Technical approach and solution of the intervention at the Pretoria Magistrates Court

CHAPTER 12.

Technical development

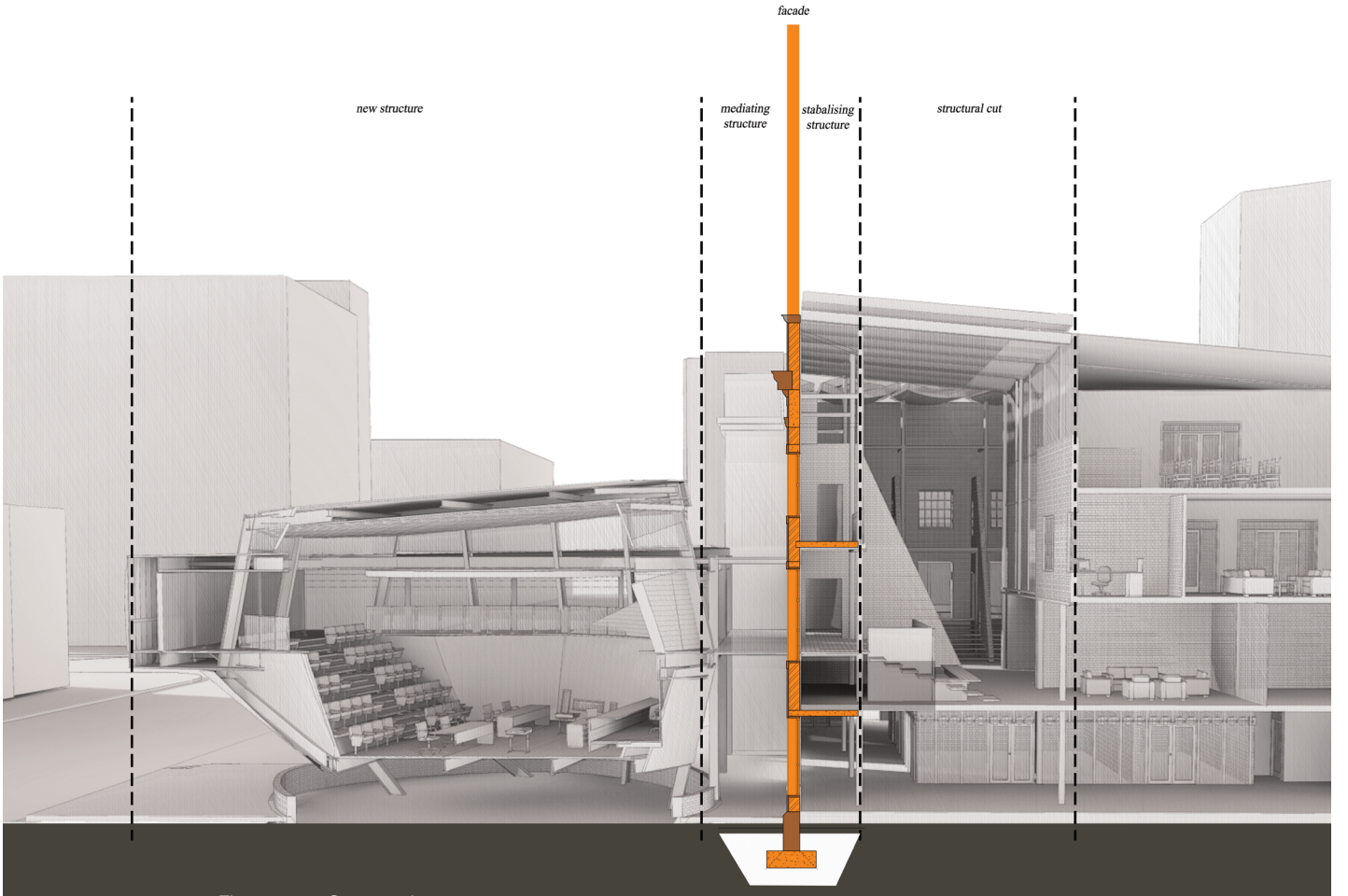


Figure 12_1 Structural strategy

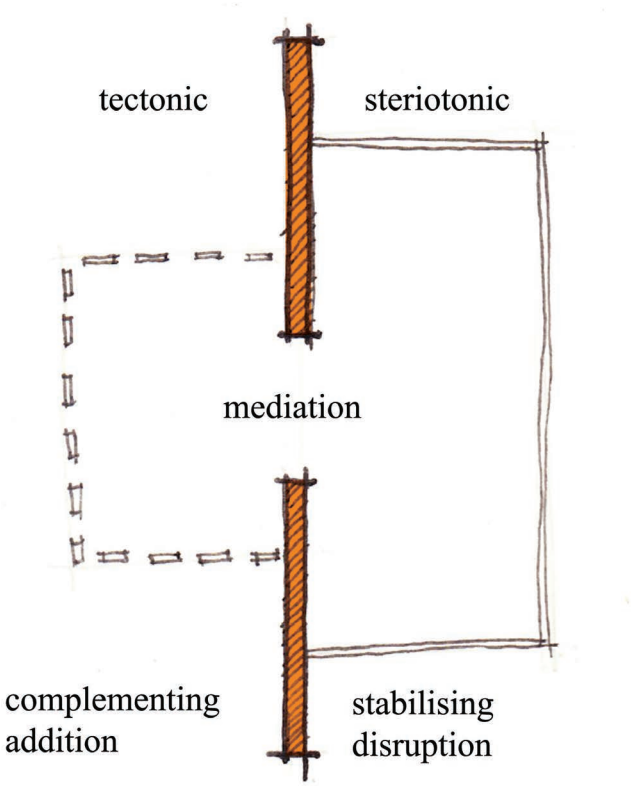


Figure 12_2 Structure concept diagram

The technical development of this project focused on the area around the western façade. This are stretches from the newly created circulation and waiting space where the existing fabric was strategically demolished, moving through the façade which becomes the mediator between the old spaces and new editions towards the newly added courts.

The main concept of this engagement remains with the mediation between dissonant elements. In the physical built fabric this is the mediation between old and new, the structural and material tension between what is existing and what is new.

In this engagement there is structured in the following way:

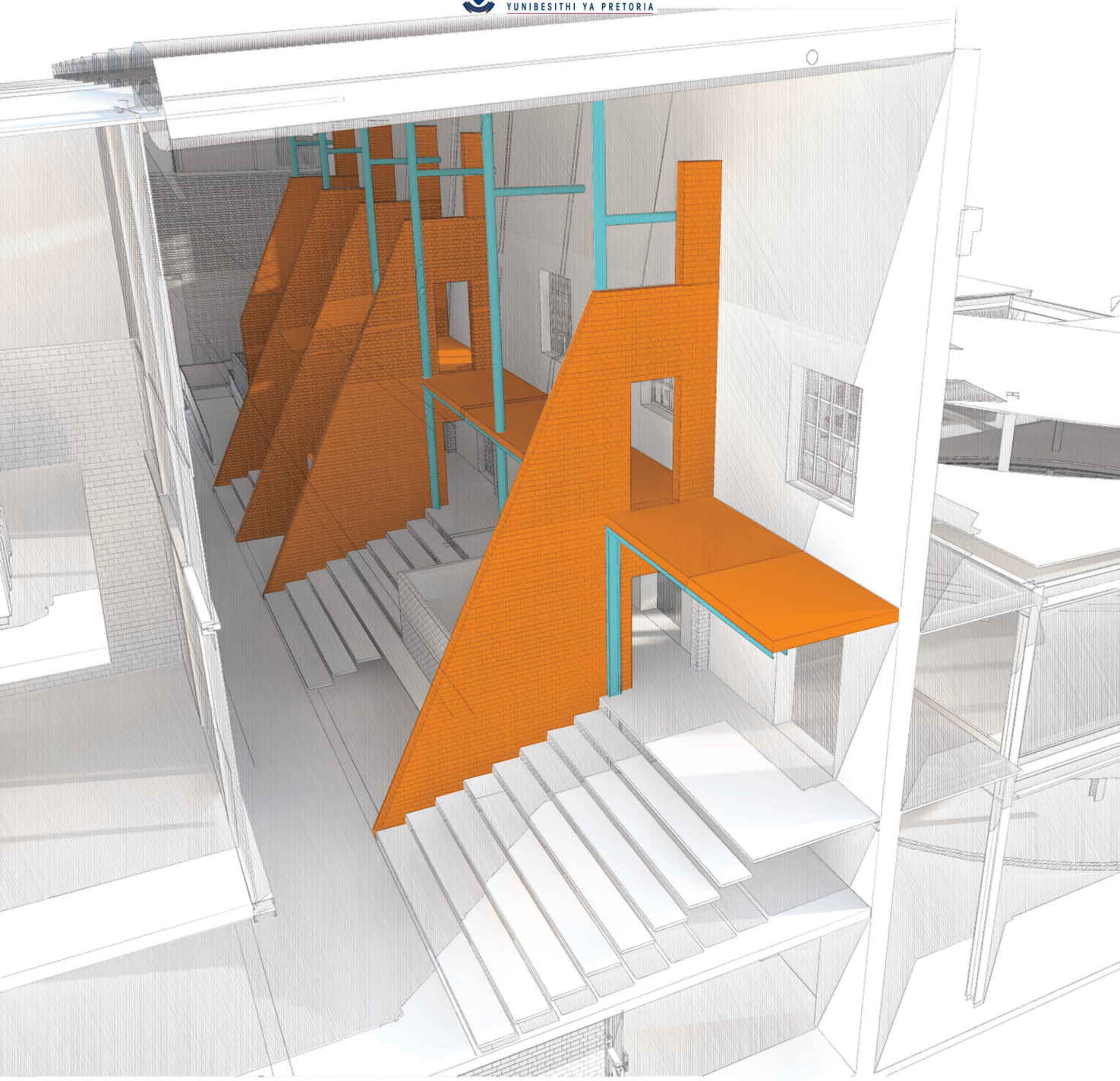


Figure 12_3 Existing and supporting steel structure

THE EXISTING BUILDING

The first, which deals with the interior, is one of adaptive reuse intervention with the aim of facilitating new use and relevance. Since the interior of the building is so severely disrupted, the approach is not one of material sensitivity but firm engagement. Connections are bold and visible and yet they pull away from the material they connect to, in order to celebrate the connection.

The steel members are painted gloss black in order communicate visible structure without becoming the focus and relate back to the burned fabric of the existing building. Disruption brought about resilient new intervention. This structure erected here is to aid in the stabilisation of the existing façade, facilitate movement and to support the newly installed transparent ETFE-roof.

