PRETORIA STATION PRECINCT
&
COMMUNITY DEVELOPMENT CENTRE

PRESENTED BY
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Dedicated to my beautiful beautiful, Marcelle
The Pretoria inner city is envisioned to embark on a major redevelopment era with the Pretoria ISDF (Integrated Spatial Development Framework) outlining specific areas to which these developments are proposed to take place. With the re-alignment of the proposed Gautrain Rapid Rail Link through part of the city, the Salvokop area to the south has been recognized as an important site to compliment the development of Freedom Park, and a Gautrain station has been proposed in close proximity to Pretoria Central Station. Here a mere pedestrian tunnel is envisaged to become the link between the two stations and that of Salvokop en route to Freedom Park and the area East of the historical Sir Herbert Baker-designed building has been earmarked as a parking reserve, whereas a great opportunity lies in creating a functional and meaningful space that could bring many aspects of urban form into play.

The vision for the City of Tshwane is to be:

“The leading international African city of excellence, that empowers the community to prosper in a safe and healthy environment”

(GAUTRAIN: Pretoria SDF, OCT 2003)
The great synergy embodied in the meeting of two railway stations as major areas of arrival and departure, passage of movement and opportunity for social interaction and gathering is extremely important in the urban landscape. This synergy needs to be embraced and can be harnessed in many forms within the city as is shown by numerous international examples such as Madison Square Gardens in New York City, the new Lehrter Stadt Bahnhoff in Berlin and even the Johannesburg Park Station to some extent.

All these examples reflect how building forms serve as catalysts that enhance social, economic and cultural values, and through meaningful association the area between Pretoria Central Station and the Gautrain Station can become a successful urban place.

The proposed Pretoria Gautrain Station should not be seen in isolation, since it forms part of the historical Pretoria Station precinct, and its vital that it is integrated into the precinct from both a functional and spatial perspective. The interrelationship between the proposed Gautrain station, the latest Salvokop Vision (December 2003), the Freedom Park National Legacy project, and the historical Pretoria station along with the Paul Kruger Street spine towards Church Square, is of particular importance.

According to the Urban Design Framework of the Paul Kruger Street Spine prepared by the University of Pretoria (2000) the Pretoria Station precinct is “one of the most important public spaces in the city and its development can do much to enhance the image of the inner city”.

This thesis investigates and develops an urban design framework for the Pretoria Station Precinct. This framework proposes the development of an inter-modal facility, with retail and commercial potentials, as well as the establishment of a community-based facility. The focus of this study aims to produce a suitable development that addresses the needs of the local community, whilst incorporating the principles of adaptability where building functions are designed to accept change and accommodate growth.
Major stakeholders who are directly involved with the development of the Pretoria Station Precinct are the following:

**Intersite Property Management Services** (on behalf of SARCC – South African Rail Commuter Corporation)

**City of Tshwane Metropolitan Municipality**
- City Planning
- Inner City Partnership
- Transportation Planning

**Gautrain Project Team** (on behalf of Department of Public Transport, Roads and works: Gauteng Province)

**Freedom Park National Legacy Project** (including Salvokop)
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CBD: Central Business District
CSAR: Central South African Railways
DTI: Department of Trade and Industry
du/ha: Dwellings per hectare
HIA: Heritage Impact Assessment
ICOMOS: International Council on Monuments and Sites
IDF: Inner city Development Framework
ISDF: Integrated Spatial Development Framework
JIA: Johannesburg International Airport
SAR&H: South African Railways and Harbours
PSP: Pretoria Station Precinct
NZASM: Nederlansche Zuid Afrikaanshe Spoorweg-Maatschappij
SAHRA: South African Heritage Resources Agency
SAR: South African Railways
SARCC: South African Rail Commuter Corporation
SATS: South African Transport Services
UNESCO: United Nations Educational, Scientific, and Cultural Organisation
ZAR: Zuid Afrikaansche Republiek
1.1 CONTEXTUAL REFERENCE

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1.1 CONTEXTUAL REFERENCE

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1.2 A NAMING OF THE ZONES AND ELEMENTS OF SALVOKOP

Zone A: NZASM Court - Defined by the NZASM houses and school.
Zone B: CSAR/SAR housing - Defined by CSAR layout and CSAR/SAR houses.
Zone C: Workshop and marshalling, station and rail - Defined by existing and demolished railway workshop buildings and marshalling yard, the station complex and hotel, and the rail lines and ancillary structures to the east and south-east.
Zone D: Compound - Defined by the layout of the former black compound.
Zone E: School - Defined by site of Jopie Fourie Primary School.
Zone F: 'Hillside' - Consists mainly of SAR houses in an area designed as an extension of the CSAR Section, but following a contemporary 'garden city' approach.
Zone G: Reservoir - Defined by the Findlay Reservoir.
Zone H: Koppie (Salvokop/Timeball Hill itself).
Zone I: Head office - Location of the former NZASM head office buildings.
Zone J: Berea/Central – New Belgrave Hotel, Berea Club.

FIG. 1.2.2 Zones and Elements of Salvokop 

(BAKKER 2004, p3)
1.2 NAMING OF THE ZONES

The Pretoria Station Precinct is situated in the southern periphery of the old CBD (Central Business District) of Pretoria; the area defined by two major transportation systems, namely the primary access roads to central Pretoria and the existing railway lines. Both are strong form-giving aspects that have influence on the development of the City, its cultural heritage and the utilization of the Pretoria Station Precinct.

Railway Street and Scheiding Street forming the eastern and northern boundaries of the site respectively delineate the Station Precinct. The existing rail network forms the site’s southern and western boundaries.

Bosman Station and Pretoria Station, situated 400m apart, are both accessible to vehicular and pedestrian traffic. Vehicular access to either station is obtained mainly from Paul Kruger Street (from the CBD) or Scheiding and Railway Streets (from the east), while pedestrian access is primarily obtained via Bosman and Paul Kruger Streets (from the CBD) and to a lesser extent from Scheiding and Railway Streets. Many of these streets do not provide access to the Station Precinct, but also form an axis of orientation and vistas that enhance the Station Precincts cultural-historic significance.

Notable suburbs and districts, such as Salvokop, Muckleneuk, and Berea Park are situated adjacent to the Station Precinct, while places of cultural importance, such as the Transvaal Museum, the Old Pretoria City Hall, Melrose House and Burgers Park are situated within walking distance.

The Station Precinct is prominently located in Pretoria and is highly accessible. The Station Precinct is one of the most importance and well-known elements in Pretoria which forms part of an integrated urban culture and heritage that should be preserved.
1.3 THE STATION PRECINCT

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FIG. 1.3.13 Southern elevation of the CSAR Main Station building of 1910

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1.3 THE STATION PRECINCT

UNISA

FREEDOM PARK

VOORTREKKER MONUMENT

PRETORIA STATION PLATFORM BUILDING

PRETORIA STATION BUILDING

PRETORIA STATION FORECOURT

“DU PREEZ HOEK”

RENAULT SERVICE CENTRE

McCARTHY MOTORS SHOWROOM

SAR HOUSES 1930’s TO 1940’s

CSAR COACH WASHING SHED MADE FROM NZASM RAILS AS ROOF 1904-10

1928 AUDIT BUILDING

HISTORICAL NZASM PRINTING STORE

FIG. 1.3.24 Panoramic view over the Pretoria Station Precinct looking south west
A PICTORIAL REVIEW OF THE IMMEDIATE AREA OF INTERVENTION

The Pretoria Station Preceinct is one of the best located sites in the inner city, abundant in historically significant buildings that carry the character of time gone by. The memoriableness of these buildings provides new life and urban inclusion to the rejuvenation of Pretoria City.

FIG.'s 1.4.1-2 SAR Houses on Railway Street

FIG. 1.4.3  Panoramic view north of site

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1.4 SITE ANALYSIS

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CONTEXT ANALYSIS

AREA OF INTERVENTION

FIG. 1.4.26 Panoramic of southern area of precinct, showing rear of McCarthy Motors
The NZASM railway initiatives, which focussed on the hub of Salvokop before 1902 (IMR/SCAR), was the biggest single state driven infrastructure venture the Transvaal Republic ever undertook. The venture provided job opportunities for thousands of white and black citizens at the time, and made a huge contribution to the ZAR economy, in terms of revenue and of sustaining the all-important mining industry and also the agricultural community. The increased mobility of labour, black and white, became the pillar on which the capitalist economy trusted. Control over the railway system dominated South African interstate politics up to the Anglo Boer War, and remained an important issue afterwards. During the Anglo Boer War the importance of the railways to the ZAR and the Empire was paramount. British troops were stationed there at various times between 1877 and 1902. After the Anglo Boer War Salvokop, under control of the Central SA Railway, expanded rapidly and became an even more important part of Pretoria’s townscape. The buildings and infrastructure of the NZASM and the CSAR/SAR&H also made a significant contribution to the economic wellbeing of Transvaal towns, and in this case Pretoria. The historical involvement of the railways with the needy section of the white population (in lieu of black) goes back to the days of the CSAR in 1907, and was solidified in JBM Hertzog’s Pact Government in 1924.

The physical presence of the NZASM, CSAR, and SAR&H spread far beyond the confines of the Salvokop area south of the railroad track: The large goods yard, offices, townships, abattoir yard, recreational areas and hotels in the area indicate the large footprint of the railways on the ecology of the city. The railway line served the industries to the west and east of Pretoria, as well as the abattoir. Only after 1848, when the new Afrikaner nationalist government initiated the large Koedoespoort and Capital Park railway complexes as part of a gargantuan, culture-specific job creation initiative, did the large presence of Salvokop in Pretoria wane. During this time the railway fulfilled an important part in servicing the ISCOR development. The Pretoria station and railway also became an important link in a successful and efficient implementation of the Homeland strategy, which included industrial relocation.

Currently, Salvokop is the focus of a renewed urban revitalisation attempt, initially rooted in the IDP process and the Inner City Spatial Development Framework that evolved from this process, as well as the development initiatives forthcoming from Propnet (for the landowner Transnet), conjoined to the Freedom Park Trust framework proposal for Salvokop, and the Mayoral initiative to develop the area as an urban housing component.

(BAKKER 2004; p2)
FIG. 1.5.4 Pretoria - Reconnaissance map of Pretoria by the British RE Office just before the start of the war in 1880

FIG. 1.5.5 Surveyor General 1902 map of Pretoria from 1900 survey
1.5 HISTORICAL REFERENCE

**FIG. 1.5.6** Imperial Military Railway plan drawn in 1901.

**FIG. 1.5.7** Map of Pretoria, Southampton Survey Ordinance Office, 1908
Prehistoric times: Elandsport (east of Salvokop) used as migratory route.
15-1600: The 'Transvaal' Ndebele were the first occupants around Pretoria.
Pre-Voortrekker settlement of 'Pretoria': The Ndebele were followed by Bakgatla. A large settlement existed near [west of] Salvokop - removed by Pres P Kruger to Makau [Garankua].
1842 Voortrekker brothers Lukas and Gerhardus Bronkhorst establish the farm Elandsport (named after Elandspoort between Bronberg/Railway/Timeball/Signal /Salvokop Hill on the west and Muckleneuk Hill on the east).
1855 On 16 November the town of Pretoria is formally proclaimed as the Transvaal capital.
1875 The ZAR was dependant on the Colonies for access to harbours. The need for a railway to the east was identified.
1877 Annexation of the Transvaal. Pretoria becomes the seat of British control.
1880 Start of 1st Anglo-Boer War. War ends Feb1881.
1883 Pres Kruger of the restored ZAR revives the idea of the railway and gains the right from Portugal to construct a line through Mozambique.
1886 Discovery of the main gold reef on the Rand provided capital for the ZAR railway venture.
1887 The Nederlandsche Zuid-Afrikaansche Spoorweg-Maatschappij (NZASM) established on 21 June in Amsterdam.
1888 Construction of the first NZASM building in Pretoria, a red brick house on the corner of Minnaar and Paul Kruger Street. It was first used as the Chief Engineer's residence and later became an office building.
1895 Formation of the Pretoria-Pietersburg Spoorweg Maatschappij (PPSM) to construct and operate a railway line to link Pretoria with Pietersburg.
1895-6 Jameson Raid – The ZAR Government uses its right to temporarily take control of the NZASM railway company.
1896 Completion of storage depot for printed matter (formerly a national heritage site).
1899 Completion of Telegraph office building.
1899 Start of the 2nd Anglo-Boer War. On 13 Sept 1899 the ZAR government takes control of the railway service. In Salvokop the central workshops are used to repare cannons and make ammunition.
1902 After peace had been achieved in May 1902, the entire NZASM and PPSM network, together with the railway system of the Free State, became the Central South African Railways (CSAR).
1902 End of Anglo-Boer War.
1906 Completion of Findlay Reservoir (Started in 1905 - Named after Councilman Findlay) in Salvokop for municipal water provision – the first in Pretoria. Water comes from the Fountains Valley by means of a stone aqueduct.
1907 Institute Building erected for the Berea Club (from 1890’s) for use by Railway staff. Only sport facility of 'young' Pretoria.
1909 NZASM is liquidated. Many [the foreign] workers are deported to the Netherlands.
1909 Design for the new station settled, contract awarded and work in progress.

_A RELEVANT TIMELINE...

FIG. 1.5.8 Original NZASM Station at Pretoria

FIG. 1.5.9 A rare view of the south side of the Station building taken during construction in 1910
1.5 HISTORICAL REFERENCE

1910  CSAR and Cape and Natal railway administrations merge to form the South African Railways and Harbours (SAR (& H)).
1910  Foundation stone of the new station building designed by H Baker laid by Mr Hull in May 1910.
1912  Replacement of the NZASM passenger station when the new building designed by sir Herbert Baker is inaugurated. The original station buildings were demolished a few years later and the old public place on Scheiding St disappeared.
1920s  Demolition of former NZASM station buildings
Re-erection of the statue of Pres P Kruger on Station Square in October 1926. A century after his birth – statue originally unveiled at Prince’s Park in 1913).
1929  Belgrave Hotel designed in Art Deco style by Hoffman & Hoffman at Railway St 22. Hotel is part of the railway environment.
1912-50’s  The busiest era of the SAR&H operations in Salvokop – many new buildings are erected in the railway zone as well as in the railway camp.
In 1928 the Railway Audit building was constructed by Pretice and Mackie, who were involved with the Union Buildings. In 1937 the Railways started refraining from building identical rows of houses, and started to disperse railway properties in other parts of town - many employees houses are to be found east of Railway Street.
1946  Sunken garden constructed at Pretoria Station before the Royal visit in 1947.
1948-55  Closure of compound at Salvokop and resettlement of residents in Mamelodi and other black townships established in terms of apartheid policies.
1958  The old NZASM head office buildings and Director’s residence were demolished to make way for a modern office block for housing the headquarters of the SAR’s northern region (Northern Transvaal). This building, named NZASM Building, was taken into use in 1963.
1960-70  The last Salvokop houses are built.
1961  Demolition of former NZASM office buildings in Minnaar Street.
1963  Railway housing scheme for ‘Coloureds’ [Bakker 2004; 9] is implemented.
1976  Simon vd Stel Foundation requests conservation of NZASM Hof.
1980  The NZASM Hof is renovated by the SAR&H.
1981  In 1981 the administrative organisation of the railways became known as the South Africa Transport Services (SATS)
1981  NZASM depot for printed matter declared a national monument. SATS completes the renovation of the NZASM Hof.
1989  Rovos Rail established with headquarters in the Victoria Hotel.
1990  Establishment of TRANSNET as a public company to manage railways, ports, pipelines, road transport etc. The Transnet era was characterised with a decrease in scale of the operations, closure of uneconomical lines and the Pretoria West Goods Yard just north-west of Salvokop.
1995  NZASM Centenary. Commemorative journey to Maputo organised by Transnet, with the two Presidents participating. Attempt to declare NZASM Court a national monument as part of the Pretoria-Maputo railway centenary celebrations.
2001  Paul Kruger Street Spine Spatial Framework establishes the Station precinct as a very important node in the central city. Pretoria Station is burnt down by angry commuters. Freedom Park Architects in Association draws up a development framework is drawn up for Freedom Park National legacy site on Salvokop – a draft urban design framework for the suburb below is part of the Freedom Park framework.
2002  Station building re-built. GAP/MMA Architects appointed to draw up a spatial development framework for Salvokop for the TRANSNET/Freedom Park Trust/City of Tshwane client partnership.
The Freedom Park development re-establishes the role of Salvokop as an urban precinct. International architects invited to enter a design competition for Freedom Park components.

FIG. 1.5.10  Image of Pretoria Station during the blaze that almost destroyed the building in 2001

(BAKKER 2004; p4)
Pretoria, being the capital of the ZAR, was chosen as the Transvaal headquarters of the NZASM. Here the Oosterlijn from Delagoa Bay and the Zuiderlijn from Vereeniging and Elandsfontein terminated. The NZASM district was designed for the stretch of land, situated on the southern tip of the western portion of the original Elandspoort farm that was proclaimed as Pretoria. The gently northward sloping land was situated between the southern edge of the city grid, formed by Scheiding Street (The separation between city and townlands used for grazing), and the Bron Kopie later named Time Ball Hill, Signal Hill, Salvo Kop and also Railway Hill.

The eastern aspect of the development was reserved for the Signalling and Telegraph department (still existing), a Construction store, a Printing works (still existing), two goods sheds, the station master’s house (still existing), all edging the site’s eastern boundary at what we now know as Railway St. On the northern perimeter we find the customs house (at the end of Market St) and the main station buildings south of Scheiding St. Lamp rooms and more Black quarters were established on the north-western side, at the junction of Scheiding and Bosman (historically Koch) St. The position of the lines and station buildings relative to Scheiding St created a public square south of Scheiding St. The station buildings consisted of five different buildings [from the east]: A corrugated iron parcels office, and four red brick buildings with low-pitched iron roofs - ie the service building and ladies waiting room placed facing the railway line with...
lean to roofs on the south and north sides - and the larger general waiting room and refreshment room with gable ends facing the lines. The general waiting room was more elaborate, showing mixed white sandstone and red brick embellishments (stepped gable decoration and window and door arches), a round gable window and a horizontal sandstone band.

The old cemetery was situated next to the railway lines in the south east at what was known as Du Preez’s Hoek (Erf of Jan ‘Diknek’ Du Preez). These graves were moved to the present Pretoria cemetery in Church St west, but the poplar trees that Du Preez planted are still there today. The railway district was accompanied by a hotel in these early days, notably the Station Hotel on the corner of Scheiding and Paul Kruger Streets replaced by the Hollandia Hotel in 1896, renamed the Victoria after 1900 – this remains Pretoria’s oldest hotel.

East of the railway lines, the ca1906 CSAR plan shows a new building on what we know as the corner of Sheiding and Railway St, just north of the Station Master’s house, and a few new structures between the Construction store and the Telegraph building.

(BAKKER 2004; p12)
The main changes occur in the station area. The old station buildings, the customs house and a few lines on the east of the site were replaced by the Sir Herbert Baker-designed station complex, taken in use by 1912.

A major new pedestrian bridge was erected across the lines adjacent to the roundhouse to allow access to the southern area of the site, with pedestrians moving around the northern side of the roundhouse. The bridge aligns the roundhouse center point with Clara St – giving access to the Railway Club complex – where it joins to Railway St.

(BAKKER 2004; p16)
1.5 HISTORICAL REFERENCE

FIG. 1.5.23 CSAR Pretoria Station by Baker, completed in 1914

FIG. 1.5.24 NZASM station taken from north-west, with CSAR Station by Baker behind (ca. 1914 - 1920)

FIG. 1.5.25 A tram arrives at the Station along Market Street prior to 1925

FIG. 1.5.26 Troops processing down Market Street, returning from World War I in 1919
The site in 1947

The connection of Scheiding St and Station Square in front of the main station was redesigned as a circle junction. There was an insertion of three new structures in the goods shed area west of the station. The pedestrian bridge between the station building and Salvokop was still only the single bridge with the curved ramp (An oral source states that only whites were allowed over the bridge, and that station personnel guarded the stairs going down to the platforms). A new platform was constructed between the main station and the 1928 Audit bldg. Two new houses were built between the existing row of houses in Railway St. More sheds appeared just north of the Telegraph Office building. The Magazine building across the road was extended with two new structures.

From aerial photographs that date from late 1950’s or before 1962 (From the 1962 Pretoria Chamber of Trade and Industry publication) one discerns new additions to the central workshop, east and adjacent to the pedestrian bridge at the station, and also new structures in Railway road at the main bend, at the Telegraph office area and at Du Preez’ Hoek. The new main station shed also dates from this period.
The Station Square has always been a fundamental space in terms of the station building itself. Unfortunately today it is largely used for parking as the necessity demands for the area, but this open space in front of the building was part of Baker’s intended design when he focused the Station on the one-mile vista to Church Square.

The statue of Paul Kruger was unveiled on Station Square on 10 October 1925, one hundred years after the former president’s birth. The statue was commissioned by the Traansvaal Republic after the local industrialist, Sammy Marks donated £10,000 for the project to proceed. The statue of Paul Kruger and of the four Boers that complete the sculpture, were designed by the local sculptor Anton van Wouw, who had the artwork cast in Italy and shipped back to South Africa for the unveiling.

During the outbreak of the Anglo Boer War, the statue was moved to Lourenzo Marques (known as Maputo today) in Mozambique for safe-keeping until 1912 when it was erected in Prince’s Park, central Pretoria. On 25 August 1925 a foundation slab was laid in Station Square for the statues and was finally unveiled as part of the celebrations for the centenary of Kruger’s birth.

Only later were the four Boers added, and all five pieces were then moved to Church Square in 1954, where they still stand today.

In February 1947, the British Royal Family arrived in South Africa for an official visit for which Italian-style gardens were laid out around the Kruger statue. Their Royal Majesties, King George VI and Queen Elizabeth and Their Royal Highnesses, Princesses Elizabeth and Margaret visited the Union of South Africa from 17 February to 24 April.
The Apartheid era

During the Apartheid years, separate stations were allocated for use by Black passengers and Pretoria Station was declared a “Whites only” facility. The Station gardens were used as a form of barrier that separated the main railway station from the station set aside for Blacks, located just west of the main station building complex. This station, today known as Bosman Station, was built during a large construction project that took place from 1955 – 1959 to build the Pretoria – Saulsville line.

