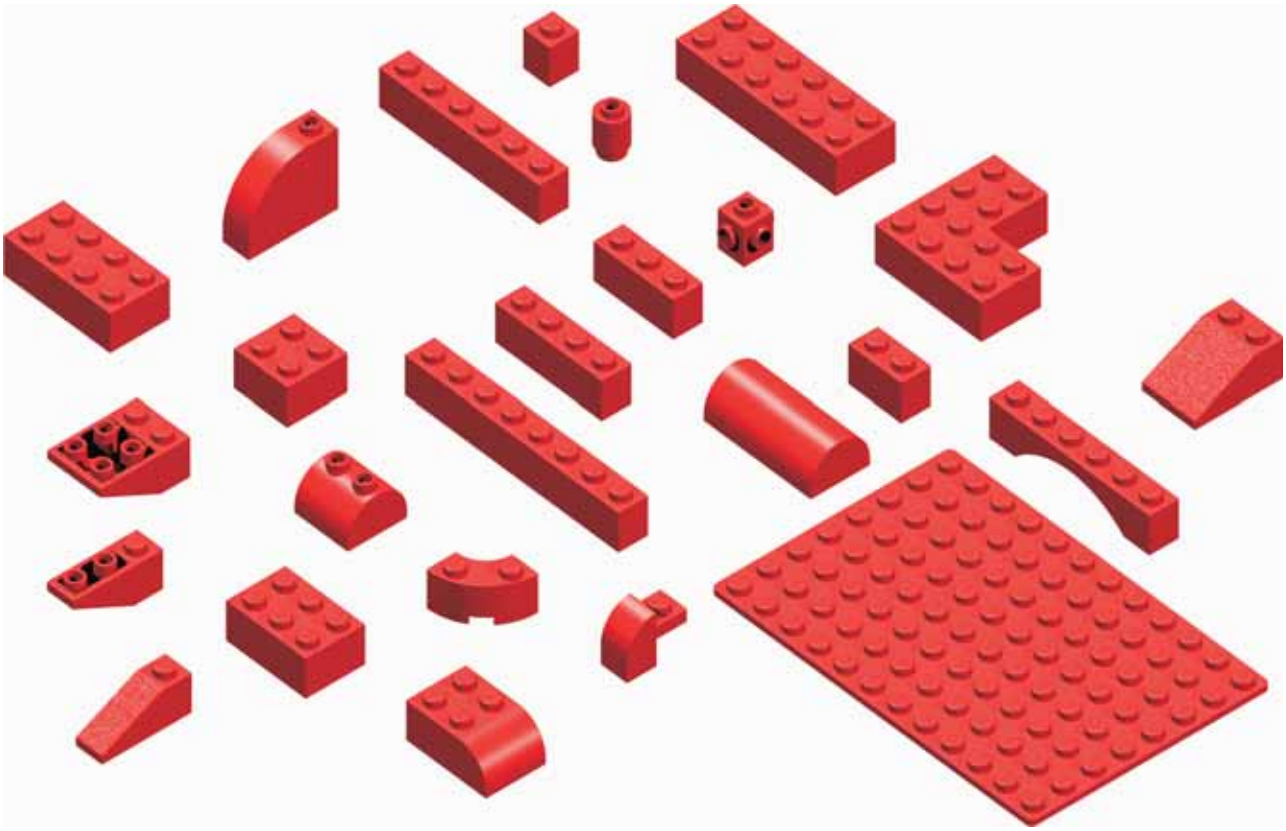
TECHNICAL INVESTIGATION

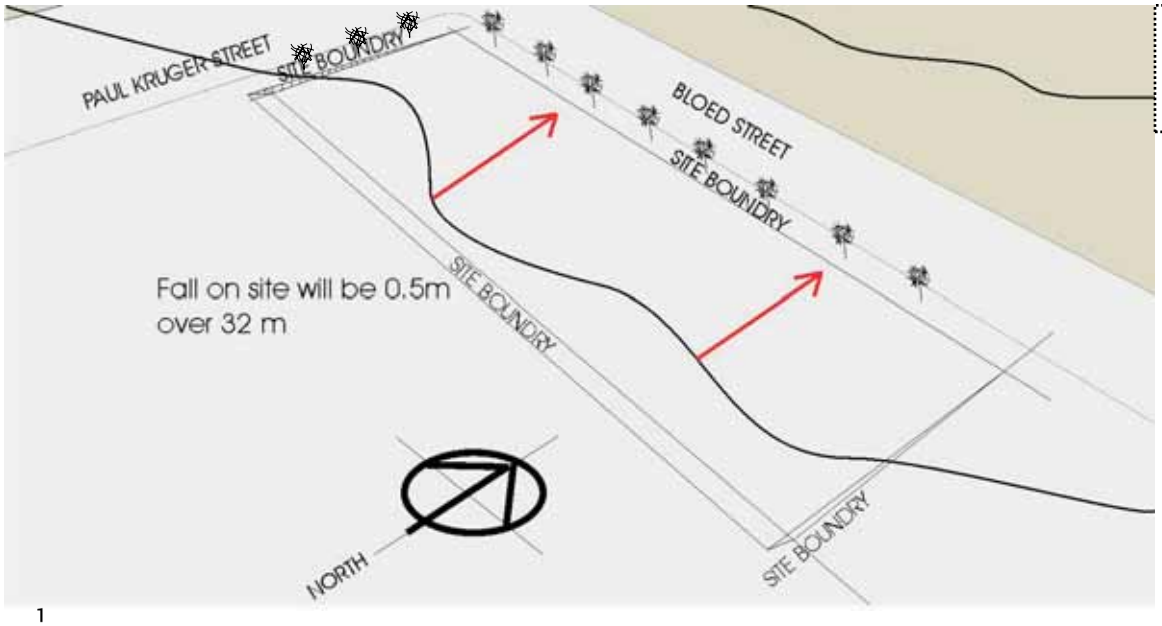
ON SITE WORK
OFF SITE WORK



1

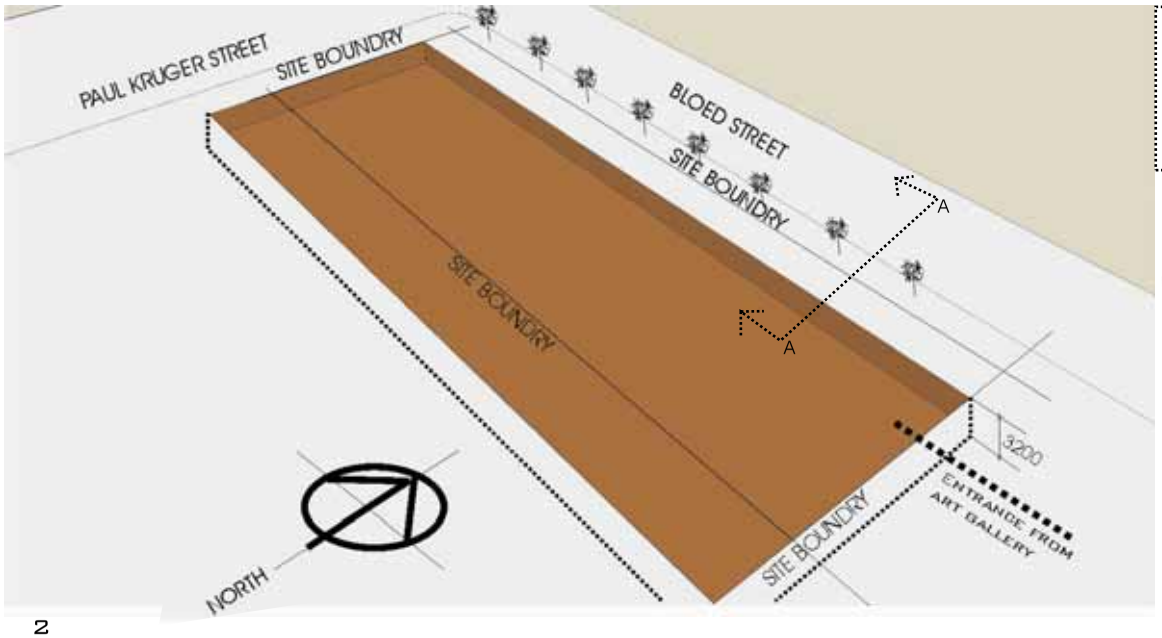
ON SITE WORK

PREPARATIONS TO SITE BEFORE ASSEMBLY OF THE BUILDING STARTS.



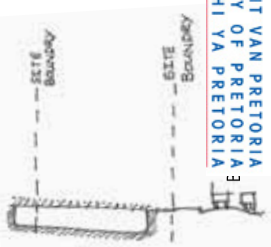
1

The existing site slopes 1/64 m from south to north. The size of the site is 32 m x 100 m. Cut and fill to a depth of maximum 0.5 m. Existing trees to stay.

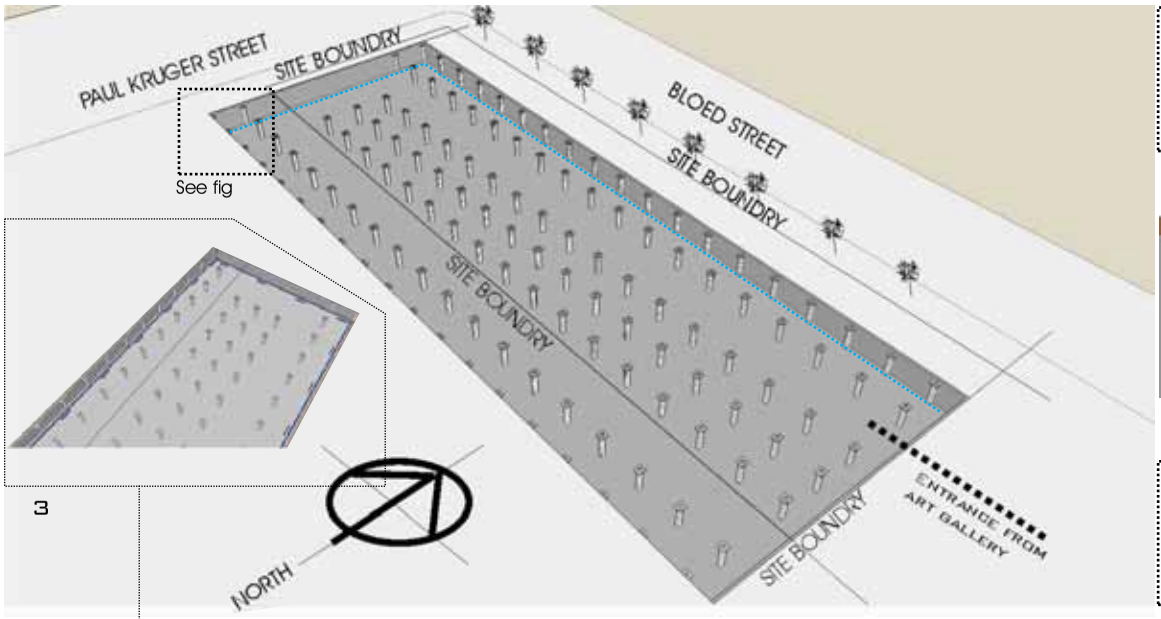


2

Excavations on site to a depth of 3.2 m for basement. Only one level of ba parking is required. Entrance into baseme from Bloed street ar situated under the A gallery.

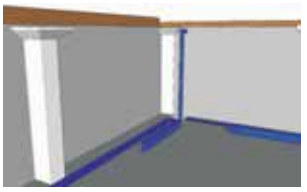


SECTION A-A



3

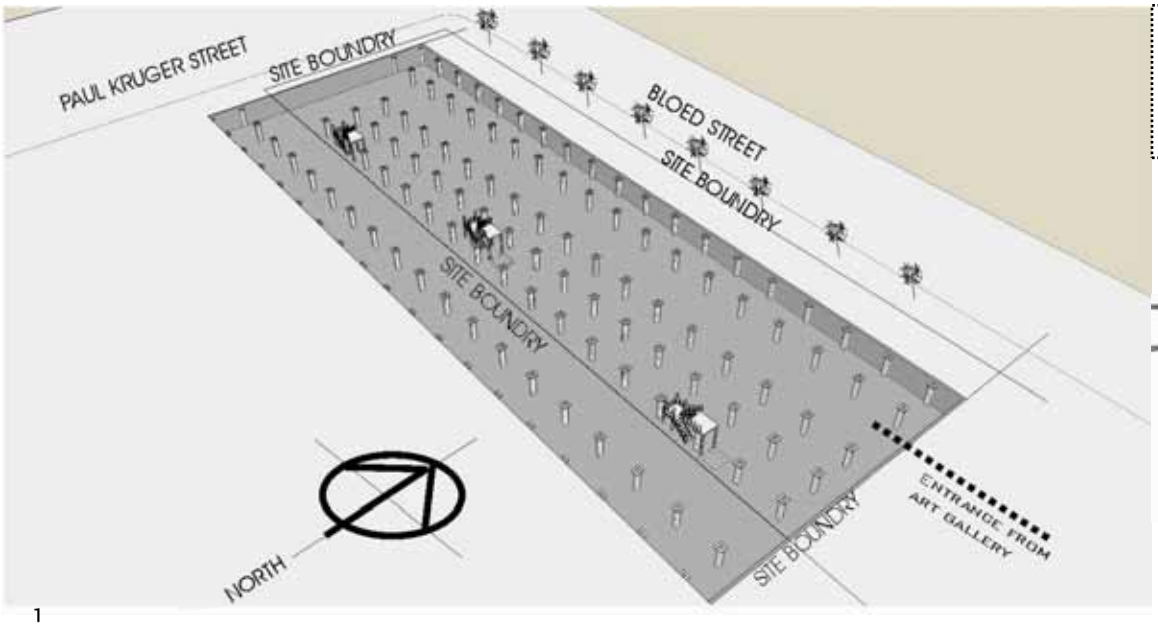
Flat slab and column head system are used for basement floor system. Basement to extend into neighboring site as the parking will be shared.