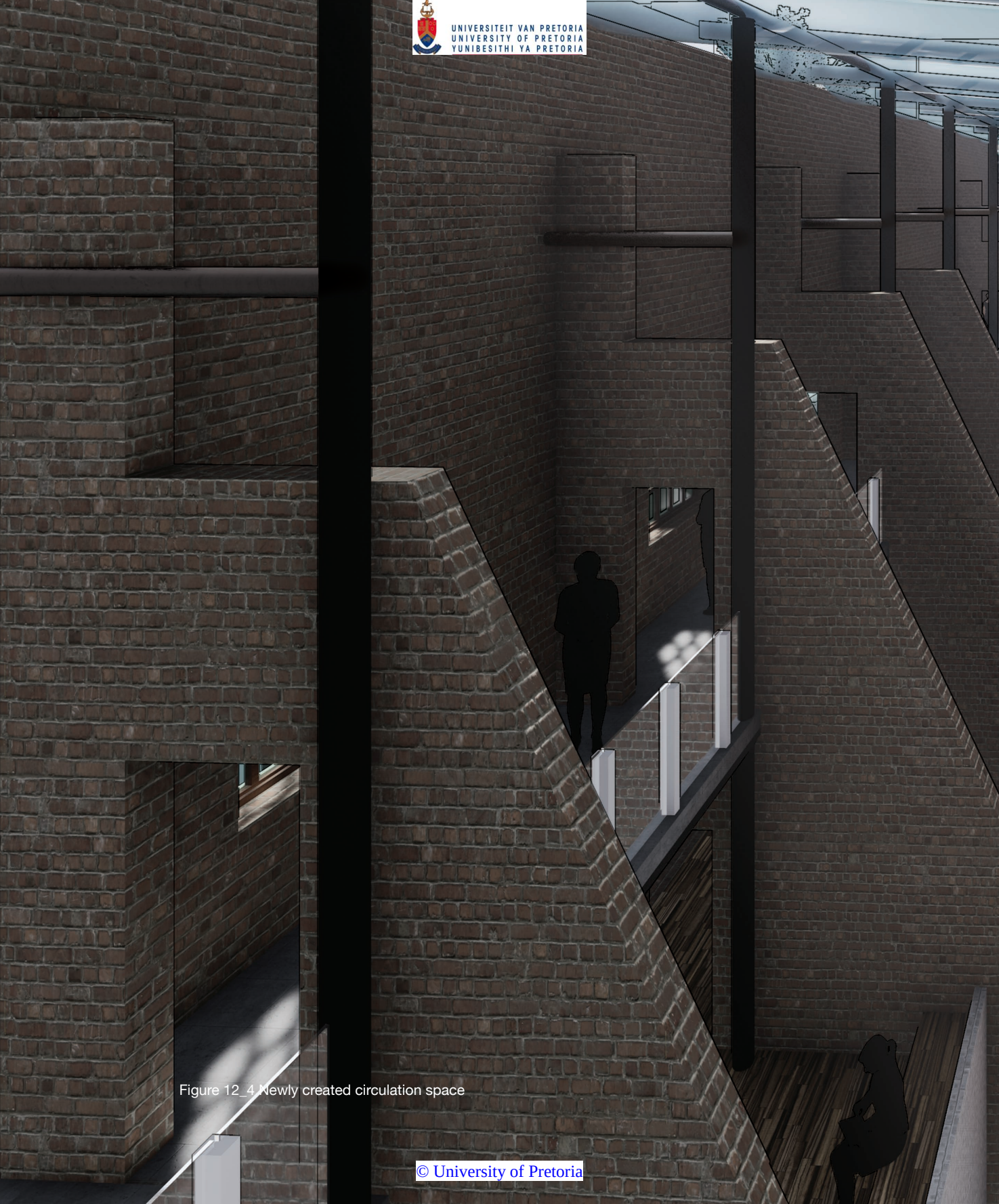
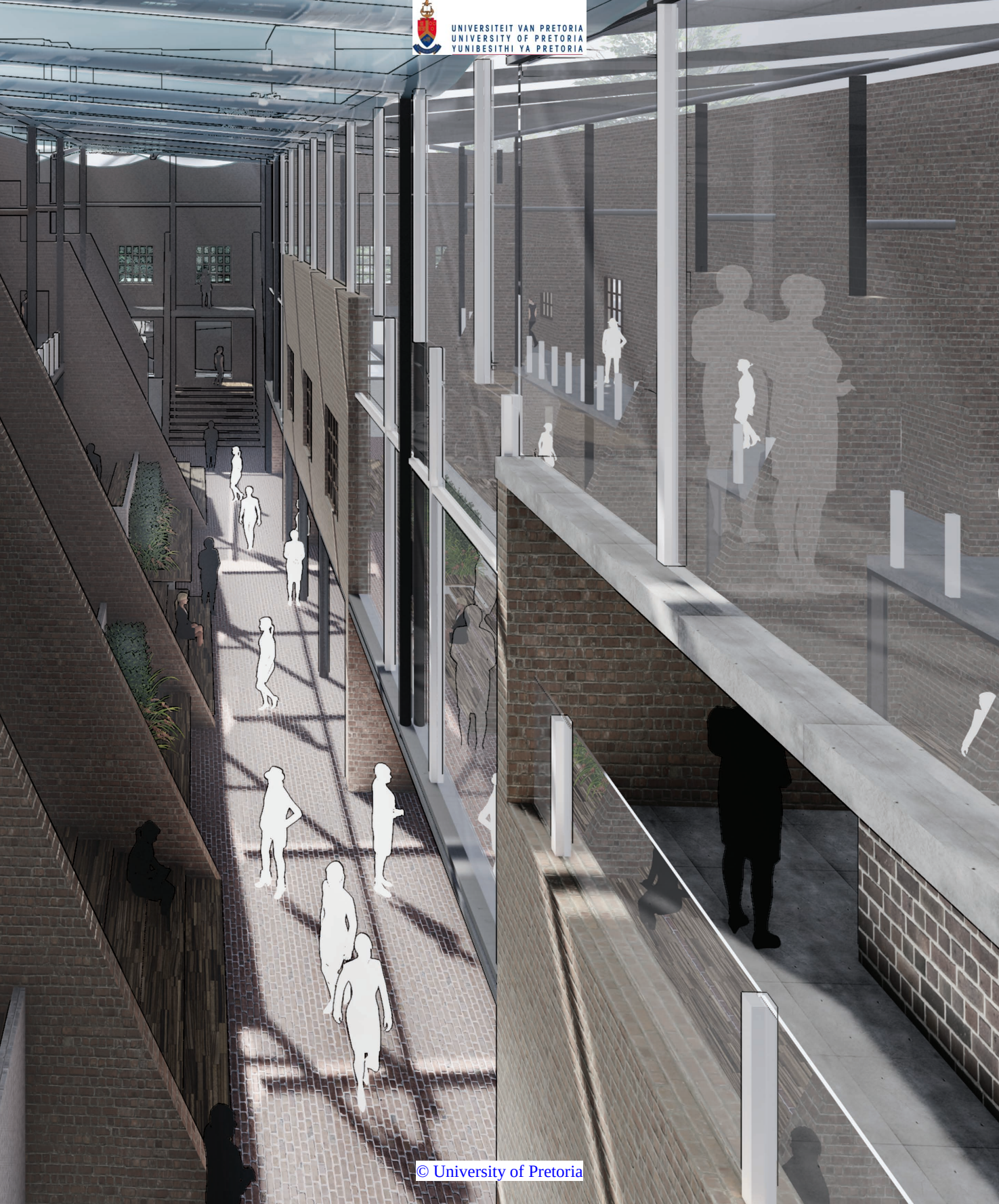


Figure 12_4 Newly created circulation space



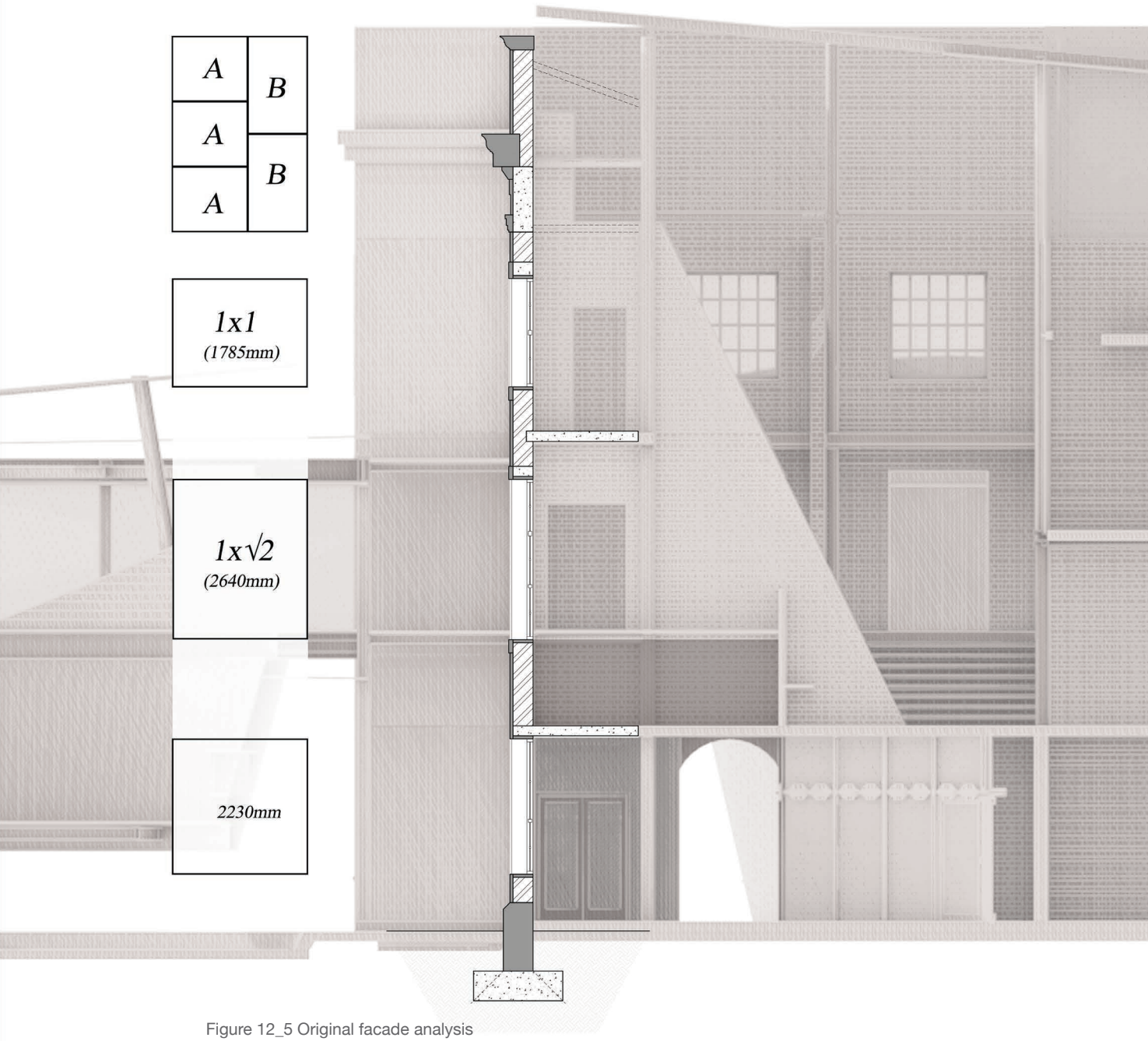


Figure 12_5 Original facade analysis

Structural system

The main structure here remains the existing building as it has met the structural requirements for 75 years. It is made up of a concrete beam structure and structural brick, cladded with marble.

The steel substructure then becomes secondary structure to support the existing as well as elevating the pressure of the new interventions on the existing structure. The tertiary structure then consists of the connections between old and new and the surfaces that accommodates circulation.

Materiality

Because of the extensive disruption in the interior and the removal of the plaster, the materiality is that of exposed brick with many imperfections and stains. Together with this, many burn marks remain.

The newly installed structure will be painted gloss black and the flooring material will consist of laminated timber, treated for wearing. The glazing of the added spaces adjacent to the façade will be reflective, so that this condition be reflected unto itself and to increase the feeling op spaciousness.

THE EXISTING FACADE

In this engagement the façade is used as mediating spatial element through which movement is facilitated. The built fabric left intact acts as stabilising buttresses while the secondary structure compensates for any shortfalls. Both public and magistrate moves through the façade towards the new courts. In order to accomplish this movement the first floor windows are transformed into door openings, without doors, since their dimensions (1650x2650mm) allow for this. Only one window opening is enlarged, in order to facilitate magistrate movement on the second floor.

Materiality

The façade on one side is made up of exposed bricks with imperfections and burn marks, but as you pass through this condition the cladding on the exteriors starts to become apparent. Here it is cladded with sunlit beige marble, fixed with copper clamps to the brick structure.

Figure 12_6 Mediating steel structure

MEDIATING STRUCTURE

The exterior of this façade constitutes a second heritage approach. Here the marble cladding is intact and untouched by the disruptions that happened on the interior. Thus the approach here is to touch the façade as lightly as possible and avoid any connections that might damage the cladding. In order to facilitate the movement between the old façade and the new structure, a mediating structure is cantilevered from the new structure. This glass and steel structure doesn't touch the existing façade and aims to obscure as little of the view of this façade.

