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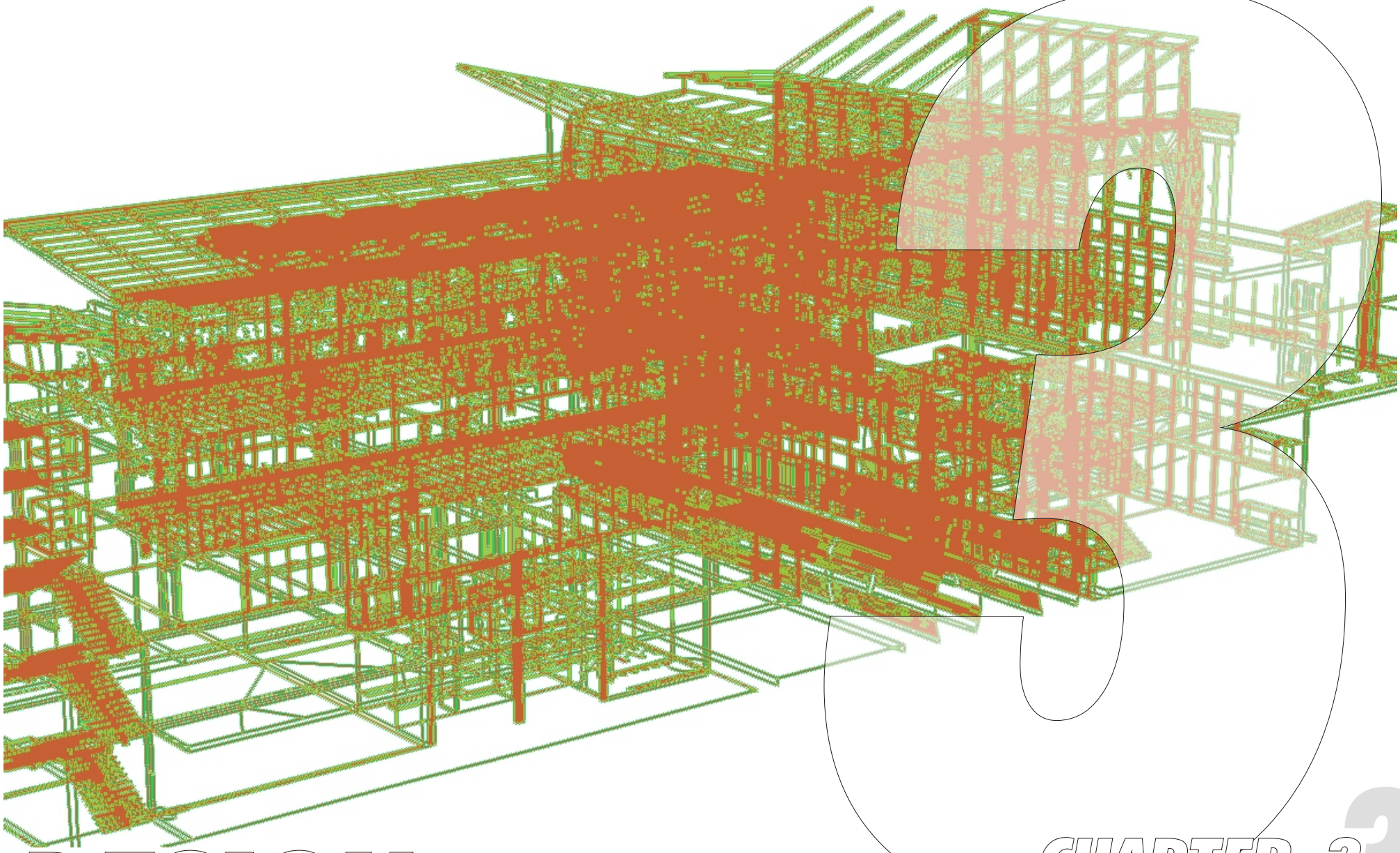

DESIGN

CHAPTER 3

NATURAL VENTILATED

train station

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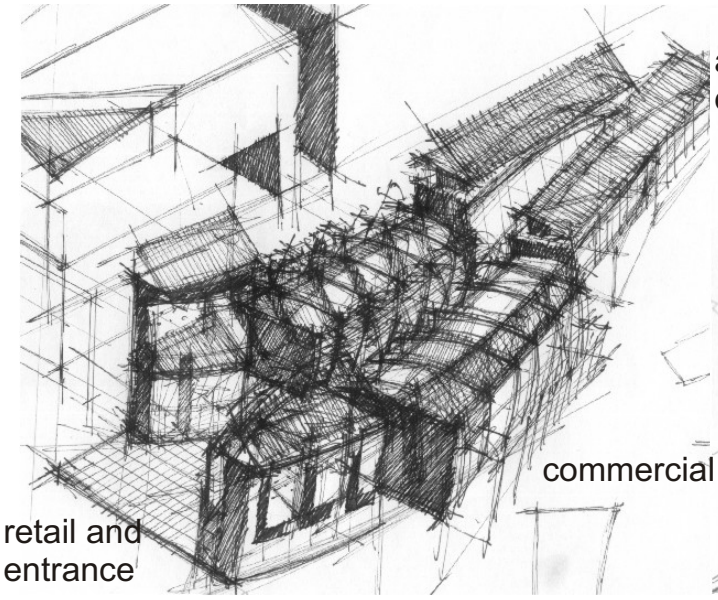
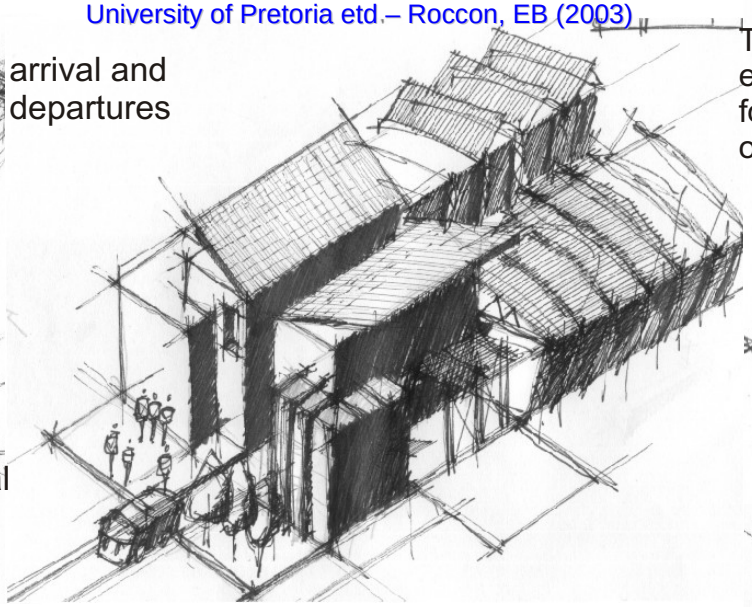
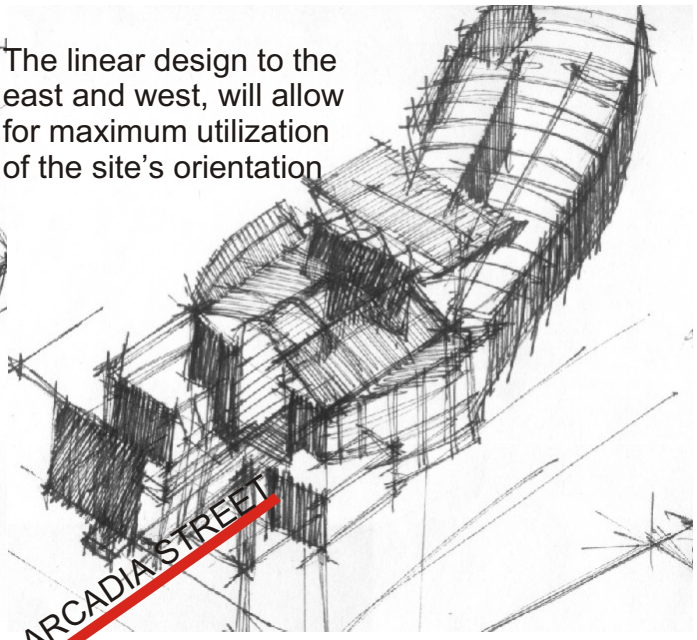
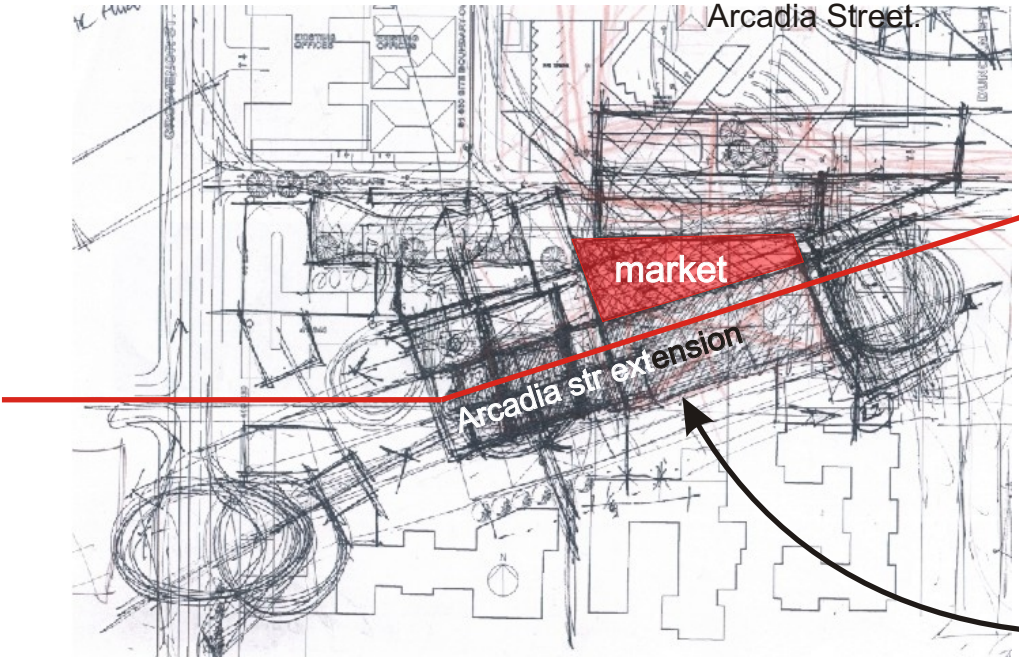






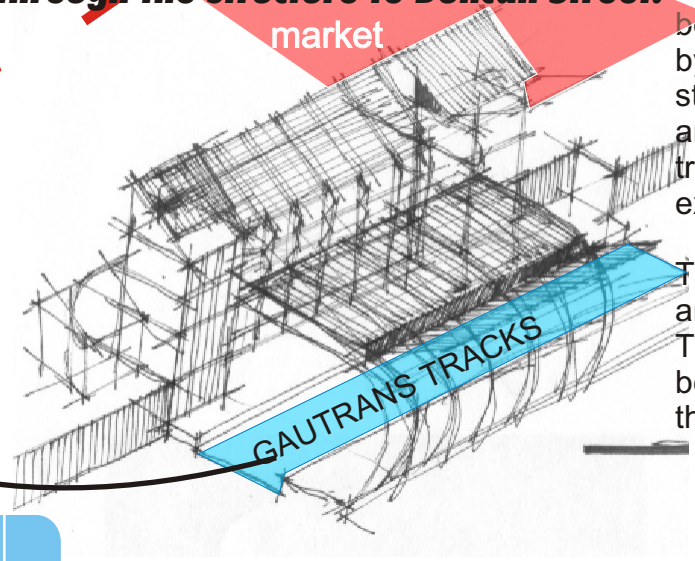
Concept sketches explaining the linear movement with the existing rail road tracks. These buildings will form an activity line perpendicular to the rail road. The design will not incorporate the surrounding buildings and activities. The public open spaces will not be formed, due to the linear (east/ west line) activity line. The building will only form an extension of Arcadia Street.

