6. technical investigation

6.technical investigation

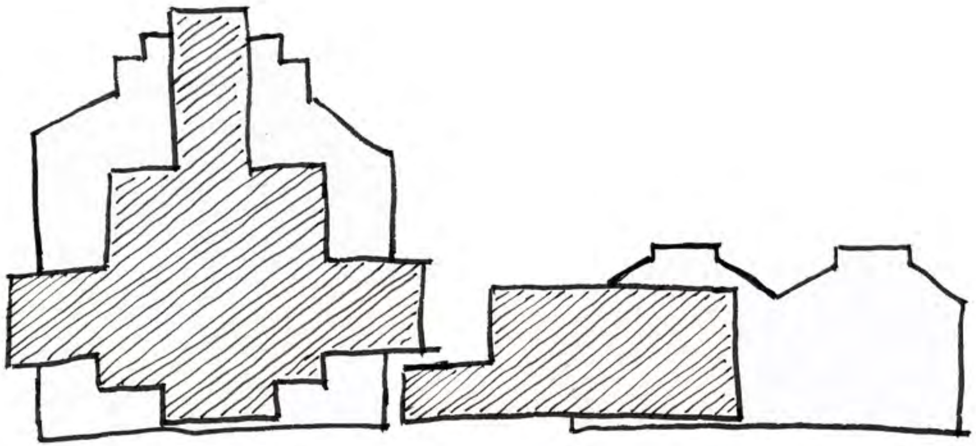


Fig 6.1 Diagram showing conceptual intention of how new building is inserted into existing structure.

6.1_conceptual approach towards technology

This chapter deals with the technical aspects and decision making process of the design

In the new extensions to the existing building a contrasting design approach was taken, this approach will be maintained in the technical investigation and resolution of the building. As with fashion photography where a model is placed in a contrasting environment, so will the new extensions to the existing building be placed in it, in a contrasting fashion. This is to emphasise the age and technology used during construction of the existing building as well as the new extension.

6.2_structural system

The existing building structure consists of concrete columns and beams laid out on a regular grid. This concrete frame was filled in with brick to act as bracing. The structure of the existing building is exposed.

The new design extension will have a steel structure, this is to contrast the heavy concrete frame structure. Since the new building is on the inside of the existing building, it will also be easier to assemble the new part if it was a steel structure, which consists of prefabricated parts that can be joined together once it arrives on site. To contrast the exposed structure of the existing building, the new steel structure will be cladded on the outside and the inside to hide the structure. The cavity between the outside and inside can be used for services and storage.

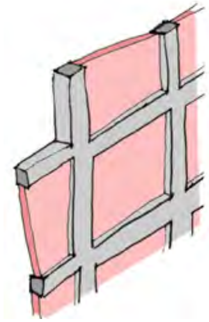


Fig 6.2 Structure of existing building consists of concrete frame with brick infill, structure is exposed.

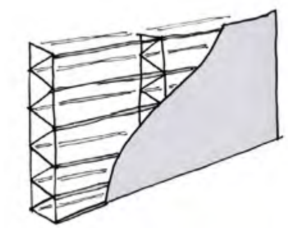
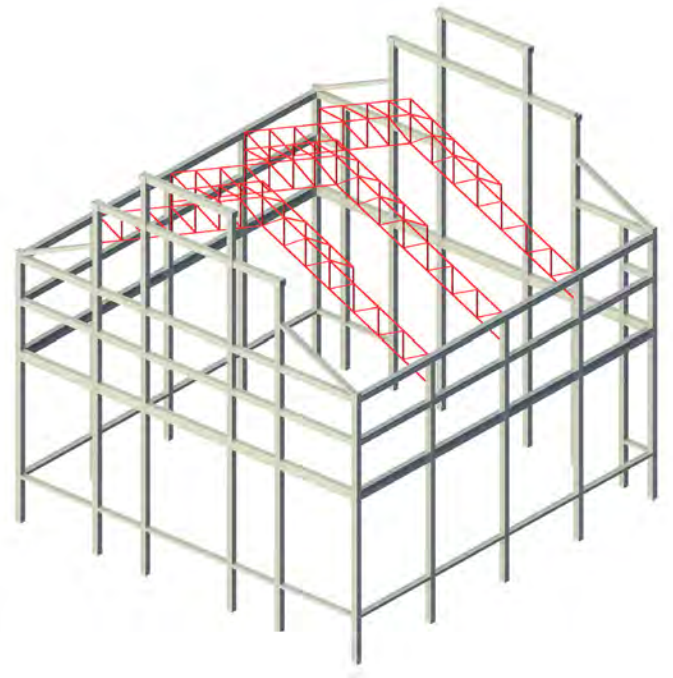


Fig 6.3 Structure of new building consists of steel frame with cladding, structure is hidden.

6.2.1_structural calculations



new roof for existing building

The existing Boiler House's roof is supported by steel columns. These steel columns need to be removed to make space for the new building inside the existing. New deeper roof trusses will be inserted to span the length of the existing building.

