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

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

The area between Johannesburg and Pretoria - two major cities in South Africa - is recording the fastest rate of economic development in Southern Africa. The Gautrain Rapid Rail Link will be a new rail-bound mass transit system to serve the Johannesburg-Pretoria corridor as well as a link between Sandton and Johannesburg International Airport. Apart from the convenience, the new rail-bound mass transit system will provide economic and social development along Gauteng’s north-south axis with associated population and related concentrations.

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

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

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

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

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

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

In summer, Pretoria has 60% of its days as sunshine days and in wintertime 80% of its days are filled with sunshine, but with less heat intensity. In September, Pretoria will have an average of 9.4 hours of sunshine per day. The use and functional application for sun control devices are thus a necessity, for this will be the time the site will be most occupied with visitors and residents. Summer sun should be shaded and winter sun should be allowed to penetrate the structure and to heat the structure, to utilize the re-radiant heat within the building at night.

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

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

- 22 December. 87 deg.
- 21 March/23 September 64 deg
- 22 June 41 deg.

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

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

1.3 History of the old Arcadia Primary School.

Hatfield Township was established in 1904. The suburb name is derived from Hatfield town and Hatfield house in Herefordshire, England, to commemorate the arrival of Lord Selborne to Pretoria.
Arcadia Primary School was established to serve the 159 families within the borders of Hatfield and serve those ‘outlying areas’ of Pretoria. Arcadia Primary School admitted its first pupils on 10 October 1916. The school building evolved with the changing times and through the introduction of different individuals in charge of decisions over the school. Since the initial planning of the school in 1913, to the opening in 1916 and up to the sale of the school in 1994, the addition of new elements and upgrading of others, were according to what the different principles felt appropriate for the school to further develop, giving the pupils the best education possible.

1.4 Precedents.

- Johannesburg International Airport

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

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

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

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

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

The terminal itself is extremely spacious but never looses its intensity as a vibrant movement line. It’s scale and proportion is on a humane level and a feeling of comfort and relaxation promotes free movement through the different levels of transition. The entrance to the terminal could have been better defined and expressed and to find the entrance from entering the site was difficult. Signage on its own will not replace defined routes.
The first floor acts as food court and retail area, where the visitor can relax, look out on the people and keep busy by the various shops and rest areas. The second floor acts as arrival point.

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

The Metro Mall accommodates 25 bus ranks that serve 35 different routes and an area for 2000 mini-bus taxis. The spaces for each taxi association have been allocated, to minimize the risk of taxi association conflicts. The site also provides sufficient space for the 800 formal and informal traders.

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

- **Statement 1:**

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

- **Statement 2:**


The JHB domestic terminal cater for a large scale of daily requirements needed when arriving from or leaving for your destination. The functional activities are aimed at the passenger and to cater for their needs. The Metro Mall site also caters for daily necessities, but aims for a larger market group, the travelers and the passers by, thus linking the site with its neighboring sites. By using the informal market within a streetscape, the activities attract a larger group of people, adding to the social interaction and to the community construction. The transportation service acts as central attraction function.

The airport terminal has access to public transport in the form of vehicular taxis, situated at the entrance to the terminal. A dedicated national bus service, also cater for the tourist and is not easily accessible from the terminals. The access is not direct, the information and route to the bus services are vague and in descriptive. Tourists should be given direction from a central point of arrival and not routed and re-routed to a destination. The incorporation and functional integration of the transport modes at the airport terminal is lacking coherency.

- **Statement 3:**

  "Linkage is simply the glue of the city. It is the act by which we unite the different layers of activity and resulting physical form of the city." (Dewar,D., and Uytenbogaardt, RS. 1991. South African Cities: A Manifesto for Change, Cape Town).

The Metro Mall is an urban renewal initiative for Newtown in Johannesburg. The site stretches over two land parcels, for a total site area of 2.6 hectares. This urban renewal project is important because it links Braamfontein, to the north of Johannesburg, with Newtown to the south. The project catered for the street vending trading and for the huge volume of mini-bus taxis, to provide an area of opportunity for both pedestrian and road traveler.

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

The domestic airport terminal had a different feel around its circulation spaces. The terminal comprises of three stories, where the first floor level consists of the formal shops and the food court. The ground floor level is for departures and the second floor is for arrivals. The terminal will be functional 24 hours a day, for flights will commence on a 24-hour schedule.

