



07 DESIGN DEVELOPMENT

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7_01 INITIAL IDEAS

DESIGN PROCESS STRUCTURE

The design was developed through various different techniques such as sketching, model building, computer aided drawing and photography. The process was documented after every review during the year in the form of summarizing sketches that indicate progression in the form of iterations and explorations. The following section includes a condensed version of sketches and other graphic explorations selected by the author in order to form a coherent documentation of the design process.

The first site visit sketches indicate an interest in the views of Noord Street from Johannesburg Art Gallery, which was used as a base-point for every site visit.

The strong axis of movement of both the sunken railway line and pedestrian activity on Noord Street feature prominently in these drawings. Relationships between the prominent roleplayers which frame the various 'urban scenes' were established. As the project progressed, selected scenes organically evolved into focal points, which became the most important design drivers.

The most challenging part of the design development, was creating an architectural language that spatially respond to the surrounding environment and manipulating movement to establish physical links on a local scale. These aspects are therefore eminent in the process documentation.

Sketch 1 indicates the sectional relationship of JAG with the railway fissure and Joubert Park. Prominent features of JAG like the entrance portico are noted. Lines of movement and activity and the relationships of existing structures in terms of scale and public space are also explored.



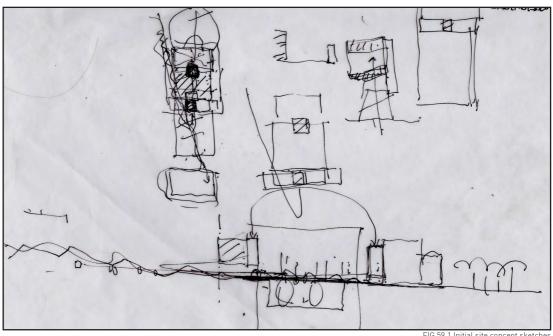


FIG 59.1 Initial site concept sketches



Sketch 2 indicateds an exploration on plan of Noord Street's pedestrian activity, views across the railway fissure and prominent frames to public performance and urban scenes (facade relationships). The location of public gathering spots are also mapped on this sketch for further investigation.



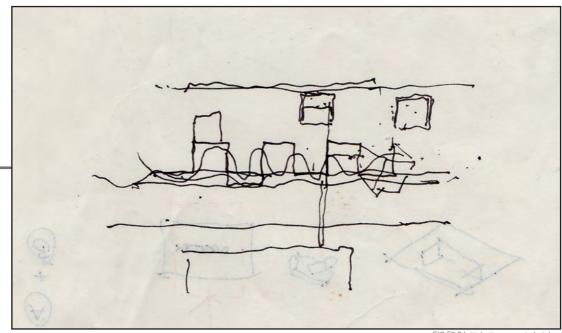
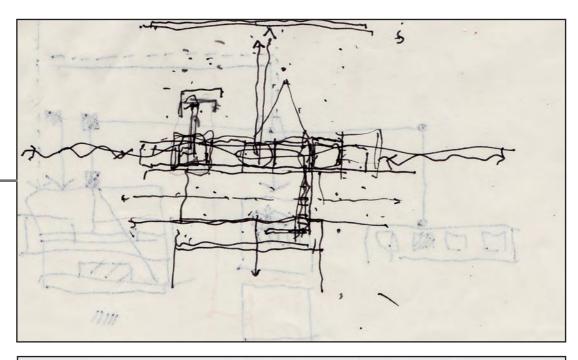


FIG 59.2 Initial site concept sketches



Sketch 3 indicates an evolved exploration on plan of Noord street with views across the railway fissure, edges and obstructive elements being mapped. A possible connection between JAG, Noord Street and Noord Taxi Rank is also starting to feature. Sketch 4 indicates the first stages of an architectural language being formed and possible location of the building (in Noord Street), floating above the market. On an urban scale - the possibility of follies (scattering elements across the site) to challenge the typology of JAG and conceptually creating a static vehicle features in this sketch





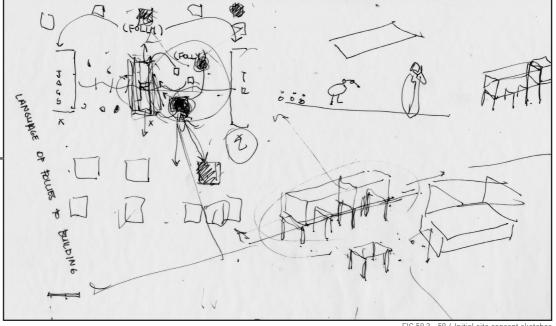


FIG 59.3 - 59.4 Initial site concept sketches



Sketch 5 indicates an evolved exploration of the architectural language by establishing relationships with surrounding elements (framing an urban stage) as well as allowing movement through and underneath the building.



