Republic of India

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Study on Urban Transport Sector in India
Final Report

June, 2013

Japan International Cooperation Agency (JICA)

Mitsubishi Research Institute, Inc.
Japan International Consultants for Transportation Co., Ltd.

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Abbreviations

AC	Air Conditioner
AC	Alternate Current
ADB	Asian Development Bank
AEL	Airport Express Link
AFC	Automatic Fare Collection
AFTC	Audio Frequency Track Circuit
AGT	Automated Guideway Transit
ATO	Automatic Train Operation
ATP	Automatic Train Protection
BAFO	Best and Final Offers
BART	Bay Area Rapid Transit
BEML	Bharat Earth Movers Limited
BMRCL	Bangalore Metro Rail Corporation Limited
BOO	Build-Own-Operate
BOOT	Build-Own-Operate-Transfer
BOT	Build-Operate-Transfer
BQ	Bill of Quantity
BRT	Bus Rapid Transit
BS	British Standard
CAF	Construcciones y Auxiliar de Ferrocarriles
CAG	Comptroller and Auditor General
CATC	Continuous Automatic Train Control
CBTC	Communications-Based Train Control
CCEA	Cabinet Committee on Economic Affairs
CCTV	Closed Circuit Television
CEC	Continental Engineering Corporation
CENELEC	European Committee for Electrotechnical Standardization
CIDCO	City and Industrial Development Corporation of Maharashtra Ltd.
CMRS	Commissioner of Metro Rail Safety
CNR	China Northern Rail Corporation Limited
Cr	Crore (= ten million)
CSR	China South Locomotive & Rolling Stock Corporation Limited
CVC	Central Vigilance Commission
DAMPEL	Delhi Airport Metro Express Private Ltd
DC	Direct Current
DD	Detailed Design
DMRC	Delhi Metro Rail Corporation
DoE	Department of Expenditure
DORTS	Department of Rapid Transit Systems (Taiwan)
DPE	Department of Public Enterprises
DPR	Detailed Project Report
DPSE	Directorate of Planning, Statistics & Evaluation
EBR	Expanded Board of Railway
E&M	Electrical & Mechanical
EFC	Expenditure Finance Committee
EGoM	Empowered Group of Ministers
EIRR	Economic Internal Rate of Return
EMC	Electro-Magnetic Compatibility
EMU	Electric Multiple Unit

EN	European Standard
EOI	Expression of Interest
EPC	Engineering, Procurement & Construction
EU	European Union
F/S	Feasibility Study
FDI	Foreign Direct Investment
FIDIC	Fédération Internationale des Ingénieurs-Conseils
FIRR	Financial Internal Rate of Return
FYP	Five Year Plan
GC	General Consultants
GDP	Gross Domestic Products
GIDB	Gujarat Infrastructure Development Board
GIDC	Gujarat Industrial Development Corporation
GoI	Government of India
GoK	Government of Kerala
GSDP	Gross State Domestic Product
HUDA	Haryana Urban Development Authority
IC	Integrated Circuit
ICF	Integral Coach Factory
ICPE	International Centre for Public Enterprises
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IEMs	Independent External Monitors
IGI Airport	Indira Gandhi International Airport
IIFCL	India Infrastructure Finance Company Limited
IIPDF	India Infrastructure Project Development Fund
IL&FS	Infrastructure Leasing & Financial Services Limited
IMF	International Monetary Fund
INR	India Rupee
IR	Indian Railways
ISO	International Organization for Standardization
IT	Information Technology
ITS	Intelligent Transportation System
JBIC	Japan Bank for International Cooperation
JETRO	Japan External Trade Organization
JIC	Japan International Consultants for Transportation Co. Ltd.
JICA	Japan International Cooperation Agency
JIS	Japan Industrial Standard
JV	Joint Venture
KMRL	Kochi Metro Rail Limited
L&T	Larsen and Toubro
L&T MRHL	L&T Metro Rail Hyderabad
L/A	Loan Agreement
LIBOR	London Interbank Offered Rate
Lk	Lakh (= hundred thousand)
LRT	Light Railway Transit
MD	Managing Director
MEAT	Most Economically Advantageous Tender
MEGA	Metro-Link Express for Gandhinagar & Ahmedabad
MMOPL	Mumbai Metro One Private Limited
MMRDA	Mumbai Metropolitan Region Development Authority
MMTPL	Mumbai Metro Transport Private Limited

MoEF	Department of Economic Affairs
MoF	Ministry of Finance
MoIC	Ministry of Commerce and Industry
MOU	Memorandum of Understandings
MoUD	Ministry of Urban Development
MRG	Minimum Revenue Guarantee
MRT	Mass Rapid Transit
MRTS	Mass Rapid Transit System
MTA	Metropolitan Transport Authority
MTRC	Mass Transit Railway Corporation (Hong Kong)
NCR	National Capital Region
NMT	Non-motorised Transport
NURTA	National Urban Rail Transit Authority
NUTP 2006	National Urban Transport Policy 2006
O&M	Operation and Maintenance
OCC	Operation Control Center
ODA	Official Development Assistance
OECD	Organization for Economic Co-operation and Development
OHE	Over Head Equipment
PAPDs	Passenger Announcement and Passenger Display
PC	Prestressed concrete
PHPDT	Peak Hour Peak Direction Traffic
PIB	Public Investment Board
PAMD	Project Appraisal Management Division
PMC	Pune Municipal Corporation
PPP	Public Private Partnerships
PPPAC	Public Private Partnership Approval Committee
PQ	Pre-Qualification
PSD	Platform Screen Doors
PSE	Public Sector Enterprises
PSU	Public Sector Undertaking
RAMS	Reliability Availability Maintainability and Safety
RATP	Régie Autonome des Transports Parisiens
RBI	Reserve Bank of India
RDSO	Research Designs and Standards Organization
RFP	Request for Proposal
Rinfra	Reliance Infrastructure
RMGL	Rapid Metrorail Gurgaon Limited
ROW	Right of Way
Rs	India Rupee
RTS	Rail Transit System
S&T	Signal and Telecommunications
SCADA	Supervisory Control and Data Acquisition
SCOPE	Standing Conference of Public Enterprises
SEEPZ	Santacruz Electronics Export Processing Zone
SEZ	Special Economic Zones
SG	State Government
SIL	Safety Integrity Level
SNB	Swiss National Bank
SPC	Special Purpose Company
SPV	Special Purpose Vehicle
STEP	Special Terms for Economic Partnership

STRASYA	Standard urban Railway System for Asia
TETRA	Terrestrial Trunked Radio
TOD	Transport Oriented Development
TRC	Technical Review Committee
UMTA	Unified Metropolitan Transport Authority
UPS	Uninterruptible Power Supply
USD	United States Dollar
VFM	Value for Money
VGF	Viability Gap Funding
WG	Working Group

Chapter 1

Objectives and Implementation

1.1. Background and Objectives

1.1.1. Background

The urban population of India has grown rapidly. The population in year 2001 of 285 million[1] has grown to 387 million[2]. The population will likely reach 482 million[3] by 2021. Concurrently, registered number of automobiles and two-wheelers increase at an average annual growth rate of 8%. These extremely rapid growths in population and transport vehicle volume cause chronic traffic congestion and severe air pollution from vehicular emission in urban areas which may lead to impact Indian economy.

In order to accommodate the rapid population growth and transportation demands in urban areas, the Government of India (GoI) announced a National Urban Transport Policy in 2006 that will serve as framework in the development of mass rapid transit systems.

The working group on urban transport recommended developing Metro Development Plan for cities with populations of more than 2 million, and commencing construction of Metros for cities with populations of more than 3 million. The estimate is INR 1, 300 billion of investments in Metro projects during the period of 12th Five Year Plan (April 2012 - March 2017)[4].

The adoption of Metro Rail Systems is expected to spread all over the country: Metros are already in operation in Kolkata, Delhi and Bangalore, under construction in Chennai, Mumbai, Hyderabad, and Jaipur, and many other cities are planning for Metro projects. Aside from these projects, some cities have also conceived of LRT and/or Monorail Projects.

1.1.2. Objectives

This study is aimed to collect and analyze the data and information concerning urban transportation sector in India, in order to facilitate the contribution of Japanese technology in the sector and determine the direction for Yen Loan (ODA).

In addition, JICA foresees lack of experience and/or insufficient implementation capability of executing government agencies as major issues for small and medium-sized cities, the type of management and construction procurement packages must be carefully studied to determine which is suitable and will complement the implementing agency's level

1 *"Recommendations of Working Group on Urban Transport for 12th Five Year Plan"* Ministry of Urban Development, 2011
2 Census/GoI, 2011
3 Forecast by GoI(http://www.censusindia.gov.in/2011-prov-results/data_files/india/Final_PPT_2011_chapter8.pdf)
4 *"Recommendations of Working Group on Urban Transport for 12th Five Year Plan"* Ministry of Urban Development, 2011

of experience. The possibility of technical cooperation for these agencies is therefore considered as part of the JICA assistance strategy.

1.1.3. Target Rail Modes: Metro, LRT & Monorail

Urban Rail is the terminology used in this study that collectively refers to Metro, LRT, and Monorail. The definitions of these three urban transport modes are as follows:

- METRO
  Railway located in urban areas, including subways and elevated railways
- LRT (Light Rail Transit)
  Rail transit system of light-to-medium ridership capacity that runs primarily on the road
- MONORAIL
  Orbital transportation system which runs the course induced by a single rail

Example pictures of respective urban transportation modes are shown in Figure 1.1-1.

Left to Right: Metro (ex. Delhi), LRT (ex. Paris), Monorail (ex. Dubai)

Sources: Delhi Metro Rail Corporation Limited[5], RATP[6],
Dubai Department of Tourism & Commerce Marketing (Press release, May 19, 2009)

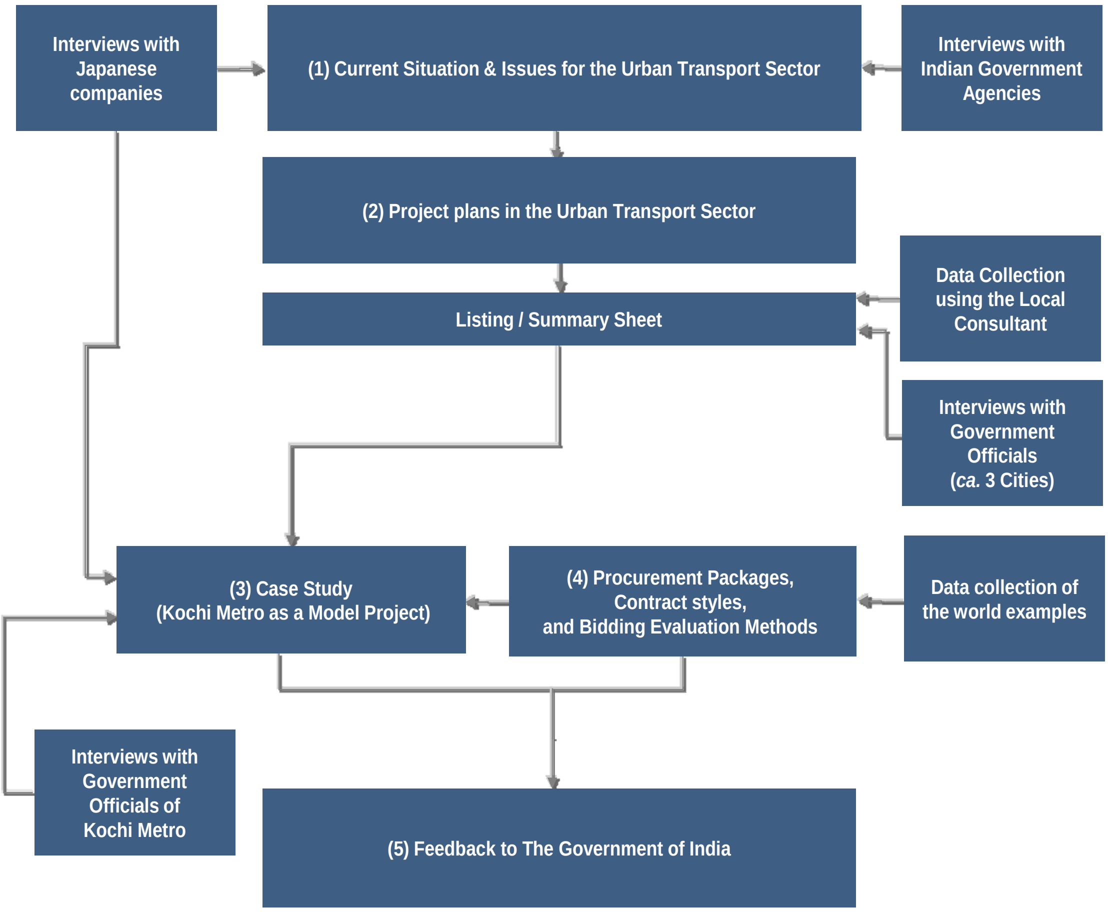
Figure 1.1-1 Urban Transportation Modes in this Study

[5] http://www.delhimetrorail.com/
[6] http://www.tramway.paris.fr/

1.2. Implementation

1.2.1. Research Flow

The research flow is shown in Figure 1.2-1.



Source: Study Team

Figure 1.2-1 Flow of the Study

1.2.2. Domestic Interview

In order to understand (1) the sales trends of Japanese companies in the urban rail sector in the Indian market, (2) their strategies, and (3) their requests for assistance from Japanese and/or Indian Governments, etc., 17 leading Japanese companies, cumulatively, in the subsectors of rolling stock, signal & communication, civil & track works, systems integration, were subjected to interviews (Table 1.2-1).

Table 1.2-1 Domestic Interviews / Attributes of Interviewees

Sub Sectors		No. of Companies*
Rolling Stock	Rolling Stock	4
	Maintenance	1
	Electrical Equipment / Parts	3
Signal & Communication		3
Civil & Track		3
Systems Integration		3
Total		17

Source: Study Team

* When a single company is comprised of several departments for railway-related supply (e.g. a rolling stock department and a signal department) and both departments were subjected to interview, the number of companies was counted cumulatively (e.g. two companies, for this example).

1.2.3. On-site Research

To understand the current situation of (1) the concerned agencies and organizations in India, and of (2) the major cities, etc., from the view point of urban transport development, field studies (site visits, interviews, and discussions) were conducted. The schedule of the field studies and the list of interviewees are shown in Table 1.2-2. The results of the field surveys are reflected in the report.

Table 1.2-2 Schedule of the Field Surveys

Organization	Date	Interviewee
MoUD	Jan. 23, 2013	Prakash Singh, Director (MRTS)
	May 29, 2013	Raj Kumar Singh, Director (Urban Transport)
DMRC	Nov. 26, 2012	Dinesh Kumar Saini, Director (Project & Planning)
DMRC	Dec. 04, 2012	Satish Kumar, Director (Electrical)
DMRC	Dec. 04, 2012	Raj Kumar, Director (Operation)
KMRL (Kochi)	Nov. 29, 2012	Elias George, Managing Director P. Sriram, Project Director (DMRC Kochi Metro Project)
KMRL (Kochi)	Nov. 29, 2012	Dr. Sreedharan, Advisor of KMRL
MEGA (Ahmadabad)	Jan. 15, 2013	Rajendra Harsh, Financial Advisor Kapil Sharma, Sr Project Manager
MMRDA (Mumbai)	Jan. 17, 2013	R. Ramana, Additional Chief (Transport Planning)
MMRDA (Mumbai)	Jan. 18, 2013	Vishnu Kumar, Director Monorail, Transport and Communication
PMC (Pune)	Jan. 21, 2013	Srinivas Bonala, Additional Chief Engineer
CIDCO (Navi	Feb. 06, 2013	Vijay C. Kamble, Superintending Engineer

Organization	Date	Interviewee
Mumbai)		
IIFCL	Jan. 31, 2013	Dr E. Sankara Rao, Chief General Manager Mr. Rajeev Mukhija, General Manager-CFO
WB	Feb. 07, 2013	Mr. Shige Sakaki, Senior Urban Transport Specialist Mr. Ben L.J.EijBergen, Lead Transport Specialist & Country Sector Coodinator
ADB	Feb. 07, 2013	Mr. Anil Motwani, Team Leader of Transport

Source: Study Team

Chapter 2

Current situation & Issues on the Urban Transport Sector

2.1. Policies, Administration & Legal System

This section is devoted to receiving policies, administration & legal system, organization, and budget, in order to find the basic situation and issues of urban railways in India.

2.1.1. Policies

(1) National Urban Transport Policy 2006

The National Urban Transport Policy (NUTP) 2006, which was launched by the Ministry of Urban Development (MoUD), is a comprehensive policy for the urban transportation in India.

NUTP takes an approach of “right-technology right-place.” That is, NUTP analyses relative characteristics of available public transport technologies, such as Heavy Rail Systems (underground, elevated or at grade), Light Rail Systems and several kinds of bus systems, for introduction as suitable transport modes for the cities.

It should be noted that NUTP puts emphasis on “Integrated public transport systems”. As a result of the “right-technology right-place” approach, operators’ management of their respective systems may vary, while a seamless service is preferable for the passengers.

To address the problem, NUTP puts more weight on the need for proper inter-modal infrastructures with which passengers are able to use a single ticket over different transportation modes.

In line with this approach, NUTP discusses integration of land use and transportation. And towards that integration, NUTP proposes to establish Unified Metropolitan Transport Authorities (UMTAs) in cities with populations over one million.

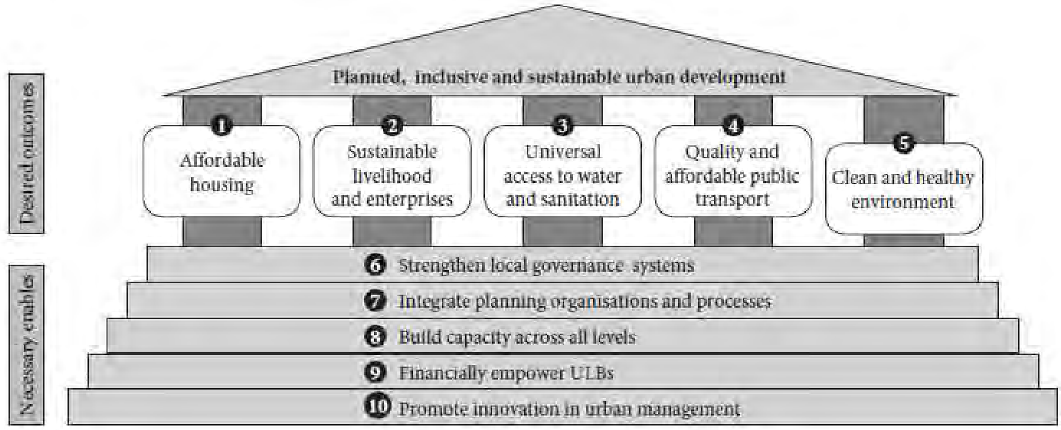
UMTAs have been established in Jaipur, Mumbai and Hyderabad, etc.

(2) 12th Five Year Plan

The Planning Commission of India released the Draft 12th Five Year Plan (2012 - 2017) in January 2013 (hereinafter referred as “12th FYP”).

12thFYP sets five goals or “Desired outcomes” of India’s Urban Future: (1) Affordable housing, (2) Sustainable livelihood and enterprises, (3) Universal access to water and sanitation, (4) Quality and affordable public transport, and (5) Clean and healthy environment.

To achieve the goals, 12th FYP focuses on five “enablers” for strategic urbanization: (1) Strengthen local governance systems, (2) Integrate planning organizations and processes, (3) Build capacity across all levels, (4) Financially empower Urban Local Bodies, and (5) Promote innovation in urban management (Figure 2.1-1).



Source: Draft 12th Five Year Plan (2012–2017), Planning Commission 2013

Figure 2.1-1 Key Components of India's Urban Future

1) Recommendations for Quality and affordable public transport

Towards "Quality and affordable public transport", 12th FYP presented 11 recommendations as follows:

- Strengthen Urban Transport Wing in MoUD

  Being capital intensive by nature, urban transport will attract the highest share of investment in the urban sector in the coming years. A key challenge is to generate non-budgetary resources to fund these projects. To manage this scale and complexity, it is recommended that the Urban Transport (UT) wing of the MoUD is appropriately strengthened with a full time Additional Secretary in-charge who will exclusively focus on urban transport issues.

- Constitution of National Urban Rail Transit Authority

  In view of the growing importance of rail-based mass urban transit, there is a requirement from a national level organization for research, drafting of specifications and standards, developing appropriate financing model of MRTS projects and so on. The MoUD should initiate a proposal that will setup an apex institution, namely, the National Urban Rail Transit Authority (NURTA), to promote rail-based mass urban transport in the country.

- Setting up of a Research Centre for Rail-based Urban Mass Transport System

  MoUD should initiate a proposal that will setup a centre of excellence for rail-based mass transit system which should promote research in all the major components of such system viz. civil network, rolling stock, tracks and signaling. Fostering innovation in such capital intensive systems would reduce dependence on imports for projects in the country and would help India emerge as an exporter of equipment.

- Promote High Speed Urban Rail and Regional Rapid Transit System

  Linking the core of large cities with their periphery through a fast and efficient transport system has the potential to unlock significant gains and reduce transport-related bottlenecks. As disposable incomes rise, citizens value their time and are more likely to be willing to pay higher fares. This also offers the opportunity for transit-oriented development and promotes efficient land use.

- Intelligent Transport System and Seamless Integration of Different Modes through Smart Card

  Use of IT based applications for making public transport more efficiently should be an integral part of any urban transport project. This initiative should be expanded in 12th FYP to have a Common Mobility Card across all operators and all modes.

- Policy to Discourage Use of Private Vehicles

  Based on the 'polluter pays principle,' it is recommended that an additional urban transport tax be imposed on private vehicles. Congestion pricing may also be explored as a means to reduce or attenuate traffic on busy corridors and generate revenues for further expansion of public transport.

- Social and Gender Auditing of Transport Projects

  It is necessary that the benefits of urban transport projects are shared by all. Hence, alignment selection and operational scheduling of trains and buses should be carefully done so that the poorer sections of the society and workers in the informal sector are given priority.

- Promote Non-motorized Transport (NMT)

  NMT such as bicycles, pedal rickshaws and pedestrianism are affordable, environment friendly and promote healthy living. These are particularly suitable for short trips, especially for last mile connectivities. MoUD should bring out a comprehensive set of guidelines to incentivize NMT.

- Create New Departments of UT in State Urban Development Ministries

  States should institute a dedicated department for urban transport within the Municipal Administration and Urban Development Ministry.

- Institute a Safety Commission for Rail/Guided and Road Transport

  Safety is a critical issue in urban transport. For rail-based mass rapid system, the Central Safety Commission should be appropriately strengthened. For road-based systems, State-level commissions may be set up to perform safety audits.

- Promote Public-Private Partnership (PPP) Arrangements, where Appropriate

  All metro projects which are in high density corridors, and are viable on their own may be encouraged under PPP mode. However, projects which are financially not viable without providing additional real-estate development rights and so on, should primarily be funded by the government. The Central Government may appropriately contribute in funding such projects preferably by way of grants. Similarly PPP arrangements in bus transport systems based on a gross cost model should be encouraged.

The O&M of metro rail projects as well as BRT projects should also be entrusted to the PPP concessionaire to bring in the efficiency gain.

2) Criteria for deployment of Metro rail

The FYP provides criteria for deployment of Metro rail. According to the criteria, a metro rail project is recommended in cities which ordinarily have:

- Peak hour peak direction traffic (PHPDT) of more than 20,000 for at least 5 kms of continuous length by 2021
- Total population of more than 2 million as per 2011 census
- Average trip length of more than 7–8 kms for motorized trips
- At least 1 million ridership per day on organized public transport

(3) Recommendations of Working Group on Urban Transport for 12th Five Year Plan

1) The Working Group

The Working Group on Urban Transport for 12th Five Year Plan, which was established in MoUD, released its recommendations in 2011. The recommendations are on investment and plans in urban transport.

2) Selection Criteria of MRT Modes

The Working Group (WG) recommends guidelines for selection of Mass Rapid Transit modes (Metro Rail, LRT, Monorail, Bus Rapid Transit System, and Organized City Bus Service) with PHPDT, population and average trip length for motorized trips in kilometer. According to the criteria, Metro Rail is suitable for the cities with traffic over 15,000 PHPDT along at least 5 km of continuous length, more than two million population, and average trip length for motorized trips over 7 or 8 km (Table 2.1-1).

Table 2.1-1 Selection Criteria of Mass Rapid Transit Modes

Mode choices	PHPDT in 2012	Population as per 2011 census (Million)	Average Trip length for motorized trips in km
Metro Rail*1	>=15,000 for at least 5 km continuous length	>= 2	> 7-8
LRT primarily at grade	>=10,000	>1	> 7-8
Monorail*2	>=10,000	>2	About 5-6
Bus Rapid Transit System	>=4,000 and Up to 20,000	>1	>5
Organized City Bus Service	–	>0.1	>2 to 3

*1) For having Metro Rail, the city should have a ridership of at least 1 million on organized public transport (any mode)

*2) Monorail is desirable only as a feeder system or where the narrow roads are flanked on either side by high rise buildings. In monorail while the cost of construction, operation and maintenance is almost the same as elevated metro rail, the carrying capacity is much lesser.

Source: Recommendations of Working Group on Urban Transport for 12th FYP

For comparison, some examples of PHPDTs of Japanese urban rails are shown in Table 2.1-2.

Table 2.1-2 PHPDTs of Japanese Urban Rails

Category	Name of Line	Length (km)	PHPDT	
			Capacity (person)	Passing Passenger (person)
Automated Guideway Transit (AGT)	Yurikamome	14.7	6,336	6,416
Monorail	Tokyo Monorail	17.8	10,512	10,281
Metro (Small section)	Toei Metro / Oedo Line	40.7	14,820	22,511
Metro	Tokyo Metro / Ginza Line	14.3	18,240	30,219
	Tokyo Metro / Hibiya Line	20.3	28,224	44,865
Commuter Rail	JR East / Yamanote Line	34.5	40,700	83,200

Note: As of FY2008

Source: Ministry of Land, Infrastructure, Transport and Tourism

(4) Policy Interventions to Realize the Goals for 12th Five Year Plan

The WG maintains that public transport should be the "preferred" mode of transport, and urban transport has to be properly recognized in the constitution as well as in the institutional mechanism. In this context, the WG suggests 17 "policy interventions" to realize the above-mentioned scenario. Among them, following recommendations are noteworthy:

- A new department of urban transport to be set up in MoUD at Government of India level and in Municipal Administration and Urban Development Department in each state / Union territory within full time Secretary as in charge;
- Setting up of Commission for Urban Road Transport Safety to cover safety certification and audit of road vehicles and road infrastructure in urban areas;
- Setting up of a Commission for Metro Railway Safety;
- The funds flow for urban transport projects to various implementing agencies (as they exist today) to be routed through Unified Metropolitan Transport Authorities (UMTA);
- Setting up of a National Urban Rail Transit Authority;
- Setting up of Dedicated Urban Transport Fund at National, State level and city level;
- Taking up of new Central Sector schemes for innovation, research and development in guided transit to promote indigenization and development of low cost technologies, pilot projects, public bicycle scheme, improvement of para-transit through Intelligent Transport Systems and setting up of a research, design, standardization and standard setting authority for Metro Railway;
- Continuing the existing schemes of Urban Transport Planning and capacity building in urban transport with additional allocation and scope.

(5) Capacity Building

In order to achieve the scenario for urban transport envisaged in 12th FYP, the WG places great importance on capacity building in the transport sector and need for "creation of a pool of urban transport professionals". The WG identified four key activities, that is, education, training, knowledge creation and dissemination in the field of land-use transport, and presented strategies for capacity building (Table 2.1-3).

As to costs for capacity building, the WG recommends that at least 1.5% of the cost of each project needs to be earmarked for capacity building efforts.

Table 2.1-3 Activities in Capacity Building

Objective person / body	Strategies
City and State officials	➢ Develop awareness and skills
Leaders and Change agents	➢ Leaders program for in-service officers ➢ Young leaders program for the post graduates and other young professionals
State government and city governments / parastatals*	➢ Create jobs for these professionals with common state cadres

* Quasi-governmental organization or company.

Source: Recommendations of Working Group on Urban Transport for 12thFYP, collated by the Study Team

2.1.2. Administration & Legal System

(1) Administration

As will be discussed in "Section 2.1.3: Organization", institutional framework for urban railways is yet to be established fully. MoUD recognizes this problem and the report of "Working Group on Urban Transport for 12th Five Year Plan" described the situation as, *"Urban Transport is the responsibility of no organization and a general lack of planning skills. Urban transport professionals, as a rule are not employed by cities. Keeping in view the investments projected, the institutional framework for urban transport has to be extensive and more importantly effective*[7]*."*

(2) Legal system

1) Legislations on Metro

Metro railway projects in India are basically regulated by three basic acts, that is, Metro Railways (Construction of Works) Act of 1978 (hereinafter referred to as "Act 1978), Metro Railways (Operation & Maintenance) Act of 2002 (Act 2002), and an amendment, Metro Railways (Amendment) Act of 2009 (Act 2009) (Table 2.1-4).

Act 1978 was originally legislated to facilitate construction works of the Kolkata Metro, the first Indian metro railway. And afterwards, the scope of the act was extended to other cities by the Gazette of GoI. For example, the construction works of the Delhi Metro is under the control of the Act 1978.

The first act for operation and maintenance of metro railways is the Act 2002, which was legislated for the Delhi Metro Project, thus the Act is also known as the "Delhi Metro Railways Act", however, the scope of the application of the Act was extended to other cities. Subsequently, the jurisdictions of the Acts were extended to National Capital Region (NCR), Mumbai, Bangalore, and Chennai by the Act 2009.

Furthermore, the scope of the application of both Act 1978 and Act 2002 were extended to Jaipur by the notification issued in January 2011[8].

In the cities where the Acts 1978, 2002 and 2009 do not apply, construction of metro railways is regulated by State's own "Tramways Act."

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[7] *"Recommendations of Working Group on Urban Transport for 12th Five Year Plan"* Ministry of Urban Development, 2011, P.54

[8] According to *"Urban Rail Transport in India"* (India Infrastructure Research, 2012), P5

Table 2.1-4 Legislation for Metro Railways

Legislation		
Brief Descriptions	**Chapter**	**Remarks**
Metro Railways (Construction of Works) Act, 1978[*1)]		
Applied for the construction works of metro railways.	1: Preliminary 2: Metro Railway Administration 3: Acquisition 4: Construction of Metro Railway 5: Inspection of Metro Railway 6: Miscellaneous	➢ Applied to Calcutta, extended to the other cities by notification of GOI. (Art.1(3))
Delhi Metro Railways (Operation & Maintenance) Act, 2002[*2)], *aka Delhi Metro Railways Act*		
Applied for the operation and maintenance of the metro railways in Delhi and other cities.	1: Preliminary 2: Gov. Metro Railway Administration 3: Functions and Powers of the Metro Railway Administration 4: Commissioner of Metro Railway Safety 5: Opening of Metro Railway 6: Working of the Metro Railway 7: Fare Fixation 8: Accidents 9: Claim Commissioner 10: Liability of Metro Railway Administration Due to Accidents 11: Offences and Penalties 12: Miscellaneous	➢ Applied to Delhi, may be extended to other cities by notification (excl. Calcutta) . (Art. 1(2)) ➢ Commissioner appointed by GOI. (Art. 7) ➢ Sanction of GOI is required to open a metro railway. (Art. 14&15) ➢ Railway Administration is by government or non-gov. (Art. 2(J)) ➢ Functions of railway administration are to operate & maintain the metro railways. (Art. 5) ➢ Railway administration shall have the power to carry out the function. (Art. 7)
Metro Railways (Amendment) Act, 2009[*3)]		
Regulates implementation, operation, maintenance and safety of metro railways in NCR, Bangalore, Mumbai, Chennai and Jaipur	1: Preliminary 2: Amendment to the Railways (Construction of Works) Act, 1978 3: Amendment to the Railways (Operation and Maintenance) Act, 2002	➢ Amendments for above mentioned Acts

[*1)] http://www.urbanindia.nic.in/programme/ut/Metro_Railway_Act_1978.pdf
[*2)] http://urbanindia.nic.in/programme/ut/MetroRail_Act_2002.pdf
[*3)] http://www.urbanindia.nic.in/programme/ut/Metro.pdf
Source: Study Team

2) Rules on Metro

Legislation necessary for Metro rail operation, maintenance, accident report and conditions of carriage, etc. are enacted by GoI and announced. Based on the legislations, a Metro operating company is to draft necessary rules and applies for the approval of GoI. Parliament deliberation is required to approve the rules.

The following are major rules applied to DMRC.

- Delhi Metro Railway General Rules, 2002
- The Opening of Delhi Metro Railway for Public Carriage of Passengers Rules, 2002
- The Delhi Metro Railway (Notice of Accidents and Inquiries there to) rules, 2002
- Delhi Metro Railway (Prohibition of Carriage of Large-sized Luggage, Carriage of Offensive and Dangerous Goods in the Metro Railway, Travelling of Persons Suffering from Infectious and Contagious Diseases in the Metro Railway and Value, Period of Validity and Such Other Particulars Indicated in the Ticket Issued by the Metro Railway) Rules, 2002

Also, MoUD has published "Metro Railways General Rules, 2013" and "Opening of Metro Railways for Public Carriage of Passengers Rules, 2013" on February 2013, as the revised version of standards applicable not only for DMRC but also for all the metro lines. In these rules, equipment technical standard is also specified in details, as one of the rules necessary for operation and maintenance of Metro.

(3) Relationship with RDSO in urban railway

According to the interview with MoUD, all of the past urban railway projects have followed the standards established by RDSO (Research Designs and Standards Organization) of the Indian Railways. In the case where the project implementing agency adopts some system or technology, it must seek permission from RDSO. RDSO will then review the system or technology based on the checklist.

2.1.3. Organization

(1) Pertinent Organizations

1) Ministry of Urban Development

The Ministry of Urban Development (MoUD) is the apex authority of Government of India at the national level that formulates policies, sponsors and supports programs, coordinates the activities of various Central Ministries, State Governments and other nodal authorities, and monitors the programs concerning all the issues of urban development in the country.

As per Government of India (Allocation of Business) Rules 1961, the following business has been allocated to the Ministry of Urban Development:

10. Planning and coordination of urban transport systems with technical planning of rail based systems being subject to the items of work allocated to the Ministry of Railways, Railway Board[9].

In this way, even though MoUD is said to have a jurisdiction over urban transportation plans in the central government, planning of individual lines or actual project operations is conducted by each state government. In other words, MoUD does not have a comprehensive jurisdiction over every policy requirement related to urban transportation.

2) State Governments and GoI

Basically, the State Governments are responsible for management of urban areas including urban transport. However, as discussed in the previous section, important Acts (and Rules, etc.) are administered by the Central Government.

3) Empowered Committee

Empowered Committee is chaired by Cabinet Secretary with Secretary of Urban Development, Secretary of Finance, Secretary of Home Affairs, Secretary of Road Transport, Secretary of Environment, Deputy Chairman of Planning Commission, Chief Secretary, etc. The committee has the authority to give final approval to Detailed Project Report (DPR).

(2) Approval of Projects

1) Procedure of approval of Metro Projects

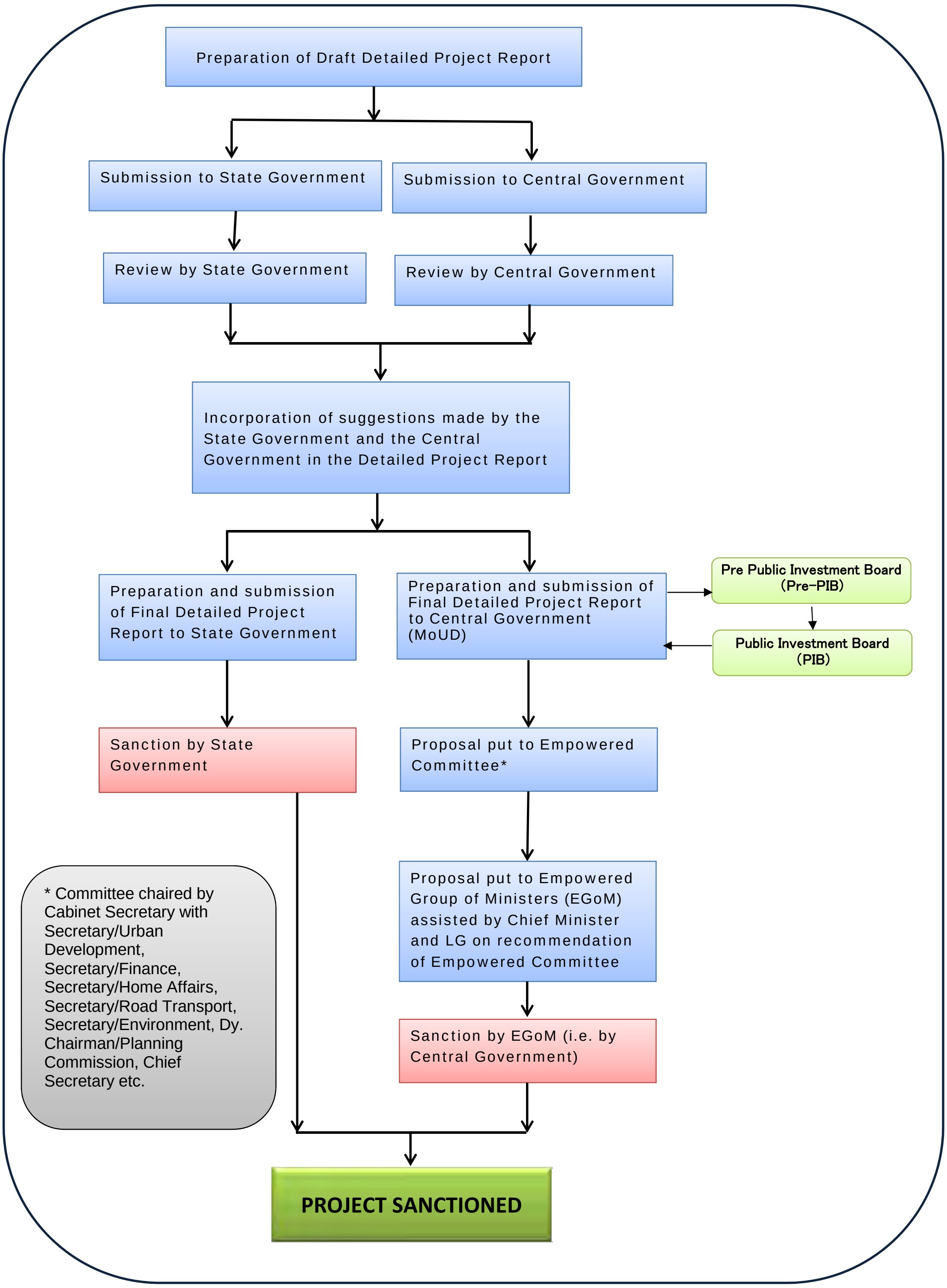
The procedure of approval of a metro project is as follows (See Figure 2.1-2):

- The execution agency prepares a draft of DPR, submits it to state and central government, and receives reviews.
- The execution agency prepares the DPR for State Government and MoUD.
- The State Government approves the proposed DPR.
- A procedure within the Central Government includes an approval by Public Investment Board (PIB). PIB consists of Prime Minister’s Office, Planning Commission, Ministry of Railways, Ministry of Finance, Ministry of Environment, Ministry of Road Transport, and Ministry of Urban Development. Before PIB, MoUD requests the

[9] http://urbanindia.nic.in/theministry/ministry_page.htm

arrangement of Pre-PIB at administrative level to examine the proposal.

- Empowered Committee of Secretaries studies the DPR and approves the proposal, and then sends to Empowered Committee of Ministers for approval and obtains final approval from the Union Cabinet.



Source: Study Team

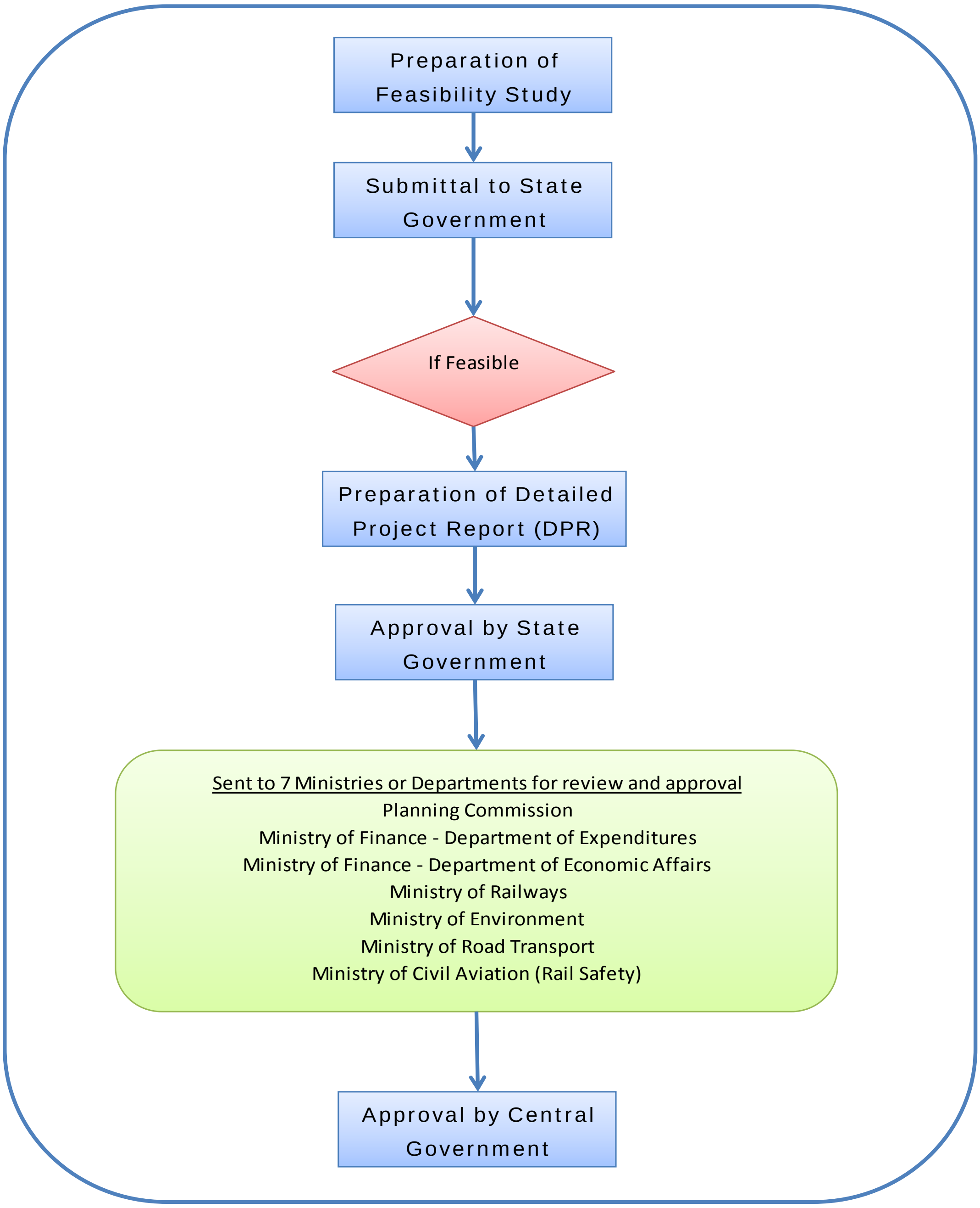
Figure 2.1-2 Project Sanction Procedure

Above is the standard procedure for sanction of projects. In principle, projects including PPP projects are approved through this procedure[10]. However, in some cases where a State government does not require the financial resources of the Central Government (i.e., a project is financed by the State budget or the development profit), the project does not follow this procedure. Such cases are exceptional, but projects in Navi Mumbai and Ahmadabad are such cases among the on-going metro projects.

Project Sanction Procedure in the Navi Mumbai Case[11] is shown in Figure 2.1-3. In this procedure, the implementing agency will prepare a Feasiblity Study Report and subumit it to the State Government, and if it is determined to be feasible, a Detailed Project Report (DPR) will be prepared by the agency to acquire an approval of the State Government. In the next step, an approval of seven Ministries or Departments of the Central Government follows (Review of DPR by MoUD is not required).

- Planning Commission
- Ministry of Finance - Department of Expenditures
- Ministry of Finance - Department of Economic Affairs
- Ministry of Railways
- Ministry of Environment
- Ministry of Road Transport
- Ministry of Civil Aviation (Rail Safety)

[10] Based on the information from interview with MoUD.
As the Central Government bears the VGF of PPP projects, this approval procedure is required.
[11] Based on the information from interview with CIDCO.



Source: Study Team

Figure 2.1-3 Project Sanction Procedure in the Navi Mumbai Case

2) Sanction of the Central Government for the opening of metro railway

Section 14 of the Delhi Metro Railway (Operation and Maintenance) Act of 2002 (hereinafter referred to as *Act 2002)* stipulates that the sanction of GoI is required to commence the operation of metro railway in the metropolitan city of Delhi. Where, GoI shall obtain a report from the Commissioner of Metro Railway Safety (CMRS) (Section 15). The sanction of GoI is also required to open certain works such as addition of new line, etc. (Section 16).

Commissioner is appointed by GoI (Section 7) and inspects the metro railway with a view to determine whether it is fit to be opened for the public carriage of passengers (Section 8).

(3) Current Movements

1) Current Movements in Standardization[12]

There is an on-going railway standardization program being conducted by the government. The Standardization Committee formed is composed of representatives from Ministry of Urban Development, Ministry of Railways, urban metros (*i.e.*, DMRC, etc.). The Committee is comprised of five subcommittees:

- Rolling stock
- Electrical system
- Maintenance
- Automatic Fare Collection (AFC)
- Signaling system

The committee is drafting a report on standardization and the report will be completed by the end of February 2013[13]. The new standards will be applied to construction of new projects and expansion of existing lines. The new standards are not very detailed at this stage, but are intended to serve as approximate guidelines.

2) Urban Rail Project Monitoring

The “Recommendations of Working Group on Urban Transport for 12th Five Year Plan” recommends setting up the National Urban Rail Transit Authority, but the plan is suspended at this moment. On the other hand, the Metro Advisory Board (MAB) will be established as a national level board, in charge of monitoring of urban rail technologies and urban rail projects under construction or operation.

Members of the MAB are from MoUD, Planning commission, Railway Board, RDSO and Ministry of Finance. There is a discussion that experts from both government and non-government sectors can be participated in the MAB.

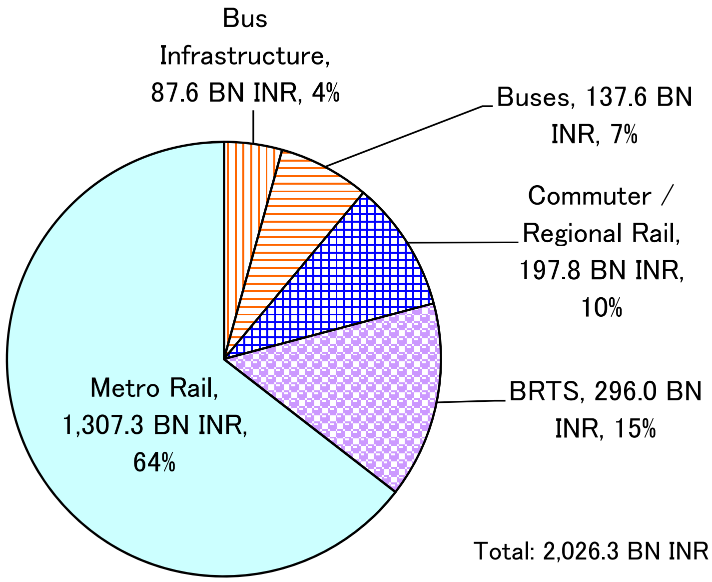
[12] Based on the information from interview with MoUD.
[13] Although the Study Team requested MoUD the latest information, it was not yet obtained by March 2013.

2.1.4. Budget

(1) Investments Required for Urban Transport in 12th FYP period

In order to achieve the goal of urban transport in 12th FYP, total investment of INR 3,883 billion is the estimated requirement. Public transport (Bus/Infra, BRTS, Metro rail, Commuter / Region rail) takes 52% share or INR 2,026 billion.

Among the urban transport modes, share of Metro Rail and Commuter / Regional rail are 65% (INR 1,307 billion) and 10% (INR 198 billion), respectively, and three quarters (INR 1,505 billion) in total.



Source: Recommendations of Working Group on Urban Transport for 12th FYP, graphed by Study Team

Figure 2.1-4 Investments in Public Transport in 12th FYP

(2) Financial Resources for Metro Rail and Commuter / Regional Rail

Regarding the financial sources for Metro Rail and Commuter / Regional Rail, the Working Group (WG) on Urban Transport for 12th FYP forecasts that about 20% projects are envisaged for PPP.

However, it is pointed out that *"A study of global experience in urban rail transit provisioning shows that PPPs have not been very successful"* elsewhere in the same report[14]. It was suggested that there are issues to make use of PPP in the Metro development. (This point will be discussed in Section 2.2.)

[14] *"Recommendations of Working Group on Urban Transport for 12th Five Year Plan"* Ministry of Urban Development, 2011

2.1.5. Issues

(1) Issues related to the policies

As described in this chapter, the direction for promoting the urban railway development is clearly specified in the "Recommendations of Working Group on Urban Transport for 12th Five Year Plan" as the government policy of urban railway in India. Based on this policy, it is assumed that the development plans of metro lines and monorails will be promoted in major Indian cities, following the cities of Kolkata, Delhi and Bangalore where metro lines are already in operation.

In Japan, the first metro line (Ginza Line) was introduced in Tokyo in 1927, followed by the metro line (Midosuji Line) in Osaka in 1933. However, it was after the 1950s-60s when the other metro lines in major cities, as well as in Tokyo and Osaka, were rapidly developed. It was during this period that Japan entered in an era of high economic growth and positioned the metro system as the important infrastructure to support the urban growth. From this reason, the current situation in India has a similarity with the historical background of that period in Japan. Therefore, based on those past experiences in Japan, the Study Team points out the issues associated with the urban railway policy of India, as below.

- Collaboration of urban policy and urban transportation policy

  In the big cities in Japan, the segregation of areas is quite common for people to do business in a city while living in a suburb, and the urban railway systems are often used for commuting between suburbs and cities. In suburban areas, there are examples of metro stations established at the center of large-sized residential areas for development (e.g., Sendai Municipal Subway, Yokohama Municipal Subway). On the other hand, in urban central areas, there are many examples of metro stations directly connected with buildings such as office buildings, department stores, commercial facilities, etc. in redevelopment areas (e.g., Tokyo Metro).

  Thus, a direction of scheme that contributes to the creation of convenient urban areas through the organic collaboration of urban policy (land-use policy) and urban transportation policy should be adopted by India as well.

- Improvement of connection among different modes of transportation

  For Japanese urban railways, improvement of connection between different modes of transportation has been emphasized. In cities like Tokyo, Osaka and Fukuoka, the inter-operability of suburban railways (JR, private railways) and subways has allowed transfer-less railway services. This scheme was referenced in the urban railway in Paris, France. Also, connection between urban railways and buses has been emphasized, and there are examples where facilities for transfer to/from buses are established in metro stations, discounted fares for passengers who make transfers between metro and bus services (e.g., Sapporo Municipal Subway).

Under the current situation of metro system in India, connection between different modes of transportation has been not necessarily satisfactory, and thus, those Japanese examples can be referenced when considering in the future.

- Division of roles between the national government, local governments, and business operators

In Japan, the division of roles between the three parties is clarified: The national government which has the jurisdiction over the institutional designs, technical standards, etc. related to urban railways (MLIT: Ministry of Land, Infrastructure, Transport and Tourism); local governments which are responsible for the development plans of urban railways (prefectures, ordinance-designated cities, etc.); and the railway operators which are responsible for urban railway businesses (Tokyo Metro, transportation bureaus of each municipal government, JR, private railways). Under this structure, local governments create the urban transportation plans that are consistent with their urban policies, while the railway business operators use their own creative ingenuity and implement the efficient railway business operations.

Currently in India, the urban railway policy is being developed by the national government. Yet, it will be necessary to develop a structure to promote the voluntary efforts of local municipalities and the railway operators, by using the examples of Japan as reference.

- Pursuing the efficiency and eliminating the excessive political intervention through incorporation/privatization

The Japanese urban railway business operators include Tokyo Metro, transportation bureaus of each municipal government, JR, and private railways. Of these, Tokyo Metro became incorporated in 2004, and is seeking to list at an early point. As for the JR, Japanese National Railways was privatized as the JR Group in 1987 and became listed, and each company of the JR Group, including the JR East (which is responsible for the urban railway operation in the Tokyo Area) and the JR West (which is responsible for that of in the Kinki Area), is now completely privatized. The private railways are originally the private companies. Thus, through privatization of businesses that were originally-public, the Japanese urban railway business operators have been pursuing efficiency and elimination of excessive political interventions.

In India, the development and operation of metro railway has been implemented by DMRC in Delhi and achieved a measure of success. However, it will be necessary to consider the privatization of business in order to prevent the bloated organization or the excessive political intervention, in the medium and long terms.

- Capacity building and emphasis on the workplace skills for the urban railway operation

  In the urban railway operation, it is necessary to maintain and manage its own railway facilities, and in addition, to ensure the safety and to accumulate the improvements, such as, increased number of trains to respond to the demand for capacity improvement. In Japan, each individual railway business operator has been in charge of this role, and also conducts safe and reliable railway operation over the long term. Therefore, in order to strengthen the sustainability of such business, the Japanese railway operators enhance the capacity building and put emphasis on workplace skills.

  Japanese experience can be utilized in the long-term for Indian urban railway operation.

(2) Issues related to the administration and legal systems

In this chapter, the Study Team has organized the administration and legal systems that are relevant to urban railways in India. The following are the issues related to these areas in India as compared with that in Japan.

- Relationship between the national government and railway operators for establishing the technical standards

  In Japan, major railway operators (JR, metro companies, and major private railway companies) were proactive in establishing the technical standards and in operating the business, based on the guidelines established by the national government (MLIT). As a result, safe and efficient railway operations reflecting the actual on-site condition have been achieved.

  Currently in India, the legal system is being developed, and the standard concept of metro-related technology is considered by the Standardization Committee (including the demarcation with RDSO). In order for the Indian urban railway to be developed in accordance with the situation of each city in the future, India should consider the Japanese example in the establishment of relationship between the national government and railway operators, as a reference.

- Participation of railway operators in the approval procedure

  In Japan, the approval of initiating railway operation, including the urban railway, is granted for the application by a railway operator. In contrast, in India, there are some cases where a railway operator is not involved nor in existence in the approval procedure, except for the DMRC. For example, the tender has been announced and the type of procurement (E&M package) is specified for the Navi Mumbai Metro Project, despite the fact that the railway operator has not been decided yet.

  Ideally, railway operators should take responsibility for the procurement or for placing an order. Thus, it is necessary for railway operators to participate in the approval procedure for railway business.

(3) Issues related to the budget

As the Study Team has organized in this section, amongst the different sectors of urban transportation, the estimated amount of investment in urban railways is large, compared to other modes of transportation. With the financial situation of the government of India that is currently underfunded, the attractiveness of utilizing PPP scheme is increasing in general infrastructure projects. However, there are less examples where PPP schemes have been successful in the urban railway projects, as will be described later in Sections 2.3 and 2.4.

Under these circumstances, Yen Loans were utilized for the railway projects of Delhi Metro, Bangalore Metro, and Kolkata Metro. There are growing expectations for the ODA provisions from the donor countries and organizations including Japan. As described in Section 2.6, it is necessary for the India-side to make better use of the loans, in light of the terms and conditions of loan, and the characteristics of each donor organization, etc.

2.2. Role-sharing between Public and Private Finances

This section is devoted to analyzing the utilization of public finance as well as private finance in the construction, operation and maintenance of metro rail systems. More importantly, a comparison between the PPP approach and the approach of implementation by government institutions is also conducted.

2.2.1. Funding for Urban Transport Development

As described in the previous section, an estimated total investment of INR 3,883 billion is required to achieve the goals for urban transport in 12th FYP. In this regard, a plan concerning the source of funds for the urban transport sector is also proposed as revealed in the following paragraphs.

(1) Sources of Funds for the Urban Transport Sector as a Whole

The above-mentioned huge investment requirement is assumed to be met by various financial resources indicated in the table below.

Table 2.2-1 Source of Funds for the Urban Transport Sector

Source of Funds	Amount (INR. Billion)	%
Central Government	858	22.1
State Government/Development Authorities	1,076	27.7
Property Development	53	1.4
Private Sector	1,356	34.9
Debt from Multilateral/Bilateral institutions	316	8.1
Debt from domestic financial institutions	224	5.8
Grand Total	3,883	100.0

Source: “Recommendations of Working Group on Urban Transport for 12th Five Year Plan”

Amongst these sources, the domestic public sector is expected to account for 49.8%, which will consist of 22.1% from the Central Government and 27.7% from the State Government/Development Authorities, while the private sector is expected to take up 34.9% of the total amount of investment required for the urban transport sector. As for the rest, debt from the Multilateral/Bilateral institutions (World Bank, ADB and governments of major developed countries), debt from the domestic financial institutions and property development are supposed to respectively contribute 8.1%, 5.8% and 1.4%.

(2) Sources of Funds for Metro Rail Sector

Regarding the sources of funds for the metro rail sector, as indicated in Table 2.2-2, only 20% of the funding is assumed to be acquired by means of PPP. And of this PPP funding source, only 60% is expected to come from the private sector and the rest of the support will be from Viability Gap Funding (VGF).

Table 2.2-2 Suggested Weight of PPP among the Source of Funds for Metro Rail

Sources of Funds	Composition Ratio	Breakdown of Source of Funds	Composition Ratio
PPP	20%	VGF from GoI	20%
		VGF from State Government	20%
		Other sources (private sector)	60%
Non-PPP	80%	Equity/subordinate debt/grant from GoI	20%
		State Government/Parastatal	20%
		Property development	5%
		Development agencies	5%
		Loan from international and domestic financial Institutions	50%

Source: "Recommendations of Working Group on Urban Transport for 12th Five Year Plan"

In the case of PPP approach, the difficulty in attracting private investment for urban transport development in general and for metro rail project in particular is not unique to India, but is a rather common issue among many countries. Based on international experience in metro rail projects, the afore-mentioned Working Group on Urban Transport for 12th Five Year Plan recommends the following approach:

- PPP in MRTS projects should be permitted if a project is found to be suitable and viable for this approach on account of ridership. This, however, should not be linked with providing land for property development beyond what is needed for the operation of rail transit;
- The decision in the application of PPP for O&M should be left to the project owner;
- Different models of PPP should be allowed to develop and flourish;
- This should be done in the overall ambit of realization that very few metro rail projects are amenable to PPP

2.2.2. Infrastructure Development by PPP in India

To better understand the current situation of PPP in India's urban transport sector, it is necessary to look at it in the context of PPP in infrastructure development. The following gives an account of the major initiatives undertaken by GoI for PPP promotion and an overview of PPP projects conducted so far in India.

(1) Initiatives Undertaken by GoI for PPP Promotion

The Indian Government's major initiatives in promoting PPP consist of the following three categories:

- Formulation of special purpose agencies to enhance and streamline the appraisal and approval of PPP projects as well as relevant financial support for these projects;
- Setup of special purpose funds and financial institutions that will facilitate potential PPP project development, and to ensure the user affordability of PPP projects as well as their access to long term debt finance, and;
- Other initiatives by the Ministry of Finance aimed at PPP capacity building.

A summary of these initiatives is given in the following table.

Table 2.2-3 Summary of Initiatives Undertaken by GoI for PPP Promotion

Category	Agency/fund/entity/activity	Start time/purpose/status
Formulation of special purpose agencies	Public Private Partnership Approval Committee (PPPAC)	Set up in Oct. 2005 by CCEA to streamline the appraisal and approval of PPP projects. Chaired by the Department of Economic Affairs with members from different agencies.
	Committee for appraisal of PPP projects more than INR 1 billion but less than INR 2.5 billion	Set up in Oct. 2005 by CCEA, comprising the Secretary of Department of Economic Affairs and Secretary of the Ministry/Department sponsoring the project.
	Committee for appraisal of PPP projects of INR 2.5 billion and over but less than INR 5 billion	Set up in Oct. 2005 by CCEA, comprising the Secretary of Department of Economic Affairs and Secretary of the Department of road Transport and Highways
	Empowered Committee for approval of VGF funding over INR 1 billion but up to INR 2 billion	Set up in Oct. 2005 by CCEA, comprising the Secretaries of Department of Economic Affairs, Planning Commission, Department of Expenditure and the line Ministry concerned.
	Empowered Institution for approval of VGF funding up to INR 1billion	Set up in Oct. 2005 by CCEA, comprising the Additional Secretaries or Joint Secretaries of the above agencies.
Setup of special purpose funds and financial institution	India Infrastructure Project Development Fund (IIPDF)	Set up in Dec. 2007 as a revolving fund to finance PPP project development with interest-free loan.
	Viability Gap Funding (VGF) Scheme	Approved by CCEA in Jul. 2005 to improve the commercial viability of PPP projects
	India Infrastructure Finance Company Ltd (IIFCL)	Established in Jan. 2006 as GoI SPV to finance infrastructure projects with long term debt.
Other initiatives in capacity building	Human resource development (by MoF)	Expert support to PPP cells, legal advice, sector specific workshops, officer training and exposure of best practices
	Institutional development (by MoF)	Standardization of contractual/bidding documents and development of online toolkit and manual

Source: Website, “PPP in India” by the Ministry of Finance of GoI

With regard to VGF mentioned in the table above, according to the document, “Guidelines for Financial Support to Public Private Partnerships in Infrastructure”, issued by GoI on Jan. 23, 2006, the financial support to be provided to PPP projects under the VGF Scheme “shall be in the form of a capital grant at the stage of project construction. The amount of VGF shall be equivalent to the lowest bid for capital subsidy, but subject to a maximum of 20 percent of the total project cost. In case the sponsoring Ministry/State Government/statutory entity proposes to provide any assistance over and above the said VGF, it shall be restricted to a further 20 percent of the total project cost”. Accordingly, the maximum amount of financial support to a PPP project in the form of a capital grant could be as high as 40% of the total project cost.

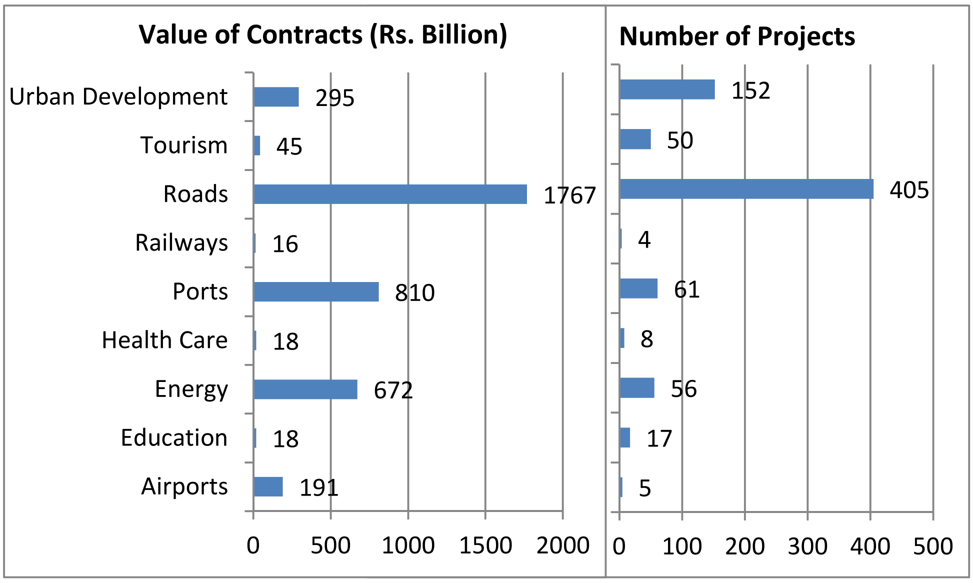
(2) Overview of PPP Promotion Achievement in India

According to the data released by the Ministry of Finance (MoF) in the website of “PPP in India”, development and use of PPPs for delivering infrastructure services has now at least 11 years of precedence in India, with the majority of projects coming in line in the last 5 to 7 years. The cumulative total number of PPP projects and total value of contracts up to now have reached 758 projects and INR 3,833 billion respectively.

With respect to the performance of PPP promotion by sector, it is evident that the four sectors of Roads, Ports, Energy and Urban Development have fared far better than the other sectors in terms of either cumulative number of projects or contract value. Amongst these, the Road sector takes up the top spot in both cases, while Ports and Energy rank No.2 and No.3 in terms of contract value, and No.3 and No.4 in terms of number of projects.