CONCEPTS

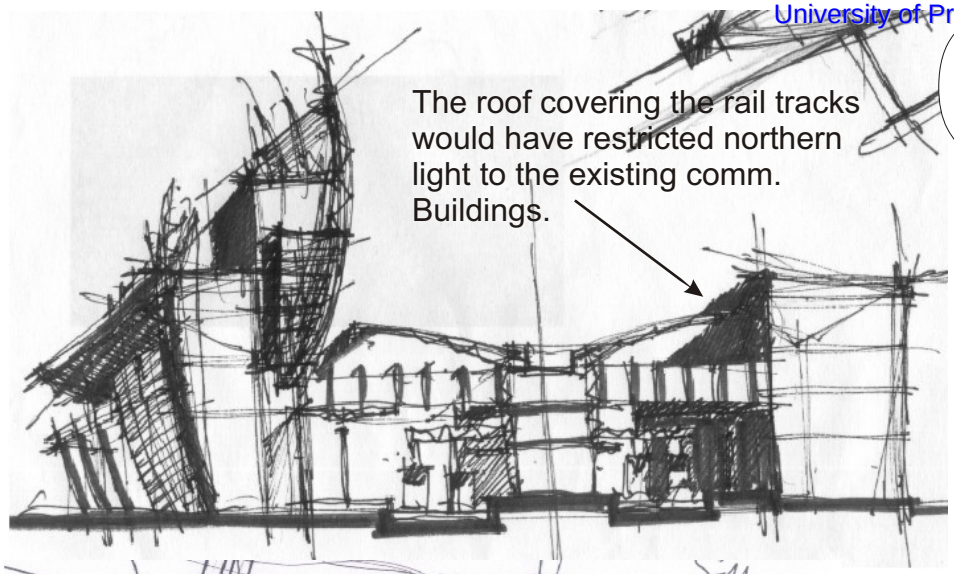


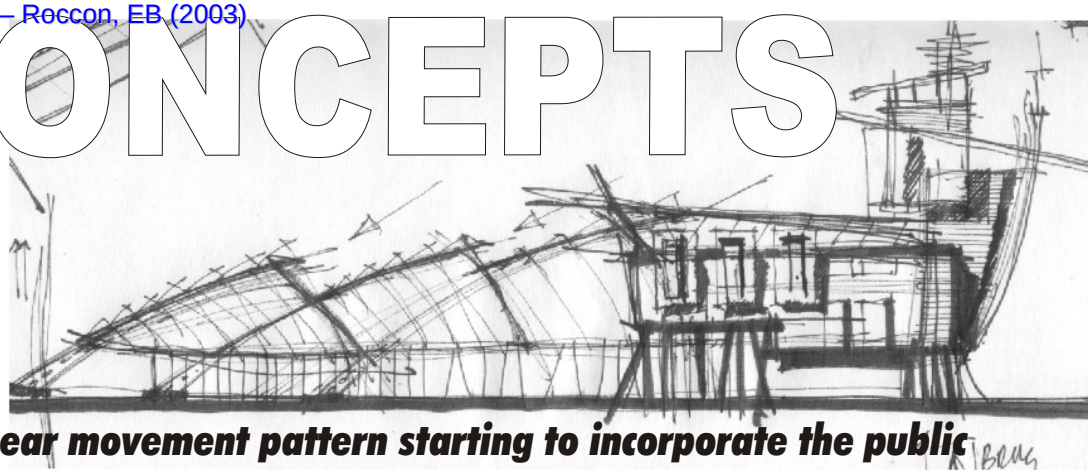
the linear movement on plan will progress from a public open space through the structure to Duncan Street. The main public open space will be linked to the market open space by the activity line through the station. The arrival and departures are still perpendicular to the rail tracks. The Gautrans tracks are still exposed and not bridged.

The idea was to expose the trains and platform pedestrian movement. The southern facade would have been glazed for natural light to enter the structure.

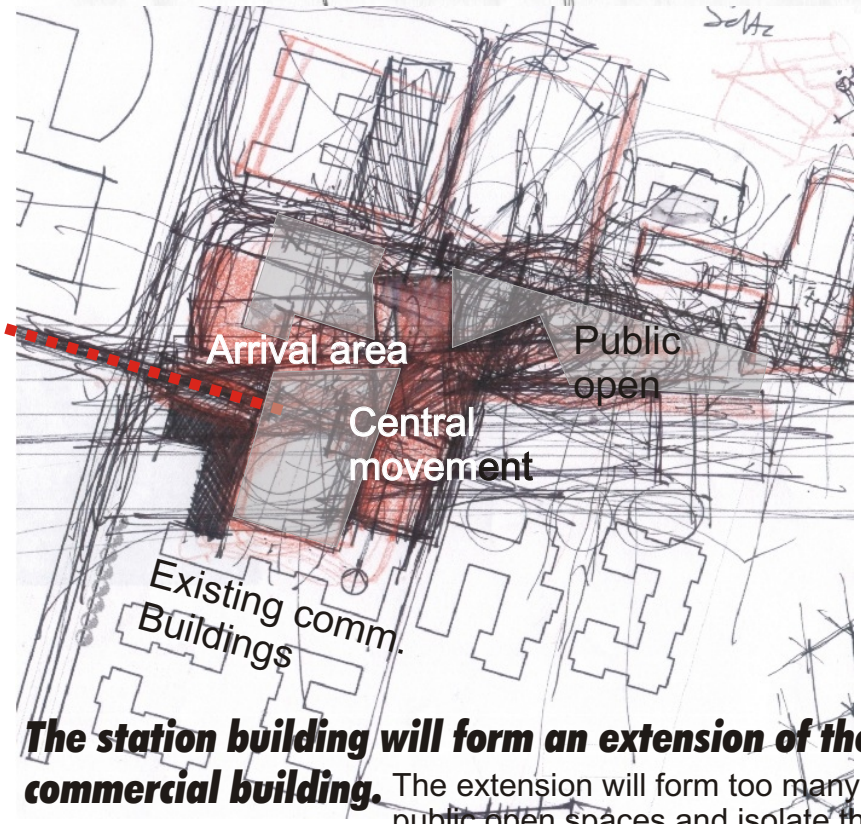


CONCEPTS

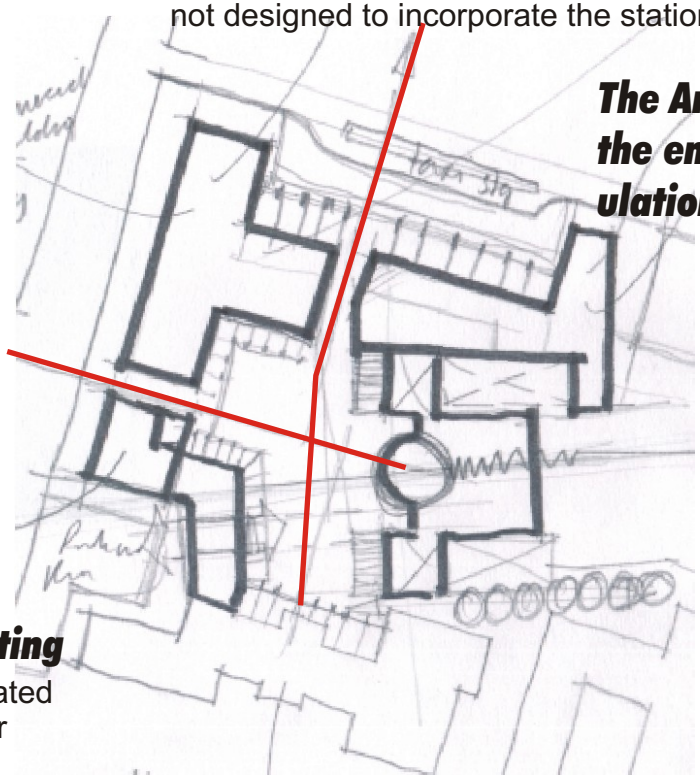




The linear movement pattern starting to incorporate the public open spaces and the railway tracks starting to move under ground as an enclosed and separate movement space. The railway tracks and platform levels are still visible and covered by a separate roof structure. The existing commercial buildings on the southern side of the site were not designed to incorporate the station.

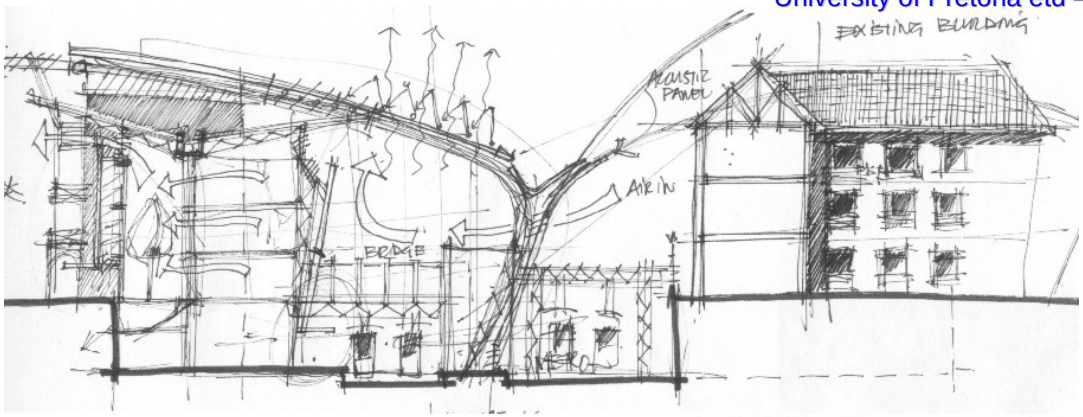


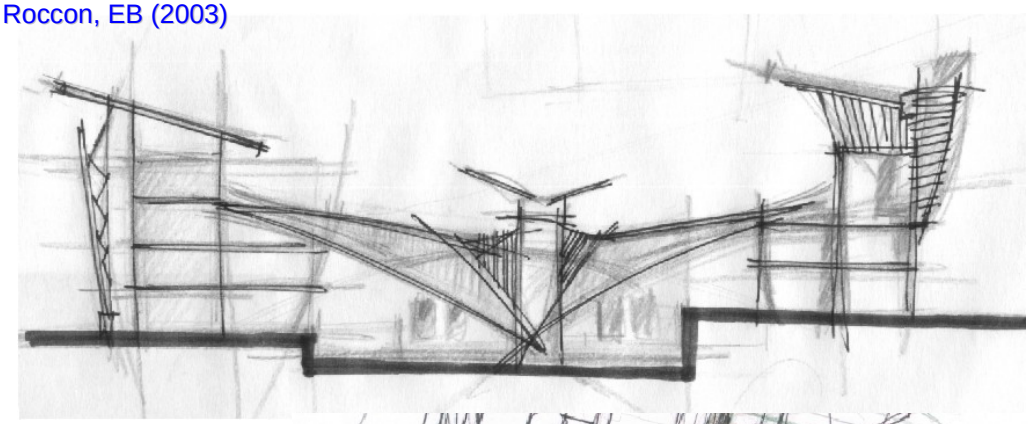
The station building will form an extension of the existing commercial building. The extension will form too many separated public open spaces and isolate the other existing buildings

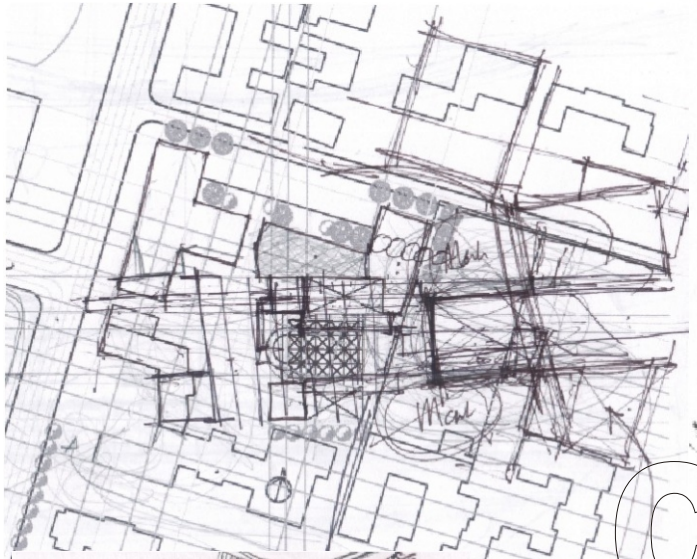


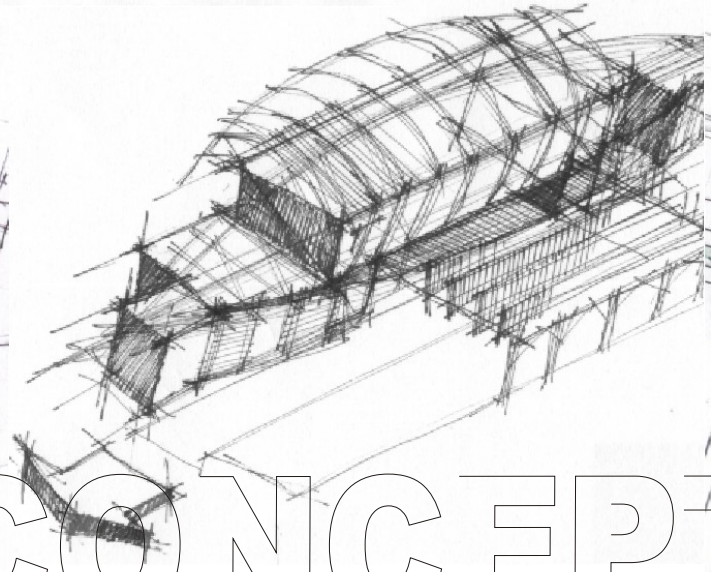
The Arcadia Street axis defining the entrance to the main circulation foyer. The building placed Over the tracks and the movement to and from the tracks will be vertical.

