

2.4

#FarmingTechnologies

This chapter looks at new farming technologies being tested in other parts of the world. Technology that aims to be implemented at The Byre. The Byre aims to not intrude in current farming systems, it is a modern facility that provides farmers and communities with the means and support to develop farming in South Africa. It marries the pragmatic elements of farming with everyday needs.

Tweeting cows



Eat, milk, eat, milk, eat, milk. It never gets old. 13.9 kg from the udder.

4:03 PM Apr 13th via API

Reply Retweet



ChargeCindy
Charge Cindy

Above (50) and below (51): Screen shots of tweets of the tweeting cows. (O'Dell, 2010)

At Wed, Apr 14 '10 10:51 am I entered the robot stall. In 3:34 secs. the milker massaged out 13.1 kgs of milk.

8:00 AM Apr 14th via API

Reply Retweet



Jerry_J_Lo
Jerry J Lo

At the University of Waterloo, Ontario, Canada, a herd of 12 cattle are using twitter to “teat tweet”, a Critic Media Lab Project, that allows cattle to tweet about their milk production, RFID transponder glitches, eating habits and technical issues with the milking machine. (O'Dell, 2010: online) The new social media project, has been named the Teat Tweet Dairy Diary, is showing that the farming industry is changing. (Lauren, 2010: online)

Lab members have teamed up with dairy farmer and twelve of his favourite cows on Buttermine Farms in Ontario. The tweet data comes from a modern, computer operated and cow-initiating milking system. (O'Dell, 2010: online)

The twelve cows wear a RFID (Radio Frequency Identification) tag that is used to record the cows activities with a central computer. As the cow approaches the robotic milking pen, the tag is read by the computer and determines if the cow is scheduled to be milked, based on the cows stage of lactation and average daily milk production. If the cow is scheduled to be milked it would be let into the pen, a robotic arm washes the cows teats, attaches to the teat (with the use of lasers to located the teat), the cow is milked while eating feed. The milk collected, milking time, milking duration, and feed eaten is recorded by the main computer and the data is stored in the computers database. (O'Dell, 2010: online) The tweets are generated by the cows interaction with the computers/robots.

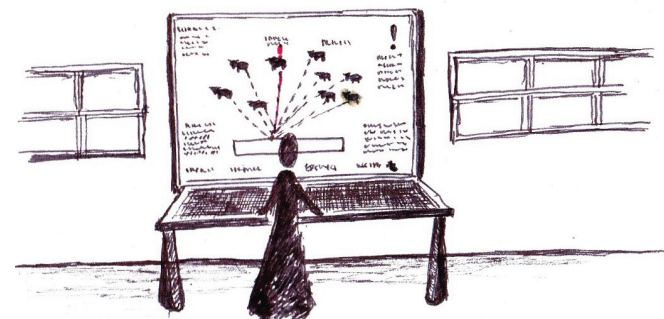
The milking system used is called Voluntary Milking System (VMS), this hands free milking technology

acts more as a information manager than a farmer. It is becoming popular in farms in Ontario, with about 25 farmers in the area using this technology in the southwest region Ontario alone. It is also widely used in Europe. (Lauren, 2010: online)

The Teat Tweet Dairy Diary was conceived as a means for the farmer to regain intimacy with his cows, and allow the milk consumers to learn more about where their milk comes from. (Lauren, 2010: online)

This technology would be proposed and incorporated at The Byre, for assisting the recording of important information regarding cattle every day activity. Capturing the data of the cattle's feeding habits, their health condition and tracking their movement and activities throughout the day.

As this technology works by the interaction of cow and computer. Receiving points would be strategically placed on the site, this way once the tag worn by the cow has been read, its location is recorded. This technology could also be a useful means of centralising all the information about a respective cow. The cattle's health information can be recorded whenever the cattle visits the Veterinary Clinic, this information can then be then accessed when needed.



Cattle Identification:

In 1922, a dairy researcher at the University of Minnesota, Dr. W. E. Petersen, conducted a research report on obtaining nose ink prints and its uses. The following conclusions were identified:

- The nose print (the area from the upper lip to the top nostril) is a result of subcutaneous (under the skin) glands which cause distinct elevations and ridges.
- Each print or pattern of ridges and grooves is unique to that animal.
- Nose prints can be used as a form of positive identification and can be made from a small portion of print.
- The procedure of ink noseprinting is simple and practical to use.

(Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources, 2007: online)

Animal identification is used for keeping accurate production methods and information of the herd. Nose printing as a form of identification is effective in that it can not be altered, like many other methods of identification. (Neary and Yager, n.d: online)

Cattle nose prints are similar to human finger prints, each line and dot found on a nose print is unique to each cattle. Nose printing is also a more humane method of identification as opposed to branding and tattooing. (Neary and Yager, n.d: online)

Effective identification is also used for identifying cattle ownership, some countries are using noseprinting

to identify stolen cattle. (Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources, 2007: online)

At the moment, noseprints are acquired by restraining the animal in a head gate, drying the nose area and applying some ink to the hairless area. An index card, braced by a piece of wood is then placed on the inked area to acquire the noseprint. (Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources, 2007: online). With the fast paced development of technology, the noseprint may be able to be read using a non evasive scanning device.

Nose prints



Above (52): Noseprints from the same cow. (Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources, 2007)

Below (53): Photograph (Health and Consumers Directorate-General. N.d)





It was a stifling hot day as I stopped next to the road in rural KwaZulu-Natal to admire some Nguni cattle grazing next to the road. As my eyes feasted on the beautiful shapes and colours, I noticed a wizened old man leaning on a stick, also gazing at the cattle. It was a timeless moment when I asked him where these cattle come from. With a far-off look in his eyes he nodded and slowly said: “These cattle have always been here.”

Chris Van Der Merwe

CELEBRATION





"I have dreamed of my coloured cattle in the hills of yellow
and brown"

Johnny Clegg & Juluka

3.1

Site and Context

This chapter looks at the site options explored and finally the site selected and its context.

Site selection:

Below: Locality map showing the site in relation to Johannesburg and Vereeniging.

Right: The proposed site shown in red along side the R59 highway.

As the thesis was initially intended to be an abattoir, the original proposed site was just outside the city of Johannesburg, Meyerton, in the Midvaal region. The midpoint point between Johannesburg and Vereeniging. On site there is an existing chicken farm and a greens market.

It is situated along side the R59 highway, on Corridor R59, an initiative by the Midvaal Local Municipality to promote development along this section of the highway. The R59 highway is a significant route that connects Johannesburg and Ekurhuleni (East Rand) to Meyerton and Emfuleni (Vereeniging / Vanderbijlpark) or Vaal Triangle, in the south of Gauteng. The concept for the development is for a desired line

between two major nodes, with land uses distributed along the highway.

The Midvaal area is predominately a rural area with extensive farming consisting approximately half the physical area. The west side of the highway has been allocated for residential and agricultural use, while the east of the R59 largely serviced for engineering and infrastructure.

This section of highway sees about 35 400 vehicles per day, this was another feature that made the site ideal for the proposed abattoir, as the public interface was a key component to the project.



Once the thesis had changed focus, the site in mid-vaal was no longer appropriate, it was an ideal site for farming, but not ideal for incorporating a learning and research component.

A different site was needed, a location with abundant space for the cattle to roam free and an institutional infrastructure friendly area was required to facilitate the learning and research component.

Onderstepoort, University of Pretoria's, Faculty of Veterinary Science was suggested, and seemed to be a place that best suited the intentions of the thesis.

The university's existing academic infrastructure

lends well to fulfilling one site criteria, the learning component, this will add to the university's existing tertiary curriculum and programme. Onderstepoort campus is an appropriate site selection as it is a institution of learning as well as research.

The campus also houses several types of animals such as horses, cows, and dogs. The animals are used for practical training and for treatment purposes. Many of these animals are private owned by members of the public. (University of Pretoria, 2011). As the campus is already equipped to facilitate animals, cows for The Byre can be accommodated for, without having to change too much of existing facilities and infrastructure catered for the animals.



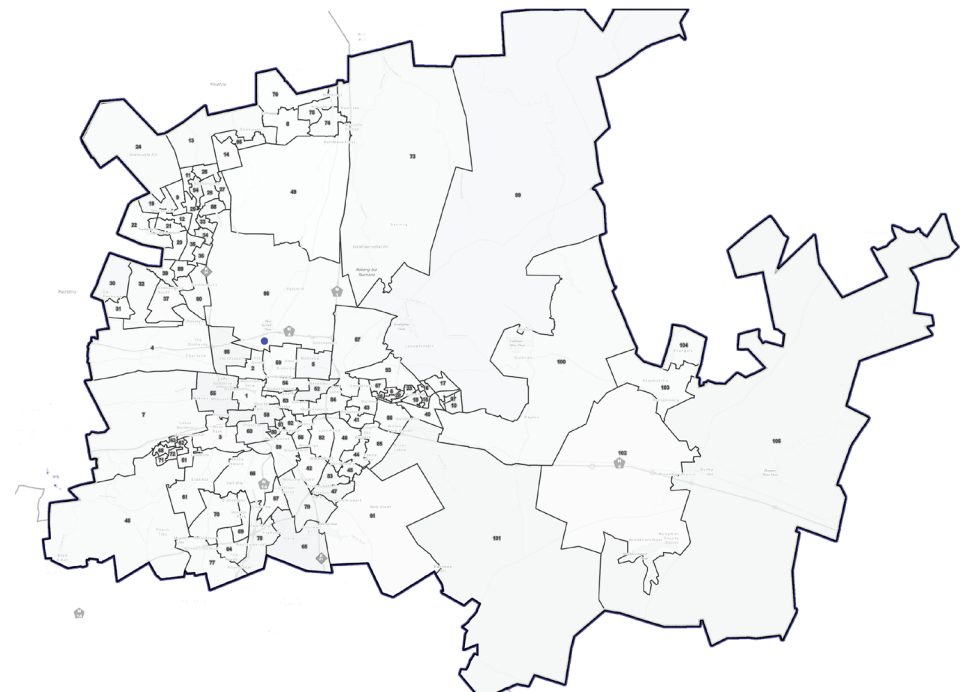
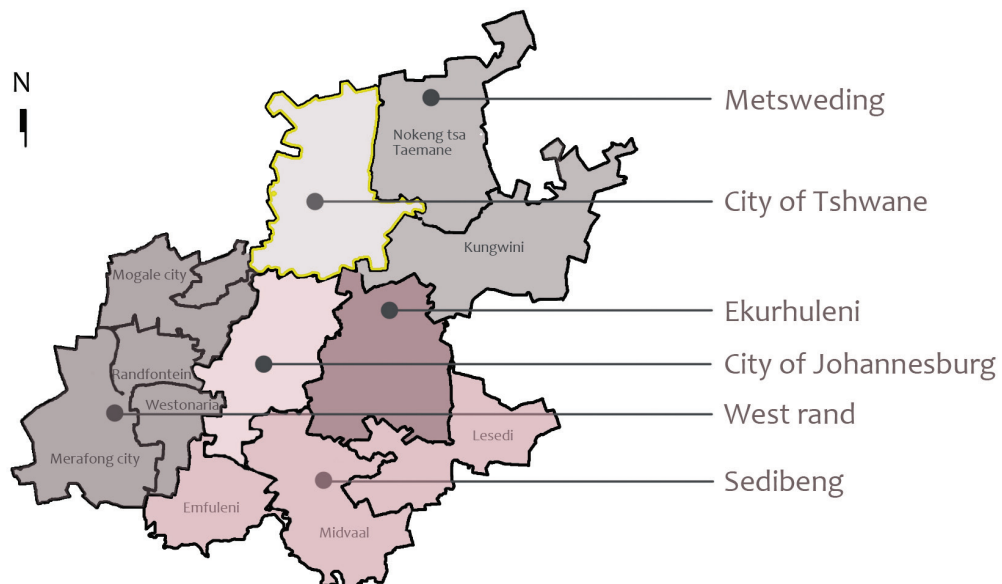
Left top: Panoramic view of proposed site (for abattoir). View of site from across the R59 highway.

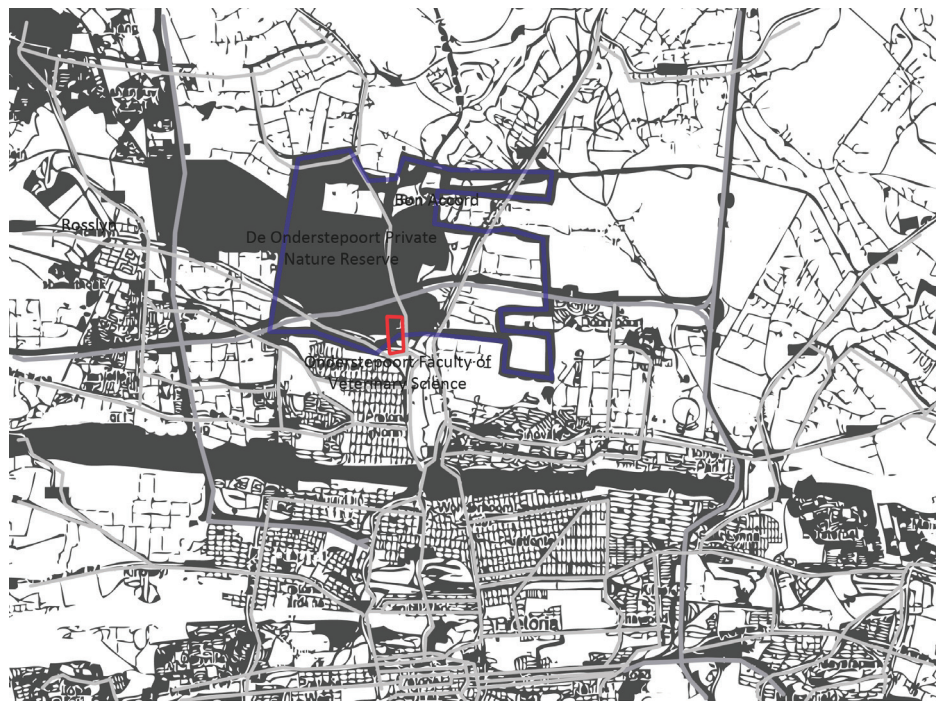


Left bottom: Panoramic of site in Midvaal.

Below: Regional map of Gauteng

Below right: Ward map of City of Tshwane region.

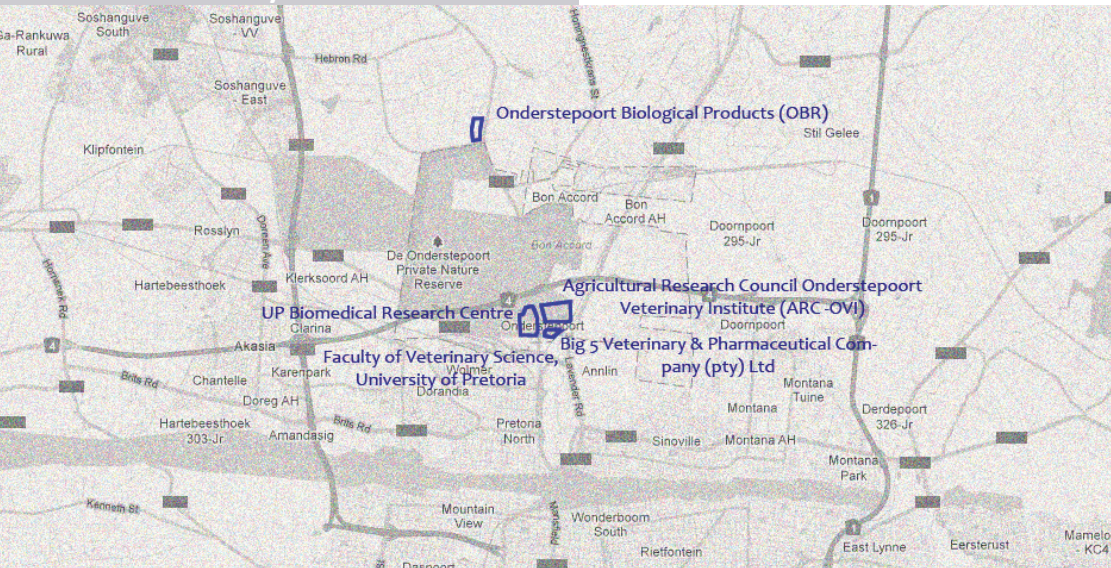




Below left: : Map of City of Tshwane, Onderstepoort is outlined in blue and the University of Pretoria, Faculty of Veterinary Science outlined in red.

Below: Site map of the Faculty of Veterinary Science, Onderstepoort campus.

Site study:



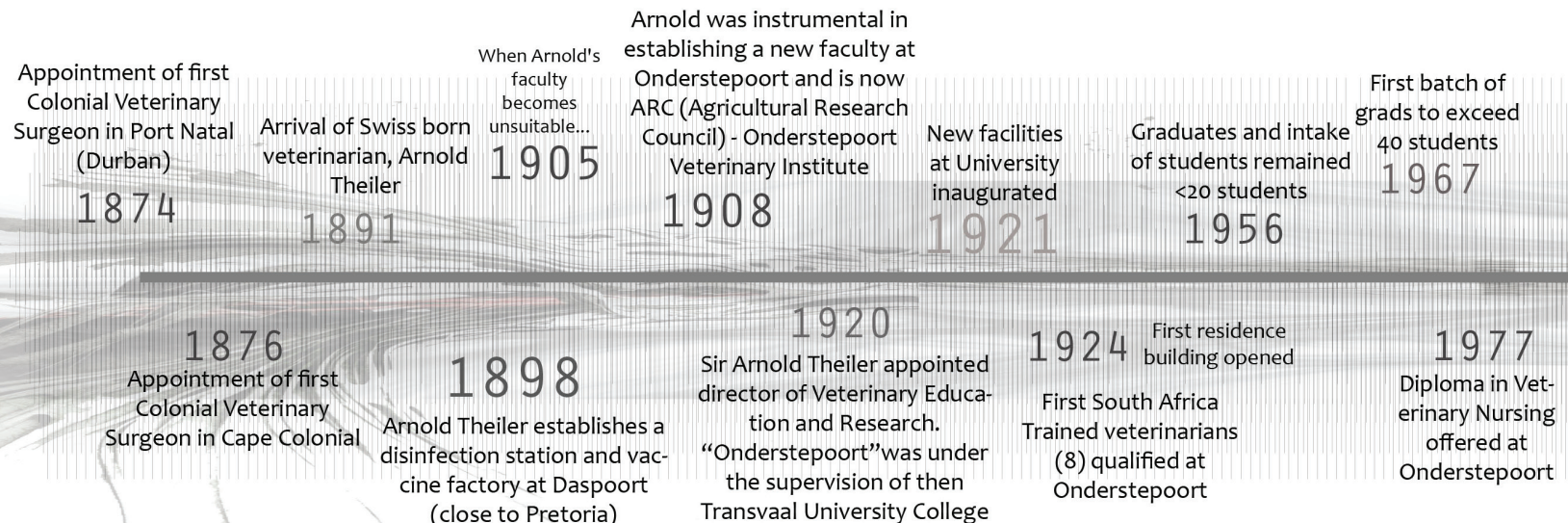
The University of Pretoria's, Faculty of Veterinary Science, Onderstepoort campus, is situated approximately 20 km from north west of the Hatfield main campus and 15 km north of City of Tshwane's city centre. The Faculty is situated on a ring-fenced property of 65 hectares. The buildings on the campus cover a total of 55 000 m², approximately 8.5% of the site. (University of Pretoria, 2011)

Onderstepoort comprises of 5 main entities, varying from organisations and institutions, small industries and holdings.

- The Faculty of Veterinary Science of the University of Pretoria



University of Pretoria
Faculty of Veterinary Science
ONDERSTEPOORT



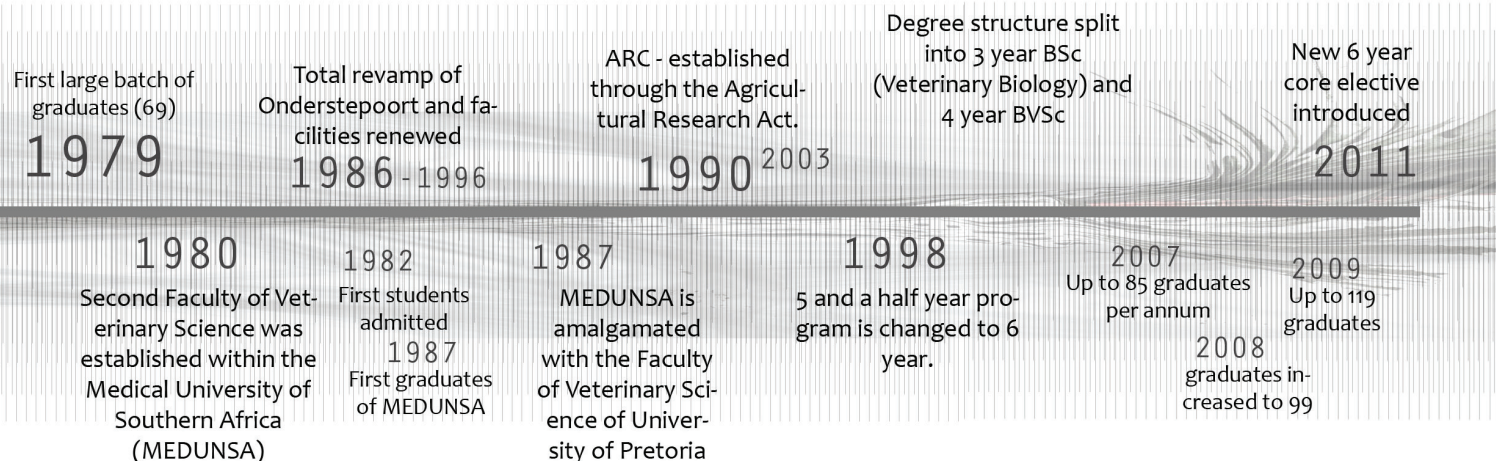
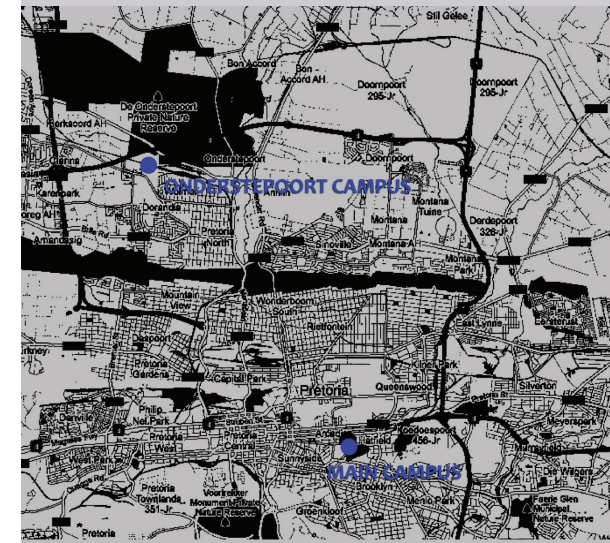
- The University of Pretoria Biomedical Research Centre (UPBRC)
- The Agricultural Research Council Onderstepoort Veterinary Institute (ARC-OVI) and its Exotic Diseases (EDD)
- Onderstepoort Biological Products (OBP)
- Big Five Veterinary Pharmaceutical Company (Pty) Ltd

There are 46 veterinary facilities in Africa, The faculty of Veterinary Science of the University of Pretoria was established in the early 1920's, making it the second oldest in Africa and the only one of its kind in South Africa. (University of Pretoria, 2011)

The Veterinary Science Faculty has 5 academic departments responsible for teaching, conducting re-

search and rendering services. These programmes are further facilitated by services provided by an academic hospital, various departmental laboratories, general and administrative sectors, a teaching animal unit and numerous research centres. The Veterinary Academic Hospital boasts state of the art facilities for the clinical departments and is the focus of the Faculty's service driven activities to the immediate community. It also serves as a national referral clinical facility. (University of Pretoria, 2011)

The Faculty has approximately 1 000 students, offering undergraduate veterinary degree programme; a veterinary nursing diploma programme; as well as a variety of postgraduate academic programmes. (University of Pretoria, 2011)

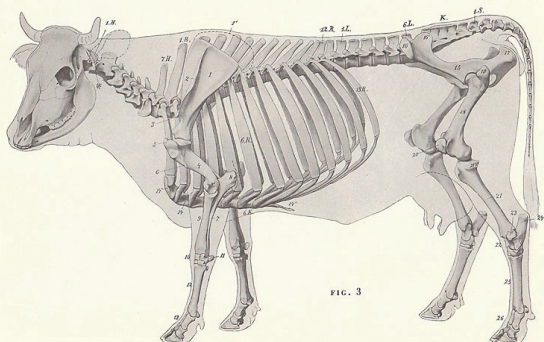


Above: Map indicating Onderstepoort campus in relation to main campus.