Depth of new roof truss:
Span = 24m
L/d = 15
24000/15 = d
min d = 1600mm

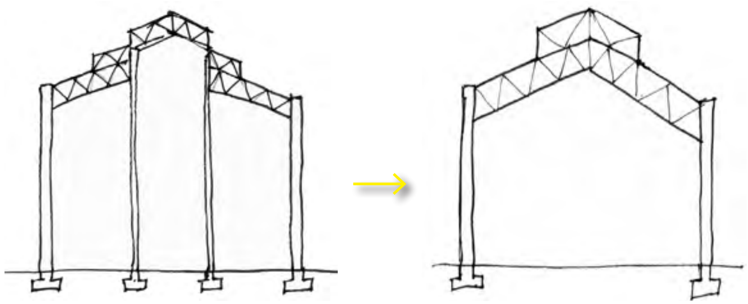


Fig 6.4 (a),(b) Diagram and sketches showing the new roof for the existing building.

bottom structural support for event space

The structural support below the event space are hidden within the walls of the of the ablution and bar area, as well as the ticket sales booth. These areas read as extrusions from the event space.

Thickness of vertical hollow section steel support:
Height = 4m
h/d = 20-25
4000/20-25 = d
d = 160mm to 200mm

base of event space

The base that forms the base for the rest of the structure of the event space.

Depth of steel girder truss
Longest span = 10m
L/d = 15-25
10000/15-25 = d
d = 400mm to 660mm

floor of event space

Depth of steel girder truss
Longest span = 3500
L/d = 15-25
3500/15-26 = d
d = 140mm to 230mm

Cantilever = 3000
L/d = 8
3000/8 = d
d = 375mm

walls of event space

Lattice columns
Height 9.5 m
h/d = 20-25
9500/20-25 = d
d= 380mm to 475mm

roof of event space

The roof space above the event space is a VIP bar area. In order to reduce the chance of an acoustic sound bridge, two steel girder trusses are used that span independently from one another, one will support the floor above and the other will support the ceiling and lighting on the inside.

Span = 13.4m
L/d = 15 - 25
13400/15 - 25 = d

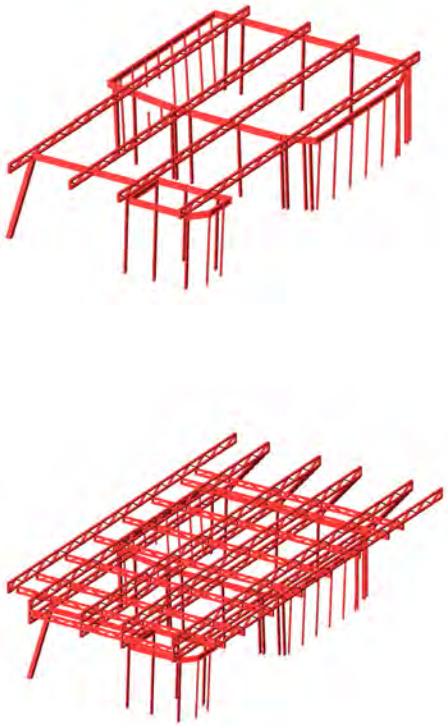


Fig 6.5 (a),(b) Diagram showing the base structure and floor structure of the new Event Space.

STRUCTURE OF EVENT BOX

PRIMARY STRUCTURE

SECONDARY STRUCTURE
(CLADDING SUPPORT)