Water drainage inside basement in channels along the retaining walls to catchment, where water are pumped to existing storm water system.

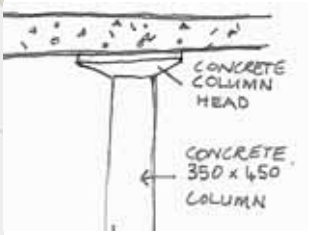
ON SITE WORK

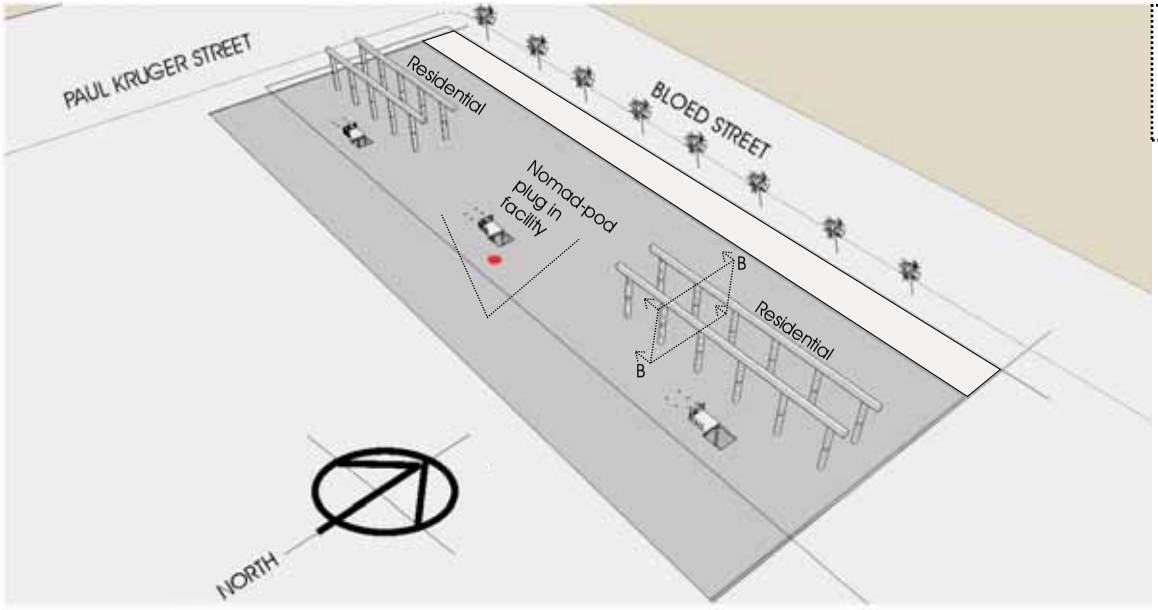
PREPARATIONS TO SITE BEFORE ASSEMBLY OF THE BUILDING STARTS.



1

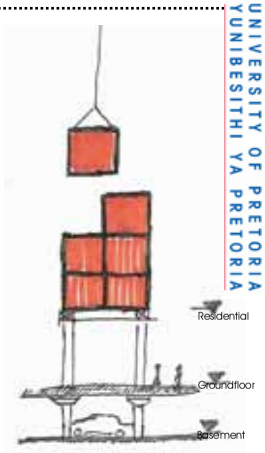
The access lift and staircase are installed into the basement where the stacking elements start from.Retaining wall 300 mm thick.Columns 350 x 450 mm with column heads.



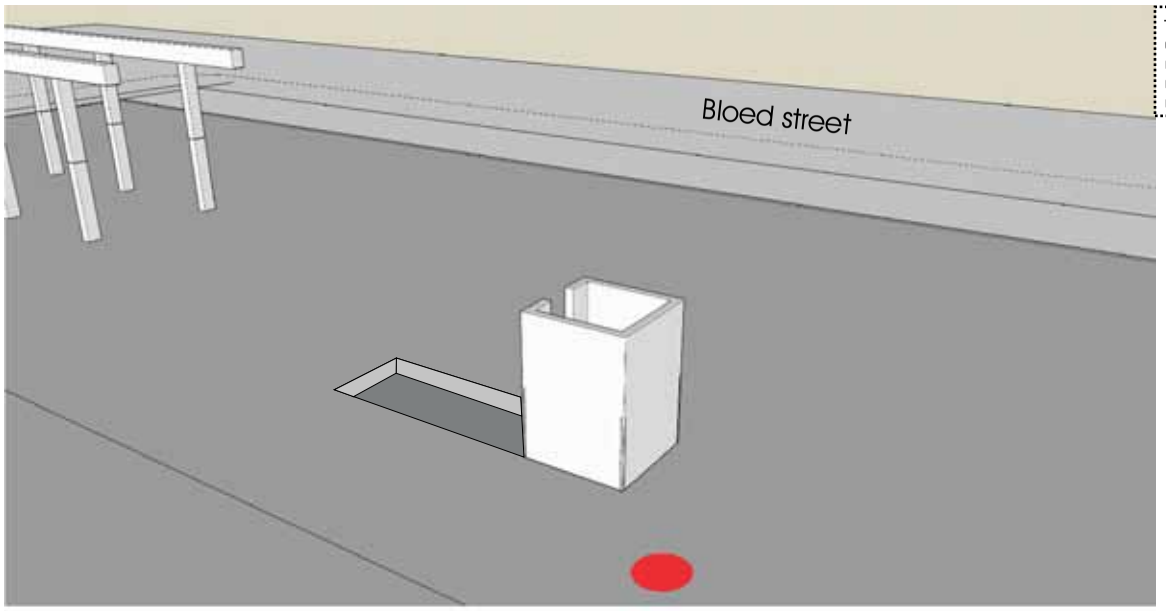


2

Structural supports are erected on the grid of basement columns. Th structural supports form the platform fo residential stacked l



Section B-B

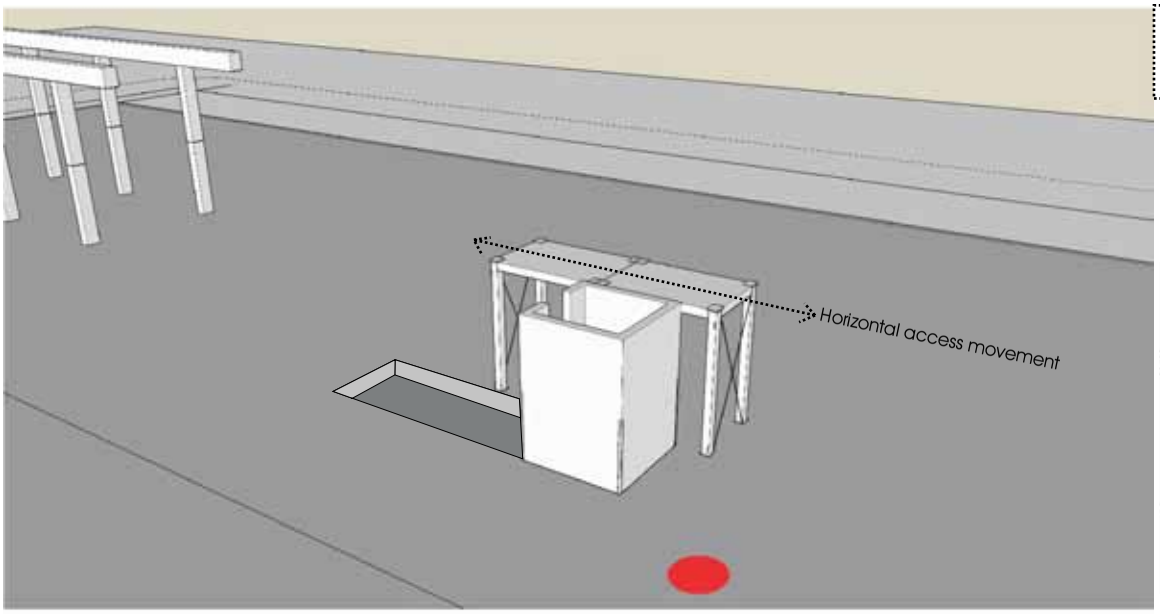


3

The transportable Pre-cast concrete lift shaft are placed on the already installed shaft in the basement.

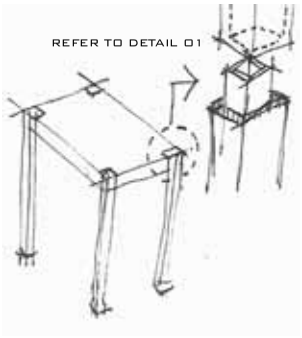
ON SITE WORK

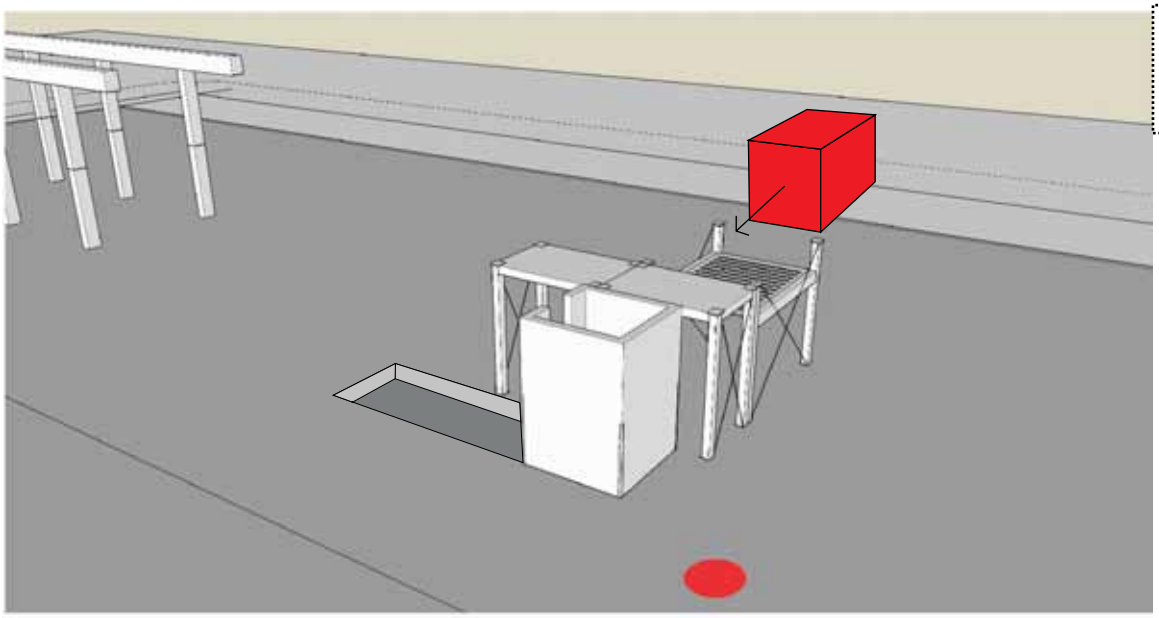
PREPARATIONS TO SITE BEFORE ASSEMBLY OF THE BUILDING STARTS.



1

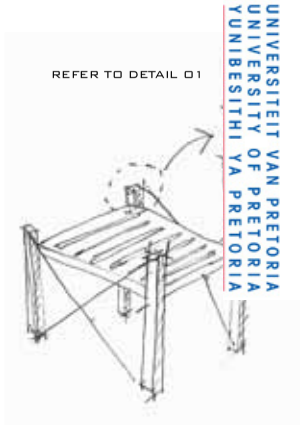
Transportable access walkway module are fixed onto the lift shaft to give more stability.

