The Architecture of Railway Stations and Transportation Nodes, towards the design of a Proposed New Commuter Railway Station in Kingspark Sports Precinct.

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A DISSERTATION SUBMITTED TO THE SCHOOL OF ARCHITECTURE, UNIVERSITY OF KWAZULU-NATAL DURBAN, IN PARTIAL FULFILLMENT OF A MASTERS DEGREE IN ARCHITECTURE

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DECLARATION

I hereby declare that this dissertation is my own original work. It is being submitted to the School of Architecture, Housing and Town Planning, University of KwaZulu- Natal, Durban, for the Masters in Architecture degree, and has not been submitted before for any degree or examination at any other University.

Signed by me on the 31ST March 2008

Mxolisi Sikhumbuzo Mtembu

DEDICATION

Dedicated to my beloved parents, Beauty and Simphiwe Mtembu.

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Abstract

In a world of increased daily travel, more efficient means of transporting people become all the more relevant as citizens constantly try to bridge time and distance in an effort to get to work and other meeting places. The ability to transport large numbers of people at the same time, establishes the rail transport as one such mode viable for this task. As a result, cities throughout the world constantly revive existing rail networks and introduce new ones to cater for this growing traveling demand of the 21st century.

The most popular forms of transportation in the city of Durban, namely the bus, taxi and private car are the main contributors to the traffic congestion and air pollution problems in the city, hence the need to reconsider the importance of the train. Following international precedent, South Africa is planning to revive its railway services by changing its image and ensuring passenger safety in order to establish it as a major public transport system (Ministry of transport, 2006).

In creating the building form of railway station buildings, it is necessary to understand passenger movement and activity within the station as well as the spaces required for such activities. This is vital if the designer has to make a meaningful contribution to society though his building intervention. Railway stations do not function in isolation to other modes of transportation in the city, hence the need for this study to consider the station in a node or interchange context to enforce its role within the city's transportation system as a whole.

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Definition of Concepts

- **Apartheid** was a system of government policy that enforced racial segregation between Black and White South Africans, especially in public services facilities and is primarily used in this dissertation to refer to the separation which was applied in the railway service.

- **A Node** according to Lynch (1960:47) can be referred to as a point of concentration of activities. A node is usually triggered by a concentration of people using different paths which converge towards a common point. In this research, a node will primarily be used to refer to either a node of activities or a transportation node.

- **A Node of activities** is a collection of different but related facilities like shops and offices, to form a coherent group that functions together as a whole.

- **A Square** is an open public urban space that is usually defined by buildings and is used for public gatherings.

- **A Taxi** in this study refers to a mini-bus vehicle which conveys passengers in exchange for fares. This form of transport is primarily used by the worker sector of the population in South Africa as an alternative to the bus.

- **A Transportation Node** refers to a grouping of different transportation systems like the bus, taxis and a railway station in

one precinct. This assembly is vital in creating an efficient overall transportation system within a city, because it allows for the different modes of transport to be linked together.

- **Catchment** refers to an area, usually within walking distance to the station, from which the station draws its passengers.

- **National Rail Passenger Plan** is an initiative by the Department of Transport in South Africa to investigate means by which the rail service can be improved so that it becomes a preferred mode of transport for all South Africans. This initiative supports rail, because of its affordability and low environmental impact when compared to other modes of transport available in South Africa.

- **Natural lighting** refers to sun light, which is allowed into an internal building space for illumination. This concept is aimed at saving electricity that could be used by lights for illumination, in the case of artificial lighting.

- **New Durban Stadium** refers to the stadium currently under construction in the Kingspark Sports precinct for the 2010 FIFA Soccer World Cup tournament.

- **Proposed Station** refers to the **Proposed New Commuter Railway Station** planned for the Kingspark Sports Precinct near the New Durban Stadium, ahead for the 2010 FIFA Soccer World Cup tournament.

- **Railway Servitude** refers to a strip of land reserved for the location of railway tracks.

- **Utilitarian architecture** refers to the "brutal" concrete structures which were implemented in railway station buildings to create an image of permanence and robustness. This approach was a response to a vandalism threat posed by some passengers and influenced by the novelty of concrete at the time of their construction.

Abbreviations

ETA – Ethekwini Transport Authority

CBD – Central Business District

CIA – Central Intelligence agency

NDS – New Durban Stadium

SARCC- South African Rail Commuter Corporation

1.1 Introduction

This study investigates the origin of railway station buildings and their characteristic arched sheds that distinguish them as an industrial revolution invention, and also identifies it as a unique typology. These arched constructions were a response to a need for wide span structures that would cover the massive volumes of the stations. The result was a new type of building, which now epitomises the Nineteenth Century era, and remains the symbol of technological advancement of the Industrial Revolution.

Time has seen an evolution of the station from the Nineteenth Century model of an elegant front building with elaborate brick details coupled with the wide span train shed behind it, through to modern single structure forms. Light, structure and volume have always defined railway architecture and the skillful interplay of these elements gives the station its character. Because stations have moved from being mono-functional places for rail travel, it is important to understand the station in the context of a node, which is what this research is seeking to examine.

South African Rail is currently perceived negatively because of the social history which was influenced by the policies of Apartheid. Black South Africans resisted the oppression which manifested in all structures of daily living, including rail. The robustness of railway station architecture was then a reaction to the anticipated retaliation from the suppressed sector of the community. To achieve the character intended, the architects used concrete, which was still a novelty in the 1970s (Fisher, 1998:E2).

Illustration 1: An external view of the Berea Road Station illustrating the robust image achieved through concrete in the 1970s Main Station buildings in Durban. (Author)

Concrete became vital in realising a low-maintenance building type that would survive any threats of vandalism. The architecture however lacks the imagination of creating a sense of place and identity, the image in illustration 1 shows this. This demonstrates the negative effect that Apartheid had on architecture. The wing of the Station shown in illustration 1 was previously used by White commuters, who have now largely deserted the commuter rail service. Apart from a small number of stalls lining the walkway, the place now lacks vibrancy because of the few activities on this portion of the Station. This space has been neglected and has therefore created an unsafe place for pedestrians to walk through.

Whilst existing stations clearly illustrate factors originating from the past, there is a need for the present generation of architects not only to respond to current demands, but to also design for anticipated future needs.

Durban-based architects have already started defining a social architecture that responds to local commuter demands, whilst at the same time, trying to improve conditions in stations. This research will engage with this idea of social architecture which has been promoted by these architects. The intention is to create a more concrete platform for the design of a new railway station in Durban. International and local examples of stations have been critically analysed, in order to understand the principles that differentiate between a successful and a bleak modern day railway station. The outcome of this analysis will inform the design of the proposed new Commuter Railway Station, to be positioned in the Kingspark Sports Precinct.

The new Station will be located on Walter Gilbert Road, next to the New Durban Stadium, and is part of the proposed precinct which is being constructed for the 2010 FIFA soccer World Cup tournament. The Ethekwini Municipality is planning to turn the Kingspark Precinct into a new "Sports City", which caters for various sports codes. This new Station is planned to ease the traffic congestion that occurs during sports matches at Kingspark, and is part of the city's strategy to upgrade the public transportation system in the city ahead of the World Cup tournament, and beyond. The Proposed Station will not only cater for the New Stadium, but also, for the people working at the Beachfront and along Umgeni Road (SARCC, 2006:1). This research will use predicted passenger figures from the findings of a research done by the South African Rail Commuter Cooperation. This information will assist in understanding the sizes required for the Proposed Station, to ensure that the building will cater adequately for the designated commuter population.

1.2 Research Problem

According to the Berea Road Station Manager Mr. S Khan, rail in Durban as is the case with the rest of South African cities, has lost its patronage to the busses and taxis. The growing popularity of the private car hasn't helped the cause of rail either. The challenges that these modes of transport pose however, include a dilapidated environment because of air pollution and traffic congestion.

Rail has, on the other hand been proven to have an advantage over its competitors, since it does not contribute to toxic fuel emissions like the car does (Button and Rothengatter, 1993:33). Given this benefit over road transport, there is therefore a need to investigate railway transport in order to help re-establish it as a worthwhile public transportation option in South Africa.

The growing unpopularity of rail in Durban is also partly due to the negative perception which was generated in people's minds during the times of Apartheid. This saw rail as a Black worker's mode of transportation, and hence a low-grade system of traveling.

Apart from the unattractive concrete exterior in Stations, incorrect circulation planning and uncontrolled informal trading within the station precinct has proved to be a challenge. This impedes pedestrian movement along the station's corridors as evident at the Berea Road Station, which is analysed later in this study.

In addition to the railway station building being incorrectly planned, the urban setting of the stations in Durban is also not ideal. At the busiest

Station in KwaZulu-Natal - the Berea Road Station for example, there is no public plaza between the Station and the roads bordering the Station. This would be useful in receiving the multitude of passengers which use the Station on a daily basis. The above situation therefore leaves pedestrians having to walk through moving vehicles, when leaving and entering the Station, which is hazardous.

South Africa has a challenge of poverty and unemployment, which is the case with most African cities. According to the year 2000 estimation, results show that 50% of South African people live below the poverty line. While a 25, 5% unemployment rate according to 2006 estimates was confirmed (Central Intelligence Agency, 2007). Road transport harms the environment through air pollution and air travel can be afforded by only a few South Africans. There is therefore a need to encourage a cheaper mode of transport which addresses the needs of the majority of the people in Durban.

Rail is also a more economically viable transportation system when compared to the costs of taxis and buses. A report by the Durban Investment Promotion Agency (2005) reveals that transport cost per person in Durban is R0.96c/ km for rail, R1.20c/ km for the bus and the taxi, while the private car sits at R2.25c/ km. The problems with the rail system however are passenger safety, unreliability and uninviting station precincts which push potential passengers away. These problems need to be addressed in order to ensure that the rail service, which is a worthwhile and relevant option for South Africa because of its affordability, is fully utilised.

1.3 Main Question

Given the inadequacy of the existing railway stations in Durban and drawing good design clues from examples both locally and internationally, what is the appropriate architecture for the design of the proposed new Commuter Railway Station in Durban?

1.4 Subsidiary Questions

- What is the building technology applicable in the creation of a railway station in Durban?
- What is the accommodation to be included in a railway station Building in Durban?
- What are transportation nodes and what role do railway stations play within them?

1.5 Working Hypothesis

Architecture can play a role in changing the perception of rail travel in South Africa. This can be achieved through the improvement of the station building's image by making places that respond to the local context and the people's needs, while relating to other modes of transportation within a context of a transportation node.

1.6 Aims and Objectives

- To explore the planning of a railway station, together with other forms of transportation in the city, towards the creation of a transportation node that helps the efficiency of the city's public transport system.

- To understand the relevant architecture of railway stations in the context of Durban. This will be achieved by studying good examples of newly renovated stations so as to build on already established trends that have been identified as relevant to Durban.

- To understand the technique of international station design in order to adapt such concepts for application in the design of the proposed new Railway Station in Durban.

- To explore the extent to which architecture can contribute to a new image of railway stations in Durban and thus promote rail as a worthwhile transport system for all sectors of the community.

Chapter 2- Research Methodology

2.1 Introduction

This chapter outlines the method used in carrying out this research, while specifying the study area and the techniques to be employed for gathering data.

2.2 Study Area and Setting

The study area is Durban, South Africa.

2.3 Target Group

This section describes the target group of people chosen by the researcher to provide relevant information for this research. This target group includes:

Professionals from organizations that are involved in station designs and maintenance in Durban, namely:

- Mr. Dave Stromberg, Architect (Spoornet)
- Mr. Ashley Peters, Rail Network Planning Manager (Metrorail)
- Mr. David Harms, Civil Engineer (Protecon)
- Mr. Andrew Okamp, Civil Engineer (Ethekwini Transport Authority)
- Mr. Derek van Heerden, Architecture lecturer (University of Kwa-Zulu Natal)
- Mr. Craig Simmer, Civil Engineer (Iliso Consulting Engineers)

This research has been carried out in a qualitative rather than a quantitative approach; hence the reason why the interviews to collect data were conducted only with professionals. The reason being that, professionals have the competence to contribute beneficial information for the purpose of this research document and the proposed design solution.

2.4 Data collection Techniques and Instruments

In this study, data will be collected by use of Primary and Secondary sources.

2.4.1 Primary Research

Primary research includes visiting existing railway stations and observing passenger patterns inside them. This will also include the taking of photographs for analysing the character of the structures and taking note of the accommodation within the existing buildings. This research was carried out to critically analyse the existing architecture of railway stations as well as to explore ways of improving current design trends for future station designs in Durban.

Key informants from the departments of Railway engineering, Architecture, and Rail maintenance were interviewed to establish guidelines and restrictions which would inform the design of a station in Durban.

2.4.2 Secondary Research

This section sources information from literature in: books, journals and reports that are relevant to this dissertation. As such, ensuring that this project adds value to an already existing body of knowledge. The information attained through this method includes history of railway stations, environmental benefits of rail and the international examples of stations which will be analysed under the Precedent Studies chapter of this dissertation.

2.5 Conclusion

The information discussed in this chapter has been instrumental in focusing the research towards a specific and desired outcome on railway architecture in Durban.

3.1 Introduction

There are fundamental principles that have been established in the early examples of successful railway stations. These defined and shaped the station as a unique typology while ensuring that it offered the patrons of the rail service, comfort and convenience in an environment of a fast paced people movement. The ideas discussed in this chapter will be used to interrogate the precedent and case studies in chapters 5 and 6 respectively, and have been arranged under the following sub-topics:

- Space, Light, and ventilation.
- Circulation and linkages.
- The station as a landmark.
- The station as an urban renewal catalyst.

3.2 Space, Light, and ventilation

"Form directed towards a given purpose functions as an apparatus, and where form and programme are mutually evocative the apparatus itself becomes an instrument." (Hertzberger, 1991:170)

Hertzberger suggests that a space can be purpose-made to suit its function. In the above statement the author argues that a space can be designed to be perceived in the same way by all users like an instrument. This can be done for example, in the planning and by ensuring legibility of the circulation concourses to read effortlessly for all people using the building instead of a few regular users. Specific place design therefore, eliminates the element of ambiguity which arises when a place is not easily identifiable for its function through its character and arrangement.

The ideas of Hertzberger as discussed above are complimented by Alexander's (1979:64) premise of understanding prevailing patterns of events that occur in a place. These elements are said to shape and condition a building, which then becomes a better functioning space, or series of spaces, that enhance the 'episodes' that occur within it. The understanding of these trends is vital towards creating a less ambiguous design that arises when the designer is not sure about the trends to be considered.

The main ticket hall in a station for example, is meant for people who are queuing up to buy tickets as well as those circulating within the station, hence the need for a bigger space. Some people could be waiting while a partner buys a ticket; which suggests the need for seating on the periphery of the space. The progression of passengers starts from the entrance hall, to the ticket hall which has turnstiles and these allow for people to pass through to the platforms. There is however less need for seats in the entrance hall as people are primarily moving through it while at the ticket hall and the platforms, people are expected to wait for a while, hence the need for seating . These trends determine the layout of a station building. Alexander (1979:64) therefore suggests that for an architect to create a meaningful building he or she must first understand passenger trends that exist in that building type and only then can efficient planning be made.

Edwards (1997:21) highlighted the fact that the traditional visual form of a station comprised of an office building in front and a train shed behind it. The modern railway station on the other hand has continued to have varying design forms; the concept is usually a single covering structure which envelopes the entire station instead of the traditional front building and shed structure. The canopy houses all the necessary

facilities of the station within a single roof, and accommodation can occur in different levels under the canopy.

The canopy is usually an arched shape, although not always. Large crowds utilise the station simultaneously with each person tying to get to their destination at a fast pace. Few impediments from structure like columns on the concourse are vital in ensuring the efficiency of people movement in a station. The application of the arched form in most cases addresses the undesirable element of intermediate supports through its wide span. Whilst providing shelter and making certain that the main floor area is planned in such way that it allows free flow of movement. It is important for the designer to consider the quality of the space created under the canopy, and the incorporation of elements such as natural lighting, helps in illuminating the internal space, thus ensuring it's the legibility.

A railway station as a typology consists of different spaces that house diverse functions and thus creates rooms that vary in size. This means that the design approach should be different with each situation. As much as the planning of the station floor plan is important, the overall character and ceiling height of the space is directly linked to the viewer's perception of that space. An area with a bigger floor area must have a higher ceiling in order to achieve the right proportion within that room. The Ticket Hall requires a higher volume than the retail outlets for example, because more people are expected to gather for tickets than they would for shopping, in a station situation.

A higher ceiling gives a hall a sense of spaciousness which is important for the comfort of the many people gathered together in that one place. Ceiling heights indicate the hierarchy of the different spaces based on their function and size. Alexander notes that a lower ceiling

denotes intimacy, while a high ceiling symbolises formality (Alexander, 1977:877). This means that higher volumes are more inviting and welcoming when dealing with large crowds, while lower ceilings give an impression of enclosure and intimacy. In the design of a station therefore, the ceiling heights have to differ with each space in order to give the different areas distinctiveness. A unique spatial form is easily identifiable from the rest, and thus helping with the orientation of the passengers within the building, as larger volumes are identifiable as being more public and therefore inviting to all. The main functions in a station are to be located in these areas since most people are more likely to be drawn to them than to smaller spaces.

Alexander (1977:645) states that:

"People are by nature, phototrophic – they move towards light, and when stationary, they orientate themselves toward the light."

Allowing natural light into a building does not only foster the legibility of the spaces but also brings a sense of place and belonging. Illustration 2 demonstrated this principle.

Illustration 2: A View of a hall in Central Station, Glasgow. Designed by Rowand Anderson and completed in 1879.The picture shows the different facilities and shops that give the station a character of an ordinary street in the city. Natural lighting through the roof ensures the legibility of the space. (Hertzberger, 1991: 73)

Light brings the feeling that one can be in a place and relate to it without feeling alienated and out of place, because people are attracted to light. It follows then that humans feel comfortable in well lit spaces. The idea that people tend to orientate themselves towards light, suggests that the main focal points in a building must be well lit to attract the attention of the observer. Darker areas are also important in creating a variation within the overall space. A carefully designed method of bringing in natural light can therefore not only give a space character but also help to orientate people within the building and thus help with the proficient flow of movement- the essence of an efficient station.

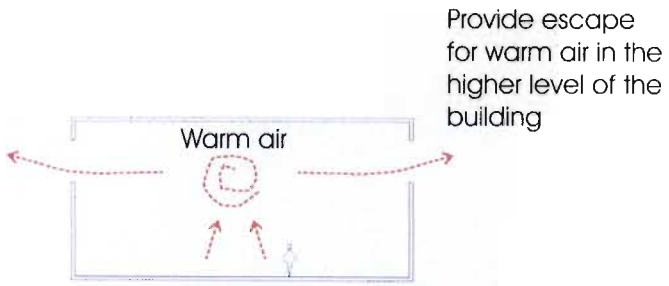


Illustration 3: Warm air generated by people and activities in a closed space rises and needs to be let out in order to ventilate the space. (Author)

In addition to lighting, the ventilation of the space is crucial for the comfort of people using the station. In a railway station, heat gets generated from the concentration of people in the same place, and allowing warm air to escape through the upper parts of the building as shown in illustration in 3, helps ventilate the space. This process is called the stack effect and is driven by buoyancy resulting from the difference between indoor and outdoor air density which is due to air temperature and humidity (Wikipedia, 2006). In essence, the greater the difference and the height of the structure, the more the buoyancy. This means that the warm air inside the building becomes buoyant and rises, seeking outlets to escape on the upper level of the building. Apart from the Stack effect, a building can be orientated to capture the

cooling winds to achieve cross-ventilation in a space, like the prevailing North easterly winds in Durban.

3.3 Circulation and linkages

This dissertation proposes that a railway station can make a meaningful contribution to the overall city transportation network by relating to other forms of transportation like the bus and the taxi. As indicated in the Problem Statement, rail is an affordable mode of transport and has less impact on the environment in terms of pollution. This makes it a much more favourable mode of transport for the Durban context however, the promotion of the use of railway should coincide with its integration with already established public transportation within the city.

Since there are other public transport systems in place in Durban, rail can only play a part and not take over completely. This idea refers to the fact that if a node, which is the convergence point for all the transportation paths is inefficient; the same node becomes the weakness that affects the whole system. An efficient transportation node is therefore paramount. Alexander (1977:94) recommends that interchanges or nodes be treated as primary elements while the transportation lines or paths that feed them should be treated as secondary. Hence the position of the taxi rank, which although separate, must be linked to the station and its path of connection made legible to facilitate efficient movement between the different modes of transport. The walking distance between the different modes should be shortened in order for passengers to have a smooth transition between station and a taxi rank.

Lynch (1960:47) argues that people have heightened attention at nodal points because they are places of breaks in transportation. He further says that spatial form is more important than its external form at these junctions, since space is related to the person's experience whilst within in a node. This idea suggests that not only a taxi rank or a station must be crafted to have a particular image, but the external spaces between the buildings must have their own form to complete a uniform indoor and outdoor experience within a node.

Lynch (1962:56) states that:

> *"In its essence, the sensuous experience of a site is a spatial one, a perception of the volume of air which surrounds the observer, appreciated principally but not entirely through the eyes."*

Open spaces between buildings that constitute a node act as outdoor rooms and these must be designed for pedestrian priority. Cars and taxis on the surface where pedestrians walk can be hazardous and are uncomfortable to negotiate. In nodes therefore, locating parking and railway tracks underground is an important consideration. This would ensure that the person using a node can experience the spaces without the impact of vehicles and visual blight. These open spaces are gathering spots that receive people before continuing into the buildings. These include landscaped parks and paved squares.

The square is the main arrival or gathering space in a node, it is pivotal as it acts as the central space from which people can orientate themselves to other parts of the precinct. Illustration 4 demonstrates this principle.

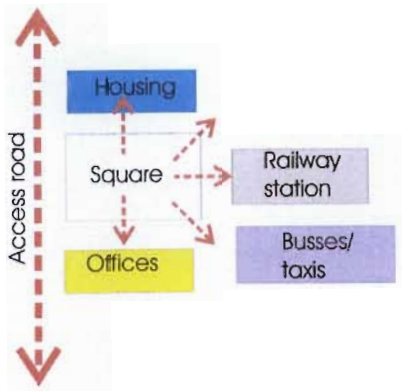


Illustration 4: A plaza or a closed square is instrumental in orientating people within a node. (Author)

The square ensures that the station precinct primarily caters for pedestrians while strengthening the connectivity of facilities that make up the node. The making of a square includes the consideration of the edges which are adjacent to buildings that define the square itself so as to avoid amorphous spaces that are not usable. Since the landscape has a horizontal emphasis, vertical elements like trees and buildings assist in creating edges along the open spaces and thereby defining them as a place.

Lynch (1962:27) also mentions the importance of linkage to other facilities by incorporating existing street patterns in the city. This includes legibility of circulation within a building as a key consideration when designing within a transport node. When building within a well established street pattern it is ideal for the designer to project lines of desire or connection from existing path patterns in the city to better inform the circulation within a new building as seen in illustration 5. Permeability of a station in this context is paramount if the station is to continue the existing pattern. Linkages ensure access to facilities or spaces which in turn ensure the usability of these spaces.

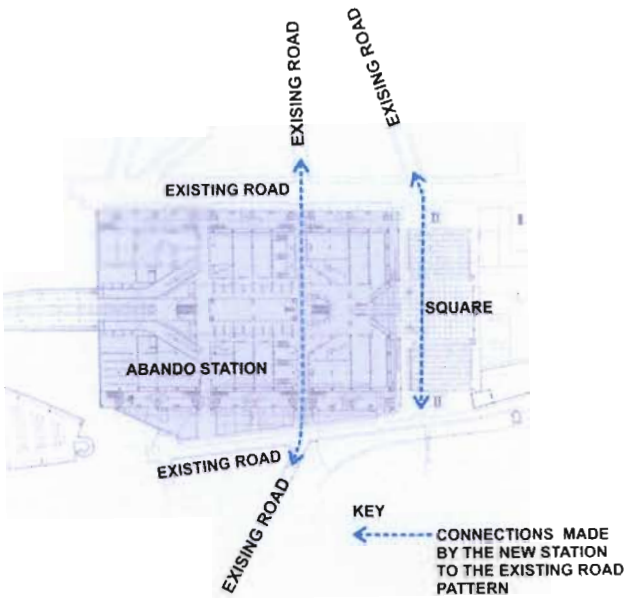


Illustration 5: Plan of Abando Station, Spain. This plan indicates station corridors which are extensions of the existing city pattern. The continuation of existing paths establishes the station as a roofed part of the city that maintains permeability through it. (Edwards, 1997: 60)

3.4 The station as a landmark

A railway station is usually set apart from other buildings and developments because it has to be on the railway reserve land. Sometimes the station is planned away from other buildings of commercial or residential functions. Besides being a stand-alone building, the station's visual form usually contrasts to the neighbouring buildings because of its dominant roof treatment. This then marks the architecture of a station as a unique and memorable one. Illustration 6 demonstrates the grand form which transpires from the expression of the station roof to ensure its visibility. Sometimes a station design that serves as a connotation of culture can render itself as a point of reference, and thus becomes a landmark.

Illustration 6: The bold distinct form of the Lyon-Santolas Airport Station Identifies the station as an easily notable landmark. (Edwards, 1997: 84)

3.5 The station as an urban renewal catalyst

In trying to understand a station as an urban renewal catalyst, the Parramatta Rail Link project in Australia was selected for a brief analysis. The project was built in Sydney and architects Terry Farrell and Partners were commissioned to design part of the Project which started in 2002. Parramatta lies 24km to the West of Sydney city centre, where the Sydney harbour meets the Parramatta River. This project has been planned to revive Parramatta through the creation of a railway line which links the suburb of Parramatta to Chatswood. This would complete the railway line around Port Jackson, from Sydney CBD to Chatswood, as indicated in illustration 7.

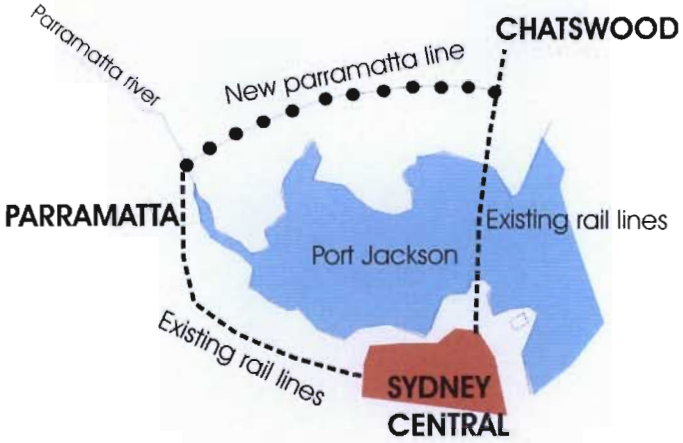


Illustration 7: A diagrammatic plan of Parramatta Railway Project.
(Author / Terry Farrell and Partners, 2000: 124)

The new line was planned to have 12 stations which were designed as nodes of activities. The station itself was meant to be a generator of new developments like housing, commercial activity and offices, within the same precinct. The buildings that house these facilities were designed as mixed-use to ensure that the above mentioned functions support each other. Another key idea in this scheme is that the edges of the station are permeable to allow maximum access to the surrounding square from more than one direction.

Illustration 8: A photograph of the Camelia station model which is one of the stations on the Parramatta Rail Link Project showing a huge plaza that connects the station to the adjacent mixed-use development in the area, ensuring unobstructed connectivity for pedestrians. (Terry Farrell and Partners, 2000: 127)

The model in illustration 8 shows the mixed-use development in relation to the square and the station. The wide open space is designed for the use of pedestrians and maximizes the connection between the two. The square is given definition by the buildings that surround it and it acts as the central point of arrival and orientation for people going to the station or the mixed-use development. The square therefore ties the different elements that make up this node which are: the station and the mixed-use development. The character of the square is enhanced by the different textures and finishes which include the park and the hard landscape. This created a desirable contrast for the observer while giving him or her an option of sitting on the soft landscape under the shade of the trees or mingle with people in the paved area, which is also ideal for public performances.

Lessons from the Parramatta Railway Project

The stations on the Parramatta line act as triggers for further developments around them. This would co-exist to create a functional node through the inter-dependence of the station on other facilities. This as a result revitalises the precinct. The idea of having housing near a station as part of a mixed-use development provides a catchment for the station and maximises the use of public transportation which reduces congestion caused by the private car. Housing also provides surveillance to the precinct, and therefore a safer environment.

Hertzberger (1991:73) refers to stations as *"roofed parts of the city"*; this idea suggests that stations need a strong link to its immediate environment. In Camelia this is achieved through multiple entrances which connect the station to the adjacent developments. A station can function as an urban element or landmark which enhances the

image of a precinct. In Camelia, the central location of the station within its precinct renders it as a point of reference.

3.6 Conclusion

In creating a station in a nodal interchange, the designer has to be mindful of place making within and outside the station. In order to enhance the experience of the traveler throughout the node, the external rooms like the square should be defined with buildings, which act as edges.

Inside the station, the spatial form results from the structure needed to create a free span that creates an unobstructed floor area. The space has to be ventilated and well lit for it to be inviting to people. Light is therefore an important element in the creation of an airy feeling of internal spaces. Light also helps in illuminating the circulation within the station, and thus enhancing legibility for the passengers.

To give a space the appropriate proportion, wider spaces must have higher volumes. This also allows for a better ventilation of a busy area. Volume can also help identify the hierarchy of spaces within the station to create dynamism in the path of the person walking through the different spaces. Apart from the use of materials, light and volume plays a role in giving image and character to a building. This is achieved through the identification of primary areas and functions, expressed in the difference in their ceiling heights.

Appropriate circulation is what defines a functional station. Hence the need to understand the circulation route of pedestrians within a station from entry to ticket office, then down to the platforms being the main component of the design exercise. This means that the large number of

people which needs to be catered for in a station must be well understood. Before the design can be implemented, the analysis of routes that are most likely to occur must therefore be noted.

Passengers using transportation nodes are usually in a hurry. Therefore legible, short lines of connection between a station and other facilities like the taxi rank are essential.

