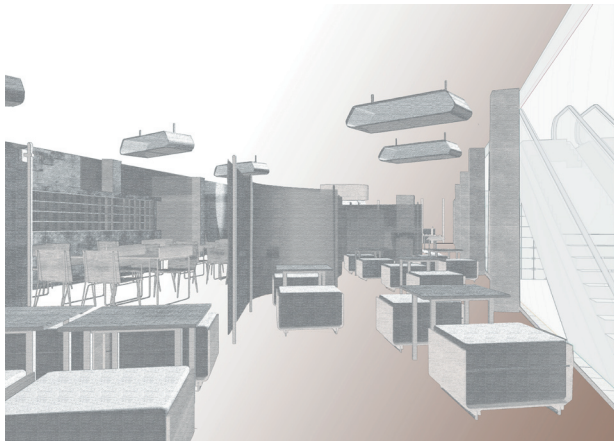


SUBTERRANEAN SPACE

INTEGRATING GENERIC COMMERCIAL ENTITIES WITHIN THE GAUTRAIN SYSTEM



JEANDRI VAN DER MERWE

NOVEMBER 2005

MENTOR: NICO BOTES

STUDY LEADER: BARBARA JEKOT

UNIVERSITY OF PRETORIA DEPARTMENT OF ARCHITECTURE

SUBMITTED AS PART OF THE REQUIREMENTS FOR THE DEGREE MAGISTER IN INTERIOR ARCHITECTURE [PROFESSIONAL]

IN THE FACULTY OF ENGINEERING, THE BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY

LIST OF FIGURES

INTRODUCTION

METRO METAMORPHOSES

FORMULATING THE DESIGN TASK

PROBLEM STATEMENT
DESIGN PROBLEM DEFINITION
ASSUMPTIONS & DELIMITATIONS
PHILOSOPHY

CONTEXT STUDY

THE GAUTRAIN RAPID RAIL PROPOSAL
SITE
CLIENT & USER PROFILE
THE SANDTON STATION SYNOPSIS

PRECEDENTS

JUBILEE LINE EXTENSION, CANARY WHARF, LONDON, GREAT BRITAIN
TGV STATIONS, PROVENCE, FRANCE
MILLENNIUM RAIL, BRENTWOOD SKY STATION, VANCOUVER, CANADA
DEUTSCHE BAHN, BONATZ ZERO ENERGY STATION, STUTTGART, GERMANY
AIRSIDE CENTRE, ZURICH AIRPORT, SWITZERLAND
DESIGN INFLUENCE

BASELINE

DESIGN DISCOURSE

PROGRAMME
CONCEPT
DESIGN PROCESS AND DEVELOPMENT:

STATION ENVELOPE
LIGHTING & FINDING DIRECTION
RETAIL & CATERING ENTITIES
SERVICES

TECHNICAL RESOLUTION

STATION CIRCULATION AND ACCESS
FIRE & EMERGENCY SAFE AREAS
HEATING AND VENTILATION
INFORMATION

DESIGN DRAWINGS

CONCLUSION

BIBLIOGRAPHY

APPENDICES

CONTENT

Archives - Naam Mem'i



LIST OF FIGURES



INTRODUCTION



METRO METAMORPHOSES



FORMULATING THE DESIGN TASK



CONTEXT STUDY



PRECEDENTS



BASELINE



DESIGN DISCOURSE



TECHNICAL RESOLUTION



DESIGN DRAWINGS



CONCLUSION



BIBLIOGRAPHY



APPENDICES

LIST OF FIGURES

METRO METAMORPHOSES

- FIG 001 The cramped interior of a City and South London carriage
 FIG 002 Art Nouveau entrances of the Paris metro, designed by Guimard c. 1913
 FIG 003 Harry Beck's original diagram for the stylized London Underground map
 FIG 004 Current iconic London Underground map

FORMULATING THE DESIGN TASK

- FIG 005 Proposed Gautrain with route alignment map
 FIG 006 Sengkang station, North east line Singapore

CONTEXT STUDY

- FIG 007 Stylized Gautrain map
 FIG 008 Arial photograph of Sandton Central
 FIG 009 Arial photograph of Sandton station precinct and surroundings
 FIG 010 Nelson Mandela Square and Sandton Library, Sandton convention Centre, Sandton City Shopping Centre
 FIG 011 Site photograph, Rivonia and West intersection
 FIG 011 The multidimensional user profile

PRECEDENTS

- FIG 012 Canary Wharf: Open vertical space from concourse to platform level
 FIG 013 Canary Wharf: Escalator banks connecting to a glass canopy entrance at ground level
 FIG 014 Canary Wharf: Section
 FIG 015 Canary Wharf: ticketing machines placed neatly on the side of passenger routes create clear and legible space
 FIG 016 Canary Wharf: Plan of platform level
 FIG 017 Canary Wharf: Glass and steel canopy entrance
 FIG 018 Canary Wharf: Open concrete concourse with ticketing machines
 FIG 019 TGV, Valence: Staircase expressing passenger routes
 FIG 020 TGV, Valence: Section and photograph illustrating the central glass box floating over the platform and tracks
 FIG 021 TGV, Valence: Longitudinal Section of valence station
 FIG 022 TGV, Valence: Duality - Duality - robust concrete platforms in contrast with the glass and steel station structure
 FIG 023 TGV, Avignon: Avignon station's continuous sloping concourse
 FIG 024 TGV, Avignon: Section Avignon station
 FIG 025 TGV, Aix-en-Provence's curving facade indicates the station entrance
 FIG 026 TGV, Section Aix-en-Provence station
 FIG 027 TGV, Aix-en-Provence: Mezzanine levels and bridges offer an overlook on the Aix-en-Provence station activities
 FIG 028 Brentwood: The luminous Brentwood station hovering above ground
 FIG 029 Brentwood: combination of wood, glass and steel creates warmer natural tones for aesthetic appeal and transparency for safety
 FIG 030 Brentwood: 3 dimensional section
 FIG 031 Bonatz: Model of the proposed Bonatz Zero Energy station

FIG 032	Bonatz: A punctured concrete shell illuminates the platform level and makes a connection with a public park above
FIG 033	Bonatz Sections
FIG 034	Airside Centre: Plan and Section
FIG 035	Airside Centre: The tranquil waiting lounge overlooking the Zurich Airport runway
FIG 036	Airside Centre: The timber finished retail components are inserted next to passenger routes and function independently to avoid interfering with passenger flow
FIG 037	Airside Centre: Cafe bars are positioned at either end of "malls" along passenger routes

DISCOURSE

FIG 038	Concept development June 2005
FIG 039	Concept development June 2005 Sections indicating Retail and catering zones clipped on to the main station envelope in orange
FIG 040	diagrammatic exploration of shape and development of station circulation - movement from entrance to platform
FIG 041	Vertical and horizontal progression in station composition
FIG 042	Station envelope as framework
FIG 043	concept development of lightbox-wall with integrated signage
FIG 044	Stainless steel fitting with integrated LED for signage
FIG 045	Lightbox-wall with integrated signage
FIG 046	Signage concept
FIG 047	Retail box as separate entity inserted in station envelope
FIG 048	Plywood and bent steel book display units with drawer extension for storage
FIG 049	Interior of Cafe bar showing dining area
FIG 050	Interior of Cafe bar, cocktail bar with screens
FIG 051	Plywood and bent steel tables and chairs of Cafe bar dining area
FIG 052	Concept development of toilet and washroom facilities
FIG 053	Toilet and washroom facilities

TECHNICAL RESOLUTION

FIG 054	Speedstile, electronic access control units
FIG 055	Modified and adapted Octopus smartcard as part of the automatic ticketing
FIG 056	diagrammatic illustrations of back projection principles





The idea of building underground is fascinating. From a designer's perspective the creation of architectural spaces beneath the earth's surface is a great accomplishment. Without building facades and a predetermined exterior shell it seems to be the ultimate interior and engineering challenge. Despite the enigma hereof, many people are startled by this concept as underground spaces are commonly associated with uncertainty; depicted by dark and confined passages. Many metro stations, especially older, more traditional ones, are detached from their external context. It is this disconnection that generates confusion and results in fear. Subterranean spaces have a unique atmosphere and the experience of being underground is quite different to that of being in a building or structure above ground level.

When one enters a subterranean space you are confronted with a change in light quality and intensity. Artificial light, though used as the primary illumination source in most building structures, visibly play a more significant role due to the deficiency of natural light. The prominence of artificial light simultaneously enhances an awareness of the shadows and contrasts it produces. It is this "play" of light and dark that creates a mood and atmosphere different to that of other spaces. Furthermore, one becomes dependent on the provision of information, which can manifest in various forms such as signage, to orientate and direct oneself. Textures and finishes act as narrative tools that direct users safely to their destination. The scale and size of the space and the elements placed within it, is also experienced more intensely by users because of the contained nature of the space. Scale is therefore fundamental as the spaces can easily become uncomfortable and cramped.

Though the subterranean experience is different, it does not imply that it is superior. It simply means that those differences should be acknowledged, which necessitates that underground spaces require

a unique approach in their design in order to allow them to be appreciated and functionally utilised.

The underground metro has become the most common occupant of subterranean space across the world. Thus it's also the most obvious choice for an investigation and a design with a subterranean nature. In the South African context the Gautrain Rapid Rail Link presents the perfect opportunity to introduce the novel concept of travelling underground.

This dissertation will investigate the functioning and progression of the metro with the intention of creating a design methodology aimed at initiating an underground culture fit for the contemporary South African society. It aspires to produce a station that would enhance the commuting experience, firstly by presenting a pleasant, safe and legible station and secondly, by offering retail and catering options to add

- — LIST OF FIGURES
- — INTRODUCTION
- — METRO METAMORPHOSES**
- — FORMULATING THE DESIGN TASK
- — CONTEXT STUDY
- — PRECEDENTS
- — BASELINE
- — DESIGN DISCOURSE
- — TECHNICAL RESOLUTION
- — DESIGN DRAWINGS
- — CONCLUSION
- — BIBLIOGRAPHY
- — APPENDICES

David Bennett examined the history and progress of underground travel in his book *Metro, the story of the underground railway*. The following is based on his findings.

London was one of the first cities in the world to experience extreme traffic congestion. In 1843 Charles Pearson, a lawyer by profession thought an underground line running beneath the surface to be the solution. The line from Paddington through Euston, St Pancras and Kings Cross on to Farrington would provide easy access to central London via an underground railway, thus creating a transport system that would avoid the crowded city streets. The venture was easier said than done, and the Metropolitan Line only opened in 1863. Nevertheless, it gave birth to the London underground culture.

The Thames Tunnel in London was the first underground tunnel constructed through the use of modern excavating principles developed by engineer Marc Brunel. Though risky, the concept of underground tunnels weren't new as it was alleged that the Romans constructed a tunnel under the sea at Marseilles and that the ancient Assyrian Queen Semiramis had a tunnel through the Euphrates. The completion of the Thames Tunnel was a great achievement even though it took 9 years before it could be opened for public use in May 1843. The process was hindered by several flooding incidences, tunnel collapses, human tragedies and financial downfall.

The East London Railway gained control over the Thames Tunnel in 1869 and decided to transform the pedestrian tunnel into a railway tunnel. At the turn of the century the tunnel was transferred to the London Underground and today it forms part of the Metropolitan Line. In 1870 a second tunnel, the Tower Subway tunnel connecting Tower Hill to Vine Lane was opened by the East London Railway company. Due to financial issues the open-top carriage railway



FIG 001

The cramped interior of a City and South London carriage

service had to be closed and the tunnel became a pedestrian subway.

The City and South London Line, between London and Stockwell, was the first twin-tunnelled underground railway in the world and opened in 1890. The line was the first deep-level tube system in London.

In mainland Europe, Budapest opened its underground railway service in 1896, while Paris opened the first of its six planned lines just after the Great Exhibition in 1900. The first electrically powered rapid transit rail, the U-Bahn, started operation in Berlin, Germany, in 1902, although the Vienna U-Bahn started operation in 1898.

In the United States of America, New York opened its first elevated metro system on Ninth Avenue in 1863 and a New York subway followed in 1904 (http://en.wikipedia.org/wiki/rapid_transit). Boston was the first city to open a "subway" in America. In 1901 it converted its streetcar (electrically driven tram) tunnel into an underground system.



FIG 002

Art Nouveau entrances of the Paris metro, designed by Guimard c.1913

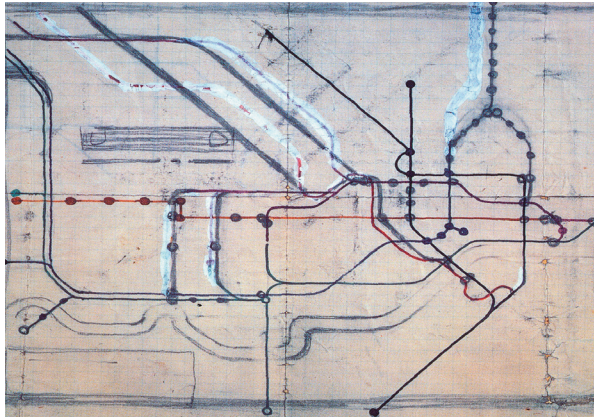


FIG 003
Harry Beck's original diagram for the stylized London Underground map

Moscow, the world's busiest system, was the first Soviet underground metro and started operation in 1935, while subterranean building issues caused the first planned system for St Petersburg only to open in 1955 (<http://www.urbanrail.net/as.htm>).

Asian underground rapid transit development only became prominent later in the 20th century. The Hong Kong Mass Rapid Transit (1976) and the Singapore Mass Rapid Transit (1987) offer technologically leading systems (<http://www.urbanrail.net/as.htm>). Lines are almost entirely automated since the introduction of the EZ-link and Octopus fair systems in 2002.

As the idea of underground transport became more popular, original lines were extended and transformed to increase carrying capacities and to accommodate the technological advances in train

and track development. New and improved lines with new stations and platforms were introduced. The Paris Métro initiated its conversion from steel to rubber-tyred trains in 1959 which allowed the system to increase its capacity without the need to modify station platforms. Vertical transportation in subway stations became more critical as stations became deeper and passenger numbers increased. The elevator was able to cope with the light passenger traffic of the early days, but it was the invention of the escalator in 1922 that allowed progression in deep underground station design.

Metro systems became a dense network with many interconnecting lines and a new mapping system had to be developed to aid commuters in finding their way. Scaled topographic maps were used until 1940 when the simplified metro map concept was introduced. Due to the lack of good colour printing, early maps were printed in black and white and not in the bright colours we see them in today.

Station designs have evolved from the traditional cylindrical corridors and platform spaces, to technologically advanced architectural structures that capture the user's attention. The introduction of smart cards (rechargeable tickets that look like credit cards) and electronic access control units provide a faster and more efficient circulation to cope with increasing station capacities. Today modern trains and stations can operate entirely automatic. Platform screen doors, an idea that was introduced in St Petersburg to regulate the underground station's temperature, are now becoming a safety feature where sliding powered doors on trains allow such intervention (<http:// railway-technical.com/stations>). Davey, a journalist for the Architectural Review states (2002:70) that great attention is given to transparent spaces that import daylight into the underground platform levels and so prevents dark, isolated and confusing spaces that are uncomfortable to commuters.

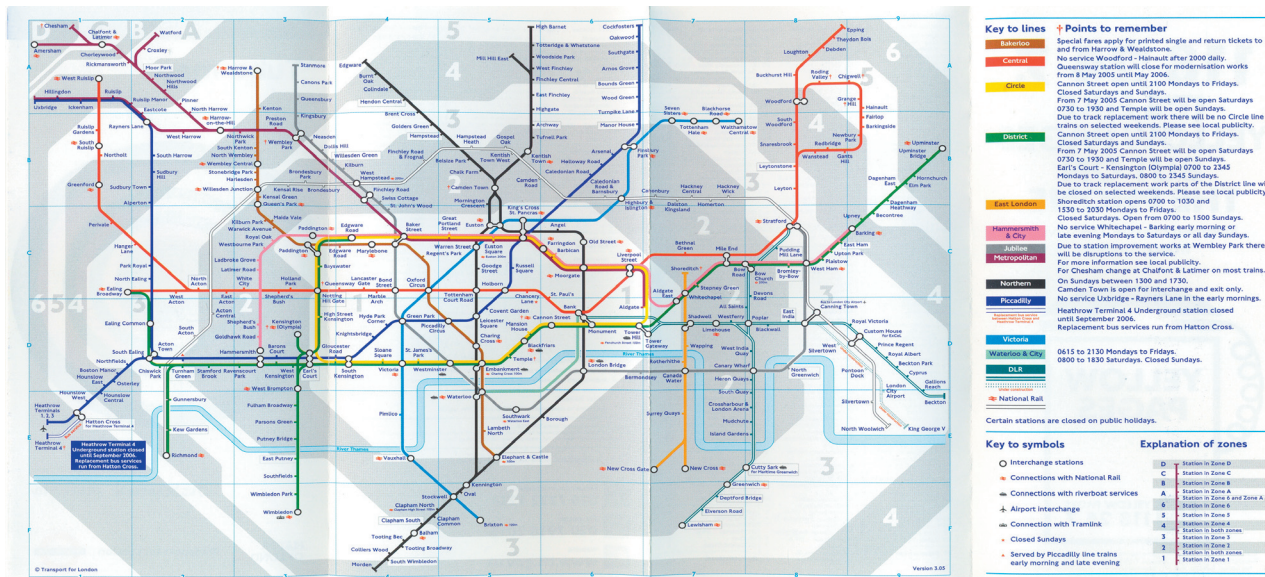


FIG 004
Current iconic London Underground map

○	LIST OF FIGURES
○	INTRODUCTION
○	METRO METAMORPHOSES
○	FORMULATING THE DESIGN TASK
○	PROBLEM STATEMENT
○	ASSUMPTIONS & DELIMITATIONS
○	DESIGN PROBLEM DEFINITION
○	PHILOSOPHY
○	CONTEXT STUDY
○	PRECEDENTS
○	BASELINE
○	DESIGN DISCOURSE
○	TECHNICAL RESOLUTION
○	DESIGN DRAWINGS
○	CONCLUSION
○	BIBLIOGRAPHY
○	APPENDICES

PROBLEM STATEMENT

“The fascination and freedom of road travel have long been overtaken by the grim realities of inescapable congestion, featureless motorways, frustrating breakdowns and hazardous accidents.” (Slessor 2003:52)

Pawley and Paoletti (2000:27) encourage the expansion of underground travelling as the best solution for the following reason: In most countries, major cities have attended to the need of people to travel quickly from one place to another by introducing public transport systems such as trams, light-rail systems and most importantly, the rapid underground train. As buses, taxis, trams and light-rails all compete for inflexible road space, underground transport corridors claim to be the only answer. In cities like London, Budapest, Berlin and Paris the tradition of using underground trains have been established more than a century ago (Bennett 2004:9). However, in South Africa the opportunity of travelling underground has not yet been introduced.

Gauteng, South Africa’s economic hub, is no exception when it comes to highways and roads with traffic congestion, accidents, death tolls and growing pollution; the most obvious example being the overcrowded N1 Freeway. Also known as the Ben Schoeman, the N1 between Johannesburg and Pretoria (Tshwane), has to tolerate traffic volumes that exceed 157 000 vehicles per day (<http://corporate.gautrain.co.za>).

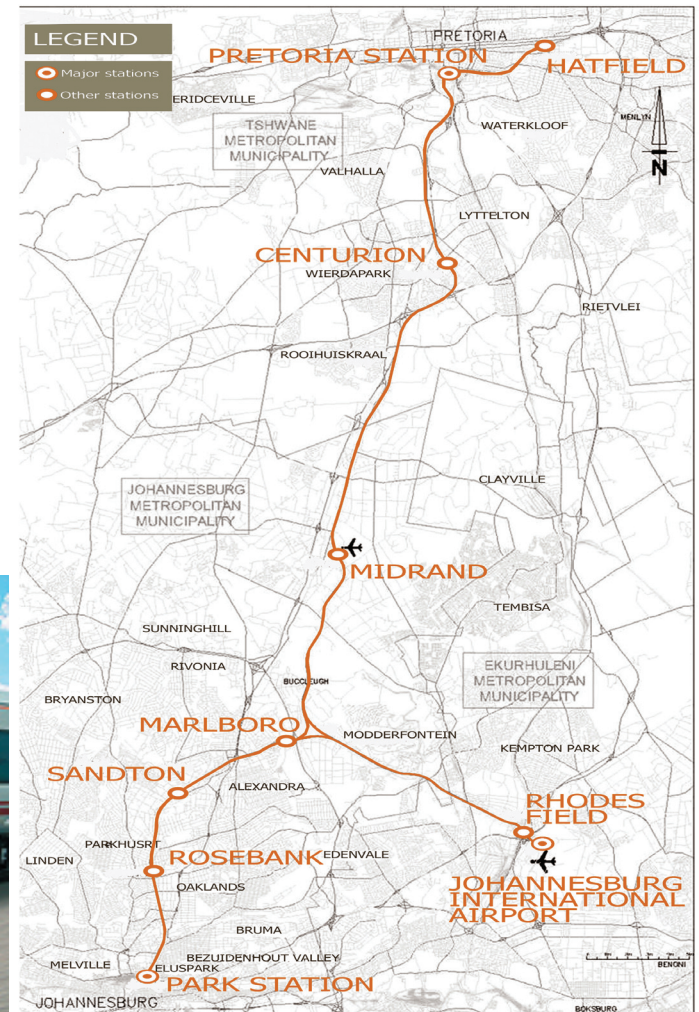
As a solution and also as a means to develop economic infrastructure in Gauteng, the Gauteng Provincial Government has proposed the Gautrain Rapid Rail Link. The Gautrain is aimed at offering a fast, safe and more sustainable method of transportation between Johannesburg, Pretoria,

and Johannesburg International Airport (JIA) (<http://corporate.gautrain.co.za>).

As the first underground public transport system in South-Africa, the Gautrain poses many design challenges and opportunities; one such being the transition from road transport to that of underground rapid rail transport. From Harding’s (2001:56) article about the new Singapore rapid transit station, it is understood that likewise, the South African public will in all probability be in favour of such a transition when the alternative of public transport is perceived as a proficient system that offers many advantages to its users. The novelty can be used to learn from the past. The history and evolution of the metro offers the opportunity to make well informed decisions, avoid past mistakes and simultaneously continue with methods that achieved superbly designed spaces.



FIG 005
Proposed Gautrain with route alignment map



DESIGN PROBLEM DEFINITION

An adequate and commendable identity, manifested in and portrayed through the design of safe, functional and inviting spaces in the Gautrain stations should be created. Though safety, functionality and pleasant appearance are generally required from the design, stations don't always comply with all these requirements and if they do, they are not necessarily that evident to commuters. Creating an awareness of these features is a principal design goal that should be reached to generate comfortable and successful underground spaces.

In addition, supplementary services offered within the Gautrain rapid rail link stations should assist in enhancing the image of this transport system. Additional features, such as commercial and retail components that satisfy commuters' needs, will add value and contribute to a positive perception of this new transport system in South Africa. Retail components expand the commuter experience and as a result could generate more commuters. But although the solution in concept seems fairly simple, the reality of introducing leisure activities within a punctual structure that operates at a high-frequency is complex.

The challenge lies in the integration of spaces of intermission, which require "dwell time", within a structure that primarily conveys movement and flow. One should be able to pause and linger without delaying or interfering with the main circulation of human and mechanical traffic, while similarly, main circulation should not accelerate the pace of those who dwell.

Furthermore, the station as a whole and each of its separate entities should be inclusive and comfortable, technologically advanced, predictably-legible and transparent, safe and secure, aesthetically pleasing and alas, still connected to its external context

and surroundings! Needless to say, in the South African context it is vital that the stations function as democratic and socially equitable environments where people of all races and cultures can interact.

The Subterranean Space dissertation will concentrate on the design and development of the relationships between the various components of the Gautrain Sandton underground station. Focus will be on the integration of **commercial and supplementary spaces** within the larger identity and structure of the transportation hub, and on aspects that will promote the comfort and clarity of the commuter experience.



FIG 006
Sengkang station, North east line Singapore

— ○ — ASSUMPTIONS & DELIMITATIONS

The dissertation is conducted within the scope of the draft Environmental Impact Assessment (EIA) compiled and completed by Bohlweki Environmental, in compliance with the environmental requirements of the Government Notice R1183 in Government Gazette No. 18261 of September 1997, under the Environmental Conservation Act, No 73 of 1989.

In accordance, reference route alignments, site locations and station concepts, accepted as economically and financially feasible and environmentally acceptable by the Department of Agriculture, Conservation and Environmental and Land Affairs, will be used.

It is assumed that all necessary requirements, management plans and proposed developments set out within the EIA will be implemented and thus will not be elaborated on in this document.

Further, as the bidding process was still active during the start of this dissertation, all information regarding the project was strictly confidential and therefore this dissertation is based on the information available at that stage (May 2005). Consequently no station designs or proposed station layouts were published and therefore a station envelope had to be defined to work in. The design of the station envelope was strategically planned to address the challenges mentioned in the problem statement in order to assist the goals of the Subterranean Space. However, it should be noted that the focus is placed on the interior architecture, specifically the design and integration of commercial activities within the station structure in compliance with the requirements for the degree: Master in Interior Architecture.





PHILOSOPHY

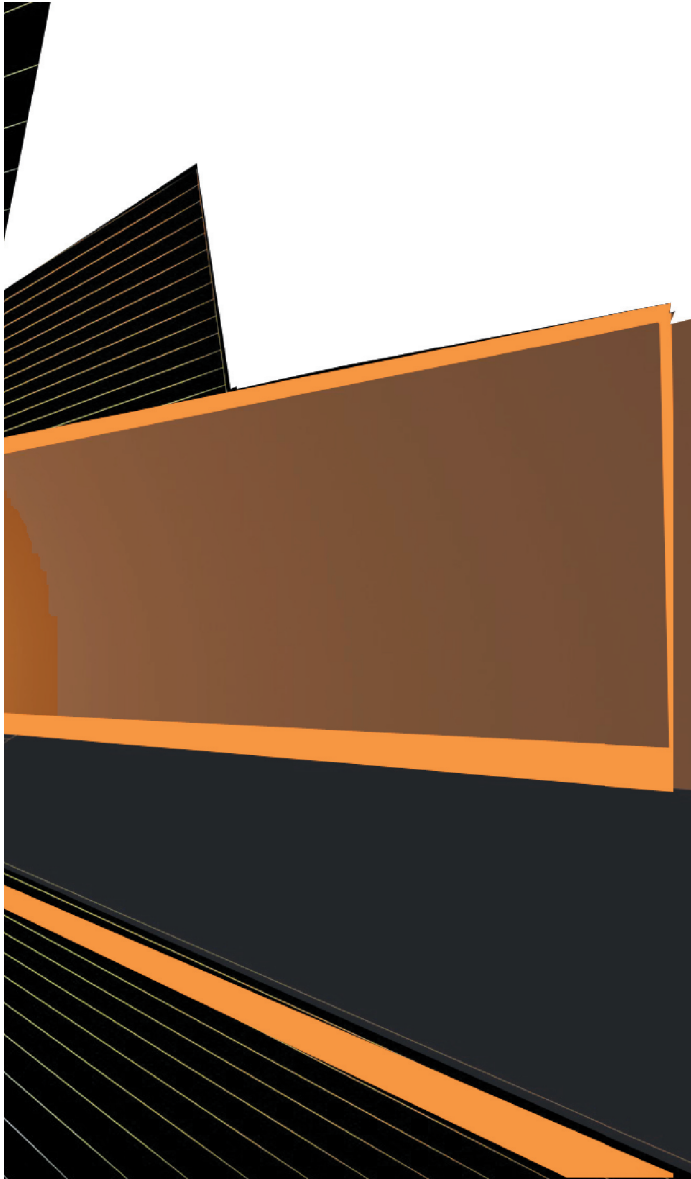
Within the realm of interior architecture the relationship between user, space and object compose design. It is the arrangement of these relationships within the design that create environments in which we are comfortable. Within subterranean space, the user's awareness of being underground plays a particular role. Design offers the opportunity to create underground spaces in which the user is informed and at ease. This is possible by acknowledging and using the characteristics of the underground environment to notify the user of his location - to orientate and direct to the point of aim, while keeping a link with the position of arrival and departure, thus making the space legible. This legibility and connotations with exterior surroundings, even if only subconscious, succeed in avoiding detached and confined spaces that confuse and alienate the user.

In a mass transit station, space is primarily a reflection of its function. As evident in the Avignon TGV station in France, such spaces respond to the passengers and how the passengers move through them (Slessor 2003:46). In its simplest form a station's function is just that, namely a medium through which passengers move from one destination to another. Therefore a station's design should be one of movement and flow, in which emphasis is placed on communicating direction. Supplementary activities and spaces in transportation hubs such as stations should be integrated in the holistic strategy. The placement, orientation and design of supplementary activities, and the spaces that house them, should assist the general circulation process of the station, while functioning autonomously in their own right.

So the activities that are thought to commence in a space, hence the function assigned to the space by its users, direct the composition of the relationships

between the users, objects and space. In a public space such as the Gautrain Sandton station the user has a complex and varied profile; therefore several intricate relationships should be established in order to design inclusively. In the case of the more complicated Sandton station, where the station will have a multifunctional character, which is that of a transportation hub and as retail environment, it is necessary to consider the impact different user intentions will have on the design. This implies that there will be commuters strictly using the station as a means to access and use the transport system, whereas some users will see the station as a place to meet friends, family or business associates, while others will make use of the commercial services provided. Therefore, to accommodate the extended activities and needs, the design should provide attractive and adequate facilities. Spaces which are identifiable and distinguishable through their architectural qualities and atmosphere will ease commuters' navigation of the system. Attention to materials and finishes that convey both function and aesthetic significance will allow simplicity which communicates to a larger user profile.

