8 TECHNICAL INVESTIGATION

Fig 8

The following text is supplementary to the set of drawings and motivates decisions that were made on a technical level. The more important technical aspects are revealed in this chapter with its main focus on the interior design aspects towards the project. The design interventions are not just spatially visible, but apparent in the different use of materials and construction methods.

The existing structure consists mainly of concrete with the wooden planks used during construction imprinted on the exterior walls. The two existing grids are evident from the existing plans. The first grid runs horizontal with four meters spacing between columns but the second grid runs at a 45 degree angle with various column spacing, less structured than the first grid.
The concrete soffit is removed to re-establish the interior courtyard, bringing more natural light and ventilation into the building. The existing concrete first floor to the east of the building is demolished to specific parameters to ensure structural stability; creating extravagant double volume spaces for the entrance and exhibition area.

The secondary structural elements are placed in specific areas to allow for movement through the spaces and improve the overall circulation in the building. The circulation areas are moved to the outer edges of interior spaces. Critically stated these routes could be referred to as 'outside' for most of these routes fall outside of the existing footprint of the building.

The material used for these structural elements include Mild Steel Rectangular Tubing fixed elegantly to the existing concrete structure. The infill material is site specific, enhancing the qualities required for the specific activity.

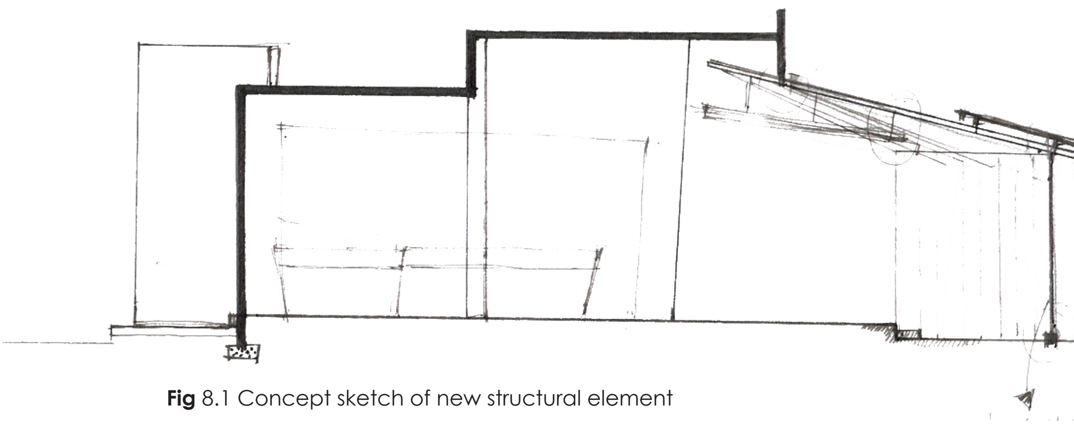


Fig 8.1 Concept sketch of new structural element

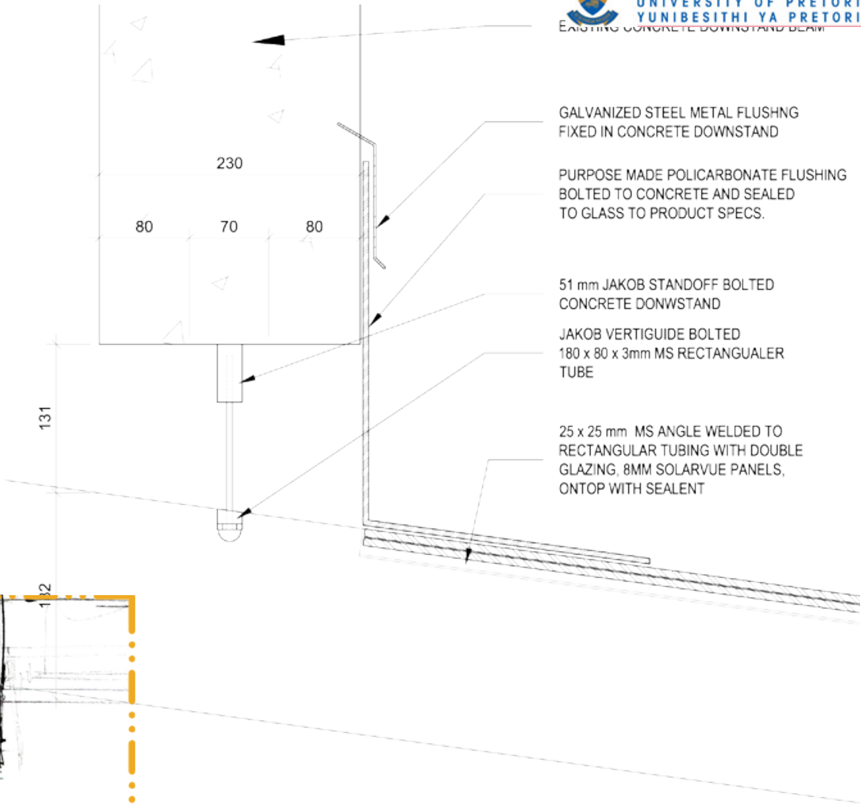


Fig 8.2 Detail for rectangular tubing connection to concrete

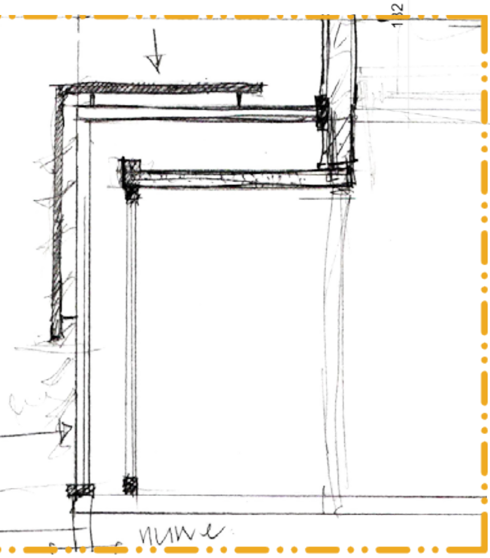
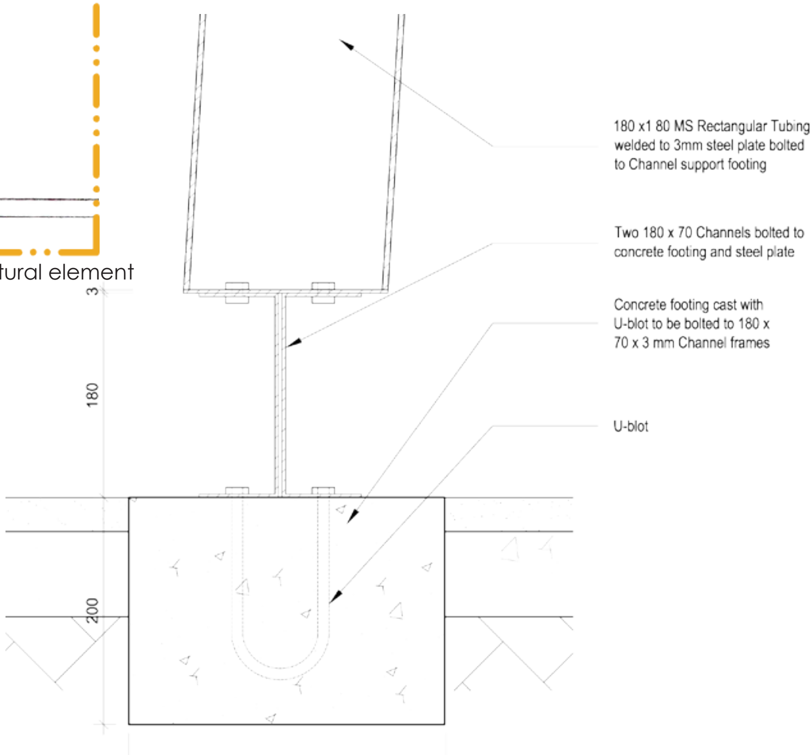


