

CHAPTER 14

COST ESTIMATES AND IMPLEMENTATION PLAN

14.1 INTRODUCTION

- 14.1.1 Detailed cost estimates for Bangalore Metro Project have been worked out covering civil, electrical, signalling and telecommunication works, rolling stock, environmental protection, rehabilitation etc., considering 750V dc traction at April, 2003 price level.
- 14.1.2 While preparing the capital cost estimates, various items have generally been grouped under three major heads on the basis of (i) route km length of alignment, (ii) number of units of that item and (iii) item being an independent entity. All items related with alignment, whether in underground or elevated or at grade construction have been estimated on rate per route km basis. Cost of elevated and at-grade station structures, other electrical services at these stations and automatic fare collection (AFC) installations at all stations have been assessed in terms of each station as a unit. For items like Rolling Stock, Receiving Sub Station (RSS)/Traction Sub Station (TSS)/Auxiliary Sub Station (ASS), service connections, Permanent Way, OHE, Signalling & Telecommunication, whether in main lines or in Maintenance Depot etc., costs have been estimated in terms of number of units required for each item. For remaining items, viz. land, utility diversions, rehabilitation etc, the costs have been assessed separately.
- 14.1.3 In order to arrive at realistic cost of various items, costs have been assessed on the basis of accepted rates in various contracts awarded by DMRC for their ongoing works during 1998 – 2002. A suitable escalation factor has been applied, wherever necessary, to bring the costs at April, 2003 price level. The element of customs duty, sales tax and works tax has been excluded for working out the capital cost of the project..
- 14.1.4 The overall capital cost of Bangalore Metro at April, 2003 price level, works out to Rs. 3970 Crores excluding custom duty , sales tax and works tax, but including general charges @ 8%. The general charges are inclusive of contingencies. The abstract capital cost estimate is shown at **Table 14.1**.

Details of methodology of arriving at these costs, are discussed in paras hereinafter.

TABLE 14.1

**ABSTRACT CAPITAL COST ESTIMATE FOR BANGALORE METRO
(COSTS AT APRIL, 2003 PRICE LEVEL)**

S.No.	Description	Amount (Rs. in Crores)		
		E - W Corridor	N - S Corridor	Total
1.	Land (Ann.14.1.1 & 14.1.2)	170.00	190.00	360.00
2.	Civil Engineering Works (Ann.14.2)			
2.1	Alignment and formation			
2.1.1	Underground Section	332.50	294.5	627.00
2.1.2	Elevated	235.20	190.4	425.60
2.1.3	Under ground stations	168.00	126.0	294.00
2.1.4	Utilities (Civil work) Environmental Protection, Rehabilitation & resettlement.	30.00	20.00	50.00
2.2	Station Buildings (elevated and at- grade).	135.00	105.00	240.00
2.3	Permanent Way	97.00	79.00	176.00
2.4	OCC & Administrative building	27.00	-	27.00
	Sub Total (Item 2)			1839.60
3.	Electrical works (Ann.14.3.1 & 14.3.2)			
3.1	Traction & Power Supply	170.22	148.03	318.25
3.2	VAC	40.40	30.27	70.67
	Sub Total (Item 3)			388.92
4.	S & T works (Ann. 14.4.1 & 14.4.2)			
4.1	Signalling & Telecommunication including cable diversions	140.00	108.00	248.00
4.2	AFC installations at stations	35.00	27.22	62.22
	Sub Total (Item 4)			310.22
5.	Depots (Ann.14.5.1 & 14.5.2)	84.00	50.00	134.00
6.	Rolling Stock (in 2007) (Ann.14.6)	346.50	297.00	643.50
7.	GRAND TOTAL (Item 1 to 6)	2010.82	1665.42	3676.24
7.	General charges @ 8 % inclusive of contingency @ 3%			294.10
	Grand total:			3970.34
Say		Rs. 3970 Crores		

14.2 CIVIL ENGINEERING WORKS

14.2.1 Land

Land requirements have been kept to the barest minimum and worked out on area basis. Out of total requirements of 48.4 hectares, only 29.5 hectares is Government/Semi-Government land and the rest 18.9 hectares private land, including land required for Maintenance Depot. For the underground and the elevated alignment, no land is proposed to be acquired permanently, except small areas for locating entry/exit structures and traffic integration etc. at stations.

- a) Cost of land has been worked out, based on prices notified by the revenue authorities of the city.
- b) Rate for the government land is adopted at government transfer rate.
- c) The cost of land as assessed is Rs. 360 crores.