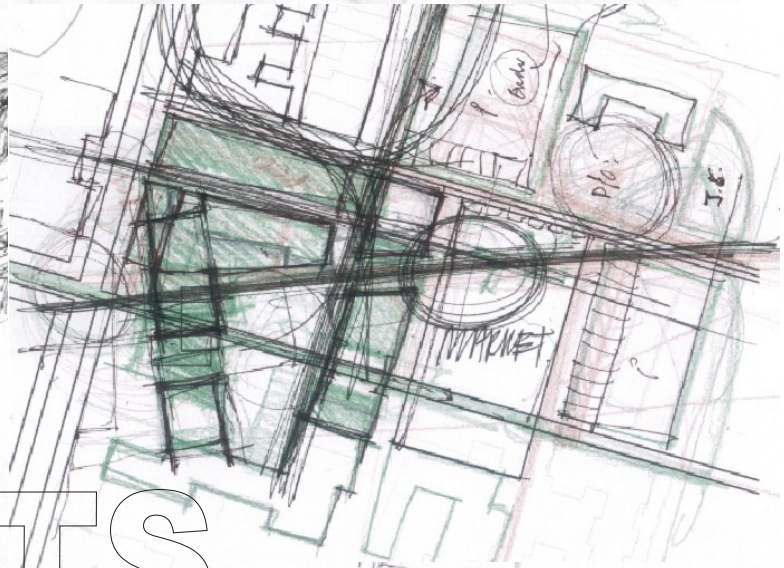
The design in elevation and perspective will be too dominant on the site and too elaborate in terms of focus point. The station building must fit into the local context of the existing structures



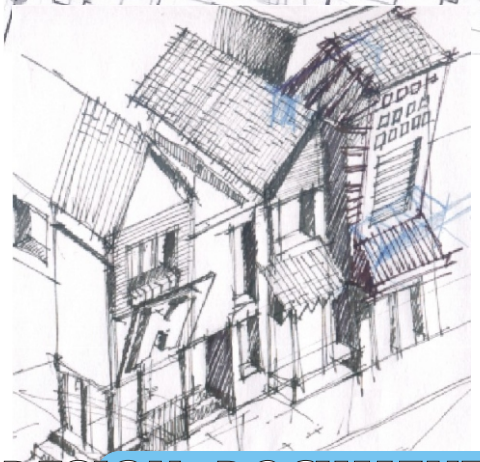


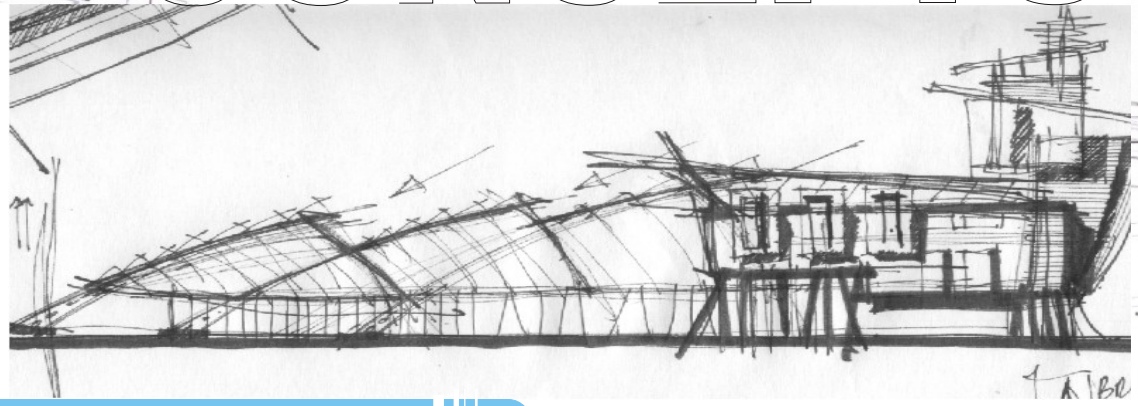


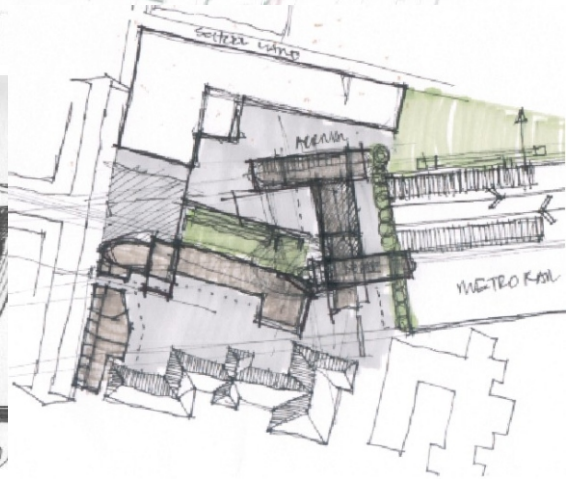




CONCEPTS







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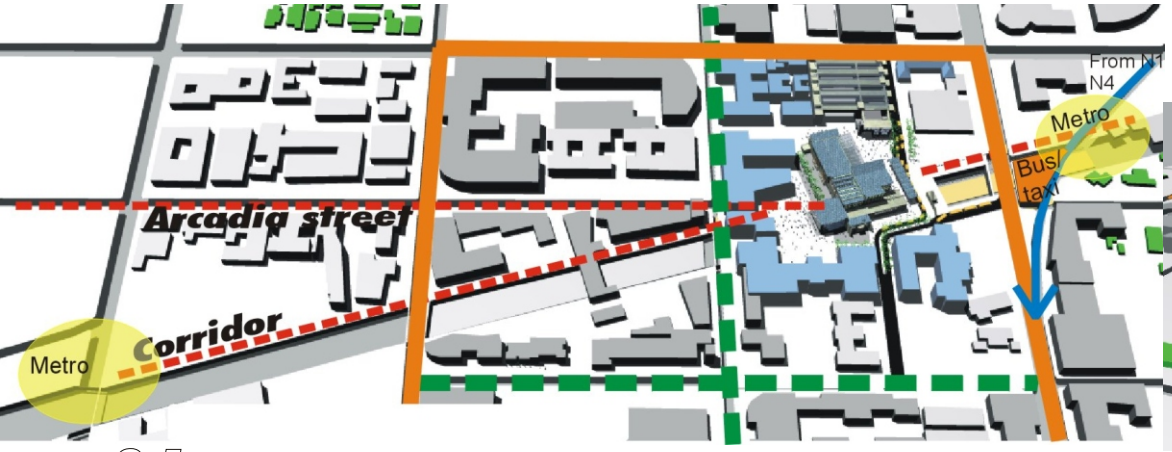
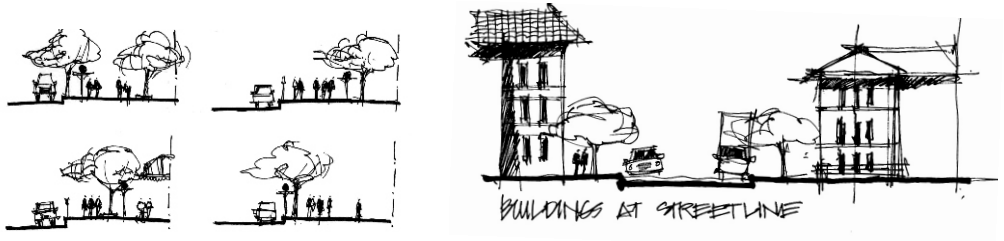


3.1 *(Perspective 1: development and surrounding structures)*

The Arcadia street axis will culminate to the east into the station's main public open space. The main public open space will also be the space to enter and exit the structure. The main entrance link internally to the main movement foyer in the building. The axis will therefor be the line that will lead to the platforms under ground. The main entrance is a glass and steel structure, shaded on the northern side with recycled and reformed-reworked plastic panels. The recycled plastic's chemical properties will be altered to a plastic technologist's specifications to give it the needed toughness against the sun for a longer life span, less re-radiated (storage capacity), to avoid direct heat gain into the building and to be used as advertising or even LCD display boards for information to commuters for arrival/ departure times.

The second axis will be a corridor (refer to urban design) axis, with mixed use, from the Metro Rail Stations. This functional activity line will connect the two modes of rail transport (Metro an Gautrans). The corridor will therefor be utilize primarily by commuters to Hatfield..

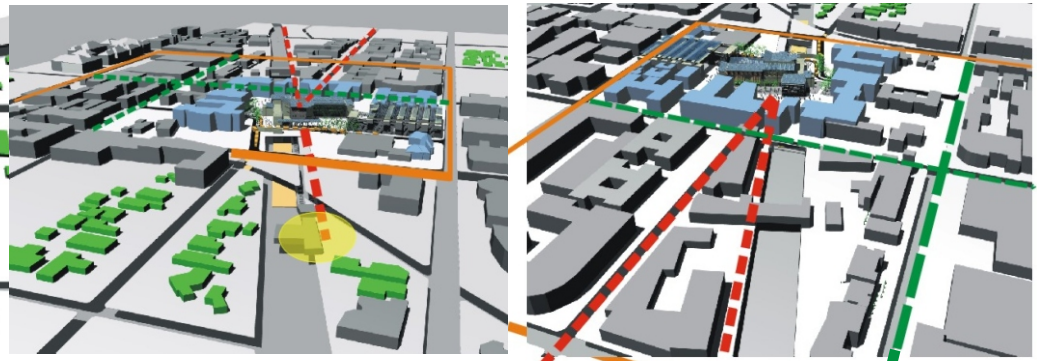


3.3a *(Figures illustrating pedestrian scale for street edges)*

The pedestrianized walk streets will link to the ring road system as a way to maximize the use of public transport and minimize the use of personally owned motor cars. The majority of the housing proposed will be student housing. Students or people just entering the real world out here, will benefit from this by saving on petrol,maintenance, service and insurance on motor cars.

Motor cars will not dominate the street scape anymore, rather people commuting on foot, enjoying street activities and the paving once required for parking areas, will be replaced by green, soft shaded areas.

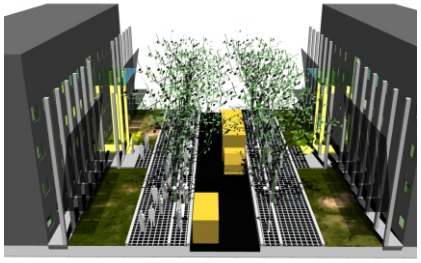
Interaction between people passing by, neighbors or even workers from the area, will promote a sense of community and national ship.



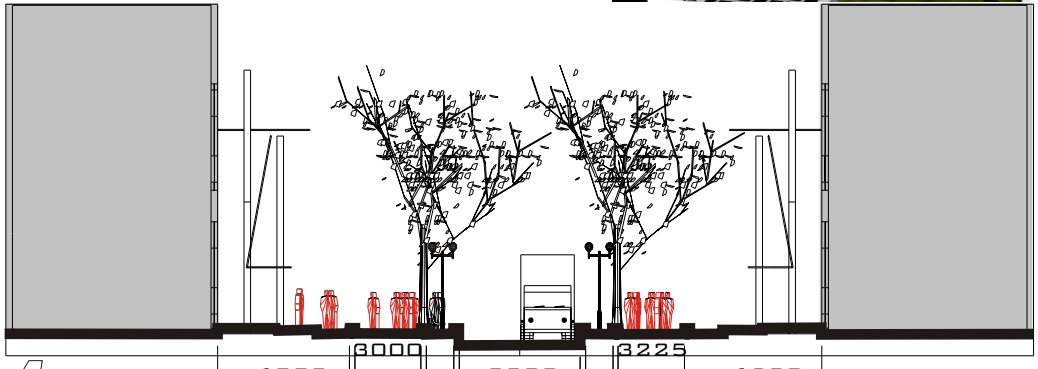
3.2 *(Perspective 2: south-western view)*

The ring road system will add quality, comfort and convenience to students, working people and local inhabitants. The need for an active and reliable public transport system will create job opportunities and can be provided by the government, privately owned taxis or private companies.

Bus/ taxi stops will occur at the intersections of the ring road and pedestrian streets.



3.3b (Perspective of Grosvenor Street as pedestrian orientaded street)



3.4 (Section through Grosvenor Street).

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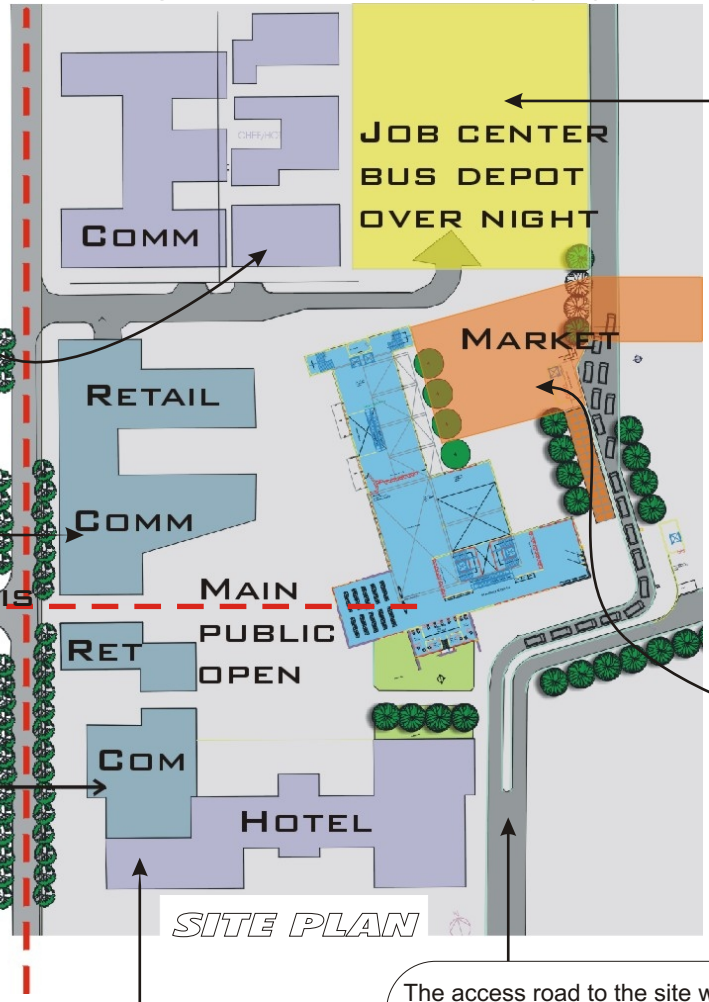
This building is being used by a hotel school to train and educate students.
This facility can be incorporated into the management system of the site by creating practical experience in the proposed hotel on the site.