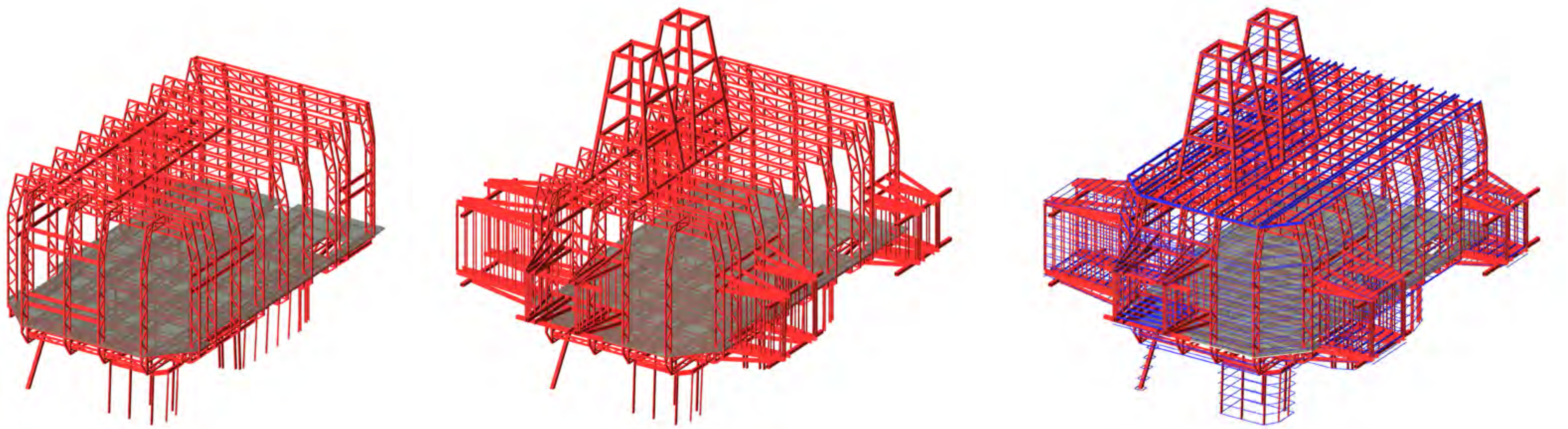
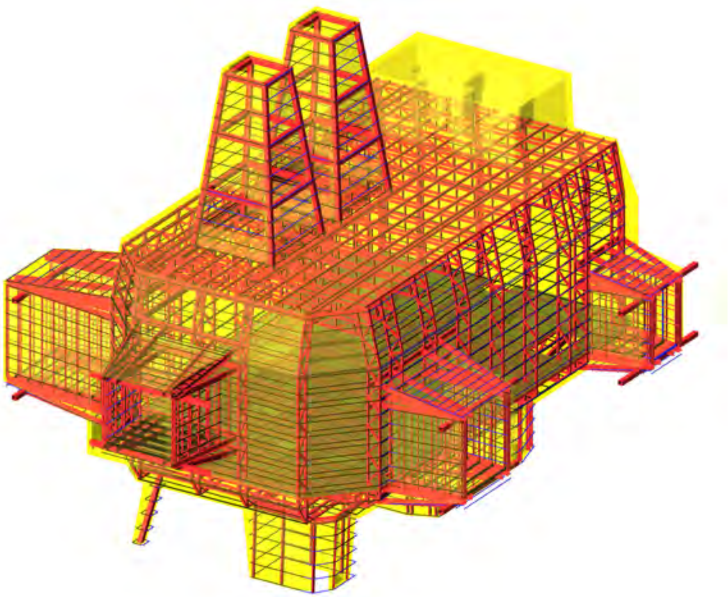


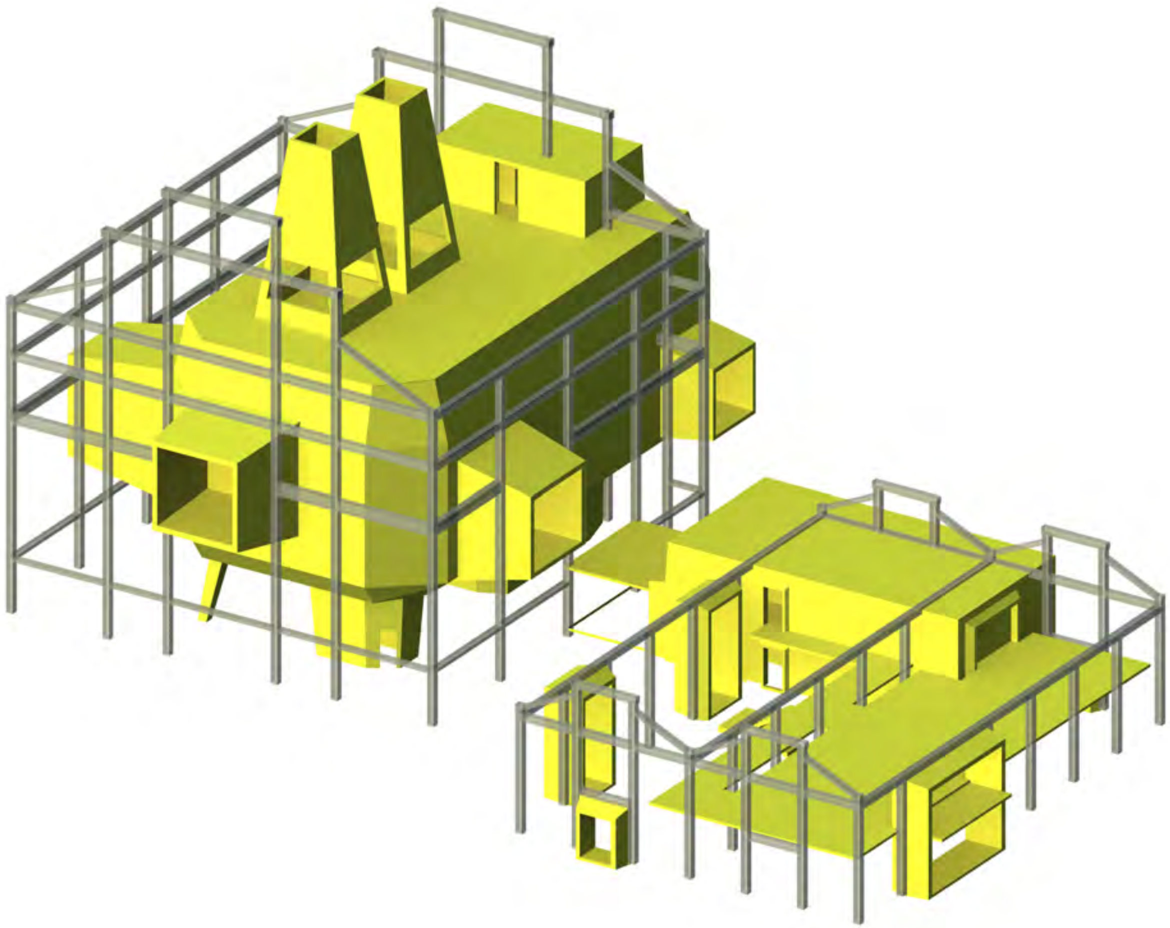
Fig 6.6 Diagram sequence showing structure of Event Space and its placement within the existing building.