The area around Bosman station developed a settlement for the community that was not permitted to live in the white areas, including a number of hostels that housed both professional and unskilled labour forces, as well as retail facilities that catered primarily for this community. This area has grown tremendously into what is known today as the Dairy Mall, consisting of both formal and informal retail facilities as well as a local taxi rank.

After desegregation, entities such as the South African Rail and Harbours (SAR&H) were directed to open their facilities to other races at their own discretion and the Pretoria Station became open to all passengers in the mid-eighties. Today, the passengers at Pretoria Station are largely commuters, the majority of whom are Black, having grown up in the old segregated townships. The Bosman Station still serves as a stop for commuters, and was the only point of arrival and departure for commuters in the area during the restoration process on the Pretoria Station building after the fire that almost destroyed it in 2001.

During the SATS period: 1981 - 2002

Railway zone east of Station: The new road alignments in this area obliterate many of the historical urban patterns. The connection road between the station and Belgrave Hotel has been removed, resulting in the loss of the strong and planned physical connection. The historical edge on the eastern side of Railway St, between Tulleken and Clara Streets has been demolished for the two way road system, leaving only an unoccupied traffic island.

The workshops and stores north of the Telegraph building had to make way for a new motor repair facility and showrooms, leased from the land owner. Similar facilities appear just north and just south of the Magazine building and stores. The scale (in terms of height rather than bulk) and style of these buildings appear to have been planned to augment the historical character of the environment.
The recent past

The past decade in South Africa's history has experienced more dramatic changes than in the hundred years before it, and the railway industry is no exception to this change.

The management of rail has moved from the Central South African Railways (CSAR), through the South African Rail and Harbours (SAR&H) and finally into the possession of Transnet and the South African Rail Commuter Corporation (SARCC) that were both established in 1992.

All rail infrastructure used for commuter transportation in the main metropolitan areas is the ownership of the SARCC. These stations, including Pretoria Station, are now managed by Intersite Property Management Services, a subsidiary of the SARCC.

Today, thousands of commuters pass through the Pretoria Station and its precinct daily and hundreds more come to use the log-distance transport facilities as well as the luxurious Blue Train.

The precinct has developed into an active inter-modal transport facility, although much of this needs serious attention in order to bring the operations into high standards and quality. Apart from the most recent renovations that took place on the Herbert Baker building after the fire in 2001, the Blue Train facilities are the only amenities that have set a standard which distinguishes them from the other services, that can be described as "basic" and dilapidated.

The Station is still a main stop for the world-famous Blue Train, with passengers boarding and disembarking on Platform 4, the only platform long enough to host it. Porters then escort the passengers to their passenger lounge, built in 1999 on the site of the old gentlemen’s toilets in the south-east wing.
FIG.'s 1.5.41 - 47 Images of Pretoria Station during and after the fire in 2001
THE BURNING OF PRETORIA STATION

On the evening of Monday, 19 February 2001, the Pretoria Station Building became victim to arson as a small group of angry commuters became violent in a large crowd as train delays mounted. Restlessness on the platforms led to the attack of Station staff members in the building, and finally on the building itself when the mob stormed the Mainline Passenger Services Centre (MLPS) on the ground floor in the centre of the building, right at the main entrance, and set it on fire.

The building burnt throughout the night as fire-fighters fought against an ever-increasing inferno, which destroyed almost the entire roof and severely damaged the clock tower. Fortunately, the fire was concentrated only in these areas, as the fire had made its way up light-wells to the roof and much of the office zones were not effected due to the concrete slab below the trusses. However, damage was estimated at R20 million, with the Mainline Passenger Services Centre and its immediate surroundings, including the ticket offices (approximately 4800 m²) were completely gutted.

Apart from the roof and the clock tower, the passenger elevator was damaged beyond repair, heat and water destroyed the electrical installations of the building and smoke caused severe damage to much of the Station.

On 26 June 2001, construction on the restoration commenced and was completed in June 2002. On Monday, 24 June 2002, the Minister of Transport, Dr Dullah Omar officially re-opened the Station and operations commenced the same day.

THE SWASTIKA

Only recently discovered during the restoration process of the building, is a much debated swastika, located just below the recess into which the clock is set. One belief is that the symbol was in acknowledgement of the unification celebrations of 1910, when work on the Station began, with the symbol representing the four new provinces of the Union. Another view is Herbert Baker’s fascination with symbology, but the most interesting theory is that of a secret love of Baker.

It is rumoured that Baker was secretly in love with a Hindu woman, forbidden in both their cultures, and the swastika is a tribute to this relationship. The swastika has been a sacred symbol to the Hindus for centuries, and it is common belief that use of the sign will ward off forthcoming evil or undesirable events. Ancient warriors wore it in the belief that they would always be victorious.
FIG. 1.5.50 SAR&H Township and related functions: HERITAGE RESOURCES IN 1911

FIG. 1.5.51 SAR&H Township and related functions: HERITAGE RESOURCES IN 1932
1.5 HISTORICAL REFERENCE

1938 - 1948 Fabric

1948 - 1960’s Fabric

1892 - 1901 Fabric

1903 - 1911 Fabric

1912 - 1937 Fabric

1937 vegetation

FIG. 1.5.53 SAR&H Township and related functions: HERITAGE RESOURCES IN 1937

FIG. 1.5.54 SAR&H Township and related functions: HERITAGE RESOURCES IN 1948
FIG. 1.5.55 SAR&H Township and related functions: HERITAGE RESOURCES IN 1977

1938 - 1948 Fabric
1948 - 1960’s Fabric
1912 - 1937 Fabric
1937 vegetation

FIG. 1.5.56 SAR&H Township and related functions: Status quo protected HERITAGE RESOURCES IN 2001

1938 - 1948 Fabric
1948 - 1960’s Fabric
1948 - 1973 Fabric
1.5 HISTORICAL REFERENCE

FIG. 1.5.57  SAR&H Township and related functions: Consolidated plan of demolished and current protected HERITAGE RESOURCES IN 2002

- 1892 - 1901 Fabric
- 1903 - 1911 Fabric
- 1912 - 1937 Fabric
- 1937 vegetation
- 1938 - 1948 Fabric
- 1948 - 1960’s Fabric

FIG. 1.5.58 TRANSNET Salvokop Township zones, Register of built resources in SDF area and relevant context 2002
FIG. 1.5.59 TRANSNET Salvokop Township zones, Register of built resources in SDF area and relevant context 2002
1.5 HISTORICAL REFERENCE

ZONE C – Workshop, marshalling, station and rails area

1-2: Offices, 1950’s.
3: NZASM station master’s house – 1893-1895
4: NZASM store for printed matter
5: Rem. of NZASM Apies River bridge of Komatiport line, ca 1894.
6: 1928 Audit building
7: CSAR coach washing shed made from NZASM rails as roof supports, built 1904-10
8: SAR workshop and ancillary buildings 1930-1940’s
9: SAR P 53 house.
10: SAR house [unknown type]
11: SAR P 44 standard type bungalow
12: SAR P 95A
13: SAR P 53 house.
14: NZASM Telegraph Office 1898-1899.
15: CSAR Resident Engineer’s office, 1909[curr. Pop-Up].
16: SAR Workshop, 1930’s.
17: SAR Workshop, 1930’s (Demolished)
18: Steam hammer w/shop
19: SAR Traffic control centre, 1940’s.
20: SAR Workshop/office 02AA815 (before 1911)
21: SAR Schuiping building – Goods shed
22: Later addition to no.21 (before 1937)
23: SAR Accounting building 02AA846 (before 1937)
24: SAR Parcel Store and offices (before 1911)
25: SAR Toilet block 02AA850 (before 1947)
26: ‘Bantu station’ of <1911, currently toilets 02AA833
27: Office extension (before 1947)
28: StationSquare with WW1 and WW2 Memorial
29: StationBuilding designed by Sir H. Baker in 1909.
30-31: Frame of asbestos buildings
32: Derelict asbestos building
33: Facebrick SAR utilities building, 1970’s

ZONE I - Head office

1: NZASM head office buildings, 1893-1899 (demolished 1961)
2: NZASM Director’s office and residence, 1894 (demolished 1958)

ZONE J – Berea/Central

1: SARElectricity Dept and Magazine.
2: Institute Building, or SAR Berea Club, 1906.
3: Half for Berea Club, 1926.
4: Belgrave Hotel, 1929.
5: Hollandia Hotel, 1896, renamed Victoria Hotel, 1900.
6: Various houses (western one of Mr. EF Bourke) in what is known as ‘Du Preez Hoek’, sine anno but some possibly ca 1900-10 because erven appear on 1911 Surv-Gen plan.
1.6 DEVELOPMENTS WITHIN IMMEDIATE CONTEXT

The redevelopment of the Salvokop area is directly linked to the development of the Freedom Park National Legacy Project, and part of the Pretoria SDF (Spatial Development Framework) as an initiative for the inner city rejuvenation scheme. Both have a direct influence on the Pretoria Station Precinct, that will act as a gateway to both these areas.

The most recent, and by far the most influential, project to affect the Pretoria Station Precinct is the proposal of a new station for the Gautrain Rapid Rail System that is due for completion in 2010. This project brings with it a whole new dimension to the area, and its effects are directly aimed at the context within which it is placed. This study attempts the challenge of this influence.

THE SALVOKOP AND FREEDOM PARK DEVELOPMENT

The most recent, and by far the most influential, project to affect the Pretoria Station Precinct is the proposal of a new station for the Gautrain Rapid Rail System that is due for completion in 2010. This project brings with it a whole new dimension to the area, and its effects are directly aimed at the context within which it is placed. This study attempts the challenge of this influence.

THE GAUTRAIN STATION DEVELOPMENT AT PRETORIA

The most recent, and by far the most influential, project to affect the Pretoria Station Precinct is the proposal of a new station for the Gautrain Rapid Rail System that is due for completion in 2010. This project brings with it a whole new dimension to the area, and its effects are directly aimed at the context within which it is placed. This study attempts the challenge of this influence.
After intense planning procedures, final decision has been met for the alignment in this region to pass through a tunnel of Salvokop whilst maintaining an underground station for the Gautrain just east of the main Station buildings. For this reason, a cut-and-fill process is necessary to create the tunnel, with the demolition of certain buildings that are directly affected by the construction process of the new Station. One such building is the McCarthy Motors showroom, located on the Railway Street edge.
FIG 2.0.1 Sketch of precinct in context
Vision for the Gautrain Pretoria Station, as formulated by the Gautrain Project:

“**The Gautrain should be the heart and gateway of tourism in Pretoria, and should lead to urban renewal in the CBD**“

(GAUTRAIN: PRETORIA STATION DEVELOPMENT FRAMEWORK, OCT 2003)

**GAUTRAIN PLANNING PHILOSOPHY**

Current urban development proposals (Gautrain 2003) suggest the need to create compact cities and limit urban sprawl in order to utilize urban infrastructure and land more effectively and efficiently. The Gautrain Rapid Rail Link is believed to be the catalyst to encourage this; as such a rapid rail transport system will operate most effectively in a densely populated and utilized urban environment. Therefore, the spatial development for the Gautrain focuses on the demand of seeking a new urban form that can and will support the proposed rail system.

The critical focus is to achieve support or patronage with a view of creating long term sustainability. This support or back-up system can be created by improving access to the train either through effective feeder and distribution systems or by developing the right type, mix and density of uses around the stations.
The Gautrain Rapid Rail Link is a state-of-the-art rapid rail network planned in Gauteng. The rail connection comprises of two links, namely a link between Pretoria and Johannesburg and a link between Johannesburg International Airport and Sandton. Apart from the three anchor stations on these two links, seven other stations will be linked by approximately 80 kilometres of rail along the proposed route located at:

Rosebank;
Sandton;
Marlboro;
Midrand;
Centurion;
Hatfield; and
Rhodesfield (Kempton Park).

This modern train will offer international standards of public transport with high levels of safety, reliability, predictability and comfort. Travelling at maximum speeds of 160 to 180 kilometres per hour it will reach Pretoria from Johannesburg in less than 40 minutes. The minimum frequency between Johannesburg and Tshwane will initially be six trains per hour per direction and it will operate approximately 18 hours per day. This public transport service will include dedicated, exclusive bus services to transport passengers to and from stations.
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Besides the commuter service, air passengers will have a dedicated service between Johannesburg International Airport and Sandton. This purpose-designed service brings Gauteng in line with global practice which links cities by rail to international airports.

The Gautrain Rapid Rail Link project offers a cost effective, efficient, environmentally friendly and safe solution to some of the worst transport problems in the most densely developed area in Gauteng. It also supports many other government objectives. Gautrain is one of eleven Blue IQ projects of the Gauteng Provincial Government (GPG). Blue IQ is a multi-billion Rand initiative of the Gauteng Provincial Government to develop economic infrastructure for specific major projects in smart industries, high value-added manufacturing and tourism.
Blue IQ works in partnership with business and government departments as a catalyst to promote strategic private sector investment in key growth sectors of the Gauteng economy. Its central aims are to lift the growth of the Gauteng economy onto a new and significantly higher growth trajectory and to shift the mix of Gross Geographic Product (GGP) towards the three above-named sectors. The Gautrain project is, therefore, primarily aimed at enhancing and supporting economic growth in the Gauteng Province and generating employment. This project is part of a longer-term vision, which will include a commitment towards creating and sustaining a new culture of public transport usage.

**Why a rapid rail system?**

Gauteng, the country’s economic hub, is currently experiencing traffic congestion on its major routes, especially between Pretoria and Johannesburg. The current transport facilities and services between these two cities are mainly road based. The land required for a rapid rail system is far less than that of a road system. Apart from alleviating the severe traffic congestion, economic development will be stimulated by the rapid rail system and it will have distinct environmental advantages over other forms of transport.

The N1 Freeway currently carries some of the highest traffic volumes in South Africa with more than 157 000 vehicles travelling on it per day and a traffic growth rate of 7% per year. There is currently 300 000 cars per weekday in the Pretoria-Johannesburg traffic corridor. It is estimated that approximately one-fifth of Pretoria-Johannesburg commuters will make the switch from travelling by road to travelling by rail. Gautrain should initially transport more than 100 000 passengers per day.
2.2 FEEDER AND DISTRIBUTION SERVICES

The development of Feeder and Distribution solutions for the Gautrain was based on the following:

Many passengers using the Gautrain will not be able to walk to and from the station area due to the existing land-use developments and densities around the stations.

Effective door-to-door transport solutions must be provided for the Gautrain to be an attractive alternative to those potential passengers currently using private vehicles.

As many passengers are unable to walk to and from the station area, provision of public transport or park-and-ride facilities is essential.

Provision is made all at proposed stations (excluding JIA) for private vehicle parking and drop-off zones.

Due to the quality and areas served by the existing public transport services and operators, it was decided to supplement the existing system with new road-based dedicated feeder and distribution services operated by or under contract to the Gautrain Operator.

The routes for the feeder and distribution services were identified and optimized through a process of inter-action with the demand forecasting model.

The dedicated feeder and distribution services will consist of high frequency shuttle-bus type services running on a fixed schedule.

Full operational cost for providing these services will not be covered by the fares and cross-subsidization from the rail fare income will be required.

In order to optimize these operational costs, the proposed routes are limited to only include areas and nodes within a 5km to 10km radius from proposed stations.

Not all nodes and areas will be effectively covered by the feeder and distribution service and potential passengers will have to use private vehicles or existing public transport in order to utilize the services of the Gautrain.

FIG 2.2.1 Extent of Feeder and Distribution Services in Pretoria CBD

FIG 2.2.2 Bus services
2.3 AS AN INTER-MODAL FACILITY

The PSP (Pretoria Station Precinct) provides major potential in the establishment of an inter-modal facility through the combination of existing modes of transport, the proposed modes and their feeder and distribution systems. This in turn provides enormous potential in the wake of urban development, social improvement and economic growth.

The existing modes of transport in and around the vicinity of the precinct include:

- Metro rail system (with Pretoria Station and nearby Bosman Station)
- Intercity long-distance bus facility
- Local bus facility between Pretoria Station and Bosman Station (known as “Station B”)
- Mini-bus (taxi) facility at the “Dairy Mall” close to Bosman Station (“Station B”)

Proposed modes of transport include:

- Gautrain Rapid Rail Link with a station proposed in close proximity to Pretoria Station
- The re-establishment of the Ring Rail system which is linked via feeder lines to all the disadvantaged communities in the area, such as GaRankuwa, Mabopane, Temba and Soshanguve to the north, Atteridgeville and Laudium to the west, and Mamelodi and Eersterust to the east
- Improved facilities for the intercity long-distance bus service
- The development of an intercity/long-distance taxi/mini-bus transfer facility on the “Dairy Mall” site next to “Station B”
- Proposed CBD passenger feeder and distribution system to facilitate access to the station area consisting of high frequency shuttle-bus type services running on a fixed schedule
2.4 _THE CITY - A METROPOLITAN URBAN INTERVENTION CONTEXT

2.4.1 _PRETORIA INNER CITY SPATIAL DEVELOPMENT FRAMEWORK

_Guidelines for Precinct 21 – Station precinct:

_Preserve the residential environment and encourage development of new and upliftment of existing residential land use

_Provide additional social facilities, including educational, health care and recreational facilities, to cater for the residential population

_Integrate cultural/tourism aspects in the area with rest of the Inner City. Integration in this regard includes catering for pedestrians to make the area more user friendly to visitors and tourists. Also integrate the cultural/tourism aspects with the adjacent Apies River Activity Spine and with the Museum Mall precinct

_Encourage a pedestrian and transport linkage to the CBD core along Paul Kruger Street

_Incorporate commercial development, facilities and amenities such as kiosks, cafeteria and information points at transportation facilities, transfer points and stations

_Provide trading facilities for the informal sector, with lock-up facilities, sufficient toilet facilities and strong security presence

Street furniture should reflect the historic fabric of the area

(CAPITOL CONSORTIUM 1999 Part 1; p53)

2.4.2 _FREEDOM PARK URBAN DESIGN FRAMEWORK


_Strategic imperatives:
As summary, the framework:

Enables the physical integration of Freedom Park with the Pretoria CBD
Reinforces the Visual Axis with Church Square along Paul Kruger St to the Salvokop Crest
Ensures Access to Freedom Park
Makes physical Pedestrian and Road Connections
Makes an Activity Connection from the CBD via Pretoria Station / Salvokop Suburb to Freedom Park (A High Street and part Ceremonial Route).
Proposes Commercial Development opportunities
Reinforces the residential development and associated community facilities
Retains the Transnet Museum (Railway Houses)

The Overall Contextual Framework proposes a mixed use High Street development in a curved form – This alignment approximates the orientation of earlier railway lines which curved around the housing section in the south, and in these terms this idea seems to be in dialogue with the historical footprint. As concerns the position of historical buildings in this area, input from the heritage study(Bakker; 2004) may augment the idea to enable retention and legibility of past urban patterns. The historical town had a circular public recreation area, and the later loco Roundabout on the Paul Kruger St axis was also the largest urban form in that zone. Heritage related clues could influence the position and/or form of the main public square or elements around the square.

In terms of the position of the intended land-use activities, the heritage study provides clues for the position of certain land uses that will enhance the cultural narrative of the area (Bakker 2004; Phase A p40).
2.4.3 _GAUTRAIN HIGH SPEED RAIL PROJECT

The current and preferred final alignment of the Gautrain has been accepted to pass through a tunnel of Salovkop whilst retaining a station east of the main Pretoria Station building below ground level. Having established this change from the initial intention of having the Gautrain pass through Salvokop itself and emerging from a tunnel with a bridging element over the existing rail, full impacts in visual, heritage, social, economic and noise terms have been mitigated.

2.4.4 _PAUL KRUGER STREET SPINE

The precinct is identified as one of the most important public places in the city. As arrival/departure point, focal point on the main axis of Paul Kruger Street, as well as due to the existence of important historical resources (mainly focusing on the railway function). The main proposals and design principles for the precinct, which relate to a heritage aspect, are:

- Development of the station forecourt as a pedestrian orientated public space that is edged by buildings and that is clearly legible, as well as the retention of historical buildings. Parking is envisaged on the south-eastern side of the main station building.

- It is very important that the Salvokop heritage conservation and tourism initiatives link seamlessly with this initiative. The manner of this linkage, as well as the linkage of Gautrain passengers with Salvokop must receive attention. The manner in which the connection between the precincts for pedestrians, as well as the promotion of distinct precinct character clues, are essential. (Bakker; Phase A; 2004)
2.5 _SPATIAL PRINCIPLES FOR STATION DEVELOPMENT

2.5.1 _DENSITIES

Certain density is important to ensure that there are or will be enough people within a determined area who will use the train. The more densely populated the area, the higher its potential of success. According to international examples, a gross density of ±25 dwelling units per hectare (du/ha) should be able to attain acceptable levels (see section “Proposed Land Use” on page 9 of this document) where it has been determined that the Pretoria Station Precinct has a potential gross density of 30 du/ha). Without sufficient density, proper feeder and distribution systems become critical.

2.5.2 _ACCESS TO A STATION

To promote access in less dense areas, feeder and distribution systems need to be established in order to facilitate access to the station area, whereas in concentrated areas people can effectively reach the area by walking, which requires limited expenditure. Walking is restricted to a defined area because people are reluctant to walk longer than five minutes to reach their destination. Given that this time equates to approximately 500m in distance, the critical zone of influence around the station is a circle with a 500m radius, or a square kilometer (1km x 1km). This area represents the most important area of development.

2.5.3 _IMPACT OF LAND USE ON TRAVEL GENERATION

Land-use is a major influence of patronage as different land-uses generate different journey volumes at different times of the day, which is influenced by the land-uses established in the area around the station. International research indicates that:

- **Residential development** (with the correct density) is the most important land-use for journey generation as people need and want to move around. Therefore, residential development in and around the station area, and along the length of the line is important.

- **Retail areas** generate approximately 10 times more trips per unit than office space, indicating that retail facilities can act as anchors to encourage the support system of a specific destination. This also occurs during off-peak periods.

- **Office space** has higher peak periods than retail space due to daily journeys to and from work places. Efficient feeder and distribution systems, ample parking, park-and-ride facilities and safe walking environments must be provided to achieve office-based travel.

- **Manufacturing** and warehousing have limited impacts on passenger train facilities, mainly due to the reduced density of people in these areas.

