09. technical investigation

When one visits a food market, the different produce can be smelled, touched and tasted. The ingredients are on display in their natural state. The construction and materials used in this project were chosen to portray the raw and unprocessed products sold at the market. The different ingredients of this dish (the building) are recognisable, and one can tell the elements that make up the building apart from each other. The structure is not concealed behind plaster or veneers but rather celebrated in the natural form. The play of light was an integral part of the design to signify how the natural also dictate the ritual. By using texture the shadows are accentuated. The individual parts don't have any meaning unless they are integrated with each other to shape a building. The different parts lightly touch each other to form this design, more like a salad less like a stew.

administration

ADMINISTRATION
In Barcelona, Spain, a total of 41 markets similar to this project are distributed in the city. A department in the municipality manage these markets. A similar administration faculty could be implemented in this project. Except that where the municipality represent the urbanite, another organisation like AgriSA could represent the farmer. Agri South Africa (Agri SA) is a federal organisation, which promotes on behalf of its members, the sustainable profitability and stability of commercial agricultural producers and agribusinesses. As the market is a place where the rural meet the urban the relationship should be reflected in the representation of the two parties. This partnership is responsible for the general maintenance of the property and services as well as to manage the farmers that rent spaces in the market.

How it works:
The producer rent a stall for a period of time. He/she is responsible to hire a person to handle the delivery and retail of the produce. Similar to the way a farmer would sell produce on the roadside in country side. It is recommended that this person be paid a basic salary and rewarded by giving him/her commission on the goods that is sold. This will encourage active participation and marketing in the market.
A producer may not create a monopoly by renting more than two stalls. The idea is that similar markets will be distributed through out the city and the producer can lease a number of stalls at the different markets.

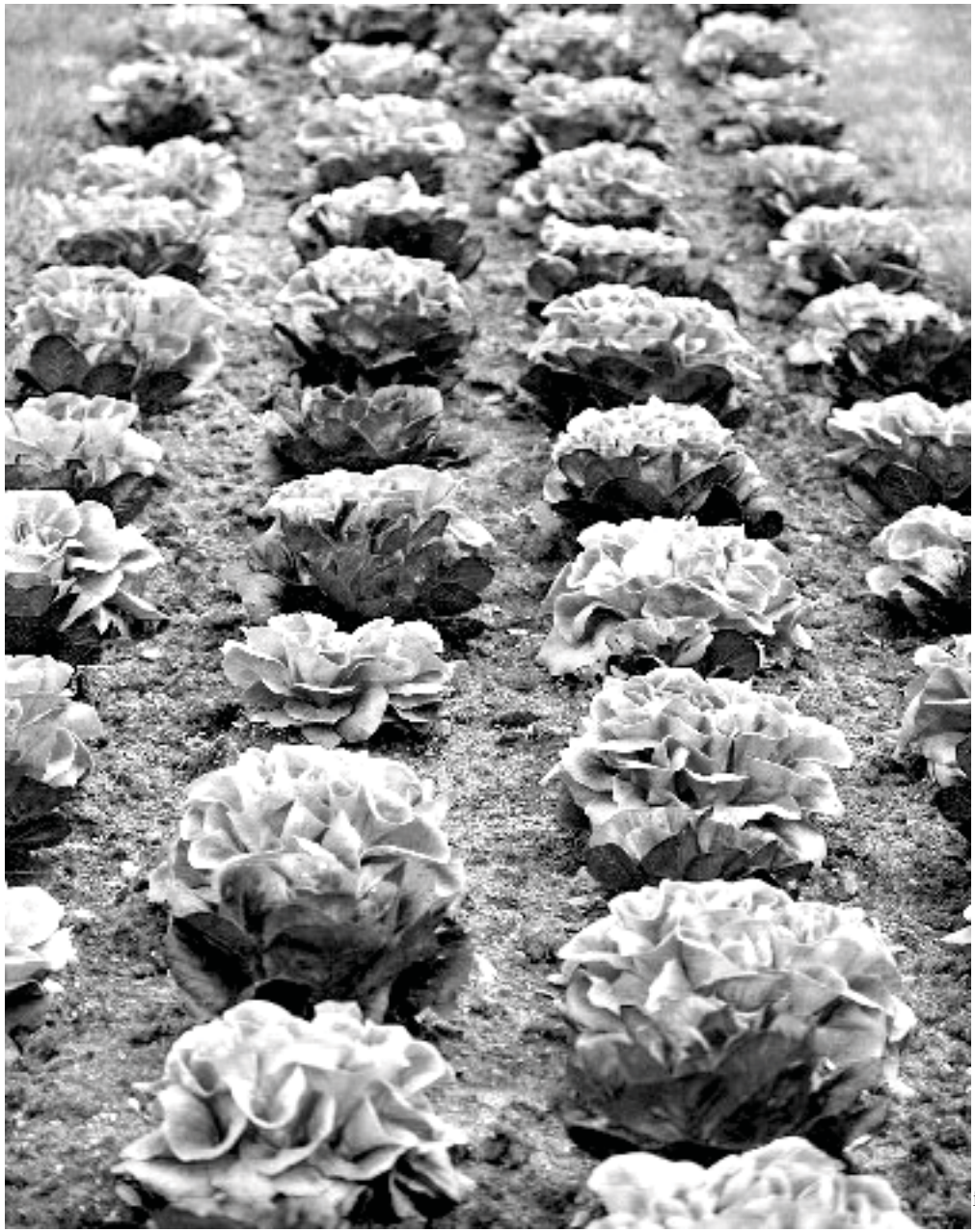

fig. 9.1

materials

In a sustainable market it will be best practise to get the produce from around Pretoria so that local farming enterprises could prosper, food miles are reduced and food that is in season around Pretoria can be enjoyed. Therefore, building materials should also be indigenous to this area. Bricks were manufactured in the vicinity of Pretoria from 1904 by JJ Kirkness. Corobrik still manufacture bricks today. PPC, or Pretoria Portland Cement was founded in 1904 by N H Nellmapius at De Eersten Fabrieken in Daspoort and is still in operation today. ArcelorMittal, the leading manufacturers of steel in South Africa, previously known as Iscor, is situated in Van der Bijl Park in Gauteng. The materials will be discussed in the different applications in this chapter.


fig. 9.2 Open Bond

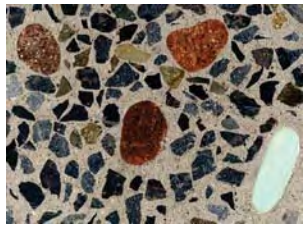
fig. 9.3 Exposed aggregate


fig. 9.4 Corobrick Antique Travertine


fig. 9.5 Masonry Bond Texture


fig. 9.6 Brownbuilt Sheeting


fig. 9.7 Spaceframe


fig. 9.8 Spaceframe


fig. 9.9 Masonry Bond Texture


fig. 9.10 Brownbuilt Sheeting


fig. 9.11 GKD Kiwi steel mesh

basement

CONSTRUCTION
A tank basement construction was used. The basement is within 170m from the Steenhovenspruit; hence the water table may be above the basement floor level. The basement is tanked by inserting 1,0mm polyolefin waterproof membrane between a 300mm thick concrete wall and a 220mm masonry wall. Construction connections must be limited and provided with continuous cast-in rubber water stops. Sumps need to be installed to collect seep water through geo-pipes that is installed in a herringbone pattern in the floor slab. A sump should not catch more than 400 sqm of floor area. The basement floor area is 4400 sqm, therefore 11sumps are needed. An electrical submersible pump with float switch is fitted in the sumps. In this large basement the sumps are connected with pipes to a larger pump chamber. (Wegelin2009:163)

JET GROUTING
The excavation that is in close proximity to the existing structure need to be stabilised and secured by solidifying a layer of soil on the excavation edge. This will minimise vibration and soil movement between the existing building and the construction site. A pipe is drilled into the soil by a driller to the correct depth. From this depth it will start to saturate the soil with a concrete mix and this then causes the soil to solidify and harden. (Franki:2009)

STRUCTURE CALCULATIONS

Columns in Basement:
Clear height required is 5 200 mm
Cast-in-place columns, typical height 2- 8m.
L/d = 12 L/d = 18
d = 5200/12 d = 5200/18
d = 433,33 d = 288.9
thus 350

Two-way reinforced slab. Suitable for heavy loading and concentrated loads.
Typical spans is 6 -11 m
L/d = 28 L/d = 35
d = 8200/28 d = 8200/35
d = 292.8 d = 234.28
thus 255 mm thick

Reinforced Wide Beam is used where height is limited.
L/d = 16 L/d = 22
d = 8200/16 d = 8200/22
d = 512.6 d = 372.72
thus 425

ACCESS
Access to the basement is calculated as follows:
Floor to Pavement Height: 6930 mm
Transition slope length: 4000 mm
y/4000= 8%
0.08 x 4000 = 320mm rise
2 x transition slope = 640 rise
6930 – 640 = 6290
6290/y = 16%
6290 x 0.016 = 39 000 mm (Ching 2008: pl.29)

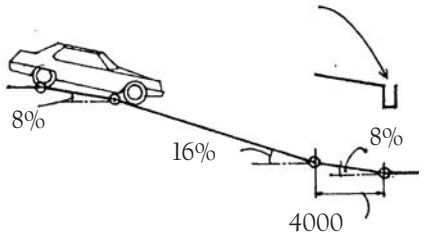

fig. 9.12 Garage Ramp

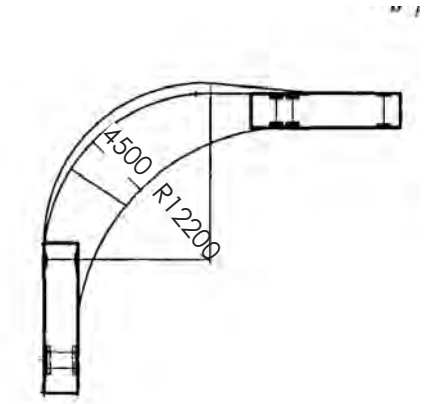

fig. 9.13 Meduim Commercial Vehicle

FINISHES
Floor finishes is smooth so that it can be easily cleaned. Epoxy mortar flooring system is used. Abescreed is a hard-wearing and chemical-resistant decorative mortar for a seamless flooring surface. Abescreed is used in areas that are subject to heavy mechanical wear like garages and food processing areas. Abescreed also provides a slip resistant finish. Epoxy flooring must not be used as screed-out-of-doors. (Abe: 2009)
Concrete Columns to be prepared with one coat alkali resistant plaster primer and finished with two coats alkyd Super Universal enamel paint. Different colours on the columns indicate the difference routes in the basement for movement or delivery.

VENTILATION:
Artificial Ventilation will have to be used as not enough natural air could ventilate the basement. Storage of produce will also need a cooler temperature. A central cooling system is proposed. Fresh air is obtained through a raised platform in the open area. Ducts are positioned as indicated on basement plan.

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delivery basement plan

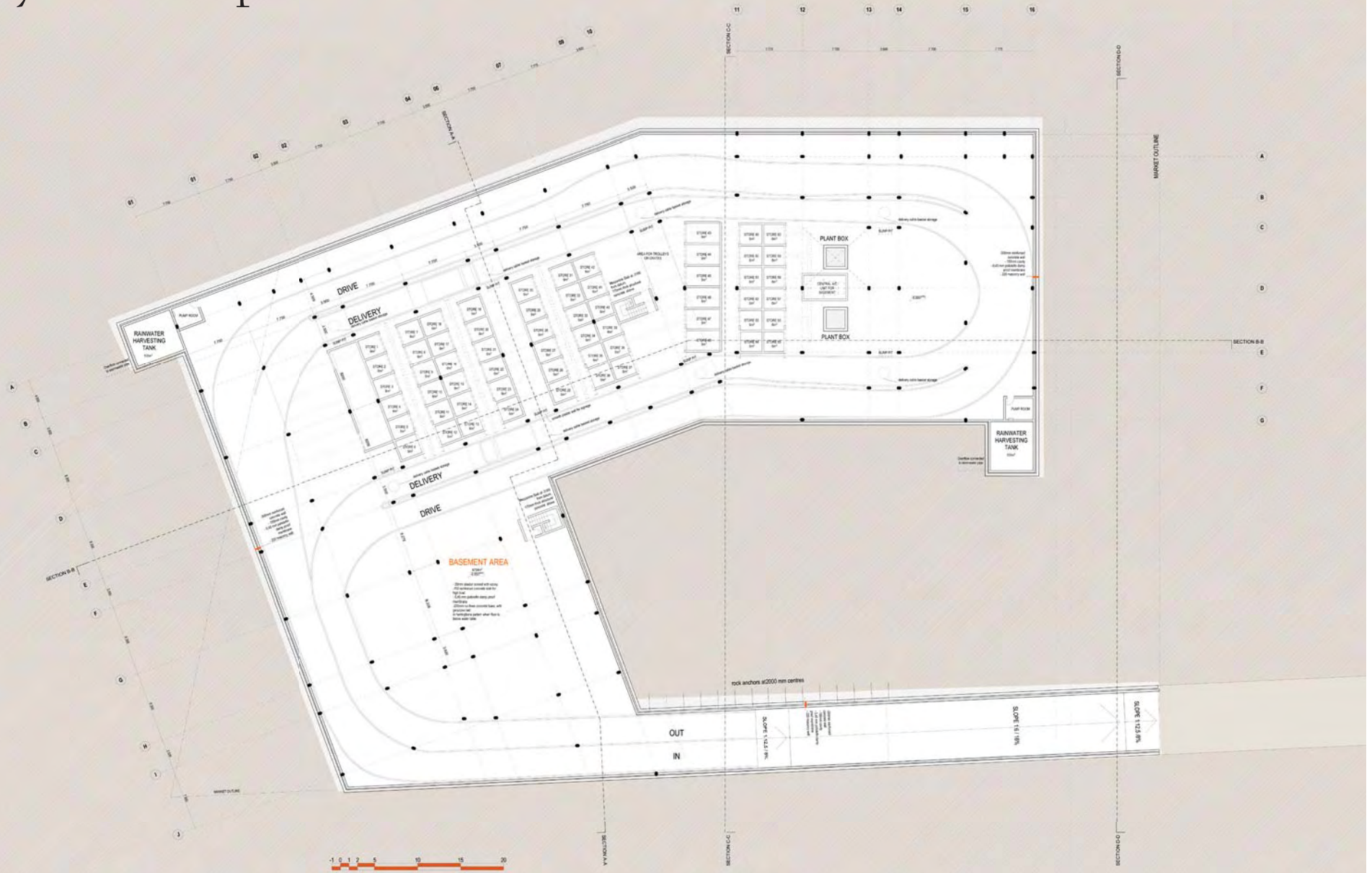


fig. 9.14

structural system

The structural grid is governed by the stall runs mentioned on p. 59. The composite columns are positioned at the cross points and support the triangle roofs. The composite of four steel columns is stabilised and supported by diagonal steel beams. The diagonal beams work against the downward load of the hoist and delivery basket. The four columns consist of two hollow steel sections (two 100x200x6mm hot rolled steel rectangular tube) with steel angels (45x45x4mm equal angle steel section) welded to the section to support the diagonal beams (100x50x3mm hot rolled steel rectangular tube). The hollow sections enable downpipes and electrical conduits to be accommodated inside the columns with accessible openings for inspection.

