CHAPTER 7_ Technical discourse

7.1_

THEORY OF STRUCTURE

M. Van Der Rohe 1961

"We call a shack a shack and not a structure."

- "By structure we have a philosophical idea.
- The structure is the whole from top to bottom, to the last detail - with the same ideas "

"That is what we call structure."

7.1.1

The **structure as** architectural response:

M. Van Der Rohe

"Architecture starts when you put two bricks carefully upon each other."

- Creating a built form that serves as a transition between the existing University Campus and the Mamelodi community.
- The end vision for the campus is being an open campus for any person to wander in and to be informed and to enjoy the company and resource available to them.
- The utilization of the existing lecture halls, increasing the size and making them dual functional to be used in the day for University classes and at night for community meetings and education functions.
- Allowing the space between the new civic and community building and that of the existing lecture halls to become the transition space between the inside and outside of the campus, the broken down barrier of future and current integration.
  As Norberg-Shultz and Robert Venturi explains it is this transitional space that defines place and creates architecture. The "openings" created between the structure and the existing campus building serves this space. The typology and character of material and scale enforces this perception and creates a new space.

R. Venturi Complexity, pg 88

" Architecture occurs at the meeting of interior and exterior forces of use and space"

C.Norberg Schultz 1979, pg 63

"Evidently this meeting is expressed in the wall and in particularly in the openings which connect the two domains."

The structure form and materiality informs this sense of being and it grounds the principle of taking the old, adding the required and resulting in a new possibility of community engaged architecture facilities.
By programming floor space correctly, it leads one to and encourages the interaction of space and society.

The built form facilitates the same doing
Having a centre core structure resembling the existing concrete and brick massing of the university, but the outer edges, the walkways, the space most often used, once again becoming the transition space between the built form and public outdoors.
This has been achieved by adding a lightweight steel structure to the solid core mass that is open and free to breath, natural lit and permeable,

The walkways are threefold demonstrations of this permeable and legible precept:
Univeristy facade, public facade 1 & 2

University facade:
cladded by polycarbonate sheet, mirrors the small dwelling sheeted shack context in colour with natural ventilation up flow draughts. Becoming a skin for green architecture and symbol for context

Public facade:1
Open corridors, light weight steel structure with lazer cut steel balustrades designed by artists in the community colored to mark the legibility of each floor,
Public facade :2
Deep corridors for large load of people, open air walkway with roof coverage, cutaway slab to allow vegetation to infiltrate the space, adding new live to finished products and material.
A building wrapping the space creating a public civic square, that becomes legible and accessible, while simultaneously morphing in roof form creating a unity of simple tectonics.
As Norberg Shultz explains:

C.Norberg Schultz 1979

" A meaningfull relationship between horizontals and verticals also depends on the form of the roof."

Hence there is no intention to dehumanize the change in vertical space and horizontal space, but rather to find an eloquent relationship between proportion and mass on open space with green felt, figure 121.

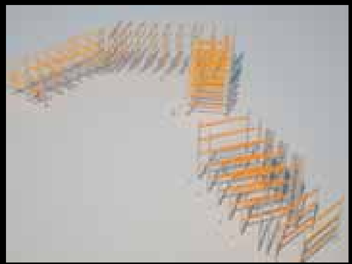
The three levels of floors are planes supported on columns divided in function. They are seen as layers, horizontally starting at basic need, finishing in furthering yourself in education and uplifting your community across the site, so it runs vertically starting at basic civic requirements for most access, to less access but more specificness needs at the top.
In the words of Mies van Der Rohe ***"We call a shack a shack and not a structure....."***
We find the image of structure and totality of building as equally required and appropriate in symbolism of theory as this dissertations community engagement facilitatory vision. Honest in form and honest in material. To reflect honestly that which is inside to those that intend to use it. Steel, concrete, Brick work and corrugated sheeting.

Note: All structural calculations for beams, columns: steel, concrete and timber on technical drawings.

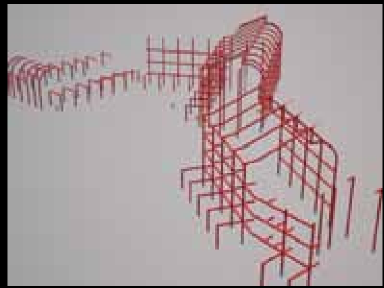
Figure. 112
3d image of total structural system of proposed CEF facility