4.1 Introduction

The railway is one of the most important inventions of the Industrial Revolution. This British invention brought a significant improvement to both the transportation of goods and people alike because of the potential of its loading capacity. This innovation also brought about a new typology in architecture, which is the railway station. This chapter focuses on the evolution of railway station architecture, its design requirements and the components that make up a railway station. As well as the aspects of a transportation node, as this is the context in which a railway station functions.

4.2 A Brief History of Railway Stations

The industrial revolution had many remarkable inventions. These include the manufacture of textile machinery, the steamboat, the electric telegraph, electricity generators and electric lighting. The invention of the railway was significant because of its major contribution to the improvement of transportation. It thereby strengthened communication and connections between people in different places thus contributing significantly to the economic development of the time.

In 1801, Richard Trevithick invented the steam locomotive (Neo-tech, 1996), which was combined with a number of James Watt's steam carriages and was used to transport coal and ore from the mines. Later, this new technology was used as a form of transportation for people. As a result, architects and engineers faced the challenge of designing large span buildings that would cater for a new transportation system. This saw the emergence of a new building typology, which would cater for the railway service.

The Euston station in London as shown in illustration 9 was the first of Europe's stations (Binney and Foehl, 1984:6) and was opened in 1837. The primary building material for this station, was wrought iron. The double pitched roof spanned a mere 12metres maximum span and needed column support between the tracks.

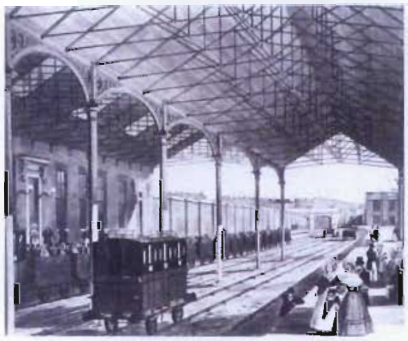


Illustration 9: An image of the Euston Station interior, which was the first station to be built in Europe. The image shows the intermediate columns needed to support the double pitched roof. The columns were well decorated on the top with elaborate Victorian-style motifs. The station was opened in 1837. (Binney and Foehl, 1984:6)

4.3 The station and the arched form

In 1865, the Saint Pancras Station utilised the arch form for its canopy. This was the beginning of a new exploration to address the need for much wider clear spans in station buildings. The principle of an arch is demonstrated in illustration 10. The arch emerged as the best solution in achieving wide clear spans that would eliminate the need for columns. Once achieved, it opened up the internal space for a smoother flow of passenger movement as well as other railway operations within the station.

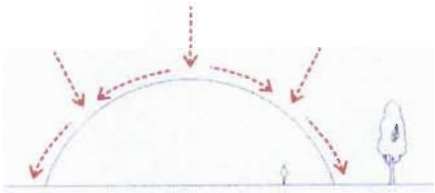


Illustration 10: An arch diagram with arrows indicating the roof weight and other compression forces. Since the arch does not have corners, the entire form does not have a weak point but distributes weight evenly across its perimeter. (Author)

The Saint Pancras Station depicted in illustrations 11 and 12 was built in England between the years 1863 and 1865 (Roth, 98: 438), and designed by W.H Barlow and R.M Ordish engineers with a massive span of 73m achieved through a 30 metre high arch. The length of the covering is 209m. The advent of the Industrial Revolution saw the introduction of iron as the main building material, since the technology for shaping the iron was now available

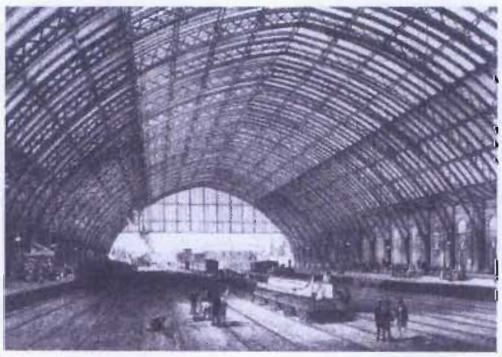


Illustration 11 and **12:** Interior perspective and plan of Saint Pancras Station in England, designed by engineers W.H Barlow and R.M Ordish (1863 -1865). The arch enabled engineers to achieve greater spans than the initial double-pitched roof seen in the Euston Station illustration 9 and as a result ushered in a whole new form for the typology (Roth, 98: 438)

Illustration 13: Building sections illustrating that wider clear span is best achieved through the use of an arch form. (Wilkinson, 1991:10)

Illustration 14: The York station building made use of cast iron to achieve a wide span within the building. The station was designed by William Peachy and built in 1874. (Artwell, 1979: 25)

Illustration 15: A picture of the Waterloo international terminal building demonstrating lightweight steel construction. It was built in 1994 by Nicholas Grimshaw (Edwards, 1997: 83)

Despite the 100 year time difference between the York and Waterloo stations, the arch form has continued to define railway architecture in general. The above illustrations 14 and 15, demonstrate the similarity between 1874 and 1994 buildings. These both illustrate the success of the curved form in achieving clear spans that are vital in public buildings which accommodate large crowds of people. Although the arch is not the only form used in station design, it has however not only provided appropriate spaces that allow for free and easier passenger movement within a station, but also identified stations as landmarks.

4.4 A change in the Image of Railway Stations

Whilst the use of the arch form has remained a strong element in railway station architecture, a significant change in the overall outlook of the typology has occurred. Since the station has to shelter other facilities apart from its main function of covering the platforms, an elaborate office block housing the railway company's headquarters or a hotel would traditionally couple the shed (Edwards, 1997:21). This building would be located in front of the shed and would act like a face or the main architectural expression of the station. Usually built in brickwork as demonstrated in illustration 16, the office building was well detailed with a powerfully expressed entrance.

Illustration 16: This picture of Saint Pancras Station built from 1863 to 1865, illustrates the well decorated front building which became the image of traditional stations. The building usually functioned as a hotel or office building, and was in front of the arch platform shed, which covered the platforms. (Betjeman, 1972: 10)

Nowadays however, the station does not have a 'front building face', but the canopy is articulated as the main form of expression of the building with offices included within the main canopy. The front façade is usually

integrated with the canopy rather separated from it. Illustration 17 of the Waterloo Station demonstrates this design trend.

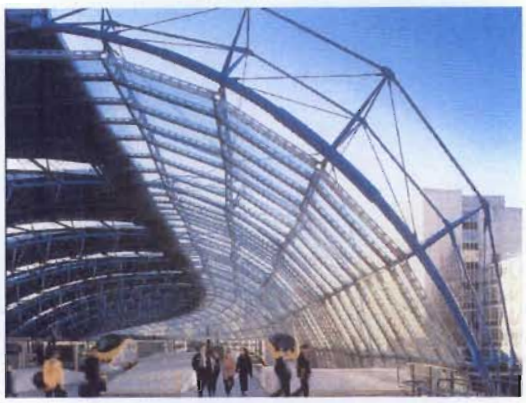


Illustration 17: The waterloo station is a typical example of a modern station, as it illustrates the well articulated structure of the canopy which becomes the architectural expression of the station (Edwards, 1997: cover page).

Over the years stations have diversified to include other facilities such as different kinds of shops, hotels and restaurants. This trend developed because stations became meeting places for passengers in transit, and this presented an opportunity for the railway companies to increase their revenue. Hence the retail component has become an integral part of the station complex.

4.5 Railway Station typologies

Railway stations are categorised according to their size which is determined by the catchment area for which they cater. This section will focus on the requirements of a Suburban typology which will inform the design of the Proposed Station for Kingspark.

The Proposed Station qualifies as a Suburban type because of its location in the Umgeni precinct. This is a Suburb that the Station is planned to serve. The station is also planned to service the patronage of people coming to the Kingspark Sports Precinct. The Suburban Station typology can be further divided into, Quiet, Busy and Interchange Suburban Stations. The location of a taxi rank qualifies the Proposed Station as an Interchange Suburban Station, because of the interdependence of the two modes of transport.

Below are the main categories under which stations can be categorised based on their size and function (Edwards, 1997: 73). The description and facilities needed in each typology may vary with different circumstances, but generally remain as listed below:

4.5.1 Mainline Terminal - these are the biggest station types and are usually

located in the centre of the city. Trains end and start their journeys at these stations. The facilities include ticket hall; ticket office and ticket machines; retail and refreshment shops; staff offices; toilets; travel centre; parcels depot; tourist information centre; staff

accommodation; first aid point and are located in a metropolitan interchange including buses and taxis.

4.5.2 Mainline Interchange stations - are Mainline Stations that are either terminals (trains terminate at the station and cannot go through) or island stations, which means that trains can go through the station. The key element in this type is its strong connection with other forms of transportation like the tram, taxis, and buses that feed the station. The facilities include: ticket office and ticket machines; retail and refreshment shops; staff offices; toilets; travel centre; parcels depot; tourist information centre; staff accommodation and a first aid point.

4.5.3 Mainline stations - are located in the city centre and have no strong link to other modes of transportation like the Mainline Interchange stations does. However the station should ideally be located close to a bus or taxi rank. The facilities included are: ticket hall; ticket office and ticket machines; retail and refreshment shops; staff offices; toilets; travel centre; parcels point; staff accommodation and first aid point

4.5.4 Suburban station - for the purpose of this dissertation the facilities required for this typology will be further discussed in this chapter in order to inform the design of the Proposed Station. Facilities include: ticket hall; ticket office and ticket machines; retail and refreshment shops; staff offices; information office; toilets; parcels point; sheltered platform waiting, staff offices and toilets. This typology can be further divided into a Busy (frequent daily use), quiet (occasional

use) or Interchange Station (stronger connection to a taxi or bus rank) typology, depending on its catchments and location.

4.5.5 Rural stations - are smaller stations which house only the basic necessities in a station. These include, a ticket and information office, car parking, bicycle storage, covered waiting area, telephones and possibly an automatic ticket machine. There may be venders but usually no formal commercial activity. This typology is usually located close to a taxi or bus drop-off point.

4.5.6 Special / unnamed stations -include the airport station and other stations that are built for a special purpose other than catering for clearly defined catchments. The requirements of a Special Station are the same as those of a Suburban Station, but could vary depending on the specific functions catered for.

As mentioned earlier, the typology of the Suburban Interchange Station is further analysed for the design of the Proposed Station. According to (Edwards, 1997: 74) the requirements for an Interchange Suburban station are as follows:

The Suburban Interchange Station:

- Retail - shops and restaurants in a station are included to add revenue to the company operating the station. Signage sizes of retail companies within the station however must be played down to ensure that priority is given to information boards for traveler information. The position of the shops and displays must be along

the circulation corridors without intruding in the corridors and disturbing the flow of pedestrians.

- Ticket hall – this is the central point of the station and is the main gathering place for passengers. Subsidiary spaces within the station can cater for mainly commercial activities to ease the crowding of the Ticket Hall which caters for the core function of the station. Ticket and information offices are the main facilities in the ticket hall. All facilities are located on the perimeter defining a central space. This space should be substantial enough to hold the crowds of people expected to queue up for tickets. At the same time, this main space must provide enough circulation room to allow other passengers to proceed to the platforms. Facilities directly related to the Ticket Hall include: Information office, travel information indicator board, the toilets, automatic teller machines, Automatic ticket machines telephones and lockers.

  Travel information indicator board - in traditional stations the clock was the main feature hanging high in the Ticket Hall for the convenience of the passengers waiting to board trains. Nowadays, information about train routes and times of departure and arrival is also a major part of passenger information. In a station, these are displayed on electronic information boards, controlled from a specially designated office. Electronic information boards should be supplemented with voice announcements on loud speakers, to cater for the visually impaired passengers.

  General Information Office – should ideally be located where it is visible to all entrances into the Hall and houses an

attendant who gives information about the station to travelers. Tourism information could also be attained in the General Information Office.

Telephones – public phones are located on the perimeter of the Ticket Hall.

Toilets – public toilets are provided according to the maximum number of people expected to use the station. They should ideally be accessed from the Ticket Hall. Separate ablution facilities for tenants and station management should also be provided.

Lockers – are provided for visitors for the storage of their bags.

Parcel point – security check point for luggage going into the trains.

Automatic Teller machines – bank machines to be provided for the convenience of passengers needing to withdraw cash for purchasing tickets.

Automatic ticket machines – to supplement the ticket office during pick times in order to ensure the smooth running of the station.

- Turnstile gates- the control of passengers entering the platform area is an integral part of managing a station. Turnstile gates allow passengers with tickets to proceeds to the platforms, thereby reducing the risk of trains overcrowding as a result of people entering the train unlawfully.

- Platforms – after passing through the turnstile gates, passengers must have ease of access to the platforms with the provision of

stairs and escalators in a case where a change in level occurs. Lifts are to be provided for disabled passengers.

Waiting area on platforms- the most basic furniture in these areas are the seats. In addition, monitors displaying arrival and departure times for the trains, a clock, and litter bins. It is important that these areas are adequately covered for passenger comfort while waiting for the trains and providing protection from the elements. High quality lighting is also required in waiting areas since most people pass time by reading. Mobile food stalls and toilets are also included in waiting areas for the convenience of passengers.

- Bus and Taxi connection – a clear route connecting the station to a nearby bus or taxi rank is paramount for the efficiency of the transportation node and the passenger transition between the ranks and the station.

- Car parking – a car parking area should not be located far away from the station entrance but must not hide the entrance either. The link should be legible and ideally covered.

- Staff Offices – Staff Offices should be located centrally within the station for ease of accessibility to all parts of the station, ideally overlooking the Ticket Hall.

4.6 Railway Stations and Transportation Nodes

Nodes are primarily created by the convergence of paths into a focal point, and because paths are lines of travel used by people, nodes therefore become areas of concentration where development starts. Transportation nodes are triggered by the convergence of more than one form of transportation into a point which creates an interchange where the different modes of transport can feed into each other. An example of how a transportation node or interchange works would be a case where people ride their bicycles from home to board a train at the station. Since there is a break in transportation from the bicycle to the train within a node, this creates a concentration of people in these areas. Consequently, the concentration of people becomes an opportunity for the development of facilities such as shops, housing and offices that would be useful to the people at these nodes. The meeting point of different paths to form a transportation Node, can therefore initiate a commercial node.

Main Components of a transportation node:

Components that make up a transportation node differ with each specific situation and are based on the type of facilities that the node is planned for. For the purpose of this study, the following elements that make up a node will be studied for application in the Durban context:

1. Paths
2. Transportation station
3. Supporting Facilities
4. Public Open Spaces

1. Paths – are lines used or designed to be used by a viewer to travel between points. These include streets, roads, walkways and railroads (Lynch, 1960:47). Pedestrian walkways that connect the different modes of transportation are vital in facilitating circulation for pedestrians and the access of the different facilities within a node. While the walking distance for passengers from their work place or homes to the station should ideally be 1 kilometre (SARCC, 2006:6a), Alexander (77:183) suggests that the walking distance between the different modes of transport within a node should be approximately 90metres, with an absolute maximum of 180 metres.

2. Transportation station – since a node is a meeting point of different paths and transport modes, stations are provided to cater for the people boarding the vehicles. The railway station, taxi rank as well as the bus terminus constitutes such stations. These different stations make up the components of a transportation node. Parking for private vehicles can also be placed in this category. Since a taxi rank or a station can have commercial activities within it, the transportation station can become a node of activities on its own.

Hertzberger (1991:73) sees railway stations as public spaces, and as roofed parts of the city. This idea clearly indicates that stations have to be designed as covered streets, with facilities like shops, which cater for more than just rail travel. Stations can act as gateways to the city or precincts, this means that the building should be planned to orientate visitors not only at the station, but the city at large, hence the latest initiative to include tourist information centres in railway stations. The proposed new

Commuter Station is positioned to be a gateway to the Kingspark Sports Precinct.

3. Supporting Facilities -are developments that occur as a result of the transportation stations. These include amenities like housing, office and retail facilities. Since people are less inclined to use deserted interchanges, surrounding transport nodes with mixed use developments including offices and housing keeps the node lively. Railway stations have over the past few years developed to have quite diversified functions as they cater for more than just rail travel. This then raised the idea of catering for communities who arrive at the station with no intention to travel, but to visit the restaurants and other commercial facilities which have now became a major part of railway station buildings.

4. Public Open Spaces - are either squares or parks, and occur in between the buildings or the stations within a node. The square is a key element in a node as it acts as an arrival point for pedestrians and a central point of orientation .The squares should be given definition through buildings that surround it, thereby acting as edges.

In conclusion, a transportation node is made up of the different elements which include; paths, transportation station, Supporting facilities and Public open spaces. The different elements include indoor and outdoor spaces, which flow one into the other, and hence the need to look at the different elements as part of the whole node that facilitates easy pedestrian movement within it.

4.7 Environmental benefits of Rail

The environmental problems caused by all forms of transportation have become pressing topics throughout the world because of their implications to the well being of people in general. This section briefly discusses the predicament imposed by the transport system and highlights rail as a form that can be instrumental in reducing the negative impact of transport on the environment.

4.7.1. Rail and traffic Congestion

A standard, nine coach train combination for Durban accommodates about 1080 people. According to Mr. Ashley Peters of Metrorail in Durban. This number is equivalent to 18 buses of 60 people each. This clearly illustrates the efficiency of the train over the bus service and better still, over the number of taxis, which would be 72. This comparison shows the superiority of rail over its competitors in curbing congestion, especially if the drivers of private cars are also encouraged to use public transport. The idea that the railway travels on fixed tracks, suggests less accidents as expected with road transport.

People prefer using private cars because of the option of being able to drive directly to the desired destination and this is faster than public transport. In advocating the use of rail, this dissertation does not promote the absolute banning of the car but suggests measures that can be taken to regulate the use of the car in favour of rail. Options like car-sharing, and heavier car taxes have been investigated in different parts of the world in efforts to reduce congestion with varying degrees of success.

The on-going construction of freeways in modern cities to cater for the automobile only adds to the problem of congestion. This is because more cars are being acquired and driven into the city centres. Freeways also

use up much needed land in urban areas as well as becoming barriers that divide communities and create "lost space."

In Britain, there is an extensive use of the underground rail system which helps free up surface land for pedestrian boulevards and cycling lanes. Underground rail lines addresses the visual blight of rail within the city's visual form, as well as lessening the vibration of moving trains that can be felt when trains run on the surface. Although this system is successful overseas, it could be expensive to apply in an African city. In addition, hidden spaces like underground tunnels tend to perpetuate crime, as opposed to defensible spaces that are born from their position within the general public view. It is the duty of all architects to ensure that the spaces they create counteract crime opportunities, especially in a South African context where crime is rife. However, this idea could be applied in fewer areas, including the station precincts where there is need for ample surface land for pedestrian circulation, instead of an extensive underground system.

4.7.2. Rail and Air pollution

According to the Automobile Association findings in the United Kingdom alone, road transport comes in as the third worst air polluter after Power stations and other heavy industries (Morris, 1993:158). This trend shows the extent of the damage caused by automobile fuel emissions globally. Fuel emissions from road transport have been proven to cause many different diseases in humans as well as contributing to global warming. The extensive use of environmentally friendly transportation types such as rail helps in reducing the negative air pollution effect inflicted on society by road transport.

4.7.3. The Green- Gold coalition

Green-Gold refers to the initiative of promoting economic development through environmentally friendly methods (Goodwin, 1993:258). The word *gold* refers to the economic development of enrichment, while *green,* stands for environmentally friendly methods. This ideology can be applied to all sectors of human existence. In transportation, this can imply the promotion of methods that deal with air pollution and traffic congestion for the betterment of the environment, while addressing the business of having to transport large numbers of people efficiently. Rail is the transport section's strongest candidate in partnering with the global Green-Gold concept, because of its ability to move about a significant number of people in one coach-set while limiting toxic fumes emission.

The argument for Green-Gold promotes the idea that remedying pollution is costly, hence the need to reduce it, while environmentally friendly methods are sustainable and thus ensure long term economic growth.

4.8 Conclusion

From its inception to date, the railway station typology has evolved with the times in order to meet the needs of each specific era. The need for the creation of efficient public buildings by designing spacious internal spaces through the application of the arch and other large spans structures has continued to characterise the typology.

In conclusion, this research reveals that rail offers an efficient transportation system which addresses most of the problems caused by road transport. In a bid to promote an extensive use of public transport, investment to rail as the most viable transport system, is irrefutable. This would help in the effectiveness of transport networks in the city, while not compromising the natural environment through air pollution.

Chapter 5- Precedent Studies

5.1 Introduction

The architecture of railway stations has over the years evolved. This is as a result of various architect's initiatives in trying to find ways of enhancing the travellers' experience before and after their train journey. Diverse elements like natural lighting, ventilation and image have been explored by different architects in many ways. This has been done in a bid to improve the station environments, as well as to bring serenity and a sense of place in these fast-paced precincts. In this chapter, three international station examples are analysed and conclusions drawn from each design approach for application to the Proposed Station project.

5.2 Lyon Airport Station- completed in 1994

Client: French National Rail Company

Architect: Santiago Calatrava

Location: Lyon Airport, Satolas. France

The Station was designed as a facility for the high speed rail that transports passengers from the Lyon city centre and surrounding suburbs to the airport. The brief required the design of a station that would accomplish this task, while creating a regional landmark. The architecture was required to complement the elegance of the trains themselves, hence the iconic design.

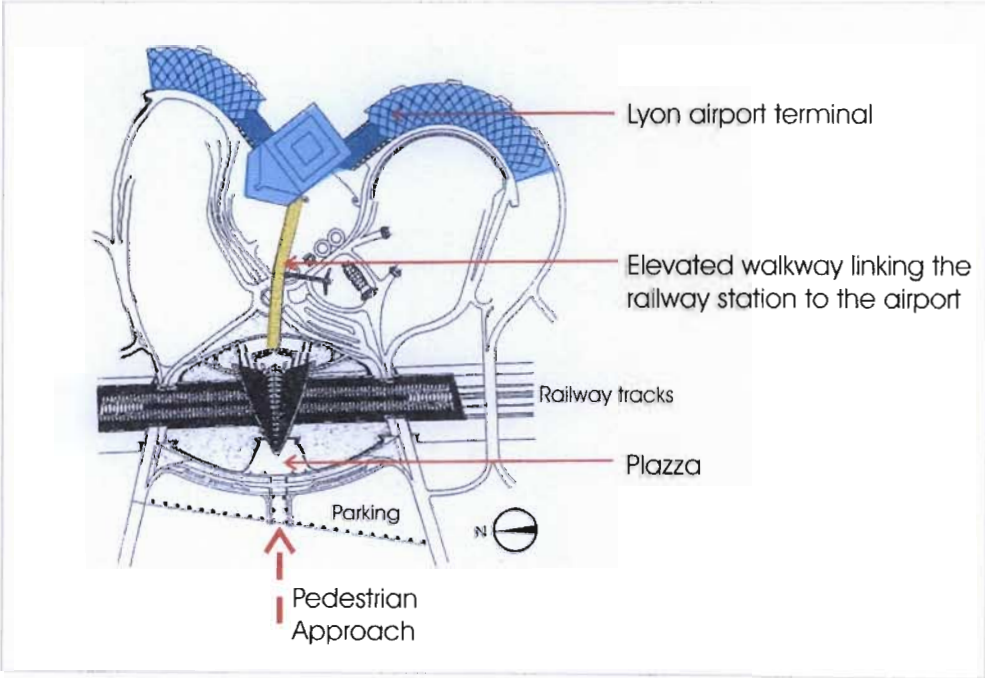


Illustration 18: The Lyon Airport Station Site plan in relation to the Airport terminal (Author / Slessor, 1995: 36)

Illustration 19: An exterior rear view image of the station demonstrating the covered circulation linking the Main hall to the platforms and the airport (Gazzaniga, 1994: 40).

Background: The station has six tracks passing through it. Four tracks serve the platforms, while two go through without stopping. The 500 metre long Platforms were determined by the length of the high speed trains serving the Station.

Circulation

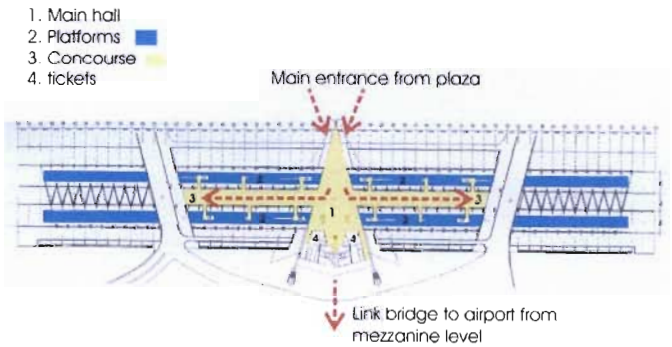


Illustration 20: A plan of the Station illustrating the circulation pattern internally (Mertz, 1994:63).

In this station, passenger circulation to access platforms that are positioned far apart is achieved through the extension of the concourse to reach to the ends of the platforms. The same platform situation occurs on the proposed Commuter Railway Station site. The study of this example will therefore be instrumental in informing the design of the proposed Commuter Railway Station.

The Hall which is triangular in plan shape, is the main arrival point to the Station, and acts as a gateway to the airport. It also has a high volume to emphasize its hierarchy over the rest of the Station spaces.

The ticketing offices on the ground floor and escalators to the mezzanine level are located straight ahead from the entrance for easy orientating of the passengers. The Hall is located in the middle of the Station. From the Hall, passengers walk to either end through the walkways, and make their way down to the platforms using a vertical circulation which includes stairs, lifts, and escalators.

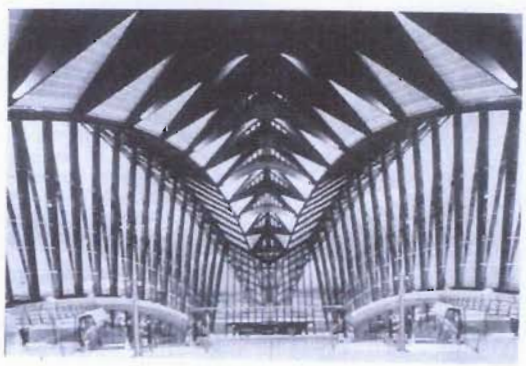


Illustration 21: A view of the Main Hall interior (Edwards, 1997:66)

The 120 x 100m triangular main hall has a 40m high volume which denotes the importance of the space. According to the architect's concept, this is the "belly" of the 'bird' and is translucent to allow light in. The Architect chose to express the massive steel structure that gives form to the space. The structure resembles a skeleton, and it is a way of carrying through the 'bird' concept of the building. The volume of the internal space epitomises the great railway sheds of the Nineteenth Century.

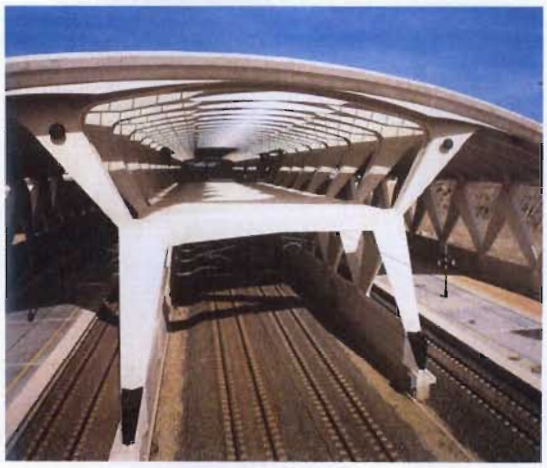


Illustration 22: The concrete concourse above the tracks links the main hall and the platforms. Natural lighting is utilized along the walkways, to help guide passengers through. (Mertz, 1994: 92)

Illustration 22 shows the biomorphic concrete structure covering the platforms. This is made of in-situ concrete, to achieve a seamless finish on the final product.

Technology

The roof covering the Main Hall converges towards a point which resembles a birds 'beak' as it touches the ground. The roof valleys channeling rainwater also converge at this point for drainage.

Steel is the main material for the canopy covering the Main hall with glass panels as in-fill. Steel was used because of its ability to achieve clear wide spans without columns to disturb the flow of people within the building.

Project Strengths

- The use of Steel has helped to achieve large clear span space in the Main Hall. This is key in attaining column-free circulation spaces in the Station.

- The extensive use of natural light which immerses the Main hall and the main spaces of the Station create a feeling of voluminous spaces and better legibility of the Station.

Project Weaknesses

- Whilst achieving total covering of the platforms, the architecture of the platform covering and the Main hall are unrelated. The use of concrete over platforms and Steel on the Main Hall creates two different representations.

- The seemingly imposed triangular shape on the Main Hall has the narrower end towards the entrance. This planning suggests a

constricted entrance instead of a wider one which gives a welcoming gesture to the passengers.

In conclusion, the dominating main roof marks the Station as a landmark, which also characterises the building as a symbol of the region. This on the other hand, defines the high volume of the internal Hall that is required to create a comfortable space for large crowds of people. The success of the design is also revealed by the fact that, tourists visit the Station with no intention to travel at all, other than to admire the grandeur of the architecture (Slessor, 1995:36). The Lyon Airport Station demonstrates the different treatment of volumes within the spaces required inside a station in order to differentiate the more important areas from the lesser ones.

5.3 Stratford Station- completed in 1999

Client: London underground

Architect: Chris Wilkinson Architects

Location: London. United Kingdom

The brief requested that the architects acknowledge the importance of the area as a regional interchange, where different rail lines converge, and to create a civic symbol which denotes the primacy of the precinct.

The station uses natural draught drawn from the bottom of the main canopy, which flows out through the top of the building to cool the interior of the Station. The Station planning also demonstrates the intended simplicity that achieves legibility for passengers within the station, hence its selection a precedent.

