

5.9 Estimation of Project Cost

This section describes the estimated cost of the project.

5.9.1 Overview of Project Cost

Project costs are composed of the following main categories i.e., costs for utility relocations and land acquisition, civil construction, E&M system, rolling stock, and consultant fees. Costs of each category are divided into the local currency and the foreign currency portions based on India's procurement possibilities, and further divided by fiscal year for allocation. Additional investment costs for rolling stock in response to future increase in demand are also considered. In addition, contingencies and taxes and duties are taken into account.

Table 5.9.1 shows the aggregated project cost. The details of each category are explained in the following sections.

The estimation of the project cost is based on the following premises:

Construction schedule: As stated in 5.8, after the implementation of the F/S in 2013, utility relocations and land acquisitions will be conducted from 2014 to 2016. Two stages of construction are planned from 2016 to 2020. Additional procurement of rolling stock will be conducted in 2023, 2028 and 2033.

Cost items: In addition to utility relocations and land acquisitions, civil works, E&M system, track work and rolling stock, other items including costs for consulting services, contingency and tax and duty are included in the project cost. The details of the cost estimation for these items will be given in the following sections.

Base year of estimation: November 2012

Exchange rate adopted: Indian Rupee (Rs.) 1 = Japanese Yen 1.5 for 2012. The rate fluctuations are considered by assuming that the Indian Rupee will be devaluated against JPY at the rate of 5% annually from 2012 to 2020 considering the average change rate of the past ten years.

Price escalation: Annual escalation of 4.2% and 2.1% are assumed for local and foreign currency portions respectively.

Table 5.9.1-(1) Total Project Cost (Without Price Escalation and Exchange Rate Fluctuations)

(Unit: Million Rs.)

	2013-2020 Total			2023			2028			2033			Grand Total
	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	
(1) Civil works													
Land acquisition, Utility r	0	4,118	4,118										4,118
Civil Works	0	14,597	14,597										14,597
Sub total	0	18,715	18,715										18,715
(2) E&M													
Track	453	1,480	1,933										1,933
E&M	2,262	2,831	5,093										5,093
Rolling Stock	8,213	0	8,213	2,746		2,746	845		845	704		704	12,508
Sub total	10,929	4,311	15,239	2,746		2,746	845		845	704		704	19,534
Total Civil Works and E&M	10,929	23,026	33,955	2,746		2,746	845		845	704		704	38,249
(3) Others													
Consulting service	546	945	1,492										1,492
Contingency	574	993	1,566	137		137	42		42	35		35	1,781
Total Construction	12,049	24,964	37,013	2,883		2,883	887		887	739		739	41,522
Tax & Duty	2,065	4,315	6,380	494		494	152		152	127		127	7,153
Grand Total	14,114	29,279	43,393	3,377		3,377	1,039		1,039	866		866	48,675

Source: Study Team

Table 5.9.1-(2) Total Project Cost (With Price Escalation and Exchange Rate Fluctuations)

(Unit: Million Rs.)

	2013-2020 Total			2023			2028			2033			Grand Total
	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	
(1) Civil works													
Land acquisition, Utility r	0	4,662	4,662										4,662
Civil Works	0	18,377	18,377										18,377
Sub total	0	23,039	23,039										23,039
(2) E&M													
Track	688	1,877	2,564										2,564
E&M	3,405	3,572	6,977										6,977
Rolling Stock	12,494	0	12,494	5,202		5,202	1,776		1,776	1,642		1,642	21,113
Sub total	16,586	5,449	22,036	5,202		5,202	1,776		1,776	1,642		1,642	30,655
Total Civil Works and E&M	16,586	28,488	45,074	5,202		5,202	1,776		1,776	1,642		1,642	53,693
(3) Others													
Consulting service	829	1,191	2,021										2,021
Contingency	871	1,251	2,122	260		260	89		89	82		82	2,553
Total Construction	18,287	30,930	49,216	5,462		5,462	1,865		1,865	1,724		1,724	58,266
Tax & Duty	3,135	5,342	8,477	936		936	320		320	296		296	10,028
Grand Total	21,421	36,272	57,693	6,398		6,398	2,184		2,184	2,019		2,019	68,295

Note: Estimates for Civil Works are based on the assumption of elevating the entire route in MIDC area.

Source: Study Team

5.9.2 Approximate Project Cost for Civil Engineering and Architectural Facilities

Approximate project cost for civil engineering and architectural facilities are calculated using the unit prices of the Delhi metro and Pune Metro projects. There are two route structure plans. One is the plan with a full elevate route in the Hinhyawati IT Park. The other one is a combination of an elevated route from St.1 to St.20 and ground route after St. 21. Based on these 2 plans, approximate project costs are calculated and shown in Figure 5.9.1.

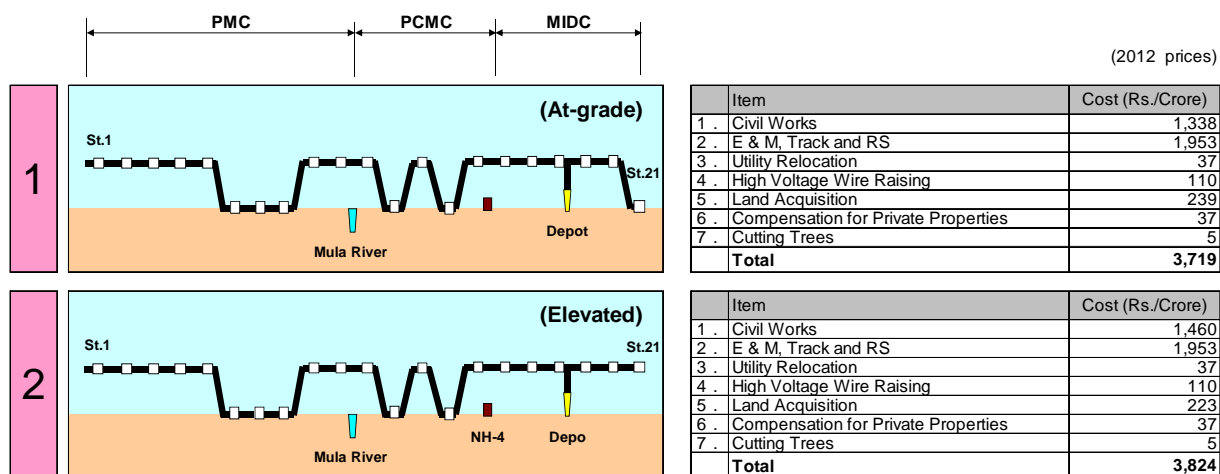


Figure 5.9.1 Approximate Project Cost for Civil Engineering and Architectural Facilities

Source: JICA Study Team

Approximate project cost is calculated using the unit prices of the Delhi Metro Project and Pune Metro Project.

5.9.3 Project Cost Estimation for Railway (Tram) Systems

1) Preconditions

Based on the result of a railway system study, project costs for electrical and mechanical (E&M) systems and operation and maintenance (O&M) are estimated.

- This figure represents the year 2012 prices.
- E&M cost includes cost for signaling, track works, telecommunications, power, automatic fare collection, depot facilities and rolling stock from the construction phase (2016-2018) up to 2048 (30 years after opening).
- Operation and Maintenance (O&M) cost includes the labor cost and others, such as electricity expense and maintenance supplies expense and so on, for 30 years from opening year 2019 to 2048. The electricity expense is considering the power consumption of running rolling stock and of use at train stops.

2) Project Cost for Electrical and Mechanical (E&M) System

The estimated project cost is shown in the following table.

Table 5.9.2 Project Cost for E&M System

(Unit: Rs. Million (Year 2012 Price))

Items		Foreign Portion	Local Portion	Total
E&M	E&M	3,121	3,905	7,026
	Rolling Stock	12,508	0	12,508
Total		15,629	3,905	19,534

Source: JICA Study Team

3) Project Cost for Operation and Maintenance (O&M)

When construction of the LRT system is finished and the commercial operation starts, operation and maintenance cost shall occur. The operation and maintenance cost for 30 years is estimated as shown below.

Table 5.9.3 Project Cost for O&M (30 years)

Unit: Rs. Million (Year 2012 Price)

Items		Foreign Portion	Local Portion	Total
O&M	Staff Cost	0	5,783	5,783
	Other Costs	4,155	15,312	19,467
Total		4,155	21,095	25,249

Source: JICA Study Team

5.9.4 Price and Physical Contingencies

A total of 5% of civil works, E&M costs, and consultant fees are estimated for contingencies.

5.9.5 Consultant Fees

The fees for the consultant work during the construction period are estimated at 5% of civil works and E&M costs each year, excluding additional purchases of rolling stock.

5.9.6 Central and State Taxes and Duties

Taxes and duties that can be applied in implementing this project include both central taxes and duties (such as custom duty and excise duty) and state taxes and duties (such as VAT). In this cost estimation, both the central and state taxes and duties incurred are estimated to aggregately correspond to 18% of civil works, E&M costs, and consultant fees, using the past studies conducted for other urban transport projects in India (such as the Detailed Project Report for Pune Metro by Delhi Metro Rail Corporation) as a reference.

5.9.7 Operation and Maintenance Costs

The operation and maintenance (O&M) costs consist of labor cost and other expenses such as electricity and maintenance costs. Table 5.9.4 shows the total amount of O&M costs during the operation period from 2019 to 2048, divided into the foreign and local currency portions.

Table 5.9.4 Operation and Maintenance Costs

(Unit: Million Rs.)

Cost Item	Currency Portion	2019-2048 Total Without Price Escalation	2019-2048 Total With Price Escalation
Labor cost	Local	5,783	15,286
Other cost	Foreign	4,155	10,221
	Local	15,312	41,088
	Tax	4,545	11,987
	Total	29,795	78,581

Source: Study Team

The above labor cost is estimated based on the number of personnel calculated in “5.10.1 Organization Plan”. The unit labor cost is decided according to the base salary used in the Pune Mahanagar Parivahan Mahamandal Limited (PMPML) that is a bus operating company jointly owned by PMC and PCMC. A pay increase of 1% every year is assumed for the labor cost. All of the labor cost will be incurred in local currency, since the operation is expected to be carried out entirely by local human resources.

Other expenses include electricity costs for rolling stock and other operations, and supplies for system maintenance (for rolling stock, signals, communications, depot, power substations, etc.), except for costs for the maintenance staff that are included in the above labor cost. Electricity costs are estimated based on the tariff rate for 2012 of the Maharashtra State Electricity Distribution Co. Ltd. (MSEDCL) which is a public power distribution company. All of the electricity costs are assumed to be in local currency. A part of the costs for maintenance supplies are allocated to the foreign currency portion in anticipation of importing from abroad.

5.10 Operation plan

5.10.1 Organizational plan

There are several options for the corporate structure and funding for PUNE Urban Railway Company, which will be created to operate and maintain the LRT facilities. The first is a corporation in which 100% of the shares are owned by private entities, second is requesting private entities and PUNE City to jointly invest in the company and a third would be assuming loans from JBIC or JICA. In any case, the company shall be established as the operation and maintenance company based on a PPP scheme.

PUNE Urban Railway Company shall procure and operate a set of operation equipment including the rolling stock and signal systems, and also conduct off-rail businesses including commercial development of stations and the vicinities to improve the business environment.

In structuring the organization, the organizational system as per the following specifications will be structured, while respecting safety first of the transportation business and considering the integrity and appropriateness of the business operation.

- 1) In India, there is a regulation similar to Japan in order to operate a track system occupying a part of an ordinary road. Therefore, an organizational system will be structured corresponding to the local regulations with reference to the case of Calcutta Tramways Company which is operating the only one track system in India (Figure 5.10.1 Calcutta Tramways Company Organizational Chart)
- 2) To structure the safety-first train operation, safety management rules*1 will be made to clarify the operation manager (top management) as the primary responsible person, the general safety supervisor to govern and manage services pertaining to securing transportation safety, responsibilities and powers of each manager, and management system.

*1 Safety management rules must be prepared by a transportation operator under the “Act for Amending a Part of a Railway Business, for Improving Transportation Safety”, Ministry of Land, Infrastructure, Transport and Tourism of Japan (Act No. 19 of 2006).

- 3) Information on train schedule, service situations and fares will be provided to passengers clearly and swiftly through digital signage in the stations, the Internet and mobile terminals. Service will be made seamless by smoothing fare receipt, and introducing common IC cards among railway companies. The system will be made barrier-free by introduction of the latest low floor vehicles and appropriate station facilities. Organizational structure shall be made thereby to provide safe, reassuring and comfortable service.
- 4) The basic idea will be “failsafe” in order to secure the punctuality and safety of the trains. Efficient train operation control (centralized traffic control, operation arrangement system and passenger guidance) systems will be introduced. The organizational structure will be arranged to respond to frequent train service, crowded service, speeding up trains and through service (mutual operation with other lines), resulting from the expected growth of demand of passengers in the future.
- 5) A maintenance management system will be introduced for smooth maintenance of vehicles, engineering and electricity. Various pieces of information will be managed uniformly by making database. The organizational structure will be thereby arranged to propose facility safety management plan and maintenance work plan, stabilization of train service, and efficient management and procurement of inventory parts.
- 6) Clerical management (human resources, finance and accounting) system will be introduced to efficiently reflect revenue management and capital investment plans, and personnel plans in the management. The organizational structure will be thereby arranged to speed up managerial decisions and efficiently utilize managerial resources.
- 7) A transportation technology school for drivers and technical staff will be established for initial and capacity building education, education for acquiring licenses, and improvement of technology for operation and maintenance in order to establish an organizational structure to develop human resources as foundations of the company.

- 8) To additionally support profitability of the railway business, an incidental business development sector will be installed to structure an organization to actively develop off-rail business in the future.

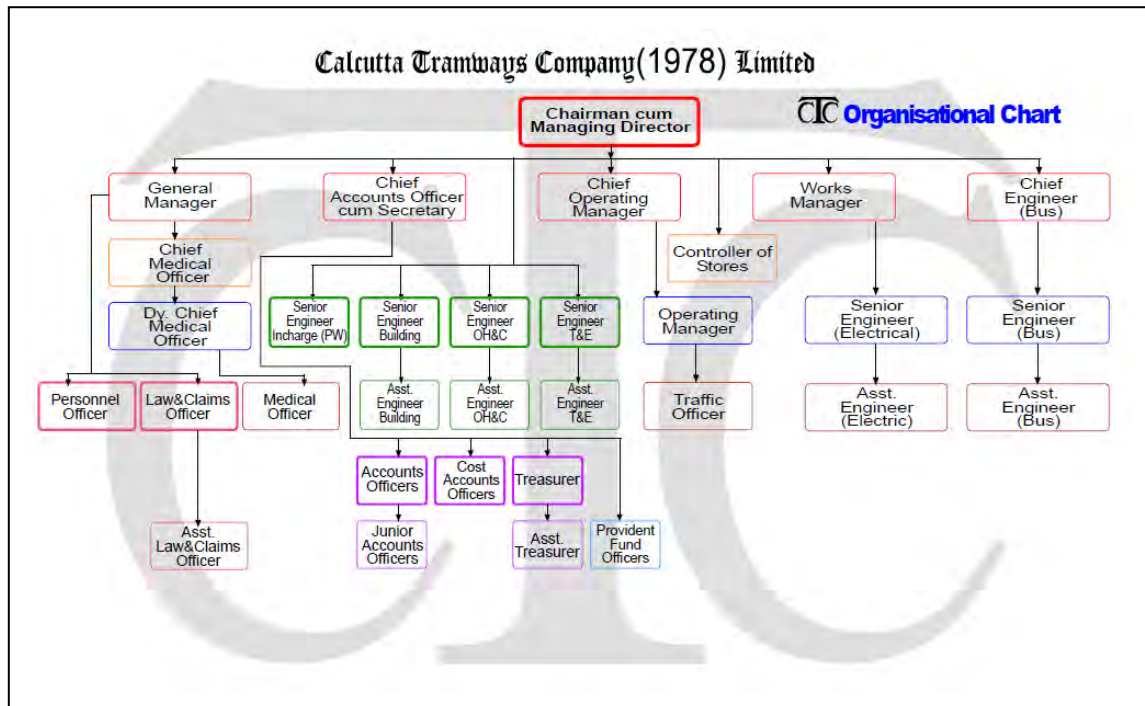


Figure 5.10.1 Calcutta Tramways Company Organizational Chart

Source: Calcutta Tramways Company

5.10.2 Managerial plan

The operation manager shall effectively enforce a safety management system based on the organizational plan. In order to build a responsible system concerning assurance of transportation safety and to manage proper profit/loss, the company shall structure the following divisions and establish personnel system/appoint managers to operate the corporate organization.

Job descriptions of each division

1) Administration division

- General affairs department
Business related to corporate registration, keeping and recording documents, public relations activities and grievance procedure.
- Legal department
Confirmation and examination of the contents of external contracts, debt collection service, negotiations with attorneys at law, guidance in compliance with laws.
- Personnel department
Recruitment of personnel, attendance management and payment of wages, health management, employee education, organizational formation, negotiation with labor unions.

2) Financial management division

- Finance department
Fundraising, settlement of accounts, revenue and expenditure control.
- Assets management division
Operation and maintenance, and repair of land, buildings, and company cars, inspection of delivered goods.

3) Management planning division

- Management planning department
Proposal of managerial plan, profitability evaluation of investment plans and projects, and proposal of crisis management measures.
- Information systems department
Development, operation and management of computer systems for train operation control, fare settlement, and maintenance management.
- Business development department
Administration of off-rail business such as advertisements, leasing store space in stations, and park-and-ride.

4) Transportation division

- Supervisory department
Plans for capital investment, expenses and staffing, assistance in capacity building, guarding in the station facilities.
- Marketing department
Due diligence of fares and marketing rules, maintenance of station-related facilities, and the quality of station personnel, other station operations.
- Driving department
Maintenance of train services, and the quality of drivers, other matters related to operation.

5) Technology division

- Rolling stock department
Overall matters relating to rolling stock in general
- Engineering department
Overall matters relating to facilities pertaining to engineering
- Electricity department
Overall matters relating to facilities pertaining to electricity
- Materials department
Matters relating to procurement and management of spare parts

Number of employees

The number of employees after inauguration shall be as follows. It is calculated based on the management, operation and technical levels in Japan, so it may be necessary to restructure the number of employees in consideration of operation capabilities and business achievements in India.

Table 5.10.1 Number of Employees

(Unit: persons)

	2018	2023	2028	2033	2038
Total	786	807	814	821	821

Duties and responsibility of managers in the safety management system

The operation manager needs to structure a mechanism by which the corporate organization will be properly managed in accordance with the safety management rules, and take initiative to prioritize safety. For this purpose, the operation manager should select managers required to establish, implement and maintain properly the safety management system, and to allocate the following responsibilities and powers to them.

- (1) Operation manager
Take the ultimate responsibility in securing safety of transportation.
- (2) General Manager of Transportation Group (general safety supervisor)
Generally oversee the operations concerning securing of safety in transportation.
- (3) General manager of managerial planning division
Oversee legal affairs, capital investment, finance and staffing required for securing safety of transportation from the viewpoint of the whole company.
- (4) General manager of overall affairs
Oversee capital investment required for securing transportation, expenditure and staffing plan, assistance in capacity building, and guards in station facilities, and assist the general safety supervisor.
- (5) General manager of marketing
Oversee station-related facilities and other station businesses under the guidance of the general safety supervisor.
- (6) General manager of drivers (driving manager)
Oversee matters related to services including train operation and maintenance of the capabilities of drivers, under the guidance of the general safety supervisor.
- (7) Manager of train section (Manager of staff's abilities)
Manage matters related to train operation and the abilities of drivers under the guidance of service manager.

- (8) Manager of rolling stock (rolling stock manager)
Oversee matters related to vehicles under the guidance of the general safety supervisor.
- (9) Manager of engineering (manager of engineering facilities)
Oversee matters related to engineering facilities under the guidance of the general safety supervisor.
- (10) Manager of electricity (electrical facility manager)
Oversee matters related to electricity facilities under the guidance of the general safety supervisor.
- (11) General manager of materials
Oversee matters related to procurement and management of spare parts under the guidance of the general safety supervisor.
- (12) General manager of driving technique education center
Oversee matters related to education/training of drivers and engineers and accident prevention under the guidance of the general manager of overall affairs.

5.10.3 Education and training plan

In operating PUNE Urban Railway Company, it is considered necessary to assist the company in driving technology, safety measures, operation and maintenance technologies, and ways of management. In particular, if the infrastructure is developed by the two-tiered scheme (ownership of railway infrastructure and operation of railway services belong to different entities) under the PPP, it is assumed that the equipment and devices of each maker will be introduced and it will be an important task to establish education and training facilities for human resources development both for structural and non-structural aspects.

Concerning education of a driver, if you would like to be a driver in general in Japan, you should start as being one of the station staff, and experience the job of a conductor for several years, and you can enter the Transportation Education Center upon passing the examination to be a driver. After completing the training period of 6 months to 1 year at the center, you can finally acquire a license as a driver after passing the Test for Driver License administered by the Ministry of Land, Infrastructure, Transport and Tourism.

However, much time and labor is needed in India to perform education for licensing drivers and education for operation and maintenance by the technicians under a condition lacking instructors and education/training facilities. If all candidate drivers and technical trainees in India are educated in Japan, it is problematic concerning the recipient company, education curriculum, education facilities, training cost, and language.

Therefore, under the basic idea on safety similar to that of Japan, in order to acquire technical abilities for driving and maintenance and promote human resources development as future managers, it is

considered best to select trainees in India for each job description (15-16 trainees in total) in advance, and let them learn knowledge and skills for 1 year at transportation education centers or technical sections of Japanese operators. Upon completion of the training, completion tests will be conducted to confirm their levels of education. The successful trainees will, after returning home, acquire licenses or qualifications under the laws and regulations of India at the education and training facilities newly established in India.

Preparatory education in Japan

The preparatory education in Japan for Indian trainees is scheduled as follows:

- Driver
 - Japanese language education 3 months: learn Japanese, establish safety awareness as transportation staff and other knowledge
 - Theoretical training 5 months: learn special knowledge on rules required for driving and the structure of vehicles.
 - Skill training 4 months: driving skills, inspection before departing from yard, disorder response, and training for abnormalities.
- Technician
 - Japanese language education 3 months: learn Japanese, establish safety awareness as transportation staff and other knowledge
 - Theoretical training 5 months: learn special knowledge including various regulations and structures.
 - Skill training 4 months: Practical training on technology and skills.

Establishment of transportation technology education center

A transportation technology education center will be established under an education policy of “pursuing safe, reassuring and comfortable service and improving/maintaining corporate ideals, skills, knowledge and talent” for smooth human resources development for the future and for preparation for opening of the railway by transportation staff in parallel with the construction of various facilities and rolling stock inspections.

The instructors will be Indians educated and trained in Japan for the inauguration stage and Japanese staff involved in management, service and technical support (including technical staff of the manufacturers), and the Indian instructors will be successively trained.

In addition, people experienced in railways such as Indian Railways will be actively recruited, and the program shall be operated in consideration of an education plan which meets the actual situations of India and consistency of environmental development pertaining to education.

1) Major education items

- (a) Basic education for transportation operators for all employees.
- (b) Various management education programs for clerical jobs.
- (c) Driver license education.

- (d) Practical training concerning train service for driving operators *1.
- (e) Training for acquisition of technology and skills for technical positions *2.

*1 Driving operators refer to drivers, assistant station masters and traffic controllers.

*2 Technical positions refer to attendants engaged in engineering, rolling stock, electricity, signals, and telecommunications.

Education plan before opening

The transportation technology education center will achieve a smooth inauguration by considering the rolling stock inspection process as indicated below, compiling education plans for preparation of opening for each job, managing progress and achievements of education, and properly adjusting the education contents with the instructors.

Table 5.10.2 Education plan for preparation of opening

Date	2017	2018													
Contents	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
Rolling stock inspection process	Factory inspection		Rolling stock inspection	Attachment function test						Overall test		Opening			
Clerks and other attendants	Basic education		Preparations for opening												
Assistant station masters, traffic controllers	Basic education		Theoretical training	Skill training	Drills for practice and abnormalities										
Drivers	Recruitment	Basic education	Theoretical training			*1 Skill training (license test)			Mastery of driving						
Technical jobs	Recruitment	Basic education	Theoretical training		Technology and skill training/drills for abnormalities										

*1 The driving skill training by actual vehicle shall be 6 months at minimum.

Source: JICA Study Team

Education plan after opening

The education after opening will be planned for freshmen and experienced people, each class and each job. Skills, knowledge, and capacity will be raised by initial education, follow-up education, capacity building education and on-the-job training. Drills for accidents, disasters and other abnormalities, and reception education will be performed as well.

The proposed plan from the initial year to the 5th year is indicated below. Education in and after the 6th year will be conducted on the basis of individual abilities and aptitudes, so it is omitted here.

2) Education plan for clerical personnel and drivers

Table 5.10.3 Education plan for clerical personnel and drivers

	Clerical personnel	Driver	Assistant station master
1 st year	Freshmen education Various aspects of management education Reception education OJT	New driver education Driving handling drills Reception education	New assistant station master education Business knowledge education Driving handling drills
2-3 rd year	Follow-up education OJT Various aspects of management education	Follow-up education Business knowledge education Driving handling drills	Follow-up education Business knowledge education Driving handling drills
4-5 th year	Specific management education Manager education	Business knowledge education Driving handling drills Leader education	Business knowledge education Driving handling education Manager education

Source: JICA Study Team

Special education for clerical employees

From the initial year to the 3rd year, education will be given concerning legal affairs, contracts, finance, accounting, negotiations and all other general subjects pertaining to the management of the company. From the 4th year onwards, the focus will be the assignment to the area corresponding to the ability and aptitude, and the special education.

