BIM & Design Coursework

Ahbab Ullah 3425658

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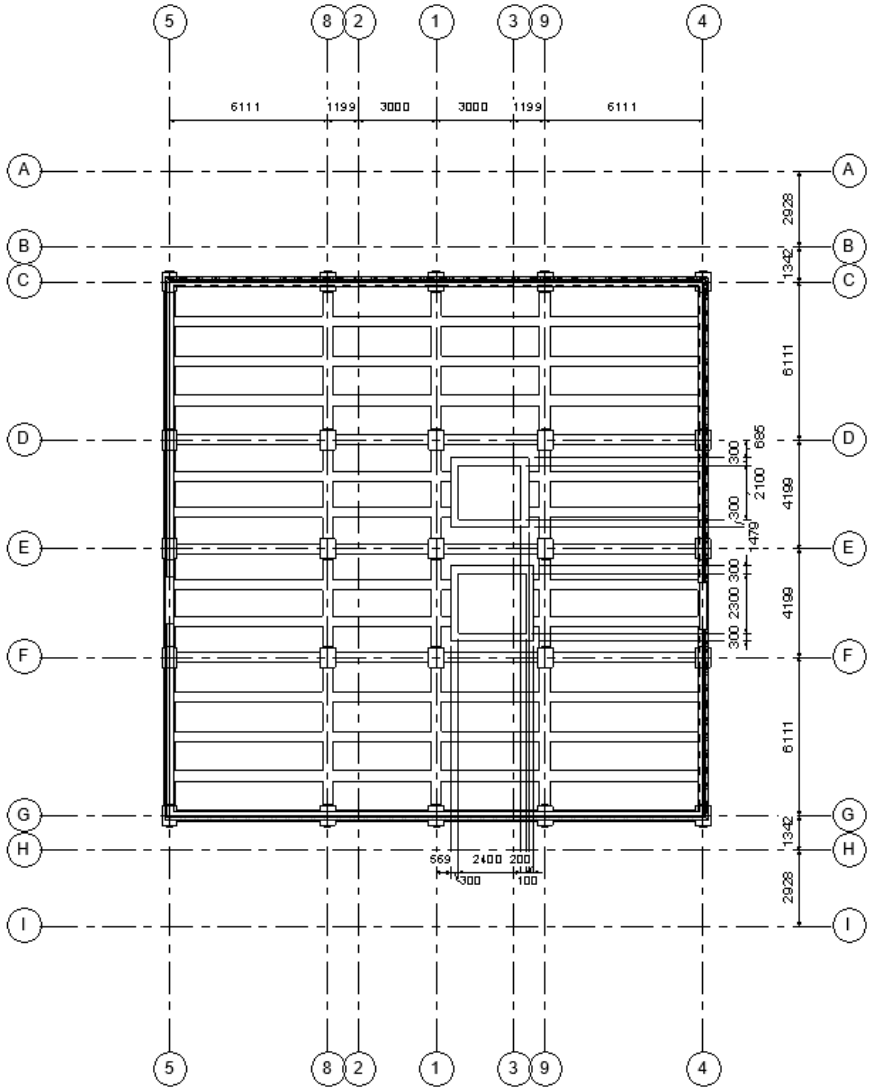
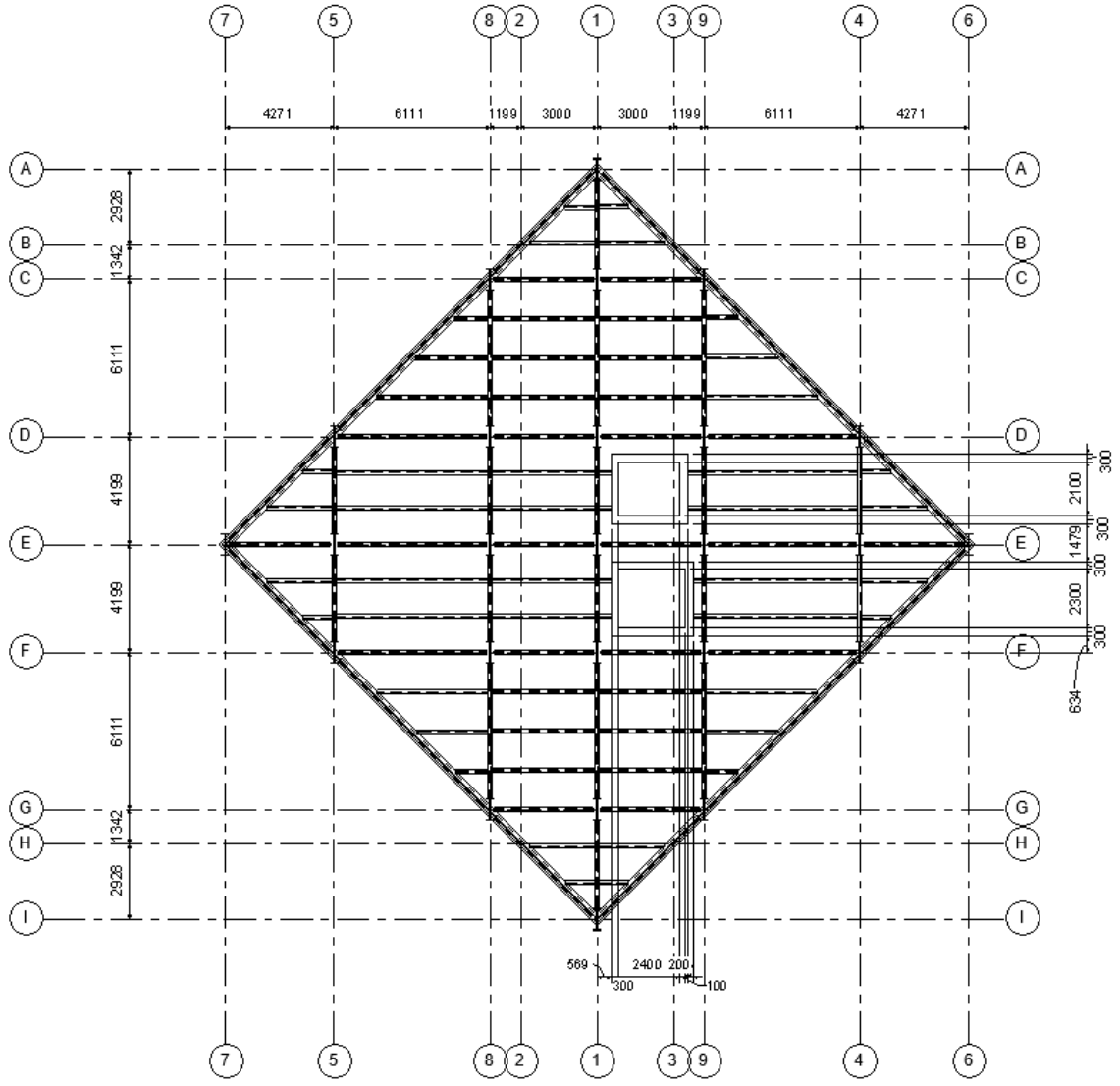
Introduction: Show capability to be able to use BIM software Revit. To design a beautiful building which is original, creative and interesting. Understanding the application and learn to process and model a finished building. Take into consideration of the environmental factors, engineering services and operational managers. To improve work with companies whist understanding management issues and account technical.

Gridlines and dimentions on first floor (mm)

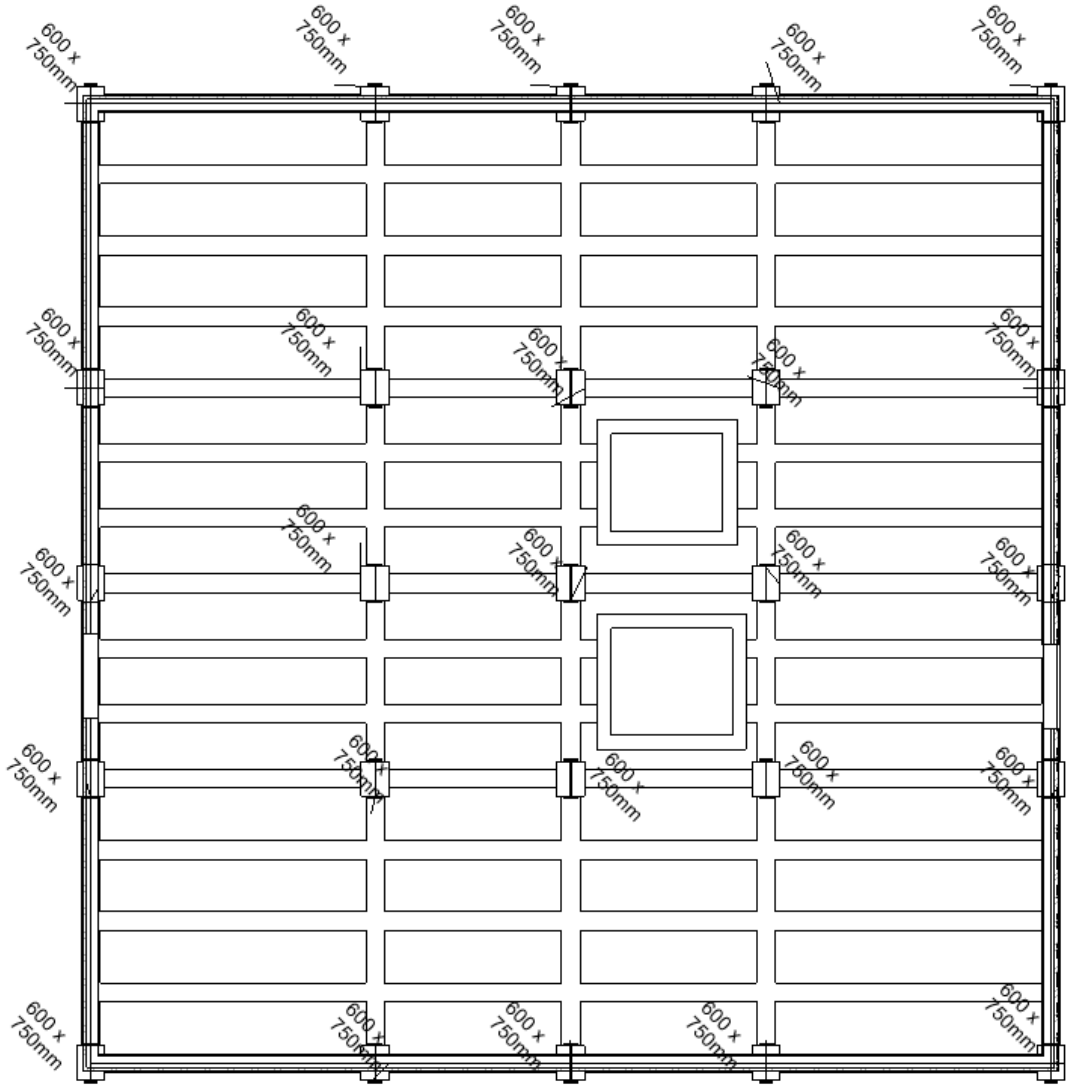


Gridlines and dimentions on upper floor (mm)



