

9. Conclusion

Given that we can barely begin to understand the present urban realities in the African context, it would be even more problematical to begin to comprehend how the city would operate in the future, therefore we can only begin to predict or begin to affect the way the future African city might be; and such a process would begin with redefining and re-conceptualising the urban condition, that encompasses democracy and sociability. Perhaps an African City, in accordance with (Koolhaas, et al. 2000:653) is one where public space is continuously been occupied in different ways, and interior spaces are dynamic and flexible constantly regenerating themselves; where boundaries are flexible and elastic, allowing for variable and impermanent patterns to occur.

The dissertation is an investigation of the role of architecture and open space in the African urban condition. The author is of the opinion that architecture cannot be the sole contributor to urban reform and that architects should begin to implement a multi-disciplinary approach that begins to understand and work within the context that is unique to South African cities. It is important that the city should rather be understood as a social structure in which the temporal condition supersedes the physical condition, in order for the public to actively engage with each other and the urban condition. This is to be achieved by implementing multi-disciplinary strategies, which go beyond mere architectural solutions, but rather strategies that have the ability to strengthen the social tissue. It is in this social condition that urban processes begin to emerge.

10. Technical Investigation

10.1. Ventilation

10.1.1. Mechanical Ventilation of the Underground Parking Garage.

In any underground parking garage, ventilation is an important issue to consider due to the carbon monoxide build up as a result of the combustion of fuels. The design of the basement parking, which has been proposed for Pretorius Square, is not a completely enclosed structure, as it has openings on the south side where it meets the proposed building and on the north side where the vehicular entrance is situated. As a result of this the most efficient method of ventilation would be to mechanically extract the contaminated air and not use a mechanical method to introduce clean air, but rather use the openings that are part of the structure and the openings as a result of the ramp that connects all three levels of the basement, as inlets points for the introduction of fresh air (Mahmood, 2007). This method of ventilation that involves the creation of pressure differentials by exhaust fans and air return inlets is known as *space air distribution* (McQuiston & Parker, 1994:107).

This method of ventilation will be achieved by having an exhaust fan on each basement level, each one of them to be in a plant room and connected to a shaft that has an outlet on the roof, in this case the ground floor, that will allow for the extracted air to escape. It is important that openings in the basement structure are sufficient enough to ensure that there is always a balance between the amount of air mass entering and the amount leaving the space (McQuiston & Parker, 1994:107).

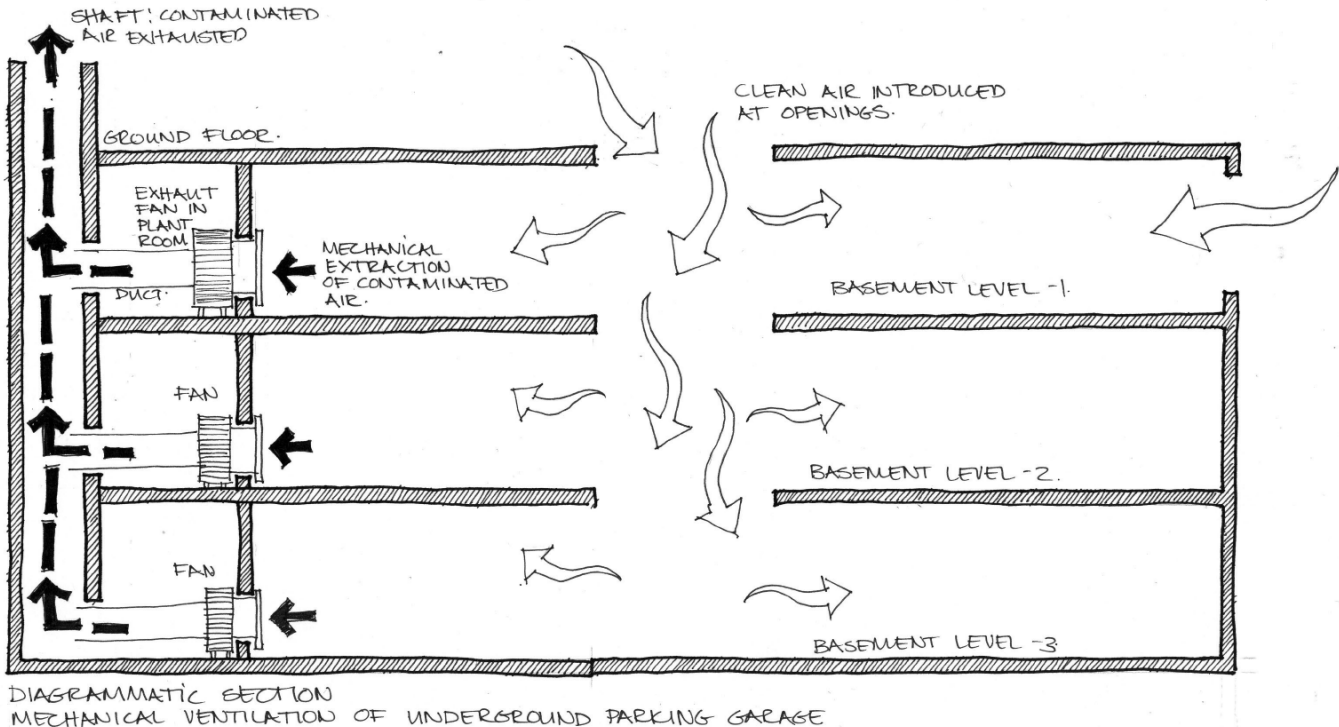


Fig. 138 Space air distribution, the mechanical extraction of contaminated air (Author, 2007).

A centrifugal fan will be used as the exhaust fan, as it not only makes the least amount of noise, but it can efficiently move large volumes of air over a wide range of pressures therefore creating a high flow rate which is essential in this type of ventilation (Mahmood, 2007). The factors that influence the type, size and power of the fan is determined by the noise level and the required flow rate. The following calculation was used to determine the size and power of the centrifugal fan, and hence the space required for the plant room to house the fan. The following factors were worked into the calculation, as they contributed to the overall loss of pressure which has a direct influence on the flow rate:

- The maximum number of cars the parking garage can accommodate
- Size and length of the duct
- Number and size of columns
- Filters in ducts to prevent the entry of dust

An underground parking garage will not always require the same level of ventilation as the amount of cars within it will always differ; therefore it will be uneconomical to have the fans requiring the same amount of energy whether or not the garage is completely occupied or empty. Therefore the installation of carbon monoxide sensors will be able to determine the level of mechanical extraction that is necessary, therefore ventilation is activated only when needed. As a result the energy requirement, maintenance needed and noise levels are reduced. A carbon monoxide sensor is a small device that is box shaped and is fitted to top of a column. A sensor is only able to detect the amount of carbon monoxide within a 15,2m radius (Mahmood, 2007).



10. Technical Investigation

10.1. Ventilation

10.1.2. Calculations to Determine the Horsepower and Dimensions of the Exhaust Fan

$$A_{flow} = (2,8m \times 135m) - 28$$

$$= 350m^2.$$

* 2,8 m BASED ON FLOOR TO CEILING HEIGHT = 2,720m.
135m = LENGTH OF BASEMENT

N° OF CARDS = 1215

A = AREA OF DUCT. (A_{duct})
= 1m²

A_{beam} = 28m

A_{duct} = $\frac{\pi}{4}$ HYDROLIC DIAMETER = 0,8 x AREA OF DUCT (1)

ΔP = CHANGE IN PRESSURE
= 87000 kPa (PRESSURE OUTSIDE) - 84000 kPa (PRESSURE IN BASEMENT)
= 3000 kPa.

ρ_{air} = DENSITY OF AIR
= 1,2

ρ_{water} = DENSITY OF WATER
= 999.

g = GRAVITATIONAL CONSTANT
= 9,81.

H_{losses} = LOSS IN PRESSURE BASED ON SIZE OF DUCT, N° OF BENDS IN DUCT, LENGTH OF DUCT, N° OF CARDS IN PARKING + COLUMNS. + SCREENS IN DUCT TO PREV. THE ENTRY OF DUST
= 5m.

Q = AIRFLOW FLAT (m³/SECOND)

= V x A_{flow}
= (0,1) 350
= 35m³/s

* V = VELOCITY OF AIRFLOW
= 0,1 m/s

$$\frac{\Delta W}{g} = \frac{\Delta P}{\rho_{water} g} + H_{losses} + \left(\frac{Q^2}{A_{duct}^2}\right) \left(\frac{1}{2g}\right)$$

$$\frac{\Delta W}{g} = \frac{3000}{(999)(9,81)} + \frac{5}{1} + \left(\frac{35^2}{0,8^2}\right) \left[\frac{1}{2(9,81)}\right]$$

$$= \frac{3000}{9800,19} + \frac{5}{1} + \left(\frac{1225}{0,64}\right) \left(\frac{1}{19,62}\right)$$

$$= 0,306 + 5 + (1914,06)(0,051)$$

$$= 5,306 + 97,62$$

$$= 102,92 \approx 103,3$$

103,3 = $\frac{\Delta W}{9,81}$

∴ ΔW = 1013

ΔW = 43 kW. (POWER OF FAN)
≈ 58 Horse Power

m = mass flow.

= ρ_{air} x Q

= 1,2 x 35

= 42.