Open web joist steel beams span between these columns to support the light precast concrete slab of 170mm thick. Beams are bolted with two M20 bolts to the custom made steel hangers that have a minimum bearing length of 100mm. (Ching 2008:6.13)

All steelwork should be treated with a factory primer. Apply two coats of zinc phosphate primer; finish with two coats of structural steel intumescent paint to have a three hour fire resistance. Steel is painted white. All base plates must be galvanised.

CALCULATIONS
Hollow Rolled Steel Section Column
h/d= 7 h/d= 28
d=4700/7 d= 4700/28
d= 671.4mm d=167.86mm
therefore 200mm

The composite column can be seen as a
Steel Lattice Columns
h/d= 21 h/d= 25
d=8700/21 d= 8700/25
d= 414.3 mm d=348 mm
1500 x 1500 mm would be efficient then

Cold formed open web joist steel joist
Span of 18600mm
h/d= 15 h/d= 25
d=18600/15 d= 18600/25
d= 1240 mm d=744 mm
Thus 900mm deep

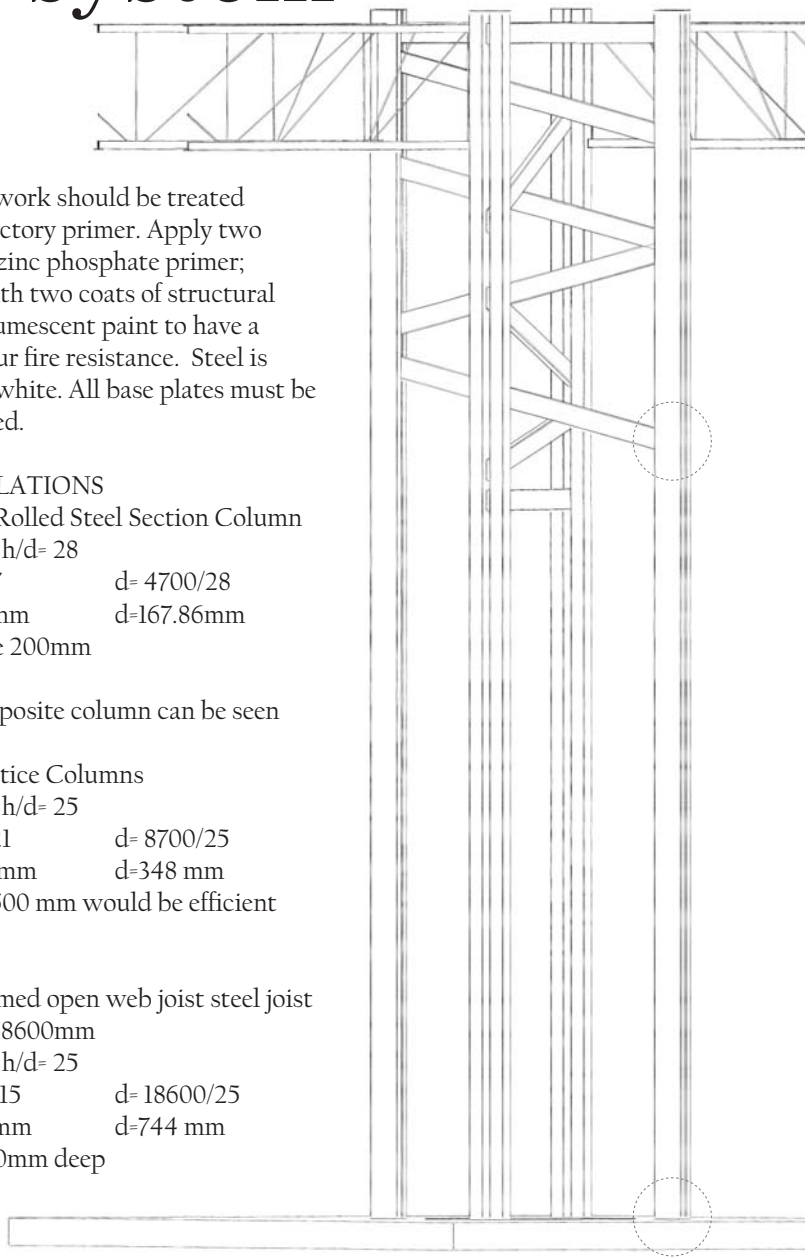


fig. 9.15 Composite column

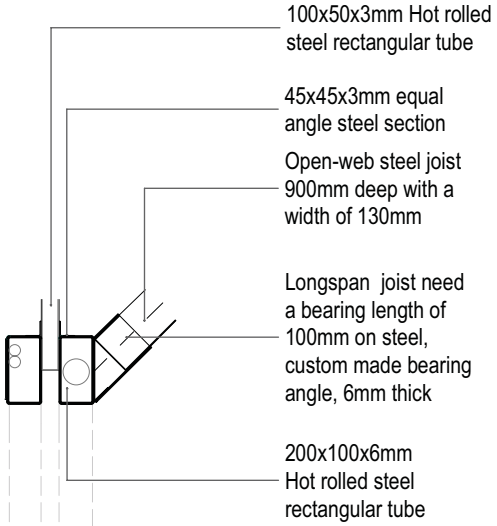


fig. 9.16 Open web joist steel beam support

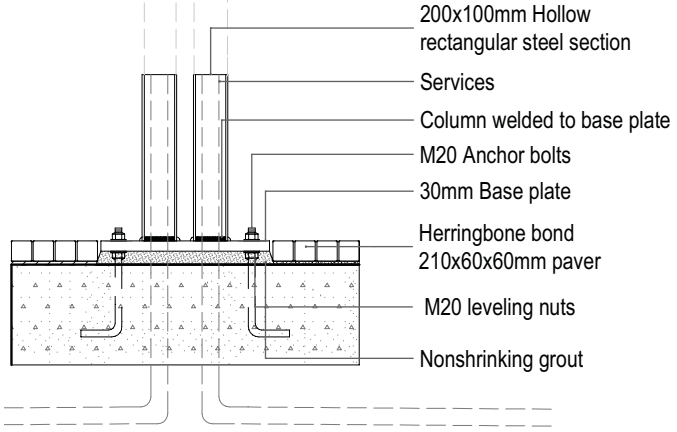


fig. 9.17 Column Footing

ground floor plan

- FRUIT AND VEGETABLES
- MILK/CHEESE/FISH
- MISCELLANEOUS
- BAKERIES
- PERMANENT STALLS
- FORMAL RESTAURANTS
- BATHROOMS
- BUTCHERIES
- SERVICES

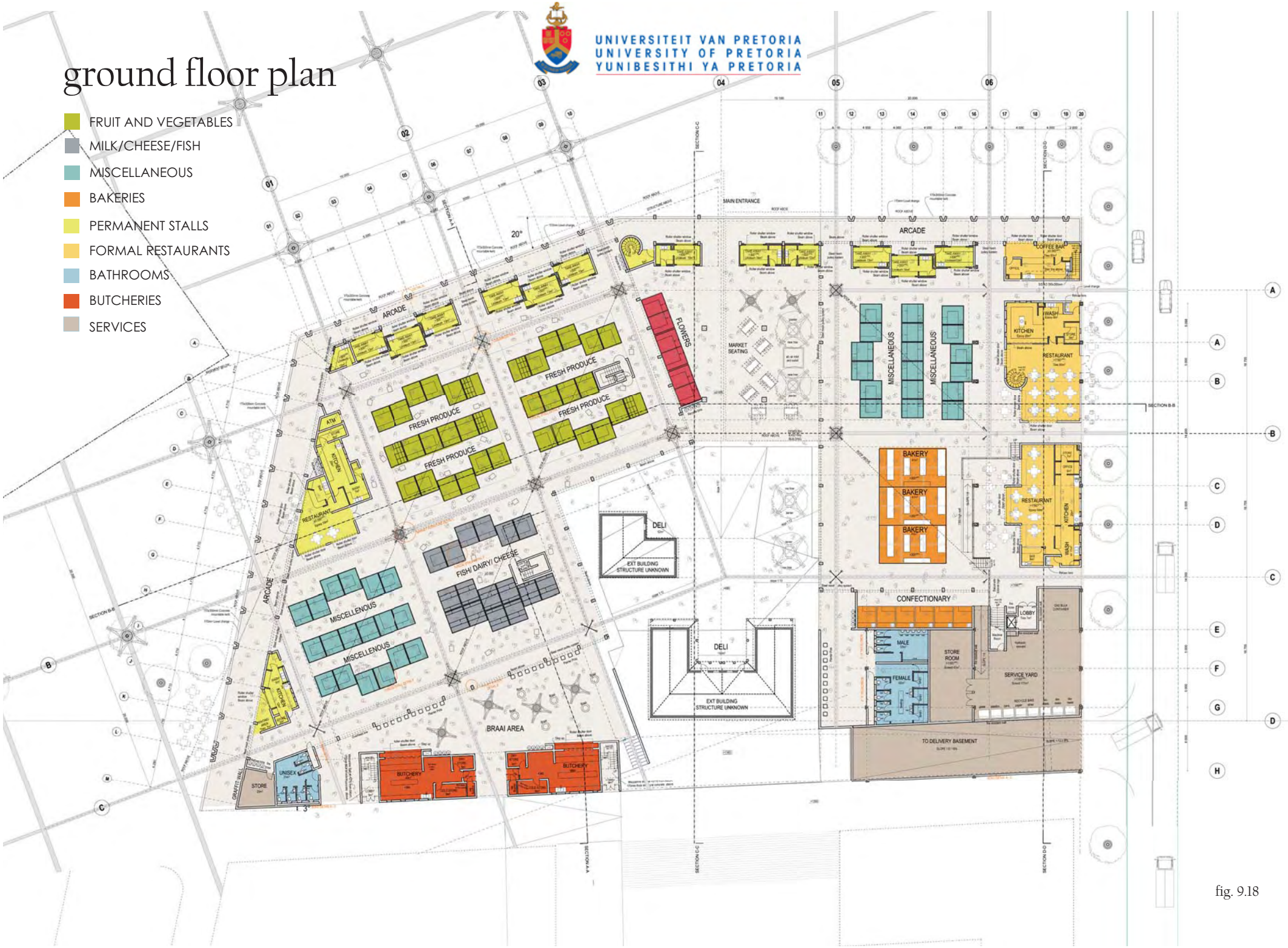


fig. 9.18

delivery system

This thesis accentuated the importance of the direct exchange the farmer must have to the city at its inhabitants. This can only be possible if a market is designed with an infrastructure to accommodate a number of farmers to bring their produce to the market. Produce's quality degrades every time it is handled. In the current industry, produce have a few detours before it ends up in one's plate.
To eliminate all the detours a delivery system is proposed where the food can be loaded on the farm and then unloaded on the market floor.

A F1 Top, type CTS601 (supplied by lift and shift) hoist with a capacity to pull 2 ton up is fitted on an I-beam of 203x102mm that is supported by the hollow section columns discussed beforehand. The produce is loaded on a 'cable basket' (fig. 9.16) that is constructed of a round shaped unequal angle steel section (50x70mm) with timber fastened to it with countersunk steel woodscrews. Steel cable of 5mm diameter connects the two timber platforms. By using cables instead of fixed steel members enable the basket to collapse and be stored in the basement floor. (fig. 9.22)

The cable construction of the basket enables it to collapse to fit in the pit in the basement floor.

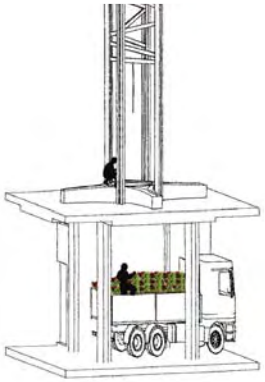


fig. 9.19 Trucks drive into the basement and park underneath one of the eight delivery wells.

fig. 9.20 The cable basket is loaded with produce and is pulled from above into the market by an electrical hoist.

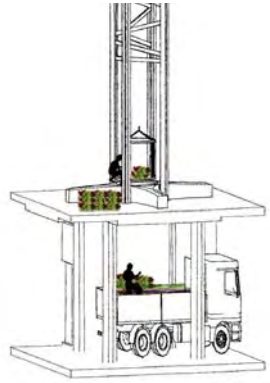


fig. 9.21 The food is then distributed to the designated stall. Excess produce can be stored in the basement.