STRUCTURE

STRUCTURE WITH CLADDING

NEW BUILDING WITHIN EXISTING STRUCTURE





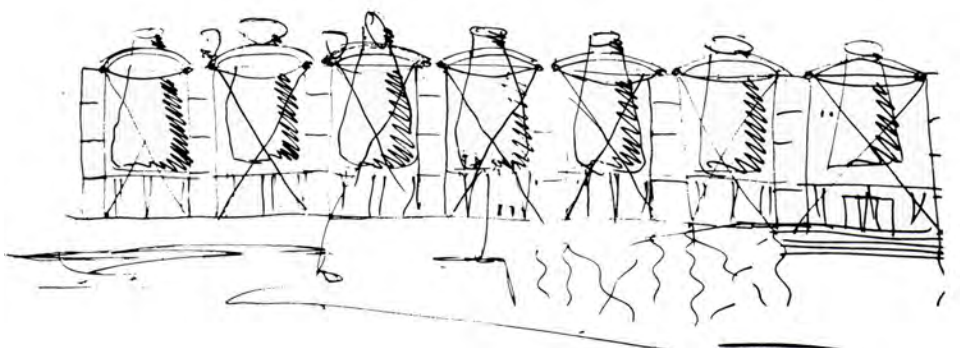


Fig 6.7 (a)-(d) Law Court, Bordeaux, France by Richard Rogers Partnerships. The solid nature of the seven courtrooms and lightness of the walkways, was maintained from conceptual sketches right up to the realisation of the project.

law courts, bordeaux, france (1998)
richard rogers partnership

description

In a nationwide attempt of France to construct new court house facilities, the Richard Rogers Partnership (RRP) has satisfied the municipal authority of Bordeaux with their design (Ryan, 1999: 48). In an attempt to contrast the existing weight and opacity of the old buildings in the city, the new design aims to add lightness and transparency to this court house, which is traditionally experienced as a closed and intimidating building (Ryan, 1999: 49).

materiality

On the eastern side of the building, seven vat-like forms which house the courtrooms are arranged in a line. These 'pods' are cladded in cedar wood and are supported by circular concrete feet. They are individually linked with delicate 'light' walkways and bridges to the glass-floored catwalk, which connects all the courtroom chambers to the entrance (Ryan, 1999: 49).

design influence

The solid 'pod'-like structures are treated differently with materials to create a solid element. The 'lightness' of the stairs, bridges and walkways around it, put more emphasis on these courtroom chambers.

6.3_materiality + finish

The choice of materials for the new building was influenced by the contrasting approach for this project. As previously mentioned, the new building's structure consists of steel columns and beams, which will be cladded with a material that will contrast the existing building.

The materials that were used in the existing building are reinforced concrete and brick, with a steel structure for the roof, covered with a corrugated steel sheet roof. These materials and other textures found on the site gives the building and area a very robust quality.

In keeping with the concept and the programme - a facility for fashion - the decision was made to clad the new building with a polymer, as well as aluminium panels where the existing building punches through the existing structure. The materials and textures for the new building should have a finer quality.

The new intervention inside the existing Boiler House consists of two main elements: the events space 'box' with its protruding elements, and the circulation (stairs and walkways). To put more emphasis on the solid nature of the event 'box', the stairs and circulation will have a more light appearance. The Law Courts in Bordeaux, France is an example where the emphasis is on the solid 'pod' structures, surrounded with 'light' stairs and walkways.

Fig 6.8 (a)-(f) Materials and Textures on site with rough, robust quality.

