EXECUTIVE SUMMARY OF HIGH SPEED RAIL LINK PROJECT

1 BACKGROUND

1.1 Bangalore, the Capital of Karnataka State popularly known as the Garden City of India is now the 5th largest City of the country with a population of over 8 million. It is also known as the Silicon Valley of India and has developed as a centre for advanced sciences, higher education, research & development. Bangalore has now become one of the top ten high-tech cities of the world and with its salubrious climate for most part of the year, it has emerged as one of the successful commercial and industrial hubs of the Indian sub-continent.

HAL AIRPORT: Earlier, until 29-05-2008 the air traffic at Bangalore was handled by the erstwhile HAL Airport, situated by the side of Hindustan Aeronautics Limited. This was originally an airstrip meant for trial flights of the aircrafts produced by HAL but subsequently came to be used as a full fledged Airport both for domestic and international flights. Even after completing possible capacity expansion works, this Airport was fully saturated and was unable to handle anymore incoming or outgoing flights. Besides, this Airport was situated practically within the city area and with the city having further grown on all its sides, no further expansion was possible. Movement of passengers between the Airport and the city was primarily through taxies, private/official cars and also by autos to some extent. A good proportion of the Airport staff made use of bus services. Due to heavy traffic congestion on the roads leading to the airport, the travel time to the Airport for passengers and staff was long particularly during peak hours.

1.2 Both domestic and international aircraft movements at the erstwhile HAL Airport was increasing at a fast pace in the last few years.

Table 0.1

AIRCRAFT MOVEMENTS AT THE ERSTWHILE HAL AIRPORT, BANGALORE

Year	Aircraft Movement (yearly)		
	Domestic	International	Total
2001-02	30,742	2,887	33,629
2002-03	36,176	3,893	40,069
2003-04	41,699	5,214	46,913
2004-05	50,851	7,082	57,883
2005-06	63,392	8,477	71,869

While the domestic aircraft movements increased at about 20% p.a. the international aircraft movements grew at about 30% p.a over the last five years but more rapidly in the later years. The total annual aircraft movements have grown from 33,629 in 2001-02 to 71,869 in 2005-06.

1.3 INTERNATIONAL AIRPORT AT DEVANAHALLI:

In view of the unprecedented growth of Bangalore City and the consequent enormous increase in air traffic, both domestic and international, a new state-of-the art, green field International Airport was built near Devanahalli, about 34 kms from Bangalore City by the name 'Bangalore International Airport Limited' (BIAL). This is a PPP Project and the shareholding pattern consists of private promoters holding 74% equity stake (Siemens Projects Ventures, Larsen & Turbo and Unique Zurich Airport), with the remaining 26% being jointly held by the Airport Authority of India and Karnataka State Industrial Investment Development Corporation. The BIAL completed the work and opened the International Airport for commercial operations on 24th May 2008. Since the new International Airport is situated about 34 kms from the city, it would take a much longer time, to reach it by taxi / car. The travel expenses will also be high in addition to heavy fuel consumption. It was against this background that the need for a High Speed Rail Link to the new International Airport was felt.

1.4 The Delhi Metro Rail Corporation Ltd (DMRC) was commissioned by the State Government of Karnataka for preparing a Detailed Project Report (DPR) for a High Speed Rail Link to the International Airport, with check-in facilities at the city end. Accordingly, DMRC undertook necessary studies and investigations and prepared and submitted the DPR in October 2007. Now this revised DPR is prepared incorporating the changes that have occurred after the preparation of the original DPR in October 2007.

DMRC is a joint venture of Government of India and Government of Delhi (the Government of the National Capital Territory of Delhi) and have completed and commissioned phase-I of Delhi Metro (65 kms). DMRC is now implementing

phase-II of Delhi Metro covering over 120 kms including a High Speed Rail link from New Delhi Railway Station/Shivaji Stadium (20 kms) to the IGI Airport with City check-in facilities. The Detailed Project Report (DPR) for the Bangalore Metro Rail Project was also prepared by DMRC proposing two lines, the East – West Line (18.10 kms – 18 stations) and the North – South Line (14.90 kms – 14 stations) consisting of elevated and underground sections. Further, DPR for Proposed Phase – II of Bangalore Metro Rail Project covering a total length of about 90 kms is under preparation.

1.5 The Airport Authority of India (AAI) anticipates a steep growth in air traffic to be handled at the Bangalore International Airport in the coming years. BIAL has estimated passenger traffic to increase as follows:

Table 0.2 Yearly Growth in air traffic

Year	Passengers in millions
2006-07	7.9
2007-08	9.8
2008-09	12.3
2009-10	14.9
2010-11	17.2
2011-12	19.3
2016-17	30.0
2021-22	40.1
2026-27	50.2

The figures of passenger traffic during 2001-02 to 2005-06 as obtained from the AAI are given in the Table:

Table 0.3 passenger traffic as obtained from AAI

Year	Passengers in millions per annum		
	Domestic	International	Total
2001-02	2.06	0.21	2.27
2002-03	2.40	0.36	2.76
2003-04	2.70	0.47	3.18
2004-05	3.50	0.67	4.16
2005-06	4.80	0.86	5.65

The traffic at the erstwhile HAL airport was 5.65 million passengers in the year 2005-06 which is likely to grow to 19.3 million in 2011-12, i.e. more than 340% growth in the six years. In the subsequent years also the growth is expected to be of a fairly high order, necessitating development of the New International Airport and the road and rail connectivity keeping in view the air traffic demands.

2.0 ROAD CONNECTIVITY TO INTERNATIONAL AIRPORT

2.1 At present the primary connectivity to the Bangalore International Airport (BIA), , is through the NH-7. Traffic from the city destined to the Airport has to reach this road and then proceed towards the International Airport. The NH-7 is a divided dual carriageway with 3 lanes in each direction. As NH-7 is a busy highway, connecting Bangalore to Hyderabad, the traffic volume on it is about 50,000 vehicles (each way) per day, with the peak hour traffic being about 5,000 vehicles per hour each way. The connection from NH-7 to the New International Airport is through the main access road connecting NH-7 at the proposed trumpet interchange on the southwestern side. The total distance to be covered from City Centre (M.G. Road) to the new Airport will be about 34 kms.

2.2 GOK is also planning a Peripheral Ring Road for Bangalore, about 6 kms beyond the Ring Road and 16 kms short of BIAL main access road. The Peripheral Road crosses the NH-7 beyond Yelahanka which might also give connection to BIAL access road through NH-7. This project, being executed by BDA, is in the initial stages as only land acquisition has been launched so far.

3.0 HIGH SPEED RAIL CONNECTION

3.1 Why a High Speed Express Link?

Keeping the New International Airport far away from the City about 34 kms from Centre of the City has many advantages but equally many disadvantages. While land availability for such an Airport is easy and would be cheap and the Airport can be expanded as the traffic grows, the real sufferers are the Air travelers and Airport employees who have to cover this long distance to reach the Airport. Apart from the high cost of travel to reach the Airport from the City, the time taken for the travel is more and uncertainties due to traffic hold-ups enroute will have to be reckoned with. On the other hand, a High Speed Rail Link Connection will make such a travel comfortable, hassle free, cheap and reliable. Therefore, the majority of the travelers to the Airport would prefer a fast and reliable rail journey and with check-in facilities.

