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Gautrans sub-URBAN train station

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2015122
Gautrans Rapid Rail System
Hatfield sub-station.

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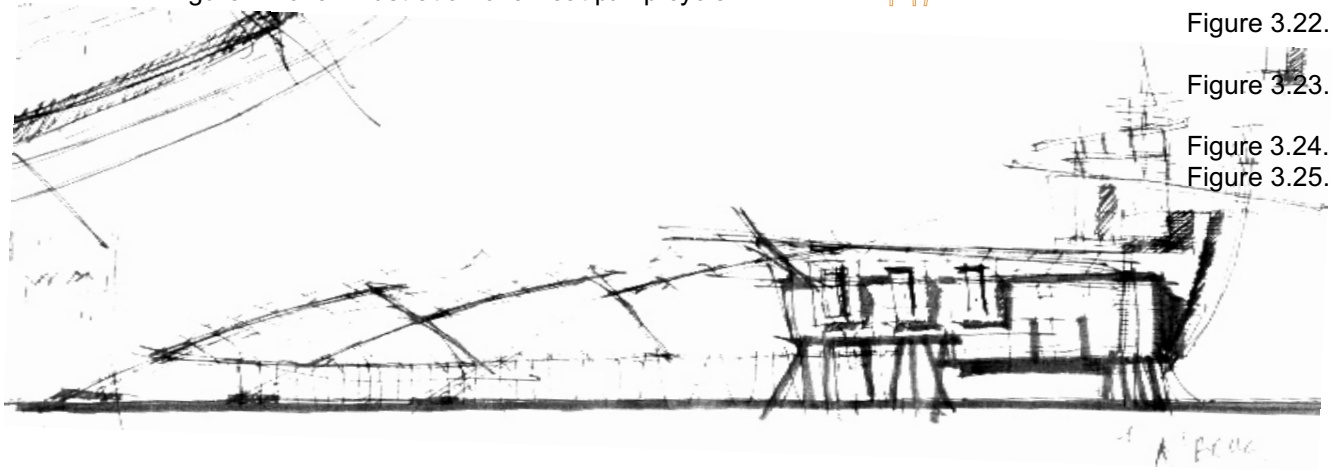

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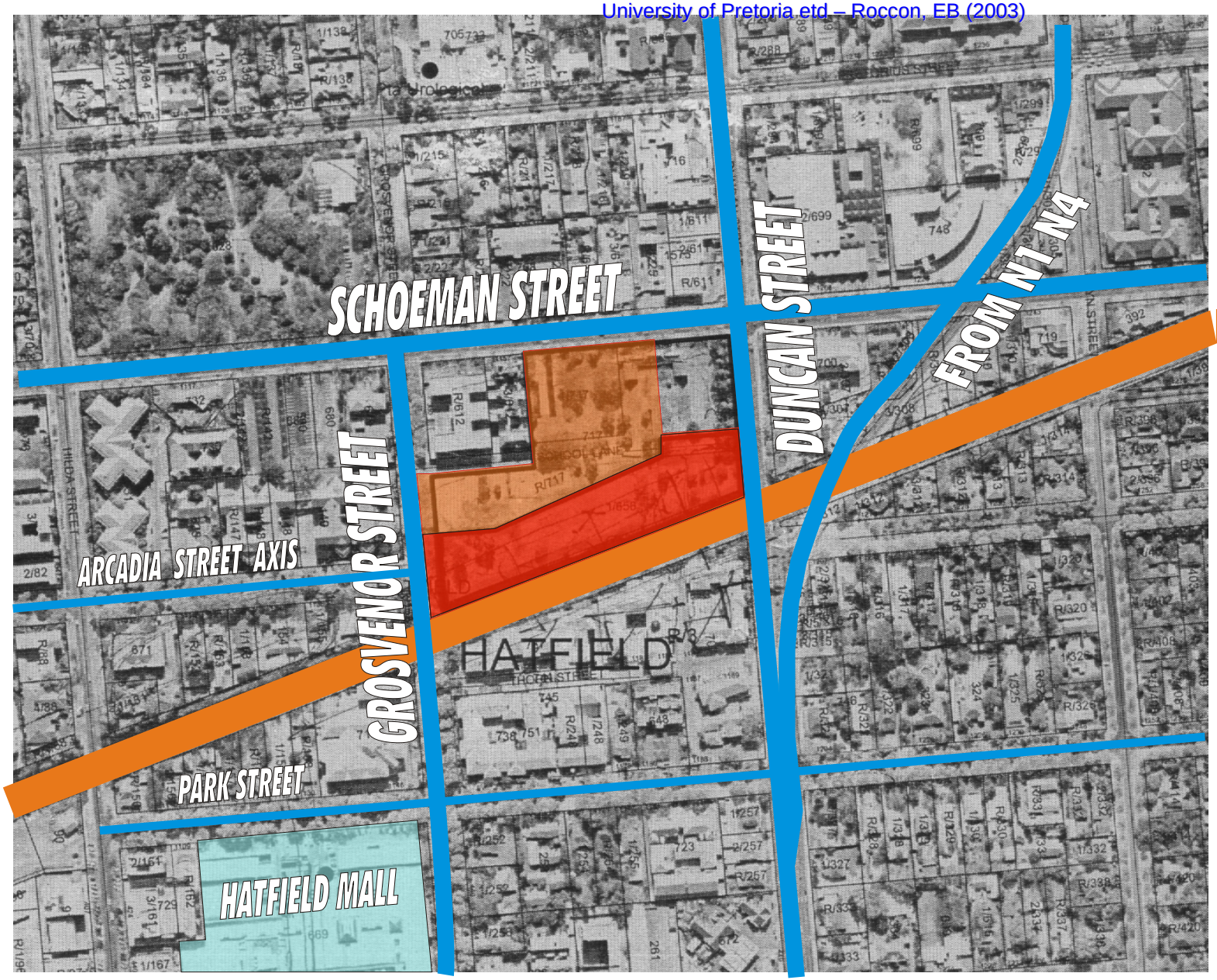

BRIEF

CHAPTER 1

NATURAL VENTILATED

train station

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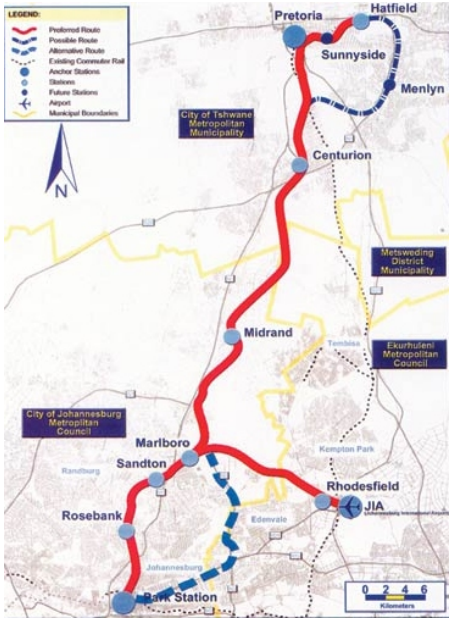
Gauteng is the powerhouse of the South African economy. The Province covers less than 2% of South Africa's surface area, but it generates more than 36% of the country's GDP, and more than 25% of the GDP of all the countries in Southern Africa.
(South African Government.2001. Gautrans rapid rail link.)

The proposed Hatfield Station is located in a cut along north of the existing Metro rail reserve, between the existing Rissik and Hartbeesspruit Stations, both of which form part of the Pretoria Ring Rail system. From a vehicular perspective the station is located between Park Street and School Lane and between Grosvenor and Duncan Streets on Portion 1 of Erf 656 Hatfield and Remainder of Erf 717 Hatfield. It is therefore; north of the existing rail line but falls within the Hatfield business area uniquely located in an area of prime developmentThe Gautrans is a Blue IQ initiative and forms part of ten other Spatial Development initiatives (SDI

The N1 highway between Pretoria and Johannesburg has a carrying load of 150 000 motorists per day and has an annual growth of 7% of motorists. This is indicative that an alternative means of transport is needed to ease the carry load on this road network. One solution will be the rapid rail system between these two cities.
The area between Johannesburg and Pretoria - two major cities in South Africa - is recording the fastest rate of economic development in southern Africa. The Gautrain Rapid Rail Link will be a new rail-bound mass transit system to serve the Johannesburg-Pretoria corridor as well as a link between Sandton and Johannesburg International Airport. Apart from the convenience, the project will provide economic and social development along Gauteng`s north-south axis with associated population and related concentrations.



The 80 km network line will link Johannesburg, Sandton, Pretoria and Johannesburg International Airport and will have 10 stations. The distance between Pretoria Central and Johannesburg will be covered in less than 35 minutes at speeds of 160 km/h or more. It will be served by dedicated road-based feeder and distribution systems and park-and-ride facilities at the station nodes. The trains will operate 18 hours a day, this will lead to a nodal interchange that must cater for functional activities for the duration of the time visitors and passengers will spend there. The time lapse between trains will be initially 10- 15minutes. This time will vary at specific times of the day to cater for the passenger loads.

Safety will be a key factor to the success of the train system

1.1 (Proposed Gautrans rail line links).

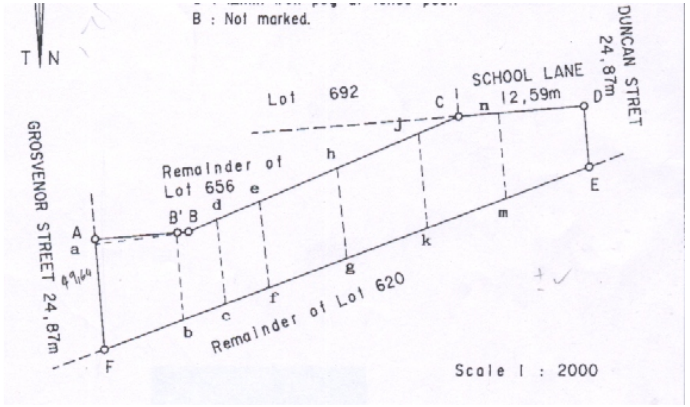
Safety will be a key factor to the success of the train system. The safety will be in terms of commuter safety on trains, on the waiting platforms, at the park and ride system and at night in and around the stations. It is Government's stated policy to promote public transport and to give it priority over private transport. The new ***National Land Transport Transition Act, Act 22 of 2000***, places an obligation on Gautrans to actively implement this policy.

This initiative will be more convenient for people traveling not just between work and home, but also for tourists, business people and holidaymakers to Johannesburg International airport. The shuttle services, public transport system and the taxi services at the end of the line will also provide job opportunities, convenience for travelers and ease of movement through the visiting areas.

Less carbon dioxide emissions will lead to a cleaner environment and will be healthier, for the train will be powered electrically. Reliability, safety and security, comfort and short travel times are important requirements. A new attractive image is required. It must be able to attract motorcar users out of their cars into the train system. It must therefore be an attractive, cheaper and realistic alternative for the motorcar user. It must be predictable, particularly also for the airport user.

1.1. The site

The railroad tracks are currently owned by the SARCC, (Remainder of lot 620). The site adjacent to the railroad tracks is the proposed Gautrans site and is currently owned by the Municipal of Pretoria and the site, Lot 692 is owned by SAGE investments. Different land-use rights occur on the three sites, due to different zonings and functional requirements. Lot 620 is reserved for the metro rail system and it's relevant functional activities.



1.2 (LG diagram of proposed site).

In order for the Gautrans to function as an intermodal, multi-functional site, the land use rights and zoning of the site must accommodate the proposed usages. The Gautrain station and platform will be erected on lot 656 and the remainder. The owner, Municipal of Pretoria, will be the owner and client. Lot 692 will be developed by SAGE investments, according to the draft document, as a multi functional development. These activities will range from retail, informal and formal, commercial and living units.

These activities proposed for this site will have to interlink and connect with the layout and planning of the station to form a unity and vibrancy on an 18-hour time scale. The remainder of lot 620 will still belong to Metro rail and the platforms will be “shared” with the Gautrans. The Gautrain will operate on separate rail tracks.

According to the Gauteng Transportation Infrastructure Act, the current land use rights must be disowned, to give rise to a different and new land use right. The new sites must be re-proclaimed, to give new rights to the site and after this has been achieved, can the re-zoning of the site be achieved for future use. The Gautrans site will undergo a concession agreement with three groups of people

The design and construction team (principle agent, construction companies, contractors)

The operations team (operating company for the Gautrain relevant functions)

1.2 Climate

Pretoria has a moderate climate with hot summers and mild to cold winters and lies in a summer rainfall region of South Africa. To utilize the moderate to warm climate of the region, it can commonly be acknowledged to create buildings as an extension of the environment and create shaded areas, as movement lines and functional spaces as part or through the constructed area. As evident from the UVB index, the mid afternoon is the time for maximum protection against the sun.

In summer, Pretoria has 60% of its days as sunshine days and in wintertime 80% of its days are filled with sunshine, but with less heat intensity. In September, Pretoria will have an average of 9,4 hours of sunshine per day. The use and functional application for sun control devices are thus a necessity, for this will be the time the site will be most occupied with visitors and residents. Summer sun should be shaded and winter sun should be allowed to penetrate the structure and to heat the structure, to utilize the re-radiant heat within the building at night.

Thermal mass is effective for half of the under heated period and the whole of the over heated period. Massive floors, roofs and internal partitions may provide it. Lightweight insulated roofs are feasible in this region, provided that the walls and floors supply sufficient thermal mass.

Solar angles at 12:00 for Pretoria (UVB intensity at its optimum).

22 December. 87 deg.

21 March\ 23 September 64 deg

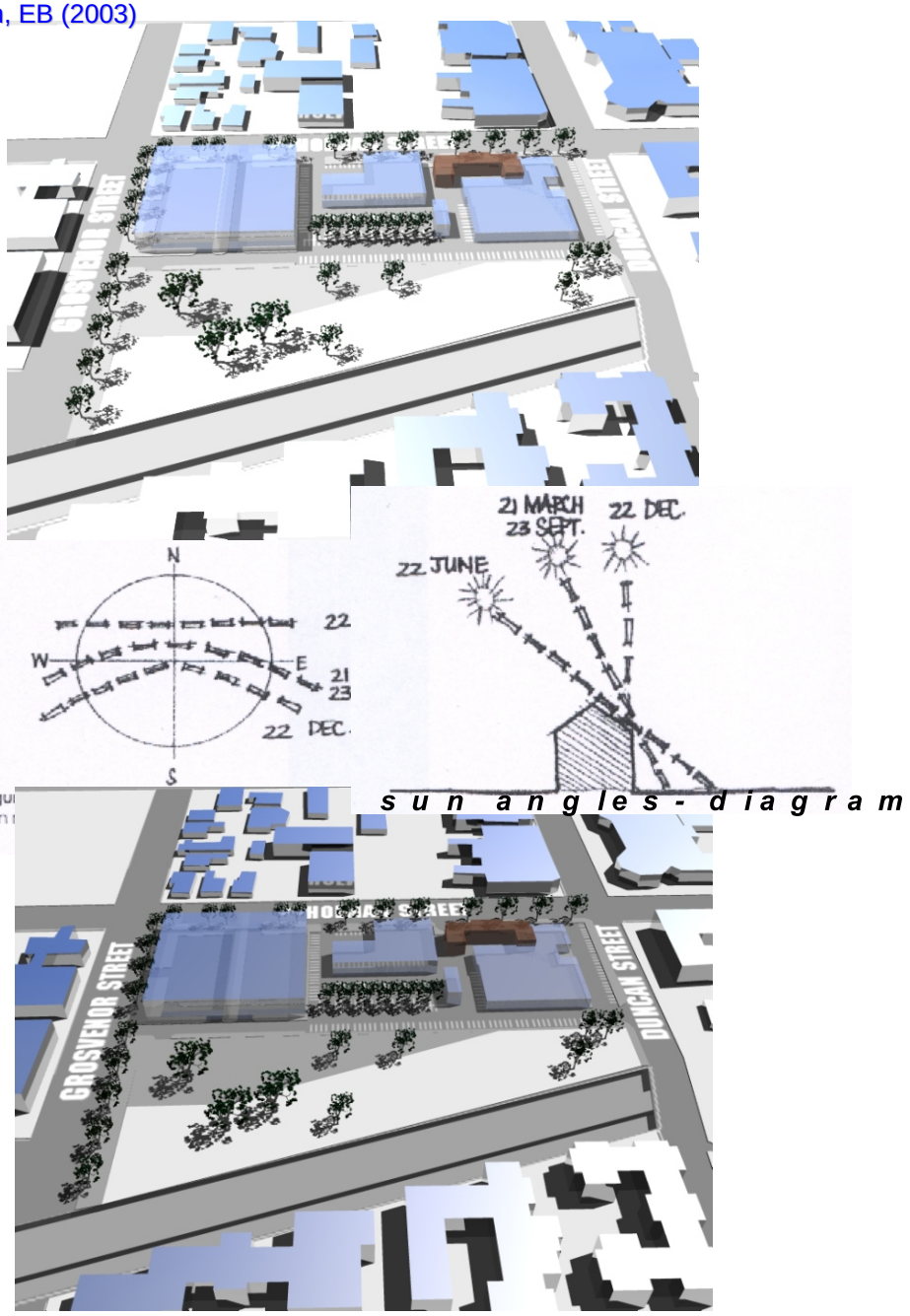
22 June 41 deg.

As illustrated, the degree of shadow cast by the afternoon summer sun, can be calculated and incorporated into the design, to form pathways, rest areas, open spaces and sheltered areas for the pedestrian and vehicle.

Pretoria use the following coordinates for sun angle calculations:
25 degrees south- latitude.
28 degrees east- longitude.
Pretoria is in a Highveld region and is 1362m above sea level.

1.3. History of the old Arcadia Primary School.

Hatfield Township was established in 1904. The suburb name is derived from Hatfield town and Hatfield house in Herefordshire, England, to commemorate the arrival of Lord Selborne to Pretoria.



sun angles - diagram

1.3 (sun angle diagram and analysis).

Arcadia Primary School was established to serve the 159 families within the borders of Hatfield and serve those 'outlying areas' of Pretoria. Arcadia Primary School admitted its first pupils on 10 October 1916. The school building evolved with the changing times and through the introduction of different individuals in charge of decisions over the school. Since the initial planning of the school in 1913, to the opening in 1916 and up and to the sale of the school in 1994, the addition of new elements and upgrading of others, were according to what the different principles felt appropriate for the school to further develop, giving the pupils the best education possible.

1.4 (photos of the old school structure).

1.4. Precedents.

Johannesburg International Airport

The sites that were visited were Johannesburg International Airport, the domestic arrival and departure terminals and Metro rail Intermodal interchange, also in Johannesburg, Newtown.

Photo no:1

Photo showing the large volume of movement space and glazed facades to improve and enhance the view to the outside activities, weather cond and to maximize natural light to enter the structure.
External sun control devices to control sun entry.

An airport is a place where people arrive from and depart to a destination. It's a place where millions of people pass through per year. It's a place with functional activities 24-hour a day and must accommodate large groups of people periodically before and after arrivals and departures.

The airport acts as an introduction to Pretoria and Johannesburg but also act as gateway for our country. A first impression always lasts.
The new approach to airports has introduced the idea that you don't just board or get off an aeroplane anymore. The idea of occupying the visitor's thoughts is evident in the fully stocked shops lining the broad passages of the arrival and departure terminals. These functions will expand in future, as the choice of destinations will broaden.

Photo no:2

Advertising and information boards are easily visible by placing them above circulation nodes.
Double volumes around the circ nodes-visibility to lower levels

Convenience, efficiency and mobility have become synonymous with airport travel. The terminal itself is user friendly, easy to read and very functional. The interacting play of the triple volume entrance space is not over whelming on entry and the three-leveled functional spaces, adjacent, are convenient to move in and human scaled. Escalators and lifts are placed within movement patterns and easily accessible for handicapped people, even from the car park. The entrance from the car park though is not well defined and the direction to move to, from your vehicle is not legible.

Photo no:3

On-route information cubicles and rest area seating is provided for passengers and visitors.
These will occur on the axis of the vertical circulation nodes.
The scale of the ceiling volume suggest an area of informality .

The terminals are divided into three strategic levels. The triple volume ground floor acts as arrival point for departures, with vast open movement spaces. This space is connected by the check-in points for the different airlines to be used for your travels.
The structure comprises of large, central concrete column structures that supports the roof. The triple volume entrance area is cladded by external glass paneling in a steel column structure.

The terminal itself is extremely spacious but never looses its intensity as a vibrant movement line. It's scale and proportion is on a humane level and a feeling of comfort and relaxation promotes free movement through the different levels of transition. The entrance to the terminal could have been better defined and expressed and to find the entrance from entering the site was difficult. Signage on its own will not replace defined routes.

Photo no:4

The first floor acts as food court and retail area, where the visitor can relax, look out on the people and keep busy by the various shops and rest areas. The second floor acts as arrival point.

Photo no:5

The concrete columns also houses the air condition outlets and has been utilized as an aesthetic featured, representing the jet propelled engines of a Boeing. Air circulation at roof level has been enhanced, by air movement in a curved form, as represented by the ceiling form.

Metro Mall

The Metro Mall is an urban renewal initiative for Newtown in Johannesburg. The site stretches over two land parcels, for a total site area of 2,6 hectares. This urban renewal project is important because it links Braamfontein, to the north of Johannesburg, with Newtown to the south. The project catered for the street vending\ trading and for the huge volume of mini-bus taxis, to provide an area of opportunity for both pedestrian and road traveler.
The Metro Mall accommodates 25 bus ranks that serve 35 different routes and an area for 2000 mini-bus taxis. The spaces for each taxi association have been allocated, to minimize the risk of taxi association conflicts. The site also provides sufficient space for the 800 formal and informal traders.

Theory around proposed development. (As illustrated and set out in the urban design document-annexure 5)

Statement 1:

" Spaces around transportation terminals are places of considerable economic potential. This potential is reinforced where there is a coincidence of different modes of transport". ***(Dewar,D., and Uytenbogaardt, RS. 1991. South African Cities: A Manifesto for Change, Cape Town).***

As was evident at the Metro Mall intermodal interchange, the passengers that travel are the primary source of business for the informal street markets that line the streets and the formal shop keepers benefited from the clients, but to a lesser degree. The development comprises of a central covered multi story parking lot that is surrounded by informal and formal arcades. On a secondary level, passers by can also penetrate the arcades and use the informal market as a shopper. The business also provide for a sense of vibrancy through the cultural music that fills the compacted informal market lanes and the food courts that provide the smells and tastes of a home cooked meal. The site is vibrant for the time people travel to and from the site, this will usually be normal working hours of the 6:00 to 18:00.

The domestic airport terminal had a different feel around its circulation spaces. The terminal comprises of three stories, where the first floor level consists of the formal shops and the food court. The ground floor level is for departures and the second floor is for arrivals. The terminal will be functional 24 hours a day, for flights will commence on a 24-hour schedule.
Both these sites are economic nodes within their urban infrastructure. It is a place of convenience for their users and not for the people in its urban structure, for it does not act as a shopping mall for every one, but only for its users, the travelers.

Statement 2:

"Daily requirements to be accessible within walking distance. Public transport should provide access at a larger scale." ***(Dewar,D., and Uytenbogaardt, RS. 1991. South African Cities: A Manifesto for Change, Cape Town).***

The JHB domestic terminal cater for a large scale of daily requirements needed when arriving from or leaving for your destination. The functional activities are aimed at the passenger and to cater for their needs. The Metro Mall site also caters for daily necessities, but aims for a larger market group, the travelers and the passers by, thus linking the site with its neighboring sites. By using the informal market within a streetscape, the activities attract a larger group of people, adding to the social interaction and to the community construction. The transportation service acts as central attraction function.
The airport terminal has access to public transport in the form of vehicular taxis, situated at the entrance to the terminal. A dedicated national bus service, also cater for the tourist and is not easily accessible from the terminals. The access is not direct, the information and route to the bus services are vague and in descriptive. Tourists should be given direction from a central point of arrival and not routed and re-routed to a destination. The incorporation and functional integration of the transport modes at the airport terminal is lacking coherency.

Statement 3

"Linkage is simply the glue of the city. It is the act by which we unite the different layers of activity and resulting physical form of the city."

These two precedents are two different linkage systems. The Metro Mall is situated within a city block, to form a nodal function and the airport terminal act as a node on its own. A network of transport systems links both. The routes or access to the two sites must be readable and easily accessible. The Metro rail is on a smaller scale and is accessible on foot or by vehicular movement. The airport can only be accessed by vehicular movement, and the signage and movement pattern to identify the desired destination is not read easily.

Visual linkages through the sidewalks and arcades and the airport link the Metro Mall by the vehicular roads leading to the parking or drop-off areas. Internally, the buildings are linked linearly and the departures and arrival terminals are very easy to understand and accessed.

Statement 4

"Legibility. The quality, which makes a place comprehensible. This is important at two levels: physical form (landmarks) and activity patterns (nodes)." ***(The Architectural Press, London , Responsive Environments,1985 .Bentley et al.)***

Its contemporary design features can identify both the Metro Mall and the airport terminal node. The scale and proportion of the Metro Mall fits in with its surroundings. The construction methods and materials used are very much the same, but the techniques and applications of the different materials differ. The corner treatments, with its triple volume entrance halls, are decorated with rusted irregular strung sheet metal panels will invite the visitors to the functional activities. The floating concrete roofs with its abnormal large, thin overhangs are evident of the changing application of reinforced concrete. The building is shaded with galvanized sun controlling louvers and the poly carbonate sheeting on the galvanized I-beams speaks of low maintenance, long life-span, but not low cost. This treatment of external elements is a contemporary application of external elements, as is evident in Melrose Arch and also JHB airport. Its external features and construction elements can thus identify the building.

The JHB airport will be recognized and identified on approach by the aircraft lined along the terminals. The routes and direction to travel is clear and legible but as soon as the buildings are approached, the functions or building destined for becomes vague. Signage, information boards and staff members are needed to direct first time users. As soon as the destined buildings are entered, the legibility and movement are readable and easily understandable.

2. Purpose and strategic objectives.

As it is an SDI project, the Gautrain project must promote and stimulate economic growth, development and employment creation in the future. The system must bring a realization amongst users to travel on foot to nearby functional activities, to walk from the station to work, past buzzing activities. This can be achieved by creating walking streets, open public spaces, (hard and soft), multi functional buildings, movement corridors and a safe, convenient environment to move in. The related activities and functions will vary from station to station and create a rich experience to see and experience different cultures and people from region to region.

The following strategic objectives have been identified by the Gautrans initiative:

The Gautrain Rapid Rail Link (Gautrain) must *facilitate development* in the Province.
The project must contribute directly and indirectly *to job creation*.
It must assist in unlocking the *economic development* potential of the Gauteng SDI projects and *strengthen existing development nodes* in Gauteng.
It must *improve accessibility* and *mobility* in this development corridor.
It must *promote the use of public transport.*
It must *develop an integrated public transport system*, through the use of feeder and distribution systems.
It must *integrate land-use* and transportation planning in the corridor.
It must assist in *improving the image* of public transport.
(Integrated station functional area guidelines, Draft 3. September, 2002.)

Create or reinforce densities, to promote rider ship (getting feet to the station);
Establish different land uses to generate different trip volumes at different times of the day;
Ensure correct mix of land uses, thus, land uses that generate frequent trips and not extensive land uses where population density is low; and
Establish new urban form that embraces the train system.
(South African government.2001. Gautrans rapid rail link.)

2.1.Concept

In concept the network consists of two lines. One line connecting Pretoria and Johannesburg and the second line, to link with Johannesburg international airport. There will be three anchor stations: Pretoria station, Johannesburg station and Johannesburg International station. Further more there will be seven satellite stations.

This initiative is expandable as the population develops, resettle and grow. There will be extensive feeder and distribution services at each station, of which a part will be dedicated and under the control of the Gautrain operator. There will also be a park and ride systems at various stations for comfort and ease of movement. At stations, provision will be made for commercial, retail and other development opportunities, to add value and provide additional income. Densification around stations is also very important.

This project is aimed at economic development, growth and job creation. If these objectives are reached, the local economy can grow and a better standard of living can be achieved. The number of joblessness will be reduced, skilled labor will increase and people will be able to sustain their own way of living.

3. A Public Transport Project

The Hatfield station will rise to the forefront as economic-, social-, and transportation node of the Hatfield precinct. The station will, with its presence, bring large volumes of people to a central activity node. To help transport the different people to their destinations, a carefully planned distribution route system has to be in place. As evident in the urban design proposal (annexure 1) Schoeman Street, Duncan Street, Burnett Street and Festival Street, will be the primary public and private vehicle distribution veins. At every cross street and corridor (these streets will be more pedestrian orientated), there will be taxi stops for the pedestrian traveling on foot.

The Gautrain will act as the central activity node and within a 500m radius, public transport has to be accessible for the pedestrian. Within this radius, the metro rail train stations are situated, to enhance and strengthen the public transportation system. (a transportation facility in reach within five minutes on foot.)
Passengers traveling to and from Hatfield Station will use private vehicles for park-and-ride purposes. Based on the results of the demand modeling process, these passengers will mainly originate from the northern and eastern suburbs of Pretoria. It is estimated that the following will have to be provided at this station to accommodate passengers accessing the system by means of private vehicles:

4 How will Gauteng benefit from the Gautrans?

A socio-economic impact analysis determined the potential benefit of the project with regard to matters such as job creation, economic growth and a wide range of other benefits far outweighs the cost of the project for the present and also has benefits that will influence economic growth for the future.
The socio-economic impact analysis showed that the Gautrain could have the following economic benefits (year 2000 Rand values):

- Potentially 43 000 job opportunities will be created during the construction phase of the project.
- The business activities related to the construction of the system could be worth R3, 6 billion per year.
- Result in an increase of between 0,7% and 1,0% in the GGP over the implementation period.
- 1 200 people will be employed to operate and maintain the rapid rail system.
- The business related to the operation and maintenance of the system could be worth R325 million per year.
- Up to 40 000 jobs can be created as a result of the other economic activities related to the project leading to additional business of up to R3, 6 billion.