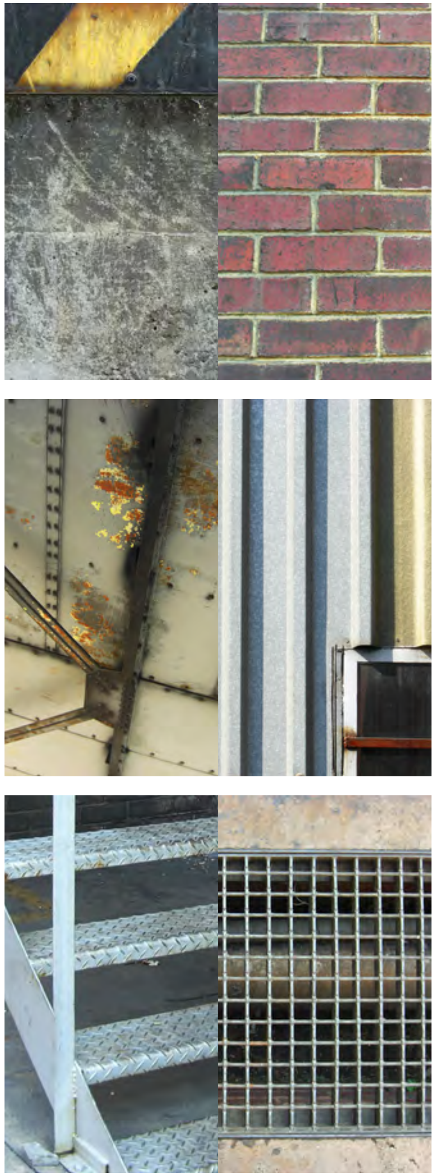


Fig 6.9 (a)-(c) New proposed materials, with a smoother and finer quality

6.4_services

6.4.1_wet services

Wet services were placed as close as possible to the 'back' of the building from where it can easily be accessed for maintenance, away from public view.

6.4.2_natural ventilation

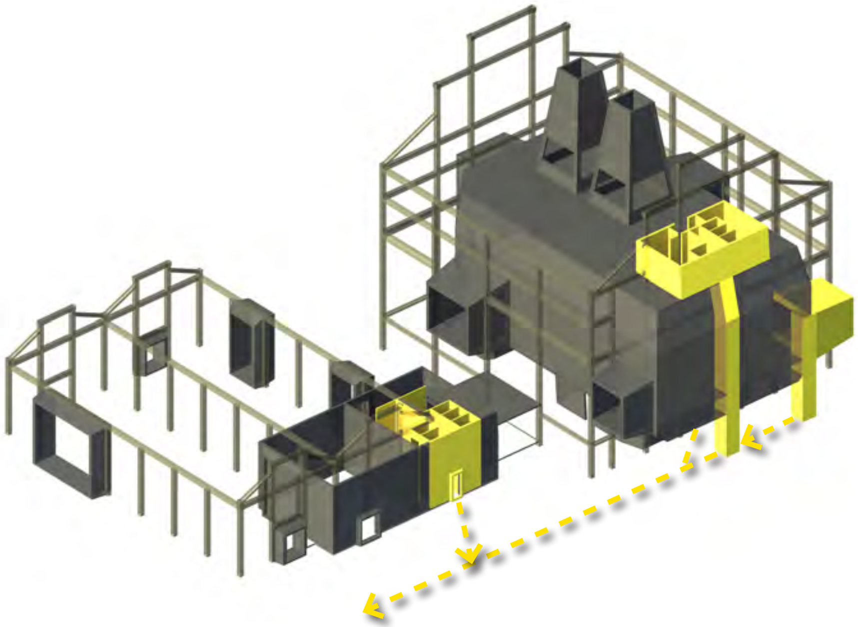
The spaces around the event space box in the existing Boiler House will be naturally cross ventilated. Some of the brick infill will be removed from the concrete frame, so the space between the existing building and the new event space box will be exposed to the elements.

The workshop space will also be naturally cross ventilated with openings on the northern and southern side of the building.

6.4.3_mechanical ventilation

The new event space box is isolated from the outside and, the concentration of people with events, demanded that mechanical ventilation be provided for this space. A chiller plant room and air handling unit will be accessed from the backstage area that will supply fresh air to the pressurised system. The steel structure that is cladded both inside and outside, above and below, will provide the supply and return air plenum in which air conditioning vent pipes can be hidden.

SERVICES CONNECT AT
'BACK' OF BUILDING



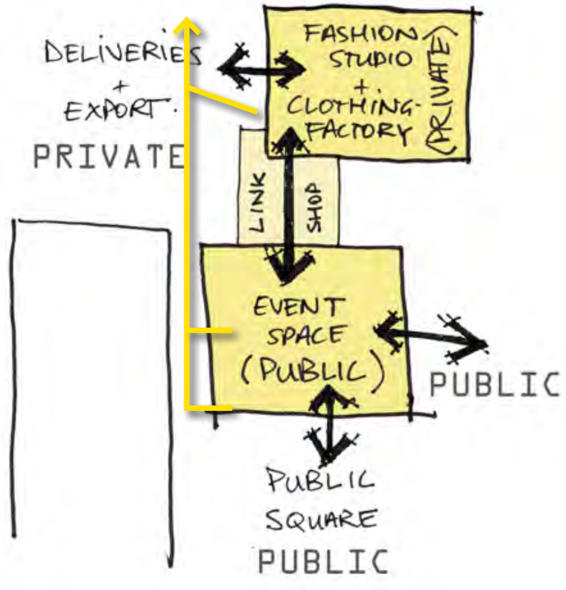


Fig 6.10 Diagram and sketch showing the wet services placed at the 'back' of the building.

