9.0

TECHNOLOGY

The technical investigation is discussed under four headings namely:

Stereotomy
Techtonic - The Frame and the Skin
Systems

These four headings cover all aspects of the structural, technological and design decisions made when the repetitive module shown in Fig 8.42 was designed.

Figure - 9.1 - *Photograph of the roof in Rietvlei Abattoir depicting the amount of structure and technology housed in it (By Author).*

TECHNICAL INVESTIGATION

Stereotomy - The Slaughter Pit

The pit, as discussed in the design development chapter (8), is recessed into the ground to relate to the existing heritage, and to create a insulated condition under which the pit can stay cool without excessive mechanical cooling.

The pit is constructed from a concrete retaining structure, which is moulded to create working platforms, circulation and the canvas. The next concept was to integrate the pit into the ground. A decision was made to not tank the basement in the traditional manner, which allows no water in. The design explored manners in which the ground water can enter the building allowing the canvas plane, the bottom plane of the pit (Fig 9.4), to be in a constant active state. This resulted in the following technological decisions to be made.

Ferrule Holes

The ferrule holes in the diagonal pit wall is left open, with a root barrier and prefilter layer (Fig 9.3) the ground water is allowed to push through, run down the wall, and start to wash the blood from the pit floor. This allows the pit floor to be in constant flux, creating a ebb and flow of water and blood.

Retaining walls

On the northern edge the pit is constructed of a vertical concrete retaining wall. The wall is not tanked and employes a drained cavity with a geotextile/ rootbarrier and pre-filter layer (Fig 9.5). The entering water runs underneath the floor, through a raised precast concrete floor channel system, and into the drainage channel from where it is pumped to the water treatment plant. The drainage channel is divided in two, separating the groundwater from the contaminated water.

Drains

Drains from the processing areas are laid to fall through the service duct shown in Fig 9.3, which allows even more water to enter the pit area. The water from here will mostly consist of water used to clean the processing floors, contaminated with blood and soap.

Recycling

All the contaminated water entering the pit runs of the sloped pit floor into a drainage channel from where the contaminated water is pumped to the water treatment plant.

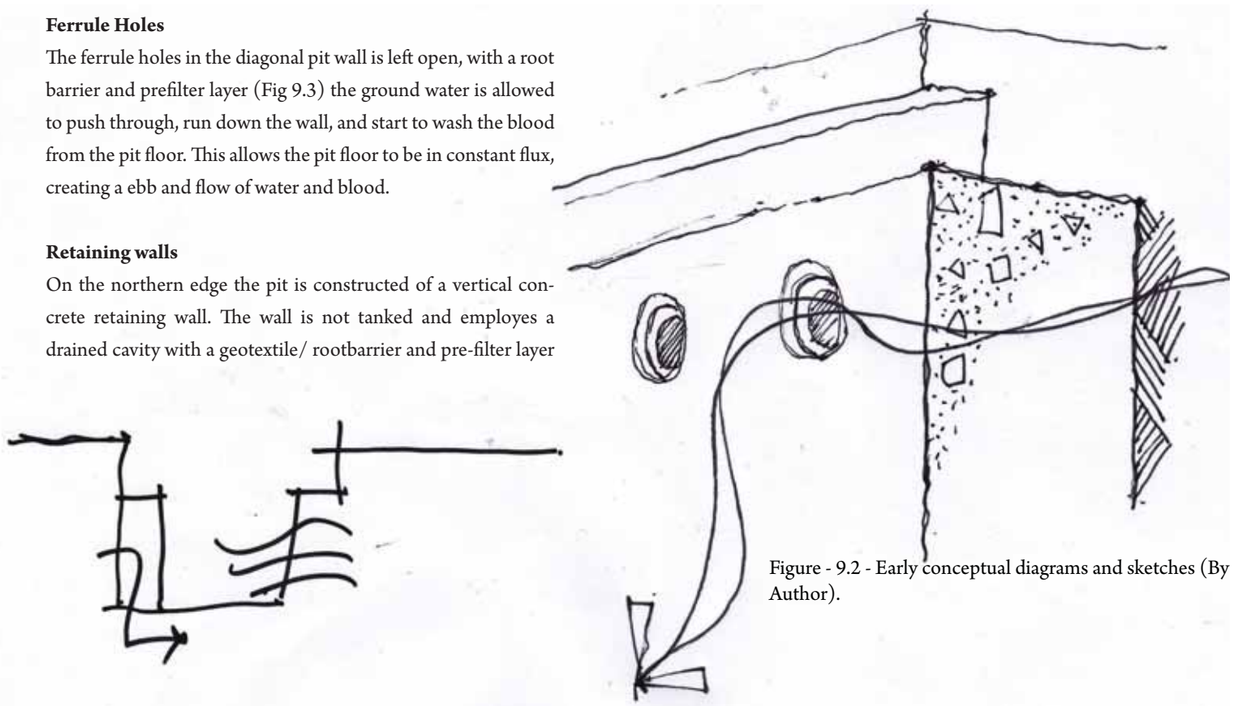


Figure - 9.2 - Early conceptual diagrams and sketches (By Author).

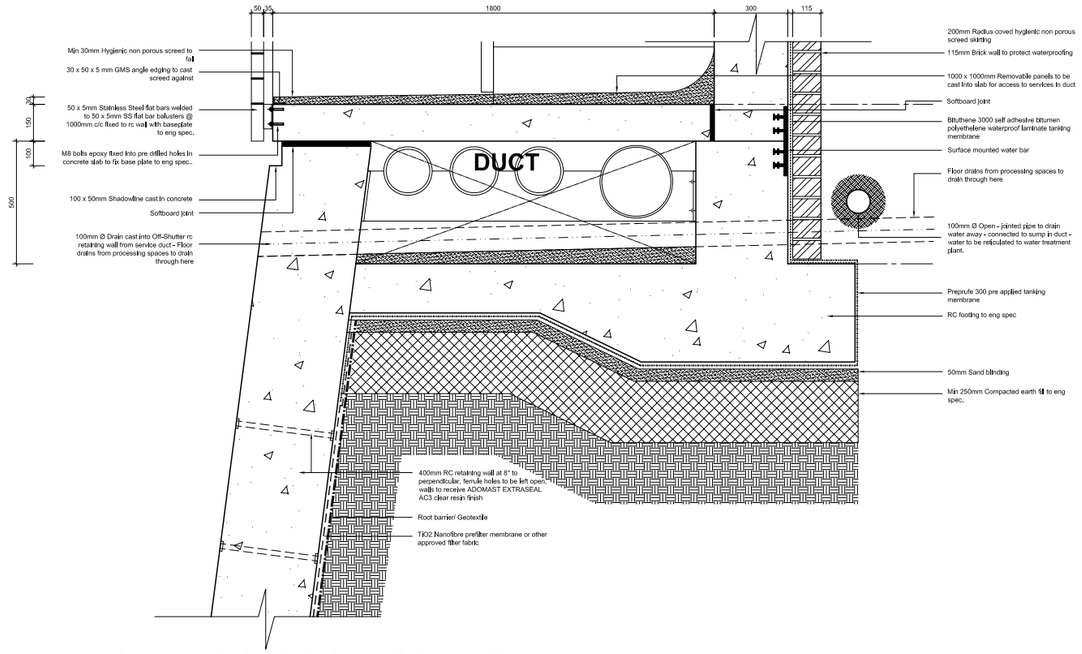


Figure - 9.3 - Above - Detail of work platform and the pit wall, illustrating the detailing around water entering the structure (By Author).

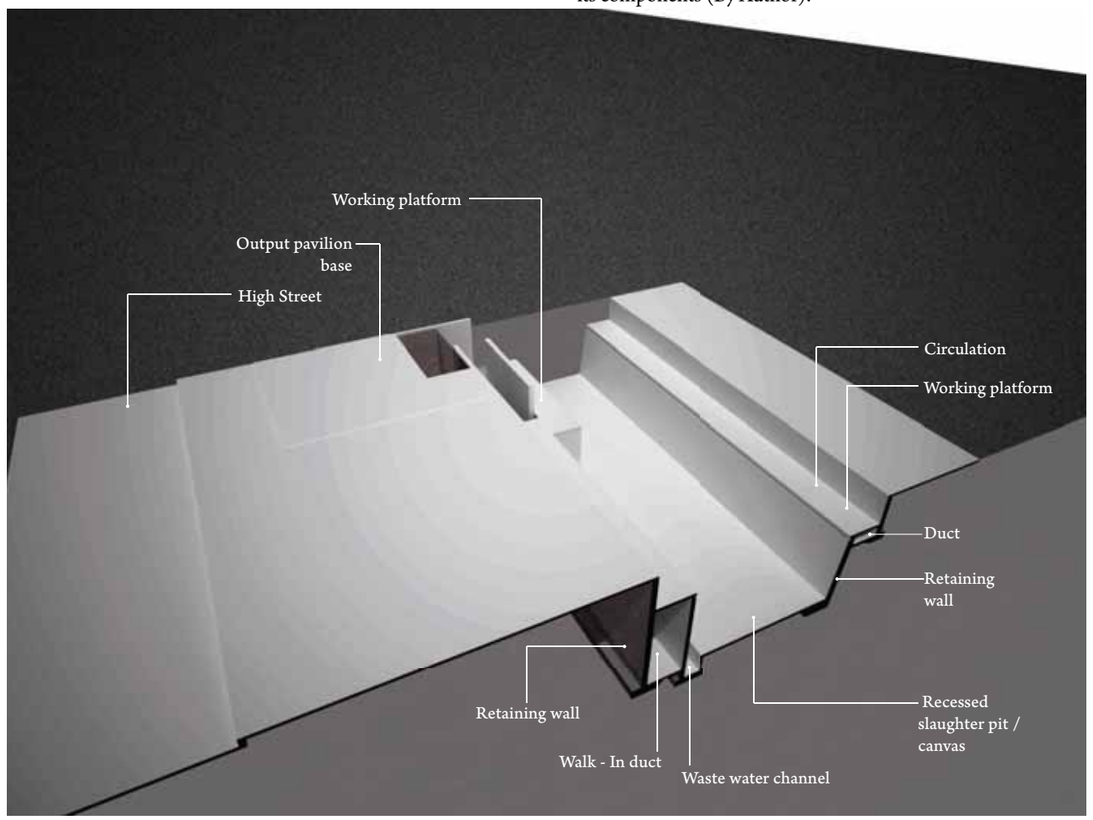


Figure - 9.4 - Below - 3D section render of the slaughter pit and its components (By Author).

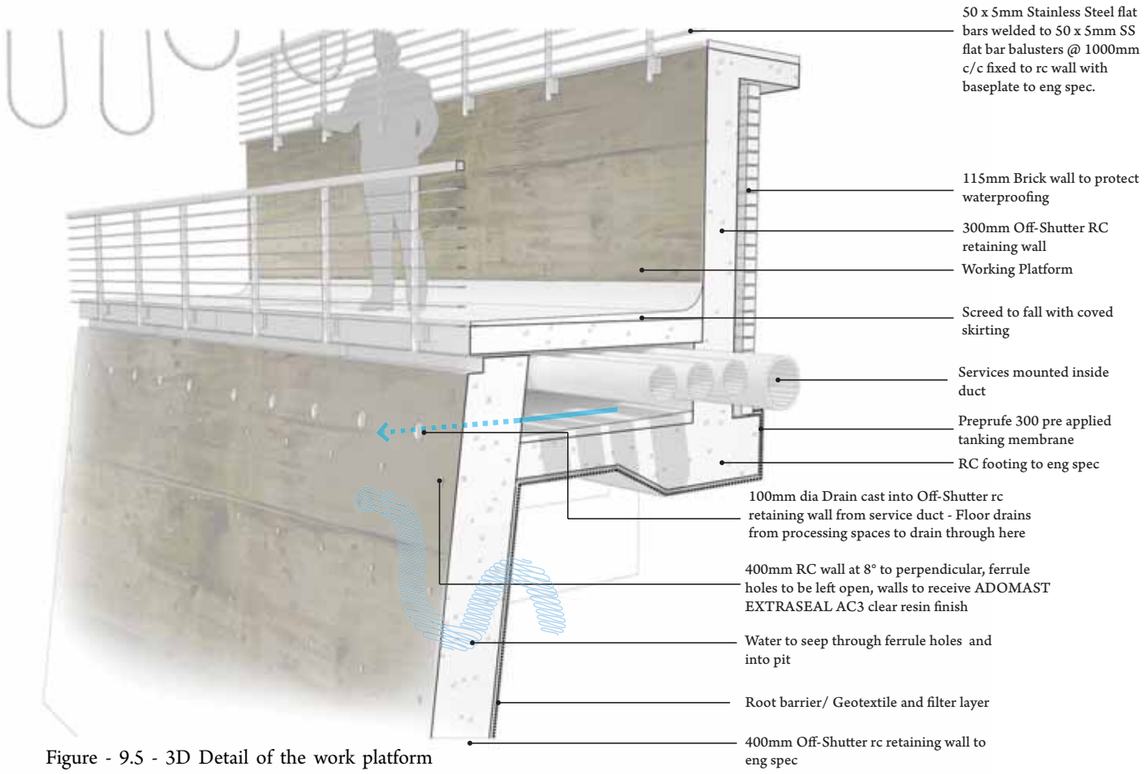


Figure - 9.5 - 3D Detail of the work platform showing the pit, its components and how the water enters (By Author).