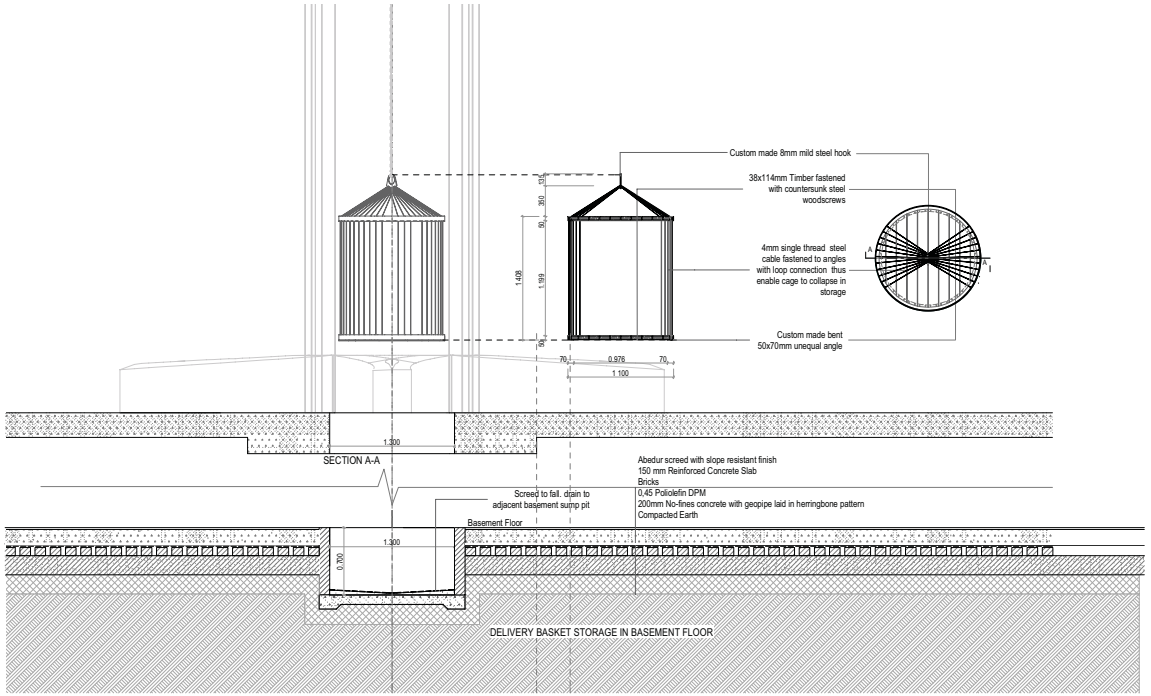


fig. 9.22

street furniture

Market seating is positioned on the cross points of the grid to give rhythm and legibility both in the market as well as in the adjacent squares. The seating furniture form sculptural elements underneath the structural columns in the market. This furniture is so designed so that the element could be altered in a language to accommodate different needs. (fig.9.23)When it is used at the delivery points, the opening can be accommodated in the middle. The opening is closed with a timber hatch so it may function as stage when it is not used for unloading. The benches that are used in the square are larger than those in the market and trees can be planted in the openings. The seating is made from light weight in-situ concrete.

Trees located in the market and in the square must not have an aggressive root system. Therefore the Celtis Africana or White Stink Wood was opted for. Bio barriers should be introduced in the plant boxes in the basement to make sure the roots do not jeopardize the structure.

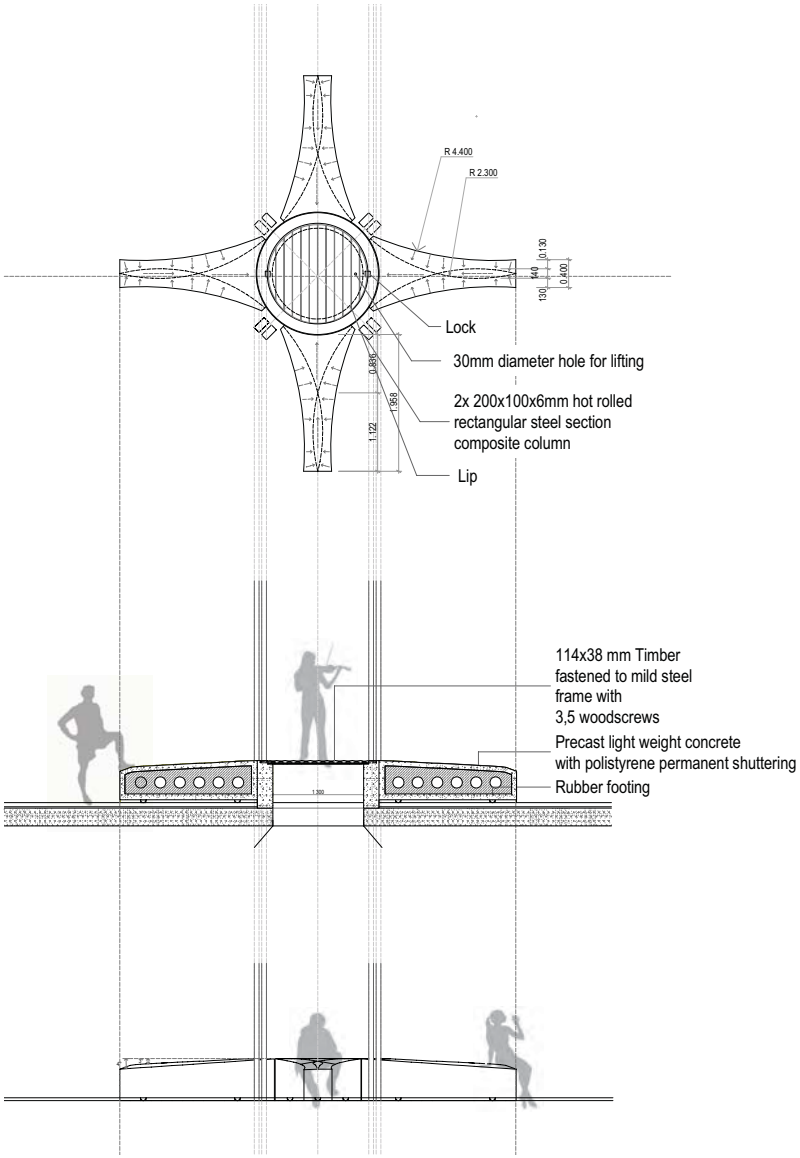


fig. 9.24 Market seating

fig. 9.23 Different Configurations

INNER BOUNDARY
Concrete columns, with a height of 8200 mm is placed at 5 m centres, define the inner boundary of market from the arcade. These columns support 170mm deep reinforced concrete beams. The beams are finished with exposed fine aggregate.
220 mm normal Flemish bond from Corobrik Village Antique Travertine FBS masonry wall that is built on the beams, 4760 mm from ground level strenghten the inner edge.

Advertisement can be accomodated on these walls.

CALCULATIONS:
Masonry Wall 3400 mm high
L/d = 18 L/d = 22
d = 3400 /18 d = 3400/22
d = 188.9 d = 154.5
thus 220 mm

Precast concrete columns
Typical height is 2-8m
h/d= 15 h/d= 30
d=8200/15 d= 8200/30
d= 586,7mm d=293,3mm
therefore 300mm

Reinforced concrete beam
Typical span is 2-7m
l/d= 22 l/d= 32
d=5000/22 d= 5000/32
d= 227,3mm d=156,3mm
therefore 170mm

ARCADE COLUMNS
The exterior columns that create the arcade around the market are a Reinforced Grouted Masonry Column. The brick used is also the Corobrik Village Antique Travertine FBS.
See (fig.9.4)
Column height of 8200 mm
h/d= 15 h/d= 20
d=8200/15 d= 8200/20
d= 544 mm d=408 mm
600x 650 mm open column.

CLOSING MECHANISM
For security and control the market must be able to be closed. A pulley system is used where steel mesh of GKD Kiwi metal mesh (fig.9.11) is hoisted up during open times and manually locked when closed. This creates a visual permeable barrier when the market is closed but keeps out vagrants or vandals. The Kiwi mesh with a light weight of 2.44kg/sqm was chosen. The mesh has a total of 25sqm and will be 61kg in total. The weights on either side of the pulley should equal this mass.

BUILDINGS
The buildings (that relate to the urban context on the east and south side of the market) are constructed with masonry walls with concrete floors and roof. Different bonds (fig.9.26) create a texture on the first floor façade that is accentuated by the shadows that the Jacaranda trees cast on the building. This emphasise the individual bricks that make up the masonry wall. Through these bonds the concept of realizing the different ingredients in the buildings is portrayed.