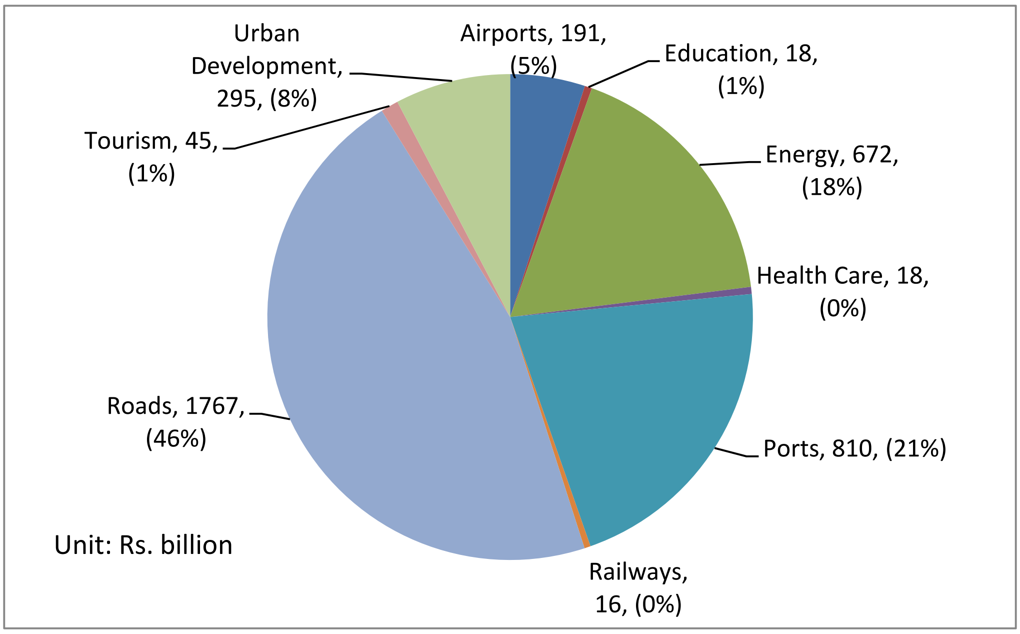
When focusing on the indicator of contract value by referring to Figure 2.2-2, it can be seen that the share of Roads is overwhelmingly large, accounting 46% or nearly a half of the total amount. In fact, if looking at the indicator of number of projects, its share would further enlarge to more than half of the total.

In contrast, fewer cases of PPP projects have been found in the field of Railways. As shown in Figures 2.2-1 and 2.2-2, so far there have only been 4 PPP projects with a total of contract value of not more than INR 16 billion, which accounts for far less than 1% of the total PPP projects in India. The reason for this poor result of PPP promotion in the field of Railways is to be discussed in Section 2.3.



Source: Website, "PPP in India" by MoF of GoI

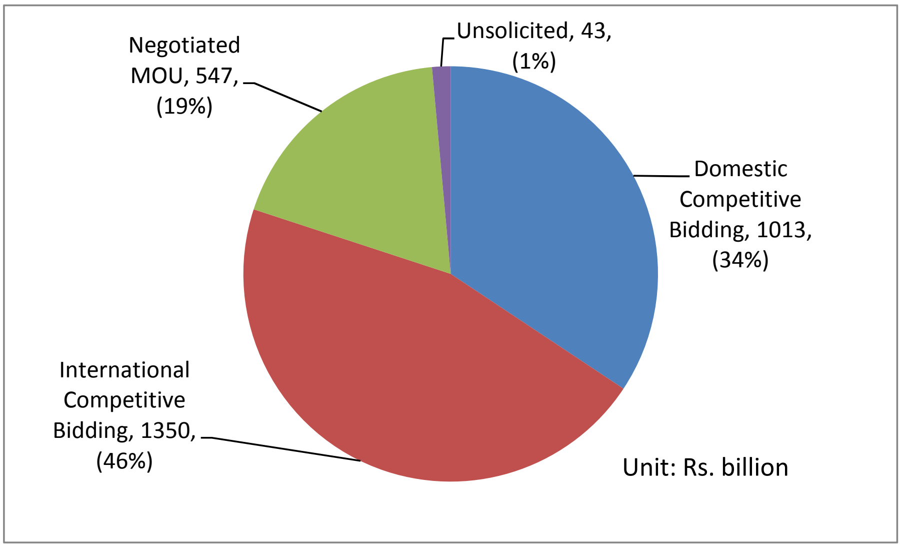
Figure 2.2-1 Total Number of PPP projects and Total Value of Contracts by Field



Source: Website, "PPP in India" by MoF of GoI

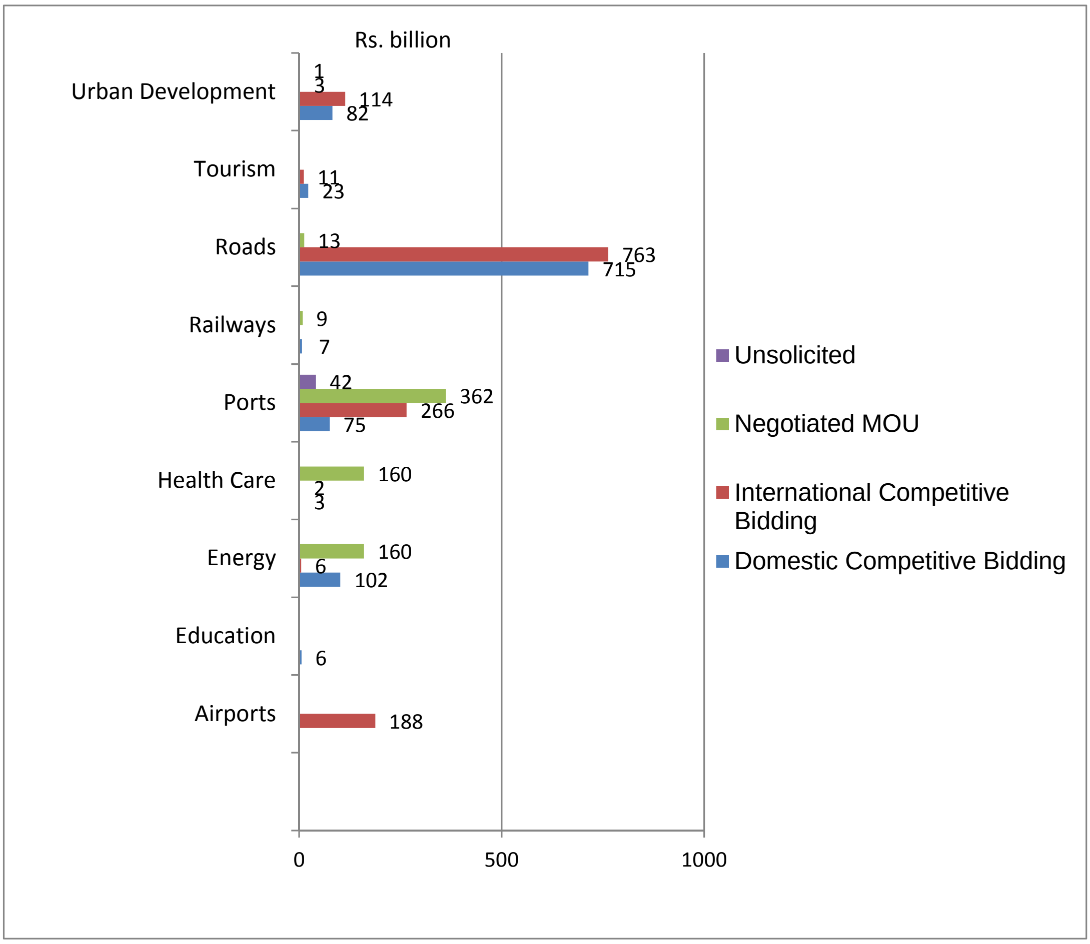
Figure 2.2-2 Shares of Respective Fields among Total Contract Value of PPP Projects

Another point worthy of mentioning is the feature of contract award methods. As indicated in Figures 2.2-3 and 2.2-4, although international competitive bidding as the most important contract award method of PPP projects accounts for 46% of the total, it has not yet been adopted in the field of Railways.



Source: Website, "PPP in India" by MoF of GoI

Figure 2.2-3　Shares of Contract Value of PPP Projects by Contract Award Method



Source: Website, "PPP in India" by MoF of GoI

Figure 2.2-4　Contract Value of PPP Projects by Field and Contract Award Method

2.2.3. Argument for and against PPP Adoption in Metro Rail Projects

In light of the fact that the actual result of PPP promotion varies greatly with the different sectors, the afore-mentioned Working Group points out in its recommendation that PPP is not a panacea for all cases. Meanwhile, it further explores the respective rationale behind the approach of implementing metro rail projects by PPP and the approach of implementing projects of this kind through a government company. Although discussions on this issue are expected to continue as it will remain to be important to the policy-makers, the following passages are meant to outline the arguments cited by the working group with regard to the two approaches.

(1) Advantages of PPP Approach in Metro Rail Projects

The advantages of adopting PPP approach in both the components of construction and O&M of a metro rail project are cited below:

- It brings in private capital, thus speeding up urban infrastructure development.
- It also results in the improvement of efficiency.
- It reduces the risks borne by the national exchequer by transferring part of the responsibility to the concessionaires.
- In the case when the risk is to be borne by the concessionaire, as the justification for the project is decided by the market, the situation where the formulation and sanction of a project is influenced by excessive lobbying could possibly be prevented.
- When PPP approach is adopted in both components of construction and O&M, the concessionaire awarded the two components as a single package is more likely to make the transition smoothly from construction stage to O&M stage, and can concurrently take a long-term perspective in design, quality control and standard satisfaction as well as cost reduction. Moreover, problems like unfair allocation of risks and benefits, and unclear accountabilities between partners could be avoided.
- Unlike Government owned SPV projects, the liability of Government of India in a PPP project is limited to payment of VGF which is determined by market and hence not open ended.

(2) Advantages of the Approach of Implementation by Government Companies

In contrast, the advantages of implementing metro rail projects by government companies can also be listed as follows:

- The Global experience of PPP in metro rail so far has not been very encouraging. Even in India, the experience so far is not very promising.
- It is true that, as the projects of metro rail are capital intensive and are unlikely to be viable on the basis of fare box revenue alone, in taking up the project under a PPP

scheme, the contract needs to be suitably "**s**weetened". Normally this comes in the form of real estate development rights. However, since this would require densification, higher FAR and removal of land use restriction, all these measures would lead to a substantial appreciation in value of real estate in due course. This implies that even the value of real estate without relevance to urban rail transport would appreciate and all the capital gains whereby would be captured by the concessionaire, which would be certainly against the interests of the country.

- Besides, the ridership in rail transit generally rises as the network gets larger and larger. Under PPP, the concessionaire of the initial segment of the project is likely to benefit from the extension of the network without contributing anything to the new segment, which is considered unfair.

- In addition, to look at it in a broader sense, the following are arguments in favor of implementation by government companies rather than by adoption of PPP approach:

  - A government entity is better positioned than a private company in dealing with highly sensitive issues, such as land acquisition;
  - It has been argued that relatively speaking, lack of capacity to execute projects like rail transit is likely to be more acutely felt by a private concessionaire;
  - Standardization of specifications and technologies in metro rail projects can be achieved more easily if the projects in different parts of the country are built by government companies;
  - Integration of various corridors/phases of a project is considered extremely difficult in the case of PPP;
  - As seen in PPP metro rail projects in Kuala Lumpur, Bangkok and Manila, private concessionaires only concentrate on how to recoup their earlier investments, which generally results in the government left with huge liabilities.
  - A government company can raise capital at a much cheaper cost as compared to a private party, thus bringing down the cost of the project.

(3) Is PPP suitable to urban railway project?

Working Group does not indicate a clear answer to the above question. But it points out that PPP is not a panacea for all cases, and thus the number of urban railway projects where PPP is suitable is considered quite limited.

2.2.4. Issue

As described in this chapter, the Government of India has been promoting the PPP scheme as a funding mechanism for infrastructure development projects in India. However, there are few cases of railway projects where PPP schemes were actually applied. Especially for the urban railway projects, there have been disputes over the pros and cons of applying PPP schemes, and negative views toward the use of PPP schemes were expressed by the working group on 12th Five Year Plan for urban railways. The issues on the application of either PPP scheme or Government Company approach for urban railway projects are as follows:

- Issues on the application of PPP scheme for urban railway projects

In the application of PPP scheme for capital-intensive projects like urban railway, it is often associated with grants of land development rights. This is to enhance the project's low feasibility if the revenue forecasts are solely reliant on fares. From this reason, there is possibility that preferential treatment for increasing the ratios of building-to-land and floor-space, or eliminating the restriction of purpose of land use may lead to the excessive influence peddling of a concessionaire. On the other hand, because the project associated with the land development tends to be a high-risk business, foreign railway operators and related industries with broad experiences in urban railway projects have a tendency not to participate in the concessionaire to avoid risks.

In order to solve these particular issues involved with PPP scheme, there is a need to formulate design of a PPP system in urban railway projects. (The discussion on actual examples of Indian urban railway projects conducted through the PPP system and the issues involved with the system design are described in Section 2.3.2.)

- Issues on the application of Government Company approach to urban railway projects

In general, when the capital-intensive projects like urban railways are implemented by Government Companies, there exist various issues, such as: a huge financial burden is requested; an organization's unnecessary expansion; penalties for project delays or increase in cost are prone not to function; political interferences tend to happen, etc.

In the case of the Delhi Metro, which applied Government Company approach, relatively fewer problems have occurred, mainly because DMRC has implemented the project with the above issues in mind. However, the above-mentioned issues must still be addressed in the implementation of future urban railway projects with the Government Company approach.

2.3. Trends and Hurdles in Private Financing

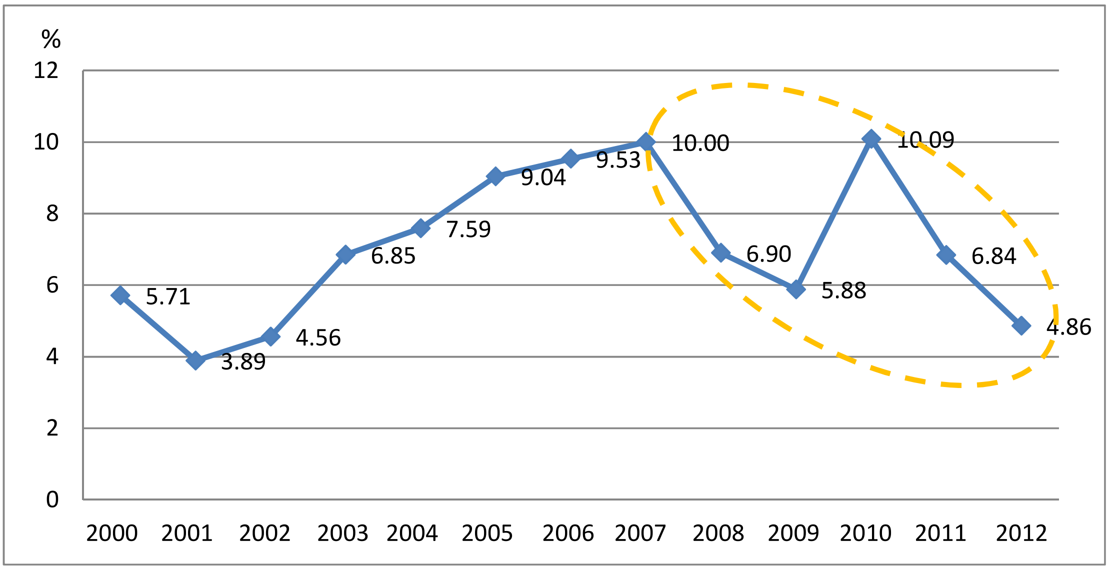
The trends in private funding in India are analyzed in this section. Firstly, the analysis of the macroeconomic environment will be conducted to get an overall picture of the investment environment of private sector in India, which is then followed by analysis of the positive and negative factors that impact the promotion of private investment on PPP projects. This study is accomplished by conducting case studies of sample PPP projects in metro rail development.

2.3.1. Macroeconomic Environment

As reflected by major economic indicators, although the Indian economy underwent certain periods of dynamic growth, its macroeconomic environment has gradually became severe in recent years, with some of the risk factors looming large. Nevertheless, the vigorous increase of foreign direct investment (FDI) inflow shows the confidence of foreign investors in this country, which could be taken as its advantage in promoting private investment.

(1) Economic Growth Rate

The annual growth rate of Gross Domestic Products (GDP) kept on increasing between 2001 and 2007, accelerating from 3.9% in 2001 to 10% in 2007. The impact of the Lehman-induced world economic crisis precipitated the growth down to 6.9% in 2008 and 5.9% in 2009. Although during the year 2010, the growth recovered to 10.1%, which turned out to be temporary phenomenon, as in the succeeding year, dampened by the government's credit restraint policy, this tumbled again to 6.8% in 2011 and further down to 4.9% in 2012. In short, not only the economic slowdown, but also the drastic fluctuations of economic growth should be considered as major risk factors worthy of precaution.

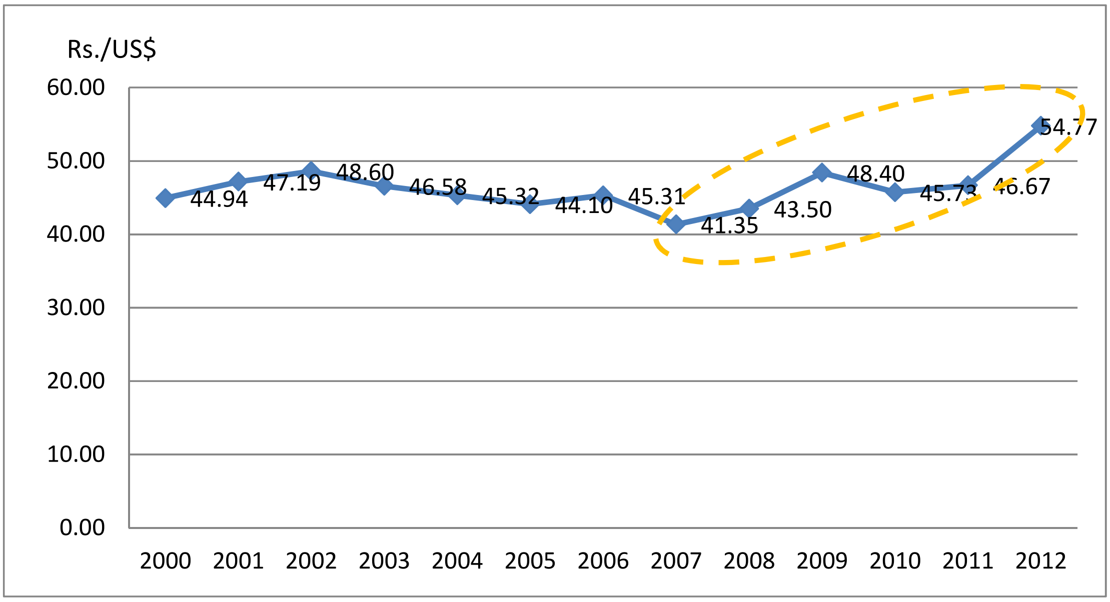


Source: IMF, “World Economic Outlook Data” October, 2012

Figure 2.3-1 GDP Growth Rate of India (Constant Prices of 2004-05)

(2) Foreign Exchange Rate

The exchange rate of Indian rupee against the US dollar was on a rising trend from year 2002 to 2007. During this 5-year period, the value of one dollar denominated in rupee fell all the way from INR 48.6 to INR 41.35, resulting in a 14.9% rise of rupee’s value. However, the subsequent years witnessed rupee’s trend of depreciation, wherein the value of dollar climbed up to INR 54.77 in 2012, resulting in Rupee’s 24.5% value depreciation over a 5-year period. The trend of rupee’s depreciation is certainly posing risk especially for those infrastructure projects with huge loan amount in foreign currency, but with revenue sources in local currency.



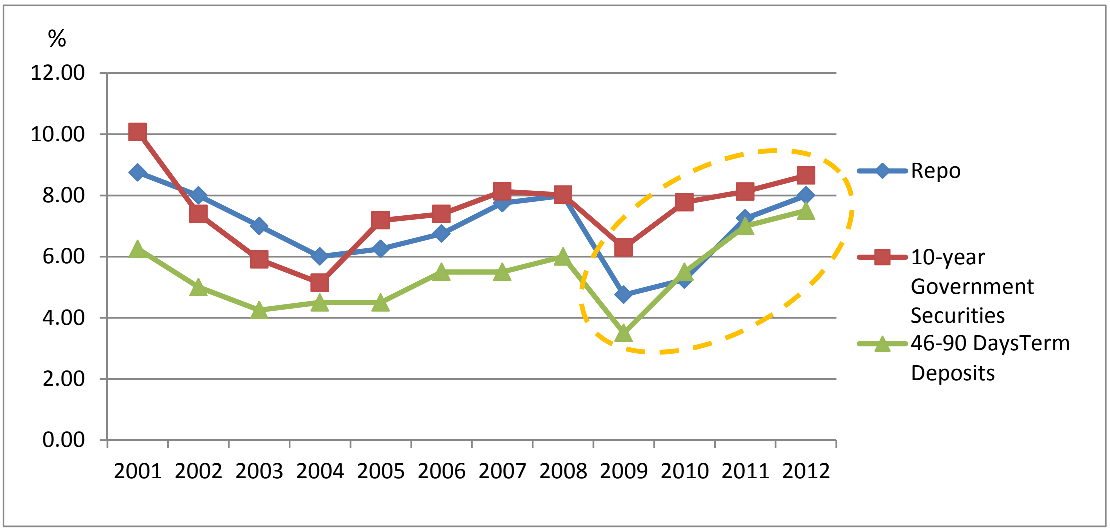
Source: Website of Reserve Bank of India, "Database on Indian Economy"

Figure 2.3-2 Trend of Rupee' Foreign Exchange Rate

(3) Interest Rate

Regarding the trend in interest rate, analysis is focused on 3 kinds of rates, i.e. the Repo Rate as the central bank (Reserve Bank of India/ RBI) lending rate, the interest rate on 10-year Government Securities as the long-term interest rate, and the interest rate on 46-90 Days Term Deposits as the short-term interest rate.

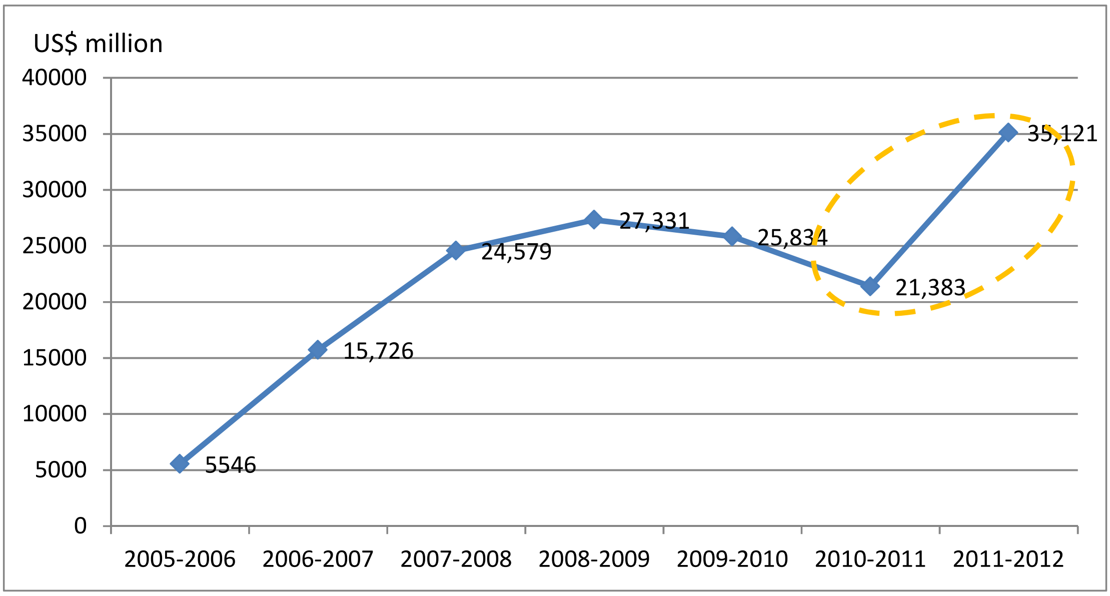
As seen from Figure 2.3-3, with the Repo rate reduced to the decade's lowest point of 4.75% in 2009, interest rate on 46-90 Days Term Deposits slipped to 3.5% at the same year from 6% of the previous year, while interest rate on 10-year Government Securities also fell sharply from 8.02% in 2008 to 6.29% in 2009. But all the 3 kinds of rate rebounded in 2010 and increased further in 2011 and 2012, when Repo recovered to the level of 8%, while interest rates for 46-90 Days Term Deposits and on 10-year Government Securities respectively reached 7.5% and 8.65%. Therefore, fund raising is becoming difficult under such a tight-money environment.



Sources: 1) Repo: Website of Reserve Bank of India, "Database on Indian Economy"
2) Interest on 10-year government securities:
Website of Reserve Bank of India, "Handbook of Statistics on Indian Economy"
3) 46-90 days term deposits: All kinds of newspaper articles

Figure 2.3-3 Trends of Key Interest Rates

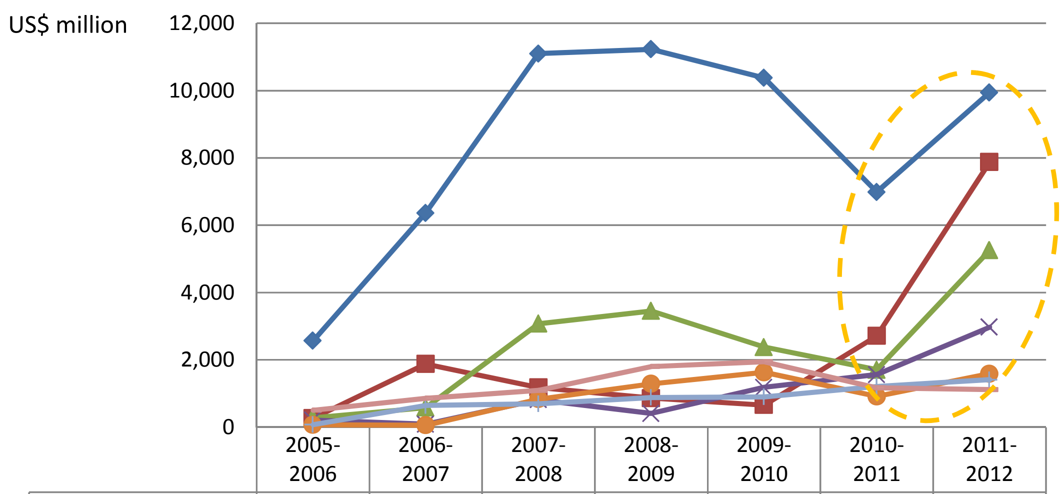
(4) FDI



Source: Ministry of Commerce and Industry, "Fact Sheet on Foreign Direct Investment"

Figure 2.3-4 Trend of FDI Inflow to India (by Financial Year)

Despite the above-mentioned risk factors, FDI inflow shows robust growth. Annual amount of FDI inflow registers a 6-time growth within a period of 6 years, growing from $5,546 million in the financial year of 2005-2006 to $35,121 million in 2011-2012. The average annual growth rate within this period stands at 36.02%, while that of the latest financial year (2011-2012) reaches 64.25%.



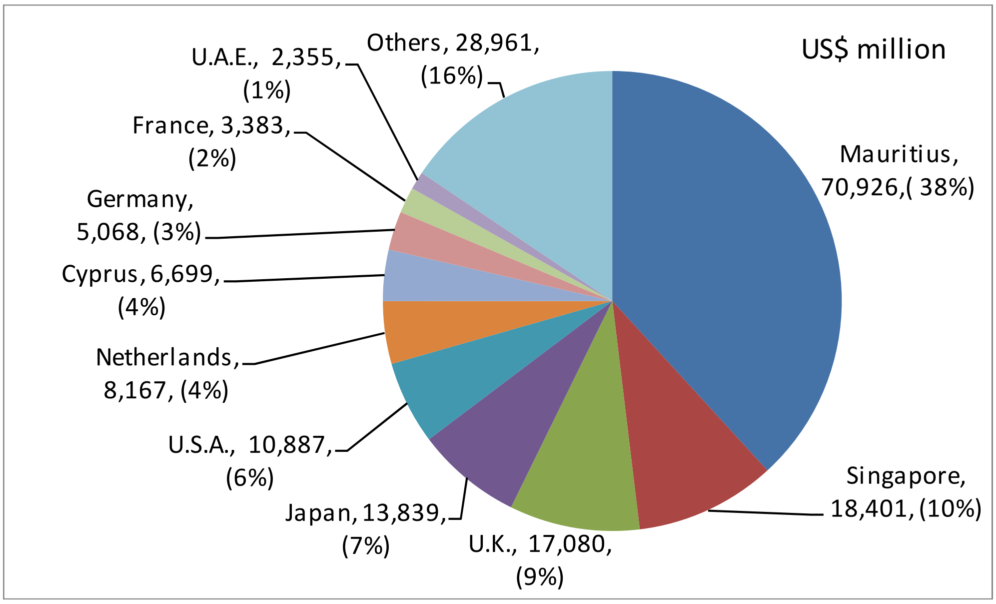
	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012
Mauritius 11,229	2,570	6,363	11,096	11,229	10,376	6,987	9,942
U.K. 1,802	266	1,878	1,176	864	657	2,711	7,874
Singapore 3,454	275	578	3,073	3,454	2,379	1,705	5,257
Japan 864	208	85	815	405	1,183	1,562	2,972
Cyprus 1,287	70	58	834	1,287	1,627	913	1,587
Netherlands 405	76	644	695	883	899	1,213	1,409
U.S.A. 883	502	856	1,089	1802	1943	1,170	1,115

Source: Ministry of Commerce and Industry, "Fact Sheet on Foreign Direct Investment"

Figure 2.3-5 Trend of FDI Inflow to India from Major Countries (Financial Year)

A further look into the trend of FDI inflow by host country shows that Mauritius has always been the top country in providing FDI to India[15], accounting for 38% of cumulative total FDI inflow to India from April 2000 to October 2012. As for the other major countries of FDI provider for India, Singapore took over the 2nd place in terms of cumulative total in the same period, though U.K. surpassed it to become the No.2 in the financial year of 2011-2012 in terms of annual amount. With regard to Japan, its annual amount of FDI to India increased from $405 million in 2008-2009 to $3 billion in 2011-2012, which ranks No. 4, next to that of Singapore. Besides, Japan also stands at No.4 in terms of cumulative total FDI inflow to India from April 2000 to October 2012, which accounts for 7% of the total, next of that of U.K. (9%).

[15] It is reported that there are many oversea Indians living in Mauritius (Non-residential Indian/ NRI), which they deem as a place of Tax Heaven where they bring in money and then reinvest the money to India. (Source: Mr. Hiroki Fujimori, "India the Great Power: Its Real Picture and Future" in "Asia Forum 21st, June 23, 2006)



Source: Ministry of Commerce and Industry, "Fact Sheet on Foreign Direct Investment"

Figure 2.3-6 Shares of Major Countries among Cumulative Total FDI Inflow to India from April 2000 to October 2012

2.3.2. Examples of Metro Rail PPP Projects

(1) List of PPP Projects in the Metro Rail Sector

Currently, there are altogether 6 metro rail projects under PPP already in operation or under construction in India, i.e.

- New Delhi - IGI Airport Express Link (AEL) in Delhi,
- AEL Extension in Delhi,
- Versova - Andheri - Ghatkopar Metro Corridor (I) in Mumbai,
- Charkop - Mankhurd - Metro Rail (II) in Mumbai,
- Hyderabad Metro in Hyderabad, and
- Gurgaon Metro in Gurgaon.

There are several sources of information regarding PPP projects in the field of metro rail available for the study, including "Urban Rail Transport in India- Market Analysis and Project Profiles", a report issued in November, 2012 by India Infrastructure Research, "Metro Rail Projects in India", a new book written by Mr. M. Ramachandran, former Secretary of Ministry of Urban Development (MoUD), the website of "PPP in India" set up by MoF, and the information acquired by the Study Team through field study. As relevant data and information revealed in the report by India Infrastructure Research are comparatively better arranged and with more details, the basic facts regarding the 6 projects summed up in the following table are mainly based on this report, though it was revised by other data sources.

Out of the 6 PPP projects in operation or under construction, 2 are in Delhi, 2 in Mumbai, 1 in Hyderabad and 1 in Gurgaon, but the 2 projects in Delhi are actually of the same metro line though implemented in different phases.

Table 2.3-1 Metro Rail PPP Projects in Operation or under Construction

Name of Project	State/ Location	Length (km)	Cost/EPC (INR Billion)	Source of Funds	Status	Remarks
New Delhi-IGI Airport Express Link (AEL)	Delhi	19.2	56	Private 100% (Reliance 95%, CAF 5%)	In operation	Civil portion by public/ Completed in Sep 2010.
AEL Extension	Delhi	3.5	7.93	Same as above	In operation	Civil portion by public/ Started on Feb. 2011.
Mumbai Metro (Line I)	Maharashtra/ Mumbai	11.1	23.56	Public 26% Private 74% (Reliance 68%, Veolia 5%)	Under construction	-
Mumbai Metro (Line II)	Maharashtra/ Mumbai	31.9	112.82	Public 30% Private 70% (Reinfra 48%, SNC 26%, Reliance 26%)	Under Construction	Currently construction stopped
Hyderabad Metro	Andhra Pradesh/ Hyderabad	71.2	163.78	Public 20% Private 80%	Under construction	-
Gurgaon Metro (Rapid Metro System)	Haryana/ Gurgaon	11.6	31.88 Ph.1: 10.88 Ph.2: 21.00	Private 100% (ITNL Enso 74%, DLF Ltd. 26%)	Under construction	Awarded by HUDA on BOT basis

Source: Based on India Infrastructure Research, "Urban Rail Transport in India- Market Analysis and Project Profiles," Nov. 2012, and other sources.

In addition, there are many potential metro rail projects still at the stage of formulation or preparation for bidding, which include projects with PPP prospect as well as projects which were previously assumed to be potential PPP projects but the option of PPP has been abandoned. The table below describes the basic information regarding these two kinds of metro projects.

The sites of 5 metro projects listed in this table are respectively located in Mumbai, Bhiwandi, Ahmedabad, Jaipur, and Kochi. Among them, only Jaipur Metro Phase 2 is regarded as a potential PPP project, and the process of selecting PPP concessionaire has begun, while the other 4 projects were all previously assumed to be with PPP prospect but the option of PPP has been said to have been abandoned.

Table 2.3-2 Metro Rail PPP Projects under Bidding, in Pipeline or with PPP Option Forgone

Name of Project	State/ Location	Length (km)	Cost/EPC (INR Billion)	Source of Funds	Status	Remarks
Mumbai Metro (Colaba-Bandra-SEEPZ Metro Corridor)	Maharashtra/ Mumbai	33.5	244.3	GoI+GoM 30% JICA loan 50% Other debt 20%	Bidding; prepared	PPP option abandoned
Mumbai Metro (Thane-Bhiwandi-Kalyan-Badlapur)	Maharashtra / Bhiwandi	N.A	54.86	Municipal Corporation, Bhiwandi	In pipeline	PPP option abandoned
Ahmedabad Metro	Gujarat/ Ahmedabad	76.0	150	GIDB	Bidding	PPP option abandoned
Jaipur Metro Phase 2	Rajasthan/ Jaipur	23.1	65.83	Public 81% Private 19%	Bidding prepared	Contribution of VGF 40%
Kochi Metro	Kerala/ Kochi	25.6	51.81	GoI 19% GoK 39% JICA loan 42%	Bidding	PPP option abandoned

Source: Based on India Infrastructure Research, "Urban Rail Transport in India- Market Analysis and Project Profiles," Nov. 2012, and other sources.

(2) Major Examples of PPP Projects in the Field of Metro Rail

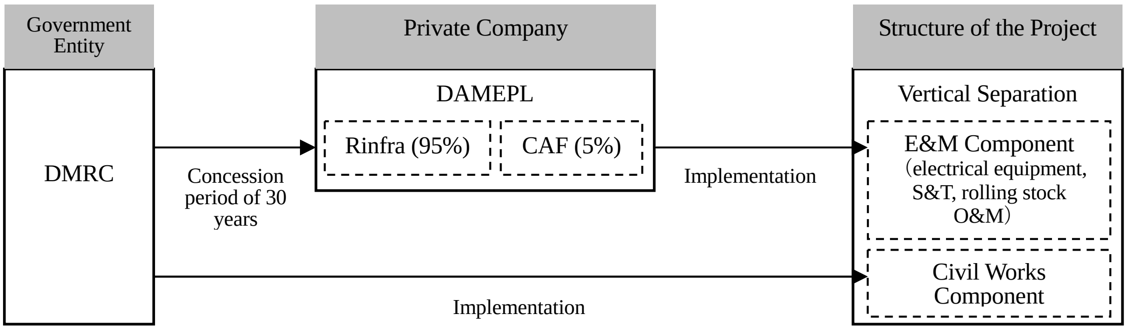
The paragraphs below provide further details regarding two cases of the aforementioned 6 metro rail projects undertaken by means of PPP, with an overview of the main features of metro rail PPP projects in India.

1) New Delhi-IGI Airport Express Link (AEL) and AEL Extension

The development plan of Delhi Metro, of which the AEL project is just one component, is being implemented in four phases, spanning a total length of over 400km, consisting of 20 metro rail lines and more than 200 stations. Phases l and 2 are operational, and Phase 3 is currently under construction, while Phase IV is yet to be approved. In this project, the AEL is 1 of the 6 metro lines constructed during Phase 2, which has a total length of 22.7km including 3.5km of the extension section, covering 6 stations altogether.

The project has two packages, one for civil works and the other for E&M. The civil works portion was implemented and financed by DMRC itself, while the E&M component (including electrical equipment, S&T, rolling stock and O&M) was implemented under a PPP Framework. The SPV formed, Delhi Airport Metro Express Private Ltd (DAMEPL), is composed of Reliance Infrastructure (Rinfra), a local developer, and the Spanish train maker CAF, with the shares of their respective contribution being 95% and 5%, respectively.

This kind of contract style could be called Vertical Separation, in which the lower portion (civil works component) was implemented by a public enterprise (i.e., in this case, DMRC), while the upper portion (E&M component) was contracted out to a private company or consortium (herein referred to as DAMEPL). The concession period is for 30 years, and the total cost of the project is estimated to be INR 56 billion, with the components of civil works and E&M each requiring INR 28 billion.



Source: Based on India Infrastructure Research, "Urban Rail Transport in India- Market Analysis and Project Profiles," Nov. 2012

Figure 2.3-7 Contract Style of the AEL Project

The AEL started its commercial operation in February 2011, but services had to be suspended in July 2012, less than 16 months after the commencement of commercial operation, because of defects detected in the civil structures, specifically, the problems with the bearing pads which serve as the interface between the columns/piers and girders. These defects had since been rectified by DMRC and the line was offered for re-inspection to the Commissioner of Metro Rail Safety in December 2012. With a formal clearance for commercial operation received from the Commissioner of Metro Rail Safety on January 18, 2013, the line resumed operation in January 22 after 6 months of suspension.

However, since the reopening of the AEL, the speed of the train has been reduced to 50km/h from the previous 105km/h by order of the Commissioner, while the fare has been raised by 50%, with the minimum fare up from the former INR 20 to INR 30 and the maximum fare from INR 100 to INR 150. According to the explanation given by DAMEPL, this is based on a provision in the Concession Agreement that allows increase of fares after completion of 2 years of operation. However, as some users have reportedly complained about the fare increase, which thereby raises concern about further decrease in ridership.

During the period of operation suspension and civil structure defect rectification, DAMEPL was reported to have sent notice to DMRC raising the issue of terminating the Concession Agreement in October 2012, which was said to be ascribable to its inability to run the line profitably and to its failure in raising revenue through non-fare businesses such as retail operations, property development, advertising and other commercial activities[16].

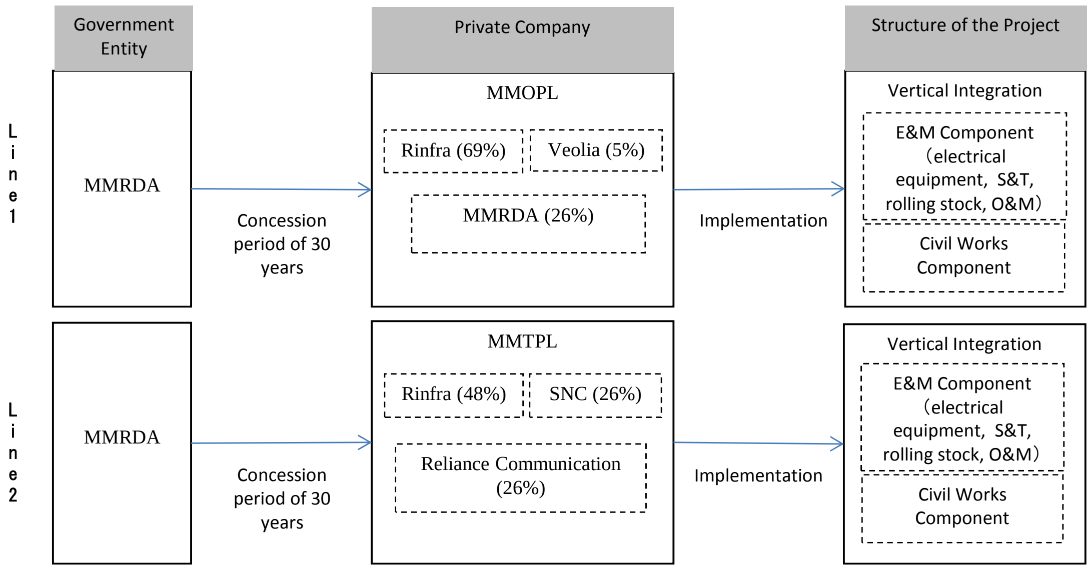
[16] Articles in "Mail Today" July 7, 2012, "Press Trust of India" January 23, 2013, "NDTV Profit" January 22, 2013, and "Manu Kaushik" November 1, 2012

Although, at the moment, DAMEPL seems to have given up on the termination of the Concession Agreement, how the group will deal with the issue of unprofitable operations regarding the AEL remains to be seen.

2) Mumbai Metro Line 1 and Line 2

The Mumbai Metro is scheduled to be implemented in 3 phases with a total of 9 metro rail lines spanning a total length of 159.24km. Phase 1 covers the construction of 3 metro rail lines, including Mumbai Metro Lines 1 and 2. Line 1 spans 11.07km, encompassing 12 stations, while Line 2 has a total length of 31.87km with 27 stations.

For all the 3 lines in Phase 1, DMRC has functioned as a consultant that undertook preparation of DPR. Both Lines 1 and 2 are implemented under a BOOT (Build-Own-Operate-Transfer) contract. The contract style adopted for the two projects of Mumbai Metro is different from that of the AEL project. The AEL project is separated vertically into two parts with only the upper part, i.e. the E&M component contracted out to the SPV by concession agreement, whereas, in the case of Lines 1 and 2 of the Mumbai Metro project, both the upper and lower parts are integrally contracted out to the SPV by concession agreement.



Source: Based on India Infrastructure Research, "Urban Rail Transport in India- Market Analysis and Project Profiles," Nov. 2012

Figure 2.3-8 Contract Style of the Projects of Mumbai Metro Line 1 and 2

The SPV set up to undertake the Line 1 project is "Mumbai Metro One Private Limited" (MMOPL), which is a joint-venture between Rinfra, Mumbai Metropolitan Region Development Authority (MMRDA), and the French company, Veolia Transport RATP Asia. The shares of the three companies are 69%, 26% and 5%, respectively. With respect to the Line 2 project, the SPV known as "Mumbai Metro Transport Private Limited" (MMTPL) is formed by Rinfra, Reliance Communications and the Canadian company SNC Lavalin, and the shares contributed by the three companies are 48%, 26% and 26%, respectively. The difference between Lines 1 and 2 is that, unlike what has been observed in the SPV of Line 1, the government entity MMRDA does not have a stake in the SPV of Line 2, leaving it as a consortium of purely private companies. Nevertheless, MMRDA functions as the government representative that concluded a concession agreement with the SPV in both cases. The two projects have also in common, a concession period that is stipulated at 35 years with possibility of 10-year extension.

With regard to the issue of financing, the details about source of funds and method of fund raising are described in Table 2.3-3 below. Both Lines 1 and 2 projects are conducted using syndicate loan. In addition, as shown in the table, grant from the government is of great importance to the improvement of project's capital structure. As far as Line 1 is concerned, debt-equity ratio would be 70:30 without government grant, whereas with its inclusion, the debt-equity ratio changes to 51:49. With regard to Line 2, the inclusion of government grant turns the debt-equity ratio from 91:9 into 62:38, with even greater margin of improvement.

Table 2.3-3 Overview of Fund Raising Regarding Mumbai Metro Lines 1 and 2

Line	Method of Fund Raising	Amount (INR billion)	Capital Investor/ Lender
Line 1	Loan	11.95	IDBI Bank (lead bank), Corporation Bank, Karur Vyasa Bank, Canara Bank, Indian Bank, Oriental Bank of Commerce
	VGF	6.50	MMRDA
	Equity Capital	5.11	MMOPL
	Total	**23.56**	
Line 2	Loan	70.00	Axis Bank (lead bank), IDBI Bank, Syndicate Bank, Indian Overseas Bank, Canara Bank, Punjab National Bank, UCO Bank, Bank of Maharashtra, Andhra Bank, Reliance Capital
	VGF	22.98	Maharashtra State Government
		15.32	Central Government
	Equity Capital	4.52	MMTPL
	Total	**112.82**	

Source: Based on India Infrastructure Research, "Urban Rail Transport in India- Market Analysis and Project Profiles," Nov. 2012

The construction work for Line 1 started in February 2008. Although MMRDA was obliged to complete land acquisition along the metro rail and hand it over to MMOPL by mid-August in accordance to the original agreement, it was not until October 2012 that MMRDA could fulfill its obligation. At this point, Line 1 is expected to open entirely by March 2013[17]. As for Line 2, the construction work has not yet begun due to similar reason that the approval process regarding the land acquisition and environmental clearance have been delayed[18].

3) Summary of Case Study

The above-mentioned examples of metro rail projects implemented in Delhi and Mumbai, by means of PPP, either in operation or under construction, show that adoption of risk mitigating measures has become a vital issue in promoting PPP metro rail projects.

As far as the two examples are concerned, the risks of insufficient demand and delay in land acquisition are particularly noteworthy in PPP projects for metro rail.

● Risk of Insufficient Demand

As suggested by the example of Delhi AEL project, in addition to the fact that the metro rail operation itself has been unprofitable, efforts in raising revenues from non-fare businesses like property development and so on have fallen short of expectations. All this have once prompted DMRC to express its intention to terminate the concession agreement.

It is held to be the major reason for the unprofitable metro rail operation that the demand forecast for metro rail (i.e. the ridership) was overestimated at the stage of DPR preparation. With the actual ridership turning out to be smaller than the overly optimistic forecast rail traffic, prevalent occurrence of insufficient ridership demand looms into view.

However, if the investors were to set the fare at an unreasonably high levels in an attempt to recover the cost of investment as early as possible, this might result into decrease in ridership, thus becoming the reason behind insufficient demand. As seen in the case of AEL, although the decision of DAMEPL to raise the fare by 50% at the resumption of line operation on January 22, 2013, has not extended beyond what is stipulated in the concession agreement, people are still wary about the negative impact of decreasing ridership incurred thereafter. This is a dilemma usually confronted by the concessionaire of a metro rail PPP project. There is no better way than improving the accuracy of demand forecast and project cost estimation at the stage of DPR preparation.

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[17] Articles in "Daily News & Analysis" January 7, 2013, and "The Indian Express" October 15 and 17, 2012

[18] Articles in "Daily News & Analysis" March 13, 2012, "Mumbai Mirror" September 22, 2012, "Hindustan Times" March 13, 2012, "Express India" March 13, 2012, "Times of India" November 20, 2010 and "Daily News & Analysis" March 15, 2012

- Risk of Delay in Land Acquisition

In general, people tend to think that, as the government participates in PPP projects as a partner, land acquisition should not be a problem. However, as proven by the examples of Mumbai Metro Lines 1 and 2, there is no justification for overconfidence in these undertakings.

In the case of Line 1, MMRDA, the government entity has provided assurance to complete the ROW acquisition process within 6 months from the point when the concession agreement was under negotiation, but the process turned out to be far more time-consuming as it took 4 years and 8 months to entirely complete the procedure. Likewise, in the case of Line 2, owing to the various unexpected obstacles found in the approval process regarding land acquisition and environmental clearances, so far, the construction work is yet to begin.

The issue of land acquisition is in many cases are entangled with issues on large-scale resettlement and recovery, and would become more complicated when the proposed railway passes through an environmentally-protected area, an ethnic minority area or an indigenous people settlement area. Therefore, at the stage of contract negotiation, it would be important to carefully verify the possibility of large-scale resettlement and its potential impact to ethnic minority or indigenous people, as well as the duration to solve all these problems.

2.3.3. Issues

In this chapter, the Study Team firstly outlined the private investment environment in India by sorting out the macroeconomic environment. Secondly, the Study Team presented specific examples of PPP schemes used in urban rail projects and listed its apparent risks. In view of these risks, the Study Team describes the issues related to private investment environment and the issues related to PPP scheme, as follows.

- Issues related to private investment environment

The recent major economic indicators for India indicated that some of the risk factors (such as, decline in economic growth rate, depreciation trend of the Indian rupees against the dollar, rising interest rate) are apparent in the India, a country which has previously achieved dynamic economic growth. It is pointed out that these economic trends make it difficult for foreign companies to invest in Indian railway projects and to earn payback for a long term; and likewise, to invest in Indian railway industry and to earn payback for a long term as well.

However, as was mentioned in Section 2.1, medium-and-long-term demands for urban railway in India are high, and coupled with the demand for other railway development by MoR, there is little doubt that an enormous market exists in India. From both sides presented above, foreign private entities are enjoined to apply business judgment in taking advantage of the investment opportunities in India.

● Issues related to PPP scheme

From the examples of urban railway PPP projects which are in operation, under construction, or in the planning phase for Delhi and Mumbai, as described in this chapter, mitigating measures to various risks related to demand, land acquisition, etc. will be an important issue for the promotion of PPP projects in this sector. When using a PPP scheme for urban railway projects in India, consideration of the following points will be necessary in the future.

➢ Hedge against demand risks

For the projects of Seoul Metro 9 and Manila MRT 3, the demand risks are basically borne solely by the public. Seoul Metro 9 has Minimum Revenue Guarantee (MRG), while Manila MRT3 has similar features in the form of lease payments[19]. On the other hand, in India, proposals from companies with less VGF requirement will be selected and the demand risks are basically borne by the private group. As the unreasonable burden of demand risks assumed by the private proponent will increase the probability of business failure, consideration should be made to improve the system.

➢ Vertical separation

The feasibility of a project can be increased by using "vertical separation", as the case for Seoul Metro Line 9, where substructure (civil works) of the project is conducted as a public undertaking, while the superstructure (E&M and O&M) is implemented under a PPP scheme. However, vertical separation can be an obstructive factor in the implementation of the project under a PPP scheme, if the operation of the superstructure is constrained by some technical problems in the substructure, as the case for the Delhi Airport Metro Express.

➢ Clarification on tariff setting and revenue sharing contracts

In most cases, revenue from fares is not enough to cover the capital cost of the project, because oftentimes the fares are kept low. For this reason, clarification on tariff setting and on the MRG set by the government will potentially lead to increase the project's feasibility.

➢ Disclosure of prerequisite information on demand forecast

It is pointed out that, a government, being in the position to promote a project, tends to

19 In Seoul Metro 9, the MRG is applied for five years after the operation. The level of the subsidy is varied depending on the ratio of the actual revenue compared to the revenue that covers the cost. (1) Less than 50%: No subsidies. (2) More than 50% to less than 90%: Seoul City subsidizes the balance of the amount of 90%. (3)More than 90% to less than 110%: No subsidies. (4)More than 110%: Seoul City obtains the surplus.

overestimate the demand forecasts in general. The demand forecast will be more accurate if the information related to government's demand forecasts is disclosed and made available to bidders for them to conduct reviews appropriately.

- Avoidance of delay in land acquisition

In order to avoid worsening of the project feasibility resulting from delays in land acquisition, it will be necessary to have some governmental measures, such measure can be the requirement of a certain amount of land acquired as a pre-condition to consider in the project feasibility.

2.4. Movement of Japanese Companies and Their Interests

Here, the Study Team has organized the past results of orders received and interests of Japanese companies in the urban railway projects in India.

2.4.1. Track Records in India

The following Table 2.4-1 shows the past results of orders received by Japanese companies in India.

At this point, the number of Japanese companies that have received orders related to the metro projects in India are: 3 (including 1 commercial firm) in the field of civil engineering, 2 (including 1 commercial firm) in the field of rolling stock, and 1 in the field of AFC.

Table 2.4-1 Track Records of Japanese Companies in India

Project	Subsystem	Company	Contractors
Delhi Metro (Phase1)	Civil	Kumagai, Itochu	Skansa, Hindustan Construction
		Shimizu	Dywidag, Samsung, Larsen and Toubro, Ircon Intl
	Rolling stock	MELCO, Mitsubishi Corp	Hyundai Rotem
	Signal	Sumitomo	Alcatel, Alstom
Delhi Metro (Phase2)	Rolling stock	MELCO, Mitsubishi Corp	BEML, Hyundai Rotem
Bangalore Metro (Phase 1)	Rolling stock	MELCO, Mitsubishi Corp	BEML, Hyundai Rotem
Chennai Metro (Phase 1)	AFC	Nippon Signal	—
Kolkata Metro	Rolling stock	MELCO	CAF

Source: Study Team

2.4.2. Movement and Interests

Even though some general construction firms have actual experience with the Delhi Metro (Phase 1), the Study Team has found from interviews that they take a negative stance toward the deployment in India at this moment. They point out that there are not many areas for Japanese companies to actively participate in India, unless there is a need for special engineering skills and techniques for constructing tunnels/bridges, from the perspective of price competition with local companies.

Of the field of rolling stock, car body manufacturers have shown their intentions of advancing into the field of urban railway in India. So far, some firms have actually joined in the biddings, but are not successful yet.

In regard to electric equipment manufacturers, there is a Japanese firm which has received many orders in the past, and other firms are also having intentions of advancing into India.

Parts manufactures of rolling stocks have intentions to enter Indian market.

The manufacturers of signals also show their intentions, and some of them have already established their local offices. Also, there is an AFC manufacturer with the actual experience in the past that continuously has an interest in doing business in India.

2.4.3. Issues

As described above, there were not so many Japanese companies resulted in receiving orders in the past even when the projects were financed by yen loans. In addition to requesting efforts to Japanese suppliers, the Study Team will propose procurement package and contract style in Section 5.2 and bid evaluation method in Section 5.3, so that Indian side and Japanese companies will have a win-win relationship.

2.5. Movement of Foreign Companies and their Interests

In this chapter, movement of foreign companies and their interests are analyzed, including the Japanese companies shown in Section 2.4.

2.5.1. Track Record in India

(1) Civil Works Contractors

In India's urban transport sector, the Civil Works Contracts are dominated by local contractors. There are some specialized fields wherein the foreign players have had participation such as construction of underground sections/stations and depot development. The following Table 2.5-1 provides details on the type of participation in Metro projects all over India.

Table 2.5-1 Civil Works Contractor

Metro Project	Civil Works Contractor	Country of Main Company
Bangalore Metro Phase 1	CEC-SOMA-CICI, Coastal, Simplex Infrastructure, Larsen and Toubro, & other Indian contractors	Taiwan, India
Chennai Metro Phase 1	Lanco Infratech Ltd., Larsen and Toubro, SOMA, Gammon and other Indian Contractors	India
Delhi Metro Phase 1	***Kumagai***, Skansa, ***Itochu***, Hindustan Cons. Ltd., Dywidag, Samsung, ***Shimizu***, Larsen and Toubro, Ircon Intl.	Japan, South Korea, India, Germany
Delhi Metro Phase 2	Larsen and Toubro, Afcons, Chinese and Taiwanese Companies	India, China, Taiwan
Gurgaon Metro	IL&FS Engineering	India
Mumbai Metro Line 1	Sew Infrastructure, Simplex Infrastructure, SNB, VNC-Rail One, Alhuwalia Contracts	India, Germany
Navi Mumbai (Corridor 1-Ph. 1)	SanJose-Mahavir Consortium	Spain, India

***Japanese Companies**
Source: Study Team

(2) E&M Suppliers and Contractors

The involvement of foreign companies in the supply of railway E&M products and services are listed in the Table 2.5-2. The Big 3 - Siemens, Alstom and Bombardier, other European companies such as ABB and Thales, and Hyundai Rotem (Korean) had won the bid.

Table 2.5-2 E&M Contractor

Metro Project	Funding	E&M Suppliers/Contractors
Bangalore Metro Phase 1	With JICA funding	Alstom, Thales, ABB, Samsung, Kalindee, BEML, ***MELCO, Mitsubishi Corp***., Hyundai Rotem
Chennai Metro Phase 1	With JICA funding	Siemens, ***Nippon Signal***, Alstom
Delhi Metro Phase 1	With JBIC funding	Alstom, Alcatel, ***Sumitomo***, Ircon, Eliop, ABB, Best and Crompton, Thales, ***MELCO, Mitsubishi Corp***., Hyundai Rotem
Delhi Metro Phase 2	With JBIC funding	Siemens, Bombardier, Alcatel, GE, Motorola, Samsung, BEML, ***Mitsubishi Corp., MELCO*** and Hyundai Rotem
Gurgaon Rapid Metro	PPP	Siemens Mobility, FIBCOM, Thales
Jaipur Metro Phase 1	100% State Government funding	Alstom
Mumbai Metro Line 1	PPP	Siemens, ABB, Thales, Indra Systems, CSR Nanjing
Kolkata Metro	JICA	CAF, ***MELCO***

****Japanese Suppliers***
Source: Study Team

(3) PPP Contractors

Contractors of PPP projects (SPC) and its shareholders are listed in Table 2.5-3. Indian industrial companies such as Reliance and such railway operation providers as Veolia Transport RATP Asia (French ownership) are the shareholders of those SPCs.

Table 2.5-3 PPP Contractor

Metro Project	Special Purpose Vehicle	Shareholders
Delhi Metro Airport Express	Delhi Airport Metro Express Private Limited (DAMEPL)	Reliance Infrastructure Limited (95%) Construcciones y Auxiliar de Ferrocarilles (5%)
Mumbai Metro Line 1	Mumbai Metro One Private Limited (MMOPL)	Reliance Infrastructure Limited (69%) MMRDA (26%) Veolia Transport RATP Asia (5%)
Mumbai Metro Line 2	Mumbai Metro Transport Private Limited (MMTPL)	Reliance Infrastructure Limited (48%) SNC Lavalin (26%) Reliance Communications (26%)
Gurgaon Metro	Rapid Metrorail Gurgaon Limited (RMGL)	Infrastructure Leasing and Financial Services Limited (100%)

Source: Study Team

2.5.2. Movement and Interests

(1) Big 3

In the previous section, it is quite evident that in the field of E&M of urban railway in India, European suppliers including Big 3 (Siemens, Alstom and Bombardier) had won the projects. Here, the moments of Big 3 in India are described (Table 2.5-4).

Alstom (based in France) has been in India for more than 100 years but its main involvement was in power plant equipment manufacturing. The transport business was established in Bangalore only in 2001. From its establishment, the company has put up in 2010 its Transport Manufacturing Facility in Coimbatore and Transport Software Development and Research Center in Bangalore. Alstom built a rolling stock manufacturing plant in Chennai when they won the Chennai Metro project.

Bombardier, which is another Europe-based company[20], has also been in India for quite some time. It has a long-standing relationship with the Indian Railways that stretches back to 1993 when it was awarded a contract to design and build electric mainline passenger and freight locomotives.

The two main competitors, Alstom and Bombardier, are fully established and are both planning to expand their transport manufacturing businesses in India.

Siemens does not have a manufacturing facility of rolling stocks in the country, but it has a manufacturing facility of electric devices. Siemens has track records in Delhi Metro Phase 2 (Signal), Delhi Airport Express (Signal), Mumbai Metro Line 1 (Signal), Chennai Metro (OHE), and Gurgaon Metro (E&M Turnkey). Indian Railways is also another government entity that Siemens has supplied some of its railway E&M products.

Table 2.5-4 Big 3's facilities and track records in India

Company Name	Manufacturing Facility	Software Development and Research Center	Metro Projects
Alstom	Coimbatore (electric devices), Chennai (rolling stock)	Bangalore	Bangalore Metro Phase 2 Chennai Metro Phase 1 Delhi Metro Phase 1 Jaipur Metro Phase 1
Bombardier	Savli (rolling stock) Vadodara (electric devices)	Vadodara	Delhi Metro Phase 2
Siemens, Siemens Mobility	Kalwa (electric devices) Nashik (electric devices)	-	Mumbai Metro One Delhi Metro Phase 2 Delhi Metro Airport Express Chennai Metro Phase 1 Gurgaon Rapid Metro

Source: Study Team

[20] Although headquarter of Bombardier is in Canada, the base of railway business is in Germany.

(2) Other E&M Suppliers

The other foreign-based competitors except for Japanese identified from different metro projects are CAF (Spain), Eliop (Spain), Hyundai Rotem (South Korea), Thales (France), ABB (Switzerland), Samsung (South Korea), Alcatel(France), General Electric (US), Motorola (US), Indra Systems (Spain), Ansaldo STS (Italy) and CSR Nanjing (China).

The E&M suppliers that are locally-based and incorporated are Kalindee, BEML, Best and Crompton Engg Ltd., Fibcom and Keltron.

2.5.3. Issues

The local-content requirement of Implementing Agencies during the bidding process for metro projects, would pose huge difficulties for suppliers or contractors based abroad. In the E&M contracts, only a handful of suppliers can satisfy this local-content requirement. Although the government has good intentions on requesting for this requirement, the down side is that the number of potential bidders will also be limited to just a few, thereby closing its doors to other suppliers which may be are offering better products.

Some suppliers have foreseen this requirement and have already put up their manufacturing facilities in India, while others have circumvented this requirement by tie-ups with local manufacturers.

2.6. Movements of International/Foreign Donors

In this section, the latest development of other international assistance agencies like the World Bank and Asian Development Bank (ADB) in their aid to India is to be comprehended for the purpose of learning their implication for JICA's assistance activities.

2.6.1. World Bank and ADB Assistance

With respect to the activities conducted by international assistance agencies (or multilateral assistance agencies) in the field of Indian metro rail, examples of the World Bank and ADB deserve to be mentioned. But in fact, the two projects supported by the World Bank are relevant to suburban railway operated by Indian Railways instead of metro rail confined only to the urban areas. Therefore, in a strict sense, currently ADB is the only international assistance agency undertaking aid activities in the field of Indian metro rail.

With this being borne in mind, an overview of the present situation of assistance to India by the World Bank and ADB in terms of project implementation and way of thinking regarding their assistance in the field of urban railway in the broad sense is to be given in the following passages.

(1) Assistance by the World Bank

1) Basic Information of Projects

As mentioned above, both of the two urban railway projects being undertaken in India by the World Bank are in the broad sense of urban railways, which are in fact suburban railway projects operated by the state-owned company, the Indian Railways.

The basic information of these two projects is described in the table below.

Table 2.6-1 Overview of Indian Urban Railway Projects Supported by World Bank

Name of Project	Borrower/ Implementing Agency	Project Cost/ Source of Fund (million)	Implementation Term	Objectives of Project / Components
Mumbai Urban Transport Project (MUTP)	Borrower: GoI Implementing Agency: · MMRDA · MRVC · MCGM · BMESTC	Total Amount: 1,128 GoI 674 WB Group 454 (IBRD 371 IDA 83)	Starting Date: 2002/11/06 End Date: 2011/06/15	Objectives: · To facilitate urban economic growth and improve quality of life by fostering the development of an efficient and sustainable urban transport system including effective institutions in Mumbai Metropolitan Region (MMR) Components: · Railway transport · Road-based transport · Resettlement & rehabilitation
Mumbai Urban Transport Project-2A (MUTP-2 A)	Borrower: GoI Implementing Agency: · MRVC	Total Amount: 971 GoI 541 WB Group 430	Starting Date: 2010/10/08 Due End Date: 2015/07/15	Purpose: · To improve the passenger carrying capacity, operational efficiency, level of comfort of, and the institutional capacity of entities involved in, the suburban rail system of MMR. Components: · Rolling stock increase (864 additional coaches) · DC to AC conversion · EMU maintenance facilities and stabling lines (73 additional lines) · Capacity building and technical assistance

Source: World Bank documents, “Implementation Completion and Results Report on Mumbai Urban Transport Project”, “Implementation Status and Results: India Mumbai Urban Transport Project-2A”, and Website information: www.worldbank.org/projects/P113028/mumbai-urban-transport-project-2a?lang=en

2) Attitude towards Assistance to Metro Rail Projects

According to World Bank’s Urban Transport experts, the fact that the World Bank so far has not been involved in any metro rail project in the field of Indian urban transport may be ascribed to the attitude held by the Bank’s officials in charge that the BRT projects with relatively small capital cost are more preferable than the metro rail projects with huge cost of investment. This is not a case solely confined to India, but rather it is a general tendency in the Bank’s urban transport projects all over the world, with the exception of Brazil in the South America.

Nevertheless, the Bank's has the intension to look for suitable metro rail projects in India's large cities and to consider the way to get involved in this kind of projects. In addition, it is also the opinion of the Bank's experts that it does not necessarily mean that BRT can be applicable everywhere, but rather it is needed to make a choice between BRT and metro rail case by case based on the actual situation of respective cities.

With regard to the issue of PPP, although it is still considered risky to be engaged with PPP projects In India and it is true that so far there has not been any successful example of this kind, it is now under consideration as to how the Bank could get involved in this field. However, it does not necessarily mean that the Bank will participate in PPP projects in a general way; instead it is fully aware that it should carefully examine the applicability of respective projects to PPP and consider their respective tailor-made models. Up to now, the Bank has not yet conducted any full PPP project in metro rail, as it is only a part of the PPP project in Brazil, while the one in China it is financing is a conventional one, i.e. a government-sponsored project.

3) Conditions for Financing the Metro Rail Projects and the Associated Risks

The following passage is also a summary of the World Bank urban transport experts' opinions.