Figure. 112 a - c
Structural elements

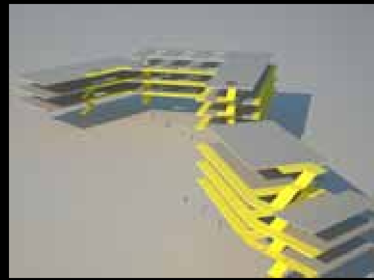
Concrete beam & columns

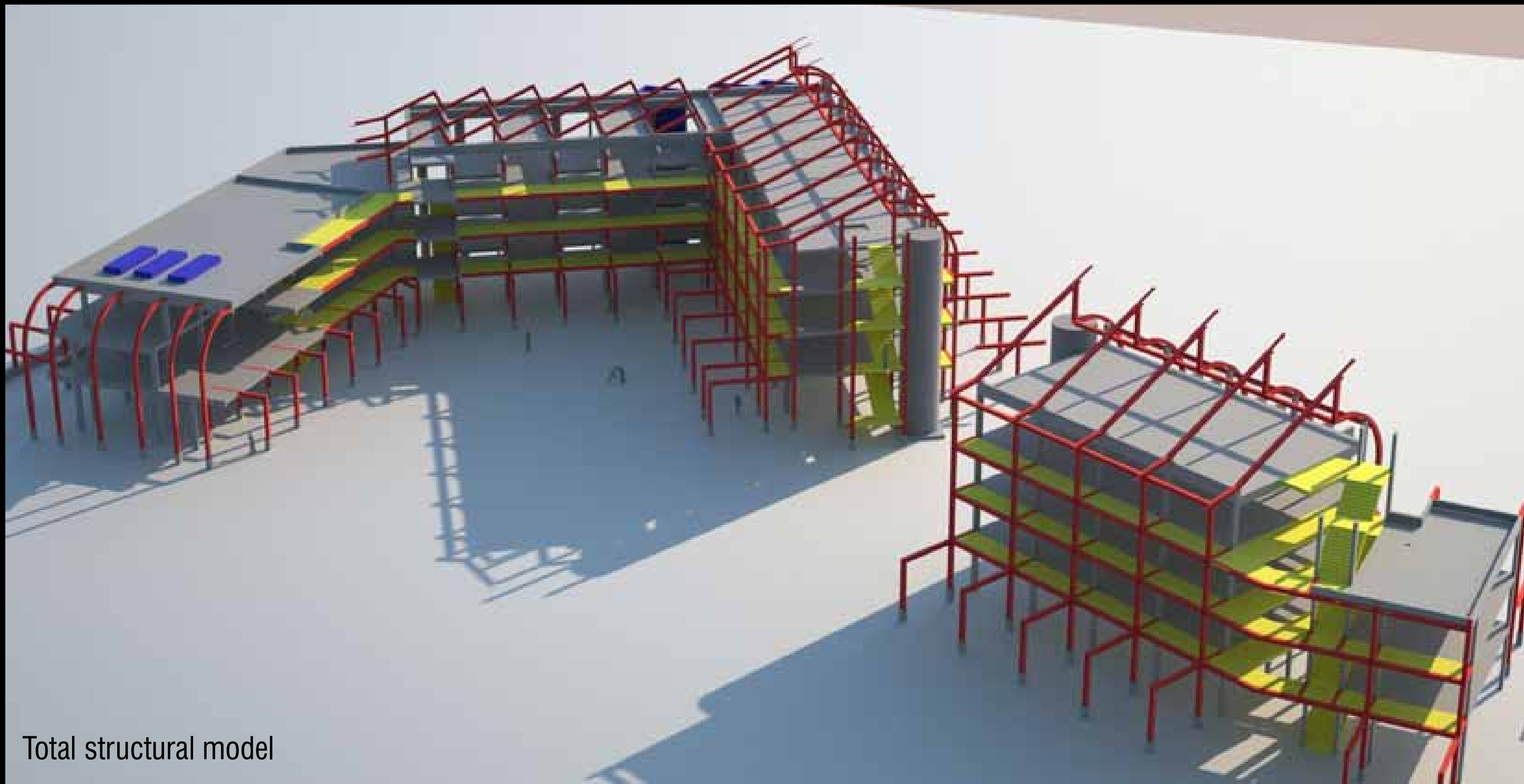


Steel beam & columns



Concrete slab & walkway





Concrete

Walkways & stairs

Steel

Ventilation systems

Service areas

Figure. 113a
3d2 image of structural system of proposed CEF facility

Concrete

Walkways & stairs

Steel

Ventilation systems

Service areas

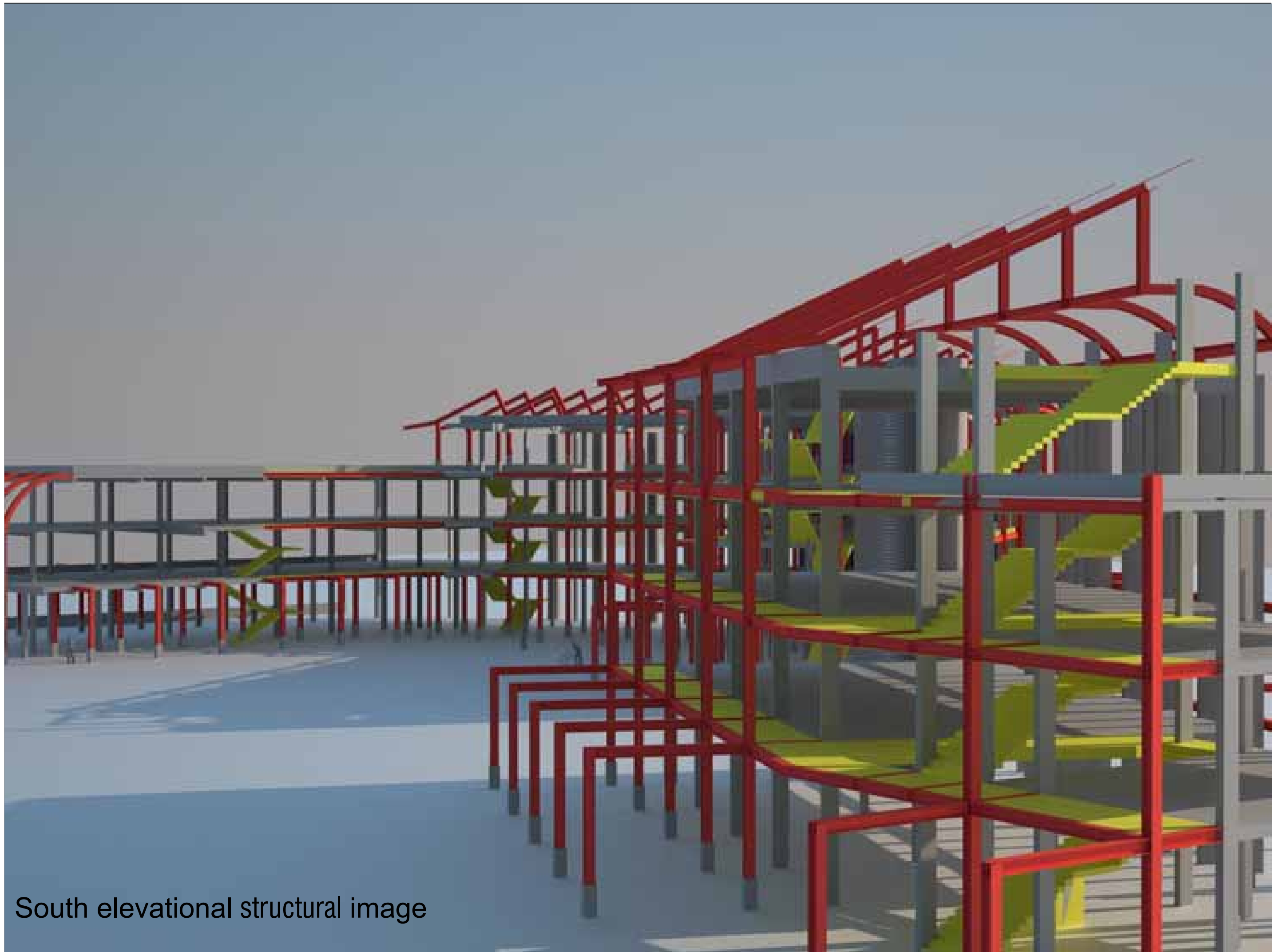


Figure. 113b
3d 4 image 3 of structural system of proposed CEF facility

Figure. 113 c -f
3d 5 image of structural system of proposed CEF facility

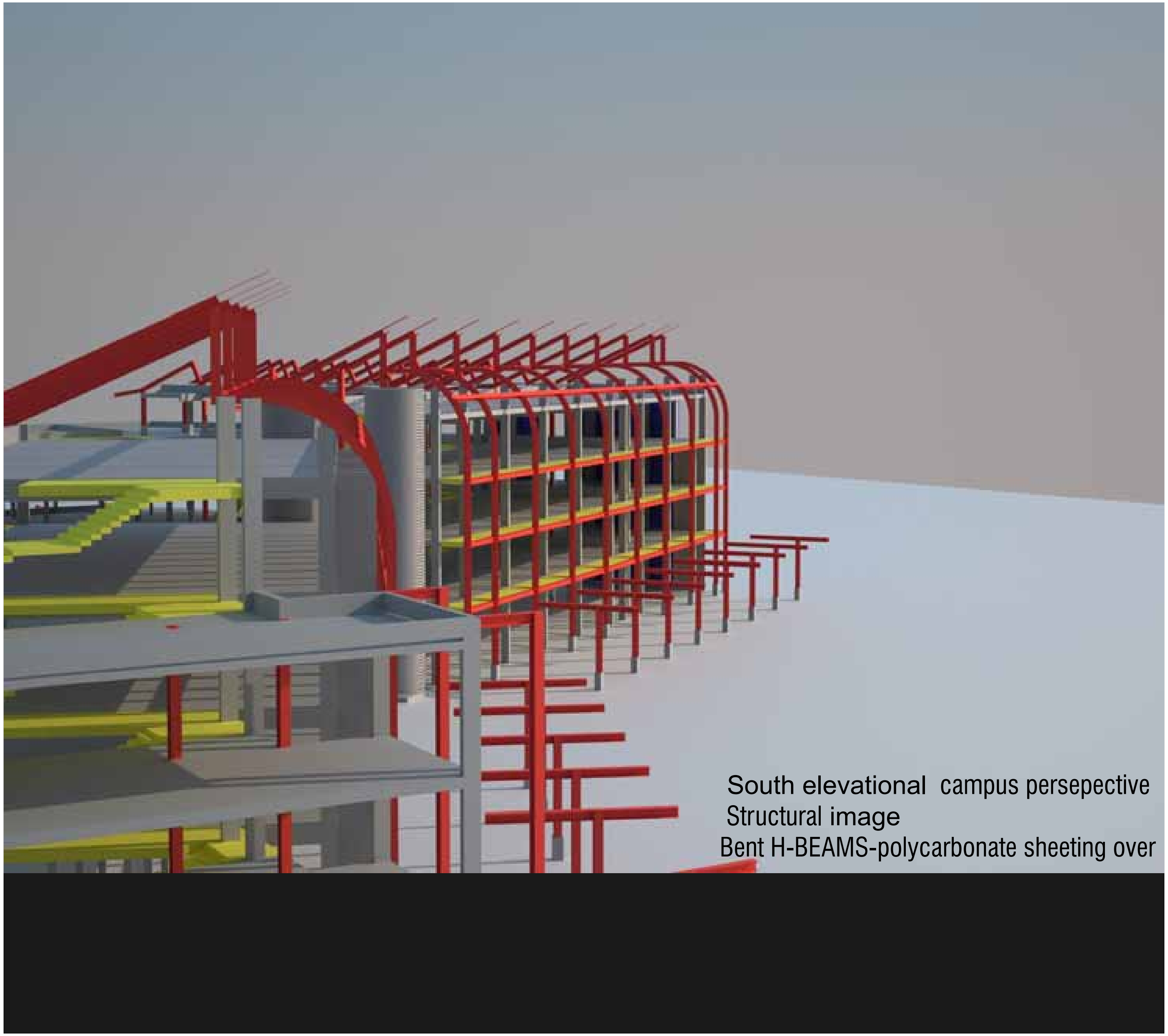
Concrete

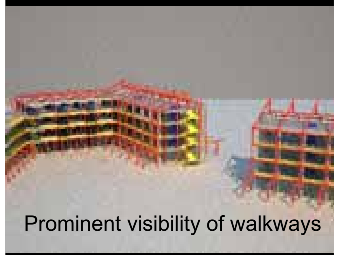
Walkways & stairs

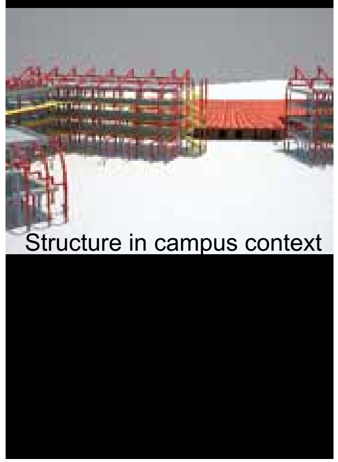
Steel

Ventilation systems

Service areas







7.2_ ## SYSTEMS AND SERVICES_ A SUSTAINABLE APPROACH

7.2.1 SYSTEMS:

7.2.1.1 PASSIVE VENTILATION_

Flank A+B; figures. 114

The building is not holistically attempting to claim a green building status, however It was with intent that the use of a passive ventilation system was designed. For purposes of dissertation Flank B and subsequently Flank A is similarity in design was used for calculation purposes.
These flanks are mechanically assisted to passively ventilate the buildings.
The usable space are centralised with corridors at the edge, allowing for reduced heat gain, but resulting in reduced ventilation by natural means.
A series of development has taken place of which the final product as seen in Section Z-Z chapter 8,has been the answer.
The placement of two shafts running 1 st floor to roof top slab, 4sqm each with a cat-lader fixed internally and turbo extractor fan overhead, extracting all air in building 8x per day. More than the regulation requirement of converted 5x per day.
This does not cool the air as in air-conditioning but recycles the air, replacing warm latent air with fresh; hence cooler air. (See calculation on dwg.)
The system is powered by voltaic cells placed over curved roof edge, allowing enough energy collection to run the extractors as well the smaller jet motors for the louvre systems.

The extractor and louvres motors start & stop simultaneously 8 times per day and or when the thermometer drops and or reaches a certain temperature.

The allocated space for the shafts are sized for future changed ability with sufficient space on roof top for future plant requirements.

The excess voltaic energy is used for lighting in public ablution and corridor lighting during night time, in the attempt to reduce the electrical bill. Even if only by a fraction.

Flank C; figures. 115

Flank C face majority western sun hence heating up immensely, while the opposite public corridors face east collecting Eastern morning sun. The proposal to deal with this predicament is to recess the corridors and use vegetation to cool the space. Simultaneously using the thermal flywheel, or heat stack system on the western side. This will allow the air to be drawn across the offices from east to west in the afternoons when the offices should theoretically heat-up.

The chimneys, are cladded with corrugated sheeting to add to the heating effect, with a small top vent opening. They serve as service shaft for cable trays and

7.2.1.2 SYSTEMS:

PHOTO VOLTAIC_ AS NOTED AND MENTIONED
2X KEY SECURITY SYSTEM PER ORGANISATION OR COMPANY

7.2.2 SERVICE:

The in-house servicing is run from Flank C, ground floor being delivery yard and first floor being administration and communication.
The facility is run by a private management and maintenance company. Service lift connecting to all floors.
Major tenants have fixed storage bays on lvl 1.

All ablution facilities are connected by service shafts, leading to access doors, all at external sides of building. Flank A at Northen edge. Flank C at western edge in vent shaft.

Existing service yards for lecture halls are removed and repositioned as noted on dwg's. New yard caters for existing and increased size air conditioning units for lecture halls, new power supply to building, back-up generator as well as transistors are required.

Connecting to existing sewer mains, by means of six new manholes. Existing fire points to be reused and additional added as per regulation. See technical drawings chapter 8.
Storm water off site drained to existing storm water channel. Water tanks act as holding tanks with overflows into storm water channel.

Roof access by cat-ladder fixed to vent shaft at flank C. Flank A to be accessed from rooftop at conference centre.

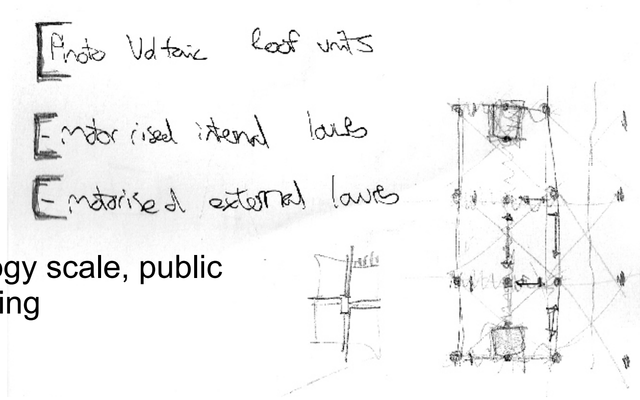
6.1.4

Figure. 114a
Flank A & B
exploration of passive ventilation

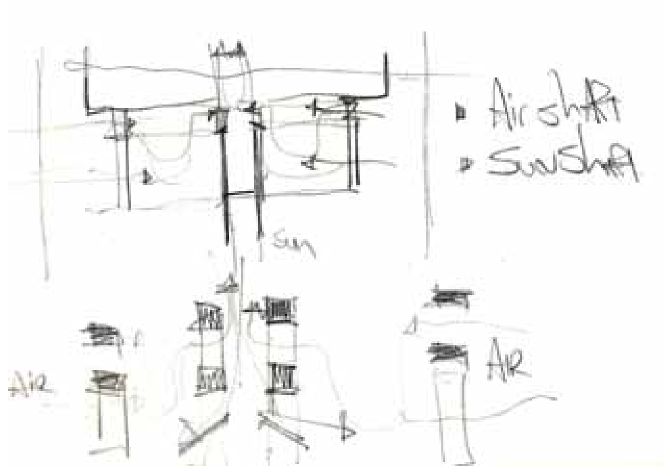
Figure. 114b
Flank A & B
exploration typology of form with response to ventilation

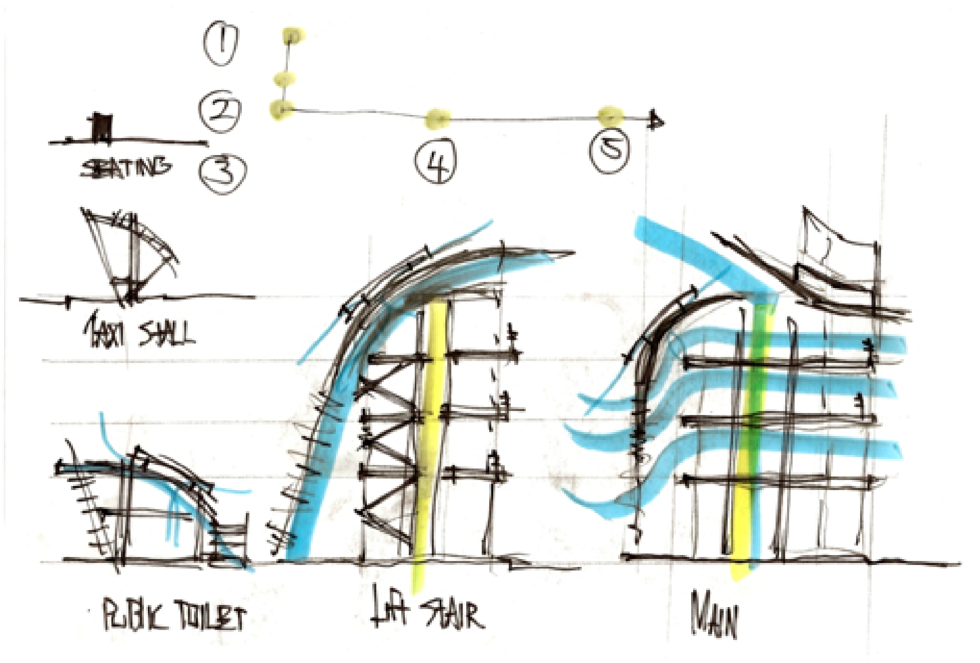
Figure. 114c
Flank A & B
exploration of central core air and light wells

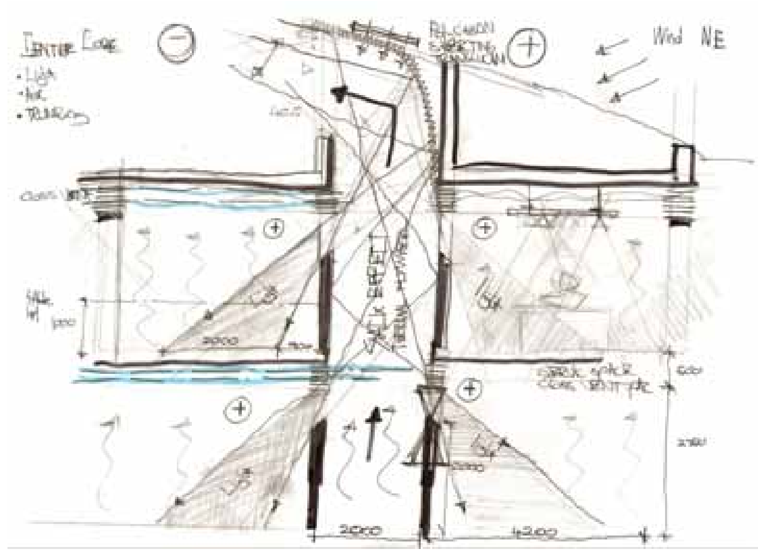
FLANK A&B
Passive ventilation process sketch design and detailing



Ventilation design & morphology scale, public Architecture - large civic building







7.2.3 CALCULATIONS

7.2.3.1 PASSIVE VENTILATION CALCULATIONS_
Flank A; B SECTION Z-Z

Note: proposal to make use of extractor fans to replace the air in the building 8 times per day (working hours), every hour, in doing so removing all warm air and replacing with fresh air, working on green building principles. Outcome results in the omission of an air-conditioning system, and the extractor system function on free energy basis, running of the solar voltaics as noted in photo voltaic calculations.
The louvers and extractor are linked and the motors start simultaneously opening and closing 8 times per day, with a thermostat connected to the motor, if the air temperature does pass over a set temperature the system starts up, if the temperature drop below a set temperature the system does not start up.
The system works only during daylight hours as it is powered by voltaics, but can be used at night on stored battery power, consideration was taken that none or very few employees will be at office after dark.
The two required shafts are over-specified by $2m^2$ each, to allow for future users to change the system to air-conditioning, as all users do not find comfort in a energy efficient and co^2 free environments.