3.2 Advantages of Rail Connectivity over road access

- The rail journey will take 25 minutes as against an hour or more by road.
- Rail journey will be in air-conditioned comfort, very safe and reliable. There will be no uncertainty in regard to traffic hold-ups.

- The energy needed for a passenger km. by rail is only 1/5th of the energy needed by road. Therefore, there will be considerable fuel saving if Air travelers choose rail journey.

- Air travelers can have check-in facilities at the City itself. This would be a great advantage available both for International and Domestic travelers and would reduce the congestion at the check-in counters at the Airport as also the need for parking facilities at the Airport end.

- By rail, there will be no pollution and can have a relaxed travel without any tension and passengers can be sure of the time by which they can reach the Airport.

- The travel by rail would be far cheaper than the road journey apart from being very safe.

- A Rail Connection has flexibility of increasing the capacity by reducing the headway between the trains.

- The need for many visitors to reach the Airport for seeing off or meeting the relatives can be considerably reduced since this activity can take place at the City Air Terminal itself.

However, it has to be reckoned that many of the rail travelers may still have to take another mode of journey to reach the City Air Terminals.

4.0 ROUTE ALIGNMENT

4.1 City Airport Terminal

The High Speed Rail link (HSRL) to the new International Airport starts from the Police Grounds situated between M.G. Road and Cubbon Road. Police Grounds represents practically the city centre, well connected on all sides to the entire city and its outskirts. The ramp of the Bangalore Metro Rail Phase-I is also located in this area. The structure of the City Airport Terminal (CAT) is being planned in such a way that the needs of Bangalore Metro are fully met while at the same time the remaining area is utilized for the CAT. The proposed Bangalore Metro Rail crosses Police Grounds diagonally as a ramp from the underground station of Minsk Square to the elevated station on the M. G. Road. It is possible to accommodate in the Police Grounds the requirements of both the Bangalore Metro Rail and CAT of the Airport Rail Link. The CAT structure will be put up around the Bangalore Metro Rail Ramp. In other words the Metro ramp structure will go through the CAT Building, the two systems totally isolated, at the same time integrated together.

The CAT structure will be multi storied with separate departure and arrival areas. Initially, it will have 60 check – in counters for international passengers and another 60 for domestic passengers with provision to increase their numbers to cater to future demand. Provision is also being made for facilities such as Airline Ticketing Offices, CAT and Rail Line Offices, Shopping Arcade, Restaurants, Coffee Shops, Rest Rooms, etc. There will be adequate parking facilities for private cars, taxis, autos etc. The Complex will have about 1800 parking capacity for "park and fly" passengers.

4.2 The High Speed Rail Link from the City Center to the New International Airport (a distance of 33.65 kms) shall be of double Track, one up-line and the other down-line. These lines will be mostly elevated (except in IAF Area & BIAL Area) starting from the Police Grounds, where Cubbon Road Station (chainage 0.095 km) will be located. From here, this Rail Link will traverse on the Cubbon Road by the side of the Bangalore Metro Rail, (which will be underground at this location). It will then traverse on the Cubbon Road, cross over the Minsk Square underground station of Bangalore Metro Rail (BMR) short of Thimmiah square the BMR takes a left turn and the High Speed Rail Link to the International Airport moves on to the the Raj Bhavan Road up to the All India Radio Complex. At this point the alignment takes a right-hand curve to move to the middle of Chowdiah Road. From here the alignment will be generally on the median of Chowdiah Road/Sankey Road/Bellary Road up to the approach of Hebbal Fly-over except at the BBMP's newly constructed flyovers locations i.e. BDA Junction, Sanjay Nagar Cross and CBI Junction where the HSRL will be on the side of these flyovers. The High Speed Rail Link will fly over the existing Road Over Bridge and Railway Bridge near Windsor Manor Hotel and the Mekhri Circle Underpass Bridge.

4.3 **Hebbal Check In Station**: The High Speed Rail Link will then traverse on the right side of Hebbal Fly Over. The second luggage Check-in Station at Hebbal has been located at the end of, and to the right of the Hebbal Fly Over at chainage 8.822 km where Government lands are available. The State Govt. has planned integration of Bus services by the side of this area. From here the alignment is taken on to the right side divider between the future 4-lane main carriage way and the service road (facing Devanahalli) of the National Highway No-7(Hyderabad Highway) upto Yelahanka. Due to easy access from the Ring Road this Station is expected to attract a large clientele in due course

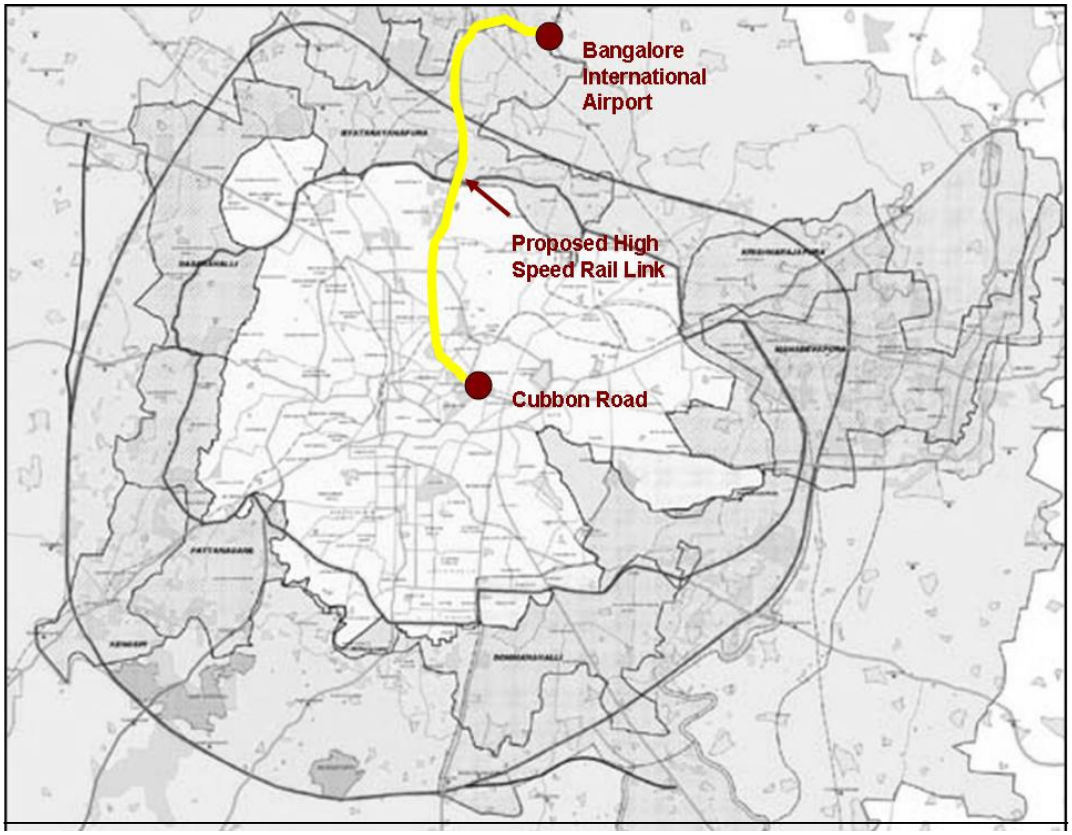
4.4 **Yelahanka Pick Up Station:** The alignment continues on the right side divider between the future 4-lane main carriage way and the service road (facing Devanahalli) of NH-7 and traverses over the Railway Under Bridge and then to Yelahanka pick-up Station, which is located near the junction of the National Highway and the Yelahanka town road on RHS (facing Devanahalli) at chainage 15.073 km. Luggage Check-in facilities are not provided here but passengers with hand baggages can board the train and alight with their