Structural system

The primary structure is the square hollow sections that span the cantilever and carries the rest of the structure. The secondary structure consists of the steel angle irons that forms a grid and support the structural glass in order to achieve its spans and the Z-lipped cold-rolled sections that supports the secondary glass leaf. Lastly the tertiary structure is the 45mm laminated structural glazing that carries the foot traffic towards the court.

Materiality

Here the steel is painted gloss white in order to relate to the marble façade and yet be differentiated from it. The glass is left naturally transparent as to simplify the colour addition to the exterior.

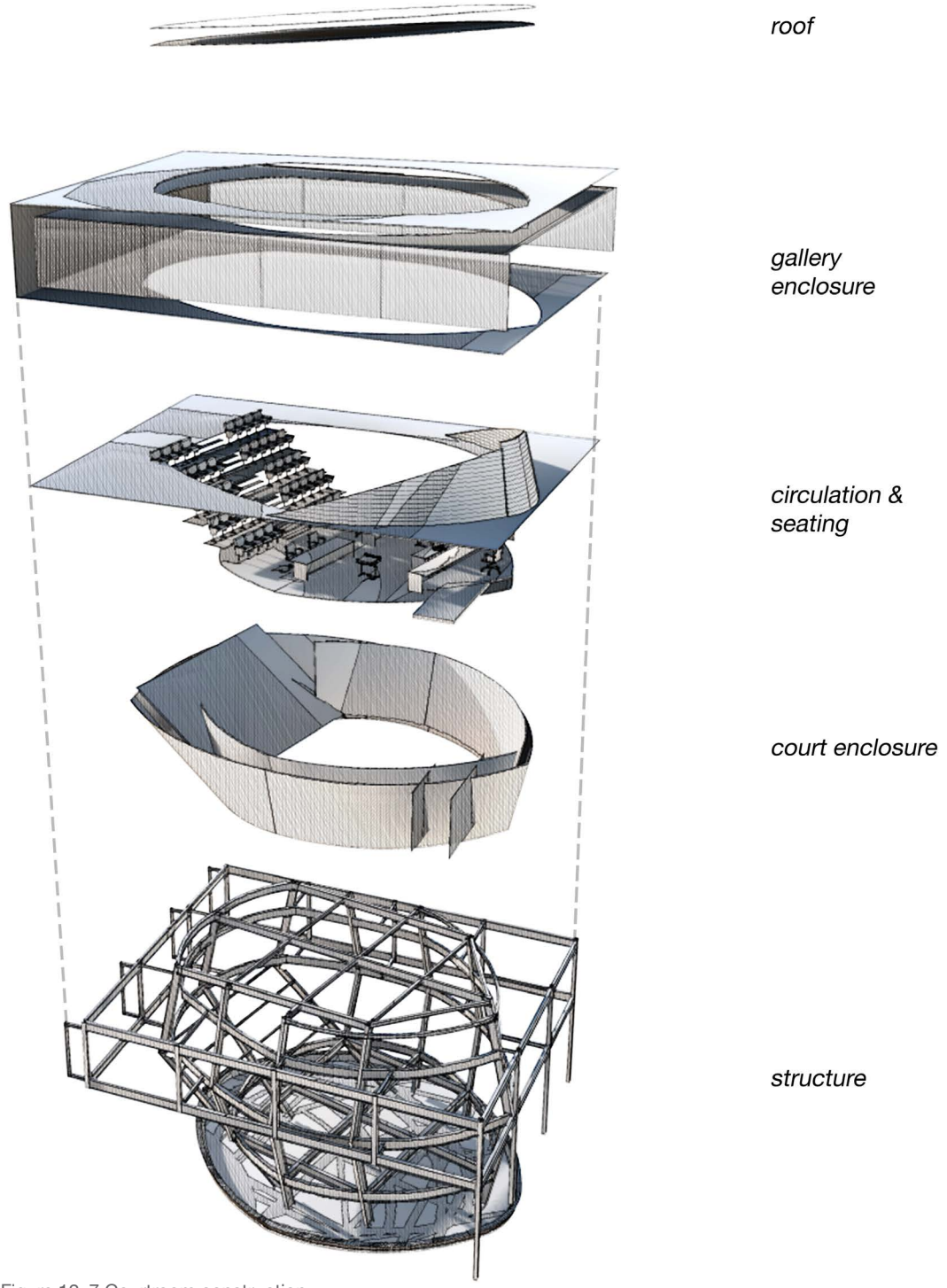


Figure 12_7 Courtroom construction

THE NEW COURT

The new structure not only facilitates the added court spaces but also house the supporting systems and circulation. This structure is made up off three distinct parts which form the coherent whole.

GALLERY

Firstly there is the steel and glass box which extends from the façade and adheres to the classical grid which is derived from the existing. This structure defines the public circulation area as well as the public gallery.

Structural system

The primary structure is the I-sections that make up the beams and columns that is bolted together and forms the structure of the box. The secondary structure is then the cold-formed lipped channels that acts as purlins and the steel angle irons that facilitates the glazing system.

Materiality

The steel of the gallery structure will be painted gloss white, as all the steel on the exterior. In the interior of the building the flooring will be laminated timber and the ceilings finished matt white. The glazing remains natural transparent. On the exterior this box is cladded in the recycled marble from the intervention on the northern façade. This is mounted on a slanted steel substructure.

COURTS

Secondly the procedural court space drops below the box structure. This rounded organic shaped space facilitates the court procedure and is largely closed off from the existing environment. Its connection to the box is independent from its grid.

Conceptually this refers to the law that gives guidance and structure to society, but also the freedom we have within it to hold the judiciary to account. The design allows for diversity in the design, where on the other court this space is not suspended from the box but grounds it in the sidewalk.

Structural system

The primary structure consists of the continuation of the portal structure, made up out of I-beams. The secondary structure consists of timber beams which are curved to the shape of the court. This structure facilitates the tertiary structure which is made up from plywood boards on the exterior, carrying the copper sheeting, and the interior dry walling.

Materiality

While these spaces will have laminated timber flooring and white finished dry walling on the interior, it will be finished with copper sheeting on the outside, or constructed out of the recycled brick. This is determined by the position of the particular court.

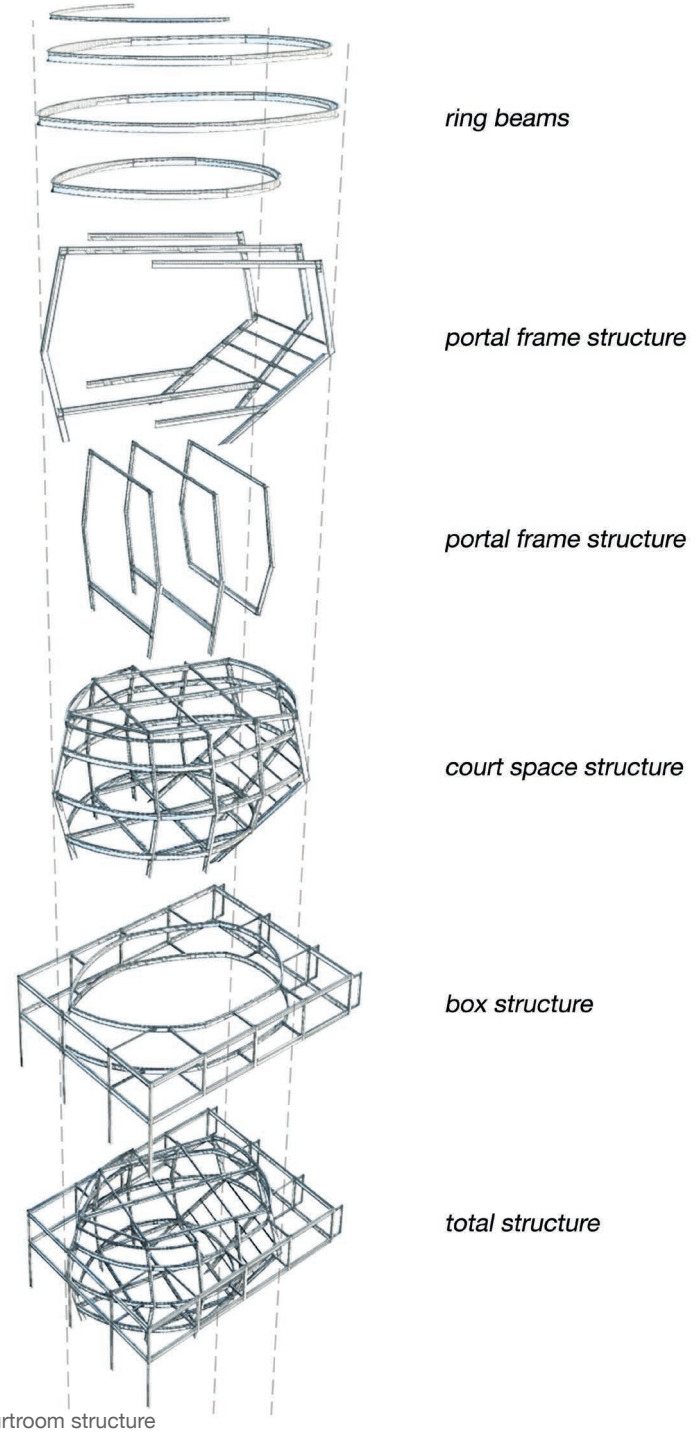


Figure 12_8 Courtroom structure

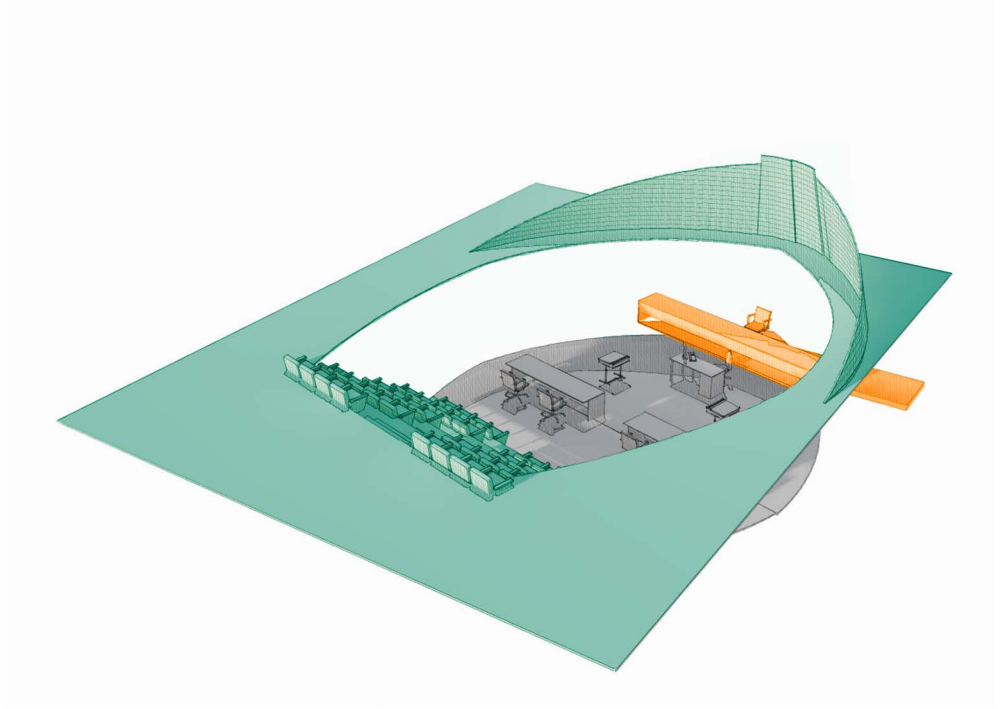


Figure 12_9 Courtroom circulation

Roof

Lastly the roof extends upwards from the box structure, slanting towards the west and opening up towards the existing building. The shape of the roof emulates the shape of the court and starts to disintegrate the space towards existing building, representing the completion of the spatial intervention.

Structural system

The roof structure is made of I-beams primarily, secondly the cold-rolled lipped channels and lastly from the Kliplok 700 sheeting.