Fig 8.3 Concept sketch of new structural element



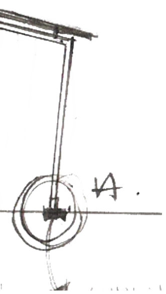


Fig 8.4 Detail for rectangular tubing fixed to ground surface

The floor covering material mainly used in the building is compact acoustic resilient flooring; the material is designed for heavy traffic commercial areas. The material caters for both acoustic comfort and indentation resistance. The screed floors must be carefully examined before installation to ensure that no damp or cracks appear on the surface. The definition of different spaces is signified by the different floor covering colours and patterns. The floor covering used in the laboratories is specialised optic compact flooring with specialised qualities that make for excellent use. The optic compact range is made of 30% recycled material, has low energy consumption and is 100% recyclable. The material has a long life span, is resistant to colour stains and is easy to clean. Carpets are placed in the consultant offices, creating an intimate and warmth space for consultants to meet with potential students.

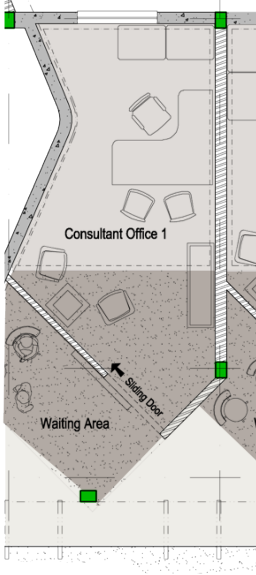


Fig 8.5 Plan indicates ceiling in exhibition area

The ceilings introduced in the exhibitions areas do not solely aspire to the technical aspect of acoustic comfort but also define the spatial boundaries to a vast open space. The ceiling void in most areas will be used to hide services for lighting and air-conditioning. All ceilings will return back to the soffit to end the corners off neatly.

The lighting dedicated for exhibitions areas will run on a track system to ensure flexibility. In general lighting to exhibition spaces will consist of low voltage halogen lamps which generate good quality lighting and colour rendering. Fluorescent lamps will be

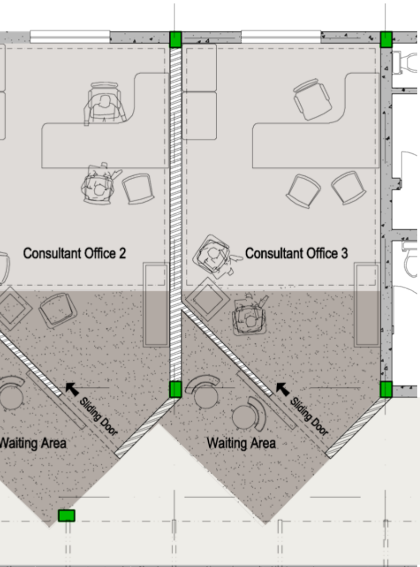


Fig 8.6 Plan indicates different floor materials

used in the laboratories, which be fixed to a metal track braced back to the soffit. The lecture room will have a combination of clustered Light-Emitting Diode (LED) which generate very little heat, have a lifespan up to 100 000 hours and produce a diffuse light. These lights will include dimmers that allow the speaker to adjust the lighting qualities.

The existing sewage services will be inspected and upgraded according to building regulations. The new WC will be connected to the existing system and a duct will be added for the facilities on the first floor.

Fire hydrant units are placed throughout the interior space to comply with the regulations of SABS 0400 Part T. The units are placed with 30 meter radius coverage from each other. The clearly indicated emergency exits are allocated in specific areas for ease of access.

The added structural elements placed in the design are constructed in an approach of steel frame structures acting as the main support frames which are then connected to the existing structural elements. The secondary material gives a spatial definition to the steel frame with the tertiary materials that reveal the qualities of the specific space. With reference to the above approach the following aspects of the design reveal the approach in more detail. The design of the entrance staircase counter is discussed in more detail to reveal the approach towards loose objects in the design, and then the design of the interactive lecture room will be dealt with to reveal a similar approach to an interior space.

STAIRCASE COUNTER

The reception counter will be a landmark for visitors to receive information and guidance to the activities on site.

Main Structure

- Mild steel channel frames fixed to existing concrete floor to support balustrade panels
- Mild steel channel frames fixed to existing concrete floor to support counter
- Hot rolled rectangular tubing to support staircase

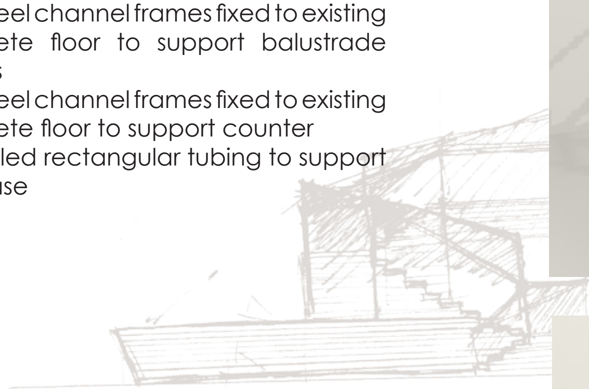


Fig 8.7 Concept sketch of staircase

Substructure

- Mild steel square tubing fixed to main structure for additional support
- Mild steel square tubing fixed to main structure to create shape of counter
- Custom-made steel tread plates bolted to rectangular tubing

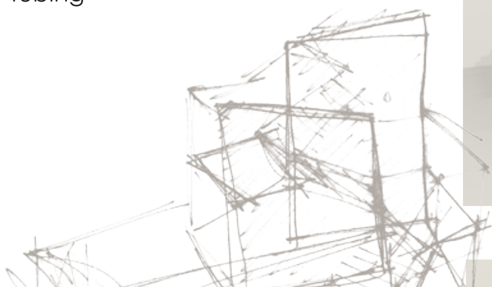


Fig 8.8 Concept sketch plane volumes

Cladding Structure

- 3Form Chroma, Cast Polymethyl Methacrylate (PMMA), resin panels are bolted to the substructure to create balustrade walls
- 3Form Chroma, Cast Polymethyl Methacrylate (PMMA), resin panels are bolted to the substructure to create counter face
- Timber panels are bolted to substructure to create counter face
- Timber treads slide into steel treads and bolted to stay in position

