technical investigation

technical realization of design

In the creation of experience, materials and their application plays a very important role. Every level has to be approached differently in terms of the sensory experience of the space. The lift, the structure and the cladding onto that is the most permanent elements of the intervention, with the infill of the spaces being semi permanent.

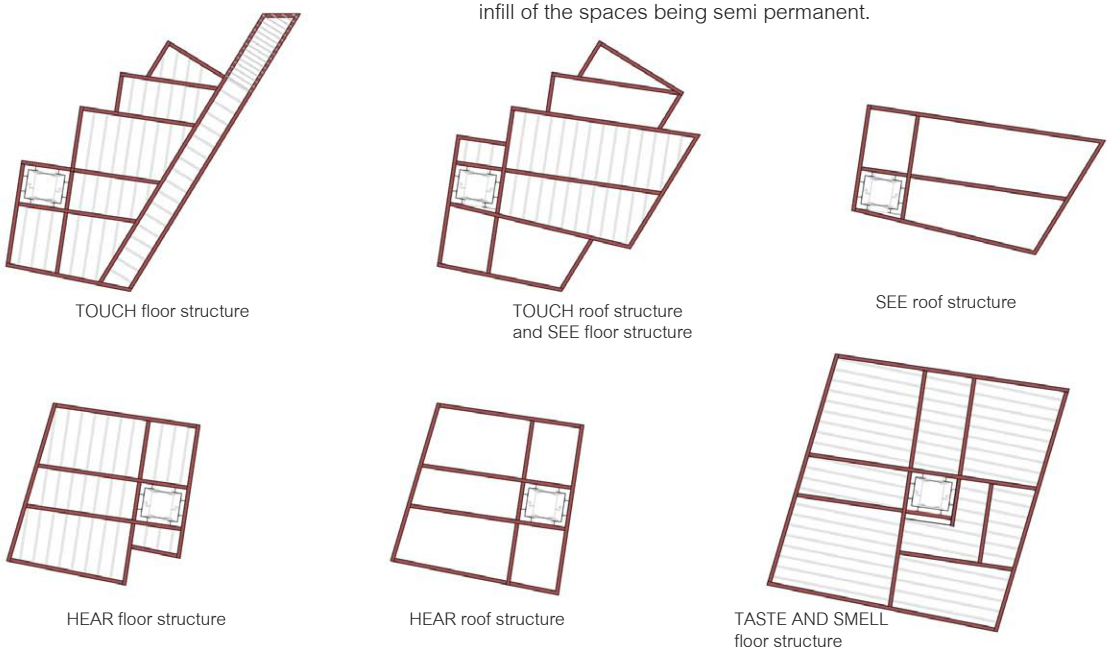


Figure 8.1: Diagram showing floor and roof structures for all levels

8.1

8.1 Structure

The structure of the intervention is cantilevered from the core structure. 457x191x 67 kg/m steel I-beams forms the primary structure, with 127x76x13 kg/m steel I-beams as secondary structure and support for the floor.

The Schindler 5400 motor-room-less lift, two sided entrance, forms the core of the structure. The shaft is formed by 254x254x16 kg/m I-columns that support the lift as well as the cantilevered structure.

8.2 Cladding

Aluminium sheet will be used for cladding of the exterior of the intervention with a standing seam fixing. Aluminium is a light weight material which is also corrosion-resistant and maintenance free. It can be recycled without any loss of properties and saves 95% of energy required to produce primary aluminium when recycled (Alu 2009).

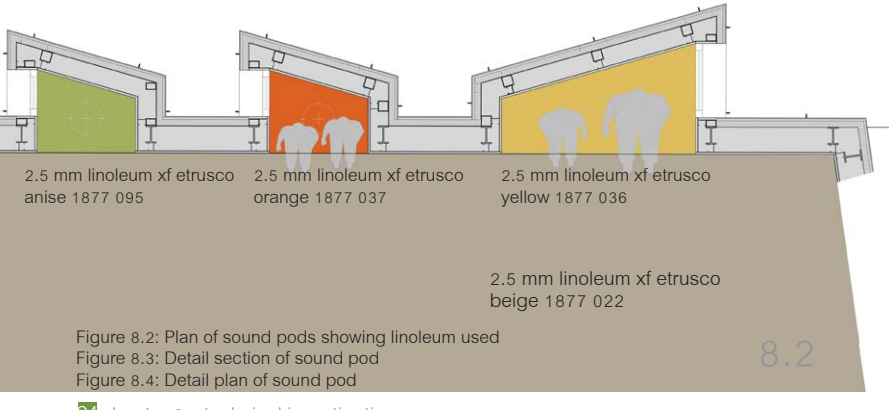
There are different possible surface finishes available. To keep reflectivity of the exterior surface to a minimum, the 2 mm thick sheets will be anodized. A variety of colours are available, of which grey is the most suitable.

8.3 Floor finishes

Linoleum was chosen as floor finish for most of the areas, because of its durability, flexibility, low maintenance and sound absorption properties. For the Touch level, a combination of Tarkett linoleum xf Etrusco Beige and Qaurtz Carpet Slate will be used because of its texture. Etrusco has a thickness of 2.5 mm (Tarkett [sa]) and the Qaurtz Carpet is 6 mm thick (Bezuidenhout 2010). The Etrusco will have to be installed on an underlayer of 3.5 mm.

On the stairs to Level 1 - Hear, Etrusco Beige will continue, but with a 2 mm Elafono underlayer, to create an environment in which most sounds are absorbed. The Elafono underlayer reduces sound by 14 dB (Tarkett [sa]). The total thickness will be 4.5 mm. The other materials in this area should contribute to the sound absorption.

The Etrusco Beige and Elafono underlayer will continue into Level 1 - Hear, except for the sound reflective space, where steel flooring will ensure loud sounds from footsteps of the users. The other materials in this area should contribute to the sound reflection.