The Processing and Circulation Spaces

These spaces are covered by three ramps, which grow out of the ground from the southern edge of the site. The ramps and its supporting structure consists of Off-Shutter concrete. The ramps connect to the flat concrete roof over the processing areas, which in turn connects to the slaughter pit.
Sustainable concrete technology was researched to counter the environmental effects of the amount of concrete being used.

The TX Active range of cements developed by ESSROC (North American company) was selected based on its innovative approaches to sustainable concrete practice. The product identified is the photocatalytic cement product called TX Aria. Some facts concerning this cement product as listed by the company on www.essroc.com:

The TX Aria is a self cleaning and pollution reducing concrete consisting of a photocatalytic cement mixture.

Photocatalysis

A natural phenomenon in which a substance, the photocatalytic principle, utilizes light to alter the speed of a chemical reaction. By taking advantage of the energy of light, the principle will accelerate the formation of strong oxidizing reagents which will result in the decomposition of organic and inorganic pollutants. These pollutants are responsible for gathering on the surface of concrete causing discolouration, as well as, many health related issues. Photocatalysis is an accelerator of an oxidation process that already exists in nature. It promotes faster decomposition of pollutants and prevents them from accumulating.

Admixtures

Further investigation was done into the sustainable placing of concrete. Admixtures were investigated and CAEXOL air entraining admixture reducing water required and increasing durability, and BASF Rheomix® 630 S plasteciser further reducing water required for mixing and increasing the production rate was incorporated into the concrete structure.

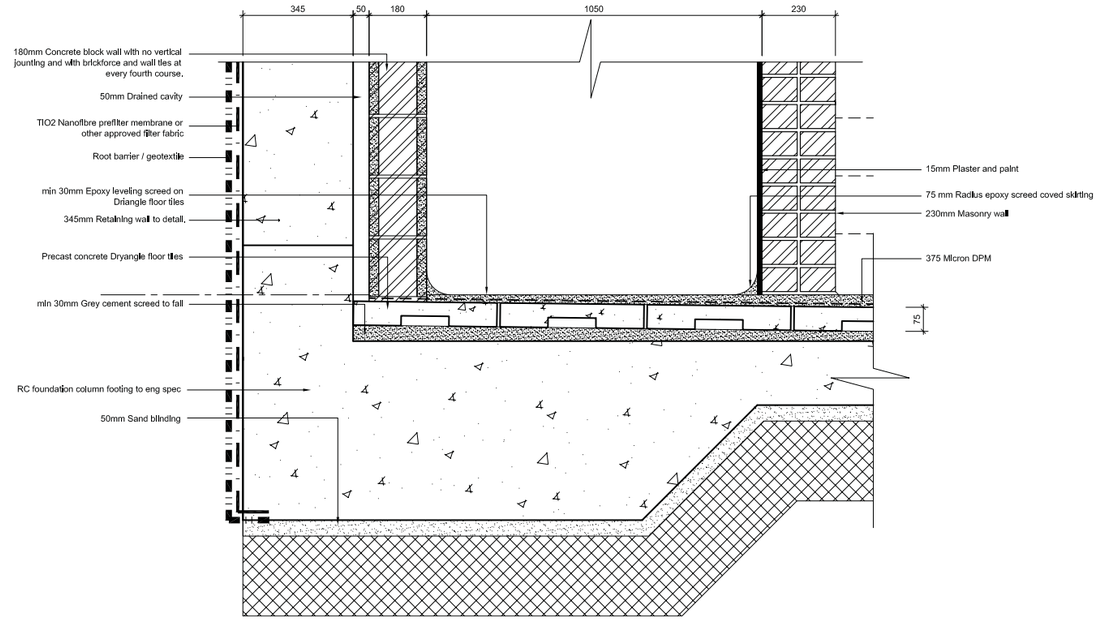
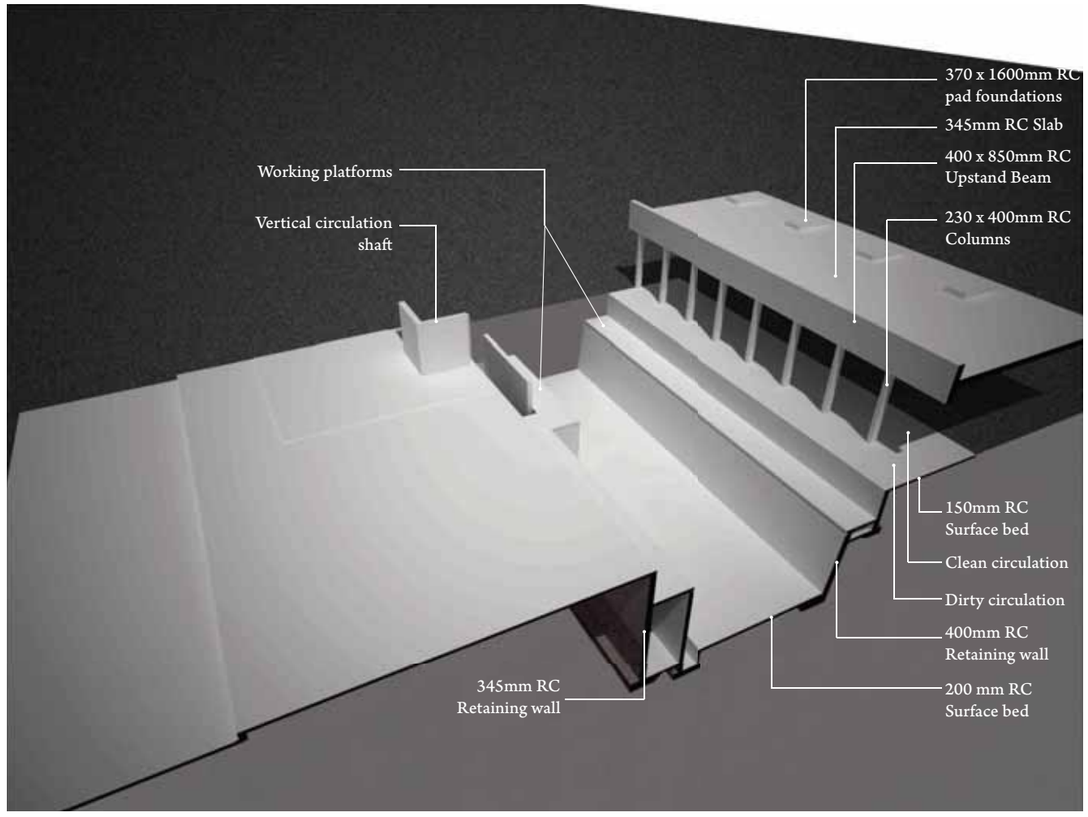


Figure - 9.6 - Above - Detail of the retaining wall on the northern side of the slaughter pit (By Author).

Figure - 9.7 - Below - 3D section render of the slaughter pit and the connection of the processing spaces on top of it (By Author).



Tectonic - The Frame

The roof over the pit was generated from two design informants. Firstly, the concept of the roof as the central nervous systems of the abattoir , as it has to contain most of the services and systems. Secondly, it was designed around environmental considerations, to harness natural light and ventilation.

The resultant is a portal frame steel structure shaped around the environmental elements. The roof slopes from the north down to the south allowing north light to enter the slaughter space.

The roof creates a internal space for the systems and is shaped to create space for service runs and circulation. (Refer to Fig 9.9 - 9.10)

The roof over the pit and the pavilion roof become one, with the processing pavilion roof articulated as a lean to structure onto the portal frame.

The portal frame is broken where it connects to the concrete structure which provides support on the southern side. The portal frame column is fixed to a 800 x 400 mm reinforced concrete upstand and the floor beam is connected to the side thereof.

The frame allows for openings on the northern and southern sides, and is narrow enough to cross ventilate.

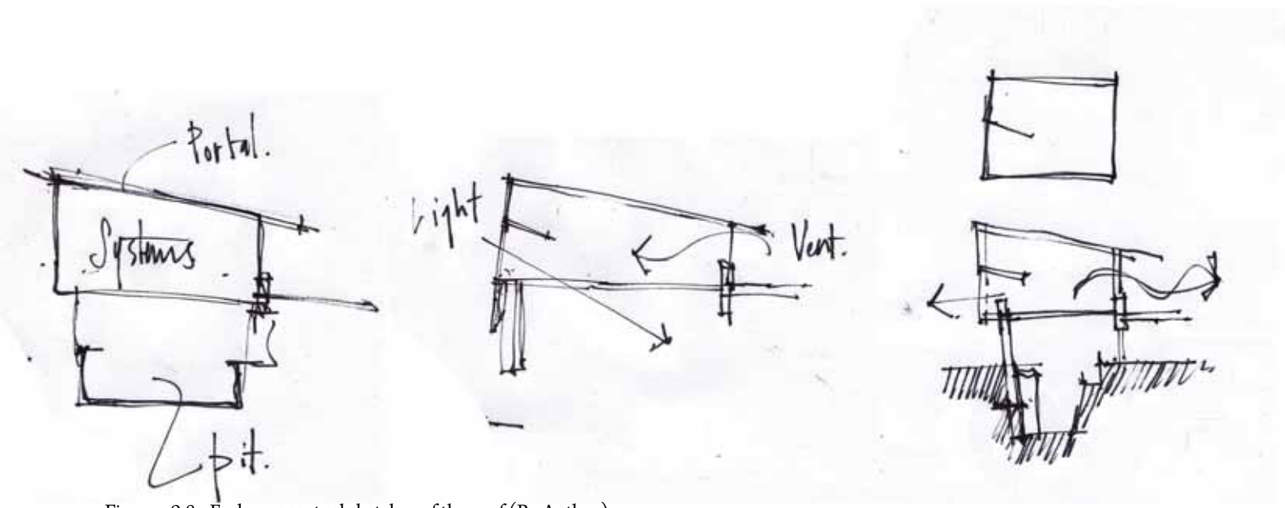


Figure - 9.8 - Early conceptual sketches of the roof (By Author).

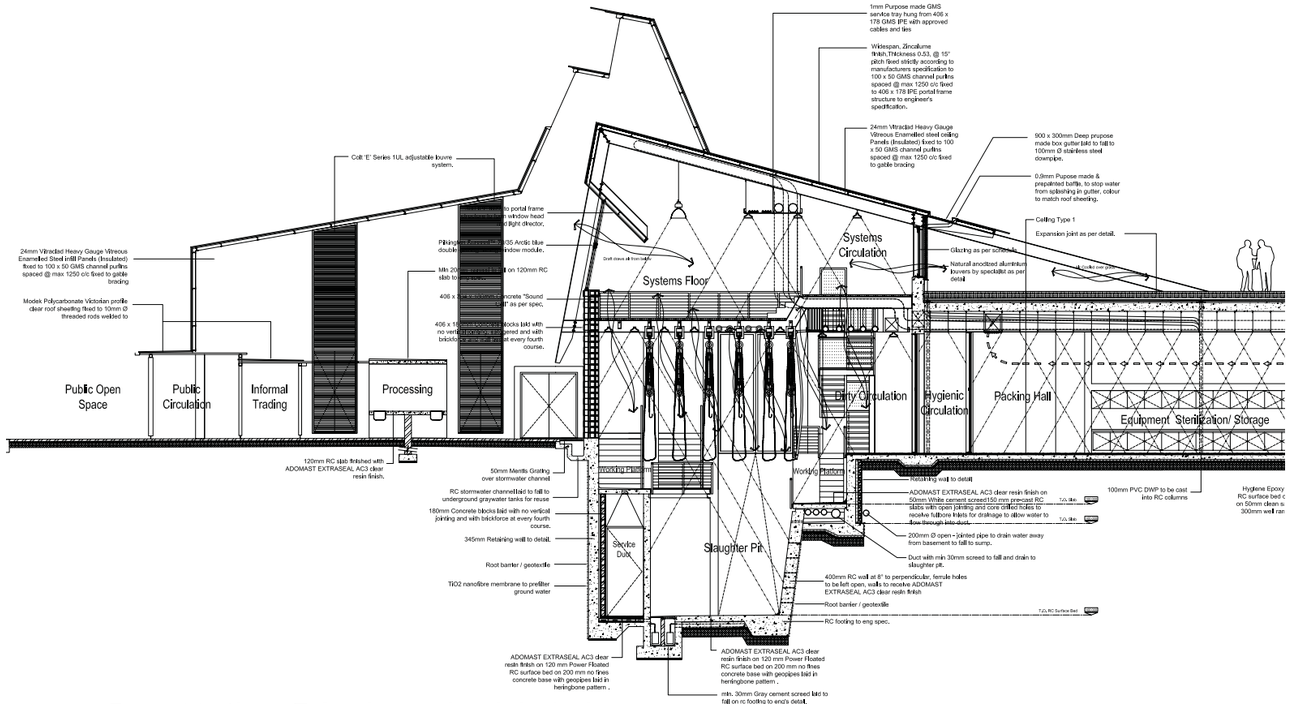


Figure - 9.9 - Above - Technical section through the slaughter pit (By Author).