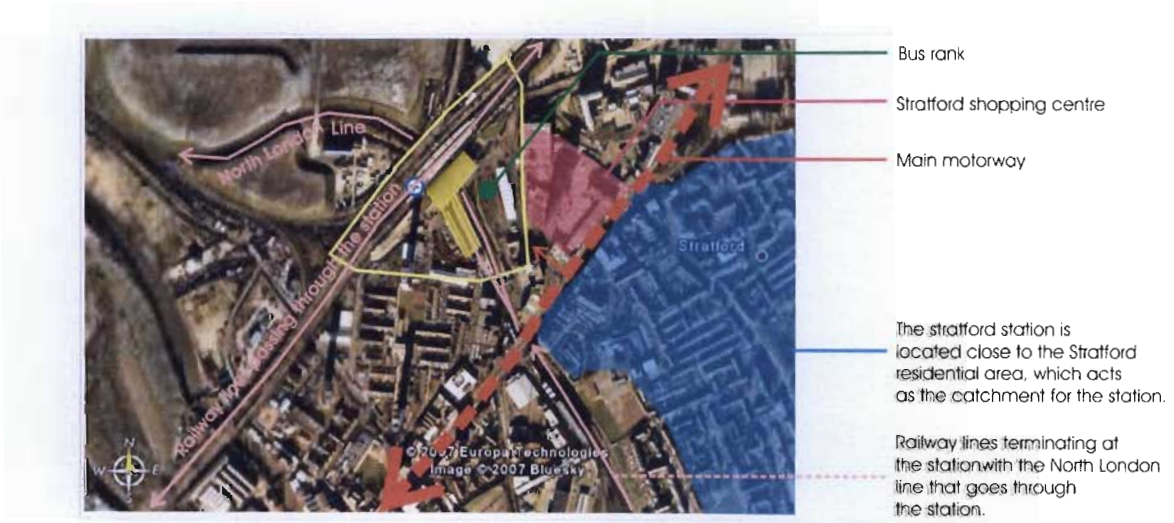


Illustration 23: An aerial view of Stratford Station (Author / Google, 2005)

The architect's approach in creating a landmark building that amplifies the significance of the node was a system that combines form, structure

and climatic control like a tree (Davey, 1999: 58). This approach ensured the creation of an efficient iconic building.

The station was meant to be a catalyst for revitalising this part of London, and the site is located adjacent to a bus rank and car park, and as such, can be seen as an interchange.

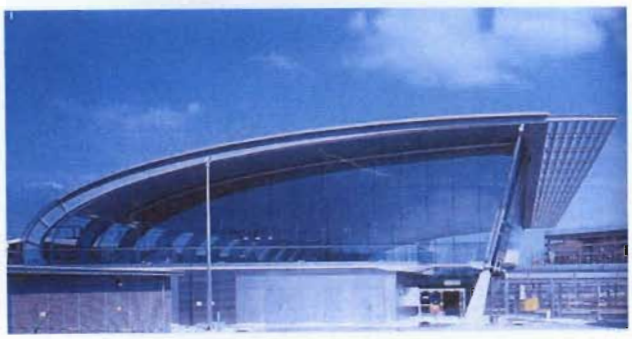


Illustration 24: The landmark status of the building is achieved through a minimalist and thermally sound structure. (Russell, 1999: 116)

Image: The station building has an almost perfect quarter ellipse with a big airy volume inside which is enclosed with glazing all-round, to allow for maximum light inside the Station. The canopy is projected to provide deep overhangs that protect the glazing from being over heated by the sun. Located at the centre of the precinct, the Station building is the main point of orientation and the glass walls allow for viewing on all sides of the building for observation of the entire precinct from a higher point.

The ceiling is made up of silver-finished metallic slats, which reflect floodlighting at night to maintain the theme of a light-filled volume that is achieved through the glazed facades during the day.

Circulation

From the busses and cars, the pedestrians arrive at a large plaza in front of the Station entrance. The plaza is essential in orientating people in an interchange as it acts as the central external place of arrival.

The Station facilities are on the same level as the platforms since most of the lines terminate at the Station, and a direct connection between Station and the platforms is ideal. The North London line however, runs through the building under a walkway accessed through lifts, stairs and escalators. The raised walkway ensures safety for passengers by separating them with the trains.

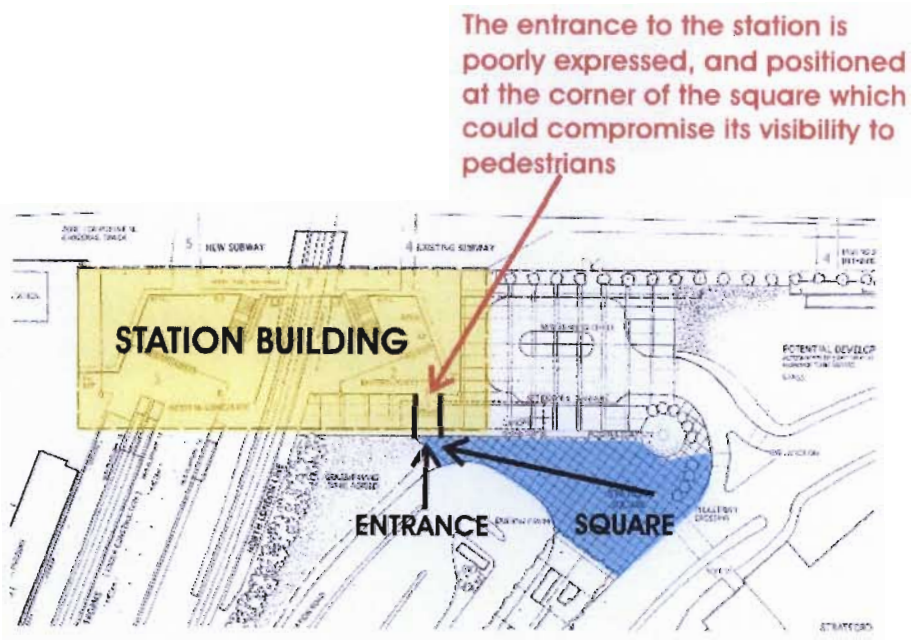


Illustration 25: The Station plan. The square is vital in orientating passengers within a node. The entrance to the Station however, is not well emphasised as main (Davey, 1999: 59/ Author).

Because of the small size, and the simplicity of the Station planning, a passenger has a view of the ticket machines and the platforms, from the

entrance since they are all located in the same level. This facilitates an easier process for the passenger using the Station.

Technology

The ellipse springs from the embankment in a series of curved plate girder ribs which taper in cross section along their length away from the embankment, in both depth and width (Davey, 1999: 58). The girders are linked with horizontal steel tubular members and cross-bracings to create a giant vierendeel truss of the entire canopy.

The load of the structure is carried by four massive concrete piers, which transfer the load of the building on these four points in-between the tracks. The piers are designed to take flying bits from passing trains so that the structure of the station would not be disturbed in the event of accidental contact.

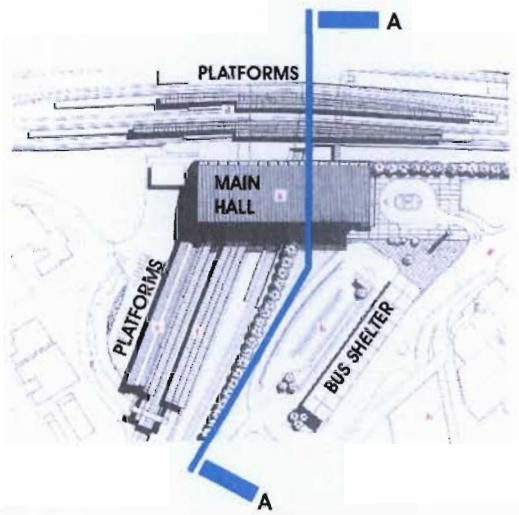
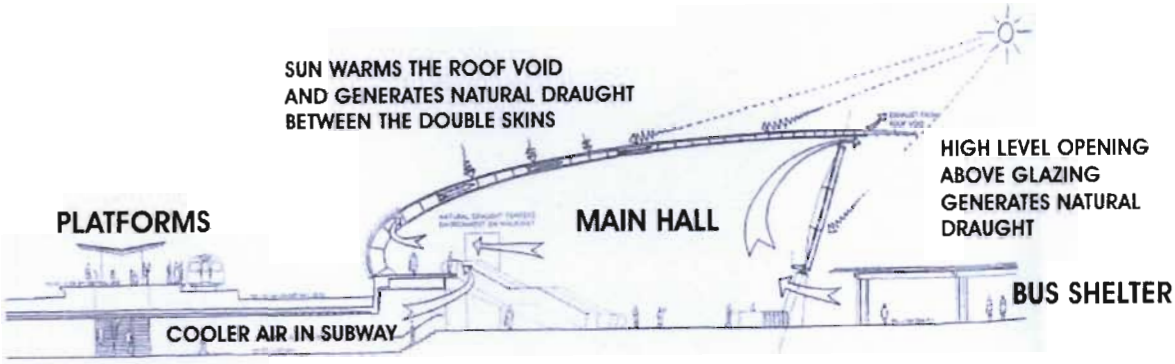


Illustration 26: The overall architecture of the precinct looks fragmented because of the difference in scales between the roof of the main hall and platforms. Section A-A on illustration 27 shows the varying levels of the Main Hall and Platform roofs. (Davey, 1999: 59)

Environmental Response



SECTION A-A

Illustration 27: A cross-section demonstrating the ventilation technique of the Stratford Station building, which is through convection cooling. This drawing also shows the different roof forms of the Platforms, Main Hall and Bus shelter, within the same precinct. (Davey, 1999: 59)

The overall shape of the roof suggests a convection mechanism. While the outer skin is being heated by the sun, the voids between the girder ribs act as channels for natural draughts that draw relatively cool air from subways and outside. This process of drawing air allows it to pass through the main volume inside, which reduces the temperature of the internal space. This is a good example of passively controlled internal climate, and is it becomes more efficient when the sun gets hotter.

Project Strengths

- The building achieves an efficient thermal system within its elegant roof from, without any chimney stacks protruding out.
- The location of the Station as a central building in the interchange makes it to be easily recognizable as a landmark.
- Louvres on the South side cut the sun rays to the slanted façade, while articulating the edge of the canopy.

Project Weaknesses

- The Station entrance from the square is not easily recognizable as a focal point.
- The architecture of the main building and platform canopies is fragmented. While the main building is elegant, the platforms are covered with simple shelters that do not resemble the aesthetics of the main building as indicated in the section labeled, illustration 27.

In ending, the Station demonstrates a skill of combining environmentally friendly techniques with the creation of meaningful architectural form. This idea is relevant for Durban as the climate calls for the creation of sustainable architecture to minimize the cost of maintaining the building through mechanical means.

5.4 Olympic Park Rail Station- completed in 1998

Client: Olympic Co-ordination Authority

Architect: Hassell Architects

Location: Sydney. Australia

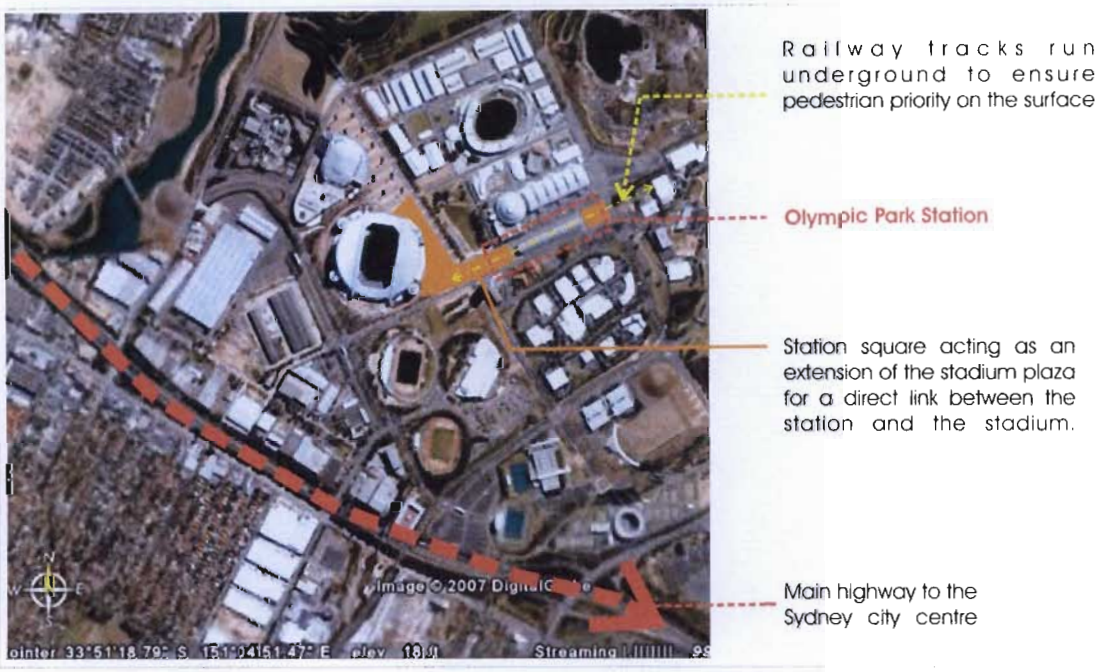


Illustration 28: An aerial view of the Sydney Olympic Park showing the position of the Station in relation to other facilities within the precinct. The main open space between the Olympic Stadium and the Station, acts as the orientation point for pedestrians within the node. (Author / Google, 2005)

The Olympic Park Station is located in a similar context to the Proposed Station in that it was designed to transport people to and from a major Sports Precinct. The Proposed Station is planned to service the Kingspark Sports Precinct which includes the NDS while the Olympic Park Rail Station was designed to serve the Olympic Park in Sydney.

Illustration 29: A bird's eye view of the Olympic Park Station (Caro, 1998: 61)

Technology: The canopy which is the main visual element of the Station is formed by arched tubular steel sections which are clad in 'zincalume' sheeting. The ridges are sealed with glazing panels to allow natural light into the Station. The arched steel tubes rest on tapered concrete columns that form the base of the canopy.

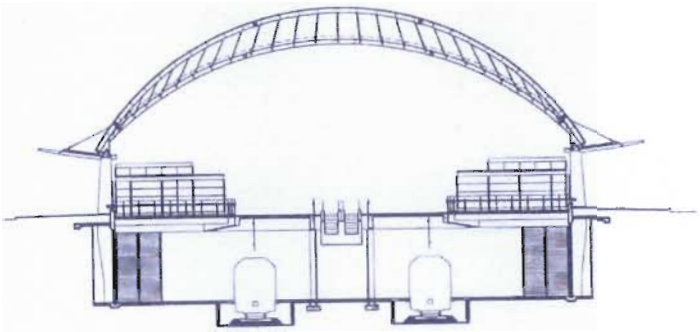


Illustration 30: A Cross section through the Olympic Park Station showing the voluminous interior capped by a lightweight steel canopy (Caro, 1998: 61)

Circulation: The strongest idea in the planning of this Station is the uninterrupted straight lines of movement from the arrival hall through to the walkways leading to the platforms. The efficiency of the horizontal circulation is supported by the combination of stairs, escalators and lifts between the concourse and platform levels. The concourse, which is at ground level, is entered through the plaza, and the second level, and the platform level is located at the basement.

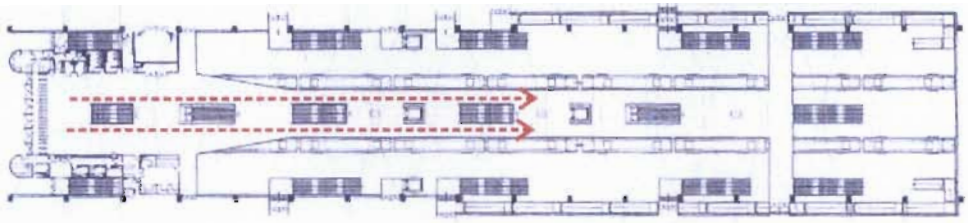


Illustration 31 The Olympic Park Station plan demonstrating the legibility needed to channel passengers through a Station, achieved in this case through the liner planning of the concourse, parallel to the platforms (Caro, 1998: 59)

Illustration 32: A long section through the Olympic Park Station illustrating the movement of the trains at the basement level to free up the surface for pedestrians (Caro, 1998: 59)

Urban design aesthetics: Following the alignment of the platforms, the Station sits parallel and above to the tracks, and terminates with a plaza on either ends. The advantage in this is that the tracks are hidden below the plaza as they get to the Station, freeing the surface for pedestrian priority spaces. The idea of hiding the tracks underground is not only ideal for noise reduction, but also in eliminating the visual blemish that railway overhead lines can place on the image of an environment.

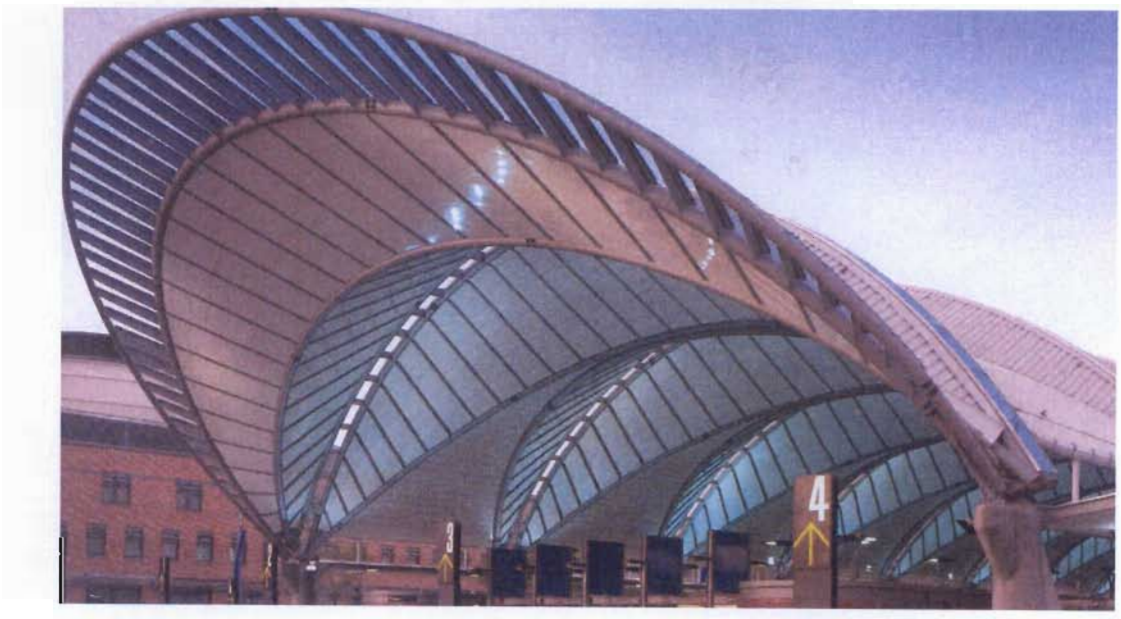


Illustration 33: An illustration of the over-sailing canopy above the plaza as a welcoming gesture to commuters. (Caro, 1998: 61)

Image: The architecture of the single barrel vault that covers the Station speaks the same language as the other roofs within the Olympic Park. The premise of *'form follows function'* is clear in the design of this Station since the arched roof does suggest the two story height voluminous Hall inside. According to architect, the combination of a well lit roof and the breathtaking volume suggest the light and sleek image of the new trains using the Station.

Project Strengths

- The generous square is instrumental as a point of orientation within in the precinct, and links the Station to the rest of the Sports precinct.

Project Weaknesses

- While the Station can handle up to 50 000 passengers per hour, attending sports events in the precinct. There is however no retail included within the Station, or nearby housing to support the Station on a day to day basis. The Station is therefore designed as a mono-functional travel entity which could be quite when there are no travelers, and thus making it an unsafe place.

To conclude, the Sydney Olympic Park Station acts as a gateway to the entire precinct and hence the character of the stadia echoed on the Station materials to display a sense of identity and belonging. The Station functions efficiently in terms of passenger handling, but apart from the architectural language which represents the entire precinct, the Station lacks a sense of place. This is due to the fact that, the Station does not have any other functions like shops within it, which could bring vibrancy to the Station.

5.5 Conclusion

Volume is a key component in differentiating spaces in terms of their hierarchy as demonstrated in the internal volumes of the Lyon Airport Station. The Main Hall is highlighted from the extended concourses leading the platforms through its higher volume. From outside, the dominant roofs form which envelopes the Main Hall is easy to read as the focal point of the building. This is helpful in orientating approaching passengers from the parking area towards the main entrance. On all three precedents analysed in this chapter, steel is the main material utilised to achieve wide span roof structures, in a bid to eliminate columns which could interrupt circulation.

In South Africa, platforms are usually only covered partially, which becomes a challenge in cases of inclement weather. The Lyon Airport Station and Sydney Olympic Park Stations demonstrate a practice of treating these spaces as well-ventilated indoor rooms. Enclosing the platforms also helps in unifying the architecture of the station in general, as opposed to creating platform shelters that seem separate from the overall station form.

For light and ventilation, the entire side facades of the Lyon Airport Station and Statford Stations are glazed to allow maximum natural lighting to immense the interior while using innovative ways such as long overhangs to create sun shading which protects the buildings from overheating from direct sun rays.

In terms of circulation, these international examples combine lifts, stairs and escalators for vertical circulation. This is because escalators have the ability to transport large masses of people within a short space of time,

while stairs need less maintenance. Stairs are also instrumental in a case where escalators are out of order, and the lifts are needed to cater for the disabled.

Although the European climate is different from Durban's, the architectural decisions taken to enhance the space character and the legibility of the station's circulation can be applied in the design of the proposed new Commuter Railway Station in Kingspark.

6.1 Introduction

In this chapter, railway stations in Durban will be analysed. As well as a brief historic overview and recent initiatives done by local architects in South Africa to improve railway stations in the city. This initiative was first carried out in Soweto (Beni, *1997*: 3) and was aimed at changing the image of the stations, from a worker's transportation system to being a worthwhile option for all sectors of the community. The local examples analysed in this chapter namely, Berea Road, Umbilo and KwaMashu Stations have been part of this country-wide revamping project which has now been realized in Kwazulu-Natal. Subsequent to this, was the need for this study to analyse conditions of current stations in Durban and establish principles for further development of the railway within the city and the rest of South Africa. This would ensure a continued role of the service in the growth and efficiency of South African cities.

6.2 A brief Historic background of Railway Stations in Durban.

Commuter and transportation railways have been an integral part of the growth and development of Durban since its introduction to the city in 1860. Its inception prompted a new typology of buildings which have become a valuable part of the architectural heritage of Durban.

On the 28th of June 1860, the first train in South Africa made its trip from the Point to Durban. This train was second only to the Egyptian Railway on the entire continent of Africa (Campbell, 1951:1). The railway soon become a key transport system for goods and later for people, which then helped in the overall development and planning of the City of Durban.

The advent of the railway created architecture which opitomised the era in which they were built, the old station building in Durban as seen in illustration 34 is one such an example. The old station complex buildings have now been converted into a new precinct because of its prime location in the city. This has become the Workshop shopping Centre, the Gym building and the Tourist Junction, which used to be the offices of the Natal Railway company. While the function of the buildings has changed, their architectural heritage still enriches the cityscape of Durban.

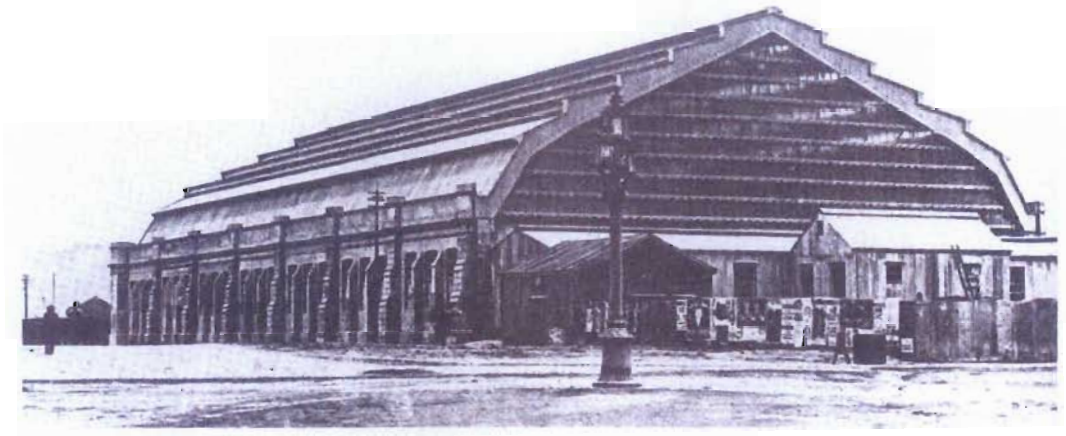


Illustration 34. The old Durban Station employs heavy iron trusses to achieve a clear span over the platforms. Built in 1893, with engineering details done by Mr. Butterton, the building still stands to date and serves the city as a gym .(Daniel, 1975:18)

The Main Station was later moved from the Centrum Site to its current Umgeni Road position. The relocated station building in Umgeni Road and the construction of more stations in the province occurred when the railway had become a workers' mode of transport. This factor influenced the design of the new stations which also saw the decline of railway prominence from being a novelty in the early 1900s, to being a lower class method of transportation.

The policy of Apartheid contributed to the negative perception of railways in South Africa. Black people, who were automatically categorised as lower class became the main group of people using

the railway facilities. The architecture of stations in the 1970's then became a 'hard' utilitarian one, as a response to the vandalism threat ostensibly posed by the oppressed group. This design approach was also a way of minimising maintenance costs. The design of stations was then reduced to a response to theft and vandalism, instead of the creation of a welcoming environment (Beni, 1997:2). The tough pragmatic look was achieved with exposed concrete which was a popular material for Modernists at that time (Fisher, 1998: E2).

With the new democratic dispensation, architects throughout South Africa heeded the call by the Department of Transport to improve the image of the railway service, and Durban was no exception. This national initiative is aimed at re-establishing the railway as a major passenger transportation system to benefit the entire South African community, instead of just catering for its current market- the workers. This is expected to improve the efficiency of public transportation in the country's cities. The concept of using rail as an effective, all-inclusive public transportation system has been initiated in the Gauteng province through the new Gautrain project.

6.2.1 Upgrading of stations in Durban

Local architects were commissioned in 1994 by the railway managers - Intersite, to carry out research on how stations could be improved in the province. Since rail was looked upon as a Black workers' mode of transport and the policies of Apartheid in operation in the 1980's in favour of the White community, the development of rail facilities in Black townships was ignored. This instigated the stigma now attached to rail as a low-grade means of transport. The architects who initiated in this study included Viles Mikula Architects and Planners, Derek Van Heerden of East Coast Architects, Janina Masojada, Laren Beni and architects from Protecon as well as Craig Simmer who is a civil engineer

and Norman Freeman of Metrorail- (the main operators of the commuter train service). The research carried out culminated in the following suggestions by the professionals:

- A change from Apartheid's social engineering to social architecture.
- Balancing requirements of Metrorail with commuter needs.
- Developing the commercial potential of the station precinct from hawker to anchor tenant.
- Facilitating Intermodal Transfer Facility developments.
- The study and understanding of passenger trends within and around the stations in order to respond to the patterns that shape the planning of railway stations.
- The creation of better environments in the station and on the train itself as well as establishing a better transition between the two.
- Passenger comfort and Legibility of routes within the station.
- As well as establishing support services which complement the function of a railway station. Beni (1997: 2):

These ideas were a response to a new political climate in South Africa which came about after the first democratically elected government. The aim was to find ways of creating a people centered architecture as opposed to one that imposes upon the people. Examples analysed in this study explore some of these principles, as relevant to their specific contexts.

6.3 Major Railway Routes and Stations in Durban

According to Spoornet's resident architect Dave Stromberg, the KwaMashu to Umlazi route within the overall KwaZulu-Natal network carries about 60% of the province's total commuter trips. This is why the stations on this route, as demonstrated in illustration 35, were earmarked for revamping in an effort to improve the main railway route in the province.

Stations along this route are categorized according to size and function. For the purpose of this research, a station in each of the following categories will be studied. According to Mr. Stromberg, the categories are: Main inner city stations, Intermediate stations and Terminal stations. The stations to be analysed in this research will be the Berea Road Station as an Inner city station, Umbilo Station as an Intermediate station and the KwaMashu Station as a Terminal Station.

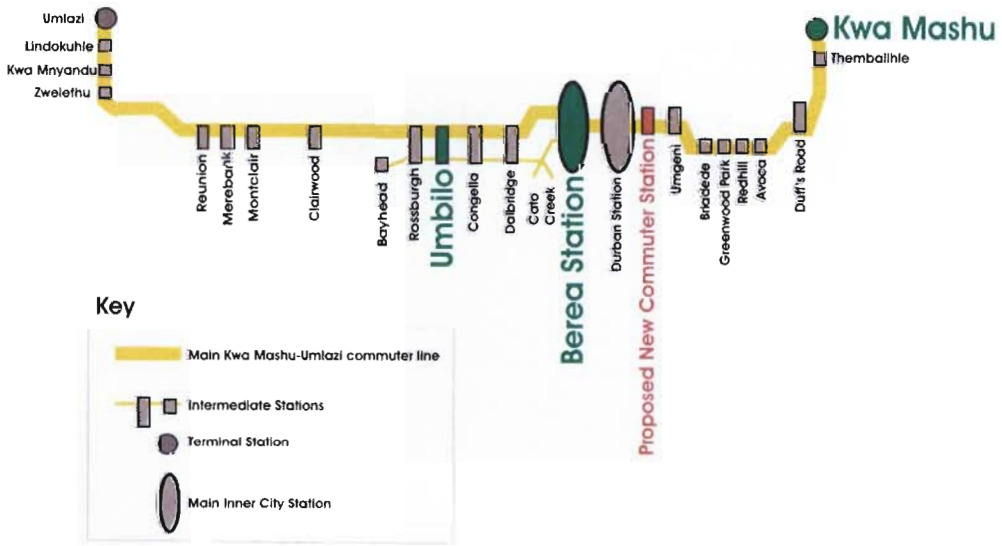


Illustration 35: The drawing highlights the Stations analysed in this research, as well the position of the Proposed New Commuter Station. The new Station will assist, primarily in the efficiency of KwaMashu to Umlazi the line, as well as to serve other destinations within the province, which are illustrated on Appendix D of this document. (Author)

6.4 Berea Road Station - completed in 1973

Client: Intersite Management Services

Architect: Protecon Architects

Location: Berea, Durban

Location: The station is located at the Warwick Triangle which bustles with about, 2000 taxis, 140 000 daily departures on trains and Buses and 460 000 pedestrians passing through it each day (KZNIA, 2001: 6). Its location therefore makes the Berea Road Station the busiest in the Province.

According to Dobson (KZNIA, 2001.p6) the development of Warwick Triangle was selected because of the flat land which was ideal for the construction of bus shelters at the edge of the city. This site was further supported by the planning of a "White City", which promoted edge city developments of modal interchanges. The same principle led to the relocation of the Durban Station from the city centre to its current position on Umgeni Road. These initiatives were supported by the fact that the city centre was purposefully reserved for the White community, hence the view of locating the Black people's transportation on the periphery of the "White City".

