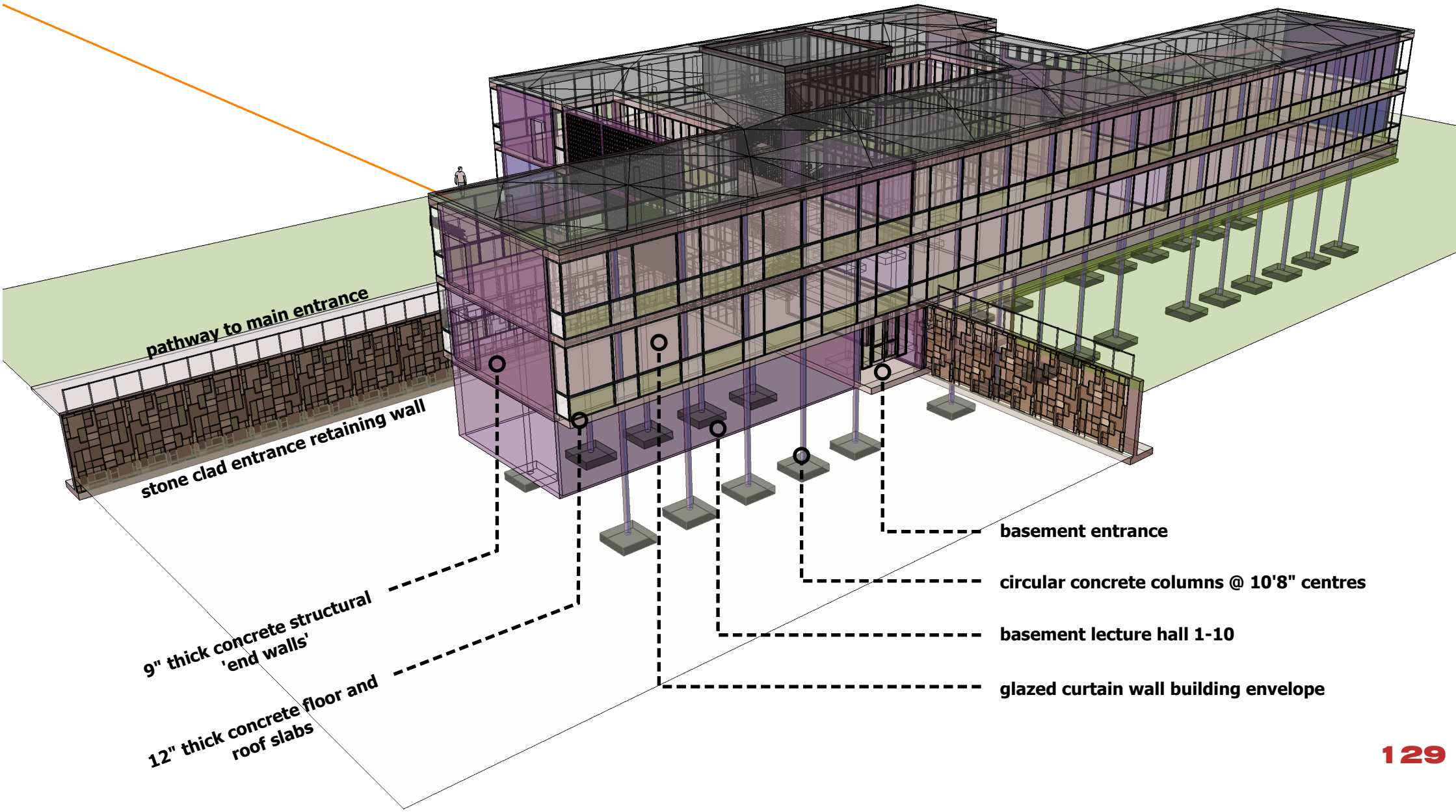




**retrofit : space plan**

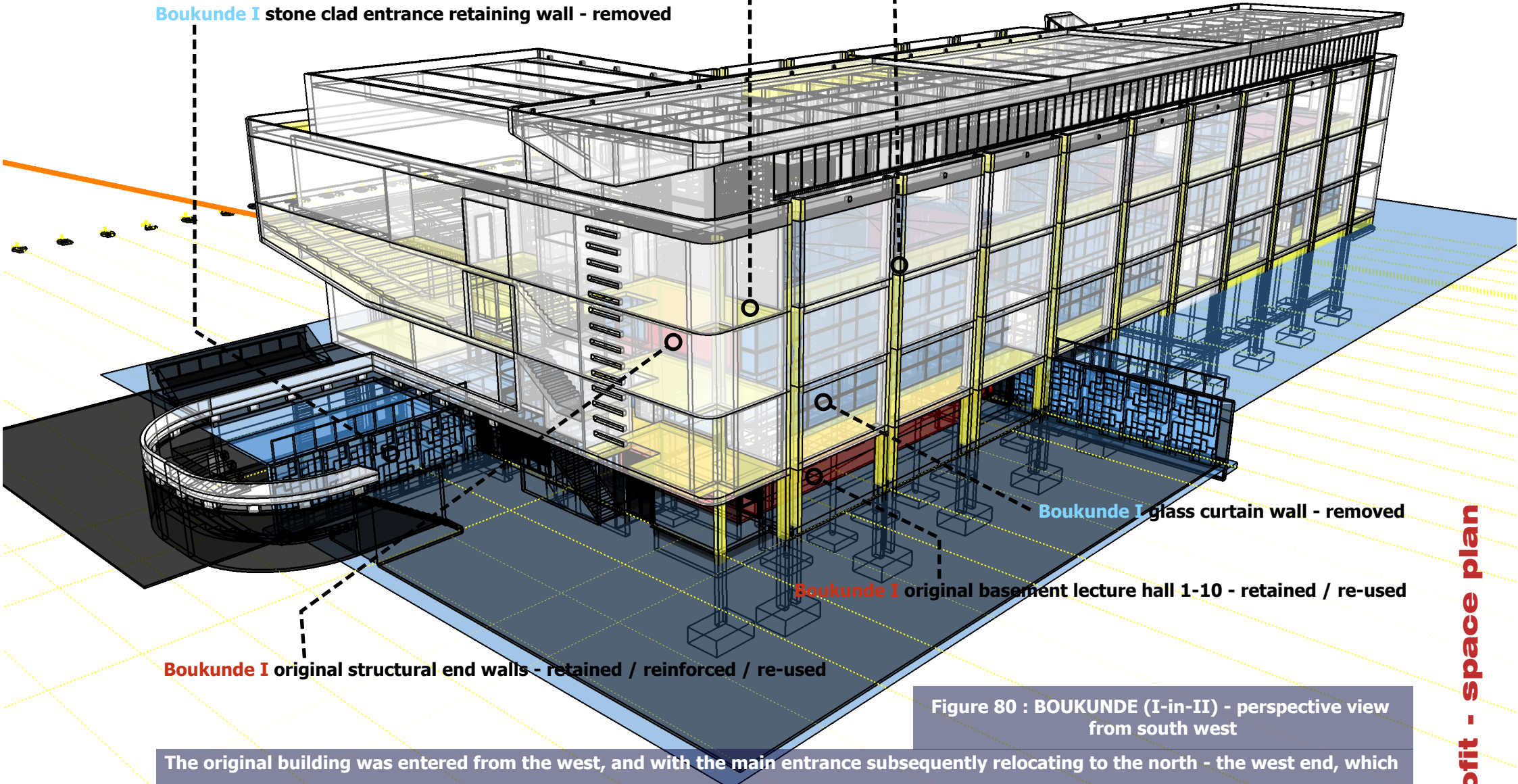
Figure 79 : BOUKUNDE I - perspective view from south-west



**Boukunde II supplementary floor surface area**

**Boukunde II supplementary support columns**

**Boukunde I stone clad entrance retaining wall - removed**



**Boukunde I glass curtain wall - removed**

**Boukunde I original basement lecture hall 1-10 - retained / re-used**

**Boukunde I original structural end walls - retained / reinforced / re-used**

Figure 80 : BOUKUNDE (I-in-II) - perspective view from south west

The original building was entered from the west, and with the main entrance subsequently relocating to the north - the west end, which is only accessible from basement level - has become a 'dead' zone. This lack of inter-activity extends around to the south, and east - where the first significant perforations in the building's envelope are to be found. The western end of the building is endowed with sculptural qualities and significant design detail that is lost upon the occupants who scarcely visit the amphitheatre level due to the predominance of services infrastructure.

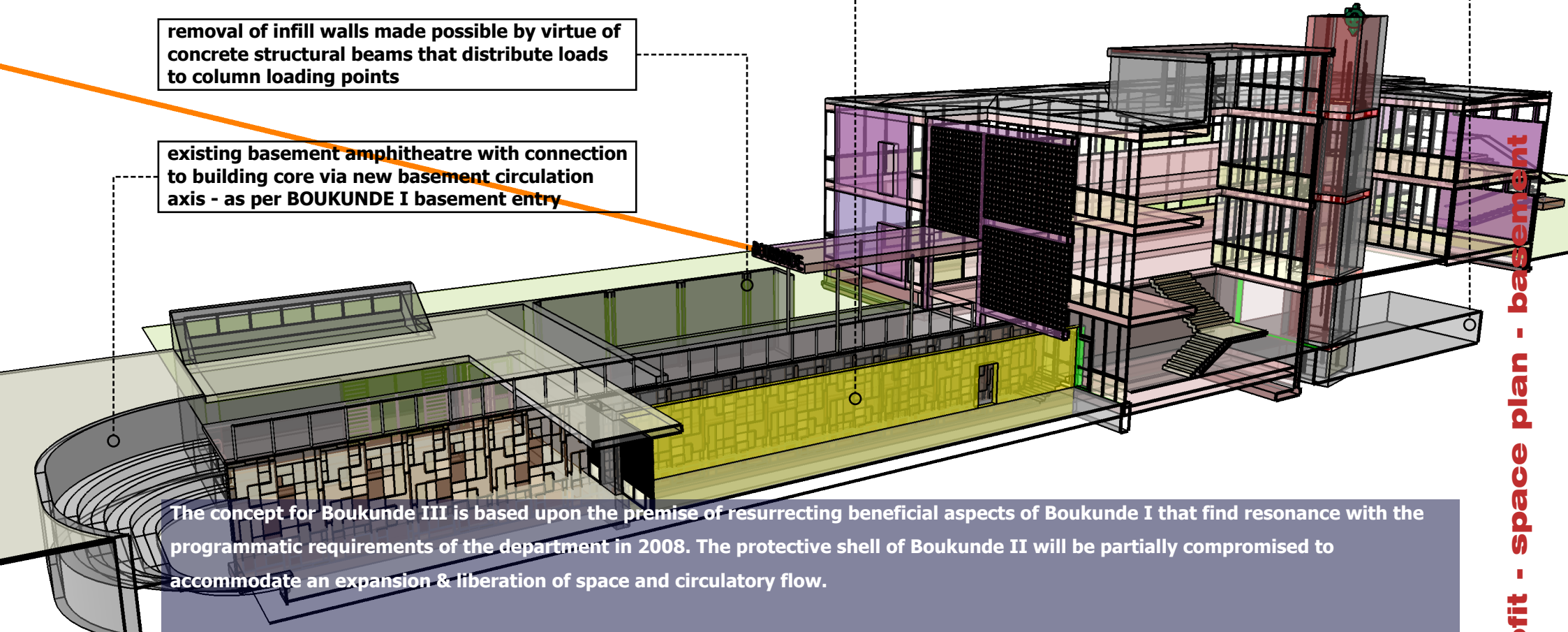
basement footprint extended beyond existing stair to accommodate new personnel elevator and exhibition space beyond

existing air-conditioning room wall to be broken out to form wide passage / exhibition space in concert with existing basement passage

removal of infill walls made possible by virtue of concrete structural beams that distribute loads to column loading points

existing basement amphitheatre with connection to building core via new basement circulation axis - as per BOUKUNDE I basement entry

Figure 81 : BOUKUNDE II basement - perspective section view from south-west (overlaid with BOUKUNDE I)



The concept for Boukunde III is based upon the premise of resurrecting beneficial aspects of Boukunde I that find resonance with the programmatic requirements of the department in 2008. The protective shell of Boukunde II will be partially compromised to accommodate an expansion & liberation of space and circulatory flow.

The starting point is at the most neglected sector of the current building - being the western basement area. The reconfiguration of the hvac system - from primarily a central mixed-air system to a hybrid of geothermal heat exchange, displacement air-conditioning and natural ventilation will afford the opportunity of relocating- & scaling down the bulk of the current system. This action will create the opportunity for new circulation paths to develop from the derelict nether-regions of Boukunde.

retrofit - space plan - basement

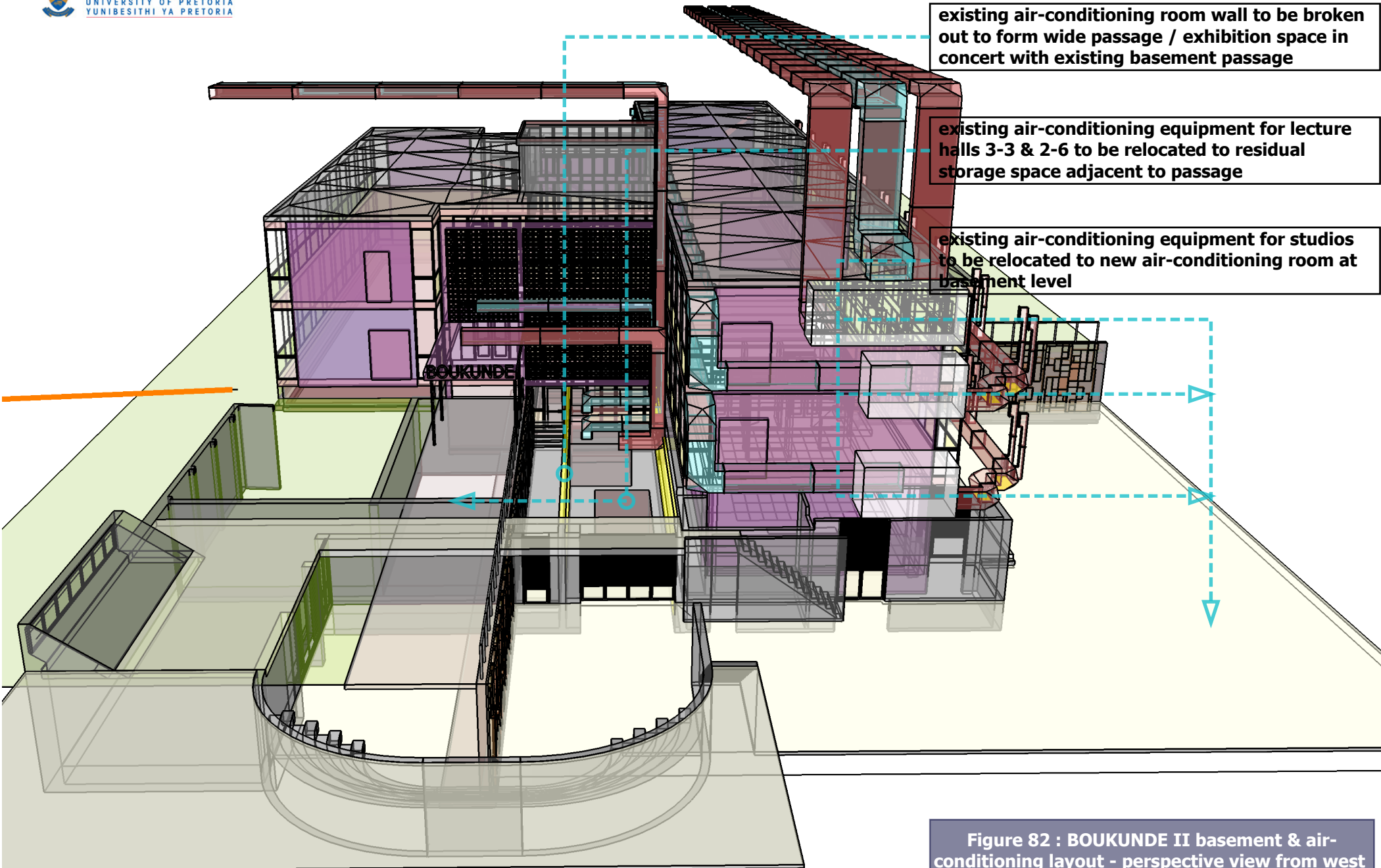


Figure 82 : BOUKUNDE II basement & air-conditioning layout - perspective view from west (overlaid with BOUKUNDE I)