Fig. 139 A calculation to determine the horsepower of the fan required to mechanically extract contaminated air from the underground parking garage. (Author & Mahmood, 2007)



POWER = 421
AIR FLOW RATE = $35 \text{ m}^3/\text{second}$
CENTRIFUGAL. = $126\,000 \text{ m}^3/\text{hr}$

NEW YORK BLOW COMPANY.
↳ centrifugl.
↳ air flow.
↳ air flow = $36 - 72 \text{ m}^3/\text{s}$

AIR FLOW
= $35 \text{ m}^3/\text{s}$
= $126\,000 \text{ m}^3/\text{hr}$
* $\text{m}^3/\text{hr} \div 1,7021277$
= cfm. (cubic feet per minute)
= 74 024,998
 $\approx 74\,025 \text{ cfm}$

NEW YORK BLOWER.
MODEL 665
wheel $\phi = 66'' = 1\,676,4 \text{ mm}$
outlet area = $27,7 \text{ sq. ft.}$
= $2,57 \text{ m}^2$

Fig. 140 The size and type of centrifugal fan required based on the horsepower that is needed for sufficient mechanical extraction. (Author & Mahmood, 2007)

10. Technical Investigation
10.2. Ventilation & Cooling of the Building

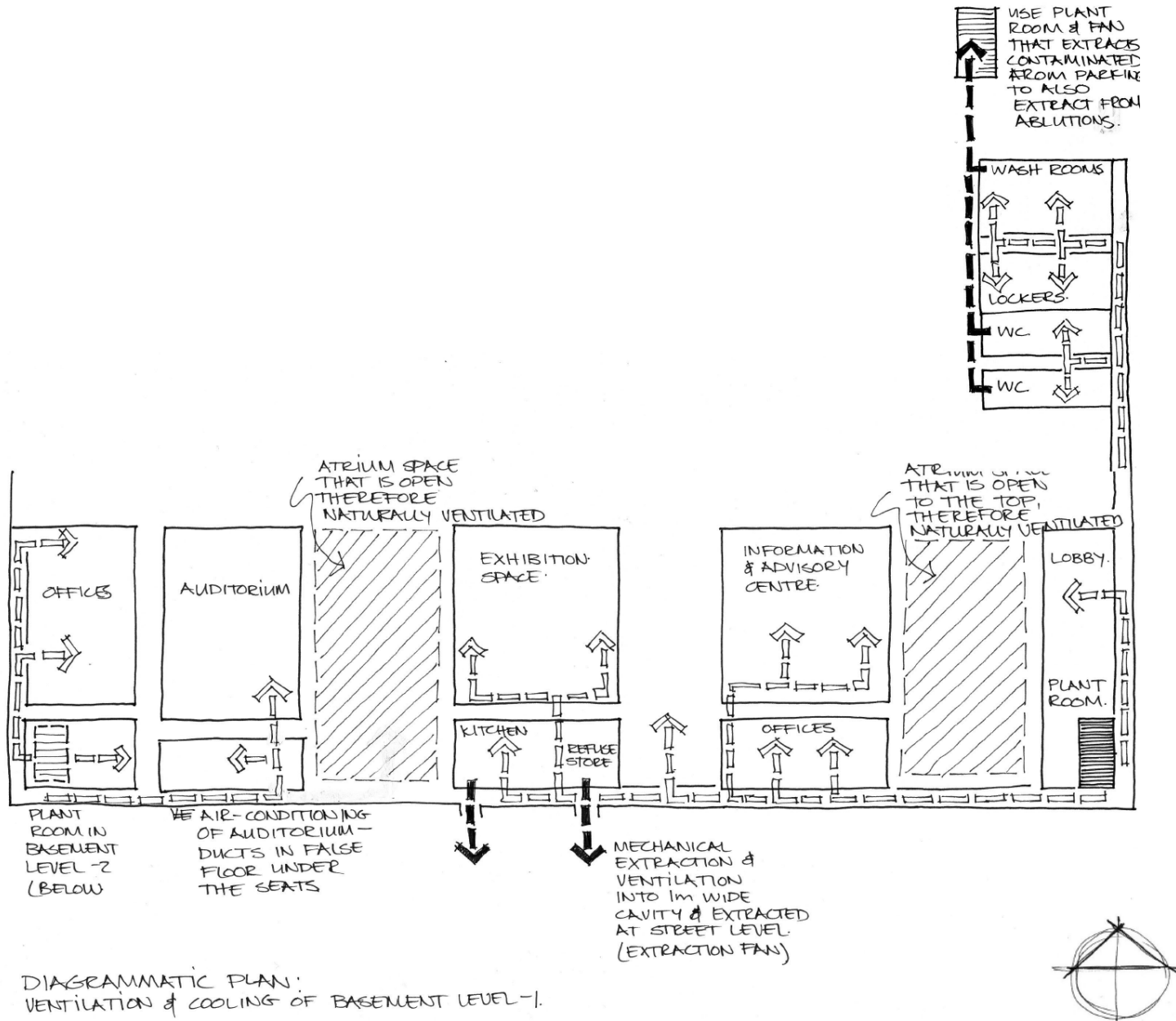


Fig. 141 Investigation of the the ventilation and cooling of basement level -1 (Author, 2007)

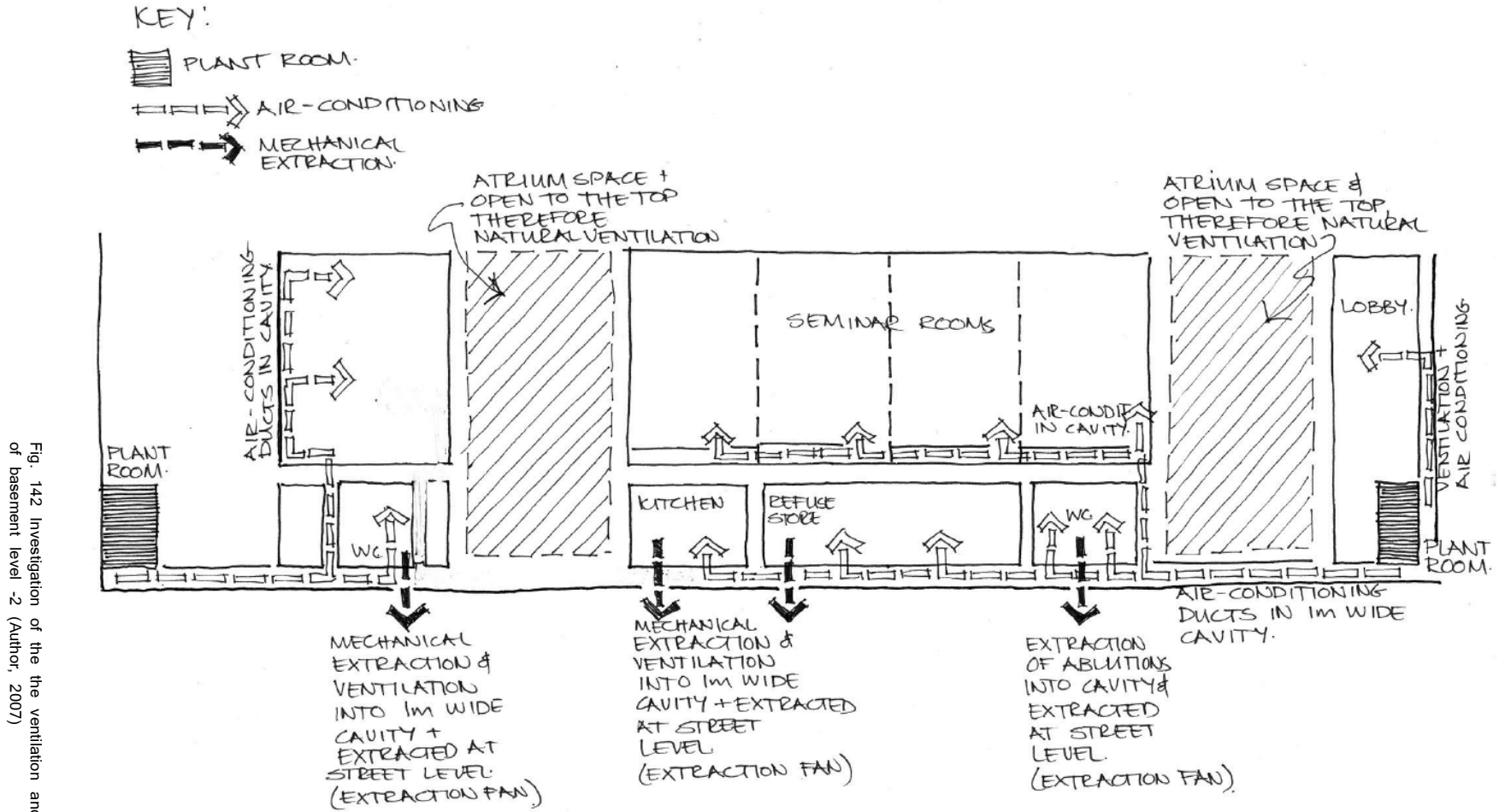
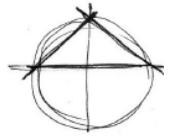


Fig. 142 Investigation of the the ventilation and cooling of basement level -2 (Author, 2007)

DIAGRAMMATIC PLAN!
VENTILATION & COOLING OF BASEMENT LEVEL -2.



