

ANNEX B

BIM PRACTICAL EXAMPLE DOCUMENTATION

TABLE OF CONTENTS

B.1. Introduction	2
B.2. Drawings	2
B.2.1. Drawing generation	2
B.2.2. Drawing typologies	4
B.2.3. Generated drawings	6
B.3. Schedules	35
B.3.1. Schedule generation	35
B.3.2. Schedule typologies	36
B.3.3. Graphical column schedule	36
B.3.4. Material take-off schedules	38
B.3.5. Schedule advanced capabilities	43
B.3.6. Generated schedules	44
B.4. Renders	57
B.4.1. Architectural interior finishes	57
B.4.2. Urbanisation finishes	68
B.5. Camera views	77
B.5.1. Construction phases simulation: Camera 1	77
B.5.2. Construction phases simulation: Camera 2	83
REFERENCES	89

B.1. INTRODUCTION

BIM models are meant to represent every relevant aspect of a designed project. All information needed for construction, management and operation tasks can be implemented, from highly accurate geometry to building component's physical properties, quantities and cost attributes. There are several ways in which this information can be presented. Ideally, exploration of all project attributes should be made available directly on BIM platforms. With adequate interoperability, engaged BIM users would be able to successfully interchange and consult all necessary information, relieving the need for document based communication. Nevertheless, until this integration becomes a reality, project information flow will still take place in traditional ways.

Most BIM platforms have advanced tools for document generation integrated in their interfaces. As all project data is kept in a database, selective withdrawals of desired information allow automated generation of project documents. As exposed in the '*BIM Technology*' section, all views of a BIM model are kept consistent between each other because they are sourced from the same database. The same occurs with all documentation representing a particular set of model characteristics.

Several types of model deliverables can be distinguished:

- 2D Drawings
- Schedules
- Visualisation: Camera views; Renders; Walkthroughs

For the treated building model, all documentation considered relevant has been created from the corresponding developed models. Structural and architectural drawings have been generated from the structural and architectural model respectively. Schedules and other spreadsheets have been generated as well from the construction model. Some drawings regarding building site organisation have also been created as well from the construction model. All the renders drawn in both the architectural and construction models have been included in this section.

B.2. DRAWINGS

B.2.1. Drawing generation

The modelled building has been defined to a great level of detail in a full 3D environment. This will be of great help when generating drawing sheets in fairly automated ways.

As the purpose of this work is merely instructional, only the necessary drawings to generally define the building will be generated. At least one of each document typology available in Revit will be generated in order to briefly describe its features and intended use.

Autodesk Revit allows for bidirectional associativity of its views and documents. As described in the '*BIM Technology*' section, this capability implies that not only changes made to a model are propagated to its respective view, but can also be propagated the other way around. In laymen's terms, this means that modifications made to a 2D view of the model will affect its database, keeping consistency with all other views. This feature applies to schedules as well, and a brief example of this capability has been developed with a graphical column schedule in subsection B.3.3. of this annex.

Project documentation requires a wide range of drawing sets and typologies, all representing geometric definition and information specific to certain disciplines or aspects of the project. The necessary number of drawings to satisfactorily define edification projects such as the one developed in this work are listed and categorised in *Table 1*.

For the purpose of this work, the drawings that have been highlighted will be generated.

Discipline/Drawing typology	Structural	Architectural	Systems	Site
Plan views	Foundations	Functional area plan	Electrical systems (Power supply, telecoms, fire protection, etc.)	Topography (Original, excavated)
	Suspended floor	Architectural finishes	Piping systems (Water supply, drainage, sewage, fire protection)	Urbanisation (Parking, equipment, planting)
	Structural steelwork	Reflected ceiling	Duct systems (HVAC)	
	Structural roof			
Sections	General building structural cross sections (N-S, E-W)	General building cross sections (N-S, E-W)		Façade & urbanisation sections (N-S, E-W)
Elevations	Steelwork framing elevations	Façade elevations (N,E,S,W)	Electrical systems (Power supply, telecoms, fire protection, etc.)	Façade & urbanisation elevations (N,E,S,W)
			Piping systems (Water supply, drainage, sewage, fire protection)	
			Duct systems (HVAC)	

Drafting views	Steelwork structure connections	Interior wall connections	System connection details	
	Structural roof connections	Window & door details	System equipment details	
	Reinforced concrete rebar details	Suspended ceiling details		
	Closings layer details	Architectural floor connections		
	Closings connection details (Roof-external walls, suspended floor-external walls)			
Key legends	Structural materials	Commercial furniture & other elements	Connection & equipment symbols	Commercial urbanisation equipment
				Planting species

Table 1: Drawings for building definition categorised by field and typology

B.2.2. Drawing typologies

The provided drawings have been generated based on Autodesk's drawing tools, templates and capabilities. Following, the basic available types of 2D documentation are briefly explained:

Plan views

There are several plan view typologies, each focused on representing specific fields of project definition. Pre-defined 2-Dimensional drawing styles are implemented in these templates, and can be customised at will by users. Furthermore, each template view does selectively represent relevant object families and types to the field it pertains to. These features have been explored in further depth in the '*BIM Technology*' section, and imply major saving of editing efforts in drawing generation.

Plan view typologies are listed following:

- Floor plan: Represents space distribution and architectural arrays.
- Reflected ceiling plan: Represents ceiling layout, as if it had been reflected in plan view.
- Structural plan: Represents objects and elements relevant to project's structural system.
- Area plan: Represents spatial relationships in the project.

Section views

Section views are defined as planes that cut straight through the 3-Dimensional model, generating 2-Dimensional model representations automatically.

Callout views

Callouts can be defined in 2-Dimensional views of the model to isolate a certain portion of the model geometry and represent it in a greater level of detail. By defining the callout area directly on a 2-Dimensional view, the callout view is automatically generated.

Elevations

Vertical representations of the model's geometry can be generated automatically from any point of view and orientation. There are two distinguished elevation typologies:

- Elevation views: Commonly generated exteriorly and oriented towards the model's geometry. Interior elevations can be defined as well.
- Framing elevation views: Destined to structural element representation. Usually used to represent vertical bracing. Drawing styles are pre-defined for structural drawing standards.

Drafting views

Drafting views are destined to represent specific portions of the model's geometry or particular details of model elements. Unlike most of other views, drafting views are not entirely generated from the 3-Dimensional model. Although they may start off as 2-Dimensional model views, BIM platforms allow CAD-based drawing and annotation capabilities which allow their further detailing. The overwritten information is particular of drafting views and does not propagate to the model's database.

Legends

Legends display a list of the various building components and annotations used in a project. Usually legends are used to list materials, symbols, line styles, project phases and keynotes.

B.2.3. Generated drawings

The generated drawings in this annex are listed and grouped by field as follows:

Structural drawings

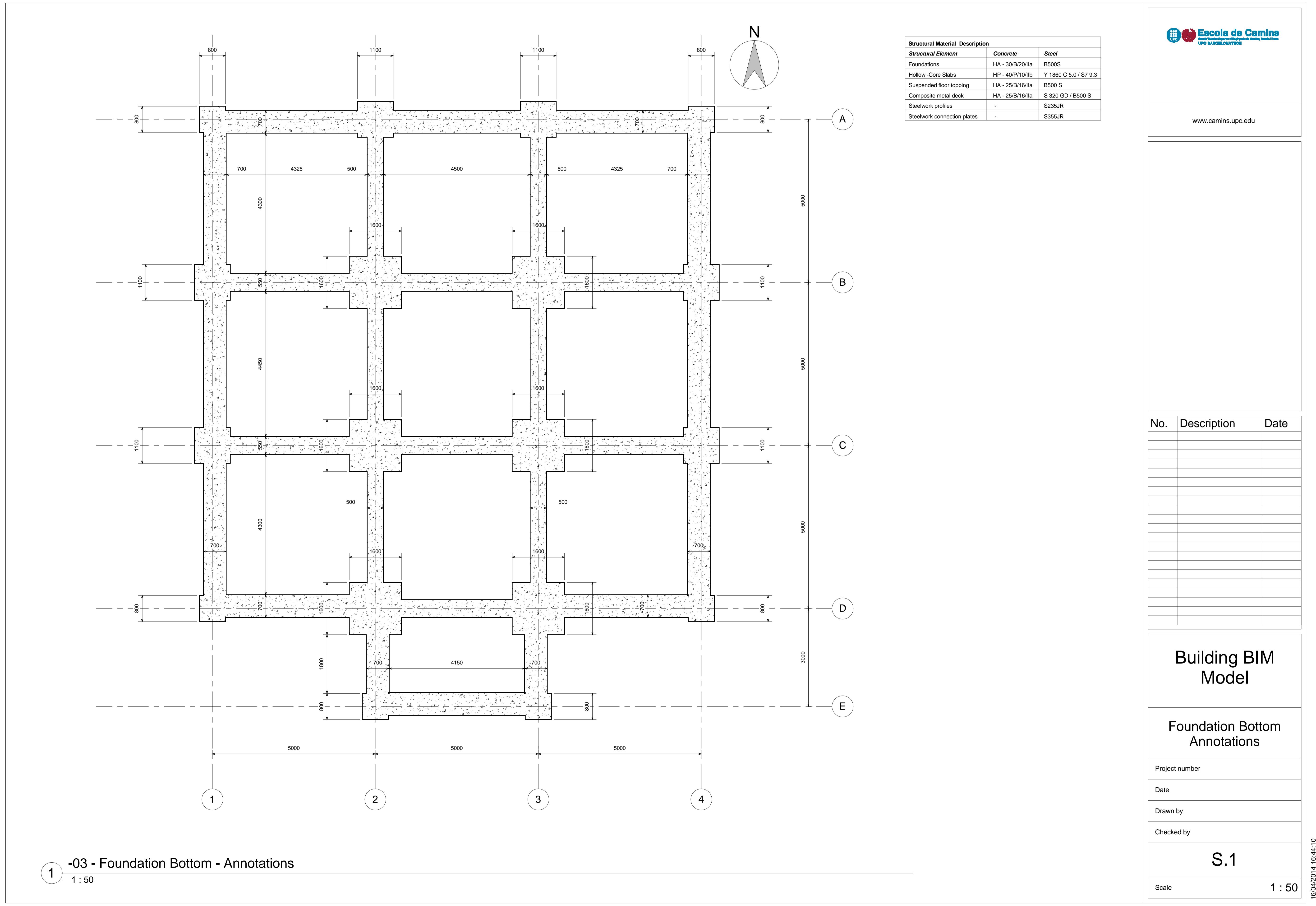
- S.1 Foundation bottom - Annotations
- S.2 Foundation bottom - Tags
- S.3 Foundation top - Annotations & tags
- S.4 Suspended floor - Annotations & tags
- S.5 Concrete topping - Annotations & tags
- S.6 Framing system - Annotations & tags
- S.7 Structural roof- Annotations & tags
- S.8 Framing elevations (1,2) - Annotations & tags
- S.9 Framing elevations (3,4) - Annotations & tags
- S.9b Sections (1,2)
- S.10 Sections (3,4)
- S.11 Details

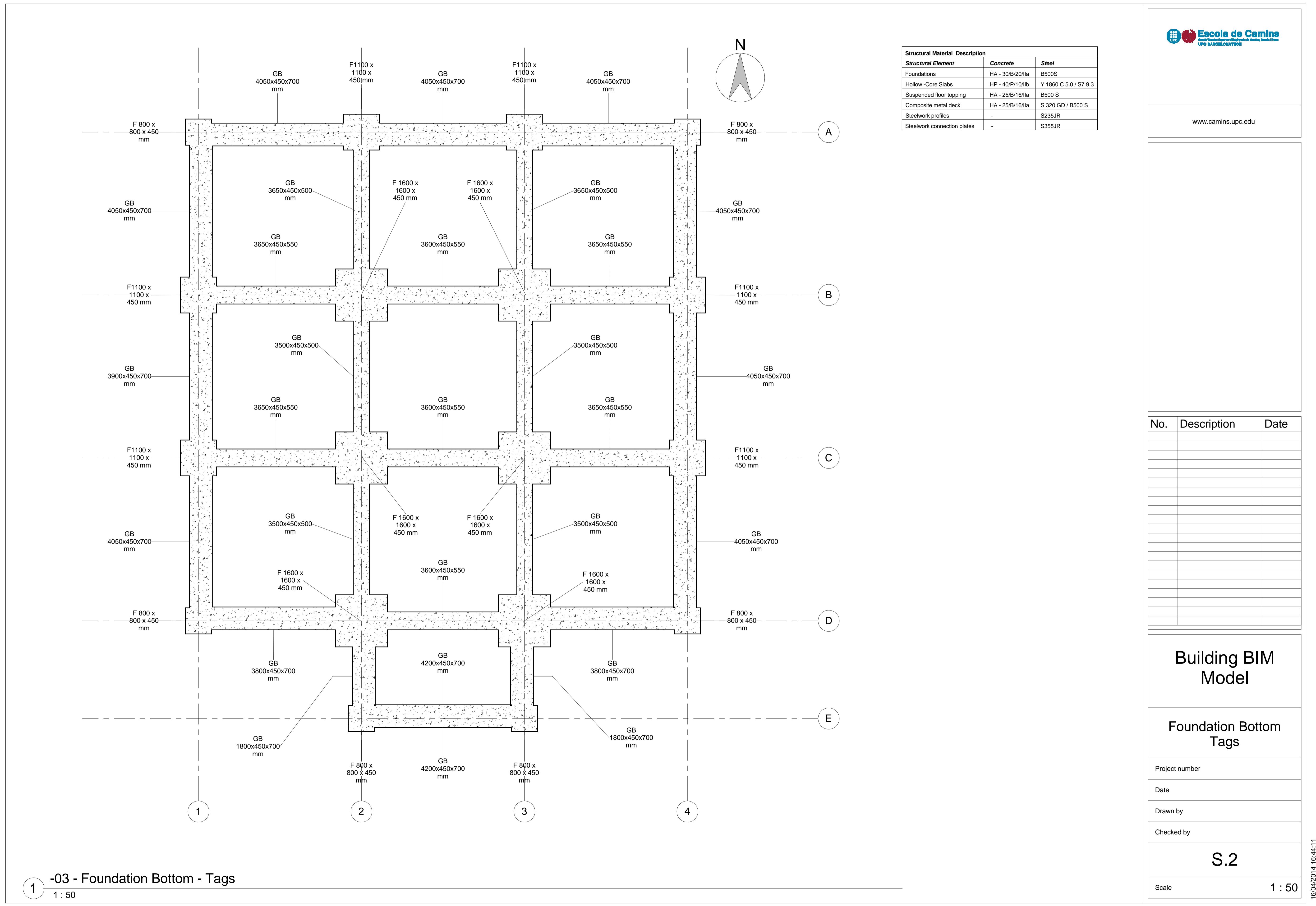
Architectural drawings

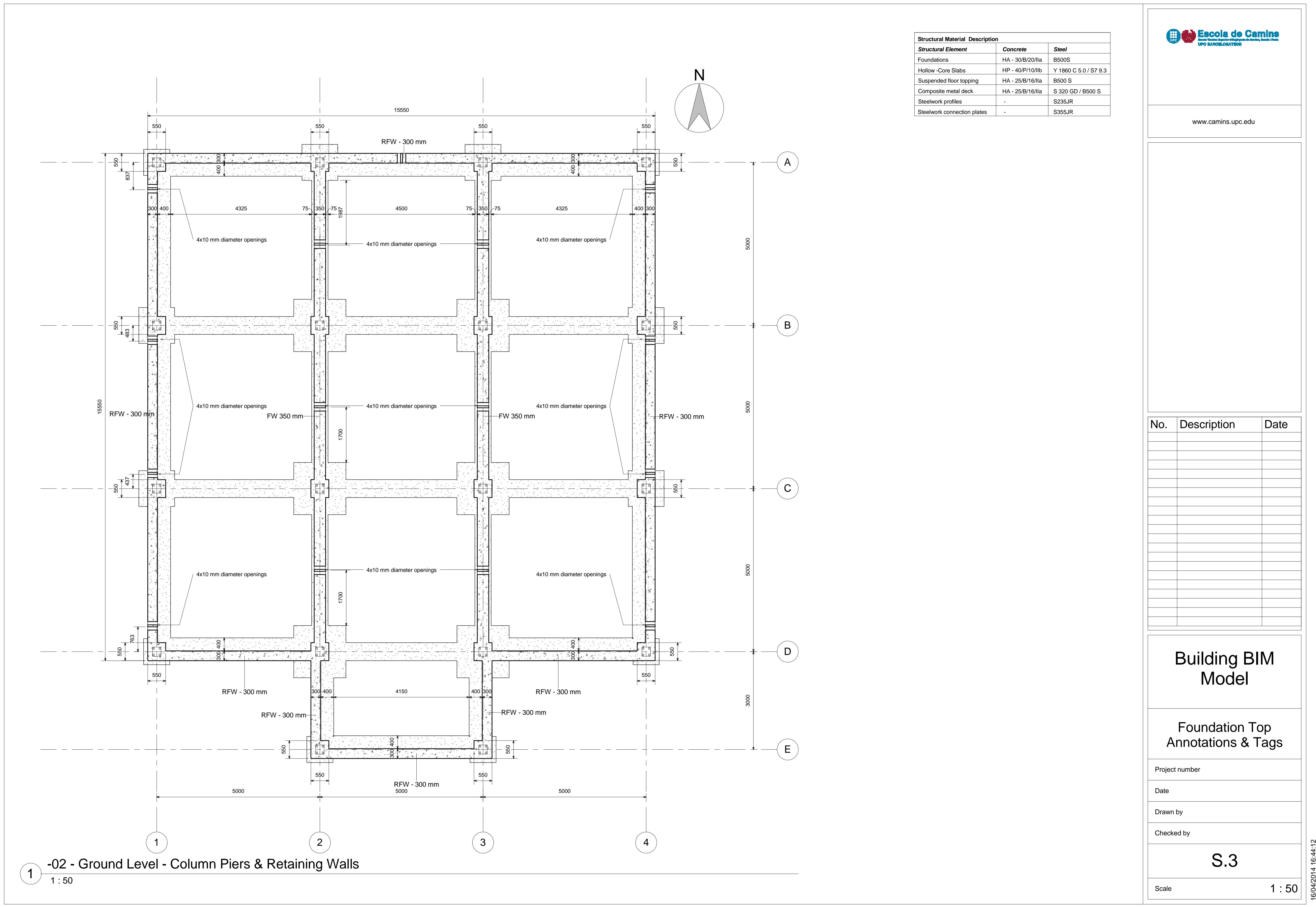
- A.1 Ground floor – Architectural finishes
- A.2 Ground floor – Architectural finishes tags
- A.3 Elevations (N,S)
- A.4 Elevations (E,W)
- A.5 Reflected ceiling
- A.6 Finished roof level
- A.7 Ground floor – Area plan
- A.8 Sections (1,2)
- A.9 Sections (3,4)

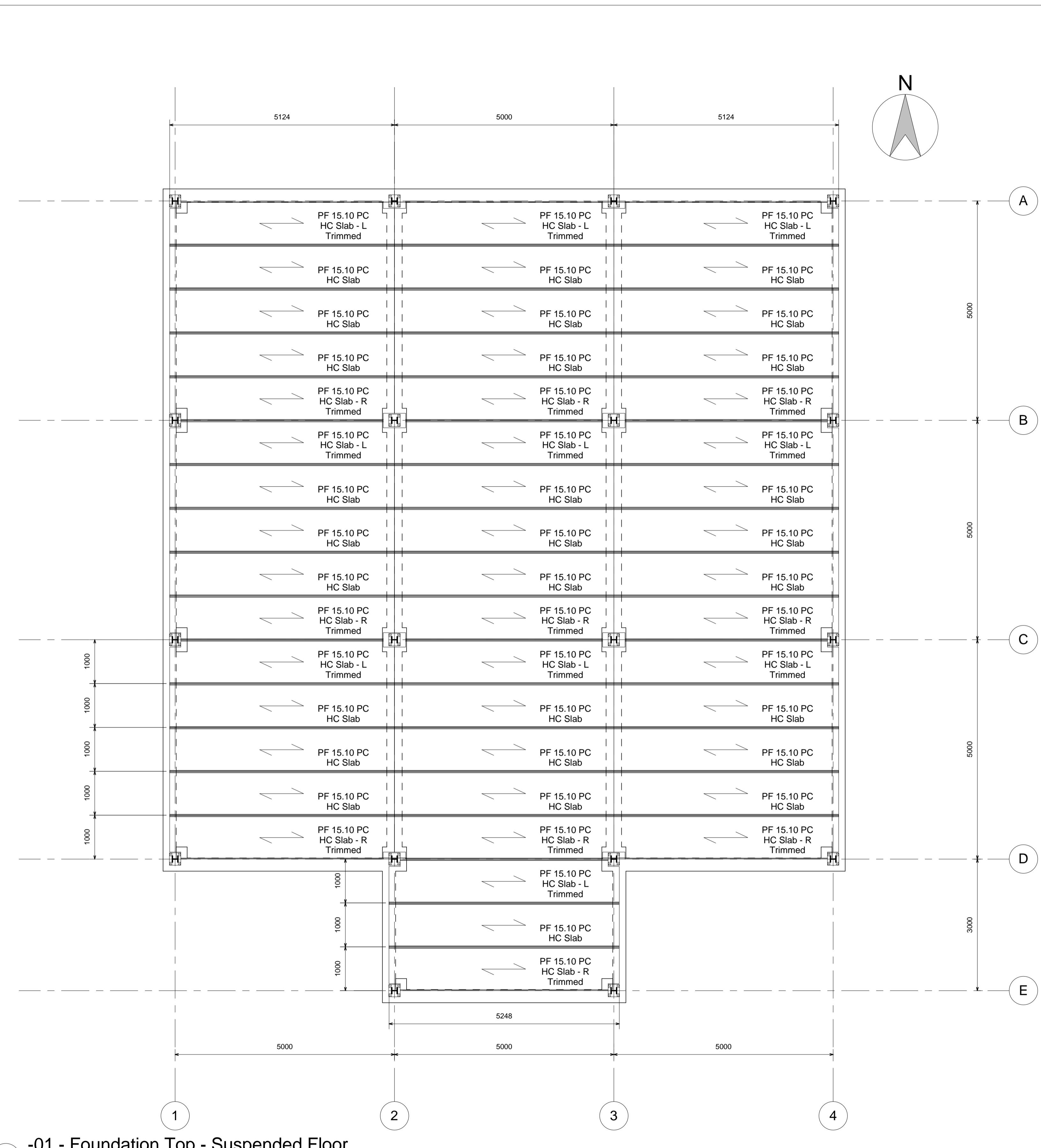
Construction drawings

- C.1 Original topography
- C.2 Site topography
- C.3 Urbanisation plan - Annotations
- C.4 Urbanisation plan - Tags
- C.5 Urbanisation plan – Planting tags
- C.6 Urbanisation sections (1,2)
- C.7 Urbanisation sections (3) & Access plant









Structural Material Description		
Structural Element	Concrete	Steel
Foundations	HA - 30/B/20/Ila	B500S
Hollow -Core Slabs	HP - 40/P/10/Ilb	Y 1860 C 5.0 / S7 9.3
Suspended floor topping	HA - 25/B/16/Ila	B500 S
Composite metal deck	HA - 25/B/16/Ila	S 320 GD / B500 S
Steelwork profiles	-	S235JR
Steelwork connection plates	-	S355JR



www.camins.upc.edu

Building BIM Model

Suspended Floor Annotations & Tags

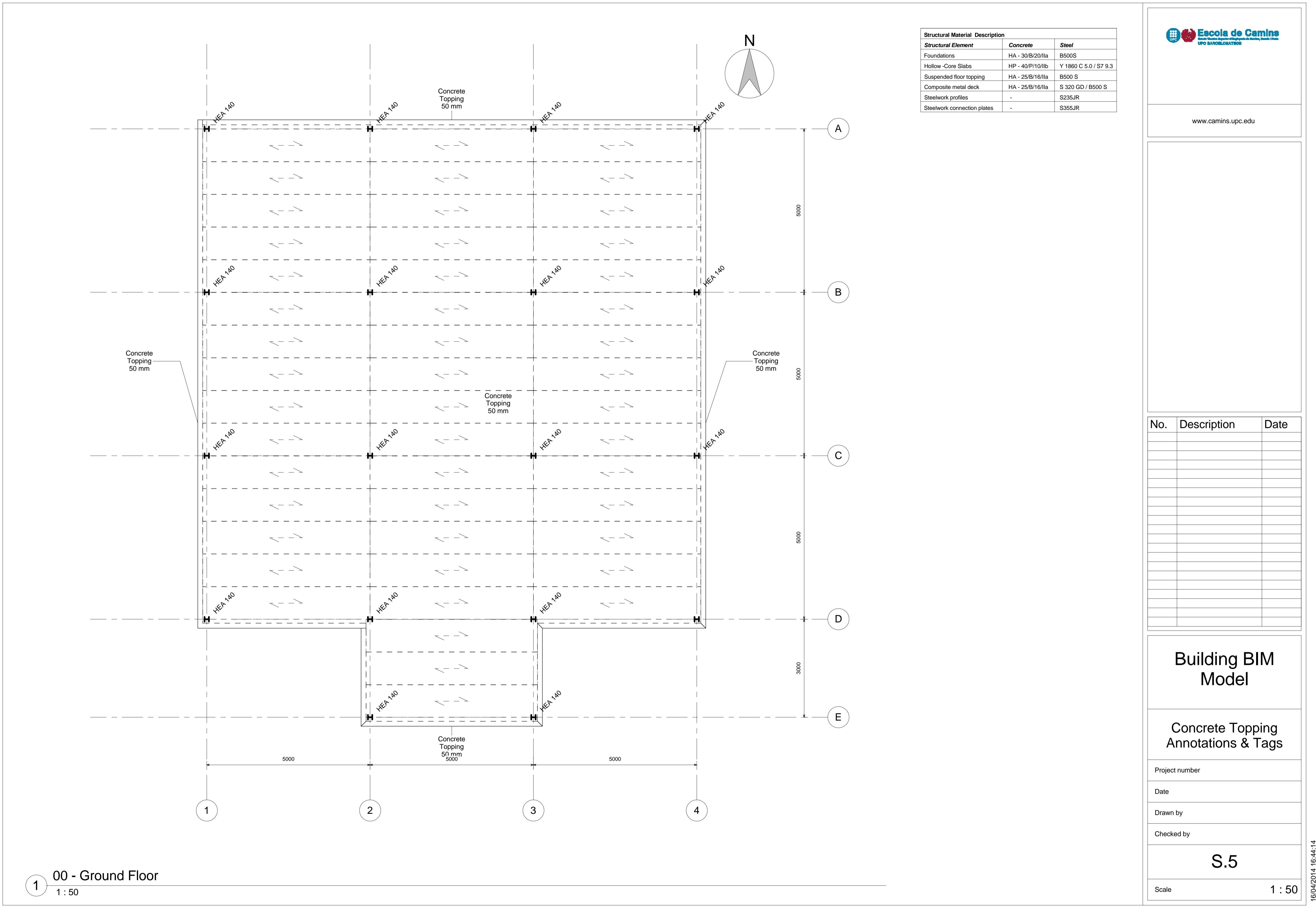
Project number

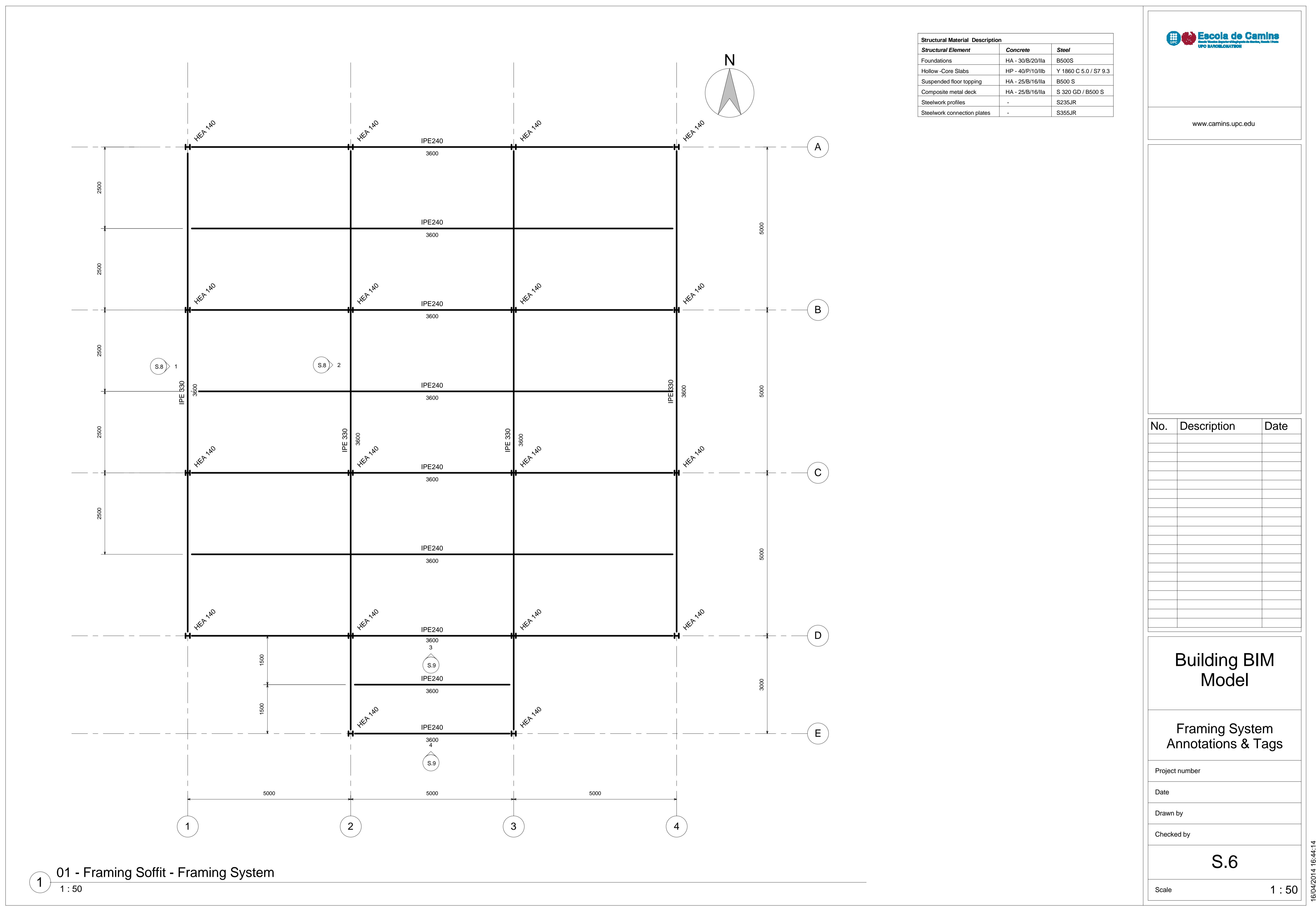
— 1 —

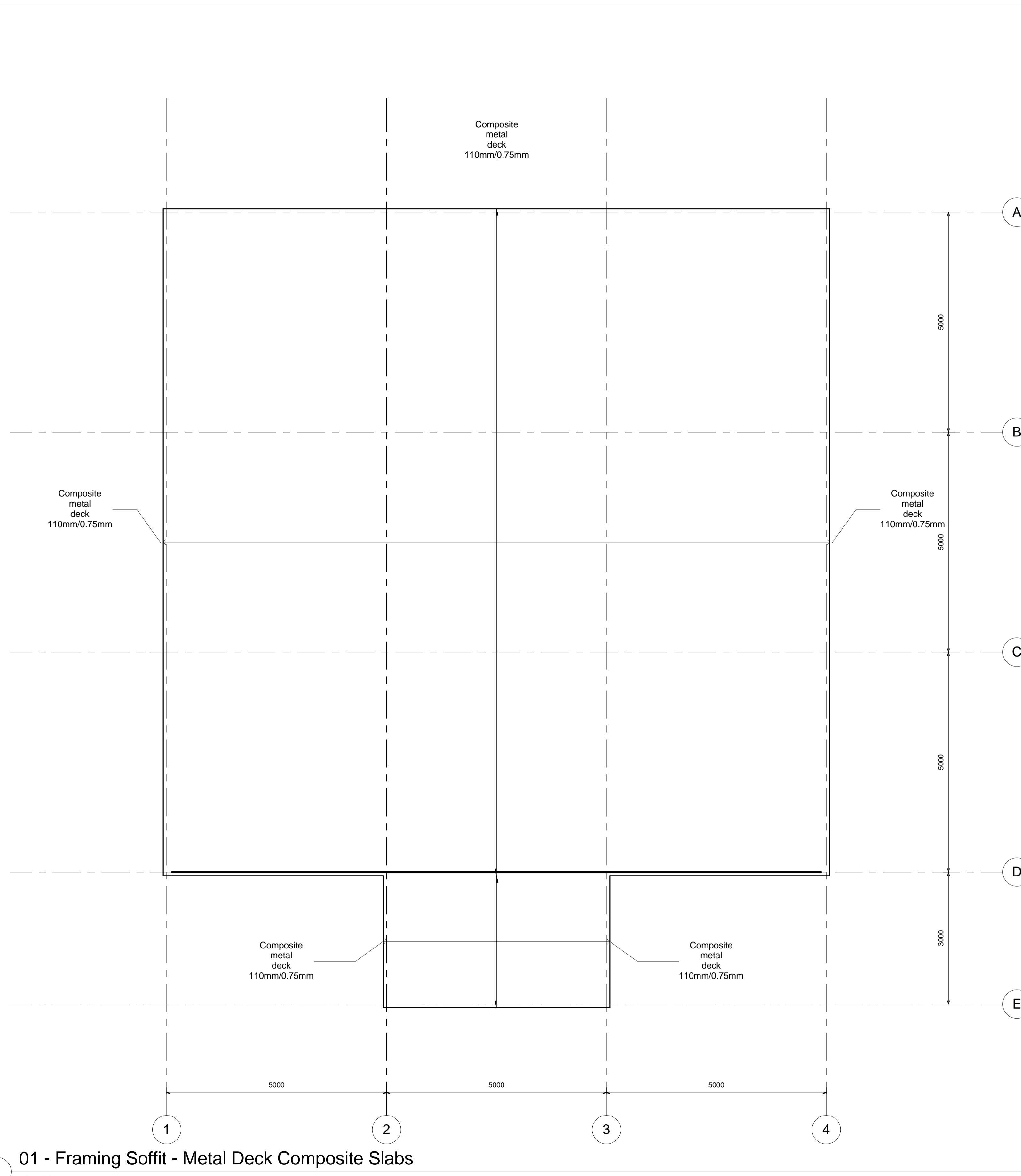
•

checked by

Scale 1 : 50







Structural Material Description		
Structural Element	Concrete	Steel
Foundations	HA - 30/B/20/Ila	B500S
Hollow -Core Slabs	HP - 40/P/10/Ilb	Y 1860 C 5.0 / S7 9.3
Suspended floor topping	HA - 25/B/16/Ila	B500 S
Composite metal deck	HA - 25/B/16/Ila	S 320 GD / B500 S
Steelwork profiles	-	S235JR
Steelwork connection plates	-	S355JR