- **CBD’s** are key places in rail development due to the densities achieved. These densities relate to the residents of the CBD (apartment buildings) and offices, which attract people on a daily basis.
2.6 STRUCTURING ELEMENTS

(Cape Metropolitan Council; 1996) pg34

2.6.1 Urban Nodes

Nodes refer to centers where many activities mutually reinforce one another and where there are high concentrations of people. An urban node is normally a place of high accessibility, usually at an important modal interchange or road intersection. Generally, the greater the number of vehicular and pedestrian traffic through an interchange, the larger the potential node or center. Traders wishing to locate businesses for maximum exposure to as many people as possible use this principle.

Modal interchanges provide excellent locations for retail, offices and community facilities, as well as for informal sector activity. The development of nodes will play an important part in changing investment patterns and encouraging a sustainable urban economy to emerge. In particular, nodes of all sizes are catalysts for development. Nodes, through appropriate location and development, can also act as triggers for the development of corridors. Historically, these have led to the growth of towns that developed as agricultural service centers and markets.

Key characteristics of Nodes

a. located at modal interchanges, providing maximum access – the larger the modal interchange, the greater the potential of the node;

b. locations for higher order, health, recreational, educational, commercial, and residential activities

c. they allow for high residential densities (100 du/ha gross, or more); and

d. create conditions for sustained growth and development through major public- and private-sector investment and increased accessibility. Nodes are points of high accessibility, and offer the most rational location for public investment and impact. Combined with incentives and opportunities for the private-sector, some nodes have great potential for ensuring improved access to facilities and services for the most disadvantaged.

Urban nodes can give social, economic and physical character to a residential area that distinguishes it from other areas. Urban areas around nodes should offer a full range of activities within a satisfying environment, rather than monotonous residential areas, industrial estates or office parks.
2.7 TOWARDS A DEVELOPMENT FRAMEWORK

2.7.1 CITY OF TSHWANE IDENTITY AND DEVELOPMENT FRAMEWORK FOR THE INNER CITY

VISION:

“To be the hub of a world class city as the capitol of Africa by being a friendly and vibrant all-day-all-night Peoples Place catering for the social and human needs of all its people which proudly calls it ‘Our City and Our Home’” (Capitol Consortium 1999)

This hub is to be supported and continually strengthened by sustainable economic growth and development, efficient service delivery and adequate infrastructure provision as well as the political power and institutional support to make it the best city in Africa (Capitol Consortium 1999).

GUIDING PRINCIPLES FOR CITY BUILDING

DEVELOPMENT FACILITATION ACT

The government’s Urban Development Framework (South Africa 1997) calls for “the physical, social and economic integration of our towns and cities” and stresses the need for higher density, more compact and, in terms of land use, more mixed-use settlements. Similarly, the Development Facilitation Act, No 67 of 1995 (South Africa 1995), inter alia, calls for environments which:

- Promote integrated land development in rural and urban areas in support of each other;
- Promote the availability of residential and employment opportunities in close proximity to or integrated with each other;
- Optimize the use of existing resources, including resources relating to agriculture, land minerals, bulk infrastructure, roads, transportation and social facilities;
- Promote a diverse combination of land uses, also at the level of individual erven or sub-divisions of land;
- Discourage the phenomenon of “urban sprawl” and contribute to the development of more compact towns and cities;
- Contribute to the correction of historically distorted spatial patterns of settlement in the Republic and to the optimum use of existing infrastructure; and
- Encourage environmentally sustainable land development practices and processes.
SUB-FUNCTIONAL AREA WEST BEREA

- Maintain and uplift the cultural and historical elements in order to create a cultural precinct within the inner city
- Integrate extensive land uses such as depots with extensive land uses and service industries to the west
- The nature of the area must respond to the transportation node to the south (station) – cater for pedestrians and the informal sector
- Institute appropriate design and policy measures to effectively treat the interface between the cultural precinct and extensive land-use (depots)

SUB-FUNCTIONAL AREA SOUTH BEREA

- Encourage mixed land use to respond to the station and the gateway to the south - formal/ informal retail (street level), tourist facilities (such as hotels)
- Develop resources and facilities for the residential population to the North and East, eg Berea Park
- Include the parks in an integrated open space system

SUB-FUNCTIONAL AREA BEREA

- Provide social support services to cater for the residential population
- Institute appropriate policy to maintain standards for these services
- Provide appropriate transportation planning and types – relook at the major traffic routes through the residential area
- Cater for pedestrian in terms of facilities and pedestrian routes
- Integrate with Sunnyside and appropriately treat the interface with surrounding areas
2.7.2 _THE GENERAL PROBLEM ENVIRONMENT

According to the Pretoria ISDF and the proposed re-alignment of the Gautrain, major development opportunity emerges in the area southeast of Pretoria Central Station and the nearby-proposed Gautrain Station. This area is currently a dilapidated and much abandoned railway yard, comprising of the historical wash-bay shed structure and a few small historical buildings, which holds much potential in the wake of new development in the area.

Outlined in the Salvokop Development Framework Heritage Impact Assessment of February 2003, the suggested re-alignment of the Gautrain is to pass through a tunnel of Salvokop whilst retaining a station east of the current main station, placed in such a way that it will respect the current heritage resources in the precinct. Certain notes are made by the report and have been extracted here:

-If the Gautrain can deliver the same amount of feet to an intended central peoples’ dispersal place in Salvokop, without the impact, it will be a major generator of tourism to the Salvokop precinct and Freedom Park – this external stimulus, if (and only if) well conceptualized and designed according to best practice norms in urban design and urban heritage conservation, may be compatible with heritage development for the precinct.

FIG 2.7.2.1 Zones of Salvokop: areas of influence
STATION ZONE:

- The initiatives to redesign this Zone must be linked to and integrated with the Salvokop development. Functions are to include transport interchange, commercial (formal), public amenities, administrative (e.g., Intersite), residential (e.g., short term accommodation). The zone needs to link with the Kruger St Spine, the Workshop zone to the southwest of the railway lines, the heart of Salvokop, as well as with the undeveloped area southeast of the Station and the Berea Zone.

- Apart from the redevelopment of the square, the removal of the diagonal road to Railway St with the subsequent re-instatement of the eastern border of the square and the historical street leading to Belgrave Hotel, are important actions.

- The pedestrian link with Salvokop, just west of the main Station building, needs to be emphasized.

- The zone west of Station square, being the original NZASM station square and station buildings, is currently used as bus station and market stalls. Whilst these uses are compatible with the historic fabric, the introduction of additional public amenities and shops, and the development of spaces between buildings as movement space as well as space for access to services, is required to properly utilize its potential.

- The new Bosman Street bridge must address the public nature of the area. The design for this area should make the railway history and currently confused spatial pattern of the zone, more legible.

- The parking area east of the main Station building, earmarked by Intersite and by Gautrans as a parking zone, should incorporate the 1928 Audit building, the historical coach washing shed and subsidiary buildings into future planning initiatives, respect the scale of these buildings and recognize the Station building as the important focal point of the zone.

- Railway Street as a whole, including the NZASM Station Master’s House and Printing Office, the CSAR railway houses and the NZASM Telegraph Office, is to be developed as an ‘edge’. The re-connection of the eastern side of the station Zone with Salvokop, by means of a pedestrian link on the axis of the old Roundhouse, should be considered.

- The scale and nature of new developments along the street (as was the case with the motor garages in the area), should acknowledge the precinct scale that has been established and retained over more than a century.
ZONE J (BEREA/ CENTRAL):

- The need for the historical function of the Berea Club and sports field to be revitalized must be stressed as an action related to the experience of the total railway related cultural landscape – its role in tourist activities, as well as for use by the citizens of the city, should be better understood. The residential and light industrial character of the zone should be re-enforced. A manner of relation with the Station and Salvokop needs to be devised.

- The historical spatial link with Salvokop is to be re-enforced – i.e. the visual link between the Berea Club and the Station Zone is to be strengthened, and if possible, the open space west of the Club is to be articulated as green space, and Clara Street is to be extended over VD Walt St to re-connect with Railway St.

EASTERN RAILWAY-LINE ZONE:

- Consolidation of the historical edge of the main railway precinct is required. The development and use of the eastern open space system in which the NZASM line to Maputo curves over Nelson Mandela Drive, in accordance with environmental objectives for the area, may be an asset to the city: The heritage resources in the space, the historical houses in Du Preez Hoek, must be important elements in any redevelopment. The railway buildings along the railway line itself, which are still in use, need to be identified as protected heritage resources to the landowner.

- The re-use of the section adjacent to and west of the Blue Train shed needs careful consideration – this area is not ‘empty space’. The retention of a memory of the largest urban element of historical
Salvokop, i.e. the Roundhouse (centered in the rail reserve) will not only enhance the retention of a site specific memory of the emphasis placed on the Paul Kruger St axis and the Jailhouse axis, but also facilitate the successful re-introduction of the intended visual and physical axis aligned with Paul Kruger St.

-New buildings on the northern portion of this zone must react to the historically diagonal movement patterns and building positions, as well as the historical resolution of mass, space, movement and topology. Large, flat open spaces should be avoided.

With the realignment of the Gautrain passing underneath the railway lines, a major engineering structure of irreversible order and form, as well as a "roof" level that would have dictated and further development, has been avoided. Therefore the development can be lead by the analysis of the historical site and the dictates of the Freedom Park and Salvokop philosophies and frameworks.
2.7.3 _URBAN DESIGN GUIDELINES

_ZONE C  ‘WORKSHOP AND MARSHALLING YARD, STATION AND RAIL’

Defined by Potgieter St on the west, Skietpoort St on the south, Scheiding St on the north, Railway St on the east, and the railway line on the south-west diagonal for the area from Skietpoort St east to the Komatipoort line and NZASM bridge on Nelson Mandela Drive.

_AREA CB (STATION PRECINCT – NORTH AND NORTH EASTERN SECTION OF ZONE C)_

Defined as the area north of the diagonal railway reserve, Scheiding St and Railway St up to the connection with Clara St.

Zone guidelines

Historical street patterns in this area must be re-instated in the event of the diagonal street east of Station Square being removed. Railway St must be developed in a way that requires new buildings to edge on and address the street. The historical buildings on the east and west of Railway St north and central must be conserved, and the area’s scale, grain and pattern must not be overpowered by the Gautrain parking facilities - these buildings must retain a street edge character.

_AREA CC (AREAS ADJACENT TO RAILWAY – SOUTH EASTERN SECTION OF ZONE C):_

Portion east of railway reserve

Defined as the area between the railway reserve and Railway St, from the McCarthy Garage to the eastern side of the Salvokop Koppie.

Zone guidelines

Key conservation elements:

Conservation related guidelines included in the Phase A report of the Heritage Impact Assessment by Bakker (2004) have to be included in a future construction of a combined conservation management plan for the total Railway Area.

Character: An industrial character in the northern section as well as along the total railway reserve, but with quality green space with mature trees in the south, is outlined. The historical buildings on the east (and west) of Railway St south must be conserved, and the area’s scale, grain and pattern must not be overpowered by the Gautrain rail and station, with the historical buildings retaining a street edge character. Any new developments resulting from the cut-and-cover operation must follow the same urban pattern.
The possibility of a crossing over the railway line and achieving a pedestrian connection with Clara St and the Berea Club area that lies beyond, must not be prevented by any proposed developments.

Linkage/s: A pedestrian linkage is required across the rail lines in line on the axis between Clara St and the historical Roundhouse, in order to re-institute historical pedestrian connection as well as to deliver visitors, urban users and inhabitants to Salvokop from the east – this connection can be adjacent or connected to the Gautrain tunnel, but with a purpose in delivering people on the public square NE of the NZASM Hof.

**ZONE I: HEAD OFFICE**

Defined at corner of Minnaar and Paul Kruger St.

**Zone guidelines:**

**Land use:** Retain Railway related function.

**Key conservation elements:** Location of the demolished, former NZASM era head office buildings, but presently still occupied by the Modern NZASM Building.

**Character:** Retain status quo.

**Linkage/s:** Paul Kruger Street Spine [establish connection with Station Square and Salvokop through information transfer].

**ZONE J: BEREA/CENTRAL**

Defined as the area between Railway St, Scheiding/Walker Street, Nelson Mandela Drive and Willow St.

**Zone guidelines**

**Land use:** Mixed use

key conservation elements are described here for use in future actions:

• SAR Electricity Dept and Magazine
• Institute Building, or SAR Berea Club
• Hall for Berea Club, 1926
• Belgrave Hotel, 1929
• Various houses in what is known as ‘Du Preez Hoek’, *sine anno* but some possibly *ca* 1900-10 (western one of Mr. EF Bourke).
• Various houses on Clara St and vicinity.

Conservation related guidelines are included in the Phase A of the Heritage Impact Assessment by Bakker (2004) must be included in a future construction of a combined conservation management plan for the total Railway Area.
2.7.4 _DEVELOPMENT OBJECTIVES AND GUIDING PRINCIPLES

2.7.4.1 PEDESTRIAN LINKS:

The historical pedestrian links at Bosman St and from Railway St across the lines (aligned with old roundhouse) to Salvokop, should ideally be revived. The latter could tie the Gautrain, main station platforms and Blue Train platforms together. Accessibility and permeability will be increased whilst reviving historical pathways and linkages. The Bosman St pedestrian link is vital to link the public space at Scheiding/Bosman, with a public space that should occur at the Chief Engineers Office [or ‘POPUP’], and from where further connections may be made to the township’s residential or main public space elements. A pedestrian link from the Fountains’ open space system is desirable for access to heritage resources in that area, as well as for access to the Unisa South and North campus and from the Sunnyside/Berea/Muckleneuk areas.

2.7.4.2 ECONOMIC DEVELOPMENT

Mixed use area - sustainable development criteria – use of current inhabitant skills/labour.

Use of heritage resources as tourist attraction linked with station precinct, Museum Mall and Freedom Park.

In order to be most effective, the conservation of Salvokop and adjacent areas should be an integral part of coherent policies of economic and social development and of urban and regional planning at every level. This implies adherence to Local Development Objectives (LDOs), the Integrated Development Plan (IDP) for the area, the Gautrain and Freedom Park projects, local zoning and zoning regulations, the development of Station Square and the new Bosman Street taxi rank and cultural/tourism development as exemplified by the neighbouring Museum Park precinct. There is a need for community participation (Bakker, Phase A; 2004).

2.7.4.3 CONTEXTUAL LINKS

The identity of Salvokop as a precinct with a railway history should be at the core of conceptual urban design decisions. The strong links with the NZASM Headquarters and Paul Kruger St, the Station precinct with its main Station building and square and subsidiary spaces to the west and east with historical structures, the Victoria Hotel, the Berea Club building and sports ground (together with the Clara St connection and the open space on Van Der Walt St), the historical houses of railway people in Central, the Belgrave Hotel, the historical houses and the NZASM/CSAR buildings on Railway St, the trees and houses of Du Preez’s Hoek, the sub-station area at the railway precinct south rail entrance, as well as the NZASM structures to the east and south of Salvokop (Bridge, culvert, aqueduct), form a cultural landscape with a common historical activity pattern – unfortunately many development proposals have separated the zones or are preventing the possibility of reading their interconnectedness.

The establishment and/or strengthening of visual and/or physical links, with the Museum Park precinct in the Inner City (especially the Kruger Street Spine, but the Bosman Street side connection is also important), as well as with the Correctional Services precinct to the west (Correctional Services Museum), the Fountains Valley recreational area to the south and the Berea Park recreational precinct in the east, are important.
2.7.5 _URBAN DESIGN DIRECTIVES FROM HERITAGE ANALYSIS

FIG. 2.7.5.1 Heritage resources of the precinct

- VICTORIA HOTEL
- BELGRAVE HOTEL
- 1928 AUDIT BUILDING
- BEREA CLUB RECREATIONAL
- HISTORICAL HOUSES
- RAILWAY STREET
- NZASM/CSAR BUILDINGS
- DU PREEZ’S HOEK

IMPORTANT HISTORICAL EDGES AND MASS
IMPORTANT VISUAL AND HISTORICAL CONNECTIONS
2.7.6 _ISSUES AND CONSTRAINTS_

2.7.6.1 ISSUES

The historical analysis (Bakker; 2004) has indicated that the Salvokop heritage site is integrally connected with various important historical phases in the growth of our nation, particularly in terms of the growth of the Boer ZAR, British imperialist incursions in the Transvaal and Boer resistance, the period of Union and the Afrikaner nationalist phase. In all these phases the railways played an integral part, which is richly demonstrated on the Salvokop heritage precinct and its neighbouring Station heritage precinct, both of which ultimately form an integral whole.

The Salvokop area is deemed to be of high historical value to society and its value as a precinct – seen with the Station precinct - is placed at national level due to the amount of resources and roles that the railways have played in the evolution of our country.

The site, which has been functioning as a railway precinct since 1892, has always existed in stages of separation from the ‘normal’ urban fabric and has not been well maintained. Several important architectural elements have been demolished, however the large amount of remaining offices, sheds and housing elements of Salvokop are structurally sound, and many of the places and streetscapes of the historical layers of the site remain intact with a high degree of authenticity.

Retention of the heritage resources benefits the Inner City through an increase in usable heritage assets: Salvokop has the potential to act as bridge between the Museum Mall precinct and Freedom Park - with attached development opportunities and increased legibility of the city fabric.

The Gautrain development, as a railway function, is a compatible function for the larger city sector, but only if planned correctly. The impact of the Gautrain, in terms of its alignment, frequency, noise and speed, as well as the size of the infrastructure and the physical intervention of both tunnel and feriduct on the qualities of landscape and intended development (Freedom Park and Salvokop), has been debated. The only way to avoid the impact is concluded to tunnel all the way, whilst retaining a station east of the current main station, placed in such a way that it will respect the current heritage resources in the precinct.

The Freedom Park development is the largest opportunity for the regeneration and utilisation of the heritage fabric of Salvokop. Where various previous attempts at regeneration have failed, this opportunity must be wisely grasped. It must be stressed that Salvokop cannot be seen in simple development terms – ie where only market forces determine the outcome of its regenerated urban form and content – the opportunity which the large component of heritage resources of Salvokop presents also requires involvement and investment from the State on various tiers, and if possible non-governmental cultural organisations, in order to safeguard the future of the resources and their use in regenerative development.
2.7.6.2 CONSTRAINTS

Heritage recourses in the area are in a neglected state apart from NZASM Hof - renovated by Transnet - and a few buildings in the Station precinct - which have been renovated by Intersite.

Inclusion of the historical structures and spaces of the precincts around Salvokop - the Station precinct, the Berea precinct, NZASM headquarters in Paul Kruger Street, the NZASM and CSAR/SAR&H buildings on the southern part of Railway Street, the old NZASM bridge and the small water reservoir and fort structures on Salvokop - into an integrated heritage conservation framework which revolves around the railway history will benefit the development of Salvokop greatly, but requires the involvement of more diverse stakeholders in the design and management process than is presently the case. These stakeholders must be made aware of the opportunities involved, and briefed at an opportune time in the conceptual phase of the design. The Intersite development in the Station precinct must specifically be linked with the Salvokop development.
2.7.7 _PROPOSED LAND USE_

A quantitative assessment of the land use was made using status quo information to predict a future densification scenario for 100 hectares around the station according to the densification proposals of the Gautrain Project Team. The status quo and suggestion to proposals are tabulated in Table 1 below, followed by explanatory notes.

**TABLE 1: CURRENT LAND-USE**

<table>
<thead>
<tr>
<th>Land Use Component</th>
<th>Status Quo</th>
<th>Quantified Concept for 100 ha</th>
<th>Foot Print</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total area</td>
<td>Future Bulk Area (m²)</td>
<td>Future Mix %</td>
</tr>
<tr>
<td></td>
<td>bulk</td>
<td>Average Height</td>
<td>%</td>
</tr>
<tr>
<td>Residential</td>
<td>248.362</td>
<td>500.000</td>
<td>53.4</td>
</tr>
<tr>
<td>Offices</td>
<td>82.822</td>
<td>55.000</td>
<td>5.9</td>
</tr>
<tr>
<td>Retail</td>
<td>28.790</td>
<td>35.000</td>
<td>3.7</td>
</tr>
<tr>
<td>Industry</td>
<td>5.435</td>
<td>5.500</td>
<td>0.6</td>
</tr>
<tr>
<td>Community facility</td>
<td>1.380</td>
<td>10.000</td>
<td>1.1</td>
</tr>
<tr>
<td>Recreation/ Parks</td>
<td>22.770</td>
<td>30.000</td>
<td>3.2</td>
</tr>
<tr>
<td>Hotel&amp; conference</td>
<td>6.553</td>
<td>20.000</td>
<td>2.1</td>
</tr>
<tr>
<td>Transport/ Parking</td>
<td>261.823</td>
<td>280.000</td>
<td>29.9</td>
</tr>
<tr>
<td>Vacant land</td>
<td>265.184</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>923.099</td>
<td>935.500</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Notes for Table 1:

- Coverage is estimated at 55% due to the large transportation-related areas. Densification is possible in areas such as Salvokop and other vacant areas.

- Present residential: @ 100m² / unit there are 2484 units in this node.

- Densification will be achieved through the development of Salvokop (residential). Existing empty offices can also be converted into residential accommodation.

- To attain 30du/ha (dwelling units per hectare) need to attain 3000 units @100m² on average per unit. Therefore, requiring 300 000m² areas taken up by residential within area (including existing residential).

- An additional 516 units are required to attain 30du/ ha for this area, resulting in an additional 8.6 residential blocks (6 floors @ 10 units/ floor). This can be accommodated in the Salvokop area.