The entire Warwick Triangle precinct appears, unhygienic and is faced with uncontrollable trade growth and crime. Despite this, the precinct is vibrant because of the multiplicity of activities that keep the area buzzing from about 4:30 am to 7:00 pm when the shops and vendors close.

Illustration 36: A site plan showing the location of Berea Station in relation to the city centre and Warwick Triangle. The station acts a bridge for pedestrians going across from either side.
(Author / Google, 2005)

Railway services have left deep dividing scars within the city, and as such, have brought about the need to bridge them in order to re-integrate communities. The Berea Road Station achieves this by acting as a bridge between the Warwick Triangle and the city centre. The Station is kept accessible to pedestrians who have no intention to board the trains except to cross over the tracks. In this way the Station is a key element in the urban design system of the city (see illustration 36).

The railway station's ideal functional context is as an interchange; because of the other transportation means that rail has to be

connected to in order to facilitate a smooth transition for passengers. Berea Road Station is no exception, and since people working in the Berea and the city centre use taxis and buses to get to the Station, it is therefore bordered by taxi and bus ranks which establish a link between the different transportation modes.

Since Warwick Triangle is such a busy precinct however, there is need for a transition zone between the taxis and the station in a form of a plaza. Currently passengers coming out of the station towards the Warwick Triangle face the problem of coming out onto fast moving vehicles on the street. Overhead pedestrian bridges have been built in an effort to deal with this situation. The bridges sometimes get extremely congested as they are lined with vendors along their sides (illustration 37). Another factor is that narrow walkways cannot efficiently handle large crowds of people streaming in and out of the Station, hence the need for an open public space like a square.

Illustration 37: As an alternative to a plaza, the Berea Road Station is connected to the Warwick Triangle through walkways, which sometimes get over crowded. The overcrowding demonstrates their inefficiency as a transition between the station and the surrounding area. (Author)

Circulation: In the station, the platform level is located at the bottom level of the building with the concourse above it. This idea is essential in creating a safer place for passengers by separating the trains from the concourse.

The general, planning in the concourse follows a rectangular form which suggests straight lines of travel within the Station. The absence of a common central space within the Station and the separated planning of the ticket sales and turnstiles however, suggest that a first time visitor could find it difficult to navigate the station easily. The Station therefore does not act as an instrument (Hertzberger, 1991:170) which is legible to all commuters apart from regular users (Illustration 38)

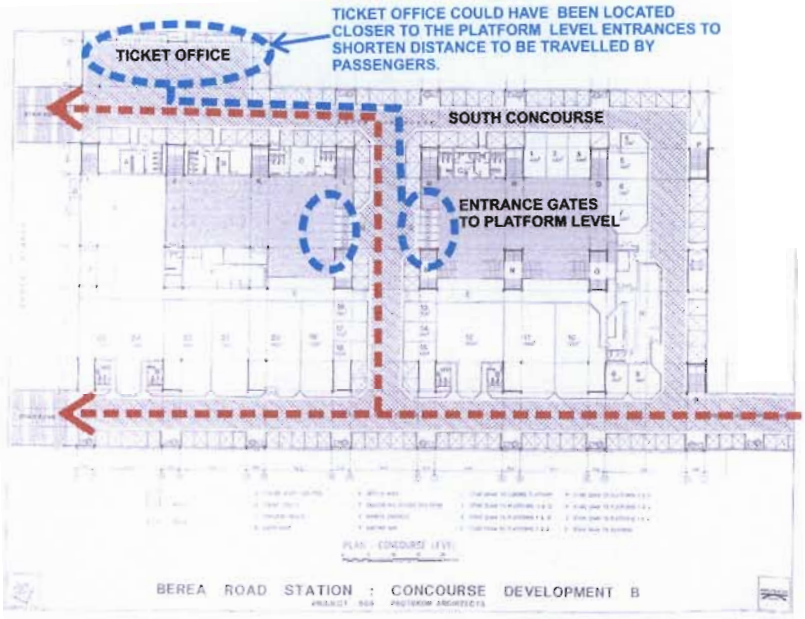


Illustration 38: The Station plan illustrates a rectangular grid planning. The relationship between the Ticket Office and the turnstiles, as indicated on the plan is not ideal as it creates undesirable cross-flows between the two points. (Author / Protecon architects).

Rapoport (1977:12) differentiates between designed and non-designed spaces, arguing that ordering space according to stated rules gives rise to an ideal environment. Unordered activity within Berea Station creates circulation difficulty. This refers specifically to the overcrowding of passages by Informal traders, which reduces the circulation space in the station. The solution here is to plan more vending areas within, or preferably outside the Station as suggested on the Stations Upgrade programme for KwaZulu-Natal, mentioned at the beginning of this

chapter. The views of the architects include the suggestion that, vendors should best be located on the periphery of an external square, while the internal commercial facility could be a formal tenant type (Beni, 1997: 2).Illustration 39 demonstrates the crowding caused by vendors inside the Berea Road Station.

Illustration 39: A picture illustrating uncontrolled informal traders along main circulation routes. This trend narrows these walkways, which affects the efficiency of the Station. (Author).

Image

The building is a utilitarian concrete structure with a flat roof that leaves little room for expression of different spatial treatment to differentiate different spaces within the station. The utilitarian concrete structure was adopted to emphasise the functionality of the Station over architectural aesthetics. The concrete envelope of the building suggests that the structure is internally focused and the building does not engage with its immediate environment.

The monotonous flat concrete roof not only compromises the dynamism of internal spaces, it is also not an ideal solution in terms of dealing with rainwater since flat roofs are less efficient in draining rainwater.

Alexander notes that a lower ceiling denotes intimacy, while a high ceiling symbolises formality (Alexander, 1977:877). This means that higher volumes are more inviting and welcoming, while lower ceilings give an impression of restriction and exclusivity. When the ceiling level is constant within a station, important spaces can easily be missed since their relevance as a space is read to be the same as that of lesser spaces(illustration 40).

Illustration 40: An interior view of the Station illustrating the uniform ceiling level that occurs throughout the Station, without the variety of higher volumes to differentiate the importance of the Ticket Hall over the circulation corridors. (Author)

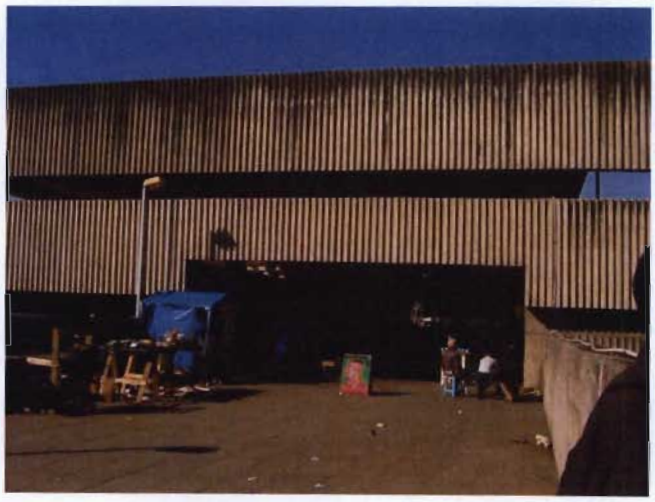


Illustration 41: A Typical exterior concrete façade of the Berea station demonstrating the utilitarian look of the Station. (Author)

Environmental response

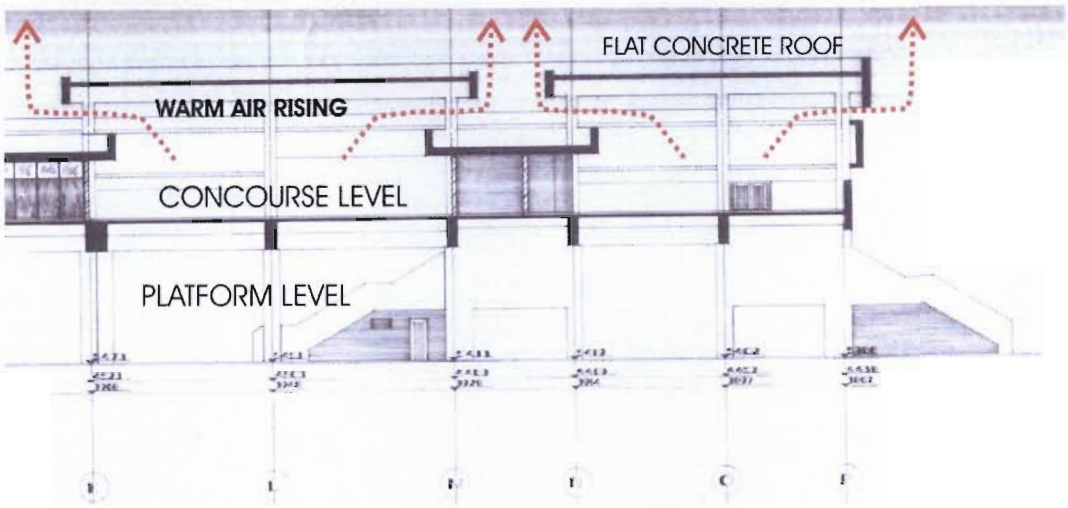


Illustration 42: A Typical cross-section though the Station concourse demonstrating the use of the ventilation gaps in releasing warm air from the building , as well as allowing natural lighting along the corridors for legibility. (Author/ Protecon Architects)

The envelope of the building is made up of concrete grid segments as seen on the section drawing in illustration 42. The segments have gaps in-between them to allow for the ventilation of the Station. The principle applied in the design of the Station is that warm air generated by the crowds of people on the concourse rises and escapes through the openings on the higher level of the room. As the warm air is released to the outside, the interior is left cooler.

Illustration 43: A picture illustrating the high-level openings which allow for natural lighting and ventilation in the Station. (Author).

Project Strengths

- The Station forms a bridge which is accessible to the general public and links Warwick Triangle to the city centre.
- High level opening to ventilation to allow hot air to escape.
- Natural light within the station is at a high level designed along the circulation spine for easier orientation.

Project Weaknesses

- There is a need for an external arrival point like a square, outside the Station to create a sense of pedestrian priority in the Station precinct. Walkways which channel people out of the Station get congested and are therefore not ideal as overflow spaces for the Station.
- The plan in made up of a series of corridors lined by shops instead of a central main hall which allows easier movement of pedestrians within the Station.

In conclusion, Railway tracks usually divide the city into two, and as seen in the Berea Station scenario, the Station links the city by forming a bridge across the railway tracks. This means that not only does Berea station cater for its passengers, but also acts as a bridge for pedestrians traveling from Warwick Junction to the city centre. Berea station therefore forms a linkage between Warwick Junction and the city centre.

In this analysis one can conclude that interchanges are important not only for the train passengers but also for the rest of the city. It is for this reason that one can conclude that the proper design of a station together with the integration of its planning with the existing fabric of

the city is important for the overall network of roads and pedestrian footpaths in the city.

Safety and efficiency are key aspects of making user-friendly transport nodes. As a proposal, the inclusion of housing in a transport node towards creating a compact city development would bring surveillance over the public spaces while a linear planning pattern exposes shops and services along the main lines of movement for maximum frontage.

6.5 Umbilo Station - completed in 1999.

Client: Intersite Management Services

Architect: Langa Makhanya and Associates

Location: Umbilo, Durban

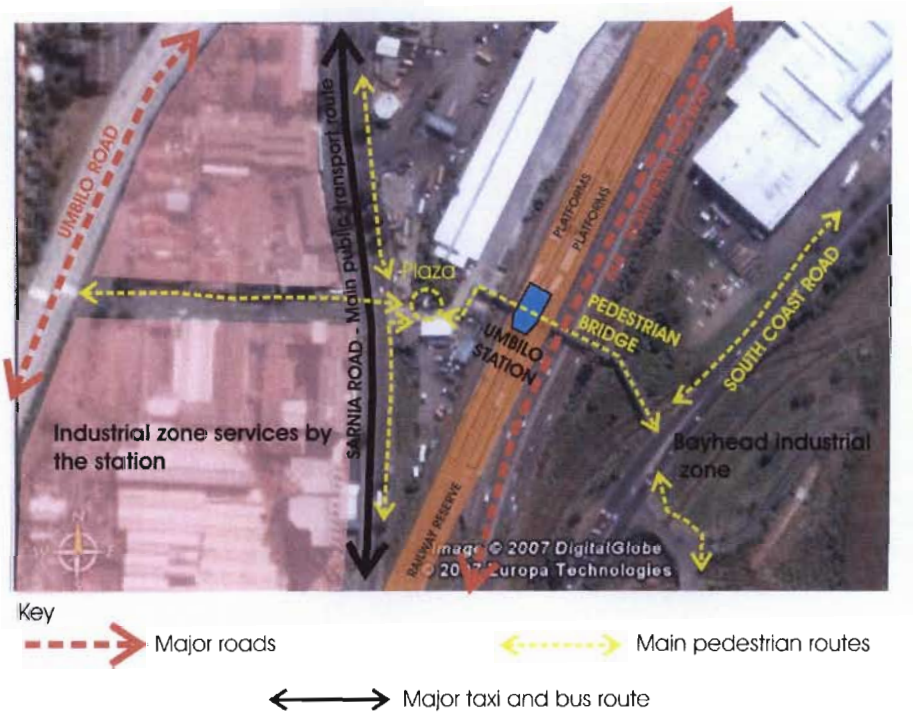


Illustration 44: An aerial view of Umbilo Station (Author / Google 2005)

Illustration 45: A covered pedestrian bridge to the Station. Portions of this bridge have mesh as illustrated in the above picture to prevent people from throwing objects down on the moving trains. (Author)

Umbilo Station can be categorized as an Intermediate station, as it occurs between Umlazi and the city centre. The Station serves the Umbilo and Bayhead industrial areas. As indicated in illustration 44, the main feeders of the Station apart from pedestrians are the taxis and busses traveling on Sarnia Road.

The Station has a square in front to receive people from Sarnia Road as well as an arrival space for passengers from the Station.

Circulation

Like most stations, Umbilo forms part of a pedestrian walkway that bridges across the South Coast Freeway and railway tracks to connect the suburbs of Umbilo and Bayhead. A large number of people pass through the Station as a thoroughfare, and as a result of this, the station is fully accessible to the public. This highlights the role that the station plays in keeping an existing urban connection route alive instead of closing it or diverting people away from the station.

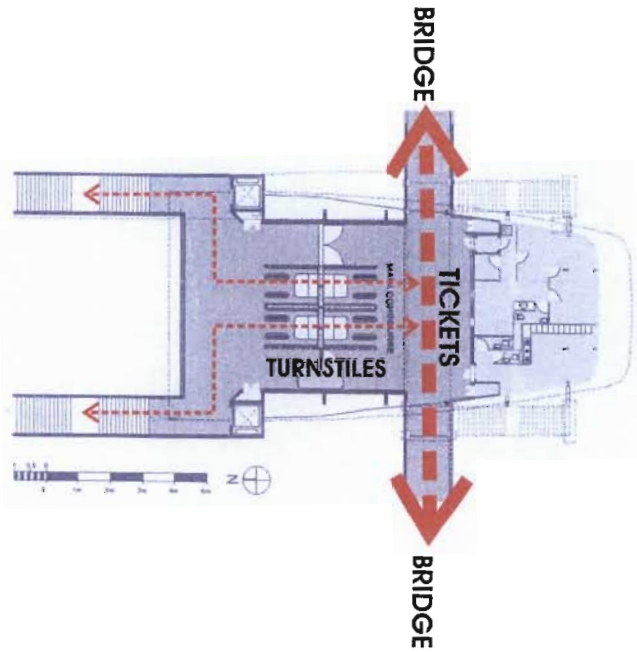


Illustration 46: Umbilo Station plan indicating the main thoroughfare through the station. (Author / Peters, 2002: 7

The thoroughfare forms part of the main ticket hall and from here passengers make their way down to the platform level through the

turnstiles. The cross-flow of passengers between the ticket windows and the turnstiles is interrupted by the pedestrians passing through the Station on the thoroughfare.

Technology: The roof of the Station, which is built of steel and clad with sheeting is aligned parallel and above the tracks with glazed gable end façades for views overlooking the tracks. The roof eaves oversails the walls to cover cross-ventilation gaps underneath, as seen in illustration 47.

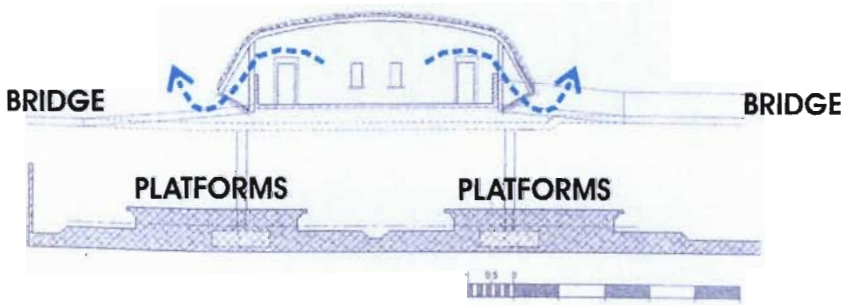


Illustration 47: Umbilo Station cross section showing a cross ventilation strategy which is crucial in a humid climate like Durban's. (Author/ Peters, 2002: 7)

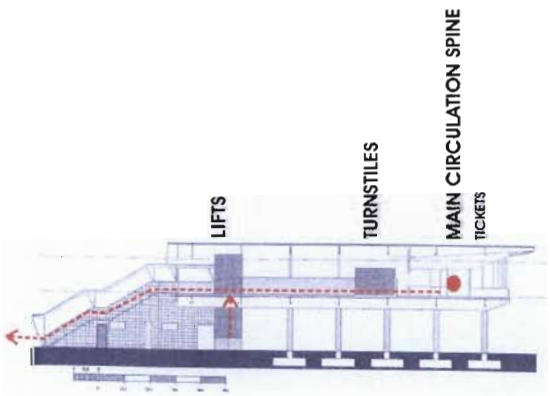


Illustration 48: A longitudinal section showing vertical circulation in the station (Author/ Peters, 2002: 7).

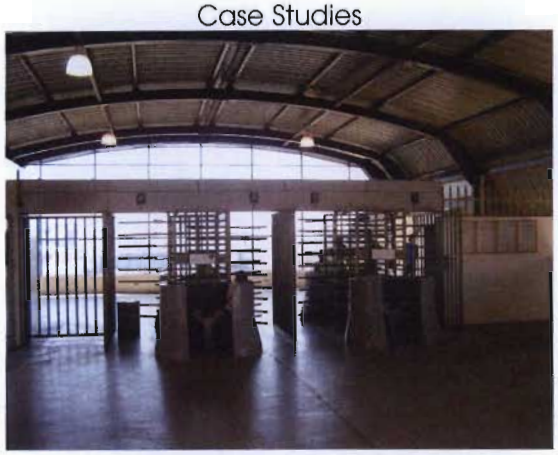


Illustration 49: An interior view of the Station looking towards the turnstiles. The fully glazed façade allows for views overlooking the platforms from the concourse level (Author/ Peters, 2002: 7).

Project Strengths

- The project achieves cross-ventilation through high level openings on the walls in an effort to cool the internal space.

Project Weaknesses

- The Ticket Office and the turnstiles are located on either side of the main thoroughfare through the Station. The route of the passenger from the Ticket Office to the turnstiles is therefore interrupted by the cross-flow of people passing through the Station, which could potentially cause congestion of pedestrian traffic.

- Formalised commercial activity was not included in the design of this Station due to the building size. There are however, hawkers on the external bridge, which could be treated as the commercial component of the Station. The hawkers could be accommodated by widening some points within the bridge to make room for the stalls. This idea could help control venders selling on the bridge, as well as maintaining a steady flow of people through the bridge without the interruptions of the stalls along the way.

Finally, the Umbilo Station bridges across the Southern Freeway and railway tracks to connect the Umbilo and Bayhead areas. The planning of the thoroughfare within the Station however is not ideal as it clashes with the basic function of ticket purchase within the Station. The architecture of the roof form is both functional and elegant as the openings covered by the roof allow for cross-ventilation. Located on the Western side of the Southern Freeway and highlighted with the Grey and Yellow colours of the station operators-Metrorail, the roof marks the Station as a landmark.

6.6 KwaMashu Station - completed in 1997

Client: Intersite Management Services

Architect: Architects Collaborative and John Royal Architects

Location: KwaMashu, Durban

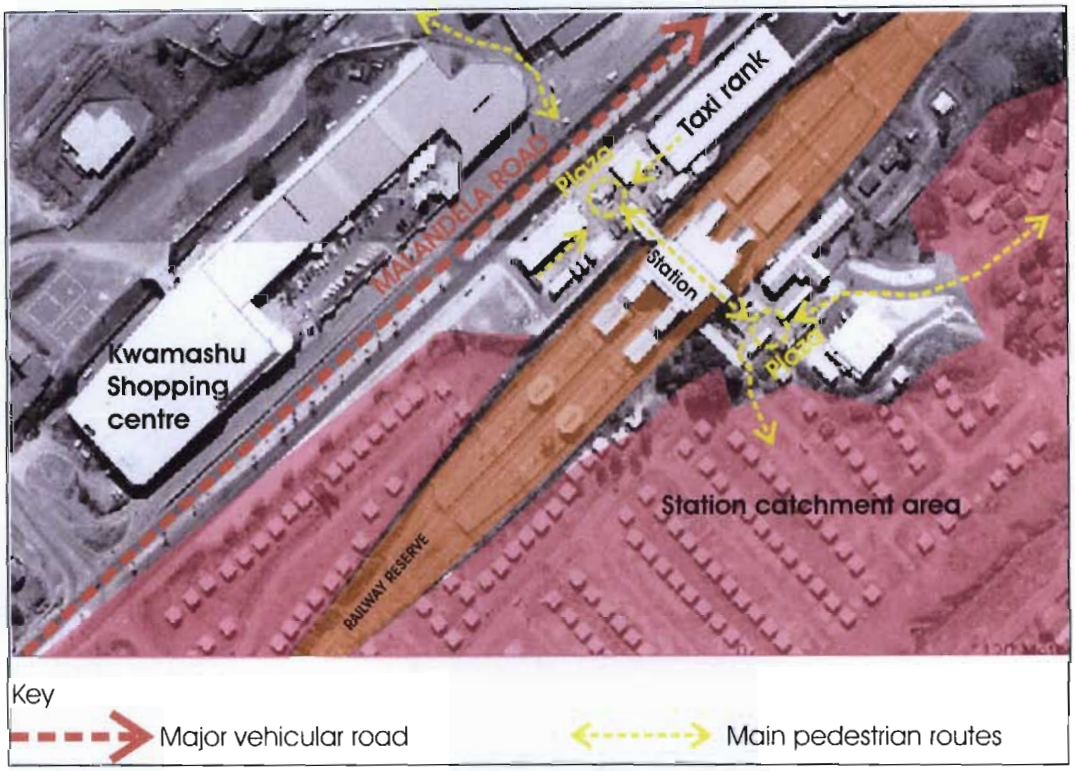


Illustration 50: An aerial view of the KwaMashu Station (Author / Ethekwini maps)

The KwaMashu Station is part of a new town centre which is currently being developed in the township and forms a node of activities as shown in illustration 50. The Town Centre includes the KwaMashu Shopping Centre, a police station and some office developments. A large residential area is also within close proximity to the Station to ensure a reliable catchment area for the Station.

Located adjacent to a taxi rank and a bus drop-off point on Malandela Road, the Station is located in a transportation node context. The transportation node achieves the required link which Lynch (1962:27) attributes to a successful overall transportation network within a city. This link is beneficial to the passenger as it provides a

quicker changeover for the passengers, from one mode of transport to the next.

Illustration 51: A view of the square separating the Station and the taxis to create a pedestrian friendly precinct. (Author)

Circulation: Access to the station, is through a bridge that also acts as a public thoroughfare. On the station concourse, the bridge widens and is flanked on either sides of the walkway by shops and turnstiles.

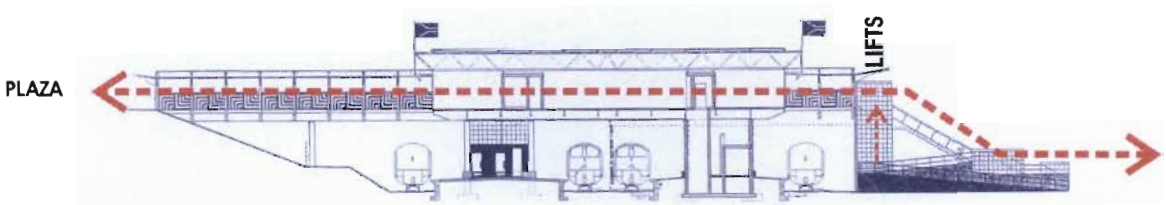


Illustration 52: A Longitudinal section indicating the main thoroughfare through the Station. (Author/ Wale, 1998:27)

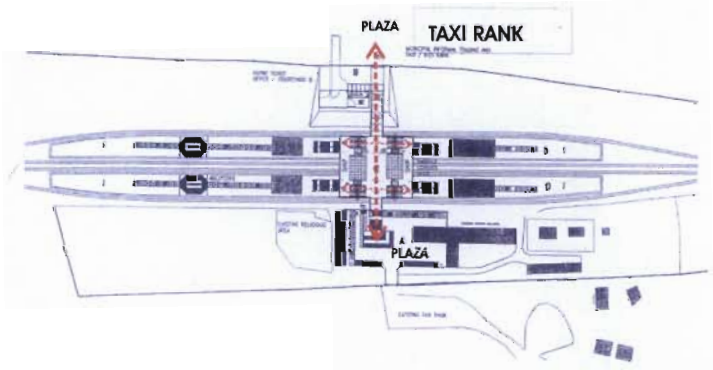


Illustration 53: The Station ground floor plan indicating routes to the platforms through the turnstiles, on either sides of the main thoroughfare. (Author / Wale,1998:26)

The planning flow of this Station is ideal as the Ticket Offices are located on either side of the concourse adjacent to the turnstiles. This avoids a potential clash between the general public going through the Station, and the passengers making their way down to the trains.

Image and technology: The planning of the Station is symmetrical, resulting from the idea of allowing passengers to access the platforms on either side of the thoroughfare. The roof expresses this symmetry through two steel barrel vaults on either side of a gently pitched butterfly roof that accentuates the main walkway. This acts as the central spine of the building.

Lynch (1960:47) argues that people heighten their attention at nodal points because they are places of breaks in movement. The overall architectural form is closely linked to the experience of the spaces they envelope. A high level of peoples' awareness in nodal points must therefore be catered for through clear planning, coupled with elegant architectural forms that emphasise the planning. This is be demonstrated in the KwaMashu Station walkway as seen in illustration 54. The canopy as an architectural element emphasises the walkway into the Station. It also serves as a landmark feature for a person looking for the Station entrance within the node.

Illustration 54: A view of the main pedestrian thoroughfare under the steel canopy. (Author)

Illustration 55: A vista creates a clear view of the Station's entrance from the Shopping Centre on the opposite side of the road. The plaza is bordered by hawkers on either sides. (Author)

Project Strengths

- The architects were able to create order in the Station by including anchor tenants within the Station and bordering the external square with hawkers.
- The Ticket Offices are on located on either side of the thoroughfare next to the turnstiles. This creates an ideal relationship between the ticket office and the turnstiles without creating a problematic clash of cross-flow traffic amongst the pedestrians passing through the station.

- The planning of the Station within a transportation node ensures maximum functionality of the Station because of the surrounding facilities that generate the catchment for the Station.

In conclusion, the location of the Station within a transportation node that is part of a node of activities increases the usability of the Station and ensures its usefulness to the KwaMashu Town Centre development. The main thoroughfare within the Station creates a vista which links the

Station to its immediate environment. The KwaMashu Station therefore is designed as a key and well-integrated element within the urban fabric of its precinct.

Project Weakness

- From the public plaza off Malandela road, the Station building relies on a signage board which is detached from the building, for its identification. A more expressive roof form could not only establish the building as an icon, but would also be instrumental in its visibility to pedestrians.

6.7 Conclusion

The analysis of local examples has revealed design techniques that are well adapted to the local context and which could be improved upon for application in the design of the Proposed Commuter Railway Station in Durban. In the Berea Road Station for example, the architect designed high level openings for natural lighting and ventilation. This concept creates a better illuminated and comfortable environment within the Station.

In the South African context, hawkers are undeniably a major part of transportation nodes. The challenge which arises however is that, venders ought to be regulated and controlled to prevent their unrestricted growth within these nodes. In the Berea Station, venders line the circulation corridors and in the process narrow the walkways. An idea suggested for the KwaZulu-Natal Station Upgrade Programme was that, commercial activities provided inside the stations should be that of the formal, anchor tenant types. This would offer more revenue

for the station. The hawker stalls could be designed with shelters around the external open spaces instead of including them within the interior space, where they could interfere with the station's primary function of circulation.

With the exception of the concrete construction applied in the Berea Road Station, steel is the most commonly used building material in local Station buildings. This is because, the technology of steel construction has been extensively applied within the local construction industry, and as such proved to be a reliable and effective option. Steel structures also take a shorter time to erect as compared to the mainly concrete construction that would need a longer time to construct.

All the Stations analysed under this chapter are located close to taxi and bus feeders, the KwaMashu Station demonstrates the best solution of planning a relationship between the station and a taxi rank. This is illustrated in the positioning of the square in-between the two to cater for the large crowds of people expected within the transportation node precinct, as well as the visual connection between the two. Successfully applied principles in these examples, give clues for future station developments in the province. At the same time, they give a clearer view of the challenges which still need to be addressed in order to ensure better station environments which are necessary for an improved image of the railway service in South Africa.

Chapter 7- Functional Requirements for the design of the Station

7.1 Introduction

The creation of a new railway station requires an analysis of passenger figures expected to use the station, as well as an understanding of the site context, which then informs the design of an optimal station relevant to a specific setting. Subsequently, this chapter analyses the Station function, its catchments and other constraints to be understood before the design of a station can take place.

7.2 Site Location

Illustration 56: A Map showing the marshalling yard between Walter Gilbert and Argyle Roads, which has been identified by SARCC as an ideal location for a new station because it is positioned halfway between the two existing Umgeni and Durban Stations (Author).