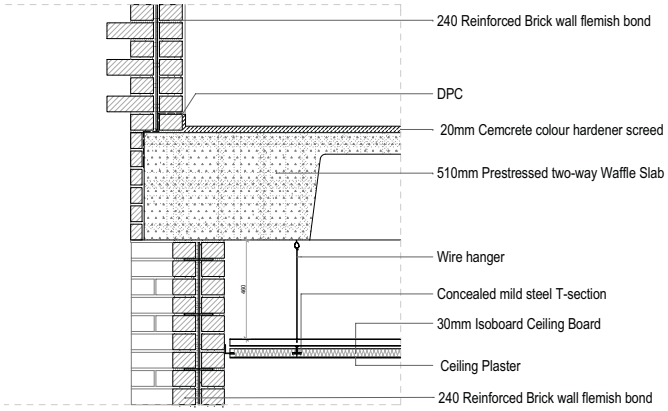


fig. 9.25 Shadowline

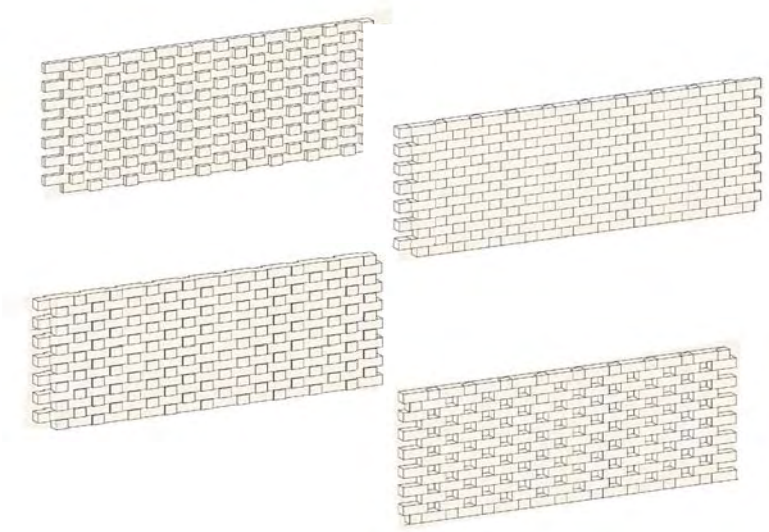


fig. 9.26 Adaptions to flemish bond

first floor plan

- FORMAL RESTAURANTS
- BATHROOMS
- INDUSTRIAL KITCHENS

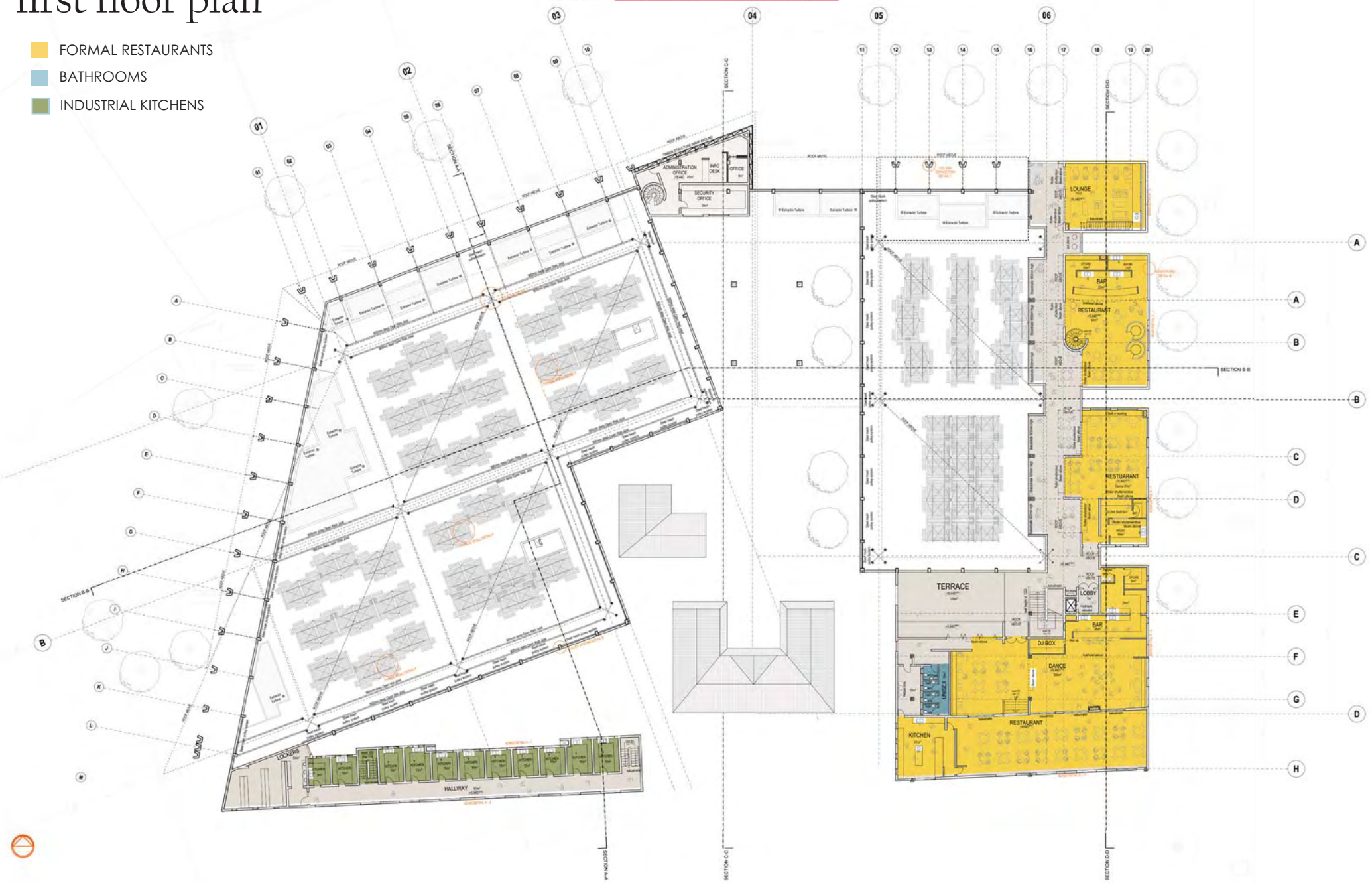


fig. 9.27

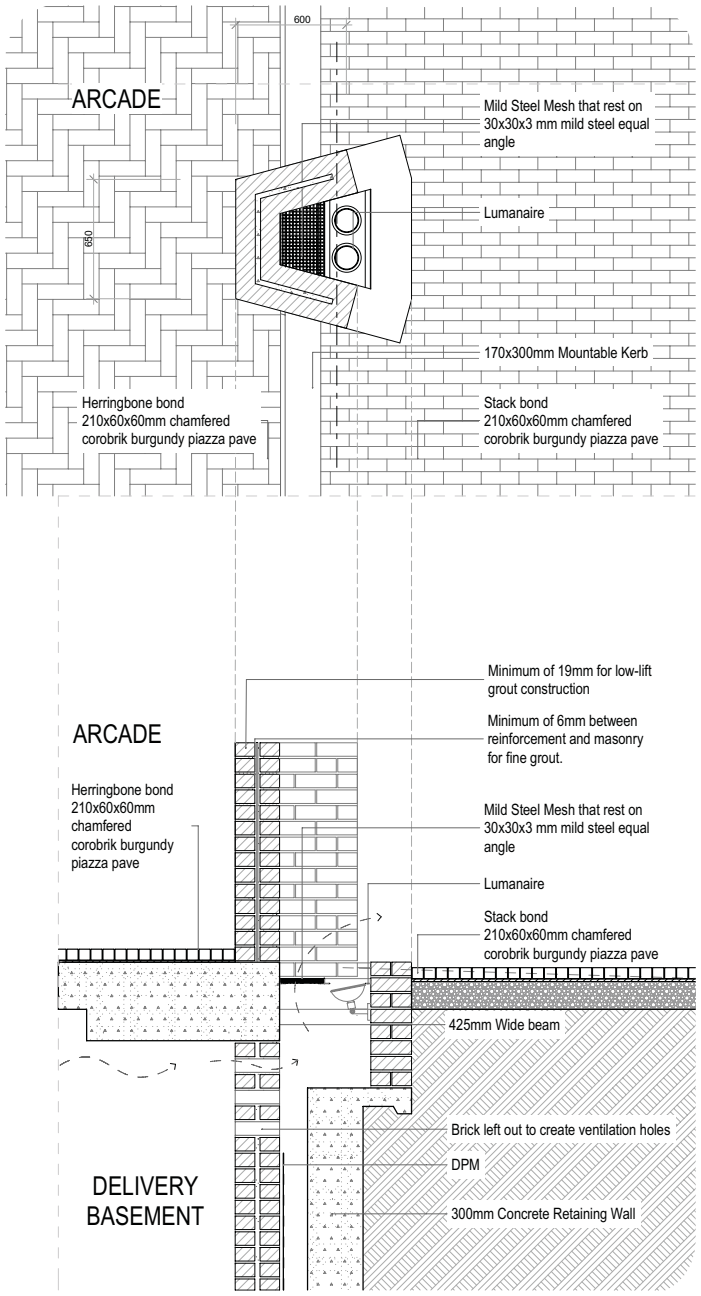


fig. 9.28 Arcade Column Detail

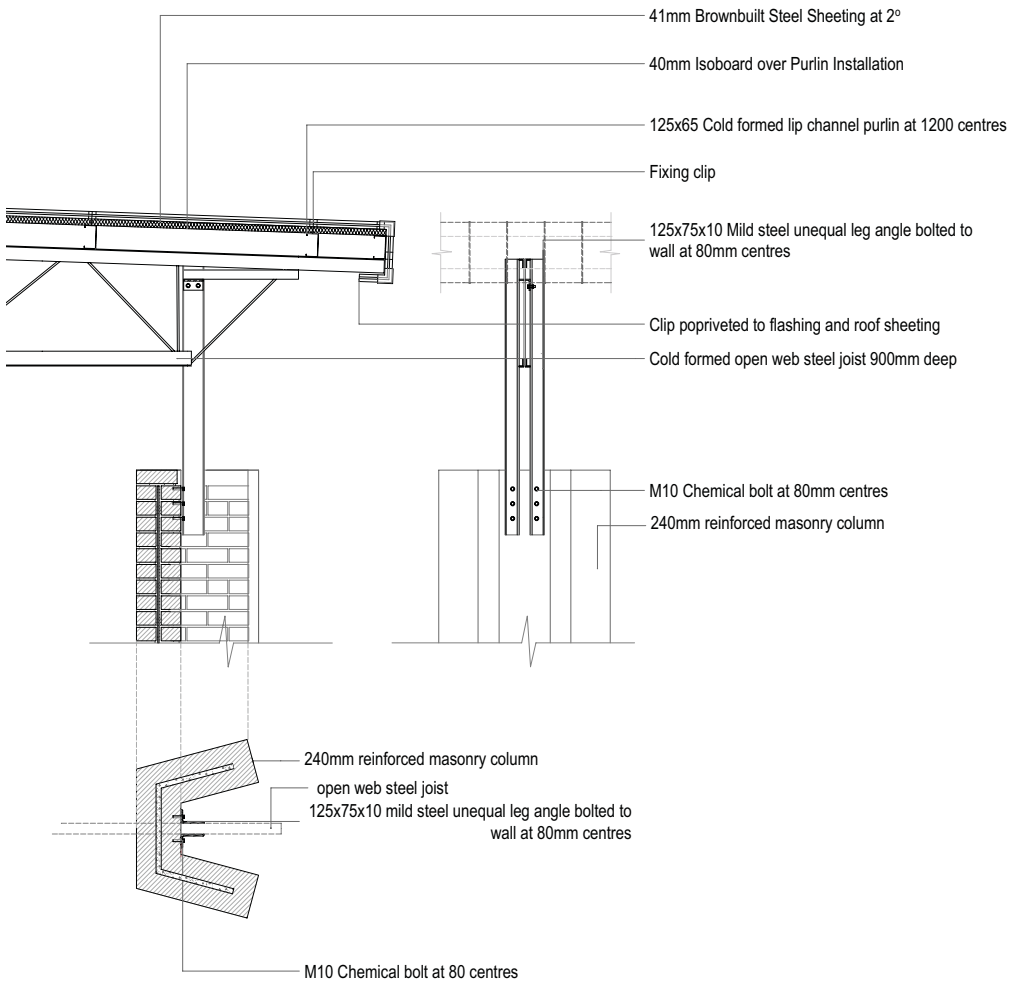


fig. 9.29 Arcade Column Top Detail

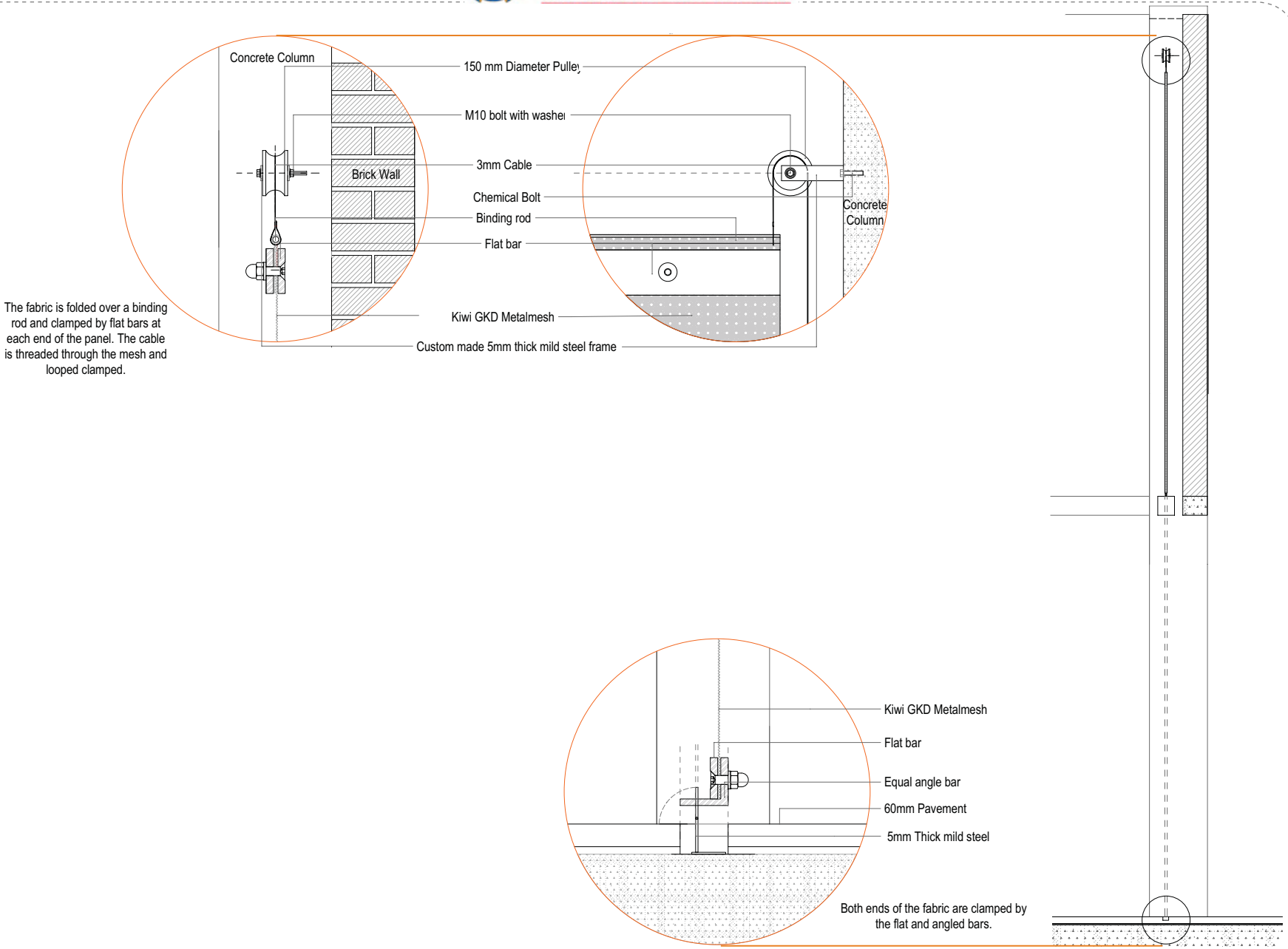


fig. 9.30 Closing mechanism - Steel Mesh Pulley System

roof

STRUCTURE

To accommodate the large spans of 25.6 m, a space frame structure was chosen. Space frames is a long-spanning three dimensional plate structure based on the firmness of the triangle and made of linear steel components subject only to axial tension or compression. The added benefit of a space frame is that it is aesthetically pleasing and need not be concealed. Another consideration was the way the members of the space frame break sunlight in the same manner as foliage of a tree does. This creates a play of shadow on the market floor and strengthens the ritual or the sun's pattern.

A Pyramid Sphere space frame was opted for because:

This is applicable for simple flat or flat sloping space frame projects; spans are not limited; the bottom chords are round with tapered ends, connected to a ball node connector; the bottom connector is unique in that there are no exposed fasteners, no sleeve pins, bolts etc.

The top chord is square or rectangular to allow direct deck attachment. This eliminates the need for a purlin level found on standard ball and tube systems. All web members are round. (Delta:2009)

Noncombustible steel construction may be left exposed if at least 6095 mm above the finish floor. These roofs are more than 8m above floor finish and therefore don't need fire proofing. (Ching 2008: 6.11)

The space frames are supported by rolled steel of hollow section of 200x200 columns (see structural system) spaced in a nearly square. This square is cut diagonal in two triangles. The two triangles slope at 15 degrees in opposite directions to provide sufficient natural light in the market.

Typical span may be 30-150m
Diagonal span is 25 600mm
l/d= 15 l/d= 30
d=25 600/15 d= 25 600/30
d= 1706.7 mm d= 853.3 mm
therefore 900 mm deep.

INSULATION

ISOBoardÆ high density 34-36kg/m3 rigid extruded polystyrene, 100% closed cell insulation board is 40 mm thick and 600mm wide. The boards are fixed parallel with roof covering over steel purlins at approximately 900 mm centres. Tongue and groove joints clip the boards together. The lightweight nature of the board, its strength, length and flexibility, as well as the tongue and groove edge profile makes isoboard one of the easiest and cheapest insulators to install, particularly when combined with its ability to be used in exposed applications.

SHEETING

The roof- and side-cladding is Brownbuilt profile sheeting. Roll formed in continuous lengths of 0,8 mm thick ISQ 300 quality galvanised steel with a galvanised finish of Z275. The rib height is 41 mm. This sheeting is used in practise for large spanning sheds because of its structural strength. It is easy to erect and very versatile to be cranked. Fascia boards are not used as the sheeting is bent to form a lip around the edges. (Brownbuilt:2009)

Gutters are from 0,8mm galvanised steel flashing. (Fig)

Gutter of 125 mm needed for a roof of 130sqm roof. Roof area = 18.5mx19.3m/2
= 180sqm (Ching 2008; 7.17)

Thus is 250mm sufficient.