Periodical drills for drivers

In the 1st, 3rd, 5th and 10th year after assignment to the current position, driving handling drills and skill drills will be performed corresponding to the ability of the particular person.

Emergency drills for drivers

Emergency drills will be performed corresponding to an annual plan for each job for the purpose of knowing and understanding the rules for emergencies and learning driving handling knowledge to enable practical measures.

Drivers

Vehicle disorder investigation, emergency restoration drills, and driving handling drills upon disorder of the safety devices.

Assistant station master

Driving handling and driving arrangement drills upon vehicle disorder and disorder of safety devices.

3) Education plan for technical positions

Table 5.10.4 Education plan for technical positions

	Engineering	Vehicle	Electricity
1 st year	Freshmen education Basic engineering education Education to avoid contact accidents OJT	Freshmen education Basic vehicle education Plant site education OJT	Freshmen education Basic electricity education Education to avoid contact accidents OJT
2-3 rd year	Follow-up education Engineering knowledge and skill education Education for train watchman OJT	Follow-up education Vehicle knowledge and skill education OJT	Follow-up education Electricity knowledge and skill education OJT
4-5 th year	Education of person responsible for works Maintenance car driving education Education for supervisor of track closure works	Education for person responsible for works Regular inspection technology education	Education for person responsible for works Electricity skills education

Source: JICA Study Team

Emergency drills for technical personnel

Emergency drills will be planned every year for each job for the purpose of knowing and understanding regulations regarding emergencies and acquiring technical knowledge for practical measures.

Engineering:

Point adjustment drills, drills for emergency restoration of rails and turnouts, and drills for recovery from derailment.

Rolling stock:

Drills for recovery from derailment, vehicle break-down investigation, and drills for emergency restoration.

Electricity:

Drills for recovery from disorder of station facilities, and drills for recovery from breakage of overhead wires

Signals:

Drills for recovery of broken safety devices.

Telecommunications:

Drills for recovery of telecommunication device disorder.

Chapter 6 Private Facilities

6.1 Policy for Development

This project is expected to be implemented by a PPP formation. A potential approach to attract the private sector to implement a PPP formation is discussed in this chapter.

One of the important factors which made it possible to create an efficient and sustainable city while ensuring high mobility in the largest / core city in Japan, was to develop cities based on the urban rail transportation system. Based on this experience, we propose to introduce public urban mass transportation in order to build PUNE area into a compact "Eco-City" in this project. The "Eco-City" concept is an important strategy for PUNE City, so that contribution to the "Eco-City" is also the strategic important concept for business promotion to secure passengers.

The mixed-use development around the station is expected to have a high commercial value in combination with the convenient transportation linkages. The development rights for the areas surrounding the stations will lead to improvement of the financial situation of the rail business, and will also be an important attraction to promote private investment.

As one of the potential developments along this proposed LRT line, a comprehensive development including intermodal facilities and commercial development, which will require a huge amount of land, is proposed for the depot site.

Development of this Depot station as an intermodal centre of public transportation will encourage public service facilities and commercial facilities to move into the area surrounding the station, and will contribute to the convenience and quality of life of the residents and employees in and around HITP, as well as activation of the HITP area.

6.2 Potential Development of Depot Station St 18 RGIP Phase 4

As discussed in 5.4.3, LRT a depot is planned at St 18, and the potential to develop this depot site as one of the possibilities to attract private investment is discussed hereinafter.

The depot site is planned to be in the Hinjawadi Industrial Park Phase IV area, which is under control of MIDC (Maharashtra Industrial Development Corporation). Potential development is studied based on the regulation/guideline of MIDC.

This depot site requires more than 12 ha, which includes spaces for a stabling yard for 40 trains, inspection and repair building, train wash machine, wheel retrofitting plants, etc. and also space for gradual descent from the Elevated line level to the ground level of the maintenance facilities.

According to the regulation/guideline of MIDC, basic F.S.I for sites in the HITP is 1.0, but F.S.I for the site with IT related company/factory is allowed to be 2.0 maximum.

On the other hand, there is a newly approved regulation for the area along PUNE Metro, which allows development with F.S.I 4.0 in the area around the station (within 500m of the stations) for the purpose of promoting development of TOD centres with the concept of the Eco-City.

Therefore, with the expectation to introduce a similar kind of special F.S.I rule for the LRT line, two scenarios with F.S.I 4.0 and F.S.I 2.5 were developed for the Depot site;

- Scenario 1: Apply F.S.I 4.0, which is the proposed F.S.I for areas around the PUNE Metro Stations with the TOD Concept.
- Scenario 2: Apply F.S.I 2.0, which is the maximum F.S.I set for development with IT related companies in HIT.

Potential Scenario for Development

This 12ha site and F.S.I 2.0 (or F.S.I 4.0) will make large scale commercial development possible on the site. Figure 6.1.1 and 6.1.2 present possible development plans for this depot site, with the following development concept.

- Space in front of St.18 will be a transfer point between the LRT, Feeder Bus Service, Company pick-up buses within the Industrial Area, City Buses, Taxi Stands and Rickshaw Stands, etc.
- Parking space for the public adjacent to the station will promote Park & Ride.
- Develop large scale commercial / office buildings around the station by utilizing the F.S.I.
- Taking advantage of convenience at public transportation nodes, community service facilities such as clinics, post offices, banks etc. as well as commercial facilities for residents and employees in the HITP will be attracted to this area.
- Good accessibility to the public transportation will be attractive for the hotels and recreation facilities like cinemas and parks.
- Office space will be used for the LRT (SPC) and IT related companies.
- For the scenario of 4.0, space for residential development will also be proposed with the expectation to contribute to create sustainable mixed-use development.
- According to the regulation for green conservation in MIDC, it is required to secure more than 30% of the land for green area in the case to construct commercial buildings having over 2,000sqm floor area.
- Income estimation was calculated based on the rental cost of Rs. 447ps/Sq.m for floors in this area (December 2012)

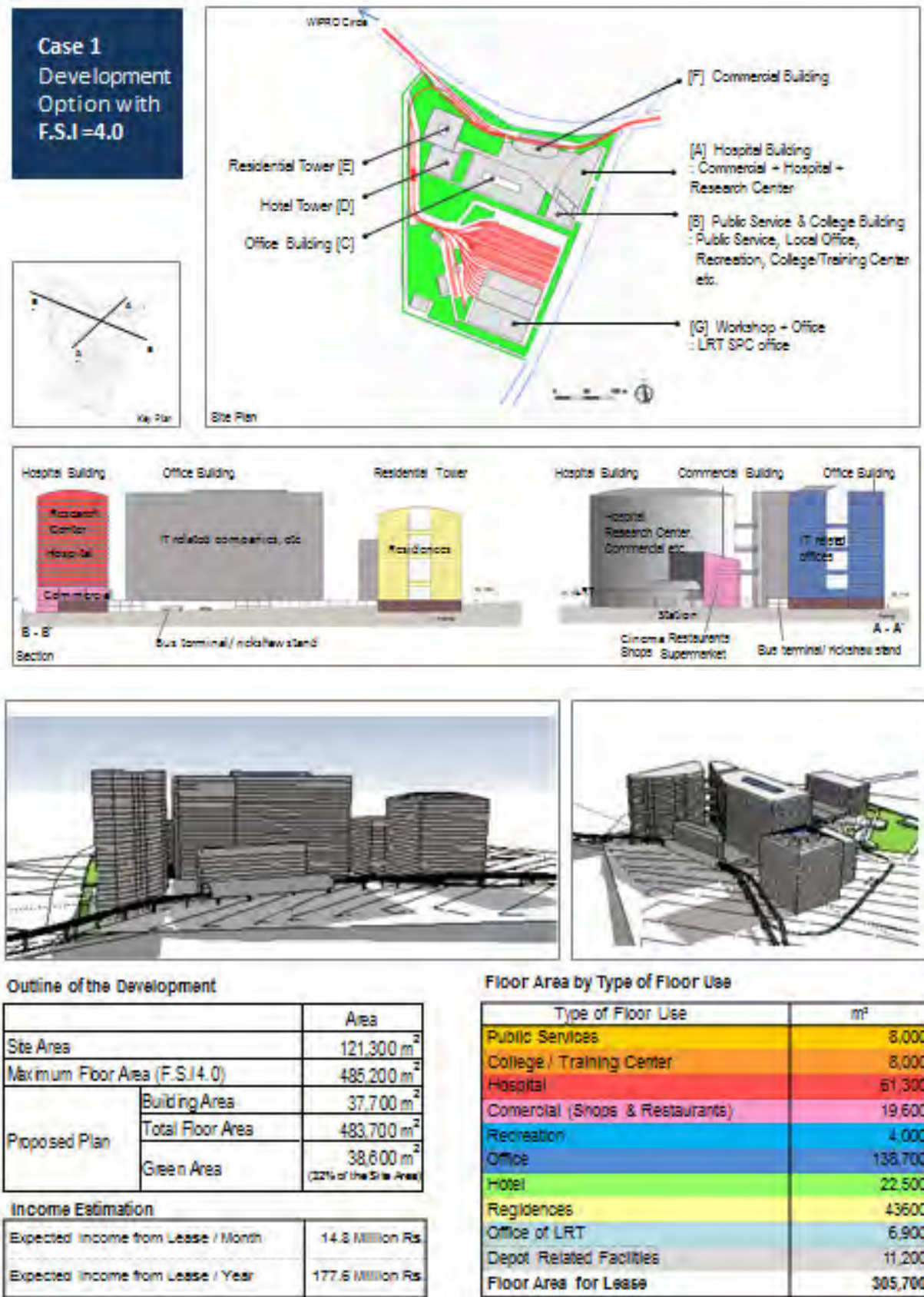
Table 6.2.1 Comparison of two scenarios

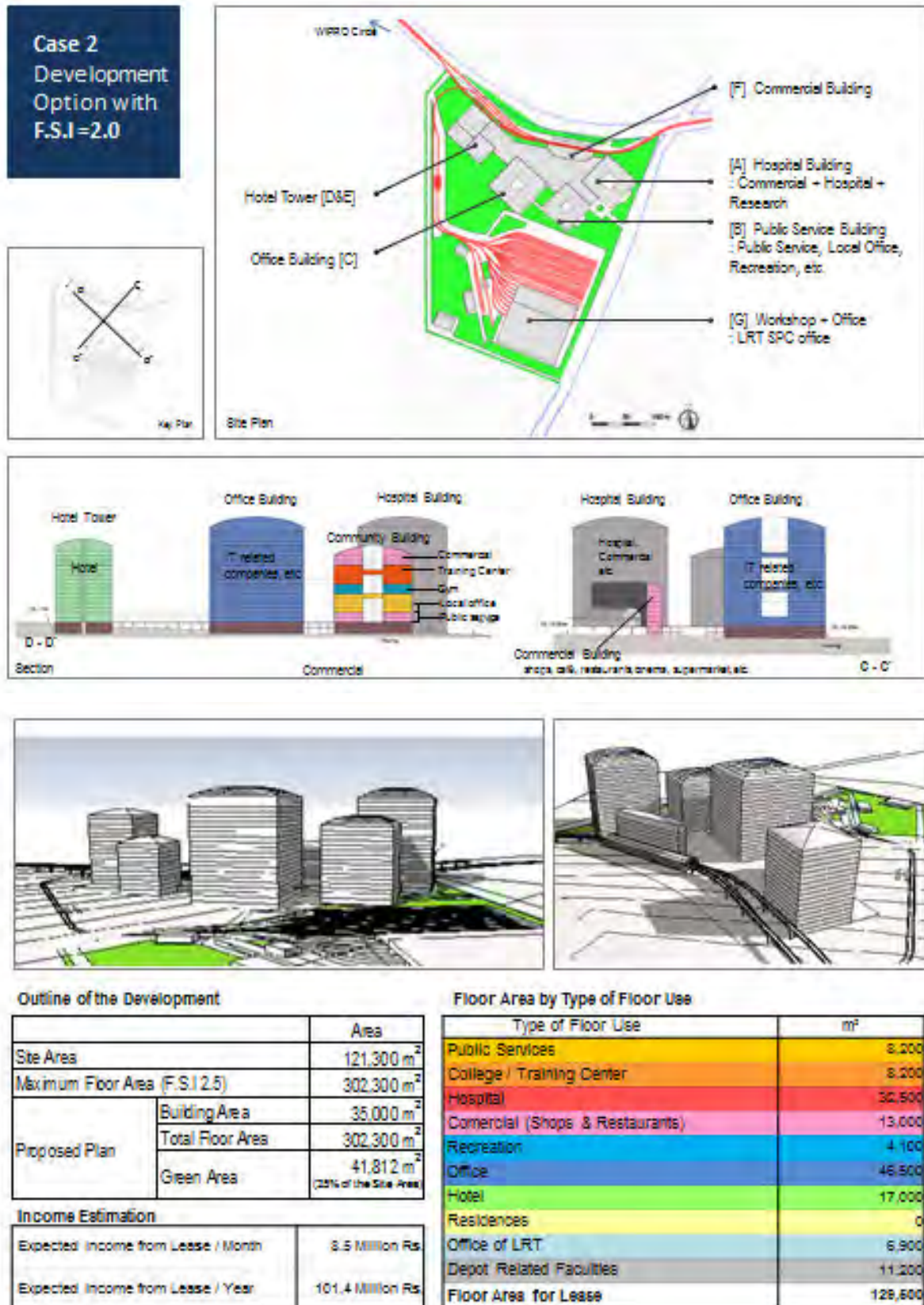
	Scenario 1	Scenario 2
F.S.I	400%	200%
Building Area	37,700 m ²	35,000 m ²
Total Floor Area	483,700 m ²	241,500 m ²
Green Area	38,600 m ² (32% of the site area)	42,812 m ² (35% of the site area)
Floor Area in Development Scenarios(Figure 6.1.1 & 6.1.2)	305,700 m ²	129,500 m ²
Proposed use for redevelopment	LRT Headquarters Office Depot related facilities	LRT Headquarters Office Depot related facilities
	Public Service Facilities College / Vocational Training Hospital/ Health Facilities Commercial Facilities (Shops & Restaurant) Recreation Office Hotel Residential Facilities	Public Service Facilities College / Vocational Training Hospital/ Health Facilities Commercial Facilities (Shops & Restaurant) Recreation Office Hotel
Expected Revenue from Floor Rental (Monthly)	14.8 Million Rs.	6.2 Million Rs.
Expected Revenue from Floor Rental (Yearly)	177.6 Million Rs.	74.7 Million Rs.

Source: JICA Study Team

Market research for commercial and office spaces will be needed in order to determine the feasibility of the development. As shown the table above, introduction of special F.S.I (4.0) will make the floor area available for renting out more than double.

Development of the Depot site for commercial purposes is expected to contribute economic activities and convenience for residents and employees in the MIDC area, as well as attract private investors. Coordination with MIDC and relevant authorities on the possibility to introduce a special rule for F.S.I will be necessary.





Chapter 7 Environmental & Social Safeguards

7.1 Environmental Policies and Regulations in India

7.1.1 Summary of Environmental Policies and Regulations

Environmental Policies and Regulations in India are shown in Table 7.1.1.

Table 7.1.1 Environmental Policies and Regulations in India

No.	Type of Regulation or Policy	Name/ Establishment Date	Abstract
1	Basic Act	The Environment (Protection) Act, 1986	Amended in 1991
2	Individual Act	—	The Environment Rules, 1986
3	Individual Act	—	Environmental Impact Assessment, 2001
4	Individual Act	Land Acquisition	Land Acquisition Act, 1894
5	Individual Act	Noise	Noise Pollution (Regulation and Control) Rules, 2000
6	Individual Act	Water	The Water (Prevention and Control of Pollution) Cess Act, 2003
7	Individual Act	Air	The Air (Prevention and Control of Pollution) Act, 1981
8	Individual Act	Forest	Forest (Conservation) Act, 1980
9	Individual Act		The Indian Forest Act, 1927
10	Individual Act		State/ Union Territory Minor Forest Produce (Ownership of Forest Dependent Community) Act, 2005
11	Individual Act	Biological	The Biological Diversity Act, 2002
12	Individual Act	Wild Animals	The Wildlife (Protection) Act, 2006 – 2002
13	Individual Act		The Indian Wildlife (Protection) Act, 1972
14	Individual Act	Energy	Energy Conservation Act, 2001

Source: JICA Study Team

Environmental Administrative Framework of India

The MoEF which is the top organization of the environmental administrative framework of India, CPCB, SPCB and the local environmental agencies manage the Indian environment. In Pune district, Maharashtra Pollution Control Board (MPCB) conducts state environmental administration. Under its supervision, the environmental departments of PMC and PCMC undertake the environmental management (See Figure 7.1.1) .

Environmental Clearance (EC)

In India, the projects which are shown in table 7.1.1 require an EC (Environmental Clearance) from an EAC (Expert Appraisal Committee) or SEAC (State level Expert Appraisal Committee). Before construction and land acquisition, in the case that projects are Category A, an EC is obtained from the

EAC and in the case of Category B projects, an EC is obtained from the SEIAA. EAC means the MoEF (Ministry of the Environment and Forests).

Table 7.1.1 shows the projects which require an EC. "Project Activity" shows categories of projects such as "Mining of minerals" and "Offshore and onshore oil and gas exploration, development and production" which require an EC. "Category with threshold limit" shows the project is Category A or Category B. For example, regarding "Mining of minerals" projects, if the mining lease area is more than 50ha, the project is Category A, however if it is less than 50ha, the project is Category B.

Table 7.1.2 List of Projects or Activities Requiring Prior Environmental Clearance

Project or Activity		Category with threshold limit		Conditions if any
		A	B	
1		Mining, extraction of natural resources and power generation (for a specified production capacity)		
(1)	(2)	(3)	(4)	(5)
1(a)	Mining of minerals	≥ 50ha. of mining lease area	< 50ha ≥ 5ha. of mining lease area	General Conditions shall apply
1(b)	Offshore and onshore oil and gas exploration, development & production	All projects		
1(c)	River valley project	≥ 50 MW hydroelectric power generation; (2) ≥10,000ha. of cultivable command area	<50 MW≥25 Mw hydroelectric power generation; (2) <10,000 ha. of cultivable command area	Generation Conditions shall apply
1(d)	Thermal power plants	≥ 500 MW (coal/ lignite/ naphtha & gas based); ≥ 50 MW (Pet coke diesel and all other fuels)	< 500 MW (coal/ lignite/ naphtha & gas based); <50 MW≥ 5MW (Pet coke diesel and all other fuels)	General conditions shall apply
1(e)	Nuclear power project, processing of nuclear fuel	All projects		
2		Primary Processing		
(1)	(2)	(3)	(4)	(5)
2(a)	Coal washeries	≥ 1million ton/annum throughput of coal	< 1million ton/annum throughput of coal	General Conditions shall apply
2(b)	Mineral beneficiation	≥ 0.1 million ton/annum mineral throughput	< 0.1 million ton/ annum mineral throughput	General Conditions shall apply
3		Materials Production		
3(a)	Metallurgical industries (ferrous & non-ferrous)	a) Primary metallurgical industry All projects b) Sponge iron manufacturing ≥ 200 TPD c) Secondary metallurgical processing industry All toxic and heavy metal producing units ≥ 20,000 tonnes/annum	Sponge iron manufacturing > 200 TPD Secondary metallurgical processing industry i) All toxic and heavy metal producing units < 20,000 tonnes/annum ii) All other non-toxic secondary metallurgical processing industries >5000 tonnes/annum	General Conditions shall apply
3(b)	Cement plants	≥1.0 million tonnes/annum production capacity	<1.0 million tonnes/annum production capacity. All stand alone grinding units	General Conditions shall apply

Project or Activity		Category with threshold limit		Conditions if any
		A	B	
4		Materials Processing		
(1)	(2)	(3)	(4)	(5)
4(a)	Petroleum refining industry	All projects		
4(b)	Coke oven plants	≥2,50,000 tonnes/annum	<2,50,000&≥25,000 tonnes/annum	
4(c)	Asbestos milling and asbestos based products	All projects		
4(d)	Chlor-alkali industry	≥300 TPD production capacity or a unit located outside the notified industrial area/estate	< 300 TPD production capacity and located within a notified industrial area/ estate	Specific Conditions shall apply
4(e)	Soda industry	All projects		
4(f)	Leather/ skin/ hide processing industry	New Projects outside the industrial area or expansion of existing units outside an industrial area	All new or expansion of projects located within a notified industrial area/estate	Specific Conditions shall apply
5		Manufacturing/Fabrication		
(1)	(2)	(3)	(4)	(5)
5(a)	Chemical fertilizers	All projects		
5(b)	Pesticide industry and pesticide specific intermediates (excluding formulations)	All units producing technical grade pesticides		
5(c)	Petro-chemical complexes (industries based on processing of petroleum fractions & natural gas and /or reforming to aromatics)	All projects		
5(d)	Manmade fibre manufacturing	Rayon	Others	General Conditions shall apply
5(e)	Petrochemical based processing	Located outside the notified industrial area/estate	Located in a notified industrial area/estate	Specific Conditions shall apply
5(f)	Synthetic organic chemicals industry (dyes & dye intermediates; bulk drugs and intermediates excluding drug formulations; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)	Located outside the notified industrial area/estate	Located in a notified industrial area/ estate	Specific conditions shall apply
5(g)	Distilleries	i) All Molasses based distilleries ii) All cane juice/ non-molasses based distilleries ≥ 30 KLD	All Cane juice/ non-molasses based distilleries-< 30 KLD	General Conditions shall apply
5(h)	Integrated paint industry		All projects	General Conditions shall apply
5(i)	Pulp & paper industry excluding manufacturing of paper from waste paper and manufacture of paper from ready pulp without bleaching	Pulp manufacturing and Pulp & Paper manufacturing industry	Paper manufacturing industry without pulp manufacturing	General Conditions Shall Apply
5(j)	Sugar Industry		≥ 5000 tcd cane crushing capacity	General Conditions shall apply
5(k)	Induction/arc furnaces/ cupola furnaces 5TPH or more		All projects	General Conditions shall apply

Project or Activity		Category with threshold limit		Conditions if any
		A	B	
6		Service Sector		
(1)	(2)	(3)	(4)	(5)
6(a)	Oil & gas transportation pipe lines (crude and refinery/petrochemical products), passing through national parks/ sanctuaries/coral reefs/ ecologically sensitive areas including LNG Terminals	All projects		
6(b)	Isolated storage & handling of hazardous chemicals (As per threshold planning quantity indicated in column 3 of schedule 2 & 3 of MSIH Rules 1989 amended 2000)			General Conditions shall apply
7		Physical Infrastructure including Environmental Services		
(1)	(2)	(3)	(4)	(5)
7(a)	Air ports	All projects		
7(b)	All ship breaking yards including ship breaking units	All projects		
7(c)	Industrial estates /parks /complexes /areas, export processing Zones (EPZs), Special Economic Zones (SEZs), Biotech Parks, Leather Complexes	If at least one industry in the proposed industrial estate falls under the Category A, the entire industrial area shall be treated as Category A, irrespective of the area. Industrial estates with areas greater than 500 ha, and housing at least one Category B industry	Industrial estates housing at least one Category B industry and area <500 ha Industrial estates of area >500 ha, and not housing any industry belonging to Category A or B	Special conditions shall apply
7(d)	Common hazardous waste treatment, storage and disposal facilities(TSDFs)	All integrated facilities having incineration & landfill or incineration alone	All facilities having land fill only	General Conditions shall apply
7(e)	Ports and harbours	≥ 5 million TPA of cargo handling capacity (excluding fishing harbours)	<5 million TPA of cargo handling capacity and /or ports/harbours≥ 10,000 TPA of fish handling capacity	General Conditions shall apply
7(f)	Highways	i) New National Highways and ii) Expansion of national Highways greater than 30 KM, involving additional right of way greater than 20 m involving land acquisition and passing through more than one State	i) New State Highways and ii) Expansion of national Highways greater than 30 KM, involving additional right of way greater than 20 m involving land acquisition	General Conditions shall apply
7(g)	Aerial ropeways		All projects	General Conditions shall apply
7(h)	Common Effluent Treatment Plants (CETPs)		All projects	General Conditions shall apply
7(i)	Common Municipal Solid Waste management Facility (CMSWMF)		All projects	General Conditions shall apply

Project or Activity		Category with threshold limit		Conditions if any
		A	B	
8				
(1)	(2)	(3)	(4)	(5)
8(a)	Buildings and Construction projects		>20,000sq.mtrs and <1,50,000 sq.mtrs. of built-up area	Built up area for covered construction: in the case of facilities open to the sky, it will be the activity area
8(b)	Township and Area Development Projects		Covering an area \geq 50ha and or built up area \geq 1,50,000 sq.mtrs	All projects item 8(b) shall be appraised as category B1

Source: Ultra Tech Environmental Consultancy & Laboratory

There are 4 stages in the Environmental Clearance process.