7.2.3.1a **CALCULATION:**
shaft size: 2m x 2m = $4m^2$ x 2 shafts
Total building flank b air intake openings as seen in section z-z
2700mm x 380mm = $1.026m^2$ x 8 openings = $8.208m^2$
for 3 lvls/rooms excluding ground floor = $8.208m^2$ x 3
= $24.624m^2$
total building flank b extract openings as seen in section z-z
1560mm x 380mm = $0.5928m^2$ x 3 openings x 2 shafts
= $3.56m^2$ per floor
$3.56m^2$ x 3 floors
= $10.68m^2$

7.2..3.1b **Total air volume required to transfer in flank b as seen in section z-z**
24680mm x 10200mm = $251.736m^2$ - $8m^2$ for shaft space
= $243.736m^2$ x 3200mm height
= $779.95m^3$ per floor
$779.95m^3$ x 3 floors = $2339.86m^3$ total volume of air
replacement of air 8x per day

In order to specify the correct extractor one needs to calculate the speed required to transfer the air.
In the calculation of air volume, one needs to check that no draft or internal wind is created inside the room.

Thus:
Fan required for volume replacement in flank b as seen in section z-z
$2339.86m^3$ x 8 (time per day replaced) = $18718.88m^3$ total volume of air to be changed
thus $18718.88m^3$ / 12hours = $1559.91m^3h$ / 2 shafts = $779.95m^3h$
thus one needs to change $779.95m^3$ h of air every hour:
$18718.88m^3$ / 12 hours / 60min = $26m^3$/min per fan.
turbo fan from Ewha machinery ltd. manufacturers a fan that passes $28m^3$/min with no noise.
fan no 2#: size_ 480mm x 330mm x 230mm with 0.62kw power requirement to drive the shaft.

7.2.3.1c **Air movement required in shaft, air movement in room in flank b as seen in section z-z**
$779.95m^3h$ / $4m^2$ = 194.99mh in shaft
thus: 194.99mh / 3600 = 0.05m/sec
0.05m/sec x 1000 =
50mm/sec required for movement in shaft to replace air 8 times per day.

7.2.3.1d **Resultant air movement in room in flank b as seen in section z-z**
$779.95m^3$ x 3 rooms = $2339.86m^3$ total volume per day
$2339.86m^3$ / 12hours = $194.98m^3h$
max air movement area: 10200mm x 3200mm height = $32.6m^2$
thus $194.98m^3h$ / $32.6m^2$
=5.98m/h, but to replace 8 times every 12 hours.
5.98m/h / 8 x 12 = 9m/h
9m/h /3600sec = 0.003m/s air movement inside room for replacement of air 8 times per day
Note: one feels air only at 5m/s, thus no wind draft will be experienced, but total air replacement will occur 8 times per day, making it fully passive ventilated rooms

7.2.3.2 ELECTRICAL REQUIREMENT FOR EXTRACTOR FANS AND LOUVRE SYSTEM
Flank A; B SECTION Z-Z

Extractor turbo fan : 0.62kw x2 fan units x 12 hours = 14.88 kWhr per day
fan Louvre jet: 0.1kw per motor, single motor = 3 louvers
thus 42 louvers in take and exhaust vents / 3 = 14 motors
14 x 0.1kw = 1.4kw

14 motors @ 100w each @ 1min/h = 1400w
1400w / 1000 = 1.4kw @ 1min/h
1.4kw / 60sec = 0.02kw/sec x 12hours
0.28kWhr per day

0.28 + 14.88 = 15.16kWhr per day
as noted previously the voltaic has capacity at minimum & maximum to generate
minimum 26.72kw x 7hrs = 187.04kw/h
maximum 26.72kw x 9.91hrs = 264.8kw/h
thus in both cases one has
171.88kWhr per day left for store for public facilities and corridor lighting
249.64kWhr per day left for store for public facilities and corridor lighting

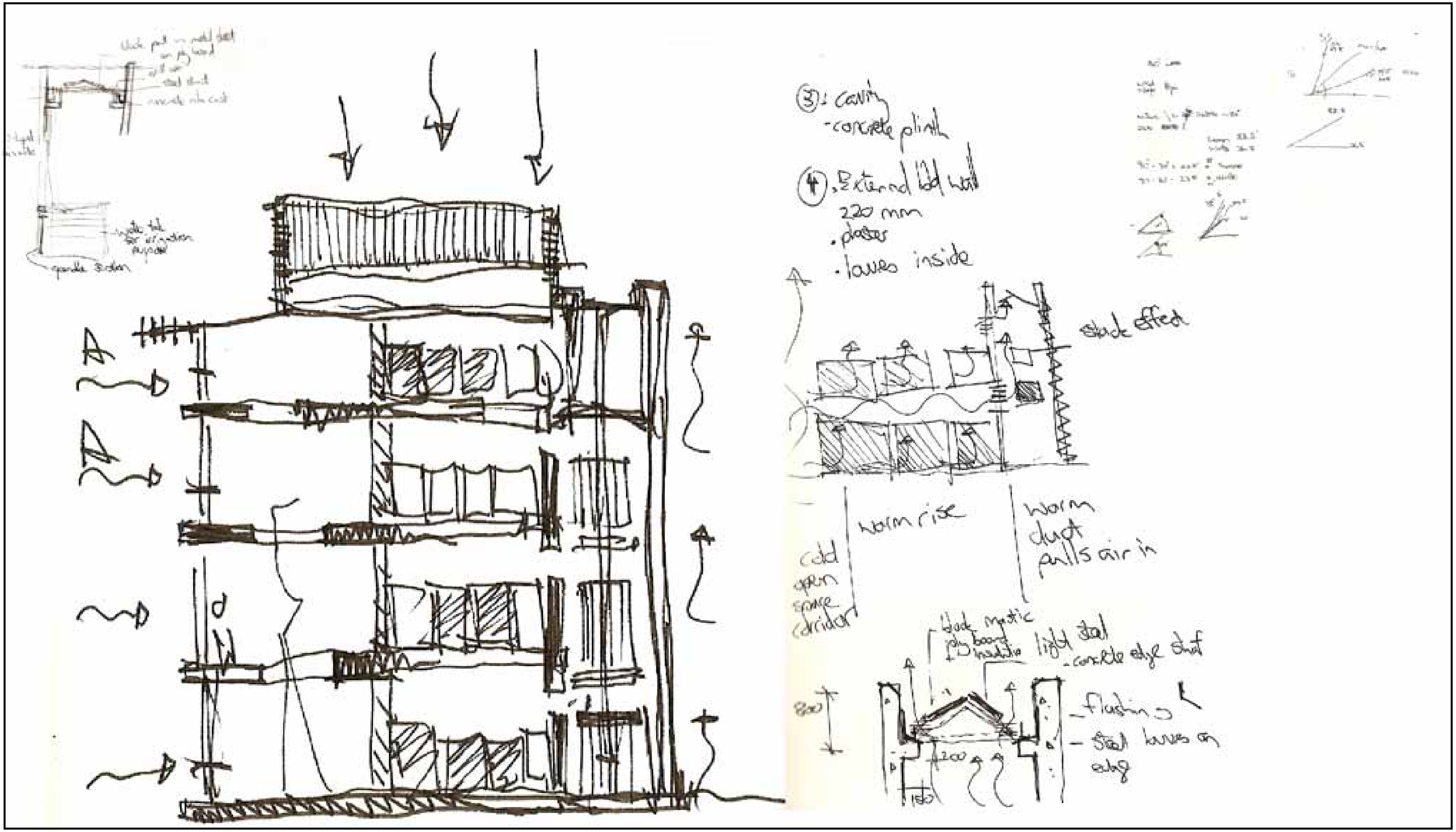
7.2.3.3 **Photo voltaic energy harvest quantity:**
note photo voltaics are only mounted on flank a & b.
SEE CALCULATION IN CHAPTER 5

6.1.4

FLANK C
Passive ventilation process sketch design and detailing

Figure. 115a
Flank C exploration stack vent shafts.

Figure. 115b
Flank C exploration of sun angles, as seen in previous drawings.



5.3.7 SITE CALCULATIONS

(SEE FIGURE 40 FOR AREA REFERENCE)
CALCULATIONS AS NOTED ON DWG: SITE, SERVICES & STRUCTURE PLAN

5.3.7.1 PHOTO VOLTAIC ENERGY HARVEST QUANTITY: figure 42, indicated area in red.

NOTE PHOTO VOLTAICS ARE ONLY MOUNTED ON FLANK A & B.
TOTAL VOLTAIC AREA FLANK A_ 87.38m^2
TOTAL VOLTAIC AREA FLANK B_ 87.38m^2
AS PER AMERICAN STANDARDS,75ft^2 IS REQUIRED FOR 1kW of energy.
thus 75ft^2 x 0.093m^2 = 6.54m^2 is required for 1kW of energy.

87.38m^2 / 6.54 = 13.36kW X2
TOTAL OF 26.72kW ENERGY TO BE HARVESTED.
AVG SUNLIGHT HOURS PER DAY PER ANNUM OVER PAST 11 YEARS =Min avg 7Hrs per day, Max avg 9.91Hrs per day
(Data station [0513314C9] - PRETORIA EENDRACHT)
Minimum 26.72kW X 7Hrs = 187.04kWhrs
Maximum 26.72kW X 9.91Hrs = 264.8kWhrs
ESKOM COST: 44.39c per kWh
thus 225.92 avg x 44.39c = R.100.29 saving per day

Note, energy harvest used primarily for passive ventilation system, serving as switch for the extractor fan and automated louvered system, connected to a temperature gauge. See passive ventilation, electrical motor and air replacement calculation. differences of energy stored in power packs at rooftop, to be used for low voltage incandescent lighting in public toilets and along public corridors at night time

5.3.7.2 WATER CATCHMENT ROOF:

FLANK B+C ROOF AREA:1949m^2
FLANK A ROOF AREA: 530m^2
PARKING ROOF AREA: 2591m^2
ALTERATION ROOF AREA: 144m^2
TOTAL AREA: 5214m^2
MAX RAINFALL PAST 17 YEARS: 1546.3mm / 365 = 4.24mm per day average
MAX MONTHLY RAINFALL PAST 17 YEAR: 281.1mm / 31 = 9.07mm per day
(Jan 2006,data station [0513465 1] - PRETORIA UNIV PROEFPLAAS)

MAX MONTH_
9.07mm / 1000 = 0.01m
5214m^2 x 0.01m = 52.14m^3, per day at max rainfall
52.14m^3 x 31 = 1616.34m^3 per month at max rainfall
1000l = 1m^3, thus 1616.34m^3 x 1000l = 1616340L per month of max rainfall

ANNUAL MAX AVERAGE_
4.24MM / 1000 =0.004m
5214m^2 x 0.004m = 20.86m^3, per day at max yearly average
20.86m^3 x 365 = 7612.44m^3 per year at max yearly average
1000l = 1m^3, thus 7612.44m^3 x 1000l = 7612440L per year at yearly max average

5.3.7.3 GUTTER SIZE REQUIREMENT:

TOTAL ROOF AREA: 5214m^2
140mm^2/1m^2 , regulation standard
5214m^2 x 140mm^2 = 72996mm^2 gutter area required
Proposed size: = 345429mm^2, reason for over size, for architectural aesthetic and steep roof pitch angle 25°, thus increased flow rate.

5.3.7.4 DOWN PIPE SIZE REQUIREMENT:

TOTAL ROOF AREA: 5214m^2
100mm^2 / 1m^2, regulation standard
5214m^2 x 100mm^2 = 521400mm^2
521400mm^2 / 15 proposed down pipes = 34760mm^2 per down pipe
4/3 x $\sqrt{34760mm^2}$ = 186.44mm□ for 15 down pipes required, as per design intent the gutter water tank detail is to be expressed and thus size is correct for both architectural

5.3.7.5 WATER TANK SIZE REQUIREMENT:

NOTE: Proposal for water harvest at current for irrigation purposes only any and all overflow and excess to be discharged into water-pipe under square into storm water channel, excess water at parking garage to be discharged into public park and retained and discharged by method of berms and large vegetation growth.

Water tanks detail
2 x 4 stack (3&4.8m per stack) 3325mm□,
= Πr²: Π1662.5mm^2 = 8.678m^2 x 16.8m = 145.79m^3x2 x 1000l = 291580.0L
1 x 3 stack (3&4.8m per stack) 2264mm□
= Πr²: Π1132.0mm^2 = 4.023m^2 x 16.8m = 67.59m^3 x 1000l = 67586.4L
7 x 3 stack (3&4.6m per stack) 1126mm□
= Πr²: Π 563.0mm^2 = 0.995m^2 x 16.8m = 16.72m^3x 7 x 1000l = 117040.00L

total water store available:
291580.0 + 67586.4 + 117040.0
= 476206.4L
DAILY MAX AVERAGE CATCHMENT: 16163401L / 31 = 521400.03L PER DAY
MONTHLY MAX AVERAGE CATHMENT:16163401 PER SINGLE MAX AVERAGE MONTH
476206.4L - 521400.03L
= 45193.63L excess overflow into public park and storm water channel,
NOTE: berms to be designed by landscape architect
to allow for excess quantity.