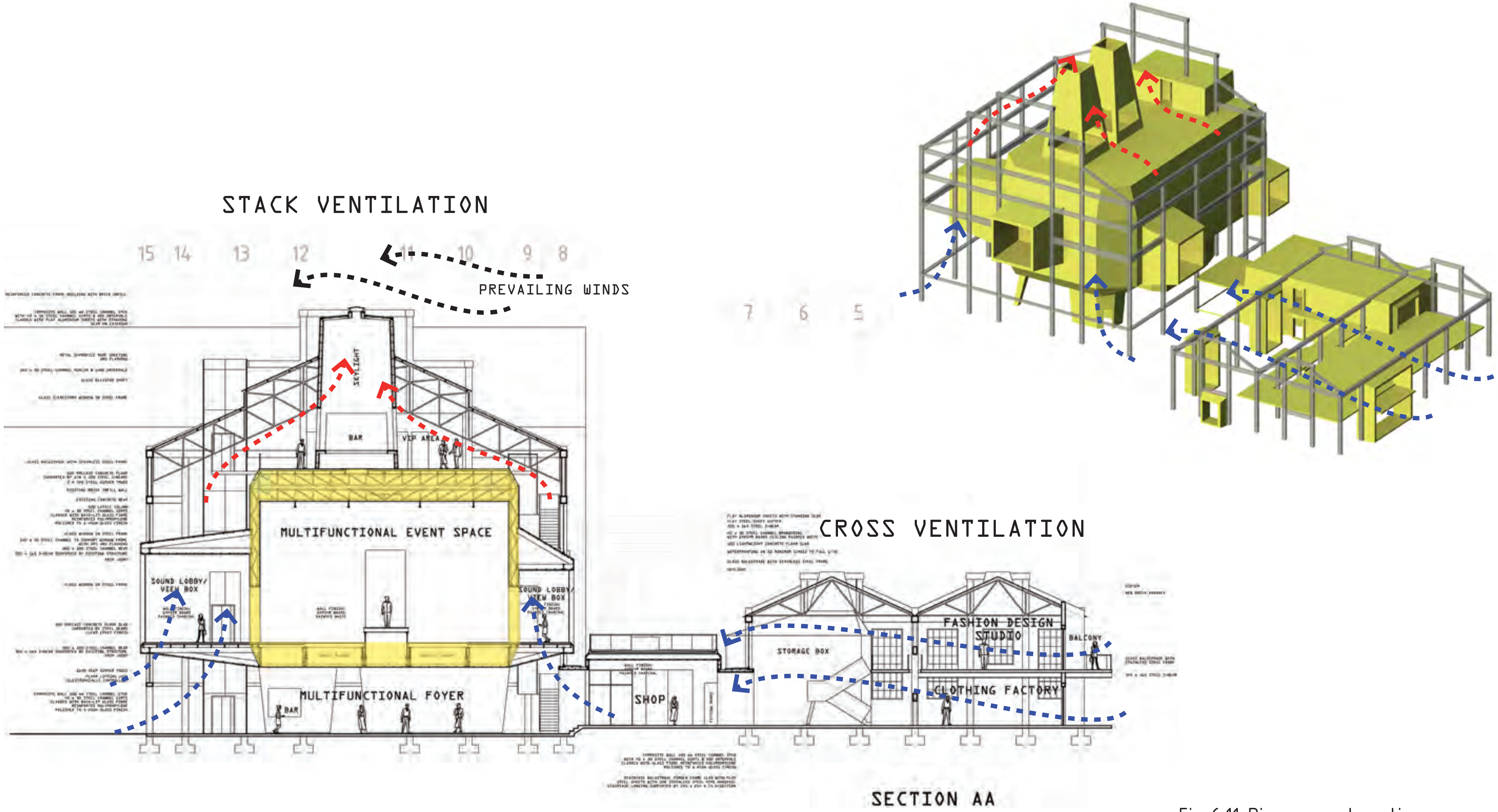
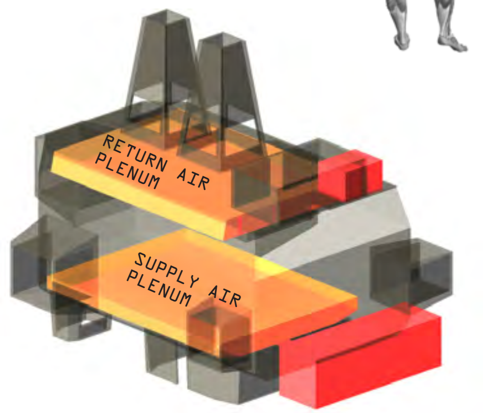
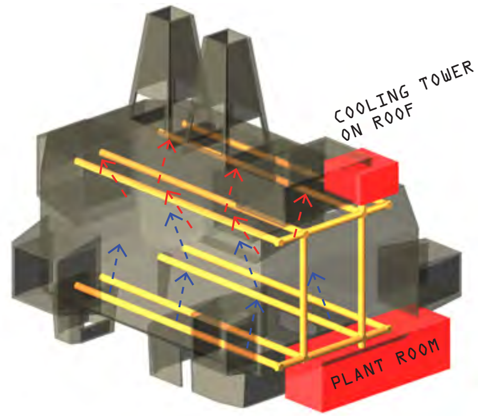


Fig 6.11 Diagram and section showing natural ventilation.