Figure - 9.10 - Below - 3D section render of the portal frame roof over the slaughter pit.

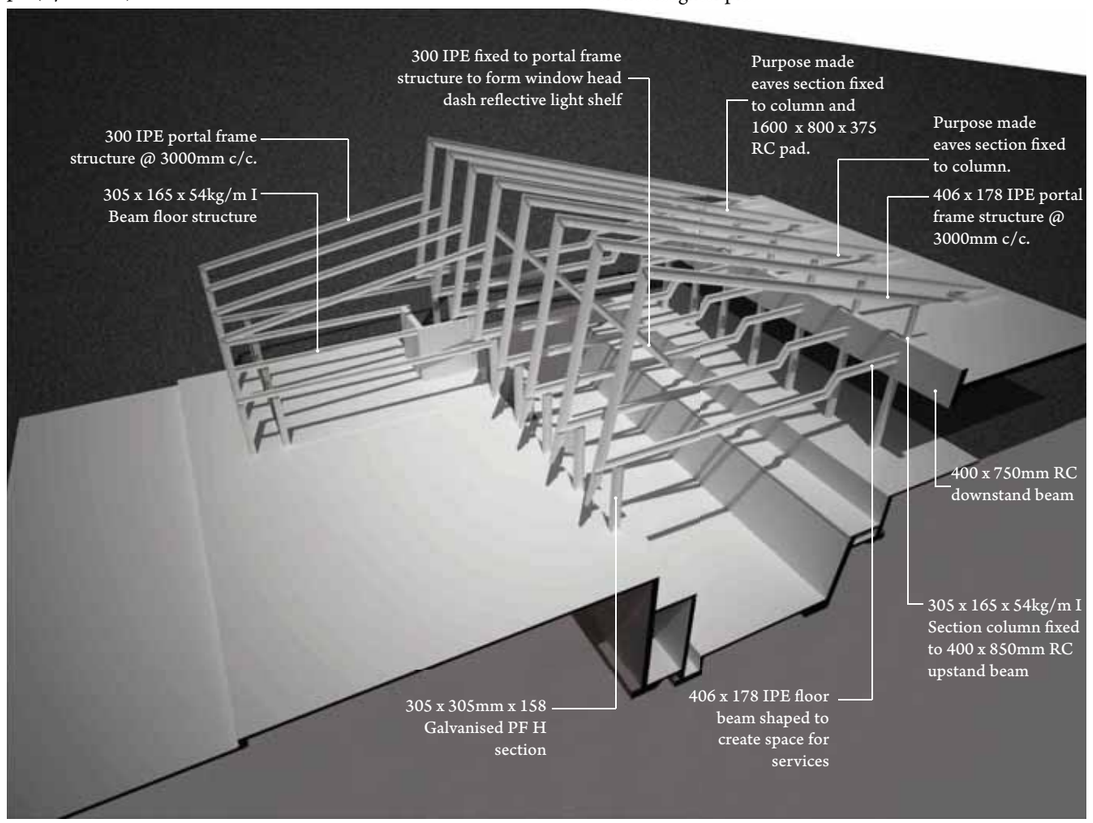
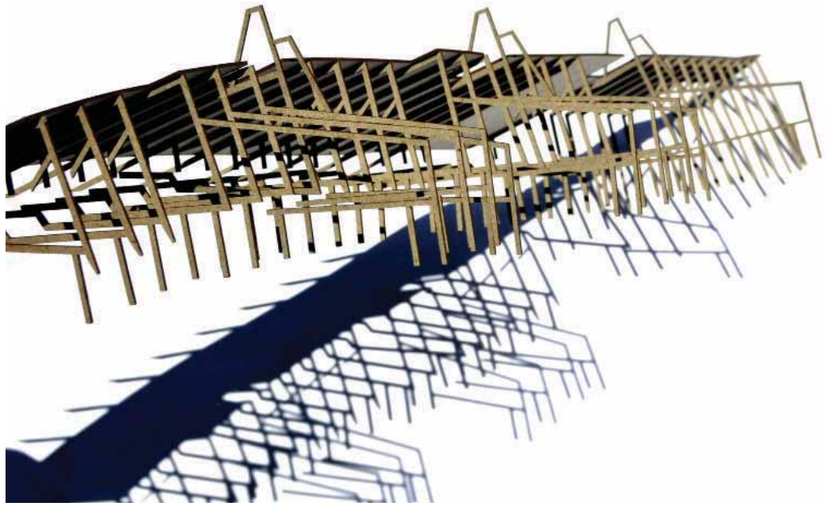


Figure - 9.12 - Opposite - Image of explorative model built of the roof structure (By Author).

Figure - 9.11 - Below - Image of explorative model built of the roof structure (By Author).

Figure - 9.13 - Image of explorative model built of the roof structure (By Author).



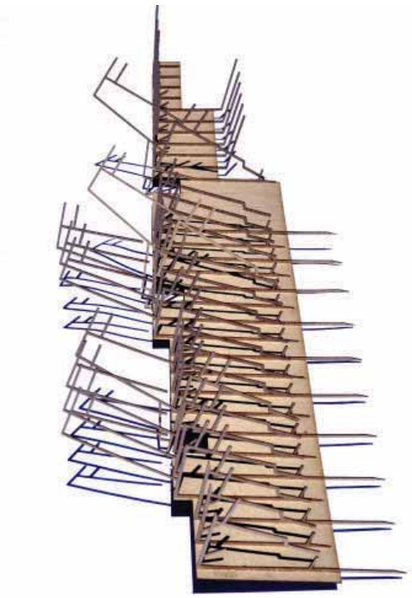
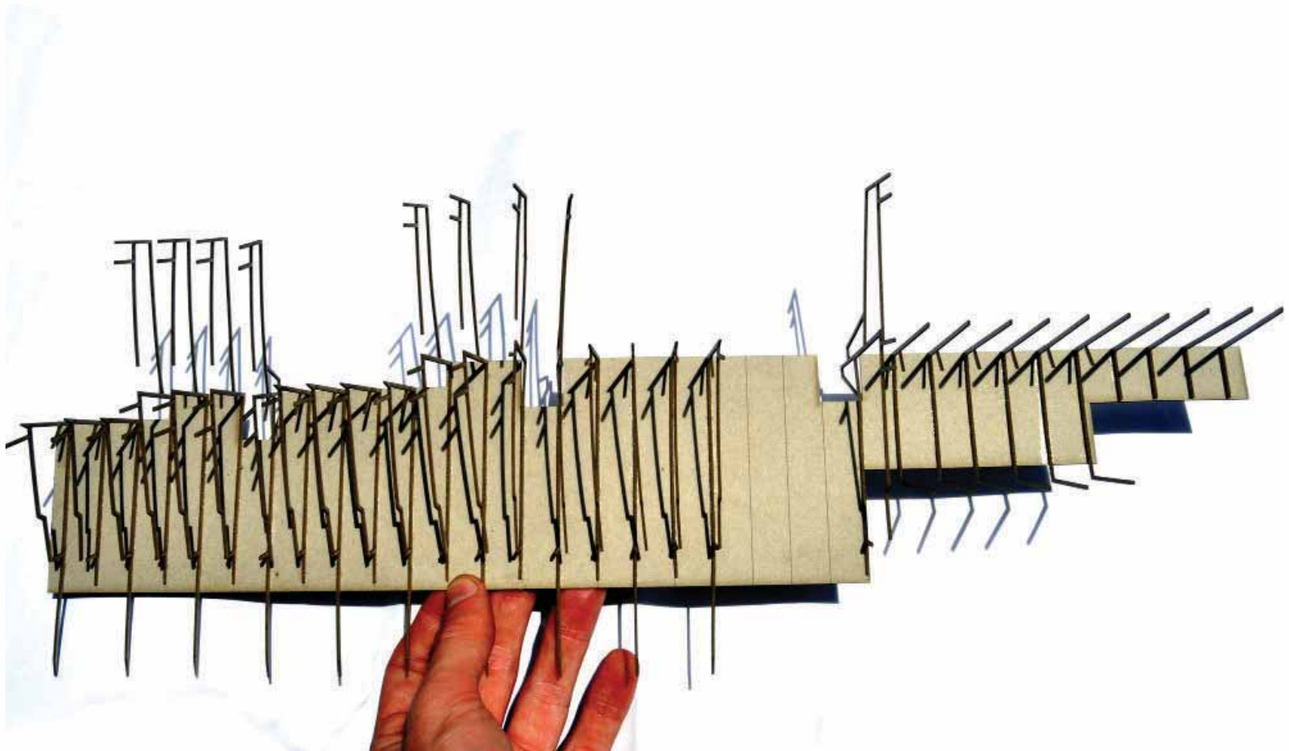


Figure - 9.14 - Below - Image of explorative model built of the roof structure (By Author).



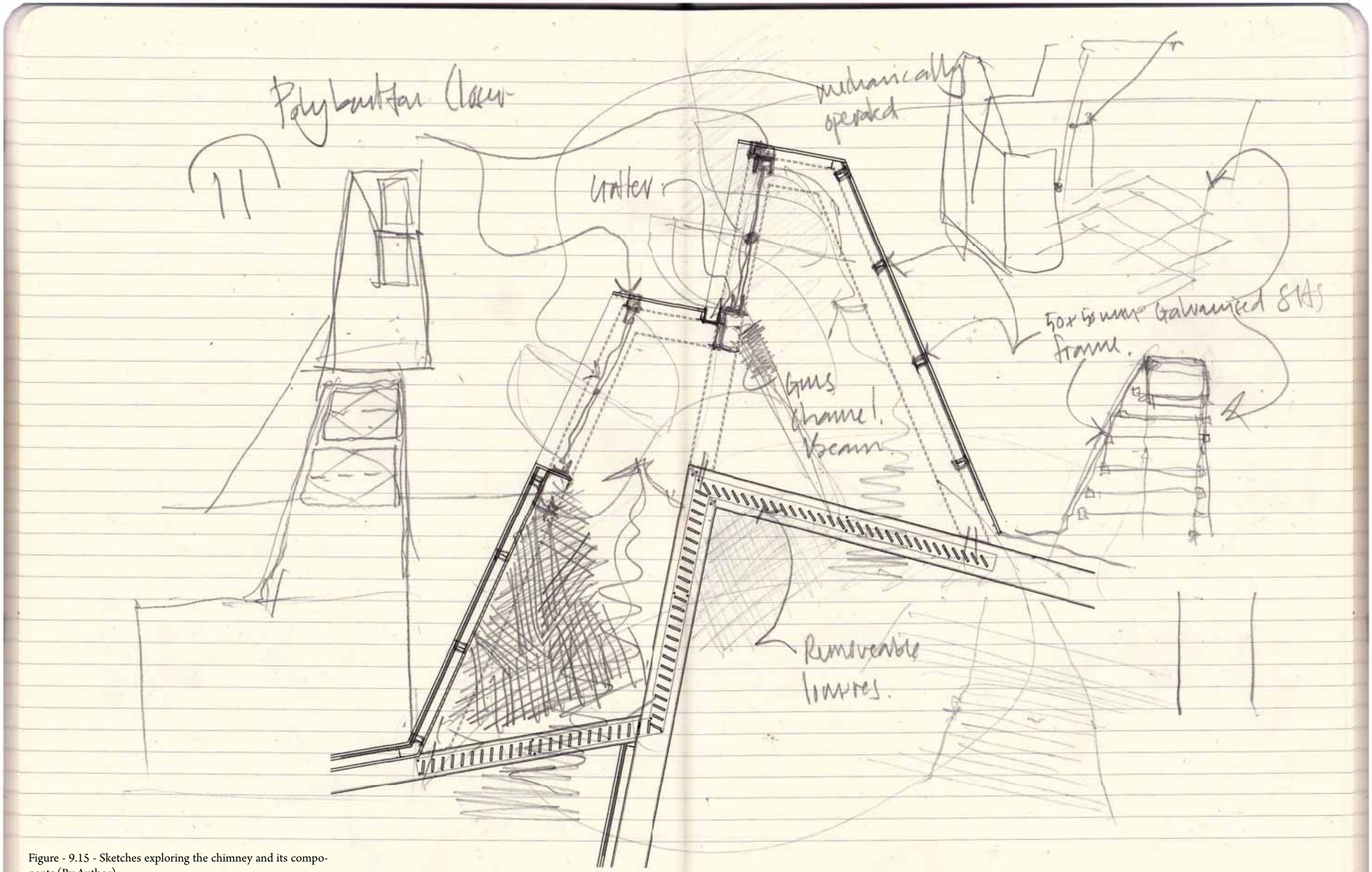


Figure - 9.15 - Sketches exploring the chimney and its components (By Author).