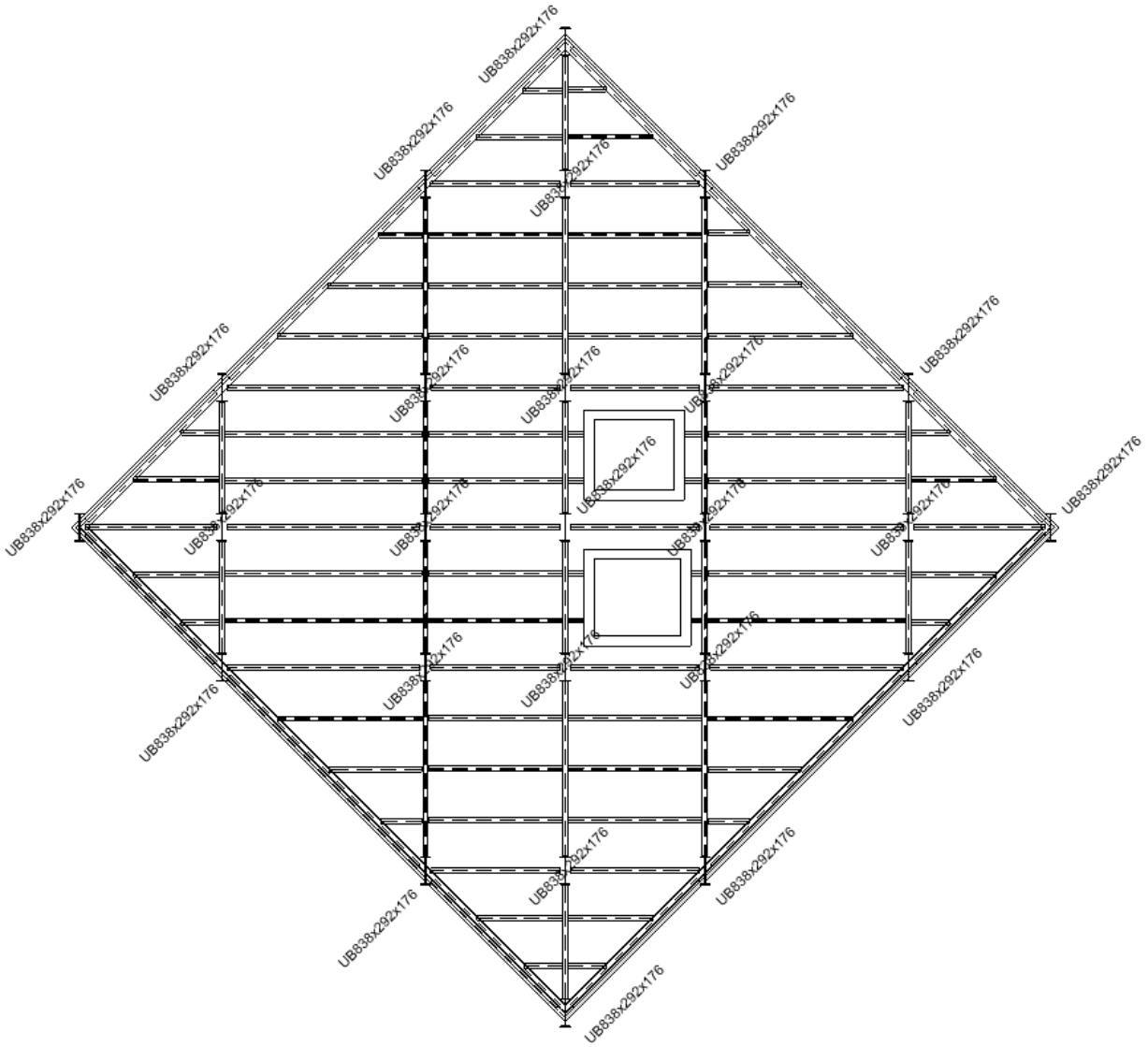
Structural column tags

Concrete 1st floor



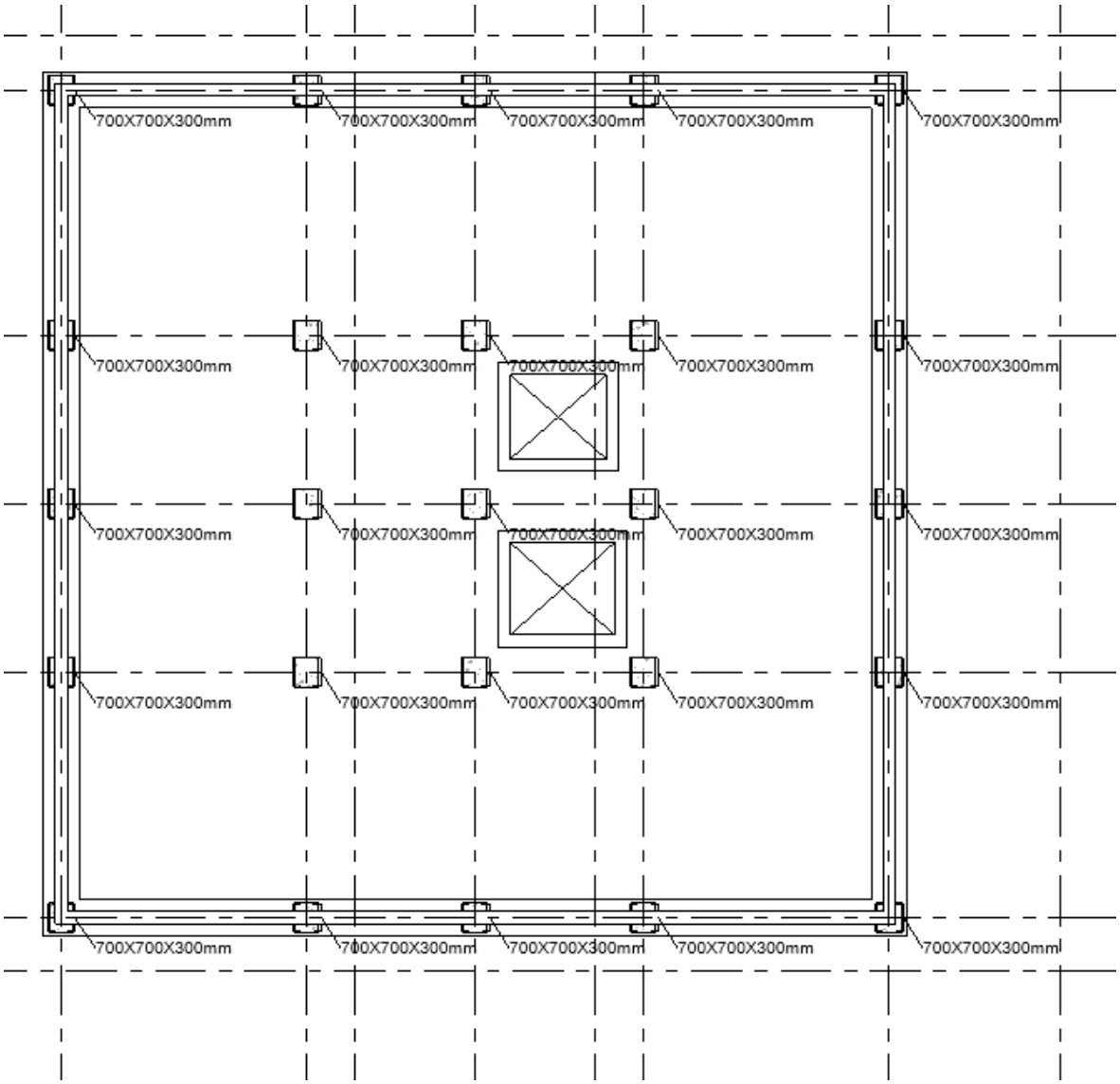
Structural column tags

Steel upper floor

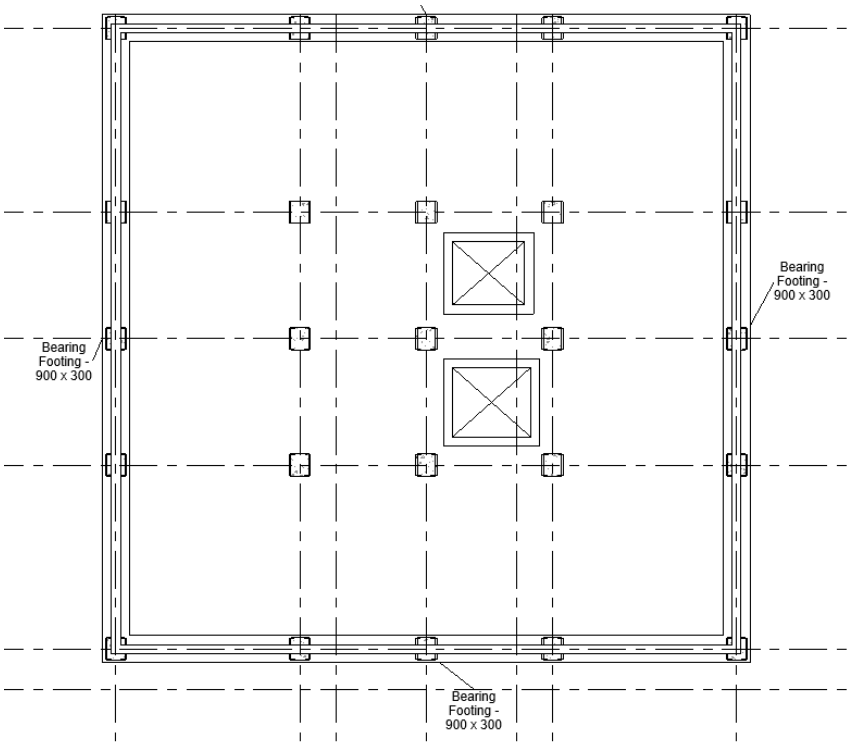


Footing Tags

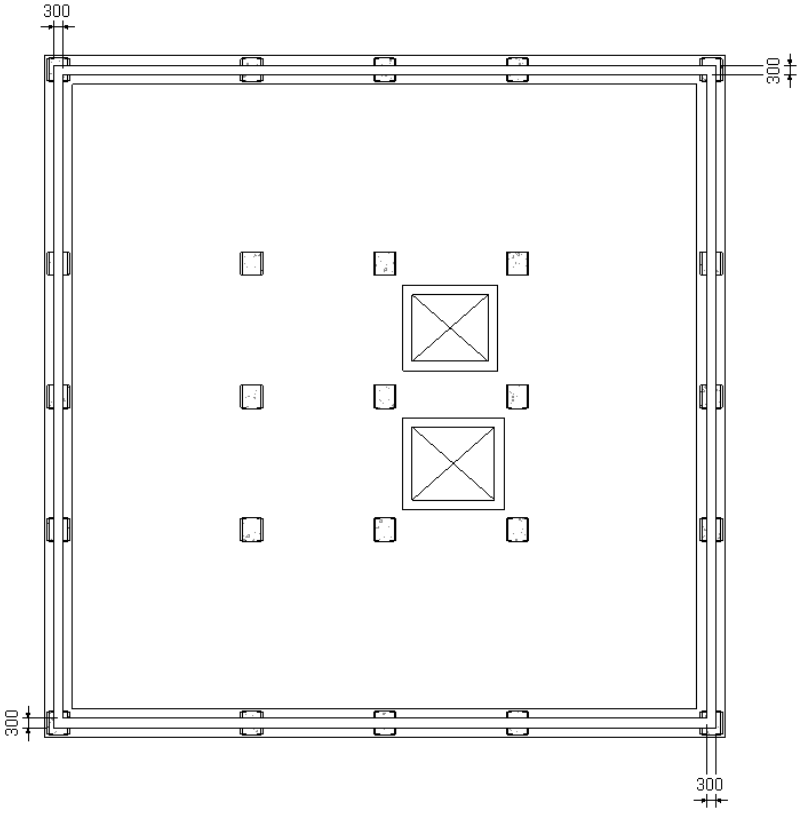
Column Footing



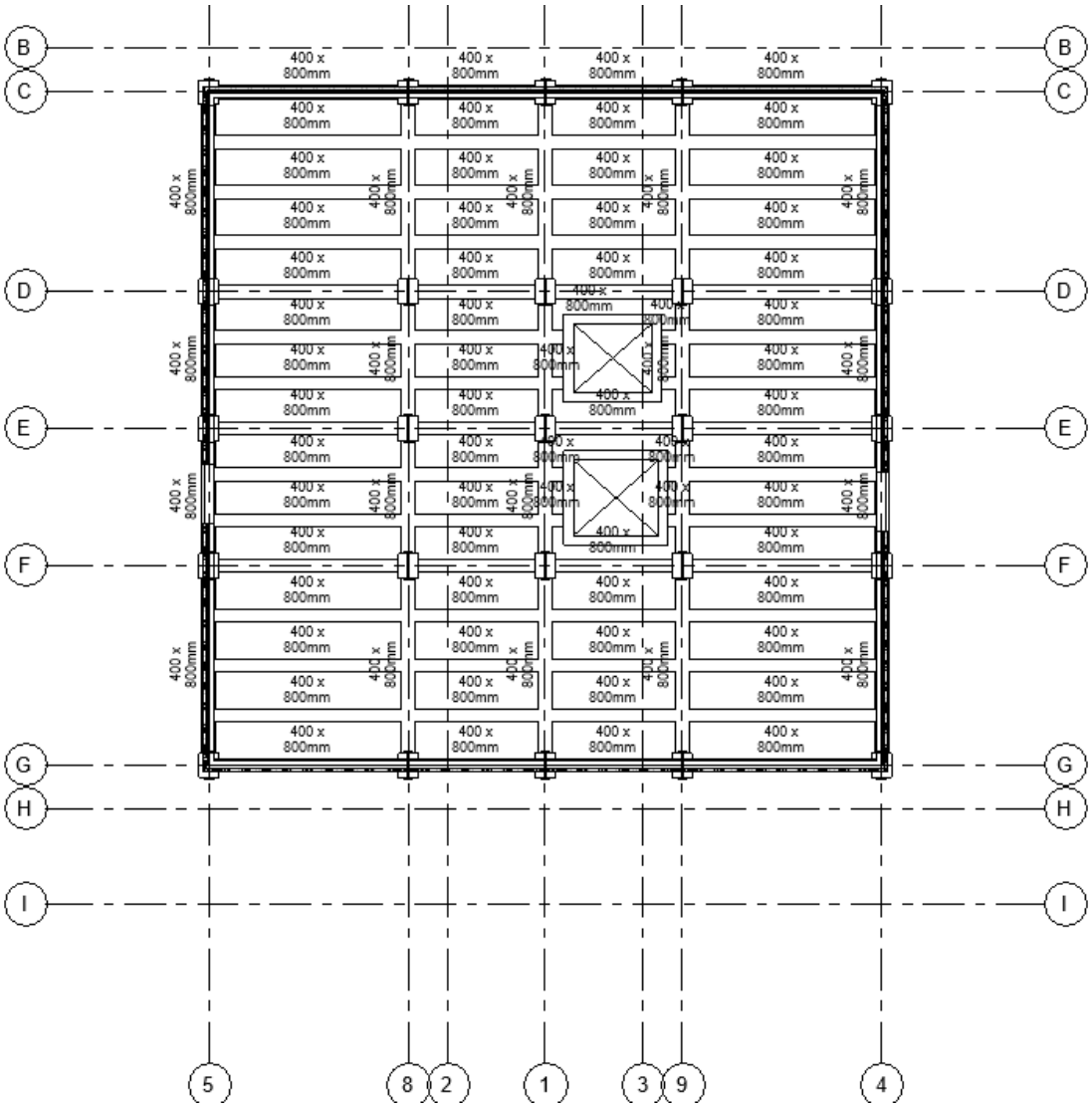
Wall Footing



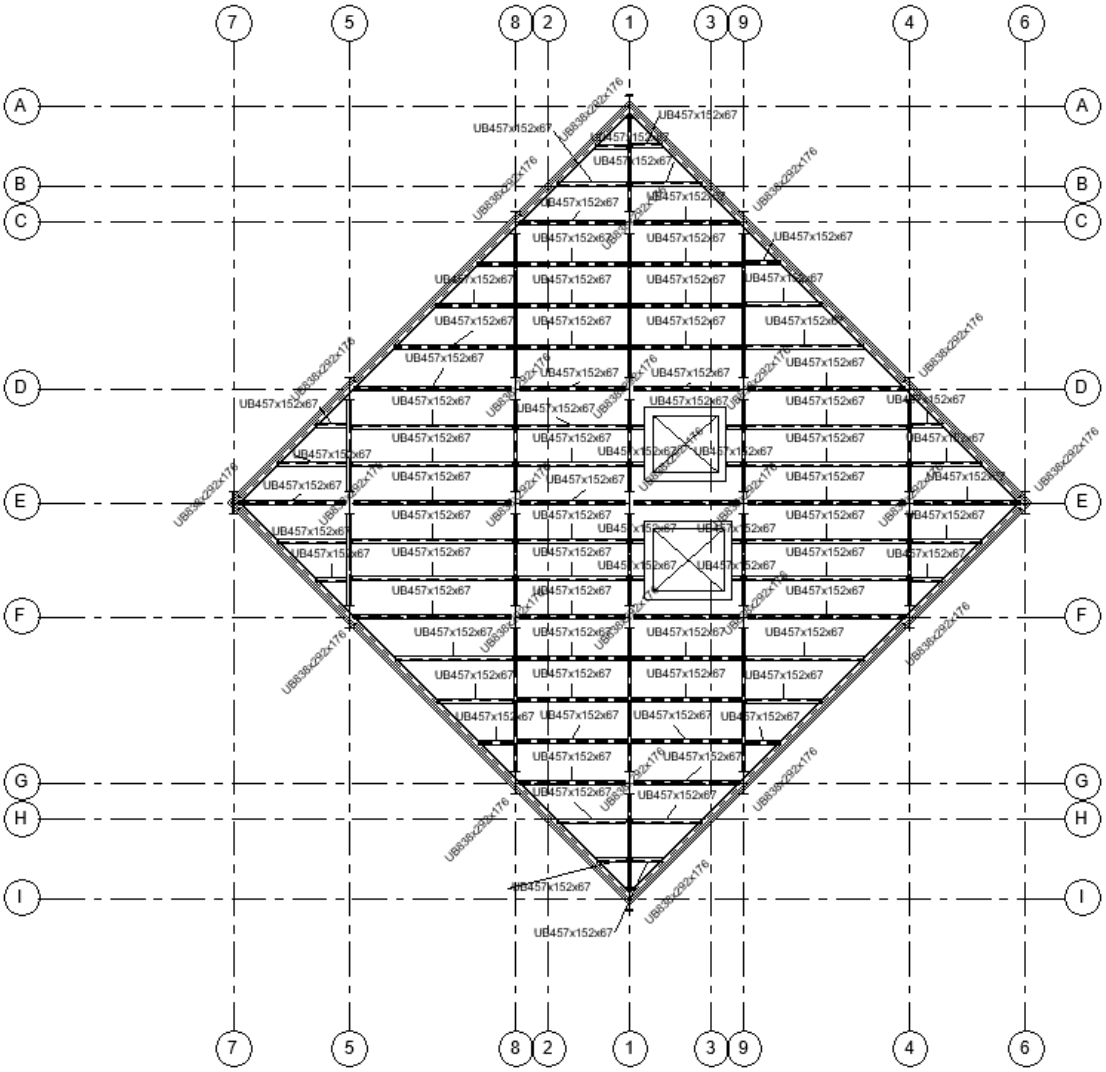
Foundation Wall tags



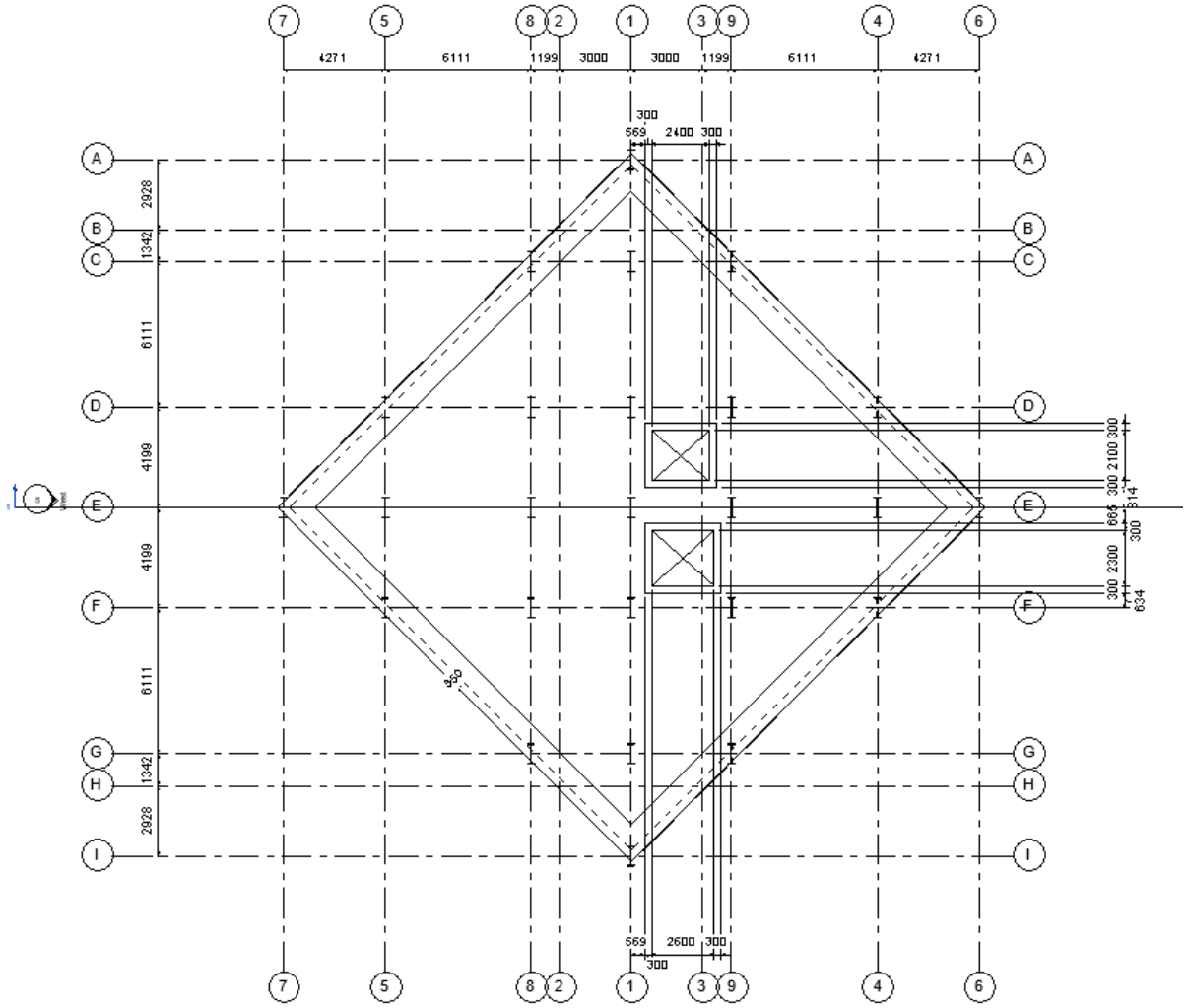