www.camins.upc.edu

Building BIM Model

Structural Roof Annotations & Tags

Project number

Date

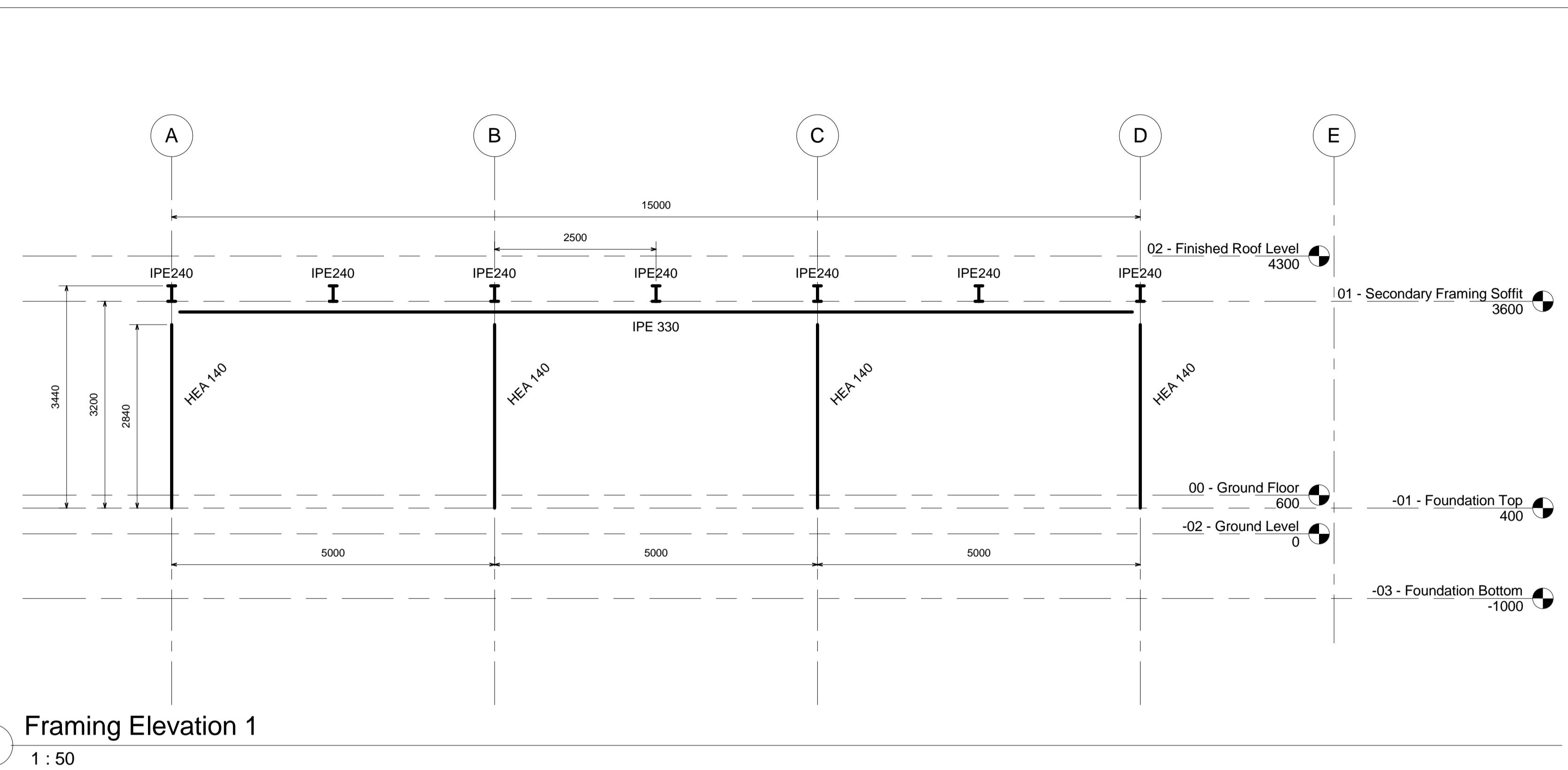
Drawn by

Checked by

S.7

Scale

1 : 50



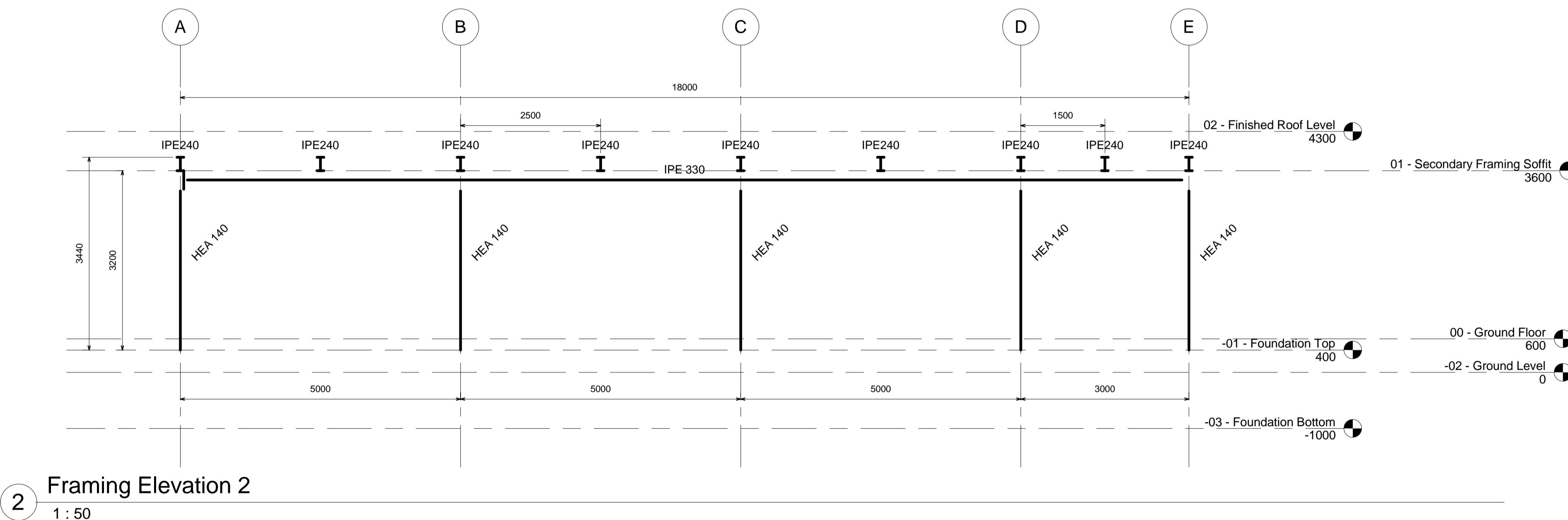
Framing Elevation 1

1 : 50

Structural Material Description		
Structural Element	Concrete	Steel
Foundations	HA - 30/B/20/Ila	B500S
Hollow -Core Slabs	HP - 40/P/10/Ilb	Y 1860 C 5.0 / S7 9.3
Suspended floor topping	HA - 25/B/16/Ila	B500 S
Composite metal deck	HA - 25/B/16/Ila	S 320 GD / B500 S
Steelwork profiles	-	S235JR
Steelwork connection plates	-	S355JR



www.camins.upc.edu



3 Framing Elevation 2

2 1 : 50

Building BIM Model

Framing Elevations (1,2) Annotations & Tags

Project number

Date

Drawn by

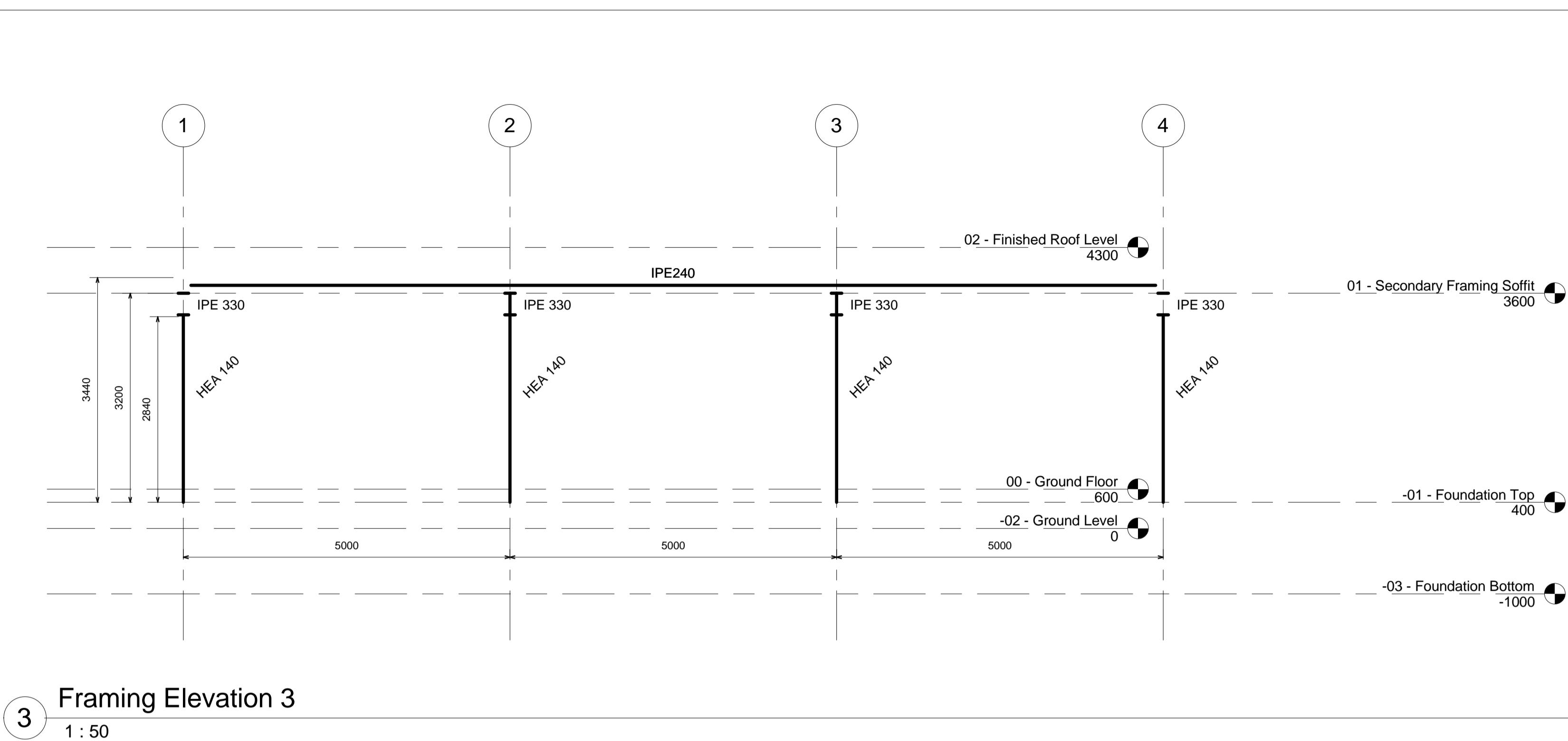
Checked by:

www.nature.com/scientificreports/

S.8

Scale

1 : 50



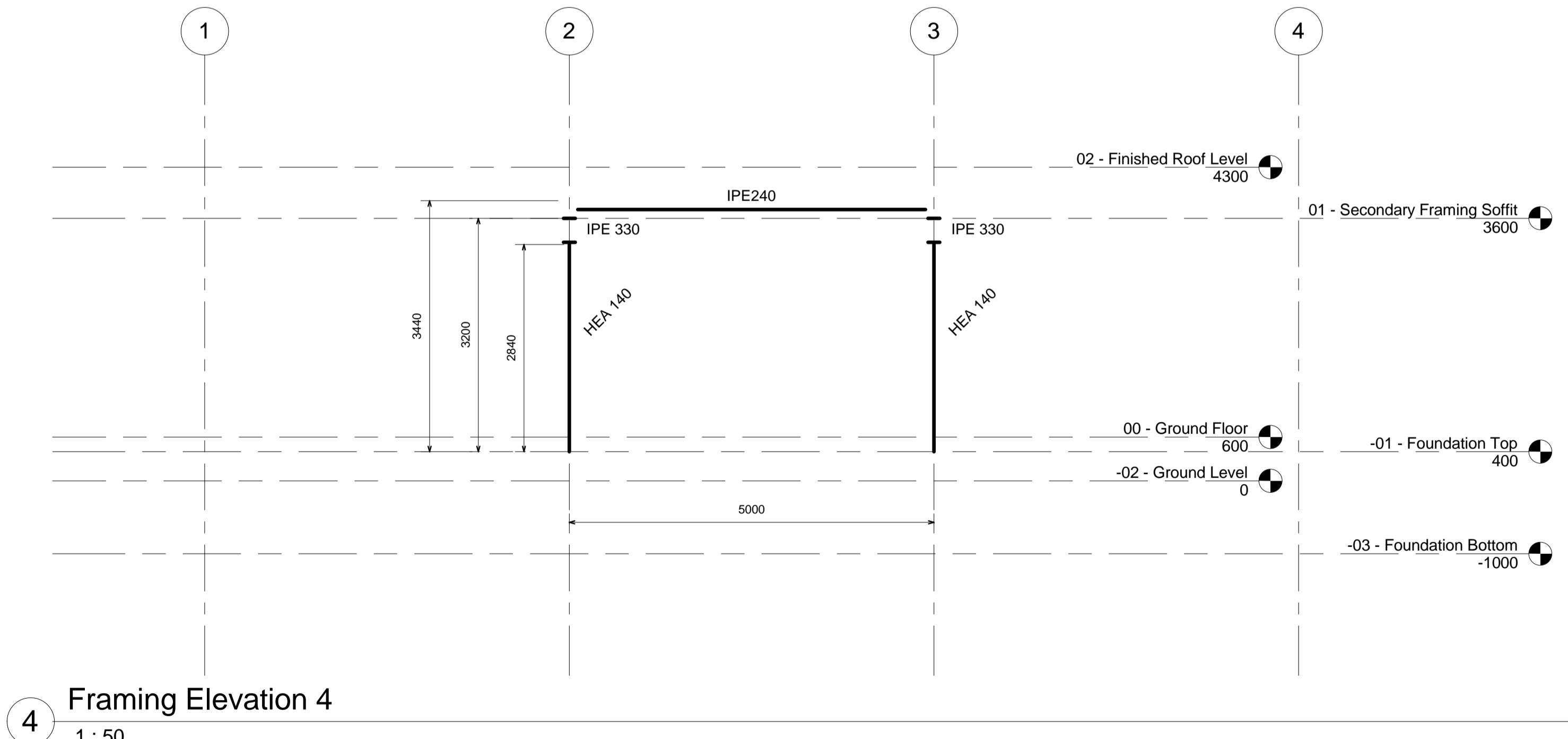
Framing Elevation 3

1 : 50

Structural Material Description		
Structural Element	Concrete	Steel
Foundations	HA - 30/B/20/Ila	B500S
Hollow -Core Slabs	HP - 40/P/10/Ilb	Y 1860 C 5.0 / S7 9.3
Suspended floor topping	HA - 25/B/16/Ila	B500 S
Composite metal deck	HA - 25/B/16/Ila	S 320 GD / B500 S
Steelwork profiles	-	S235JR
Steelwork connection plates	-	S355JR

  **Escola de Camins**
Escola Tècnica Superior d'Enginyeria de Camins, Canals i Ports
UPC BARCELONATech

www.camins.upc.edu



Framing Elevation 4

1 : 50

Building BIM Model

Framing Elevations (3,4) Annotations & Tags

Project number

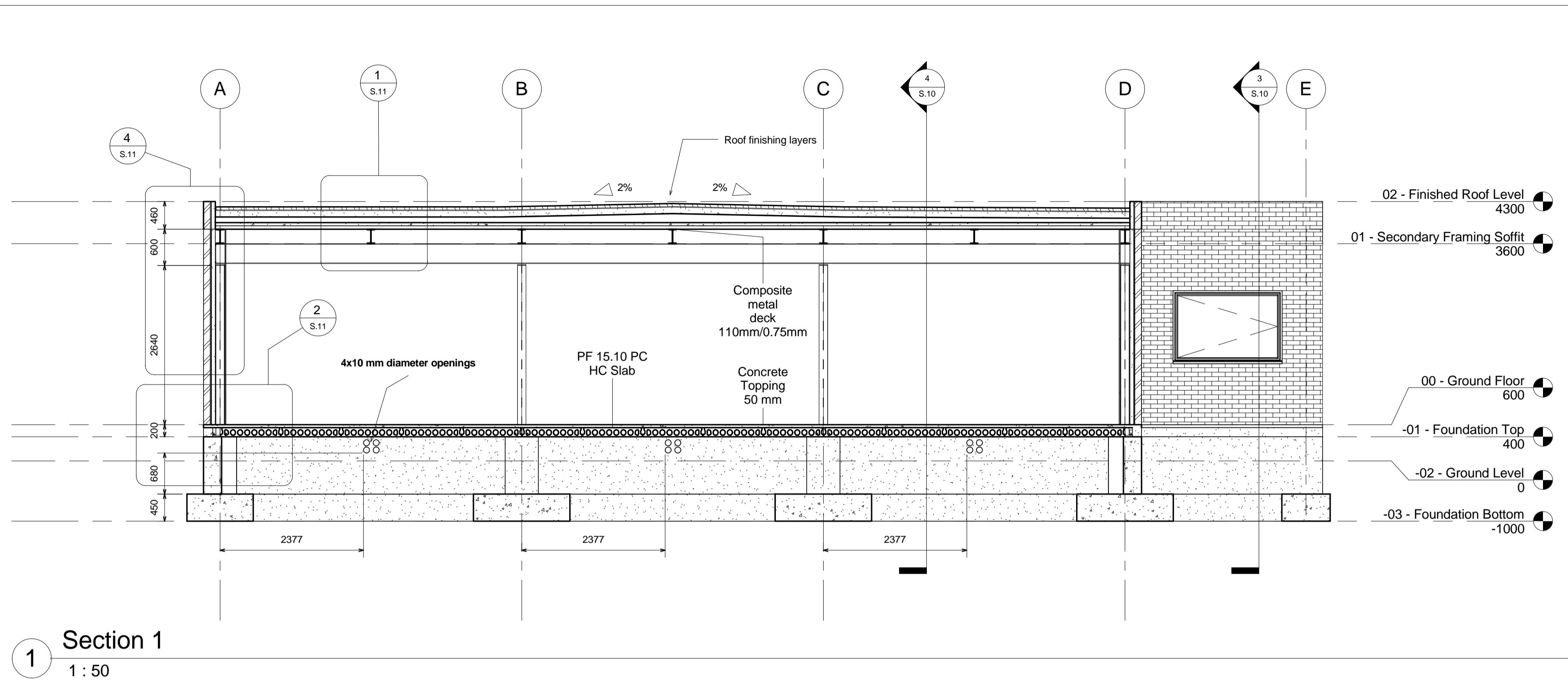
1

5

S.9

Scale

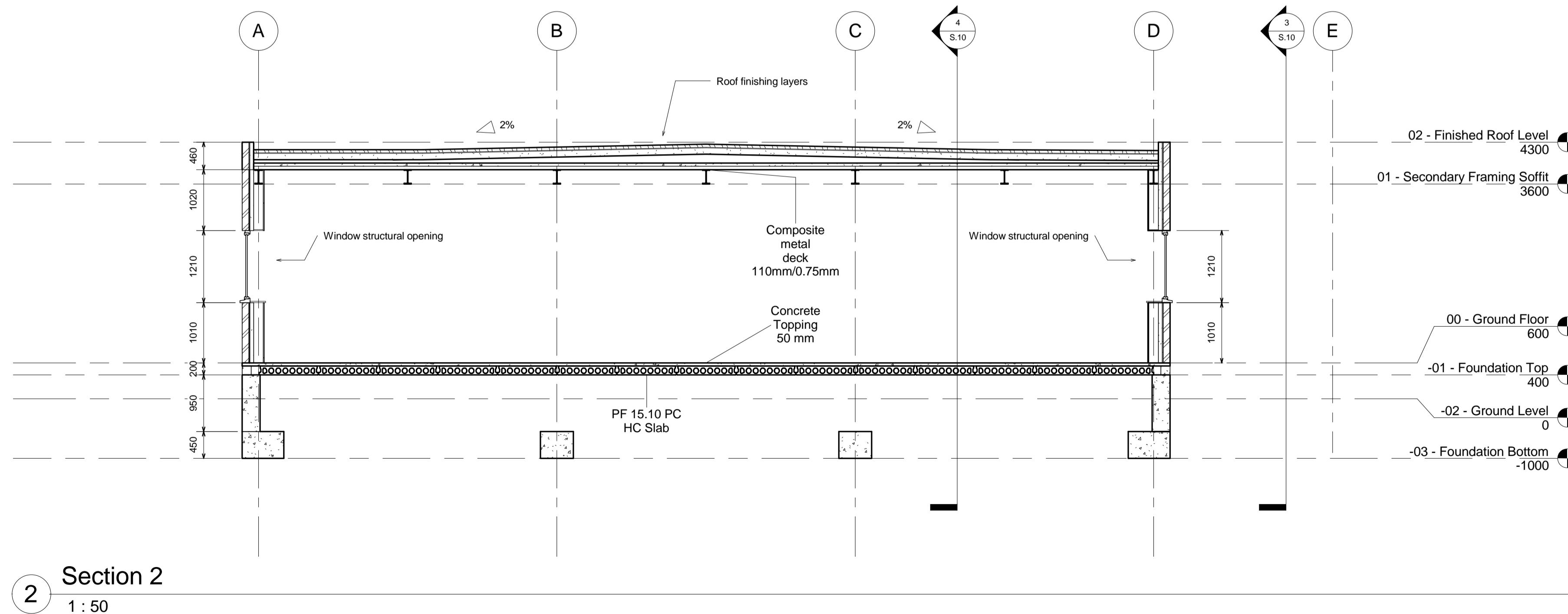
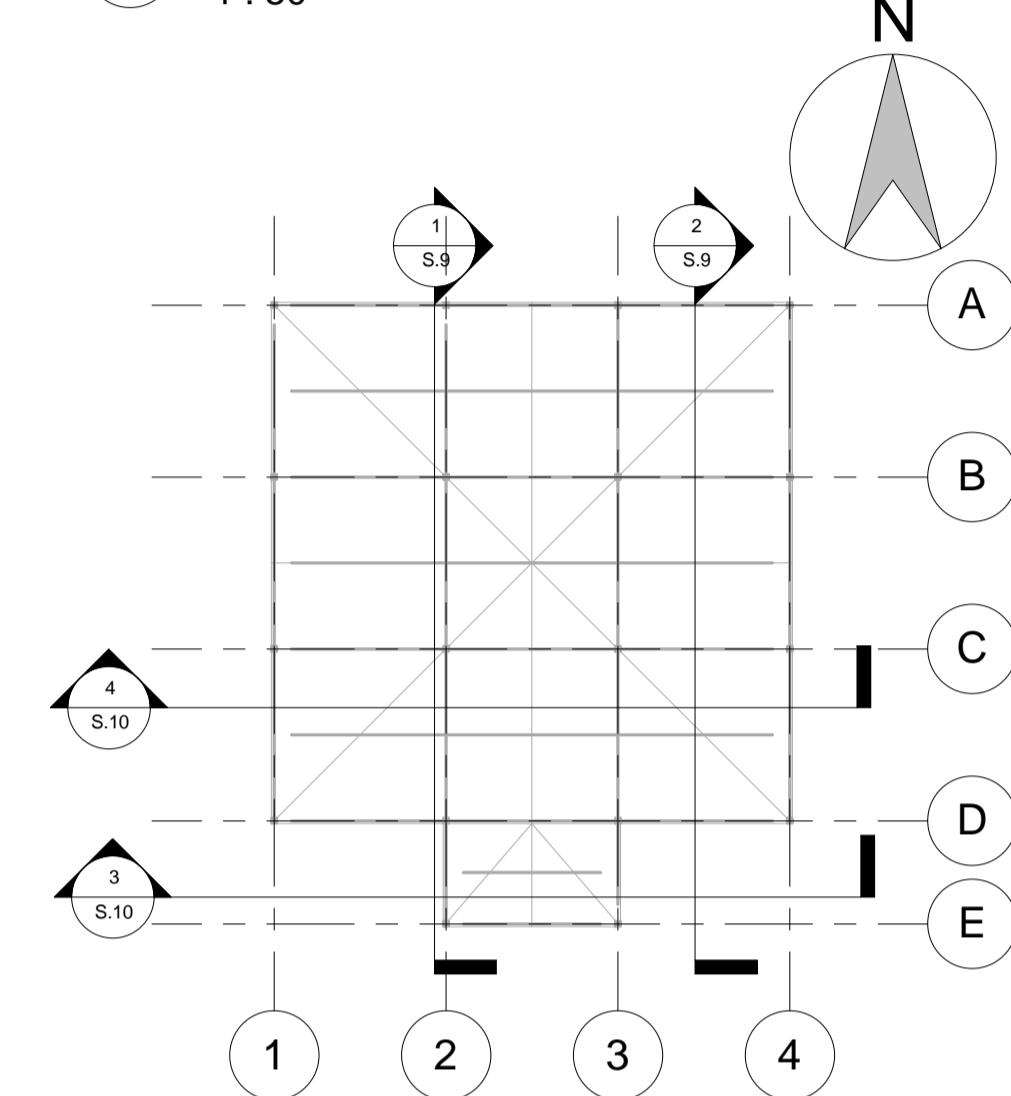
1 : 50



Structural Material Description		
Structural Element	Concrete	Steel
Foundations	HA - 30/B/20/Ila	B500S
Hollow -Core Slabs	HP - 40/P/10/Ilb	Y 1860 C 5.0 / S7 9.3
Suspended floor topping	HA - 25/B/16/Ila	B500 S
Composite metal deck	HA - 25/B/16/Ila	S 320 GD / B500 S
Steelwork profiles	-	S235JR
Steelwork connection plates	-	S355JR

Structural materials

1 : 50



Project Name

Sections (1-2)