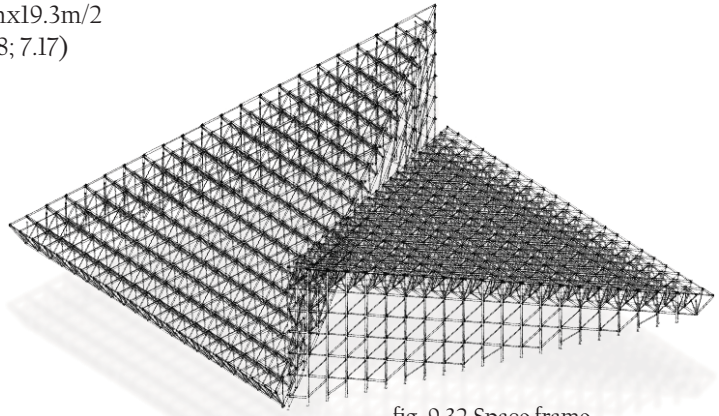


fig. 9.32 Space frame

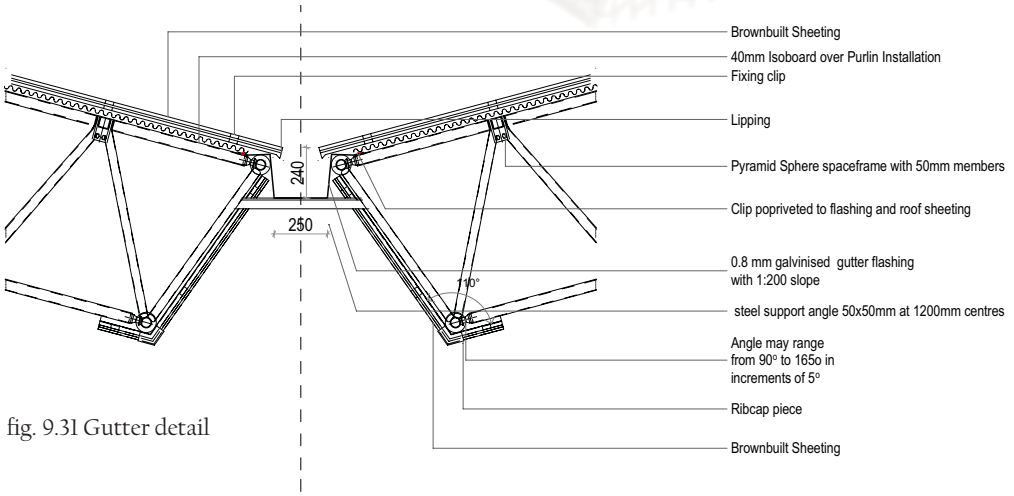


fig. 9.31 Gutter detail

roof plan

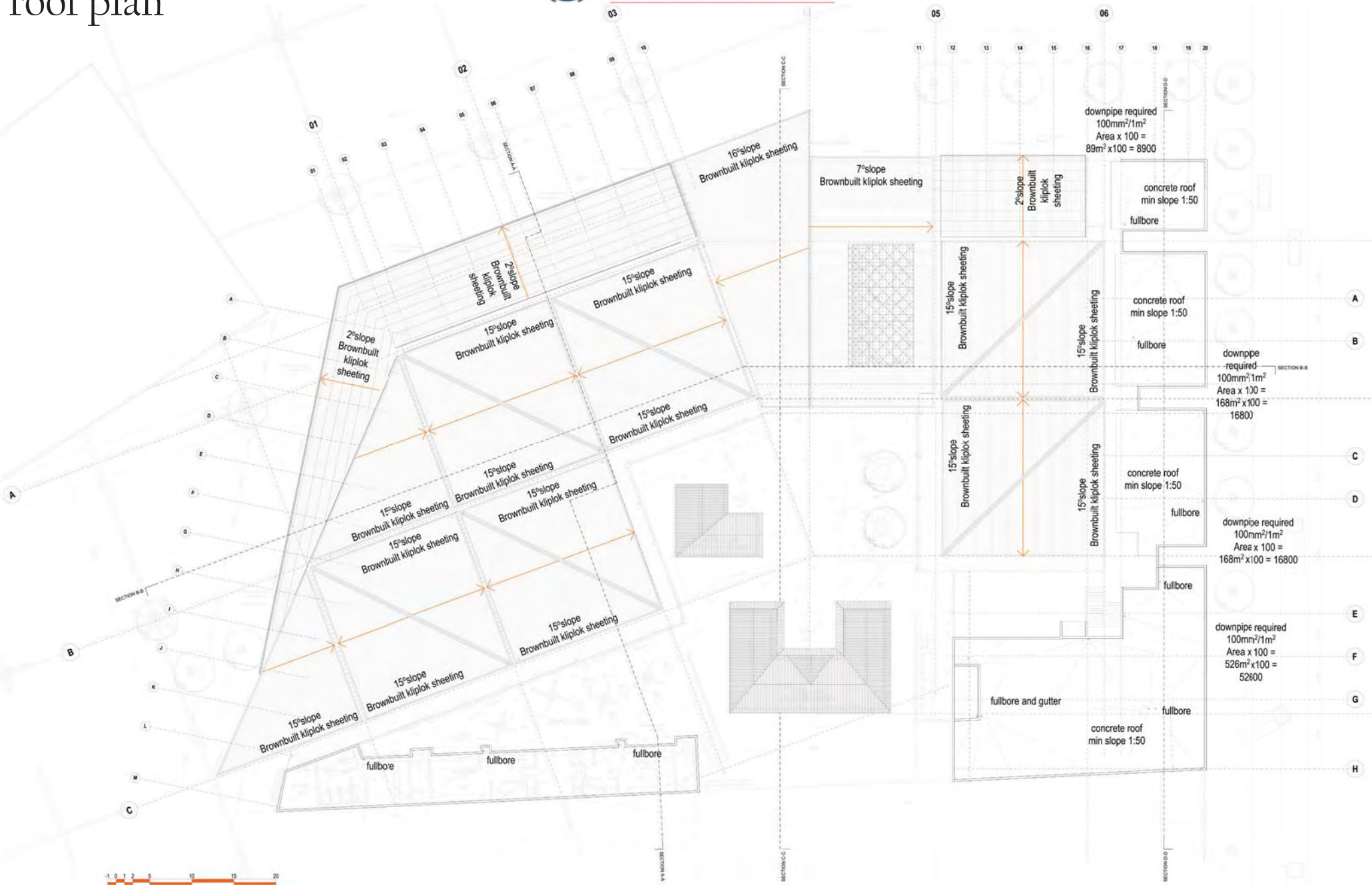


fig. 9.33

ventilation

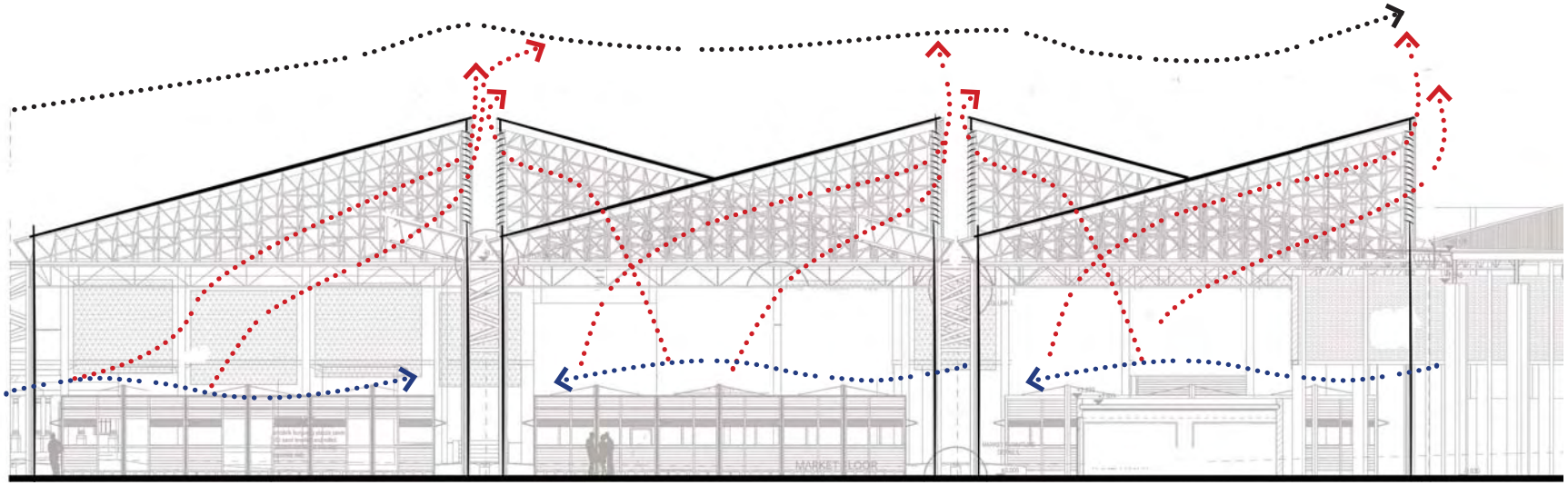


fig. 9.34 Stack Ventilation

6m

15m

fig. 9.35 Cross Ventilation
Diagram (Adler 1999; 38.23)

Passive ventilation is used on the market floor where the stack effect can be used. Stack effect take place when the inside and outside air temperature differs. The air gets warmer from heat emission from the users and produce, warmer air is less dense and will rise. The rising warm air can escape through the louvers provided. (fig.9.36) It will be replaced by cooler, denser air drawn into the space at low level. Stack effect is enhanced with rising inside/outside temperature differences and increasing height between the higher and lower openings. (Adler 1999;38-22) Extractor fans are installed on the roofs of the take-away stalls on the periphery of the market to increase the air flow.

The formal restaurant complex was designed for cross-ventilation. The width of the building is less than 15m (fig.9.34) and will thus be suitable for cross-ventilation. Extractor fans will be needed in the kitchens as the heat and humidity is more intense in this space.

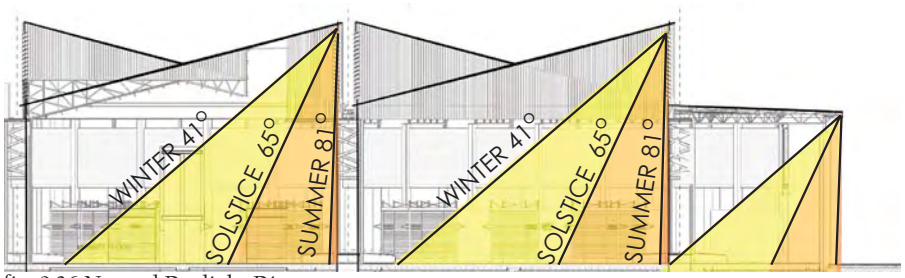


fig. 9.36 Natural Daylight Diagram

NATURAL LIGHTING

Daylight is utilised as far as possible to cut energy cost and to give the space the perception of clarification and freshness. The dweller does not feel enclosed in a building but rather in the open air. This opposes the enclosed supermarket one is accustomed too.
A problem that may arise from this lighting is that direct sunlight from the north will not only light, but also heat the interior space. To prevent this, SolarShield glazing from Smartglass is proposed. Solarshield is a combination of a metallic coating and a clear or tinted PVB (polyvinyl butyral) interlayer, designed primarily to keep out as much of the sun's heat as possible.
In addition to reducing solar heat, Solarshield also limits the amount of light entering the interior and blocks up to 99% of damaging UV radiation. (Smartglass:2009) On the southern façade normal glazing may be used as direct sunlight is not that a big issue.

ARTIFICIAL LIGHTING

The following lighting requirements are needed for different functions:

Storeroom	50 lux
Toilet areas	100 lux
Stairs	100 lux
Office	500 lux
Foodstuffs industry	200 lux
Restaurants	200 lux
Mixing, unpacking	300 lux
Butchery, dairy work	300 lux

Height of more than 5m in supermarkets need up to 750 lux (Neufert :143)
The market is lit with lighting fixtures installed on the open web joist steel beam. With different angles, the fixtures illuminate the whip up roofs so that it becomes a landmark in the urban landscape at night. Lighting at the foot of the arcade columns (fig.9.28) creates a feature in the square.
All bulbs should be energy efficient and recycled.

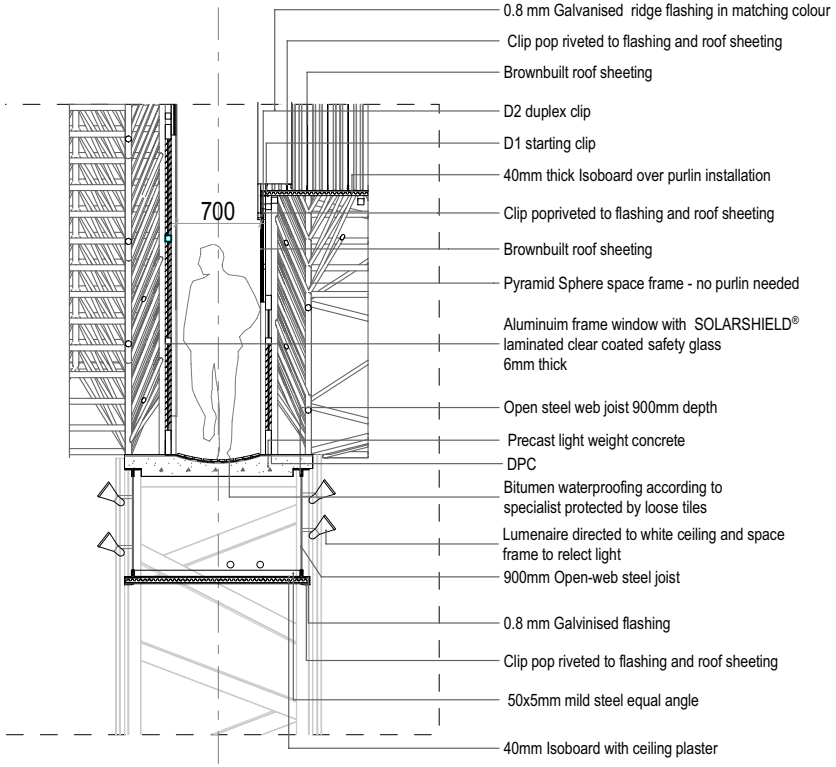
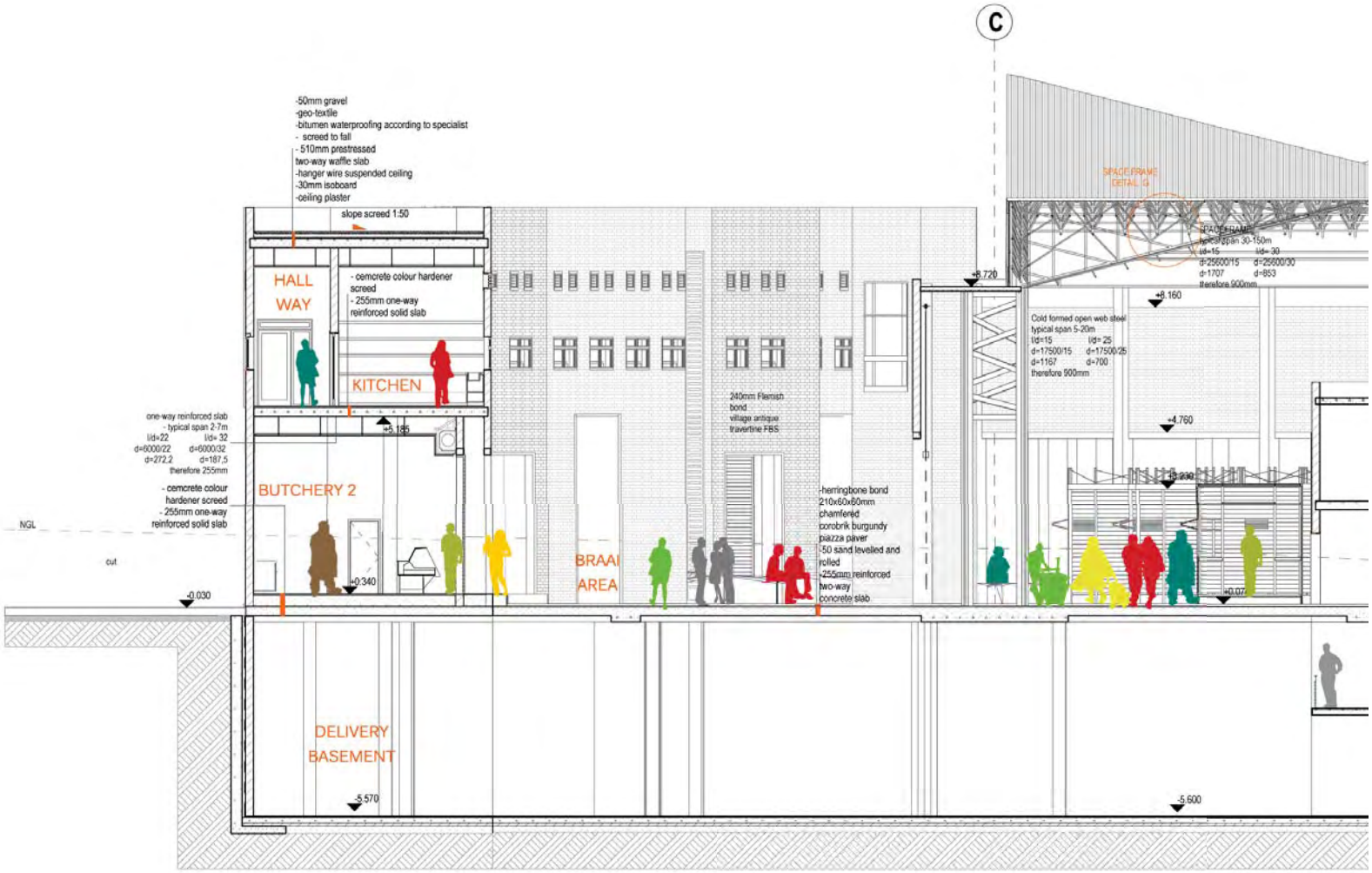