Space is perceived in both its physical and emotional forms. Therefore the tactile as well as intangible qualities of the space and architecture should resonate with the user. A product in which movement and flow is clear will require all facets of architecture to function as structural elements, communication elements, aesthetic elements, atmospheric elements and safety elements. For these reasons it will benefit users greatly if engineering, architecture and interior are **integrated** and a **holistic** design methodology is used.



LIST OF FIGURES

INTRODUCTION

CONTEXT STUDY

FORMULATING THE DESIGN TASK

CONTEXT STUDY

- THE GAUTRAIN RAPID RAIL PROPOSAL**
- SITE**
- CLIENT & USER PROFILE**
- THE SANDTON STATION SYNOPSIS**

PRECEDENTS

BASELINE

DESIGN DISCOURSE

TECHNICAL RESOLUTION

DESIGN DRAWINGS

CONCLUSION

BIBLIOGRAPHY

APPENDICES

THE GAUTRAIN RAPID RAIL PROPOSAL

“The Gautrain Rapid Rail Link is one of the Spatial Development Initiatives (SDIs) of the Gauteng Provincial Government. The Gauteng SDI projects, including the Gautrain, are aimed at stimulating development in specific areas of the province with a high potential for economic growth, thereby creating employment opportunities. The Gautrain project is also in line with national government’s stated policy to promote public transport, and to prioritise it over private transport. The project is targeted at attracting current private car-users to the rapid rail system” (Bohlweki Environmental EIA (draft) 2003).

The proposed network of approximately 80 km consists of two spines; one linking Johannesburg and Pretoria, and the other linking Sandton and Johannesburg International Airport. The estimated journey time from Johannesburg to Pretoria is 40 minutes, while the journey from Sandton to the airport will take less than 15 minutes. The train will be travelling at speeds of 160- 180 km per hour. The service will operate 18 hours a day with a frequency of six trains per hour. This public transport service will include dedicated, exclusive bus services to transport passengers to and from stations. The project proposes to develop the following stations (<http://corporate.gautrain.co.za>):

Three anchor stations

- Johannesburg International Airport (within the airport)
- Pretoria (next to the old Pretoria Station)
- Johannesburg (existing Park station)

Six other stations

- Rosebank
- Marlboro
- Midrand
- Centurion
- Hatfield
- Rhodesfiel Kempton Park and

One Station connecting the main link to the Johannesburg International Airport

- Sandton

It is believed that the Gautrain will play a cardinal role in the initiation of a new urban structure and urban form. With the stations as catalysts, it would attempt in creating “more effective and functional” environments that will sustain the transport system itself, and encourage economic growth through development opportunities (<http://www.gautrain.co.za>).

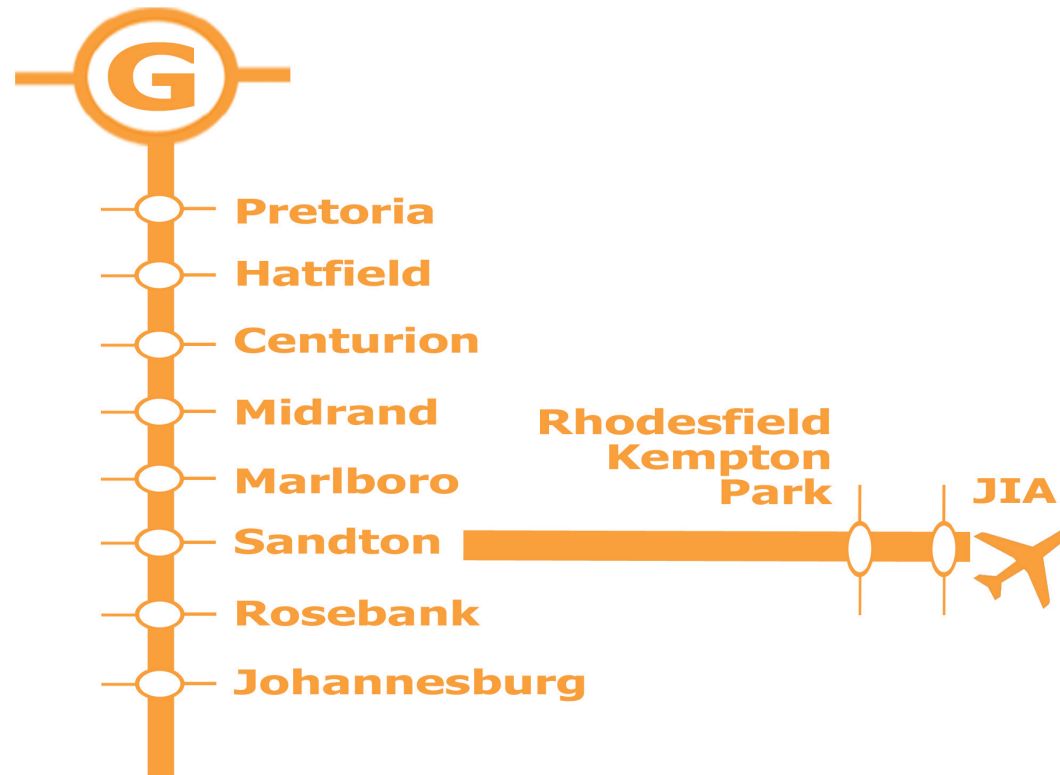


FIG 007
Stylized Gautrain map

 **SITE**



FIG 008
Aerial photograph of Sandton Central

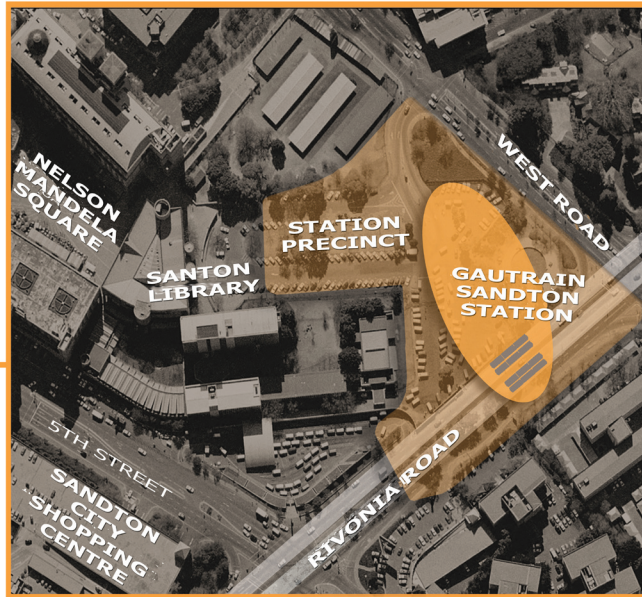


FIG 009
Aerial photograph of Sandton station precinct and surroundings

The main entrance to the Sandton Gautrain station and access points to basement parking bays and drop-off areas will be located at a site adjacent to the Rivonia Road and West Road intersection in the Sandton business district. According to Dr. Joubert, chief engineering consultant of the Gautrain team, due to tunnelling issues caused by the nearby Sandspruit and other economical factors, the platform and concourse areas of the station will be situated 30m below ground level.

The station will form part of The Sandton Central Node along with the surrounding Sandton City shopping centre, Sandton Convention Centre, Sandton Towers, Nelson Mandela Square, Sandton Sun Hotel, Sandton Library, Michelangelo Hotel and Sandton Civic Gallery (Johannesburg RSDF 2004/2005).

SANDTON CENTRAL

Rivonia Road, Grayston Drive and Sandton Drive define the boundaries of the Sandton business district. This city improvement district, branded as Sandton Central, is the second-largest office area in the country with approximately 1 000 000 square meters of office space. It is favoured by most management consultancies, foreign tenants, corporate professional practices and finance houses such as Investec, Johannesburg Stock Exchange, Citybank and Nedcor (<http://www.sandtoncentral.co.za>).

Various upmarket hotels like the Hilton, Sandton Towers and the nearly completed Michelangelo Towers contribute to the region's thriving tourism industry (Johannesburg RSDF 2004/2005). Sandton Central presents a total of 10 hotels.

The retail component of the Sandton Business district, comprising of Sandton City shopping centre, Nelson



FIG 010
Nelson Mandela Square and Sandton Library, Sandton Convention Centre, Sandton City Shopping Centre

Mandela Square and the Village Walk shopping centre, is identified as one of the most significant retail nodes in the country. According to the Joburg Wholesale and Retail Sector shopping report 2003/2004 the highest concentrations of the largest (in terms of m² gross leasable floor area) and most popular (in terms of annual foot count) shopping centres are located in the administrative Region 3 of the metropolitan municipality of Johannesburg.

Within Sandton Central two improvement districts, namely the Sandton City and Convention Centre Improvement District and the Sandton Business Improvement District, are set out to “create a clean, well-managed environment”. As part of urban renewal partnerships the area is privately managed. Management includes key issues such as crime prevention, cleaning-maintenance and landscaping. Operating under the Sandton Central brand, and additionally to services provided by local council, a cleaning unit, consisting of 25 members and a crime prevention unit of 68 officers are present in the area (<http://www.sandtoncentral.co.za>).

Marketing in Sandton Central is aimed at promoting the district’s image as a place of prestige, style, leisure and status.



FIG 011
Site photograph, Rivonia and West intersection



FIG 011
The multidimensional user profile

CLIENT & USER PROFILE

Due to its scale, the Gautrain Rapid rail link is a complex project consisting of numerous stakeholders ranging from City Councils to community based organisations and business organisations (Bohlweki Environmental EIA (draft) 2003). It is one of eleven Blue IQ projects. It is a Public-Private-Partnership, with the Gauteng Department of Public Transportation, Roads and Works (Gautrans) as promoter. The Gauteng Government will contribute by undertaking the planning and to subsidise its share of the capital cost upfront. The Concessionaire selected through a bidding process will be responsible to oversee all activities and parties appointed in regard to the design, construction, operation and maintenance of the project (Bohlweki Environmental EIA (draft) 2003

KEY CLIENT GROUPS

- Blue IQ as the Gauteng Provincial Government's, multi-billion Rand, economic development initiative,
- Gautrans as proponent and governmental supervisor of the project,
- The appointed Concessionaire, Bombela-consortium,
- The Business sector, involved with retail and private ventures within the station precinct and
- The Public as represented through the multidimensional user.

USER

The Gautrain will attract a variety of users ranging from the professional commuting to work, to a school group on an educational trip. Each station will have to cater for all types of users, though the preferences of predominate user types as influenced by the station's location, will inevitably reveal itself in the station's character. By investigating the demographics and visitor profile of an area, planners can predict what user type will form the majority and so allow the design to respond accordingly.

In general, the socio-economic profile of Sandton indicates affluence with a low percentage of unemployment. The area has the lowest percentage of lower income groups in the City of Johannesburg. Numerous young, skilled professionals are situated in the area along with students and families (Johannesburg RSDF 2004/2005). As mentioned earlier, Sandton is a major upmarket tourist and retail destination and due to the many business and financial establishments many corporate professionals are present in the area daily. Consequently the Gautrain Sandton station will primarily appeal to and cater for these types of users, but the Gautrain transport system is aimed to be utilised by all types of users from various income groups, affluent and poor.

The multidimensional user represents:

- Professionals
- Students
- Workers
- Shoppers
- Learners
- Tourists
- Families
- Elderly and disabled persons



THE SANDTON STATION SYNOPSIS

All the proposed stations should comply with the general recommendations set out in the EIA (draft) 2003 report. Each station also has its own guidelines that deal with area-specific issues and the station's land-use. The relative issues and some of their expected outcomes as set out in the EIA are discussed below.

The EIA recommend that the Sandton Station should be designed to blend in with the existing urban fabric. Facades and building styles are to match or blend in with the existing buildings surrounding the station such as the Nelson Mandela Square, the Sandton Convention centre and the Michelangelo Hotel (Bohlweki Environmental EIA (draft) 2003). Based on this concept, the interior spaces of the station should exhibit a complimentary style to that of the surroundings, to create a connection with the exterior environment. This is not interpreted to mean that the design should have a similar aesthetic character to that of the mentioned buildings, as they also differ from each other, but the station shouldn't have a negative influence on the established architectural quality of the area.

The station will be constructed through cut-and-cover methods. This will offer ample opportunity for landscaping and the planting of indigenous trees at the surface after construction. It will also allow the opportunity to plan the station precinct in a way that will provide possibilities for the use of natural light in the station itself, in order to assist the orientation process through a visual context.

The planned station's land-uses incorporate a retail and commercial component. Monica Albonico, architect and urban designer leading the Sandton Central initiative states that the provision of commercial activities within and the development

of such activities in and around the station precinct are aimed to attract commuters. All stations have the prospect of offering coffee shops, banks, automatic teller machines, newspaper outlets and some form of entertainment. Additionally, Sandton station is planned to offer airline passenger orientated services that will consist of a travel centre, foreign exchange facilities and a tourism information outlet. The station will also provide a variety of parking facilities which will serve as an extra form of income to sustain the transport system. Options include: kiss-and-ride, park-and-ride, short-term, as well as long-term parking. Local government approval should be obtained for all rezoning (Bohlweki Environmental EIA (draft) 2003).

The Sandton station is expected to handle a maximum of 6 000 commuters moving through the station per hour during peak times (interview Dr. Joubert). Trains will depart and arrive at intervals of 10 minutes during peak and intervals of 20 minutes during off-peak periods.

Safety and security, in terms of avoiding accidents and deterring criminal activity is a priority issue (<http://corporate.gautrain.co.za>). The winning concessionaire is expected to develop a complete safety and security management plan, incorporating the Gauteng Provincial Government's minimum requirements.

In and around all Gautrain stations, the following preventive safety issues have been considered (<http://corporate.gautrain.co.za>):

- **Signage:** All walkways within the station will be properly sign posted. Dangerous places must be highlighted by prominent painted lines. An example is the areas that are to close to

moving trains which must have painted islands to indicate the danger to which passengers may be exposed.

- **Lighting:** All walkways will have proper lighting and illumination. A regular maintenance programme of lighting in walkways will be carried out.
- **Steps, lifts and escalators:** Steps, lifts and escalators will be provided with handrails and working emergency stop buttons.
- **Services for the disabled:** To direct paths for the disabled, tactile materials will be used. Facilities like tactile floors can be used to lead the blind to safe areas of the station. Smooth floors will be avoided as these may result in passengers slipping and hurting themselves. Visibility impaired commuters will be assisted in accessing and utilising various services of the Gautrain system.
- **Emergency and safety equipment:** Fire extinguishers and other equipment that is used in emergency situations will be provided at the stations.
- **Communications:** Communication points with the central control points or emergency centres will be provided. Responses to requests from the passengers will be swift.
- **Safe operation procedures:** Passengers will always be informed of unsafe conditions on the stations. Unsafe operations could include: wet floors and workmen doing repair work on the stations.

A few of the security measures include

(<http://corporate.gautrain.co.za>):

- A closed ticketing system will be used. This means that access can only be obtained to the platform areas and trains with a valid ticket.
- The design of the stations will take security into account and all areas will be properly lighted. The design of the trains is such that there are no hiding places for criminals and passengers will have an open view of the whole inside of the train.
- The entire Gautrain rail reserve will be secured with appropriate fencing, with access only at predetermined places.
- Closed Circuit TV (CCTV) equipment, including many hundreds of CCTV cameras, will be utilised within the Gautrain Rail system to continuously monitor situations within the system by security staff so that they can take immediate action when required.
- Identification of problem areas: Spatial statistics about occurrences of crime within the Gautrain system and surrounding areas will be kept. Action will be taken to address the identified problem areas.
- Identification of suspicious activities: Regular patrols by the policing unit will identify suspicious activities and remove threatening activities before a crime is committed.

○	—	LIST OF FIGURES	
○	—	INTRODUCTION	
○	—	CONTEXT STUDY	
○	—	FORMULATING THE DESIGN TASK	
○	—	CONTEXT STUDY	
○	—	PRECEDENTS	
—	○	CANARY WHARF JUBILEE LINE EXTENTION LONDON, GREAT BRITAIN	
—	○	TGV STATIONS PROVENCE, FRANCE	
—	○	BRENTWOOD SKY STATION MILLENIUM RAIL VANCOUVER, CANADA	
—	○	BONATZ ZERO ENERGY STATION DEUTSCHE BAHN STUTT GART, GERMANY	
—	○	AIRSIDE CENTRE ZURICH AIRPORT SWITZERLAND	
	○	BASELINE	
	○	DESIGN DISCOURSE	
	○	TECHNICAL RESOLUTION	
	○	DESIGN DRAWINGS	
	○	CONCLUSION	
	○	BIBLIOGRAPHY	
	○	APPENDICES	

 **CANARY WHARF** JUBILEE LINE EXTENTION, LONDON, GREAT BRITAIN



FIG 012 (left)
Open vertical space from
concourse to platform level

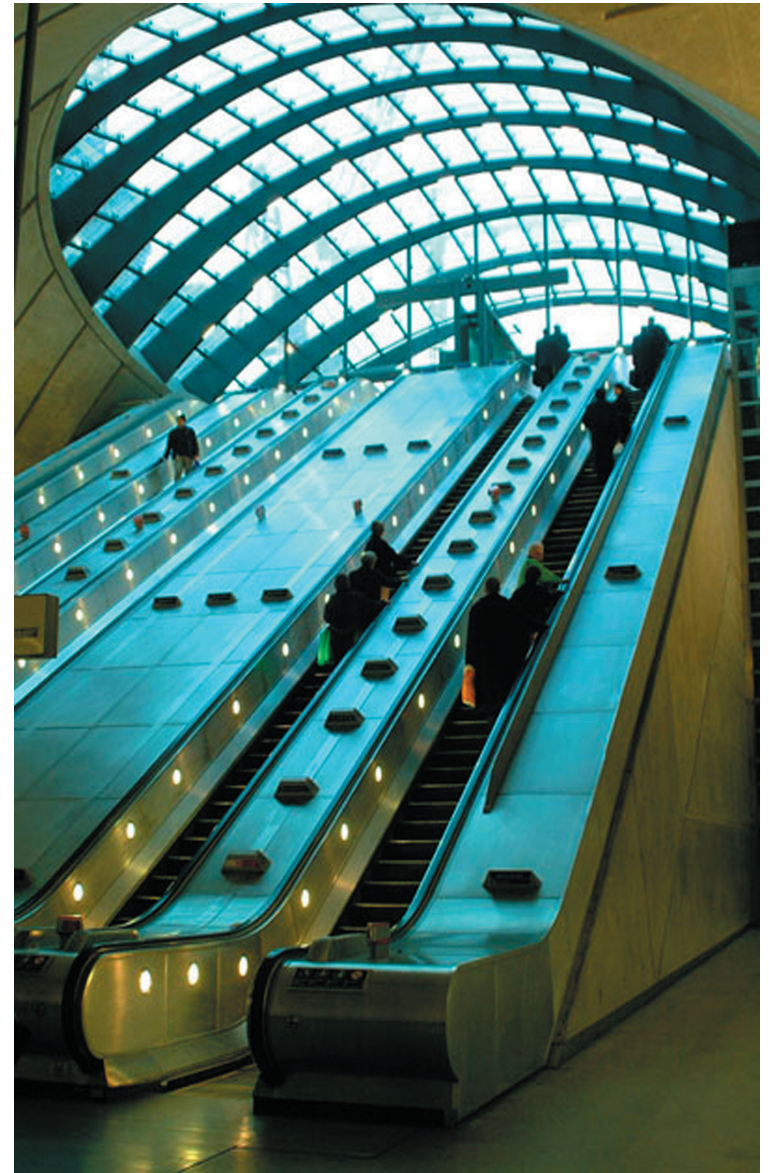


FIG 013 (right)
Escalator banks connecting to
a glass canopy entrance at
ground level

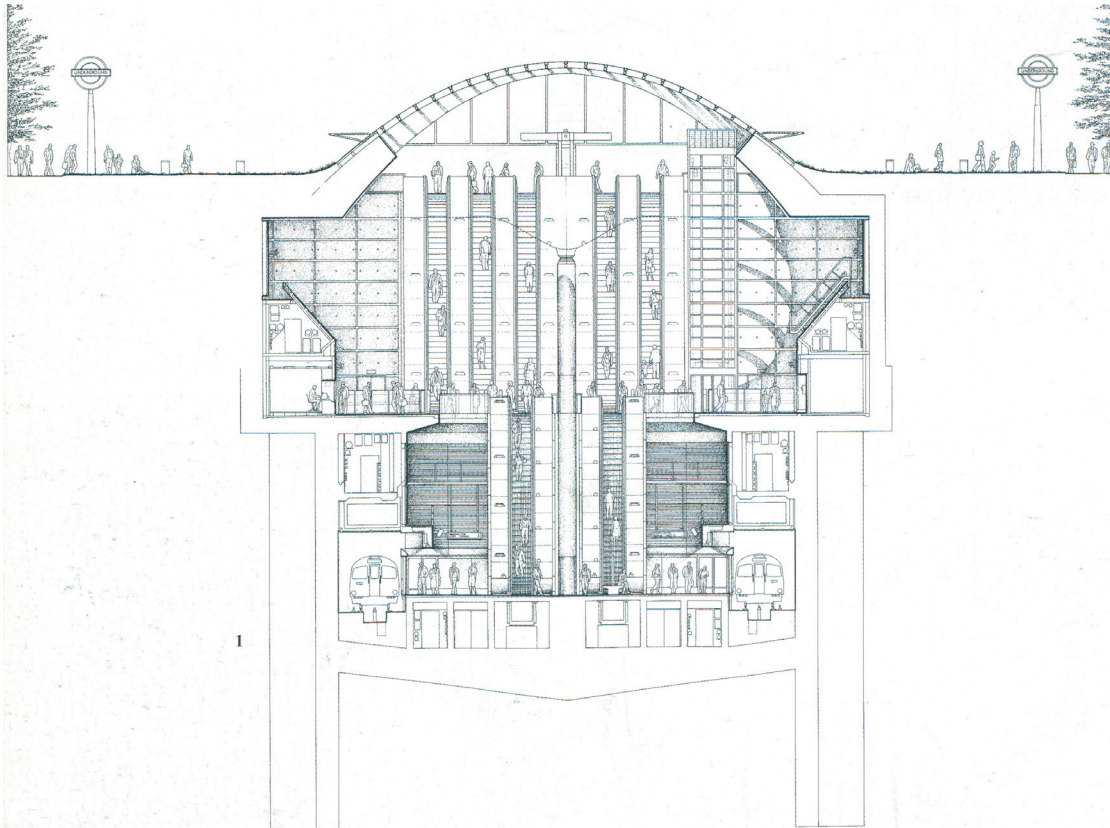


FIG 014
Section

"The station architecture of the new Jubilee Line Extension has received worldwide acclaim and has brought a new understanding and social awareness about the value that good architecture can bring to a city's transport infrastructure." (Bennet 2004:35)

The Jubilee Line Extension (JLE) completed in 1999 was a £3 billion, 11 station link between the East and West of London. The new underground railway connected new Docklands directly to the centre of the city (Pawley 2000:31). Roaland Paoletti, the

architectural concept developer for the Jubilee Line (2000:35) said the line brought about an architectural intervention in the London underground. This was because until the JLE, the spaces and volumes of all the London underground stations were planned by civil engineers rather than designed by architects; the architects only did the fit-out.

Canary Wharf, the flagship and RIBA award-winning station by Norman Foster, addressed many of the traditional concerns and issues of the London



FIG 015

Ticketing machines placed neatly on the side of passenger routes create clear and legible space

underground by introducing innovative solutions in order to change the user's mundane travelling experience into something pleasant. According to Pawley (2000:33), Foster and Partner's design approach focussed on the clarity of circulation, the legibility of spaces and the durability of materials and ease of maintenance.

Similar to Canary Wharf, the Sandton Station is also located entirely underground. The Canary Wharf platform level is approximately 24m underground

(Russell 2000:138). At ground level the three curved steel and glass entrance canopies are the only visible indication of the huge structure lying beneath. Regardless of this the design allows some natural light to filter through down to platform level, and on concourse level the space receives as much natural light as possible (Harding 2000:54). The curved concrete roof stretched out over the concourse level propagates the natural light admitted by the glass canopies above. Artificial light, though furtively, is still the primary source of illumination, but it is the sense of natural light that removes the user's uncertainty in order to create "clear and direct passenger routes" (Harding 2000:54).

Way-finding (also an essential component in the Sandton station design) is made uncomplicated by the naturally-lit, open and vertical central space. Harding (2004:54) accredits the station's clarity to atriums opening up the space. In certain areas cathedral-like spaces are created as the structure gapes from platform to roof. Sightlines are unobstructed with the ticketing machines positioned neatly on the sides of the ticketing hall and the ribbed roof rests on a single row of elliptical reinforced concrete columns that reaches down to platform level. Further reinforcing the design approach, Russell (2000:139) explains that exit stairs, service shafts for both fresh and exhaust air, together with the elevator shafts, are located at either end of the station to maximise free central space. This makes it possible for commuters not to be solely dependent on signage for direction.

Passenger movement is communicated through the spaces and the architecture itself suggests the direction to the platforms and exits.

Canary Wharf expresses a robust rawness through its natural concrete finishes. Durability is further accentuated by the use of stainless steel as cladding to protect the structure. The use of stainless steel and glass creates an aesthetic that assists in conveying clarity and it also minimizes maintenance.

Located in one of Europe's fastest expanding business and commercial centres, Canary Wharf has the highest capacity of the line's stations with 16 000 passengers per peak hour, which could even rise to 40 000 in future. The design had to accommodate the predicted programme by providing 20 banks of escalators to serve the station. The setting also substantiated Canary Wharf's larger budget in comparison to that of the other stations on the Jubilee Line Extension. The design had to rise to the challenge in order to compete and in an area known for its skyscrapers. Comparably, the Sandton station's location will also demand a design that will comply with its competing and ostentatious surroundings.

Besides the strategic and technical design issues that make Canary Wharf so successful, it is the station's proportions and the use of stage lighting principles, which highlight and compliment the material and structural compositions, that creates such a pleasant and attractive station space.



FIG 017
Glass and steel canopy entrance



FIG 018
Open concrete concourse with ticketing machines

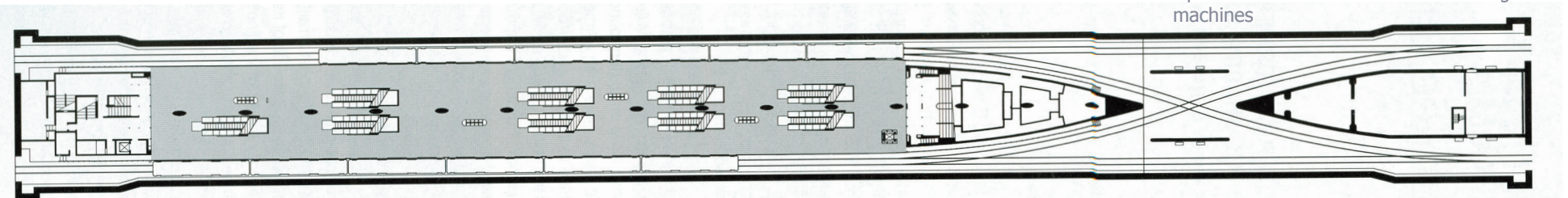


FIG 016
Plan of platform level

TGV STATIONS PROVENCE, FRANCE

TGV is the French national high-speed rail service that connects the various parts and cities of France. It is therefore fairly different to the Gautrain. Even though the Gautrain will be connecting three cities and an airport, the close proximity of the stations and the high frequency service classifies the Gautrain in the metro system class. Even so, the new TGV stations that opened in 2001 in Provence, designed by Jean-Marie Duthilleul and Etienne Tricaud of AREP – a French architectural firm based in Paris, are worth investigating as they display the progress and constant possibilities that rail travel offer.

VALENCE

Catherine Slessor (2003:46) rationalises the design according to the parallel volumes of incoming and outgoing traffic that the Valence station programme has to accommodate. The symmetry of passenger flow is articulated in the station shape and form. A long elevated and centralised concourse area connects all the station components, track and platforms, shops and concessions, and the parking areas surrounding it. The route to the platforms accentuates effectively “a sense of arrival and anticipation.”

The use of glass connects the user with the macro context, the landscape and the micro context, ranging from the tracks below to other passengers moving through the space. The central glass box, as Slessor describes the concourse, acts as a “watchtower” for passengers to watch and be watched. This is believed to be AREP’s key instrument in creating space that is legible to Valence’s users. This firstly allows the user to be informed of what is happening around him and secondly, to observe where he is in relation to where he is going. The design’s finishing contribution to the orientation process is the contrast created by the light and lucid concourse floating above the firm



FIG 019
Staircase at Valence station expressing passenger routes

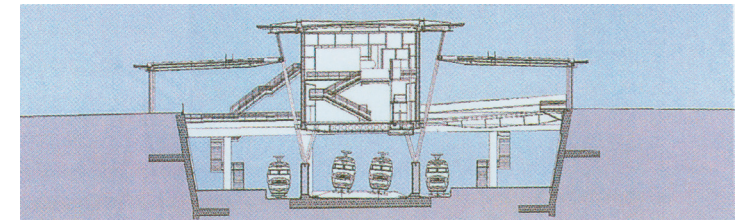


FIG 020
Section and photograph illustrating the central glass box floating over the platforms and tracks

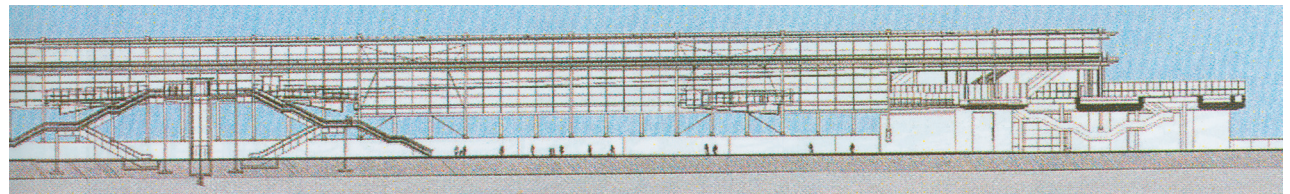


FIG 021
Longitudinal Section of Valence station

and rigid concrete and steel platform levels. This binary play between light structure and mass aids the user to distinguish between the station's two major function areas, i.e. the transport service at platform level and the station's services.