Stage 1: Screening (Only for Category B projects)

Stage 2: Scoping

Stage 3: Public Consultation

Stage 4: Appraisal

Stage 1: Screening

In the case of Category B projects, this stage will entail the scrutiny of an application seeking prior environmental clearance made in Form 1 by the concerned State level Expert Appraisal Committee (SEAC) for determining whether or not the project requires further environmental studies for preparation of an Environmental Impact Assessment (EIA).

The projects requiring an EIA report shall be termed Category B1. Projects of Category B2 are not required to prepare an EIA report. In projects of Category B, the projects of Category B1 are only 8 (b) "Townships and Area Development projects", the other projects are Category B2.

Stage 2: Scoping

Scoping refers to the process by which a review is undertaken by the Expert Appraisal Committee in the case of Category A projects, and State level expert appraisal Committee in the case of Category B1 projects. All projects of Category B require scoping. The projects for 'Construction', 'Township', 'Commercial Complex' and 'Housing' shall not require scoping and will be appraised on the basis of Form 1/ Form 1A and a conceptual plan.

Stage 3: Public Consultation

Public Consultation refers to the process by which the concerns of local affected persons and others who have a plausible stake in the environmental impacts of the projects are ascertained with a view to taking into account all the material concerns regarding the project or activity design as appropriate. All Category A and Category B1 projects or activities shall undertake Public Consultation, except the following:

- a) Irrigation projects,
- b) All projects located within industrial estates or parks,

- c) Expansion of Roads,
- d) All Building / Construction Projects,
- e) All projects as determined by the Central Government

Stage 4: Appraisal

Applicants shall submit the final EIA report and outcome of the public consultations including public hearing proceedings to the regulatory authority concerned (EAC or SEAC) for obtaining the EC. The appraisal of all projects which are not required to submit an Environmental Impact Assessment report shall be carried out on the basis of the prescribed application Form 1 and Form 1A as applicable. After the final EIA report is received by the EAC or SEAC, it takes 60 days to approve the report.

EC for railway projects

All Railway Projects, with no exception, are totally exempted from seeking Environmental Clearance under Government regulations. It should be noted however, that some external funding agencies, such as JBIC, may require an EIA as part of the feasibility study or DPR. (See Table 7.1.1) (Reference: Overview of Environmental Impact Assessment, Ministry of Finance, Government of India)

If the Indian government requires an EC for railway projects, the railway projects shall be classified in the categories of 7(f) Highway, 8(a) Building and Construction projects or 8(b) Townships and Area Development projects which are shown in Table 7.1.1, and follow the process for getting an EC as referred to above, (Appendix 32)

DPR and SIA

In India, Submissions of a DPR (Detailed Project Report) and SIA (Social Impact Assessment) are needed before projects are implemented.

1) DPR

The administrative Ministry should prepare the DPR for the project/scheme which is offered funds from the local government

The project preparation should commence with the preparation of a Feasibility Report (FR) by the administrative Ministry, in principle. For this project, the JICA study team prepared the FR. The project will be considered for in-principle approval by the Planning Commission (In this project, it was a stakeholders' meeting instead of the Planning Commission) for inclusion in the Plan based on the FR.

After the FR is approved by the Planning Commission, a DPR should be prepared. As well as the FR, the administrative Ministry shall prepare the DPR and obtain approval of the Planning Commission. The services of Experts/ professional bodies may be hired for preparation of the DPR and it must address all issues related to the justification, financing and implementation of the project

/scheme. Finally the DPR is circulated and commented on by the EFC (Expenditure Finance Committee) and PIB (Public Investment Board). It takes 6 weeks to get the comments for the DPR.

(Compendium of Important Orders/ Circulars regarding formulation, appraisal and approval of Plan schemes/ project : Ministry of Finance Government of India, 2010)

2) SIA

An SIA (Social Impact Assessment) is to study the social and/or economic situation of the affected people and develop mitigation plans to overcome the potential negative impacts on the individuals and communities. (Social Impact Assessment : Council for Social Development, 2010)

Whenever it is desired to undertake a new project or expansion of an existing project, which involves involuntary displacement of four hundred or more families, en masse in plain areas, or two hundred or more families en masse in tribal or hilly areas, the appropriate Government entity shall ensure that a Social Impact Assessment (SIA) study is carried out regarding the proposed affected areas in such manner as may be prescribed.

[Process of SIA]

Step 1: Define the impact area

Step 2: Collect current information/data of the affected people (religion, gender, poverty level and so on)

Step 3: Share information of Step2 with stakeholders

Step 4: Conduct screening and screen out “no significant impacts” from those with significant impacts on the social environment

Step 5: Carry out scoping in the field and find alternatives that help avoid or at least reduce the magnitude and severity of adverse impacts

Step 6: Prepare a socioeconomic profile of baseline conditions

Step 7: Survey of host area (enough land, income earning opportunities, population and so on)

Step 8: Identify and assess the potential impacts

Step 9: Develop a mitigation plan

Once a Social Impact Assessment has been completed, a formal Report with a brief Executive Summary should be prepared for submission to the authority which sponsored it.

EC and EIA of this project

From the viewpoint of the Indian EIA, obtaining EC and implementing EIA are not required for railway projects as a general rule. Under the Indian EIA law EC and EIA are not needed but an EIA must be required because PSIF (Private Sector Investment Finance), which is JICA's fund, will be adapted to this project (Points of PSIF (Draft) and JICA guidelines for environmental and social considerations, JICA). According to this, EIA should be required for implementation of this project which is adopted PSIF to.

"Mumbai Metro Line 3 construction" which is a loan aid similar to this project because it is a railway project in Maharashtra like this project. For the implementation of the "Mumbai Metro Line 3 construction" project, an EIA report has been prepared and approved by MMRDA (Mumbai Metropolitan Region Development Authority).

PMRC (Pune Metro Railway Company), which is the organization similar to MMRDA, will be established. The procedure and appraisal authority of the EIA for "The urban railway project in Pune city" is the same as for the "Mumbai Metro Line 3 construction."

It should be noted that this foreign investment (PSIF) will be used in the project. It is necessary to confirm whether or not EIA procedures and approval authority will be the same as described for the above project even when overseas investment is used.

In addition, considering that the results of 7.2, Preliminary Environmental Assessment, are taken together with the JICA guidelines for environmental and social considerations, an EIA should be required. This project is the first project to construct an LRT in Pune city in India. Therefore, it is difficult to predict the impacts that could be caused by this project. Along the route, 25 retail businesses, 6 houses, 2 temples, a school, a police station, and a police training centre should be acquired. The depot is about 11ha and there are no houses, but plots which 312 farmers own exist in the depot area. Also, many trees have to be cut along the route. According to this, this project could have a large impact on the environment and society (Category A) in Pune city and Implementation of an EIA is desired.

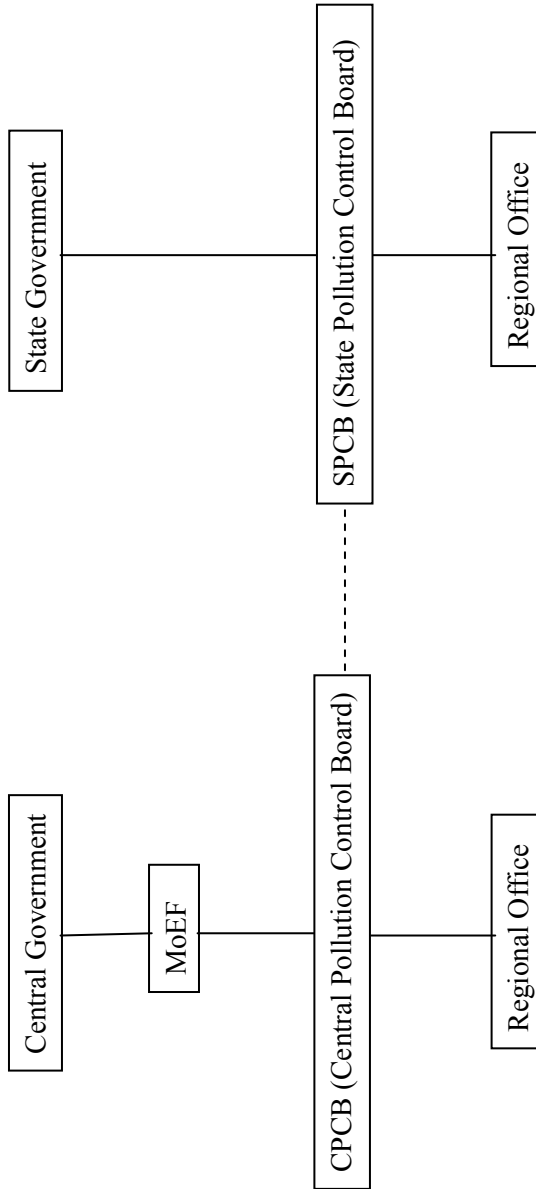


Figure 7.1.1 Environmental Administrative Framework of India
Source: J.K. Panigrahi, S. Amirapu/Environmental Impact Assessment Review (2012)

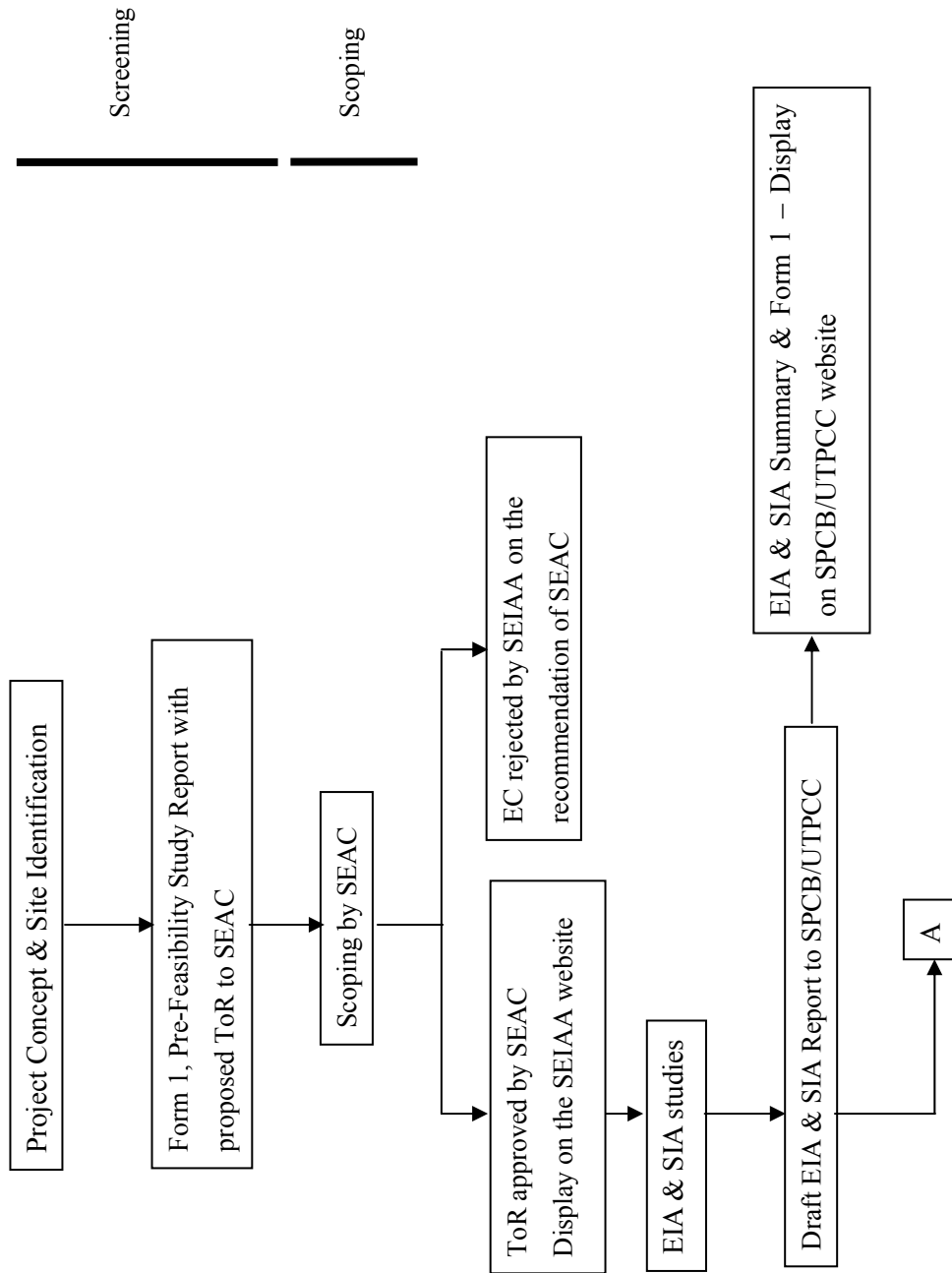


Figure 7.1.2 Flowchart of EIA Process in India (Category B)

Source: J.K. Panigrahi, S. Amirapu/Environmental Impact Assessment Review (2012)

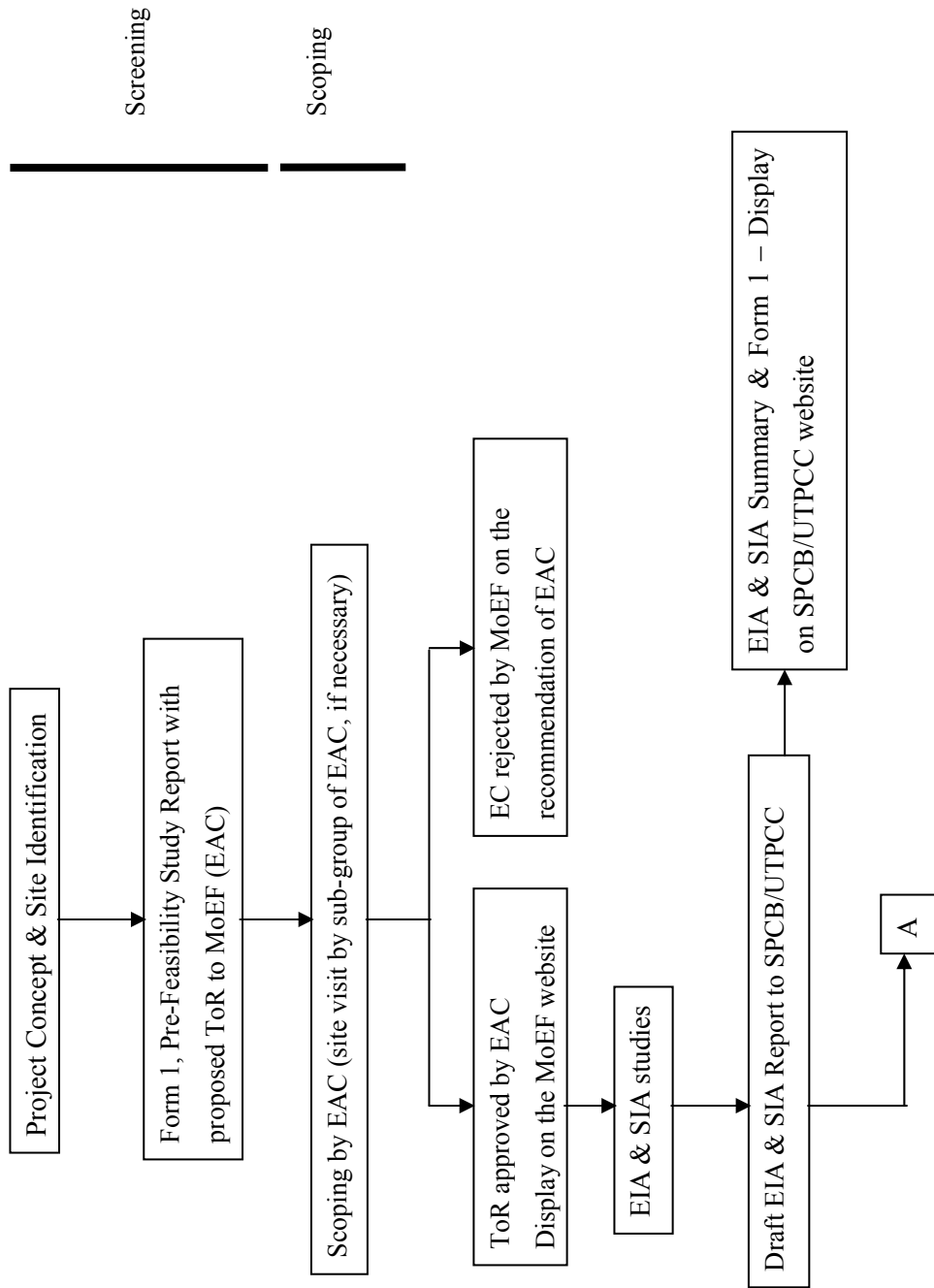


Figure 7.1.3 Flowchart of EIA Process in India (Category A)

Source: J.K. Panigrahi, S. Amirapu/Environmental Impact Assessment Review (2012)

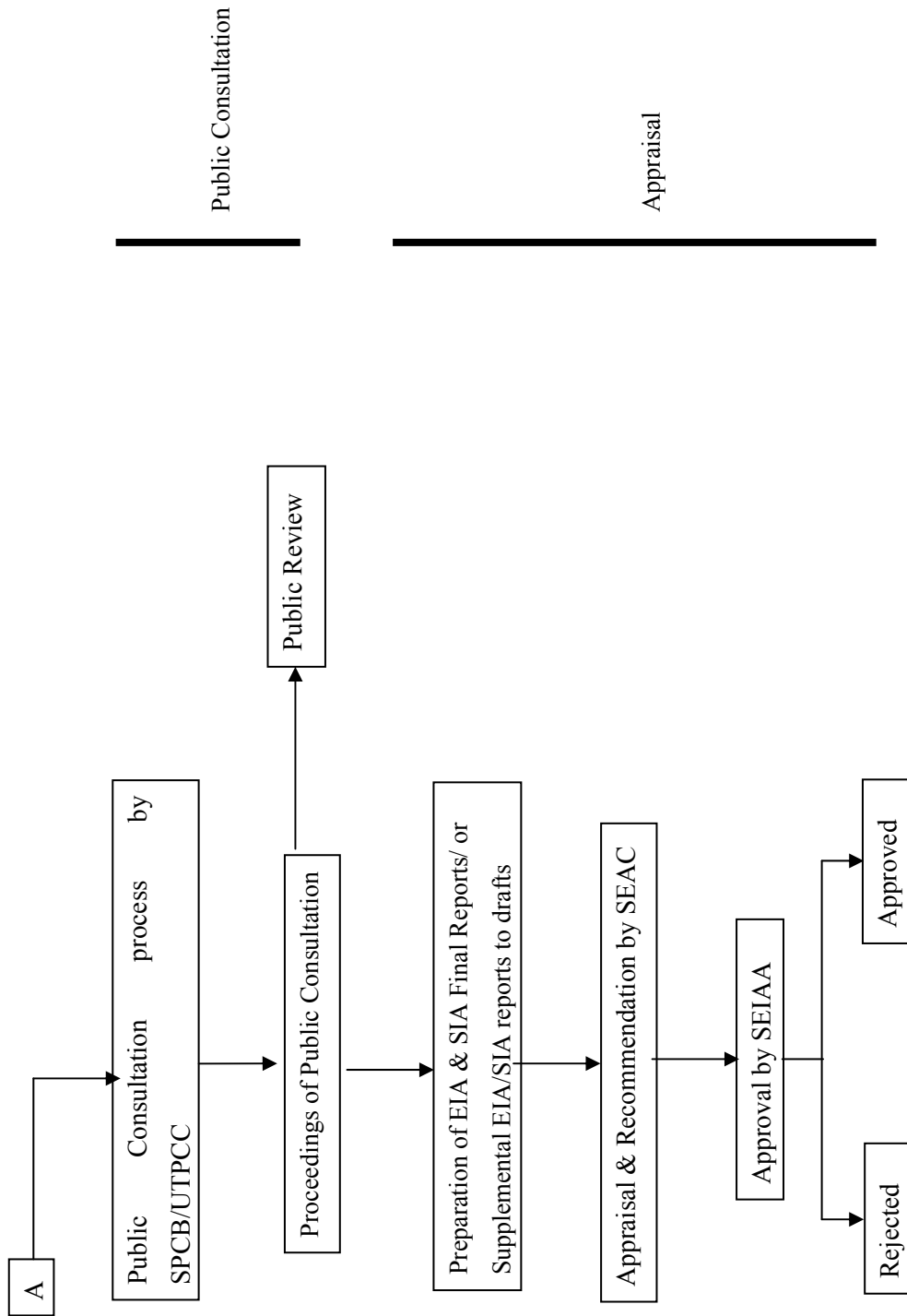


Figure 7.1.4 Procedure of EIA in India (Category B)

Source: J.K. Panigrahi, S. Amirapu/Environmental Impact Assessment Review (2012)

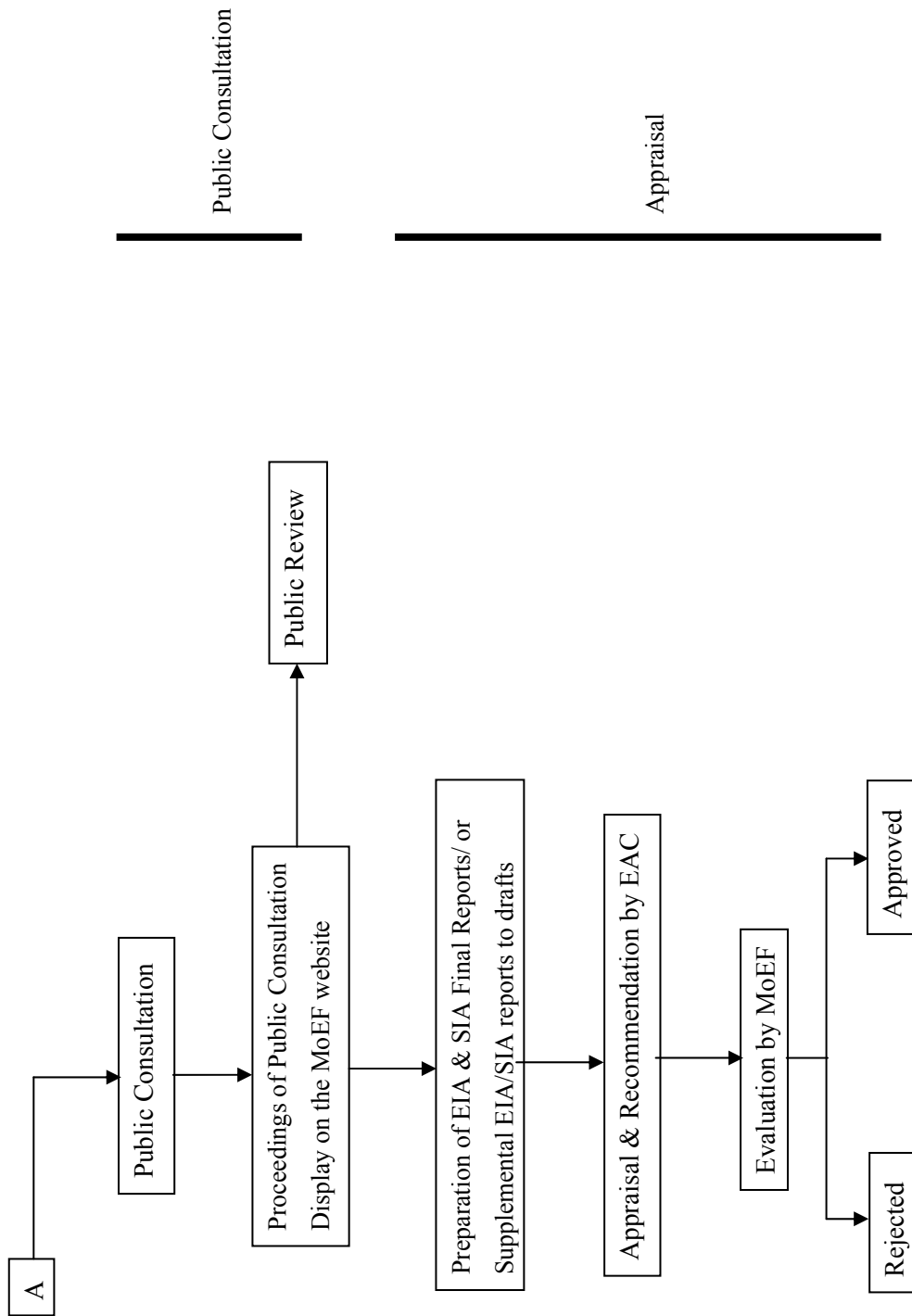


Figure 7.1.5 Procedure of EIA in India (usual projects)

Source: J.K. Panigrahi, S. Amirapu/Environmental Impact Assessment Review (2012)

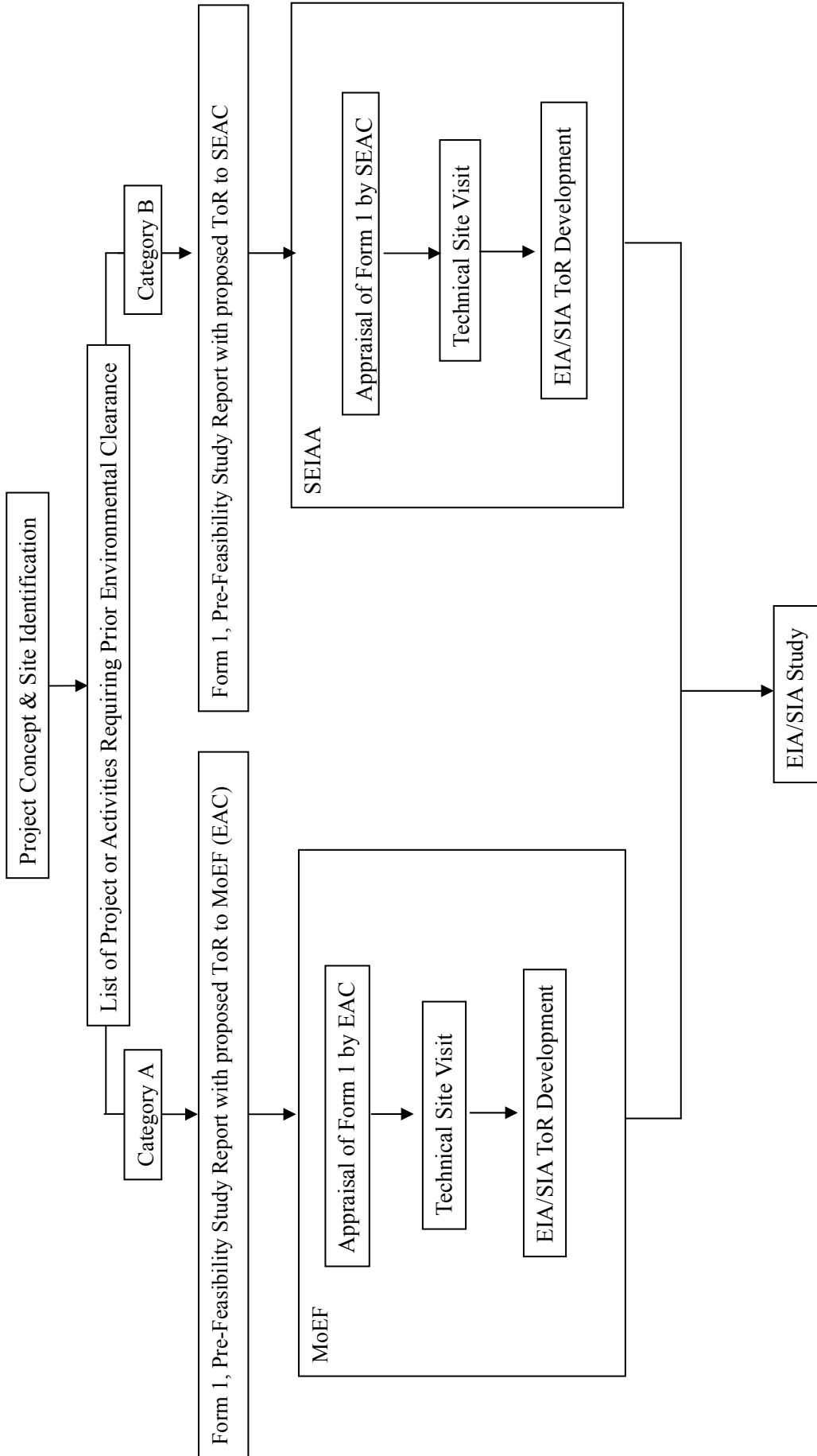


Figure 7.1.6 Detailed Process of Screening/Scoping

Source: J.K. Panigrahi, S. Amirapu/Environmental Impact Assessment Review (2012)

7.2 Preliminary Environmental Assessment

7.2.1 Site Descriptions (SD Table)

Site Descriptions (SD) which are the basis of implementation of screening and scoping in the target area are shown in Table 7.2.1.