baggages. The alignment continues on the right side divider between the future 4-lane main carriage way and the service road (facing Devanahalli) of NH-7 until it reaches the region of the Indian Air Force Station, Yelahanka. At this location the alignment of High Speed Rail Link is required to be dipped to at-grade to suit the requirements of the Air Force. This is necessary because the HSRL is crossing the approach of the runway of the Air force. The HSRL Alignment will have to be taken to the eastern side of NH-7 as the HSRL Alignment is dipping at this location.

After crossing IAF area, the alignment will then traverse on the right side divider between the future 4-lane main carriage way and the service road (facing Devanahalli) of the NH-7 as elevated until it reaches short of the trumpet junction on the NH-7. From here onwards the alignment leaves the NH -7 in a curve to the right and after crossing a stretch of private land crosses the BIA approach road and runs parallel to it on the northern side to reach the central area in front of existing terminal building T-1/future terminal T-2 and future terminals T-3/T-4. There may be some changes in the number of Terminals and location of terminal buildings T2 to T4

The route map of the alignment has been shown in Figure - 0.1. The Index section of the alignment has been enclosed as Annexure Figure- 0.2.

Figure: 0.1- Route Map



4.5 **Widening Of Bellary Road and Other Roads:** As already stated above, the alignment of Airport Rail Link traverses on (i) Cubbon Road – Raj Bhawan Road – Chowdaiah Road– Sankey Road – Bellary Road up to the Hebbal Flyover which belong to Bruhat Bangalore Mahanagar Palika (BBMP), and (ii) Bellary Road (which is a part of NH-7) from the Yelahanka end of Hebbal Flyover to short of trumpet interchange. At the Hebbal Flyover, the alignment is located to the right of the flyover and traverses on the right side divider between the future 4-lane main carriage way and the service road (facing Devanahalli) of NH-7 after the Flyover.

The roads in item (i) are generally of four lanes with a narrow median and in some lengths no median at all. Hence, there is need for land acquisition for widening of these stretches of roads by about 2 meters on each side, i.e. 8 km x 4 m = 3.2 Hectares. However, these stretches of the road are already planned for widening by BBMP. Hence the cost of land acquisition and the cost of widening have not been taken in this project.

Beyond Hebbal Flyover, the NH – 7 divider between the future 4-lane main carriage way and the service road on RHS (facing Devanahalli) is only about 1.5 m wide which needs to be widened to 3.5 m to accommodate the piers of the rail link. The additional area of land involved in this stretch is 18.5 km x 2.0m = 3.7 Hectare. But in this length NH – 7 has already got wide right of way (ROW) for locating the piers of HSRL, however NHAI authorities are in the process of acquisition of land for their widening programme and have agreed to include 5m strip of land on RHS (facing Devanahalli) on HSRL's account. And therefore no fresh land acquisition may be involved.

5.0 TRANSPORT DEMAND FORECAST

5.1 For the purpose of estimating transport demand, in addition to the available secondary data, various primary surveys, such as classified traffic volume, origin & destination surveys, willingness to travel by the proposed High Speed Express Rail link, etc at the present Airport Terminal were undertaken.

Traffic at the erstwhile HAL Airport Complex

As per the traffic surveys conducted at the erstwhile HAL airport complex, it is estimated that about 30,000+ trips are coming to and going from the Airport on a normal working day. Out of these, about 28,500 trips are by air passengers, while 1,000 trips are by the staff working at the `Airport Complex, the remaining trips being attributed to the visitors.

5.2 Willingness to Travel by the Proposed High Speed Rail Link

Opinion survey conducted shows that a large number of passengers and workers (80%) are willing to use the proposed high Speed Rail Link. About 71 % staff surveyed also expressed their willingness to shift to the `proposed Rail Link. About 81% of the surveyed passengers expressed their preference for a City Check-in facility.

5.3 Transport Demand Forecast

The High Speed Rail Link will provide a fast, convenient, and comfortable linkage and will attract passengers from the private modes and contract carriage buses. In this perspective, it is observed that a direct dedicated Rail Link to the new International Airport will be an attractive option. It may be pointed out that this dedicated Rail Link could attract the daily traffic of work staff of the new Airport and a large number of work staff of the Aero City being developed by BIAL.

As per the O-D survey, a sizeable Airport traffic will be from central, south, southeast, southwest, west and north areas of Bangalore. These passengers will be attracted to travel from the center of the city to the new Airport. These are comparatively heavily populated areas besides the existence of Government offices, business houses, hotels etc. The Rail Link will take only about 25 minutes to reach the New airport with the facility of Check-In at the center of the city (Police Grounds between M G Road and Cubbon Road) and at Hebbal, where the Ring Road passes through. There will be a pick up station at Yelahanka to attract those passengers who come from the interior areas and north of Yelahanka. This facility of Rail Link is thus expected to attract Airport users from all sides of Bangalore except the northeast side.

According to the traffic forecast by BIAL, the air traffic will be 17.2 million passengers p.a. in 2010-11. As per the rider ship forecast, about 40% of this figure will be using the High Speed Rail Link. The other important factors which will be contributing traffic to the proposed system will be: (i) the work force of about 5,000 persons at the Airport at the time of opening in 2008 and whose number will be growing approximately in line with the overall growth in passenger figures, and (ii) the traffic from Aero City which is being constructed within the BIAL premises for offices, retail, entertainment and hospitality complex, which has been estimated to grow from 2000 persons in year 2008 to approx 1,00,000 persons in 10 yrs after the Airport opening.