5.3.7.6 TOTAL SITE WATER CATCHMENT INTO STORMWATER CHANNEL& BERMS:

SITE AREA EXCLUDING BUILDINGS :8272m^2 excluding public road space including public park
(note overflow from roof as calculated previously to be added:
MAX RAINFALL PAST 17 YEARS: 1546.3mm / 365 = 4.24mm per day average
MAX MONTHLY RAINFALL PAST 17 YEAR: 281.1mm / 31 = 9.07mm per day
(Jan 2006,data station [0513465 1] - PRETORIA UNIV PROEFPLAAS)

MAX MONTH_
9.07mm / 1000 = 0.01m^2
8272m^2 x 0.01m^2 = 82.72m^3, per day at max rainfall
82.72m^3 x 31 = 2564.32m^3 per month at max rainfall
1000l = 1m^3, thus 2564.32m^3 x 1000l = 2564320L per month of max rainfall

ANNUAL MAX AVERAGE_
4.24MM / 1000 =0.004m^2
8272m^2 x 0.004m^2 = 33.09m^3, per day at max yearly average
33.09m^3 x 365 = 12077.12m^3 per year at max yearly average
1000l = 1m^3, thus 7612.44m^3 x 1000l
= 12077120L per year at yearly max average

Note: existing storm water channel has been designed to handle all public stormwater of sites and road surface as per zoning regulations noted on this drawing at the relevant site zoning information for this site: ERF 29552 Mamelodi ext 5 storm water channel to be modified, RENO MATT to be installed, as per manufacturer: MACAFERRI specification.

5.3.7

Figure. 42
New proposed
Community Engagement
facilitator (CEF) roof plan

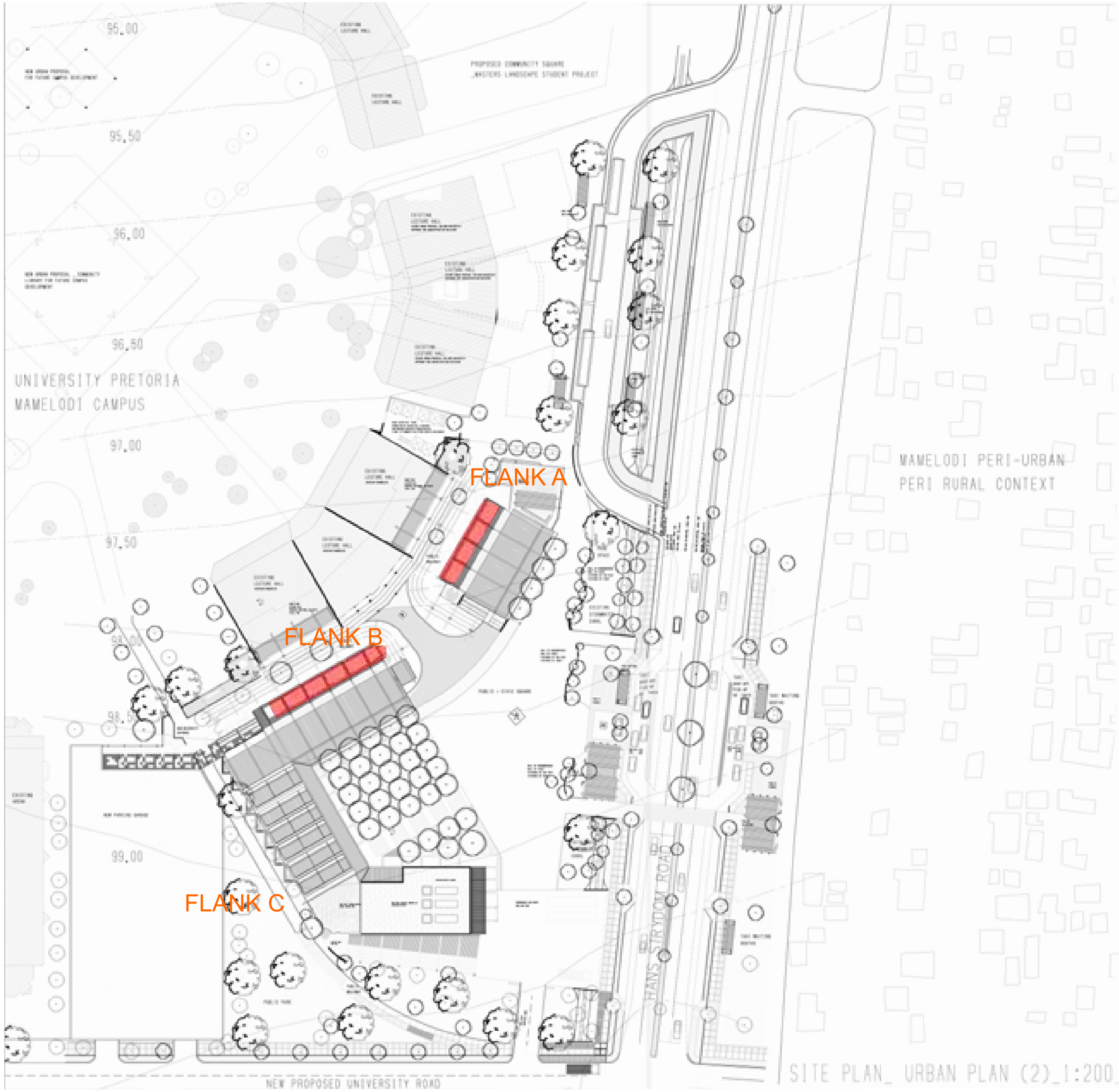


Photo voltaic

Figure. 116
3d images of ventilation shafts & stack vents in CEF building.

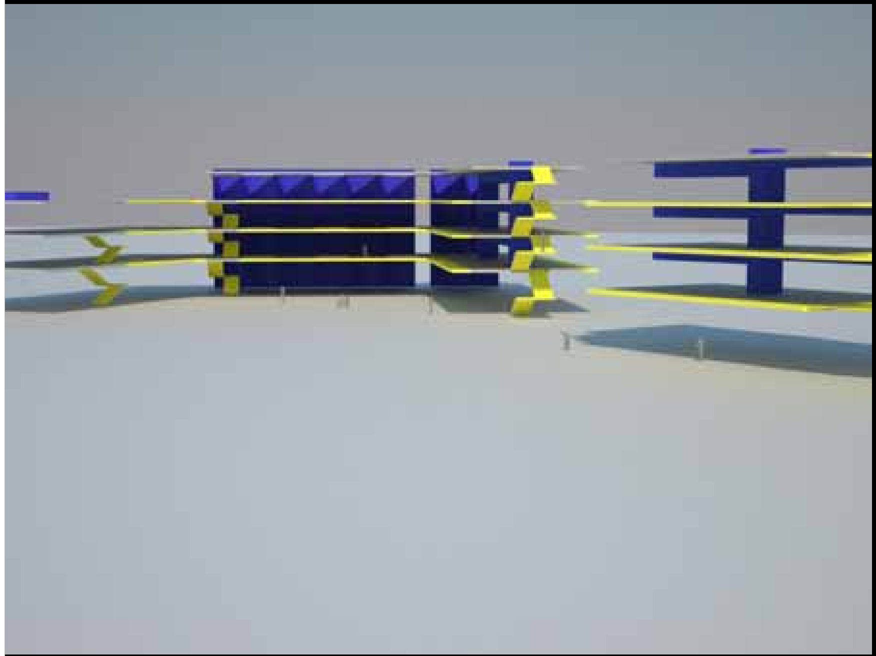
Concrete

Walkways & stairs

Steel

Ventilation systems

Service areas



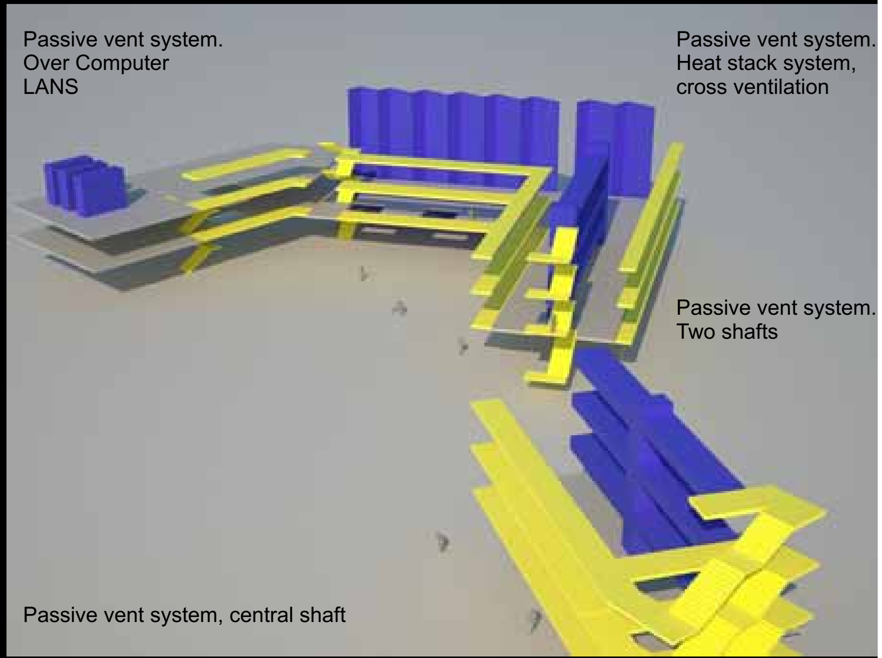


Figure. 117
3d image of light shafts in CEF building.

Figure. 118 a & b
3d image of service points in CEF building.

Concrete

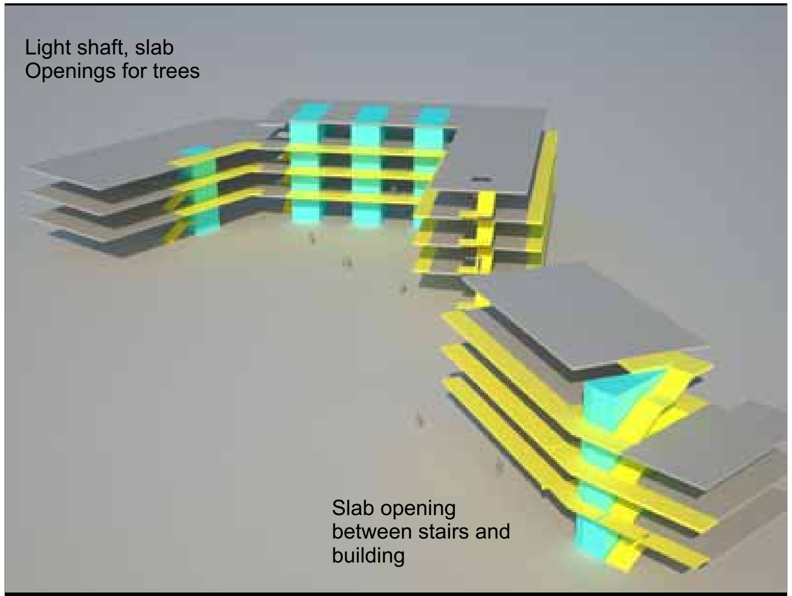
Walkways & stairs

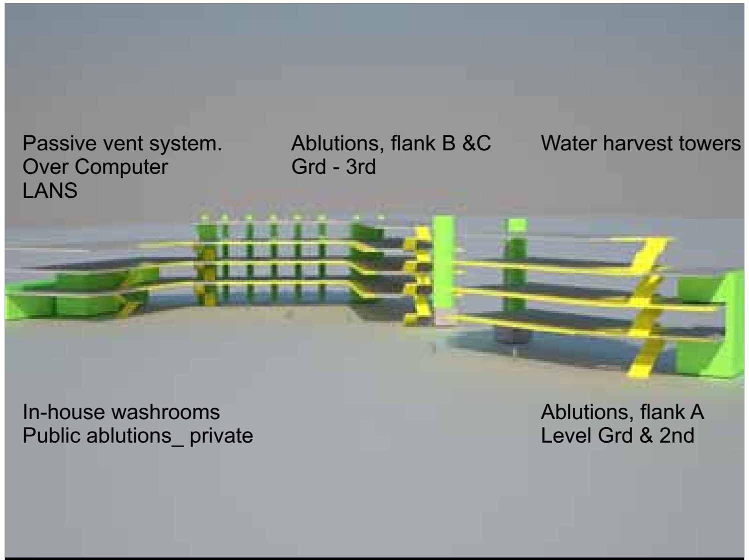
Steel

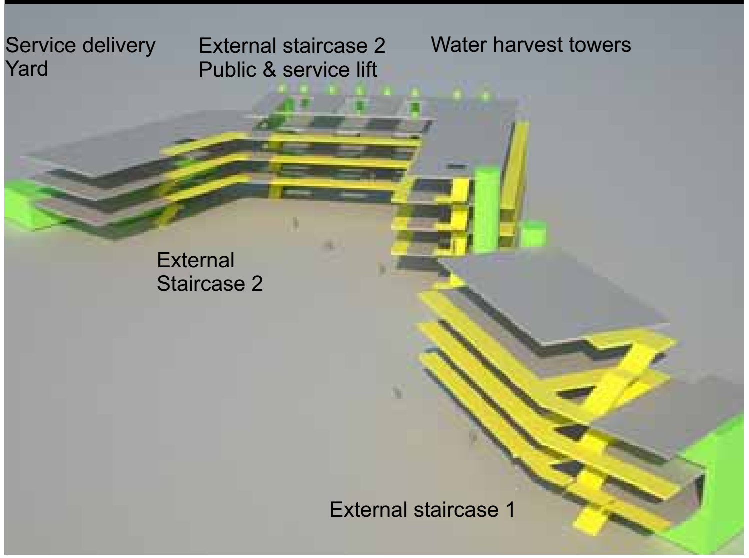
Ventilation systems

Service areas

Light shafts







7.3_

TECTONIC APPROACH

C.Norberg Schultz 1979, pg 58

"The distinctive quality of any man made place is enclosure, and its character and spatial properties are determined by how it is enclosed."