So far as the feasibility of an urban railway project is concerned, Economic Internal Rate of Return (EIRR) is more relevance than Financial Internal Rate of Return (FIRR) as an indicator for evaluation, in light of the fact that while the investment cost of this kind of projects is usually huge, the social benefit is equally great. Accordingly, while generally speaking the EIRR of a project is considered acceptable so long as it is above the level of 12%, this is regarded too easy as a target in the case of an urban railway project, where the Bank makes it between 30-40%. For example, the EIRR of the MUTP project is estimated as 30%. In spite of this, the Bank does not particularly set any threshold for EIRR, as the inclusion of other aspects of social impact is also needed in the project viability assessment.

However, when a project to be financed by the World Bank includes the O&M component, the calculation of FIRR is also required. Moreover, in the case of a PPP project, financial analysis including estimation of FIRR, ROI and so on is considered necessary with the participation of private capital in the project.

The payback period for the World Bank's loan to an urban railway project is generally 18 years, with a grace period of 5 years, and the lending rate is LIBOR +0.5%. But, since LIBOR is a floating rate, the World Bank's lending rate is also fluctuated. So far most of the Bank's loans have been provided in the form of independent financing, and there has almost not been any example of syndicate loan which the Bank has participated in, except for the case of a project in Bangladesh, where the Bank joined the co-finance with JICA and ADB.

With regard to the issue of risks associated with urban railway project, there should not be any foreign exchange risk for the World Bank, as all its loans are lent out and paid back both in dollar. But the Indian government as the borrower needs to bear the foreign exchange risk.

However, there do exist the risks arising from problems of difficulty in land acquisition, inadequate capacity of the implementing agencies and operation entities, and insufficient feasibility study including ridership forecast; all this call for appropriate countermeasures.

(2) Assistance by ADB

1) Basic Information of Projects

ADB's assistance in India's field of metro rail is reflected in the "Bangalore Metro Rail Transit System Project," the only one project as seen from Table 2.6-2, which is the first project in this field it has ever financed. The loan for this project is provided in the form of Non-sovereign Debt, meaning a loan given without guaranty by the central government.

Table 2.6-2 Overview of Indian Metro Rail Project Supported by ADB

Name of Project	Borrower/ Implementing Agency	Project Cost/ Source of Fund ($ million)	Implementation Term	Objectives of Project/ Components
Bangalore Metro Rail Transit System Project	Borrower: GoK Implementing Agency: · BMRCL	250	Date of approval: 2011/03/31 Starting Date: 2012	Objective: · To implement metro rail project in Bangalore, including the development of 42.3km of metro rail corridors, 40 stations, 2 station depots, signaling, E&M system, and all ancillary facilities and rolling stock. Components: · The East-west Corridor of 18.1km (Byappanahalli-Mysore Road) · The North-south Corridor of 24.2km (Nagasandra-Puttenahall)

Source: ADB "Project Data Sheet"

2) Attitude towards Assistance to Metro Rail Projects

According to the interview with an ADB official conducted by the Study Team, ADB will reinforce its support to the field of metro rail development in the next few years. This is a policy not only applicable to India, but also applicable to Asia as a whole. As far as India is concerned, in addition to the $2.5 million already disbursed to finance the Phase 1 investment of the "Bangalore Metro Rail Transit System Project" in the form of Non-sovereign Debt, ADB is also scheduled to finance the Phase 2 activities of this project. Moreover, its support to the Jaipur Metro project is also under consideration.

Although the borrower of the on-going Bangalore Metro project is the local government (Karnataka State government), the loan has to take the form of Non-sovereign Debt since the central government does not want to be the guaranty of it. In this case, the lending rate of interest is somewhat higher than a Sovereign Debt. The loans provided by JICA are in the form of Sovereign Debt only. As for ADB, while it is also mainly financing Sovereign Debt, it would rather take a more flexible approach in support of the efforts by local governments and the private sector. Therefore, even in the case that the local government fails to secure guaranty of debt by the central government for its project, ADB may still be willing to extend a loan so long as the project is considered viable.

Regarding the issue of PPP, although ADB has not been engaged with any PPP project in the field of metro rail, it holds the attitude that it is possible to finance a project of this kind so long as it is viable.

3) Conditions for Financing the Metro Rail Projects and the Associated Risks

Although it is known that the benefit of a public utility project like metro rail is very large, its quantification is rather difficult. For this reason, FIRR is generally not taken into account in this kind of project, and only the indication of EIRR is evaluated. However, when the private capital comes in, the evaluation of FIRR will be necessary.

The lending rate of ADB is basically LIBOR (now 50 basis points i.e. 0.5%) + spread (0.4-0.5%). LIBOR is a floating rate though the fluctuation is not drastic. With respect to the spread, it is related to the length of payback period of the loan in that, the longer the payback period, the higher the spread. In the case of ADB, the payback period of a loan is normally between 13 and 19 years, with a grace period of 3 to 5 years.

As far as foreign exchange risk is concerned, as ADB lends in dollar and requires the loan be paid back also in dollar, there is no foreign exchange risk for its part, while the Indian government as the borrower needs to bear the risk.

As for the other risks, the major one should be the one arising from the over optimistic forecast of ridership and cost of investment at the stage of project formulation. That is to say, either the case where the actual ridership is lower than what was estimated at the early stage or the case where the actual investment cost is higher than the previous estimation will be the cause of risk. This is exactly the problem the Delhi Metro in operation is now encountered. However, although it might be considered reasonable to try to compensate for the shortfall by a fare hike, this will in turn result in the decrease of ridership. Accordingly, efforts need to be made to find a balance between the two factors after all.

2.6.2. ODA from Governments of Countries

With regard to assistance to India in the form of ODA by governments of major countries, the following three important features deserve mentioning.

- As a part of its foreign policy, India has decided to accept ODA exclusively from the five countries, i.e. Japan, U.K., Germany, U.S. and Russia.
- Among them, the only country which is now assisting India in developing metro rail is Japan, which is specifically engaged with metro projects in four metropolises, i.e. Delhi, Chennai, Bangalore and Kolkata.

2.6.3. Issues

Here, the Study Team has organized the past results of financial aid to the urban railway sector and future direction to know the trends in financial aid by donors, with a focus on the World Bank and ADB. Both the World Bank and ADB do not have enough past results but are willing to provide loans for the future urban railway sector in India.

It can be assumed that the interest rates, pay-back periods, presence of governmental guarantee, types of currency (in yen, dollar, rupee, etc.), and requirements for providing loans, such as social environment, will become more diversified in the future, if each financial donor reinforces and increases loans. Also, the financing side will be required to show the loan condition that appropriately meets the demand of the Indian side.

Chapter 3

Projects in the Urban Transport Sector

3.1. List

The Study Team has gathered as much information as possible about urban railway projects in India and created a list (basically for the project where DPR has been created).

3.1.1. Methodology

The Study Team organized the following information.

- City
- Mode
- Project Status
  - Planning (Detailed Project Status)
  - Under Procurement
  - Under Construction
- Financial Scheme
  - Government Sponsored
  - PPP
- Length (km)
- Cost

3.1.2. List

By gathering information on the projects described in Table 3.1-1, the Study Team prepared the list of 14 cities. Note that the Study Team did not confirm the presence of a LRT project where DPR was created.

Table 3.1-1 Urban Railway Projects in India

No.	City	Mode	Phase	Lines	Project Status	Detailed Project Status	Finance	Length (km)	Cost (crore)
1	Ahmedabad	Metro	1	Line 1A	Under Procurement	-	Government Sponsored (100% State)	23.1	17,215
2	Ahmedabad	Metro	1	Spur Line-3	Under Procurement	-	Government Sponsored (100% State)	6.58	
3	Ahmedabad	Metro	1	Spur Line-4	Under Procurement	-	Government Sponsored (100% State)	3.69	
4	Ahmedabad	Metro	1	Spur Line-5	Under Procurement	-	Government Sponsored (100% State)	5.7	
5	Ahmedabad	Metro	2	Line 2A	Under Procurement	-	Government Sponsored (100% State)	13.1	
6	Ahmedabad	Metro	3	Line 1B	Planning	DPR Prepared	N/A	N/A	
7	Ahmedabad	Metro	3	Line 2B	Planning	DPR Prepared	N/A	N/A	
8	Bangalore	Metro	2	Line 1 - Green Line (Puttenahalli - Anjanapura)	Planning	Pre-PIB Reviewing	Government Sponsored	6.29	26,405
9	Bangalore	Metro	2	Line 1 - Green Line (Hesaraghatta cross - BIEC)	Planning	Pre-PIB Reviewing	Government Sponsored	3.77	
10	Bangalore	Metro	2	Line 2 - Purple Line (Mysore Road - Kengeri)	Planning	Pre-PIB Reviewing	Government Sponsored	6.465	
11	Bangalore	Metro	2	Line 2 - Purple Line (Baiyyappanahalli - Whitefield)	Planning	Pre-PIB Reviewing	Government Sponsored	15.5	
12	Bangalore	Metro	2	Line 3 (R V Road - Bommasandra)	Planning	Pre-PIB Reviewing	Government Sponsored	18.8	
13	Bangalore	Metro	2	Line 4 (Gottigere - Nagavara)	Planning	Pre-PIB Reviewing	Government Sponsored	21.25	
14	Chandigarh	Metro	1	Corridor 1	Planning	DPR Prepared	Government Sponsored	12.497	10,900
15	Chandigarh	Metro	2	Corridor 2	Planning	DPR Prepared	Government Sponsored	25.076	
16	Delhi	Monorail	-	Line 1 (Shastri Park - Yamuna Pushta Road - Raja Ram Kohli Marg - New Patpar Ganj Road - Sanjay Nagar Lake - Trilokpuri Metro Station - Laxmi Nagar)	Planning	DPR Prepared	N/A	10.8	N/A
17	Gurgaon	Metro	1	Sikanderpur - DLF(Ph.2) - DLF(Ph.3) - Mall of India - Gateway Towers - Belverdere Towers - DLF(Ph.2)	Under Construction	-	PPP	5.1	2,100
18	Gurgaon	Metro	2	Sikanderpur to Sector 55-56	Planning	DPR Prepared	PPP	7.1	
19	Hyderabad	Metro	1	Line 1 (Miyapur – Chaitanyapuri corridor)	Under Construction	-	PPP	29	14,132
20	Hyderabad	Metro	1	Line 2 (Jubilee Bus stand – Secunderabad - Charminar - Falaknuma)	Under Construction	-	PPP	15	
21	Hyderabad	Metro	1	Line 3 (Nagole - Secunderabad - HiTech City - Shilparamam)	Under Construction	-	PPP	28	

No.	City	Mode	Phase	Lines	Project Status	Detailed Project Status	Finance	Length (km)	Cost (crore)
22	Jaipur	Metro	1A	Green Line (Mansarovar - Chand Pole)	Planning	Pre-PIB Reviewing	Government Sponsored	11.527	3,353
23	Jaipur	Metro	1B	Green Line (Chand Pole - Badi Choupar)	Planning	Pre-PIB Reviewing	Government Sponsored	2.349	
24	Jaipur	Metro	2	Orange Line (Sitapur Industrial Area - Ambabari)	Planning	Pre-PIB Reviewing	PPP	23.099	3,049
25	Kochi	Metro	-	Line 1 (Alwaye - Petta)	Under Procurement	-	Government Sponsored	25.253	4,910
26	Kozhikode	Monorail	-	Line 1 (M.C. Hostel to Meenchnada)	Planning	DPR Prepared	Government Sponsored	14.2	1,991
27	Lucknow	Metro	-	Line 1 (CCS Airport to Munshi Pulia) + Gomti Nagar Link	Planning	DPR Prepared	Government Sponsored	26.541	12,671
28	Lucknow	Metro	-	Line 2 (Lucknow Rly Station - Vasant Kunji)	Planning	DPR Prepared	Government Sponsored	11.098	
29	Ludhiana	Metro	-	Line 1 (Ayali Chowk - BBMB Power House)	Planning	DPR Prepared	Government Sponsored	15.798	10,516
30	Ludhiana	Metro	-	Line 2 (Gill Village - Rahon Road Chungi)	Planning	DPR Prepared	Government Sponsored	13.035	
31	Mumbai	Metro	1	Line 1	Under Construction	-	PPP	15	2,356
32	Mumbai	Metro	1	Line 2	Under Construction	-	PPP	36	8,250
33	Mumbai	Metro	1	Line 3	Planning	PIB Reviewing	Government Sponsored	33	21,752
34	Mumbai	Metro	2	Line 4	Planning	DPR Prepared	N/A	7.5	N/A
35	Mumbai	Metro	2	Line 5	Planning	DPR Prepared	N/A	12.4	N/A
36	Mumbai	Metro	3	Line 6	Planning	DPR Prepared	N/A	19.5	N/A
37	Mumbai	Metro	3	Line 7	Planning	DPR Prepared	N/A	18	N/A
38	Mumbai	Metro	3	Line 8	Planning	DPR Prepared	N/A	21.8	N/A
39	Mumbai	Metro	3	Line 9	Planning	DPR Prepared	N/A	3.5	N/A
40	Mumbai	Monorail	-	Line 1 (Gadge Maharaj Chowk -Wadala – Chembur Railway Station)	Under Construction	-	Government Sponsored (100% State)	19.543	N/A
41	Navi Mumbai	Metro	-	Line 1 (Uran - Ranjanpada-Nerul + C22)	Under Procurement	-	Government Sponsored (100% State)	28.3	4,163
42	Navi Mumbai	Metro	-	Line 2 (Belapur - Kharghar - Taloje - MIDC - Kalamboli - Khandeshwar - Airport)	Planning	DPR Prepared	Government Sponsored (100% State)	21.4	N/A
43	Navi Mumbai	Metro	-	Line 3 (Vashi - Nerul - Panvel)	Planning	DPR Prepared	N/A	25	N/A
44	Navi Mumbai	Metro	-	Line 4 (Uran - Ranjanpada - Nerul)	Planning	DPR Prepared	N/A	14	N/A
45	Navi Mumbai	Metro	-	Line 5 (Belapur - Kharghar - Taloje - MIDC - Kalamboli - Khandeshwar - Airport)	Planning	DPR Prepared	N/A	20	N/A
46	Navi Mumbai	Metro	-	Line 6 (Vashi - Nerul - Panvel)	Planning	DPR Prepared	N/A	9	N/A
47	Noida - Greater Noida	Metro	-	Line 1 (Noida - Greater Noida)	Planning	DPR Prepared	Government Sponsored (100% State)	29.707	3,629
48	Pune	Metro	1	Line 1 (PCMC - SWARGATE)	Planning	DPR Prepared	Government Sponsored	16.598	7,984
49	Pune	Metro	1	Line 2 (Vanaz - Ramvadi)	Planning	DPR Prepared	Government Sponsored	14.925	

Source: Study Team

3.2. Summary Sheet

The Study Team prepared summary sheets for each of the listed projects. The individual summary sheet is provided as Appendix 1, at the end of this report.

3.2.1. Methodology

A summary sheet is prepared for each plan of urban railway project in India. It includes the detailed information about the metro and monorail projects that are currently under plan or on-going, in terms of the following items.

A. City Profile

- Population, Population Density, Major Industries, GSDP, Share of Transportation Modes, Fare per km

B. Project Routes

- Planned Route, Length (km), PHPDT
- Route Map

C. Project Status

- No. of Planned New Lines, No. of Planned Stations, Operator, Expected Commercial Operation Year, Driverless or not, Specification of Rolling Stock, Daily Passenger Volume, Traction & Power Supply, Current Collection System, Signaling System, Telecommunication, Fare Collection, Platform Doors, Track Gauge

D. Progress Status of Project

- Status (Planning/Under Procurement/Under Construction)
- DPR: Project Cost, FIRR, EIRR

E. Investment Plan

- Financial Scheme (Government Sponsored/ PPP), Sources of Funds

Chapter 4

Case Study (Kochi Metro as a Model Project)

4.1. Review of DPR (Detailed Project Report)

In this study, a case study was done for Kochi Metro as a model project. Based on the interviews and discussions with Kochi Metro Rail Limited (KMRL), a review was conducted for the DPR of Kochi Metro. Here, the Study Team explained the meaning of DPR, and organized 1) Points of DPR, 2) Review of DPR, 3) What was confirmed during the discussion with KMRL, 4) Proposal by the Study Team for each technical area.

4.1.1. About DPR

(1) Meaning of DPR

The Detailed Project Report (DPR), as a requirement by the Ministry of Urban Development (MoUD), is in recognition of the need to come up with reliable, document that can be used to ensure appraisal, approval and implementation of infrastructure projects, including urban rail projects, for the cities in India. The guidelines for the preparation of the DPR have been issued by MoUD in November 2006. This common set of guidelines outline the essential requirements for DPR preparation that would keep the proposed transport projects in line with the National Urban Transport Policy approved by the Government of India in April 2006.

The main rationale for the issuance of the guidelines is due to the prevalence of proposals received by the government which are neither part of the overall transport/mobility plan nor integrated with the land use plan.

(2) Background of Kochi Metro DPR

Several studies have been conducted for the development of Kochi’s urban and transport network plan. These include, among others, (i) Structure Plan for the Central City, prepared by Greater Cochin Development Authority; (ii) Kerala Urban Development Plan Project sponsored by the World Bank; and (iii) Comprehensive Study for Transport System for Greater Cochin Area conducted by RITES in 2001. From these studies, the RITES Study recommended provision of LRTS between Alwaye to Thripunithura as a long term measure. This study established the need for further study, thus by December 2004, the Government of Kerala (GoK) requested Delhi Metro Rail Corporation (DMRC) to undertake detailed traffic and transportation study for the city. The 1st Detailed Project Report (DPR) was submitted by DMRC in July 2005. This DPR was updated in August 2011.

Both the RITES report and the updated DPR identified several planned mega projects that will potentially increase the ridership in the proposed LRTS/Metro. The projects along the alignment that is expected to contribute to the increase in rail ridership are: SMART City, INFO Park, FASHION City and Special Economic Zones.

The "Recommendations of Working Group on Urban Transport for 12th Five Year Plan" has set the criteria for the selection of metro as follows: "Census population in 2011 of more than 2 million; PHPDT of more than 15,000 people for the successive 5km or more." For the city of Kochi, it is expected that the population will be 602,000 and PHPDT will be 10,700-13,681 people (in 2015), both of which will not meet these criteria. However, the urban population of Kochi is 2,118,000; and the mega projects are expected to generate employment, which if the current population of Kochi is not able meet, would require in-migration from surrounding towns and provinces further hastening the population growth of the city.

4.1.2. Overall Evaluation

(1) Points of the DPR

The updated DPR in August 2011 mainly just considered the Kochi Metro plan. This DPR does not clearly mention the Kochi Metro's integration with other urban development projects that are significant to maximizing its ridership capacity. The successful implementation of these mega projects as scheduled is essential in attaining financial success for the Metro and optimizing its socio-economic benefits to the Kochi constituency.

(2) Review of DPR

The review of the DPR has yielded the following observations:

- Officially accepted overall transport network plan for the city is needed.
- Viability of investment on the Kochi Metro is dependent on the successful implementation of other development plans linked to the Metro.
- Intermodal facilities are not fully taken into account.

(3) What was confirmed during discussions with KMRL

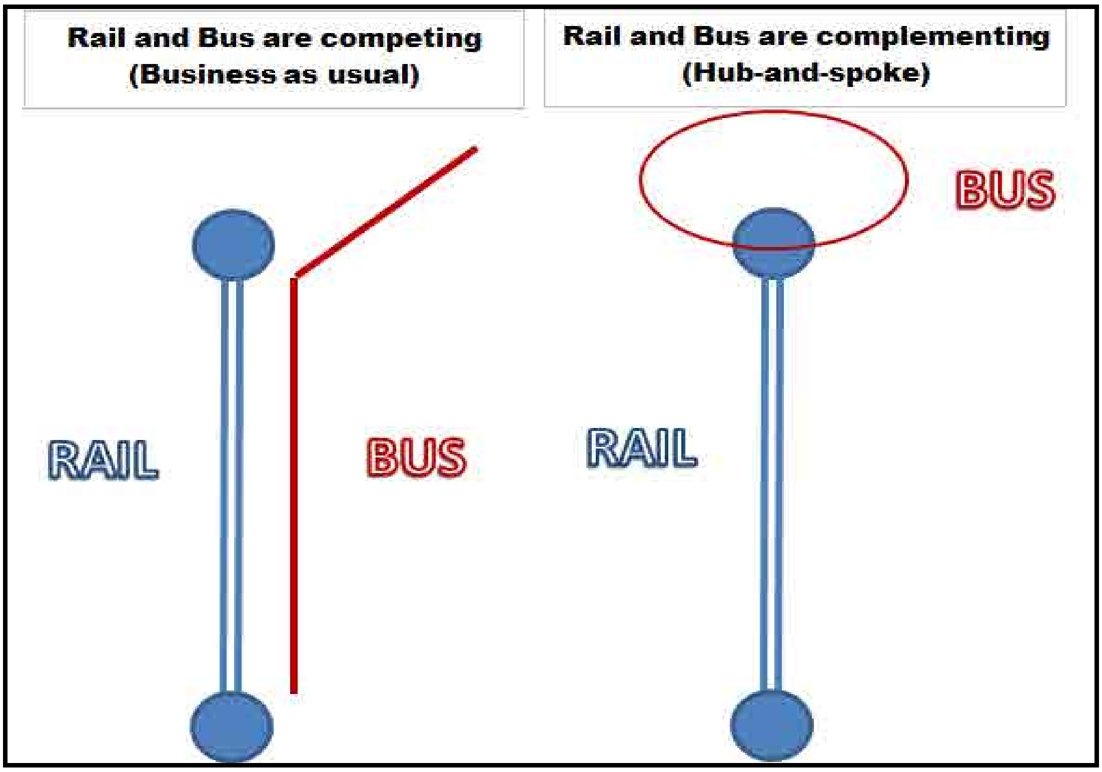
During the discussions with KMRL/DMRC, the followins were confirmed or clarified.

- The compulsory requirement for an Urban Transport Network Plan for each city was just recently requested by MoUD. During the preparation of the DPR, this was not yet requested by MoUD. The Ministry of Urban Development, has foreseen the need to integrate this rail transport plan with other developmental plans of the city. Thus, MoUD has requested compulsory submission of an Overall Transport/Mobility Plan from cities all over India. However, this request from MoUD was issued after the DPR for Kochi Metro has been finalized.

(4) Proposal by the Study Team

The details of the proposal by the study team are listed below:

- Effective coordination with different government agencies in-charge of other transport modal facilities is necessary;
- Good design of intermodal transport facilities is crucial in feeding traffic into the Kochi Metro;
- In instances where bus and rail routes are in parallel, the bus service should complement the rail service by functioning as a spoke in a hub-and-spoke system (Figure 4.1-1).



Source: Study Team

Figure 4.1-1 Proposed Complementing Arrangement for Competing Rail & Bus Routes

- The above proposal for competing rail and bus routes to adopt a complementing arrangement must be carefully examined to ensure that both transport services under a hub-and-spoke setup would attain an enhanced overall efficiency for the urban transport network.
- On the contrary, new licenses to other transportation mode which is competing with metro should be given from the view point of whole efficiency of transportation network.
- The importance of attaining financial viability for operators is also important, especially if both transport services are operated by the private sector.

- Aside from the integration of the Metro project with the city's other developmental projects, the design of transport intermodal and transfer facilities is also crucial in feeding traffic into the Kochi Metro. There is already a planned linkage of the Metro to the existing Mobility Hub in Vytilla and with an Indian Railways Station in Ernakulam South. There is also a plan to link the alignment with another proposed Metro at J.L. Nehru Stadium. These transport linkages are expected to significantly feed passenger traffic into the Kochi Metro.

4.1.3. Demand Forecast & Economic Analysis

(1) Points of the DPR

Some of the basic data used in demand forecasting are:

- The share of public transport is quite high at 81%. Other modal shares are: 2-wheeler 8%; Car 6% and auto 5%
- Average trip length is 14.0 km
- Trip purpose : 58% work, 24% education and 18% social

Stations 4 to 14 have been identified as the most loaded sections, peak-hour loads range from 10,700 to 13,681 PHPDT in 2015. The daily ridership and average trip length for the following years are:

- 2015 – 381,870 Ave. trip length = 7.33 km
- 2020 – 468,130 Ave. trip length = 8.46 km
- 2025 – 539,427 Ave. trip length = 9.55 km

The results of the financial and economic analyses yielded the following internal rates of return. This scheme is based on a funding pattern under DMRC model (with central taxes).

- FIRR = 3.05%
- EIRR = 14.2%

The following sensitivity analyses were conducted: increase in cost by 10%, reduction in traffic by 10%, combination of 10% reduction in traffic and 10% increase in cost. The EIRR remains high even with these changes.

(2) Review of DPR

The preliminary review of the DPR shows the following initial findings:

- Travel demand characteristics show that the average monthly expenditure on transport is only INR 633. Fare structure for the Kochi Metro is maybe too high for this household transport expenditure allocation. (The explanation about this topic is later in the column.)

- Not sufficient transport data was in DPR. Specifically, travel patterns during peak and off-peak periods, which is required to find optimal capacity, was not disclosed. (Upon the request by the Study Team, KMRL provided with the demand forecast data prepared by Wilbur Smith. The analysis based on this data was described in (4).)

(3) What was confirmed during discussions with KMRL

- The extensions to different stations with very low initial traffic forecast are consistent with its urban development plan to form linkages with intermodal facilities, Smart/IT cities, special economic zones and other commercial developments;
- The compulsory requirement for an Overall Transport/Mobility Plan for each city was just recently requested by MoUD. During the preparation of the DPR, this was not yet requested by MoUD;
- Based on the inspection survey, intermodal facilities are being considered in the detailed design (e.g., transport hubs between Indian Railways and Kochi Metro; between Bus Station, Harbor and Kochi Metro);
- Other traffic data can be confirmed with the submittal of the (1) Latest Rail Ridership Demand Forecast done by Wilbur Smith; (2) Study done by Cochin University; and (3) Kochi Transport Plan/Study done by National Transportation Planning and Research Center.

(4) Proposal by the Study Team

Proposal by the Study Team based on the review of demand forecast is as follows:

- In recognition of the different travel patterns during peak and off-peak periods, the traffic surveys conducted should be adopted to show the differences in the hourly travel patterns. The surveys on trip purpose, travel directions, most loaded sections will aide in land densification plans along the rail alignment (Table 4.1-1).
- Other densification strategies adopted by similar urban transport projects should also be looked into. One such strategy is the strategy adopted for the State of Maharastra wherein the owners of land affected by the project are given the option to develop an equivalent area/property near the station in lieu of the payment for the affected property/land.

- The policy on R&R of informal settlers should be reviewed, and should take into account the possibility of having the relocation site near one of the stations. These are potential traffic generators that should not be relocated far from the metro alignment.

Table 4.1-1 Travel Patterns and Recommendation

Period	Condition	Recommended Approach
A.M. Peak	Southbound direction is heavily loaded compared to Northbound	The strategy adopted is to come up with developments near the stations located north of the alignment (near North Avenue Station). These developments are expected to generate traffic going north during A.M. Peak Period and traffic going south during P.M. peak period.
P.M. Peak	Northbound direction is heavily loaded compared to Southbound	
Off-Peak	Very low traffic volume	The trip purpose for generated trips during off-peak period should serve as guide on the type of developments that should be pursued along the alignment. Some of the trip purposes during this period are typically of the following type: social visits, trips to malls, trips to medical facilities, trips to government offices to transact. A more detailed study must be conducted to determine these types of trips during off-peak period. A marketing strategy adopting lower tariff can also be applied to increase traffic during off-peak period.

Source: Study Team

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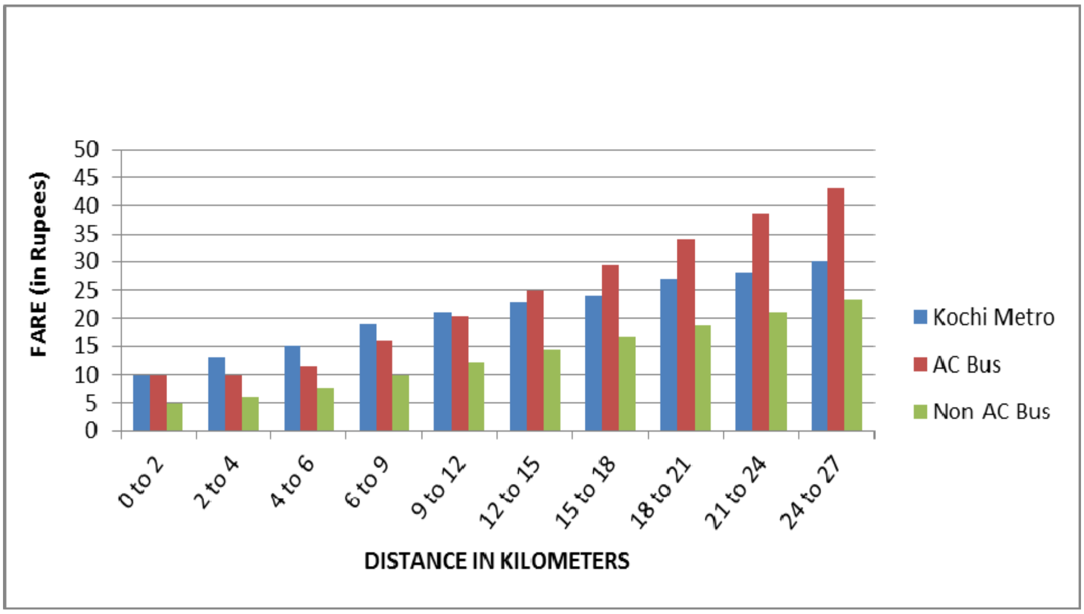
<Review of the Affordability of the proposed Metro Kochi Fares>

● Comparison with bas fare

Shown in Figure 4.1-2, trip cost for short distances in Kochi Metro is more expensive compared to AC and Non-AC buses. For distances of more than 12km., the trip cost in Kochi Metro becomes cheaper than AC buses, but still more expensive than Non-AC buses.



Source: Study Team

Figure 4.1-2 Comparison of fares for Kochi Metro and bus

● Estimation of Monthly Transport Expenditure

The average trip length for public transport as stated in the Kochi Metro DPR is 14km and average monthly transport expenditure is INR 633. Based on the tariff shown in the DPR, supposing to travel 14km by Metro, monthly transport expenditure is INR 1,012. Suppose traveling 7km by Metro and 7km by Non-AC bus, the monthly transport expenditure is INR 1,271. Suppose traveling 7km by Metro and 7km by AC-Bus, the monthly transport expenditure is INR 1,540. Those are higher than the current expenditure.

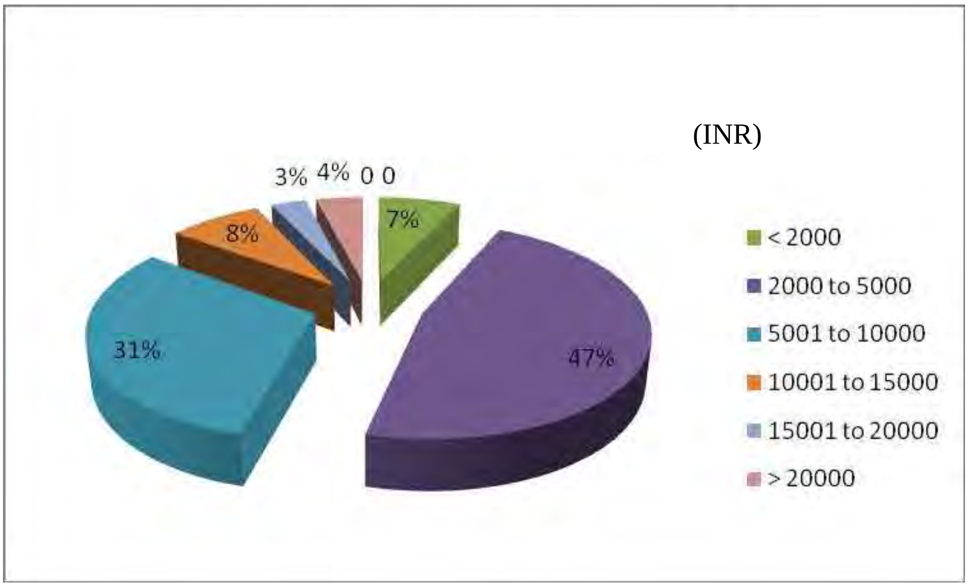
Figure 4.1-3 shows that almost half or 47% or the households have monthly income range of INR 2,000 to 5,000. The transport expenditure seems higher as compared to this household income.

It is also important to review the discount tariff setting when traveling by Metro and bus together. It should be noted that this policy would reduce the revenue of operators.

Table 4.1-2 Monthly Transport Expenditure

Trip Length and Transport Mode		Monthly Transport Expenditure	Estimated No. of Trips
Current	14 km (transport mode not specified)	INR 633	(from Kochi DPR)
Estimated	14 km on Kochi Metro	INR 1,012	2 trips per day 22 trips per month
	7 km on Kochi Metro+ 7 km on Non-AC bus	INR 1,271	
	7 km on Kochi Metro+ 7 km on AC bus	INR 1,540	

Source: Study Team



Source: Kochi Metro Detailed Project Report, August 2011

Figure 4.1-3 Distribution of Monthly Household Income

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4.1.4. E&M (Electrical & Mechanical) — Rolling Stocks

(1) Points of DPR

Rolling stock specifications described in the DPR seems based on those for DMRC system (i.e. stainless steel carbody, AC25kV supply and overhead catenary), while train car dimensions are reduced from those for DMRC system in order to meet passenger demand of Kochi Metro which is less than that of DMRC.

Table 4.1-3 Comparison of train car dimensions of KMRL and DMRC RS3

	KMRL	DMRC RS3
Length	18,000 mm (leading car) 17,860 mm (intermediate car)	21,640 mm
Width	2,700 mm	2,900 mm
Height	4,048 mm	4,003 mm

Source: Kochi Metro DPR, tabulated by Study Team

(2) Review of DPR

AC25kV system is commonly used for heavy rail system, mass rapid transit system or high-speed rail system, while Kochi Metro intends to introduce medium-capacity metro or LRT. Major medium-capacity metro and LRT use DC traction system instead of AC traction, and combination of small train car dimension and AC traction system is not commonly used other than Kochi Metro. (Comparison of AC/DC traction is in the later column.)

Table 4.1-4 References of train systems which use AC25kV

Country	Operator	Operation Line	Max. speed (Operation)	Remarks
Japan	JR Companies	Shinkansen lines	300km/h	High speed dedicated lines
Hong Kong	MTRC	West Rail / East Rail / Ma On Shan Line	130km/h	Heavy rail commuter lines
India	Indian Railways	Most of electrified lines	-	Passenger and freight lines
India	DMRC	All lines	80-85km/h	Metro

Source: Study Team

Table 4.1-5 References of train systems which use DC tractions

Country	Operator	Operation Line	Max. speed (Operation)	Remarks
Japan	Tokyo Metro	Ginza Line	65km/h	DC 600V / 3rd rail
Taiwan	DORTS	All lines	80km/h	DC 750V / 3rd rail
India	KMRC	East West Line	80km/h	DC 750V / 3rd rail (Under construction)
India	BMRCL	Purple Line	80km/h	DC 750V / 3rd rail (Partially in operation)

Source: Study Team

Further, compared with maximum passenger capacity (600 passengers/train under crush load condition) required for Kochi Metro, train car dimension seems not enough.

Proven systems are recommended to Kochi Metro who is not experienced operator.

(3) Confirmed information in the Discussion with KMRL

In the meeting between KMRL and JICA Study Team, KMRL presented its revision of outline train specifications as follows;

1) Traction system: AC25kV with overhead catenary => DC750V with 3rd rail

2) Train car dimension have been enlarged to L20.8m x W2.9m.

The revised combination of train car dimension and traction system is equivalent to the systems which are broadly employed to metro systems including Bangalore Metro and Kolkata Metro, that is, proven system.

With regard to indigenization of rolling stock, the Study Team confirmed whether KMRL would require the contractor the same way of indigenization as employed by DMRC. KMRL addressed its intention to include the same obligation of indigenization as employed by DMRC, although it seemed that KMRL had not proceeded with study about the requirement for indigenization, because there was no detailed explanation about indigenization.

Following conditions are required under the latest contract of DMRC;

- The contractor can manufacture rolling stock in the off-shore factory outside India up to a quarter of total quantity of rolling stock to be supplied by the contractor, while balanced quantity shall be manufactured in India. (However, no detailed descriptions about the scope of indigenization are given.)

- The parts and components designated by DMRC shall be sourced in India for the quantity equivalent to a quarter of total quantity of rolling stock to be supplied by the contractor. In case of any deviation on above, the contractor shall supply half the number of shortfall items as spares free of cost to DMRC.

(4) Proposal by the Study Team

- Specification of Rolling Stocks

  In the KMRL's presentation, there are no descriptions about changes to be applied to other systems than rolling stock such as, but not limited to, electric supply, substation and civil structures. Careful review on other subsystems interfacing with rolling stock was recommended by JICA Study Team so that KMRL can optimize overall system configuration of Kochi Metro.

  Further, KMRL intends to expand train formation from 3-car formation to 6-car formation, if there is increase of passenger demands. Future conversions which will be required for adding intermediate cars shall be examined in the project planning stage.

● Requirement for indigenization

The Study Team suggested that KMRL should relax its requirements for indigenization so that indigenization requirements will not cause barrier to entry for the prospective tenderers for the following reasons:

● Indigenization requirements will be a great barrier for the prospective tenderers who have no manufacturing facilities in India to enter the Indian market.

● Compared with other metro projects in India such as Delhi Metro or Kolkata Metro, the quantity of rolling stock to be supplied under a single contract is significantly small. The prospective tenderers who intend to participate in Kochi Metro tender as its first project in India will have great difficulty to decide investment for setting up a new factory in India for such small quantity of rolling stock.

● If more tenderers participate in the tender as the result of relaxation of indigenization requirements, it will benefit KMRL as well.

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<Comparison of AC/DC traction>

The merits and demerits of Direct Current (DC) and Alternate Current (AC) are as follows:

Table 4.1-6 Comparison of AC/DC

	Pros	Cons
AC	・With the higher feeding voltage, number of substations can be less, compared to DC (=distance between substations can be longer).	・As the conversion device must be equipped on a rolling stock, structure of electronic parts for rolling stock will be more complicated, compared to DC. AC will be more disadvantaged than DC, in terms of voltage drops.
DC	・Structure of electronic parts for rolling stock can be simpler, compared to AC. ・With the working voltage smaller than that of AC, less space will be required between overhead wires and third rails, resulting in the smaller structure.	・Because the feeding voltage is lower than that of AC, more substations must be established.

Source: Study Team

AC feeding is adopted for Delhi Metro, for the possible reasons as follows: 1) to make the ground installations simpler, by reducing the number of establishment of substations and so on; 2) to continue with the AC feeding on the standard-gauge lines, the same feeding system used in the early broad-gauge Delhi Metro lines. (It can be assumed that some former employee of the IR, where AC feeding was mostly preferred, played a role in determining the technical specifications of Delhi Metro.)

For Indian metro, it is difficult to say which traction system is better because the decision should be made based on the needs of operator and the fitness to the environment.

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4.1.5. E&M (Electrical & Mechanical) — Signaling & Telecommunication

(1) Points of DPR

Points of DPR are as follows:

- Continuous Automatic Train Control (CATC) with cab-signaling is chosen as the signaling system for Kochi Metro. It is the same signaling technology with that of Delhi Metro Phase 1&2.
- CENELEC standards are adopted for safety and EMC (Electro-Magnetic Compatibility) in signaling.
- Analog radio technology is proposed for the mobile radio communication.
- Standalone system is also proposed for passenger announcement system.

(2) Review of DPR

It seems that all the specifications for signaling & telecommunication are the same with those of Delhi Metro Phase 1&2. The CBTC technology should be considered for Kochi Metro due to the fact that Delhi Metro Phase 3 and several other Metro projects have chosen CBTC.

(3) Confirmed Information in the Discussion with KMRL

Kochi Metro selected CBTC technology because of its lower cost and its capability for capacity-increase. Kochi Metro has referred to the proposal for Delhi Metro Phase 3. As for procurement package, KMRL plans a single package of Signaling and Telecommunication.

(4) Confirmed Information in the Discussion with DMRC

Delhi Metro has chosen CBTC technology for Phase 3 lines because of its capacity-increase capability, less occurrence of failure, and lower cost. Under CBTC control, Delhi Metro will use axle counters both for accurate location of train, train around points in interlocking station and for back-up. As for train detection in a train yard, either axle counter or AFTC will be used depending on the suppliers' proposal.

Delhi Metro has adopted and plans to adopt CENELEC standards for signaling. As for CBTC, Delhi Metro also follows IEEE 1474 as its standards.

Delhi Metro has formed Committees for Standardization to undertake the standardization activities. The functions of Metros will be standardized based on its handling capacity, whether heavy, medium, and light. Reduced functionalities will be applied to for medium and light Metros. One such example is the no requirement of driverless for medium and light Metros.

TETRA radio system and automatic passenger information system are used for Delhi Metro Phase 1&2 lines. These are different from those proposals in DPR of Kochi Metro.

The procurement for Delhi Metro regarding signaling and telecommunication consists of one package of signaling and five packages of telecommunication. In the signaling package, UPS (Uninterruptible Power Supply) and cable are provided by DMRC. For cost reduction, the telecommunication package is divided into five; radio, CCTV, announcement & display, optical fiber, and clock & telephone.

DMRC achieves cost reduction of 40% while it has responsibility for all integration work. The division of procurement package depends on how much risk an employer can take for integration work.

(5) Proposal by the Study Team

- About Technical Specification

There have been many proposed changes, such as the choice of CBTC for signaling and 750V DC third rail for traction system since DPR of Kochi Metro was updated in August 2011. The details of those changes have to be examined. There may be the possibility of cost cutting by using reduced functions of CBTC and other systems, examining the difference between Delhi and Kochi Metro requirements.

There are some reduced functions in DPR of Kochi Metro such as Analog radio for train mobile communications, and standalone system for passenger information systems. However, since CBTC has been chosen and the use of digital telecommunication technology is already wide spread, digital radio for train mobile communication may be adopted with the same amount of cost. Also, since the increase in capacity with the headway of less than 120 seconds is possible, automatic passenger announcement may be necessary and standalone system may lack necessary functionalities.

Concerning the train detection system under CBTC control, train detection in interlocking stations and depot has to be carefully examined because accurate determination of train location near these points is strictly required for safety. Delhi Metro will use axle counter for Phase 3 and seemingly, Kochi Metro will follow the same way. Detailed arrangements have to be checked.

CBTC is a train control system using radio. While every CBTC system has the fundamental function of transmitting the Movement Authority to a train through radio, CBTC systems by different suppliers vary in system and equipment configuration. The integration ratio of equipment and the amount of wayside cable impact on cost. For example, in the CBTC system by Nippon Signal, wayside radio stations transmit and relay information though radio and no wayside cable between the radio stations is required, which leads to cost reduction.

- About Technical Standards (Refer to Appendix4)

Since Delhi Metro has strongly indicated its intention to adopt CENELEC standards for signaling, suppliers have to follow CENELEC standards. However, there still might be the possibility to ask Delhi Metro to adopt not only CENELEC but also IEC standards.

CENELEC standards are European ones. They cover special conditions peculiar to Europe such as interoperability. They don't cover conditions for countries outside Europe. In contrast, IEC standards are common world ones and cover various conditions for all the countries of the world. While countries outside Europe basically adopt IEC standards, some countries including India adopt CENELEC standards. IEC standards mainly originated from CENELEC standards and the two are very similar to each other. Take Safety Integrated Level (SIL) for instance, SIL4, which is required for safety systems in signaling is defined both in EN50129 and in IEC62425, and both of the definitions are exactly the same.

It seems that in India, CENELEC standards are often referred in the specifications of railway signaling systems issued by RDSO of Indian Railways, and therefore CENELEC standards are usually treated as basic reference standards. However, signaling systems for Metro are independent of those of Indian Railways, and it is natural to treat IEC standards equally as reference standards, in terms of encouraging foreign prospective bidders to come and join.

- Procurement Package

While KMRL plans a single package of signaling and telecommunication, it is recommended that signaling and telecommunication are separate packages as those in Delhi Metro Phase 3 because KMRL will be capable of system integration with support by DMRC and a package of signaling including train management and train control is best for CBTC.

4.1.6. Civil & Track

(1) Points of DPR

The following specifications are applied in DPR:

- Standard gauge
- Ballastless Track (Main line)
- Bed rock location of more than 40m depth in some locations.
- U-shape PC precast 28m long, 9.0m wide beam for viaducts is proposed as standard superstructure.
- Minimum curve radius is R = 200m (in unavoidable cases R = 90m)
- Platform for 54m long trains
- Vehicle axle load is 13 tons

(2) Review of DPR

Careful investigation for settlement of viaduct would be required.

(3) Confirmed Information in the Discussion with KMRL

Following points are confirmed in the Discussion with KMRL

- Minimum curve radius (unavoidable case) is changed from 90m to 120m.
- Pile test for 2-meter diameter bored cast-in site piles and studying the substructure type including pile number. (*cf.* Photos 1 & 2)
- There are some sites do not have enough distance between the planned railway viaduct and buildings.
- Platform for 125-meter trains is installed.
- Vehicle axle load is changed from 13 tons to 15 tons.

Photo 1 Loading Test Site at Kochi
Source: Study Team

Photo 2 Loading Test of 2.0 m Pile at Kochi
Source: Study Team

(4) Proposal by the Study Team

- Station Square

KMRL regards the intermodal connections highly important, and the study team strongly endorses the notion. To multiply the financial efficiency, the study team recommends the development of *"Station Squares"* at suburban intermodal facilities.

Japanese experiences show that a Station Squares with bus and taxi terminals enhance the convenience of passengers and boosts the railway demand. A plan and a view of a station square are shown in Photos 3 & 4.

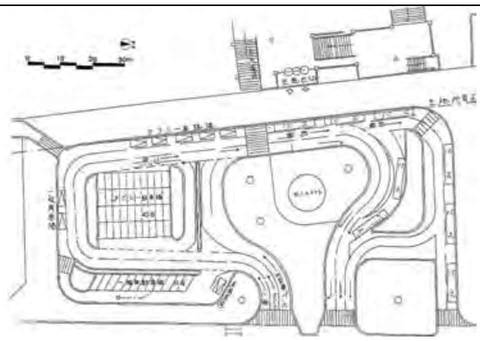

Photo 3 Example of Station Square (Takasaki station, Japan) Source: Japan National Railways	Photo 4 Example of Station Square (Kasai station, Japan) Source: Study Team

- Anticipatory Planning

An eastward extension of the Metro line from the Jawaharlal Nehru Stadium Station is envisaged, while the kind of the passenger connection (*through service* or *transfer*) is not yet determined. In general, however, the construction plan should be developed taking those future plans into consideration from the beginning.

- Clearance Gauge

The clearance between a viaduct and adjacent buildings seems to be too tight at some sites: in the proximity of the Aluva Station for example. In Japan, more than 6.0m distance is recommended between the viaduct and the buildings.

- Noise Prevention

From the experiences of the Delhi Metro which is already in operation, noise / vibration pollutions along the railway lines are the concerns of importance, thus sufficient measures should be taken against the issue.

In this context, the *"Elastic direct fastening track"* technology, which is widely used in Japanese urban rails, is highly effective to mitigate the problems (Photos 5 & 6). In addition, a method of *"Direct fastening track with fiber-reinforced formed urethane (FFU) composite sleeper"* contributes to maintenance-free operation (Photos 7 & 8).

Squeal noise of wheel at sharp curve section becomes a problem among track side people. High quality noise prevention wall using in Japan is effective for such countermeasure.

- Construction management

Japanese general contractor can show their power for management of construction work in India. For construction work, sever management of punctuality, safety, quality, etc. is important. Japanese construction work management technic will contribute to Indian Metro construction.

● Substructure technic

An engineer of DMRC expects the Japanese cooperation for mono-pile technic. Japanese contractor has an experience of mono-pile substructure[21]. Japanese engineers also have an experience of friction pile which is used at the site supporting stratum is too deep. But friction pile may occur some settlement, and then careful consideration is required to adopt the friction pile.

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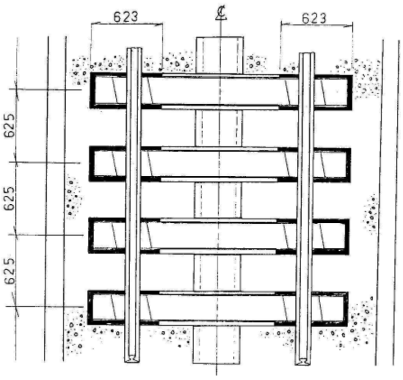
<tr><td></td><td></td><td></td><td>
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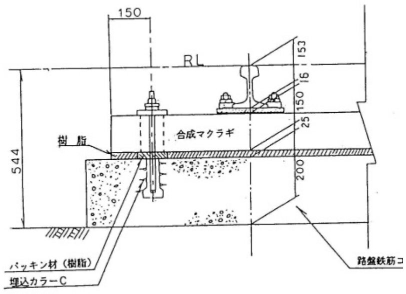
<tr><td></td><td>Photo 5 Example of Elastic Direct Fastening Track
Source: Study Team</td><td></td><td>Photo 6 Example of Elastic Direct Fastening Track
Source: Japan Railway Civil Engineering Association</td><td></td></tr>
<tr><td></td><td></td><td></td><td>
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<tr><td></td><td>Photo 7　Example of FFU Composite Sleeper
Source: Study Team</td><td></td><td>Photo 8 Example of Direct Fastening of FFU Composite Sleeper
Source: Japan Railway Civil Engineering Association</td><td></td></tr>
</table>

21 It is supposed that there are some merits to adopt mono-pile foundation in such special cases as the following: (1)at thick soft grounds where negative friction may affect; or (2)in other cases where some devices are required.

4.1.7. Operation Planning

(1) Points of DPR

Points of DPR are as follows:

- Train is composed of 3 cars and peak-hour headway in 2015 of 5 minutes; 4 min in 2020; and 3 minutes in 2025.
- Train capacity is estimated on the condition of 6 persons per square meter of standee area and 8 persons per square meter of standee area under the dense conditions.
- Overloaded operation is proposed to reduce the demand for increased deployment of rolling stock.

(2) Review of DPR

Shortage of capacity is observed to have occurrence rates of 33% in 2015, 35% in 2020, 28% in 2025 based on the calculation by the Study Team's calculations.

In the above mentioned conditions, 12.7 persons per square meter in 2015, 13.1 persons per square meter in 2020 and 11.6 persons per square meter in 2015 have to fit in standee area and the occupied area per person is less than 0.1 square meter for all cases. Attaining high frequency of punctuality in operation seems impossible under such conditions.

Table 4.1-7 Capacity and Shortage rates

Year	2015	2020	2025
Cars/trains	3	3	3
Head way (Minutes)	5	4	3
Max.PHPDT Demand	13,681	17,663	21,065
PHPDT Capacity Available	7,200 *(9,144)	9,000 *(11,430)	12,000 *(15,240)
Capacity Shortage rate	47% *(33%)	49% *(35%)	43% *(28%)

*Crush Capacity (8 persons/m^2 of standee area)

Source: Kochi Metro DPR

(3) Confirmed information in the Discussion with KMRL

- KMRL increased transport capacity by changing the following coach dimensions:
  - Length = 20.8 m instead of L = 17 m
  - Width = 2.9 m instead of W = 2.7m
- As a result, the floor area increases by 25% and thus, the shortage of transport capacity will be pretty much improved.

- Kochi Metro has chosen CBTC technology because of its lower cost and its capability of capacity-increase.
- Effective preparation for future expansion has been confirmed, as the depot is designed to cope with 6-car operation, and the possibility to acquire additional land for depot in the future is high.

(4) Proposal by the Study Team

- "Gradually-increasing the capacity" policy is basically in line with the Japanese experiences.
- In addition, some solutions to increase the capacity of trains to reduce additional deployment of Rolling Stock might be considered, such as: wide-body cars; retractable seats used in urban transport train of JR.

Photo 9 Example of wide-body car
Source: Study Team

Photo 10 Example of wide-body car
Source: Study Team

Photo 11 Example of retractable seat
Source: Study Team

Photo 12 Example of retractable seat
Source: Study Team

4.1.8. O&M (Operation & Maintenance)

(1) Points of DPR

Points of the DPR in O&M are as follows:

- Optimization of energy consumption (electric power saving) and lower electricity power tariff for Kochi Metro (at "No Profit No Loss" basis).
- Multi-tasking of train operation and maintenance staff.
- A maintenance depot along with minimum repairing facilities has been proposed at Muttom.

(2) Review of DPR

There are two options for the framework of implementing O&M.

- Establish a larger organization for O&M as a part of policies. O&M will be performed by the organization as its own business.
- Establish a smaller organization for the O&M management. O&M will be performed by subcontractors (outsourcing).

As for the acquired land for the maintenance depot, the sufficiency of the space for the future expansion of the Metro network should be confirmed.

(3) Confirmed information in the Discussion with KMRL

KMRL was established as a Joint Venture (JV) between the Government of India and the State Government of Kerala, and has adopted officials who have relevant background and experience: they were in charge of infrastructures such as road, power generation, etc. in other States.

Also education and training of the staff will be held at training center of Delhi Metro (DMRC Training Institute) which offers training for executives, station controllers/train operators, maintenance supervisors of signaling/telecom, traction & electrical, track and rolling stock and maintainers was confirmed.

As for the space of the depot, KMRL explained that enough space for the future expansion of the Metro network is available in the acquired land, and thus it was confirmed.

(4) Proposal by the Study Team

To maintain the quality of O&M high enough in sustainable manner, technical cooperation from outside is recommended as an effective measure.

4.2. Proposal of Procurement Packages & Contract Styles

4.2.1. Procurement Packages Considered to be Applied for Kochi Metro Project

According to the findings from the field visit, Kochi Metro (or KMRL which is the employer) is supposed to consider as follows:

- KMRL is considering the adoption of Fragmented Approach as DMRC has already done so far.
- In this context, following packages are under consideration, as shown in Table 4.2-1.
  - Civil Works: 6 packages (6 packages by construction section)
  - Electrical Works: 5 packages (2 packages for power facilities for stations, 1 package for power supply and traction, 1 package for elevators & escalators, I package for power facilities for depot)
  - Signal & Communication/AFC: 1 package for signal & communications, 1 package for AFC
  - Rolling Stocks: 1 package
  - Tracks: 4 packages (1 package for rails, 1 package for fastening devices, 1 package for railroad switches, 1 package for tracks)
- Out of the above, packages to be considered for Design-Build procurement are as follows:
  - Power Supply and Traction
  - Elevators and Escalators
  - Signal and Communications
  - AFC
  - Rolling Stocks
- Followings are to be considered for Design / Build Separation Approach.
  - Civil Works
  - Electrical works for Stations
  - Electrical works for Depot
  - Tracks
- As for civil works, design has already been undertaken by a design consultant.
- KMRL is going to establish an organization, under the guidance of DMRC, to do the procurement, integration, upkeep and maintenance, and operation of urban railway projects.

- Materials of Kochi Metro (See the Note of the Table 4.2-1) indicate the intention of DMRC to do the invitation of bidding, contract and contract management on behalf of KMRL. (It was found that the recent bidding of civil works for Kochi Metro was actually done by DMRC.)

- KMRL intends to implement the low cost procurement by ensuring the transparency and competitive bidding.

Table 4.2-1 Procurement Packages Considered to be Applied for Kochi Metro Project

S.No.	Contract Package No.	Description of Work	Approximate Cost
A. Civil Works			
1.	KC1	Construction of Boundary Wall, Diversion Works and mass earth filling at Muttom Depot.	31 cr
2.	KC2	Construction of Elevated Viaduct, 6 Elevated Stations viz Aluva, Pulinchodu, Companypady, Ambattukavu, Muttom, and Kalamassery (From Chainage -120.000mTo 7055.218 m) Including Architectural Finishing Works of Stations.	410 cr
3.	KC3	Construction of Elevated Viaduct, 6 Elevated Stations viz CUSAT, Pathadipalam, Edapally Junction, Changampuzha Park, Palarivatom, JL Nehru Stadium (From Chainage 7055.218 m to 14580.000 m) Including Architectural Finishing Works of Stations.	405 cr
4.	KC4	Construction of Elevated Viaduct, 5 Elevated Stations viz Kaloor, Lissie, Madhava Pharmacy, Maharajas College, Ernakulam South (From Chainage 14580.00-19330.025) Including Architectural Finishing Works of Stations.	279 cr
5.	KC5	Construction of Elevated Viaduct, 5 Elevated Stations viz GCDA, Elamkulam, Vyttila, Thaikoodam, Petta (From Chainage 19330.025-25600m) Including Architectural Finishing Works of Stations.	364 cr
6.	KC6	Construction of inspection pits, workshops, Depot Control Centre, etc. at Muttom Depot.	38 cr
B. Electrical Works			
7.	KE4	E & M works of stations Aluva, Pulinchodu, Companypady, Ambattukavu, Muttom, Kalamassery, CUSAT, Pathadipalam, Edapally Junction, Changampuzha Park, Palarivatom and JL Nehru Stadium.	34.5cr
8.	KE5	E & M works of stations Kaloor, Lissie, Madhava Pharmacy, Maharajas College, Ernakulam South, GCDA, Elamkulam, Vyttila, Thaikoodam and Petta.	28cr
9.	KE6	Design, procurement, supply, installations and commissioning of Power Supply and Traction for kochi metro project.	290cr

10.	KE7	Design, supply, installation and commissioning of Lift and Escalators for 22 stations of kochi metro.	56cr
11.	KE8	Electrical and Mechanical works of Depot at Muttom.	100Cr
C. Signalling Works			
12.	KS1	Design, procurement, supply, installations and commissioning of Signalling and Telecommunication system for kochi metro project.	388cr
13.	KS2	Design, procurement, supply, installations and commissioning of Automatic Fare collection for kochi metro project.	86Cr
D. Rolling Stock			
14.	KRS1	Design, manufacturing, supply and commissioning of rolling stock for kochi metro project.	664Cr
E. P Way Rails			
15.	KT1	Supply of UIC-54, grade 1080 Head hardened as per IRS-T 12-96 for kochi metro project.	227Cr
16.	KT2	Supply of Vossloh-336 fastening system for ballastless track.	
17.	KT3	Supply of 1in9 and 1in7 Turnout for kochi metro rail project.	
18.	KT4	Supply, installation and commissioning of ballastless track from chainage -120.00 to 25600 and lying of track network in depot at Muttom.	

Note

1. DMRC will float the Tender and finalize the contract.

2. DMRC will do the contract management also.

Source : KMRL

4.2.2. Options to be Applied for Kochi Metro Project

As already mentioned in Section 4.2.1, KMRL intends, with strong influence of DMRC and bearing in mind the cost reduction, to procure with Fragmented Approach. At the time of the interview in Kochi, KMRL has already mobilized 20 staff together with 40 support staff from DMRC to examine the method of procurement[22]. As will be discussed in Section 5.2.2, there is a possibility of downsizing the organization of the employer in case of E&M Turnkey procurement. However, as KMRL has already launched a large scale organization for procurement, and that cost is considered as "sunk cost." On the other hand, as Japanese firms basically welcome the Fragmented Approach. Overall, it may be reasonable for KMRL to procure with Fragmented Approach. As for the evaluation system, however, as will be mentioned in Section 4.3, there seems to be room for improvement based on the experience of Delhi Metro and other countries.

[22] It should be noted that only 30 staff members were assigned to the employer organization of Ho Chi Minh Metro, where Semi-integration Approach was used.

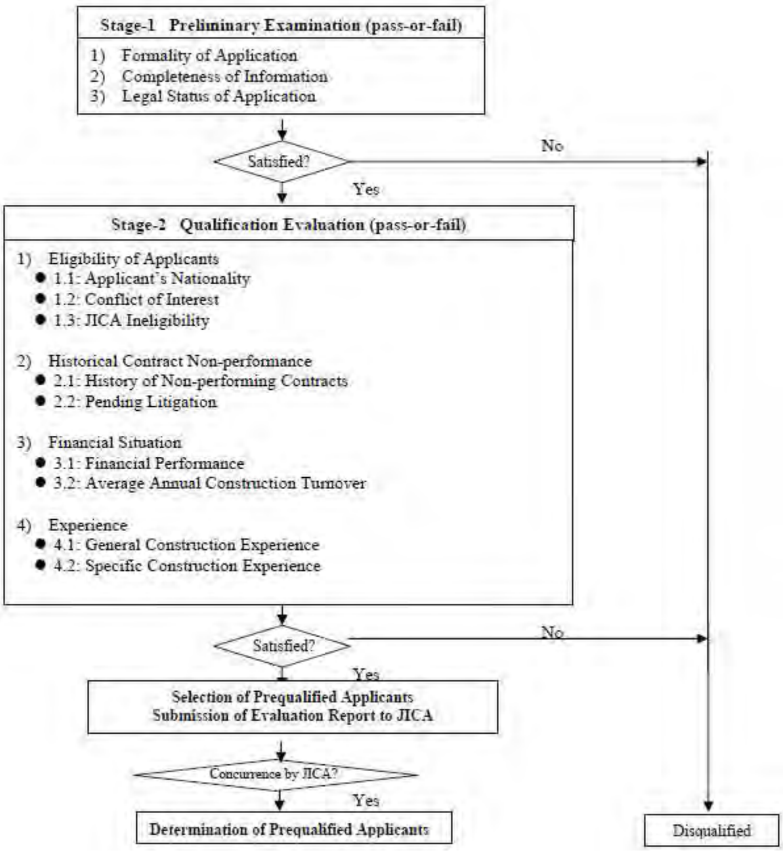
4.3. Bid Evaluation Methods & Criteria

4.3.1. Review of 'Evaluation Guide for Prequalification and Bidding under Japanese ODA Loans' by JICA

(1) Pre-Qualification

A prequalification procedure is required for selecting potential contractors and suppliers for large-scale contracts or contracts with complex and highly specialized services under Japanese ODA Loans.

The evaluation procedure consists of two stages: Stage-1, "Preliminary Examination," and Stage-2, "Qualification Evaluation." "Preliminary Examination" is to assess the documents formally required as Prequalification Documents, for each applicant using pass-or-fail criteria. "Qualification Evaluation" is to examine whether the submitted documents are in compliance with the different qualification requirements for "Eligibility of Applicants", "Historical Contract Non-performance," "Financial Status," and "Experience" by using pass-or-fail criteria. The "Typical Prequalification Procedure for Contracts under Japanese ODA Loans" is shown in the following chart.



Source: JICA Guidelines

Figure 4.3-1 Prequalification Procedure for Contracts under Japanese ODA Loans

(2) Bidding Procedures

JICA has adopted three international bidding procedures: 1) Single-Stage: One-Envelope Bidding Procedure; 2) Single-Stage: Two-Envelope Bidding Procedure; and 3) Two-Stage Bidding Procedure.

Important features of each procedure are pointed out as follows:

1) Single-Stage: One-Envelope Bidding Procedure

- One envelope containing both technical and financial proposals submitted;
- Awarded to the lowest evaluated bidder.

2) Single-Stage: Two-Envelope Bidding Procedure

- Two envelopes for technical proposal and financial proposal submitted at the same time;
- Technical proposal firstly opened, and evaluated for conformity to the specified technical requirements;
- Financial proposal of the technically responsive bidders are opened;
- Awarded to the lowest evaluated bidder;
- The procedure to be applied on works, machinery and equipment for which complete technical specifications are prepared in advance.

3) Two-Stage Bidding Procedure

- Technical offers are submitted, opened, evaluated, and discussed with the bidders;
- The bidders are allowed to revise or adjust the technical proposal to meet the requirement;
- Invite the bidders to submit technical and financial proposals;
- Awarded to the lowest evaluated bidder;
- The procedure to be applied for turnkey contracts, contracts for large and complex plants or procurement of equipment, which is subject to rapid technological advances, for which it may be undesirable or impractical to prepare complete technical specifications in advance.

Regardless of adopting any of the above mentioned procedures, JICA clearly mentions in this document that “the lowest evaluated substantially responsive bid may or may not necessarily be the lowest price bid.” As is stated in the interpretation of Clause 5.06 in ‘Guidelines for Procurement under Japanese ODA Loans’, this means that among the bids which conform to the technical specifications, the bid with the lowest evaluated cost, not necessarily the lowest submitted price shall be selected for award. The lowest evaluated cost is different from the lowest submitted price. In the lowest evaluated cost, factors other than price should be taken into account including the payment schedule, time of construction completion or delivery, operating costs, efficiency and compatibility of the equipment, consumption (energy) efficiency, availability of service and spare parts, reliability of the quality control methods (including construction methods) proposed, safety, environmental benefits, and minor deviations, if any. To the extent practicable, these factors other than price shall be expressed in monetary terms according to criteria specified in the bidding documents,' and non-price factors can be reflected to the bidding price.

Also, the interpretation of Clause 5.06 mentions that 'In principle, price-quality evaluation method in which the bidder with highest combined score of price and technical will be the winner is not accepted under Japanese ODA loan.' The reason is that objective or impartial method of scoring allocation between price and technical factors has yet been established, and thus, it is inevitable that the evaluation becomes subjective. This guideline requests the borrower to prepare definite technical specifications, and to compare and evaluate the bidders' prices which meet these technical specifications.' Therefore, price-quality evaluation method is not applicable for the project under the JICA ODA loan in principle.

However, this is 'in principle', and price-quality evaluation method is not completely disallowed. If objectivity and impartiality in the score allocation of price and technical factors is achieved, then there is room to adopt this method.

Based on the above understandings, the Study Team has conducted bidding evaluation method for the Kochi Metro Project.

It is pointed out that CVC (Central Vigilance Commission) guidelines only specify fundamental policies on anti-corruption, etc.