10. Technical Investigation

10.3. Services

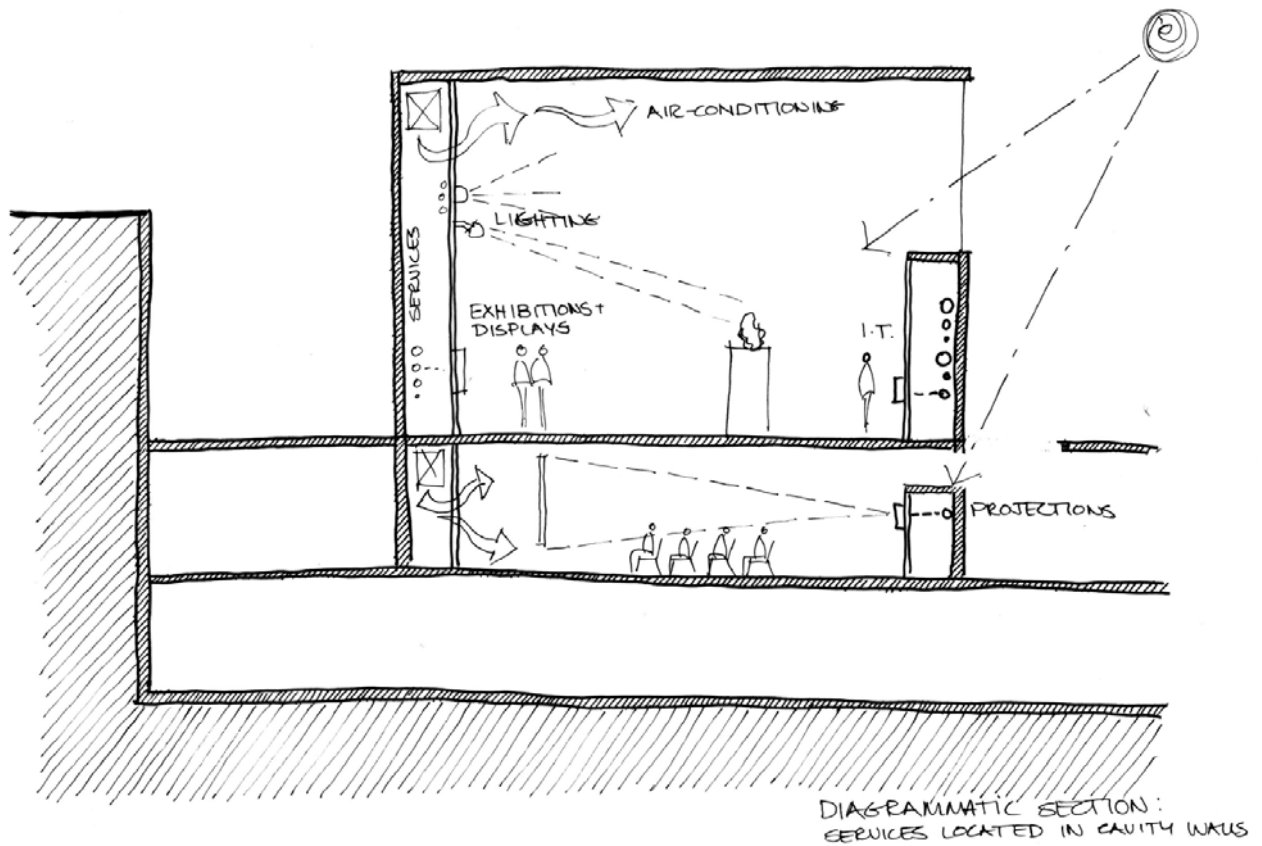


Fig. 143 Investigation of the incorporation of services into cavity walls. These services are aimed at providing digital information and to facilitate exhibitions (Author, 2007).

10. Technical Investigation

10.4. Stormwater Management

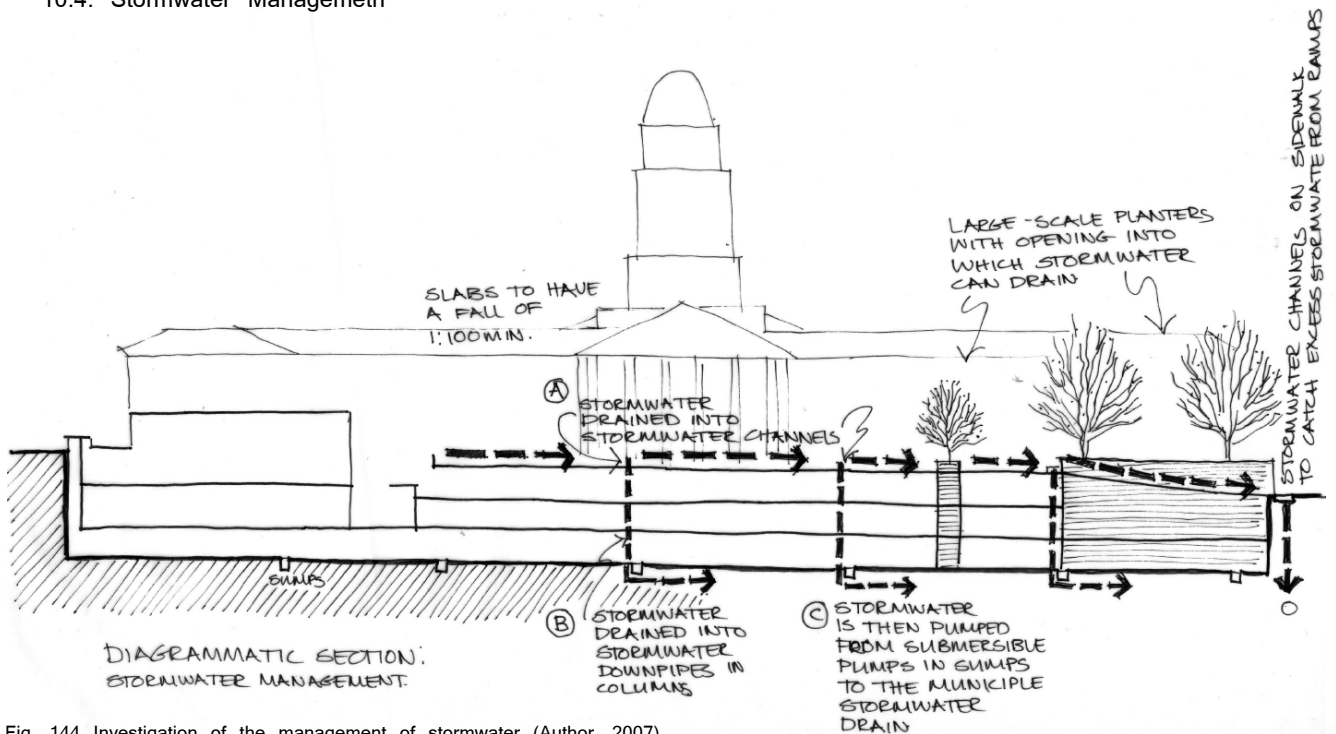


Fig. 144 Investigation of the management of stormwater (Author, 2007).

11. Design

11.1. Photo Montage

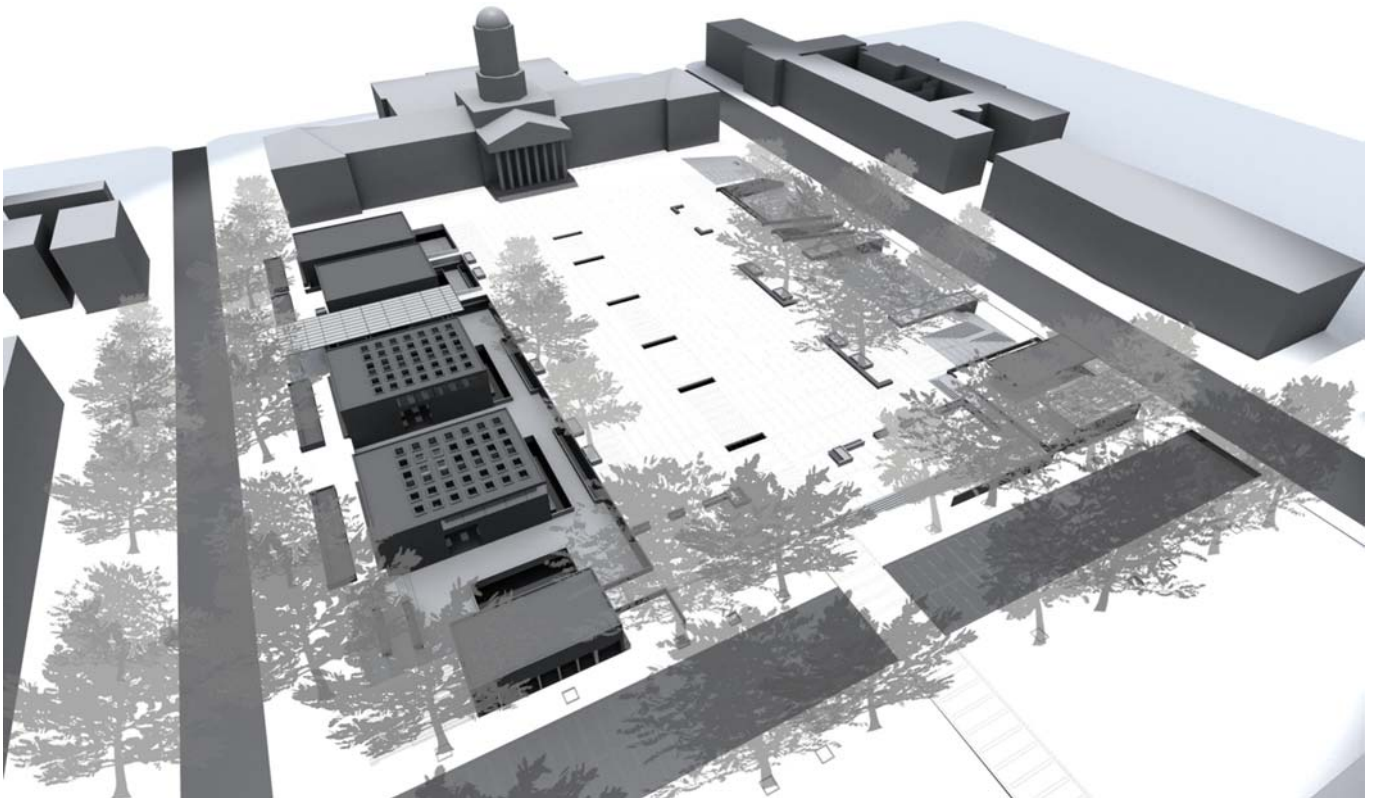


Fig. 145 An aerial view of the square (Author & Sackett, 2007).