The Sandton station will develop such a duality in the design in order to construct legible spaces in which the user can easily distinguish between the various station functions. Further, the idea of spaces where commuters observe their surroundings and the activities taking place about them, while simultaneously being observed by others, is a theory that the Subterranean space will apply to create transparent and interactive spaces.



FIG 022
Duality - robust concrete platforms in contrast with the glass and steel station structure

AVIGNON

Unlike Valence, Avignon station has a distinct variation in passenger flow. As Slessor (2003:48) explains, the majority of passengers are departing from the South to the North of France at Avignon while only a few arrive there. The station design replies by separating the departure and arrival areas and assigning distinctive architectural features to each.

Consequently, the Departures hall illustrates its dominance through its much larger concourse to that of the Arrivals concourse. Slessor (2003:48) describes the bolder Departures pavilion as a sweeping volume reminiscent of an upturned ship's hull, whereas the Arrivals pavilion, only accommodating 20% of the station's traffic, is housed in a more modest steel and glass structure. The concept of splitting departure and arrival access will offer many advantages in terms of station circulation, even if arrival and departure flow is predicted to be more equal in the Sandton station.

The Departures pavilion in Avignon station is divided into two levels; a lower level where passengers enter the station, and an upper platform where trains are boarded. Access to the higher level is granted through a choice of escalators, lifts and a wide ramp/promenade running along the station's length. The hall's vaulted and sloping structure bend slightly in its length and this generates sightlines that indicate the direction to the platforms. It also creates the illusion of a never-ending concourse level. For this reason Avignon station is a prime example of how architectonic elements can be used to subconsciously act as part of the station's information and directional system.

Avignon station also responds to the harsh Mediterranean Provençal climate with the departure hall's South façade sheltered by a thick white sandstone wall, while the Northern façade,

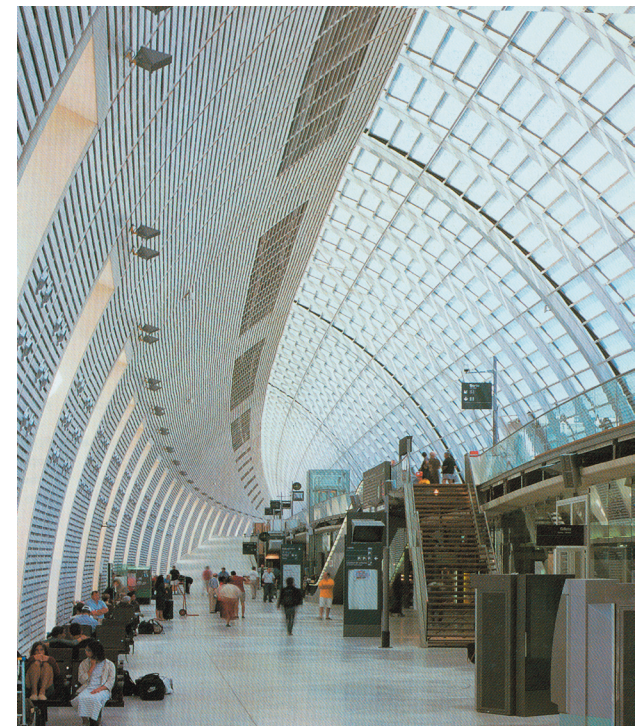


FIG 023
Avignon station's continuous sloping concourse

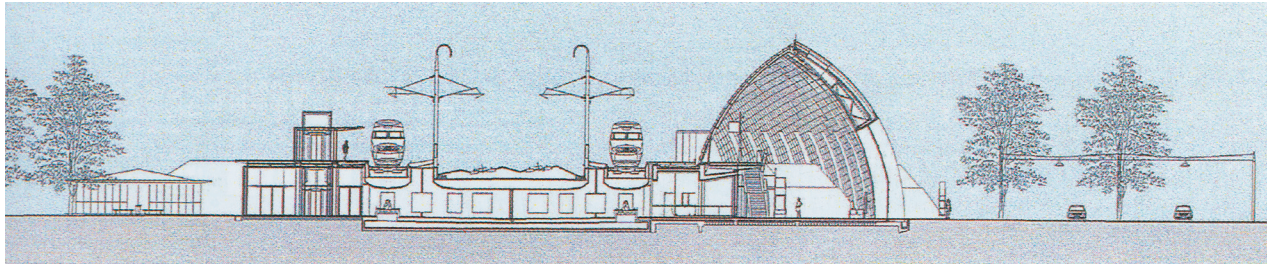


FIG 024
Section Avignon station



FIG 025
Aix-en-Provence's curving facade indicates the station entrance

overlooking the platforms, allows a flood of light to pass through its curved glass enclosure (Slessor 2003:48-49).

AIX-EN-PROVENCE

Aix station, like Valence, also shares a single concourse between arriving and departing passengers. However, Aix station doesn't have the advantage of lowered platform levels (tracks run at ground level) to signify passenger routes. Nevertheless, Slessor (2003:50) implies that the use of mezzanine levels and suspended glass bridges crossing the tracks compensate for this and accomplishes enough excitement. Mezzanine areas are utilised as waiting areas where passengers are offered a clear view of the station activities commencing below, and the glass bridges promote clarity and orientation. Additionally, the use of glass along with roof lights and the whitewashed roof surface succeeds to create lightness in the space.



FIG 027
Mezzanine levels and bridges offer an overlook on the Aix-en-Provence station activities

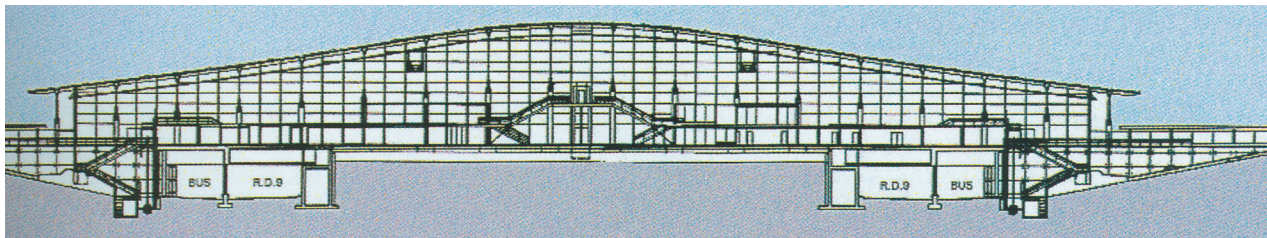


FIG 026
Section Aix-en-Provence station

Externally the building shape indicates the main entrance with a "slight bulge" in its Western glass façade (Slessor 2003:50). Thus by placing emphases on certain station areas, through the use of architectural features, passengers can be guided through the station to entrance and exit points.

BRENTWOOD SKY STATION MILLENIUM RAIL, VANCOUVER, CANADA

The Millennium line in Vancouver is the 9-station expansion of the Vancouver Sky train system launched in 2003. The name "Sky station" indicates a contradiction and poses to have no relevance to the Subterranean Space. However, the Busby & Associates-designed Brentwood sky station's application "transparency", to act as advertisement for the system, and to make the station legible and safe, is undeniably relevant.

In general, the Millennium line's design shifted focus to the commuters experience. Randy Gragg, an architecture critic explains (2003:137) that according to Lecia Steward, project head, the intention was to create stations that would allow a sense of ownership. The project team even formulated a requirement list based on a public participation exercise. The wish-list emphasised: visibility for safety's sake, the use of warmer materials such as wood and ambient night-time lighting.

Brentwood is the line's model station as it exhibits all the qualities the ideal station design had to meet. Abrahams (2003: 57) comments that the use of glass assembles a transparent structure which minimizes passenger confusion. The gentle swell in the middle of the structure provides adequate room for services such as stairs and lifts, while opening up the structure and giving clear views over the platforms. Additionally, it allows the station to act as a neighbourhood landmark. The station's visibility, especially from the freeway below, also plays a key role in encouraging people to use the train system.

Wood is incorporated in roof elements. Gragg (2003: 138) contributes the use of wood in structural elements, throughout many of the stations, as a means to grant the public its wish for the use of the material, but also as a measure to limit vandalism on the less resistant material.

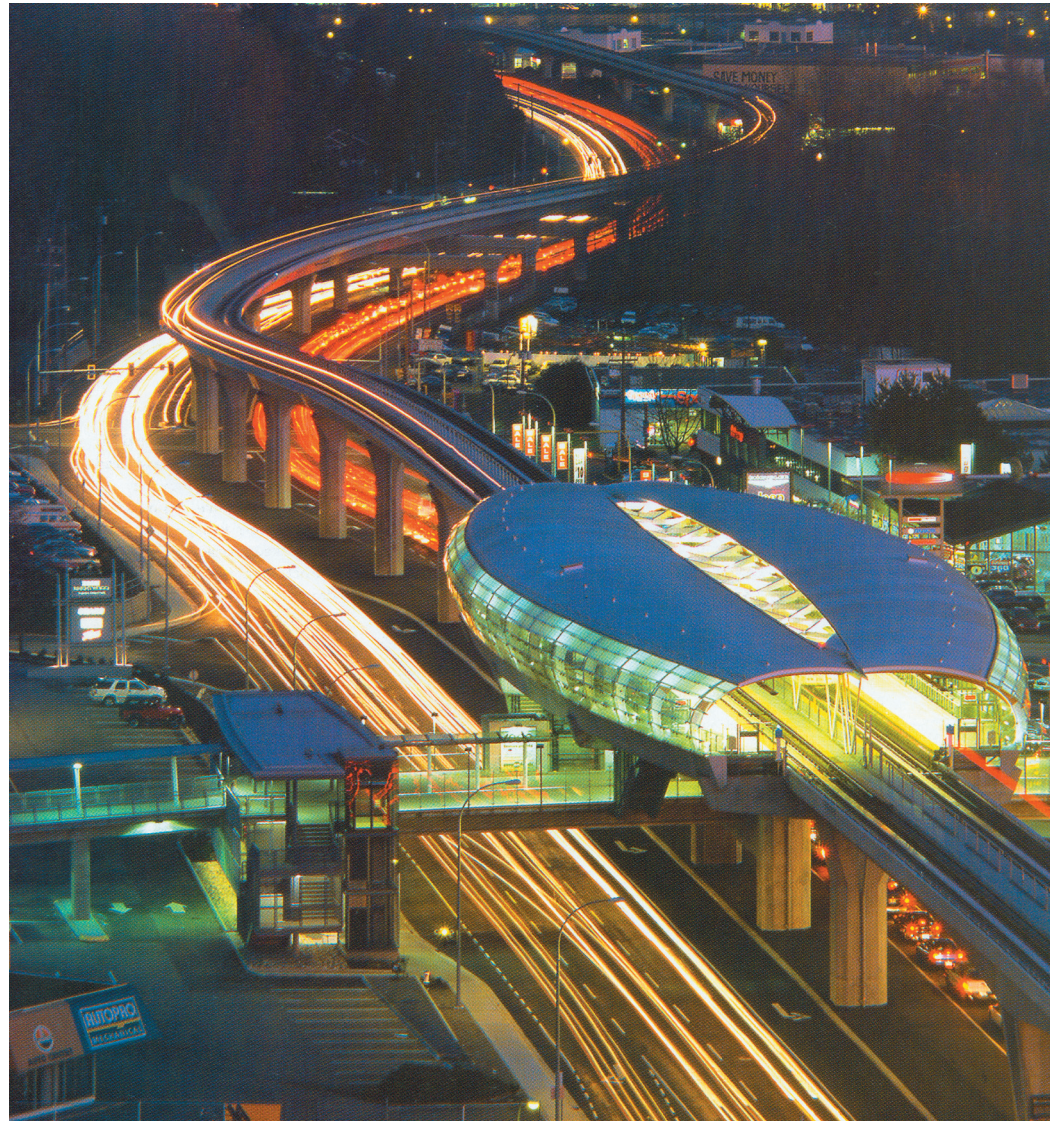


FIG 028
The luminous Brentwood station hovering above ground

The concept of transparency can be utilised on various levels and in various scales within the Sandton station design. Besides the various advantages the use of translucent and transparent materials give in terms of legibility, safety and security, it can also offer numerous advertising and marketing opportunities. This ranges from promoting the Gautrain transport system, to the Sandton station, the shops in the station and the products they sell.



FIG 029

Brentwood's combination of wood, glass and steel creates warmer natural tones for aesthetic appeal and transparency for safety

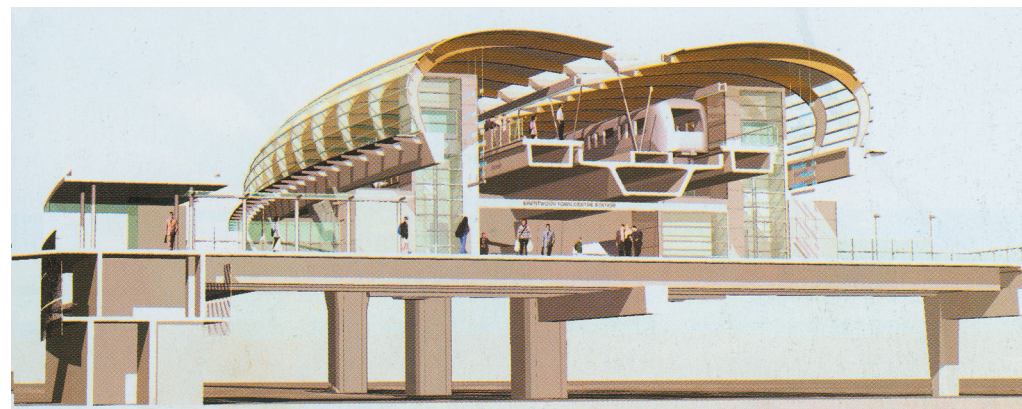


FIG 030

3 dimensional section

BONATZ ZERO ENERGY STATION DEUTSCHE BAHN, STUTTGART, GERMANY

Ingenhoven Overdiek und Partner's winning proposal in the international competition for a new underground station in Stuttgart's city centre concentrated on a sustainable solution. Davey (2003: 66) explains that the environmentally conscious approach consists of a no-heating, cooling or mechanical ventilation imperative. The station design relies on the utilisation of passive systems to ensure thermal control and user comfort.

Expected to be completed in 2013, the station design incorporates a public park located above the station and will have a concrete shell roof structure. The park has a number of "light eyes;" organically formed circular openings that are responsible for passive ventilation and illumination. The openings are carefully planned to provide adequate natural light at average, but to prevent intense heat gains. The concrete shell utilises the Venturi effect of winds to further advance the station's air flow.

The light eyes, planned to consist of poured concrete clad with glazing, also creates a link between the subterranean platforms 12m below ground level and the activities commencing above. The station is planned to produce a social atmosphere with the provision of shops and catering opportunities on an opened concourse level.

The Sandton station, besides from also being an underground station, is quite different to the Bonatz Zero-energy station as it is not developed to such extensive sustainability standards. However, the Sandton station will strive to create a sociable atmosphere in the station itself and in its surroundings above, by creating a public space (to be developed by Landscape architects and urban designers) on ground level above the station. "Peepholes" at ground level, through which to look down on the platform level or on to other activities in the station is also suggested.

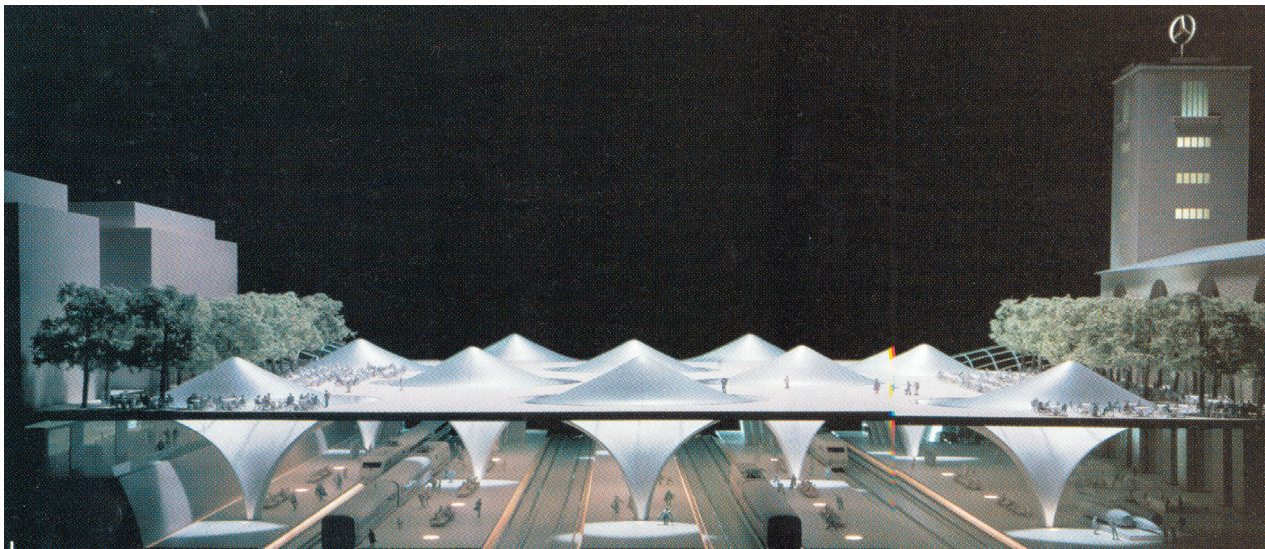


FIG 031
Model of the proposed Bonatz Zero Energy station

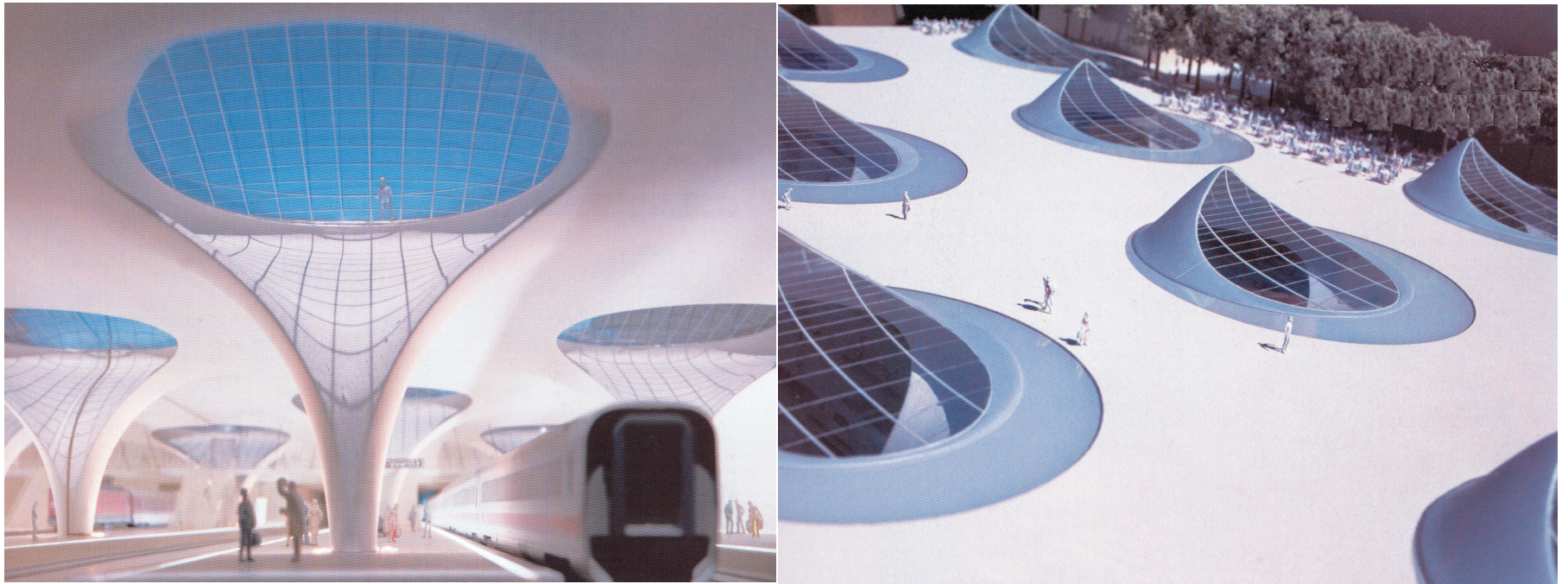


FIG 032
A punctured concrete shell illuminates the platform level and makes a connection with a public park above

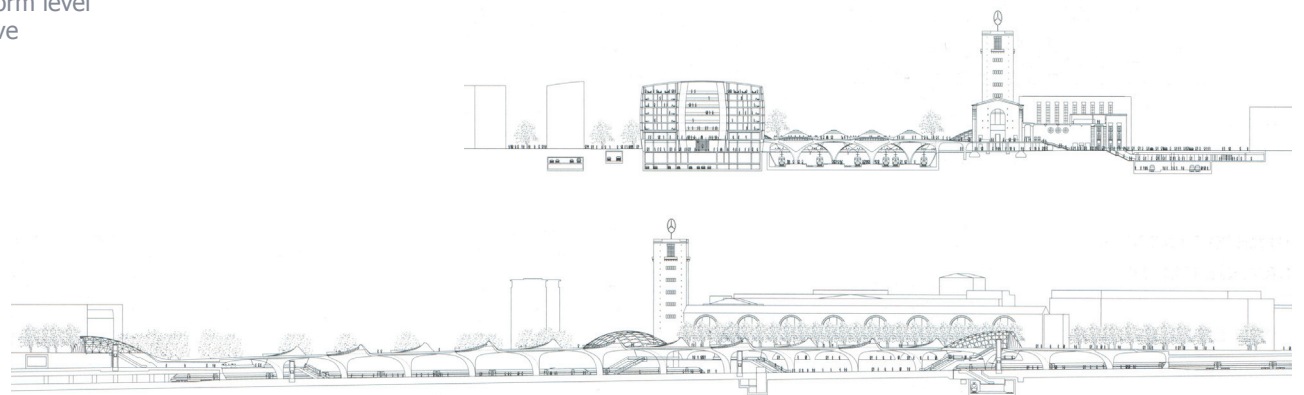


FIG 033
Bonatz Sections



AIRSIDE CENTRE

ZURICH AIRPORT, SWITZERLAND

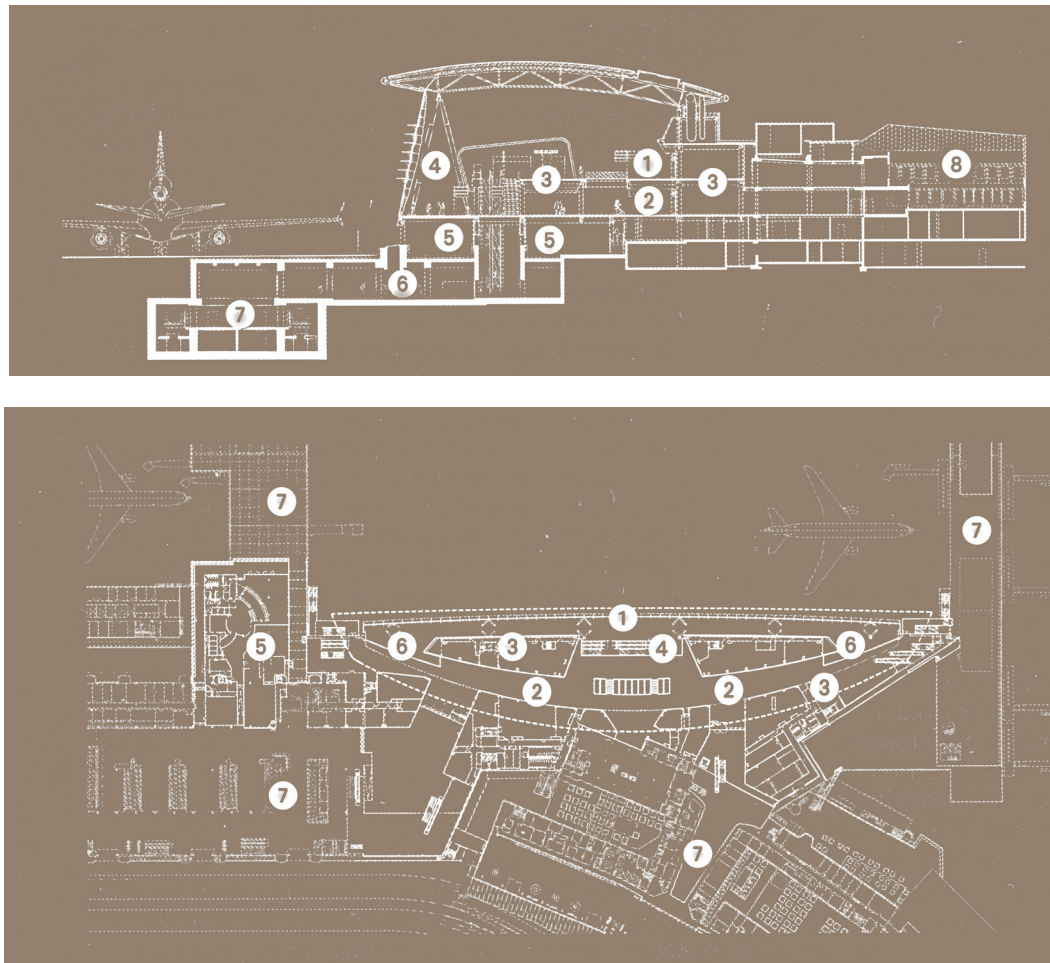


FIG 034
Plan and Section

Train stations are fairly different from airports. Besides the fact that airports are complex technical buildings, both are transportation hubs that deal with passenger and circulation related issues, but airports require passengers to book-in in advance. Therefore, depending on whether the passenger is on a domestic or international flight, there is at least an hour to spare before the plain can be boarded and so the time a passenger spends at the airport far exceeds that of a commuter boarding a train in a metro station.

During the time spent waiting for the boarding call, passengers are tempted by various retail outlets, bars and restaurants. For this reason airports have become very commercially driven, especially in the international departures lounges where passengers spend two or more hours splurging on last minute gifts, souvenirs and a last taste of the country's cuisine. In arrival halls, passengers are not that exposed to commercial activities, as they tend to leave directly to their destination.

Marcus Field (1995:39) asserted that: "...the speedy, efficient manoeuvring of passengers from ground and into the air is no longer the principal concern of airport operators: enticing customers into a shopping mall is... passengers are expected to shop till they drop..." He also explains that many airport expansions are directly related to the need for retail space and consequently airports are turning into shopping malls.

The recently completed Airside Centre at Zurich airport has a refreshing take on the trend and shifts commercial integration in another direction. Designed by Grimshaw, Itten & Brechbühl and Arup, Spring said (2004:33) their aim was to produce a design that wasn't commercially compromised.

The Airside centre is an international passenger terminal, departure lounge, shopping and catering combination, which passengers enter after passport control. It offers the usual duty-free shops, cafés and bars, but without crowding and cluttering the space. The shops and catering facilities are presented subtly to allow passengers to choose between indulging in shopping activities or to wait while looking out over the runway. Shops are inserted in unique freestanding two storey structures, centrally placed in a lofty open volume space, though some retail activity spill to the sides of the concourse levels. This allows passenger flow to continue unhindered, while also giving the retail component of the centre a unique identity which makes the space more legible. Retail activities commence in its own environment, though it is unquestionably part of the holistic functioning centre.

The “malls”, as Spring (2004:35) refers to the enclosed timber shopping additions, shield passengers who prefer a more tranquil waiting experience, from the commercial noise of the concourse. In addition, access to these shops is provided from the concourse side and café bars are neatly placed at either end of the malls to optimise circulation space. The timber malls provide a cool and reserved departure lounge with a warm and natural element which supports a relaxed and comfortable atmosphere.

The Subterranean Space’s integration of commercial entities will correlate with the basic strategy followed in the Airside centre, with its extended departures lounge. This implies a design that offers direct routes to platforms, as well as indirect routes along retail and catering activities. Commercial entities should be introduced into the station structure in such a way that they are distinguishable from the main station structure/function so that they are able to function independently.