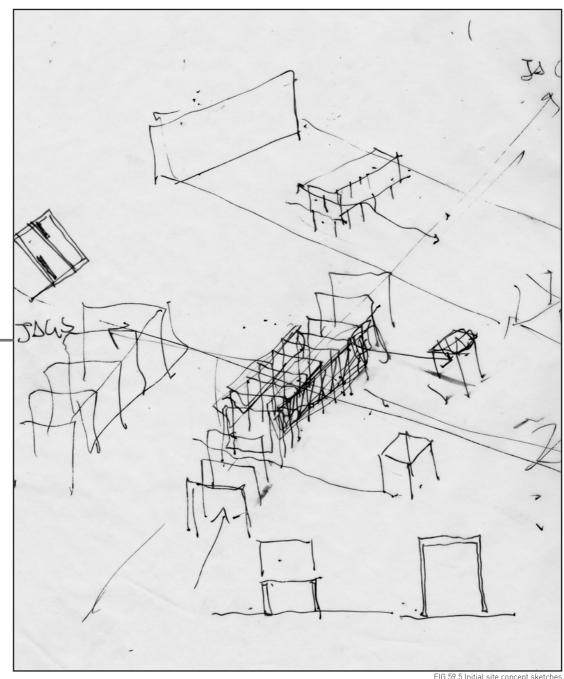


FIG 59.5 Initial site concept sketches



7_02 REVIEW/CRIT PROCESS DOCUMENTATION IN SKETCHES

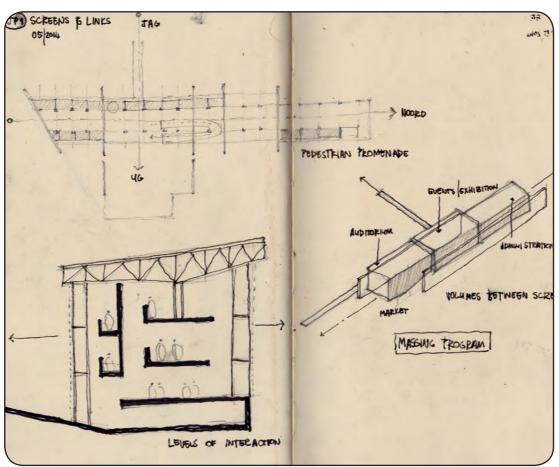


FIG 60.1 Design process sketch May 2014

SCREENS AND LINKS 05/2014

KEY IDEAS

Promenade over North Street market, different levels of public interaction, massing of program, connection to market in North and Wolmarans Street as well as Johannesburg Art Gallery. Screens framing the urban event spaces. The reinstating of the old Union Grounds.

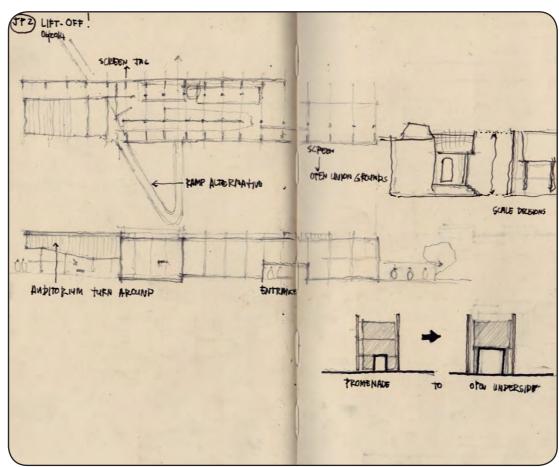


FIG 60.2 Design process sketch June 2014

ELEVATED STRUCTURE 06/2014

KEY IDEAS

Elevating the building to allow open pedestrian flow beneath. Openings in screens that (at this stage) touch ground level, for better pedestrian flow. Scale (appropriate to Johannesburg Art Gallery and Noord Taxi Rank).

MAIN ITERATION

Removal of formal market underneath building - risk of institutionalizing the informal.



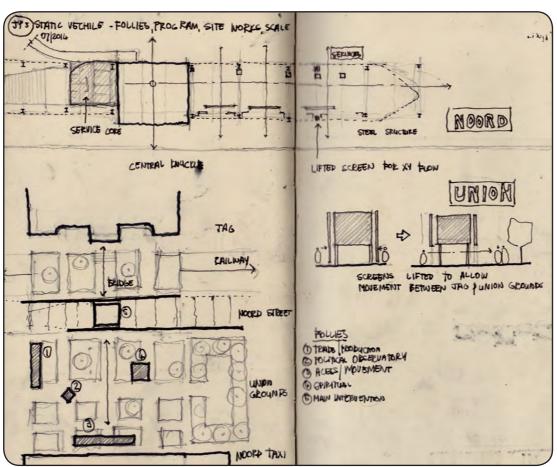


FIG 60.3 Design process sketch July 2014

EXPLORING CONCEPTUAL IDEAS 07/2014

KEY IDEAS

Playing with the possibility of follies as elements removed from the building. Creating an element of the building that relates to a feature of JAG (entrance portico). Lifting the screens for one continuous open public space between Joubert Park and the Union Grounds.