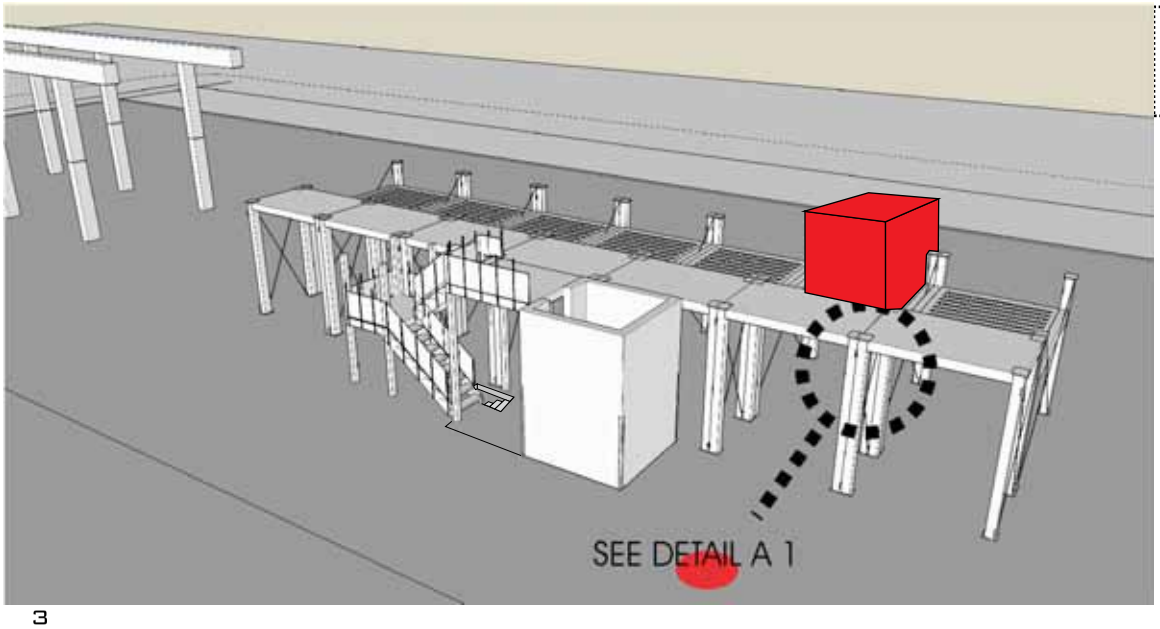




2

The loading tray are only installed for the nomad-pod plug in facility. The residential units will the same access syst but withoutthe loadi



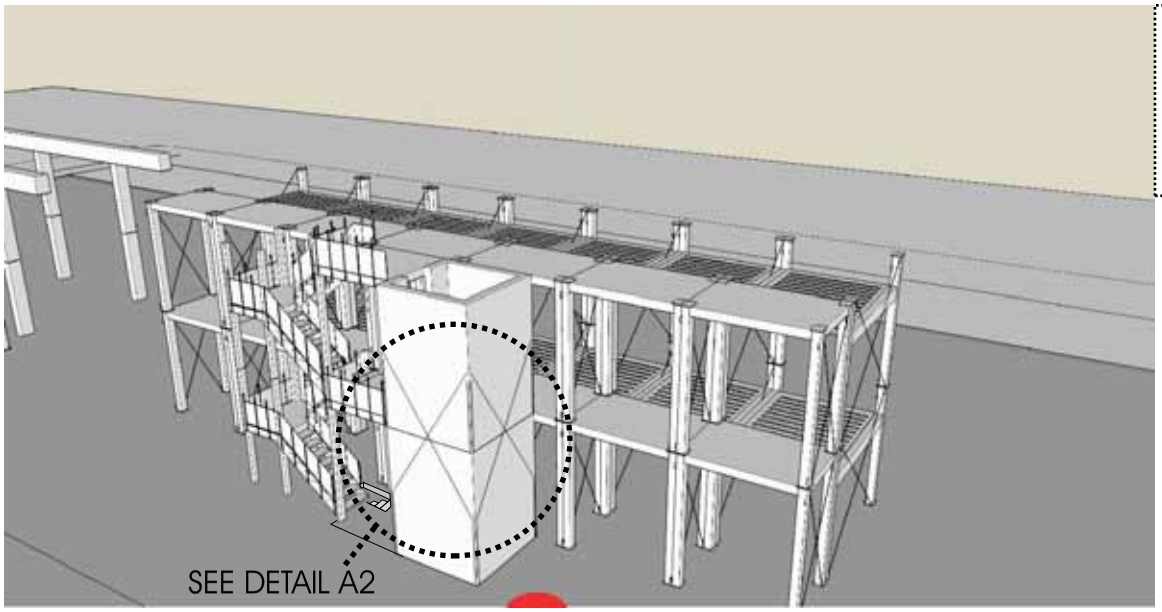


3

The transportable Pre-cast concrete lift shaft are placed on the already installed shaft in the basement.

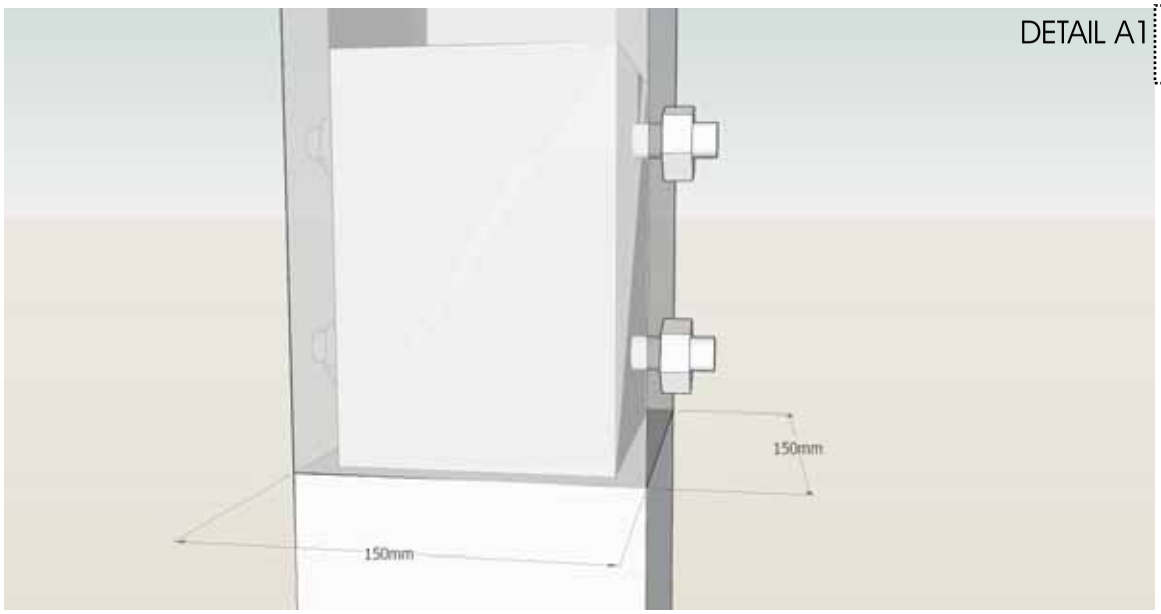
ON SITE WORK

PREPARATIONS TO SITE BEFORE ASSEMBLY OF THE BUILDING STARTS.



1

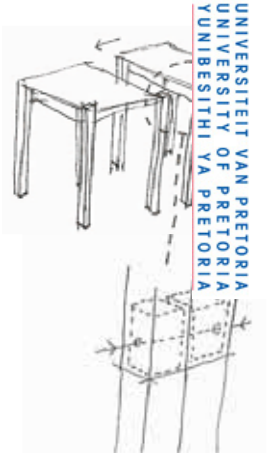
All these elements are fixed together to form a stable structure and to provide access to the units. This system developed from; smaller component sizes for when in compression and transportable sizes for off-site prefabrication.

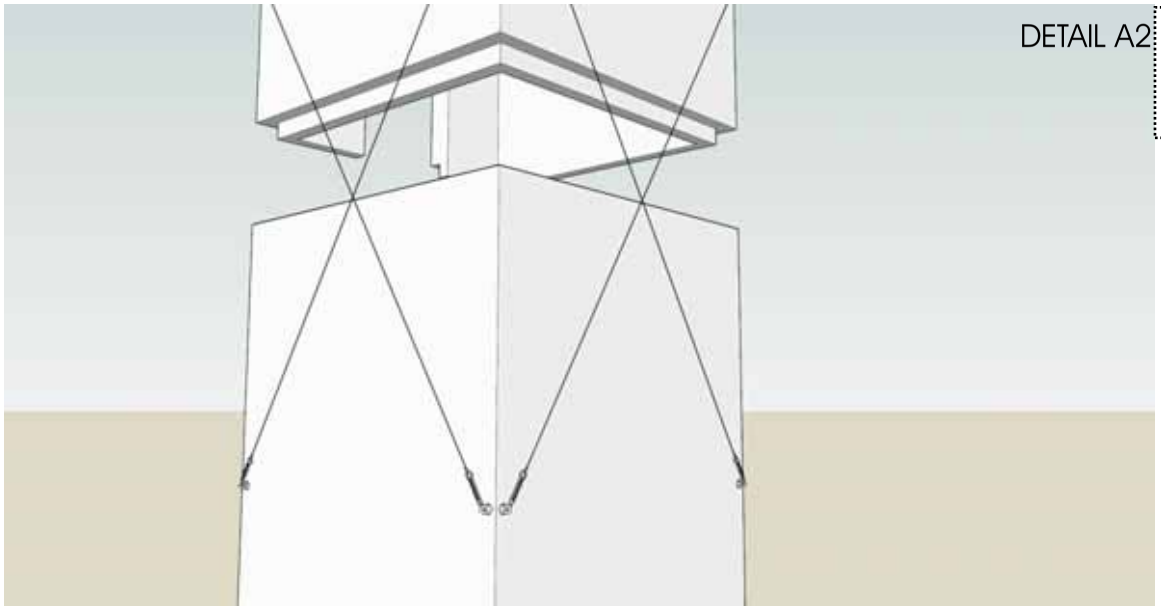


2

DETAIL A1

The transportable elements are bolted together for disassembly purposes





3

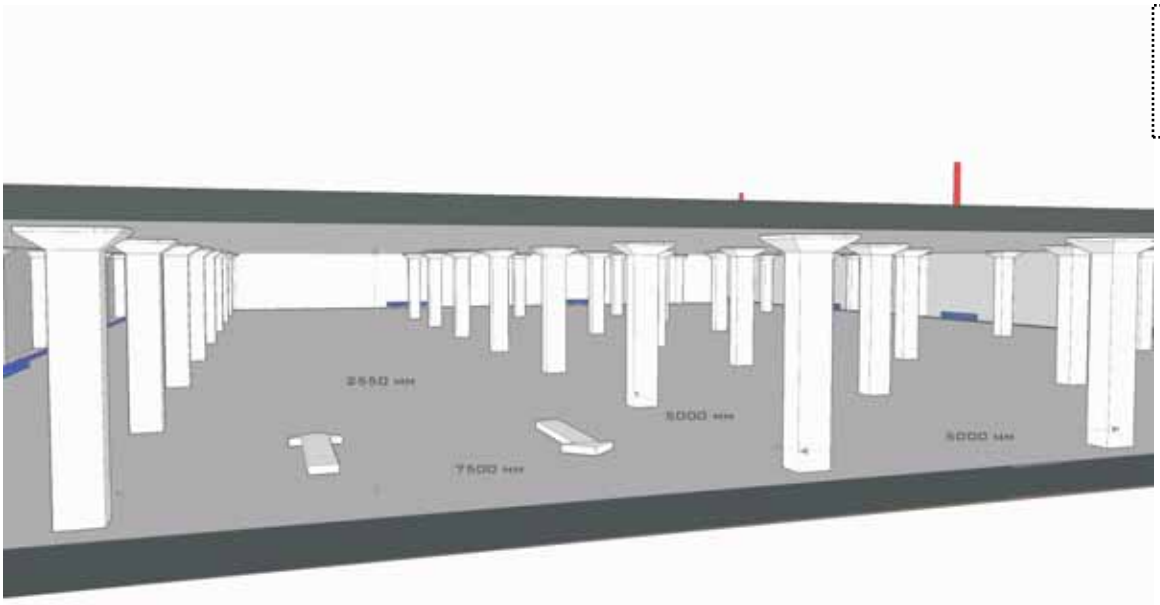
DETAIL A2

Lift shafts are stacked and cross braced to give further stability. After the shaft is stacked the lift rails and coach are installed.

ON SITE WORK

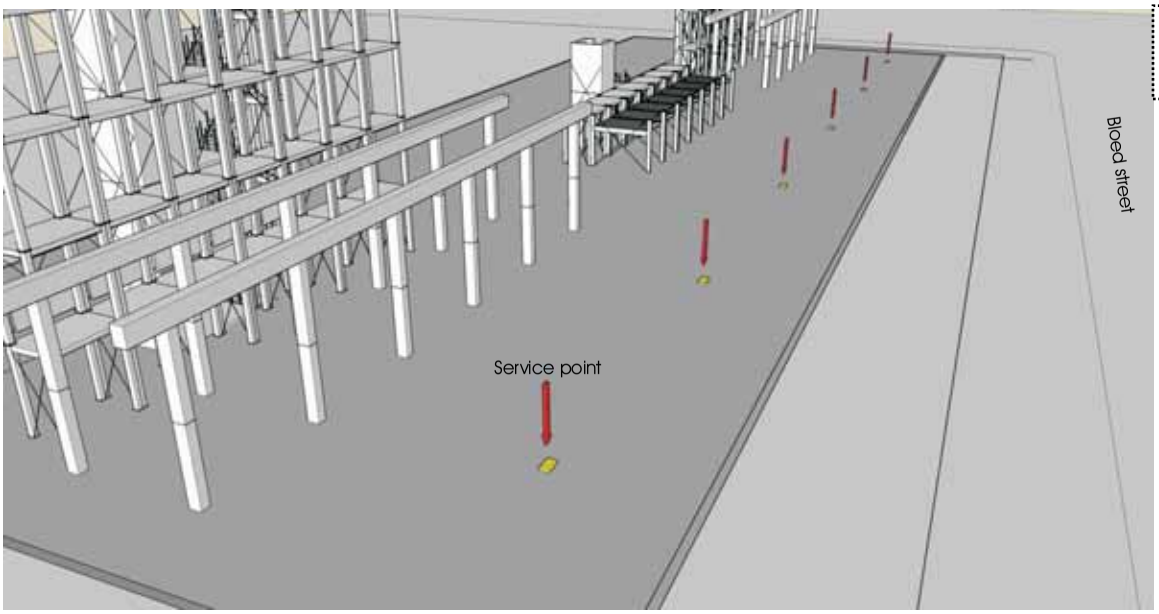
PREPARATIONS TO SITE BEFORE ASSEMBLY OF THE PREFABRICATED ELEMENTS STARTS.