Table 7.2.1 Site Descriptions (SD Table)

Item	Descriptions
Socio-Cultural Environment	
Community (residents/minority/ awareness of the proposed project and others)	Routes cross three provinces, which are PMC (Pune Municipal Corporation), PCMC (Pimpri Chinchwad Municipal Corporation) and MIDC (Maharashtra Industrial Development Corporation). Along the route there is no community which has illegal occupation. The presence of minority ethnic and indigenous people has not been reported. In Hinjewadi IT Park where the last station is located, the area is divided into six regions from Phase 1 to 6, each area is to be developed in stages and Tata Motors and foreign companies are doing business there. The movement to IT Parks will increase in the future. For the passage of the planned Metro Line 2, widening of the road is planned, because residents are opposed to the plan, the route which avoids the road is adopted in this project.
Land Use (urban/rural/historical sites/scenic places/hospitals and others)	Along the planned route, commercial facilities like shopping malls, office buildings and small shops, and public facilities like the University of Pune, municipal corporations, fire stations, police stations, hospitals and military land, are present. In addition, there is a military defence area, Pimple Nilakh Park, along the route. Also, there are 2 temples near Mula river. Next to one temple, there is about 450m ² of land which is on the bank of Mula river. Also, the other temple is 160m away from Mula river. About historical buildings, from St9 to St10, there are a police station and police training centre which is certified as a Historical Building (Grade II).
Regional economy/transport condition (commercial/agricultural activities, industrial parks/ bus terminals and others)	Buses and auto rickshaws (tricycles) are much used, but taxis are used less. The route from St11 to St15 overlaps the planned BRT route. Metro lines 1 and 2 are also being planned, stations connected to Metro stations are considered. The amount of traffic from the centre of Pune city to Hinjewadi IT Park peaks during the morning and evening rush hours.
Bio-Physical Environment	
Topography/Geology (e.g., Cliffs, Steep slopes, floodplains, marshes, wetlands/fault lines)	The planned area is located in the flat land of Pune City (altitude 50m), there are no steep slopes. The ground along the route isn't soft or wetlands (BH1: Deposited materials such as rubble and compacted sandy soils, BH2: Cohesive soil with sand and cobble stone size basalt, BH3: Sand and gravel, BH4: Compacted silt and very compacted sand, BH5: Sandy silt exists within the site). Urban floods have occurred in Pune city in the rainy season every year. The water level rose to the floor slab of the Z-bridge in 2011. Temporary flooding has occurred in the lowlands. St14 is close to Mula river and 18km upstream from the confluence of the Mula and Mutha rivers. If flooding occurs in the city, there is a risk due to the backwater.
Important flora/fauna (e.g., national parks, occurrence of rare/or endangered species).	There is a military defence area, Pimple Nilakh Park, along the route. It is just a military facility, but there's a green belt in the park, if cutting of trees is needed because of the construction work, it is necessary to study and follow the procedure required by The Maharashtra (Urban Areas) Protection and Preservation of Trees Act (1975). In this study, the route is chosen to avoid the defence area. In addition, there're many large trees along the route. It is necessary to plant 3-5 or more for every tree cut down for construction. The number depends on the type of tree and region. Three trees should survive three years and transplantation has priority over chopping. To investigate the type of trees, age, size, and locations of the transplantations should be studied.
Pollutions	
Complaints	There is chronic traffic congestion. Noise and air pollution from the traffic are also problems. Other problems are the large amount of garbage, slums and water pollution caused by drainage of small and medium-sized enterprises.
Mitigations	There are three air monitoring stations in PMC. Monitoring was started in 2004. NOx, SOx, PM2.5 (from 2012) and RSPM are measured. Sampling is conducted at 20 locations around the river, PMC also examines water quality, however, underground water isn't monitored (see Appendix 22).
Miscellaneous	High-voltage lines pass 9m above along the route. An area 7.5m on each side (width 15m) of the high-voltage towers can't be developed. Relocation of high-voltage towers and lines is possible.

Source: JICA Study Team

The results of monitoring water quality, air quality, and noise are described in Appendix 22. Water quality was improved in 2011 compared to that in 2008, however, BOD and DO values in most areas are beyond the standard value. Regarding air quality, SOx is within the standard value, but NOx is substantially beyond the standard value in almost areas. The maximum standard value of RSPM is 60 µg / m³, and more than twice that amount has been observed every year. The measurements of PM2.5

were began in 2011, it was measured in February and March 2011 and the value was about 15 ~ 40 $\mu\text{g} / \text{m}^3$ beyond the standard value, which is 40 $\mu\text{g} / \text{m}^3$.

7.2.2 Environmental Checklist

Based on the results of the study so far, a JICA environmental checklist has been created for this project. (See Table 7.2.2)

Table 7.2.2 Environmental Checklist (Railways)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been officially completed? (b) Have EIA reports been approved by the authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of the EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a)N (b)N (c)Y (d)N	(a) In this study, an environmental assessment report has not been made. (b) In this study, the environmental assessment report has not been made. (c) EIA must be required because PSIF (Private Sector Investment Finance) which is JICA's fund will be adopted to this project. The procedure and appraisal authority of EIA for "The urban railway project in Pune city" is the same as "Mumbai Metro Line 3 construction." PMRC (Pune Metro Railway Company) will approve EIA report. In addition to EIA report, submissions of DPR (Detailed Project Report) and SIA (Social Impact Assessment) are needed. (d) In this study, an EC isn't acquired.
	(2) Explanation to the Public	(a) Are the contents of the project and the potential impacts adequately explained to the public based on appropriate procedures, including information disclosure? Is understanding obtained from the public? (b) Are proper responses made to comments from the public and regulatory authorities?	(a)N (b)N	(a) Stakeholder meetings were held on June 14 and November 6 to report the progress of this study. (Because the representatives from nearby residents were not invited, actually stakeholder meetings mean Steering Committees.) In addition, on March 15, the last stakeholder meeting was held. The JICA study team presented a final report on this study. In these stakeholders meetings, the understanding of the relevant agencies for this project has been attained. The stakeholder meetings which nearby residents join in will be held in the next survey. (b) The results of the Stakeholders Meetings were reflected in the contents of this project; comments from residents are not reflected.
	(3) Consideration of alternative proposals	(a) Have several alternatives to this project been considered? (During the study, including items related to environmental and social matter)	(a)Y	(a) All routes: Routes from Shivaji Nagar to Hinjawadi IT Park, a route where 1) there's no illegal residences 2) there's fewer places of land acquisition was chosen. Also, the route is planned to construct in the existing road in order to acquire fewer lands. St1: The following 3 options were examined and compared ①Positioning at Shivaji Maharaj Road , ②Positioning at Jangali Maharaj Road, ③Positioning at Samgaam Bridge Road Mula river bridge: This bridge over the Mula river is located near Station 10 and is planned to be constructed upstream from the existing Road bridge crossing the river. Two feasible methods can be planed. ①The plan setting typical girder spans cross the river, ②The plan for a long continuous girder cross the river In addition to the above proposals, to avoid the military defence area near Mula river, constructing an elevated LRT line on the existing bridge is also considered. St13: At the Y junction, which is located between St12 and St13, at first a route from Aundh-Ravet Road to Wakad Road was proposed, the route was changed and passes along the BRT route because of the recommendation of PCMC's Additional Commissioner Mr. Yadav. The route from Aundh-Ravet Road to Wakad Road has a proposal to expand the road, which spur opposition from adjacent neighborhood. From that aspect, the route is avoided. Depot: In broad places along the route, a place where the residence is less (3 apartments) was chosen and it is a barren waste (11ha).

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations
2 Mitigation Measures	(1) Water Quality	(a) Is there a possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas? (b) Do effluents from various facilities, such as stations and parking areas/service areas comply with the country's effluent standards and ambient water quality standards? Is there a possibility that the effluents will cause areas that do not comply with the country's ambient water quality standards?	(a)N/A (b)N/A	(a) Soil erosion could be caused during the construction near Mula river, during the excavation for the construction of footings and column legs, and filling and cutting earth in the depot.. Every year during the rainy season, floods have occurred in the city. In the flood of 2011, the water level rose to the floor slab of the Z bridge. Temporary flooding has occurred in the low area. St14 is close to the Mula river, it is located about 18 km upstream from the confluence of Mula and Mutha rivers. If flooding occurs in the city, there is a risk from its backwater. St14 is an elevated station, so there is no serious consequence, although there is a possibility of erosion and scour due to floods. As part of the communication system of the railway system, a gauge and anemometer are planning to be installed on the bridge. Disaster prevention alarm equipment has also been investigated. (b) In the depot, waste liquid (1. lubricant oil, 2. wash fluid) is discharged. Whether the proposed drainage systems fulfil the emission standard in India is considered in the following investigation. Also, whether there currently is water that does not to meet the national environmental standards is discussed in the next survey.
	(3) Wastes	(a) Are wastes from the infrastructure facilities and ancillary facilities properly treated and disposed of in accordance with the country's standards?	(a)N/A	(a) (Waste liquid)In the depot, waste liquid (1.lubricant oil, 2.wash fluid) is discharged. The washing treatment facility should be set in the depot and wash fluid must be treated appropriately. The treatment of lubricant oil also should be given consideration. (Lithium-Ion Battery Cells)Approximately 230 tons of lithium-ion battery cells are to be used in total. Its functional lifetime is 10-15 years. Safe battery disposal and/or recycling systems and the market for them have been established in India. However, the recycling and/or disposal system for the lithium-ion battery cells is at the rudimentary stage (note that it is probable that its capacity will be improved in near future). So, it is reasonable to use a reliable battery disposal and/or recycling system from outside of India for the time being. Recycling, for example, as it is done in Japan. Recycling fees (Disposal Fees) are included in the cost of transportation. For importing used Lithium-Ion Battery Cell, it is necessary to implement the following procedures. <ul style="list-style-type: none"> • Inclusion examination and dissolution test for lead, mercury and cadmium are conducted. If they are lower than the standard value, it is possible to import them into Japan as items which are restricted by the Basel Convention. • The disposal facility should be decided. (Personal computers) Inadequate addition to lithium-ion battery cells, several forms of electric/electronics equipment such as 10 desktop computers (the functional lifetime of this desktop computer is approximately 10 years) are to be used for the operation control of the entire system within this proposed LRT project. Disposal and/or recycling programs are considered in the next step.
	(3) Noise and Vibration	(a) Do noise and vibrations from vehicle and train traffic comply with the country's standards?	(a)N/A	(a) In the next step, noise and vibration should be examined under the construction and operation.
	(4) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a)N	(a) The ground along the route isn't soft or wetlands (BH1: Deposited materials such as rubble and compacted sandy soils, BH2: Cohesive soil with sand and cobble stone size basalt, BH3: Sand and gravel, BH4: Compacted silt and very compacted sand, BH5: Sandy silt are found in the subject area) and extensive excavation isn't needed. Therefore, it is extremely improbable that subsidence will occur.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations
3 Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties or conventions? Is there a possibility that the project will affect the protected areas?	(a)Y	(a) There is a military defence area, Pimple Nilakh Park, along the route. It is just a military facility, but there's a green belt in the park, if cutting of trees is needed because of the construction work, it is necessary to study and implement the procedure s as specified by The Maharashtra (Urban Areas) Protection and Preservation of Trees Act (1975). In this study, the route is chosen to avoid the defensive area. A Police station and police training centres are near St9. They are specified as being Heritage Buildings (grade II). Heritage Buildings of grade II can be relocated if permission from the police station is obtained. There are two temples. For temple 1, the area containing the steps leading to the temple must be acquired, but the temple itself does not have to be acquired. PMC has a relocation plan for temple 2 where is 160m away from Mula river, but its land owner and the trustee are not agreeing with the compensation, so the issue is pending. (PMC: Mr. Shyaam, Mr. Shinde, personal communication, 2013)
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, or ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties or conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Are adequate protection measures taken to prevent impacts, such as disruption of migration routes, habitat fragmentation, and traffic accidents involving wildlife and livestock? (e) Is there a possibility that installation of roads will cause impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, or disturbance of ecosystems due to introduction of exotic (non-native invasive) species or pests? Are adequate measures for preventing such impacts considered? (f) In cases where the project site is located in undeveloped areas, is there a possibility that the new development will result in extensive loss of natural environments?	(a)N (b)N (c)Y (d)Y (e)Y (f)N	(a) They are not included in this project. (b) They are not included in this project. (c) Trees should be cut from St1 to St3, St6 to St10, St11~St13, St16 and from St18 to St21. There're many large trees along the route that must be cut for this project. It is necessary to plant 3-5 or more for every tree cut down for construction. The number depends on the type of tree and the region. Three trees should survive for three years and transplantation has priority over cutting. Investigating the type of trees, age, size, and locations of the transplantations should be studied. (d) Areas considered to be at-grade have a large traffic volume and the speed of the traffic is relatively high. For this reason, it is preferable to ensure stable LRT operation by preventing accidental contacts between LRT and road traffic as well as pedestrians entering into the railway, With the exception of certain parts such as crossing areas, the railway would be for the exclusive use for the LRT. Separating the area by fences and/ or others to stop people from entering into the railway should be considered. (e) The greatest influence on the ecosystem is cutting the trees along the route. It is necessary to plant 3-5 or more for every tree cut for construction or transplant them. (f) In this project, LRT runs on the existing road.
	(3) Hydrology	(a) Is there a possibility that alteration of topographic features and installation of structures, such as tunnels will adversely affect surface water and groundwater flows?	(a)N/A	(a) In the next study, the surface water and ground water shall be investigated.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations
3 Natural Environment	(4) Topography and Geology	<p>(a) Is there any soft ground on the route that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides where needed?</p> <p>(b) Is there a possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides?</p> <p>(c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, or borrow sites? Are adequate measures taken to prevent soil runoff?</p>	<p>(a)N (b)Y (c)Y</p>	<p>(a) None of the ground along the route is soft or wetlands (BH1: Deposited materials such as rubble and compacted sandy soils, BH2: Cohesive soil with sand and cobble stone size basalt, BH3: Sand and gravel, BH4: Compacted silt and very compacted sand, BH5: Sandy silt exists within the site) and no large scale excavation is needed. Therefore, it is extremely improbable that a collapse of soil or landslide can occur. Every year during the rainy season, floods have occurred in the city. In the flood of 2011, the water level rose to the floor slab of the Z bridge. Temporary flooding has occurred in the low areas. St14 is close to the Mula river about 18 km upstream from the confluence of the Mula and Mutha rivers. If flooding occurs in the city, there is a risk from its backwaters. St14 is an elevated station, so there is no serious consequence, although there is a possibility of erosion and scour due to floods. As part of the communication system for the railway, a gauge and anemometer are planned to be installed on the bridge. Disaster prevention alarm equipment has also been investigated.</p> <p>(b) Filling and cutting earth in the depot site are necessary. The northwest area of the depot is higher and the south area is lower. According to this, the northwest area shall be cut and the south portion shall be filled 2-3m. Construction during the rainy season (from June to August) must be avoided.</p> <p>(c) Construction during the rainy season (from June to August) must be avoided. Because the places for the dumping and removal of soil have not been determined, it is essential to consider soil runoff as soon as is the places are decided.</p>
4 Social Environment	(1) Resettlement	<p>(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts being made to minimize the impacts caused by the resettlement?</p> <p>(b) Is adequate explanation regarding relocation and compensation given to the affected persons prior to resettlement?</p> <p>(c) Is the resettlement plan, including proper compensation, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?</p> <p>(d) Is compensation paid before relocation?</p> <p>(e) Is the compensation policy formulated in the document?</p> <p>(f) Does the resettlement plan pay particular attention to vulnerable groups or persons, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?</p> <p>(g) Are agreements with the affected persons obtained prior to resettlement?</p> <p>(h) Is the organizational framework established to properly implement the resettlement? Are the capacity and budget secured to implement the plan?</p> <p>(i) Is a plan developed to monitor the impacts of resettlement?</p> <p>(j) Is handling of complaints considered?</p>	<p>(a)Y (b)Y (c)N/A (d)N/A (e)N/A (f)N/A (g)N/A (h)N/A (i)N/A (j)N/A</p>	<p>(a) With the implementation of this project, involuntarily-resettlement will be required. The land between St9 and St10 (Width: about 3.2m, Distance: about 80m, Area: about 256m²), from St10 to Mula river (Width: about 3.2m, Distance : about 150m, Area : about 480m²) and near NH4 (Width: about 8m, Distance: about 500m, Area: about 4,000m²) are to be acquired. There's a police station and training centre between St9 and St10. Small shops, residential houses and primary schools between St10 and Mula River. Near NH4, there are small shops and residential buildings. It's necessary to pay compensation for the businesses in the shops near St14 and from St17 to 21. The planned site for the depot is farmland and acquisition of agricultural land is needed. At the site, there is a school and residences. The site has a factory, a school, residences and fields. Planned site for the depot is farmland and acquisition of agricultural land is needed. At the site, there is a factory, a school, fields and residences. (See Appendix 23)</p> <p>(b) Public meetings shall be held.</p> <p>(c) LAP and LARAP have not been prepared. Their preparation is mentioned in 7.5.4 TOR (Drat) of this report.</p> <p>(d) LAP and LARAP have not been prepared. Their preparation is mentioned in 7.5.4 TOR (Drat) of this report.</p> <p>(e) LAP and LARAP have not been prepared. Their preparation is mentioned in 7.5.4 TOR (Drat) of this report.</p> <p>(f) LAP and LARAP have not been prepared. Their preparation is mentioned in 7.5.4 TOR (Drat) of this report.</p> <p>(g) LAP and LARAP have not been prepared. Their preparation is mentioned in 7.5.4 TOR (Drat) of this report.</p> <p>(h) LAP and LARAP have not been prepared. Their preparation is mentioned in 7.5.4 TOR (Drat) of this report.</p> <p>(i) LAP and LARAP have not been prepared. Their preparation is mentioned in 7.5.4 TOR (Drat) of this report.</p> <p>(j) LAP and LARAP have not been prepared. Their preparation is mentioned in 7.5.4 TOR (Drat) of this report.</p>

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations
4 Social Environment	(2) Living and Livelihood	<p>(a) Where roads or railways are newly installed, is there a possibility that the project will affect the existing means of transportation and the associated workers? Is there a possibility that the project will cause significant impacts, such as extensive alteration of existing land uses, changes in sources of livelihood, or unemployment? Are adequate measures considered for preventing these impacts?</p> <p>(b) Is there a possibility that the project will adversely affect the living conditions of inhabitants other than the affected inhabitants? Are adequate measures considered to reduce the impacts, if necessary?</p> <p>(c) Is there a possibility that diseases, including communicable diseases, such as HIV will be introduced due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary?</p> <p>(d) Is there a possibility that the project will adversely affect road traffic in the surrounding areas (e.g., by causing increases in traffic congestion and traffic accidents)?</p> <p>(e) Is there a possibility that roads and railways will impede the movement of the inhabitants?</p> <p>(f) Is there a possibility that structures associated with the roads (such as bridges) will cause sun shading or radio wave interference?</p>	<p>(a)Y (b)Y (c)Y (d)Y (e)Y (f)Y</p>	<p>(a) LARAP and EMP shall be prepared after considering the change in the use of the land and livelihood and any associated unemployment.</p> <p>(b) With the implementation of this project, involuntarily resettlement will be required. The land between St9 and St10 (Width: about 3.2m, Distance: about 80m, Area: about 256m²), from St10 to Mula river (Width: about 3.2m, Distance : about 150m, Area : about 480m²) and near NH4 (Width: about 8m, Distance: about 500m, Area: about 4,000m²) are to be acquired. There's a police station and training centre between St9 and St10. Small shops, residential houses and primary schools between St10 and Mula River. Near NH4, there are small shops and residential buildings. It's necessary to pay compensation for the businesses in the shops near St14 and from St17 to 21. The planned site for the depot is farmland and acquisition of agricultural land is needed. At the site, there is a school and residences. The site has a factory, a school, fields and residences. The planned site for the depot is farmland and acquisition of agricultural land is needed. At the site, there is a school and residences. (See Appendix 23) LARAP and EMP shall be prepared to mitigate the effect on residents.</p> <p>(c) LARAP and EMP shall be prepared to consider the sanitation.</p> <p>(d) The railway is planned to cross an intersection near station 12. A traffic signal system would be employed to control the Vehicles crossing the railway and to prioritize railway traffic across the intersection. Traffic accidents will be prevented by the signals, however, congestion may occur. In the at-grade section, the railway would be for the exclusive use of the LRT. Separating the area with fences and/ or others to stop people from entering into the railway should be considered.</p> <p>(e) To separate the area with fences and/ or others to stop people from entering into the railway causes interruption in the transportation of the residents. Hence, a pedestrian crosswalk will be constructed to make the transportation smooth. Areas considered to be at-grade have a large traffic volume and the speed of the traffic is relatively high. For this reason, it is preferable to ensure stable LRT operation by preventing accidental contacts of LRT and road traffic as well as with pedestrians entering into the railway, With the exception of certain parts such as crossing areas, the railway would be for the exclusive use of the LRT. Separating the area by fences and/ or others to stop people from entering into the railway should be considered.</p> <p>(f) Sunshine inhibition and interference will not occur.</p>
	(3) Heritage	<p>(a) Is there a possibility that the project will damage local archaeological, historical, cultural, or religious heritage sites? Are adequate measures considered to protect these sites in accordance with the country's laws?</p>	<p>(a)Y</p>	<p>(a) There is the military defence area, Pimple Nilakh Park, along the route. It is just a military facility, but there's a green belt in the park, if cutting of trees is needed because of the construction work, it will be necessary to study and go through the procedures as stipulated by The Maharashtra (Urban Areas) Protection and Preservation of Trees Act (1975). In this study, the route is chosen to avoid the defence area. A police station and police training centres are near St9. They are specified as Heritage Buildings (grade II). Heritage Buildings of grade II can be relocated if permission from the police station is obtained. There are two temples. For temple 1, the area containing the steps leading to the temple must be acquired, but the temple itself does not have to be acquired. PMC has a relocation plan for temple 2, but its land owner and the trustee are not agreeing with the compensation, so the issue is pending. (PMC: Mr. Shyaam, Mr. Shinde, personal communication, 2013)</p>
	(4) Landscape	<p>(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures being taken?</p>	<p>(a)Y</p>	<p>(a) Pune is called the Green City and there are many trees along the LRT. Although trees have to be cut, the plan is to position the LRT line within the existing road as much as possible. Also, not cutting but transplanting is considered and the number of trees that need to be cut should be reduced.</p>