FUNCTION





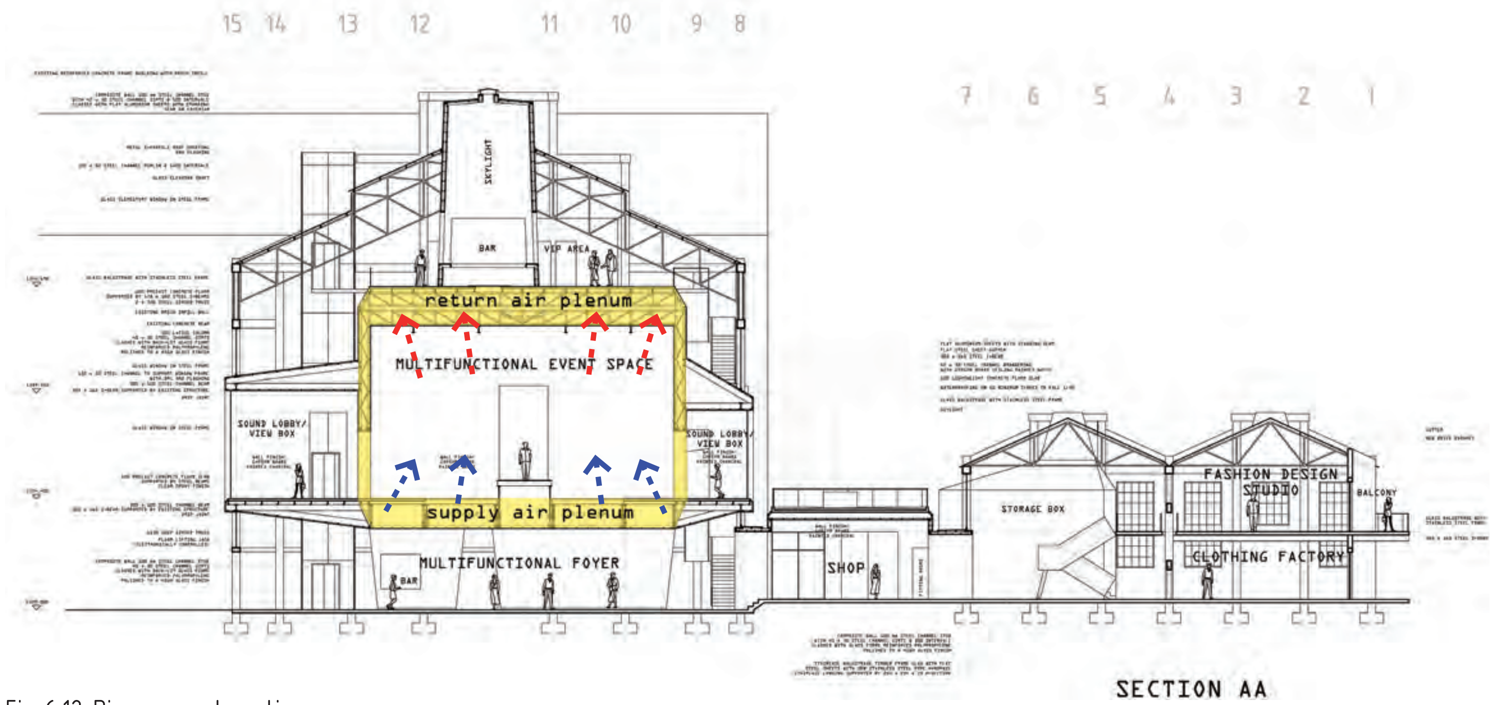


Fig 6.12 Diagram and section showing mechanical ventilation.