7.3.1

SEE FIGURES: 121 - 123 for tectonic clarification

Central core structure
Concrete columns, with brick infill
Externall structure
Lightweight steel structure with balustrading and polycarbonate sheet skin
Central floor structure:
Two way span concrete slab system on concrete beams, effectively forming a ring beam with the steel I-BEAM. The span of 10550mm for a floor slab has been reduced to 5300mm by using the beams. This also allowed for the entire structure to form a single module and thus reduce any possible deflection. If one looks at the costing analysis done for the most effective slab, column and beam as seen on Section Z-Z dwg this outweighs any other tested system.
Outer floor structure:(walkways)
Steel frame with mentis grid and timber floor boards allowing ventilation vertically along building, to work in conjunction with the polycarbonate skin on the Univeristy facade of flank B.

C.Norberg Schultz 1979

" A meaningfull relationship between horizontals and verticals also depends on the form of the roof."

The roof typology is intended to be an extended skin over building. Becoming a morpholgy of scale and shape, terminating at public square into light weight Permeable wall structure.

Top roof Flank A + B; figure 121
Curved edge to match curved roof typology of existing building on campus
Contrast on typology by using lightweight polycarbonate sheeting as appose to heavy weight steel sheeting.
Roof typology changes as it moves towards the eastern side on the public facade, opening up and covering the square. Matching single lean-to roof typology of surrounding shack and informal housing. Use of corrugated sheeting Br 7 to match the use of steel plates and sheeting for shack dwellings.
Roof and structure, laid into modules enforcing the principle idea of layers, with vertical steel members breaking the massing, dividing the unit into smaller units. This gives a more human scale appearance to the built form. The detail on Section Z-Z expresses this principle with the sheeting laid between steel member and flashed under and over.

Top roof Flank C; figure 121
A morphology of roof A & B, transforming into light shaft roof pitches: facing north north west. Allowing light to enter meeting rooms and public corridors through the cut back concrete slab openings. This allows light on Flank C during morning and afternoon, avoiding cold shadow spaces. Simultaneously dividing the public space and the private space but connecting the sense of place of the two domains. As noted by Shultz.

C.Norberg Schultz 1979, pg 63

"Evidently this meeting is expressed in the wall and in particularly in the openings which connect the two domains."

Rooftop function venue with flat slab, roof light openings fitted over computer flat slab to allow natural light to enter the double volume space and lan without ambient light affect functionality of room

Top roof Flank C front.
Roof line completed with curved skin of polycarbonate over sealed windows, as room houses computer LAN.

Note: All structural calculations for beams, columns: steel, concrete and timber on technical drawings.

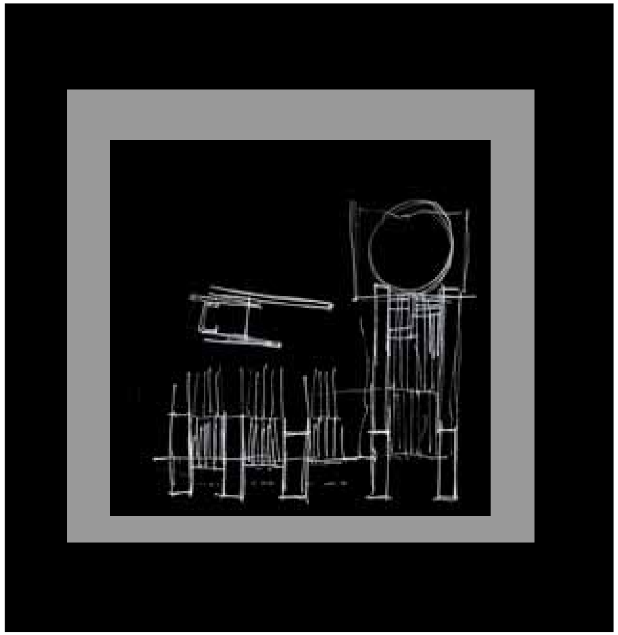
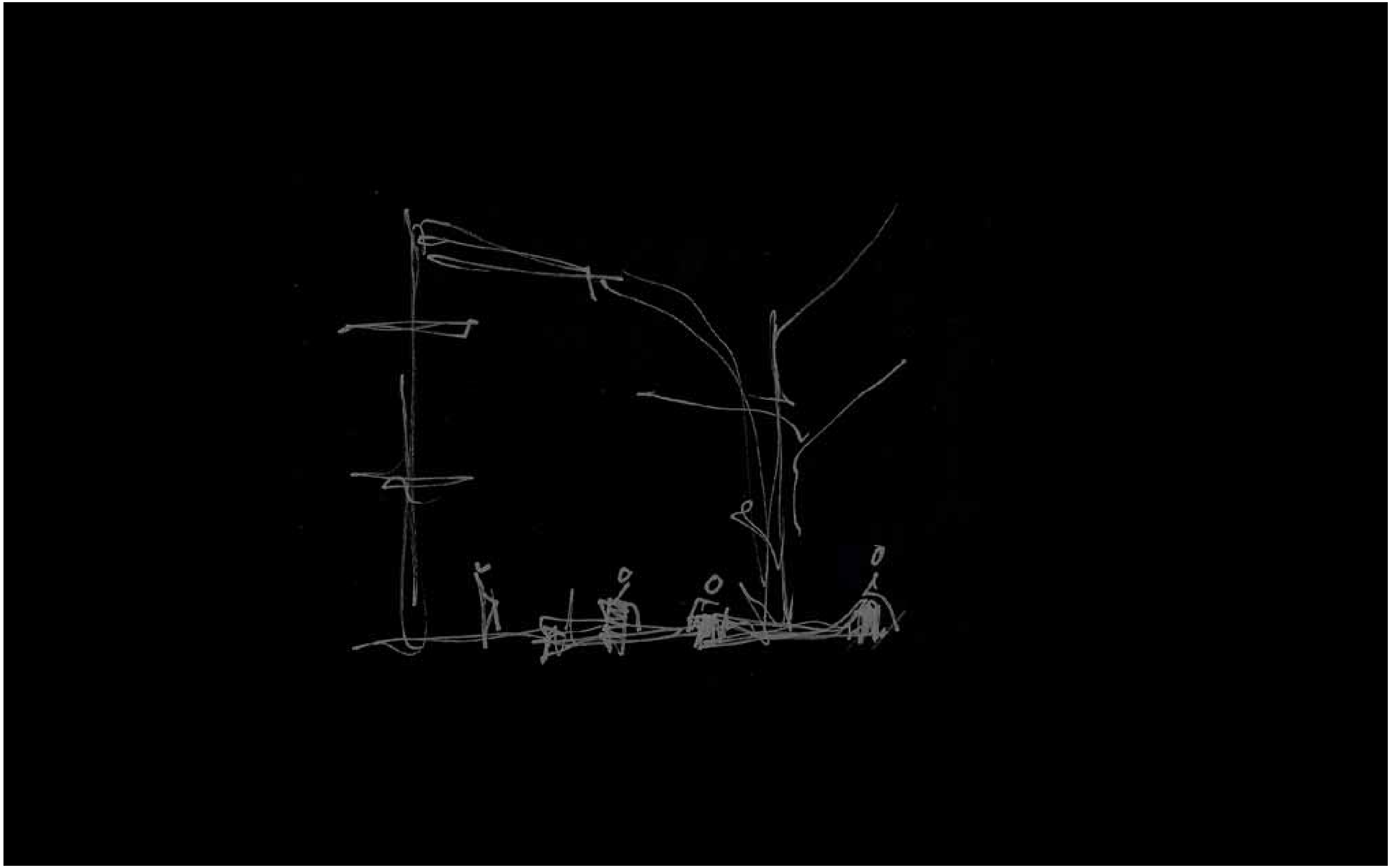


Figure. 119 Layers of material & sketch design

Figure. 120a
Tectonic dialogue a story board, precedent images of site and immediate context_ small scale structures

Figure. 120b
Tectonic dialogue a story board, precedent images of site and immediate context_ large scale Structures

Figure. 121a, b
Tectonic design
development



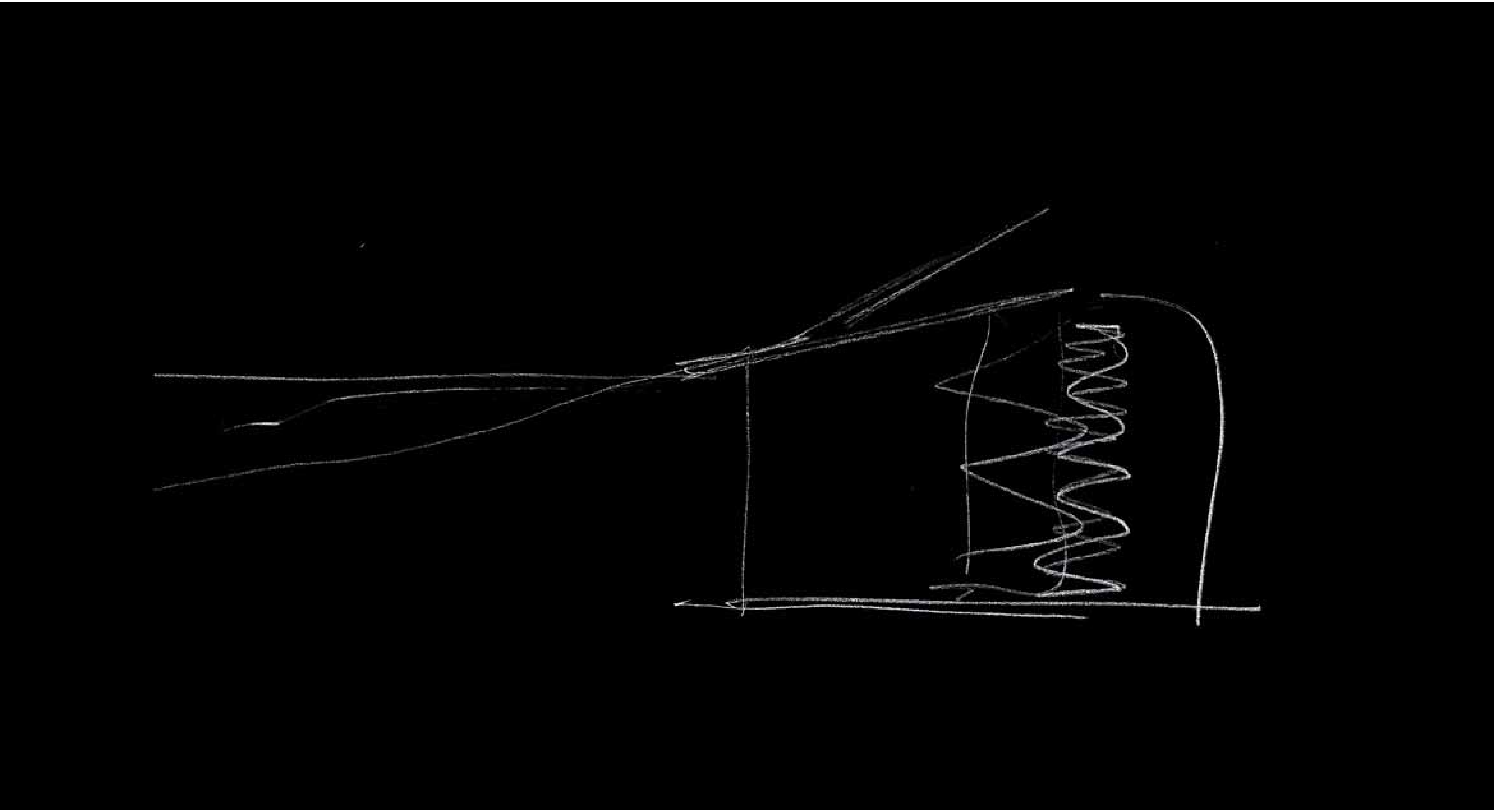
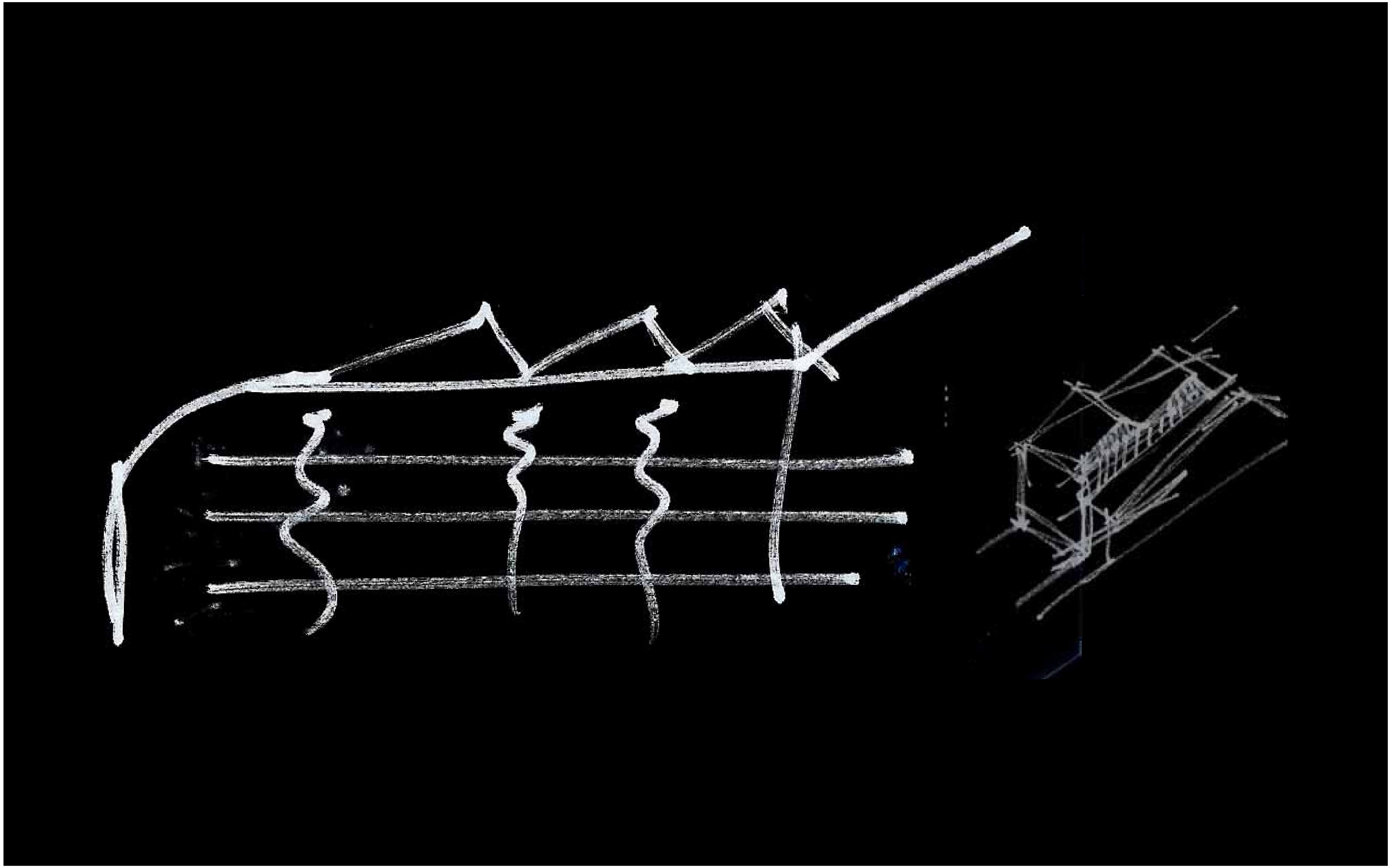