The projected ridership for embarking, disembarking, and employees respectively on a per day basis is furnished below

Table 0.4 - The projected ridership on a per day basis

Year	Disembar-king	Visitors	Embarking	Visitors	Emp Arrivals	Emp Departur e	Aero city Arrival	Aero city Depart	In	Out
2011	11,450	4,294	10,024	3,759	2,635	2,635	2,977	2,977	21,357	19,396
2016	17,236	6,464	15,279	5,730	4,244	4,244	4466	4466	32410	29719
2021	26,958	10,109	24,408	9,153	6,835	6,835	6699	6699	50601	47095
2026	43,160	16,185	38,084	14,282	11,009	11,009	10048	10048	80402	73423

The All day Station Loadings are presented below:

Table 0.5 - All Day Station Loadings on Airport Link

All day Station loading	2011		2016		2021		2026	
	Police Gr to Airport In	Airport to Police Gr Out	Police Gr to Airport In	Airport to Police Gr Out	Police Gr to Airport In	Airport to Police Gr Out	Police Gr to Airport In	Airport to Police Gr Out
Police Grounds	18,925	17,187	28729	26,343	44853	41745	71268	65083
Hebbal	1,702	1,546	2580	2,366	4028	3749	6400	5844
Yelahanka	730	663	1101	1010	1720	1601	2734	2496

Table 0.6
The Link Loadings For Peak Hour (Phpdt) Are Presented Below

From	To	2011	2016	2021	2026
Police Gr (Cubbon Rd)	Hebbal	2,926	4469	6966	10974
Hebbal	Yelahanka	3,190	4871	7592	11960
Yelahanka	BIA	3,302	5043	7859	12381
Hebbal	Police Gr (Cubbon Rd)	2,768	4799	7541	11746
Yelahanka	Hebbal	3,018	4636	7285	11347

BIA	Yelahanka	3,124	4253	6685	10412

Table 0.7 The ridership forecast per hour, to the International Airport

Year	Passengers	Visitors	Employees	Aero city	Projected Total PHPDT	Designed PHPDT
2011	954	477	878	992	3302	2526
2016	1436	718	1415	1474	5043	3158
2021	2247	1123	2278	2211	7859	4210
2026	3597	1798	3670	3316	12381	11500

Table 0.8 - The ridership forecast per hour, from the International Airport

Year	Passengers	Visitors	Employees	Aero City	Projected Total PHPDT	Designed PHPDT
2011	835	418	878	992	3124	2526
2016	1273	637	1415	1474	4799	3158
2021	2034	1017	2278	2211	7541	4210
2026	3174	1587	3670	3316	11746	11500

Design PHPDT has been worked out considering that peak hour for all the above categories will be different.

6.0 PLANNING & DESIGN PARAMETERS

The design parameters related to High Speed Express Rail link to the New International Airport have been chosen based on a detailed evaluation, experience and internationally accepted practices for such rail connections.

6.1 Gauge: Standard Gauge (1435 mm.)

6.2 Horizontal Curves

The line is being planned with the maximum speed potential of 160 kms. per hour with the maximum operational speed of 145 kms Per hour. The horizontal curves have been therefore limited to 1000 m radius except at very special locations where a flatter curve is not possible. Where trains slow down for approaching stations, sharper curves have been adopted such as the approach to Airport Terminal, CAT at Police Grounds and Hebbal Station.

All the curves are transitioned for comfort and safety. Vertical curves have been provided at each change of gradient with a minimum radius of 2500 m.

6.3 Viaduct Structure

The two tracks will be carried on two independent 'U' shaped pre-stressed and pre-tensioned concrete girders supported on single columns, generally at 25 m. intervals, generally located in the central median of the road. As the girders will be manufactured at a central casting depot, high quality can be ensured and their erection can be managed easily by two cranes working from the road level. The decking will have a minimum vertical clearance of 5.5 m. above road level. 'U' shaped girders will serve the dual purpose of noise attenuation as well as derailment guarding. A typical cross section of the viaduct can be seen at Figure 0.3.

6.4 Gradients

Stations shall be on level stretch. In between stations, generally the grades may not be steeper than 2.0%. Maximum grade provided is 3.33% opposite IAF Yelahanka due to their existing run way nearby.(This is an exception)

6.5 Track

It is proposed to adopt ballastless track, constructed by embedding the pre-cast twin block sleepers in 2nd pour concrete. The two RCC blocks of a sleeper are connected by lattice truss, which ensures proper integration of these RCC sleepers with surrounding concrete. The detailed design of track structure including the arrangements for integrating this slab track with deck will have to be carried out making it compatible with the structural designs of supporting structures. It is proposed that complete track may be laid as CWR duly integrating the turnout also in the CWR. For this purpose, the rail-structure interaction analysis will have to be carried out to ascertain additional forces for which the viaduct will have to be designed. Allowable maximum cant will be 140mm and cant deficiency 100 mm.

6.7 Route Length

Total alignment length from center of Cubbon Road (Police Grounds) station to the Centre of New International Airport Terminal is 33.1555kms. Actual construction route length will be 33.65 kms.

6.8 Air-conditioning

The train will be fully air-conditioned and all the stations will also be air-conditioned in the passenger movement areas including the platforms where platform screen doors are proposed to be installed. The stations and trains will be designed and constructed to meet the high standard of fire safety requirements needed for such systems.

6.9 Station Planning

Four stations have been planned on the proposed Airport Rail Link. The stations are fully air-conditioned and with platform screen doors. The Stations of HSRL are listed below:

Table 0.9 - Details of Stations on HSRL

S No	Stations	Type	Chainage (Meters)	Inter Station Distance (KM)
1	Cubbon Road Station	Elevated	95	-
2	Hebbal	Elevated	8822	8.727
3	Yelahanka	Elevated	15073	6.251
4	New International Airport (Terminal building) **	Underground	33250	18.177

** The BIA Terminal Station is now planned as underground as per the requirement of BIAL.

The line is being planned to cater to dedicated airport traffic. To cater to this requirement, baggage check-in facility is being planned at Cubbon Road Station and Hebbal Station through which air travelers (both domestic and international) will be able to check-in their luggage at the Metro station itself while boarding the train to the Airport. For this, additional area in the passenger concourses is provided at these two stations. Arriving passengers have to collect their baggage at the Airport and board the High Speed Rail Link by the side of the Terminal building where several counters for issue of tickets will be operating. Free assistance will be available for loading and unloading luggage from the trolley to the train and vice-versa.

Stations have been planned following the norms and criteria being adopted by DMRC. Traffic integration facilities are provided at almost all the stations keeping in view the ridership pattern and availability of land. The integration facilities at Rail Link stations include approach road to the stations, circulation facilities, pedestrian ways and adequate parking areas for various modes likely to come to these stations, including feeder buses/mini-buses. Provision has been made to cater to the peak hour demand.

7.0 TRAIN OPERATION AND SYSTEM DESIGN

7.1 Operation Philosophy

The main features of the operation philosophy are to make the Airport Link more efficient and attractive. These are:

- Selecting the most optimum frequency of train services to meet sectional capacity requirement during peak hours on most of the sections.
- Optimum train service frequency not only during peak period, but also during off-peak period.
- Train formation consisting of 6 coaches based on the traffic demand.
- Multi-tasking of train operation and maintenance staff.