Primary and secondary beam tags first floor



Primary and secondary beam tags upper floor



Roof


7
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4271
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3000
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1199
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569
2400
300
A
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C
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E
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G
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I
2928
1342
6111
4199
4199
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2928
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2100
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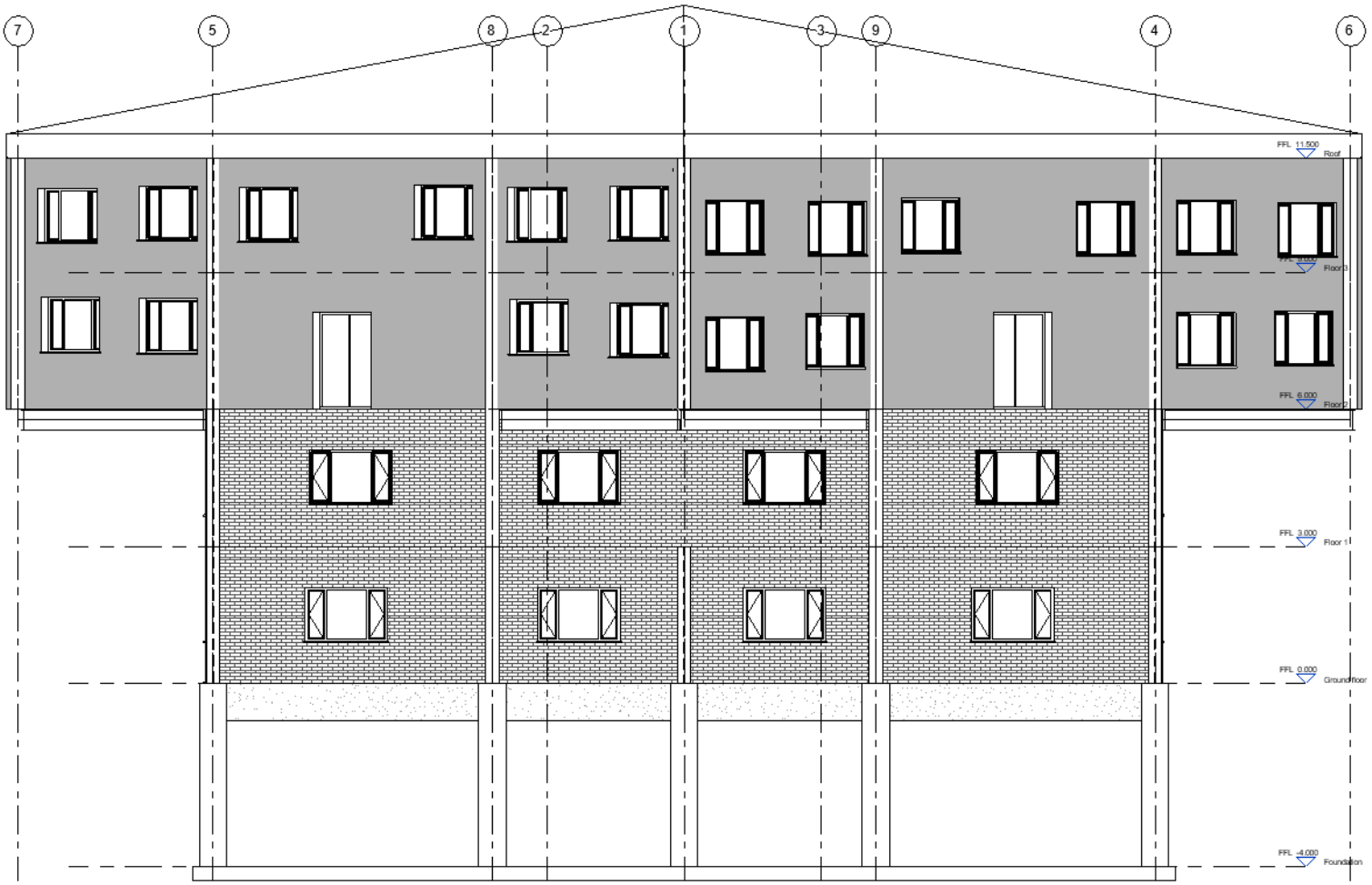
314
665
300
2300
300
634
569
2600
300
300