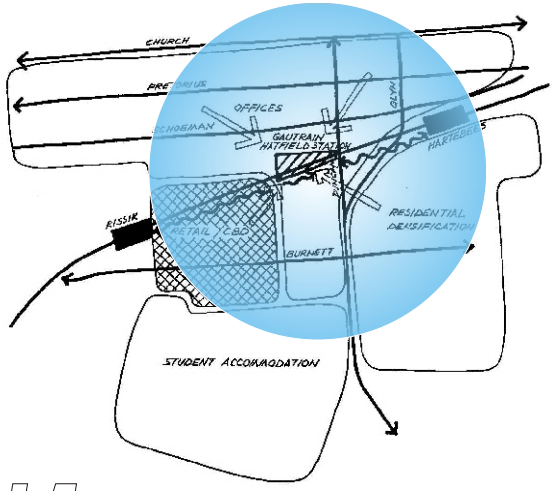
(Integrated station functional area guidelines, Draft 3. September, 2002.)

Similarly, the economic analysis indicted that the main quantifiable transport benefits are (year 2000 Rand values):

- Saving in the cost of time of R933 million per year.
- Saving in accident costs of R15 million per year.
- Reduction of 70 000 tons of CO_2 emissions per year.

(South African government.2001. Gautrans rapid rail link.)

The land required for a rapid rail system is far less in comparison to a road system that can move the same amount of people per hour a day.



1.5 (Diagram illustrating densification towards the station).

5.3. Land uses

The land use composition of Hatfield's functional area is very diverse accommodating a whole range of activities. The main land use characteristics are summarised below: Retail forms the centre of the area, consisting of Hatfield Plaza and Hatfield Square as well as associated uses located along Burnett Street*; (refer to **annexure 1** and urban design proposal to compare current situation to proposed situation and distribution of land uses.)*

There is a significant concentration of offices north of the railway line and particularly around the proposed station. The offices vary in type some being newly developed office blocks and parks, others converted homes into offices, and still some being a mix of home and office space;

The areas of highest residential concentration are located east of Duncan Road in Hatfield Village and south of Prospect Street including the student accommodation. Where Hatfield Village is concerned the area comprises low-density single dwelling per erf typology while the student accommodation is a mix of high-rise blocks and low-density alone standing units.

6. Development framework.

The core area should accommodate mixed-use development, retail and offices, office and residential or retail, office and residential to enforce the core as primary business area and to achieve desirable densification. It is proposed that all high-density residential development be located along the periphery of the residential zone between the offices and the low-density residential area to act as a point of transition.
An ever-increasing demand for student accommodation is placing pressure on further eastward expansion to define the spine and in support of the Gautrain residential densification along this road is proposed.

Diversity of land uses / variety of opportunities
Linear pedestrianisation and access to development along the railway line, connecting Loftus Station, Rissik Station, proposed Gautrain station and Hartbeesspruit Station.
The development that has occurred in Hatfield has generally been of a low density and includes extensive uses such as motor showrooms which de-density concentrations.
Linking with Hartbeesspruit station as part of the Tshwane Ring Rail system and proposed extension of the Hatfield Centre. Increased traffic congestion into the city will make the station less accessible.
The coverage is estimated at 45% due to the potential for densification and availability of vacant land, especially in Hatfield village near Hartbeesspruit station.
Present residential: @200m^2/unit there is 472 units in the node.
Densification in this node will mainly be through high-density developments.

To attain a density of 25du/ha - need to attain 2500 units. If it is accepted that there are 472 units in the 100ha area an additional 2028 units will be required.

The expected economic profile of the future residents in the study area is middle-income families with none or one vehicle per family and young and upcoming professionals. On average an area of 60m² per residential unit is accepted.
Taking parking and landscaping requirements into account, coverage of 50% and a height of 4 storeys is accepted for residential buildings. Therefore, 6ha is required in addition to the existing high-density residential facilities.

The parking requirements of the station have been calculated as 1500 @25m² per parking space. Parking facilities will be provided over three storeys.
Since residential densification should take place there should be an increase in community facilities, such as crèches, schools and clinics. The area surrounding the station is well served by schools and other community facilities. The provision of more localised facilities should be incorporated into the areas where densification is planned.
Open space will have to be provided as part of the high-density residential developments.
In the core area surrounding the station it is proposed that an additional 30 000m² of retail be provided at ground level, with four levels of offices above the retail and penthouse residential units above that. Accepting coverage of 60% for this land uses an additional 4,8ha of land is required.
No additional hotel development is foreseen in this node, since there is adequate provision.
Where Hatfield becomes a tourist destination (both for local and foreign visitors) incorporating entertainment, educational and sport facilities,

(Integrated station functional area guidelines, Draft 3. September, 2002.)

7. Accommodation list

Platform screens and doors.

There has been a trend recently in modern metro systems towards incorporating glazed screens along platform edges. This is only possible where sliding powered doors are available on trains and where the location of these doors is always consistent, which is why screen doors do not appear on main line railways. There are a number of interesting points to remember when considering platform screen doors.

Climate control was the reason why doors were introduced for underground stations in Singapore when its metro system was started in 1989.On most lines equipped with platform screen doors, the space between the sliding doors has emergency doors that can be pushed open onto the platform, so if the train stops out of position, there is still emergency access to the platform. There are also local station door controls provided at the platform ends, in case the automatic system fails.

Against the provision of platform doors must be the cost of maintenance. Train doors account for more than half the rolling stock failures of most metro and suburban railways and the same sort of designs are used for platform doors. Any system, which uses such doors, must ensure that adequate provision for maintenance is made and that any savings in heating or ventilation costs is not outweighed by failures

Entrances and exits.

Station entrances and exits must be designed to allow for the numbers of passengers passing through them, both under normal and emergency conditions. Specific emergency exit requirements are outlined in many countries as part of safety legislation or to standards set down by the railways or other organizations.

The entrances to a station must be welcoming to the prospective passenger. Stations must also have sufficient entrances to cater for the different sides of the railway route but the number must also take into account the cost effectiveness of each entrance. The cost of staffing ticket offices can be very considerable and the numbers of ticket offices must be managed to suit the patronage offering. Consideration must be paid to issues like which way doors open.

Passenger information.

Information systems on stations are variously referred to as a Passenger Information System (sometimes referred to as PIS). There must be a reliable way of informing the passengers where the trains are going. Passenger information systems are essential for any railway. One of the most common complaints by passengers on railways is the lack of up to date and accurate information. When asking the staff for information, passengers expect an accurate and courteous response with the latest data. This means that staff must have access to the latest information and they must be trained to use it properly and to pass it on to passengers. Information displays mounted in public areas must be visible in all weather conditions and be updated regularly with accurate information. There are two types of information - *constant* and *instant.*

Constant information can be described as that which describes the services and fares available and which changes only a few times a year or less. This information can be displayed on posters and fixed notices. There also might be special offers, which can be posted from time to time.
Instant information is that which changes daily or minute-by-minute. This is better displayed electronically or mechanically - both systems can be seen around the world.
For instant systems, it can be assumed that passengers require knowing:

Current time
The destination and expected time of arrival of the next train
The stations served by this train
Major connections requiring boarding of this train
The position of their car - if traveling with a reserved place
Where the train will stop - for variable length trains
Other destinations served from this station and from which platform

There are some information systems appearing with advertising in some form or other. This is a useful source of revenue or sponsorship but it must not be allowed to detract from the main aim of providing the passenger with train service information.

Some modernized lines are provided with bi-directional signaling. This allows trains to travel along either line at normal speeds and be fully under the control of fixed signals. This is a useful facility to have when engineering works have made one track unusable. Trains operating in either direction will then use the other track(s)

Ablution facilities.

Public toilets are regularly abused and vandalized in many countries and railway administrations end up paying large amounts to maintain and repair them. They can also often be used for illegal activities, such as drug related offences, sexual activities and for robberies. An increase in the number of passengers relieving themselves in the public and sometimes in the prohibited areas of the railway, including cases where they have wandered onto the track and got themselves killed by passing trains. At the very least, these activities cause an odor and health risk nuisance.
Any railway operators responsible for stations will have to decide whether they are prepared to pay for the installation of toilets and, if they do so decide, they must be prepared for the management and maintenance of such facilities. Nowadays, it is considered good marketing to provide good restroom, baby changing and toilet facilities.

In spite of all the difficulties, toilets must be considered a requirement, if for no other reason than the public expect them. If they are installed, they must be designed to a high standard and then kept spotlessly clean throughout the day

Concessions.

Concessions on railway premises can be a lucrative source of income for a railway and the opportunity to provide for them should be taken wherever possible. The normal types of concessions are coffee shops, refreshment counters and small lunchrooms, plus pharmacies, dry cleaners, newspaper shops and flower shops

Some larger stations are able to provide space for so many shops that they are almost shopping malls in their own right. This is good for the railway, since it attracts customers and it provides a sense of community, which would otherwise be lacking.

Platform design

Side Platform Station.

On a railway, which requires passengers to be in possession of a valid ticket or "authority to travel" whilst on the property, the station area is divided into an "unpaid area" and a "paid area", to denote the parts where passengers should be in possession of a valid ticket. Of course, there are now many railway operators who have "open stations", which allow passenger to wander at will without a ticket. In these circumstances, in addition to a ticket office or ticket selling machines, tickets can be purchased on the train. The basic station design used for a double track railway line has two platforms, one for each direction of travel.

Where there is a high frequency service or for designs with high platforms, a footbridge usually connects the two platforms. In the case of a station where tickets are required to allow passengers to reach the platform, a "barrier" or, in the case of a metro with automatic fare collection, a "gate line", is provided to divide the "paid area" and "unpaid area". This design allows equal access for passengers approaching from either side of the station but it does require the provision of two ticket offices and therefore staffing for both of them. Sometimes, stations with two ticket offices will man only one full time. The other will be manned as required at peak hours.

Lifts and escalators

Vertical transportation at stations in city environments and on urban railways is almost as important as the horizontal transportation provided by the trains. Any station not easily accessible on the surface and which requires stairs, will nowadays, require lifts for the disabled.

Stations with a height difference between levels of more than 4 to 5 meters will probably need escalators as well - certainly in the up direction. Escalators are expensive, so the number of passengers using the facility must be at a sufficient level to make them worthwhile. Both lifts and escalators are high cost maintenance items and need to be kept in good condition.

The siting of lifts and escalators is important. Passengers have to queue to board them so there must be space at the boarding point to accommodate a large number of people at busy times. Such areas must be kept free of obstructions and not be too close to platform edges. The number of stairways and escalators must be sufficient to allow a trainload of alighting passengers to clear a platform before the next trainload arrives. This may seem obvious, but it isn't always done. Most countries require an evacuation standard to be applied to the number and location of stairs and escalators.

Basic construction.

One other point to note. Escalators in the railway environment usually get a lot more use than those in commercial or retail. A railway, with a standard department store design escalator, may find it will quickly wear out and will need constant repairs.

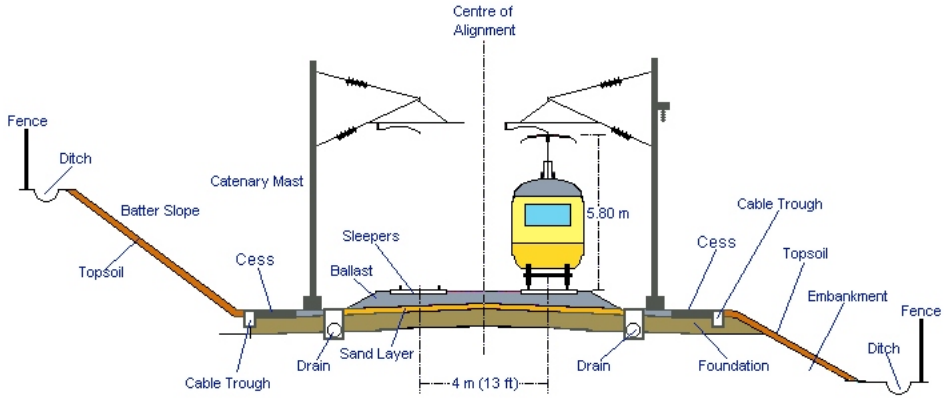
The sub structure.

This part of the road consists of three main elements; the formation, the sub-ballast and the ballast. The formation is the ground upon which the track will be laid. It can be the natural ground level or "grade" or it can be an embankment or cutting. It is important that the formation is made of the right materials and is properly compacted to carry the loads of passing trains. The formation under the track has a "camber" rather like that seen on a roadway. This is to ensure ease of water run-off to the drains provided on each side of the line.

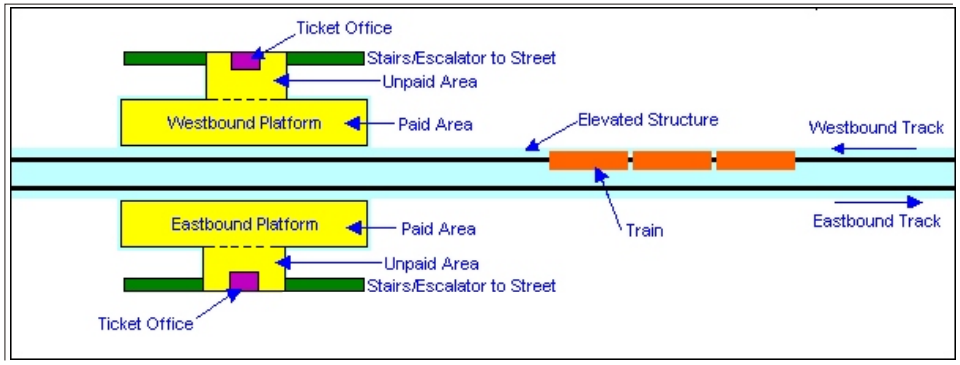
The track itself is supported on "ballast", made up of stones usually granite, below, which is a layer of sand, which separates it from the formation. For new or renewed formations, the sand is normally laid over some sort of geotextile screen or mesh to separate it from the foundation material below. In the past, asphalt or plastic sheeting has been used to prevent water seepage.
Catenary masts (if the line is electrified on the overhead system) are located outside the drains and, beyond them; there is a walkway area. This may just be a cleared path for staff to walk safely, avoiding passing trains or, on modernized routes, a properly constructed path. Next to this path will be a cable trough. These were originally concrete but are nowadays often made of plastic. A plastic tube, usually bright orange in the UK, protects Cables crossing the track.

Usually, the edge of the railway property is outside the pathway or cable runs. If the line is built through an area requiring an embankment or cutting, the slopes will be carefully designed to ensure that the angle of slope will not take an excessive width of land and allow proper drainage but without risking an earth slip. The slope angle depends on the type of soil available, the exposure, the climate and the vegetation in the area. Drainage ditches are often added along the edges of cuttings and embankments. In the UK, fences are always provided along the boundary line of the railway to protect the public from wandering onto the track. Even so, there are a few accidents every year when trespassers are killed or injured by trains or electric conductor rails.

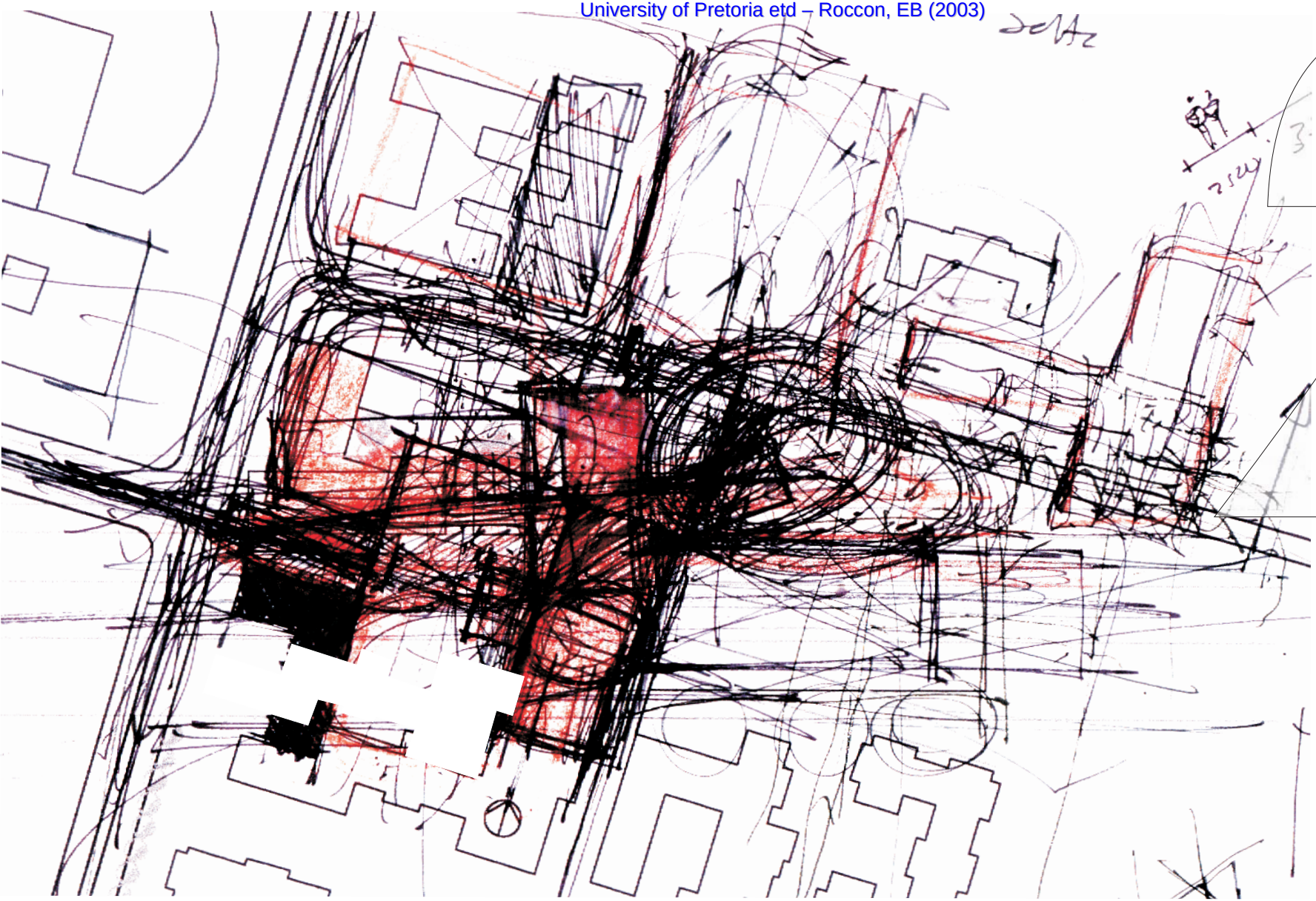
(http://www.trainconstructions.com)



1.6 (Cross section of a typical rail road construction line).



1.7 (Diagram illustrating the principle for platform design).



BASELINE

CHAPTER 2

NATURAL VENTILATED train station

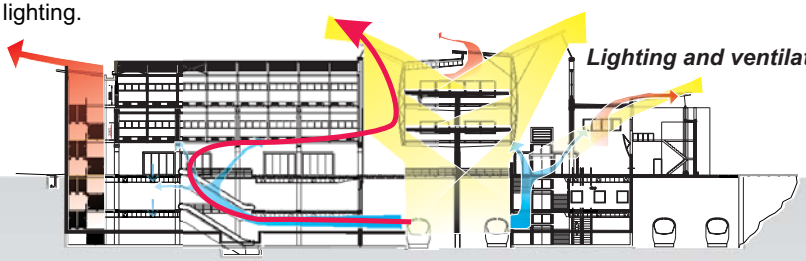
9 783829 035644

1.1) Occupant Comfort

The comfort of people in and around the building is the reason for good design. It will create a place with spaces within a space, where ease and comfort of movement will enhance the functional activities. People of South Africa enjoy sunshine. We thrive, as a country to function outside, between the buildings, with our environment.

1.1.1)Lighting and ventilation:

The building, will predominantly be orientated east/west. To avoid direct sun penetration on these facades, vertical sunscreen devices (designed to retain heat in winter and ventilate heat during summer) must be implemented and therefore, minimize natural lighting penetration during the day. The more natural light that penetrates the building will ensure less artificial lighting. This means less electrical energy used and less heat within the building, generated by the electrical heat through lighting.



Lighting and ventilation diagram

2.1

Lighting

The natural lighting will penetrate the lower levels (platforms), by means of double volumes. The double volume will introduce ventilation from the platform level, to create airflow, air changes per hour and ventilation for the structure. The ventilation will transfer warm air or will ventilate and extract warm air as required, to keep the internal temperature at desirable temperatures.
The platforms and pedestrianised areas must be well lit to ensure a safer environment. Lighting can also be used to enhance the visual and functional clarity of the different circulation routes, entrances, fare-vending areas, platforms and building facades. It can also be used for information graphics to inform people and passer-byes of train arrival and departure times.

The passive cooling and heating system will not act as a single heating and cooling ventilation system but assist the air condition system and therefore the air conditioning system, will use less conventional energy for operation. The system can even be switched off if the passive system is sufficient enough.
The lighting should not obstruct free movement of pedestrians or motor cars. The glare must be at a comfortable level and placed to enhance and create a safe environment.

(Exterior Locations	Foot-candles
Station Shelter	15 minimum
Interior Locations	**Foot-candles**
Station Platforms	10 minimum
Fare Vending Area	12 minimum
Station Platforms, Uncovered	10 minimum

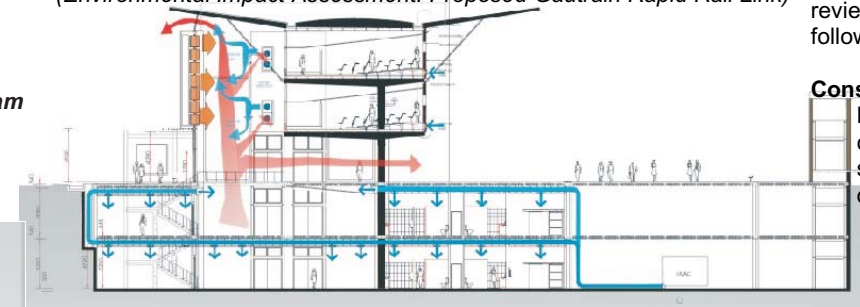
(Table 1: lighting requirements)

Toilets	10 l/s per sq.m
Offices	15 l/s per sq.m
Arrival and departure	20 l/s per sq.m
Shops (retail)	10 l/s per sq.m
Platforms	20 l/s per sq.m
Staircase	Pressurization -fire req
Equipment rooms	As per functional req

(Table 2: ventilation requirements)

1.1.2) Noise:

Period of Day (T) (dBA), LAeq,T(dBA)Lamax
•06h00 – 22h00 (daytime/evening) 60- 85(*dBA)*
•22h00 – 06h00 (night-time) 50- 85(*dBA)*
(Environmental Impact Assessment: Proposed Gautrain Rapid Rail Link)



Ventilation

All aspects of the potential construction modes, based on the most likely scenario as anticipated by the civil engineering consultants were reviewed. These included the following noise attributes:

Construction techniques.
Location of construction camps, ancillary plant sites borrow-pits and dumpsites
Construction material delivery routes.
Work program.

(Environmental Impact Assessment: Proposed Gautrain Rapid Rail Link)

Other specific noise situations related to the train operations:

The noise at stations.
The noise generated from ancillary equipment related to the rail system (tunnel ventilation, pressure relief and dewatering pump systems, traction stations, etc.).
The interior noise in the passenger cars.
Problems related to marshalling yards and workshops.
Potential noise problems from track maintenance operations.

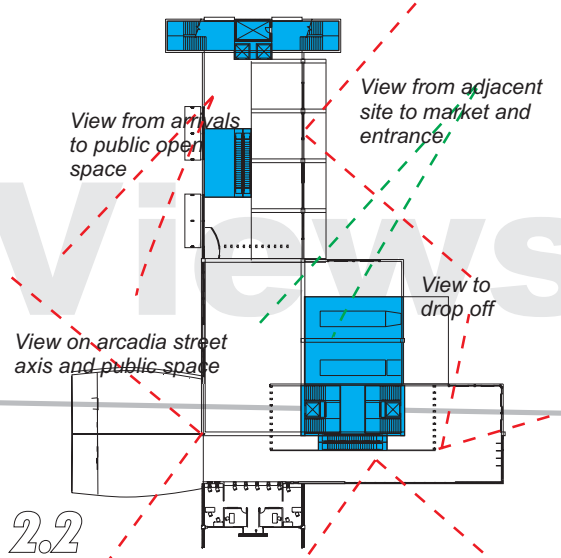
1.1.3). Views:

It is important for working people within a structure, to feel part of the outside and not isolated. At least a third of a person's day will be spent working and people work within the confined spaces of a structure. If a building can be an extension of the outside, people will feel more "free" and part of the activities that passes them by, while working. They will feel part of the movement infrastructure.
The passing trains can be used as a viewport to the outside, if the movement can be exposed to the people. The pedestrians and commuters will also be exposed to the working people in the structure. To further enhance the viewpoints of working people and commuters, a greenhouse, will act as the linking space or foyer, between the inside and outside.

Views

The viewports and greenery will both be used, not just as an aesthetic component, but as a natural ventilation mechanism and a microclimate establisher to minimize the use of artificial heating and cooling to acquire the desirable temperature for the functional activities.

The access roads (pedestrian and vehicular) will form view lines towards the departure and arrival platform areas. This will promote access to the station. Access to and from the station is the most important point to create a fluid movement pattern, avoid confusion and promote sufficient usage of the station and its related functional activities.
The arrival platform will lead people to the point where they can choose the next functional activity. As the commuters arrive on this point, they will have access to retail and commercial facilities to satisfy their daily requirements or appointments. The commuters can travel further in the form of bus and taxi travel or make use of the Gautrain mini-busses. The open air market, job center and hotel will also be directly viewed from this point.
The views at this point, will be crucial, for this will be the point of decision making, planning and then moving towards or away from and influence the movement on the site. This will also be valid for commuters, arriving for departure from the station. They will have access to the same activities, but will access these facilities through and with other view lines and line connection activities.



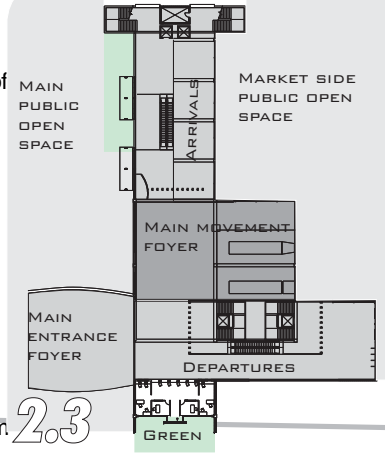
2.2

(Plan explaining views and vertical circ).

1.1.4) access to green outside

The outside area will consist of public open spaces that will bridge the railway lines and reserves. The implementation of green open spaces will be coupled to extreme expenses and construction difficulties. The greenhouse will not only be used as a microclimate establisher, but will reduce radiant heat to the building on the northern façade. The greenhouse will also provide access to greenery, in the form of a green courtyard.

The building's façade will open towards the green courtyard to allow cross ventilation and as a climate control element.
Trees will form a fundamental constructor of pedestrian paths and pedestrian orientated streets.



2.3

(Plan illustrating green areas)

1.2.) Inclusive environment.

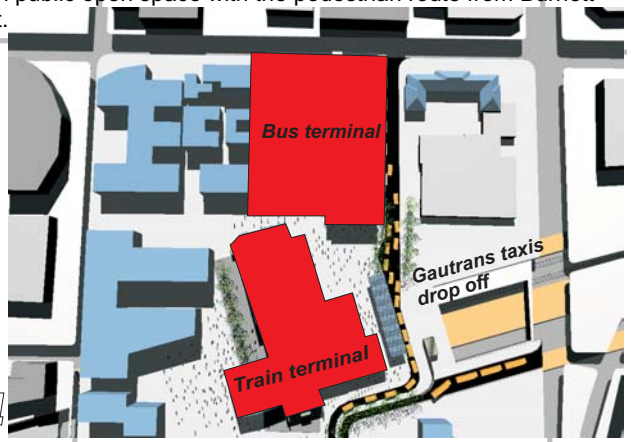
Hatfield station will be a specifically designed building for its function. The building must accommodate 1500 people at peak travelling hours per platform. This will cause vacant open spaces at certain times(minimum of 1500 sqm) during non-peak hours. To create a sense of activity and occupancy, commercial, retail and overnight space will be introduced as shared volumes, but not as shared usable spaces. The building's function will be a train station, for as long as the railway commuters will use train travel as transport medium.

The surrounding structures that form part of the station prescient, must be flexible designed, to adopt different functional activities for changing times. The environment must therefore also be designed for the building to function.

1.2.1) Public transport and routes:

Public transport will form the main access medium, with pedestrian routes, for the departure and arrival areas on the station building. A primary access route that runs north/ south across the site will be used as a service route, drop-off zone and pick-up area for arriving and departing passengers.

A bus depot will be located within 50m of the arrival platform and the Gautrain mini-bus service will be available to transport passengers to nodal activity areas (Brooklyn, Hatfield and Menlyn). A ring road system (Schoeman St, Duncan St, Burnett St and Festival St), that will be serviced by mini busses and the municipal bus service, will be within walking distance from the station, to the north and the university, to the south, to reduce travel time within the Hatfield precinct.
As described in the urban design principals, Schoeman Street and Duncan Street will be hard edges. These streets are not pedestrianized but will have mini-bus and municipal bus stations for pick up and drop off. These waiting shelters will be adequately transparent to minimize vandalism and provide adequate surveillance of the station and enhance a sense of security and openess. Festival Street and Burnett Street will be pedestrianized and Grossvenor Street, will be an extension of Burnett, linking the station public open space with the pedestrian route from Burnett Street.



2.4

(plan showing public transportation on site).

A station building that will form an extension of our environment, but still keep the identity and functional requirements of a train station, within the context of the site and neighborhood.

Bus criteria:

Buses should be as close as possible to the train station.
Promote fast efficient movement with no obstructions (e.g.: crossing railway tracks).
Provide emergency services for railway line failure.
Separate bus and motor car access.
Minimize conflicts between buses, motorcars, pedestrians, cyclists and train.
One bus bay with 3,5m x 20m with 15m tapers on each side.
(LRT Design Criteria Manual. Revise October 2000).