7.2 Train Formation

The Rolling Stock chosen allows for the following train rake formations with train carrying capacities as mentioned below:

Table 0.10 - Rake Information

Rake Formation	
6 Car =	DMC+TC+MC+MC+TC+DMLC
DMC	: Driving Motor Car
MC	: Motor Car
TC	: Trailer Car
DMLC	: Driving Motor cum Luggage Car

Table 0.11 – Train Carrying Capacities

	Driving Motor car	Motor car /Trailer Car	Driving Motor car cum Luggage car	6 Car Train
Seated	56	64	38	350
Standing	11	13	8	71
Wheel chair	2	0	1	3
Total	67	77	46	421

Basic unit of 6 car trains has been selected to meet the traffic demand in years 2011, 2016 and 2021.

7.3 Train Operation Plan

The train operation plan (headway and train composition) is given as under:

Year 2014

The train operation on Airport High Speed Rail Link is planned with 6 car trains at 10 minutes headway during the first year of operation i.e. 2014. The 6 car train capacity with 10 min headway is 2526 per hour per direction. The capacity planned is nearly equal to the peak demand. This has been done to cater for the uneven distribution of traffic in the peak hour.

Year 2016

The train operation on Airport High Speed Rail Link is planned with 6 car trains at 8 minutes headway during the year 2016. The 6 car train capacity with 8 min headway is 3158 per hour per direction. The capacity planned is adequate for the peak demand. This has been done to cater for the uneven distribution of traffic in the peak hour.

Year 2021

The train operation on Airport High Speed Rail Link is planned with 6 car trains at 6 minutes headway during the year 2021. The 6 car train capacity with 6 min headway is 4210 per hour per direction. This has been done to cater for the uneven distribution of traffic in the peak hour.

Table 0.12 - Train Operation Plan

Year	PHPDT Demand	Headway Planned (minutes)	No of Cars per train	Train carrying capacity per Hour per direction
2014	4346	10	6	2526
2016	5043	8	6	3158
2021	7859	6	6	4210

No services are proposed between 12 PM to 04:30 AM, which period is reserved for maintenance of infrastructure and Rolling Stock. Depending up on actual arrival and departure of aircrafts the maintenance slot will need to be adjusted

7.4 Rake Requirement

Based on Train formation and headway as decided above to meet Peak Hour Peak Direction Traffic Demand in different years, the rake requirement has been calculated which includes traffic and maintenance reserves and tabulated below:

Table 0.13 –Rake Requirement

Year	Headway (minutes)	No. of Rakes	No. of Cars per Rake	No. of Cars
2014	10	10	6	60
2016	8	12	6	72
2021	6	15	6	90

The additional requirements of rolling stock from 2026-27 have not been considered.

7.5 Rolling Stock

The Rolling Stock design requires an operation at maximum attainable speed of 160 kmph. The interiors of the coaches shall be different from normal metro coaches with more facilities. Comfortable seating facility for passengers is provided with provision of TV screen at the back of the seat for displaying information. Standing capacity of 20% of seating capacity has also been provided. Provision for luggage space is also kept in the coaches.

Low Life Cycle Cost

The low life cycle cost is achieved by the way of reduced scheduled and unscheduled maintenance and high reliability of the sub-systems. It is possible to achieve these objectives by adopting suitable proven technologies.

8.0 TRACTION SYSTEM AND POWER SUPPLY

8.1 Traction system

25 kV AC Traction system is proposed for Airport Rail Link. The system shall be with flexible OHE.

8.2 Power requirement

The power requirements of a HSRL system are determined by peak-hour demands of power for traction and auxiliary applications. Broad estimation of auxiliary and traction power demand is made based on the following requirements:-

(i) Specific energy consumption of rolling stock – 80KWh/1000 GTKM
(ii) Regeneration by rolling stock – 30%
(iii) Elevated/at –grade station load – initially 350kW, which will increase to 500 kW in the year 2031

(iv) Stations with check in facility-: initially 3400 kW, which will increase to 4000 kW
(v) Depot auxiliary load - initially 2000kW, which will increase to 2500 kW in the year 2031.

Keeping in view of the train operation plan and demand of auxiliary and traction power, power requirements projected for the year 2014 and 2021 are summarized below:-

Table 0.14 - Power Demand Estimation (MVA)

Power Demand	Year		
	2014	2016	2021
Traction	8.3	12.9	21.2
Auxiliary	4.2	4.2	5.5
Property Development	2.0	2.0	2.5
Total	**14.5**	**19.10**	**29.2**

8.3 Continuous & reliable power supply is mandatory for efficient operations. To ensure reliability of power supply, it is essential that both the sources of supply and connected transmission & distribution networks are reliable and have adequate built in redundancies. Therefore, it is desirable to obtain power supply at high grid voltage of 220 or 66 kV from stable grid sub-stations and for BIAL itself well before revenue opening date.

8.4 Standby Diesel Generator (DG) Sets

In the unlikely event of simultaneous tripping of all the input power sources or grid failure, the power supply to stations as well as to trains will be interrupted. It is, therefore, proposed to provide a standby DG set of 200 KVA capacity at all stations to cater to the following essential services:

(i) Essential lighting
(ii) Signaling & telecommunications
(iii) Fire fighting system
(iv) Lift operation
(v) Fare collection system
(vi) Security Check Equipment

Silent type DG sets with low noise levels are proposed, which do not require a separate room for installation.

8.5 Supervisory Control and Data Acquisition (SCADA) System

The entire system of power supply (receiving, traction & auxiliary supply) shall be monitored and controlled from a centralized Operation Control Centre (OCC) through SCADA system. Modern SCADA system with intelligent remote terminal units (RTUs) shall be provided. Optical fiber provided for telecommunications will be used as communication carrier for SCADA system.

9.0 TRAIN CONTROL, COMMUNICATION AND FARE COLLECTION SYSTEM

9.1 Continuous Automatic Train Control (CATC) system with cab signalling has been proposed for the Rail Link operation transporting a high volume of passengers at tight headways to ensure strict safety enforcement monitoring. Line side LED signals shall be provided at all stations and at diverging routes from the main line (i.e. at points & crossings), which shall serve for backup signalling in case of failure of CATC system.

9.2 Power supply for the signalling & train control equipment provided at the stations, depot & rolling stock shall be on the similar pattern to be provided in Bangalore Metro phase-I System. The power supply will have at least 3 levels i.e. mains power supply from the State Electricity Supply, traction power supply and UPS/battery backup/Diesel Generator to support uninterrupted train operations.

9.3 A reliable telecommunication system encompassing multitude of functions and activities is essential for a rail based HSRL system interconnecting various locations like stations, depots, trains, OCC, site staff, administrative offices, data and MIS links.