The students can also arrange and cater for functions in the i-active conference facility of the station.

The adjacent site to the north will be developed as a job center, where commuters can assemble for vacant job opportunities on site, neighborhood, city or Johannesburg, Midrand. It will also have over night accommodation for travel and commuters.
A inter city coach terminal will add to the transport node and people traveling to or from distant cities will utilize the terminal.
The building will have access to Schoeman street for pedestrians and vehicles.
The building will form a hard edge on the street and the scale will be orientated towards vehicular travel and not for pedestrians.



This building will be one of two proposed new buildings. On ground floor there will be retail, cafes and restaurants. The floors above will be housing or a mix of housing and comm.

The facades will be set back from the street, to promote pedestrian movement.

The implementation of an African and fresh produce market, will rekindle the market on a public open space as it was on Church Plane and at the State Theater in the past.
Currently the market is situated in Pretoria-West and not easily accessible by the general public.

The market will expose cultures from Africa, different arts, crafts, foods and languages will meet for not only locals to enjoy, but also the travelers.

Goods will arrive per Metro Rail and loaded onto the central platform into rentable storage rooms. Workers can be obtained from the job center.

The market will produce fresh produce for every day use.

ARCADIA STREET AXIS

This will be a proposed new development. The western facade design, must be planned to the adjacent building's facade across the street. The building will have arcades on the public open space side with retail.
The floors above, commercial.

The building will be set back from the street, to promote pedestrian movement.

Grosvenor Street will be bridged and the scale will be pedestrian orientated. This street will in future become a primary pedestrianised street from the hostels and campus towards the station, taxi/bus-stops and job center.

This street will be one of the streets, connecting the ring road system with pedestrians.

This building is currently being used as a commercial building. Its function on ground floor will accommodate retail and the hotel foyer.

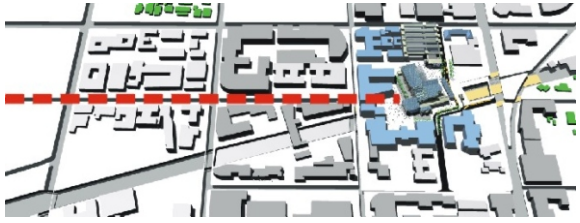
An arcade on the northern facade with its café and retail will add to the vibrance of the public open space.

The access road to the site will be a one way route to the north for the kiss and ride and Gautrans busses, to drop passengers and to pick-uo passengers.
The Gautrans buses will have stops next to the taxi and public transport bus stops.

The service entrance will branch from the main access route to the east. A service lift will handle deliveries to the departure platform levels.

Next to the Gautrans drop-off area, will also be a service lift, to handle deliveries on-foot, repairs, emergencies to and from the arrival platform.

The existing commercial buildings will keep its function. The reason for this is that Duncan street will develop into a commercial street in future and the function of the buildings will form part of this development.



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1.) Introduction.

The universe depends on balance to oscillate in harmony. In balance we find certain ways of thinking to establish ideas in solving life.

"Oscillations that almost repeat themselves but not quite, seemingly random and yet forming complex, highly organized patterns".
(The Web of Life, F.Capra.,1996.)

Capra also states that there are tension between the whole and the parts. He describes the *'parts'* as a mechanistic, reductionist or atomistic way of thinking and the *'whole'* as a holistic, organismic or ecological way of thinking and that we are changing our way of seeing and perceiving the world from the parts to the whole.

Contemporary architecture is moving towards the whole. In practice, laws are being passed to design, plan and act more in harmony with nature. Tertiarary architecture education emphasizes the fact that there are subjects called sustainable architecture, Agenda 21, recycling, re-usability and retro fitting, brownfied sites, grey water and renewable building materials.

2). **Systems thinking:**

Think about micro-organisms. They cant live on their own. They are in a symbiotic relationship with their host to feed and survive. This is a living biological system.

We humans are a biological system, formed during conception from xy and xx chromosomes. We receive half our chromosomes from our father and half from our mother (balance). We are whole from parts.

"There are a continual flux of matter through a living organism, while its form is maintained".
(The Web of Life. F.Capra.,1996.)

Cities can be described, metaphorically the same. We as inhabitants of a city (matter), diverse In culture, behavior and up bringing, is a continual flux to give character, atmosphere and structure to our city.

The Gautrans will be a part of the whole in terms of function, location and structure. The building will also operate or function according to a system. People will again form the flux of matter (body heat, daily requirements, transport) and will form part of the whole.

Nanotechnology is to break a material down to its smallest molecular structure and change the properties of the smallest particle to create the same material but with different properties.

An example can be the swivel panels over the double volume area of the building. Imagine a gas that can be manipulated its molecular structure to expand and create enough pressure in a volume to create energy and the only heat added will be that of our daily sun.

The warmer the day, the more the expansion of the gas. The more the gas expands, the more pressure and the more energy created to open the panel. The panel will open according to the temperature outside and therefore control the internal environment according to the external environment.
A computer management system will be replaced by natural physics.

Another example can be the effect of 'sunglasses' for a building. To manipulate a gas in molecular structure, again to densify as the day gets warmer. The gas heats up expands and densify, to create a barrier against the sun and provide shade for the internal space.

The building will be a closed system. This means that air will enter the structure on platform level through the double volume openings over the rail tracks (louver system), the vertical circulation area in the arrival flank and the vertical circulation area at the departure flank.

The louvers will close and the air will then be treated and conditioned by the heat pumps in the HVAC rooms on the 2nd lower floors of the departure and arrival platform levels.
The heat pumps will be provided with air from the suction fans in the ceilings and the staircase areas (natural chimney effect), naturally added heat for winter heating.

If the air is not sufficiently heated or cooled, the air conditioning unit will be activated and provide the necessary temperature difference.

Evaporative cooling can be introduced at the double volume over the train tracks. This can occur through electrical operated fans with a moist membrane. Air will be blown through the moist mesh and the droplets can evaporate and cool the air.

The desired comfort level to be achieved internally will be a dry bulb temperature of 22 deg Celsius and a relative humidity content of 60%.

Sensors to calculate temperature differences, air pressure levels and moisture content, will be placed every 100 sq/m at roof level on ground floor. This will allow certain outlets and inlets of air, to cool or heat certain areas more or less than other areas to achieve a constant temperature through out the building. The temperature differences can also be caused due to different functional activities within the different functional spaces.

"Oscillations that almost repeat themselves but not quite, seemingly random and yet forming complex, highly organized patterns"

Oscillations: refer to people. People's daily routine, working, inter- acting, resting and eating.

Patterns: each individual has its own routine or pattern but form part of the whole.

A footpath in the veld is an example. People do not walk in each other's footsteps, but a path form because people instinctively walk to a point on a 'path". The pattern forms the path.

The railway tracks and public road based transport system will crate a **oscillation**. They will repeat their function daily.

A single person will **repeat themselves, but not quite**, for the person will not arrive at the same time today as he/she has yesterday or will, tomorrow.

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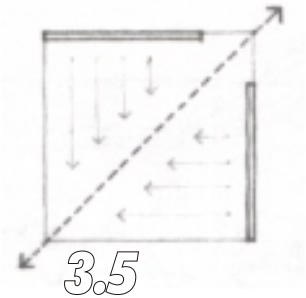

3.5 (figure explaining the shortest path between two points).

People will always choose the shortest route from point A to point B (oscillate, repeat), this pattern will form the path.

This **random** usage of the transport system will form a **highly organized pattern** of functional movement to and from the station.

"There are a continual flux of matter through a living organism, while its form is maintained".

The continual flux of matter reflects to the cell structure and groupings of any living organisms. A human and an ape, in terms of form look the same (two arms, two legs etc). Human cells have different 'orders' to group and evolve.

This order of grouping or flux of matter internally, give rise to different characters in form and presence. Both are still living organisms.

People are made up of cells to produce different anatomical feature to distinguish us as humans. The flux of matter differ from person to person, but we are all humans grouped to form a society.
If the people whom are grouped together can be seen as the flux of matter and the form can be seen as the building, the people and the building can be made up as a single living organ. The grouped buildings on the site can then be seen as an entity (person).
Duncan Street and Schoeman Street can then be seen as a arterial vain, supplying the organ or station with the necessary growth matter.

The different functional spaces within the structure will also act as a continual flux of matter within an organism.

3). Air.

An example of the influence of air on people and society can be found in the Ten Books of Architecture by Vitruvius.

Vitruvius stated that there were four primary winds (north, east, south and west) and four secondary winds (north-east, south-east, etc).
He translated this analysis of the wind into a structure: Tower of Andronicus. The sides of the tower (primary and secondary winds) represented the human characteristics to the wind, engraved on the sides.

Vitruvius also used the wind to plan and lay out cities. The primary wind directions during the season was established and then noted. Where the lines of the different seasonal primary winds meet, will be the center of the city.

Air rises when it is heated by the sun. The pressure of the air lower. Colder air (higher pressure displace warmer air).The pressure difference gives rise to wind.

In the time of Vitruvuis, wind was seen as a health risk. Roads were laid out in the direction of the wind, towards the town center, so the wind could be channeled down the streets past the building's facades and not enter the structure.

Vitruvius contributed to our understanding of wind by stating the following three characteristics in his writings from: "Ten Books of Architecture" :

1) wind will flow along a path given to it
2) wind tunneled from a larger space to a smaller space, will increase the velocity speed of the air stream.
3) obstructions in the path of the air stream, will decrease the air stream's velocity.

3.6 (figure showing the different seasonal wind directions).

Today we utilize the wind to cross-ventilate our volumes in a structure, evaporative cooling, extraction of hot air by means of the stack effect, the "malqaf" effect, with trombe walls and to use the volume of air present and treat it with air-conditioning units.

The train station will utilize wind (air movement) from the environment to assist the air-conditioning system in controlling the internal environment.

The primary principle surrounding the design is the 2nd Law of Thermodynamics:

" Among all the allowed states of a system with given values of energy one and only one is a stable equilibrium state. Such a state can be reached from any other allowed state of the same energy and leave no effects on the environment".
(Encyclopedia Britannica, 1982.).

This means that a higher energy will find equilibrium with a lower energy of the same energy. As we find in nature, everything must have balance. If the balance is disturbed, we find disorder. Our ecological footprint for example must be in equilibrium. We must only use as much as nature provides and if we use more, we deplete our resources to survive.

We have to adopt a sustainable point of view towards life, to ensure the future existence of our children.

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In nature, our weather is an example of equilibrium. The North and South Poles keeps the earth revolving around an axis. The equatorial region provides heat and evaporation from the ocean, the high and low pressure systems create weather patterns and seasonal heat, cold, rain, snow, hurricanes and wind.

Any structure typically has four sides. As the sun heats the structure during the day, there will form hot and cold areas. The eastern side will heat up during the mornings and radiate heat first during the afternoon. This heating and cooling of the structure will create different pressure zones in the building and therefor, airflow within the structure.

In a structure, there are basically two methods of passively distribute and remove air in a structure.

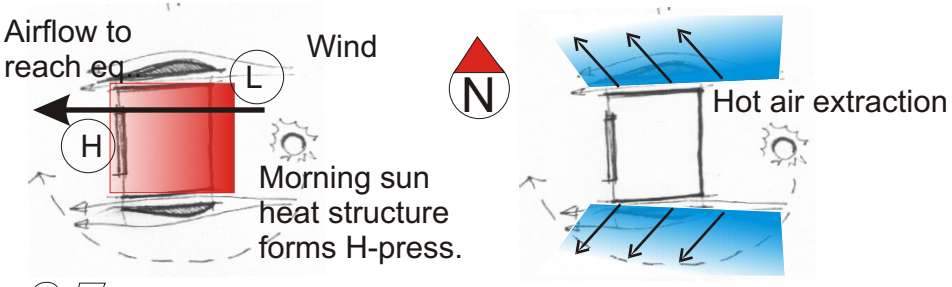
3.1). Wind-induced:

The ***Bernoulli-effect*** is an effect where air moves over a surface with two sides of different profile and length. This will create an air stream with different velocity and pressure on the different sides.
An example of this principle is that of an aeroplane wing profile. The two sides of different length and profile create lift from the difference in velocity and air pressure passing over the wing.

The air takes longer to pass over the rounded top part of the wing than the flat part of the bottom side. The air at the bottom side loses velocity and pressure increases. This effect creates lift from the bottom side upwards.

This principle can be used on a structure. The pressure difference on the two sides can be used to extract air from a structure. The air to be extracted can be associated with the bottom side of the wing.

This system can be used as a roof structure (rising hot air) or as a wall extracting system (pressure differences-cross ventilation).