fig. 9.37 Accessible Roof



section a-a

-1 0 1 2 5

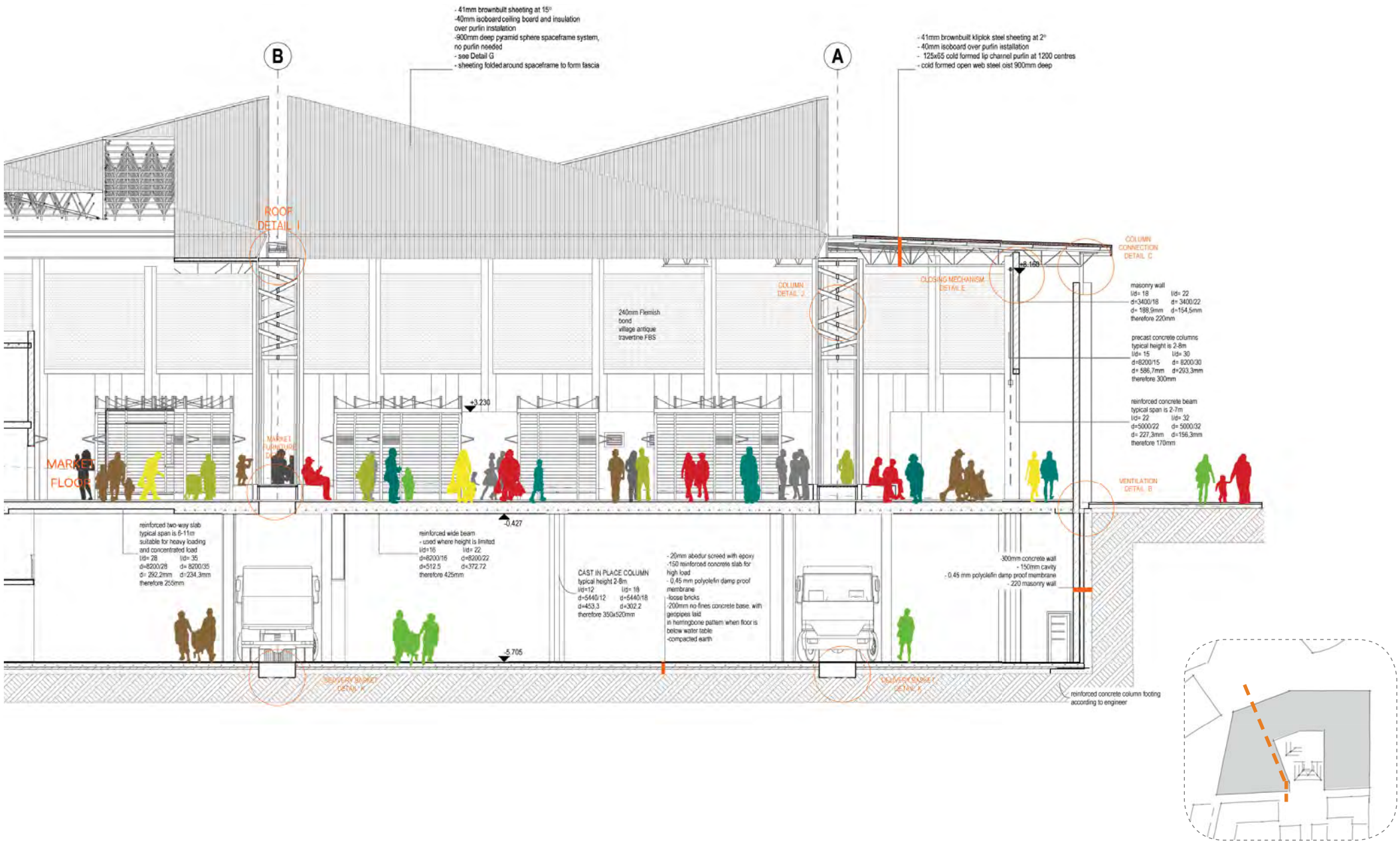
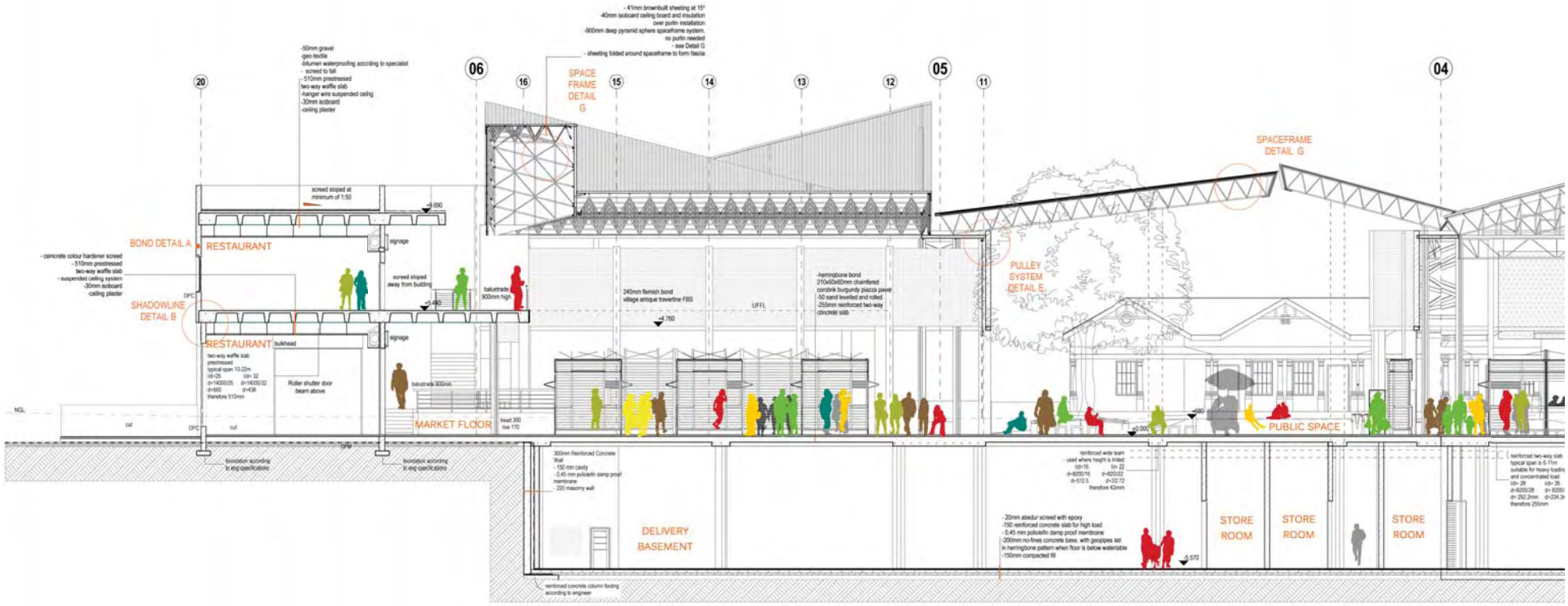
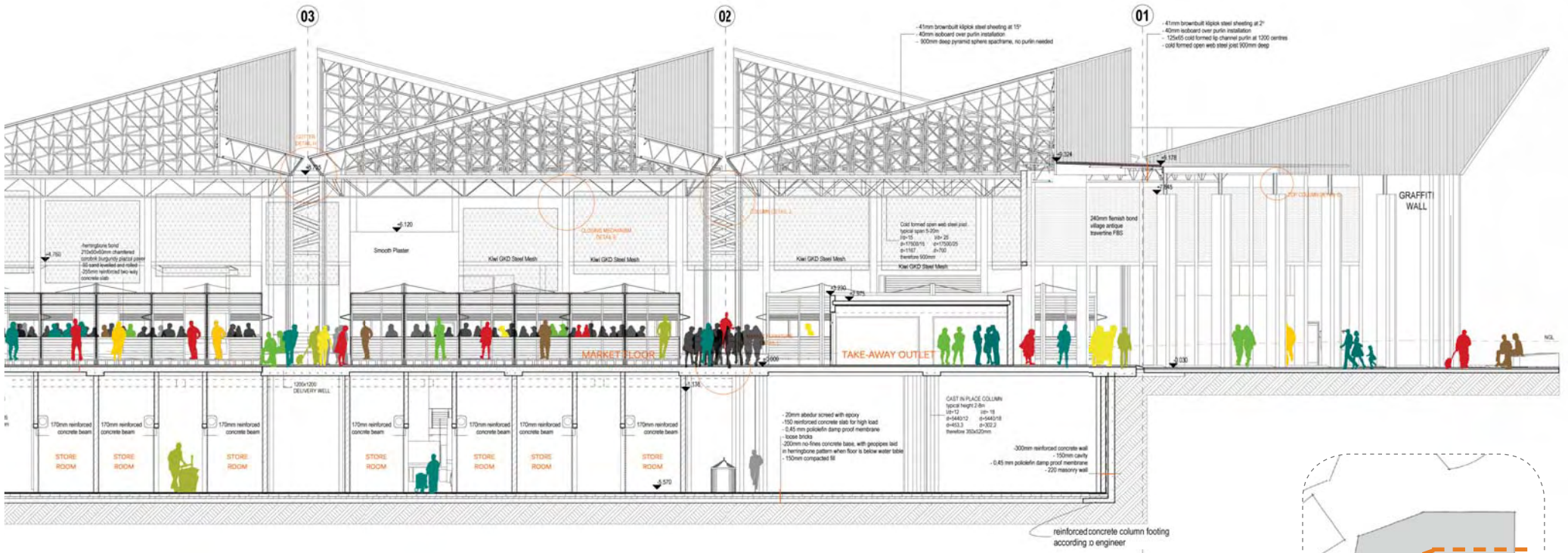

- 41mm brownbuilt sheeting at 15°
-40mm isoboard ceiling board and insulation over purlin installation
-900mm deep pyramid sphere spaceframe system, no purlin needed
- see Detail G
- sheeting folded around spaceframe to form fascia
- 41mm brownbuilt kliplok steel sheeting at 2°
- 40mm isoboard over purlin installation
- 125x65 cold formed lip channel purlin at 1200 centres
- cold formed open web steel oist 900mm deep
B
A
ROOF DETAIL I
COLUMN DETAIL J
CLOSING MECHANISM DETAIL E
COLUMN CONNECTION DETAIL C
VENTILATION DETAIL B
+8.160
+3.230
-0.427
-5.705
240mm Flemish bond village antique travertine FBS
masonry wall
l/d= 18 l/d= 22
d=3400/18 d= 3400/22
d= 188,9mm d=154,5mm
therefore 220mm
precast concrete columns
typical height is 2-8m
l/d= 15 l/d= 30
d=8200/15 d= 8200/30
d= 586,7mm d=293,3mm
therefore 300mm
reinforced concrete beam
typical span is 2-7m
l/d= 22 l/d= 32
d=5000/22 d= 5000/32
d= 227,3mm d=156,3mm
therefore 170mm
MARKET FLOOR
reinforced two-way slab
typical span is 6-11m
suitable for heavy loading and concentrated load
l/d= 28 l/d= 35
d=8200/28 d= 8200/35
d= 292,2mm d=234,3mm
therefore 255mm
reinforced wide beam
- used where height is limited
l/d=16 l/d= 22
d=8200/16 d=8200/22
d=512.5 d=372.72
therefore 425mm
CAST IN PLACE COLUMN
typical height 2-8m
l/d=12 l/d= 18
d=5440/12 d=5440/18
d=453,3 d=302.2
therefore 350x520mm
- 20mm abedur screed with epoxy
-150 reinforced concrete slab for high load
- 0.45 mm polyolefin damp proof membrane
-loose bricks
-200mm no-fines concrete base, with geopipes laid in herringbone pattern when floor is below water table
-compacted earth
-300mm concrete wall
- 150mm cavity
- 0.45 mm polyolefin damp proof membrane
- 220 masonry wall
reinforced concrete column footing according to engineer

fig. 9.38



section b-b

0 1 2 5


03
02
01
GRAFFITI WALL
MARKET FLOOR
TAKE-AWAY OUTLET
STORE ROOM
Smooth Plaster
Kiwi GKD Steel Mesh
reinforced concrete column footing according to engineer