4.3.2. Evaluation System considered to be applied for Kochi Metro Project

Currently, KMRC intends to adopt "Two-Envelope Bidding Procedure" following the advice of DMRC. This procedure is currently being adopted by DMRC. The bidding evaluation procedure is as follows:

(1) Initial Screening

This is equivalent to Pre-Qualification, and KMRC evaluates the conformity of the bidders to the requirement written in "SCREENING OF APPLICANTS- CHECKLIST" and "ASSESSMENT TOPICS."

(2) Evaluation of Tenders and Determination of Responsiveness

KMRC evaluates the bidder's capability in executing the project, including the evaluation of its conformity to the employer's requirements and specifications in terms of material procurement, project schedule, technical proposal, and others.

(3) Evaluation of Financial Proposals

KMRC evaluates the bidders' proposed prices. The lowest price bidder is selected among the bidders who have passed the above two evaluations.

DMRC considers that this procedure complies with the statement of JICA ODA guidelines, and that this is the best method to ensure transparency of the bidding evaluation.

4.3.3. Evaluation method to be studied for Kochi Metro Project

Basically, the "Two-Envelope Bidding Procedure" which is being adopted by DMRC requires KMRC to show detailed and fulfilled technical specifications to bidders, and the bidders need only to prepare their technical proposals to meet the minimum specifications. Therefore, KMRC only checks the conformity of their proposals to the specifications, and in other words, the bidders are not given any incentives to submit their own innovative or advanced technical proposals.

Therefore, it is recommended that KMRC should consider the adoption of price-quality evaluation method. Under this method, KMRC evaluates the bidders' technical and financial proposals at the same time, and this enables KMRC to evaluate the bidders' technical proposal more positively. This point will be discussed in Section 5.3.

4.4. Consideration of Technical Cooperation

4.4.1. Methodology

In order to facilitate smoother procurement and construction, and to ensure safer and more efficient operations of the Metro system, further reinforcement of project implementation system in KMRL is called for. Specifically, utilization of experiences and know-hows of DMRC and other countries including Japan in the following areas is recommended.

4.4.2. Areas Necessary for Technical Cooperation

(1) Designing of Intermodal Facilities

Intermodal connections are regarded as highly important in the Kochi Metro: Intermodal connection with the bus terminal at Aluva Station, with Indian Railways at Ernakulam South Station, with the large bus terminal and port facilities at Vytilla Station (transit hub) are planned[23].

These plans can be evaluated from the perspectives of improving the convenience for users and boosting demands. However, because India does not have sufficient experience with the intermodal facilities for a transit station, it is recommended to refer to the design examples of Japan, where traffic lines of users are carefully considered. For this reason, cooperation on designs by relevant Japanese experts is beneficial.

(Examples of Japanese companies which have relevant experts in this field[24])

- Japan International Consultants for Transportation Co., Ltd.
- Oriental Consultants Co., Ltd.
- Japan Transportation Consultants, Inc.
- Chuo Fukken Consultants Co., Ltd.
- Fukken Engineering Co., Ltd.
- Tonichi Consultant
- JR East Design Corporation

  etc.

(2) Civil Engineering Technology

An official in charge of civil engineering at DMRC, which supports KMRL, pronounced that they seek for technical cooperation with foreign partners on monopile structure. As there are some practical examples where Japanese construction company installed monopiles in foreign countries.

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23 Intermodal connection with airport will be also important for the future airport extension.
24 Companies with good track records in construction of monopiles for offshore wind turbines

Recently, monopile structure is becoming popular in the world especially for the off-shore wind power generation. However, India has little experience with this structure. Because the pile itself and body of the pier are in common with other structures, the area of technical assistance will be analytical method of the joint part of pile and pier, horizontal load, etc. Although monopile foundation is not used for the railway structures in Japan, due to the structural disadvantage in earthquakes, there is a case where a major Japanese firm has constructed the monopile foundations in the overseas project. So, Japan will be capable of providing appropriate technical assistance to the Indian side.

(Examples of Japanese companies which have relevant experts in this field)

- Obayashi Corporation
- Kajima Corporation
- Takenaka Civil Engineering & Construction Co., Ltd.
- Kumagai Gumi Co., Ltd.

etc.

(3) Maintenance of E&M Systems

KMRL may need the know-how on maintenance of rolling stocks, electrical facilities, signaling facilities, etc. for further safety and reliability.

Among these, depot under the Design/Build Separation contract will be involved with various operations for maintaining trains, such as daily operations like shunting and cleaning, periodic inspections. For the implementation of these tasks in effective manner after the start of operation, depot design must be carefully considered from the design stage. For the preparation of depot specifications, Japan will be capable of providing appropriate support, through the dispatch of experts with experiences and know-hows on operation of work plans and installation of equipment.

(Examples of Japanese companies which have relevant experts in this field)

- Japan International Consultants for Transportation Co., Ltd.
- East Japan Railway Company
- West Japan Railway Company
- Tokyo Metro Co., Ltd.
- East Japan Transport Technology Co., Ltd.

etc.

(4) Know-how on Train Operation Control

KMRL may need the know-how on train operation control, including capacity building of train operation controller.

Particularly for developing the necessary structures like alternative transportation in case of emergency, developing the instruments for gathering/distributing information, planning of emergency operations, and training of train operation/maintenance, support on education of personnel and preparation of specifications of installations related to the operation control through the dispatch of experts with know-hows will be required.

(Examples of Japanese companies which have relevant experts in this field)

- Japan International Consultants for Transportation Co., Ltd.
- East Japan Railway Company
- West Japan Railway Company
- Tokyo Metro Co., Ltd.

etc.

(5) Know-how on IC Card, including Intermodal Integration

As discussed above, reinforcement of intermodal connections is planned or the Kochi Metro. In this context, the integration of ticketing system will enhance the convenience of passengers, and thus enhance the demand for Metro system. A single IC card (smart card) is used in common across the different transportation modes in Japan, and a passenger can board train, metro, bus, etc. with the same IC card. This know-how can be exploited in the Kochi Metro.

Because Kochi Metro is not a network plan that covers the whole city, coordination with the bus transportation is required in terms of promoting the use of public transportation system. So, with a view of creating an integrated transportation network for the future, support on preparation of AFC specifications through the dispatch of experts with know-hows of Japanese urban transportation will be effective.

(Examples of Japanese companies which have relevant experts in this field)

- Japan International Consultants for Transportation Co., Ltd.
- East Japan Railway Company
- West Japan Railway Company
- Tokyo Metro Co., Ltd.
- JR East Mechatronics Co., Ltd.

etc.

(6) Marketing Know-how for Demand Boosting

Utilization of the marketing know-hows obtained from the experiences of Japan and other countries, will also considered effective for boosting the railway demands, such as setting of fares, introduction of flexible fares based on the usage frequency, conducting PR activities or events, etc.

For the promotional measures, such as setting different fares for various time zones, discounted fares for specific sections, support on introduction of promotional measures and preparation of AFC specifications through the dispatch of experts with know-hows will be effective.

(Example of Japanese companies which have relevant experts in this field)

- Japan International Consultants for Transportation Co., Ltd.
- East Japan Railway Company
- West Japan Railway Company
- Tokyo Metro Co., Ltd.

etc.

Chapter 5

Recommended Procurement Packages, Contract styles and Evaluation Methods

5.1. World Urban Rail Examples

Here, the Study Team sorted out the examples of urban transportation sector in the world, for the purpose of offering the implications for the procurement package and contract styles involved with the urban rail projects in India. The study result is presented in Appendix 5 at the end of this report. Also, finding from these examples feeds back in the discussions later in Sections 5.2 and 5.3.

5.1.1. Methodology

Following items are organized for each project:

- Project Name
- Line
- Mode
- Year of operation
- Finance Scheme
- Procurement Package and Contract Style
- Contractor
- Implication to this Study

5.1.2. Countries

The following countries are the countries subject to study for each mode of transportation. In view of the possibility with its future development, Automated Guideway Transit (AGT) was included in addition to metro, LRT, and monorail.

○Metro

(1) India
(2) Vietnam
(3) Thailand
(4) Malaysia
(5) Indonesia
(6) Philippines
(7) Korea
(8) Singapore
(9) Hong Kong
(10) USA

(11) UAE

〇LRT

(1) Australia

(2) Morocco

〇Monorail

(1) India

(2) Singapore

(3) China

(4) Brazil

(5) UAE

〇AGT

(1) Singapore

(2) Macau

5.2. Proposal of Procurement Package and Contract Styles for Urban Railway Projects in India

Here, the Study Team classifies and proposes procurement packages and contract styles for urban railway projects in India.

5.2.1. Classification of Procurement Packages & Contract Styles

There are two different ways of procurement package for urban railways, i.e. Fragmented Approach where subsystems such as civil works, track, electrical works, signal & communications, rolling stocks, AFC (Automatic Fare Collection), and depot are procured as individual packages; and Integrated Approach where subsystems are combined and procured as a whole package. The Integrated Approach can be divided into two types depending on the degree of integration; i.e. Semi-Integrated Approach and Full-Integrated Approach. In addition, the system where the whole of the above-mentioned subsystems are combined with maintenance and train operation together with fund procurement is called PPP (Public-Private Partnership).[25]

In terms of contract styles, there are varied styles such as Design/Build Separation, Design-Build Combined, E&M Turnkey, Full-Turnkey, and PPP depending on the ways how packages of Design, Construction/Manufacturing, Commissioning/Test, Maintenance, and Train Operation are procured. The detailed explanation of each style is given below.

5.2.2. Features of Each Package

(1) Fragmented Approach

Subsystems are procured separately (Figure 5.2-1). Contract styles of each package are either Design/Build Separation or Design-Build Combined in the area of civil works and track & depot, while Design-Build Combined is usually adopted in other packages. There are cases where subsystems are further divided into smaller segments than those illustrated in the figure.

The cases include the separation of civil works in line with the construction sections, and the separation of signal and communications, for example. Generally, the cost for the employer in the Fragmented Approach is smaller than other approaches. (See the column in the next page for the quantitative evaluation of cost reduction.)

[25] PPP here basically means BOT. However, PPP includes various types such as Vertical Separation and Lease System, etc. Therefore, PPP does not necessarily mean the full-integrated subsystem procurement.

The reasons for this could include:

- The overhead cost for package integration is not necessary in the procurement cost since the employer bears the risks of integration.
- Bidders have to "fight" each other based on the specifications given by the employer, and therefore the competition among them is prone to be serious.
- The limited technical scope for bidders tends to increase the number of bidders.
- Bidders can concentrate on the specific areas with their strong technical merits. That reduces the risks to be borne by bidders, and allows them to bid with lower price.

Further, when applied the Fragmented Approach, it seems possible that the employer can obtain higher skills of ordering and accumulate experiences within the organization. (Note that if the procurement process is outsourced, and if the employer is too much depending on the general consultant, it would be difficult to obtain the skills of ordering and to accumulate experiences, even though the Fragmented Approach is selected.)

The Fragmented Approach was adopted by the Delhi Metro, the first case in the urban railways in India, and followed by Kolkata Metro, Bangalore Metro and Chennai Metro. The introduction of the said system to Kochi Metro and other cities with the strong influence of DMRC might be possible.

<table>
<tr><th>Scope
Package</th><th>Design</th><th>Construction/
Manufacturing</th><th>Commissioning/
Test</th><th>Maintenance</th><th>Train Operation</th></tr>
<tr><td>Civil</td><td>Design</td><td>Build</td><td></td><td></td><td></td></tr>
<tr><td>Track</td><td colspan="3">Design-Build</td><td></td><td></td></tr>
<tr><td>Substation / OHE</td><td colspan="3">Design-Build</td><td></td><td></td></tr>
<tr><td>Signal & Comm.</td><td colspan="3">Design-Build</td><td></td><td></td></tr>
<tr><td>Rolling Stock</td><td colspan="3">Design-Build</td><td></td><td></td></tr>
<tr><td>AFC</td><td colspan="3">Design-Build</td><td></td><td></td></tr>
<tr><td>Depot</td><td>Design</td><td>Build</td><td></td><td></td><td></td></tr>
</table>

Note: In this figure, Civil, Track and Depot are described as Design/Build Separation.
But it is possible that they are Design-Build Combined.

Source: Study Team

Figure 5.2-1 Fragmented Approach

****

[Procurement Cost Reduction through Fragmented Approach]

As afore-mentioned, the procurement cost of the Fragmented Approach is smaller than other approaches due to its competition-enhancing effect. However, it is not easy to make quantitative evaluation on how much the Fragmented Approach reduces the procurement cost. It might be possible to verify the assertion if there are cases of separate procurement of individual packages under the similar conditions. According to DMRC, they experienced such cases in their packages of communications and AFC. They say the procurement cost of the communications package in the Phase 2 (5 sub-packages separated) was reduced by 40% compared to the Phase 1 procured in one integrated package. They also noted the cost of the AFC in the Phase 2 (2 sub-packages separated) was reduced by 30% compared to the Phase 1 (one integrated package). (See Table 5.2-1.)

Although the cost of procurement tends to be smaller in the Fragmented Approach, the cost of managing an organization should be bigger because the size of the organization of the employer needs larger scale.

Table 5.2-1 Procurement Cost Reduction in Delhi Metro

	Phase 1	Phase 2		Cost reduced
Telecommunications	1 Package	5 Packages	(1)Radio (2) CCTV (3)PAPDs (4)fiber Optics (5)Clocks and telephone	**40%**
AFC	1 Package	2 Packages	(1) Design and Supply (2) Installation	**30%**

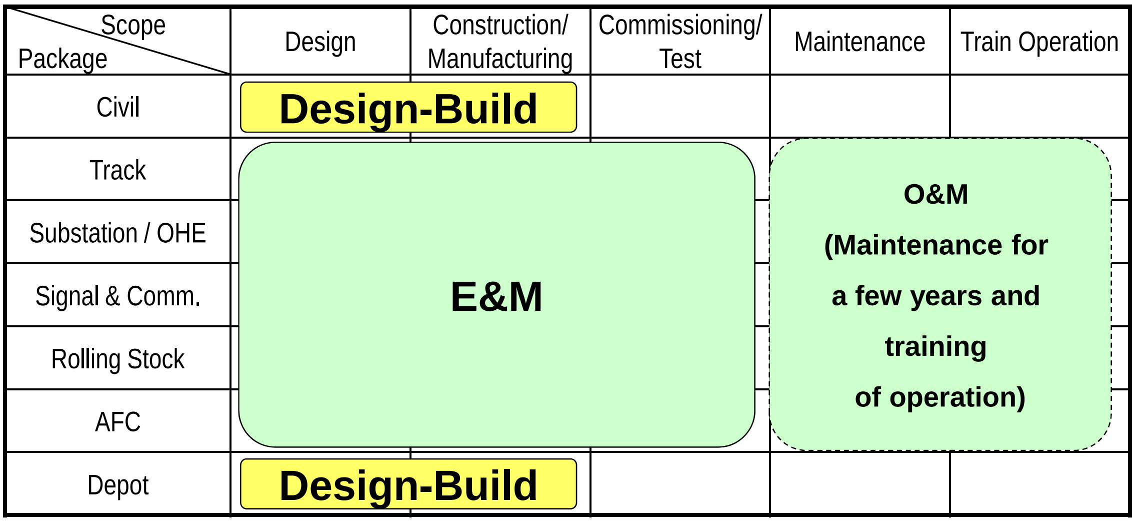
Source: Based on the interview with DMRC

****

(2) Semi-Integrated Approach

E&M subsystems are procured as a single turnkey package, while civil works and depot are usually purchased in the Design-Build style. In some cases, the O&M package is combined with the E&M procurement for the provision of initial training and operation for a few years (Figure 5.2-2). While the employer does not bear the risks of package integration, they have to incur the overhead cost. In other words, as the organization of the employer does not need the integration works, no large scale organization, compared to the case of Fragmented Approach, is required at least at the initial stage of the project. (See the column next page for the discussion on procurement packages and the scale of the employer's organization.)

The Semi-Integrated Approach in urban railways in India is adopted by Navi Mumbai Metro.



Source: Study Team

Figure 5.2-2　Semi-Integrated Approach

****

[The relationship between the Semi-Integrated Approach and the scale of the employer's organization]

The procurement under the Semi-Integrated Approach has been in preparation in Navi Mumbai Metro. In the case of Navi Mumbai Metro, the employer is CIDCO, which is responsible for the urban development in Maharashtra State. Different from DMRC, which operates Delhi Metro, CIDCO is not the organization to exclusively manage urban railways. Metro projects are one of their urban development projects for CIDCO.

According to CIDCO, they adopted the turnkey procurement for E&M packages, since they have no sufficient staff and experience to manage the metro system, and they also wanted to avoid the issues of integration and interface. In the case of Fragmented Approach, the employer faces the shortage of staff responsible for integration and interface. Metro is a part of CIDCO's many projects while they have to administer the whole gamut of urban development projects. That is why CIDCO adopted the Semi-Integrated Approach to minimize their administrative input by letting one consortium administer the whole packages of E&M.

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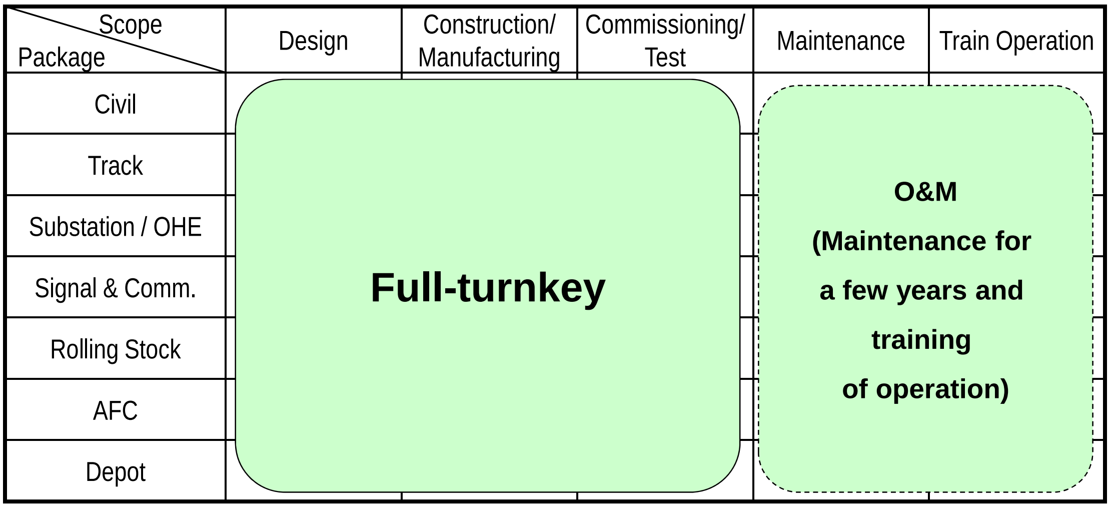
(3) Full-Integrated Approach

E&M subsystems as well as civil works and depot are all procured in one full-turnkey basis. As in the case of Semi-Integrated Approach, there are cases of provision of maintenance and training for the initial few years (Figure 5.2-3). This approach may be suitable for monorail projects, which are comparatively simpler as a system than metro projects. Similar to the case of Semi-Integrated Approach, the employer does not take the risks of integration while they have to bear the overhead cost. It might be difficult for India who has no sufficient technological experiences in monorail, for example, to take the risks of integration at least for the time being.

One of the examples of Full-Integrated Approach adopted in India is Mumbai Monorail. (The current situation of Mumbai Monorail is described in the column.)



Source: Study Team

Figure 5.2-3 Full-Integrated Approach

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〔Procurement Packages of Mumbai Monorail〕

The first monorail system in India has been in progress in Mumbai. Out of the planned total length of 100km, about 20km are being in progress. It has been financed by the government, though PPP was once proposed. MMRDA is the employer of the procurement packages. In the Mumbai Monorail procurement packages, two consortiums i.e. 1) L&T (India) and Scomi (Malaysia) and 2) Reliance Infrastructure (India) and Hitachi (Japan) submitted their proposals in 2008, and the L&T / Scomi eventually received the order. According to MMRDA, L&T / Scomi satisfied the employer's condition with the time of delivery of 3 years, while Reliance / Hitachi proposed 5 years. (See the Table 5.2-2)

MMRDA says the civil works have been completed by 80 % and they will inaugurate in

August 2013 for the Phase 1, while the initiation of the Phase 2 has been in delay and it takes a few more years to start it. They say the reason of the delay is the insufficient experience of the contractor.

As for O&M, bid was not done. MMRDA was supposed to be an operator.

Table 5.2-2 Proposals by Two Bidders for Mumbai Monorail

	L&T/Scomi	Reliance/Hitachi
Rolling stock Spec.	Body length11m Wheel base 7m	Body length 15-16m Wheel base10m
Headway	3 minutes	5-7 minutes
Delivery	3 years including Signal and Rolling stock	5 years without Signal

Source: Based on the interview with MMRDA

****

(4) PPP

This is an all-in-one package of subsystems including Design, Construction/Manufacturing, Commissioning/Test, Maintenance and Train Operation. The fund procurement is also undertaken by the contractor. PPP here basically means BOT. However, PPP includes various types such as Vertical Separation and Lease System, etc. Therefore, PPP does not necessarily mean the fully integrated subsystem purchase. The employer neither takes the risks of integration including civil works and E&M nor bears the cost of Maintenance, Train Operation, not to mention the fund procurement risk. Risks are all passed on to the contractor.

In India's PPP for urban railways, the competition among the bidders depends on the amount of Viability Gap Funding (VGF), with the tariff level as a given condition. Whereas the employer is responsible for the land acquisition, the contractor takes all the other responsibilities. In some cases, the contractor is given the concession of developing the lands around railway stations. In the case of urban railways in India, PPP was adopted by Mumbai Metro (Line 1 and 2) and the Delhi Airport Express, etc. In the Delhi Airport Express, facilities were developed by PPP with Separation of Public-Private Roles. (The details of the railway lines developed by PPP were already given in Section 2.3.2.)

Scope / Package	Design	Construction/ Manufacturing	Commissioning/ Test	Maintenance	Train Operation
Civil					
Track					
Substation / OHE					
Signal & Comm.			PPP		
Rolling Stock					
AFC					
Depot					

Note1: BOT is considered in this figure.
Note2: Funding is also included.
Source: Study Team

Figure 5.2-4 PPP

5.2.3. Case Study in India and Other Countries

(1) Case Study in India and Other Countries

The Fragmented Approach, Semi-Integrated Approach and Full-Integrated Approach classified in this chapter are summarized below (Table 5.2-3) with major examples of India and other countries.

Table 5.2-3 Examples in India and the world

	Examples in India	Examples in the World
Fragmented Approach	Delhi Metro Kochi Metro Mumbai Metro Line 3	Hong Kong Metro New York Metro (USA)
Semi-Integrated Approach	Navi Mumbai Metro	Ho Chi Minh Metro (Vietnam)
Full-Integrated Approach	Mumbai Monorail	Dubai Monorail (UAE)
PPP	Delhi Airport Line Mumbai Metro Line 1 Mumbai Metro Line 2	Seoul Line 9 (Korea) Manila MRT3 (Philippines)

Source: Study Team

(2) Cases of India

The situations of examples of India by the classification above are as follows.

1) Fragmented Approach

- Delhi Metro

Delhi Metro consolidated the Fragmented Approach. They have set up the more elaborated procurement packages in the Phase 2 than the Phase 1 (Separation of stations & E&M from the civil works, Division of signal/communications into signal and communications).

DMRC says whereas GC played a big role in the Phase 1, DMRC enhanced their own role (the increased procurement capability) and introduced more fragmented packages in the Phase 2.

They say the procurement cost is reduced because of the Fragmented Approach. As was shown in the column of Section 5.2.2, the communications package in the Phase 2 was reduced by 40 % compared to the Phase 1.

Procurement Package of Delhi Metro

(Phase 1)

1) Civil-Underground Stations (incl. lighting, ventilation & air-conditioning): Design-Build
2) Civil-Elevated stations and viaduct (incl. lighting, ventilation and air-conditioning): Design-Build
3) Rolling Stock: Design, manufacture, supply and commissioning
4) Signaling and Train Control, Communication System: Supply, installation, testing and commissioning
5) Traction Power and Power Distribution System: Supply, installation, testing and commissioning
6) Automatic Fare Collection: Supply, installation, testing and commissioning
7) Trackworks: Supply, installation and testing

(Phase 2)

1) a) Civil - Underground Stations - Several Packages
   b) E&M - Underground Stations (Ventilation & Air-conditioning) - Several packages
2) Civil - Elevated stations and viaduct - Several packages
3) Rolling Stock (Separate contracts for broad and standard gauge) - Design, manufacture, supply and commissioning
4) Signaling and Train Control - Supply, installation, testing and commissioning
5) Communications and Telecommunications
6) Traction Power and Power Distribution System - Supply, installation, testing and commissioning

7) Automatic Fare Collection - Supply, installation, testing and commissioning
8) Trackworks - Supply, installation and testing

With the strong commitment by DMRC, Kochi Metro is considering the Fragmented Approach similar to that of Delhi Metro. (See the more detailed explanation in Section 4.2.)

In Mumbai Metro Line 3, though with less commitment by DMRC, they are also considering the Fragmented Approach under the guidance of GC.

2) Semi-Integrated Approach

- Navi Mumbai Metro

Navi Mumbai Metro, an example of Semi-Integrated Approach, is under procurement with the E&M turnkey basis. As already mentioned in Section 5.2.2, CIDCO, which is responsible for the urban development in Maharashtra State, is not a specialized organization for urban railways business. As they have insufficient staff and experience to administer the metro system, and in order to avoid the problems of integration and interface, they adopted the E&M turnkey approach.

Procurement Package of Navi Mumbai
1) Construction of Viaducts: 2 packages
2) Design and construction of stations: 2 packages
3) Depot Development
4) General Consultants
5) E&M Package - Design, Manufacture, Supply, Installation, Testing, Commissioning of complete metro system including spares, Training of Operation and Maintenance Personnel, handover to the Authority of the whole equipment (includes Rolling Stock with driving simulator, Signaling and Train Control, Communication System, Power Supply, Traction and SCADA, Trackworks, AFC and Depot Equipment and Railway System's Maintenance for three years).

3) Full-Integrated Approach

- Mumbai Monorail

Mumbai Monorail, an example of Full-Integrated Approach, is proceeding with full turnkey basis including civil works and E&M packages.

Regarding the O&M, there was no bidding. MMRDA will be an operator.

Procurement Package of Mumbai Monorail

(Procurement package for main contractor)

Full turnkey including civil works

(Reference procurement package for subcontractors)

Subcontractors supply the following items for Section 1:

1) Design and integration of the system; rolling stock (15 4-car train sets)

2) Construction, ticketing and power supply

3) Design, supply and commission the train control and signaling system

4) Project management and proof-checking consultant

5) System integration contract

6) Independent assessor for the testing and commissioning (Section 1)

4) PPP/BOT

Delhi Airport Express and Mumbai Metro Lines 1 & 2 are the cases of PPP/BOT.

- Delhi Airport Express

Delhi Airport Express was constructed by PPP with Vertical Separation, namely the infrastructure (tunnels and elevated bridges) was procured by DMRC whereas others (E&M, operation and management) were developed by PPP. The SPV, DAMEPL (Reliance 95%, CAF 5%), won the bid; and they did not request VGF, rather they intended to pay premium to the employer. The SPV planned that they could earn the profit because Vertical Separation is applied in this project[26].

As mentioned in Section 2.3.2, the technical problems occurred in the infrastructure, which resulted in the suspension of railway operation.

Procurement Package of Delhi Airport Express

1) Civil Works for Tunnels, viaducts and stations - thru DMRC

2) E&M - Design, Supply, Installation, Testing, Commissioning, Operate and Maintain

[26] http://www.business-standard.com/article/economy-policy/q-a-lalit-jalan-director-ceo-r-infra-111050600043_1.html

- Mumbai Metro Line 1

This is a full-package by PPP (BOT). The contractor, MMOPL, functioned as the SPV for the project. The capital of MMOPL was invested by Reliance Infra (69%), MMRDA (26%), Veolia Transport RATP Asia (5%). The procured packages introduced by MMOPL are as follows.

Procurement Package of Mumbai Metro Line 1

(Procurement package for main contractor)

PPP package

(Reference: Procurement package for subcontractors)

1) Civil Works - Viaducts
2) Civil Works - Stations
3) Civil Works - Special Bridges
4) Civil Works - Depot Earthworks
5) Rolling Stock
6) Signaling System
7) Power Supply Traction & SCADA
8) Communications System
9) Trackworks
10) Automatic Fare Collection
11) E&M: Escalators, Lifts
12) Depot Machinery & Plant
13) Depot Civil Works

- Mumbai Metro Line 2

This is a full-package by PPP (BOT). As mentioned in Section 2.3.2, the progress after the SPV's bidding has been stagnant due to the delay of land purchase. The SPV is MMTPL (Reliance Infra 48%, Reliance Communication 26%, SNC 26%).

Procurement Package of Mumbai Metro Line 2

PPP package

(3) Cases of Other Countries

Cases of other countries classified by procurement packages are as below.

1) Fragmented Approach

- Hong Kong MTR, West Rail

Inaugurated in 2003, MTR West Rail was developed by MTR Corporation and its predecessor KCRC, both of which have enough experiences of operation of railways. Funds were provided by KCRC and the Government of Hong Kong Special Administrative Region. The procurement was made individually in civil works, rolling stocks, signals, AFC and platform doors, as shown below.

From Japan, two consortiums, one by Itochu, Kinki Sharyo, Kawasaki Heavy Industries, and the other by Nissho Iwai and Nabco received the order of rolling stocks and platform doors respectively. Although European suppliers took part in the bid, Japanese companies won the bid because of both price and technology. The employer used the fragmented approach based on their long experience. There were no delay or technical problems.

Procurement Package of Hong Kong MTR West Rail

1) Civil works (2 major tunnels): Design-build
2) Civil works (others): Build only
3) Rolling stock: EPC
4) Train control system, Signaling system: EPC
5) Telecommunication: EPC
6) AFC: EPC
7) Platform Door: EPC

- R160 for New York City Transit Authority, MTA

This is a rolling stock replacement project for MTA New York implemented in 2006. Funds were from MTA and the federal government. This is a single package of rolling stocks. The joint venture by Alstom and Kawasaki Heavy Industries received the order. The employer used the fragmented approach based on their long experience. There were no delay or technical problems.

Procurement Package of New York Metro (replacement of existing trains)
1) Rolling Stock: Design, manufacture, delivery, testing and commissioning
*There were no packages for civil, electricity, signal, etc. because this is for a replacement of rolling stocks.

2) Semi-Integrated Approach

- Ho Chi Minh Metro Line1

This project is undertaken by the Vietnamese government with the planned inauguration in 2017, to which the yen loan (two-step loan) was provided. The procurement packages are composed of 3 civil-work packages and E&M turnkey component. As for civil works (elevation and depot), a consortium of Sumitomo Co. and CIENCO6 received the order in May 2012 as a sole bidder. As for E&M package, 4 Japanese groups, Mitsubishi Heavy Industries and Sumitomo Co.; Kawasaki Heavy Industries and Itochu; Marubeni and Toshiba; Hitachi and Hitachi Plant Technologies offered bids, and Hitachi group gained the right of first negotiation.

Sources say JICA and the Vietnamese government had already agreed on the procurement of E&M packages on a turnkey basis. In this project, the base of specification is from an urban railways standardization system from Japan (STRASYA).[27]

It is also mentioned the competition among 4 Japanese firm groups brought about the reduction of the price tendered. (The price difference between the lowest and the second lowest was 10 billion yen, while that between the lowest and the highest was 15 billion yen.)

Procurement Package of Ho Chi Minh Metro Line 1
1) a) Civil works (Underground Stations, incl. station architectural works, and building services works): Build only
b) Civil works (Underground Stations): Design-Build
2) Civil works (Elevated stations and viaduct, Depot, incl. station architectural works and building services works): Design-Build
3) E&M (Signaling system, Traction and Auxiliary power supply system and substations, Telecomunications systems and operation control center facilities, Depot workshop and equipment and Fare collection system Rolling Stock, Track work, Maintenance for 5 years including supply of spare parts, repair work, maintenance work and training for technical transfer.

[27] STRASYA＝STandard urban RAilway SYstem for Asia. Designed by MLIT in the aim of introducing the excellent urban transport system of Japan, STRASYA is a railway system developed through the standardization of systems for rolling stocks, signals, communications, etc. that are widely used in Japan.

3) Full-Integrated Approach

- Dubai Monorail

Inaugurated in 2008, this is a monorail project undertaken by Nahkeel, a developer in Dubai Emirate, with the full-turnkey basis as shown below. Funds were from the private sector. Marubeni received the order as the prime contractor whose procurement packages are also shown below. Other Japanese contractors are Hitachi (Rolling Stock, Electrical Works, Operation Management, Communications, Platform Doors), Nippon Signal (Communications), Omron (AFC), JV of Obayashi & Oriental Construction (Civil Works), Tonichi Consultant & Tostem (Design Management).

The O&M package was included in the initial stage, but it was brought out of the package afterward. SMRT from Singapore won the bid.

Procurement Package of Dubai Monorail

(Procurement package for main contractor)

Full turnkey handover including civil engineering and construction

(Reference: Procurement package for subcontractors)

1) Rolling stock, Electrification system, Operation management, Communication, platform screen doors

2) Signaling facilities

3) Automatic Fare Collection

4) Civil engineering and construction

5) Design supervision work

4) PPP

- Seoul Metro 9

Inaugurated in 2009, this is a metro project undertaken by Seoul City with PPP procurement (operation and maintenance for 30 years). The SPV (subscribed by Hyundai Rotem, Macquarie, Veolia Transport), as the prime contractor, procured EPC, and outsourced the railways operation. The details are as follows. 1) Operation Contract for 10 years : Seoul Line 9 (Veolia Transport Korea 80%, Hyundai Rotem 20%), 2) Rolling Stock Maintenance Contract : rolling stock maintenance firm (Veolia Transport Korea 20%, Hyundai Rotem 80%), 3) Maintenance Contract for other E&M facilities : Seoul Line 9.

They adopted the Vertical Separation with Civil Works by the Public Sector, and E&M by PPP. The Minimum Revenue Guarantee (MRG) system was also introduced, and demand risks and revenue risks are duly shared by the employer and the contractor. This was all to enhance the feasibility of the project by the strong intervention by the government. When the project owner requested the fare increase, they eventually had to withdraw it due to the strong public criticism that they were gaining profit with the support of the government.

The intention of the employer (Seoul City) was that they seek efficient management that has not realized through existing public metro operators in Seoul. The bidder proposed an effective operation through less-labor intensive operation, and that proposal was afforded[28].

Procurement Package for Seoul Metro 9 (Procurement package for main contractor) PPP Package (BTO: O&M Concession for 30 years) (Reference: Procurement package for subcontractors) 1) Operations Contract for 10 years 2) Maintenance of Rolling Stock Contract 3) Maintenance of other E&M facilities

- Manila MRT 3

Manila MRT 3 was undertaken by the Philippine government (DOTC) with PPP (Build, Lease, Transfer) and inaugurated in 1999. The concession to develop stations was also combined. Although the initial stockholders of the MRTC (SPV) were local industries, the current major stockholders are DBP and LBP, both of which are Philippine banks. While MRTC procured the fixed price EPC packages and outsources the maintenance work in the contract with Sumitomo Co., the operation itself is undertaken by DOTC. Under Sumitomo Co., Mitsubishi Heavy Industries is in charge of management of EPC procurement, and its affiliated firm, TES Philippines, is responsible for the maintenance work.

As the PPP scheme of MRT 3 is BLT, MRTC leases the facilities to the government, and receives the fixed lease payment, while the government is responsible for the operation. Therefore, the demand risks are borne solely by the government. As in the case of the above-mentioned Seoul Metro 9, this is different from that of India which the private sector takes most of the risks related to demand and revenue. However, it is noted there is the criticism against the private sector’s risk-aversion attitude in the Philippines.

By using PPP, the effect was that the employer obtained private funding, know-how of urban railway operation and maintenance from foreign companies, non-railway revenue

[28] Based on the information from Dr. Kim, former CEO of Veolia Korea at the lecture of ITPS, on February 28, 2013.

based on the land development around the station, and demand creation from retail business in the station development.

Procurement Package of Manila MRT 3

PPP (BLT, including land development right around stations)

5.2.4. Comparison of the Procurement Packages and Implications

Based on the above explanation, pros and cons of each approach of Fragmented, Semi-Integrated, Full-Integrated and PPP of urban railways procurement are spelled out in the Table 5.2-4.

Table 5.2-4 Comparison of Procurement Packages

	Pros	Cons
Fragmented Approach	-Cost effective -Technology can be reserved within the organization of employer	-Need a large organization in employer -Lack of coordination among sub-systems if the technical expertise is insufficient in employer
Semi-Integrated Approach	-Suitable if the technical expertise is insufficient in employer	-Overhead cost is incurred
Full-Integrated Approach	-Suitable if the technology is relatively simple (such as monorail)	-Overhead cost is incurred
PPP	-Saving the resources of employer (organization/ finance) to procure systems and O&M respectively	-Often the business becomes failure financially -Reluctant of bidders to apply if risk is too much incurred

Source: Study Team

1) Fragmented Approach

(Positive Aspect)

The merit of Fragmented Approach is the cost reduction. The reasons are:

- As the employer takes the risks of integration, the overhead cost for integration is unnecessary.
- The competition among bidders is serious.
- The limited technical scope requested for bidders tends to increase the number of bidders.
- Bidders can concentrate on the specific areas with their strong technical merits. That reduces the risks to be borne by bidders, and allows them to bid with lower price.

An example of cost reduction by 40% in the procurement of signal & communications by Delhi Metro is already mentioned in the column in Section 5.2.2.

Furthermore, Fragmented Approach enables the organization of the employer to accumulate technological capabilities internally. Delhi Metro has absorbed the high level of technology through procurement processes of phases 1 and 2. For DMRC that operates a number of urban railway networks and is going to expand them in future, the internalization of technology is significantly important.

(Negative Aspect)

The employer needs a relatively large organization at least at the time of package procurement, and it should bear a cost to maintain that organization. Although the technology absorption is possible, there is a concern that the internalized technology does not keep abreast of the advancing technology proposed by bidders. Another demerit of Fragmented Approach is that in case the employer does not have enough capabilities of placing orders for procurement, Fragmented Approach is not suitable. The employment of GC to get support could be a solution.

In the case of Mumbai Metro Line 3, as MMRDA, the employer, did not have experiences of integration of procurement packages, they employed a GC to let them do procurement work. In this case, as the procurement work is outsourced, it might be difficult for the employer to feedback the knowhow of railway operation and maintenance for the procurement work.

2) Semi-Integrated Approach

(Positive Aspect)

In Semi-Integrated Approach, the adoption of semi-turnkey procurement for E&M component brings about the appropriate integration of procurement packages by the contractor. If the employer does not have enough capabilities of placing orders for procurement, this approach is beneficial.

In the example of Navi Mumbai, in the circumstances that for CIDCO, the employer, the metro project is merely a part of its many urban development projects, it is expected the overall management of E&M by a single consortium could minimize the burden on the employer.

In view of the future expansion of urban railways projects to local cities in India, as is the case with Kochi Metro, requesting for the consultation and advice of DMRC could be possible. However, there might be cases of little relationships with DMRC depending on cities, or shortage of DMRC resources if urban railways projects are organized in too many local cities in India in future. In such circumstances, the Semi-Integrated Approach might be a suitable option to consider.

(Negative Aspect)

In the case of the adoption of semi-turnkey procurement for E&M component in Semi-Integrated Approach, the cost of package integration as well as overhead cost is to be borne by the contractor. Therefore, the cost of employment of contractor could be higher than the Fragmented Approach.

3) Full-Integrated Approach

(Positive Aspect)

In this approach, civil works and E&M are combined and procured as a whole. The integration of all technical packages is made by the contractor. This approach is effective in the case of comparatively simple system or in the field of little experience for India. Monorail projects, for example, are suitable for this.

(Negative Aspect)

As is the case with Semi-Integrated Approach, the cost of package integration as well as overhead cost is to be borne by the contractor, and the cost of employment of contractor could be higher than the Fragmented Approach.

4) PPP

(Positive Aspect)

It is considered this approach might save human and financial resources of the employer. This is because it is unnecessary for the employer to do any technical package integration on their side, and also they outsource O&M and fund procurement. In addition, in many PPP projects for urban railways, they are combined with land development around stations, and the external effects of railway operation can be internalized.

(Negative Aspect)

As already mentioned in Section 2.3.2, there have been no examples of PPP projects for urban railways going well. (Delhi Airport Express, Mumbai Metro Line 1, Line 2 etc.)

In the circumstances, it might be difficult for experienced international firms and active Indian businesses to take part in unless the risks taken by the private sector decrease through the solution of institutional challenges of PPP in India. (Refer to Section 2.3.3.)

5.2.5. Proposal

(1) Recommended Package

As was mentioned in Section 5.2.4, the Fragmented Approach, firstly adopted by Delhi Metro and was expanded to other metros, seems to become a mainstream procurement approach of urban railway in India. On the other hand, Navi Mumbai was only one example where Semi-Integrated Approach was adapted so far. As for the PPP, currently no projects are going well. Furthermore, most Japanese companies who intend to enter Indian market favor the Fragmented Approach. Thus, it is recommended to introduce the Fragmented Approach for the future metro projects in India.

Next, as for the monorail projects in India, Full-Integrated Approach was adapted in Mumbai Monorail. A Japanese monorail supplier also favors this approach. So the Full-Integrated Approach is recommended for the future monorail projects in India.

(2) Notes when using Fragmented Approach

As mentioned, it is recommended to use the Fragmented Approach for metro projects in India. However, the following points should be noted, when considering metro will be expanding to the tier-2 cities:

- Capacity building of ordering

  It is important to maintain the capability of ordering by the employer. Because integration between subsystems should be done by the employer, higher technical capacity is required in the employer. However, an employer who is planning to introduce metro rails in the tier-2 cities has less experience of railway business. It is important to support the capacity of management. Specific options are: 1) Obtaining support by experienced operators including foreign operators or 2) Obtaining support by other (private) General Consultants.

  Although integration between subsystems is responsible for the employer, it is also important to bring a good interface among the suppliers. How this interface management is done (employer-driven or bidder-driven) depends on the technical expertise of the employer.

- Quality control and securing supply of parts

  Under the Fragmented Approach, in order to maintain the safety and the reliability of urban railway, the quality control and securing supply of parts are important. For example, DMRC requires the following in the procurement of rolling stock for Delhi Metro[29]:

To facilitate ease in maintenance and easy availability of spares, DMRC is keen in standardization and expects contractor to make efforts to source maximum number of equipments and materials from India.(A1.3)

According to this, it is important that high-reliable parts should be supplied within India. Thus direct investment and alliances by manufacture of electric devices and other parts from foreign countries including Japan are appreciated.

(3) Other packages

Other packages than Fragment Approach might be beneficial if the following conditions are available.

- Like Navi Mumbai's case, when an organization that is in charge of urban planning becomes an employer, and when they like to outsource the integration part, the Semi-Integrated Approach will work.
- In PPP, when a reasonable level of risk sharing by the public and the private sectors is agreed, the PPP will be more fascinated to investors.

Among them, the Semi-Integrate Approach has two types of contractors: 1) Main contractor is an independent integrator, or 2) Main contractor is a JV leader as well as one of the suppliers of the subsystem (e.g. rolling stock).

[29] Delhi Metro Rail Corporation Limited; Mass Rapid Transport System-Phase III; Design, Manufacture, Supply,, Testing, Commissioning and Training of 486 No. Standard Gauge Cars (Electrical Multiple Units); Tender 'RS10', Volume 1; Instruction to Tenderers; P5

5.3. Study of Evaluation Methods for Urban Railway Projects in India

5.3.1. World Trend of Introducing Price-Quality Evaluation Method

(1) History of Introduction in US or European Countries

Up to 1980s, the US and UK had adopted lowest price bid evaluation method in their public procurement. Both countries encountered low quality works due to the lower price procurement, and since 1990s, they have introduced price-quality bid evaluation method in positive manner. In the introductory process, they have studied and implemented various ways of evaluation in order to achieve the procurement of high quality and low price with transparency and accountability.

The public procurement in Japan had used the selective bidding system for roughly 100 years since the beginning of 20th century; however, in 1997 the Japanese Government introduced open bidding system for the procurement in order to cope with bribery problems emerged in the middle of 1990s. After introducing open bidding system, the Japanese government encountered low quality procurement due to lower bidding price. In 2005, a new law called 'Law for ensuring quality of public works' was established, and price-quality bid evaluation method was introduced.

From the understandings of the history of bid evaluation method in the US, UK and Japan, India seems to be on the transition stage from price-focused bidding system to price-quality bid evaluation system.

(US)

- In the 1980s, study on modern procurement systems, since the lowest price bid system is not the best way to ensure quality
- In 1987, set up special committee in Transportation Research Board to study innovative public procurement system, which led to studies in AASHTO and FHWA
- In 1990, pilot study of modern procurement system in the States, and SEP-14 started

(UK)

- In 1979, privatization of public works and agency of central government started under Thatcher administration
- Encountered problems with bad quality of roads and bridges due to the lowest price bid system
- After 1990s, in order to maximize VFM for public works, modern procurement system such as DB, DBFO, PFI, and two-envelope evaluation system started to be adopted

(JAPAN)

- Since the 1900s, selective bidding system had been used for around 100 years
- Due to collusion problems in 1994, open bidding system applied for public works
- In 1997, encountered bad qualities, and started to study modern procurement system
- In 2005, introduced new procurement system evaluating both quality and price under the new law for ensuring quality of public works

(2) Adoption of Price-Quality Method in EU Directives

EU Directive limits the criteria that a contracting authority may apply to award a public contract to either the lowest-price criterion; or the most economically advantageous tender (MEAT) criterion, which means applying criteria in addition to or other than price. Also, in order to ensure transparency of the procurement, the directives state that decision criteria of contractor's selection should be set up in advance, and that it should be open to the bidders.

Transparency, which means that the award criteria must be set in advance and duly disclosed to tenderers. The purpose of establishing and formally disclosing the award criteria to be applied is to ensure that:

- tenderers can prepare their tenders in a more appropriate way, trying to best meet the stated priorities of the contracting authority;
- the evaluation of tenders is carried out by a contracting authority in a transparent and reliable way and as objectively as possible;
- the relevant stakeholders, for example, audit bodies, review bodies, other government bodies or economic operators can monitor the process so as to prevent discriminatory or non-authorised award criteria from being used.

EU Directive states that the lowest price criterion has the advantage of simplicity and rapidity, but it presents some limitations, including the following:

Limitations of the lowest-price criterion: The lowest price criterion has the advantage of simplicity and rapidity, but it presents some limitations, including the following:

- It does not allow the contracting authority to take into account qualitative considerations. Apart from the quality factors built into the specifications, which must be met by all tenders, the quality of the requirement being procured is not subject to evaluation.
- It does not allow the contracting authority to take into account innovation and innovative solutions. Tenders that meet the set specifications are compliant.
- For requirements that have a long operating life, it does not allow the contracting authority to take into account the life-cycle costs of the requirement procured. When the lowest-price criterion is used, only the direct cost of the purchase or the initial purchase price within the set specifications can be taken into consideration.

EU Directive states advantages of the MEAT criterion, as opposed to the lowest price criterion, presents a series of advantages, including in particular the following:

- It allows contracting authorities to take into account qualitative considerations. The MEAT criterion is typically used when quality is important for the contracting authority.

- It allows contracting authorities to take into account innovation or innovative solutions. This is particularly important for small and medium-sized enterprises (SMEs), which are a source of innovation and important research and development activities.

- For those requirements with a long operating life, it allows the contracting authority to take into account the life cycle costs of the requirement purchased and not only the direct cost of the purchase or initial purchase price within the set specifications.

EU Directive states the following illustrative list of non-price criteria and its interpretation in order to determine the most economically advantageous tender (MEAT).

- quality
- price
- technical merit
- aesthetic and functional characteristics
- environmental characteristics
- running cost
- cost-effectiveness
- after-sales service and technical assistance
- delivery date and delivery period or period of completion

- **quality** - the quality characteristics that the object of the procurement must satisfy, for example the number of pages per minute produce by a printer or its durability
- **technical merit** - if the object of the procurement is fit for purpose and how well it performs
- **aesthetic and functional characteristics** - how the object of the procurement looks and feels and how easy it is to use
- **delivery date** - the guaranteed turnaround time from order to delivery and the ability to meet the set deadline
- **after-sales services** - what support is required and available to the contracting authority after the contract has been signed

The Directive requires the contracting authority to specify the relative weight that it gives to each criterion chosen in order to determine the most economically advantageous tender. Where weighting is not possible for demonstrable reasons, the contracting authority must indicate the criteria applied in descending order of importance. One of the reasons why weighting may not be possible is the complexity of the contract.

Source: Support for Improvement in Governance and Management: A joint initiative of OECD and EU, principally financed by EU

5.3.2. Examples of Price-Quality Method in US, UK, and other countries

(1) Highways Agency for Design-Build procurement (UK)

(Overall)

- Technical and financial proposals evaluated and scored separately;
- Total score of technical and financial calculated by weighting;
- Financial proposal is unopened and returned to the bidder, if the score of its technical proposal is less than specified value;
- Interviews to be conducted to the first and second ranked bidders for clarification of technical proposals (price negotiation not admitted);
- The bidder with highest total score will win the bidding in usual

(Weighting)

- From innovative projects to typical projects, weighting of technical and price factors is established by Employer in accordance with the projects.

Characteristics of the projects	Weightings (Technical : Price)
Innovative Project	60 : 40
Complex Project	50 : 50
Semi-complex Project	25 : 75
Typical Project	20 : 80

(Technical Evaluation Method)

- Setup evaluation items including technical proposal, contract execution, organization, etc.
- Setup weights and scores for each item

(Financial Evaluation Method)

- Provide 100 points for the lowest priced bidder, and 1 point reduction for the other bidders for every 1% price exceedance of the lowest price

(Price-Quality Evaluation Method)

- Sum up weighted technical and financial scores, and calculate price-quality score

(Evaluation Committee)

- Set up separate committee consisting of three people for each for technical proposal evaluation and financial proposal evaluation
- Evaluation works to be assisted by the consultant hired by the employer

Bidder : Evaluator :			
Main Evaluation Items	Weights (a)	Score (b)	Weighted Score (c)
Evaluation of Technical Proposal ▪ Appropriateness of Structure, Place, Drainage, Soil Works ▪ Appropriateness of Quality Control Plan including Inspection and Supervision of Works ▪ Appropriateness of Traffic, Health, and Safety Control ▪ Appropriateness of Environment Improvement Plan of Exterior, Landscape, Outdoor Facilities	10% 5% 5% 10%		
Evaluation of Contract Execution Method ▪ Contract Execution Control Schedule, Understandings of Project, Innovative Challenge ▪ Construction Method and Applying Technologies ▪ Challenge for Partnering	10% 10% 5%		
Evaluation of Organizational Management including Main Personnel Allocation Plan ▪ Adaptability of the below personnel regarding Experience, Knowledge, Technical Skill, Proficiency, etc. Project Manager Quality Manager Construction & Safety Manager Designer Training Staffs	25%		
Subcontractor Selection Process and Standards, Way of Management	10%		
Employer ▪ Contact Method with Employer and other related persons ▪ Correspondence and PR to Users	10%		
	100%		

TOTAL SCORE : ____________________ EVALUATOR : __________________

DATE & YEAR : ____________________ SIGNATURE : __________________

	Evaluation Standards	Score
A	No problems, Very High Level	10
B	A little inferior to A, but High Level	9
C	Some problems, but level meeting with Order Conditions	7
D	Severe Problems, Low Level to receive	4
E	Not Complying with Order Conditions	0

Main Evaluation Item	Weights (a)	Score (b)				Weighted Score (c)			
		A	B	C	D	A	B	C	D
Evaluation of Technical Proposal									
▪ Appropriateness of Structure, Place, Drainage, Soil Works	10%	9	7	7	9	90	70	70	90
▪ Appropriateness of Quality Control Plan including Inspection and Supervision of Works	5%	4	4	7	9	20	20	35	45
▪ Appropriateness of Traffic, Health, and Safety Control	5%	4	4	7	7	20	20	35	35
▪ Appropriateness of Environment Improvement Plan of Exterior, Landscape, Outdoor Facilities	10%	9	7	4	7	90	70	40	70
Evaluation of Contract Execution Method									
▪ Contract Execution Control Schedule, Understandings of Project, Innovative Challenge	10%	7	7	7	7	70	70	70	70
▪ Construction Method and Applying Technologies	10%	7	7	4	7	70	70	40	70
▪ Challenge for Partnering	5%	4	4	4	7	20	20	20	35
Evaluation of Organizational Management including Main Personnel Allocation Plan ▪ Adaptability of the below personnel regarding Experience, Knowledge, Technical Skill, Proficiency, etc. Project Manager Quality Manager Construction & Safety Manager Designer Training Staffs	25%	7	7	7	7	175	175	175	175
Subcontractor Selection Process and Standards, Way of Management	10%	7	7	4	7	70	70	40	70
Employer ▪ Contact Method with Employer and other related persons ▪ Correspondence and PR to Users	10%	4	7	4	7	40	70	40	70
	100%					665	655	565	730

TOTAL SCORE : ____________________ EVALUATOR : __________________

DATE & YEAR : ____________________ SIGNATURE : __________________

Technical Score of A 665/730*100=91 Technical Score of B 655/730*100=90

Technical Score of C 565/730*100=77 Technical Score of D 730/730*100=100

(1) Bid Price

		Ratio to Minimum Price
Bid A	£ 2,160,000	(1.08)
Bid B	£ 2,000,000	(1.00)
Bid C	£ 2,290,000	(1.15)
Bid D	£ 2,380,000	(1.19)

(2) Price Score

Price score of 100 point to be given to Bid B which offers minimum bid price

Price score of each bid is calculated by drawing % of excess value over the minimum price from 100

Bid A	8.00 (=160,000/2,000,000*100)	100-8=92
Bid B	0.00 (=0/2,000,000*100)	100-0=100
Bid C	14.5 (=290,000/2,000,000*100)	100-14.5=85.5
Bid D	19.0 (=380,000/2,000,000*100)	100-19=81

	(1)	(2)	(3)	(4)	(5)	(6)
Bidder	Technical Score	20% of (1)	Bid Price	Price Score	80% of (4)	Total Score (2)+(5)
A	91	18.2	2,160	92	73.6	91.8
B	90	18	2,000	100	80.0	98.0
C	77	15.4	2,290	85	68.0	83.4
D	100	20.0	2,380	81	64.8	84.8

Technical Evaluation: 20%, Price Evaluation: 80%

Bidder B wins the bid.

(2) Procurement of Construction Works at Scotland, UK (Design-Build)

(Overall)

- The tenders must be evaluated on the basis of VFM (defined in the Regulations as “most economically advantageous to the contracting authority”) and not lowest cost alone, and the award stage of the process must involve a fair, transparent and accountable method of evaluating tender submissions.
- It should also involve an appropriate balance of quality with price taking account of whole life costs. The weights may be specified as a range. Where it is not possible to provide weights, the criteria should be listed in descending order of importance.

＜Typical award process＞

- confirm candidates;
- establish:
  - award criteria;
  - weightings for award criteria;
  - quality/price ratio;
  - award mechanism; and
  - quality and price scoring.
- prepare instructions to tenderers and invite tenders;
- publish award criteria and weightings
- evaluate “quality” element of tenders then evaluate “price” element:
- balance quality and price;
- notify award decision and debrief unsuccessful candidates
- adhere to ‘standstill period’ before awarding contract.

<Examples of Award Criteria>

- teamworking arrangements:
  - partnering with client; and
  - partnering with sub-contractors and suppliers;
- aesthetic and functional characteristics:
  - design;
  - operating costs;
  - ease of use;
  - adaptability for changes in use;
  - demonstration of innovation in proposals; and
  - maintainability;
- proposals for managing the contract:
  - procedures for planning, programming and management;
  - programme for completing contract, including milestones for achieving objectives;
  - risks identified and proposals for their management;
  - communication arrangements; and
  - quality plan;
- project team organisation:
  - qualifications and experience of team members, relevant to the project;
  - appropriately experienced senior managers/partners;
  - responsible senior managers;
  - qualifications;
  - length of service; and
  - directly relevant experience;
  - quality of other senior personnel:
  - suitably qualified;
  - position within the organisation; and
  - amount of time devoted to the project;
  - resources;
- technical merit:
  - appropriate to the client's needs and constraints;
  - degree of flexibility in carrying out the contract;
  - method of carrying out contract;
  - approach to Construction Design and Management Regulations;
  - how health and safety issues will be identified, assessed and managed during the design and construction stages (see also Section 5);
  - quality of documentation;
  - method of presenting information; and
  - standards of materials, checks and independent inspections;
- services provided from external sources:
  - joint-venture arrangements proposed;
  - if so, are responsibilities of the joint venture parties clear; and
  - arrangements made for sub-contracting:
    - proposals for managing the delivery of any sub-contracted services successfully;

＜Examples of Award Mechanism＞

TABLE 2 – ILLUSTRATIVE EXAMPLE OF AWARD MECHANISM

Project title:			Assessors: *Assessor 1* *Assessor 2*				
Quality weighting: *60*							
Price weighting: *40*							
QUALITY SCORES (see paragraph A3.7)							
Quality criteria	Criteria weight %	Firm A		Firm B		Firm C	
		Score	Wtd. Score	Score	Wtd. Score	Score	Wtd. Score
Proposals for, and understanding of, project.	*30*	*60*	*18.00*	*65*	*19.50*	*75*	*22.50*
Experience and resources of proposed project team.	*20*	*55*	*11.00*	*65*	*13.00*	*70*	*14.00*
Project management/ teamworking skills.	*10*	*65*	*6.50*	*60*	*6.00*	*60*	*6.00*
Risk management skills and experience.	*10*	*60*	*6.00*	*70*	*7.00*	*65*	*6.50*
Aesthetic character of proposals.	*15*	*70*	*10.50*	*75*	*11.25*	*70*	*10.50*
Maintainability.	*15*	*50*	*7.50*	*65*	*9.75*	*75*	*11.25*
Totals	100		***59.50***		***66.50***		***70.75***
PRICE SCORES (see paragraphs A3.8 and A3.12)							
Tender price		*£550,702*		*£740,217*		*£640,360*	
Price score (mean *£643,760*)		***64.50***		***35.00***		***50.50***	
OVERALL SCORES							
Quality weighting x quality score		*60% x 59.50 = 35.70*		*60% x 66.50 = 39.90*		*60% x 70.75 = 42.45*	
Price weighting x price score		*40% x 64.50 = 25.80*		*40% x 35.00 = 14.00*		*40% x 50.50 = 20.20*	
Overall score		***62***		***54***		***63***	
Order of tenders		***2***		***3***		***1***	
Comments:							
Signed by Assessors: *Assessor 1*			*Assessor 2*			Date:	

(Quality/Price Ratio)

- Quality/Price Ratio increases in proportion to the complexity of the project

Type of project	Indicative quality/price ratio for consultants	for contractors
Feasibility studies	80/20 to 90/10	not applicable
Innovative projects	70/30 to 85/15	20/80 to 40/60
Complex projects	60/40 to 80/20	15/85 to 35/65
Straight forward projects	30/70 to 60/40	10/90 to 25/75
Repeat projects	10/90 to 30/70	5/95 to 10/90

(Quality Scoring)

- The quality scoring system indicates how well each organization's quality bid meets each of the award criteria

Score	How well the organisation's bid meets each criterion
100	meets criterion exceptionally well (difficult to improve);
50	meets criterion at an acceptable level; and
0	does not address criterion at all.

(Price Scoring)

- The mean price of the acceptable tenders received is given 50 points;
- 1 point is deducted from the score of each tenderer for each percentage point above the mean; and 1 point is added to the score of each tenderer for each percentage point below the mean

(Value for Money)

- The prime objective of the Scottish Government's procurement policy is to achieve VFM – the optimum combination of whole life cost and quality to meet the customer's requirement.
- Every opportunity to achieve VFM should be evaluated properly and informed decisions taken.
- VFM does not necessarily mean accepting the lowest bid as quality, as well as price, must be considered when appointing consultants and contractors.

What is Value for Money (VFM)?

The prime objective of the Scottish Government's procurement policy is to achieve VFM – the optimum combination of whole life cost and quality to meet the customer's requirement. Quality may relate to a number of relevant factors including functionality, durability, aesthetic appropriateness to surroundings, long-term adaptability and maintenance, environmental implications and ability of consultants and contractors to innovate, improve buildability and work as a team.

Why is it important and how is the process monitored?

Every opportunity to achieve VFM should be evaluated properly and informed decisions taken. In this way, management can have confidence in answering any subsequent questions on the entire decision making process and provide full justification for the decisions taken.

When internal or external audit carry out reviews of works projects, it can be expected that consideration will be given to how resources have been used, what influenced the decisions that were taken, whether the best advice available was obtained and implemented, whether risks were managed properly and whether informed judgements were made.

Is lowest always best?

VFM does not necessarily mean accepting the lowest bid as quality, as well as price, must be considered when appointing consultants and contractors. Innovation should not be stifled through rigid adherence to mechanistic procedures, although accountability for public funds remains extremely important and should not be compromised.

The Scottish Government and certain other public sector organisations must comply with the EC procurement rules as implemented by the Public Contracts (Scotland) Regulations 2006 and Amendment Regulations 2009. They are entirely consistent with the policy objective of achieving VFM.

Source: Construction Works Procurement Guidance

(3) Adjusted Scoring Method in the US (Road Sector, Montana State)

(Overall)

- The TRC should establish meeting procedures, confidentiality expectations, set rules of order and determine the methodology and criteria it will employ in the evaluation and scoring process in advance of evaluating the Technical Proposals.
- The TRC will evaluate each Firm's Technical Proposal based on the rating criteria provided in the Request for Proposals. Each TRC member is responsible for scoring each Technical Proposal for all evaluation criteria.
- A minimum of three TRC member scores is required for each evaluation criteria prior to adding or averaging the scores for development of a final Technical Proposal score.
- The Contract Plans Bureau will publicly open the sealed Bid Price Proposals and divide each Firm's price by the total Technical Proposal score provided by the TRC to obtain an adjusted score.
- The lowest adjusted score will be considered the best value proposal.

＜Examples of Adjusted Score＞

FIRM	TOTAL TECHNICAL SCORE	BID PRICE PROPOSAL AMOUNT	ADJUSTED SCORE (Best Value)	
A	90	$6.7 Million	74,444	
B	80	$6.5 Million	81,250	
C	70	$6.3 Million	90,000	
D	90	$6.3 Million	70,000	◎
E	70	$6.7 Million	95,714	

＜Examples of Adjusted Score considering Value of Time＞

	Total Technical Score	Contract Time (Days)	Time Value (Days x $/day)	Bid Price Proposal	Time Adjusted Price (Time Value + Bid Price Proposal)	Adjusted Score	
A	90	300	$600K	$6.7 M	$7.3 M	81,111	◎
B	80	250	$500K	$6.5 M	$7.0 M	87,500	
C	70	400	$800K	$6.3 M	$7.1 M	101,428	

Value of time: $2,000/day

＜Examples of Scoring Sheet＞

1. Environmental Protection/Commitments (_____ points)

Credit will be given for minimizing impacts to the environment during all phases of design/construction and ensuring that all environmental permits and commitments are honored. The amount of credit should be proportional to the amount of reduction in wetlands or other types of mitigation quantities.

2. Maintainability (_____ points)

For building facilities, credit will be given for a design that minimizes periodic and routine maintenance. The following elements should be considered: access to provide adequate inspections and maintenance of plumbing, HVAC and electrical systems and quality of construction materials. Credit will be assigned for exceeding minimum material requirements to enhance durability of structural components and for providing extended warranties/guarantees for major elements such as roof systems, siding, doors and fixtures.

3. Warranty/Contractor Guarantee (_____ points)

For other than building facilities, credit will be given for the extent of the warranty coverage.

4. Schedule (_____ points)

Credit will be given for a comprehensive and logical schedule that minimizes contract duration while adhering to applicable Specifications. Proper attention should be provided to the project's critical path elements.

5. Coordination (_____ points)

Credit will be given for a coordination plan and effort that includes, as a minimum, coordination with the following groups:

- MDT Management Team
- Community and Businesses
- Adjacent Property Owners
- Permitting/Environmental Agencies
- Utility Owners
- Local Governments

6. Quality Management Plan (_____ points)

Credit will be given for a timely, complete and comprehensive quality management plan that incorporates effective QC/QA and includes all phases of the project.

7. Maintenance of Traffic (_____ points)

Credit will be given for a Maintenance of Traffic (MOT) scheme that minimizes disruption of roadway traffic and implements the Work Zone Safety and Mobility Policy. This will include, but not be limited to, minimization of lane closures, lane widths, visual obstructions, detours and significant reductions in speed limits.

8. Aesthetics (_____ points)

A narrative description with conceptual sketches for proposed aesthetics will be considered in the geometry, economy, and appropriateness of structure type, structure finishes, shapes, proportion and form. Architectural treatments such as tiles, colors and emblems will not be considered as primary aesthetic treatments.

9. Design and Geotechnical Services Investigation (_____ points)

Credit will be given for the quality of the following elements:

- Quality and quantity of design resources
- Design coordination and plans preparation schedule
- Construction coordination plan minimizing design changes
- Geotechnical investigation plan
- Structure design

10. Construction Engineering Inspection (_____ points)

Evaluation of construction engineering and inspection capabilities will be based on the reputation, qualification and experience of the CEI Consultant team assigned to the project. Credit will be given for a comprehensive CEI program managed by qualified, competent and experienced field/construction personnel. Experience in providing CEI services on projects of a comparable nature, size, and complexity and on projects for MDT, other DOTs or public agencies will be considered in evaluating proposals.