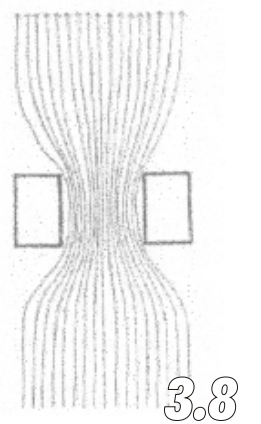


3.7 (figure explaining the Bernoulli - effect on the building in principle).

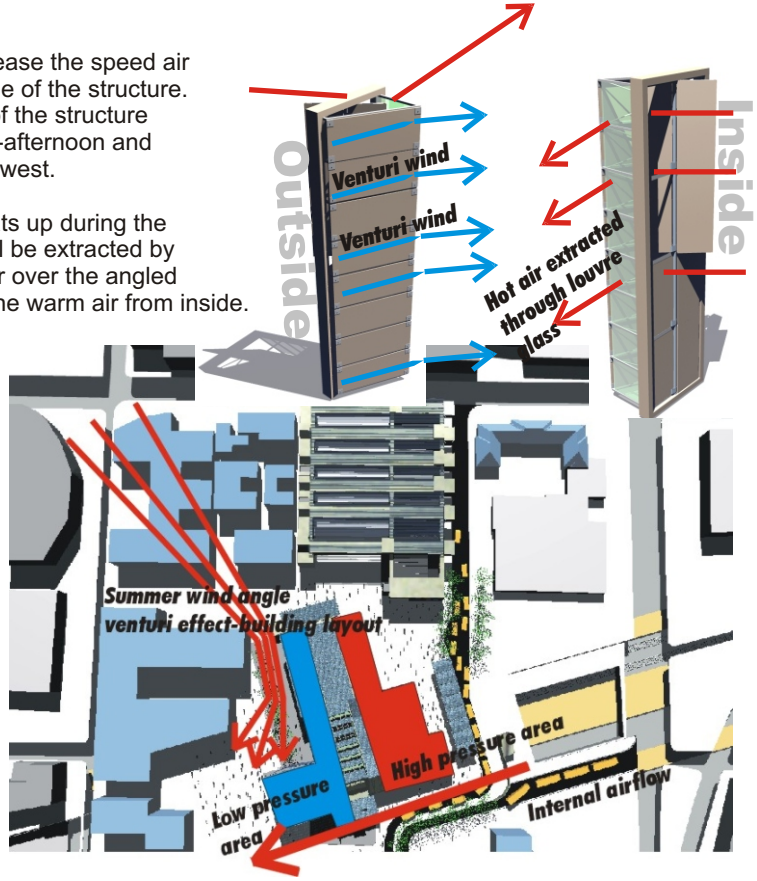
The **Venturi effect** is when a volume of air passes from a larger surface area through a narrower, smaller surface area, the velocity of the volume of air will increase.

The Venturi effect will increase the speed air will flow on the western side of the structure. The internal eastern side of the structure would have heated by mid-afternoon and create airflow from east to west.

As the western facade heats up during the afternoon, the warm air will be extracted by the Bernoulli-effect. The air over the angled timber panels will extract the warm air from inside.

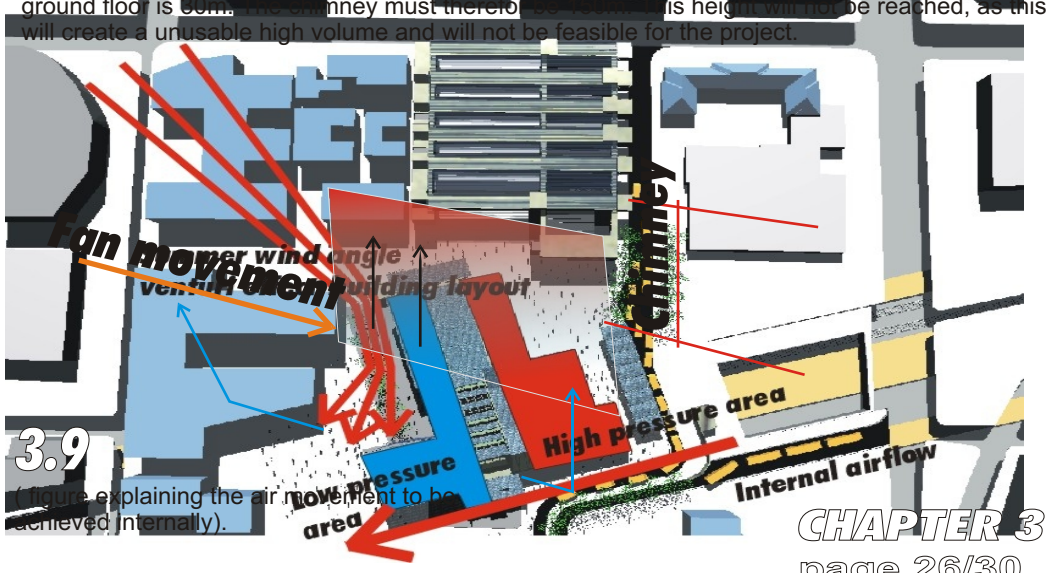


3.8 (figure explaining the Venturi effect on plan and elevation).



3.2). Stack induced

This effect works mathematically on the principle that the height of the chimney must be five times higher than the depth of the volume. The depth of the volume over the Gautrans platform on ground floor is 60m. The chimney must therefore be 300m high. This height will not be reached, as this will create a unusable high volume and will not be feasible for the project.



3.9 (figure explaining the air movement to be achieved internally).

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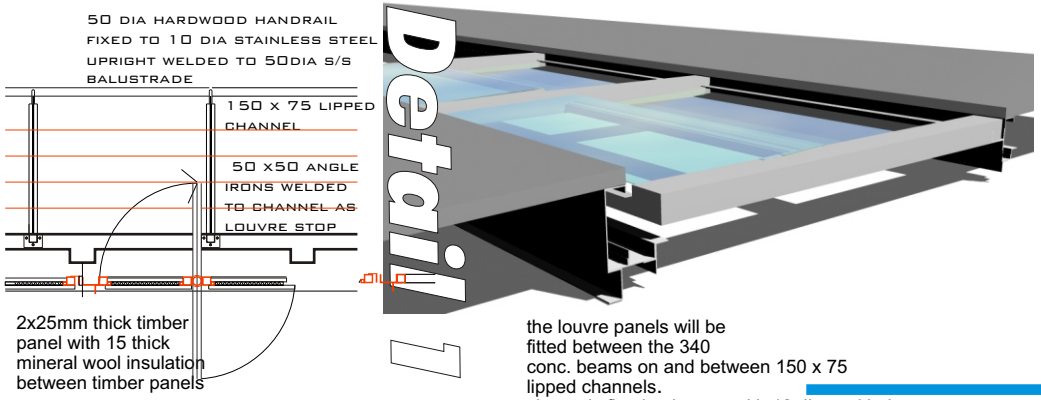
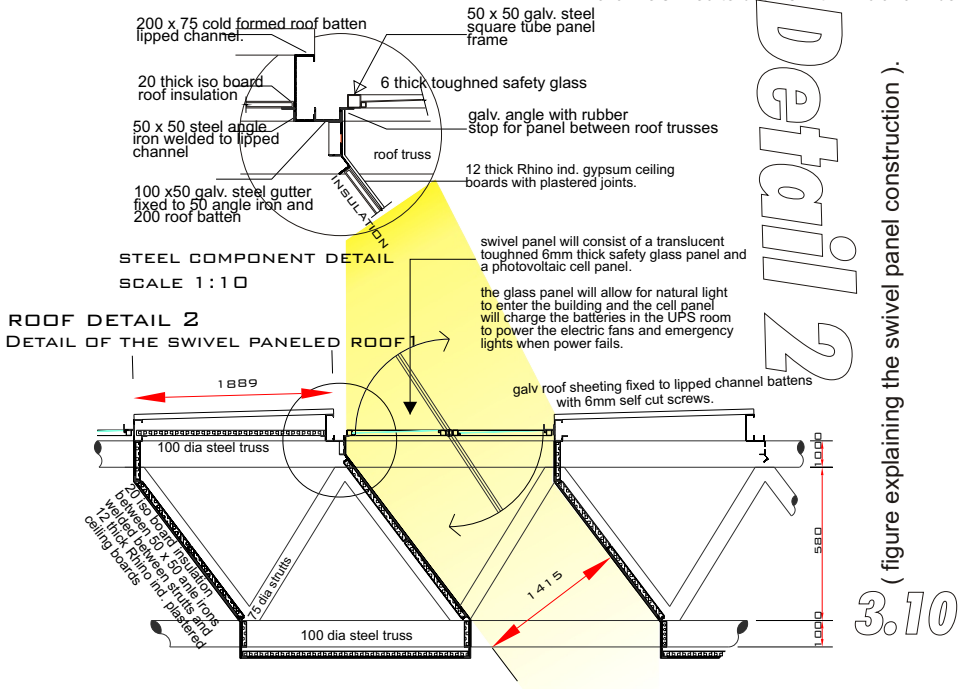
The lack of height will mean that there will be a deficiency in airflow, to create the necessary air stream to create the stack effect. As the top part of the foyer volume heats up, the air becomes less dense and rises. Cooler air from platform level will replace the rising air and airflow will occur. Extra means of promoting airflow has been established, by electrical operated fans on the top part of the western facade. These fans will blow air to the foyer and therefor help the air move towards the swivel panel roof.

The double volume opening over the trains will be opened and closed as sensors record high temperatures at the top part of the swivel panel roof. The computer operating system will then trigger the louvers over the double volume to open first and then the roof panels, to extract the hot and stale air from the structure.





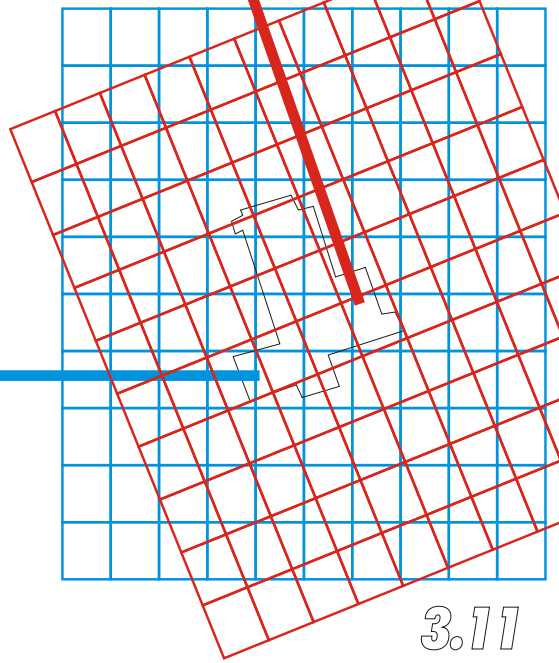
(figure explaining the swivel panel construction).

3.10

The double volume opening over the trains can be fitted with filters, where air will be forced through a mesh with the surface covered with grey water. This will introduce evaporative cooling into the structure and can be used in scorching summer days to assist the air conditioning system in cooling the structure.

4). Identity.

What elementary feature will identify the structure as a train station? The design in terms of identifiable element will be the positioning of the structure within a group of buildings.
The primary defining element will be the public open spaces. The building will not rise above the surrounding buildings in height, to define its importance.



3.11

(figure explaining the inter-polation of the grid patterns).

The interpolation of the **city grid** and the **station grid** will form the defining form on plan. The station building grid will be on the existing railway line.

The main entrance will be on the western public open space in line with the city grid.

The entrance on the market side will be on the railway line grid and will link with the adjacent site.
The routes will be established by the two grids.

Apart from the grid and lower height of the building, the structure will also be defined by its facades. The proportion and scale of openings on the facades will differ from the surrounding buildings. The materials will differ as well.

The glass and steel modular elements, used as infill panels between the load bearing H-profile columns, will differ from the surrounding standardized window and door frames used. The mass production of the panels to be used, will minimize the cost/unit aspect and there usability of the panel will promote financial viability.

The surrounding building's roofs are all pitched roofs. The station building's roofs will be more horizontally orientated in terms of visual aesthetic. The structure will therefor be defined more horizontally than vertically, to suggest and promote the idea of movement on this plane.

The main entrance on the public open space will be defined by being the lowest element on the facade. The entrance will be enhanced by the activities within the structure, visible through the glass and steel structure.

The grid will form the movement pattern for the matter (people) to move in, in advancing to the building. The oscillating or periodical movement of people (from arrivals or to departure) can be seen as the *continual flux of movement* but the building will *still maintain its form.* The users of the building and its facilities will create the flux of movement where the building will be the host.