MAIN ITERATION

Twisting screens to represent the dynamic and incomplete. Central solid knuckle representing the permanent and monumental.



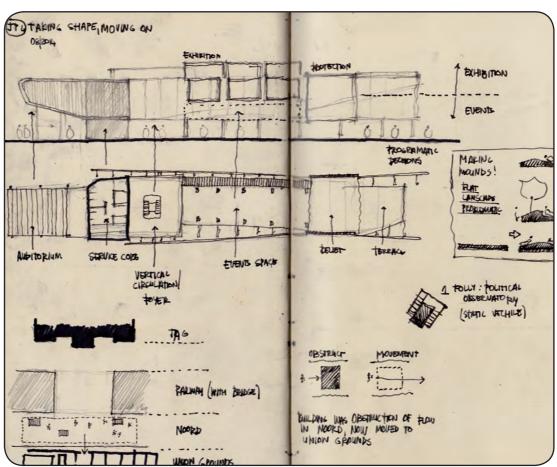


FIG 60.4 Design process sketch August 2014

FORMAL AND FUNCTIONAL DECISIONS 08/2014

KEY IDEAS

Service core's need to have a ground level connection, therefore, the building is moved out-off Noord Street into the Union Grounds (on the city grid) as elements touching ground plane become obstructions to pedestrian flow. Developing landscaping ideas for the Union Grounds as the section reads flat and to open - a possible conceptual reference to the Highveld landscape (mounds, veld-grass).

MAIN ITERATION

Moving the building, improving interior circulation, developing the program and placement thereof in the building.



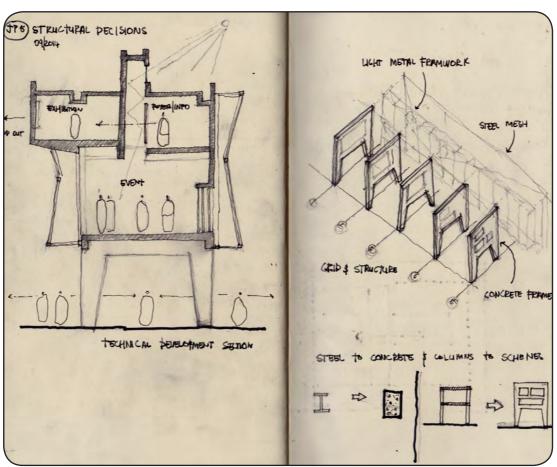


FIG 60.5 Design process sketch September 2014

STRUCTURE AND TECHNICAL DEVELOPMENT 09/2014

KEY IDEAS

Environmental concerns such as noise levels from the railway line and North Street (acoustic insulation), high thermal mass material choice on North side on horizontal planes (corresponding with the idea of the monumental / permanent). Arranging and punching through structure to create tectonic 'scenes' for rhythm and better programmatic organisation.

MAIN ITERATION

Structural development (steel to concrete), improved programmatic organisation, material research and application thereof.



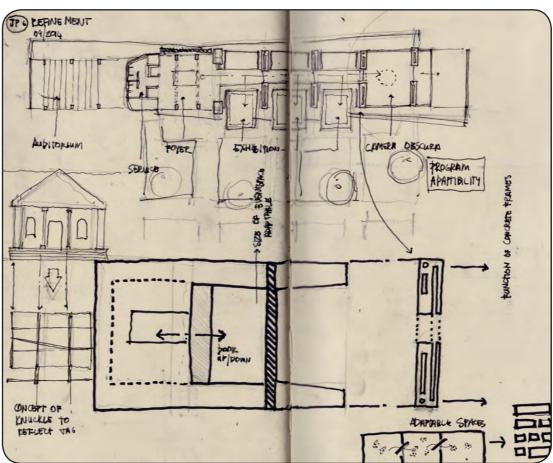


FIG 60.6 Design process sketch September 2014

TECHNICAL REFINEMENT 10/2014

KEY IDEAS

Structure to be functional (house services and contribute to multifunctional event space by housing spatial dividers), refinement of program and construction of auditorium (to appear thin and floating).

MAIN ITERATION

Internal shuttering need to be minimized. The structure needs to simplify and improve formally and functionally. Material choice for exhibition spaces on the South of the building should correspond with concept and therefore become a lightweight insert in order to respond to the dynamic and incomplete site component.



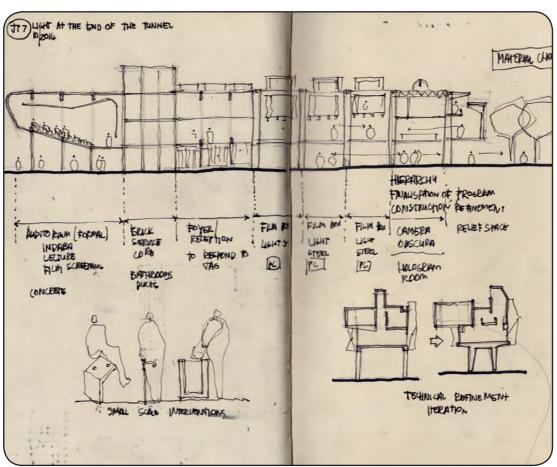


FIG 60.7 Design process sketch October 2014

TECHNICAL REFINEMENT 10/2014

KEY IDEAS

The programming of exterior spaces and ground floor (small scale informal interventions), finalization of the program, formal and technical improvement on main structural elements.