Project number

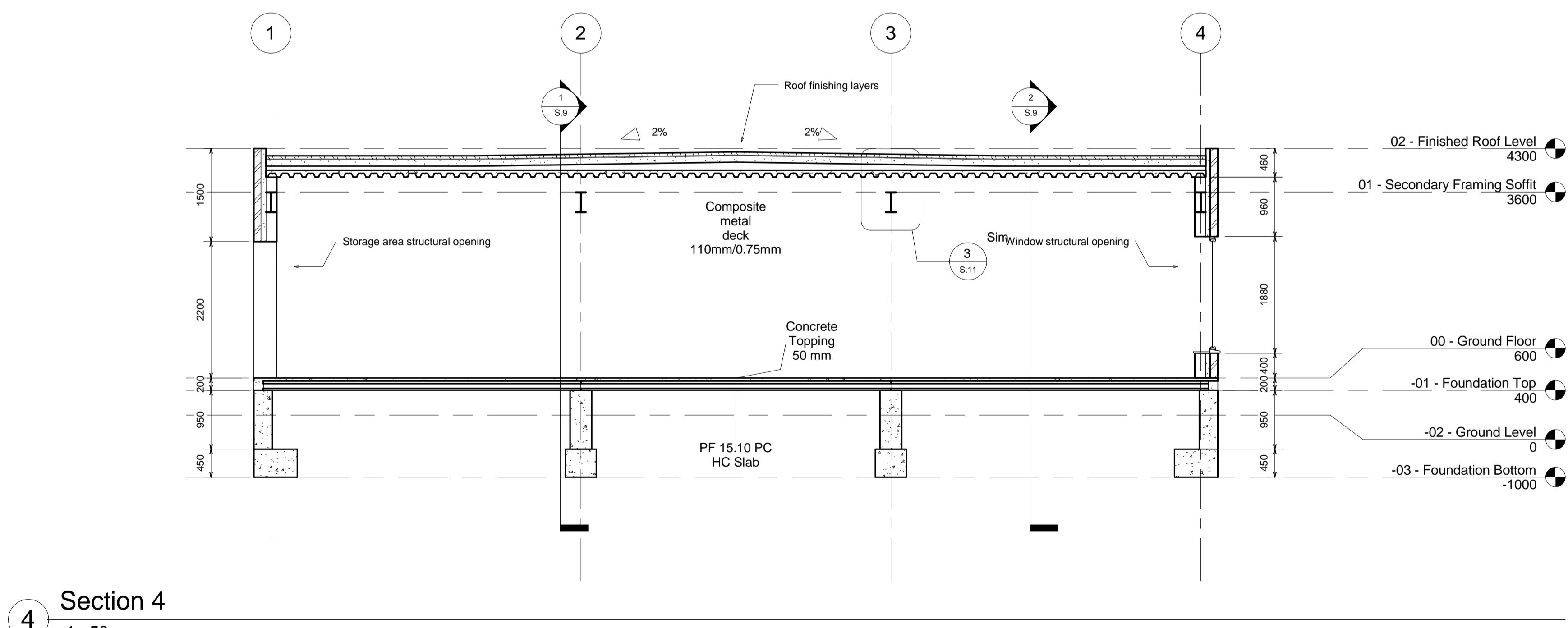
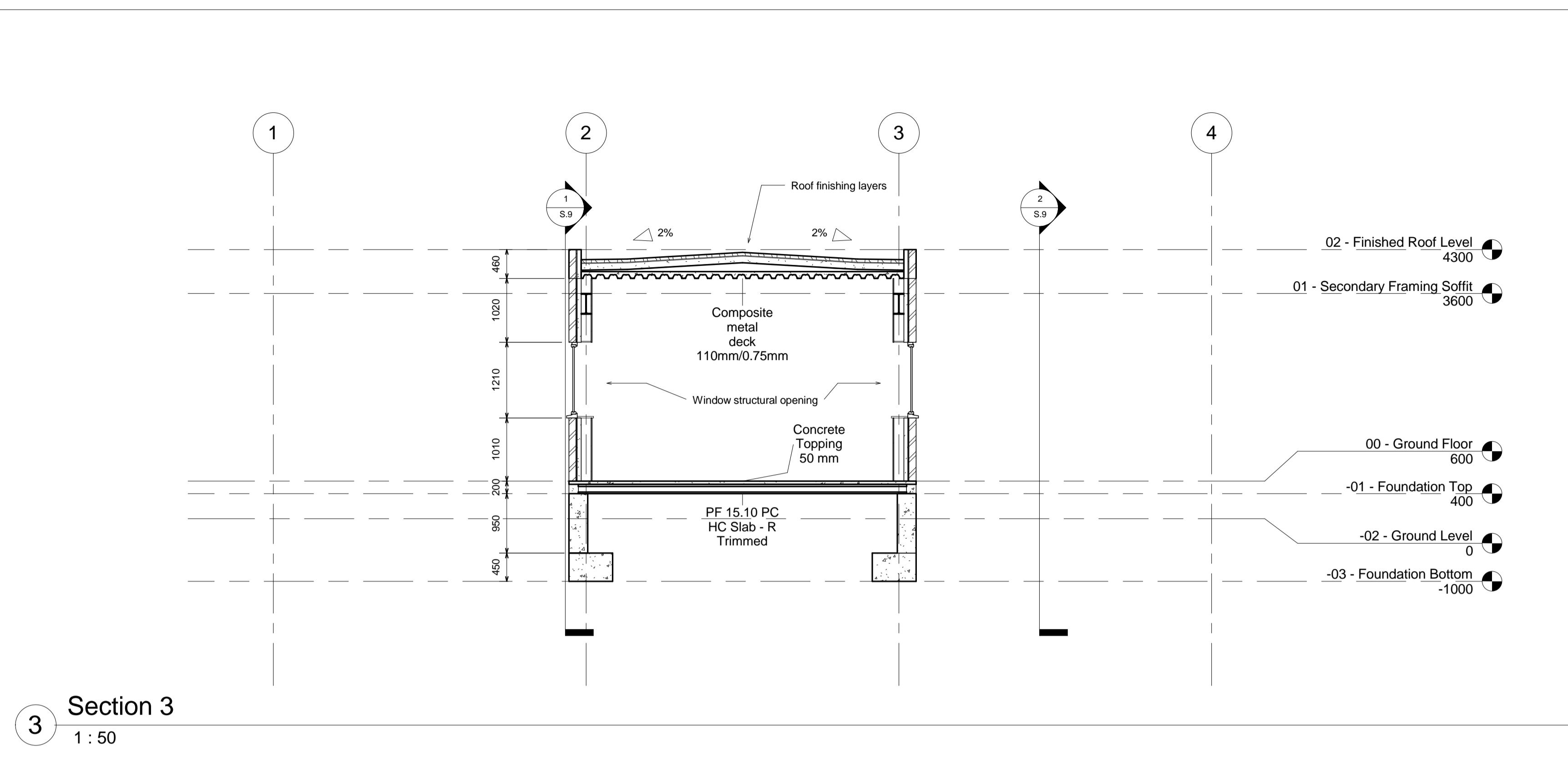
note

drawn by

backed by

Digitized by srujanika@gmail.com

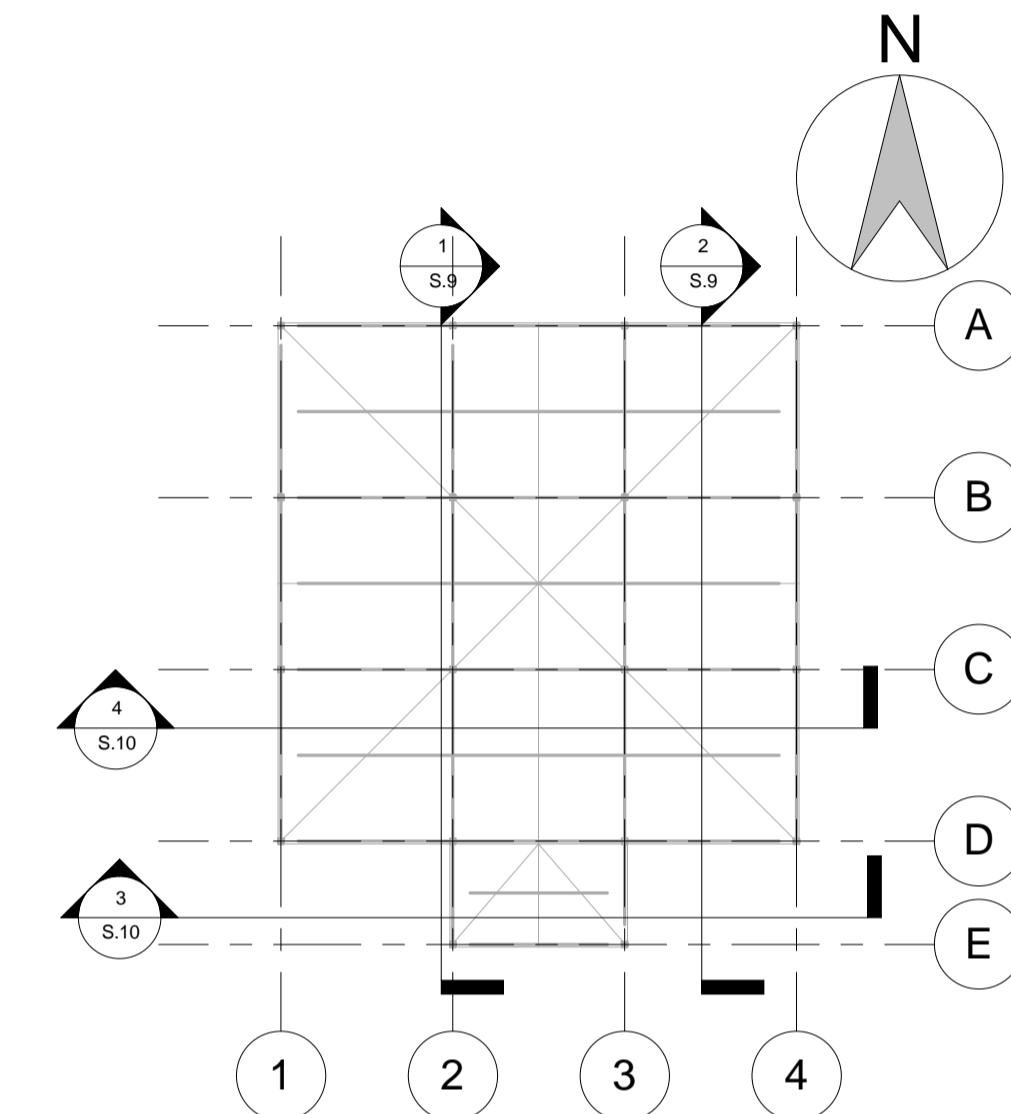
S.9



Structural Material Description		
Structural Element	Concrete	Steel
Foundations	HA - 30/B/20/IIa	B500S
Hollow -Core Slabs	HP - 40/P/10/IIb	Y 1860 C 5.0 / S7 9.3
Suspended floor topping	HA - 25/B/16/IIa	B500 S
Composite metal deck	HA - 25/B/16/IIa	S 320 GD / B500 S
Steelwork profiles	-	S235JR
Steelwork connection plates	-	S355JR

Structural materials

1 : 50



Project Name

Sections (3-4)

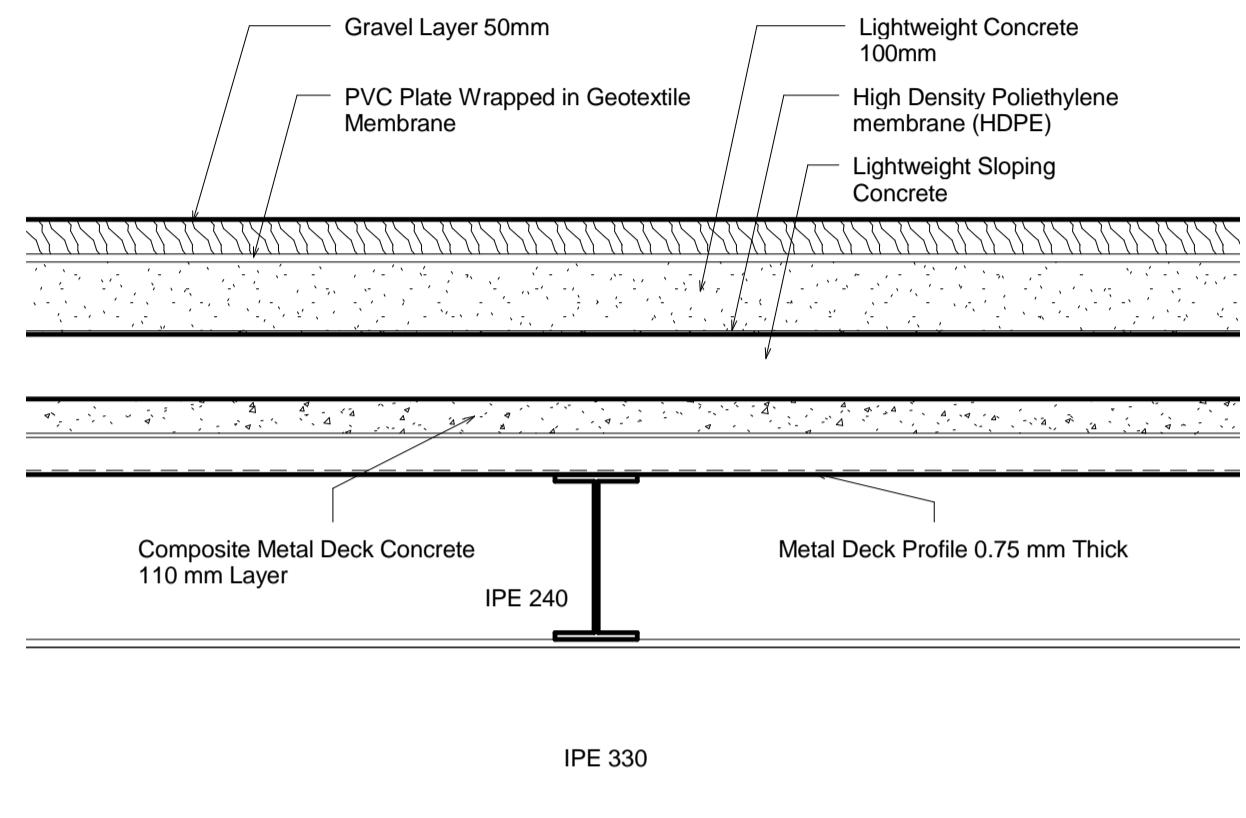
Project number

— 1 —

9

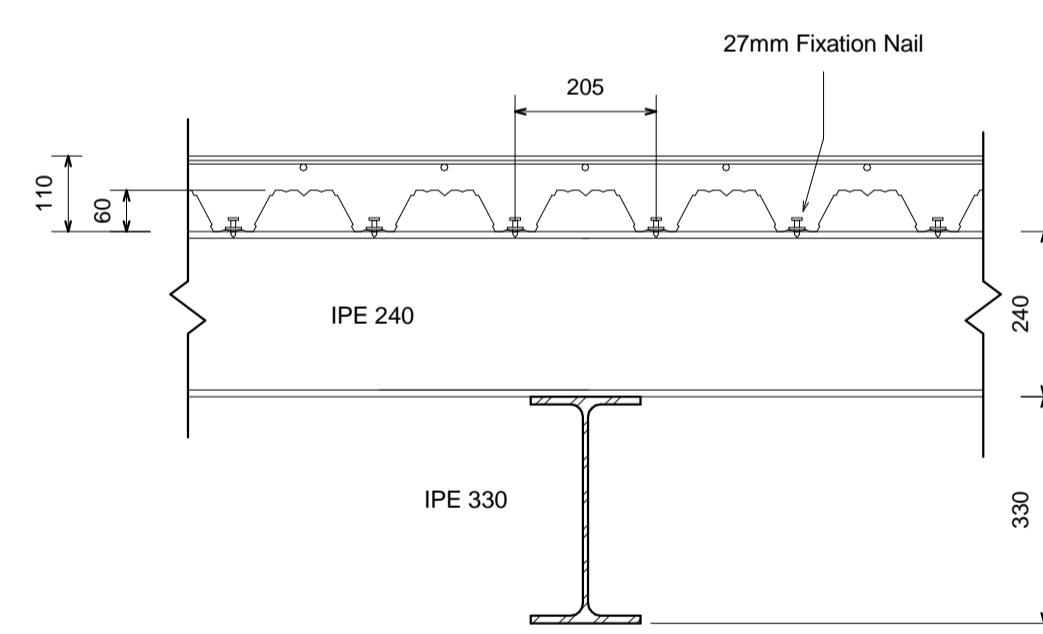
S.10

As indicated



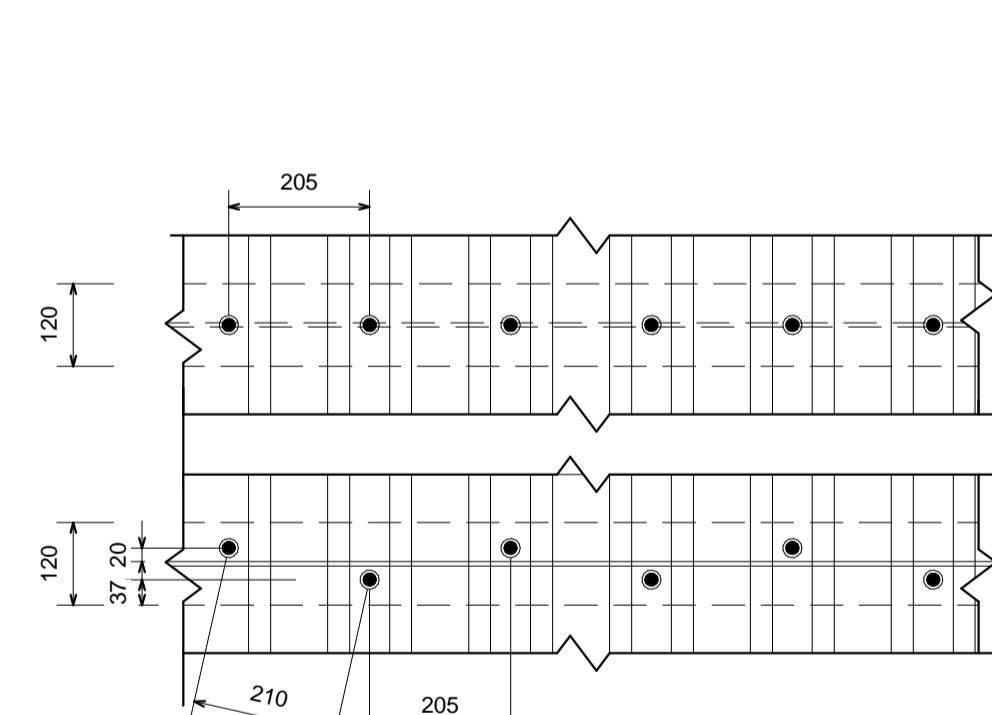
Roof Finishing Layers

1 : 1



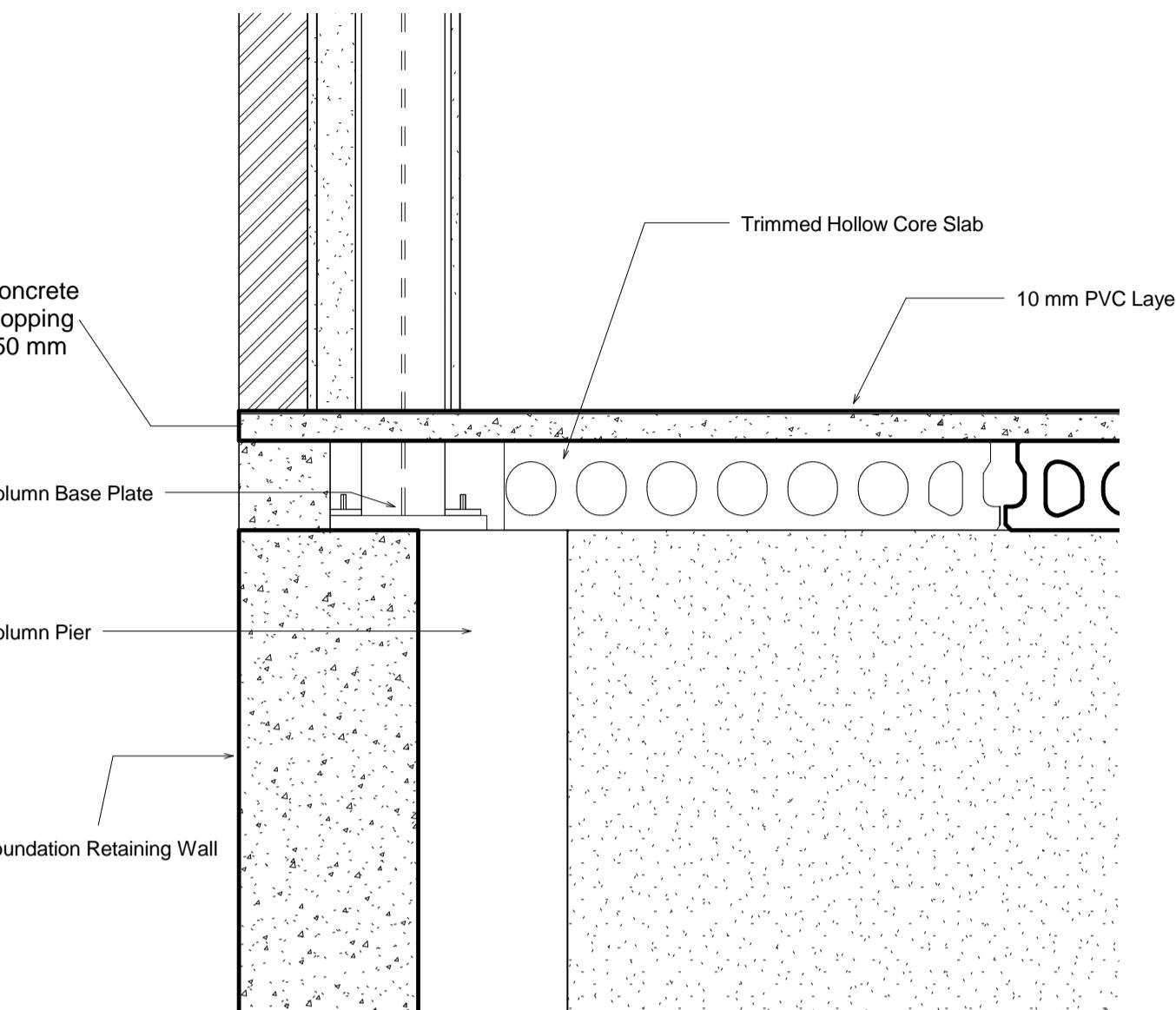
3 Composite metal deck connection to Secondary Framing System
1 : 10

3 1 : 10



Column Base Connection

2 1;



Generic Wall Layers

4

Project Name

Details

Project number

1

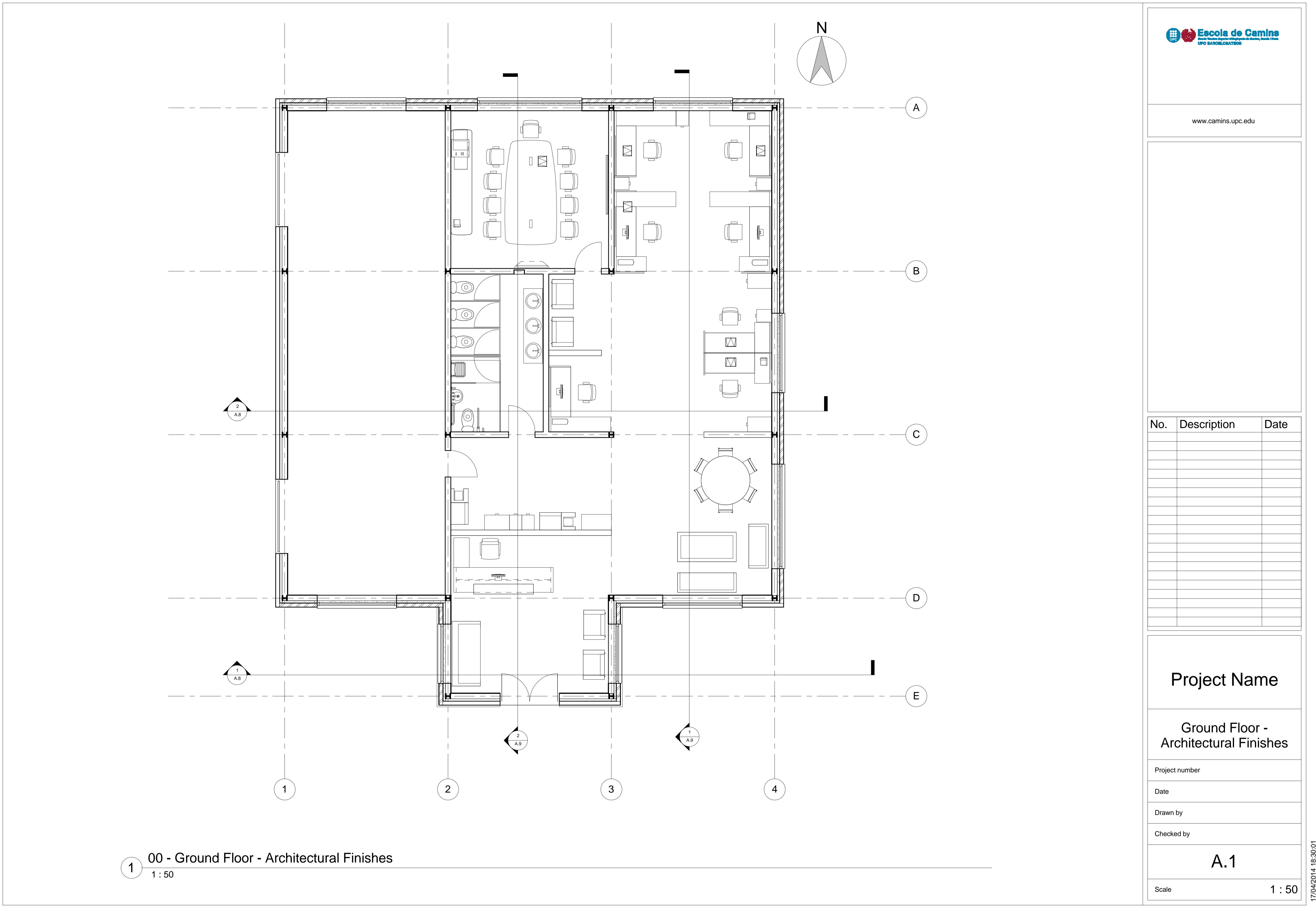
—
—

100-100

S.11

Scales

1 · 10





www.camins.upc.edu

Project Name

Groud Floor - Architectural Finishes Tags

Project number

Date

10 of 10

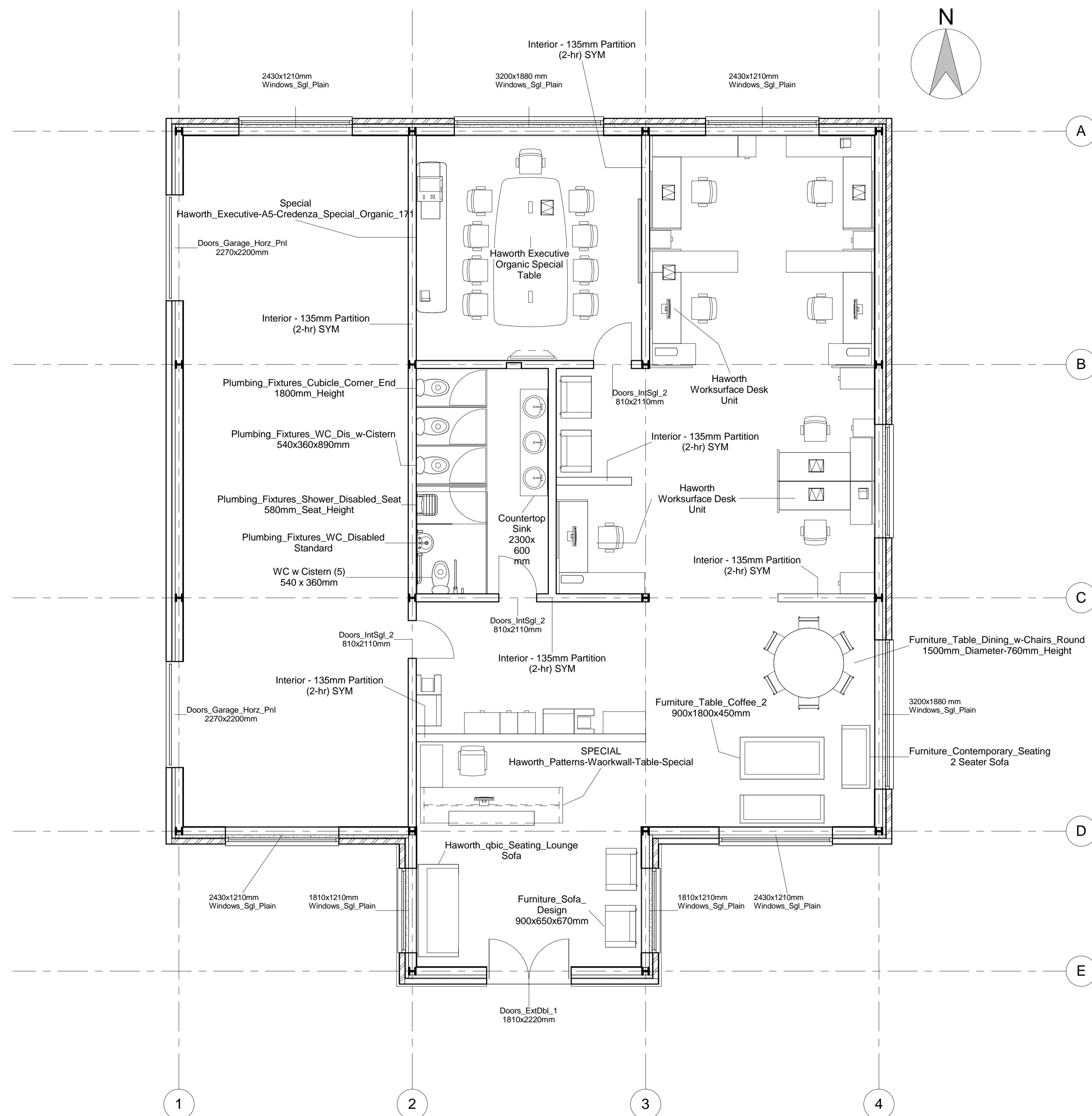
•

A.2

Scale

1 : 50

17/04/2014 18:30:01

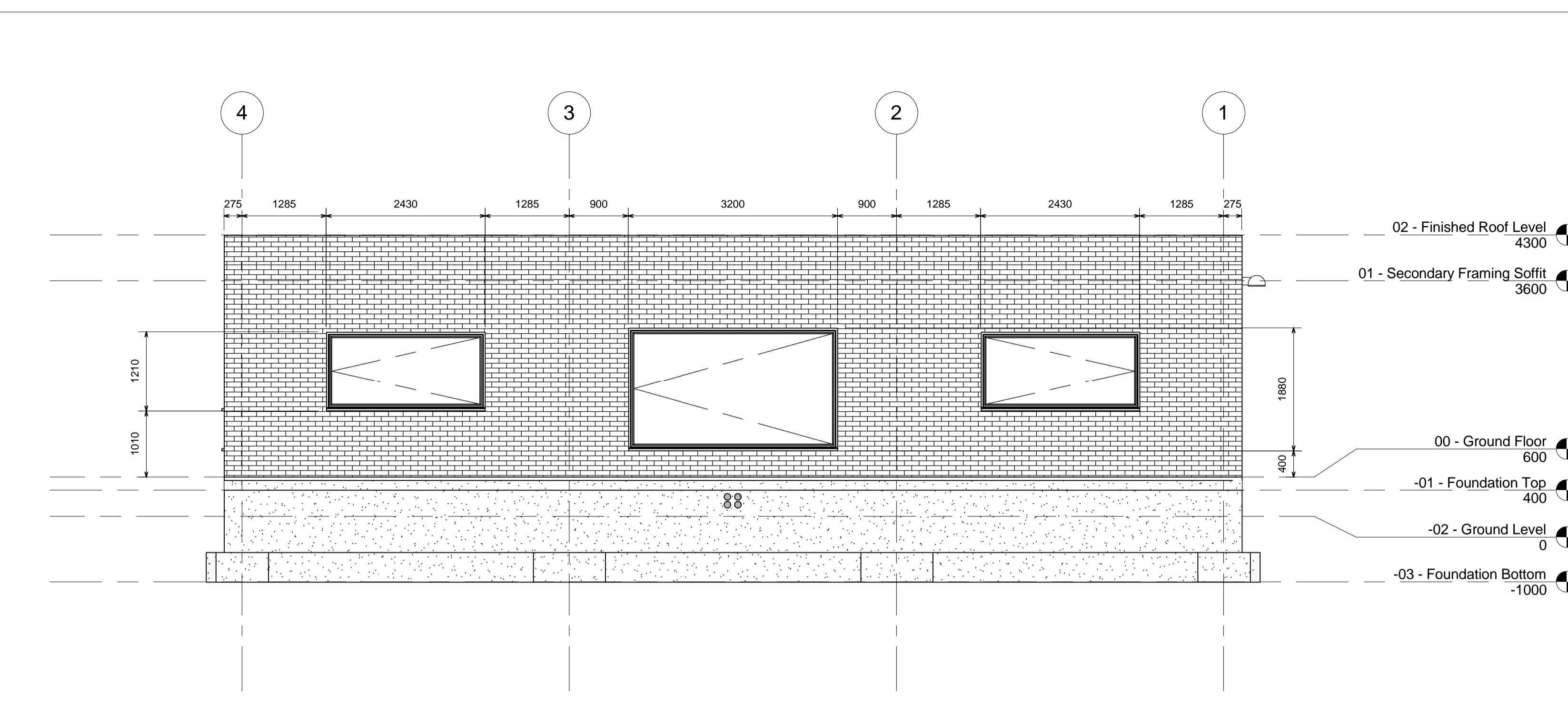


00 - Ground Floor - Architectural Finishes - Annotations & Tags

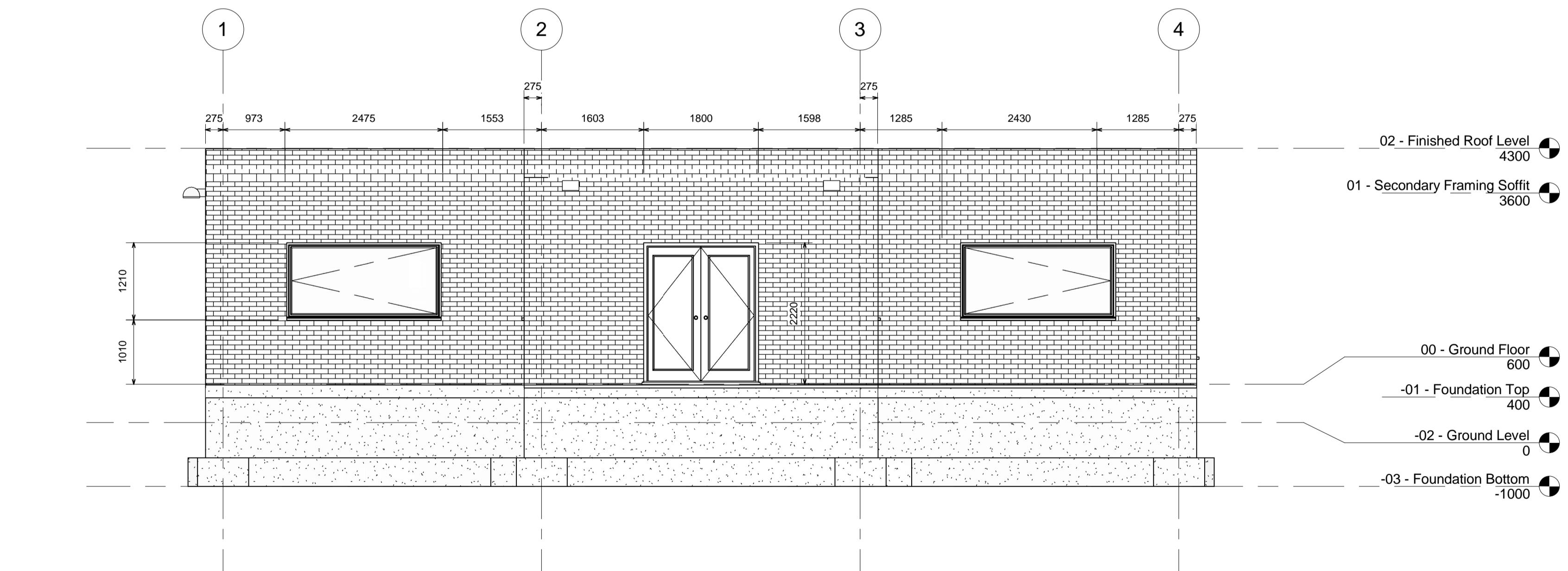
1 : 50

1 : 5

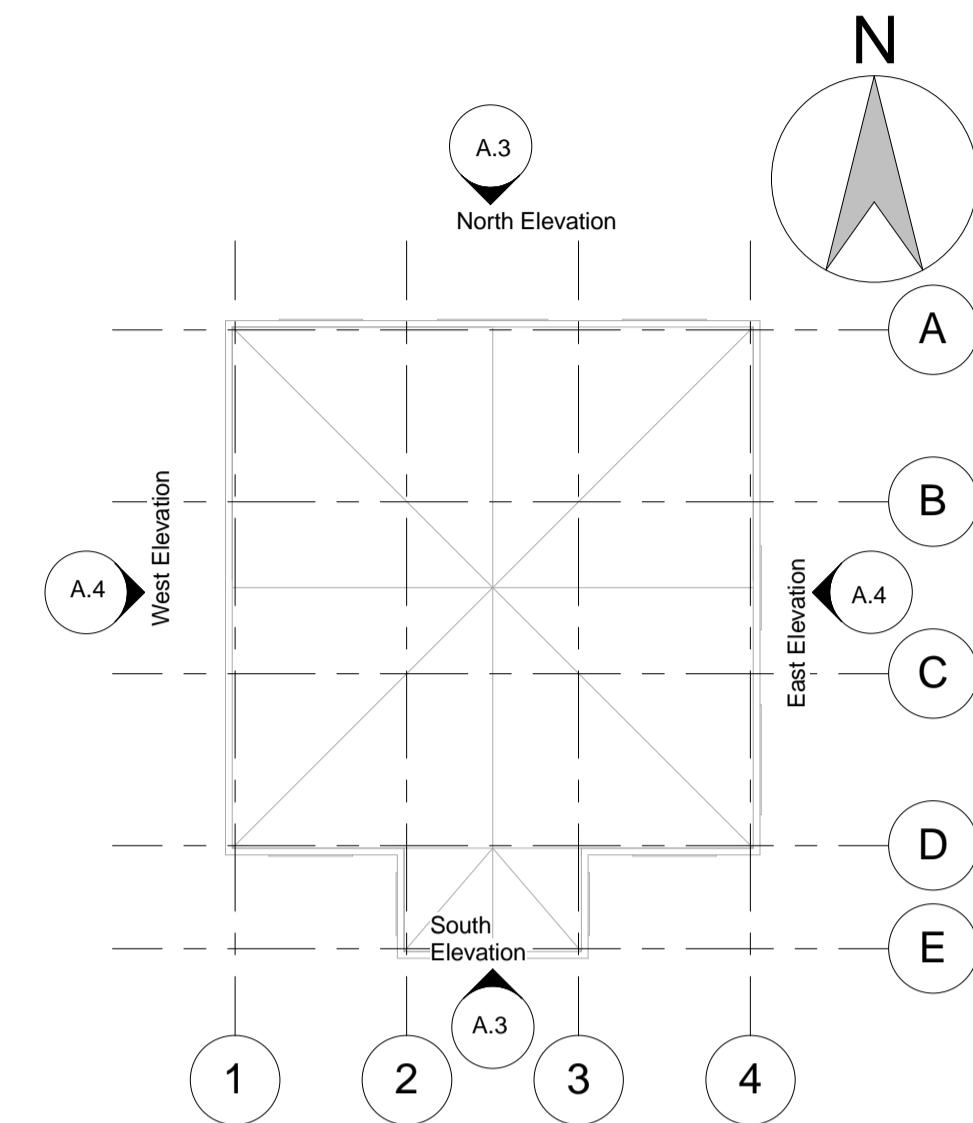
1 : 5



1 North Elevation
1 : 50



South Elevation



www.camins.upc.edu

Project Name

Elevations (N,S)