The Chimneys

The chimney is designed around passive principles and active systems. The highest point of the roof flows into the chimney to allow warm, stale air to exit. The chimney promotes constant natural circulation and air changes.

There are systems components located within the chimney such as an air scrubber system, which removes bad smell from the air before allowing them to exit, air conditioning condensers and the extraction system which is also connected to the air scrubbing system.

After a consultation with a mechanical engineer, Mr E. Groenewald, these systems were placed within the chimney. It was advised to place the condensers and the extraction system within close proximity so that the cool air which is extracted can be recycled by the condensers, which relieves the mechanical cooling system from excessive work, saving energy.

The chimney has a automated flap which opens and closes as required, controlling the ventilation or just keeping the rain out. The operation of the flaps will be overseen by the systems manager as he will constantly monitor the building performance.

The chimneys occur at each output pavilion and there are five in total. The first pavilion, housing the administration, does not require the chimney for ventilation and systems, and utilises it as a light well.

The chimneys also serve the processing spaces within the pavilions. The pavilion roofs are shaped into the chimneys of the slaughter pit roofs creating one chimney, serving both.

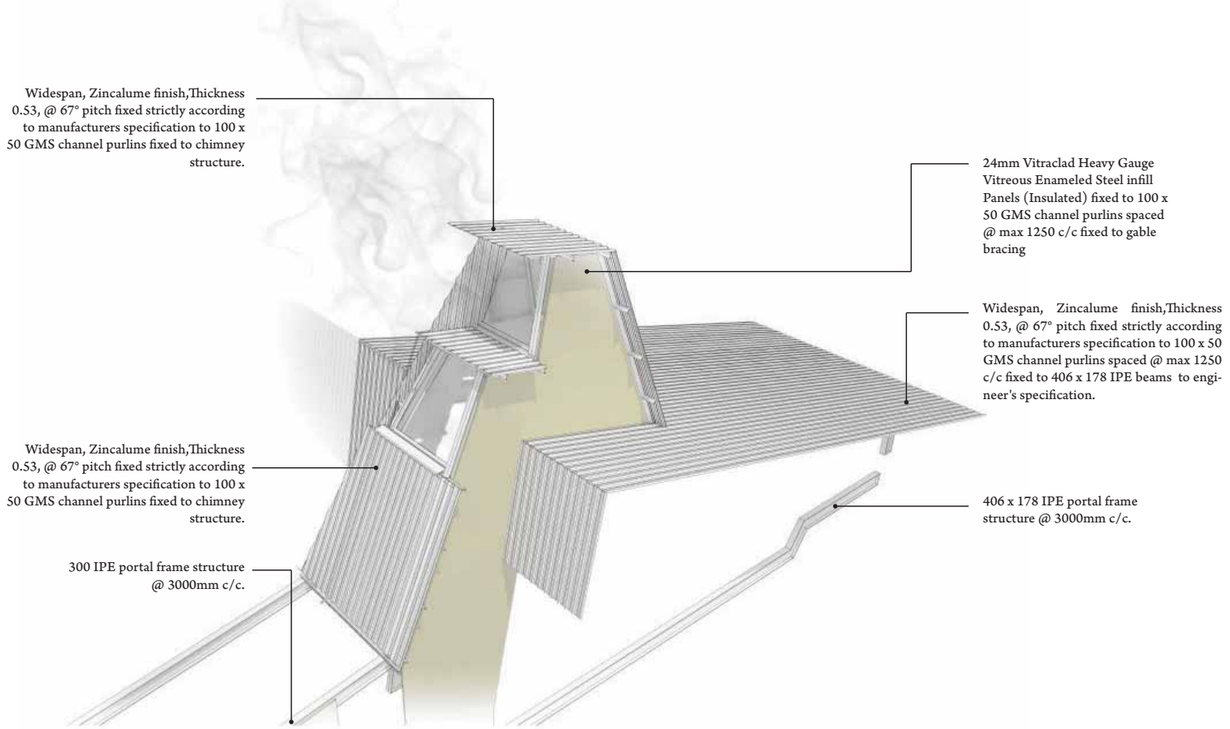


Figure - 9.16 - 3D Detail of final chimney, its components and materials (By Author).

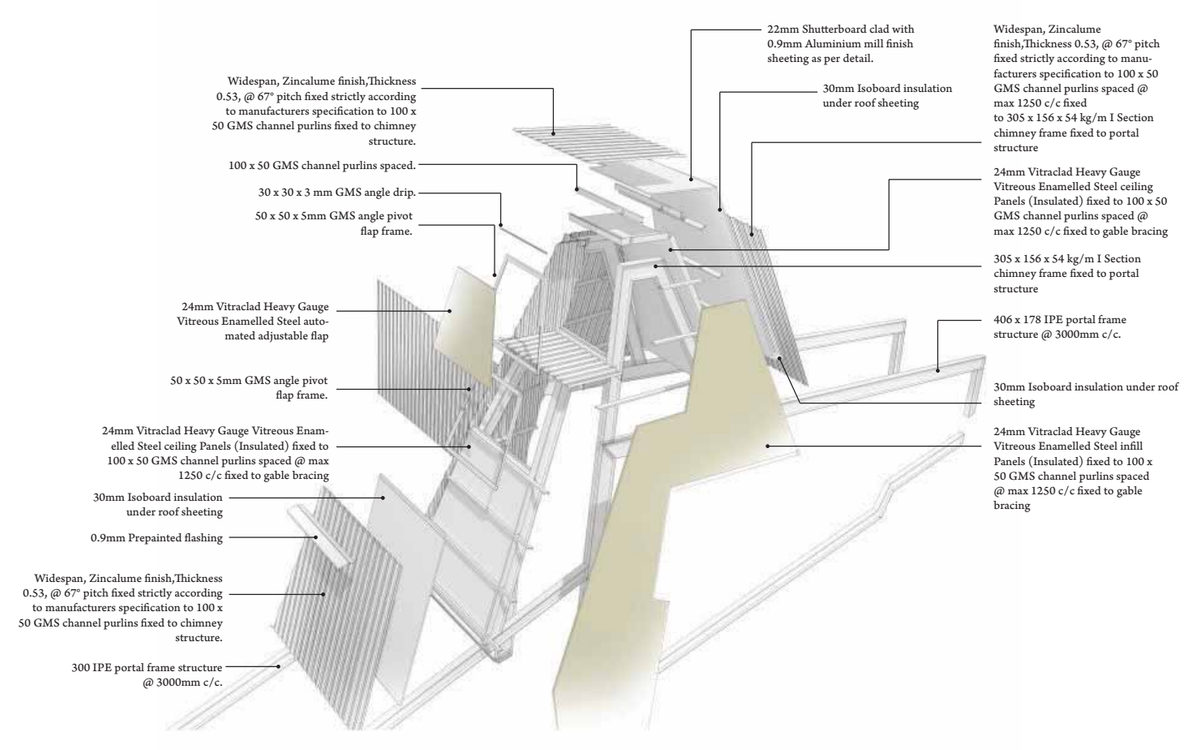


Figure - 9.17 - 3D Exploded detail of the chimney and its components (By Author).

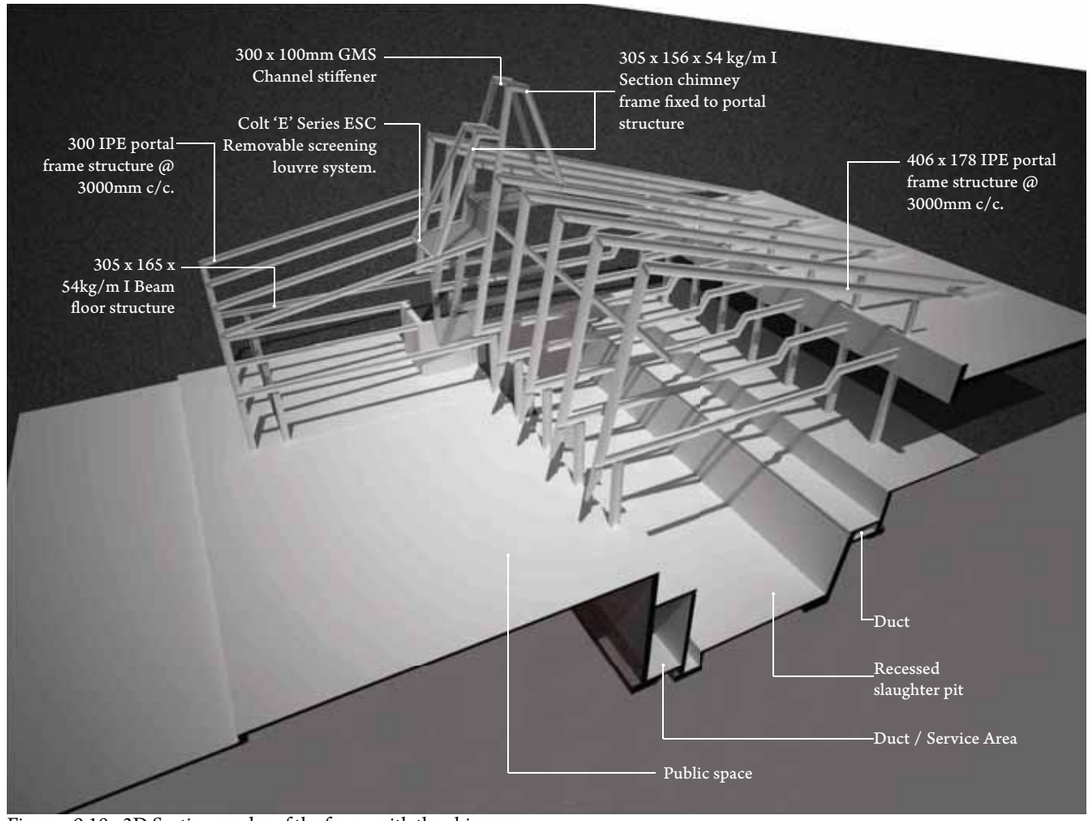


Figure - 9.18 - 3D Section render of the frame with the chimney structure extending from it(By Author).