FIG 035 (top)
The tranquil waiting lounge overlooking the Zurich Airport runway

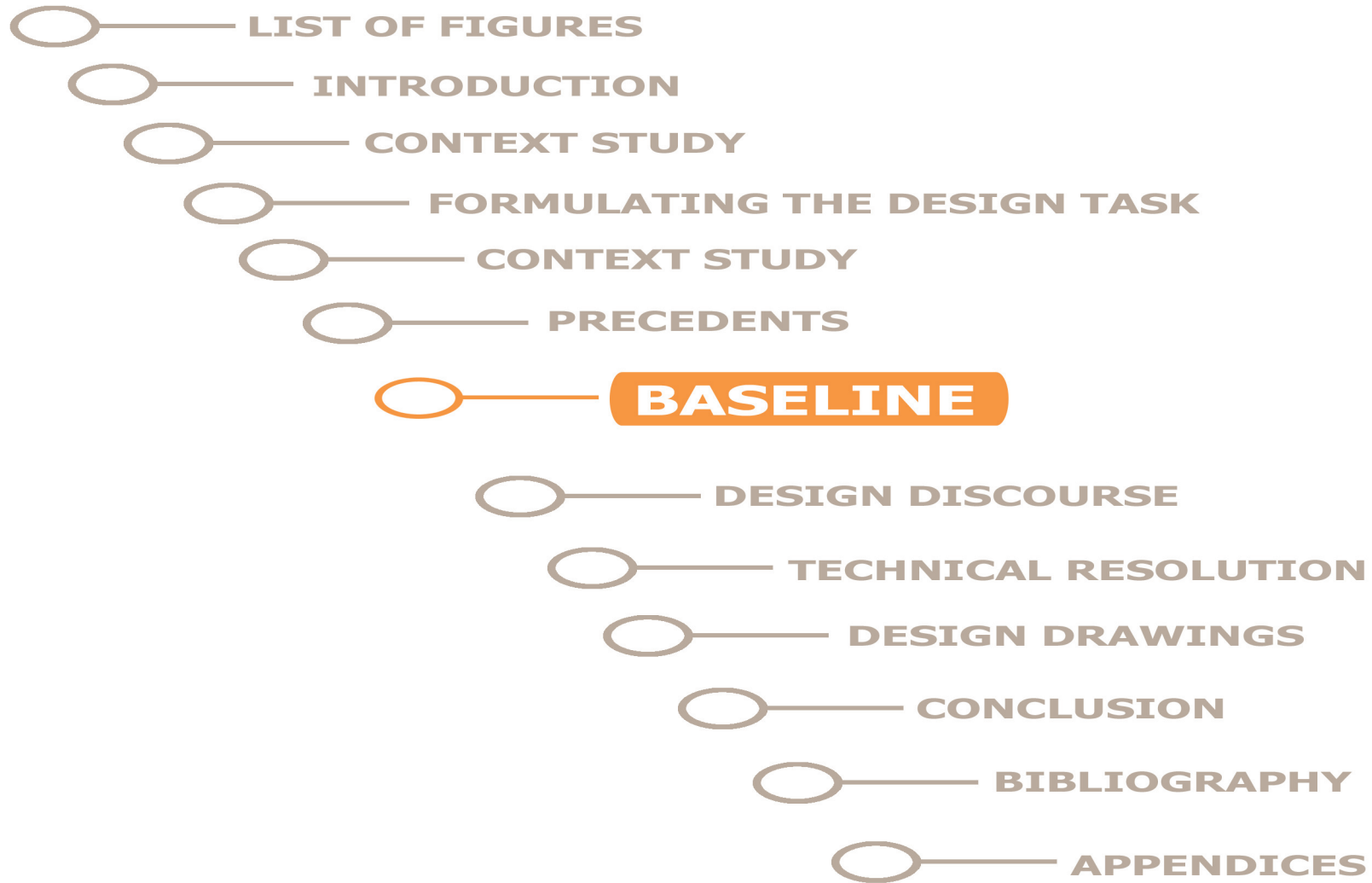
FIG 036 (bottom)
The timber finished retail components are inserted next to passenger routes and function independently to avoid interfering with passenger flow

DESIGN INFLUENCE

The Precedents offer valuable solutions and principles that are to be applied in the Sandton station. Communication, circulation, interactive transparency, response to volume, commercial integration and social requirements are key factors. The abstract and aesthetic qualities of the spaces influence, support and compliment the above mentioned and cannot function in isolation. Spatial relationships, atmosphere and cognitive expressions should influence and motivate the product and purpose; forming elements of the design that will achieve the most.



FIG 037
Cafe bars are positioned at either end of the “malls” along the passenger routes



The Gautrain development is a project with environmental and sustainability concerns. One of its primary goals is to improve the public transport system and to reduce the use of private cars. The project will generate employment opportunities and stimulate economic growth. Though the Gautrain is believed to have a positive impact in the long term, one has to accept that it will also have negative effects such as a rise in noise and vibration levels. Fortunately the positive impacts outweigh the negative ones and therefore making a sacrifice for the greater good is preferred.

For the Sandton station to be a safe, healthy and inclusive environment, designed with sufficient sustainable measures, certain baseline goals and standards, based on the Sustainable Building Assessment Tool (SBAT) developed by Jeremy Gibbert, Neufert Architects Data and the National building regulations (NBR), are set out below.

OCCUPANT COMFORT

The station should be well lit. Preference should be given to minimise the use of artificial, specifically electric lighting. However, because the station has a subterranean nature, methods to optimise the use of natural light are restricted. Nonetheless, the design should attempt to allow natural light to penetrate the structure, even if only to a limited extent. Glare, harsh shadows and high contrasts (in relation to background) produced by very bright light sources are undesirable, but moderate shadowing can aid perception of textures. Similarly, contrasts – if used to a limited extent – could be used very successfully to draw attention to elements such as edges, level differences, etc.

Thermal control and ventilation in a building are vital components in creating healthy and comfortable environments. Depending on humidity, the clothing and the level of the user's activity an average

temperature of between 22°C and 24°C is usually satisfactory. Mechanical methods of ventilation, cooling and heating, though used frequently, do not provide energy efficient solutions and waste valuable resources. Passive systems should be applied to ventilate, cool and heat the station where possible and mechanical methods of ventilation should, if possible, be limited to toilets and kitchens.

The noise and vibration levels produced by trains should be addressed through the use of sound absorbing and isolation methods. In this instance it is presumable that certain structural solutions, to absorb ground born vibrations will also be incorporated. An acoustic engineer's assistance is required to resolve all matters in this regard.

ERGONOMICS & INCLUSIVE ENVIRONMENTS

The design should provide spaces wherein the special and dimensional requirements for comfort and easy use are met. Because of the extensive user profile in a station, the design should be able to adapt and provide solutions that are not restricted to a single group of users. The station is also a work space; consequently a productive and comfortable work environment should be created in addition to the required comfortable customer/user environment. Numeric data and standards for the calculation of size and dimensions of objects, spatial relationships, sightlines and view angles should be used.

Station facilities should be accessible to all users. The design should provide for easy access and use by disabled persons, the elderly and children.

The first issue to address is safety, especially in regards to level changes. Balustrades and railings should comply with SABS 0400 standards, safety glass should be installed where glazing is used. Elevators (where appropriate) and ramps of 1:12

fall should be provided at all level changes. Level differences should be indicated clearly. Edges such as stair nosings and wall and floor joins should be distinguishable through the use of high contrasts and a change of texture or finishing.

At platform level users should be protected from the train tracks to avoid accidents and suicide attempts. Platforms should have marked indicators and surface changes to signify the platform's edge.

The creation of facilities for disabled people is an important inclusive aspect. Design for the disabled covers a large and varied spectrum. Catering for the physically impaired/wheelchair users include sufficient and well designed toilets, lowered counter levels at ticketing machines, offices, information desks, ATM's, etc. Elevator controls that are reachable from a wheelchair and appropriate and safe access to all levels are further considerations. Provision for the visually impaired and blind means approving and allowing guide dogs in the station and if required, facilities like water bowls should be provided. By using Braille on elevator controls, ticketing machines and access control units, along with audio announcements will go a long way in making the station more accessible and comprehensible. Visual aids such as lighting signals, indicators and appropriate signage and information systems will assist the hearing impaired and deaf.

FACILITIES

Communication (email, telephones), retail /catering, banking and childcare are services that should be considered from a social perspective. Social spaces for social interactions, such as coffee shops and cafes should be provided. Easy access to refreshments are also important.

EDUCATION

Spaces within the station should also be used to educate commuters about relevant issues such as Aids, the environment, and safety concerns. This could be done through exhibitions and posters, images and messages printed on travel cards or even by screening short audio-visual adverts.

ECONOMIC

The design should incorporate and provide for the use of local labour, local materials and locally manufactured components. Black economic empowerment businesses should participate in all levels of the project. It is also important to create employment by training local workers to repair and maintain the building. Cleaning, security and catering services should be sourced out to small emerging businesses. Training and skills development can empower local communities through entrepreneurship development.

ADAPTABILITY AND FLEXIBILITY

Though the location and design make it very unlikely to re-use and adapt the structure for any function other than a station, care should be taken to design the commercial spaces for multiple functionality and flexibility. The lifespan of materials and commercial ventures should be taken into consideration along with recycling and re-use possibilities of materials and fittings. Installations should be easy to assemble, requiring low energy input and it should be simple to take apart and remove. By providing an adequate vertical dimension, spaces can be used more efficiently and adapted to accommodate different functions.

ONGOING COSTS

The design should specify materials that require low maintenance and low cost maintenance. Materials that are hard-wearing, durable and easy to clean should be used. All materials should comply with the safety and standard requirements set out in the building regulations. Care should be given to ensure that maintenance, inspections and replacements keep disruptions to a minimum.

ENVIRONMENT

The use of scarce resources should be avoided. Materials with low energy inputs should be preferred to those with high embodied energy. Recyclable materials should be used where possible.

Waste generated in the station should also be recycled. Dust and garbage bins can be divided into labelled sections to sort glass, paper and tin cans for this purpose.

The station should be equipped with water efficient devices and water saving components for flushing toilets and in showers. Energy efficient fittings, devices and lamps with low energy consumption such as fluorescents should be used where appropriate.

The station landscape should focus on the planting of indigenous plant species. The landscape should be easy to maintain and the use of fertilisers, insecticides and pesticides should be avoided where possible

○	LIST OF FIGURES
○	INTRODUCTION
○	CONTEXT STUDY
○	FORMULATING THE DESIGN TASK
○	CONTEXT STUDY
○	PRECEDENTS
○	BASELINE
○	DESIGN DISCOURSE
○	PROGRAMME
○	CONCEPT
○	DESIGN PROCESS & DEVELOPMENT
○	STATION ENVELOPE
○	LIGHTING & FINDING DIRECTION
○	RETAIL & CATERING ENTITIES
○	SERVICES
○	TECHNICAL RESOLUTION
○	DESIGN DRAWINGS
○	CONCLUSION
○	BIBLIOGRAPHY
○	APPENDICES

PROGRAMME

The Sandton station is one of the highest capacity stations on the Gautrain link. According to Dr. Herman Joubert it is expected to cope with 6 000 passengers at peak times. These consist of commuters using the main line between Johannesburg and Pretoria and passengers arriving from and departing to the Johannesburg International Airport station. An equal volume of incoming and outgoing passenger volumes is expected.

Located in South Africa's corporate and tourist capital, the station will aim to act as beacon and access point to Sandton central and surroundings. The station will also provide adequate basement parking facilities to serve the station itself and its adjoining trade and industries. As mentioned in the station synopsis Sandton station will offer various commercial components and tourist facilities.

CONCEPT

The Project concept is formulated through the development of two distinctive identities within the station envelope. The first is the identity of the Gautrain and the areas in which its associated functions operate; thus the basic station configuration. The second is additional functions and activities such as retail, catering and tourist information. A dualistic approach, aimed at creating a legible and aesthetically appealing space, is applied. Commuters are to have a better comprehension of the subterranean space, which will promote circulation and prevent cluttered spaces. This double quality allows the introduction of warmer, casual and spontaneous environments with playful elements that don't conform to the predictable and pragmatic system required for efficient circulation. Hence, the station mood reflects the variety and diversity of the station's users and functions to reveal a vibrant underground culture.

The identity of the Gautrain will manifest itself in the primary building envelope and architecture. The spaces which serve the transport system directly: entrances, ticketing areas, platforms and the areas linking the entrances to track and platform level will be designed for predictability, clarity and legibility to prevent confusion and to allow easy flow and movement of commuters.

Secondary spaces which will house activities of a commercial and catering nature will have its own architectural identity, which will be distinctive to that of the primary structure's architectural character. By presenting these spaces with their own individual character an energetic reaction and interplay between interior elements, space and objects are initiated. The commercial elements introduce the opportunity to generate intriguing and exciting spaces where commuters spontaneously engage with their surroundings, other commuters and station activities.

These supplementary and supporting spaces will compliment the operation and programme of the primary structure, but they will also function in their own right.

The dualistic collaboration initiates a dramatic interplay between the light and heavy, illuminated and dim, solid and transparent, and raw and refined qualities of the spaces within the holistic station space. A series of spatial layers define the spatial dynamic and embraces the linear and non-linear elements that formulate them.

New commercial ventures exclusively designed for the Gautrain rapid rail link stations will be developed. Depending on station capacity and size, each station will have the appropriate commercial components such as coffee shops, café bars and newspaper outlets.

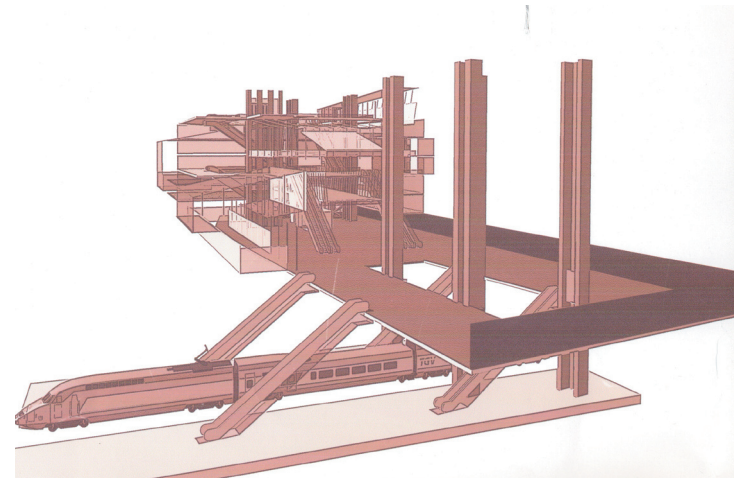


FIG 038
Concept development June 2005

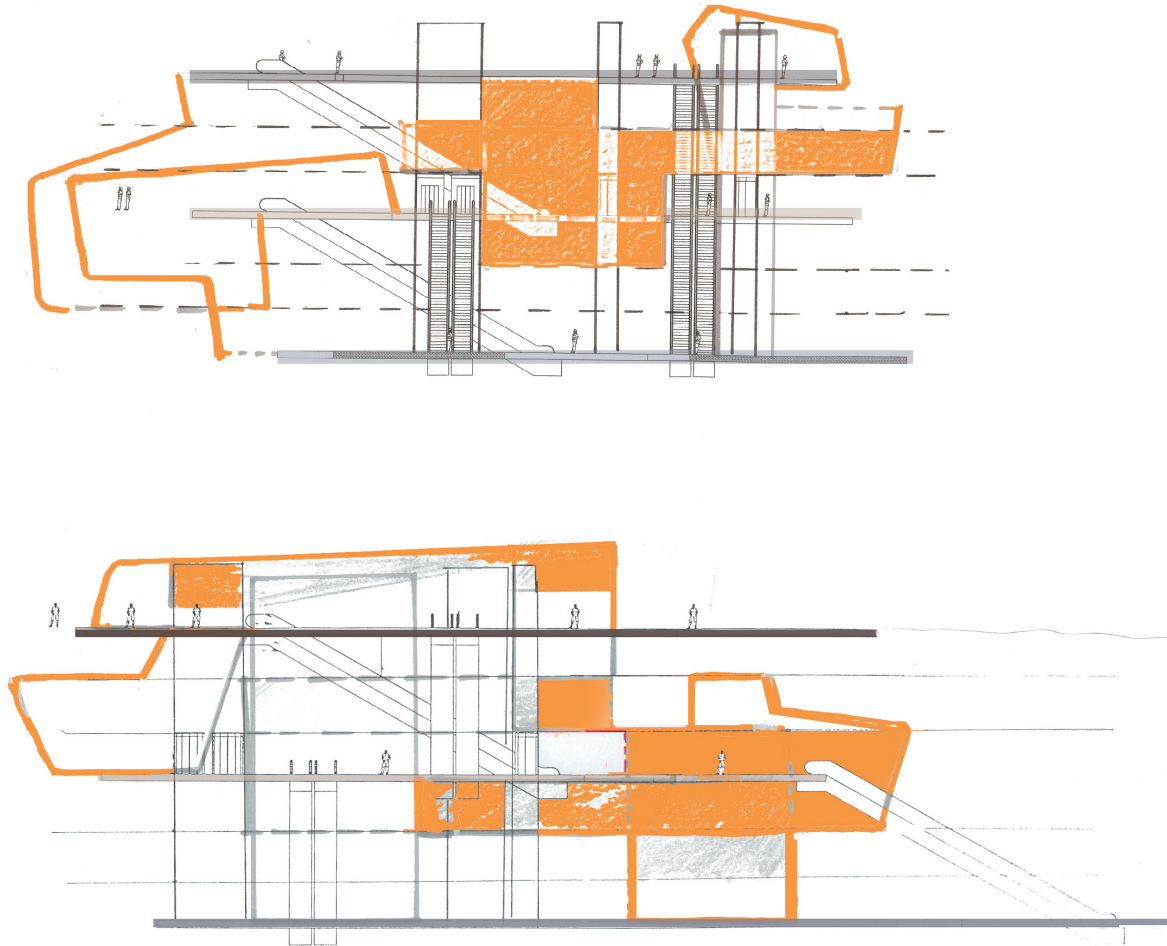


FIG 039
Concept development June 2005
Sections indicating **Retail and Catering** zones clipped on
to the main station envelope in orange

DESIGN PROCESS & DEVELOPMENT

As a building envelope did not exist, an investigation into the expected circulation and movement was done to develop a diagrammatic structure to work in. Various alternatives were weighed against one another and a suitable option was chosen and developed to more detail. A preliminary layout and zoning was proposed and then refined in order to explore the design concept and to expand the Subterranean Space strategy.

The lack of definite limitations and obvious guiding solutions regarding the formative rationale of the station envelope and with the restricted influence a response to site could offer – a difficult task was set in defining a station space. The product addresses relevant issues and delivers a capable container for the development of the interior. However, compromises can never be avoided. A solution that offers potential for one aspect can generate problems and limitations for another. Consequently, the design aims to accommodate as many issues relevant to the specific scenario. Aesthetic quality / form and functionality contend to construct an attractive and competent product.

The outline of the resulting structure, as strategic product to work in, is discussed below.

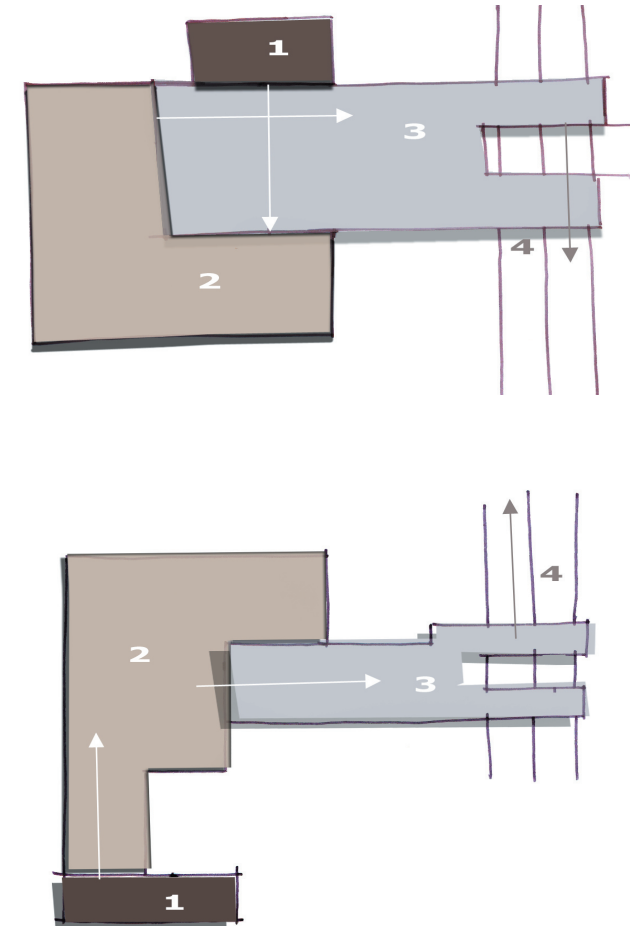
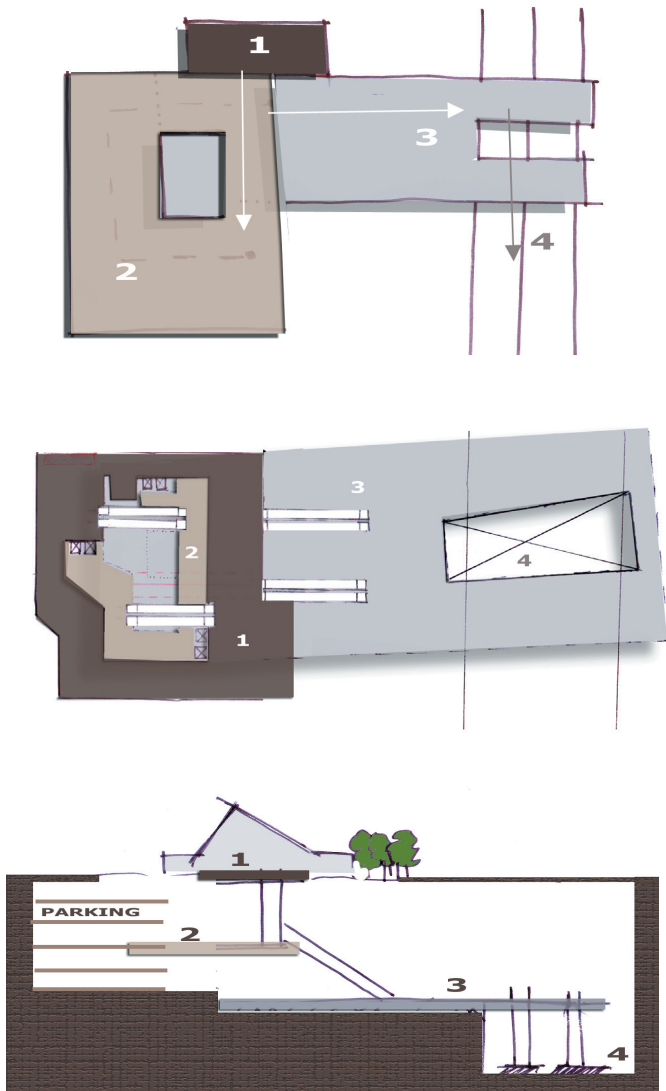


FIG 040

diagrammatic exploration of shape and development of station circulation - movement from entrance to platform

STATION ENVELOPE



The space has to accommodate a 30m level change from Entrance level (at ground level) to platform and track level. This level difference generates the opportunity to create an atrium. The atrium composes an open luminous vertical space around which glass elevators are situated and where escalator banks link the various levels to express passenger routes. The atrium assists the orientation process by opening up the space, placing elements in context to inform users of their surroundings and creating sightlines which indicate directions. It also acts as the station connecting point from where users can find their way. It assists the Subterranean Space approach, in which transparent spaces, where users observe while being observed by other users, are created. Additionally a tilted glass and steel louvre box canopy covering the station admits natural light that spreads through the atrium into the surrounding spaces to create a natural and ambient underground space. Natural light supports artificial lighting sources with the illumination task, while establishing a connection with the exterior. At night light from the station interior travel through the cathedral-like space to illuminate the external glass box that appears as a glowing beacon in the landscape above.

Circulation is the most essential factor in defining the station structure and hence forms the basis for the station layout. The programme allows the strategy in which the space provides direct passenger routes to the platforms as well as indirect routes that support the retail components. The station is structured accordingly, comprising an Entrance level at ground level, a double volume General Concourse level, two levels below ground level, and a triple volume Ticketing Concourse level, 5 levels below ground level before dropping another 9.5 m to reach Platform level. Passenger routes become more defined as levels descend. This vertical configuration

indicates the progression in passenger movement and flow. It reflects the reduction in the number of users closer to Platform level and the increase in user numbers closer to ground level. This is due to the location and occurrence of activities within the station. At General Concourse level, close to ground level a bigger variety of activities occur, but closer to Platform level activities become more and more specific and purpose driven.

To make the space predictable, a quality required to enhance the station's legibility, the main envelope has a pragmatic design. A wide spanning concrete structure optimises circulation space to provide unobstructed walkways and large open concourses to cope with large crowds during peak hour commuter rush. The station envelope has a robust and rigid architectural character produced by the predominant use of concrete elements and raw concrete finishes sealed with epoxy varnishes. The use of glass as transparent and translucent elements also strengthens the legibility of the structure as it creates sightlines and strengthens visual connections.

Two island platforms are located on the south eastern side of the main structure beneath Rivonia road. A sculptured glass and steel structure located on the island between the two roads keeps a connection with the exterior and admits some natural light, travelling down through the punctured concrete structure, to the track level. The glass structure establishes a connection to the larger canopy located North West above the station entrance. It announces the station and subterranean activities commencing below the passing vehicles travelling along Rivonia road.

On Platform Level commuters are protected from the tracks through the provision of glass platform screens with automatic doors that open in correspondence

with train doors. The platform screens are sandblasted with the Sandton station name, route maps and the logos of the Gautrain and associated services as a safety feature, advertising means and information display. Programmed LED strips light up on platform edges and along platform screens to alert passengers of train arrivals. Platform edges are indicated in two strips of bright orange textured tiles on either side of the platforms. Information displays are combined with dustbins and positioned strategically, for instance beneath escalators, to keep routes clear and unobstructed.

Parking is located on two of the station's wings. In order to provide sufficient parking, basement parking levels occur consecutively in a single volume arrangement. For this reason and to avoid the cluttering of station circulation points, parking levels are provided with their own access areas. These access areas consist of elevators and stairs that connect the basement parking levels to the station's to foyers on General Concourse level.

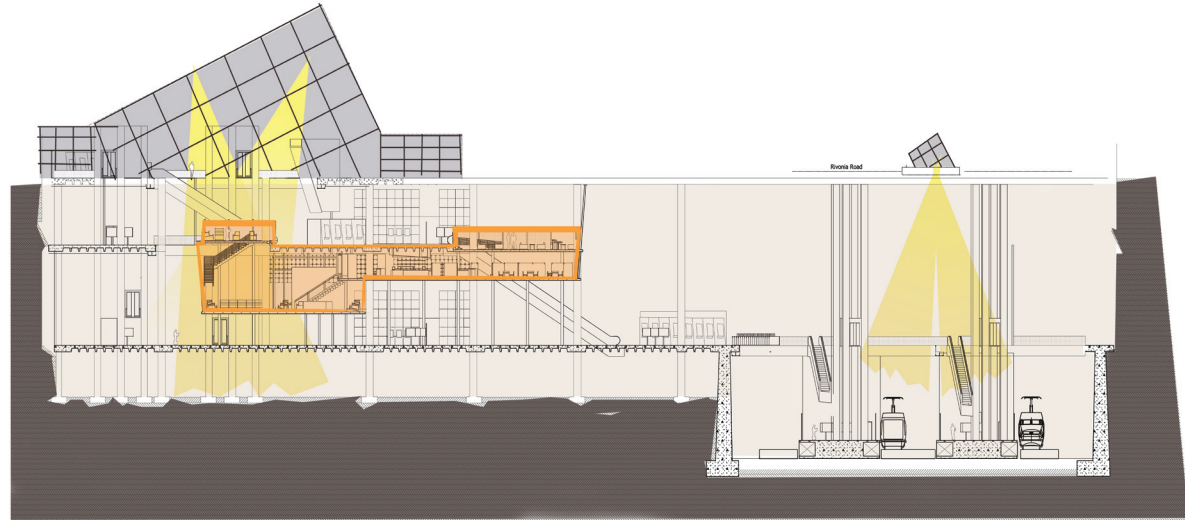


FIG 041

Vertical and horizontal progression in station composition

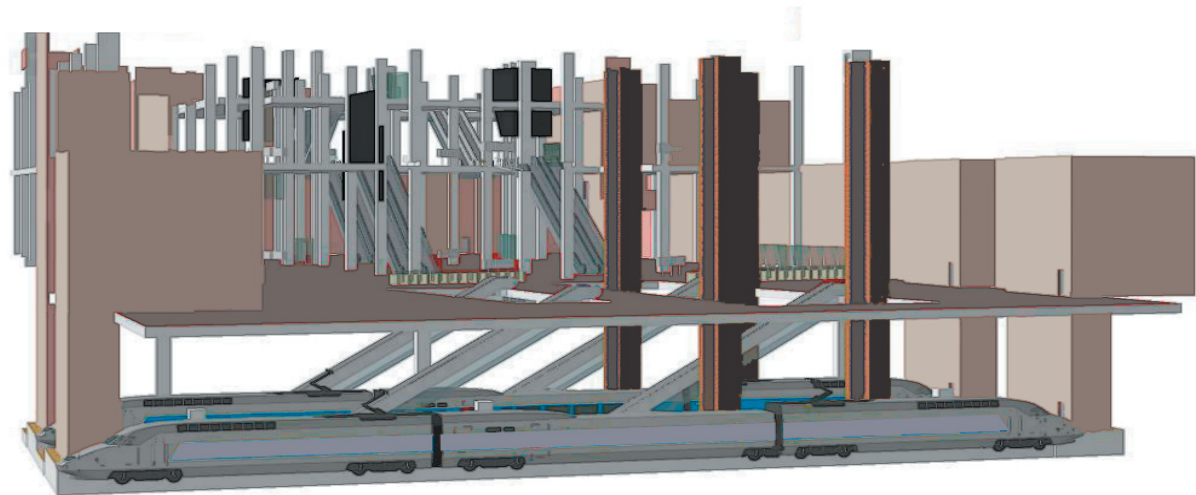


FIG 042

Station envelope as framework

LIGHTING & FINDING DIRECTION

Dark station spaces are undesirable as they influence users' perception of safety and security. As mentioned in the Brentwood Millennium Rail precedent, a well lit station and precinct is essential in offering a transport service and environment in which users feel comfortable. The use of natural light, as discussed previously, will also assist in creating a sense of luminosity.

GENERAL LIGHTING

The station requires general illumination of the interior and its contents. As visual tasks within the main station mostly consist of a degree of detail perception proficient for movement and walking, illuminance of 300lx will be sufficient. To achieve this 150W suspended power pendant, metal halide downlights are distributed throughout the station passenger routes. In areas with more activity, such as where ticket purchasing occur, higher illuminance is provided by series of low volt dichroatic reflector lamps used as suspended spotlights.

To highlight and use the idea of being underground, ambient lighting is used to create the station mood. Indirect light sources (low volt dichroatic reflector lamps) are placed in built-in fixtures at floor level along station walls, boundaries and walkways to create a mystical atmosphere while suggesting direction.

MULTIFUNCTIONAL INFORMATION

The lightbox-wall is a concept that serves both as an aesthetic lighting feature and as guidance tool in and around the station. The lightbox-wall comprises of a translucent box fitted with several fluorescent tube lights. The box is made of translucent glass with a few engraved translucent coloured acrylic panels, fit

together, and to an unexposed inner steel structure, with countersunk stainless steel fittings to create an uninterrupted and illuminated outer surface. The boxes are perceived as glowing elements rising through the lofty station.