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations
4 Social Environment	(5) Ethnic Minorities and Indigenous Peoples	(a) Where ethnic minorities or indigenous peoples are living in the rights-of-way, are considerations given to reduce the impacts on culture and lifestyle of the ethnic minorities and indigenous peoples? (b) Does the project comply with the country's laws for rights of ethnic minorities and indigenous peoples?	(a)N (b)N	(a) There are no ethnic minorities or indigenous peoples. Also there is no slum along the route. (b) There are no ethnic minorities or indigenous peoples. Also there is no slum along the route.
	(6) Working Environment	(a) Are Indian acts about the working environment conformed to during the implementation of this project? (b) Is the plan safety-conscious for the related people of this project? For example, are installation of safety facilities and management of hazardous substances for industrial accident prevention considered? (c) Are designing safe sanitation plans and safety training for labourers including road safety and public health implemented for related people of this project? (d) Are appropriate measures implemented for security personnel related to this project so as not to violate the safety of concerned personnel and residents?	(a)Y (b)Y (c)Y (d)N	(a) In India, there is a regulation similar to Japan regarding operating a track system occupying a part of an ordinary road. Therefore, an organizational system will be structured corresponding to the local regulations with reference to the case of Calcutta Tramways Company which is operating the only track system in India. (b) To increase the safety in the elevated section, an automatic block system, which allows only one train to enter a block section, is employed and the trains are also equipped with an Automatic Train Stop (ATS) system so that a train can be stopped automatically in the event of an emergency. The basic idea will be to achieve failsafe in order to secure the punctuality and safety of the trams. The functional life of lithium-ion battery cells is 10-15 years. Safe battery disposal and/or recycling systems and the market for them have been established in India. However, the recycling and/or disposal system for the lithium-ion battery cells is at the rudimentary stage (note that it is probable that its capacity will be improved in near future). So, it is reasonable to use a reliable battery disposal and/or recycling system from outside of India for the time being. Recycling, for example, as it is done in Japan. Disposal and/or recycling programs are considered in the next step. (c) To structure the safety-first train operation, safety management rules will be made. Special education for clerical employees, drivers and technical positions, and periodic drills and emergency drills for drivers and technical positions are discussed. An Education Plan for technical positions from the first year to fifth year has been prepared. (d) Measures for the security personnel are not examined in this study. In the following research, it will be examined.
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? (d) If necessary, is health and safety education (e.g., traffic safety, public health) provided for project personnel, including workers?	(a)Y (b)Y (c)Y (d)N/A	(a) Provisions regarding the waste have been discussed. (See 2-(2)) Other problems (noise, vibration, muddy water, dust and exhaust gas) shall be investigated in the next step. (b) To minimize the cutting of trees along the route, the route will be constructed within the existing road as much as possible. Not cutting trees but transplantation shall be chosen as much as possible and the cutting of trees must be reduced. (c) There is the military defence area, Pimple Nilakh Park, along the route. It is just a military facility, but there's a green belt in the park, if cutting trees is needed because of the construction work, it is necessary to study and go through the procedures as stipulated by The Maharashtra (Urban Areas) Protection and Preservation of Trees Act (1975). In this study, the route is chosen to avoid the defence area. A Police station and police training centres are near St9. They are specified as Heritage Buildings (grade II). Heritage Buildings of grade II can be relocated if the permission from the police station is obtained. There are two temples. For temple 1, the area containing the steps leading to the temple must be acquired, but the temple itself does not have to be acquired. PMC has a relocation plan for temple 2, but its land owner and the trustee are not agreeing with the compensation, so the issue is pending. (PMC: Mr. Shyaam, Mr. Shinde, personal communication, 2013) (d) The mitigation of traffic congestion caused by construction work has not been considered yet. In the following study, it will be examined.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations
5 Others	(2) Monitoring	(a) Does the proponent develop and implement monitoring programs for the environmental items that are considered to have potential impacts? (b) Are the items, methods and frequencies included in the monitoring program judged to be appropriate? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a)Y (b)N/A (c)N/A (d)N/A	(a) Making and Implementing the Environmental monitoring plan (EMP) for the affected matters shall be conducted. (b) In this study, Environmental monitoring plan (EMP) isn't made. In the next study, EMP shall be undertaken. (c) In this study, no Environmental monitoring plan (EMP) has been prepared yet. In the next study, the EMP shall be undertaken. (d) In this study, no Environmental monitoring plan (EMP) has been prepared yet. In the next study, the EMP shall be undertaken.
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Forestry Projects checklist should also be checked (e.g., projects including large areas of deforestation). (b) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of power transmission lines and/or electric distribution facilities).	(a)N (b)Y	(a) The Forestry Projects checklist isn't reviewed because no large areas of deforestation are expected in this project. (b) See Table 7.2.3.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed, if necessary (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a)Y	(a) See 2-(2).

- Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are made, if necessary. In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).
- The Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete items taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

Source: JICA Study Team

Table 7.2.3 Environmental Checklist (Power Transmission and Distribution Lines)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations
3 Natural Environment	(3) Topography and Geology	(a) Is there soft ground in the route of power transmission lines that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides where needed? (b) Is there a possibility that civil works, such as cutting and filling, will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides? (c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, or borrow sites? Are adequate measures taken to prevent soil runoff?	(a)N (b)N (c) N/A	(a) The ground along the route isn't soft or wetlands (BH1: Deposited materials such as rubble and compacted sandy soils, BH2: Cohesive soil with sand and cobble stone size basalt, BH3: Sand and gravel, BH4: Compacted silt and very compacted sand, BH5: Sandy silt exists within the site. Therefore probabilities of slope failures and landslides are low. (b) Only the construction of the depot (11ha) is required to fill and cut the earth. The north western area of the depot is higher and the southern area is lower. Because of this, the north western area shall be cut and the southern area shall be filled 2-3m. There's no steep sloping land. When high voltage lines and towers are relocated, earth works of filling and cutting are not needed. (c) Soil runoff from the area from which the sand is taken should be considered in the next step.
	(2) Ecosystem	(c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Are adequate measures taken to prevent disruption of migration routes and habitat fragmentation of wildlife, and livestock?	(c) N (d) N	(c) Relocation of high voltage lines and towers has little impact on the ecosystem, however, when they're relocated, trees must be cut along the route. (d) Relocation of high voltage lines and towers will not disrupt migration routes or cause habitat fragmentation of wildlife or livestock. When the LRT runs in the at-grade sections, accidents with animals may occur. In the at-grade portion of the route the LRT will be separated from the surroundings with fences and/ or others to prevent accidents.

- 1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are to be implemented, if necessary. In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).
- 2) The environmental checklist provides general environmental items to be checked. It may be necessary to add or delete items taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

7.2.3 Preliminary Environmental Scoping Results

Table 7.2.3 and 7.2.4 show a summary of the results of the environmental scoping in the planning and construction phases.

The 21.6km road is to be built from the centre of Pune city to Hinjawadi IT Park. The route has an elevated portion and an at-grade portion.

In Stage 1 the route from St6 to St18 shall be constructed. Then the whole route will be opened in Stage 2. The year of the establishment of business in Stage 1 is 2018, and that of Stage 2 is 2020.

Table 7.2.4 Preliminary Environmental Scoping Results (Stage 1: from St6 to St18)

Environmental Factor		Evaluation			Comments
		Pre-Construction	Construction	Operation	
Socio-Cultural Env					
1	Involuntary Resettlement	A-	A-	A-	(-)With the implementation of this project, involuntarily-resettlement will be required. The land between St9 to St10 (Width: about 3.2m, Distance: about 80m, Area: about 256m ²), from St10 to Mula river (Width: about 3.2m, Distance : about 150m, Area : about 480m ²) and near NH4 (Width: about 8m, Distance: about 500m, Area: about 4,000m ²) are to be acquired. There's a police station and training centre between St9 and St10. Small shops, residential houses and primary schools are located between St10 and Mula River. Near NH4, there are small shops and residential buildings. It's necessary to provide compensation for businesses in the shops near St14 and from St17 to 21. The planned site for the depot is farmland and acquisition of agricultural land is needed. At the site, there is a school and residences. The site has a factory, a school, fields and residences.
2	Local Job Market and Economy	A-	A±	A±	(-)It's necessary to provide compensation for the businesses in the shops near St14 and from St17 to 21. 7 retail businesses near St10 and 18 retail businesses near NH4 should be acquired. The planned site for the depot is farmland and acquisition of agricultural land is needed. Not only compensating for relocation, but also supporting livelihood is necessary. (+)Employment of skilled and unskilled labor will be expected. This project may develop near stations and boost regional economic activities along the route.
3	Land use and Utilization of Local Resources	D-	A-	A+	(-)The land between St9 to St10 (Width: about 3.2m, Distance: about 80m, Area: about 256m ²), from St10 to Mula river (Width: about 3.2m, Distance : about 150m, Area : about 480m ²) and near NH4 (Width: about 8m, Distance: about 500m, Area: about 4,000m ²) are to be acquired. The police station and police training centre between St9 and St10 are to be acquired. 7 retail businesses, a temple, the ground of the school and 4 residences should from St10 to Mula river be acquired. 18 retail businesses and 2 apartments near Mula river will be taken The land for the depot is 11 ha and most of it is waste land and only a 4665m ² field of sorghum is there. There are a factory, a school and residents in the depot area. (+)Effective utilization of present unused land is anticipated due to new development in the surrounding area.
4	Social Institutions	D	D	D	Throughout the whole project cycle, there will be impacts on social organizations, such as the regional social capital and decision-making body.
5	Existing social infrastructures and services	B-	A-	B±	(-)At the junction near St12, traffic is managed by signals and LRT has priority of going through first. The signals can prevent accidents, however congestion will occur. Also, in the at-grade portion of the route the LRT will be separated from the surroundings with fences and/ or others to stop people from entering into the railway. Therefore, the residents will have difficulty crossing the road. Especially in the centre of Pune city from St1 to St5, the junction in front of Pune University near St5, the junction near St15 and the grade separated crossing with NH4 will be heavily congested. The route from St11 to St15 overlaps the planned BRT route. Along the route there are high voltage lines but they can be relocated. (Maharashtra State Electricity Distribution, Mr. Kolap, personal communication, 2012) (+)Traffic congestion on the roads will be eased.
6	The poor and Indigenous ethnic groups	D	D	D	There are no indigenous groups or ethnic minorities. Along the route there are no slums, therefore, none will be acquired. Very few poor people will be negatively affected by this project.

Environmental Factor		Evaluation			Comments
		Pre-Construction	Construction	Operation	
7	Misdistribution of benefits and damage	D	D	D	Metro line 1 and 2 are also being planned, connecting LRT stations to Metro stations is considered. The route from St11 to St15 overlaps the planned BRT route. There is military residence area from St12 to St13. St12 is an at-grade station and St 11 and St13 are elevated stations. In this regard, attention needs to be given to the military residence area. Disposal sites for construction debris and impacts should be investigated in the next phase.
8	Cultural Heritage	D	B-	B-	(-) There is the military defence area near Mula river. In this study it is proposed that the route will be set on the bridge to avoid the defence area. There's a park with an area of about 450m ² near Mula river, it is close to the temple. The route will be set to avoid the temple. It's possible to acquire only the park. A police station and police training centres are near St9. They are specified as Heritage Buildings (grade II). Heritage Buildings of grade II can be relocated if permission from the police station is obtained. Also, there's another temple near Mula river. PMC has a relocation plan for the temple, but its land owner and the trustee are not agreeing with the compensation, so the issue is pending. (PMC: Mr. Shyaam, Mr. Shinde, personal communication, 2013)
9	Local Conflict of interests	D	D	D	The planned site for the depot is farmland and acquisition of agricultural land is needed. In the next step, the interests of BRT, Auto Rickshaw and Pune Metro should be examined. Regarding the BRT, negotiations with PMPML, which is the operating company of BRT, will be required. Disposal sites for the construction debris and their impacts should be investigated in the next phase. There's another temple near Mula river. PMC has a relocation plan for the temple, but its land owner and the trustee are not agreeing with the compensation, so the issue is pending. (PMC: Mr. Shyaam, Mr. Shinde, personal communication, 2013) The planned site for the depot (11ha) is farmland and there are 312 farmers who own the land.
10	Water use/or water rights	D	D	D	Intake sources in Pune are dams. In PMC water is taken from Khadakuasla dam, Warasgaon dam, Temghar dam and Panshet dam. In PCMC water is taken from Pavana dam and Bhama Askhed dam. These dams will not be affected by this project because they're far from the route. In order to prevent damage to the existing water pipes that have been buried along this route or to relocate them as necessary, an investigation of the situation should be conducted in the next phase.
11	Sanitation	D	C-	C-	(-) During the construction and operating periods, surface modification and the deformation is expected. This may cause an increase the risk of dengue fever due to the formation of temporary pools of water.
12	Infectious Disease (e.g., HIV.AIDS)	D	B-	C-	(-) When shops are houses are demolished, the risks of dust, polluted water and foul-smells will be increased. Increase of traffic by construction vehicles and trucks for transport and disposal of construction debris and worsening of congestion are expected, and the risk of traffic accidents is also increased. The route is to be separated from the surroundings with fences to prevent people from entering into the route to avoid accidents. However, the risk of traffic accidents will increase compared with the pre-construction state.
Bio-Physical Env					
13	Landform and condition	D	D	D	The north western area of the depot site (11ha) is higher and the southern area is lower. Because of this, the northwest area shall be cut and the southern area shall be filled 2-3m. The impact on the landform and condition must be estimated in the next phase. Because the sites for dumping and removing soil have not been determined, it is essential to consider the landform and condition as soon as the sites are decided.

Environmental Factor		Evaluation			Comments
		Pre-Construction	Construction	Operation	
14	Groundwater	D	D	D	In this project no underground work is proposed, therefore, it is unlikely that there will be any impacts on groundwater.
15	Denudation	D	B-	D	(-) The north western area of depot is higher and the southern area is lower. Because of this, the north western area shall be cut and the southern area shall be filled 2-3m. There's no steep sloping land.
16	Hydrological forecast	D	B-	B-	(-) During the construction and operating period, the surface modification by cutting and filling is expected. The occurrence of changes in the local hydrological characteristics (water balance) is expected.
17	Coastal ecosystem	D	D	D	Nothing.
18	Aboriginal flora and fauna	D	A-	D	(-) There is no valuable species. Approximately numbers of trees which should be cut are investigated in the next stage.
19	Meteorological phenomenon	D	B-	B-	(-) During the construction and operating period, the surface modification for the construction of the depot is expected. Changes in meteorological phenomenon are expected.
20	Landscape	D	B-	B±	(-) A catenary free system is used as a part of the systems of the rolling stock. In addition, there are trees by the roadside and in order to build a station and line, trees must be cut down. (+) A catenary free system doesn't spoil the scenery compared to some of the overhead line systems and it has a positive impact on the landscape.
21	Global warming	D	B-	C+	(-) During construction, the use of construction materials such as concrete, operation of construction vehicles and handling of construction debris contribute to emit carbon dioxide temporarily. (+) On the other hand, the use of regenerative braking reduces greenhouse gas emissions. In addition, this project contributes to reducing carbon dioxide emissions of Auto rickshaws and buses (see 7.4.2).
Pollution					
22	Air Quality	B-	B-	C+	(-) Impacts on air quality due to vehicles along the route have been observed currently. An increase in traffic in the area due to construction vehicles during construction and temporary degradation of roadside air quality associated with it are expected. Air quality before and after the implementation of this project should be studied in detail in the next stage. (+) The project may contribute to the ease of traffic congestion and decrease of CO ₂ emission.
23	Water Quality	D	C-	C-	(-) There is a possibility that water pollution could occur because of the construction work near Mula river.
24	Soil Contamination	D	D	B-	(-) In the Depot, the risk of soil contamination is increased because of waste liquid (1. lubricant oil, 2. wash fluid). The wash facility should be installed in the depot and the wash fluid treated appropriately.
25	Waste	D	B-	B-	(-) During construction, handling construction debris due to removal of 42 retail businesses and residences is required. In the depot, waste liquid (1. lubricant oil, 2. wash fluid) will be discharged. The wash facility should be set in the depot and wash fluid is to be treated appropriately. Approximately 230 tons of lithium-ion battery cells are to be used in total. Its functional lifetime is 10-15 years. Safe battery disposal and/or recycling systems and the market for them have been established in India. However, the recycling and/or disposal system for the lithium-ion battery cells is at the rudimentary stage (note that it is probable that its capacity will be improved in near future). So, it is reasonable to use a reliable battery disposal and/or recycling system from outside of India, for example in Japan.

Environmental Factor		Evaluation			Comments
		Pre-Construction	Construction	Operation	
26	Noise /Vibration	D	A-	C-	(-) Impacts on noise and vibration due to vehicles travelling along the route have been observed currently. An increase in traffic in the area due to construction vehicles during construction and temporary increase in roadside noise and vibration associated with it are assumed. During the operation period, the LRT may cause noise and vibration. The LRT has adopted resin rail clips which cause less noise and vibration. Thus, there will be little impact. Noise and vibration before and after the implementation of this project should be studied in detail in the next stage.
27	Ground subsidence	D	D	D	Along the route, there is no ground subsidence. Also, no underground work is to be implemented. Thus, the possibility of subsidence is low.
28	Obnoxious smell	D	B-	C-	(-) During construction, the risk of temporary pond of water due to poor drainage in the localized regions is increased. If left to stand for an appreciable amount of time the risk of obnoxious smell would be increased.
29	River bed/Benthos	D	C-	D	(-) There's a possibility that muddy water could flow into Mula river and the transported soil be deposited on the river bed because of the construction near Mula river.
30	Accidents	D	B-	B-	(-) Increasing the traffic because of construction vehicles and an increase in congestion is predicted. The risk of traffic accidents will increase. A specialized LRT line shall be constructed. However, the risk of traffic accidents will be increased if the LRT runs on ground level.

Note A: significant, B: major, C: unknown, D: less significant, +: positive impact, -: negative impact

Source: JICA Study Team

**Table 7.2.5 Preliminary Environmental Scoping Results
(Stage 2: St1 to St5 and St19to St21)**

Environmental Factor		Evaluation			Comments
		Pre-Construction	Construction	Operation	
Socio-Cultural Env					
1	Involuntary Resettlement	D	D	D	There's no involuntarily-resettlement.
2	Local Job Market and Economy	A-	A±	A±	(-) It's necessary to provide compensation to offices, malls and shops from St1 to St5 for business lost during the construction period. (+) Employment of skilled and unskilled labor will be expected. This project may develop near stations and boost regional economic activities along the route.
3	Land use and Utilization of Local Resources	D	B-	B+	(-) There are trees from St1 to St5. Therefore to cut trees is needed for this project. Approximate number of trees is to be investigated in the next study. (+) Effective utilization of present unused land is anticipated due to new development in the surrounding area.
4	Social Institutions	D	D	D	Throughout the whole project cycle, there will be impacts on social organizations, such as the regional social capital and decision-making body.

Environmental Factor		Evaluation			Comments
		Pre-Construction	Construction	Operation	
5	Existing social infrastructures and services	B-	A-	B±	(-)When the route and stations are constructed, the roads to access the construction shall be congested temporarily. Especially in the centre of Pune city from St1 to St5, which is congested currently, heavy congestion is expected during the construction. (+)Traffic congestion on the roads will be eased.
6	The poor and Indigenous ethnic groups	D	D	D	There are no indigenous groups or ethnic minorities which are affected by this project.
7	Misdistribution of benefit and damage	D	D	D	Distribution of profit or loss due to the project is rare.
8	Cultural Heritage	D	D	D	There's no cultural heritage to protect in the target area.
9	Local Conflict of interests	D	D	D	There are no opposing interests in the target area that would be affected by this project.
10	Water use/or water rights	D	D	D	In this project, no underground work is to be performed. Therefore, water use is not affected.
11	Sanitation	D	C-	C-	(-)During the construction and operating period, surface modification is expected. This may cause an increase in the risk of dengue fever due to the formation of temporary pools of water.
12	Infectious Disease (e.g., HIV.AIDS)	D	B-	C-	(-)When shops and houses are demolished, the risk of dust, polluted water and foul-smells will be increased. Increase of traffic by construction vehicles and trucks for transport and disposal of construction debris and worsening of congestion are expected, and the risk of traffic accidents is also increased. The route is to be separated from the surroundings by fences to prevent people from entering into the route to avoid accidents. However, the risk of traffic accidents will increase compared with the pre-construction level.
Bio-Physical Environment					
13	Landform and condition	D	D	D	Earthmoving on a scale that could lead to large-scale changes has not been planned. The effect on the surrounding landform and condition is not serious.
14	Groundwater	D	D	D	In this project underground work is not planned, therefore, impacts on groundwater are unlikely.
15	Denudation	D	D	D	Earthmoving on a scale that could lead to large-scale changes has not been planned. Also there are no steep slopes.
16	Hydrological forecast	D	B-	B-	(-)During the construction and operating period, surface modification is expected. This may cause an increase in the risk of change in local hydrological characteristics (water balance).
17	Coastal ecosystem	D	D	D	None.
18	Aboriginal flora and fauna	D	A-	D	(-)There are trees along the route that need to be cut for construction of the station and route.
19	Meteorological phenomenon	D	B-	B-	(-)During the construction and operating period, surface modification is expected. This may cause an increase in the risk of fluctuation in the meteorological phenomenon associated with it.
20	Landscape	D	B-	B±	(-)A catenary free system is used as a part of the rolling stock systems. In addition, there are trees by the roadside and in order to build a station and line, some trees must be cut down. (+)A catenary free system doesn't spoil the scenery compared to some of the overhead line systems and it has a positive impact on the landscape.

Environmental Factor		Evaluation			Comments
		Pre-Construction	Construction	Operation	
21	Global warming	D	B-	C-	(-) During construction, the use of construction materials such as concrete, operation of construction vehicles and handling of construction debris will emit carbon dioxide temporarily. (+) On the other hand, the use of regenerative braking reduces greenhouse gas emissions. In addition, this project contributes to reducing the total carbon dioxide emissions of Auto rickshaws and buses (see 7.4.2).
Pollution					
22	Air Quality	B-	B-	C+	(-) Impacts on air quality due to vehicles along the route have been observed currently. An increase in traffic in the area due to construction vehicles during construction and the temporary degradation of roadside air quality associated with it are assumed. Air quality before and after the implementation of this project should be studied in detail in the next stage. (+) The project may contribute to the ease of traffic congestion and decrease of CO ₂ emission.
23	Water Quality	D	D	D	In this project, no underground work is to be performed. Also there are no water sources such as a river or lake along the route. Therefore the water quality will not be affected.
24	Soil Contamination	D	D	D	Soil contamination will not be caused by this project.
25	Waste	D	B-	B-	(-) Approximately 230 tons of lithium-ion battery cells are to be used in total. Their functional lifetime is 10-15 years. Safe battery disposal and/or recycling systems and the market for them have been established in India. However, the recycling and/or disposal system for the lithium-ion battery cells is at the rudimentary stage (note that it is probable that its capacity will be improved in near future). So, it is reasonable to use a reliable battery disposal and/or recycling system from outside of India, for example in Japan.
26	Noise/Vibration	D	A-	C-	(-) Impacts on noise and vibration due to vehicles along the route have been observed currently. Increase in traffic in the area due to construction vehicles during construction and a temporary increase in roadside noise and vibration associated with it are assumed. During the operation period, the LRT may cause noise and vibration. The LRT has adopted resin rail clips which cause less noise and vibration. Thus, there will be little impact. Noise and vibration before and after the implementation of this project should be studied in detail in the next stage.
27	Ground subsidence	D	D	D	Along the route, there is no ground subsidence. Also, no underground work is to be implemented. Thus, the possibility of subsidence is low.
28	Obnoxious smell	D	B-	C	(-) During construction, the risk of temporary pond of water due to poor drainage in localized regions is increased. Therefore, if the puddles are allowed to remain for any appreciable time the risk of obnoxious smell is increased.
29	River bed/Benthos	D	D	D	No change in river bed/ benthos is expected due to this project.
30	Accidents	D	B-	B-	(-) Increasing traffic because of construction vehicles and an increase in congestion is predicted. The risk of the traffic accidents will increase. A specialized LRT line shall be constructed. However, the risk of traffic accidents will be increased if the LRT runs on the ground level.

Note A: significant, B: major, C: unknown, D: less significant, +: positive impact, -: negative impact

Source: JICA Study Team

7.3 RAP Preliminary Research

7.3.1 Laws and regulations regarding Land Acquisition

1) Land Acquisition Act (1894)

The Land Acquisition Act was established in 1894, which was in the colonial age. The Act continues to be applied even today. The procedure is written below.