Pedestrian movement and circulation to, from and across train platforms is essential for the smooth operation and functioning of a train station. Movement patterns must be as simple, obvious and comfortable as possible.

The Implementation of color, texture, patterns and clear signage will enhance the movement of pedestrians to the functional activities.
Elevators, escalators, ramps and stairways will achieve changes in level. These circulation elements must be placed on the pedestrian routes but must not obstruct movement.

1.2.2). Circulation zones: (edges)

A *Through Zone* is an unobstructed area void of above-grade utility boxes, vertical elements, furnishings, etc. that provides free flow of pedestrian movement.
A *Curb Zone* is an unobstructed area void of utility boxes, vertical elements, furnishings, etc. that provides space for loading and unloading of vehicles.
A *Furniture Zone* is an area where furnishings, utility boxes, light and sign poles, newsstands, trash receptacles, shelters, platform equipment, etc. are located.
A *Guideway Zone* is the horizontal train movement area that corresponds with the vehicular dynamic envelope.
A *Bus Zone* is an area where buses transition in and out of the station and stop for passenger loading and unloading.
A *Building Frontage Zone* is an area between a building line and the through zone where passengers might lean, window shop, or avoid because of building obstructions such as window ledges, columns, etc.
A *Drop-off Zone* is an area generally associated with kiss-and-ride where automobiles drop-off and pick-up passengers.
A *Taxi Zone* is an area designated for taxi drop-off and pick-up.
A *Clear Zone* is an area at the corner of an intersection that is void of utility boxes, vertical elements, signs, newsstands, trash receptacles, etc. to allow adequate sight distances.
A *Pedestrian Crosswalk Zone* is an area designated for pedestrians that cross a street and that is clearly marked by paving or paint.
(LRT Design Criteria Manual. Revise October 2000).

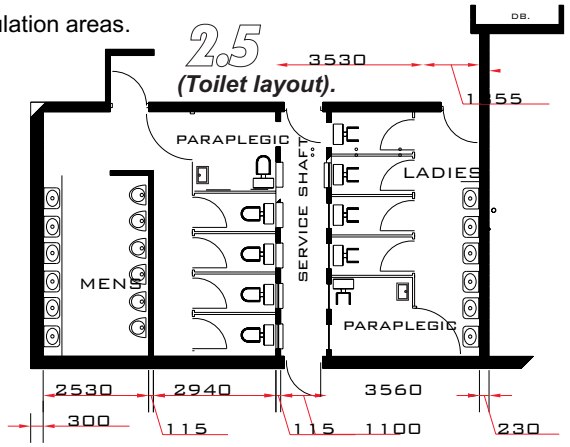
Movement patterns must be as simple, obvious and comfortable as possible.

1.2.3) Toilets:

Each level that will be associated with the arrival and departure platforms will be equipped with public toilet facilities.
These facilities will be situated near vertical circulation areas.

Men: at least 5 wash hand basins,
5 WC's and 5 urinals.

Women: 10WC's and 10 wash hand basins.



1.3.) Access to facilities.

Daily living and working activities require access to daily necessities and requirements of a range of services. By providing these services to people, it will increase the efficiency of the building's function and reduce impacts on the environment.

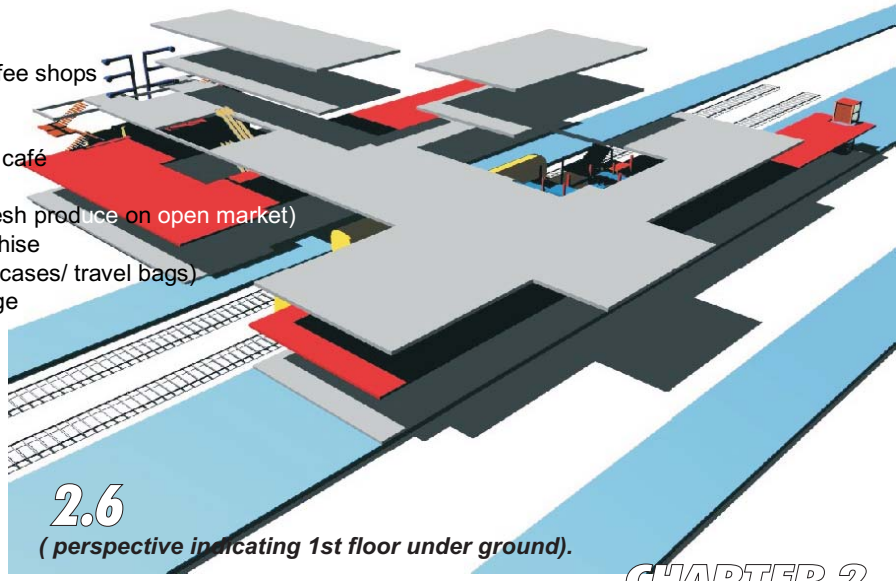
1.3.1) Banking:

Banking facilities will occur in the station building and on the public open spaces. Public telephones and ATM's will be grouped together, to form a functional unit and add to security precautions, for it will be placed where there will be sufficient surveillance and on movement axis.

1.3.2). Retail:

Retail will be in the form of daily requirements. The retail component will form an extension of the arrival platform of the station and a lengthen activity line of the open-air market. Retail will include the following:

Stationary shop (150-200sqm)
Chemist
Doctor/ Dentist
Street cafés/ coffee shops
Restaurants
Take away
Post office/ I-net café
Bank
Supermarket (fresh produce on open market)
Cell phone franchise
Travel shop (suitcases/ travel bags)
Bureau de change



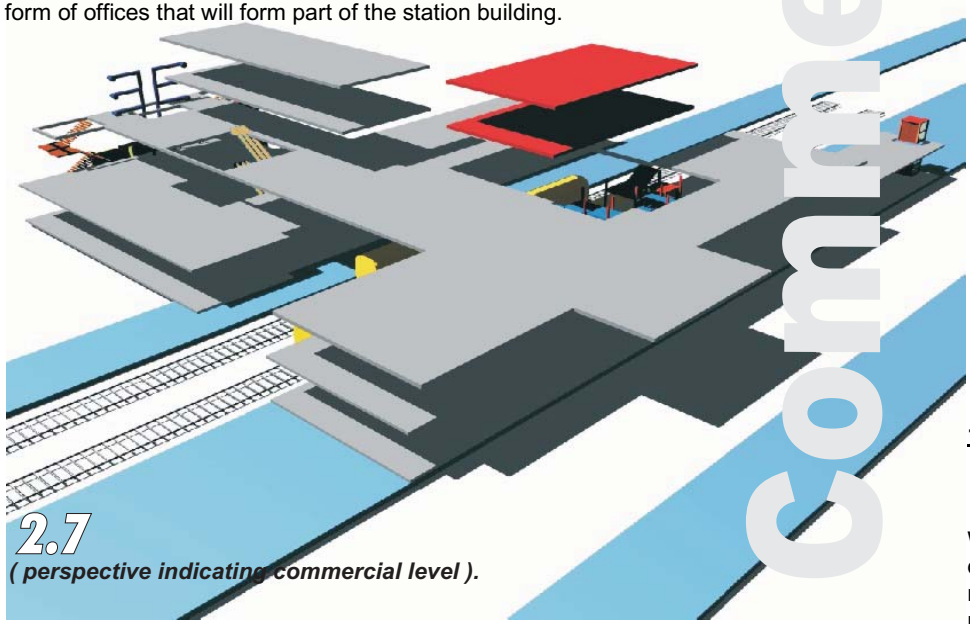
2.6
(perspective indicating 1st floor under ground).

1.3.3. Residential:

The existing building to the south of the public open square, will be converted into a hotel. The existing building to the north of the site is currently being used as a hotel school. As a job creation opportunity and a functional requirement, the students and trainees can be utilized as staff members for the proposed hotel.
Overnight accommodation, as a cheaper form of accommodation will be available at the arrival platform area. There are sufficient accommodation facilities within a 12-km radius from the station, for the site is situated in a residential area. Student accommodation for the hotel school staff and students will be proposed on the adjacent site to be developed as well as accommodation for the proposed job center.

1.3.4) Commercial:

Commercial and retail facilities have been introduced to the area over the last 10 years. The commercial component will further lend to the multi functional development in the form of offices that will form part of the station building.



1.4.) Participation and control.

Occupants that participate and help to decide in the functioning of their environment they work in, will enable the users to manage and control their environment. Control over aspects of their environment will enable personal comfort control and satisfaction.

The implementation of the passive airflow system and the trombe wall system can educate people in different applications of these construction techniques.

1.4.1) Environmental control:

Users of buildings have reasonable control over their environment. Except for the building management system to be implemented, occupants can participate in the climatic control of their environment, to adjust their own comfort levels, by opening and closing louvers and windows for cross ventilation and airflow and the adjustment of blinds. The implementation of the passive airflow system and the trombe wall system can educate people in different applications of these construction techniques.

1.4.2) User adaptation:

The occupants must have the freedom to utilize the space, as they desire. This calls for areas that allow different uses over time. Flexibility of the spaces created, is the design principle that must be achieved. This includes the design, manufacture and implementation of a modular partition system.

Social spaces:

Social spaces in the building and on public open spaces and pedestrian routes are important for the interaction between people. This can range from informal to formal spaces. Street furniture can be used to create seating areas along a pedestrian route and promote interactions and rest areas. These spaces in buildings can be the restaurants or coffee cafes on the platforms, the tearooms in the commercial offices and the arcade in front of retail shops.

Community involvement

The station will act as a part of the Hatfield prescient. The community will use the station as a transport medium to reach their destination. The university and surrounding schools can utilize the station for field or day trip escersions. The metro rail can utilize the central platform for deliveries for the open-air market. The job center can provide the necessary day-to-day job opportunities. The part of the departure platform that will not be used for commuters can be used as a capital generator, where space can be rent for storage. An overhead crane can be used to distribute heavy loads and a service lift for smaller particles.

1.5.) Education, Health and Safety.

1.5.1) Education

We live in a technological age. Information in our respective fields is important for us to keep up with daily advances in our professions. Information comes in a wide range of mediums. Access to newspapers, newsmagazines, Internet and people in the same fields of interests are important to keep up with what passes us by. Seminar rooms can be used as function rooms, education rooms and lecture rooms, to educate and inform the community. The community can use the room(s) as a community hall, as a church or for discussions, relevant on the community.

1.5.2) Security:

Security in this area is important for the use of the station. If the station is labeled as an unsafe and dangerous place, commuters will return to their more expensive way of travelling and visitors will stay away. Access routes (pedestrian and vehicular) must be well lit during the nighttime. Activities must overlook the pedestrian routes and buildings (commercial, residential and retail) must be placed along these routes.

2.1.) Local economy.

Hatfield station and the related development that will impact the site will hold enormous economic benefits for local contractors and development in the region. The local economy of the area can grow by utilizing local resources, skills and workers.
There are enormous amounts of jobless people on the streets of Hatfield and can be trained and educated in the construction, management and distribution skills of building construction, road construction, bridge construction, train related aspects, commercial, retail and education. The proposed job center can already start to promote, recruit, train, educate and advertise through the planning phases of the project.

2.1.1) Local contractors:

The principal agent, employer, contractor and tender document must try and promote 80% of the construction be carried out by contractors based within a 40km radius from the site. By using local contractors and sub-contractors, the local economy will grow. From an ethical and judicial point of view, the tender document, experience and quality of work must also be considered before appointing. The aim is not to be partial to the local community but to uplift, educate and train people from the local area. If a tender of better quality is accepted, local unskilled laborers must try to be incorporated into the contractor's team.

2.1.2) Local building material supply:

An estimate has been set to use 80% of building construction material, manufactured and produced within 200km of the site. These include pre-manufactured components. A building system or separate building component (e.g. wall unit, passive cooling device component).

2.1.3) Outsource opportunities:

Small emerging businesses can be given a chance to establish a reputation, by providing an opportunity for them in the development, planning, construction and maintenance phases of the project. These provisions include the education and training emerging businesses, outsourcing catering, cleaning services, security and to create space and opportunities for business to use space for retail and education during the phases of the development. The maintenance of the building and site can be through self-developed and trained staff or outsource to companies within 50km of the site.

2.2.) Efficiency of use.

The efficiency of buildings occupied and used by people can be unsustainable if the planned spaces are not used to its full potential. Spaces within a structure can be used for different function during the day. This means to utilize the same space for different functional activities during different times of the day. This will promote a longer occupancy during the day to reach the 18-hour day functional activities.

2.2.1) Usable space:

Non-usable (non-rentable) spaces (toilet facilities, plant rooms, communication rooms, etc) must be in the right proportional relation to usable (rentable) spaces. A train station has arriving and departure platforms that can not be utilized as capital generators. To accommodate and utilize these non-usable spaces, retail can be incorporated on the path towards the platforms, to generate income, to accommodate specific daily requirements and needs. The non-usable spaces, must not be more than 20% of the total building area.

2.2.2) Occupancy:

The station and surrounding buildings must be occupied for at least 30 hours per week. The introduction of retail, housing, commercial and open-air market activities with a train station, will produce functional daily activities for at least 18 hours per day.

2.2.3) Space use:

The optimum management of spaces during different times of the day will intensify the functional activities during the day.

2.2.4) Use of technology:

Technology in communications will reduce the necessity for extra space required for conference facilities. Video conferencing and Internet access will be incorporated and assist the surrounding commercial companies to reduce travelling time and expenses.

Technology in construction will be introduced in the greenhouse structure, to regulate and control the microclimate. A louvered roof structure will open to allow ventilation from the platform levels and close to heat the air. The roof will open when there are too much moisture or heat within the green house. Thermostat and moisture sensors will trigger the opening of the roof.
A computer management system will regulate the dry bulb, wet bulb and relative humidity inside the greenhouse and allow for evaporative cooling (cross ventilation) or heating (heat pump) to allow for a comfortable environment.

Evaporative cooling will be in the form of a fine spray with gray water from the building. The spray will also provide the necessary moisture for the plants.

2.3.) Adaptability and flexibility

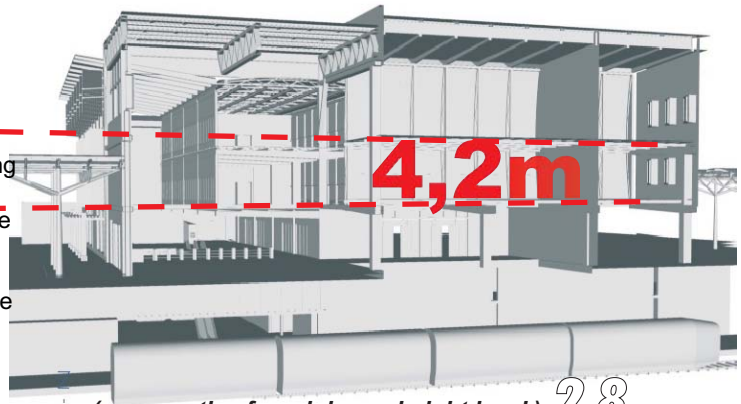
As mentioned, the structure must be flexible to accommodate future functional changes during the building's life span.

2.3.1.) Vertical dimension:

A minimum of 3 meters from the floor level to the underside of the floor slab must be achieved. As a passive cooling system will be implemented in the design, access for ducting must be provided. Access floors and hung-ceilings will provide adequate space for ventilation ducts, piping and electrical conduits. To achieve optimum flexibility and adaptability a minimum of 4,2m will be adequate to allow the required space for access floors hung ceilings and enough internal space. The height of 4,2m min can later be divided into two 2,1m levels min for extra usage and flexibility. The use of brickwork and a desirable height of 4,420m will be adequate. All levels do not have to adhere to this flexible height.

2.3.2) Running costs.

Buildings must be an investment. It must generate more income than expenses. If running costs per month can be kept to a minimum, there are more capital left at the beginning of each month. This means more profit and a sound investment.



(perspective for minimum height level). 2.8

2.3.3.) Maintenance:

A low maintenance building will ensure lower running costs per annum. Materials that will be used must be of high quality and the application of materials must ensure a long life span for its intended use. The structure to bridge the railway lines can not be of heavy mass, for the point load on the bridge structure will mean a higher construction cost of the bridge itself.

2.3.4.) Internal partitions.

The load bearing structure must be designed in such a way that internal load bearing structures are not required. This will allow for internal partitions to be erected at any place to utilize every area to its full potential.
The partition panels can be designed to fit in with increments of the load bearing structure grid and will enhance the flexibility.

2.3.5.) Services.

The service shafts and service ducts must be ea accessible and can also lend its weight to structural stability, ventilation and service routes. Well-planned service entrances will mean an easier way of maintenance and service providing.
A lightweight structure on the bridge grid will mean a structure of timber, steel, pre-cast concrete elements and non-load bearing brickwork and stonework. Heat retention advantages from heavy mass structures will therefore be a problem with lightweight structures.
This in itself will mean carefully planned and design sun protection elements for the building to utilize stored heat energy during night and protection from the sun during the day.

2.3.6.) Cleaning:

The construction elements and choice of materials to be used must be of such a nature to be cleaned easily and maintained longer. The use of tiles instead of carpets as an example. The cleaning of windows, will it be easily reachable.

2.3.7.) Insurance/ water/ energy/ sewerage:

A managed plan to ensure that water usage can be reduced will be implemented. Low flush toilets and urinals can be used. Water from wash hand basins, sinks and drinking fountains can be filtered and reused as gray water for the gray water system (greenhouse watering and evaporative cooling).
Using low energy light bulbs can reduce energy usage and the use of natural daylighting during the day can also reduce energy usage. A light filter automatic timer can be used to switch lights on at different times of the year in and around the building.
The measuring and management of water and energy usage can be determined by the management system to control and check for in-consistencies during usage.

2.3.8.) Disruption and "downtime":

The operating, management, communications, HVAC and back-up systems will be accessible by a service lift and near a service entrance on the southern side of the building. This area will function on its own and will not be accessible by the commuters or public. A separate controlled access point will allow entry for staff and service staff.

2.4.) Capital costs.

The site has the ability to bride the gap between low income and high-income living standards and conditions. An open-air market and informal trading can co-exist and compete with affluent commercial and retail activities. The dirt and grime point of view perception can be eliminated if the situation and environment are pleasant and safe enough to be used.

2.4.1.) Build ability:

The station building will be placed on the site to maximize its orientation sun and view advantages. It must also fit into context and into the existing building placement and existing building fabric. The building will be a simple U-shaped structure that will provide access from the main public open space on the western side of the building (departure platform) and link with the market on the northern side of the building (arrival platform).
There will be replication of components on the building and in the building in the form of load bearing columns and cladding components. This will reduce construction and manufacturing costs establish a standardized component, to reduce wastage (cut-off).

2.4.2.) Construction:

The site will be developed in phases as the need for functional activity increase with commuter usage of the train station. The planning of the project is essential in the success of the planning and construction phases. The first phase of the development will be the most important or the anchor of the development. In this case the train station and platforms will be the first phase of construction. If the station is safe and operational for use, the functions to support the station can start with construction.
The retail and overnight accommodation will therefore be the second phase.
The commercial building to relocate the proposed hotel structure (currently commercial) will be the first to start construction with the retail. The third phase will be the rest of the proposed commercial structures.
The buildings should be constructed as a shell (load bearing elements e.g. columns and slabs) and then the facades, finishes and secondary elements (ventilation installations, electrical installations, toilets, basins etc.)

3.1.) Water:

Water is a daily necessity to sustain life. Water has to be stored to accommodate the daily needs of the building and its occupants and take up large amounts of space. The cost of constructing the space required and the cost of conventional water supply, must be weight up against each other to work out the feasibility of each choice. To store water, will mean a more environmental and cost saving method of water usage. The reuse and re-distribution of water (gray water) will have cost saving implications.

3.1.1.) Rainwater and water use:

Rainwater will be collected and stored in basement tanks (50 kl). The water can be used with or separate from the gray water for evaporative cooling, flushing toilets and watering the greenhouse. Heat pumps can utilize solar heated water for heating in winter. The reverse effect can also be used to introduce cooler air during summer time. Water can still circulate the solar heaters during summer times and used from the geysers. Warmer water in the geyser means less energy to be added for the desired water use temperatures.

The water has to be filtered first before it is introduced into the geyser for use. During periods of little or no rain (winter times) water can be obtained from the conventional municipal connections.

3.1.2.) Run off:

Using steel grids in paved surfaces and paving with a fall towards channels can collect the run off. This water can also be stored in the storage tanks and then filtered for use.

3.1.3.) Planting:

Trees and soft landscaping will be used around the building as surface covering instead of hard paved areas. The soft landscaping on the western side of the structure will have less re-radiation properties than the paved surface. Deciduous trees will be planted on the eastern and western sides as sun control elements and as a natural environment element. The green planted areas will be on visual axis from within the building and on movement axis.

3.2.) Energy:

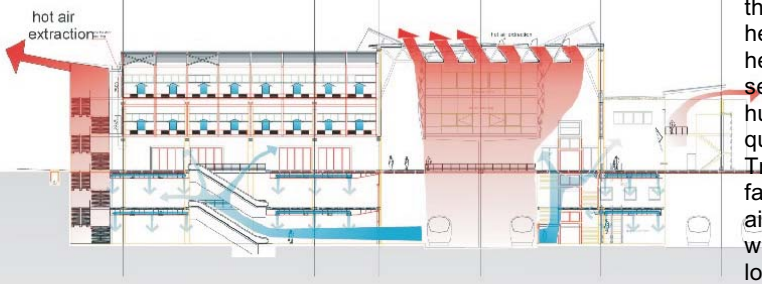
Buildings consume large amounts of energy (in the form of air-conditioning units, artificial lighting, electrical appliances etc), to operate on a daily basis. All electrical appliances and equipment need electricity from the national grid to operate. Conventional energy production contributes to the depletion of non-renewable resources and therefore damages the environment. This lead to a large environmental footprint (use more energy per day than nature can replace per day). The use of less conventional energy will leave a smaller ecological footprint and the use of renewable resources can lead to a controlled and manageable environmental resource usage.

3.2.1.) Location:

Commuters and visitors will use less energy, for the station is within walking distance from Hatfield, the University, schools and the residential suburbs. People will not need to use vehicular transport to visit or make use of the station presciecnt.

3.2.2.) Ventilation system:

The building will make use of a passive ventilation system for cross ventilation. Cooler air will be introduced through the platform level into the building by louvers in summer times. The louvers will be adjusted by a computer management system that will be connected to thermostats and pressure control sensors. The pressure sensors will ensure positive air pressure on the inside of the building and will open the outside façade, to introduce new air into the building every hour (depending on the space and the activity).



2.9

(section explaining ventilation and cooling cycles)

The air that will be in the building at this time will circulate through the heat pump, to cool the air down or heat the air, depending on the season and the air temperature, humidity in the air and the air quality.
Trombe walls on the western façade can further heat the internal air by opening the building's façade windows and closing the ventilation louvers of the wall. The trombe wall will be used to ventilate the hot air on the building's façade in summer time and will also be used as a vertical sun-screening device at this seasonal time.

In wintertime the reverse effect will take place. The ventilated air will be introduced into the building to heat the air.
The greenhouse will also absorb CO2 from the surrounding environment and through the microclimate, introduce fresh air as a "cleaner air supply".

Accommodation	Air changes per hour
Offices-above ground	2-6
Offices-below ground	10-20
kitchens	20-40
Public toilets	6-12
Plant room	10-15
Restaurants	10-15
Storage room	1-2
Assembly hall	3-6
Class room	3-4
Domestic habitable rooms	1

(J.Greeno.1998. Building services, technology and design.)

The natural ventilation system will assist the artificial cooling/heating system in controlling the internal environment's climate.

3.2.3.) Heating and cooling system:

Air changes will occur every hour during occupation times. The air that is introduced will then be heated or cooled through the heat pump. The “new” air will replace the “old air”(warm air rises to the roofline. Ventilation ducts open. Cold air from beneath will create airflow and replace the “old air”. Electrical fans can assist in air distribution/ expulsion). The ventilation shafts close and traps the “new air”. Blow fans on ground level will start air movement upwards, through the triple volume and extractor fans extract air on the other side through air ducts, where the heat pump will heat the air, add extract moisture or cool the air down.

Solar water heaters will introduce heat to the air (heat pump stage) and will also introduce warm water into the geysers. As mentioned, the trombe wall will also heat the air or ventilate the building’s façade.

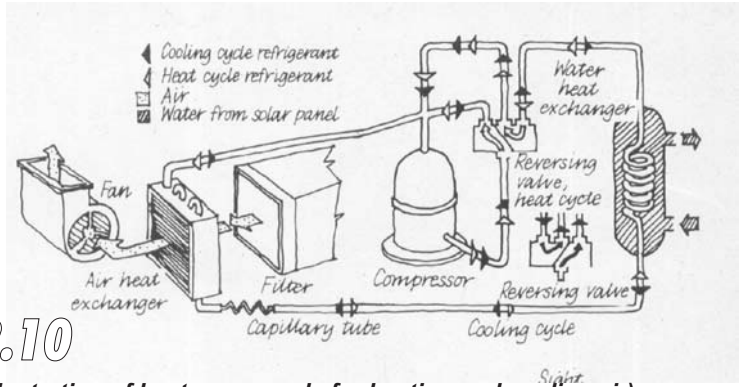
This passive heating/ cooling system will only act as a mechanism to reduce energy usage and time of usage of the air conditioning system. On extreme weather conditions during the different seasons, the air conditioning system will be more efficient.

3.2.4.) Appliances and fittings.

All water pipe fittings must be covered with insulation materials to reduce the loss off heat during water distribution and flow. Low energy light bulbs can be used and fluorescent tubes can be used to reduce the energy usage. The lighting can also operate on a timer mechanism for different seasons, as mentioned.

3.2.5.) Renewable energy:

Energy can be generated through photovoltaic cells. The generated energy can then be stored in the form of rechargeable batteries. Electrical lights can be operated during night from these batteries.



(illustration of heat pump cycle for heating and cooling air)

(energy conservation in hot climates: D.Holm, 1983)

3.3.) Recycling and reuse:

Raw materials and new components used in buildings consume resources and energy in their manufacture and processes. Buildings accommodate activities that consume large amounts of resources and products and produce large amounts of waste. Reducing the use of new materials and components in buildings and in the activities accommodated and reducing waste by recycling and reuse supports sustainability by reducing the energy consumption and resource consumption.
(J.Gibbert, 2002.Sustainable Building Assessment Tool.)

3.3.1.) Toxic waste:

Areas where dangerous and toxic materials will be discarded will need to be addressed, by providing the right precautionary measures to avoid accidental exposure to the waste material. The loading and transportation of the toxins must also be considered. These areas will include the service yards for the trains (oil, cleaning fluids etc.), the batteries for the photovoltaic cells, commercial companies and equipment used in offices, retail or household appliances.

3.3.2.) Inorganic waste:

There will always be waste products where there are people. The best way to accommodate for the recycling of waste materials is to design and create space for waste materials. Recycle waste areas can be designed for and arrangements for pick-up can be utilized at service entrance.
The waste material can also be sold to recycle companies per load, kilogram or in other measurable formats.

3.3.3.) Construction waste:

During the construction phase of the project, arrangements have to be implemented for the clearing of waste material on site. Excavated earth can be used to fill uneven soil areas for building purposes, but should not be used to cover the existing topsoil, for that can destroy the existing micro-habitat of organisms and cut off the necessary sun, air and ventilation system needed for their survival.
The added soil can also cause soil erosion (loose soil with no established root system).

Construction waste can also be sold to waste management companies. The waste materials can also be re-used (loose bricks as pavers).
In the design process, standardized and modular elements can also be used and designed to minimize wastage.

3.4.) Site:

Buildings invade the natural environment and replace the natural fabric with a manmade structure that uses natural resources for the construction and running of the structure. The depletion of the natural fabric impacts on the environment we live in and need to survive and support life on earth. The building leaves a “footprint” and if the footprint uses non-renewable elements, too much energy in the construction and running of the building, the footprint can leave a permanent imprint on the earth’s surface.

This is one reason to density the functional usage on the site in an ordered, coherent and planned form. The more multi functional activities on a site will mean less ground to be broken for more buildings. This will also have financial gain for investors and developers, for the more rentable floor area, means more capital gain. For the occupants and users can only benefit from the functional activities on the site.

3.4.1.) Brownfield site:

The Gautrans site was previously occupied by the Arcadia Primary School. It has since been divided into different portions and the proposed developed site, owned by the Sage Life Investment Company, forms part of the divided site

The station will form part of a new station public open area. The existing buildings were not planned to form a public open space for the train station. The facades of the existing building will be looked at and altered where necessary to form the desired building form and public open area.

3.4.2.) Neighboring buildings:

The buildings surrounding the site will only be altered where necessary and only the new part of the Delta Motor Corporation building will be broken down and construction elements reused where applicable. The new structures will be designed to allow maximum heat and natural sun light penetration and also placed for sufficient natural ventilation.