Fig 8.9 3D Model of main structure

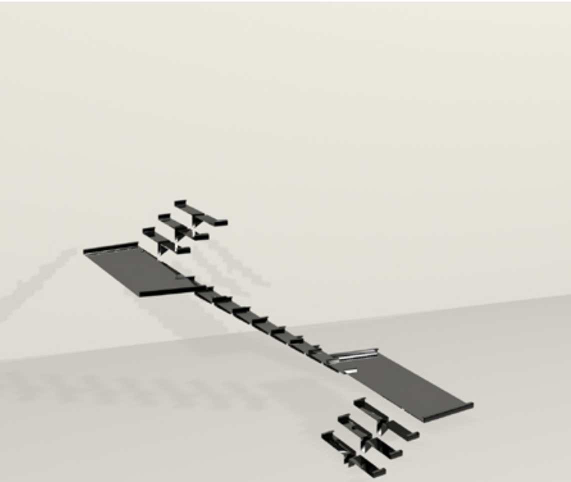


Fig 8.10 3D Model of substructure

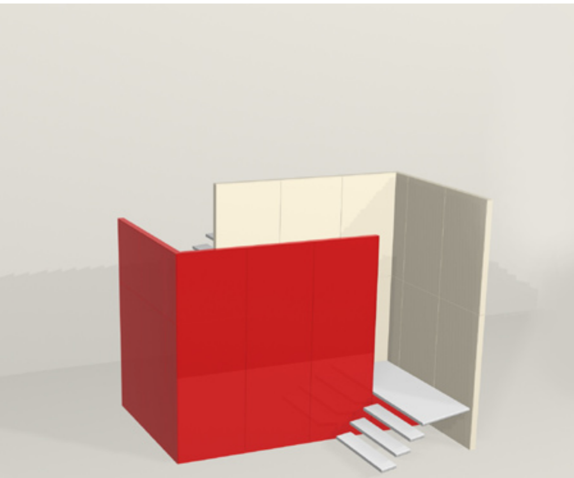


Fig 8.11 3D Model of infill materials

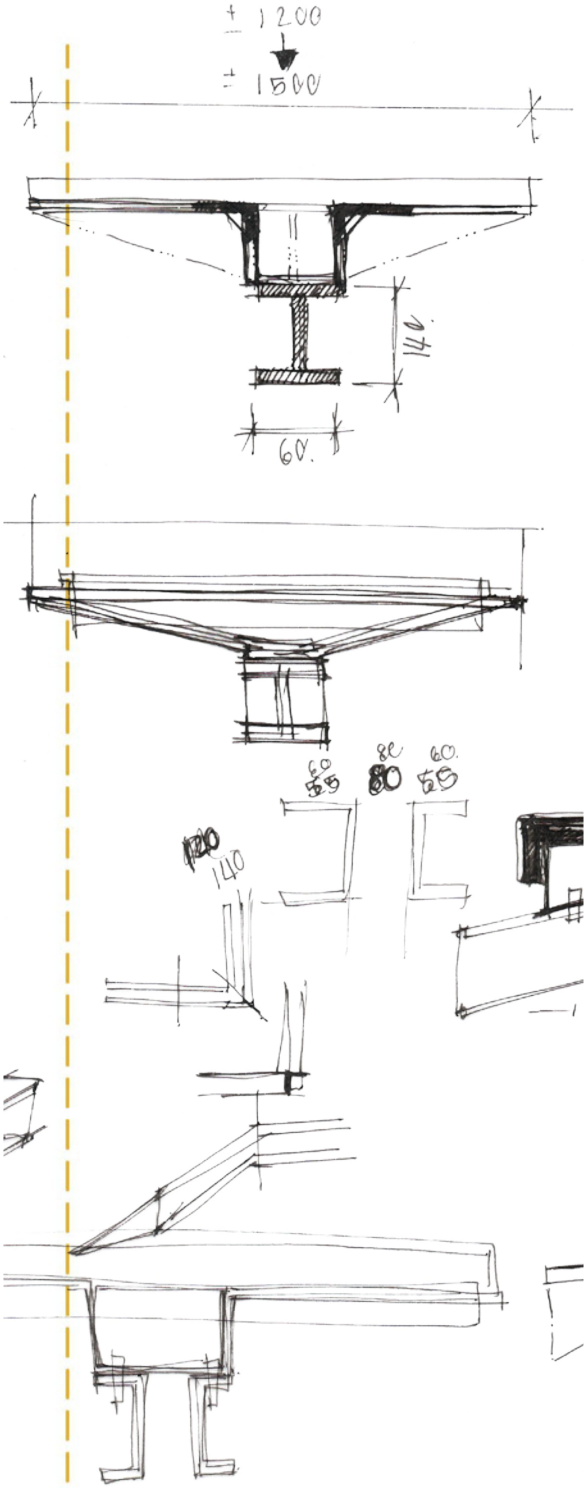


Fig 8.12 Concept sketches of tread design

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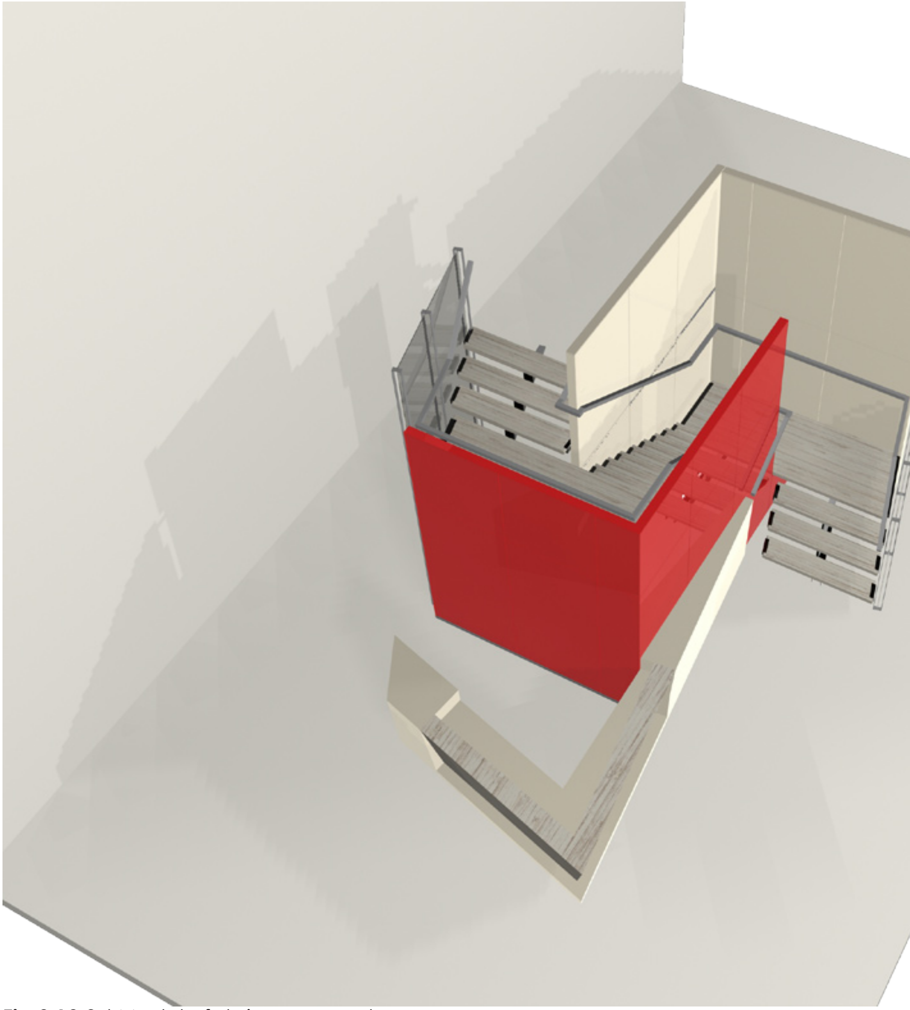