14.2.2 Formation and Alignment

i) Underground section

In the underground alignment section, rates have been based on contracts awarded by DMRC for Delhi Metro Project. These rates cover all works viz. civil, electrical including utility diversions, fire fighting, air conditioning, lighting and other electrical installations like lifts, escalators at stations, but exclude customs duty (CD) and works tax (WT). These rates also exclude cost of Permanent Way, Power Supply, Ventilation, OHE, S & T works etc. for the entire corridor and cost of AFC installations at stations.

Provision towards cost of operating link at Majestic station, between the NSC & EWC has been made separately.

ii) Elevated section and at-grade section

Rate is based on accepted rates of Delhi metro project but modified for the structural arrangement proposed for Delhi Metro. The cost excludes cost of viaduct in station lengths (135 m each).

14.2.3 Station buildings

i) Elevated stations

Rate is based on accepted rates for works in progress for Delhi Metro project for phase I. This includes cost of civil architectural and electrical works. The cost has been reduced in view of reduction in station area as compared to the stations of Delhi metro

ii) At-grade stations

Only two station are involved. Rates are based on accepted rates of Delhi Metro, which include platforms, coverings, station building, circulating area, electrical services etc. These have been duly escalated to April, 2003 price level.

iii) Underground stations

Costs of underground stations is also based on the accepted rates of Delhi Metro project but modified for the smaller stations for Bangalore metro.

14.2.4 Permanent way

For elevated and underground sections, ballastless track and for at-grade alignment and in depot area, ballasted track has been planned. Rates adopted are based on accepted rates for Delhi Metro project including the imports, which covers both ballastless & ballasted tracks. These rates do not include custom duties and other taxes.

14.3 BAIYAPPANAHALLI AND YESHWANTAPUR DEPOT

A depot-cum-workshop at Baiyappanahalli and Yeshwantapur has been proposed. The Baiyappanahalli depot when completed shall have all the facilities for inspection, stabling and periodic overhauls while Yeshwantapur Depot will not have facilities for overhauling and major repairs. The cost estimate is based on consideration of similar facilities provided in Shastri Park Depot for the Delhi Metro Project. However, for the Yeshwantapur Depot, only part development of various facilities in the initial stage is considered.

14.4 UTILITY DIVERSIONS

Costs per running meter of various utilities like trunk and main sewers, water mains, storm water drains etc. requiring diversion have been worked out for Bangalore Metro. Since the utility diversion works in the underground section have been covered in per km through rate adopted for underground alignment, the costs of utility diversions involved in at-grade and elevated stretches only have been considered the under head utility diversions. Lump sum provision for other works like road diversions etc. have also been made.

For diversion of other utilities, relocation of 66 kV & 33 kV overhead power lines, provisions have been made on tentative basis. Provision has also been made towards diversion of L.T. lines, traffic signal posts, street lighting poles etc.

14.5 ENVIRONMENTAL IMPACT ASSESSMENT

Provision has been made for cost towards the environment protection and mitigation measures. The cost includes transplantation of trees and compensatory afforestation on the basis of 10 trees for every tree required

to be cut. The cost for environmental protection during construction is part of the respective work.

14.6 REHABILITATION AND RESETTLEMENT

Private Structures

The proposed Metro alignment affects Subash Nagar colony, and number of structures on the corners of the various roads due to curves. These are to be relocated nearby for which areas have been identified in most of the cases. The cost of reconstruction is charged to the project.

Government structures

A few government structures are affected on Magadi road along with the Police quarters at Ulsoor area. These are also to be reconstructed at identified locations.

14.7 TRACTION AND POWER SUPPLY

Provisions have been made under following subheads:

- i) Third rail
- ii) Receiving cum- Traction sub stations including cables
- iii) Auxiliary Sub Station (ASS) for U.G. stations
- iv) ASS for elevated and at- grade stations
- v) Service connection charges for Receiving Sub-stations
- vi) Miscellaneous items e.g illumination, lifting T and P for stabling lines etc.

The rates adopted for various items are based on the accepted contract rates for similar works for Delhi Metro project and the rates available for similar works carried out abroad. The concerned authorities at Bangalore have also been contacted in this regard.

All the 4 RSS are to be commissioned by 2007 but 2 of them are to be augmented later as the train services increase.

14.8 ELECTRICAL SERVICES AT STATIONS

These are included in estimated costs of elevated, underground and at-grade stations.

14.9 SIGNALLING AND TELECOMMUNICATION WORKS

Rates adopted are based on accepted contract rates of Delhi Metro project. These rates include manufacture and supply of equipment, their installation at site and escalation but exclude CD & WT.

14.10 AUTOMATIC FARE COLLECTION

Adopted rates are based on accepted contract rates of Delhi Metro Project. These rates exclude CD & WT, but include escalation during the period of equipment manufacture and their supply including installation.