South view


7
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8
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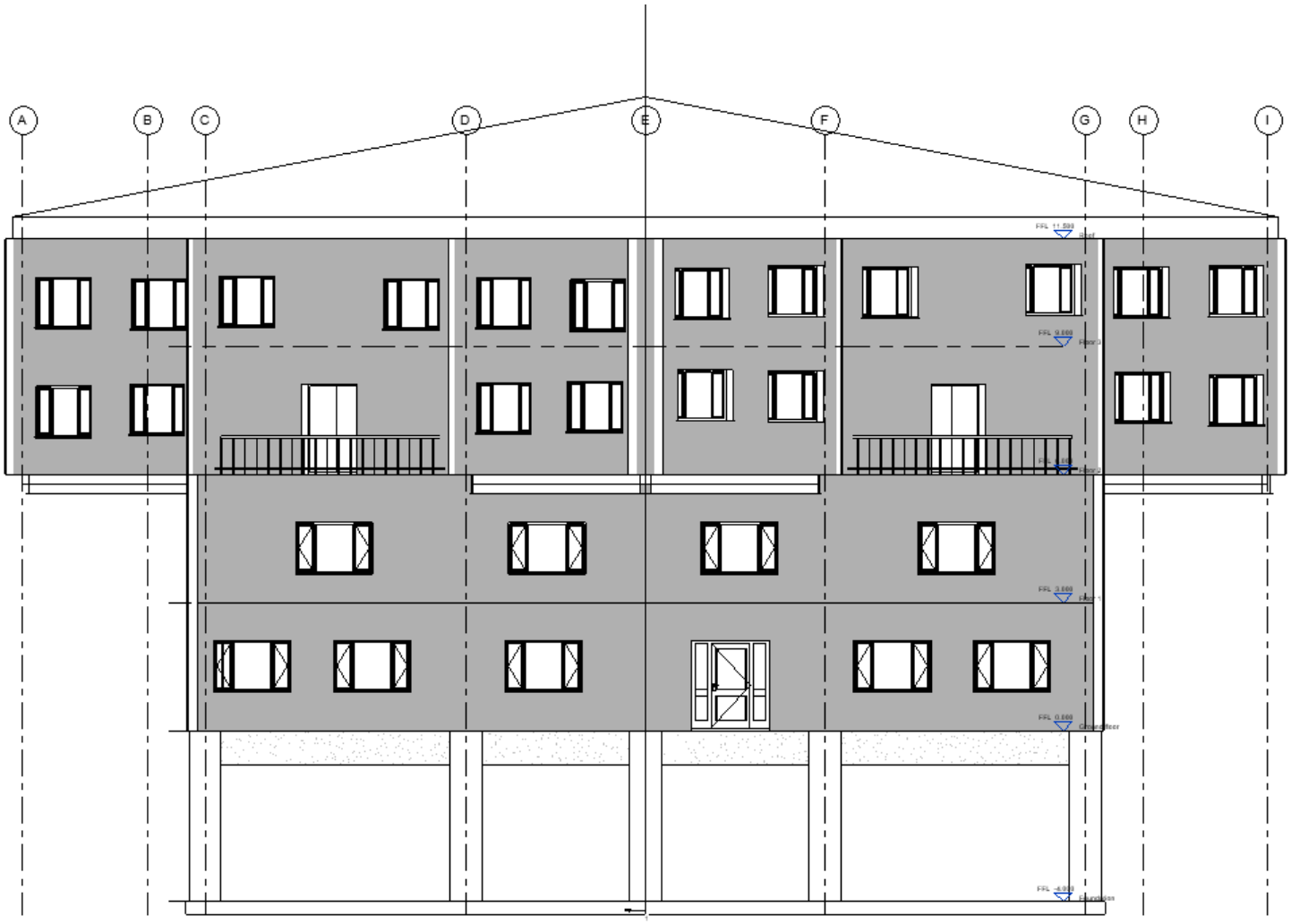
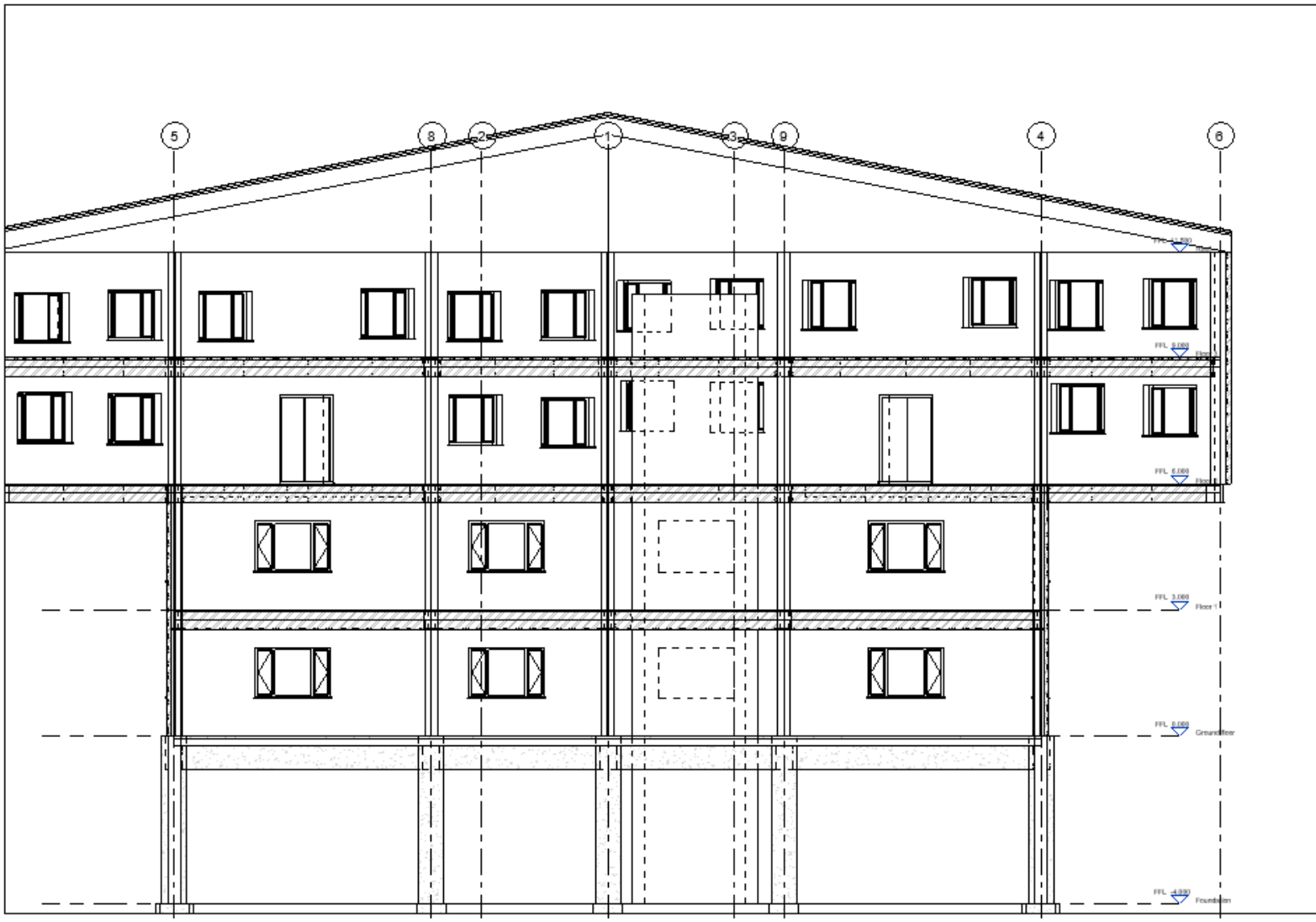
4
6
FFL 11.500
Roof
Floor 3
FFL 6.000
Floor 2
FFL 3.000
Floor 1
FFL 0.000
Groundfloor
FFL -4.000
Foundation

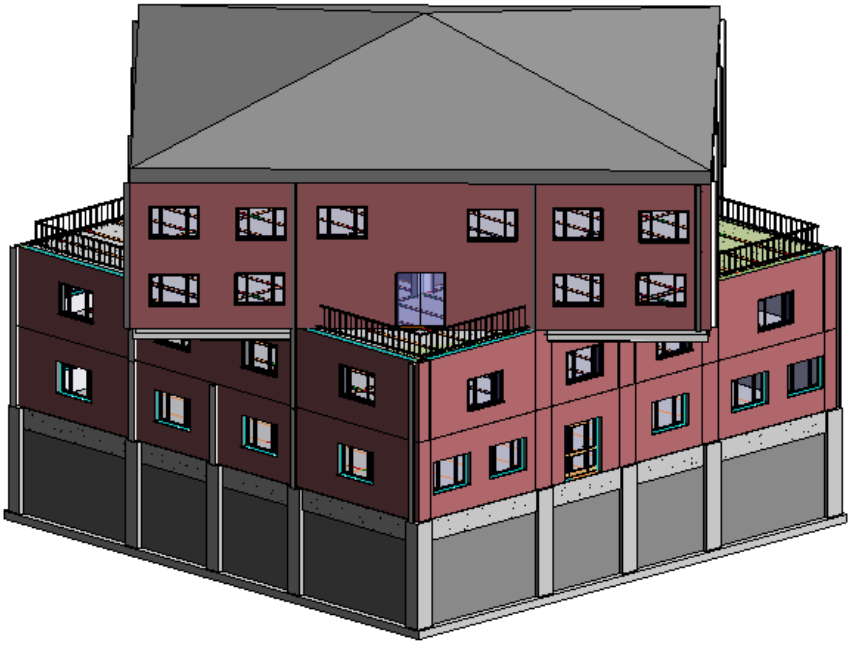
West view



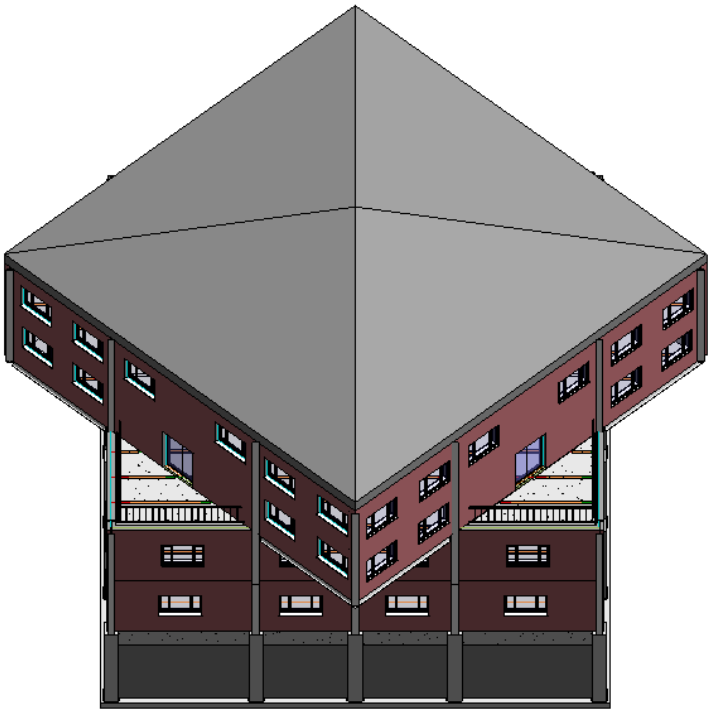
Section view



3D view



3D View



How the building can be improved to be sustainable

To improve the building, it will need to have fire exits at the upper floors as it is very important and may not with the health and safety requirement. Stairs could be installed from the balconies which would made it safer.