MAIN ITERATION

Proportion, structure, circulation, service core functionality.









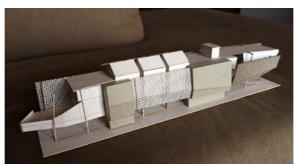






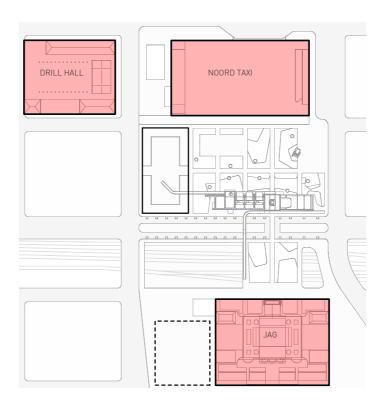


FIG 60.8 - 60.14 Concept model photgraphs 2014



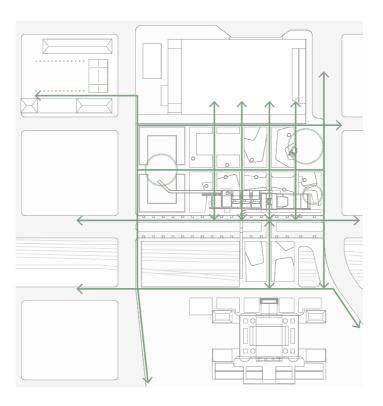
7_03 FINAL DIAGRAMS

MAIN ROLEPLAYERS





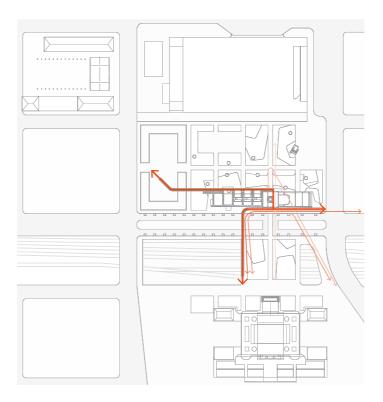
PEDESTRIAN FLOW (URBAN VISION)





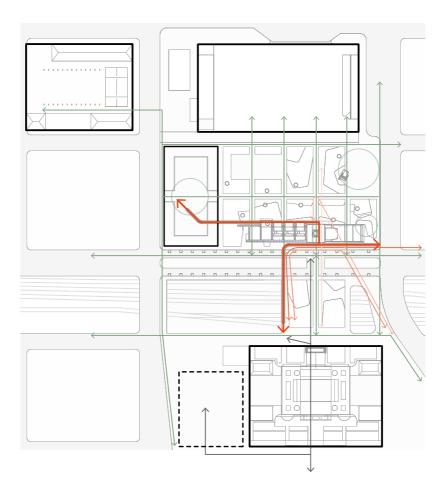
MOVEMENT ITERATIONS

Light to dark = Process of iteration, (darkest red represents final design)