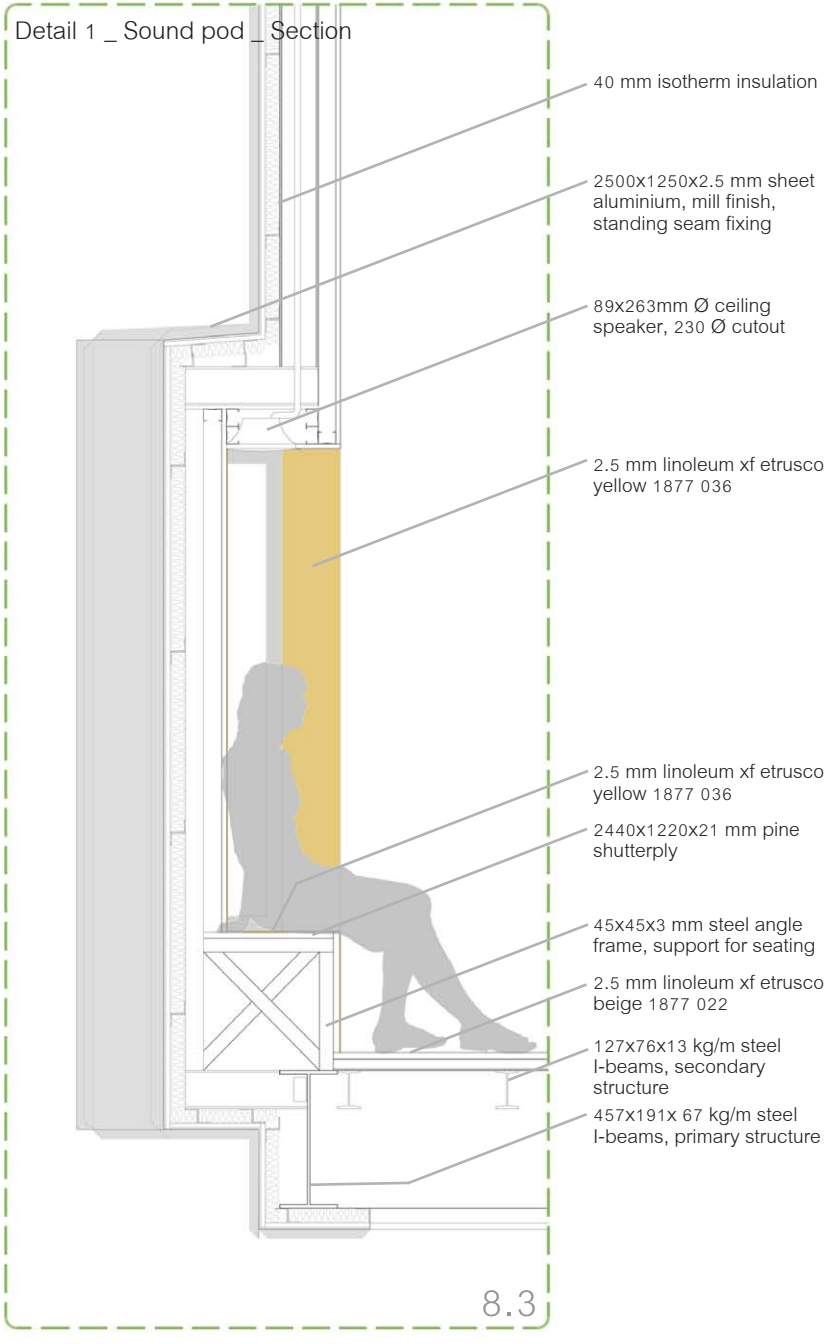
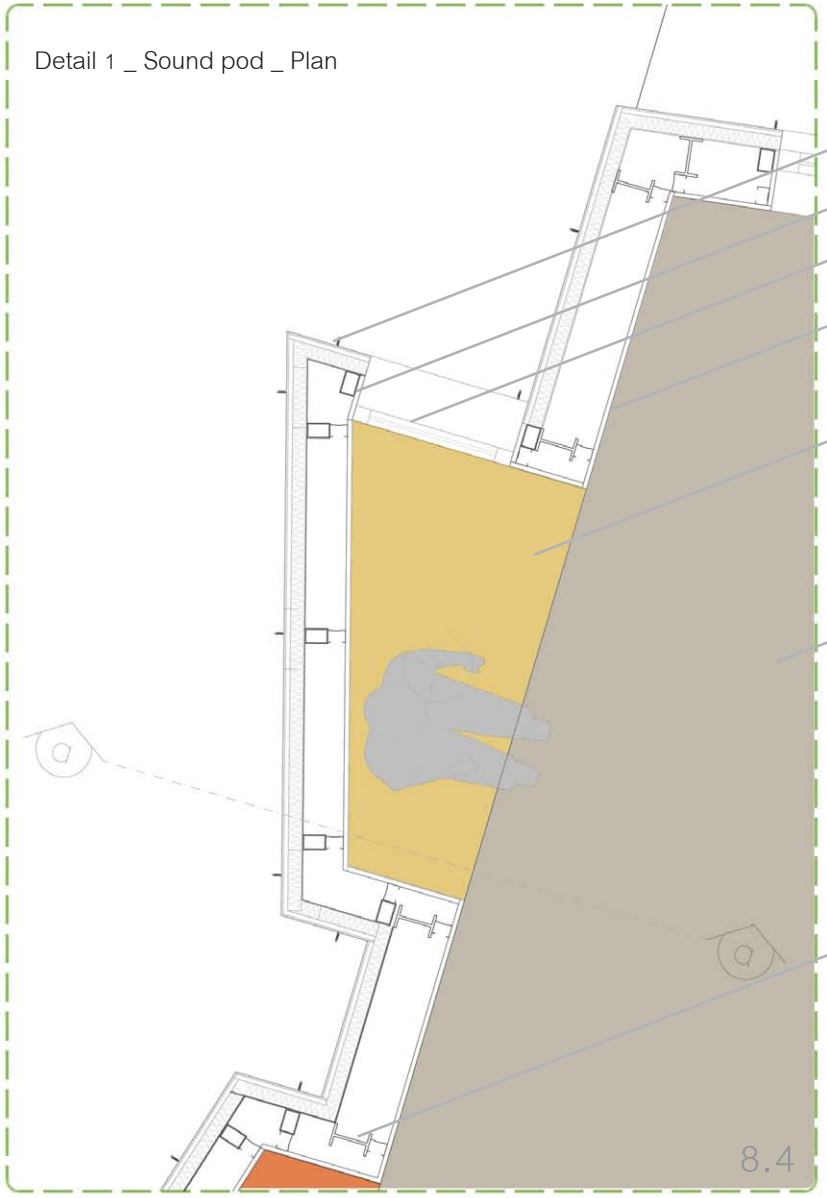


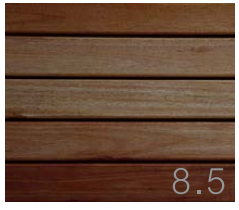
Figure 8.2: Plan of sound pods showing linoleum used
Figure 8.3: Detail section of sound pod
Figure 8.4: Detail plan of sound pod

The sound pods on the Level 1 - Hear, will be finished with linoleum as well (figure 8.2 and 8.3). Each pod will have a different colour. Although this will create a visual stimulation in the user, which is not the primary goal of this level, it will serve as attraction to the pods, where the exhibition is purely sound based.