Basement layout to accommodate required parking. Dimensions suitable for double lane access, column spacings allow for two parking bays.



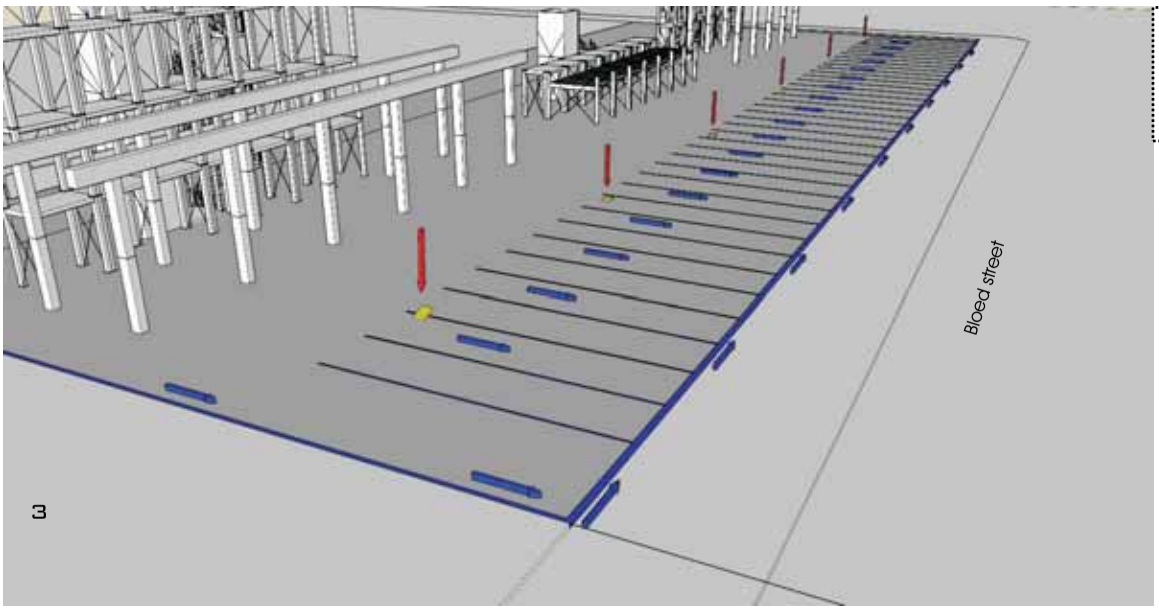
1

Service points for commercial. Arrangement for floor layout woi around this point.



2

Strom water runoff from commercial. Spacing of 2500 mm allows system to line up with any configuration of the commercial space



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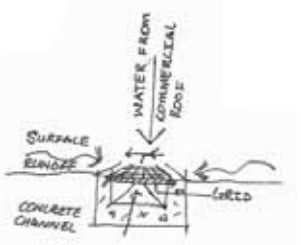
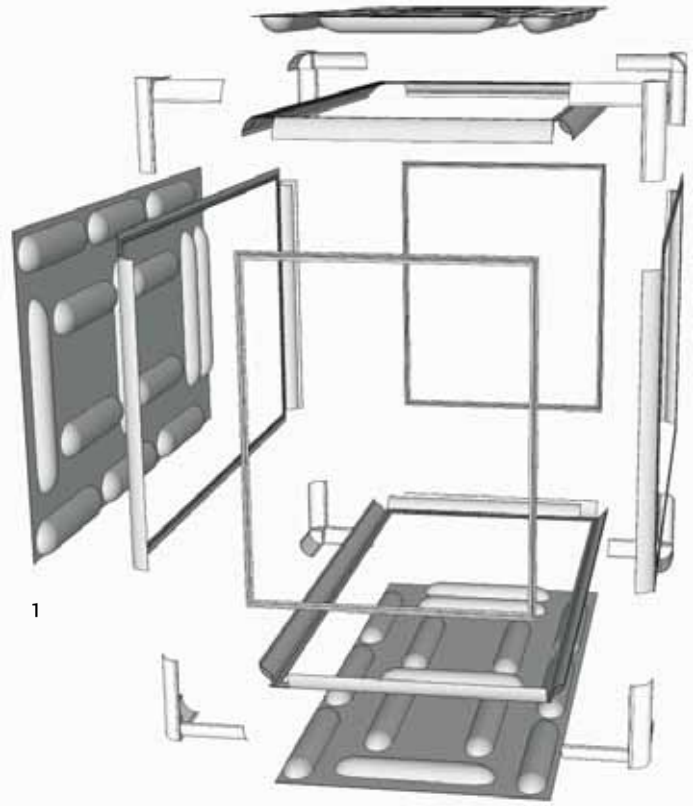


OFF SITE WORK

CONSTRUCTION OF MODULES IN CONTROLLED ENVIRONMENT.



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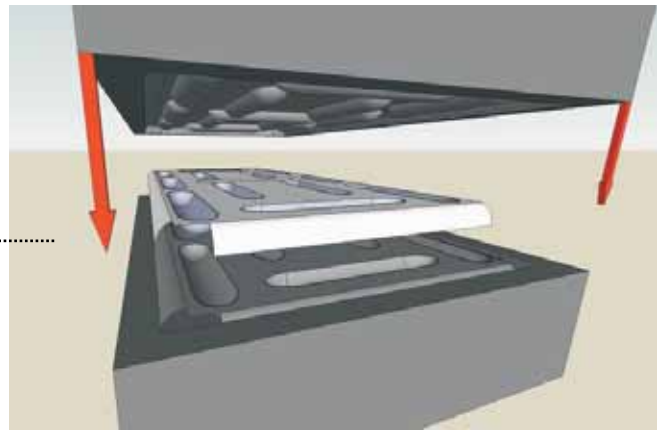
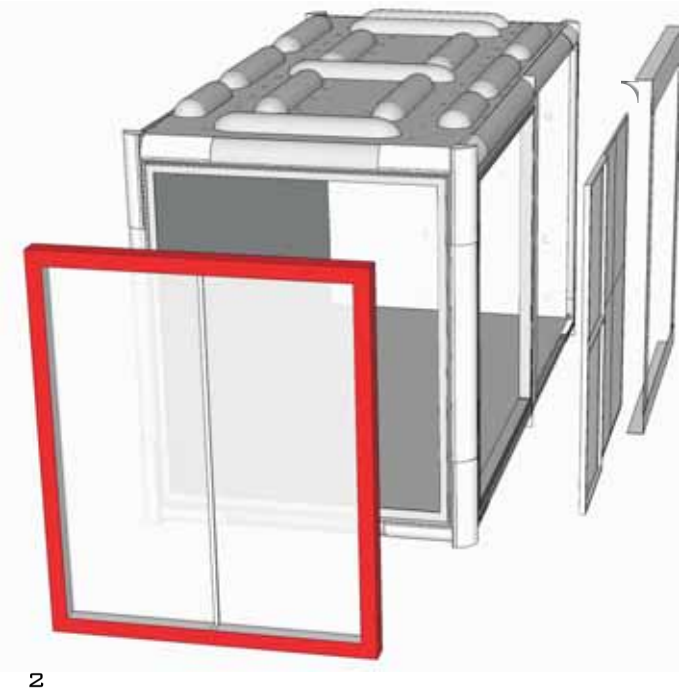
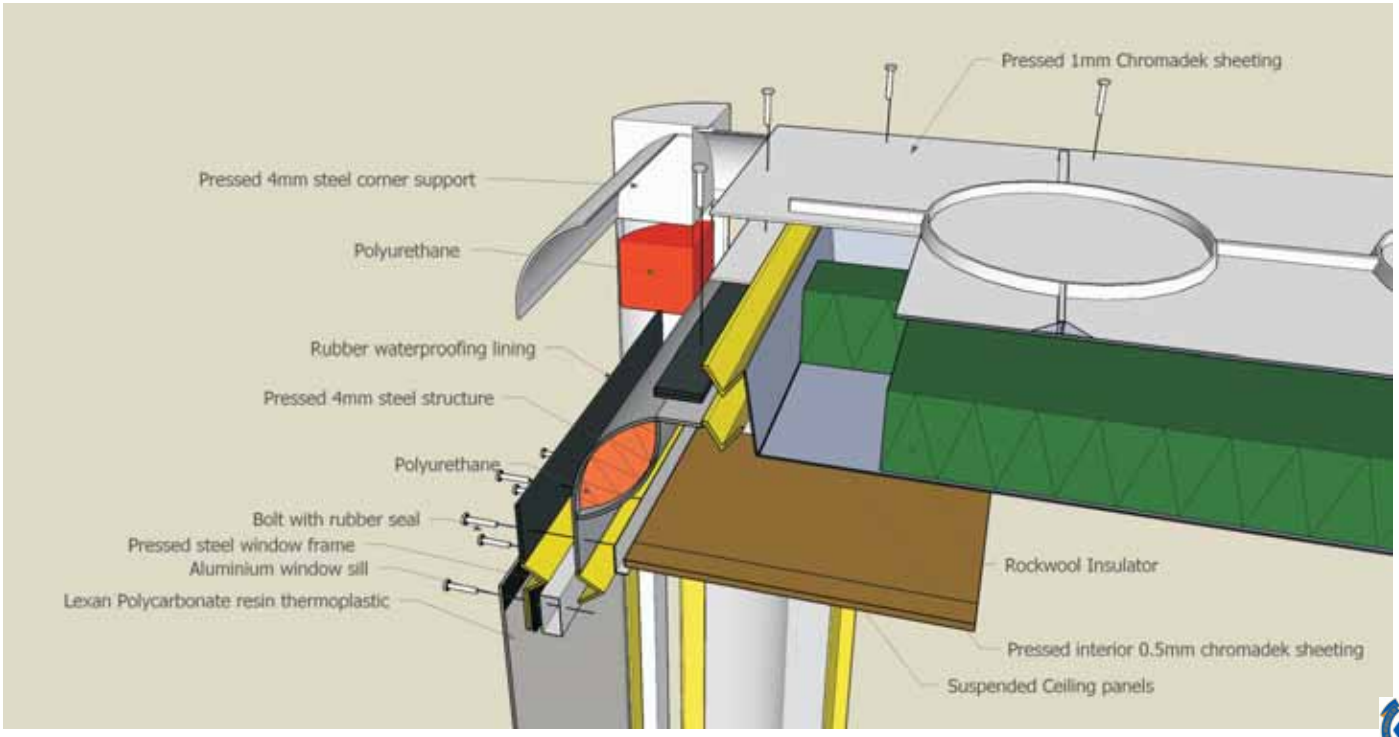