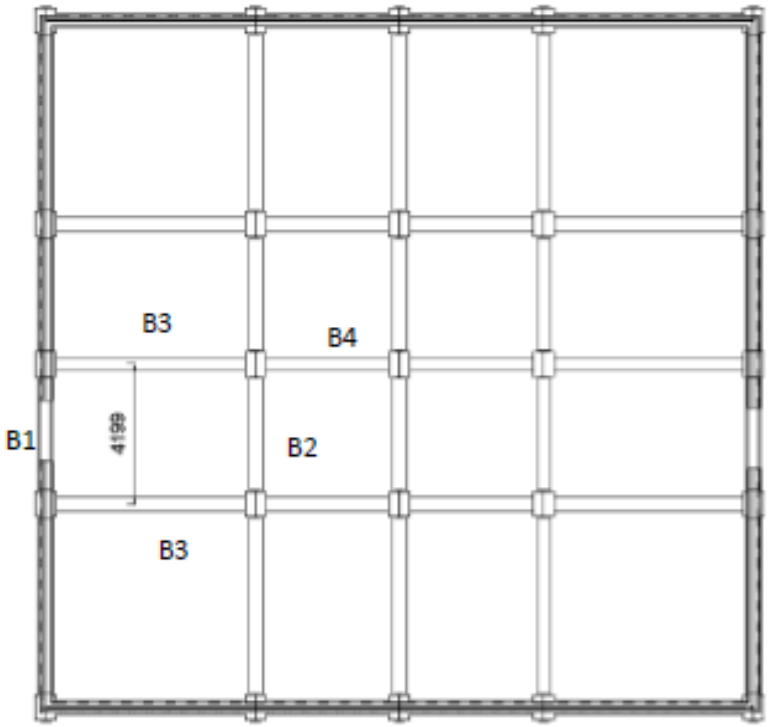
The building isn't wheelchair accessible which could be easily be fixed with a ramp

To lower the energy consumption the design of the building can be altered so that walls are made of glass. This will allow natural sunlight to light up the room

How the building can be more cost effective

The steel columns used were very expensive and was more than what was needed. Had I used a column which was more suitable for this built it would have made this build cheaper

Load take down for concrete



Slab Thickness = 225mm

Beam = 400x800mm

Column 600x700mm

Screed Finish = 50mm = 1.15KN/m² (0.05 x 1.151.15KN/m²)

Concrete = 25KN/m²

Slab

Self weight:gk= (0.225*25KN/m³)+(0.05 x 1.15KN/m²)=5.68 KN/m²

Variable (Live load) per m²: qk = 2.75 KN/m²

Design load on slab per m²: Ws = (1.35 x5.68) + (1.5 x 2.75) = 11.79 KN/m²

Loads on Primary beam

B1 : 11.79 KN/m² x $\frac{6.111m}{2}$ = 36KN/m

B2 :11.79 KN/m² x 6.111m= 72KN/m

B3 : 0

B4: 79 KN/m2 x 4.199= 49.51 KN/m

Self weight

(Slab weight included) :

(0.4m x 0.8m x 26.15 KN) = 8.4KN/m

B1 : 36 KN/m + (1.35 x 8.4 KN/m) = 47.3 KN/m

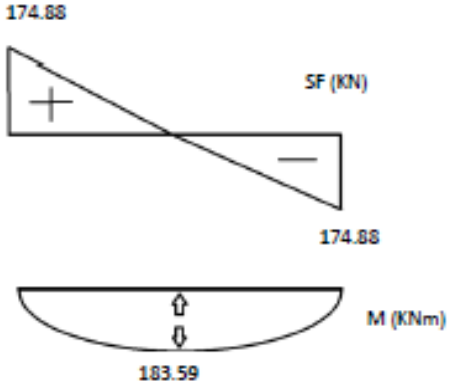
B2 : 72 KN/m +(1.35 x 8.4 KN/m) = 83.3 KN/m

B3 : 0 + (1.35 x 8.4 KN/m) = 11.3 KN/m

B4: 49.51+(1.35 x 8.4 KN/m) = 60.80 KN/m

Reactions, Shear force and Bending moment diagram on beams

RA RB



B2

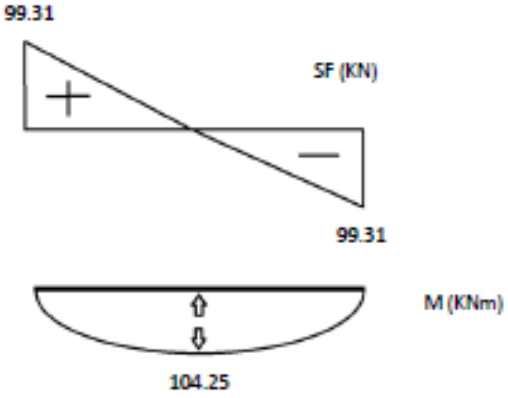
RA = RB = = $\frac{WL}{2}$ = $\frac{83.3\ x\ 4.199}{2}$ = 174.88 KN

SF Max = 174.88 KN

$Max\ M = \frac{WL\text{^}2}{8} = \frac{83.3\ x\ 4.199\text{^}2}{8}$ =183.59 KN/m

Reactions, Shear force and Bending moment diagram on beams

RA RB



B1

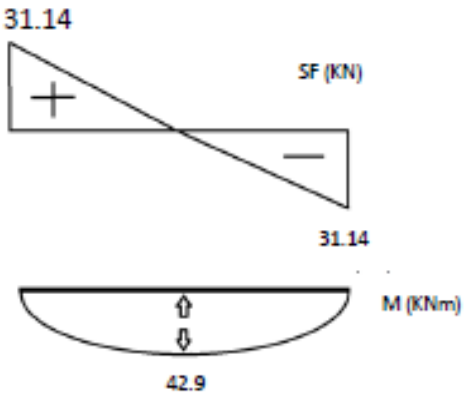
RA = RB = $= \frac{WL}{2} = \frac{47.3 \, x \, 4.199}{2}$ = 99.31 KN

SF Max = 99.31 KN

$Max\ M = \frac{WL\text{^}2}{8} = \frac{46.8 \, x \, 4.199\text{^}2}{8}$ =104.25 KN/m

Reactions, Shear force and Bending moment diagram on beams

RA RB



B3

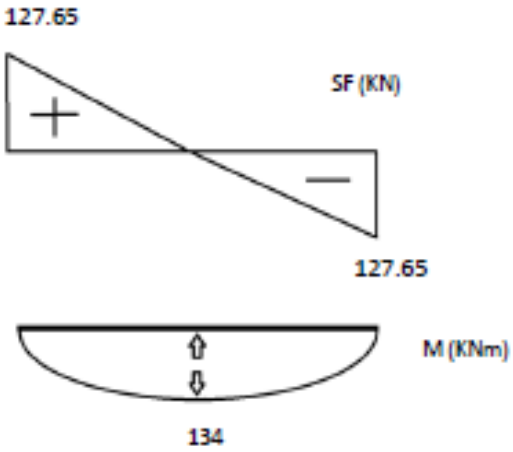
RA = RB = $= \frac{WL}{2} = \frac{11.3 \, x \, 5.511}{2}$ = 31.14 KN

SF Max = 31.14 KN

Max M = $\frac{WL\text{^}2}{8} = \frac{11.3 \, x \, 5.511\text{^}2}{8}$ =42.9 KN/m

Reactions, Shear force and Bending moment diagram on beams

RA RB



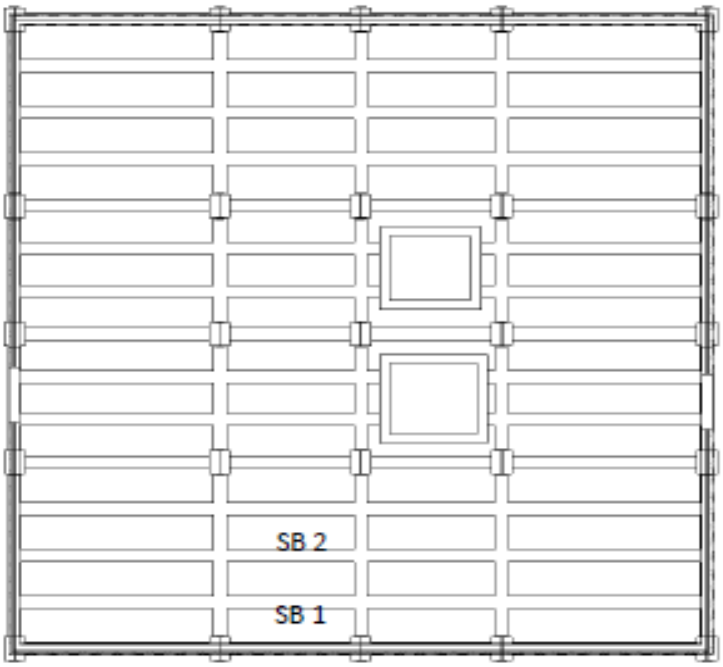
B4

RA = RB = $= \frac{WL}{2} = \frac{60.80 \, x \, 4.199}{2} = 127.65$ KN

SF Max = 124.97KN

Max M = $\frac{WL^{\wedge}2}{8} = \frac{60.80 \, x \, 4.199^{\wedge}2}{8} = 134$ KN/m

.