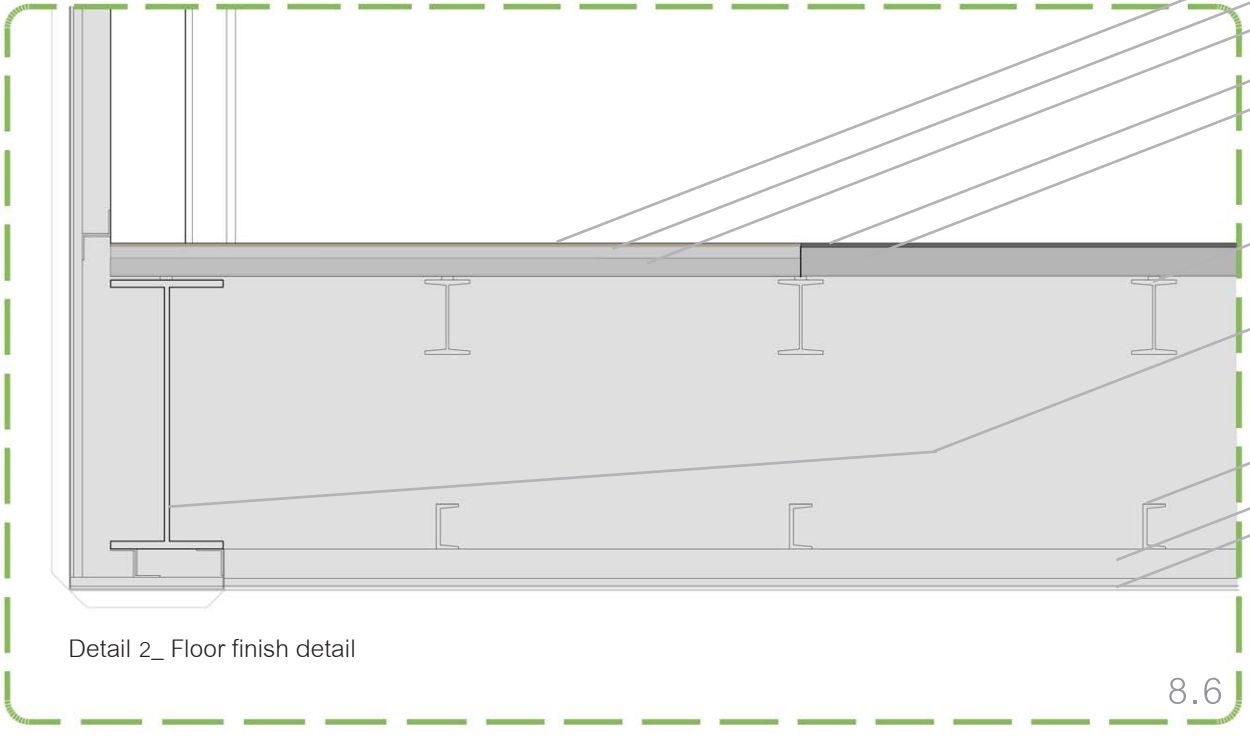


On the lowest level, Taste and Smell, Saligna solid wood flooring is specified (figure 8.5). It is suitable for exterior use, grown in south Africa, relatively cheap and contributes to the natural feeling of the level. The wood will be sealed with Woodoc Deck sealer which offers wind, water and pollution protection while nourishing the wood (Woodoc 2010).

Resolving the transition between the different floor finishes becomes important, because of the different thicknesses and danger it might hold if not finished off flush (figure 8.6). Different elements will be used to ensure that floor finishes line up.


8.5


8.7



Detail 2_ Floor finish detail

8.6

Figure 8.5: Saligna solid wood decking
Figure 8.6: Detail section through floor
Figure 8.7: Aluminium plate and Linouleum xf Etrusco Beige

8.4 Materials

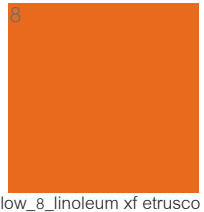
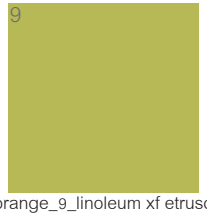

1_aluminium diamond plate_


2_wild fig leaves_


3_water mist_


4_linoleum xf etrusco beige_5_etrusco metal welding rods_
5_quartz carpet slate_





6_linoleum xf etrusco beige_7_linoleum xf etrusco yellow_8_linoleum xf etrusco orange_9_linoleum xf etrusco anise_


10_light and shade_


11_recessed fluorescent light fitting_


12_track lighting_


13_linoleum xf etrusco beige_


14_view onto building across from vault structure_


15_vertical garden_


16_saligna solid wood flooring_

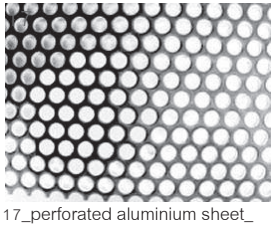

17_perforated aluminium sheet_

Figure 8.8: Materials according to level

8.5 Lighting

The quality, intensity and type of light play an important role in exhibition design. Light, as discussed in previous chapters, plays an important role in experience as well.

On Level 2 - See, a progression of light will be experienced as the light change from artificial to natural. To enhance the experience of progression and make the user aware of the changes in lighting condition, the extremes will be applied.