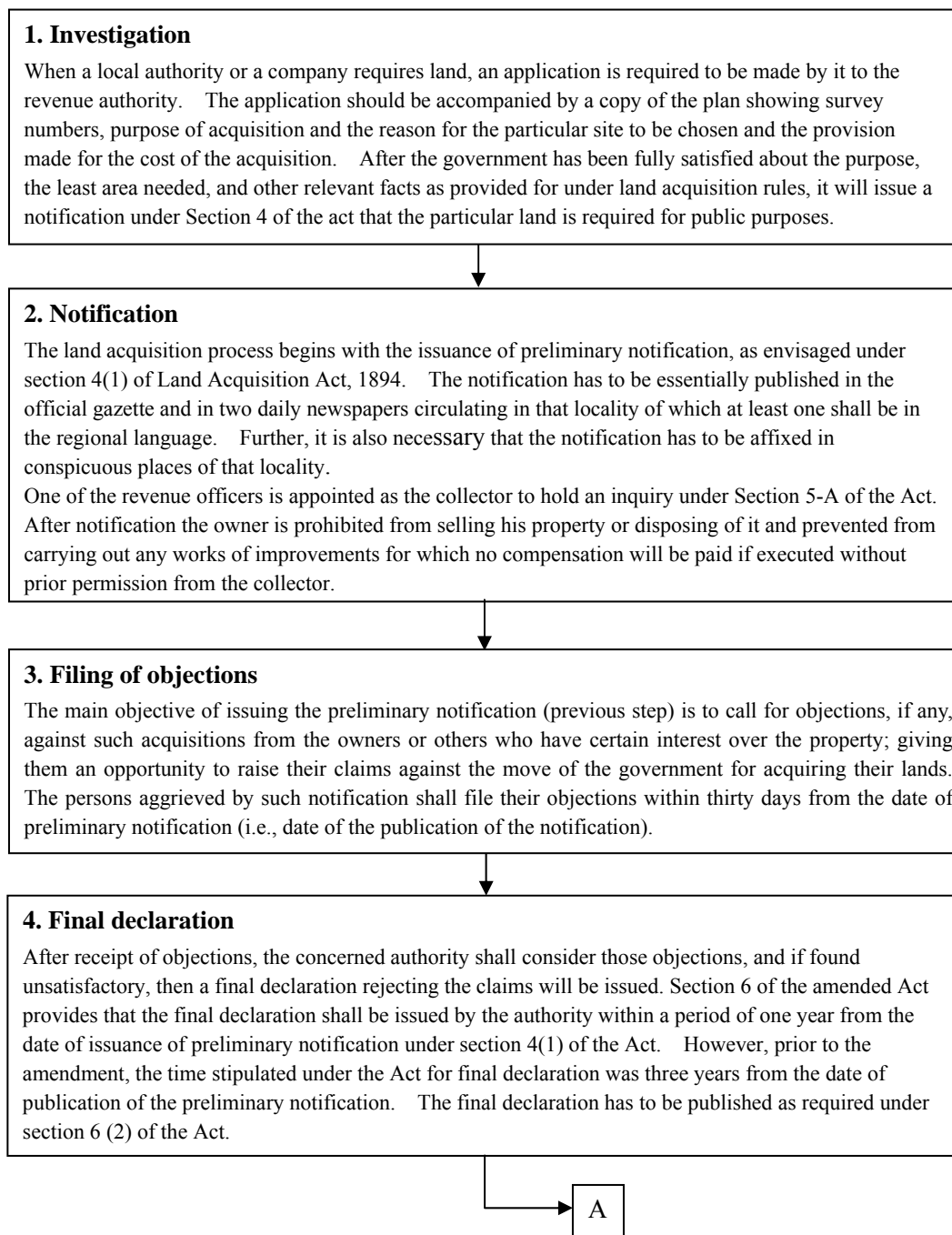


Figure 7.3.1 Land Acquisition process in India 1 (1894)

Source: JICA Study Team

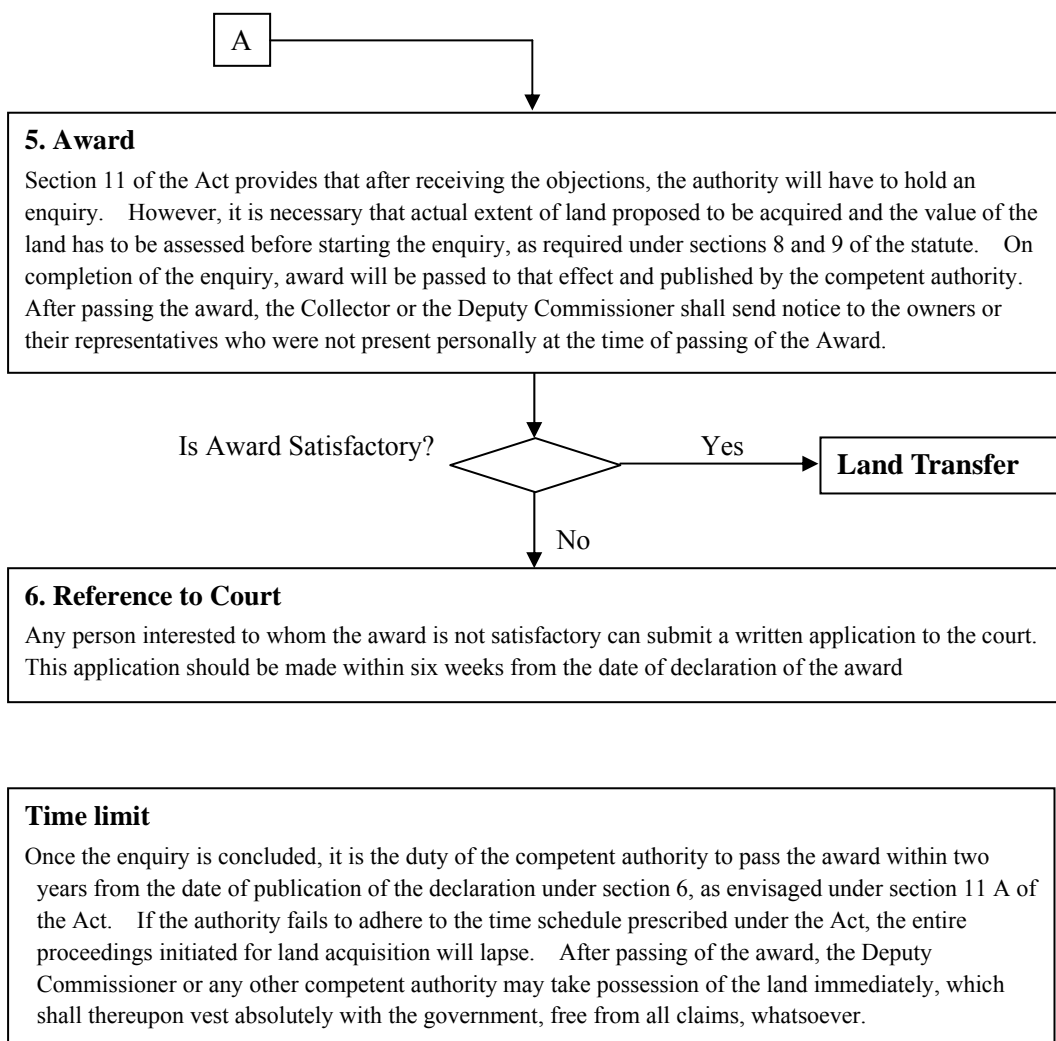


Figure 7.3.2 Land Acquisition process in India 2 (1894)

Source: JICA Study Team

Under current law (1894) it is stipulated that 'Compensation cost has a 30% surcharge over market price'. However, there is no provision about guarantee of an alternate site or livelihood security.

There are problems with land acquisition in public works, for example, construction of dams and agricultural land reforms. Constructing facilities for the public is easy for residents to understand and share relatively; also some of the affected people were guaranteed to be given priority regarding employment in the public sector. After 1991, the situation was changed because of economic deregulation and the percentage of employment promotion in the public sector, which has been low because development initiated by the public sector has switched to that initiated by private sector. As a result, there were many reports that land acquisition did not go smoothly.

With this background, the amendment of the Act has been discussed and a new land acquisition act (Land Acquisition Rehabilitation and Resettlement (LARR)) was formulated in November 2012. But it has not been formally approved at this time (April 2013).

JICA guidelines for environmental and social considerations Appendix 1 refers “The main items which must be listed in The World Bank's environmental and social safeguard policies OP4.12 Annex A should be included in a RAP (Resettlement Action Plan)”. A comparison of the main items and survey items that are listed in the Indian land acquisition act (1894) and the World Bank policies is shown in Table 7.3.1.

Table 7.3.1 Comparison of the World Bank's environmental and social safeguard policies and Indian Land Acquisition Act (1894)

No.	The World Bank's environmental and social safeguard policies	Land Acquisition Act in India(1894)
1	Results of socio-economic research related to the resettlement	Nothing in particular.
2	Definition and eligibility requirements of compensation and support of transfers	With the implementation of the project, houses, offices and land that exist in the planning area are subject for project affected people (PAP). Public announcement is given for negotiations for land acquisition.
3	Ways of compensating and calculating loss amount	After the public announcement, asset evaluation is carried out for each PAP, the calculation of loss and the method of compensation is determined based on the survey results. The Land Acquisition Act (1894) states that “compensation cost is market price plus 30%”, there is no provision concerning "guarantees of alternative land." or "guarantee for provision of basic needs". It prescribes a "compensation premium of 30% of market price" in the current law (1894 statute), but there is no provision for livelihood security or guarantee of an alternate site.
4	Specific details of compensation and support	Compensation can be in the form of alternative land or compensation in money. Some options are proposed.
5	Housing, infrastructure, public facilities are to be provided in the area of resettlement	Nothing in particular.
6	Participation in the process by resettlement residents and the community	Explanatory meeting is held for the resettlement residents, there's no meeting with the community.
7	Handling mechanism for complaints	Nothing in particular.
8	Implementation Schedule	After public announcement, the period for negotiations of land acquisition is defined as within one year as a rule. Normally it takes 3 and 4 years to deliver the land (See. p7-27).
9	Cost estimates and Budget planning	Overall cost estimates and budget plan are considered based on the results of No. 3 and 4.
10	Overview of the monitoring and ex-post evaluation	Nothing in particular.

Source: JICA Study Team

Land acquisition in this project should follow the Land Acquisition Act (1894) because the new land acquisition act (LARR) is not approved officially. (Mr. Shinde : PMC Land Acquisition Department and Ms. Pratibha Badhane : PCMC Town Planning Department, personal communication, 2013)

2) The Land Acquisition and Rehabilitation Resettlements (LARR) Bill 2011

The Land Acquisition Act (1894) defines that "compensation cost is market price plus 30% ", there is no provision concerning "guarantees of alternative land." or "guarantee for provision of basic needs". The Government submitted the LARR to the National Assembly in September 2011 in the context of this situation. Amended items are as follows (Source : 6th Business Report, Sumitomo Corporation, October 2012). Its features include:

- (1) Defining public works specifically (national defence, public interest, disaster recovery and so on)
- (2) Not only the owners but also peasants and workers related to the land are protected.
- (3) Minimum purchase price of the land is "Compensation for farmland is four times (double in the city area) the market price or transaction price."
- (4) If a benefit is created through resale of the asset, 20% of the benefit should be returned to the original owner.
- (5) Roads, sewers, agricultural irrigation, transportation, receiving equipment, schools and installation of safe drinking water should be provided in the relocation site of the residents.
- (6) Providing a house which has prescribed width and prescribed value to the residents who resettle is mandated.
- (7) After development starts, if the employment of the household bread winner is lost, the households which must be relocated have the opportunity for "placement individually " in principle.
- (8) In addition to (7), moving expenses and adequate compensation to supply basic needs for one year are to be paid.
- (9) Compensation clauses are also applicable to large-scale land acquisition of private land.

The LARR has been created, however it has not been approved and amended formally yet. Therefore, the land acquisition in this project will follow the Land Acquisition Act (1894) (Mr. Shinde : PMC Land Acquisition Department and Ms. Pratibha Badhane : PCMC Town Planning Department, personal communication, 2013)

3) The procedures for land acquisition in PMC and PCMC

(1) The procedure of land acquisition in PMC

There are two methods to acquire the land of PMC. One is to follow The Maharashtra Regional and Town Planning Act, 1966 and the other is to follow the Land Acquisition Act, 1894.

The Maharashtra Regional and Town Planning Act, 1966

Land under DP reservation or DP Road – PMC will issue a request letter under MRTP (The Maharashtra Regional and Town Planning Act, 1966) section 126 (Compensation section) to the concerned owner. If the owner agrees to hand over the land, it is taken by PMC with a conditional receipt, which mentions the method for compensation (FSI / TDR / cash) in the form. It'll take 3 or 4 months to acquire the land by following this Act.

Land Acquisition Act, 1894

Another way for land Acquisition is to follow the Land Acquisition Act (1894). It'll take 3 or 4 years to acquire the land by following this Act.

(2) Compensation Cost of PMC

There are 3 ways for Compensation of land acquisition in PMC.

- a) Cash Compensation – This will be as per the Ready Reckoner (<http://www.readyreckoner.in/>) i.e. as per the market value of the property. This procedure will take approximately 2 years.
- b) Compensation (Alternate) Land – Alternate land as compensation under PMC is to be given to the owner for which it may take 3-4 months by mutual understanding between the two bodies
- c) FSI and TDR – This is possible only when the project is owned or planned by PMC. PMC, PCMC and MIDC conduct this project. In that case, c) is adopted.

(3) The procedure for land acquisition in PCMC

Following the procedures of the Land Acquisition Act (1894), PCMC conducts land acquisition. This takes a minimum of one and half year to acquire the land.

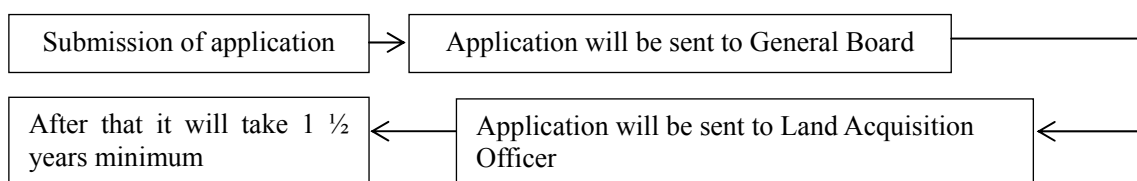


Figure 7.3.3 Process for land acquisition (PCMC)

Source: JICA Study Team

(4) Compensation Cost of PCMC

The Land Area required near NH4 for this project is not in the development plan area of PCMC so no TDR or FSI is applicable to it as compensation. The compensation of this land is only done by cash compensation that will be based on the Ready Reckoner (<http://www.readyreckoner.in/>) rate for the land + 30% + Toll money etc.

7.3.2 The area of Land Acquisition

With the implementation of this project, involuntarily-resettlement will be required. The land between St9 and St10 (Width: about 3.2m, Distance: about 80m, Area: about 256m²), St10 to Mula river (Width: about 3.2m, Distance: about 150m, Area: about 480m²) and near NH4 (Width: about 8m, Distance: about 500m, Area: about 4,000m²) are to be acquired. There's a police station and training centre between St9 and St10. Small shops, residential houses, temples and primary schools between St10 and Mula River. Near NH4, there are small shops and residential buildings.

The planned site for the depot is farmland and 11 ha. At the site, there is a factory, a school, field and residences. (See Appendix 23)

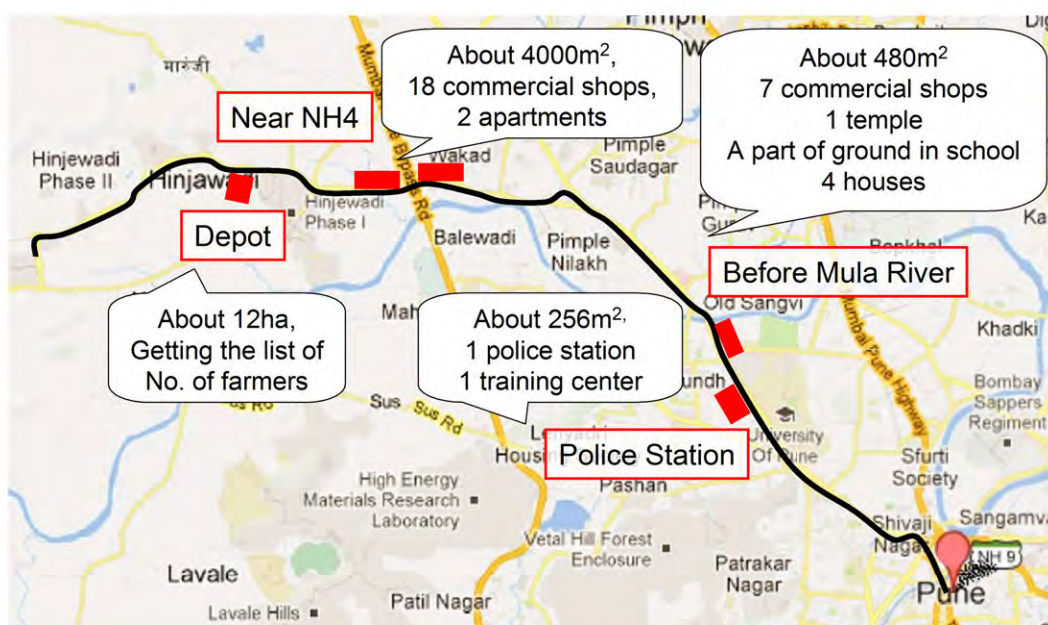


Figure 7.3.4 The locations of Land Acquisition

Source: JICA Study Team

Table 7.3.2 Land acquisition which is required for LRT project

No.	Location	Expected land acquisition areas and types of buildings
1	From St9 to St10	256m ² : a police station and a police training centre
2	From St10 to Mula river	480m ² : retail businesses, residencies, temples and a school
3	Near NH4	4000m ² : retail businesses and residencies
4	Depot	About 11 ha: a factory, a school, field and residences

Source: JICA Study Team

Table 7.3.3 The List of the area of Land Acquisition

No.	Category	Location	Note
1	Police station	St9~10	Heritage Building, Grade II
2	Police training centre	St9~10	Heritage Building, Grade II
3	Small shop	Near Mula river	
4	Retail	Near Mula river	
5	Retail	Near Mula river	
6	Retail	Near Mula river	
7	Retail	Near Mula river	
8	Retail	Near Mula river	
9	Retail	Near Mula river	
10	Temple 1	Near Mula river	The relocation of this temple is considered.
11	Steps (associated with Temple 2)	Near Mula river	Temple 2 isn't acquired.
11	Temple 2	Near Mula river	Shri Shivaji High School
12	Residence	Near Mula river	
13	Residence	Near Mula river	
14	Residence	Near Mula river	
15	Residence	Near Mula river	
16	Retail	Near NH4	
17	Retail	Near NH4	
18	Retail	Near NH4	
19	Retail	Near NH4	
20	Retail	Near NH4	
21	Retail	Near NH4	
22	Retail	Near NH4	
23	Retail	Near NH4	
24	Retail	Near NH4	
25	Retail	Near NH4	
26	Retail	Near NH4	
27	Retail	Near NH4	
28	Retail	Near NH4	
29	Retail	Near NH4	
30	Retail	Near NH4	
31	Retail	Near NH4	
32	Retail	Near NH4	
33	Retail	Near NH4	
34	Residence (Apartment)	Near NH4	
35	Residence (Apartment)	Near NH4	
36	Farmland	Depot	Plot No.360, The number of farmers: 21
37	Farmland	Depot	Plot No.361, The number of farmers: 16
38	Farmland	Depot	Plot No.362, The number of farmers: 55
39	Farmland	Depot	Plot No.363, The number of farmers: 11
40	Farmland	Depot	Plot No.364, The number of farmers: 13
41	Farmland	Depot	Plot No.365, The number of farmers: 7
42	Farmland	Depot	Plot No.366, The number of farmers: 2
43	Farmland	Depot	Plot No.367, The number of farmers: 3
44	Farmland	Depot	Plot No.368, The number of farmers: 20
45	Farmland	Depot	Plot No.369, The number of farmers: 73
46	Farmland	Depot	Plot No.370, The number of farmers: 6
47	Farmland	Depot	Plot No.371, The number of farmers: 5
48	Farmland	Depot	Plot No.372, The number of farmers: 18

No.	Category	Location	Note
49	Farmland	Depot	Plot No.373, The number of farmers: 24
50	Farmland	Depot	Plot No.374, The number of farmers: 3
51	Farmland	Depot	Plot No.375, The number of farmers: 35
52	School	Depot	SAU.C.N.D. English Medium School
53	Factory	Depot	
54	Residence(Apartment)	Depot	
55	Residence(Apartment)	Depot	
56	Residence(Apartment)	Depot	
57	Residence(Apartment)	Depot	
58	Residence(Apartment)	Depot	
59	Residence(Apartment)	Depot	
60	Field	Depot	area: about4,500m ² , variety: sorghum

Source: JICA Study Team

7.3.3 Land Acquisition along LRT route

Along the LRT Route, there're 3 places to acquire. (See Figure 7.3.2)

- 1: police station and police training centre
- 2: the place near Mula river
- 3: the place near NH4

The first and second places mentioned above are under the jurisdiction of PMC and the third is under that of PCMC. (See Table 7.3.2)

Table 7.3.4 The jurisdiction of the area where Land Acquisition is required

The area of Land Acquisition	Municipal corporation of the jurisdiction
Police station and police training centre	PMC
The place near Mula river	PMC
The place near NH4	PCMC

Source: JICA Study Team

[Buildings that require special attention]

Police station and Police training centre

The police station and police training centres are specified as Heritage Buildings (gradell). Heritage Buildings of grade II can be relocated if the permission from the police station is obtained. (See Table 7.3.3 and Figure 7.3.3)

Table 7.3.5 Listing of urban heritage buildings in Pune

Grade I	Grade II	Grade III
A. Definition		
Heritage Grade-I comprises buildings; precincts of national or historical importance, embodying excellence in architectural style, design, technology and material usage; they may be associated with a great historical event, personality; movement or institution. They have been and are, the prime landmarks of the city.	Heritage Grade-II [A and B] comprises buildings of regional or local importance, possessing special architectural or aesthetic merit, cultural or historical value, though of a lower scale than in Heritage Grade. They are local landmarks contributing to the image and identity of the City. They may be the work of master craftsmen, or may be models of proportion and ornamentation, or designed to suit a particular climate.	Heritage Grade-III comprises buildings, and precincts of importance for townscape; they evoke architectural aesthetic or sociological interest though not as much as in Heritage Grade II. These contribute to determine the character of the locality, and can be representative of the life style of a particular community or region and may also be distinguished by setting on street-line or special character of the façade and uniformity of height, width and scale.
B. Objective		
Heritage Grade-I richly deserves careful preservation.	Heritage Grade-II deserves intelligent conservation.	Heritage Grade-III deserves protection of unique features and attributes.
C. Scope for Changes		
No interventions would be permitted either on the exterior or interior unless it is necessary in the interest of strengthening, and prolonging the life of the buildings, precincts or any part or features thereof. For this purpose, absolutely essential and minimal changes would be allowed and they must be in accordance with the original.	Grade-II Internal changes, and adaptive reuse will generally be allowed, but external changes will be subject to scrutiny. Care should be taken to ensure the conservation of all special aspects for which it is included in Heritage Grade-II [Grade-II-B] In addition to the above, extension or additional buildings in the same plot or compound could, in certain circumstances, be allowed provided that the extension/ additional building do not detract from the existing heritage building(s) or precincts, especially in terms of height and facade.	External and internal changes and adaptive reuse would generally be allowed. Changes can include extensions, additional buildings in the same plot or compound provided that the extension/ additional building is in harmony with and does not detract from the existing heritage. Building/precinct especially in terms of height and/ or façade. Reconstruction may be allowed when the building is structurally weak or unsafe or when it has been affected by accidental fire or any other calamity or if consume the permissible FSI and no option other than reconstruction is available. However, unless absolutely essential, nothing should spoil or destroy any special features or attributes for which it is placed in the Heritage List.
D. Procedure		
Development permission for the changes would be given by the planning authority on the advice of the Heritage Conservation Committee to be appointed by the State Government.	Development permission for the changes would be given by the Planning Authority in Consultation with a sub-Committee of the Heritage Conservation Committee.	Development permission would be given for changes by the Planning Authority itself but in consonance with guidelines, which are to be laid down by the Government in Consultation with the Heritage Conservation Committee.
E. Vitas/ Surrounding development		
All development in areas surrounding Heritage Grade-I shall be regulated and controlled, ensuring that it does not mar the grandeur of or views from, Heritage Grade-I.		