6.5_sustainability

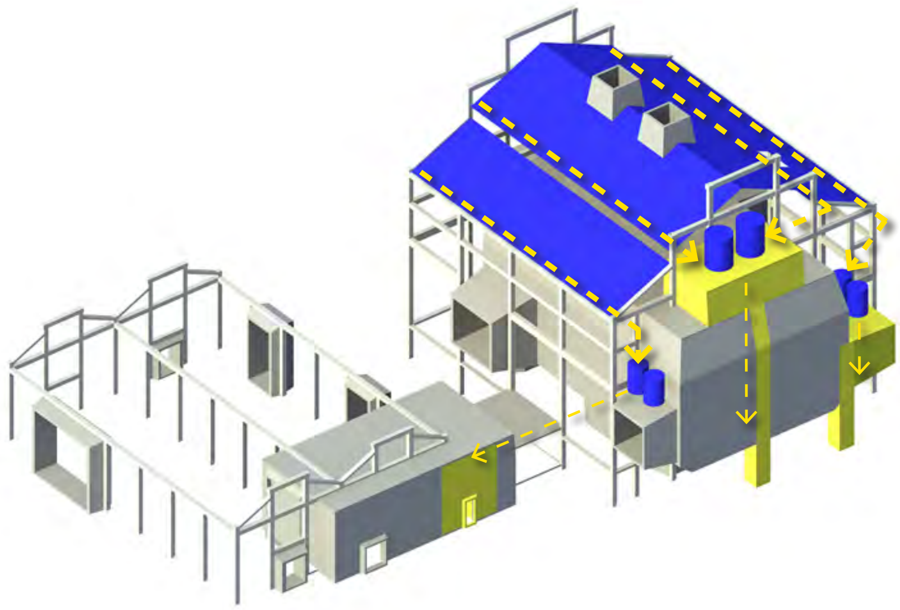


Fig 6.13 Diagram showing the position of rainwater tanks

The adaptive re-use of an existing building is effectively a sustainable approach to the development of a city. This project aims to serve as a possible example of how buildings can be re-used and redressed to serve current and future needs.

The materials for the new building were chosen primarily based on the concept for the design and the approach to contrast the existing building and materials in the new design. These materials (aluminium and plastics) have a high embodied energy in their manufacturing process, however both materials can be sourced in the Pretoria West area.

Strategies to minimise the impact on the environment during the life time and maintenance of the new building include the use of solar panels that can be attached to the roofs of the existing buildings that face in a northern direction.

Rainwater can be harvested by capturing the rainwater from the roof in water tanks and used in the building where potable water is not required. Especially in the new Boiler Hall building, harvested rainwater can be used by the air conditioning plant room to cool the air for the event space, as well as for the use of toilet flushing, urinals and hand basins.

6.5.1_rainwater harvesting

boiler hall water usage

	liters used	Usage / day	Water Usage	Quantity	Total	TOTAL
Flush Toilet	9	8	72	17	1224	
Hand basin	3	8	24	20	480	
Urinal	2	8	16	7	112	
Days per month (15)					1816	27240

workshop water usage

	liters used	Usage / day	Water Usage	Quantity	Total	
Flush Toilet	9	8	72	10	720	
Hand basin	3	8	24	10	240	
Urinal	2	8	16	4	64	
Days per month (22)					1024	22528
Water Usage for Air Conditioner						27360

TOTAL usage per month (l) — 77128

average monthly rainfall	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(mm)	136	75	82	51	13	7	3	6	22	71	98	110
Roof Area (24m x 25m) 608 m^2												
Rainwater Harvested (m^3)	82.7	45.6	49.9	31.0	7.9	4.3	1.8	3.7	13.4	43.2	59.6	66.9
m^3 = 1000liter (l)	82688	45600	49856	31008	7904	4256	1824	3648	13376	43168	59584	66880

provide rainwater harvesting tank for 80000 litres of water

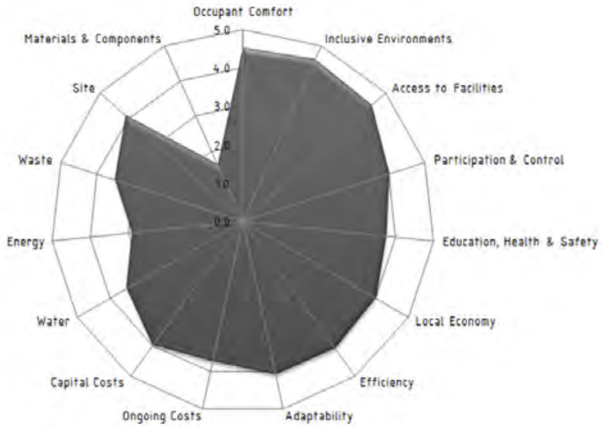
rainwater usage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Rainwater Harvested (l)	80000	48472	49856	31008	7904	4256	1824	3648	13376	43168	59584	66880	409976
Water from municipality (l)	0	28656	27272	46120	69224	72872	75304	73480	63752	33960	17544	10248	518432
Water Usage (l)	77128	77128	77128	77128	77128	77128	77128	77128	77128	77128	77128	77128	925536

409976 / 925536 = 44% saving on potable municipal water

6.5.2_Sustainable Building Assessment Tool (SBAT)

The SBAT system was developed by Jeremy Gibberd from the CSIR and acts as a tool to rate a buildings sustainability.

The specific project received an average rating of 3.8/5 and is classified as good. The materials that were used to construct the new part of the building has a high embodied energy, but according to the concept of the building and the aim to use contrasting materials in the new design, the use of these materials is necessary.



SOCIAL	4.3	OVERALL	3.8
ECONOMIC	4.0	CLASSIFICATION:	GOOD
ENVIRONMENTAL	3.1		

Fig 6.14 Results from SBAT rating