From this study, the results indicate an existing residential population of 26.9% and it can be determined that the greatest need for the area would be the development and establishment of community-based facilities. The culmination of the proposed transport network and proposed land uses will bring about an energy and vibrancy our city wants, and from this it can be determined what our city needs.
FIG. 2.7.7.1 Existing Landuse of site: Commercial motor vehicle showroom due for demolition with Gautrain Development. Existing landuse of precinct: abandoned Railway yard

FIG. 2.7.7.2 Proposed Landuse of site: Community Development Centre with retail and office space. Proposed landuse for precinct: Inter-modal facility and public urban open-space
FIG. 2.7.8.1 Eastern elevation of proposed development to Pretoria Station Precinct
2.7.8 RESPONSE AS A THESIS

A solution to this urban problem would be the creation of a community-based development facility within the Pretoria Station Precinct. The great opportunities provided by the rail networks ensures that easy access to the area is possible for those from more rural areas, those from neighboring metropoles, to those commuting from Johannesburg International Airport, resulting in a broad scale involvement of the population. As the development is situated between the two stations with considerable heritage value (as outlined in the Salvokop Development Framework Heritage Impact Assessment: February 2003) and possesses high potential as an urban space, a suitable name would be “The Pretoria INTER-STATION DISTRICT and Community Development Centre. Here the functions of the built form would begin to merge surrounding nodes of activity in an appropriate and meaningful manner through its mere presence, and reinforce the new energy foreseen for Pretoria inner city.

The development shall have the character of a convention centre with a strong focus on the community and the public. Not only will it embrace the energy of movement between two major rail stations, it shall also be the bridging element to Salvokop and Freedom Park, as well as nearby local areas of influence. Above this, the centre will have conference facilities, business opportunities and capacity-building facilities, with adaptable exhibition and social facilities.

The community would benefit from the centre with the establishment of spaces such as a multimedia library and study facilities for children during the day, child care for working parents, night-school and skills development for adults, as well as a social events calendar. The building could also cater for the international market as a venue for conventions or trade fairs, and the government would find interest in using the location as a stepping stone from the new DTI (Department of Trade and Industry) campus on Nelson Mandela Drive. Business opportunities will emerge with the establishment of a commercial section with rental office and retail space, and a well conceptualized scheme will embrace the heritage forms according to best practice norms in urban design and urban heritage conservation that it may be compatible with heritage development for the precinct.

The building itself must embrace the concept of adaptability, where at varied scales the building functions are engineered to accept change and be able to grow with the demand of our evolving city over the years. In essence, the building should also be a subtle landmark with symbolic characteristics, not to be a distraction from important historical buildings such as Herbert Baker’s Pretoria Central Station building nor the important axial view down Paul Kruger Street towards Church Square that has been envisaged from Freedom Park. It must however, be an addition to the new developments in the area and recognized for its importance in the urban fabric.
“Community development implies interdependence between individuals, communities and states and presupposes equal rights and opportunities to grow and develop. Taking responsibility for one’s own interests and those of the community is an integral part of community development.”

Community development aims at enhancing the quality of life by means of comprehensive development, i.e. physical, social, economic and political development, in a multi-professional team context.

Lombard (1991) discusses the relationship between community development and community work, and shows how the philosophy and underlying principles, on which community development and community work are based, are in fact quite similar. Although community work is founded on its own set of principles, it can be deduced that the differences are to be found in the contextual matter, rather in the underlying principles themselves. This deduction is valid according to Lombard (1991: pg 200) because “community development is aimed at comprehensive development, whereas community work is concerned exclusively with the social functioning of the community”.

In the table below, Lombard (1991) show how the principles fundamental to community work are subsequently used as the point of departure in order to illustrate the degree community development endorses the same principles:
<table>
<thead>
<tr>
<th>COMMUNITY WORK</th>
<th>COMMUNITY DEVELOPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respect for human dignity</td>
<td>Human dignity forms the basis of community development. Human dignity originates in self-respect, which in turn is fundamental to the acceptance of others, notwithstanding their way of living, social standing, race or nationality. In every community all people should be regarded by themselves and others as the ultimate aim of and medium for community development.</td>
</tr>
<tr>
<td>Individuality</td>
<td>Every person is unique and therefore has the opportunity to create his or her own unique living space (“Lebensraum”). Like individuals, communities too, are unique. The South African society, consisting of communities that differ regarding race, origin, language, culture and level of development, is a good example of this.</td>
</tr>
<tr>
<td>Self-determination</td>
<td>The principle of self-determination restrains the community developer from making decisions on behalf of the community. The individual wants the responsibility of making his or her own choices. Because the individual’s human dignity he/she is free, in his/her own world of opposites to choose and decide as he/she likes… but always in a responsible manner.</td>
</tr>
<tr>
<td>Self-help</td>
<td>Self-help leads to self-respect. The members of a community should be enabled to improve their own circumstances. Successful self-help projects serve as a source of motivation in the process of becoming independent.</td>
</tr>
<tr>
<td>Community needs</td>
<td>Activities that are undertaken, should be in accordance with the basic needs which the community itself has expressed and identified.</td>
</tr>
<tr>
<td>Partnership</td>
<td>Comprehensive and balanced community development demands joint action and the establishment of multi-purpose programmes. Each partner in the partnership should know his or her rights, duties and responsibilities. The community developer is part of this partnership.</td>
</tr>
<tr>
<td>Change</td>
<td>Change in the attitudes of people is as important as the change which evolves from community development projects, especially during the initial development phases of these projects. The potential of the human race is fundamental to this principle. Because self-realization is a human’s highest calling, humans are always in a process of “becoming” and thus never static.</td>
</tr>
<tr>
<td>Development of local leadership</td>
<td>The identification, encouragement and training of local leadership, should be a basic objective of any programme. The importance of leadership development is confirmed by the premise that every person has the ability to learn and to grow and that everyone should make a contribution to community life.</td>
</tr>
<tr>
<td>Involvement and participation</td>
<td>Community development is aimed at (1) the improvement an increase in the community’s contribution to community affairs, (2) the rebirth of the existing forms of local government, and (3) the transition to effective local administration where it does not yet exist. The goals imply that the community development makes allowances for power-sharing and active participation in the decision making process.</td>
</tr>
<tr>
<td>Equity</td>
<td>Equity means the effort to give equal opportunity to everybody, for each person to reach his full potential. In the first instance this implies a struggle against injustice, not against inequality.</td>
</tr>
</tbody>
</table>
Lombard (1991; pg 206) successfully summarizes the aim of community development as:

“...the improvement of the quality of life of the individual and the community on the physical, social, economic and political terrains of development, to help establish a balanced growth, resulting in social stability, prosperity and progress in the community”.

Community development aims at providing people with the opportunity to improve their own circumstances; thus the goals of community development are directed mainly at the process (Lombard 1991; p208). When the community becomes involved in the planning process or is taught in some manner or another, the people have been taught to help themselves and thus this community action can be called community development.

The elements of the “good life” which are valid for many people in the United States of America, can also be applied to the people of South Africa (after Dunham 1970 in Lombard 1991: pg207). These elements are the following:

- Physical health, mental health and the capacity for emotional adaptation;
- A home and creative relationships with family and friends;
- An education enabling the individual to play a suitable and effective role in life;
- A job and the basic economic security of being able to provide food;
- Opportunities and facilities for recreation;
- Spiritual and ethical development; and;
- Opportunities for the realization of the self, which include:
  - respect for the individual as a person;
  - acceptance by and a feeling of “belonging to the community”;
  - the personal freedom to make decisions and exercise options;
- freedom regarding economic, social, and political opportunities; and
- the opportunity to cooperate with others in the community.

Therefore, when the quality of life in a community is the aim of community development, the elements of a dignified human existence mentioned above, offer a basic guideline to the community developer. All development dimensions of the human being, i.e. the physical, social, economic and political, are represented by these elements. From this it can be deduced that, irrespective of the level of the quality of life the community is aspiring to, attempts to improve the quality of life should still be aimed at the comprehensive development of the community (Lombard 1991; pg 208).
3.1 SUSTAINABLE DEVELOPMENT

3.2 COMMUNITY
   3.2.1 Sustainable Communities
   3.2.2 Model Principles for Sustainable Communities
   3.2.3 Principles of Sustainable Design

3.3 SUSTAINABLE CONSTRUCTION
   3.3.1 Construction Methods and Materials
   3.3.2 Construction Process Program
   3.3.3 Construction Preservation/Restoration
   3.3.4 Visitor Safety and Security

3.4 SUSTAINABLE URBAN DESIGN

3.5 SUSTAINABLE TRANSPORTATION

3.6 SOCIAL ISSUES
   3.6.1 INDOOR ENVIRONMENT AND OCCUPANT COMFORT
   3.6.2 INCLUSIVE ENVIROMENTS
   3.6.3 ACCESS TO FACILITIES

3.7 ECONOMIC ISSUES
   3.7.1 LOCAL ECONOMY
   3.7.2 ADAPTIBILITY AND FLEXIBILITY
   3.7.3 ONGOING COSTS

3.8 ENVIRONMENTAL ISSUES
   3.8.1 ENVIRONMENTAL ARCHITECTURE
   3.8.2 ECOLOGICAL BUILDING
   3.8.3 GREEN BUILDING

3.8.4 ENERGY
   3.8.4.1 The thermal performance of buildings
   3.8.4.2 Understanding heat transfer
   3.8.4.3 Heat absorbing capacity and thermal insulation
   3.8.4.4 U-values of typical walls
   3.8.4.5 Commercial and Industrial Building Use of Energy
   3.8.4.6 Energy Efficiency
   3.8.4.7 Renewable Energy

3.8.5 WATER

3.8.6 SITE DESIGN
   3.8.6.1 Factors
   3.8.6.2 Site Access
   3.8.6.3 Utilities and Waste Systems
   3.8.6.4 Site-Adaptive Design Considerations
   3.8.6.5 Natural Characteristics
   3.8.6.6 Cultural Context
   3.8.6.7 Designing with climate

3.8.7 MATERIALS
   3.8.7.1 Embodied Energy

3.8.8 WASTE

3.8.9 PROCESS
Economic dimensions of sustainability:
- Creation of new markets and opportunities for sales growth
- Cost reduction through efficiency improvements and reduced energy and raw material inputs
- Creation of additional added value

Environmental dimensions of sustainability
- Reduced waste, effluent generation, emissions to environment
- Reduced impact on human health
- Use of renewable raw materials
- Elimination of toxic substances

Social dimensions of sustainability
- Worker health and safety
- Impacts on local communities, quality of life
- Benefits to disadvantaged groups e.g. disabled

Sustainability represents a balance that accommodates human needs without diminishing the health and productivity of natural systems. The American Institute of Architects defines sustainability as “the ability of society to continue functioning into the future without being forced into decline through exhaustion or overloading of the key resources on which that system depends.” (Mendler 2000)

While environmental and economic sustainability is the goal, sustainable design is the means we as designers have to contribute to that goal. Sustainable design moves away from extractive and disposable systems that are energy intensive, resource inefficient, and toxic toward cyclical, closed-loop systems that are restorative, dynamic, and flexible.
A sustainable community revolves around the interconnectedness of society, economy and environment. According to Maureen Hart (2003; pg 1), a sustainable community is one in which the economic, social and environmental systems that make up the community provide a healthy, productive, meaningful life for all community residents, present and future. Sustainable communities acknowledge that there are limits to the natural, social and built systems upon which we depend.

A traditional view of community viewed its parts as separate and unrelated, and the quality of life was measured as such. The sustainable view toward community embraces all the components and views them as a whole; a system that functions on the reliability of its parts: the economy exists within society, and both the economy and society exist within the environment.

Apart from the aspects of a society above, one of the most important aspects to a sustainable community is the participation of all elements of society in decision-making processes. Local governments can help their communities to become more sustainable, but they cannot do it without a mandate from, and the participation of the local community.

Sustainability must be community-led and consensus-based because the central issue is will, not expertise; only a community-based process can overcome the political, bureaucratic and psychological barriers to change. But citizen-led processes must be complemented by top-down government support because it is still only governments that have the regulatory powers to secure the transition to sustainable development.

The following twelve principles, proposed by the Ontario Round Table on Environment and Economy, encompass the social, economic, environmental and decision-making aspects of sustainable communities:

### 3.2.2 MODEL PRINCIPLES FOR SUSTAINABLE COMMUNITIES

A sustainable community is one which:

1. Recognizes that growth occurs within some limits and is ultimately limited by the carrying capacity of the environment

2. Values cultural diversity

3. Has respect for other life forms and supports biodiversity

4. Has shared values amongst the members of the community (promoted through sustainability education)

5. Employs ecological decision-making (e.g., integration of environmental criteria into all municipal government, business and personal decision-making processes)

6. Makes decisions and plans in a balanced, open and...
3.2.3 PRINCIPLES OF SUSTAINABLE DESIGN

Understanding Place
- Inhabit without destroying
- Preservation of the natural environment
- Access to public transportation

Connecting with Nature
- Inner city or natural setting
- Brings life, informs us of our place within nature

Natural Processes
- Regenerate rather than deplete

Environmental Impact
- Evaluating the site
- Embodied energy
- Toxicity of the materials
- Energy efficiency of design, materials and construction techniques
- Recycling building materials

Embracing Co-creative Design Processes
- Consultants, engineers and other experts early in the design process
- Local communities

Understanding People
- Sensitivity and empathy


3.3 _SUSTAINABLE CONSTRUCTION_

Definition: “The creation and responsible management of a healthy built environment based on resource efficient and ecological principles” (SABD)

“Architecture presents a unique challenge in the field of sustainability. Construction projects typically consume large amounts of materials, produce tons of waste, and often involve weighing the preservation of buildings that have historical significance against the desire for the development of newer, more modern designs.” -- The Earth Pledge (http://www.earthpledge.org/)

Sustainable construction is based on:

- minimising non-renewable resource consumption
- enhancing the natural environment
- eliminating or minimising the use of toxins

Sustainable building strives for integral quality including economic, social and environmental performance. Therefore, the rational use of natural resources and appropriate management of the building stock will contribute to saving scarce resources, reducing energy consumption (energy conservation), and improving environmental quality. (SABD)

Five objectives for sustainable buildings:

- Resource Efficiency
- Energy Efficiency (including Greenhouse Gas Emissions Reduction)
- Pollution Prevention (including Indoor Air Quality and Noise Abatement)
- Harmonisation with Environment (including Environmental Assessment)
- Integrated and Systemic Approaches (including Environmental Management System) (SABD)

### TABLE 3: ISSUES FOR CONSIDERATION FOR SUSTAINABLE CONSTRUCTION PRACTICES

<table>
<thead>
<tr>
<th>Theme</th>
<th>Environmental Primary Issues</th>
<th>Economic Primary Issues</th>
<th>Social Primary Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-theme</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Global</td>
<td>- Climate change</td>
<td>- Construction</td>
<td>- Equity</td>
</tr>
<tr>
<td>- Local and site</td>
<td>- Resources</td>
<td>- Materials</td>
<td>- Community</td>
</tr>
<tr>
<td>- Internal</td>
<td>- Internal environment</td>
<td>- Infrastructure</td>
<td></td>
</tr>
<tr>
<td>Issues</td>
<td>- External environment</td>
<td>- Profitability</td>
<td>- Poverty</td>
</tr>
<tr>
<td>- Wildlife</td>
<td>- Wildlife</td>
<td>- Employment</td>
<td>- Minorities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Productivity</td>
<td>- Inner cities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Transport and utilities</td>
<td>- Transport</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Building stock value</td>
<td>- Communications</td>
</tr>
</tbody>
</table>
Construction Methods and Materials

- local craftsmen and materials.
- environmental damage should not be permitted.
- Non-toxic, renewable or recyclable, and environmentally responsive building products are available to use when specifying materials.

Construction Process Program

- For developers, construction contractors, and maintenance workers that covers materials, methods, testing, and options.
- Organization and sequencing of construction. Maintenance and operations staff to be involved in the construction program and participate in the development of an operations manual.

Construction Limits and Landscape Features

- To be fenced and protected
- All topsoil from construction area should be collected for use in site restoration.
- Flexibility in revising construction plans should be allowed to change materials and construction methods based on actual site impacts.

Native Landscape Preservation/Restoration

- Preservation of the natural landscape is less expensive and more ecologically sound than restoration.
- Noxious or toxic plant materials should not be used adjacent to visitor facilities.
- plantings of native materials to control exotics should be used.
- Water for new plantings can be provided by locating plants in drainage swells or using temporary irrigation.

Visitor Safety and Security

- protect visitors from natural and manmade hazards.
- The design should consider safety from climate extremes; visitors may be unaware of natural hazards, including intense sun, high wind, heavy rainfall, etc
- Various challenge levels in site facilities should be provided to accommodate all visitors, including visitors with disabilities.
- artificial lighting limited to retain natural ambient light levels - light fixtures to limit impacts while providing a basic sense of security
3.4 SUSTAINABLE URBAN DESIGN

Principles of sustainable urban design

- Principle 1: Increasing Local Self-Sufficiency
- Principle 2: Human Needs
- Principle 3: Structure Development Around Energy-Efficient Movement Networks
- Principle 4: The Open Space Network
- Principle 5: Linear Concentration
- Principle 6: An Energy Strategy
- Principle 7: Water Strategy

[Barton, H., 1996]

<table>
<thead>
<tr>
<th>Landform/Microclimate</th>
<th>Site Design</th>
<th>Infrastructure Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Topography</td>
<td>- Solar orientation</td>
<td>- Water supply and use</td>
</tr>
<tr>
<td>- Light-colored surfacing</td>
<td>- Pedestrian orientation</td>
<td>- Wastewater collection</td>
</tr>
<tr>
<td>- Vegetative cooling</td>
<td>- Transit orientation</td>
<td>- Storm drainage</td>
</tr>
<tr>
<td>- Wind buffering/channeling</td>
<td>- Micro climatic building/siting</td>
<td>- Street lighting</td>
</tr>
<tr>
<td>- Evaporative cooling</td>
<td></td>
<td>- Traffic signalization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Recycling facilities</td>
</tr>
<tr>
<td>Land-Use</td>
<td>Transportation</td>
<td>On-Site Energy Resources</td>
</tr>
<tr>
<td>- Use density</td>
<td>- Integrated, multimode street network</td>
<td>- Geothermal/groundwater</td>
</tr>
<tr>
<td>- Use mix</td>
<td>- Pedestrian</td>
<td>- Surface water</td>
</tr>
<tr>
<td>- Activity concentration</td>
<td>- Bicycle</td>
<td>- Wind</td>
</tr>
<tr>
<td></td>
<td>- Transit</td>
<td>- Solar</td>
</tr>
<tr>
<td></td>
<td>- High-occupancy vehicles</td>
<td>- District heating/cooling</td>
</tr>
<tr>
<td></td>
<td>- Pavement minimization</td>
<td>- Cogeneration</td>
</tr>
<tr>
<td></td>
<td>- Parking minimization/siting</td>
<td>- Thermal storage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Fuel cell power</td>
</tr>
</tbody>
</table>
3.5 _SUSTAINABLE TRANSPORTATION_

Integrating land-use, transport and environmental planning is important to _minimise the need for travel_ and to _promote efficient and effective mode of transport_, including walking. There are four principal ways to influence transport system efficiency and energy consumption:

- urban and land-use planning;
- modal mix (cars, trucks, rail, air, etc.);
- behavioral and operational aspects (occupancy of vehicles, driver behavior, system characteristics); and
- vehicle efficiency and fuel choice.

Pedestrianisation is to restrict vehicle access to a street or area for the exclusive use of pedestrians. It provides a pleasant and safe environment for pedestrians, and is ideal for venues for shopping, social and cultural activities, such as street markets and fairs.

*FIG 3.5.1 Rail transportation is regarded as one of the most sustainable forms of movement*
3.6 SOCIAL ISSUES

3.6.1 INDOOR ENVIRONMENT AND OCCUPANT COMFORT

- Indoor air quality
- Visual quality
- Acoustic quality
- Noise control
- Controllability of systems

Healthy Buildings

Building ecology refers to the constructed environment inside a building as it relates to human health. Building ecology is concerned with indoor air quality, acoustics, and daylight. Building ecology is effected by a number of constituents: overall building tightness, heating, cooling and ventilation systems, interior finishes, adhesives, cleaning, and maintenance.

Indoor Air Quality

The air inside buildings has been measured to be worse than the polluted air outside. Building elements, particularly new building elements, “offgas” or emit chemical compounds. Adhesives, paints, particleboard, carpeting, vinyl flooring, and furnishings can contribute significantly to the airborne contaminants found inside new buildings. The facility design team shall design a building that promotes indoor air quality through the selection of nontoxic and least toxic building materials and through the design of mechanical and electrical systems that circulate and evenly distribute fresh, clean air.

The steps to promote good quality indoor air are:

1. Minimize the sources of off gassing. Select low- or zero-VOC (volatile organic compound) paints and adhesives.
2. Provide a source of clean fresh air.
3. Design good ventilation into habitable rooms.
4. Design a good air filtration system.
5. Choose low-VOC emitting furnishings.
6. Choose nontoxic cleaning products.
7. Regularly clean high-humidity areas so mold and mildew can’t develop.
8. Monitor the facility for leaky pipes and roof leaks.

Acoustics

The acoustic performance of a space can contribute to an occupant's feeling of well being. Unwanted noise can create conditions that make it difficult to concentrate. Consider acoustically isolating a building from its environment if that environment is too noisy. Acoustic nuisances include mechanical system noise, plumbing noise, and electrical noise. Acoustic privacy, that is the ability to speak without being overheard, is desirable but rarely achieved in environments that use systems furniture.

The Value of Daylight

Daylight is an important factor in a building's environmental performance. If properly used, daylight can reduce electrical demand, reduce cooling requirements, and contribute to improved occupant performance.
The quality of environments in and around buildings have been shown to have a direct impact on health, happiness and productivity of people. Healthier, happier, more effective and people contribute to sustainability by being more efficient and therefore reducing resource consumption and waste. However the quality of this environment needs to be achieved with minimal cost to the environment (Gibberd 2003; SBAT).

**Lighting**
All work and living environments must well daylit. Day lighting control and glare is to be minimised to ensure that no spaces require constant electrical lighting. Recommended lux levels for interior lighting is given in TABLE 5.

**Ventilation**
Required ventilation can provided by natural means, where mechanical ventilation used in buildings can be minimised or even abandoned altogether. Mechanical and passive systems can be designed to work in conjunction with each other to provide god results with little or no energy.