The coloured extruded acrylic panels (Plexiglas) are engraved with logos and signage symbols to function as part of the station's signage and information system. Within the station interior, the light-box-walls are positioned in front of the washroom and toilet facilities to act as screens and as facility indicator. Lightbox-walls are also used on ground level at the station's two entrances to highlight the station's entry points, especially at night.

A similar concept is used to conceal the station's slab edges, while also acting as points of reference. Translucent acrylic panels are assembled to a hidden stainless steel structure that is fixed to the coffer slab edge. The stainless steel fittings used to fix the panels to the structure contain low energy, low voltage LED's that illuminate and highlight engraved information. The LED electronic driver is located up to 4000mm away in the service duct.

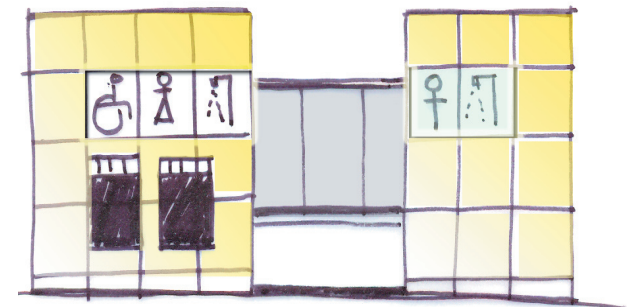


FIG 043
concept development of lightbox-wall with integrated signage

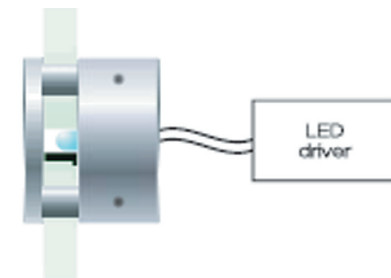


FIG 044
Stainless steel fitting with integrated LED for signage

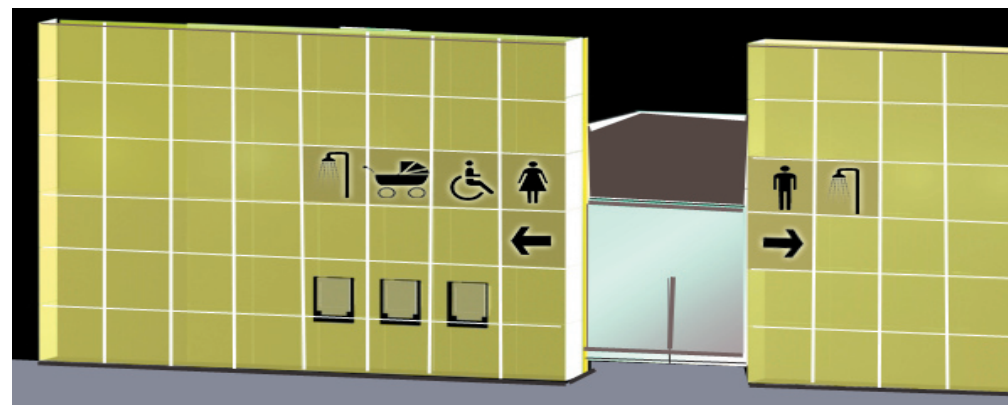


FIG 045
Lightbox-wall with integrated signage

SIGNAGE

The station signage system utilises a transparent and refined architectural expression. Translucent glass and/or translucent acrylic panels are combined with stainless steel structures and fixtures. A combination of suspended and free standing units is used throughout the station.

The signage system makes a distinction between information used to indicate general direction in the station (such as the location of elevators and escalators, information desk, ticketing points, exit routes, etc.) and information that indicate specific retail activities and their products (such as the news outlet that sell airtime.) The system is structured according to a hierarchy in order to aid users in identifying the information they require.

TEXTURES AND FINISHES

Different surface finishes and textures are used in different station zones and areas to distinguish them from one another. The transition from one zone to another is observed both visually and experienced tangibly, so to inform the user on multiple sensory levels. This approach assists the inclusive objective of the design as it supports the station's legibility and enhances accessibility and ease of use by a large spectrum of users.

The duality created between the primary activities and secondary activities relies on the use of differentiated architectural qualities, of which textures and finishes are major factors. This aspect in relation to its particular role in the integration of the commercial entities within the station will be discussed in more detail under the heading Retail and Catering Entities.

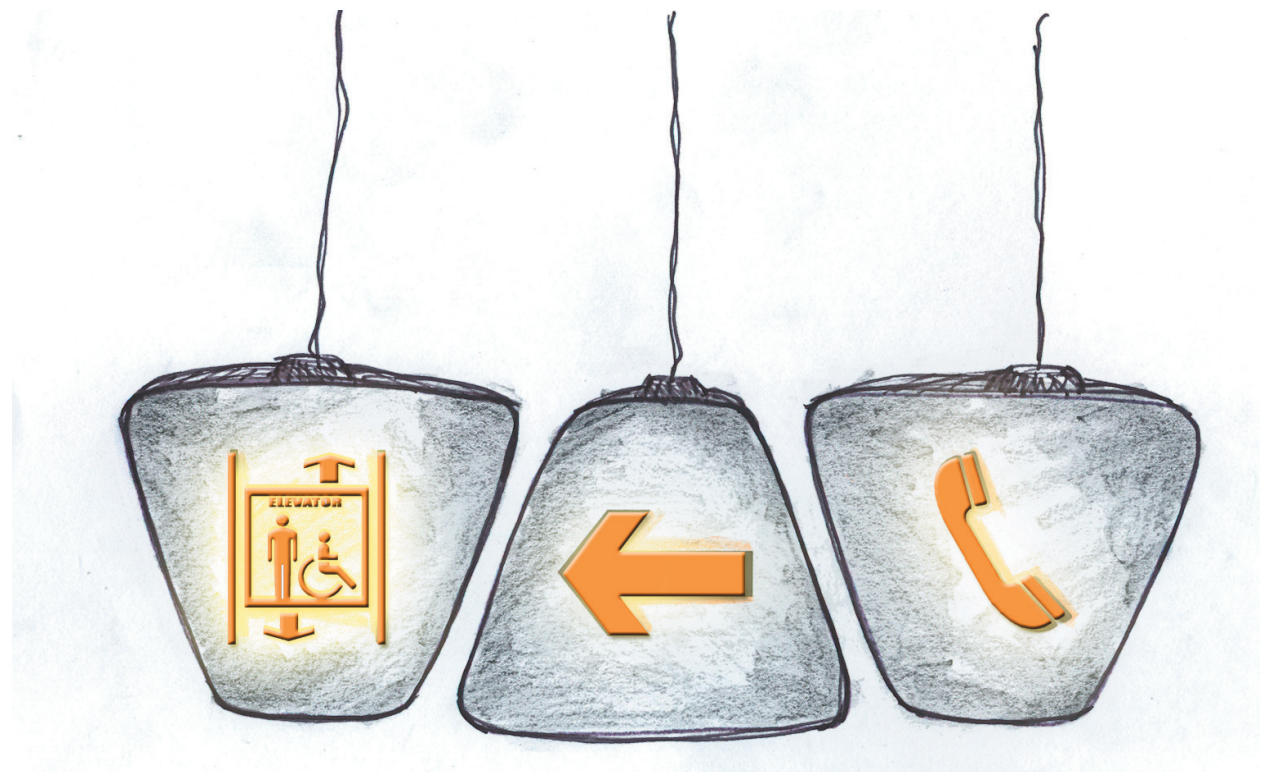


FIG 046
Signage concept

RETAIL & CATERING ENTITIES

RETAIL & CATERING ENTITIES

Retail and catering components are supplementary and complimenting services provided to enhance the commuting experience and will operate the same hours as the train service (expected to be from 6 am till 11 pm). They are a means to create a multifunctional and attractive station environment for users. Commercial activities offer commuters the convenience of purchasing goods on their way to their destination and the treat of having a snack and beverage while waiting for the next train. Retail goods range from a suitcase for a tourist on the way to the airport, to a gift or book on the way home. Coffee shops and cafés also provide a social environment where passengers can meet family and friends. Sandton station, because of its capacity and multidimensional user profile, offers the unique opportunity to incorporate a variety of commercial and catering facilities.

The commercial spaces are arranged from general to specific and located as a result of this. The station's General Concourse Level houses wide-ranging express facilities that are quick and easy to access. These services include banking facilities, a news agent, internet access, a small coffee bar, etc. The Ticketing Concourse Level offers a tourist information centre, foreign exchange facilities, travel agencies, car hire outlets, souvenir shops and a luggage and travelling-gear store, which are all aimed at tourist and passenger specific needs. Very particular functions, associated with "dwell time" and which are purpose motivated, like the café bar and bookshop, are accommodated on their own mezzanine levels.

The last mentioned, along with two decks on the General Concourse Level, shape an individual and more refined glass box retail environment, within

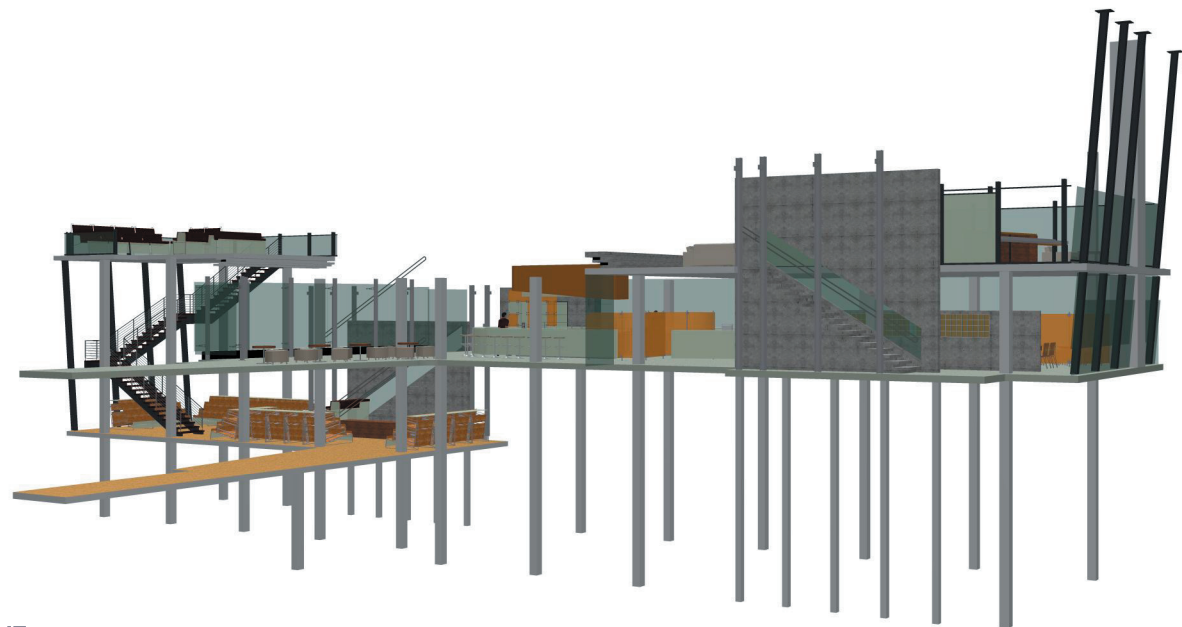


FIG 047
Retail box as separate entity inserted in station envelope

the larger robust station structure. The commercial structure has a distinct character and each retail component within the “mall” also has its own brand and identity. The primary use of transparent and translucent materials throughout the retail and catering entities convey the Subterranean Space’s aim of creating transparent spaces that maintain visual connections with surroundings. The use of lucid materials create clear, radiant and receptive spaces which also function well as promoting and advertising agents to invite people passing by. These spaces present themselves as lighter, refined spaces in contrast to the heavy and rigid circulation space.

The commercial insertion is clipped onto the General Concourse Level and floats above the Ticketing Concourse Level. It acts as a pausing element within the high paced station rhythm, skipping monotonous beats to introduce the informal. Reposing links open up a continuous flow of passengers, to entice the enthusiastic to explore the paradoxical environment. Vertical inclinations and adjusted horizontals interrupt the linear and repetitive composition of the station’s uniformity and distinguish the commercial structure.

The “mall” is positioned between two escalator banks with entrances flanking the main passenger route to ensure maximum exposure. The structure is also divided into a retail and a catering section with its own dedicated circulation. Each shop (commercial or catering entity) is discussed in detail below.

GENERAL CONCOURSE LEVEL – **EXPRESS COFFEE BAR**

The Coffee Express bar consists of a small lounge area, preparation counter and storage space. It provides a quick and fast service. Refreshments are ordered and paid at the counter and can be enjoyed in the bar itself or in take-away format. The menu is limited to a selection of coffees, teas, non alcoholic beverages and small pre-packaged snacks like muffins and cookies that are supplied by an external source. The concept and design theme of the Coffee Express should be maintained and applied similarly in all stations throughout the Gautrain system. In small stations the Coffee Express can manifest as a take-away counter, without the lounge (with bar stools if required), along passenger routes.

The express coffee bar is inserted 530 mm below the General Concourse Level. The small level difference distinguishes the deck from the concourse walkway, though still allowing quick and easy access through a ramp and 3 reinforced pre-cast concrete steps running across the entire span of the deck entrance. Miniature fluorescent tube lights located beneath the stair treads pronounce the entrance and a transition of function and space.

The counter/ preparation space is equipped with the necessary: espresso machines, display, tap and basin, and other equipment. It is primarily used as a preparation counter and therefore a working height of 900mm screened by a 1050 wood and steel panel is maintained, except for a lowered portion at the pay point where disabled users are accommodated. The menu is displayed on a raised screen located behind the counter. The adjacent storage space is located to the side of the deck next to the staircase leading down to the Higher Mezzanine Level. It is enclosed with a translucent glass panel and exposed I-beam profile structure which is fixed to a concrete wall.

The lounge offers a few comfortable contemporary couches where customers are able to read the daily newspaper while enjoying a mocha chino or latté. The space is defined by clear glass panels fixed to exposed I-beam profiles. The glass allows a “watching ritual” where passing commuters are observed as they travel down the escalators to the platforms. This maintains a link with station surroundings and activities. The exposed I-beams remind of the steel structures used to construct early train sheds. This concept persists in the steel finished balustrade of the ramp. The floor is covered with bevelled edged natural decorative wood finish laminated flooring to create warm and natural tones. This collaboration of materials generates a retro atmosphere that celebrates the industrial revolution and the evolution of station design.

GENERAL CONCOURSE LEVEL – NEWS KIOSK

The news agent and bookshop is one entity. In small stations the news agent will function separately and in stations where it’s appropriate, like Sandton, the larger bookshop division is also incorporated. The kiosk offers a selection of newspapers, magazines, cell phone airtime, camera film, some stationery items and maps.

Located opposite the express coffee bar, on the other side of the concourse walkway on a raised deck, the news kiosk follows the same quick access approach as the Coffee Express. The spanning concrete steps with lighting and a ramp for wheelchair access and the bevelled edged natural decorative wood finish laminated flooring is repeated. This allows the two activities and spaces to communicate as a unity in order to establish a link that constructs the retail “mall” environment.

The kiosk is an informal space. The bent steel rod

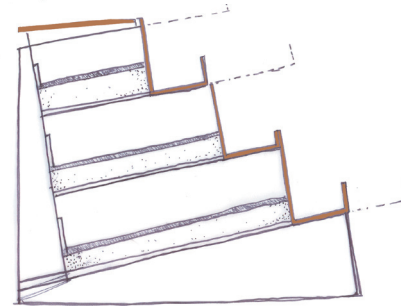
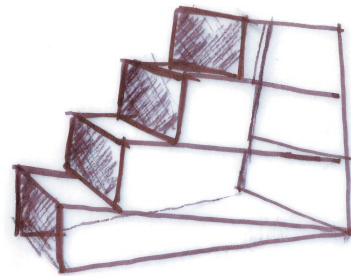


FIG 048

Plywood and bent steel book display units with drawer extension for storage

and plywood newspaper and magazine stands, along with glass balustrades articulate the deck boundaries with the counter placed to observe browsing customers. The relatively small area requires optimum use of space and thus the display stands also serve as storage. The counter incorporates display and merchandising in a similar way. An exclusive staircase links the news kiosk to the bookshop on the Lower Mezzanine Level.

LOWER MEZZANINE LEVEL – BOOKSHOP

The bookshop provides a more established shopping environment that offers all the services and goods expected from a bookshop.

An enclosed glass corridor curves and opens up toward the bookshop to lead users directly from the elevators into the double volume shop and a pre-cast concrete block staircase cantilevering from concrete wall connects to the Higher Mezzanine Level. The staircase projects through the concrete wall to express the route to the next level. A glass insertion inclining along the stair treads imitates a balustrade and allows a glimpse of customer traffic going up and down.

Both mezzanine levels are enclosed with glass and exposed steel I- beam facades and the laminated flooring introduced in the coffee bar and news kiosk are sustained. The bookshop interior presents a refined and polished look provided by the primary use of stainless steel, translucent acrylic sheets and plywood for shop display and lighting elements. Display and storage is combined for efficient use of space, display shelves have drawers for storage and packaged goods.

The double volume allows a lighter space with ample advertising and display prospects.

HIGHER MEZZANINE LEVEL – CAFÉ BAR

The urban-feel café bar offers a variety of wines, coffees, beverages (alcoholic as well as non alcoholic), light meals and snacks. Snacks such as sandwiches and salads are prepared from scratch, while other meals such as pies, pasta dishes, pastries, cakes and deserts are sourced in pre-prepared format, from nearby suppliers, on a daily basis. The sourced foods are then heated and prepared for serving from the café bar kitchen. Though Sandton station makes it possible to have a coffee bar and a café bar, it is assumed this is not a viable option in all the Gautrain stations. The station's capacity would determine which of the options would be more suitable.

A similar glass enclosed corridor bend and expand in the opposite direction as its counterpart below on the Lower mezzanine Level leading customers from the elevators to the café bar space. Text and images that illustrate the café mood and menu are showcased on the glass wall slanting towards the bar. On the other side of the corridor a back projection screen for advertising tilts out into the station in front of an escalator bank.

The café bar includes a cocktail bar counter with barstools, casual seating arrangements as well as a small, more traditional dining area. The bar area is a prominent feature in the space. A large illuminated bar counter swirls around the cocktail preparation counter and its transparent spirit displays shelves. A combination of stainless steel, translucent glass and coloured acrylic panels are used to split the counter in two dissimilar portions divided by a large column in the space. The bar is screened from the pay point and dining area by a coloured translucent acrylic and stainless steel structure used for spirit and liquor bottle storage. The structure is illuminated to cast bottle shaped shadows on the back of a translucent panel. This creates a screen with appealing silhouettes that indicate the bar area. A bulkhead

that highlights the cocktail preparation counter is layered in a sloping outer plywood shell that reveals an inner glowing profile.

A series of similar screens coil in the space to split the café into a casual seating area and a dining space. Casual seating is provided in the form of mobile ottomans and small tables, while the dining area involves comfortable chairs placed at shaped plywood tables that define personal space. Configurations of ottomans and tables also spill into the glass corridor.

The café bar has a galley kitchen that runs through

the main station space to connect with the service area (office, storage, coldroom and waste disposal facilities) located beneath the General Concourse Level next to basement parking. The kitchen and service are also covered with structural glass screens.

Two toilets are provided in front of the kitchen and service entrance. A translucent acrylic panelled wall acts as a screen that also provides signage information. On the other side of the space another concrete staircase provides access from the express coffee bar deck and General Concourse Level.



FIG 049

Interior of Cafe bar showing dining area

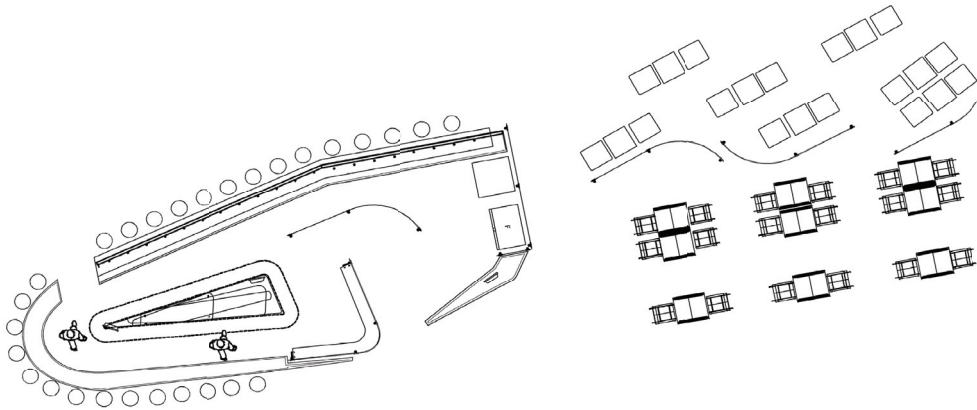


FIG 050
Interior of Cafe bar, cocktail bar with screens



FIG 051
Plywood and bent steel tables and chairs of Cafe bar dining area

SERVICES

TOILETS

Washroom and toilet facilities are services that passengers and commuters expect at stations. Unfortunately public toilets are subject to vandalism and often serve as places for drug abuse and other crimes. The abuse of public toilets amplifies maintenance and repair costs which don't justify their operation ([http:// railway-technical.com/stations](http://railway-technical.com/stations)). This assumingly is the reason why none of the stations on the Jubilee Line, with the exception of Canary Wharf, provide toilet facilities.

Seeing that toilets at stations are constantly exposed to numerous users, the station scenario requires washrooms which will simplify and minimise maintenance and cleaning tasks. For this reason, the durability and properties that will influence performance in terms of hygiene should determine the choice of finishes in the washrooms. A material such as stainless steel is easy to clean, very durable and consist of low smoke and low toxicity properties, which is why it was the primary material used in Canary Wharf station's toilets, even the cubicle doors were clad in stainless steel (Building Design: p24). Glass is also a popular material in public toilets because of its easy maintenance.

Pay toilets provide a reasonable solution to the problem. Charging a fee to use the washroom decreases the opportunity for people to use the toilet for unwanted and illegal activities. It also sustains operational costs, which make it feasible to have staff permanently present to ensure that the facilities are clean and in the required condition (having staff constantly present also raises security measures). By charging for sanitary services, the toilet facilities could be seen as a self-sufficient business venture run independently from the Gautrain Concessionaire.

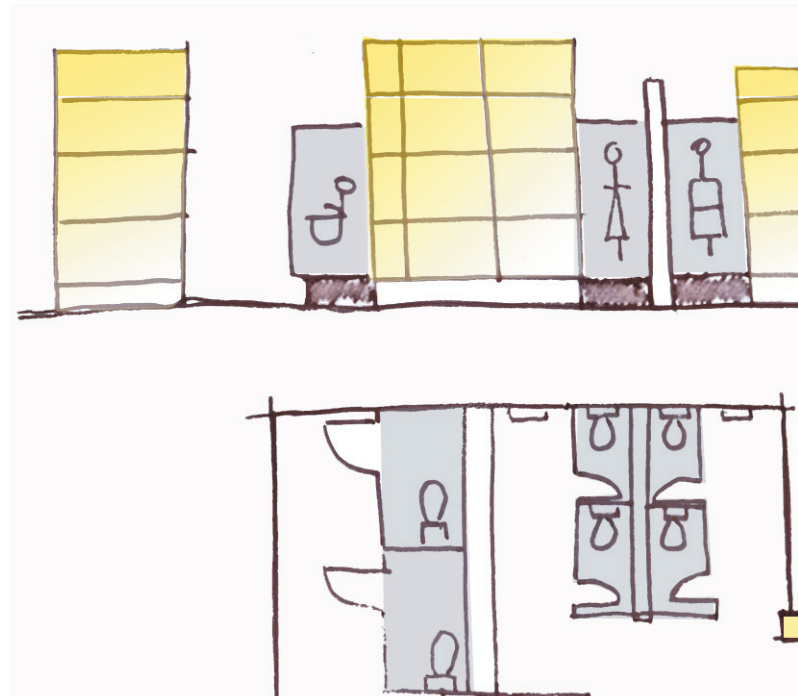


FIG 052

Concept development of toilet and washroom facilities

In Europe it is accepted to pay or tip €0,50 to use a washroom facility and these facilities are expected to be clean and in a good condition. It should be mentioned that these toilets usually consist of ultra hygienic automated tap systems and self-cleaning-automated water closets. Paying to use toilet facilities is a custom South Africans are not used to, but surely users won't mind paying a small fee if good maintenance and cleanliness is guaranteed. If a pay system is to be used, the design and specification of durable, more sustainable and therefore usually more expensive toilets, will also be substantiated. The pay system can in some ways be linked with the transport ticketing system so that valid metro tickets include limited complimentary use of the toilet and shower facilities.

In a modern-day society, conventional segregation of washrooms is no longer mandatory. Unisex toilets is a concept that recognizes the potential of integrating male and female toilets within suitable environments. It is quite successful in the TGV Aix-en-Provence station where toilets consist of pay cubicles each containing its own hand wash basin, water closet and disposable towel dispenser or dryer.

In the South African context the integration of male and female washrooms in a public space, such as the Sandton station, poses certain risks. Sexual crime is a relevant issue and should be dealt with in the design. Although the use of a pay toilet system and close circuit television monitoring will reduce the likelihood of such crimes occurring, the Sandton station design will rather take a preventive approach and avoid the use of unisex toilets. Facilities provided include male and female toilets with showers, toilets for disabled people and family toilets/ baby change rooms.

The toilets reflect the character of the main station. A combination of opaque glass (preventing visual

intrusion) with epoxy sealed concrete walls as partitions and self levelling epoxy floors are used for easy maintenance and durability. Stainless steel sanitary fixtures are chosen to achieve maximum durability and life-span.

WASTE AND GARBAGE

Stainless steel waste and garbage bins are situated at station entrances and in combination with signage systems throughout the station.

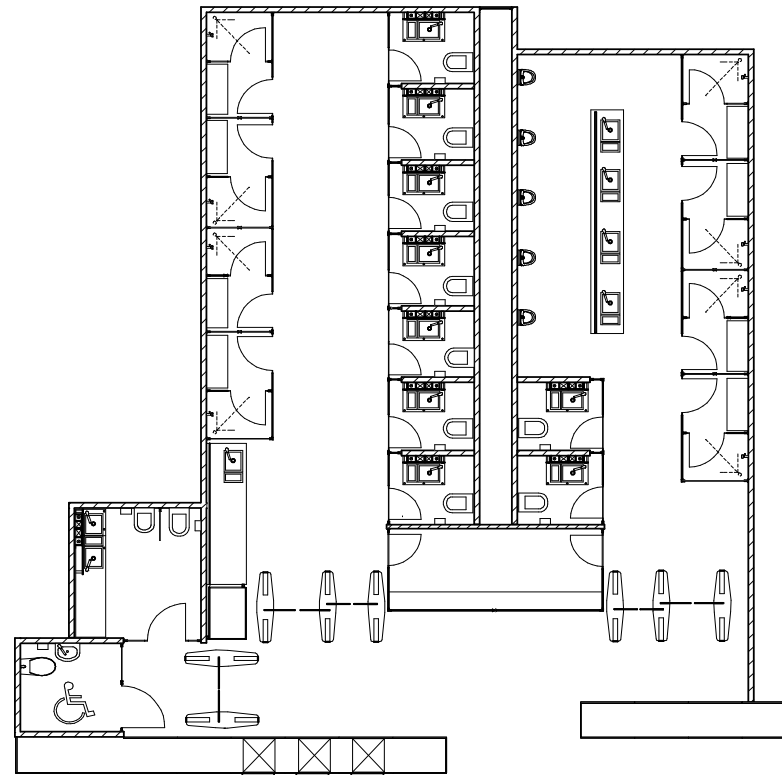


FIG 053
Toilet and washroom facilities

LIST OF FIGURES

INTRODUCTION

METRO METAMORPHOSES

FORMULATING THE DESIGN TASK

CONTEXT STUDY

PRECEDENTS

BASELINE

DESIGN DISCOURSE

TECHNICAL RESOLUTION

- STATION CIRCULATION & ACCESS**
- FIRE & EMERGENCY SAFE AREAS**
- HEATING & VENTILATION**
- INFORMATION**

DESIGN DRAWINGS

CONCLUSION

BIBLIOGRAPHY

APPENDICES

STATION CIRCULATION & ACCESS

The station design and layout has to accommodate large passengers and commuter volumes moving through the space in frequent intervals. In the Sandton station specifically, the user has to make various level changes to move from Platform level to the Entrance level and vice versa. In order to accommodate the heavy passenger traffic and to ensure good circulation, direct passenger routes equipped with two directional heavy duty high-speed high-rise escalator banks are provided. For safety reasons all escalators are angled at the standard 30° inclination.

Passenger routes are kept open and transparent to avoid confusion. Sightlines lead commuters from the Entrance level to the General Concourse Level then to the Ticketing Concourse Level, before passing through electronic access control units to reach escalators and elevators connected to the separate platforms. To accelerate travelling time from

Entrance to Platform level automatic self-service ticketing machines are provided at various points along the side of the passenger routes. Nevertheless, a conventional staffed ticket office is provided on the Ticketing Concourse Level. Ticketing points are angled according to the passenger flow direction and for optimal use of space. Departure and arrival areas are also separated on the Ticketing Concourse Level to enhance security and circulation. Atriums: double and triple volumes assist in orientating the user in the underground structure.

In addition all levels are connected with elevators that are positioned at key circulation points and a general staircase positioned in the central Atrium. Mezzanine levels are connected to the main structure with individual staircases and a main circulation elevator pair. The mezzanine service lift is accessible from the basement parking level and serves the mezzanine café exclusively.