Illustration 52 demonstrates the 3, 4 kilometre distance between the two existing Stations. This implies that the existing rail commuters in the area have to travel a 1, 7 kilometre distance to either Umgeni or Durban Station to board a train. This situation is not ideal, as the recommended maximum walking distance to a Station is one Kilometre (SARCC, 2006a:3). Hence the proposal for a new station between Walter Gilbert and Argyle Roads. The location of the site is therefore determined by its functions.

7.3 Functions of the Proposed Station

The main reason for the planning of the Proposed Station emerged from the plans to improve the transport infrastructure in South African cities ahead of the 2010 FIFA Soccer World Cup tournament. The train is seen as one of the most efficient commuter transportation systems because of its ability to convey larger numbers of passengers in comparison to the bus or the taxi, hence need for a new Station. The recommended position for the new Station is on the marshalling yards (see illustration 56). The advantage of this position is its close proximity to the New Durban Stadium.

Apart from catering for the New Durban Stadium, the Proposed Station is planned to accommodate existing passengers who work along Umgeni Road and in the Kingspark area. Currently, passengers have to either walk or take a taxi to the Durban Station in the South, or the Umgeni Station to the North of the Kingspark area for a train, hence the need for a new station halfway between these existing stations.

The Proposed Station has therefore two main functions, namely:

7.3.1 Providing transportation for the 2010 FIFA soccer World Cup tournament.

7.3.2 Providing transportation on a normal work day scenario.

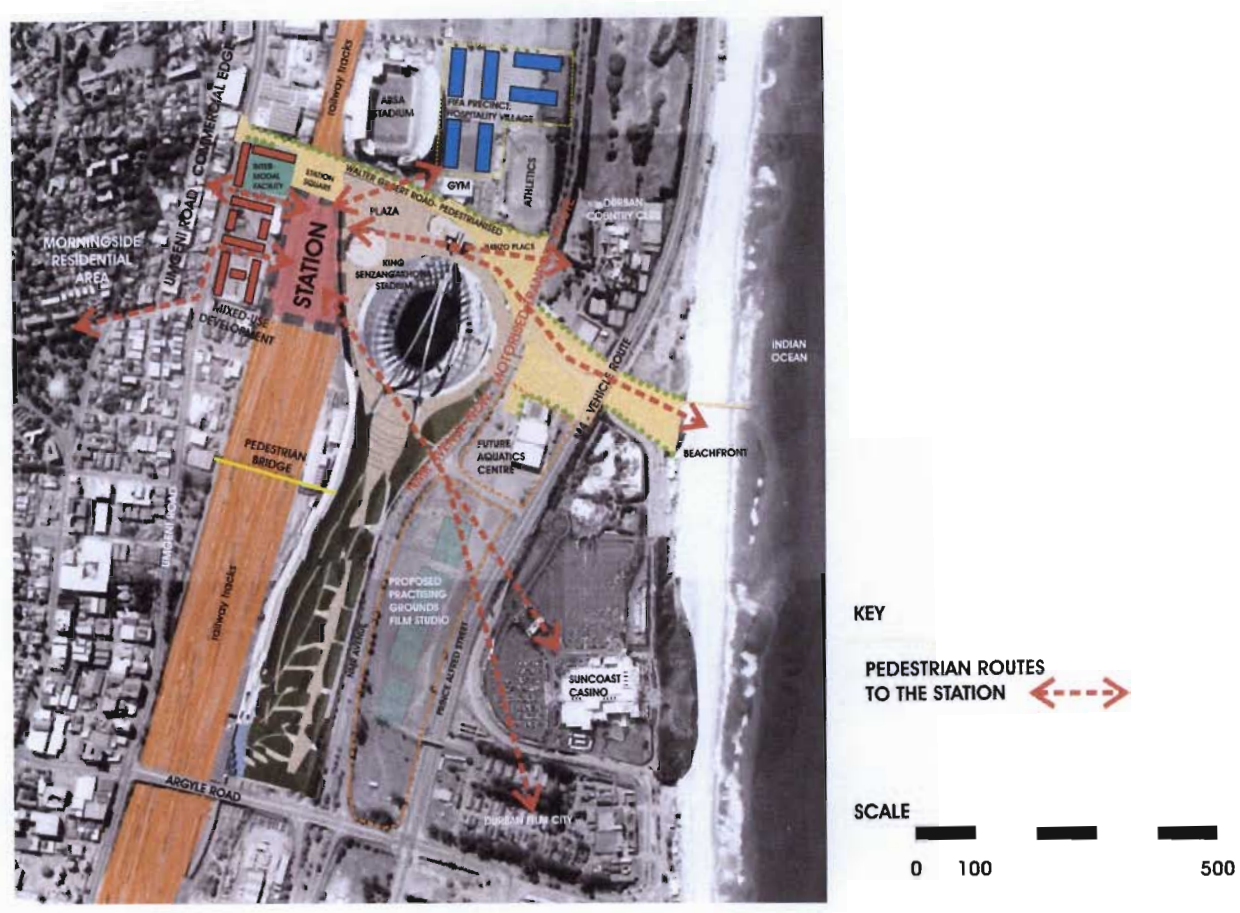


Illustration 57: A Map showing proposed and existing sports and recreational facilities that make up the Kingspark Sports precinct as well as immediate areas to be serviced by the proposed Station (Author).

7.3.1 Providing transportation for the 2010 FIFA soccer World Cup tournament

As mentioned earlier, the Station is planned as part of an improved transportation system within the city of Durban and to serve the soccer fans using the new Durban Stadium and the KingsPark Sports Precinct during the 2010 FIFA Soccer World Cup tournament.

The 'iconic' New Durban Stadium is located in the KingsPark Sports precinct. The Stadium is designed to seat 70 000 spectators. This figure comprises of 45 000 permanent and 25 000 temporary seats. When necessary, the Stadium also has a capacity of being expanded to 100 000 seats (Peters, 2006:8). With this seating capacity, a more efficient movement system like rail is imperative in ensuring a smoother transportation of spectators. As shown in illustration 53, not only the new stadium benefits from the Station, but other recreational facilities along the beachfront would be better accessed with the creation of the new Station.

According to transport analysis figures done by Iliso Engineers in the South African Rail Commuter Corporation Proposed Kingspark Station Location and Environs Report (SARCC, 2006b), the Proposed Station is expected to accommodate at least 17 000 people traveling to the Stadium during World Cup match days. The rest of the soccer patrons to the Stadium are expected to arrive by cars, busses and taxis, as well as non-motorised transportation, which includes bicycles and pedestrians walking form nearby suburbs.

From outside of town, Airplanes and ferries are planned to be utilised. A people mover system of 10 luxury buses will be employed for transportation in the city centre. Its routes will link major parkades, tourist attractions, hotels and other accommodation, as well as places of business within the city. A tram system

could also be implemented towards the beginning of the World Cup tournament, as the ultimate people mover (ETA, 2005:18).

Taxis will also be used, especially on the outskirts of the city which will not be serviced by the people mover system. Since some taxis are perceived as dangerous and unroadworthy, the Department of Transport is currently implementing the Taxi Recapitalization Programme, which is set to ensure the scrapping of unroadworthy vehicles for safer new ones. This initiative is done to ensure that, the local taxi industry, also benefits from the 2010 FIFA World Cup tournament.

A distinct fluctuation of passenger numbers between a normal working day scenario and a World Cup Match day scenario in the Station is expected. The estimated number of people using the Station during World Cup match days is 17 000 passengers per day, while the Station should ideally be designed to handle up 27 000 passengers, for an unexpected increase. Figures for a normal working day scenario are much less, but the idea of building infrastructure ahead of the World Cup implies that the local community will be encouraged to utilise the inherited facilities, thereby increasing the use of trains after the World Cup tournament.

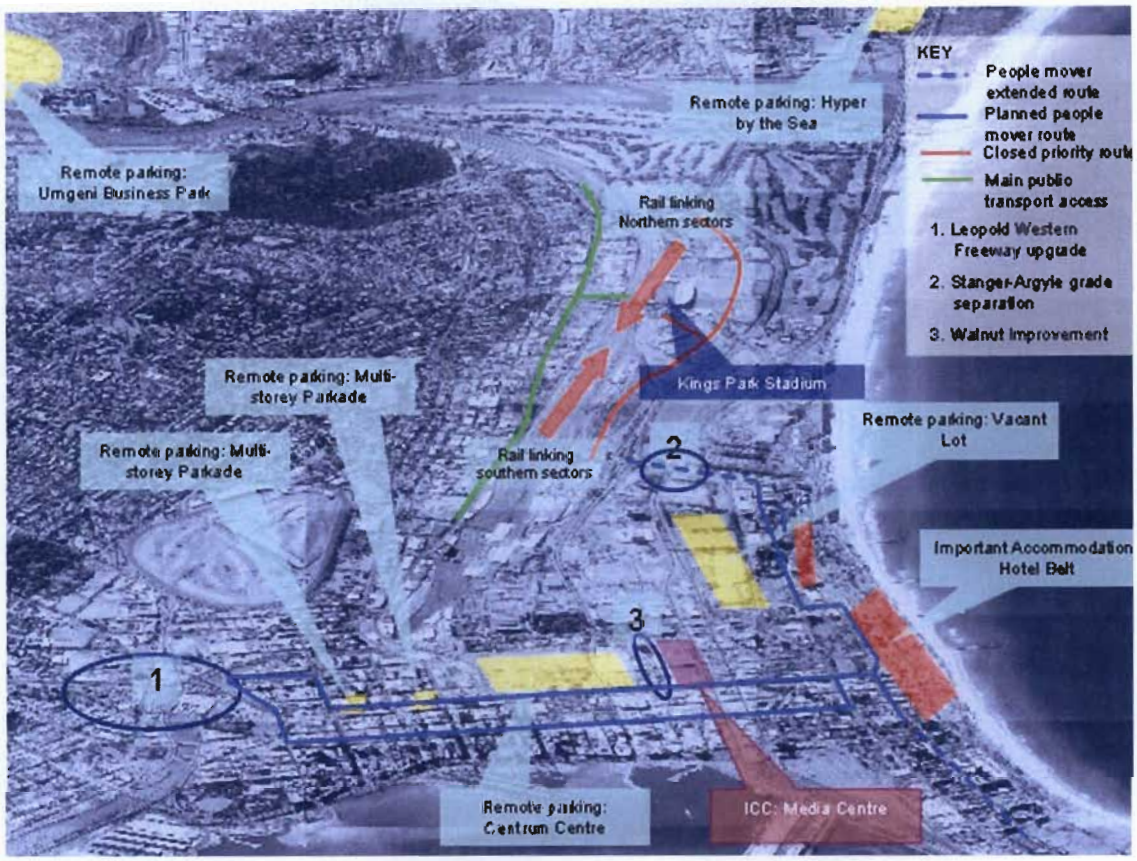
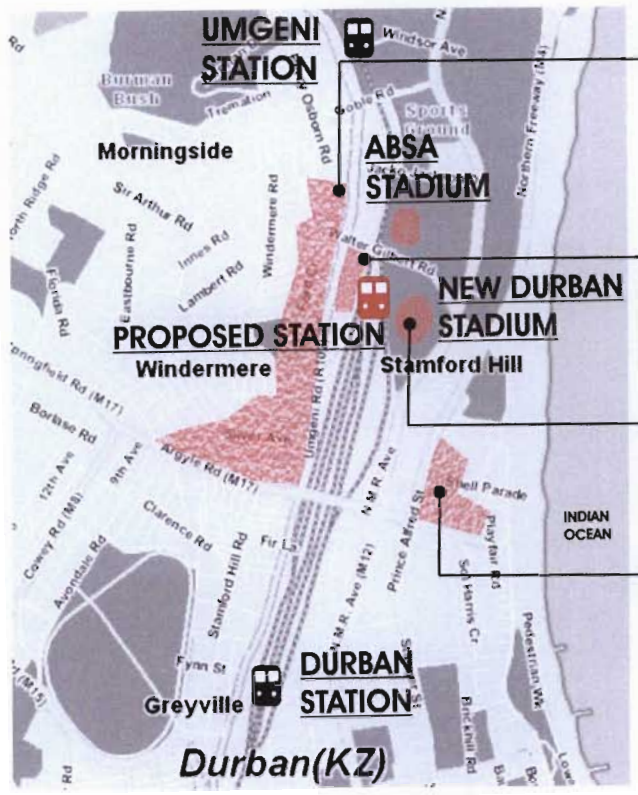


Illustration 58: A Map demonstrating the projected different transportation systems to service the Kingspark Sports Precinct during the 2010 FIFA World Cup tournament match days. (ETA, 2005:12)

7.3.2 Providing transportation on a normal work day scenario.

The second function of the Proposed Station is to provide transportation to new and existing passengers commuting from surrounding Durban townships to the Kingspark Sports Precinct and Umgeni Road corridor, on a normal working day scenario.

The estimated daily patronage is 8 600 people, which could increase by 4000 on weekday match days, making the total number to be 12 600 (SARCC, 2006: 12). This number is expected to increase considerably later with the futher development of the Kingspark Mixed-Use development, which is planned to include housing, hence additional passengers. It is also predicted that more people would be encouraged to use trains as their preferred mode of transport because of improved railway facilities inherited from the World Cup tournament. Illustration 59 demonstrates the expected catchment for daily routes.



Existing commuters

3760- Existing rail commuters on Umgeni Road corridor currently using either the Durban or Umgeni Station on either ends of the precinct, diverted to the nearer Proposed Station.

New Commercial Node next to the Station

960- New employment and housing , hence new passengers.

Sports related trips

4000- Occasional mid-week soccer matches to ABSA or NDS.

Recreational trips

920- Recreational trips to the beachfront and employment created from the proposed Durban Film City and the new Sun Coast Casino developments, generates new passengers.

OTHER STATION CATCHMENT AREAS

Berea distribution service

980- New and Existing rail commuters from Berea brought to the Proposed Station through busses and taxis.

Inanda Rail line Hault

1780- New rail commuters diverted from using busses and taxis.

Phoenix, Chatsworth and Queensburgh park and ride facility

200- New and existing rail commuters diverted from using private vehicles.

Passenger figures obtained from SARCC 2006b:12

Illustration 59: A map of the Kingspark Sports precinct illustrating the catchment of the Proposed Station and the expected number of passengers anticipated from each area. The map is to be read in conjunction with passenger figures tabled on the attached Appendix C of this document (Author).

7.4 Brief

With the site located adjacent to the New Durban Stadium, the Proposed Station is planned to have a world class image which complements the new iconic Stadium. The development of the New Durban Stadium and other sports facilities in the Greater King's Park Sports Precinct is intended to enhance the area's image of being a "Sports City," as well as establish it as a premier sports venue for Southern Africa.

The Station has to be linked to a taxi rank which is planned on the number of feeders to the new Station.

The profile of pedestrian or feeder trip demand is as follows:

- Walking/cycling - patrons within a closer distance to the Station.
- Taxi - A taxi rank will be designed next to the Station to transport people from the Berea area as well as to serve the proposed mixed-use development adjacent to the Station.
- Bus
- Drop-off point for private vehicles.
- Park and ride- 200 car parking bays and 30 motorcycle bays.(SARCC, 2006a:5)

7.5 Schedule of Accommodation

The schedule of accommodation for the proposed New Commuter Railway Station is based on the requirements of the client- Ethekwini Transport Authority.

Operational Requirements:

element	**unit**		**notes**
Main Circulation area	m^2/person	1,4	
Average speed of passenger	m/min	69	
Flow rate	p/m/min	33	
Ticket window capacity	p/15min	143	supplemented with automatic teller machines

Illustration 60: Applicable Standards Table (Protekon Simmer JV, 1998:5)

According to Mr Ashley Peters of Metrorail, each train carries: 120 passengers x 9 coaches = 1080 passengers. The Station is planned to have 4 platforms which translates to 1080 people x 4 trains arriving at the same time. The expected number of passengers at the Station during peak time brought by 4 trains is therefore 4320, which can be rounded off to 4500 people including non-commuting pedestrians inside the Station.

Passengers are expected to detrain in a rate of 300 people per minute (ILISO, 2006:16). This means that a full load of 1080 passengers will clear its passengers in 3, 6 minutes.

Each passenger departing or arriving at the Station during peak hours is estimated to spend as little time on the concourse as possible because of the rush. In addition, the crossing of each passenger through the Station is a few minutes different from the next passenger given the difference in detraining time and average walking speed of each person.

This implies that the maximum 4500 passengers are not expected to arrive at the Main Hall at the same time, the Hall area will therefore be half of the total number of passengers in the Station. Hence 2250 x 1,4m² = 3150m² .

At its best, the Station can handle 22 500 passengers in an hour, which is equivalent to a total of 5 full train loads detraining on all platforms at the same time, every 12 minutes.

Accommodation	**Function**	**No.**	**Area**	**Total area**
Main Hall	main gathering space	1	2250 x 1.4	**3150 m²**
Ticket Office	Ticket sales cubicles. If 143 people are served per 15 minutes on each cubicle, the total number of passengers serviced is, 3432 per hour. This number will be supplemented with automatic ticket machines.	6	3m²	18 m²

	Turnstiles	8		
	Strong room	1	12m²	12m²
	Information office	1	12m²	12m²
				42 m²
First aid room	for emergency situations	1	40m²	40m²
Public Ablutions	male	7	3,5m²	24,5m²
	Female	11	3,5m²	38,5m²
	Male and female disabled	2	8 m²	16 m²
				79m²
Retail	planned along the main Circulation routes of the station And on the perimeter of the Main Hall to increase revenue for the Station .It is estimated that this would be 2000 m² of sports, Magazine and gift shops provided for the convenience of the commuter while within the Station.			
				2000m²
Restaurant	If 1 person=2m² (Lawson, 94: 78) 120 seater restaurant Kitchen = 1/3 of seating area		240m² 80m²	240m² 80m²
				320m²
Coffee shop	If 1 person=1.6 m² (Lawson, 94: 78) For 100 people Kitchen = 1/3 of seating area		160 m² 53 m²	160 m² 53 m²

				213m²
Fast Food Outlet	If 1 person=1.6 m² (Lawson, 94: 78) For 80 people Kitchen = 1/3 of seating area		128 m² 43 m²	128 m² 43 m²
				171m²
Satellite police office		1	40m²	40m²
				40m²
Admin offices	Station general manager	1	20m²	20m²
	Maintenance manager	1	12m²	12m²
	Ticket management	1	20m²	20m²
	Receptionist	1	12m²	12m²
	Records room	1	12m²	12m²
	Rail technical manager	1	12m²	12m²
	Staff ablutions- female	3	3,5m²	10,5m²
	- male	2	3,5m²	7m²
				105,5m²
Platforms	Each island is to be the maximum width of 9 metres wide (ILISO, 2006:16). The length of each platform is 9 X 200 metres long	2	1800m²	

				3600m²
Offices to let				**400 m²**
Station grand total area				**10 120,5m²**

Illustration 61: Schedule of areas (author)

Car parking (Park and ride)	Staff Parking	20 bays
	Public Parking	200 bays
	Motorcycle parking	30 bays
	Bicycle racks	50 bays
Taxis	a taxi rank to service the proposed commercial development next to the station as well as to bring commuters from the Berea to the Proposed Station	
Taxi stands	5 mini- buses	
	Taxi holding area	10 mini –buses
	Cabs	10 bays

Notes:

The new Commuter Railway Station forms the main part of the design phase, while the taxi rank and the overall node will remain at a planning stage for final presentation.

The station areas, number of turnstiles, platform widths, office sizes and names, were derived from the KwaZulu-Natal Railway Station upgrade guide (Protekon Simmer JV, 1998) and the Proposed Kingspark Station Location and Environs Report (SARCC, 2006b).

The final compilation of the brief and schedule of accommodation was carried out with the help of Mr. Ishan Emiran of SARCC, Mr. Craig Simmer of Iliso Consulting Engineers and Mr. Ashley Peters of Metrorail.

7.6 Conclusion

This research is set to find ways in which rail can partner with other forms of transport towards the creation of a more efficient transportation system in the city. The profile of feeders such as cycling, walking and park and ride facilities suggest that the Proposed Station will key in to the developing transport system planned to relieve traffic congestion in the city.

In creating a more efficient railway station, the understanding of the facilities needed and the number of crowds expected in the station is essential in developing a specifically sized station.

Chapter 8- Conclusion and Recommendations

This chapter is a culmination of data gathered throughout this research and thus suggests an appropriate architecture for the design of the Proposed New Commuter Railway Station in the Kingspark Sports Precinct.

As indicated earlier in this document, under the Research Problem topic, rail has been proven to be the most economically viable mode of land transport, which makes it a relevant option for application in the South African context. Apart from being affordable, rail is also a safer and much more efficient public transport system.

The South African Department of Transport has introduced the National Rail Passenger Plan (Ministry of Transport, 2006), which is set to revive rail in South Africa and establish it as a major public transport system. This research is therefore an architect's contribution to a current body of research being assembled by different professionals towards a better railway system and ultimately an improved transportation system in the country.

Historically, stations have applied the arched form; because of its inherent strength in achieving wide span structures. The idea of pursuing column free interiors stems from the ideal of creating obstruction free spaces within station buildings. This is important in facilitating efficient passenger circulation. It is therefore advisable to employ large span roofs and arrange the structure on the periphery of the building, away from the main circulation spaces.

The station environment is a high-paced one, and the architects' challenge is to make a place which facilitates unobstructed movement through the station, whilst not compromising on the quality of the spaces. Light is key in orientating passengers within a station.

As studied in the Precedent examples of this research, natural lighting is vital for conserving electrical energy, whilst implementing the idea noted by Alexander (1977:645) which suggests that light gives people a sense of feeling welcome within a space. In places such as restaurants, covered outdoor eating areas are essential, since the sunny sub-tropical climate of Durban allows for outdoor entertaining, whilst indoor living can be uncomfortable due to the humidity and the heat.

Alexander (1977:877) also suggests that individual spaces should be designed with different volumes to distinguish their importance. This idea suggests that wide spaces should be complemented with higher volumes to create an acceptable visual proportion for the observer.

As hawkers are a major part of transportation nodes in Durban, the appropriate design and location of the stalls is crucial for the proper functioning of the node as a whole. This is because overcrowding resulting from uncontrolled hawker arrangement would interrupt circulation patterns, within a node, thereby affecting its efficiency. As mentioned earlier in this document, hawker stalls could best be located in the external spaces outside the station while anchor tenants which generate more revenue than the hawkers, could be located within the station.

8.1 Ventilation

Ventilation is also an absolute necessity in public building design, since a large number of people generate heat that can make the interior of a building uncomfortable. Implementing means like cross-ventilation, high level openings to facilitate stack effect in stations are vital. In the area of transportation in general, rail emerges as a forerunner in the idea of the Green-Gold development. The concept of Green-Gold, refers to wealth

or development which is attained through means that do not damage the environment. Rail carries a large load than any land transport form. The idea of designing environmentally friendly railway buildings is merely an architects' way of expressing rail's effect of fewer repercussions to its environment.

8.2 Linkages

As discussed earlier in this document, Lynch (1962:27) mentions the importance of linkage to other facilities and existing street patterns in the city. To achieve a more integrated Durban transportation system therefore, it is important to locate the station on a route that knits the station to the rest of the city fabric. The recommended site therefore should be linked directly to a major road to ensure maximum accessibility to the station. In the proposed Commuter Railway Station context, the station is to be connected to Walter Gilbert Road, since it joins, both Umgeni Road and the beachfront on either sides of the Station.

Since taxis are a major part of the South African public transport system, the idea of the creation of a transportation node context which includes a taxi rank near the proposed new Commuter Railway Station is crucial. This would ensure a better correlation between the two. A taxi rank would act as a feeder to the new Station as well as serving the proposed mixed-use development next to the Station.

8.3 Circulation

Moderate pedestrian ramps at gradients of 1:15 to 1:20 and an absolute maximum of 1:12 are instrumental in providing comfortable vertical circulation in a station, especially for the disabled. Ramps are instrumental

in addressing the level change between the external area and the station. The advantage of using ramps for vertical circulation is the long term benefit they offer over the lift, which constantly requires maintenance.

Within the station, horizontal circulation is best planned in straight lines for ease of orientation of passengers to the different facilities inside the station. For vertical circulation, the international examples analysed in this research, demonstrate the benefit of combining lifts, stair and escalators. This is because escalators have the ability to transport large masses of people within a short space of time, while stairs need less maintenance. Stairs are also necessary when escalators are out of use. The provision of the lifts is essential in catering for the disabled.

8.4 Technology

As a gateway to the Kingspark Sports Precinct, the new Commuter Station should ideally echo the image of the new Durban Stadium through the use of materials like concrete and steel. The main canopy of the Station would be steel, as it has the flexibility which allows for varying roof forms which could be needed in enveloping the different spaces internally. Since the new Commuter Station is built to serve the New Durban Stadium which is being built for the World Cup tournament, construction time could be a major factor. Steel is advisable for use because it can be assembled in a short space of time.

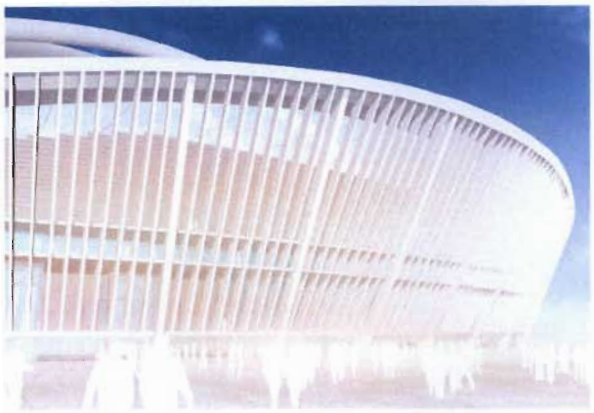


Illustration 62: An image of the New Durban Stadium. (Von Gerkan, Marg and Partner.2005)

Illustration 63: A front view of the Proposed Station. (Author)

The above two images, which are illustrations 62 and 63, demonstrate how the massive scale of both the New Durban Stadium and the Proposed Station are expressed though steel and concrete columns. These vertical elements which are essentially structural supports create a rhythm on the facades which can be seen as channeling guides for people entering the buildings. The transparency created by the use of glass on the ground floor levels helps in inviting pedestrians into the buildings, as opposed to the use of opaque materials which would be less alluring. By employing a similar building technology to the New Stadium, the Proposed Station allows the observer to identify the two developments as components of the same precinct.

8.5 The role of Architecture towards a renewed image of the South African railway service.

As a response to the National Department of Transport's call on professionals for remodeling the South African Railway Service, outcomes of this research include the following suggestion from an architect's perspective:

- Station environments should be conceived with the specific number of users in mind, to avoid huge underutilised facilities, as is the case in the Durban Station.

- The practice of covering the platforms with ample roofing as opposed to shelters, not only addresses the issue of passenger comfort and protection from, inclement weather conditions, but also reconciles the overall visual form of the station. The current South African model of a station building with shelters, presents a fragmented station architecture.

- The idea of a station as a "roofed part of the city" as suggested by Hertzberger (1991: 73), allows for the creation of inclusive places that are designed echo the very environment of a city precinct, as opposed to a place which can be classified as exclusively belonging to a particular sector of the community.

- Surrounding the station precinct with mixed-use developments ensures a vibrant node of activities as opposed to secluded station buildings, which can feel unsafe and unattractive.

- As seen in Beni (1997: 2), the idea of developing the commercial potential of the station precinct from hawker to anchor tenant, would help in creating a typical shopping centre environment which is inclusive of all members of society as well as ensuring better revenue for the Station Company.

The diverse feeder profile as required by the brief of the Proposed Station ensures an Intermodal Transfer facility development. This is important in establishing railway stations within a network of other transportation modes in the city.

8.6 Conclusion

Architecture can play a role in changing the image of railway stations in South Africa, by creating architecture that better facilitates the function of the station, while ensuring that the environment is inviting to the targeted users.

Design principles like the use of natural lighting, linkages and the legibility of the station circulation, as discussed in this study, are one of the main components to be applied in the creation of better station environments.

The design of the Proposed Station in Kingspark, is an attempt to synthesise international design practices with appropriate response techniques that are applicable to the Durban context, in a bid to define a new approach in railway station design.

Improved rail system facilities in South Africa will help in facilitating the efficiency of cities for its citizens, as well as improving South Africa's image as a tourist destination globally. South Africa is rapidly becoming a

popular host of international conferences and major sporting events, and visitors need a proficient movement system within and in-between the cities to enhance their experience of the country.

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List of illustrations

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Appendix A

Outcomes from interviews with railway station building experts.

This section contains outcomes from discussions, held with professionals in the fields of railway engineering and architecture in Durban.

David Harms – Civil Engineer

Protecon Architects and Engineers

- In the meeting with David Harms we discussed the technical aspects of railways like minimum platform sizes, clearances as per the attached Appendix B, as well as the possibility of moving existing tracks in order to fit new platforms.

- Bridges and walkways above railway tracks should have solid balustrades, either steel or concrete to the height of 1750mm to prevent people from throwing objects onto the moving trains or touching the overhead wires and be electrocuted.

- In a station, passengers must not be able to look down on uncovered trains and overhead wires. This is to avoid suicidal cases and people pushing each other over.

- For the new station, platforms can be 200m in length to accommodate the standard 9 coach train which is 180m long.

Ashley Peters – Rail Network Planning Manager

Metrorail Operations

- The new station must, if possible be located close to the existing driver change over stop, halfway between Walter Gilbert and Argyle Roads. This is to avoid the trains from stopping at the station, if located closer to Walter Gilbert Road and at the existing driver stop.

- The station platforms should ideally be placed where the tracks are parallel and straight to avoid curving in platforms because although it is still possible to have platforms on curves, this is not ideal.

- From Metrorail's tracks maintenance point of view, and signaling to the driver, straight platforms are favorable.

- At least one platform should be 275m in length to accommodate the 13 coach, long distance train which could arrive at the Proposed Station from Johannesburg or Cape Town.

- For the World Cup Soccer match day, the other suggestion made was that since the longer trains usually park at the station for the duration of the event, it would be ideal to receive such trains at the Durban Station. This already has long platforms and the use shuttle service to transport the patrons from Durban Station to the Stadium could be brought in. This means that the 200m long platforms would be sufficient for the Proposed Station.