Fig 8.13 3d Model of staircase counter

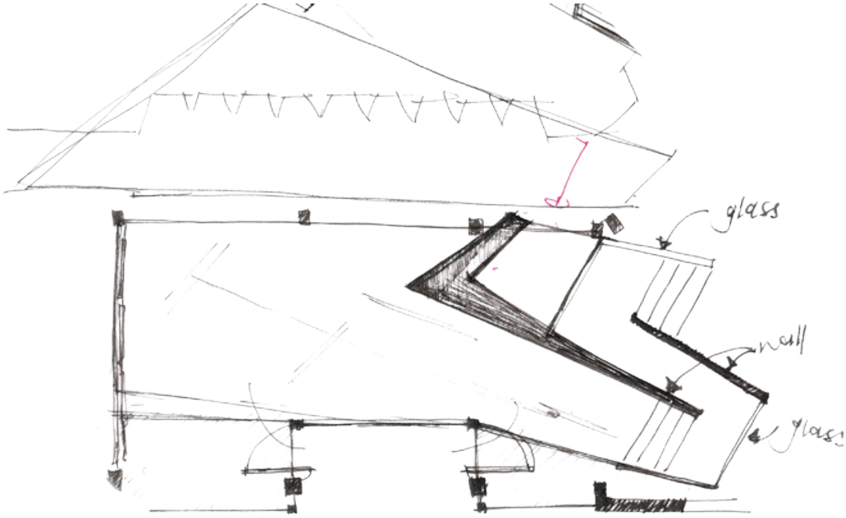

Fig 8.14 Concept sketch investigating materials and angles

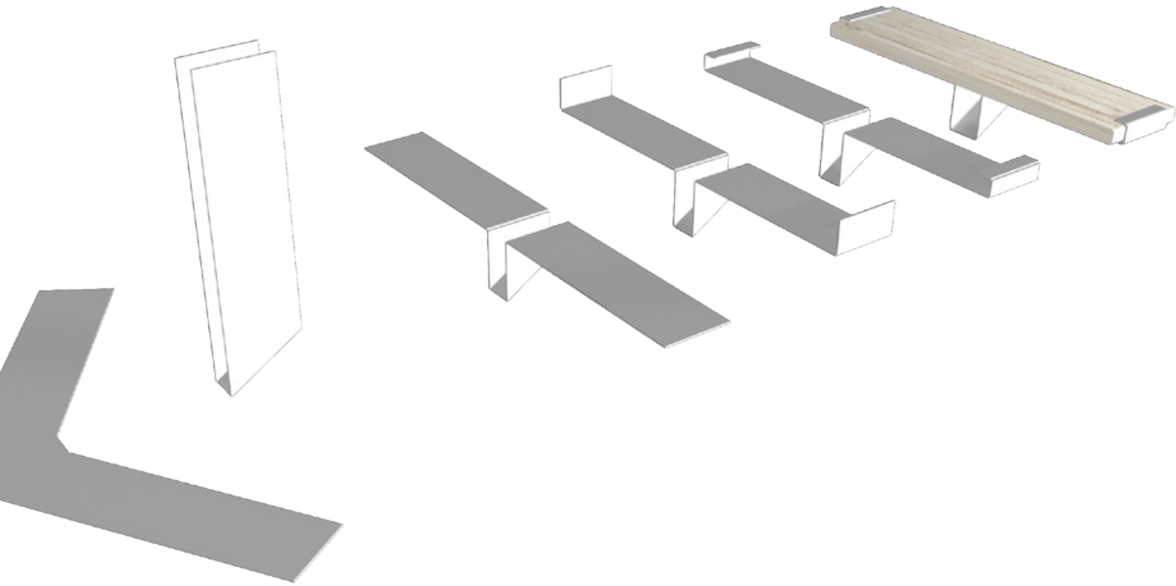

Fig 8.15 3D Model of steel tread plate bent to profile

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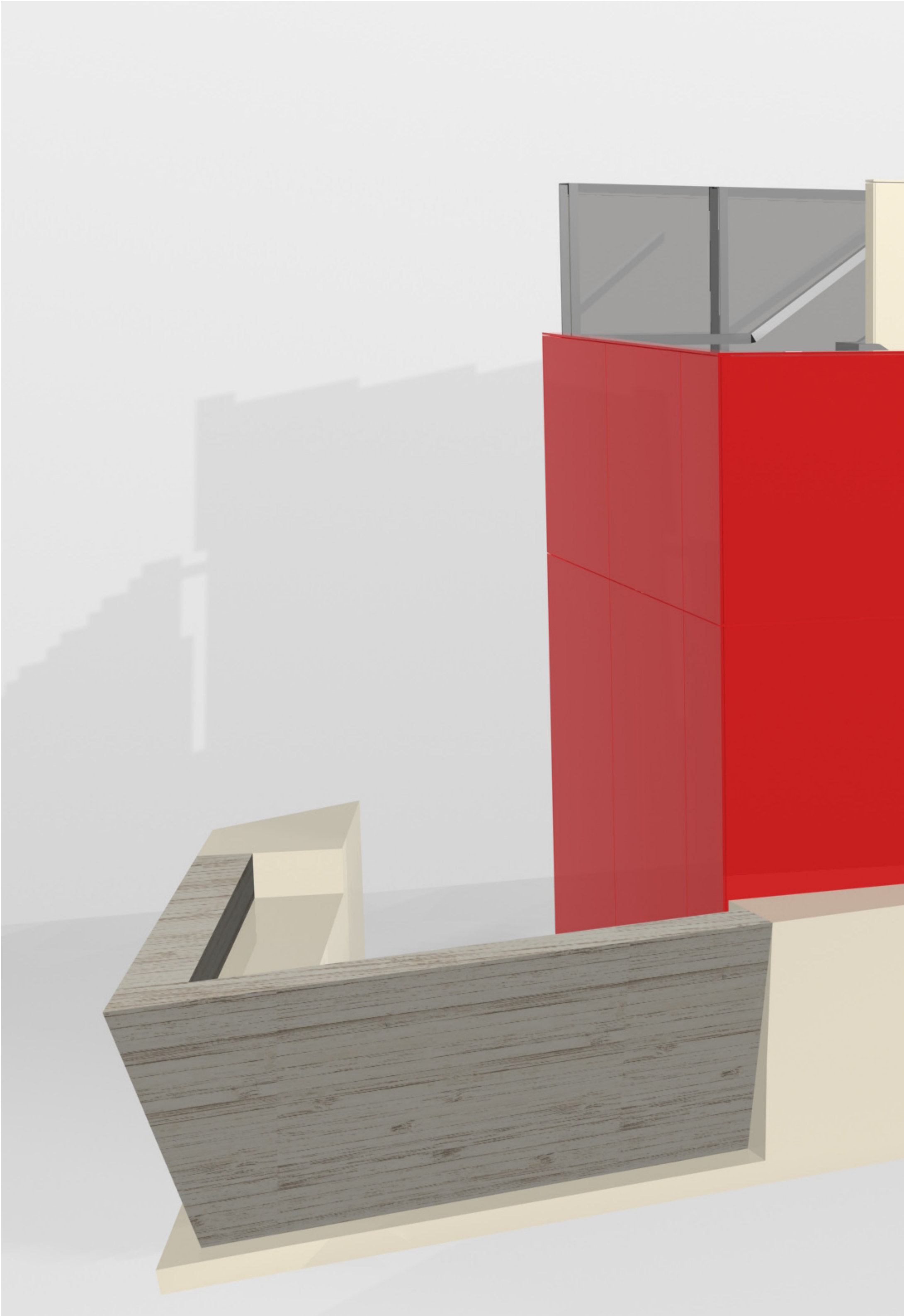