Source: PMC

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LISTING OF HERITAGE BUILDING IN PUNE (PMC)
Grade - II

Sr.No.	Title	Location	Usage	Grade	Classification
102.	115 Ruia Bungalow	115 Koregaon Park	Residential		A(arc), G(grp), D(des) I(sec)
103.	85 Koregaon Park	85 Koregaon Park	Residential		A(arc), G(grp), D(des) I(sec)
104.	104 Morvi House	121 Koregaon Park	Residential		A(arc), G(grp), D(des) I(sec)
105.	M.G. Nagarwala	86 Koregaon Park	Residential	II	A(arc), D(des), I(sec) G(grp),
105.	Aundh Moter Vahan	Aundh	Howky	II	A(arc), BC(per), B (des)
107.	Nanath Par	Phatak Gauri	Religious	II	C (seh)

Figure 7.3.5 Grading of the listed precincts

Source: PMC

Temples

There are two temples. For temple 1, the area containing the steps leading to the temple must be acquired, but the temple itself does not have to be acquired. PMC has a relocation plan for temple 2, but its land owner and the trustee are not agreeing with the compensation, so the issue is pending. (March 2012)



Picture 1 (Temple 1)



Picture 2 (Temple 2)

7.3.4 Land Acquisition in the Depot area

The depot site is about 12ha, the area is divided into small sections as shown in Figure 7.3.3. MIDC will conduct an EIA for the Depot following JICA guidelines. Presently, MIDC is carrying out negotiations for land acquisition in the IT Park including the Depot area. More than 1,000 farmers' houses must be resettled and the negotiations are proceeding with difficulty. (November 2012, Sameer, Personal Communication, 2012) In principle, land acquisition of farm land is allowed by farmers or the state government in Maharashtra, therefore usual developers cannot acquire the farm land directly. In the case of an IT Park, the state government acquires the land and changes the permitted use of the

land from farming to other purposes. After that, the state government leases the land to private companies (for example, lease period is for 99 years.)

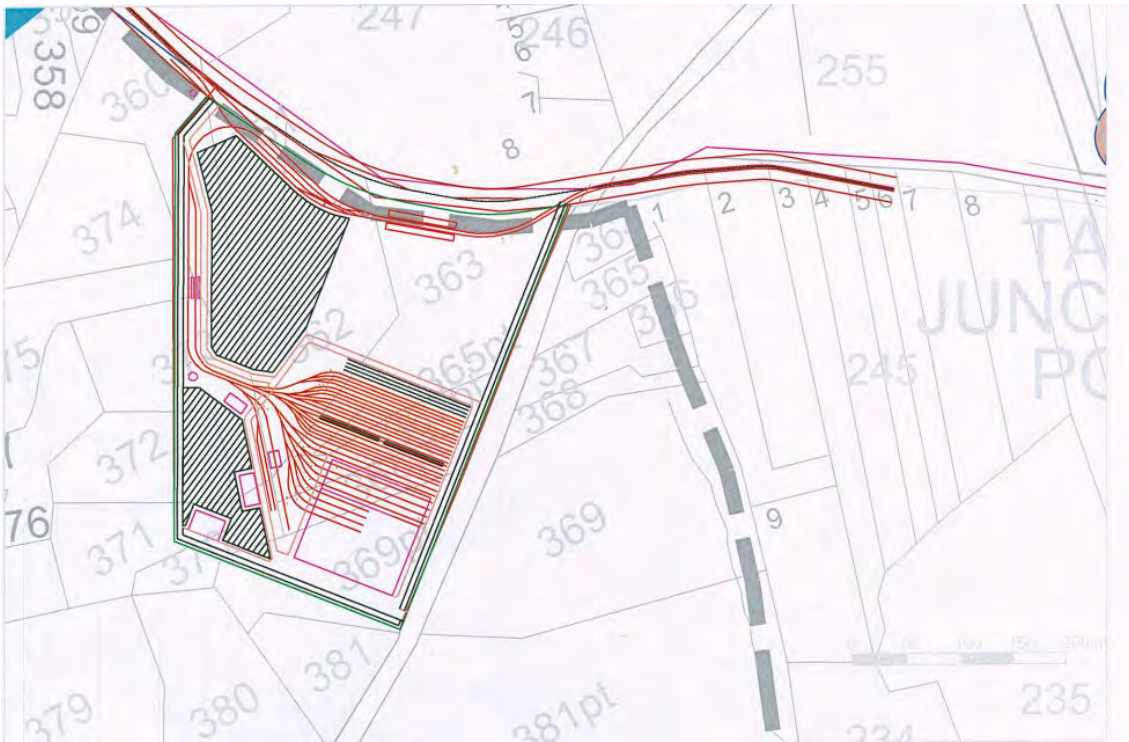


Figure 7.3.6 Plots in Depot

Source: JICA Study Team

The site has a factory, a school, fields and residences.

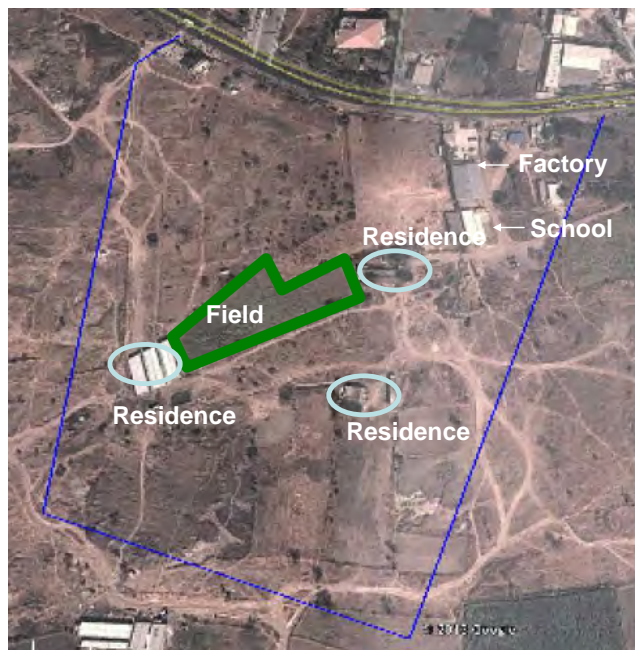


Figure 7.3.7 The locations of fields and buildings

Source: JICA Study Team

The number of farmers

Farmers own the area that is planned for the Depot, but some farmers share a single plot. (See Table 7.3.3)

Table 7.3.6 The number of farmers in each plot

Plot No.	The number of farmers
No.360	21
No.361	16
No.362	55
No.363	11
No.364	13
No.365	7
No.366	2
No.367	3
No.368	20
No.369	73
No.370	6
No.371	5
No.372	18
No.373	24
No.374	3
No.375	35
	Total 312

Source: JICA Study Team

Crop

The crop in the area planned for the depot is only Sorghum and crop acreage is 4,500m². The land is not fertile, therefore most farmers do not grow crops in the area.

**Figure 7.3.8 Sorghum**

Source: JICA Study Team

7.4 Vehicular Emission (CO₂) Study

7.4.1 Introduction

City-wide CO₂ vehicular emission is estimated for the following two scenarios; i.e., **with-** and **without** the proposed LRT project, based on the study results of the future traffic demand forecast. It is noted that CO₂ emission loading from both airplanes and the railways are excluded from this study. The computation of CO₂ emission loading itself is conducted automatically within the software called CUBE used for the future traffic demand forecast that incorporates various vehicle emission factors currently used in India. Here, the following five types of vehicles such as (i) motor bikes (TW), passenger cars (Car), (iii) Rickshaws (Auto), (iv) BRT buses, and (v) feeder buses, are of concern.

7.4.2 Results

Figures 7.4.1 and 7.4.2 show city-wide CO₂ loadings for (i) With LRT Scenario, and (ii) Without LRT Scenario, respectively. As shown in these figures, the magnitude of CO₂ loadings emitted from both passenger cars and motor bikes are dominant.

Figure 7.4.3 shows achievement rates of CO₂ reduction, to be caused by the implementation of the proposed LRT project. From this figure, it can be seen that the impacts on the reduction of CO₂ emission loading from both rickshaws and feeder buses are significant but not for the loading from motor bikes.

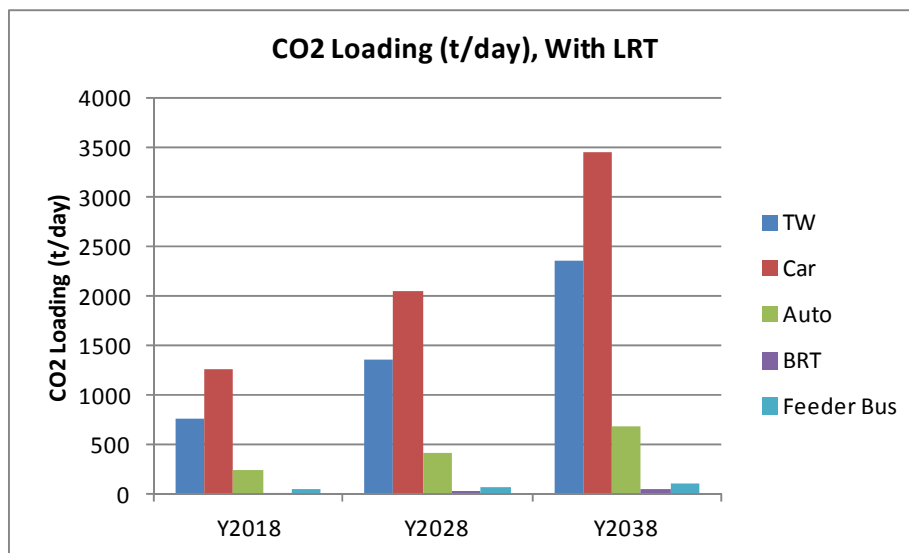


Figure 7.4.1 CO₂ Emission Loading by vehicle Type (With LRT Project)

Source: This Study, 2012

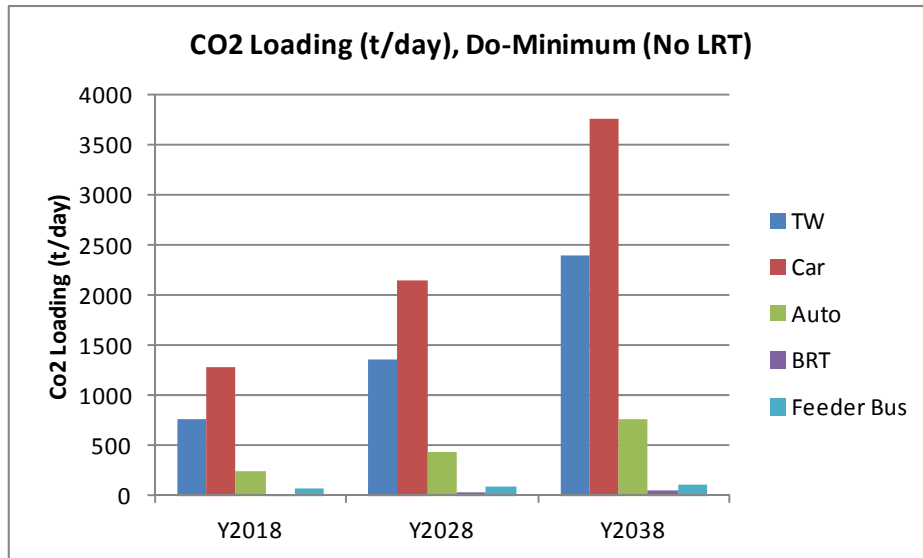


Figure 7.4.2 CO₂ Emission loading by vehicle Type (Without LRT Project)

Source: This Study, 2012

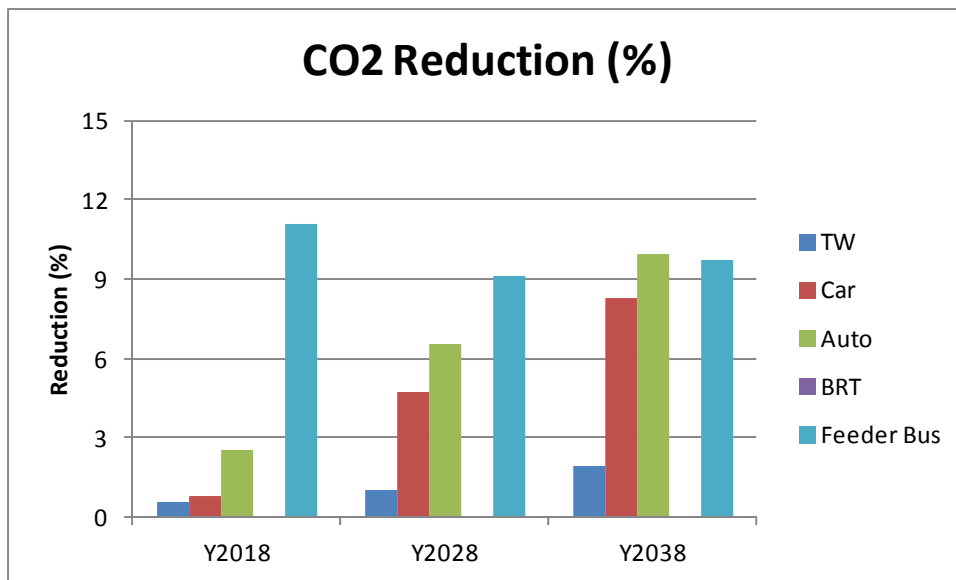


Figure 7.4.3 CO₂ Reduction Rates

Source: This Study, 2012

7.5 ToR Development for relevant environmental study

7.5.1 Introduction

Successful environmental approval for the proposed LRT Construction project is very important for its smooth project implementation. The application of this environmental approval shall be based on both Indian environmental laws and/or regulations (see Section 7.1 for more detailed descriptions) and the JICA Guideline for Social and Environmental Considerations (revised in 2010, hereinafter referred

to as JICA Guideline). As mentioned earlier, it is not a mandate to carry out an EIA study for any railway construction projects in India. However, upon considering both the spatial and temporal scale of potential negative impacts that could be caused by the implementation of the proposed project, it is recommendable to conduct appropriate environmental and social studies as a part of a successful feasibility study, which is to be conducted after this preparatory study. Also, it is important to establish engineering integrity with several on-going transport projects such as the Metro, BRT, as well as an IT Park Development Project.

Within this project, the LRT Depot (Site Area = approximately 11 ha) is to be constructed around the proposed # 18 LRT Station. There are a factory, a school, fields and residences in the depot area (References: Chapter 7.3) Currently, land take negotiations including this depot construction site are on-going by MIDC, but it is reported that the entire negotiation process faces several difficulties and is almost halted for the time being. In general, recent large-scale public works-related land take negotiations conducted in Maharashtra Province are in difficult situations, and several riots were reported to have occurred. Although the land take process is one of the undertakings of MIDC, it is essential to conduct a series of follow-up studies such as the monitoring of the land take negotiation process and a post land take social study for PAPs such as shop owners and farmers as one of the possible joint studies between JICA experts and MIDC. It is also recommended to develop a comprehensive land take negotiation process throughout a series of discussions between MIDC and JICA. Following are major critical documents and/or issues to be addressed for this environmental approval application.

- | |
|---|
| <ol style="list-style-type: none">1. Environmental Impact Assessment (EIA, see Section 7.1)2. Resettlement Action Plan (RAP, see Section 7.3)3. Application of Trees Cutting (see Section 7.2) |
|---|

Among of them, the preparation of EIA documents is one of the most important processes, and ToR for an appropriate EIA study shall be developed and be approved by the relevant environmental agency prior to its implementation. It is noted that the Expert Appraisal Committee (EAC) of Maharashtra Province is a competent environmental organization within this approval process. So, it is crucial to have a series of discussions with this organization to determine the most suitable EIA study.

In this section, several key directions for ToR development are discussed, and then, the draft ToR for suitable environmental and social studies for EIA is summarized. These EIA-related studies would be part of the feasibility study, to be conducted at the next project cycle of this proposed LRT Construction Project. Basically, any areas which would receive potential negative impacts that could be caused during both the construction and operation phases of this proposed project, are regarded as areas of concern (AOC) for these environmental and social studies. This AOC is categorized as either of “directly influenced” or “indirectly-influenced” areas, depending on the magnitude of potential negative impacts (see Section 7.5.2 for more detailed descriptions).

It is noted that the ToR for the RAP study is not finalized since the land take process including resettlement is one of the undertakings of MIDC but several suggestions for a successful land take process are summarized. As mentioned earlier, it would be most likely to need large-scale land take within the proposed LRT construction project, and those project sites shall be obtained by harmonious and peaceful ways that would not use forced involuntary relocation and/or removal of any properties. In order to conduct successful land take negotiations, it is important to grasp the precise current socio-economic baseline condition of PAPs as well as to establish well-organized stakeholder meetings and an information disclosure program in order to smoothly achieve project consensus among the various stakeholders. Fundamental directions for this successful land take for the proposed LRT project are summarized in Section 7.5.5.

7.5.2 Directions for Environmental Management Program

Table 7.5.1 summarizes relevant environmental management directions for environmental factors, evaluated as either of “A” or “B” within the environmental scoping results (see Tables 7.2.3 and 7.2.4 for more detailed descriptions).

Table 7.5.1 Environmental Management Directions

	Env. Factors	Environmental Management Directions
1	Involuntary Resettlement	There're 25 retails, 6 residences, a school, a police station, a police training center and 2 temples along the LRT route to acquire. Also in depot, residences, a factory, a school should be acquired. A comprehensive RAP study shall be conducted and its relevant follow-up monitoring program shall be established.
2	Local Economy	The local economy along most of the LRT project alignment is active (note that the exact number of those PAPs is unknown). Prior to the construction, the comprehensive socio- economic conditions of those affected areas shall be analysed. Also, it is important to establish a follow-up study to monitor recovery of regional socio-economic activity during and after the construction phase
3	Land use and Utilization of Local Resources	Large-sale agricultural lands are to be expropriated for depot construction. Thus, it would affect both surrounding land-use and local resources during and after construction. Prior to the construction, comprehensive socio-economic conditions of those affected areas shall be analysed. Also, it is important to establish a follow-up study to monitor the recovery of the regional socio-economic activity during and after the construction phase.
5	Existing social infrastructures and services	During the construction phase, local traffic jams are expected to occur temporarily. In particular, traffic jams around both proposed route from St1 to St 5 (i.e., intersection near Pune University) and the intersection with NH4 will be significant. A comprehensive traffic diversion plan and construction schedule shall be developed in order to lessen these negative impacts on surrounding areas. The new BRT line (planned) will partially run through the same road. It is essential to have engineering integrity between both projects. Several power line facilities exist near the LRT alignment. Proper considerations shall be given to those existing facilities.
11	Public health	Occurrence of long-term inundated areas, to be generated during both construction and operation phases shall be avoided in order to lessen the outbreak of mosquitoes. Therefore, a pest management program for both proper working environment and sound public health for nearby communities shall be developed.
12	Infectious Disease (e.g., HIV/AIDS)	Risks to have infectious diseases such as insect-borne diseases (e.g., Malaria), water-borne diseases, HIV/AIDS and others for construction workers exist. Comprehensive public health and occupational safety programs for construction workers shall be established and implemented periodically.

	Env. Factors	Environmental Management Directions
16	Hydrology	It is likely to have a large-scale ground surface physical change due to LRT depot construction. This may cause impacts on local hydrological and weather conditions, in particular, sites around the depot construction site. Flood risk of Mula River exists and local run-off change due to this ground surface change may worsen local flood risk. It is important to have a hydrological study around the project site while assessing local flood/or inundation risk. Based on this study, a comprehensive flood mitigation program (e.g., installation of flood warning system) shall be established.
19	Weather	
18	Flora/fauna	Pune City is famous as the "green city" in India, and there is a provincial bylaw to protect urban trees and/or vegetation therein. In the proposed LRT project, it is likely that a certain amount of trees located near the project alignment shall be cut down/or relocated, and those processes need approval from the authorities. To obtain these approvals, a study that would summarize tree inventory and baseline condition as well as an evaluation of the possibility of tree relocation shall be conducted. Also, it is expected to cause a local townscape change by cutting roadside trees as well as set-up of LRT facilities such as viaducts and stations. The LRT project itself may have the potential to improve the amenity of the townscape as a regional landmark. It would be better to conduct a visual impact study, using CG, and its amenity shall be discussed with surrounding local communities.
20	Landscape	
22	Air Quality	Risks to cause temporary degradation of the roadside air quality due to increased local traffic volume by circulation of construction vehicles and traffic jams to be caused by traffic diversions during the construction phase exist. It is essential to conduct long-term roadside air quality monitoring (e.g., PM2.5, PM10, CO and NOX) for the preparation, construction and operation phases of the proposed LRT project while preparing an anti-air quality degradation program (e.g., water sprinkling for roadside dust).
23	Water Quality	It is expected to create a certain amount of effluents such as used lubricants and detergents in the proposed depot site. Many agricultural lands exist around the proposed depot site, and thus, a proper wastewater treatment plant and/or program shall be established in order to prevent water pollution around those areas.
25	Wastes	A certain amount of construction wastes are expected to be generated, and thus, it is essential to prepare proper waste disposal sites for treatment. Some of those wastes may be toxic for human health, so that a comprehensive waste treatment framework shall be developed based on the types of wastes to be generated. Safe battery disposal and/or recycling systems and the market for them have been established in India. However, the recycling and/or disposal system for the lithium-ion battery cells is at the rudimentary stage (note that it is probable that its capacity will be improved in near future). And thus there is a need to establish a disposal system based on international standards instead for the time being. Several pieces of electronic equipment are to be used for the proposed LRT project, and their disposal shall abide provincial e-waste guidelines.
26	Noise/Vibration	Similar to "Air Quality", risks to cause temporary degradation of roadside noise/vibration levels due to increased local traffic volume by circulation of construction vehicles and resultant traffic jams to be caused by traffic diversion during the construction phase exist. It is essential to implement long-term roadside noise/vibration monitoring (e.g., Leq and L10) for the preparation, construction and operation phases of the proposed LRT project while preparing an anti-noise/vibration program (e.g., set-up of noise barriers).
28	Obnoxious smells	During the construction phase, local drainage around the project site may be worsened, and thus, cause temporary inundation. This may cause obnoxious smells (e.g., compost smell) and outbreak of mosquitoes if the inundation lasts for a long time. Daily check of those events around project sites shall be incorporated within the EMP and the risk to cause those inundations shall be minimized.
30	Accidents	During the construction phase, risks of worsened traffic accidents due to increased local traffic volume by circulation of construction vehicles and resultant traffic jams by traffic diversion exist. A well-organized construction schedule shall be developed in order to lessen those risks. A safe driver education program shall be established and implemented for construction workers. As mentioned earlier, local flood risk exists, and thus, it is essential to develop a comprehensive regional drainage program, in particular, around agricultural lands around the depot construction site.

Source: This Study, 2013

7.5.3 Areas of Concern for EIA Study

Areas of concern (AOC) for the relevant EIA study shall be delineated based on both the engineering and environmental features of the proposed project. This AOC shall include both “directly influenced” and “indirectly influenced” areas, reflecting both spatial and temporal scales of potential negative impacts to be caused by the project implementation. After delineating the AOC, an appropriate ToR for the EIA study shall be developed. It is noted that this ToR shall be approved throughout a series of discussions with MPCB and ESA prior to implementation of the EIA study.

There is no specific direction for AOC demarcation in India, yet. Within EIA studies for the BRT extension projects of Pune, boundaries of the “directly influenced” area are set at 500 meters from both sides of the project centreline. As a result, a narrow strip with a total band width of 1,000 meters was defined as the “directly influenced” area, and then, relevant environmental and social studies were conducted for these BRT extension projects (Sawant, personal communication, 2012). It can be said that the beneficiaries (or influenced area) of the LRT project is identical to that of the BRT project, so that a similar 500 meter demarcation rule of AOC is applied to this LRT project. Figures 7.5.1 – 7.5.3 show the draft AOC for the EIA study for the proposed LRT project, based on these rules. It is noted that the boundaries of AOC are located 500 meters from the outermost perimeters of all combined project components (i.e., (i) LRT line, and (ii) LRT Depot Station), and the exact AOC delineation shall be conducted based on the final study results of the basic design.