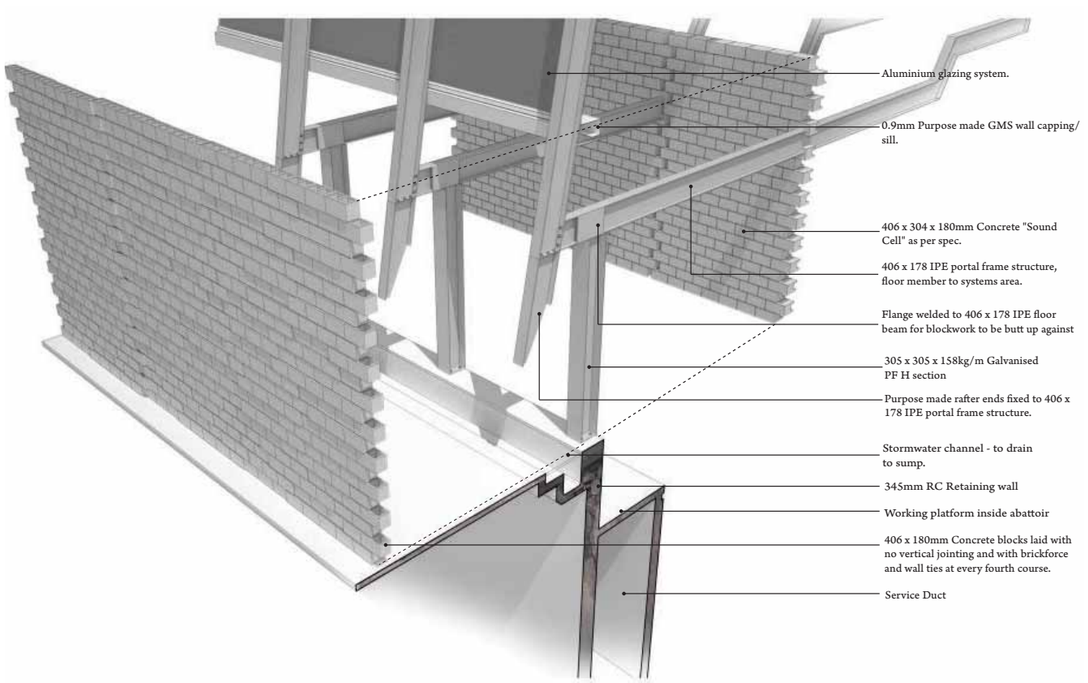


Figure - 9.19 - Above - 3D exploded detail of the wall, the portal frame and its components (By Author).

The Skin

The first part of the building skin discussed is the wall, which separates the slaughter pit from the high street.

The wall has to separate the high street from the slaughter pit, and absorb the extreme noise generated inside the abattoir. Numerous products were researched and the “Sound Cell” acoustical masonry unit by Fendt was finally decided on.

This concrete masonry unit implements a unique sound absorption system within. Two layers of sound insulation apply absorption and diffusion principles, and offers almost 100% sound absorption efficiency. The block, with its unique shape, offers a unique textured appearance when used in large quantities, like in the abattoir.

The inside skin of the abattoir wall is to be constructed of the “Sound Cell”, with the external layer constructed of standard concrete blockwork. These two layers sandwich the portal frame columns. The external layer of blockwork will be laid without vertical jointing, and staggered in horizontal groups (refer to Fig 9.19) to give the appearance of long linear blocks stacked on top of each other. This is done to emphasise the linearity of the building and the process inside.

The wall is designed in panels of three meters, which relates to the building grid. Therefore the panels and the portal frames coincide, with expansion joints at the wall’s intersection with the columns.

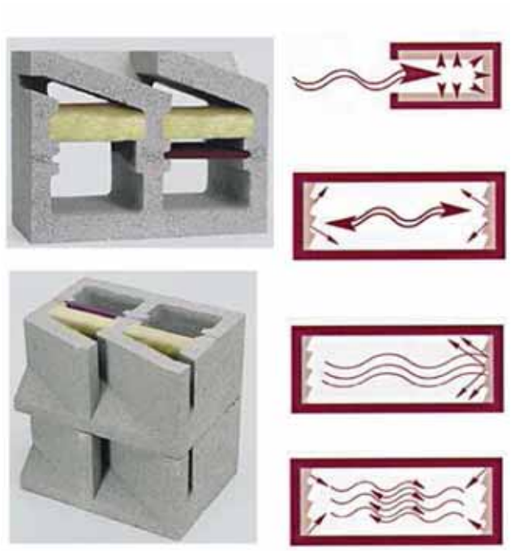


Figure - 9.20 - “Sound Cell”, Diagrams of the acoustic principles the block uses to absorb sound.

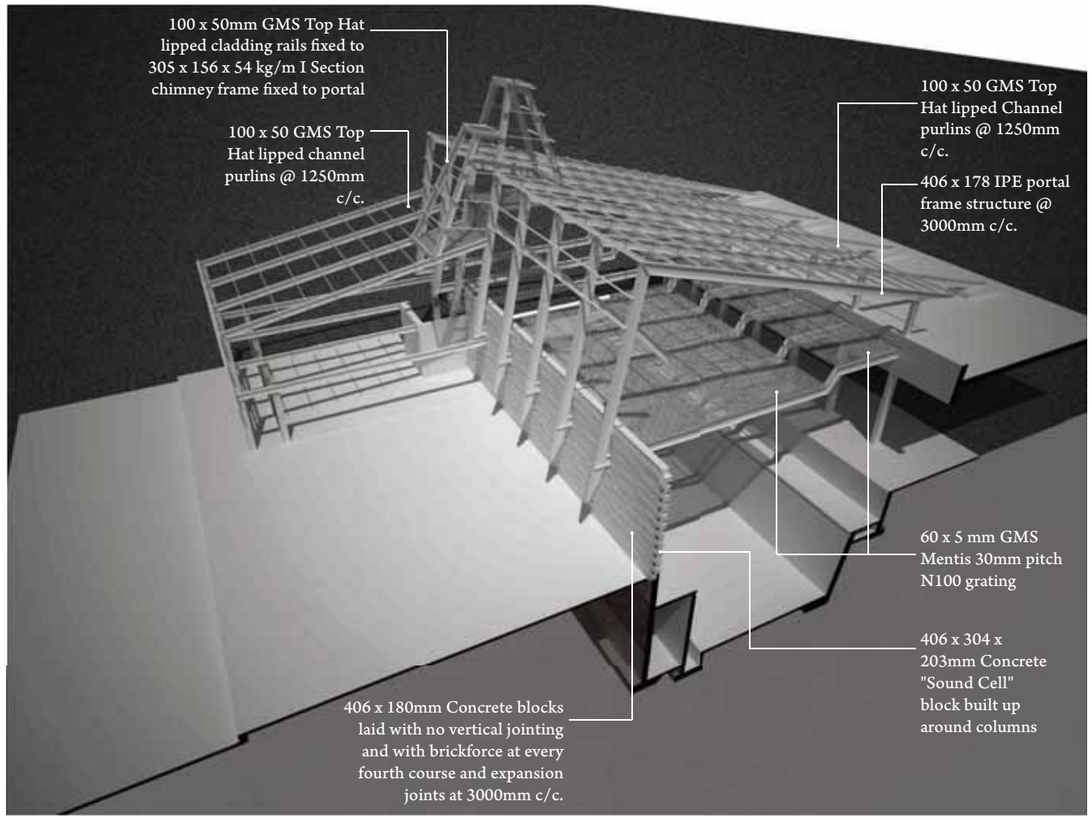


Figure - 9.21 - Above - 3D Section render of the frame, system floors and the wall opposing the high street (By Author).

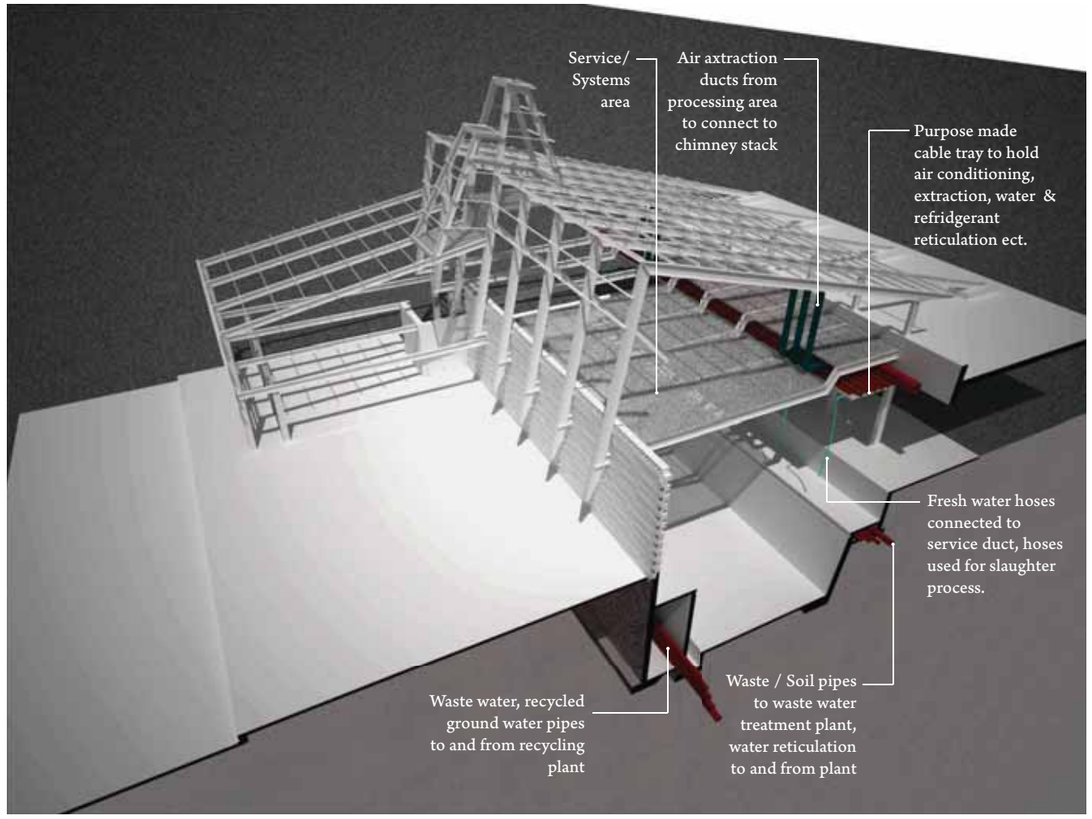


Figure - 9.22 - Below - 3D Section render of the systems added (By Author).

The Roof and its Connections

The roof is designed to appear as if it is floating above the building, which grows from the ground. This creates openings beneath the roof, which create areas where ventilation and light gain can be controlled.

The roofing material chosen is Widespan profile with a Zincalume finish. Zincalume has a very long life-span and requires less maintenance. The widespan profile is a IBR profile with intermediate ribs to strengthen the sheet.

The northern edge of the roof connects to the wall, discussed on page 192, with glazing. The glazing also requires sound insulating properties, and therefore a decision was made to use a double glazing. The interior of the abattoir requires natural light to create better working conditions, without unnecessary heat gain. Pilkington Suncool Artic blue glazing has been specified, due to its thermal insulating properties. The tinted glass allows for ample light to enter the building without overheating and glare.

On the southern edge, the building connects to the concrete upstand with glazing panels and a louvre system. Double glazing is not required on the southern edge, as it does not receive direct sunlight, and it is orientated away from the high street and the noise have little to no effect.
The floor inside the roof space is constructed of a structural mesh flooring system allowing the light that enters into the roof space to penetrate the slaughter space.

A adjustable louvre system allows the ventilation, south light gain and views into the building to be controlled. Refer to Fig 9.26 for construction details.

Figure - 9.23 - Below - 3D Deatail of the roof connection on the southern side to the concrete upstand (By Author).