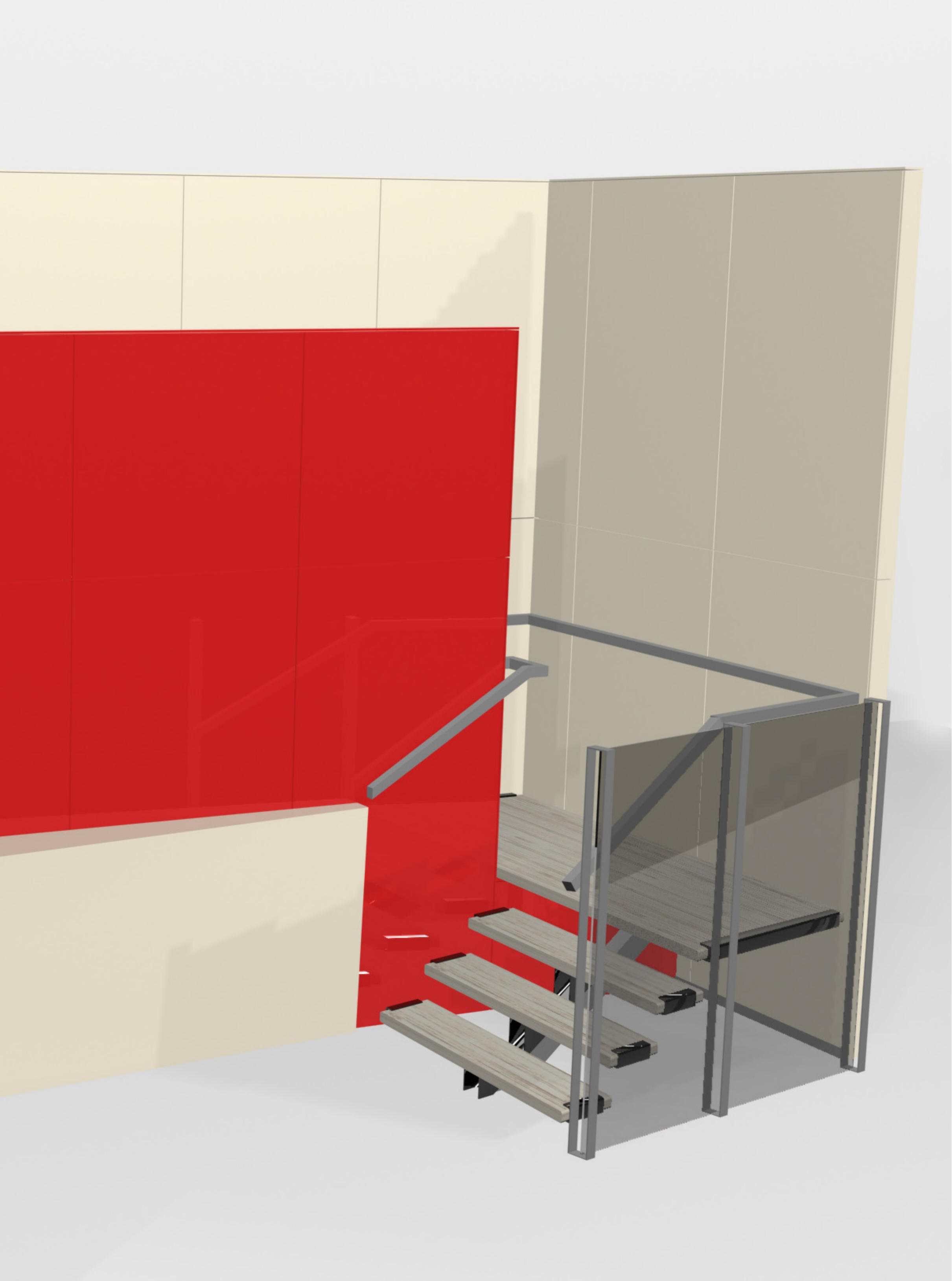


Fig 8.16 3D Model of staircase counter

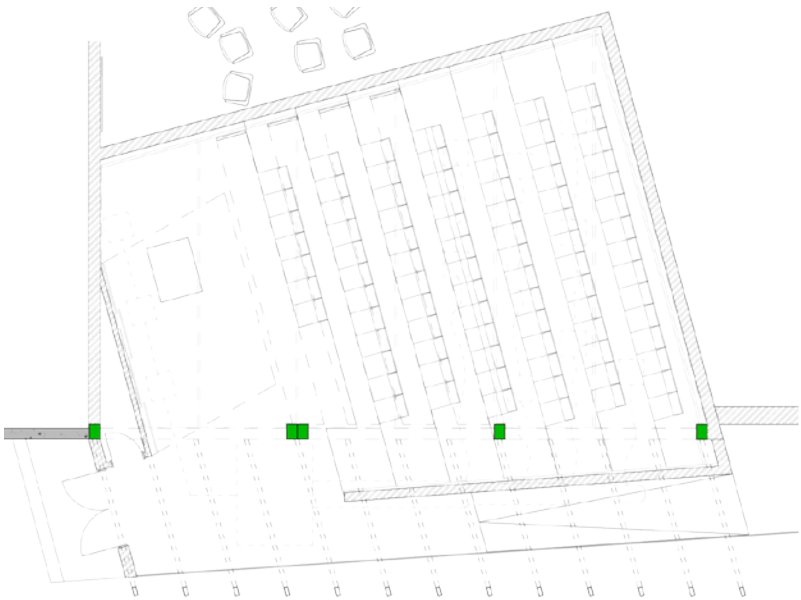


INTERACTIVE LECTURE ROOM

The Interactive Lecture Room with the objective to educate students in different areas of expertise will provide students with the opportunity to interact with lecturers.

