the quality of work.

Clearance of snow and similar work must, where possible, be done before the beginning of normal working hours.

portable cabin and storage areas
Contractor "Carpenter Main Contractor" is assigned the tasks in connection with inclement weather provisions in portable cabin and storage areas.

4.8.7. Cleaning in the portable cabin and storage area. The individual contractors are obligated to clean their respective storage areas.

If the project management's directions are not followed on this matter, the work will be done at the expense of the said contractors - - the expense being deducted from accounts owing them.

4.8.7. Cleaning in the portable cabin and storage area.
Each Contractor will provide a weekly cleaning by their own portable cabins.

Each Contractor will responsible for cleaning the storage area that they use.

4.8.8. First Aid Post

4.8.8. First Aid Post
Contractor "Carpenter Main Contractor" supplies two First Aid Boxes and has the responsibility of ensuring that them, at all times, has the necessary minimum content of items cf. The Factory Inspection's requirements.

The two First Aid Boxes are situated in Portable cabins and are accessible when work is being done on site.

Likewise, Contractor must follow all the instructions and measures that taken in the Health and Safety Plan.

4.8.9. Fire fighting materials

4.8.9. Fire fighting materials
Contractor "Carpenter Main Contractor" supplies fire fighting equipment and materials.

During the course of all building process, at least 7 fire extinguishers will be provided by the contractors following in any case the instructions and measures that have been taken in the Health and Safety Plan.

4.9. Work areas

4.9.1. Covering of holes and rebates in work areas
Rebates and holes in work areas, such as floor slabs and roof surfaces, etc., must be securely covered with fixed covers and boarding.

The responsibility for closing these and maintaining the covers is that of contractor making the hole or rebate in the first place.

4.9. Work areas

4.9.1. Covering of holes and rebates in work areas

All holes in work areas must be covered with fixed wooden boards and allows support themselves 200 kg weight and the traffic from the building site personel.

Holes over than 600 x 600 mm. width and with more than 2000 mm depth must be had special attention, in

Any temporary removal of covers due to work processes by any contractor must be followed by the same contractor replacing and fixing the cover.

4.9.2. Establishing guard railings in work areas
Where slabs, work platforms, scaffold floors and gangways are elevated more than 2 m over the surrounding area, guard railings must be fixed along their free edges.

Any temporary removal of railings due to work by any contractor must be followed by provisions for preventing falls before and during the period of removal, followed by replacement of the railings after the work by the same contractor.

4.9.3. Lighting in common work areas
The contractor must supply own light source during work in his own work areas.

4.9.4. Provisions against inclement weather in work areas
Inclement weather provisions are planned and set into action in good time and to such an extent as to minimise the effects of the weather on milestones in the project and on work quality

Clearance of snow and similar work shall, as far as possible, be done before the beginning of normal working time.

4.9.5. Clearing-up and tidiness in work areas
It is the duties of each contractor at all times to keep their work areas tidy from refuse, materials and tools and remove the aforementioned if they are an obstacle for the progress of the construction.

The project management can appoint one contractor to co-ordinate the cleaning-up and tidying-up process together with other contractors on the site's common

case of imposibility to covered them they must be sourrended by convenient railig and signals.

Provisional holes should have the same consideration as regular holes.

Likewise, Safety coordinator may be make improvements if he consider necessary in accordance with the Health and Safety plan.

4.9.2. Establishing guard railings in work areas
Contractors "Carpenter Main Contractor" sets-up, maintains and removes railings in work areas.

Individual contractors are responsible for setting up railings in their own work platforms and scaffolding, etc.

Special consideration in areas with more than 2000 mm depth.

Likewise, Safety coordinator may be make improvements if he consider necessary in accordance with the Health and Safety plan.

4.9.3. Lighting in common work areas

In accordance with the Health and Safety plan a minimum lighting strenght will be provided by the contractor in every work area.

4.9.4. Provisions against inclement weather in work areas

Contractor "Electricity Contractor" is assigned with the task of providing interim heating and drying-out of the building.

Contractor "Carpenter Main Contractor" is assigned with the task of clearing snow, de-icing and gritting (spreading gravel on) common work areas.

4.9.5. Clearing-up and tidiness in work areas

At the end of every working day, each contractor must be clear and tidy their own work areas using the appropiate container for droping refuses work areas.

Removal of dust from the building must be by vacuum cleaning.

If a contractor does not withhold the management's directions about tidiness, the management has the right to tidy up the work areas at the expense of the said contractor. The cost for such work will be deducted for the contractor's amount due.

4.10. Technical aids

4.10.1. Cranes and material lifts
If contractors decides to use a crane and/or lift above and beyond that stated in the tender documents, they must give a written account for setting-up, power supply, use and maintenance, before the equipment (after permission for the management) is put to use.

Setting up a crane or lift must only take place with the explicit permission of the project management.

4.10.2 Personnel elevators

4.10.3. Scaffolding
Individual contractors must supply their own scaffolds in their own working areas.

Setting-up and dismantling scaffolding must be done after approval form the project management.

The scaffolding system must be labelled with a plate informing about the erecting contractor, the rental company, and the permissible load.

The contractor must participate in rationalising the collective site's work by allowing others to use his scaffolding when it is appropriate and does not inconvenience the contractor and rental company, and if the scaffold does not suffer any damage.

4.11. Supply to the site

4.11.1. Water and sewer
Tap points are established in accordance with the site

4.10. Technical aids

4.10.1. Cranes and material lifts

Contractors "Crane Supplier and Lift supplier" sets-up, maintains and removes material lifts, cf. The building site drawing no. <x>.
The lift will be for the free use of all contractors in the building period.

Crane for free use of all contractors will not be set-up

Before using the Crane and the lift a set-up certify will be provided by the Crane or/and lift supplier to the safety coordinator.

Distances and safety measurements are explained in Health and safety plan.

4.10.2 Personnel elevators

There are not personnel elevators in this project.

4.10.3. Scaffolding

Contractor "Scaffoldig Supplier" erects, re-builds, maintains and removes common scaffolding. The size or extent of the common scaffolding is shown on the site drawing.
Scaffold type **bricklayer** and scaffold class 5 or 6.

Distances and safety measures are explained in Health and safety plan.

The scaffold is at the disposal of all contractors in connection with the following works:
- Demolition works
- Carpentry works
- Blacksmith works

4.11. Supply to the site

4.11.1. Water and sewer
Contractor "Plumber Contractor" establishes, maintains and removes the water supply system for

drawings.

The individual contractors must make their own provisions, and pay for, the connection of their portable cabins to the main water and sewage system of the site. Connection must be made from the connection points shown on the site drawing.

4.11.2. Electricity
The main electrical boards' shows on the site drawing are installed.

The individual contractors must bear the cost of connecting their own electrical material up to the main boards.
The employer cannot be held responsible for interruptions in the supply of electricity.

Each contractor must uncouple connections from his sub-board to the main board at the end of each workday.

4.11.3 Telephone
Each contractor is responsible for subscribing, paying for and operation of own phone.

4.12. Special conditions for buildings in use

4.12.1 Work conditions generally
If the localities are in use during the construction period, special consideration to them must be taken.

The following are valid if work is in progress in or around the building:

The contractor is obliged to man the project with persons who are able to show the necessary consideration to tenants/employees in the building. If a person repeatedly fails to show consideration, the project management can expel said person form the site.

use in construction on behalf of all contractors.

Contractor "Plumber Contractor" connects-up, maintains and removes interim water- and sewage systems to common portable cabins and meeting and office units, cf. Section 4.8.1.

The supply is established with frost proofed design by Contractor "Plumber Contarctor" if the supply is needed in the winter period.

The employer pays for water consumption and sewage surcharges.

4.11.2. Electricity
Contractor "Electricity Contractor" installs, maintains and removes the power supply for construction on behalf of all contractors.

Contractor Electric installs, maintains and removes the power supply to common portable cabins and meeting and office facilities, cf. Section 4.8.1.

Similar supplies to own portable cabins, material containers, etc., is the responsibility of the individual contractors.

The electricity consumption is paid by Employer.

Contractor Electric is responsible for mandatory inspection of electrical installations shown on site drawing no. <x>.

4.11.3 Telephone
Contractor "Electricity Contractor" is responsible for establishing a landline phone for emergency calls for the duration of the work on site.

4.12. Special conditions for buildings in use

4.12.1 Work conditions generally
Work must start at earliest 7:00 o'clock and must be finished by 19:00 o'clock.

Tools must be chosen so that they cause the least possible nuisance for any tenants/employees using the building with regard to noise, dust, vibration and emissions.

Radios and the like must not be used in the locality.

Access to localities in use must happen in accordance with the following rules:

All of the contractor's employees who have access to the localities in use must be furnished with identity cards. The contractor has an obligation to report lost ID's immediately.
Keys to dwellings must be administrated as follows:
Before the work is initiated, the keys to the dwellings are collected. Tenants can, instead of handing in a key, be at home between the hours of 08:00 and 18:00.

The contractors own site manager must keep a receipt list for keys so that he can always account for who is in possession of the keys. The receipt list must be available for the project management.

Keys that are not used shall be kept in a locked security box, which in turn should be kept in a locked container. If the key gets lost, the contractor must immediately inform the tenant and the project management, and the locks in the apartment in question must be changed at the expense of the contractor.
Keys that are handed-in must not be copied.

The apartments/dwellings must, at all times, be locked - - both when work is being done on them and when the apartment is empty.

4.12.2. Information for tenants

4.12.2. Information for tenants
The project management co-ordinates enquiries from the tenants. The project management is also responsible for informing the tenants.

Contractor "Carpenter Main Contractor" is in charge of the daily notification to tenants about access to the dwelling with regard to the current construction work.

Notice must be given in writing, by 16:00 on the day before. A copy of the notice must be delivered simultaneously to the project management.

5. Health and Safety

5.1. General information

5.1.1. Organisation

5.1.2. Safety Meetings

The safety coordinator convenes safety meetings and prepares the minutes. All the companies on site must be represented at the meetings by a representative for their site leadership and one from the operatives (safety rep) - - if it is required that there are safety groups on site.

Any comments to the safety meeting's minutes must be voiced at the following safety meeting. If this does not happen, the former minutes will be considered as approved.

5.2. Plan for Health and Safety

The person to whom the employer has transferred the duty of completing the Health and Safety Plan and coordinating safety work on site is named the Safety Coordinator.

The contractor must participate with the Safety Co-ordinator's work with and follow up of the Health and Safety Plan.

The reporting of the building site to the Factory Inspector, before work starts, is the duty of the Safety Coordinator.
Inspection of the required safety provisions is the duty of the contractor appointed to do it.

If another contractor's health and safety provisions are insufficient, the first named contractor must

5. Health and Safety

5.1. General information

5.1.1. Organisation

The project's stakeholders are following:
Employer:
Project management: Arnaldo Landivar
e-mail: 2037323@viauc.dk

Safety Co-ordinator: Main contractor
Site Inspection: Group 1, BK52E
Health and safety org.: Carpenter Main Contractor

Design Manager: Valentina Buz
e-mail: 2037284@viauc.dk

5.1.2. Safety Meetings

Safety meetings will be held every Wednesday every week.

5.2. Plan for Health and Safety

The employer has transferred his obligations to complete and follow-up the Health and Safety Plan, together with his co-ordination duties, to Contractor Arnaldo Landivar.

Proposal for the content of the Health and Safety Plan:

1. Plan for Health and Safety (copy of chapter 5.1 and 5.2 from BSB with contractor supplements)

2. Orientation (copy of chapter 2 from BSB with contractor supplements)

3. Time Schedule and Work Plan (new section)

4. Building Site (copy of chapter 4 from BSB with contractor supplements)

5. Work environment (copy of chapter 5.3 from BSB with contractor supplements).

elevate the problem without costs to the employer. During pauses in or at the end of the works in question, the contractor must establish or re-establish the health and safety provisions so the safety requirements are fulfilled at all times.

Transfer of the contractor's responsibilities for inspection and maintenance of the respective health and safety provisions can only be achieved after written approval from the safety coordinator.

6. Provisions in connection with dangerous works (copy of chapter 4 from BSB with contractor supplements)

7. The surrounding environment (copy of chapter 6 from BSB with contractor supplements)

8. readiness-, evacuation-, and exercise/drill plan (new section: Fire-fighting equipment, rescue equipment, etc)

9. Building Site Plan

5.3. The work environment

5.3. The work environment

The building site must be kept tidy and in order throughout the building period for preventing injuries. This includes using the waste containers and ensuring emptying when full as well as keeping tools, devices and flammable liquids inaccessible to outsiders at all times.

5.3.1. General information

5.3.1. General information

Proper guarding (e.g. temporary rails) must be provided in the open parts of external wall of the building while the scaffolding is being rearranged to avoid risk of dangerous falls.

Extension cords should be kept clear of the working space (e.g. attached to the walls of the building). The condition of electrical appliances should be regularly inspected to make sure that they do not endanger people at the building site. Any electrical appliances that are inappropriate for worksite use must be removed.

5.3.2. Limiting noise inconvenience

The contractor must use tools that causes as little inconvenience/nuisance re noise to the user and others on the site.

For persons using noisy tools and equipment, the Factory Inspection's rules as stated in Departmental Order 801, of 4 October 1993, must be observed. This means that no persons, not even other contractors, must be exposed to noise levels over 85 dB (Airborne) - - without the use of hearing protectors. For noise levels over 80-dB (A), hearing protectors must be available.

5.3.2. Limiting noise inconvenience

5.3.3. Limiting of damage and inconvenience from vibrations

The contractor must choose tools that emanate the

5.3.3. Limiting of damage and inconvenience from vibrations

least hand-/arm vibrations, or use methods for suspending the tools so that they don't have to be handled as such. If vibrations exceed 130 dB(HA), the contractor must vibration-curb the tool or use other work methods.

5.3.4. Limiting inconvenience caused by dust
The contractor must take steps to curb and limit dust emission from its source. Direct suction should be used on tools where it is technically feasible.

5.3.4. Limiting inconvenience caused by dust
In case it is impossible to remove the dust immediately masks have to be worn to limit the amount of dust inhaled and works in the space concerned must be put on temporary hold.

5.3.5. Limiting ergonomic inconvenience
The contractor must avoid manual transport that causes lift, carrying, push, pull and similar strain on the body. He must use technical equipment for this.

5.3.5. Limiting ergonomic inconvenience
Prevent continuous work in draft and working positions with unnatural bending of the body to an acceptable extend.

5.4. Provisions to be taken against dangerous works
The respective contractors must establish specific work procedures that describe the safety aspects of the work.
The contractor must plan work that involves the use of dangerous chemical substances.

The contractor must gather and revise information about chemical substances that are used in the performance of the contract, and make sure that they are handled in accordance with the stipulations issued by the Factory Inspection. A list of the materials and substances that, under the circumstances of the technical requirements, give the least possible strain on the work environment – and considerations to substitution -- must be documented for the project management.

The directions for use of for products must be accessible on site. There must be personal protection gear at the disposal of operatives as described in The Directions for Employers.

5.4. Provisions to be taken against dangerous works

6. The surrounding environment

6.1. General information

6. The surrounding environment

6.1. General information
The site is located in the centre of the city Aarhus. The area consists of side-by-side low-rise buildings mostly used for residential purposes but retail shops, offices and cafés as well.

8. Scheduling

6.2 Noise	**6.2 Noise** Because of the fact that the area is rather dense populated noise will only be allowed between the hours 7:00 and 17:00.
6.3. Vibration	**6.3. Vibration** As the property has common walls with the neighbouring property special attention concerning limiting vibration must be paid executing tasks on these components.
6.4. Dust	**6.4. Dust** To avoid dust in the courtyard mechanical suction in case of excessive dust must be provided.
6.5. Emissions to the atmosphere	**6.5. Emissions to the atmosphere**
7. Quality Assurance	**7.1. General information**
7.1. General information	
7.2. Project management The employer will carry out inspections independent of the contractor's control.	**7.2. Project management**
7.2.1 Site meetings Site meetings will be held on at a fixed time and day of the week. Any comments to the minutes of the site meetings must be put forward at the following meeting, otherwise the minutes will be considered approved.	**7.2.1 Site meetings**
7.2.2. "Kick-off" meetings A kick-off meeting is held before the start of works	**7.2.2. "Kick-off" meetings** The time and date for the kick-off meeting is agreed with the project management.
7.3. Quality Plan It is the task of the contractor to establish a quality plan.	**7.3. Quality Plan**
The Quality Plan must comprise the following subjects:	At latest 5 workdays after the work being awarded the contractor, he/she must send the Quality Plan to

- Organisation of the contract
- Control of documents
- Control of purchases
- Qualifications
- Process scrutiny
- Control Plans
- Demands to subcontractors and suppliers
- Processing mistakes and shortcomings in materials and work processes (rejections)
- Processing deviance from project documents.

7.4 The contractor's control and documentation

7.4.1. General information
Control and documentation is part of the contractor's services.

The contractor must ensure that:
a) running quality control of the works and deliveries is done
b) produce documentation that the control has been performed and the specified quality demands have been achieved.

Where the supplier of deliveries to the contract is a member of a public approved quality control system, it is considered sufficient to specify the type of control system in the work specifications.

If the project management evaluates that control and/or documentation should be extended, because of failure or mistakes in the works, the contractor must follow this request without cost to the employer.

The contractor must keep quality assurance and O&M-documentation separate during implementation and at handing over.

7.4.2. Documentation of quality
The control activities of the control plan must be documented and demanded. Documentation must be accessible for the project management during the construction process. Documentation includes sub-works and supplies from subcontractors and suppliers.

7.4.3. Operation and Maintenance documentation (O&M)
The contractor must deliver information about materials and components, used in the contract, for aiding the working-up of the operational plan for the

the project management.

At latest 5 workdays after the working-in revisions to the Quality Plan, the contractor must send the revised Quality Plan to the project management.

7.4 The contractor's control and documentation

7.4.1. General information

7.4.2. Documentation of quality

7.4.3. Operation and Maintenance documentation (O&M)

building. This must include amounts and times for the materials, etc. used and built-into the construction as described in the work specifications.

7.4.4. Archiving the documentation
The contractor must immediately establish a systematic archive system and maintain it for the duration of the project. The system must include all the documentation that comes in during the project regarding quality of materials, equipment, construction, and prefab components and the qualifications of the staff who may be required to have special qualifications.

7.4.4. Archiving the documentation

7.4.5. Management of the performance documentation
The contractor must establish an archive system for identification and steering of performance documents and alterations/supplements to these.
The system must also include documents of the subcontractors.

7.4.5. Management of the performance documentation

The system must minimum have the following elements:

Registration of valid documents
The listen should be able to be altered and the alterations should be registered.
The lists must be sent to all document users.

A procedure must be agreed as to how alterations are marked in documents and how the documents and their alterations are identified.

7. 5 Project preview
The contractor must participate in "project preview" before construction start under the chairmanship of the project management.

7. 5 Project preview

Before the process of project preview, contractors must thoroughly go through all the project documents, drawings, etc., and make a detailed study of the processes necessary to implement the plans. This result must be available in writing.

Before the process of project preview, contractors must evaluate how they will use their resources and other production apparatus to execute the work.

During project preview, the designers will report on conditions, which will require special care in execution because these may deviate from ordinary practice and require special control procedures.

Project preview does not alter the distribution of responsibility and risk between employer and contractor, not even if it results in alterations to the project.

The project management will convene the "project preview" process and work out an agenda and do the minutes of the meeting.

The purpose of the project preview is, through dialogue between contractor and the designers, to:

- Utilise the contractors trade abilities better
- To uncover aspects that may be risky or lead to failure and be difficult to execute.
- To solve interpretation problems in the project
- To discuss possible adjustment to the control plan
- To review the Health and Safety plan and review questions about the environment.

Basis specification	*Project specific specification*
7.6. Local authority inspection	**7.6. Local authority inspection**
7.7. Guarantee If it is required that a special guarantee is given for a service, the contractor must notify the project management as soon as the guarantee is available.	**7.7. Guarantee** The guarantee must be furnished at latest 1 workdays after the works in question are completed or the delivery is delivered.
7.8. Handing over When the work is reported finished to the project management, the contractor must deliver the required copies of quality assurance- and O&M-documentation for the completed works.	**7.8. Handing over** Quality- and control documentation must be delivered in 3 copies.
7.9. Quality Assurance after handing over The contractor's repair of shortcomings after handing over is subject to the same conditions for quality assurance as the other, original services. The contractor hands over the quality assurance documentation for repair of shortcomings, to the project management, after the handing over procedure for the repair work on the shortcomings.	**7.9. Quality Assurance after handing over**
8. Scheduling	**8. Scheduling**

8. Scheduling

8.1. General Information

8.2. Time Schedule

The tender document's time schedule shows the different contracts' start and end dates and main site based activities.

After accept, the contractor is obligated to participate in working up a detailed work schedule for the project on site within the main timeframe stated in the tender document's time schedule.

For individual trade contracts, the project management will hold up the individual trade contractors' proposal for their detailed schedules and put them together into a complete schedule for the whole project.

When deviations appear on the critical path, the contractors must participate in the revision of the time schedule.

8.3 Inclement weather

Extensions to milestones are given in cases where unusual inclement weather warrant it, under the following conditions:

- Inclement weather must have resulted in the work lying still – or being reduced in tempo, equivalent to minimum ½-workday.
- The activity must be on the critical path of the time schedule for the penalty-bearing milestone in question.
- The total numbers of inclement weather days for the activity in question must, within a month, exceed the expected number of inclement weather days.

8.1. General Information

8.2. Time Schedule

The contractor's activity and work time schedule must be sent to the project management in 10 workdays after the contract has been signed.