11. Construction Methods (_____ points)

Credit will be given for construction methods that minimize impact to the traveling public and the environment, reduce costs, improve worker safety and minimize contract duration. Credit will be given for exceeding minimum material requirements to enhance durability of project components.

12. Design-Build Experience (_____ points)

Credit will be given for the Firm's experience on similar work and the individual team member's successful design-build experience. Consideration will be given to:

- Firm leadership and areas of responsibility.
- Experience of Key personnel.
- Firm internal coordination plan.
- Firm commitment to and history of providing a quality project, completed on time and within budget.

13. Litigation/Dispute History (_____ points)

Review contractor claims records. A history of contractor claims pertaining to additional compensation or time extensions that are not negotiated and resolved through an Administrative Settlement, or final estimate quantities disputes that proceed, after final acceptance, to court or arbitration. Also, a history of disputes being escalated to the Board of Contract Appeals (or the equivalent with other owners) by a member of the Firm should be considered.

14. Landscaping (_____ points)

Credit will be given for the quality of the elements presented in a narrative describing the theme, use of native plants and methods to minimize maintenance, if applicable.

Source: Design-Build Guidelines, MONTANA DEPARTMENT OF TRANSPORTATION

(4) Bid Selection Process in Queensland, Australia

(Overall)

- According to the State Procurement Policy, VFM (Value for Money) should be achieved.
- Evaluation is conducted for Price criteria and non-price criteria separately. Criteria and weighting of non-price criteria is specified in the bidding document
- Non-price criteria includes proposed construction method, resource strategies, other items decided by the employer regarding the project, and etc.
- Tender evaluation panel consisting of more than 3 persons who are involved in the preparation of bidding document evaluates the bids

＜Requirement to the Tender Evaluation Panel＞

A tender evaluation panel is required to evaluate tenders for all projects where non-price evaluation criteria form part of the conditions of tender. The panel should comprise at least three people, including the following:

- an officer who was involved in preparing the tender documents for the project
- an officer with a sound and current technical knowledge of the construction process, capable of fully understanding and interpreting the tenders
- an officer with sound knowledge of the *Capital Works Management Framework* and the *State Procurement Policy*.

Tender panellists should be aware that information received from tenderers must be treated as commercial-in-confidence.

＜Evaluation Process by Tender Evaluation Panel＞

- an initial meeting of the tender panel, prior to tender close, to confirm the members' understanding of the project time-frame, evaluation criteria, criteria weightings and required project outcomes
- a subsequent meeting of the panel to evaluate the completeness of tender information received (i.e. that all parts of each tenderer's submission have been received)
- where non-price criteria represent more than 50% of the total weightings, presentations by tenderers may be considered (N.B. panel members evaluate and score these presentations individually)
- a meeting of the panel to finalise scoring
- the recommendation of a preferred tenderer (pending the outcome of the technical review and financial capacity assessment).

＜Non-price evaluation criteria for project＞

Non-price criteria addressing contractor methodology may focus on any of the following 'sub-criteria':

- buildability/maintainability
- community consultation
- consultant management
- design management
- environmental sustainability
- handover management
- innovation
- programming of works
- safety
- subcontractor management
- use of local industry
- waste management
- communication
- construction management
- cost management
- documentation management
- functionality
- incorporation of best practice
- life cycle costs
- quality management
- site management
- supporting equipment and systems
- user group/client management

A contractor's resource strategy will specify which individuals, companies and sub-contractors will be involved in the project: It may include some or all of the following aspects:

- key managerial and supervisory personnel
- key team members (including their resumes)
- key trade packages
- a project organisation chart
- identification of key activities in terms of tasks and people
- management structures, roles, and reporting relationships
- the contractor's past and current time-related performance
- personnel back-up strategy
- referees.

Source: Contractor PQC Tendering and Selection Process, Queensland Government

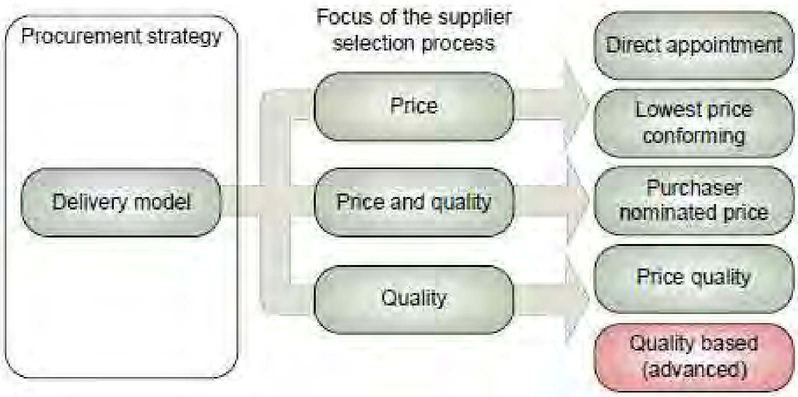
(5) Procurement of Transportation Bureau, New Zealand

(Overall)

- Three types of supplier selection system; Price focusing, Quality focusing, and Price & Quality focusing;
- 6 non-price factors including appropriate past experiences, relevant skills, etc.
- As for weights of price and quality, apply quality premiums based on the weights of price, and evaluate both price and quality

＜Selections of Suppliers＞

- Focus on price – all participants must meet quality requirements and the supplier is then chosen on the basis of price.
- Focus on both price and quality – the quality attributes of the suppliers are graded and the preferred supplier is selected by balancing price and quality.
- Focus on quality – the preferred supplier is selected on the basis of quality, with the price being negotiated afterwards.



＜Criteria of Non-price Factor＞

- relevant experience – the supplier's previous experience in technical areas relevant to the outputs being purchased
- relevant skills – the competence of the personnel that the supplier proposes to use, with particular regard to their skills and experience in areas relevant to the outputs being purchased
- methodology – the procedures the supplier proposes to use to achieve the specified end result
- track record – the supplier's record of delivering works or services to the quality standards required, on time and within budget
- resources – the equipment, including facilities and intellectual property, that the supplier proposes to use to deliver the outputs
- financial viability – the supplier's ability to access the financial resources required to deliver the outputs to be purchased.

<**Weights of Price and Quality**>

The formula for calculating the supplier quality premium value for each proposal when using the price quality method of supplier selection is:

Supplier quality premium = estimate × (weighted sum margin / price weight)

The following table shows the relationship between price weight and supplier quality premium. The supplier quality premium ($s) per grade point figures are based on an estimate of $100. They are the amount by which the supplier quality premium value (for a particular proposal) will change when the non-price attribute grades, for every non-price attribute to be graded, is increased by 1 grade point.

Price weight	Supplier quality premium ($s) per grade point
10	9.00
20	4.00
30	2.33
40	1.50
50	1.00
60	0.67
70	0.43

The impact of using a different price weight can be substantial. Supplier quality premium values when using a price weight of 10 are 21 times as large as those calculated when using a price weight of 70 (all other things being equal). Changing the price weight by just 10 (eg from 70 to 60) increases the supplier quality premium values by a factor of 1.55, while using 10 rather than 20 multiplies the values by 2.25.

To illustrate these points by way of example – if two proposals are received and the non-price attributes to be graded are each awarded 75 points for the superior supplier and 70 for the other supplier (a 5 point difference for all graded non-price attributes), the supplier quality premium for the superior supplier will be equal to 2.14 percent of the estimate when a price weight of 70 is used, 20 percent when a price weight of 20 is used and 45 percent when a price weight of 10 is used.

Source: Procurement Manual: for activities funded through the National Land Transport Program

5.3.3. Price-Quality Evaluation Method for Rolling Stock Procurement

(1) BART (Bay Area Rapid Transit) (San Francisco, US)

(Overall)

- As for the overall procurement, BART has various types of contracts including two-step sealed bidding and competitively negotiated contracts. However, for the procurement of electronic and specialized rail transit equipment or rehabilitation of transit vehicles, BART applies competitive negotiation policies and procedures.
- This decision is made by the Board of BART District that the standard competitive bidding is not applicable for this procurement, and that it cannot meet the requirements of BART.

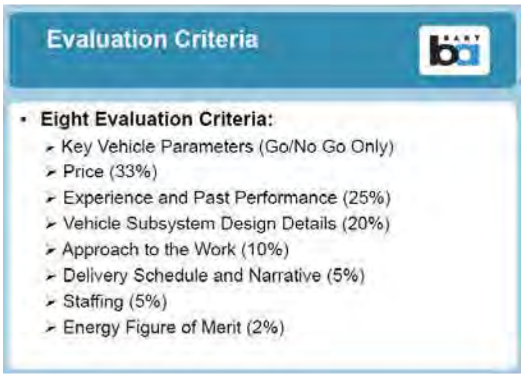
> The San Francisco Bay Area Rapid Transit District (the "District") is authorized by California Public Contract Code Section 20229.1 to purchase certain electronic and specialized rail transit equipment, as well as to contract for certain work related to the rehabilitation of transit vehicles, by competitive negotiation. The District's Board of Directors, by a two-thirds vote, may direct such a purchase upon a finding that purchasing the equipment or contracting for the work in compliance with the standard competitive bidding statutes is not adequate for the District's needs.

(Evaluation Process)

- Receive the 1st step proposal from the participants, and decide the competition criteria
- Conduct negotiation with the participants, and request and receive BAFO: Best and Final Offer
- Proposal evaluation committee consisting of price evaluation sub-committee and technical evaluation sub-committee conduct evaluation
- Evaluation item and its scoring method is specified in detail in the RFP (Request for Proposal)
- Price evaluation sub-committee conducts financial evaluation after technical evaluation. Price proposal is returned unopened to the bidder, if technical proposal is not accepted by technical evaluation sub-committee
- Sum-up technical score and financial score, and select the bidder with the highest score as contractor

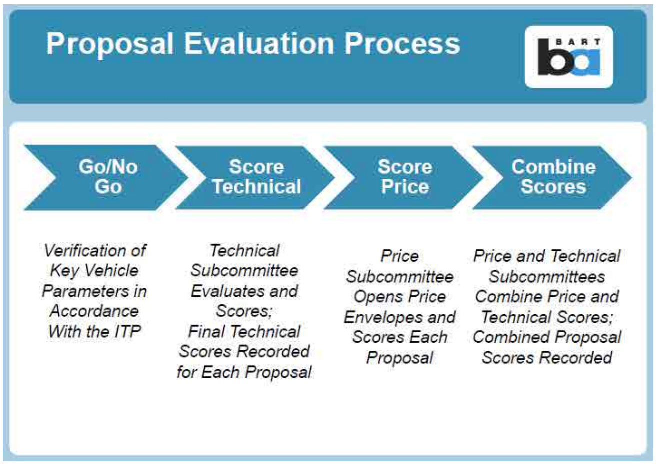
(Evaluation Item and Weight: RFP No.40FA-110)

- 8 items set up as evaluation criteria with price weight of 33%, track record and experience at 25%, design details at 20%, and others at less than 10%



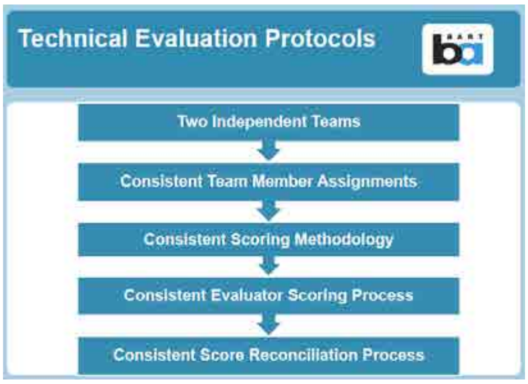
(Evaluation Procedure)

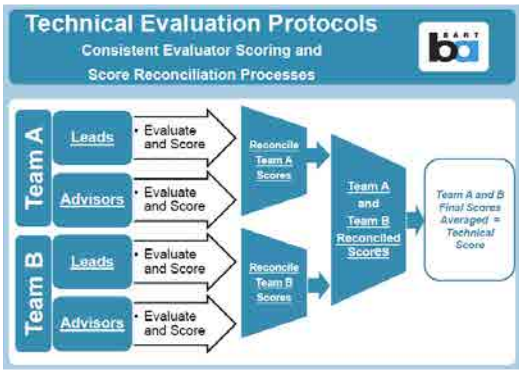
- Evaluate technical proposal, open technical proposal, open financial proposal, and conduct price-quality evaluation in sequence



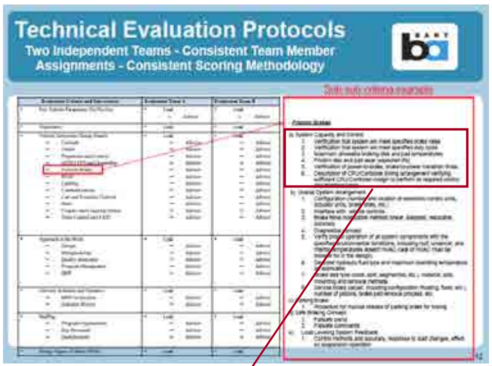
(Evaluation Protocol)

- Two independent evaluation teams conduct the evaluation of each item





- More than 20 sub-items and more than 500 sub-sub-items are organized for technical evaluation, and guidelines for the evaluator with more than 300 pages are prepared



7.D.6 Friction Brakes

a. System Capacity and Control

1. Verification that system will meet specified brake rates
2. Verification that system will meet specified duty cycle
3. Maximum allowable braking disk and pad temperatures
4. Friction disc and pad wear (expected life)
5. Verification of power-to-brake, brake-to-power transition times
6. Description of CPU/Controller timing arrangement verifying sufficient CPU/Controller margin to perform all required control and interface tasks

※Detailed description of the specification requirements and guidelines to be provided for each category in order for the evaluator to keep the relevant score for each category.

Sub-Sub-Criteria (Detailed Descriptions)

Specification Requirements and Guidelines

2.9.6 Braking

A. Friction brake rates shall be available over the full speed range with vehicle weights from AW0 through AW3 and all wheel diameters:
   1. Open-loop brake rate (80 to 0 mph): 3.0 mphps with an instantaneous tolerance of ± 10 percent, and a tolerance of ±7 percent over any 5 second period.
   2. Yard Manual: 3.0 mphps with an instantaneous tolerance of ± 10 percent and a tolerance of ±7 percent over any 5 second period.

B. Emergency Stop Rates shall be the same as Open Loop Brake Rates and shall have the same tolerances.

C. For loads from AW0 through AW2, electric brakes (regenerative and rheostatic) shall provide full braking effort from 80 mph to 3.0 mph or less.

D. Deceleration rate calculations (limited to the value and tolerances defined in Section TS2.9.6, Braking, bullet A, sub-bullet 1) shall not include train resistance, but may include motor and gear losses. Refer to Section TS2.9.1, Train Resistance.

E. Reserved.

F. Braking controls shall provide for blending of friction and electric brake systems.

G. Braking controls shall provide for linear brake rate variations from 0 to 3.0 mphps.

H. Default Brake Pressure: If open-loop brake is requested and dynamic brake torque is less than 90 percent of the requested electric brake level and no brake caliper

⋮

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Sources: Procurement Manual, San Francisco Bay Area Rapid Transit District; and Procurement Overview and Recommendation for Award to Board of Directories

(Scoring Method)

- Each individual team records the score ranging from 1 to 10.

EVALUATION SCORESHEET - TEAM A

Individual Evaluation Team Member Scores

Team Member Name (print): ____________

Date of Review: ____________

Proposer Name: ____________

NOTES: Place an X in the box to the right to note whether GO or NO-GO
Scored sections are evaluated on a 1-10 scale, with 10 being the highest score

Key Vehicle Parameters	A Points	N/A				
General Arrangement and Clearance Drawings	A_1	Go		No-Go		
Key Vehicle Dimensions	A_2	Go		No-Go		
Vehicle Weight Schedule	A_3	Go		No-Go		
Performance Simulation	A_4	Go		No-Go		
		Max Pts	*Score*		*Adj Score*	
Experience (X% of overall points assigned by eval team)	C Points	X			0.00	
Experience in Providing Similar Car Designs for Other Properties	C_1	X1	1 to 10		Score	
Transit Agency References (minimum three)	C_2	X2	1 to 10		Score	
Proposer's History of Meeting Schedule on Other Projects	C_3	X3	1 to 10		Score	
		Max Pts	*Score*		*Adj Score*	
Vehicle Subsystems Design Details (Y% of overall points assigne	D Points	Y			0.00	
Carbody	D_1	Y1	1 to 10		Score	
Trucks	D_2	Y2	1 to 10		Score	
Propulsion and Control	D_3	Y3	1 to 10		Score	
APSE, LVPS and Grounding	D_4	Y4	1 to 10		Score	
Friction Brakes	D_5	Y5	1 to 10		Score	
HVAC	D_6	Y6	1 to 10		Score	
Lighting	D_7	Y7	1 to 10		Score	
Communications	D_8	Y8	1 to 10		Score	
Cab & Trainline Controls	D_9	Y9	1 to 10		Score	
Doors	D_{10}	Y10	1 to 10		Score	
Coupler and Coupling Systems	D_{11}	Y11	1 to 10		Score	
Train Control and VATC	D_{12}	Y12	1 to 10		Score	
		Max Pts	*Score*		*Adj Score*	
Approach to the Work (Z% of overall points assigend by eval tean	E Points	Z			0.00	
Approach to the Design	E_1	Z1	1 to 10		Score	
Approach to Manufacturing	E_2	Z2	1 to 10		Score	
Approach to Quality Assurance	E_3	Z3	1 to 10		Score	
Approach to Program Management	E_4	Z4	1 to 10		Score	
Approach to SMP, Maintainability & User Ed	E_5	Z5	1 to 10		Score	

EVALUATION SCORESHEET - TEAM A

Individual Evaluation Team Member Scores

Team Member Name (print): ____________

Date of Review: ____________

Proposer Name: ____________

		Max Pts	*Score*		*Adj Score*
Schedule and Narrative (A%)	F Points	A			0.00
MPS - Validity of activities, durations, and logic	F_1	A1	1 to 10		Score
Proposer's ability to meet schedule	F_2	A2	1 to 10		Score
		Max Pts	*Score*		*Adj Score*
Staffing (B%)	G Points	B			0.00
Program Organization	G_1	B1	1 to 10		Score
Key Personnel Commitment and Resource Loading Chart	G_2	B2	1 to 10		Score
Staff Qualification/Résumés	G_3	B3	1 to 10		Score
		Max Pts			*Adj Score*
Energy Figure of Merit (C%) (net energy consumption)	H Points				
$\frac{\text{Lowest EFM x C}}{\text{Proposer's EFM}}$ = Proposer's EFM Score	H	C	Score		Score

SUMMARY:

GO	NO-GO
0	0

ID	
C	0.00
D	0.00
E	0.00
F	0.00
G	0.00
H	Score
Total Adjusted Score	0.00

Signature: ____________

Date:

Note: The sum of the points listed against each sub-element when added together would equal the Max Pts for that category. For example, under Experience, there are three sub-element C1, C2, C3. If the Max Pts for Experience is X, then X1 plus X2 plus X3 would equal the total number of points assigned "X"

Once the scores on a 1 to 10 basis are recorded against each sub-element the points, such as X1 are multiplied by the score and recorded in the box. The Adjusted Score is the sum for the whole category. The sum of all Adjusted Scores is the technical evaluation score for that proposer.

- Average score of the 2 teams for each item is calculated, and the total score is obtained.

  ※ Consideration of Energy Figure is only a part of the technical evaluation. Also, the score is not transferred into the price, nor the huge penalty (ex. 30 years) is imposed as in DMRC.

EVALUATION SCORESHEET C

Evaluation Teams Average Score

Proposer Name: ____________________ **Date:** ____________________

Item	Points	Team A	Team B	AVG
Pricing (P% assigned by eval team)	B Points			SCORE
Proposer's Price Score = $\frac{\text{Lowest Price} \times P}{\text{Proposer's Price}}$	MAX: P			
Experience (X%)	C Points	Team A	Team B	AVG
Experience in Providing Similar Car Designs for Other Properties	C_1	X1 A	X1 B	0.00
Transit Agency References (minimum three)	C_2	X2 A	X2 B	0.00
Proposer's History of Meeting Schedule on Other Projects	C_3	X3 A	X3 B	0.00
				0.00
Vehicle Subsystem Design Details (Y%)	D Points	Team A	Team B	AVG
Carbody	D_1	Y1 A	Y1 B	0.00
Trucks	D_2	Y2 A	Y2 B	0.00
Propulsion and Control	D_3	Y3 A	Y3 B	0.00
APSE, LVPS and Grounding	D_4	Y4 A	Y4 B	0.00
Friction Brakes	D_5	Y5 A	Y5 B	0.00
HVAC	D_6	Y6 A	Y6 B	0.00
Lighting	D_7	Y7 a	Y7 B	0.00
Communications	D_8	Y8 A	Y8 B	0.00
Cab & Trainline Controls	D_9	Y9 a	Y9 B	0.00
Doors	D_{10}	Y10 A	Y10 B	0.00
Coupler and Coupling Systems	D_{11}	Y11 A	Y11 B	0.00
Train Control and VATC	D_{12}	Y12 A	Y12 B	0.00
				0.00
Approach to the Work (Z%)	E Points	Team A	Team B	AVG
Approach to the Design	E_1	Z1 A	Z1 B	0.00
Approach to Manufacturing	E_2	Z2 A	Z2 B	0.00
Approach to Quality Assurance	E_3	Z3 A	Z3 B	0.00
Approach to Program Management	E_4	Z4 A	Z4 B	0.00
Approach to SMP, Maintainability & User Ed	E_5	Z5 A	Z5 B	0.00
				0.00
Schedule and Narrative (A%)	F Points	Team A	Team B	AVG
MPS - Validity of activities, duration and logic	F_1	A1 A	A1 B	0.00
Proposer's ability to meet schedule	F_2	A2 A	A2 B	0.00
				0.00
Staffing (B%)	G Points	Team A	Team B	AVG
Program Organization	G_1	B1 A	B1 B	0.00
Key Personnel Commitment and Resource Loading Chart	G_2	B2 A	B2 B	0.00
Staff Qualification/Résumés	G_3	B3 A	B3 B	0.00
				0.00
Energy Figure of Merit (C%) (net energy consumption)	H Points	Team A	Team B	AVG
$\frac{\text{Lowest EFM} \times C}{\text{Proposer's EFM}}$ = Proposer's EFM Score	H	Score	Score	0.00

Summary

B Pricing
C Experience
D Subsystem Design
E Approach to the Work
F Schedule and Narrative
G Staffing
H Energy Figure of Merit

TOTAL 0.00

(2) Macau Light Rail Transit System

(Overall)

- Evaluation weights of Price and Technical are 55% and 45%, respectively;
- Weight of price consists of 29% for system, rolling-stock, design & build of bridge; 11% for the 10-year maintenance service, and; 15% for the necessary options of capacity improvement
- Weight of technical consists of 15% for documentation; 8% for rolling-stock and system explanation, and; 7% for method and organization, and etc.

(Price)

- Lump-Sum amount for systems and number of trains necessary for 7,800 PPHPD during peak hours and for the works regarding the Design and Build, Turnkey solution for Sai Van Bridge – 29%
- **Lump-Sum amount for the 5 + 5 years Maintenance Services Options (for the systems and trains to be supplied in the Basic Proposal)** -– 11%
- **Lump-Sum amount for "Additional Trains Batch" Options (including associated parts, maintenance, upgrade of Depot in Taipa, necessary to take into account all the capacity increases)** – 15%

(Technique)

- Justifications Reports – 15%
- Rolling Stock and Systems Description – 8%
- Methodology and Organization – 7%
- Tenderer experience – 6%
- Solution for the Sai Van Bridge's Improvement Works – 6%
- Preliminary Technical Plans – 3%

(Bid Result)

- Mitsubishi Heavy Industry, Inc. (MHI) was selected from 3 competing companies: Bombardier, Siemens, and MHI;
- Bid price of MHI was at the 2nd position for main parts, however, was at the 1st position for option parts, and consequently, for the total still at the 1st position

International Open Tender for the "Rolling Stock & Systems for the Phase 1 of Macau LRT" Tenders' Public Opening Session

第一部份《文件》開啟結果

Part 1 Proposa l- Documents Opening Result

序號 No.	競投人 Tenderer	備註 Remarks
1	西門子 – 中土港澳建築工程 Siemens – CCECC Consortium	接納 Admitted
2	三菱重工有限公司 Mitsubishi Heavy Industries, Ltd.	接納 Admitted
3	龐巴迪運輸 – 中國路橋工程 BT CRBC LRT Consortium	接納 Admitted

Part 2 Proposal - Financial Portion – Basic Proposal Lump-sum Price

序號 No.	競投人 Tenderer	基本項目固定金額 (澳門幣) Basic Proposal Lump-sum Price (MOP)
1	西門子 – 中土港澳建築工程 Siemens – CCECC Consortium	$ 6,281,592,632.00
2	三菱重工有限公司 Mitsubishi Heavy Industries, Ltd.	$ 4,688,000,000.00
3	龐巴迪運輸 – 中國路橋工程 BT CRBC LRT Consortium	$ 4,567,143,775.07

Part 2 Proposal - Financial Portion – Optional Works Lump-sum Price

序號 No.	競投人 Tenderer	可選擇項目固定金額 (澳門幣) Optional Works Lump-sum Price (MOP)	
		2014-2019 及 2020-2024 維護服務 Maintenance 2014 - 2019 and 2020 - 2024	滿足 2020 年系統運量之額外兩列車批次 2 Additional Train Batches Fulfilling Year 2020 Line Capacity
1	西門子 – 中土港澳建築工程 Siemens – CCECC Consortium	$ 2,018,215,398.00	$ 2,637,841,167.00
2	三菱重工有限公司 Mitsubishi Heavy Industries, Ltd.	$ 792,810,000.00	$ 1,510,540,000.00
3	龐巴迪運輸 – 中國路橋工程 BT CRBC LRT Consortium	$ 1,662,066,540.17	$ 1,792,431,706.79

Source: Macau Light Rail Transit

(3) Kuala Lumpur MRT Rolling Stock Procurement

(Evaluation Method)

- Evaluation process is open to public considering the procurement transparency
- The bid winner is selected through the following 5 stages.

＜Tender Evaluation Process＞

7.5 Tender Evaluation Process

(a) Tender Evaluation is a staged process, with the Basic Documents, Technical, Financial, Commercial, Offset Programme and lastly Legal submissions assessed in sequence; as detailed below :

i) Stage 1 – Screening of Basic Documents & Screening of Offset Programme Submission

- It is a mandatory requirement to submit the compliant Basic Documents in full (see 'Contents Checklist for Envelope 1 (Basic Documents & Offset Programme Submission)' as attached in Appendix A1 of this ITT), failing which the Tenderer's Tender will be disqualified.
- Concurrently, the screening of an Offset Programme submission will be carried out. Failure to submit the Offset Programme proposal will result in the Tender Submission being disqualified.
- Only Tenderers who passed the screening of the Basic Documents and Offset Programme submissions will have their Technical and Financial Submissions opened and evaluated next.

ii) Stage 2 – Evaluation of Technical & Financial Submissions

- The Financial Submission will be evaluated based on the information provided and submitted as outlined in **Form C9** – Financial Data as attached in Appendix C of this ITT. This includes checking the completeness of information / data submitted (see "Contents Checklist for Envelope 2 (Financial Submission)" as attached in Appendix A2 of this ITT) and carrying out appropriate financial analysis
- Concurrently, the Technical Submission will be opened and evaluated for compliance with the Works' requirements and to assess the risk mitigation measure provisions and methods of work execution. The allocation of marks will be based on the information and supporting documents submitted by the Tenderer (see "Envelope 3 (Technical Submission)" as attached in Appendix B1 of this ITT). This includes inter alia; completeness of the scope of work, project implementation schedule, construction works programme, project execution plan, construction method statements, detailed technical requirements, provision of Quality Assurance (QA) and Safety, Health & Environmental (SHE) Plans.
- The evaluation scoring will be carried out at this stage. Only Tenderers who passed both the Financial and Technical evaluation will have their Form of Tender screened, their Commercial and Offset Programme Submission opened and evaluated next.

iii) *Stage 3 – Screening of Form of Tender, Evaluation of Commercial Submission & Evaluation of Offset Programme Submission*

- Failure to submit the Form of Tender will result in the Tender Submission being disqualified (see 'Contents Checklist for Envelope 4 (Commercial Submission)' in Appendix A3 of this ITT').

- The Form of Tender must contain the total Tender Price, in Numeric and Words, and signed by the Tenderer's Authorised Signatories, besides filling in other details as stipulated in Clause 6.9.2 of this ITT.

- Concurrently, the other Commercial Submission (see 'Contents Checklist for Envelope 4 (Commercial Submission)' in Appendix A3 of this ITT') will be opened, evaluated and marked in accordance with the Pricing Document set out in Volume V of the Tender Documents.

- Prices submitted in accordance with the Pricing Document shall be checked for completeness and arithmetical error(s). Error(s) discovered shall be treated in accordance with Clause 6.9.2 of this ITT.

- Concurrently, the Offset Programme submission (see 'Contents Checklist for Envelope 1 (Basic Documents & Offset Programme Submission)' in Appendix A1 of this ITT') will be opened, evaluated and marked in accordance with the Offset Programme set out in Volume VI of the Tender Documents. Evaluation of an Offset Programme submission will be based on, but not limited to, the detail execution plan and the value of benefits that the Tenderer's proposal will create.

- The evaluation scoring will be carried out at this stage. Only Tenderers who passed the screening of the Form of Tender, the evaluation of Commercial and Offset Programme Submissions will be assessed for their Legal Submission next.

iv) *Stage 4 – Evaluation of Legal Submission*

- The Legal Submission (see 'Contents Checklist for Envelope 1 (Basic Documents & Offset Programme Submission)' in Appendix A1 of this ITT') will be evaluated based on the information provided and submitted as outlined in **Form C10** – Contract Non-Performance And Litigation, as attached in Appendix C of this ITT.
- Only those who have not been involved in any contract non-performance in the last ten (10) years shall be considered at this stage.

v) *Stage 5 – Ranking of Best Evaluated Tenders*

- The Tenderers will be ranked according to their total overall score and Tender with the highest score will be declared as the Best Evaluated Tender.

(Tender Result)

- As a result of prequalification for tender package of electric and rolling stock systems procurement, 6 companies – Kawasaki Heavy Industries Ltd, Bombardier (Malaysia) Sdn Bhd-Bombardier Sifang (Qingdao) Transportation Ltd-Scomi Rail Bhd consortium, Changchun Railways Vehicles Co Ltd (CNR), Siemens AG and Siemens (M) Sdn Bhd, Hyundai Rotem Company, CSR Zhuzhou Electric Locomotive Co Ltd. – were qualified.
- Afterwards, 3 companies including Kawasaki Heavy Industries Ltd retracted their proposals, and eventually, only Siemens AG and Siemens (M) Sdn Bhd was qualified.

Source: MRT Corp Media Release

5.3.4. Implications from the World Trend and examples for Bid Evaluation

(1) Key points of the Implications

Key points of the implications gained from the world trend and examples for bid evaluation method are summarized as follows;

- 'Price & Quality' bid evaluation system is widely introduced in most developed countries as a modern public procurement method.
- Especially, EU Directives suggest that the most economically advantageous tender (MEAT) should be applied for quality intensive procurement.
- These trends and movements originated from the self-examination of countries which had encountered 'poor quality' procurement caused by their pursuit of the price competitive bid evaluation system.
- The lowest price bidding not only leads to low quality but also brings industrial exhaustion to the countries by excessive low-price competition, and as a consequence, it prevents their sustainable growth in the long run.
- Each of the countries shown in the examples has implemented its original evaluation system which includes evaluation criteria, item, index, method, and weight as well as evaluation process and members.

(2) Implications from Each Example

Each example in other countries shows the items to be applicable in India as follows:

	Items to be applicable in India
Example 1 (Scotland, UK)	✓Basic Idea : Achieving VFM, which is the best combination of whole life cost and quality ✓Accountability : Publishing award criteria and weightings for transparency ✓Quality/Price Ratio : Setting ranges from innovative projects to repeat ones
Example 2 (Montana, USA)	✓Independence : Setting up Technical Review Committee consisting of minimum 3 members ✓Accountability : Technical Proposal Evaluation Factors Score Sheet provided ✓Easy Calculation : Adjusted score (=Price/Technical Score) for Best Value
Example 3 (Queensland, Australia)	✓Independence : Setting up Tender Evaluation Panel consisting of at least 3 qualified persons ✓Non-price Evaluation Criteria : Preparing wide ranges of criteria
Example 4 (BART, USA)	✓Consideration of 'Complexity' : Competitive negotiation with price quality bid evaluation applied for electronic and specialized rail transit equipment ✓Evaluation Criteria : Price(33%), Experience & Past Performance (25%), Vehicle Subsystem Design Details (20%), etc. ✓Justification : Technical evaluation conducted by 2 independent teams ✓Accountability : Preparing Detailed Technical Evaluation Protocols

5.3.5. Lessons learned from the example of ‘BART’

(1) Selection if Bid Evaluation Method taking into account ‘Complexity’

As mentioned earlier, BART (Bay Area Rapid Transit) has adopted competitive negotiation other than price bidding for the procurement of rolling stock. The reason for this is due to its complexity in a word. In the memorandum of the BART Board meeting, backgrounds of adopting competitive negotiation for the procurement of rolling stocks are stated as ‘The scope of work for the procurement, in general, consists of providing the design, engineering, mockups, manufacture, assembly, testing, delivery and acceptance testing for 200 new heavy rail transit vehicles, ready for revenue service as an integral part of the District’s transportation system, and associated program management, in-service support, publications, warranty, training and data submittal, all as more fully described in the Contract Documents. A competitively negotiated procurement, rather than a low responsive bid-based procurement, is necessary to procure the transit vehicles.’

Also, in the section 20229.1 of the California Public Contract Code, competitive negotiation should be adopted for the procurement of rail transit equipment including rail cars, and the award shall be made to the qualified bidder whose proposal will be most advantageous to the district with price and other factors considered. The complex procurement like rolling stocks requires the owner to adopt competitive negotiation and comprehensive evaluation of price and other factors.

The memorandum of the BAET Board meeting and extracts of the California Public Contract Code Section 20229.1 are described as follows:

(Memorandum of the BAET Board meeting)

Approval to Conduct Competitive Negotiation for Transit Vehicles

Purpose:
To request the Board to find, by two-thirds majority, that the purchase of transit vehicles in compliance with the provisions of the California Public Contract Code generally applicable to the purchase does not constitute a method of procurement adequate for the District's needs; and to direct the purchase of transit vehicles by competitive negotiation consistent with California Public Contract Code Section 20229.1, subject to Board approval of the award.

Discussion:
Since the initial procurement of A/B transit vehicles in the early 1970s, the District has procured additional vehicles (C1 and C2) and rehabilitated the original A/B vehicles. The District currently has 669 vehicles. The projected end of useful life for each existing vehicle will occur between 2012 and 2019, depending on the age of the vehicle and whether and when it was rehabilitated. For the first time in over forty years, the District has the opportunity to procure vehicles based on specifications that will allow new technology, and that will not be constrained by the need for inter-operability between existing and new vehicles.

The scope of work for the procurement, in general, consists of providing the design, engineering, mockups, manufacture, assembly, testing, delivery and acceptance testing for 200 new heavy rail transit vehicles, ready for revenue service as an integral part of the District's transportation system, and associated program management, in-service support, publications, warranty, training and data submittal, all as more fully described in the Contract Documents. Additionally, there are two Options of 250 vehicles each, and two Options of 150 vehicles each.

A competitively negotiated procurement, rather than a low responsive bid-based procurement, is necessary to procure the transit vehicles. This will be the largest investment in equipment in the District's history. The vehicles will be relied upon to safely and efficiently transport millions of customers throughout the BART system for at least 40 years. It is imperative for the District to be able to consider factors other than price in selecting a supplier, such as a proposer's approach, capabilities and understanding of the District's requirements.

Subject to the Board approval requested in this document, this procurement will be a competitive negotiation based on procedures consistent with the California State Public Contract Code Section 20229.1. Award will be made to the qualified proposer whose proposal is most advantageous to the District with price and other factors considered. Award will not be solely based on price. Proposers whose technical proposal does not meet the minimum technical requirements will be eliminated from further consideration and deemed non-responsive.

Upon receipt, examination and ranking of the Proposals by District staff, the District may conduct a series of negotiation meetings with the proposers whose proposals have been determined to meet the minimum technical requirements and are within the competitive range. The District may award the contract at any time on the basis of the initial proposals received or may issue requests for best and final offers from selected proposers. Upon evaluation of the best and final offer(s), the District may award, resume negotiations, issue a new request for best and final offers, or not award the contract. The Office of General Counsel will review the Request for Proposals as to form.

Fiscal Impact: There is no direct fiscal impact from the proposed competitive negotiation process other than staff time and consultant costs. Funding for the procurement of transit vehicles will be identified prior to staff recommendation for award.

Alternatives: Utilize a low bid method of procurement. This could result in the least qualified bidder being awarded the contract even if the bid is only slightly lower than the bids received from more qualified bidders. For such an important procurement, this result is imprudent and undesirable.

Recommendation: Adoption of the following motion.

Motion: The Board finds by two-thirds vote that the procurement of transit vehicles in compliance with the provisions of the California Public Contract Code generally applicable to the purchase does not constitute a method of procurement adequate for the District's needs; and authorizes the General Manager to direct the purchase of transit vehicles by competitive negotiation under California Public Contract Code Section 20229.1, subject to Board approval of the award.

(Extracts of the California Public Contract Code Section 20229.1)

20229.1.
(a) Notwithstanding any other provision of law, the governing board of the San Francisco Bay Area Rapid Transit District may direct the purchase of
(1) electronic equipment, including, but
not limited to, computers, telecommunications equipment, fare collection equipment, and microwave equipment and
(2) specialized rail transit equipment, including, but not limited to, rail cars, and contracts for work that include, at a minimum, conversion of the rail car motive power system to alternating current or the complete replacement of existing rail car motive power units that utilize direct current, by competitive negotiation upon a finding by two-thirds of all members of the board that the purchase of that equipment in compliance with provisions of this code generally applicable to the purchase does not constitute a method of procurement adequate for the district's needs.

(b) Competitive negotiation, for the purposes of this section, shall include, as a minimum, all of the following elements:
(1) A request for proposal shall be prepared and submitted to an adequate number of qualified sources, as determined by the district in its discretion, to permit reasonable competition consistent with the nature and requirements of the procurement. In addition, notice of the request for proposal shall be published at least once in a newspaper of general circulation, which publication shall be made at least 10 days before the proposals are received. The district shall make every effort to generate the maximum feasible number of proposals from qualified sources and shall make a finding to that effect before proceeding to negotiate if only a single response to the request for proposal is received.
(2) The request for proposal shall identify significant evaluation factors, including price, and their relative importance.
(3) The district shall provide reasonable procedures for technical evaluation of the proposals received, identification of qualified sources, and selection for contract award.
(4) Award shall be made to the qualified bidder whose proposal will be most advantageous to the district with price and other factors considered. If award is not made to the bidder whose proposal contains the lowest price, the board shall make a finding setting forth the basis for the award.

(2) Actual Procurement Example of Rolling Stock

Actual procurement result of rolling stocks conducted in accordance with the aforementioned process and method is shown as follows. At first, price and quality bid evaluation method was applied for the initial proposals made by the participated 5 manufactures, and top 3 high-scored manufacturers were shortlisted. Secondly, BART discussed the contents of the proposal with each manufacturer, and then clarified unclear or insufficient contents of each proposal. Finally, BART received BAFO (Best and Final Offer) from each manufacturer, and the highest scored one was awarded.

Procurement of Transit Vehicles (775 cars) : RFP No. 40FA-110

(5 proposals submitted)

	ALSTOM	BOMBARDIER	CAF	CSR	ROTEM
Technical Score	42.80	46.91	18.73	6.24	29.10
Price Score	33.00	31.55	30.09	30.34	30.56
Combined Score	75.80	78.46	48.82	36.58	59.66
Price (rounded)	$1.895B	$1.983B	$2.078B	$2.062B	$2.046B

(3 shortlisted proposals submitted for BAFO)

	ALSTOM	BOMBARDIER			ROTEM
Technical Score	41.39	46.70			30.05
Price Score	31.83	33.00			18.42
Combined Score	73.22	79.70			48.47
Price	$1,727,025,189 (+$183,832,285)	$1,543,192,904 (Low Price)			$2,791,394,850 (+$1,248,201,946)

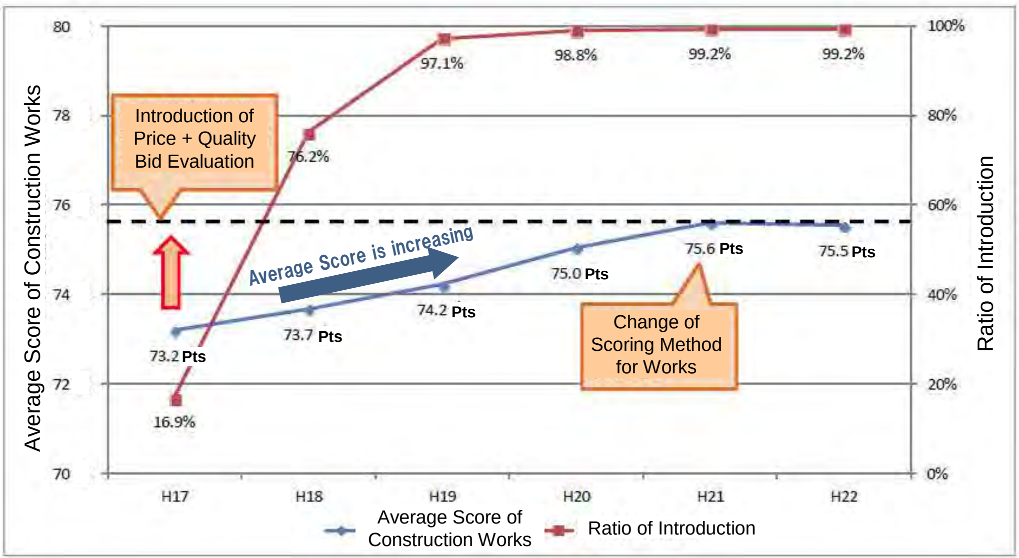
25% below Engineer's Estimate

Regarding the process and result of the procurement, we received the direct opinions from the responsible person in BART as follows.

- We were able to conduct clarification discussions and ultimately we conducted lengthy face-to-face negotiations where we discussed strengths/weaknesses of each proposer's offer to us and told the areas they needed to focus in to potentially improve the car that they were offering us so that we got the most technically modern, but highly reliable vehicle possible at the most affordable price.
- These face to face discussions would not have been possible if we simply conducted the procurement using the low bid approach.
- In addition, we obtained significant price reductions between the initial offer and the best and final offers while at the same time improving the technical performance parameters of the vehicle.
- In fact the difference between the low price and the second low price was $183,832,285, a very significant amount of money AND the company offering the lowest price also was the one to receive the highest technical score. A true WIN-WIN for us.

5.3.6. Effectiveness of Introducing Price & Quality Bid Evaluation System

Effect of introducing price & quality bid evaluation method to the national public construction projects in Japan can be explained by the improvement of the contractors' post evaluation score. The following figure shows the trend of the post evaluation score after 2005. Introduction rate of the price & quality bid evaluation method is approaching 100% after 2007, and at the same time, the post evaluation score has been improved steadily. It shows the evidence of which the construction quality has been improved by introducing price & quality bid evaluation method.



Further, the examples of the owners' opinions with regard to the effect of introducing price & quality bid evaluation method are obtained as follows:

(Quality Improvement, Cost Reduction, Early Completion)

- Expect cost reduction, early completion, and etc. by adopting the construction methods proposed by the contractors
- Expect better quality with lower price for the procurement to the needs of national people
- Achieved relevant construction management for not only the works related to the evaluation item but also the whole construction works

(Awareness Improvement for Better Quality)

- Awareness improvement for reduction of the negative benefit caused by construction works
- Awareness for regional contribution through construction works

(Technical Capacity Improvement of the Owner and the Contractor)

- Knowledge acquisition through the technical evaluation process for the most important part of the construction works
- Expansion of opportunities to propose new technology / construction method to the Owner

(Others)

- Removal of unqualified contractors with poor quality through justifiable tender competition

5.3.7. Problems with Pricing of Non-price Factors

DMRC has already adopted the pricing of non-price factors for the guarantee of energy consumption. For example, DMRC Line-7 evaluates the guaranteed energy consumption with HVACs switched off and that for HVACs of the 6 car train set for one round trip. DMRC select the bidder which proposes the lowest bid price of summing up the price and the guaranteed energy consumption.

(The Guaranteed Energy Consumption)

The best Guaranteed Energy Consumption for the round trip as above (both 'X' and 'Y') shall be submitted in the bid in the table below:

Load	Committed Energy consumption in KWH (Maximum) for a 6 car Train set for one round trip with conditions as noted above.	
	Energy consumption with HVACs switched OFF – as per 'A' above.	Energy Consumption for HVACs of the car under test - as per 'B' above x 6 (cars in a train)
AW3	X	Y

Note : "X" & "Y" shall be rounded off to the next higher integer.

(The Energy Consumption Formula)

The TOTAL VALUE (PV) based on such calculated differential 'P_{units}' for each bidder shall be calculated as per below mentioned formula:

$$PV = 'P_{UNITS}' \times D_y \times NRT \times NT \times T \times \sum_{i=1}^{30} T_i \times D_i$$

'PV'	:	Calculated Total Value in INR that shall be added to the quoted 'Lump Sum Price' of the respective bids
'P_{units}'	:	Differential energy consumption units w.r.t Baseline Energy Consumption"$('X'+'Y')_{BL}$" for a round trip
'D_y'	:	No. of days in revenue operation in a year (to be considered as '345' days)
'NRT'	:	Number of round trips per day (to be considered as '4' trips).
'T_i'	:	Multiplier factor for the cost payable in i^{th} year with per annum increase in tariff as 'R' and is equal to $(1+R)^i$ – (R' to be considered as 9% p.a.)
'D_i'	:	Annual discounting factor for i^{th} year calculated @5% per annum and is equal to $1/(1+r)^i$ — ('r' to be considered as 5% p.a.)
'NT'	:	No. of 6 car trains (considered as '81' train sets)
'L'	:	Life of the stock in years (considered as '30' years)

Also, in case the bidder is unable to establish validation of committed guaranteed energy consumption values, the penalty shall be imposed to the bidder at the amount derived from the following formula. The rate of the exceed energy consumption is around INR 40 million per kWh; and therefore, it will strongly affect the proposed bidding price.

(Penalty Formula)

Penalty for Non-Compliance of "X":

$$P_X = (AV_X - GV_X) \times D_y \times NRT \times NTP \times T \times \sum_{i=1}^{30} T_i \times D_i$$

'P_X'	:	Calculated Penalty for non compliance of "X"
'GV_X'	:	Guaranteed Energy Consumption value of "X" for 6 car TS
'AV_X'	:	Actual measured Energy Consumption value of "X" for 6 car TS
'NRT'	:	Number of round trips considered per day (considered as '4').
'T'	:	Electricity Tariff per unit (considered as INR 5.40p)
'T_i'	:	Multiplier factor for the cost payable in i^{th} year with per annum increase in tariff as 'R' and is equal to $(1+R)^i$ – ('R' to be considered as 10% p.a.)
'D_i'	:	Annual discounting factor for i^{th} year calculated @5% per annum and is equal to $1/(1+r)^i$ — ('r' to be considered as 5% p.a.)
'NTP'	:	No. of 6 car trains being procured
'L'	:	Life of the stock in years (considered as '30' years)

Penalty for Non-Compliance of "Y":

$$P_Y = (AV_Y - GV_Y) \times D_y \times NRT \times NTP \times T \sum_{i=1}^{30} T_i \times D_i$$

'P_Y'	:	Calculated Penalty for non compliance of "Y"
'GV_Y'	:	Guaranteed Energy Consumption value of "Y" for 6car TS
'AV_Y'	:	Actual measured Energy Consumption value of "Y" for 6 car TS
'NRT'	:	Number of round trips considered per day (considered as '4').
'T'	:	Electricity Tariff per unit (considered as INR 5.40p)
'T_i'	:	Multiplier factor for the cost payable in i^{th} year with per annum increase in tariff as 'R' and is equal to $(1+R)^i$ – ('R' to be considered as 10% p.a.)
'D_i'	:	Annual discounting factor for i^{th} year calculated @5% per annum and is equal to $1/(1+r)^i$ — ('r' to be considered as 5% p.a.)
'NTP'	:	No. of 6 car trains being procured.
'L'	:	Life of the stock in years (considered as '30' years)

5.3.8. Proposal

(1) Introduction of Comprehensive Evaluation Method

According to the JICA procurement guideline, comprehensive evaluation method is not accepted for the JICA ODA loan project. However, following to the worldwide trend of the public procurement, it is desirable to introduce comprehensive evaluation which evaluates price and quality simultaneously for the 'complex' procurement. It should be pointed out that reasonable setting of evaluation items and weights, and evaluation by the third parties are required to secure transparency and objectivity of the evaluation.

1) Evaluation Item and Weight

Quality evaluation is different from price evaluation, since it has no absolute criteria. Therefore, evaluation items and weights should be specified in the bidding documents and related standards or manuals for their evaluation. The following example shows the evaluation items and weights for the procurement of rolling stock. Price evaluation is 50% of the total, and quality evaluation is 50% of it. The quality evaluation consists of experience and past performance (30%), technical spec. compliance (10%), and project management experience (10%). The most weighting criteria of experience and past performance includes schedule adherence, system reliability, suppliers work history for finishing similar project, and etc., and the criteria of project management experience includes resource capability & capacity, and facility capability & capacity.

(Evaluation Items and Weights for Comprehensive Evaluation (Example))

- **Price Evaluation : 50 point**
  - Rolling Stock
  - Spare Parts
  - Special Tools and Diagnostic & Test Equipment
  - Training
  - Manual
  - Performance Bond
  - Finance
- **Experience and Past Performance : 30 point**
  - Schedule Adherence
  - Suppliers' Work History for Finishing Similar Project
  - System Reliability
  - Weight Compliance
  - Quality
  - Document Delivery / Acceptance
  - Manual & Training Delivery / Acceptance
  - Change Orders
- **Technical Spec. Compliance : 10 point**
  - Overall Design
  - Sub system Design (Propulsion, APS, Brake, Doors, HVAC, Coupler, Lighting etc)
- **Project Management Experience : 10 point**
  - Resource Capability & Capacity
  - Organization
  - Facility Capability & Capacity
  - Local Assembly
  - Interface Management

The abovementioned evaluation item and weight will be applicable not only to rolling stocks but also to all 'complex' procurement. Especially, schedule adherence which has much influence on the operation commencement, flexible response to change orders which will commonly happen after starting the project, and system reliability like mean destructive distance at the operation are indispensable for sound management of MRT. These items should be included in the evaluation for the 'complex' procurement.

2) Establishment of Evaluation Committee by third parties

In order to enhance the objectivity of the evaluation, the independent organization should be established outside for evaluation. It is important for the third party committee to be involved in the evaluation, and member of the committee will be consisting of academia or experts joined by academia or experts to conduct evaluations. Also, as described in the example of BART, it is considered that independent two technical evaluation teams are established to enable mutual checking and evaluation improvement. Furthermore, in order that each evaluator should evaluate properly following to some standard, evaluation index or criteria should be arranged.

3) Publication of Evaluation Result

Process and result of the evaluation should be open to public, and reason for the result should be explained to the bidders as necessary. For example, the evaluation score of each bidder should be disclosed, and the reasons for the result should be explained by the owners in response to the request by the bidders.

(2) Pricing of non-price factors

1) Pricing of the Energy Consumption

This has already been adopted by DMRC; however, calculation formula of running resistance, and running performance such as running time and velocity, although they will bring large influence on the energy consumption, is not specified, and they are proposed by the bidders. Consequently, in case more energy than proposed value is found necessary, huge penalty will be imposed, and the bidders will calculate the consumption volume at safer side. Therefore, those who have advanced energy reduction technology are not willing to have incentives to making positive proposals, and as a result, the most excellent contractor is not possibly selected. In order to balance the tender condition at a certain level, calculation formula for running resistance should be specified in the bidding document, and running time and velocity should be stated if possible.

Furthermore, in order for the non-price factors among the total bidding price to be set appropriately, discount rate or evaluation duration should be determined carefully.

2) Pricing of other non-price factors

Non-price factors such as system reliability and schedule adherence do not have established calculation formula, and therefore these pricing is quite difficult. One way is to calculate the pricing of social impact in case that the system liability and schedule adherence should not be followed. However, it is difficult to provide certain value, since the way of setting boundary condition is not established. For this reason, these items should be considered as an evaluation item for the comprehensive evaluation method by putting some weights compared with the price.

Chapter 6

Feedback to the Government of India

6.1. Proposal for MoUD

6.1.1. Proposal Outline

The study team gave presentation to MOUD (Ministry of Urban Development) especially focusing on the introduction of the price & quality bid evaluation method.

Proposal outline is as follows:

(1) World Trend of Bid Evaluation System

- Developed countries such as US, UK, and Japan had formerly adopted price competitive bid evaluation system.
- This system brought low quality procurement, and therefore, price & quality bid evaluation system is widely introduced.
- EU directive states that price & quality bid evaluation system should be introduced as MEAT (Most Economically Advantageous Tender)

(2) Examples of Price & Quality Bid Evaluation Method

- Examples including Construction Works Procurement Guideline in Scotland, UK, Design-Build Guidelines, Montana DOT, USA, Tendering and Selection Process, Queensland, Australia, Procurement Manual, Bay Area Rapid Transit (BART), USA Rolling Stock & Systems for the Phase 1 of Macau LRT are presented

(3) Lessons learned from the World Trend and Examples

- Summarize the lessons learned from the world trend and examples, and applicable items to India.
- Detailed descriptions regarding the procurement system of rolling stocks by BART, USA
- Explanation of effect of introducing price & quality bid evaluation method

(4) Introduction of Price & Quality Bid Evaluation System to India (Proposal)

- Transparency and accountability should be noted to introduce price & quality bid evaluation method, which is explained by the examples
- Items and their weighted score proposed for rolling stock procurement as an example

6.1.2. Content of Presentation

The presentation was made to the following two persons at MoUD in Delhi on June 30, 2013, using the presentation materials (Appendix 6):

- Sanjeev Kumar Lohia: Joint Secretary, Ministry of Urban Development
- C.K.Khaitan: Joint Secretary, Ministry of Urban Development

6.1.3. Comment of MoUD

MoUD asked the following questions to the presentation document.

- Technical score and financial score were changed between the initial offer and BAFO. Especially, financial score of ROTEM was significantly reduced. Why was this happened? Is this considered to be a replacement of the bid?
- Quality of the public construction works has been improved by introducing price & quality bid evaluation method. What is the method and criteria of evaluating the quality? The evaluation is objective? Economical benefit brought by the improvement of quality could be quantitatively calculated? For example, how much yen of economical benefit is produced by 1 point improvement? Further, we understand that the quality has been improved by the introduction of price & quality bid evaluation method, but how much the cost has been increased? The cost increase can be explained within the range of offsetting the quality improvement?
- Metro projects in Japan adopt the price & quality bid evaluation method?
- In case of sharing routes between different railway companies, which type of contracts were made between them such as rolling stock and signal system, asset including depot and drivers, and allocation of ticket incomes?

6.1.4. Response to MoUD

Presentation document in response to the above questions was prepared as Appendix 7, and resubmitted to MoUD.

6.2. Issues

6.2.1. Capacity Building of Employer

As the urban rail development in India is going on, it is anticipated that the Fragmented Approach to become mainstream in procurement.

In the Fragmented Approach, it is especially important to improve the capability of ordering by the employer. Specifically, it is necessary to obtain support by other railway operators (including foreign operators) or general consultants (GC) in making orders.

In this study, specific areas in which technical cooperation is necessary were suggested with the Kochi Metro case as a case study. For example, technical cooperation in designing of intermodal facilities, preparation of depot specifications for efficient and effective maintenance, exploitation of know-how on IC Card, including Intermodal Integration, etc., are the fields of importance.

6.2.2. Bid Evaluation System

Currently, the Indian government considers that the introduction of price & quality bid evaluation system is difficult from the viewpoints of transparency and accountability. However, most of the developed countries have encountered the problems with low-quality procurement by price competitive bid evaluation system, and therefore, it is recommended that India should study the introduction of price & quality bid evaluation system.

In order to do this, further detailed study of the examples of the other countries and way of price & quality bid evaluation system should be conducted, and its applicability to India needs to be studied and analyzed.