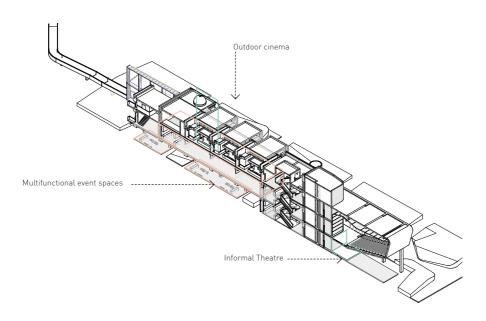




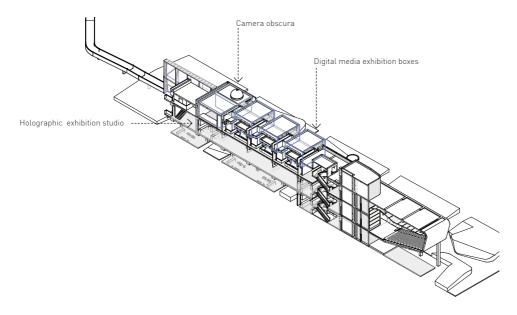
COMBINED FINAL MOVEMENT DIAGRAM





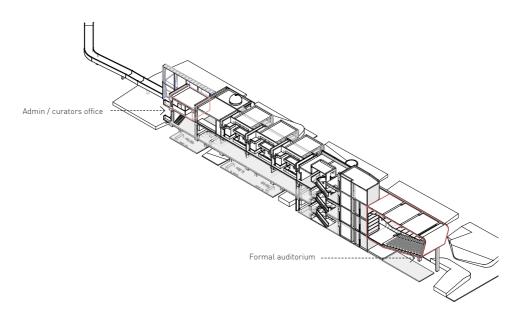


EXTERIOR AND INTERIOR EVENT SPACES

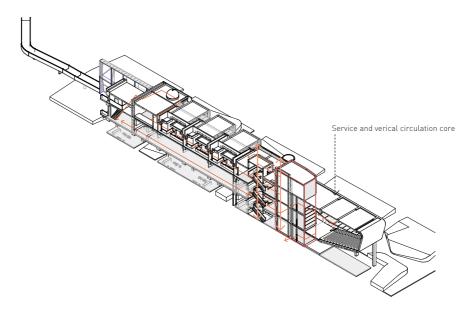


EXHIBITION SPACES

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FORMAL PROGRAM



SERVICES AND CIRCULATION

FIG 61.5 - 61.8 Final diagrams - program





08 TECHNICAL INVESTIGATION

8_01 TECHNICAL DEVELOPMENT

ORGANISATION OF STRUCTURE AND SPACES

SABS REQUIREMENTS

SYSTEMS DESIGN FOCUS: WATER

8_02 MATERIAL CHOICE AND APPLICATION

8 03 DETAIL RESOLUTION

1:20 DETAIL SECTION
1:10 DETAILS



8_01 TECHNICAL DEVELOPMENT

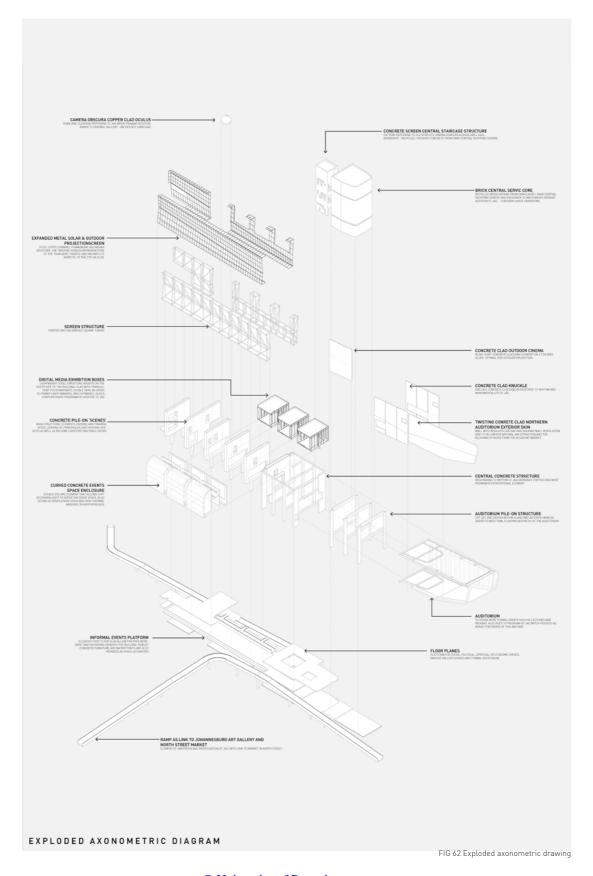
ORGANISATION OF SPACES AND STRUCTURE

The exploded axonometric drawing (figure 62) indicates a combination of all programmatic and structural elements, coming together according to the architectural concept and parameters set up by the author. Solid monolithic elements and lightweight slender inserts into the main structure (concrete pile-on 'scenes') becomes the architectural language of thresholds, interpenetration and overlaying of spaces and planes.

Ramps serve as the urban connectors. The expanded metal solar and outdoor projection screens are clipped onto the structure on the North and South with a steel structure, creating an interplay between the seeing and being seen on the interior and exterior of the building. The central knuckle responds to Johannesburg Art Gallery in rhythm and monumentality. The service and circulation cores penetrate horizontal planes with the formal auditorium double volume curved space on the Western end. The curves and linear elements as well as proportional relationships became conscious attempts in relating plan to section and *vica-verca*.

The rest of this chapter will expand further on systems-focus (water), sectional and detail resolution as well as the choice and application of materials.







SABS 10400 REQUIREMENTS

At the initial stages of the design, the SABS 10400 was consulted in order to establish functional as well as technical guiding principles for the building. Research from various sections are listed below, with application thereof explored further in the technification process of this project.

PART A

Table 1: Building classification

A1 / A2 - Entertainment and Public Assembly, Theatrical or Cinematographical

Table 2 - Occupancy planning

Number of fixed seats or 1 person per square meter if there are no fixed seats Estimated number of users = +-120

PART 0

Table 2 - Air and ventilation requirements Assembly halls, Theatres, Cinemas

3.5 l/s per person

 $3.5 \times 120 = 420 \text{ l/s}$ for auditorium

 $3.5 \times 20 = 70 \text{ l/s}$ for digital exhibition boxes

PART F

Table 4 and 6: Provision of sanitary fixtures

REQUIRED PROVIDED

Male

3 WC pans 4 WC pans 5 Urinals 4 Urinals

4 Wash hand basins 6 Wash hand basins

Female

7 WC pans 8WC pans

4 Wash hand basins 6 Wash hand basins

Disabled

2 WC pans 2 WC pans

2 Wash hand basins 2 Wash hand basins



SYSTEMS DESIGN FOCUS: WATER

The project which deals with the reinstatement of public space (Union Grounds) in the form of a plaza or park, and the site location naturally led to selecting water as a theme for a systemic investigation. The intention is to design a water recycling system that minimizes the water required from Rand Water. The strategy is to collect surface run-off and grey water from roofs, roads and hard surfaces on site, treat the water as required and recycle it back into the system.