8.3 Inclement weather

The expected number of inclement weather days, exclusive Saturday, Sunday and church holiday not falling on a Sunday are as follows:

Activity	Jan.	Feb.	Mar.
Scaffolding	0	2	0
Masonry	0	0	7

Work Specifications for Concrete works

Table of contents

Project specific specifications

1. Table of contents

2. Extent

2.1. General information
2.2. Building components
2.3. Design
2.4. Building site
2.5. Health and safety
2.6. The surrounding environment
2.7. Quality assurance
 2.7.1. General information
 2.7.2. Quality control documentation
 2.7.3. Operation and maintenance documentation
2.8. Scheduling the construction work
2.9. Samples

3. General specifications

3.1. References
 3.1.1. Norms and standards
 3.1.2. General guidelines and specifications
3.2. Materials and products
3.3. Implementation
3.4. Control
3.5. Relations to other works
3.6. Health and safety

4. Building component specifications

Blinding layer, Foundation (strip footings), Basement external wall, Basement tarrain slab, Elevator pit

Component ID, number and name for the building component
Extent and location
Reference to drawings
Relations to other works
Design
Materials and products
Implementation
Surfaces
Samples
Quality control
Health and safety

2. Extent

The scope of the refurbishment / extension of Dannebrogsgade 4, Aarhus is to bring up the require heigh in the basement.
To do so, the following is needed:
- Point and line strip foundations
- Terrain slab, with gravel layer, floor insulation and vapour barrier included
- Elevator pit, with floor insulation and drainage water pump included
- External support walls, with external drainage pipe and external insulation included
- Access airlock staircase

2.1. General information

The work comprises the building components and other services stated in point 2.2, which are described in more detail in the work specifications or in the drawings.

In addition, the work comprises the stipulations in the Case Specifications and any services required in tender forms, for example extra work or omissions that can be connected to the current works.

The work must be supervised by a qualified technician.

2.2. Building components

The work comprises all works and deliveries that are necessary for the full completion of building components.

The work encompasses the following building components:
- Blinding layer
- Foundation (strip footings)
- Basement external wall
- Basement tarrain slab
- Elevator pit

The following components, delivered by the following contractor, is mounted as part of the current works:

- Gravel	Stone and gravel supplier
- Hard insulation (Extruded poliestyren)	Coat supplier (Rockwool)
- Textile (Vapour barrier)	Coat supplier (Rockwool)
- Reinforcement	Steel supplier()
- Mesh wire	Steel supplier()
- Load-transferring steel plates	Blacksmith supplier
- Drainage membrane and joint strips	Coat supplier()
- Mold realese compound	General supplier
- Concrete	Concrete supplier
- Concrete pump	Concrete supplier
- Formwork	Formwork supplier (Ulma)
- Tower crane	Tower crane supplier (Liebherr)

- Finishing Machine General supplier

2.3. Design

The contractor would allow to makes a modulation formwork proposal showing the joint strips

2.4. The building site

See Case Specifications chapter 4.

See drawing site plan.

2.5. Health and Safety

See Case Specifications chapter 5.

2.6. The surrounding environment

See Case Specifications chapter 6.

2.7. Quality Assurance

2.7.1. General information

See Case Specifications chapter 7.

2.7.2. Quality control documentation

See Case Specifications chapter 7.

See Tender Control Plan.

2.7.3. Operation and Maintenance documentation

See Case Specifications chapter 7.4.3.

For operation, the works must be managed by an engineer, constructing architect or other knowledgable foreman.

The contractor must assure that operatives are correctly instructed and the work is controlled in all details.

The following documentation for the work's quality must be delivered:

- certificates of the steel reinforcement standards and quality; mesh wire included
- documentation for load-transferring plates and anchorages

- documentation for insulation with a minimum heat conduction-ablity of λp = 0,039 W/mK
- documentation for mold realese compound (formwork oil)
- certificates of the concrete standards and quality
- documentation of drainage membrane and joint strips
- documentation for the formwork supplier

2.8. Scheduling the construction work

The responsibility of coordinating the contract work is borne only by the contractor. The contractor must be in collaboration with the others contractors and the site management. In case of postponed work to this subcontract, a black log planning by the main contractor is expected.

Work documents
All work documents must be delivered for the project management's scrutiny on request. The work documents, which the contractor must prepare in accordance with his services, will be commented upon 1 workday for it reception.
Mounting plan must be delivered to the project leader 5 workdays before mounting.

2.9. Samples

All the materials used by "Carpenter Main Contractor" wil have quality documentation for suppliers.

3. General Specifications

3.1. References

3.1.1. Norms and standards

The norms and standards mentioned below, in their latest editions and with any enclosures are valid for the Concrete Works with any amendments, additions and omissions that are stated in these work specifications and on the drawings.
The notes and directions, etc. stated in the references are to be construed as requirements that only can be deviated from if they are stated in these work specifications and/or on the drawings, or agreed with the project management.

- DS 401, Dansk Ingeiørforenings norm for sand, gravel amd stone aggregate,1992
- DS 409, Norn for Health and Safety Provisions For Constructions, 1998
- DS 410, Norm for Loads on Constructions,1998
- DS 411, Norm for Concrete Constructions,1999
- DS 412, Norm for Steel Constructions,1998

- DS 414, Norm for Masonry Constructions,1998
- DS 415, Norm for Founding,1998
- DS 423, Norm for Testing, 1984
- DS 427, Cement.Composition, Demands for Characteristics and Approval Criteria, part 1: Standard Cements , 1995
- DS 451, Norm for Composite Constructions.Concrete – Steel,1984
- DS 481, Norm for Concrete Aggegate, 1999
- DS 482, Norm for the execution of Concrete Constructions, 1999
- DS/INF 103, Technical Report of Constructions made of Lightweight Construction Concrete, 1995
- Norm Publication nº NP-188-R, Directions for the use of Fly Ash Micro Silica in Concrete,1995
- Dansk Standards Catalogue, current edition
- Building Regulations, BR-1995, incl. current enclosures

3.1.2. General guidelines and specifications

Where the directions, reports and other documents in their latest edition, with any enclosures and together with the project documents, are made valid for the works, the stated recommendations, directions, procedures, advice, etc, must be construed as demands.

3.2. Materials and products

The required documentation for the materials and products used, for example in the form of product certificates, receipts, etc., must be presented for the project management for their approval.

The following materials and products must not be delivered onto the building site before the project management's documentation for them is available:

Materials and products of specific brands can be prescribed for the works. Other product brands can be used if they are on the same footing as the ones prescribed. Documentation for this must be presented to the project management.

3.3. Implementation

General tolerances
Demands for executing the work must follow the given standards

All sub-contractors are marking according to the already put fixings points at site that is necessary for his work.

3.4. Control

The following Tender Control Plan must be worked into the contractor's Control Plan.

☐ Tender Control Plan ☐ Control Plan

No.	Subject/item	Reference	Method	Extent	Time	Accept criterion	Documentation

All documents concerning the control must be filled out and handed out signed to the building site manager.
If mistakes are found when executing an inspection within the control section, the contractor must rectify those in the time limit imposed by the project manager.
Each inspection should be brought up to 100%, using methods as:

- measuring;
- testing;

- control of documentation.

3.5. Relation to other works
The fixing point position and the height on wall must be checked according to Tender control plan. The building site manager must be notified in any case of discordance (e.g. the height on wall).

3.6. Health and safety
See Case Specifications chapter 5.

4. Building Component Specifications

Building Component ID, the title for the building component specifications
The building component specifications are split up in the following components:
- HEB 160 columns;
- IPE 220 beams;
- C-Profiles;
- HEB 120 balcony beams.

- **Extent and location**
  - Production of columns for the structure frame: 12 pieces;
  - Production of beams for the structure frame: 24 pieces;
  - Production of C-Profiles for storey partitions: 66 pieces;
  - Production of balcony beams: 126 pieces;

- **References to drawings**

Architect:
Engineers' drawings

- **Relations to other works**

4 Bearing plates will be put in the concrete wall with grout mortar by the concrete trade;
2 Stainless steel plates for each connection between the steel beam and the wooden beams will be placed by the carpentry trade.

- **Design**

See chapter 2.3.

- **Materials and products**
  - Steel profiles for beams, columns and C-Profiles;
  - Stainless steel for railings, bolts and plates.

- **Implementation**

The main contractor will mark out coordinates and benchmarks of the axis for each column to place them.
These marks can be found on the following drawings:
The height of every storey and the position of all fixing points for each level must be checked by the main contractor.
All the bolt connections will be checked by the main contractor.

- **Surfaces**

The main beams and the columns are painted for corrosion.
The balcony beams are painted for corrosion and fire protection.

- **Samples**

No requirements for samples.

- **Quality Control**

See 3.4. (Tender control plan).

- **Health and Safety**

See 2.5.

Tradecalculation								**Concretework**							**SITE:1**
Ownproductior	174,15 minute factor								**MAT**		**MACHINERY**				**GROSSPRICE**
POS NR.	Activity	Unit	Quantity	Minutes pr.unit	Hours total	Wage total kr	Extras 0%	SOC. 40%	Unit price	Materials	Unit price	Machinery rent	Net price	Factor CM %	Gross price
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
	Blinding layer				0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
	Basement blinding layer	m2	136,28	9,00	20,44	3.559,92	0,00	1.423,97		0,00		0,00	4.983,88	1,10	5.482,27
	Foundation blinding layer	m2	18,87	9,00	2,83	493,03	0,00	197,21		0,00		0,00	690,24	1,10	759,26
	Extension blinding layer	m3	36,51	9,00	5,48	953,81	0,00	381,52		0,00		0,00	1.335,34	1,10	1.468,87
	Basement gravel	m3	19,95	30,00	9,98	1.737,40	0,00	694,96		0,00	150,00	2.992,94	5.425,31	1,10	5.967,84
	Extension gravel	m3	7,30	30,00	3,65	635,87	0,00	254,35		0,00	150,00	1.095,39	1.985,62	1,10	2.184,18
	Hard Insulation (Extruded poliesty	m2	139,33	6,00	13,93	2.426,44	0,00	970,57	145,00	20.202,90		0,00	23.599,91	1,10	25.959,90
	Textile (vapour barrier)	m2	139,33	1,00	2,32	404,41	0,00	161,76	7,00	975,31		0,00	1.541,48	1,10	1.695,63
	worker	m3	27,26	30,00	13,63	2.373,28	0,00	949,31	18,42	502,05		0,00	3.824,64	1,10	4.207,10
	Concrete (B5-Unicon)	m3	20,12		0,00	0,00	0,00	0,00	642,00	12.920,10		0,00	12.920,10	1,10	14.212,11
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
	Foundation				0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
	Reinforcing Y 16 (47 Kg/m2)	kg	1.471,70	0,48	11,77	2.050,37	0,00	820,15	2,97	4.370,94		0,00	7.241,46	1,10	7.965,61
	Inserts	pcs.	40,00	2,00	1,33	232,20	0,00	92,88		0,00		0,00	325,08	1,10	357,59
	Concrete (B25P-Unicon)	m3	11,68	62,00	12,07	2.102,32	0,00	840,93	844,00	9.860,00		0,00	12.803,25	1,10	14.083,57
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
	Basement wall				0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
	Formwork	m2	20,94	42,00	14,66	2.552,22	0,00	1.020,89		0,00		0,00	3.573,10	1,10	3.930,41
	Reinforcing Y 10	kg	620,28	0,78	8,06	1.404,28	0,00	561,71	3,19	1.978,69		0,00	3.944,68	1,10	4.339,15
	Reinforcing Y 16	kg	1.580,71	0,78	20,55	3.578,65	0,00	1.431,46	2,97	4.694,71		0,00	9.704,82	1,10	10.675,30
	Inserts	pcs.	80,00	2,00	2,67	464,40	0,00	185,76		0,00		0,00	650,16	1,10	715,18
	Concrete (B25P-Unicon)	m3	7,76	62,00	8,02	1.397,16	0,00	558,86	844,00	6.552,77		0,00	8.508,79	1,10	9.359,67
	Hard Insulation (Extruded poliesty	m2	20,94	6,00	2,09	364,60	0,00	145,84	145,00	3.035,73		0,00	3.546,18	1,10	3.900,80
	Drainage membrane	m2	20,94	1,50	0,52	91,15	0,00	36,46	100,00	2.093,61		0,00	2.221,22	1,10	2.443,34
Refered to Totalpage					154,01	26.821,50	0,00	10.728,60		67.186,81		4.088,33	108.825,25		119.707,77

Tradecalculation								**Concretework**							**SITE:2**
Ownproduction									**MAT**		**MACHINERY**				**GROSSPRICE**
POS NR.	Activity	Unit	Quantity	Minutes pr.unit	Hours total	Wage total kr	Extras 0%	SOC. 40%	Unit price	Materials	Unit price	Machinery rent	Net price	Factor CM %	Gross price
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
	Basement Slab				0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
	Mesh wire 150x150x6	m2	172,79	0,70	2,02	351,07	0,00	140,43	18,42	3.182,81		0,00	3.674,30	1,10	4.041,73
	Concrete (B25P-Unicon)	m3	18,14		0,00	0,00	0,00	0,00	844,00	15.312,73		0,00	15.312,73	1,10	16.844,00
	Basement floor worker	m2	172,79	4,10	11,81	2.056,25	0,00	822,50		0,00		0,00	2.878,76	1,10	3.166,63
	finishing machine (Polish concrete	m2	172,79	3,50	10,08	1.755,34	0,00	702,14		0,00	4,38	756,00	3.213,48	1,10	3.534,83
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0,00		0,00	0,00	1,10	0,00
Refered to Totalpage					23,90	4.162,66	0,00	1.665,06		18.495,53		756,00	25.079,26		27.587,19

TILBUDSKALKULATION

SITE: 1

Trin:

Coast shedule

Example taken from Anlægsteknik 2 page 385

I should be aware that the figures on this page are fictitious, to use your own figures

Step 1- 3	Costs		201563			
	Rig/ unrig building site		227250			
	Running cost site		626950			
Step 3	Total costs		1055763			
Step 4	Administration costs	9,0%	1055763	95019	1150781	
Step 5	Financing og guaranties	1,0%	1150781	10558	1161339	
Step 6	Risc fixed every project	0,0%	1161339	0	1161339	
Step 7	Profit	0,0%	1161339	0	1161339	
						9,09 CM1
Step 8	Salesprice		1161339			9,09 CM2
Step 9	Conversionfactor		1055762,57			1,10

The numbers written in red, you must find in your own calculation

The CM factor you calculate must be added in all positionnumbers in the calculation schedule calkulation

When you use subcontractors, you must add an CM factor 10 %

The numbers from step 4 to step 7 are variable and determined of the constant costs in the company.

Socialcost		40%	**your own figures**
minute factor from the trade union	2007	174,15	

POS NR.	Activity	Units	Ud	lenght	width	high	subtotal	total
	Basement excavation	m3	1	12,98	7,69	0,68	67,84	
		m3	1	1,65	1,65	1,85	5,04	
							72,88	
	Foundation excavation	m3	2	2,62	1,20	0,60	3,77	
		m3	1	9,66	1,20	0,60	6,96	
							10,73	
		m3	2	1,65	0,30	0,40	0,40	
	Courtyard excavation	m3	1	8,26	4,42	1,62	59,26	
			1	1,30	1,14	1,62	2,40	
			1	12,28	0,47	1,00	5,77	
			1	12,28	0,99	1,00	12,16	
							79,99	163,59
	Mini backhoe(bobcat)	hr						
	Dumper	hr						
	worker	hr						
	Container	ud						
	Gravel basement	m3	1	12,98	7,69	0,20	19,95	
	Gravel Extension	m3	1	8,26	4,42	0,20	7,30	
							27,26	
	M2 blinding lahyer							
	Basement slab	m2	1	12,98	7,69	1,00	99,76	
	Extension slab	m2	1	8,26	4,42	1,00	36,51	
							136,28	
	Wall Foundation	m2	2	2,62	1,20	1,00	6,29	
		m2	1	9,66	1,20	1,00	11,60	
	Stairs foundation	m2	2	1,65	0,30	1,00	0,99	
							18,87	
	M3 concrete							
	Basement slab	m3	1	12,98	7,69	0,10	9,98	
		m3	0	1,65	1,65	1,85	0,00	
							9,98	
	Wall Foundation	m3	2	2,62	1,20	0,60	3,77	
		m3	1	9,66	1,20	0,60	6,96	
	Stairs foundation	m3	2	1,65	0,30	0,40	0,40	
							11,13	
	Elevator wall	m3	1	1,65	1,85	0,20	0,61	
	Basement wall	m3	2	2,62	1,20	0,40	2,52	
			1	9,66	1,20	0,40	4,64	
							7,76	
	M2 Insulation							
	Basement slab	m2	1	12,98	7,69	1,00	99,76	
	Extension slab	m2	1	8,26	4,42	1,00	36,51	
							136,28	
	Elevator wall	m2	1	1,65	1,85	1,00	3,05	
	Basement wall	m2	2	2,62	1,20	1,00	6,29	
		m2	1	9,66	1,20	1,00	11,60	
							20,94	

FOUNDATION STEEL KG	distancia	intervalo	Ud+1	longitud	nº found Ud	total longitud	Kg/m	Kg	mermas	Total Kg
Barras base inferior										
Basement wall foundation		diametro 16								
Eje Y	2,62	0,15	19	2,82	2,00	107,16	1,58	169,31		
Eje X	1,20	0,15	9	1,40	2,00	25,20	1,58	39,82		
								209,13	14,64	223,77
Basement wall foundation		diametro 16								
Eje Y	9,66	0,15	66	9,86	1,00	650,96	1,58	1.028,51		
Eje X	1,20	0,15	9	1,40	1,00	12,60	1,58	19,91		
								1.048,42	73,39	1.121,81
Courtyard wall foundation		diametro 16								
Eje Y	1,65	0,15	12	1,85	2,00	22,20	1,58	35,08		
Eje X	0,30	0,15	3	0,50	2,00	1,50	1,58	2,37		
								37,45	2,62	40,07
Elevator wall										
Eje Y	1,65	0,15	12	1,85	4,00	22,20	1,58	35,08		
Eje X	1,85	0,15	14	2,05	4,00	28,70	1,58	45,35		
								80,42	5,63	86,05
										1.471,70
WALL STEEL KG		High 2,22								
Barras cara exterior										
Basement wall		diametro 16								
Eje Y	2,22	0,15	16	2,42	2,00	77,44	1,58	122,36		
Eje X	2,62	0,15	19	2,82	2,00	107,16	1,58	169,31		
								291,67	20,42	312,08
Basement wall		diametro 16								
Eje Y	2,22	0,15	16	2,42	1,00	38,72	1,58	61,18		
Eje X	9,66	0,15	66	9,86	1,00	650,76	1,58	1.028,20		
								1.089,38	76,26	1.165,63
Courtyard wall		diametro 16								
Eje Y	2,22	0,15	16	2,42	2,00	38,72	1,58	61,18		
Eje X	1,65	0,15	12	1,85	2,00	22,20	1,58	35,08		
								96,25	6,74	102,99
										1.580,71
Barras cara interior										
Basement wall		diametro 10								
Eje Y	2,22	0,15	16	2,42	2,00	77,44	0,62	48,01		
Eje X	2,62	0,15	19	2,82	2,00	107,16	0,62	66,44		
								114,45	8,01	122,46
Basement wall		diametro 10								
Eje Y	2,22	0,15	16	2,42	1,00	38,72	0,62	24,01		
Eje X	9,66	0,15	66	9,86	1,00	650,76	0,62	403,47		
								427,48	29,92	457,40
Courtyard wall		diametro 10								
Eje Y	2,22	0,15	16	2,42	2,00	38,72	0,62	24,01		
Eje X	1,65	0,15	12	1,85	2,00	22,20	0,62	13,76		
								37,77	2,64	40,41
										620,28

Tradecalculation								**Site rig, unrig**				**Site:1**
Expected wage:	**174,15** **Ownproduction**	minute factor	**WAGE**					**MAT**				**GROSSPRICE**
Activity	Unit	Quantity	Hours pr.unit	Hours total	Wage total kr.	Extras 0%	SOC. 40%	Unit price	Materials	Net price	Faktor CM %	Factor CM %
Arrange site	hr	70		0,00	0,00	0,00	0,00	200,00	14.000,00	14000	1,10	15400
Place sheds	pcs	3		0,00	0,00	0,00	0,00	1.500,00	4.500,00	4500	1,10	4950
Place sanitary shed	pcs	1		0,00	0,00	0,00	0,00	1.500,00	1.500,00	1500	1,10	1650
Downrigging of sheds	pcs	4		0,00	0,00	0,00	0,00	750,00	3.000,00	3000	1,10	3300
El instalations	pcs	1		0,00	0,00	0,00	0,00	3.780,00	3.780,00	3780	1,10	4158
Lightning	pcs	1		0,00	0,00	0,00	0,00	15.000,00	15.000,00	15000	1,10	16500
Waterinstallations	pcs	1		0,00	0,00	0,00	0,00	500,00	500,00	500	1,10	550
Telrphones	pcs	1		0,00	0,00	0,00	0,00	1.820,00	1.820,00	1820	1,10	2002
Crane up and down	ud	1		0,00	0,00	0,00	0,00	140.000,00	140.000,00	140000	1,10	154000
Mobilcrane	ud	1		0,00	0,00	0,00	0,00	14.400,00	14.400,00	14400	1,10	15840
Crane tracks				0,00	0,00	0,00	0,00		0,00	0	1,10	0
Lifts for materials				0,00	0,00	0,00	0,00		0,00	0	1,10	0
Lifts for persons				0,00	0,00	0,00	0,00		0,00	0	1,10	0
Siteroads				0,00	0,00	0,00	0,00		0,00	0	1,10	0
Paving at the sheds				0,00	0,00	0,00	0,00		0,00	0	1,10	0
Steelplates siteroads	pcs	5		0,00	0,00	0,00	0,00	200,00	1.000,00	1000	1,10	1100
Sitefence	rm	50		0,00	0,00	0,00	0,00	15,00	750,00	750	1,10	825
Gates	pcs	4		0,00	0,00	0,00	0,00	1.250,00	5.000,00	5000	1,10	5500
				0,00	0,00	0,00	0,00		0,00	0	1,10	0
				0,00	0,00	0,00	0,00		0,00	0	1,10	0
Cleaning	hrs	30		0,00	0,00	0,00	0,00	400,00	12.000,00	12000	1,10	13200
Transport of sheds	trip	5		0,00	0,00	0,00	0,00	2.000,00	10.000,00	10000	1,10	11000
Transport of machinery				0,00	0,00	0,00	0,00		0,00	0	1,10	0
				0,00	0,00	0,00	0,00		0,00	0	1,10	0
				0,00	0,00	0,00	0,00		0,00	0	1,10	0
Transferef to Totalscheduler				0,00	0,00	0,00	0,00		227.250,00	227250		249975