Appendixes

＜Appendix 1＞

Summary Sheets

- Ahmedabad Metro
- Bangalore Metro Phase 2
- Chandigarh Metro
- Gurgaon Rapid Rail
- Hyderabad Metro
- Jaipur Metro
- Kochi Metro
- Lucknow Metro
- Ludhiana Metro
- Mumbai Metro
- Navi Mumbai Metro
- Noida and Gr. Noida Metro
- Pune Metro

- Delhi Monorail
- Kozhikode Monorail
- Mumbai Monorail

PROJECT NAME: Ahmedabad Metro

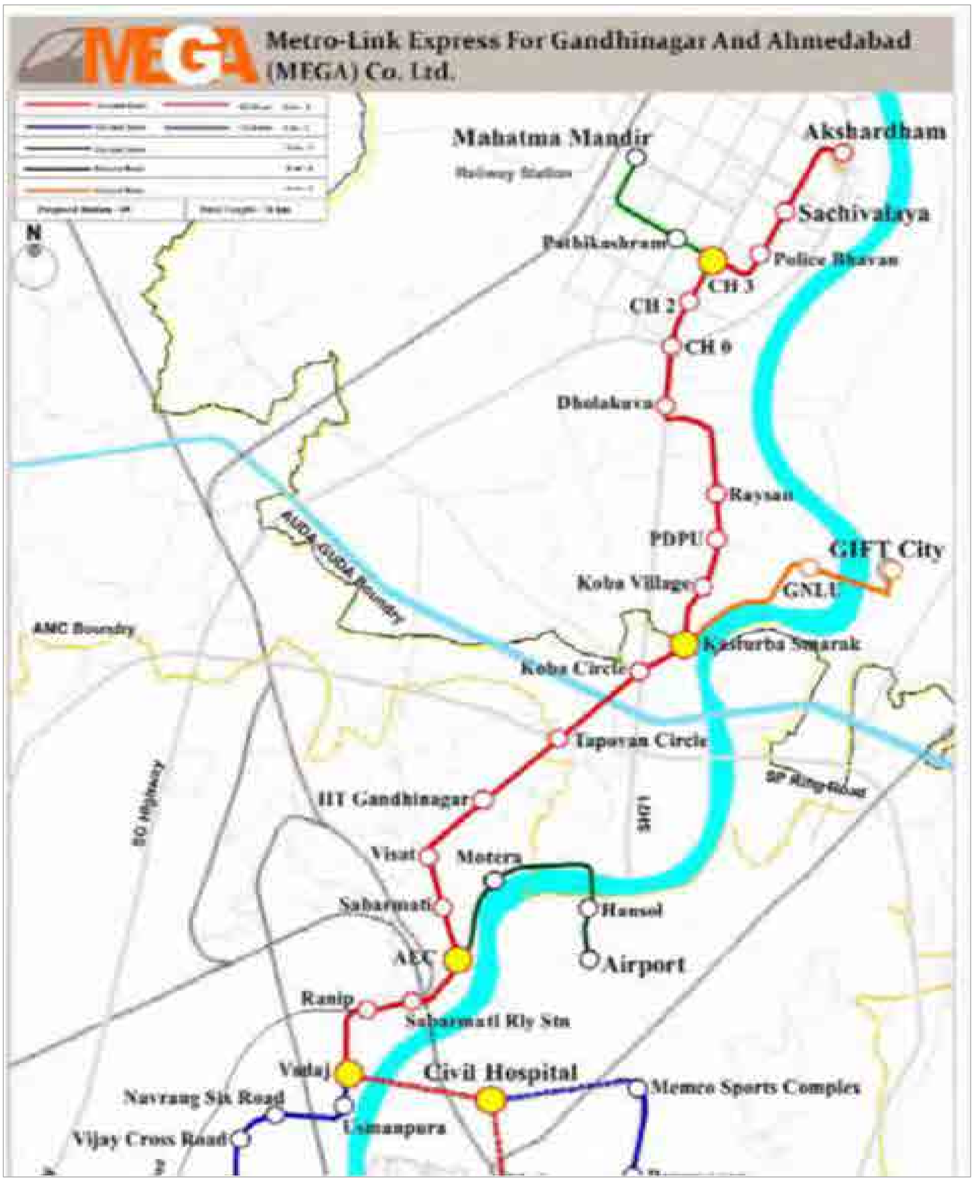
CITY PROFILE

	2001	2011
Population	5.82 M	7.21 M
Population Density (per sq. km.)	727	890
Major Industries	Heavy and chemical industry	Heavy and chemical industry, Automobile
GSDP Growth Rate (%)	8.41	8.53
Share of Transportation Modes	Bus: 14%; Cars: 38%; 2-Wheel: 35%; 3-Wheel: 13%	
Fare per km	Bus: INR 2/km; Taxi: INR 12/km; Auto Rickshaw: INR 7/km	

PROJECT ROUTES

Phase 1	Total Length (km)	PHPDT
Line 1A From Akshardham to AEC	23.1	PHPDT: Yr 2016 = 9,795; Yr 2041 = 41,872
Line 3 (Spur) From AEC to Airport	6.58	PHPDT: Yr 2016 = 2,775; Yr 2041 = 7,073
Line 5 (Spur) From GIFT City to Kasturba	5.7	PHPDT: Yr 2016 = 9,795; Yr 2041 = 41,872
Line 4 (Spur) From CH3 to Mahatma Mandir	3.69	PHPDT: Yr 2016 = 2,710; Yr 2041 = 5,781
Phase 2		
Line 2A From AEC to Jamalpur	13.1	PHPDT: Yr 2021 = 24,764; Yr 2041 = 50,870

ROUTE MAP



<table>
<tr><th colspan="4">PROJECT PROFILE</th></tr>
<tr><td>No. of Planned New Lines</td><td colspan="3">1~5 lines</td></tr>
<tr><td>No. of Planned Stations</td><td colspan="3">42 Elevated and 11 Underground</td></tr>
<tr><td>Operator</td><td colspan="3">MEGA</td></tr>
<tr><td>Expected Commercial Operation Year</td><td colspan="3">Phase 1: 2015, Phase 2: 2017</td></tr>
<tr><td>Is it Driverless?</td><td colspan="3">No</td></tr>
<tr><td>Rolling Stock (Planned)
Vehicle dimensions</td><td colspan="3">a) Length: 22.0 m to 25.0 m
Width (outer to outer): 3.2 to 3.6m
Height (above rail level): 4.0 m (Max.)
with min. 4 doors each side of modern rolling stock with stainless steel body
b) Axle load - 18 tonne (maximum Metro Car axle load)
c) Seating arrangement - Longitudinal
d) Capacity of 2 coach unit - About 800 passengers
e) Class of accommodation - One</td></tr>
<tr><td>Daily Passenger Volume (at start up)</td><td colspan="3">673,000</td></tr>
<tr><td>Traction & Power Supply</td><td colspan="3">Voltage: 1,500V dc
Current collection: Third rail bottom collection
Power supply source: 132kV
Nos. of Receiving Substations: About 5 nos.
Nos. of Traction Substations: Approx. @3km and one in each depot
SCADA system: Yes</td></tr>
<tr><td>Current Collection System</td><td colspan="3">3rd Rail</td></tr>
<tr><td>Type of Signaling System</td><td colspan="3">Communication Based Train Control (CBTC) specifically designed for metro use</td></tr>
<tr><td>Telecommunication</td><td colspan="3">Terrestrial Trunked Radio (TETRA) 122 SN Item Description Particular Communication System and SCADA for support systems control with Gigabit Ethernet network backbone with Fibre Optic cable, SCADA, Train Radio, PA system, etc.</td></tr>
<tr><td>Fare Collection</td><td colspan="3">Automatic Fare Collection System with five (5) levels of system facilities using Smart Card technology</td></tr>
<tr><td>Platform Screen Doors (if Available)</td><td colspan="3">Elevated stations: Half height (4’) Platform Screen Doors to be provided at all stations
Underground stations: Full height PSDs at all stations</td></tr>
<tr><td>Track Gauge</td><td colspan="3">Broad gauge 1,676 mm</td></tr>
<tr><th colspan="4">PROJECT STATUS</th></tr>
<tr><td colspan="2">Status</td><td colspan="2">Detailed Project Report</td></tr>
<tr><td>Phase1</td><td>Under Procurement</td><td>Project Cost</td><td>INR 17,215 crores (completion cost)
+ 2,465 crores (taxes and duties)</td></tr>
<tr><td>Phase2</td><td>Under Procurement</td><td>FIRR</td><td>9%</td></tr>
<tr><td>Phase3</td><td>Planning (DPR Prepared)</td><td>EIRR</td><td>N/A</td></tr>
<tr><th colspan="4">INVESTMENT PLAN</th></tr>
<tr><td>Financing Scheme</td><td colspan="3">Government Sponsored</td></tr>
<tr><td>Sources of Funds
(Phase 1 & 2)</td><td colspan="3">100% State Funded</td></tr>
</table>

PROJECT NAME: Bangalore Metro Phase 2		
CITY PROFILE		
	2001	**2011**
Population	6.54 M	9.59 M
Population Density (per sq. km.)	2,985	4,378
Major Industries	IT & Software	IT & Software
GSDP Growth Rate (%)	2.80	5.50
Share of Transportation Modes	Bus: 14%; Cars: 38%; 2-Wheel: 35%; 3-Wheel: 13%	
Fare per km	Metro: INR 2/km; Bus: INR 3/km; Taxi: INR 15/km; Auto Rickshaw: INR 7/km	

PROJECT ROUTES

Line	Terminals		Opening date	Length (km)	New Stations
Line 2 - Purple Line	Mysore Road	Kengeri	2017	6.465	5
Line 2 - Purple Line	Baiyappanahalli	Whitefield	2017	15.5	14
Line 1 - Green Line	Puttenahalli	Anjanapura	2017	6.29	5
Line 1 Green Line	Hesaraghatta cross	BIEC	2017	3.77	3
Line 3	R V Road	Bommasandra	2017	18.8	16
Line 4	Gottigere	Nagavara	2017	21.25	18

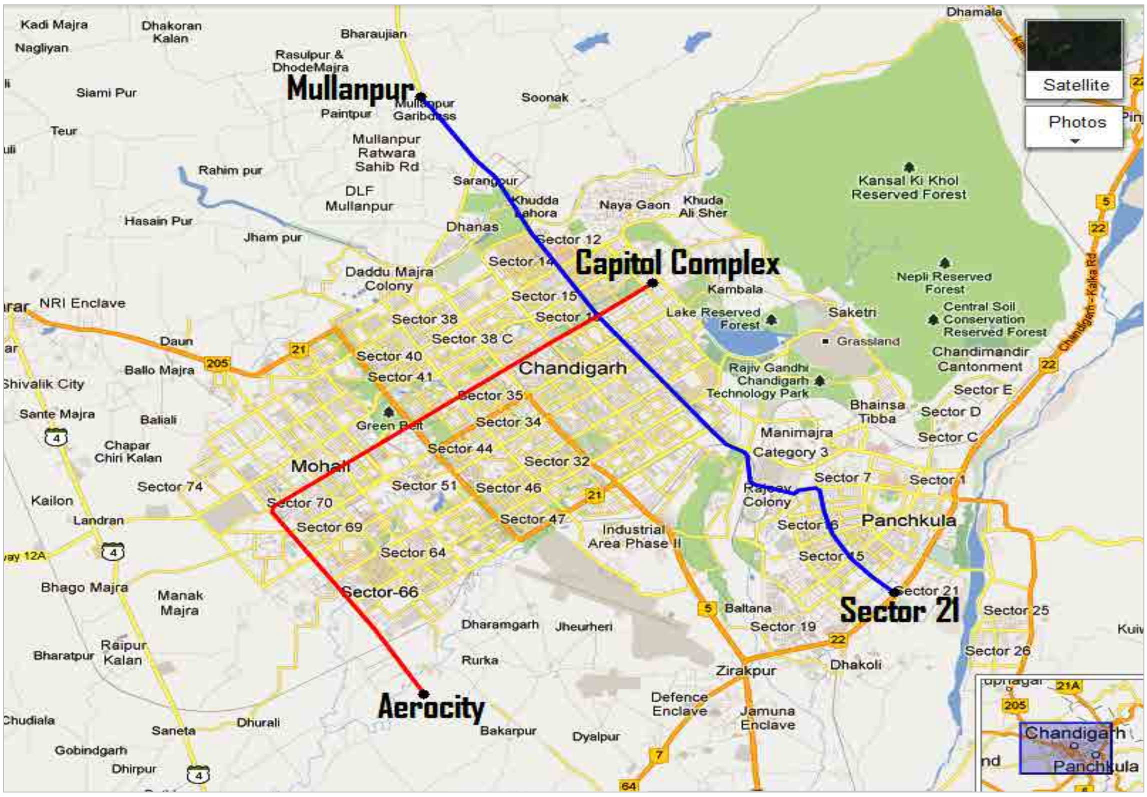
ROUTE MAP

PROJECT PROFILE	
No. of Planned New Lines	4 (Extension of Phase 1)
No. of Planned Stations	61
Operator	BMRCL
Expected Commercial Operation Year	March 2017
Is it Driverless?	No
Rolling Stock (Planned) Vehicle dimensions	a) Length: 22.0 m to 25.0 m Width (outer to outer): 2.88 m Height (above rail level): 4.0 m (Max.) with min. 4 doors each side of modern rolling stock with stainless steel body b) Axle load - 15 tonne (maximum Metro Car axle load) c) Seating arrangement - Longitudinal d) Capacity of 3 coach unit - About 786 passengers e) Class of accommodation - One
Daily Passenger Volume (at start up)	408,000
Traction & Power Supply	Voltage: 750V DC Current collection: Third rail bottom collection Power supply source: 132kV/750 VDC Nos. of Receiving Substations: About 3 nos. Nos. of Traction Sub Station: 14 nos Nos. of Traction Substations: Approx. @3km and one in each depot SCADA system: Yes
Current Collection System	3rd Rail
Type of Signaling System	Cab Signaling and continuous Automatic Train Control with Automatic Train Protection (ATP)
Telecommunication	Integrated System with Fibre Optic cable, SCADA, Train Radio, PA system, etc. Train Information System, Control Telephonic and centrlized Clock System
Fare Collection	Automatic Fare Collection System with five (5) levels of system facilities using Smart Card technology
Platform Screen Doors (if Available)	No
Track Gauge	Standard gauge 1,435 mm

PROJECT STATUS			
Status		Detailed Project Report (Phase 2)	
Phase 2	Planning (Pre-PIB Reviewing)	Project Cost	INR 26,405 Crore (Completion cost with Central taxes)
		FIRR	4.0%
		EIRR	13.40%

Financing Scheme	Government Sponsored		
Proposed Sources of Funds (Phase 2)		Amount (Crores)	%
	Equity - GoI	3,961	15
	Equity - State	3,961	15
	Sub Debt - GoI	2,641	10
	Sub Debt - State	3,961	15
	Senior Term Debt	11,882	45
	Total	26,405	100

PROJECT NAME: Chandigarh Metro		
CITY PROFILE		
	2001	**2011**
Population	0.90 M	1.05 M
Population Density (per sq. km.)	7,900	9,252
Major Industries	Paper manufacturing, basic metals and alloys, and machinery. Other industries are relating to food products, sanitary ware, auto parts, machine tools, pharmaceuticals, and electrical appliances.	Paper manufacturing, basic metals and alloys, and machinery. Other industries are relating to food products, sanitary ware, auto parts, machine tools, pharmaceuticals, and electrical appliances.
GSDP Growth Rate (%)	13.20	8.14
Share of Transportation Modes	Bus: 14%; Cars: 38%; 2-Wheel: 35%; 3-Wheel: 13%	
Fare per km	Bus: INR 2.5/km; Taxi: INR 10/km; Auto Rickshaw: INR 7/km	
PROJECT ROUTES		
Corridor 1 Capitol to Gurudwara Shign Shaheeda	Total Length = 12.497 km	PHPDT: Yr 2018 = 7,007; Yr 2041 = 17,383
Corridor 2 Line 1 From Transport Termimus to Grain Market	Total Length = 25.076 km	PHPDT: Yr 2018 = 6,711; Yr 2041 = 35,636
ROUTE MAP		



PROJECT PROFILE

No. of Planned New Lines	2 lines
No. of Planned Stations	19 Elevated and 11 Underground
Operator	CMRC
Expected Commercial Operation Yea	2018
Is it Driverless?	No
Rolling Stock (Planned) Vehicle dimensions	a) Length: 22.0 m to 22.6 m Width (outer to outer): 3.2 m Height (above rail level): 3.9 m (Max.) with min. 4 doors each side of modern rolling stock with stainless steel body b) Axle load - 17 tonne (maximum Metro Car axle load) c) Seating arrangement - Longitudinal d) Capacity of 4 coach unit - About 1,480 passengers e) Class of accommodation - One
Daily Passenger Volume (at start up)	341,901
Traction & Power Supply	Voltage: 25 KV OHE Power supply source: 132/32/25 kV SCADA system: Yes
Current Collection Syste	OHE
Type of Signaling Syster	Cab Signaling and continuous Automatic Train Control with Automatic Train Protection (ATP)
Telecommunication	Integrated System with Fibre Optic cable, SCADA, Train Radio, PA system, etc. Train Information System, Control Telephonic and centralized Clock System
Fare Collection	Automatic Fare Collection System with POM and using Smart Card technology
Platform Screen Doors (if Available)	No
Track Gauge	Standard gauge 1,435mm

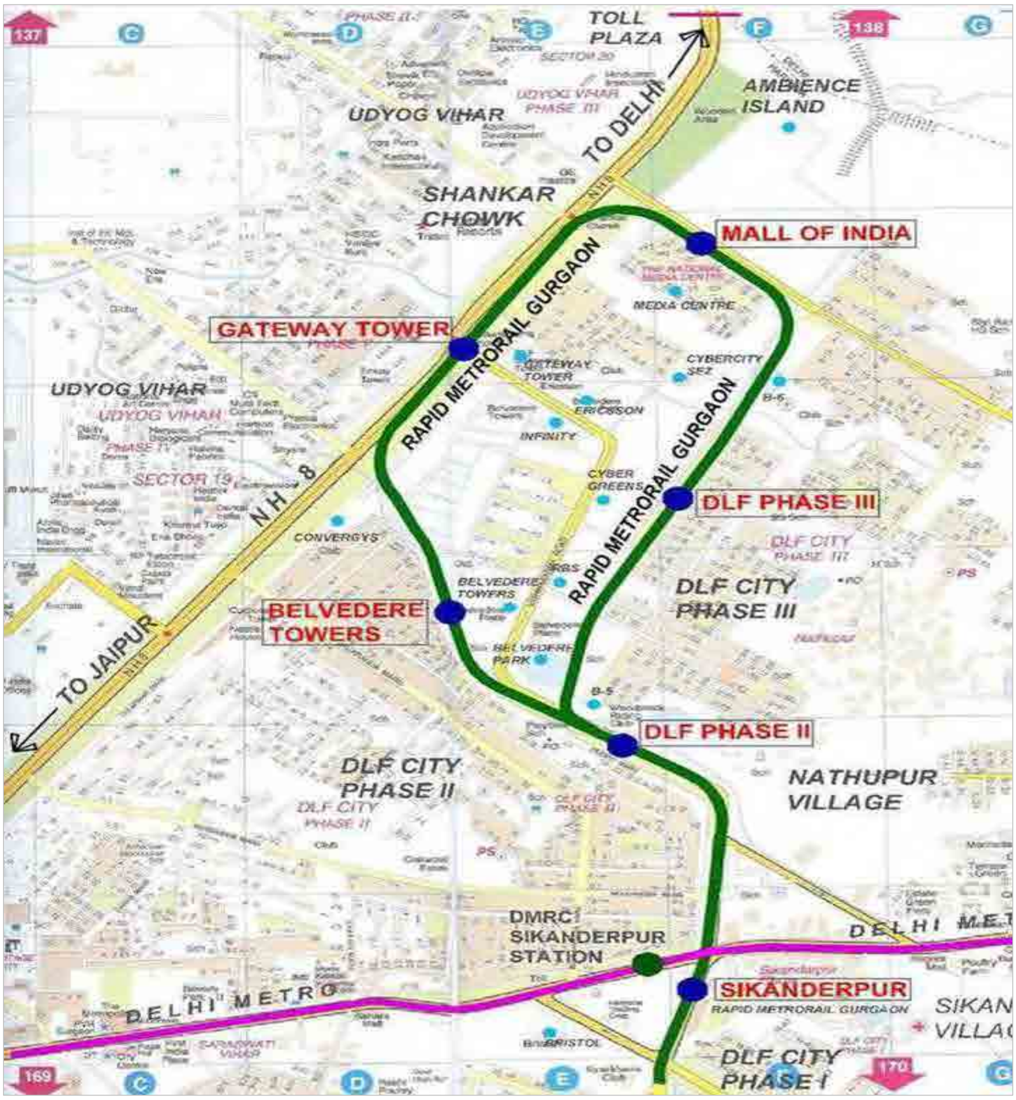
PROJECT STATUS

Status		Detailed Project Report (Corridor 1&2)	
Corridor 1	Planning (DPR Prepared)	Project Cost	INR 10,900 crores (without Taxes)
Corridor 2	Planning (DPR Prepared)	FIRR	N/A
		EIRR	N/A

INVESTMENT PLAN

Financing Scheme	Government Sponsored		
Proposed Sources of Funds (Corridor 1 & 2)		Amount (Crores)	%
	Equity - GoI and State	4,360	40%
	SD - GoI and State	1,962	18%
	JICA	4,578	42%
	Total	10,900	100%

PROJECT NAME: Gurgaon Rapid Rail		
CITY PROFILE		
	2001	**2011**
Population	0.87 M	1.51 M
Population Density (per sq. km.)	717	1,241
Major Industries	Automobile manufacturing, garment manufacturing, world-class real estate, and shopping malls	Prominent outsourcing and offshoring hubs, automobile manufacturing, garment manufacturing, world-class real estate, and shopping malls
GSDP Growth Rate (%)	7.81	7.92
Share of Transportation Modes	N/A	
Fare per km	Metro: INR 2/km; Bus: INR 3/km; Taxi: INR 15/km; Auto Rickshaw: INR 7/km	
PROJECT ROUTES		
Phase 1 Sikanderpur - DLF Ph-2 - DLF Ph-3- Mall of India - Gateway Towers - Belverdere Towers-DLF Ph-2		Total Length = 5.1 km
Phase 2 Sikanderpur to Sector 55-56		Total Length = 7.1 km
ROUTE MAP		

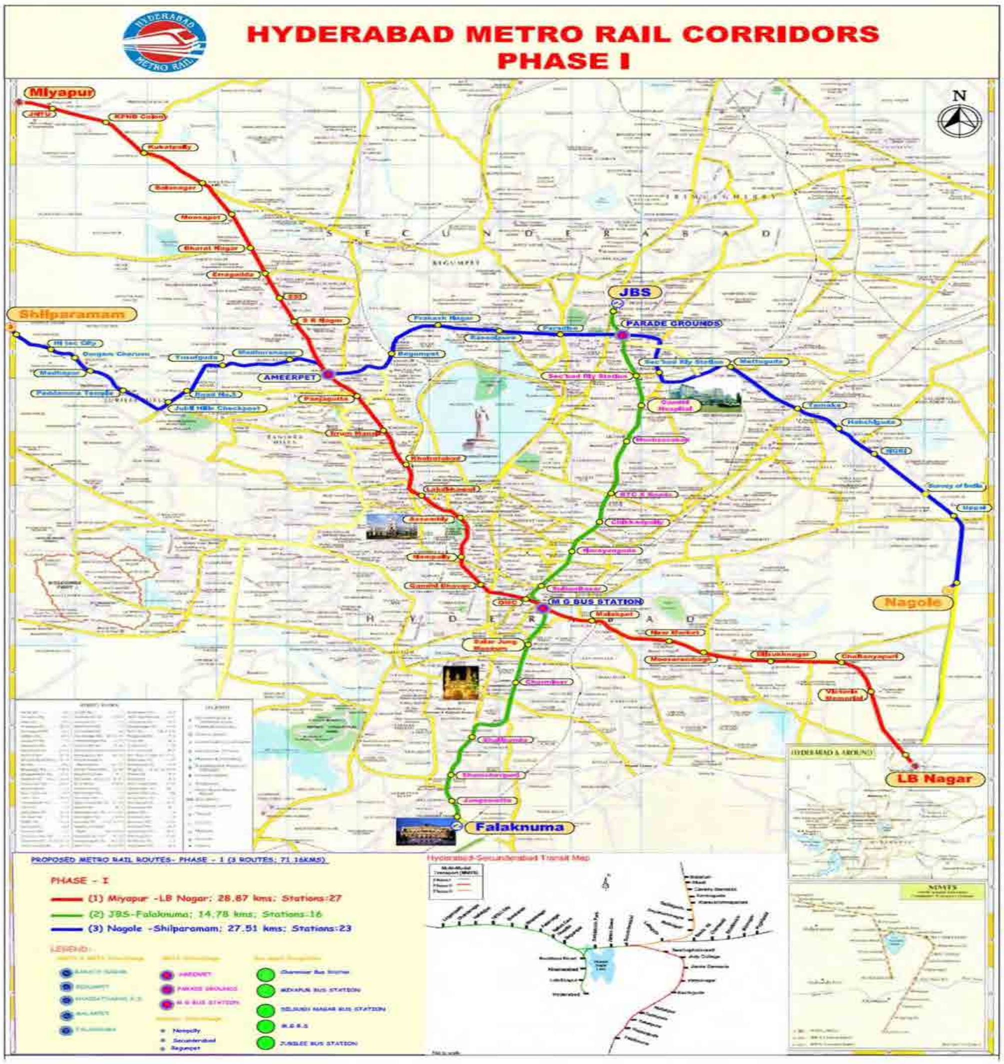


PROJECT PROFILE	
No. of Planned New Lines	2 lines
No. of Planned Stations	Phase 1: Elevated - 6; Phase 2: Elevated - 6
Operator	IL&FS & DLF
Expected Commercial Operation Year	March 2013 Phase 1: 2013, Phase 2: 2015
Is it Driverless?	No
Rolling Stock (Planned) Vehicle dimensions	3 Car - 5 Nos. of Coaches
Daily Passenger Volume (PHPDT)	100,000
Traction & Power Supply	Voltage: 750 V DC, SCADA system: Yes
Current Collection System	Third Rail
Type of Signaling System	The system will be equipped with the Automatic Train Operation (ATO), Automatic Train Protection (ATP) and Automatic Train Supervision (ATS)
Telecommunication	Integrated System with Fibre Optic cable, SCADA, Train Radio, PA system, etc. Train Information System, Control Telephonic and centralized Clock System
Fare Collection	Automatic Fare Collection System with POM and using Smart Card technology
Platform Screen Doors (if Available)	No
Track Gauge	Standard gauge 1,435 mm

PROJECT STATUS			
Status		Detailed Project Report (Phase 1&2)	
Phase 1	Under Construction	Project Cost	INR 2,100 crore (without Taxes)
Phase 2	Planning (DPR Prepared)	FIRR	N/A
		EIRR	N/A

INVESTMENT PLAN			
Financing Scheme	PPP. Consortium to pay HUDA INR 7.65 billion (US $139.2 million) over 35 years in "connectivity charges" as well as 5-10% of advertising and property development revenue		
Sources of Funds (Phase 1 & 2)		Amount (Crores)	%
	DLF	546	26%
	ITNL	1,554	74%
	Total	2,100	100%

PROJECT NAME: Hyderabad Metro		
CITY PROFILE		
	2001	**2011**
Population	3.83 M	4.01 M
Population Density (per sq. km.)	17,649	18,480
Major Industries	Information technology (IT), IT-enabled services, insurance and financial institutions	Information technology (IT), IT-enabled services, insurance and financial institutions, pharmaceutical and biotechnology industries, healthcare
GSDP Growth Rate (%)	4.22	7.82
Share of Transportation Modes	Bus: 14%; Cars: 38%; 2-Wheel: 35%; 3-Wheel: 13%	
Fare per km	Bus: INR 2/km; Taxi: INR 15/km; Auto Rickshaw: INR 7/km	
PROJECT ROUTES		
Phase 1	Total Length (km)	
Line 1 From Miyapur – Chaitanyapuri corridor	29	PHPDT: Yr 2011 = 23,003; Yr 2021 = 39,896
Line 2 From Jubilee Bus stand – Secunderabad – Charminar – Falaknuma	15	PHPDT: Yr 2011 = 23,003; Yr 2021 = 39,896
Line 3 From Nagole – Secunderabad – HiTech City – Shilparamam	28	PHPDT: Yr 2011 = 23,003; Yr 2021 = 39,896
ROUTE MAP		



PROJECT PROFILE	
No. of Planned New Lines	3 lines
No. of Planned Stations	66 Elevated
Operator	L&T
Expected Commercial Operation Year	April 2014
Is it Driverless?	No
Rolling Stock (Planned) Vehicle dimensions	a) Length: 21.0 m to 22.0 m Width (outer to outer): 2.88 m Height (above rail level): 3.9 m (Max.) with min. 4 doors each side of modern rolling stock with stainless steel body b) Axle load - 16 tonne (maximum Metro Car axle load) c) Seating arrangement - Longitudinal d) Capacity of 3 coach unit - About 1,000 passengers e) Class of accommodation - One
Daily Passenger Volume (at start up)	N/A
Traction & Power Supply	Voltage: 750V DC Current collection: Third rail bottom collection Power supply source: 132kV/750 VDC Nos. of Receiving Substations: About 2 nos. Nos. of Traction Substations: Approx @3km and one in each depot SCADA system: Yes
Current Collection System	3rd Rail
Type of Signaling System	Cab Signaling and continuous Automatic Train Control with Automatic Train Protection (ATP)
Telecommunication	Integrated System with Fibre Optic cable, SCADA, Train Radio, PA system, etc. Train Information System, Control Telephonic and centralized Clock System
Fare Collection	Automatic Fare Collection System with POM and using Smart Card technology
Platform Screen Doors (if Available)	N/A
Track Gauge	Standard gauge 1,435 mm

PROJECT STATUS			
Status		Detailed Project Report	
Phase 1	Under Construction	Project Cost	INR 14,132 crore
		FIRR	N/A
		EIRR	N/A

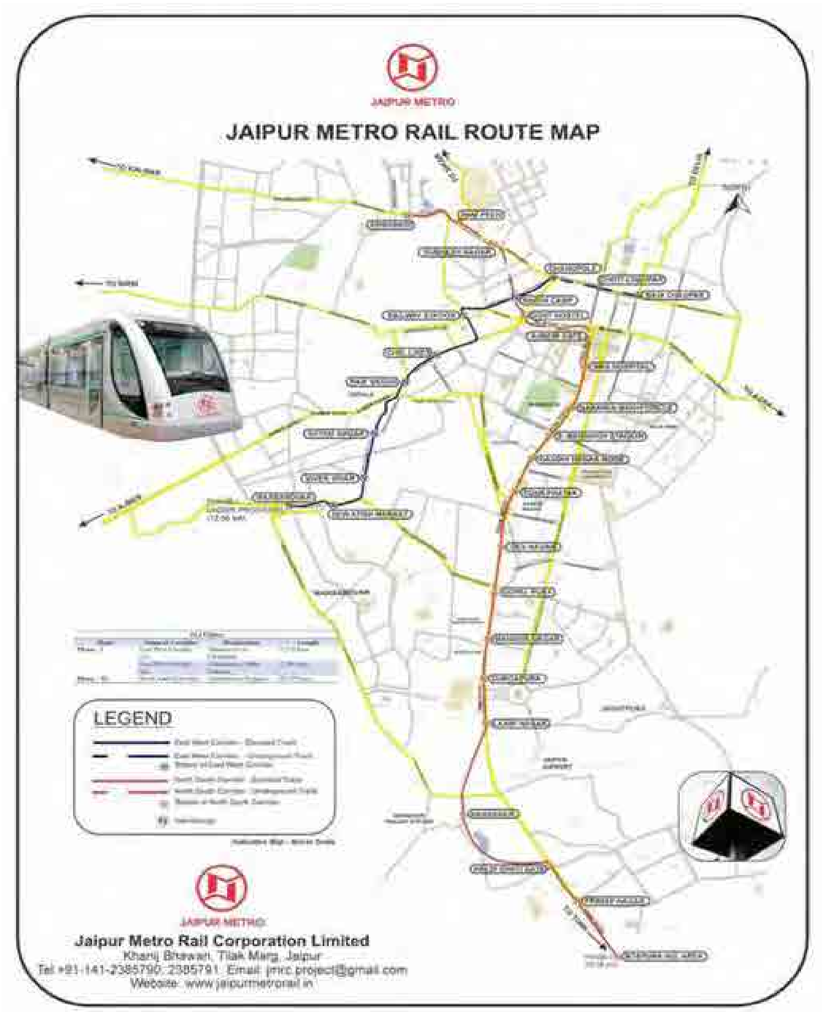
INVESTMENT PLAN			
Financing Scheme	PPP-DBFOT		
Sources of Funds		Amount (Crores)	%
	GoI	1,458	10%
	State Govt	1,980	14%
	L&T	10,694	76%
	Total	14,132	100%

PROJECT NAME: Jaipur Metro

CITY PROFILE		
	2001	**2011**
Population	1.52 M	6.64 M
Population Density (per sq. km.)	N/A	598
Major Industries	Exporter of gold, diamond and stone jewellery	Exporter of gold, diamond and stone jewellery, IT BPO, Tourism
GSDP Growth Rate (%)	10.87	6.11
Share of Transportation Modes	Bus: 14%; Cars: 38%; 2-Wheel: 35%; 3-Wheel: 13%	
Fare per km	Bus: INR 3/km; Taxi: INR 10/km; Auto Rickshaw: INR 7/km	

PROJECT ROUTES	
Phase 1A (East-West) Stage-1 Green Line From Mansarovar to Chand Pole	Total Length = 11.527 km PHPDT: Yr 2021 = 24,764; Yr 2041 = 50,870
Phase 1B From Chand Pole to Badi Chopar	Total Length = 2.349 km
Phase 2 (North- South) Orange Line From Sitapur Industrial Area to Ambabari	Total Length = 23.099 km PHPDT: Yr 2014 = 12,901; Yr 2031 = 22,429

ROUTE MAP

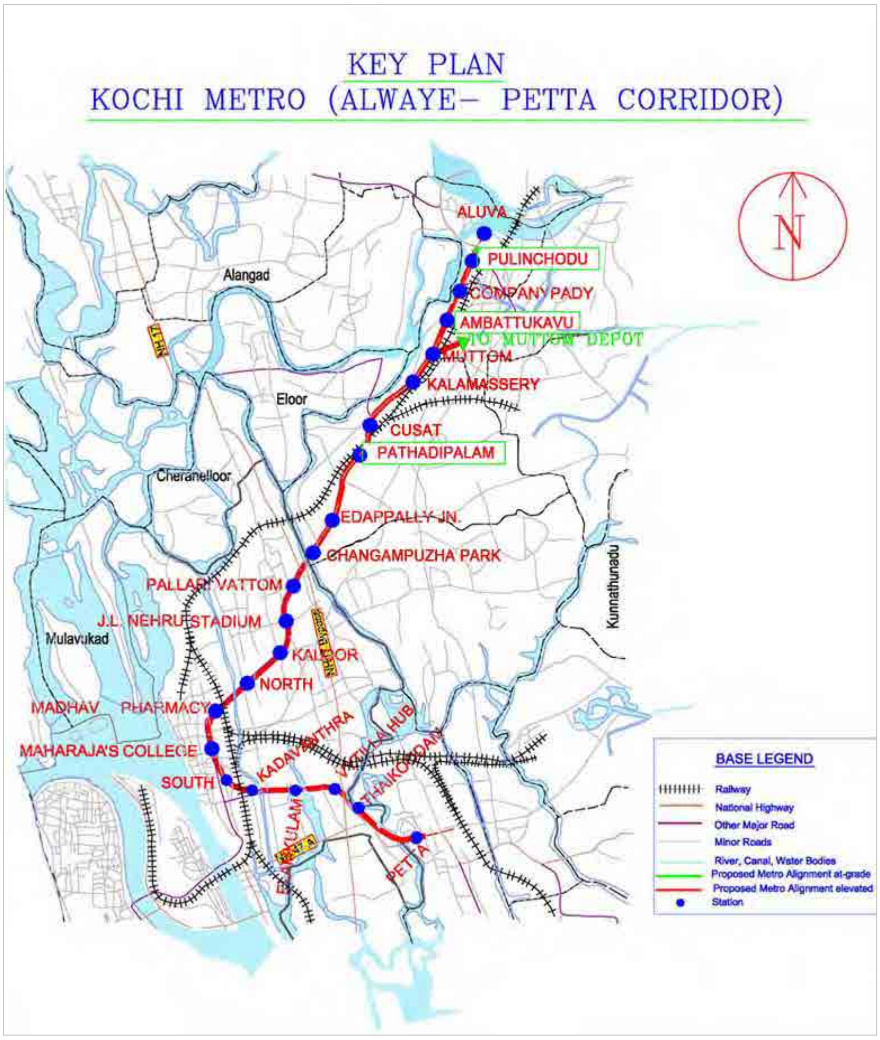


PROJECT PROFILE	
No. of Planned New Lines	3
No. of Planned Stations	Phase 1 A: 11; Phase 1 B: 11; Phase 2: 20
Operator	Jaipur Metro
Expected Commercial Operation Year	2013
Is it Driverless?	No
Rolling Stock (Planned) Vehicle dimensions	a) Length: 21.0 m to 22.0 m Width (outer to outer): 2.9 m Height (above rail level): 3.9 m (Max.) with min. 4 doors each side of modern rolling stock with stainless steel body b) Axle load - 16 tonne (maximum Metro Car axle load) c) Seating arrangement - Longitudinal d) Capacity of 4 coach unit - About 1,034 passengers e) Class of accommodation - One
Daily Passenger Volume (at start up)	320,000
Traction & Power Supply	Voltage: 25 KV OHE Power supply source: 132/32/25kV SCADA system: Yes
Current Collection System	OHE
Type of Signaling System	Cab Signaling and continuous Automatic Train Control with Automatic Train Protection (ATP)
Telecommunication	Integrated System with Fibre Optic cable, SCADA, Train Radio, PA system, etc. Train Information System, Control Telephonic and centralized Clock System
Fare Collection	Automatic Fare Collection System with POM and using Smart Card technology
Platform Screen Doors (if Available)	No
Track Gauge	Standard Gauge 1,435 mm

PROJECT STATUS			
Status		Detailed Project Report (Phase 1&2)	
Phase 1	Planning (Pre-PIB Revewing)	Project Cost	INR 9,732 crores
Phase 2	Planning (Pre-PIB Revewing)	FIRR	Phase 1: 1.27% (CCost with CTaxes) Phase 2: 7.37% (incl. property devt)
		EIRR	Phase 1: 19.0% (w/out taxes) Phase 2: 18.6%

INVESTMENT PLAN			
Financing Scheme	Phase 1: (Government Sponsored)		
Proposed Sources of Funds		Amount (Crores)	%
	Equity by GoI	1,506	20%
	Equity by State	1,506	20%
	SD for land cost (State)	296	4%
	SD for Taxes (GoI, State)	670	9%
	Property Devt (upfront)	200	3%
	JICA Loan	3,353	44%
	Total	7,531	100%
Financing Scheme	Phase 2: (PPP)		
Proposed Sources of Funds		Amount (Crores)	%
	VGF - GoI	1,317	20%
	VGF - State	626	9.50%
	Acquisition Cost for non-government land as VGF	681	10.50%
	Property Development	200	3%
	Concessionaire Equity	1,253	19%
	Concessionaire Debt	2,506	38%
	Total	6,583	100%

PROJECT NAME: Kochi Metro		
CITY PROFILE		
	2001	**2011**
Population (Ernakulam)	3.11 M	3.28 M
Population Density (per sq. km.)	1,012	1,158
Major Industries	Construction, manufacturing, shipbuilding, transportation/shipping, seafood and spices exports, chemical industries	Construction, manufacturing, shipbuilding, transportation/shipping, seafood and spices exports, chemical industries, information technology (IT), tourism, health services, and banking
GSDP Growth Rate (%)	5.17	9.51
Share of Transportation Modes	Bus: 14%; Cars: 38%; 2-Wheel: 35%; 3-Wheel: 13%	
Fare per km	Bus: INR 3 up to 5 km, 52 paise/km for additional distance Taxi: INR 50 up to 5 km, INR 6.5/km for additional distance, waiting charge INR 6/hour Auto Rickshaw: Fixed minimum fair of INR 10 up to 1.5 km, INR 5/km for additional distance, waiting charge INR 1 per 15 minutes	
PROJECT ROUTES		
Line 1 From Alwaye to Petta	Total Length = 25.253 km	PHPDT: Yr 2015 = 17,663; Yr 2025 = 23,6221
ROUTE MAP		



PROJECT PROFILE				
No. of Planned New Lines	1			
No. of Planned Stations	23 Elevated			
Operator	KOMET			
Expected Commercial Operation Year	2016			
Is it Driverless?	No			
Rolling Stock (Planned)	a) 2.7 m wide modern rolling stock with stainless steel body, Standard Gauge b) Axle load - 13 t c) Seating arrangement - Longitudinal d) Capacity of 3 coach unit - 600 passengers e) Class of accommodation - One			
Daily Passenger Volume (at start up)	381,868			
Traction Power Supply	a) 2.7 m wide modern rolling stock with stainless steel body, Standard Gauge b) Axle load - 13 t c) Seating arrangement - Longitudinal d) Capacity of 3 coach unit - 600 passengers e) Class of accommodation - One			
Current Collection System	OHE			
Type of Signaling System	Cab Signaling and continuous Automatic Train Control with Automatic Train Protection (ATP)			
Telecommunication	Integrated System with Fibre Optic cable, SCADA, Train Radio, PA system, etc.			
Fare Collection	Automatic Fare Collection system with POM and Smart Cards, etc.			
Platform Screen Doors (if Available)	No			
Track Gauge	Standard Gauge 1,435 mm			
PROJECT STATUS				
Status		Detailed Project Report		
Line1	Under Procurement	Project Cost	INR 5,146 crores (completion cost, incl. escalation, with Central and State Taxes)	
		FIRR	3.04%	
		EIRR	14.2%	
INVESTMENT PLAN				
Financing Scheme	Government Sponsored			
Proposed Sources of Funds		Amount (Crores)	%	
	Equity - GoI and State	1,571	32%	
	SD - GoI and State	1,178	24%	
	JICA	2,160	44%	
	Total	4,910	100%	

PROJECT NAME: Lucknow Metro			
CITY PROFILE			
	2001	**2011**	
Population	3.65 M	4.59 M	
Population Density (per sq. km.)	1,443	1,815	
Major Industries	IT, Manufacturing and Processing and Medical/ Bio-Technology, handicraft sector	IT, Manufacturing and Processing and Medical/Bio-Technology, handicraft sector	
GSDP Growth Rate (%)	2.17	6.86	
Share of Transportation Modes	Bus: 14%; Cars: 38%; 2-Wheel: 35%; 3-Wheel: 13%		
Fare per km	Bus: INR 2/km; Taxi: INR 10/km; Auto Rickshaw: INR 6/km		
PROJECT ROUTES			
Phase 1		Total Length (km)	PHPDT
Corridor 1 (North- South) Line 1 From (CCS Airport to Munshi Pulia) + Gomti Nagar Link		26.541	PHPDT: Yr 2015 = 13,078; Yr 2041 = 41,969
Corridor 2 (East-West) Line 2 From Lucknow Rly Station to Vasant Kunji		11.098	PHPDT: Yr 2015 = 7,639; Yr 2041 = 36,196
ROUTE MAP			

PROJECT PROFILE	
No. of Planned New Lines	2 lines and Gomtinagat Link
No. of Planned Stations	23 Elevated and 13 Underground
Operator	Lucknow Metro Rail Corporation
Expected Commercial Operation Year	2015
Is it Driverless?	No
Rolling Stock (Planned) Vehicle dimensions	a) Length: 21.0 m to 22.0 m Width (outer to outer): 2.9 m Height (above rail level): 3.9 m (Max.) with min. 4 doors each side of modern rolling stock with stainless steel body. b) Axle load - 16 tonne (maximum Metro Car axle load) c) Seating arrangement - Longitudinal d). Capacity of 4 coach unit - About 1574 passengers e). Class of accommodation - One
Daily Passenger Volume (at start up)	560,320
Traction & Power Supply	Voltage: 25 Kv OHE Power supply source: 220/33/25 kV SCADA system: Yes
Current Collection System	OHE
Type of Signaling System	Cab Signaling and continuous Automatic Train Control with Automatic Train Protection (ATP)
Telecommunication	Integrated System with Fibre Optic cable, SCADA, Train Radio, PA system, etc. Train Information System, Control Telephonic and centralized Clock System
Fare Collection	Automatic Fare Collection System with POM and using Smart Card technology
Platform Screen Doors (if Available)	No
Track Gauge	Standard gauge 1,435mm

PROJECT STATUS			
Status		Detailed Project Report (Corridor 1&2)	
Corridor 1	Planning (DPR Prepared)	Feasibility Study	INR 12,671 crores (completion cost incl. escalation and Central Taxes)
Corridor 2	Planning (DPR Prepared)	FIRR	0.63%
		EIRR	16.8%

INVESTMENT PLAN			
Financing Scheme	Government Sponsored		
Proposed Sources of Funds (Corridor 1 & 2)		Amount (Crores)	%
	Equity - GoI and State	5,068	40%
	SD - GoI and State	1,521	12%
	JICA	6,082	48%
	Total	12,671	100%

PROJECT NAME: Ludhiana Metro

CITY PROFILE

	2001	2011
Population	3.03 M	3.49 M
Population Density (per sq. km.)	848	975
Major Industries	Industrial goods, machine parts, auto parts, household appliances, hosiery, apparel, and garments	Industrial goods, machine parts, auto parts, household appliances, hosiery, apparel, and garments
GSDP Growth Rate (%)	1.92	5.94
Share of Transportation Modes	Bus: 14%; Cars: 38%; 2-Wheel: 35%; 3-Wheel: 13%	
Fare per km	Bus: INR 2/km; Taxi: INR 10/km; Auto Rickshaw: INR 5/km	

PROJECT ROUTES

	Total Length (km)	PHPDT
Corridor 1 (North- South) Line 1 From Ayali Chowk to BBMB Power House	15.798	PHPDT: Yr 2016 = 11,064; Yr 2031 = 21,492
Corridor 2 (East-West) Line 2 From Gill Village to Rahon Road Chungi	13.035	PHPDT: Yr 2016 = 9,946; Yr 2031 = 22,931

ROUTE MAP

PROJECT PROFILE	
No. of Planned New Lines	2 lines
No. of Planned Stations	16 Elevated and 11 Underground
Operator	LMRC
Expected Commercial Operation Year	2015
Is it Driverless?	No
Rolling Stock (Planned) Vehicle dimensions	a) Length: 21.0 m to 22.0 m Width (outer to outer): 2.9 m Height (above rail level): 3.9 m (Max.) with min. 4 doors each side of modern rolling stock with stainless steel body b) Axle load - 16 tonne (maximum Metro Car axle load) c) Seating arrangement - Longitudinal d) Capacity of 4 coach unit - About 1,038 passengers e) Class of accommodation - One
Daily Passenger Volume (at start up)	416,000
Traction & Power Supply	Voltage: 750 VDC Power supply source: 220/33 kV (110/33 kv) SCADA system: Yes
Current Collection System	Third Rail Bottom Collection
Type of Signaling System	Cab Signaling and continuous Automatic Train Control with Automatic Train Protection (ATP)
Telecommunication	Integrated System with Fibre Optic cable, SCADA, Train Radio, PA system, etc. Train Information System, Control Telephonic and centralized Clock System
Fare Collection	Automatic Fare Collection System with POM and using Smart Card technology
Platform Screen Doors (if Available)	No
Track Gauge	Standard gauge 1,435 mm

PROJECT STATUS			
Status		Detailed Project Report (Corridor 1&2)	
Corridor 1	Planning (DPR Prepared)	Project Cost	INR 10,516 crores (with IDC and Taxes)
Corridor 2	Planning (DPR Prepared)	FIRR	11.26% (with Central taxes)
		EIRR	12.34% (without taxes)

INVESTMENT PLAN			
Financing Scheme	Government Sponsored		
Proposed Sources of Funds (Corridor 1 & 2)		Amount (Crores)	%
	Equity - GoI and State	3,567	34%
	SD - GoI and State	1,650	16%
	JICA	2,190	21%
	Reimbursement of State taxes	319	3%
	Property Devt	2,805	27%
	Total	10,516	100%

PROJECT NAME: Mumbai Metro

CITY PROFILE

	2001	2011
Population	11.98 M	12.48 M
Population Density (per sq. km.)	19,865	20,694
Major Industries	Finance centre, economic powerhouse, and industrial hub	Finance centre, economic powerhouse, and industrial hub
GSDP Growth Rate (%)	4.05	8.54
Share of Transportation Modes	Bus: 14%; Cars: 38%; 2-Wheel: 35%; 3-Wheel: 13%	
Fare per km	Sub-Urban Rail: INR 0.5/km; Bus: INR 3/km; Taxi: INR 15/km; Auto Rickshaw: INR 10/km	

PROJECT ROUTES

Line	Corridor	Length of the Corridor (kms)			Length (kms)	Period of Implementation
		Underground	Elevated	Length		
1	Versova- Andheri- Ghatkopar	0	15	15	Phase I 84	2006 - 2013
2	Colaba-Mahim Charkop	9.9	26.1	36		
3	Mahim Kurla Mankhurd	33	0	33		
4	Charkop-Dahisar	0	7.5	7.5	Phase II 19.90	2011- 2016
5	Ghatkopar-Mulund	0	12.4	12.4		
6	BKC-Kanjur Marg via Airport	8.5	11	19.5	Phase III 62.8	2016 - 2021
7	Andheri(E) -Dahisar €	0	18	18		
8	Hutatma Chowk Ghatkopar Remaining	8.5	13.3	21.8		
9	Sewri-Prabhadevi	3.5	0	3.5		
	Total	63.4	103.3	166.7	166.7	

• *Line 1 of this project was initially of 15 kms. Now it is reconfigured to 11.40 kms. Proposed spur to International Airport and Vikhroli Car shed excluded from scope of PPP for line-1.

• **Line 2 and Line 3 of the master plan has been reconfigured to Charkop-Bandra-Mankhurd (31.8kms elevated) and Colaba-Bandra (20kms underground).

ROUTE MAP

PROJECT PROFILE

No. of Planned New Lines	9
No. of Planned Stations	Line 1: Elevated 11 Line 2: Elevated 26 Line 3: Underground - 27 Nos.
Operator	For Line 1 & Line 2 it is the SPV, Metro One For other Lines, it has to be decided
Expected Commercial Operation Year	2006 - 2021
Is it Driverless?	No
Rolling Stock (Planned) Vehicle dimensions	a) Length: 22.0 m to 25.0 m Width (outer to outer): 3.20 Height (above rail level): 4.0 m (Max.) with min. 4 doors each side of modern rolling stock with stainless steel body b) Axle load - 15 tonne (maximum Metro Car axle load) c) Seating arrangement - Longitudinal d) Capacity of 6 coach unit - About 1,792 passengers e) Class of accommodation - One
Daily Passenger Volume (at start up)	1,540,000
Traction & Power Supply	Voltage: 25 KV DC Current collection: Over head Catenary Power supply source: 132 kV/25 kV AC Nos. of Traction Sub Station: 1 nos SCADA system: Yes
Current Collection System	3rd Rail
Type of Signaling System	Cab Signaling and continuous Automatic Train Control with Automatic Train Protection (ATP)
Telecommunication	Integrated System with Fibre Optic cable, SCADA, Train Radio, PA system, etc. Train Information System, Control Telephonic and centralized Clock System
Fare Collection	Automatic Fare Collection System with five (5) levels of system facilities using Smart Card technology
Platform Screen Doors (if Available)	No
Track Gauge	Standard gauge 1,435 mm

PROJECT STATUS

Status		Detailed Project Report (Line 3)	
Phase 1-Line 1/ Line 2	Under Construction	Project Cost	INR 21,752 Crores
Phase 1-Line 3	Planning (PIB Revewing)	FIRR	2.98%
Phase 2-Line 4/ Line 5	Planning (DPR Prepared)	EIRR	10.94%
Phase 3- Line 6/ Line 7/ Line 8/ Line 9	Planning (DPR Prepared)		

INVESTMENT PLAN

	Lines	Investment	Remarks
Financing Scheme	Line -1	Cost: INR 2,356 Crores VGF 650 Crores	PPP
	Line -2	Cost: INR 8,250 Crores (2008 Price Level) VGF from GoI and ndash; INR 1,532 Crores	PPP
	Line -3	Cost: INR 21,752 Crores (excl. R and R, utility shifting, State taxes, IE fees etc.). (at 2011price)	Government Sponsored
	Line -4	N/A	N/A
	Line -5	N/A	N/A
	Line -6	N/A	N/A
	Line -7	N/A	N/A
	Line -8	N/A	N/A
	Line -9	N/A	N/A

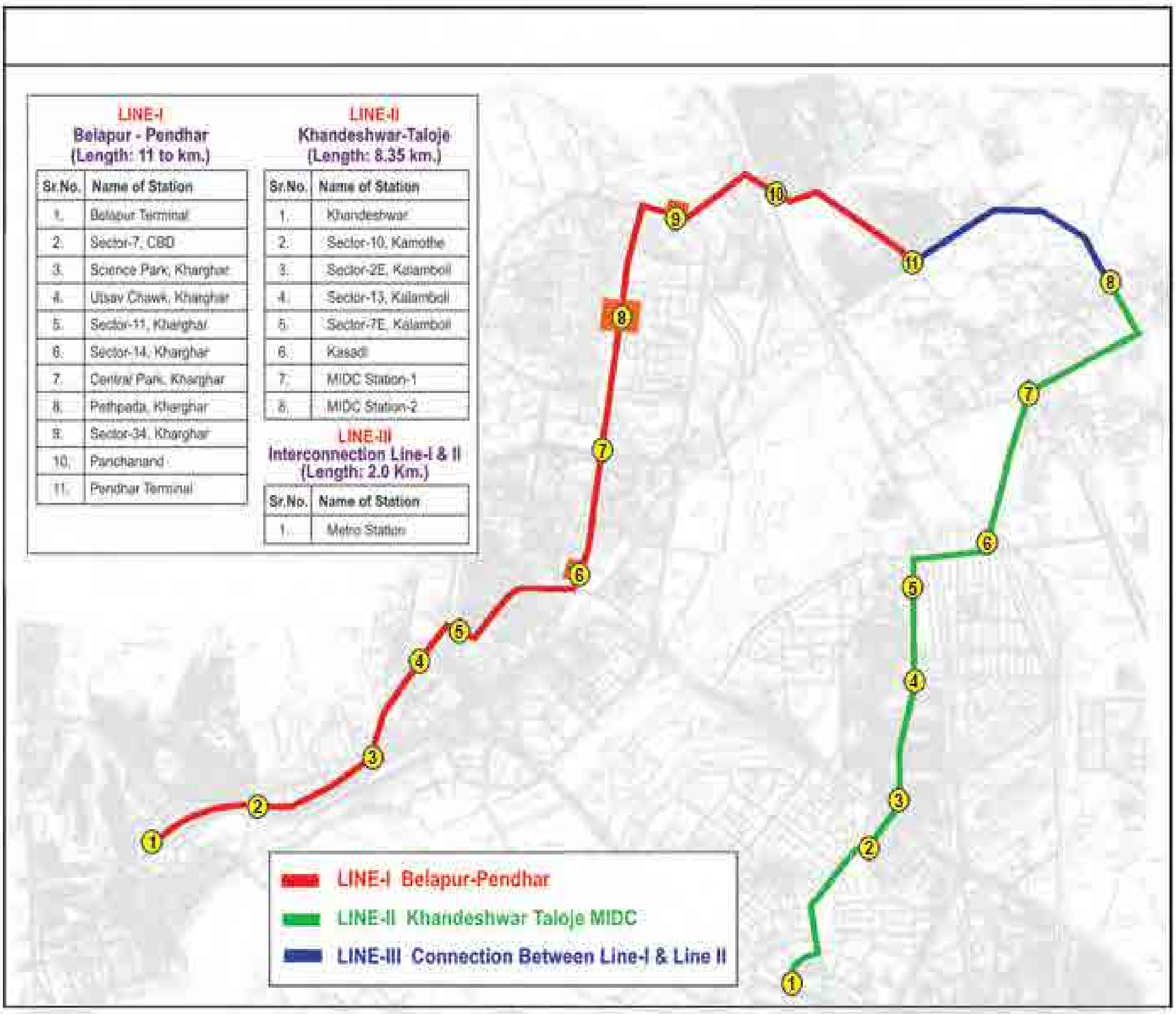
		%
Proposed Sources of Funds (Line 3)	Equity - GoI and State	36%
	SD - GoI and State	13%
	Reimbursement of taxes	2%
	Property Devt	48%
	Total	100%

PROJECT NAME: Navi Mumbai Metro		
CITY PROFILE		
	2001	**2011**
Population	1.19 M	2.32 M
Population Density (per sq. km.)	N/A	N/A
Major Industries	IT, Education finance centre, industrial hub	IT, Education finance centre and industrial hub
GSDP Growth Rate (%)	4.05	8.54
Share of Transportation Modes	Bus: 14%; Cars: 38%; 2-Wheel: 35%; 3-Wheel: 13%	
Fare per km	Sub-Urban Rail: INR 0.5/km; Bus: INR 3/km; Taxi: INR 15/km; Auto Rickshaw: INR 10/km	

PROJECT ROUTES

Line	First operational	Stations	Length (km)
Line-1 Uran-Ranjanpada-Nerul	N/A	N/A	28.3
Line-2 Belapur-Kharghar-Taloje-MIDC-Kalamboli-Khandeshwar-Airport	December 2014	17	21.4
Line -3 Vashi-Nerul-Panvel	N/A	N/A	25
Line-4 Uran-Ranjanpada-Nerul	N/A	11	14
Line-5 Belapur-Kharghar-Taloje-MIDC-Kalamboli-Khandeshwar-Airport	N/A	N/A	20
Line -6 Vashi-Nerul-Panvel	N/A	N/A	9

ROUTE MAP



<table>
<tr><th colspan="4">PROJECT PROFILE</th></tr>
<tr><td>No. of Planned New Lines</td><td colspan="3">6</td></tr>
<tr><td>No. of Planned Stations</td><td colspan="3">N/A</td></tr>
<tr><td>Operator</td><td colspan="3">Not finalized; can be CIDCO or outsourced</td></tr>
<tr><td>Expected Commercial Operation Year</td><td colspan="3">February 2015</td></tr>
<tr><td>Is it Driverless?</td><td colspan="3">No</td></tr>
<tr><td>Rolling Stock (Planned)
Vehicle dimensions</td><td colspan="3">a) Length: 21.0 m to 22.0 m
Width (outer to outer): 2.9 m
Height (above rail level): 3.9 m (Max.)
with min. 4 doors each side of modern rolling stock with stainless steel body
b) Axle load - 16 tonne (maximum Metro Car axle load)
c) Seating arrangement - Longitudinal
d) Capacity of 3 coach unit - About 764 pax
e) Class of accommodation - One</td></tr>
<tr><td>Daily Passenger Volume (at start up)</td><td colspan="3">159,334</td></tr>
<tr><td>Traction & Power Supply</td><td colspan="3">Voltage: 25 KV OHE
Power supply source: 132/32/25 kV
SCADA system: Yes</td></tr>
<tr><td>Current Collection System</td><td colspan="3">Over Head Current Collection</td></tr>
<tr><td>Type of Signaling Systems</td><td colspan="3">Cab Signaling and continuous Automatic Train Control with Automatic Train Protection (ATP)</td></tr>
<tr><td>Telecommunication</td><td colspan="3">Integrated System with Fibre Optic cable, SCADA, Train Radio, PA system, etc.
Train Information System, Control Telephonic and centralized Clock System</td></tr>
<tr><td>Fare Collection</td><td colspan="3">Automatic Fare Collection System with POM and using Smart Card technology</td></tr>
<tr><td>Platform Screen Doors (if Available)</td><td colspan="3">No</td></tr>
<tr><td>Track Gauge</td><td colspan="3">Standard gauge 1,435 mm</td></tr>
<tr><th colspan="4">PROJECT STATUS</th></tr>
<tr><td colspan="2">Status</td><td colspan="2">Detailed Project Report (Line 1)</td></tr>
<tr><td>Line 1</td><td>Under Procurement</td><td>Project Cost</td><td>INR 4,163 Cores
(completion cost with Central Taxes)</td></tr>
<tr><td>Line 2-6</td><td>Planning (DPR Prepared)</td><td>FIRR</td><td>5.0%</td></tr>
<tr><td></td><td></td><td>EIRR</td><td>11.7%</td></tr>
<tr><th colspan="4">INVESTMENT PLAN</th></tr>
<tr><td>Financing Scheme</td><td colspan="3">Government Sponsored</td></tr>
<tr><td>Sources of Funds
(Line 1)</td><td colspan="3">100% State Funded</td></tr>
</table>

PROJECT NAME: Noida and Gr. Noida Metro			
CITY PROFILE			
	2001	**2011**	
Population	1.02 M	1.17 M	
Population Density (per sq. km.)	N/A	N/A	
Major Industries	IT, Manufacturing and Processing and Medical/Bio-Technology	IT, Manufacturing and Processing and Medical/Bio-Technology	
GSDP Growth Rate (%)	2.17	6.86	
Share of Transportation Modes	Bus: 14%; Cars: 38%; 2-Wheel: 35%; 3-Wheel: 13%		
Fare per km	Metro: INR 2/km; Bus: INR 2/km; Taxi: INR 15/km; Auto Rickshaw: INR 7/km		
PROJECT ROUTES			
		Total Length (km)	PHPDT
Line 1 From Noida - Greater Noida		29.707	PHPDT: Yr 2014 = 5,362; Yr 2031 = 21,927
ROUTE MAP			

PROJECT PROFILE	
No. of Planned New Lines	1 line
No. of Planned Stations	22 Elevated
Operator	DMRC
Expected Commercial Operation Year	2016
Is it Driverless?	No
Rolling Stock (Planned) Vehicle dimensions	a) Length: 21.0 m to 22.0 m Width (outer to outer): 2.9 m Height (above rail level): 3.9 m (Max.) with min. 4 doors each side of modern rolling stock with stainless steel body b) Axle load - 16 tonne (maximum Metro Car axle load) c) Seating arrangement - Longitudinal d) Capacity of 4 coach unit - About 1,034 passengers e) Class of accommodation - One
Daily Passenger Volume (at start up)	104,000
Traction & Power Supply	Voltage: 25 KV OHE Power supply source: 132/32/25 kV SCADA system: Yes
Current Collection System	Overhead Traction (OHE)
Type of Signaling System	Cab Signaling and continuous Automatic Train Control with Automatic Train Protection (ATP)
Telecommunication	Integrated System with Fibre Optic cable, SCADA, Train Radio, PA system, etc. Train Information System, Control Telephonic and centralized Clock System
Fare Collection	Automatic Fare Collection System with POM and using Smart Card technology
Platform Screen Doors (if Available)	No
Track Gauge	Standard gauge 1,435mm

PROJECT STATUS			
Status		Detailed Project Report	
Line 1	Planning (DPR Prepared)	Feasibility Study	INR 3,629 Crores (with Central Taxes, but no land)
		FIRR	1.87%
		EIRR	12.1%

INVESTMENT PLAN			
Financing Scheme	Government Sponsored		
Proposed Sources of Funds		Amount (Crore)	%
	State Govt	3,329	92%
	Prop. Devt	300	8% (upfront income from Property Devt)
	Total	3,629	

PROJECT NAME: Pune Metro

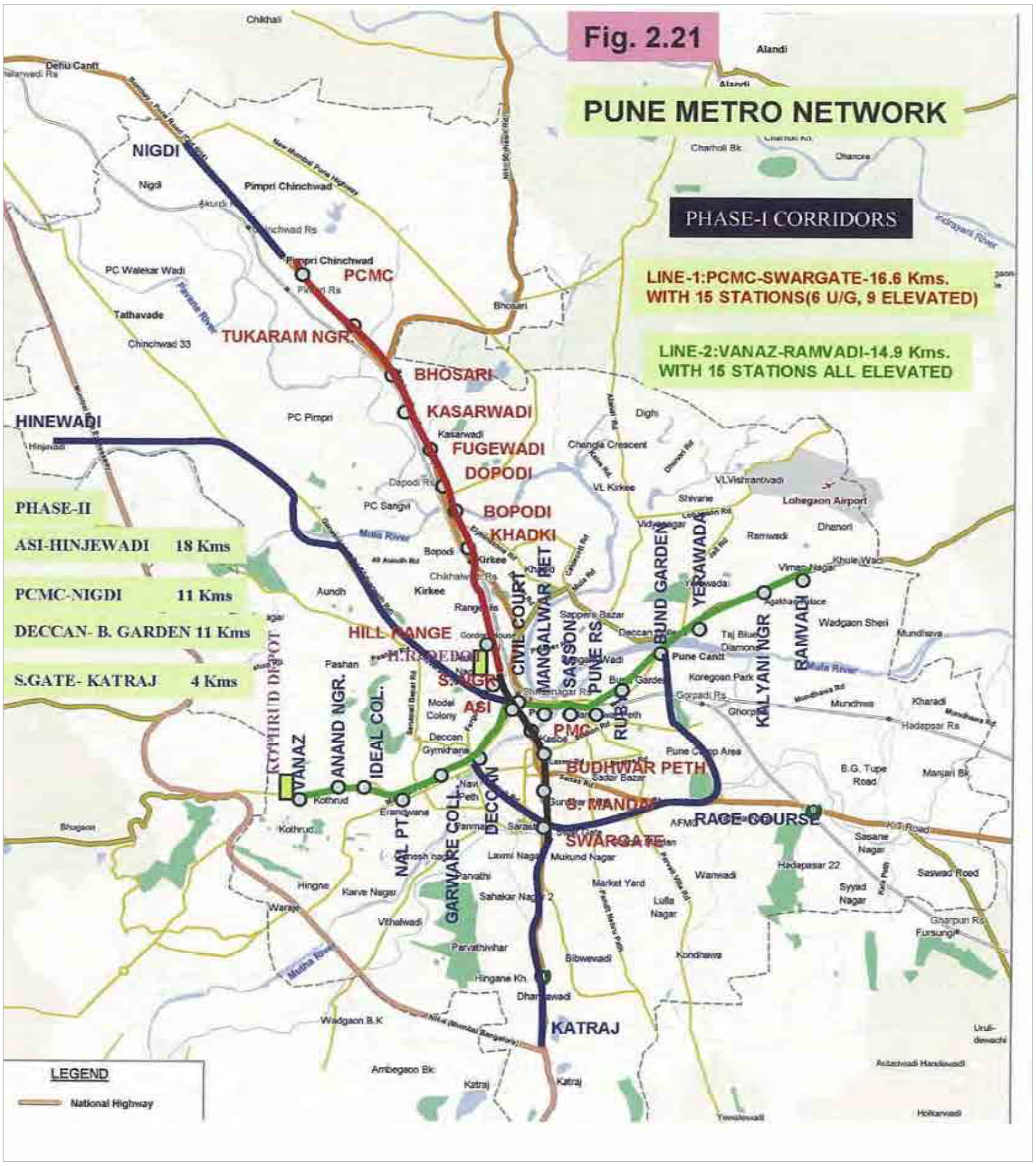
CITY PROFILE

	2001	2011
Population	7.23 M	9.43 M
Population Density (per sq. km.)	462	603
Major Industries	Automotive industry, Food Cluster, IT enabled services	Automotive industry, Food Cluster, IT enabled services
GSDP Growth Rate (%)	4.05	8.54
Share of Transportation Modes	Bus: 14%; Cars: 38%; 2-Wheel: 35%; 3-Wheel: 13%	
Fare per km	Sub-Urban Rail: INR 0.5/km; Bus: INR 3/km; Taxi: INR 15/km; Auto Rickshaw: INR 10/km	

PROJECT ROUTES

	Total Length (km)	PHPDT
Corridor 1 (North- South) Line 1 From PCMC to SWARGATE	16.598	PHPDT: Yr 2021 = 19,699; Yr 2031 = 23,387
Corridor 2 (East-West) Line 2 From VANAZ to RAMVADI	14.925	PHPDT: Yr 2021 = 13,611; Yr 2031 = 22,414

ROUTE MAP



PROJECT PROFILE

No. of Planned New Lines	2 lines
No. of Planned Stations	24 Elevated and 6 Underground
Operator	Pune Metro Rail Corporation (PMRC)
Expected Commercial Operation Year	2015
Is it Driverless?	No
Rolling Stock (Planned) Vehicle dimensions	a) Length: 21.0 m to 22.0 m Width (outer to outer): 2.9 m Height (above rail level): 3.9 m (Max.) with min. 4 doors each side of modern rolling stock with stainless steel body b) Axle load - 16 tonne (maximum Metro Car axle load) c) Seating arrangement - Longitudinal d) Capacity of 4 coach unit - About 1,034 passengers e) Class of accommodation - One
Daily Passenger Volume (at start up)	484,696
Traction & Power Supply	Voltage: 25 kV AV OHE Power supply source: 220/132 kV SCADA system: Yes
Current Collection System	Overhead Current Collection
Type of Signaling System	Cab Signaling and continuous Automatic Train Control with Automatic Train Protection (ATP)
Telecommunication	Integrated System with Fibre Optic cable, SCADA, Train Radio, PA system, etc. Train Information System, Control Telephonic and centralized Clock System
Fare Collection	Automatic Fare Collection System with POM and using Smart Card technology
Platform Screen Doors (if Available)	No
Track Gauge	Standard gauge 1,435 mm

PROJECT STATUS

Status		Detailed Project Report (Corridor 1&2)	
Corridor 1	Planning (DPR Prepared)	Project Cost	INR 7,983 Crores (completion cost, with Central Taxes)
Corridor 2	Planning (DPR Prepared)	FIRR	3.58%
		EIRR	19.76% (without taxes)

INVESTMENT PLAN

Financing Scheme	Government Sponsored		
Proposed Sources of Funds (Corridor 1 & 2)		Amount (Crore)	%
	GoI & Govt. of Maharshtra	3,194	40%
	SD for land cost by GoM	870	11%
	JICA	2,383	30%
	From PD upfront	600	%
	Additional SD for Central Taxes by GOI & Government of Maharashtra	937	12%
	Total	7,983	100%

PROJECT NAME: Delhi Monorail		
CITY PROFILE		
	2001	**2011**
Population	13.85 M	16.75 M
Population Density (per sq. km)	9,340	11,297
Major Industries	Information technology, telecommunications, hotels, banking, media and tourism, Construction, power, health and community services, and real estate	Information technology, telecommunications, hotels, banking, media and tourism, Construction, power, health and community services, and real estate
GSDP Growth Rate (%)	3.87	11.34
Share of Transportation Modes	Bus: 14%; Cars: 38%; 2-Wheel: 35%; 3-Wheel: 13%	
Fare per km	Metro: INR 1.5/km; Bus: INR 2/km; Taxi: INR 10/km; Auto Rickshaw: INR 7/km	

PROJECT ROUTES

Line 1
Shastri Park - Yamuna Pushta Road - Raja Ram Kohli Marg - New Patpar Ganj Road - Sanjay Nagar Lake - Trilokpuri Metro Station - Laxmi Nagar

Total Length = 10.8 km PHPDT = 15,000

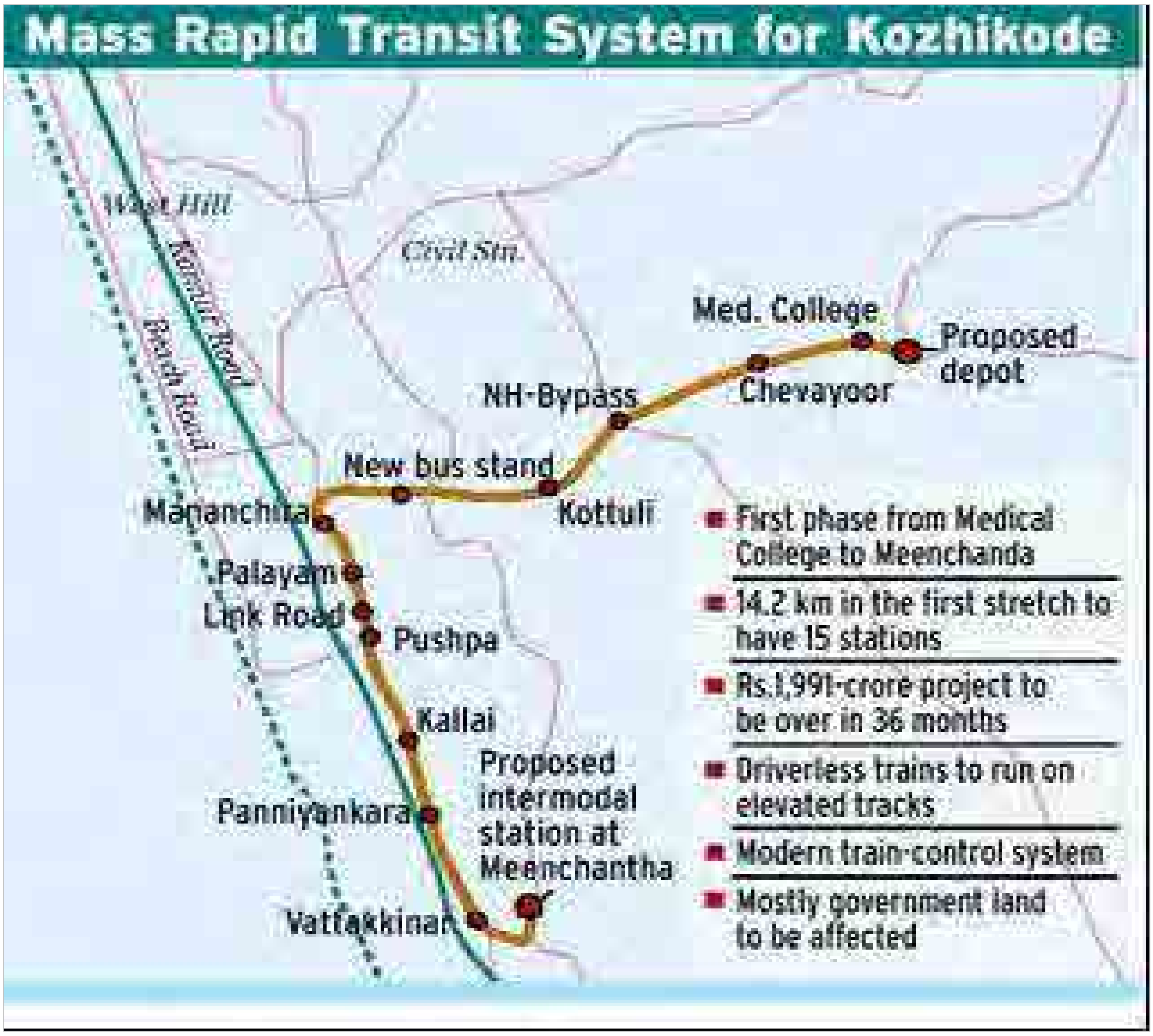
ROUTE MAP

PROJECT PROFILE	
No. of Planned New Lines	1 line
No. of Planned Stations	12 Elevated
Operator	N/A
Expected Commercial Operation Year	2015
Is it Driverless?	Yes
Rolling Stock (Planned)	N/A
Daily Passenger Volume	N/A
Traction Power Supply	N/A
Current Collection System	N/A
Type of Signaling System	Computer Based Interlocking (CBI) signaling and continuous automatic train control with Automatic Train Protection (ATP)
Telecommunication	Integrated System with Optical Fiber Cable, LED/LCD based boards, Mobile Radio, PA system, etc. Train information system, Control telephones and Centralized Clock System
Fare Collection	Automatic fare collection system has been proposed with ticket-vending machines and smart token systems
Platform Screen Doors (if Available)	N/A
Track Gauge	Monorail

PROJECT STATUS			
Status		Detailed Project Report	
Line 1	Planning (DPR Prepared)	Project Cost	INR 2,235 Crores (without Cost of land)
		FIRR	N/A
		EIRR	N/A

INVESTMENT PLAN	
Financing Scheme	N/A
Sources of Funds	N/A

PROJECT NAME: Kozhikode Monorail		
CITY PROFILE		
	2001	2011
Population	2.88 M	3.09 M
Population Density (per sq. km.)	20,038	21,261
Major Industries	N/A	N/A
GSDP Growth Rate (%)	5.17	9.51
Share of Transportation Modes	N/A	
Fare per km	Bus: INR 3 up to 5 km, 52 paise/km for additional distance Taxi: INR 50 up to 5 km, INR 6.5/km for additional distance, waiting charge INR 6/hour Auto Rickshaw: Fixed minimum fair of INR 10 up to 1.5 km, INR 5/km for additional distance, waiting charge INR 1per 15 minutes	
PROJECT ROUTES		
Line 1 From M.C. Hostel to Meenchnada	Total Length = 14.2 km	PHPDT: Yr 2015 = 5,167; Yr 2031 = 8,292
ROUTE MAP		



PROJECT PROFILE	
No. of Planned New Lines	1 line
No. of Planned Stations	14 Elevated
Operator	Kerala Monorail Corporation Ltd.
Expected Commercial Operation Year	N/A
Is it Driverless?	No
Rolling Stock (Planned)	a) Length of leading Car: 11.66 m Length of Intermediate Car: 11.66 m Width (outer to outer): 3.2 m Height (above rail level): 3.64 m with min. 4 doors each side of modern rolling stock with Aluminum body b) Axle load - 12.5 tonne (maximum Metro Car axle load) c) Seating arrangement - Depending on Client Requirements d) Capacity of 3 coach unit - About 400-525 passengers e) Class of accommodation - One
Daily Passenger Volume (at start up)	147,950
Traction Power Supply	Voltage: 750V DC Current collection: Third rail bottom collection Power supply source: 132 kV/750 VDC Nos. of Receiving Substations: About 2 nos. Nos. of Traction Substations: Approx @3km and one in each depot SCADA system: Yes
Current Collection System	OHE
Type of Signaling System	Communication based train Control with Cab Signaling and ATO - Driver less operation is possible
Telecommunication	Integrated System with Fibre Optic cable, SCADA, Train Radio, PA system, etc.
Fare Collection	Automatic Fare Collection system with POM and Smart Cards, etc.
Platform Screen Doors (if Available)	N/A
Track Gauge	Monorail

PROJECT STATUS			
Status		Detailed Project Report	
Line 1	Planning (DPR Prepared)	Project Cost	INR 1,991 Crores (Completion cost with Central Taxes)
		FIRR	2.08%
		EIRR	15.92%

INVESTMENT PLAN			
Financing Scheme	Government Sponsored		
Proposed Sources of Funds		Amount (Crore)	%
	Equity by GOI & GOK	796	40%
	SD for Central Taxes by GOI & GOK	221	11%
	Land to be provided by	143	7%
	Through Green Tax	114	6%
	JICA Loan/Supplier Credit	717	36%
	Total	1991	100%

PROJECT NAME: Mumbai Monorail		
CITY PROFILE		
	2001	**2011**
Population	11.98 M	12.48 M
Population Density (per sq. km.)	20,038	21,261
Major Industries	Finance centre, economic powerhouse, and industrial hub	Finance centre, economic powerhouse, and industrial hub
GSDP Growth Rate (%)	4.05	8.54
Share of Transportation Modes	N/A	
Fare per km	Bus: INR 3 up to 5 km, 52 paise/km for additional distance, Taxi: INR 50 up to 5 km, INR 6.5/km for additional distance, waiting charge INR 6/hour Auto Rickshaw: Fixed minimum fair of INR 10 up to 1.5 km, INR 5/km for additional distance, waiting charge INR 1 per 15 minutes	

PROJECT ROUTES

Line 1 From Gadge Maharaj Chowk - Wadala – Chembur Raiway Station   Total Length = 19.543 km   PHPDT: Yr 2016 = 7,400; Yr 2031 = 8,300

ROUTE MAP

PROJECT PROFILE	
No. of Planned New Lines	1 line
No. of Planned Stations	18 Elevated
Operator	L&T and Scomi Rail Owner MMRD
Expected Commercial Operation Year	2013
Is it Driverless?	No
Rolling Stock (Planned)	a) Length of leading Car: 11.66 m Length of Intermediate Car: 11.66 m Width (outer to outer): 3.1 m Height (above rail level): 3.64 m with min. 4 doors each side of modern rolling stock with Aluminum body b) Axle load - 10 tonne (maximum Car axle load) c) Seating arrangement - Longitudinal d) Capacity of 4 coach unit - About 700 passengers e) Class of accommodation - One
Daily Passenger Volume (at start up)	N/A
Traction Power Supply	Voltage: 750V DC Current collection: Third rail bottom collection Power supply source: 132kV/750 VDC Nos. of Receiving Substations: About 2 nos. Nos. of Traction Substations: Approx @3km and one in each depot SCADA system: Yes
Current Collection System	Third Rail
Type of Signaling System	Computer Based Interlocking (CBI) signaling and continuous automatic train control with Automatic Train Protection (ATP)
Telecommunication	Integrated System with Optical Fiber Cable, LED/LCD based boards, Mobile Radio, PA system, etc. Train information system, Control telephones and Centralized Clock System.
Fare Collection	Automatic Fare collection system with POM/TVM, Contactless Smart card and Retractable Flap Type Control Gates etc.
Platform Screen Doors (if Available)	N/A
Track Gauge	Monorail

PROJECT STATUS			
Status		Detailed Project Report	
Line 1	Under Construction	Project Cost	INR 1,664.74 Crores (Completion cost, w/out land and C. Taxes)
		FIRR	N/A
		EIRR	18.53%

INVESTMENT PLAN	
Financing Scheme	Government Sponsored
Sources of Funds	100% State Funded

<Appendix 2>

Field Study Record (Kochi Metro)

A field study on the planned sites of the Kochi Metro was conducted on November 30, 2012.