The building's water budget is first calculated according to the principles and guidelines of The council for Scientific and Industrial Research South-Africa (CSIR)

The domestic (internal) demand will then be combined with site requirements (irrigation and outdoor use) as well as environmental considerations such as climate date, to further explore water storage and recycling options.

DOMESTIC WATER BUDGET

FITTING USE	FLOW	m³	USES/DAY	M3/DAY
Toilet flush	half flush	0.005	20	0.2
Toiltet flush	full flush	0.009	10	1.8
Urinal flush		0.005	30	0.15
Basin	6l/min	0.003	60	0.12
Bar/cafe		0.2	3	0.6

Total water requirements per day = 2.88 m³ Total water requirements per week (2.88 x 6) = 17.28 m³

Total water requirements per month (17.28 x 4) = 69.12 m³

The climatic data of the site (Johannesburg, 26°11'55 S; 28°02'50, 1754 meters above see level, in the period 2014 - 2015) are used in combination with a mathematical spreadsheet, co-created by Mr. Derek Townshend (CSIR) to calculate water storage possibilities.

The average monthly precipitation (table 1) with surface run-off coefficient are used to determine the average monthly yield (table 2). The domestic demand combined with the demand for irrigating a planted area of approximately 3150m² are combined to determine the total water demand per month (table 3). A safety factor is applied to the total water budget to determine the water storage capacity and tank sizes.



The researched and calculated data (from the CSIR water budged spreadsheet) to determine the water storage capacity is summarized below:

- The yearly precipitation is 809.5mm in an average of 87 days.
- The total yield [P(m) x A(m²) x C)] is 4740m³.

P(m) = precipitation average monthly $A(m^2) = area$ C = Run-off Coefficient

 $A(m^2)$ roofs = $1200m^2$ $A(m^2)$ parking, paving, hard surfaces = $6100m^2$ C = 0.8

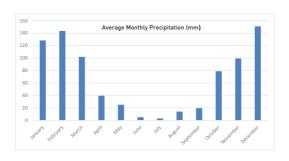
The total water demand per year (domestic and irrigation)
 Irrigation of a 1800m³ area; 0.04 m depth per week = 3733m³
 Domestic = 760m³

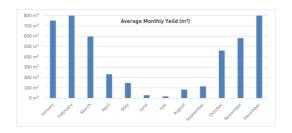
The greatest volume of water in tank/reservoir at anytime and the minimum capacity of the tank is calculated to be 1757m³. With a safety factor of 2, the final reservoir size is calculated at 3513 m³ = (15×2501) Jojo Tanks) or custom reservoir of $70 \times 10 \times 5$ m.

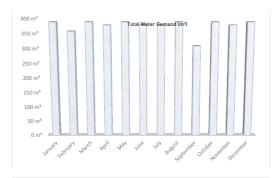
For a project of this nature, the infrastructure necessary for storing the calculated amount of water is excessive. Therefore, the safety factor of 2 will be adapted to a more suitable size tank of 1800=m³. If flash floods or unusually high rainfall occur, excess water can be treated and recycled back into the city (Rand Water) grid via and overflow and safety pump. The water collected will only be used for irrigation and recycled grey-water within the building (flushing of toilets, urinals), therefore the pollutants that need to be removed are:

- Floating debris (removed with grid inlets at specified points)
- Pollutants lighter than water (removed with oil traps at specified points)

A diagrammatic layout of water run-off and necessary distribution networks (for irrigation and grey-water recycling) is indicated on the next page.







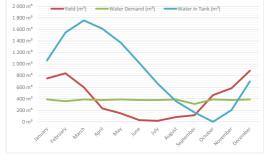
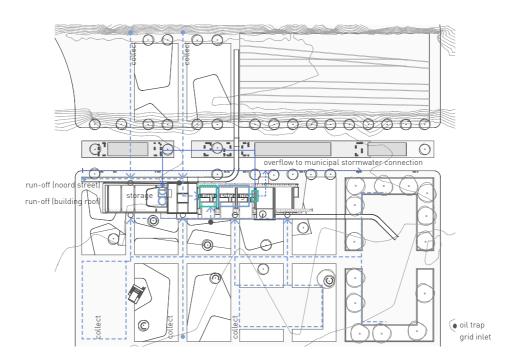