Tradecalculation *Site Operation* **Site:1**

174,15 minute factor				**Wage**				**Mat.**				**Gross price**
Site operation												
POS NR. / Activity	Unit	Quantity	Minutes pr.unit	Hours total	Wage total kr.	Extra 0%	SOC. 40%	Enh. pris	materials total	Net price	Faktor CM %	Gross price
scaffold	m2	0		0,00	0,00	0,00	0,00	29,16	0,00	0	1,10	0
smaller machines	mth			0,00	0,00	0,00	0,00		3.500,00	3500	1,10	3850
telephone	mth	11		0,00	0,00	0,00	0,00	300,00	3.300,00	3300	1,10	3630
Eating shed (10 p)	mth	11		0,00	0,00	0,00	0,00	2.000,00	2.000,00	2000	1,10	2200
Sanitary shed	mth	11		0,00	0,00	0,00	0,00	1.000,00	11.000,00	11000	1,10	12100
Foremann shed	mth	11		0,00	0,00	0,00	0,00	2.250,00	24.750,00	24750	1,10	27225
Manager Shed	mth	**11**		0,00	0,00	0,00	0,00	2.000,00	22.000,00	22000	1,10	24200
Meeting Shed	mth	11		0,00	0,00	0,00	0,00	2.300,00	25.300,00	25300	1,10	27830
Materielcontainer	mth	11		0,00	0,00	0,00	0,00		0,00	0	1,10	0
Tower Crane	mth	10		0,00	0,00	0,00	0,00	35.000,00	350.000,00	350000	1,10	385000
Mobile crane (250 tn)	hr	20		0,00	0,00	0,00	0,00	7.730,00	154.600,00	154600	1,10	170060
Crane driver	mth			0,00	0,00	0,00	0,00		0,00	0	1,10	0
Telephone	mth			0,00	0,00	0,00	0,00		0,00	0	1,10	0
Lifts for materials	mth			0,00	0,00	0,00	0,00		0,00	0	1,10	0
Lifts for persons	mth			0,00	0,00	0,00	0,00		0,00	0	1,10	0
Warming Sheds	mth	11		0,00	0,00	0,00	0,00	500,00	5.500,00	5500	1,10	6050
Lay down	hours			0,00	0,00	0,00	0,00		0,00	0	1,10	0
Running plates	m2			0,00	0,00	0,00	0,00		0,00	0	1,10	0
Cleaning sheds	hours			0,00	0,00	0,00	0,00		0,00	0	1,10	0
Cleanliness site	hours			0,00	0,00	0,00	0,00		0,00	0	1,10	0
Container	pcs	2		0,00	0,00	0,00	0,00	12.500,00	25.000,00	25000	1,10	27500
	pcs			0,00	0,00	0,00	0,00		0,00	0	1,10	0
	pcs			0,00	0,00	0,00	0,00		0,00	0	1,10	0
				0,00	0,00	0,00	0,00		0,00	0	1,10	0
				0,00	0,00	0,00	0,00		0,00	0	1,10	0
				0,00	0,00	0,00	0,00		0,00	0	1,10	0
Runmoney workers	days	**0**	**45**	0,00	0,00	0,00	0,00		0,00	0	1,10	0
				0,00	0,00	0,00	0,00		0,00	0	1,10	0
				0,00	0,00	0,00	0,00		0,00	0	1,10	0
Transferef to Totalscheduler				0,00	0,00	0,00	0,00		626.950,00	626950		689645

Tradecalculation								***Soilwork***						**Site:1**	
Expected wage:		`minute factor`													
	Ownproduction	**174,15**		**WAGE**					**MAT**		**MACHINERY**			**GROSSPRICE**	
POS NR.	Activity	Unit	Quantity	Minutes pr.unit	Hours total	Wage total kr.	Extras 0%	SOC. 40%	Unit price	Materials	Unit price	Machinery rent	Net price	Factor CM %	Gross price
	Main Excavation				0,00	0,00	0,00	0,00		0		0	0,00	1,10	0,00
	Basement soil excavation	m3	72,88	30,00	36,44	6.345,74	0,00	2.538,29		0	75,00	5466	14349,78	1,10	15784,76
	Courtyard soil excavation	m3	79,99	30,00	39,99	6.964,83	0,00	2.785,93		0	75,00	5999	15749,75	1,10	17324,72
	Foundation soil excavation	m3	10,73	30,00	5,37	934,33	0,00	373,73		0	75,00	805	2112,82	1,10	2324,10
	Dumper	hr	81,80		0,00	0,00	0,00	0,00		0	150,00	12270	12269,50	1,10	13496,45
	Mini backhoe(bobcat)	hr			0,00	0,00	0,00	0,00		0		0	0,00	1,10	0,00
	worker	m3	145,66	**30,00**	72,83	12.683,34	0,00	5.073,34		0		0	17756,68	1,10	19532,35
	Courtyard refill				0,00	0,00	0,00	0,00		0		0	0,00	1,10	0,00
	gravel	m3	5,77	30,00	2,89	502,56	0,00	201,02	232,13	1340	75,00	433	2476,21	1,10	2723,83
	soil refill	m3	13,37	30,00	6,69	1.164,45	0,00	465,78		0	75,00	1003	2633,19	1,10	2896,51
	compacting	m3	13,37	2,40	0,53	93,16	0,00	37,26		0	13,44	180	310,12	1,10	341,13
					0,00	0,00	0,00	0,00		0		0	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0		0	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0		0	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0		0	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0		0	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0		0	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0		0	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0		0	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0		0	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0		0	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0		0	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0		0	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0		0	0,00	1,10	0,00
					0,00	0,00	0,00	0,00		0		0	0,00	1,10	0,00
Refered to Totalpage					164,73	28.688,40	0,00	11.475,36		1340		26155	67658,05		74423,86

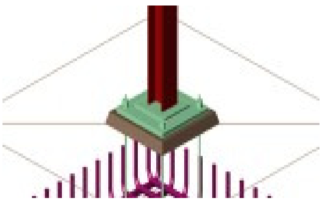
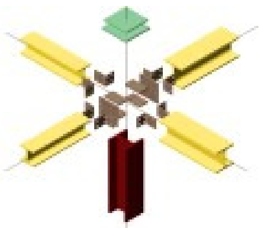
Tradecalculation

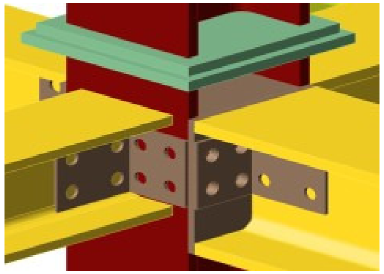
SUBJECT: Total

SITE: 1

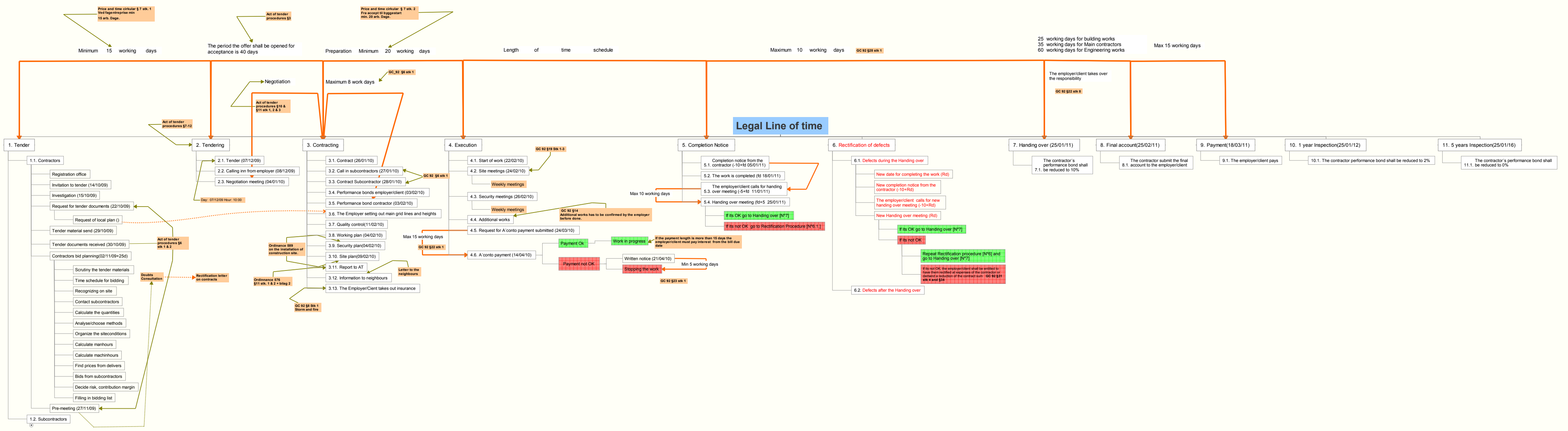
			Wage					MAT	MACHINERY			Gross price
POS NR.	Activity		Hours Total	Wages Total kr	Extras kr	Extras Hours	SOC. 40%	Materials	Machinery Rent.	Net price	Contribution margin kr	Gross price
	Soilworks		165	28.688	0	0,00	11.475	1.340	26.155	67.658	6.766	74.424
	Concreteworks		178	30.984	0	0,00	12.394	85.682	4.844	133.905	13.390	147.295
	Elementworks		0	0	0	0,00	0	0	0	0	0	0
	Sewerworks		0	0	0	0,00	0	0	0	0	0	0
	Steelworks		0	0	0	0,00	0	0	0	0	0	0
	Coating works		0	0	0	0,00	0	0	0	0	0	0
										201.563		
	Site rig, unrig		0	0	0	0,00	0	227.250		227.250	22.725	249.975
	Site Operation		0	0	0	0,00	0		626.950	626.950	62.695	689.645
Price excl Subcontractors			343	59.673	0	0,00	23.869	314.272	657.949	1.055.763	105.576	1.161.339
	Subcontractors									0	0	0
Price 1 incl. Subcontractors										1.055.763	105.576	1.161.339
		number month	Unitprice/months									
	Manager	0,00	40.000							0		
	Foreman	0,00	35.000							0		
	Winterprices											22.297
	Risk											0
										1.055.763	105.576	
										Biddingprice		1.183.636
										CM % price 1		9,09
										CM % price 2		9,09

Tradecalculation						Winterlist								Site:1	
Expected wage:	Ownproduction	174,15 minute factor		WAGE					MAT		MACHINERY		GROSS PRICE		
POS NR.	Activity	Unit	Quantity	Minutes pr.unit	Hours total	Wage total kr.	Extras 10%	SOC. 40%	Unit price	Materials	Unit price	Machinery rent	Net price	Faktor CM %	Gross price
					0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
					0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
	Wintermats				0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
	Purchase of 50 mm winter mats	m2day	50		0,00	0,00	0,00	0,00	8,00	400,00		0,00	400	1,10	440
	Tarpoulins				0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
	Rent of tarpoulins	m2day	260		0,00	0,00	0,00	0,00	40,00	10.400,00		0,00	10400	1,10	11440
	Heating the cabins				0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
	Rent of electrical stove 10 KW	day	1		0,00	0,00	0,00	0,00	35,00	35,00		0,00	35	1,10	39
	Claering of snow				0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
	Rent of flame thrower	day	13	120	26,00	4.527,90	452,79	1.992,28	45,00	585,00		0,00	7558	1,10	8314
	Claering of snow with shovels	hours	7	60	7,00	1.219,05	121,91	536,38		0,00		0,00	1877	1,10	2065
					0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
					0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
					0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
					0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
					0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
					0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
					0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
					0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
					0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
					0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
					0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
					0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
					0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
					0,00	0,00	0,00	0,00		0,00		0,00	0	1,10	0
Transferef to Totalscheduler					33,00	5.746,95	574,70	2.528,66		11.420,00		0,00	20270	2.027,03	22297

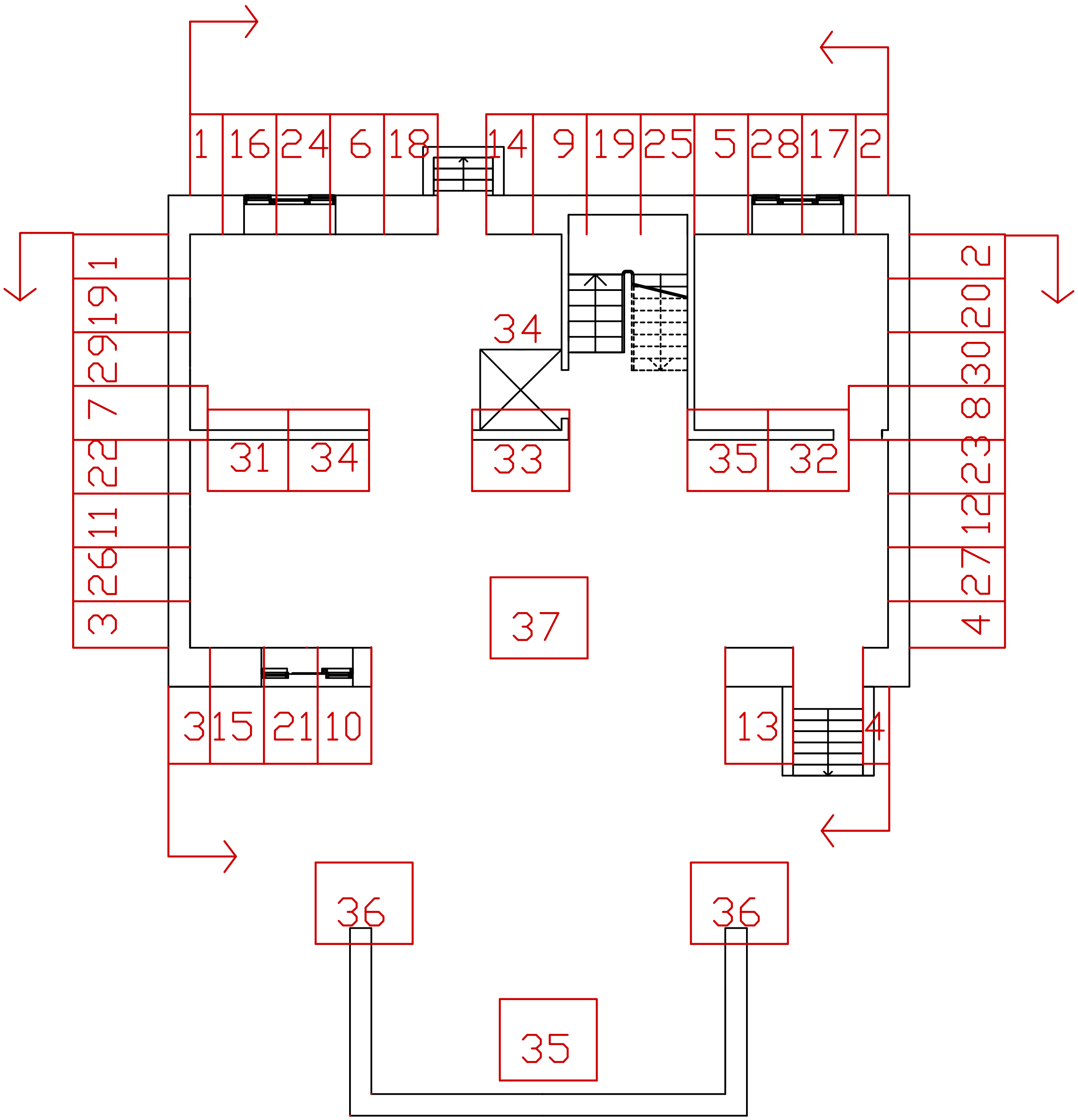
BLACKSMITH- STEEL STRUCTURE			CONSTRUCTION METHOD STATEMENT	OPERATIONAL STATEMENT		PAGE 1/3
Po Nr	Operations	Quantity	Method	Resource plant	Resource Labour	Notes (length)
1	Preparation & establishment of steel wall plates on basement walls 	2 m2 of neopren and 2 kg of 10mm steel plates.	Prepare & sort all the tools necessary for later activities. • Check & measure wall surfaces • Lay down neopren membrane under future column supports • Place the steel welding plates and fix them to concrete.	• Worker's lift if necessary • Tools from the tool shed • Materials from the steel storage area	3 steel workers and a foreman	5 hours
2	Erection of steel columns 	4 HE-160B columns per storey (4). 6 columns in penthouse storey.(1)	Dangerous activity – prepare for safety precautions. Always wear gloves and safety shoes. Remember to wake up the crane driver. • Bolt the columns securely to welding plates • Make sure that columns are supported enough before attached to the beams	•Workers' lift • Tools from the tool shed • Columns are laying in the steel storage area	•3 steel workers and a foreman	7 hours per storey. Will be alternating with beam attachments.

BLACKSMITH- STEEL STRUCTURE			CONSTRUCTION METHOD STATEMENT	OPERATIONAL STATEMENT		PAGE 2/3
Po Nr	Operations	Quantity	Method	Resource plant	Resource Labour	Notes (length)
3. Erection of steel beams (5 storeys) 			Dangerous activity – prepare for safety precautions. Always wear gloves and safety shoes. Steel beams are stored in the steel storage area. See the site plan.	• Workers' lift • Crane • Tools from the tool container	3 workers, 1 foreman	8 hours per storey
4. Roof conection 			Activity that needs utter precision. Brackets have to be secured well to the steel beam holding them up. They have to be tightened enough, so the roof rafters' position would not change even after removing the shoring.	• Ladders • Crane • Tools from the tool container	3 workers, 1 foreman	24 hours

BLACKSMITH- STEEL STRUCTURE			CONSTRUCTION METHOD STATEMENT	OPERATIONAL STATEMENT		PAGE 3/3
Po Nr	Operations	Quantity	Method	Resource plant	Resource Labour	Notes (length)
5. Balcony Beams & railings 			Balconies are to be supplied with steel railings covered with glass. Glass will be put up later by carpentry trade. Activity that needs active control for quality.	Railings will be in the steel storage area. Tools are located in the toolshed.	2 workers , 1 foreman	48hrs
6. Elevator Anchorages			The work comprises th establishment of columns for helping the elevator machinery .	Necessary tools and beams in the storage area	2 workers	24hrs



Legal Line of time
Price and time cirkular § 7 stk. 1 Ved fagentreprise min 15 arb. Dage.
Minimum 15 working days
Act of tender procedures §3
The period the offer shall be opened for acceptance is 40 days
Price and time cirkular § 7 stk. 2 Fra accept til byggestart min. 20 arb. Dage.
Preparation Minimum 20 working days
Length of time schedule
Maximum 10 working days
GC 92 §28 stk 1
25 working days for building works
35 working days for Main contractors
60 working days for Engineering works
Max 15 working days
Negotiation
Act of tender procedures §10 & §11 stk 1, 2 & 3
Maximum 8 work days
GC_92 §6 stk 1
Act of tender procedures §7-12
The employer/client takes over the responsibility
GC 92 §22 stk 8
1. Tender
1.1. Contractors
Registration office
Invitation to tender (14/10/09)
Investigation (15/10/09)
Request for tender documents (22/10/09)
Request of local plan ()
Tender material send (29/10/09)
Tender documents received (30/10/09)
Act of tender procedures §6 stk 1 & 2
Contractors bid planning(02/11/09+25d)
Scrutiny the tender materials
Time schedule for bidding
Recognizing on site
Contact subcontractors
Calculate the quantities
Analyse/choose methods
Organize the siteconditions
Calculate manhours
Calculate machinhours
Find prices from delivers
Bids from subcontractors
Decide risk, contribution margin
Filling in bidding list
Pre-meeting (27/11/09)
1.2. Subcontractors
Doubts Consultation
Rectification letter on contracts
2. Tendering
2.1. Tender (07/12/09)
2.2. Calling inn from employer (08/12/09)
2.3. Negotiation meeting (04/01/10)
Day: 07/12/09 Hour: 10:00
3. Contracting
3.1. Contract (26/01/10)
3.2. Call in subcontractors (27/01/10)
3.3. Contract Subcontractor (28/01/10)
GC 92 §6 stk 1
3.4. Performance bonds employer/client (03/02/10)
3.5. Performance bond contractor (03/02/10)
3.6. The Employer setting out main grid lines and heights
3.7. Quality control(11/02/10)
3.8. Working plan (04/02/10)
3.9. Security plan(04/02/10)
3.10. Site plan(09/02/10)
3.11. Report to AT
3.12. Information to neighbours
3.13. The Employer/Cient takes out insurance
Ordinance 589 on the installation of construction site.
Ordinnance 576 §11 stk. 1 & 2 + bilag 2
Letter to the neighbours
GC 92 §8 Stk 1 Storm and fire
4. Execution
4.1. Start of work (22/02/10)
GC 92 §19 Stk 1-3
4.2. Site meetings (24/02/10)
Weekly meetings
4.3. Security meetings (26/02/10)
Weekly meetings
4.4. Additional works
GC 92 §14 Additional works has to be confirmed by the employer before done.
4.5. Request for A´conto payment submitted (24/03/10)
Max 15 working days
GC 92 §22 stk 1
4.6. A´conto payment (14/04/10)
Payment Ok
Work in progress
If the payment length is more than 15 days the employer/client must pay interest from the bill due date
Payment not OK
Written notice (21/04/10)
Stopping the work
Min 5 working days
GC 92 §23 stk 1
5. Completion Notice
5.1. Completion notice from the contractor (-10+fd 05/01/11)
5.2. The work is completed (fd 18/01/11)
5.3. The employer/client calls for handing over meeting (-5+fd 11/01/11)
Max 10 working days
5.4. Handing over meeting (fd+5 25/01/11)
If its OK go to Handing over [Nº7]
If its not OK go to Rectification Procedure [Nº6.1.]
6. Rectification of defects
6.1. Defects during the Handing over
New date for completing the work (Rd)
New completion notice from the contractor (-10+Rd)
The employer/client calls for new handing over meeting (-10+Rd)
New Handing over meeting (Rd)
If its OK go to Handing over [Nº7]
If its not OK
Repeat Rectification procedure [Nº6] and go to Handing over [Nº7]
If its not OK, the employer/client shall be entitled to have them rectified at expenses of the contractor or demand a reduction of the contract sum GC 92 §31 stk 4 and §34
6.2. Defects after the Handing over
7. Handing over (25/01/11)
7.1. The contractor´s performance bond shall be reduced to 10%
8. Final account(25/02/11)
8.1. The contractor submit the final account to the employer/client
9. Payment(18/03/11)
9.1. The employer/client pays
10. 1 year Inspection(25/01/12)
10.1. The contractor performance bond shall be reduced to 2%
11. 5 years Inspection(25/01/16)
11.1. The contractor´s performance bond shall be reduced to 0%



Sequence

Underpinning 1-33
Elevator pit 34
Foundation 35
Concrete Walls 36
Basement slab 37

(10) Dig and clean vegetal soil

(20) make access ramp to the building til old basement slab level

(30) make piles I / II / III / IV and wall V and Demolish Basement walls and Basement floor slab.