retrofit - space plan - basement

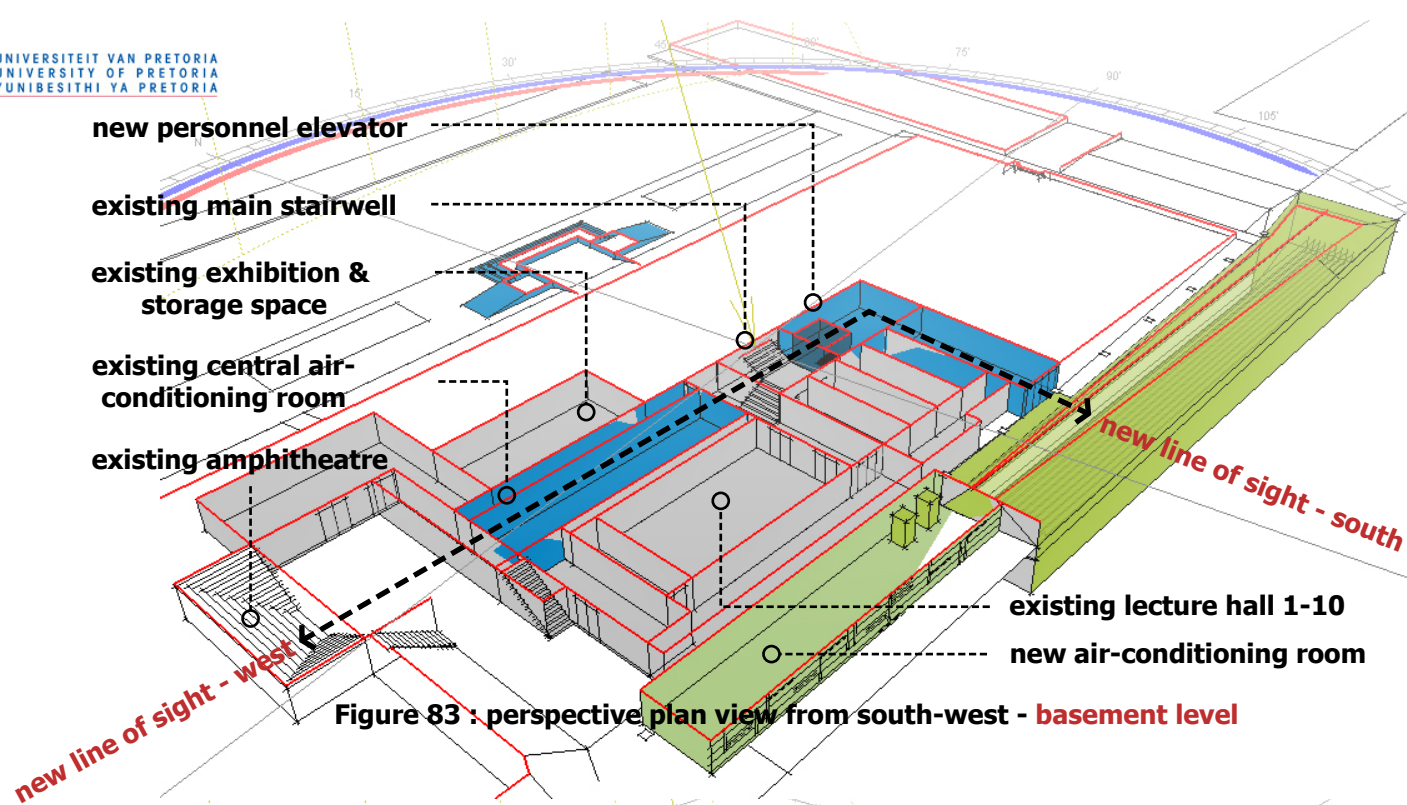


Figure 83 : perspective plan view from south-west - **basement level**

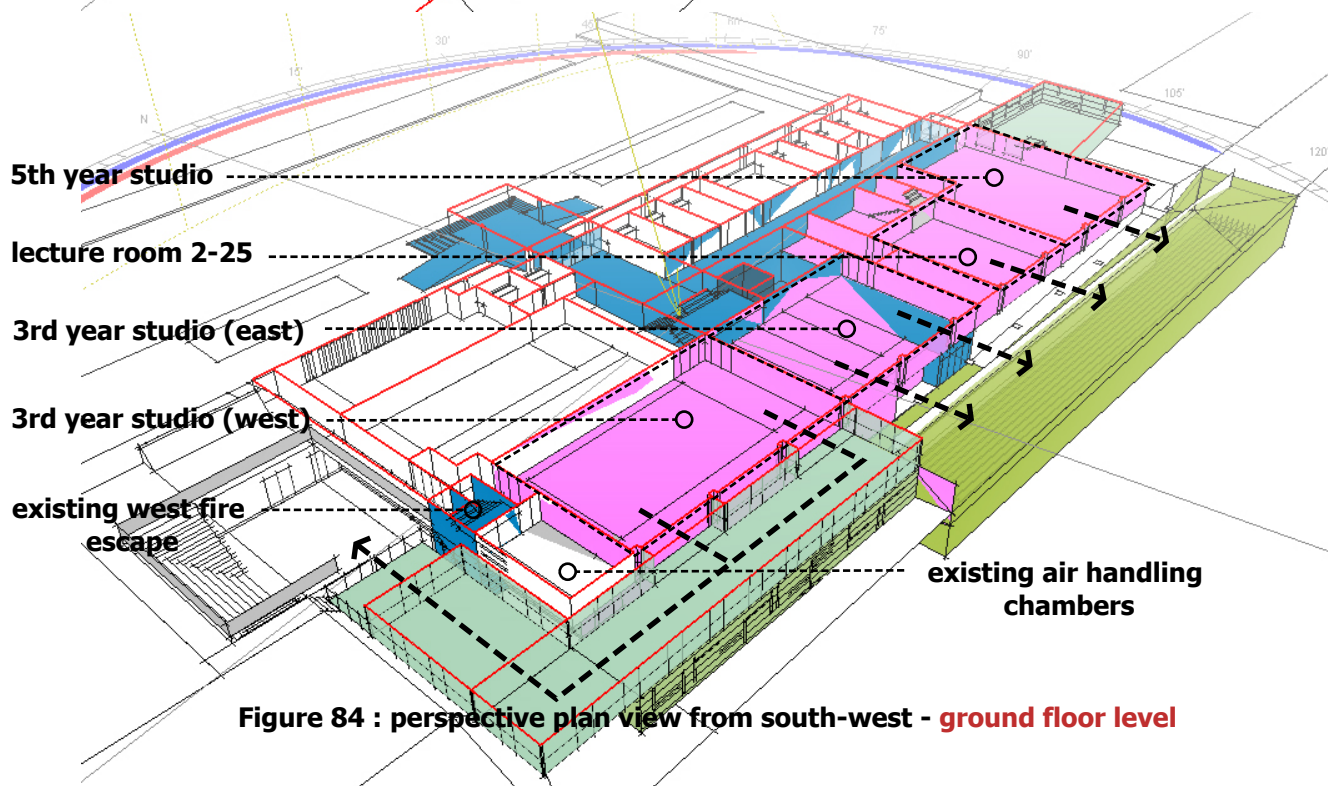


Figure 84 : perspective plan view from south-west - **ground floor level**

**BASEMENT LEVEL:**

The intention is to open up a line of sight from the buildings core to the south & west. The 2 new basement spaces will be designated as circulation / exhibition space. The west break-through will be via the existing central air-conditioning room, which will be relocated to a new external construction. The south break-through will travel under the existing 3rd year studio (east) between north-south grid lines 15-17. The 2 spaces will connect at the buildings central circulation node comprising the existing main stairwell and a new personnel elevator.

**GROUND FLOOR LEVEL:**

The entire facade is opened up to improve the daylight factor and connect visually with Lynnwood road to the south. The 3rd year studio (west) space is extended to the south above the new air-conditioning room, and around to the west - overlooking the amphitheatre. The existing air handling chambers located at the south-west corner of the building on each level remain in place as transition points for conditioned air.

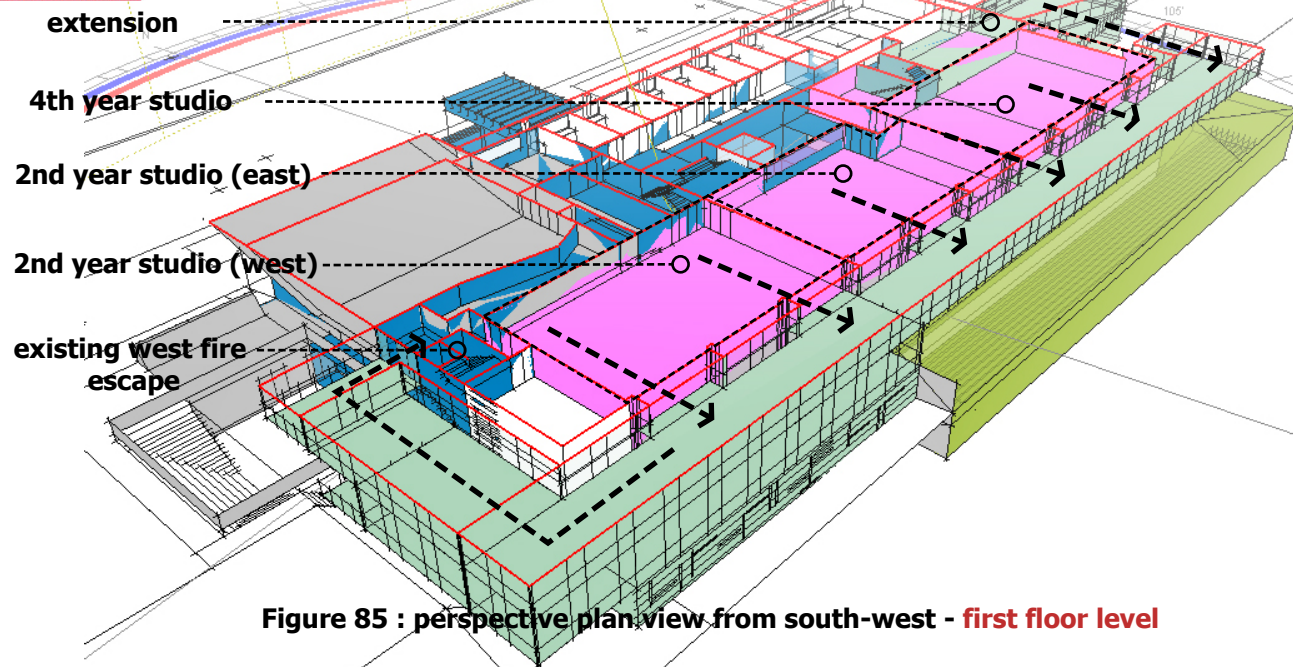


Figure 85 : perspective plan view from south-west - **first floor level**

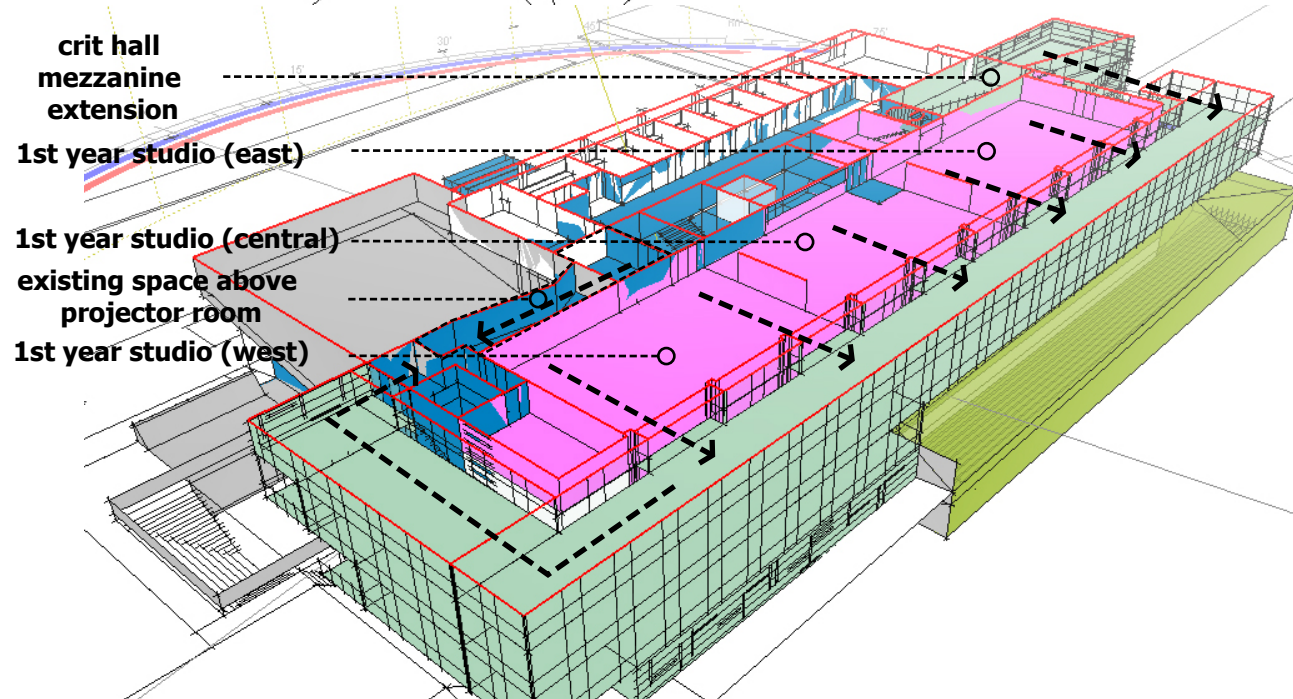


Figure 86 : perspective plan view from south-west - **second floor level**

### FIRST FLOOR LEVEL:

The studio spaces are all extended south through the existing facade. The additional space extends around the western facade and connects back into the building using the existing western fire escape as a point of entry. The extension also draws out to beyond the eastern elevation - overhanging the geothermal ground loop embankment below. The 1st floor footprint is further extended to the east via the existing double volume crit hall - which facilitates a visual connection to the southern additions and Lynnwood Road beyond it.

### SECOND FLOOR LEVEL:

The extension echoes that of the level below, and completes a circulatory loop through the central east-west axis by breaking through a pathway above the existing projector room of lecture hall 3-3 and the store room adjacent to it. The double volume of the crit hall is dissected with the addition of a mezzanine floor and extension, which connects the main passage at 2nd floor level with the new construction - including a new external eastern fire escape.