Materiality

The roof sheeting will be simply finished in white, as to match the steel structure and to minimise heat gain. The acoustic ceiling below will be finished in matt white.

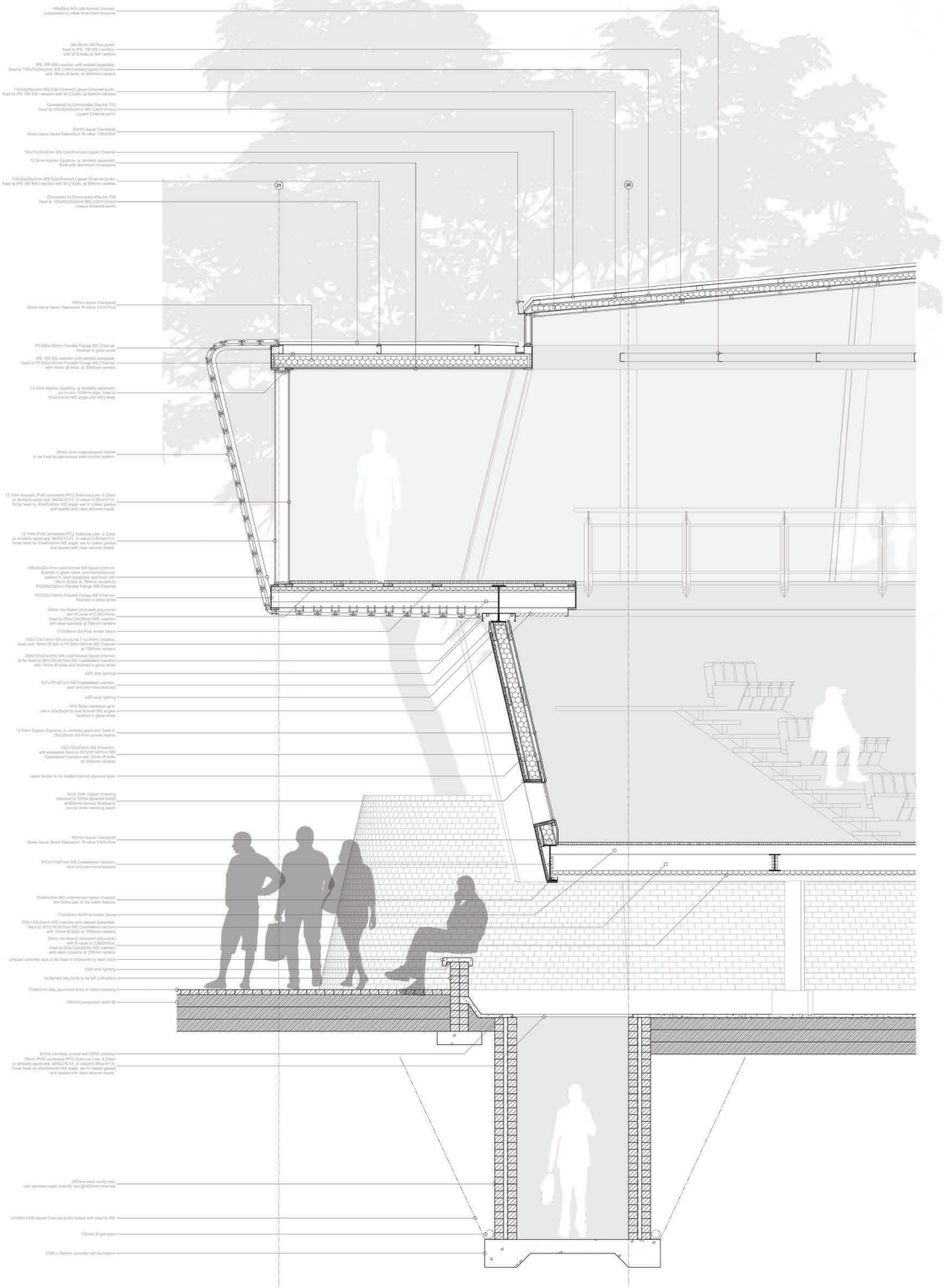


Figure 12_10 1:20 Detail section A-A Iteration 1

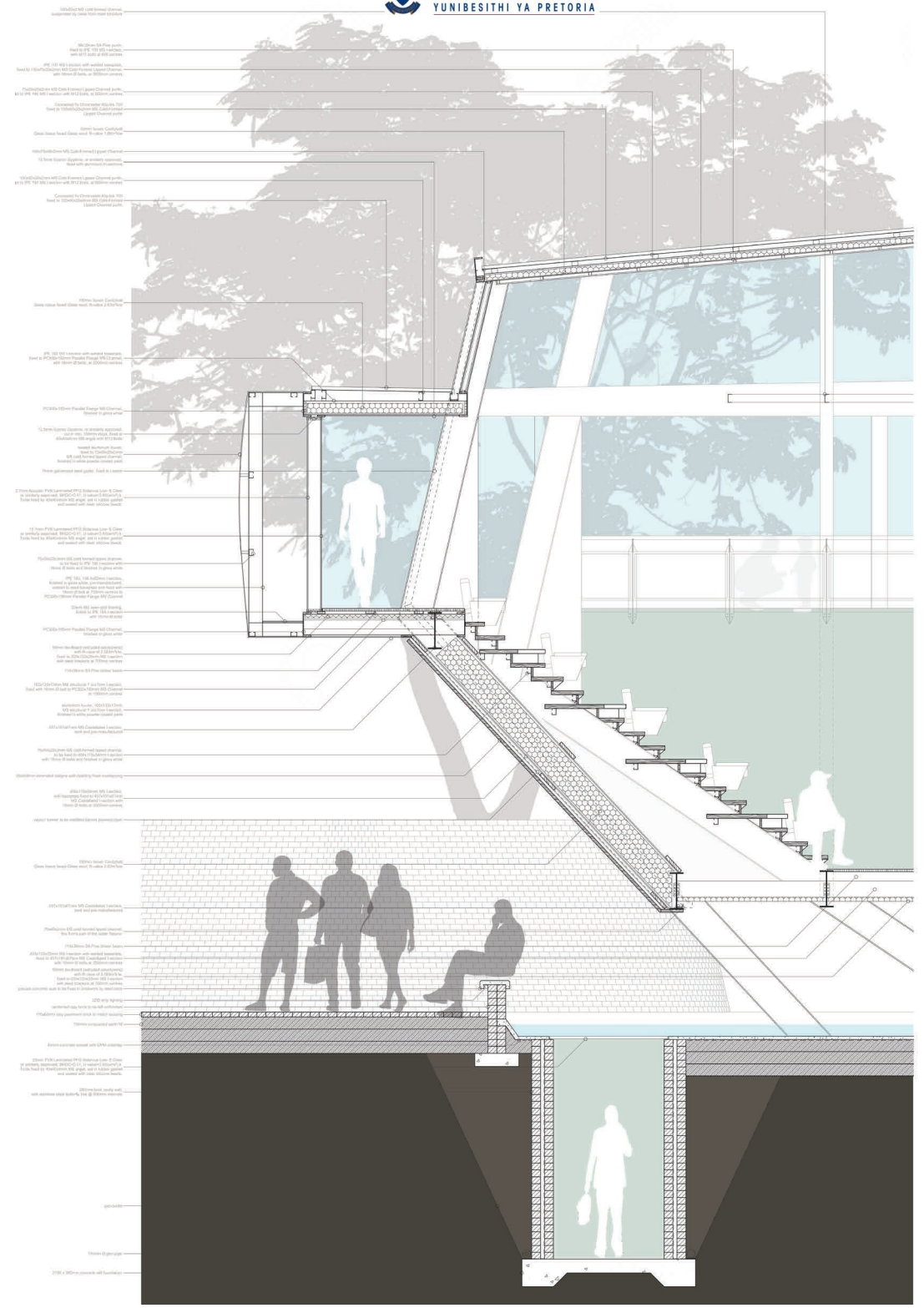
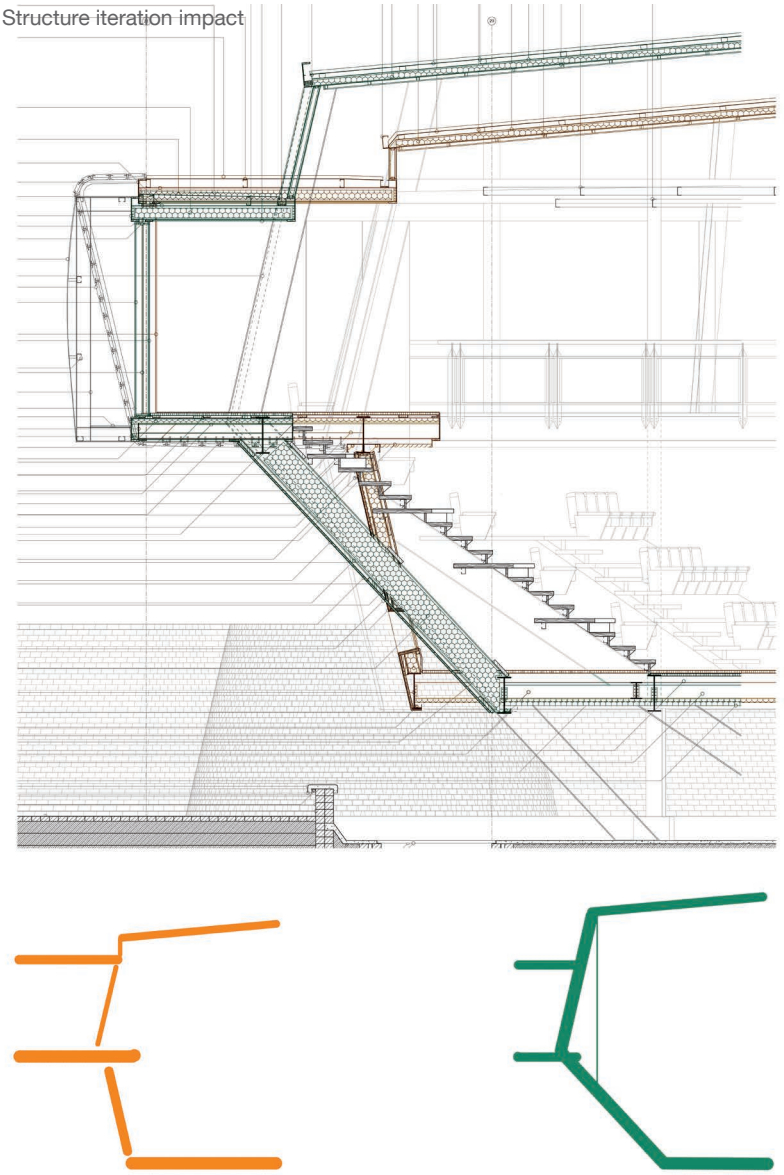


Figure 12_11 1:20 Detail section A-A Iteration 2

Figure 12_12 Structure iteration impact



COURT STRUCTURE

The previous structure was compiled out a various individual steel sections from different sizes. Thereby the structure was made unnecessarily complicated and the form fragmented and irregular.

ITERATION

After input on the original structure, various changes was made. The primary structure was adapted to be constructed out of continuous steel portal frames and flanges was implemented to strengthen the structure

RESISTANCE CALCULATIONS

The following diagram illustrates the calculations that was done to determine the material composition of the building envelope and so also the insulation material specification.

The floor, wall and roof resistance values was measured against the requirements set out in SANS 204.