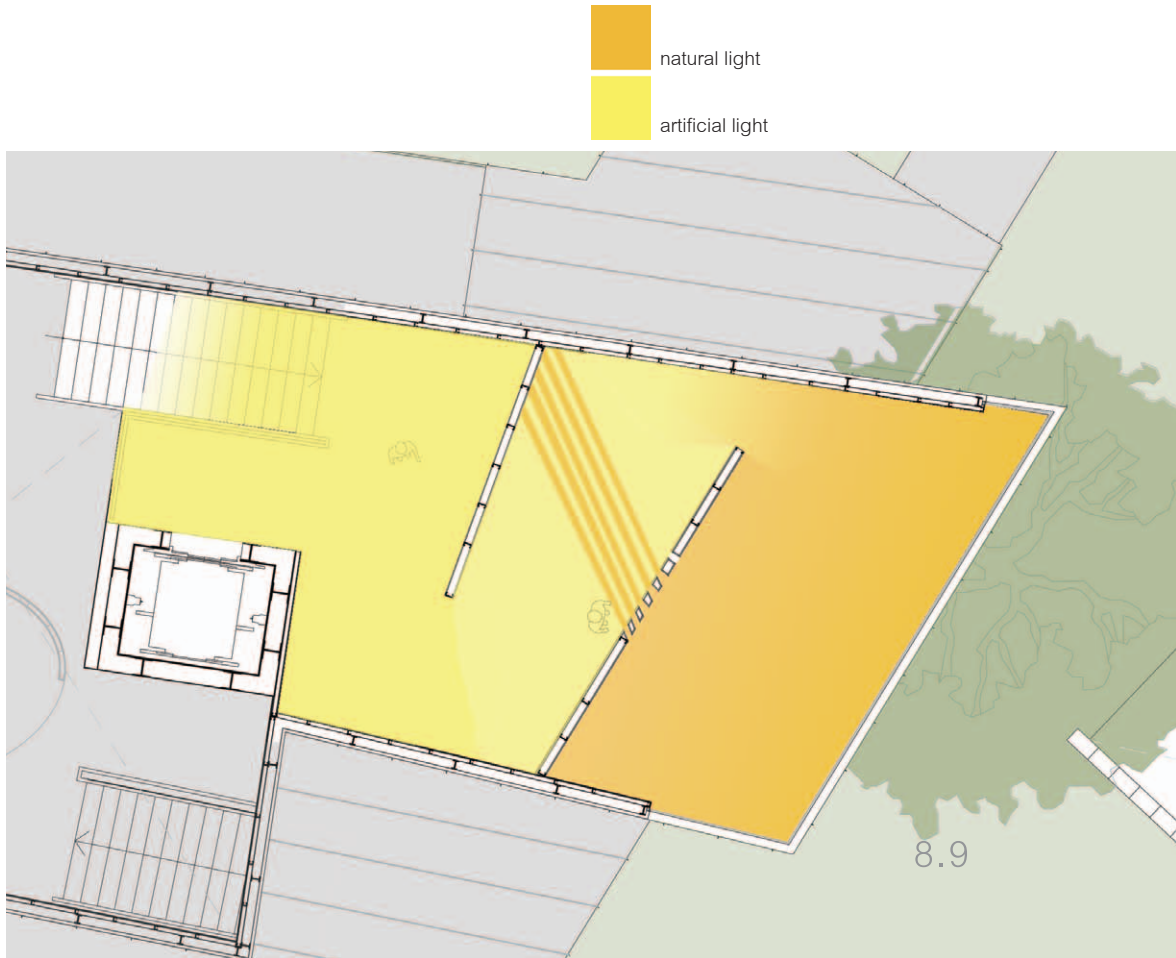
In the first space, when coming up with the stairs, a small hole in the wall will give the user a glimpse of the view throught the window at the end of the level, as he comes up the stairs. Except for that opening, the whole space will be flooded with artificial light.

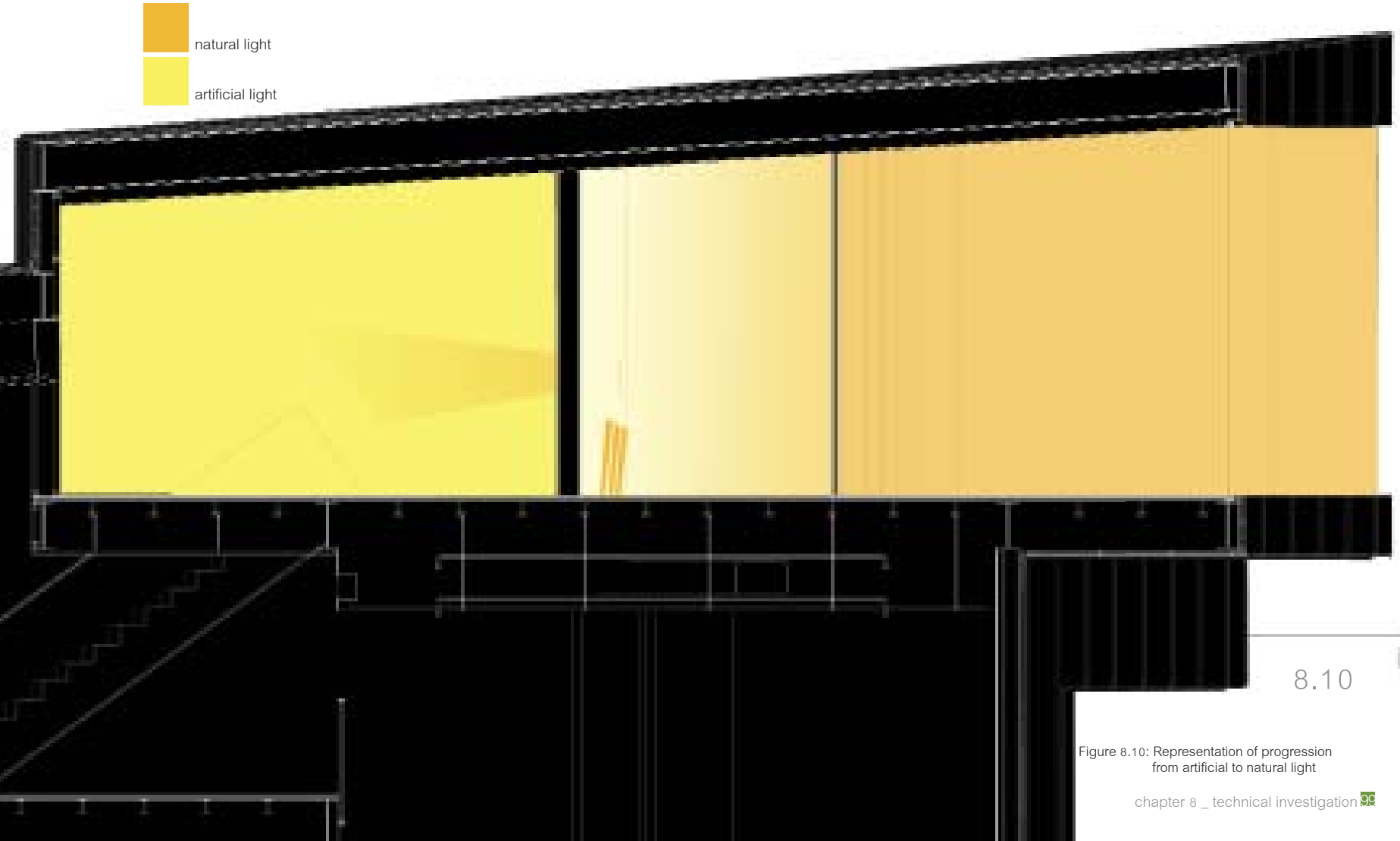
Sunlight has a colour temperature of 3000 K. To exaggerate the contrast between sunlight and artificial light, cool white fluorescent lights of 6500 K will be used (Osram [sa]). Spazio Duplo recessed light fittings will accommodate 20 S-Type T12 Tubular, G13 base lamps in total. Ten double luminaires will account for a total of 1020 lux (see appendix for details). This is higher than the recommended 500 lux for exhibition spaces as well as the 750 lux for supermarkets, workshops and kitchens for example (Architects' Data [sa]).