Andrew Okamp – Civil Engineer

Ethekwini Transport Authority

- The idea of creating the Proposed Station in conjunction with initiatives to reduce the current congestion problems in the city and to transport as many people as possible during the Soccer World Cup tournament in 2010.

- Andrew Okamp advocated the idea of locating the station as close to Walter Gilbert Road as possible to ensure an easier connection of the station to the overall city street pattern. He suggested that curved platforms are common phenomena internationally and would not pose major problems in the proper operation of the station.

- South African stations are characterized by two main visual form elements namely; the main ticket hall building and the platform canopies, which portray the station more a fragmented than a single entity. This maybe addressed in the new station design by creating completely covered platforms for passenger comfort and in meeting international standards.

Derek Van Heerden – Architect

University of KwaZulu-Natal

- Since South African stations were designed primarily for the black workers at the time of Apartheid, their planning was based on people getting through the station only with no attempt to create a place with an inviting character.

- The renovations of the Durban stations were started because rail was the main transportation to the townships and professionals were starting to challenge the existing models as the only solution.

- The stations in townships were seen by the community as imposed structures and as a result, the Apartheid era stations were characterised by vandalism. This was understood to be a result of the oppressed section of society's form of retaliation to the Apartheid government.

- Durban architects then started to think of ways in which to create better station environments by prioritising passenger comfort and creating a new image of the station.

- The railway stations in the townships mainly have hawkers as the commercial component of the location rather than anchor tenants. Local architects have therefore started to investigate ways of creating more orderly station environments by designing for anchor tenants within the station while maintaining hawkers on the periphery of the station.

- The new station design should acknowledge the grand architecture of the New Durban Stadium.

Dave Stromberg – Architect

Spoornet

Dave Stromberg is one of the professionals who were appointed to do a survey of existing Railway stations in Durban and to determine how the upgrading of those commuter stations can be carried out.

- The upgrading of the Durban Railway Stations came about after the initiative by the Department of Transport to revive rail with the city as it has always been the main mode of transport for the people in the township before the taxis came in the late 1970's.

- The existing station planning occurred in the 1940's to 1980's and was influenced by the negative perception of the township workers by White supremacy , hence the poor utilitarian architecture.

- The system of Apartheid was in the verge of breaking down in the late 1980's, and as a result in 1990, railway commuters became uncontrollable and this era saw evasion of fees and vandalism of the stations which were seen as symbols of white domination.

- It was therefore important for architects to define station environments that would help change people's perceptions of rail in the new democratic South Africa.

- This was partly achieved by involving the end-users in the design and planning process of the station to create a sense of ownership and also to better understand people's needs.

- Professionals working on the upgrade of the stations visited the Soweto stations project, which was a similar revamping task in Gauteng to draw clues on an already operating scheme.

- This upgrading in KwaZulu-Natal, started with the Umlazi and KwaMashu terminals at the ends of the main railway line. Then this was moved to Berea and Durban stations in the city centre and other smaller suburban stations in-between the terminals and main stations.

- For stations outside the city, the upgrading was mostly focused on: Switching from Apartheid's social engineering to social architecture, developing the commercial potential of the station precinct from hawker to anchor tenant and facilitating intermodal transfer facility.

- In Stations within the city, the architects proposed maximum use of space by bringing in large shops like, fast food and clothing shops in Berea Station and letting space to non rail related facilities like the Glenridge Church and warehousing in Durban Station.

Craig Simmer – Civil Engineer

Iliso consulting Engineers

Craig Simmer is a Durban-based engineer who has been involved in the research towards the upgrading of railway stations in Kwa-Zulu Natal and is currently involved in the planning and design of the NDS precinct in Kingspark.

- The proposed station is planned to cater for existing commuters along the Umgeni Road Corridor, who have to either walk or take taxis or buses to Umgeni station in the north, or Durban Station in the south. In addition to existing commuters the station is primarily designed to service the NDS as well as surrounding recreational facilities, like the beachfront and the Sun Coast Casino.
- Railway station design starts by understanding the numbers of people to be catered for in a station, which then informs the planning of the circulation and other facilities like turnstiles and ticket offices to cater for the determined number of passengers.
- Between Argyle and Walter Gilbert roads, the most ideal site for the station in terms of railway track alignment is the central one, but the Northern site is better because of its close proximity to Walter Gilbert road which links the station to the stadium and the beachfront.

Conclusion

As a result of conducting these interviews with railway experts in Durban, I have been able to better understand the main issues in railway station design as well as the historic background behind this form of transportation, both in South Africa and in the local Durban context.

The Proposed Station is meant to continue the task of redefining a new architecture that addresses the social needs of society rather that just being places built for rail travel without any commuter sensitivity. The newly renovated stations like Umbilo and KwaMashu Stations are good examples of such new initiatives that seek to undo the old models of the past which were primarily designed for black factory workers and were intended to be not inviting.

The Proposed Station is being built because of the larger amounts of people that rail can transport at one given time as compared to the numbers transported by buses and taxis. The location of a railway station relies on technical issues such as track alignments and allowable overhead clearances, which points out the fact that railway station design is not a purely architectural exercise but relies on understanding of engineering constraints that are vital in the function and location of the station. This then results in the design team of architects and engineers having to work very close together in such projects. Subsequently, for the purpose of my station design project, I intend consulting railway experts regularly during the course of the design development.

While a station has to be carefully located in its urban context to facilitate an efficient flow of passengers near and within the station, this must be balanced with a proper engineering study that determines the

best operational position for the railway tracks after the platforms have been positioned. For the purpose of the Proposed Station design, the platform should ideally be 200m in length to accommodate the 9 coach train set which is 180m long.

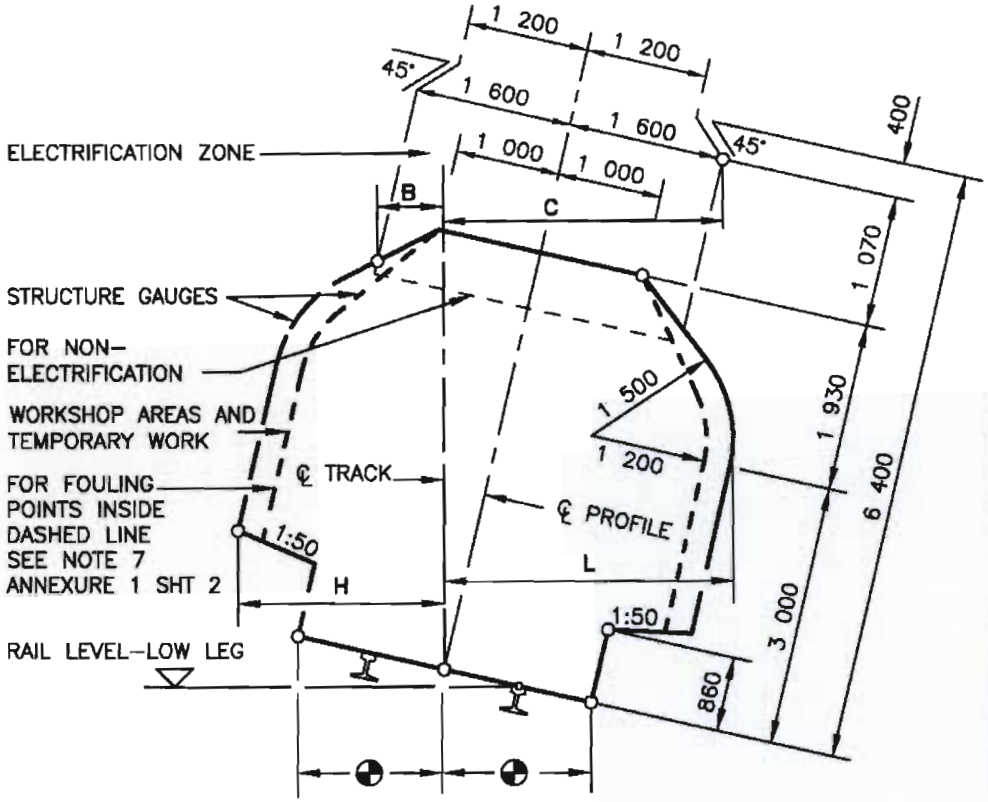
Apart from engineering matters, a railway station design depends on passenger circulation analysis. The process of passenger arrival, ticket purchase and procession to the platforms must be well understood by the designer. There are also a lot of figures that are obtainable from traffic consultants based on the established catchment area to determine the number of turnstile gates, size of the floor area and parking requirements in order to have a practical station that adequately caters for the needs of the specific commuters.

Appendix B

Extracts from the **South African Rail Commuter Service Manual for Track maintenance (2000),** illustrating critical sizes and dimensions to be implemented when designing a Railway Station.

HORIZONTAL CLEARANCES : 1 065mm TRACK GAUGE

RADIUS (m)	WITH CANT		NO CANT	WITH CANT	
	H (mm)	L (mm)	H & L	B (mm)	C (mm)
90	2 730	3 090	2 780	1 130	2 100
100	2 700	3 030	2 750	1 140	2 050
120	2 650	2 970	2 700	1 160	2 010
140	2 620	2 920	2 660	1 175	1 990
170	2 590	2 870	2 630	1 190	1 970
200	2 570	2 820	2 600	1 205	1 950
250	2 550	2 790	2 580	1 230	1 920
300	2 540	2 760	2 560	1 250	1 900
350	2 530	2 730	2 540	1 270	1 890
400	2 520	2 710	2 530	1 290	1 875
500	2 510	2 680	2 520	1 320	1 850
600	2 500	2 660	2 510	1 340	1 830
800	2 490	2 620	2 500	1 365	1 790
1 000	2 480	2 600	2 490	1 380	1 760
1 200	2 480	2 580	2 490	1 200	1 730
1 500	2 480	2 550	2 480	1 415	1 700
2 000	2 480	2 500	2 480	1 440	1 660
3 000	2 470	2 470	2 470	1 500	1 600
>5 000	2 460	2 460	2 460	1 600	1 600

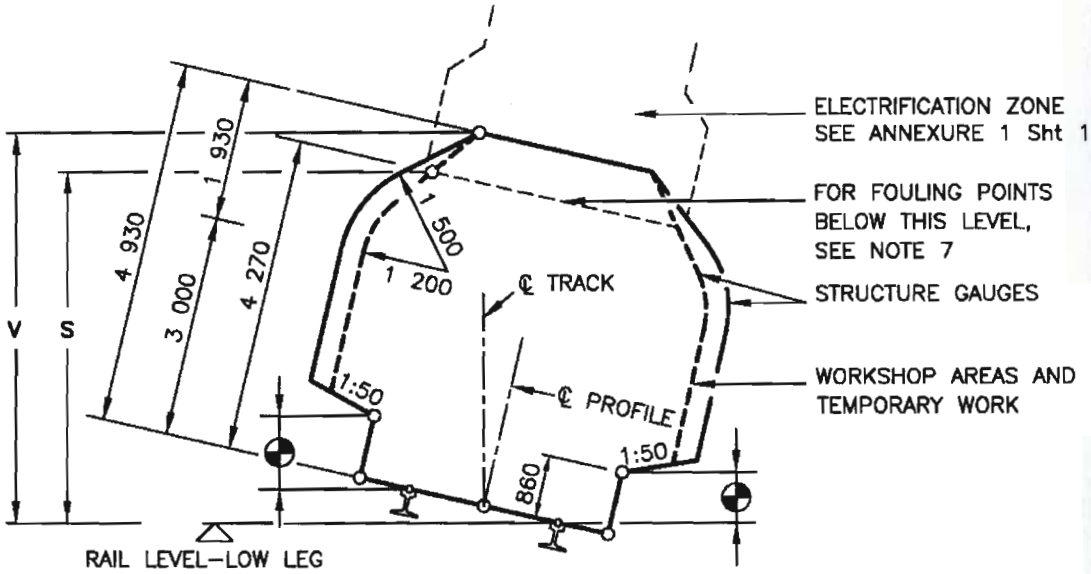


REMARKS:

1. **H** AND **B** IS THE REQUIRED HORIZONTAL CLEARANCE ON THE OUTSIDE OF THE CURVE BASED ON MINIMUM CANT.
2. **L** AND **C** IS THE REQUIRED HORIZONTAL CLEARANCE ON THE INSIDE OF THE CURVE BASED ON MAXIMUM CANT.
3. INTERMEDIATE VALUES MAY BE INTERPOLATED BY THE ENGINEER IN CHARGE.
4. FOR WORKSHOP AREAS AND TEMPORARY WORK, CLEARANCES **H** AND **L** MAY BE REDUCED BY 300mm.
5. ⊕ SEE ANNEXURE 1 SHEET 3 FOR PLATFORM CLEARANCES.
6. ALSO REFER TO REMARKS 4 TO 8 OF ANNEXURE 1 SHEET 2.

VERTICAL CLEARANCES : 1 065mm TRACK GAUGE

LOCATION		NOT ELECTRIFIED	ELECTRIFIED (PRESENT OR FUTURE)	
			3kV & 25kV	50kV
	RADIUS (mm)	S (mm)	V (mm)	V (mm)
ALL AREAS OTHER THAN THOSE INDICATED BY * BELOW	100	4 470	5 050	5 400
	300	4 410	5 020	5 370
	600	4 370	5 000	5 350
	1 000	4 350	4 990	5 340
	1 500	4 310	4 960	5 310
	2 000	4 290	4 940	5 290
	>3 000	4 270	4 930	5 280
* OVER OR NEAR POINTS AND CROSSING IF REQUIRED BY ELECTRICAL IRRESPECTIVE OF RADIUS		5 650		6 000



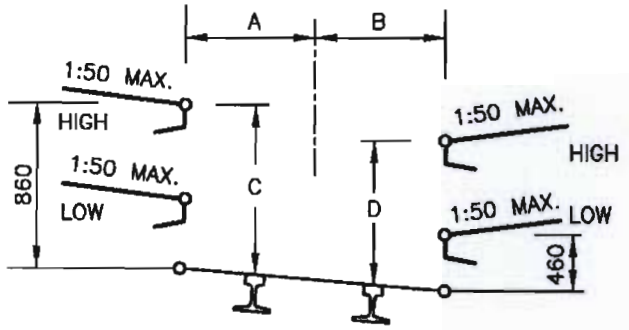
REMARKS:

1. **V** IS THE REQUIRED VERTICAL CLEARANCE EXCEPT WHERE REDUCED CLEARANCE **S** APPLIES.
2. **S** IS THE MINIMUM VERTICAL CLEARANCE FOR STRUCTURES AND TEMPORARY WORK OVER NON–ELECTRIFIED LINES.
3. INTERMEDIATE VALUES MAY BE INTERPOLATED BY THE ENGINEER IN CHARGE.
4. FOR APPLICATION AT CURVES
   - 4.1 APPLY INCREASED CLEARANCES FOR CURVES TO POINTS 3m BEYOND THE ENDS OF THE CIRCULAR CURVE.
   - 4.2 REDUCE CLEARANCES AT A UNIFORM RATE OVER THE REMAINDER OF THE TRANSITION CURVE.
   - 4.3 FOR NON–TRANSITIONED CURVES REDUCE AT A UNIFORM RATE OVER A LENGTH OF 15m ALONG STRAIGHTS.
5. NEW STRUCTURES: SEE BRIDGE CODE.
6. TUNNELS: SEE DRAWING BE 82–35.
7. FOULING POINTS: SEE CLAUSE 8.1.
8. CLEARANCES ARE BASED ON 15m BOGIE CENTRES AND 21,2m VECHILE BODY LENGTH.
9. ⊕ SEE ANNEXURE 1 SHEET 3 FOR PLATFORM CLEARANCES.

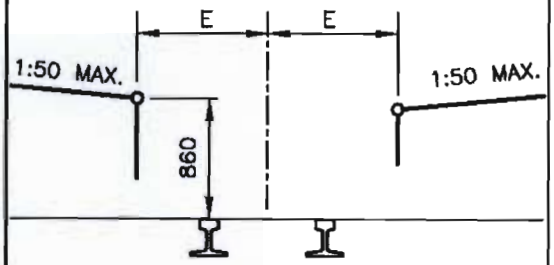
CLEARANCES : PLATFORMS

PLATFORMS : TRACK GAUGE 1 065mm

PASSENGERS



GOODS



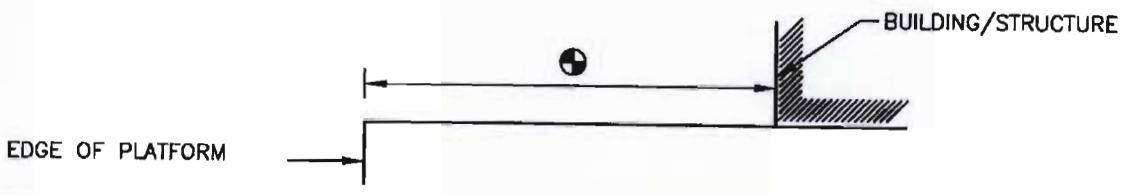
(NO CANT)

RADIUS (m)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)
90	1 690	1 820	890	810	1 840
100	1 650	1 790	890	810	1 810
120	1 610	1 740	890	810	1 760
140	1 580	1 700	890	810	1 720
170	1 550	1 660	890	810	1 690
200	1 530	1 630	890	820	1 670
250	1 520	1 600	890	820	1 640
300	1 520	1 580	890	830	1 620
350	1 520	1 560	880	830	1 600
400	1 520	1 550	880	840	1 590
500	1 520	1 540	880	850	1 580
600	1 520	1 530	870	850	1 570
800	1 520	1 520	860	860	1 560
1 200	1 520	1 520	860	860	1 550
2 000	1 520	1 520	860	860	1 540
3 000	1 520	1 520	860	860	1 530
STRAIGHT	1 520	1 520	860	860	1 520

REMARKS:

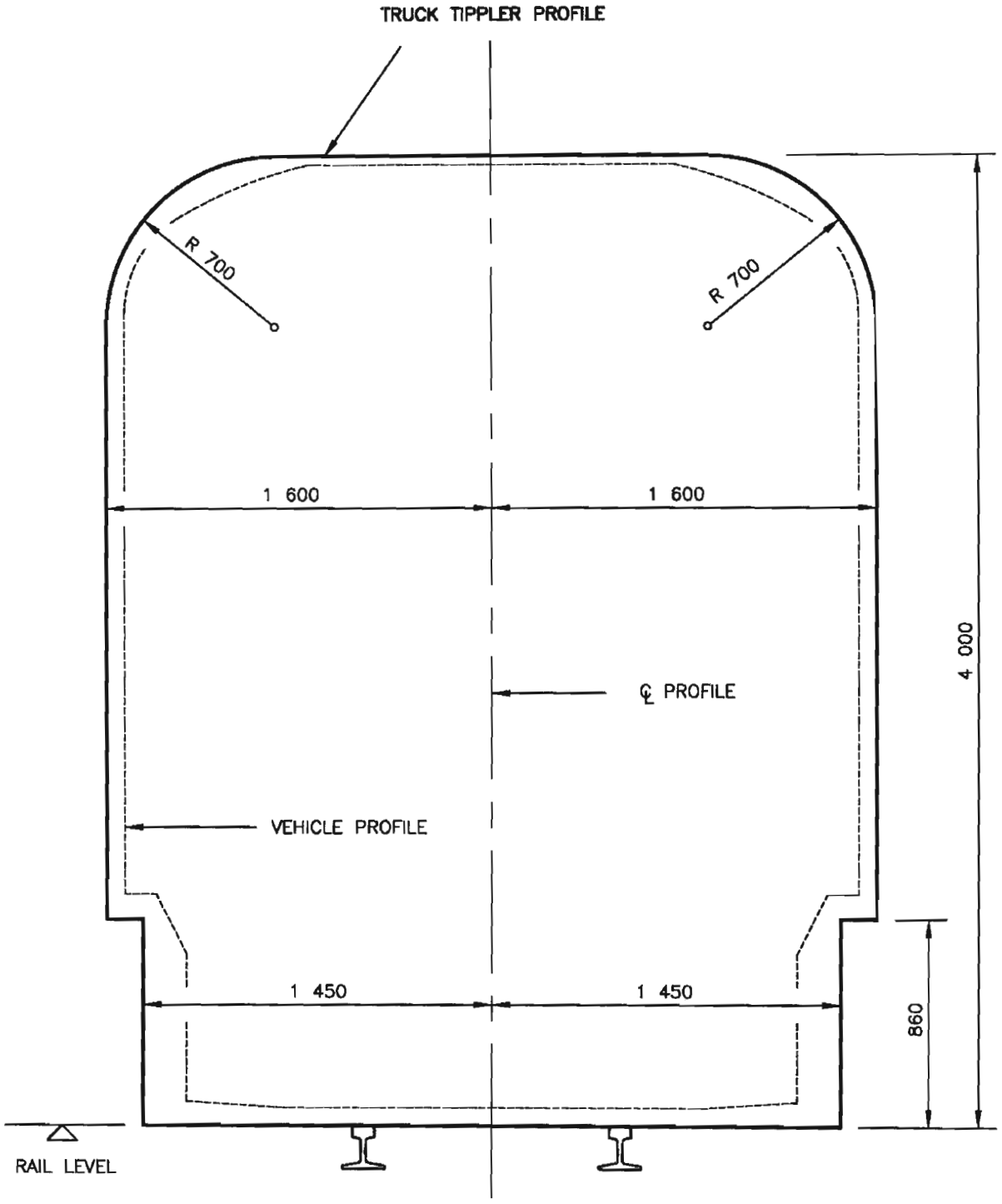
1. NO CANT TO BE APPLIED EXCEPT WHEN THE GOODS PLATFORM IS ON A RUNNING LINE.
2. INTERMEDIATE VALUES MAY BE INTERPOLATED BY THE ENGINEER IN CHARGE.
3. ⊕ 8m TO MAIN STATION-BUILDINGS AND 3m TO ALL OTHER STRUCTURES.
4. TOLERANCES : SEE CLAUSE 8.0.10.

STRUCTURES ON PLATFORMS : 1 065mm AND 610mm TRACK GAUGE



ANNEXURE 1
SHEET 4 of 5
AMENDMENT

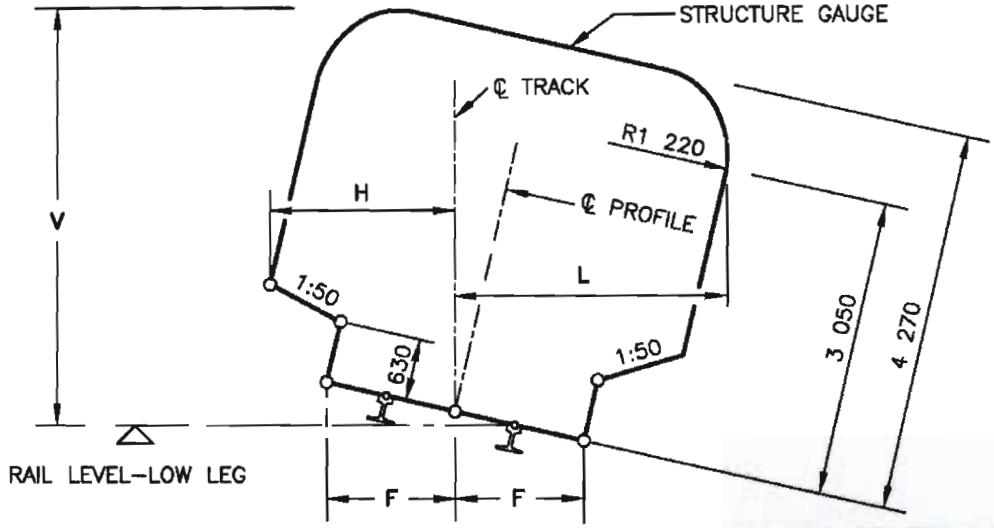
SPECIAL STRUCTURE GAUGE FOR TRUCK TIPPLER



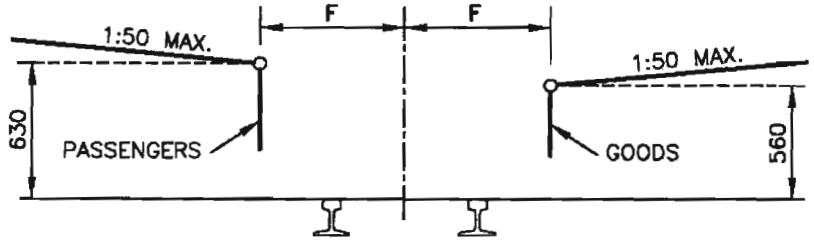
TRACK GAUGE 1 065mm

CLEARANCES : 610mm TRACK GAUGE

RADIUS (m)	WITH CANT H (mm)	WITH CANT L (mm)	NO CANT H & L (mm)	V (mm)
50	2 370	2 490	2 400	4 320
70	2 310	2 420	2 330	4 310
100	2 260	2 370	2 280	4 310
140	2 220	2 340	2 250	4 310
200	2 200	2 300	2 220	4 300
300	2 190	2 270	2 200	4 300
500	2 180	2 230	2 190	4 290
700	2 170	2 200	2 180	4 270
1 000	2 170	2 170	2 170	4 270
>2 000	2 160	2 160	2 160	4 270



CLEARANCES



(NO CANT) PLATFORMS

RADIUS (m)	F (mm)
50	1 550
60	1 510
80	1 460
100	1 430
120	1 410
140	1 390
170	1 380
200	1 370
250	1 360
300	1 350
600	1 330
1 000	1 320
>2 000	1 320
STRAIGHT	1 310

REMARKS:

1. H IS THE MINIMUM HORIZONTAL CLEARANCE ON THE OUTSIDE OF THE CURVE BASED ON MINIMUM CANT.
2. L IS THE MINIMUM HORIZONTAL CLEARANCE ON THE INSIDE OF THE CURVE BASED ON MAXIMUM CANT.
3. V IS THE MINIMUM VERTICAL CLEARANCE.
4. FOR APPLICATION AT CURVES:
   - 4.1 APPLY INCREASED CLEARANCES FOR CURVES TO POINTS 2m BEYOND THE ENDS OF THE CIRCULAR CURVE.
   - 4.2 REDUCE CLEARANCES AT A UNIFORM RATE OVER THE REMAINDER OF THE TRANSITION CURVE.
   - 4.3 FOR NON–TRANSITIONED CURVES REDUCE AT A UNIFORM RATE OVER A LENGTH OF 18m ALONG STRAIGHTS.
5. INTERMEDIATE VALUES MAY BE INTERPOLATED BY THE ENGINEER IN CHARGE.
6. ALSO REFER TO REMARKS 5, 6 AND 7 OF ANNEXURE 1 SHEET 2.
7. CLEARANCES ARE BASED ON 9 700mm BOGIE CENTRES AND 13 700mm VEHICLE BODY LENGTH.
8. SEE ANNEXURE 1 SHEET 3 FOR STRUCTURES ON PLATFORMS.

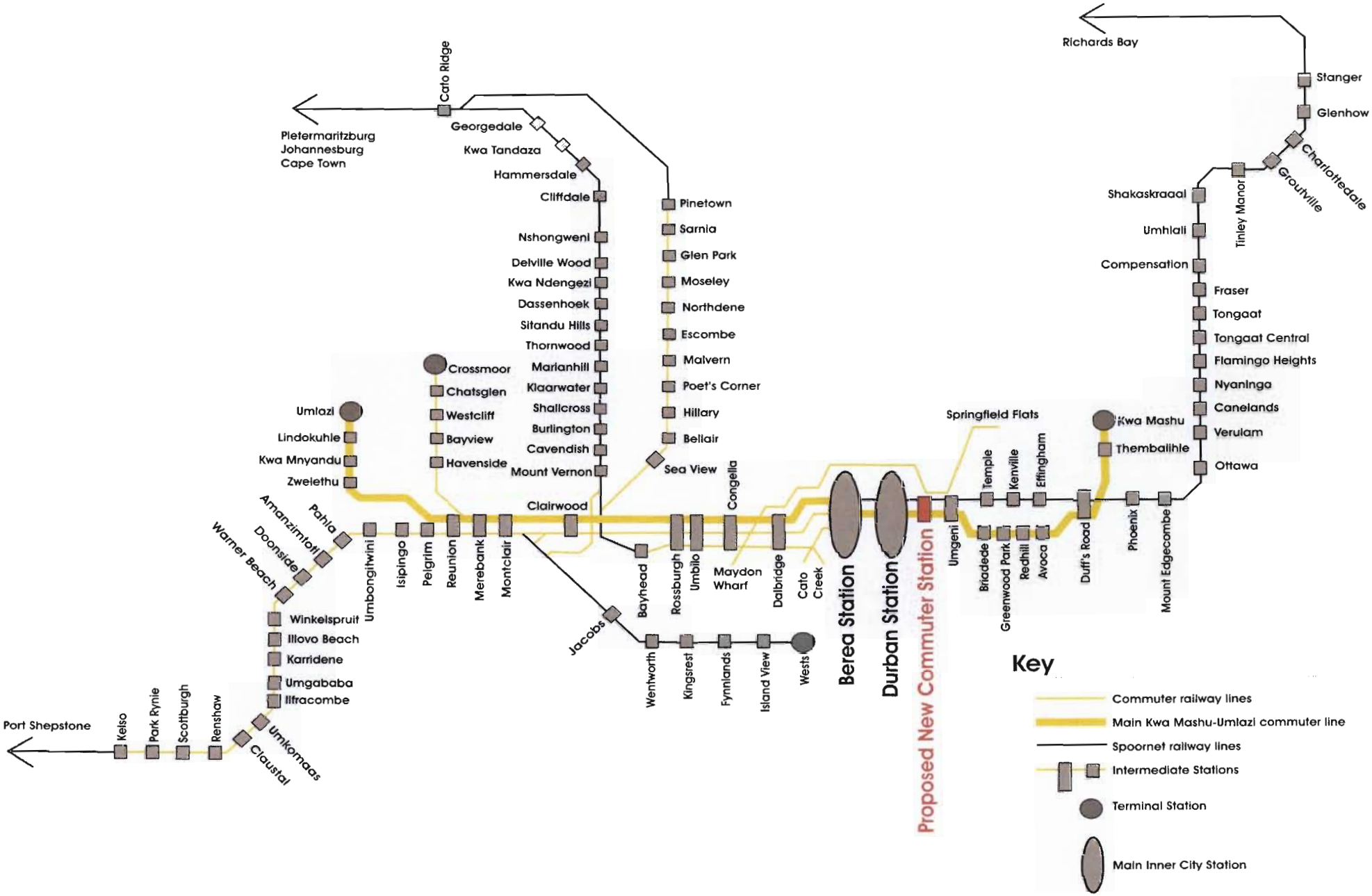
Appendix C

Patronage Estimate for the Proposed New Commuter Railway Station (SARCC 2006b:12).