Left: Timeline showing the history of the Faculty of Onderstepoort, University of Pretoria. Data source: (University of Pretoria, 2011)

Far left: University of Pretoria emblem. (University of Pretoria, 2011)

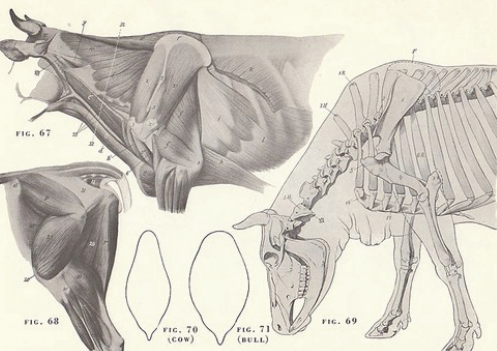
THE COW AND BULL PLATE 3



Above (67): Drawing: The Cow and Bull, skeletal structure. (1950)

Below (68): Drawing: The Cow and Bull (1950)

THE COW AND BULL PLATE 4



There are 5 Academic Departments:

- Anatomy and Physiology,
- Companion Animal and Clinical studies,
- Paraclinical Studies,
- Production Animal Studies, and
- Veterinary Tropical Disease.

Department of Anatomy and Physiology:

Anatomy:

Here, the veterinary science and nursing students (both undergraduate and postgraduate) are taught the macroscopical and microscopical anatomy. The main focus of research in the anatomy department is the study of wild animals and the reproduction biology of birds and mammals.

Physiology:

The Physiology section is responsible for the teaching and the research of basic physiology (Biological study of the functions of living organism and their parts) and physiological chemistry. The course is problem-based focusing on the holistic approach to treating animals. The research is focused on metabolic adaptation of indigenous sheep and goats, water and electrolyte balance in sheep, and certain features of nanotechnology.

The Electron Microscope Unit (EMU)

The EMU was established at the Faculty of Veterinary Science in 1976 and provides a quality diagnostic service, research, support, and training in all aspects of electron microscopy to the greater veterinary community. (University of Pretoria, 2011)

Department of Companion Animal Clinical Studies:

This department is responsible for the teaching, research and the services in the discipline of Anaesthesiology (Study and practice of anaesthetics), Clinical Pathology, Dentistry, Diagnostic Imaging, Ophthalmology (Study of structure, functions, and diseases of the eye), Equine Medicine & Surgery, and Small Animal Medicine & Surgery. This department also supports the veterinary profession in South Africa by providing a referral service. (University of Pretoria, 2011)

Department of Paraclinical Sciences:

The department was formed in May 2001 following the restructuring at the Faculty. Paraclinical Studies comprises of four divisions: Pathology (science field of study of the nature of diseases, the causes, processes, development, and consequences), Pharmacology (The study of the science and clinical application of medication), Toxicology (The study of poisons, detection, effects and treatment) and Veterinary Public Health. Each division is responsible for the maintenance and the development of their respective disciplines. The Pharmacology and Toxicology Division also serve as an information centre for veterinary drugs and animal poisoning. (University of Pretoria, 2011)

Department of Production Animal Studies:

The department of Production Animal Studies is subdivided according to the different activities/services offered:

Animal Production and Ethology - focuses on basic animal production, welfare and animal handling.

Epidemiology - responsible for all aspects of veterinary epidemiology (Study of the causes, distribution, and control of diseases)

The Herd Health - visits various production animal farms and empowers students to practice prevention medicine.

Production Animal Clinical - Responsible for the taking care of the medical and surgical production of animal cases in Onderstepoort Veterinary Academic Hospital and surrounding communities.

Reproduction - responsible for the study of productive disorders and biotechnology in all species. Specialists in this field supply a service to farmers and breeders.

Poultry Reference Centre - covers all aspects of poultry health and production, and work together with the poultry industry.

The department of Production Animal Studies work hand in hand with the Centre for Veterinary Wildlife Studies that coordinates all research and teaching activities in the Faculty related to the conservation and game ranching of indigenous wildlife. (University of Pretoria, 2011)

Department of Veterinary Tropical Diseases:

This department specialises in the research and training of postgraduate students. The departments ob-

jective is to be the leading institution for research and the regional postgraduate centre. It has been recognised by the World Animal Health Organisation as a Collaborating Centre for Training in Integrated Livestock and Wildlife Health and Management, a first of its kind in Africa. (University of Pretoria, 2011)



Above: Slr Arnold Theiler Building

Below: Onderstepoort Veterinary Academic Hospital



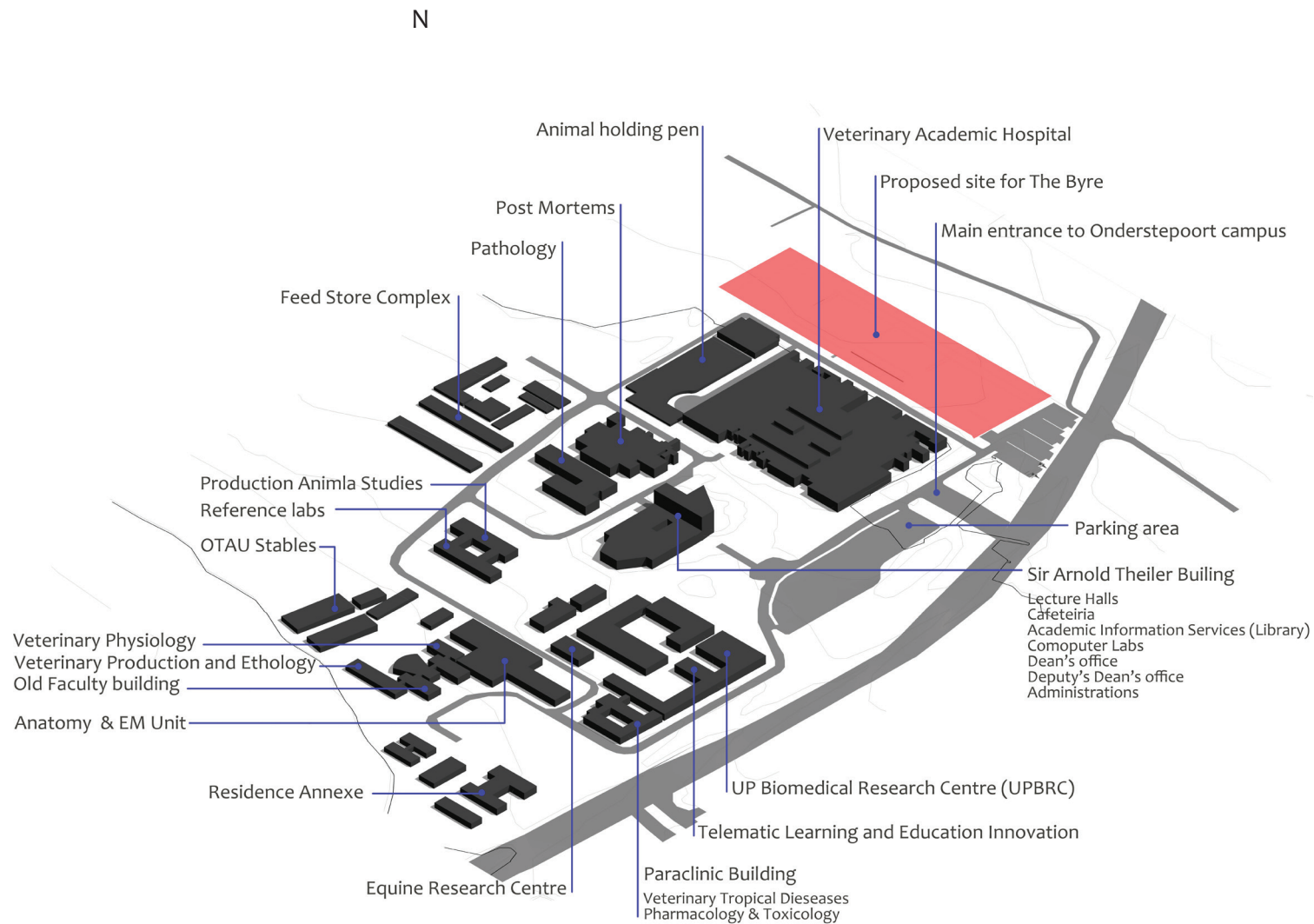
Site selection:

A portion of site to the north edge of the campus has been proposed for The Byre. Its currently occupied by covered parking, the lost parking bays will be re-covered by the new proposal. As it is on the edge of

the site, it makes the proposed building not just for the university but also for the public. The north edge of the site faces the N4 highway, making its presence visible to the public.



Right: Map indicating Onderstepoort campus, proposed site (for Byre) highlighted in red.



Left: Axonometric of Onderstepoort campus, indicating existing buildings and their respective departments.



Left: View of Onderstepoort Campus from the N4 highway.

Below: View of proposed site for The Byre.



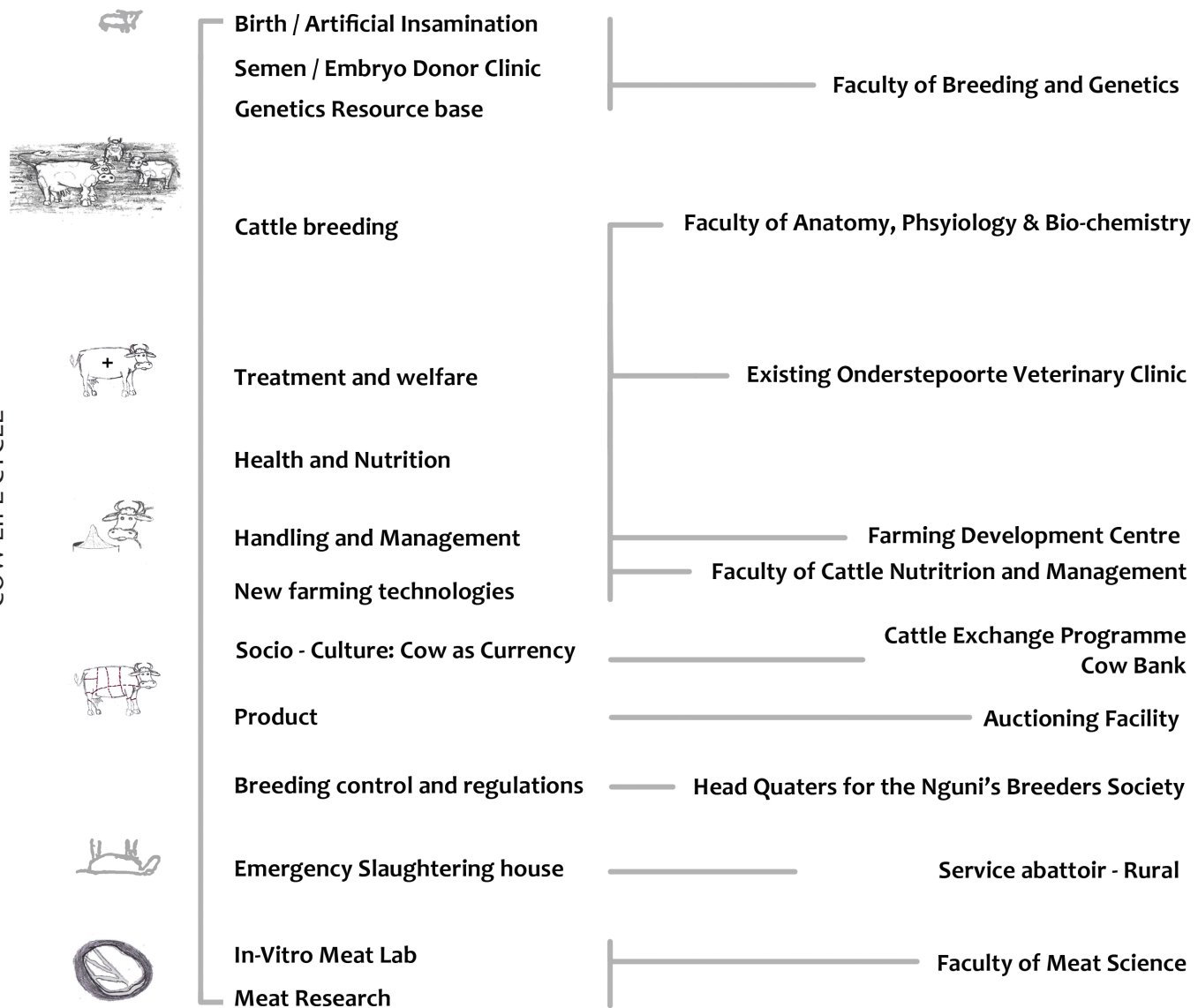


69. Photograph [Portrait of Herd] n.d.

3.2

Programme

COW LIFE CYCLE



The Programme of the building was determined by examining the life cycle of cattle, different elements pertaining to cattle wellbeing, survival and breeding and how these are related into architectural terms.

The flow diagram on the left explains how the programme was developed. The programme can be divided into three categories.

1. **Research:** A facility for research to be conducted will be accommodated for. The research conducted will pertain to the preservation and welfare of the cattle.

2. **Tertiary education:** Faculties will supplement the current University of Pretoria Veterinary Science's curriculum in the field of agriculture and Science relating particularly to cattle.

3. **Services:** Facilities that serve the public, as well as provide a service for the local community and developing communities in the greater Gauteng region. It will also serve as a base point for local farmers.

The Byre in essence is comprised of three main fields relating Nguni cattle preservation and welfare. That of Agriculture, Science and local farming.

The programme unpacked:

A Visitors centre - The Byre will be visited by school learners and the general public for educational activities.

Information area / Nguni history display area - located in the visitors, administration area, at the entrance of the building. Here the rich history of the Nguni and the Zulu will be told. This area will also provide the university with a formal exhibition space for open days and other events hosted by the university.

Nguni Cattle Breeders Society (NCBS) Headquarters

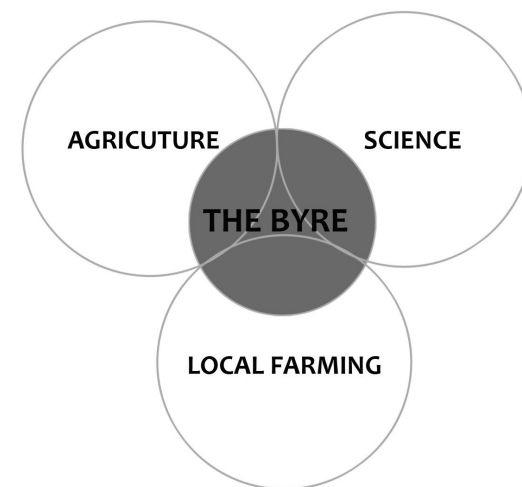
- The NCBS is a non profit organisation that is responsible for regulating how Nguni cattle are kept and treated. NCBS's current is located in Bloemfontein.

The NCBS is responsible for regulating and controlling the registered Nguni Cattle in South Africa. They strive to conserve and enhance the unique characteristics of the Nguni breed. The NCBS also support and serve the needs of the society members. (SASAS, 2009)

Faculty of Breeding and Genetics - This faculty will consist of facilities for researchers as well as training labs for students. There will be a semen and embryo donor clinic, artificial insemination (A.I) and a genetics resource base for the storage of cattle stem cells for both the purpose of preservation and continuous research.

Bovine Veterinary Clinic - The existing veterinary clinic mainly catering for the veterinary needs of small domestic animals such as cats and dogs. They also have a section of the clinic that facilitates larger domestic and wild life animals such as horses and cows and other wild animals. The Byre will introduce a Bovine Veterinary clinic, specifically catering for the veterinary needs of the cattle kept on site as well as provide a service for cattle of local farmers in the

Below: Diagram of the components that make up The Byre.



greater region of Pretoria area, and a referral Veterinary Clinic for Gauteng and South Africa.

Faculty of Animal Anatomy, Physiology and Biochemistry - Lecture halls will be provided for. This faculty will be linked to the existing university Faculty of Anatomy and Physiology, it aids to compensate for the shortage of lecture halls currently experienced at the university.

Faculty of Animal Nutrition and Management - This Faculty will serve as an extension to the ARC (Agriculture Research Centre), situated opposite the Onderstepoort Veterinary Science Faculty. A research facility for testing different grass types and its effect on cattle. It also aims to facilitate the research of new and improved means of farming, with particular focus on new advances in farming technologies.

Farming Development Centre - A handling and management training centre will provide local and developing farmers with continuous development skills as well as provide information and training needs for cattle handling and managing. The Farming Development centre will be a place that would facilitate round table discussion, a forum for exchanging farming techniques, challenges and breeding advice and ideas between local farmers and specialists.

Faculty of Meat Science - Here, the research of meat will be conducted. A research centre examining the nutritional attributes, factors affecting meat quality, production and etc. Most importantly this will be a facility where the future of meat production will be researched. As the demand for meat increases, placing immense pressure on the farming sector, a means of

relieving the demand and providing and exploring an alternative means of meat production. In-vitro meat, vat labs for lab-grown meat will be provided for.

Auctioning Facility - The auctioning facility will be managed by the NCBS (Nguni Cattle Breeders' Society) for the auctioning of registered Nguni cattle to breeders and interested members of the community.

Cow Bank - As discussed in one of the earlier chapters, the Cow Bank will facilitate the Nguni Cattle Project, the project will aid developing communities by loaning the community ten calf bearing heifers and one bull in order for the community to breed their own herd. The 'loan' is for a period of 5 years by the end of which the community is required to return the all the loaned cattle with one of their bull paid as interest, the returned cows are then given to another community. The Cow bank also ensures that any exotic cattle owned by the community is replaced with a registered Nguni bulls to prevent mixed breeding.

A cattle housing service for cattle, owned by modern cultural practicing South Africans who do not own a farm or have space to keep their cattle in the city, will be provided for The Byre. A type of 'cow hotel', providing a service in the form of housing, grooming, feeding and treating the cattle. The terms and conditions of the stay would be negotiated with a consultants at the Cow Bank.

The Cow Bank aims to provide a service to the community and the contemporary traditional South African, further services would be explored to add to the list of service options available.

Further more, the new technology initiated at the University of Waterloo in Ontario (discussed in the farming technologies chapter) where cows are able to tweet by means of a computer interacting with the RFID (Radio Frequency Identification) tag on the cattle. This technology could be adopted at The Byre specifically for enabling communication of between the cattle kept in the cattle housing / hotel service and the cattle owners. The owners would be able to 'follow' their cattle on twitter and monitor their daily activities, health condition and feeding habits without having to come to the institution to see their cattle and monitor their health.

Grooming facility - As The Byre is a research institute, that not only houses cattle for research purposes but also for the treatment of cattle of farmers in the area and South Africa. The cattle staying at The Byre as part of the cattle housing service will be cared for and groomed regularly, enhancing their stay at The Byre.

Methane exchanger room - Methane from the cattle manure will be collected and converted into methane gas in a methane gas exchanger to provide the university with its electricity needs.

Cow Shed - The cows on site will sleep in a cow shed that has been incorporated into the The Byre. Cattle housing requirements were looked to ensure the animals on site are comfortable and that all their requirements are met.

Animal Management - The Animal Management team are responsible for the welfare of the cattle on site as well as meeting all their other requirements. They will ensure the cows are fed, watered, checked

daily and treated when necessary.