- existing hvac equipment room
- existing lecture hall 1-10  
( & surrounding locales)
- new hvac equipment room
- new basement breakthrough  
(between gridlines 15-17)
- geothermal ground loop embankment
- new external circulation path  
(along sloped fall to basement level)

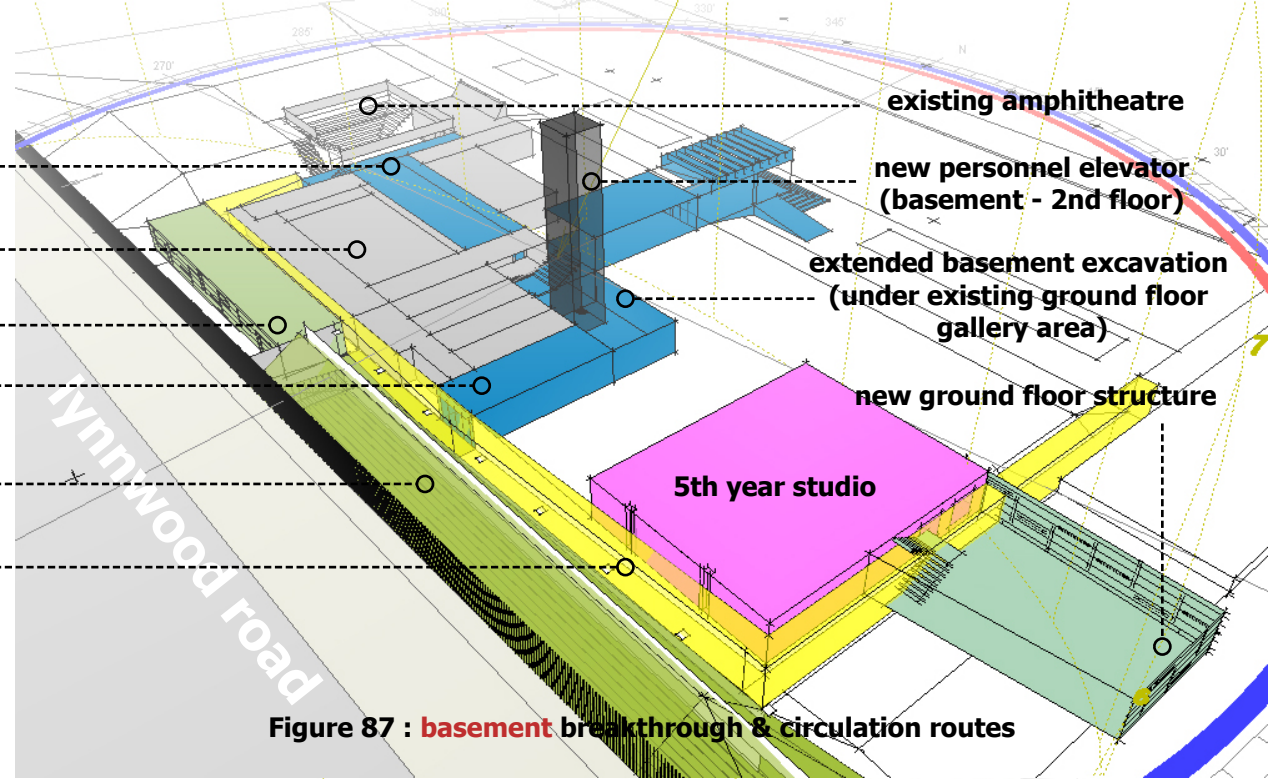


Figure 87 : **basement** breakthrough & circulation routes

- new ground floor structure
- new internal circulation path  
(connecting the existing west & south)
- existing main entrance podium

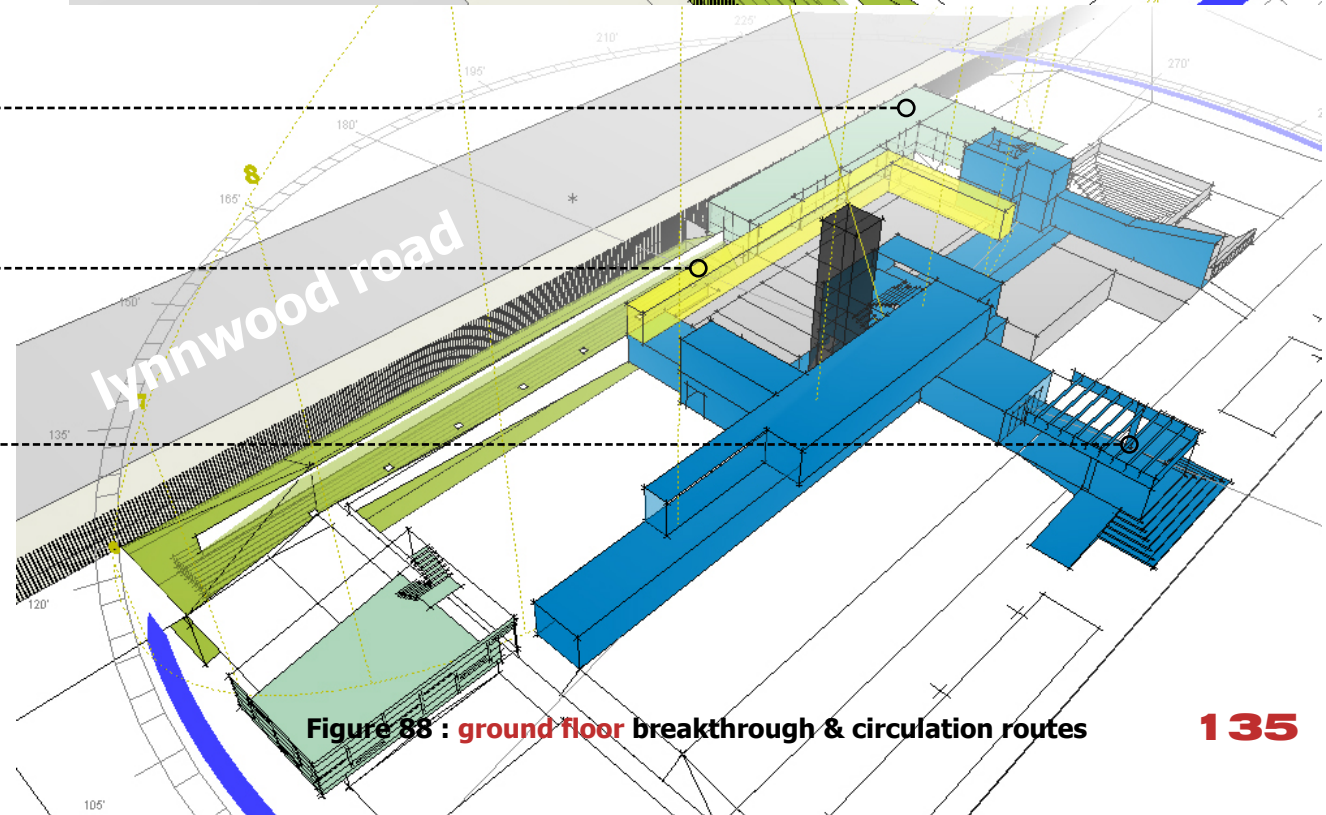


Figure 88 : **ground floor** breakthrough & circulation routes

**new 1st floor south flank**

**new internal circulation path  
(connecting east, west & south)**

**existing 1st floor passage**

**existing main entrance podium**

**existing 1st floor east crit hall**

**new 1st floor extension to east  
crit hall**

**"The height of the building was limited to three stories so that  
 people could use the stairs and meet in the stairwell, rather  
 than being forced to use the elevator..." (Brand. 1994:179)**

**new mezzanine extension above  
east crit hall**

**existing 2nd floor passage**

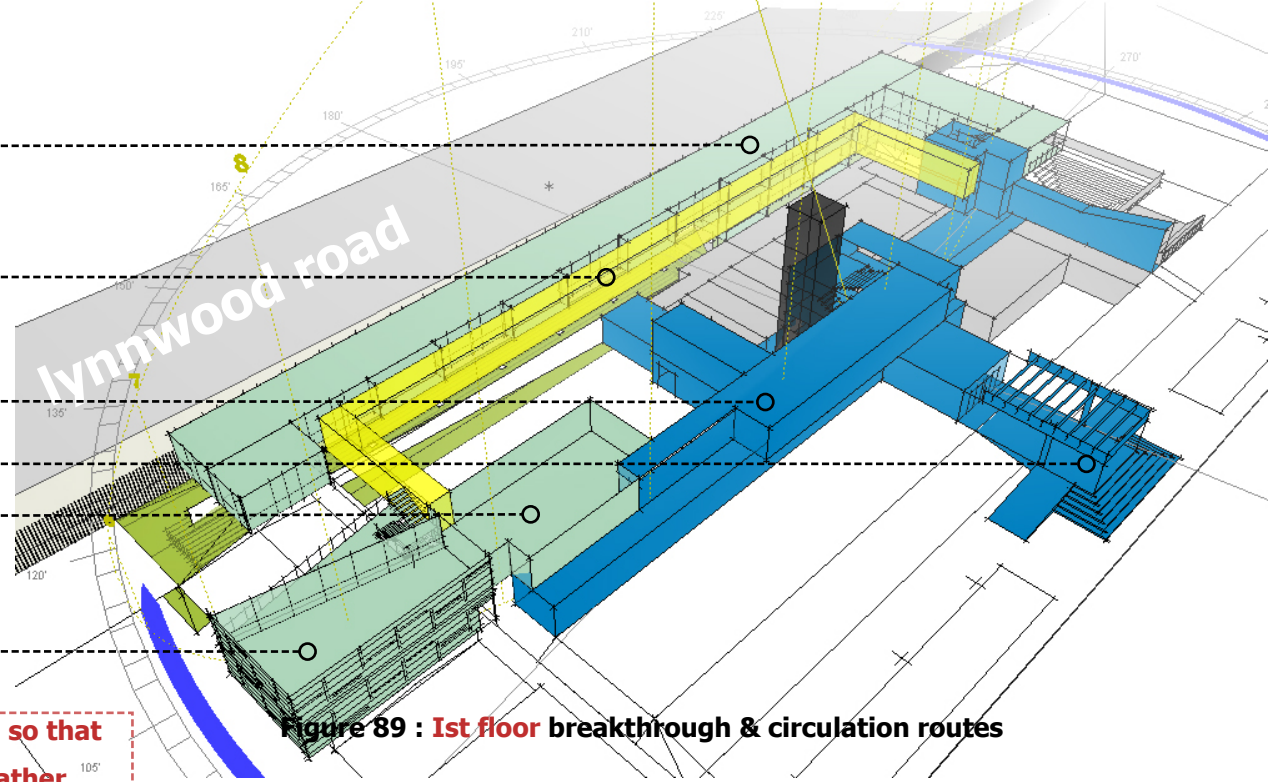
**new personnel elevator**

**existing 2nd floor store room (broken  
through to passage)**

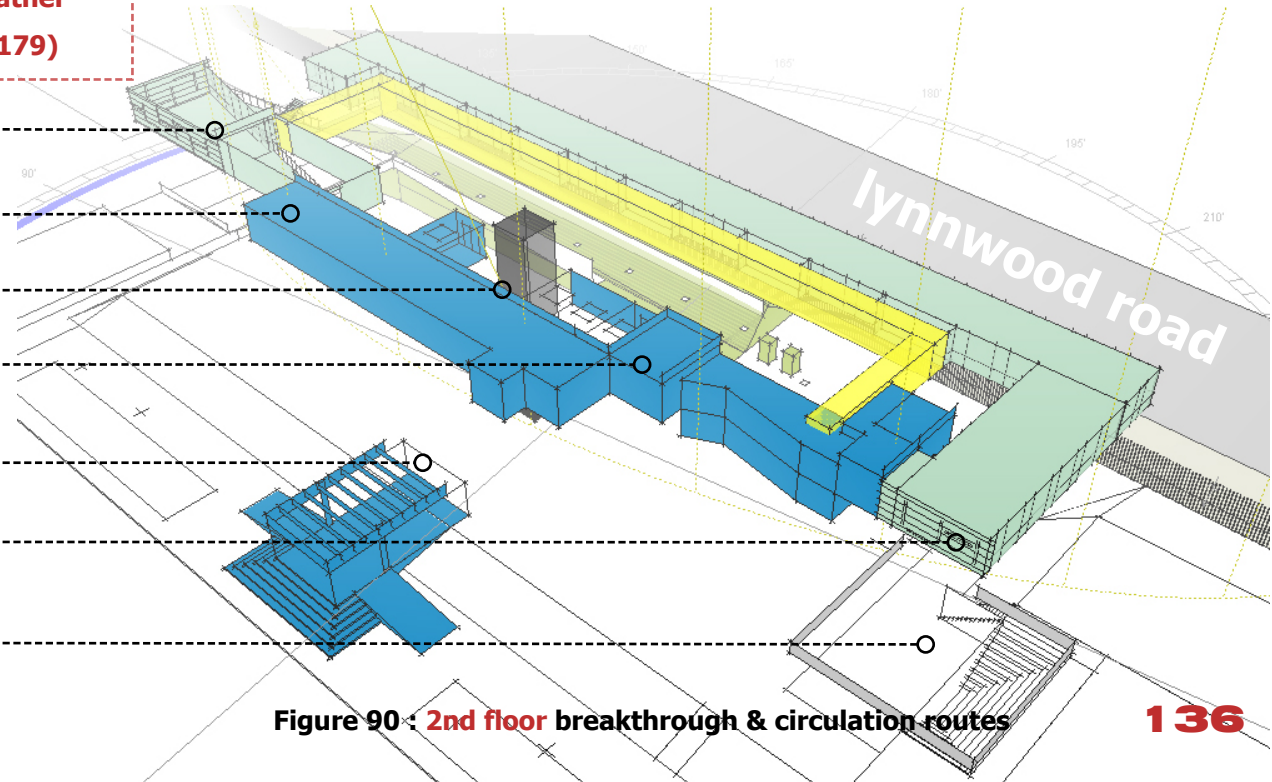
**existing volume above lecture hall 3-3  
projector room (broken through to  
store room)**

**new 2nd floor west flank**

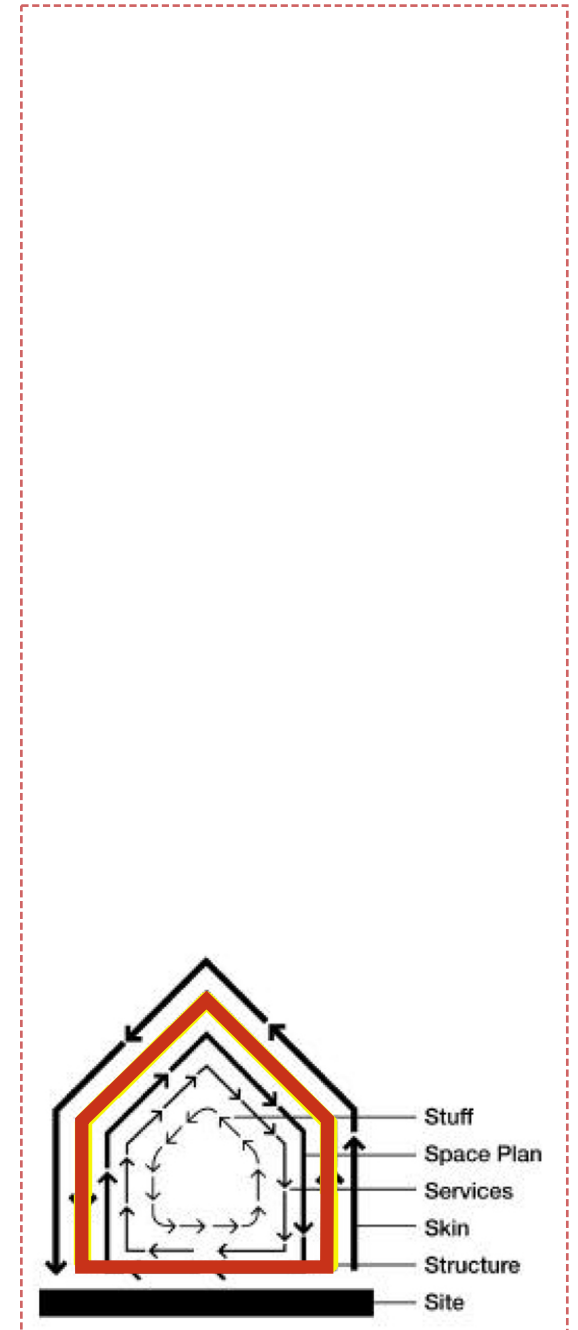
**existing amphitheatre**



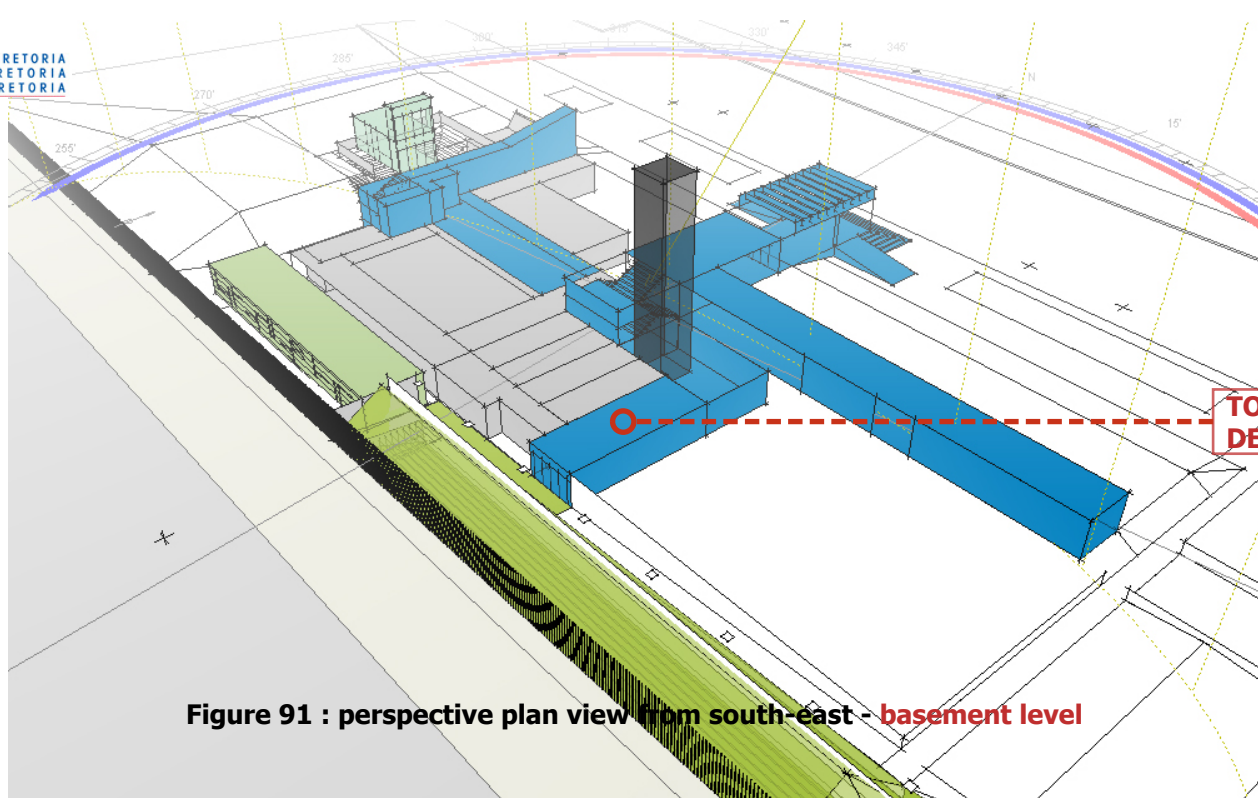
**Figure 89 : 1st floor breakthrough & circulation routes**