Both these sites are economic nodes within their urban infrastructure. It is a place of convenience for their users and not for the people in its urban structure, for it does not act as a shopping mall for every one, but only for its users, the travelers.
Visual linkages through the sidewalks and arcades and the airport link the Metro Mall by the vehicular roads leading to the parking or drop-off areas. Internally, the buildings are linked linearly and the departures and arrival terminals are very easy to understand and accessed.

- Statement 4

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

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

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

2. Purpose and strategic objectives.

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

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

- The Gautrain Rapid Rail Link (Gautrain) must facilitate development in the Province.
- The project must contribute directly and indirectly to job creation.
- It must assist in unlocking the economic development potential of the Gauteng SDI projects and strengthen existing development nodes in Gauteng.
- It must improve accessibility and mobility in this development corridor.
- It must promote the use of public transport.
- It must develop an integrated public transport system, through the use of feeder and distribution systems.
- It must integrate land-use and transportation planning in the corridor.
- It must assist in improving the image of public transport.
- It must assist in improving the image of public transport.
- Create or reinforce densities, to promote rider ship (getting feet to the station);
- Establish different land uses to generate different trip volumes at different times of the day;
- Ensure correct mix of land uses, thus, land uses that generate frequent trips and not extensive land uses where population density is low; and
- Establish new urban form that embraces the train system.

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

2.1. Concept

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

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

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

3. A Public Transport Project

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

The Gautrain will act as the central activity node and within a 500m radius, public transport has to be accessible for the pedestrian. Within this radius, the metro rail train stations are situated, to enhance and strengthen the public transportation system. (a transportation facility in reach within five minutes on foot.)

Passengers traveling to and from Hatfield Station will use private vehicles for park-and-ride purposes. Based on the results of the demand modeling process, these passengers will mainly originate from the northern and eastern suburbs of Pretoria. It is estimated that the following will have to be provided at this station to accommodate passengers accessing the system by means of private vehicles:
4 How will Gauteng benefit from the Gautrans?

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

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


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

- Saving in the cost of time of R933 million per year.
- Saving in accident costs of R15 million per year.
- Reduction of 70 000 tons of CO2 emissions per year.

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

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

5. Station development concepts.

The new train stations will be the interface between the Gautrain and its urban environment. Because of this, the stations will differ in design and functionality, because it will be situated in different precincts.

The way in which stations and station precincts are developed will therefore impact on the economic development of the precinct as well as the related aspect of using the train station and platforms.

The success of the train stations will depend on how well it will be integrated into the situated neighborhood. The quality of the development is of importance, for quality constitute more than expensive accessories. As a tourist destination, it will mean that the transport, station and activities must represent a positive, secure representation of the different cultures living and working as an economic unity (social-economic system).

In a local context, the station must provide a secure, integrated, multi functional space. A place of convenience where daily necessities can be met. The site has been identified as an infill site. This means that the site and the functions on site must fill in with the existing sites. This can also mean that the surrounding sites and activities can adopt a new function. This initiative can lead to a more densely inhabited city blocks, with more activities and therefore a more vibrant environment.

5.1 Densification

- Where Hatfield becomes a tourist destination (both for local and foreign visitors)
- Where the proposed station is fully integrated with the surrounding land uses and activities,
- Where the two SARCC stations (viz. Rissik and Hartbeesspruit Stations) and the proposed Gautrain station are linked via a pedestrian route along the existing railway reserve;
- Where pedestrian movement becomes dominant throughout the node;
- Where residential densification becomes a reality to support the Gautrain; and
- Where more permanent residents are introduced to the node to combat the seasonal nature of student accommodation.


5.2. passenger/ people

Train stations are primarily for people and the function, trains, taxis and busses are secondary elements to be used by the people. The needs to be adhered to for the passengers are very important. As a designer these Requirements must be identified and planned for. The following components and primary issues can be used to establish importance at train stations and platforms.

- Accessing the railway and site
- Waiting for the railway journey
- Boarding the train
- Exiting the railway system
- Some residential areas exist north of the railway line but these are haphazardly located between the offices and other uses

(Diagram illustrating densification towards the station).
5.3. Land uses

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

- There is a significant concentration of offices north of the railway line and particularly around the proposed station. The offices vary in type some being newly developed office blocks and parks, others converted homes into offices, and still some being a mix of home and office space;
- The areas of highest residential concentration are located east of Duncan Road in Hatfield Village and south of Prospect Street including the student accommodation. Where Hatfield Village is concerned the area comprises low-density single dwelling per erf typology while the student accommodation is a mix of high-rise blocks and low-density alone standing units.