Figure. 121c,d
Tectonic design
development



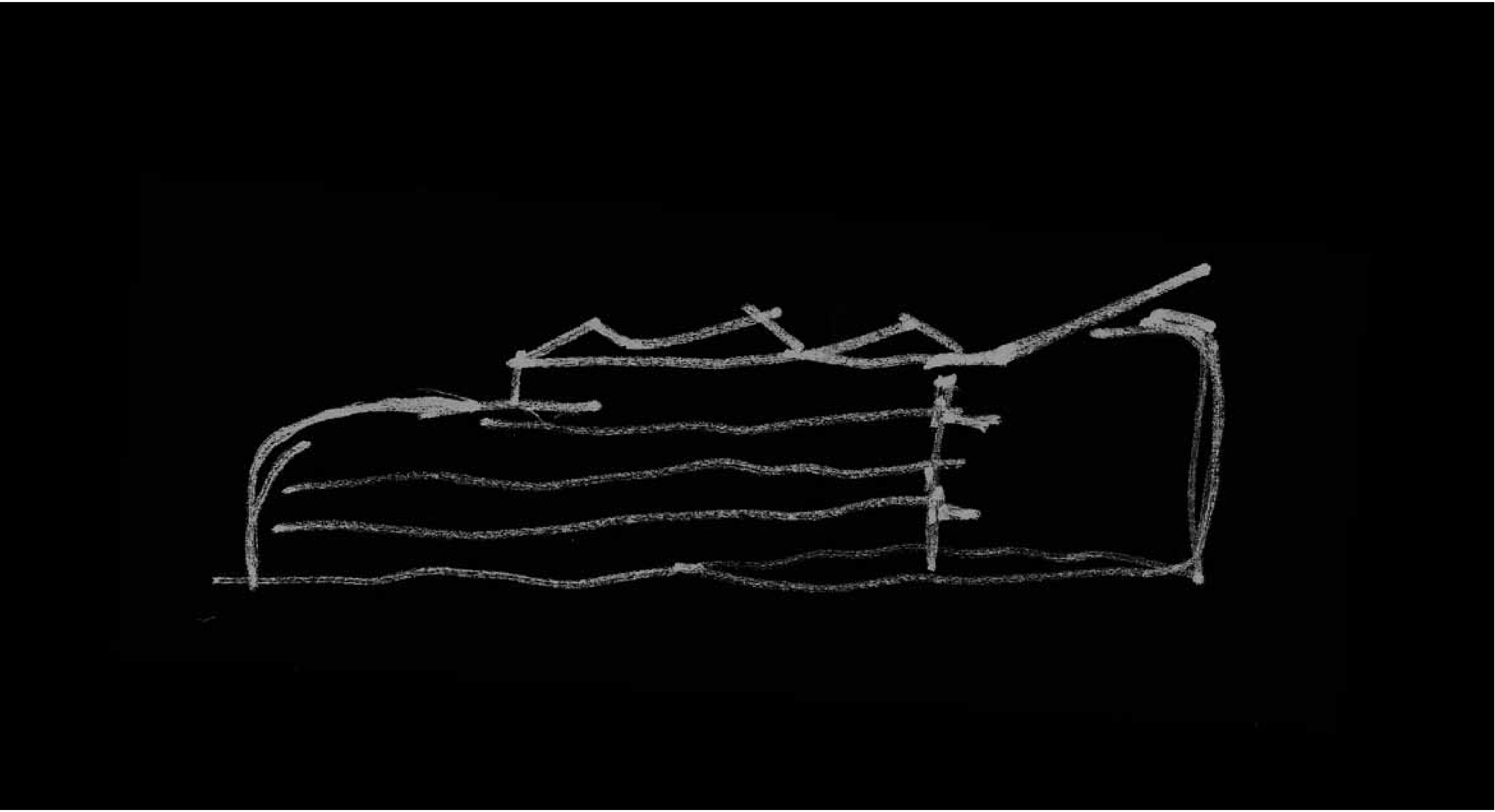


Figure. 122
3d images total CEF tectonic form and structure

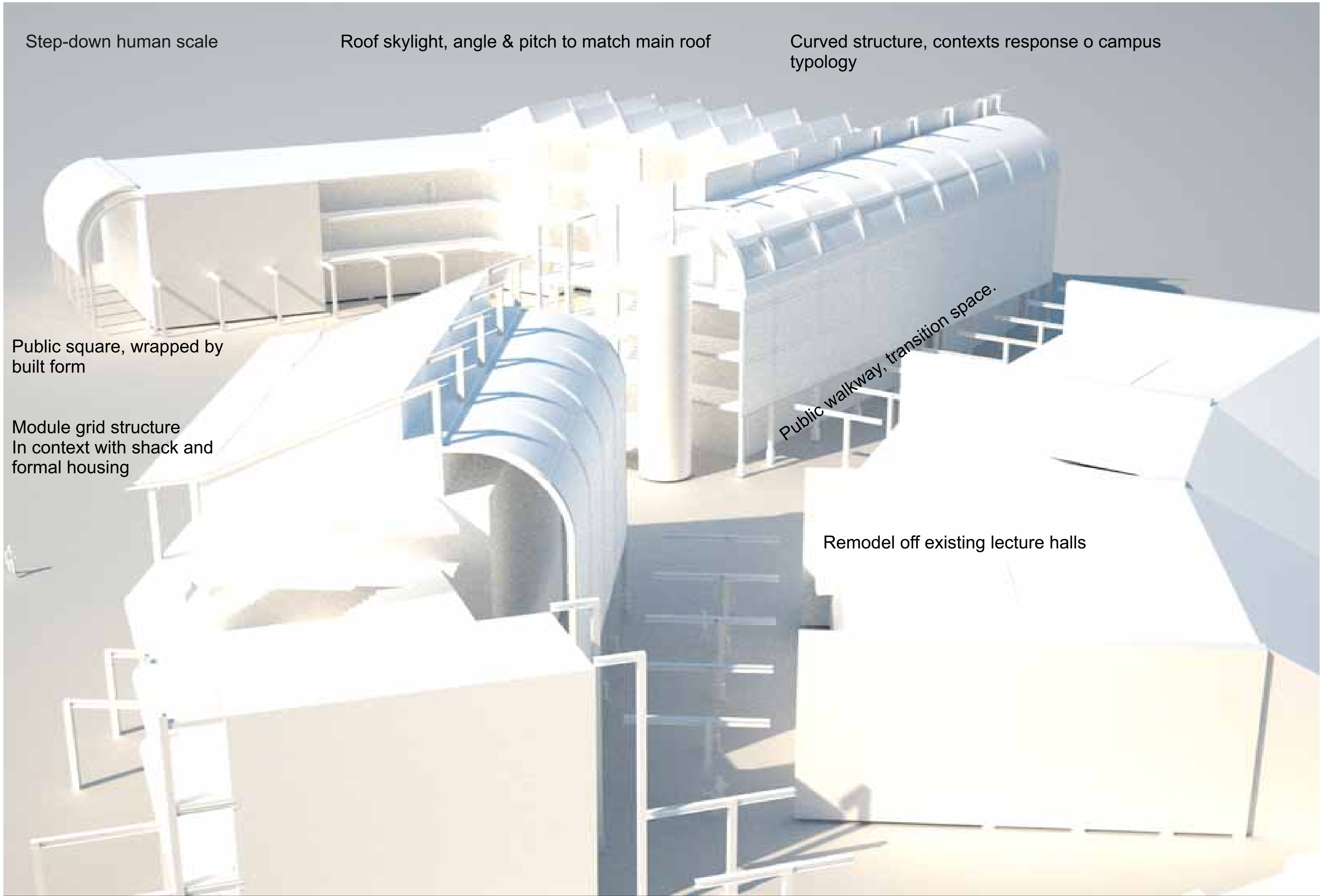
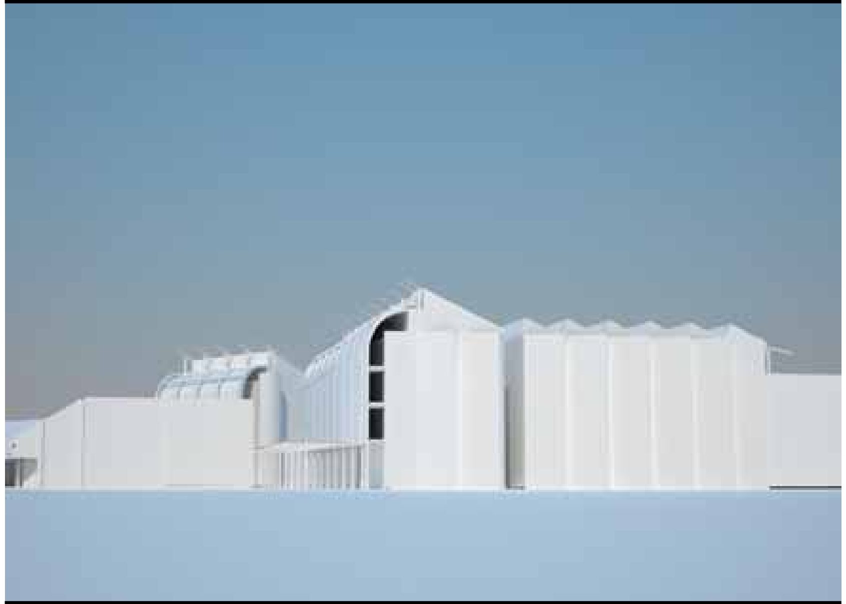


Figure. 123 a -d
3d 4 images total CEF tectonic form and structure

West elevation, building mass and typology In context with campus

South elevation, building mass and typology



North East elevation, building mass and typology, opening up to public square

Major mass at centre, stepping down in scale to outer flanks A &C terminating at roadway.

Birds eye view, building mass and typology.
Emphasis on public spaces. Visual and physical connections

7.4_

7.4.1

MATERIAL AND EMBODIED ENERGY

Note, embodied energy values are based on international standards, South African value will variy depending on material produced locally, thus a 5 - 10% reduction and addition can be expected. These figure are based on new material, preferred use of recycled material, will greatly reduce energy value.

Material type	intended use	Embodied energy	U-VALUES
Brick	_New and recycled _ Structure in-fill	2.5 MJ/kg	0.35 - 0.96 W/m K
Corrugated steel sheeting_ Br 7	_ main structure _ public architecture _ taxi waiting stalls	8.9 - 32 MJ/kg	60+ W/m K
Mild steel flats	_ mentis grid _ solar shade	8.9 - 32 MJ/kg	60 W/m K
Concrete	_ site furniture _ public seating in building _ portal frame structure _ plinths and column bases	1.3 - 2.0 MJ/kg	0.18 - 2.1 W/m K
Steel H- & I- Beams	_ structure	8.9 - 32 MJ/kg	60 W/m K
Aluminium sheets	_ balustrade lazer cutting Artist design	227 MJ/kg	200 W/m K
Polycarbonate sheeting	_ skin facade _ part roofing	30.3 -70 MJ/kg	0.17 W/m K
Glass	_ windows	15.9 MJ/kg	0.8 W/m K
Per-specs plastic sheeting	_ selected openings	30.3 - 70 MJ/kg	0.17 W/m K
Timber hardwood & soft wood floor planks	_ walkways	2.5 MJ/kg	0.13 - 0.20 W/m K
Pigmentation			

Material intent:

To make use of low budget material, either recycled or new.
Intended to be constructed by local artisans, skilled and or unskilled.
Promote the idea of work and job creation.
It was also intended to make use of material that has an effective heat transfer value, so to allow for least heat gain in summer and similar in winter heat loss, working effectively with the proposed passive ventilation system.
As noted the intended use of material must submit to a low embodied energy count.
Aimed at being as far as possible carbon friendly, and using recycled material.
The use of recycle material does play in favor of this development with relation to context.
Effort and research has been done with regards to precedents on materiality as noted under chapter 6, 6.1.