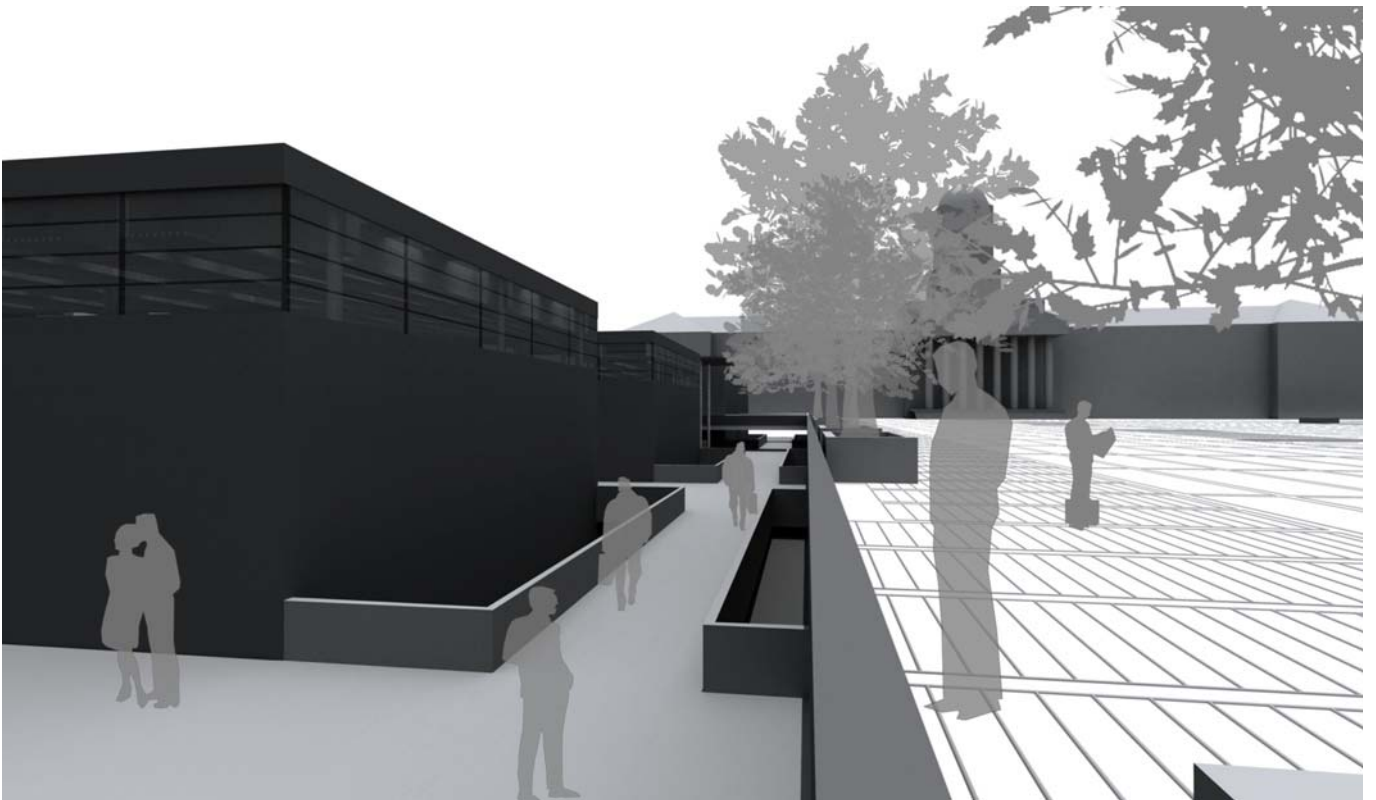


Fig. 146 A view from the Orientation Box (Author & Sackett, 2007).



Fig. 147 A view of the orientation and Information Boxes from the corner of Paul Kruger Street and Minnaar Street (Author & Sackett, 2007).

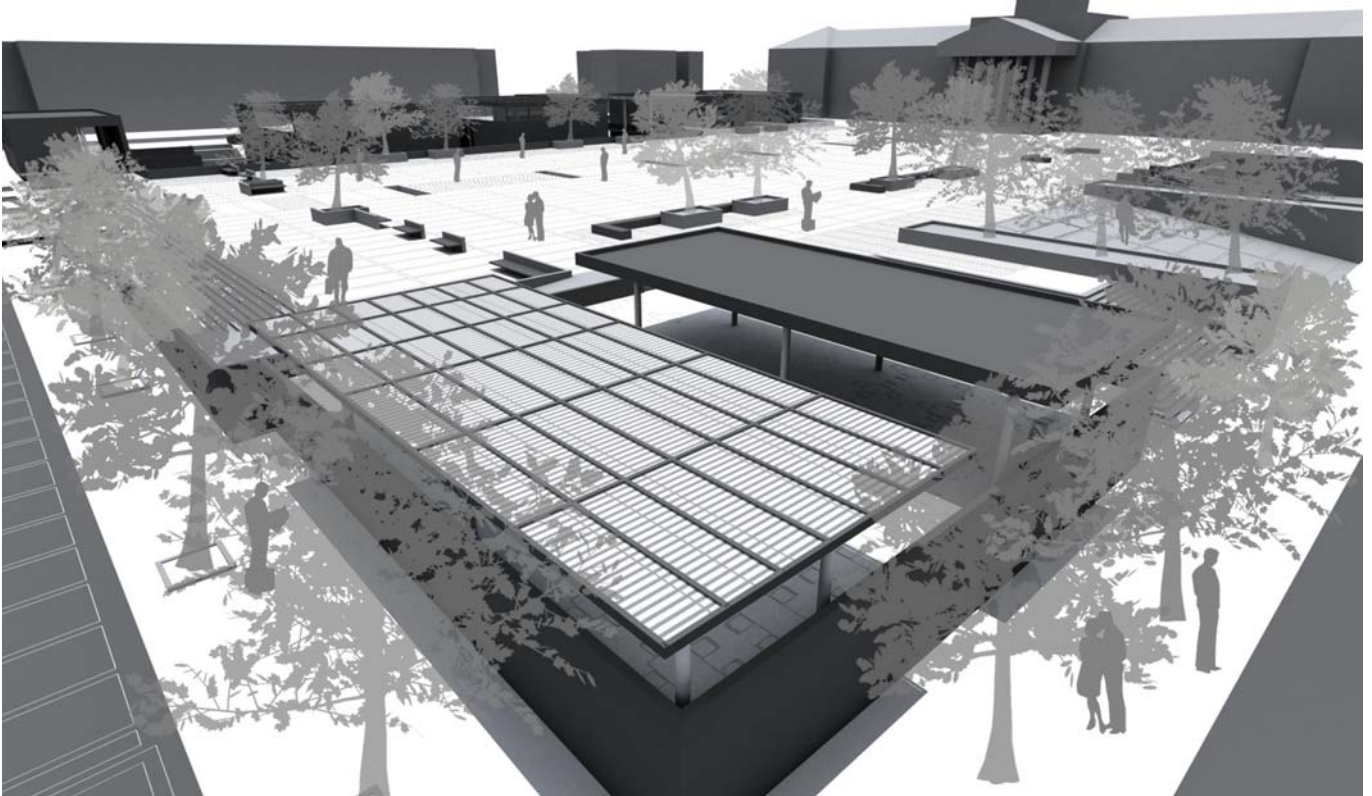


Fig. 148 A view of the Mixing Box (restaurant) from the corner of Paul Kruger Street and Visagie Street (Author & Sackett, 2007).



Fig. 149 A view of the entrance to the underground parking garage on Visagie Street (Author & Sackett, 2007).

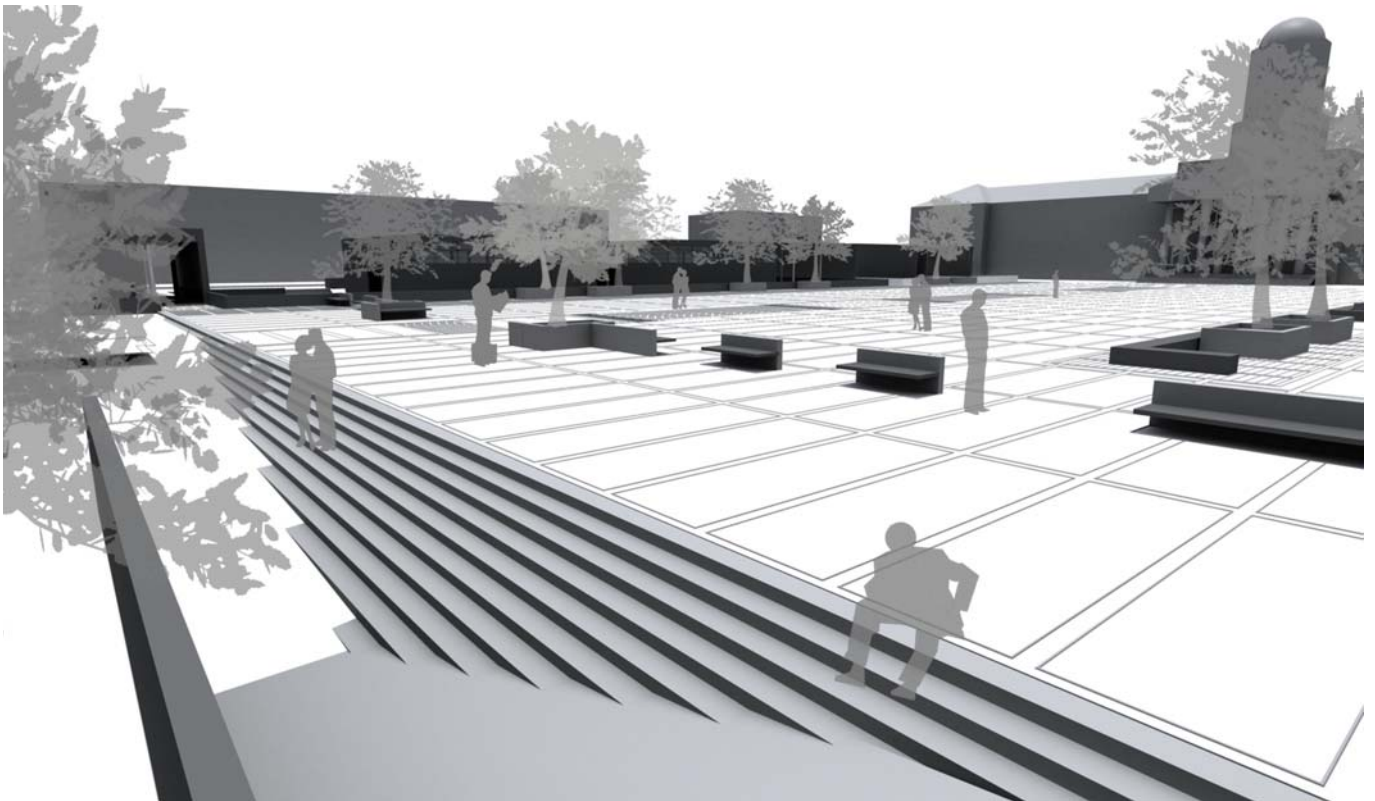


Fig. 150 A view of the stramp and the square from Paul kruger Street (Author & Sackett, 2007).