Secondary Beam

Beam to beam (spacing) = 1528mm

Ws : 11.79KN/m² Beam = 400 x 800mm

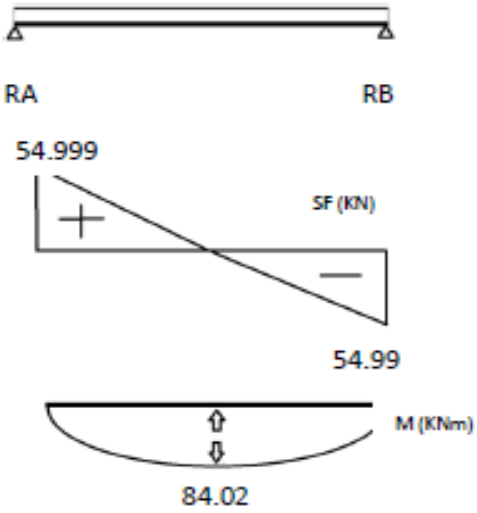
L = 3799mm SW = 8 KN/m

SB2 : 11.79 KN/m² x (1.528) = 18 KN/m

Self weight : (slab weight Included)

SB2: 18 + (1.35 x 8 KN/m) = 28.8 KN/m

Reactions, Shear force and Bending moment diagram on beams



S2

RA = RB = $= \frac{WL}{2} = \frac{28.8 \times 3.799}{2} = 52.71$ KN

SF Max = 52.71 KN

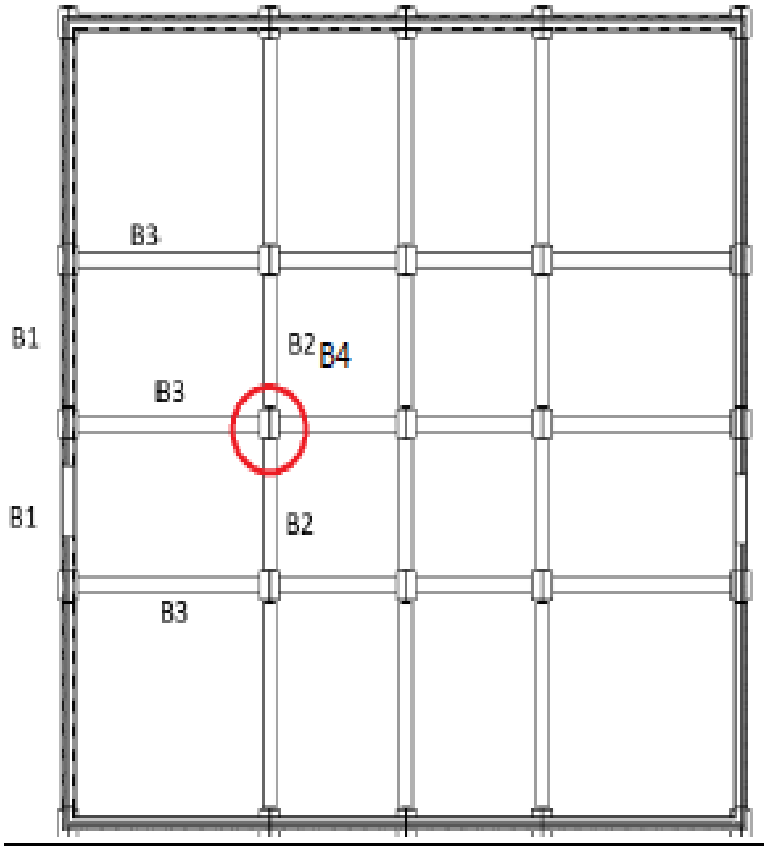
$Max\ M = \frac{WL^2}{8} = \frac{28.8 \times 3.799^2}{8} = 51.96$ KN/m

Forces in the column

Load on inner concrete column = B2 + B2 + B3 + B4 = 174.88 +174.88 + 31.14 + 124.97 = 505.87KN

Area = 400mm x 800mm =320000mm^2

Stress = F/A = 505870/ 320000 = 1.58N/mm^2 = 1.58MPa



Load take down for steel

Slab

Self weight:gk= (0.225*25KN/m^3)+(0.05 x 1.15KN/$m^{2)}$ =5.68 KN/m^2

Variable (Live load) per m^2: qk = 2.75 KN/m^2

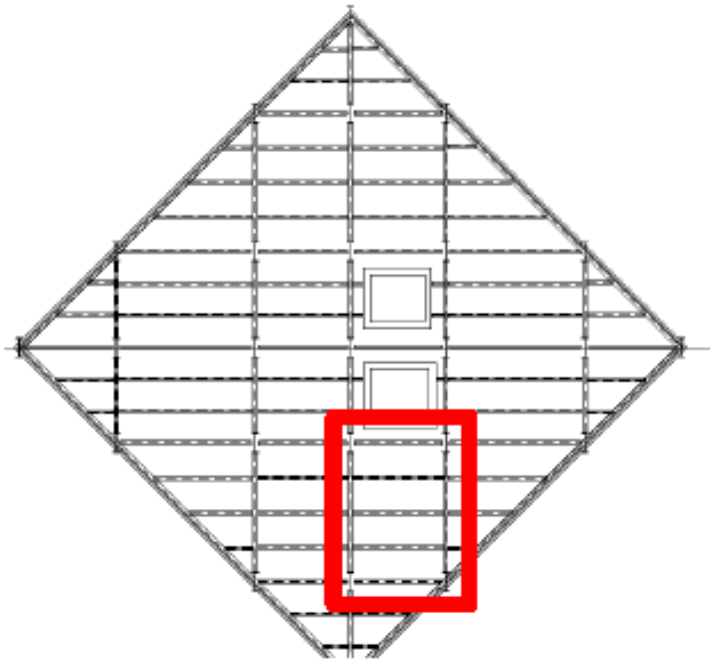
Design load on slab per m^2: Ws = (1.35 x5.68) + (1.5 x 2.75) =11.79 KN/m^2

Spacing 4 x 1.528 = 6.111

Wsb = ws x jsb

Wsb = 11.79 x 1.528 = 18KN

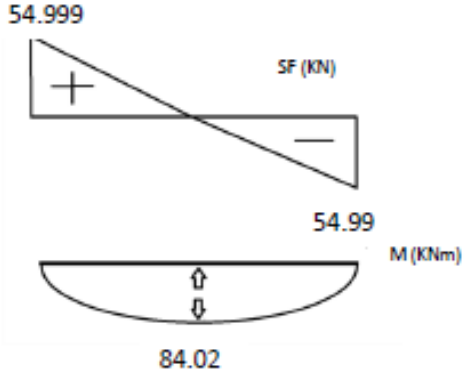
11.79 X 1.528 X 6.111 = 110.1KN



Secondary Beam

Reactions, Shear force and Bending moment diagram on beams

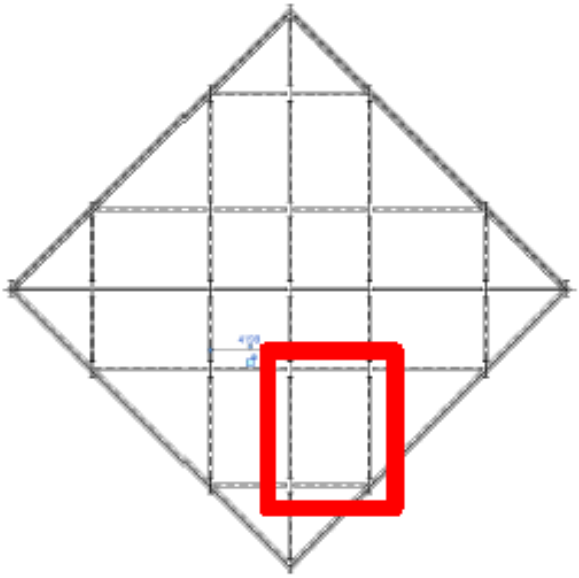
RA RB

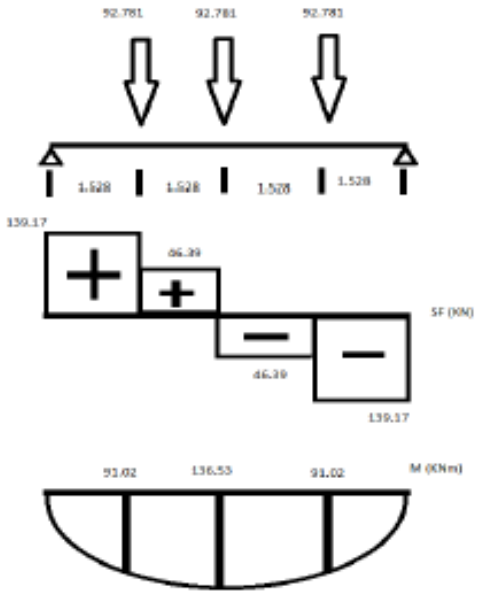


RA = RB = = $\frac{WL}{2} = \frac{18\ x\ 6.111}{2}$ = 54.99 KN

SF Max = 54.999 KN

Max M = $\frac{WL\text{^}2}{8} = \frac{18\ x\ 6.111\text{^}2}{8}$ =84.02 KN/m





Primary Beam

$\frac{18 \times 4.199}{2}$ = 37.79KN

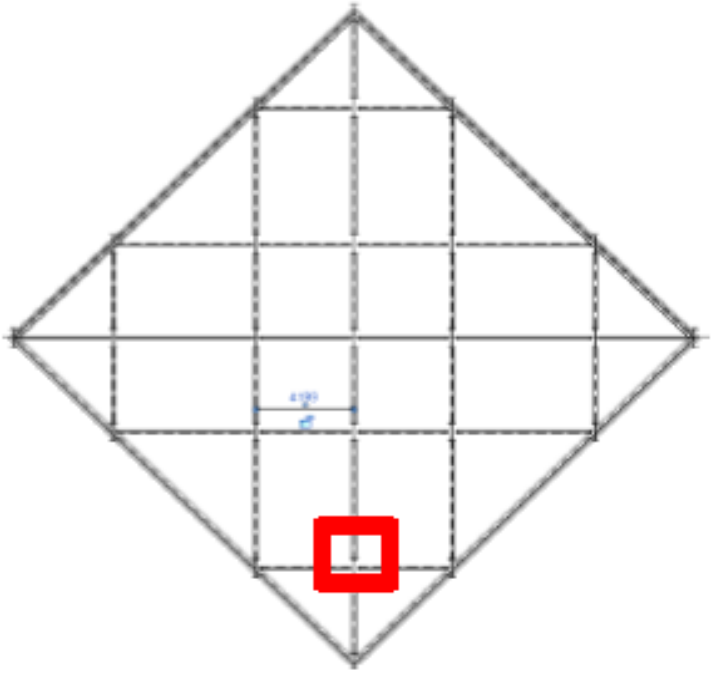
37.79 + 54.99 = 92.781 KN

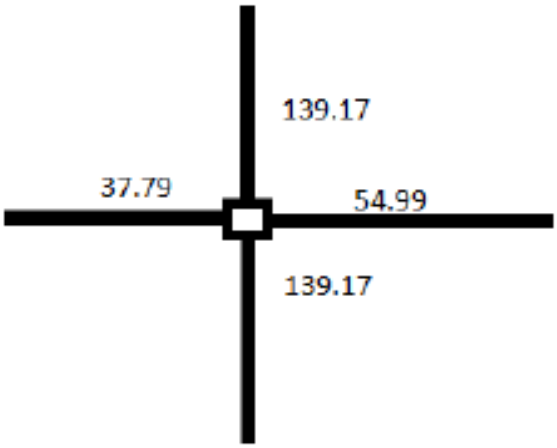
RA = RB= $\frac{3 \times 92.78}{2}$ = 139.17KN