The shape of the interactive lecture room prevents the unwanted echoes of sound waves, referred to as standing waves. Standing waves occur when sound waves are trapped between parallel walls. For that reason the room evolved to its current form with no parallel walls or floor to ceiling. The overall interior size of the room is between 1.2 and 2 times the length to the width, the parameters are ideal for auditoriums and make optimum use of the shape and space (Greeff, 2007:62).

To ensure optimum viewing the seats are placed at the correct distance from the screen; i.e. placing the front row not closer than 2 times the width of the screen and the back row between 6 or 8 times the width of the screen (Dr, Freysen, 2008). Seats that are raked to the back, limits the risk of sound shadows behind seats and ensures direct sound paths to the audience.



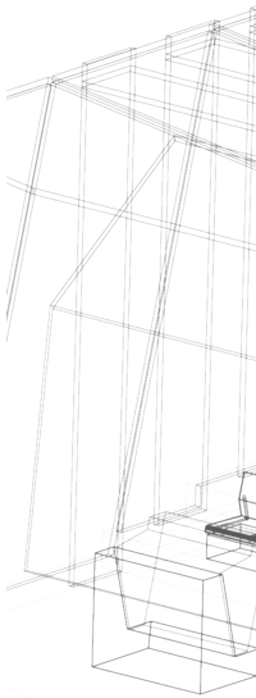


Fig 8.17 Illustration of plan for interactive lecture room

Dr, Freysen from the University of Pretoria assisted in the development of the technological equipment used for the lecture room. In a personal interview, held on 10 September 2008, Dr, Freysen revealed the problems with existing lecture rooms on campus as well as the opportunity of using new equipment researched and designed by the University.

_ The existing lecture rooms on campus are not universal according to the equipment used
_ Chalk boards are still the preferably choice of media and the use of white screens must be limited.
_ Problems occur when guest lecturers do not that have the sufficient media at hand to perform quality lecturers
_ Equipment must be fixed in position as to limit theft
_ The Smart Podium offers a universal model that can be used in all lectures
_ This will enable lecturers to work freely from one lecture room to other

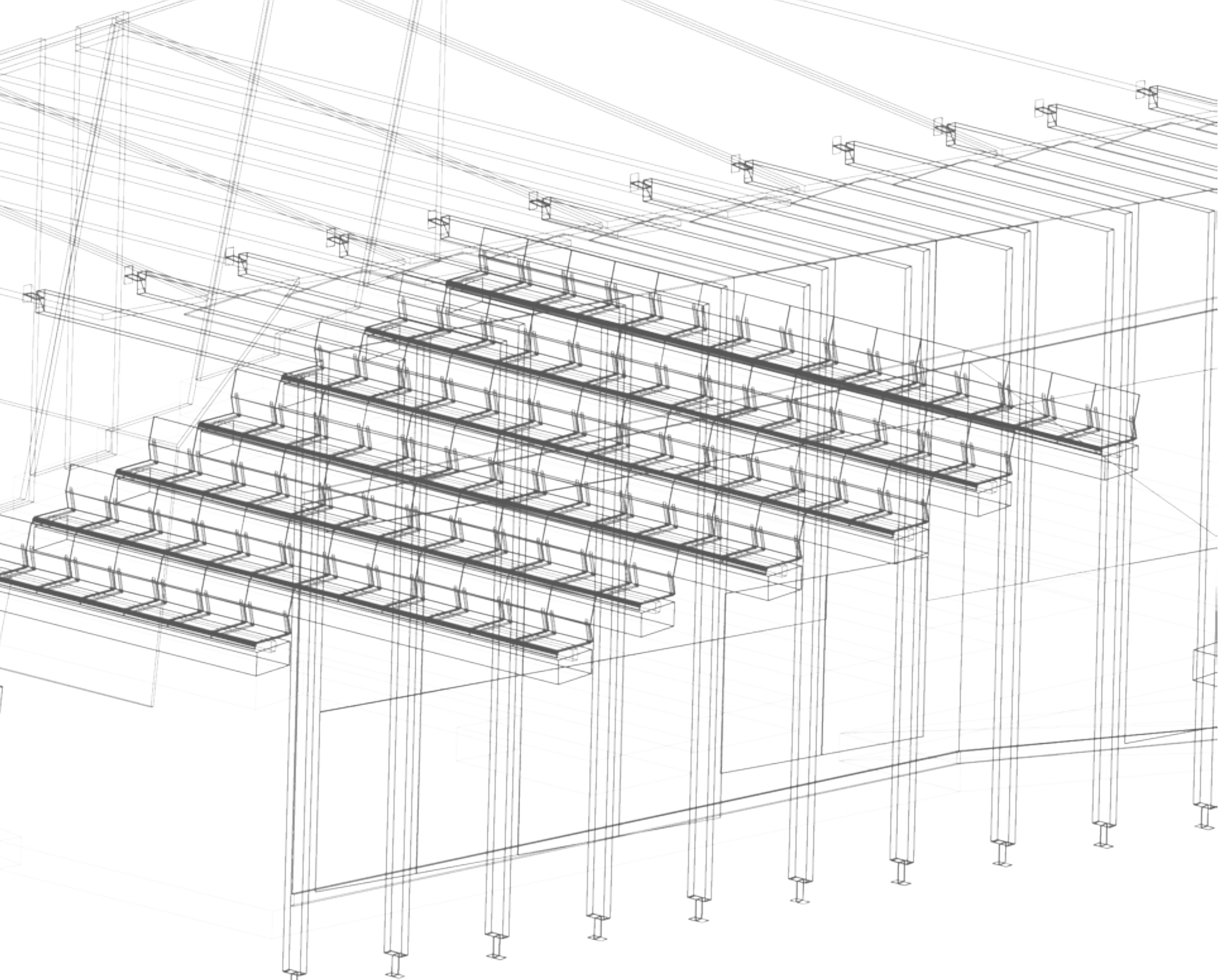


Fig 8.18 3D Model of exterior view towards interactive lecture room

_Acoustics

The acoustic quality of the room can be calculated with the reverberation time of the room, which will indicate the time it takes the sound to travel from the speaker to the audience. The preferred reverberation time for speech purposes is one second but not less than 0.25 seconds (Joubert, 2008). The calculated reverberation time is 0.4 seconds with the specified materials which is well in the specified field resulting in sufficient absorption materials.