14.11 ROLLING STOCK

Adopted rates are based on the rates accepted for Delhi Metro project though the gauge is different. It is also proposed to manufacture the part of the coaches at BEML Bangalore. The cost do not include CD and WT.

14.12 GENERAL CHARGES & CONTINGENCIES

Provision @ 8 % has been made towards general charges on all items including contingencies @ 3 % and 2% design charges

14.13 IMPORT DUTY AND WORKS TAX

The component of Import Duty and Works Tax, not included in the capital cost estimates. The estimated taxes and duties works out to Rs.350 crores.

14.14 PROJECT COMPLETION COST

The construction of this corridor is proposed to be taken up in Phase I and expected to be completed by end of 2007. The estimated completion cost of this corridor in 2007 including escalation is Rs.4379 crores. The completion cost works out to Rs.4989 crores, considering the escalation factors and Interest during construction (IDC) @ 10.5% per year.

14.15 IMPLEMENTATION PLAN

14.15.1 The Project Implementation Plan will require following action after submission of the Detailed Project Report:-

- i) Approval of the Detailed Project Report by State Government.
- ii) Approval of Detail Project Report by Central Government.
- iii) Signing of MOU by Central Government (MOUD and State Govt.) for equity.
- iv) Formation of Corporation on the line of DMRC as implementing agency.
- v) Arrangement of Finances as per financing plan.

All these actions will require a minimum period of about 4 to 6 months. During this period, the State Government can go ahead with the following preliminary works:

- i) Preliminary action for diversion of utility and preparation of estimates there of.
- ii) Reservation of land along the corridor, identification and survey for acquisition.

Once the Corporation is formed, the Corporation has to take action for appointment of consultant for Project Management and proof checking including preparation of tender documents. Simultaneously, action is also to be taken for detailed design for structures for elevated corridors. It is proposed to implement the project through following contracts:

Civil works

- a) Detailed design contract(s) for Elevated structure / stations.
- b) Construction contracts following sections Viaducts.
 - (i) From Baiyappanahalli Station to Cricket Stadium Station (6.73 km)
 - (ii) From Mysore Road terminal dead end to Ramp on Magadi Road. (6.70 km)
 - (iii) Yeshwantapur dead end to Swastik Railway Station. (6.21 km)
 - (iv) From ramp after City Market to R.V. Road terminal (4.35 km)
- c) Design and construction of underground section on both the North – South & East – West corridors including 7 stations and administrative office at Majestic.
- d) Construction of stations
 - (i) Mysore road terminal to Vijay Nagar station (3 stations)
 - (ii) Hoshalli Road station to Magadi Road station (3 stations)
 - (iii) Cricket Stadium to Ulsoor Station (4 stations)
 - (iv) CMH Road to Baiyappanahalli Road terminal (4 Stations)
 - (v) Yeshwantapur to Rajaji Nagar station (3 stations)
 - (vi) Kuvempu Road to Swastik and K.R. road (4 stations)
 - (vii) Lal Bagh to RV road terminal (4 stations)

It is proposed to carry out the General Electrical Works for the stations through Civil Contractors.

14.15.2 System Contracts

- a) Design, construct and installation for Traction and Power Supply.
- b) Design, construct and installation of Signal and Telecommunication works.
- c) Design, construct and installation of lifts.
- d) Design, construct and installation of Escalators.
- e) Design, construct and commissioning of Automatic Fare Collection System.
- f) Design and supply of Rolling Stock.
- g) Design of track works.
- h) Installation of track in Depot and on Main Line.

14.15.4 Depot Contracts

Following contracts are proposed for Depot works:

- a) Design of Depot layout and buildings for Baiyappanahalli and Yeshwantapur Depot.
- b) Construction of Baiyyappanahalli Depot including general electrification.
- c) Construction of Yeshwantapur Depot including general electrification.
- d) For supply of Depot Equipment, the number of contracts may be decided as and when the work is in progress.

14.5.5 A suggested project implementation schedule is enclosed for consideration. It is recommended that project be commissioned in 5 different stages. In the first stage, the section from Baiyappanahalli to Cricket Stadium for a length of about 7 km is to be commissioned. This will take about 3 years time. In the second stage, the section from Yeshwantapur to Swastik may be opened in about 3 ½ years time. These sections have been preferred over other section due to connection with depot on both the corridors.

In the Stage – III, the underground section on both the corridors can be opened simultaneously which will take about 4 years to commission after start of work. In stage IV & V, the remaining section of East - West corridor and North - South corridor can be commissioned one after the other. The total time required for commissioning of both the lines is about 5 years from commencement of the work.