_Nelson Mandela Interpretation centre

_Phillipi transport interchange

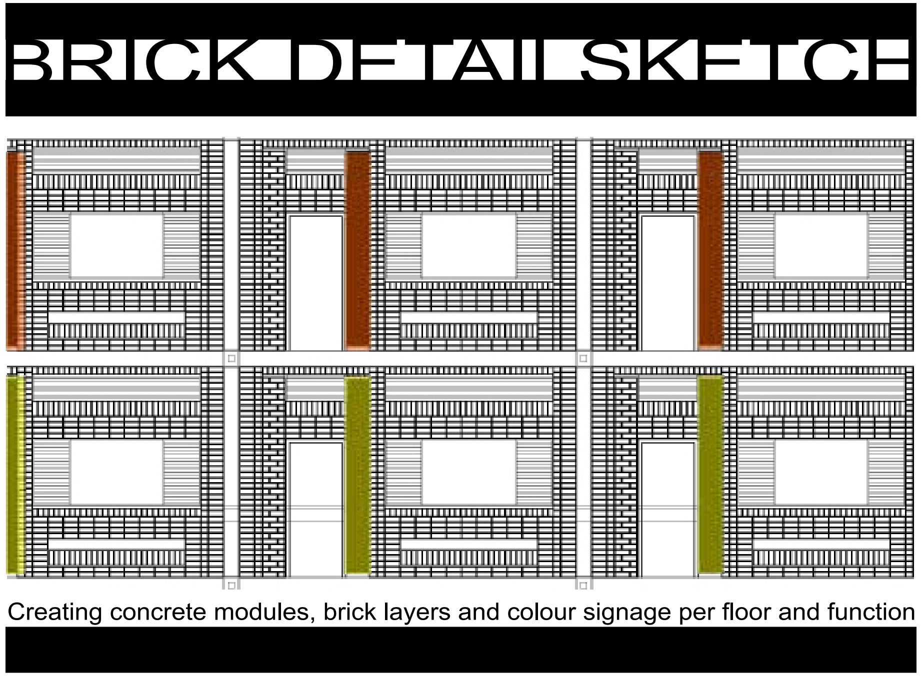
The use of specific materials are not limited to structure and aesthetics, but are also intended to serve as signage and legibility. The material intend to be guidance to the blind using textures, colour to the illiterate that cannot read. Textured images to the colour blind who can not depict colour.
Hence the language of the building also serves as signage and guidance of the facility. Examples, figure: 25a

Final material use for signage type, layout and purpose as per signage diagram
Figure: 25b

Figure. 124
Materiality:
Poly-carbonate sheets
Brick work
Recycled metal sheets
Roof corrugated sheet
Concrete panels

Figure. 125a
Materiality:
Textures_ floor and walls

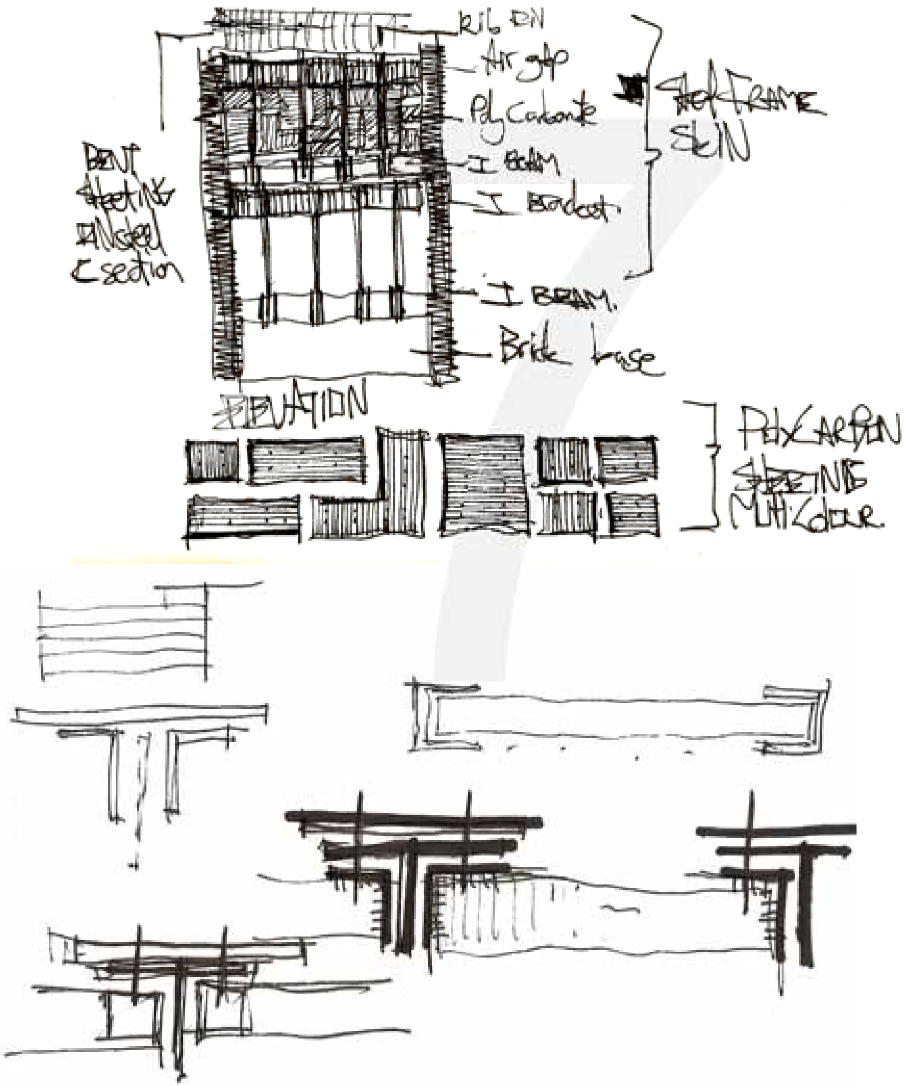
Figure. 125b
Materiality:
Early brick detailing at office corridors.



7.5_ TECHNICAL DESIGN PROCESS_DETAIL SKETCHES

7.5.1

Figure. 126a Technical design process sketches



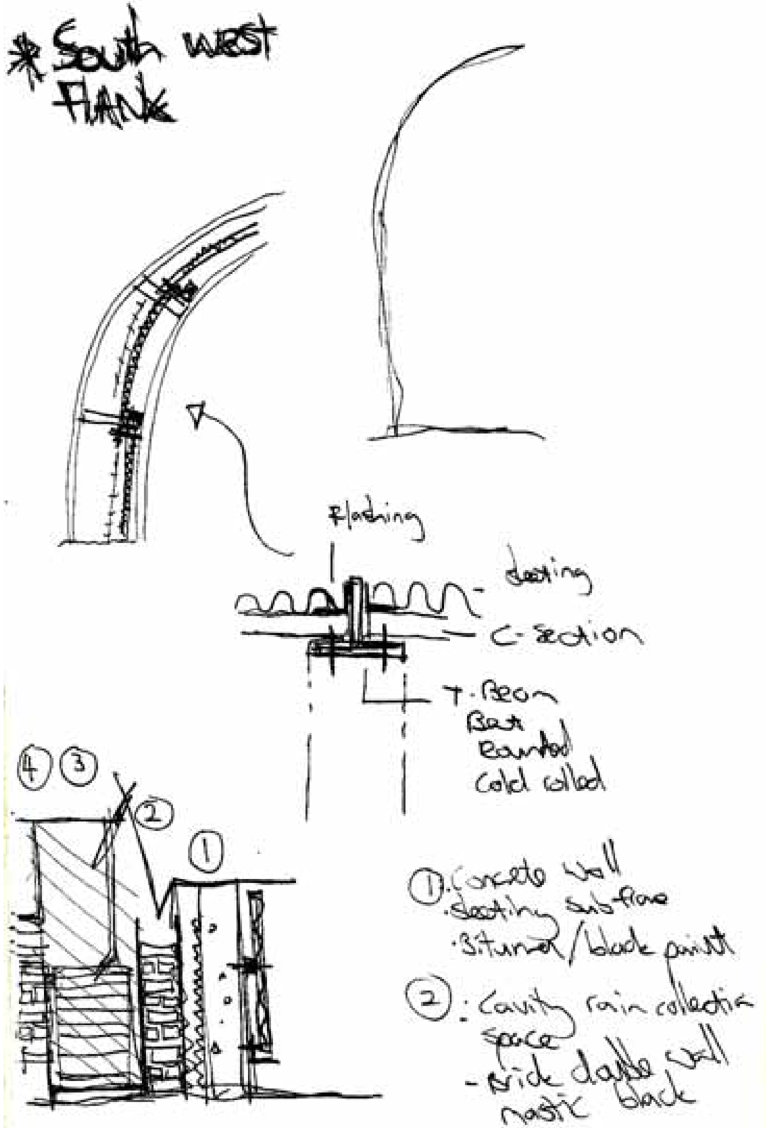
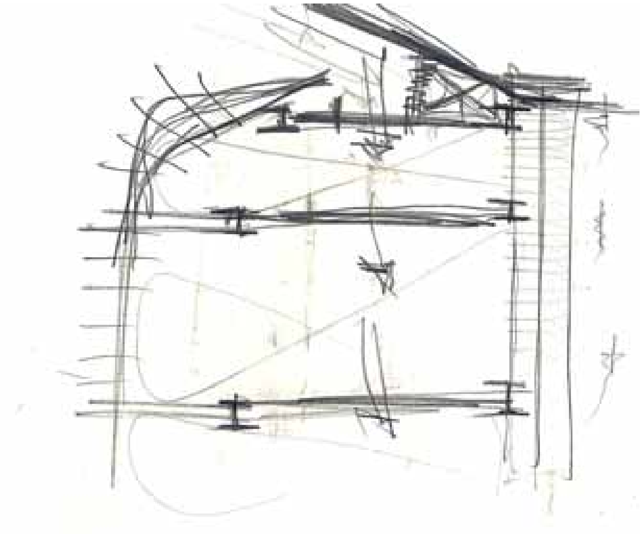


Figure. 126b
Technical design
process sketches



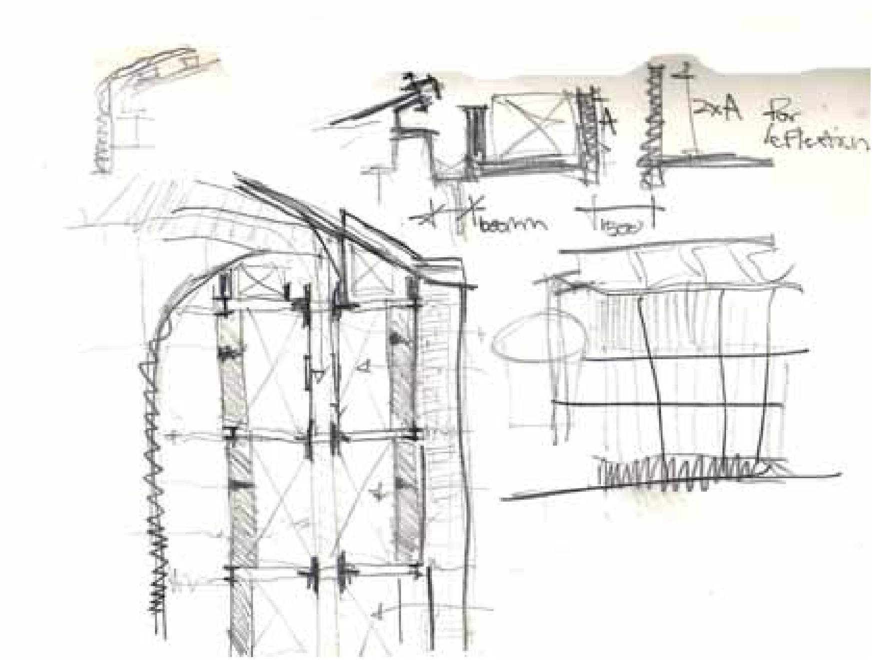
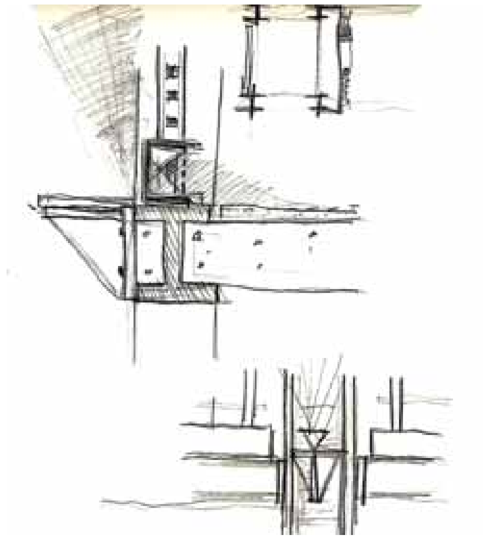