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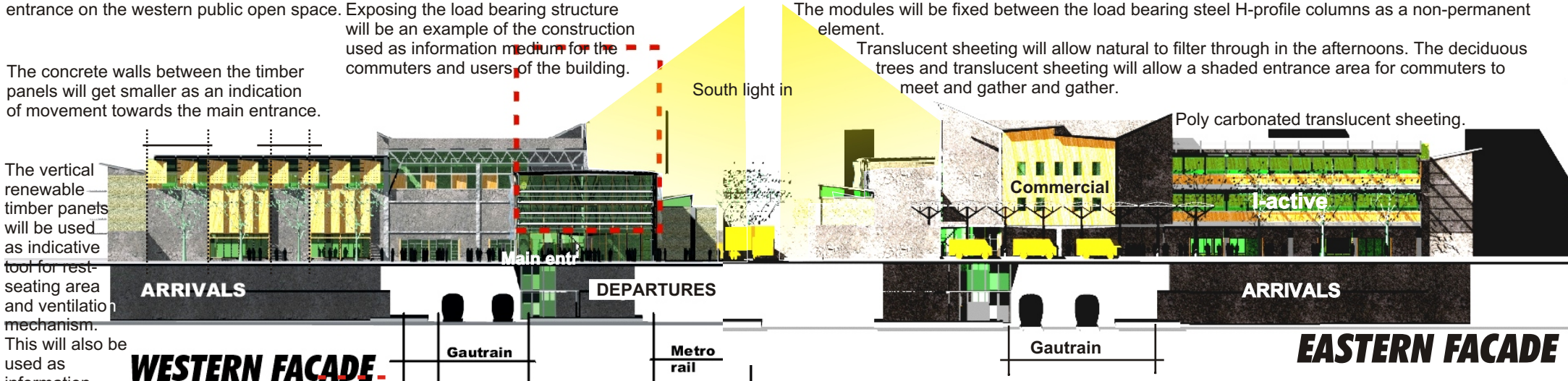
The entrance on the market side public open space will also be defined by the visual aspect of a glassed facade. But this element will be more vertically defined than the main entrance on the western public open space. Exposing the load bearing structure will be an example of the construction used as information medium for the commuters and users of the building.

The concrete walls between the timber panels will get smaller as an indication of movement towards the main entrance.

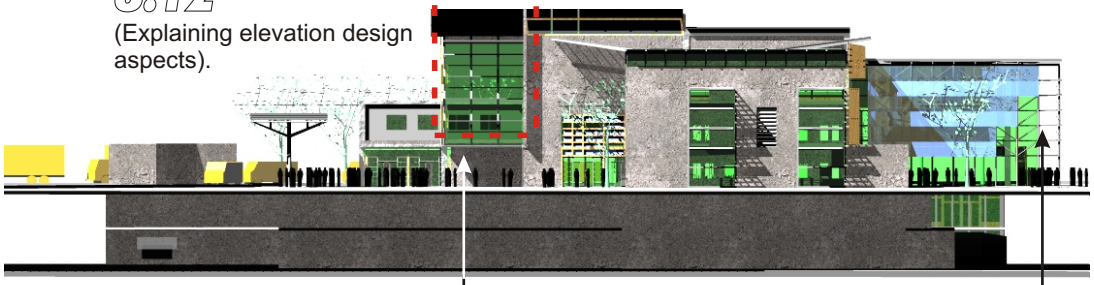
The vertical renewable timber panels will be used as indicative tool for rest-seating area and ventilation mechanism. This will also be used as information medium to educate and create an awareness among users of the structure, on the structural elements.



WESTERN FACADE

3.12

(Explaining elevation design aspects).



NORTHERN FACADE

Large roof overhangs will be used on the facade as sun-screen elements to minimize summer sun exposure.

The recycled and reworked plastic panels at the main entrance, will be used as sun-screen elements. The glazed commercial structure that will overhang the main structure will be used to define the entrance from the market side public open space and the Gautrans bus station.

300 thick concrete load bearing walls will be used as building element. Maintenance will be limited for concrete has not to be painted or plastered. The initial construction costs will be more than brickwork but the maintenance over the years of occupation will be less. The mass construction properties of concrete will lend itself to good thermal properties in terms of insulating the structure for the control of the internal temperature.

The use of mass elements (concrete) and light elements (steel and glass) will inter play to create "floating" and solid elements. The idea will be to screen the internal space from direct sun on the east and west and to create a lighter, translucent, floating elements on the northern and southern sides of the structure.

The modular inter-active conference facility structure will protrude from the main concrete structure. The modular sections will be made up from timber panels, insulation panels and glass. The modules will be fixed between the load bearing steel H-profile columns as a non-permanent element.

Translucent sheeting will allow natural to filter through in the afternoons. The deciduous trees and translucent sheeting will allow a shaded entrance area for commuters to meet and gather and gather.

Poly carbonated translucent sheeting.

EASTERN FACADE

The commercial flank's facade will be made of timber panels and insulation board. The renewable building element can be maintained by replacing damaged panels and not a whole facade. This will also add flexibility, for the facade can aesthetically be altered in future if desirable with minimum impact in terms of construction and disruption..

The ground floor level will predominantly be glazed to enhance the visual aspect of commuters moving through the building. Passengers and users of the structure will, visually, see departing passengers "disappear" to the departing platform and arriving passengers "appear" from the arrival platform.

The bandit windows on the inter-active space, will appear more formal in appearance to define its function.
The tipple volume translucent roof will act as interface space between the open air market and the enclosed structure.

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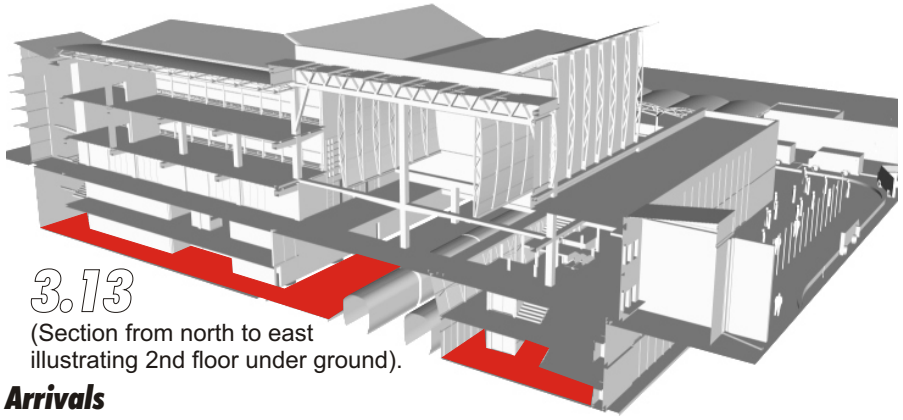
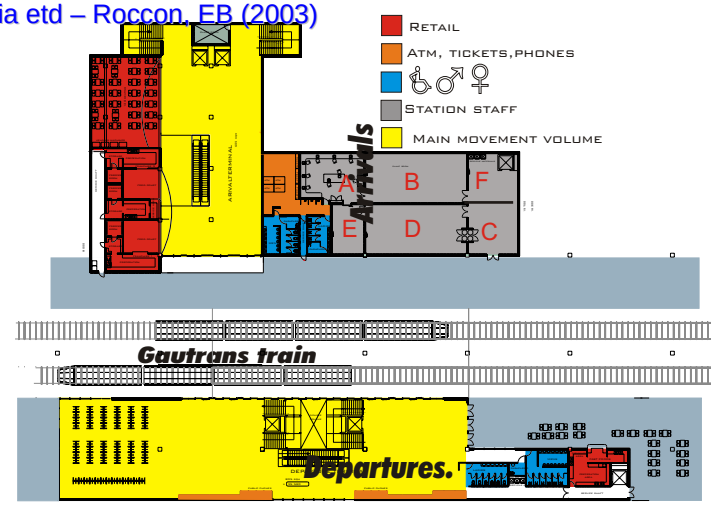
1) 2nd floor under ground.

The 2nd floor under ground will be divided by the Gautran Railway track to accommodate for the functions of arrival and departure.



3.13
(Section from north to east illustrating 2nd floor under ground).



3.14 *(layout plan of 2nd floor under ground.)*

Arrivals

The functional activity on this level will provide the passenger with:
a) 155 sqm seating for food court
b) 160 sqm franchise fast food rentable area.
C) 605 sqm movement foyer.

The food hall area can be utilized in future as an expansion on the amount of franchise food retail stalls to satisfy the demand. As the train station will be seen as prime property, the space will be rented at R150 per square meter. This will generate initial revenue of R24 000 per month and can double if the food court area is converted.

The food hall area on the arrival area will provide rest, food and beverages for commuters.
The ladies and mens toilets will also be at the beginning of the entrance foyer, easily accessible for paraplegic commuters as well.

On-route to the rest rooms, will be the ATM, ticket renewal vending machines and public telephones.
Vertical circulation will be accessible in the form of double escalator, that will be the first focal point on entry. Elevators will be at the end of the structure and split two directionally to the two staircases.

The buildings maintenance and management spaces will also be situated on this level.:

A) Operations room: (75 sqm).

The room will host some of the computer assisted operations. The CCTV control panel, computerized controls of systems (diesel levels, generator status, heat pump status etc).
Allowance for manual override during power failure.

All the systems can be checked from this room for operating status, emergency shut down and control.

B) Plant Room: (122 sqm).

The heat pumps, ducting, conduits and heat retention pumps will be situated in this room. Special care has to be taken in cooling down the room, to prevent the machinery from additional working heat generated from its use.
The lift shaft can be utilized, to act as chimney for cross ventilation.

C) UPS room (60 sqm).

The photovoltaic cells on the swivel paneled roof will be used to charge the batteries. The batteries will be used to operate the electrical fans to establish airflow on wind-still days and enhance cross ventilation.

D) Dealer room (122 sqm).

In the case of a power failure, the generators will be activated to produce the needed energy to operate the building. The rail road will have a separate back-up system, supplied from a sub station on the national grid.

Back-up diesel tanks will ensure extended fuel supply for extreme periods of power delays.
The air conditioning split unit will operate from this room as well.
The heat gain of approximately 82 W/sqm, for a 400 Watt dealer unit must be taken in consideration by the mechanical engineer in the cooling of the room.

As part of the heating cooling equipment, a heat retention pump will also be used to collect warm air during winter time from the internal spaces, to heat conditioned air for re-use.

E) Control room (40 sqm).

The data from the sensors (every 100 sqm), will be processed by the computer management system and controlled from this central area. The system will be flexible for manual over ride and the heat pumps, air conditioning unit, heat retention pump and water (for evaporative cooling), will be controlled from this room.

The difference between this room and the operations room is that the control room will control (adjustment, settings, changes) the systems from here and the operations room will be used to manage the changes.

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F) Service/ Deliveries (60 sqm).

From ground floor, the service lift will access the room. This area will be used for general repairs to equipment and related subjects (pipe leaks, door repairs etc). The lift will be large enough to handle any repairs to equipment on the lower levels.
The ease of access for repairs is important, to reduce the time equipment is not running due to repairs.

Deliveries to the arrival franchise retail stores will also be from this area. Deliveries will happen during non-peak hours on the arrival platform. After 19:00 in evenings, before 6:00 in mornings.
The departure are will consist of a large departure foyer of 805 sqm.

As part of the volume:

The volume will have the *vertical circulation* area (155 sqm), consisting of two staircases, two lifts for the handicap and two escalators.

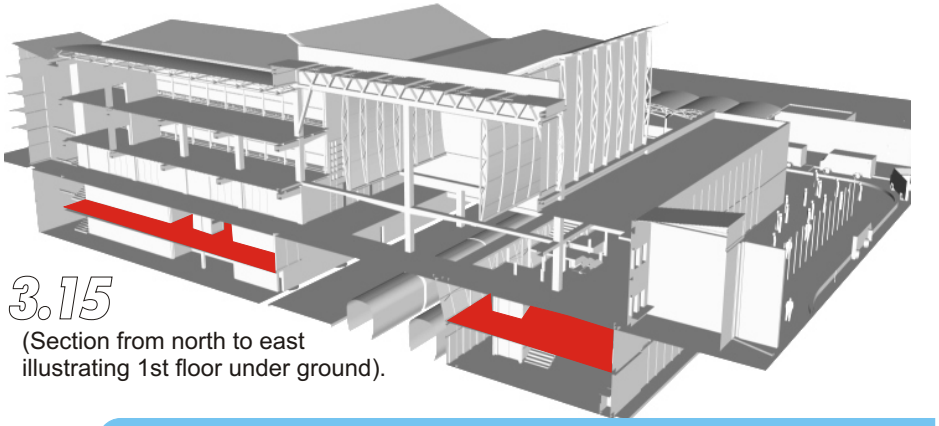
Ticket vending machines, public telephones and ATM machines will also be available for passengers on this level.

A rest or waiting foyer (245 sqm) will be provided on the western side of the structure. LCD display boards, television screens and advertising boards will inform and entertain waiting travelers. Access to the trains will occur from within the structure through sliding doors that will open across the door opening of the carriage.
This is convenient during winter times, rainy days or even during hot summer days, for the passenger will be shielded from the elements.

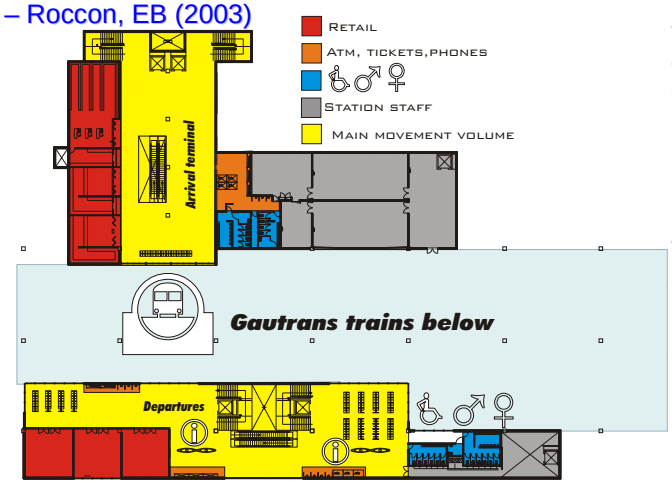
On the eastern side of the structure will be a platform café, where waiting passengers can obtain, beverages, food, magazines, newspaper or just sit in the sun watching passing trains, passengers and activities on the adjacent arrivals platform and activities in the structure.