**Figure 90 : 2nd floor breakthrough & circulation routes**

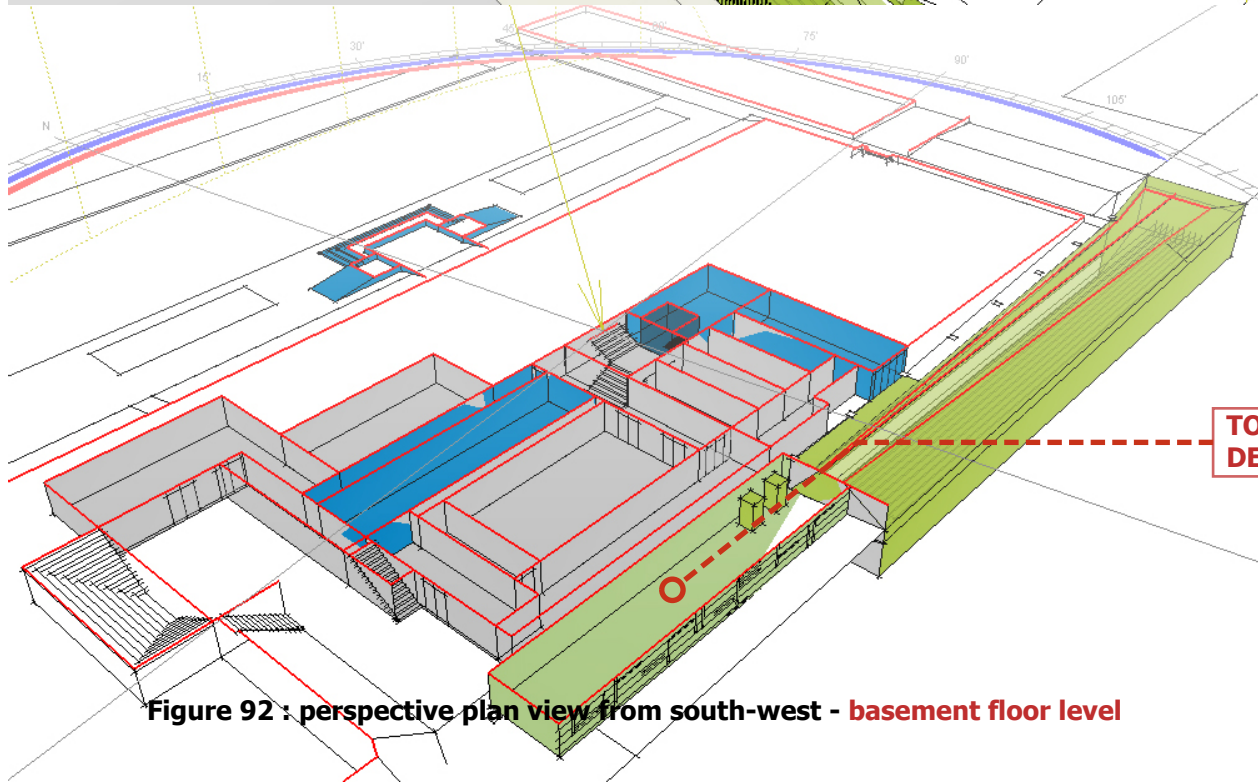


**retrofit : structure**



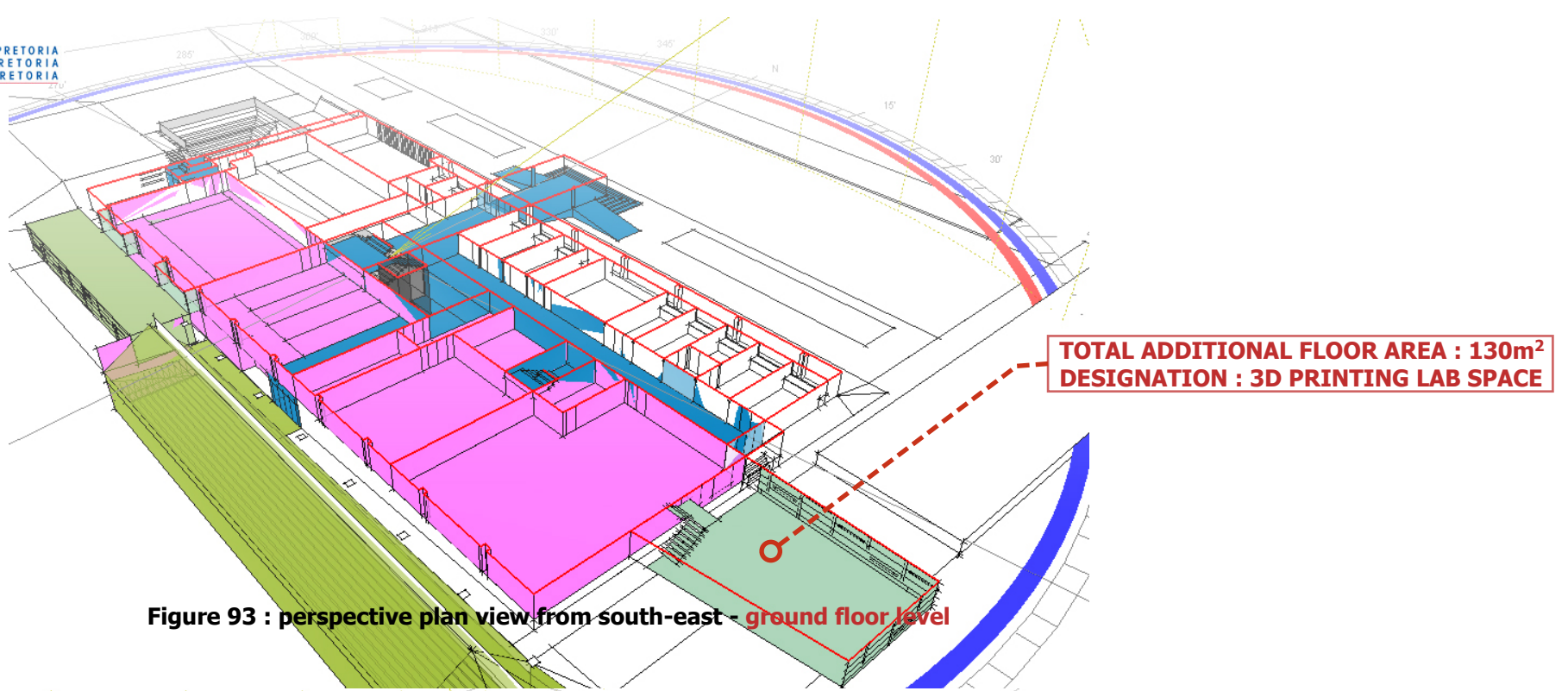
**TOTAL ADDITIONAL FLOOR AREA : 164m<sup>2</sup>**  
**DESIGNATION : EXHIBITION SPACE**