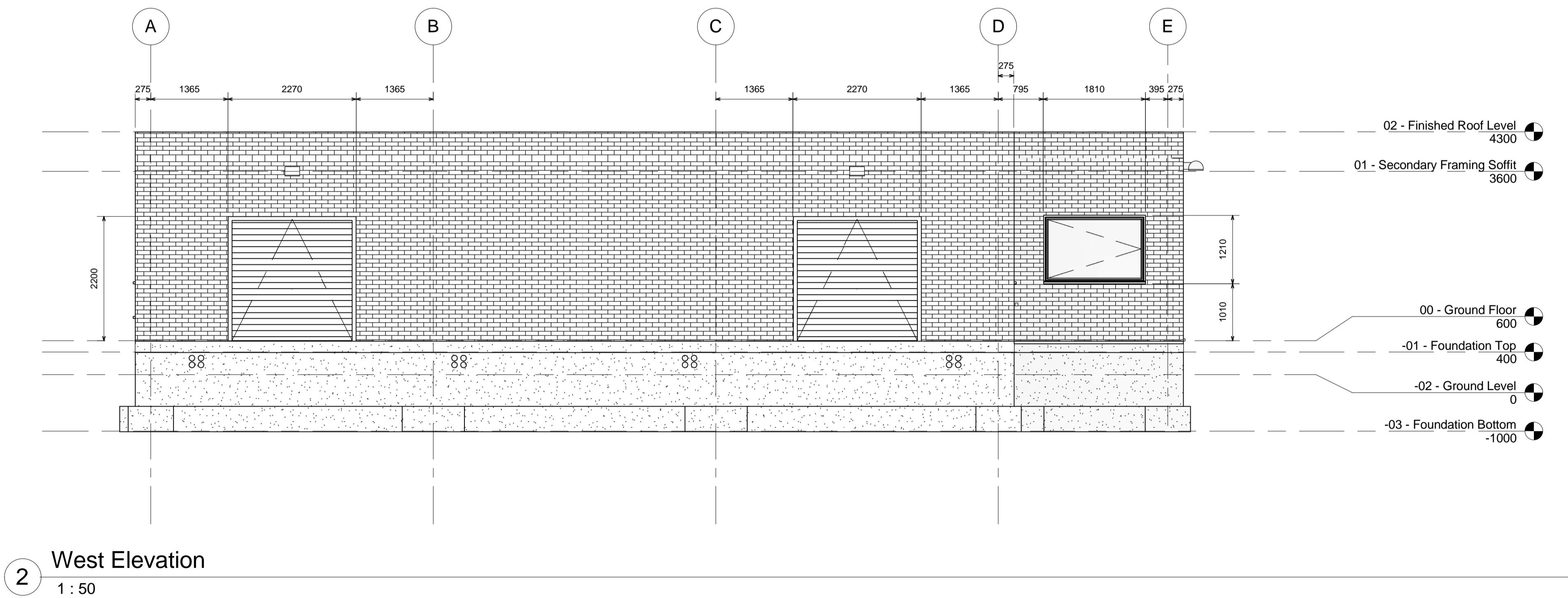
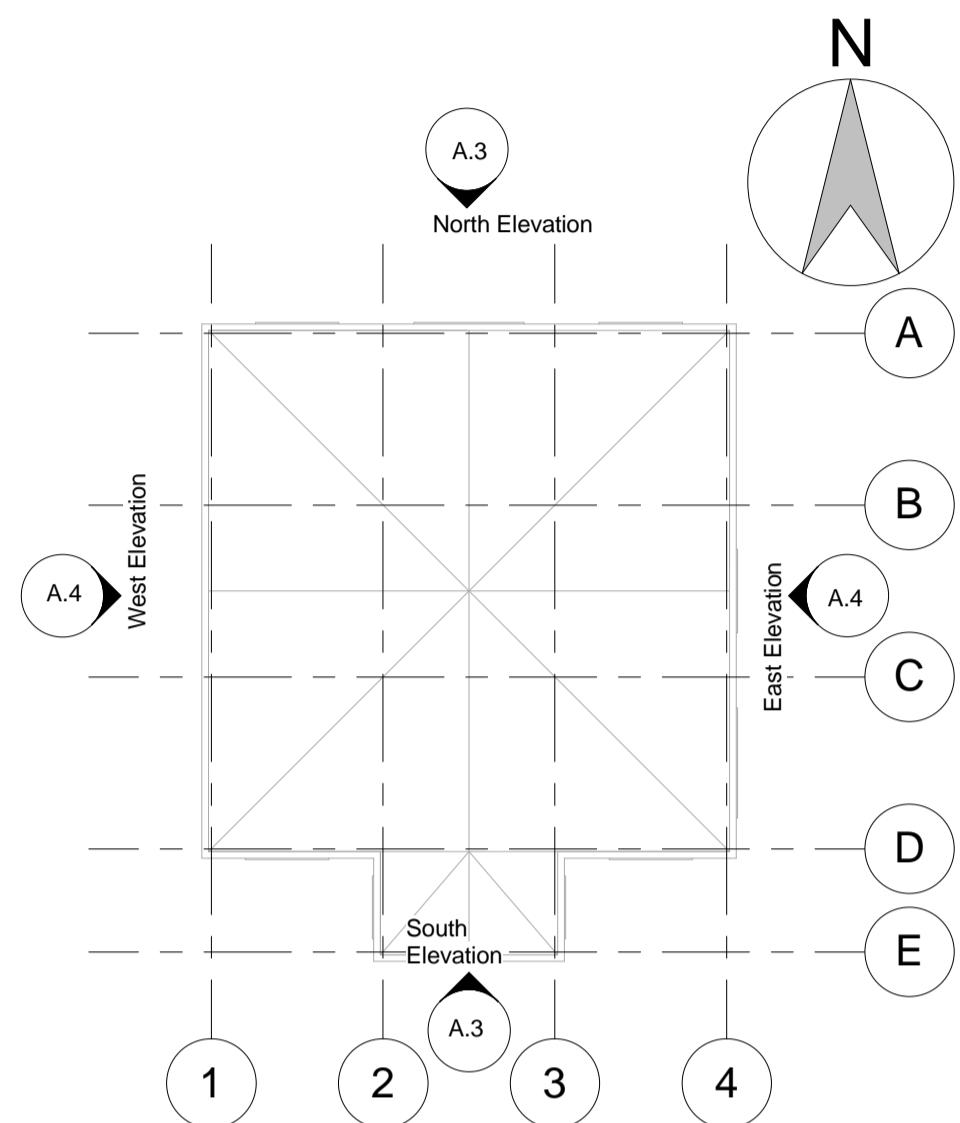
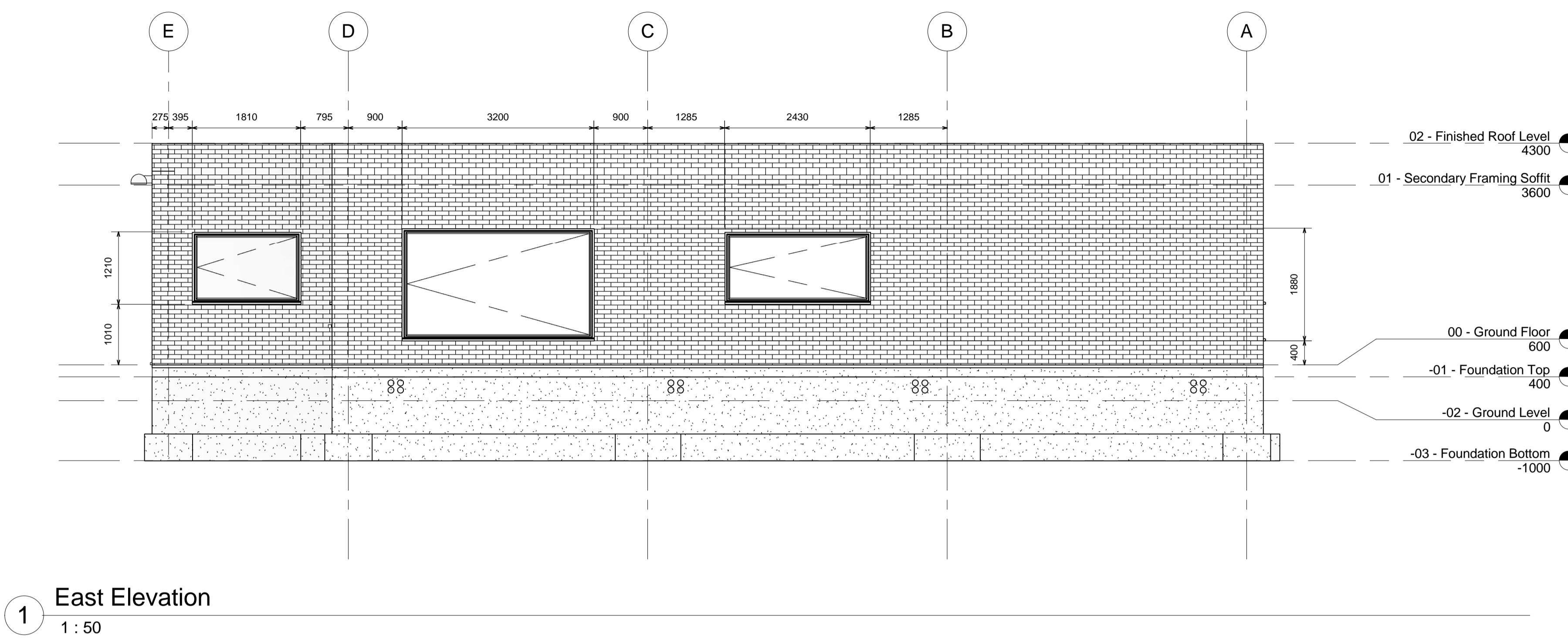
Project number

Date

Drawn by

Start 11

A.3



No.	Description	Date

Project Name

Elevations (E,W)

Project number

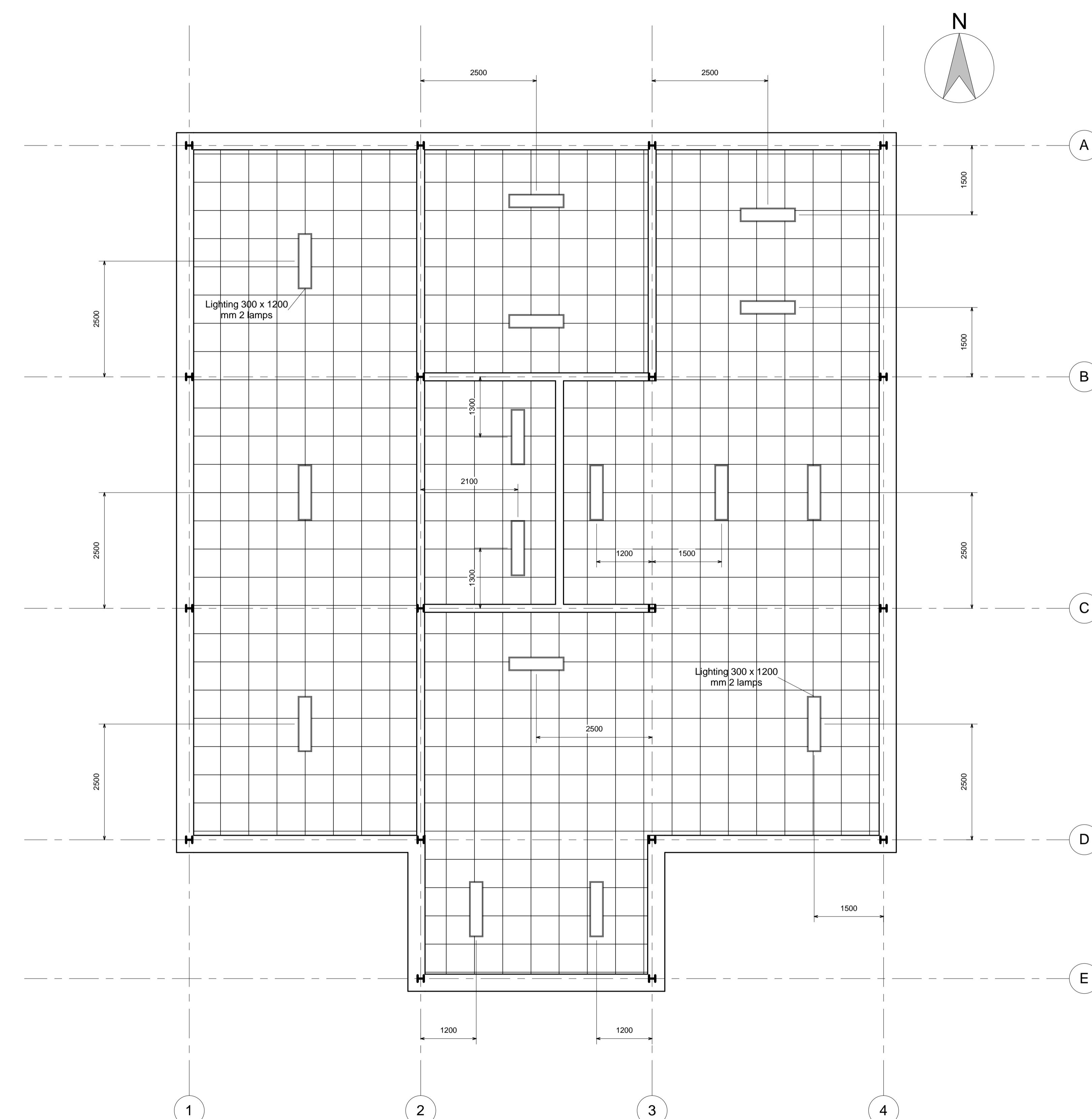
Date

Drawn by

Checked by

A.4

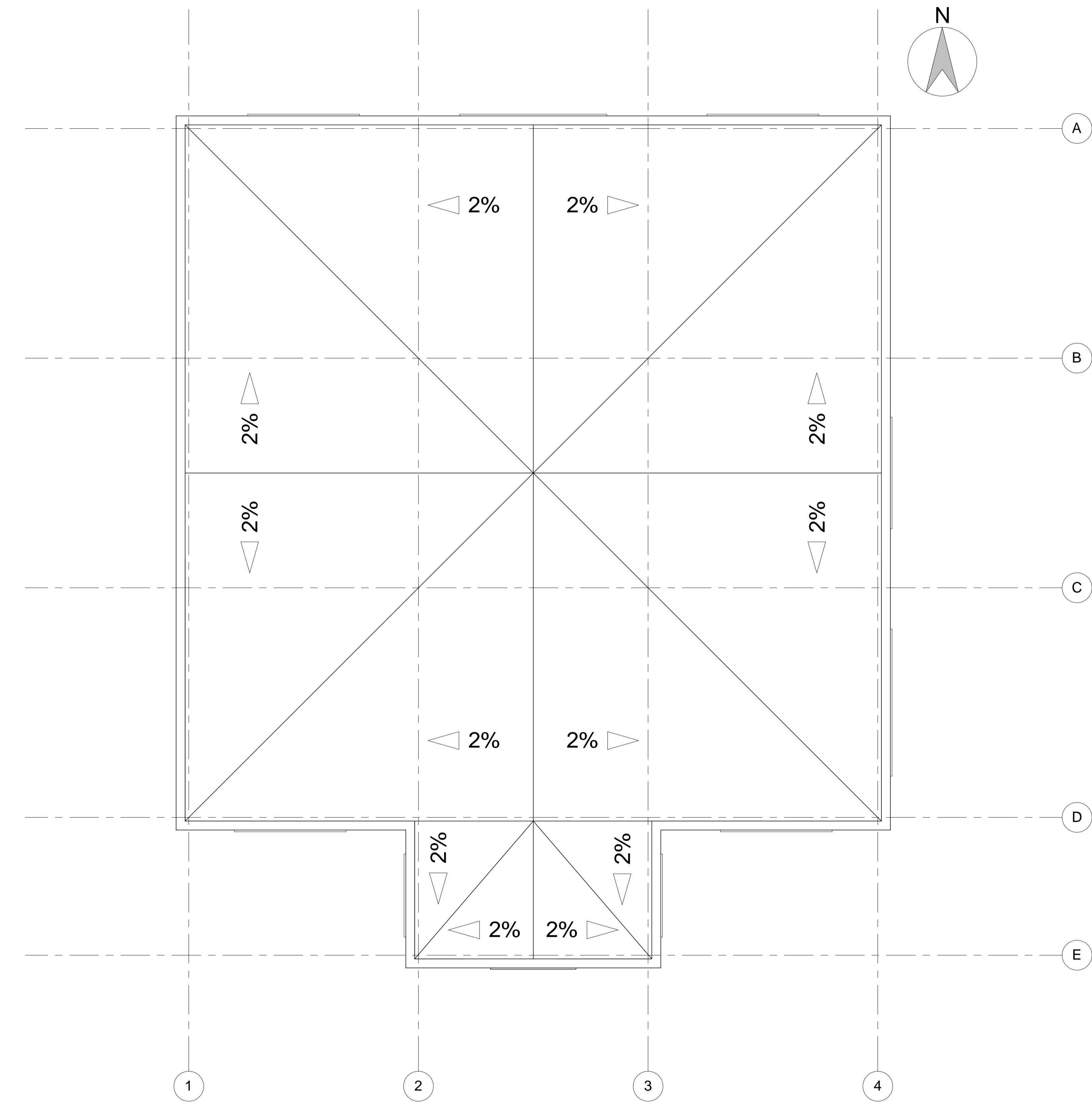
Scale As indicated



1 Reflected Ceiling - Lighting Fixtures
1 : 50

Project Name		
Reflected Ceiling		
Project number		
Date		
Drawn by		
Checked by		
A.5		
Scale	1 : 50	

17/04/2014 18:30:40



02 - Finished Roof Level

1 : 50

1 : 50



www.camins.upc.edu

Project Name

Finished Roof Level

Project number

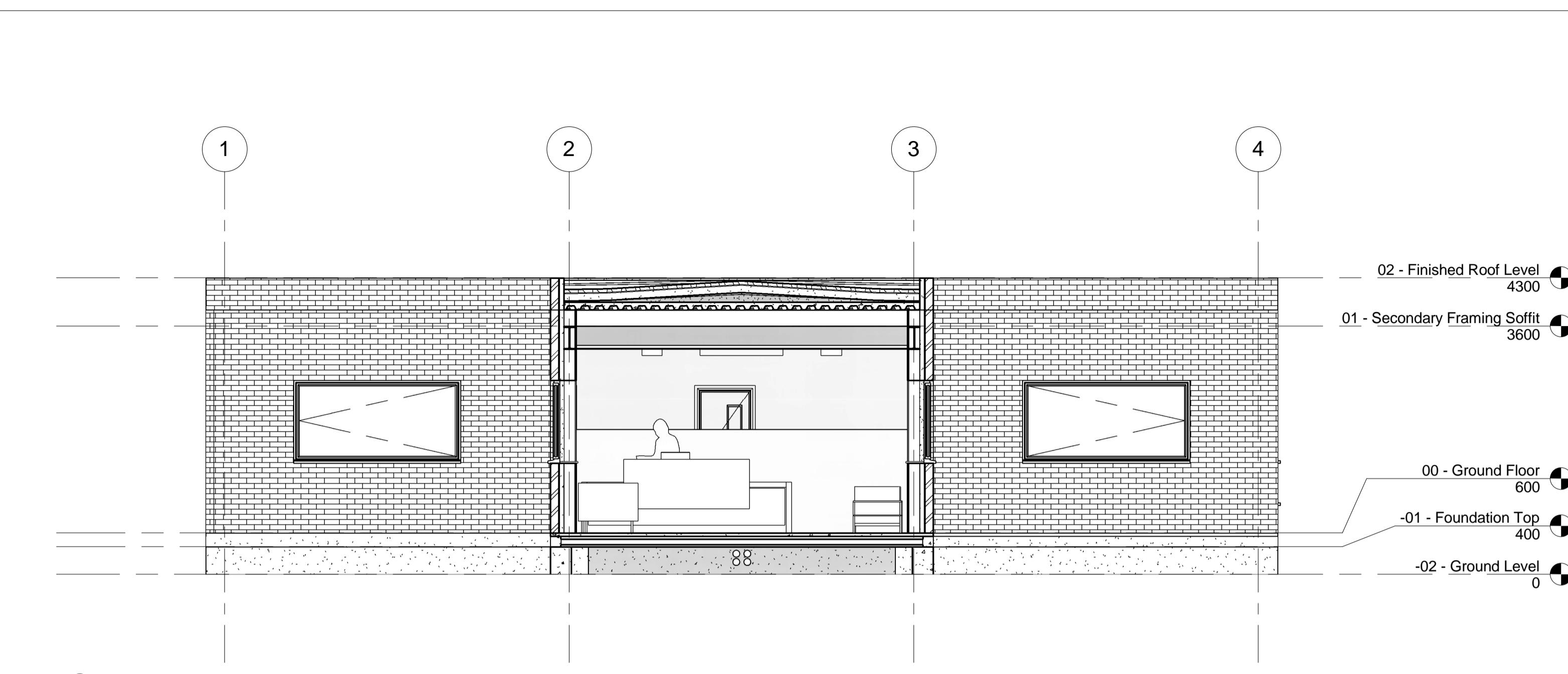
1

9

A.6

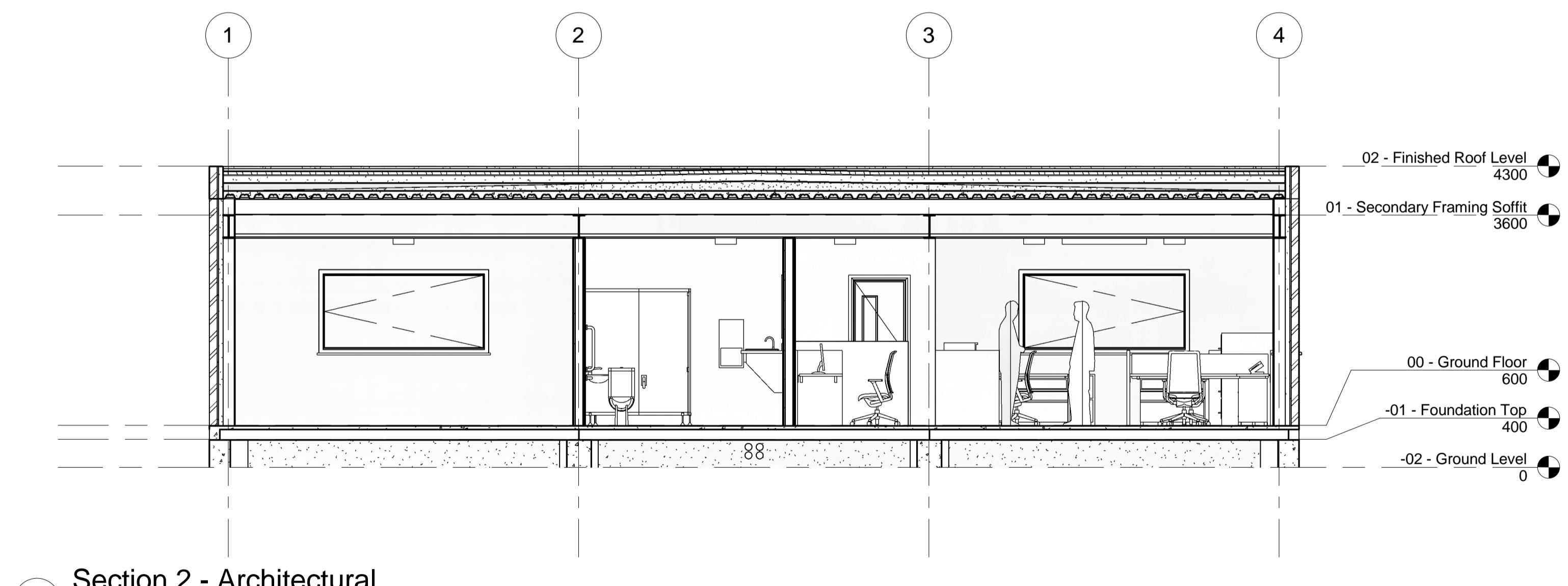
1 : 50





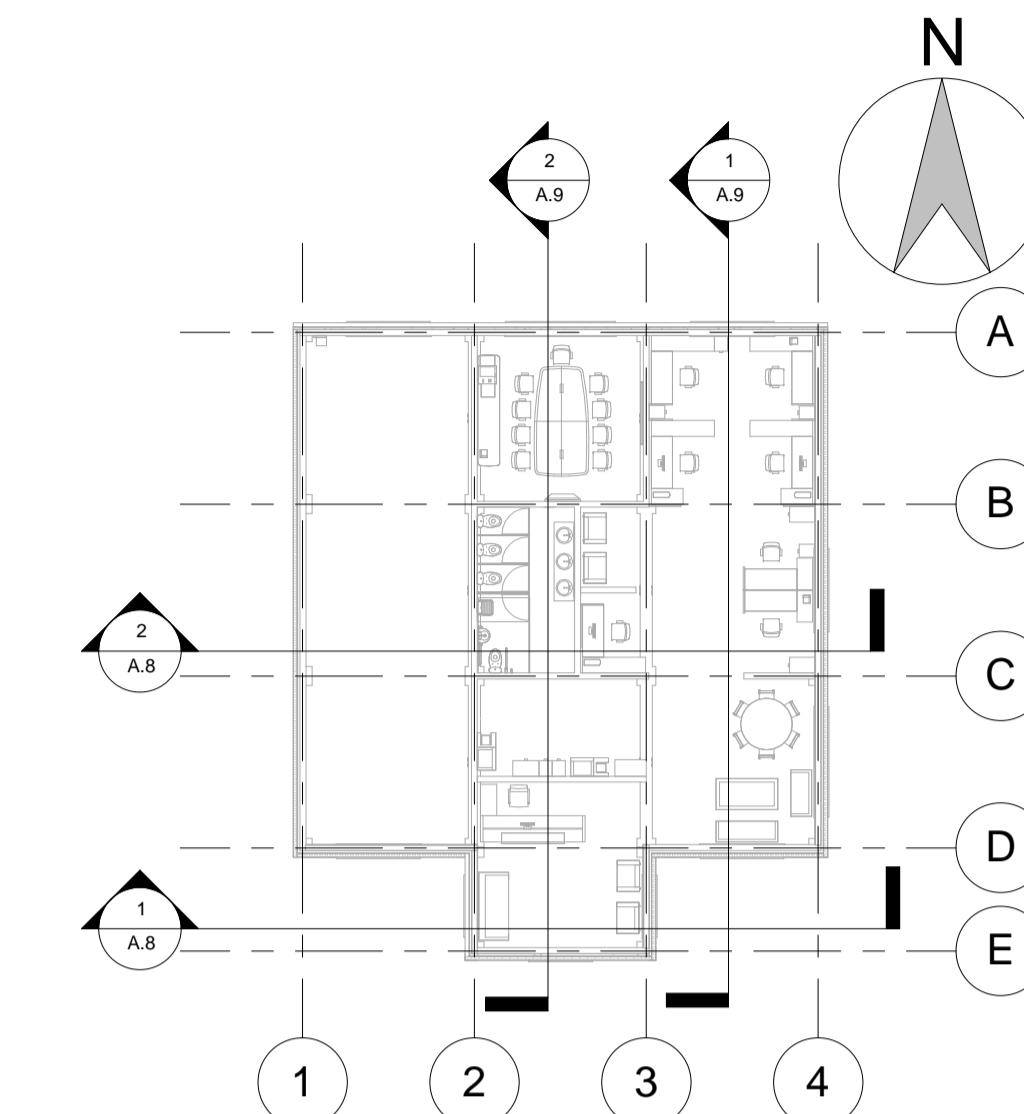
Section 1 - Architectural

1 : 50



Section 2 - Architectural

1 : 50



www.camins.upc.edu

Project Name

Sections (1,2)