(40) Dig til strip foundation upper level

(50) Dig elevator pitch

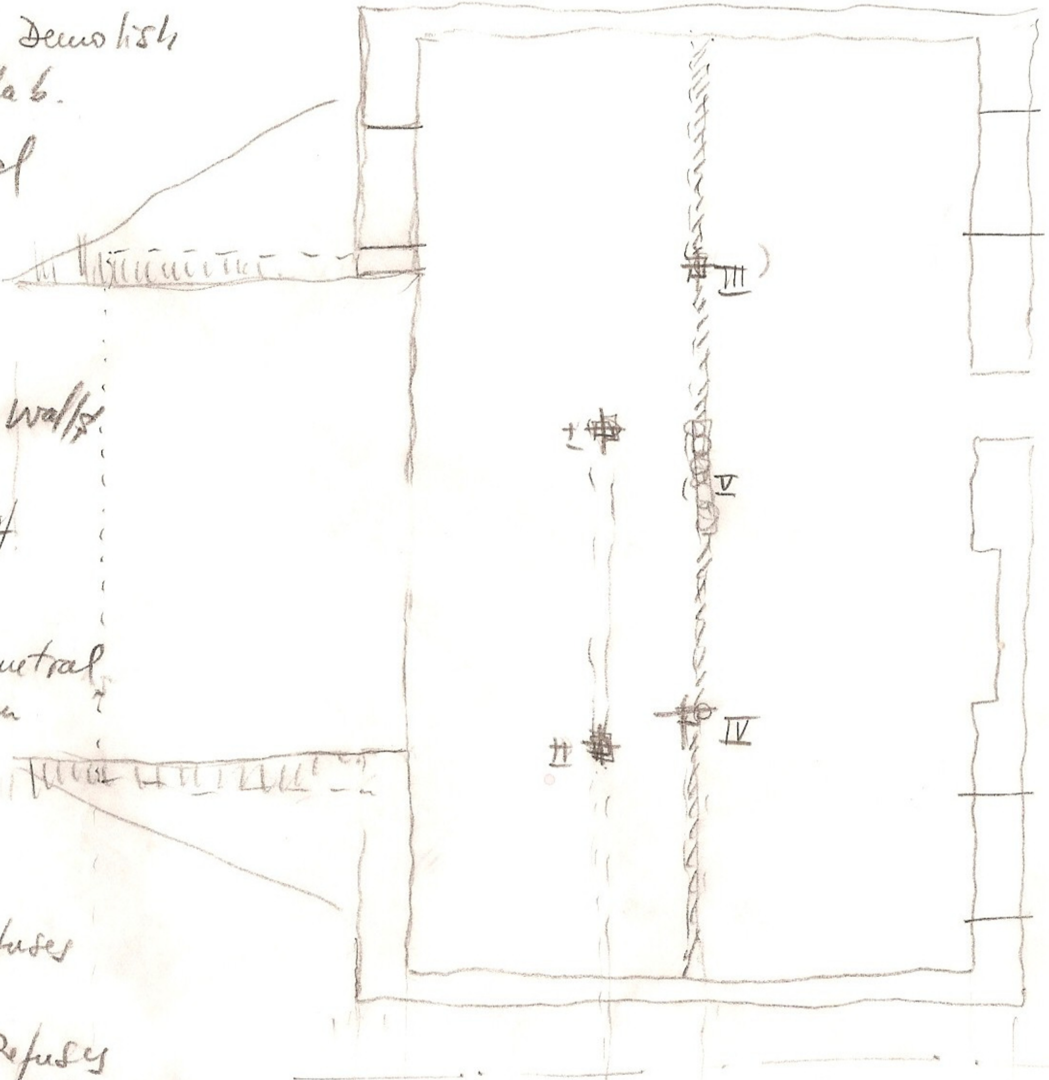
(60) Dig foundation

(70) Strip foundation a (90) perimetral walls

(80) Gravel under Blinding layer of

(21) Dig til head piles Demolish level

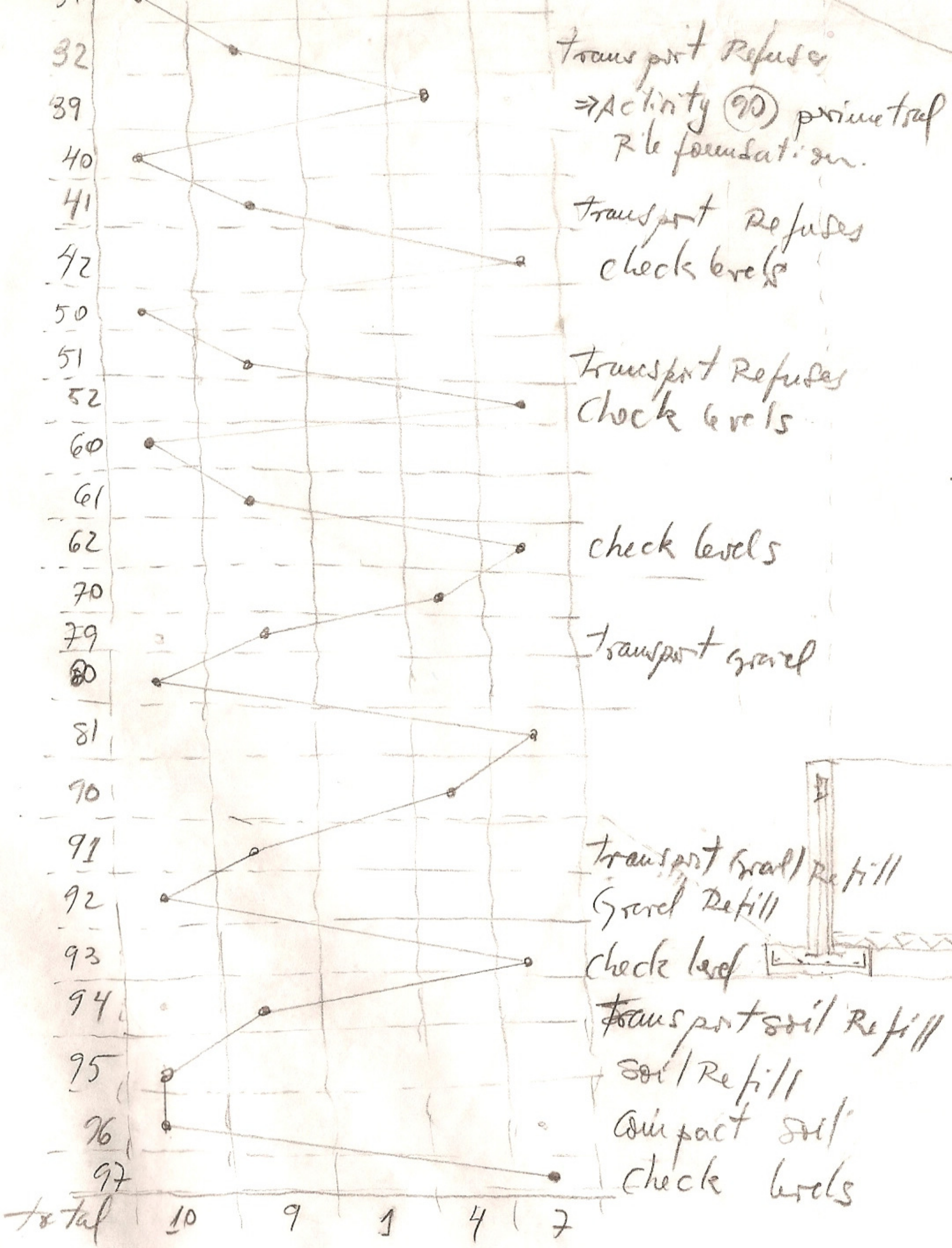
↳ ⇒ (78) Activity in perimetral pile foundation

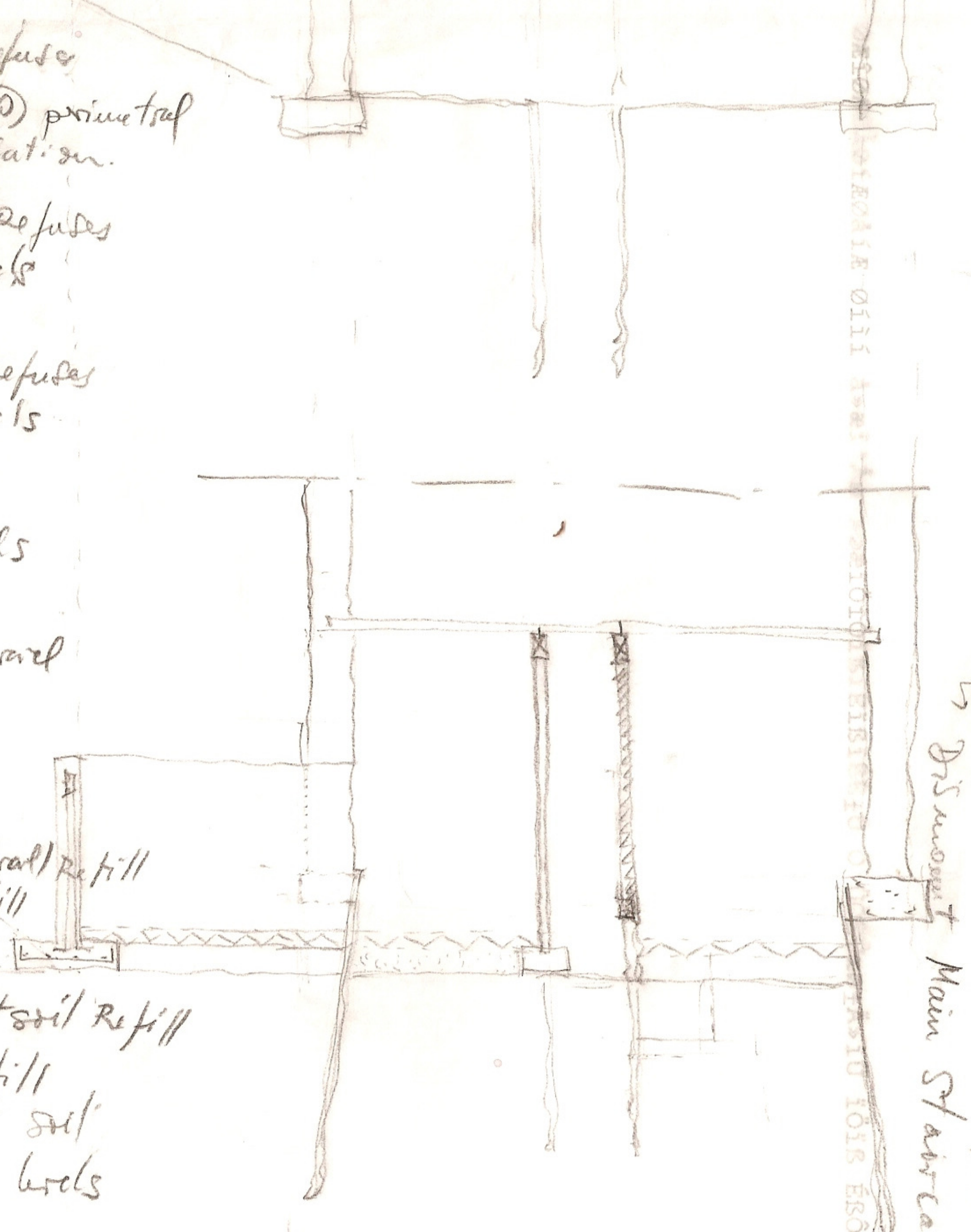


Process Chart

Activity	○	⇨	▽	D	□	Remarks
10	•					
11		•				transport Refuses
20	•					
21		•				transport Refuses
22			•			Storage Refill Needed
23					•	Check levels
30				•		

Soil


32
transport Refuse
39
⇒Activity (90) perimetral
Pile foundation.
40
41
transport Refuses
42
check levels
50
51
Transport Refuses
52
Check levels
60
61
62
check levels
70
79
Transport gravel
80
81
90
91
transport Gravel Refill
92
Gravel Refill
93
Check level
94
Transport soil Refill
95
soil Refill
96
compact soil
97
Check levels
total
10
9
1
4
7


Previous works
Demolish Bearing wall Area
Dismount
Main Staircase

Top VIEW

400 m.

Symbols for process charts

Symbol	Activity	Predominant Result
○	Operation	Produces, accomplishes, furthers the process
⇨	Transport	travels
▽	Storage	Holds, keeps or Retains
D	Delay	Interferes or Delays
□	Inspection	Verifies quantity and/or quality

Activity	○	⇨	▽	D	□	Remarks
20					•	
21	•					
30	•					
40				•		Order Concrete
41		•				
42					•	Check R cage
43					•	check Concrete
44	•					
45					•	Check concrete level
50	•					
51				•		Concrete Hardening time
60	•					
70	•					
other trade → 78				•		Dig til Demolish level
79					•	Inspection of Demolition area
Subtotal	6	1		3	5	

Activity	○	⇨	▽	D	□	Remarks
Subtotal	6	1	–	3	5	
80	•					
81	•					
82					•	C Reinf in S. trea
83		•				Transport R.
90	•					
91	•					
99		•				
100	•					
101					•	C Reinf + Aff + formwork
102				•		Order Concrete
109					•	C. Concrete
110	•					
111				•		Concrete Hardening Time
112	•					Remove F. and clean
total	13	3	–	5	8	

Soil WORKS

Process and Process Charts

(10) Dig til find old foundation

(20) check levels and marks

(21) Mark holes and place the auger machine

(30) Make temp. holes and put joist

(40) wait concrete to (41) transport R cage

(44) pour concrete

(50) insert reinforcement cage

(60) take out steel joist

(70) Repeat process (2) to (6) til finish all piles.

(80) Demolish head of pile max 500 mm. and clean

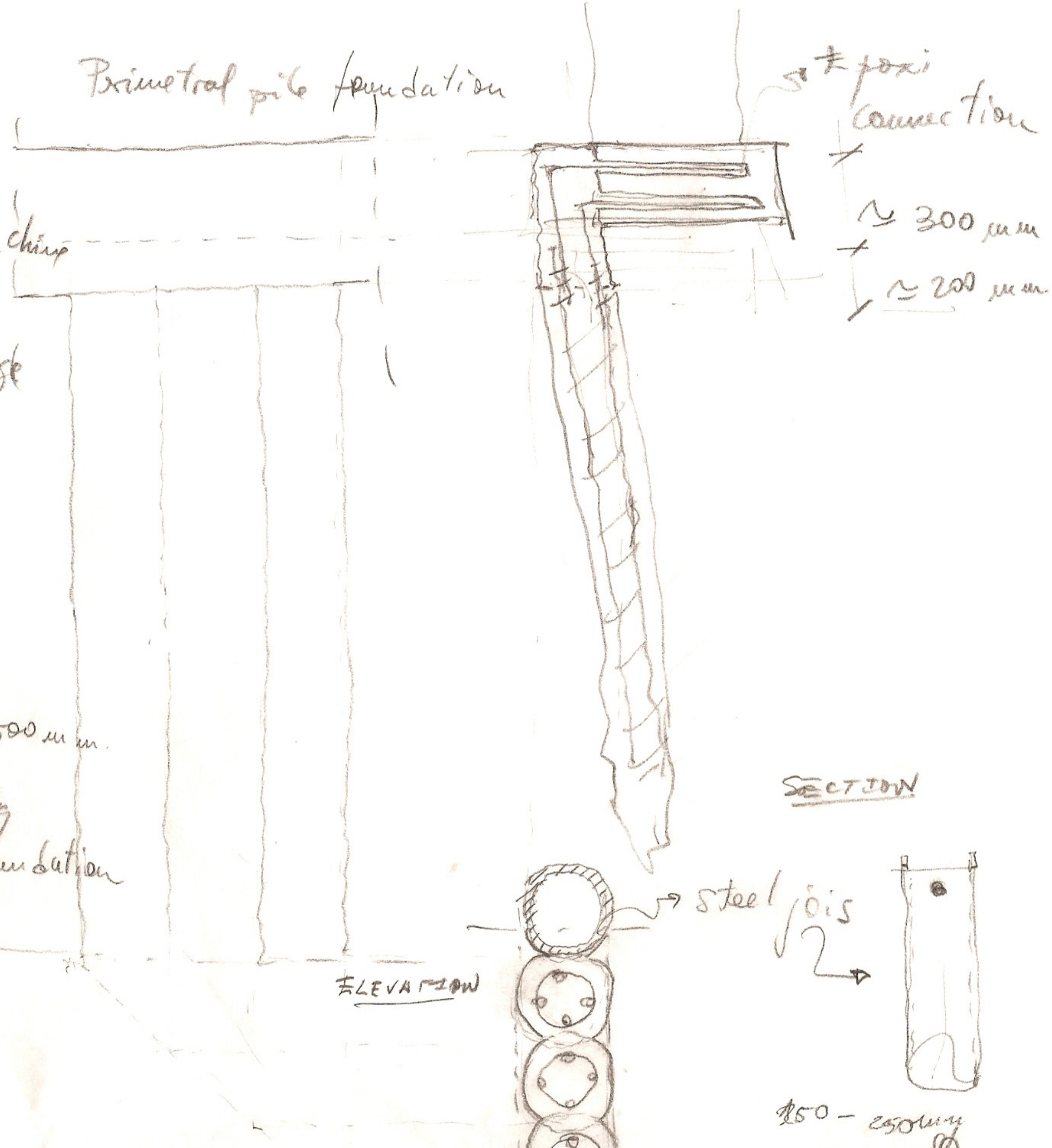
(90) Make a perimetral beam attaching all head piles with the old foundation connectors

(81) Drill connection holes in old foundation and clean

(100) prepare formwork

(110) pour concrete

Primetral pile foundation



Tender control plan

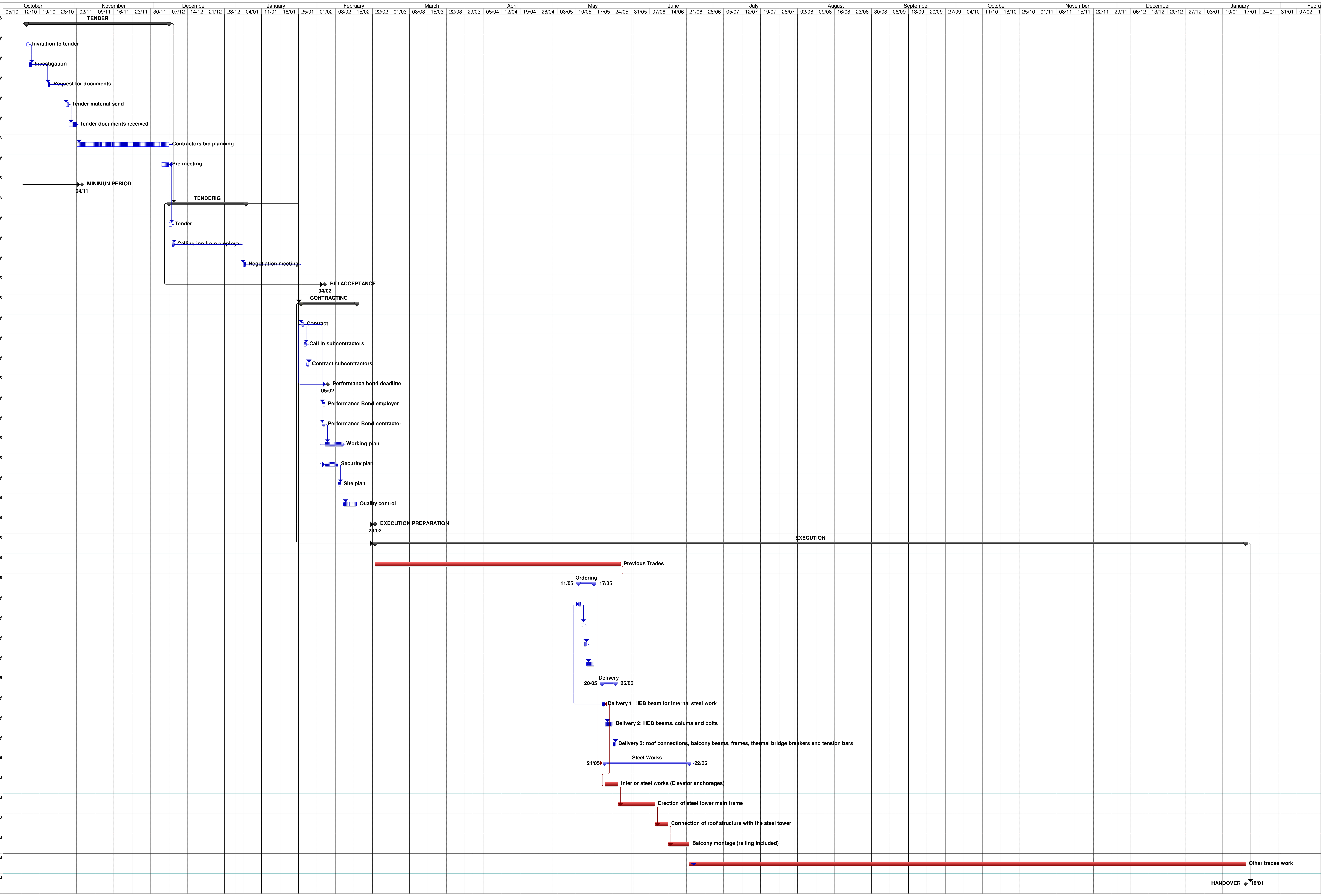
☐ Supervision plan ■ Tender control plan ☐ Control plan