Programme in their respective categories:

1. Research:

- Breeding (also Artificial Insemination lab)
- Genetics (with Genetics Resource Base)
- Animal Nutrition and Management
- Farming Development Methods
- Meat Science (with In Vitro labs)

2. Tertiary education:

- Faculty of Animal Anatomy, Physiology and Biochemistry.
- Faculty of Animal Nutrition and Management.
- Faculty of Meat Science
- Library
- Computer lab

3. Services:

- Visitors Centre
- Nguni Cattle Breeders' Society
- Farming Development Centre
- Bovine Veterinary Clinic
- Semen and Embryo Donor Clinic
- Auctioning facility
- Cow Bank
- Grooming facility



56. Photograph [Wide angle cameras: Cows] n.d.

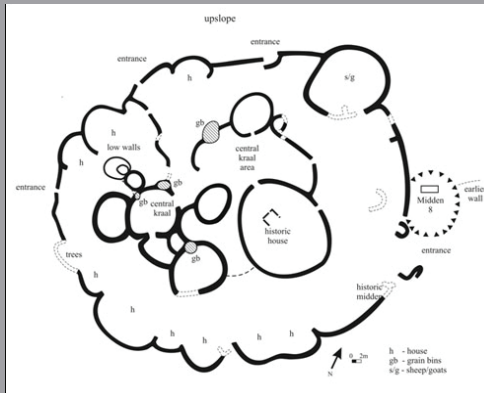
3.3

Precedent studies

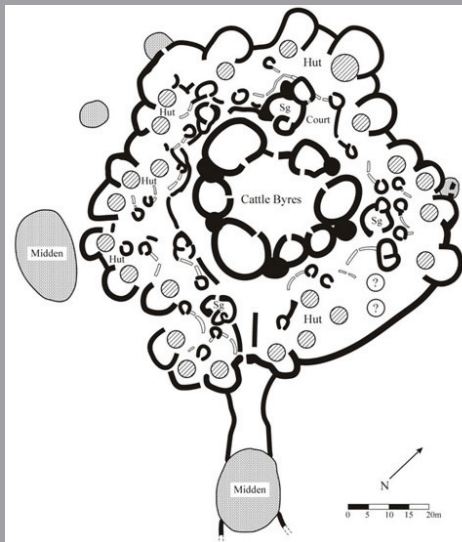
The case studies examined in this chapter were studied based on four themes:

1. Man and beast living together
2. Landscape + architecture
3. Traditional farm buildings
4. Design principles for cattle

Man and beast living together: The Kraal



57. Plan of Klipriviersberg settlement, Johannesburg (n.d.)



58. Plan of Molokwane homestead, Gauteng (n.d.)

The Kraal was studied as it is a great example of where cattle were kept in close proximity with man, in their case, their caretakers.

In a Zulu traditional homestead, the cattle kraal is located at the centre of the homestead. All doors often open out to the cattle kraal where they spend every evening. This association is a result of rich legacy of cattle metaphor and similes in the Zulu language. (Entabeni Communications, 2010: online).

Zulu life revolved around the homestead. Clusters of beehive shaped huts circled around the cattle kraal, on a slope for drainage. The homestead was a stage, whereby family life played out. "It was the confines of the homestead that the pageant of life was enacted - children were born and socialised, food was prepared, clothing and utensils crafted, and the warm and sometimes strained relation of the family group were experienced." (Poland, Hammond-Tooke, Voigh, 2003: p20)

The centralisation (physically, in the centre of the kraal) of the cattle expressed both symbolic importance both economically and spiritually. Not only are the cattle (that provide sustenance and social status) guarded this way, it is also said to be the "local habitation of the ancestral shades" who "brood" over their descendants. (Poland, Hammond-Tooke, Voigh, 2003: p20)

The entrance to a kraal is situated at the lowest most part of the site, firstly for practical reasons to let rain-water out therefore cleaning the kraal when it rains. Another reason is that foes would have to fight uphill

when attacking.

The cattle are kept on the centre of the kraal where they can be supervised, there is a separate gate that leads into cattle's quarters. The Chief's hut is located at the very top of the Kraal and to its right is the Chiefs's mothers quarters. To the left of the Chief's hut are the chiefs wives huts. To the left of the entrance is the unmarried girls hut and on the left, the unmarried boys hut.

The cattle being the centre of attention, will be constantly viewed and looked upon at any part of the building will be implemented in the Byre. The connecting passages that separate the four building segments will have viewing decks overlooking the pasturing areas. Similar to some of the South African homesteads where a platform is built for the cattle caretakers stand to view and inspect all their cattle.

As the cow bank and the Nguni Cattle Breeders Society is considered to be some of the most valuable programmatic element of the building, it is raised to conceptually relate to the how the Zulu kraal is built, on a slope.

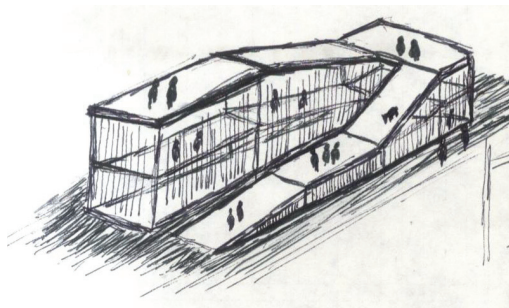


The Byre is a building for both cattle and humans a practical design that would easily accommodate for cattle is a building that allows the landscape to filter into the building.

A-cero, an international architecture firm based in Madrid, Spain, with principle architect, Joaquin Torres. Won the competition for an academic centre that Researchers Renewable Energy Sources. (Bustler, 2009: online)

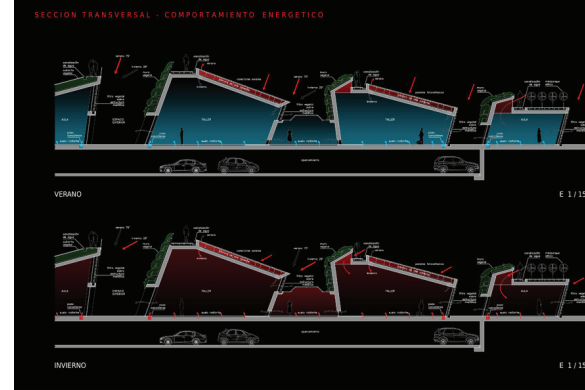
The Brief required that the building blends into the surrounding landscape. The building is 9 000 m² consisting of teaching areas, library, audio-visual, auditorium, administration area, facilities and services. (Bustler, 2009: online)

A-cero, has raised the centre as a landscape building, merging the architecture and landscape. The ground planes raises to to reveal openings and access. The walls and coverings adapt to the orientation and the programme it feeds. The idea is to cover the building, making it an extension of the park and green space. Designated areas will have photovoltiac panels and other green energy saving systems. (Bustler, 2009: online)



In the case of the Byre, the cows are kept at natural ground level. In the initial design stage, using different levels was explored and making the cattle access certain levels relating to the programme where the presence of the cattle is needed for research purposes. Later though, with the realisation that cows are in fact lazy animals and making the cattle travel up levels would have been cruel and a little far fetched.

Landscape & Architecture



Above (59): Section of Research Renewable Energy Source centre. (A-cero, n.d)

Below (60): Perspective (A-cero, n.d)



Traditional Farm Buildings

Traditional farm buildings:

The essence of planning and arranging these farm building is obviously function, the circulation of people and animals and the change in nature of use over time (there may need to be alterations and additions later). (Gunn, 1935, p13)

There three main circulations to consider:

1. Entry and exit of animals

Access needs to be direct and practical, involving no sharp turns, passages, or slippery surfaces. Routes for the animals are mainly to and from the grass lands. (Gunn, 1935, p15)

2. Feeding: delivery, storage, and distribution

All feeds are fairly bulky and heavy, delivery vehicles should be able to drive up to the storage area. Protection from rodents should be accommodated for, this is sometimes achieved by raising the storage space. (Gunn, 1935, p16)

3. Dung

The disposal of dung should be direct and easy as possible. (Gunn, 1935, p16)

Barns:

Buildings designed to shelter animals should be made of robust and durable material.

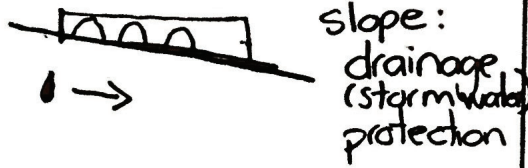
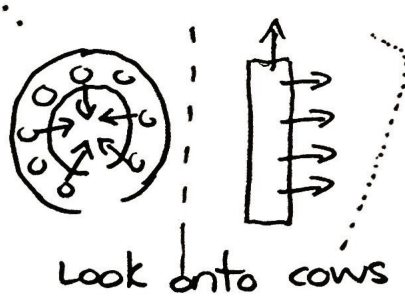
“...farm buildings in the past accommodated several processes and also housed several activities or functions ...Sometimes each function justified a separate building, sometimes several functions were accommodated under one roof.”

(Brunskill, 1999, p13 cited in Gaskill & Owen, n.d)

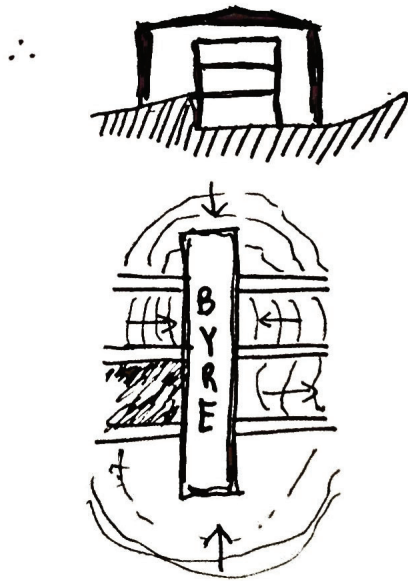
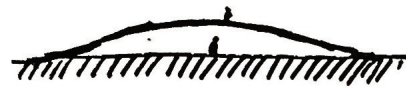
The circulation routes of all the building users, cows, students, researchers, lecturers and staff was explored and very influential in the design process.

In terms of the cattle, the circulation routes from the sleeping areas, to feeding areas, to milking area, to grooming area and to the Bovine Veterinary Clinic was carefully resolved in order to make the routes as efficient as possible.

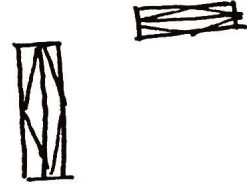
The Kraal



Landscape and Architecture



Farm buildings



- separate different functions.
- Consider: Entry | Exit
Delivery
Dung

Designing for cows

Cattle develop friendly relationships with each other, based on mutual preferences. In the wild, cows rely on each other for detection and avoidance of predators. A solitary cow, in the wild, has very little chance of survival. There is a tight cohesive social structure within a herd. Partners develop lasting, loving, and stable hierarchical dominated relationships with other, making the interactions amongst them predictable and also provides a maintained harmonious coexistence as a coherent social group. (Reinhardt, 1980). As opposed to intensive housing systems, aggressive conflicts amongst cows are uncommon, the presence of horns pose no threat in the natural, free ranging farming systems, the animals have enough room for respecting each other's dominance-related spatial needs. (cited in Reinhardt and Reinhardt, online)

Dominance rank in a herd is determined by age, which therefore relates to the length of their horns. Old cows that are no longer the strongest and heaviest, do not lose their position in their herds social hierarchy. Their horns allow them to retain the respect from their herd. (Reinhardt, 1980). Cattle do not use their horns to harm each other, subordinate cows avoid conflict by moving out of the way of dominant herd members. When cattle have been dehorned, the biological foundation of the hierarchical system is destabilized, this leads to high rates of aggression. (Reinhardt, 1975; cited in Reinhardt and Reinhardt, online)

Long lasting relationships exist among cattle not only between friends (cattle who prefer each other's company for grazing, grooming and resting), but there is

also a special bond between mother and their calf. This bond is not affected by the weaning process (process where calves are weaned off their mother's milk at approximately 10 months of age), but lasts for many years, developing a close family unit within a herd. (Reinhardt and Reinhardt, 1981, 1986; cited in Reinhardt and Reinhardt, online)

Cattle, in their daily routine, are able to develop habits, moving from one location to another, they move in a predictable order in which each herd member has a defined place. (Reinhardt, 1973; Reinhardt, 1983; Andrade et al., 2001). Individual cattle choose specific resting sites, with consistent preference. (Schimisseur et al., 1966; Thinés et al., 1975; Reinhardt et al., 1978). (cited in Reinhardt and Reinhardt, online)

Site:

Under natural conditions, cattle divide the day into lengthy periods of foraging while moving long distances, and chewing their cud for long periods while resting. (Reinhardt, 1980; Krohn and Munksgaard, 1997). Cattle prefer to spend most of their days on a grass field rather than in a stable with deep bedding. (Krohn et al., 1992). In the case of Research farming settings, a well managed grazing field is most appropriate. (Krohn and Munksgaard, 1997). The effects of cattle on pasture is evident, the cattle are not restless as there is no spatial restrictions (O'Connell et al., 1989; Miller and Wood-Gush, 1991). (all cited in Reinhardt and Reinhardt, online)

Intensive grazing systems, which imitate the natural grazing patterns of wild herds of herbivores that at one point roamed the African veld, improve the soil

quality and grasses, improving their yield. Rotational grazing systems increases the decaying of organic material that feeds micro-organisms, restores subsoil health, creates water-absorbing voids, and therefore increase the organic matter or carbon content of the soil. These aspects restore depleting soil. Persistent crops are able to extract the methane and carbon dioxide from the atmosphere and stores it in the soil. (Van der Merwe, n.d: p21)

Good quality fields for grazing is required or additional hay should be provided for in order to keep cows in peak condition. (FAO, 1986)

Molasses supplements should be placed at new grazing sites, the supplements help motivate the cattle to stay on the new site or move to a new site. (Bailey, 2001 cited in Grandin, 2008)

Cattle prefer shaded areas during the hottest times of the day. (Kidd, 1993; Silanikove, 2000; Mitlöhner et al., 2001). Cattle like to lie on relatively soft and dry surfaces. (Irps, 1983; Jansen et al., 1988). (cited in Reinhardt and Reinhardt, online)

If the yard space for 40 to 60 m² is available, it may be unpaved provided the feeding and water area is paved. (FAO, 1986)

Sun Shade:

A shade structure should allow 2.5 to 3m per cow, it should be a minimum of 3m high and well ventilated. Depending on its orientation, the floor should extend beyond the roof line as to create a shaded areas all day. (FAO, 1986)

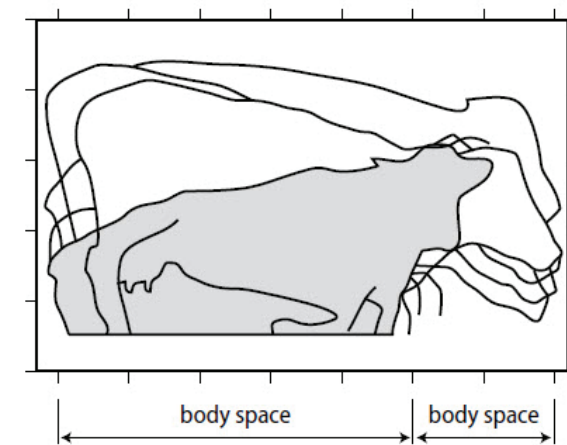
Housing:

In order to provide appropriate housing and handling conditions for cattle in research facilities, there are specific needs for behavioural, emotional, and physical well-being that need to be facilitated for. (Reinhardt, online)

In research institutions, group-housing is only the acceptable farming system for cattle. Social isolation causes stress leading to 'increased heart rate and plasma cortisol concentration, vocalization and behavioural signs of frustration and fear'. (Dantzer and Mormede, 1983; Hopster and Blokhuis, 1994; Munksgaard and Simonsen, 1996; Veissier et al., 1997 cited in Reinhardt and Reinhardt, online). Data collected from a stressed animal cause inaccuracies and therefore have very little scientific value. The need for a social partner can only be met by another cow. Contact with a familiar, gentle human can improve the stress reactions, but is not sufficiently comforting to reduce stress created due to isolation. (Rushen et al., 2001 cited in Reinhardt, online)

Cows kept in a barn need little to no reason for competition, there needs to be sufficient feeding space, bedding area large enough to accommodate all the animals comfortably at the same time, and access to food and water. Barriers between cattle help to avoid aggressive behaviour in the confines of group housing. Space is required for inferior animals to yield to the dominate cattle, reducing the hostility. (Bouis-sou, 1970, cited in Reinhardt and Reinhardt, online)

A spacious cattle housing system designed to meet the animal's social spatial requirement the necessary



Source: Irish and Merrill.

Above (61): Figure 7: "Swing" up into a standing position. (Hofmann, H. 1975)

Below (62): Tie-Stall housing type.
(FAO, 1986)

management to facilitate that animals social hierarchy, makes dehorning unnecessary. (Menke et al., 1999). Dehorning is a sign if inadequate animal farming, it is also a stressful and painful experience for the cattle. (Tashke, 1995). (cited in Reinhardt and Reinhardt, online)

A temporarily tied-up cattle, in the case of being treated or subjected to research needs to at least keep visual contact with other close members of the herd to reduce stress in the animal. Under special circumstances, for less than 24 hours, a mirror may be used as a substitute. (Piller et al., 1999 cited in Reinhardt and Reinhardt, online)

Cattle require, dry, heat-insulated, straw bedding area. (Lowe et al., 2001 cited in Reinhardt and Reinhardt, online)

Types of housing:

Deep-bedded - Here, saw dust, straw or other bedding material needs to be periodically placed in resting areas. Shielding the building from east and west light, shading can be improved. Paved and shaded area is favoured.

Loose-housing with free stalls - This type provides more protection. Less bedding is required and less manure to be moved. Stalls that are too small will injure the cow. In large herds, only 90% of the animals need to be accommodated for at one time. Passages need to be wide enough to allow smooth and free flow. (FAO, 1986)

Tie-Stall - Used only in the case of purebred herds

where individual attention. Equipment and stalls may be purchased. (FAO, 1986)

General housing requirements:

Concrete floors and pavements should be used for areas where cows are limited. (FAO,1986)

Water Troughs:

Size of water troughs depends on the size of the herd. A trough should allow 60 to 70 cm for each cow. One should be provided for every 50 animals. The trough needs a 300 to 400 mm step along the front in order to prevent manure from entering the trough, the cows will step up to drink but will not back up onto a raised area. (FAO,1986)

Water requirements per day:

Calves:	10L
Young stock:	25L
Heifers:	35-45L
Bulls:	35-45L
Milking cows:	50-100L

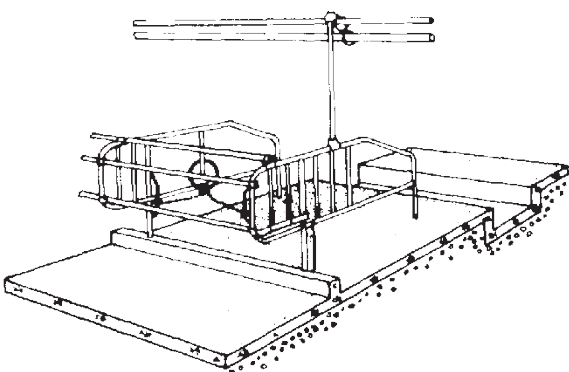
(FAO,1986)

One of the technology component of the thesis is collecting water, the water will be collected and stored, purified then used for the water requirements of the building, such as providing water for the cattle.

Manure Handling:

Waste management is needed when:

- Utilising the fertilizing qualities of manure, urine



Cattle dips:

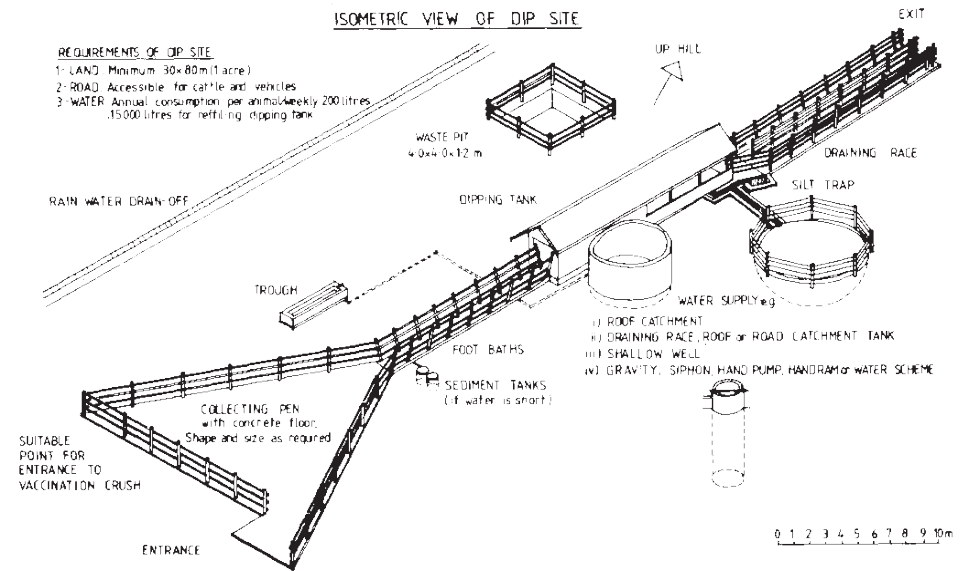
With regards to animal diseases, ticks have been a great hindrance to livestock development. The most effective and efficient way to control ticks is dipping or spraying the cattle with acaricide. Cattle must not be hot or thirsty when being dipped, so it is important to have water troughs in the collecting yard. (FAO,1986)

Dipping tanks are to be designed to a size and shape that fits a jumping cow and allows her to climb out again. (FAO,1986)

Poured reinforced concrete is the best material for a dipping tank. Shading should be provided for to reduce water evaporation and dilution of dip wash by rain. (FAO,1986)

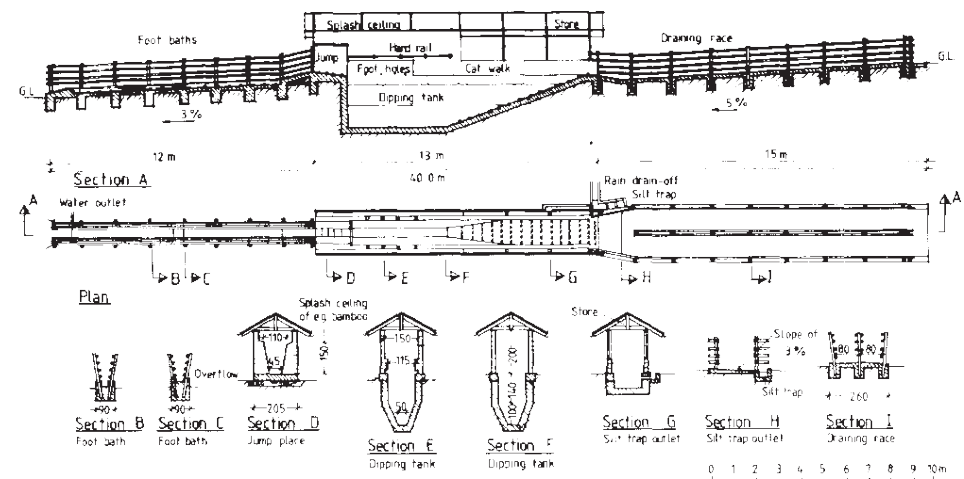
A catwalk and hand rails should be provided to allow a handler access between splash walls to rescue an animal in difficulty. (FAO,1986)

The Cattle dip at the Byre is located at the basement level, firstly the slopes works well in terms of what is required. The basement is also a cool place, not in direct sunlight, which makes it a suitable location for the cattle dips, keeping the cattle out of the sun during the dipping so they will not drink the water in the cattle dip tank.