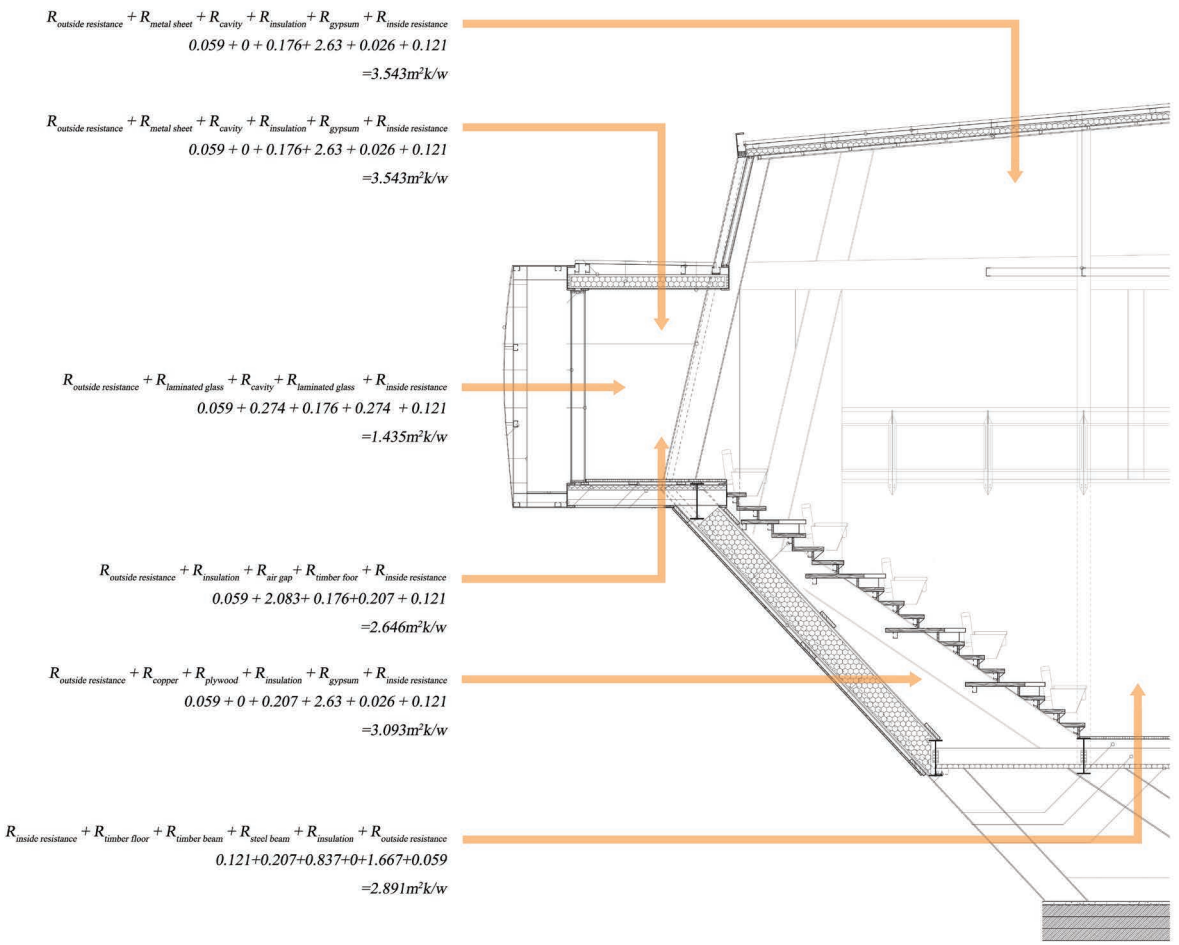


Figure 12_13 resistance calculations

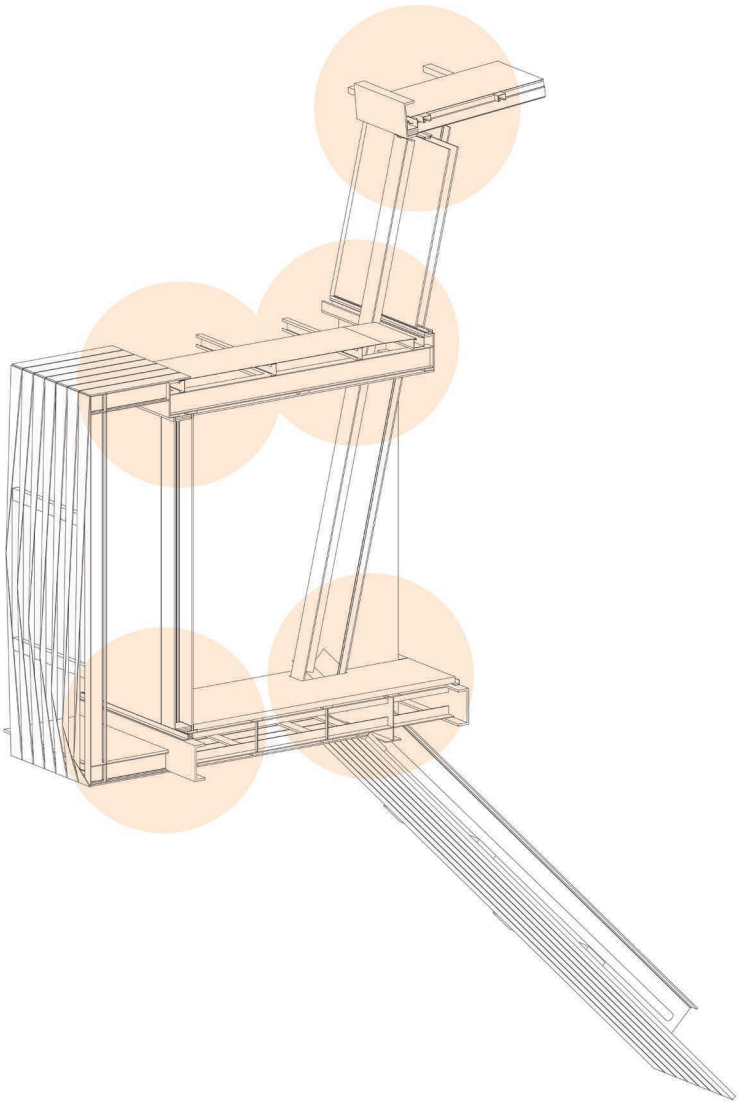
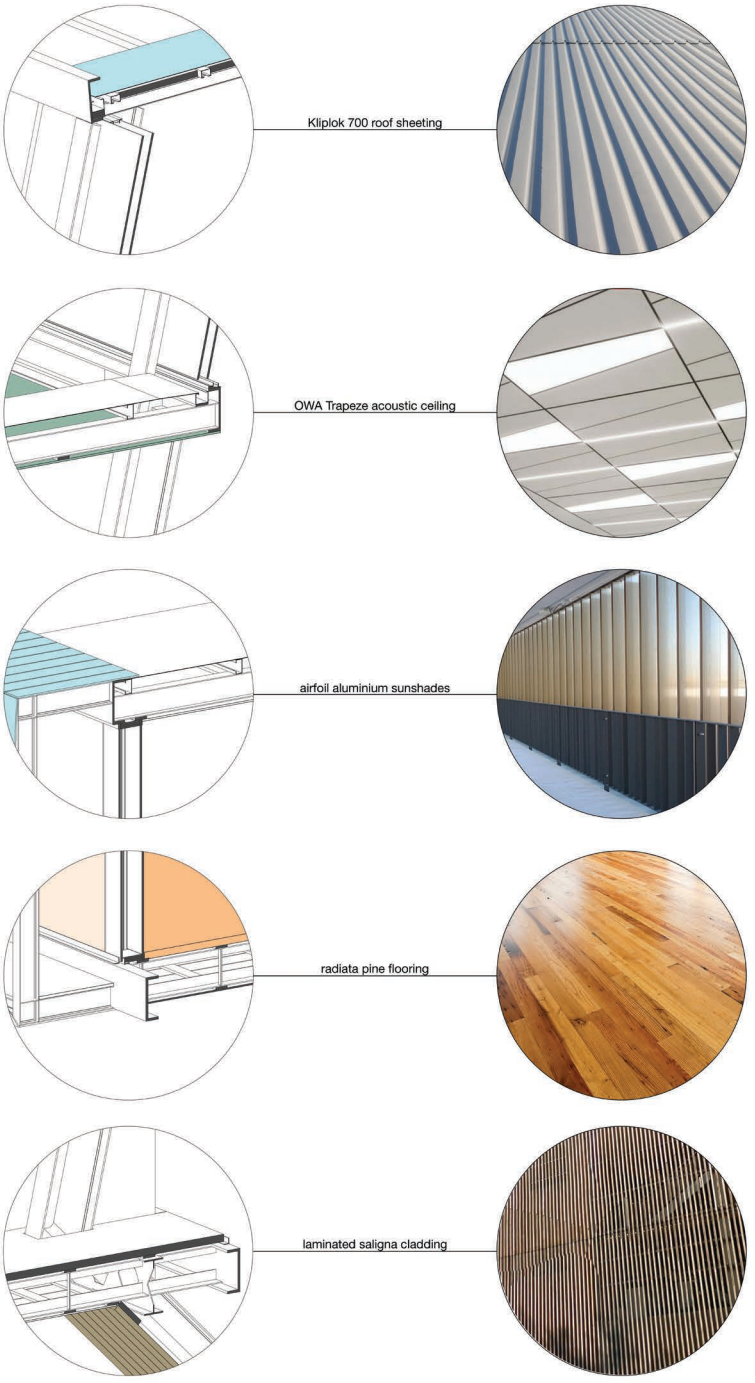
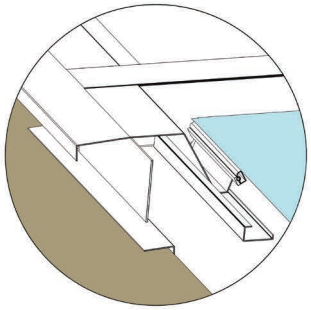
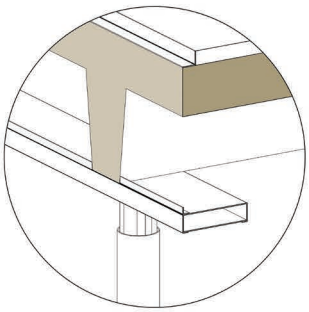
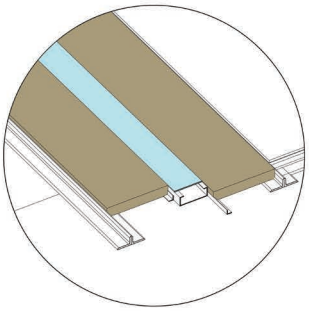