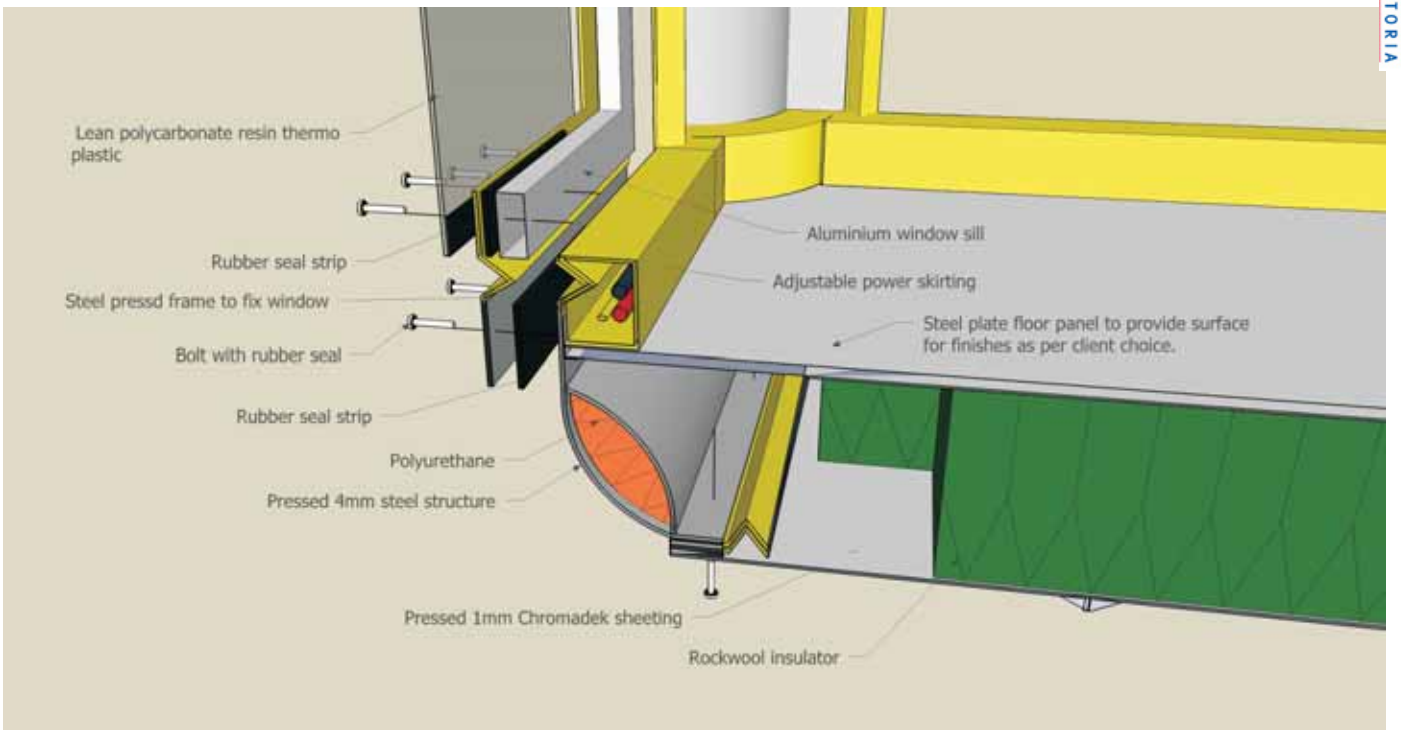
2

OFF SITE WORK

UNIT ASSEMBLY DETAILS



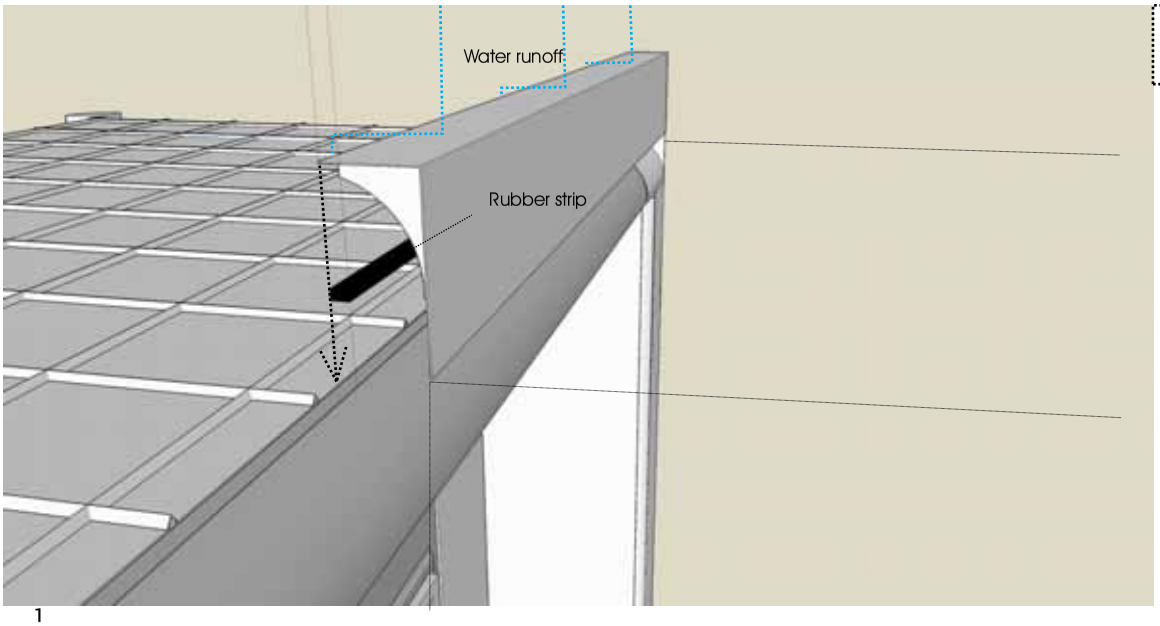
1



2

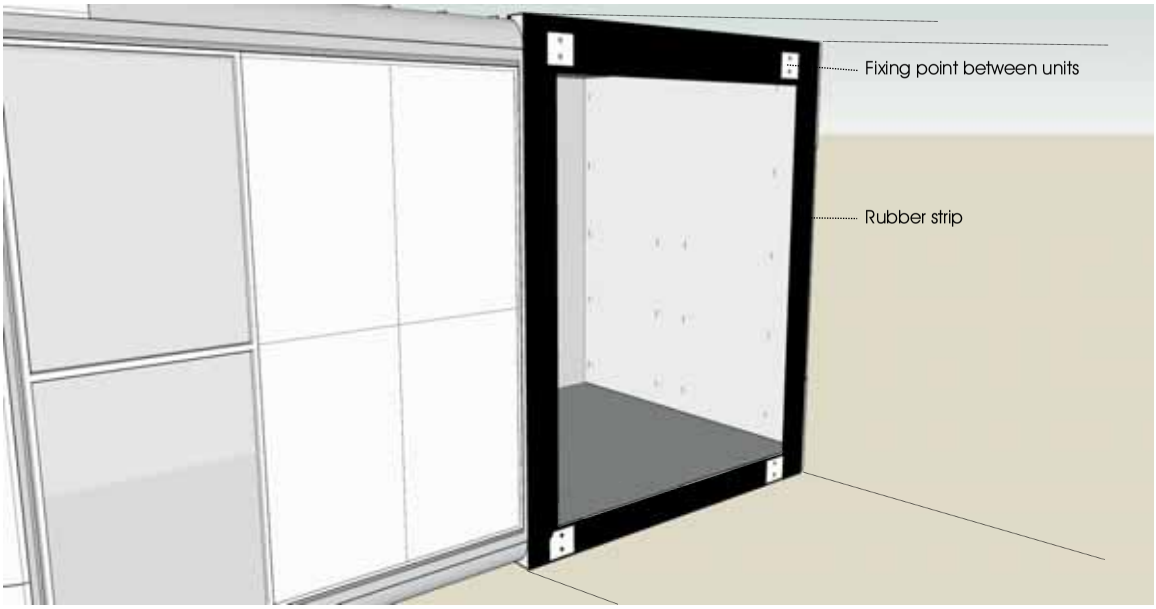
OFF SITE WORK

WATERPROOFING AT RESIDENTIAL EXTENSION UNITS

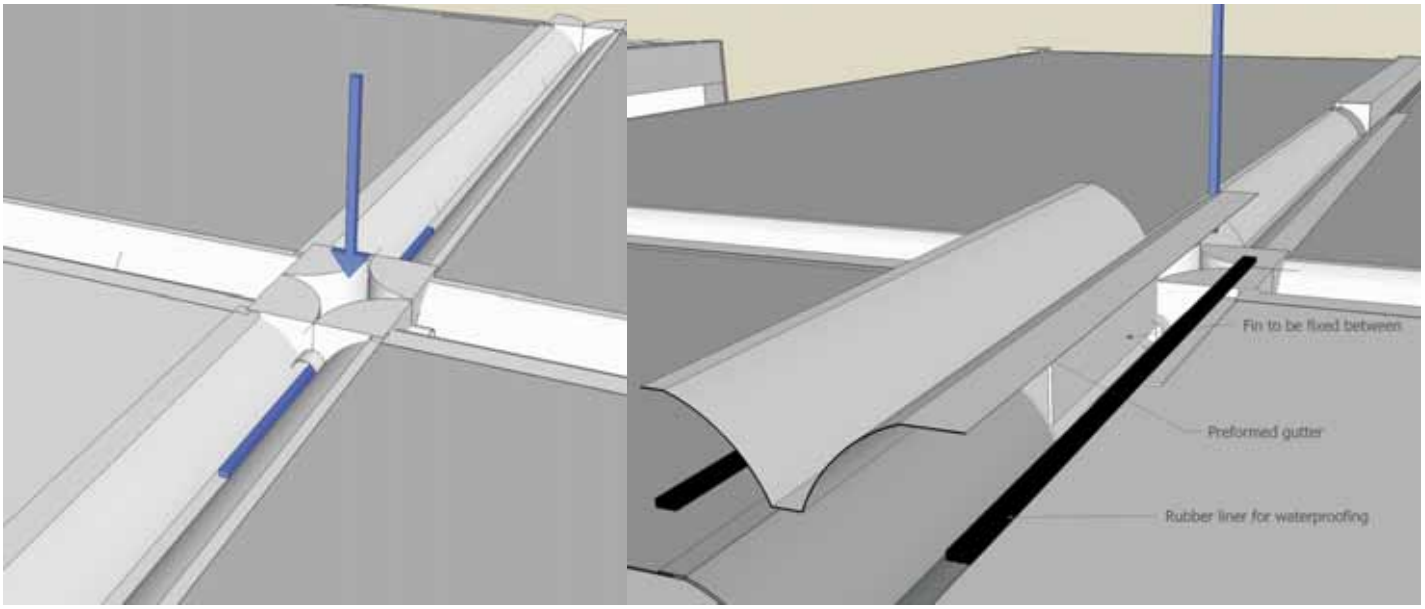


WATERPROOFING BETWEEN THE EXTENSION UNIT ADDED ONTO THE RESIDENTIAL UNIT.

1



2



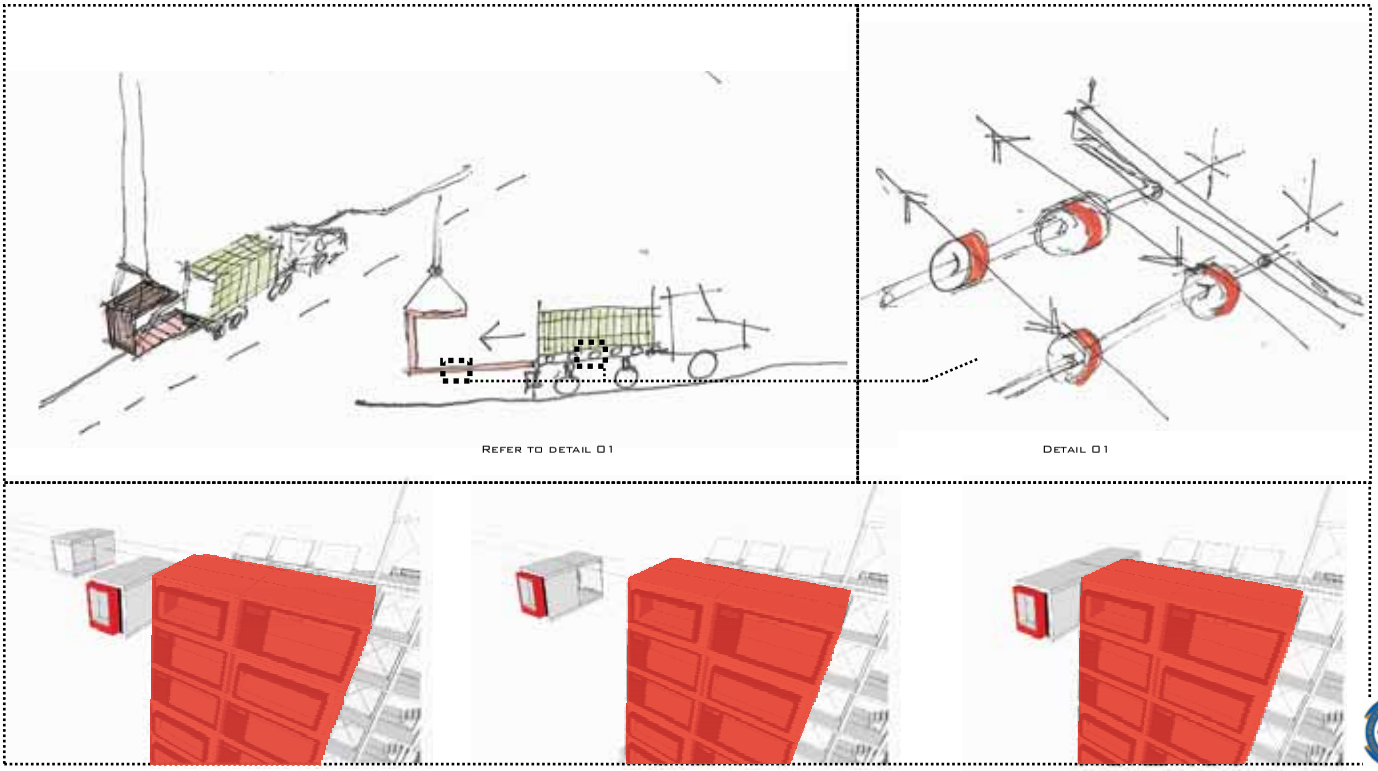
3

With a lot of the technical aspects, solutions was found that will not interfere with the layout and function of the units. The system technically functions as simple as possible to make the assembly process simple. This dissertation needed a lot of technical investigation. For the process a lot of technical issues was resolved.