Case: Refurbishment of Dannebrogsgade 4	No. of case: 04.125	Date:	Rev: -	Page 1 of 1
Location: 8000 Aarhus, Denmark	Contract/building component: Blacksmith			

No.	Subject	Reference	Method/How	Frequency	Time	Demands	Demands to documentation	Responsible
	Materials							
1.	Materials of Beams/Columns Bolts/Welds	Drawing plans	Control of documents about Quality of the materials, size and quality of welds and bolts	Every delivery	Before production	Accepted only if it suites the requirements	Copy of delivery and order forms	The main contractor
	Production part							
1.	Thickness and Length	Drawing plans	Measurement	Every delivery	Arrival on site	Accepted only if it suites the requirements (DS/ENV 1090-1 +/- 1 mm)	Copy of delivery and order forms	The contractor
2.	Welding		Visual inspection of the welded parts		On site, before mounting structure	Accepted only if it suites the requirements		The contractor
3.	Holes/Plates	Drawing plans	Visual inspection and measurements of plates dimensions and hole diameters	Every delivery	Arrival on site	Accepted only if it suites the requirements	Copy of delivery and order forms	The contractor
4.	Coating		Visual inspection of the coated surfaces	Every delivery	Arrival on site	Accepted only if the coated surfaces are continuous		The contractor
5.	Crane	Drawing plans	Visual inspection of the	One time	After mounting the tower crane	Accepted only if it suites the	Specifications and instructions	The contractor

			position of the crane and it’s power in conformity with the work necessary to be done on site		and before running the works on site	requirements	for usage	
6.	Storage place for materials	Drawing plans	Visual inspection for placing the storage area and measurements in conformity with the requirements of space	One time	Before the arrival of the materials on site	Accepted only if it suites the requirements		The contractor
	Execution on site							
1.	Check height on walls and fixed point on site	Drawing plans	Measurement of the height and fixed point in conformity with the existent drawings	Every floor	Before the arrival of the materials on site	Accepted only if the measurements match the existing drawings	Engineer plans	The contractor
2.	Check diagonal	Drawing plans	Measurement of diagonals in conformity with the existing drawings	Every floor	After mounting the structure	Accepted only if the measurements match the existing drawings	Engineer plans	The contractor
3.	Check connections	Drawing plans	Visual inspection and mechanichal testing of the steel connection	All connections	After mounting the structure	Accepted only if the inspection proove that the connections are stable	Engineer plans	The contractor

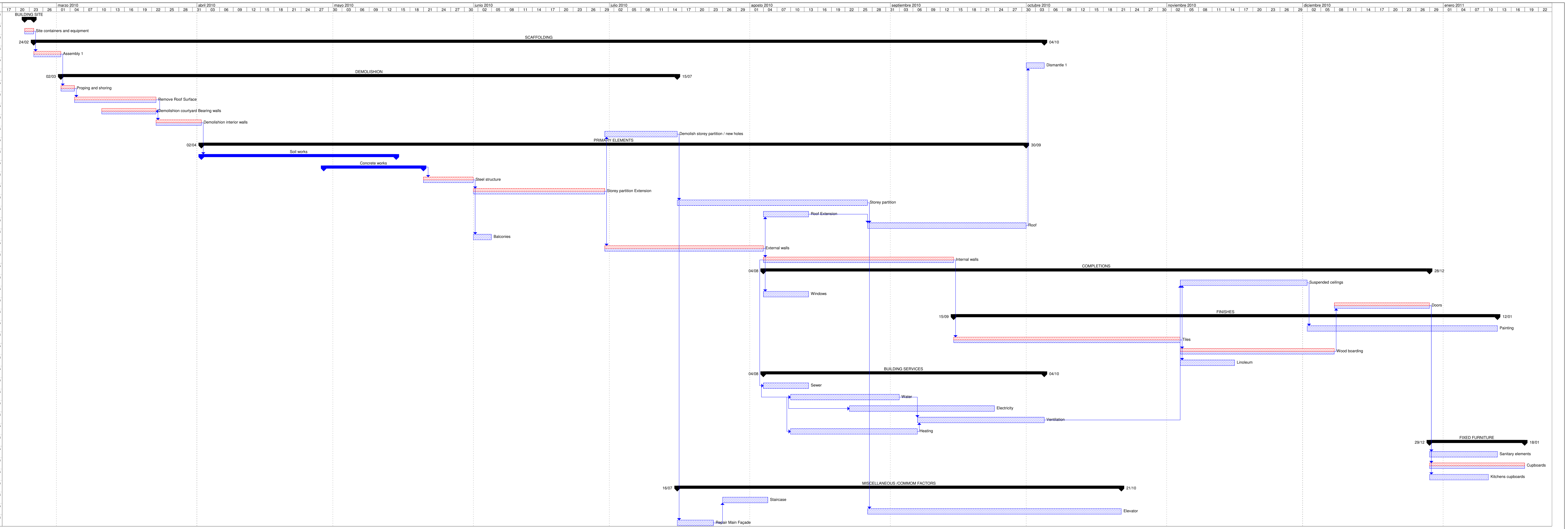
ID	Nombre de tarea	Duration
1	**TENDER**	**38 days**
2	Invitation to tender	1 day
3	Investigation	1 day
4	Request for documents	1 day
5	Tender material send	1 day
6	Tender documents received	1 day
7	Contractors bid planning	25 days
8	Pre-meeting	1 day
9	**MINIMUN PERIOD**	0 days
10	*TENDERIG*	**18 days**
11	*Tender*	1 day
12	*Calling inn from employer*	1 day
13	*Negotiation meeting*	1 day
14	**BID ACCEPTANCE**	0 days
15	***CONTRACTING***	**15 days**
16	*Contract*	1 day
17	*Call in subcontractors*	1 day
18	*Contract subcontractors*	1 day
19	*Performance bond deadline*	0 days
20	*Performance Bond employer*	1 day
21	*Performance Bond contractor*	1 day
22	*Working plan*	5 days
23	*Security plan*	3 days
24	*Site plan*	1 day
25	*Quality control*	3 days
26	**EXECUTION PREPARATION**	0 days
27	**EXECUTION**	**236 days**
28	Previous Trades	67 days
29	**Ordering**	**4 days**
30	Ordering of HEB columns and beams with welded connection plates	1 day
31	Ordering of bolts	1 day
32	Ordering of roof connections	1 day
33	Ordering of balcony beams, frames, thermal bridge breakers and tension bars	1 day
34	**Delivery**	**3 days**
35	Delivery 1: HEB beam for internal steel work	1 day
36	Delivery 2: HEB beams, colums and bolts	1 day
37	Delivery 3: roof connections, balcony beams, frames, thermal bridge breakers and tension bars	1 day
38	**Steel Works**	**22 days**
39	Interior steel works (Elevator anchorages)	3 days
40	Erection of steel tower main frame	10 days
41	Connection of roof structure with the steel tower	3 days
42	Balcony montage (railing included)	6 days
43	**Other trades work**	151 days
44	**HANDOVER**	0 days



Proyecto: Time Schedule Steel_w
Fecha: Thu 20/10/11

Critical Split	División	Resumen	Tareas externas	Inactive Task	Inactive Milestone	Manual Task	Manual Summary Rollup	Start-only	Progreso	Critical
Tarea	Hito	Resumen del proyecto	Hito externo	Inactive Task	Inactive Summary	Duration-only	Manual Summary	Finish-only	Fecha límite	

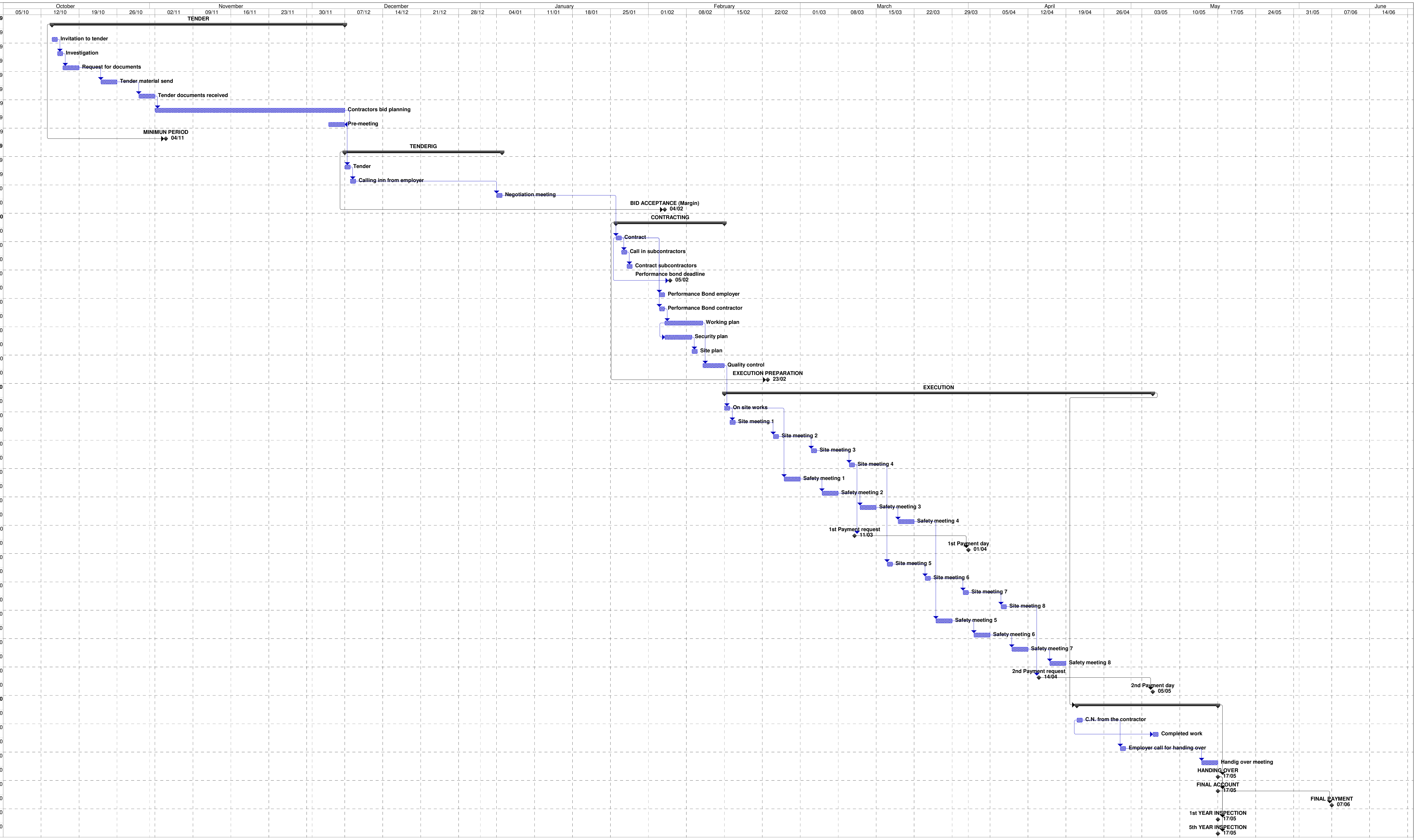
Id	Nombre de tarea	Duración
1	**BUILDING SITE**	2 días
2	Site containers and equipment	2 días
3	**SCAFFOLDING**	159 días
4	Assembly 1	4 días
5	Dismantle 1	2 días
6	**DEMOLISHION**	98 días
7	Proping and shoring	3 días
8	Remove Roof Surface	12 días
9	Demolishion courtyard Bearing walls	8 días
10	Demolishion interior walls	8 días
11	Demolish storey partition / new holes	12 días
12	**PRIMARY ELEMENTS**	130 días
13	Soil works	31 días
20	Concrete works	16 días
42	Steel structure	7 días
43	Storey partition Extension	21 días
44	Storey partition	30 días
45	Roof Extension	8 días
46	Roof	25 días
47	Balconies	4 días
48	External walls	25 días
49	Internal walls	30 días
50	**COMPLETIONS**	105 días
51	Suspended ceilings	20 días
52	Windows	8 días
53	Doors	15 días
54	**FINISHES**	86 días
55	Painting	30 días
56	Tiles	36 días
57	Wood boarding	24 días
58	Linoleum	8 días
59	**BUILDING SERVICES**	44 días
60	Sewer	8 días
61	Water	18 días
62	Electricity	24 días
63	Ventilation	20 días
64	Heating	20 días
65	**FIXED FURNITURE**	15 días
66	Sanitary elements	11 días
67	Cupboards	15 días
68	Kitchens cupboards	9 días
69	**MISCELLANEOUS /COMMOM FACTORS**	70 días
70	Staircase	8 días
71	Elevator	40 días
72	Repair Main Façade	6 días



Proyecto: Execution
Fecha: dom 24/01/10

Tarea | División | Progreso | Hito | Resumen | Resumen del proyecto | Tareas externas | Hito externo | Fecha límite | Tarea crítica

ID	Nombre de tarea	Duration	Start
1	**TENDER**	**38 days**	**Wed 14/10/09**
2	Invitation to tender	1 day	Wed 14/10/09
3	Investigation	1 day	Thu 15/10/09
4	Request for documents	1 day	Fri 16/10/09
5	Tender material send	1 day	Fri 23/10/09
6	Tender documents received	1 day	Fri 30/10/09
7	Contractors bid planning	25 days	Mon 02/11/09
8	Pre-meeting	1 day	Fri 04/12/09
9	**MINIMUN PERIOD**	0 days	Wed 04/11/09
10	**TENDERIG**	**18 days**	**Mon 07/12/09**
11	Tender	1 day	Mon 07/12/09
12	Calling inn from employer	1 day	Tue 08/12/09
13	Negotiation meeting	1 day	Mon 04/01/10
14	**BID ACCEPTANCE (Margin)**	0 days	Thu 04/02/10
15	**CONTRACTING**	**14 days**	**Tue 26/01/10**
16	Contract	1 day	Tue 26/01/10
17	Call in subcontractors	1 day	Wed 27/01/10
18	Contract subcontractors	1 day	Thu 28/01/10
19	Performance bond deadline	0 days	Fri 05/02/10
20	Performance Bond employer	1 day	Wed 03/02/10
21	Performance Bond contractor	1 day	Wed 03/02/10
22	Working plan	5 days	Thu 04/02/10
23	Security plan	3 days	Thu 04/02/10
24	Site plan	1 day	Tue 09/02/10
25	Quality control	2 days	Thu 11/02/10
26	**EXECUTION PREPARATION**	0 days	Tue 23/02/10
27	**EXECUTION**	**57 days?**	**Mon 15/02/10**
28	On site works	1 day	Mon 15/02/10
29	Site meeting 1	1 day	Tue 16/02/10
30	Site meeting 2	1 day	Wed 24/02/10
31	Site meeting 3	1 day	Wed 03/03/10
32	Site meeting 4	1 day	Wed 10/03/10
33	Safety meeting 1	1 day	Fri 26/02/10
34	Safety meeting 2	1 day	Fri 05/03/10
35	Safety meeting 3	1 day	Fri 12/03/10
36	Safety meeting 4	1 day	Fri 19/03/10
37	1st Payment request	0 days	Thu 11/03/10
38	1st Payment day	0 days	Thu 01/04/10
39	Site meeting 5	1 day	Wed 17/03/10
40	Site meeting 6	1 day	Wed 24/03/10
41	Site meeting 7	1 day	Wed 31/03/10
42	Site meeting 8	1 day	Wed 07/04/10
43	Safety meeting 5	1 day?	Fri 26/03/10
44	Safety meeting 6	1 day?	Fri 02/04/10
45	Safety meeting 7	1 day?	Fri 09/04/10
46	Safety meeting 8	1 day?	Fri 16/04/10
47	2nd Payment request	0 days	Wed 14/04/10
48	2nd Payment day	0 days	Wed 05/05/10
49	**COMPLETION NOTICE**	**18 days?**	**Wed 21/04/10**
50	C.N. from the contractor	1 day	Wed 21/04/10
51	Completed work	1 day	Wed 05/05/10
52	Employer call for handing over	1 day?	Thu 29/04/10
53	Handig over meeting	1 day	Fri 14/05/10
54	**HANDING OVER**	0 days	Mon 17/05/10
55	**FINAL ACCOUNT**	0 days	Mon 17/05/10
56	**FINAL PAYMENT**	0 days	Mon 07/06/10
57	**1st YEAR INSPECTION**	0 days	Mon 17/05/10
58	**5th YEAR INSPECTION**	0 days	Mon 17/05/10



Proyecto: legal time line
Fecha: Thu 20/10/11

Tarea	Hito	Resumen del proyecto	Hito externo	Inactive Task	Inactive Summary	Duration-only	Manual Summary	Finish-only	Fecha límite
División	Resumen	Tareas externas	Inactive Task	Inactive Milestone	Manual Task	Manual Summary Rollup	Start-only	Progreso	

1 Contract 01/10

Aarhus, January the 26th of 2010

Between

Damien Crosse, representative of Housing association and tenants from Aarhus Kommune
Dannebrogsgade 4
8000 Aarhus (hereinafter referred to as the client)

and

Carpenter main contractor
Amaliagade 112
8700 Horsens (hereinafter referred to as contractor)

who have, on this day, entered into the following:

C O N T R A C T A G R E E M E N T

For the refurbishment of a residential building and extension at Dannebrogsgade 4, Aarhus with a total area after renovation of 738 m2.

1.

The contractor undertakes the execution of works in the

Specialistcontract

2.

The bases for the delegation of the works are the following documents:

1. This contract.
2. The contractor's bid dated 07.12.2009, subject to the reservations contained therein.
3. Correction Letter No. 1, dated 04.12.2009
4. Invitation to tender, dated 14.10.2009
5. Conditions of contract (Case specification), dated 04.12.2009
6. Work specifications, dated 04.12.2009
7. Drawing schedule with architectural drawings, dated 30.10.2009
8. Drawing schedule with engineering drawings, dated 30.10.2009
9. Architectural and engineering drawings in accordance with the aforementioned drawing schedules, dated 30.10.2009
11. Tender forms , dated 05.12.2009
12. GC 92 with changes

(In case of any discrepancy between the above documents, the documents take precedence in the order listed)

3

The client undertakes to pay the contractor for the correct execution of his contractual obligations:

Tendered bid/ accept sum excl. VAT	Dkr 10.988.574,20
Stipulated payment	Dkr
Total contract sum excl. VAT	Dkr 10.988.574,20
+ 25% VAT	Dkr 2.747.143,50
Total contract sum incl. VAT	**Dkr 13.735.717,70**

3 Contract 01/10

They stipulated payments are paid according to the unit prices stated in the bid, and adjusted if necessary in compliance with GC 92.

4.

The price is fixed for a period of 12 months from the bid day/ for the whole construction period, however, in accordance with the Building and Housing Agency's circular dated 10 October 1991 re Price and Time, § 8 and § 9.

5.

Billing and payment is in accordance with common specificationsGC-92 section 22, with the following change:

The Contractor shall be entitled to receive payment once a month for work performed. Within 10 days of rceipt request the Employer shall effect payment of the amount for wich works been finished on-site.

6.

The work must be started no later than 22.02.2010, and handed over no later than 25.01.2011
The work must also be performed in accordance with the attached time schedule x.
In case of delay on the part of the contractor, a penalty of Dkr. 21.977,15 per working day, comprising 0,2% of the total contract sum, must be paid.

7.

The are no reservations in the bid, except for the ones mentioned below, which are void:
Standard Reservations of May 2008, paragraphs 3,

8.

The contractor must, within 8 days of entering into a contract with the client, establish a performance bond in accordance with GC 92´s § 6 re surety. The performance bond must constitute DKK 1.648.286,10, representing 15% of the total contract sum excl. VAT.

4 Contract 01/10

The performance bond must be drawn up in accordance with GC 92´s § 6.

9.

The client must, within 8 days of entering into an agreement with the contractor, provide a surety as stipulated in GC´s § 7. The surety must constitute Dkr 2.197.714,80, equivalent to 3 months' average payment/10% of the contract sum, and must be drawn up in accordance with GC 92´s § 7.

10.