08:20 Starting Station: Planned site of the Aluva Station

The starting station is planned to be constructed in the north of the Rajiv Gandhi bus terminal, on the east side of the road.

In order to construct the station, the land on the east side of the road is planned to be acquired. The main road in the proximity of the planned site is mostly flyover, and the Metro will be constructed on the flanking road of the main road, which runs near the private land. The location is approximately 800 meters west of the Aluva Station of the Indian Railways.

From the viewpoint of the convenience of transfer between the Station and the bus terminal, an elaborate design is required in layout of the Station and the connecting passage.

The design will vary greatly if it is the elevated walkway (crossover bridge) which crosses the road, or the road under the viaduct (flyover). The planned line of the Metro which runs in the vicinity of the Station has some sections with grade (inclination) and tight curves. Therefore, the extent of private lands needs to be considered along with other factors.

09:05: Planned site of Muttom Depot

Along the east side of the National Highway (NH) 47, on which the Metro line will be laid, a double-track electrified line of the Indian Railways (IR) runs at the same level of the road. The planned site of depot is a grassed area lies further east of the IR line. The level of the site is approximately four meters lower than the IR line. The grassed area will be mounted about one meter, and the depot will be constructed on the mound. According to the officials, although it looks like that the ground level of the site is considerably lower than surroundings, but it is higher enough than the high-water lever (flood water lever) of neighboring river, thus there is no risk of the water immersion.

09:20 Planned site of Kalamassery Station

As the Station will be constructed above the road, the structure of the building will be three-layered and the ticket gate and the concourse will be on the second layer.

The elevated walkway which crosses the road will be constructed, and land will be prepared on the both side of the road to install stairways and doorway. Besides, a parking lot will be constructed.

09:40: Planned site of Edapally JN Station

The Station will be constructed on the north side of the crossing of the Kochi-Mumbai Road and Kochi-Chennai Road. A large-scale shopping mall is on the northwest side of the road. There is an idea to develop the desolate canal neighboring the Station and provide ferry service, which enables an intermodal passenger transport.

10:50: Planned site of J.L Nehru Stadium Station

The Station will be constructed on 300 meters west of the Stadium. As there is a land for parking lot at present, it will be easy to develop the vicinity of the station. Construction of a feeder line from the Station is planned for future. Besides, the head quarter and control center of the Kochi Metro Rail Ltd. will be located at the neighboring area. The officials say the methods for connection of the main line and the feeder line is the subject of future investigation.

11:06: Overbridge over IR line, north of the planned site of the Town Hall-North Station

The rebuilding of the overbridge over the IR line, which is double-tracked and electrified is in progress. Here, the construction of the Metro is ongoing as accomplished fact. Existing overbridge with two-lane & walkway will be added with new bridge lanes on the both sides, and the existing traffic will be transferred to the new lanes, then existing (old) lanes will be demolished (removed).

The Metro and new National Highway will be constructed on the room made by the above operation.

11:20: Planned site of the Madhava Pharmacy Station

The Station will be constructed on the MG Road (Mahatma Gandhi Road: NH-47) in the central area of the city. As the NH-47 bends at a right angle at the Major Junction, the exceptional curvature for the unavoidable case, that is, 120 m-radius will be applied to connect the line with the Station.

11:40: Pile load test site at the KSRTC Bus terminal

Extension of the road leads to the KSRTC Bus terminal and construction of overbridge over the IR line is now in progress. As congestion of NH-47 is anticipated with the construction work of the Metro, utilization of the road as a bypass road of NH-47 is considered, according to the officials. Earlier than the construction work of the Metro, a deliberate transport infrastructure development is in progress all over the city.

Pile load tests are conducted at the corner of the bus terminal, and a load test of a two-meter (diameter) pile test was in progress. According to the officials, they want to use monopile pier (bridge column) by using two-meter piles.

12:30: Planned site of Ernakulam South Station

In order to connect with the Station of the IR, the Metro line track will be laid to the front of the Ernakulam Junction (South) form NH-47. The stations of Metro and IR will be connected with an elevated walkway. In order to run along the Sahadarah Ayyappan Road, the Metro will turn to the east at this point. For this routing to be realized, a long-span overbridge over the IR's line will be constructed. Because the Sahadarah Ayyappan Road goes over the IR's line by an overbridge, it is indispensable to acquire the land on the north side of the road to way around the existing overbridge road.

13:00 Planned site of the Vytila Station

The route has been changed. New route is: From the Sahadarah Ayyappan Road via the crossroad of NH-47 bypass to the bus terminal. Then, crosses the canal two times to enter the Thipunithura Road. Besides the connection with the bus terminal, connection with the transportation by water is considered.

13:20: Terminal Station: Planned site of the Petta Station

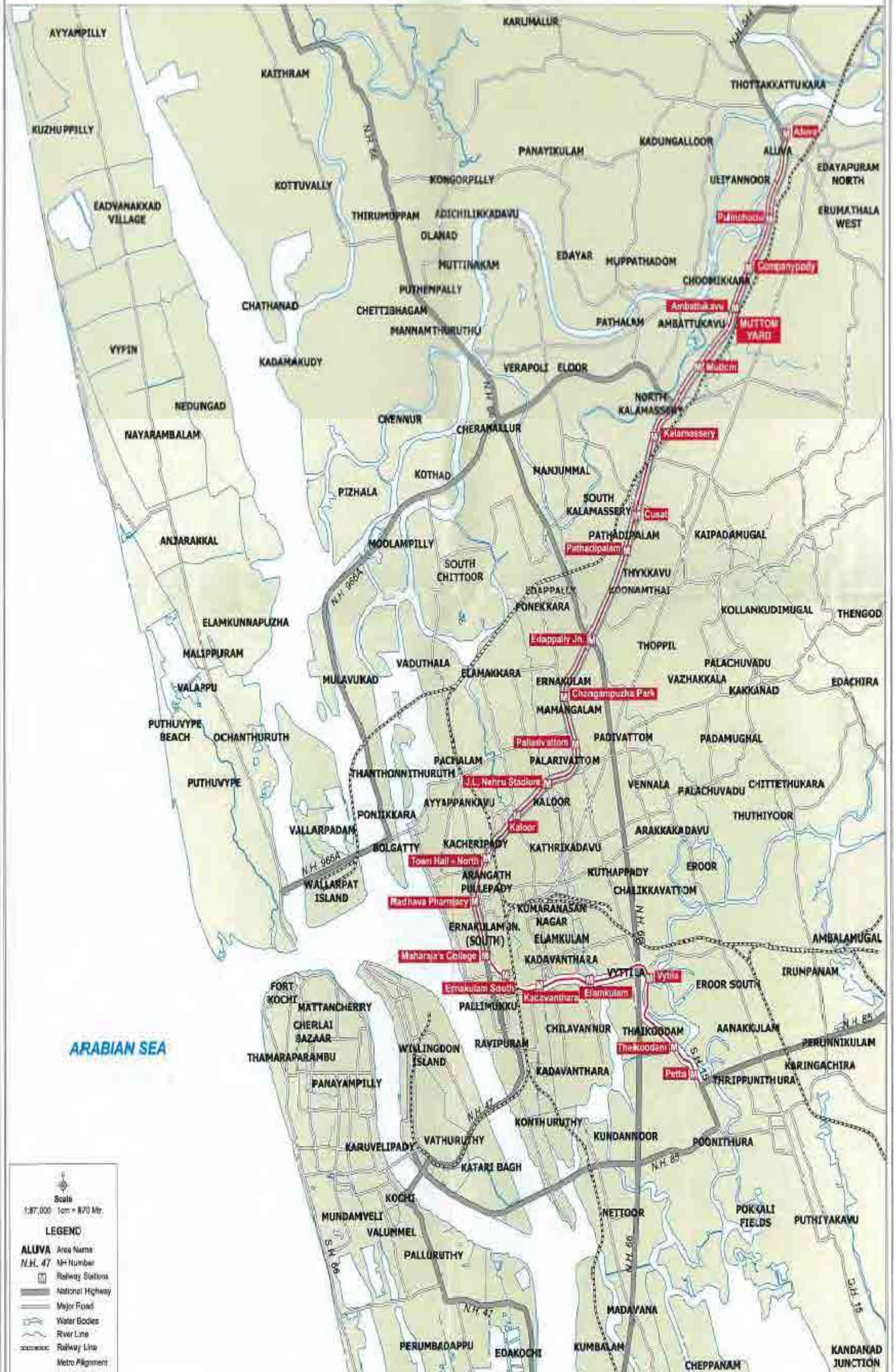
Planned site of the Petta Station is the point where the Thipunithura Road meets the NH-49 and its vicinity.

Paved width of the road section of the Thipunithura Road between Vytila and the terminal, Petta, is approximately 15 meters, and road width of approximately 25 is acquired. However, additional upgrading will be necessary. Parking lot development is planned around the Petta Station. Besides, another road extension plan (3 km) exists.

KOCHI METRO RAILWAY NETWORK

METRO RAILWAY STATIONS

1. Aluva
2. Pulinchodu
3. Companypady
4. Ambattukavu.
5. Muttom.
6. Kalamassery.
7. Cusat
8. Pathadipalam.
9. Edapally junction.
10. Changampuzha Park
11. Palarivattom
12. J.L.Nehru Stadium
13. Kaloor
14. Town Hall- North Station
15. Madhava Pharmacy
16. Maharaja's College
17. Ernakulam south
18. Kadavathra
19. Elamkulam
20. Vytila
21. Thaikoodam
22. Petta



<Appendix 3> Field Study Pictures

Site Photographs of the Kochi Field study

	
Planned Site of the Aluva Station	Road under the Aluva flyover
	
Buildings along the bypass facing downtown near the Aluva Station	Aluva Station bus terminal
	
Electrified double track of the Indian Railways between the Muttom yard and the planned line	Planned site of the Muttom yard (grassed area, will be raised to road level)

				
	Planned site of the Muttom yard (grassed area). Approx. 4m-high mound for the Indian Railways line on the right		Planned site of the Muttom Depot planned site (grassed area)	
				
	Kalamassery Station planned site		Near-by road of the Kalamassery Station planned site	
				
	Planned site of the Edapally road Junction Station		Road adjacent to the planned site of the Edapally road Junction	

Development of waterway near the Edapally road Junction (ferry service plan)

Large-scale shopping mall at the Edapally road Junction Station

Edapally road Junction

Edapally road Junction

Edapally road Junction

JL Nehru Stadium gate

	
JL Nehru Stadium	Vicinity of the JL Nehru Stadium Station
	
Vicinity of the JL Nehru Stadium	Parking lot of the JL Nehru Stadium, a planned site for the Head Quarters and Control Center of the Kochi Metro
	
Construction site of the overbridge renovation near Lissi	Construction site of the overbridge renovation near Lissi

	
Construction site of the overbridge renovation near Lissi	Construction site of the overbridge renovation near Lissi
	
Urban center, near the Chennai Silks and the petrol station: Planned site of the Madhav Pharmacy Station	Urban center, near the Chennai Silks and the petrol station: Planned site of the Madhav Pharmacy Station
	
Urban center: Planned site of the Madhav Pharmacy Station	Urban center: Planned site of the Madhav Pharmacy Station

KSRTC bus terminal: Newly-built Road over rail construction site

Pile load test site at the KSRTC bus terminal

Pile load test site at the KSRTC bus terminal

Pile load test site at the KSRTC bus terminal

Pile load test site at the KSRTC bus terminal: Pile driver (Earth auger method)

Pile load test site at the KSRTC bus terminal

Planned site of the Ernakulam South Station

Planned site of the Ernakulam South Station

Planned site of the Ernakulam South Station

Planned site of the Ernakulam South Station

Heading from the planned site of Ernakulam South Station to the flyover via the overbridge

Heading from the planned site of Ernakulam South Station to the flyover via the overbridge

Vyttla bus terminal

Vyttla bus terminal

Canal behind the Vyttla bus terminal

Viewing downtown form the Vyttla bus terminal

Road adjacent to the planned site of the Petta Station

Road adjacent to the planned site of the Petta Station

	
Road adjacent to the planned site of the Petta Station	Road adjacent to the planned site of the Petta Station
	
Petta Skylark Tower	
	
Press corps	Press corps

				
	Press corps		Press corps	

Site Photographs of the Mumbai Field study

	
Construction site of the Mumbai Metro Line 1 (1)	Construction site of the Mumbai Metro Line 1 (2)
	
Planned to be the node of the Mumbai Metro Line 3	Planned site of terminal station of the Mumbai Metro Line 3 (SEEPZ Station)
	
Bus terminal near the planned site of the SEEPZ Station	Construction site of the depot for the Mumbai Metro Line 3 (1)

	
Construction site of the depot for the Mumbai Metro Line 3 (2). Public dairy company owns the land.	Bus terminal near the planned site of the terminal station of the Mumbai Metro Line 3 (Cuffe Parade Station).
	
Construction site of the Mumbai Monorail (1)	Construction site of the Mumbai Monorail (2)
	
Construction site of the Mumbai Monorail (3)	Construction site of the Mumbai Monorail (4)

Site Photographs of the Pune Field study

	
Vicinity of the planned site of the Civil Court Station (corridor 1) of the Pune Metro Phase I	Vicinity of the planned site of the Shivajinagar Station (corridor 2) of the Pune Metro Phase I
	
Planned site of the viaduct stretch of the Pune Metro Phase II (LRT system is proposed by Toshiba)	Construction site of a BRT bus station in the Pune city (1)
	
Construction site of a BRT bus station in the Pune city (2)	Vehicle for BRT: Besides the wide doors for BRT platform, ordinary doors are installed on the opposite side.

Site Photographs of the Navi Mumbai Field study

	
Belapur Central Business District Railway Station of the Indian Railways, adjacent to the planned site of the Betapur Terminal Station (terminus of the Line 1)	Planned site of the Betapur Terminal Station (Northwest adjacent to Belapur Central Business District Railway Station. Used as a bus terminal as of now)
	
Construction site of the viaduct of the Line 1 (1)	Construction site of the viaduct of the Line 1 (2)
	
Construction site of the viaduct of the Line 1 (3)	Construction site of the viaduct of the Line 1 (4)

<Appendix 4>

Major standards in Railway Signaling

IEC standard	Name	Corresponding CENELEC standard	Remarks
IEC62278	Railway applications – Specification and demonstration of reliability availability, maintainability and safety (RAMS)	EN50126	RAMS standard for Railway
IEC62425	Railway applications – Communication, signaling and processing systems - Safety related electronic systems for signaling	EN50129	A standard for safety-related electronic systems for railway signaling The standard includes the definition of SIL (Safety Integrated Level)
IEC62279	Railway applications – Communications, signaling and processing systems - Software for railway control and protection systems	EN50128	A standard for safety-related software for railway control and protection systems
IEC62280-1	Railway applications – Communication, signaling and processing systems – Part 1: Safety-related communication in closed transmission systems	EN50159 -1	A standard for safety-related communication in closed transmission systems. The standard is essential for the safety-related signaling system using a closed and exclusive network.
IEC62280-2	Railway applications – Communication, signaling and processing systems – Part 2: Safety-related communication in open transmission systems	EN50159 -2	A standard for safety-related communication in open transmission systems The standard is essential for the safety-related signaling system using an open network.
IEC62236-4	Railway applications – Electromagnetic compatibility – Part 4: Emission and immunity of the signaling and telecommunication apparatus	EN50121 -4	A standard for EMC (Electro-magnetic compatibility) for railway signaling and telecommunication apparatus

Note: The name of the corresponding CENELEC standard is exactly the same as that of the IEC standard

Source: Study Team

CENELEC standards are originally for European railways. They usually include certain conditions special to European railways such as interoperability. On the other hand, IEC standards are worldwide standards. Based on the corresponding CENELEC standards, IEC standards take into account various conditions of worldwide railways and exclude the special conditions of European railways. Therefore, from the view of basic safety and performance, both IEC and CENELEC standards describe the same, and the two should be treated in the same way as reference standards

It seems that in India, CENELEC standards are often referred in the specifications of railway signaling systems issued by RDSO of Indian Railways, and therefore CENELEC standards are usually treated as basic reference standards. However, signaling systems for Metro are independent of those of Indian Railways, and it is natural to treat IEC standards equally as reference standards, in terms of encouraging foreign prospective bidders to come and join.

＜appendix 5＞

World Urban Railway Examples

Table of Contents

* AGT: Automated Guideway Transit

World Urban Rail Examples

(1) Country: India -1

Project Name	Delhi Metro Phase 1
Line	Line 1 (Red Line), Line 2 (Yellow Line) and Line 3 (Blue Line)
Mode	Metro
Year of operation	2006
Finance Scheme	ODA (JBIC)
Procurement Package / Contract Style	1) Civil-Underground Stations (incl. lighting, ventilation & air-conditioning): Design-Build 2) Civil-Elevated stations and viaduct (incl. lighting, ventilation and air-conditioning): Design-Build 3) Rolling Stock: Design, manufacture, supply and commissioning 4) Signalling and Train Control, Communication System: Supply, installation, testing and commissioning 5) Traction Power and Power Distribution System: Supply, installation, testing and commissioning 6) Automatic Fare Collection: Supply, installation, testing and commissioning 7) Trackworks: Supply, installation and testing
Contractor	1) a) Consortium of Kumagai Gumi, Skansa, Hindustan Construction Limited, Itochu b) Consortium of Dywidag, Samsung, Shimizu, Larsen and Toubro, Ircon International 2) Various Indian Companies 3) Consortium of Mitsubishi Electric/Mitsubishi Corporation/Hyundai Rotem (Koros) 4) Alstom, Alcatel and Sumitomo 5) a) Underground - Ircon, Cobra, Eliop b) Elevated - ABB Ltd, Best and Crompton Engg 6) Thales 7) Ircon

World Urban Rail Examples

Implication to this Study	- Considered as the first model project of metro in India initiated by DMRC. - Design-Build was used for civil works; civil works included lighting, ventilation and air-conditioning; two types of packages were used for civil works: underground and elevated. - Fragmented approach was used for E&M but less fragmented as compared to Phase II. - Mitsubishi Electric, Mitsubishi Corporation and Kumagi Gumi, Shimzu won the bid as Japanese companies.

World Urban Rail Examples

(1) Country: India -2

Project Name	Delhi Metro Phase 2
Line	Line 4 (Green Line), Line 5 (Violet Line)
Mode	Metro
Year of operation	2010
Finance Scheme	ODA (JBIC)
Procurement Package / Contract Style	1) a) Civil - Underground Stations -Several Packages b) E&M - Underground Stations (Ventilation & Airconditioning) - Several packages 2) Civil - Elevated stations and viaduct - Several packages 3) Rolling Stock (Separate contracts for broad and standard gauge) - Design, manufacture, supply and commissioning 4) Signalling and Train Control - Supply, installation, testing and commissioning 5) Communications and Telecommunications 6) Traction Power and Power Distribution System - Supply, installation, testing and commissioning 7) Automatic Fare Collection - Supply, installation, testing and commissioning 8) Trackworks - Supply, installation and testing
Contractor	1) a) Several contractors - L&T, Afcons, Chinese Cos (tie-up or JV with Indian Cos.), Taiwan Cos., etc b) Several contractors - L&T, Afcons, Chinese Cos (tie-up or JV with Indian Cos.), Taiwan Cos., etc 2) Several Contractors 3) a) Broad gauge - Bombardier b) Standard gauge - BEML, MC, Rotem, (MELCO supplies electric parts) 4) Siemens and Bombardier 5) Alcatel, GE and Motorola 6) Several contractors 7) Samsung 8) Several contractors

World Urban Rail Examples

Implication to this Study	- More fragmented compared to Phase 1, Civil works for Underground, Elevated and viaduct packages have been given to different contractors instead of single package for consortiums - Integration was done by DMRC instead of GC - Reduction in cost resulted from fragmentation - Reduction in cost is mainly due to reduced number of foreign experts hired by GC for the project, instead this has been replaced by DMRC local experts

World Urban Rail Examples

(1) Country: India -3

Project Name	Delhi Metro Phase 2
Line	Airport Express
Mode	Metro
Year of operation	2011
Finance Scheme	- E&M is financed by PPP - Civil work is financed by DMRC
Procurement Package / Contract Style	1) Civil Works for Tunnels, viaducts and stations - thru DMRC 2) E&M - Design, Supply, Installation, Testing, Commissioning, Operate and Maintain
Contractor	1) N.A. 2) DAMEPL (consortium between Reliance Infrastructure and CAF)

World Urban Rail Examples

Implication to this Study	The project has two packages, one for Civil works and the other for E&M. The Civil works portion was implemented and financed by DMRC, while the E&M component was implemented under a PPP Framework. The SPV formed, DAMEPL, is composed of Reliance Infrastructure (95%) and CAF (5%).

World Urban Rail Examples

(1) Country: India -4

Project Name	Mumbai Metro Project - Line 1
Line	Line 1 - Versova-Andheri-Ghatkopar
Mode	Metro
Year of operation	2015
Finance Scheme	PPP (BOOT) - thru an SPV Mumbai Metro One Private Limited (MMOPL); Reliance Infra - 69%, MMRDA - 26% and Veolia Transport RATP Asia - 5%
Procurement Package / Contract Style	- PPP Package - Subsystem 1) Civil Works - Viaducts; 2.) Civil Works - Stations; 3.) Civil Works - Special Bridges; 4.) Civil Works - Depot Earthworks; 5.) Rolling Stock; 6.) Signalling System; 7.) Power Supply Traction & Scada; 8.) Communications System; 9.) Trackworks; 10.) Automatic Fare Collection; 11.) E&M; Escalators; Lifts; 12.) Depot Machinery & Plant; 13.) Depot Civil Works
Contractor	- Main contractor: MMOPL - Subcontractors: 1.) Simplex Infrastructure Ltd 2.) Sew Infrastructure Ltd 3.) Sew Infrastructure Ltd 4.) Shyam Narayan & Bros 5.) CSR Nanjing, China 6.) Siemens 7.) ABB 8.) Thales 9.) VNC Rail One 10.) Indra 11.) ABB; Schindler; OTIS 12.) Awarded to various suppliers 13.) Ahluwalia Contracts (India) Ltd.

World Urban Rail Examples

Implication to this Study	- Several European Suppliers/Contractors were able to obtain contracts from the SPV/Private consortium but no Japanese company was able to do so. - First PPP project under a BOOT framework (Build-Own-Operate-Transfer) - The AFC plan is to use both smart cards and tokens. Although this is not yet finalized and the group is still entertaining other options. - The train operational specs is to use during initial years 4-coach trains and increase this eventually to 6-coach trains. The platforms are designed to accommodate 6-cars. - The total cost of the Versova-Ghatkopar route is Rs.23.5 billion and Rs.65 billion is funded by the government thru VGF. - The project status on civil works as of November 2012 shows that the viaduct works is already 99% completed.

World Urban Rail Examples

(1) Country: India -5

Project Name	Mumbai Metro Project - Line 2
Line	Line 2 - Charkop to Mankhurd via Bandra (32 km)
Mode	Metro
Year of operation	To be decided.
Finance Scheme	PPP - Central and State Govt -Rs.30 billion - Reliance Infra, SNC Lavalin, Reliance Infocomm Consortium -Rs.59.5 billion - MMRDA -Rs.7.7 billion
Procurement Package / Contract Style	PPP Package
Contractor	To be decided.
Implication to this Study	

World Urban Rail Examples

(1) Country: India -6

Project Name	Kolkata - East-West Metro Rail Project
Line	East - West Corridor
Mode	Metro
Year of operation	2014
Finance Scheme	Financed by Kolkata Metro Rail Corp Ltd - an SPV formed between West Bengal State Govt and GoI
Procurement Package / Contract Style	(1) Supply of Rolling Stock (2) Design and Supply of Signalling and Telecoms Systems * Information not available for civil works, etc.
Contractor	(1) CAF - 120 Million for supply of 14 6-car trainsets (2) Ansaldo
Implication to this Study	-Main project features include: (a) track gauge - 1435 mm; (b) Route length of 8.9 km underground and 5.77 km elevated; (c) Traction Power system is 750 V DC Third Rail; (d) Rolling Stock - 2.88 m wide with 1626 pax for a 6-car train; (e) Signalling - cab signaling with CATC with ATP; (f) Civil Works - underground all by TBM; all underground stations by cut-and-cover; elevated sections using U-shaped girders on single pier.

World Urban Rail Examples

1) Country: India -7

Project Name	Chennai Metro Phase 1
Line	Corridor 1 and Corridor 2
Mode	Metro
Year of operation	2014 - 2015
Finance Scheme	Chennai Metro Rail Limited has equal equity of (20.5%) Government of Tamil Nadu and (20.5%) GoI. The balance is funded thru a JICA loan.
Procurement Package / Contract Style	1) a) Design & construction of elevated stations, viaducts & cut-cover tunnels b) Design & construction of elevated stations c) Design & construction of viaducts 2) Design & build - Underground stations airconditioning 3) Design & build - Tunnel ventilation system 4) Design & build - Automatic Fare Collection 5) Design & build - Signalling, Platform Doors and Telecommunications 6) Design & construction - Underground stations 7) Design & build - Traction/substation (Power supply and OHE) 8) Design & build - Lifts and escalators 9) Design & construction - Track works in viaducts, tunnels, underground and depot 10) Design & construction - Depot and Supply of Depot Minor Machines 11) Design, manufacture, supply, testing and commissioning -EMUs; and training of personnel 12) Prefilling of Depot 13) Supply of Rolling Stock
Contractor	1) a) Lanco Infratech Ltd.; b) Consolidated Construction Consortium c) Larson and Toubro; Soma Enterprise Ltd 2) Voltas Ltd. 3) ETA, EPL, India Consortium 4) Nippon Signal Co. Ltd. 5) Siemens 6) Gammon-OJSC Mosmetrostroy JV; Transtonnelstroy-Afcons JV; Metro Tunneling Chennai L&T-SUCG JV 7) Siemens 8) Johnson Lifts Pvt Ltd and SJEC Corp 9) Larsen & Toubro Ltd, Alstom 10) Larsen & Toubro 11) Alstom 12) Tantia Construction Ltd. 13) DRNRECL (Daulat Ram NRECL)

World Urban Rail Examples

Implication to this Study	- Estimated base cost of the project is Rs.140 billion. Central and state governments are expected to provide 41% of the financing, with the balance granted thru a loan from JICA. - General Consultants for this project are: EGIS Rail (France and India), Maunsell, Balaji Rail (India), Yachiyo Engineering. DMRC serves as the Prime Consultant which provides CMRL with advisory services for Phase 1. - Nippon Signal is the Japanese company supplier/contractor for AFC. - Daulat Ram NRECL inaugurated a Rs.2.0 billion rolling stock facility at Sherpur, Mahdya Pradesh.

World Urban Rail Examples

(1) Country: India -8

Project Name	Bangalore Metro Rail Project Phase 1
Line	Purple Line (East-West Corridor) and Green Line (North-South Corridor)
Mode	Metro
Year of operation	2013
Finance Scheme	Thru an SPV named Bangalore Metro Rail Corporation Limited: GoI (25%), GoK (30%), JICA Loan (45%)
Procurement Package / Contract Style	1) Construction of Stations, viaducts 2) Construction of depot 3) Track Laying work 4) Construction of Underground sections 5) Traction, Power Supply & SCADA 6) Escalators 7) Elevators 8) Tunnel Ventilation Systems 9) Environmental Control Systems 10) Manufacture and Supply of Rolling Stock 11) Signalling and Telecommunications 12) AFC
Contractor	1) Navayuga Engg; IVRCL-I8CR; Simplex Infrastructure Ltd.; Ahluwallia Contracts; Punj Loyd-Sembawang; L&T Ltd; Nagarjuna Construction Company; JMC Projects 2) Maytas; URC Construction, Gammon India 3) ITD-ITD CEM JV 4) CEC-SOMA-CICI JV; Coastal-TTS JV 5) ABB 6) Johnson Lifts Pvt Ltd 7) Schindler India Pvt Ltd 8) ETA-LLC 9) Blue Star 10) BRMM BEML, ROTEM, MELCO, MITSUBISHI 11) Alstom, Thales 12) Samsung, Kalindee

World Urban Rail Examples

Implication to this Study	- General consultants of the project are: RITES, Oriental, PB and Systra. - Project features include: (a) Traction and Power Supply - 750 V DC Third Rail (b) Signaling - ATP and ATO (c) 3-car trains for initial years but extendable to 6-cars (d) Elevated (33.48 km) and Underground (8.82 km) - The project is also called "Namma Metro (=Our Metro)".

World Urban Rail Examples

(1) Country: India -9

Project Name	Hyderabad Metro
Line	Corridor 1, 2 and 3
Mode	Metro
Year of operation	2014 (First section in operation)
Finance Scheme	PPP-DBFOT - GoI (10%, thru VGF funding) and Concessionnaire L&T Metro Rail Hyderabad Ltd (90%)
Procurement Package / Contract Style	- PPP Package (DBFOT) - Subsystem (1) Supply of Rolling Stock of 57 3-car trainsets (2) Supply of CBTC (Signalling, Train-control, Communications Systems) (3) Operations Contract
Contractor	- Main ontractor: Larsen and Toubro - Subcontractors: (1) Hyundai Rotem; (2) Thales; (3) Keolis
Implication to this Study	Financial closure achieved in 2011 by Concessionaire (Rs.141 billion). The DBFOT Contract awarded to L&T; has the lowest central financial assistance (VGF) request of Rs.15 billion. Project completion in 5 years, Concession for 35 years with the option to extend for another 25 years. -HMRL has appointed Louis Berger as Independent Engineer for the project. -(a) Traction & Power Supply system is thru 25 kV OHE; (b) ATC and ATP with the option for upgrade to ATO -Survey works, geotechnical investigation works and design engg works (in some parts) have been completed.

World Urban Rail Examples

(1) Country: India -10

Project Name	Ahmedabad Metro
Line	MEGA (Metrolink Express for Gandhinagar and Ahmedabad)
Mode	Metro
Year of operation	To be decided.
Finance Scheme	A Government of Gujarat undertaking; Project Cost is Rs.150 billion
Procurement Package / Contract Style	1) Design & construction of Tunnel by Shield TBM and Underground Stns 2) Design, Manufacture/ Procure, Supply, Installation, Testing, Commissioning and Training of Personnel for Automatic Fare Collection System 3) Design, Manufacture/ Procure, Supply, Installation, Testing, Commissioning and Training of Personnel for Platform Screen Door System 4) Design, Manufacture/ Procure, Supply, Installation, Testing, Commissioning and Training of Telecommunication System and Sub System 5) Design, Manufacture/Procure, Supply, Installation, Testing, Commissioning and Training of Communication Based Train Control System (CBTC) 6) Design, Manufacture/ Supply, Erection, Installation, Testing and Commissioning of Lifts and Escalators 7) Supply, Installation and Commissioning of Power Supply and Traction Electrification System 8) Supply, Installation, Testing & Commissioning of Trackwork and Installation of Third Rail System 9) Design, Manufacture, Supply, Testing, Commissioning of Passenger Rolling Stock (Electrical Multiple Units) and Training of Personnel 10) Construction of Superstructure 11) Construction of Substructure
Contractor	To be decided. EOIs have been requested.

World Urban Rail Examples

Implication to this Study	-Total project length is 76 km with 10 km underground; Viaduct design is twin U- shaped girders; TBM is used for underground sections and cut-and-cover for stations -Initial operation uses 2-car trains, expandable to 4-cars -Driverless metro -Other project features: (a) Traction and Power Supply - 1.5 kV DC Third Rail (b) Signalling and Train control is CBTC with ATP/ATO and ATS (c) Track Gauge is 1676 mm (broad gauge) (d) AFC - smart card technology

World Urban Rail Examples

(1) Country: India -11

Project Name	Jaipur Metro Rail Project - Phase 1
Line	Mansarovar to Chandpole; Chandpole to Badi Chaupar
Mode	Metro
Year of operation	Phase 1A - 2013; Phase 1B - 2017
Finance Scheme	Undertaken thru Jaipur Metro Rail Corporation Ltd., a wholly owned company of the state government of Rajasthan. Total project cost is Rs.31 billion.
Procurement Package / Contract Style	EPC Mode: In Agreement with DMRC on "deposit work" basis for both Phase 1A and 1B. 1) Design, manufacture, supply, installation, testing and commissioning of the complete train control, traffic management and signaling systems for Corridor 2 (EW-A section) of Phase I of Jaipur metro 2) Supply of Rolling Stock
Contractor	1) Alstom 2) BEML
Implication to this Study	-Route Length for Phase 1A -9.7 km and Phase 1B -2.3 km; -Project Status: Phase 1A -civil works under progress, rolling stocks ordered -BEML is in the process of designing affordable metro cars for 2nd tier cities

World Urban Rail Examples

(1) Country: India -12

Project Name	Jaipur Metro Rail Project - Phase 2
Line	Sita Pura to Amba Bari
Mode	Metro
Year of operation	2017
Finance Scheme	Proposed to use PPP mode; Total Completion cost is Rs.65.8 billion.
Procurement Package / Contract Style	- PPP Package
Contractor	Shortlisted bidders: 1) Gammon Infrastructures - Irridium Concession 2) Soma-I.C.F. 3) Reliance Infrastructure 4) Essar Projects-Samsung C.N.T.
Implication to this Study	-Total route length from Sita Pura to Amba Bari: Elevated section is 18.0 km and underground section is 5.1 km.

World Urban Rail Examples

(1) Country: India -13

Project Name	Navi Mumbai First Phase
Line	CBD Belapur-Navi Mumbai International Airport Corridor
Mode	Metro
Year of operation	Line 1 in 2015; Lines 2 and 3 in 2016
Finance Scheme	- Funds from CIDCO; State and Central govts provide tax exemptions; - Estimated Project Cost for Phase 1: Stage 1 -Rs.20 billion for 11.1 km; Stage 2 -Rs.15 billion for 8.35 km; and Stage 3 -Rs.6 billion for 2.0 km.
Procurement Package / Contract Style	1) Construction of Viaducts 2) Design and construction of stations 3) Depot Development 4) General Consultants 5) E&M Package - Design, Manufacture, Supply, Installation, Testing, Commissioning of complete metro system including spares,Training of Operation and Maintenance Personnel, handover to the Authority of the whole equipment (includes Rolling Stock with driving simulator, Signalling and Train Control, Communication System, Power Supply, Traction and SCADA, Trackworks, AFC and Depot Equipment and Railway System's Maintenance for three years).
Contractor	1) Nagarjun Construction Company Ltd & J. Kumar Infraprojects Ltd 2) San Jose Constructura – Mahavir – Supreme consortium (5 stations) 3) Shortlisted bidders - Ahulwalia Contracts; Simplex Infrastructure; Ira Infra Engineering; J. Kumar – CREG Consortium; San Jose – Mahavir – Supreme Consortium; Unity Infra Projects; IVRCL – ETAEPL Consortium; B.G. Shirke (as of 12/19/12). 4) Louis Berger and Balaji Rail Road Systems 5) Document for Qualification (DFQ) issued

World Urban Rail Examples

Implication to this Study	Priority I (thru CIDCO) - execution of corridor 1, Phase 1, 2 and 3 with total length of 23.4 kms Priority II (thru MMRDA) - execution of 2 corridors with total length of 54 kms Priority III (thru NMMC) - execution of 2 corridors with total length of 29 kms Institutional arrangement still to be decided for these phases. Other Project Details: (a) Viaducts - Box girder superstructures, precast segmental construction; single pier substructure; (b) Rolling Stock - 3.2 m wide; 4-coach train(1500 pax) configuration for initial year but expandable to 6-coach (2250 pax) trains in the future; (c) Traction and Power Supply - 25 kV AC OHE; (d) CBTC with ATP/ATO and ATS; (e) AFC - smart card and contactless smart tokens -Formation of an SPV for operation and maintenance is recommended.

World Urban Rail Examples

(1) Country: India -14

Project Name	Gurgaon Rapid Metro Project
Line	Sikanderpur to DLF Phase III
Mode	Metro
Year of operation	2013
Finance Scheme	100% Privately financed; Project cost is Rs.11 billion
Procurement Package / Contract Style	- PPP Package - Subsystem 1) Rolling stock, signaling, power & systems integration; Line Electrification 2) Design, manufacture, supply, installation, testing & commissioning of communication systems 3) Manufacture and installation of AFC 4) Design and construction of elevated viaducts and stations 5) General Consultant
Contractor	- Main contractor: a private contractor - Subcontractors 1) Siemens Mobility 2) FIBCOM 3) Thales 4) IL&FS Engineering and Construction Company Limited 5) DMRC
Implication to this Study	-Route length is 5.1 km; elevated -Same fare structure as Delhi Metro -Number of trains is 5; 3 coaches per train; frequency is 3-4 minutes -Other project features: (a) Traction and power supply - 750 V DC Third Rail; (b) Ballastless track; (c) ATO, ATP and ATS system

World Urban Rail Examples

(1) Country: Vietnam -1

Project Name	Hochimin urban rail No.1
Line	Line 1
Mode	Metro
Year of operation	2017
Finance Scheme	ODA STEP (JICA)
Procurement Package / Contract Style	1) a) Civil works (Underground Stations, incl. station architectural works, and building services works): Build only b) Civil works (Underground Stations): Design-Build 2) Civil works (Elevated stations and viaduct, Depot, incl. station architectural works and building services works): Design-Build 3) E&M (Signaling system, Traction and Auxiliary power supply system and substations, Telecomunications systems and operation control center facilities, Depot workshop and equipment and Fare collection system Rolling Stock, Track work, Maintenance for 5 years including supply of spare parts, repair work, maintenance work and training for technical transfer
Contractor	1) To be decided. 2) Consortium of Sumitomo Corporation and a Vietnamese company (CINECO6-Civil Engineering Construction Co. No.6) 3) To be decided.
Implication to this Study	-Considered as the first model project of metro in HoChiMinh - Design-Build was used for civil works - Consulting contract includes training of train operators and 5 years O&M advisory service - Sumitomo Corporation won the bid as Japanese companies. - It is expected that the Hanoi Line-2A will start operation in 2015 as the first urban railway in Vietnam.

World Urban Rail Examples

(1) Country: Vietnam -2

Project Name	Hochimin Urban Rail No.2
Line	Line 2
Mode	Metro
Year of operation	2018
Finance Scheme	1) Vietnam Gvernment fund; 2), 3), 4), 5), 7) ADB; 6) KfW; 4), 5), 6), 8) EIB
Procurement Package / Contract Style	1) a) Utility diversion (Relocation of water, sewer, storm drainage, electric, comms, etc) b) Resettlement (Clearance within site boundary) 2) Initial Depot Works: Build only 3) Main Depot construction: Yellow book, Design-build 4) Civil works (Tunnels and underground stations and Depot advance work): Yellow book, Design-build 5) Civil works (Elevated stations, viaducts, transition line to depot): Yellow book, Design-build 6) E&M (Rolling stock and platform screen doors, Depot equipment, Signaling system, Traction power supply system and substations, SCADA, Telecomunications systems and operation control center facilities, Automatic Fare Collection system): EPC contract (Silver book), 5 year Maintenance 7) Civil works (Track work): Yellow book, Design-build 8) E&M for non-railway system (Tunnel equipment, station equipment, lighting, ventilation): Yellow book, Design-build
Contractor	N.A.
Implication to this Study	Construction work is expected to start Aug. 2013

World Urban Rail Examples

(1) Country: Thailand -1

Project Name	Bangkok Metro Blue-line
Line	MRT Blue Line
Mode	Metro
Year of operation	2004
Finance Scheme	Infrastructure: ODA (JBIC) Upper portion: BOT (Private fund)
Procurement Package / Contract Style	- Infrastructure: 1) Civil work south section -Underground line and approach line to Depot (incl. Stations lighting, ventilation & air-conditioning): Design-Build 2) Civil work north section -Underground (incl. stations lighting, ventilation and air-conditioning): Design-Build 3) Depot -Upper portion E&M (private fund): Rolling Stock, Signalling and Train Control, Communication System, Traction Power and Power Distribution System, Automatic Fare Collection
Contractor	- Infrastructure: 1) Kumagai Gumi, Bilifinger & Burger Bauaktien Gesellschaft (Germany), CH. Karnchang Public Co. (Thai), Tokyu Kensetsu 2) Italian-Thai Development Public Co. (Thai), Ohbayashi-kumi, Nishimatu Kensetsu 3) Hazamakumi, Siam Syntech Construction Public Co. (Thai), Mitsui-bussan, Kajima Kensetsu, Maeda Kensetsu -Upper portion: BMCL (Bangkok Metro Public Company Limited) -Siemens
Implication to this Study	- Considered as the first model project of metro in Thailand. - Design-Build was used for civil works - Separation system of infrastructure from operation - E&M contractor Bangkok Metro Co. (owner CH Karnchang Co.) selected the rolling stock of Siemens - Operation concession for 25 years

World Urban Rail Examples

(1) Country: Thailand -2

Project Name	Bangkok Sky-train
Line	Bangkok Sky-train
Mode	Metro
Year of operation	1999
Finance Scheme	Mixture of BOT and BTO
Procurement Package / Contract Style	1) Infrastructure - BTO 2) Railway system & Operation - BOT
Contractor	Whole contractor: BTS (Bangkok Transit System Co., Ltd.) The largest stockholder is Tanayong. 1) Civil works - BTS 2) Railway system and operation - Siemens
Implication to this Study	- Considered as the first model project of urban railway in Thailand. - Concession Contract of BOT.

World Urban Rail Examples

(1) Country: Thailand -3

Project Name	Bangkok Airport Rail Link
Line	SRT Airport Rail Link Line
Mode	Metro
Year of operation	2010
Finance Scheme	ECA (Export Credit Agency) finance
Procurement Package / Contract Style	Full turnkey
Contractor	JV of B Grimm, STECON (Sino Thai Engineering & Construction Public Company Limited) and Siemens 1) Civil works (Viaduct, Depot) - Sino Thai consortium 2) Railway system (Track, Signal, Electric, Rolling stock) - Siemens
Implication to this Study	- Civil works: BQ. - Railway system: lump-sum. - SRT (State Railway Thailand) project. - The contractor proposed a funding including the bank and interest rate.

World Urban Rail Examples

(1) Country: Malaysia

Project Name	Kuala Lumpur MRT (Mass Rapid Transit)
Line	Sungai Buloh – Kajang Line (SBK Line, also known as Blue Line)
Mode	MRT (Metro)
Year of operation	Dec 2016 (1st Phase); July 2017 (2nd Phase)
Finance Scheme	Financed by MRT Corp (MRT Corp is fully owned by Ministry of Finance, Government of Malaysia)
Procurement Package / Contract Style	1) System works 2) Elevated/depot 3) Underground works
Contractor	1) MMC-GAMUDA 2) MMC-GAMUDA 3) MMC-GAMUDA Tunnel JV a) Advance Works - several contractors b) Elevated Sections - several contractors c) Depot (Construction and Completion) - TRC; TSR Bina Sdn Bhd d) System Works Packages: EPC, Testing and Commissioning (i) Rolling Stock - Siemens Malaysia, Siemens AG and SMH Rail (ii) Depot Equipment & Maintenance Vehicles - Siemens Malaysia, Siemens AG, Hisniaga (iii) Signalling & Train Control System - Bombardier (Malaysia) (iv) Power Supply & Distribution System - Meidensha Corporation (v) Trackworks - Mitsubishi Heavy Industries, Ltd. (vi) Telecommunications System - Apex Communication - LG CNS e) Multi-storey Car Park (Construction and Completion) - TSR Bina f) Supply and Delivery of Segmental Box Girders - SPC Industries Sdn Bhd; Eastern Pretech (M) Sdn Bhd

World Urban Rail Examples

Implication to this Study	- The SBK line is implemented under a Project Delivery Partner (PDP) model. This eliminates the time and cost overrun and there is a single point of accountability. - The PDP (MMC-GAMUDA KVMRT Sdn Bhd) appointed in 2011 is a 50:50 joint venture between MMC and Gamuda. - The route is 51 km long with 31 stations and has a 9.5 km of underground section. - Two other lines are planned by MRT Corp.

World Urban Rail Examples

(1) Country: Indonesia

Project Name	Jakarta Mass Rapid Transit North – South Line Phase 1
Line	South Line
Mode	Metro
Year of operation	2016
Finance Scheme	ODA (STEP)
Procurement Package / Contract Style	1) Civil Works: Plant and Design-Build 2) Rolling Stock: EPC/Turn key 3) EPC/Turnkey indluding Trackwork and railway E&M sysytem for entire project (including Power Distribution and Substation System, Overhead Contact System, Signalling and Telecommunication System, SCADA, AFC System, PSD) 4) Depot: Plant and Design-Build
Contractor	To be decided.
Implication to this Study	- Route Length 15.2km, 13 Stations - The basic specification of Rolling Stock is referred to STRASYA (Standard urban Railway System for Asia).

World Urban Rail Examples

(1) Country: Philippines -1

Project Name	Manila MRT 3
Line	MRT 3
Mode	Metro (LRT)
Year of operation	1999
Finance Scheme	PPP-BLT
Procurement Package / Contract Style	- PPP Package: Construction, ERC and Maintenance by BLT (Build-Lease-Transfer) - Subsystem: 1) Turnkey 2) Maintenance
Contractor	- Turnkey Contractor: Metro Rail Transit Co. (MRTC) - Subcontractors: 1) Sumitomo Corp. and Mitsubishi Heavy Industries 2) TESPI Philippines
Implication to this Study	- Project is initiated by DOTC (Department of Transport & Communication) - Operation is by DOTC

World Urban Rail Examples

(1) Country: Philippines -2

Project Name	Manila LRT Line 1 Modernization Project (Phase II)
Line	LRT Line 1
Mode	Metro (LRT)
Year of operation	Package A (2009); Package B (2010)
Finance Scheme	JBIC finance GOP Assistance/ Corporate Funds (OCL)
Procurement Package / Contract Style	1) Package A 2) Package B 3) Consulting Services
Contractor	1) Sumitomo Corp. and Itochu Joint Venture 2) Marubeni Corp. 3) Pacific Consultants
Implication to this Study	- The project includes the acquisition and installation of air-conditioning units in the old fleet, additional upgrading and acquisitionof equipment (signaling, telecommunications, traction power supply and distribution, track works, automated fare collection system, etc.), acquisition of additional 12 trains (air-conditioned, 4-cars), and additional civil works for some stations and depot to accommodate the new trains and enhance the headway.

World Urban Rail Examples

(1) Country: South Korea

Project Name	Seoul Metro 9
Line	Phase 1: Gimpo International Airport to Shinnonhyun
Mode	Metro
Year of operation	2009
Finance Scheme	PPP
Procurement Package / Contract Style	- PPP Package (BTO: O&M Concession for 30 years) - Subsystem 1) Operations Contract for 10 years 2) Maintenance of Vehicles Contract 3) Maintenance of other E&M facilities
Contractor	- Main contractor: Seoul Metro Line 9 (Consortium is made up of manufacturers led by Hyundai-Rotem, and financial investors led by Macquarie group) - Subcontractors: 1) Seoul Line 9 Operator - Veolia Transport Korea (80%) and Hyundai-Rotem (20%) 2) Veolia Transport Korea (20%) and Hyundai-Rotem (80%) 3) Seoul Line 9 Operator
Implication to this Study	- Phase 2 will be another 12.5 km and estimated to start in 2014

World Urban Rail Examples

(1) Country: Singapore

Project Name	Trains for North East Line (Contract 751C) and Circle Line (Contract 830C)
Line	North East Line and Circle Line (Trains were procured for increasing capacity of existing lines)
Mode	Metro
Year of operation	Not yet started
Finance Scheme	Land Transport Authority of Singapore (LTA)
Procurement Package / Contract Style	Design, manufacture, delivery, testing and commissioning of trains
Contractor	Alstom Transport S.A. / Alstom Transport (S) Pte Ltd Consortium
Implication to this Study	- Fragmented approach was applied, because this contract was to increase capacity of existing lines. - Since LTA is well-experienced operator, interface management between rolling stock and other systems can be conducted by LTA.

World Urban Rail Examples

(1) Country: Hong Kong

Project Name	West Rail for MTR Corproration (ex. Kowloon Cantnon Railway Corporation)
Line	East Rail and West Rail * East Rail was existing line, while West Rail was newly constructed under this Contract. Following inforamtion is related to West Rail only.
Mode	Commuter Line
Year of operation	2003
Finance Scheme	Operator's own funding and HKSAR Government funding
Procurement Package / Contract Style	1) Civil works (2 major tunnels): Design-build 2) Civil works (others): Build only 3) Rolling stock: EPC 4) Train control system, Signalling system 5) Telecommunication 6) AFC 7) Platform Door
Contractor	1) Dragages-Zen Pacific JV and Nishimatsu-Dragages JV 2) Maeda-Chun Wo JV, Balfour Beatty-Zen Pacific JV, etc. 3) Itochu-Kinki-Kawasaki Consortium (IKK Consortium) 4) Alcatel Canada 5) Siemens 6) Thales 7) Nissho Iwai-Nabco Consortium
Implication to this Study	- Since MTRC is well-experienced operator, interface management between rolling stock and other systems can be conducted by MTRC.

World Urban Rail Examples

(1) Country: USA -1

Project Name	R160 for New York City Transit Authority, MTA
Line	Replacement of existing trains for existing lines
Mode	Metro
Year of operation	2006
Finance Scheme	MTA funding and Federal funding
Procurement Package / Contract Style	Rolling Stock: Design, manufacture, delivery, testing and commissioning
Contractor	Alstom-Kawasaki Joint Venture
Implication to this Study	- Since NYCT is well-experienced operator, interface management between rolling stock and other systems can be conducted by NYCT. - Since the trains procured by the Contract runs existing line, there is no applicable contract style than fragmented contract.

World Urban Rail Examples

(1) Country: USA -2

Project Name	PA-5 trains for Port Authority Trans-Hudson Corp (New York)
Line	Replacement with existing trains for existing lines
Mode	Metro
Year of operation	2009
Finance Scheme	PATH funding and Federal funding
Procurement Package / Contract Style	Rolling Stock: Design, manufacture, delivery, testing and commissioning
Contractor	Kawasaki Rail Car, Inc.
Implication to this Study	- Since PATH is well-experienced operator, interface management between rolling stock and other systems can be conducted by PATH. - Since the trains procured by the Contract runs existing line, there is no applicable contract style than fragmented contract.

World Urban Rail Examples

(1) Country: USA -3

Project Name	7000 Series for Washington Metropolitan Area Transit Authority (WMATA)
Line	Replacement with existing trains for existing lines and airport line extension
Mode	Metro
Year of operation	Not yet started
Finance Scheme	WMATA funding and Federal funding
Procurement Package / Contract Style	Rolling Stock: Design, manufacture, delivery, testing and commissioning
Contractor	Kawasaki Rail Car, Inc.
Implication to this Study	- Since WMATA is well-experienced operator, interface management between rolling stock and other systems can be conducted by WMATA. - Since the trains procured by the Contract runs existing line, there is no applicable contract style than fragmented contract.

World Urban Rail Examples

(1) Country: USA -4

Project Name	Procurement of Transit Vehicles RFP No. 40FA-110
Line	Replacement with existing trains for existing lines
Mode	Commuter
Year of operation	To be delivered in April 2020
Finance Scheme	BART Budget, Banking, Others
Procurement Package / Contract Style	Design and Construction of 410 train cars
Contractor	Bombardier
Implication to this Study	- "Competitive Negotiation" and "Price Quality Evaluation System" applied for the procurement of rolling stock or other equipment due to the comlexity of the specifications.

World Urban Rail Examples

(1) Country: UAE

Project Name	Dubai Metro
Line	Red line, Green line
Mode	Metro
Year of operation	2009
Finance Scheme	UAE Gv. Fund
Procurement Package / Contract Style	Full turnkey (include 3 years maintenance) 1) Railway system: Rolling stock, Signal, Electric, Track 2) Structures: Design-build, 3 years maintenance
Contractor	Arranged by Mitsubishi Corporation 1) Railway system: Mitsubishi Heavy Industries, Mitsubishi Corporation 2) Structures: Ohbayashi, Kajima, Yapi (Turkey)
Implication to this Study	- Full automatic operation - Mono pile sub-structure is adopted

World Urban Rail Examples

(1) Country: Australia

Project Name	Gold Coast Light Rail - Stage 1
Line	Gold Coast University Hospital to Griffith University
Mode	LRT (Tram)
Year of operation	2014
Finance Scheme	PPP
Procurement Package / Contract Style	Design, Build, Finance, Operate and Maintain
Contractor	- Consortium of GoldLinQ Pty Ltd, McConnell Dowell Constructors Pty Ltd, Bombardier Transportation Australia Pty Ltd, and KDR Gold Coast Pty Ltd

World Urban Rail Examples

Implication to this Study	- Funding partners: - Government funded early construction works will prepare the corridor for construction and includes road widening, the relocation of public utilities, and other accommodation works. - GoldLinQ's Equity Partners - Equity financing has come from Marubeni Group (26.7%); International Public Partnerships Limited (26.7%); Keolis SA (10%); Aveng Australia (10%); and Plenary Group, in a strategic alliance with Palisade's Australian Social Infrastructure Fund (26.7%).

World Urban Rail Examples

(1) Country: Morocco

Project Name	Casablanca CASA Tram
Line	Sidi Moumen Terminus ~ Faculties Terminus ~ Ain Diab Beach Terminus
Mode	LRT
Year of operation	2012
Finance Scheme	Mainly financed by the government: State Government, DGCL, CUC, Hassan II Fund and others
Procurement Package / Contract Style	- E&M Contract: includes Rolling Stock, Power Supply and Distribution System, Signalling - Maintenance Contract: 2 five-year contracts; one for infrastructure and one for rolling stock
Contractor	- Rolling Stock: Alstom - Operation and Maintenance (for 5 years): RATP Dev, Morocco's Caisse de Depot et de Gestion, Transinvest - Maintenance subcontractor: Alstom
Implication to this Study	Operational Specs: - 4-to-5-minute headway during peak period; - 8.5 minutes during off-peak; - Expected to carry 250,000 passengers per day - Alstom provided 74 low floored trams; operate in pairs as 65 meter trains with capacity of 660 passengers

World Urban Rail Examples

(1) Country: India-1

Project Name	Mumbai Monorail
Line	Mumbai Monorail
Mode	Monorail
Year of operation	2013 (partly operational)
Finance Scheme	Own fund by MMRDA
Procurement Package / Contract Style	- Full turnkey including civil works - Subcontractors supply the following items for Section 1: 1) Design and integration of the system; rolling stock (15 4-car train sets) 2) Construction, ticketing and power supply 3) Design, supply and commission the train control and signalling system 4) Project management and proof-checking consultant 5) System integration contract 6) Independent assessor for the testing and commissioning (Section 1)
Contractor	- Main contractor: Consosium of Larsen&Toubro (L&T) and Scomi - Subcontractors: 1) Scomi 2) L&T 3) Italy-based Ansaldo STS 4) US-based Louis Berger Group 5) Consort Digital Private Limited 6) UK-based Mott MacDonald
Implication to this Study	- Planned length of 19.5km, spanning 18 stations. - The cost of construction is estimated at Rs.27 billion. Of this, 56% is borne by L&T and 44% by Scomi. - The network is divided into two sections: Section 1: Wadala-Chembur (8.26km, 7 stations) Section 2: Jacob Circle-Wadala (11.28km, 11 stations) - Section 1 is likely to become operational in March 2013, Section 2 in December 2013 - The project is being developed by Mumbai Metropolitan Region Development Authority (MMRDA). - While several other routes besides the 19.5km stretch were planned initially, MMRDA, in September 2012, has put them on hold until Section 1 enters service - Hitachi faled to receive an order because the proposed construction period was longer than that of the consosium of L&T and Scomi.

World Urban Rail Examples

(1) Country: India -2

Project Name	Delhi Monorail
Line	Delhi Monorail
Mode	Monorail
Year of operation	2017
Finance Scheme	To be decided.
Procurement Package / Contract Style	To be decided.
Contractor	To be decided.
Implication to this Study	- Network of 11km, connecting Shastri Park Metro station and Trilokpuri through 12 stations. - The system will be integrated with metro coridors. - DMRC is in the process of preparing a revised DPR. - The total investment: Rs. 16.65 billion (estimated based on the RITES proposal) - The Delhi State Infrastructure and Industrial Development Corporation will contribute in equity. - In August 2012, Infrastructure Leasing and Finantial Services Limited (IL&FS) had approached Government of the National Capital of Delhi (GNTCD) proposing PPP model for the project. - GNTCD has suggested that the company participate in the tender process which is likely to open in March 2013.

World Urban Rail Examples

(3) Country: Singapore -1

Project Name	Sentosa Express
Line	Sentosa Express
Mode	Monorail
Year of operation	2007
Finance Scheme	Private fund (related to Government)
Procurement Package / Contract Style	- Full turnkey - Consosium of Hitachi Ltd and Kajima Corporation - Hitach Asia Ltd is the leader of the consisium. - Kajima Corporation suplies civil engineering and construction. - Hitachi Ltd, supplies the following core systems: 1) Monorail vehicles (2 vehicles x 4 configuration); 2) Signalling, Power supply, Operatoin system and Track switches; 3) System design and systems integratoin
Contractor	- Main Contractor: Hitachi Asia Ltd (with Hitachi Ltd and Kajima Corporation)
Implication to this Study	- The route is a 2.1km long double-track which links the main island of Singapore and Sentosa, with gateway stations at World Trade Centre's Harbor Front MRT Station and Central Beach on Sentosa. The route has 4 stations. - Hitachi Asia Ltd. won the S$78 million (=J Yen 5.4 billion) cotract from Sentosa Development Corporation (SDC)

World Urban Rail Examples

(4) Country: China -1

Project Name	Chongqing Rail Transit
Line	Line 2
Mode	Monorail
Year of operation	2005 (extention in 2006)
Finance Scheme	Japanese ODA tied loan (JBIC)
Procurement Package / Contract Style	Each subsystem has a Chinese company which acts as a main contractor. Mitsui & Co., Ltd arranges subcontracts of the following packages for Japanese companies 1) Signalling system 2) Straddle type monorail cars 3) Supply & installation of turnout equipment All of the contracts of civil engineering and construction are managed by Chinese companies. *There are special local requests peculier to China, which results in a very complicated contract formation.
Contractor	- For rolling stock and turnout equipment: Main contractor: Changhun Railway Vehicles Co., Ltd. (China) Subcontractor: Mitsui & Co., Ltd. Sub-subcontractor: Hitachi Ltd. - For signalling system: Main contractor: a Chinese company Subcontractor: Mitsui & Co., Ltd. Sub-subcontractor: Nippon Signal Sub-subcontractor for on-board equipment: Hitach Ltd.
Implication to this Study	- Total cost: about 47 billion Yen (27 billion Yen from Japanese ODA loan) - The first monorail project in China - The 13.5km route with 14 stations was in operation in 2005. (17.4km after extention) - Technical supports by Tokyo monorail and JARTS. - 24 people participated in the 15-day training program held in Japan. - 21 four-car train sets (84 cars in total) - Hitachi Ltd received an order of 2 four-car train sets and electrical parts of all the train sets. - Changhun Railway Vehicles Co. Ltd manufactured the remaining 19 four-car train sets with a technical support by Hitachi Ltd.