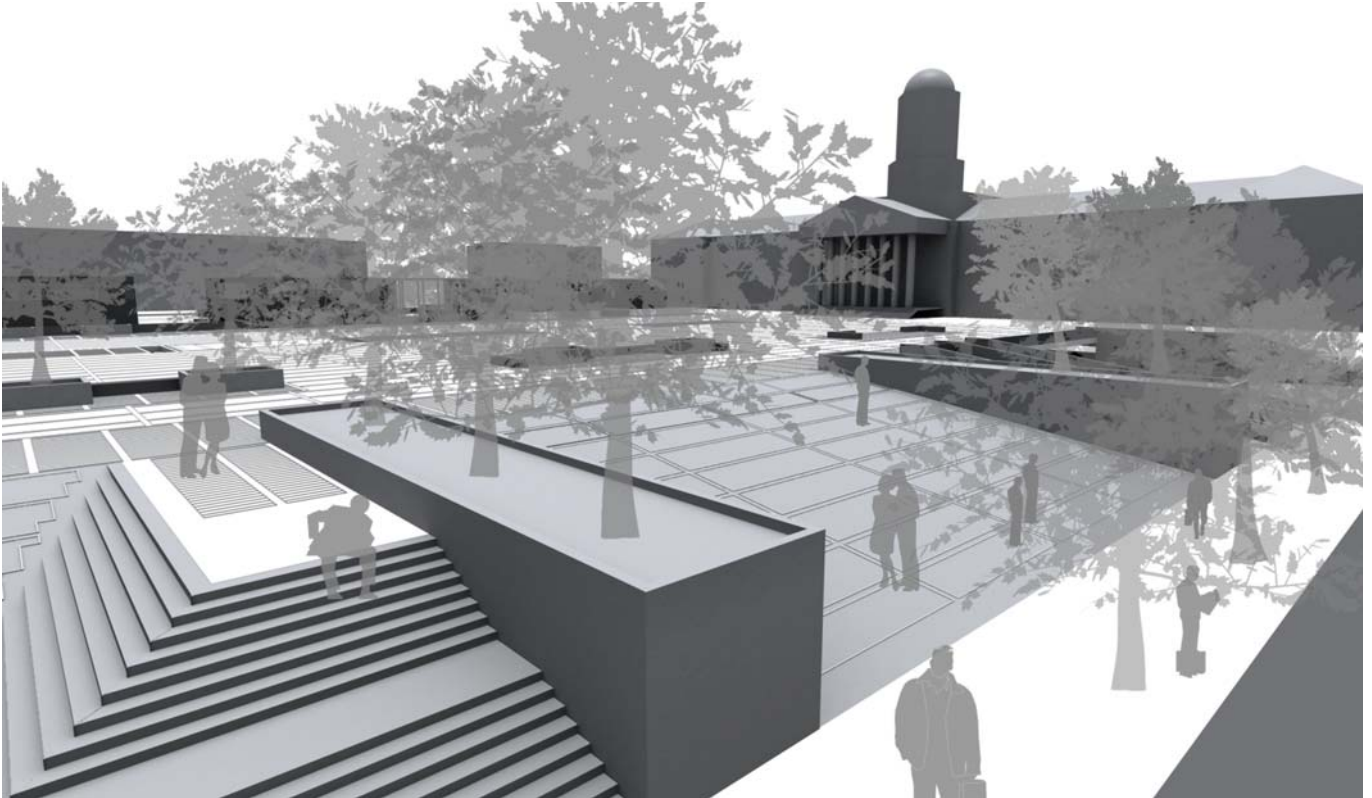


Fig. 151 A view of the square along Visagie Street (Author & Sackett, 2007).



Fig. 152 An interior view of the skylights and timber screens in the Information and Exhibition Boxes (Author & Sackett, 2007).

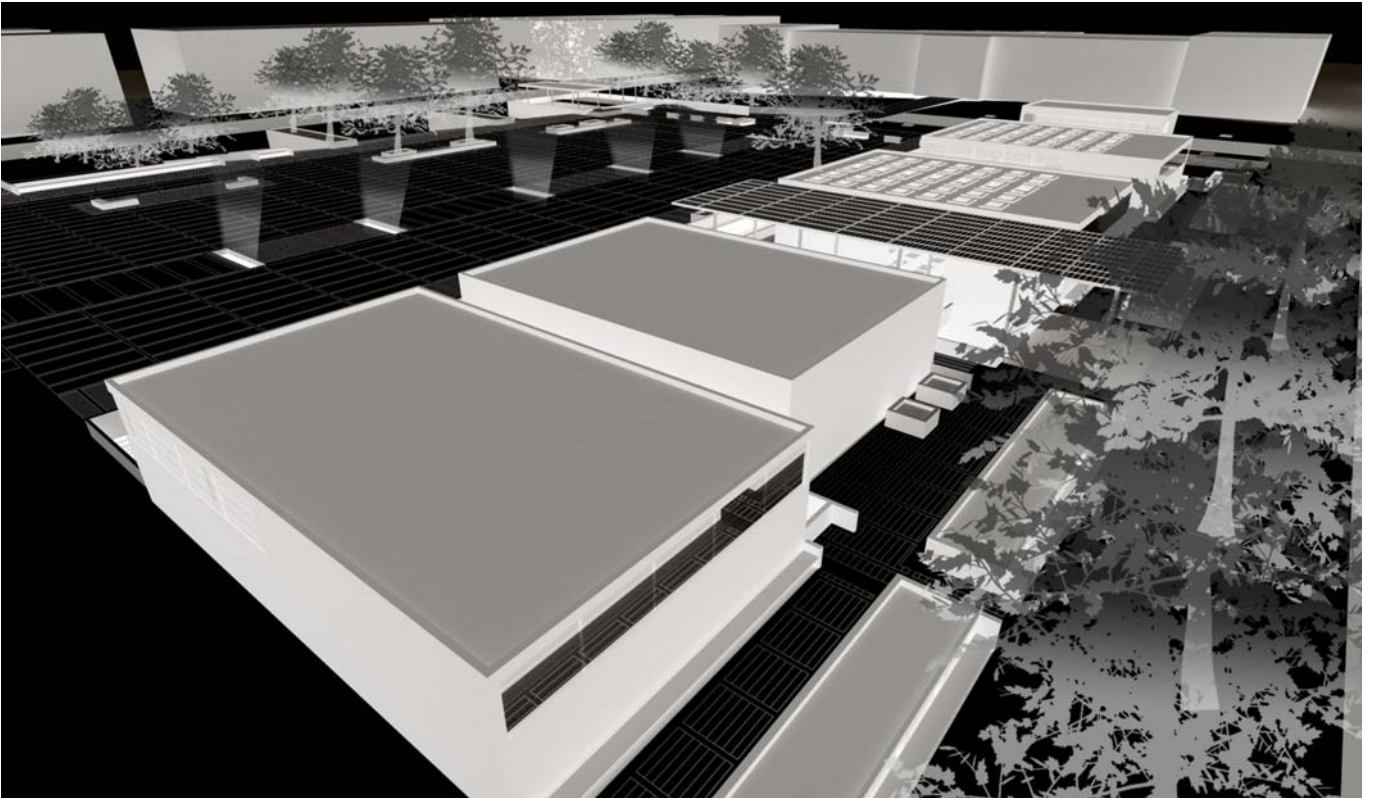
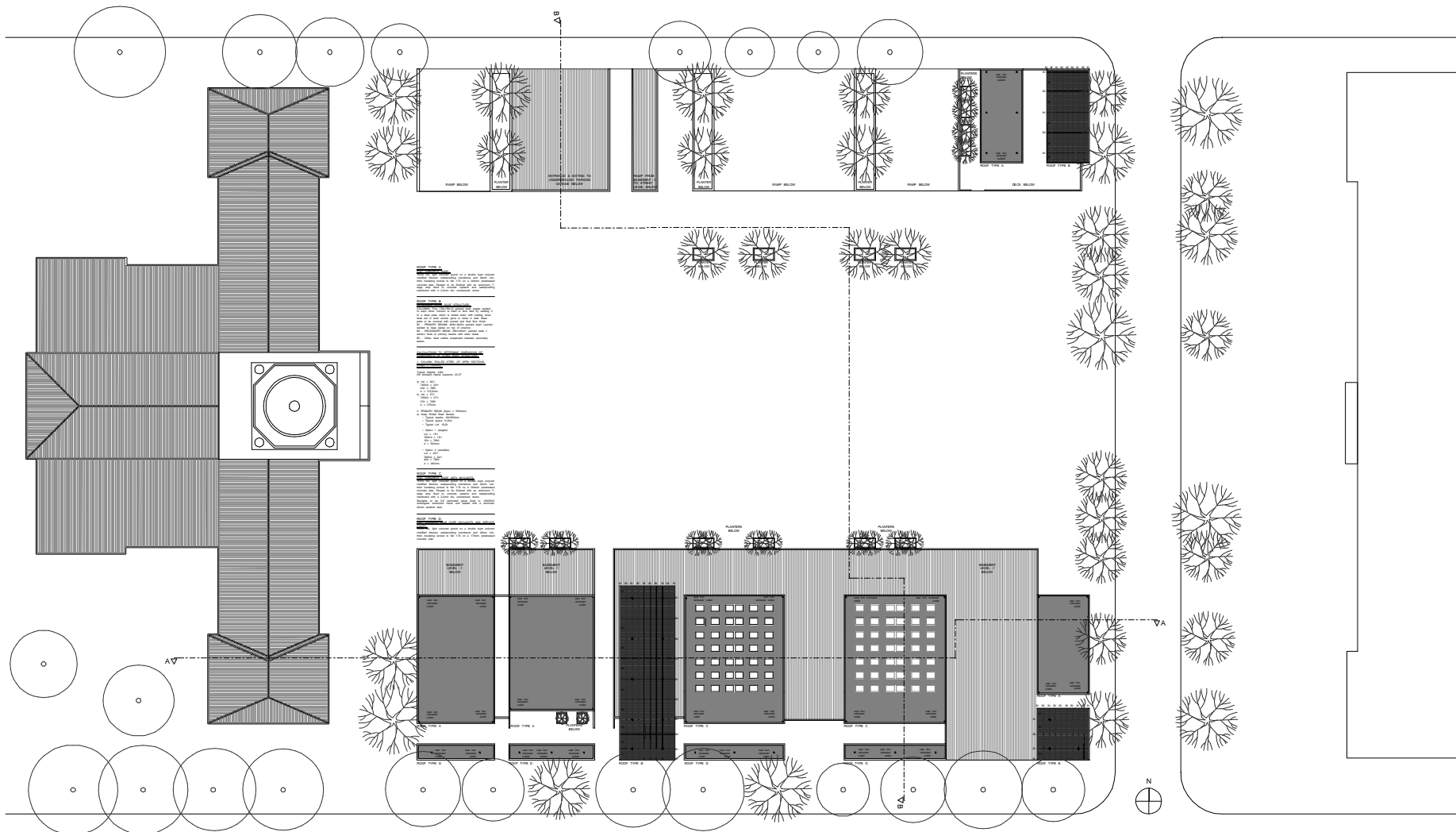