After various discussions and fine tuning with all details for the process of assembly and extensions to the residential units was feasible and working. This indicated that the project can be implemented. No problem could be identified that will hinder the project or technology platform.

DELIVERY AND LOADING

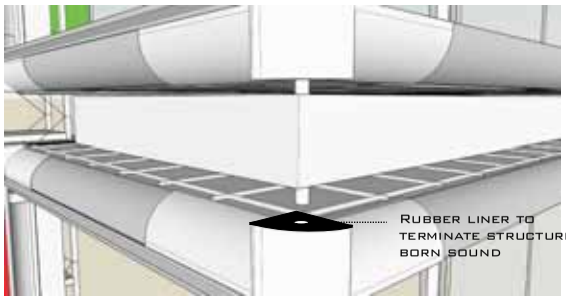
NOMAD-POD EXTENSION UNIT

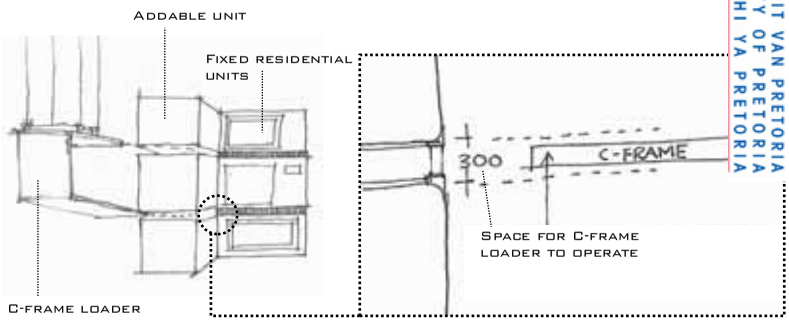


1

Images illustrating the fixed residential unit that extends by the addition of floor space.

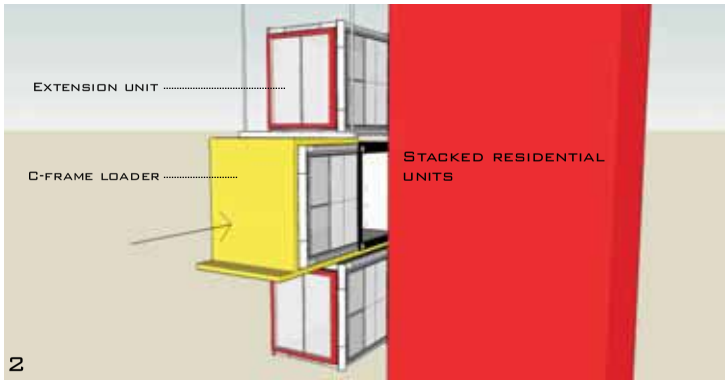
Pods added onto the residential unit will be loaded from the street. The unit will be loaded into the C-frame loader from where it will be lifted into position.





In this detail the 300 mm high spacer between the stacked residential units are shown, and it has a cover plate.

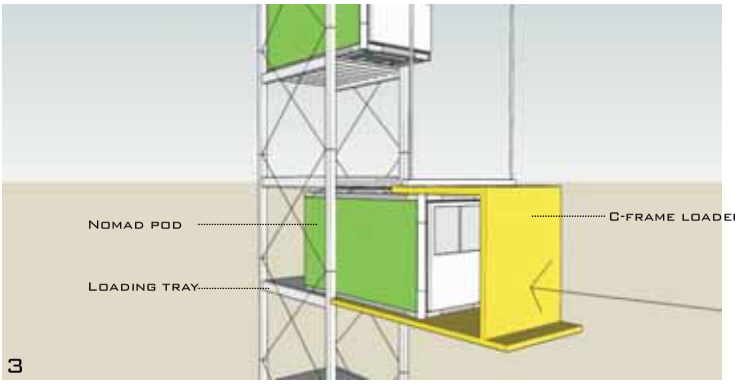
Residential extension unit system:



2

Residential extension unit is loaded into the C-frame loader. The pod placed next to the residential unit and fixed, the pod will not be rolled into place as the C-frame loader will extend to where the pod need to be fixed.

Nomad pod plug in system:

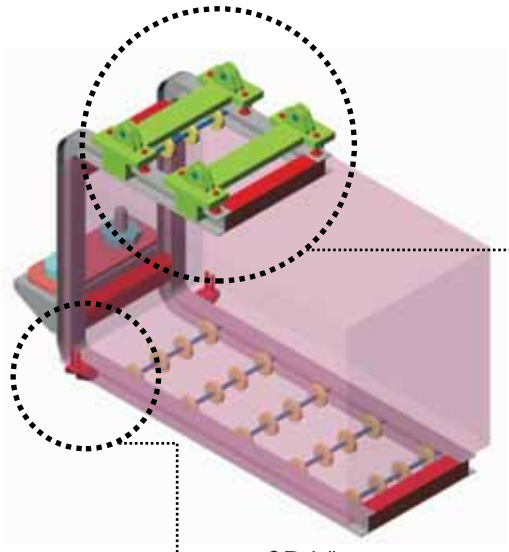


3

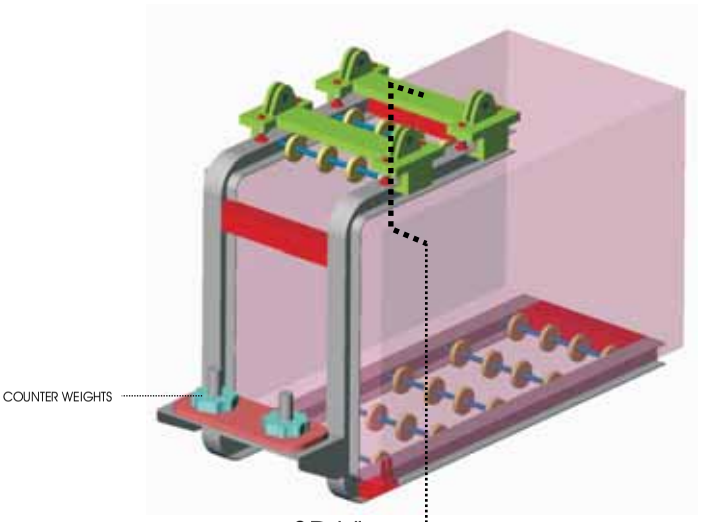
The nomad-pod is loaded into the C-frame loader. The Pod is pulled into place from the C-frame on the holding tray. Holding tray and C-frame will have wheels for the pod to roll on into place.

C-FRAME LOADER

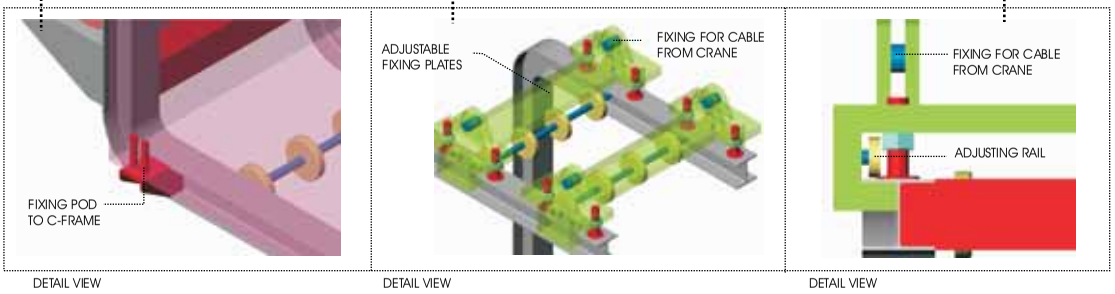
SPECIFICATIONS



1 3D View

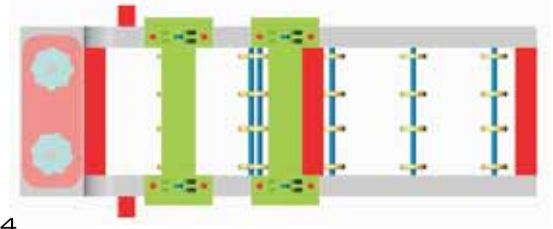


2 3D View

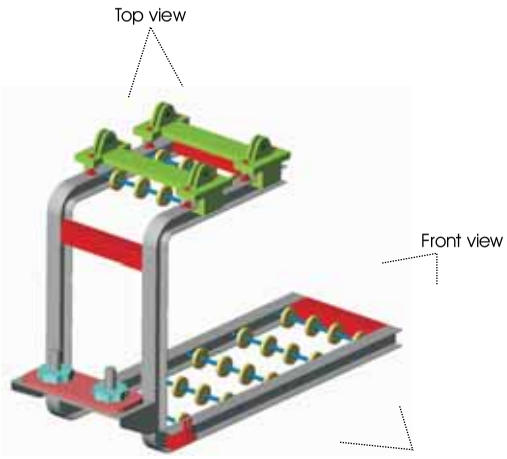


DETAIL VIEW DETAIL VIEW DETAIL VIEW

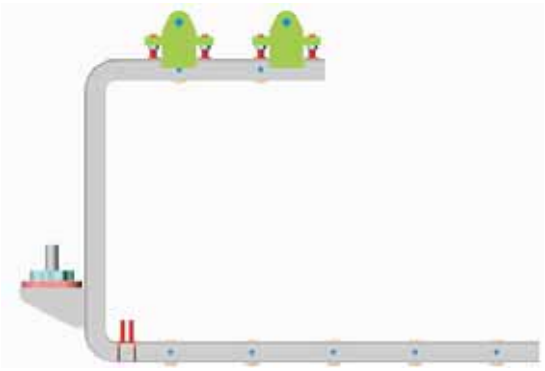
3



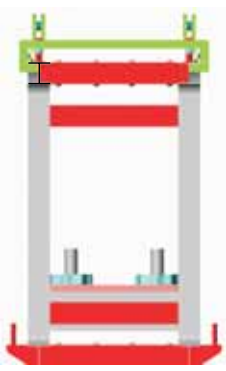
4 Top View



5 3D View



6 Side View



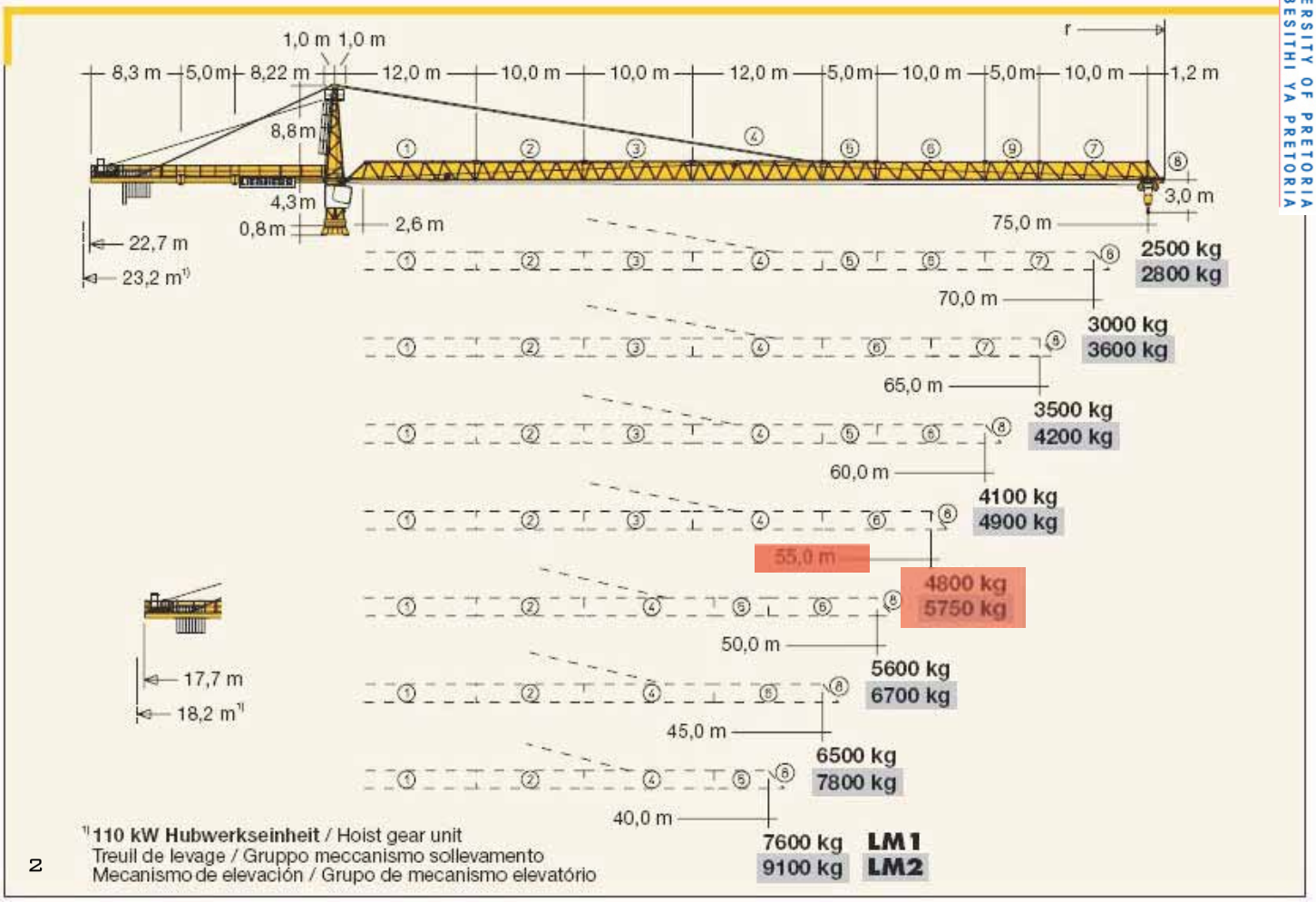
7 Front View

Images not to scale

TOWER CRANE
SPECIFICATIONS

The site requires a 50 m radius tower crane, and the weight at the end should be able to carry 4000 kg, this weight is the including the C-frame loader and Pod.
The tower crane specified can carry a load of 5750 kg maximum at 55 m.