Scenario Name	Scenario Description	Passenger Source	Appox. No. of Passengers per week day.
1. Existing commuters	Rail passengers under existing Development and service condition.	Divert from Umgeni and Durban Stations. These are KwaMashu (North) and Umlazi (South) routes.	3760
2. Berea distribution service operated via Proposed Station.	Berea distribution service routed from or via Proposed Station.	Passengers diverted form busses to rail.	980
TOTAL EXISTING RAIL PASSENGERS DIVERTED			**4740**
3. Inanda Rail line Halt	New halt in Inanda.	Existing commuters to Proposed Station diverted from busses and hence new passengers.	1780
4. Park and Ride facilities	Park and Ride facilities developed and marketed in Phoenix, Queensburgh and Chatsworth.	Existing private vehicle commuters to Kingspark Precinct diverted from private vehicle usage and hence new passengers.	200
5. Commercial Node Development at Proposed Station	New commercial Node near the Proposed Station.	New employment generated and hence new passengers.	960
6. Durban Film City	Development of the Durban Film City at the Army Base.	New employment generated and hence new passengers.	920
7. New Durban Stadium	Rail service to cater for sporting events.	New Station makes New Durban Stadium accessible to new spectators.	4000
TOTAL NEW RAIL PASSENGERS			**7860**
TOTAL OVERALL			**12 600**

Appendix D

Existing commuter railway routes and destinations in KwaZulu-Natal, which the Proposed New Commuter Station will service, as an additional Intermediate Station within the existing network (Author / Protekon Simmer JV. 1998:8).

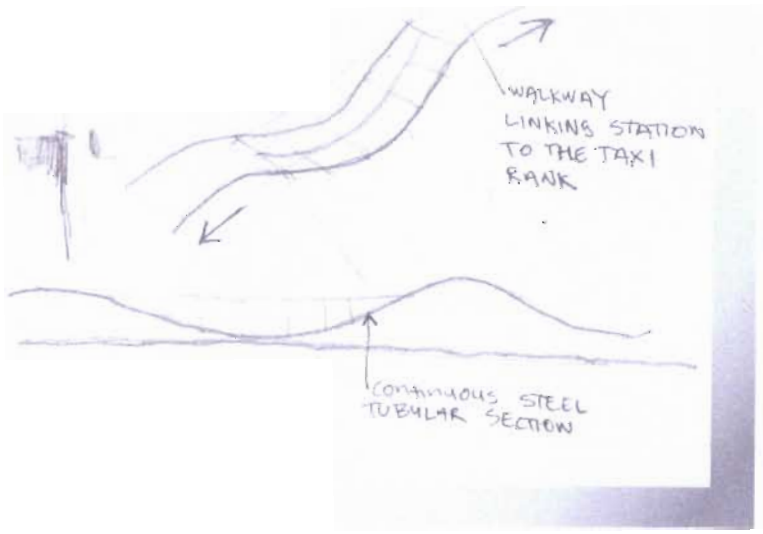

Richards Bay
Stanger
Glenhow
Charlottedale
Groutville
Tinley Manor
Shakaskraaal
Umhlali
Compensation
Fraser
Tongaat
Tongaat Central
Flamingo Heights
Nyaninga
Canelands
Verulam
Ottawa
Kwa Mashu
Thembalihle
Springfield Flats
Temple
Kenville
Effingham
Briadene
Greenwood Park
Redhill
Avoca
Duff's Road
Phoenix
Mount Edgecombe
Umgeni
Cato Ridge
Pietermaritzburg
Johannesburg
Cape Town
Georgedale
Kwa Tandaza
Hammersdale
Cliffdale
Nshongweni
Delville Wood
Kwa Ndengezi
Dassenhoek
Sitandu Hills
Thornwood
Marianhill
Klaarwater
Shallcross
Burlington
Cavendish
Mount Vernon
Pinetown
Sarnia
Glen Park
Moseley
Northdene
Escombe
Malvern
Poet's Corner
Hillary
Bellair
Sea View
Crossmoor
Chatsglen
Westcliff
Bayview
Havenside
Umlazi
Lindokuhle
Kwa Mnyandu
Zwelethu
Clairwood
Amanzimtoti
Pahla
Doonside
Warner Beach
Umbongiwini
Isipingo
Pelgrim
Reunion
Merebank
Montclair
Bayhead
Rossburgh
Umbilo
Congella
Maydon Wharf
Dalbridge
Cato Creek
Jacobs
Wentworth
Kingsrest
Fynnlands
Island View
Wests
Berea Station
Durban Station
Proposed New Commuter Station
Winkelspruit
Illovo Beach
Karridene
Umgababa
Ilfracombe
Umkomaas
Claustal
Renshaw
Scottburgh
Park Rynie
Kelso
Port Shepstone
Key
Commuter railway lines
Main Kwa Mashu-Umlazi commuter line
Spoornet railway lines
Intermediate Stations
Terminal Station
Main Inner City Station

Appendix E

Design Report

A Design Report

of the Proposed New Commuter Railway Station in Kingspark Sports Precinct, Durban.



MXOLISI SIKHUMBUZO MTEMBU

Table of Contents

Page

1. Introduction

This design project is a culmination of the thesis titled; Railway Stations and Transportation Nodes towards the design of a proposed new commuter railway Station in Kingspark Sports Precinct. The scheme is therefore informed by the findings of the research component in order to establish an informed design foundation towards an improved station image in Durban.

2. Project information

Client: Ethekwini Transportation Authority

Building functions: The Proposed Station has two main functions, namely:

(i) To provide transportation for the 2010 FIFA soccer World Cup tournament patrons, to and from the New Durban Stadium.

(ii) As well as to provide transportation for existing rail commuters working on the Umgeni Road Corridor between the existing Durban and Umgeni Railway Stations.

Brief and sizes:

Located next to the New Durban Stadium, the Proposed Station is planned to have a world class image which complements the new iconic Stadium. The development of the New Durban Stadium and other sports facilities in the Greater King's Park Sports Precinct is intended to enhance the area's image of a "Sports City," whilst establishing it as a premier sports venue for Southern Africa.

The profile of pedestrian or feeder trip demand is as follows:

- Walking/cycling – for patrons living closer to the Station.

- Taxi – A taxi rank will be designed next to the Station to transport people from the Berea area as well as to serve the proposed mixed-use development adjacent to the Station.
- Link to a bus drop-off point on Umgeni Road.
- Park and ride- 200 parking bays and 30 motocycle bays.
- Private vehicle, drop-off point (SARCC 2006a:5)

Schedule of accommodation

Accommodation	Function	No.	Area	Total area
Main Hall	main gathering space	1	2250 x 1.4	**3150 m²**
Ticket Office		6	3m²	18 m²
	Turnstiles	8		
	Strong room	1	12m²	12m²
	Information office	1	12m²	12m²
				42 m²
First aid room	for emergency situations	1	40m²	40m²
Public Ablutions	male	7	3,5m²	24,5m²
	Female	11	3,5m²	38,5m²
	Male and female disabled	2	8 m²	16 m²
				79m²
Retail	Planned along the main Circulation routes of the station and on the perimeter of the Main Hall to increase revenue for the Station. It is estimated that this would be 2000 m² of			

4. Site location

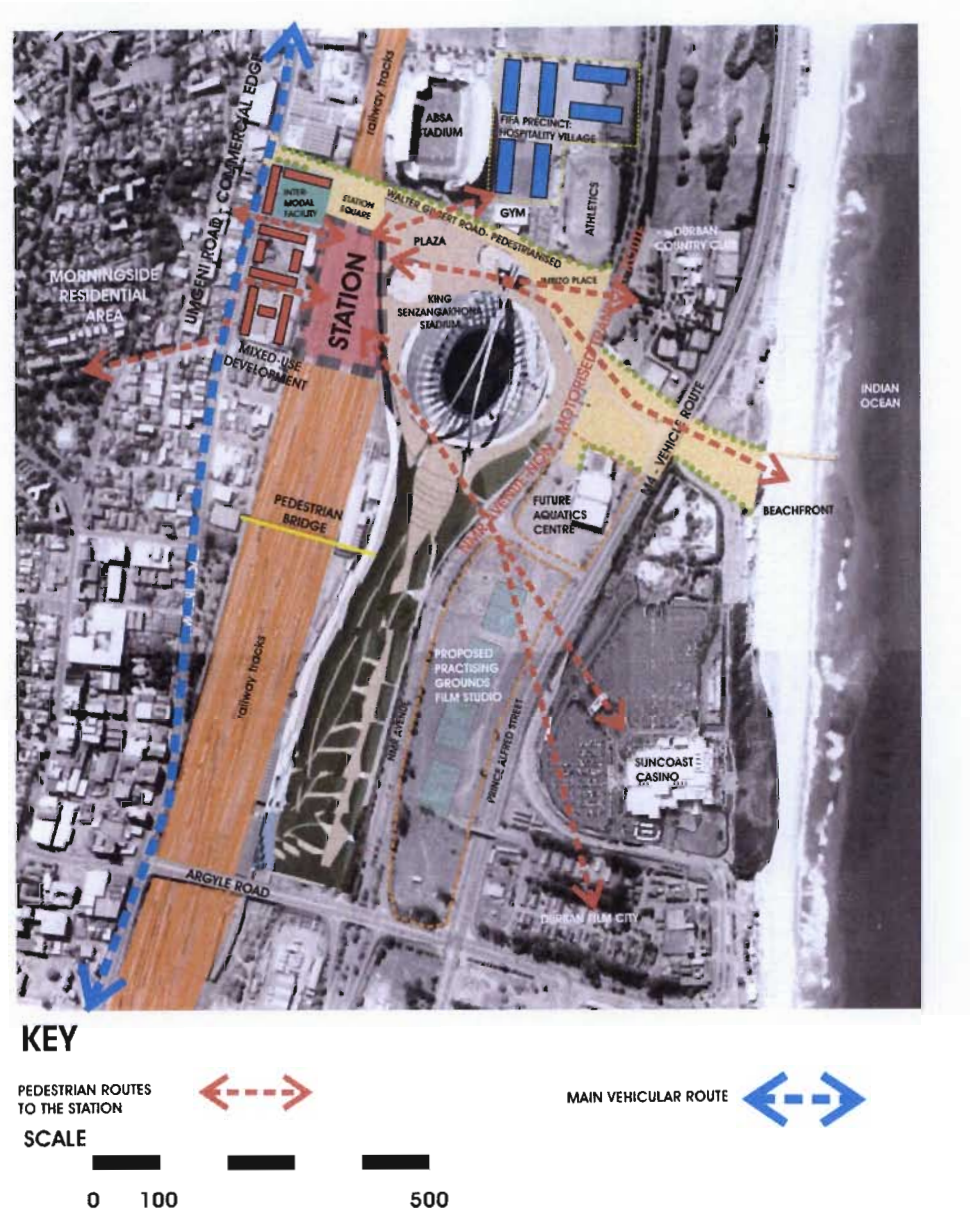
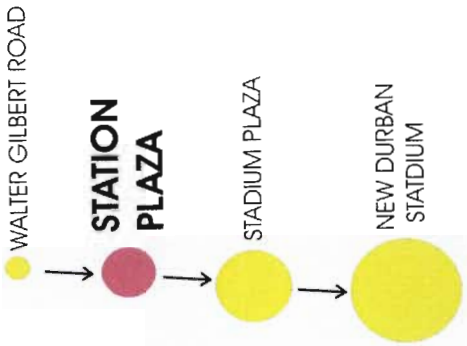


Illustration 4: Kingspark Precinct Plan (Author)

5. Design concept

5.1 Urban design concept -The Station plaza is created to complete the sequence in the hierarchy of spaces which constitute the progression towards the main focal point of the precinct, which is the New Durban Stadium. The sizes of public spaces increase towards the focal point as demonstrated in illustration 5.



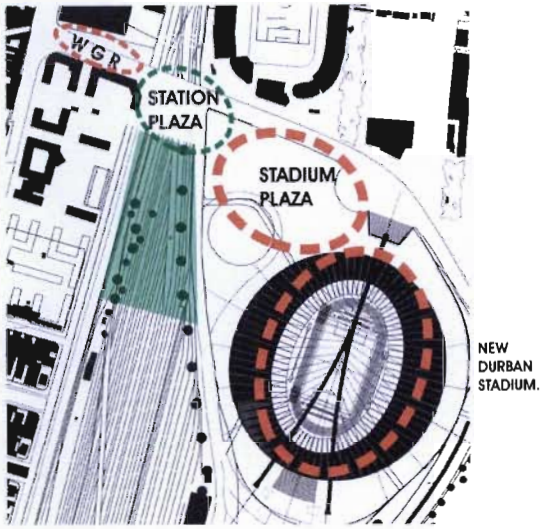


Illustration 5: Urban Space design concept. (Author)

The main entrance into the station is from the Station Plaza which acts as the central point of the node as show in illustration 6 below. This idea ensures that commuters from the different transportation modes within the precinct have a common point of entry into the station.

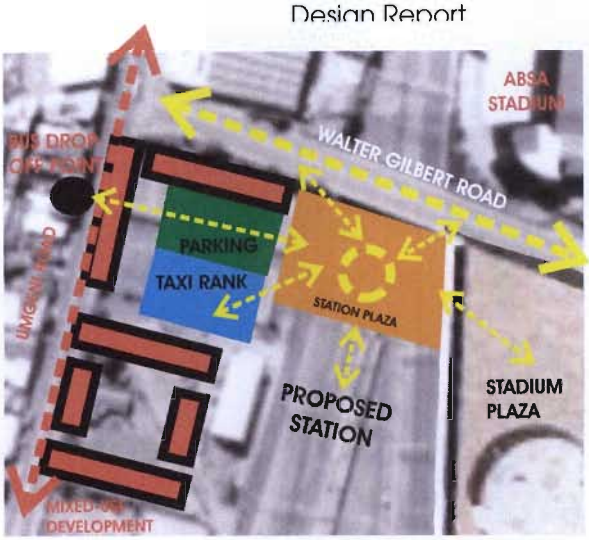


Illustration 6: A diagram illustrating the plaza as the main arrival point within a transportation node. (Author)

5.2 Station Building design concept

The station is designed to cater for a fixed platform position that is determined by an Engineer. As shown in illustration 7, the concourse is extended to reach the 2 platform islands to ensure an efficient circulation route.

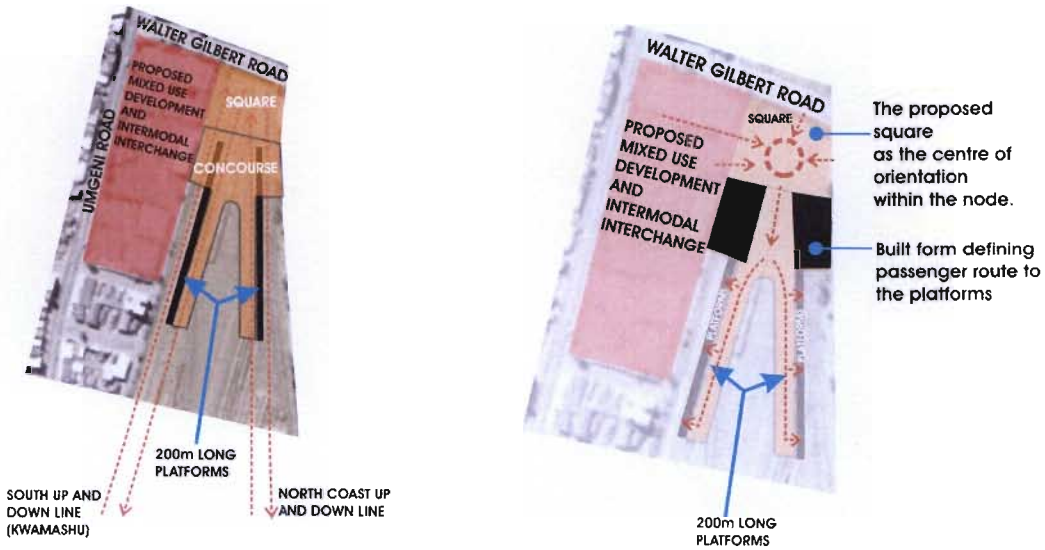


Illustration 7: Footprint study (Author)

5.3 Form derivation

Although railway stations have evolved to have diversified functions within themselves, the definition of the passenger route remains paramount as the main purpose of the station is rail travel. In defining the passenger route, shops and other secondary facilities within the station act as edges to the main circulation space to give it definition.

The design of the Station is based on the articulation of the passenger route which progresses though a series of internal spaces.

According to Alexander (1977: 877), higher ceilings mark rooms as more public and lower ceilings denote more intimate spaces. The ample Main Hall volume therefore, signifies the hierarchy of the space as the main and most public area within the Station.

Spaces within the Station have different volume heights, which are proportional to their floor areas. These are based on the expected number of people within them.

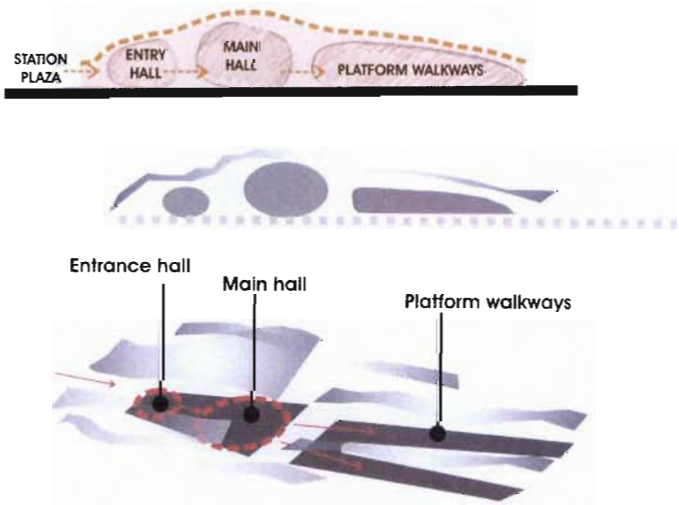


Illustration 8: Conceptual diagrams of the roof form (Author)

The series of spaces marking the passenger route in the Station are enveloped with one continuous form, which expresses the shape resulting from the different internal spaces, hence the curvilinear roof form.

6. Building environmental Study

As part of the architectural language of the building, louvers are extensively used for expressing the horizontal emphasis of the trains and the Station building. The function of these louvers is to allow for ventilation within the Station

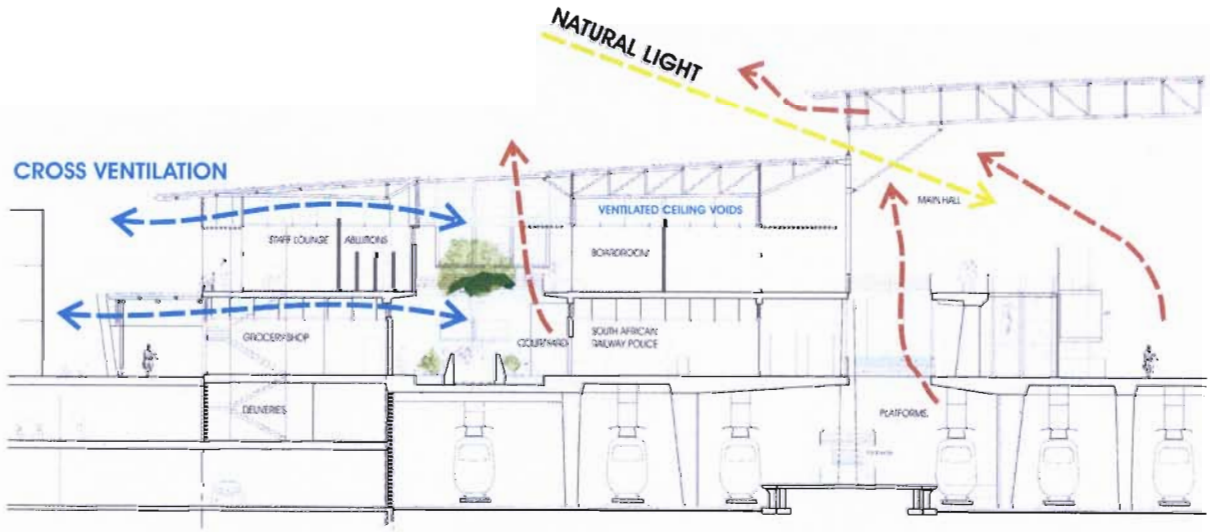


Illustration 9: A cross section through the part of the Station showing, the ventilation of the ceiling voids to cool the internal spaces (Author)

7. Technical Resolution

Due to the required large spans within the building, steel has been used as the main material for the roof structure, and capped with aluminium sheeting. The use of aluminium instead of steel sheeting is necessary for the corrosive Durban climate.

The main hall roof span is achieved through the use 2m deep steel trusses, connected to form a space frame structure.

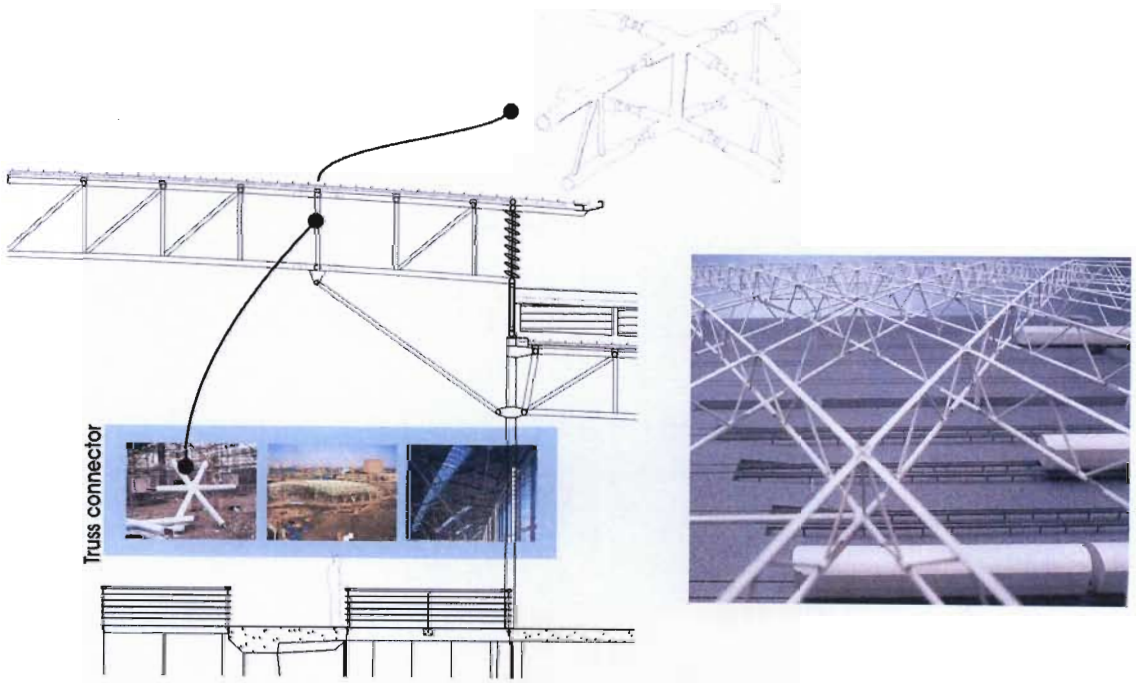
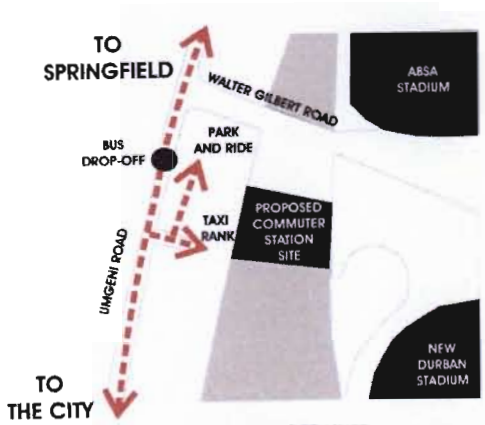


Illustration 10: A steel space frame truss system (Author / Wilkinson 2001: 114)

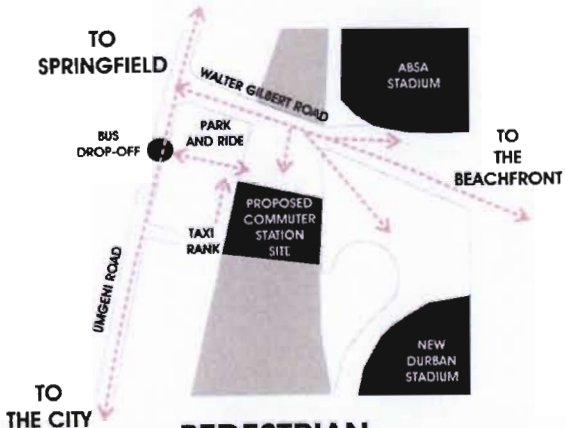
8. Design drawings

LINKAGES TO PROPOSED SITE



VEHICULAR

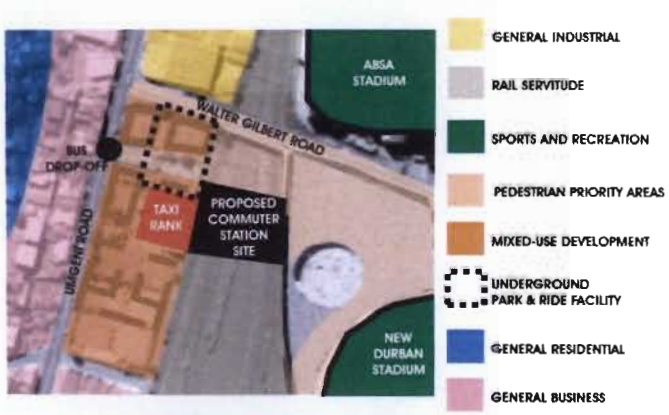
Umgeni Road is the closest arterial route to the site which makes it an ideal feeder route to the Park and Ride facility, taxi rank and deliveries to the Station site.



PEDESTRIAN

The proposed site is linked to Umgeni Road through pedestrian walkways. These pedestrian walkways become the generational axis of urban form in the precinct.

The proposed mixed-use development adjacent to the Station site will be used to define the strong line of pedestrian movement from the bus drop-off point in Umgeni Road, which allows both visual and physical access to the Station.

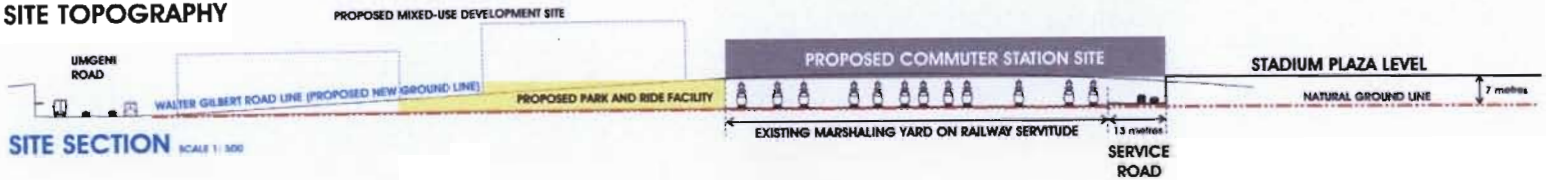


LAND-USE

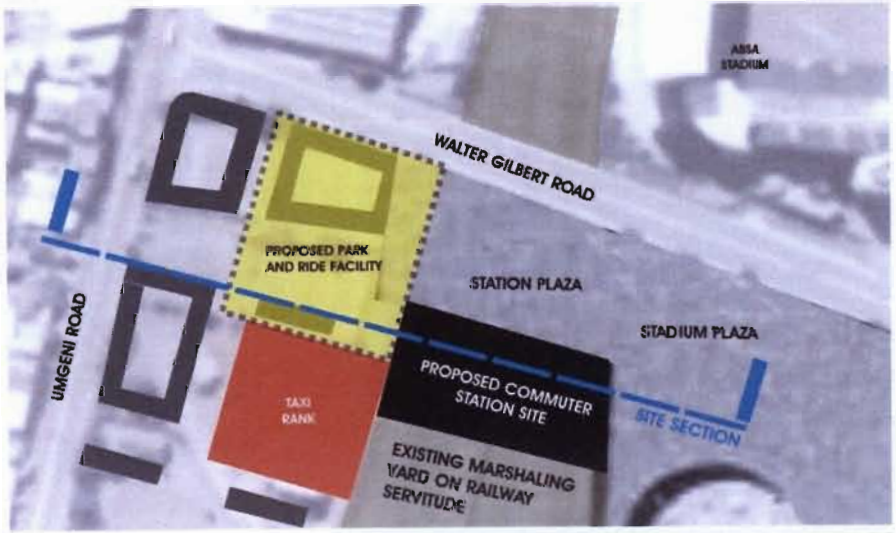
The proposed mixed-use development is part of the urban renewal initiative which seeks to density urban areas.

The station accommodation is planned to include commercial facilities and offices for rental. This concept is relevant for the Umgeni Corridor because of the current rapid redevelopment within the area, and the subsequent need for more of such facilities.