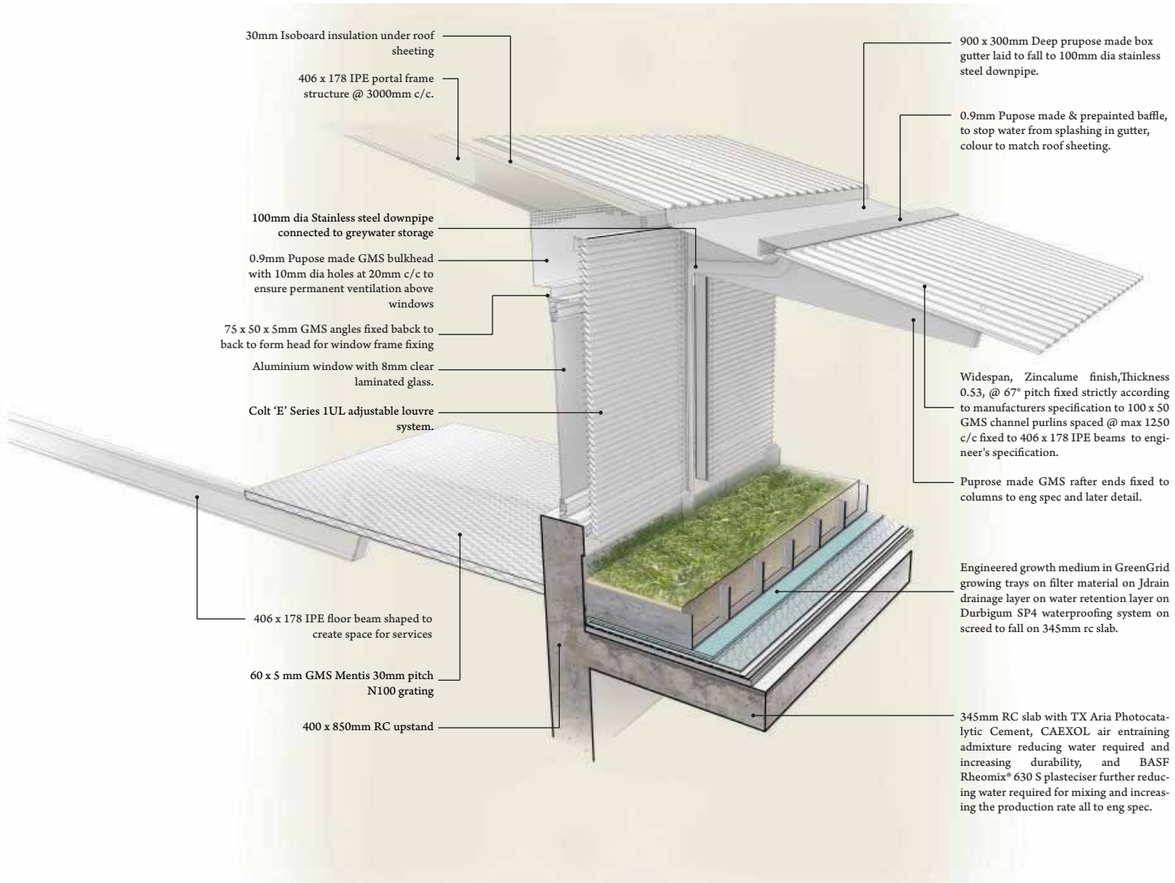
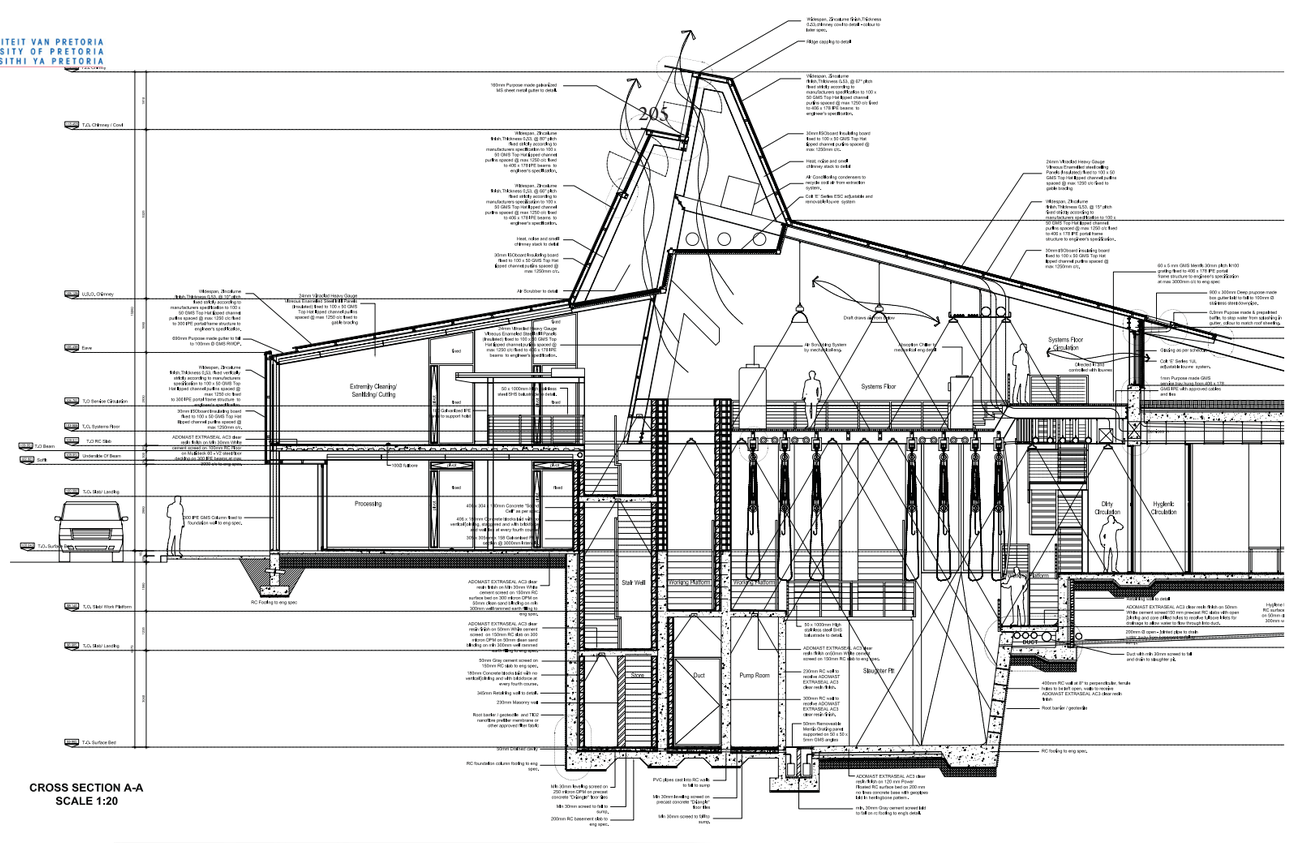


Figure - 9.24 - Opposite - Technical Section A-A, a cross section through the slaughter pit and the roof at the chimney(By Author).



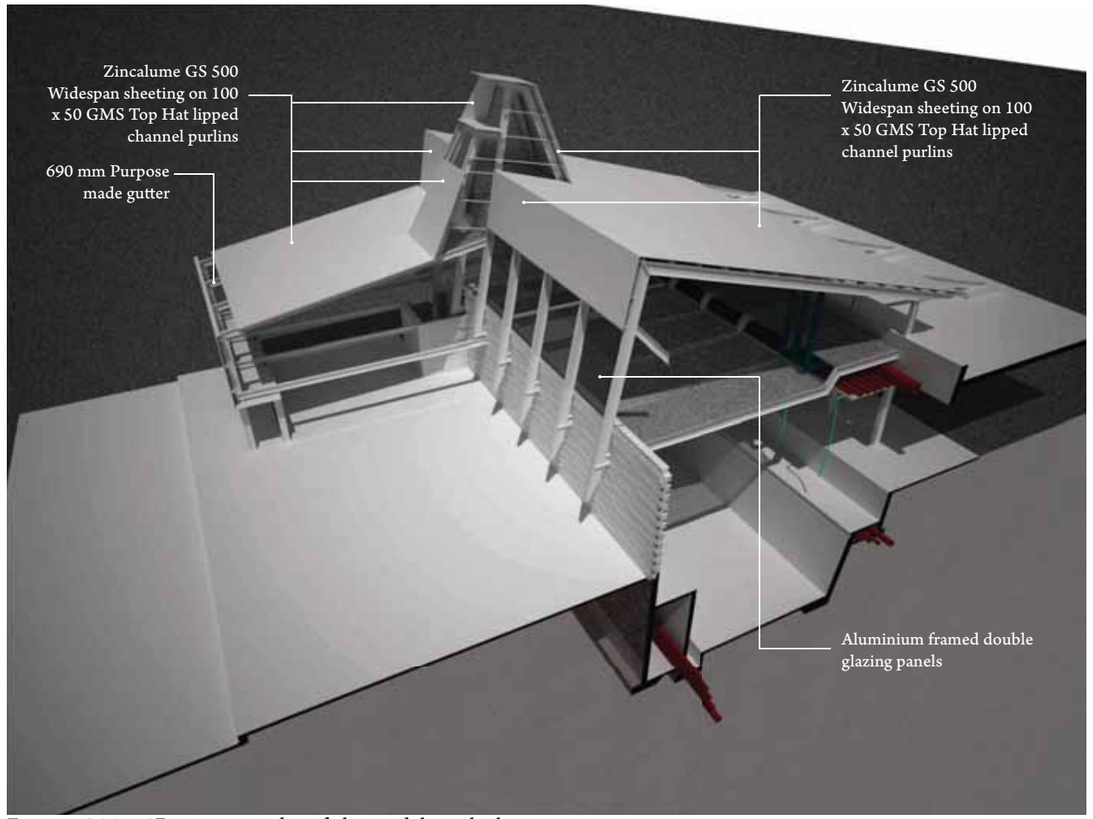


Figure - 9.25 - 3D section render of the module with the Widespan sheeting added (By Author).

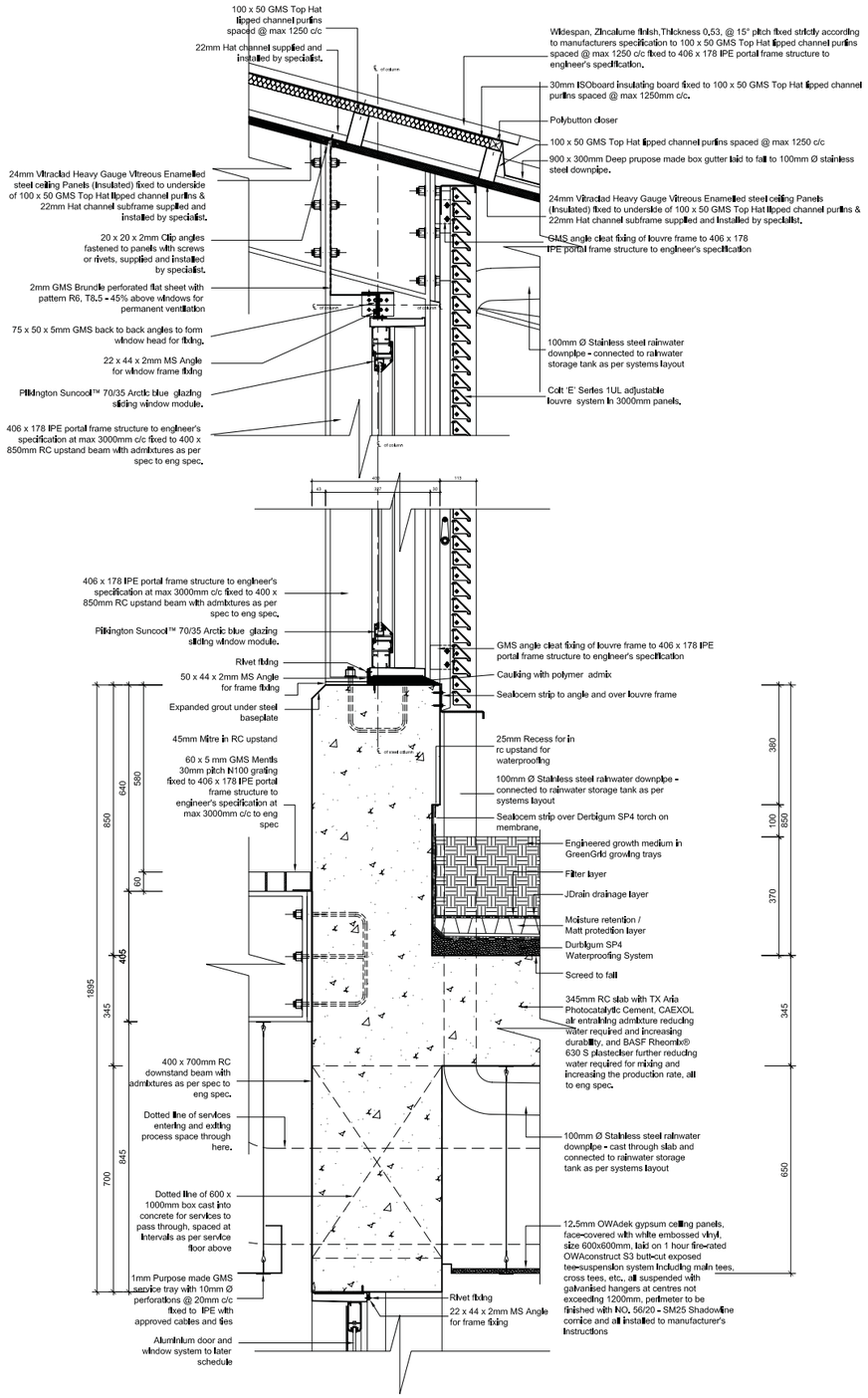


Figure - 9.26 - Detail of roof connection to the concrete structure (By Author).