1



¹⁾ **110 kW Hubwerkseinheit** / Hoist gear unit
Treuil de levage / Gruppo meccanismo sollevamento
Mecanismo de elevación / Grupo de mecanismo elevatório

2

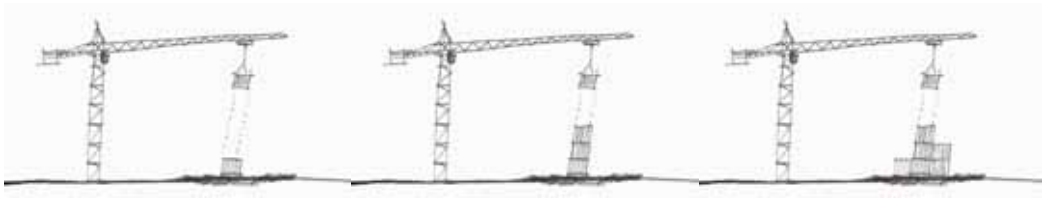
Hubhöhe Hoisting height / Hauteur sous crochet / Altezza di sollevamento / Altura bajo gancho / Altura de montagem

1

2

le Corbusier remarked that if you could place a windmill next to a building and it compliments the building the design was good. The windmill is essential form follows function. Functionally it pumps water from groundwater levels into a concrete dam.

The Tower crane is an essential prefabricated structure. It symbolizes the heart of the project, everything happens from this heart. It functionally moves transportable sized boxes into place and thus gives shape to the layout of the building.



3

Images illustrates the growth and heart that the tower crane identifies.

Similarly these two elements are functionally driven in design and material to perform according to its specific function. Also iconic in functional practicality and symbolizes more than just itself. The windmill symbolize: countryside, and the tower crane: progress, and that a city is never completely built.

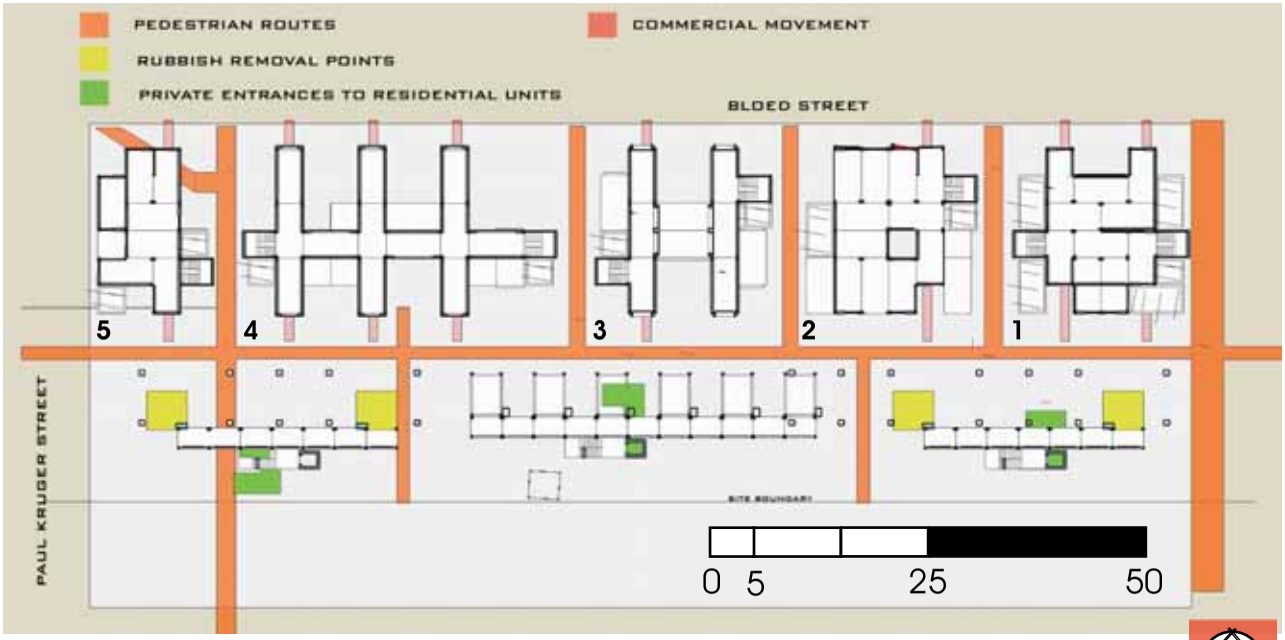
(Krane, J) states in a bussiness article "DUBAI, United Arab Emirates — New York has the Statue of Liberty. Paris has the Eiffel Tower. Dubai's symbol, for now, is the construction crane. This Persian Gulf boomtown is more accurately described as an enormous construction site rather than a finished city. Cranes cram the skyline and line the highways, marring the view from almost any window. Their latticed booms wheel over hundreds of half-finished skyscrapers, hauling up gray slabs of prefabricated wall, buckets of wet concrete, and bundles of steel reinforcing rod resembling rust-colored spaghetti. Building analysts say Dubai has emerged as the world's fastest growing city, as well as its largest repository of building cranes".

The tower crane can symbolize prosperity and growth, and can also serve to suggest the question of; are cities ever completely built or finished? Within the context of the inner city of Pretoria constantly fluctuating especially with the investment currently in this area, one can see the crane as a symbol of growth and progress.

4

ACCOMMODATION SCHEDULE

Residential		
Area per unit		19.32 m²
Total units	56	
Total		1 081.92 m²
Plug-in Facility		
Area per unit		9.66 m²
Total units when fully occupied	42	
Commercial ground- and first floors		
Area commercial 01		217.35 m²
commercial 02		72.45 m²
commercial 03		72.45 m²
commercial 04		222.18 m²
commercial 05		120.75 m²
Total commercial area		705.18 m²
Toilet facilities commercial		
SABS 0400 B3		
1 WC and 1 HWB for male and 1 WC and 1 HWB for female /15 persons		
1 Person/ 15m² commercial floor space		
705.18 m² / 15 m² = 47 Persons / 15 = 4 WC and 4 HWB for each male and female		
Total Supplied = 8 Paraplegic toilet facilities.		
Access walkways		
Area per floor /Residential and Plug-in facility		93.75 m²
Total for all floors		656.25 m²
Rubbish Storage facilities		
Area		19.32 m²
Laundromats		
Area		38.64 m²



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Groundfloor plan

Basement:

Total parking bays required as per

TABLE F: PARKING APPLICABLE TO AREAS

IN ZONES A AND B ON ANNEXURE A

Duplex dwellings	As per schedule 3
Flats	One parking space per 93 square metres of the gross floor area of the flats
Residential buildings	One parking space per 37 square metres of bedroom and bathroom accommodation (other than Dwelling-houses and blocks of flats)
Offices	One parking space per 116 square metres of the gross floor area of the offices and their appurtenances such as storerooms, cloak-rooms, corridors etc.
Shops	One parking space per 93 square metres of the gross floor area of the shops and their appurtenances such as offices used in conjunction therewith, storerooms, cloak-roomscorridors etc.
Industries Restricted Industries Warehouses	One parking space per five employees including management.

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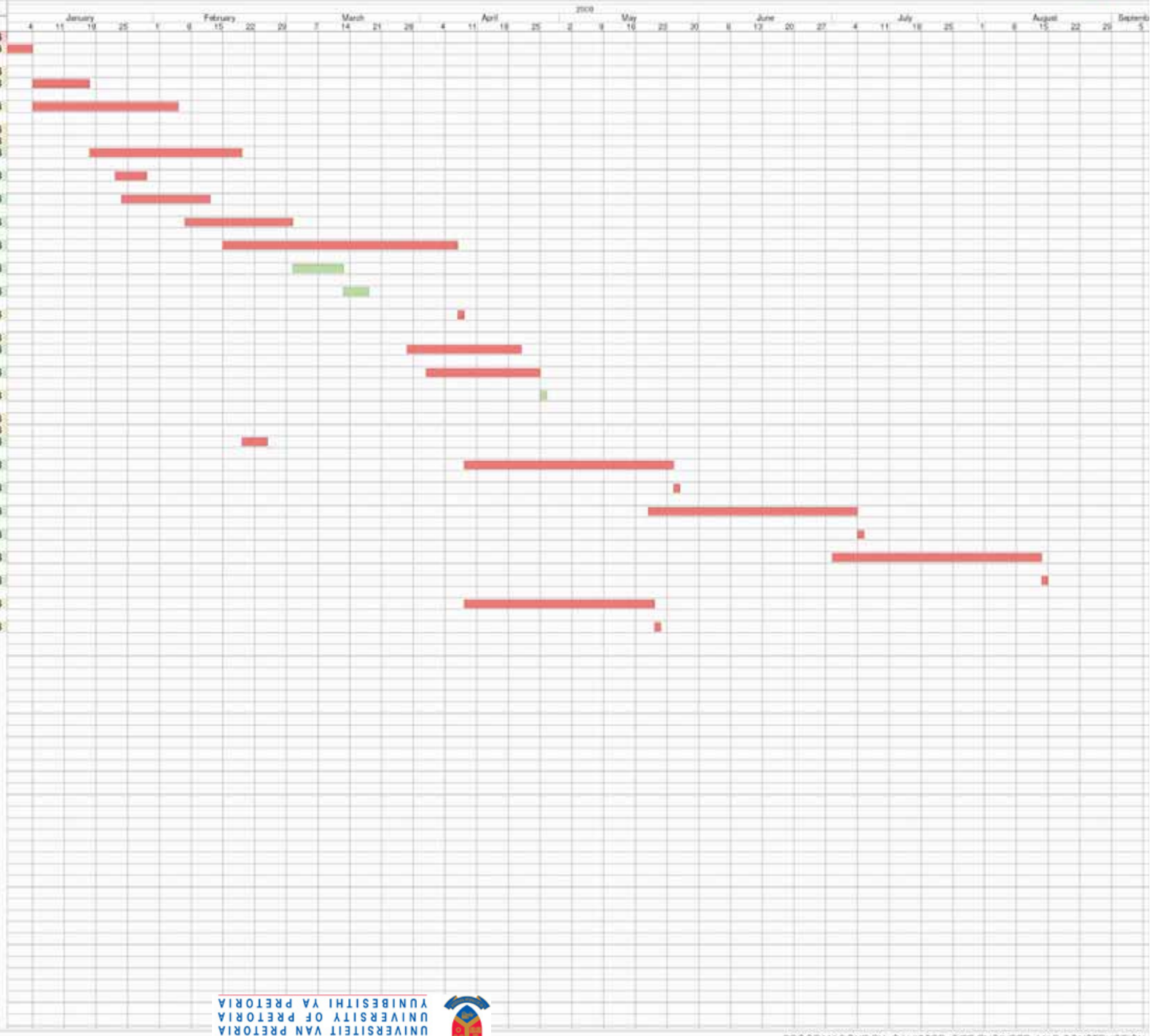
Function	Total area	Parking area	Bays required
Residential	1 081.92 m²	93 m²	12
Nomad pods	n.a.	n.a.	9
Shops	705.18 m²	56 m²	13

One parking space per 5 nomad plug-in pods.