Project number

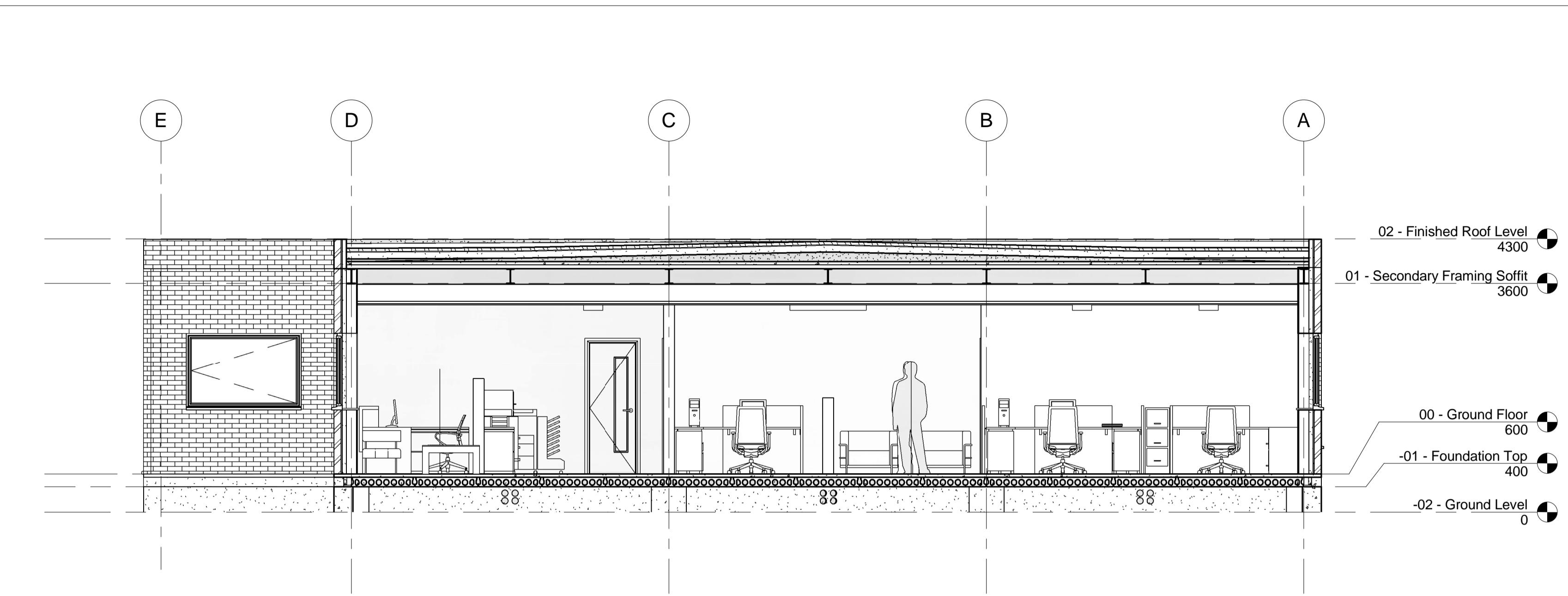
Date

Drawn by

Checked by

A.8

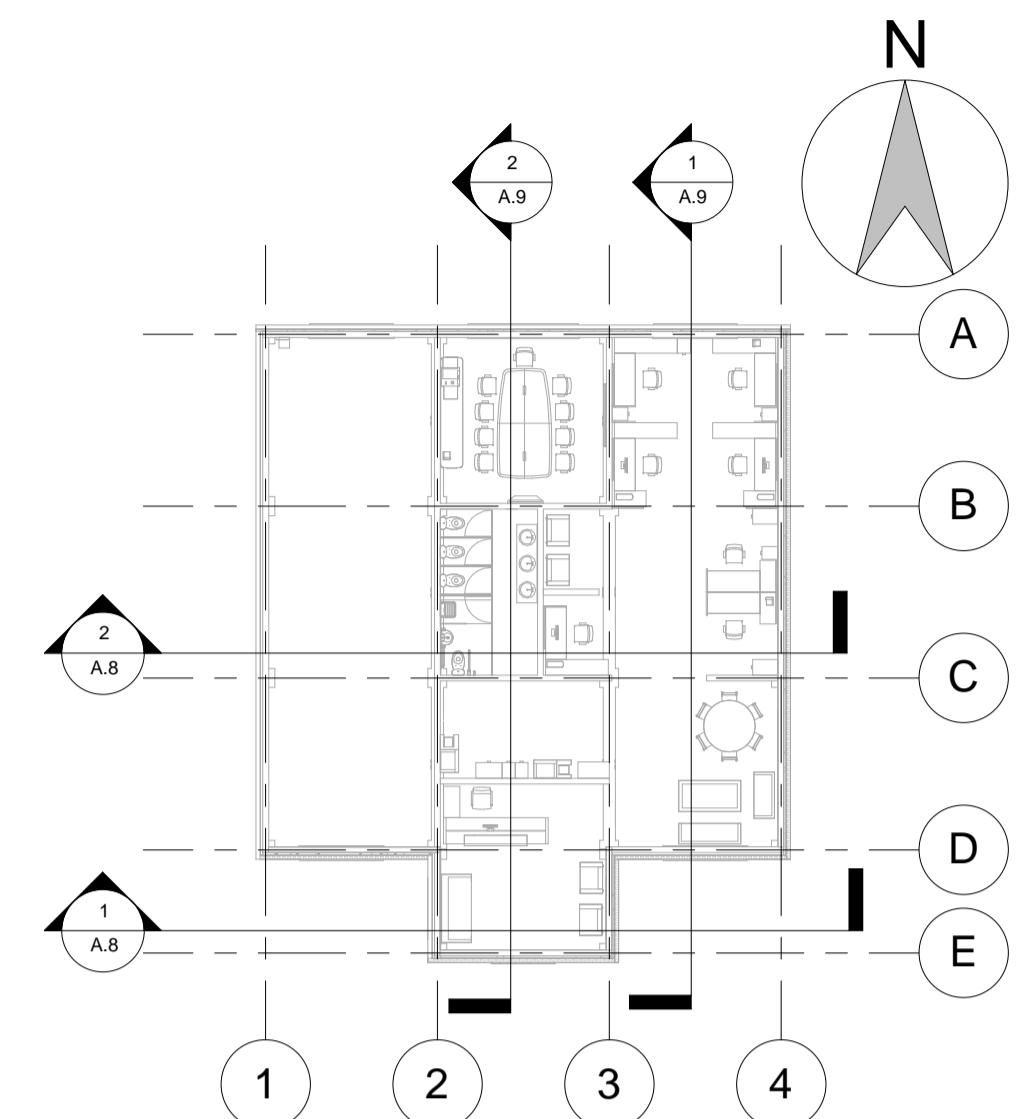
As indicated



Section 3 - Architectural
1 : 50

1 : 50

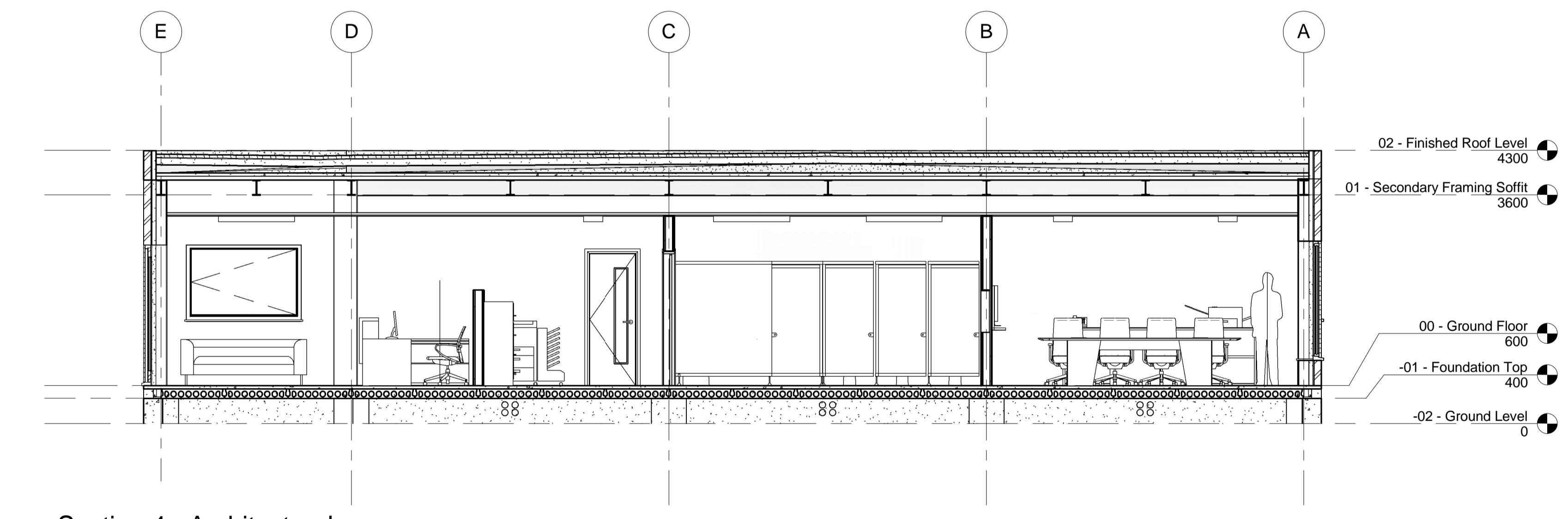
1 : 50





Escola de Camins
 Institut Universitari Superior d'Enginyeria de Barcelona, Ciències i Tècniques
UPC BARCELONATech

www.camins.upc.edu



Section 4 - Architectural
2 1 : 50

1 : 50

1 : 50

Project Name

Sections (3,4)

Project number

Date

Drawn by

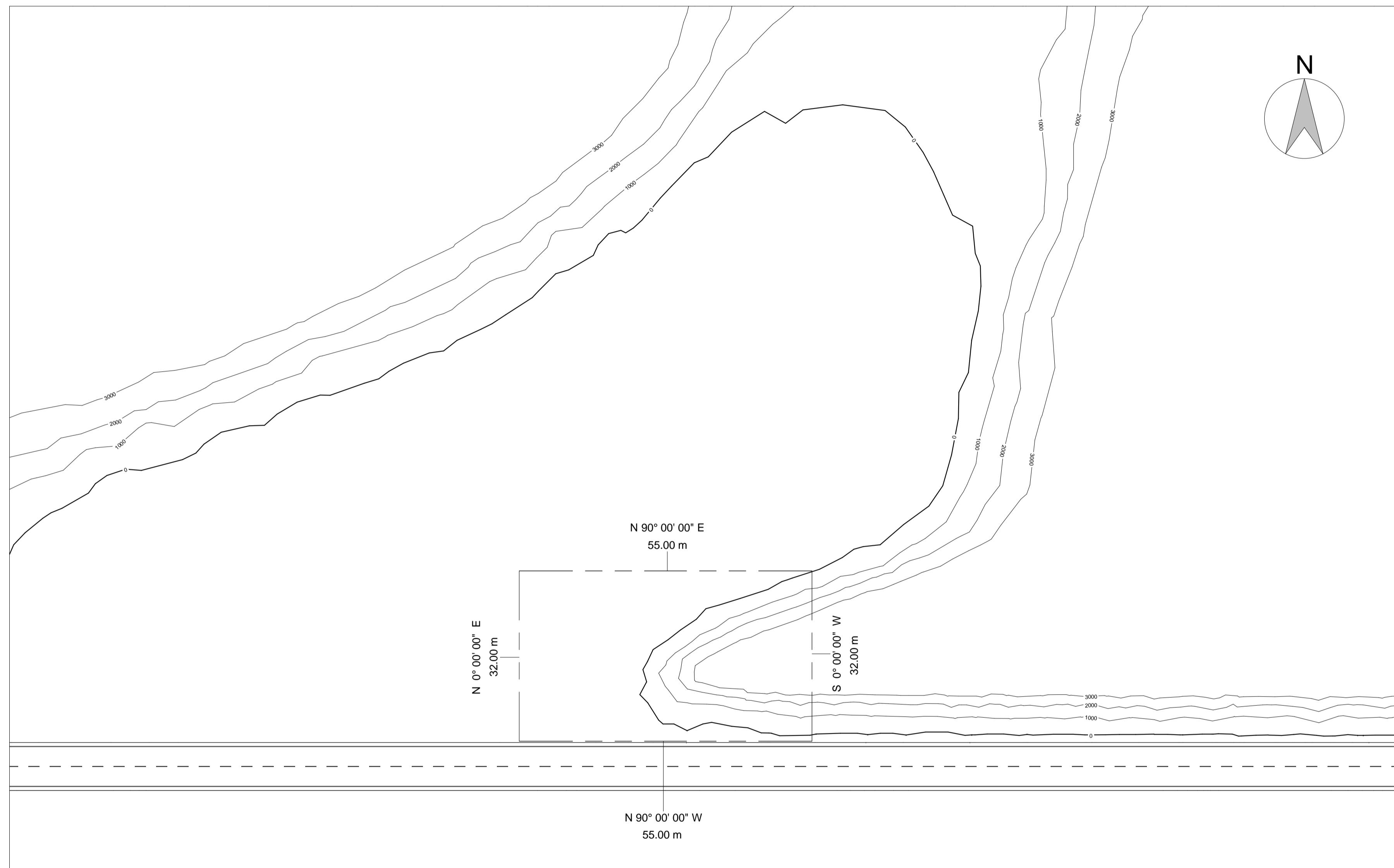
Checked by

A.9

As indicated



www.camins.upc.edu



Site Plan - Original Topography

Project Name

Original Topography

Project number

Date

Drawn by

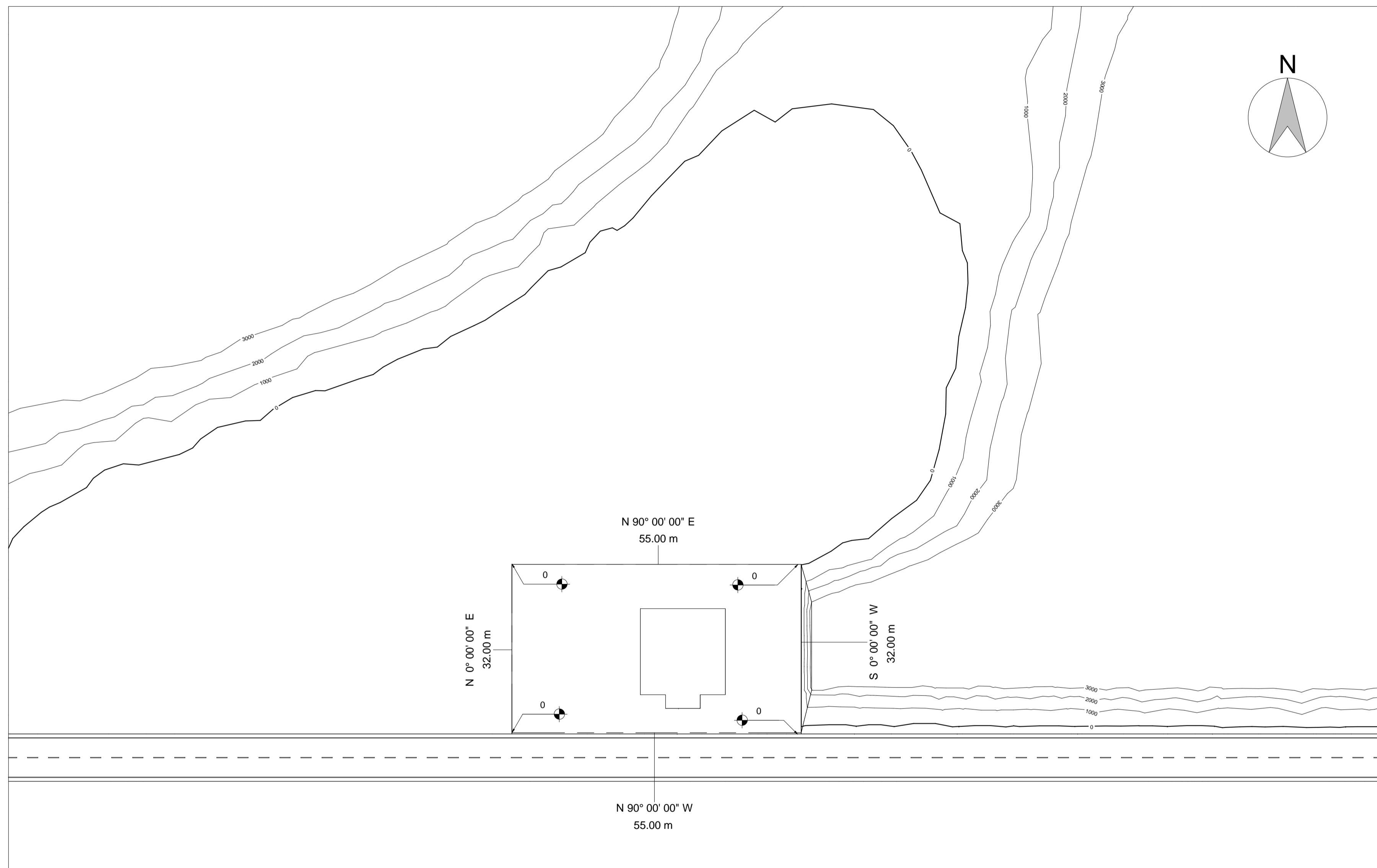
Checked by

C.1

1 : 500



www.camins.upc.edu



Site Plan - Site Topography

Project Name

Site Topography

Project number

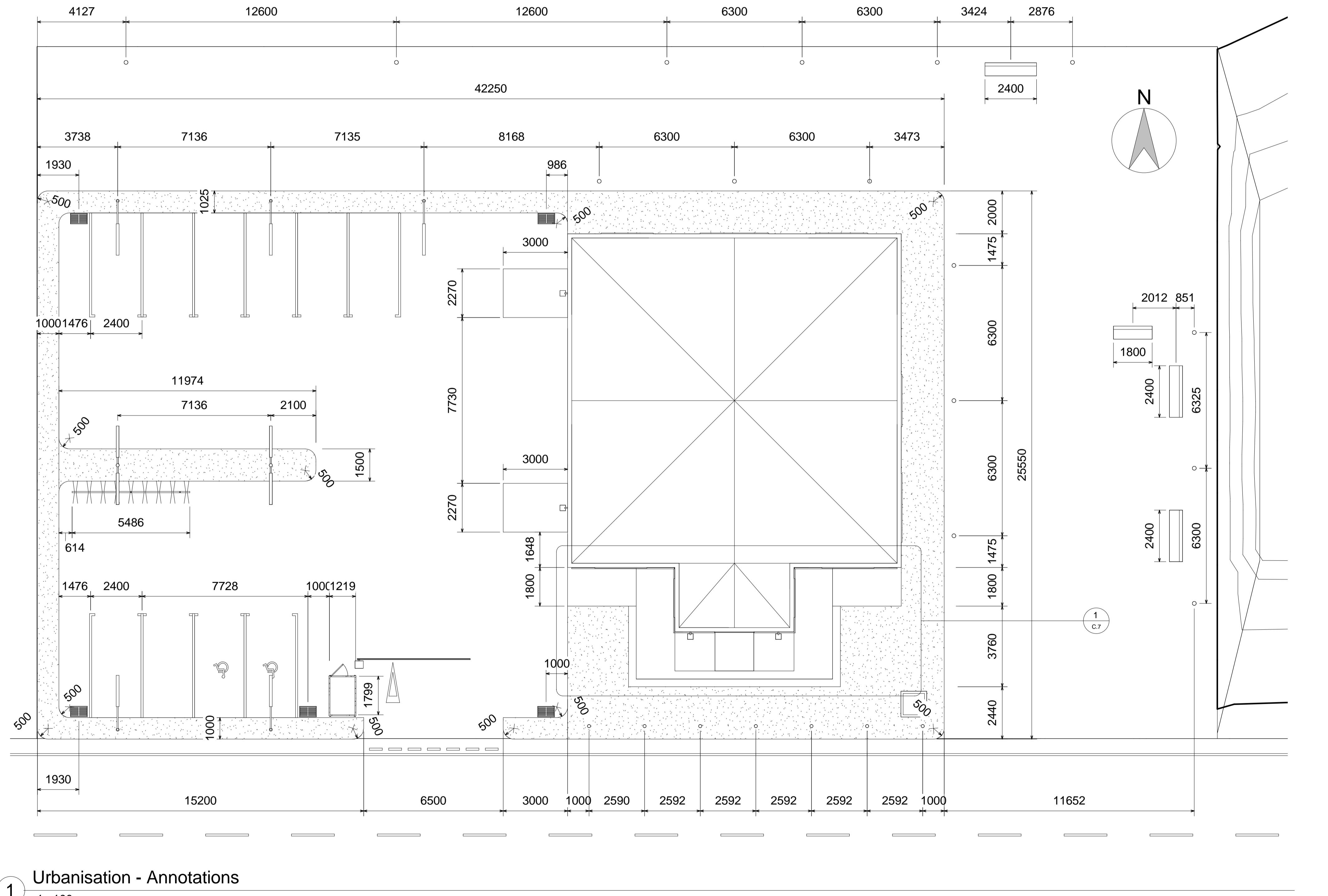
Date

Drawn by

Checked by

C.2

1 : 500



www.camins.upc.edu

Project Name

Urbanisation Plan - Annotations

ject number

- 7 -

C.3

As indicated



www.camins.upc.edu

Project Name

Urbanisation Plan - Tags

reject number

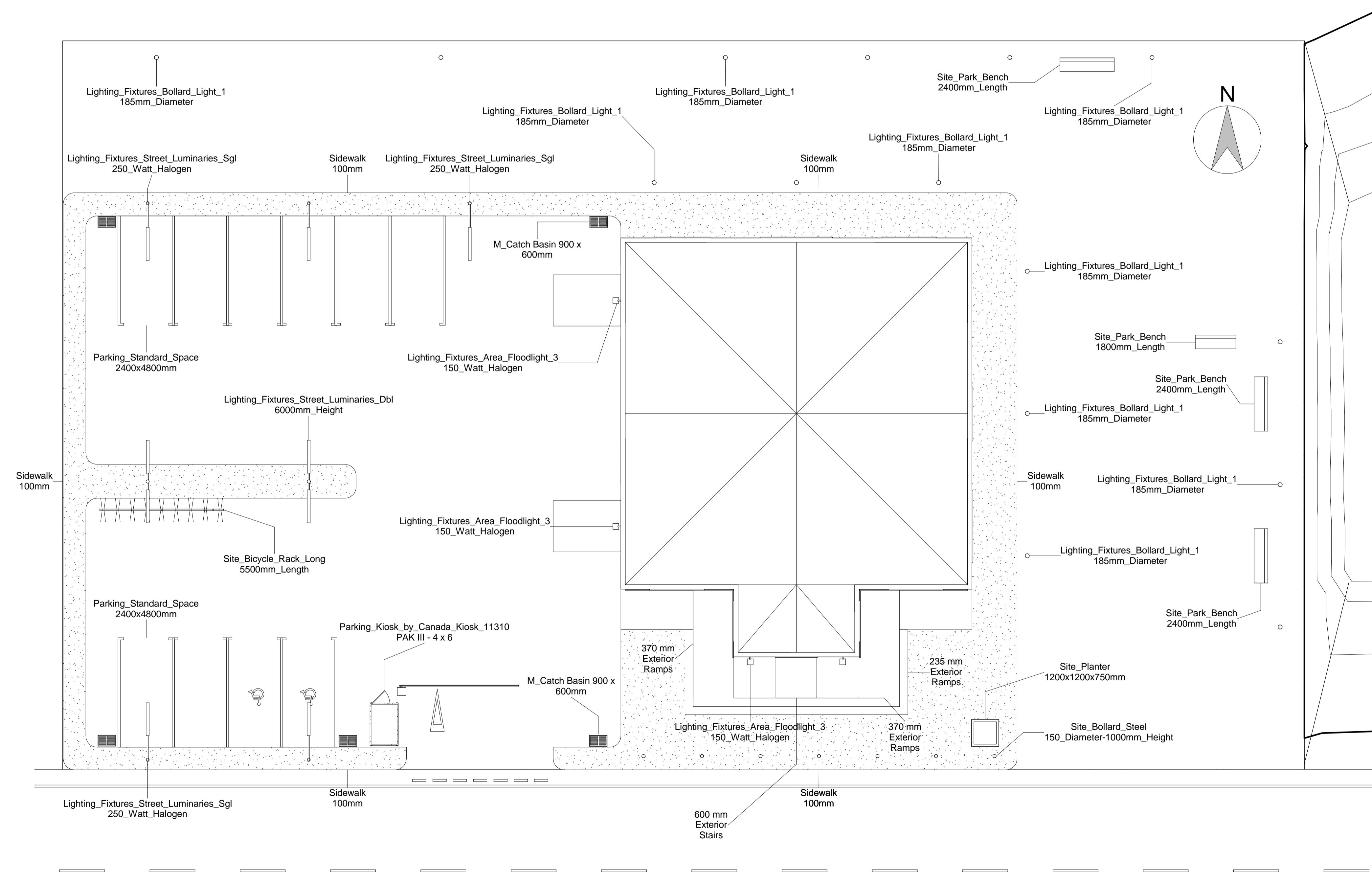
1

— 1 —

5

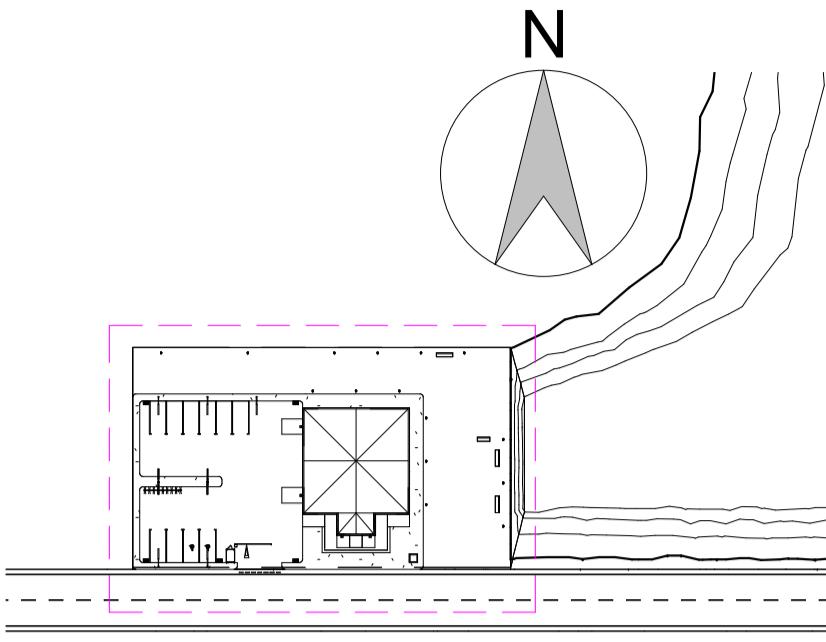
C.4

As indicated





www.camins.upc.edu



Project Name

Urbanisation Plan - Planting Tags

project number

ate

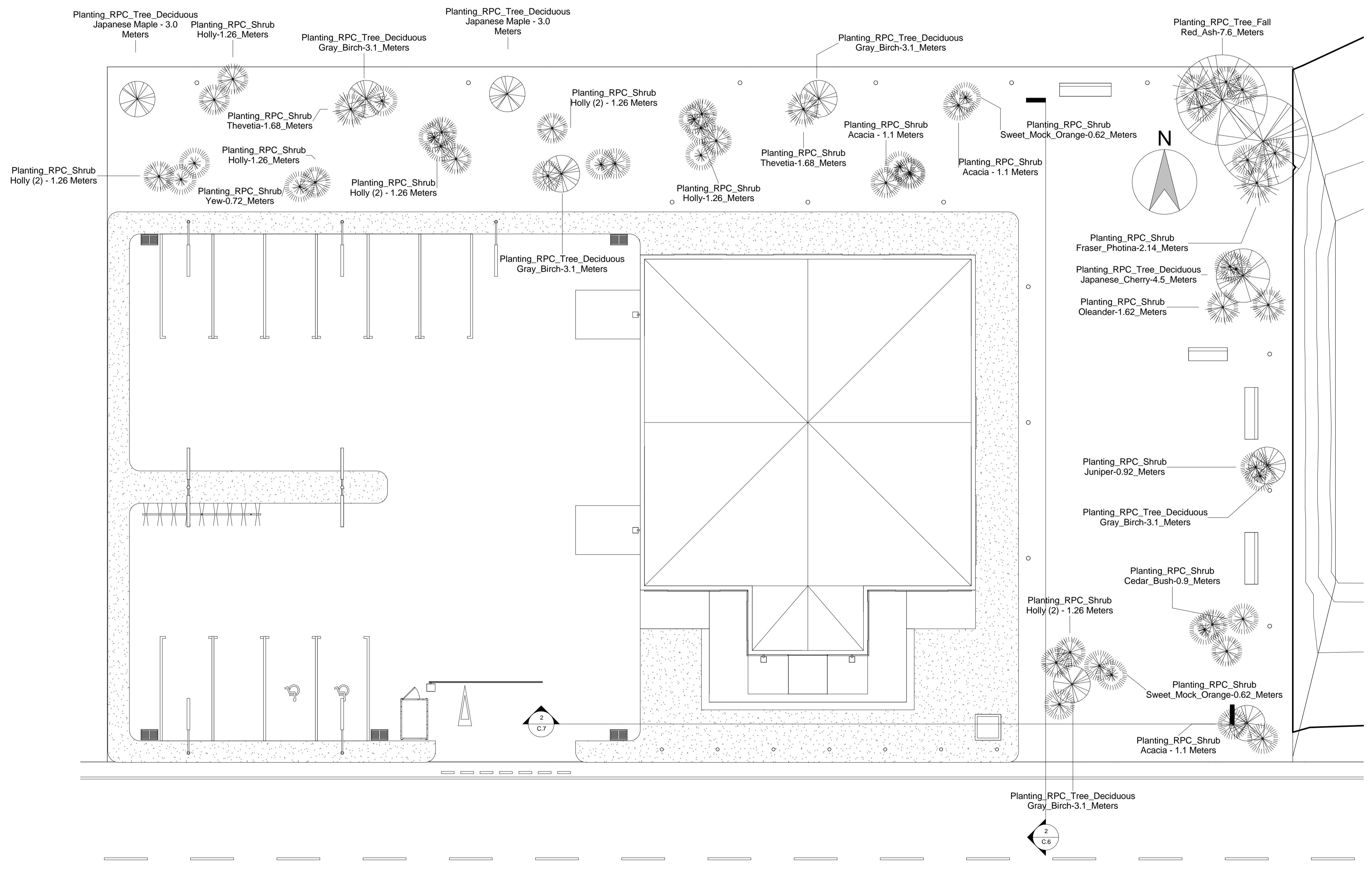
drawn by

backed by

Page 1

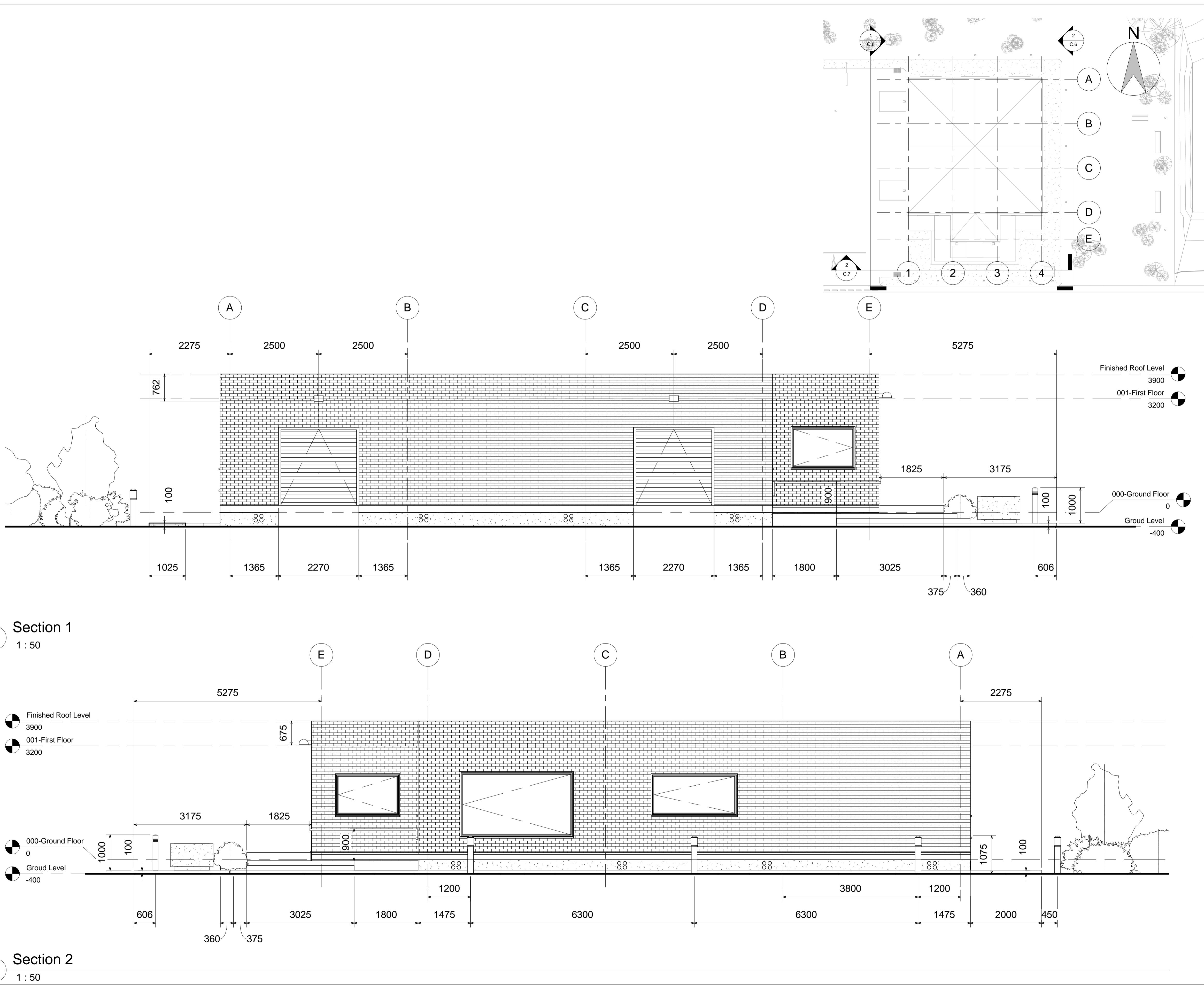
C.5

7/04/2014 18:22:18



Urbanisation - Planting Tags

1 : 100



www.camins.upc.edu

Project Name

Urbanisation Sections (1-2)