**Figure 91 : perspective plan view from south-east - basement level**

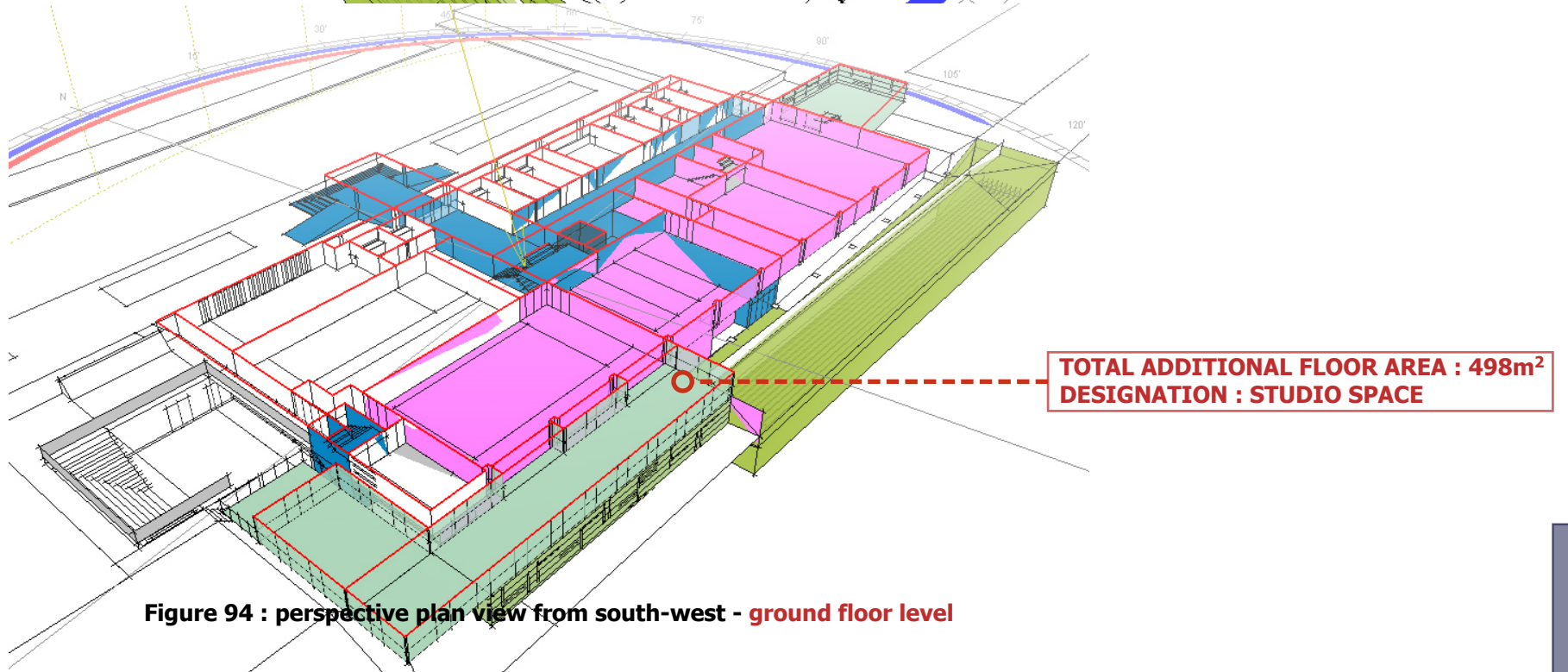


**TOTAL ADDITIONAL FLOOR AREA : 252m<sup>2</sup>**  
**DESIGNATION : HVAC PLANT ROOM**

**Figure 92 : perspective plan view from south-west - basement floor level**



**Figure 93 : perspective plan view from south-east - ground floor level**



**Figure 94 : perspective plan view from south-west - ground floor level**

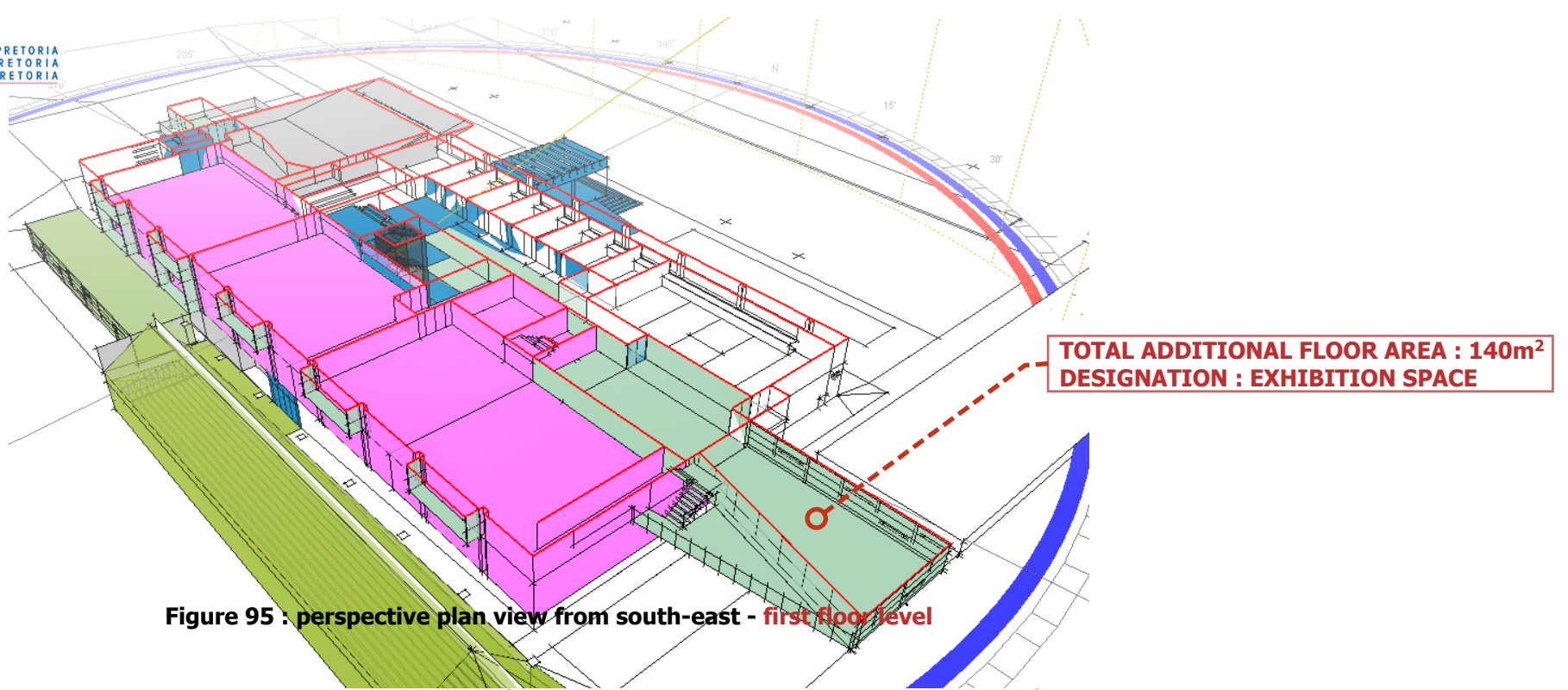


Figure 95 : perspective plan view from south-east - first floor level

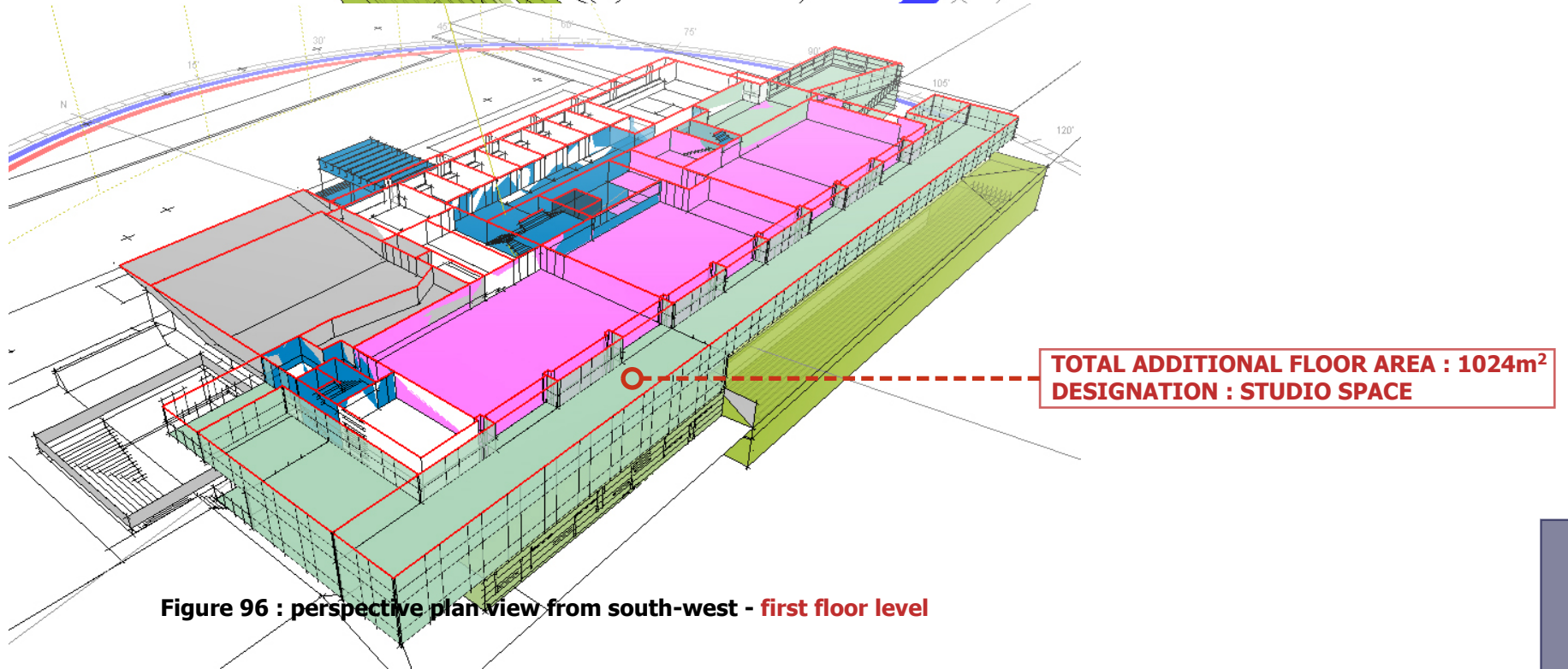
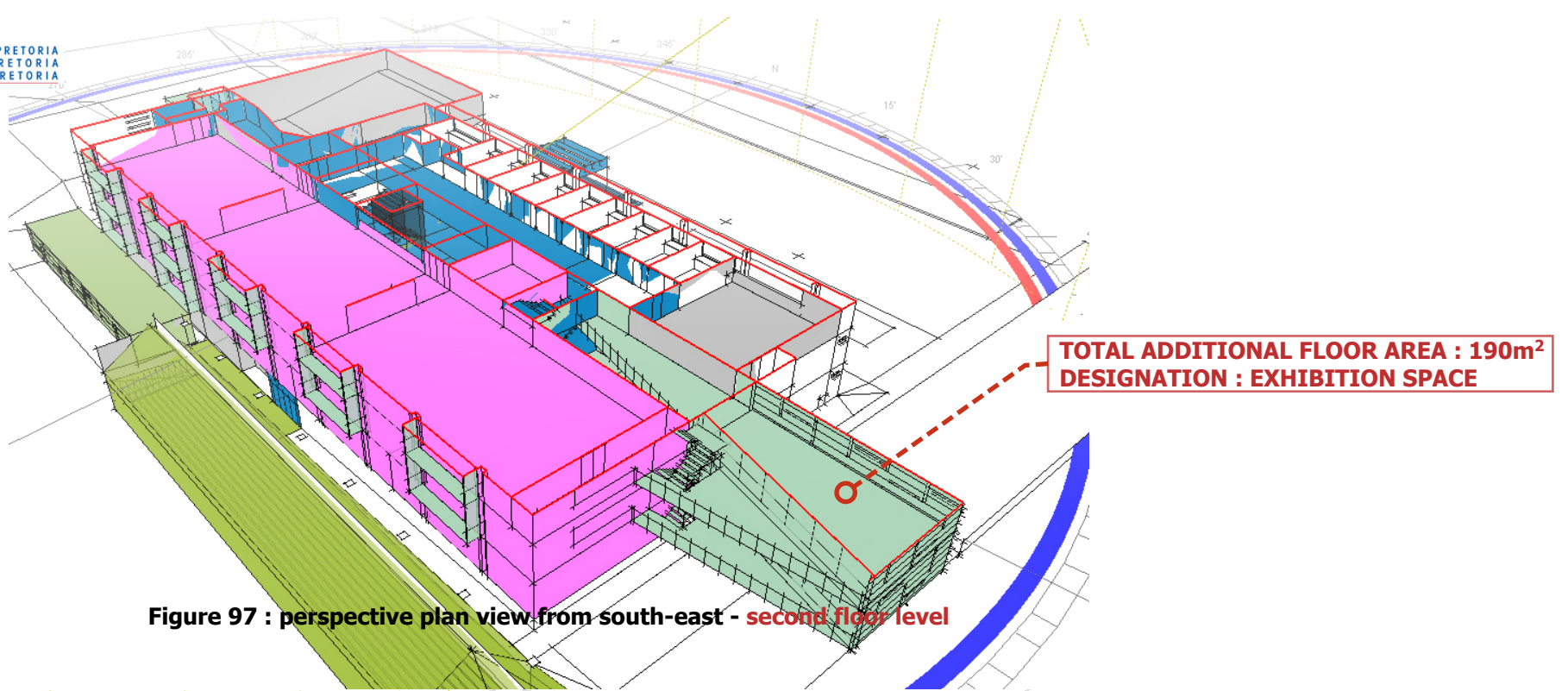
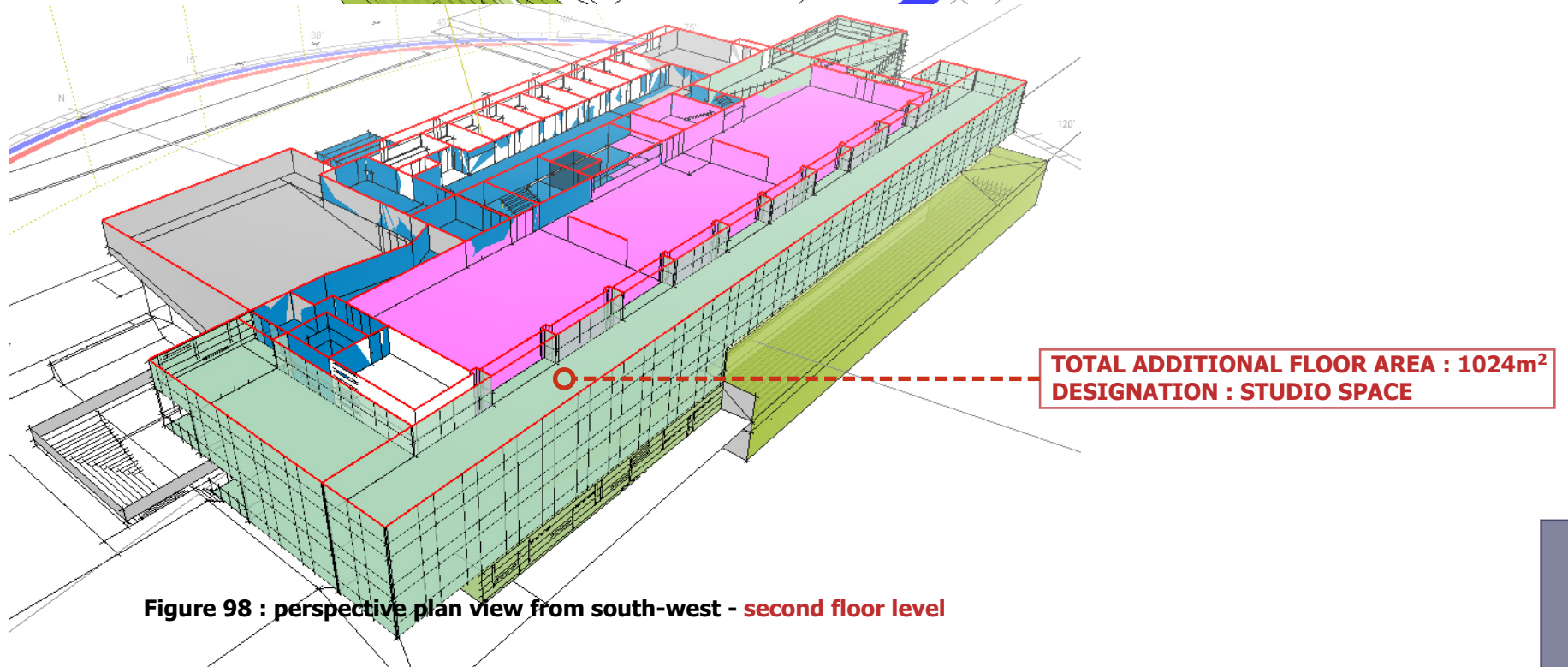


Figure 96 : perspective plan view from south-west - first floor level



**TOTAL ADDITIONAL FLOOR AREA : 190m<sup>2</sup>**  
**DESIGNATION : EXHIBITION SPACE**

**Figure 97 : perspective plan view from south-east - second floor level**



**TOTAL ADDITIONAL FLOOR AREA : 1024m<sup>2</sup>**  
**DESIGNATION : STUDIO SPACE**

**Figure 98 : perspective plan view from south-west - second floor level**

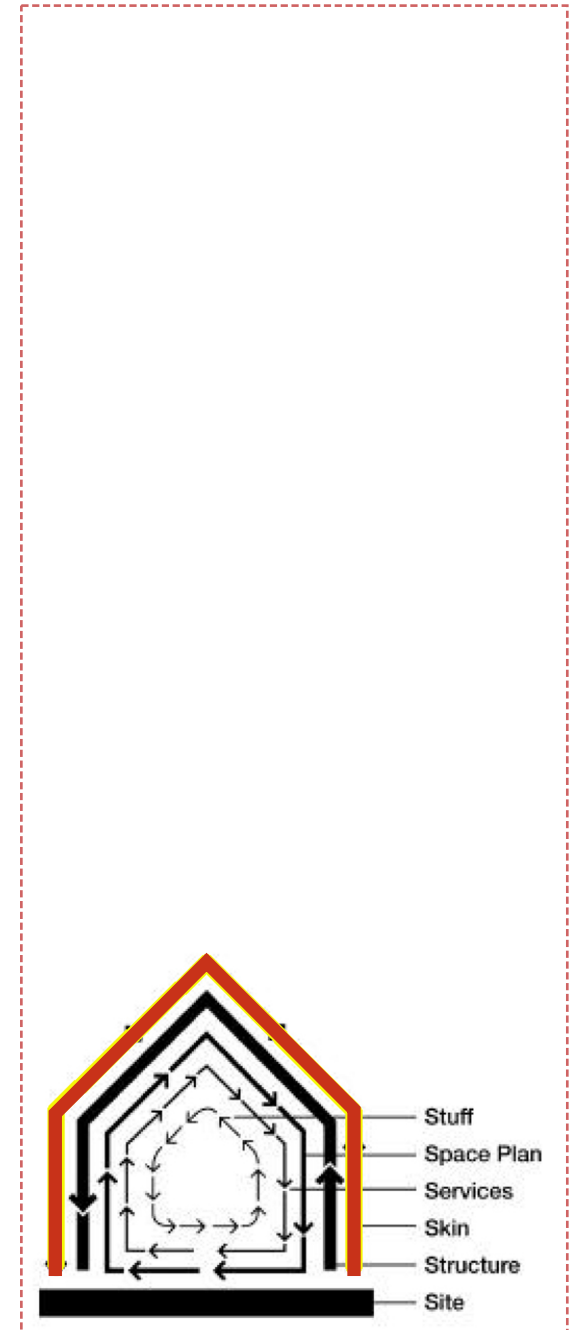
**SPATIAL QUOTAS:**

ADDITIONAL	STUDIO/LAB SPACE	EXHIBITION SPACE (formal)	
Basement	0m <sup>2</sup>	284m <sup>2</sup>	
Ground floor	768m <sup>2</sup>	0m <sup>2</sup>	
1st floor	1024m <sup>2</sup>	150m <sup>2</sup>	
2nd floor	1024m <sup>2</sup>	190m <sup>2</sup>	
RESULTANT	STUDIO/LAB SPACE	EXHIBITION SPACE (formal)	EXHIBITION SPACE (informal)
Basement	0m <sup>2</sup>	284m <sup>2</sup>	190m <sup>2</sup> (amphitheatre + store room)
Ground floor	1428m <sup>2</sup>	172m <sup>2</sup>	60m <sup>2</sup> (passage ways)
1st floor	1724m <sup>2</sup>	300m <sup>2</sup>	110m <sup>2</sup> (passage ways)
2nd floor	1724m <sup>2</sup>	190m <sup>2</sup>	800m <sup>2</sup> (1st year studio + passage)

**The 3D printing lab would be run by the 5th year students - whose studio is adjacent to the new facility. The lab itself, is therefore seen as supplementary 5th year studio space and allocated accordingly.**

**The resultant spatial quotas have been added to the existing space plan in an open format which does not specifically demarcate areas for the various tertiary levels within the Department. If the new studio space were to be allocated according to proximity - the following approximate assignments would result:**

<b>2015 (projected - excluding research)</b>	<b>population increase</b>	<b>available workspace increase</b>
1st Year - 140 within 1724m <sup>2</sup> = 12.30m <sup>2</sup> / head	30%	146%
2nd year - 130 within 1164m <sup>2</sup> = 8.95m <sup>2</sup> / head	30%	165%
3rd year - 100 within 1028m <sup>2</sup> = 10.28m <sup>2</sup> / head	30%	157%
4th year - 80 within 560m <sup>2</sup> = 7.00m <sup>2</sup> / head	30%	115%
5th year - 60 within 400m <sup>2</sup> = 6.70m <sup>2</sup> / head	30%	54%



**retrofit : skin**

**Boukunde II** supplementary floor surface area

**Boukunde II** supplementary support columns

**Boukunde I** glass curtain wall - removed

**Boukunde I** original structural end walls - retained / reinforced / re-used

Boukunde I has been enveloped in concrete by its successor. The architect of Boukunde II re-used the structural core and grid layout of the original building and supplemented it where required to meet the demands of the buildings new footprint. The first building presumably informed certain aspects of the design, and an effective concrete shield was drawn up around what once stood. The proposal for Boukunde III now seeks to resurrect certain aspects of the original built form which could benefit the current condition.

Figure 99 : BOUKUNDE (I-in-II) - perspective view from north-east

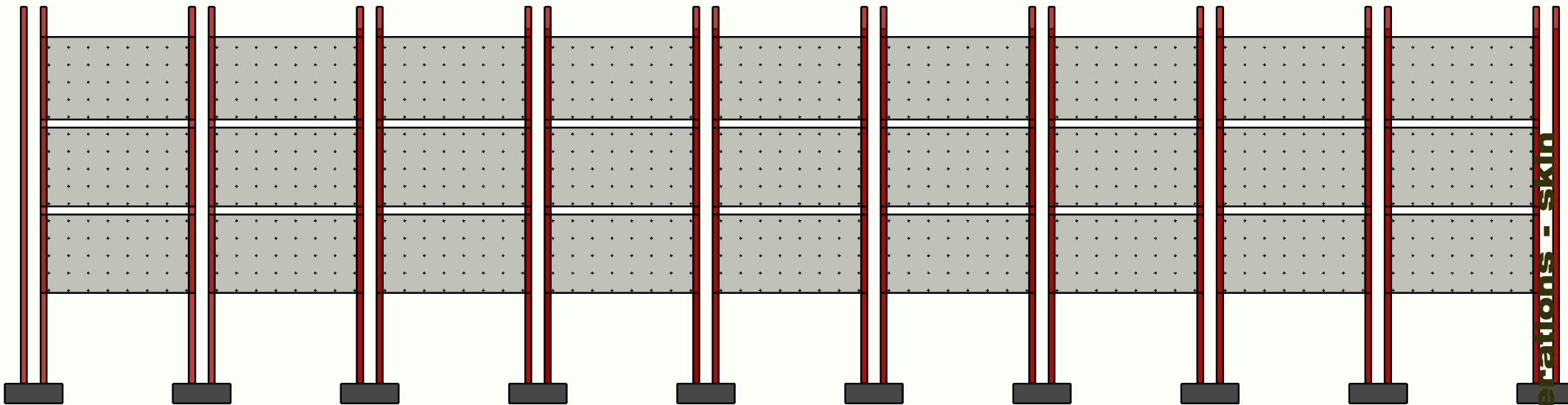


**"Concrete is treated like nuclear power: we try not to think about decommissioning." (Brand. 1994:126)**

27 x 7" (178mm) thick concrete panels will be removed from between the southern facade columns.