FIG 63.1-63.4 Water tank size calculation graphs

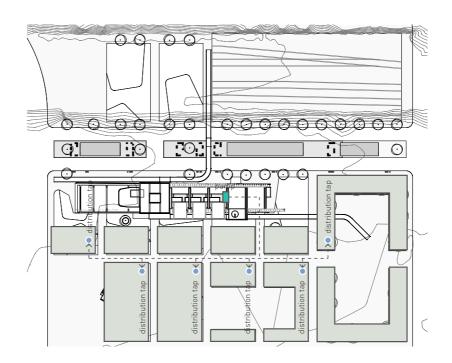


WATER COLLECTION SYSTEM





WATER DISTRIBUTION SYSTEM





8 02 MATERIAL CHOICE AND APPLICATION

STRUCTURE



CONCRETE

The main representative structural elements consist of 250 - 345 MPa cast-in-situ concrete at 7.6 to 8 meter intervals. The concrete structure unifies all spaces and required services. The elements have an inherent robustness, ideal for its context and conceptually representative of the monumental.



STEEL TUBING

The facade structure is constructed with 150mm square steel tubing, bolted to a steel cleat system which is fixed to the main concrete with cast in place anchor-bolts. The structure becomes a lightweight add-on and contrasting feature to the robust concrete, therefore representative of the temporal or dynamic.



STRUCTURAL STEEL

The main exhibition feature (digital media boxes) are framed with structural steel elements, to appropriately contrast and represent a floating additive form, protruding into the solid concrete form and the exterior urban space. The steel structures are cantilevered from the main concrete structural.



STRUCTURAL GLAZING

To benefit from natal light, to maximise the view towards the reinstated Union Grounds, and for a clear, unobstructed glass aesthetic, structural glazing is used at main auditorium's Southern edge. Double glazing system to be used in order to minimize acoustic disturbance





FAIR-FACE CONCRETE WALLS

Cast-in-situ with specialist form-work, used as repetitive element at event space and gallery as well as at the auditorium (plywood shuttering). Waterproofed where required with Sika 1 specialist add mixture.



POWERFLOATED CONCRETE SCREED

This element is implemented as alternative to brick floor finish to indicate spaces of lower traffic and as transitional material to acoustic flooring. Material chosen for its relative simplicity, low maintenance and aesthetic quality.



BOND DECK

25-50 MPa Robertson bond-deck lightweight composite floor and roof system applied to digital media exhibition space. System supported by structural steel framing. Element on Southern side of the building represents the concepts of temporality.



50mm COROBRIC BUR-GUNDY PAVER

Paving bricks used at public gathering or event spaces (high traffic) for it's low maintenance, thermal massing, easy construction, relatively low cost and warm aesthetic quality. Used at interior and exterior spaces, the material acts as transitional element, bringing the outside



ISOCRETE ACOUSTIC FLOORING

The digital media exhibition boxes require sound insulation. The Isocrete floor panel system is an excellent sound insulator and closest to the aesthetic of concrete, which is implemented in various other parts of the design.



PLYWOOD FLOORING

Used as floor finish in the main auditorium. This material performs well acoustically, it is affordable and available as a recycled product. The plywood panels will be installed in combination with polypropylene reinforced acoustic floor panels and fixed to steel channel framework.



MASONRY (RECYCLED & COROBRIC AGATE TRAVERTINE)

Recycled bricks from the Park Central Shopping Centre in combination with Corobric Agate Travertine to be used for construction of the main service core and other smaller feature elements to closely resemble JAG sandstone and brickwork of Meier Pienaar addition.



40mm DAMPALON TRANSLUCENT POLY-CARBONATE CLADDING

Durable, translucent, lightweight material to be used as double skin wall cladding at digital media exhibition boxes kin order to permit light towards the exterior without disturbing exhibition activities.



EXPANDED METAL MESH

Lightweight screen covering, representative of the dynamic and incomplete. Welded to secondary steel structure.



PERFORATED STEEL CLADDING

Panels to be used at event space as interior wall skin and acoustic ceilings, creating a warm aesthetic and also acoustically sound environment. To be used in combination with therm-acoustic insulation.