The client must take out fire and storm damage insurance from the beginning of the construction works. The contractor, and possible subcontractors, must be included as insured in the client's insurance policy.

The contractor has taken out the usual liability insurance from: ALLIANZ

11.

Executives who have power of attorney.

For client:

Damien Crosse

For contractor:

Arnaldo Landivar

On behalf of the client... ... ... On behalf of the contractor

Damien Crosse Arnaldo Landivar

PROJECT	Renovation Multistorey house, Aarhus
PHASE	Execution
DATE	

Low risk Area			Small
Medium risk Area			Medium
High risk area			Large

RISK AREAS	IDENTIFIED	FAILURE PROBABILITY	CONSEQUENCES
Underpinning Excavation	Damage and collapse of above wall foudation		
Underpinning and elevator excavation	Floor drainage		
Underpinnig old foundation	Old building stability		
Underpinnig process	Collapse of above wall foudation		
Horizontal and vertical concrete levels for underpinning	Correct to be able to continue with the basement slab, moisture		
New foundation reinforcement	Stability extension, cracks		
New foundation horizontal concrete level	Stability extension, cracks ,dampness		
New Concrete basement walls	Stability estension		
	Heat loss, cold bridges		
	Dampness and floor drainages		
New basement slab	Cracks		
	Dampness and floor drainage		
	Heat loss, cold bridges		
Elevator pit	Old building stability		
	Dampness and floor drainage		
	Heat loss, cold bridges		

Assesment concernig the construction period

Risk Areas	1.-Assessment	Remarks (elaboration)	Risk-limited measures to be implemented	2.-Assessment after measures	Remarks during the execution
Underpinning Excavation	**4**	Damage and collapse of above wall foudation	Excavation Lenght < 1 m	**3**	
Underpinning and elevator excavation	**3**	Floor drainage	Provide water pumps	**2**	
Underpinnig old foundation	**2**	Old building stability		**2**	
Underpinnig process	**2**	Collapse of above wall foudation		**2**	
Horizontal and vertical concrete levels for underpinning	**1**	Correct to be able to continue with the basement slab, moisture		**1**	
New foundation reinforcement	**3**	Stability extension, cracks	Make a proper joints	**2**	
New foundation horizontal concrete level	**3**	Stability extension, cracks ,dampness	Water proof membranes	**2**	
New Concrete basement walls	**5**	Stability estension		**4**	
	5	Heat loss, cold bridges	Insulation	**4**	
	3	Dampness and floor drainages	Water proof membranes	**2**	
New basement slab	**5**	Cracks	Make a proper joints	**4**	
	3	Dampness and floor drainage	Water proof membranes	**2**	
	4	Heat loss, cold bridges	Insulation	**3**	
Elevator pit	**1**	Old building stability		**1**	
	5	Dampness and floor drainage	Water proof membranes and water pumps	**4**	
	3	Heat loss, cold bridges	Insulation	**2**	
Work in heights	**4**	Risk of falls	Acoording to PHS-Handbook	**3**	
Difficult view for the crane	**3**	The crane is in the courtyard-limited visbility		**3**	
Execution of work in a daily busy area	**3**	Pedestrians might get lost in the site	Case Specification (fences)	**1**	Prevent unauthorized people to access the building site
Sum,average of risk areas	**3,3**			**2,5**	

Written conclusion
Risk of 2,5% will be added to the bid of the project. Several measures were proposed to our client to lower the natural risk in the project such as: * Detailed meeting schedules *Creating site meetings forms *Introduction PHS (Plan of Health and Safety) Handbook guidelines *Fencing the building site

Project : Renovation Multistorey House,Aarhus	
Concrete works	
Project Responsible	Arnaldo Landivar
Journal Number	
Trade form	Individual trade contract
Case stablished date:	04.01.2010
Bidding date:	05.12.2009
Bid accepted date:	07.12.2009
Start of construction:	28.04.2010
Handng over:	20.05.2010
1st year inspection	20.05.2011
2nd year inspection	20.05.2012
Client	Damien Crosse
Architects	Group 01
Engineers	Group 01
Employees on the project	Arnaldo Landivar
In the bidding phase	Arnaldo Landivar
In the Construction phase	Arnaldo Landivar

Risk level	Project parties Assesment reliability, competence, experience	Project material	Technical Risks	Own Organization	In construction period
1. Small Risk	Good experiences, competences, finances	Excellent worked out material	Few risks-known technology and working procedures	Good experience and competence, sufficient resources	Small risk
2.					
3. Some Risk	Medium risk	Normal standard	Normal	Medium	Medium
4.					
5. High risk	Low level of experience, unknown companies, unknown financial status	Defective / Confusi	New technology, new work methods	Poor experience, insuficient resources	High risk

Acceptable risk	**Risk reducing measures to be considered**	**Not acceptable risk**

Regarding risk management
1.-Risk management doesn´t mean that all the risks can be avoided, but it can provide ceratin knowledge of the risk level in a construction project.
2.-A clear idea regarding the importance of knowing the risks and how to handle it , is achieved by the assessment.
3.- The condition for an Organization success is understood risks perspectives from top to bottom and established a vertical and horizontal communication, as well, within the Company

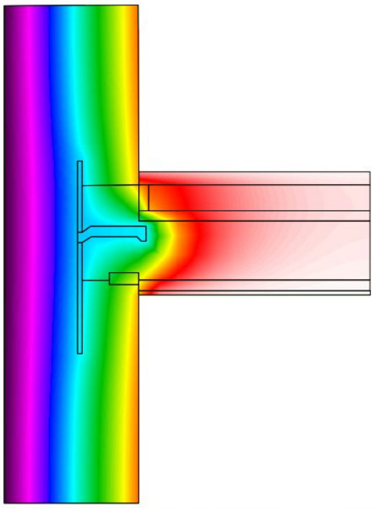
Assesment of the Project

Risk areas	1. Preliminary assesment	Remarks / elaboration	Risk limiting measures / reservations, to be included in the bid	2. Assesment of the bid	Remarks (elaboration)	Project changes, Contract changes	Assessment based on signed contract	Risk conditions at start of construction Average 1-2-3
A- Project parties								
Client	**5**	No information	Meetings / performance bond request	**3**	GC92-7-Clients performance bond 15%	Detailed meeting scheduls made	**2**	
Consultants	**1**	Good work history		**1**			**1**	
Suppliers	**2**	Relatively trustworthy		**2**			**2**	
Other Contractors	**4**	Unknown	Meetings / refferences	**3**		Detailed meeting scheduls made	**2**	
Project Team	**1**			**1**			**1**	
Other	**-**			**-**			**-**	
Part sum,average (sum/6)	**2,2**			**1,7**			**1,3**	**1,7**
B- Project material								
Project proposal	**2**	ok for the bid		**2**			**2**	
Project material	**4**	Detail 2 work drawings not exist		**4**			**4**	
Contracts	**2**			**2**			**2**	
Other	**-**			**-**			**-**	
Part sum,average (sum/4)	**2,0**			**2,0**			**2,0**	**2,0**
C- Technical risks								
Are specific risk information available	**2**			**2** º			**2**	
Other	**-**			**-**			**-**	
Part sum,average (sum/2)	**1,0**			**1,0**			**1,0**	**1,0**
D- Own Organization								
Ability to execute the assigment (resources and competencies)	**5**	No history information		**5**			**5**	
Other	**-**			**-**			**-**	
Part sum,average (sum/2)	**2,5**			**2,5**			**2,5**	**2,5**
Sum,average A-B-C-D	**1,9**			**1,8**			**1,7**	**1,8**

Control form for the working environment of the site

Topic	Work area	Are the conditions ok		The problem is solved by	Date for solution of problems	Other
		Yes	No			
Access- traffic and transport routes						
Clearing and cleaning						
Handrails, coverings and barring						
Ladders and scaffolding						
Machinery and manual tools, shielding and maintenance						
Excavation and shoring						
Hoist and lifting equipment						
Light						
Signboards, cables and wires						
Dusty work						
Noisy work						
Dangerous substances and materials						
Welfare provisions						
Draught, heat, cold						
Other						

Date: Signature



NEW TOOLS.

THERMAL BRIDGES

DETECTION IN THE REFURBISHMENT

OF MULTI-STOREY HOUSES

Arnaldo Landivar Taborga –BK52

Index

Section 1.-Introduction to problem issue and the problem formulation pag.3

Section 2.-Literature study pag.6

Section 3.-Emperical case pag.10

Section 4.-Analysis pag.14

Section 5.-Main conclusion pag18

Section 6.-The future that deserves the building industry pag.19

Section 7.-Literature pag.21

Enclosures.- pag.22

INTRODUCTION TO THE PROBLEM ISSUE AND THE PROBLEM FORMULATION

1.-Introduction

Despite the financial crisis, nowadays, the building industry is a growing industry and in constant development, new materials have arisen and consequently new techniques for developing these new materials

Likewise, the technology applied for developing the building industry grows as well as the failure detection mechanisms in new buildings, and in order to detect these failures, we use:

- Concrete test hammers, to check the strength of a reinforced concrete.(Schmidt 1950)
- X-ray, to check weldings in steel structure frames.
- Cameras, to check the slope and the sealing joists in sewer concrete pipes.
- Thermographic pictures, to chek thermal and sound bridges, leaks in water pipes.
- Thermal software, to check thermal bridges and obtain U-values.
- Ground-penetrating radar (GPR), to detect failures in underground building services.

All these methods have in common the following aspects and they are:

- Non-destructive methods

- Used to detect failures when the works were finished

As the specialised publications says, a 60% building execution failures were detected in the design phase, therefore we would consider this phase as the most important phase to achive a succesful building development.

The design phase in refurbishmet of old buildings becomes important phase, as a matter of fact we work with:

- Buildings do not fullfill the current energy frame requirements.
- Buildings were built-up with obsolete and useless techniques.
- In many cases, there is a buliding deteroriation caused by the natural decaying of component materials.

2.-Problem formulation

Therefore,

Why not use some of those non-destructive methods as a tool in order to improve and achieve the building design?

Particularly in old buildings,

Why not use themography and thermal software in order to detect thermal bridges in the refurbishment of multi-storey houses in the outline phase?

How we can use those methods as tools in the refurbishmnt of multi-storey houses?

Could we use Thermography and Therm software as new tools to improve building refurbishment projects?

As a non-destructive method, thermography and thermal software would be used not only for detecting failures in new buildings, but also to preserve some building components in refurbishment of builldings heritage we would recommend this method, as much as possible.

LITERATURE STUDY

1.-Introduction

The pourpose of this report is to establish how important is to make a "failure preliminar report" in old multi-storey buildings in order to achieve and make an accurate Refurbishment Project specially in the energy frame requirements thereby we could reduce the energy consumption, improve the building envelope conditions and reach a sustainable and enviromental friendly building.

2.-Scope

The scope of this report is exclusively Refurbishment Projects of multi-storey houses.

3.-Normative References

- DS/EN 13187. Thermal performance of buildings -- Qualitative detection of thermal irregularities in building envelopes -- Infrared method.
- EN ISO 10211:2007. Thermal bridges in building construction -- Heat flows and surface temperatures -- Detailed calculations.
- EN ISO 10456:2007. Building materials and products -- Hygrothermal properties -- Tabuled design values and procedures for determining declared and design thermal values.
- EN ISO 6946:2007. Building components and building elements -- Thermal resistance and thermal transmittance -- Calculation method.

- EN ISO 10077-2:2003. Thermal performance of windows, doors and shutters -- Calculation of thermal transmittance -- Part 2: Numerical method for frames
- Danish Building Regulations 2008

4.-Definitions

- Building envelope: A region consisting of external surrounding line that contain the building
- Defect class: Defect criterion clasification (Samuelsen, Hans 1984, Insulation defects in buildings pag.16 and 17).
- Thermal/thermographic images: Image which is produced by an infrared radiation sensing system and which represents the apparent radiance temperature distribution over a surface.
- Isotherm: A region on the display consisting of points, lines or areas having the same infrared radiation density.
- Critical area: Area (structural details) of the building where experience show a great risk of defects (Nordic Committee on Building Regulations 1996, The significance of thermal bridges for heat loss from buildings pag 23):

    1. Basement/Wall
    2. Ground floor/Ext. wall
    3. Door and window sills

4. External wall corner
5. Floor slab/Ext. wall
6. Inner wall/Ext. wall
7. Floor/Slab balcony
8. Roof/External wall

- U-Value: Thermal transmittance of a flat structural element (surface) of a certain area (W/m2ºC)

5.-Development

Recently, the last years we have seen how the buildings energy frame requirements were evoluting.

If we take in account the crisis in the new building developing, that means that would be a possible encrease in Refurbishment Projects of multi-storey houses wich also means new energy frames requirements for those projects.

Therefore, for this pourpose a building preliminar report is necessary in order to check not only structural and design aspects, also the buildings´energy failures in order to improve our projects´ building envelope conditions.

Thereby, as the same time we begans with the building registration we recommended a visual inspection in order to determinate the defect class of the critical areas, these critical areas that we would inspected could gives us information about air leaks, that means thermal and acoustic bridges which could turns in moisture if there is an inappropriate buiding envelope conditions

(Engelund Thomsen and Rose from Danish Building Research Institute, 2009 Analysis of Execution Quality Related to Thermal Bridges).

Therefore:

- Thermal bridges
- Air leaks
- Moisture

There are the three main problems that we would have.

However, the thermographic images results of this method were qualitatives data and in order to achieve those results we need a previous data analysis, for analysing those datas we will use an auxiliar freeware software which is included in a tools catalogue for the thermal bridges evaluations and validations (Tilmans and Van Orshoven, 2009 Software and atlases for evaluating thermal bridges)

THERM, software developed by the BERKELEY University (USA), evaluates the 2D heat transfer through solids elements, with this software we obtain from the used models their U-values and also the isotherms images, these graphics would be used to compare the initial results from the thermal images taken from our studied detail in order to determinate its defect class.

EMPIRICAL CASE

1.-Introduction

The pourpose of this section is to make a “preliminar report” of the critical areas in an old multi-storey building in order to determinate the defect class type of these critical areas using as a tools the thermal images and Therm software as control software of the thermal images.

2.-Scope

The scope of this section is exclusively Refurbishment Projects of multi-storey houses.

3.-Normative References

- DS/EN 13187. Thermal performance of buildings -- Qualitative detection of thermal irregularities in building envelopes -- Infrared method.
- EN ISO 10211:2007. Thermal bridges in building construction -- Heat flows and surface temperatures -- Detailed calculations.
- EN ISO 10456:2007. Building materials and products -- Hygrothermal properties -- Tabuled design values and procedures for determining declared and design thermal values.
- EN ISO 6946:2007. Building components and building elements -- Thermal resistance and thermal transmittance -- Calculation method.

- EN ISO 10077-2:2003. Thermal performance of windows, doors and shutters -- Calculation of thermal transmittance -- Part 2: Numerical method for frames
- Danish Building Regulations 2008

4.-Definitions

- Defect class: Defect criterion clasification (Samuelsen, Hans 1984, Insulation defects in buildings pag.16 and 17).
- Thermal/thermographic images: Image which is produced by an infrared radiation sensing system and which represents the apparent radiance temperature distribution over a surface.
- Critical area: Area (structural details) of the building where experience show a great risk of defects (Nordic Committee on Building Regulations 1996, The significance of thermal bridges for heat loss from buildings pag 23):

  9. Basement/Wall
  10. Ground floor/Ext. wall
  11. Door and window sills
  12. External wall corner
  13. Floor slab/Ext. wall
  14. Inner wall/Ext. wall
  15. Floor/Slab balcony

16. Roof/External wall

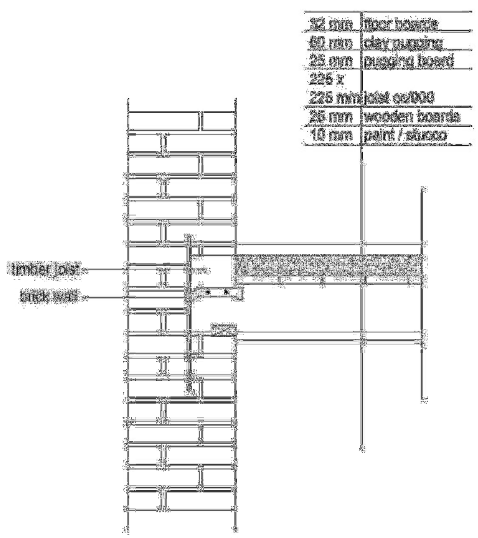
- U-Value: Thermal transmittance of a flat structural element (surface) of a certain area (W/m2ºC)

5.-Development

First of all we need to select the critical areas of our multi-storey building, then, the next step is to take pictures (thermal images) of these critical areas following the Danish Standar DS/EN 13187

At the same time, modelize the critical areas using Therm software in order to control and contrast the thermal images that was taken.

Those data allows us to know and anlyze the real scope of damage in each critical area and the best solution that we will achive in each one.



Floor slab/External wall connection

Detail from registration

On a thermal image, warm objects stand out well against cooler backgrounds. This makes it easy to identify un-insulated constructions and thermal bridges.

Thermal image example. For the preliminar report we need to take pictures of each critical area in this case for the following connection: floor slab/external wall.

ANALYSIS

1.-Introduction

The pourpose of this section is to analyse the obtained data in the previous section of the critical areas.

2.-Scope

The scope of this section is exclusively Refurbishment Projects of multi-storey houses.

3.-Normative References

- DS/EN 13187. Thermal performance of buildings -- Qualitative detection of thermal irregularities in building envelopes -- Infrared method.
- EN ISO 10211:2007. Thermal bridges in building construction -- Heat flows and surface temperatures -- Detailed calculations.
- EN ISO 10456:2007. Building materials and products -- Hygrothermal properties -- Tabuled design values and procedures for determining declared and design thermal values.
- EN ISO 6946:2007. Building components and building elements -- Thermal resistance and thermal transmittance -- Calculation method.
- EN ISO 10077-2:2003. Thermal performance of windows, doors and shutters -- Calculation of thermal transmittance -- Part 2: Numerical method for frames

- Danish Building Regulations 2008

4.-Definitions

- Color infrared map: A region on the display consisting in areas having the same temperature.
- Flux vector map: A region on the display consisting in vectors showing the heat loss path.
- Isotherm: A region on the display consisting of points, lines or areas having the same infrared radiation density.
- Critical area: Area (structural details) of the building where experience show a great risk of defects (Nordic Committee on Building Regulations 1996, The significance of thermal bridges for heat loss from buildings pag 23):

    17. Basement/Wall
    18. Ground floor/Ext. wall
    19. Door and window sills
    20. External wall corner
    21. Floor slab/Ext. wall
    22. Inner wall/Ext. wall
    23. Floor/Slab balcony
    24. Roof/External wall

- U-Value: Thermal transmittance of a flat structural element (surface) of a certain area (W/m2ºC)

5.-Development

The combination of the thermography method and the Therm analysis provides us the following **advantageous resuslts**:

- Non-destructive methods
- Color infrared temperature maps to compare the thermal images that was taken before in order to see the coolest areas, we also could see the thermal bridges.Fig 1

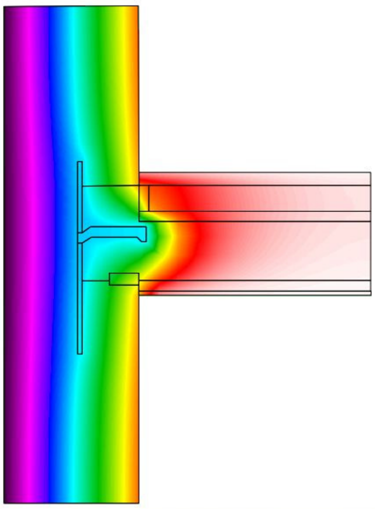


Fig 1

- Isotherm maps that help us to determinate and calculate moistures and condensation. Fig 2

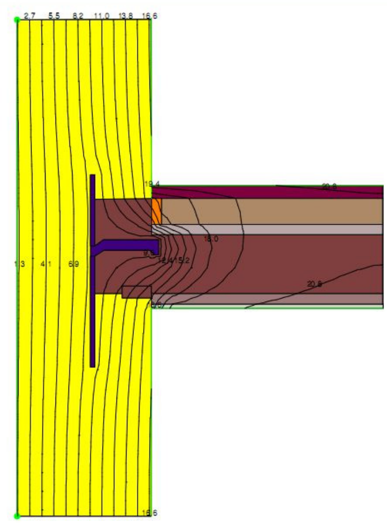


Fig 2

- Flux vector maps to determinate the heat loss paths and where are located the thermal bridges. Fig 3.

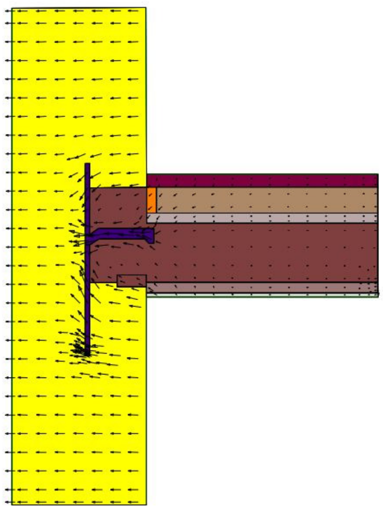


Fig 3

Furthermore, we could obtain a U-value that help us to reach this building requirement, if it is needed.

MAIN CONCLUSION

At the introduction of this report the following question was fomulated:

“Could we use Thermography and Therm software as new tools to improve building refurbishment projects?”

Yes.

The fact is that we shoud use these tools.