World Urban Rail Examples

(4) Country: China -2

Project Name	Chongqing Rail Transit
Line	Line 3
Mode	Monorail
Year of operation	2011
Finance Scheme	Japanese ODA loan (JBIC)
Procurement Package / Contract Style	1) Train control system (CBTC) 2) Electrical & brake systems of monorail cars and supply & installation of turnout equipment *1) and 2) are separate packages 3) Rolling stock 4) Civil engineering and construction
Contractor	1) & 2) Hitachi Ltd and Mitsui & Co., Ltd 3) Changhun Railway Vehicles Co., Ltd (China) 4) Phase 1: Hitachi Plant Technologies, Ltd. (Subcontractor from Chongqing) Phase 2: A company from Chongqing (Hitachi Plant Technologies, Ltd as a subcontractor)
Implication to this Study	- The 39.1km route with 29 stations was in operation in 2011. (55.6km with 39 stations in the end) - Total cost: about 78.7 billion Yen (22.7 billion Yen from Japanese ODA loan) - The first CBTC application for Hitach Ltd.

World Urban Rail Examples

(5) Country: Brazil -1

Project Name	Sao Paulo monorail (also known as "Expresso Tiradentes")
Line	Line 2 - Green
Mode	Monorail
Year of operation	2014 (when Brazil will host the FIFA World Cup)
Finance Scheme	N.A.
Procurement Package / Contract Style	Design, supply, and install an automated monorail line
Contractor	- Express Monotrilho Leste Consortium led by: Brazilian civil engineering contractor Queiroz Galvao, along with construction firm Construtora OAS, and Bombardier as the E&M equipment supplier.
Implication to this Study	- The line will be 23.8km long with 17 stations between Vila Prudente and Cidade Tiradentes. - Total cost: US$ 1.44 billion - The initial cars to be manufactured in Pittsburgh and later ones at Bombardier's Brazilian plant in Hortolandia, around 100km from Sao Paulo. - Bombardier will supply its Innovia Monorail 300 technology, including 54 7-car trains, and its Cityfro 650 automatic train control technology for driverless operation. The company will also provide project management and systems engineering for the integration, testing and commissioning of the new trains and signalling. - MLIT and JICA had cooperated with Sao Paulo in the feasibility study of the monorail project, expecting future oders to Japanese suppliers.

World Urban Rail Examples

(5) Country: Brazil -2

Project Name	Sao Paulo monorail
Line	Line 17 - Gold
Mode	Monorail
Year of operation	2014
Finance Scheme	N.A.
Procurement Package / Contract Style	Turnkey Design, supply, installation and commissioning of the Sutra straddle monorail, including 24 3-car trains to be provided by Scomi
Contractor	Monotrilho Integracao Consortium of -Scomi, -Andrade Gutierrez, -CR Almeida, -Montagens e Projetos Especiaisled
Implication to this Study	- The 17.7 km elevated Gold Line with 18 stations will link São Paulo-Morumbi on Line 4 with Jabaquara, the southern terminus of Line 1. - Total cost: BRZ Real 1.4 billion - Companhia do Metropolitano de São Paulo (CMSP), the operator of the line, has the turnkey construction contract to the consortium..

World Urban Rail Examples

(2) Country: UAE -1

Project Name	Dubai Monorail
Line	Dubai Monorail
Mode	Monorail
Year of operation	2008
Finance Scheme	Private fund
Procurement Package / Contract Style	- Full turnkey handover including civil engineering and construction - Subcontractors supply: 1) Rolling stock, Electrification system, Operation management, Communication, platform screen doors 2) Signalling facilities 3) Automatic Fare Collection 4) Civil engineering and construction 5) Design supervision work
Contractor	- Main contructor: Marubeni Corporation - Subcontructors: 1) Hitach, Ltd 2) Nippon Signal Co., Ltd 3) Omron Corporation Co.,Ltd 4) Joint venture of Obayashi Corporation and Oriental Construction Co.,Ltd. 5) Tonich Engineering Consultants, Inc. and Tostems, Inc.
Implication to this Study	- The monorail originates at Gateway Station, located on the mainland-side entrance of The Palm Jumeirah Island, and terminates at Atlantis, a marine resort complex planned for construction at the tip of the island. - The 5.4km line is fully elevated. - Japanese technologies are thoroughly applied - Construction Supply Contract worth approximately 390 million dollars (approximately 47 billion yen) with Nakheel Co. L.L.C. of Dubai Emirate in the UAE. - Nakheel is one of Dubai’s largest developers, and is currently planning the development of The Palm Jumeirah Island and other major resort islands.

World Urban Rail Examples

(1) Country: Singapore

Project Name	Singapore LRT project
Line	Sengkang LRT Line and Punggol LRT Line
Mode	AGT（Automated Guideway Transit）
Year of operation	2003
Finance Scheme	Owned capital of Land Transport Autority (LTA)
Procurement Package / Contract Style	- Full turnkey indluding civil works and APM system (Rolling Stock, Signalling and Train Control, Communication System, Traction Power and Power Distribution System, Trackworks, Depot)
Contractor	- Main contractor: Consortium of Mitsubishi Corporation, Mitubishi Heavy Industries and Local contractor - Subcontractor: APM: Mitubishi Heavy Industries Singnalling: Kyosan Electric Mfg
Implication to this Study	- Sengkang LRT Line: Route Length 10km, 14 stations - Punggol LRT Line: Route Length 10km, 15 stations - After delivery of the APM system, Mitubishi Heavy Industries corresponds to O&M

World Urban Rail Examples

(1) Country: Macau

Project Name	Macau LRT (Light Rail Transit) Phase 1
Line	Macau LRT Line
Mode	AGT（Automated Guideway Transit）
Year of operation	2015
Finance Scheme	Owned capital of Macau SAR Government
Procurement Package / Contract Style	1) Civil works: 2 packages of design and construction 2) APM system: Full turnkey (including Rolling Stock, Signalling and Train Control, Communication System, Traction Power and Power Distribution System, Trackworks, Platform screen door, fare collection), and also including acquisition of additional rolling stock and maintenance as an option 3) Depot: 3 packages of design, foundation work and building block construction
Contractor	1) Civil works: - Design: Hong Kong-based consultant and Macau-based consultant - Construction: Taiwan-based construction company and Chinese construction company 2) APM system: - Main contractor: Consortium of Itochu Corporation and Mitubishi Heavy Industries - Subcontractor: APM -Mitubishi Heavy Industries; Singnalling -Kyosan Electric Mfg
Implication to this Study	- The route Length is 21km, with 21 stations. - Lightweight vehicle which is a feature of the APM system has been highly appreciated because this pre-project includes the construction of a bridge of a two-layer structure in which the car will pass through the upper layer and LRT will pass through the lower. - Macau government has a comprehensive evaluation as tender price in 55% and technical in 45%. - It is possible to reduce the cost of the entire project by selecting APM system.

Introduction of New Bid Evaluation Method for Urban Transport Projects in India

- Learned from the world experience and practice -

May 30, 2013

Japan International Corporation Agency
Mitsubishi Research Institute, Inc.
Japan International Consultants for Transportation Co., Ltd.

1. World Trend of Bid Evaluation Method

Overall Trend

- Up to 1980s, the lowest price bidding system had been widely adopted for a long time: however, around 1990s, <u>modern procurement system to evaluate both quality and price has been adopted in US, UK, Japan, and other countries</u>.
- The reason for changing the bid system is that <u>the above countries encountered low quality procurement as a result of pursuing the lowest price</u>.
- Much effort and determination have been placed in the adoption of modern bid evaluation system, and then various types have been studied and applied to achieve the best procurement of higher quality with lower price.
- From the historical trends of bid evaluation systems from 'price' to 'price + quality', which has been experienced by the above countries, <u>we could say that</u> <u>the procurement system in India is on the transition period to introduce bid evaluation system of 'price + quality'</u>.

Struggle and Practice in USA, UK, Japan

- USA
  - ✓ In the 1980s, modern procurement systems have been studied, since the lowest price bid system was deemed not the best way to secure quality
  - ✓ In 1987, the Transportation Research Board set up a special committee to study innovative public procurement system, which lead to the studies in AASHTO and FHWA
  - ✓ In 1990, pilot study of modern procurement system in the states, and SEP-14 started
- UK
  - ✓ In 1979, privatization of public works and agency of central government started under Thatcher administration
  - ✓ Encountered problems with low quality of roads and bridges due to the lowest price bid system
  - ✓ After 1990s, in order to maximize VFM for public works, modern procurement systems such as DB, DBFO, PFI, and 2-envelop evaluation systems started to be adopted
- Japan
  - ✓ Since 1900, selective bidding system had been adopted for around 100 years
  - ✓ Due to collusion problems in 1994, open bidding system applied for public works, amount of which is above the specified value
  - ✓ In 1997, encountered low qualities, and started to study modern procurement systems
  - ✓ In 2005, introduced new procurement system evaluating both quality and price under the newly established law for ensuring quality of public works

Instructions by EU Directive

- EU Directive limits the criteria that a contracting authority may apply to award a public contract to either:
  - ✓ the lowest-price criterion; or
  - ✓ the most economically advantageous tender (MEAT) criterion, which means applying criteria in addition to or other than price
- EU Directive states that the lowest price criterion has the advantage of simplicity and rapidity, but it presents some limitations, including the following:
  - ✓ It does not allow the contracting authority to take into account qualitative considerations. Apart from the quality factors built into the specifications, which must be met by all tenders, the quality of the requirement being procured is not subject to evaluation.
  - ✓ It does not allow the contracting authority to take into account innovation and innovative solutions. Tenders that meet the set specifications are compliant.
  - ✓ For requirements that have a long operating life, it does not allow the contracting authority to take into account the life-cycle costs of the requirement procured. When the lowest-price criterion is used, only the direct cost of the purchase or the initial purchase price within the set specifications can be taken into consideration.

Instructions by EU Directive

- EU Directive states advantages of the MEAT criterion, as opposed to the lowest price criterion, presents a series of advantages, including in particular the following:
  - ✓ It allows contracting authorities to take into account qualitative considerations. The MEAT criterion is typically used when quality is important for the contracting authority.
  - ✓ It allows contracting authorities to take into account innovation or innovative solutions. This is particularly important for small and medium-sized enterprises (SMEs), which are a source of innovation and important research and development activities.
  - ✓ For those requirements with a long operating life, it allows the contracting authority to take into account the life cycle costs of the requirement purchased and not only the direct cost of the purchase or initial purchase price within the set specifications.
- EU Directive states the following illustrative list of criteria in order to determine the most economically advantageous tender (MEAT)
  - ✓ quality, price, technical merit, aesthetic and functional characteristics
  - ✓ environmental characteristics
  - ✓ running cost
  - ✓ cost-effectiveness
  - ✓ after-sales service and technical assistance
  - ✓ delivery date and delivery period or period of completion

2. Examples of 'Price & Quality Bid Evaluation'

Example 1 - Construction Works Procurement Guideline in Scotland, UK -

■ Scottish Government procurement policy is to achieve value for money (VFM).

What is Value for Money (VFM)?

The prime objective of the Scottish Government's procurement policy is to achieve VFM – the optimum combination of whole life cost and quality to meet the customer's requirement. Quality may relate to a number of relevant factors including functionality, durability, aesthetic appropriateness to surroundings, long-term adaptability and maintenance, environmental implications and ability of consultants and contractors to innovate, improve buildability and work as a team.

Why is it important and how is the process monitored?

Every opportunity to achieve VFM should be evaluated properly and informed decisions taken. In this way, management can have confidence in answering any subsequent questions on the entire decision making process and provide full justification for the decisions taken.

When internal or external audit carry out reviews of works projects, it can be expected that consideration will be given to how resources have been used, what influenced the decisions that were taken, whether the best advice available was obtained and implemented, whether risks were managed properly and whether informed judgements were made.

Is lowest always best?

VFM does not necessarily mean accepting the lowest bid as quality, as well as price, must be considered when appointing consultants and contractors. Innovation should not be stifled through rigid adherence to mechanistic procedures, although accountability for public funds remains extremely important and should not be compromised.

The Scottish Government and certain other public sector organisations must comply with the EC procurement rules as implemented by the Public Contracts (Scotland) Regulations 2006 and Amendment Regulations 2009. They are entirely consistent with the policy objective of achieving VFM.

Example 1 - Construction Works Procurement Guideline in Scotland, UK -

■ Procurement Process

- confirm candidates;
- establish:
  - award criteria;
  - weightings for award criteria;
  - quality/price ratio;
  - award mechanism; and
  - quality and price scoring.
- prepare instructions to tenderers and invite tenders;
- publish award criteria and weightings
- evaluate "quality" element of tenders then evaluate "price" element;
- balance quality and price;
- notify award decision and debrief unsuccessful candidates
- adhere to 'standstill period' before awarding contract.

Example 1 - Construction Works Procurement Guideline in Scotland, UK -

■ Criteria for Technical Evaluation

- ✓ Teamworking Arrangements
- ✓ Aesthetic and Functional Characteristics
- ✓ Proposals for Managing the Contract
- ✓ Project Team Organization
- ✓ Technical Merit
- ✓ Services provided from External Sources

■ Quality / Price Ratio

Innovative Projects	20/80 to 40/60
Complex Projects	15/85 to 35/65
Straightforward Projects	10/90 to 25/75
Repeat Projects	5/95 to 10/90

Examples of Award Mechanism

Project title:	Assessors:
Quality weighting: *60*	*Assessor 1*
Price weighting: *40*	*Assessor 2*

QUALITY SCORES (see paragraph A3.7)

Quality criteria	Criteria weight %	Firm A		Firm B		Firm C	
		Score	Wtd. Score	Score	Wtd. Score	Score	Wtd. Score
Proposals for, and understanding of, project	*30*	*60*	*18.00*	*65*	*19.50*	*75*	*22.50*
Experience and resources of proposed project team	*20*	*55*	*11.00*	*65*	*13.00*	*70*	*14.00*
Project management/ teamworking skills	*10*	*65*	*6.50*	*60*	*6.00*	*60*	*6.00*
Risk management skills and experience	*10*	*60*	*6.00*	*70*	*7.00*	*65*	*6.50*
Aesthetic character of proposals	*15*	*70*	*10.50*	*75*	*11.25*	*70*	*10.50*
Maintainability	*15*	*50*	*7.50*	*65*	*9.75*	*75*	*11.25*
Totals	100		**59.50**		**66.50**		**70.75**

PRICE SCORES (see paragraphs A3.8 and A3.12)

	Firm A	Firm B	Firm C
Tender price	*£550,702*	*£740,217*	*£640,360*
Price score (mean *£643,760*)	**64.50**	**35.00**	**50.50**

OVERALL SCORES

	Firm A	Firm B	Firm C
Quality weighting x quality score	*60% x 59.50 = 35.70*	*60% x 66.50 = 39.90*	*60% x 70.75 = 42.45*
Price weighting x price score	*40% x 64.50 = 25.80*	*40% x 35.00 = 14.00*	*40% x 50.50 = 20.20*
Overall score	**62**	**54**	**63**
Order of tenders	**2**	**3**	**1**

Comments:

Signed by Assessors: *Assessor 1* *Assessor 2* Date:

Example 2 - Design-Build Guidelines, Montana DOT, USA -

- Proposals segmented into two parts, Technical Proposal and Bid Price Proposal
  - ✓Technical Proposals
    include a detailed project schedule using CPM (or other techniques as appropriate), preliminary design plans, preliminary specifications, technical reports, calculations, permit requirements, total contract time and other data requested in response to the RFP
  - ✓Bid Price Proposals
    include one lump sum cost for all design, construction, and construction engineering and inspection (if CEI services are included) of the proposed project.
- TRC (Technical Review Committee) evaluate Technical Proposal
  - ✓Minimum 3 members to be assigned
  - ✓Technical Proposal Evaluation Factors Score Sheet to be provided to TRC member
- CPB (Contract Plans Bureau) open Bid Price Proposal
  Calculate adjusted score (= price / technical score), and award to the firm of the lowest value

FIRM	TOTAL TECHNICAL SCORE	BID PRICE PROPOSAL AMOUNT	ADJUSTED SCORE (Best Value)
A	90	\$6.7 Million	74,444
B	80	\$6.5 Million	81,250
C	70	\$6.3 Million	90,000
D	90	\$6.3 Million	70,000
E	70	\$6.7 Million	95,714

Example 2 - Design-Build Guidelines, Montana DOT, USA -

Example of Technical Proposal Evaluation Factors Score Sheet

1. Environmental Protection/Commitments (_____ points)

Credit will be given for minimizing impacts to the environment during all phases of design/construction and ensuring that all environmental permits and commitments are honored. The amount of credit should be proportional to the amount of reduction in wetlands or other types of mitigation quantities.

2. Maintainability (_____ points)

For building facilities, credit will be given for a design that minimizes periodic and routine maintenance. The following elements should be considered: access to provide adequate inspections and maintenance of plumbing, HVAC and electrical systems and quality of construction materials. Credit will be assigned for exceeding minimum material requirements to enhance durability of structural components and for providing extended warranties/guarantees for major elements such as roof systems, siding, doors and fixtures.

3. Warranty/Contractor Guarantee (_____ points)

For other than building facilities, credit will be given for the extent of the warranty coverage.

4. Schedule (_____ points)

Credit will be given for a comprehensive and logical schedule that minimizes contract duration while adhering to applicable Specifications. Proper attention should be provided to the project's critical path elements.

5. Coordination (_____ points)

Credit will be given for a coordination plan and effort that includes, as a minimum, coordination with the following groups:

- MDT Management Team
- Community and Businesses
- Adjacent Property Owners
- Permitting/Environmental Agencies
- Utility Owners
- Local Governments

6. Quality Management Plan (_____ points)

Credit will be given for a timely, complete and comprehensive quality management plan that incorporates effective QC/QA and includes all phases of the project.

7. Maintenance of Traffic (_____ points)

Credit will be given for a Maintenance of Traffic (MOT) scheme that minimizes disruption of roadway traffic and implements the Work Zone Safety and Mobility Policy. This will include, but not be limited to, minimization of lane closures, lane widths, visual obstructions, detours and significant reductions in speed limits.

⋮

Example 3 -Tendering and Selection Process, Queensland, Australia-

- VFM should be achieved in accordance with the State Procurement Policy
- Criteria and weighting for price and non-price factors should be specified in the bidding document
- Tender evaluation panel consisting of more than 3 persons who have been involved in the preparation of bidding document conduct bidding evaluation as follows;

> A tender evaluation panel is required to evaluate tenders for all projects where non-price evaluation criteria form part of the conditions of tender. The panel should comprise at least three people, including the following:
>
> - an officer who was involved in preparing the tender documents for the project
> - an officer with a sound and current technical knowledge of the construction process, capable of fully understanding and interpreting the tenders
> - an officer with sound knowledge of the *Capital Works Management Framework* and the *State Procurement Policy.*
>
> Tender panellists should be aware that information received from tenderers must be treated as commercial-in-confidence.

Example 3 -Tendering and Selection Process, Queensland, Australia-

- Non-price evaluation criteria

> Non-price criteria addressing contractor methodology may focus on any of the following 'sub-criteria':
>
> - buildability/maintainability
> - communication
> - community consultation
> - construction management
> - consultant management
> - cost management
> - design management
> - documentation management
> - environmental sustainability
> - functionality
> - handover management
> - incorporation of best practice
> - innovation
> - life cycle costs
> - programming of works
> - quality management
> - safety
> - site management
> - subcontractor management
> - supporting equipment and systems
> - use of local industry
> - user group/client management
> - waste management

Example 4 – Procurement Manual, Bay Area Rapid Transit (BART), USA

- Several types of procurement methods such as 2 Step Sealed Bidding and Competitively Negotiated Contracts provided for procured works
- For the purchase of electronic and specialized rail transit equipment and rehabilitation of transit vehicles, Competitive Negotiation Policies and Procedures to be applied, since the standard competitive bidding is deemed to be inadequate by the Board of BART

The San Francisco Bay Area Rapid Transit District (the "District") is authorized by California Public Contract Code Section 20229.1 to purchase certain electronic and specialized rail transit equipment, as well as to contract for certain work related to the rehabilitation of transit vehicles, by competitive negotiation. The District's Board of Directors, by a two-thirds vote, may direct such a purchase upon a finding that purchasing the equipment or contracting for the work in compliance with the standard competitive bidding statutes is not adequate for the District's needs.

Example 4 – Procurement Manual, Bay Area Rapid Transit (BART), USA

- Tender Procedure for Competitively Negotiated Contracts (ex. No. 40FA-110)

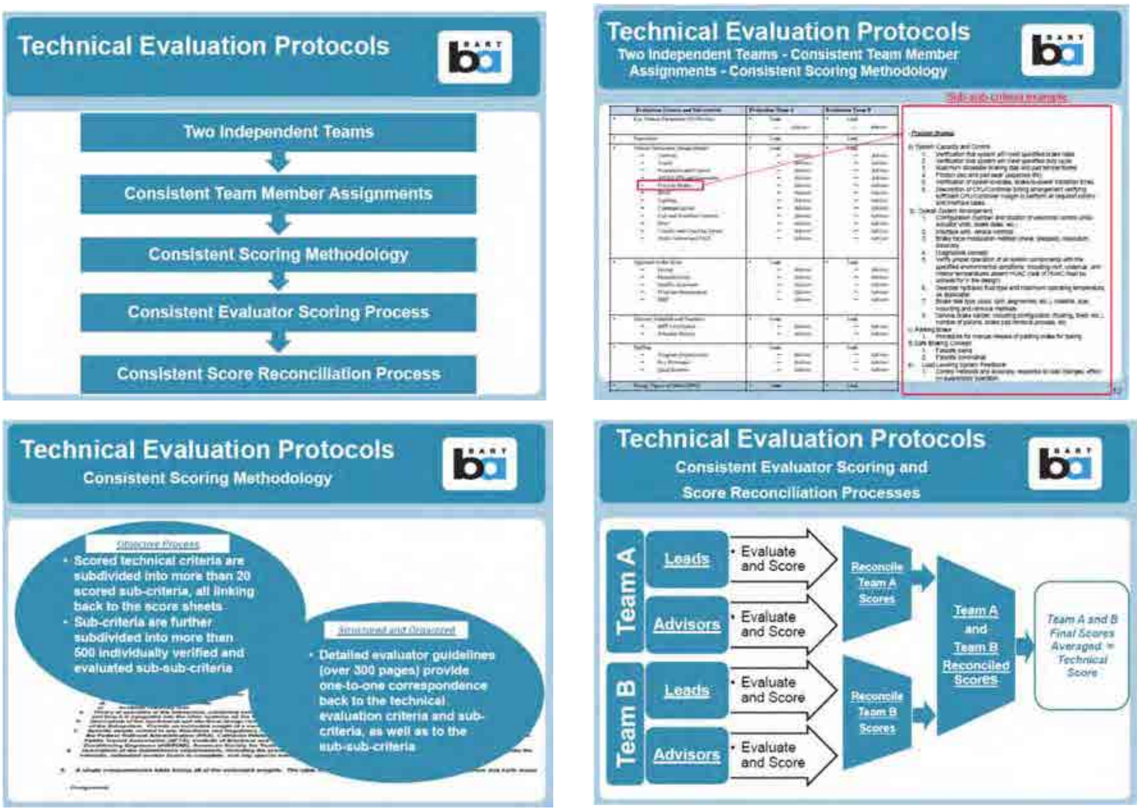
RFP No. 40FA -110 released	Sep 2009
Pre-bid conference	Oct 2009
Initial proposals received	Jun 2010
Competitive range (CR) determined	Aug 2011
Negotiations with proposers in CR	Oct 2011
Request for BAFO issued	Dec 2011
Best and Final Offers received	Feb 2012
Recommendation for award (for information only)	Apr 2012
Board action on recommendation for award	May 2012

- Evaluation Criteria
  - Key Vehicle Parameters (Go/No Go Only)
  - Price (33%)
  - Experience and Past Performance (25%)
  - Vehicle Subsystem Design Details (20%)
  - Approach to the Work (10%)
  - Delivery Schedule and Narrative (5%)
  - Staffing (5%)
  - Energy Figure of Merit (2%)
- Evaluation Process

Go/No Go	Score Technical	Score Price	Combine Scores
Verification of Key Vehicle Parameters in Accordance With the ITP	*Technical Subcommittee Evaluates and Scores; Final Technical Scores Recorded for Each Proposal*	*Price Subcommittee Opens Price Envelopes and Scores Each Proposal*	*Price and Technical Subcommittees Combine Price and Technical Scores; Combined Proposal Scores Recorded*

Example 4 – Procurement Manual, Bay Area Rapid Transit (BART), USA

■ Technical Evaluation Protocol



Example 5 - Rolling Stock & Systems for the Phase 1 of Macau LRT -

■ Evaluation Method
- ✓ Weight : Price 55%, Quality 45%

■ Price Evaluation (55%)
- ✓ Lump-Sum amount for systems and number of trains necessary for 7,800 PPHPD during peak hours and for the works regarding the Design and Build, Turnkey solution for Sai Van Bridge – 29%
- ✓ Lump-Sum amount for the <u>5 + 5 years Maintenance Services Options</u> (for the systems and trains to be supplied in the Basic Proposal) – 11%
- ✓ Lump-Sum amount for <u>"Additional Trains Batch" Options</u> (<u>including associated parts, maintenance, upgrade of Depot in Taipa, necessary to take into account all the capacity increases</u>) – 15%

■ Quality Evaluation (45%)
- ✓ Justifications Reports – 15%
- ✓ Rolling Stock and Systems Description – 8%
- ✓ Methodology and Organization – 7%
- ✓ Tenderer experience – 6%
- ✓ Solution for the Sai Van Bridge's Improvement Works – 6%
- ✓ Preliminary Technical Plans – 3%

Example 5 - Rolling Stock & Systems for the Phase 1 of Macau LRT -

■ Tender Result : Mitsubishi Heavy Industries, Ltd. awarded

International Open Tender for the "Rolling Stock & Systems for the Phase 1 of Macau LRT" Tenders'

Public Opening Session

第一部份《文件》開啟結果

Part 1 Proposa l- Documents Opening Result

序號 No.	競投人 Tenderer	備註 Remarks
1	西門子 – 中土港澳建築工程 Siemens – CCECC Consortium	接納 Admitted
2	三菱重工有限公司 Mitsubishi Heavy Industries, Ltd.	接納 Admitted
3	龐巴迪運輸 – 中國路橋工程 BT CRBC LRT Consortium	接納 Admitted

Part 2 Proposal - Financial Portion – Basic Proposal Lump-sum Price

序號 No.	競投人 Tenderer	基本項目固定金額 (澳門幣) Basic Proposal Lump-sum Price (MOP)
1	西門子 – 中土港澳建築工程 Siemens – CCECC Consortium	$ 6,281,592,632.00
2	三菱重工有限公司 Mitsubishi Heavy Industries, Ltd.	$ 4,688,000,000.00
3	龐巴迪運輸 – 中國路橋工程 BT CRBC LRT Consortium	$ 4,567,143,775.07

Part 2 Proposal - Financial Portion – Optional Works Lump-sum Price

序號 No.	競投人 Tenderer	可選擇項目固定金額 (澳門幣) Optional Works Lump-sum Price (MOP)	
		2014-2019 及 2020-2024 維護服務 Maintenance 2014 - 2019 and 2020 - 2024	滿足 2020 年系統運量之額外兩列車批次 2 Additional Train Batches Fulfilling Year 2020 Line Capacity
1	西門子 – 中土港澳建築工程 Siemens – CCECC Consortium	$ 2,018,215,398.00	$ 2,637,841,167.00
2	三菱重工有限公司 Mitsubishi Heavy Industries, Ltd.	$ 792,810,000.00	$ 1,510,540,000.00
3	龐巴迪運輸 – 中國路橋工程 BT CRBC LRT Consortium	$ 1,662,066,540.17	$ 1,792,431,706.79

3. Lessons learned from World Trend and Examples

Implications from the World Trends and Examples

- ‘Price & Quality’ bid evaluation system is widely introduced in most developed countries as a modern public procurement method.
- Especially, EU Directives suggest that the most economically advantageous tender (MEAT) should be applied for quality intensive procurement.
- These trends and movements originated from the self-examination of countries which had encountered ‘poor quality’ procurement caused by their pursuit of the price competitive bid evaluation system.
- The lowest price bidding not only leads to low quality but also brings industrial exhaustion to the countries by excessive low-price competition, and as a consequence, it prevents their sustainable growth in the long run.
- Each of the countries shown in the examples has implemented its original evaluation system which includes evaluation criteria, item, index, method, and weight as well as evaluation process and members.

Lessons learned from the Examples

	Items to be applicable in India
Example 1 (Scotland, UK)	✓Basic Idea : Achieving VFM, which is the best combination of whole life cost and quality ✓Accountability : Publishing award criteria and weightings for transparency ✓Quality/Price Ratio : Setting ranges from innovative projects to repeat ones
Example 2 (Montana, USA)	✓Independence : Setting up Technical Review Committee consisting of minimum 3 members ✓Accountability : Technical Proposal Evaluation Factors Score Sheet provided ✓Easy Calculation : Adjusted score (=Price/Technical Score) for Best Value
Example 3 (Queensland, Australia)	✓Independence : Setting up Tender Evaluation Panel consisting of at least 3 qualified persons ✓Non-price Evaluation Criteria : Preparing wide ranges of criteria
Example 4 (BART, USA)	✓Consideration of ‘Complexity’ : Competitive negotiation with price quality bid evaluation applied for electronic and specialized rail transit equipment ✓Evaluation Criteria : Price(33%), Experience & Past Performance (25%), Vehicle Subsystem Design Details (20%), etc. ✓Justification : Technical evaluation conducted by 2 independent teams ✓Accountability : Preparing Detailed Technical Evaluation Protocols

Lessons learned from 'BART'

- BART (Bay Area Rapid Transit) has adopted competitive negotiation other than price bidding for the procurement of rolling stock.
- The reason for this is due to the complexities involved. In the memorandum of the BART Board meeting, background in adopting competitive negotiation for the procurement of rolling stocks is stated as follows:

> 'The scope of work for the procurement, in general, consists of providing the design, engineering, mockups, manufacture, assembly, testing, delivery and acceptance testing for 200 new heavy rail transit vehicles, ready for revenue service as an integral part of the District's transportation system, and associated program management, in-service support, publications, warranty, training and data submittal, all as more fully described in the Contract Documents. **A competitively negotiated procurement, rather than a low responsive bid-based procurement, is necessary to procure the transit vehicles**.'

- Also, stated in **Section 20229.1 of the California Public Contract Code**, competitive negotiation should be adopted for the procurement of rail transit equipment including rail cars, and the award shall be made to the qualified bidder whose proposal will be most advantageous to the district with price and other factors considered.

Lessons learned from 'BART'

Extracts of the California Public Contract Code Section 20229.1

(a) Notwithstanding any other provision of law, the governing board of the San Francisco Bay Area Rapid Transit District may direct the purchase of

(1) electronic equipment, including, but not limited to, computers, telecommunications equipment, fare collection equipment, and microwave equipment and

(2) specialized rail transit equipment, including, but not limited to, rail cars, and contracts for work that include, at a minimum, conversion of the rail car motive power system to alternating current or the complete replacement of existing rail car motive power units that utilize direct current, by competitive negotiation upon a finding by two-thirds of all members of the board that the purchase of that equipment in compliance with provisions of this code generally applicable to the purchase does not constitute a method of procurement adequate for the district's needs.

(b) Competitive negotiation, for the purposes of this section, shall include, as a minimum, all of the following elements:

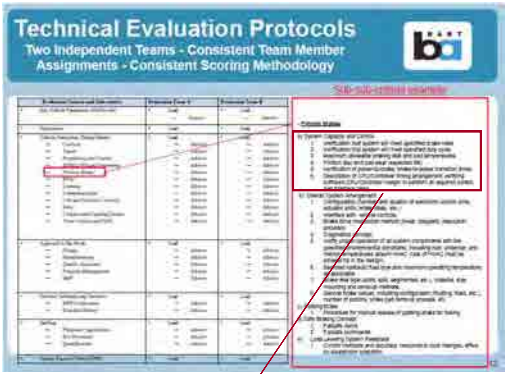
(1) A request for proposal shall be prepared and submitted to an adequate number of qualified sources, as determined by the district in its discretion, to permit reasonable competition consistent with the nature and requirements of the procurement. In addition, notice of the request for proposal shall be published at least once in a newspaper of general circulation, which publication shall be made at least 10 days before the proposals are received. The district shall make every effort to generate the maximum feasible number of proposals from qualified sources and shall make a finding to that effect before proceeding to negotiate if only a single response to the request for proposal is received.

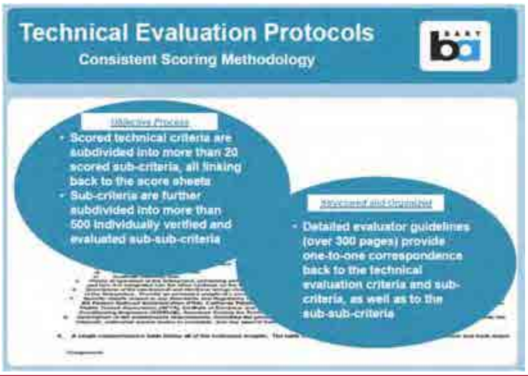
(2) The request for proposal shall identify significant evaluation factors, including price, and their relative importance.

(3) The district shall provide reasonable procedures for technical evaluation of the proposals received, identification of qualified sources, and selection for contract award.

(4) Award shall be made to the qualified bidder whose proposal will be most advantageous to the district with price and other factors considered. If award is not made to the bidder whose proposal contains the lowest price, the board shall make a finding setting forth the basis for the award.

Lessons learned from 'BART'





7.D.6 Friction Brakes

a. System Capacity and Control
1. Verification that system will meet specified brake rates
2. Verification that system will meet specified duty cycle
3. Maximum allowable braking disk and pad temperatures
4. Friction disc and pad wear (expected life)
5. Verification of power-to-brake, brake-to-power transition times
6. Description of CPU/Controller timing arrangement verifying sufficient CPU/Controller margin to perform all required control and interface tasks

※Detailed description of the specification requirements and guidelines to be provided for each category in order for the evaluator to keep the relevant score for each category.

Sub-Sub-Criteria (Detailed Descriptions)

Specification Requirements and Guidelines

2.9.6 Braking

A. Friction brake rates shall be available over the full speed range with vehicle weights from AW0 through AW3 and all wheel diameters.
  1. Open-loop brake rate (80 to 0 mph): 3.0 mphps with an instantaneous tolerance of ± 10 percent, and a tolerance of ±7 percent over any 5 second period.
  2. Yard Manual: 3.0 mphps with an instantaneous tolerance of ± 10 percent and a tolerance of ±7 percent over any 5 second period.

B. Emergency Stop Rates shall be the same as Open Loop Brake Rates and shall have the same tolerances.

C. For loads from AW0 through AW2, electric brakes (regenerative and rheostatic) shall provide full braking effort from 80 mph to 3.0 mph or less.

D. Deceleration rate calculations (limited to the value and tolerances defined in Section TS2.9.6, Braking, bullet A, sub-bullet 1) shall not include train resistance, but may include motor and gear losses. Refer to Section TS2.9.1, Train Resistance.

E. Reserved.

F. Braking controls shall provide for blending of friction and electric brake systems.

G. Braking controls shall provide for linear brake rate variations from 0 to 3.0 mphps.

H. Default Brake Pressure: If open-loop brake is requested and dynamic brake torque is less than 90 percent of the requested electric brake level and no brake caliper

⋮

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Lessons learned from 'BART'

Each of the evaluation teams keep the score for each category at the range of 1 to 10, and calculate the total adjusted score.

EVALUATION SCORESHEET - TEAM A

Individual Evaluation Team Member Scores

Team Member Name (print): ____
Date of Review: ____
Proposer Name: ____

NOTES: Place an X in the box to the right to note whether GO or NO-GO
Scored sections are evaluated on a 1-10 scale, with 10 being the highest score

Key Vehicle Parameters	A Points	N/A		
General Arrangement and Clearance Drawings	A_1	Go	No-Go	
Key Vehicle Dimensions	A_2	Go	No-Go	
Vehicle Weight Schedule	A_3	Go	No-Go	
Performance Simulation	A_4	Go	No-Go	

		Max Pts	Score		Adj Score
Experience (X% of overall points assigned by eval team)	C Points	X			0.00
Experience in Providing Similar Car Designs for Other Properties	C_1	X1	1 to 10		Score
Transit Agency References (minimum three)	C_2	X2	1 to 10		Score
Proposer's History of Meeting Schedule on Other Projects	C_3	X3	1 to 10		Score

		Max Pts	Score		Adj Score
Vehicle Subsystems Design Details (Y% of overall points assigne	D Points	Y			0.00
Carbody	D_1	Y1	1 to 10		Score
Trucks	D_2	Y2	1 to 10		Score
Propulsion and Control	D_3	Y3	1 to 10		Score
APSE, LVPS and Grounding	D_4	Y4	1 to 10		Score
Friction Brakes	D_5	Y5	1 to 10		Score
HVAC	D_6	Y6	1 to 10		Score
Lighting	D_7	Y7	1 to 10		Score
Communications	D_8	Y8	1 to 10		Score
Cab & Trainline Controls	D_9	Y9	1 to 10		Score
Doors	D_{10}	Y10	1 to 10		Score
Coupler and Coupling Systems	D_{11}	Y11	1 to 10		Score
Train Control and VATC	D_{12}	Y12	1 to 10		Score

		Max Pts	Score		Adj Score
Approach to the Work (Z% of overall points assigend by eval tean	E Points	Z			0.00
Approach to the Design	E_1	Z1	1 to 10		Score
Approach to Manufacturing	E_2	Z2	1 to 10		Score
Approach to Quality Assurance	E_3	Z3	1 to 10		Score
Approach to Program Management	E_4	Z4	1 to 10		Score
Approach to SMP, Maintainability & User Ed	E_5	Z5	1 to 10		Score

EVALUATION SCORESHEET - TEAM A

Individual Evaluation Team Member Scores

Team Member Name (print): ____
Date of Review: ____
Proposer Name: ____

		Max Pts	Score		Adj Score
Schedule and Narrative (A%)	F Points	A			0.00
MPS - Validity of activities, durations, and logic	F_1	A1	1 to 10		Score
Proposer's ability to meet schedule	F_2	A2	1 to 10		Score

		Max Pts	Score		Adj Score
Staffing (B%)	G Points	B			0.00
Program Organization	G_1	B1	1 to 10		Score
Key Personnel Commitment and Resource Loading Chart	G_2	B2	1 to 10		Score
Staff Qualification/Résumés	G_3	B3	1 to 10		Score

		Max Pts			Adj Score
Energy Figure of Merit (C%) (net energy consumption)	H Points				
$\frac{\text{Lowest EFM} \times \text{C}}{\text{Proposer's EFM}}$ = Proposer's EFM Score	H	C	Score		Score

SUMMARY:

GO	NO-GO
0	0

ID	
C	0.00
D	0.00
E	0.00
F	0.00
G	0.00
H	Score

Signature: ____
Date:

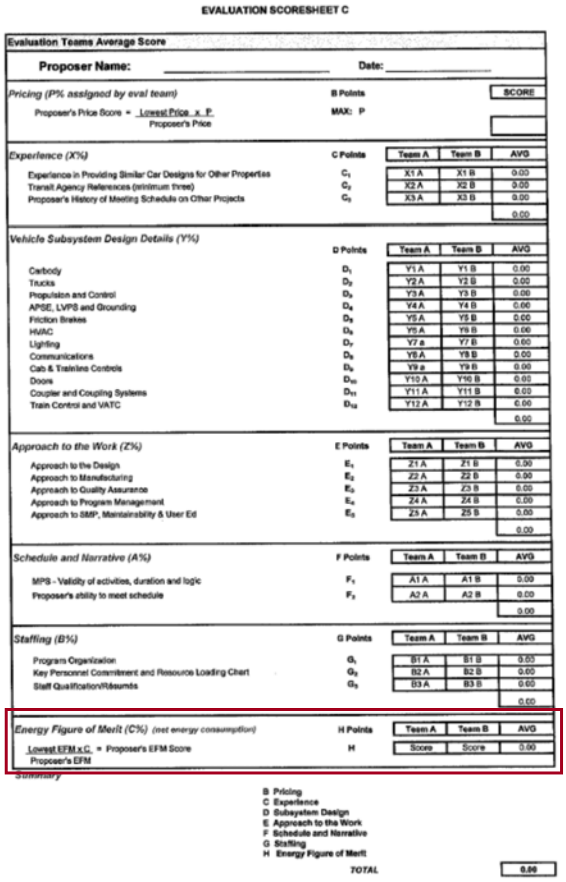
Total Adjusted Score 0.00

Note: The sum of the points listed against each sub-element when added together would equal the Max Pts for that category. For example, under Experience, there are three sub-element C1, C2, C3. If the Max Pts for Experience is X, then X1 plus X2 plus X3 would equal the total number of points assigned "X"

Once the scores on a 1 to 10 basis are recorded against each sub-element the points, such as X1 are multiplied by the score and recorded in the box. The Adjusted Score is the sum for the whole category. The sum of all Adjusted Scores is the technical evaluation score for that proposer.

Lessons learned from 'BART'

- Score of each individual team placed on the evaluation sheet for each category
- Average score calculated for each category
- Total score calculated
- Award of the contract to the qualified proposer, who provides the higher total score of price and non-price factors



EVALUATION SCORESHEET C

Evaluation Teams Average Score

Proposer Name: ______________ Date: ______________

Item	Points	Team A	Team B	AVG
Pricing (P% assigned by eval team)	B Points			SCORE
Proposer's Price Score = Lowest Price x P / Proposer's Price	MAX: P			
Experience (X%)	C Points	Team A	Team B	AVG
Experience in Providing Similar Car Designs for Other Properties	C_1	X1 A	X1 B	0.00
Transit Agency References (minimum three)	C_2	X2 A	X2 B	0.00
Proposer's History of Meeting Schedule on Other Projects	C_3	X3 A	X3 B	0.00
				0.00
Vehicle Subsystem Design Details (Y%)	D Points	Team A	Team B	AVG
Carbody	D_1	Y1 A	Y1 B	0.00
Trucks	D_2	Y2 A	Y2 B	0.00
Propulsion and Control	D_3	Y3 A	Y3 B	0.00
APSE, LVPS and Grounding	D_4	Y4 A	Y4 B	0.00
Friction Brakes	D_5	Y5 A	Y5 B	0.00
HVAC	D_6	Y6 A	Y6 B	0.00
Lighting	D_7	Y7 a	Y7 B	0.00
Communications	D_8	Y8 A	Y8 B	0.00
Cab & Trainline Controls	D_9	Y9 a	Y9 B	0.00
Doors	D_{10}	Y10 A	Y10 B	0.00
Coupler and Coupling Systems	D_{11}	Y11 A	Y11 B	0.00
Train Control and VATC	D_{12}	Y12 A	Y12 B	0.00
				0.00
Approach to the Work (Z%)	E Points	Team A	Team B	AVG
Approach to the Design	E_1	Z1 A	Z1 B	0.00
Approach to Manufacturing	E_2	Z2 A	Z2 B	0.00
Approach to Quality Assurance	E_3	Z3 A	Z3 B	0.00
Approach to Program Management	E_4	Z4 A	Z4 B	0.00
Approach to SMP, Maintainability & User Ed	E_5	Z5 A	Z5 B	0.00
				0.00
Schedule and Narrative (A%)	F Points	Team A	Team B	AVG
MPS - Validity of activities, duration and logic	F_1	A1 A	A1 B	0.00
Proposer's ability to meet schedule	F_2	A2 A	A2 B	0.00
				0.00
Staffing (B%)	G Points	Team A	Team B	AVG
Program Organization	G_1	B1 A	B1 B	0.00
Key Personnel Commitment and Resource Loading Chart	G_2	B2 A	B2 B	0.00
Staff Qualification/Résumés	G_3	B3 A	B3 B	0.00
				0.00
Energy Figure of Merit (C%) (net energy consumption)	H Points	Team A	Team B	AVG
Lowest EFM x C / Proposer's EFM = Proposer's EFM Score	H	Score	Score	0.00

Summary

B Pricing
C Experience
D Subsystem Design
E Approach to the Work
F Schedule and Narrative
G Staffing
H Energy Figure of Merit

TOTAL 0.00

※ Consideration of Energy Figure is only a part of the technical evaluation. Also, the score is not transferred into the price, nor the huge penalty (ex. 30 years) is imposed as in DMRC

Lessons learned from 'BART'

- Successful procurement achieved by competitive negotiation with price-quality evaluation system at RFP No. 40FA-110
- The responsible person in BART clearly states the followings;
  - ✓ We were able to conduct clarification discussions and ultimately we conducted lengthy face-to-face negotiations where we discussed strengths/weaknesses of each proposer's offer to us and told the areas they needed to focus in to potentially improve the car that they were offering us so that we got the most technically modern, but highly reliable vehicle possible at the most affordable price.
  - ✓ **These face to face discussions would not have been possible if we simply conducted the procurement using the low bid approach**.
  - ✓ In addition, **we obtained significant price reductions between the initial offer and the best and final offers while at the same time improving the technical performance parameters of the vehicle.**
  - ✓ In fact the difference between the low price and the second low price was $183,832,285, a very significant amount of money AND the company offering the lowest price also was the one to receive the highest technical score. **A true WIN-WIN for us.**

Lessons learned from 'BART'

Procurement of Transit Vehicles (775 cars) : RFP No. 40FA-110

(5 proposals submitted)

	ALSTOM	BOMBARDIER	CAF	CSR	ROTEM
Technical Score	42.80	46.91	18.73	6.24	29.10
Price Score	33.00	31.55	30.09	30.34	30.56
Combined Score	75.80	78.46	48.82	36.58	59.66
Price (rounded)	$1.895B	$1.983B	$2.078B	$2.062B	$2.046B

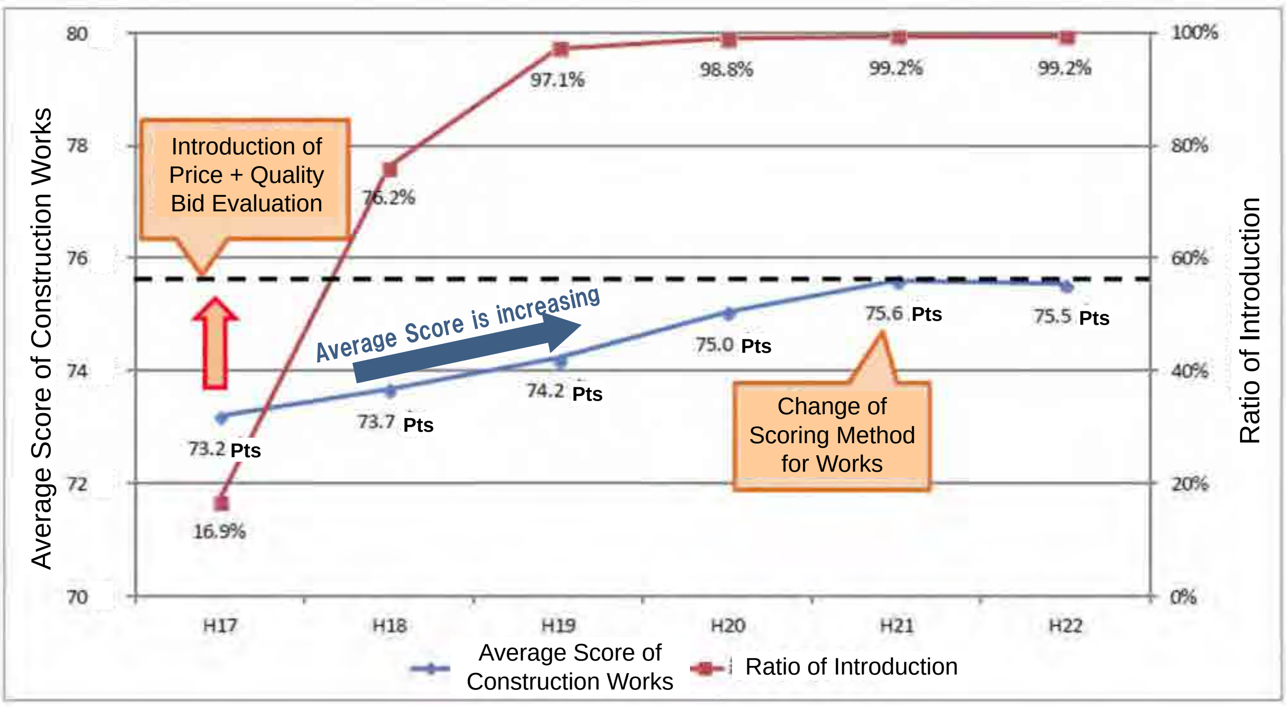
(3 shortlisted proposals submitted for BAFO)

	ALSTOM	BOMBARDIER			ROTEM
Technical Score	41.39	46.70			30.05
Price Score	31.83	33.00			18.42
Combined Score	73.22	79.70			48.47
Price	$1,727,025,189 (+$183,832,285)	$1,543,192,904 (Low Price)			$2,791,394,850 (+$1,248,201,946)

25% below Engineer's Estimate

Effect of introducing Price Quality Bid Evaluation Method (Japan)

Quality of the construction works has improved in proportion to the introduction of 'Price + Quality' bid evaluation method in Japan.



Effect of introducing Price Quality Bid Evaluation Method (Japan)

Opinions from the Employers regarding the effect of introducing Price Quality Evaluation Method

1) Quality Improvement, Cost Reduction, Early Completion

- Expect cost reduction, early completion, and etc. by adopting the construction methods proposed by the contractors
- Expect better quality with lower price for the procurement to the needs of national people
- Achieved relevant construction management for not only the works related to the evaluation item but also the whole construction works

2) Awareness Improvement for Better Quality

- Awareness improvement for reduction of the negative benefit caused by construction works
- Awareness for regional contribution through construction works

3) Technical Capacity Improvement of the Owner and the Contractor

- Knowledge acquisition through the technical evaluation process for the most important part of the construction works
- Expansion of opportunities to propose new technology / construction method to the Owner

4) Others

- Removal of unqualified contractors with poor quality through justifiable tender competition

4. Introduction of Price & Quality Bid Evaluation Method (Proposal)

Key Factors to implement Price & Quality Bid Evaluation Method

In order to achieve modern procurement system such as bid evaluation by 'price + quality', the following key factors have to be implemented in the procurement system, which is incorporated in the examples as per described in the following section.

- Transparency
  - ✓ Evaluation process and method, detailed evaluation score and weighting, etc. should be clearly specified in the bidding document
  - ✓ The 3rd party or committee should be established to evaluate the proposed quality and price
  - ✓ Quality evaluation and price evaluation should be conducted separately and independently
- Accountability
  - ✓ Evaluation result and reasons should be open to bidders with detailed scores for each bidder
  - ✓ Evaluation process and method should be in accordance with the government procurement policy, which is also presented to the pubic

Implementation of 'Price + Quality' Bid Evaluation Method in India

- Adopt the 'Price + Quality' Evaluation System
  - ✓ In order to achieve higher quality with lower price, it should be considered to adopt modern bid evaluation system, which evaluates price and quality simultaneously.
  - ✓ Weight of price and quality should be clarified and specified in the bidding document in accordance with the complexity and difficulty of the project.
- Establish Independent Evaluation Board (for Transparency)
  - ✓ In order to achieve transparency in the procurement process, it is recommended that an evaluation board be established.
  - ✓ The board members should be sourced from outside of those directly involved in the procurement process, examples of which are academia, agency, or other experts.
  - ✓ Price evaluation and quality evaluation should be conducted by separate parties.
- Produce Modern Procurement Manual or Guidelines (for Accountability)
  - ✓ Evaluation process and method should be described in the relevant manual or guideline prepared, and should be opened to public.
  - ✓ Pilot project should be arranged to identify the applicability and effectiveness of the modern bid evaluation system.

Suggestions to Evaluation Criteria (ex. Rolling Stock)

Criteria	Item
Price Evaluation (50 points)	✓ Rolling Stock ✓ Spare Parts ✓ Special Tools and Diagnostic & Test Equipment ✓ Training ✓ Manual ✓ Performance Bond ✓ Finance
Experience and Past Performance (30 points)	✓ Schedule Adherence ✓ Suppliers' Work History for Finishing Similar Project ✓ System Reliability ✓ Weight Compliance ✓ Quality ✓ Document Delivery / Acceptance ✓ Manual & Training Delivery / Acceptance ✓ Change Orders
Technical Spec. Compliance (10 points)	✓ Overall Design ✓ Sub system Design (Propulsion, APS, Brake, Doors, HVAC, Coupler, Lighting etc.
Project Management Experience (10 points)	✓ Resource Capability & Capacity ✓ Organization ✓ Facility Capability & Capacity ✓ Local Assembly ✓ Interface Management

※ Red Items : Important items and could be applied for other procurement

Examples of Price / Quality Ratio

Example	Price	Quality	Subject
Procurement Guideline in Scotland, UK			Construction Works
	80 to 60	20 to 40	Innovative projects
	85 to 65	15 to 35	Complex projects
	90 to 75	10 to 25	Straightforward projects
	95 to 90	5 to 10	Repeat projects
Design-Build Guidelines in Montana DOT, USA	50	50	Construction Works
Procurement Manual BART, USA	33	67	Rolling Stock
Macau LRT	55	45	Rolling Stock & Systems

<Appendix 7>

Answers to the Questions

Introduction of New Bid Evaluation Method for Urban Transport Projects in India

- Learned from the world experience and practice -

June 6, 2013

Japan International Corporation Agency

Mitsubishi Research Institute, Inc.

Japan International Consultants for Transportation Co., Ltd.

What was happened between Initial Offer and BAFO in BART ?

According to the responsible person in BART, the following events were taken place between the initial offer and BAFO (Best and Final Offer) for the procurement of RFP No. 40FA-110

- ✓ During the initial proposal evaluation process, the evaluation teams of BART recorded deficiencies in the proposers' technical proposals.
- ✓ The proposers were also allowed to submit "exceptions" to the technical or commercial terms and conditions.
- ✓ BART sent them all of our comments about problems the proposers had with their submittal, and asked them for any cost drivers that they thought could affect the overall price.
- ✓ BART agreed with some of the proposers' requests for changes and BART forced them to accept some of the requests by BART.
- ✓ Hence, BART put all the agreed to items in the BAFO and asked for a new technical and price proposal. These were rescored which is why the numbers changed.
- ✓ Regarding ROTEM, they had the lowest technical score to begin. In order to provide a more compliant vehicle they had to make many more improvements which they priced higher.

What is the criteria and method of technical evaluation in Japan ?

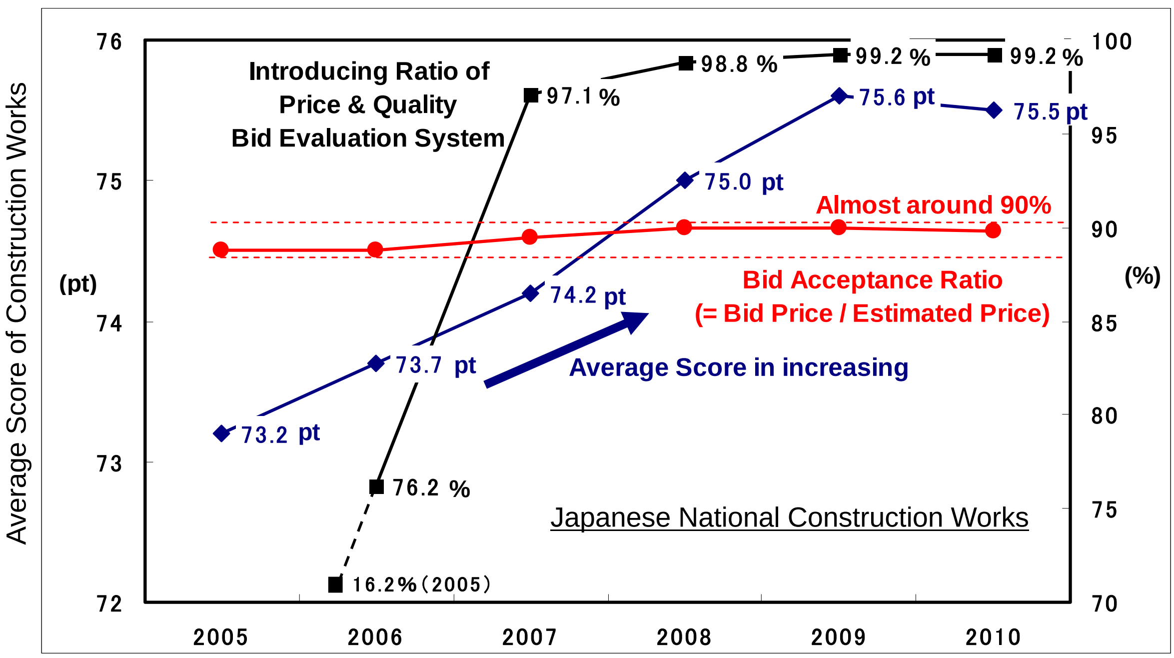
- ✓ There are 2 types of price & quality bid evaluation system; one is <u>construction capability evaluation type</u>, and the other is <u>technical proposal evaluation type</u>, in accordance with the characteristics of the construction works.
- ✓ The following is one of the examples of evaluation item, criteria, and score for construction capability evaluation type. (Resource: Comprehensive bid evaluation operation guideline, MLIT, 3/2013)

(Construction Capability Evaluation Type Ⅰ)

Evaluation Item		Evaluation Criteria	Score		
Company's Capability	Similar works experience in these 15 years	Yes, very similar	8	8	20
		Yes, similar	0		
	Average score of the similar works in the past 2 years	S≧80	8	8	
		75≦S<80	5		
		70≦S<75	2		
		S<70	0		
	Award	Yes	4	4	
		No	0		
Engineer's Capability	Similar works experience in these 15 years *	Technical Supervisor of the very similar works	8	8	20
		Resident engineer of the very similar works, or technical supervisor of the similar works	4		
		Resident engineer of the similar works	0		
	Average score of the similar works in the past 2 years	S≧80	8	8	
		75≦S<80	5		
		70≦S<75	2		
		S<70	0		
	Award	Yes	4	4	
		No	0		
	Supervising capability (Interview)	Enough level	X1.0	Multiply to the score of *	
		Certain level	X0.5		
		Other than the above	X0.0		
Construction Planning		Appropriate	Pass	Disqualified in case of Fail	
		Inappropriate	Fail		
The engineer's understandings of the construction planning (Interview)		Appropriate	Pass	Disqualified in case of Fail	
		Inappropriate	Fail		

Any economical benefits or cost reduction brought together with quality improvement in Japan?

- ✓ Quality of the construction works has improved in proportion to the introduction of 'Price + Quality' bid evaluation method in Japan.
- ✓ Awarded bid price keeps around 90% of the estimated price, although average score of the construction works are steadily increasing, which means B/C is increasing.



What is the criteria and items of scoring the result of construction works ?

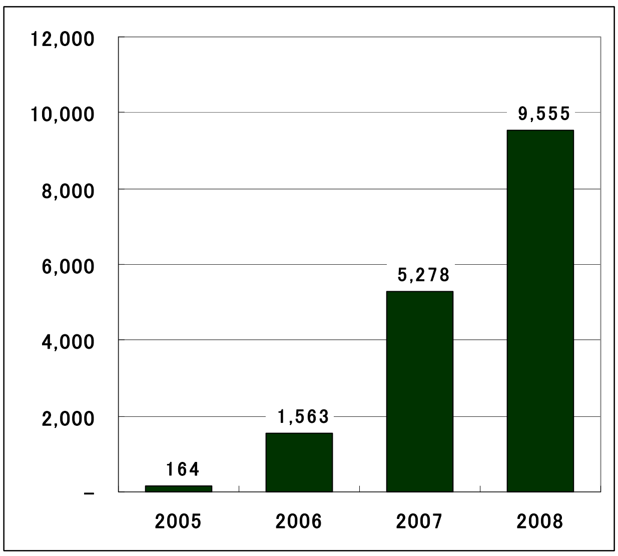
- ✓ 3 officers, Chief Engineering Evaluation Officer, General Engineering Evaluation Officer, and Engineering Inspector keep the score of each evaluation item in the following table, and the total score will be given back to the contractor

Evaluation Item	Detailed Item	Chief Engineering Evaluation Officer	General Engineering Evaluation Officer	Engineering Inspector	Score
Organization	Organization	(1.0)×0.4+2.9=3.3			3.3/3.3
	Assigned Engineer	(3.0)×0.4+2.9=4.1			4.1/4.1
Construction Condition	Construction Management	(4.0)×0.4+2.9=4.5		(5.0)×0.4+6.5=8.5	13.0/13.0
	Schedule Management	(4.0)×0.4+2.9=4.5	(2.0)×0.2+3.2=3.6		8.1/8.1
	Safety Measures	(5.0)×0.4+2.9=4.9	(3.0)×0.2+3.3=3.9		8.8/8.8
	External Affairs	(2.0)×0.4+2.9=3.7			3.7/3.7
Output & Performance	Output	(4.0)×0.4+2.8=4.4		(10.0)×0.4+6.5=10.5	14.9/14.9
	Quality	(5.0)×0.4+2.9=4.9		(15.0)×0.4+6.5=12.5	17.4/17.4
	Performance			(5.0)×0.4+6.5=8.5	8.5/8.5
Construction Characteristics	Correspondence to Construction Condition		(20.0)×0.2+3.3=7.3		7.3/7.3
Original Idea	Original Idea	(7.0)×0.4+2.9=5.7			5.7/5.7
Sociality	Contribution to Region		(10.0)×0.2+3.2=5.2		5.2/5.2
Compliance	-		(0.0)×1.0=0.0		-
				Score Sum	100/100
Technical Proposal (Price & Quality Bid Evaluation)	Confirmation of Conducting Technical Proposal		Yes or No		

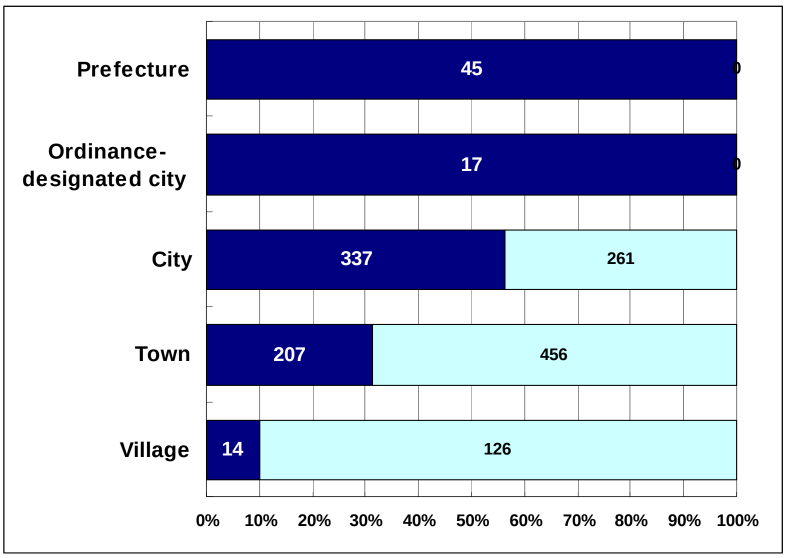
Any examples of Price & Quality bid evaluation system at Metro projects or municipalities projects ?

- ✓ The number of construction projects which introduce Price & Quality Bid Evaluation System has been dramatically increased in the Japanese municipal government.
- ✓ 100% of the prefecture and ordinance-designated city, which is allowed to construct subway system, already introduced Price & Quality Bid Evaluation System.

No. of Projects (Price & Quality Bid Evaluation System)

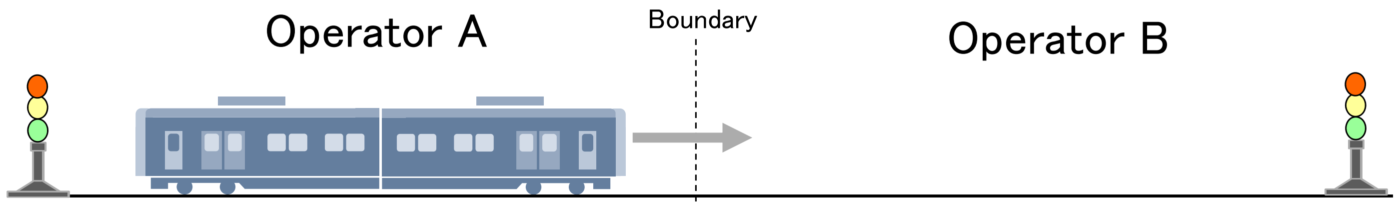


No. of Municipalities (Price & Quality Bid Evaluation System)



How is the revenue and cost allocation among two railway operators when the track is shared in Japanese urban railway?

Suppose a train which belongs to operator A goes beyond the boundary to operator B's track.
Based on the contract between the operator A and B, revenue and cost is allocated as follows:



Revenue

Fare: a yen | Fare: b yen

Passengers should pay the sum amount of fare (a+b yen) at an origin station of operator A.

Later, operator A will transfer b yen to the operator B.

Cost

A driver and a conductor changes at the boundary. ⇒ No cost transfer.

Cost of track, signal, electricity etc, occurs in each operator. ⇒ No cost transfer.

Cost of rolling stock. ⇒ Operator B pays (unit cost) X (vehicle km) to operator A.

If a train of operator B also goes beyond the boundary to operator A's track, the balance is paid between the two operators

If a train of operator A uses operator B's depot, operator A pays the cost of maintenance etc, to operator B.

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