Project number

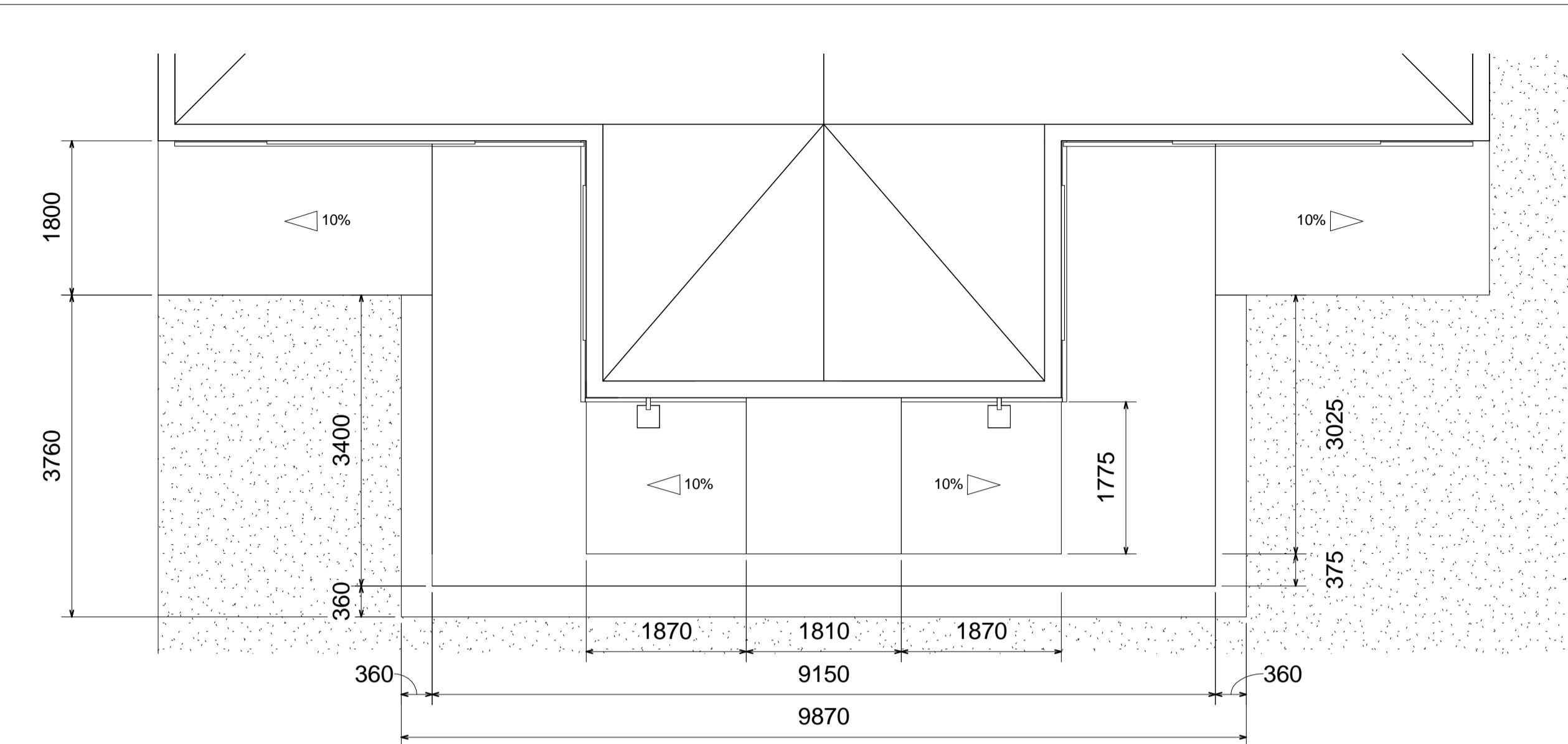
Date

Drawn by

Chapter 11

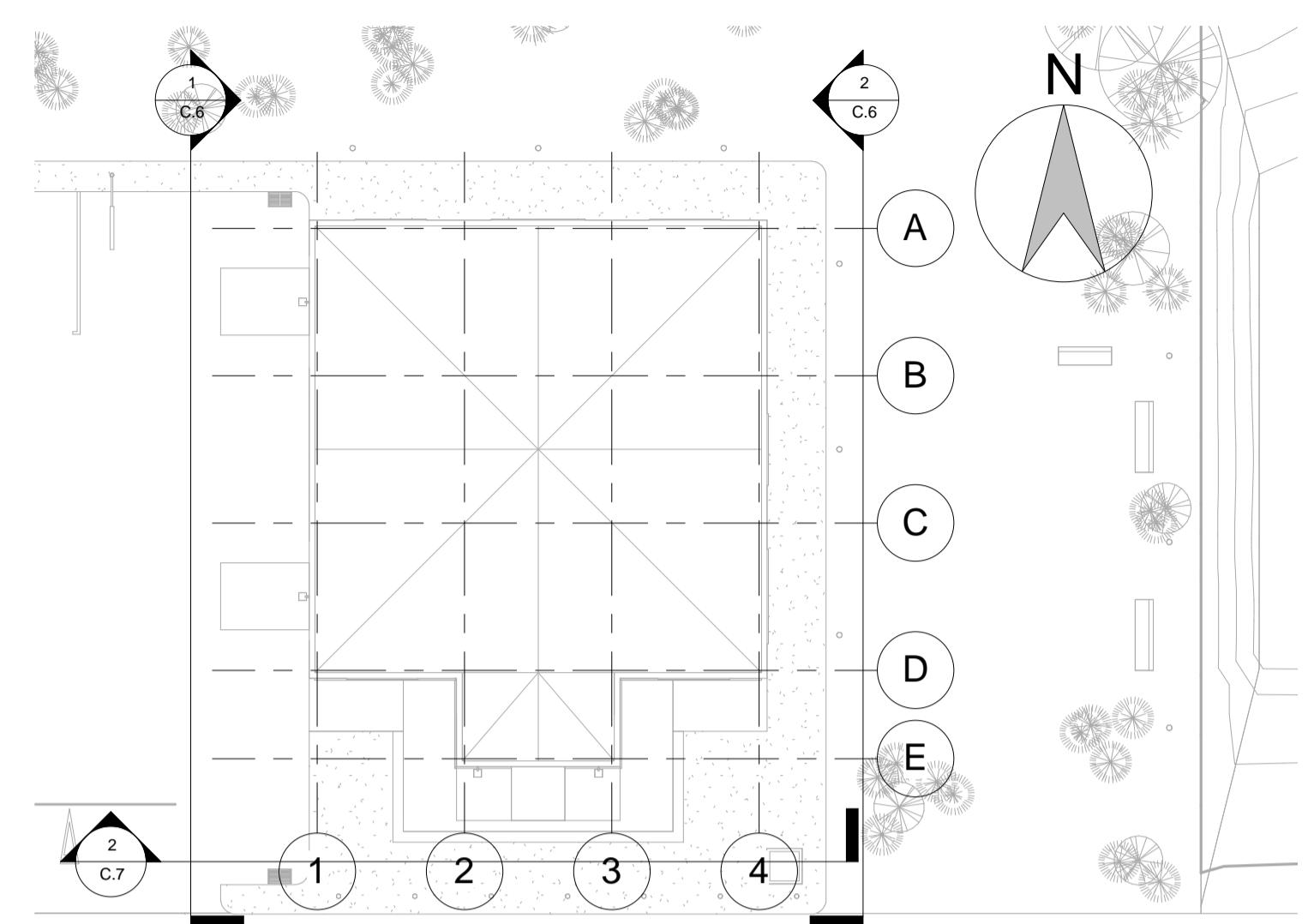
Checked by _____

C.6



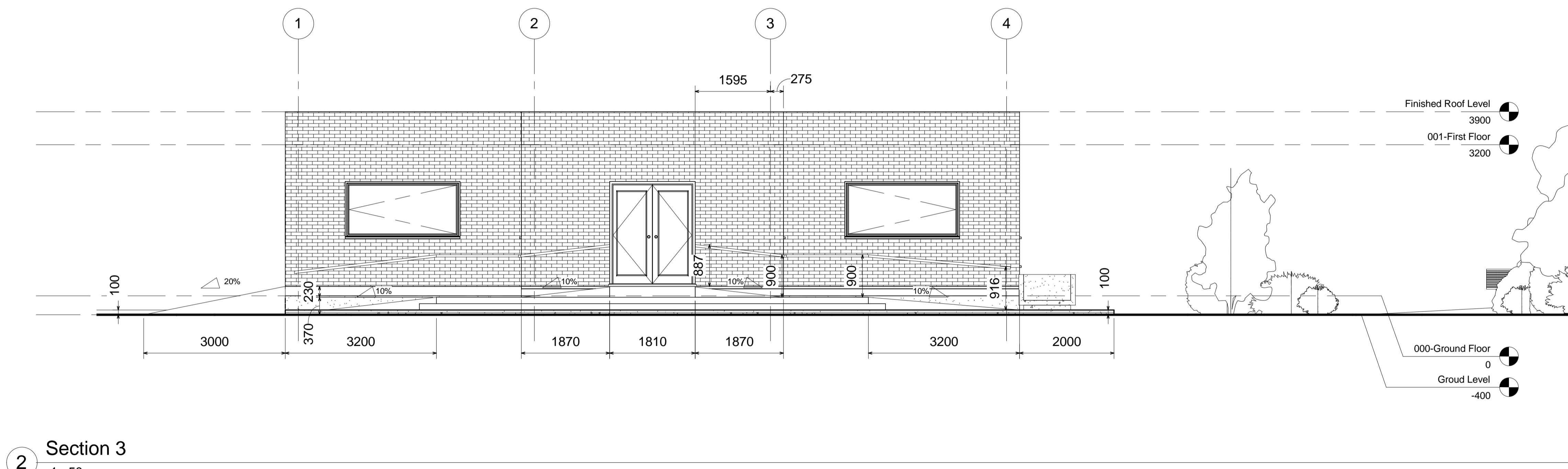
① Accesses Callout Plant View

1 : 50



 Escola de Camins
UPC BARCELONA

www.camins.upc.edu



② Section 3

1 : 50

Project Name

Urbanisation Section 3
& Access Plant

Project number

Date

Drawn by

Checked by

C.7

Scale As indicated

B.3. SCHEDULES

B.3.1. Schedule generation

Building projects involve large amounts of components with very diverse nature. The different categories of building components present in the developed model are shown in *Table 2*. As the range of component types and families is fairly wide, only the ones that have been highlighted in the table shown below will be treated.

Structure	Architecture	Systems	Urbanisation
Structural foundations	Internal walls	Electrical equipment	Pavement, ramps & sidewalks
Structural slabs	Doors	Mechanical equipment	Lighting fixtures
Structural columns	Windows	Electrical systems (Power supply, telecoms, fire protection, etc.)	Parking equipment
Structural framing & bracing	Floor components	Duct systems (HVAC)	Urbanisation equipment
Walls	Ceiling components	Piping systems (Water supply, drainage, sewage, fire protection)	Planting components
Structural roof components	Furniture components		
	Lighting & electrical fixtures		
	Plumbing fixtures		

Table 1: Building components categorised by field

For the purpose of this work, the examples developed herein will be focused on material and quantity take-offs of some representative building elements. The aim of these examples is to represent common material procurement tasks, such as the generation of cost estimates and material supply planning.

The developed schedules will be as follows:

- Graphical column schedule: For steelwork structure columns.
- Material take-off: For foundations and the steelwork structure framing systems.

Therefore, only ‘graphical column’ and ‘material take-off’ schedules will be created amongst the schedule typologies presented below.

B.3.2. Schedule typologies

The basic schedule typologies offered by Revit are listed and briefly described below:

- Schedule/Quantities: Generates a customisable generic schedule for building components.
- Graphical column schedules: Gather and present column information graphically.
- Material take offs: Generates documents similar to ‘Schedule/Quantities’, but includes information of the sub-components and materials that make up an object assembly. This schedule typology would include, for example, usual wall quantities broken down by layers, offering necessary additional information.
- Sheet list: Generates a schedule that lists drawings in a model.
- Note block: Generates a schedule that lists descriptions for symbols used in a model.
- View list: Generates a schedule that lists and organises model views within a project. Note that model views can be of very diverse nature, being this schedule typology somewhat useful to navigate within a project model.

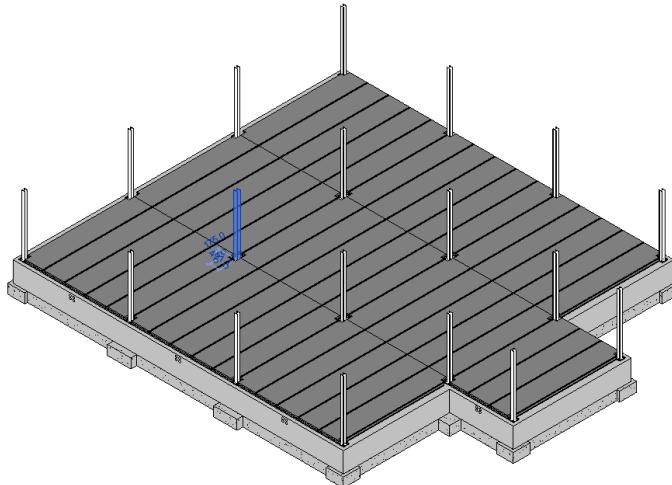
B.3.3. Graphical column schedule

Graphical column schedules represent all columns in a project through four basic parameters: their section type, their location in plan, and their base and top end levels. Their position in plan is determined by the gridline intersection they have been placed in. Each of the schedule’s columns represents a gridline intersection, which is named at the bottom of the schedule. Their base and top end levels, in turn, are found in each of the schedule’s rows. Columns are completely defined when their graphical representation, which reproduces the column’s profile and orientation, goes from their base level to their top level row. Intermediate column base or top ends within a same level may be represented as well by height values on each row title. This schedule typology may be very useful to quickly identify column length and profile type based on gridline intersections and building levels. Its generation is oriented to material procurement, but specially to the assistance in column placement tasks.

If accessed in Revit, selected columns in a schedule are found highlighted in the building model and vice versa. This allows for quick revision of column definition in schedules and for multiple corrections if any error is detected. Changes made to the schedule are reflected consistently in the building model. This has been defined as bi-directional associativity. In order to illustrate this capability, we will incorrectly define a column profile located at gridline intersection B-2 as an HEA160 instead of an HEA 140. At first sight, this error may not be detected when visualising the model, but becomes more evident when revising the generated graphical column schedule shown in *Figure 1*. Once selected, the incorrect column can be found highlighted in all of the model’s views, as shown in *Figure 2*, and assigned its pertaining HEA 140 profile. The correction is automatically transmitted to the final schedule shown in *Figure 3*.

Structural steelwork columns									
001-Suspended ceiling level									001-Suspended ceiling level
3200	HEA 140	3200							
000-Ground Floor									000-Ground Floor
0									0
Column Locations	A-1	A-2	A-3	A-4	B-1	B-2	B-3	B-4	C-1

Structural steelwork columns									
001-Suspended ceiling level									001-Suspended ceiling level
3200	HEA 140	3200							
000-Ground Floor									000-Ground Floor
0									0
Column Locations	C-2	C-3	C-4	D-1	D-2	D-3	D-4	E-2	E-3

Figure 1: Generated graphical column schedule**Figure 2:** Model view of selected column from schedule: column is highlighted in blue

Structural steelwork columns									
001-Suspended ceiling level									001-Suspended ceiling level
3200	HEA 140	HEA 160A	HEA 140	HEA 140	3200				
000-Ground Floor									000-Ground Floor
0									0
Column Locations	A-1	A-2	A-3	A-4	B-1	B-2	B-3	B-4	C-1

Structural steelwork columns									
001-Suspended ceiling level									001-Suspended ceiling level
3200	HEA 140	3200							
000-Ground Floor									000-Ground Floor
0									0
Column Locations	C-2	C-3	C-4	D-1	D-2	D-3	D-4	E-2	E-3

Figure 3: Updated graphical column schedule

B.3.4. Material take-off schedules

Material take-off schedules will be developed for two of the basic structural systems of the building: its foundations and the structural steelwork framing systems. The material take-off for foundation elements will be focused on presenting quantities broken down in subcomponents, as foundation walls are wrapped in waterproofing and protection layers. On the other hand, material take-off for structural steelwork beams will be treated to develop a basic cost estimate for procurement.

Information contained in a model database is always read under a parameter name. All data values are understood as a parameter with a unique name and an associated nature. The nature of a parameter defines the meaning of the value; whether it's a length, a cost, a density, etc. Therefore, all this metadata involved with a model's data helps its organised management and avoids its misuse. For example, the numeric value understood as 'beam length' will not be used under any other meaning. Parameters are in turn organised by semantic categories, which is very useful to easily identify and request the desired information. For instance, structural-related parameters such as 'moment of inertia', 'structural material strength', 'structural usage' and so forth are found in the same category. Furthermore, data values can be sorted and filtered by project phases, levels, gridline location and other general project categories. Some BIM platforms like Revit allow the additional processing of the model's data. For example, new parameters known as 'calculated values' can be defined from algebraic expressions involving other values. Other features include the filtering of information with the use of logic expressions.

Foundations

The building's foundation system is composed of a variety of column footings tied by ground beams. Column piers and foundation walls are in turn supported on top of these elements respectively. As the defined phases for building construction indicate, the foundation system will not be executed all at once. This is a good opportunity to include time attributes in the schedule to be created. Revit allows the filtering of information appearing in a material take-off by construction phase. Therefore, two material take-offs will result from this distinction. One will contemplate column footings and ground beams executed in phase '1.1' and the other will present column piers and foundation walls cast in phase '1.2'.

To begin with, material take-off for ground beams and isolated footings will be rather simple. Very basic pre-defined parameters will be used. These include: family and type, count, dimensions, soffit level, structural material information, quantities and phase of creation. As shown in *Figure 5*, the schedule contains each instance itemised. If need be, a summarised schedule can be obtained by grouping object instances by family type, as shown in *Figure 4*.

Moving on to foundation walls and column piers, we find an increase of complexity regarding object sub-components. As stated in the '*Structural Model*', retaining foundation walls include several wrapping layers in their external faces. These correspond to waterproofing, drainage and filtering layers. As described previously, material take-offs allow the break-down of these assemblies into individual material sub-components. As these layers are applied in contact with the ground, perimeter retaining foundation walls will be the only ones to be assigned quantity values. Note that column piers have been contemplated as additions to foundation walls under the same family category, so that they share similar parameters. In the material take-off shown in *Figure 6* all parameters previously presented for ground beams and footings have been included. Additionally, wall object specific properties such as thermal mass, thermal resistivity and conductivity have been included to demonstrate that BIM models are capable of bearing information beyond mere geometric parameters.

Wall Material Takeoff										
Family	Family and Type	Count	Function	Length	Width	Height	Total Volume	Material: Name	Material: Description	Material: Volume
Basic Wall	Basic Wall: Retaining (W,D,F) - 300mm Concrete	1	Retaining	5400 mm	370 mm	950 mm	1.81 m ³	Damp-proofing	Waterproofing membrane	0.00 m ³
Basic Wall	Basic Wall: Retaining (W,D,F) - 300mm Concrete	1	Retaining	5400 mm	370 mm	950 mm	1.81 m ³	Concrete, Sand/Cement Screed	Concrete wall lining	0.10 m ³
Basic Wall	Basic Wall: Retaining (W,D,F) - 300mm Concrete	1	Retaining	5400 mm	370 mm	950 mm	1.81 m ³	Cavity Fill (Highly Permeable)	Loose fill drainage material	0.25 m ³
Basic Wall	Basic Wall: Retaining (W,D,F) - 300mm Concrete	1	Retaining	5400 mm	370 mm	950 mm	1.81 m ³	Geotextile	Filtering membrane	0.00 m ³
Basic Wall	Basic Wall: Retaining (W,D,F) - 300mm Concrete	1	Retaining	5400 mm	370 mm	950 mm	1.81 m ³	HA-30	Cast-in-place reinforced concrete	1.47 m ³

Material: Area	Reinforcement volume	Steel reinforcement	Steel density	Reinforcement mass	Phase Created	Thermal mass	Heat Transfer Coefficient (U)	Thermal Resistance (R)
4.95 m ²	3390.27 cm ³	B500 S	7850.00 kg/m ³	26.61 kg	1.2 Foundation walls & Column piers	33.20 kJ/K	1.1563 W/(m ² ·K)	0.8649 (m ² ·K)/W
4.95 m ²	3390.27 cm ³	B500 S	7850.00 kg/m ³	26.61 kg	1.2 Foundation walls & Column piers	33.20 kJ/K	1.1563 W/(m ² ·K)	0.8649 (m ² ·K)/W
4.95 m ²	3390.27 cm ³	B500 S	7850.00 kg/m ³	26.61 kg	1.2 Foundation walls & Column piers	33.20 kJ/K	1.1563 W/(m ² ·K)	0.8649 (m ² ·K)/W
4.95 m ²	3390.27 cm ³	B500 S	7850.00 kg/m ³	26.61 kg	1.2 Foundation walls & Column piers	33.20 kJ/K	1.1563 W/(m ² ·K)	0.8649 (m ² ·K)/W
4.95 m ²	3390.27 cm ³	B500 S	7850.00 kg/m ³	26.61 kg	1.2 Foundation walls & Column piers	33.20 kJ/K	1.1563 W/(m ² ·K)	0.8649 (m ² ·K)/W

Figure 6: Material take-off of a foundation wall: Properties are shown for each wall sub-component

This material take-off also presents the opportunity to introduce calculated parameters. Unlike ground beams and column footings, foundation walls are cast-in-place against formwork elements. As these elements are difficult to quantify automatically due to the need of human evaluation, Revit does not include a pre-defined parameter for formwork quantities. Therefore, a formwork parameter with area nature will be created as a calculated parameter based on wall length and height. In order to do so, a summarised schedule containing only foundation walls will be created. As appreciated in *Figure 7* the resulting schedule contains all formwork surface areas accounting for both lateral faces of each foundation wall element.

Foundation Wall Formwork Quantities								
Family	Family and Type	Count	Function	Length	Width	Height	Volume	Formwork area
Basic Wall	Basic Wall: Foundation - 350mm Concrete	1	Foundation	14700 mm	350 mm	950 mm	4.77 m³	27.93 m²
Basic Wall	Basic Wall: Foundation - 350mm Concrete	1	Foundation	14700 mm	350 mm	950 mm	4.77 m³	27.93 m²
Basic Wall	Basic Wall: Retaining (W,D,F) - 300mm Concrete	1	Retaining	15250 mm	370 mm	950 mm	5.40 m³	28.98 m²
Basic Wall	Basic Wall: Retaining (W,D,F) - 300mm Concrete	1	Retaining	15250 mm	370 mm	950 mm	5.31 m³	28.98 m²
Basic Wall	Basic Wall: Retaining (W,D,F) - 300mm Concrete	1	Retaining	5400 mm	370 mm	950 mm	1.81 m³	10.26 m²
Basic Wall	Basic Wall: Retaining (W,D,F) - 300mm Concrete	1	Retaining	5250 mm	370 mm	950 mm	1.98 m³	9.98 m²
Basic Wall	Basic Wall: Retaining (W,D,F) - 300mm Concrete	1	Retaining	3000 mm	370 mm	950 mm	0.91 m³	5.70 m²
Basic Wall	Basic Wall: Retaining (W,D,F) - 300mm Concrete	1	Retaining	5400 mm	370 mm	950 mm	1.94 m³	10.26 m²
Basic Wall	Basic Wall: Retaining (W,D,F) - 300mm Concrete	1	Retaining	15250 mm	370 mm	950 mm	5.14 m³	28.98 m²
Basic Wall	Basic Wall: Retaining (W,D,F) - 300mm Concrete	1	Retaining	3000 mm	370 mm	950 mm	0.91 m³	5.70 m²

Figure 7: Material take-off of a foundation wall: Calculated formwork area parameter

Steelwork framing

Schedules often include parameters which are specific of certain object families. For instance, reinforced concrete elements have attributed steel reinforcement volumes; wall and cladding elements are associated thermal resistivity parameters for their use in energetic analyses, and so forth. Framing elements are no different, and have specific attributes pertaining to the 'structural parameter' field. In order to reflect this, a material take-off will be created for steelwork frames including basic cross-sectional parameters such as area and moments of inertia. The schedule presenting beam properties is shown in [Figure 8](#).

Section properties_Structural Framing Material Takeoff											
Family	Family and Type	Count	Length	Volume	Section Area	Ix	Iy	Iz	Structural Material: Name	Material: Description	Material: Volume
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	5000 mm	0.019 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.020 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	5000 mm	0.019 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.020 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240: 9										
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	15000 mm	0.090 m³	62.6 cm²	25.70 cm⁴	11766.90 cm⁴	788.14 cm⁴	S235JR	Structural steel	0.094 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	15000 mm	0.089 m³	62.6 cm²	25.70 cm⁴	11766.90 cm⁴	788.14 cm⁴	S235JR	Structural steel	0.093 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	18000 mm	0.108 m³	62.6 cm²	25.70 cm⁴	11766.90 cm⁴	788.14 cm⁴	S235JR	Structural steel	0.113 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	18000 mm	0.107 m³	62.6 cm²	25.70 cm⁴	11766.90 cm⁴	788.14 cm⁴	S235JR	Structural steel	0.112 m³
IPE-Steelwork Beam: IPE 330: 4											

Figure 8: Material take-off for structural framing: Structural properties of steelwork profiles

Up until now, generated schedules have been used to simulate documents used for material procurement and description. Yet, no cost parameters have been included for cost estimating purposes. In order to generate a fairly basic cost estimation of the procurement and execution of steelwork framing beams, the previously developed schedule will be linked to a cost database. There are several on-line databases where most of constructive operations are catalogued and priced, not only including material cost but also the cost of necessary personnel and equipment for task execution. The following prices per steel kilogram have been extracted from CYPE Price generator [1] and ITeC price database [2], choosing the highest total costs between them in a conservative approach:

- Primary framing beams IPE 330: 2.10 €/kg
- Secondary framing beams IPE 240: 2.10 €/kg

The presented costs are decomposed in the table shown below:

Concept	Units	Unitary price (€)	Quantity per steel kilogram	Price per steel kilogram (€/kg)
Beam profile S235JR steel	kg	0.96	1.050	1.01
Primer coating	l	4.80	0.050	0.24
Equipment and auxiliary means for welding	h	3.09	0.015	0.05
Main welder	h	18.10	0.020	0.36
Welder assistant	h	16.94	0.020	0.34
Auxiliary means and indirect costs	%	-	5	0.1
TOTAL PRICE (€/kg)				2.10 €/kg

Table 2: Steelwork framing cost per executed kilogram

Still, there are further considerations that have to be taken into account in these execution costs. The majority of beams exceed 12 m in length, which means that they have to either be brought to site in special transportations or have to be assembled and welded on site from shorter beam segments not exceeding 12 m. Therefore, steelwork frames exceeding limit length will be attributed an extra cost expressed per steel kilogram corresponding to welding operations.

The additional cost has been considered as shown in the following table:

Concept	Units	Unitary price (€)	Quantity per steel kilogram	Price per steel kilogram (€/kg)
Equipment and auxiliary means for welding	h	3.09	0.008	0.02
Main welder	h	18.10	0.01	0.18
Welder assistant	h	16.94	0.01	0.17
Auxiliary means and indirect costs	%	-	5	0.1
TOTAL PRICE (€/kg)				0.39 €/kg

Table 3: Additional steelwork framing cost per executed kilogram

In order to identify beams exceeding 12m in length, Revit schedules are capable of integrating conditional formats. This means that schedules can highlight parameter values that comply with a specified condition. In our case, we will determine that all beam length values surpassing 12m are to be highlighted in red. *Figure 9* shows the highlighted values in the schedule indicating beams that have to be applied extra welding costs.

Conditional Format_Structural Framing Material Takeoff						
Family	Family and Type	Count	Length	Structural Material: Name	Material: Description	Material: Volume
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	5000 mm	S235JR	Structural steel	0.020 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	5000 mm	S235JR	Structural steel	0.020 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam: IPE 240: 9						
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	15000 mm	S235JR	Structural steel	0.094 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	15000 mm	S235JR	Structural steel	0.093 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	18000 mm	S235JR	Structural steel	0.113 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	18000 mm	S235JR	Structural steel	0.112 m³
IPE-Steelwork Beam: IPE 330: 4						

Figure 9: Material take-off for steelwork framing: Highlighted beams with greater associated cost.

With all beam types categorised by cost, we can now proceed to add a calculated value corresponding to the total cost of the beam instance. This cost will be calculated as the product of the beam's length, the profile's steel kilograms per metre and the corresponding cost per steel kilogram. With all these commands executed, the final cost estimate for steelwork framing beams has been generated. The resulting schedule is shown in [Figure 10](#). Note that manufacturer name can be included for each instance. For this example 'Celsa Group' has been designated as steelwork beam manufacturer.

Cost Estimate_Structural Framing Material Takeoff										
Family	Family and Type	Count	Length	Structural Material: Name	Material: Description	Material: Volume	Weight per metre	Cost per kilogram	Cost	Manufacturer
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	5000 mm	S235JR	Structural steel	0.020 m³	30.70 kg/m	2.10€	322.35€	Celsa Group
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	5000 mm	S235JR	Structural steel	0.020 m³	30.70 kg/m	2.10€	322.35€	Celsa Group
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m³	30.70 kg/m	2.49€	1146.65€	Celsa Group
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m³	30.70 kg/m	2.49€	1146.65€	Celsa Group
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m³	30.70 kg/m	2.49€	1146.65€	Celsa Group
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m³	30.70 kg/m	2.49€	1146.65€	Celsa Group
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m³	30.70 kg/m	2.49€	1146.65€	Celsa Group
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m³	30.70 kg/m	2.49€	1146.65€	Celsa Group
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m³	30.70 kg/m	2.49€	1146.65€	Celsa Group
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m³	30.70 kg/m	2.49€	1146.65€	Celsa Group
IPE-Steelwork Beam: IPE 240: 9										
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	15000 mm	S235JR	Structural steel	0.094 m³	49.15 kg/m	2.49€	1835.75€	Celsa Group
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	15000 mm	S235JR	Structural steel	0.093 m³	49.15 kg/m	2.49€	1835.75€	Celsa Group
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	18000 mm	S235JR	Structural steel	0.113 m³	49.15 kg/m	2.49€	2202.90€	Celsa Group
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	18000 mm	S235JR	Structural steel	0.112 m³	49.15 kg/m	2.49€	2202.90€	Celsa Group
IPE-Steelwork Beam: IPE 330: 4										

Figure 10: Cost estimate based on material take-off for steelwork framing

B.3.5. Schedule advanced capabilities

The presented examples show simplistic capabilities of schedule views. Nevertheless, there are some advanced features that can be used for material procurement, execution control and maintenance operations. For instance, Revit allows the identification of each object instance in a modelled project individually through a unique ID code. This code can be shown in schedules,

and therefore can be used to track down the related object instance in any model view. When placing, executing or maintaining construction elements, they may be referred or tagged with their unique ID so that results of quality control checks or maintenance operations can be consistently related to the project's BIM model. Radio-frequency technology can be used as well to quickly identify each object instance in site. In order to illustrate element identification, assigned ID codes have been included in the steelwork framing schedule developed previously.

Unique ID_Structural Framing Material Takeoff										
Family	Family and Type	Count	Structural Usage	Reference Level	Length	Structural Material: Name	Phase Created	Unique Id	Manufacturer	
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	Secondary	001-Suspended ceiling level	5000	S235JR	3.3 Secondary framing system	365	Perfil Celsa	
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	Secondary	001-Suspended ceiling level	5000	S235JR	3.3 Secondary framing system	366	Perfil Celsa	
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	Secondary	001-Suspended ceiling level	15000	S235JR	3.3 Secondary framing system	355	Perfil Celsa	
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	Secondary	001-Suspended ceiling level	15000	S235JR	3.3 Secondary framing system	356	Perfil Celsa	
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	Secondary	001-Suspended ceiling level	15000	S235JR	3.3 Secondary framing system	357	Perfil Celsa	
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	Secondary	001-Suspended ceiling level	15000	S235JR	3.3 Secondary framing system	358	Perfil Celsa	
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	Secondary	001-Suspended ceiling level	15000	S235JR	3.3 Secondary framing system	360	Perfil Celsa	
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	Secondary	001-Suspended ceiling level	15000	S235JR	3.3 Secondary framing system	361	Perfil Celsa	
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	Secondary	001-Suspended ceiling level	15000	S235JR	3.3 Secondary framing system	362	Perfil Celsa	
IPE-Steelwork Beam: IPE 240: 9										
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	Primary	001-Suspended ceiling level	15000	S235JR	3.2 Primary framing system	351	Perfil Celsa	
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	Primary	001-Suspended ceiling level	15000	S235JR	3.2 Primary framing system	354	Perfil Celsa	
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	Primary	001-Suspended ceiling level	18000	S235JR	3.2 Primary framing system	352	Perfil Celsa	
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	Primary	001-Suspended ceiling level	18000	S235JR	3.2 Primary framing system	353	Perfil Celsa	
IPE-Steelwork Beam: IPE 330: 4										

Figure 11: Material take-off for steelwork framing: Associated unique ID parameter

B.3.6. Generated schedules

The generated schedules for the construction model are included below in their full length and extension.