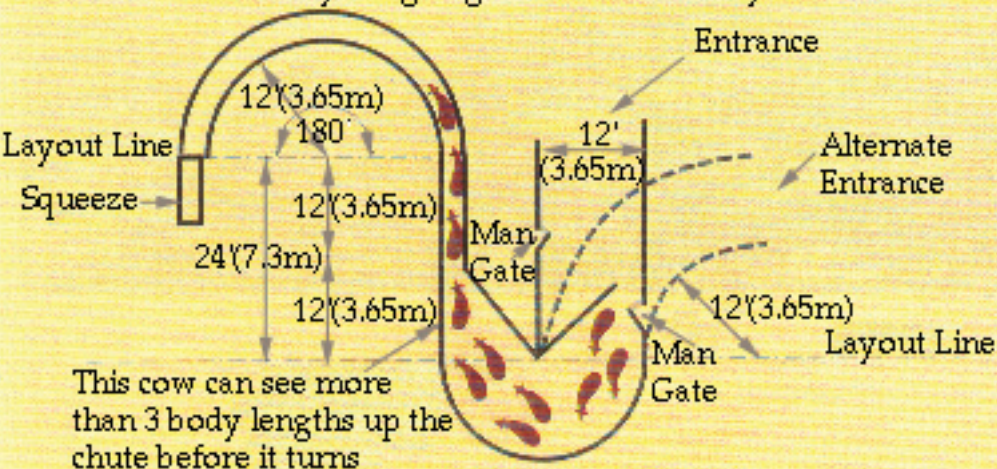
Above (63): Isometric view of dip site. (FAO, 1986)

Below (64): Detail of dipping tank.
(FAO, 1986)



High Efficiency 180 Degree Round Crowd Pen

Cattle think they are going back to where they came from



Above (65): High efficiency crowd pen design. (Grandin, 2011)

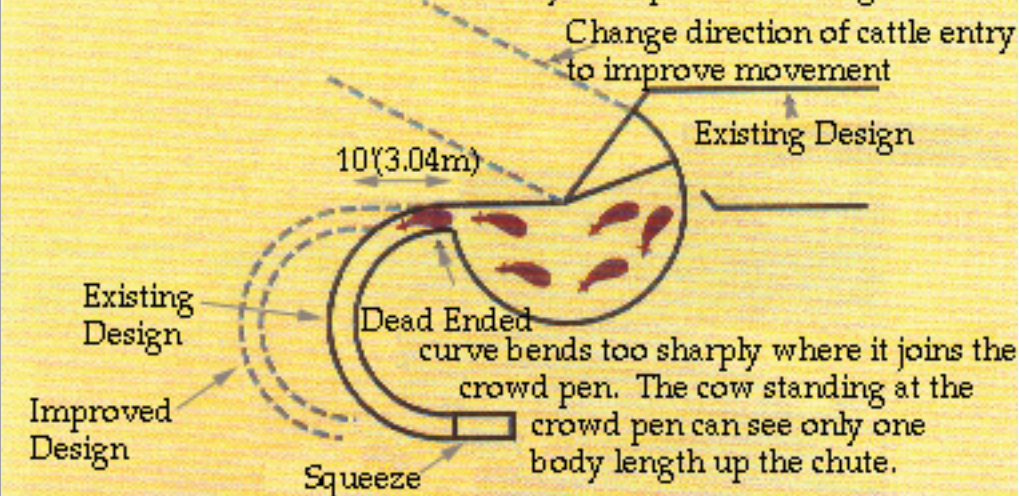
Below: (66) Bad chute design. (Grandin, 2011)

Bad Design - Chute Is Bent Too Sharply

1. Single file chute is dead ended.

2. Cattle move straight through crowd pen

Dotted lines show way to improve this design.



Footbath's:

Footbath's are provided to wash mud off the feet of the cattle. The floor of the footbath should be studded with hard stones in the aggregate to provide grip for the animal, to splay the hooves apart and remove the mud. (FAO,1986)

In size, the bath should be 4.5m long and 25 to 30cm deep. It should be arranged to cascade, so clean water can be added. (FAO,1986)

Crowd pen and Chutes:

Cattle's tendency, natural behaviour, when entering a pen or chute is to go back in the direction they came from and to get out. Therefore chutes are designed with a 180° round pen to make the cattle think they are going back in the direction they came from. (Grandin, 2011)

A chute that is straight is ineffective as the cattle think its a dead end and will be reluctant to walk the chute. (Grandin, 2011)

It is also in a cattle's nature to follow the herd, if in a chute a cow can not see at least two more cows in front of it, it will be hesitant to go through. Cattle refuse to go somewhere unless they can see a place to go. (Grandin, 2011)

Pens and chutes should also be free of distractions (hanging chains). A well lit area for when cattle need to travel to is recommended, skylights and translucent panels can bring in light that is shadow free.

Crowd pens should not be filled more than 1/4 full, cattle need space to move around. (Grandin, 2011)

Requirements of cattle farming in a research setting:

1. Social housing;
 2. Sufficient feeding area and straw-bedded lying area for entire herd;
 3. Stable social relationships;
 4. Access to pasture;
 5. Positive human-animal relationship's;
 6. Firm-and-gentle handling.
- (Reinhardt and Reinhardt, online)

Things to consider:

1. Movement of cattle for feeding, milking and pasture (and treatment).
 2. Movement of bulk feed from store to feeding area.
 3. Transfer of milk from milking shed to dairy. (if applicable) Clean and dirty activities, milk handling, waste disposal should be separated.
 4. Diversion pen in Artificial Insemination stalls
 5. Easy periodical cleaning of accommodation, yards, milking facility should be implemented. Waste to storage.
 6. Movement of herdsman.
 7. Provision for future expansion.
- (FAO,1986)

The design requirements for cattle has been looked at adhered to in The Byre in order to make the cattle as comfortable as possible.



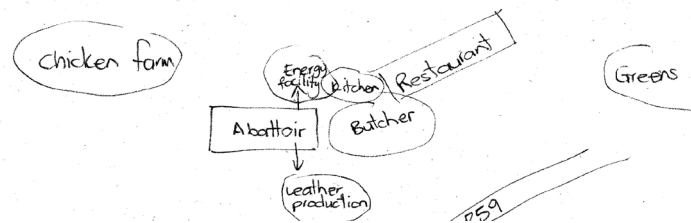
70. Photograph (n.d.)

3.4

Design: Process and Principles

In this chapter looks at the design informants,
principles applied and process development

Charette:



At the start of the charette the focus of the thesis was on the entire process of the food production from farm, to abattoir, to distribution. The main element being the abattoir. As it was about exposing the process, a public component was to be added as well as a meat research centre. A cultural programmatic element was to be added in the form of a cultural slaughtering centre. The aim here, was to try create a link between the celebration of cultural slaughtering and the negative connotation created by the abattoir.

'The Abattoir' as the thesis was initially called was to look at points of cruelty throughout the life span of the animal, and through an experimental approach using the medium of architecture address these issues.

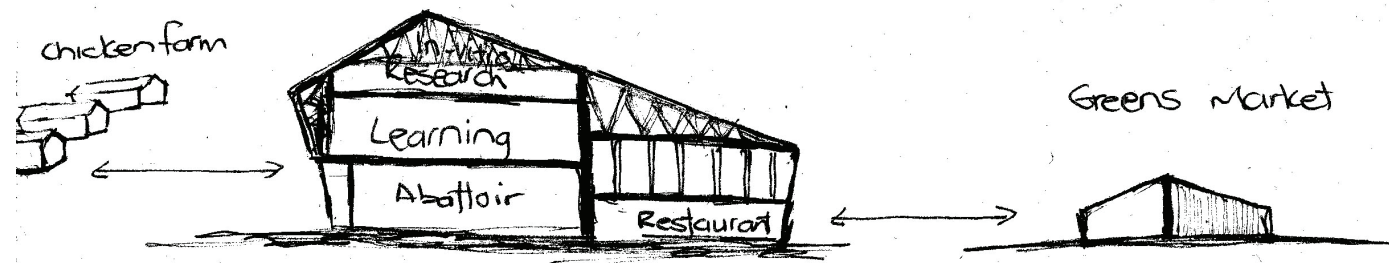
The site, initially chosen, as discussed in the site chap-

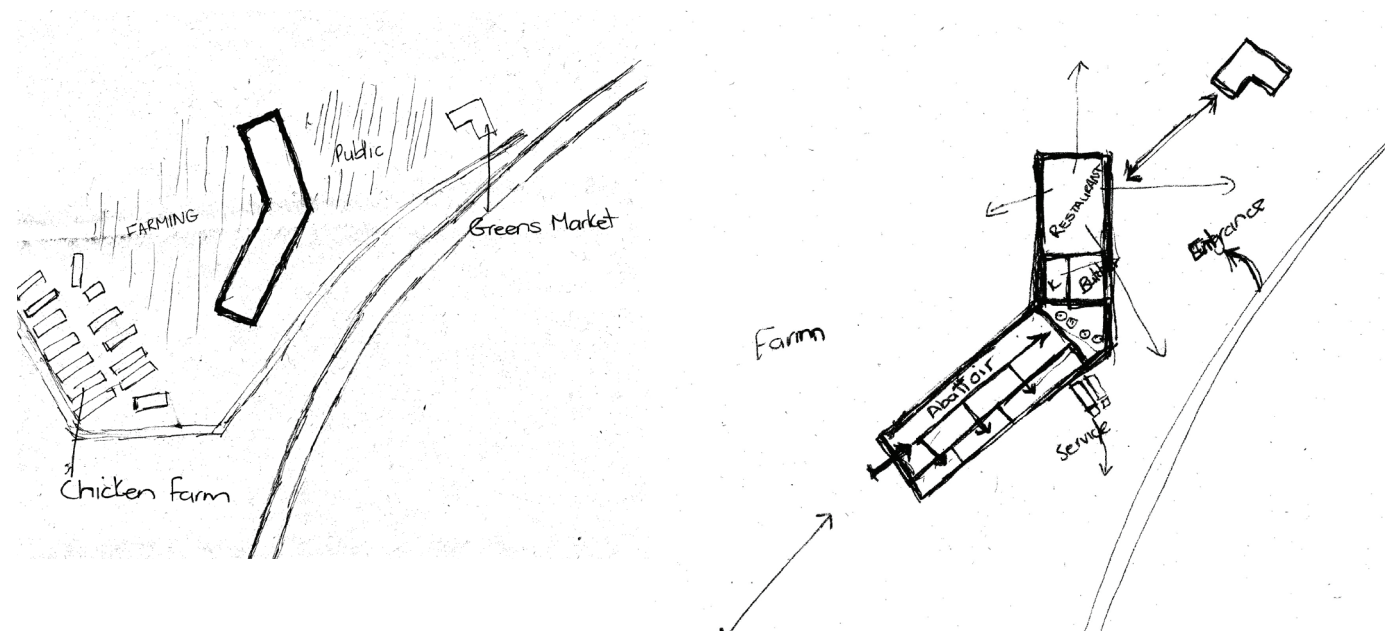
ter was Meyerton, the site had an existing chicken farm and a greens farmer market. The abattoir was to be an addition to these existing facilities. In a sense 'The Abattoir' would be revisiting the abattoir as a prototype in an effort to mend some of the issues of animal cruelty and meat consumption.

Some time into the charette it was realised that an abattoir was in fact not the architectural solution to this thesis, but rather a 'future' abattoir should be looked at, an In Vitro meat lab. A high-tech facility that looks at the future of meat production. This seemed a better response as the abattoir has an inevitable end for the animal, if this thesis aimed to address the issues of animal cruelty and meat consumption primarily, designing another abattoir would not solve the issue.

The outcome of the charette was more of an opportunity to refocus the thesis.

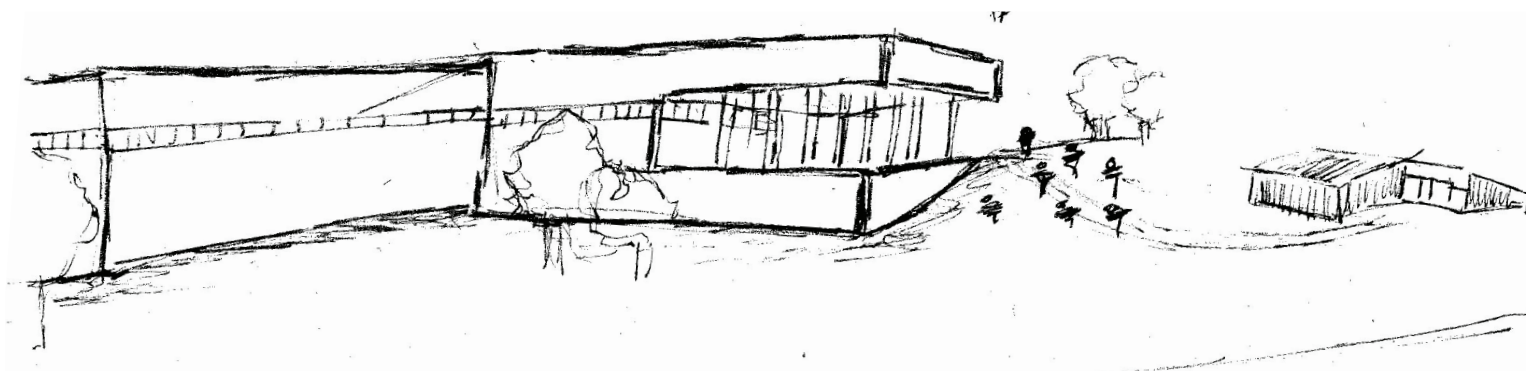
Below is a sketch of a programmatic section of 'The Abattoir'. The site was located along the R59 highway, this was beneficial as the objective of the building to also create awareness, therefore, the facade treatment would be an important component of the design.

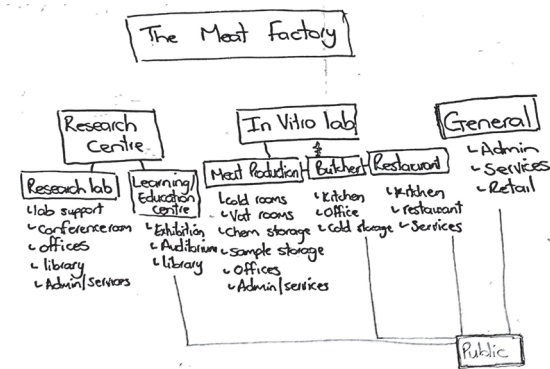




Left: Sketch plan of charette for The Abattoir.

Below: Early sketch perspective of The Abattoir.





As a concept and sketch design was required for the submission of the charette, the work done for The Abattoir was no longer applicable.

A programme for The Meat Factory, the future abattoir, was developed. In much the same way as the The Abattoir, The Meat Factory was still about creating awareness and informing the public, so a public component was still required. The site in Meyerton, was now no longer an appropriate site for The Meat Factory. For the purposes of the charette, the site remained but soon after the site changed to New Doornfontein area, Johannesburg.

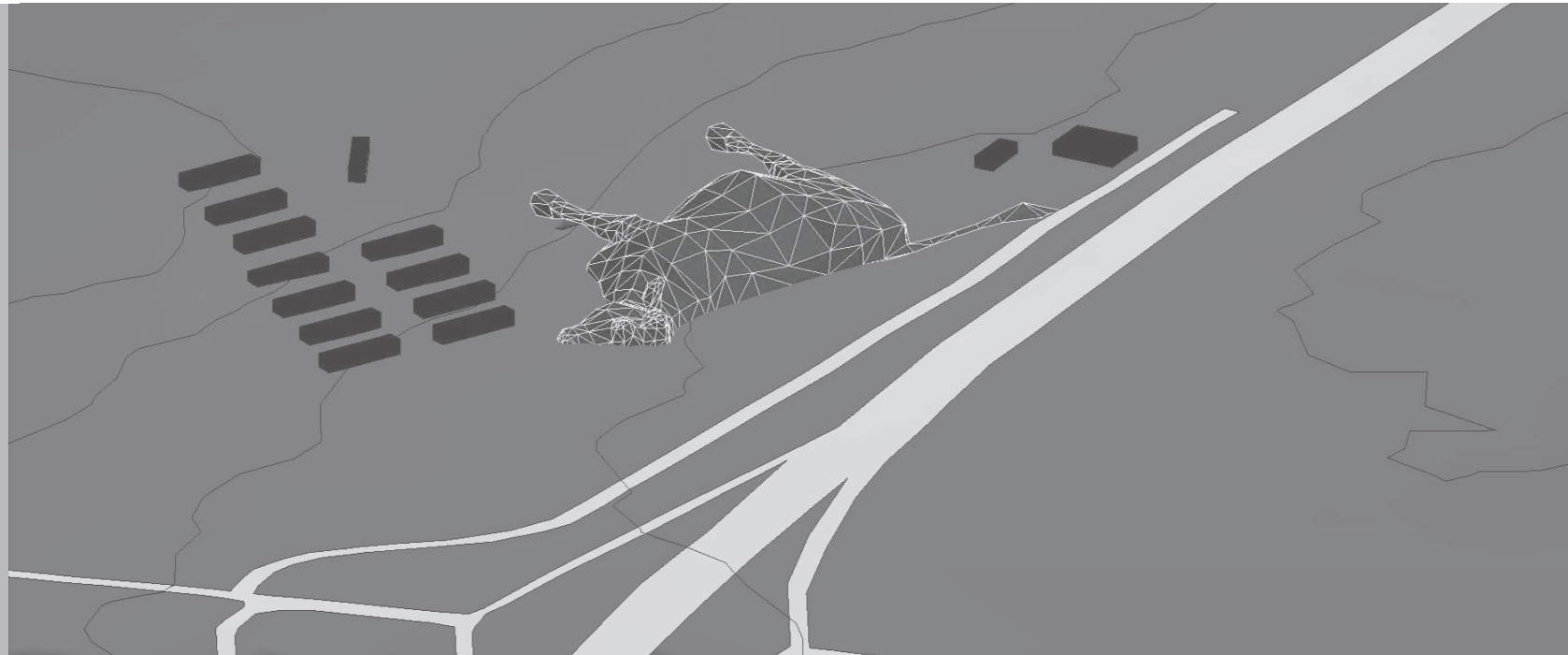
The initial concept for the building was to use the cow (body and skeletal structure) as inspiration for the building form and structure. The skeletal structure of the rib cage was investigated for the structure of the Meat Factory. The sketches on the right show the development of the concept into sketch design.

The charette process was unsuccessful in developing a solid concept in order to continue with the design process. Further exploring was needed in a new typology for an abattoir and considering new theoretical themes.

Above: Sketch programme for The Meat Factory.

Right: Site plan showing concept of using the body of a cow as a means of informing the form and structure.

Far Right: Sketches of The Meat Factory a proposed In Vitro Meat Lab and Research centre.

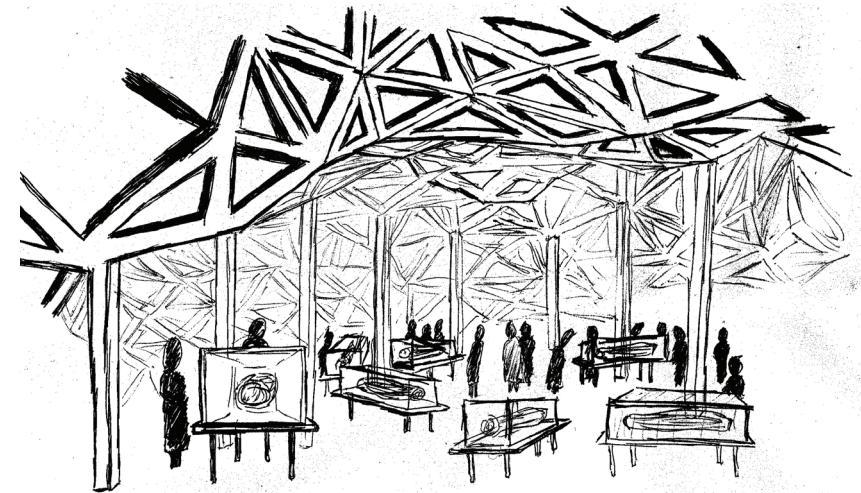
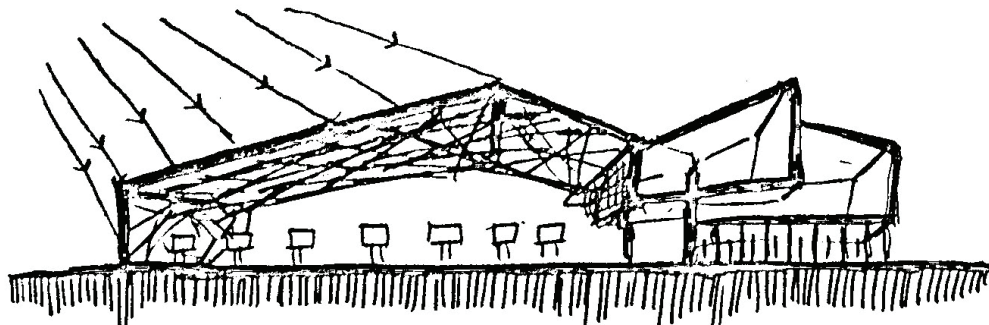
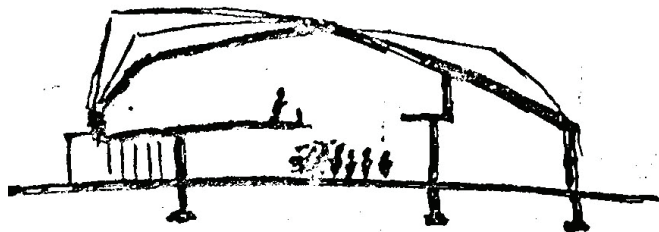
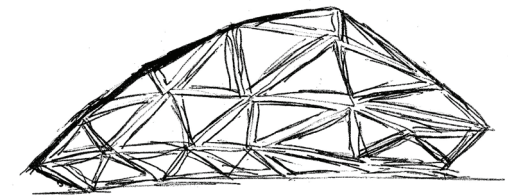


After the charette the thesis then changed focus again. The In Vitro process is still very new, and little is known about it. The In Vitro Labs and research centre as an element to the thesis and design was acceptable but proved to be thin as the basis for a thesis.