As we saw in the previous section using the Thermography and Therm software we have two powerful tools to detect critical areas failures in the building envelope to determinate the defect class in order to make a “preliminar report” that allows us to improve in the solution of construction details for the Refurbishment Project

And in the same way using these tools we prevent thermal bridges and save building energy consumption

THE FUTURE THAT DESERVES THE BUILDING INDUSTRY

Nowadays Global warming it is a fact, being co2 emisions one of the main factors for this, take control of these emisions and reduce the energy consumption are very important topics in the agenda of International Organizations as the Kyoto Protocol and the IPCC (Intergovernmental Panel of Climate Change) established by the UNEP (United Nations Environment Programme) and the WMO (World Meteorological Organization)

In the same point of view for decreaseing the building energy consumption and the building rating there are the ASIEPI (Assessment and Improvement of EPBD Impact) and the EPBD (Energy Performance of Buildings Directive) organizations which depends from European Commission for Energy and Transport

This report introduce us a sort of tools, such as thermography and therm software, that would help us to going deep in the buildability of constructions details and solutions that will taken place not only in new projects, also in Refurbishment projects of multi-storey houses.

The research in thermal bridges and their influences in the building energy consumption and in the buliding energy rating are some of the goals of the abovemention organizations, to reach more sustainable and friendly enviromental buildings

Those researchs takes an account of less building energy consumption in heating which that means an increase of U-values, however, what happens with the use of the Aconditionig Air? There are researchig lines in that way that says the opposite: a decrease of U-value (less building thermal bridges) means, an higher building energy consumption.

Therefore, we need to make a balance between the heating and cooling building energy consumption.

Other topics for researching lines in that way are:

- The airtightness in ducts in order to control the airflow in the ventilattion systems
- Innovative systems in the hybrid ventilation systems.

Thereby, there is a great sensibilty by the UE to compare all the building energy-frames requirements across Europe in order to know which ones were applied correctly instead which ones were more severe acording a list to consider in the calculations procedures.

“Regulations are only useful if they are respected” Peter Wouters, ASIEPI coordinator.

LITERATURE LIST

1/Pettersson, Bertil and Axén, Bengt 1980, Thermography.Testing of the thermal insulation and airtightness of buildings.ISBN: 91-540-3171-0.

2/DS/EN13187, Dansk Standard 1998, Thermal performance of buildings. Qualitative detection of thermal irregularities in building envelopes. Infrared Method.

3/Nordic Committee on Building Regulations 1996, The significance of thermal bridges for heat loss from buildings.ISBN: 951-53-1450-X.

4/Nielsen, Tommy 1984, Continuos automatic recording of energy balance in buildings.ISBN: 87-7511-448-8.

5/Samuelsen, Hans 1984, Insulation defects in buildings.ISBN: 87-7511-401-1.

6/Olsen, Damsgard Arne and others 1984, Research on buildings general quality of insulation.ISBN: 87-7511-442-9.

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8/Santamouris, M 2005, Energy Performance of Residencial Buildings: a practical guide for rating and efficiency. ISBN: 1-902916-49-2

9/Danish Technological Institute: www.dti.dk.

10/Assesment and Improvement of the EPbd Impact: www.asiepi.eu

11/Energy Performance of Buildings Directive: www.epbd-ca.org

12/Build up.Energy solutions for better buildings: www.buildup.eu

ENCLOSURES

[European projects]

P152

16-03-2009

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More information can be found at the ASIEPI project website: *www.asiepi.eu*

Similar Information Papers on ASIEPI and/or other European projects can be found at the Buildings Platform website: *www.buildingsplatform.eu*

Software and atlases for evaluating thermal bridges

Different tools are available for evaluating thermal bridges. This paper provides information on software and atlases that are frequently used in the Member States. The European/International standard EN ISO 10211 is also briefly presented: it establishes the conventions to be followed when modelling thermal bridges, and provides for the validation of software.

1 > Objectives of the paper

As described in Information Paper P064, thermal bridges must be taken into account in the EPB-regulations of most European Member States (MS). The detailed evaluation of the linear thermal transmittance ψ [W/(mK)] or the point thermal transmittance χ [W/K] is one of the options to do this. Specific tools are needed to determine the ψ or χ values. There are two kinds of tools: numerical calculation software and thermal bridge atlases. Numerical calculation should be carried out using validated software and following rules that are usually given in a standard, which in the framework of EPB-regulations is usually the European/International standard EN ISO 10211 *[1]*. In a first section, the present paper will summarize the content of this standard and the rules to be followed for the modelling of thermal bridges. The validation test cases of this standard will then be described. In a second section, a survey of software tools for thermal bridge calculations will be given. Finally, the available atlases used in the different MS will be presented.

This paper is based on an internal ASIEPI survey of the following countries: Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Netherlands, Norway, Poland, Romania, Spain and the United Kingdom.


EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM
EN ISO 10211
December 2007
Thermal bridges in building construction - Heat flows and surface temperatures - Detailed calculations (ISO 10211:2007)

The front page of EN ISO 10211:2007.

2 > The EN ISO 10211 standard for the calculation of thermal bridges and other transmission standards

As mentioned above, most of the EPB-regulations of the MS refer to the standard EN ISO 10211 for the detailed numerical calculation of the linear thermal transmittance of thermal bridges. In this section, we present two aspects of this standard: the modelling rules and the validation test cases. It should be noted that the description given below is only a short summary of the standard and is not intended to be comprehensive. The goal is to outline the procedure for the modelling of a thermal bridge detail in software and to emphasize the need for software validation.

Intelligent Energy Europe

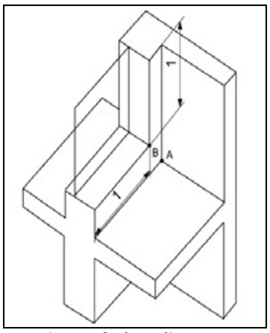
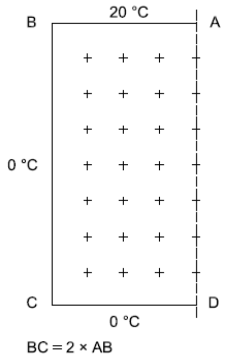


Illustration of the distances of the cut-off planes from the thermal bridge in point B (EN ISO 10211).

Modelling rules

The first set of important rules are those that concern the dimension of the numerical model. As the goal is to model a part of the whole building including the thermal bridge, cut-off planes must be defined so that the impact of the thermal bridge is the same as if the entire building was to be directly calculated. EN ISO 10211 *[1]* defines minimum distances between the cut-off planes and the investigated thermal bridge. These distances depend on the particular detail investigated. Generally speaking, a distance of 1 meter from the thermal bridge is required, but for example, when a symmetry plane is present at a closer distance, this symmetry plane is used as the cut-off plane. In case of the presence of ground, a larger zone around the thermal bridge in the ground is modelled. Another aspect related to the geometry of the model concerns the simplifications that are allowed. These simplifications mainly concern thin layers, the use of quasi homogeneous layers that incorporate minor thermal bridges, and changes related to the external or internal surface positions or interfaces.

Another set of rules concerns the conditions that should be applied at the boundaries of the model and the thermal conductivities or thermal resistances that should be used. The thermal conductivity of the building materials should be determined according to the standard EN ISO 10456 *[2]* or national conventions. For air layers and cavities, the thermal resistances can be determined according to different standards (EN ISO 6946 *[3]*, EN 673 *[4]* and EN ISO 10077-2 *[5]*), depending on the particular building element modelled. The boundary conditions consist of the temperatures and the surface resistances, or the heat fluxes. Temperatures can generally be freely chosen (but should be realistic in relation to radiative heat transfer), whereas surface resistances depend on the direction of the heat flux and on the purpose of the thermal bridge calculation. For surface resistances for the calculation of the linear thermal transmittance, reference is made to the EN ISO 6946 *[3]*, but simplification rules are given in addition. It should be noted that for the evaluation of the risk of superficial condensation, specific surface resistances are to be used, which are given in the standard EN ISO 13788 *[6]*.
While many other rules are described in the standard EN ISO 10211 *[1]*, it is beyond the scope of this paper to mention all of them.



Analytical solution at grid nodes (°C)			
9,7	13,4	14,7	15,1
5,3	8,6	10,3	10,8
3,2	5,6	7,0	7,5
2,0	3,6	4,7	5,0
1,3	2,3	3,0	3,2
0,7	1,4	1,8	1,9
0,3	0,6	0,8	0,9

Test reference case 1 of the annex 1 of the EN ISO 10211.

Test cases for software validation

Annex A of EN ISO 10211:2007 *[1] defines* four different test cases for the validation of software. Two of them are two-dimensional (2D) models; the other two are three-dimensional (3D) models.
In order for software to be classified as a 2D steady-state high precision method, it should be able to calculate test cases 1 and 2 (2D test cases) and to fulfil the requirements associated with these.
In order for software to be classified as a 3D steady-state high precision method, it should be able to calculate all four test cases (2D and 3D test cases) and to fulfil the requirements associated with these.
Unfortunately, a couple of small but annoying errors with respect to the sign conventions have slipped into case 3[1] and case 4[2] of Annex A of EN ISO

---

1 Practically speaking, it concerns the following points:

- figure A.3.b: the boundary condition between A and C should be γ
- equation A.5 should read: $\Phi_{\beta,\alpha}$ = ...= 2,094 x (15-20) = -10,47 W
- equation A.7 should read: $\Phi_{\beta,\gamma} + \Phi_{\alpha,\gamma}$ = 24,36 + 35,62 = 59,98 W
- equation A.8 should read: $\Phi_{\beta,\gamma} + \Phi_{\beta,\alpha}$ = 24,36 - 10.47 = 13,89 W
- equation A.9 should read: $\Phi_{\alpha,\gamma} + \Phi_{\alpha,\beta}$ = 35,62 + 10,47 = 46,09 W

2 Second paragraph of the section A.1.5 Case 4 : "lowest internal surface temperatures" to be replaced by "highest surface temperature on the external side"

10211:2007. Even though the corrections are self-evident, so as to avoid any further confusion and officially remove any doubts, it seems warranted to publish a corrigendum in the short term (which should also include the correction of other small mistakes elsewhere in the text).
This practical example is illustrative of easily avoidable errors, which regrettably occur more often in definitive versions of standards. Generally speaking, the authors themselves make great efforts and sacrifices, often in difficult working conditions, so as to deliver texts as good as reasonably achievable. In order to reduce the occurrence of such type of evident errors in future standards/revisions, structural improvements in the standardisation process seem therefore called for. These may include such things as the structural and systematic provision of sufficient means and financing allowing for the development of high quality standards, and the institution of systematic final quality checking procedures (e.g. by remunerated third persons, not previously involved in the drafting process).
In the framework of EPB-regulations, it seems highly desirable that all MS explicitly require that software used for thermal bridge calculations fulfill at least these test cases. From the survey, it appears that this is actually already the case in the Czech Republic and in Spain, and it is planned in Belgium.
While the validation according to the EN ISO 10211 *[1]* gives a first indication of the quality of the calculation software, it appears that these test cases are not sufficient to ensure that the software will correctly calculate all situations encountered. Indeed, the four test cases are all based on rectangular geometries, so that errors or imprecisions related to non-rectangular situations are not addressed. Nor do the test cases cover any kind of air layers, losses through the ground or more complex boundary conditions.
Often, software capable of doing thermal bridge calculations can also calculate heat transfer through window frames. For this type of calculation, a set of ten test cases is given in Annex D of the European/International standard EN ISO 10077-2:2003 *[5]*. The successful validation of software according to this standard widens the scope of applicability of the software and increases the degree of confidence about the general quality of the software.

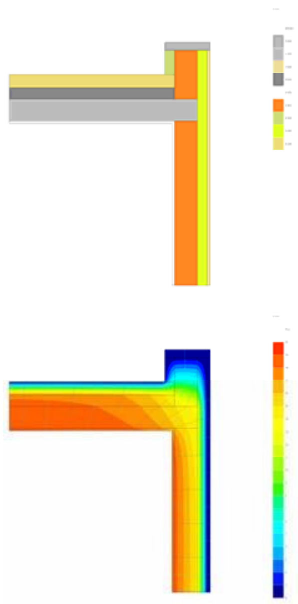
Other European/International transmission standards

EN ISO 10211:2007 *[1]* is part of a larger suite of standards that together should deal with all the aspects of thermal transmission calculations. It concerns among others EN ISO 13789 *[7]*, EN ISO 6946 *[3]*, EN ISO 13370 *[8]* and EN ISO 10077-1 *[9]* and -2 *[5]*. However, when systematically and rigorously applying the standards, a number of issues remain unanswered, or it is unclear how the recent changes in another standard affect thermal bridge calculations. This is for instance the case for slightly ventilated air layers. Different readers have different interpretations for the application to thermal bridges. Additional specifications or examples in the standard could clarify such issues.

Although in past revisions great strides have already been made to better adjust the different transmission standards among each other, some voids and inconsistencies still remain. Therefore, in order to achieve a fully streamlined set of transmission calculation rules, it appears desirable that at the time of the next revision of these standards, they are merged into one single standard, with unified definitions, terminology and symbols. This may better guarantee that the total coherence among all different aspects is fully thought through in the published text. The present standards of the transmission suite could then become different parts of such a fully adjusted, unique standard.

3 > Software tools

Over the past 2-3 decades, dedicated software for the numerical calculation of thermal bridges has been developed, in pace with the astounding advance of computer technology. From experimental research tools for specialists on basic computing machines in the early days, these tools have become ever more powerful and user-friendly, lowering the threshold for more generalised use. Their present features are already impressive, and there is no reason to assume this evolution will cease. The table below gives an overview of a selection of current software, with the characteristics and abbreviations as explained below. All the software is available in an English language version, except when otherwise indicated.



Example of a model and the associated results from a numerical calculation.

Name	Type	2D/3D	SS/TR	FF/RECT	ψ-value	License	Validation
Heat transfer software							
AnTherm [36]	H-T (1)	3D	SS	R	Y	commercial	EN ISO 10211:2007 EN ISO 10077-2:2003
Argos (2) [37]	H-T	2D	SS	FF	Y	commercial	
Bisco / Bistra [38] / [39]	H-T	2D	SS / TR	FF	Y	commercial	EN ISO 10211:2007 EN ISO 10077-2:2003
Champs-bes [40]	HAM-T	2D	TR	R		free	EN ISO 10211:2007
David32 [41]	H-T	3D	SS	R		free	EN ISO 10211:2007
Delphin [42]	HAM-T	2D	TR	R		commercial	EN ISO 10211:2007 HAMSTAD Benchmarks 1 to 5 EN 15206:2007
Flixo [43]	H-T	2D	SS	FF	Y	commercial	EN ISO 10211:2007 EN ISO 10077-2:2003
FramePlus [44]	H-T					commercial	
HAMLab [45]	HAM-T	3D	TR	FF		free	(3)
Heat2 [46]	H-T	2D	TR	R	Y	commercial	EN ISO 10211:2007 EN ISO 10077-2:2003
Heat3 [47]	H-T	3D	TR	R	Y	commercial	EN ISO 10211:2007
KOBRA v3.0w (4) [48]	H-T	3D	SS	R	Y	free (5)	EN ISO 10211:2007
KOBRU86 / Sectra [49] / [50]	H-T	2D	SS / TR	R	Y	commercial	EN ISO 10211:2007
RadTherm [51]	H-T	3D	TR	FF		commercial	
Solido [52]	H-T	3D	SS	FF		commercial	EN ISO 10211:2007
TAS ambiens [53]	H-T	2D	TR	FF		commercial	
Therm [54]	H-T	2D	SS	FF		free	
Trisco / Voltra [55] / [56]	H-T	3D	SS / TR	R	Y	commercial	EN ISO 10211:2007
Unorm [57]	H-T	3D	SS	R	Y	free	EN ISO 10211:2007
WUFI 2D 3.2 [58]	HAM-T	2D	TR	FF		commercial	EN ISO 10211:2007
General purpose software							
Ansys multiphysics [59]	M-Phys	3D	TR	FF		commercial	
Ansys CFX [60]	M-Phys	3D	TR	FF		commercial	
Fluent [61]	M-Phys	3D	TR	FF		commercial	
Phoenics [62]	M-Phys	3D	TR	FF		commercial	
Comsol multiphysics [63]	M-Phys	3D	TR	FF		commercial	EN ISO 10211:2007
SAMCEF thermal [64]	H-T	3D	TR	FF		commercial	

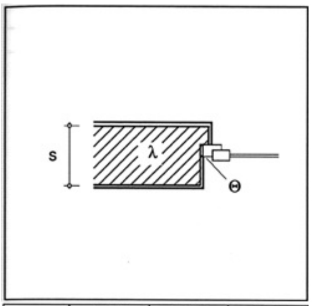
(1) Vapour diffusion can also be calculated
(2) Only available in German
(3) Not directly validated, but uses Comsol multiphysics as calculation core
(4) Only available in Dutch and French
(5) At present only for construction projects on Belgian territory

- Capabilities of the software : Heat Tranfer only / Heat, Air and Moisture transfer / general, MultiPhysics (H-T, HAM-T or M-Phys): The physical models included in software can vary. Some of them are able to model heat and moisture transfer through building components, while others are limited to heat transfer or can model a wide range of physical phenomena (fluid flow, heat conduction, radiative heat transfer, etc.).
- 2D/3D: some software has only the capability of calculating 2D models. Note that usually, 3D software can also be used to calculate 2D models.
- Steady-state or transient (SS or TR): Some software can only calculate equilibrium temperatures and heat fluxes in a model (steady-state simulations). While transient simulations are usually not required for thermal bridge calculations within the framework of EPB-regulations, they can be useful for example for calculations of heat losses through the ground with periodic variation of external conditions (see § 10.5 of EN ISO 10211 *[1]*). Note that software capable of calculating transient cases can usually also calculate steady-state solutions.

- Free-form/rectangular model (FF or R): Some software is limited to rectangular models while others can calculate free-form models.
- Automatic calculation of the linear thermal transmittance (ψ - value: Y): In some software, the linear thermal transmittance according to EN ISO 10211 is calculated automatically.
- Free/commercial : some software is distributed free of charge, other under an open source license, and still other is commercially licensed.
- Validations : As mentioned above, validation test cases are defined in the EN ISO 10211:2007 *[1]*. Some software is validated according to this standard. Others can either be validated according to another standard or are not explicitly validated at all (or validated according to a superseded standard, e.g. EN ISO 10211-1:1995). Most software is validated in one way or another, but in the present paper we only report validations according to the standards.

4 > Thermal bridge atlases

While the evaluation of linear thermal transmittance can be done using software as explained above, for standard details it may be easier and faster to make use of an atlas of thermal bridge details. The main advantage of using such atlases is that no calculations are needed, so the information can be obtained rapidly and with less preliminary knowledge. The main disadvantages are that the number of details necessary to cover the many situations encountered in reality is quite large, and the flexibility is usually lower. Moreover, when using an atlas, one must make sure that the conventions used for obtaining the values of the atlas are in accordance with the conventions set by the national EPB-regulations. Atlases that aren't general enough may therefore not be applicable in all countries. This is less of a problem with software though, as it is more flexible.



s [cm]	λ = 0,21		λ = 0,56		λ = 0,99	
	WBV	Θ	WBV	Θ	WBV	Θ
24	0,04	0,75	0,07	0,69	0,11	0,62
30	0,05	0,74	0,10	0,67	0,14	0,60
36,5	0,07	0,73	0,12	0,66	0,18	0,60

Example of data given in a thermal bridge atlas (taken from [18]).

There are different kinds of thermal bridge atlases. Many exist as stand-alone documents, originally developed independently of the EPB-regulation. But in some Member States, thermal bridge atlases have been developed specifically for the EPB-regulation. Such atlases can be of the ordinary type, i.e. a simple collection of building details with corresponding values of interest (e.g. linear thermal transmittance, temperature factor,...). Or it can be a set of details that are considered as good-practice details in the framework of the EPB-regulations. The latter approach is an important evolution in the way of dealing with thermal bridges. This change started about a decade ago. Focus has been shifting from ever more systematic and detailed analysis of thermal bridges to their avoidance as much as reasonably possible. A detailed quantification of thermal bridges is then usually considered as no longer necessary, and the designer is dispensed with this time-consuming task, a task that by itself does not solve the thermal bridge. This important new development will be presented in a future ASIEPI Information Paper.
Finally, values of linear thermal transmittances are also given in the European/International standard EN ISO 14683 *[10]*. But the number of details in this standard is small, they are rather simplistic, and the values are on the safe side, which makes it quite difficult to use it in practice to obtain precise evaluations of the thermal bridges.

The table below summarizes the main atlases that are used in the surveyed countries. A special case of an atlas is the highly flexible electronic atlas "KOBRA", initially developed as a DOS programme in the framework of the European project "Eurokobra" and more recently made compatible with the Windows operating system. In this atlas, the dimensions, the thermal conductivities and the boundary conditions of predefined topologies can be changed and the value of the linear thermal transmittance is accurately

recalculated for the precise case. It is thus in effect a combination of an atlas and a numerical calculation programme, but it requires no specific modelling knowledge of the user.
While in most of the surveyed countries thermal bridges atlases are reported in common circulation, they don't appear to be widely used in Greece, Italy, the Netherlands and Finland.