**Noise**
Noise levels limited in work and living environments to acceptable levels.

**Views**
All living and work areas have access to a view out. All users located in 6m or less from a window.

**Access to green outside**
Access to green outside spaces should be available.

### TABLE 5: RECOMMENDED LUX LEVELS FOR INTERIOR LIGHTING

<table>
<thead>
<tr>
<th>TYPES OF SPACES</th>
<th>LUX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circulation areas</td>
<td></td>
</tr>
<tr>
<td>Corridors, passageways</td>
<td>150</td>
</tr>
<tr>
<td>Lifts (passanger)</td>
<td>150</td>
</tr>
<tr>
<td>Stairs</td>
<td>150</td>
</tr>
<tr>
<td>Escalators</td>
<td>150</td>
</tr>
<tr>
<td>External covered ways</td>
<td>30</td>
</tr>
<tr>
<td>ENTRANCES</td>
<td></td>
</tr>
<tr>
<td>Halls, lobbies, waiting rooms</td>
<td>150</td>
</tr>
<tr>
<td>Enquiry desks</td>
<td>500</td>
</tr>
<tr>
<td>KITCHENS</td>
<td></td>
</tr>
<tr>
<td>Food stores</td>
<td>150</td>
</tr>
<tr>
<td>Working areas</td>
<td>500</td>
</tr>
<tr>
<td>Canteens, dining areas</td>
<td>200</td>
</tr>
<tr>
<td>Servery</td>
<td>300</td>
</tr>
<tr>
<td>OUTDOOR AREAS</td>
<td></td>
</tr>
<tr>
<td>Controlled entrances/ exits</td>
<td>150</td>
</tr>
<tr>
<td>Entrances/ exits</td>
<td>30</td>
</tr>
<tr>
<td>STAFF ROOMS</td>
<td></td>
</tr>
<tr>
<td>Changing, locker, wc etc</td>
<td>150</td>
</tr>
<tr>
<td>Cleaning rooms</td>
<td>150</td>
</tr>
<tr>
<td>STORES</td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>150</td>
</tr>
<tr>
<td>CAR PARKS</td>
<td></td>
</tr>
<tr>
<td>Underground</td>
<td>30</td>
</tr>
<tr>
<td>Multistory</td>
<td></td>
</tr>
<tr>
<td>Parking floors</td>
<td>30</td>
</tr>
<tr>
<td>Ramps</td>
<td>50</td>
</tr>
<tr>
<td>ASSEMBLY HALLS</td>
<td></td>
</tr>
<tr>
<td>Theatres and concert</td>
<td>100</td>
</tr>
<tr>
<td>Cinemas</td>
<td>50</td>
</tr>
<tr>
<td>Multipurpose</td>
<td>100-500</td>
</tr>
<tr>
<td>Foyers</td>
<td>75</td>
</tr>
<tr>
<td>LIBRARIES</td>
<td></td>
</tr>
<tr>
<td>Shelves</td>
<td>150</td>
</tr>
<tr>
<td>Reading tables</td>
<td>300</td>
</tr>
<tr>
<td>Reference library</td>
<td>500</td>
</tr>
<tr>
<td>SCHOOLS</td>
<td></td>
</tr>
<tr>
<td>Assembly halls, general</td>
<td>300</td>
</tr>
<tr>
<td>Platforms/ stage</td>
<td>special</td>
</tr>
<tr>
<td>Teaching spaces (general)</td>
<td>300</td>
</tr>
<tr>
<td>Lecture theatres</td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>300</td>
</tr>
<tr>
<td>Chalk board</td>
<td>500</td>
</tr>
<tr>
<td>Demo tables</td>
<td>500</td>
</tr>
<tr>
<td>Art rooms</td>
<td>500</td>
</tr>
<tr>
<td>Laboratories</td>
<td></td>
</tr>
<tr>
<td>Workshops</td>
<td>300</td>
</tr>
<tr>
<td>OFFICES</td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>500</td>
</tr>
<tr>
<td>Deep plan general</td>
<td>750</td>
</tr>
<tr>
<td>Business machine and typing</td>
<td>750</td>
</tr>
<tr>
<td>Conference</td>
<td>750</td>
</tr>
<tr>
<td>Executive offices</td>
<td>500</td>
</tr>
<tr>
<td>Banking halls</td>
<td></td>
</tr>
<tr>
<td>Working spaces</td>
<td>500</td>
</tr>
<tr>
<td>Public spaces</td>
<td>300</td>
</tr>
<tr>
<td>Computer rooms</td>
<td>500</td>
</tr>
<tr>
<td>Drawing offices</td>
<td></td>
</tr>
<tr>
<td>Drawing boards</td>
<td>750</td>
</tr>
<tr>
<td>SHOPS</td>
<td></td>
</tr>
<tr>
<td>Conventional with counters</td>
<td>500</td>
</tr>
<tr>
<td>Wall displays</td>
<td>500</td>
</tr>
<tr>
<td>Self service</td>
<td>500</td>
</tr>
<tr>
<td>Supermarkets</td>
<td>500</td>
</tr>
<tr>
<td>Hypermarkets</td>
<td>500-1000</td>
</tr>
<tr>
<td>Showrooms</td>
<td>500</td>
</tr>
<tr>
<td>General</td>
<td>500</td>
</tr>
<tr>
<td>Arcades and circulation</td>
<td>100-200</td>
</tr>
</tbody>
</table>
3.6.2 _INCLUSIVE ENVIRONMENTS_

“Buildings can be designed to accommodate everyone, or specially designed buildings need to be provided. Ensuring that buildings are inclusive supports sustainability as replication is avoided and change of use supported”. (Gibberd 2003; SBAT)

**Public Transport**

Building is located 100, or less metres to disabled accessible public transport

**Routes**

All routes between and within buildings of a smooth and even surface (ie easily navigable by wheelchair)

**Changes in level**

Changes in level between or within buildings are catered for with appropriate ramps of 1:12 fall by use of the elderly and disabled, as well as the provision of lifts.

**Edges**

All edges ie between walls and floors and stair nosings must be clearly distinguished through the use of contrasting colour (For visually impaired)

**Toilets**

Required number of disabled toilets provided
3.6.3 _ACCESS TO FACILITIES_

“Convention living and working patterns requires regular access to a range of services. Ensuring that these services can be accessed easily and in environmentally friendly ways supports sustainability by increasing efficiency and reducing environmental impact.” (Gibberd 2003; SBAT)

**Childcare**
Childcare provided in building development or can be catered for within a 1km radius of the building.

**Banking**
Banking services (ie ATM) provided in building.

**Retail**
Grocery, items required on a day to day basis available in building or close by (within 3km). Informal and formal trade allows for the provision of daily goods to be purchased readily.

**Communication**
Postal, telephone or email facilities provided in the building.

**Residential**
Home, for occupants of the building is within 12km. Ease of access to the area is maintained through effective transport facilities of the precinct, as well as the presence of nearby residential areas.
3.7 _ECONOMIC ISSUES

3.7.1 _LOCAL ECONOMY

The development of a particular area can stimulate growth of the economy whilst providing employment opportunities and contribute to the development of local skills and resources. For the development to maintain a sustainable approach, it should adopt the following principles in order for its success:

**Local contractors**
Contractors based within 40km of the building/refurbishment should carry out 80% of the construction. This figure should be a mixture of a skilled to unskilled labour force, whilst allowing the opportunity for training programmes and educational tasks to take place.

**Local building material supply**
80% of construction materials: cement, sand, bricks etc must be produced within 200km of site. The adaptive use of the existing rail on the site can be used to minimise transport needs, whilst limiting the number of construction vehicles to and from the site.

**Local component manufacturer**
80% of building components ie windows and doors should be produced locally (within 200km)

**Outsource opportunities**
Opportunities created and provision provided for small emerging businesses. This includes outsourcing catering, cleaning services and security as well as making space and equipment available for businesses to use for retail, education etc.

**Repairs and maintenance**
All repairs and maintenance required by the building (including servicing of mechanical plant) can be carried out by contractors within 200km of site.

**Efficiency of Use**
Effective and efficient use of buildings supports sustainability by reducing waste and the need for additional buildings. The use of space is very important, and should be minimised to control costs.

**Useable space**
Non-useable space such as bathrooms, plant rooms and circulation should not make up more than 20% of total area. Some spaces can also be adaptive, that they be used for more than one function when necessary.

**Occupancy**
Building and all working/living spaces should be occupied for an average equivalent minimum of 30 hours per week to ensure efficiency.

**Space use**
Use of space intensified through space management approach and policy such as shared work spaces ie ‘hot-desking’.

**Use of technology**
Communications and information technologies used to reduce space requirements ie video conference, teleworking etc.

**Space management**
Policy to ensure that space is well used. This may include regular audits, or space management system that charges space to cost centres.
3.7.2 _ADAPTABILITY AND FLEXIBILITY

Most buildings can have a life-span of at least 50 years. It is likely that within this time that the use of the building will change, or that the feasibility of this will be investigated. Buildings that can accommodate change easily supports sustainability by reducing the requirement for change (energy, costs etc) and the need for new buildings. (Gibberd 2003; SBAT)

**Vertical dimension**

Structural dimension (Floor to underside of roof, or slab of the floor above) should be a minimum of 3m. This ensures ease of change, good depth for future services, as well as comfortable environment for occupants for visual, acoustical, as well as thermal qualities.

**Internal partitions**

Internal partitions between living/work spaces are non-load bearing (ie non-load bearing brick /block or plasterboard partitions) and can be ‘knocked-out’ relatively easily.

**Services**

Easy access provided electrical, communication and (and HVAC, where appropriate) in each useable space. Provision made for enabling easy modification of system (ie addition subtraction of outlets)

3.7.3 _ONGOING COSTS

**Maintenance**

Specification and material specification for low maintenance and or low cost maintenance should be implemented at initial design stages to ensure their availability and guarantees. All plant and fabric have a maintenance cycle of at least 2 years. Low or no maintenance components (ie windows, doors, plant, ironmongery etc) should be selected. Maintenance can be carried out cost effectively and efficiently, with access to hard-to-reach areas provided for cleaning etc..

**Security / care taking**

Measures must be taken to limit the requirement and costs of security. This should include mixed-use development to ensure that occupied neighbouring buildings overlook the buildings and spaces. Another useful system would be to ensure that some activities be placed in such a way that they either reuse spaces at night, or facilities are located such that the building is always occupied.

**Insurance / water / energy / sewerage**

Costs of insurance, water, energy and sewerage should be monitored. Consumption and costs must be regularly reported to management and users. Policy and management to reduce consumption (ie switching off lights on leaving building spaces) implemented, whereas passive systems can be used for the control of energy-saving, such as polar voltaic cells that control ventilators or supply night-lighting through energy-efficient controls.

**Disruption and ‘downtime’**

Electrical and communication services, HVAC and plant located where they can be easily accessed with a minimum of disruption to occupants of building. This should be the maximising of access to this from circulation areas (rather than work/living areas) and lift-off panels at regular intervals to vertical and horizontal ducting.
3.8 _ENVIRONMENTAL ISSUES

3.8.1 _ENVIRONMENTAL ARCHITECTURE

Five principles of an environmental architecture (Thomas; 1992):

• **Healthful Interior Environment.** All possible measures are to be taken to ensure that materials and building systems do not emit toxic substances and gasses into the interior atmosphere. Additional measures are to be taken to clean and revitalize interior air with filtration and plantings.

• **Energy Efficiency.** All possible measures are to be taken to ensure that the building’s use of energy is minimal. Cooling, heating and lighting systems are to use methods and products that conserve or eliminate energy use.

• **Ecologically Benign Materials.** All possible measures are to be taken to use building materials and products that minimize destruction of the global environment. Wood is to be selected based on non-destructive forestry practices. Other materials and products are to be considered based on the toxic waste out put of production.

• **Environmental Form.** All possible measures are to be taken to relate the form and plan of the design to the site, the region and the climate. Measures are to be taken to “heal” and augment the ecology of the site. Accommodations are to be made for recycling and energy efficiency. Measures are to be taken to relate the form of building to a harmonious relationship between the inhabitants and nature.

• **Good Design.** All possible measures are to be taken to achieve an efficient, long lasting and elegant relationship of use areas, circulation, building form, mechanical systems and construction technology. Symbolic relationships with appropriate history, the Earth and spiritual principles are to be searched for and expressed. Finished buildings shall be well built, easy to use and beautiful.

<table>
<thead>
<tr>
<th>DESIGN</th>
<th>SITING &amp; LAND USE</th>
<th>MATERIALS</th>
<th>EQUIPMENT</th>
<th>JOB SITE &amp; BUSINESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smaller is better</td>
<td>Renovate older buildings</td>
<td>Avoid ozone-depleting chemicals in mechanical equipment and insulation</td>
<td>Install high-efficiency heating and cooling equipment</td>
<td>Protect trees and topsoil during site work</td>
</tr>
<tr>
<td>Design an energy-efficient building</td>
<td>Create community</td>
<td>Use durable products and materials</td>
<td>Install high-efficiency lights and appliances</td>
<td>Avoid use of pesticides and other chemicals that may leach into the groundwater</td>
</tr>
<tr>
<td>Design buildings to use renewable energy</td>
<td>Encourage in-fill and mixed-use development</td>
<td>Choose low-maintenance building materials</td>
<td>Install water-efficient equipment</td>
<td>Minimize job-site waste</td>
</tr>
<tr>
<td>Optimize material use</td>
<td>Minimize automobile dependence</td>
<td>Choose building materials with low embodied energy</td>
<td>Install mechanical ventilation equipment</td>
<td>Make your business operations more environmentally responsible</td>
</tr>
<tr>
<td>Design water-efficient, low-maintenance landscaping</td>
<td>Value site resources</td>
<td>Buy locally produced building materials</td>
<td></td>
<td>Make education a part of your daily practice</td>
</tr>
<tr>
<td>Make it easy for occupants to recycle waste</td>
<td>Locate buildings to minimize environmental impact</td>
<td>Use building products made from recycled materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Look into the feasibility of “gray water”</td>
<td>Provide responsible onsite water management</td>
<td>Use salvaged building materials when possible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design for durability</td>
<td>Situate buildings to benefit from existing vegetation</td>
<td>Seek responsible wood supplies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design for future reuse and adaptability</td>
<td>Avoid materials that will give off gas pollutants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avoid potential health hazards: radon, mold, pesticides</td>
<td>Minimize use of pressure-treated lumber</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minimize packaging waste</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 6: ENVIRONMENTAL ISSUES FOR CONSIDERATION**
Based on the objectives of the Building Research Establishment’s Environmental Assessment Method (BREEAM)

The principles are:

- demolish and rebuild only when it is not economical or practicable to reuse, adapt or extend an existing structure;
- reduce the need for transport during demolition, refurbishment and construction and tightly control all processes to reduce noise, dust, vibration, pollution and waste;
- make the most of the site, e.g. by studying its history and purpose, local micro-climates and the prevailing winds and weather patterns, solar orientation, provision of public transport and the form of surrounding buildings;
- design the building to minimize the cost of ownership and its impact on the environment over its life span by making it easily maintainable and by incorporating techniques and technologies for conserving energy and water and reducing emissions to land, water and air;
- wherever feasible, use the construction techniques which are indigenous to the area, learning from local traditions in materials and design;
- put the function of the building and the comfort of its occupants well before any statement it is intended to make about the owner or its designer. That is, make it secure, flexible and adaptable (to meet future requirements) and able to facilitate and promote communications between staff;
- build to the appropriate quality and to last. Longevity depends much on form, finishes and the method of assembly employed as on the material used;
- avoid using materials from non renewable sources or which cannot be reused or recycled, especially in structures which have a short life;
- (SABD)
3.8.2 _ECOLOGICAL BUILDING_

This movement aims to create environmentally friendly, energy-efficient buildings and developments by effectively managing natural resources. This entails passively and actively harnessing solar energy and using materials which, in their manufacture, application, and disposal, do the least possible damage to the so-called ‘free resources’ water, ground, and air.

A building can be compared to the qualities of an organism when one relates the effects of the environment to a building itself. An organism makes use of immediately and local materials to construct itself, and does so with economy and efficiency. The same strategies when used in development can minimise global and local impacts on resources.

The organism adapts to its environment through instinctive reaction and an evolutionary process of generations. Through the ability to rationalise and mechanise, humans have the ability to adapt psychologically and physically in a matter of hours, but with little instinct for harmony with the environment.

The organism however, maintains a harmonious relationship with its environment by establishing a balance between its needs and available resources. Similarly, the ecologically sensitive design adjusts demands, lifestyles and technologies to evolve a compatible balance with the natural and cultural systems within its environment.

### TABLE 7: ENVIRONMENTAL ISSUES FOR CONSIDERATION

<table>
<thead>
<tr>
<th>Environment</th>
<th>Building Fabric</th>
<th>Building Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free air</td>
<td>- Natural</td>
<td>Direct</td>
</tr>
<tr>
<td></td>
<td>ventilation</td>
<td>- Electrically driven</td>
</tr>
<tr>
<td></td>
<td>- Wind force</td>
<td>chiller</td>
</tr>
<tr>
<td></td>
<td>- Energy</td>
<td>- Absorption chiller</td>
</tr>
<tr>
<td></td>
<td>content</td>
<td>- Gas-motor driven</td>
</tr>
<tr>
<td></td>
<td>Stack effect</td>
<td>chiller</td>
</tr>
<tr>
<td></td>
<td>Solar energy,</td>
<td>- Cooling towers</td>
</tr>
<tr>
<td></td>
<td>diffuse</td>
<td>- Tandem systems</td>
</tr>
<tr>
<td></td>
<td>radiation</td>
<td></td>
</tr>
<tr>
<td>Solar energy,</td>
<td>direct</td>
<td></td>
</tr>
<tr>
<td></td>
<td>daylighting</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Soil</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aquifer</td>
<td>- Heat storage</td>
<td>Direct</td>
</tr>
<tr>
<td></td>
<td>- Cool storage</td>
<td>- District heating</td>
</tr>
<tr>
<td></td>
<td>- Groundwater</td>
<td>- Boiler (gas, oil,</td>
</tr>
<tr>
<td></td>
<td>- Cold energy</td>
<td>coal, biogas,</td>
</tr>
<tr>
<td></td>
<td>- Heat energy</td>
<td>condensing)</td>
</tr>
<tr>
<td></td>
<td>Earth/rock</td>
<td>- Electric boiler (w</td>
</tr>
<tr>
<td></td>
<td>- Geothermal</td>
<td>ith storage)</td>
</tr>
<tr>
<td></td>
<td>cooling</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Heat energy</td>
<td>- Solar thermal system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Combined heat and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>power (CHP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Heat pumps</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Flue gas heat exchanger</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Water surfaces</strong></td>
<td></td>
<td>Indirect</td>
</tr>
<tr>
<td>Lake/ River/ Sea</td>
<td>- Pump water or</td>
<td>- Mains supply</td>
</tr>
<tr>
<td></td>
<td>greywater</td>
<td>- Commercial power</td>
</tr>
<tr>
<td></td>
<td>- Heat energy</td>
<td>supply utilities</td>
</tr>
<tr>
<td></td>
<td>- Cold energy</td>
<td>- Self supply</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Combined heat and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>power (CHP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Emergency generator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Photovoltaic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Tandem system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Wind energy generator</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Atria</strong></td>
<td></td>
<td>Indirect</td>
</tr>
<tr>
<td>- Green zones</td>
<td>- Evaporative</td>
<td>- Pure water</td>
</tr>
<tr>
<td></td>
<td>cooling</td>
<td>- Public supply (drinking,</td>
</tr>
<tr>
<td></td>
<td>- Passive solar</td>
<td>cooking)</td>
</tr>
<tr>
<td></td>
<td>energy</td>
<td>- Greywater</td>
</tr>
<tr>
<td></td>
<td>- Heat buffer</td>
<td>- Waste water (condenser</td>
</tr>
<tr>
<td></td>
<td></td>
<td>water, flushing, cleaning)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Rainwater</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Flushing, cleaning, cooling</td>
</tr>
<tr>
<td><strong>Electrical energy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Mains supply</td>
<td>- Energy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Supply (drinking,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>cooking)</td>
<td></td>
</tr>
</tbody>
</table>

**Table 7: Environmental Issues for Consideration**
3.8.3 _GREEN BUILDING

Green Building architecture considers all the resources that are involved in the design, construction and performance of a building throughout its entire life-cycle, involves resolving many conflicting issues and requirements, and each design decision has environmental implications.

Measures for green buildings can be divided into four areas:

- Reducing energy in use
- Minimizing external pollution and environmental damage
- Reducing embodied energy and resource depletion
- Minimizing internal pollution and damage to health

In turn, “Green design” emphasizes a number of new environmental, resource and occupant health concerns:

- Reduce human exposure to noxious materials.
- Conserve non-renewable energy and scarce materials.
- Minimize life-cycle ecological impact of energy and materials used.
- Use renewable energy and materials that are sustainably harvested.
- Protect and restore local air, water, soils, flora and fauna.
- Support pedestrians, bicycles, mass transit and other alternatives to fossil-fuelled vehicles.

Most green buildings are high-quality buildings; they last longer, cost less to operate and maintain, and provide greater occupant satisfaction than standard developments.
3.8.4.1 The thermal performance of buildings

Most of the energy consumed by commercial buildings is devoted to heating, cooling and lighting. Sustainable design affords opportunities to reduce these loads while increasing the comfort and productivity of the occupants. The sun can provide light wherever possible. Solar heat that is retained by masses of concrete and masonry can reduce the demand on the HVAC (Heating Ventilation and Air Conditioning) system. Sustainable design considers all the structural elements and mechanical systems of a structure and optimizes how they work together in a productive whole.

The thermal performance of a building may be defined as the result of the process whereby the design, layout, orientation and construction materials of the building modify the prevailing outdoor climate to create the indoor climate. In a house this is generally perceived by the occupants in terms of the extent to which the house seems cool in the heat of summer and warm in cold winter weather, taking into account the amount of heating or cooling required to create comfortable thermal conditions.

3.8.4.2 Understanding Heat transfer

With buildings, we refer to heat flow in a number of different ways. The most common reference is “R-value,” or resistance to heat flow. The higher the R-value of a material, the better it is at resisting heat loss (or heat gain). U-factor (or “U-value,” as it is often called) is a measure of the flow of heat--thermal transmittance--through a material, given a difference in temperature on either side.

Thermal performance can be expressed in numerical or quantitative terms in various ways. The information evaluated is aimed to arrive at:

- maximum indoor temperatures in summer
- the amount of energy required to maintain a minimum temperature throughout the winter months

The energy required to maintain a minimum temperature (16 °C) throughout the winter months is expressed in kWh/m2 year.