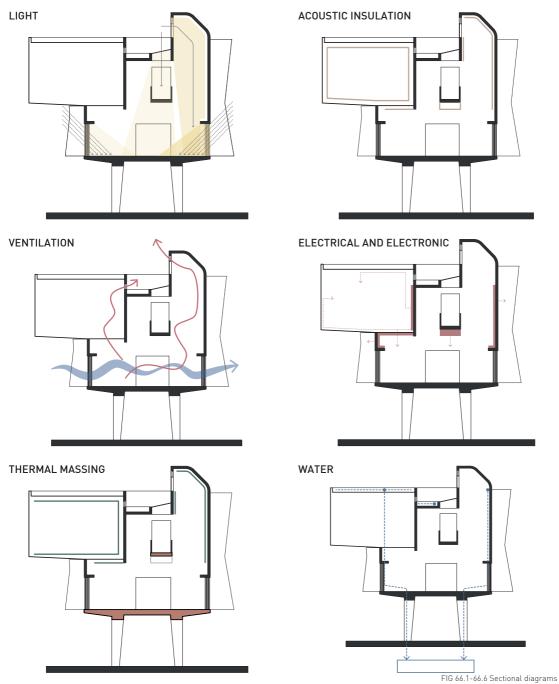
HORIZONTAL

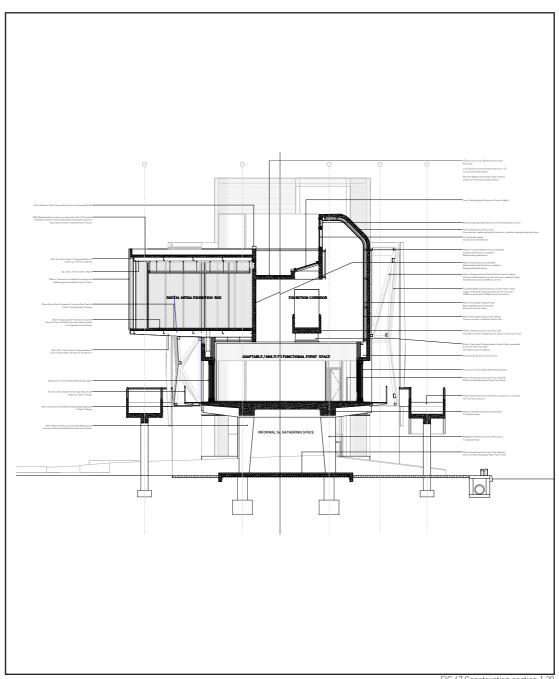


CONCRETE 245MPa 170, 255 and 340mm Cast-in-situ reinforced concrete (according required span. Concrete floors are used as hight thermal mass material and flat roofs as part of water gathering system.

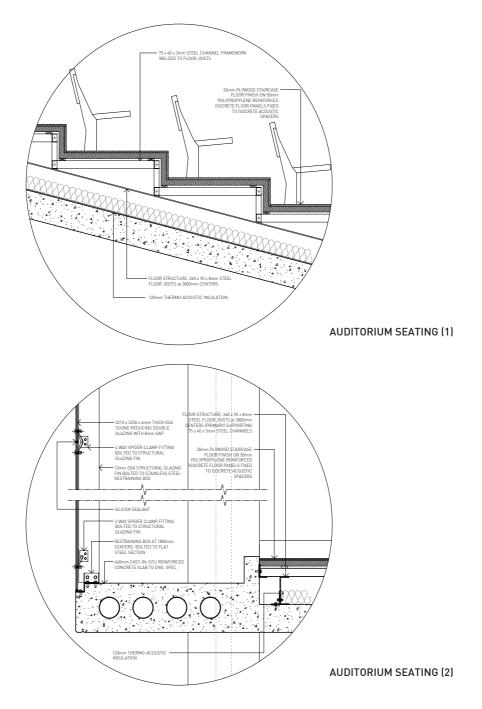


8_03 DETAIL RESOLUTION

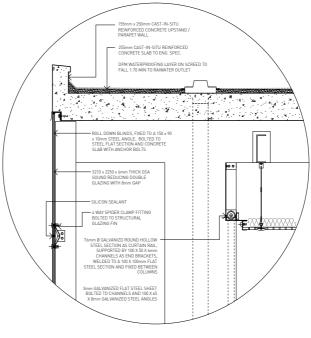




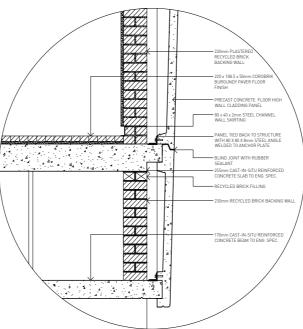




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AUDITORIUM ROOF



CONCRETE CLADDING

FIG 68.1-68.4 Construction details 1:10



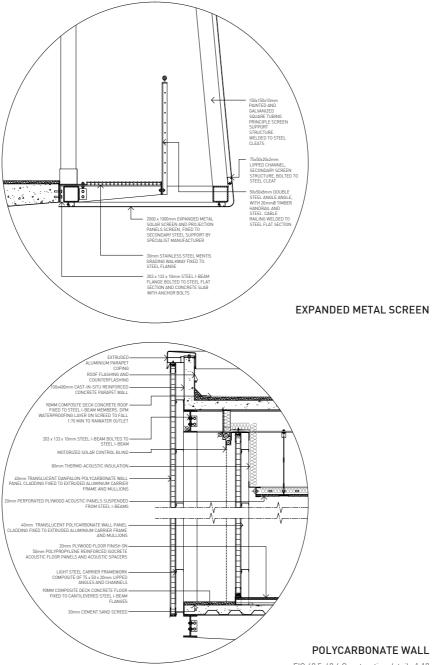


FIG 68.5-68.6 Construction details 1:10