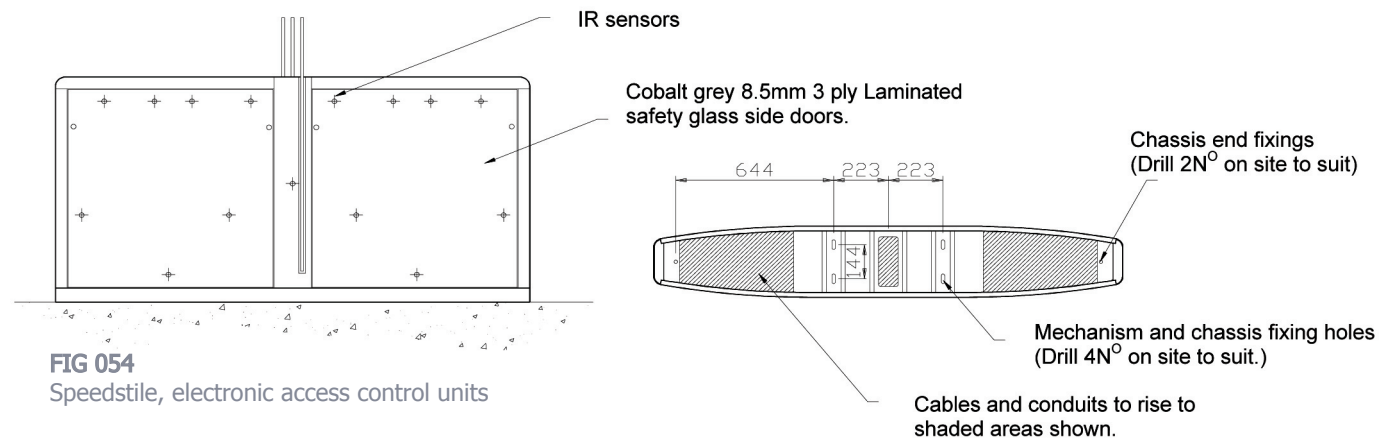


FIG 054
Speedstile, electronic access control units

FIRE & EMERGENCY SAFE AREAS

A rational approach is taken in terms of the station's fire and evacuation design. Safe areas which also serve as emergency routes enfold the station core. Emergency escape routes from the Platform Level connect to safe areas of the Ticketing Concourse Level, which are connected to all the other levels. The safe areas comply with the requirements for structural stability, fire resistance, surface finishes etc. set out for emergency routes in the SABS 0400 National Building Regulations.

The safe areas are well lit with artificial lighting powered by an emergency energy/ electricity supply to maintain the minimum illuminance of 50lx. Individual ventilation shafts and fireman's lifts with fire lobbies are provided as required and the safe areas do not comprise of any materials that have a toxic nature or emit smoke.

The station is fit with the required sprinkler, alarm and fire distinguishing systems.

Emergency fire doors providing access to the safe areas from the station interior are set out and well indicated at regular intervals. These doors comply with SABS 1253 regulations and are equipped with automatic self closing mechanisms. Doors, when opened, do not intrude more than a 100 mm in the emergency route and don't obstruct any person escaping via the route.

The walls and floors of the safe areas offer a minimum of 2 hour fire resistance and structural stability. The floors and stairs have flat unobstructed surfaces with a slip resistant finish. All staircases are 1500mm wide with solid treads and are provided with hand railing on both sides. The safe area provides sufficient head space and exceeds the minimum required width of 1800mm due to the large station capacity.

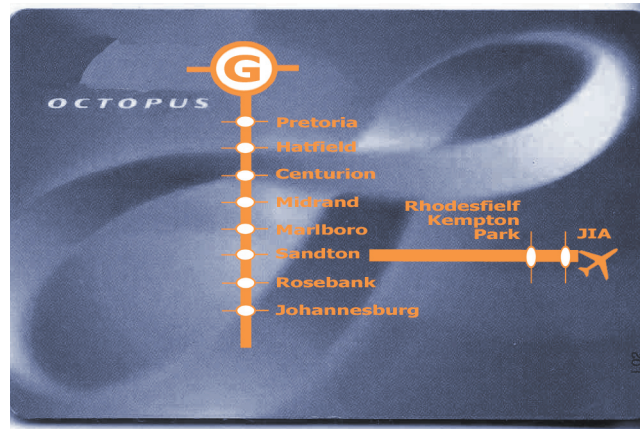
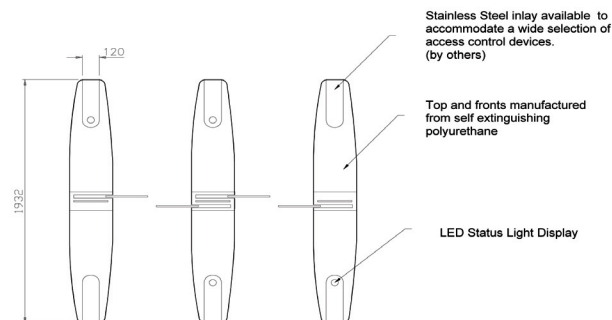


FIG 055
Modified and adapted Octopus smartcard as part of the automatic ticketing



HEATING & VENTILATION

The heating and ventilation strategy proposed below is based on a consultation with Patrick Cochler of Spoomaker and Partners Inc, an engineering company specialising in thermal control and occupancy comfort in building structures. Spoomaker and Partners Inc. were also appointed as consultants by one of the bidding concessionaires of the Gautrain project.

Stations in general are open structures in the sense that the trains moving through them constantly push air in and out of the station structure. Air also escapes through the train tunnels. For this reason thermal control of the station envelope by means of air conditioning is not viable. It is however, suitable to supply enclosed spaces such as retail components with air condition units. The introduction of platform screen doors will offer a moderate advantage in thermal control, but as the doors open frequently (every 10 – 15 min.), it still doesn't validate the use of air-conditioning and fortunately the South African climate doesn't pose the risk of extremely cold winters where heat loss becomes a critical consideration.

For general user comfort the station envelope will be ventilated and cooled by means of evaporative cooling. By implementing evaporative cooling systems humidity can be controlled, while a temperature of approximately 28°C can be maintained during summer. Infrared heating offers a suitable solution for heating in winter.

Large evaporative cooling shafts run through the entire structure and are connected to evaporative cooling plant rooms located above ground level. From these shafts air is distributed throughout the station through smaller ducts and channels.

Trains produce large amounts of heat when entering the station due to friction caused when breaking. To avoid uncomfortable conditions at platform level, the platforms are equipped with extraction fans and shafts, situated beneath the platforms next to the tracks, to extract warm air generated by the trains. The platforms are also provided with fresh air from evaporative cooling plant rooms.

INFORMATION

ESSENTIAL

Passenger Information Systems (PIS), also referred to as Passenger Information Displays (PID), play a primary role in the orientation of users and is therefore a major contributing factor in the proper functioning of a station. It is important to keep commuters informed of the services running and delayed, train destinations and connections to other stations and transport systems as well as train frequencies and intervals.

Information systems consist of constant information displays which indicate fair charges and services. Real-time information displays will show time, destination and arrival schedules ([http:// railway-technical.com/stations](http://railway-technical.com/stations)). Technology allows instant and advanced ways to display various forms of information, such as audio visual and digital information to be displayed instantly and electronically. The primary displays in the Sandton station will be two large format 300" acrylic screens (suitable for back projection) suspended over both entrances. Smaller LCD screens are also positioned along passenger routes throughout the station and at the platform areas.

ADDITIONAL

Advertisements also form part of information provided and stations are popular ad-space venues because the information displayed are exposed to large numbers of people. By designing spaces that present advertising opportunities the Gautrain system could obtain large sponsorships. Various prime locations are therefore utilised for this purpose.

The Mezzanine levels offer ample opportunity for ad-space by projecting on suitable glazing, while the LCD screens used for PID can also be used, though to a limited extent.

PROJECTION

Projectors are combined with 2 angled mirrors to minimize the space required for back projecting. Mirror reflecting angles are always less than 90° and back projection screens do not tilt more than 30° so to avoid visual disturbances in the projected material. Projection equipment is kept in isolation (in dark surfaced environments) to optimise visual quality.

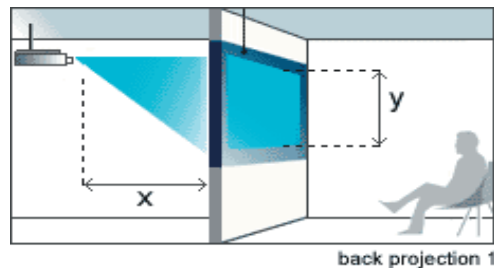
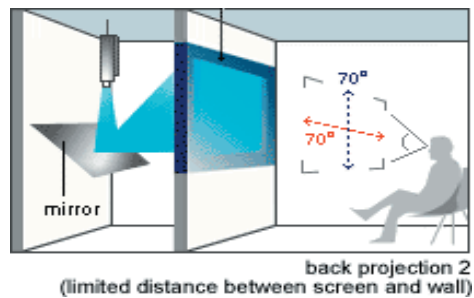
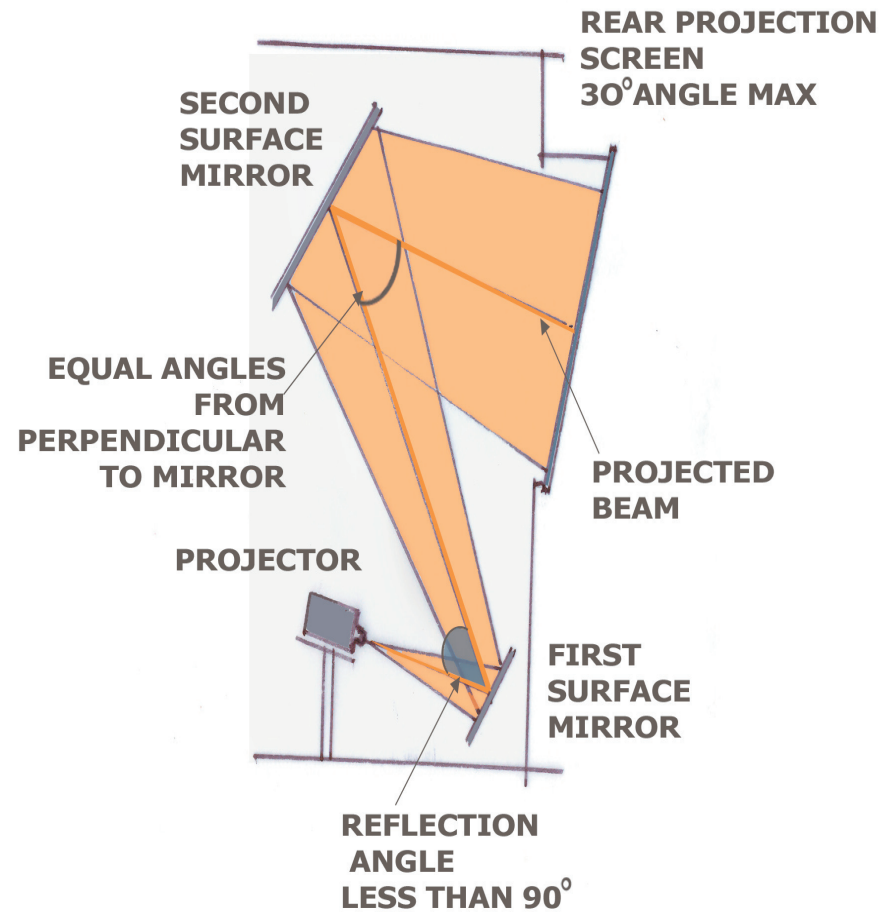


FIG 056

Diagrammatic illustrations of back projection principles



○ LIST OF FIGURES

○ INTRODUCTION

○ METRO METAMORPHOSES

○ FORMULATING THE DESIGN TASK

○ CONTEXT STUDY

○ PRECEDENTS

○ BASELINE

○ DESIGN DISCOURSE

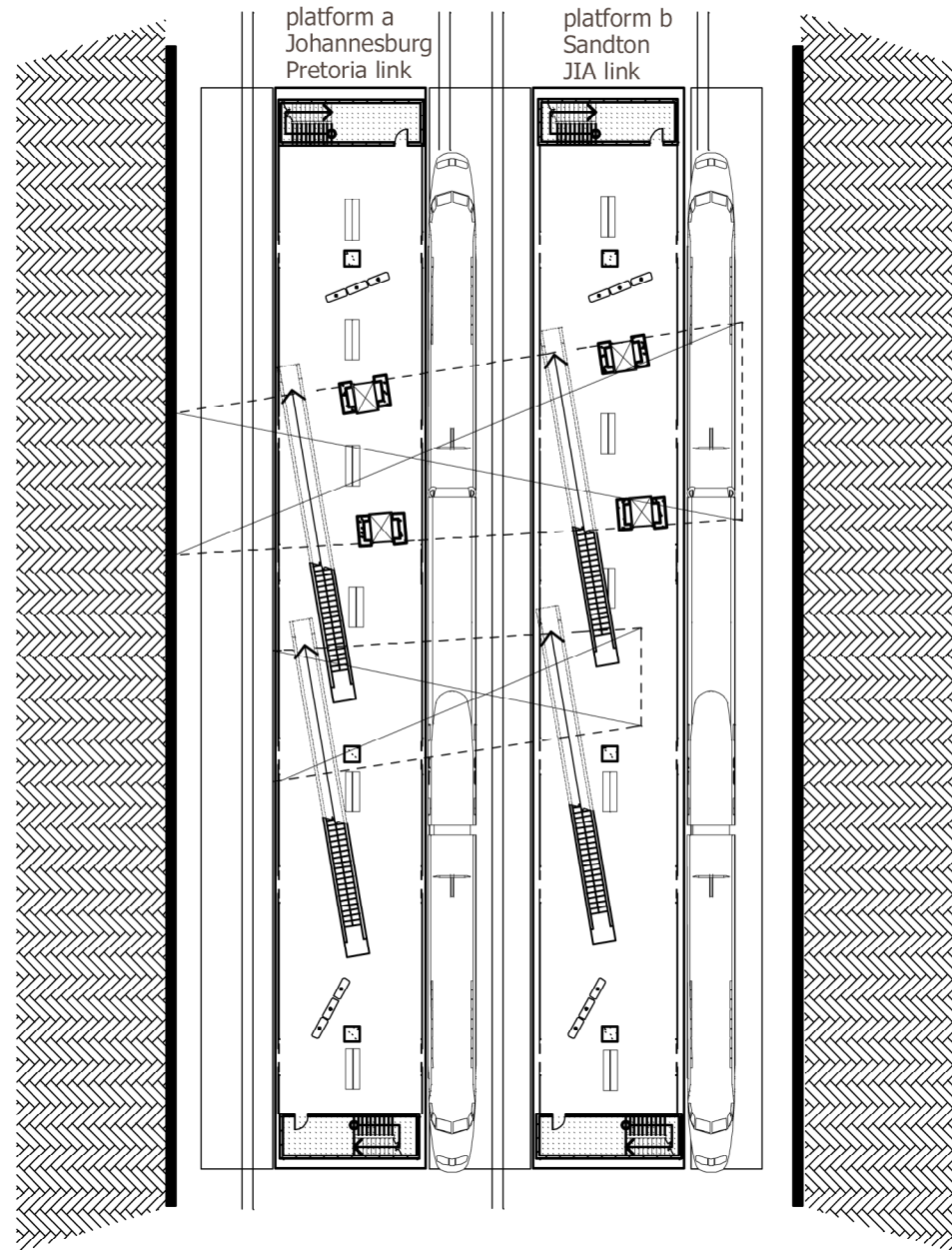
○ TECHNICAL RESOLUTION

○ **DESIGN DRAWINGS**

○ CONCLUSION

○ BIBLIOGRAPHY

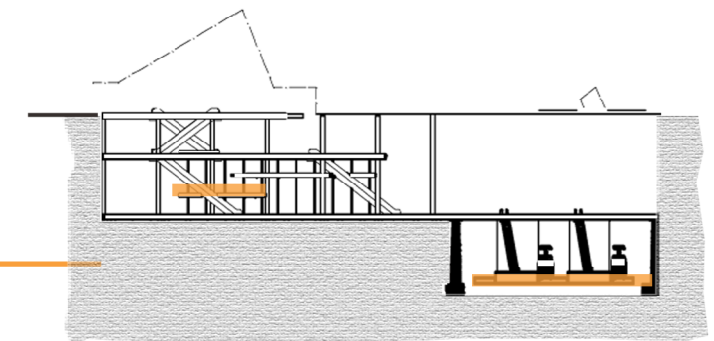
○ APPENDICES

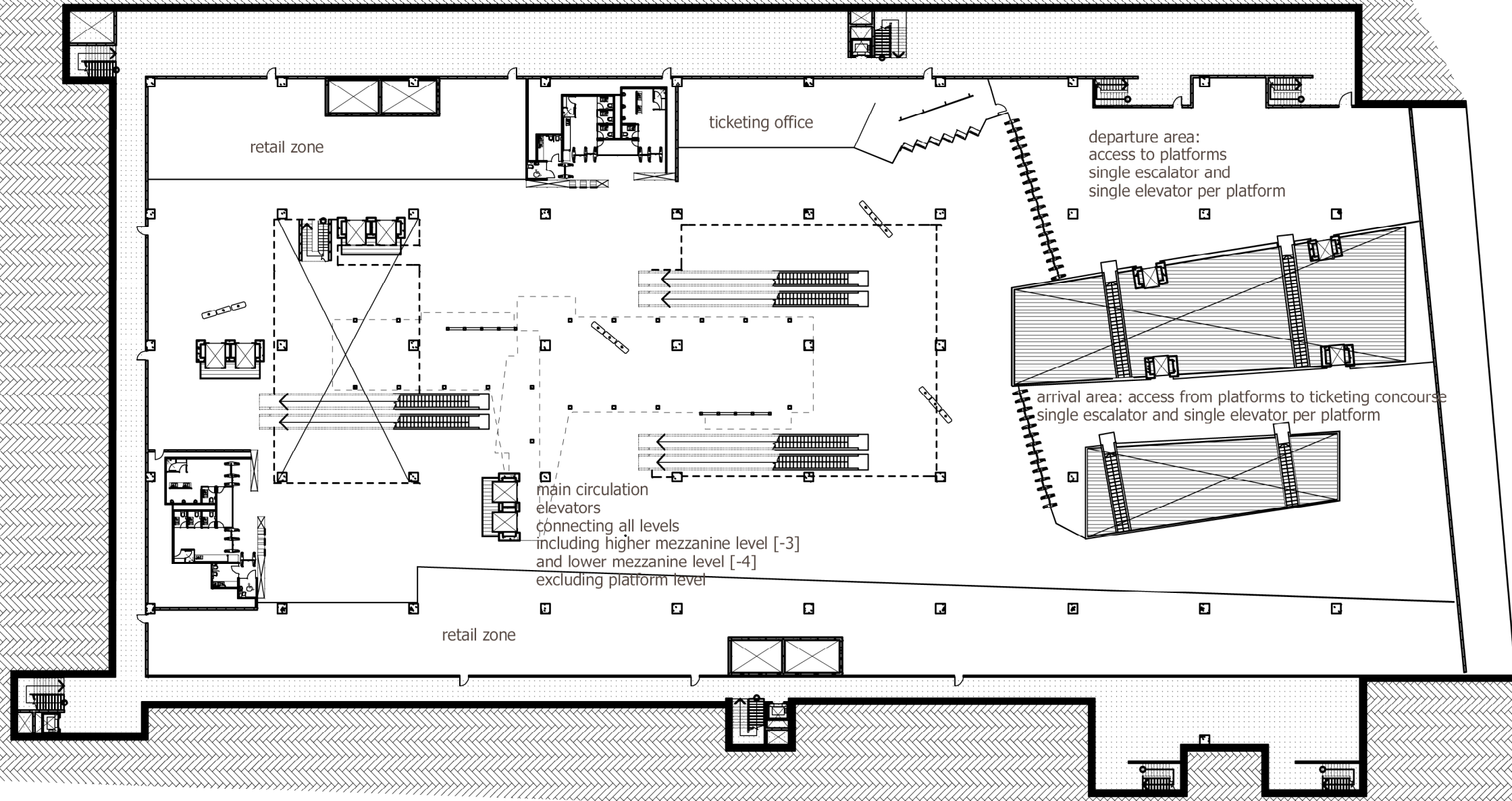


**PLAN PLATFORM LEVEL
1:500**

DRAWING 001
PLAN
PLATFORM LEVEL
1:500

TRACK AND PLATFORM
LEVEL
-29900

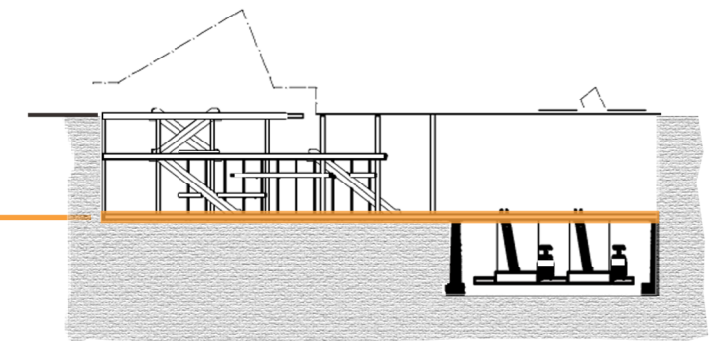


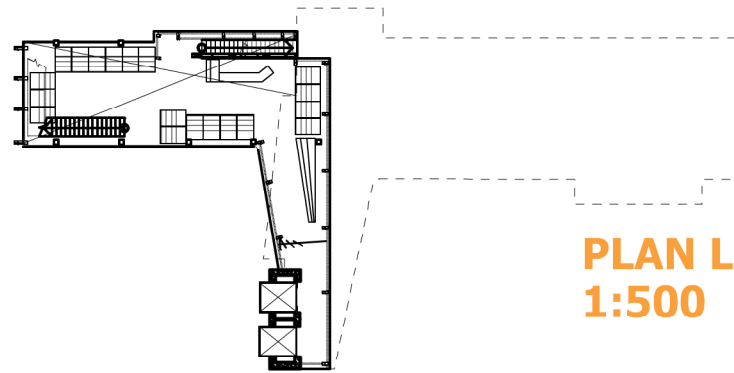


DRAWING 002
PLAN
TICKETING CONCOURSE
LEVEL [-5]
1:500

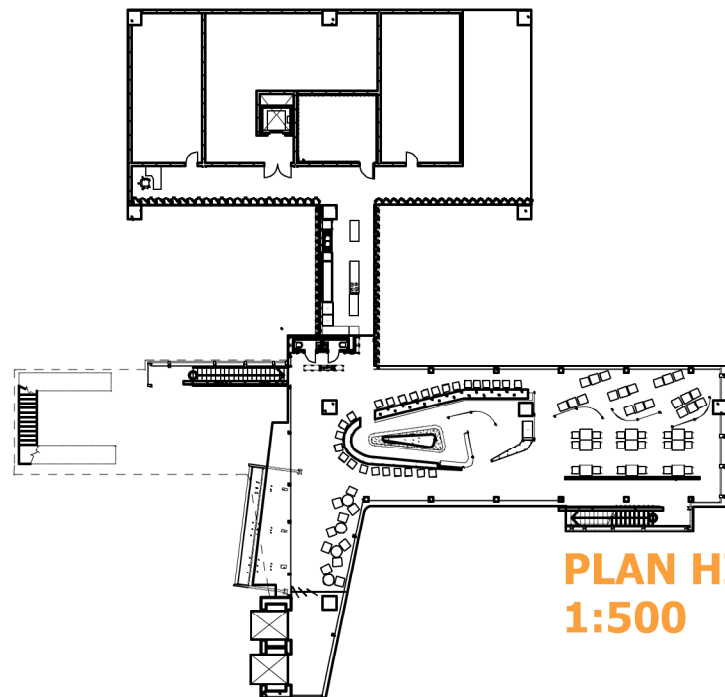
PLAN TICKETING CONCOURSE
LEVEL [-5]
1:500

TICKETING CONCOURSE
LEVEL [-5]
-18500





**PLAN LOWER MEZZANINE LEVEL [-4]
1:500**



**PLAN HIGHER MEZZANINE LEVEL [-3]
1:500**

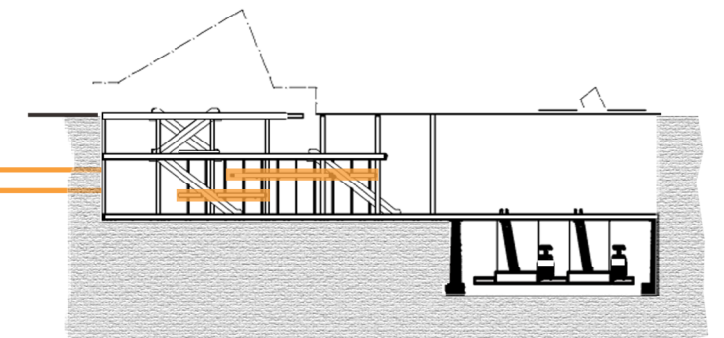
DRAWING 003

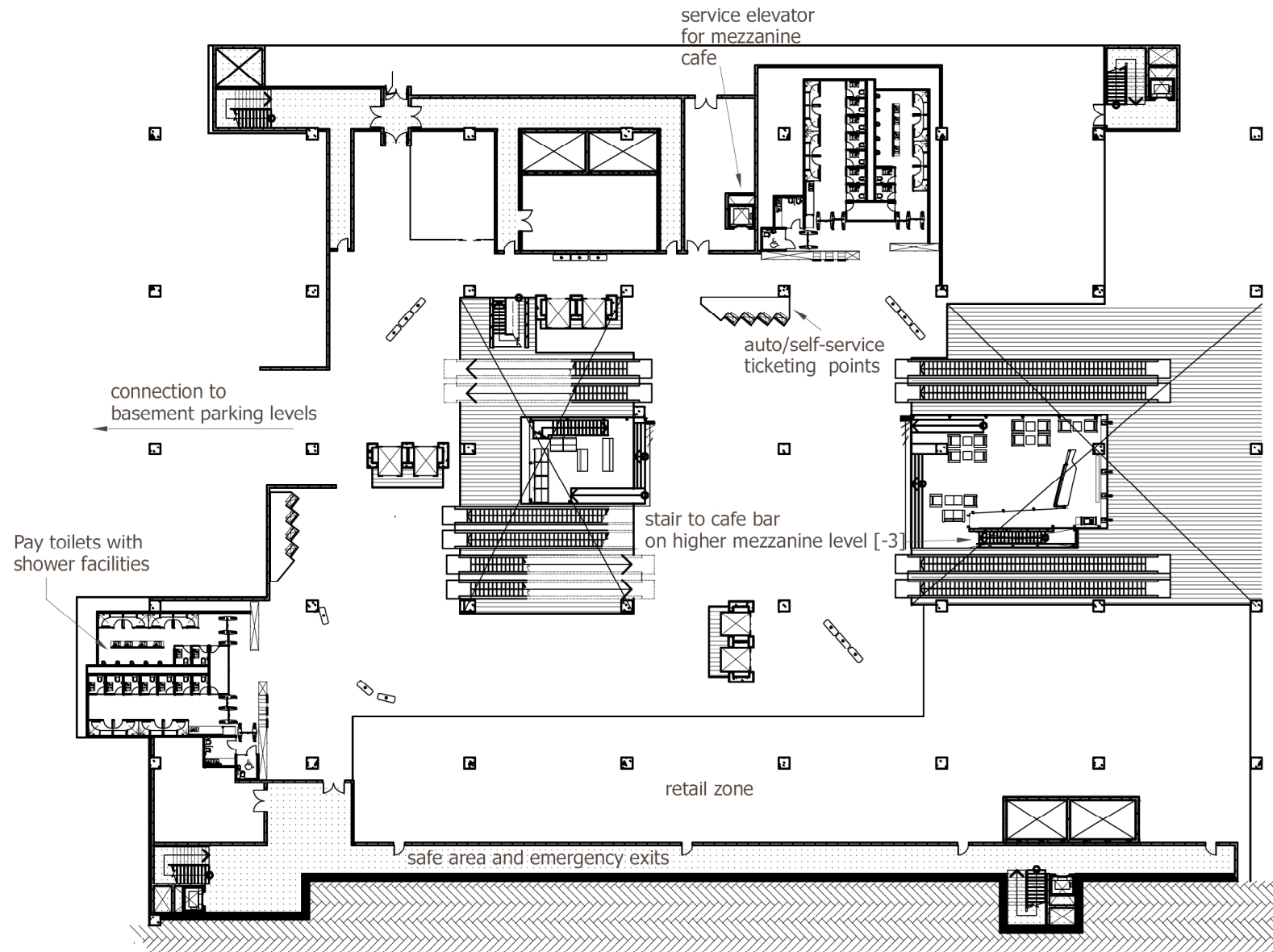
**PLAN
LOWER MEZZANINE LEVEL [-4]
1:500**