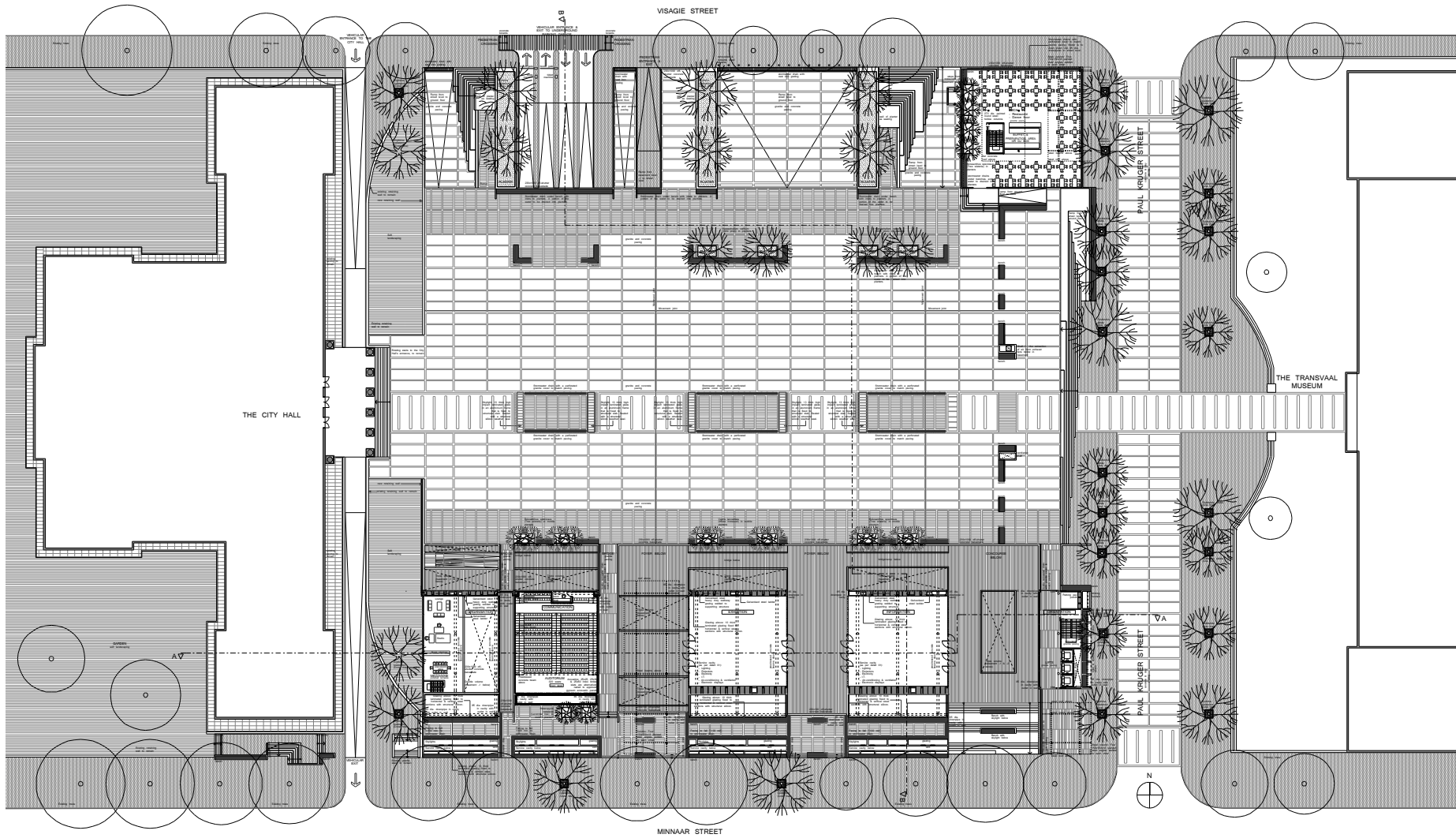
Fig. 153 A view of the skylights on the square (Author & Sackett, 2007).



Legend

1. Roof Type A
 2. Roof Type B
 3. Roof Type C
 4. Roof Type D
 5. Roof Type E
 6. Roof Type F
 7. Roof Type G
 8. Roof Type H
 9. Roof Type I
 10. Roof Type J
 11. Roof Type K
 12. Roof Type L
 13. Roof Type M
 14. Roof Type N
 15. Roof Type O
 16. Roof Type P
 17. Roof Type Q
 18. Roof Type R
 19. Roof Type S
 20. Roof Type T
 21. Roof Type U
 22. Roof Type V
 23. Roof Type W
 24. Roof Type X
 25. Roof Type Y
 26. Roof Type Z
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 28. Roof Type AB
 29. Roof Type AC
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 33. Roof Type AG
 34. Roof Type AH
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 38. Roof Type AL
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 41. Roof Type AO
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 548. Roof Type UB
 549. Roof Type UC
 550. Roof Type UD
 551. Roof Type UE
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 554. Roof Type UH
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 556. Roof Type UJ
 557. Roof Type UK
 558. Roof Type UL
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 563. Roof Type UQ
 564. Roof Type UR
 565. Roof Type US
 566. Roof Type UT
 567. Roof Type UU
 568. Roof Type UV
 569. Roof Type UW
 570. Roof Type UX
 571. Roof Type UY
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 573. Roof Type VA
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 581. Roof Type VI
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 617. Roof Type WS
 618. Roof Type WT
 619. Roof Type WU
 620. Roof Type WV
 621. Roof Type WW
 622. Roof Type WX
 623. Roof Type WY
 624. Roof Type WZ
 625. Roof Type XA
 626. Roof Type XB
 627. Roof Type XC
 628. Roof Type XD
 629. Roof Type XE
 630. Roof Type XF
 631. Roof Type XG
 632. Roof Type XH
 633. Roof Type XI
 634. Roof Type XJ
 635. Roof Type XK
 636. Roof Type XL
 637. Roof Type XM
 638. Roof Type XN
 639. Roof Type XO
 640. Roof Type XP
 641. Roof Type XQ
 642. Roof Type XR
 643. Roof Type XS
 644. Roof Type XT
 645. Roof Type XU
 646. Roof Type XV
 647. Roof Type XW
 648. Roof Type XX
 649. Roof Type XY
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 651. Roof Type YA
 652. Roof Type YB
 653. Roof Type YC
 654. Roof Type YD
 655. Roof Type YE
 656. Roof Type YF
 657. Roof Type YG
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 659. Roof Type YI
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 698. Roof Type ZV
 699. Roof Type ZW
 700. Roof Type ZX
 701. Roof Type ZY
 702. Roof Type ZZ