Structural steelwork columns									
001-Suspended ceiling level									001-Suspended ceiling level
3200	HEA 140	HEA 160A	HEA 140	HEA 140	HEA 140				
000-Ground Floor									
0									
Column Locations	A-1	A-2	A-3	A-4	B-1	B-2	B-3	B-4	C-1

Structural steelwork columns									
001-Suspended ceiling level									001-Suspended ceiling level
3200	HEA 140								
000-Ground Floor									
0									
Column Locations	C-2	C-3	C-4	D-1	D-2	D-3	D-4	E-2	E-3

Structural steelwork columns										
001-Suspended ceiling level										001-Suspended ceiling level
3200	HEA 140	3200								
000-Ground Floor										000-Ground Floor
0										0
Column Locations	A-1	A-2	A-3	A-4	B-1	B-2	B-3	B-4	C-1	

Structural steelwork columns										
001-Suspended ceiling level										001-Suspended ceiling level
3200	HEA 140	3200								
000-Ground Floor										000-Ground Floor
0										0
Column Locations	C-2	C-3	C-4	D-1	D-2	D-3	D-4	E-2	E-3	

Autodesk® Revit®

www.autodesk.com/revit

Foundation Wall Formwork Quantities								
Family	Family and Type	Count	Function	Length	Width	Height	Volume	Formwork area
Basic Wall	Basic Wall: Foundation - 350mm Concrete	1	Foundation	14700 mm	350 mm	950 mm	4.77 m ³	27.93 m ²
Basic Wall	Basic Wall: Foundation - 350mm Concrete	1	Foundation	14700 mm	350 mm	950 mm	4.77 m ³	27.93 m ²
Basic Wall	Basic Wall: Retaining (W.D.F) - 300mm Concrete	1	Retaining	15250 mm	370 mm	950 mm	5.40 m ³	28.98 m ²
Basic Wall	Basic Wall: Retaining (W.D.F) - 300mm Concrete	1	Retaining	15250 mm	370 mm	950 mm	5.31 m ³	28.98 m ²
Basic Wall	Basic Wall: Retaining (W.D.F) - 300mm Concrete	1	Retaining	5400 mm	370 mm	950 mm	1.81 m ³	10.26 m ²
Basic Wall	Basic Wall: Retaining (W.D.F) - 300mm Concrete	1	Retaining	5250 mm	370 mm	950 mm	1.98 m ³	9.98 m ²
Basic Wall	Basic Wall: Retaining (W.D.F) - 300mm Concrete	1	Retaining	3000 mm	370 mm	950 mm	0.91 m ³	5.70 m ²
Basic Wall	Basic Wall: Retaining (W.D.F) - 300mm Concrete	1	Retaining	5400 mm	370 mm	950 mm	1.94 m ³	10.26 m ²
Basic Wall	Basic Wall: Retaining (W.D.F) - 300mm Concrete	1	Retaining	15250 mm	370 mm	950 mm	5.14 m ³	28.98 m ²
Basic Wall	Basic Wall: Retaining (W.D.F) - 300mm Concrete	1	Retaining	3000 mm	370 mm	950 mm	0.91 m ³	5.70 m ²

Consultant
Address
Address
Phone
Fax
e-mail

No.	Description	Date

Owner

Project Name

Schedules Wall Formwork Quantities

Project number Project Number

Date Issue Date

Drawn by Author

Checked by Checker

S.5

Scale

Autodesk® Revit®

www.autodesk.com/revit

Consultant
Address
Address
Phone
Fax
e-mail

No.	Description	Date

Owner

Project Name

Schedules
Section
Properties

Project number Project Number

Date Issue Date

Drawn by Author

Checked by Checker

S.7

Scale

Section properties - Structural Framing Material Takeoff											
Family	Family and Type	Count	Length	Volume	Section Area	Ix	Iy	Iz	Material: Name	Material: Description	Material: Volume
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	5000 mm	0.019 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.020 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	5000 mm	0.019 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.020 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	0.056 m³	39.1 cm²	25.70 cm⁴	3892.00 cm⁴	284.00 cm⁴	S235JR	Structural steel	0.059 m³
IPE-Steelwork Beam: IPE 240	9										
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	15000 mm	0.090 m³	62.6 cm²	25.70 cm⁴	11766.90 cm⁴	788.14 cm⁴	S235JR	Structural steel	0.094 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	15000 mm	0.089 m³	62.6 cm²	25.70 cm⁴	11766.90 cm⁴	788.14 cm⁴	S235JR	Structural steel	0.093 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	18000 mm	0.108 m³	62.6 cm²	25.70 cm⁴	11766.90 cm⁴	788.14 cm⁴	S235JR	Structural steel	0.113 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	18000 mm	0.107 m³	62.6 cm²	25.70 cm⁴	11766.90 cm⁴	788.14 cm⁴	S235JR	Structural steel	0.112 m³
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	4									

08/04/2014 12:27:40

Cost Estimate - Structural Framing Material Takeoff										
Family	Family and Type	Count	Length	Structural Material: Name	Description	Material: Volume	Weight per metre	Cost per kilogram	Cost	Manufacturer
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	5000 mm	S235JR	Structural steel	0.020 m ³	30.70 kg/m	2.10€	322.35€	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	5000 mm	S235JR	Structural steel	0.020 m ³	30.70 kg/m	2.10€	322.35€	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ³	30.70 kg/m	2.49€	1146.65€	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ³	30.70 kg/m	2.49€	1146.65€	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ³	30.70 kg/m	2.49€	1146.65€	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ³	30.70 kg/m	2.49€	1146.65€	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ³	30.70 kg/m	2.49€	1146.65€	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ³	30.70 kg/m	2.49€	1146.65€	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ³	30.70 kg/m	2.49€	1146.65€	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ³	30.70 kg/m	2.49€	1146.65€	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ³	30.70 kg/m	2.49€	1146.65€	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ³	30.70 kg/m	2.49€	1146.65€	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ³	30.70 kg/m	2.49€	1146.65€	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ³	30.70 kg/m	2.49€	1146.65€	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ³	30.70 kg/m	2.49€	1146.65€	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ³	30.70 kg/m	2.49€	1146.65€	Perfil Celsa
IPE-Steelwork Beam: IPE 240	9									
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	15000 mm	S235JR	Structural steel	0.094 m ³	49.15 kg/m	2.49€	1835.75€	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	15000 mm	S235JR	Structural steel	0.093 m ³	49.15 kg/m	2.49€	1835.75€	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	18000 mm	S235JR	Structural steel	0.113 m ³	49.15 kg/m	2.49€	2202.90€	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	18000 mm	S235JR	Structural steel	0.112 m ³	49.15 kg/m	2.49€	2202.90€	Perfil Celsa
IPE-Steelwork Beam: IPE 330	4									

Autodesk® Revit®

www.autodesk.com/revit

Consultant Address
Phone Fax e-mail

No.	Description	Date

Owner

Project Name

Schedules Cost Estimate

Project number Project Number

Date Issue Date

Drawn by Author

Checked by Checker

S.8

Scale

Conditional Format_ Structural Framing Material Takeoff						
Family	Family and Type	Count	Length	Structural Material: Name	Material: Description	Material: Volume
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	5000 mm	S235JR	Structural steel	0.020 m ²
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	5000 mm	S235JR	Structural steel	0.020 m ²
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	5000 mm	S235JR	Structural steel	0.020 m ²
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	5000 mm	S235JR	Structural steel	0.020 m ²
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ²
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ²
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ²
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ²
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ²
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ²
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ²
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	15000 mm	S235JR	Structural steel	0.059 m ²
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	9				
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	15000 mm	S235JR	Structural steel	0.094 m ²
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	15000 mm	S235JR	Structural steel	0.093 m ²
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	18000 mm	S235JR	Structural steel	0.113 m ²
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	18000 mm	S235JR	Structural steel	0.112 m ²
IPE-Steelwork Beam: IPE 330: 4						

Autodesk® Revit®

www.autodesk.com/revit

Consultant
Address
Address
Phone
Fax
e-mail

Consultant
Address
Address
Phone
Fax
e-mail

Consultant
Address
Address
Phone
Fax
e-mail

No.	Description	Date

Owner

Project Name

Schedules Conditional Format

Project number Project Number

Date Issue Date

Drawn by Author

Checked by Checker

S.9

Scale

Structural Framing Material Takeoff																			
Family	Family and Type	Count	Structural Usage	Reference Level	Length	Volume	Section Area	Ix	Iy	Iz	Structural Material: Name	Material: Description	Material: Volume	Material: Surface Area	Weight per metre	Phase Created	Unique Id	Manufacturer	
IPF-Steelwork Beam: IPF 240	IPF-Steelwork Beam: IPF 240	1	Secondary	001-Suspended ceiling level	5000	0.019 m ³	39.1 cm ²	25.70 cm ⁴	3892.00 cm ⁴	284.00 cm ⁴	S235JR	Structural steel	0.020 m ³	4.69 m ²	30.70 kg/m	3.3 Secondary framing system	365	Perfil Celso	
IPF-Steelwork Beam: IPF 240	IPF-Steelwork Beam: IPF 240	1	Secondary	001-Suspended ceiling level	5000	0.019 m ³	39.1 cm ²	25.70 cm ⁴	3892.00 cm ⁴	284.00 cm ⁴	S235JR	Structural steel	0.020 m ³	4.76 m ²	30.70 kg/m	3.3 Secondary framing system	366	Perfil Celso	
IPF-Steelwork Beam: IPF 240	IPF-Steelwork Beam: IPF 240	1	Secondary	001-Suspended ceiling level	15000	0.056 m ³	39.1 cm ²	25.70 cm ⁴	3892.00 cm ⁴	284.00 cm ⁴	S235JR	Structural steel	0.059 m ³	13.98 m ²	30.70 kg/m	3.3 Secondary framing system	355	Perfil Celso	
IPF-Steelwork Beam: IPF 240	IPF-Steelwork Beam: IPF 240	1	Secondary	001-Suspended ceiling level	15000	0.056 m ³	39.1 cm ²	25.70 cm ⁴	3892.00 cm ⁴	284.00 cm ⁴	S235JR	Structural steel	0.059 m ³	13.98 m ²	30.70 kg/m	3.3 Secondary framing system	356	Perfil Celso	
IPF-Steelwork Beam: IPF 240	IPF-Steelwork Beam: IPF 240	1	Secondary	001-Suspended ceiling level	15000	0.056 m ³	39.1 cm ²	25.70 cm ⁴	3892.00 cm ⁴	284.00 cm ⁴	S235JR	Structural steel	0.059 m ³	13.98 m ²	30.70 kg/m	3.3 Secondary framing system	357	Perfil Celso	
IPF-Steelwork Beam: IPF 240	IPF-Steelwork Beam: IPF 240	1	Secondary	001-Suspended ceiling level	15000	0.056 m ³	39.1 cm ²	25.70 cm ⁴	3892.00 cm ⁴	284.00 cm ⁴	S235JR	Structural steel	0.059 m ³	13.91 m ²	30.70 kg/m	3.3 Secondary framing system	358	Perfil Celso	
IPF-Steelwork Beam: IPF 240	IPF-Steelwork Beam: IPF 240	1	Secondary	001-Suspended ceiling level	15000	0.056 m ³	39.1 cm ²	25.70 cm ⁴	3892.00 cm ⁴	284.00 cm ⁴	S235JR	Structural steel	0.059 m ³	13.91 m ²	30.70 kg/m	3.3 Secondary framing system	360	Perfil Celso	
IPF-Steelwork Beam: IPF 240	IPF-Steelwork Beam: IPF 240	1	Secondary	001-Suspended ceiling level	15000	0.056 m ³	39.1 cm ²	25.70 cm ⁴	3892.00 cm ⁴	284.00 cm ⁴	S235JR	Structural steel	0.059 m ³	13.98 m ²	30.70 kg/m	3.3 Secondary framing system	361	Perfil Celso	
IPF-Steelwork Beam: IPF 240	IPF-Steelwork Beam: IPF 240	1	Secondary	001-Suspended ceiling level	15000	0.056 m ³	39.1 cm ²	25.70 cm ⁴	3892.00 cm ⁴	284.00 cm ⁴	S235JR	Structural steel	0.059 m ³	13.98 m ²	30.70 kg/m	3.3 Secondary framing system	362	Perfil Celso	
IPF-Steelwork Beam: IPF 240	IPF-Steelwork Beam: IPF 240	1	Secondary	001-Suspended ceiling level	15000	0.056 m ³	39.1 cm ²	25.70 cm ⁴	3892.00 cm ⁴	284.00 cm ⁴	S235JR	Structural steel	0.059 m ³	13.98 m ²	30.70 kg/m	3.3 Secondary framing system	363	Perfil Celso	
IPF-Steelwork Beam: IPF 240	IPF-Steelwork Beam: IPF 240	1	Secondary	001-Suspended ceiling level	15000	0.056 m ³	39.1 cm ²	25.70 cm ⁴	3892.00 cm ⁴	284.00 cm ⁴	S235JR	Structural steel	0.059 m ³	13.98 m ²	30.70 kg/m	3.3 Secondary framing system	364	Perfil Celso	
IPF-Steelwork Beam: IPF 330	IPF-Steelwork Beam: IPF 330	1	Primary	001-Suspended ceiling level	15000	0.090 m ³	62.6 cm ²	25.70 cm ⁴	11766.90 cm ⁴	788.14 cm ⁴	S235JR	Structural steel	0.094 m ³	18.84 m ²	49.15 kg/m	3.2 Primary framing system	351	Perfil Celso	
IPF-Steelwork Beam: IPF 330	IPF-Steelwork Beam: IPF 330	1	Primary	001-Suspended ceiling level	15000	0.089 m ³	62.6 cm ²	25.70 cm ⁴	11766.90 cm ⁴	788.14 cm ⁴	S235JR	Structural steel	0.093 m ³	18.65 m ²	49.15 kg/m	3.2 Primary framing system	354	Perfil Celso	
IPF-Steelwork Beam: IPF 330	IPF-Steelwork Beam: IPF 330	1	Primary	001-Suspended ceiling level	15000	0.108 m ³	62.6 cm ²	25.70 cm ⁴	11766.90 cm ⁴	788.14 cm ⁴	S235JR	Structural steel	0.113 m ³	22.60 m ²	49.15 kg/m	3.2 Primary framing system	352	Perfil Celso	
IPF-Steelwork Beam: IPF 330	IPF-Steelwork Beam: IPF 330	1	Primary	001-Suspended ceiling level	15000	0.107 m ³	62.6 cm ²	25.70 cm ⁴	11766.90 cm ⁴	788.14 cm ⁴	S235JR	Structural steel	0.112 m ³	22.46 m ²	49.15 kg/m	3.2 Primary framing system	353	Perfil Celso	
IPF-Steelwork Beam: IPF 330	IPF-Steelwork Beam: IPF 330	1	Primary	001-Suspended ceiling level	15000	0.107 m ³	62.6 cm ²	25.70 cm ⁴	11766.90 cm ⁴	788.14 cm ⁴	S235JR	Structural steel	0.112 m ³	22.46 m ²	49.15 kg/m	3.2 Primary framing system	362	Perfil Celso	
IPF-Steelwork Beam: IPF 330	IPF-Steelwork Beam: IPF 330	1	Primary	001-Suspended ceiling level	15000	0.107 m ³	62.6 cm ²	25.70 cm ⁴	11766.90 cm ⁴	788.14 cm ⁴	S235JR	Structural steel	0.112 m ³	22.46 m ²	49.15 kg/m	3.2 Primary framing system	363	Perfil Celso	
IPF-Steelwork Beam: IPF 330	IPF-Steelwork Beam: IPF 330	1	Primary	001-Suspended ceiling level	15000	0.107 m ³	62.6 cm ²	25.70 cm ⁴	11766.90 cm ⁴	788.14 cm ⁴	S235JR	Structural steel	0.112 m ³	22.46 m ²	49.15 kg/m	3.2 Primary framing system	364	Perfil Celso	
Autodesk® Revit®																	www.autodesk.com/revit		
Consultant Address	Consultant Address	Phone	Fax	e-mail	Consultant Address	Consultant Address	Phone	Fax	e-mail	Consultant Address	Consultant Address	Phone	Fax	e-mail	Consultant Address	Consultant Address	Phone	Fax	e-mail
No.	Description	Date																	
Owner																			
Project Name Schedules																			
Structural Framing																			
Mat. T/C Off																			
Project number	Project Number	Date	Issue Date																
Drawn by	Author	Checked by	Checker																
S.6																			
Scale																			

Unique ID_ Structural Framing Material Takeoff									
Family	Family and Type	Count	Structural Usage	Reference Level	Length	Structural Material: Name	Phase Created	Unique Id	Manufacturer
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	Secondary	001-Suspended ceiling level	5000	S235JR	3.3 Secondary framing system	365	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	Secondary	001-Suspended ceiling level	5000	S235JR	3.3 Secondary framing system	366	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	Secondary	001-Suspended ceiling level	15000	S235JR	3.3 Secondary framing system	365	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	Secondary	001-Suspended ceiling level	15000	S235JR	3.3 Secondary framing system	366	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	Secondary	001-Suspended ceiling level	15000	S235JR	3.3 Secondary framing system	367	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	Secondary	001-Suspended ceiling level	15000	S235JR	3.3 Secondary framing system	368	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	Secondary	001-Suspended ceiling level	15000	S235JR	3.3 Secondary framing system	369	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	Secondary	001-Suspended ceiling level	15000	S235JR	3.3 Secondary framing system	371	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 240	1	Secondary	001-Suspended ceiling level	15000	S235JR	3.3 Secondary framing system	362	Perfil Celsa
IPE-Steelwork Beam: IPE 240: 9									
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	Primary	001-Suspended ceiling level	15000	S235JR	3.2 Primary framing system	351	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	Primary	001-Suspended ceiling level	15000	S235JR	3.2 Primary framing system	354	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	Primary	001-Suspended ceiling level	18000	S235JR	3.2 Primary framing system	352	Perfil Celsa
IPE-Steelwork Beam	IPE-Steelwork Beam: IPE 330	1	Primary	001-Suspended ceiling level	18000	S235JR	3.2 Primary framing system	353	Perfil Celsa

Autodesk® Revit®

www.autodesk.com/revit

Consultant Address	Consultant Address
Phone	Phone
Fax	Fax
e-mail	e-mail

Consultant Address	Consultant Address
Phone	Phone
Fax	Fax
e-mail	e-mail

No.	Description	Date

Owner

Project Name

Schedules
Unique ID

Project number	Project Number
----------------	----------------

Date	Issue Date
------	------------

Drawn by	Author
----------	--------

Checked by	Checker
------------	---------

S.10

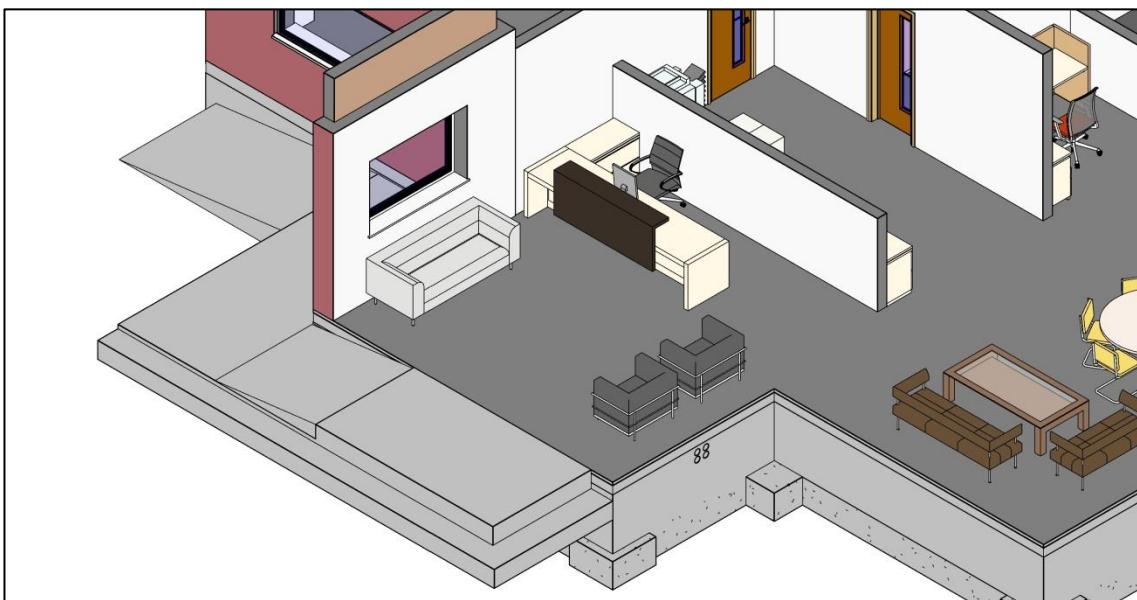
Scale

B.4. RENDERS

B.4.1. Architectural interior finishes

Each and every one of the following renders has been generated from its associated camera view and focus on a particular space of the architectural model. Object component appearance and texture of nearly all elements in the building have been carefully determined and managed in order to give a realistic impression of the materials that compose them. Furthermore, natural and artificial lighting have been adjusted using Revit's rendering tools in an attempt to obtain appealing images of the building's interior design. Note that a provisional suspended ceiling has been defined in order to fit artificial lighting components, which represent lighting devices and have associated luminescent attributes that are used by the rendering tools.

The following renders are organised by the area they represent. To better understand and locate each rendered image, an interface view of the treated model area is offered beforehand.

RECEPTION



SOCIAL AREA

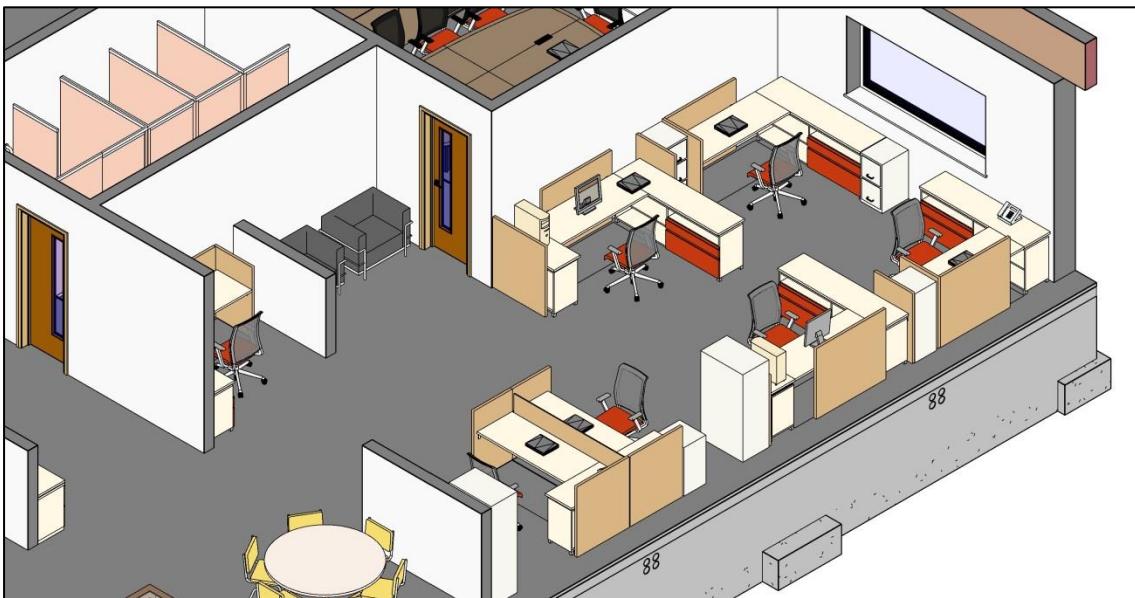






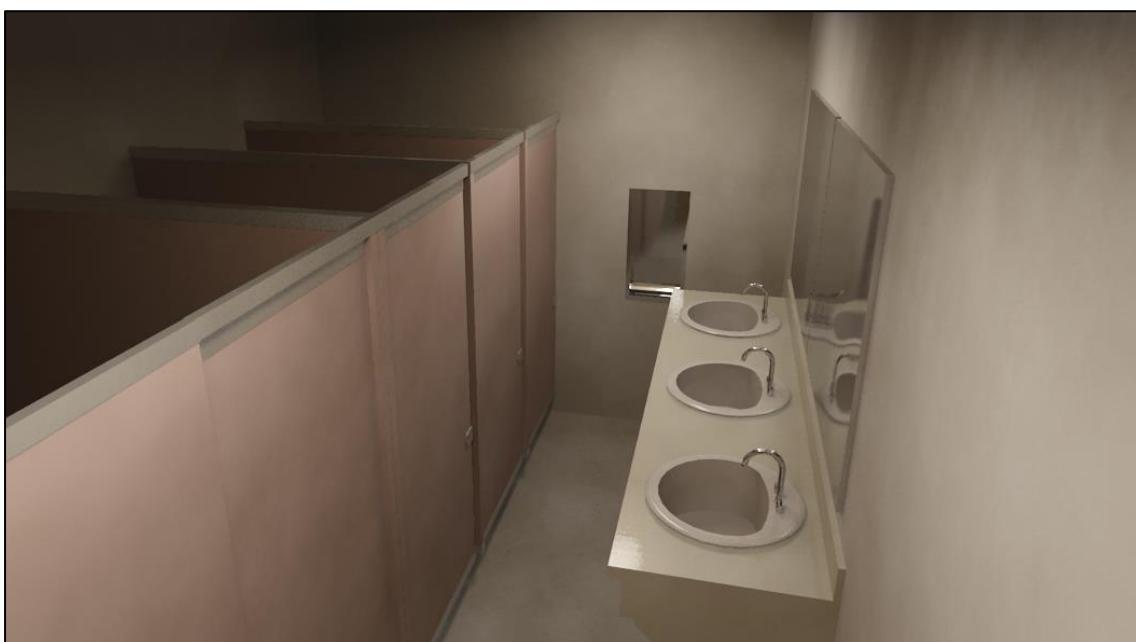
OFFICE SPACE

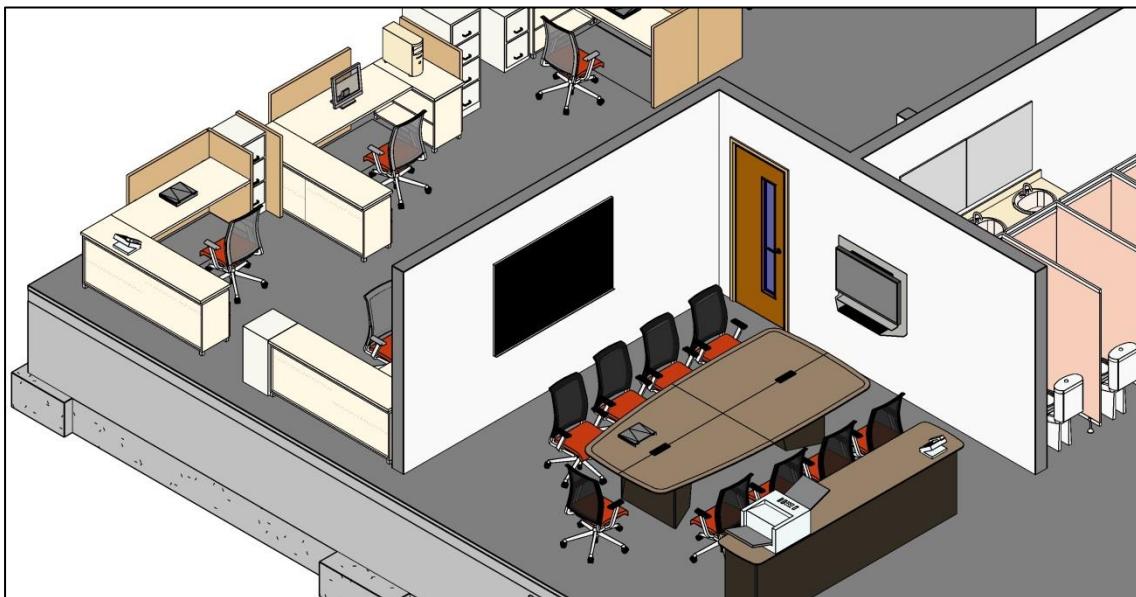




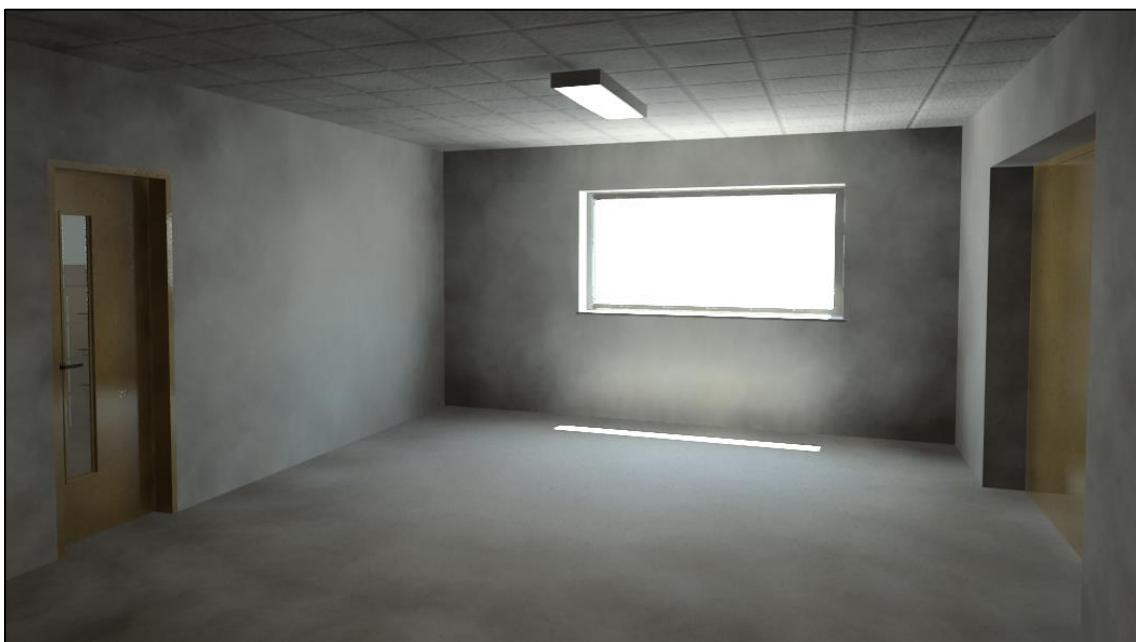


RESTROOM



MEETING ROOM



STORAGE AREA



B.4.2. Urbanisation finishes

The following renders correspond to model views of the final urbanisation design. Planting and entourage elements have been included in an attempt to simulate how the project would look like once finished. These kinds of images are commonly used to transmit the design intent of a project to the general public and to owner stakeholder parties. Projects with great exposure to public spaces and their surroundings can find in these views a useful resource to evaluate their eventual visual impact.