3.8.4.3 Heat absorbing capacity and thermal insulation

Two properties of a building have a major influence on its thermal performance: its heat absorbing capacity and the thermal resistance of its shell. The values for each of these varies from one construction material to another (eg burnt clay bricks, timber, steel, concrete, etc) and the way in which the material is used (ie cavity or solid walls, single or double glazing, etc).

The heat absorbing capacity of a building element depends partly on its mass and the density of the material from which it has been made. The greater the density and hence the mass of the external and internal walls, the more heat can be absorbed.
The insulating properties of a material or building element depend on the extent to which it limits the transmission of heat through it. The ability of a building component such as a wall to transmit heat is expressed as the U-value of the component.

The U-value of building components is defined as the amount of heat transmitted in watts per square metre per degree Celsius difference in temperature between air on one side of the component and air on the other side of the component. The U-value, therefore, takes into consideration the thermal transmittance of both surfaces of the component as well as the thermal transmittance of individual layers and air spaces that may be contained within the component itself.

The heat absorbing capacity and the insulating property of each material used determines the heat storage capacity of a building.

The relative importance of each of these properties in providing a pleasant indoor thermal environment depends on the climate of the area in which the building is erected. In cold and cool climates, buildings with low U-values (ie where heat will not pass through the external walls and roof to the outside easily) will be easier to heat and to maintain at comfortable thermal levels than buildings with high U-values.

In dry areas with wide diurnal variations in outdoor temperatures, a building with a greater heat storage capacity will tend to even out the effect of the outdoor fluctuations in temperature by absorbing and storing heat during the day without passing much of the heat to the inside of the building, but gradually losing heat to the indoor and outdoor environment at night.

**TABLE 8: TYPICAL U-VALUES OF WALLS**

<table>
<thead>
<tr>
<th>TYPE OF CONSTRUCTION</th>
<th>U-VALUE [W/m² °C]</th>
</tr>
</thead>
<tbody>
<tr>
<td>270 mm thick imperial brick cavity wall (110-50-110) plastered on the interior face</td>
<td>1.7</td>
</tr>
<tr>
<td>230mm thick imperial brick solid wall plastered on both sides</td>
<td>2.1</td>
</tr>
<tr>
<td>150 mm thick hollow concrete block wall bagged on both sides</td>
<td>3.2</td>
</tr>
<tr>
<td>140mm solid concrete brick plastered externally</td>
<td>3.7</td>
</tr>
<tr>
<td>82mm thick insulated lightweight wall: steel frame clad on both sides with 9mm thick unpressed fibre-cement sheets and the 64mm space between sheets filled with mineral wool insulation</td>
<td>0.6</td>
</tr>
<tr>
<td>82mm thick insulated lightweight wall: steel frame clad on both sides with 9mm thick unpressed fibre-cement sheets and 25mm thick mineral wool insulation in 64mm space between sheets</td>
<td>1.0</td>
</tr>
</tbody>
</table>
3.8.4.5 Commercial and Industrial Building Use of Energy

- Lighting 31%
- Space Heating 22%
- Space Cooling 18%
- Water Heating 7%
- Office Equipment 6%
- Other 6%
- Ventilation 6%
- Refrigeration 3%
- Cooking 2%

Source: U.S. Energy Information Administration

3.8.4.6 Energy Efficiency

The benefits from the energy-efficient siting and design of buildings are economic, social and ecological. Typically, heating and cooling load reductions from better glazing, insulation, efficient lighting, daylighting and other measures allows smaller and less expensive HVAC equipment and systems, resulting in little or no increase in construction cost compared to conventional designs. Simulations are used to refine designs and ensure that energy-conservation and capital cost goals are met; and to demonstrate compliance with regulatory requirements.

3.8.4.7 Renewable Energy

Alternative energy sources:

primary renewable energy resources

- sun, wind, and biogas conversion.

Solar applications range from hotwater preheat to electric power production with photovoltaic cells. Wind-powered generators can provide electricity and pumping applications in some areas.
3.8.5 WATER

The principles of sustainable design apply, without reservation, to all types of climates. In an park or tourism development, where health considerations are paramount, water issues center on providing safe drinking, washing, cooking, and toilet flushing water.

Water is required for many activities. However the large-scale provision of conventional water supply has many environmental implications. Water needs to be stored (sometimes taking up large areas of valuable land and disturbing natural drainage patterns with associated problems from erosion etc), it also needs to be pumped (using energy) through a large network of pipes (that need to be maintained and repaired). Having delivered the water, a parallel efforts is then required to dispose of this after it is used, ie sewerage systems. Reducing water consumption supports sustainability by reducing the environmental impact required to deliver water, and dispose of this after use in a conventional system (Gibberd 2000; SBAT).

**Rainwater**
Rainwater is harvested, stored and used.

**Water use**
Water efficient devices

**Grey water**
Grey water (water from washing etc) recycled (to flush toilets or water plants)

**Runoff**
Run off reduced by using pervious or absorbant surfaces. Hard landscaping minimised, previous surfaces specified for car parking and paths.

**Planting**
Planting has low water requirement (indigenous species)

### TABLE 10: WATER CONSERVATION METHODS

<table>
<thead>
<tr>
<th>Toilets</th>
<th>Urinals</th>
<th>Wash hand basins</th>
<th>Shower</th>
<th>Outside and garden</th>
<th>Clothes Washers</th>
<th>Water supply</th>
<th>Rain water and grey water</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Low flush toilets</td>
<td>Urinal controls (infrared, radar, autoflush)</td>
<td>Push taps</td>
<td>Shower mixers</td>
<td>Water saving washers</td>
<td>Water control</td>
<td>Auto shut off and pressure regulators</td>
<td>Rainwater recycling systems</td>
</tr>
<tr>
<td>- Dual flush toilets (3/6 litres)</td>
<td>Waterless urinals</td>
<td>Flow control, self closing</td>
<td>Water saving showerheads</td>
<td>Control &amp; usage</td>
<td>Self closing shower system</td>
<td></td>
<td>Grey water recycling systems</td>
</tr>
<tr>
<td>- Vacuum or compressed air toilets</td>
<td>Tap flow regulators</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) Cistern displacement devices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3) Waterless toilets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Composting toilets (heated or unheated)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Incinerating toilets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.8.6 _SITE DESIGN

Site design is a process of intervention involving the location of circulation, structures, and utilities, and making natural and cultural values available to visitors. The process encompasses many steps from planning to construction, including initial inventory, assessment, alternative analysis, detailed design, and construction procedures and services.

### 3.8.6.1 Factors

The programmatic requirements and environmental characteristics of sustainable tourism development will vary greatly, but the following factors should be considered in site selection:

- **Capacity** - for structures and human activity based on the sensitivity of site resources and the ability of the land to regenerate.
- **Density** - concentration versus dispersal.
- **Climate** - human comfort and protecting the facility from climatic forces.
- **Slopes** - costly construction practices, soil erosion, loss of hillside vegetation, and damage to fragile wetland and marine ecosystems.
- **Vegetation** - avoid habitat fragmentation and canopy loss.
- **Views** - critical and reinforce a visitor experience, maximize views of natural features and minimize views of visitor and support facilities.
- **Natural Hazards** - consideration of precipitous topography, dangerous animals and plants, and hazardous water areas and controlled access.
- **Access to natural and Cultural Features** - maximize pedestrian access to resources and recreational activities. Low impact development is the key to protecting vital resource areas.
- **Traditional Activities** - compatible with traditional agricultural, fishing, and hunting activities and responsive to the local economy.
- **Energy and Utilities** - connections to offsite utilities and spatial needs for onsite utilities, potential for alternative energy use: solar- and wind-based energy systems.
- **Separation of Support Facilities from Public Use Areas** - Safety, visual quality, noise, and odor separated from public use and circulation areas.
- **Proximity of Goods, Services, and Housing** - availability of goods and services and the costs involved in providing them.

### 3.8.6.2 Site Access

- pedestrian, transit systems, private vehicles
- Road Design and Construction
- Other Access Improvements

Core Site Access
3.8.6.3 Utilities and Waste Systems

- **Utility Systems**: Development requires sanitary facilities for human waste and provisions for water, electricity, gas, heating, cooling, ventilation, and storm drainage that will not adversely affect the environment and will work within established natural systems. Careful planning and design is required to address secondary impacts such as soil disturbance and intrusion on the visual setting.

- **Utility Corridors**: Utility lines should be buried near other corridor areas that are already disturbed, such as roads and pedestrian paths and not be located in desirable viewsheds or over landform crests.

- **Utility System Facility Siting**: Reducing scale, dispersals of facilities, and the use of terrain or vegetative features to visually screen intrusive structures. Odor and noise are strong nuisance factors that must be addressed by location and buffering. Also, the insulation of mechanical equipment that can have acoustical impacts should be considered.

- **Night Lighting**: Limit night lighting to the minimum necessary for safety. Low voltage lighting with photovoltaic collectors should be considered as an energy-efficient alternative. Light fixtures should remain close to the ground, avoiding glare from eye level fixtures.

- **Storm Drainage**: To regulate runoff to provide protection from soil erosion and avoid directing water into unmanageable volumes. Removal of natural vegetation, topsoil, and natural channels that provide natural drainage control should always be avoided. An alternative would be to try and stabilize soils, capture runoff in depressions (to help recharge groundwater supply), and re-vegetate areas to replicate natural drainage systems.

- **Irrigation Systems**: Restoration projects should consider the use of ultraviolet-tolerant irrigation components laid on the surface of the soil and removed when native plants have become established. Irrigation piping can be reused on other restoration areas or incorporated into future domestic hydraulic systems. Captured rain water, recycled grey water, or treated effluent could be used as irrigation water.

- **Waste Treatment**: It is important to use treatment technologies that are biological, nonmechanical, and do not involve soil leaching or land disposal that causes soil disturbance. Constructed biological systems are being put to use increasingly to purify wastewater. They offer the benefits of being environmentally responsive, nonpolluting, and cost-effective.

3.8.6.4 Site-Adaptive Design Considerations

- Site components should respond to the indigenous spatial character, climate, topography, soils, and vegetation as well as compatibility with the existing cultural context.

3.8.6.5 Natural Characteristics

- Important to understand natural systems and the way they interrelate in order to work within these constraints with the least amount of environmental impact:

  - **Wind**: Cooling aspect / “natural” air conditioning
  - **Sun**: Provide shade for human comfort and safety in activity areas (e.g., pathways patios). Use natural vegetation, slope aspects, or introduced shade structures. Natural light and solar energy are important considerations to save energy and showcase environmental responsive solutions.
• **Rainfall** - Rainfall should be captured for a variety of uses (e.g., flushing toilets, washing clothes). Wastewater or excess runoff to be channeled and discharged for groundwater recharge and limit soil erosion. Natural drainage-ways protect the environment as well as the structure.

• **Topography** - Topography can potentially provide vertical separation and more privacy for individual structures. Changes in topography can also enhance and vary the way a visitor experiences the site by changing intimacy or familiarity. Protection of native soil and vegetation.

• **Geology and Soils** - Soil disturbances to be kept to a minimum to avoid erosion of soils and discourage growth of exotic plants.

• **Vegetation** - Exotic plant materials are disadvantages to healthy native ecosystems. Sensitive native plant species need to be identified and protected. Existing vegetation to encourage biodiversity and to protect the nutrients held in the biomass of native vegetation.

• **Visual Character** - Natural vistas to be used in design whenever possible. Use native building material, blend structures within the vegetation, and work with the topography.

### 3.8.6.6 Cultural Context

Local archeology, history, and people are the existing matrix into which visitation must fit. Sustainable principles seek balance between existing cultural patterns with new development. Developing an understanding of local culture and seeking their input in the development processes can make the difference between acceptance and failure.

- **Archaeology** - Archeological survey prior to development to preserve resources. They can be incorporated into designs as an educational or interpretive tool. If discovered during construction activities, work should be stopped and the site reevaluated. Sacred sites must be respected and protected.

- **History** - Cultural history should be reinforced through design by investigating and then interpreting vernacular design vocabulary. Local design elements and architectural character should be analyzed and employed to establish an architectural theme for new development.

- **Indigenous Living Cultures** - Cultural traditions should be encouraged and nurtured. A forum should be provided for local foods, music, art and crafts, lifestyles, dress, and architecture, as well as means to supplement local incomes (if acceptable). Traditional harvesting of resource products should be permitted to reinforce the value of maintaining the resource.
3.8.6.7 Designing with climate

In a hot dry climate, sun protection is essential (we need shade, and pale surfaces to reflect the sun’s radiation). Shading can reduce glare and reflected heat from these pale surfaces from eaves, verandas and from vegetation. Trees are Nature’s own evaporative coolers - perfect for the dry climate, if water supply permits. Trees will also filter blowing dust from the air.

FIG. 3.8.6.7.2  Psychrometric chart showing the enlarged comfort zone obtained by supplying thermal mass to the structure. The combined effect of ventilation and thermal mass is also shown. Night structural cooling is optional.

FIG. 3.8.6.7.3  Psychrometric chart showing the comfort zone’s position relative to the climatic lines - Pretoria.

FIG. 3.8.6.7.1 The natural elements that affect a person’s environment.
3.8.7 _MATERIALS_

3.8.7.1 Embodied Energy

“*The quantity of energy required by all the activities associated with a production process, including the relative proportions consumed in all activities upstream to the acquisition of natural resources and the share of energy used in making equipment and other supporting functions. i.e. direct plus indirect energy.*”

Embodied energy is all the energy required to extract, manufacture and transport a building’s materials as well as that required to assemble and ‘finish’ it. As buildings become increasingly energy efficient, the energy required to create them becomes proportionately more significant in relation to that required to run them.

Some modern materials, such as aluminum, consume vast amounts of energy in their manufacture. The common building material with least embodied energy is wood, with about 640 kilowatt-hours per ton (most of it consumed by the industrial drying process, and some in the manufacture of and impregnation with preservatives). Therefore, the greenest building material is wood from sustainably managed forests. Brick is the material with the next lowest amount of embodied energy, 4 times (X) that of wood, then concrete (5 X), plastic (6X), glass (14X), steel (24X) and aluminum (126X).

A building with a high proportion of aluminum components can hardly be green when considered from the perspective of total life cycle costing, no matter how energy-efficient it might be. From the perspective of embodied energy, every building, no matter what its condition, has a large amount of energy locked into it. This is yet another factor in favor of conserving and restoring old buildings, and for designing long life, loose fit buildings that easily accommodate change. Also, because the energy used in transporting its materials becomes part a building’s embodied energy, this is an incentive to use local materials, thus helping the building to be embedded in place.

The energy input required to quarry, transport and manufacture building materials, plus the energy used in the construction process, can amount to a quarter of the ‘lifetime’ energy requirement of a very energy-efficient building. To reduce embodied energy, without compromising longevity or efficiency:

- re-use existing buildings and structures wherever possible (provided their energy costs in use can be reduced to an acceptable level).
- design buildings for long life, with ease of maintenance and adaptability to changing needs
- construct buildings and infrastructure out of local and low-energy materials where possible
- reduce the proportion of high rise, detached or single-storey developments
- design layouts which minimise the extent to roadway and utility pipework per dwelling
### TABLE 11: EMBODIED ENERGY OF SOME MATERIALS

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>MJ/kg</th>
<th>MJ/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate</td>
<td>0.1</td>
<td>150</td>
</tr>
<tr>
<td>Straw bale</td>
<td>0.24</td>
<td>91</td>
</tr>
<tr>
<td>Soil-cement</td>
<td>0.42</td>
<td>819</td>
</tr>
<tr>
<td>Stone (local)</td>
<td>0.79</td>
<td>2030</td>
</tr>
<tr>
<td>Concrete block</td>
<td>0.94</td>
<td>2950</td>
</tr>
<tr>
<td>Concrete (30Mpa)</td>
<td>1.3</td>
<td>3180</td>
</tr>
<tr>
<td>Concrete precast</td>
<td>2.0</td>
<td>2780</td>
</tr>
<tr>
<td>Lumber</td>
<td>2.5</td>
<td>1380</td>
</tr>
<tr>
<td>Brick</td>
<td>2.5</td>
<td>5170</td>
</tr>
<tr>
<td>Cellulose insulation</td>
<td>3.3</td>
<td>112</td>
</tr>
<tr>
<td>Gypsum wallboard</td>
<td>6.1</td>
<td>5890</td>
</tr>
<tr>
<td>Particle board</td>
<td>8.0</td>
<td>4400</td>
</tr>
<tr>
<td>Aluminium (recycled)</td>
<td>8.1</td>
<td>21870</td>
</tr>
<tr>
<td>Steel (recycled)</td>
<td>8.9</td>
<td>37210</td>
</tr>
<tr>
<td>Shingles (asphalt)</td>
<td>9.0</td>
<td>4990</td>
</tr>
<tr>
<td>Plywood</td>
<td>10.4</td>
<td>5720</td>
</tr>
<tr>
<td>Mineral wool insulation</td>
<td>14.6</td>
<td>139</td>
</tr>
<tr>
<td>Glass</td>
<td>15.9</td>
<td>37550</td>
</tr>
<tr>
<td>Fibreglass insulation</td>
<td>90.3</td>
<td>970</td>
</tr>
<tr>
<td>Steel</td>
<td>32.0</td>
<td>251200</td>
</tr>
<tr>
<td>Zinc</td>
<td>51.0</td>
<td>371200</td>
</tr>
<tr>
<td>Brass</td>
<td>62.0</td>
<td>519580</td>
</tr>
<tr>
<td>PVC</td>
<td>70.0</td>
<td>93620</td>
</tr>
<tr>
<td>Copper</td>
<td>70.6</td>
<td>631164</td>
</tr>
<tr>
<td>Paint</td>
<td>93.3</td>
<td>117500</td>
</tr>
<tr>
<td>Linoleum</td>
<td>116</td>
<td>150930</td>
</tr>
<tr>
<td>Polystyrene insulation</td>
<td>117</td>
<td>3770</td>
</tr>
<tr>
<td>Carpet (synthetic)</td>
<td>148</td>
<td>84900</td>
</tr>
<tr>
<td>Aluminium</td>
<td>227</td>
<td>515700</td>
</tr>
</tbody>
</table>

Note: Embodied energy values are based on several international sources – local values may vary. These values are to be used as a guide only.
3.8.8 _WASTE_

“Waste - a resource in the wrong place” -- An old Chinese proverb.

3.8.8.1 Waste Management Strategies
- Waste prevention
- Recycling construction and demolition materials
- Architectural reuse (include adaptive reuse, conservative disassembly, and reusing salvaged materials)
- Design for material recovery (durability, disassembly, adaptive reuse)

3.8.8.2 Waste hierarchy:
- Sustainable development
- Prevention
- Reduction
- On-site reuse
- On-site recovery
- Off-site reuse
- Off-site recovery
- Landfill

3.8.8.3 Recycling and Reuse
Raw materials and new components used in buildings consume resources and energy in their manufacture and processes. Buildings accommodate activities that consume large amounts of resources and products and produce large amounts of waste. Reducing the use of new materials and components in buildings and in the activities accommodated and reducing waste by recycling and reuse supports sustainability by reducing the energy consumption and resource consumption.

Toxic waste
Arrangements made for the safe disposal / recycling of toxic/harmful substances ie batteries, printer toners, vehicle oil.

Inorganic waste
Arrangements for sorting, storage and pick up of recyclable waste.

Organic waste
Recycled on site ie compost

Sewerage
Contribution to mains sewerage from toilet minimised through use of compost toilets, and other ‘local’ systems

Construction waste:
Construction waste minimised through design careful management of construction practices. Design limits wastage by designing to comply with modular dimensions of materials etc.
3.8.9.1 Planning Process

- Site selection and planning
- Budget planning
- Capital planning
- Programme planning
- Building operation
- Maintenance practices
- Renovation
- Demolition

3.8.9.2 Design Process

- Client awareness and goal setting
- Green vision, project goals & green design criteria
- Team development
- Well-integrated design
- Resource management
- Performance goals

3.8.9.3 Operation & Maintenance

- Commissioning of building systems

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"Solving the environmental issues of the 21st century will require new approaches, not only in the measurement of progress, but also in the means of achieving it. We must improve the way we do business together by promoting teamwork instead of accepting confrontation." Final Report of the Pennsylvania 21st Century Environment Commission

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TABLE 12: Basic breakdown of the project process
_PRECEDENT STUDY SUMMARY

4.1 _FARADAY STATION - JOHANNESBURG 2003

ALBONICO + SACK ARCHITECTS AND URBAN DESIGNERS IN ASSOCIATION WITH MMA ARCHITECTS

This precinct was selected as a precedent study for its approach toward a South African identity in Architecture and use of materials. The functions of the precinct are also analysed in terms of being a catalyst for local development around an inter-modal orientated facility, where trade of the informal and formal sectors are able to combine in an element foreseen as a gateway to the city. Historical significance also plays a role in terms of buildings and movement patterns, with a strong focus on the encouragement of pedestrian movements.

4.2 _LE FRESNOY - National Studio for Contemporary Arts- tourcoing, france 1997

BERNARD TSCHUMI

An interesting approach to this redevelopment project results in a successful combination of old and new architectures, whilst maintaining the authenticity of the styles. Here an over-arching roofing element brings the building together as a whole, expressing the theme of "in-between". The design approach is further expressed through an interesting conceptual philosophy that combines cinema and architecture, resulting in Tschumi’s hypothesis that architecture can be defined, and therefore associated through three elements, namely “space”, “movement”, and “use”.

4.3 _BRE LOW ENERGY BUILDING - GARSTON, UNITED KINGDOM 1997

FEILDEN CLEGG ARCHITECTS

This experimental project is appropriate for the investigation of low-energy, comfortable and healthy workplaces. In terms of passive heating and cooling strategies, this building adopts systems that rely on the environment as the primary source of energy, while reducing the needs for mechanically operated and high-energy use systems. The systems employed to the architecture assist in ventilation and cooling, solar control and daylight, and the use of photovoltaic cells as an energy source.
4.4 _KANSAI INTERNATIONAL AIRPORT - OSAKA BAY, JAPAN 1994

RENZO PIANO

As a modern public building, this airport expresses its functions through its form and the use of high-tech materials and appropriate construction detail techniques. The structural roofing system, comprising of a number of elements that hold space frames in an appropriate form and order, ultimately produce the elegance of this building. Furthermore, the form of this structure assists in the natural movement of air (airflows), minimising the needs for additional HVAC vents.