3.4.3.) Vegetation:

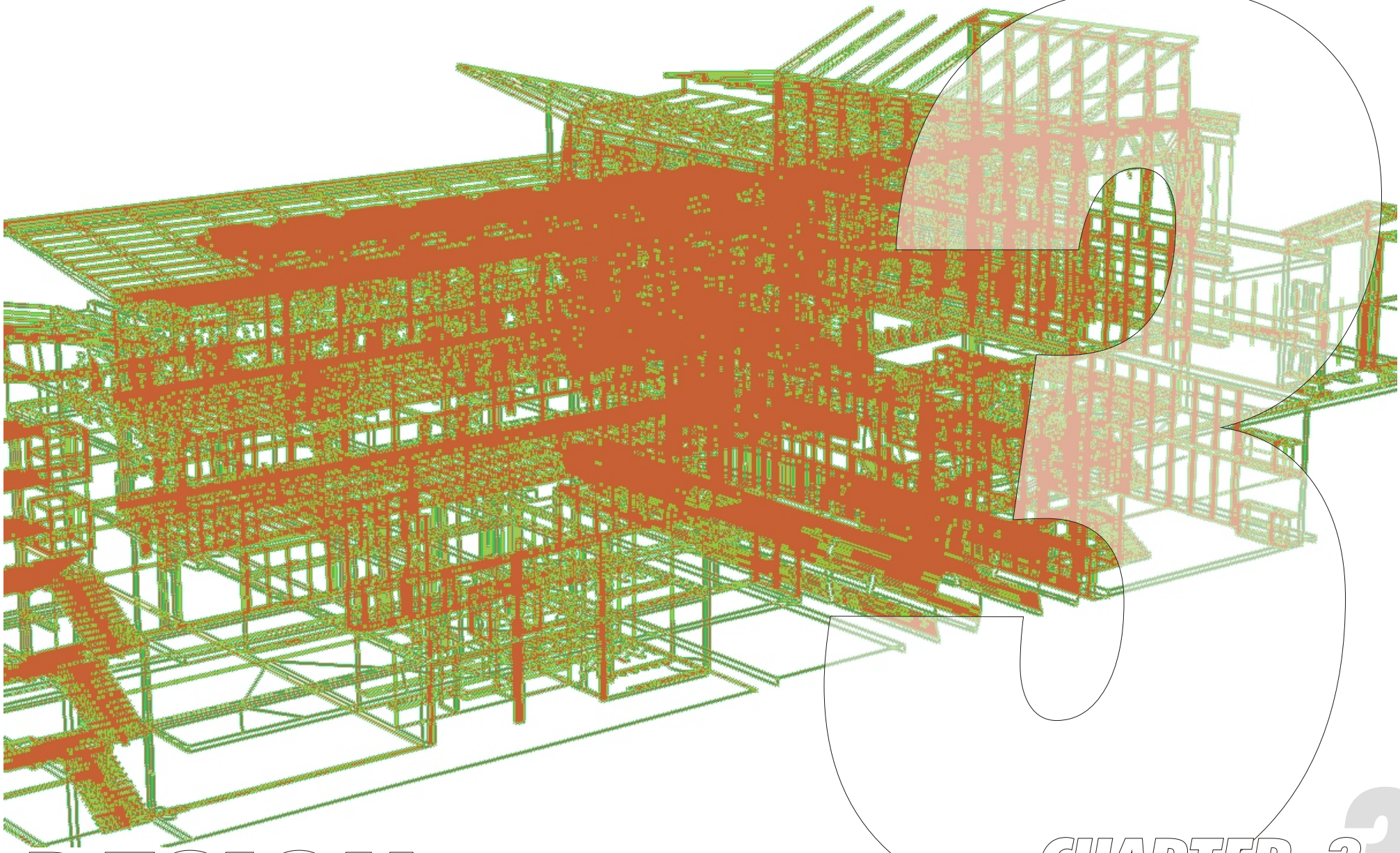
The existing vegetation on site will be retained where possible, to minimize impact on the natural environment. The greenhouse on the northern façade of the building will only use indigenous plants. A cultivated roof system can be implemented on the eastern roofs of the building for insulation purposes during the mornings and also on ground floor level on the eastern and western sides to minimize reflective and direct heat gain during the day.

3.5.2.) Manufacturing process:

The construction and manufacturing of the building components and elements must manufactured with as little as possible impact on the environment (construction and manufacturing process).

3.5.3.) Recycled/ reused materials and components:

The sun control panels on the main entrance will be manufactured from recycled plastic elements. A plastic technologist will be incorporated, as sub-contractor, into the design and development of the panels. The reason for the use of plastic panels is to utilize the waste materials as a modular system. The properties of the plastic can be altered to take on new properties on molecular level. This can be achieved through nanotechnology. The plastic panels can absorb and store heat for more sufficient and efficient heat storage. The plastic will minimize direct sunlight penetration on the eastern and western facades and can thus act as a sunscreen device on its own. The plastic can also gather more dust and still be suitable due to the plastic's characteristics.



DESIGN

CHAPTER 3

NATURAL VENTILATED

train station

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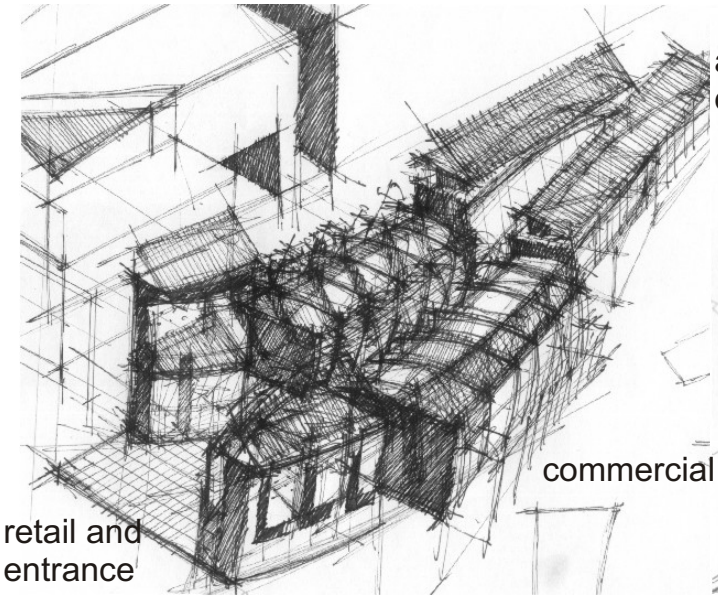
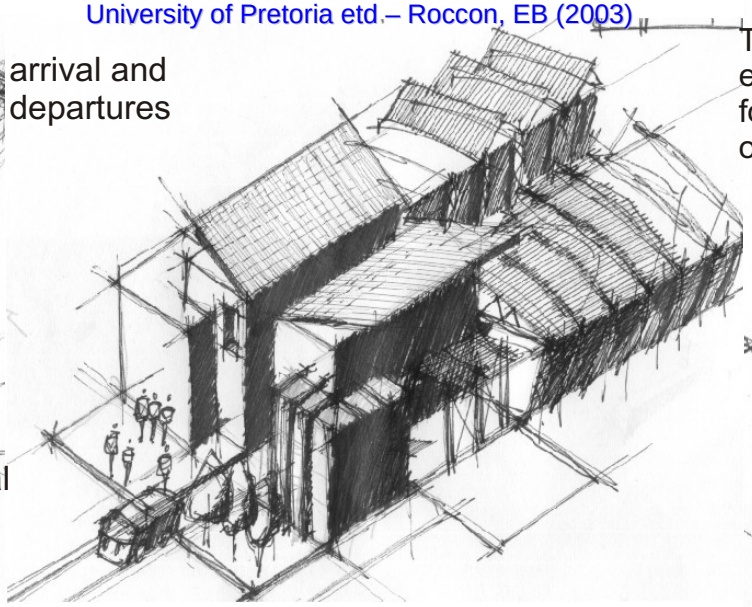
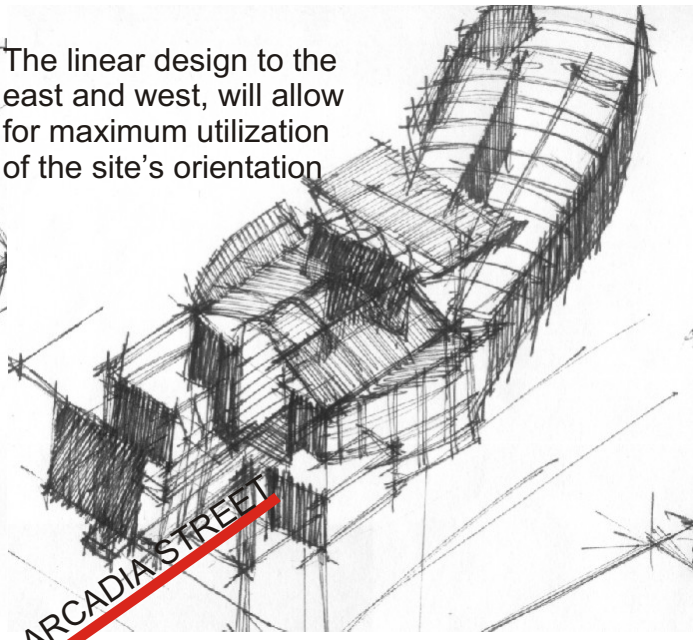
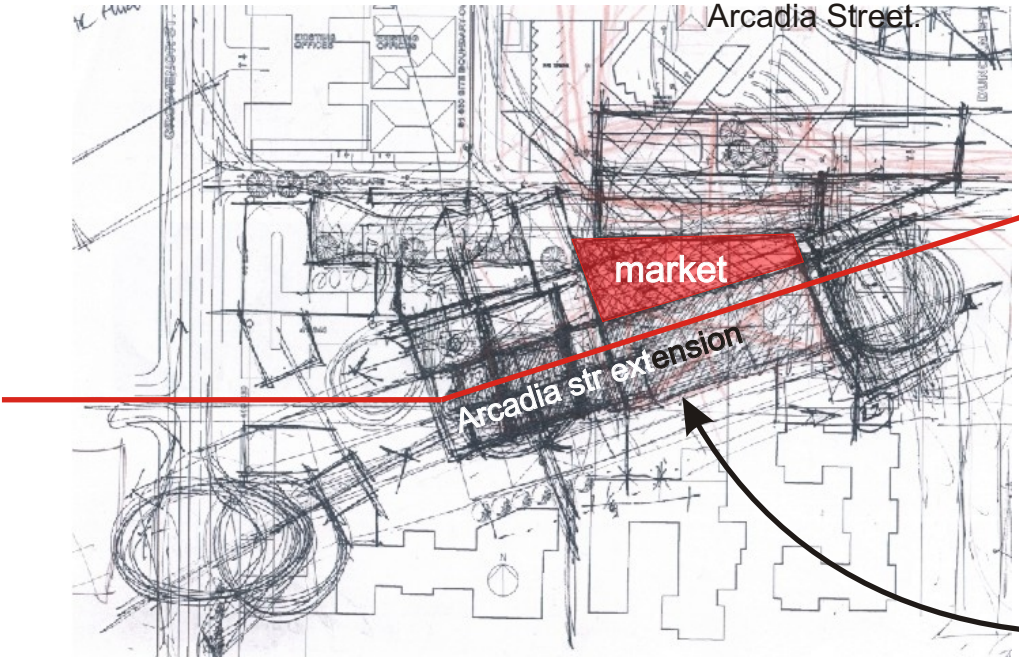




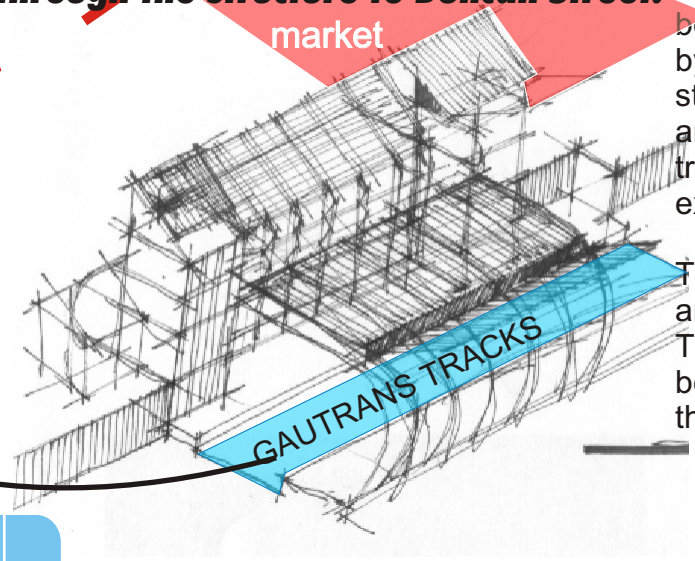


Concept sketches explaining the linear movement with the existing rail road tracks. These buildings will form an activity line perpendicular to the rail road. The design will not incorporate the surrounding buildings and activities. The public open spaces will not be formed, due to the linear (east/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

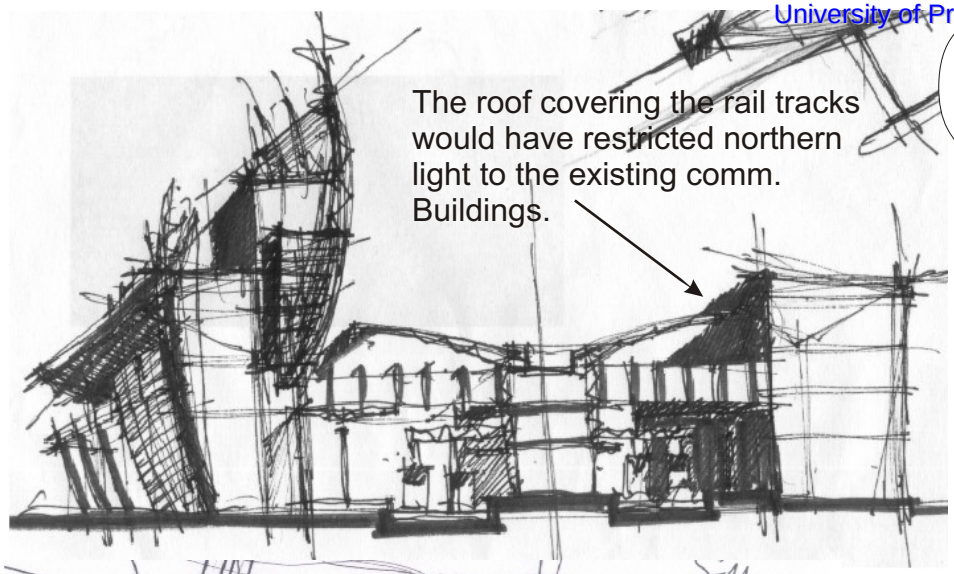


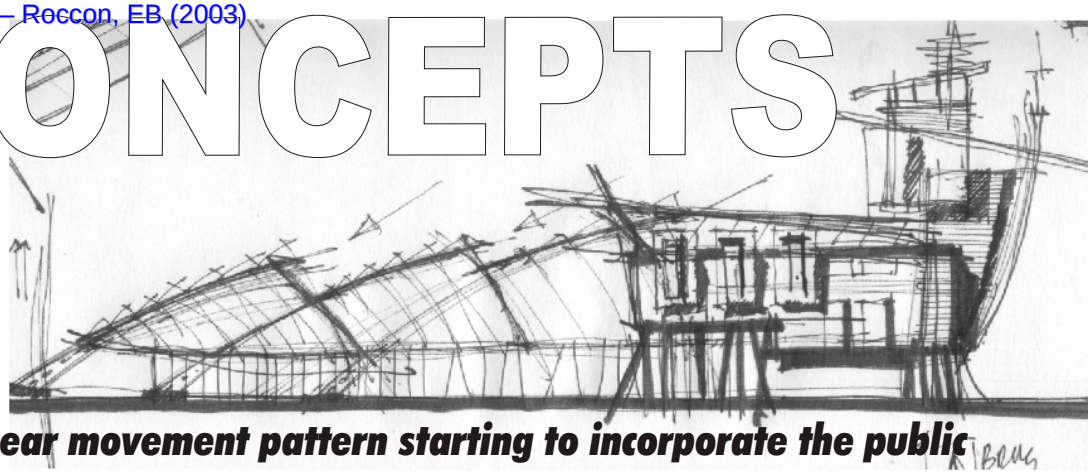
the linear movement on plan will progress from a public open space through the structure to Duncan Street. The main public open space will be linked to the market open space by the activity line through the station. The arrival and departures are still perpendicular to the rail tracks. The Gautrans tracks 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.

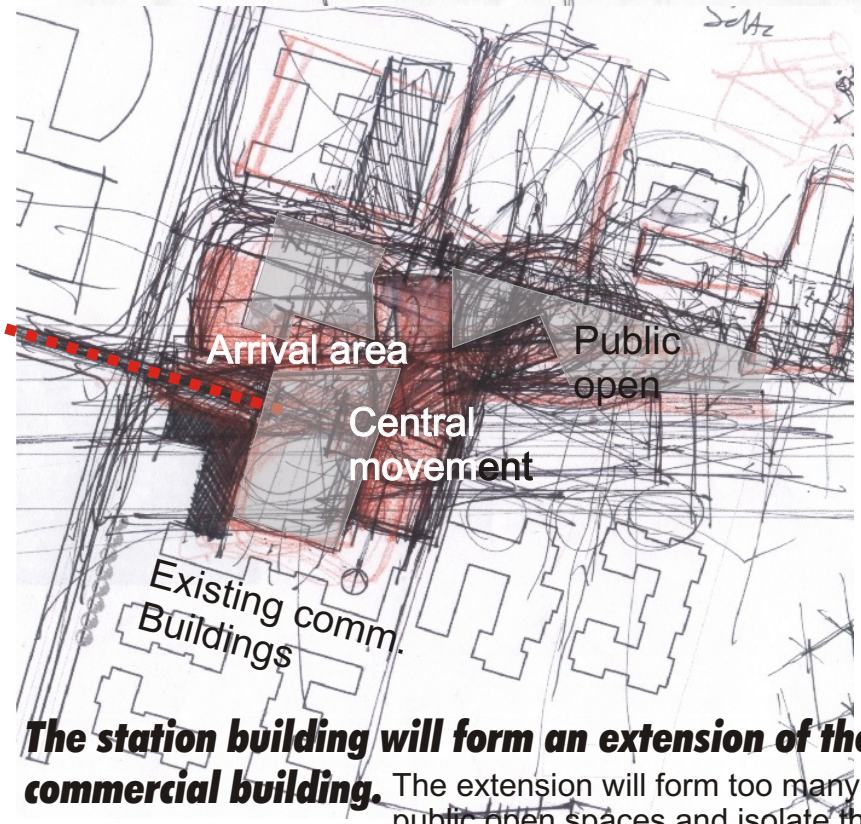


CONCEPTS

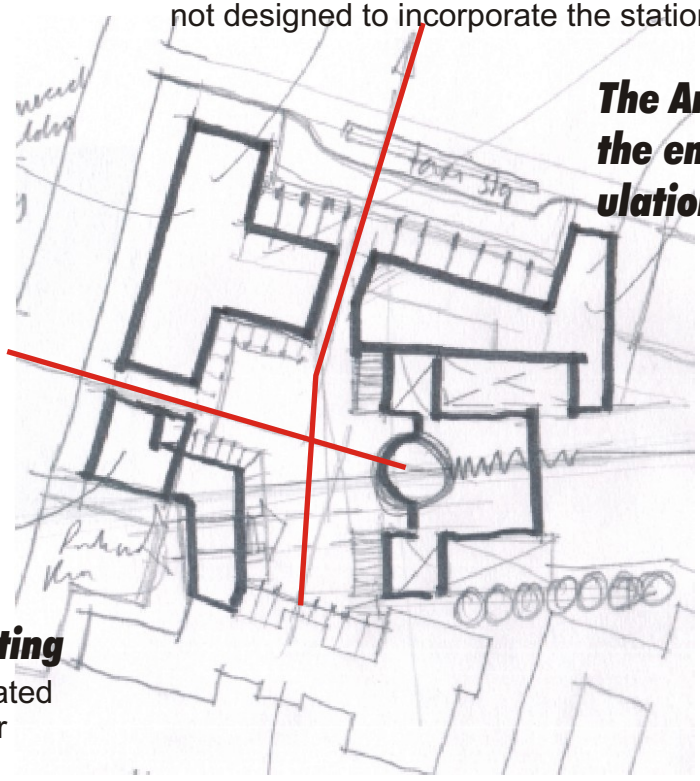




The linear movement pattern starting to incorporate the public open spaces and the railway tracks starting to move under ground as an enclosed and separate movement space. The railway tracks and platform levels are still visible and covered by a separate roof structure. The existing commercial buildings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

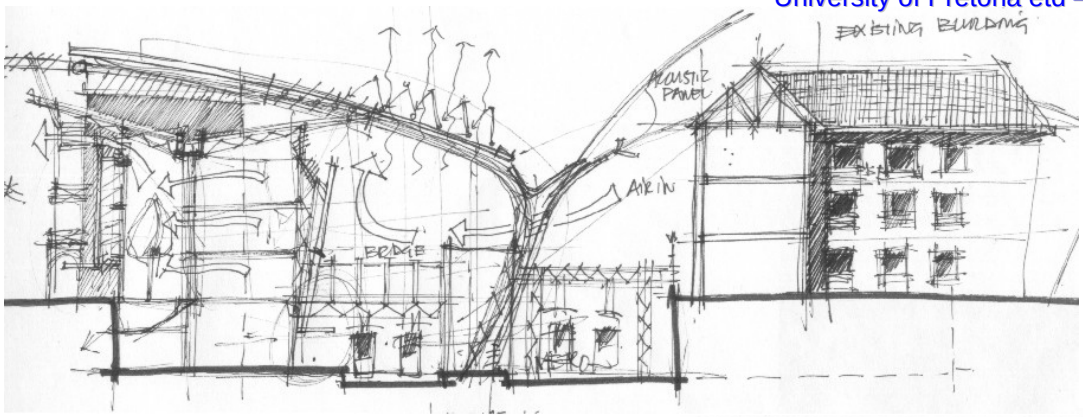


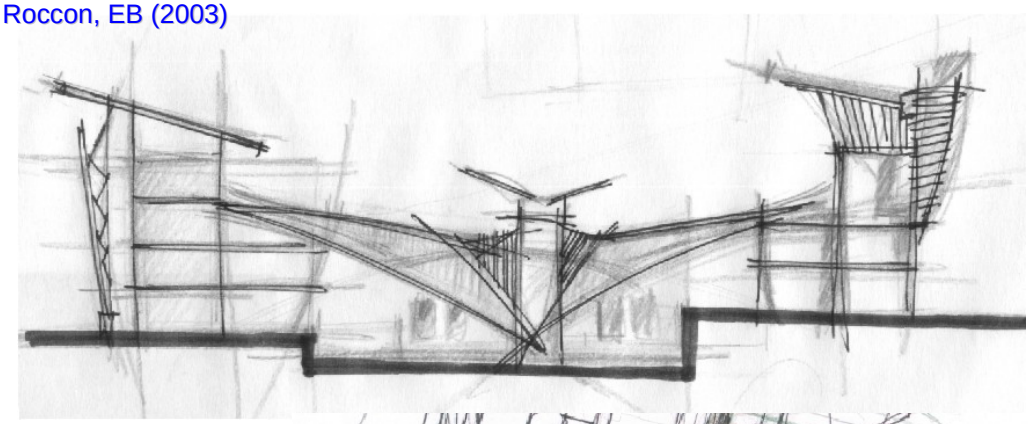
The station building will form an extension of the existing commercial building. The extension will form too many separated public open spaces and isolate the other existing buildings

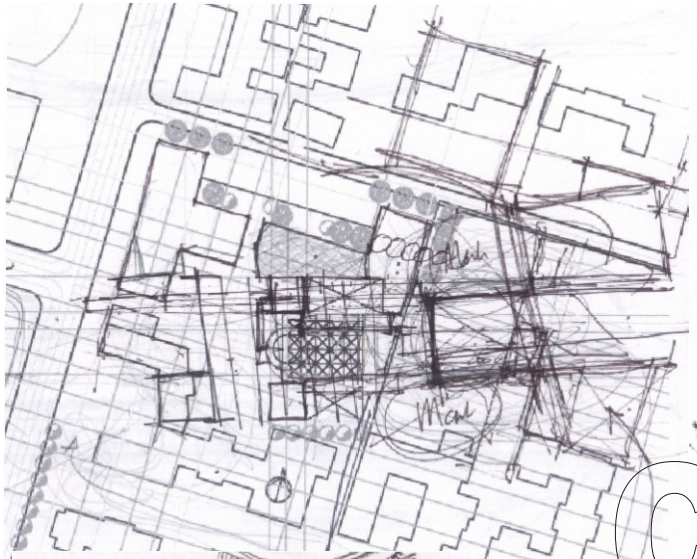


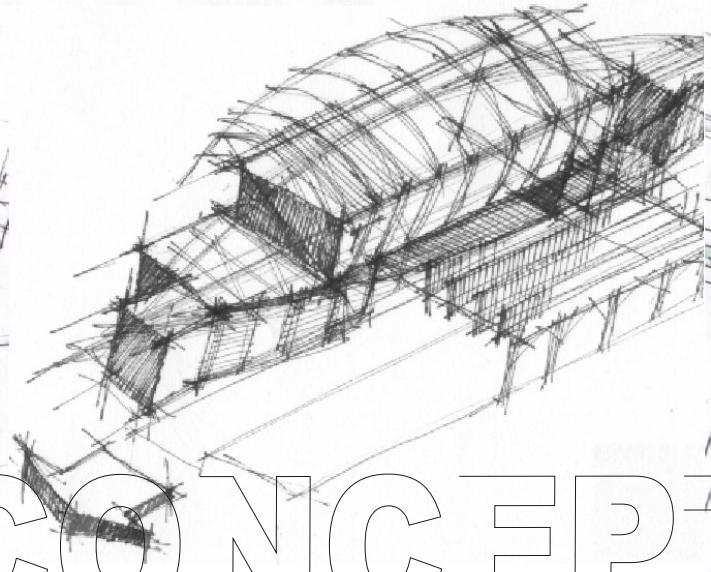
The Arcadia Street axis defining the entrance to the main circulation foyer. The building placed Over the tracks and the movement to and from the tracks will be vertical.

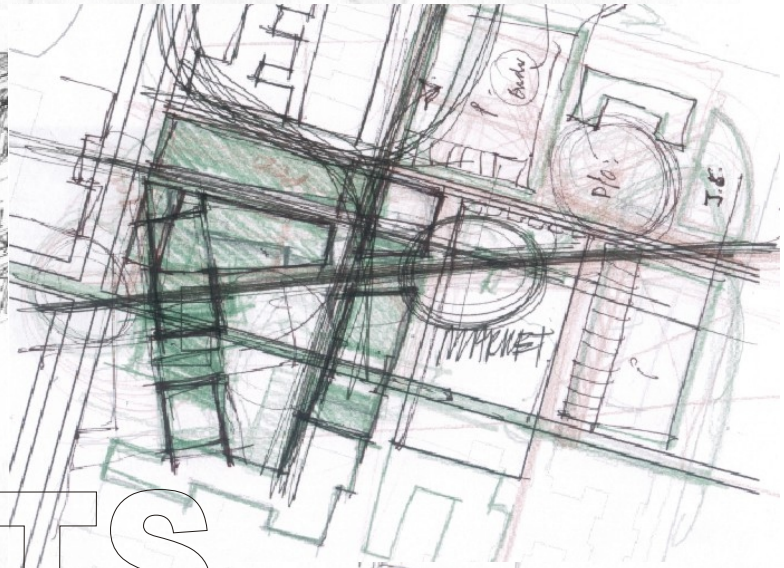
The design in elevation and perspective will be too dominant on the site and too elaborate in terms of focus point. The station building must fit into the local context of the existing structures











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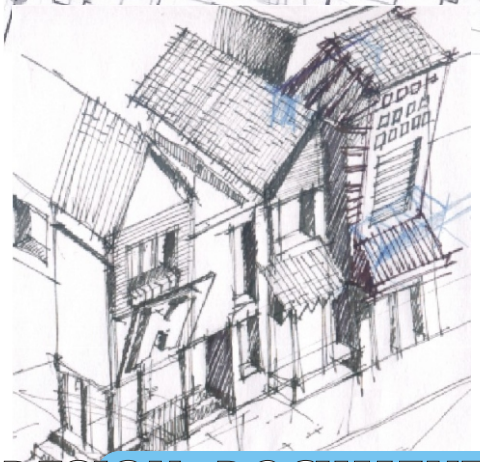
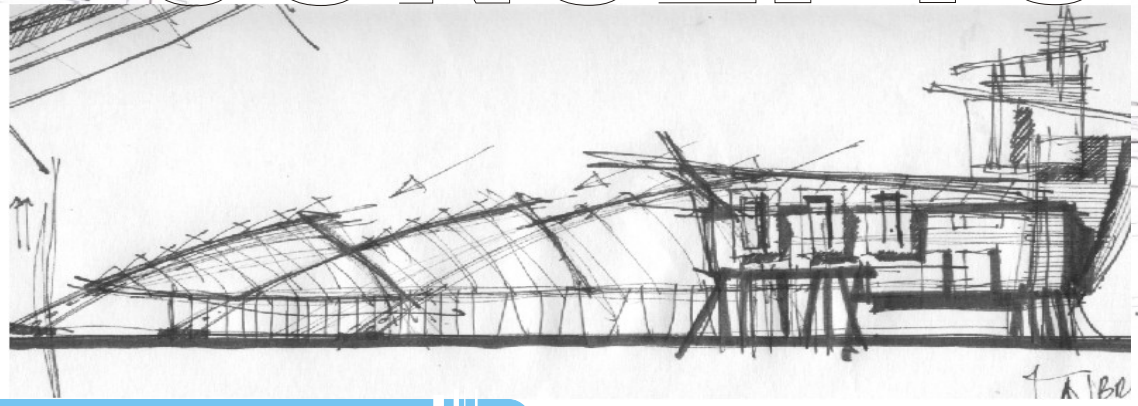
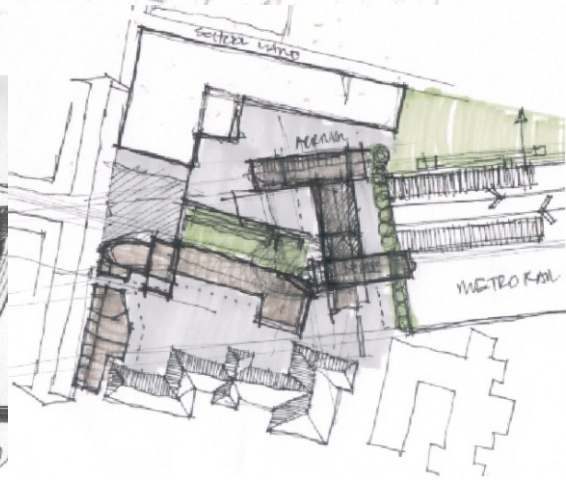
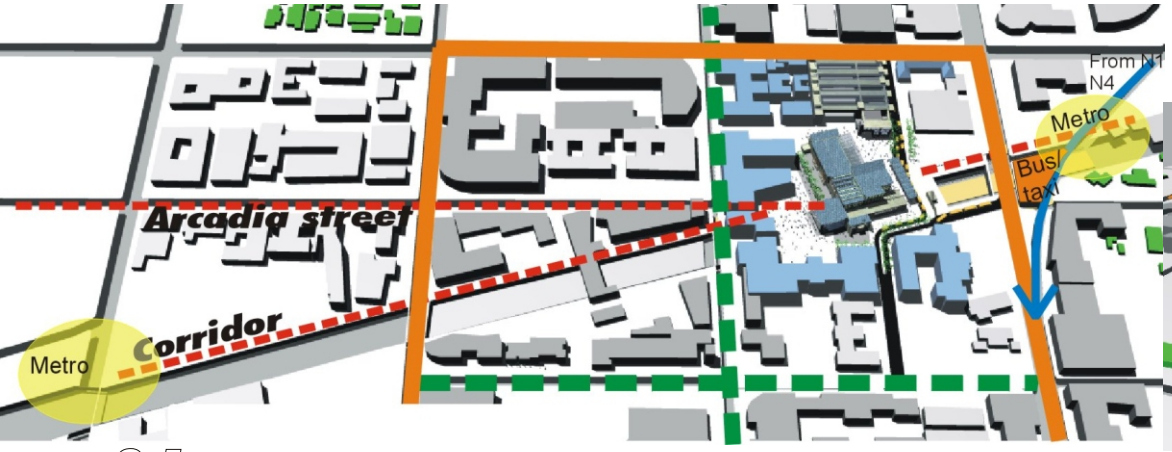




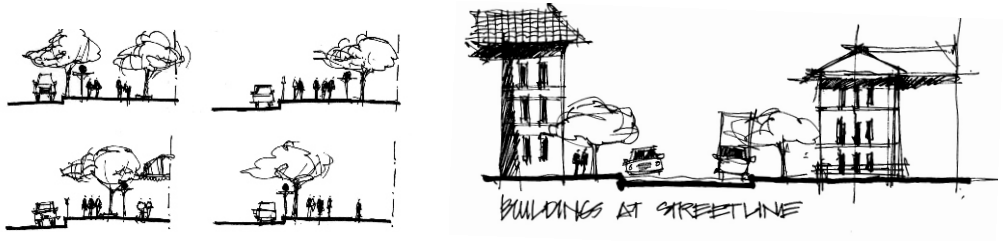




3.1 *(Perspective 1: development and surrounding structures)*

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..