Following are the rendered views grouped under their conceptual name:

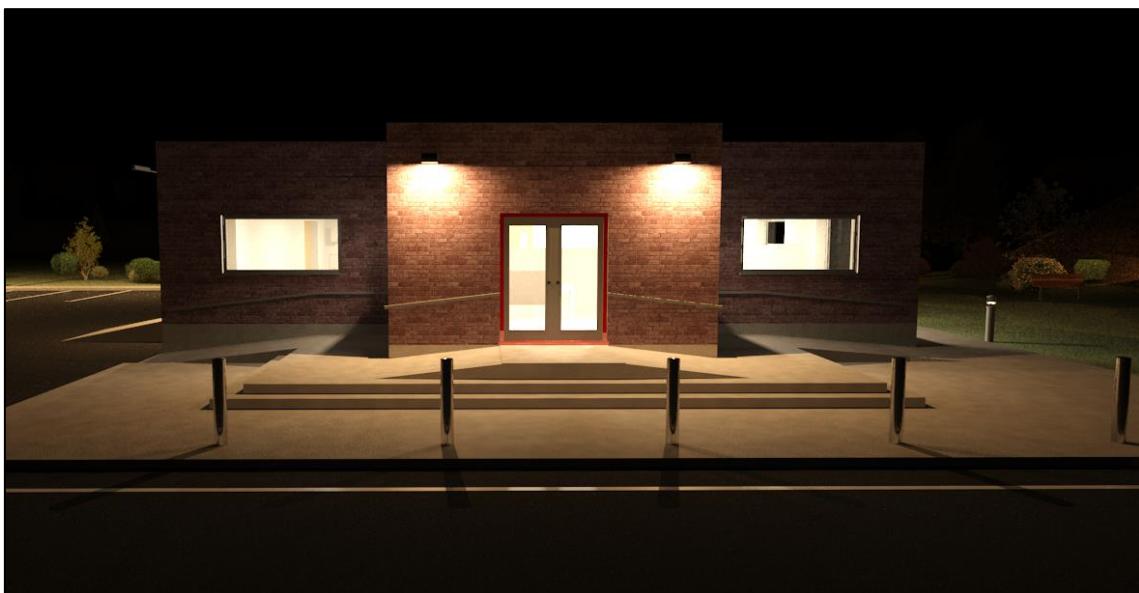
Back garden (Day & Night)



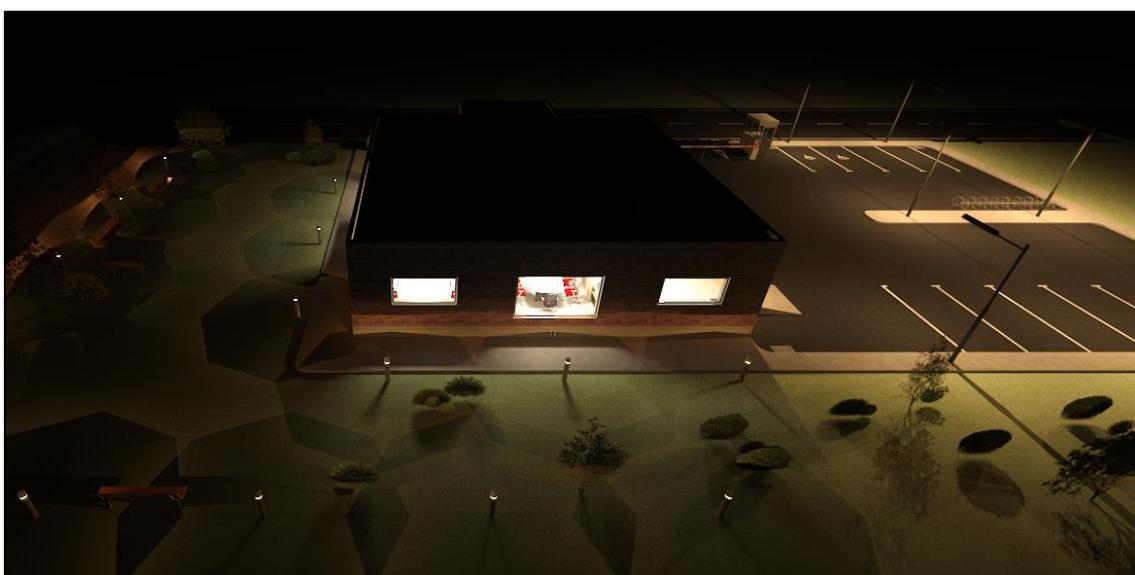
Garden close-upParking close-upEast facade (Day & Night)



Main access (Day & Night)

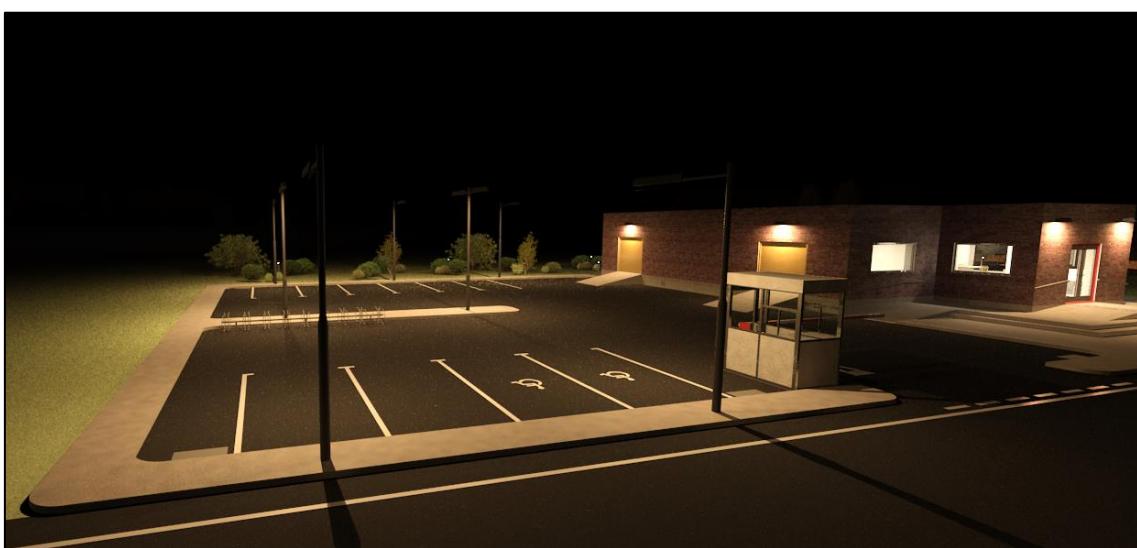


Social area interiorMeeting room interiorNorth façade (Day, Entourage & Night)



Parking (Day, Entourage & Night)





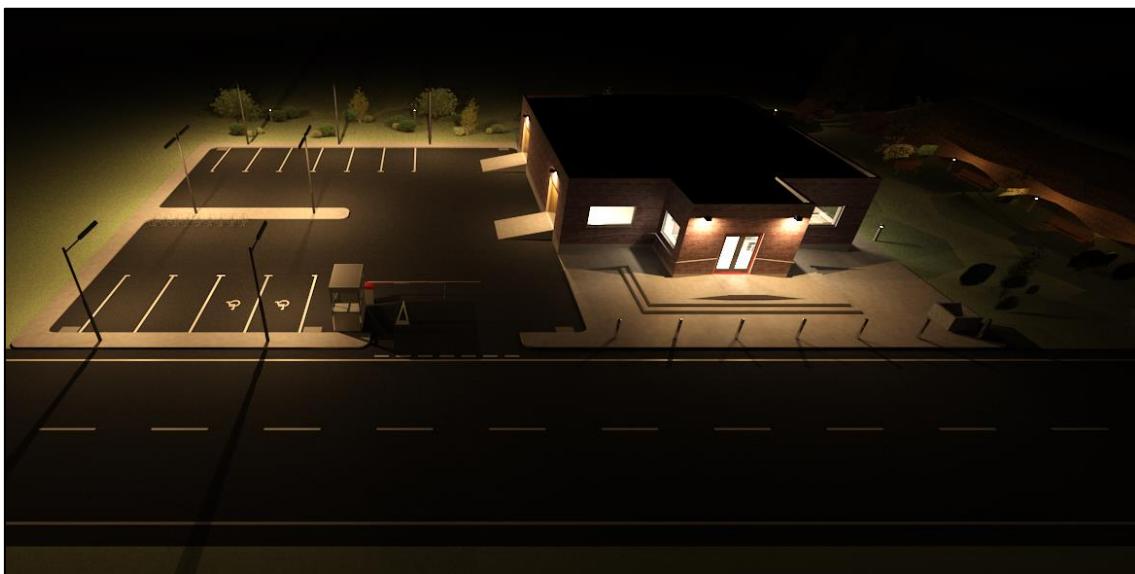
Main access road (Day, Entourage & Night)





South façade (Day, Entourage & Night)





West façade (Day, Entourage & Night)

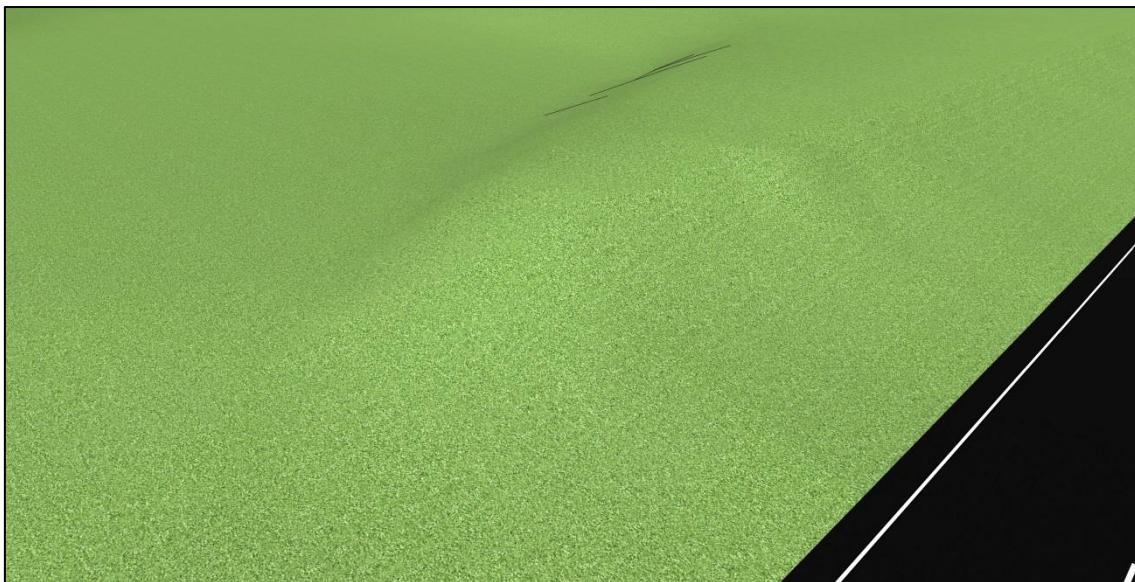




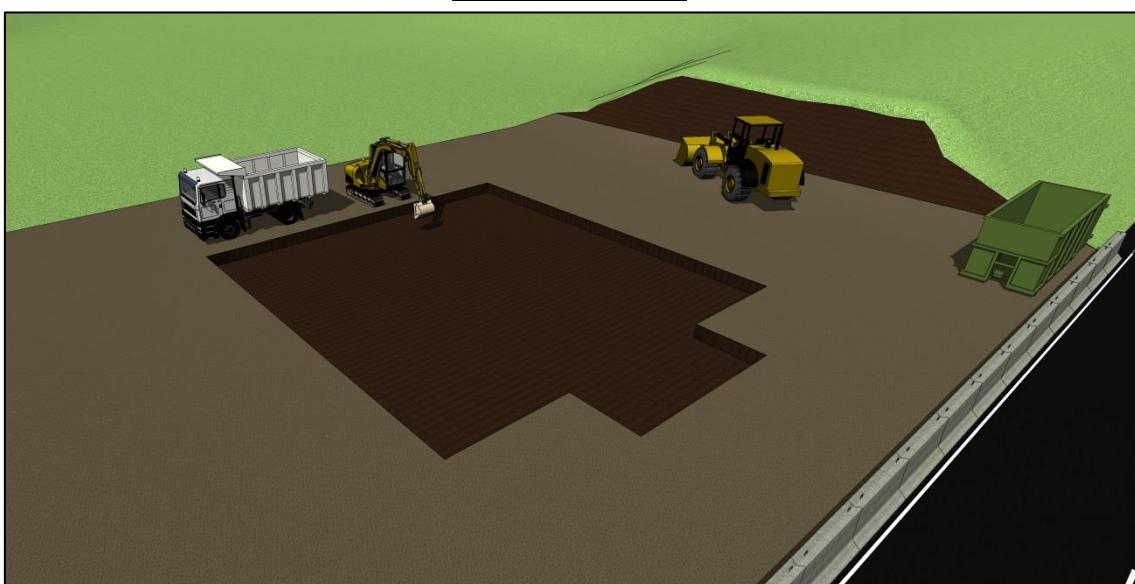
B.5. CAMERA VIEWS

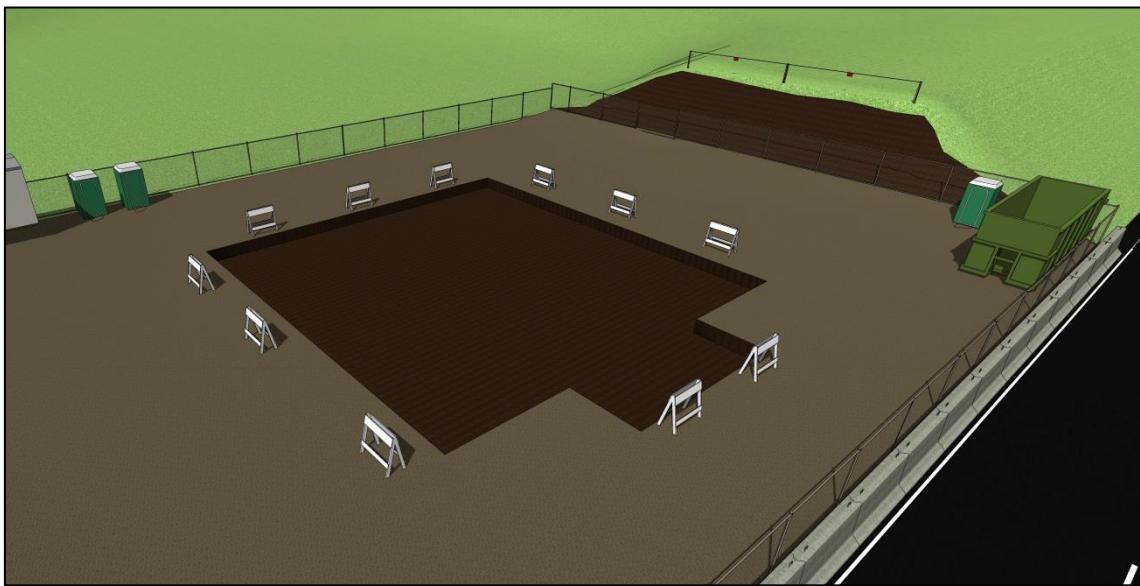
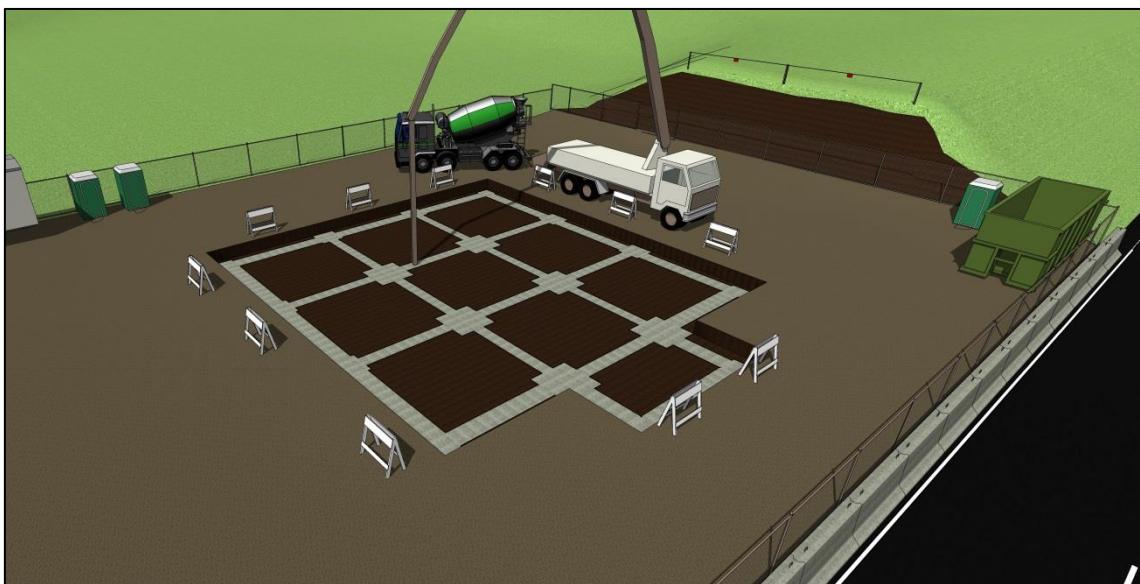
B.5.1. Construction phases simulation: Camera 1

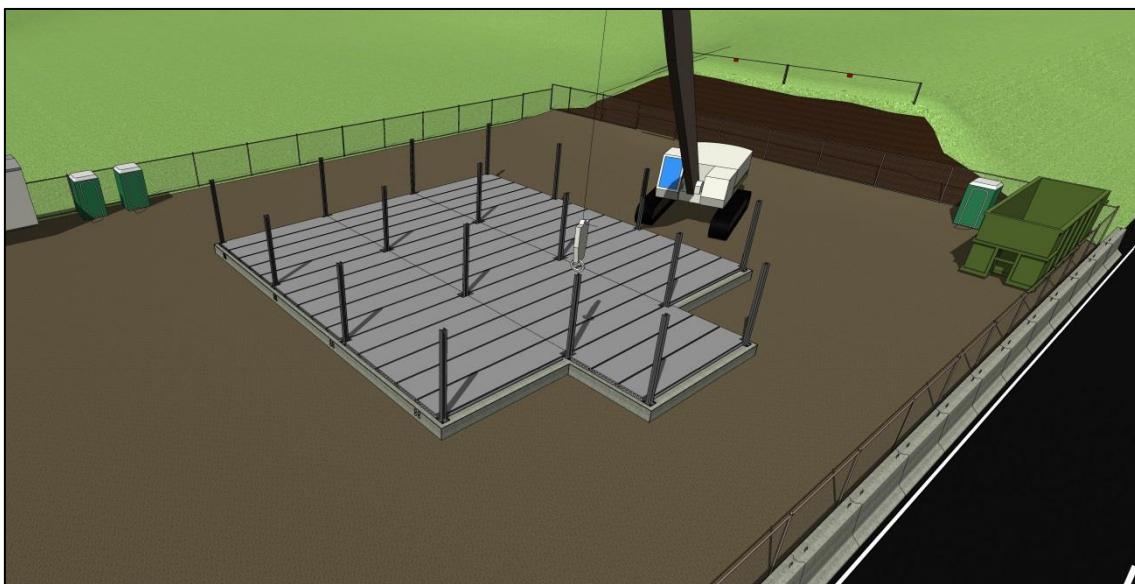
1.1 Site topography

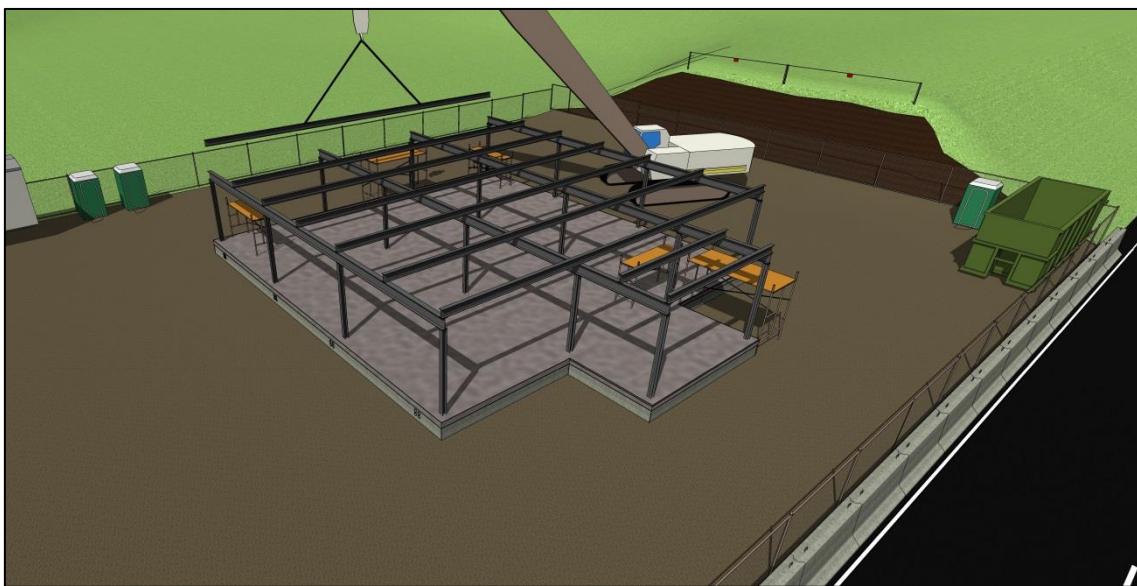


1.2 Earthwork tasks



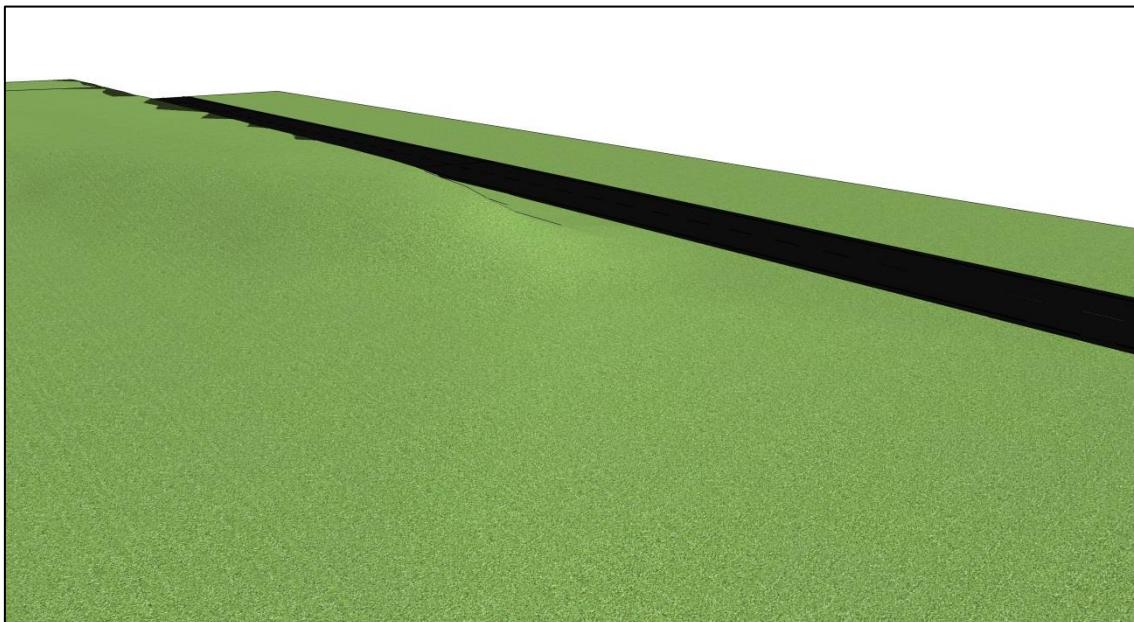
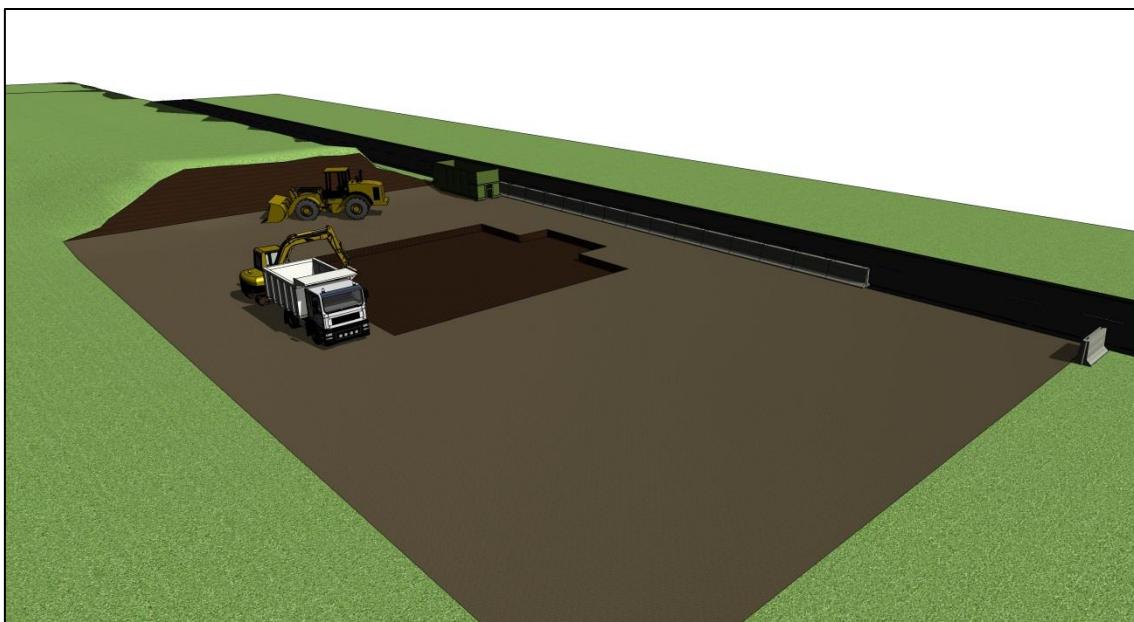
1.3 Site conditioning and equipment2.1 Isolated footings and ground beams2.2 Foundation walls and column piers

3.1 Precast hollow-core section concrete slabs4.1 Steelwork columns4.2 Compression concrete layer

4.3 Primary framing system4.4 Secondary framing system5.1-5.2 Metal deck profile; Concrete topping layer

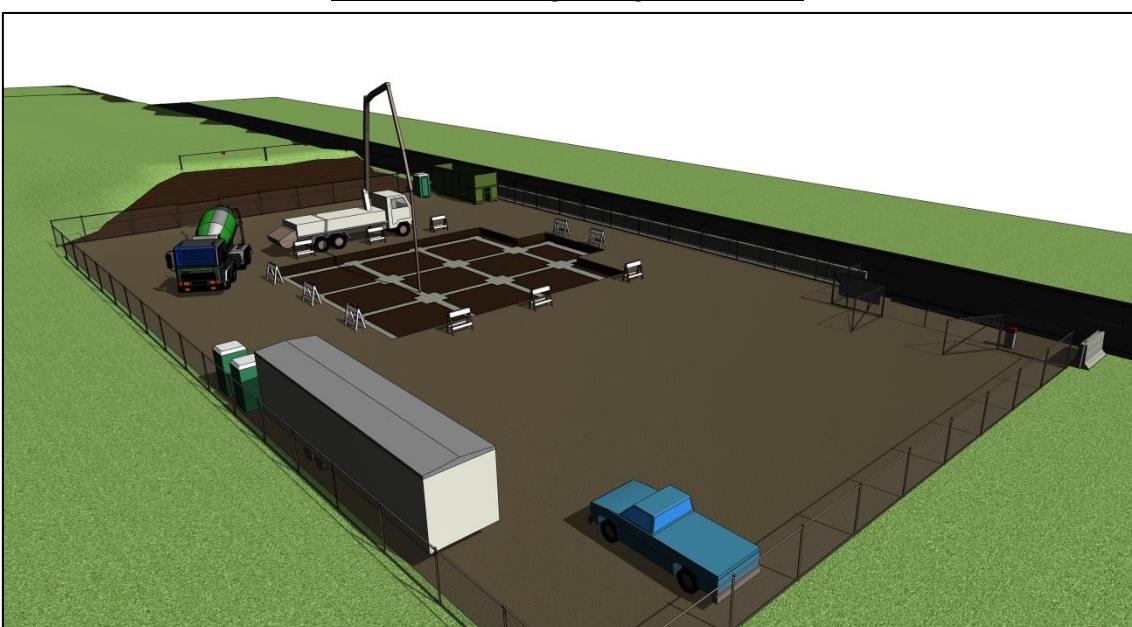
6.1 External walls with structural openings6.2 Roof finishing layers8.1-8.5 Architectural finishes and building access ramps

9.1 Urbanisation sidewalks and external lighting9.2-9.3 Parking; Urbanisation equipment9.4 Vegetation

B.5.2. Construction phases simulation: Camera 21.1 Site topography1.2 Earthwork tasks

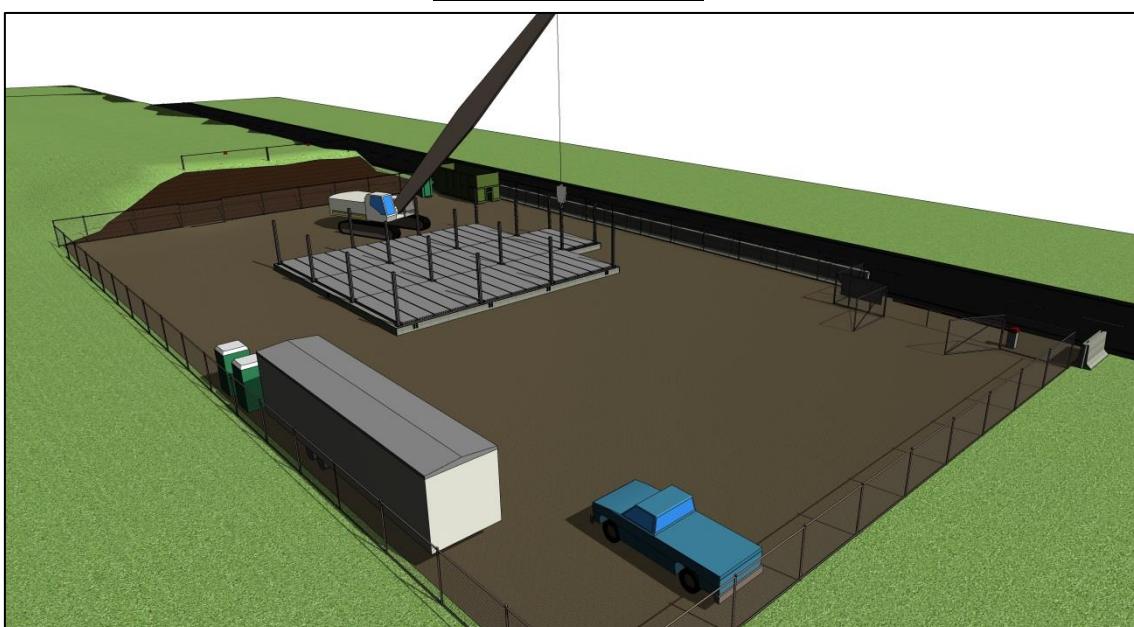
1.3 Site conditioning and equipment

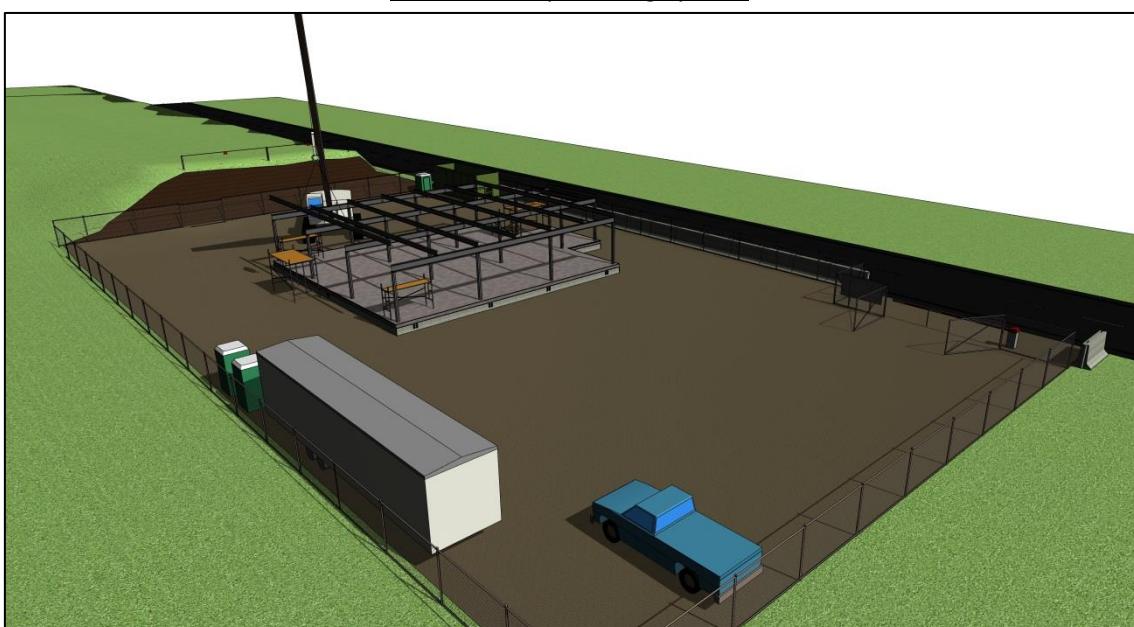
2.1 Isolated footings and ground beams



2.2 Foundation walls and column piers



3.1 Precast hollow-core section concrete slabs4.1 Steelwork columns4.2 Compression concrete layer

4.3 Primary framing system4.4 Secondary framing system5.1-5.2 Metal deck profile; Concrete topping layer

6.1 External walls with structural openings6.2 Roof finishing layers8.1-8.5 Architectural finishes and building access ramps

9.1 Urbanisation sidewalks and external lighting

9.2-9.3 Parking; Urbanisation equipment



9.4 Vegetation



REFERENCES

[1]. **CYPE.** *Generador de precios de la construcción. España. CYPE Ingenieros, S.A.* [Online] [Consulted: 05 March 2014] Available at: <<http://www.generadordeprecios.info/>>.

[2]. **ITeC.** *ITeC Banc BEDEC.* s.l. : ITeC. [Consulted: 05 March 2014] Available at: <<http://www.itec.cat/nouBedec.c/bebedec.aspx>>.