The core area should accommodate mixed-use development, retail and offices, office and residential or retail, office and residential to enforce the core as primary business area and to achieve desirable densification. It is proposed that all high-density residential development be located along the periphery of the residential zone between the offices and the low-density residential area to act as a point of transition.

An ever-increasing demand for student accommodation is placing pressure on further eastward expansion to define the spine and in support of the Gautrain residential densification along this road is proposed.

- Diversity of land uses / variety of opportunities
- Linear pedestrianisation and access to development along the railway line, connecting Loftus Station, Rissik Station, proposed Gautrain station and Hartbeespruit Station.
- The development that has occurred in Hatfield has generally been of a low density and includes extensive uses such as motor showrooms which de-density concentrations.
- Linking with Hartbeespruit station as part of the Tshwane Ring Rail system and proposed extension of the Hatfield Centre. Increased traffic congestion into the city will make the station less accessible.
- The coverage is estimated at 45% due to the potential for densification and availability of vacant land, especially in Hatfield village near Hartbeespruit station.
- Present residential: @200m²/unit there is 472 units in the node.
- Densification in this node will mainly be through high-density developments.
- To attain a density of 250dHa - need to attain 2500 units. If it is accepted that there are 472 units in the 100ha area an additional 2028 units will be required.
- The expected economic profile of the future residents in the study area is middle-income families with none or one vehicle per family and young and upcoming professionals. On average an area of 60m² per residential unit is accepted.
- Talking parking and landscaping requirements into account, coverage of 50% and a height of 4 storeys is accepted for residential buildings. Therefore, 6ha is required in addition to the existing high-density residential facilities.

7. Accommodation list

Platform screens and doors.

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

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

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

Entrances and exits.

Station entrances and exits must be designed to allow for the numbers of passengers passing through them, both under normal and emergency conditions. Specific emergency exit requirements are outlined in many countries as part of safety legislation or to standards set down by the railways or other organisations.
The entrances to a station must be welcoming to the prospective passenger. Stations must also have sufficient entrances to cater for the different sides of the railway route but the number must also take into account the cost effectiveness of each entrance. The cost of staffing ticket offices can be very considerable and the numbers of ticket offices must be managed to suit the patronage offering. Consideration must be paid to issues like which way doors open.

Passenger information.

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

Constant information can be described as that which describes the services and fares available and which changes only a few times a year or less. This information can be displayed on posters and fixed notices. There also might be special offers, which can be posted from time to time.

Instant information is that which changes daily or minute-by-minute. This is better displayed electronically or mechanically - both systems can be seen around the world. For instant systems, it can be assumed that passengers require knowing:

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

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

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

Abution facilities.

Public toilets are regularly abused and vandalised in many countries and railway administrations and up paying large amounts to maintain and repair them. They can also often be used for illegal activities, such as drug related offences, sexual activities and for robberies. An increase in the number of passengers relieving themselves in the public and sometimes in the prohibited areas of the railway, including cases where they have wandered onto the track and got themselves killed by passing trains. At the very least, these activities cause an odor and health risk nuisance.

Any railway operator responsible for stations will have to decide whether they are prepared to pay for the installation of toilets and if, they do so desire, they must be prepared for the management and maintenance of such facilities. Nowadays, it is considered good marketing to provide good restroom, baby changing and toilet facilities.

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

Concessions.

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

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

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

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

Basic construction.

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

The sub structure.

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

The track itself is supported on "ballast", made up of stones usually granite, below, which is a layer of sand, which separates it from the formation. For new or renewed formations, the sand is normally laid over some sort of geotextile screen or mesh to separate it from the foundation material below. In the past, asphalt or plastic sheeting has been used to prevent water seepage.

Catenary masts (if the line is electrified on the overhead system) are located outside the drains and, beyond them; there is a walkway area. This may just be a cleared path for staff to walk safely, avoiding passing trains or, on modernized routes, a properly constructed path. Next to this path will be a cable trough. These were originally concrete but are nowadays often made of plastic. A plastic tube, usually bright orange in the UK, protects cables crossing the track.

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

(http://www.trainconstructions.com)