9.4 Telecommunication System shall comprise various sub-systems viz. Fiber Optic Transmission System (FOTS), Telephone, Radio, Public Address, Close Circuit TV and Public Information Display System, Centralized Clock System, SCADA etc. The FOTS shall have an armoured optical fiber cable with path diversity. The equipment proposed shall be of STM-1/STM-4 Digital Hierarchy (DH) with expandable capability to STM-16. This system will have built in Network Management System (NMS) to monitor overall system performance and capability for reconfiguration. It is proposed to provide ISDN-EPABX system to be integrated with other telephone systems with access to PSTN and interface to radio system. The proposed radio system shall support both train radio and hand held portable sets for communication with central control. Microprocessor based Network Management System covering radio/optical fiber based communication and telephone exchange system shall be provided.

10.0 AUTOMATIC FARE COLLECTION SYSTEM

10.1 For trouble-free and efficient ticketing & passenger control, Automatic Fare Collection (AFC) System shall be provided. The base AFC system shall make use of "Contact-less Smart Cards and Tokens" for multiple and single journey respectively, as well as working with multiple operators. The AFC system shall have equipment located at OCC and stations.

10.2 Ticket vending shall be both manual and through Ticket Vending machines.

11.0 TRAIN MAINTENANCE DEPOT

Train Maintenance depot is planned in open land near the International Airport. 25 Hectares of land area is proposed for acquisition for depot and other purposes. The depot shall cater for normal repair, maintenance and inspection, washing of rakes etc.

12.0 OTHER ENGINEERING ITEMS

12.1 GEO-TECHNICAL INVESTIGATIONS:

The area under study is part of gneissic terrain of peninsular origin. The soil formation is due to physical weathering of parent rock caused by temperature changes accompanied by chemical transformations. Generally the soils contain Kaolinite, Montmarillonite, Muscovite and quartz as the dominant clay minerals. Twenty-one boreholes were drilled up to a maximum depth of 30-m below the existing ground level.

12.2 For the viaduct structure generally pile foundation has been proposed, but at many locations open foundation is possible.

12.3 **Utility and Services**: The proposed alignment is mostly on the central median in BBMP area up to Hebbal Fly-over. In the further length of alignment from Hebbal Fly- over to short of trumpet junction, the alignment is on right side divider between the future 4-lane main carriage way and the service road on RHS (facing Devanahalli) of NH-7 and and hence not many Utility Crossings exist. However, there are some electric poles, telephone poles, sign boards, Advertising boards, traffic signals, police umbrellas etc. These may not have significant effect on construction and project implementation time schedule / costs. In any case necessary planning action will have to be taken before actual construction.

12.4 **Land:** Land is mainly required for City Air Terminal, other station buildings, traffic integration facilities, depot/car shed, receiving/traction sub-stations, property development, temporary construction depots, and work sites, etc.

Abstract of land requirements for different components of this corridor are summarized below:

Government Land

- Government land to be acquired at stations & other locations – 37.045 Hectare.

For Govt. Land (within road ROW), permission is to be obtained from the respective depts.

Private Land

- Private Land to be acquired including land for Depot - 28.99 including land for temporary works & construction Depots Hectare

12.5 Permission from NHAI is under process to use the right side divider between the future 4-lane main carriage way and the service road on RHS (facing Devanahalli) for locating the viaduct piers of HSRL.

13.0 ENVIRONMENTAL IMPACT ASSESSMENT

13.1 Detailed Environmental Impact Assessment Study has been carried out As a part of this study, comprehensive environmental baseline data such as water quality, vegetation, air and noise quality was collected. Both positive and negative impacts of the project were assessed in detail. There are approximately 371 trees on the proposed alignment, which will need to be uprooted and another 254 trees are required to be pruned. Most of these trees are in the private farm lands before entering the Airport area. No historical/cultural monuments will be affected as a result of the proposed development of project. Acquisition of private land is kept to the barest minimum although a few properties are affected. To minimise the negative environmental impacts, a comprehensive Environment Management & Monitoring Plan has also been drawn up, both for construction and operational phases, outlining necessary remedial measures.

The positive environmental impacts are:

- Traffic congestion reduction
- Quick service and safety
- Less fuel consumption
- Reduction in air pollution
- Better roads
- Employment opportunities

Based on environmental baseline conditions, planned project activities and its assumed impacts, a set of measures are to be taken during implementation and operation to avoid or offset adverse environmental impacts or to reduce them to

acceptable levels. Environmental monitoring will be required for the construction and operational phases. The parameters needed to be monitored are water quality, air quality and noise levels.

14.0 COST ESTIMATES

14.1 Cost estimates have been prepared based on the price levels prevailing in January 2010. It has been assumed that land owned by Government / Municipal Corporation will be provided free of cost to the project. It has been further assumed that cost of civil works of the airport line including the terminal station located within BIAL premises will be provided as one time grant to the owner of the Airport Rail Link. The length of the Rail Link upto Terminal inside BIAL premises comes to 3.82 kms as per the present thinking of BIAL and its estimated cost is Rs.483 crores (i/c taxes). This cost does form part of the completion cost of the project.

- Estimated cost (without land cost) =Rs.3758 Crores
- Estimated cost (Including land cost) = Rs.4327 Crores
- Estimated Central & State Taxes = Rs. 593 Crores
- Estimated cost (Including Taxes) with Land =Rs. 4920 Crores
- Completion cost by July 2014 with Taxes and Land = Rs.5338 Crores
  But excluding IDC of Rs.499 Crores.

15.0 THE PROPOSED FARE STRUCTURE

15.1 Fare structure proposed to be adopted at the time of opening of the Airport Rail Link will be as under:

From CAT at Police grounds to International Airport	=	Rs. 200/-
From Hebbal to International Airport	=	Rs. 150/-
From Yelahanka to International Airport	=	Rs. 100/-

15.2 Monthly or quarterly season tickets will be priced on the basis of Rs.50/- per journey and forty journeys per month i.e. Rs.2000/- p.m.

16.0 Property Development

16.1 There is excellent scope for raising funds through property development at Cubbon Road Station (CAT), Hebbal and Yelahanka Stations. In addition the Car depot also provides opportunities for property development.

16.2 Finances expected to be raised at these 4 locations are -

1) CAT Rs.300 crores
2) Hebbal Rs.200 crores

3) Yelahanka & Depot Rs.805 crores

Property Development at all the above four locations will be done by the Concessionaire earmarking Rs. 650 crores for Capital funding. Out of balance 655 crores, 75 crores will be taken as operating income during second year of operation and balance over a period of 25 years as continuous revenue generation.

17.0 PROJECT FIRR

17.1 The FIRR of the Project with taxes and duty will be 13.99%. The economic rate of return has not been worked out as this will not be very significant and project can not be justified on social grounds.