**PLAN
HIGHER MEZZANINE LEVEL [-3]
1:500**

HIGHER MEZZANINE
LEVEL [-3]
-11100

LOWER MEZZANINE
LEVEL [-4]
-14800

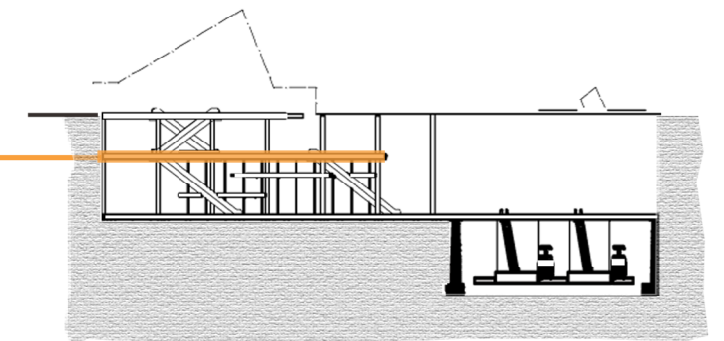


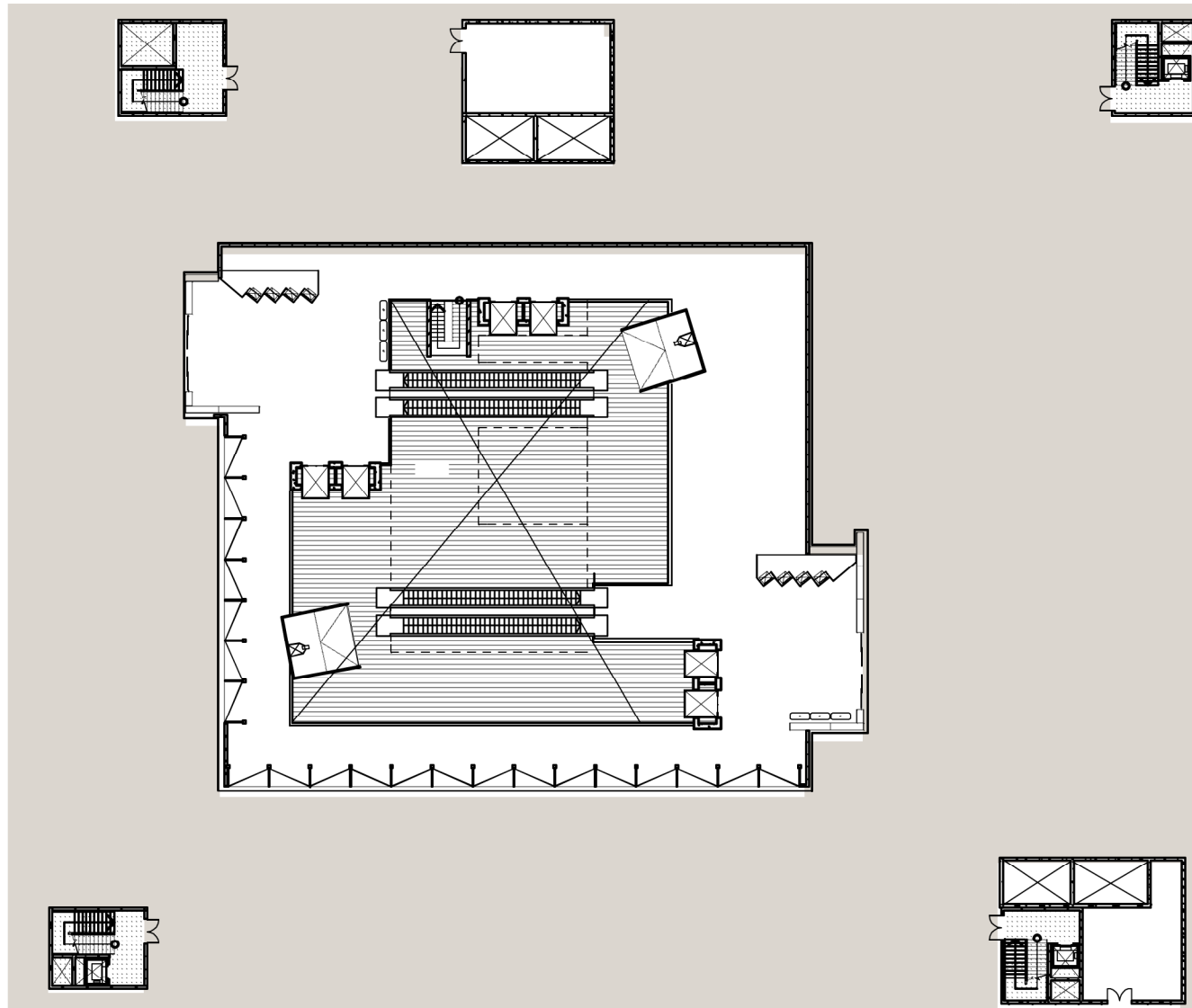


PLAN GENERAL CONCOURSE LEVEL [-2]
1:500

DRAWING 004
PLAN
GENERAL CONCOURSE
LEVEL [-2]
1:500

GENERAL CONCOURSE
LEVEL [-2]
-7400

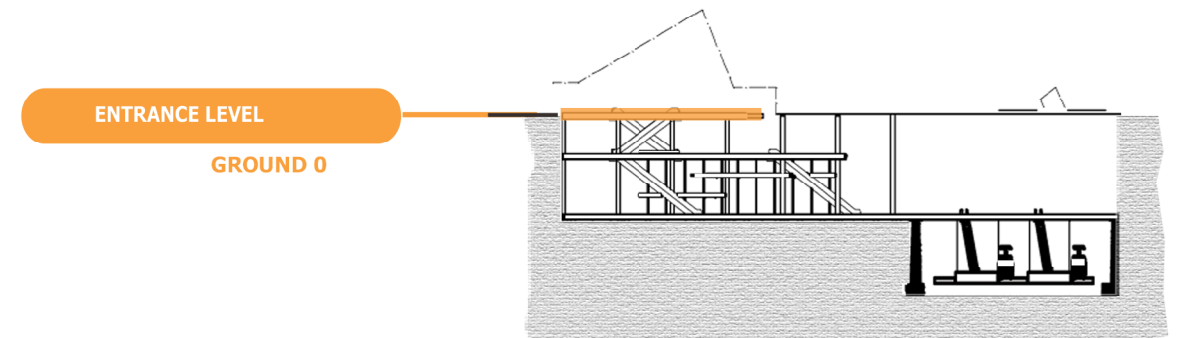


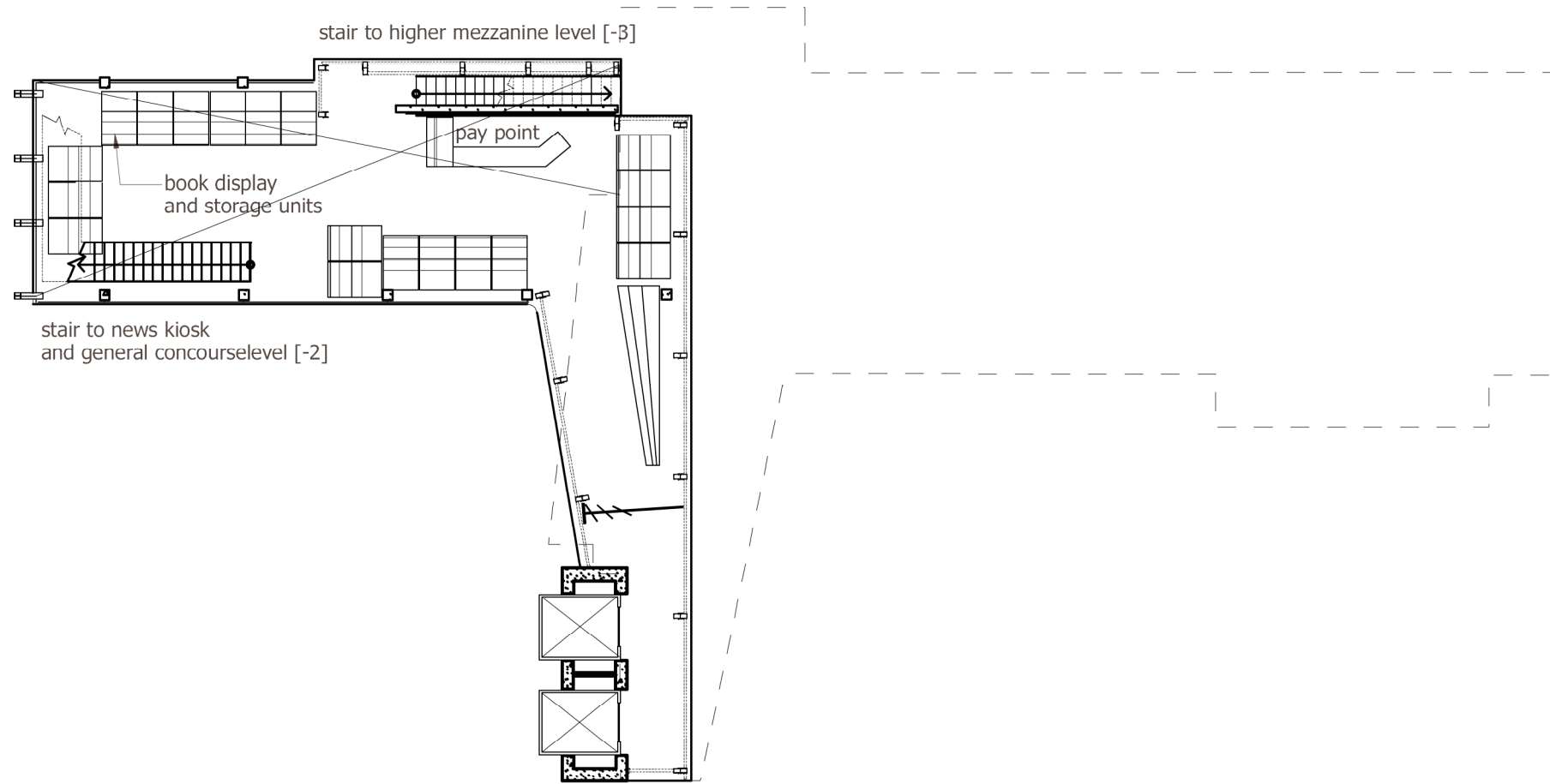


**PLAN ENTRANCE LEVEL
1:500**

DRAWING 005

**PLAN
ENTRANCE LEVEL
1:500**



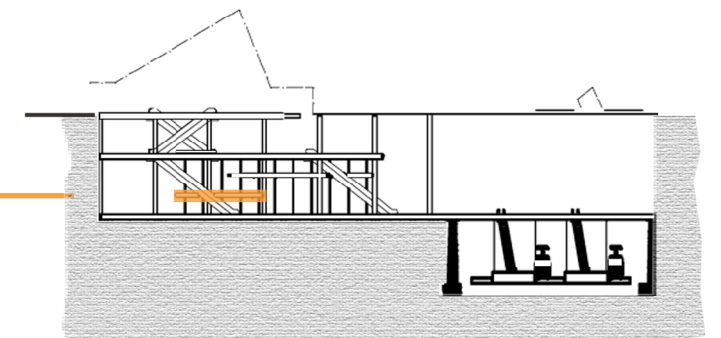


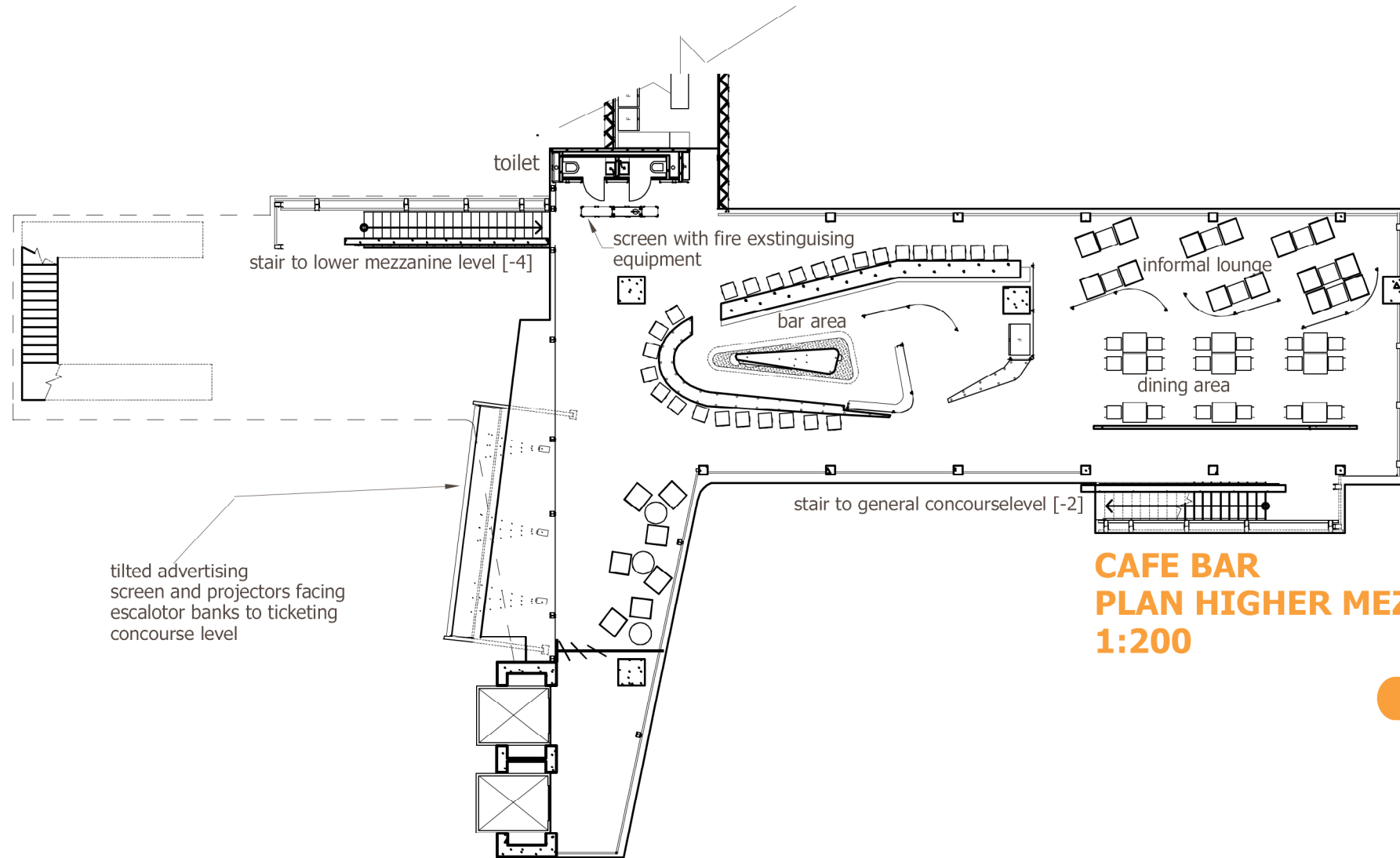
BOOKSHOP
PLAN LOWER MEZZANINE LEVEL [-4]
1:200

DRAWING 006

PLAN
LOWER MEZZANINE
LEVEL [-4]
1:200

LOWER MEZZANINE
LEVEL [-4]
-14800

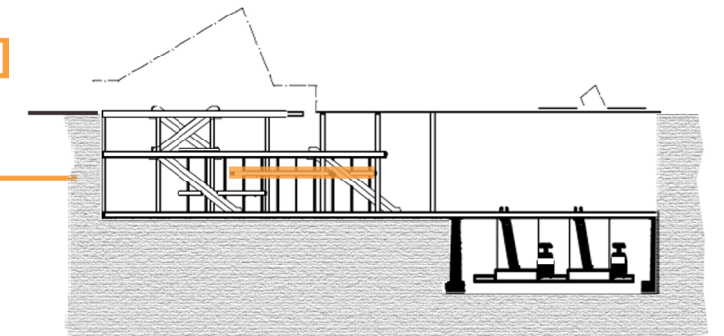


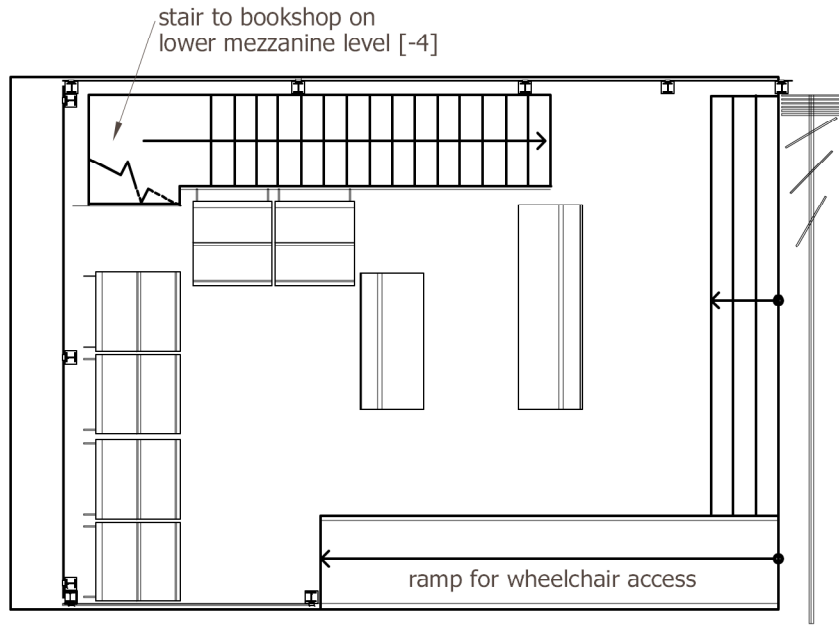


DRAWING 007
PLAN
HIGHER MEZZANINE
LEVEL [-3]
1:200

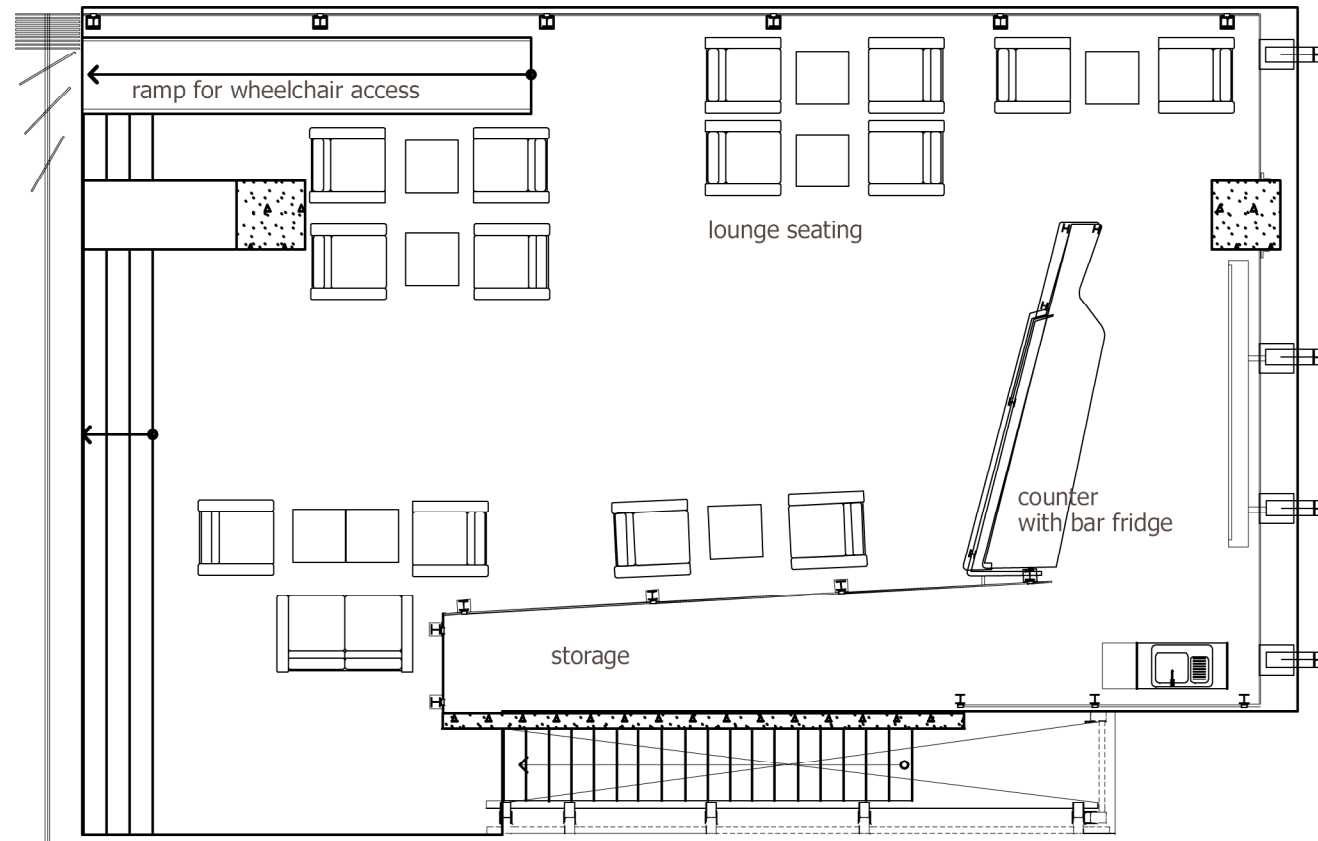
CAFE BAR
PLAN HIGHER MEZZANINE LEVEL [-3]
1:200

HIGHER MEZZANINE
LEVEL [-3]
-11100





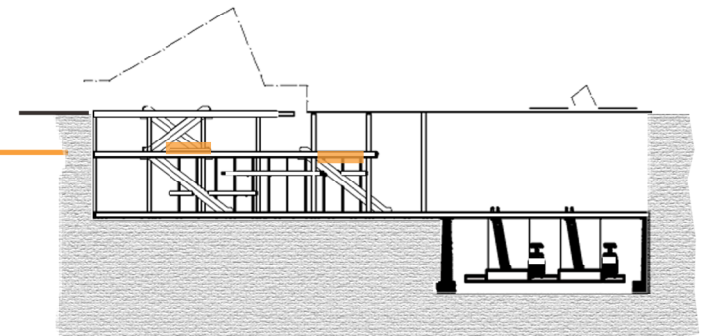
NEWS KIOSK
PLAN GENERAL CONCOURSE LEVEL [-2]
1:100