The Green Roof

The processing spaces and the employee service spaces such as, ablutions, cafeteria, labs etc are contained under a green roof which grows out of the ground. The decision to do this, as discussed under the design development chapter (8), is to use the earth as insulation for the cool spaces beneath. The processing space must, during processing times, remain at 7 degrees Celsius or less.

By employing a green roof, the earth will act as insulation against heat gain. The heat that finds its way through the multiple layers, latent heating effect, can be purged at ceiling level, through automatic high level windows (refer to systems section).

The green roof consists of multiple layers, to achieve optimum growing condition for the vegetation but also to protect the building from water seeping through (refer to Fig 9.26 & 9.27)

The Pavilions

The sides of the processing pavilions are clad with Vitraclad, which is a enamelled composite steel sheet cladding system. The material is hard wearing and requires little to no maintenance. The system is also very quick to install. The 24mm panel, which incorporates a 20mm layer of insulation, is specified to limit any additional panels and insulation internally.

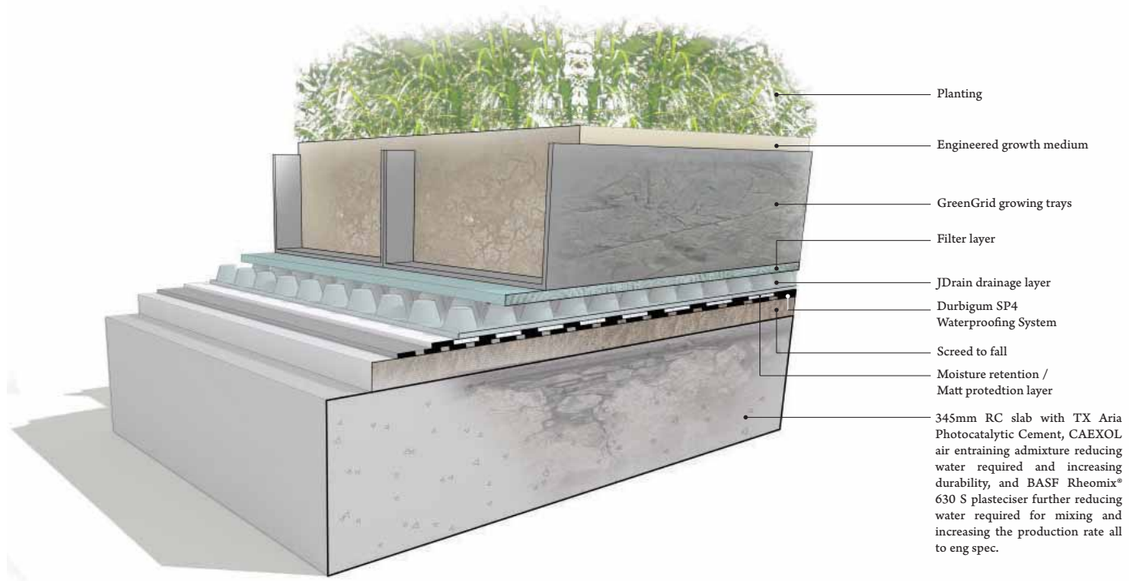


Figure - 9.27 - Above - The composition of the green roof (By Author)

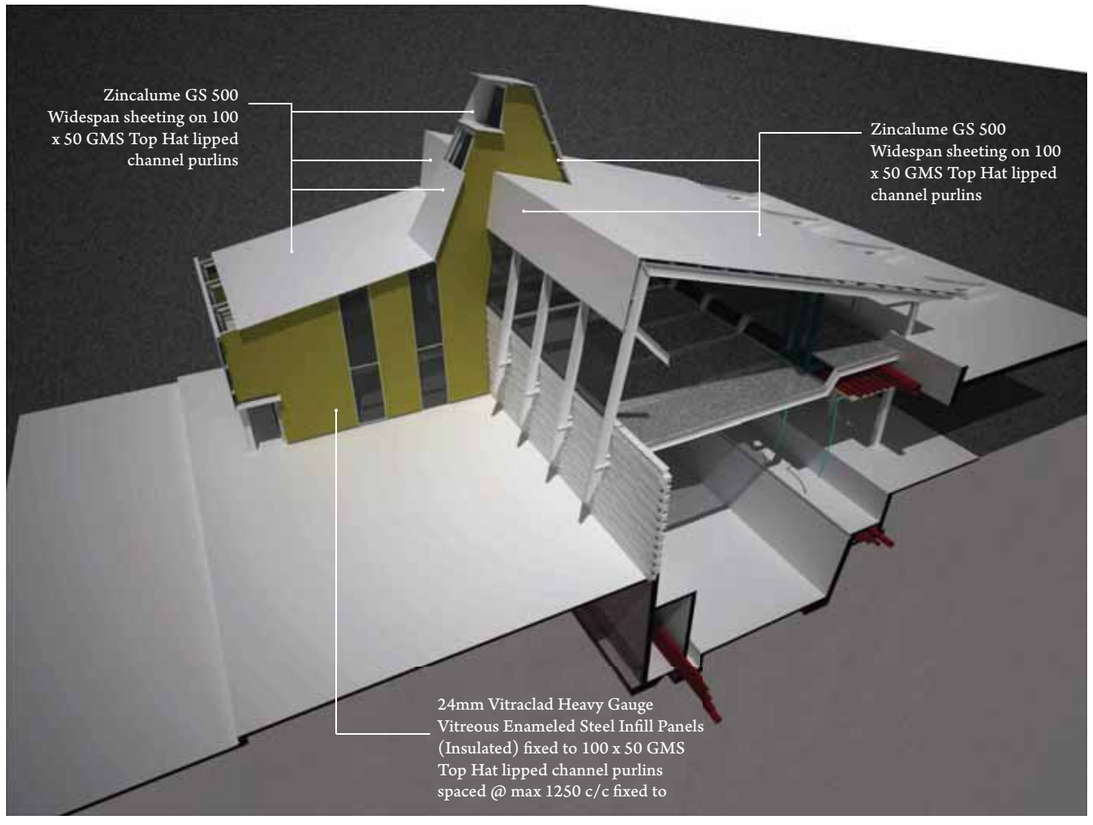


Figure - 9.28 - 3D Section render of the processing pavilion with the Vitraclad panels on the side (By Author).

The Layers - Public Interface

Fig 9.29 depicts the final module which is to be repeated along the high street. The only difference is that each module will step back further than the previous as the slaughter pit becomes narrower concentrating the process. This allows the pavement to grow in front of these pavilions, encouraging more activity toward the end of the process which terminates in the meat market.

The public element of the processing pavilion is a very basic structure, which is based on what you might find in a harbour where fresh fish are processed. Closest to the abattoir there is a solid structure which contains basins and counters for working where people, small business owners and local vendors can process products made available directly from the abattoir.

The second layer is a space made available for vendors to set up stalls to sell products made from the abattoir waste directly to the public. This structure consists of a simple lightweight steel SHS (Square Hollow Section) post and lintel system with a polycarbonate sheeting covering it. This space is to be freely appropriated by the public and vendors, completely filling this space.

The final layer is a undercover walkway for the public, leading them parallel to the vendor space, all along the abattoir. This walkway starts at the bus stop on the western edge of the site and terminates in the meat market on the eastern edge of the site.

As seen in Fig 9.29, the pavement becomes wider as the building steps back, the building steps back as the process becomes narrower, allowing more public activity around these areas. This concentrates people at the more public end of the process in larger numbers where at the beginning of the process less people can circulate around these spaces. The tighter spaces are located at the killing end of the abattoir, and the more abundant public spaces around the processing side. Therefore, the abattoir process imposes itself on the flow of people in the high street.

When processing is done for the week the building can act as a market fro informal trading along the entire high street including the meat market. This allows the building to be functional seven days a week increasing the sustainability of the project and breaking away from the mono functional nature of industrial buildings

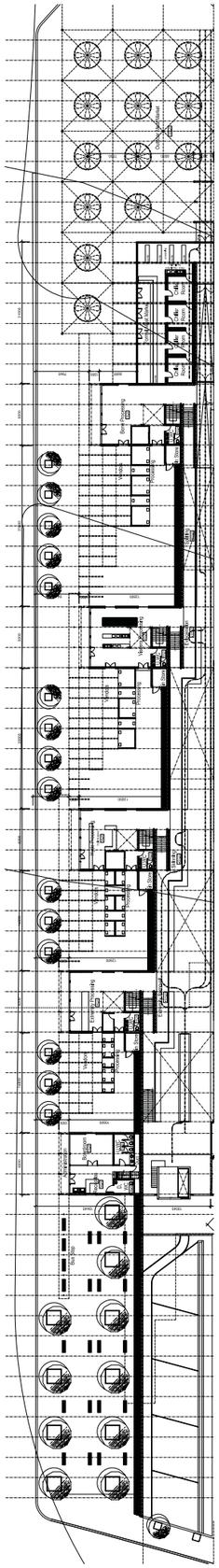


Figure - 9.29 - Right - Plan of the high street edge of the abattoir with the pavilions and its activities in between (By Author).

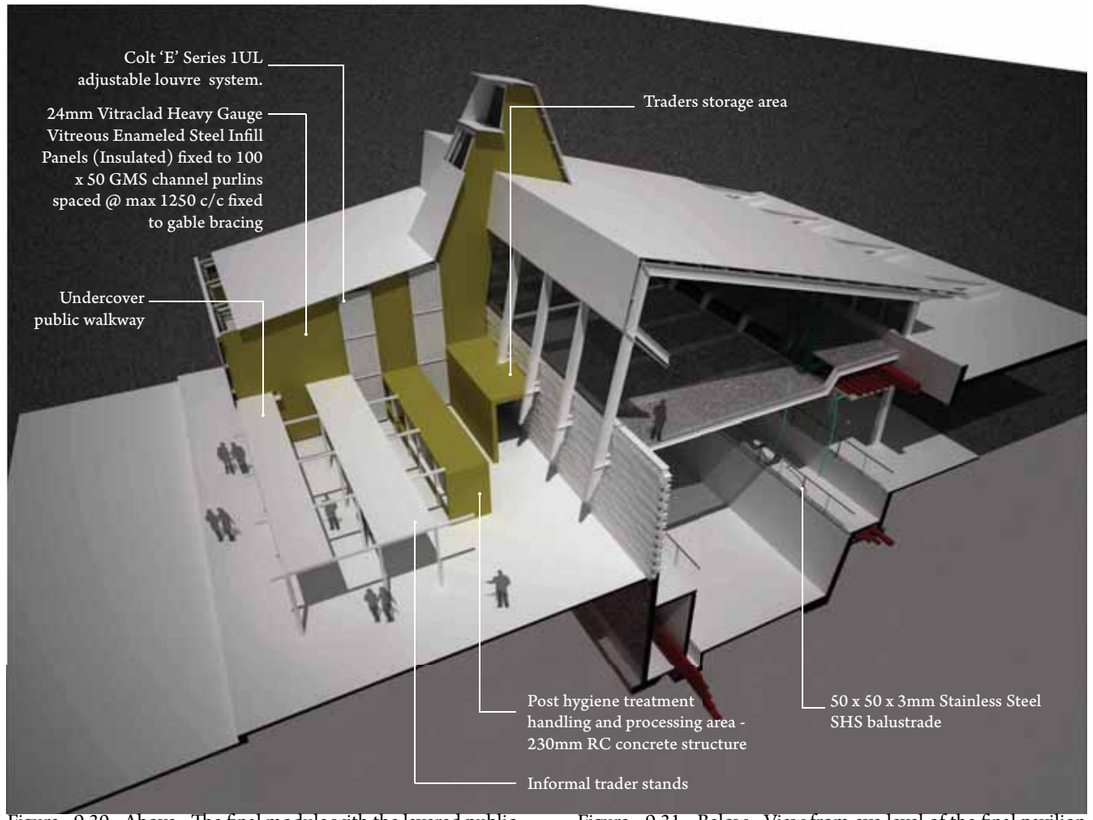


Figure - 9.30 - Above - The final module with the layered public interface. The space is to be freely appropriated by the public (By Author).

Figure - 9.31 - Below - View from eye level of the final pavilion module (By Author).