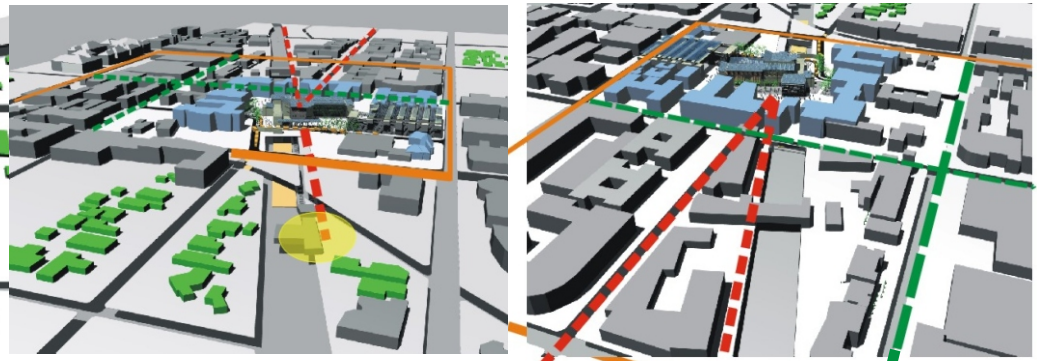


3.3a *(Figures illustrating pedestrian scale for street edges)*

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.

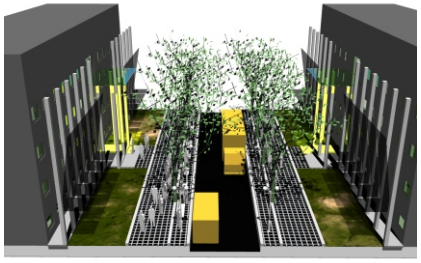
Interaction between people passing by, neighbors or even workers from the area, will promote a sense of community and national ship.



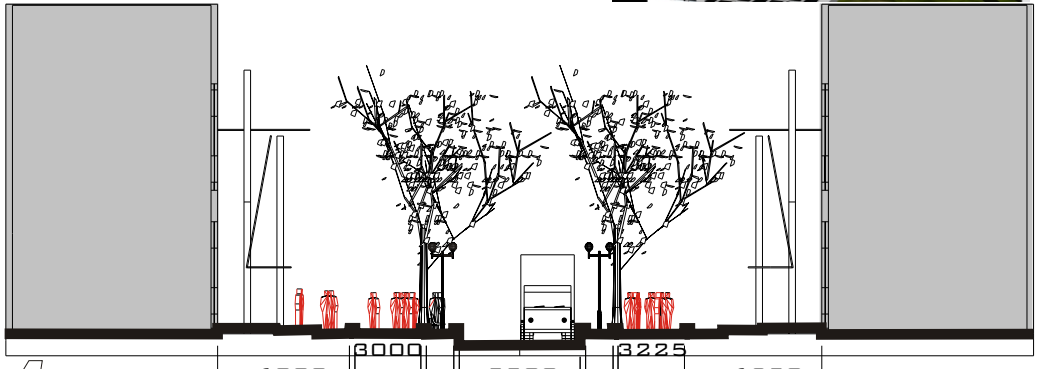
3.2 *(Perspective 2: south-western view)*

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)



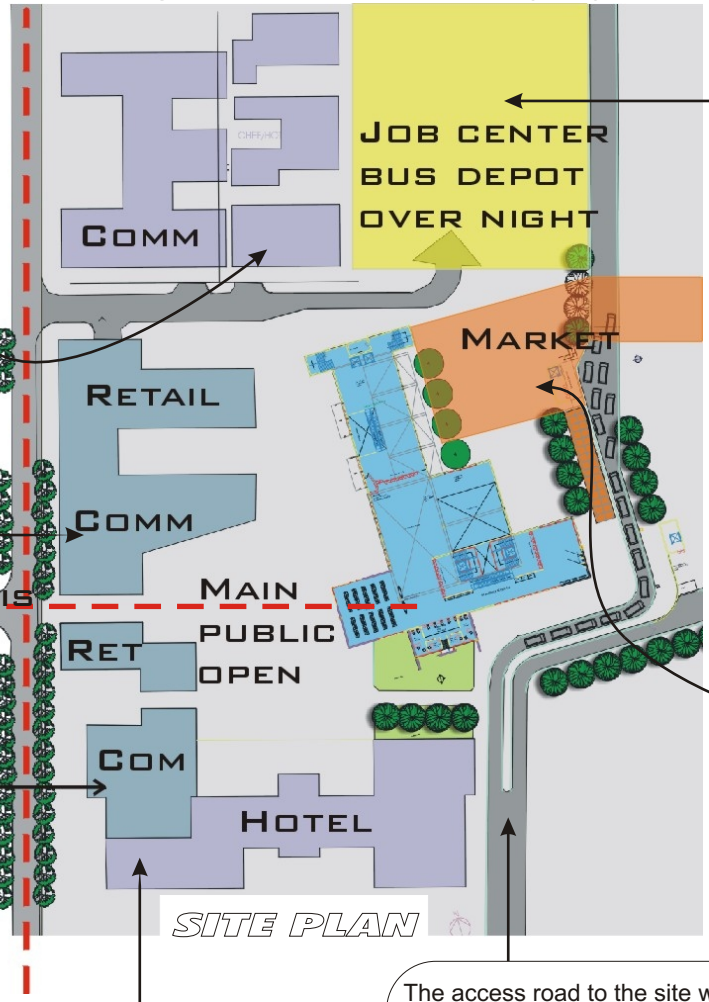
3.4 (Section through Grosvenor Street).

University of Pretoria etd – Roccon, EB (2003)

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.

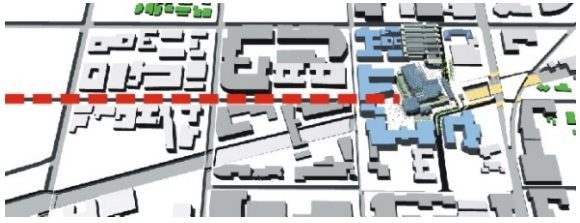
An arcade on the northern facade with its café and retail will add to the vibrance of the public open space.

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.



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"

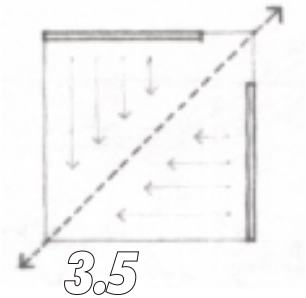
Oscillations: refer to people. People's daily routine, working, inter- acting, resting and eating.

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.



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.

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.

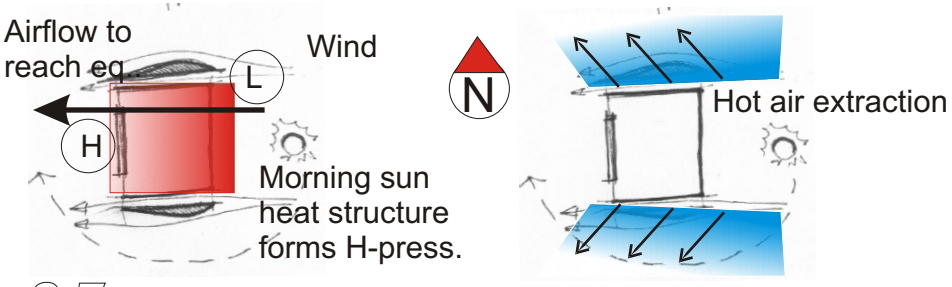
3.1). Wind-induced:

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).

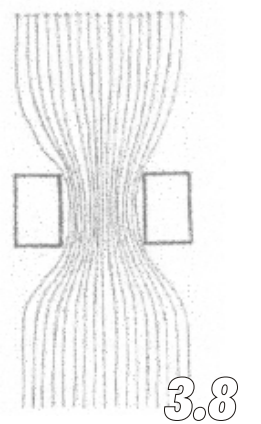


3.7 (figure explaining the Bernoulli - effect on the building in principle).

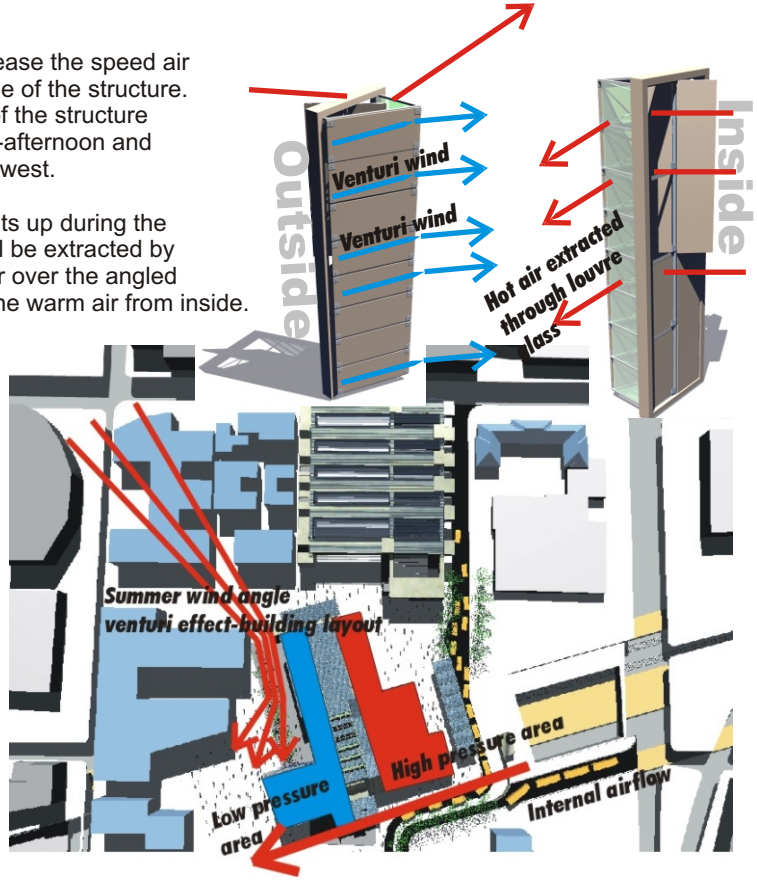
The **Venturi effect** is when a volume of air passes from a larger surface area through a narrower, smaller surface area, the velocity of the volume of air will increase.

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.

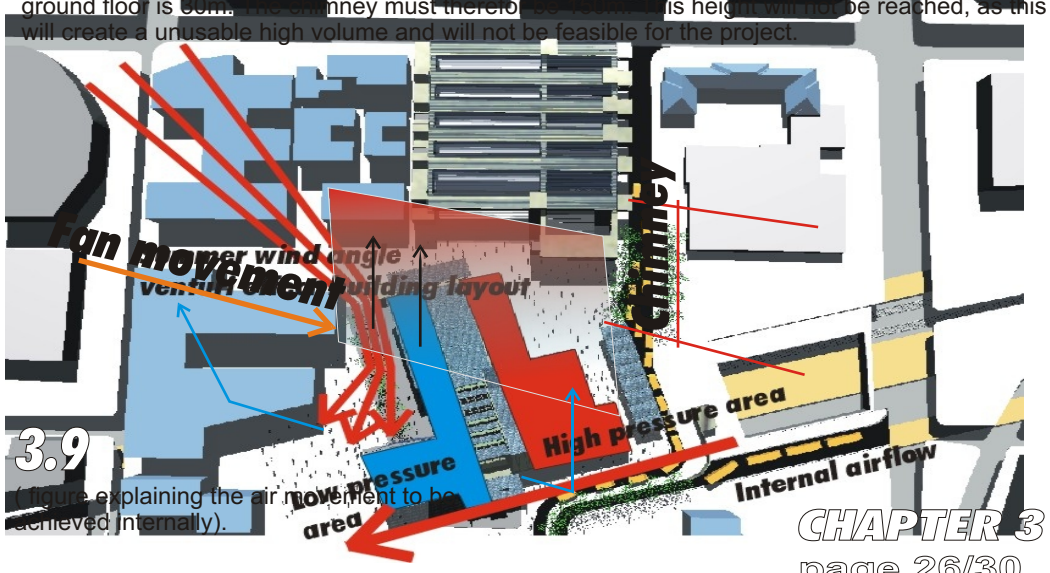


3.8 (figure explaining the Venturi effect on plan and elevation).



3.2). Stack induced

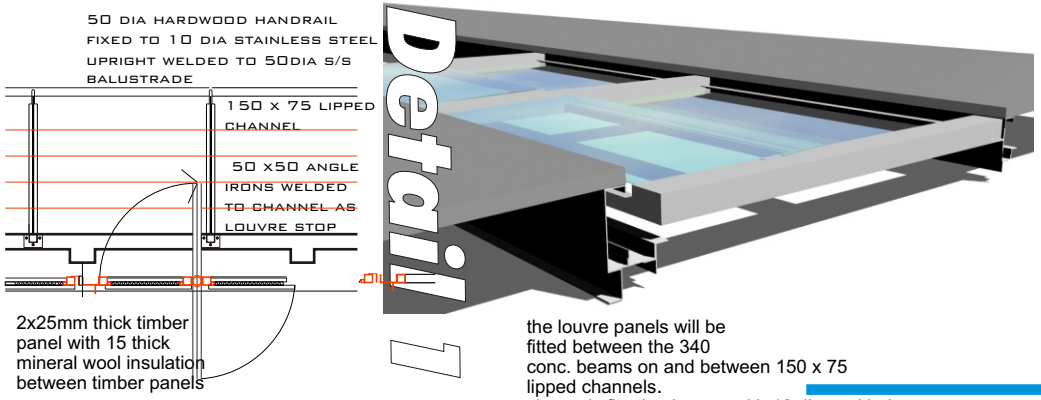
This effect works mathematically on the principle that the height of the chimney must be five times higher than the depth of the volume. The depth of the volume over the Gautrans platform on ground floor is 60m. The chimney must therefore be 300m high. This height will not be reached, as this will create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

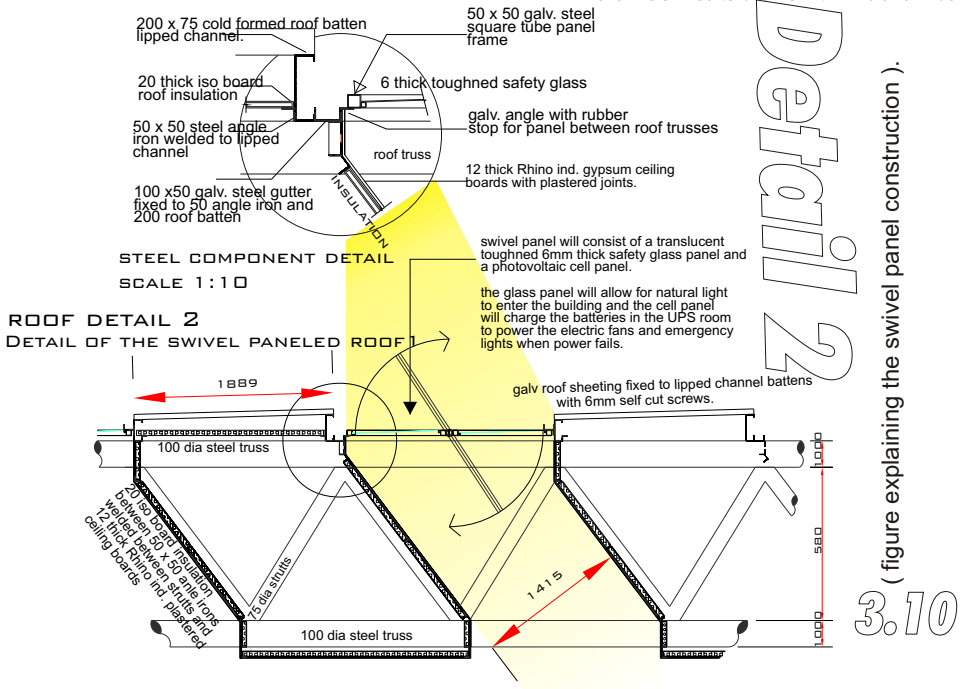


3.9 (figure explaining the air movement to be achieved internally).

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.





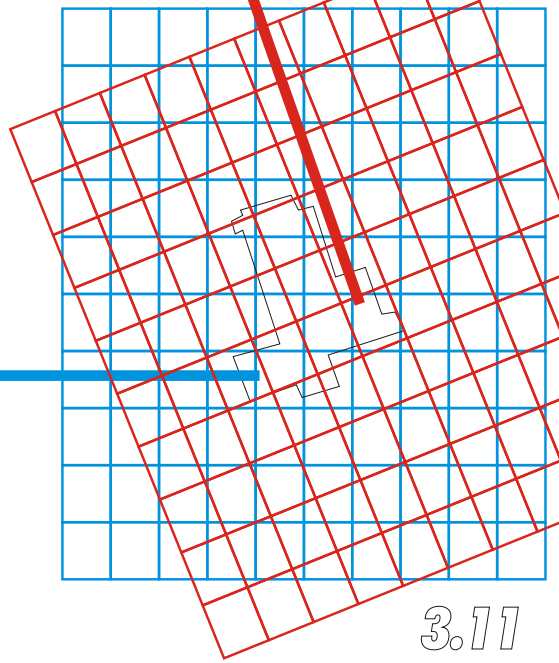
(figure explaining the swivel panel construction).

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.

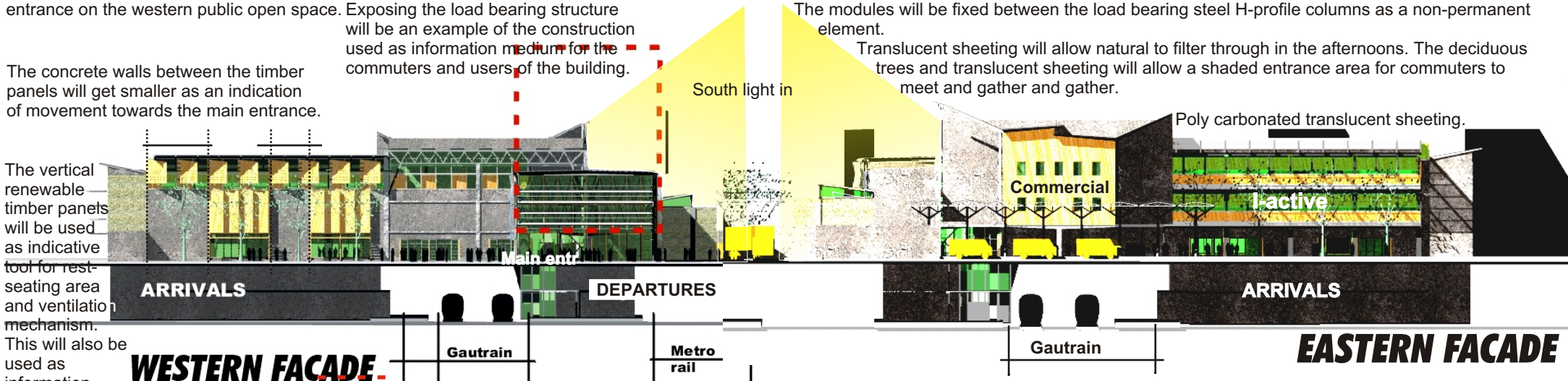
The main entrance on the public open space will be defined by being the lowest element on the facade. The entrance will be enhanced by the activities within the structure, visible through the glass and steel structure.

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.

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.

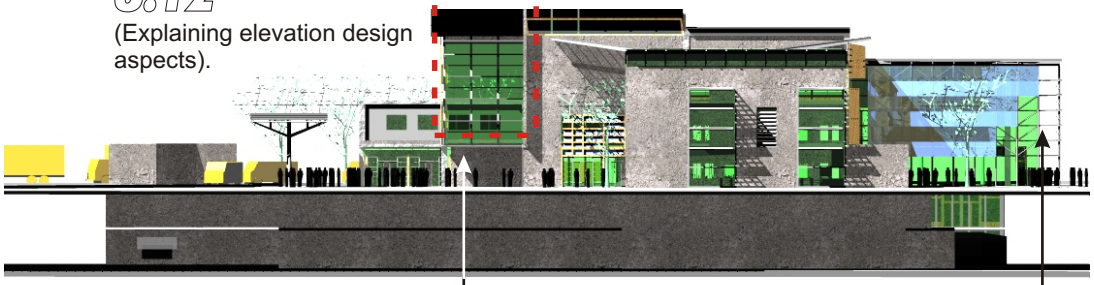
The vertical renewable timber panels will be used as indicative tool for rest-seating area and ventilation mechanism. This will also be used as information medium to educate and create an awareness among users of the structure, on the structural elements.



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

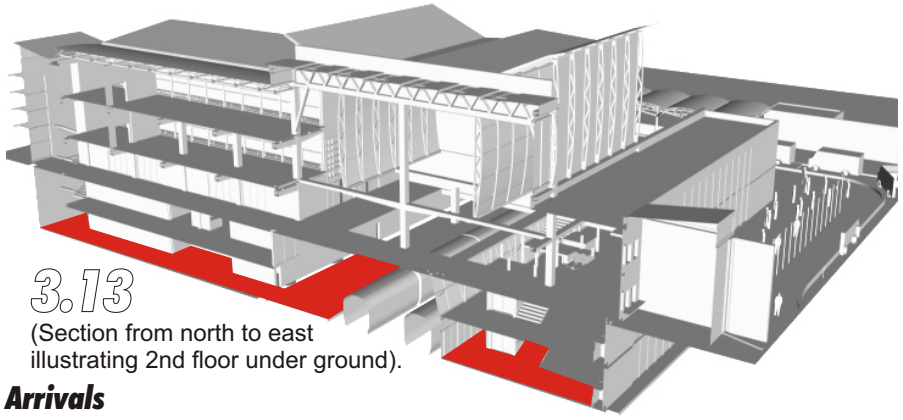
The commercial flank's facade will be made of timber panels and insulation board. The renewable building element can be maintained by replacing damaged panels and not a whole facade. This will also add flexibility, for the facade can aesthetically be altered in future if desirable with minimum impact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

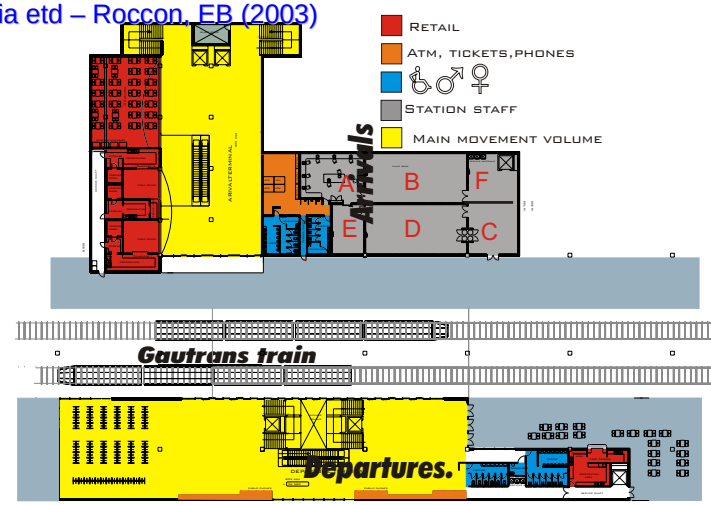
The bandit windows on the inter-active space, will appear more formal in appearance to define its function.
The tipple volume translucent roof will act as interface space between the open air market and the enclosed structure.

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.

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.

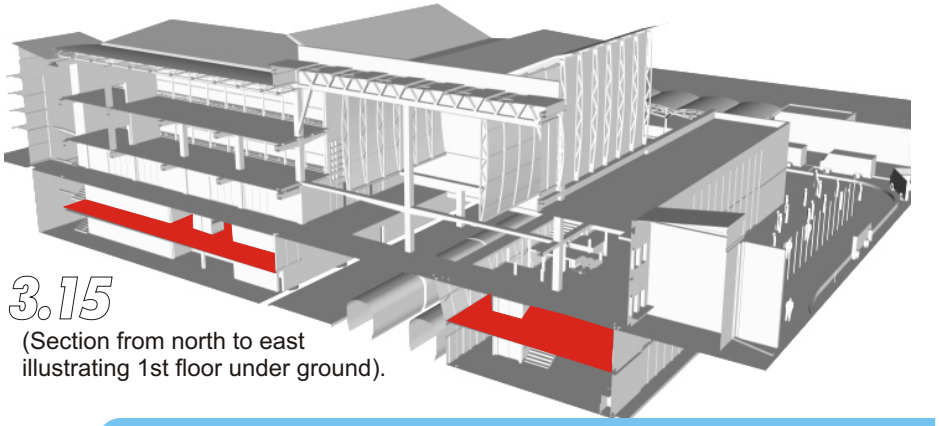
Ticket vending machines, public telephones and ATM machines will also be available for passengers on this level.

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.

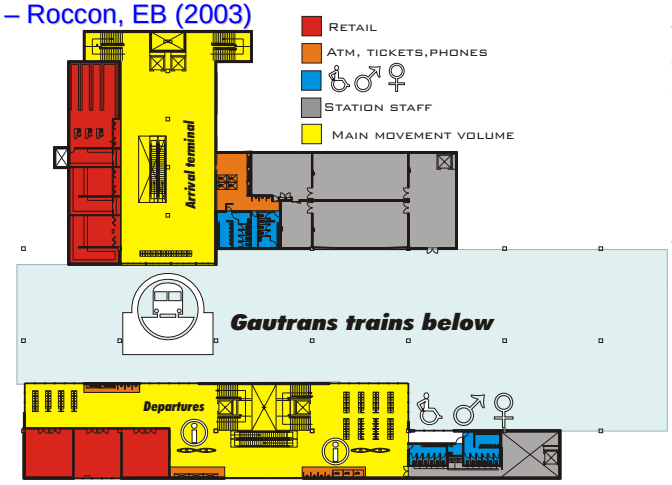
On the eastern side of the structure will be a platform café, where waiting passengers can obtain, beverages, food, magazines, newspaper or just sit in the sun watching passing trains, passengers and activities on the adjacent arrivals platform and activities in the structure.

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).



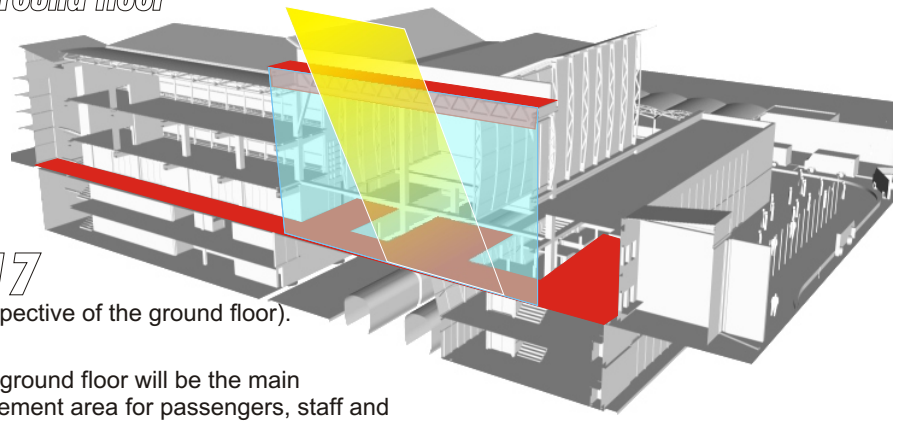
3.16
(Plan layout of the 1st floor under ground).