MIX-USE RESIDENTUAL & COMMERCIAL DEVELOPMENT

Selection: Summarised to level 4

Activity Description	Durn	Current Start	Current Finish
A000 MIX-USE RESIDENUAL & COMMERCIAL DEVEL.	164	01/01/2008	15/08/2008
A050 SITE ESTABLISHMENT	4	01/01/2008	04/01/2008
A010 EARTHWORKS	23	07/01/2008	06/02/2008
A020 BASEMENT	9	07/01/2008	17/01/2008
A130 ACCESS ROAD	23	07/01/2008	06/02/2008
A110 CIVIL CONSTRUCTION	72	18/01/2008	28/04/2008
A120 BASEMENT	58	18/01/2008	08/04/2008
A770 FOUNDATIONS	24	18/01/2008	20/02/2008
E490 CRANE INSTALATION & COMITIONING	5	24/01/2008	30/01/2008
A780 COLUMNS	14	25/01/2008	13/02/2008
C080 RETAINING WALL	17	08/02/2008	03/03/2008
C790 FLAT SLABS	37	18/02/2008	08/04/2008
D360 WATER SEALANT - RETAINING WALLS	8	04/03/2008	13/03/2008
D390 BACKFILL BEHIND RETAINING WALL	4	14/03/2008	19/03/2008
D410 HANDOVER - BASEMENT	1	09/04/2008	09/04/2008
D450 STRUCTURAL SUPPORT	21	28/03/2008	25/04/2008
D460 SUPPORT COLUMNS & BEAMS - EAST TOWER	18	28/03/2008	22/04/2008
D900 SUPPORT COLUMNS & BEAMS - WEST TOWER	18	02/04/2008	25/04/2008
E330 HANDOVER - STRUCTURAL SUPPORT	1	28/04/2008	28/04/2008
E360 STRUCTURAL ASSEMBLY	127	21/02/2008	15/08/2008
E560 RESIDENTUAL UNITS	127	21/02/2008	15/08/2008
E570 BASEMENT	4	21/02/2008	26/02/2008
5140 NOMAD TOWER	33	10/04/2008	26/05/2008
5050 HANDOVER - NOMAD TOWER	1	27/05/2008	27/05/2008
F660 EASTERN TOWER	33	21/05/2008	04/07/2008
5060 HANDOVER - EASTERN TOWER	1	07/07/2008	07/07/2008
5010 WESTERN TOWER	33	01/07/2008	14/08/2008
5120 HANDOVER - WESTERN TOWER	1	15/08/2008	15/08/2008
5870 COMMERCIAL UNITS	30	10/04/2008	21/05/2008
5920 HANDOVER - COMMERCIAL UNITS	1	22/05/2008	22/05/2008



Without the basement the program will be 3.5 months shorter.
Total construction time on site:
7.5 months

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UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

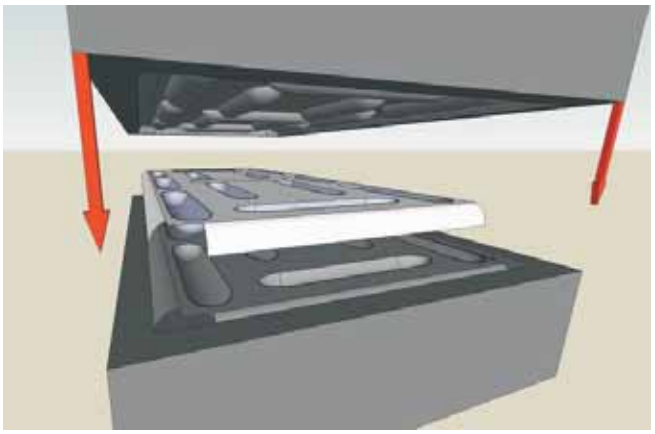
PROGRAM DONE BY: GJ VISSER, SITE ENGINEER, M&R CONSTRUCTION.

MATERIALS

STEEL

Steel metal sheeting for external use of modular unit.

The choice for this material stems out of recycling. This material is also very durable, especially with the harsh climate in Pretoria. The car inspired the choice of this material as it is a great example of great durability. The container serve as a great example for the use of sheet metal as structure.



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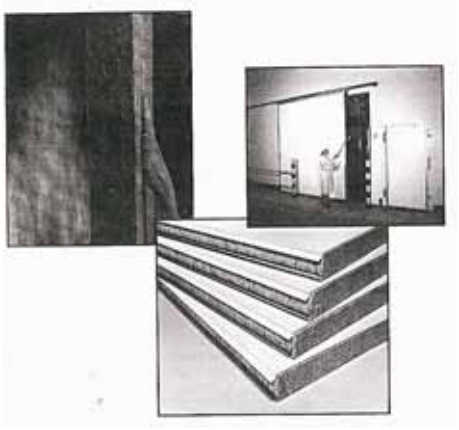
INSULATION

ROCKWOOL

The product is engineered from volcanic stone to use the properties of the stone fibres to achieve a structurally, sound, thermal and acoustically efficient panel. Bonded panels provide the solution to various types of insulation and exterior/interior cladding requirements. What makes Rockwool a suitable insulated panel is the fact that it has great thermal characteristics and is non-combustiable," compared to other insulation materials.



Characteristics

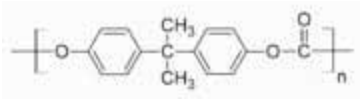
- Great strength and rigidity
- Stable in cold & hot conditions
- Great thermal insulation values
- Chemically neutral
- stable under humidconditions
- Acoustic insulation
- equivalent to impermeable
- surface
- Fire-safe

Fire Requirements

Fire starts when an ignition source, fuel and oxygen are simultaneously present. It is therefore of the utmost importance that the insulation core of any composite panel is as follows:

- Non Combustible
- High melting point
- Low smoke co-efficient
- Non toxic when heated
- Not a contribution towards fire

MATERIALS
WINDOWS



The chemical structure of Lexan
LEXAN is a registered trademark for General Electric's brand of highly durable polycarbonate resin thermoplastic intended to replace glass where the need for strength justifies its higher cost. It is a polycarbonate polymer produced by reacting Bisphenol A with carbonyl chloride, also known as phosgene. Lexan is the brand name for polycarbonate sheet in thicknesses from 0.75 mm (0.03 in) to 12 mm (0.48 in). Applications are mainly in three domains building (glazing and domes), industry (machine protection and fabricated parts) and communication and signage.

Imperial sizes	Metric sizes
Width / length	Width / length
81 " x 49 "	2050 x 1250
96 " x 48 "	2450 x 1230
120 " x 81 "	3050 x 2050

Lexan / Makrolon Polycarbonate

- Half the weight of glass
- As used in riot shields
- Fire resistance to BS476
  Often used to cover church windows

Perspex / Plexiglass Acrylic Sheets

- 10 times stronger than glass
- Glass clear 92% light transmission
- Ideal for secondary glazing
- Lightweight
- Easy to cut and drill
  Excellent weather resistance

SOLAR WATER HEATER

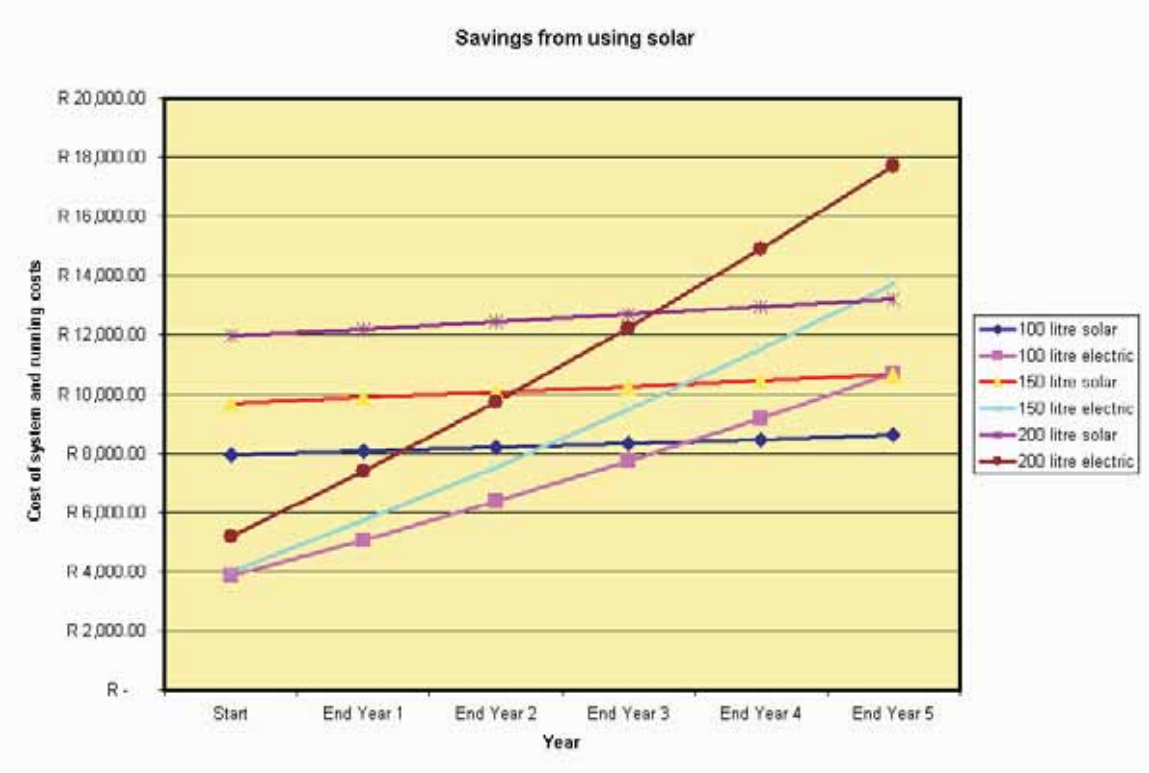
230 liters / day

5min shower = 100 liter/day
Flushing toilet with a 9 liters system = 45l/day
Washing clothes with top loader machine using 130liters/washcycle for a family of 4 = 33l/day
Washing dishes= 27liters/day
Cooking = 15 liters/day
Drinking washing hands and other uses = 10 liters/day

Reduced water consumption, Methods on reducing

3min shower or low flow shower head delivering 10 liters/ minute = 60liter/day
Install a 41/2:9 liter dual flush toilet = 32 liters/day
Wait until you have a full load of washing before washing clothes/ or use the halfload button on machine.
Frontloading machines uses 45% less water, so the Laundromat will be provided with these machines. = 16 liters/day
Don't wash the dishes under a running tap, use a bowl.
And use a bowl for washing vegetables.
(Sustainable Water (16 April 2007))

Solar Water heaters can supply 50-100% of a homes hot water needs, and provide savings up to 50-80% over electric heaters.



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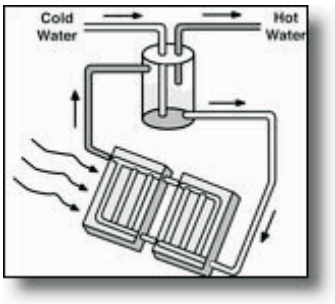
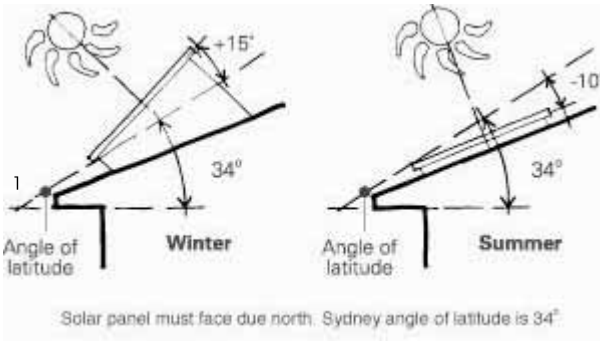
Passive systems
In Passive systems (or thermosiphon systems) the tank is placed above the solar collectors
so that cold water sinks into the collectors, where it is warmed by the sun, and rises into the tank. A continuous flow of water through the collectors is created without the need for pumps.

tank. A continuous flow of water through the collectors is created without the need for pumps.





2 persons per flat, and 7 units = 14 persons each using 76 liters hot water per day = 1064 liters hot water / day

Panel PG 2.0 size 2000 x 1000 mm
Panels needed:

5.7 liter storage for water for every 0.1 m² collector area. In very warm sunny climates the ratio is 7.6 liters storage for water every 0.1 m2 of collector area.

1064 liters / 7.6 = 140 x 0.1 m2 = 14 m²
panels needed.

Total of 7 panels of 2 m² needed.

300 liters storage capacity tank to be used with a backup heating element.
- Separation of potable water from solar fluid through thermal jacket
- Galvanised and painted special tank with high corrosion resistance
- Storage tank volumes 150 or 300 litres, depending on application
- Polyurethane foam insulation with additional polyurethane casing for optimum insulation and protection against the weather

thermosiphon collector
- Collector frames and rear panel made from aluminium
- Radiant piping for optimum thermal flow

- 4 mm clear glass with optimum angle correction factor – tested for resistance to hail in accordance with DIN EN 12975
- Integrated return flow pipe for protection against weather and to allow simplified installation
- Seamless, non-bonded EPDM gasket between glass and collector frame for thermal stress-free and secure sealing under all temperature conditions.

Climate data
Pretoria

Position: 25° 44' S 28° 11' E
Height: 1330m
Period: 1961-1990
This climatological information is the normal values and, according to World Meteorological Organization (WMO) prescripts, based on monthly averages for the 30-year period 1961 – 1990

Month	Temperature (° C)				Precipitation		
	Highest Recorded	Average Daily Maximum	Average Daily Minimum	Lowest Recorded	Average Monthly (mm)	Average Number of days with >= 1mm	Highest 24 Hour Rainfall (mm)
January	36	29	18	8	136	14	160
February	36	28	17	11	75	11	95
March	35	27	16	6	82	10	84
April	33	24	12	3	51	7	72
May	29	22	8	-1	13	3	40
June	25	19	5	-6	7	1	32
July	26	20	5	-4	3	1	18
August	31	22	8	-1	6	2	15
September	34	26	12	2	22	3	43
October	36	27	14	4	71	9	108
November	36	27	16	7	98	12	67
December	35	28	17	7	110	15	50
Year	**36**	**25**	**12**	**-6**	**674**	**87**	**160**

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