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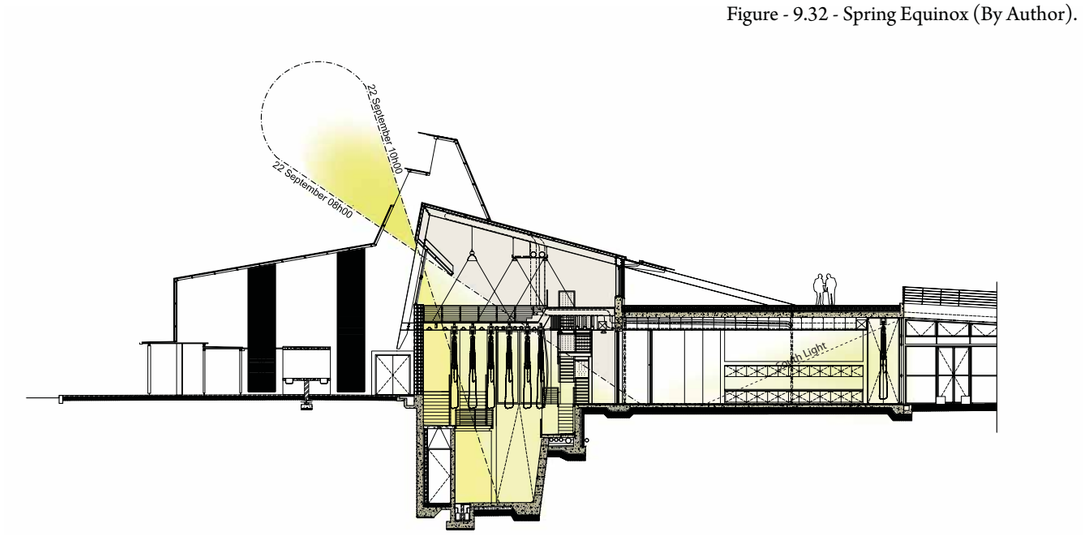
SOLAR STUDY

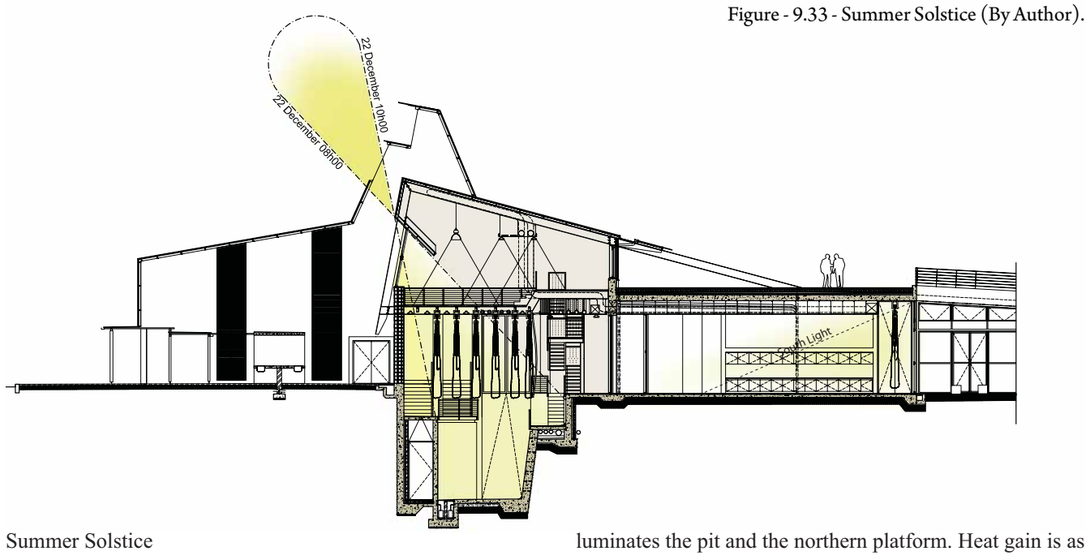
Figure - 9.32 - Spring Equinox (By Author).



Spring Equinox

Natural light enters deep into the building, making the need for artificial lighting much less during the morning hours. Heat gain form direct sunlight us minimal due to the tinted glazing system. From 10h00 the direct sunlight is restricted to the pit floor and the processing floors on the northern edge. This light allows backlighting and will not hinder the workers. Constant south light enters the processing spaces. These spaces must avoid any direct sunlight, because these spaces are mechanically cooled to be a constant 7°C.

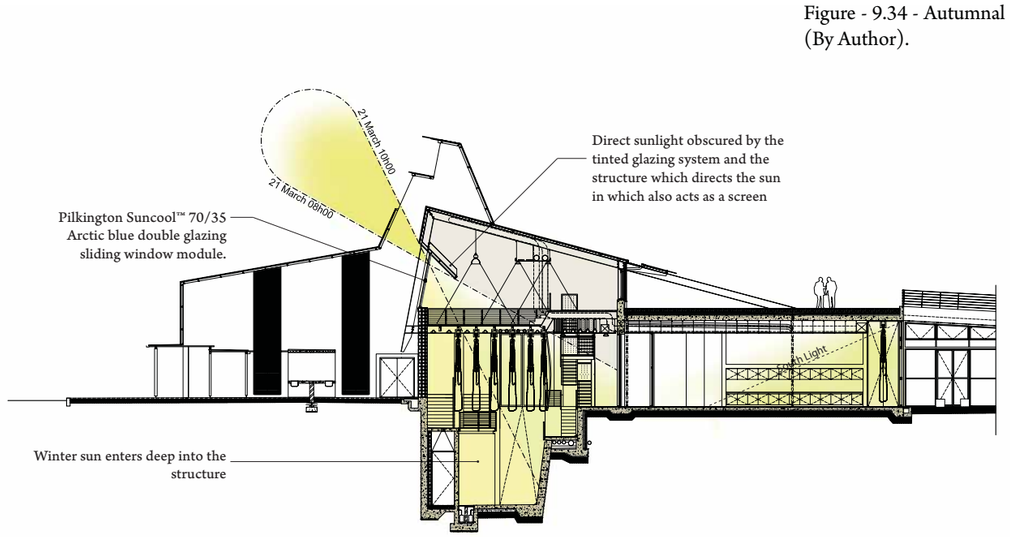
Figure - 9.33 - Summer Solstice (By Author).



Summer Solstice

The harsh summer sun enters the slaughter pit from 6 am to 11 am. During the early hours of the morning the sun illuminates both working platforms, where after it just illuminates the pit and the northern platform. Heat gain is as previously stated avoided by the Pilkington Suncool double glazing module on the northern edge. The glazing system allows maximum illumination with minimum heat gain.

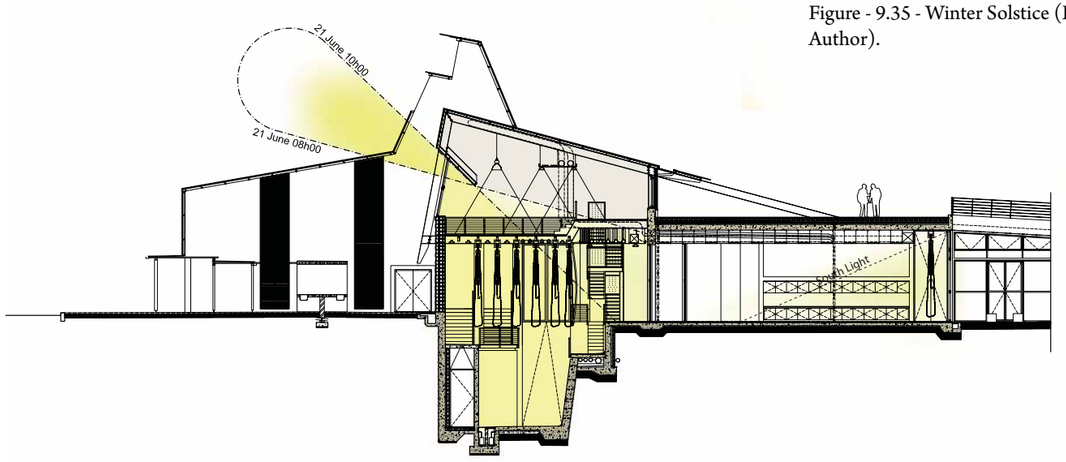
Figure - 9.34 - Autumnal Equinox (By Author).



Autumnal Equinox

The sun starts the penetrate deeper into the structure, providing ample light to the slaughter pit interior. Light is mostly kept out of the systems space in the roof by the roof structure creating a shelf which directs the light into the lower part of the building. The slaughter pit is illuminated well enough to require minimum artificial lighting during the morning hours.

Figure - 9.35 - Winter Solstice (By Author).



Winter Solstice

Early morning sun enters very deep into the building, illuminating the entire slaughter area. Very little to no artificial lighting is required during the morning hours (8 am - 12am), saving energy. The slaughtering starts at 6 am, therefore artificial lighting will be required between 6 am and 8 am. The tinted glazing system will protect the workers from direct sunlight and the mechanical cooling system from unnecessary heat gain. The double glazing system with the tinted glass act as a good insulation, maintaining the ambient temperature within the slaughter area.

SYSTEMS SUMMARY

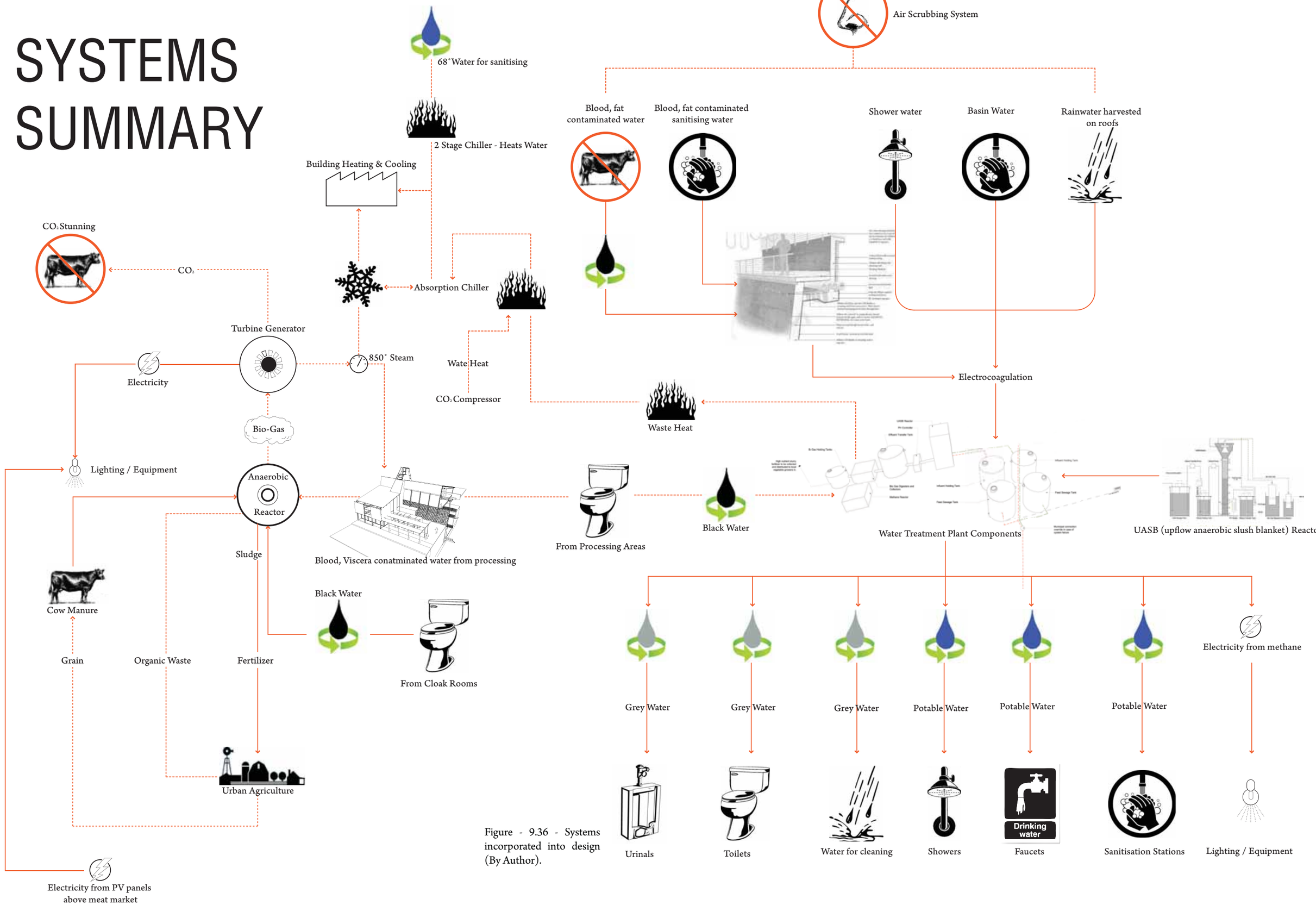


Figure - 9.36 - Systems incorporated into design (By Author).