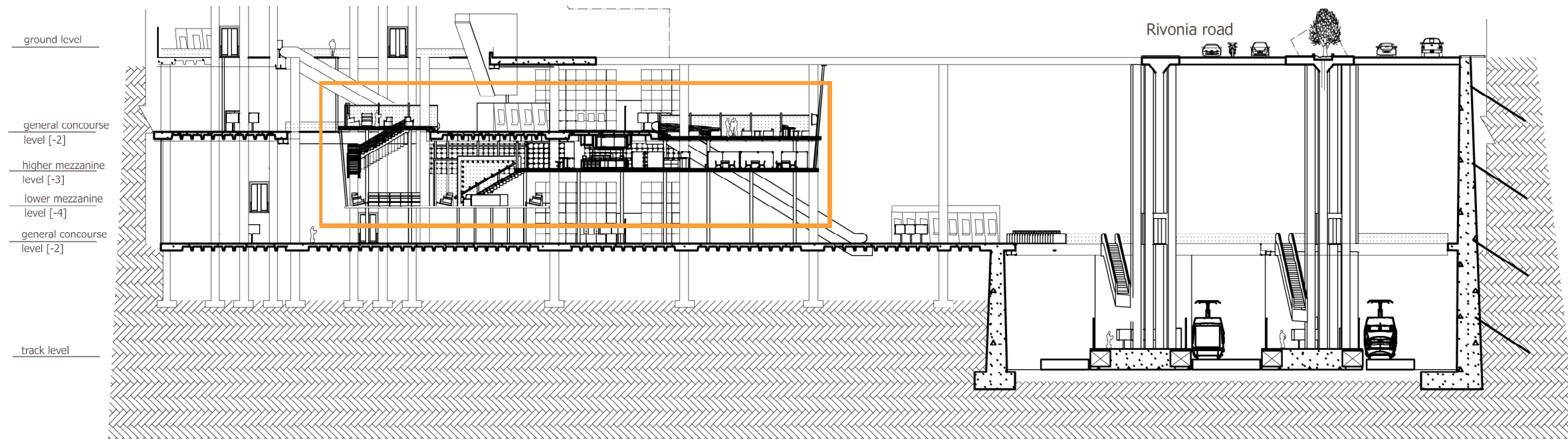


COFFEE EXPRESS BAR
PLAN GENERAL CONCOURSE LEVEL [-2]
1:100

DRAWING 008
PLAN
GENERAL CONCOURSE
LEVEL [-2]
DECK
EXPRESS COFFEE BAR
NEWS KIOSK
1:100

GENERAL CONCOURSE LEVEL [-2]
 DECS
 -6900 & 7900

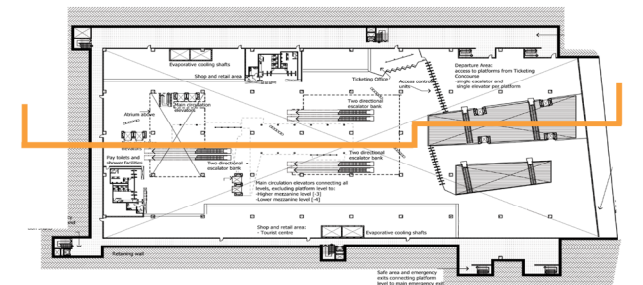


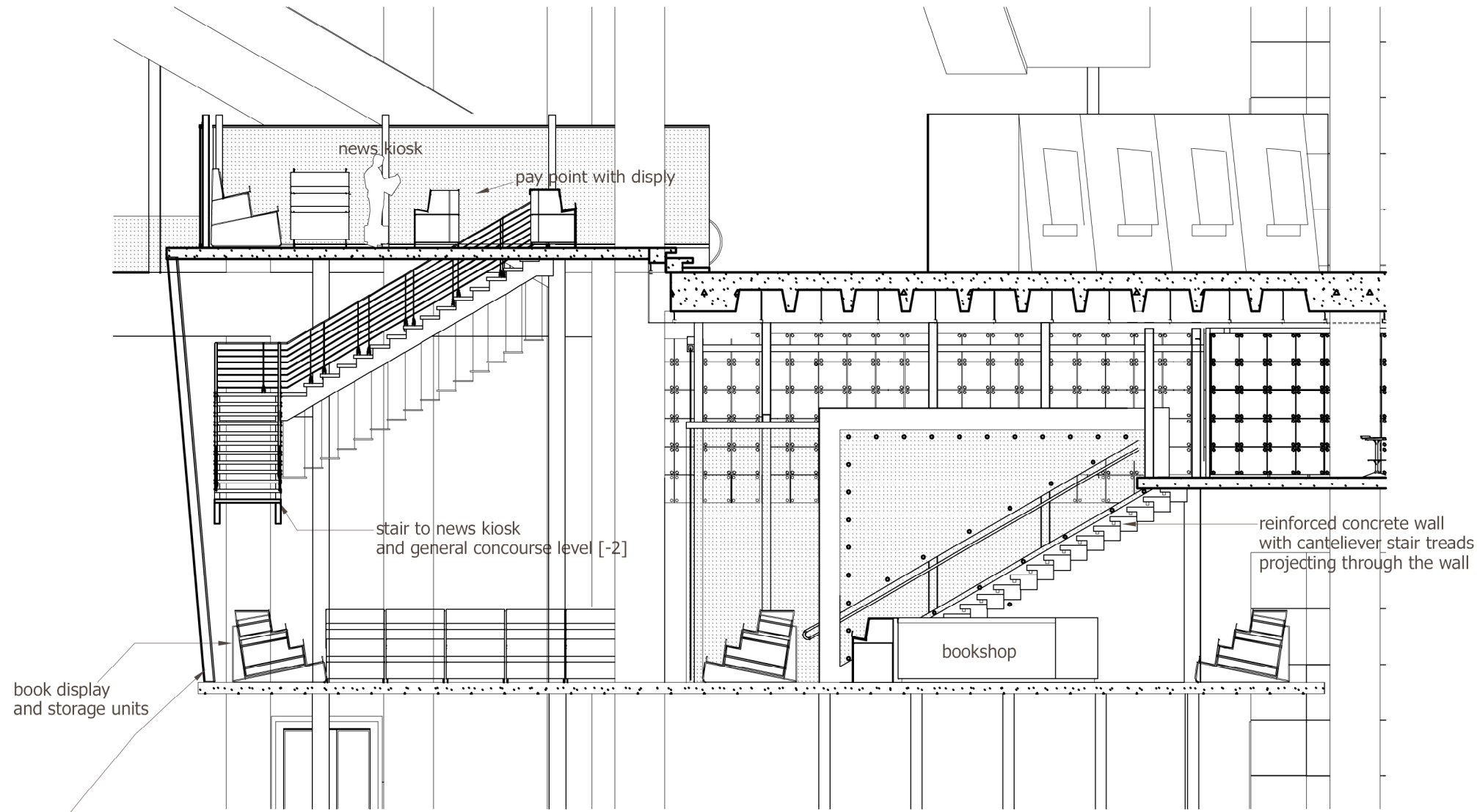


DRAWING 009

SECTION AA 1:500

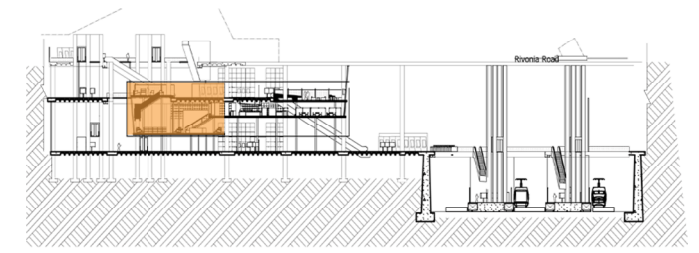
SECTION AA 1:500

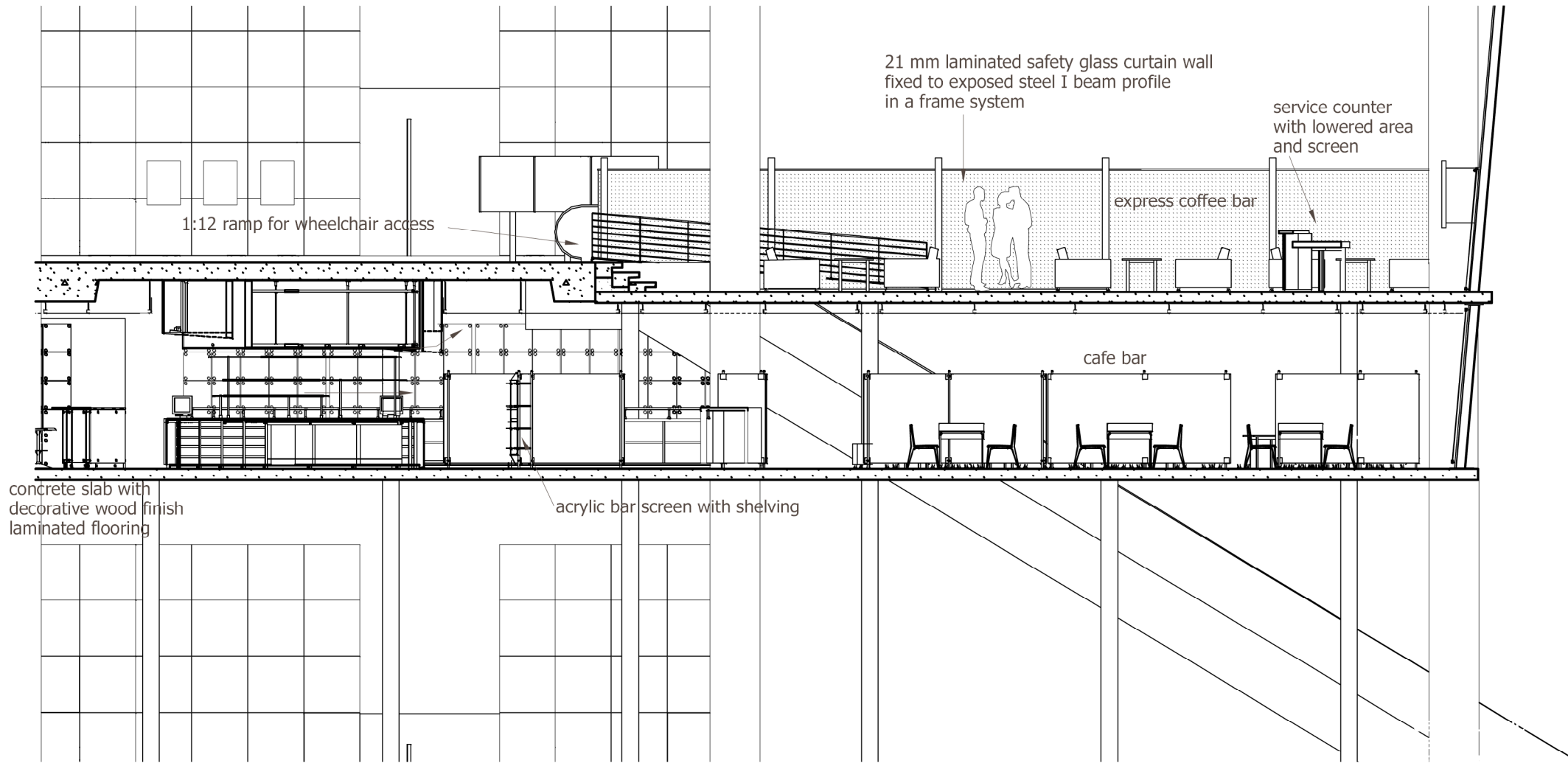




DRAWING 010
SECTION
AA ENLARGED PORTION 01
1:100

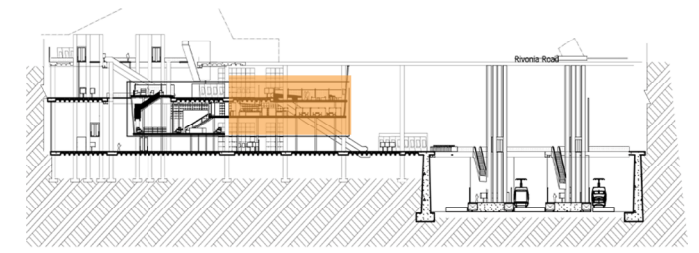
SECTION AA PORTION 01
1:100

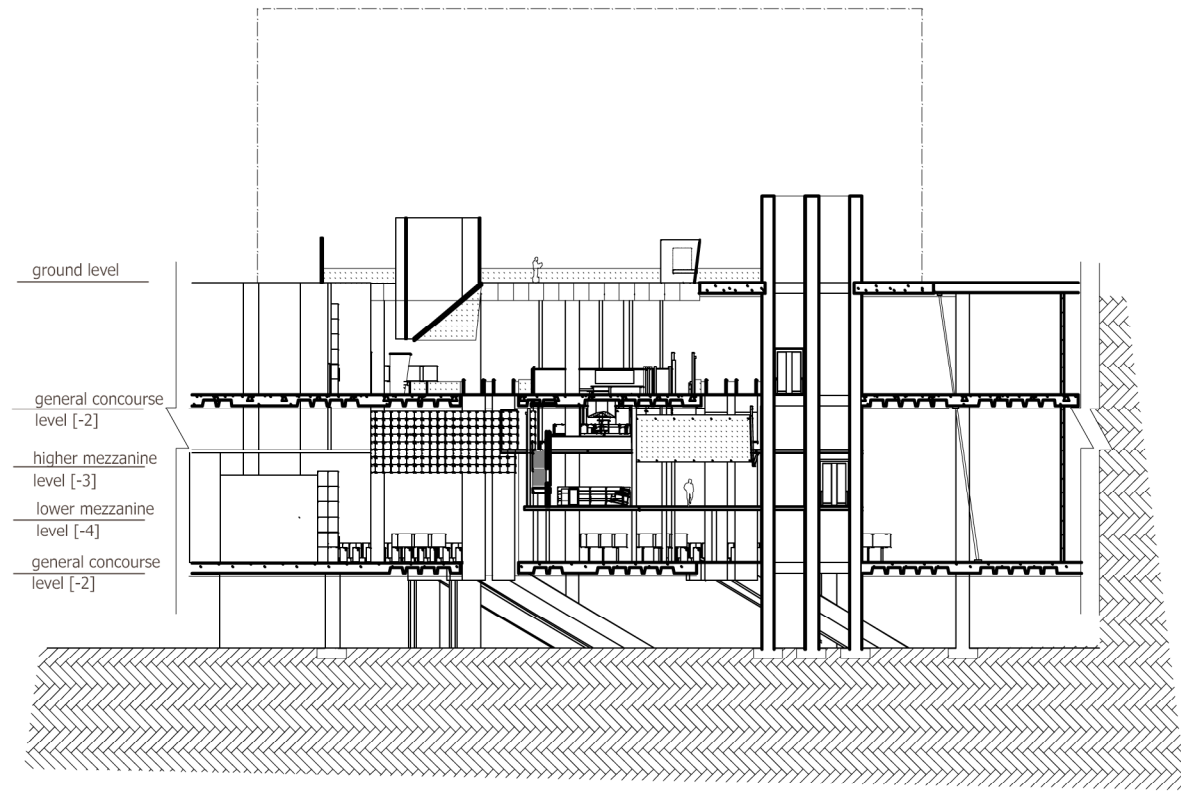




DRAWING 011
SECTION
AA ENLARGED PORTION 02
1:100

SECTION AA PORTION 02
1:100

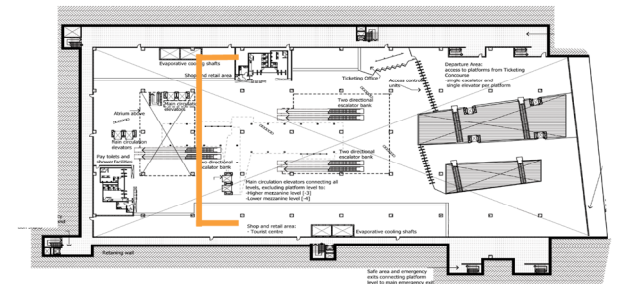


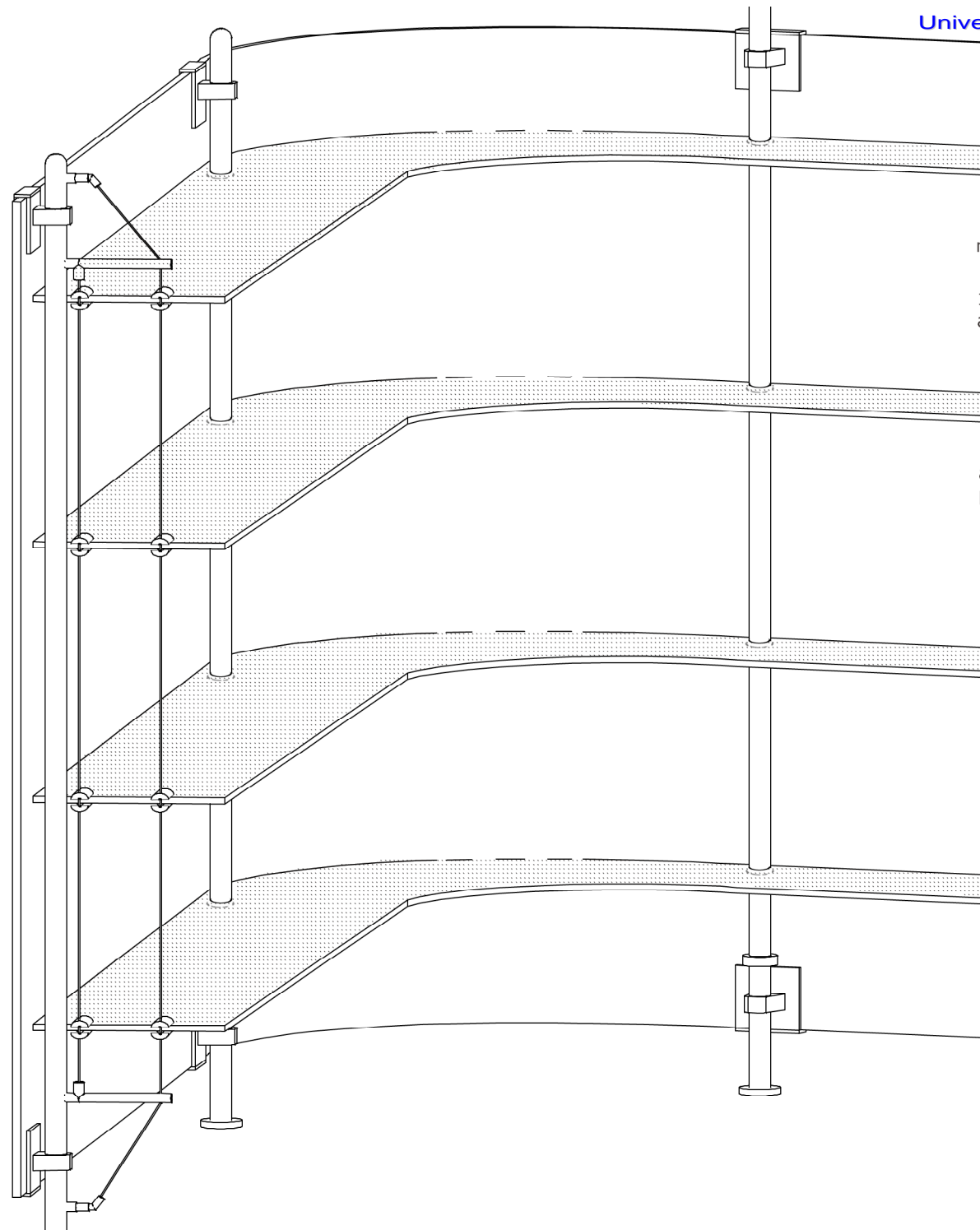


SECTION BB
1:500

DRAWING 012

SECTION
BB
1:500



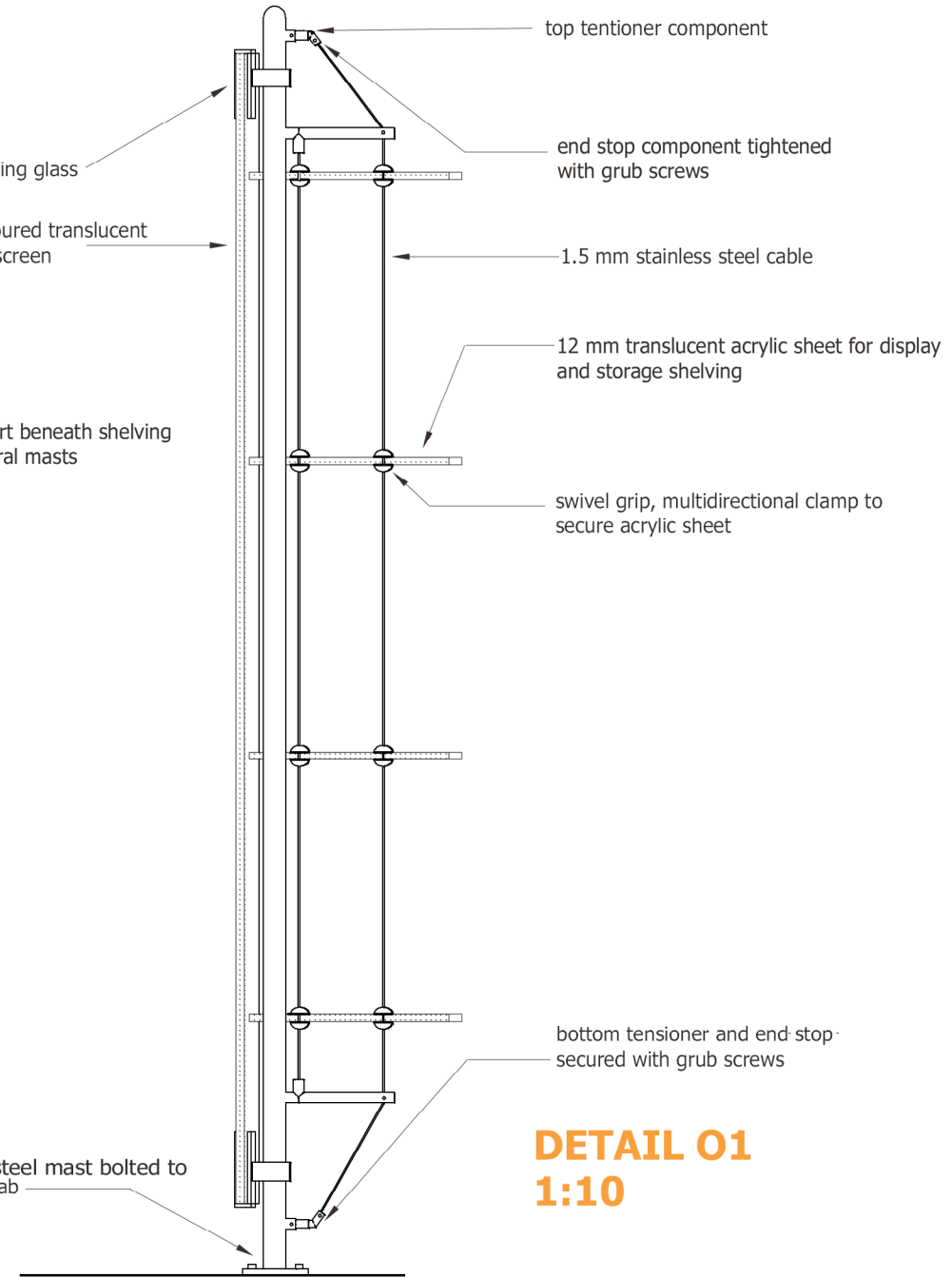


mast frame housing glass

12 mm bent coloured translucent acrylic sheet as screen

additional support beneath shelving provided in central masts

stainless steel mast bolted to concrete slab



top tensioner component

end stop component tightened with grub screws

1.5 mm stainless steel cable

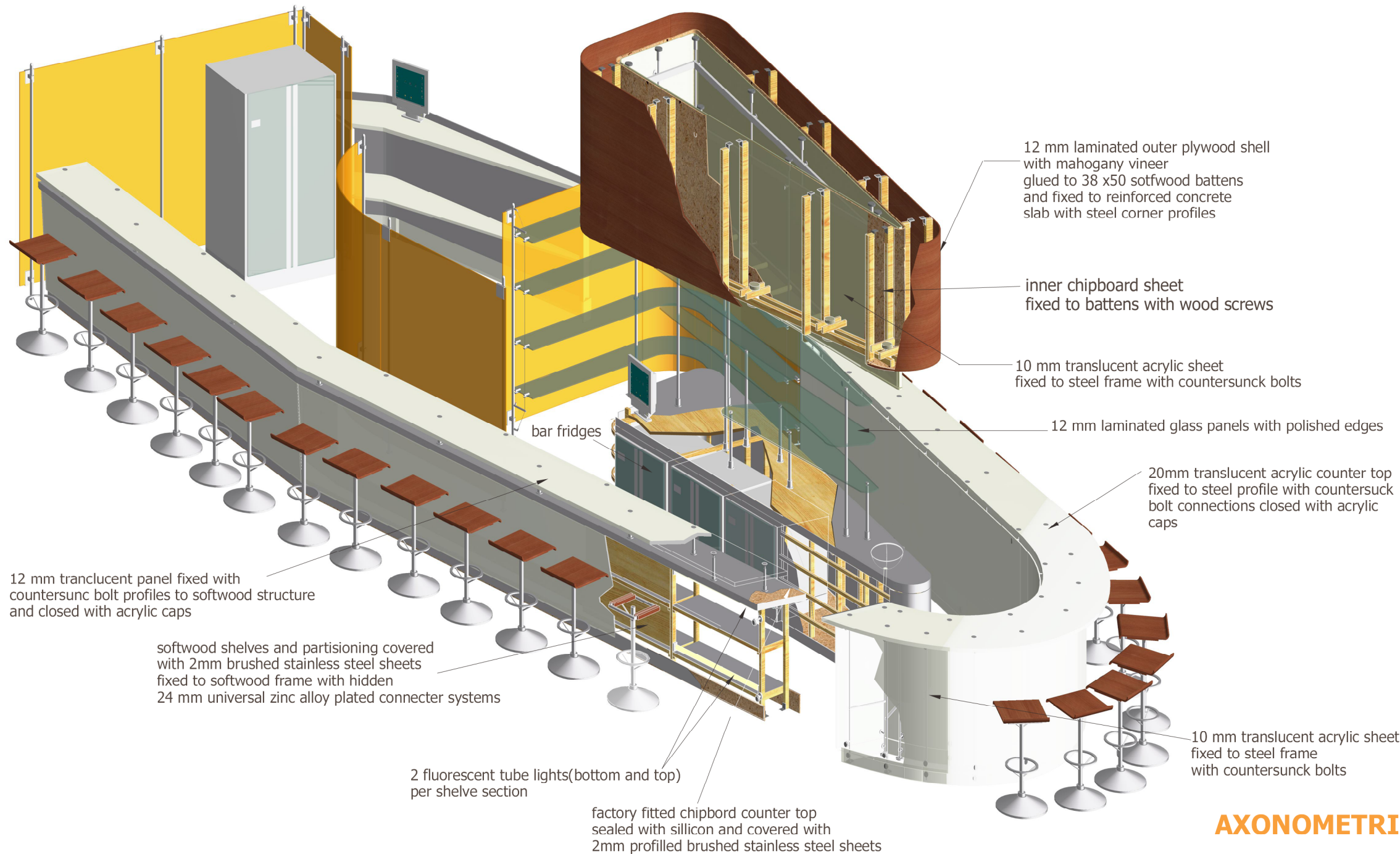
12 mm translucent acrylic sheet for display and storage shelving

swivel grip, multidirectional clamp to secure acrylic sheet

bottom tensioner and end stop secured with grub screws

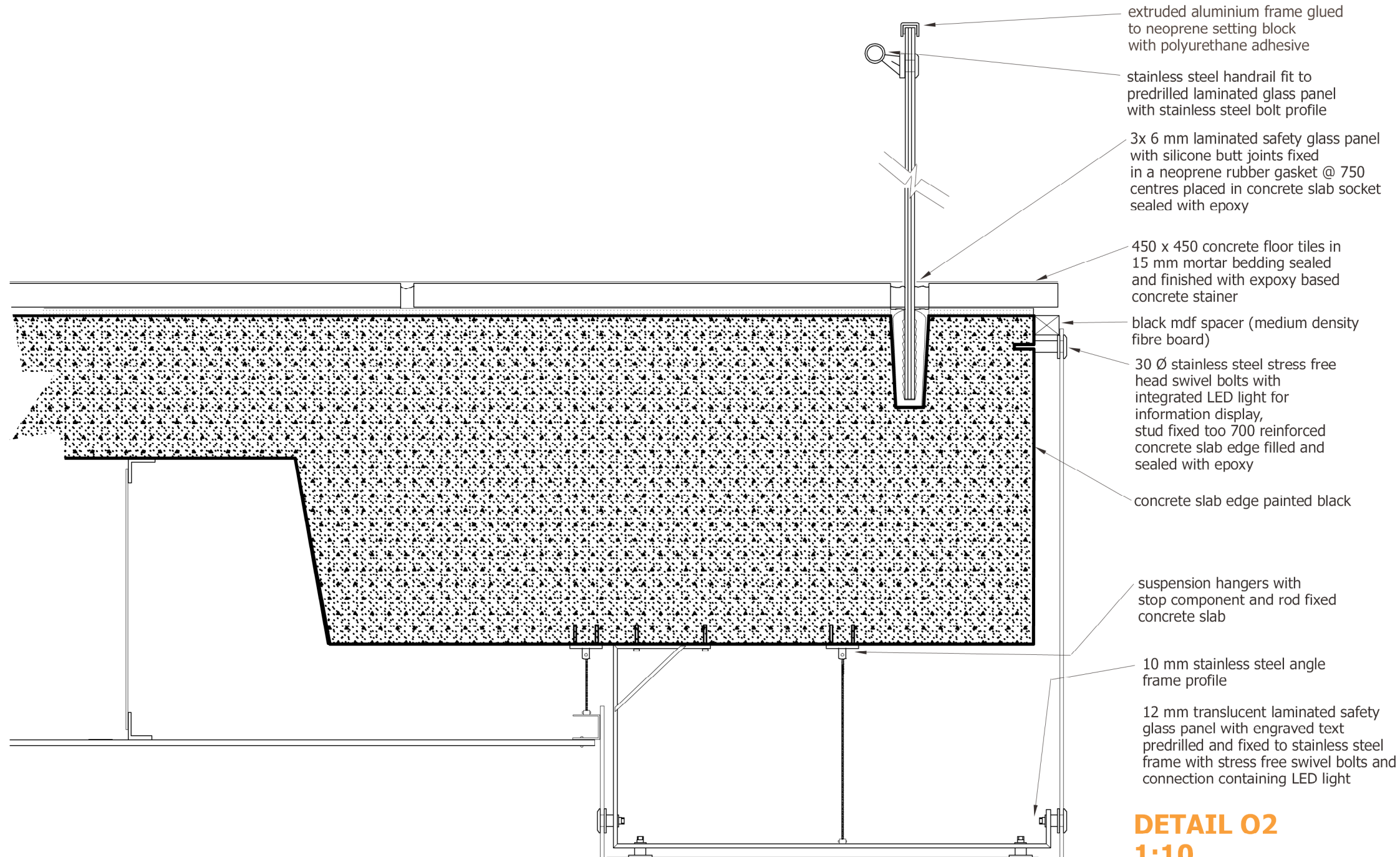
DETAIL O1
1:10

DRAWING 013
DETAIL 01
TRANSLUCENT BAR SCREEN
1:100



DRAWING 014 AXONOMETRIC OF CAFE BAR, BAR AREA

AXONOMETRIC



DRAWING 015

DETAIL 02 SLAB EDGE DETAIL 1:10

DETAIL 02 1:10

LIST OF FIGURES

INTRODUCTION

METRO METAMORPHOSES

FORMULATING THE DESIGN TASK

CONTEXT STUDY

PRECEDENTS

BASELINE

DESIGN DISCOURSE

TECHNICAL RESOLUTION

DESIGN DRAWINGS

CONCLUSION

BIBLIOGRAPHY

APPENDICES

CONCLUSION

The Gautrain Sandton station formed the ideal prototype station for the Subterranean Space methodology. It highlights important principles that can be applied in other scenarios to achieve similar qualities. The design delivers a transparent commercial environment that interacts and reacts to a pragmatic and predictable station structure. It intends to achieve spatial clarity, which is provided by relationships formed between space in space, space and user, user and object and object in space. Space, object and user refer to the station envelope, commuters/customers, and the commercial structure with its objects. Proportion and aesthetic qualities assist the process.

This investigation substantiates the importance of clear circulation and legible space in a transportation hub. However, modern-day society requires multifunctional spaces that tend to its needs and hence supplementary services are supplied. The design attempts to avoid compromising the essence of the station's function and space. The station remains to be the interface of transport service and as such the primary functions associated with this task should not be vague. Additional and supplementary services strengthen the purpose and promote the transport system by establishing its own language, distinguishable from the articulation and expression of primary functions. The station interior is perceived in a multilayered spatial arrangement of responses and contrast.

The strategic integration of commercial entities within the station structure provided the opportunity to create a safe, transparent, inclusive and appealing station environment that will attract users. The design allows the station to become a destination in its own right.

LIST OF FIGURES

INTRODUCTION

METRO METAMORPHOSES

FORMULATING THE DESIGN TASK

CONTEXT STUDY

PRECEDENTS

BASELINE

DESIGN DISCOURSE

TECHNICAL RESOLUTION

DESIGN DRAWINGS

BIBLIOGRAPHY

CONCLUSION

APPENDICES

BIBLIOGRAPHY

BOOKS:

BENNETT, D. 2004. Metro: The story of the underground railway. London: Mitchell Beazley.

JONES, V. et al 1994. Neufert Architects Data. 2nd international English edition. London: Blackwell Scientific Publications.

PAPERS, REPORTS AND OFFICIAL PUBLICATIONS:

BOHLWEKI ENVIRONMENTAL, 2003. Environmental Impact Assessment (draft) report for the proposed Gautrain rapid rail link between Johannesburg, Pretoria and Johannesburg International Airport

Jeremy Gibbert, Sustainable Building Assessment Tool (SBAT), Notes compiled for Continued Practice Development 713 (2004), Department of the Built environment, University of Pretoria

Johannesburg Regional Spatial Development Framework 2004/2005, Johannesburg Metropolitan municipality

SOUTH AFRICAN BUREAU OF STANDARDS 0400, Code of practice for the application of the National Building Regulations, 1990. 1st revised addition. Republic of South Africa: Bureau of Standards

JOURNAL ARTICLES:

BUILDING DESIGN , 1999. Foster's Canary Wharf Station, Nov, p24.

ABRAHAMMS, E. 2003. Sky station, Architectural Review, April, vol.213/1274, p56-59.

DAVEY, P. 2002. Seeing the light, Architectural Review, December, vol.212/1270, p70.

DAVEY, P. 2003. In the public eye, Architectural Review, April, vol.213/1274, p66-70

FIELD, F. 1995. Interiors: Going into a retail spin, Architect's Journal, March, vol.201, p39-41

GRAGG, R. 2003. Millennium Rail Line, Architectural Record, Augustus, vol.191, p132-139

HARDING, S. 2000. Canary Wharf Station, Jubilee Line Extension, Domus, April, vol.825, p54

HARDING, S. 2001. The new shape of the metro, Domus, February, vol.234, p56

PAWLEY, M & PAOLETTI, R. 2000. Going underground, Architects' Journal, vol. 211, p27

RUSSELL, J.S, 2000. Transit Stations, Engineering Civility, Architectural Record, March, vol.188, p138-139

SLESSOR, C. 2003. French lessons, Architectural Review, April, vol.213/1274, p46-51

SLESSOR, C. 2003. On the road again, Architectural Review, April, vol.213/1274, p52

SPRING, M. 2004. The jet set, Building, December, p33-38

PERSONAL INTERVIEWS:

ALBONICO, M. Architect / urban designer working on the Sandton Central Project, personal interview; 15/05/2005

COCHLER, P. Consulting engineer, Spoomaker and Partners Inc., personal interview; 12/09/2005

JOUBERT, Dr. H. Chief consulting engineer of the Gautrain Project Team, personal interview; 11/03/2005

WORLD WIDE WEB INFORMATION:

<http://www.corporate.gautrain.co.za>, accessed on 4 February 2005

<http://www.railway-technical.com/stations> accessed on 15 April 2005

<http://www.sandtoncentral.co.za>, access on 8 April 2005

<http://www.urbanrail.net/as.htm> accessed on 25 September 2005

[http://en.wikipedia.org/wiki/rapid transit systems](http://en.wikipedia.org/wiki/rapid_transit_systems) accessed on 25 September 2005

ILLUSTRATION CREDITS:

Fig 001 London Transport Museum

Fig 002 RATP

Fig 003 BECK, H. London Transport Museum

Fig 004 London Underground, Transport of London

Fig 005 <http://www.corporate.gautrain.co.za>

Fig 006 <http://www.urbanrail.net/as.htm>

Fig 008,009 Johannesburg Metropolitan municipality

Fig 011 <http://www.gettyimages.com>

- Fig 012,017 BRITTON, I. <http://www.freepictures.com>
- Fig 015 RUSSELL, J. S, 2000. Transit Stations, Engineering Civility, Architectural Record, March, vol.188, p138-139
- Fig 014,016,018 GILBERT, D. 2000. Canary Wharf Station, Jubilee Line Extension, Domus, April, vol.825, p54
- Fig 019-027 RAFTERY, P. 2003. French lessons, Architectural Review, April, vol.213/1274, p46-51
- Fig 028-030 LEHOUX, N. 2003. Sky station, Architectural Review, April, vol.213/1274, p56-59.
- Fig 031-033 KNAUF, H. 2003. In the public eye, Architectural Review, April, vol.213/1274, p66-70
- Fig 033-37 SUMNER, E. 2004. The jet set, Building, December, p33-38
- Fig 054 <http://www.gunnebo.com/metro.aplication/speedgate>
- Fig 056 adapted from JONES, V. et al 1994. Neufert Architects Data. 2nd international English edition. London: Blackwell Scientific Publications.

LIST OF FIGURES

INTRODUCTION

METRO METAMORPHOSES

FORMULATING THE DESIGN TASK

CONTEXT STUDY

PRECEDENTS

BASELINE

DESIGN DISCOURSE

TECHNICAL RESOLUTION

DESIGN DRAWINGS

CONCLUSION

BIBLIOGRAPHY

APPENDICES



Café bar rendering



Café bar rendering



Bookshop rendering

Acknowledgements

Nico: Your endless support, motivation and constructive ideas inspired me to be a creative thinker and designer.

Barbara: Thank you for your guidance and help with my study this past year.

Stephanie: My "Boukunde-partner in crime", for being the best friend I could ask for.

My parents: For your help and support, especially my mother for all your love and the opportunity to have completed my studies.

All my friends: For being there for me.

To God: My Creator, for the talent, inner strength and guidance given to me; without You none of this would ever have been possible.