Further development of the thesis lead to focusing on one animal, the cow. It was through the theoretical research that determined that the basis of thesis is not to address the slaughtering or meat consumption (directly, at least). If a change in thinking is to be achieved, the root of animal perception was to be addressed, which is the relationship shared between

humans and animals. Re-examine this relationship will be the first step in addressing the high meat consumption and ruthless slaughtering of animals. The intentions is not to turn everyone to vegetarians but to introduce an appreciation for the animals that provide us with so much.

Further research lead to selecting the Nguni breed as the main research subject, as they are an indigenous breed to South Africa. The site was changed to link to an existing animal research facility, Faculty of Veterinary Science, University of Pretoria, Onderstepoort.



Site response:

Brief:

The Byre is a building that aims to aid in the preservation, awareness and celebration of the Nguni cattle. The building is a facilitator of the functions it houses, a gesture in the landscape. This utilitarian building serves its required function, and is easily adaptable for change of use over time, if necessary. It needs to be robust and self-sustaining. The Byre is more than just a building, its function facilitates and serves beyond the walls of the building. Cattle will be kept on site, therefore provision will need to be made for their specific needs.

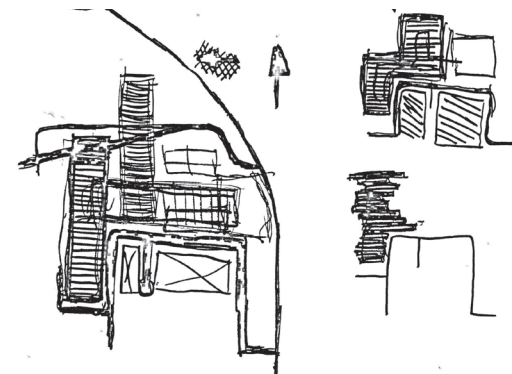
Building position on site:

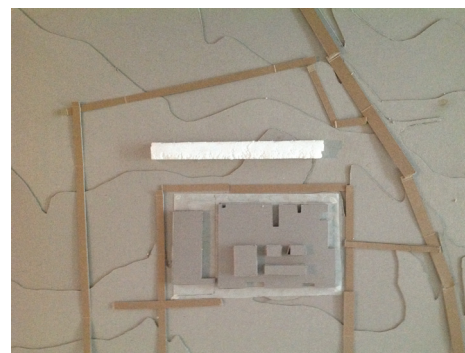
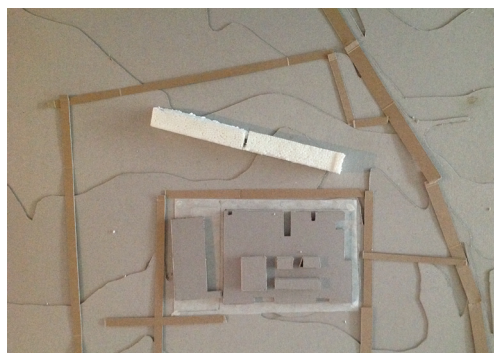
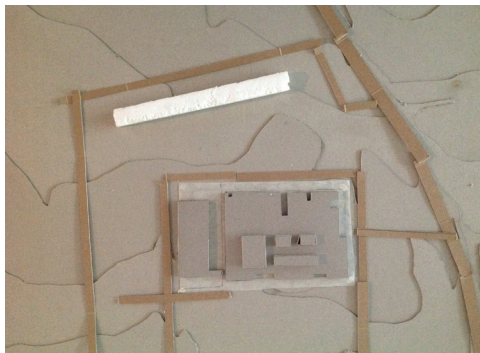
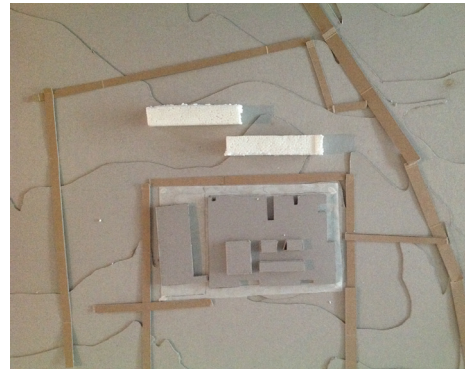
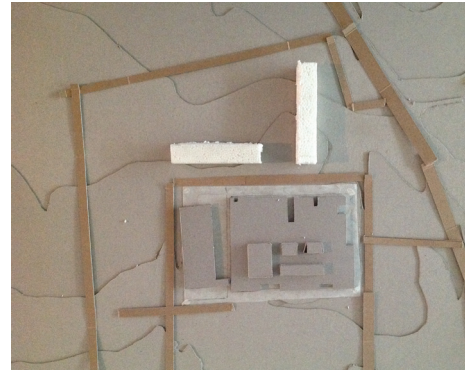
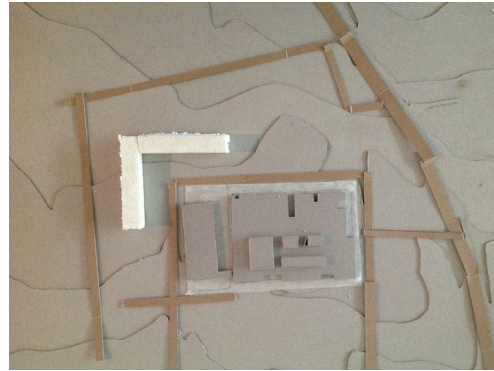
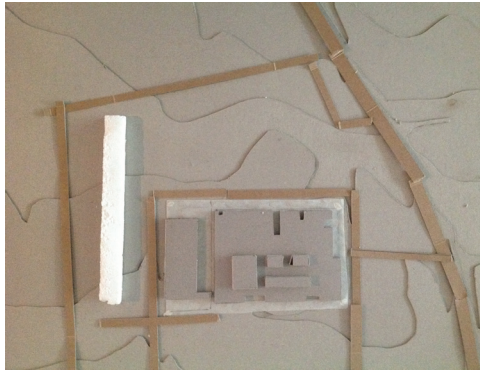
Several positions and orientation on site were explored. First the building orientated north-south was tested, running the length of the free site available at the back of the Onderstepoorte campus, reason for this option was to take advantage of the slope of the site to incorporate a building that engages with its landscape. Several issues arose with this option, light, the longer length of the building will be completely exposed to east and west light. Shading methods would have to have been explored to compensate for this. A saw-tooth roof was a solution for letting in north light. Another issue with this position was that of accessibility. The building in this position is at the very end of the university campus, a building closer to the entrance would be preferred. The building orientated north-south on the site also meant that the shortest facade of building would be seen from the N4 highway, located north of the site, the

building's presence ideally should be seen in order to create interest and awareness.

The building position was then rotated 90 degrees and orientated east-west along the width of the site. The building in this position seems to be the better option, not only is the longer length of the building orientated to get north and south light. The building is ideally positioned to receive visitors as it is much closer to the main entrance of the university. The building now had more of a presence, as it is visible from both the highway as well as the main road, running east (in front) of the university campus.

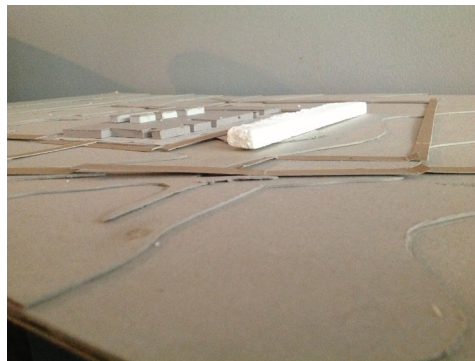
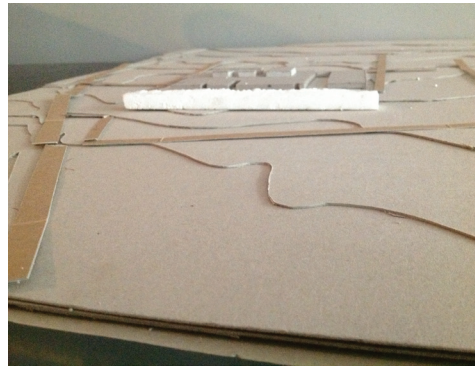
The building in the chosen position is situated next to the existing Veterinary Academic Hospital, on a vast section of land which is partly used for covered parking area for the Veterinary Academic Hospital. New and replacement parking will be provided for. There is also unused animal holding pens on the site, these would be cleared as The Byre proposes to include cow housing facilities within the building.





Left: Study using models to determine best position for the building on site.

Design development:



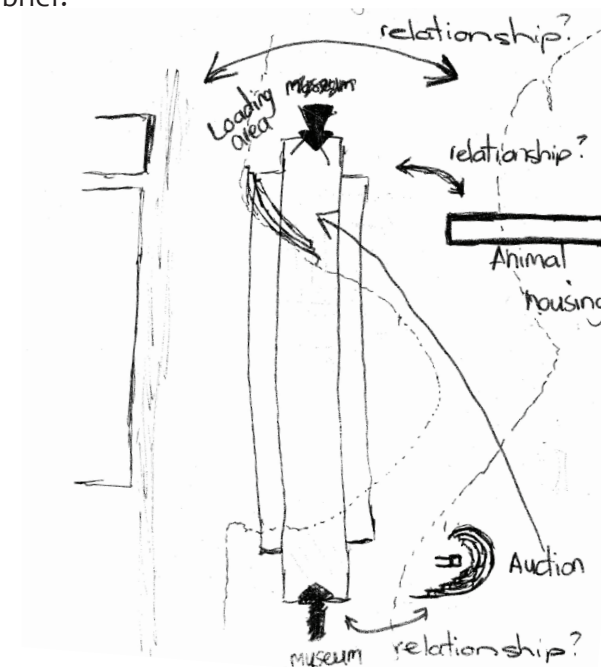
Right: (Top) Aerial view of site for the direction of the highway. (Middle) View from the direction of the main road in front of the campus, East. (Bottom) Further on the main road, from North-East direction.

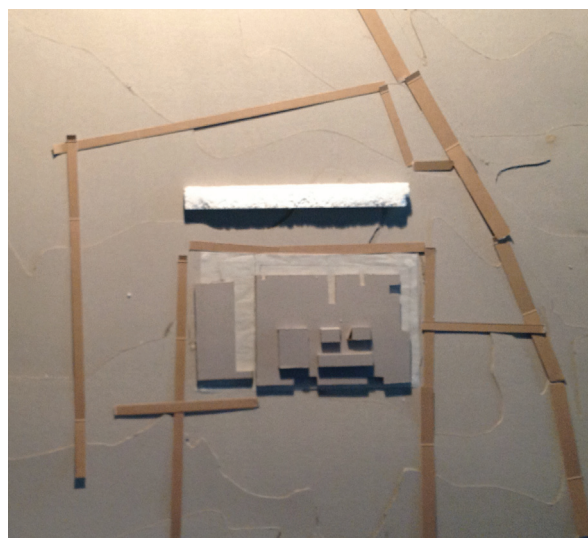
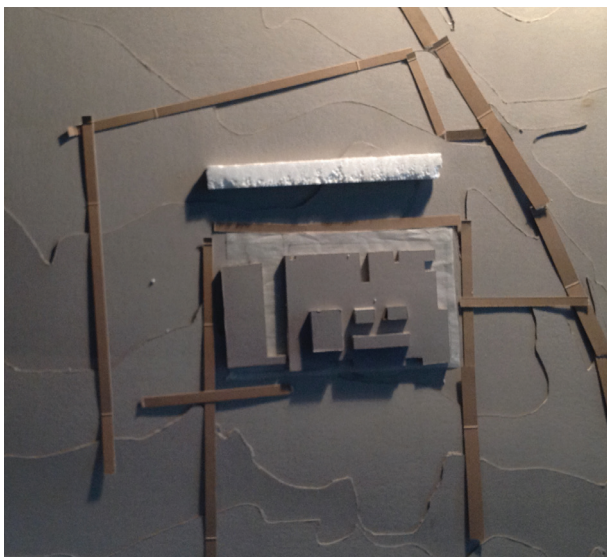
Opposite page: Shading test study during winter (Top row) and summer (Bottom row) at varying times of the day, first images: morning; second: midday and third: late afternoon.

There is a slight gradient on site where the building is positioned, approximately one meter, running on a north-south axis, with the slope going down towards the highway (north of the site).

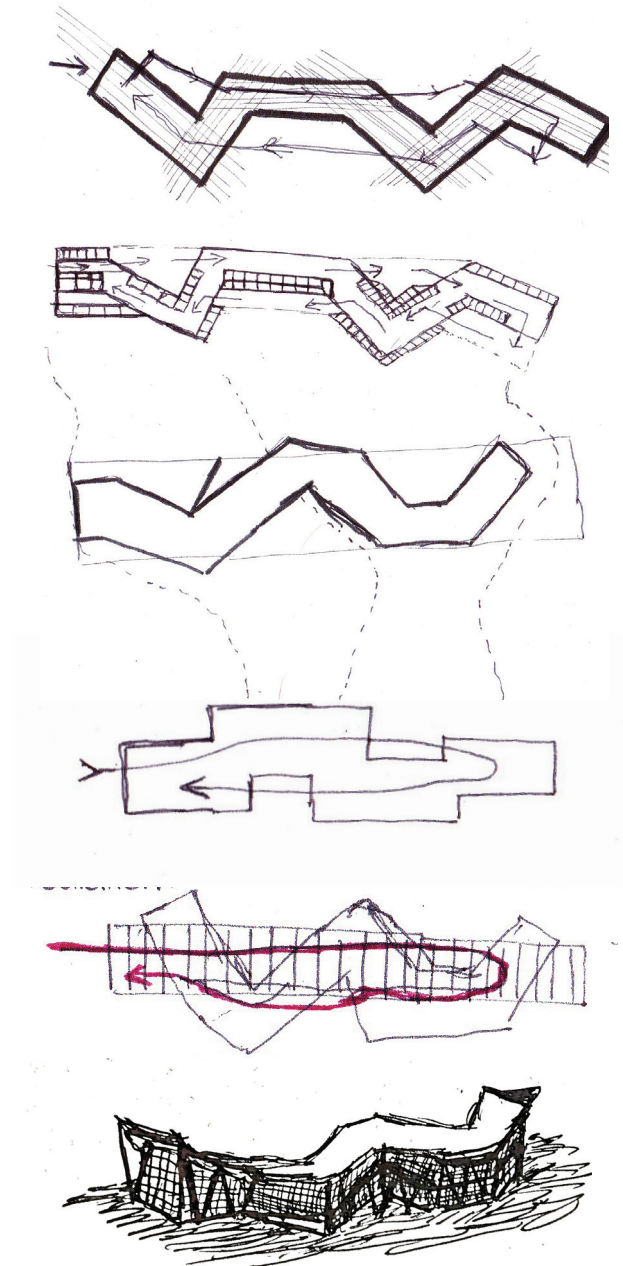
The building positioned close to the veterinary clinic, not only provided the necessary link between The Byre and the Animal Hospital, as this is most transparent form of animal welfare. Sufficient space will be provided for the animals to roam on site.

This position proved the most appropriate and successful position to meet the requirements of the brief.





Form:



Right: Sketches of building form

Building Form:

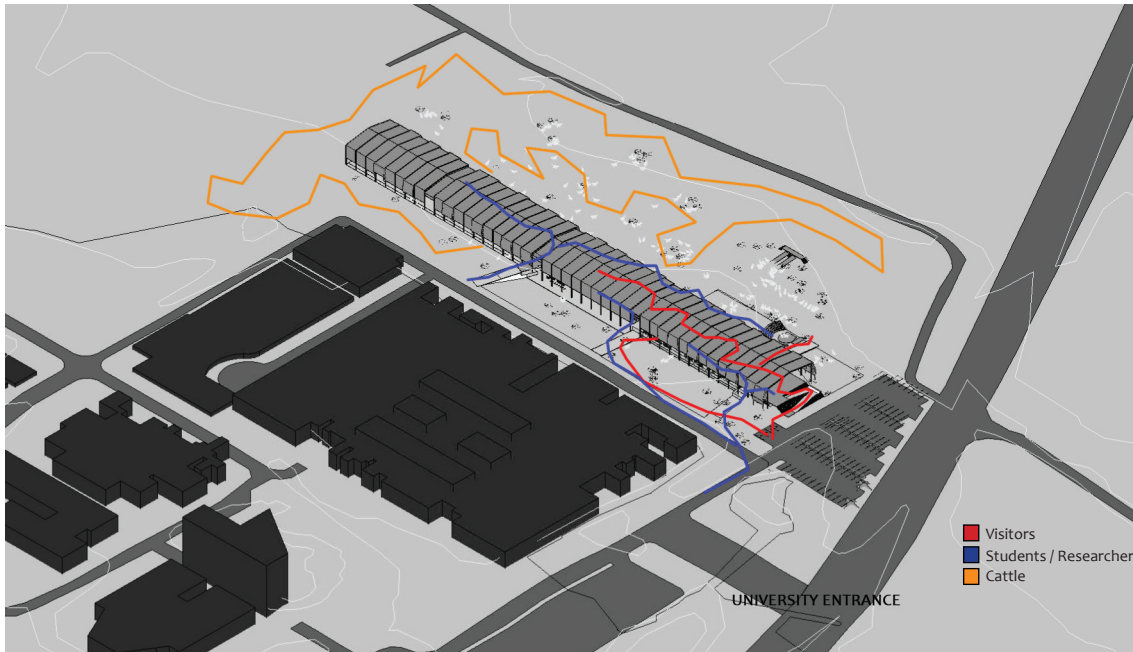
Several building forms and layout were explored. Circulation routes played an important role in informing the building form, both of the animals and humans. With long buildings the difficulty is circulating the users through the building but leading them back to the main entrance to where their car is parked. A zig-zagged building form was tested. Although interesting, its expressiveness conflicted with the nature of the building. The zig-zagged shape was random and was not informed by anything.

The linear form was revisited and seemed more appropriate for satisfying the brief of being unobtrusive to the landscape. The linear building relates to grid the existing buildings on the campus.

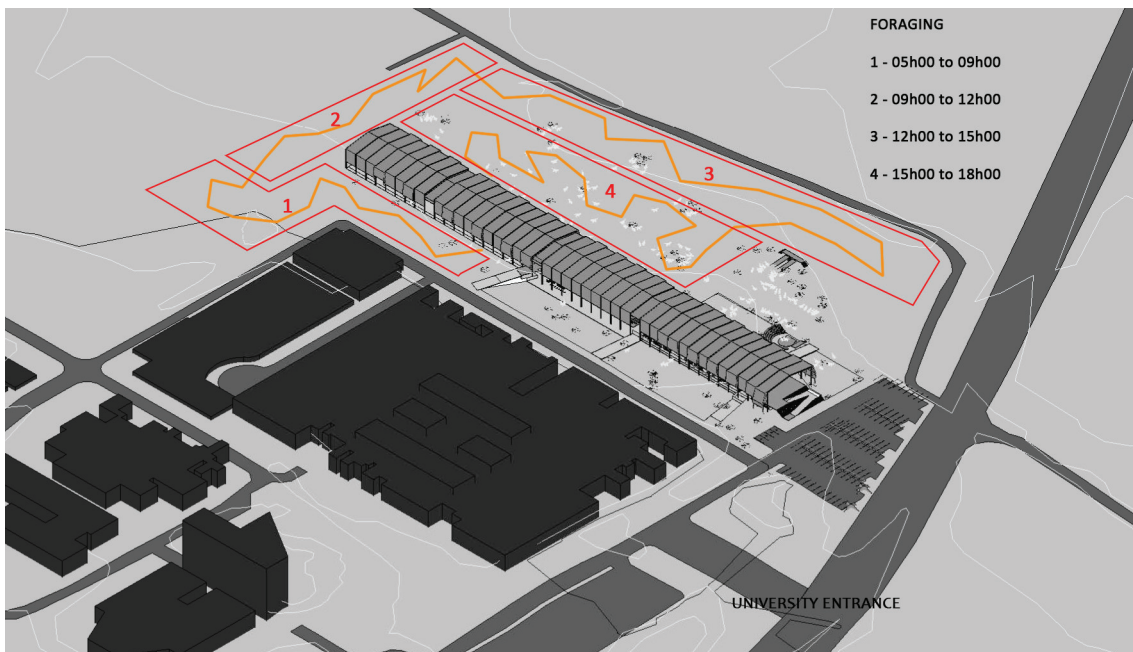
On the opposite page is a quick study of human and animal circulation. The white strips represent vehicle and human movement, the rope represents the movement of the cows.

The cows cattle divide their day into lengthy periods of foraging, and cattle that graze on the same grazing area makes the area ungrazeable as the manure piles up. The site has been divided into 4 grazing areas where the cattle will forage and graze during the day, the route leads back into the building where they sleep.