A service shaft will supply the platform of the necessities needed to function from day to day.
The shaft on ground floor level will be situated at the service entrance to Duncan street.

2) 1 st floor under ground.



3.15
(Section from north to east illustrating 1st floor under ground).



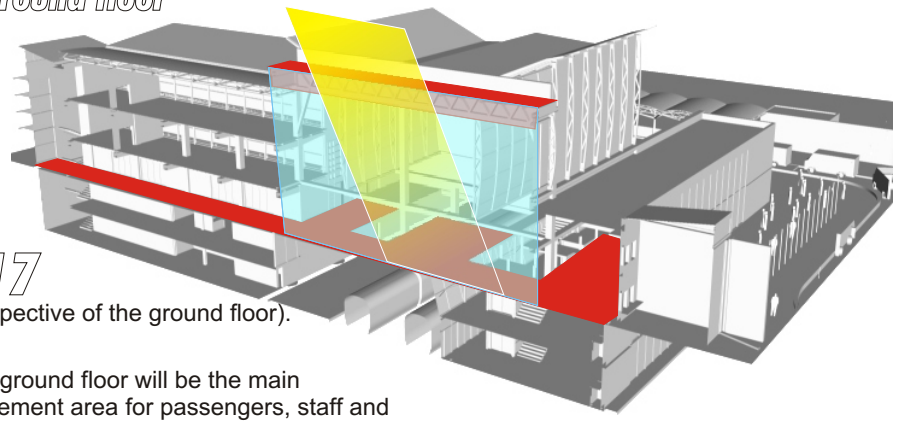
3.16
(Plan layout of the 1st floor under ground).

The floor will host the retail component of the station, comprising of a convenience store as anchor tenant (150 sqm) and 5 smaller retail tenants (68 sqm each). Converted into revenue, the floor can generate R 75 000 of income per month.

The retail stores will generate approximately R 120 000 of revenue per month of rentable space. Taken into account the commercial component, storage space for the market and market stall's revenue has to be taken into account, the R1,450,000 per year, just from retail rentable space is a feasible and lucrative investment.

The station management, security, track safety, track communication and track management, will operate from the staff station allocated in figure 11 in grey.
The same convenience functions on the 2nd floor under ground will be on the 1st floor under ground.
On both levels it is important to 'entertain' passengers while they await the train to depart or if they arrive from the train.

3) Ground floor

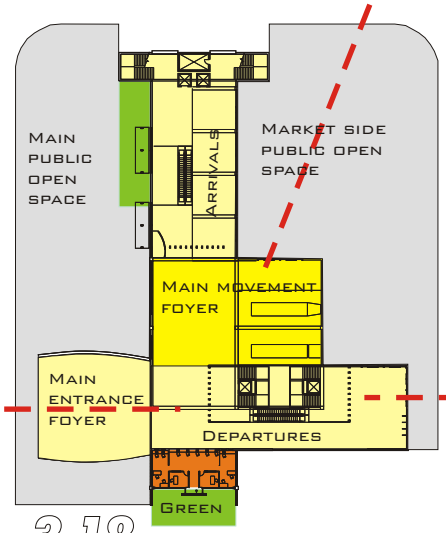


3.17
(Perspective of the ground floor).

The ground floor will be the main movement area for passengers, staff and visitors to the platforms, commercial, retail and conference centers.

Access to the main circulation foyer will be from the market side public open space (east), the main public open space (west) and from the Gautrans drop-off stop (east).
The main movement foyer will direct people to the different functional spaces.
The swivel paneled roof will create a triple volume foyer that will establish a sense of arrival from the arrival platform, to the departure platform and the entrances from the public open spaces.

The foyer will be naturally ventilated and lightened. Timber cladding, advertising and LCD display panels between the concrete beams and columns will be the aesthetic features to inform, direct and position people.



3.18 (Ground floor spaces).

An information center will be on a visual axis from the arrival platform and on the axis from the entrances from the public open spaces.

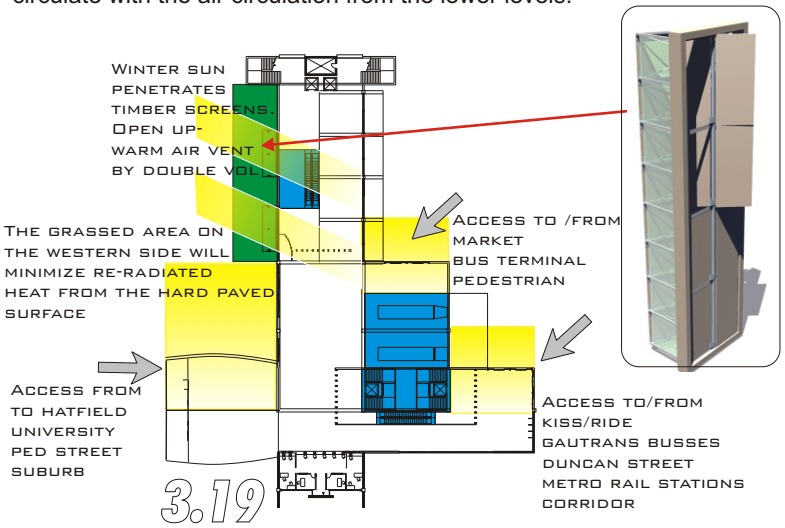
The info center will consist of a help desk, two offices each of 12 sqm and two open plan offices each 22 sqm. The open offices will also have two ticket booths for first time train travel users, group traveling and information on ticket related aspects.

The green areas will accommodate visitors to a view of a softer landscape. The green areas will be on pedestrian paths and trees will ensure shaded rest areas with street furniture like dust bins, drinking fountains lighting and seating space.

The green soft surface area will also act as an element to minimize re-radiated heat on the western side. Deciduous trees on the eastern and western sides will shade the facades in summer time to allow less direct sunlight on the facades and allow sun to warm the facade in winter times.

The more natural light to enter the building, the less artificial lighting will be needed to illuminate the internal volumes. This means less heat generated by artificial lighting and a saving in electricity used from he national grid.

The timber panels on the western side that will open and close, will be situated next to the double volume of the vertical circulation area. This will allow warm air, that enter through the panel to circulate with the air circulation from the lower levels.



3.19 (vertical ventilation and natural light penetration).

4) main entrance

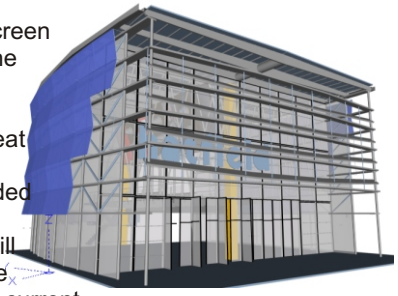
The main entrance will be the culmination of the Arcadia street axis to the east. The street will form an axis with the Pretoria Art Museum to the west.
The northern facade will be glazed with 6mm thick toughened safety glass in a steel frame structure. The facade will be cladded with 10mm thick recycled and reworked plastic panels.

The plastic will be melted down and additives will be added to structurally alter the chemical composition of the material. This will be done to the plastic technologist's specifications. The plastic will have a long life span, low maintenance cost and very cost effective to replace. The altered material will have a low heat gain capacity and also a low re-radiation value.

At night the internal lighting will illuminate the glazed box, to act as a beacon in the prescient and also act as a directional beacon. The illuminated box will also light up the public open space.

3.20

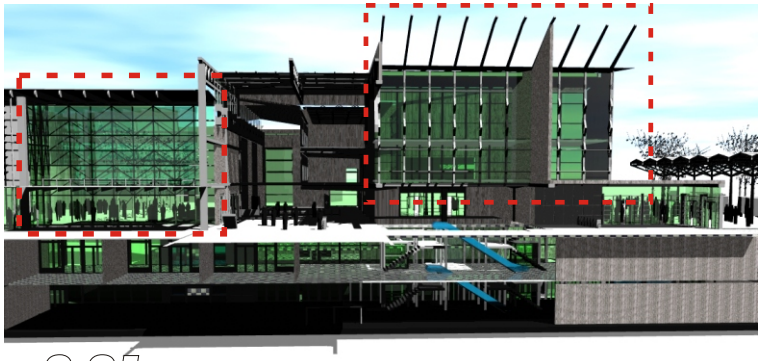
Angled horizontal sun screen blinds will be added to the western side of the entrance structure, to avoid direct afternoon heat gain. The first floor structure will be suspended between the 600 thick concrete columns and will function as a café, where visitors can catch up on current news events, financial figures, read the newspaper and enjoy breakfast, before departure or on arrival.



(Perspective view of the main entrance on the western side public open space).

A 270 degree view over the public open space will create a transition between departure, arrival and the daily functional activities.

5). Commercial component.



3.21 (section from east to west in perspective).

The existing buildings surrounding the site and on adjacent blocks are all commercial orientated. Houses on Duncan Street and Schoeman Street have all been rezoned and hold the title of business rights.
These houses, in future, will make way for commercial high rise structures.

To accommodate future expansion, certain guidelines and rules was set in the urban design framework. This will help in the planing, design and initiation of the upliftment and growth of the area.

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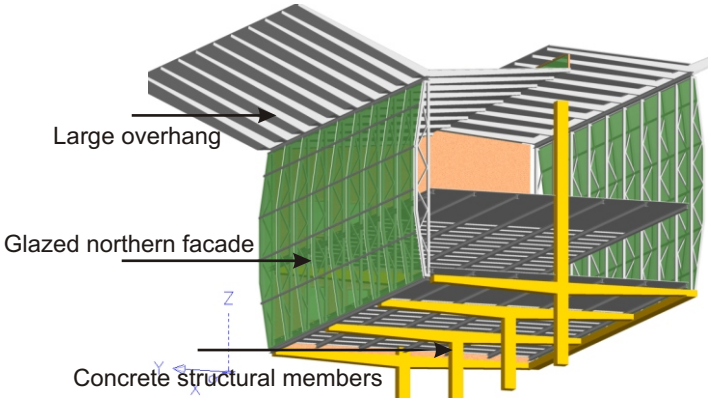


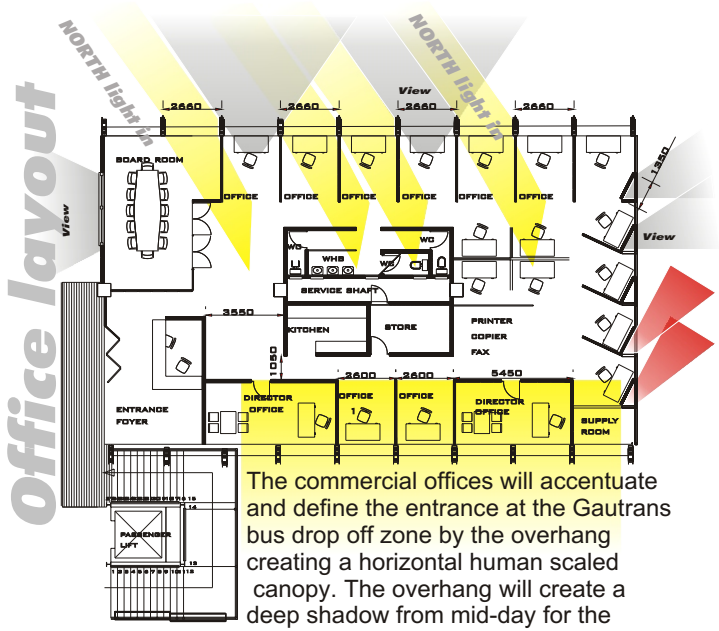
The commercial structure in the station will be constructed on 600dia concrete beams and columns as load bearing structure. Steel profiles will form the frame of the timber floor. The walls on the northern and southern side will be glazed to ensure maximum utilization of natural light into the office space, to minimize artificial lighting to be used.

The glazed facades will also ensure that staff members can keep in touch with the environment it is constructed in. Passing pedestrians can also have a view into the office, so they feel part of the function inside the structure.

The northern facade will be shaded by a large overhang, as an extension of the roof trusses. The eastern timber cladded wall with its 45 deq angled windows, will ensure protection against un-favorable morning sun penetration.

The structure can easily expand vertically, by removing the side glazed structure and add columns on the existing 600 column and beams. The steel roof structure will be used again, for it is bolted to the steel and glazed columns.

Currently, there are two floors, comprising of a total of 720sqm of rentable office space.

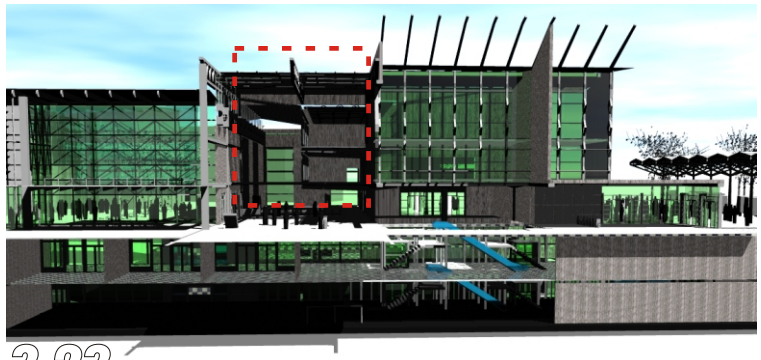


The commercial offices will accentuate and define the entrance at the Gautrans bus drop off zone by the overhang creating a horizontal human scaled canopy. The overhang will create a deep shadow from mid-day for the internal entrance space.