Panel Surface area:  
5520mm x 3048mm = 16.82m<sup>2</sup> each

Panel Mass = approx. 6880kgs each  
(based upon a bulk density of  
2300kg/m<sup>3</sup> for in-situ concrete)



During construction almost 186 tonnes of concrete will be cut from the buildings southern facade & brought to ground level. The method being proposed for effecting these incisions is thermolancing - as opposed to mechanical cutting (using a combination of circular saws & percussion drills). The process of using heat energy to cut through concrete instead of brute force and abrasion-based techniques would be less disruptive to functional continuity within the building due to less noise & vibration produced.

Regardless of the cutting method used - the intention would be to reduce the production of rubble waste and dissect the panels into uniform concrete 'sub-panels' to be redeployed as building block units. This 'disassembly' of the facade - as opposed to destruction - would also reduce the carbon footprint of the building works as approx. 186 tonnes of rubble would not have to be trucked away from site.

The entire building facade is punctuated with 60mm diameter shutter holes which are spaced at approx. 760mm horizontal centres & 670mm vertical centres. Each panel would be divided into sections generally in accordance with this shutter hole 'grid'. Accordingly, 20 sub-panels of approx. dimensions - 580mm x 1350mm x 178mm thick would be rendered from each facade panel.

column line

column line

floor slab line

column line

column line

floor slab line

Each sub-panel has a mass of approx. 320kgs.

670mm

11' (3352.8mm) floor-floor height

760mm

retrofit - alterations - skin

"Concrete is second only to water as the worlds most heavily consumed substance." (Brand. 1994:125)

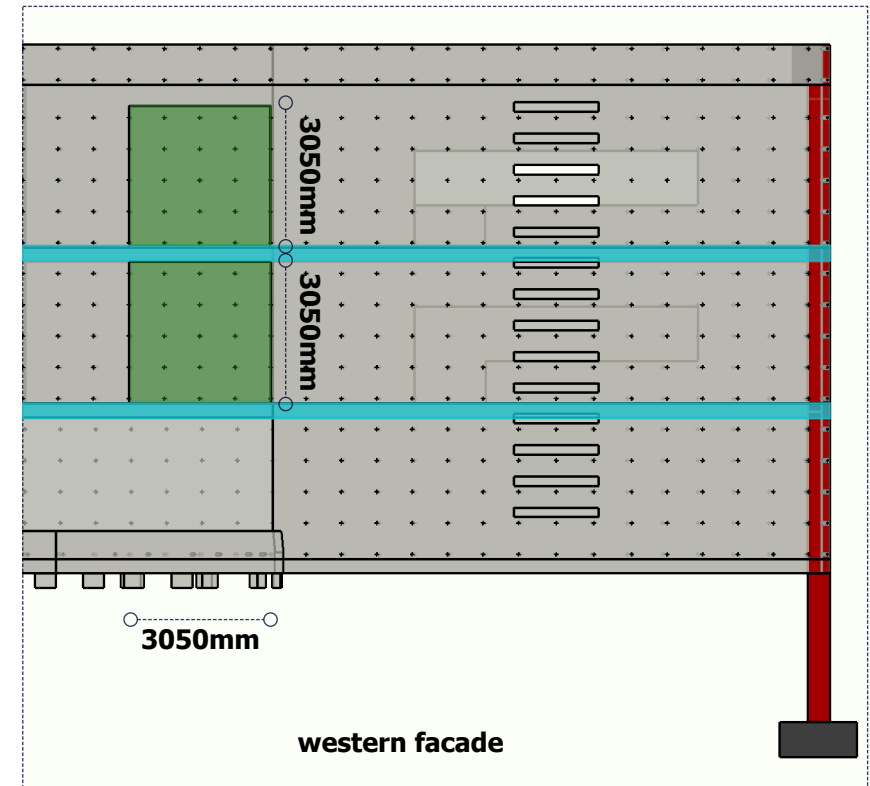
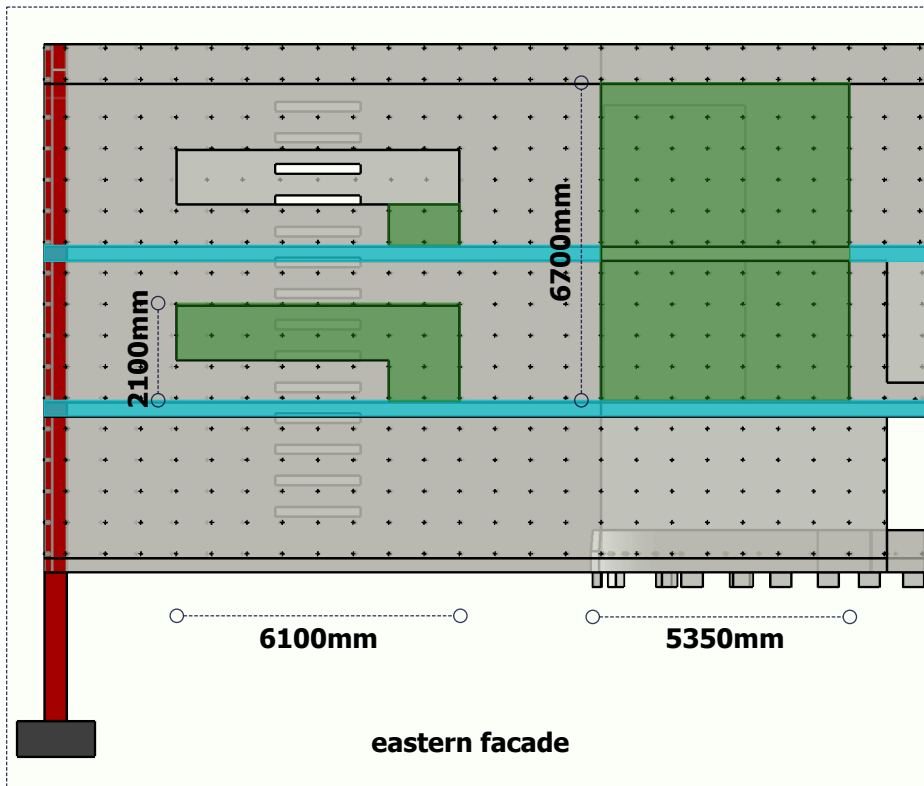
(152mm) thick concrete panels will be removed from the eastern- & western facades.

Panel Surface area:

East = 45.87m<sup>2</sup> / West = 18.61m<sup>2</sup>

Panel Mass:

East = approx. 18 780kgs / West = approx. 7 620kgs



The new building works would produce approx. 518.62m<sup>2</sup> of concrete 'facade' that would be re-used as building block units. The designated unit dimensions of approx. 1350mm x 580mm x (178/152mm) thick could vary without affecting their application, and 30mm variance in block measurements has been factored in for their use in this scheme.

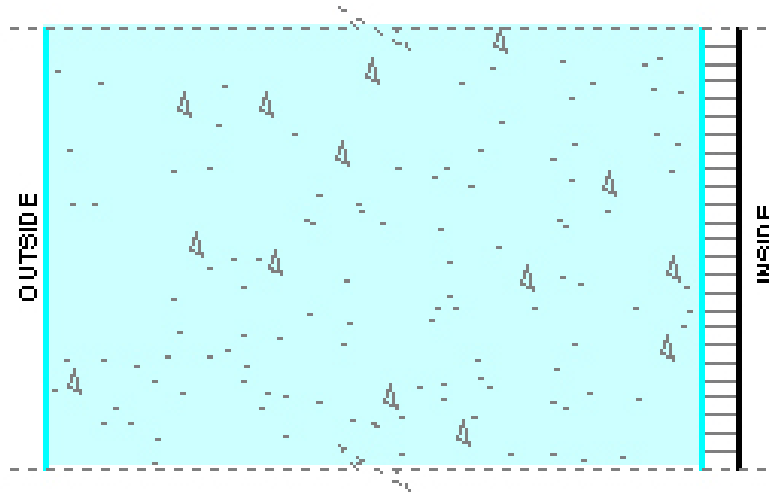


Figure 100 : Detail Section - Boukunde II wall panel

The wall panels are all of the same general construction, with walls to the south being 1" thicker than those on the 3 remaining facades.

**EXISTING WALL PANEL:**

- 10mm thick cement plaster
- 6/7" (152/178mm) thick mesh reinforced in-situ concrete wall panel

**152mm thick:**

**U-value : 2.90 (W/m<sup>2</sup>.K)**

**Thermal Decrement : 0.69**

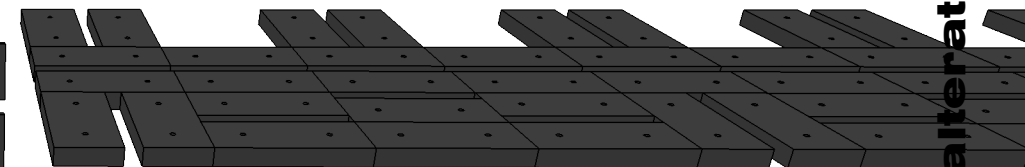
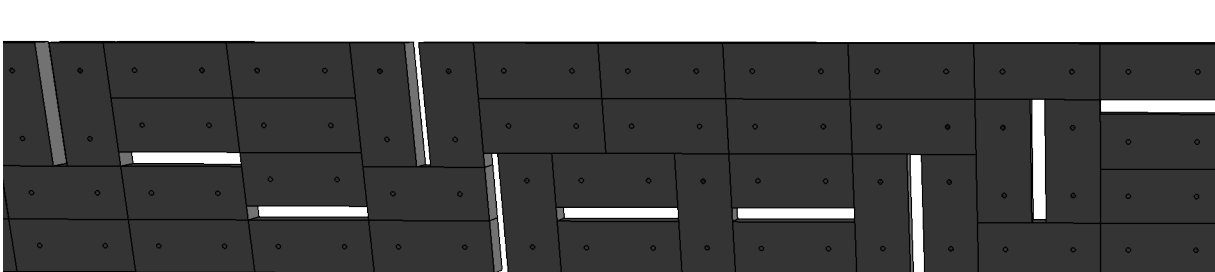
**Thermal Lag : approx. 4 hours**

**178mm thick:**

**U-value : 2.68 (W/m<sup>2</sup>.K)**

**Thermal Decrement : 0.60**

**Thermal Lag : approx. 5 hours**



The re-deployment of the concrete panels will be in accordance with their inherent thermal capacity and the areas of the new construction that would benefit most from these qualities. Thus, the thicker panels with a greater capacity to exclude unwanted heat in summer, and to reduce the extent of this penetrative heat - will be used on the north-, east- & western facades. The remaining panels will be used on the southern facade (basement level), and as landscaping / retaining / ballast structures.

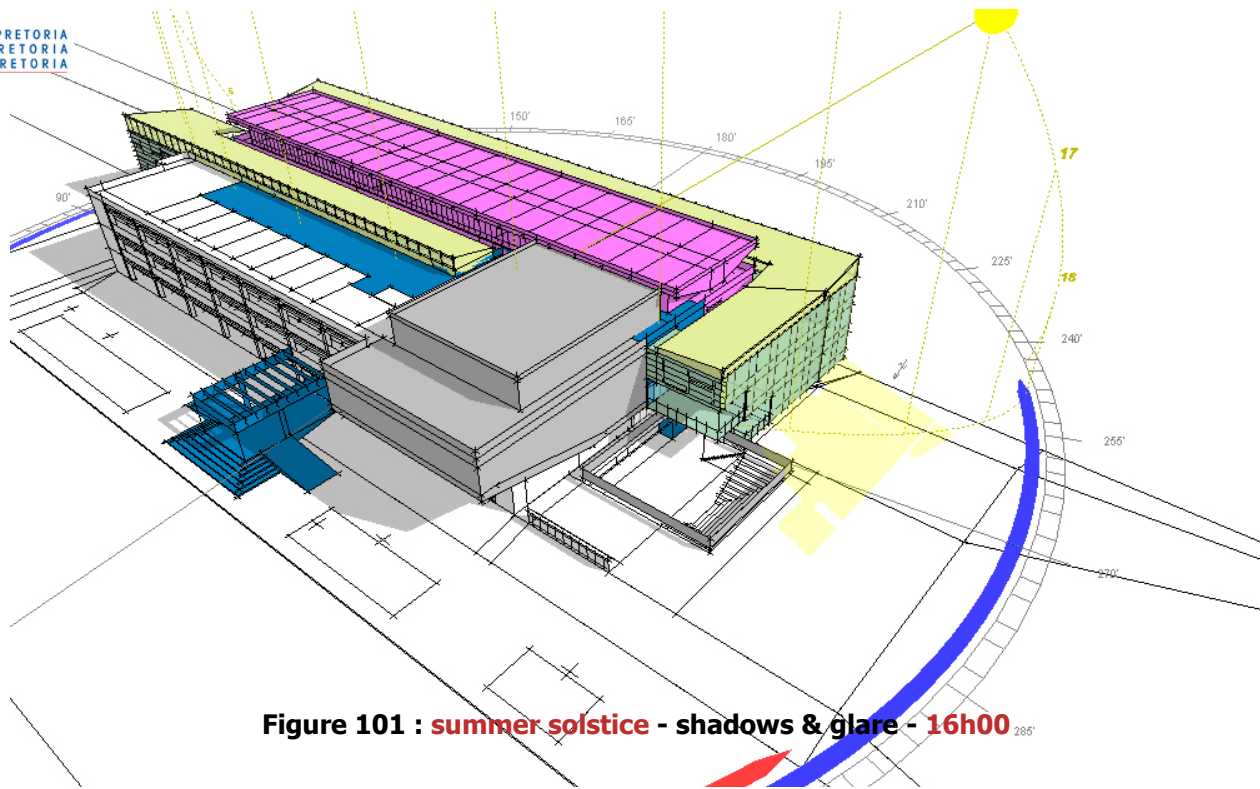


Figure 101 : **summer solstice** - shadows & glare - 16h00

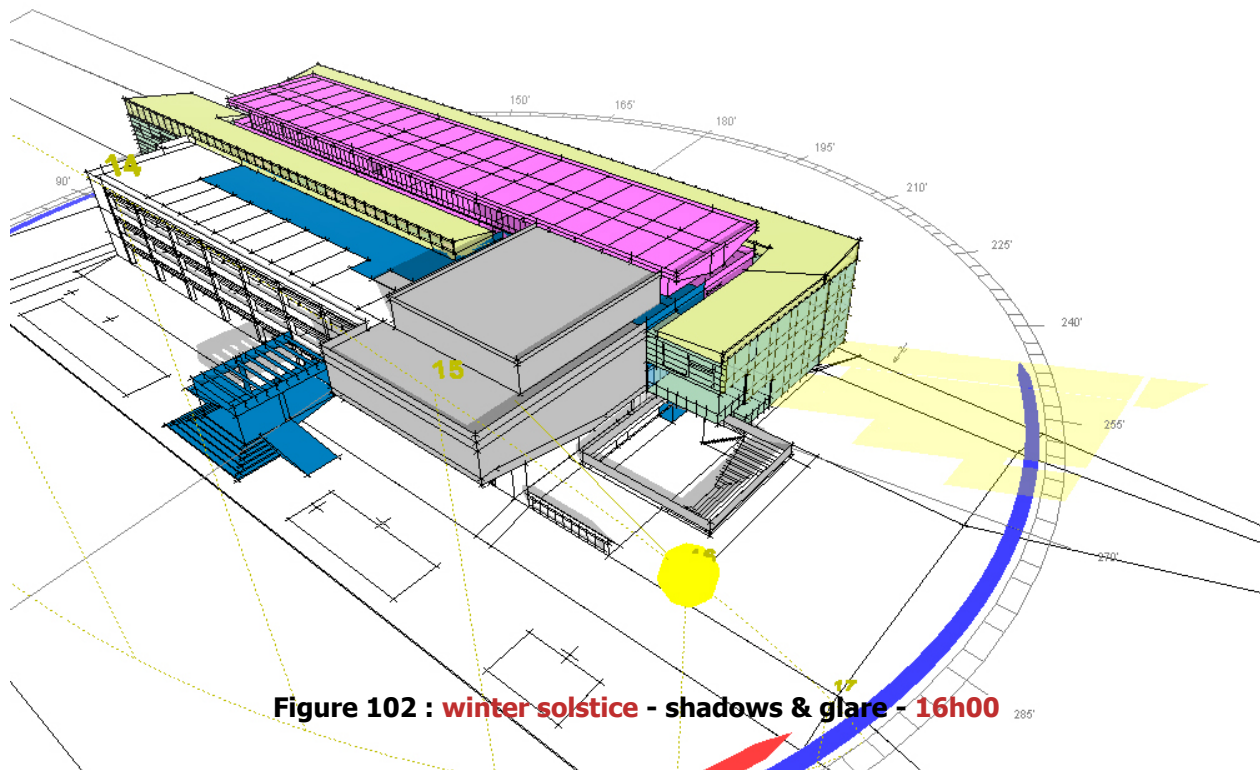


Figure 102 : **winter solstice** - shadows & glare - 16h00

One of the salient goals of the Boukunde III proposal is to achieve a significant improvement in natural light disbursement throughout the building. The execution of this ideal comes primarily via the southern flank, which is broken through and extended, resulting in a translucent elevation facing Lynnwood road.