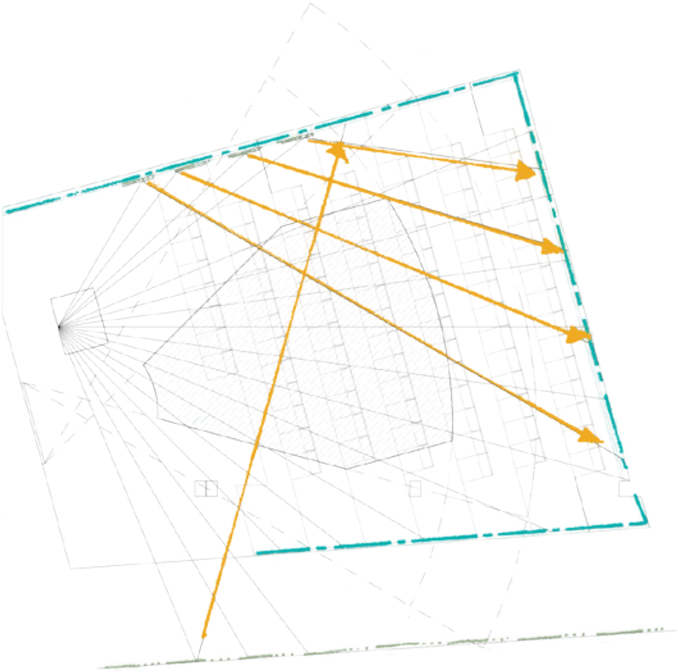


Fig 8.19 Illustration of sound reflection from wall panels

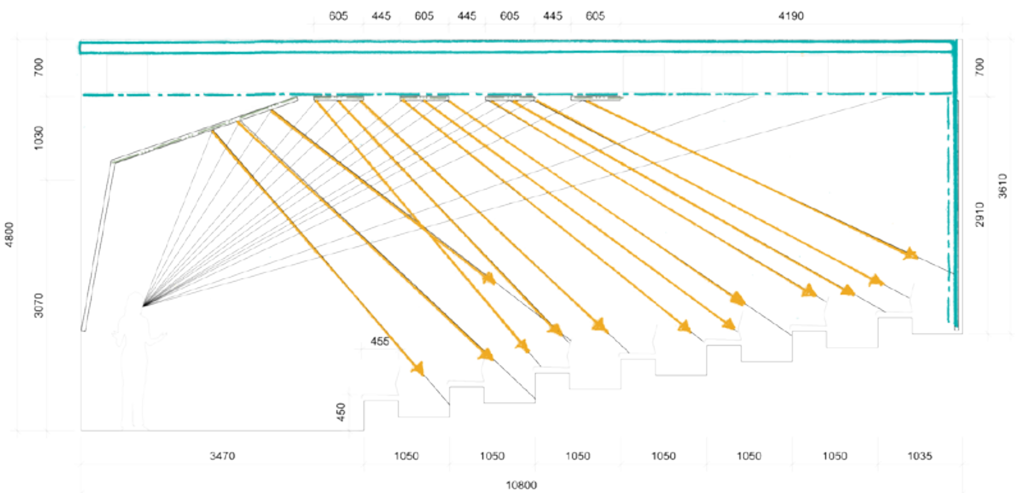
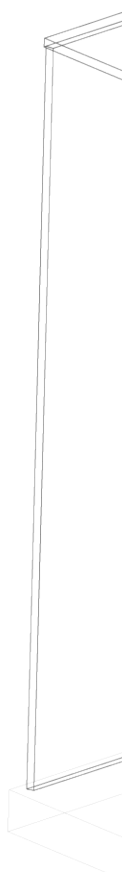