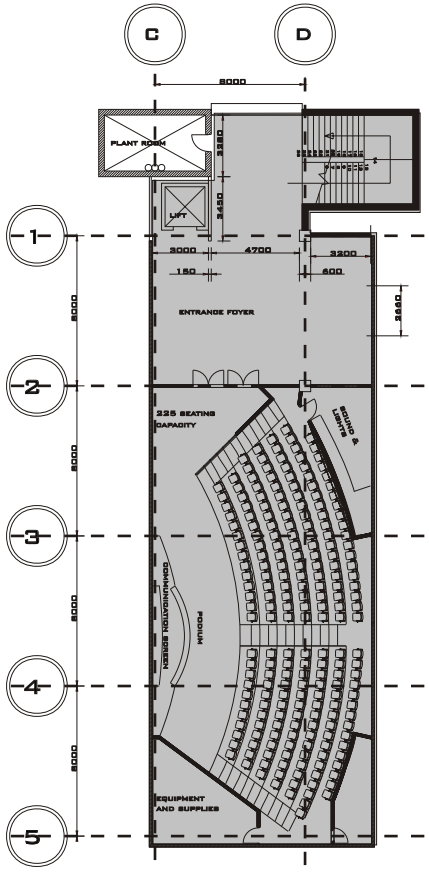
3.22
(layout plan and component perspective of the commercial flank of the building).

The office space will generate R46 800 of revenue per month (720sqm @ R65/sqm). This will ensure a yearly income of R561 600.
Access to the offices will be part of the departure vertical circulation components. This will ensure safety and control to the office staff and management.
The entrance foyer will be on the main circulation foyer side and will be the transition area from the public to the private office space. The board room will overlook the foyer.

6) Inter active- conference (commercial)



3.23 (section from east to west in perspective).



3.24
(layout plan of -iactive flank).

The inter-active conference facility, will be implemented to minimize the need to use one's own vehicle to attend meetings. It will create a central gathering point for surrounding businesses to interact with other regional businesses.

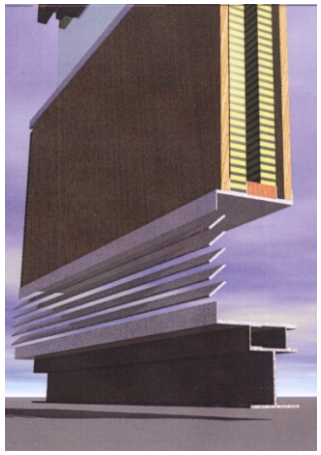
Access will primarily cater for the arriving passengers from the arrival platform.
From the main movement foyer, the controlled access point will be used to control the people using the space. This will also be for safety and security reasons.

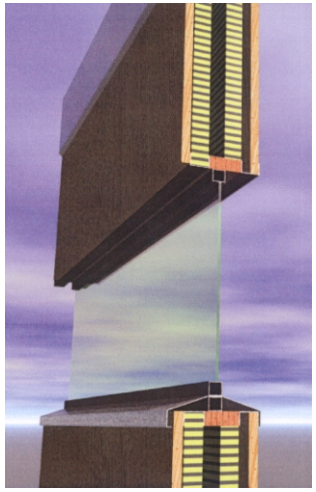
A satellite feed will ensure long distance communi-cation and reliable service.
The vertical circulation staircase and lift shaft will be used to access the entrance foyer.
The hall will seat 225 people. The stepped seating will have ducting to provide fresh air from the market side public open space.
The fresh air will replace the warmer rising air, that will be extracted by the extracting fans on ceiling level.

The hall can also be used by students and schools, to interact with other education institutions.
At night the space can be used for adult education, staff training or by the home owner organization of the neighborhood.
The structural components will be very much the same as with the commercial structure. This will reduce the cost per unit of production.

The difference is that the facade will not be glazed. Timber panels will be used to ft between the steel H-profile column sections.

The panels will be constructed in modular sections and can be re-used for other projects as paneling, if the current finish is not desirable over time. The timber will be a renewable resource and as for every timber component in the structure, can easily be repaired and replace for the modules it exist in.





3.25

(perspective of structural components and modular timber panel elements).

Thermal performance

The thermal performance of the 300mm concrete wall with 25mm timber paneling:

R = *x/k.*

Thermal resistance

R = thermal resistance (m2.K/W).
x= thickness (m)
k = thermal conductivity (W/m.K)
(k = 1/r).

R tot = (0.3)+(0.123)+(0055)+(0.14) / 1.4
= 0.618/ 1.4
= 0.441 m2.K/W

U = 1/R
=1 / 0.441 m2.K/W
=2.27 W /m2.K

The higher the U-value, the lower the internal surface temperature for a given heat input to the space.

Qf = U x area x temp diff.

Heat loss

Qf = heat loss
U = U-value

Qf = (2.27).(10m2).(35-20 deg Celsius)
= 340 Watt

this implies that the concrete wall will re-radiate 340 W of energy per 10m2 back to the environment.

Internal temperature

Internal temp = (T diff) x (U) x (Rsi)

T diff = temperature difference outside - inside temp
U = thermal resistance
Rsi = internal surface resistance.

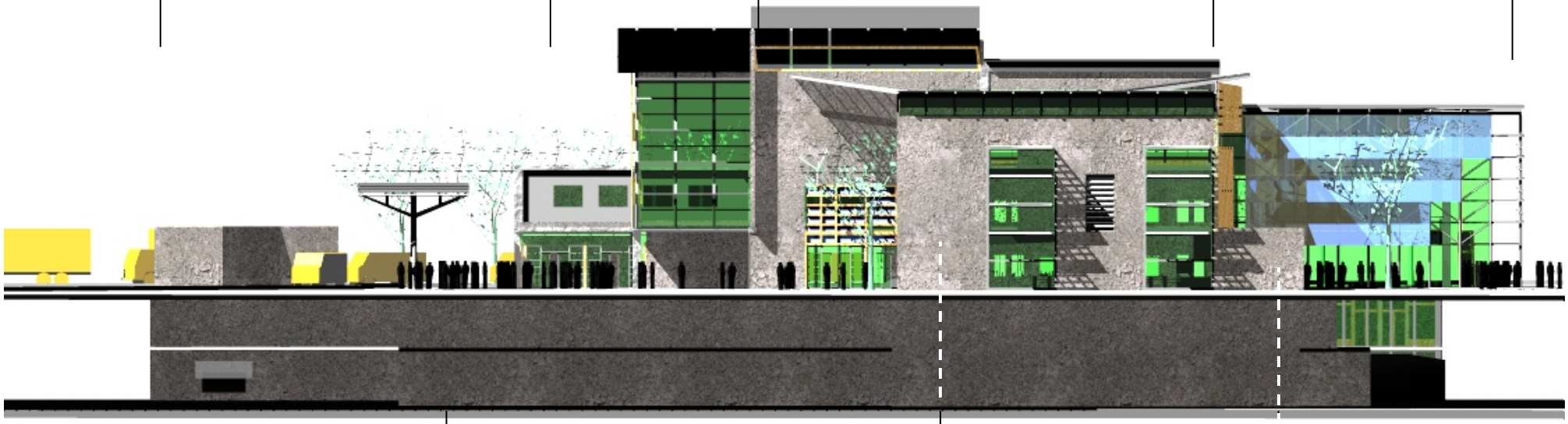
Internal = (15 deg C).(2.27). (0.123)
= 4,2 degC
temp diff +4,2 deg C
15 deg C + 4,2 degC = 19,2 deg C internal temperature.

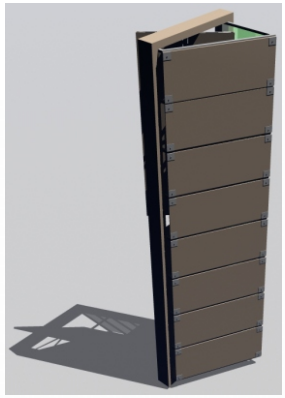
The concrete wall as a mass structure element will be used to insulate the structure. The timber panels will allow heat to enter the structure and heat the internal air.

NORTH ELEVATION

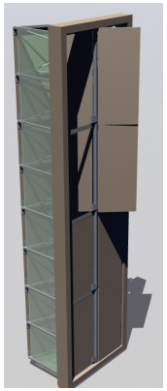
Access from the job center, bus terminals and overnight accommodation on the adjacent site will be enhanced by the over scaled entrances to the station.

Glazing will again be used to promote the visualization of the functional activities.



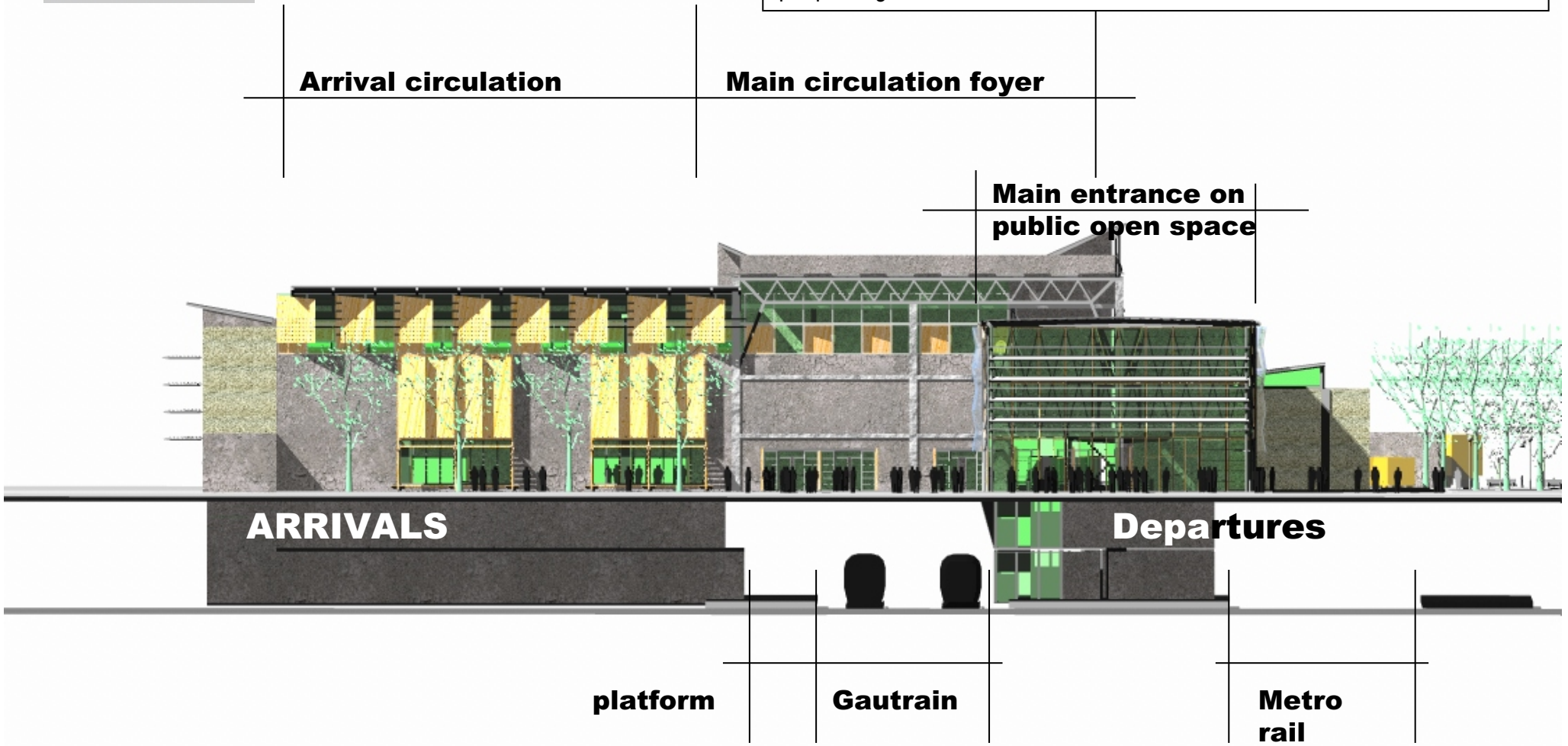


The modular timber panels will gather heat in the cavity. Swivel panels will open to allow warm air into the structure. The vertical circulation space will allow for warm air distribution.



WEST ELEVATION

The main entrance will be used as an orientation point and illumination 'lamp' during the night. Horizontal beams will be used as sun control element on the western side and re-cycled, re-worked plastic panels will be used as sun control device on the northern façade. Deciduous trees and timber angled timber panels will be used on the rest of the façade for sun control. (*refer to chapter 3).* Shaded rest areas, dust bins and drinking fountains will allow people to gather, rest and meet.



SOUTH ELEVATION.

The glazed façade will allow for natural light to illuminate the internal structure. The passing pedestrians will have visual access to the internal functions and the people inside will have visual access to the functional activities outside.

The public open spaces on the western and eastern side of the site will be connected by the structure.