Based upon the surface finish of the material being proposed to render this translucence - there will be a light reflective component that will affect the pedestrian & vehicular traffic passing by the buildings south facade. Given the law of reflection - angle of incidence = angle of reflection - the figures indicate the potential hazardous glare that could result off the western facade in the mid- to late afternoon during winter.

This would be indicative of specular reflection - typically from a hard polished surface such as plate glass. If one were to replicate the envelope of Boukunde I in the new facade proposals, then this form of reflected glare would have to be accounted for.

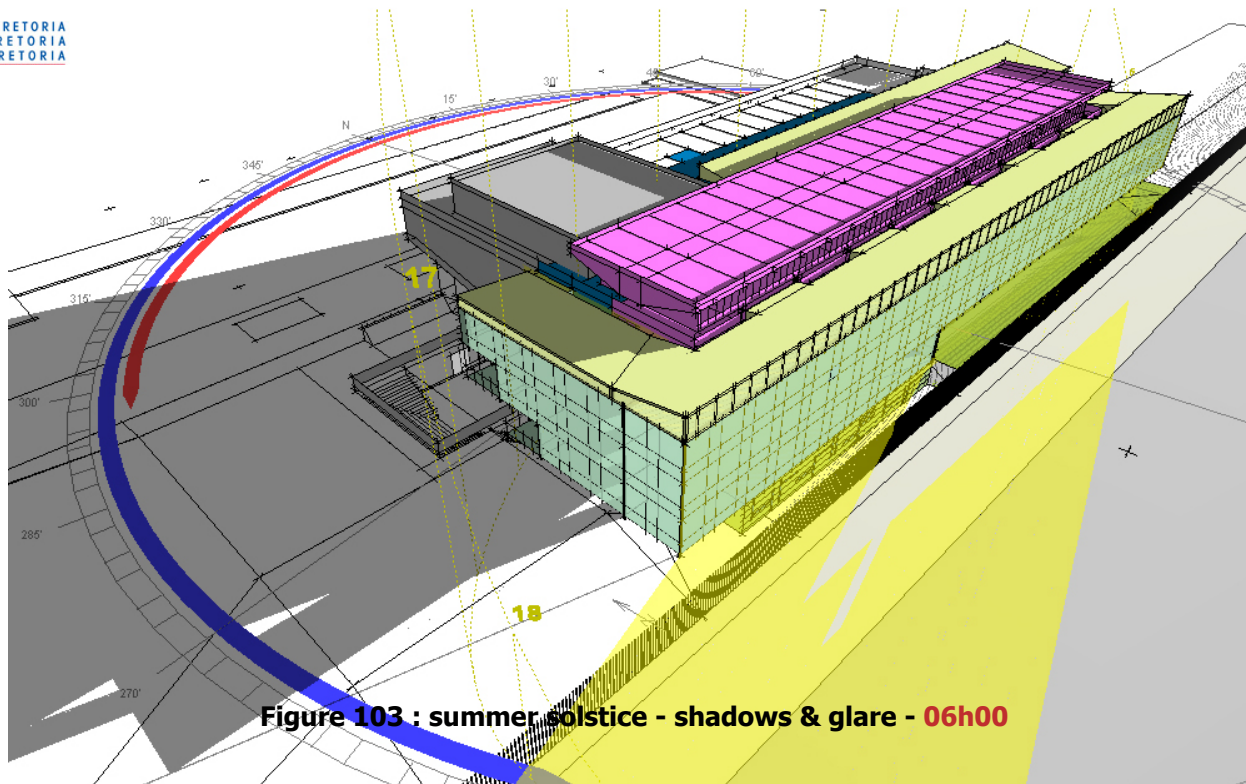


Figure 103 : summer solstice - shadows & glare - 06h00



Figure 104 : summer solstice - shadows & glare - 18h00

The reflective glare off the southern facade alone would only be a factor during the summer months - peaking at the solstice. The solar altitude during early morning- & late afternoon hours would result in an incident angle sufficient to produce glare off the glazed facade.

Due to the fact that Lynnwood road traffic flow is bi-directional and fairly evenly weighted in terms of directional volumes throughout the day - a glare attenuation strategy will have to accommodate both easterly- & westerly traffic flow, and do so at all times that there is a risk of reflected glare.

The form of Boukunde I is to be 'resurrected' for the new building - it will have to be evaluated for its prospects in terms of over-exposure, as was indicative of the building in the 1960's. There will be a significant measure of overshadowing from the existing building, but not much from other elements in the immediate vicinity.

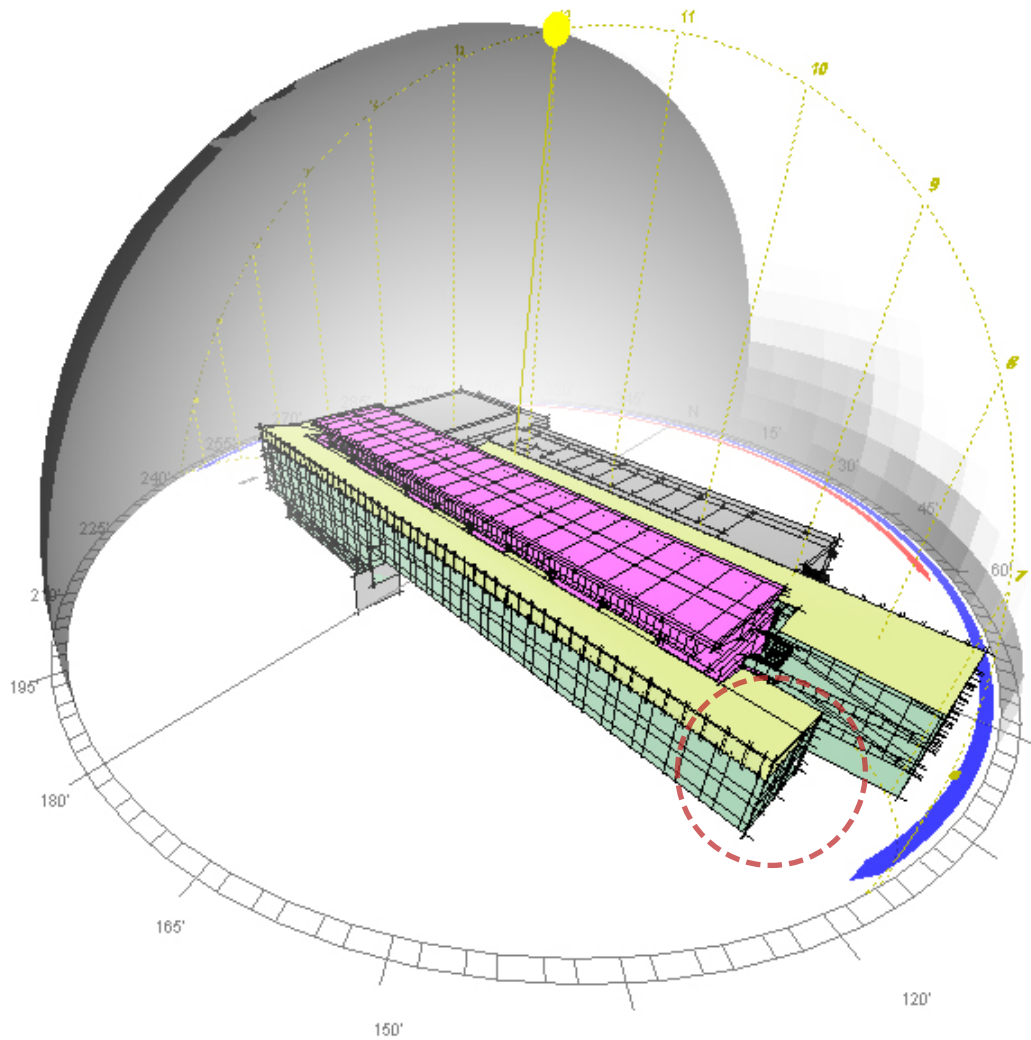


Figure 105 : overshadowing profile - new east facade

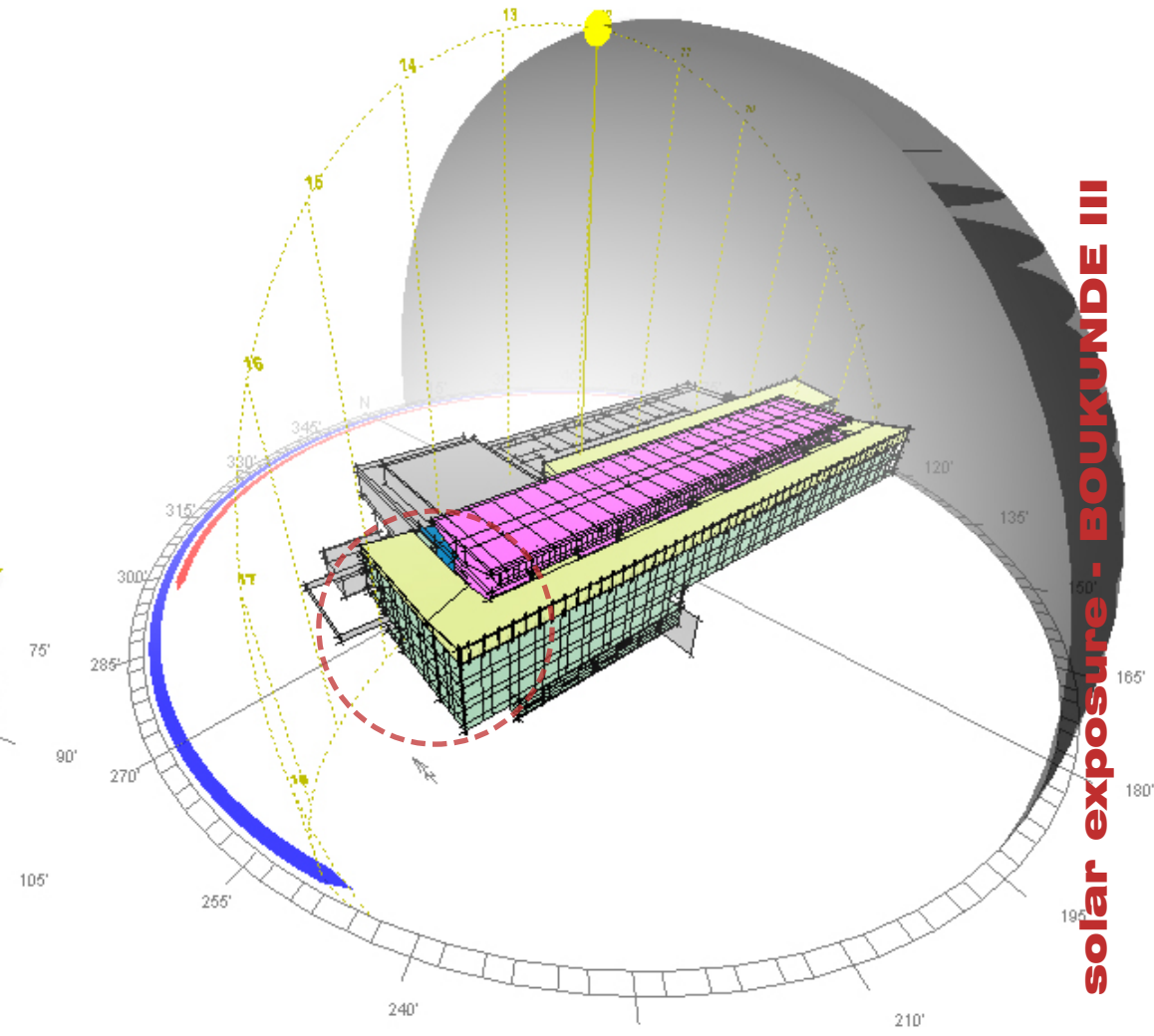
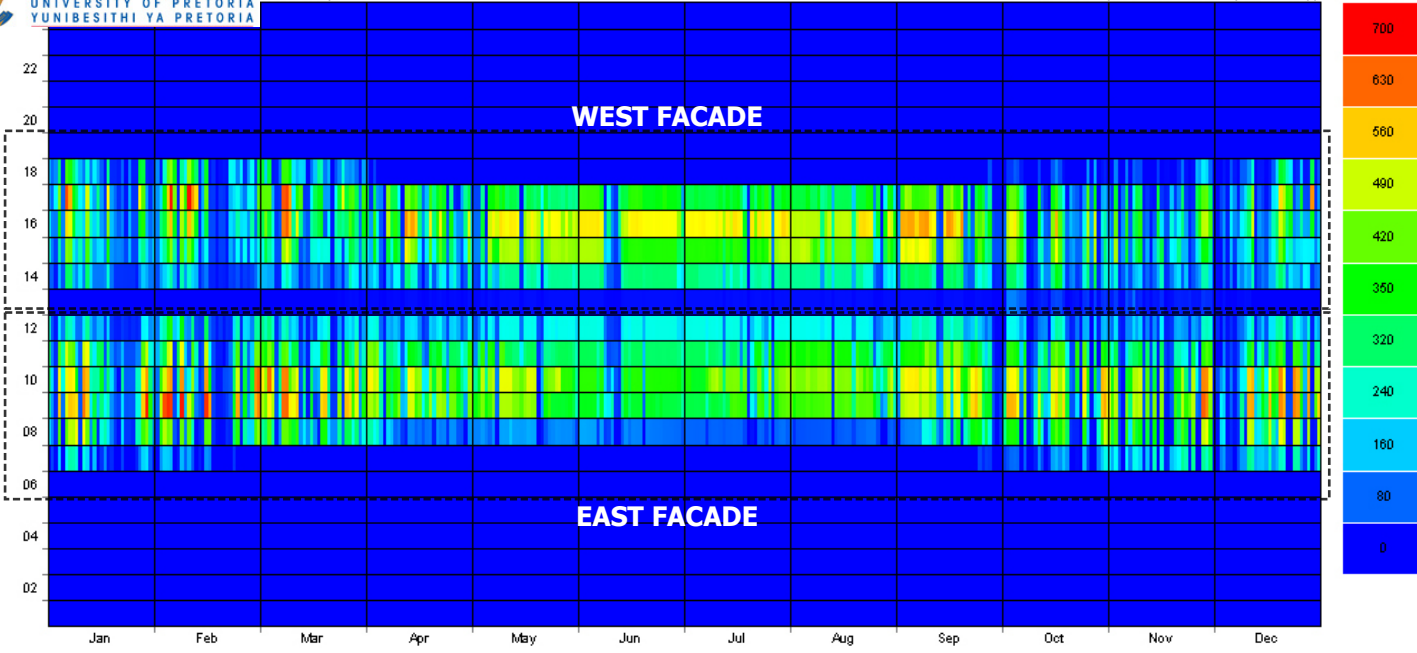


Figure 106 : overshadowing profile - new west facade



The graphs facilitate a comparison between the eastern & western facade proposals in terms of the amount of solar radiation incident upon them during the course of the year. Both facades will experience a more consistent exposure during winter months, and a greater magnitude - albeit less consistently - in summer.