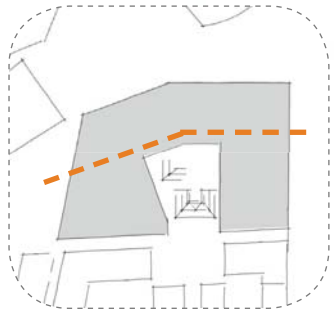
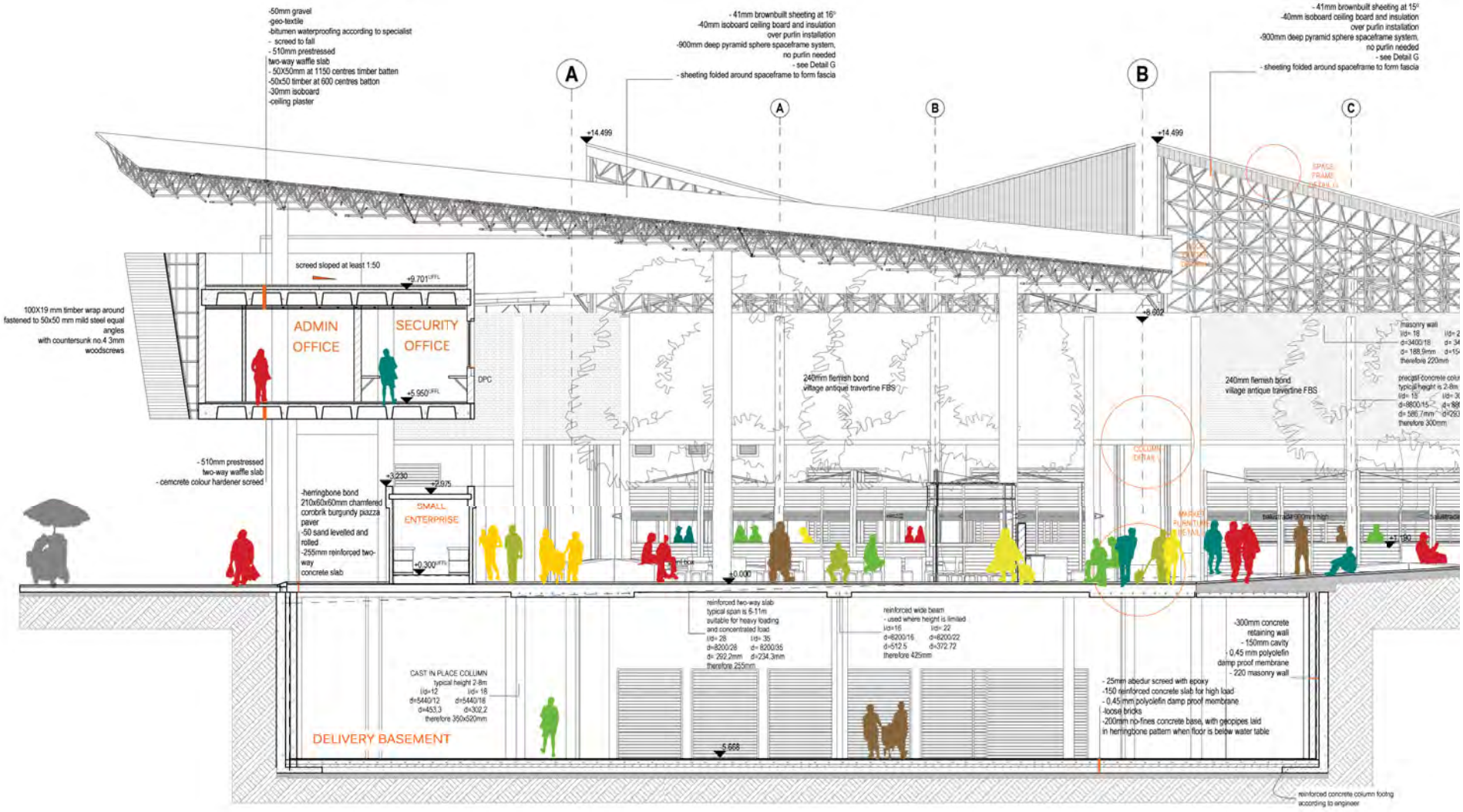
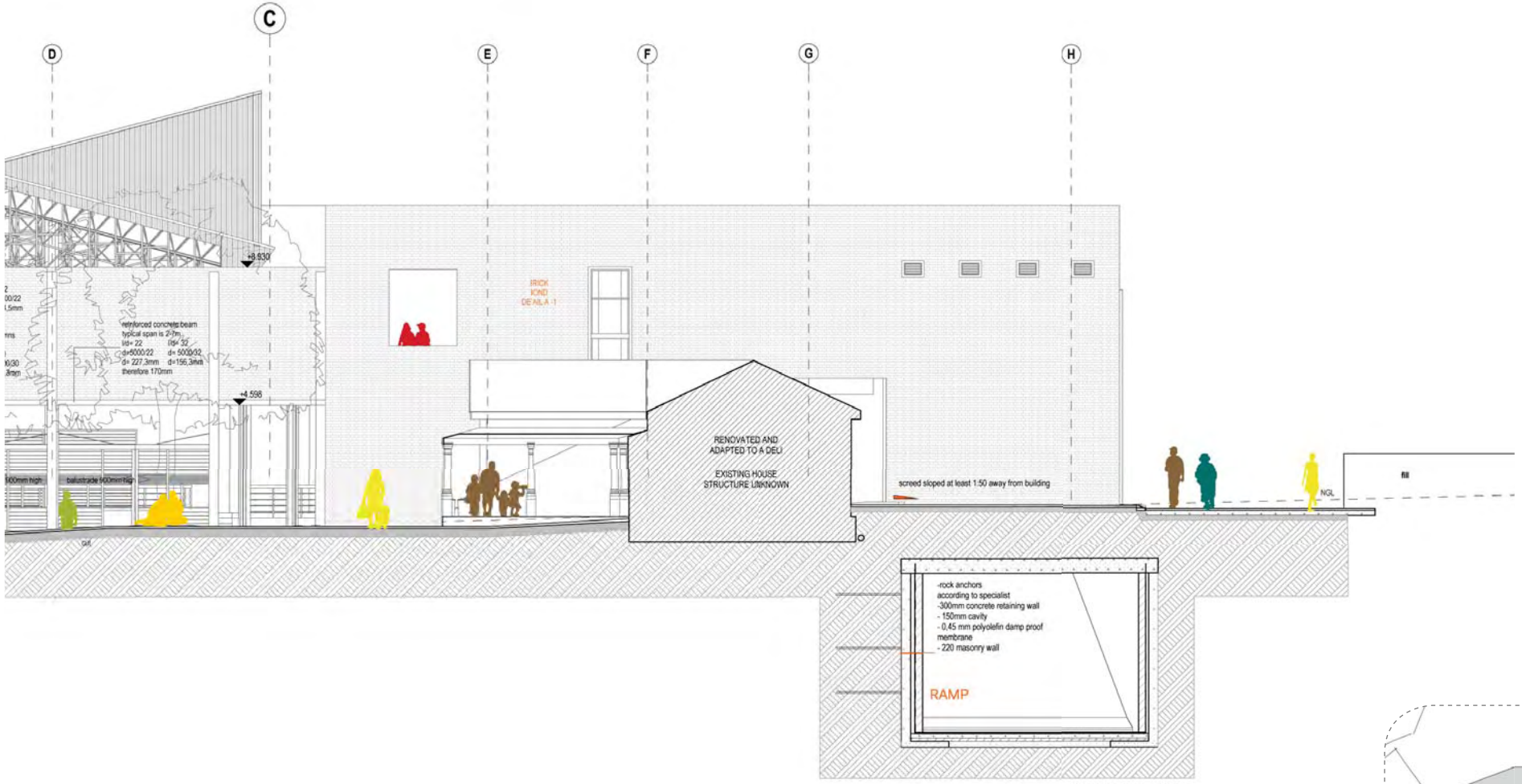


fig. 9.39



section c-c

-1 0 1 2 5


C
D
E
F
G
H
+8.930
+4.598
reinforced concrete beam
typical span is 2-7m
id= 22 ds= 32
d=5000/22 d= 5000/32
d= 227.3mm d=156.3mm
therefore 170mm
BRICK
KIND
DETAIL -1
RENOVATED AND
ADAPTED TO A DEU
EXISTING HOUSE
STRUCTURE UNKNOWN
screed sloped at least 1:50 away from building
NGL
-rock anchors
according to specialist
-300mm concrete retaining wall
- 150mm cavity
- 0,45 mm polyolefin damp proof
membrane
- 220 masonry wall
RAMP

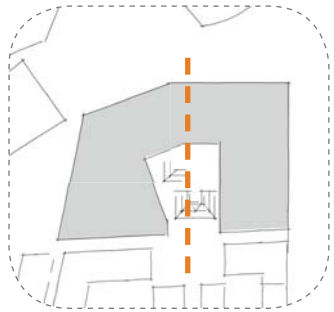
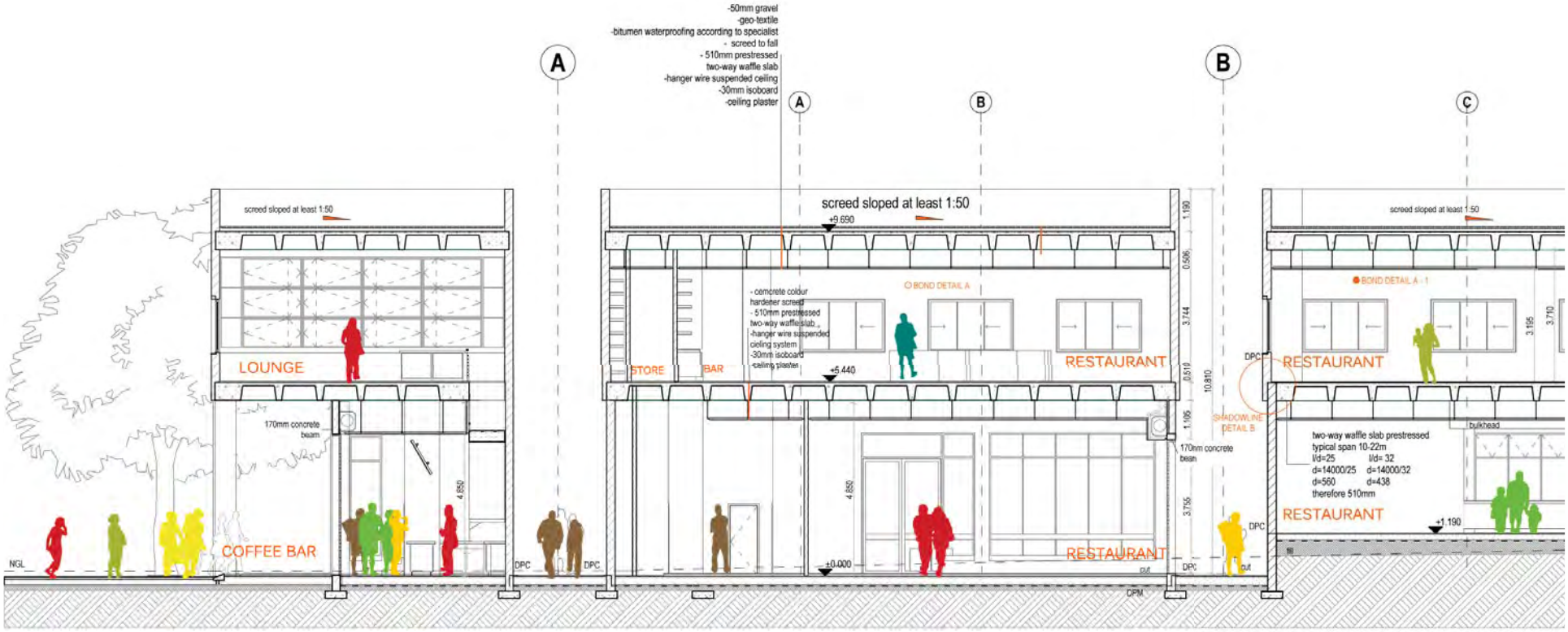
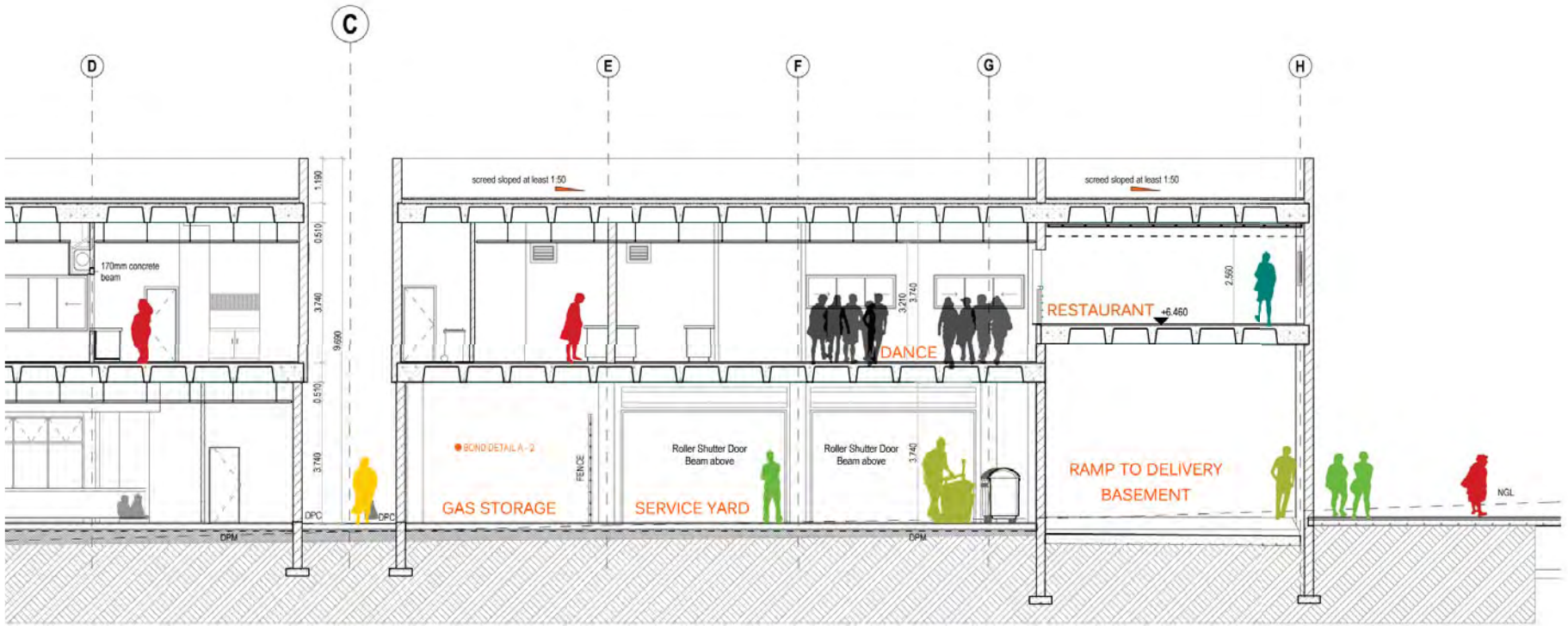


fig. 9.40



section d-d

-1 0 1 2 5


C
D
E
F
G
H
screed sloped at least 1:50
screed sloped at least 1:50
170mm concrete beam
1.190
0.510
3.740
9.990
0.510
3.740
3.210
3.740
2.550
RESTAURANT +6.460
DANCE
BOND DETAIL A - 2
FENCE
Roller Shutter Door Beam above
Roller Shutter Door Beam above
3.740
RAMP TO DELIVERY BASEMENT
GAS STORAGE
SERVICE YARD
NGL
DPC
DPC
DPM
DPM