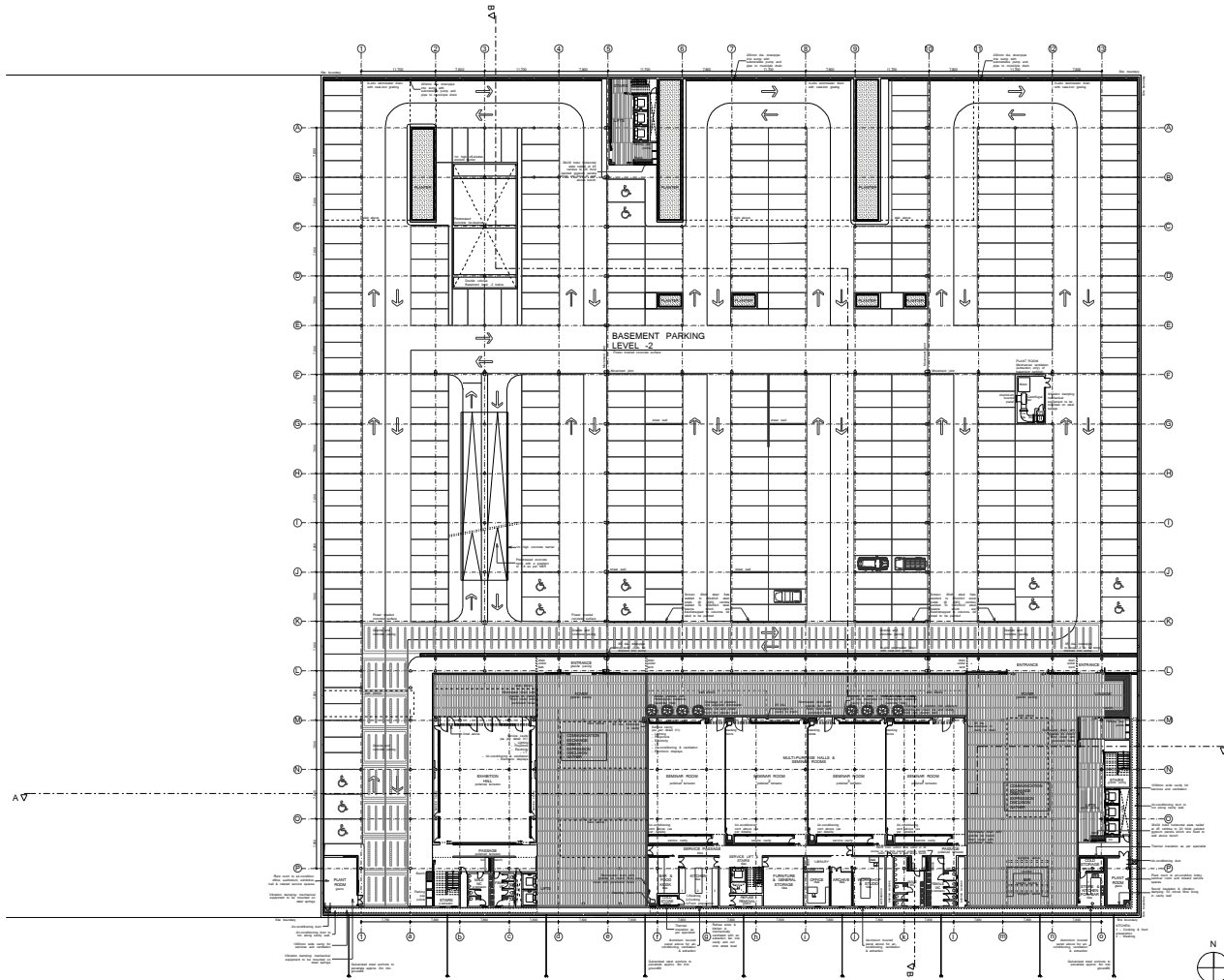
ROOF PLAN 1:500



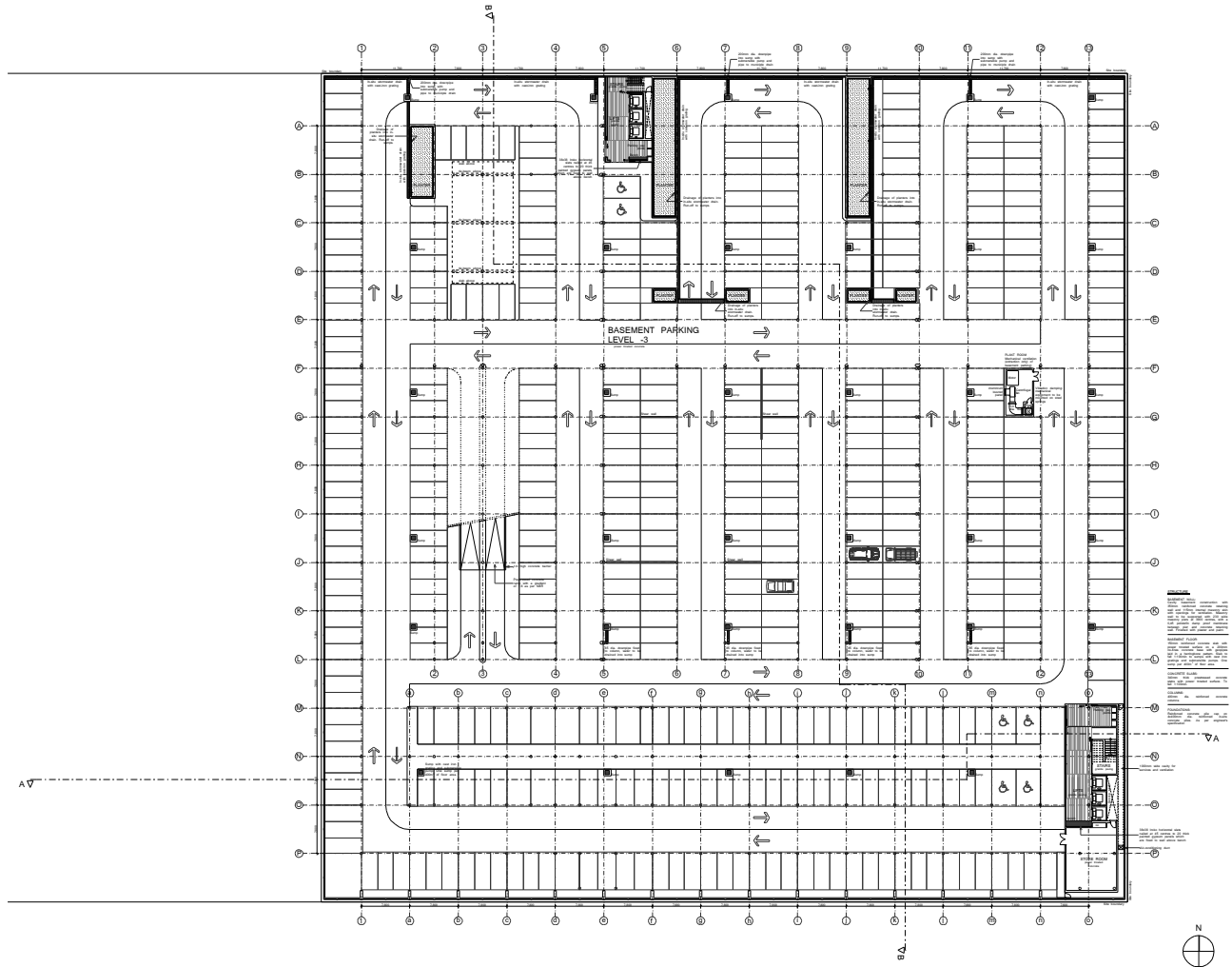
GROUND FLOOR PLAN 1:500



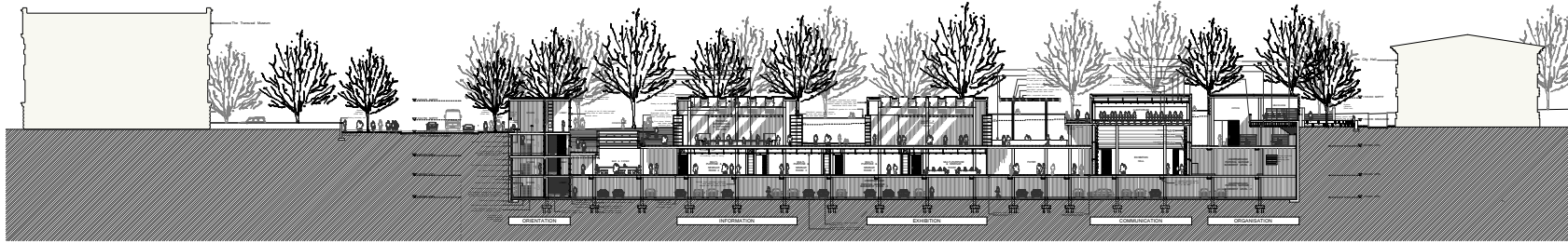
BASEMENT -1 FLOOR PLAN 1:500



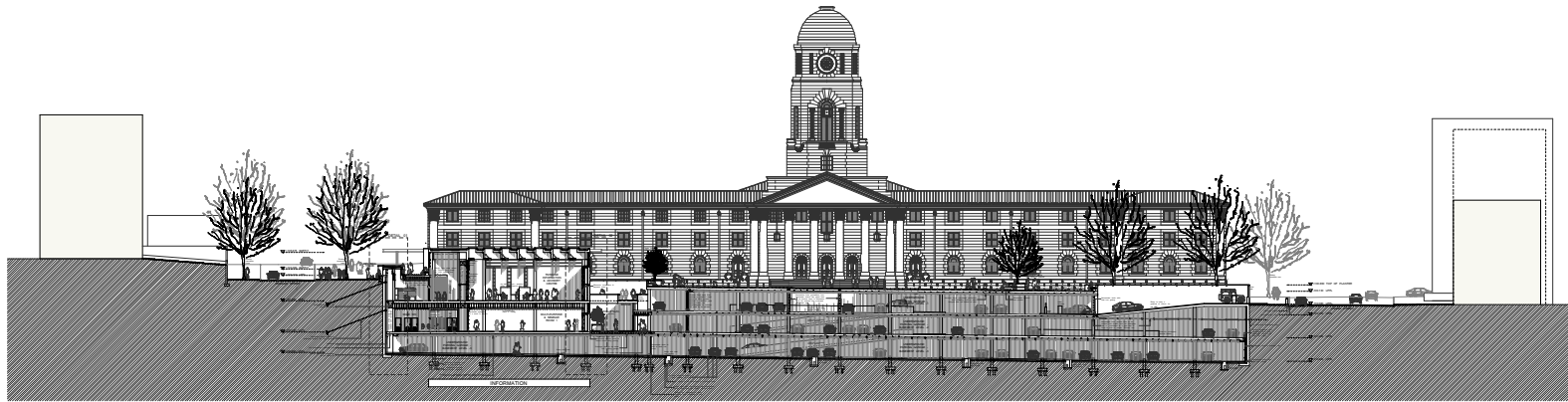
BASEMENT -2 FLOOR PLAN 1:500



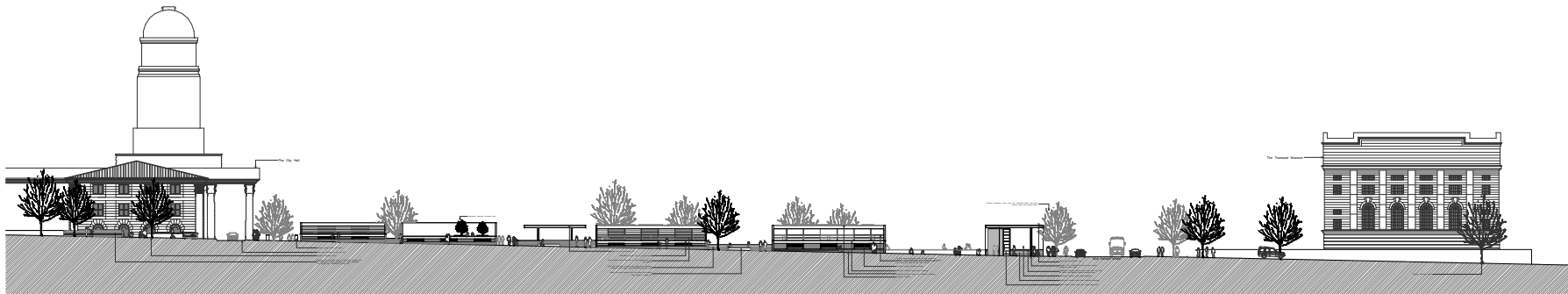
BASEMENT -3 FLOOR PLAN 1:500



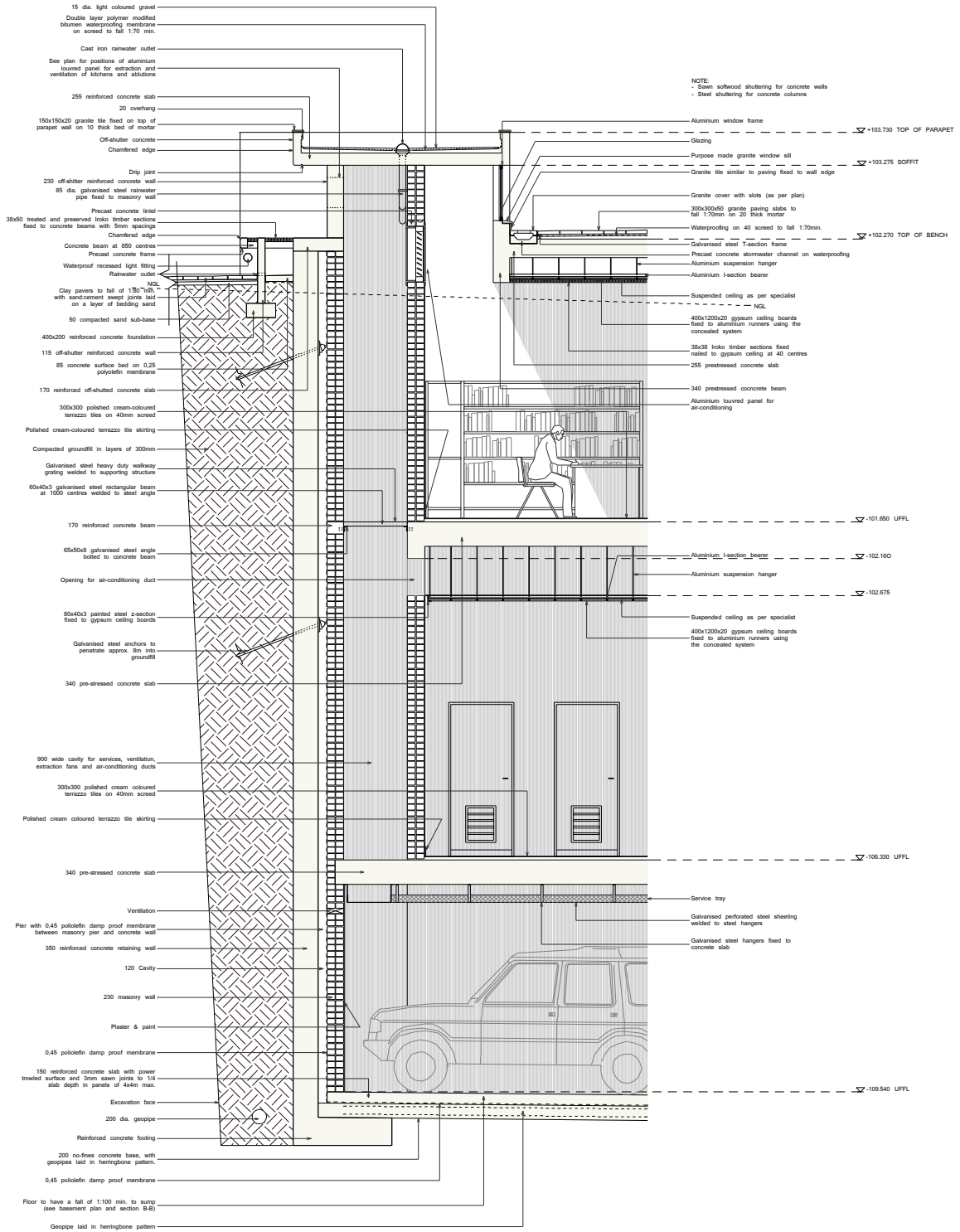
SECTION A-A 1:500



SECTION B-B 1:500



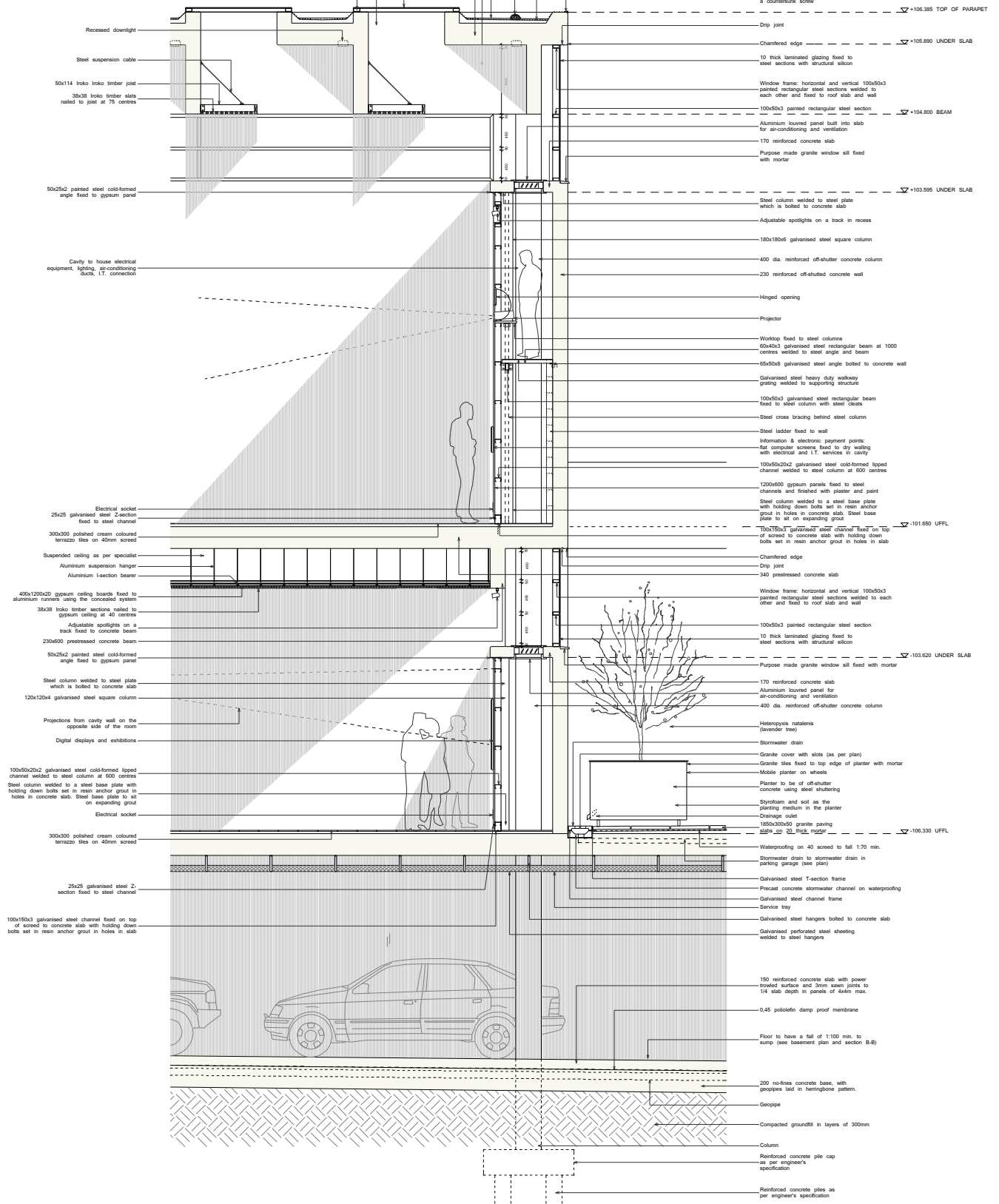
SOUTH ELEVATION 1:500





<p>BEAM TO SUPPORT TIMBER CEILING (Span = 7200mm)</p> <p>OPTION 1: STEEL - Wide Flange Rolled Steel Section</p> <p>Typical depth: 100-500mm Typical spans: 6-14m Typical L/c: 20-30</p> <p>a) L/d = 20/1 1500x6 = 20/1 20d = 7400 d = 370mm</p> <p>b) L/d = 30/1 1500x9 = 30/1 30d = 7400 d = 247mm</p>	<p>STEEL COLUMN IN CAVITY (Height = 5100mm)</p> <p>OPTION 1: Rolled Steel Hollow Section</p> <p>Typical heights: 2-8m H/c between lateral supports: 20-35</p> <p>a) L/d = 20/1 5100x6 = 20/1 20d = 6100 d = 255mm</p> <p>b) L/d = 35/1 5100x9 = 35/1 35d = 6100 d = 146mm</p>
<p>REINFORCED CONCRETE COLUMN (Height = 6340mm)</p> <p>Typical heights: 2-8m H/c between lateral supports: 6-16</p> <p>a) L/d = 6/1 6340x6 = 6/1 6d = 6340 d = 1056mm</p> <p>b) L/d = 15/1 6340x9 = 15/1 15d = 6340 d = 396mm</p>	<p>PRESTRESSED FLAT CONCRETE SLAB (Span = 7200mm)</p> <p>Typical depth: 100-300mm Typical spans: 2-7m Typical L/c: 22-32</p> <p>a) L/d = 22/1 7800x6 = 22/1 22d = 7800 d = 355mm</p> <p>b) L/d = 32/1 7800x9 = 32/1 32d = 7800 d = 243mm</p>

NOTE:
- Sawn soffwood shuttering for concrete walls
- Steel shuttering for concrete columns



DETAIL 02 (N.T.S)

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