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

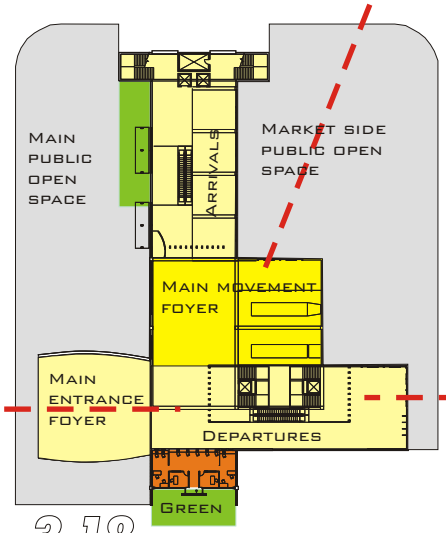


3.17
(Perspective of the ground floor).

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.

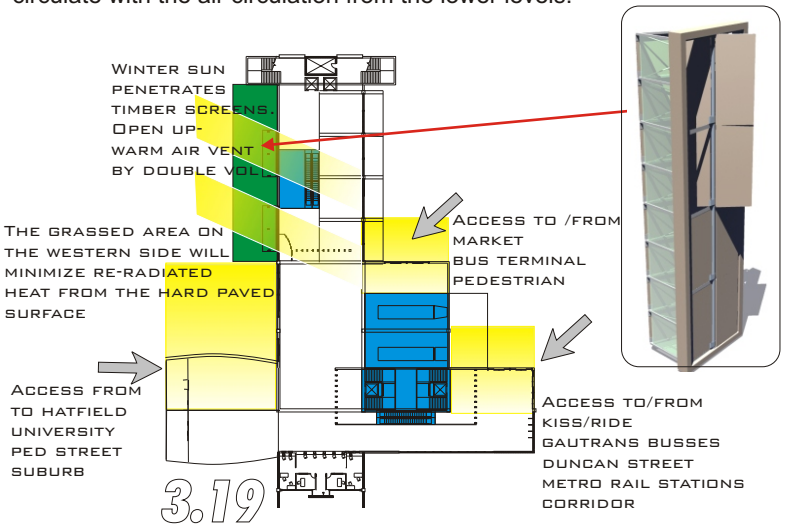
The info center will consist of a help desk, two offices each of 12 sqm and two open plan offices each 22 sqm. The open offices will also have two ticket booths for first time train travel users, group traveling and information on ticket related aspects.

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

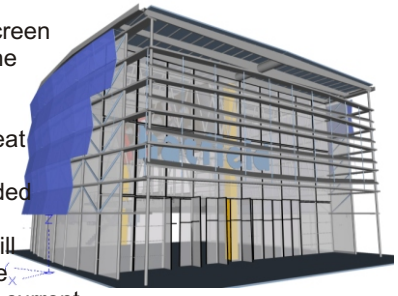
The main entrance will be the culmination of the Arcadia street axis to the east. The street will form an axis with the Pretoria Art Museum to the west.
The northern facade will be glazed with 6mm thick toughened safety glass in a steel frame structure. The facade will be cladded with 10mm thick recycled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

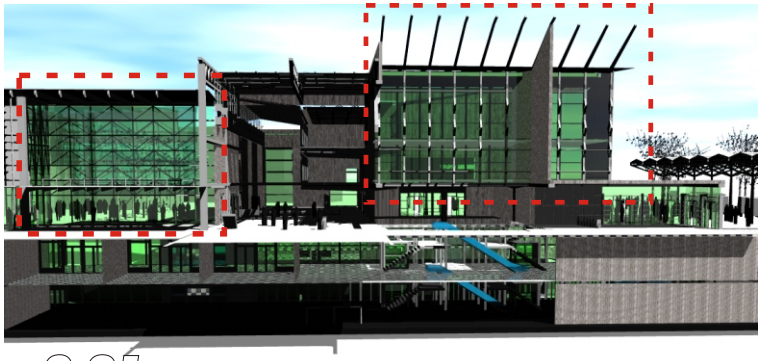
Angled horizontal sun screen blinds will be added to the western side of the entrance structure, to avoid direct afternoon heat gain. The first floor structure will be suspended between the 600 thick concrete columns and will function as a café, where visitors can catch up on current news events, financial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

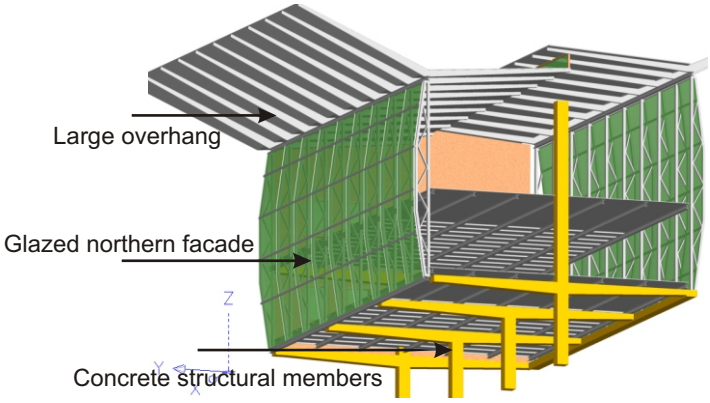
5). Commercial component.



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.



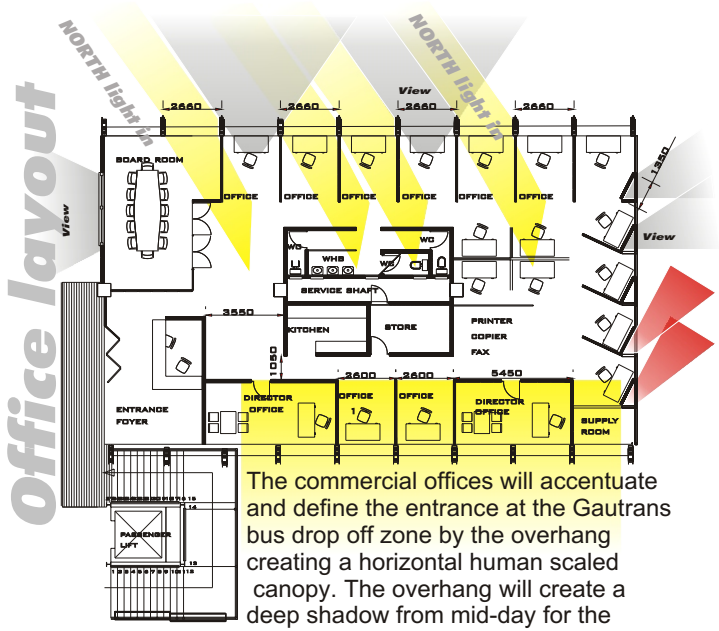
The commercial structure in the station will be constructed on 600dia concrete beams and columns as load bearing structure. Steel profiles will form the frame of the timber floor. The walls on the northern and southern side will be glazed to ensure maximum utilization of natural light into the office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

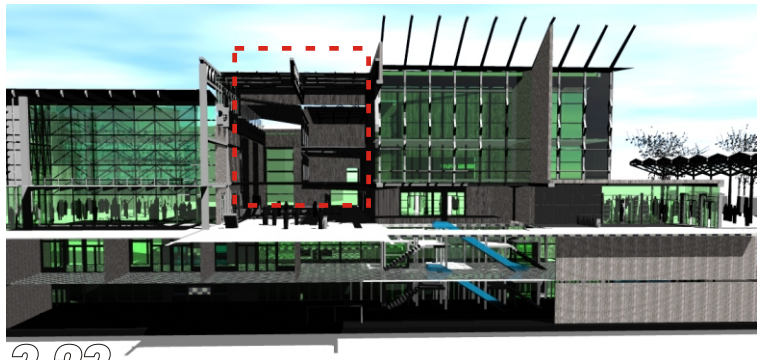


The commercial offices will accentuate and define the entrance at the Gautrans bus drop off zone by the overhang creating a horizontal human scaled canopy. The overhang will create a deep shadow from mid-day for the internal entrance space.

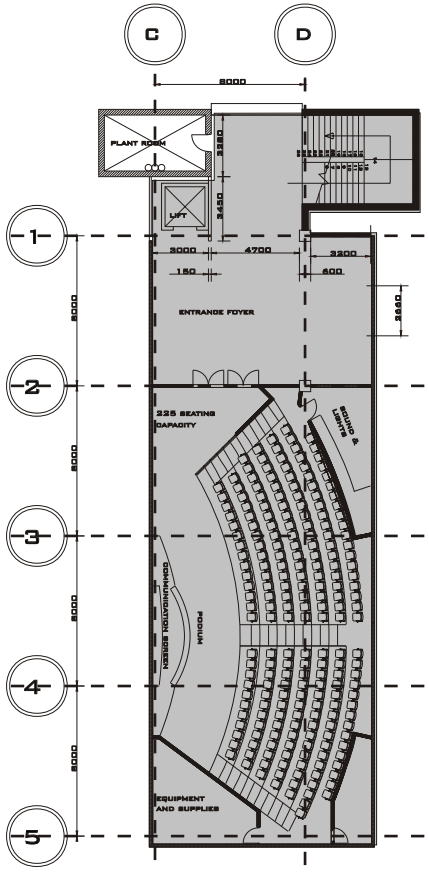
3.22
(layout plan and component perspective of the commercial flank of the building).

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.

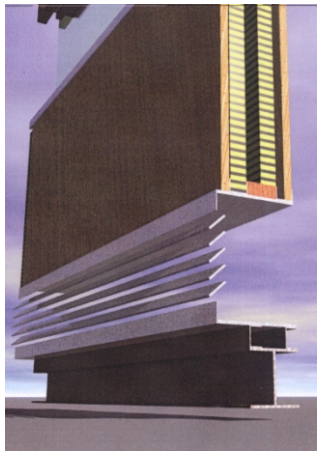
Access will primarily cater for the arriving passengers from the arrival platform.
From the main movement foyer, the controlled access point will be used to control the people using the space. This will also be for safety and security reasons.

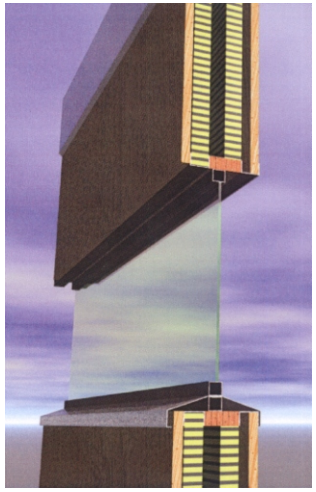
A satellite feed will ensure long distance communi-cation and reliable service.
The vertical circulation staircase and lift shaft will be used to access the entrance foyer.
The hall will seat 225 people. The stepped seating will have ducting to provide fresh air from the market side public open space.
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.

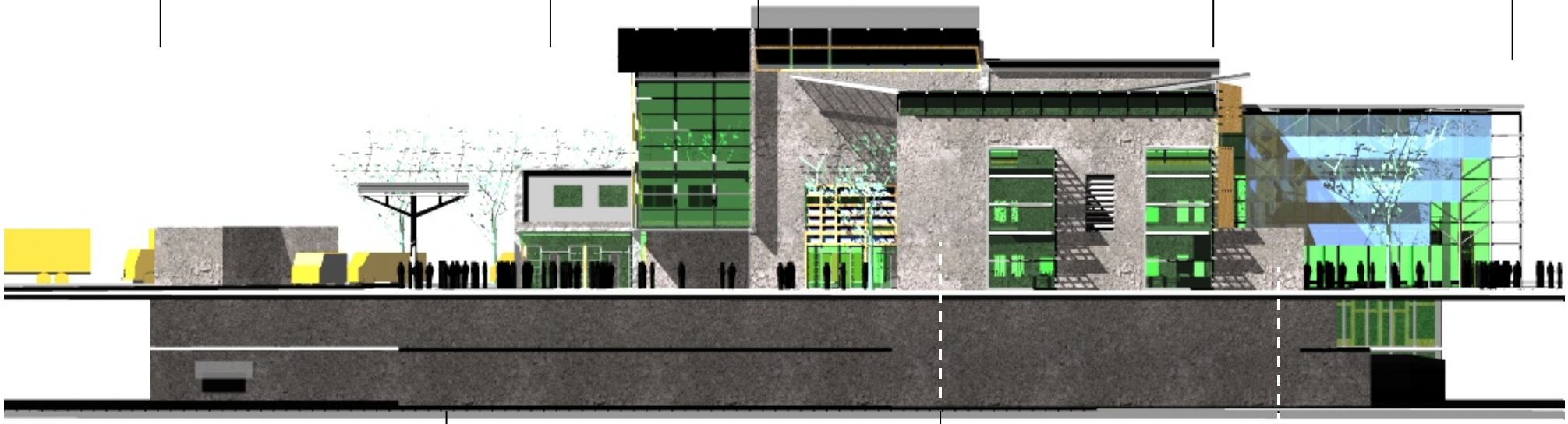
Internal = (15 deg C).(2.27). (0.123)
= 4,2 degC
temp diff +4,2 deg C
15 deg C + 4,2 degC = 19,2 deg C internal temperature.

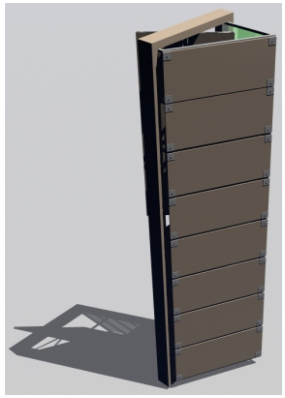
The concrete wall as a mass structure element will be used to insulate the structure. The timber panels will allow heat to enter the structure and heat the internal air.

NORTH ELEVATION

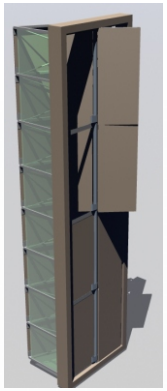
Access from the job center, bus terminals and overnight accommodation on the adjacent site will be enhanced by the over scaled entrances to the station.

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



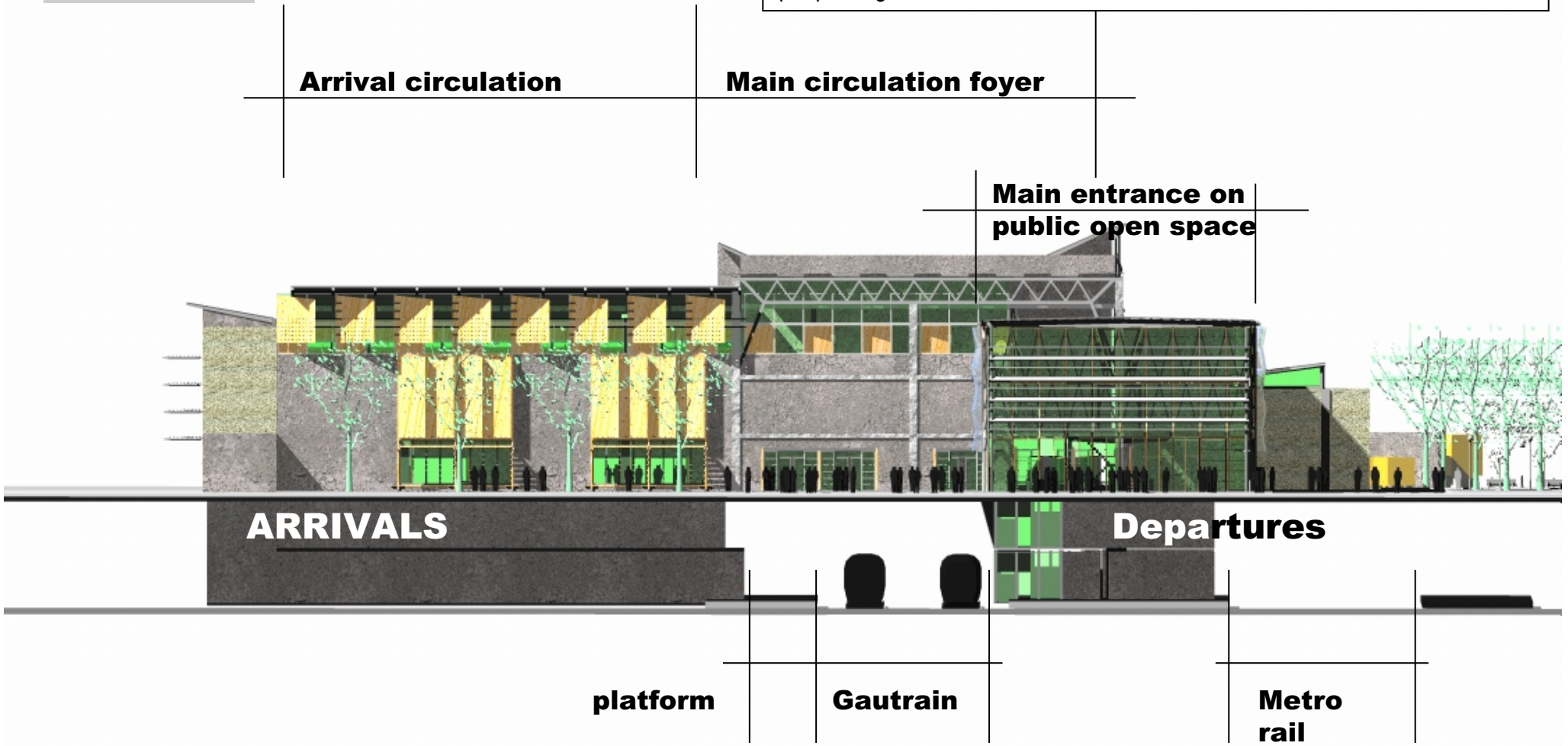


The modular timber panels will gather heat in the cavity. Swivel panels will open to allow warm air into the structure. The vertical circulation space will allow for warm air distribution.



WEST ELEVATION

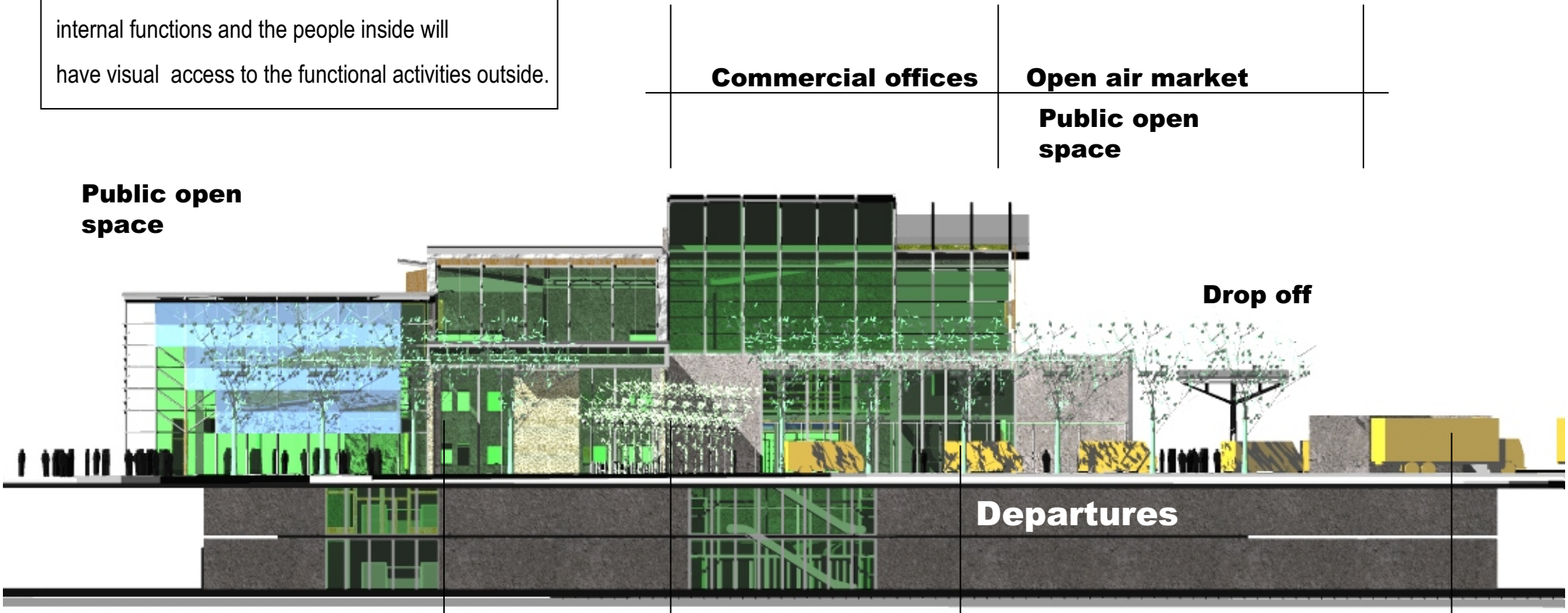
The main entrance will be used as an orientation point and illumination 'lamp' during the night. Horizontal beams will be used as sun control element on the western side and re-cycled, re-worked plastic panels will be used as sun control device on the northern façade. Deciduous trees and timber angled 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.



SCHOEMAN STREET

SCHOEMAN STREET

GROSVENOR STREET TWO-WAY NORTH-SOUTH

CHEF/HOTEL SCHOOL

PORTION 3 OF 612.

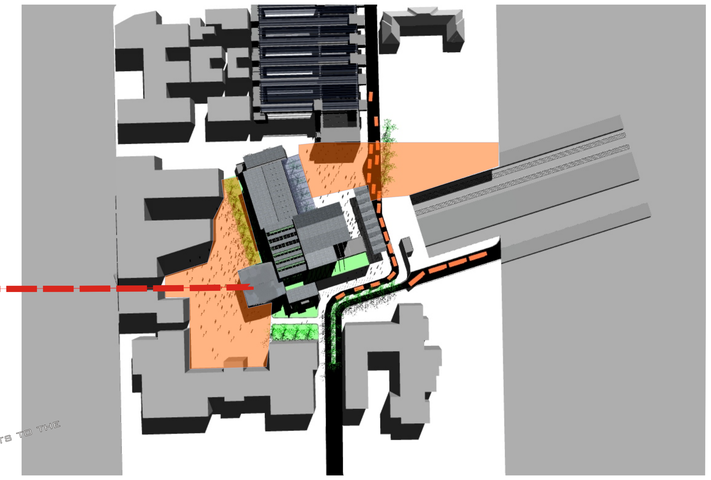
THE 24-HOUR NATURE OF THE DEVELOPMENT TOGETHER WITH THE

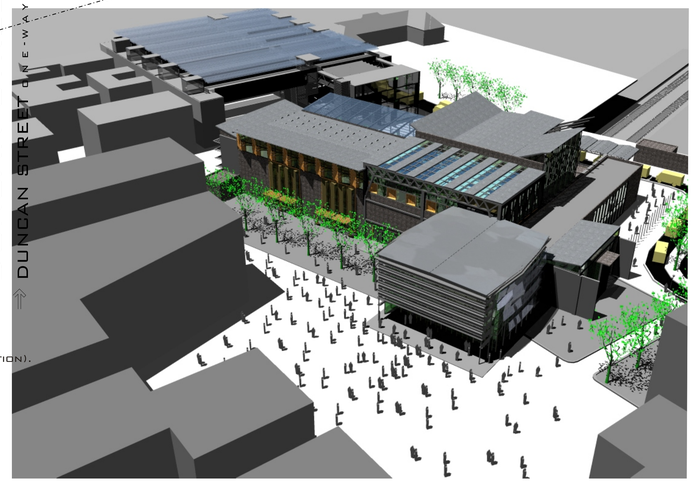
THE PROPOSED DEVELOPMENT ADJACENT TO THE HISTORICAL HATFIELD PRIMARY SCHOOL NEED TO RESPECT THE EXISTING BUILDING AS WELL AS PROVIDE AN EDGE TO DEFINE THE FRESH PRODUCE MARKET. TO ENSURE A VIBRANT URBAN ATMOSPHERE , THE DEVELOPMENT NEED TO FIT IN WITH THE PROPOSED HATFIELD URBAN DESIGN FRAMEWORK AND SHOULD THEREFORE BE MIXED USE WITH A MAIN COMPONENT

THE JOB CENTRE REACTS TO THE NEEDS OF :
1. THE LOCAL COMMUNITY
2. THE FIRM OF SAVOUR AND DOMINION GROUP PROVIDING
(a) CERTAIN OFFICE SPACE
(b) A RESTAURANT SERVICE
SHOPPING
(c) A NEIGHBOURHOOD ACCOMMODATION
(d) STUDENT ACCOMMODATION
2. THE UNITED PLANT RATES STAFF BY A DEVELOPMENT BY PROVIDING:
(a) A TEMPORARY STORAGE
WAREHOUSE
(b) A CLEANING SERVICE
(c) PASSIVE SURVEILLANCE AND SECURITY DUE TO 24-HOUR ACTIVITY

THE INTERCITY COACH TERMINAL PROVIDES A SERVICE TO COMMUTERS TRAVELLING LONGER DISTANCES TO NEARBY TOWNS AND OTHER NOT COVERED BY THE GAUTRANS AND METRORAIL NETWORKS

TO PROVIDE FOR THE NEEDS OF COMMUTERS ARRIVING AT THE STATION, A FRESH PRODUCE MARKET HAS BEEN INCORPORATED IN THE DEVELOPMENT...THE MARKET MAKES USE OF ITS VICINITY TO THE METRORAIL GOODS LOADING BAY TO ENSURE EFFECIENT DELIVERY OF GOODS



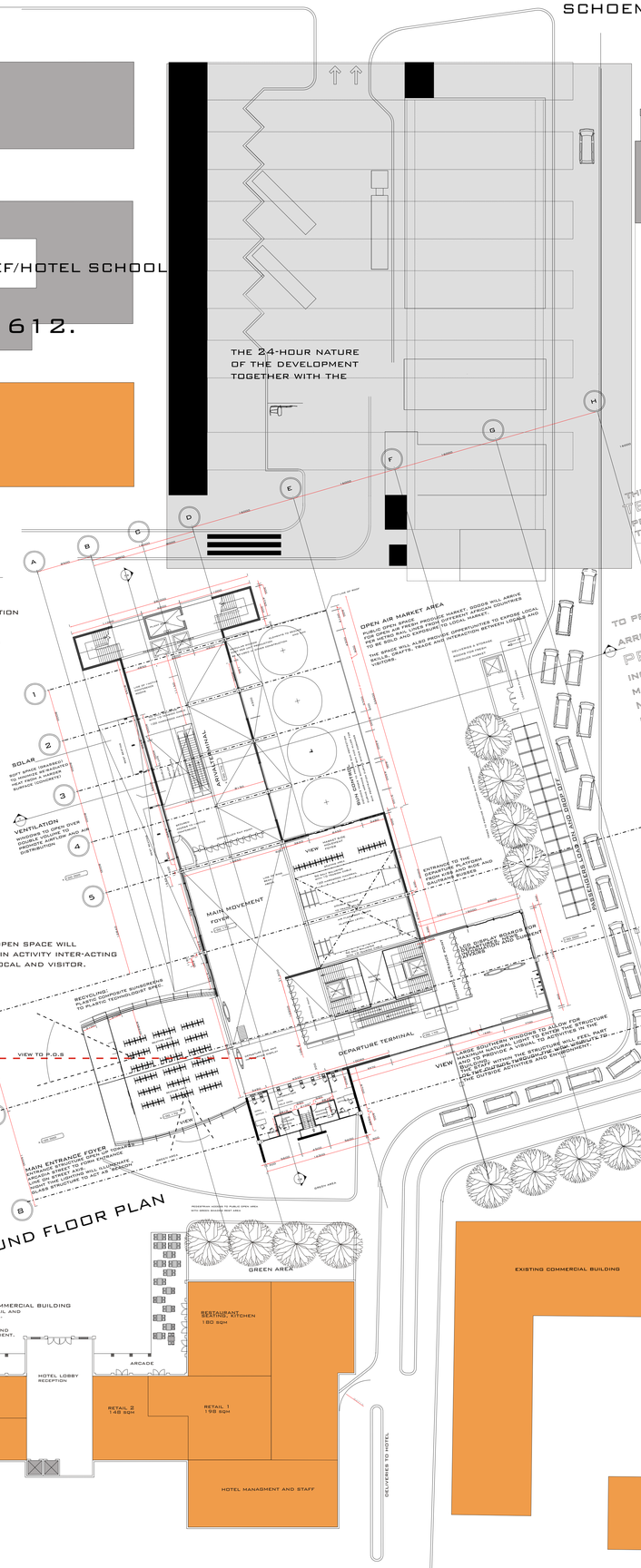


DUNCAN STREET ONE-WAY FROM SOUTH TO NORTH

The adjacent HOTEL SCHOOL has physically been incorporated into the development by way of linking courtyards to enhance office day-lighting. A functional link has been established by providing practical training opportunities for students in managing the overnight accomodation units.
The hostel-type accomodation units also serves as possible for housing students.

PROPOSED NEW RETAIL AND COMMERCIAL DEVELOPMENT.
WESTERN FACADE AND ENTRANCE TO BE DESIGNED ACCORDING TO PROPORTION AND SCALE OF EXISTING ADJACENT BUILDING

ARCADIA STREET AXIS



GROUND FLOOR PLAN

ground floor: EXISTING COMMERCIAL BUILDING WILL BE REDEVELOPED FOR RETAIL AND AND ENTRANCE FOYER TO HOTEL.

FIRST AND SECOND FLOOR: ACCOMMODATION FOR GUESTS AND VISITORS TO THE HATFIELD PRECINT.

EXISTING COMMERCIAL BUILDING

The proposed station will uplift the hatfield precinct by providing job opportunities exposure through transport (economic) education, training and security (investment protection).

The station and related economic facilities (market, retail, comm, multi funct spaces) will ensure a vibrant active and inter-acting public space.

The station will form the "anchor" for proposed developments in duncan street and schoeman street.