According to The Engineering Toolbox the lux level of direct sunlight is 107 527, while that of full daylight is 10 752 lux. This means that the contrast between the artificial light in the first space and the natural light in the third space will be approximately 9700 lux. Although this is still a very big difference, the lux levels of the artificial lights should be enough to make the user specifically aware of the lighting, because of the colour rendering as well as the contrast with the other interior spaces.

Lighting in this space does not only assist in showing the exhibition, but becomes exhibition. The lamps will be dimmable to accommodate the possibility that, in the future, the space might be used at night. This will prevent a contrast from 1020 lux to darkness which might be a bit extreme.

Figure 8.9: Representation of light progression on Level 2 - See





8.10

Figure 8.10: Representation of progression from artificial to natural light

In the space that follows on the first, natural light starts seeping through openings in the wall that separates the user from the window (figure 8.9). Here, a lamp type with a warmer colour temperature should be used and lower lux levels are required.

Spazio Profi track Control Spotlight 6713/00 will accommodate six Decostar 51 cool blue 50 W halogen lamps (Osram [sa]). These lamps have a colour temperature of 4500 K, which falls between the 6500 K fluorescents and 3000 K sunlight. In combination with the halogen lamps, which is specifically for illumination of the exhibition, two Osram Dulux D 18W/840 G24D-2 FS1 compact fluorescent, 18 W luminaires will assist in the general lighting (see appendix for details).

The window in the next space provides sufficient natural light so that no artificial light is necessary. The weather outside determines the quality of light coming into the space, which in turn determines the experience within the space. If the space is used at night in future, the artificial light from the spaces prior to this one, will enter through the openings in the wall, which will create the inverse of the experience in the day. The light in this space will probably not be enough to illuminate exhibition on the walls, but the exhibition of the surroundings becomes more pronounced.

8.5. Split unit air conditioning

Split unit air conditioning was chosen as system after a discussion with Mr. Pieter Joubert, a Mechanical Engineer (Joubert 2010). Evaporative cooling was suggested, but according to Mr. Joubert, this option is not viable in the Pretoria climate and the main cooling unit and outlets would have to be larger than what can be accommodated.

Casette type outlets will be used in the interior spaces with the main unit on ground level against the main building. An advantage of using this system is that no ducting is required. It makes use of a 50 mm diameter connecting cable to connect the main unit with the outlet units. This cable will run underground from the main unit to the core structure of the intervention, from where it will go up to the different outlets.