Figure.
126c
Technical
design
process
sketches



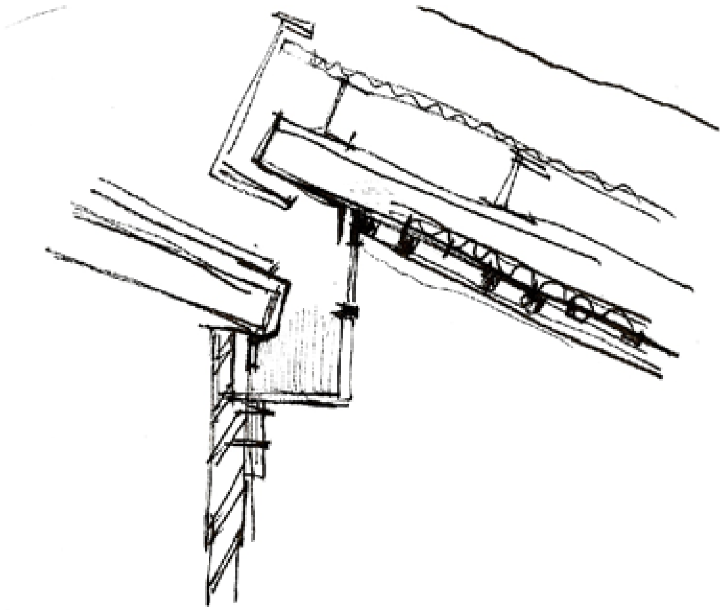
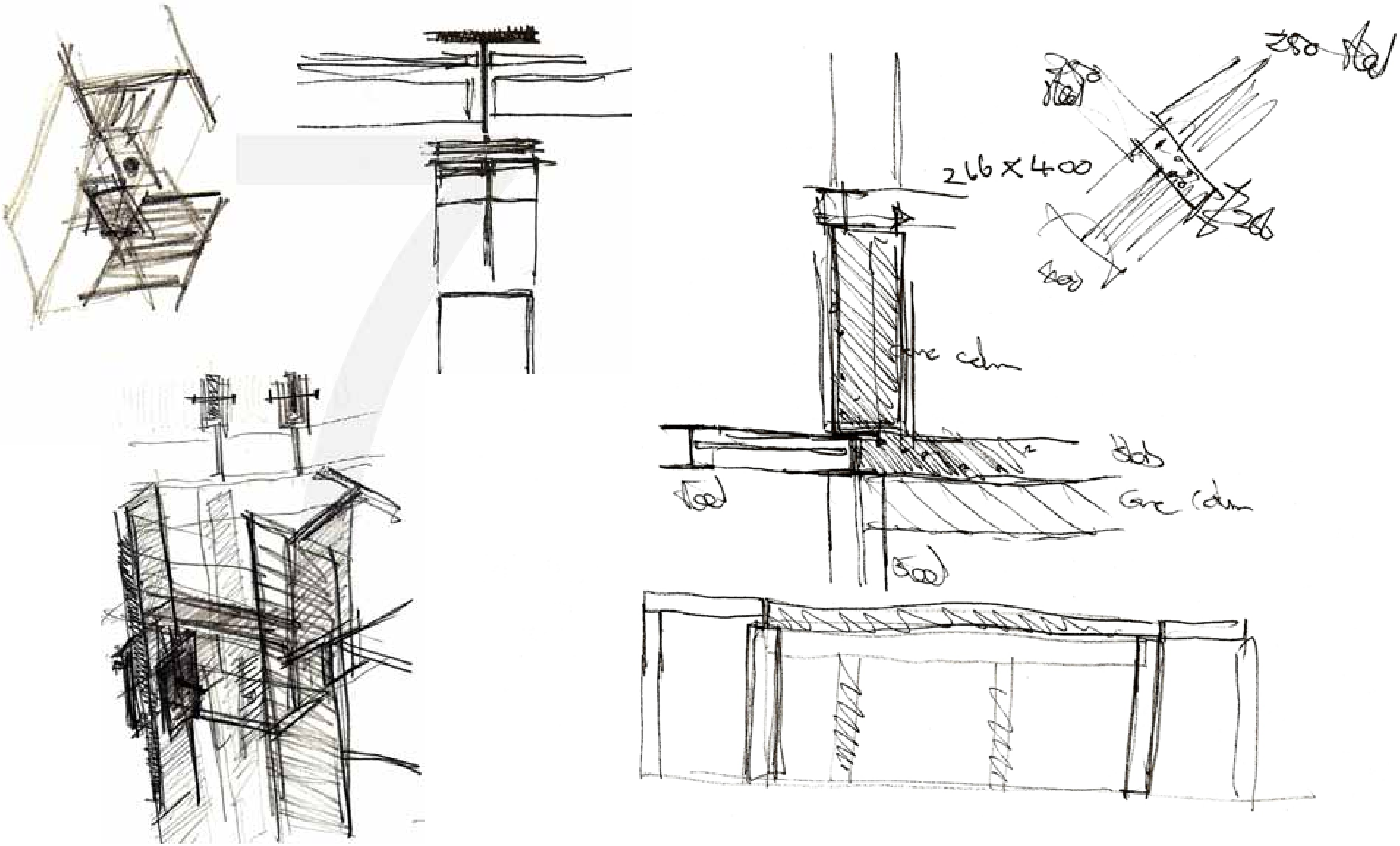


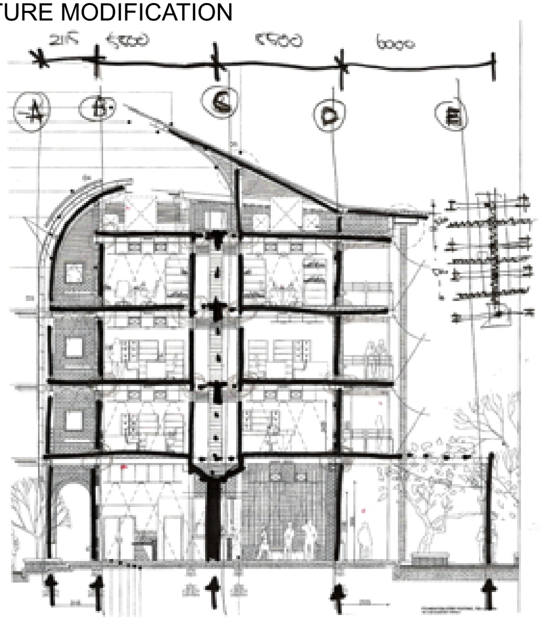
Figure. 126d
Technical design
process sketches



7.5.2

Figure. 127a
Technical design, structure modification process

DESIGN STRUCTURE MODIFICATION PROCESS 1



Structure supports phase1

Figure. 127b
Technical design, structure modification Phase 2

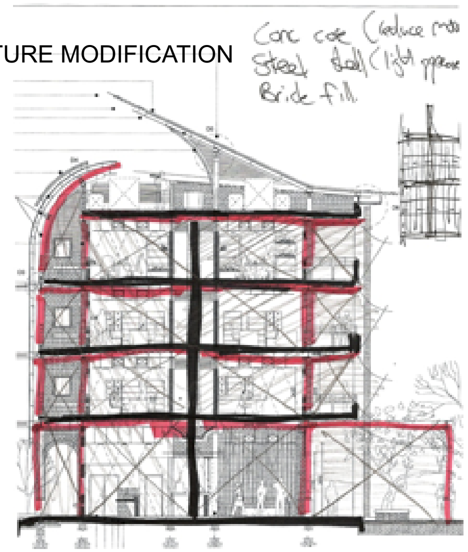
DESIGN STRUCTURE MODIFICATION PROCESS 2

Structure concrete

Structure steel

Figure. 127c
Technical design, structure modification process, phase 3

DESIGN STRUCTURE MODIFICATION PROCESS

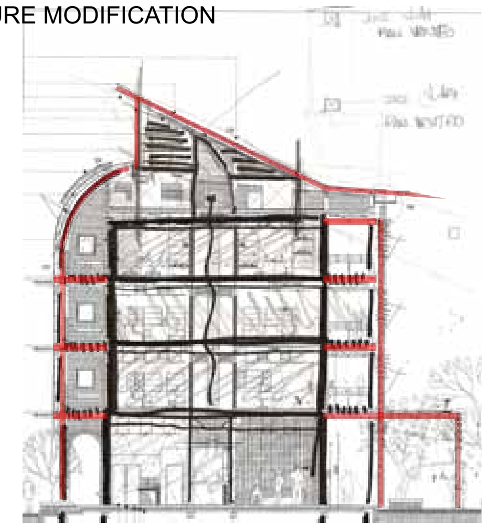


Structure concrete

Structure steel

Figure. 127d
Technical design, structure modification process. Final phase

DESIGN STRUCTURE MODIFICATION PROCESS 4



Structure concrete

Structure steel

7.6_ EXISTING STRUCTURES_ IMAGES AND SKETCHES

Figure. 128
Site technical sketches:
Elevations
Detail section

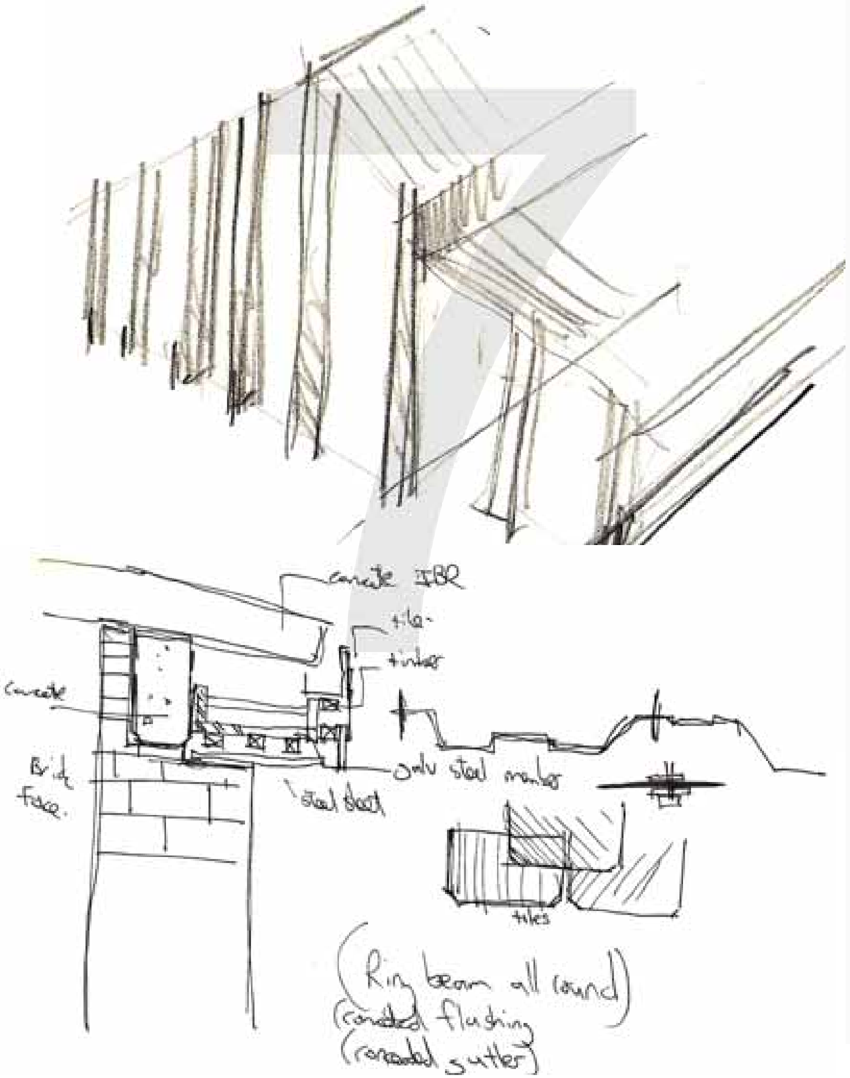


Figure. 129a Structure Lecture halls: roof steel frame

Figure. 129b Structure Lecture halls: internal

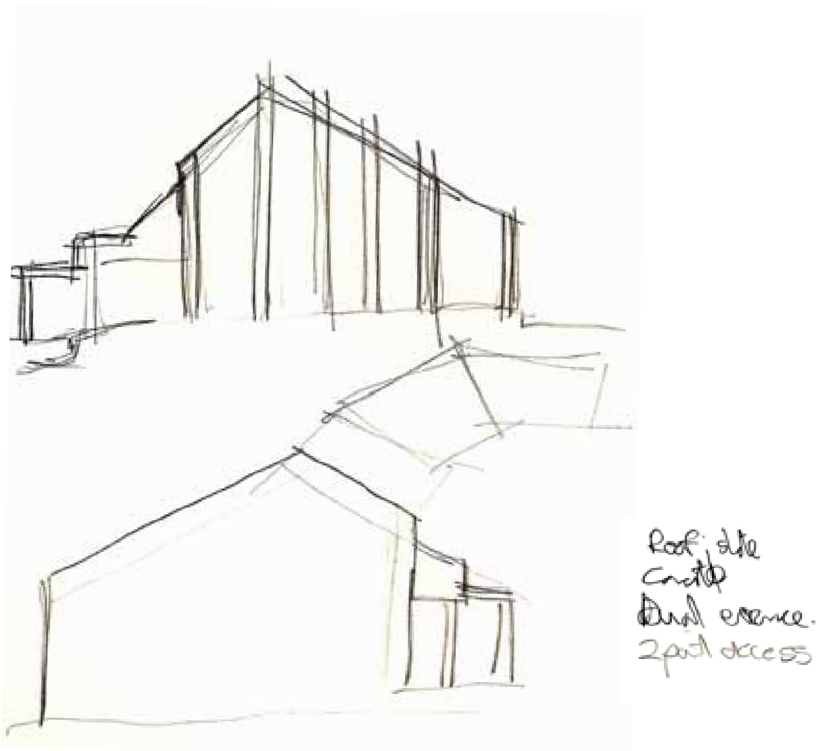


Figure. 130
Existing structure site plan