The Byre is not just a cow shed, not just a research centre and not just a farming development centre, the combination of these users makes defining the building typology more challenging. How do we

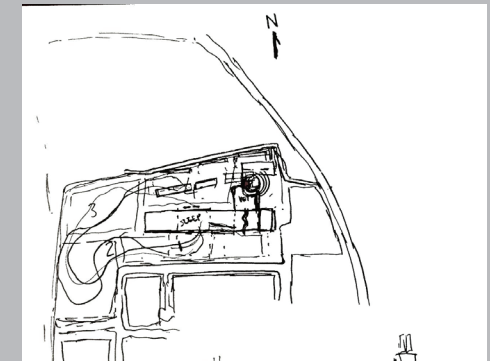


Final mapping circulation routes of all users of the building



Allocation of grazing areas

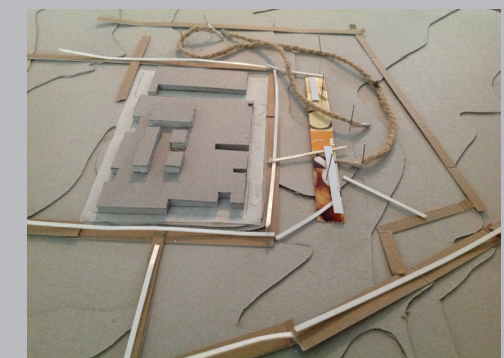
Circulation:



Sketch of circulation routes

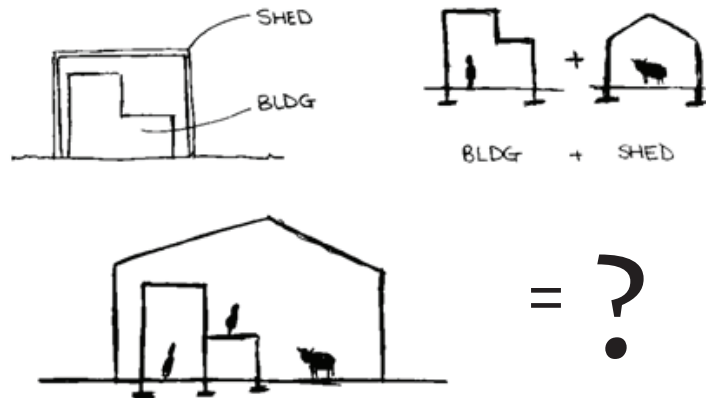


Human circulation with building

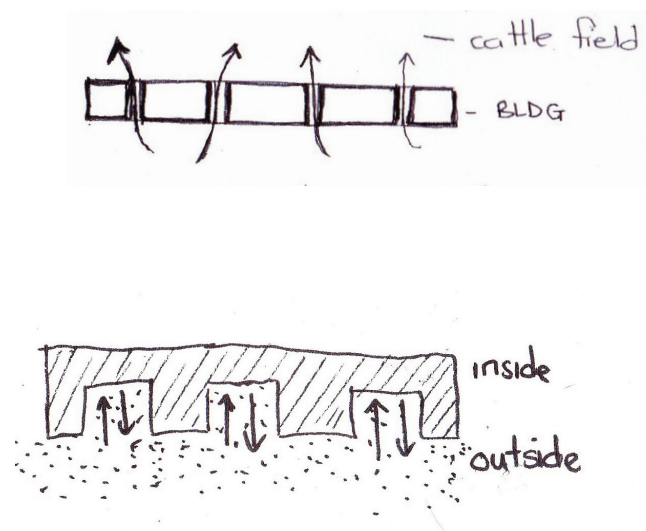


Circulation of humans and animal with building

Programme implementation:



HOW DO WE MERGE BUILDINGS FOR CATTLE AND BUILDINGS FOR MAN?



Right: Incisions in the building.

merge these building types and users into one building? A building within a shed approach was chosen to house not only the human users but also the cattle users.

Circulation of cattle and humans is facilitated in the buildings forms, closed versus open spaces.

The long building is dissected to separate the different programmatic sections, this allows a thoroughfare through the building from the main activities of the university to field where the cattle are grazing.

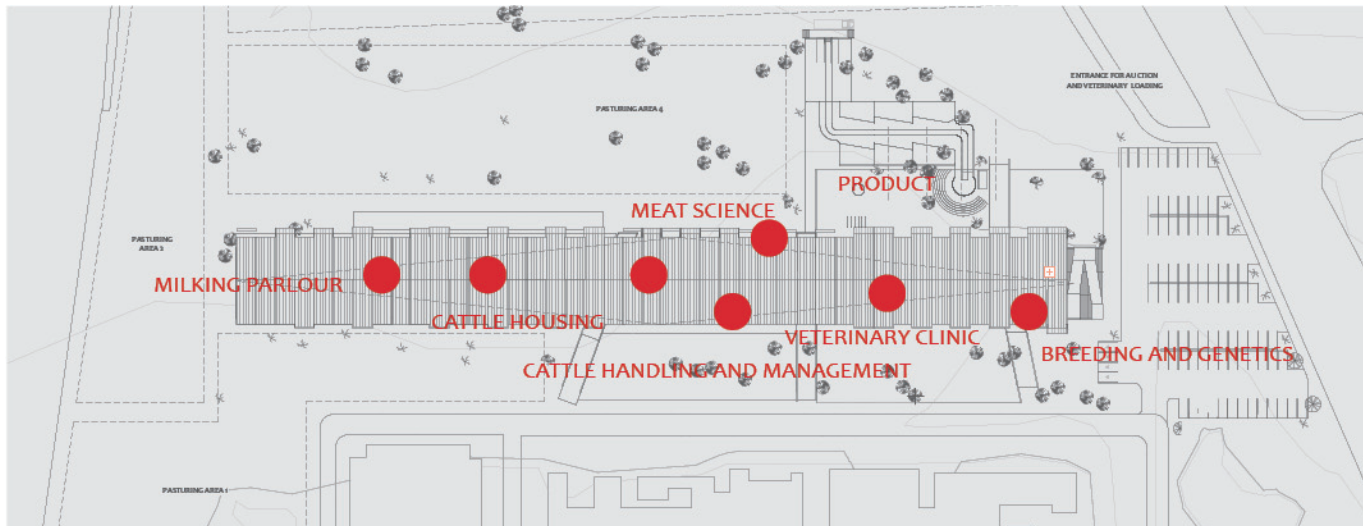
These incisions will be clear sheeting making the building appear to be portions of smaller buildings. They create openings in the building form to let in light at strategic places where necessary, the doors to these openings will be large doors as found in barns and sheds creating a changing facade.

Implementing programme:

Conceptually the programme of the building has been arranged according to the life cycle of the cow. This has been influenced by how the programme was developed. The life cycle of the cow was examined, key aspects considered, and used where it could make up the development of facilities that would in turn improve the cattle's well being at each respective stage in its life cycle.

The intention is that the user experiences the building in the sequence of the cattle's life cycle. Therefore a 'museum' type building was the initial approach, at the different programmatic sections of building the different programmes are experienced in different

Informants:



ways. Therefore, walking through the building becomes a journey of experience, a new way of learning, making the user constantly aware of the cattle's presence. In some cases, an interactive displays will be placed in its corresponding area of programme.

One long thin building is best suited to compactly express and experience the programme and building. A long thin building in the landscape, like a shed on a farm, subtle and unobtrusive to the landscape, but framing the main characters of the building, the cows.

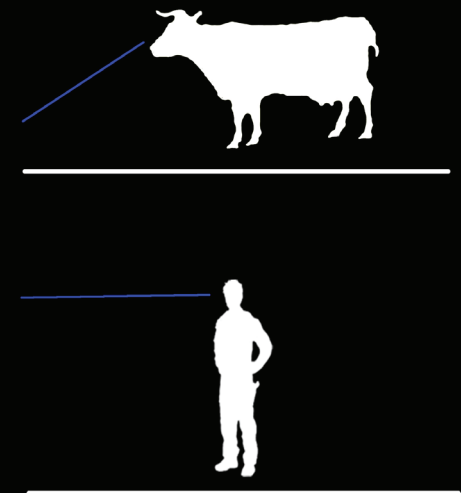
The programme has been linked by their respective services and different users within the prescribed parameters set by the life cycle concept. Researchers labs and student training labs have been paired together in their respective fields. This not only allows the services to be linked but also an opportunity for the students and the researchers to informally inter-

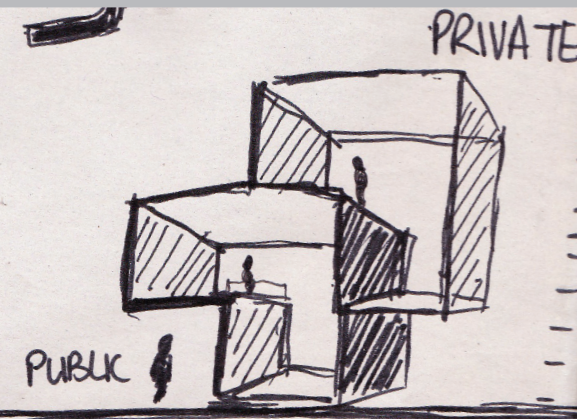
act daily. Visitors, buyers for the auction and clients of the Cow Bank are received at the entrance of the building, and the Farming Development Centre is located in the middle of the building. The cow housing is situated at the end of the building, forcing interaction between users and cattle. Throughout the building, the cow is constantly visible or being referenced, watering trough's are located close to the building in order to force the cows to engage with the building.

In section, the building is separated in levels for the different users.

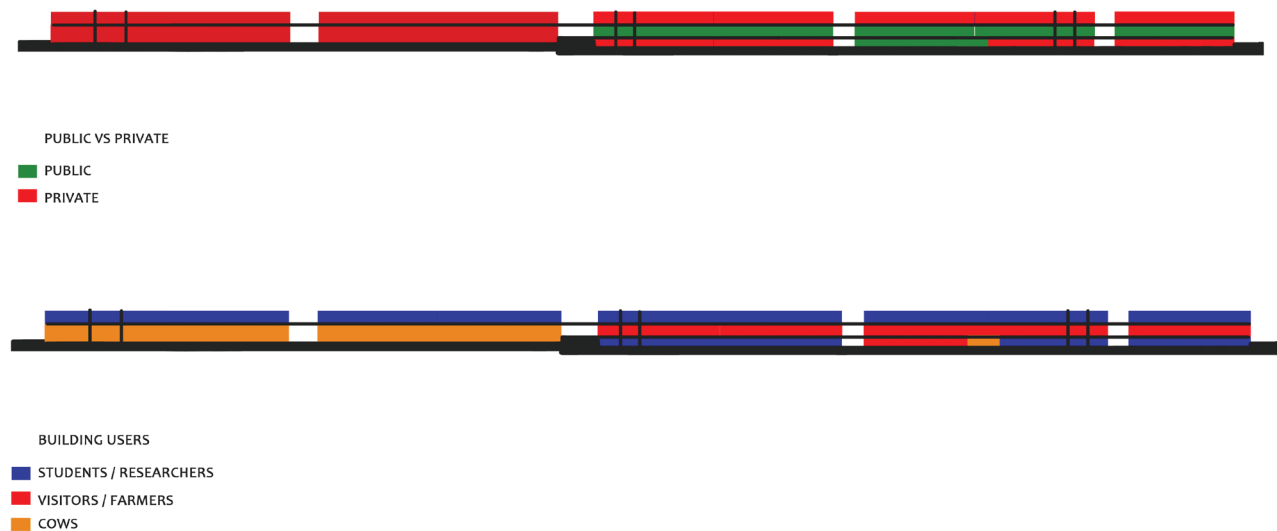
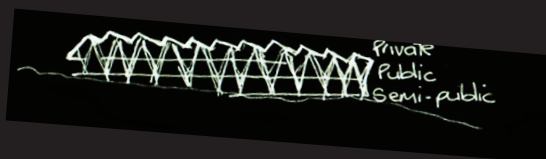
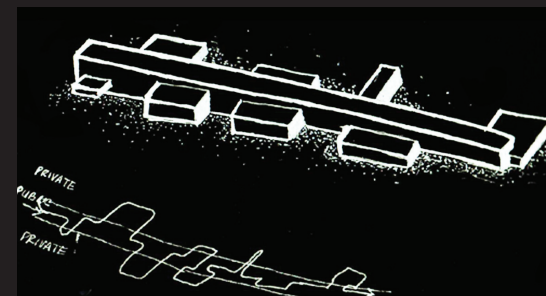
Through observing cattle it became evident that cattle always look to the ground, mainly because they constantly grazing. Through architecture, with change in floor levels the user will be encouraged to look down when they use the building.

Sight line of cattle and human.





Public vs Private



Public versus Private:

As the building has multiple groups of users students, lecturers, researchers, local farmers and cattle, the public and privacy gradient is arranged so that visitors of The Byre are not constantly crossing paths.

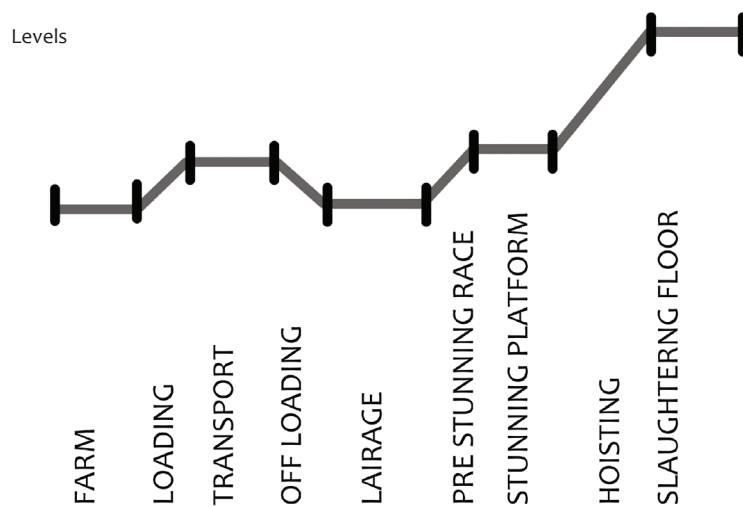
The ground level of The Byre is mainly used for visitors and local farmers, coming to the farmers development centre. The basement level is used by researched and students as this is where most of the labs are situated. The first level will also be occupied by research and students, here the staff and researchers have their offices it is also where the lecture halls are located.

Levels:

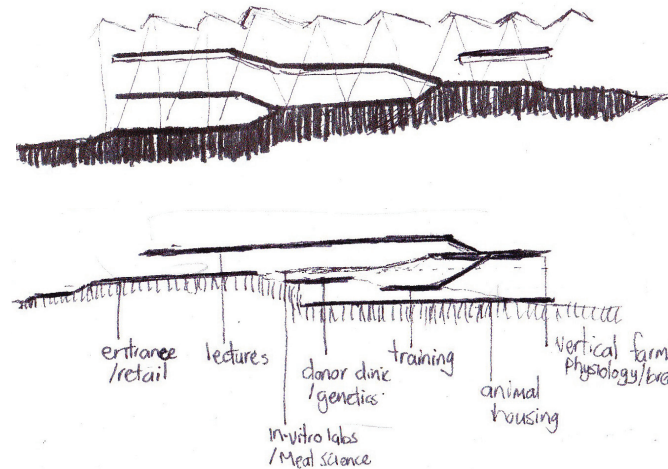
The visit to the abattoir was very informative, what was observed was, the animal experiences its life through many physical level changes. The connection between these levels are all ramps, as cows are not able to climb stairs. The levels experienced was mapped, see above for the mapping of the different levels.

These different levels were applied to the building programme. Further studies were done to investigate at which point of the life cycle of cow (in relation to the programme of the building) is either in covered or uncovered spaces, the intention was to then mimic the outside/covered/semi covered spaces of the natural life cycle to the building at each respective programme.

In the building, where the animal interacts with the



Experimenting with levels

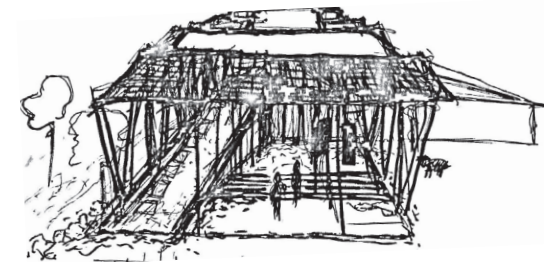
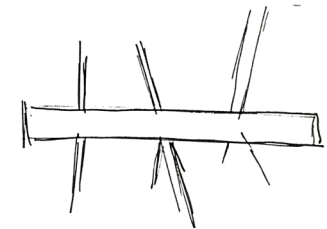
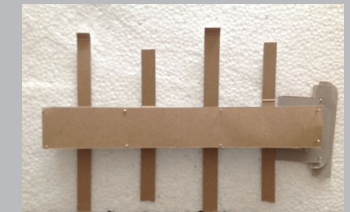
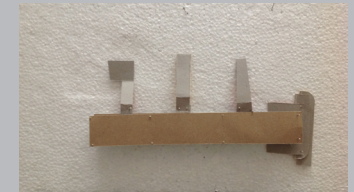


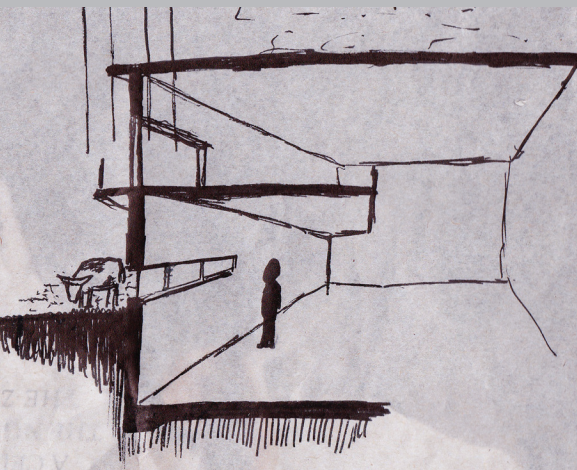
building, the ground level will be at natural ground level as to not add discomfort to the cows. As the building is for and about the cows, the researchers/students and visitors will need to get down to the cows level.

Integrating landscape and architecture:

Slits in the landscape have been introduced to bring the landscape to the building, integrating the architecture into its context. Where it is necessary for the cow to access the building at either the basement level or ground floor, this has been informed by the programme. These slits create direct access points to the different sections of the building for the everyday users. The slits in the building are also connecting passages from the campus at specific nodes of access, to the pasturing fields. These slits also create openings that allow the different users of the buildings to enter the building at exactly where the different user needs to be.

Building reaching out to the landscape





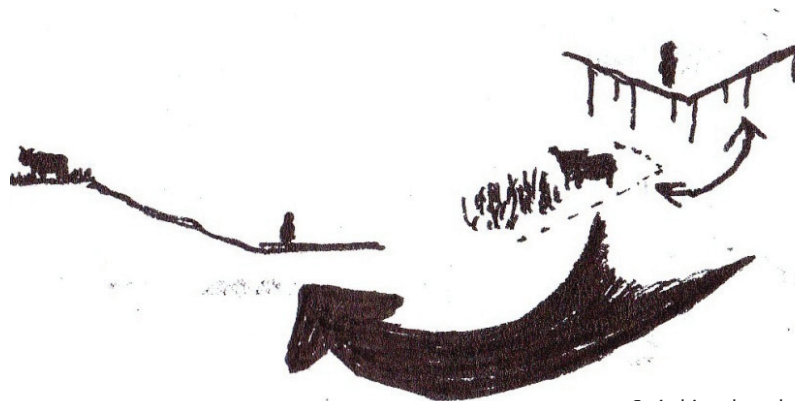
Switching the roles:

The Byre attempts to deal with the animal/human relationship, one way to change the experience of using the building, for cow and human. A concept of 'cow is king' was attempted. As the labs are sunken into the basement, this level difference allows the cows to look down to the humans and the humans to look up to the cow.

The cow is also constantly being referenced throughout the building, wherever the user is in the building he will be able to view the cow on the fields or see them up close. The water troughs are to be integrated into the roof to bring the cattle to the building to interact with the users.

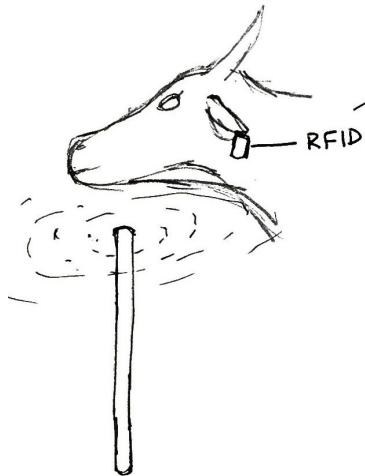
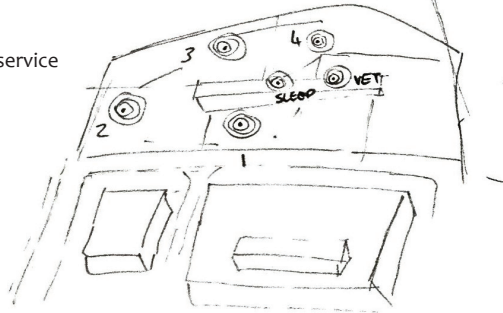
Social-cultural aspect:

How it works: The cattle (staying at the cattle housing service) are tagged with RFID (Radio Frequency Identity tags, data capturing sensors are strategically positioned on site over the four grazing fields as well as near the Veterinary clinic. Once the cattle come within a radius of the data capturing sensors a tweet is emitted and the owner of the cattle will be able to track the cattle's activities throughout the day.