8.11

Figure 8.11: Casette type outlet

Detail 3_Stair detail _ Section

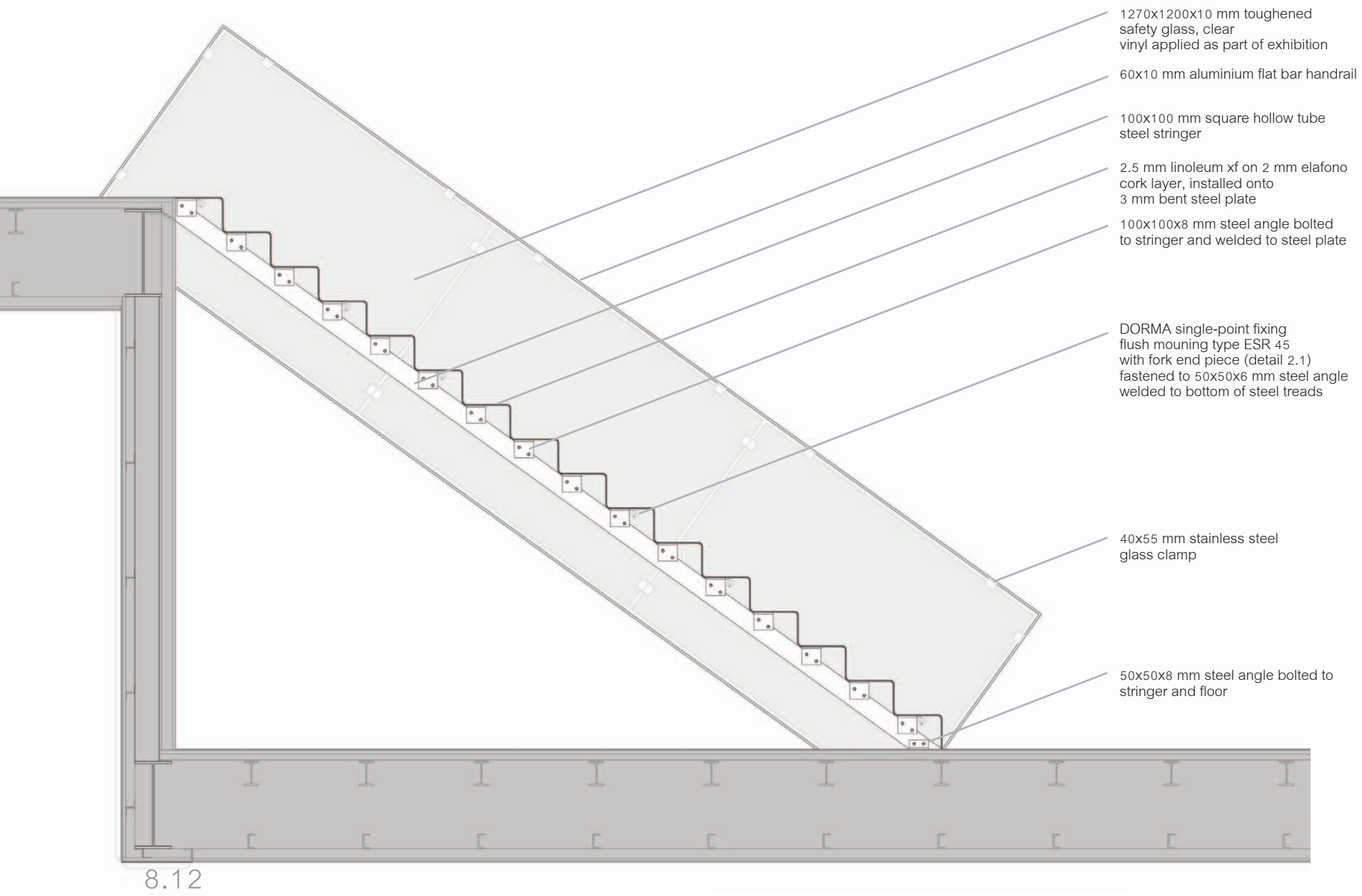
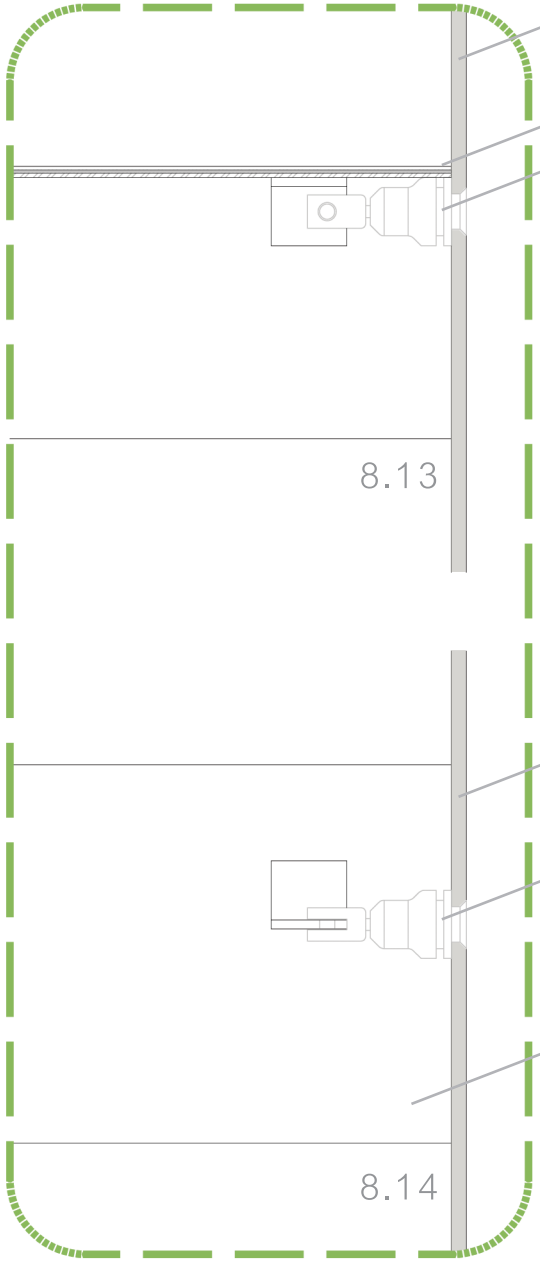


Figure 8.12: Stair detail

Detail 3.1_Fixing of glass balustrade to tread
_Scale 1:10



1270x1200x10 mm toughened
safety glass, clear, countersunk bore for flush
mounting
vinyl applied as part of exhibition

stair tread

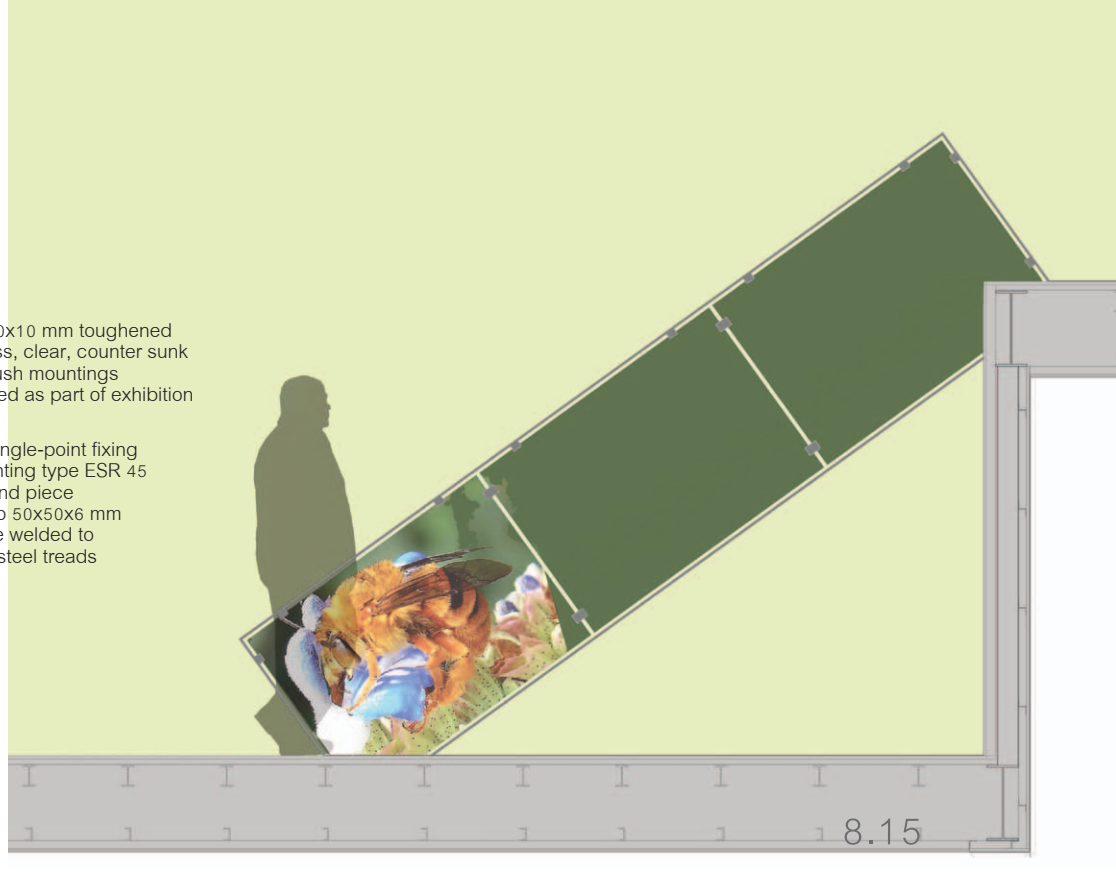
DORMA single-point fixing
flush mounting type ESR 45
with fork end piece
fastened to 50x50x6 mm steel angle
welded to bottom of steel treads