4.5 _CAPE TOWN INTERNATIONAL CONVENTION CENTRE - CAPE TOWN 2003

FORESHORE ARCHITECTS

This building plays an important role as a national an international symbol to the city of Cape Town and South Africa as a whole. Its status strives toward first-world standards, as a congregator of social and political affairs, maintaining its presence to be that of a gateway, a catalyst, and a connector. The program and positioning of functions as a response to the dominant characteristics of the site and of the building is studied, as well as the approaches toward environmentally conscious design techniques.
The search for a South African identity becomes evident in the appropriate application of materials, structure and form within a particular context. Local materials and craftsmanship can be applied to give unique characteristics to a building, such as in the case of the Faraday Station, where the celebration of the transient commuter culture and capturing of the memory through historical significance reinforce the “genius loci” - the spirit of the place.

The development of this precinct is to act as a catalyst to further development in the area, whilst satisfying the local council’s requirements of providing facilities for holding and ranking taxis, as well as informal traders. It has been placed in such a way as to allow for easy vehicular access to adjacent highways, whilst maximising the number of ‘opportunity sites’ that can be created between the rank, the CBD, and other modes of transport such as trains and buses.

The architectural character aims to maintain the character of buildings that have contextual or historical relevance to the city, promote the maintenance of a close building-street relationship and the concept of containment, promote the use of appropriate technology and incorporate the principles of sustainability.

“...to provide public amenities and to maximise interpersonal encounters and socialbility” (SAIA 2003; pg20)
The main public-space functions as a threshold between various transport destinations, creating the opportunity for a focal point and gateway to the city - a space freed for social and cultural interaction. A further design intention is to reveal the history and significance of Faraday as one of the first black urban footholds through a programme of public art, allowing for community participation and inclusion of the precinct.

The facility allows for the activation of the street edges by placing retail facilities along these routes, providing for maximum legibility and accessibility. One of the main aims of this project is “to provide public amenities and to maximise interpersonal encounters and socialability” (SAIA 2003; pg20) through the creation of systems that interlock spaces of different scale and purpose structured into a linear system, which is designed to accommodate a range of conditions.

The precinct has also been designed to encourage pedestrian movement into and through the facility and nearby amenities. This would include an extension to an existing pedestrian system and allow for linear markets, encouraging the freeing of pedestrian sidewalks that are safer and more pleasant to walk on.
Conceived for the new art forms of the twenty first century, Bernard Tschumi's Le Fresnoy, the National Studio for Contemporary Arts in Tourcoing, France, is part experimental art laboratory, part multimedia production centre, part cinema and exhibition and performance space. This highly celebrated building defies categorization, encouraging cross-overs between architectural programs and art forms. A huge, technologically advanced roof covers both existing and recent construction, housing the renovated spaces of a former entertainment complex built in the 1920's. In Tschumi’s remarkable building, the “in between” or residual spaces located between the existing tiled roofs and the new, hovering steel structure punctuated by glass “clouds” become a place where artists can take over.

Tschumi turns toward an artistic explosion of varied polemics of literature, philosophy and cinema. He was fascinated by certain modes of montage found in cinema. In exercises called screenplays, he took excerpts from films, image by image, and tried to find an architectural relation by substituting the principle of montage for the compositional principle generally used by architects.
The first of these Screenplays begins with a Hitchcock sequence drawn from *Psycho*, a conventional filmic technique, the fade-over, is transported into another mode, that of architecture. In this example, the geometrical and rectangular blocks of the Manhattan grid begin to interpenetrate, to superimpose themselves on the organic contours of Central Park, before transforming into something radically different.

The same principle is in operation in another image, which takes Palladio’s Villa Rotanda and places it over the famous Rietveld-Schroeder House in Utrecht in an act of superimposition/transformation. But in this sequence there is no longer any correlation between the upper and lower images. In the *Psyco* screenplay, there was still a cause-and-effect relationship between the cinema system and the architecture system. In the Palladio-Rietveld screenplay, this relation no longer needs to exist: the architectural fade-over is now paralleled by a fixed image. We thus find there are two systems functioning independently of one another.

Excerpts from The Manhattan Transcripts such as “The Block” demonstrate a tripartite relationship among the spaces of the architecture, the vectors of movement, and the event or action. Tschumi’s hypothesis was that architecture could be defined, and therefore dissociated, through three elements, SPACE (the fabrication of physical or material spaces), MOVEMENT (the movement of bodies in space), and finally, the event or USE.
The new Environmental Building at BRE’s (Building Research Establishment) Garston site provides a large-scale experimental facility for evaluating environmentally advanced technologies and operations. The design brief for the 2,000 square-meter, three-story office building included a demanding low-energy performance specification drafted by the Energy Efficient Office of the Future (EOF) project. The EOF project is a partnership between BRE and manufacturers, designers, utilities, and other building professionals to investigate low-energy, comfortable, and healthy workplaces for the 21st century. BRE expects its £2.5 million Environmental Building to use 30 percent less energy than the best current buildings.

One of the building’s innovative passive design features is its concrete floor-ceiling assembly with a sinusoidal-shaped ceiling. Tension in the troughs of the wave structure and compression in its crests make a stiff floor using minimal concrete. Still, the assembly’s mass helps limit peak summer temperature of the ground and first-floor offices. Hollow sections of the wave troughs provide space for fresh air delivery to the room below. Raised access flooring for the floor above tops the troughs and alternates with underfloor heating and cooling slabs riding the crests. The building is the first in the UK to use recycled aggregate in ready-mixed concrete. Recyclers crushed, screened, and graded demolished concrete from a London building to supply 20-5 mm coarse aggregate for 1,500 cubic meters of concrete (Bunn 1997; 28).

FIG. 4.3.1 View of southern facade of building

FIG. 4.3.2 Structural system showing its adaption as a ventilator and provider of thermal energy

FIG. 4.3.3 Glass-fronted ventilation shafts to warm the air inside and create stack-effect
**Ventilation and cooling**

Ventilation shafts running up the façade form a key part of the energy-saving natural ventilation and cooling system. Warmed air naturally rises out of the stainless steel ‘chimneys’ and causes air from inside the building to be drawn through to replace it. The movement of air across the tops of these chimneys increases this ‘stack’ effect, while low-energy fans in the tops of the stacks can be turned on to give greater airflow. Cooler fresh air is then drawn through ventilation openings by this movement of air.

On warmer or windy days (when its windy the air on the north side is not as cool), air is drawn in through passages in the curved hollow concrete floor slabs. Because of its bulk - or thermal mass - the concrete cools the incoming air by absorbing heat from it. Additional cooling can be achieved by circulating cold water through the slab.

Overnight, the control systems can open ventilation paths right through the concrete slab to cool it further, storing this ‘coolness’ for the following day. During the winter months the water circulating through the concrete slab is heated to give gentle underfloor heating.

The ventilation and heating systems are controlled a building management system (BMS), but, as with most other systems in the building, a degree of user override is provided to suit individual needs.

**Solar control and daylighting**

To prevent excessive heating and glare from the sun shining in the building has a system of motorised louvres on the south façade to control the daylighting levels.

During the day the angle of the louvres changes according to the position of the sun. At times when direct sunshine is not a problem the louvres are angled to act as ‘light shelves’ - reflecting light off their smooth upper surface onto the ceilings of the offices. This reduces the amount of artificial lighting needed in the parts of the offices furthest from the windows.

**Photovoltaics**

A building-integrated photovoltaic array (BIPV) was installed as a demonstration experiment and report the findings back to industry.

The array uses thin film amorphous silicon cells incorporated into a glazed cladding. The output from the cells (as direct current) is fed into the building’s main supply panel via an inverter, providing additional power to the building from a non-polluting source. Inside the building a status panel shows the amount of electricity being generated, the percentage contribution to the building’s lighting load, and the cumulative total since May 97 - the date of first occupation.
4.4 _KANSAI INTERNATIONAL AIRPORT - OSAKA BAY, JAPAN 1994
RENZO PIANO

“Kansai is a precision instrument, a child of mathematics and technology. It forms a strong and recognisable landmark; it has a clear and simple shape that declares itself without hesitation. But it is also an extraordinary spatial experience” (Renzo Piano 1994)

From the very first sketch of the Kansai structure, it can be seen that Rezno Piano wanted to create a structure full of smooth contours. His final design is a structure that is free of obstructions, by placing a glass front wall, as well as using baffles that reflect light. It is evident that the architect wanted the building to seem very open and communicative. His ideals are to have an interior and exterior that is not hindered by walls of other obstructions, so the traveller is able to navigate him or herself fairly easily from anywhere, as virtually every area is visible from anywhere in the structure.

The building represents everything that modern architecture is about. Use of modern materials, detailed construction techniques, and an innovative construction paradigm were all in place when thinking about the design. Rezno Paino’s work has always been fascinating and this is no exception. The airport, apart from being an aesthetic marvel, is also an engineering marvel, with clever ideas such as allowing the contours of the roof to guide the flow of air in the building, thus eliminating the needs for extra HVAC vents inside the building.
The inverted triangle shaped trusses are referred to as the ‘A’ truss type, and constitutes 18 trusses of the structure. Each of these is supported by inclining columns, and on the street-side, by vertical columns. The height gradually decreases towards the airside, giving it the wing-shell structure.

The transitional section has been designed to produce a sense of visual unity, and connects the lower chord of the truss to the wings. The gable end trusses (‘B’ trusses), sandwich the glazing of the end walls between 2 trusses. This gives the structure and glazing it independent orders by allowing the glazing to pass between trusses, as well as avoids complexities when joining trusses and glazing. The divided truss with the same form inside and out serves to strengthen the sense of continuity in the roof as it extends over the interior and outdoor space.
FORESHORE ARCHITECTS an association comprising: Revel Fox and Partners cc Architects and Planners, Van der Merwe Miszewski Architects, Lucien le Grange Architects and Urban Planners, Stauch Vorster Architects, ACG Architects and Development Planners, dhk Architects, Magqwaka Associates, Architects

The CTICC (Cape Town International Convention Centre) is situated on an old landfill site previously used as a parking lot that is comparatively isolated at the edge of the CBD. The site is exposed to unfavorable climatic conditions, overlooked by a highway, and not easily accessible. However, the architectural concept is a direct and rational response to the dominant characteristics of the site, where the building was anticipated to become a major catalyst and connector between the port and the city itself.
The program for the building consists of windowless exhibition halls located along the freeway boundary, with meeting rooms, restaurants and arrival points extending along the line of bus and taxi drop-off zones. The administration, main entrance foyer and minor concessions face onto a square, with the auditorium finding its place at a noisy intersection, having already required special acoustical treatment. Ballroom bridges and a hotel are also located off the square. Critical to the cohesion of the plan is the three-level gallery or spine extending the full length of the site, and linking all the elements in an easily understood movement system.

Environmentally conscious design was implemented, resulting in the provision of screens, canopies and planting in and around the building for protection from the sun and wind. Attention has also been given to energy- and water-saving devices. A carefully controlled interior climate has been created for the exclusion of direct sunlight during the heat of the day despite the extensive use of glass.

The interior also features a display of some important art works, as well as the provision of opportunities for formally unknown artists to exhibit their works without compromising the high standards set for all aspects of the CTICC.
CHAPTER FIVE
5.1 INTRODUCTION TO DESIGN DISCOURSE

5.2 URBAN DESIGN OBJECTIVES

5.2.1. INTEGRATION OF PROPOSED DEVELOPMENT WITH GAUTRAIN STATION AREA...
5.2.2. PROVIDE CLEAR CONNECTIONS TO THE GAUTRAIN STATION...
5.2.3. REINFORCE IMPORTANT PHYSICAL CONNECTIONS...
5.2.4. ADDRESS THE STREET EDGE AT RAILWAY ST...
5.2.5. PROVIDE A PUBLIC URBAN OPEN SPACE FOR PHYSICAL ORIENTATION AND SOCIAL INTERACTION
5.2.6. RESPECT HISTORICAL BUILDINGS AND THEIR SIGNIFICANCE...
5.2.7. POSSIBILITY OF CHANGING LINES

5.3 DESIGN PROPOSAL

5.3.1. FORM FOLLOWING FUNCTION
5.3.2. STRUCTURE
5.3.3. MOVEMENT PATTERNS
5.3.4. RESPONSE TO ORIENTATION AND CLIMATIC CONDITIONS
   5.3.4.1 VERTICAL LOUVRES AS SECONDARY SKIN
   5.3.4.2 AN ATRIUM AS AN INTERNAL ENVIRONMENT
   5.3.4.3 VENTILATING HEAT-STACKS
   5.3.4.4 MASSING OF THE ATRIUM WALL
   5.3.4.5 AIR-CONDITIONING : CENTRALIZED CHILLED WATER AIR-HANDLING UNIT
   5.3.4.6 ROOF STRUCTURE AS A NATURAL VENTILATOR

APPROACH TO DESIGN

“If we assume that buildings are acts of construction that will occur whether we like them or not, architecture is an attempt to give shape to them, then the act of design may be to transform what already is into what could be in such a manner that preserves what once was. By rescuing the object from the process, we may make mirrors of our continued existence in time and space.” (Betsky, A; 2000)
5.1 **INTRODUCTION TO DESIGN DISCOURSE**

Economic growth and social development are vital in order to address the historical legacy of under-development and deprivation that has contributed to leaving our cities and towns spatially and socially divided, highly inefficient, reliant on subsidies (particularly for public transport) and in many areas, environmentally disastrous. Unless a concerted effort is made to alter and improve land-use and transport patterns, communities and the private sector will be unable to respond to all development opportunities. Development and public sector funds should be able to create the necessary conditions for local communities and the private sector to grow and develop. This is necessary to establish the basis for lasting growth from which all South Africans will benefit and to provide the context within which communities and private sector activity (formal, informal and international) can grow and expand such as in the case outlined in the draft Cape Metropolitan Spatial Development Framework (1996; pg 3).

Inner city development and redevelopment is vital to any city, in order to contain its resources, increase productivity, control urban sprawl and protect the historical, natural and agricultural assets to its particular region. Pretoria is no exception to the phenomenon of urban sprawl and its detrimental effects to the inner city. Major developments are only occurring in the east where land values and open space were the catalysts for the housing and retail boom, as well as the establishment of “office parks”. The effect on the inner city can only be negative, where once thriving activities that brought urban life to our city are either left to decay as the city continues to lose its assets, scattered in other parts of the metropolis, or (and possibly worst of all) they are re-concentrated in other areas that were not designated for the activities they now support, in terms of land-use and infrastructure. Cities do constantly change their functional diagrams, however in the attempt to control urban sprawl we need to question the reasons for rezoning residential areas and providing greater infrastructure in these regions whilst little concern is given to the CDB itself.

Unless initiatives are set in place in order to create growth and stimulate development, through public or private investments or even a combination of the two, the result is the degradation of the inner city. Such initiatives need to act as catalysts for further development in order to create, or recreate the densification values that the South African city needs in order to have a thriving, functioning CBD.

*FIG. 5.1.1 Diagramatic and conceptual sketch of site and context*
With the development of the Gautrain Station at Pretoria within the CBD, there is major potential in creating a functional and meaningful space that could bring many aspects of urban form into play. However, the site immediate to the proposed Gautrain Station has been earmarked as a mere parking facility and suitable development has been ignored. If well designed, a suitable development in this precinct could enhance the area, surrounding nodes and their corridors, as well as compliment local developments such as Salvokop, Freedom Park, the Paul Kruger Street Spine, Museum Mall and the Nelson Mandela Development Corridor.

A suitable development for the precinct would be an inter-modal facility that sees the culmination of all the immediate modes of transport i.e. the existing long distance and regional bus facilities, taxi rank, metro-rail as well as the proposed Gautrain Rapid Rail (see Context Analysis pg 40-41 and Design Directives pg 1-6) into an integrated, mixed-use urban node that serves as a connector to local facilities and nearby nodes, as well as regional and national areas. With these transport activities forming the catalyst required to activate or enhance an urban node, it in turn becomes the generator of development opportunities in the immediate environment.

“Modal interchanges provide excellent locations for retail, offices and community facilities, as well as for informal sector activity” (Cape Metropolitan Council, 1996: 34)


## 5.2 URBAN DESIGN OBJECTIVES

The design development exposes the urban design objectives in order to produce form-giving criteria to the precinct. This in turn is analysed to produce an appropriate built structure that responds to the characteristics of the site, the precinct and the environment in reaction to the accommodation schedule and needs identified in the Design Directives and Baseline Document of this study.

<table>
<thead>
<tr>
<th>URBAN DESIGN OBJECTIVES</th>
<th>APPROACH</th>
<th>ACCOMODATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Response to the Gautrain Station development as a catalyst of further development opportunities to the immediate urban environment and CBD of Pretoria.</td>
<td>Identify social, economical and environmental issues that address the need for a suitable development</td>
<td>Site selected within Pretoria Station Precinct immediate to the area of development for the Gautrain Station</td>
</tr>
<tr>
<td>2. Provide clear connections to the Gautrain Station in terms of visibility and approach that encourages pedestrian movement</td>
<td>Identify the most important lines of visibility and approach across the precinct and immediate urban environment.</td>
<td>Retain open-space and clear relationships between the Gautrain Station, the axial view from Station Square, and Railway Street</td>
</tr>
<tr>
<td>3. Reinforce important physical connections to nearby facilities and nodes, in terms of historical, existing and those resulting from the development of this Brownfield site</td>
<td>Allow connections to guide the establishment of built forms to the site in an appropriate system</td>
<td>Defined forms identified that respond to important connections and commence relationships in the urban environment that reinforce these connections</td>
</tr>
<tr>
<td>4. Address the street edge at Railway St</td>
<td>Reinforce the major line of vehicular movement and incorporate facilities that accommodate for pedestrian movement and needs</td>
<td>Retail edging at ground level maximised to address the street, whilst maintaining suitable access to the precinct for vehicular and pedestrian movement</td>
</tr>
<tr>
<td>5. Provide a public urban open space for physical orientation and social interaction</td>
<td>Allow relationships of built form and movement systems to define open spaces appropriate to the development and precinct</td>
<td>Defined open space network system that creates public square and allows for myriad connections between facilities and visual axes</td>
</tr>
<tr>
<td>6. Respect historical buildings and their significance, their relationships to the physical environment as well as their scale</td>
<td>Provide suitable character to the development that expresses an attempt to reinforce the <em>genius loci</em> (spirit of the place).</td>
<td>Massing of built form structured to respect the scale of the precinct and reinforcing an interaction with historical buildings whilst addressing the accommodation needs and relationships between built forms and proposed development</td>
</tr>
</tbody>
</table>
5.2.1. INTEGRATION OF PROPOSED DEVELOPMENT WITH GAUTRAIN STATION AREA

The development at the Pretoria Station Precinct must be integrated with the Gautrain terminal to ensure the success of the precinct as a well-balanced mixed-use node that will cater for the demands and activities of the market. As the location of the development is situated in such close proximity to a major point of arrival and departure to the capital, it therefore must act as a gateway and express itself as thus. Therefore, it should be symbolic to Pretoria and achieve the status of the vision the city strives toward; “The leading international African city of excellence, that empowers the community to prosper in a safe and healthy environment” (Capitol Consortium 1999). The symbolism must be taken throughout the design, as the built form will be a showcase for Pretoria City en route to the CBD and other nodes of attraction. Sequentially, as the built forms are to also cater for direct community involvement, it is therefore also showcasing the immediate community, adding to the drama of the architecture.
5.2.2 PROVIDE CLEAR CONNECTIONS TO THE GAUTRAIN STATION IN TERMS OF VISIBILITY AND APPROACH THAT ENCOURAGES PEDESTRIAN MOVEMENT

Through the integration of the development of the Precinct and the Gautrain terminal, clear lines of approach and visibility must be established to direct masses of people through the use of spatial clues, such as:

- Open space for unobstructed views
- Use of landmarks as orientation devices
- Urban landscaping (textured surfaces, bollards)
- Routes and edges (opportunity for market stalls)
- Signage

Orientation devices are important to accommodate for the large crowds that are expected to arrive and depart from this area en route to local attractions such as Freedom Park and Museum Mall. Open space is one of the most important, allowing people to experience as much of the environment as possible, giving a sense of place and orientation. Here a public square becomes an important element in the scheme, while a clear visual relationship must be established between the Gautrain terminal and Railway Street.

Landmarks become necessary points of gathering and orientation and are incorporated into the design of the overall scheme. These can include the proposed conceptual Gautrain Station roof structure, a possible vertical element at the station itself that can be illuminated at night to attract attention to its position, the reused historical building for the Ring Rail Station on axis with the vehicular entrance to the site and the proposed reconnecting bridge to Salvokop, an information and ticket office positioned where it can be observed from all directions and recognized for its function, as well as the public square itself at the center of the scheme.

Incorporated into the design of the urban landscape, textured surfaces and use of bollards aid to direct the public across the precinct define important routes and edges and guide the movement of people. Signage is important to provide physical directional opportunities and adds to the character of the street furniture.
FIG. 5.2.2.4 Sketch expressing visual connection of Gautrain Station to Railway Street. Note the vertical landmark element to the station.

FIG. 5.2.2.5 Route from Pretoria Station to Gautrain station; market possibility

FIG. 5.2.2.6 Sketch expressing access through building

FIG. 5.2.2.7 Sketch depicting clear visual connection from Pretoria Station to the Gautrain Station terminal
5.2.3. REINFORCE IMPORTANT PHYSICAL CONNECTIONS TO NEARBY FACILITIES AND NODES, IN TERMS OF HISTORICAL, EXISTING AS WELL AS THOSE RESULTING FROM THE DEVELOPMENT OF THIS BROWNFIELD SITE

FIG. 5.2.3.1 Conceptual collage depicting linkage and connectivity

FIG. 5.2.3.2 Informing lines of connectivity
The integration of the proposed development with the Gautrain terminal allows for the establishment of clear routes and connections that reinforce relationships to local amenities and nodes of attraction. These include connections to:

- Pretoria Station Building on axis with Paul Kruger Street for connection to the Metro Rail system and the CBD;
- Proposed new terminal for long distance bus facility at existing shed-structure;
- Historical buildings in the precinct and local vicinity; and most importantly

The proposed reintroduction of the pedestrian bridge over to Salvokop (that connected the Berea Sports Club) could serve as a direct connection to the ceremonial route to Freedom Park and reconnect the Berea Club with the Station Precinct via Clara Street.
2. Design Objective.