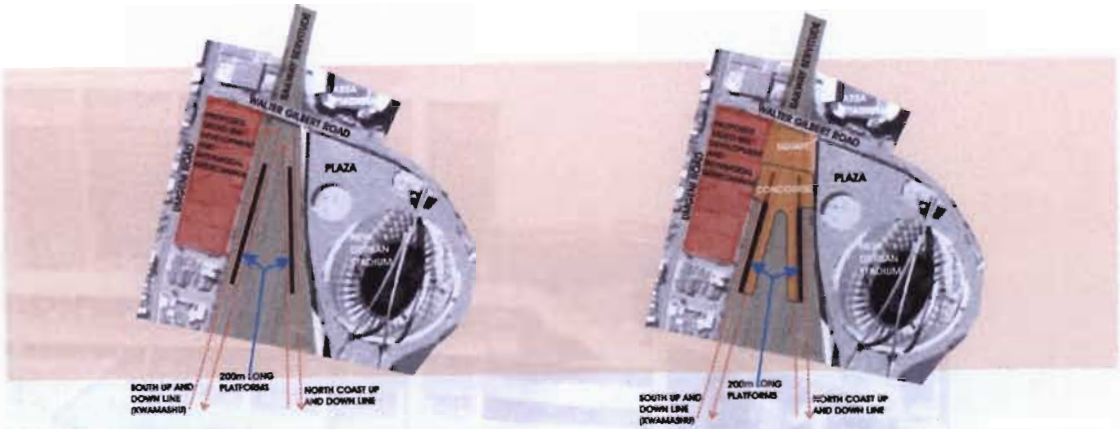
SITE TOPOGRAPHY



SITE SECTION SCALE 1: 500

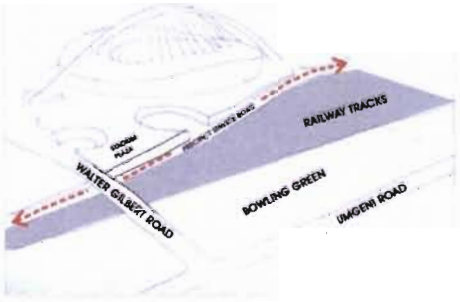


SITE PLAN SCALE 1: 250

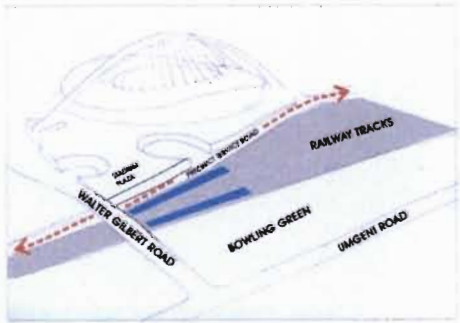


FIXED PLATFORM POSITIONING

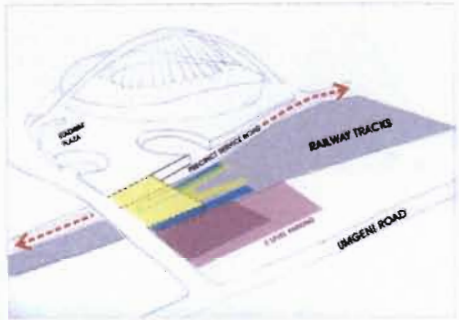
PROPOSED CONCOURSE POSITION TO SERVE THE PLATFORMS



The Proposed Station site is located adjacent to the 7metre HIGH stadium plaza.

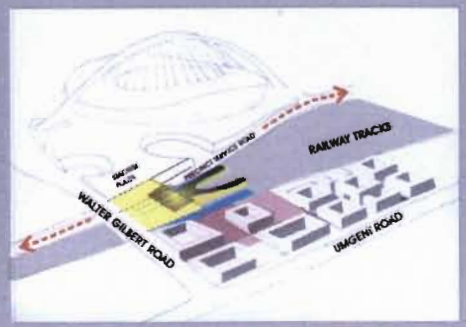


Island platforms are located on either end of the railway servitude to cater for the existing North and South lines.



A station plaza which is an extension of the stadium plaza forms a stronger connection between the station and the stadium by bridging over the railway tracks. The Station floor becomes an extension of the plaza and designed to reach each of the island platforms.

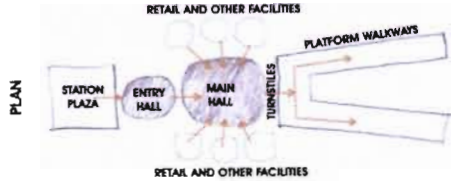
To overcome the 7m height difference between the Station level and Umgeni Road, a stepping 2 level parking is proposed.



The roof of the station envelopes defines the circulation within the station.

As part of the Urban densification strategy in the city of Durban, the area currently used as bowling greens adjacent the station is designed to accommodate a mixed-use development to maximise the potential of the land.

STATION FORM DERIVATION



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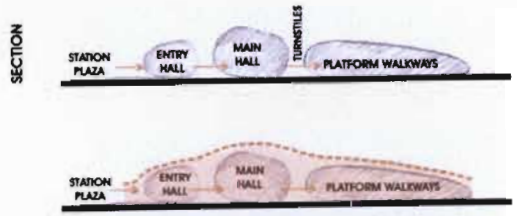
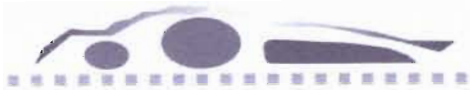
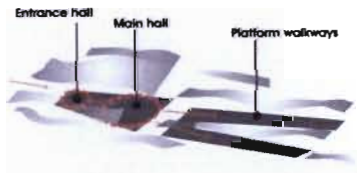


The series of spaces marking the passenger route in the station are enveloped with one continous form, which expresses the different internal volumes Hence the curvliner roof form.

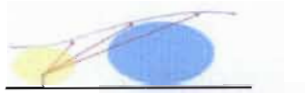




ENVELOPING A CONTINUOUS PASSENGER ROUTE

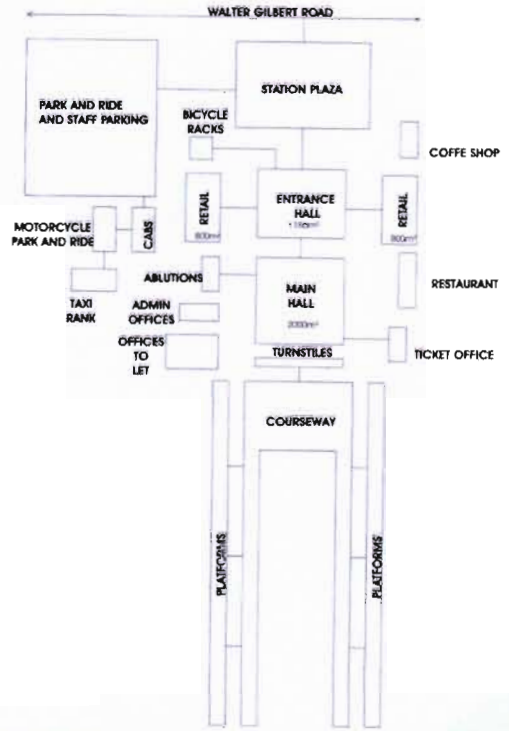
INTER-WOVEN SPACES OF DIFFERENT VOLUMES

CONCEPT MODEL



A CURVING ROOF ALLOWS FOR GRADUAL INTRODUCTION INTO THE NEXT SPACE, HENCE A BETTER VISUAL CONNECTION BETWEEN THE DIFFERENT SPACES ALONG THE PASSENGER ROUTE.

THE SPACIAL QUALITY ACHIEVED IS THAT OF A CONTINUOUS PASSENGER PATH WHICH ASSISTS CIRCULATION LEGIBILITY.



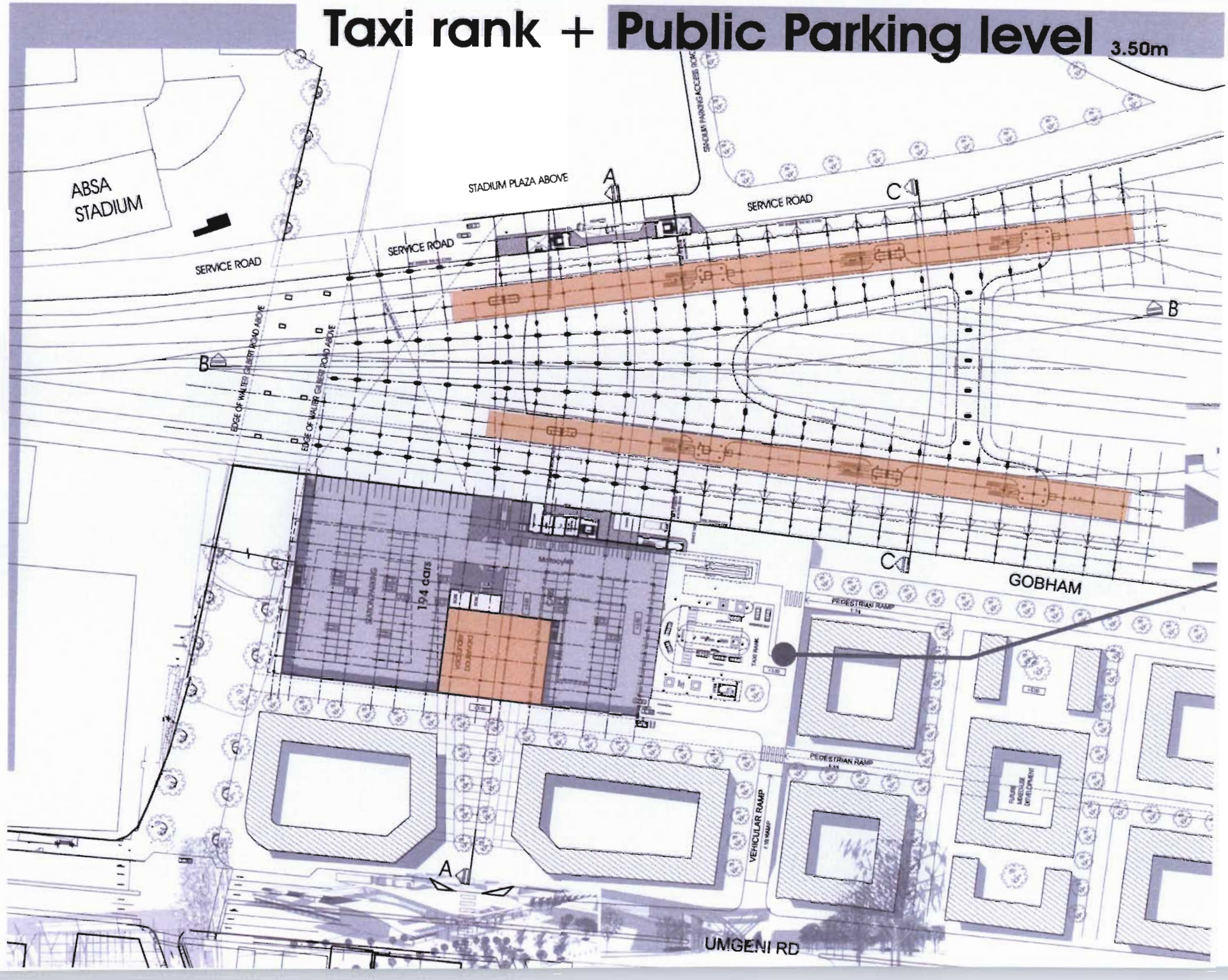
STATION ACCOMMODATION

STATION IMAGE

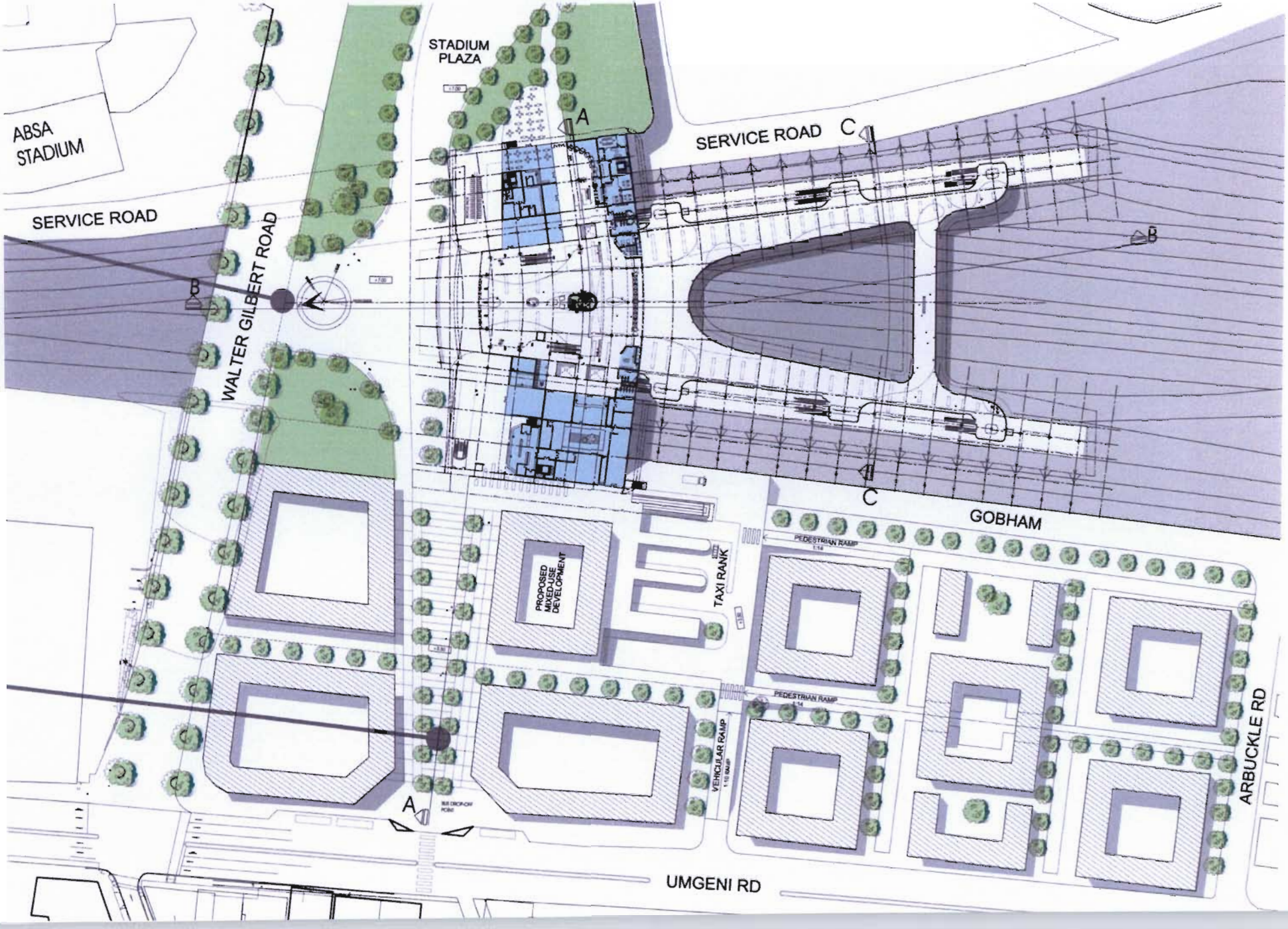
A View of a hall in Central Station, Glasgow. Designed by Rowand Anderson and completed in 1879.The picture shows the different facilities and shops that give the station a character of an ordinary street in the city. Natural lighting through the roof ensures the legibility of the space. (Hertzberger, 1991: 73)

An interior view of the Workshop Shopping, Durban Centre. The use of natural light gives the space a feeling of an ordinary city street.

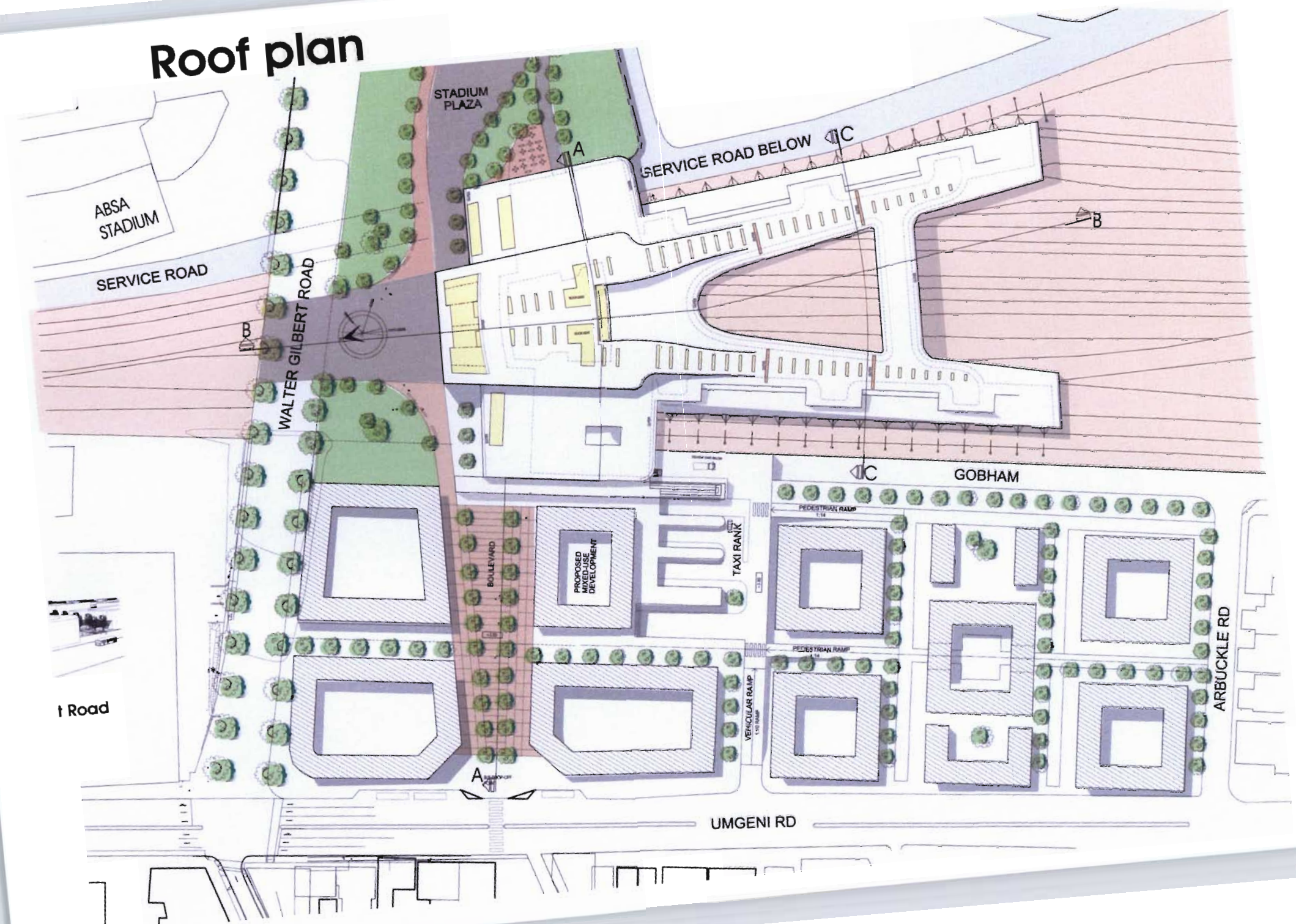
Taxi rank + Public Parking level 3.50m



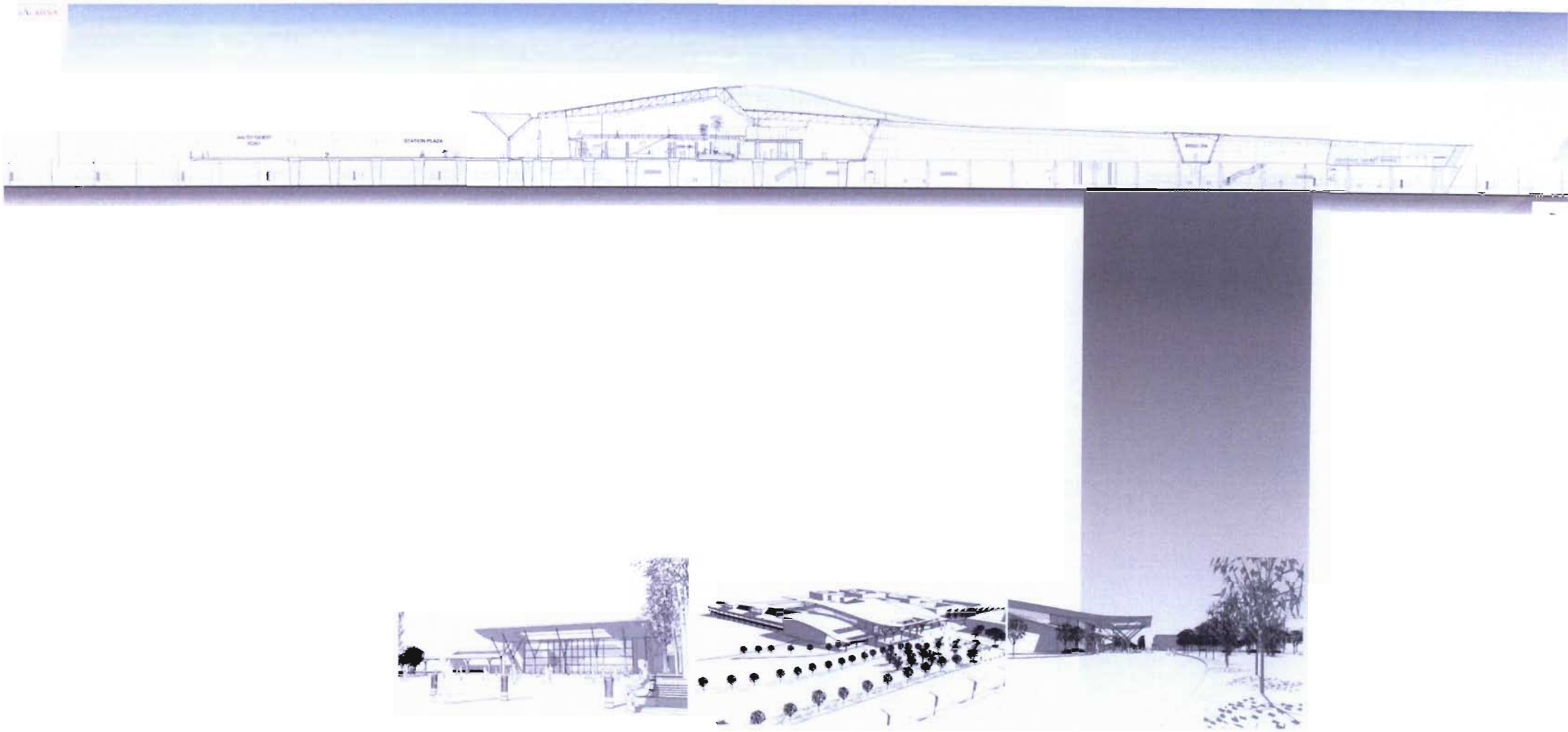
Station plaza +Ground floor level 7.00m

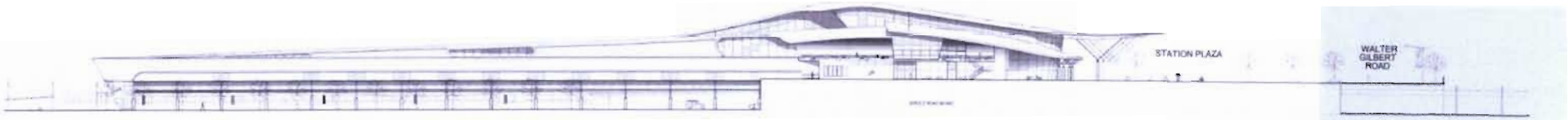


Roof plan

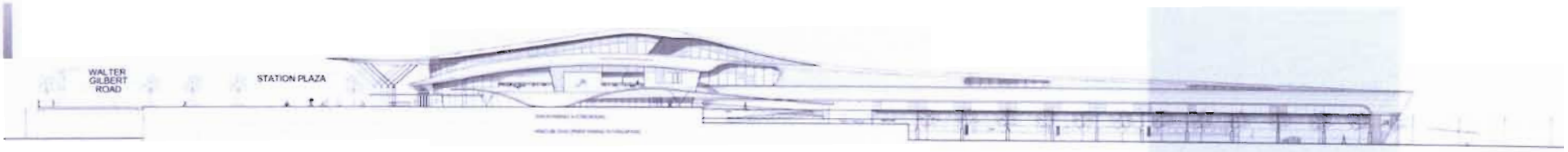

STADIUM PLAZA
ABSA STADIUM
SERVICE ROAD
WALTER GILBERT ROAD
SERVICE ROAD BELOW
A
B
C
GOBHAM
BOULEVARD
PROPOSED MIXED-USE DEVELOPMENT
TAXI RANK
PEDESTRIAN RAMP
VEHICULAR RAMP
ARBUCKLE RD
UMGENI RD
t Road

Section B-B





East Elevation

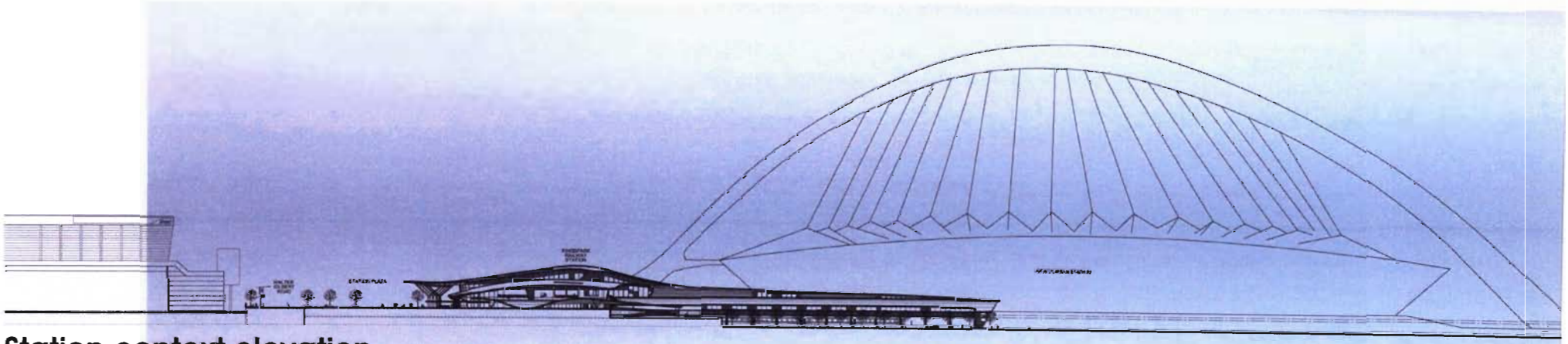


West Elevation

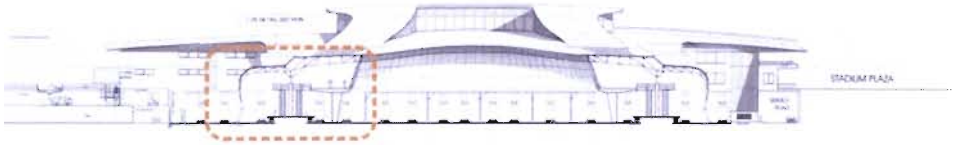
North Elevation

The architectural language of the elevations is derived from the horizontal emphasis of a train coach and the rhythm of its windows.

.....expressed through the use of louvres to allow for ventilation throughout the building.... whilst creating a tapestry of light which illuminates the internal spaces.

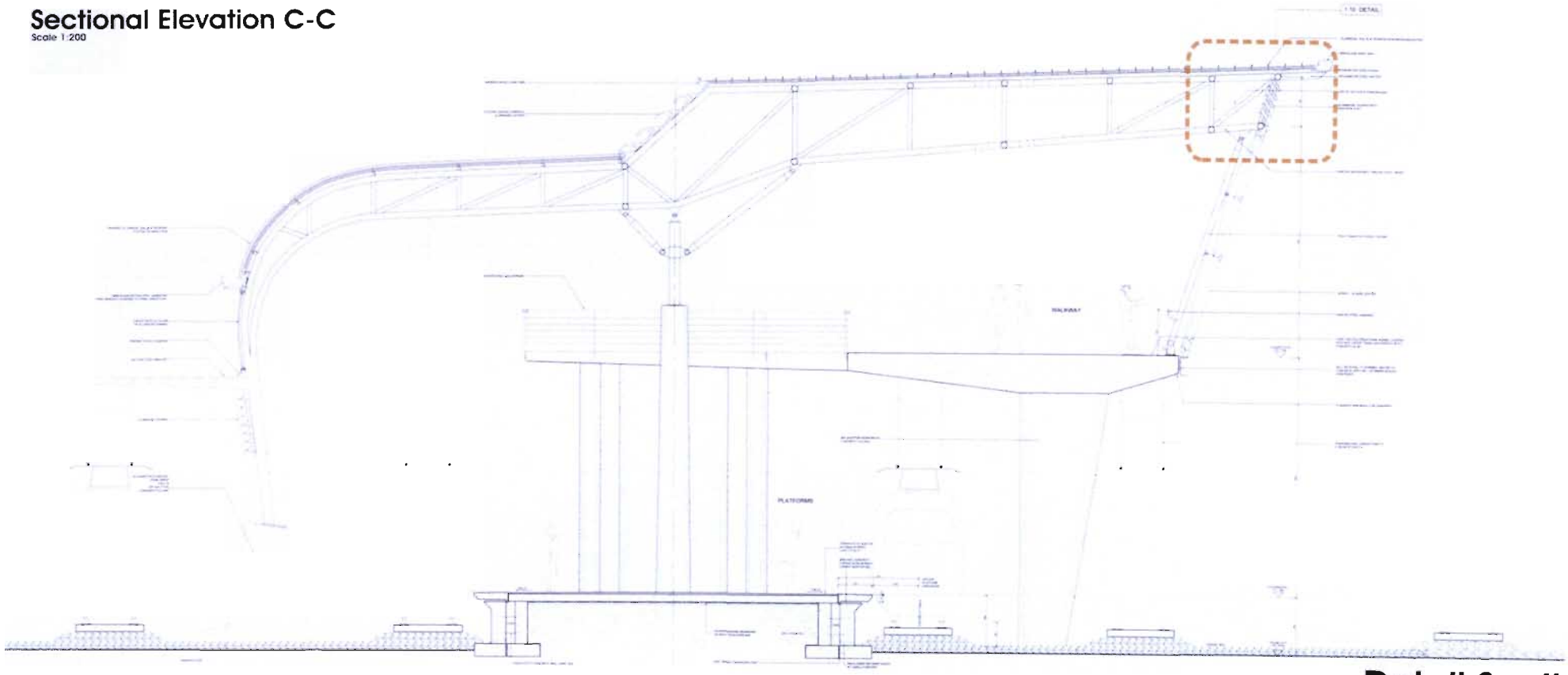


Station context elevation scale 1:1000



Sectional Elevation C-C

Scale 1:200



Detail Section

Scale 1:25

9. Design Report Conclusion

The design of the proposed station building is a synthesis of international and local station design principles towards a more improved South African model of station.