1270x1200x10 mm toughened
safety glass, clear, counter sunk
bore for flush mountings
vinyl applied as part of exhibition

DORMA single-point fixing
flush mounting type ESR 45
with fork end piece
fastened to 50x50x6 mm
steel angle welded to
bottom of steel treads

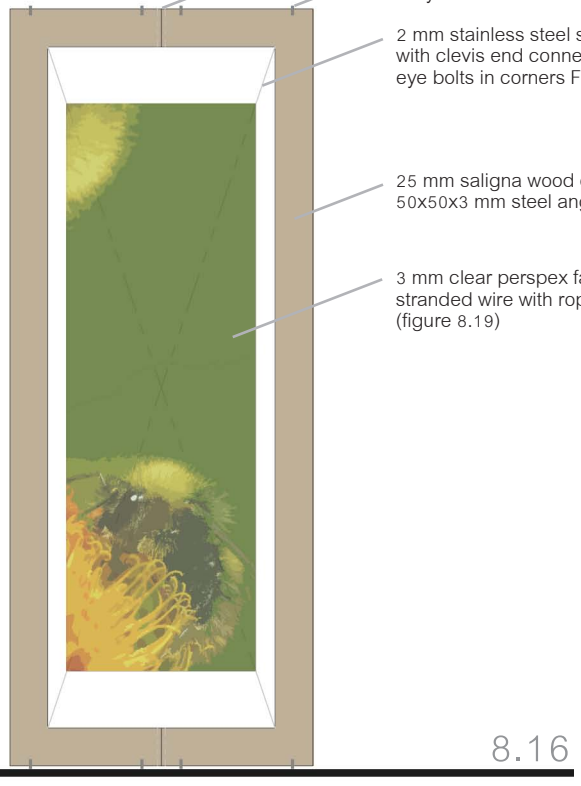
stair tread

Figure 8.13: Front view of DORMA fixing detail
Figure 8.14: Bottom view of DORMA fixing detail
Figure 8.15: Illustration of printed vinyl stuck on balustrade glass

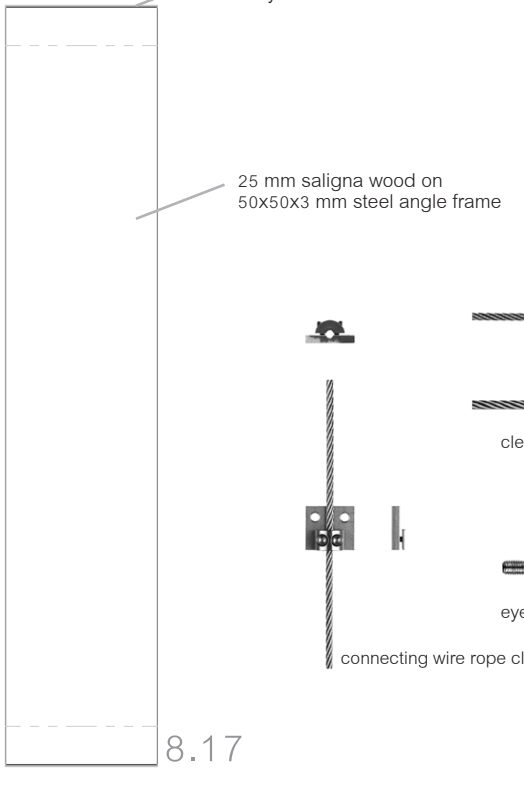


Detail 4_Seating and exhibition

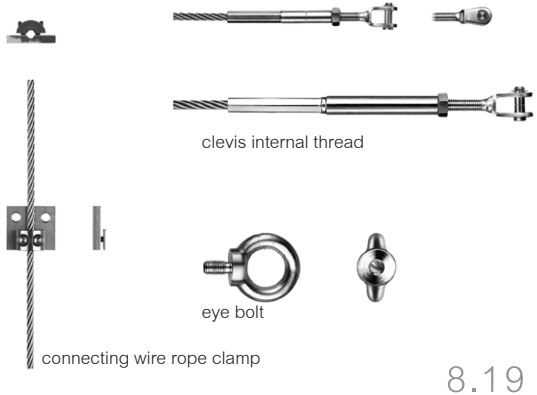
_Scale 1:20



8.16

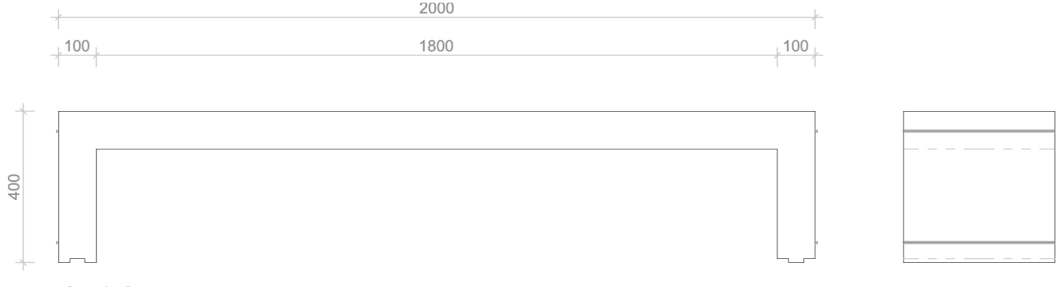


8.17



8.19

The seats provide seating on Level -1 - Taste and Smell and ground level, as well as exhibition surface by lifting two seats on their sides with the male and female ends of the opposite seats together. Stranded wire from corner to corner, keeps the seats together and provide opportunity for exhibition surface to attach.