The magnitude of variation and respective location different will determine whether a significantly varied approach is applied in ultimately resolving the 2 elevations.

**Table 33 : Incident Solar Radiation (annual) - Boukunde III facade - EAST & WEST**

TOTAL MONTHLY SOLAR EXPOSURE - direct / no reflection  
PRETORIA, SOUTH AFRICA

EAST FACADE (Exposed Area: 51.00 m2)									WEST FACADE (Exposed Area: 203.70 m2)											
MONTH	AVAIL Wh/m2	AVG INCIDENT			ABSORBED			TRANSMITTED			AVG SHADE %	INCIDENT			ABSORBED			TRANSMITTED		
		SHADE	Wh/m2	TOT.Wh	Wh/m2	TOT.Wh	Wh/m2	TOT.Wh	Wh/m2	TOT.Wh		Wh/m2	TOT.Wh	Wh/m2	TOT.Wh	Wh/m2	TOT.Wh			
Jan	119043	43%	41938	2138859	3483	177639	31348	1598755	57%	25145	5122074	2123	432381	18436	3755429					
Feb	107949	43%	37351	1904921	3111	158646	27996	1427816	57%	24208	4931222	2040	415537	17717	3608896					
Mar	138774	48%	46441	2368492	3878	197771	34901	1779937	52%	31808	6479247	2707	551428	23519	4790814					
Apr	140162	56%	40116	2045921	3330	169839	29972	1528550	50%	27352	5571564	2299	468289	19964	4066665					
May	185742	56%	44495	2269234	3653	186315	32879	1676836	50%	38456	7833486	3224	656783	27997	5703052					
Jun	183244	59%	36015	1836779	2913	148539	26213	1336850	50%	39909	8129522	3337	679806	28976	5902396					
Jul	193465	57%	40895	2085664	3346	170630	30111	1535674	50%	42593	8676285	3545	722056	30771	6268125					
Aug	186277	56%	43750	2231233	3600	183623	32404	1652606	50%	38535	7849580	3199	651618	27767	5656139					
Sep	163402	51%	47033	2398662	3926	200205	35330	1801842	51%	36234	7380964	3065	624418	26626	5423783					
Oct	134069	49%	44950	2292445	3755	191501	33794	1723509	51%	25986	5293371	2132	434281	18498	3767980					
Nov	109570	49%	39292	2003903	3301	168358	29710	1515219	51%	19885	4050537	1635	332986	14184	2889325					
Dec	119249	45%	43724	2229912	3654	186336	32883	1677020	55%	20980	4273670	1760	358603	15287	3113948					
<b>TOTALS</b>	<b>1780946</b>		<b>506000</b>	<b>25806024</b>	<b>41949</b>	<b>2139402</b>	<b>377542</b>	<b>19254618</b>		<b>371092</b>	<b>75591520</b>	<b>31066</b>	<b>6328186</b>	<b>269743</b>	<b>54946552</b>					

From the detailed breakdown of exposure values it can be seen that the eastern facade will experience greater incidence of solar radiation per m<sup>2</sup> than the west due to its longer period of exposure, however the greater surface area of the western facade results in a far larger total transmitted load being brought into the open, contiguous volumes of the new construction.

solar exposure - BOUKUNDE III

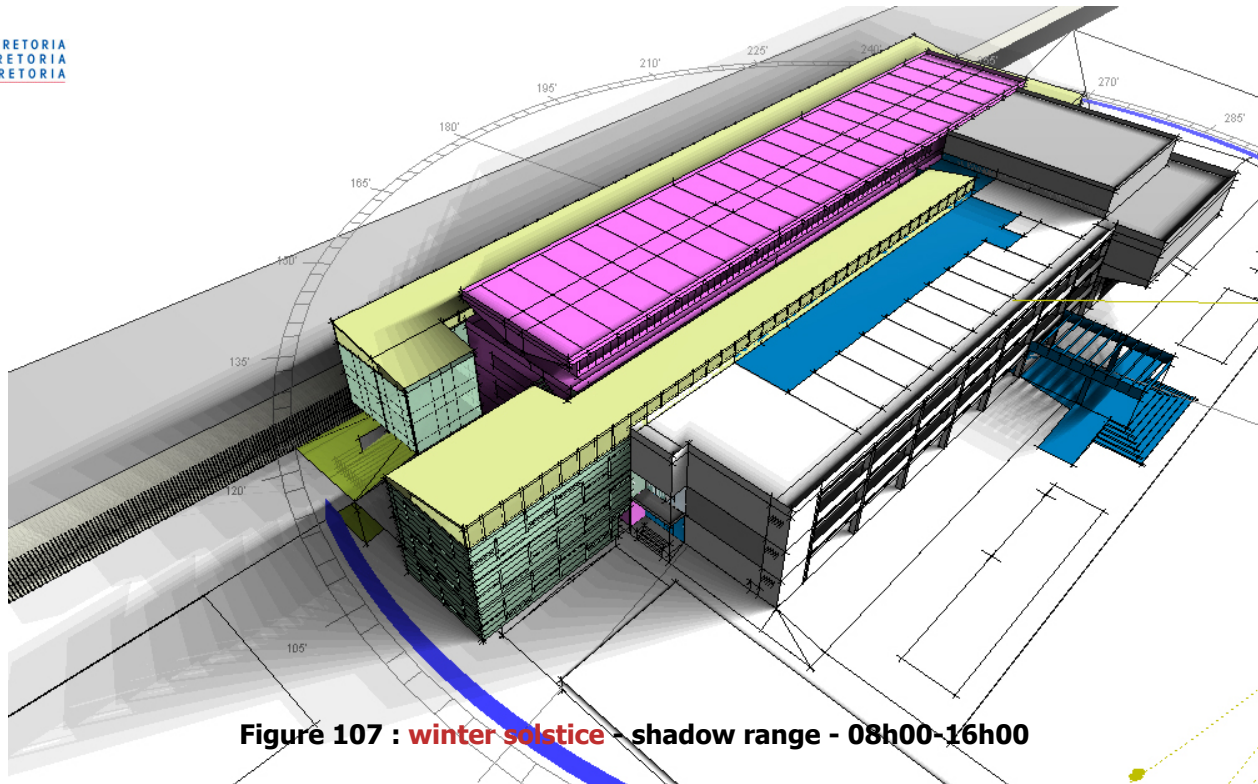


Figure 107 : **winter solstice** - shadow range - 08h00-16h00

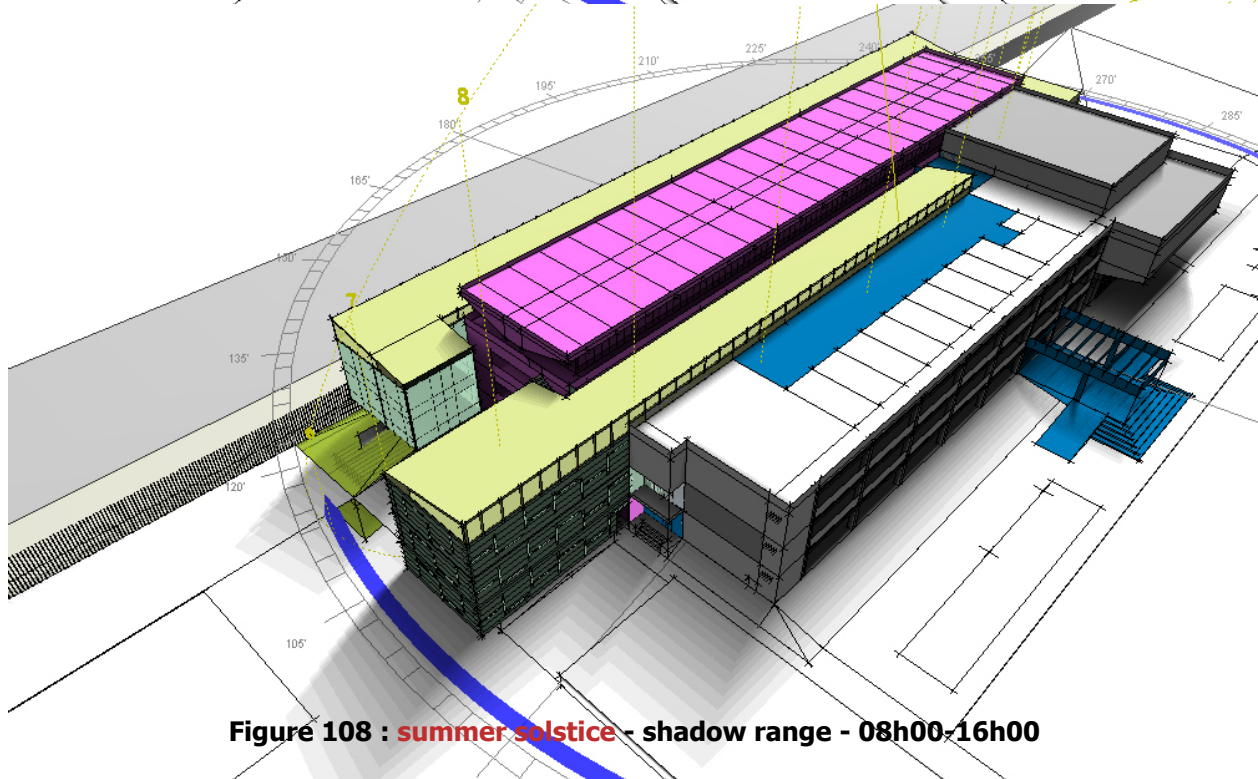


Figure 108 : **summer solstice** - shadow range - 08h00-16h00

The figures illustrate the extent of diurnal overshadowing that will be applicable during the longest- and shortest days of the year. This protection of the new exposed skin elements will be supplemented by new screening elements, as well as pre-existing natural features of the site. (\*see technical annexure for development & incorporation)

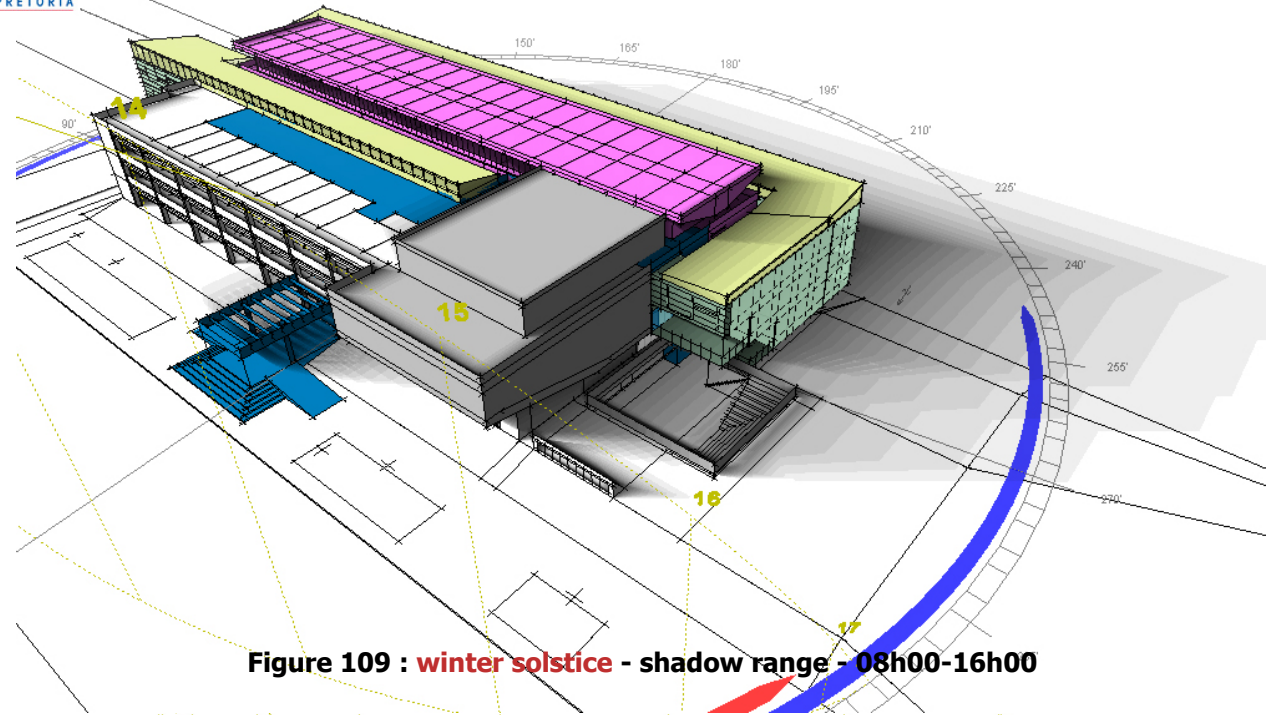


Figure 109 : winter solstice - shadow range - 08h00-16h00

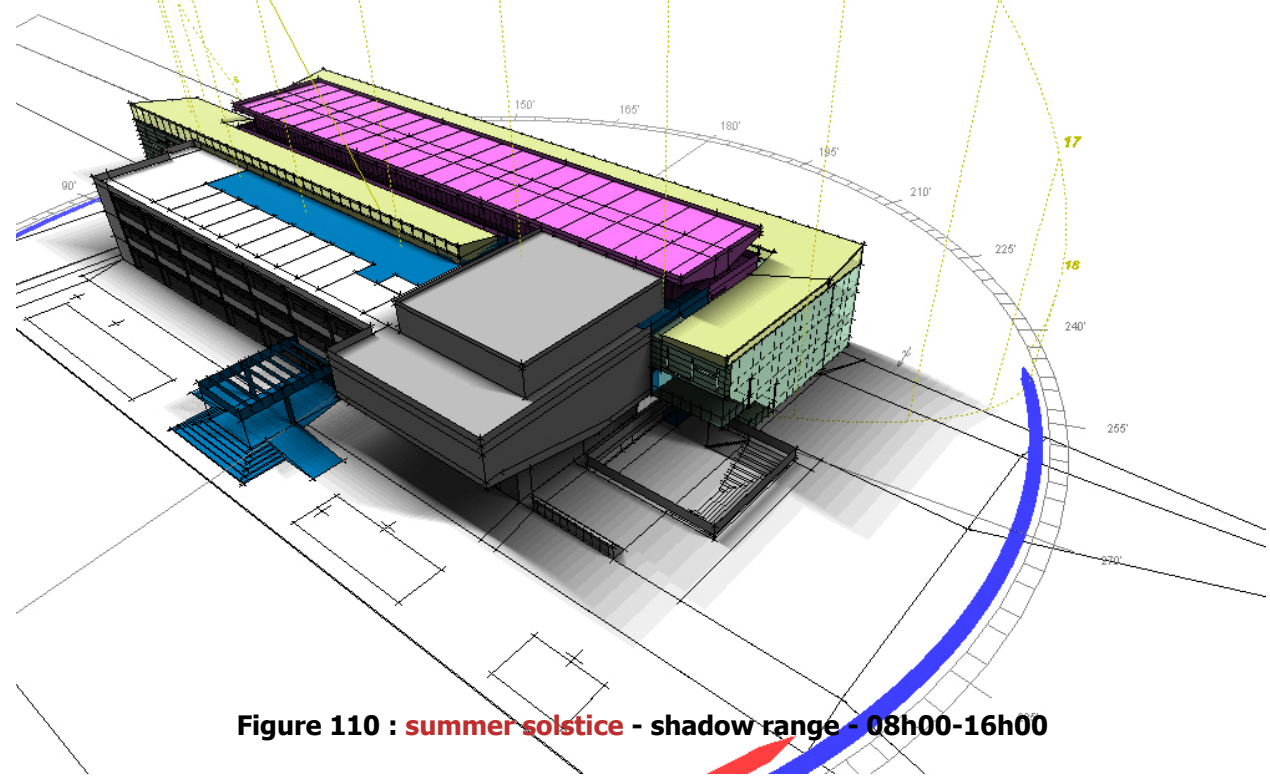


Figure 110 : summer solstice - shadow range - 08h00-16h00