The existing buildings surrounding the site is commercial orientated. These buildings, on ground floor, will be re-developed as retail stores with arcades. (Refer to urban proposal)

Perspectives of station and surrounding buildings

GAUTRANS
Hatfield station

REFERENCE NUMBER
SCH1122
MARCH 11

Site layout plan

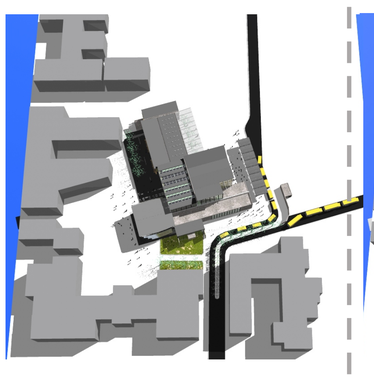
INTERCITY COACH TERMINAL

PROVIDES A SERVICE TO COMMUTERS TRAVELLING LONGER DISTANCES TO NEARBY TOWNS AND CITIES NOT COVERED BY THE GAUTRANS AND METRORAIL NETWORKS

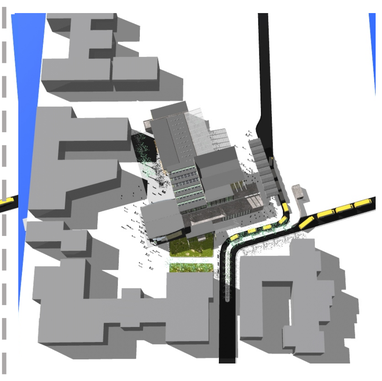
THE ADJACENT **HOTEL SCHOOL** HAS PHYSICALLY BEEN INCORPORATED IN THE DEVELOPMENT BY WAY OF LINKING OFFICE COURTYARDS TO ENHANCE DAYLIGHTING ... A FUNCTIONAL LINK HAS BEEN ESTABLISHED BY PROVIDING PRACTICAL TRAINING OPPORTUNITIES FOR STUDENTS IN MANAGING THE OVERNIGHT ACCOMMODATION UNITS...THE HOSTEL-TYPE ACCOMMODATION UNITS ALSO SERVES AS POSSIBLE

THE **PROPOSED DEVELOPMENT** ADJACENT TO THE HISTORICAL **HATFIELD PRIMARY SCHOOL**

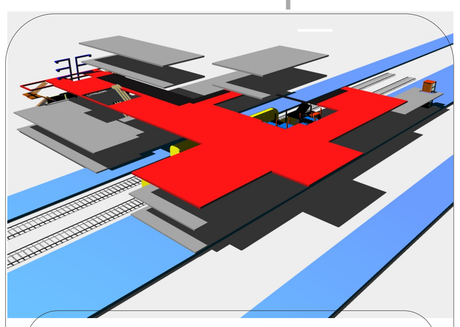
NEED TO RESPECT THE EXISTING BUILDING AS WELL AS PROVIDE AN EDGE TO DEFINE THE FRESH PRODUCE MARKET ... TO ENSURE A VIBRANT URBAN ATMOSPHERE, THE DEVELOPMENT NEED TO FIT IN WITH THE PROPOSED HATFIELD URBAN DESIGN FRAMEWORK AND SHOULD THEREFORE BE MIXED USE WITH A MAIN COMMERCIAL COMPONENT



Morning shadows



Afternoon shadows



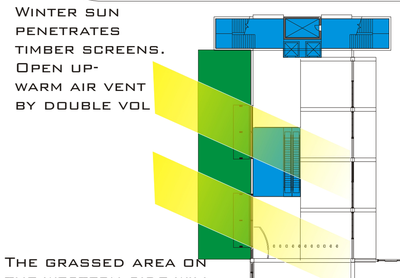
THE **GROUND FLOOR** WILL BE THE INTERNAL LINKING SPACE BETWEEN THE TWO PUBLIC OPEN SPACES. IT WILL FORM THE ACTIVITY NODE WHERE TRAVELER, VISITOR AND STAFF INTERACT TO FORM A PART OF THE DAILY FUNCTIONAL ACTIVITIES.

THE **VERTICAL CIRCULATION** SPACES WILL ALSO BE USED TO CIRCULATE TREATED AND CONDITIONED **AIR** VERTICALLY THROUGH THE SPACES, HELPED BY ELECTRICAL OPERATED FANS

THE GROUND FLOOR HAS AS PRIMARY FUNCTION: CENTRAL CIRCULATION FOYER: THE CONNECTION SPACE OF THE TWO PUBLIC OPEN SPACES, ENTRANCE FROM ARRIVAL- AND EXIT TO THE DEPARTURE PLATFORM.

THE PLATFORMS WILL ONLY BE ACCESSIBLE THROUGH A VALID TRAIN TICKET FOR SECURITY AND CONTROL REASONS. THE MAIN MOVEMENT FOYER AND INFORMATION/ HELP DESK WILL BE ACCESSIBLE BY ANY PERSON

Per 1 **Ground floor**



Plan 2 **Circulation &ventilation**

PUBLIC OPEN SPACE

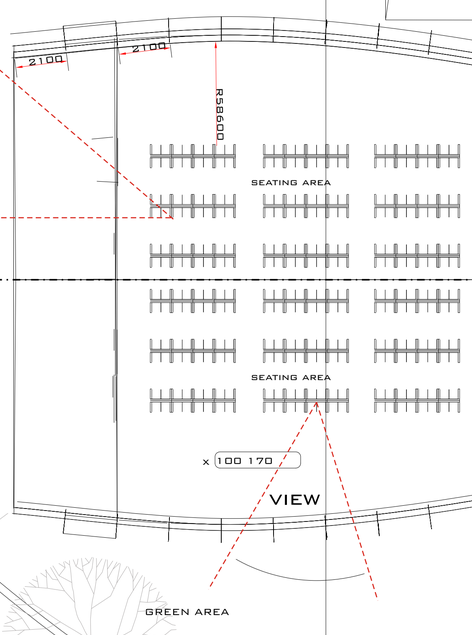
THE PUBLIC OPEN SPACE (POS) WILL FORM AN END NODE WITH PRETORIA ART GALLERY TO THE WEST. ARCADIA STREET WILL FORM THE ACTIVITY LINE. RETAIL, CAFES AND RESTAURANTS WILL FORM THE ACTIVITIES ON THE PUBLIC SPACE. THE BUILDINGS ON THE P.O.S WILL HAVE A HEIGHT RESTRICTION OF 12 M TO ALLOW FOR ADEQUATE SUN PENETRATION.(REFER TO URBAN DESIGN APPENDIX)

Main public open space

VIEW TO P.O.S

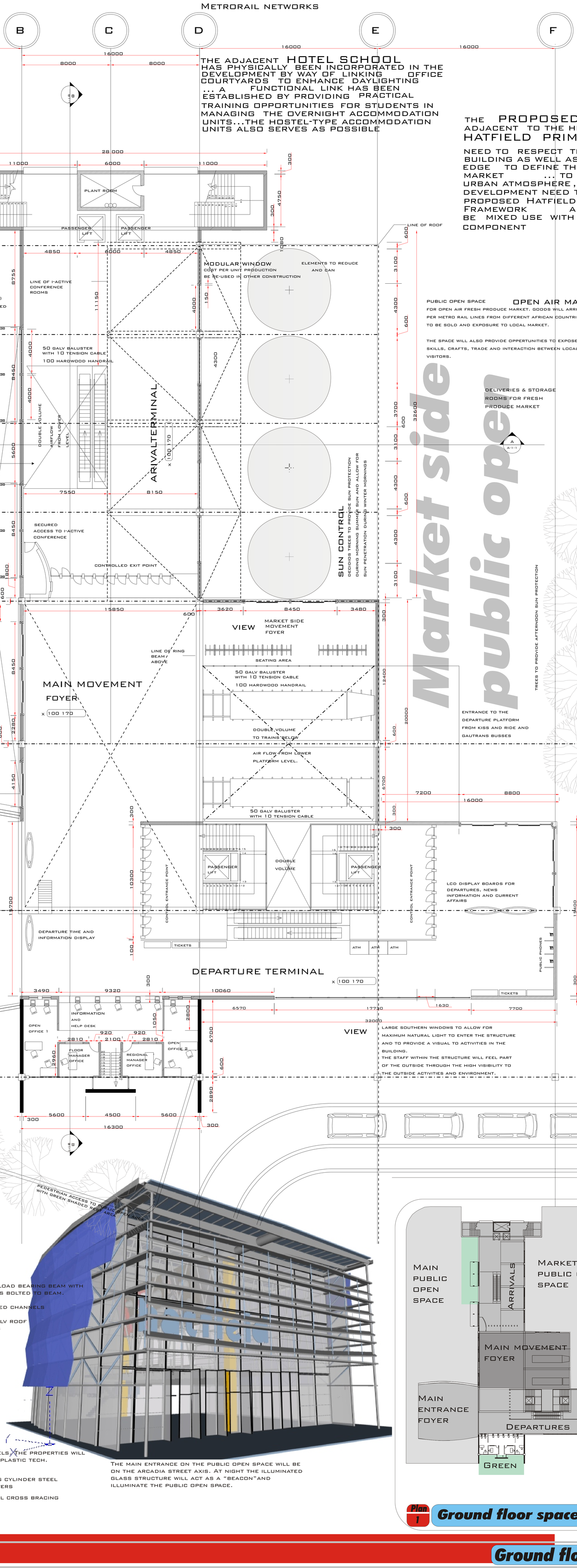
RECYCLING:

PLASTIC COMPOSITE SUNSCREENS TO PLASTIC TECHNOLOGIST SPEC.



MAIN ENTRANCE FOYER

ENTRANCE STRUCTURE OPEN UP TOWARDS ARCADIA STREET TO FORM ENTRANCE LINE ON STREET AXIS.
NIGHT TIME LIGHTING WILL ILLUMENATE GLASS STRUCTURE TO ACT AS "BEACON"



The first floor structure will be suspended from the beam between the 600 x 600 concrete columns

Recycled plastic sun screen panels will be fitted horizontally to 25 dia vertical steel tubings and tension cables will add lateral stability for wind loads.

Per 2 **Main entrance-arcadia str**

200 dia cylinder load bearing beam with steel roof trusses bolted to beam.

75 x 50 lipped channels

100 galv roof sheets

Recycled plastic panels. The properties will be changed (chem) to plastic tech. Specifications.

100 dia load bearing cylinder steel column @ 2100 centers

50 dia cylinder steel cross bracing

The main entrance on the public open space will be on the arcadia street axis. At night the illuminated glass structure will act as a "beacon" and illuminate the public open space.

Plan 1 **Ground floor spaces**

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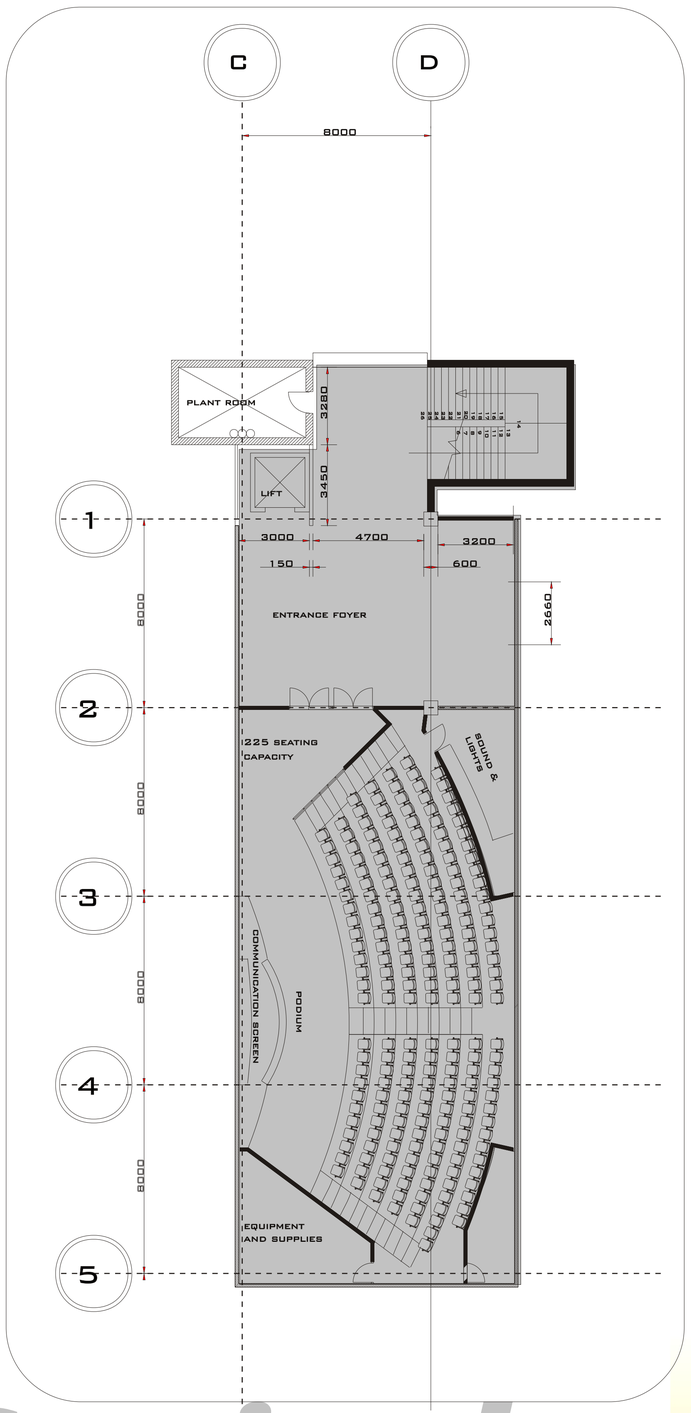
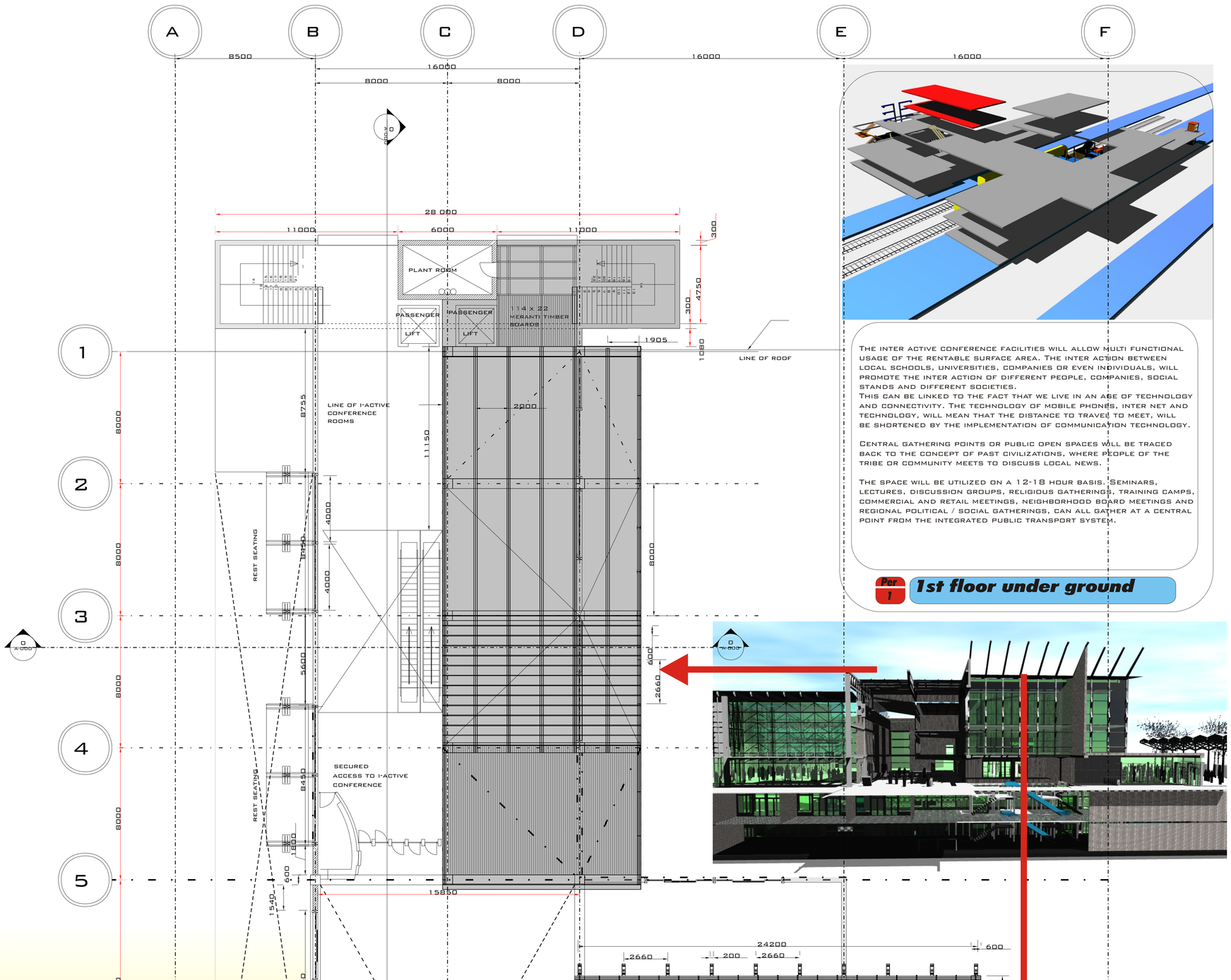
Ground floor plan





The inter active conference facilities will allow multi functional usage of the rentable surface area. The inter action between local schools, universities, companies or even individuals, will promote the inter action of different people, companies, social stands and different societies.
This can be linked to the fact that we live in an age of technology and connectivity. The technology of mobile phones, inter net and technology, will mean that the distance to travel to meet, will be shortened by the implementation of communication technology.

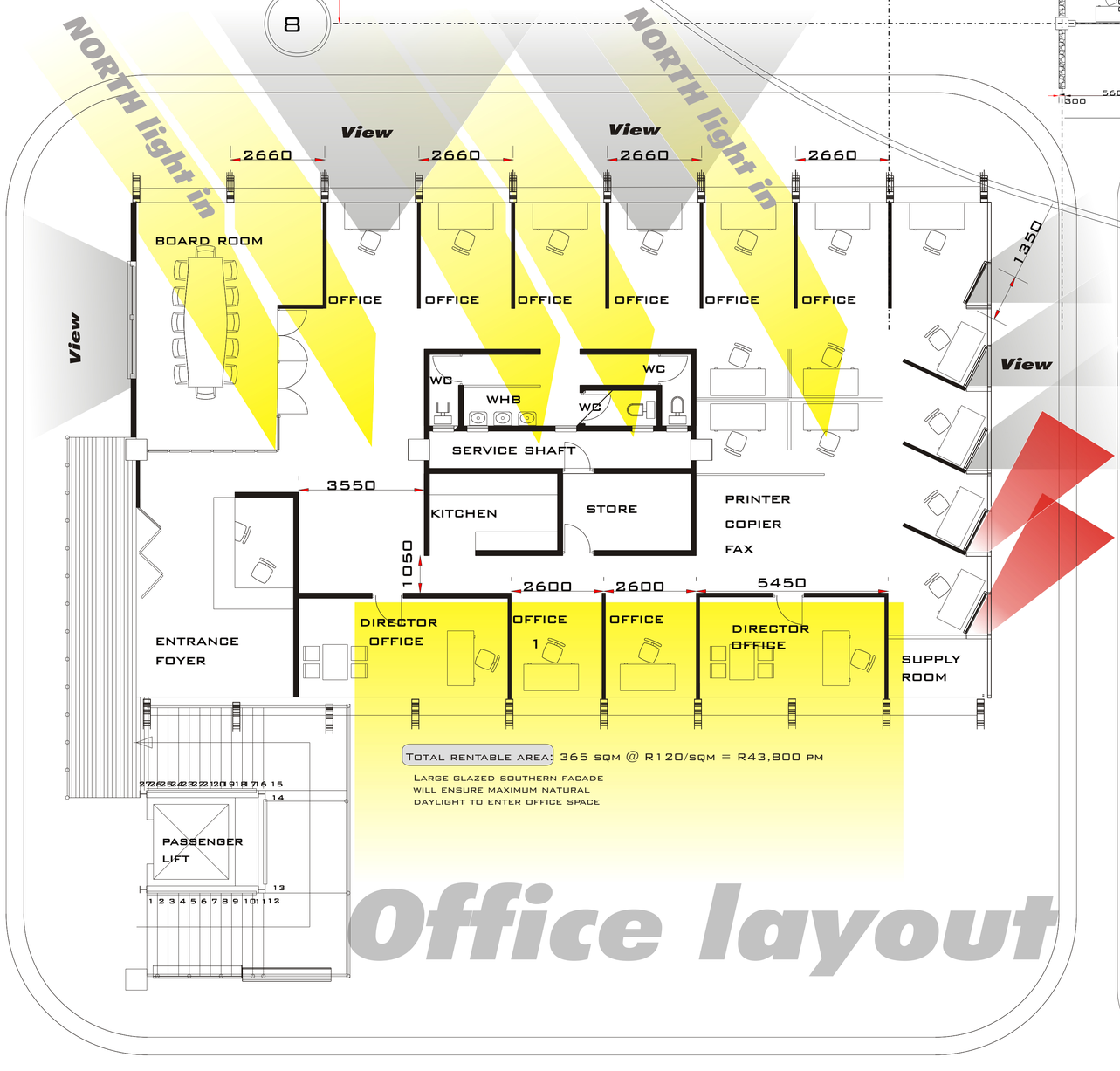
Central gathering points or public open spaces will be traced back to the concept of past civilizations, where people of the tribe or community meets to discuss local news.

The space will be utilized on a 12-18 hour basis. Seminars, lectures, discussion groups, religious gatherings, training camps, commercial and retail meetings, neighborhood board meetings and regional political / social gatherings, can all gather at a central point from the integrated public transport system.

Per 1 **1st floor under ground**

Seating layout

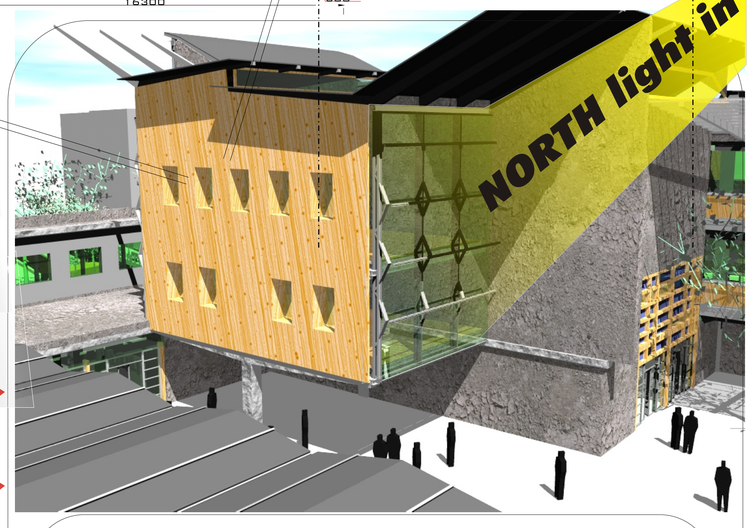
RECYCLING:
PLASTIC COMPOSITE SUNSCREENS TO PLASTIC TECHNOLOGIST SPEC.



Total rentable area: 365 sqm @ R120/sqm = R43,800 pm

Large glazed southern facade will ensure maximum natural daylight to enter office space

Office layout



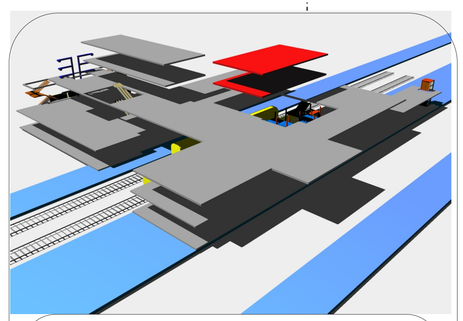
Angled windows will avoid direct eastern sun to enter the structure but still be utilized as a work station with a view to the outside and reflected light to enter the structure.

It is important for the office space to allow the maximum natural daylight into the structure to illuminate the internal floor area. A minimum of 6meters of natural daylight must enter the floor space. The roof will extend to the north, to act as a shading structure against the summer sun angle of 88 deg.

The load bearing structure and cladding structure will be separate. This will allow the cladding (glass & steel) to 'grow' vertically if additional floor space is required. The roof trusses, batten, insulation and roof sheeting will be reused.

The commercial structure will also define the entrance to the structure by providing a horizontal plane next to the entrance.

Per 1 **Commercial & entrance**



The commercial floor will act as linking activity wit adjacent buildings on site and on duncan street.
The glass and steel structure will provide a sense of lightness and low mass feel. This will stand in contrast with the off-shutter concrete walls.

The timber used in the structure will add bring the neutral colors and textures together to give the building a more natural feel.

Per 1 **First floor-commercial**

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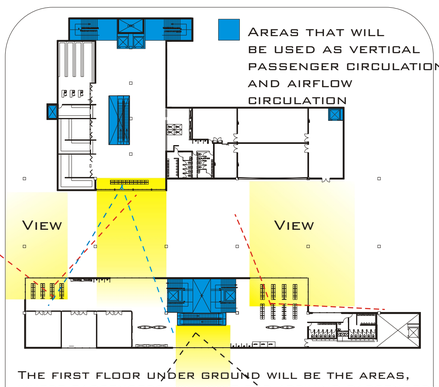
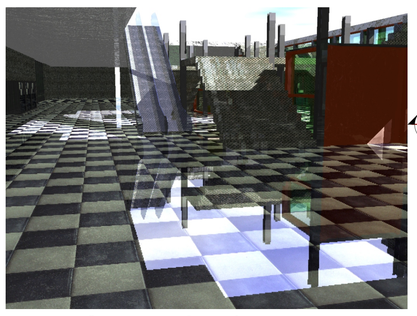
First floor plan



Areas that will be used as vertical passenger circulation and airflow circulation

The first floor under ground will be the areas, where passengers will wait for arriving passengers, to rest, to shop and to relax. This will be an area where movement slow from the 2nd floor under ground.
The retail and minimal seating will be the rest areas.
Glazed facades will ensure reflected light in through the double volume spaces and as viewport to the outside activities.

Plan 2 **Circulation & ventilation**



Internal perspective view

VENTILATION

ELECTRIC BLOW AND EXTRACTION FANS WILL ALLOW FOR CONSTANT AIRFLOW CIRCULATION ON THE DIFF LEVELS.

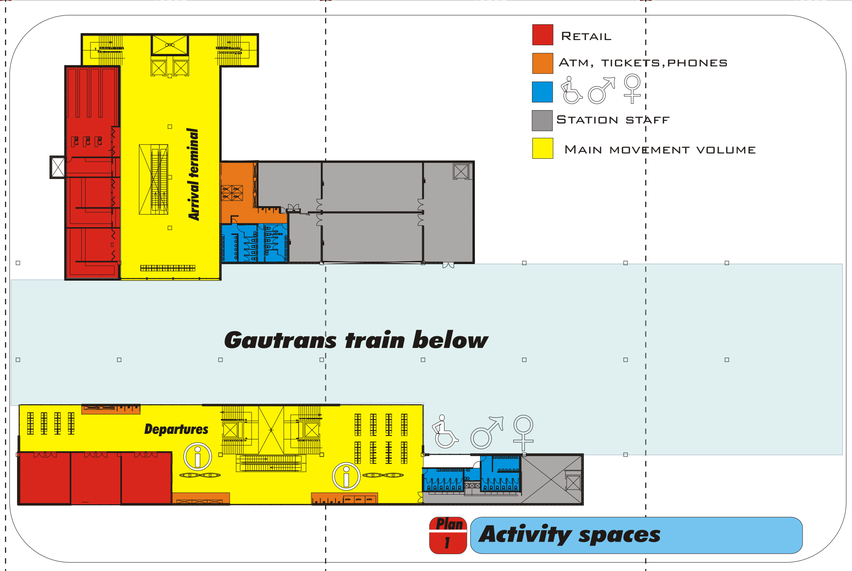
ELECTRICAL FANS CAN BE POWERED BY BATTERIES-SOLAR PANELS ON RETRACT ROOF- OR BY PRESS DIFFERENCES (ANGLE OF FAN BLADE-MOVEMENT)

BY USING HEAT PUMPS THE AIR COND CASETTE SPLIT UNIT WILL USE LESS ELECTRICAL ENERGY FROM THE NAT. GRID.

HEATING/COOLING

COMPUTER SENSORS WILL BE INCORPORATED IN SWITCHING BETWEEN AIR-CON AND HEAT PUMPS TO ALLOW A TEMP OF 21DEG AND DESIRED RH FOR OCCUPANT COMFORT IN DIFFERENT ACTIVITY SPACES.

450 GALV VENTILATION PIPING WRAPPED IN INSULATION BLANKETS. HEAT PUMPS WILL ASSIST IN HEATING/ COOLING THE INTERNALL ENVIRONMENT.



Plan 1 **Activity spaces**

Arrivals

The first floor under ground will be the transition space between the platform level and ground floor circulation level. This level will host retail facilities for everyday use, toilets, atm's and public telephones.
Ticket vending machines will be available on-route to the vertical circulation areas.
On the southern side will be seating area, where passengers can relax while viewing the train activities, passengers and activities in the departure structure.

Departures

The departure volume will be characterized by passenger seating and information display boards. These lcd display panels will hold travel information, current news, and local information (stations weather) this level will also have retail (every day needs, food, beverages).
There will also be toilets, ATM, public telephones and ticket renewals. The northern face of the structure will be primarily glazed, to view surrounding activities.