8.18

Figure 8.16: Detail of seating becoming exhibition
Figure 8.17: Plan of seat
Figure 8.18: Elevations of seat
Figure 8.19: Stranded wire fittings

Conclusion

Experience of interior architecture depends on a number of factors. These factors or elements cannot always be controlled or predicted. The subconscious mind contributes a great deal to experience, and should be taken into consideration. Through a phenomenological approach, the space is experienced not only in terms of the visual sense, but through touch, sound, taste and smell as well. Through stimulating the senses of the user and encouraging interaction, the elements in space become worth more than only their aesthetic or practical value. It's not only a means to a functional end, but a means to an experience.

The ideas and expectations that inspired this project were altered and developed into the final design. Because of guidelines set by the site and programme, the project developed slightly differently to what was anticipated at the start of the thesis. Starting out with a much more expressive approach in terms of the subject of the exhibition, the intervention evolved into a more generic envelope, with opportunity for the exhibition to change annually.

The envelope, became more responsive to the existing building and surroundings, which anchors it to the site and brings the user into contact with the existing. The intervention explores human senses and creates spaces specific to certain senses which inform the exhibition that layers onto that.

The vault volume, through the intervention, can now be experienced by users of the museum. The intervention will hopefully attract more users to the museum and strengthen the identity of the museum as a whole.

The experience within any space should be an important consideration in the design process. Experience may sometimes overpower the user, but should never overpower the programme or the site.

Interior space must be felt, heard, smelled, tasted and seen. It must be experienced.

appendix

lighting study

Definitions according to Mains lighting definitions ([sa]):

Colour rendering:
A measure of the degree to which the appearance of a surface colour under a given light source compares to the same surface in sunlight. The index has a maximum value of 100.

Lamp Lumen Maintenance Factor (LLMF):
The proportion of light output of a lamp after a stated period, compared with initial lumen output.

Lamp Survival Factor (LSF):
The proportion of functioning lamps in an installation after a stated period.

Lumen (lm):
The unit of luminous flux used to describe the quantity of light emitted by a source or received by a surface.

Lux = lumens/m ^{2}

Luminaire Maintenance Factor (LMF):
The proportion of light output from a luminaire with dirt deposition after a stated period, compared with the initial light output when clean.

Maintenance Factor (MF):
The ratio of the illuminance provided by an installation at a stated period, compared to the installation when new. Calculated as a product of lamp lumen, lamp survival, luminaire and room surface maintenance factors.

Room Index (K):
Index defining the relationship between the height, length and width of a room. Used for illuminance calculations.

Room Surface Maintenance Factor (RSMF):
The proportion of illuminance provided by a lighting installation with dirt deposition on the room surfaces after a stated period, compared with the illuminance when the room was clean.

Utilaization Factor (UF):
The proportion of luminous flux emitted by a lamp (or lamps) which reaches the working plane.

Lighting calculations will be done for the areas on level 2 - See.

AREA 1: Osram S-Type T12 Tubular lamps L65 W/765 S

Technical information (Osram [sa]):

Life span: 10 000 h

Luminous flux: 4200 lm

Colour temperature: 6500 K

Colour rendering: 70

LLMF at 4000h: 0.7

LSF at 4000h: 0.99

LMF: 0.82 (Table A 2.2 in Bean 2004)

RSMF: 0.94 (Table A 2.3 in Bean 2004)

With 20 lamps:

MF = LLMFx LSF x LMF x RSMF

= 0.7 x 0.99 x 0.82 x 0.94

= 0.61

RI = W/2H (width of room/height from 850 mm height to luminaire)

= 3000/2(2240)

= 0.67

Reflectance of: Ceiling - 0.7 (white)

Walls - 0.3 (colours will differ)

Floor - 0.2 (beige)

UF = 0.3 - derived from Table A 3.2 which takes reflectances and RI into concideration (Bean 2004)

$E_{av} = n \times F_L \times UF \times MF / A_{WP}$

= 20 x 4200 x 0.3 x 0.61 / 15

= 15372 / 15

= 1024 lux

Condition	Illumination	
	(ftcd)	*(lux)*
Sunlight	10,000	107,527
Full Daylight	1,000	10,752
Overcast Day	100	1,075
Very Dark Day	10	107
Twilight	1	10.8
Deep Twilight	.1	1.08
Full Moon	.01	.108
Quarter Moon	.001	.0108
Starlight	.0001	.0011
Overcast Night	.00001	.0001

Figure a-1: Table showing lux levels of outdoor conditions (The Engineering Toolbox [sa]).

AREA 2: Osram Dulux D 18W/840 G24D-2 FS1 compact fluorescent, 18 W, 2 lamps per luminaire

Technical information (Osram [sa]):

Life span: 10 000 h

Luminous flux: 1200 lm

Colour temperature: 4000 K

Colour rendering: 80

LLMF at 4000h: 0.78

LSF at 4000h: 0.99

LMF: 0.82 (Table A 2.2 in Bean 2004)

RSMF: 0.94 (Table A 2.3 in Bean 2004)

With 12 lamps:

MF = LLMFx LSF x LMF x RSMF

= 0.78 x 0.99 x 0.82 x 0.94

= 0.6

RI = W/2H (width of room)/height from 850 mm height to luminaire)

= 3000/2(2240)

= 0.67

Reflectance of: Ceiling - 0.7 (white)

Walls - 0.3 (colours will differ)

Floor - 0.2 (beige)

UF = 0.3 - derived from Table A 3.2 which takes reflectances and RI into concideration (Bean 2004)

E_{av} = n x F_L x UF x MF / A_{WP}
= 12 x 1200 x 0.3 x 0.6 / 15
= 2592 / 15
= 170 lux

The 170 lux from the compact fluorescents in combination with the halogen spots will be sufficiant to illuminate the space for exhibition purposes and create a transition between the spaces before and after it.