Fig 8.20 Illustration of sound reflection from ceiling panels



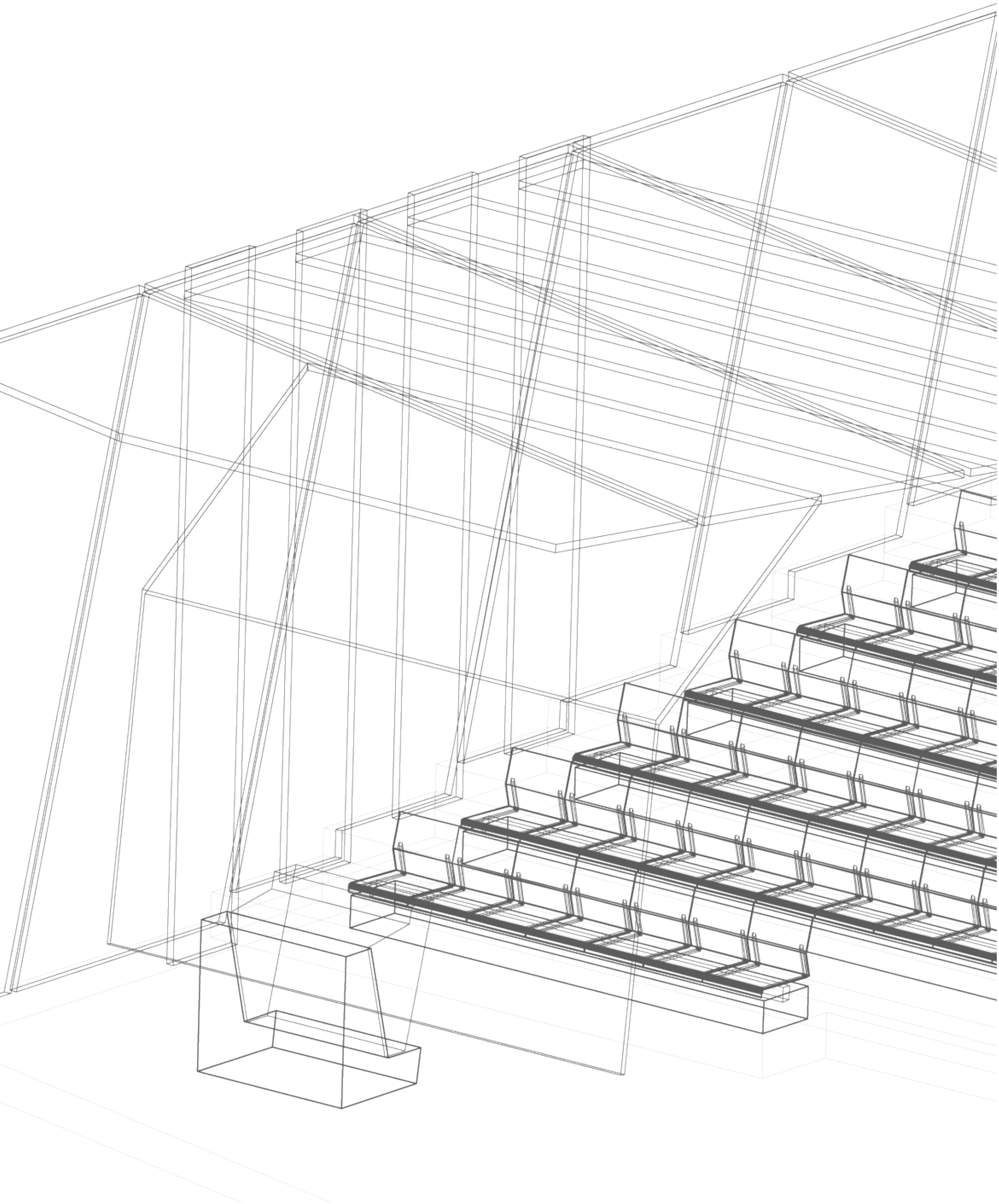


Fig 8.21 3D Model of interior view of interactive lecture room

_Ventilation

The room will be ventilated mechanically with a Rooftop Package Unit that will diffuse cold clean air to the back of the room and take the return air from behind the speaker. This will enable cold air to run over and past the audience to the front of the room behind the speaker where the now hot air will rise to the ceiling. The hot air will be returned to the unit on the outside of the room, thus creating a U-shape air flow from the back to the front. The unit will be placed to the new concrete slab on the outside of the building. The unit will be visually hidden with metal cladding fixed to the structural rectangular tubing to add sufficient access for maintenance. The flexible piping that will be used to supply cold air to the room will be specific insulated piping to ensure that the noise level be kept to a minimum level. Sufficient ceiling space is kept for the piping to be installed above the ceiling panels and this increase the noise reduction of the air-conditioner.

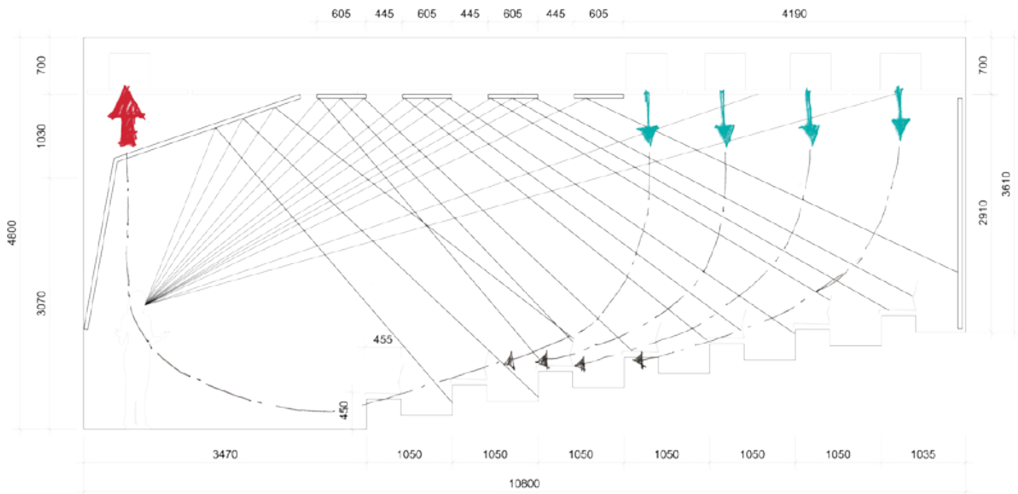


Fig 8.22 Illustration of air movement

_Materials

In the main scheme of the project materials were chosen for their aesthetic qualities as well as for functionality in creating a new improved space with specific needs.

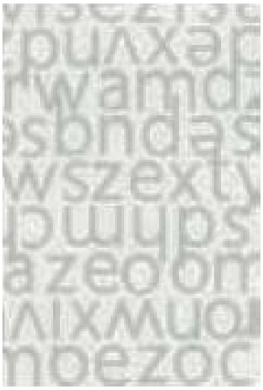


Fig 8.23 Tapiflex Optic 4

Tapiflex Optic 4, compact acoustic resilient flooring, is used for the floor covering.
This advanced material is used for heavy traffic commercial areas with an excellent balance between acoustic comfort (17db) and indentation resistance (0.10mm). The need for maintenance and cleaning is reduced due to the PUR-reinforced PVC wear layer that improves resistance to scuffing and abrasion.

Perforated Gypsumboard, Pregybel C10 n°8
The high performance system meets the needs of both noise reduction and aesthetic appearance in commercial buildings. The ceiling boards are very cost effective and ease of installation is achieved as results as to the protective glass mat which is glued to the back of the board and which prevents dust emission. The perforation rate is 13.4% with square blocks of 10 x 10mm square perforations, increasing the absorption of low frequency sound waves.

Fig 8.24 3Form Chroma

3Form Chroma, Cast Polymethyl Methacrylate (PMMA) Resin.
Colour: Smoke Grey
Texture: Renewable Matte
The material acts as the reflective panels in the room, placed in front of the Pregybel Gypsumboard on the wall and ceiling. With a durable finish and ease of installation the material enhances the qualities and aesthetic qualities of other materials used in the room. The panels are engineered to be re-coloured and resurfaced over and over, thus increasing their life span and keeping them from the waste cycle.

PFG Building Glass Smartglass, Insulvue.
Insulvue works on the principle of two panels of glass held apart by a metal spacer and bonded with a primary and secondary seal, trapping dehydrated air between the glass. Using triple glazing increases the sound absorption as well as the energy efficiency in the room.

Absorption Co-efficient

Room size: 10.87 x 7.025 x 4.1

Freuquency	Hz	250	500	1k	2k
Floor		0.04	0.05	0.05	0.07
Walls (Pregybel)		0.96	0.72	0.6	0.49
Walls (Chroma)		0.2	0.65	0.9	0.95
Ceiling (Pregybel)		0.96	0.72	0.6	0.49
Ceiling (Chroma)		0.2	0.65	0.9	0.95
Glazing		0.06	0.04	0.03	0.02
Seats Occupied 75% (per seat)		0.25	0.38	0.3	0.35
Air (per m³)		0.001	0.003	0.006	0.011

Absorptioin	m²	250	500	1k	2k
Floor	86	3.44	4.3	4.3	6.02
Walls (Pregybel)	83.4	80.064	60.048	50.04	40.866
Walls (Chroma)	9.2	1.84	5.98	8.28	8.74
Ceiling (Pregybel)	52.8	50.688	38.016	31.68	25.872
Ceiling (Chroma)	15.2	3.04	9.88	13.68	14.44
Glazing	10	0.6	0.4	0.3	0.2
Seats Occupied (people)	66	16.5	25.08	19.8	23.1
Air (per m³)	313	0.313	0.939	1.878	3.443
Total Absorption in Room (A)			144.643		

Room Total Surface (S)	256.6
Average absorption co-efficient (a)	0.56
Reverberation Time (T60)	**0.4**

Calculatioin:

$$a = \frac{A}{S}$$

$$T60 = \frac{0.161\ V}{A}$$

Fig 8.25 Table for calculation of reverberation time