Per 1 **1st floor under ground**

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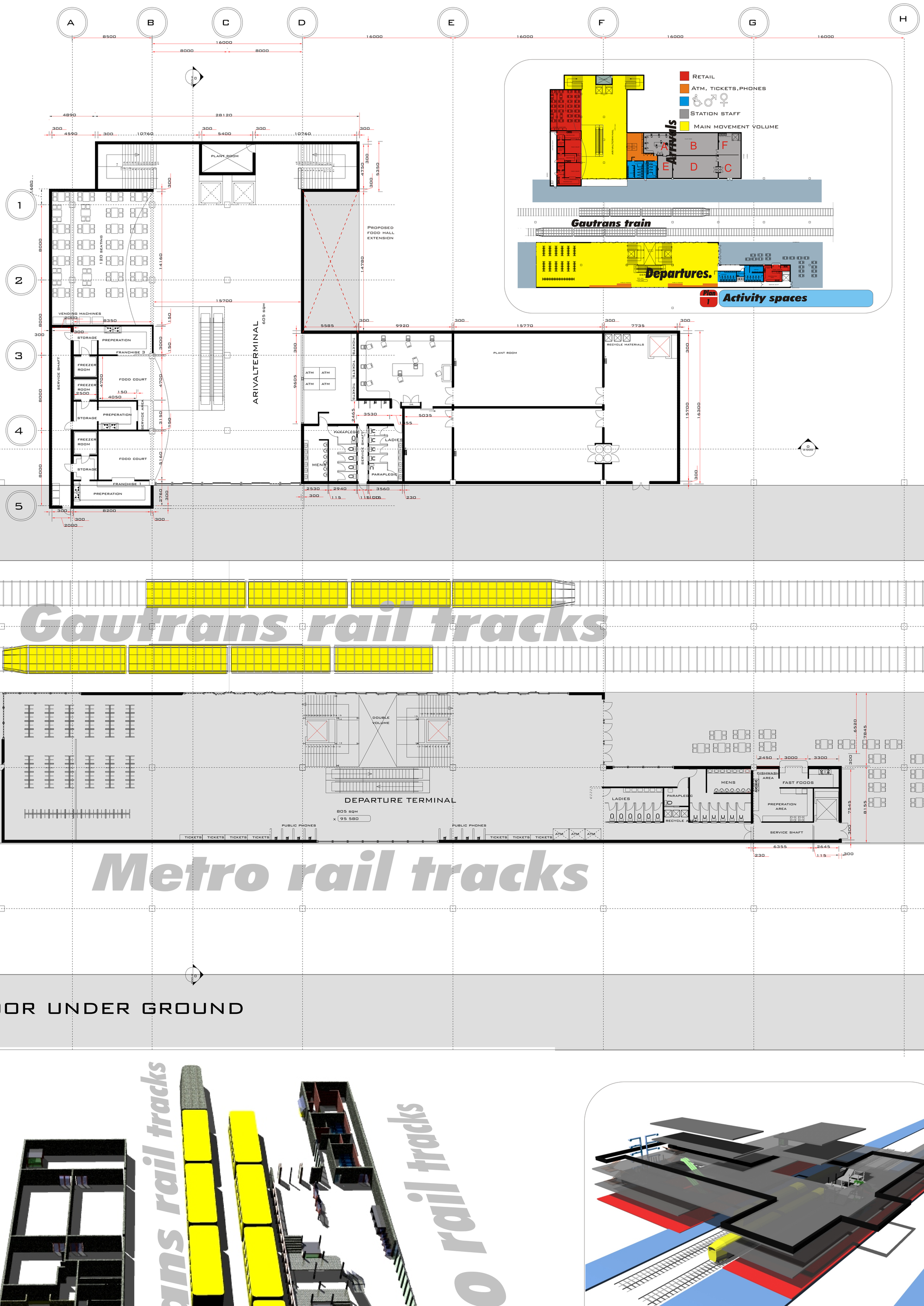
Ground floor plan

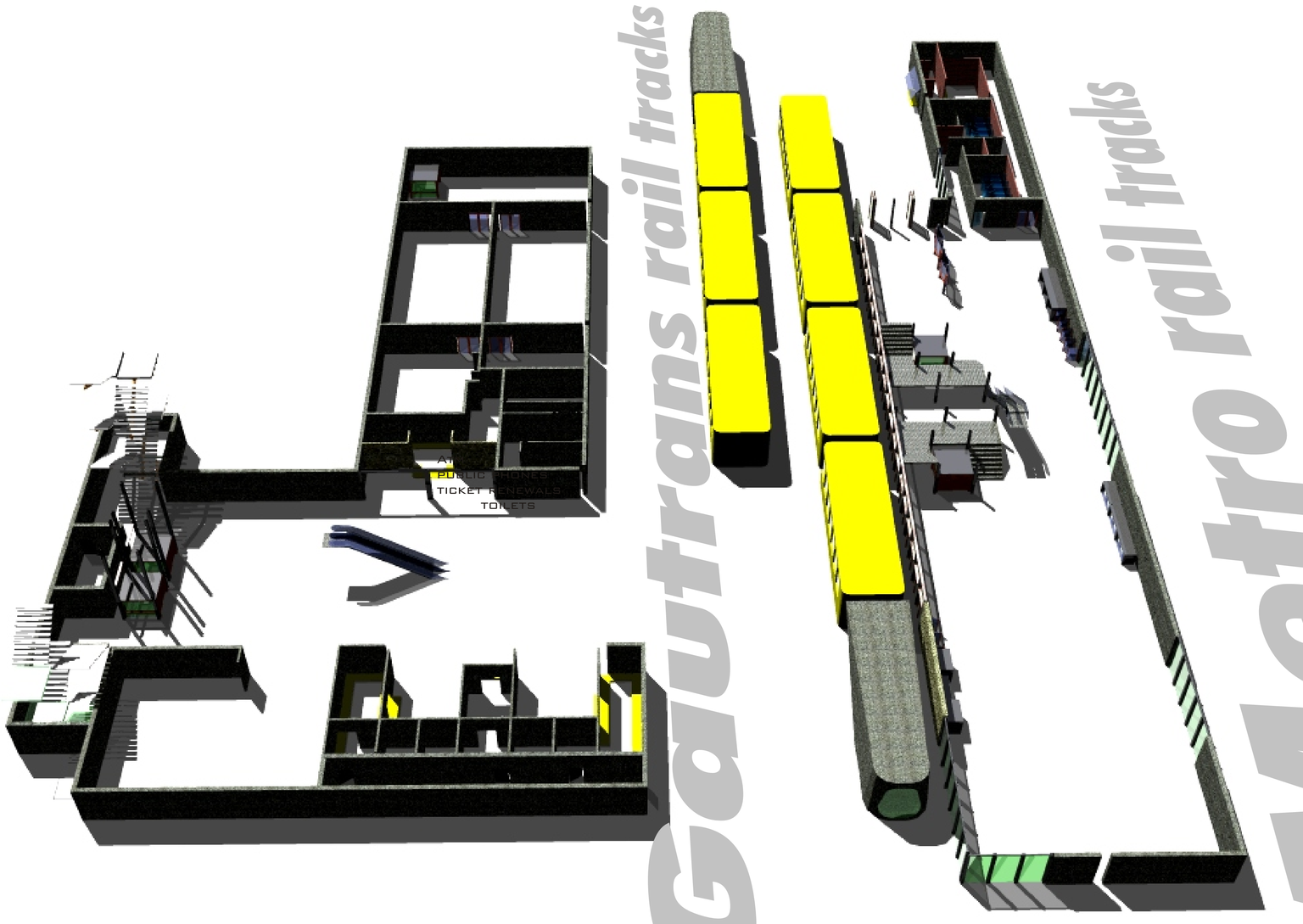


Gautrans rail tracks

Metro rail tracks

SECOND FLOOR UNDER GROUND

SCALE 1:100

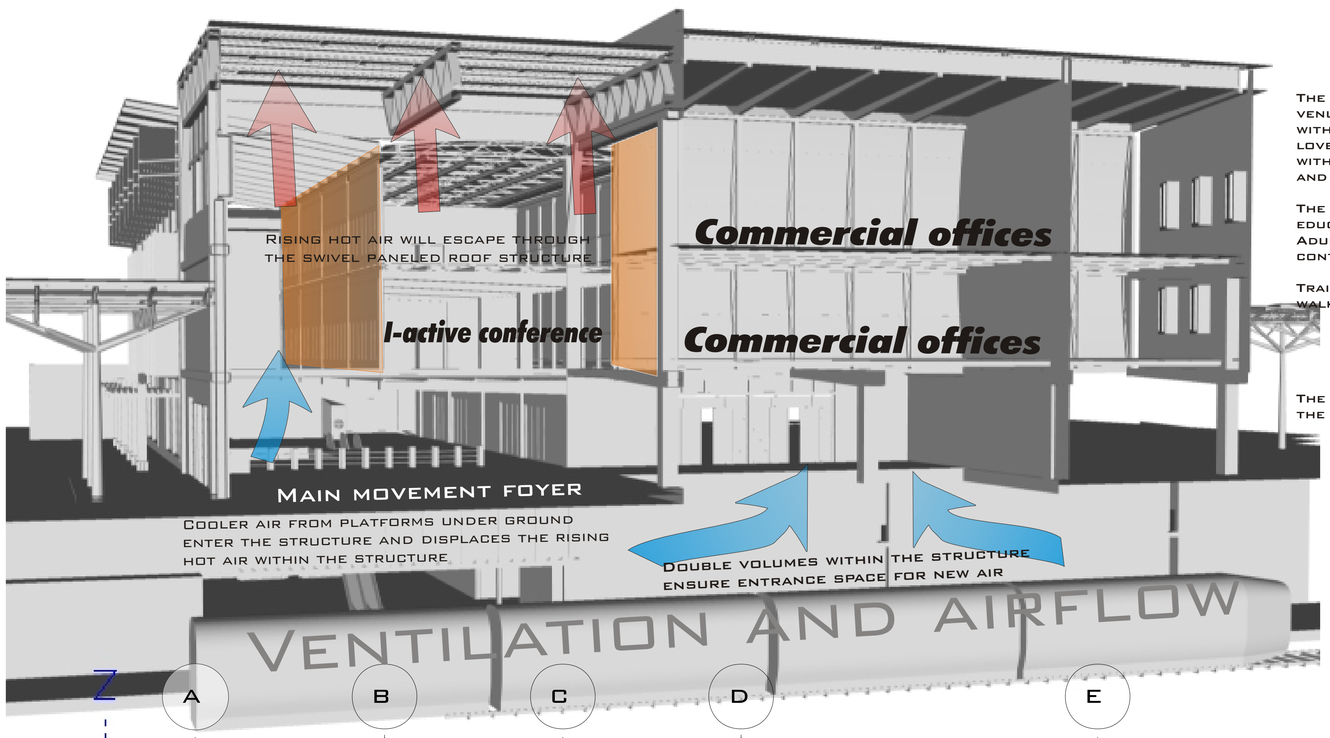


Arrivals

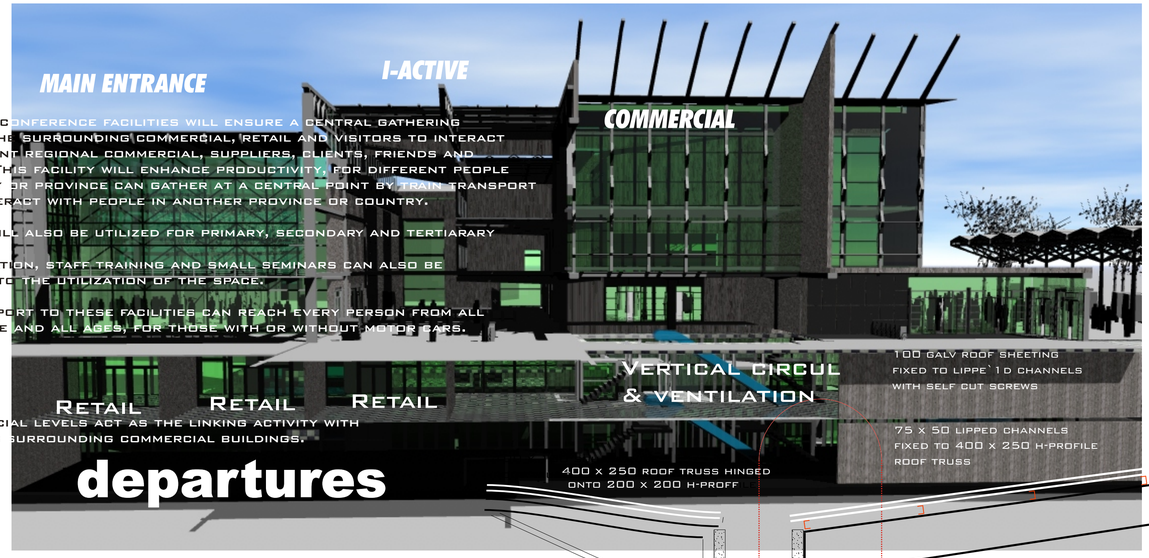
This level will accommodate passengers in the form of franchise food stalls. Toilets, ATM public phones and ticket renewals can also be accessible on this level. Fresh air will be introduced into the building on this level.
The floor will intersect the platform and the first floor will also canter over the entrance to emphasize the arrival to the building

Departures

Access to trains will be through doors that will open in accordance to train access doors. The terminal will also open onto the platform with a café for awaiting commuters.



3 dim section



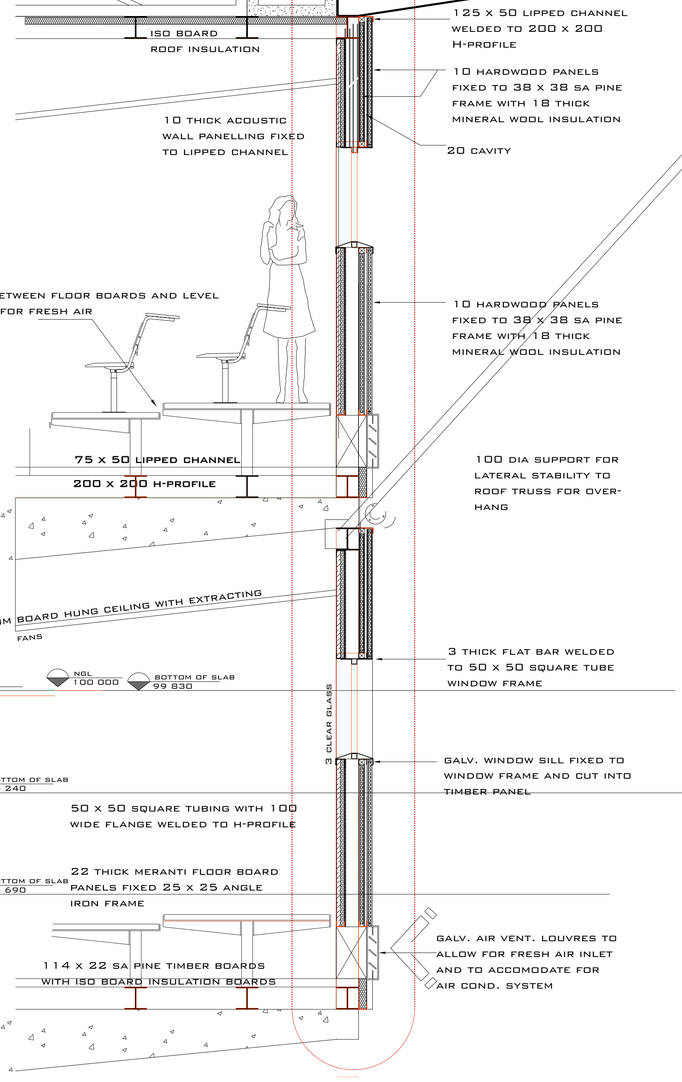
The i-active conference facilities will ensure a central gathering venue for the surrounding commercial, retail and visitors to interact with different regional commercial, suppliers, clients, friends and love ones. This facility will enhance productivity, for different people within a city or province can gather at a central point by train transport and can interact with people in another province or country.

The halls will also be utilized for primary, secondary and tertiarary education.
Adult education, staff training and small seminars can also be contribute to the utilization of the space.

Train transport to these facilities can reach every person from all walks of life and all ages, for those with or without motor cars.

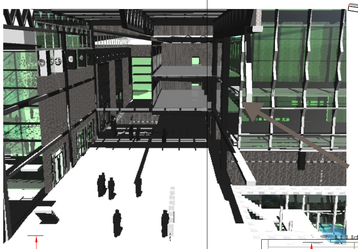
The commercial levels act as the linking activity with the existing surrounding commercial buildings.

3 dimensional section from west to east.



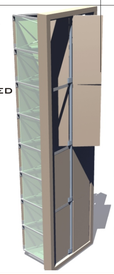
3 dimensional section from west to east.

Timber panels



SECTION a-a

SCALE: 1:100



The hardwood timber panels will be fixed with 10dia bolt and nut with washer on a 50 x 50 fixing plate.

15 mineral wool fixed between two planes of 20 hardwood panels. Heat will enter the timber box through 3 thick clear glass and be further insulated in summer by timber and mineral wool swivel panels on the inside.

In winter the swivel panels will open and hot air will circulate over the infernal double volume

Outside

Inside

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Section a-a

GALV ROOF SHEETING FIXED TO 75 x 50 STEEL LIPPED CHANNELS WITH 6MM SELF CUT SCREWS.

LIPPED CHANNELS WELDED BETWEEN ROOF TRUSS@600 CENTRES WITH 20 THICK ISO-BOARD ROOF INSULATION AND 12 THICK PLASTERED RHINO INDUSTRY GYPSUM CEILING BOARDS

1200 NORTHERN OVERHANG

100 x 100 ANGLE IRONS WELDED TO 150 x 400 STEEL ROOD TRUSSES

300 x 150 GALV ROOF GUTTER FIXED TO LIPPED CHANNEL END BATTENS

150

930

600 600 600

400

10 GALV END FLASHING

6 THICK GALV STEEL FLAT BAR FIXED BETWEEN LIPPED CHANNELS TO INSULATE ROOF VOLUME

2700

2560

3740

50 DIA CROSS BRACING TUBES WELDED TO 100 x 100 ANGLES

2190

R 28 950

114 x 22 MERANTI FLOOR BOARDS FIXED TO CHANNELS WITH SELF CUT SCREWS.

2190

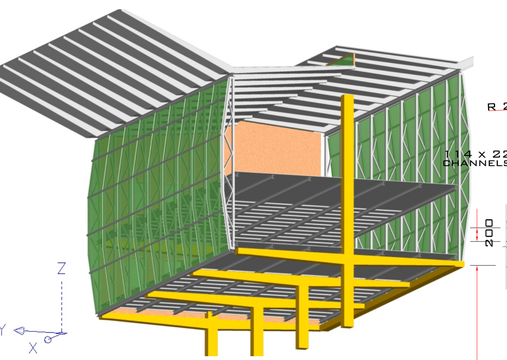
850

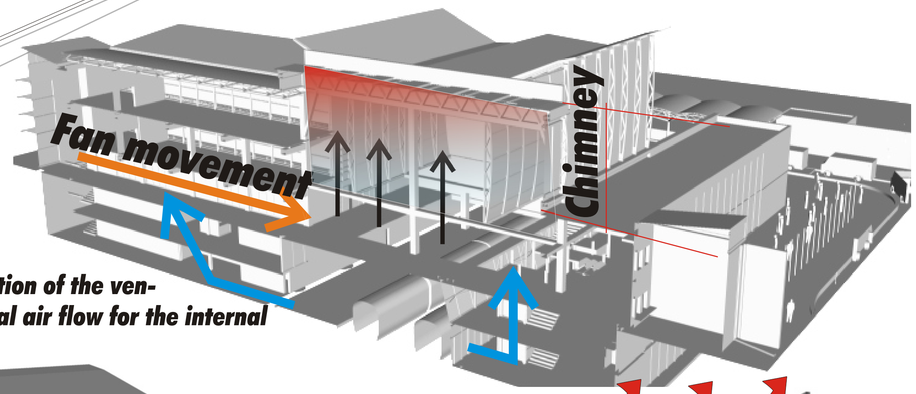
200

4250

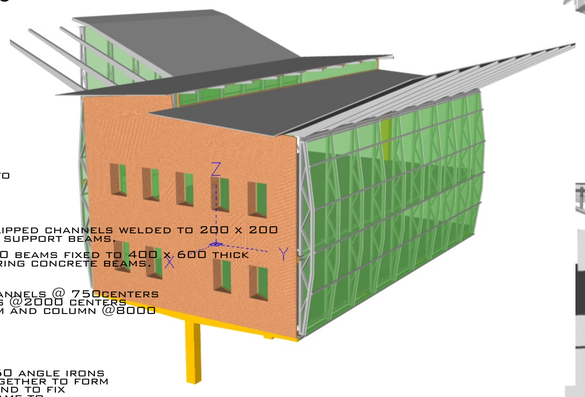
scale 1:25

3 dimensional perspective of the commercial flank and its construction components





3 dimensional section of the ventilation and natural air flow for the internal volume



75 x 50 LIPPED CHANNELS WELDED TO 200 x 200 H-PROFILE SUPPORT BEAMS.

200 x 200 BEAMS FIXED TO 400 x 600 THICK LOAD BEARING CONCRETE BEAMS.

LIPPED CHANNELS @ 750CENTERS
H-PROFILES @2000 CENTERS
CONC BEAM AND COLUMN @8000

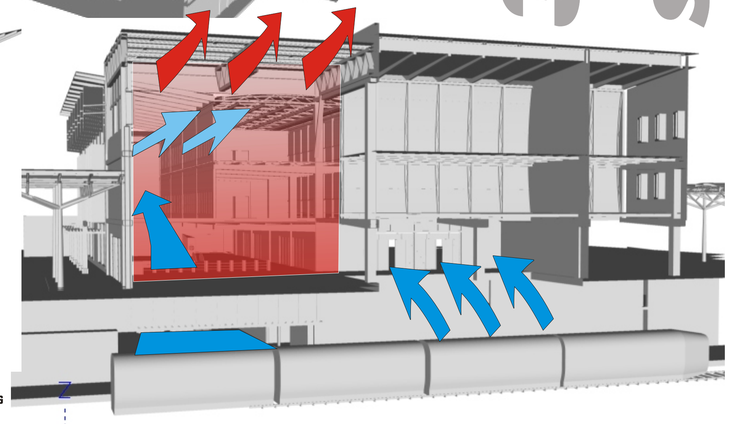
TWO 50 x 50 ANGLE IRONS WELDED TOGETHER TO FORM T-PROFILE AND TO FIX WINDOW FRAME TO

50 x 50 SQUARE TUBING WINDOW FRAME

6MM THICK SAFETY GLASS ON THE INTERNAL FACADE.

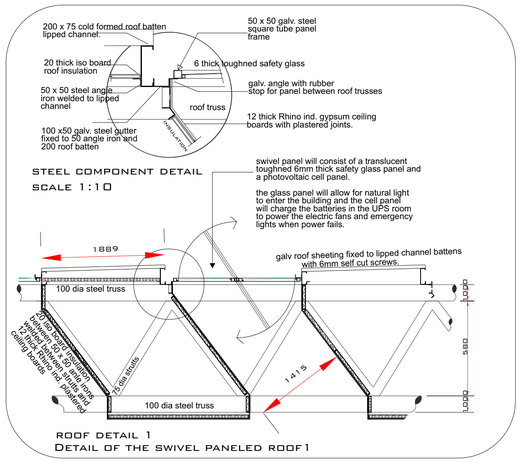
200 x 200 BEAMS FIXED TO 400 x 600 THICK LOAD BEARING CONCRETE BEAMS.

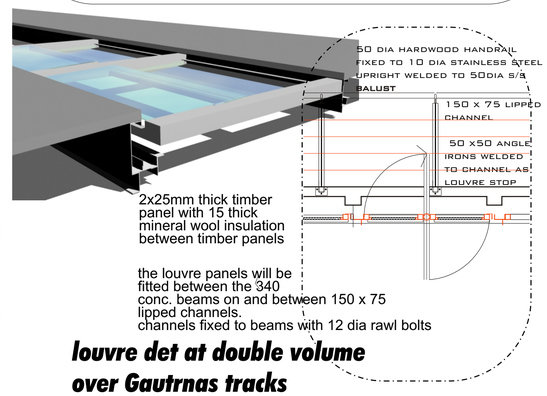
20 THIC ISO BOARD INSULATION BOARD PANELS SUSPENDED BETWEEN FLOOR BATTENS



GROUND FLOOR LEVEL WILL PROVIDE SEATING AND VIEW TO PUBLIC OPEN SPACE

3 dim section





2x25mm thick timber panel with 15 thick mineral wool insulation between timber panels

the louvre panels will be fitted between the 340 conc. beams on and between 150 x 75 lipped channels.
channels fixed to beams with 12 dia rawl bolts

louvre det at double volume over Gautrnas tracks

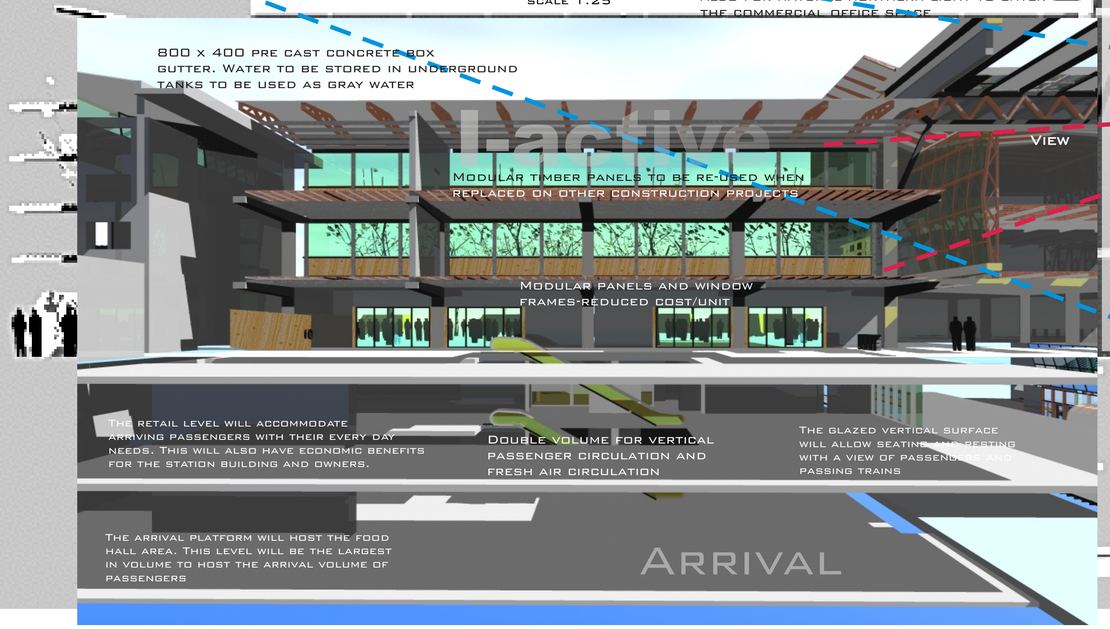
THE SWIVEL ROOF PANELS WILL BE OPERATED BY COMPUTER THROUGH A COMPUTER MANAGEMENT SYSTEM. THE SENSORS WILL CALCULATE THE TEMPERATURE, RELATIVE HUMIDITY AND WET BULB TEMP AND ACT ACCORDINGLY.

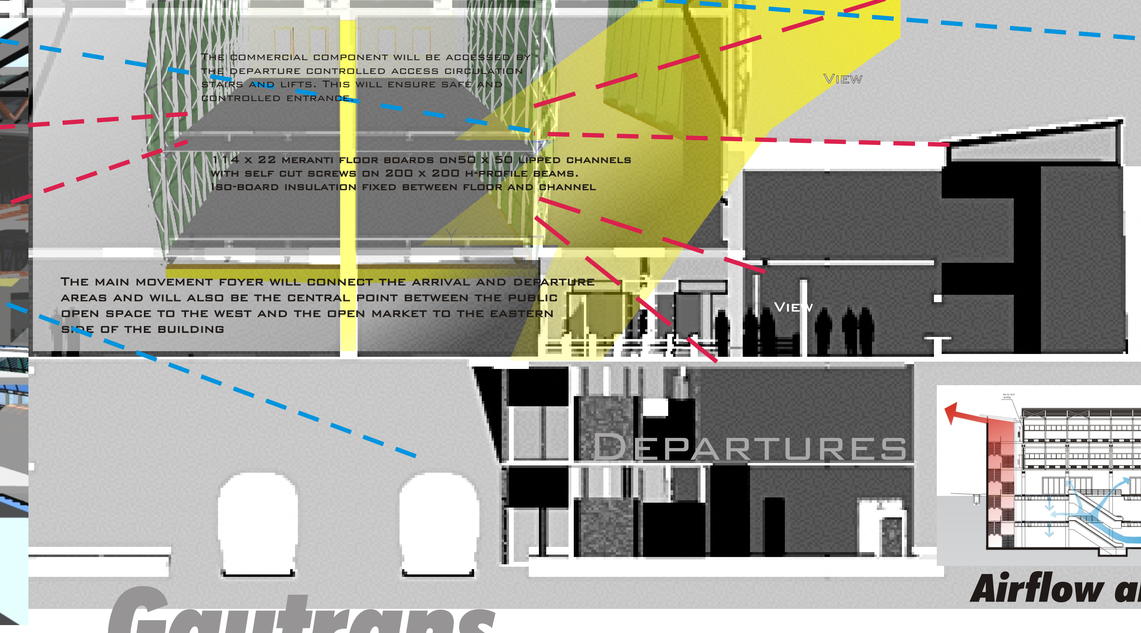
THE PANELS WILL BE CONSTRUCTED OF RECYCLED POLY CARBON-BASED COMPOSITE PLASTICS TO PREVENT HAIL DAMAGE AND TO RESIST SUN HARDENING.

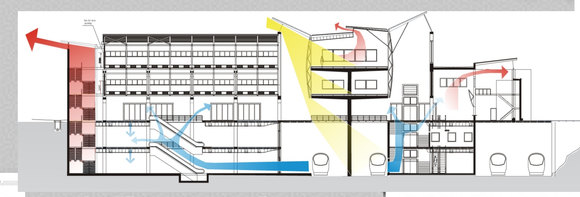
CASED INSIDE THE PLASTIC CONTAINERS WILL BE PHOTOVOLTAIC CELLS THAT WILL CHARGE THE BATTERIES IN THE UPS ROOM AT ARRIVALS.

THE LARGE GLAZED SURFACE FACADE ON THE SOUTHHERN SIDE OF THE BUILDING WILL ENSURE MAXIMUM NATURAL SUN LIGHT PENETRATION INTO THE OFFICE SPACE AND THE DEPARTURE FOYER'S LEVELS.

THE TRIPLE VOLUME WILL PROVIDE THE DISTANCE REQUIRED FOR HOT AIR TO HEAT AND RISE AND ALSO FOR NATURAL NORTHERN LIGHT TO ENTER THE COMMERCIAL OFFICE SPACE







Airflow and natural light

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Section b-b