Figure 12_14 Structure detail and materiality









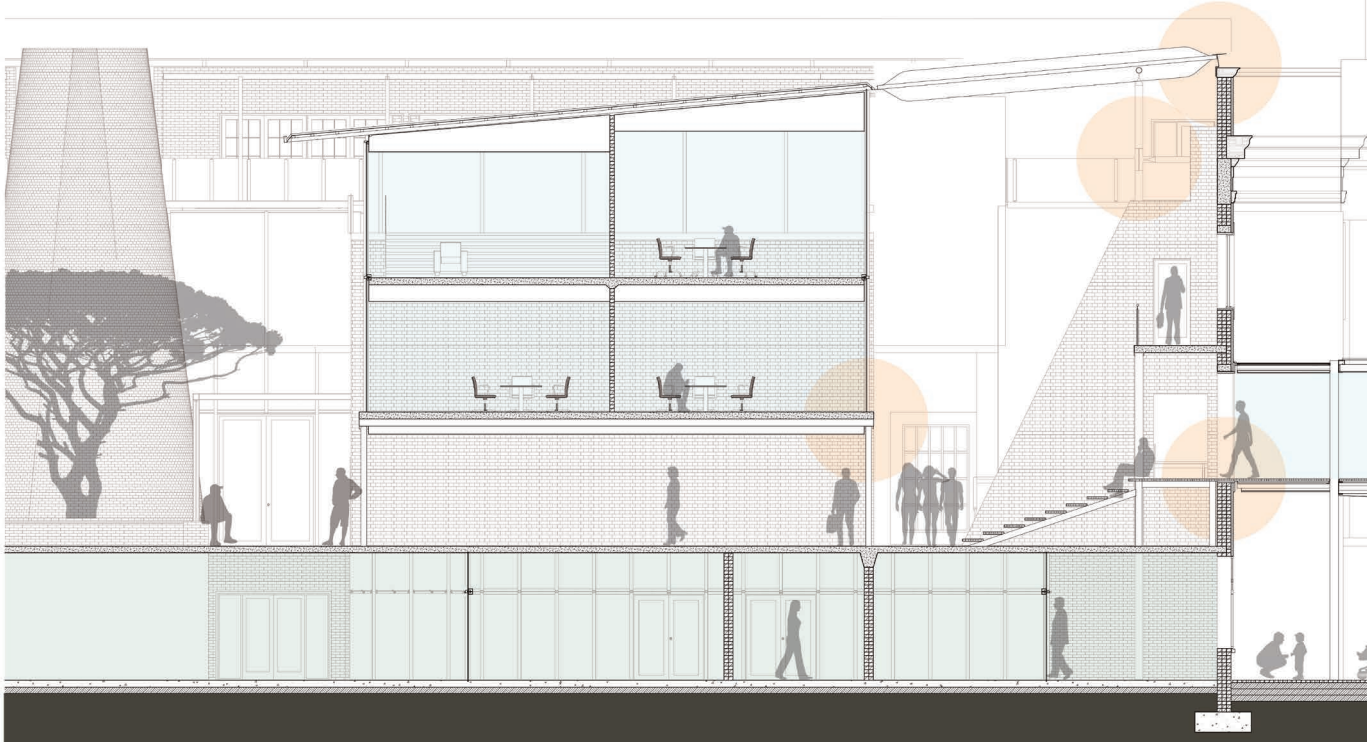
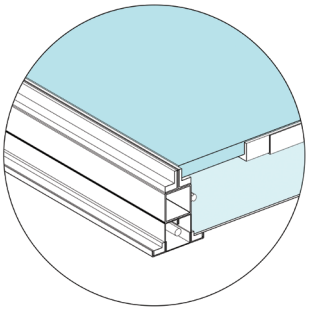
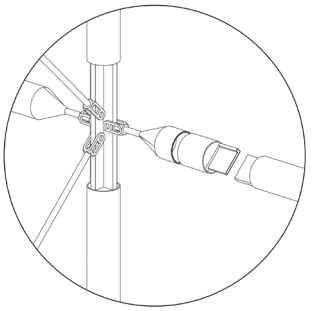
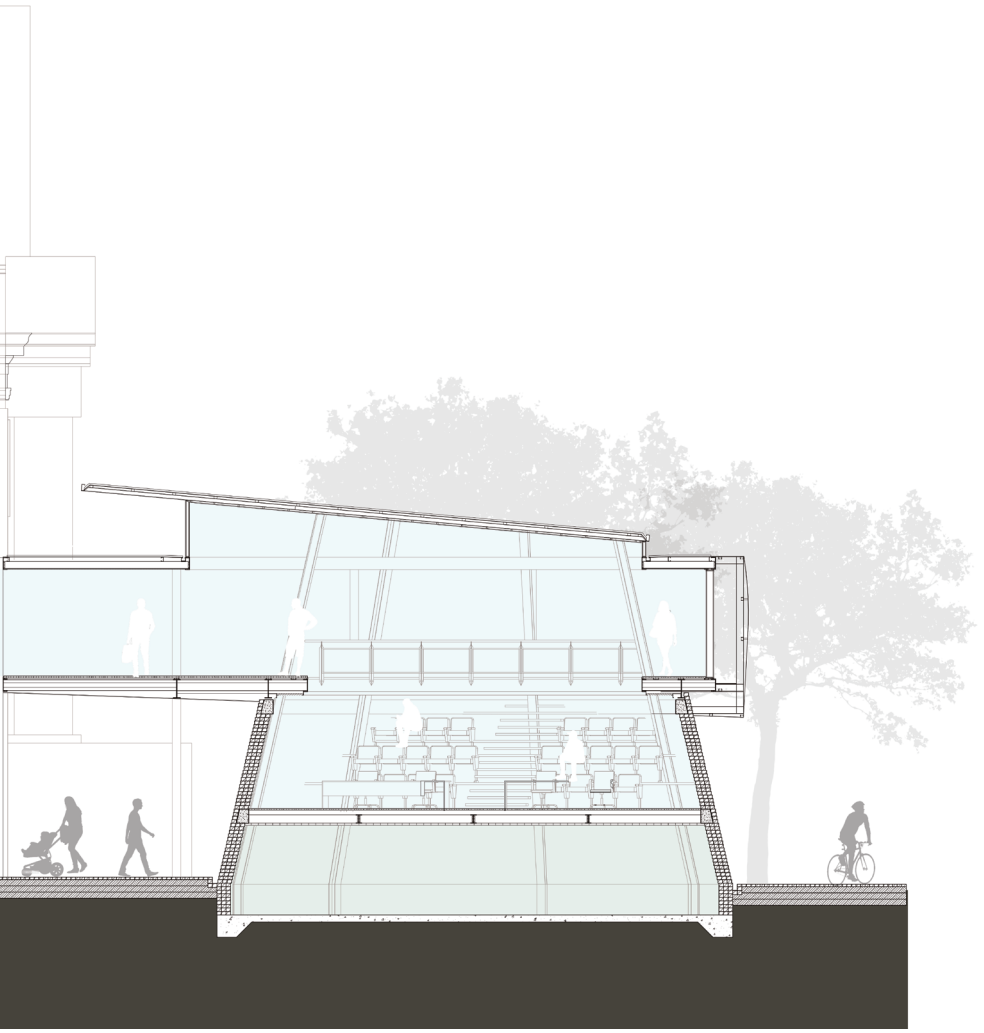
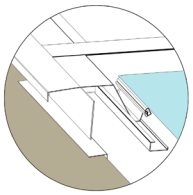