17.2 The Project is proposed to be taken up on BOT basis through a concessionaire with a concession period of 30 years including construction time. Assuming that the concessionaire will have to raise resources from the market at 12% and he would expect a return on his equity to the extent of 14% the viability gap funding (VGF) has been assessed as Rs. 50 crores considering that Government & Private land is made available free of cost and Airport operator will bear the cost of civil works within the Airport premises for the value of Rs.483 crores. Land inside the Airport premises will also be made available free of cost. This gap in viability will have to be met by the owner of the project namely the SPV from its own equity capital/Govt. of India

18.0 FINANCING OF THE PROJECT

For funding this project two options namely 1) Public Private Partnership (PPP) model, 2) Build Operate and Transfer (BOT) model, with a concession period of 30 years are examined as under:

Under PPP model, the civil construction job will be done by SPV with funds to be made available by GOI & Government of Karnataka (GOK) and the systems and E&M works will be done by the concessionaire by bringing required funds in the debt equity ratio of 2:1. Under BOT model, the BOT operator will construct the project and run the system for 30 years including construction period. To attract concessionaire to implement the project on BOT basis, a minimum post tax return of 17% on his equity has been assured. It is further assumed that concessionaire will be able to arrange loans @ 11% interest. Land is to be provided free of cost (Rs. 548 Crores) in both the options.

Since, under both the PPP and BOT model, the governments' outflow will be Rs. 1598 Crores (with zero upfront from PD), Rs. 948 crore (with PD upfront of Rs. 650 Crore) and Rs. 1348 Crore (with PD upfront of Rs. 250 crore), keeping the total responsibility required to be handled by the operator, it is recommended for adoption of BOT model. In brief the funding of the project on BOT basis will be as under-

- Concessionaire equity - Rs. 1247 Crores
- Concessionaire loan - Rs. 2493 Crores
- Viability gap funding as per details below:-

Particulars	With No Upfront	With Upfront of Rs. 650 Crore	With upfront of Rs. 250 Crore
	Amount (Rs/Crore)	Amount (Rs/Crore)	Amount (Rs/Crore)
VGF by GOI & GOK	1050.00	1050.00	1050.00
Land to be provided free of cost by GOK	548.00	548.00	548.00
Total	1598.00	1598.00	1598.00
Less: PD Upfront	0.00	650.00	250.00
Net VGF	**1598.00**	**948.00**	**1348.00**

- Funding by BIAL (Civil Cost in Airport compound) - Rs. 606 Crores
- Post tax return on concessionaire equity - 17%
- Completion cost with Land and taxes - Rs. 5338 Crores

19.0 INSTITUTIONAL ARRANGEMENT

Under the BOT model there should be owner owning and be responsible for the project. Therefore an SPV is required to be formed to own the project and administer the Concession Agreement. The G.O.K, G.O.I and the BIAL should be the share holders of this SPV. The share holding ratio can be considered at later stage. However it is necessary that AAI should represent G.O.I in the SPV. The cost of Govt & private lands is to be borne by the G.O.K and the cost of civil works within airport limits will be contributed by BIAL as one time grant. These two amounts is not to be reckoned as equity capital.

BARL should be a very slim and competent organization with not more than 10 persons on its rolls. All activities can be farmed out to Consultants including project management, but superintendence, monitoring and administration of the Concession Agreement will be the full responsibility of BARL.

The Board of BARL may consist of not more than 7 Directors, 3 from each Government and one from BIAL. While the M.D. will be from G.O.K., the Chairman will be from AAI. At least one of the G.O.I. Director should be from Indian Railways or from Delhi Metro.

BARL will have to engage an interim Consultant to prepare the EOI document, shortlist the bidders and for preparation of RFP document and Concessionaire agreement. Global competitive bidding will be invited by them and they will assist BARL to select the Concessionaire and get the Concession Agreement signed. An organization which has experience in preparing such bid documents and which has metro experience and background should be selected as interim Consultant. Such a Consultant will generally charge 0.5% of the project cost as their fee. BARL has engaged Delhi Metro Rail Corporation (DMRC) as interim Consultant to prepare the EOI document, shortlist the bidders and for preparation of RFP document and Concessionaire agreement.

Once the Concession Agreement is signed BARL will need a project Management Consultant to assist them in overseeing the Project Implementation. Such a Consultant should have the expertise and experience for checking and clearing all technical specifications, competence to supervise the civil construction, approve System parameters, clear all system designs, rolling stock designs, supervise system integration trials, apply for CRS' safety inspection, satisfy CRS during his inspection and obtain final Safety Certificate. The Consultant may have to engage independent Safety Assessors in certain areas particularly in Signalling and Tele-Communication, Rolling Stock oscillation trials etc. and should have Metro experience.

The Project Consultants generally charge 4 to 5% of the project cost as their fee.

All the civil works and property development will be carried out by the concessionaire as a part of HSRL Project.

20.0 HIGH POWER COMMITTEE

During the implementation of the project several problems with regard to acquisition of land, diversion of utilities, shifting of structures falling on the project alignment, rehabilitation of project affected persons, etc. are likely to arise. For expeditious resolution of these problems, an institutional mechanism needs to be set up at the State Government level. Towards this end, it is recommended that a High Power Committee under the chairmanship of Chief Secretary, Karnataka should be set up. Other members of this Committee

should be Secretaries of the concerned Departments of the State Government and Heads of civic bodies who will be connected in one way or the other with the implementation of the project, representatives of BIAL, representative of Indian Railways and a representative of the consultants. This Committee should meet once a month and sort out all problems brought before it.

21.0 LEGAL COVER

The High Speed Rail Link (HSRL) may be taken up under the METRO RAILWAYS (AMENDMENT) ACT 2009. However, for the applicability of this Act Bangalore city including Devanahalli area has to be declared as the Metropolitan area and the State Government should approach GOI (Ministry of Urban Development) to take up HSRL project under Metro Act.

22.0 IMPLEMENTATION SCHEDULE

Considering the fact that the new International Airport has commissioned in May 2008 and that the Airport is a good 34 kms away from the City and that the Airport users are put to considerable handicap and cost in the absence of a Rail connection, the High Speed Rail Link has to be ready as early as possible. The following implementation schedule, though tight, but easily achievable, is recommended for adoption:-

a)	RFP documents ready	15.12.2009
b)	Invitation of RFP	19.04.2010
c)	Receipt of RFP	19.06.2010
d)	Finalisation of Concession Agreement	31.07.2010
e)	Financial closure by the concessionaire	15.10.2010
f)	Construction, testing and commissioning of the project	31.10.2013
g)	Revenue Operation	01.11.2013

Government of Karnataka should hasten decision on the preliminary items described in the above paras so that the project can be completed as per the above schedule.

Since the project will be executed on BOT basis, contract packages will be decided by concessionaire with the approval of BARL.

23.0 WAY FORWARD

The original Detailed Project Report has already been submitted and been circulated to all concerned and their views invited – particularly from concerned Departments of G.O.K., Planning Commission, Civil Aviation Ministry, AAI, Ministry of Defense (regarding Air Force Station at Yelahanka), NHAI, Indian Railways (Railway Board), Finance Ministry, Government of India and BIAL. On receipt of revised DPR, copies may be sent to all the above agencies.