- Reinforce important connections - existing + historical to areas by facilities + nodes.

**Implications**

The overlapping of important connection patterns and forms that become respect + reinforce these connections. Always same as above.

**FIG. 5.2.3.5** Sketch depicting anticipated lines of movement

**FIG. 5.2.3.6** Sketch depicting important pedestrian movement with proposed forms
FIG. 5.2.3.7. Proposed private and public transport routes through the precinct

FIG. 5.2.3.8. Diagram isolating the proposed private and public transport routes through the precinct
5.2.4. ADDRESS THE STREET EDGE AT RAILWAY STREET

The form of the building begins to address the street edge at Railway Street with retail activity located on the ground floor relating to both the street itself and the public square behind it. Placed on active movement routes, these edges attract attention and encourage pedestrian movement. Here the opportunity to include colonnades reinforces the edges by providing comfortable walking environments and defined routes, whilst providing maximum exposure of the retail activities. The colonnades in turn provide shading along these edges to the retail zones and opportunity to cantilever the upper floors.

The historical “Five Railway Houses” along Railway Street can contribute significantly to the establishment of an active street edge by acting as an extension of the route from the proposed development. Although still residentially occupied, these houses should be reused for functions that would benefit the nature and character of the precinct, and be exposed to the street edge and to each other in order to create an open movement system between them and to the precinct behind them. These houses could be converted into small museums that show-case the history of the precinct, or form a small retail village with a coffee shop, a restaurant, a boutique clothing store, a health pharmacy, etc.

FIG. 5.2.4.1 sketch illustrating how built forms are to address the street edge
FIG. 5.2.4.2 Graphic depicting a retail edge

FIG. 5.2.4.3 Graphic depicting an arcade typical to Pretoria

FIG. 5.2.4.4 Colonade at the new DTI Campus in Sunnyside

FIG. 5.2.4.5 Street edge address at the new DTI Campus in Sunnyside

FIG. 5.2.4.6 sketches illustrating how built forms are to address the street edge

FIG. 5.2.4.7 sketch illustrating how colonades can be used at the street edge
5.2.5. PROVIDE A PUBLIC URBAN OPEN SPACE FOR PHYSICAL ORIENTATION AND SOCIAL INTERACTION

FIG. 5.2.5.1 Sketch showing creation of public square

FIG. 5.2.5.2 Public square located at heart of scheme

FIG. 5.2.5.3 Public square as form-giving element to the urban landscape environment

FIG. 5.2.5.4 Existing rail on site

FIG. 5.2.5.5 Trolley on site. This can be used by traders from the market area on site
**Making place; design of the square**

By addressing the street edge along Railway Street in a linear fashion, opportunity is given to address the square behind it. The southern arm of the proposed development further defines the square and the location of the Gautrain Station whilst maintaining an important open space to the precinct.

This positioning of the building allows the public square to act as an orientation device, locating the Gautrain Station at its heart and encouraging major movement either northwards across the square toward other modes of transport or connections to places of interest, or eastward through the building access routes toward the retail street-edge activities. This is an important aspect to the design, as orientation needs to be an obvious experience for tourists and the general public as to where movement patterns are, and where they direct ones attention.

The existing rail on site that runs from the square and tapers outward and away from the square towards the proposed bus terminal and market area can be used as a directing device to guide movement in that direction and provide an opportunity to bring market stalls out into the square on rail-mounted trolleys. This in turn adds to the historical nature of the site, the symbolism and character of the precinct, distinguishing it as unique to any other place-forming space within the city.
5.2.6. RESPECT HISTORICAL BUILDINGS AND THEIR SIGNIFICANCE, THEIR RELATIONSHIPS TO THE PHYSICAL ENVIRONMENT AS WELL AS THEIR SCALE

Layers of historical meaning can be established in the precinct that would add value and character to the development. The adaptive re-use of building structures and structural elements ensures the memory of the precinct be kept, whilst providing an authentic character to a revitalized Brownfield site. New life can be borne from these structures of the past, to provide a new layer of meaning to the precinct. The industrial character of the precinct provides the opportunity to express and adapt the structures relatively easily through the selective use of materials and the simplicity of combining modern materials to these buildings in order for them to be reused without destroying their character and significance.

An important conceptual proposal to this development is the re-use of the old washing shed into a new bus terminal and market area. This shed can be connected to the 1928 Audit building (which is currently the long-distance bus ticket office and waiting room) through the establishment of a new link between the two. This link can be constructed from glass and steel, to enhance the qualities of the older structures, and provide improved facilities to this service.

The reestablishment of historical connections plays an important role in adding value to the precinct and surrounding amenities and nodes, by creating lines of movement between them that reinforce their significance. These connections reinforce the position of the
proposed development within its landscape and its relation to surrounding important places and landmarks, such as the historical Pretoria Station building with its forecourt on axis with Paul Kruger street toward Church Square, Museum Mall, NZASM Printing store (current Intersite Office), Berea Club, Du Preez’s Hoek, the 1928 Audit building with the old washing shed, and the historical “Five Railway Houses” in front of it. Most importantly, the reestablishment of the pedestrian bridge to Salvokop will provide a direct link between the public square in front of the Gautrain Station to Freedom Park, providing tourists with a clear and direct route between the two.

The scale of historical buildings plays an important role in defining the form of the proposed development to this precinct. The proposed development needs to respect and address these scales as not to overpower or dominate important buildings, but rather contribute to their enrichment. This is achieved by the following:

- The height of the building is kept below that of the historical Sir Herbert Baker-designed Station Building as not to overpower or dominate its importance to the precinct.
- The horizontality of the existing Platform Building provides a backdrop for the elongated nature of the proposed development with its northward-sloping roof structure relating the building mass to that of the washing-shed and “Five Railway Houses” on Railway Street by bringing the height and mass to the precinct level.
- The southern arm of the building initiates an address to the historical Signaling and Telegraph Building by retaining an acceptable distance from it that attempts to isolate the historical building and emphasize its importance. Furthermore, the inclusion of balconies and architectural forms that penetrate and cantilever from the structure, begin to relate horizontal and vertical elements of each building to one another, whilst the inclusion of trees on the street edge brings about continuity between the two.
- Additional development is suggested by this study to occur around historical Signaling and Telegraph Building, forming a backdrop that relates both to the proposed development and the historical building itself in terms of scale and mass. This is envisaged to house residential and retail activities, whilst maintaining an open street edge character to Railway Street that shall further enhance the visual and spatial qualities of this historical building.
5.2.7.  POSSIBILITY OF CHANGING LINES

The positioning of the proposed development addresses a long-term vision that connects that Gautrain terminal building to the southern area of the existing Pretoria Station platform building. This connection will provide a direct link to the Metro Rail services and those of the Gautrain instead of having to move people across the precinct to the front of the Pretoria Station building to access the platforms. This vision is the result of the fact that Pretoria Station is a poorly functioning station due to the nature of the existing rail network that terminates under the platform building, with adjacent rail continuing over to Bosman Street Station instead. These circumstances prove difficult for trains to continue on the Maputo line, having to reverse some distance out the station, and then continue on the adjacent rail.

Jack Prentice, former managing director of Intersite, points out that the greatest problem with Pretoria Station is the archaic signaling system that needs urgent upgrade in order for the station to function successfully. If this were the case, opportunity arises to redirect some of the rail that Pretoria Station may act as a highly efficient station along all routes passing through it. This would result in the current platform building functions moving deeper into the rail reserve, providing a redevelopment opportunity of the platform building into a modern train station with new concourse levels, large open spaces for movement, as well as rentable office and retail space. The concourse of the Gautrain Station can then connect directly to this development, which would highly benefit the connectivity and accessibility of the City to a national and international realm.
_DESIGN PROPOSAL

TO FOLLOW..
5.3 _DESIGN PROPOSAL_

5.3.1. FORM FOLLOWING FUNCTION

FIG. 5.3.1.1 Functions of building giving form

FIG. 5.3.1.2 concept model in plan
FIG. 5.3.1.2 CONCEPTUAL MODEL

DESIGN DEVELOPMENT

GAUTRAIN STATION AREA

NEW COMMUNITY DEVELOPMENT CENTRE

HISTORICAL SIGNALLING AND TELEGRAPH BUILDING

NEW SHORT TERM HOUSING AND RETAIL DEVELOPMENT (PROPOSED ONLY)

EXISTING PRETORIA STATION PLATFORM BUILDING

EXISTING PRETORIA STATION BUILDING

EXISTING METRORAIL RAIL-RESERVE

REINTRODUCTION OF PEDESTRIAN BRIDGE TO SALVOKOP (see correct positioning of this link according to historical connections in 1.3 of this chapter)

REINTRODUCTION OF RING-RAIL SYSTEM WITH STATION WITHIN PRECINCT (PROPOSED ONLY)

NEW RETAIL OFFICE (PROPOSED ONLY)

NEW RETAIL OFFICE (CANCELLED)

EXISTING SHED FOR NEW BUS DEPOT AND MARKET

HISTORICAL HOUSES FOR REUSE (PROPOSED ONLY)

NEW HOTEL (PROPOSED ONLY)

GAUTRAIN STATION AREA (BY OTHERS, ALTHOUGH CONCEPT STRUCTURE INCLUDED)

NEW COMMUNITY DEVELOPMENT CENTRE

UNIVERSITY OF PRETORIA – ASstrup, R (2005)
FIG. 5.3.1.9 Ground floor functions

FIG. 5.3.1.10 First Floor functions
FIG. 5.3.1.11 Second Floor functions

FIG. 5.3.1.12 Third Floor functions
FIG. 5.3.1.13  Shape of existing rail on site used as design influence

FIG. 5.3.1.14  Surrounding landscape forms used to influence the design for the site

FIG. 5.3.1.15  Eastern elevation of building showing locations of functions
The most important form-giving element to the design is the roof structure, which has a myriad functions incorporated into its form. The form of the roof was derived from site-specific criteria, such as the existing rail network across the site and the form of the surrounding landscape within which the site exists.

Not only does the roof provide the protective element to the building and symbolically holds the fragmented forms together as a whole, it brings about a lightness to the massing of the structure, which sequentially aids reducing the building scale to that of the precinct. Furthermore, it provides ample shading to the upper floors, while providing good natural day lighting through north-facing clerestory windows to other areas of the building including the interior atrium, the circulation zone and the library. The shape of the roof structure is also designed in the longitudinal and cross-section such that it acts as a natural ventilator, in its shape, by allowing hot air to rise against it and flow freely to the higher areas where it can escape through louvers at the clerestories. Covering a large portion of the building, the roof also acts as a collector of rainwater, which is then stored and re-used for irrigation purposes within the atrium itself.
5.3.2. STRUCTURE

The structure of the building consists of a reinforced concrete and steel frame to support upper floors. For contextual and historical reasons, the façades are orange-red face brick and sometimes plastered, with sandstone corners and horizontal bands along vertically proportioned openings. This provides a layer of thermal control through the use of massing between the exterior and interior, and with using materials that are locally available and widely understood by the local construction industry for their applications.
FIG. 5.3.2.5 Wall textures at the new DTI Campus in Sunnyside, Pretoria: symbolism

FIG. 5.3.2.6 Structural challenge of design

FIG. 5.3.2.7 NZASM Apies River bridge on the Eastern Line east of Salvokop
Movement patterns are extremely important in public facilities, especially when masses of people are expected to be in this space at one given time. With a scheduled arrival and departure of the Gautrain, many people will move through the precinct en route to nearby attractions and facilities. These routes need to be clear and directional, allowing the visitor to immediately acquaint themselves with the immediate surroundings and be aware of the myriad possibilities of direction.

The public square needs to be designed for this purpose, to allow a person to immediately orientate themselves in the precinct, achieved through the use of clues in the urban landscape. These would include the re-use of the existing rail combined with textured paving to highlight these routes. Linear market stalls along the routes indicate and define that line as one of movement, while more obvious elements such as bollards and signage can also be implemented into the urban landscape to provide a physical directing tool.
5.3.4. RESPONSE TO ORIENTATION AND CLIMATIC CONDITIONS

The east-west orientation of the building that addresses Railway Street and the public square needs vigilant attention to the harsh sun-angles in the morning and afternoon conditions. For this reason, certain design directives were implemented to deal with the extremities and minimize the effects on the building. Most importantly, the materials were selected to benefit the building in the long-term whilst maintaining a sustainable approach to their applications. These include the following:

- The creation of an external skin on the eastern and western facades
- The inclusion of an atrium to create an internal environment
- Heat-stacks on western and northern facades to extract unwanted warm air from the building interior
- Massing of the atrium wall to absorb radiant energy and act as an extractor of unwanted warm air
- Sunscreens on the northern facade that consist of photo voltaic ceels
- Provision of high ceilings to interior spaces to create greater depth for air to move through
- Roof design to aid in the natural movement of extracting warm air
- Centralized Chilled Water handling units with VAV (Variable Air Volume) diffusers.
- Rock-store located in basement to provide 10% fresh air intake for the chilled water handling units
5.3.4.1 VERTICAL LOUVRES AS SECONDARY SKIN

A thermal control strategy has been adopted on the exterior of the building, where a structural curtain wall has been added as a second skin or layer to deal with the east-west orientation condition. This layer comprises of a system of vertical louvers assembled in frames for support and connected back to the main structure via steel connectors. These louvers are operated through the use of solar control mechanisms that orientate the louvers for optimum effects, however an over-ride mechanism is also available for human control and comfort.

This secondary layer is vital to the success of the building, by ensuring that radiant energy does not come into contact with the main structure or glazing of the façade, to prevent unnecessary heat gains. Another advantage of the secondary skin is one of operation and maintenance, where a walk-able surface is created between the main structure and the external skin that can be used to maintain the building exterior, clean windows efficiently, as well as service the louvers themselves with ease.

The louvres are each made of 2 natural anodised allumium layers that contain a heat absorbing insulation material and supported on an anodised centre post. This centre post is connected to a small motor, which is powered through the photo voltaic cells to control their orientation. Although believed to be an unsustainable material due to the embodied energy used to produce aluminium, the material has far greater benefits:

- The essential characteristics of aluminium make it an ideal material for construction.
- It is light, strong, durable and requires minimal maintenance.
- It is flexible and easy to handle - this gives it tremendous potential for design.
- It can be curved, tapered, welded and cut to the most challenging and dynamic geometries. Where it is cut, the metal’s innate resistance to corrosion means that the trimmed edge does not need to be protected.

The recyclability of aluminium - one of its unique properties along with strength, durability and corrosion resistance - has led to its increased use in construction over recent years. Used aluminium is valuable and is easily and endlessly recycled without quality loss. The material is very rarely 'lost' entirely because of this. Important issues to note are:

- The quality of aluminium is not impaired by recycling, endlessly
- Remelting aluminium saves up to 95 per cent of the energy needed to produce the primary product
- It is the most cost-effective material to recycle

FIG. 5.3.4.0 sketches of east/ west facade design
The overall market for used aluminium is steadily growing, so the more aluminium there is in a product, the more chance it has of being recycled. The recycling rate of used aluminium products in building is over 80 per cent (over 95 per cent in transportation and 30 per cent in packaging). 30 per cent of the 1.9 million tonnes of aluminium used in Europe in 1997 came from recycling.

source: http://www.materials_environment/aluminium.org
FIG. 5.3.4.1.4 Design sketches for climate control systems for building
5.3.4.2 AN ATRIUM AS AN INTERNAL ENVIRONMENT

The cross-section of the building is comprised of three main spatial zones: the east facing zone, the west facing zone and a wide internal atrium between the two that acts both as a thermal control device as well as a circulation zone. The atrium supplies natural day-light through north-facing clerestory windows and allows the escape of unwanted air through louvers near the roof in summer, while maintaining a relatively warm environment in winter by closing the louvers and retaining much of thermal energy generated by the building. The atrium acts as a supplier of cool air to the eastern zone in the morning when the sun is exposed to the eastern façade. The vertical louvers of the external skin help to prevent direct radiant energy penetrating the building interior, thus allowing for the cooler atrium air to cross the zone and escape through openings above the windows. In the afternoon the atrium’s role is reversed, where it now acts as a supplier of relatively cooler air for the western zone when the sun is exposed to the western façade.
FIG 5.4
as an internal environment when the sun is exposed to the eastern facade
FIG 5.4. Atrium as an internal environment when the sun is exposed to the western facade.
5.3.4.3 VENTILATING HEAT-STACKS

The western facing façade, which is most affected by the orientation of the building, includes an additional thermal control mechanism i.e. ventilation heat-stacks. These aid the removal of unwanted warm air from the western zone through the stack-effect, which is achieved through the process of bouyant warm air rising upwards in a building and exiting through high level openings. The air is then replaced by cooler air drawn into the building through low-level openings such as louvres or doors. Additional mechanical fans connected to polar voltaic cells will aid this motion and serve as a back-up system in order for the stacks to operate effectively.

FIG. 5.3.4.3.2 Ventilation Stack of the BRE Low Energy Building - see Precedent Study Analysis

FIG. 5.3.4.3.1 Northern Elevation showing structural system and ventilation stacks on western façade

KEY POINTS:
- Temperature is the driving force and is therefore not reliant on wind speed and direction to operate efficiently.
- Particularly effective for night-time cooling when there is the greatest difference between internal and external temperature

LIMITATIONS:
- Only effective when outside air is cooler than the internal air.
- A relatively clear path without obstructions is required for air to travel from the low-level openings to the high-level openings
5.3.4.4 MASSING OF THE ATRIUM WALL

The eastern side of the atrium comprises of a thermal wall that acts both as a ventilator of unwanted air from the eastern zone, as well as an absorber of thermal energy from the atrium itself and from the eastern zone space. Ventilators on the exterior on top of this wall aid the removal of unwanted warm air. In winter, this wall has the reverse effect by supplying absorbed thermal energy to the building and maintaining a relatively stable environment.
5.3.4.5 AIR-CONDITIONING: CENTRALIZED CHILLED WATER AIR-HANDLING UNIT

Combined with these passive systems of thermal control, a centralized chilled water-handling unit located on the roof, with fan-coil units in separate zones, is incorporated into the design. The system consists of a central chiller plant that generates cold water (to 6 deg. C) which is circulated throughout the building in pipes and connects to fan-coil units located in the ceiling void/plant rooms. Supply air from the fan-coil units is ducted to the air-conditioned zone.

The system is suitable for multiple zones e.g. an office building with floor areas ranging from 15m² to 60m² if the fan-coil units are located in ceiling void and up to 600m² if the fan-coil units are located in floor plantrooms. There is no limitation on the number of zones served.

The effects of the passive systems minimize the energy required to cool the air within the building by this system, although these alone would never be sufficient for the harsh climatic conditions that Pretoria can experience in summer. An additional passive system, known as a rock-store, is incorporated in the basement to supply the fresh air intake to the separate zones required for the fan-coil units to operate effectively. This rock-store is comprised of a bank of rocks over which cool filtered water is passed to effectively cool the air, which is then passed via ducting to the various zones. Air supply to this system can be incorporated through the design of the Gautrain tunnel, where cool air from the base of Salvokop Hill can be filtered and fed to the system for distribution.
5.3.4.6 ROOF STRUCTURE AS A NATURAL VENTILATOR

The form of the roof structure allows the natural movement of bouyant air to rise against it and flow toward the higher regions where openings allow the escape of unwanted warm air, thereby acting as a natural ventilator.
CHAPTER SIX
SUMMER - MORNING CONDITION SCALE 1:200

SUMMER - AFTERNOON CONDITION SCALE 1:200

WINTER - MORNING CONDITION SCALE 1:200

WINTER - AFTERNOON CONDITION SCALE 1:200

MECHANICAL COOLING SYSTEM SCALE 1:200

ROCK STORE SYSTEM SCALE 1:100

PRETORIA STATION PRECINCT

HVAC - HEATING, VENTILATION AND COOLING

APPLIED METHODS OF ACTIVE AND PASSIVE THERMAL CONTROLS

ROCK STORAGE as thermal buffer for heating and cooling

ATRIUM with green space and evaporative cooling pond

SWINGING provided by rock repositioning springs

WIND TUNNEL with passive ventilation

VENTILATION STACKS designed primarily on Weisheit & Mohseni scales

To act as heat rejection devices by self-energy and mechanical back-up systems

SUNSCREENS

VERTICAL - OCHRES on north wall on East and West facades with solar control mechanisms

HIGH COLLARS in occupied spaces to assist temperature gradients

ROOF DESIGN is based on the natural movement of air flows to create a National structural element network air ventilation

VHF Distributed Heating/ Ventilation units with VHF diffusers
LIST OF REFERENCES


City Property Administration, CP de Leeuw Quantity Surveyors, Stauch Voster, GAPP Architects and Urban Designers, Oscar Hirsch and Silvio Buffler Partnership, Van Wyk & Louw, and Dr A J Kruger Transportation Engineer (1991). A concept proposal for the redevelopment of the "Pretoria Station Forum".


NADEL, M (2004). 02Pta Stn - Bidding.00.dwg. CAD Drawings of Station Precincts. Munitoria - Tshwane Municipality


UNIVERSITY OF PRETORIA (2000) *Paul Kruger Street Spine*. Urban design framework for the improvement of environmental conditions on Paul Kruger Street, on instruction of the City


RELATIVE LITERATURE

STATATORY LEGAL CONTEXT:

South African National Heritage Resources Act 25 of 1999:

Australia ICOMOS Charter for the Conservation of Places of Cultural Significance (the Burra Charter of February 23, 1981) - South Africa is a signatory of the ICOMOS Burra Charter.


RELEVANT CONSERVATION CHARTERS:

The International Charter for the Conservation & Restoration of Monuments & Sites (Venice, 1964)

Resolutions of the Symposium on the introduction of contemporary architecture into ancient groups of buildings, at the 3rd ICOMOS General Assembly. Budapest, 30th June 1972

Appleton Charter for the Protection and Enhancement of the Built Environment (Published by ICOMOS Canada under the auspices of the English-Speaking Committee, Ottawa, Canada), August 1983.


The First Brazilian Seminar about the Preservation and Revitalization of Historic Centers (ICOMOS Brazilian Committee, Itaipava, July 1987)

The UNESCO World Heritage Convention’s position regarding the need for conservation of industrial heritage places.
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