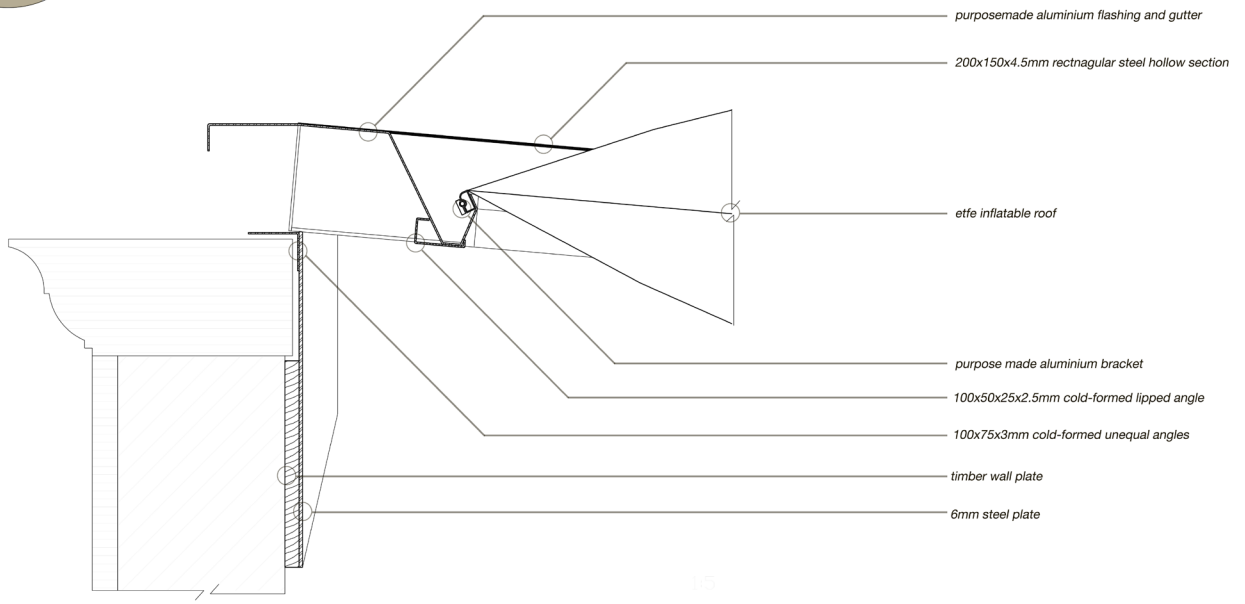
Figure 12_15 1:50 Section B-B

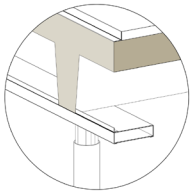


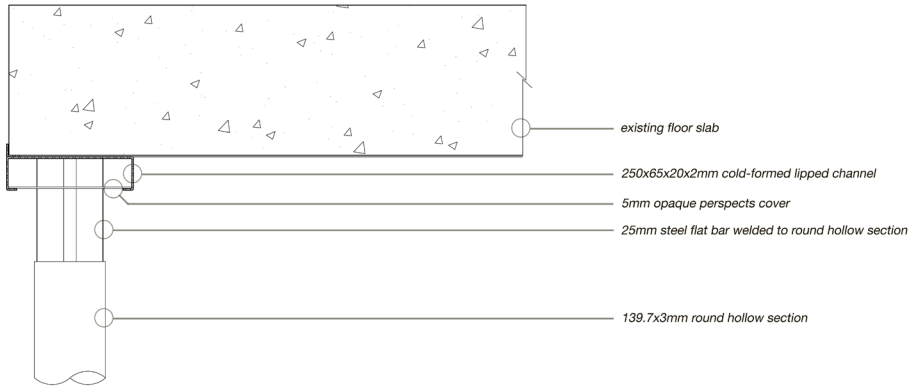


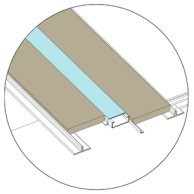


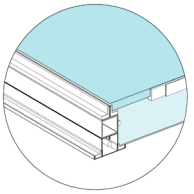


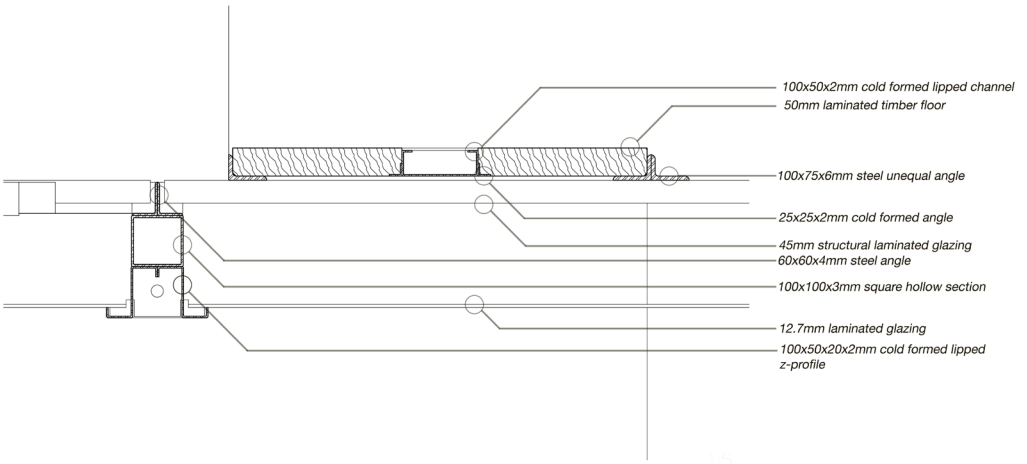


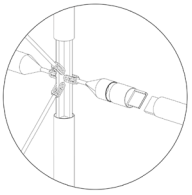


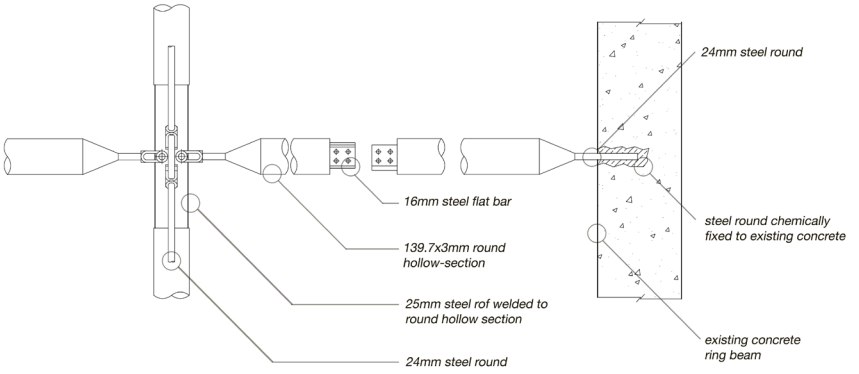












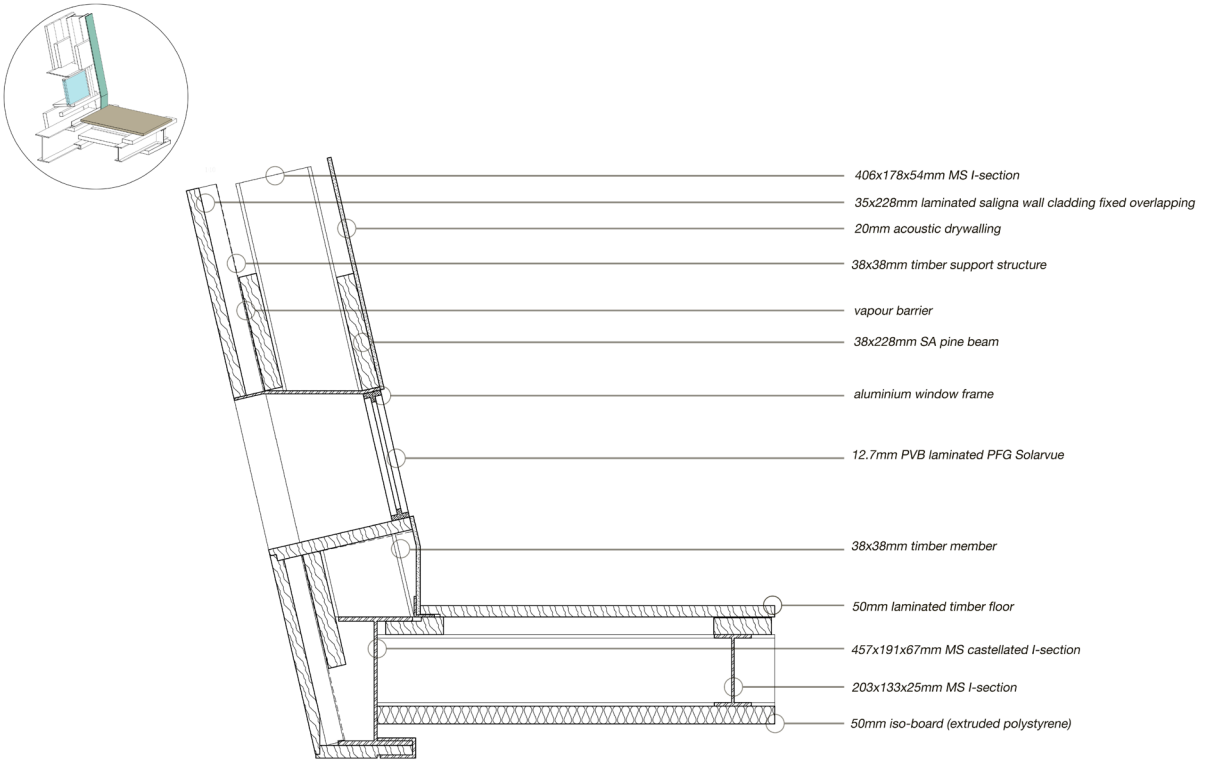


Figure 12_16 North elevation

SBAT

Analysis was done on the building performance before the fire, as it was originally. It is important note that it was done hypothetically and that certain operational assumptions had to be made based on observations.

There after another SBAT analysis was done with the dissertation interventions in mind. Thereby some social, economical and operational aspects was anticipated which could not be illustrated in the dissertation.

Two important factors could be proven in this dissertation and carried considerable impact on the SBAT rating. This was the energy generation and water harvesting and will be discussed briefly.

SUSTAINABLE BUILDING ASSESSMENT TOOL RESIDENTIAL
1.04

		Target	Achieved
BI	**Building Information**	**5.0**	**1.9**

BI 1	Building Targets	Target	Achieved
EN	Energy	5.0	0.3
WA	Water	5.0	0.0
WE	Waste	5.0	0.0
MA	Materials	5.0	1.5
BI	Biodiversity	5.0	0.4
TR	Transport	5.0	5.0
LE	Local Economy	5.0	0.5
MN	Management	5.0	3.3
RE	Resources	5.0	0.9
SP	Services and Products	5.0	4.2
AC	Access	5.0	1.7
HE	Health	5.0	2.0
ED	Education	5.0	3.9
IN	Inclusion	5.0	3.8
SC	Social Cohesion	5.0	0.8

BI 2	Priority Key (Not Performance Key)	
VH	Very High	5.0
HI	High	4.0
ME	Medium	3.0
LO	Low	2.0
VL	Very Low	1.0
NA	None / Not Applicable	0.0

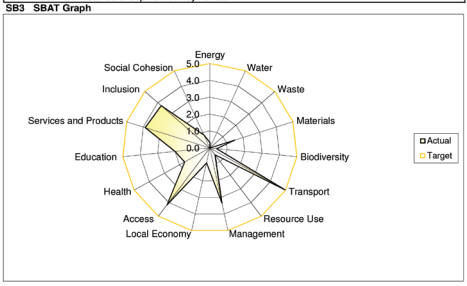
BI 3	**Project Name**	Pretoria Magistraatshof
BI 4	**Address**	Hoek van Pretorius & Sophia De Bruyn straat

BI 5	**Site Area**	10271.68 m2
BI 6	**Gross Floor Area (GFA)**	m2
BI 7	**Gross Internal Area (GIA)**	10017.35 m2
BI 8	**Number of Useable Rooms**	
BI 9	**Number of Bedrooms**	

SUSTAINABLE BUILDING ASSESSMENT TOOL RESIDENTIAL
1.04

		Achieved
SB	**SBAT REPORT**	**1.9**

SB1 Project
Pretoria Magistraatshof
SB2 Address
Hoek van Pretorius & Sophia De Bruyn straat
SB3 SBAT Graph



SB4 Environmental, Social and Economic Performance	Score
Environmental	0.4
Economic	2.8
Social	2.4
SBAT Rating	1.9

SB5 EF and HDI Factors	Score
EF Factor	1.7
HDI Factor	2.1

SB6 Targets	Percentage
Environmental	9
Economic	56
Social	49

SUSTAINABLE BUILDING ASSESSMENT TOOL RESIDENTIAL
1.04

		Target	Achieved
BI	**Building Information**	**5.0**	**4.3**

BI 1	Building Targets	Target	Achieved
EN	Energy	5.0	4.8
WA	Water	5.0	3.6
WE	Waste	5.0	3.0
MA	Materials	5.0	5.0
BI	Biodiversity	5.0	3.1
TR	Transport	5.0	5.0
LE	Local Economy	5.0	3.0
MN	Management	5.0	5.0
RE	Resources	5.0	5.0
SP	Services and Products	5.0	5.0
AC	Access	5.0	5.0
HE	Health	5.0	4.0
ED	Education	5.0	5.6
IN	Inclusion	5.0	4.6
SC	Social Cohesion	5.0	2.5

BI 2	Priority Key (Not Performance Key)	
VH	Very High	5.0
HI	High	4.0
ME	Medium	3.0
LO	Low	2.0
VL	Very Low	1.0
NA	None / Not Applicable	0.0

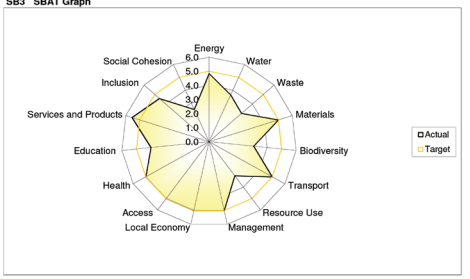
BI 3	**Project Name**	Pretoria Magistraatshof
BI 4	**Address**	Hoek van Pretorius & Sophia De Bruyn straat

BI 5	**Site Area**	10271.68 m2
BI 6	**Gross Floor Area (GFA)**	m2
BI 7	**Gross Internal Area (GIA)**	9972.2 m2
BI 8	**Number of Useable Rooms**	
BI 9	**Number of Bedrooms**	

SUSTAINABLE BUILDING ASSESSMENT TOOL RESIDENTIAL
1.04

		Achieved
SB	**SBAT REPORT**	**4.3**

SB1 Project
Pretoria Magistraatshof
SB2 Address
Hoek van Pretorius & Sophia De Bruyn straat
SB3 SBAT Graph



SB4 Environmental, Social and Economic Performance	Score
Environmental	3.9
Economic	4.6
Social	4.3
SBAT Rating	4.3

SB5 EF and HDI Factors	Score
EF Factor	4.2
HDI Factor	4.6

SB6 Targets	Percentage
Environmental	78
Economic	92
Social	87

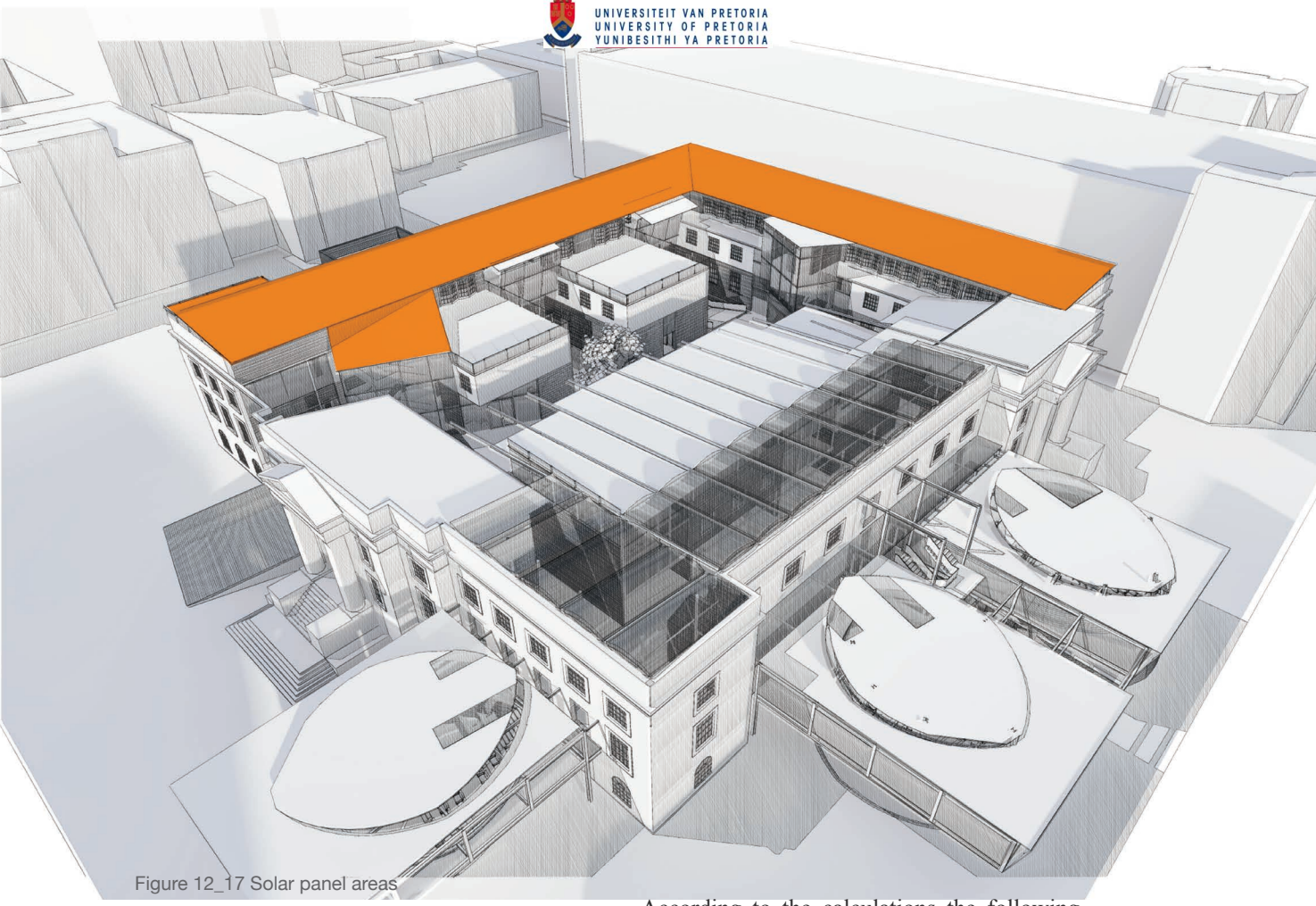


Figure 12_17 Solar panel areas

SOLAR PANEL INSTALLATION

The top diagram shows the possible position of the locally manufactured solar panels. There roof surfaces was chosen because they face predominantly north. The positions also allow the panels to be easily hidden as not to detract from the historical aesthetics.