Meanwhile an MOU should be signed by G.O.K., AAI and BIAL to form an SPV for owning the project In due course this MOU should be converted into a formal agreement. GOK should nominate a single window officer of the rank of Secretary to Government to handle the project as OSD, who in turn will form the SPV and be its first Managing Director. It is emphasized that the person selected as OSD has to continue to be in-charge of this project from beginning till Revenue Operation Date (ROD). In between there should be no change in incumbency. Then only accountability and commitment from this person can be expected to finish the project on time and within estimate. It is needless to mention the person so selected should be of high integrity, of excellent track record, competent, capable of getting along with different agencies and above all committed to the project.

It is again needless to mention, the whole success of the project will depend upon the person selected to head the project as OSD. It is equally important to state that there should be no political or bureaucratic interference in the functioning of this OSD.

Each day the project is delayed the cost will go up by Rs.28.0 lakhs due to inflation alone. Further each day the loss of revenue from the project will be Rs.41 lakhs. The price for delays in decision making will be obvious from this.

24.0 RECOMMENDATIONS

A Joint Venture for the proposed High Speed Rail Link to the International Airport with GOK, GOI and BIAL should be set up to own and implement the project. The initial share capital of this Joint Venture will be Rs.300 Crores to be contributed by GOK, GOI and BIAL in the proportions of 45:45:10. SPV will meet the VGF of Rs 50 Crores out of these funds. The share capital of the three parties will be subsequently increased in the same proportion to fund the increase in the viability gap if any. The Rail Link will be got executed by the Joint Venture on BOT basis. Since the proposed Rail Link is expected to be financially remunerative, the profit gained should be shared between the

Concessionaire and the Joint Venture after the actual traffic exceeds 120% of the projected traffic.

At present the Bangalore Airport Rail Link Limited (BARL) has been set up as SPV (Special Purpose Vehicle).

AMENDMENTS TO EXECUTIVE SUMMARY

Sl. No.	Content
1	Introduction
2	Traffic Integration
3	Additional Transport Demand Forecast
4	Financing of the Project
5	Organisational Structure
6	Suggestions of Bangalore International Airport Authorities

1 Introduction

The following paras may be noted as constituent amendments to the Executive Summary. These amendments are incorporated after a detailed deliberation with the DMRCL, iDeCK, Executive Engineer and Director (Projects), BARL under the Chairmanship of MD, BARL. These issues may be read as amendments to the Executive Summary under relevant paras.

2 Traffic Integration

There is a proposal before the Government to connect the Eastern part of Bangalore through a Metro Rail and this would integrate with HSRL at Yelahanka Station. Similarly there is one more proposal before the Government to connect the South and West Bangalore through a Mono Rail that would connect to HSRL at Hebbal Check-In Station. The Hebbal Station will be integrated with Mono Rail, BMTC, KSRTC operations and the intermediate public transport viz. Taxis and Autorickshaws.

3 Additional Transport Demand Forecast

BIAL Terminal Station in the Airport is presently situated on 4,000 acres of land. Atleast 500 acres of land is expected to be developed as an aero city with facilities for Business centres, SEZ centres and Commecial centres by BIAL. This activity should employ a substantial number of persons who work as employees as well as persons visiting the commercial centres and business establishments. In addition to this Government is planning to establish a business park in an area of 300 acres through KSIIDC on the North Western Part of Airport (outside the airport). The GoK is also putting up Industrial Parks, SEZ Centres and IT / BT Parks in the areas around the vicinity of the airport. With these activities it is expected that the airport area would develop as a sub-City of Bangalore.

HSR would provide transport facilities not only to Airport Passengers but also to persons visiting airport city for work or for visiting commercial centres and industrial centres therein. It is expected that a substantial portion of the work force would use the High Speed rail. The Mono Rail, Phase I & Phase II Metro Rail, Bus services and IPTs integrated to the HSRL at Hebbal and Yelahanka will help the work force reaching the commercial, business and industrial establishments in and around the airport. The Phase II Metro would link South Eastern portion of the City viz. IIM and Electronic City with the HSRL at Yelahanka Station. The Metro Phase I would link all four directions of the City through its Minsk Square Station which is by the side of MG Road CAT Station.

In view of the above, the traffic principles which have been projected, need to be substantially modified and analysed accordingly.

4 Financing of the Project – HSRL Project Cost Analysis

The DMRCL in the Executive Summary made some notings regarding financials of the project; the amendments in this regard are enclosed as Annexure. The annexure enclosed at the end of this chapter may be read as part of the Executive Summary.

5 Organisational Structure

"The Project would be implemented on PPP mode by the Government of Karnataka through its special purposes vehicle – Bangalore Airport Rail Link Ltd. (BARL). This will have a Managing Director appointed by the Government of Karnataka. The PPP partner will establish its own special purpose vehicle as indicated in the RFP and RFQ documents. The BARL would continue to liaise with the special purpose vehicle created by PPP partner to implement the project".

6 Suggestions of Bangalore International Airport Authorities

The DPR has indicated that there will be a underground terminal station and linked to the various counters of the Airlines. The BIAL has suggested that they are in need of one station on the Western Side of the Terminal Station and have also suggested one more station on the Eastern side to cater to the needs of the Aero City which will be developed in future. The details of these are not discussed in the present proposal. The details will be forthcoming by the time the Concession Agreement is put in place. Necessary provisions have to be incorporated in the Project as and when they are required.

Annexure

Cost Assumptions

The following cases have been considered for the computation of Project Cost.

No.	Case
Case No. 1	Overall Project Cost – (including Land Cost & BIAL Terminal)
Case No. 2	Project Cost (excluding only Land Cost but includes BIAL Terminal)
Case No. 3	Project Cost (excluding only Land Cost and BIAL Terminal)

The base cost details of each case are as given below:

in Rs. crores*

S.No	Item	Case 1 - (Overall Project Cost)	Case 2 – Project Cost excluding land cost	Case 3 – Project Cost excluding land cost and BIAL Terminal
1.	Land	532.00	-	-
2.	Alignment & Formation	1241.95	1241.95	758.95
3.	Station Buildings	533.68	533.68	533.68
4.	Depot	211.53	211.53	
5.	P-Way	332.65	332.65	332.65
6.	Traction & Power Supply	336.08	336.08	336.08
7.	Signaling & Telecom	634.77	634.77	634.77
8.	R & R incl. hutments etc	52.06	52.06	52.06
9.	Miscellaneous Utilities, roadworks etc.	93.72	93.72	93.72
10.	Rolling Stock (Phase I)	612.17	612.17	612.17
11.	Baggage Handling System Infrastructure	18.62	18.62	18.62
12.	Construction Contingency @ 3%	122.00	122.00	107.50
13.	Preliminary Expenses (5% of the Construction Cost)	209.50	209.50	184.60
14.	Base Construction Cost (as on Jan 2010)	4,930.70	4,415.53	3,932.53
15.	Construction Cost on Completion	5,507.30	4,975.30	4,384.50
16.	IDC	941.74	778.92	686.42
17.	DSRA (3 months)	286.97	256.05	225.64
18.	Project Cost at Completion	6,736.03	6,010.27	5,296.54

* Above cost are inclusive of all the taxes and duties.