Switching the roles

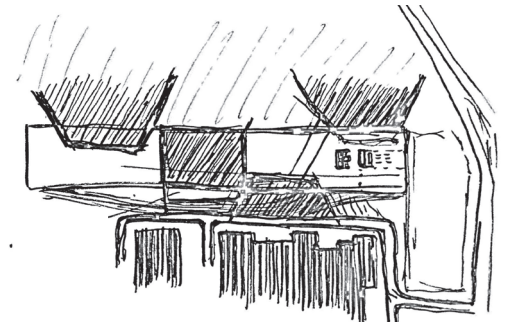
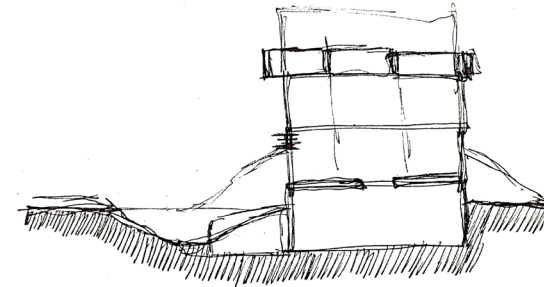
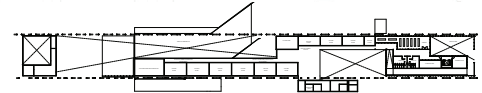
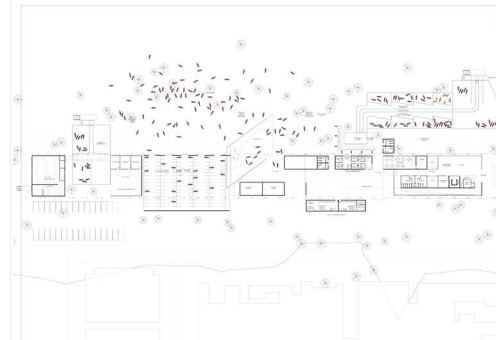
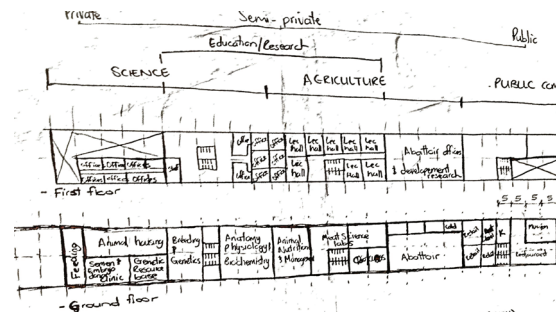
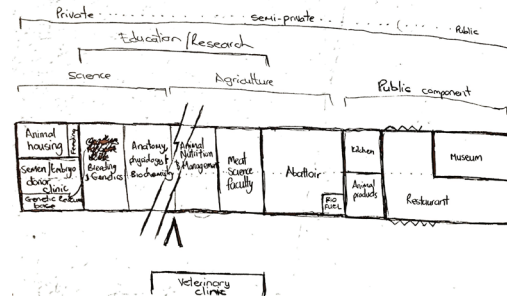
Cattle twitter service



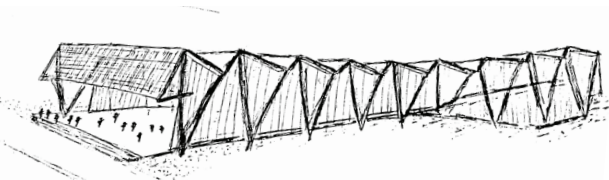
@cow: grazing at - field 2. Yum!



owner



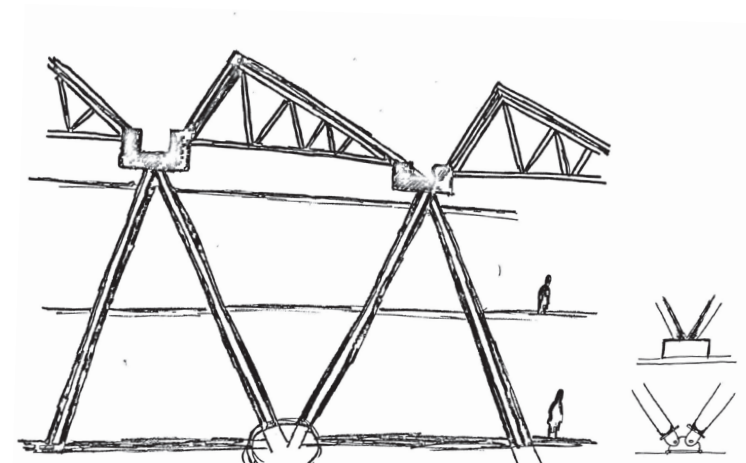
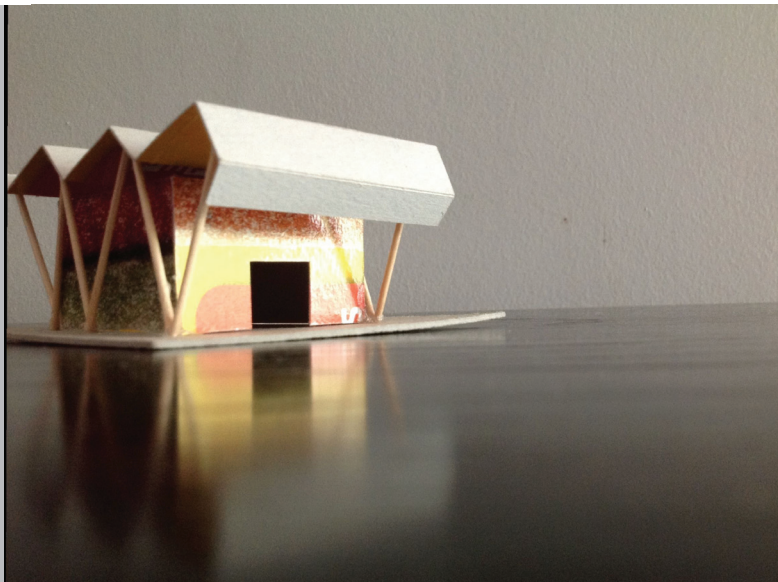
Roof development:

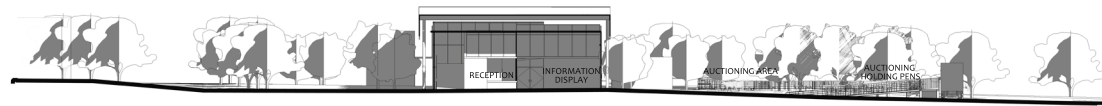
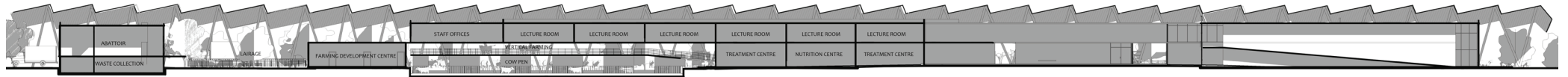


The roof is one of the most important component of the thesis. The roof design has been a rigorous process of testing numerous forms. The Byre can not be categorised as a particular typology, as It is a merge of typologies, a shelter for cows, a tertiary institution for human, and a science building.

Initial stages of design saw the building positioned in a east - west direction, therefore the saw-tooth roof was appropriate for letting in north light. This industrial roof form worked well. However, once the building position had changed the form was no longer applicable.

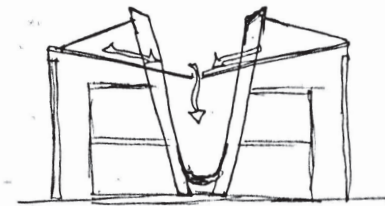
This roof form is also very inefficient as it using a large amount of material unnecessarily, not fulfilling the



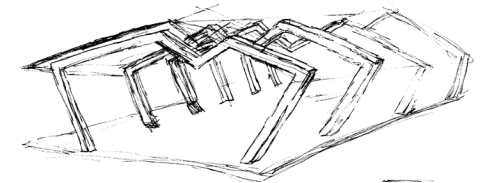




simple long span



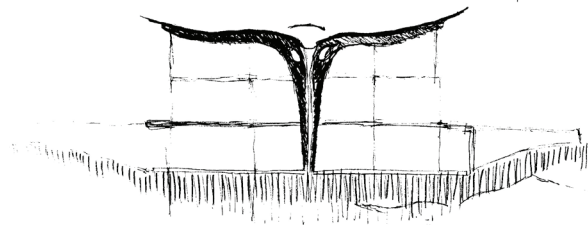
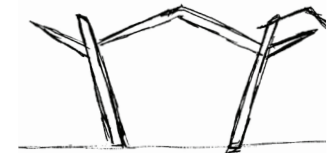
water collection



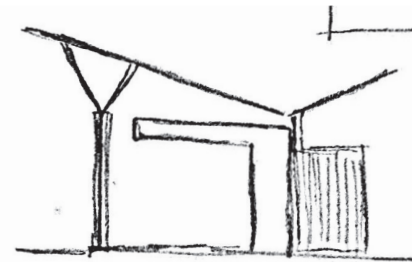
cow skeletal structure



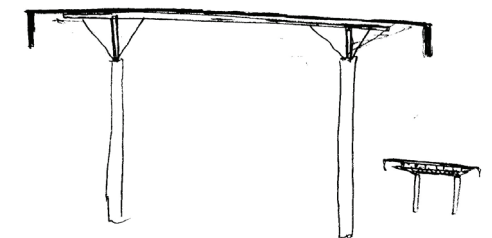
inverted shed



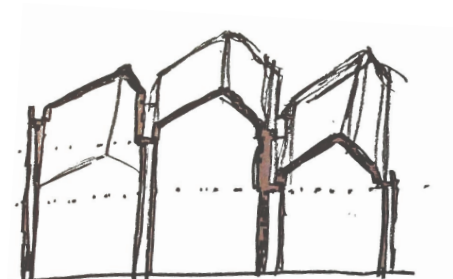
skull and horns inspired



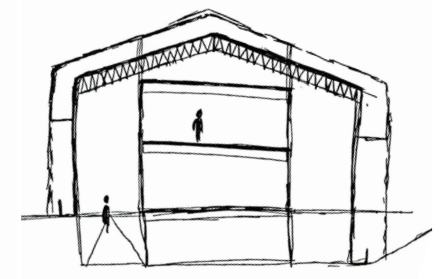
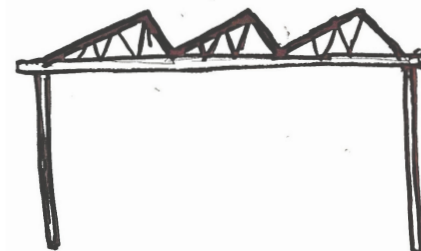
butterfly roof



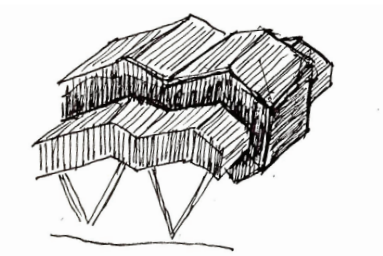
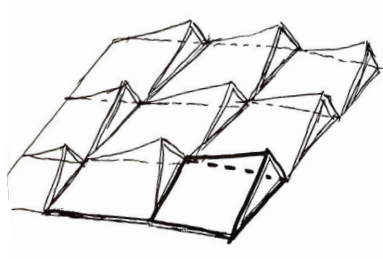
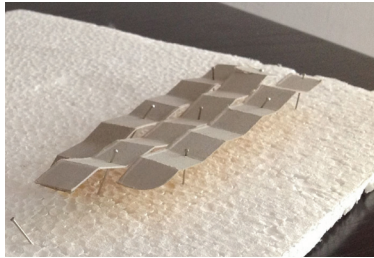
flat roof



reorientated saw-tooth



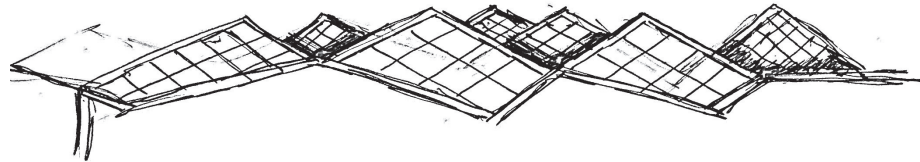
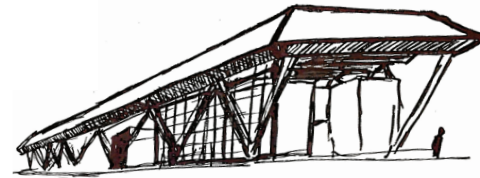
shed



programme driven



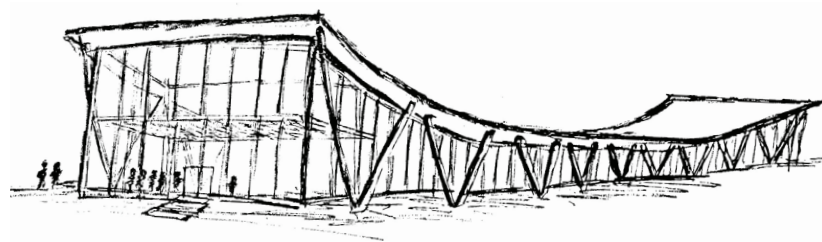
multiple roofs



off set saw tooth



wave-like roof

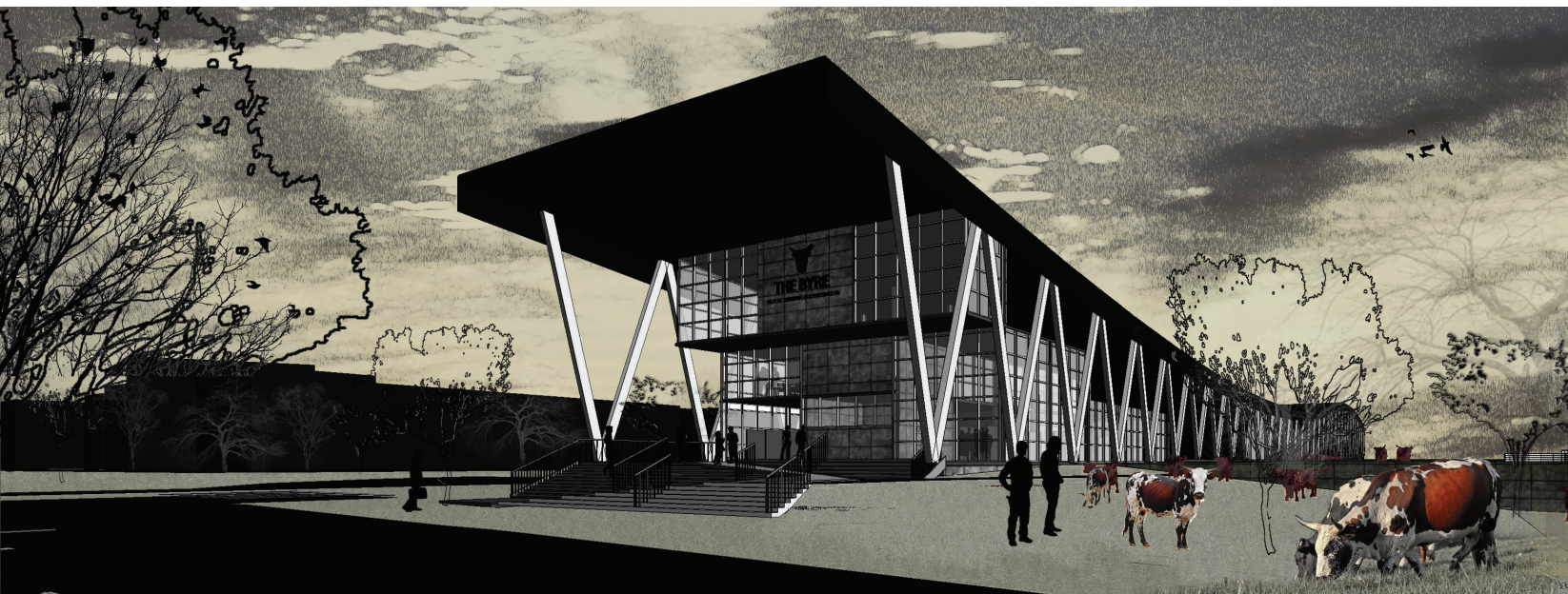
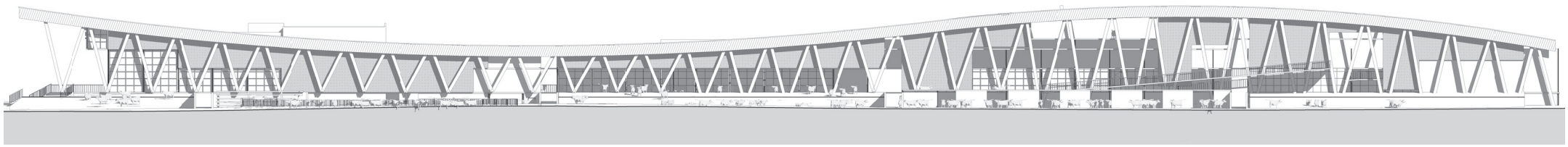


inverted curved roof

By the 3rd review, a curved roof that raised or lowered at particular section of programme. The comments for this roof type was that the building now resembled an airport, completely going against the nature of building needed to fulfil the brief requirements of a gesture in the landscape.

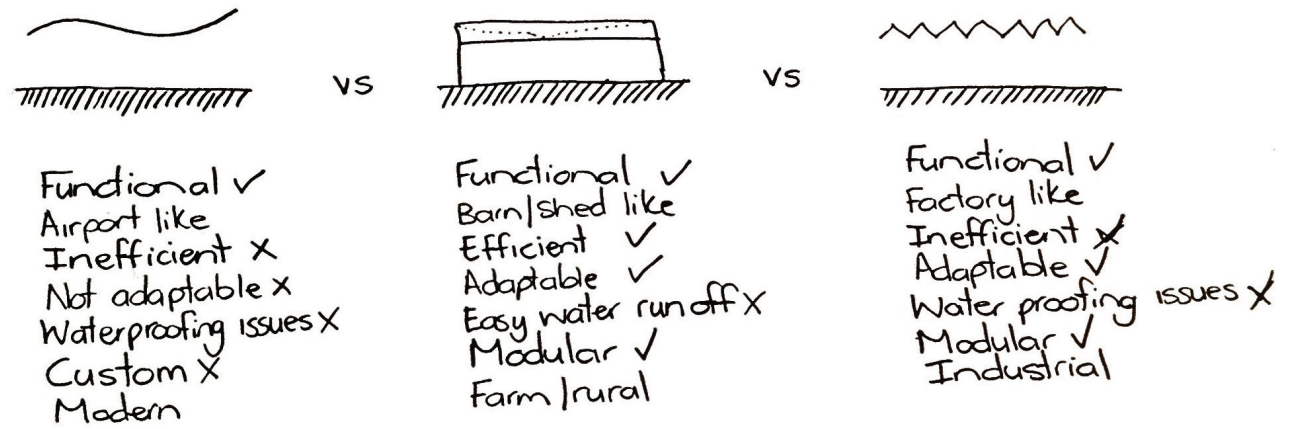
Shed buildings, in their simplicity, are functional, elegant and most importantly efficient.



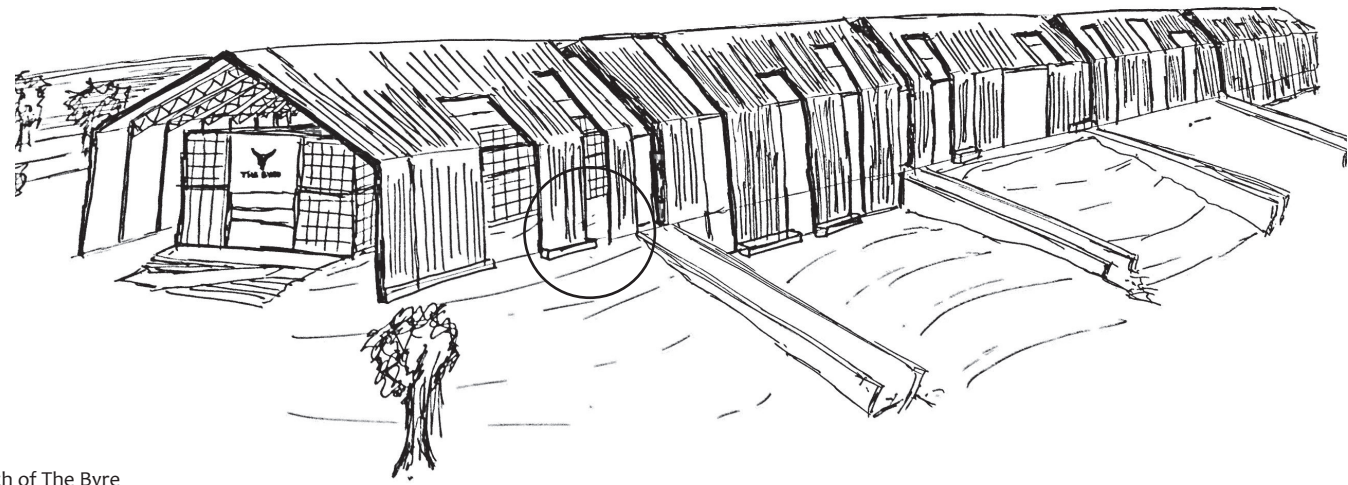




Walling = Water trough



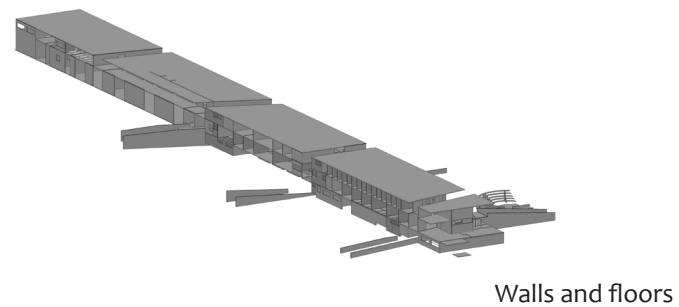
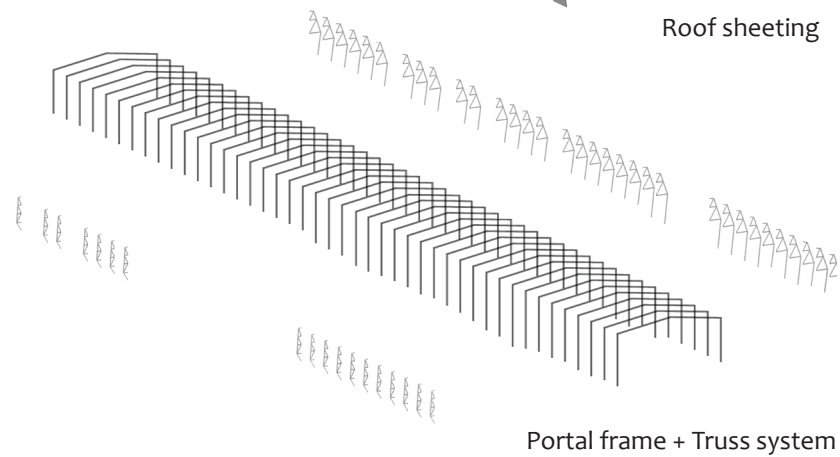
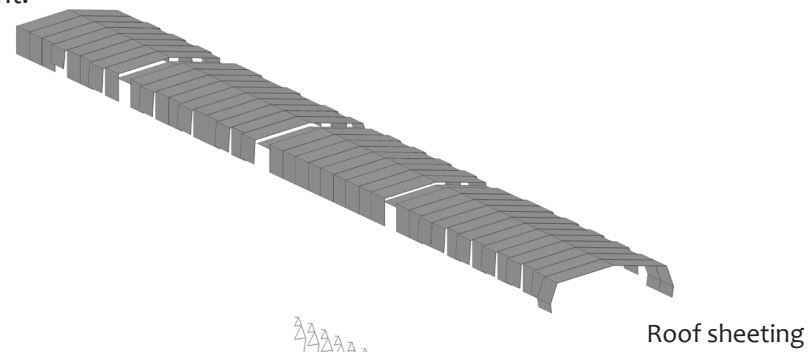
Comparative list of the three roof types tested



Recent Sketch of The Byre

Structure:

The final roof solution consisted of a portal frame structure, with truss systems placed on the sides of the structure as seen in the diagram on the right.