Flexibility of an atlas is to be understood as follows:
Y: a number of variations of parameters (dimensions, thermal conductivities,…) is taken into account for each detail
N: no variations of the parameters

Name	Language	Number of details	Types of buildings	Flexibility	Integral Part of EP-reg	In use in MS…
EN ISO 14683 : Thermal bridges in building construction - Linear thermal transmittance - Simplified methods and default values (ISO 14683:2007) [10]	English	76	Residential	N	N	Europe
KOBRA v3.0w [11]	French and Dutch	3000+	All types	Y	N	Belgium
Construction details – Thermal Bridges [12]	Czech	56	All types	Y	N	Czech Republic
U-values 2003 [13]	Danish	2000+	All types	N	N	Denmark
Danish Standard 418. Calculation of heat loss from buildings [14]	Danish	275+	All types	N	Y	Denmark
2005 thermal regulation, Th-U 5/5 Thermal bridges for new building [15]	French	10000+	New building	Y	Y	France
Th-U 5/5 Thermal bridges for existing building [16]	French	3000+	Existing building	Y	Y	France
Thermal bridge atlas for wooden constructions [17]	German	3000+	Wooden constructions wall, ceiling, roof	Y	N	Germany
Thermal bridge atlas for brick constructions [18]	German	8000+	Brick constructions with/without insulation, ceiling, roof	Y	N	Germany
Building Research Design Sheet 471.017. Thermal bridges - Tables with ψ values [19]	Norwegian	23	All types	Y	N	Norway
Electronic atlas of thermal bridges ("Kuldebroatlas") [20]	Norwegian	23+	All types	Y	N	Norway
Thermal bridges - Calculation, ψ values, and influence on energy consumption. Project report 25-2008 [21]	Norwegian	31	All types	Y	N	Norway
Thermal Bridges Catalogue Traditional Buildings [22]	Polish	100+		N	N	Poland
Thermal bridges. Basics, simple formulaes, heat loss, condensation, 100 calculated building details. [23]	German	100	All types	N	N	Austria
Thermal Bridges in Constructive Elements Catalog for Building Technical Code [24]	Spanish	300+	All types	Y	Y	Spain
Building regulation STR 2.05.01:2005 "Thermal technique of the building envelope", Annex 7 [25]	Lithuanian	200	All types	Y	Y	Lithuania
Thermal bridges catalog [26]	German	200+	All types	Y	N	Switzerland
Code for thermal energy performance calculation of building's elements C107/3-2005 [27]	Romanian	1500+	All types	N	Y	Romania
Limiting Thermal Bridging and Air Infiltration Acceptable Construction Details [28]	English	150	All types	Y	Y	Ireland
Accredited construction details [29]	English	150	Dwellings	N	Y	United Kingdom
Accredited construction details (Scotland) [30]	English	130	Dwellings	N	Y	United Kingdom
Enhanced Construction Details [31]	English	47	Dwellings	N	N	United Kingdom
Thermal bridge catalog [32]	German	323	All types	Y	N	Germany
BuildDesk (1) [33]	Polish	100+	All types	N	N	Poland
CERTO (1) [34]	Polish	100+	Traditional and concrete panel	N	N	Poland
Thermal bridge catalogue for renovation and retrofit measures to prevent mould [35]	German	92	All types, renovation	Y	N	Germany

(1) Certification software that also contains a thermal bridge atlas

5 > Conclusions and recommendations

From the survey summarised in this paper, it can be seen that many tools exist for the evaluation of thermal bridges.
Concerning the software, the main problem encountered at the start of the enquiry was the lack of systematic and up-to-date proof of validation. At the time of publication of this paper, some software still did not have documented validation. There lingers a certain degree of doubt over the calculation results of such non-validated software. Their use in the framework of EPB-regulations of MS should therefore better be avoided.
Concerning the thermal bridge atlases, it appears that a whole collection of such documents is available. Most of them are written in the language of their original country and are not translated. Of course, this may be one of the main reasons that renders the use of such documents difficult in other countries.

Overall, the following practical recommendations can be formulated to the different main actors:

- Member States:
    - They can be advised to explicitly require that software used in the context of their EPB-regulation at least satisfies the validation cases of the most recent version of EN ISO 10211. At present this is the publication of 2007.
- CEN/ISO:
    - It seems highly desirable to publish in the short term a corrigendum for the errors in cases 3 and 4 of annex A (and elsewhere in the text) of EN ISO 10211:2007.
    - In order to avoid repetition of such type of errors in future standards/revisions, structural improvements and systematic quality checks in the process of establishing standards might be indicated. This may require additional funding.
    - In a future revision of the EN ISO 10211, a more comprehensive set of validation test cases seems warranted, e.g. also encompassing more complex boundary conditions, non-rectangular geometries and air layers.
    - Further improvement, streamlining and clarification of the EN ISO transmission standards appear desirable: this can probably best be achieved by merging all present standards from the transmission suite into (different parts of) one single, fully coherent standard, with unified definitions, terminology and symbols.
- Software developers:
    - Validate systematically and continuously all thermal bridge software according to the latest versions of European and International standards and other benchmarking methods, and publish any proof of validation (including calculation files) on the internet.
    - Continue the further improvement of the capabilities and user friendliness of thermal bridge software.
- Translation of the available atlases in English, in order to allow a wider use. This may in particular be relevant for the new generation of atlases with solutions to avoid/minimise thermal bridges. In this way the Member States can profit from the efforts of each other and of common European developments. The topic of such solution-oriented atlases will be discussed in more detail in a future Information Paper.

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[European projects]

P159

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Analysis of Execution Quality Related to Thermal Bridges

Execution quality can have a significant effect on the energy consumption of buildings. The occurrence of thermal bridges due to faulty execution can increase heat losses dramatically and in the worst case even result in moisture problems and have a drastic impact on the indoor climate. At present, there is little or no information available on this topic. Therefore, a study has been set up within the framework of the ASIEPI project funded by the Community's Intelligent Energy Europe programme, to collect information from each of the participating Member States (MS) concerning execution quality. This paper presents the results of that study along with a proposal for stimulating and checking execution quality.

More information can be found at the ASIEPI project website: *www.asiepi.eu*

Similar Information Papers on ASIEPI and/or other European projects can be found at the individual project websites and in the publications database of the BUILD UP Portal: *www.buildup.eu*

1 > Effect of thermal bridges due to faulty execution

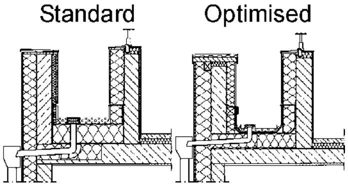
It is a well-known fact that thermal bridges can increase the transmission heat loss of buildings significantly, especially as we move towards higher and higher insulation levels in both our new and existing buildings. Thermal bridges have been the focus of many studies in Europe over the last decades and today we have at our disposal highly developed calculation tools along with thermal bridge atlases for assessing their effect. This presents an opportunity to minimise thermal bridge effects during the design phase of a building project; however, in the transition from theory to practice there is a risk of introducing thermal bridges due to faulty execution.

This paper does not include thermal bridges occurring due to air movement inside constructions (convection), air tightness etc. The latter are dealt with in a separate work package of the ASIEPI project.

A study was set up to quantify the effect of thermal bridges due to faulty execution. The study encompasses two different analyses: 1) a survey among the participating MS concerning previous individual national studies on the influence of execution quality and 2) a questionnaire containing questions pertaining to methods for assessing and stimulating execution quality, i.e. an attempt to quantify what affects the execution quality.

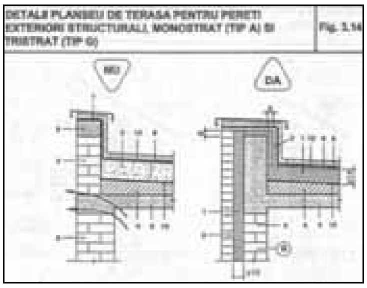
2 > Summary of existing studies concerning execution quality related to thermal bridges

Only a few studies exist on execution quality with regard to thermal bridges among the participating MS.



Sample from German study. Component joint of a roof terrace in standard (left) and optimised (right) design.

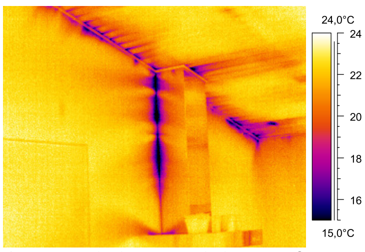
In Germany, a study was made on Burgholzhof in Stuttgart where approximately 800 low energy accommodation units were built [1]. The building process of 39 multi-family houses was monitored and the purpose of the study was to supervise 3 parts of the building process, i.e. 1) energy



Sample from Romanian study. Detail of the connection between external wall and terrace, bad (NU) and good (DA) solution.

performance certification, 2) check of building joints in both the design and realisation phases and 3) check of building materials used on the construction site. The study showed that there were on average 2.8 critical design details per building that needed to be corrected. On-site visits resulted in more than 100 protocols concerning both material choices and execution of building details. All in all execution quality was good; however, the recommendation was to have building inspections during execution in future buildings to avoid defects and increased energy losses.

Romania reports three studies that were performed nationally; two studies deal with experiences from existing buildings (retrofitting) and one deals with experiences from new buildings. The first study [2] contains general solutions for increasing the energy performance of existing buildings by renovating especially construction joints (thermal bridges). The study focuses on 37 details that are critical parts of the construction. The second study [3] shows typical building details for 23 cases that are relevant for new buildings. This study shows both good and bad solutions in order to emphasise the importance of correct execution. The third study [4] from Romania is a normative reference concerning methods for assessing the execution quality in existing buildings. Among others, infrared thermography is suggested as a method to assess execution quality.

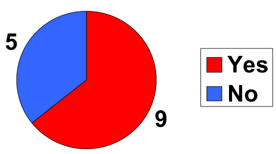


Determining positions of thermal bridges in building constructions by infrared thermography.

The England and Wales 2010 proposals include inclusion of so-called safety factors for claimed thermal bridge heat losses that are not accredited and well-tried details. These safety factors are introduced because they might cause problems with regard to execution quality (i.e. since builders have not used them before they are more likely to make mistakes), and furthermore hence their values (linear thermal transmittances or point thermal transmittances) are uncertain. Evidence for theoretical values will be required - in principle - so that uncertainty should not be any greater than for accredited details. Execution quality is certainly a concern for unfamiliar/untested details.

3 > Summary of questionnaire concerning assessment and stimulation of improved execution quality

A questionnaire was distributed among the participating MS in the ASIEPI project, in order to establish the state of assessing and improving the execution quality. The results are summarised in the following.



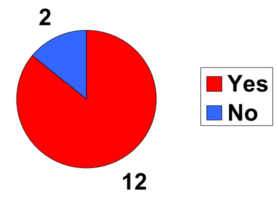
Is infrared thermography used on new buildings in your country?

Infrared thermography

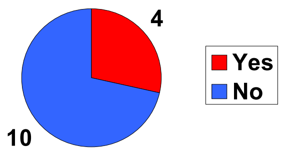
Infrared thermography is the most powerful technique for determining position and to some extent magnitude of thermal bridges in existing buildings. The technology has developed a lot over the last decades, and today everyone can operate FLIR (Forward Looking InfraRed) cameras. Prices have also plummeted, and today cameras can be purchased at prices below €3,000, making it a cheap and easily accessible technology.

Infrared thermography is not a legal requirement in any of the participating Member States. Infrared thermography is in general not used extensively anywhere and is primarily used in connection with low energy buildings, research or education projects or under circumstances where there are judicial disputes concerning building execution quality. Either infrared thermography is used by itself to locate thermal bridges -or it is used in connection with blower door tests to establish the location of air leakages.

In Denmark, infrared thermography is used on some new buildings. There is a legal requirement in the Danish Building Regulations stipulating that at least 5 % of new buildings should be tested for airtightness by blower door,



Are inspections carried out during and/or after the building process of new buildings in your country?



Do you have any other specific methods for assessing execution quality in your country?

and that this test should always be accompanied by infrared thermography in order to pinpoint the location of any leakages. It is the responsibility of the local authorities to ensure that this part of the Building Regulations is fulfilled.

Finland lists infrared thermography as part of the normal quality control for new buildings; however, there is still no legal requirement to perform the analysis and it is up to the future building owner to request a test.

Building inspections (during and after the building process)

Building inspections with focus on energy during and after the building process of new buildings is a method for ensuring that the building is realised as originally planned. In opposition to infrared thermography, building inspections can be carried out during the building process, making it possible to pinpoint and correct any faulty execution before the building is finished.

In the MS, there is a general tendency towards the use of inspections during and after the building process – especially for larger buildings. In most countries, there are legal requirements for inspections; however, these inspections seldom/never focus on energy consumption and thermal bridges, but rather on health, safety, structural elements and load-bearing capabilities. In some MS, the inspections also serve the purpose of ensuring that the realised building follows the design specifications used for obtaining the building permit.

In Italy there is a legal requirement for inspections during the building process and it is the responsibility of the local authorities that they are performed. In practice, however, inspections are rarely carried out due to limited resources (financial and human) of the local authorities/provinces.

Romania has mandatory inspections during the most important phases of the building process, but they do not include focus on energy use or thermal bridges. At the end of the building process, the local authorities and the Government Building Inspectorate will perform inspections to ensure that the realised building is as originally planned.

Norway has recently drafted new rules, proposing compulsory independent third party inspections after the building process. The rules are expected to be introduced in 2010.

Denmark uses a third party energy certification scheme for all new buildings. The certification covers all energy-related installations/parts of the building that can be inspected visually (pipe insulation, boiler characteristics, fan power usage etc.).

Alternative methods for assessing and stimulating execution quality

The participating MS were asked to list any alternative methods used in their individual countries for assessing and stimulating execution quality.

Finland mentions that a few specialised consultants have equipment for performing gas-concentration measurements of gas-filled windows.

In Germany, visual checks (inspections) are performed with specific focus on checking for thermal bridges if requested by the building owner. Comparing details on the construction site with design drawings makes this task easier.

For some building projects, Norway uses especially trained people to investigate the building design before the building process is initiated. This investigation focuses on weeding out details that may cause problems. Any problematic details found through the investigation can then be redesigned. The investigation will typically also result in a series of suggestions concerning specific inspections or measurements that should be carried out during the building process.

Incentives or penalties to stimulate/ensure good execution quality

A method for stimulating/ensuring good execution quality is to have incentives and/or penalties. The participating MS were asked in the questionnaire to list any incentives/penalties used in their respective countries.

All countries penalise bad execution quality and most have penalties that have direct (fines) or indirect (halting the building process or prohibiting building use) economic consequences for the building contractor. In the most serious cases, the responsible executive manager and/or technical supervisor may loose their certificates/licenses.

Only a few countries have incentives for stimulating good execution quality. Typical incentives come in the form of governmental funding or reduced taxes for building low-energy buildings or passive houses. The incentives are typically connected with time-limited programmes.

4 > Proposal for stimulating and assessing execution quality

The final question of the questionnaire asked the participating MS to list any suggestions they had for stimulating and assessing execution quality. Based on their answers we have drawn up a proposal for stimulating and assessing good execution quality.

Sticks:

- Inspections by energy specialists before, during and after the building process (photos, measurements)
- Increase number of mandatory blower door (IR thermography) tests (e.g. to 15% of all new buildings), and utilise the IR results.
- Possibility of withdrawing license of designer/contractor
- Bad examples done by building contractors should be published

Having inspections before, during and after the building process would be the best solution; however, for economical reasons this will not be viable for all new buildings. The extent of the inspections should be adjusted for each building project, yet energy specialists should always be included.

Building contractors will be forced to focus on execution quality by increasing the number of mandatory blower door tests and at the same time use IR thermography for thermal bridges rather than just air tightness.

Introducing the possibility of withdrawing the license of a designer/-contractor for repeatedly providing poor execution quality could centre their focus on this issue significantly. However, it is a question whether this could function in practice (maybe in some MS). Instead, making information publicly available concerning a contractor's level of execution quality – both good and bad – could have a more positive effect on execution quality.

Carrots:

- Funding programmes
- Reduction of green taxes and interest rates for low energy buildings/passive houses
- Good examples done by building contractors should be published

Funding programmes are powerful incentives for increasing focus on execution quality, and previous experience has clearly shown that economic incentives work well. The reduction of green taxes and/or interest rates for low energy/passive houses will reduce the operational cost of the houses further. This will increase the demand for this type of houses and thereby decrease their price, meaning that construction companies can cover the extra expenses associated with low energy buildings.

Other:

- Courses for designers and construction company staff or craftsmen on how to design and realise building joints with focus on air tightness and thermal bridges
- Good practice guidelines. In general passing on expert knowledge concerning the understanding of the key elements of low energy building and good workmanship
- Introduction of U-Values that take into account the installation of windows. This would motivate the window manufacturers to have stronger guidelines for installation, and thereby more training for installers

The continued education of designers, construction company staff and craftsmen with respect to execution quality will help realise future goals concerning the further reduction of building energy consumption. In addition to education, good practice guidelines will be helpful in passing on the latest expert knowledge from theory to practice. A specific information paper on good practice guidelines for preventing thermal bridges written by IEE ASIEPI will soon be available.

5 > Conclusion

This IP deals with execution quality and in particular with methods for assessing thermal bridge effects due to faulty/poor execution quality, and methods for stimulating improved execution quality to avoid/reduce thermal bridge effects.

A questionnaire distributed among the participating MS shows that only a few studies have been carried out concerning the relationship between execution quality and thermal bridge effects. These studies indicate that there is a need for increased focus on execution quality.

The questionnaire also shows that the MS use more or less similar methods for assessing and stimulating improved execution quality. Infrared thermography is used to some extent, but is not yet a legal requirement anywhere. Inspections during and after the building process are used quite extensively in all MS, especially for large buildings. Most MS have legal requirements regulating inspections; however, these do not focus on energy consumption or thermal bridges. There are only very few alternatives to inspections and infrared thermography and they include gas concentration measurements on windows and pre-building process inspections of drawings by specialists. Finally, the questionnaire shows that most MS use sanctions rather than incentives to ensure good execution quality.

Based on suggestions from the participating MS, the IP presents a "proposal for stimulating and assessing execution quality". The proposal contains different measures described as sticks and carrots, which contribute to better quality. The proposed measures are aimed at different target groups but for most of them, it is the policy makers, who will be responsible. Establishing requirements for a specific amount of inspections and for mandatory blower door test, for the possibility of withdrawing a license; all this is something that requires rules. Furthermore, reduction of green taxes and interest rates for low energy buildings/passive houses and funding programmes are also the responsibility of policy makers. Then the standardisation bodies have to follow up and prepare the standards. The building industry and the building practitioners have to arrange courses for designers and construction company staff or craftsmen on how to design and realise building joints with focus on air tightness and thermal bridges. In addition to education, good practice guidelines will be helpful in passing the newest expert knowledge from theory to practice and this is the responsibility of building industry.

6 > References

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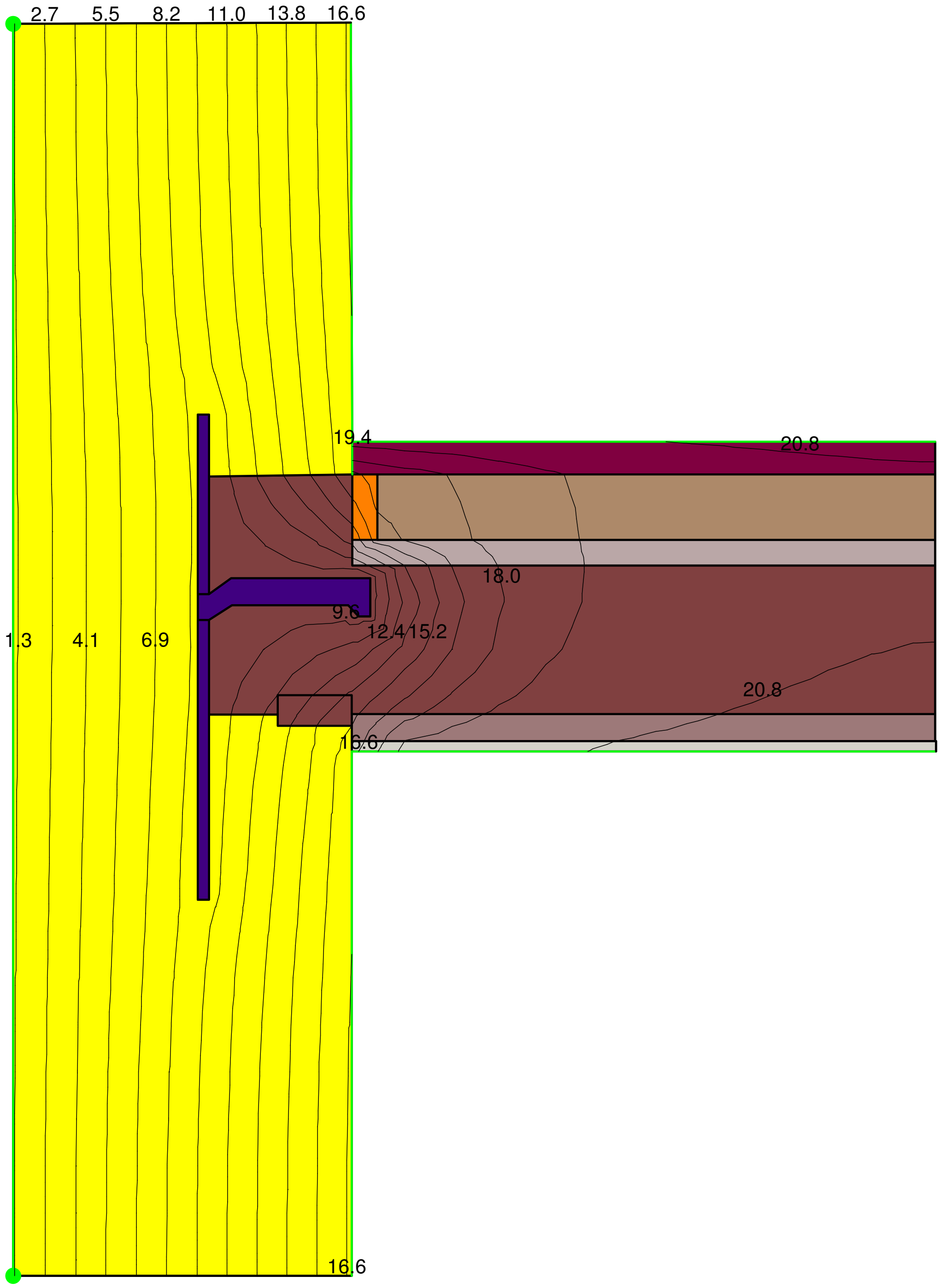

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