SF Max = 139.17 KN

Max M = (139.17 x 2) –(92.78 x 1.528)
=136.37KNM

Load on steel column

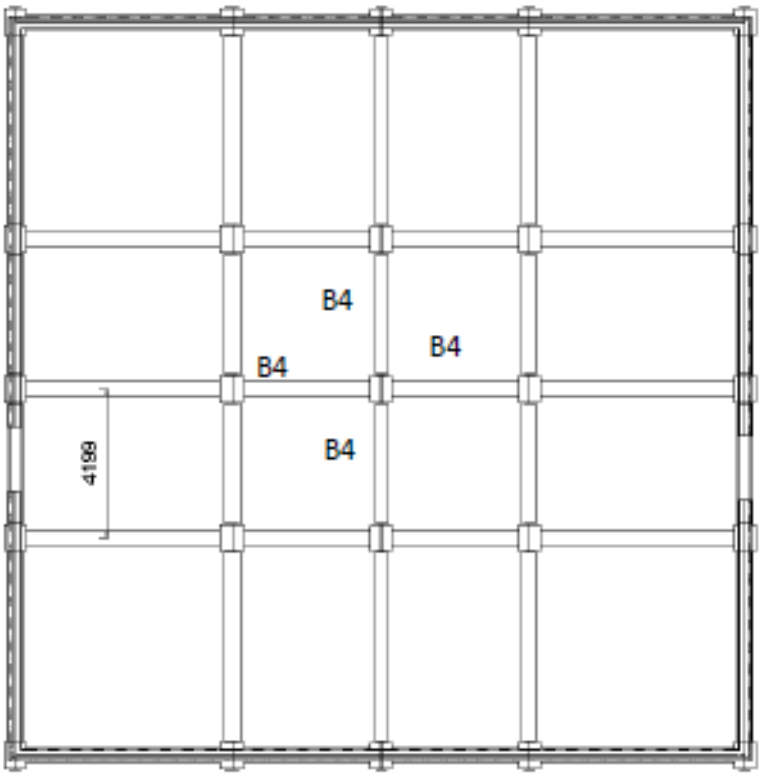




Wc = 2 x(139.17) +53.99 +37.79 = 371.12KN

Choosing the footing size based on the soil maximum compressive strength of 1 MPa

Central column force = B4 +B4 +B4 + B4 = 124.97 X 4 = 499.88KN



Total force on the foundation

F = 499.88KN + (0.6m x 0.75m x 3m x 26.15KN/m^3) x 1.35

F total = 501.70KN

Ff = 501700N/700mm x 700mm = 1 N/ mm^2 = 1MPa

Report of Environment & Sustainability, Law & Finance and Project & Construction Management

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ENVIRONMENT & SUSTAINABILITY

Environmental benefits and sustainability of using BIM:
Building Information Modelling (BIM) is increasing largely in popularity around the world. The use of BIM has dramatically reduced carbon footprint and has better managed effective waste and water management. BIM has shown many people how there are improved energy management in a project.

Starting from design stage the BIM software technology brings sustainability in the built environment, through operation and in construction too. BIM prevents unnecessary processes and practises which are useless that can have dealt with during construction, this is possible by providing data and data analysis about a building's infrastructure which then will make it possible to create schedules which will calculate the costs.

BIM allows a report in the form of a schedule to calculated and design data that will be useful for analysing building volumes, material costs, Structural loads, surface areas and how efficient the build could be. Designs can be compared very easily by practices and designs can viewed in a realistic 3d mode.
BIM considers aspects of sustainable development of social, environmental and economic. When practices use BIM in their projects many consider the environmental aspect of sustainable development which also means that there is less attention being given to the aspects of economic and social.

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WHITE COLLAR FACTORY – BREEAM

Offices – New							
The Edge	OVG Real Estate	C2N Bouwmanagement	98.36	Outstanding	OVG Real Estate	PLP Architecture	G&S Bouw
Noda	SCI LA BATAILLE	ALTO Ingenierie	93.2	Outstanding	BNP PARIBAS IMMOBILIER	Viguier & Associates	
Torsplan	NCC Property Development	IVL Svenska Miljoinstitutet AB	90.4	Outstanding	NCC Property Development AB	Bau Architects	NCC Construction
Greendale	O1 Properties	JLL Russia & CIS	88.5	Outstanding	O1 Properties	Spectrum Holding	ANT YAPI
White Collar Factory	Derwent London	Ove Arup and Partners	88.2	Outstanding	Derwent London	AHMM	Brookfield Multiplex

Companies which use BIM review at their end of accounting year and realise how much money they save because of the operation and cost efficiency of using BIM in their project. From stage one, stages such as planning and feasibility, having data from the manufacturer on BIM easily enables full compliancy with regulations. Environmental impacts, natural resource usage, soil or water acidification, depletion and many more useful information is accessible on BIM.

Decisions are made quicker and accurately because of the precise data that is in the model. Precision allows the designs to match the build as if it were built . The software reduces many risk factors abortive design later down the stages.

During the stages of operation, using BIM benefits by maintaining high standards of sustainability by having data available for replacements, refurbishments and renewals. BIM has proved to be cost efficient as well as innovative

In conclusion, Using BIM is beneficial both in short term and long term in the industry. The environmental factors and sustainability factors are taken into consideration which have benefits to the environment as well as efficiency preventing error.

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LAW & FINANCE:

Using BIM grants users access to a digital representation of a building. The software allows physical and functional characteristics. BIM makes the operation of constructing a project much easier.

There are great benefits of using BIM however, there are issues regarding liability, copyright infringements and insurance. To avoid liability for copyright infringement of a 3rd party intellectual property rights, companies must prove that they own the IP (intellectual property) rights over their own contributions for any project and give indemnity to companies which could use the similar contribution.

The use of BIM had been made mandatory in all public sector projects after 2016, the governments announced the news in 2011. Insurers have stepped in and have monitored the way BIM was being implemented by the companies and the practices. Insurance premiums are to be lowered because of the using BIM projects as a lower risk of error.

Financially, using BIM has found to be extremely effective. There are many reasons to how this is possible. The work production rate is much faster with BIM, which saves time and money for practices and companies. BIM reduces space for errors, less time spent because time is minimised, which means less money spent, this factor is beneficial the space can be also utilised so that the risks of human error are reduced.

The software BIM uses an approach which is collaborative when it comes to the aspects of designing, managing assets and constructing. Reduction in the errors saves money and has a positive effect on the longevity of the building. If human errors are made they can easily be fixed had it not been for BIM

The building's lifecycle process reduces the chances of errors and mistakes helping save costs for clients. If there are any errors made by people, these can easily be corrected/rectified much quicker than it could without the use of BIM.

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PROJECT & CONSTRUCTION MANAGEMENT:

Drawing designs physically for construction had existed for centuries which had 2d hand drawn designs. Computer Aided Design (CAD) was later used in the construction industry, which could create 2d and 3d models, however it had many flaws and wasn't as advanced as it could be when compared to BIM.

BIM isn't just a new tool. BIM is a collaborative environment in which the project team can work. The design starts with the architects and engineers, but when fully handled it is requires the contractor and the owner or end user of the building. Tools in BIM having great changes taking place not just in how construction projects are sketched, but how they are budgeted, analysed, managed and scheduled from concept to the final product.

Project managing is a process that needs monitoring during the progress. Project managing also compares the status to the schedule and orchestrates the activities in the project to make sure that schedule is being followed for full efficiency. It can be very challenging as problems can arise. Changes are very concerning as it could mean spending more time and money. When there are changes, there conditions that haven't been considered which, may be difficult to resolve. Changes that are caused by issues discovered late , change of scope, environmental factors or unforeseen conditions..

How BIM benefits Construction managers:

- Maintaining control.

The Software involves aids such as auto save, multiple backups and to connect to project histories so that time can be utilised to the fullest. The evolution in the way we design has changed dramatically in a way that getting a corrupted design or losing a design have decreased hugely

- Improve collaboration.

Sharing and collaborating designs with models is easier than when the designs had to be drawn by hand or with a drawing set. There are lot of work going on which are making communication easier. There are many tools such as the Autodesk BIM 360 Field application which runs on Apple iPads. This enables collaboration improvement and makes it easier to communicate as it is very portable.

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Autodesk BIM 360 Field

ENVIRONMENT & SUSTAINABILITY REFERENCES:

Ref 1: https://www.pbctoday.co.uk/news/bim-news/bim-aid-sustainability/26116/

Ref 2: https://www.thenbs.com/knowledge/bim-and-its-potential-to-support-sustainable-building

Ref 3: http://www.rics.org/Global/Achieving%20Sustainable%20Construction%20through%20Building%20Information%20Modeling%20over%20Complete%20Life%20Cycle.pdf

Pictures:
https://tools.breeam.com/filelibrary/BREEAM%20Awards/109611_Best_of_BREEAM_Awards_2016_WEB.pdf

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