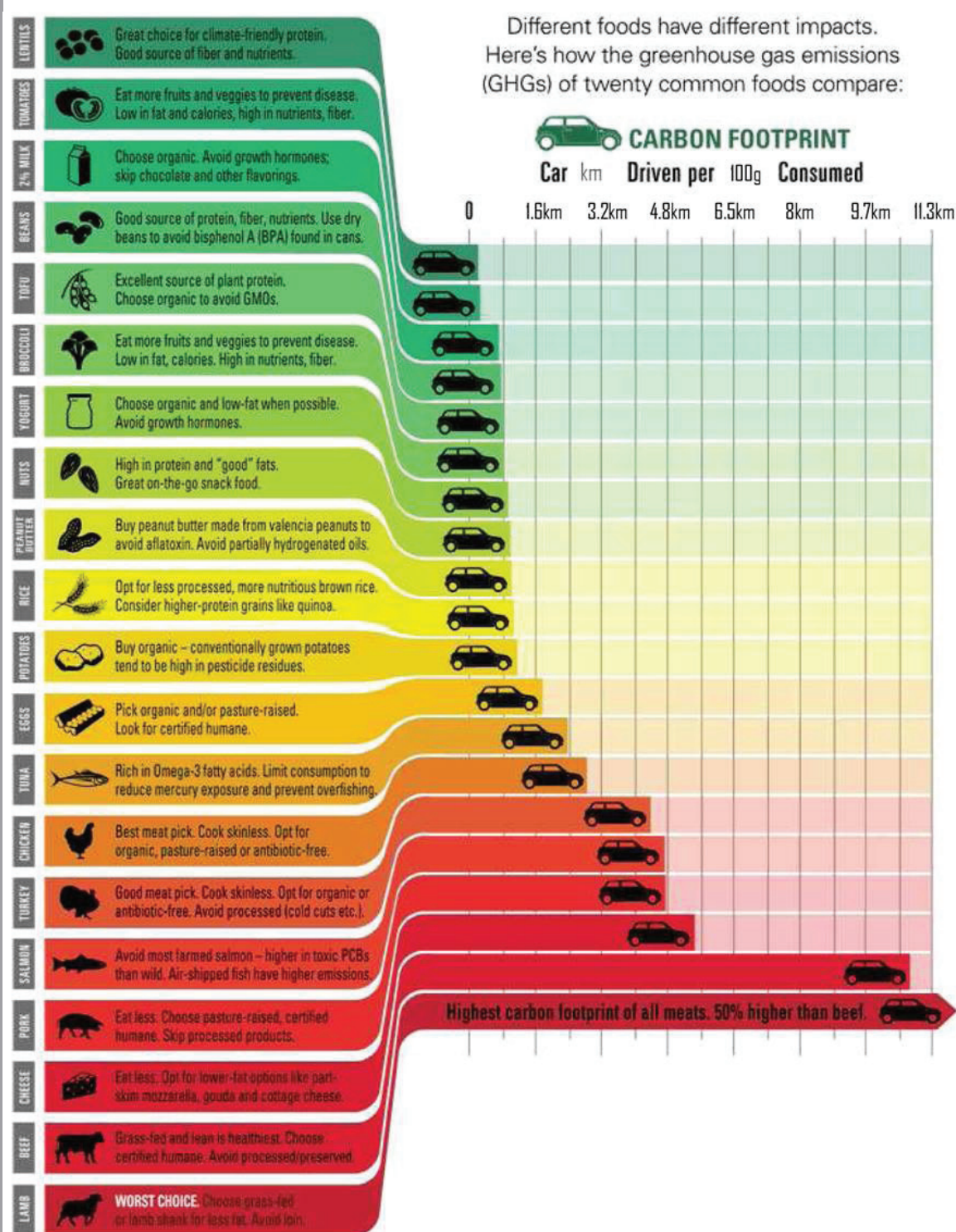


71. Photograph (Ellmist. 2002)

3.5

Technology

This chapter looks at the technical component chosen.



Livestock are responsible for 18% of greenhouse gas emissions, a larger percentage than that of the transport industry. The greenhouse gas emissions are a result of:

- Feed production (i.e. chemical fertilizer production, deforestation for pasture and feed crops),
- Cultivation of feed crops (i.e. feed transport and soil organic matter losses in pastures and feed crops),
- Animal production (i.e. methane and nitrous oxide emissions from manure), and
- The transport of animal products

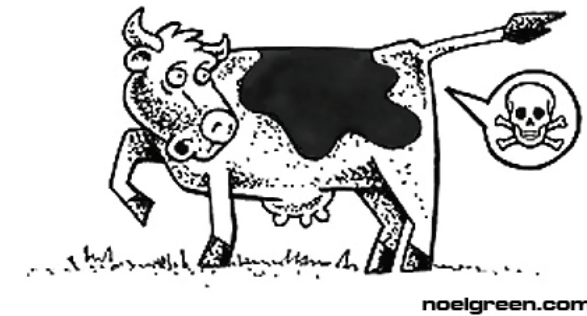
For this reason The Byre is required to be self sufficient. The cattle manure will be collected with design application. The flooring in the cattle pens will be sloped to a drainage system where the manure is taken to the methane exchange room, in the basement of the building and is converted into manure into electricity to power the building and the university campus.

Biogas typically refers to the gas produced by the biological decomposition of any organic matter in the presence of oxygen. It is produced by the anaerobic digestion or fermentation of biodegradable materials. Biogas consists of methane (CH_4) and carbon dioxide (CO_2). (Biogasfuel, n.d)

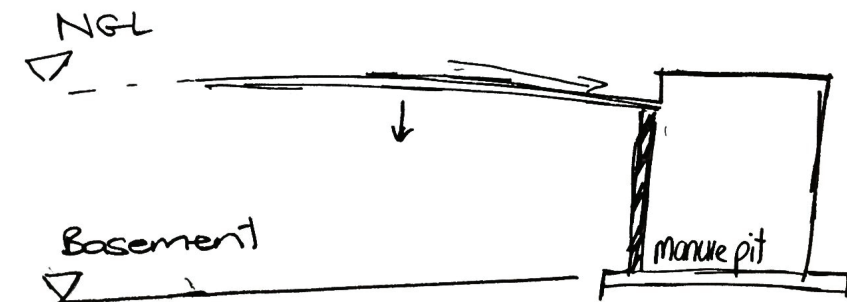
The process of retrieving the biogas is by combustion or oxidising (with oxygen) the methane, carbon mon-

oxide and hydrogen. The energy released is used as fuel. (Biogasfuel, n.d)

Anaerobic digesters is used in a gas engine to convert the energy into electricity and heat. (Biogasfuel, n.d)



Sloped flooring of ground level to collect the cattle manure.



Collection of water:

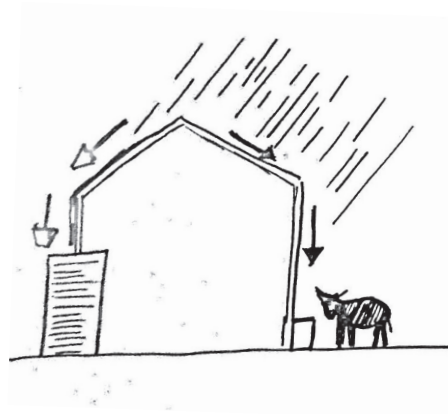
The roof is responsible for collecting the water, rain-water is collected in a gutter hidden away inside the truss system, this water is collected and taken to the water tanks stored in the basement of the building. The stored water is then filtered and circulated throughout the building to the watering troughs on site, flush the toilets, cattle dip and for irrigation purposes.

The excess water that is not collected in the rainwater down pipe is guided on the facades of the truss systems and into a cow trough. The ergonomics of a cow was studied in order to design a trough that is ergonomically comfortable for the cow.

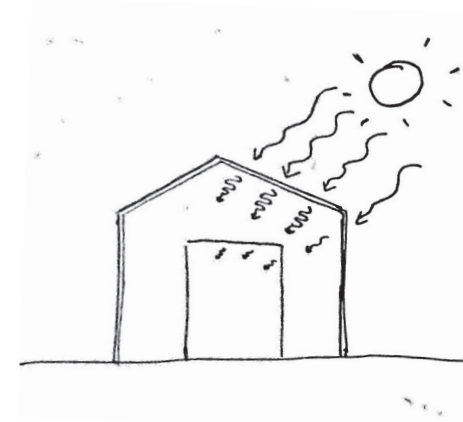
As The Byre is a building within a shed, this double roofing system helps control the heat entering the building at any time. The Building component is sealed off and protected for the elements. The shed roof over the building is not fully enclosed and allows ventilation over the building and underneath the roof.

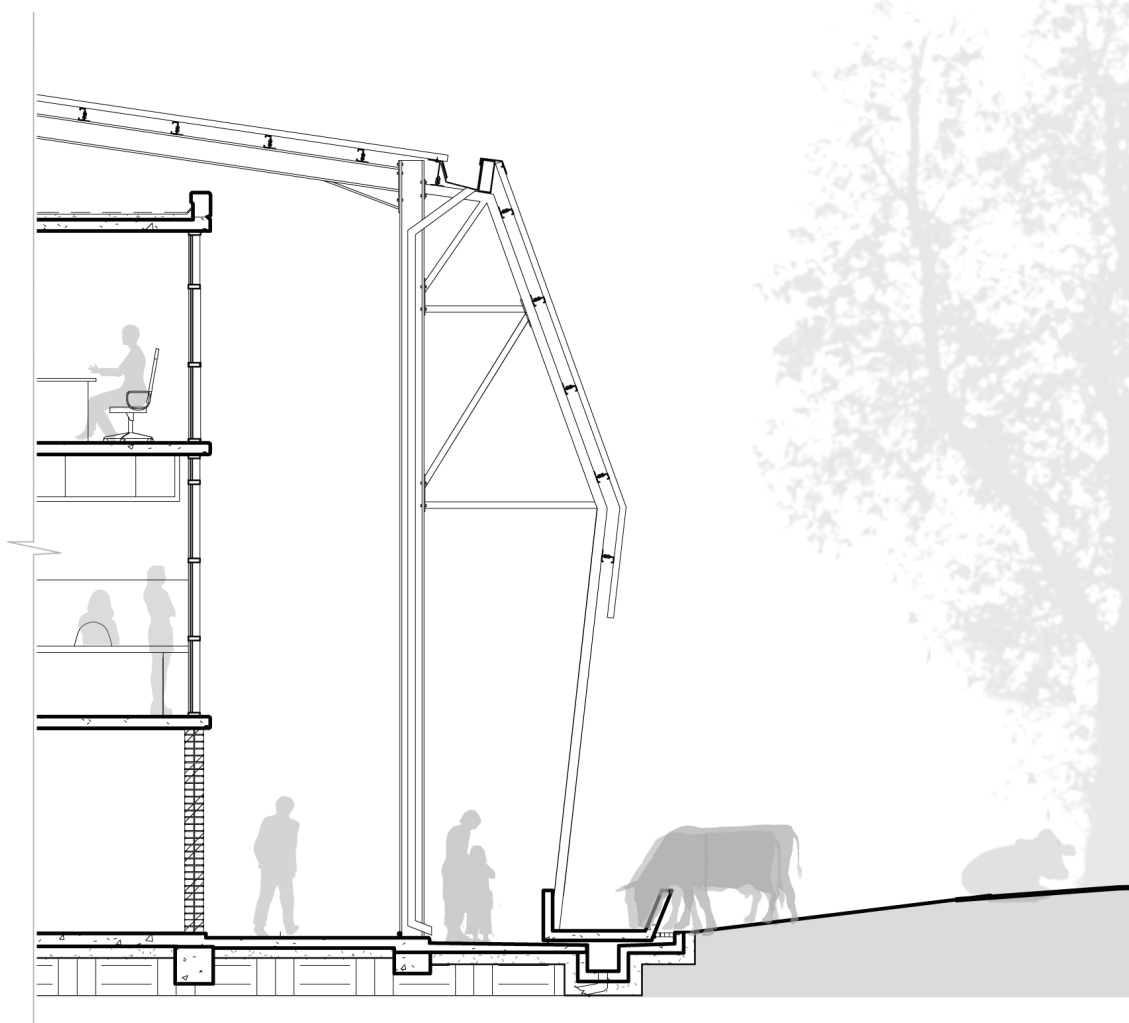
The area above the roof will be used for feed and additional storage, as it is done on traditional farm buildings.

Collection of water to be used for irrigation purposes and providing water for the cattle on site.



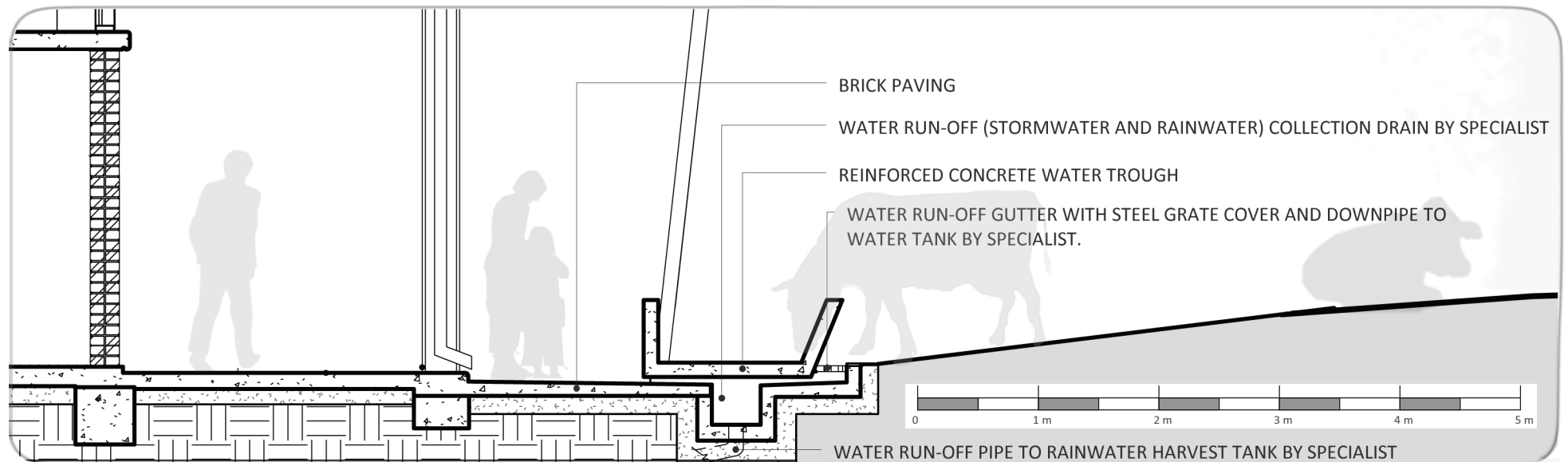
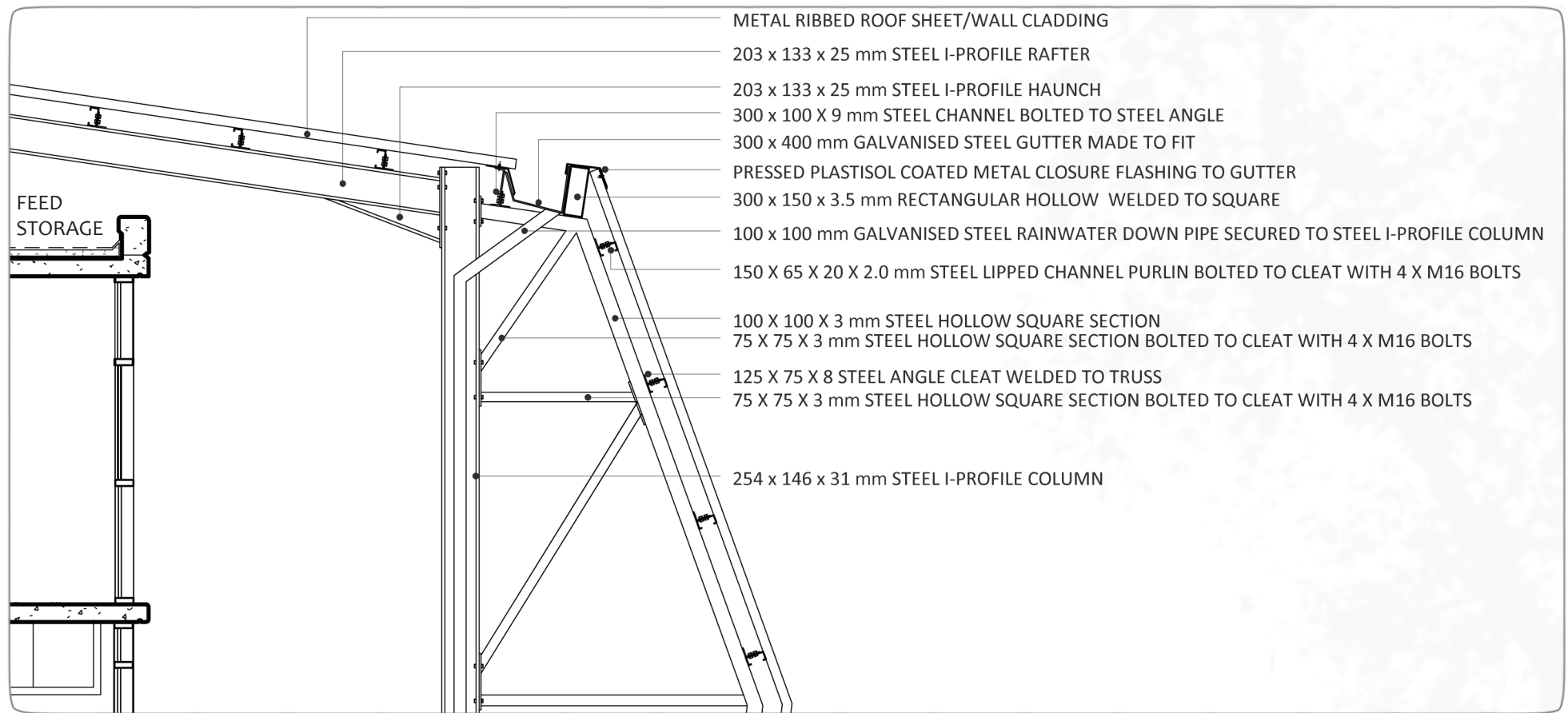
Double roof system of sheds acts as insulation layer for the building.

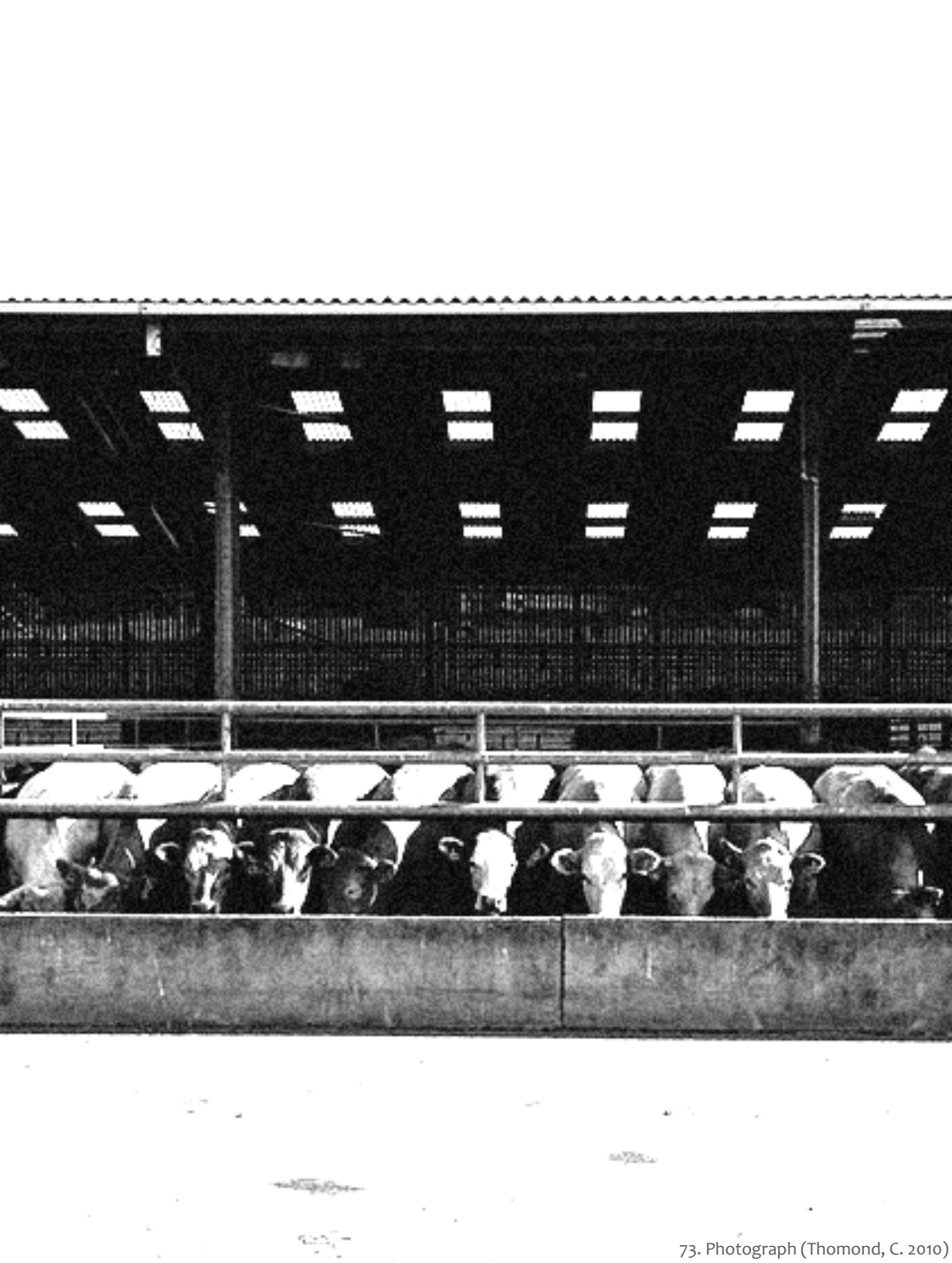




Section (Not to scale). Detailed, scaled and annotated section on the following page.







73. Photograph (Thomond, C. 2010)

3.6

Design Outcome: The Byre

Faculty of Veterinary Science, Onderstepoort Campus
University of Pretoria, Gauteng

Final design drawings.