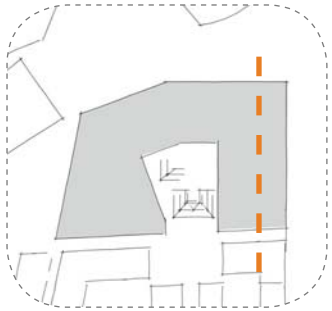


fig. 9.41

stall unit

The stalls are designed in units of 2,9x2,5m that may be adapted according to the different needs of the owners or the producers. The structure consist of steel profiles where timber planks can be inserted and fastened. Other materials can also be used. The construction reminds one of wooden vegetable crates (fig. 9.41). The roof of the unit is only supported at one side by means of cables. This makes the other three façades free to be removed so that two units can be converted to one stall. The whole stall can be disassembled and moved if needed. Adequate storage is provided in the market if these stalls are not needed.

fig. 9.43

fig. 9.42 Wooden vegetable crates

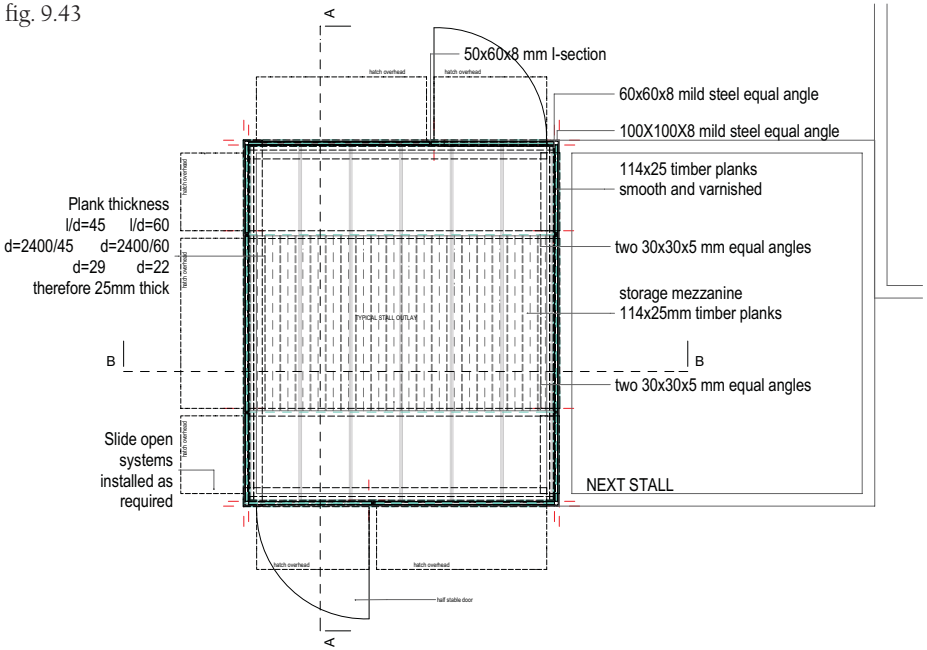


fig. 9.45 Plan

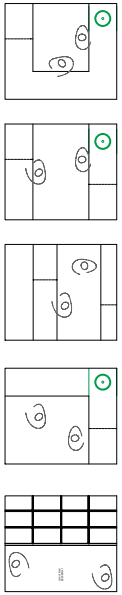


fig. 9.44 Different layouts

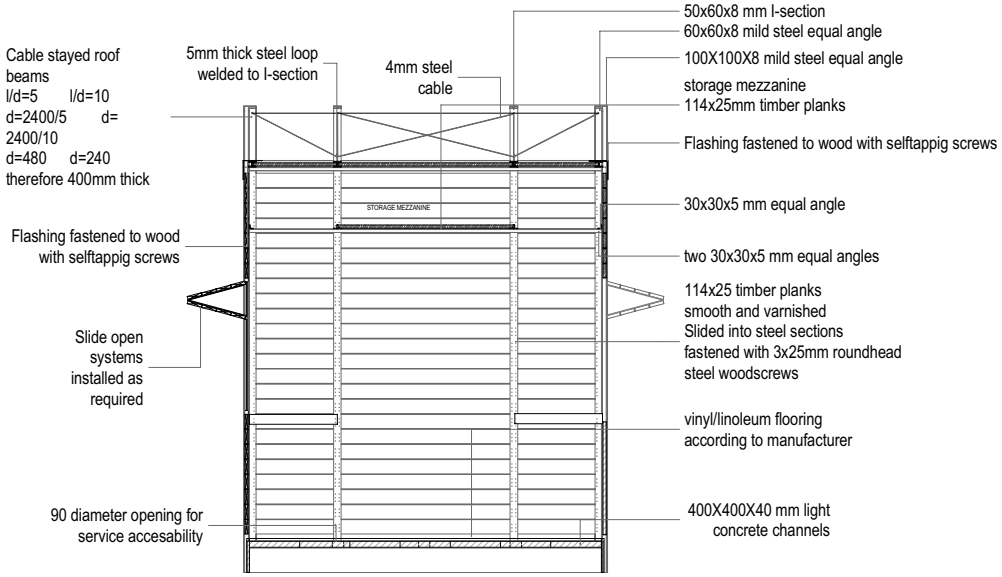


fig. 9.46 Section A-A

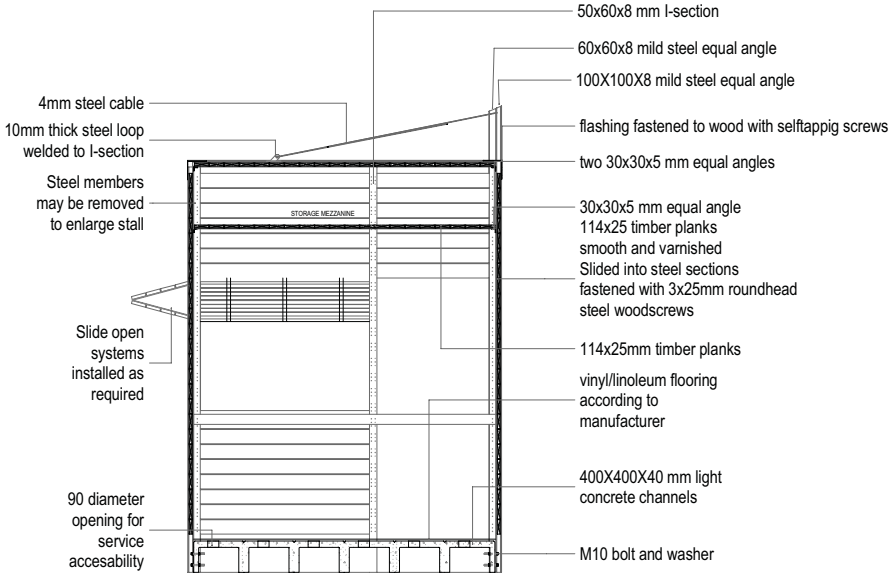


fig. 9.47 Section B-B

services

GENERAL

A market is service intensive as all stalls must be provided with water, gas and electricity. Refuse will inevitably be more than other buildings and may be a health risk.
Water and gas pipelines as well as electrical conduits are accommodated in the basement floor. Manholes are located in the market floor for ease of accessibility in the stalls. (fig.9.45)

RAINWATER HARVESTING.
Rainwater can be collected from the roof the minimise water required from the mains. This saves cost and energy. The rainwater is collected from the gutter into downpipes contained in the 200x100mm hollow section steel columns. The roof runoff is then collected in the rainwater tanks located in the basement. The tanks must be sealed by specialist. Excess water must be redirected to the storm water channel.
The capacity of rainwater tanks is calculated as follows:
Average water use for market
Cooking
3l per day per 4 persons = 90 l/month x 275= 24750l
Dishwashing
10l per day for 4 persons = 300l/month x275= 82500l
Hands washing
8.4l per day for 4 persons = 252l/ monthx275=69300l

Toilets
6l per flush. 100 flushes a month. 600l/month x 275= 165000
(Freewater:2009)

All water taps to be installed with aerators to minimise water use. Aerators restrict the flow by 50% of water without reducing water pressure. The right insert need to be chosen for flow rate requirements. For example, a 5 litre/minute aerator should be fitted to hand basins and a 7.6 litre/minute aerator is best for kitchen and laundry basins.

Month	Average Rainfall	Roof area sqm	Rainfall harvested	Water	Additional needed
January	136	2 142	291 312	341 550	50 238
February	75	2 142	160 650	341 550	180 900
March	82	2 142	175 644	341 550	165 906
April	51	2 142	109 242	341 550	232 308
May	13	2 142	27 846	341 550	313 704
June	7	2 142	14 994	341 550	326 556
July	3	2 142	6 426	341 550	335 124
August	6	2 142	12 852	341 550	328 698
September	22	2 142	47 124	341 550	294 426
October	71	2 142	152 082	341 550	189 468
November	98	2 142	209 916	341 550	131 634
December	110	2 142	235 620	341 550	105930
Total	674		1443708	4098600	2654892

GAS

Gas requirements: A take-away food outlet in an active area uses 200kg gas a month. (Trollip 2009)This market has 6 restaurants and 13 smaller units. The minimum of about 4000kg of gas is needed a month. A bulk container is proposed that can keep up to 6000kg that will cut cost as individual cylinders are very expensive. The following must be in place for gas storage:
Must be placed on a clean, dry and level base, protected from extreme weather conditions. If in a roofed area at least two sides must be permanently open. (Open Flemish bonds is on both sides).

The container must be protected against meddling or entrance from the public. It must be at least 1m away from any opening in a building that is below the valve height of the container. At least 2m away from a gulley or manhole. (Wegelin Construction notes)

A biogas plant was investigated. From 2kg of waste food one can produce 500g of methane in 24 hours. That may amount to 560kg waste needed for one day's supply of 140kg. This will not be viable to install and the conventional gas system is more effective, one may assume that methane plants may manufacture gas at a later stage. Refuse that consist of biomass can be collected by pig farmers or used for compost in the productive landscape.

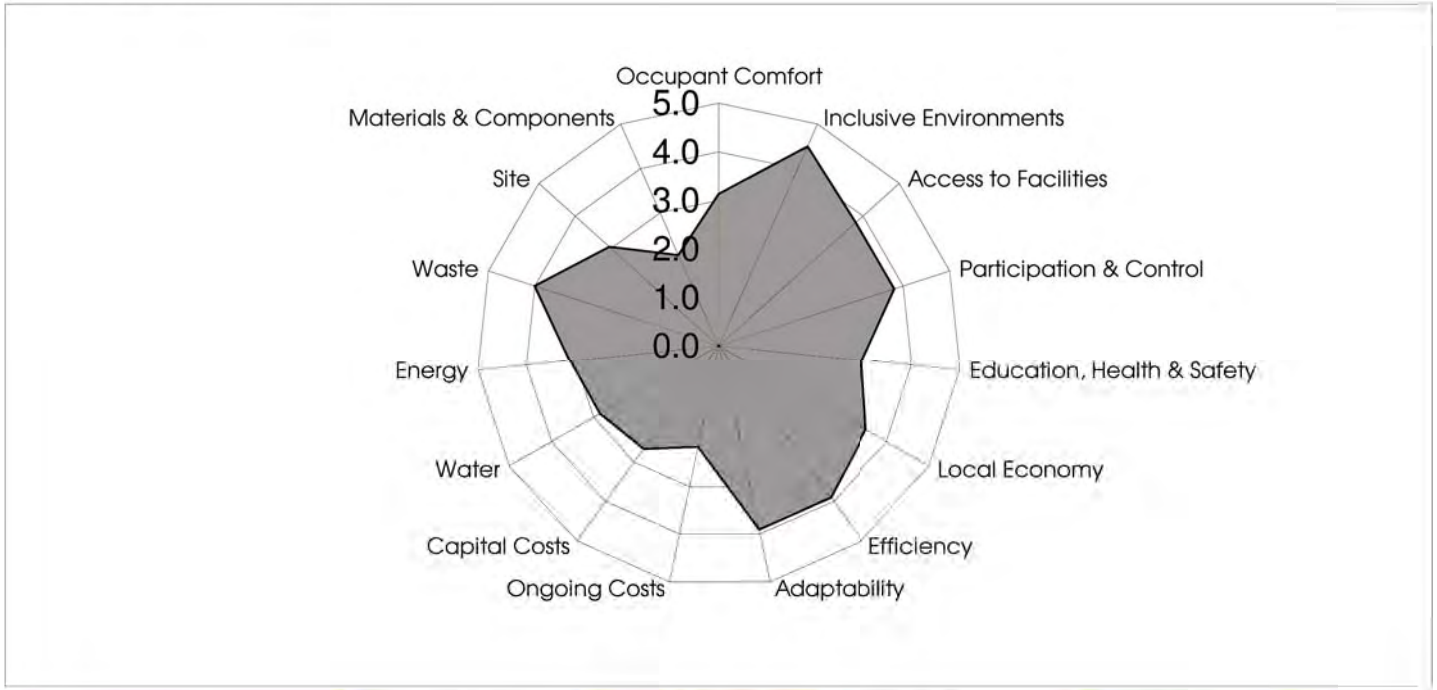
REFUSE

Besides the normal litter in a public space, stale food products that are unsuitable to sell or eat must be removed from the market floor. Refuse should not be held long in the market as this can attract rodents and be a health risk. Refuse are removed daily and collected in dust bins in the service yard. Different materials must be separated so that it can be recycled. As stated before, biomass can be used as compost or feed for pigs.

sbat rating

SUSTAINABLE BUILDING ASSESSMENT TOOL (SBAT- P) V1

PROJECT		ASSESSMENT
Project title:	Feast the City	
Location:	Pretoria CBD	
Building type:	Food Market	
Internal area (m2):	12800	
Number of users:	1100	



Social	3.6	Economic	3.2	Environmental	3.0
Overall	3.3	Classification	Good		

The environmental aspect rated the lowest with a 3 that borders between good and average. The water use in a market is intensive and although enough space is available for rainwater harvesting it only amount to 35% of the estimated water use. The most waste is recycled and adequate space is provided for dust bins. However, the basement construction influences the score negatively.
The economic part rated a 3.2. The majority of the materials used are sourced 50km from the site. Most of the building is open plan and can be altered in the future. All the height of the building is well above 3m.
The social aspect rated the highest with a 3.9 score. The location of the building being near a transport system and walking distance to existing housing and proposed housing schemes is a major positive. Most of the building except the basement is accessible for disabled persons.
An overall rating of 3.4 makes the building good sustainable addition in the urban landscape of Pretoria CBD.