According to the calculations the following amount of energy can be generated:

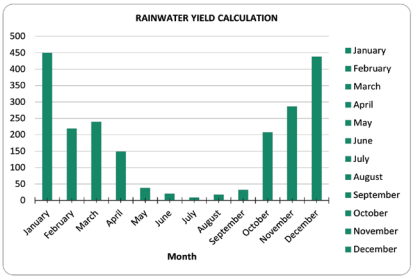
Available roof surface:	1750.3m²
Panel area: (992x1956mm)	1.94m²

Thus it is possible to install:
900 (72 cell module) panels.
The 72 cell module panels can generate 300-320 Wp (maximum power) and thus the entire installation can deliver 270 000Wp.

270 000/9972.2m² (internal floor area of design)
= 27 Wp/m²

Figure 12_18 Rain harvesting surfaces

	Temperature (°C				Percepitation		
Month	Highest Recorded	Average Daily Maximum	Average Daily Minimum	Lowest Recorded	Average Montly (mm)	Average Number of Days with > =1mm	Highest 24 hour rainfall (mm)
January	36	29	18	8	154	14	160
February	7	13	51	82	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	150	15	50
ANNUAL AVE.	36	25	12	-6	674	87	160



RAINWATER YIELD CALCULATION																
Month	Ave. monthly percepitation, P (m)	Area of catchment roof 1 (m²)	Runoff coefficient	Yield (m³)	Area of catchment roof 2 (m²)	Runoff coefficient	Yield (m³)	Area of catchment roof 3 (m²)	Runoff coefficient	Yield (m³)	Area of catchment roof 4 (m²)	Runoff coefficient	Yield (m³)	Area of catchment roof 5 (m²)	Runoff coefficient	Yield (m³)	Yield (m³) TOTAL
January	0.154	741.21	0.9	103	372.5	0.9	52	1300.8	0.9	180	830.3	0.9	115	0	0.9	0	450
February	0.075	741.21	0.9	50	372.5	0.9	25	1300.8	0.9	88	830.3	0.9	56	0	0.9	0	219
March	0.082	741.21	0.9	55	372.5	0.9	27	1300.8	0.9	96	830.3	0.9	61	0	0.9	0	239
April	0.051	741.21	0.9	34	372.5	0.9	17	1300.8	0.9	60	830.3	0.9	38	0	0.9	0	149
May	0.013	741.21	0.9	9	372.5	0.9	4	1300.8	0.9	15	830.3	0.9	10	0	0.9	0	38
June	0.007	741.21	0.9	5	372.5	0.9	2	1300.8	0.9	8	830.3	0.9	5	0	0.9	0	20
July	0.003	741.21	0.9	2	372.5	0.9	1	1300.8	0.9	4	830.3	0.9	2	0	0.9	0	9
August	0.006	741.21	0.9	4	372.5	0.9	2	1300.8	0.9	7	830.3	0.9	4	0	0.9	0	18
September	0.022	741.21	0.9	3	372.5	0.9	15	1300.8	0.9	12	830.3	0.9	2	0	0.9	0	32
October	0.071	741.21	0.9	47	372.5	0.9	24	1300.8	0.9	83	830.3	0.9	53	0	0.9	0	207
November	0.098	741.21	0.9	65	372.5	0.9	33	1300.8	0.9	115	830.3	0.9	73	0	0.9	0	286
December	0.15	741.21	0.9	100	372.5	0.9	50	1300.8	0.9	176	830.3	0.9	112	0	0.9	0	438
ANNUAL AVE.	0.674			40			21			70			44			0	2105

RAIN WATER HARVESTING

The water harvesting calculations are done in order to determine the maximum yield of water from the available roof surfaces of the Pretoria Magistrates Court

Water harvested from the roof is not only used in the building itself, the demand of which is very low, but will also aim to supply the surrounding buildings. Which does not have the capacity to harvest their own rain water runoff.

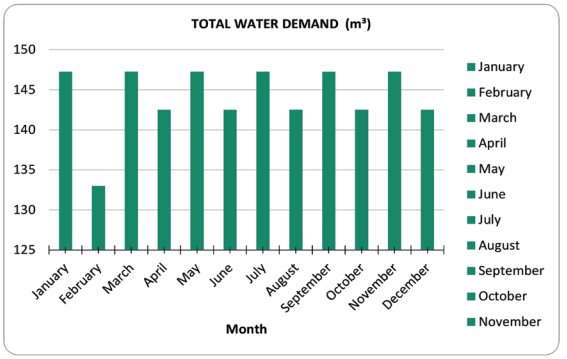
This is done in order to supplement normal municipal supply, not only of the building itself but the entire area.

USER DEMAND

Month	Persons (staff)	Water/capita /day (L)	Water/capita /month (L)	Staff Demand (L/month)	Persons	Water/capita /day (L)	Water/capita /month (L)	Visitors Demand (L/month)
January	100	40	1240	124000	250	3	93	23250
February	100	40	1120	112000	250	3	84	21000
March	100	40	1240	124000	250	3	93	23250
April	100	40	1200	120000	250	3	90	22500
May	100	40	1240	124000	250	3	93	23250
June	100	40	1200	120000	250	3	90	22500
July	100	40	1240	124000	250	3	93	23250
August	100	40	1200	120000	250	3	90	22500
September	100	40	1240	124000	250	3	93	23250
October	100	40	1200	120000	250	3	90	22500
November	100	40	1240	124000	250	3	93	23250
December	100	40	1200	120000	250	3	90	22500

TOTAL WATER DEMAND CALCULATION

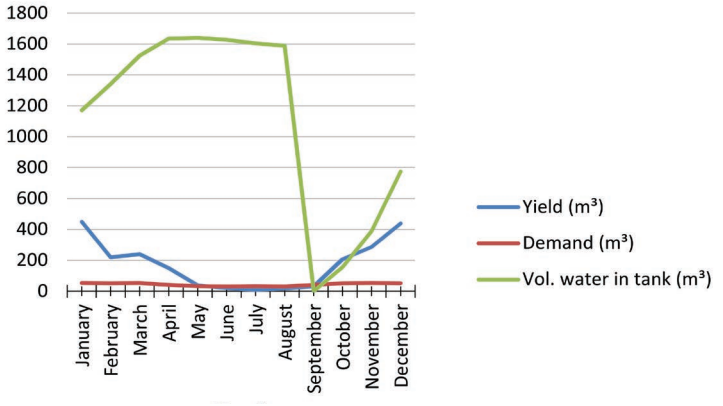
Month	Irrigation Demand (m^3)	Domestic Demand (m^3)	Visitors Demand (L/month)	Total water Demand (m^3)
January	0	124.00	23.25	147
February	0	112.00	21	133
March	0	124.00	23.25	147
April	0	120.00	22.5	143
May	0	124.00	23.25	147
June	0	120.00	22.5	143
July	0	124.00	23.25	147
August	0	120.00	22.5	143
September	0	124.00	23.25	147
October	0	120.00	22.5	143
November	0	124.00	23.25	147
December	0	120.00	22.5	143
TOTAL	0	0.00	0	1729



WATER BUDGET with tank

Month	Yield (m^3)	Demand (m^3)	Monthly balance	Vol. water in tank (m^3)
January	450	53	397	1171
February	219	51	168	1339
March	239	53	186	1526
April	149	40	109	1635
May	38	33	5	1640
June	20	32	-12	1628
July	9	33	-24	1604
August	18	32	-14	1589
September	32	41	-9	0
October	207	52	155	155
November	286	53	233	389
December	438	52	386	775

TANK SIZE (m^3)	1640
SAFETY FACTOR	1.5
FINAL TANK (m^3)	2460



SYSTEMS

The following diagram illustrates the ventilation system of the courtroom addition. The system proposed is a hybrid system between a conventional air conditioning unit and a passive soil-pipe system.

A passive ventilation system is applied to the foyer spaces. Here cold air from the soil-pipe system are brought in from ground floor area. The thermal difference between the ground floor level and the transparent roof will be enough to create a stack ventilation effect. This will be aided by the mechanical extraction from the top.

Conventional air conditioning are applied in order to create a constant climatic environment in the courtroom. The soil-pipe in turn assists by supplying cooled air which is circulated underneath the soil and obtains a constant temperature of 18º throughout the year into the conventional system.

This means that the air conditioning unit will use less energy to cool the air which is fed into the court space, in turn making the process more sustainable.

The system remains closed and has no openings, so that energy isn't lost through the circulation process.

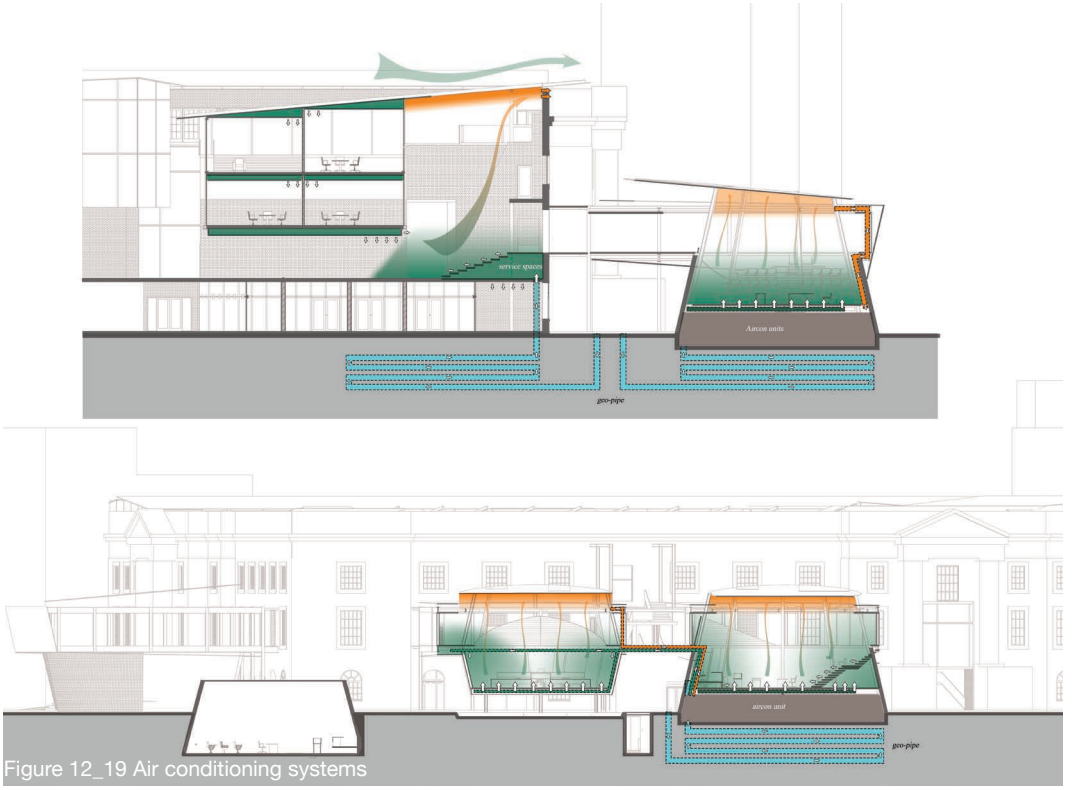


Figure 12_19 Air conditioning systems

Figure 12_20 West elevation