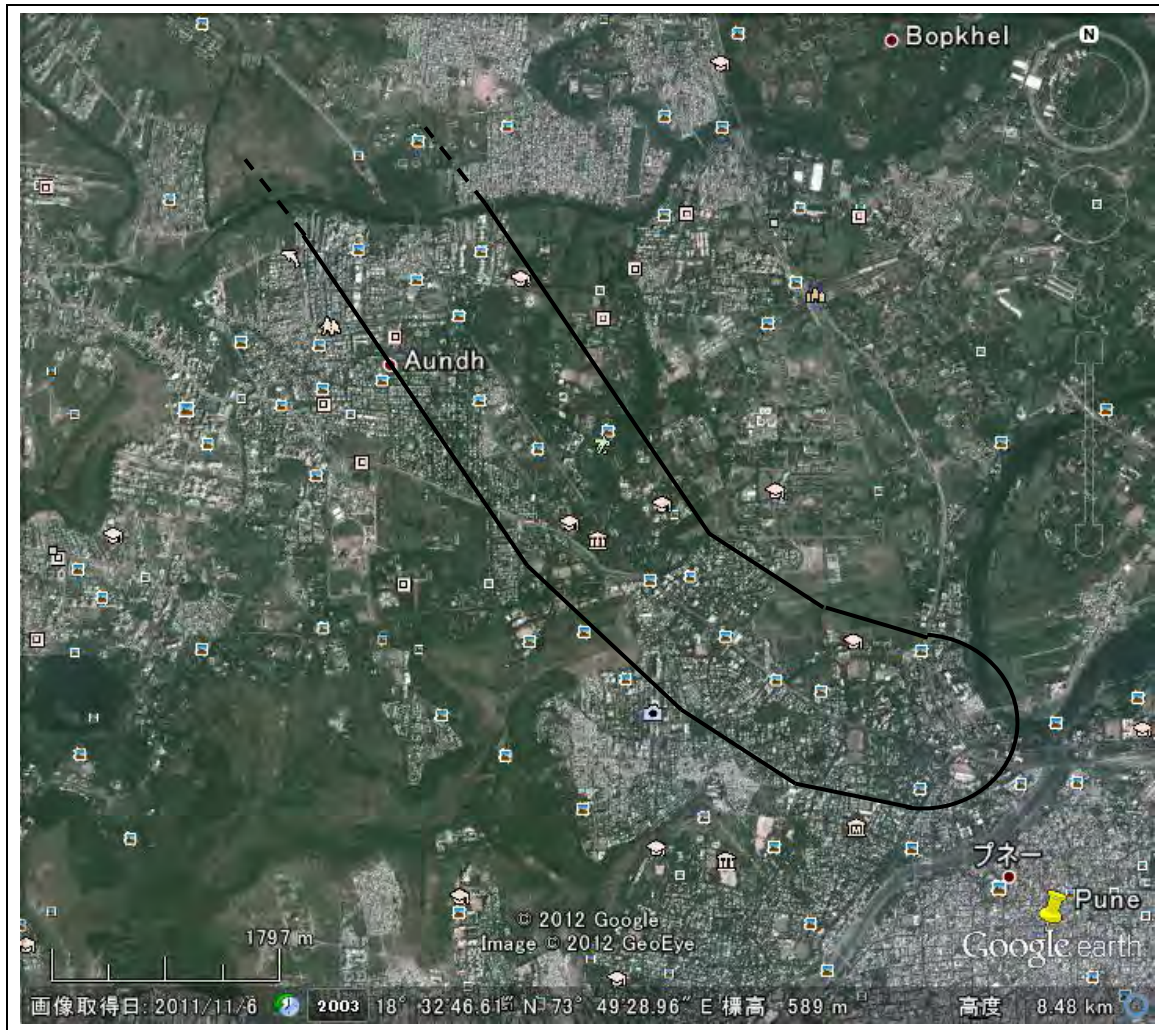


Figure 7.5.1 OC of Relevant EIA Study (estimated, part 1, PMC Area: Station 1 - 10)

Note: Solid lines drawn in this figure indicate the boundary of AOC, to require an EIA Study of the proposed LRT Project (estimated). Basically, those boundaries are located 500 meters from the project alignment.

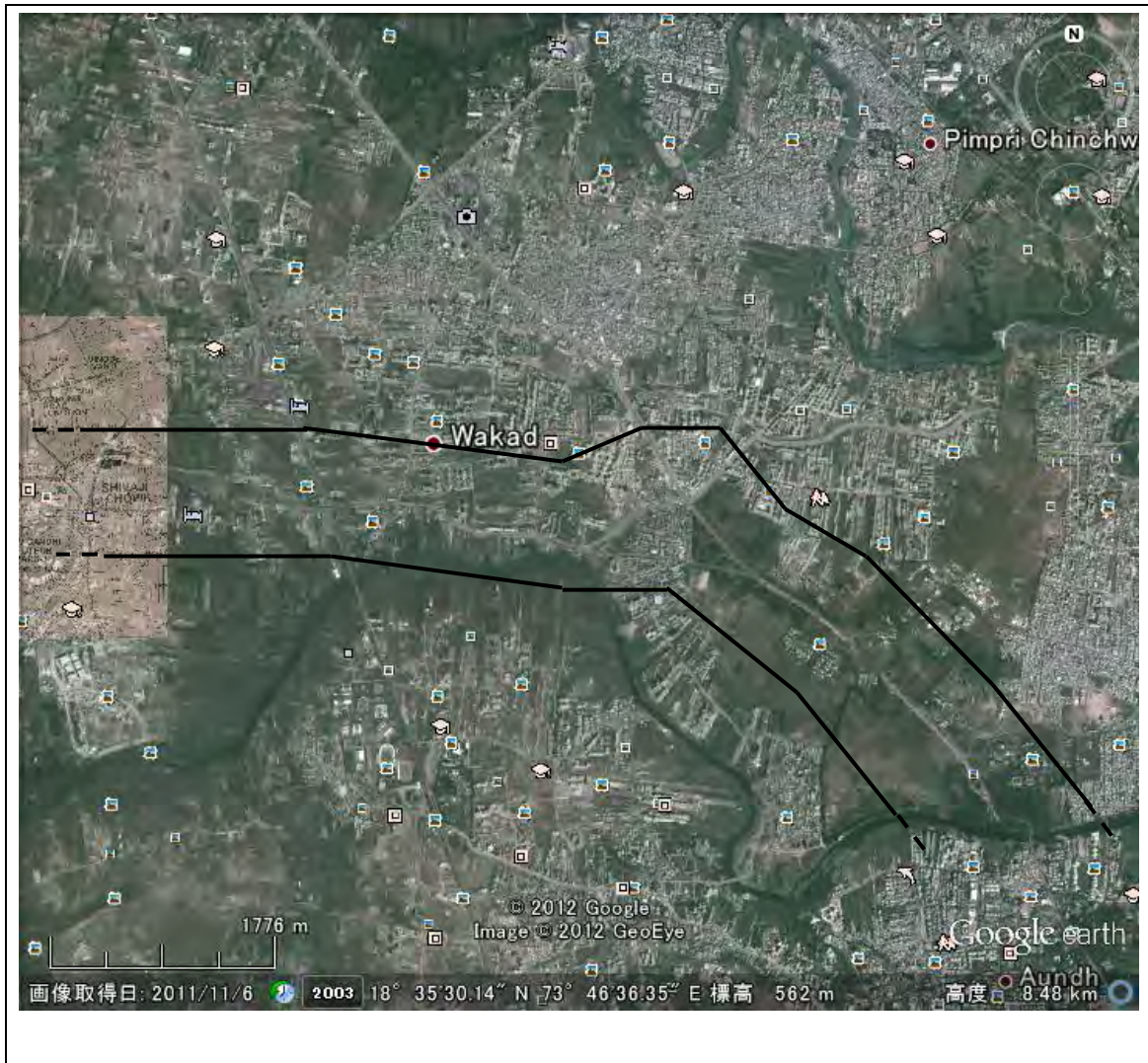


Figure 7.5.2 AOC of Relevant EIA Study (estimated, part 2, PCMC Area: Station 10 - 18)

Note: Solid lines drawn in this figure indicate the boundary of AOC, to require an EIA Study of the proposed LRT Project (estimated). Basically, those boundaries are located 500 meters from the project alignment.

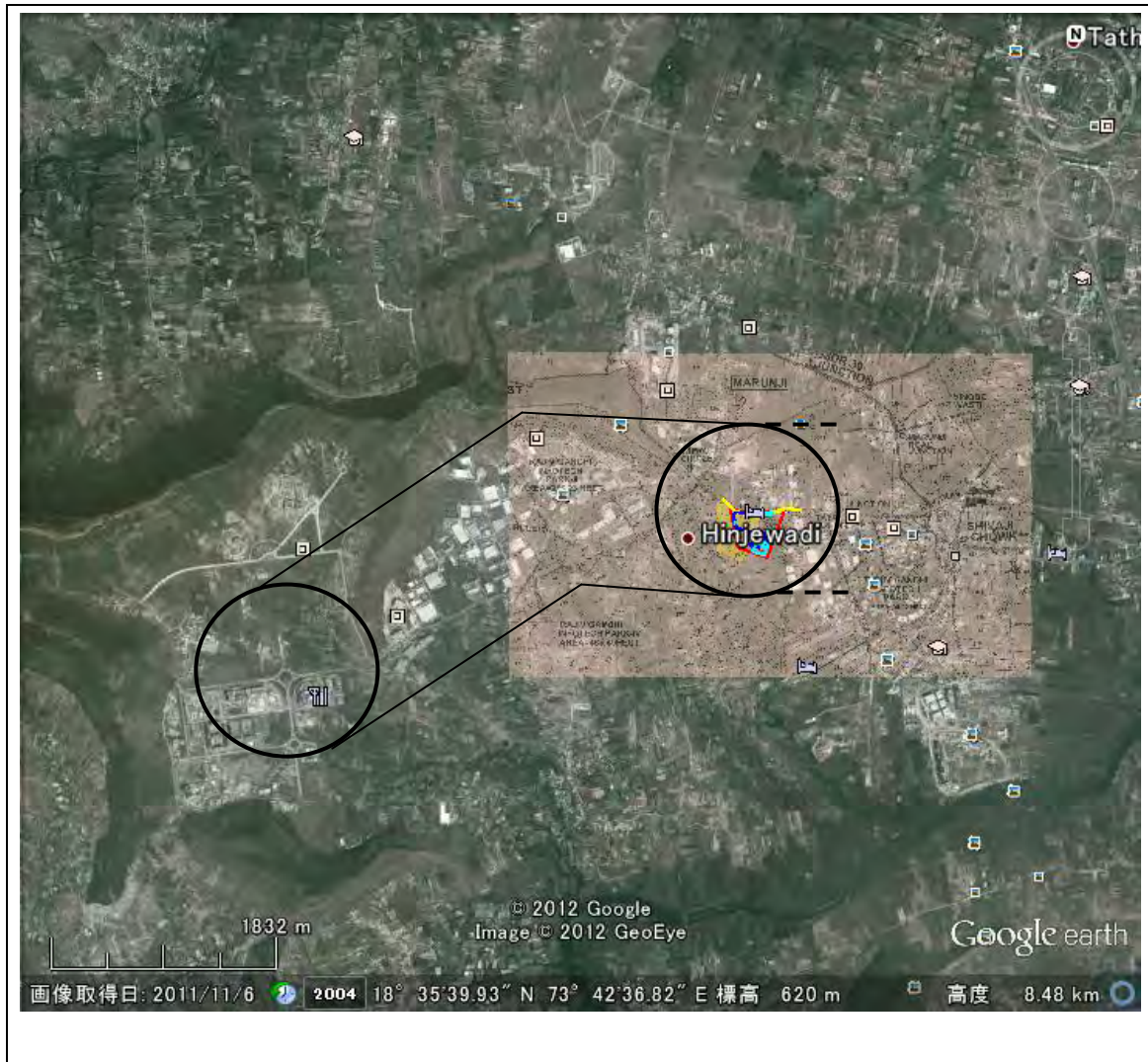


Figure 7.5.3 AOC of Relevant EIA Study (estimated, part 3, IT Park: Station 18 - 21)

Note: Solid lines drawn in this figure indicate the boundary of AOC, to require an EIA Study of the proposed LRT Project (estimated). Basically, those boundaries are located 500 meters from both project alignment and the boundary of LRT depot station.

7.5.4 ToR (Draft)

1) Major Study Tasks

Based on the preliminary environmental scoping results, summarized in Tables 7.2.3 and 7.2.4, a draft ToR for the EIA study, to be conducted within the following feasibility study, is developed. Basically, this ToR development is carried out abiding by EIA Law and/or relevant environmental regulations of India and the JICA Guideline.

Table 7.5.2 summarizes major tasks of the EIA study to be required for the proposed LRT Project. More detailed descriptions of this ToR are attached in Appendix 1. In Pune, environmental monitoring of several parameters such as the roadside air quality and the water quality has been conducted periodically since 2004 (see Table 7.2.1). Those monitoring results and/or database shall be incorporated in the baseline environmental information collection work, listed in Table 7.5.2.

Table 7.5.2 Major Tasks of Environmental and Social Consideration Study

	Major Tasks to be conducted
1	Descriptions of Baseline Environmental Condition
2	Environmental Field Survey
3	Social Survey
4	Environmental Impact Assessment
5	Environmental Mitigation
6	Environmental Management
7	Environmental Monitoring
8	Public Involvement

Source: This Study, 2013

Tentative schedules of the EIA study are summarized in Table 7.5.3. It is assumed that relevant procurement process for the EIA study covering from the tender process to mobilization would take two months, and another ten months would be required for implementation of this study.

The draft ToR of the EIA study, mentioned above, will be developed, based on the engineering study results, tentatively summarized in March, 2013. So, it is important that the proposed draft ToR for the EIA study shall be updated and/or revised once any modifications and/or new developments in engineering design work of the proposed project would occur after March 2013.

Table 7.5.3 Study Schedule of EIA Study (Estimated)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
	(month)														
1. EIA Tender Preparation.	_____														
2. Selection of EIA Consultants	_____														
3. EIA Study	_____														
4. EIA Examination												_____			
5. Public Consultation												_____			
6. EIA Approval														☆	
7. Tree-cutting Permit Approval														☆	
8. Environmental & Social Monitoring														-----	

Note: It is assumed that the EIA study including a tree cutting related study (Steps 3 of Table 7.5.3) would take ten months.

Source: This Study, 2012

2) Cutting of Roadside Trees

As described in both the environmental checklist (see Table 7.2.2) and the environmental scoping (see Tables 7.2.3 and 7.2.4), it is highly likely that several roadside trees would be obstacles for the project implementation, therefore, they must be relocated and/or be cut down. Pune City has a reputation as the “green city” in India, and the relocation (not cutting down) of urban trees is highly recommended within any infrastructure development project (Urban Trees Conservation Act of Maharashtra Province, enacted in 1975 and revised in 2004). If there is no alternative but to choose only the trees cutting option, then, the project owner will have to plant three to five new trees for every tree cut (note: amongst, at least three trees of those newly planted trees shall survive three years after those plantings. If the tree relocation option is selected, then, it is required to have a detailed tree inventory study covering floral species, age, size, original planting condition and potential relocation candidate site prior to the tree relocation. Figure 7.5.4 shows past tree relocation and planting cases conducted in Pune City. Within this study, this tree related study is incorporated as part of the EIA study (see Appendix 1).

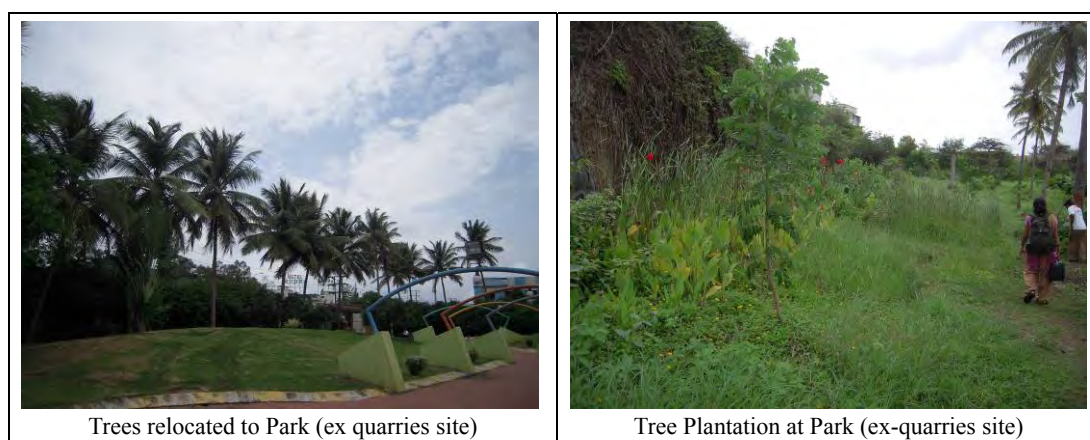


Figure 7.5.4 Relocation of Trees and/or Tree plantation within Past Development Projects in Pune (Photos taken in August, 2012)

Source: This Study, 2013

3) Green Building

According to the green conservation bylaw of Maharashtra Province a certain amount of green space should be set up within the design of new large-scale facilities. For instance, at least a quarter of the entire project site shall be allocated as a “green area” when the area of the overall construction site is larger than 2,000m². Additionally, it is specified that one tree shall be planted for every 80 m². Also, it is required to use domestic floral species, not invasive species for the design of this green space (see Appendix 2 for more detailed descriptions of the list of domestic floral species to be used for the design of green space).

4) Floods of Mula River

Figure 7.5.5 shows the local geomorphology of the Mula River running through Wakad, PCMC. As shown in this figure, the project alignment is only approximately 30 meters from the riverbank of the Mula River around the river bending point, circled within this figure. The Mula River is meandering (i.e., morphologically bending) across the floodplain around the project alignment, so that the outside river flow around this bend tends to be accelerated and may cause enhanced erosion along the north side river bank and/or local inundation across the nearest floodplain during the rainy season. One causeway is situated approximately 400 meters downstream from this river bank (see Figure 7.5.6), and this causeway is occasionally flooded during every rainy season. Local people said that the overflow depth at this causeway is approximately 1 meter. No measured flow rate data exists around this site. At this moment, the magnitude of the potential impact of the Mula River’s flood is hard to estimate. So, it is preferable to have a more detailed hydrological analysis (e.g., use of numerical simulation) to analyse the precise river flow and evaluate the flood risk quantitatively during the rainy season.



Figure 7.5.5 Mula River and LRT Alignment

Note: Dotted white line drawn in this figure indicates LRT alignment. The distance between the Mula River and LRT alignment is narrower at the bend (see circle in figure, shown in this figure) than anywhere else along the entire project alignment. No riverbank reinforcement is constructed and some parts of the Mula River floodplain occasionally flood every rainy season.

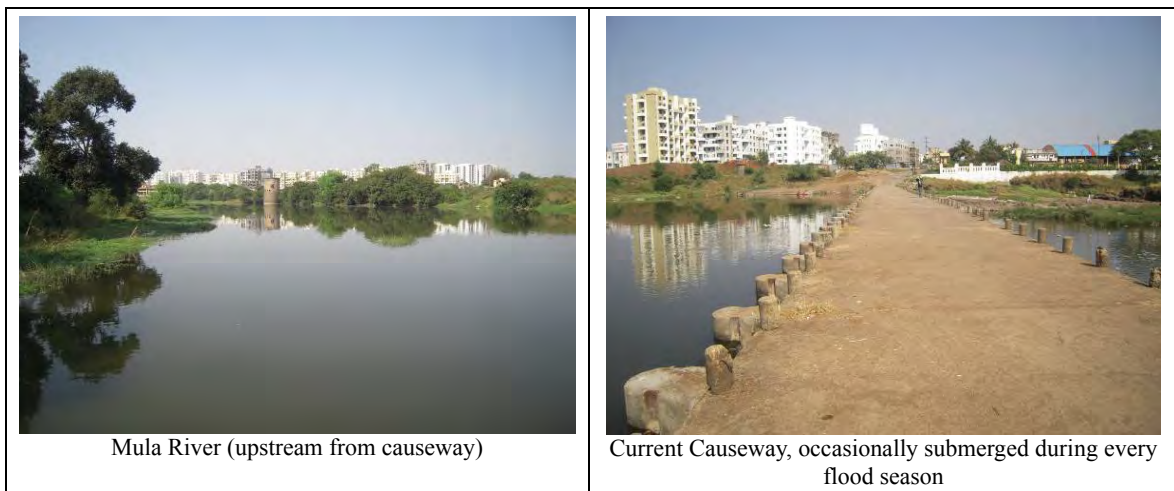


Figure 7.5.6 Mula River around causeway (photo taken in November 2012)

Note: these photos were taken at the causeway located 400 meters downstream from the Mula River's bend shown in Figure 7.5.5.

7.5.5 Technical Support for Successful Land Take Process

As mentioned earlier, the land take required for the construction of the proposed LRT project is one of the undertakings of MIDC. Recently, occurrences of several disputes and/or conflicts relating to the land take negotiations of private properties such as houses, shops and agricultural land due to development projects have been reported in Maharashtra State, and some of those projects are suspended for the time being although the relevant legal framework for the land expropriation is clearly specified in India (see Section 7.3). So, it is important to conduct a relevant follow-up study to monitor PAPs such as farmers who are to lose their agricultural lands due to the implementation of the proposed LRT project and that follow-up study shall be conducted as the joint study of both MIDC and JICA. Also, it is essential to establish proper information disclosure and stakeholder meeting framework prior to the land take process and the design of this framework shall be conducted through a series of discussions between MIDC, EAC and JICA.

Table 7.5.4 summarizes a tentative schedule of the land take process to be required for the proposed LRT project, based on current land expropriation law. As summarized in this table, the public meeting is to be held just after Task 2 (i.e., notification). From the legal point of view, any objections and/or comments can be filed in the court in India, and a final ruling for the land expropriation is to be made within 1 year after the first notification. It is noted that a large-scale of agricultural land would be expropriated for the proposed LRT project, and chances to face unexpected events that may prolong the entire land take process are not negligible unless comprehensive support framework for the land take negotiation process covering proper information disclosure, public meetings, baseline socio-economic study, follow-up study and others are developed.

It is important to grasp the correct socio-economic framework of the PAPs, and sample socio-economic survey sheets are attached in Appendix 3.

Table 7.5.4 Schedule of land take Process (tentative)

Task	2	4	6	8	10	12	14 (months)
1. Investigation	_____						
2. Notification		—					
3. Filing of objections (negotiation)			_____				
4. Final declaration			-----			☆	
5. Award							☆

Note: This draft schedule is made based on the land take law of 1894 in India. Community explanations and/or public meetings are to be held just after Task 2 (notification). Final ruling for the entire land take is to be made within 1 year after the first notice. However, upon considering the geographic features of the proposed construction sites, chances to face unexpected events that may prolong the entire land take process are negligible.

Under current law (1894) it is stipulated that 'Compensation cost has a 30% surcharge over market price'. However, there is no provision for guarantee of an alternate site or livelihood security.

There are problems with land acquisition in public works, for example, construction of dams and agricultural land reforms. Constructing facilities for the public is easy for residents to understand and share relatively; also some of the affected people were guaranteed to be given priority in employment in the public sector. After 1991, the situation was changed because of economic deregulation and the percentage of employment promotion in the public sector, which has been low because development initiated by the public sector has switched to that initiated by the private sector. As a result, there were many reports that land acquisition did not go smoothly.

With this background, the amendment of the Act has been discussed and a new land acquisition act (Land Acquisition Rehabilitation and Resettlement (LARR)) was formulated in November 2012. But it has not been formally approved at this time (April 2013).

JICA guidelines for environmental and social considerations Appendix 1 refers "The main items which must be listed in The World Bank's environmental and social safeguard policies OP4.12 Annex A should be included in a RAP (Resettlement Action Plan)". A comparison of the main items and survey items that are listed in the Indian land acquisition act (1894) and the World Bank policies is shown in Table 7.5.5.

Table 7.5.5 Comparison of the World Bank's environmental and social safeguard policies and Indian Land Acquisition Act (1894)

No.	The World Bank's environmental and social safeguard policies	Land Acquisition Act in India (1894)
1	Results of socio-economic research related to the resettlement	Nothing in particular.
2	Definition and eligibility requirements for compensation and support of transfers	With the implementation of the project, houses, offices and land that exist in the planning area are subject for project affected people (PAP). Public announcement is given for negotiations of land acquisition.
3	Ways of compensating and calculating loss amount	After the public announcement, an asset evaluation is carried out for each PAP, the calculation of loss price and the method of compensation is determined based on the survey results. The Land Acquisition Act (1894) states that "compensation cost is market price plus 30%", there is no provision concerning "guarantees of alternative land." or "guarantee for provision of basic needs". It is prescribed that there is a "compensation premium of 30% of market price" in the current law (1894 statute), but there is no provision for such livelihood security or guarantee of alternate site.
4	Specific details of compensation and support	Compensation can be in the form of alternative land or compensation in money. Some options are proposed.
5	Housing, infrastructure, public facilities be provided in the area of resettlement	Nothing in particular.
6	Participation in the process by resettlement residents and community	Explanatory meeting is held for the resettlement residents, there's no meeting for the community.
7	Handling mechanism for complaints	Nothing in particular.
8	Implementation Schedule	After public announcement, the period for negotiations of land acquisition is given as within one year as a rule. Normally it takes 3 and 4 years to deliver the land (See. p7-27).
9	Cost estimates and Budget planning	Overall cost estimates and budget plan are considered based on the results of No. 3 and 4.
10	Overview of the monitoring and ex-post evaluation	Nothing in particular.

Source: JICA Study Team

Compared with the World Bank's environmental and social safeguard policies and the Land Acquisition Act in India (1894), No. 1 (socio-economic research related to the resettlement), No. 6 (Participation in the process by resettlement residents and the community), No. 7 (Handling mechanism for complaints) and No. 10 (Overview of the monitoring and ex-post evaluation) are not covered in the Land Acquisition Act in India (1894), therefore, it is necessary to support these items.

If the support is conducted, it is important to tell the local government to meet the conditions of JICA guidelines and World Bank OP4.12 and provide long-term experts or consultants. When experts and consultants are sent, their participations in negotiations of land acquisition are necessary. It is important to monitor and support these efforts throughout the project, for instance, support for the socio-economic studies regarding the resettlement, negotiations for land acquisition, transfer of land and monitoring after resettlement.

Table 7.5.6 shows the basic handling methods for the support of land acquisition.

Table 7.5.6 Basic handling methods for the support of land acquisition

No.	Important support items	Basic handling methods	Implementation period
1	Socio-economic research related to the resettlement	On the basis of the final LRT plan, the PAPs (Project affected Persons) and resettlement site are determined and socio-economic studies are conducted. Also a new department is set up and the budget is secured.	Preliminary phase
6	Participation in the process by resettlement residents and the community	On the basis of the final LRT plan, the PAPs (Project affected Persons) and resettlement site are determined. Participation programs which are conducted by a local NGO are established. Also a new department is set up and the budget is secured.	Preliminary phase
7	Handling mechanism for complaints	During the negotiations for land acquisition and after transfer of the land, the handling mechanism for complaints from the communities in the related area is established. Also a new department is set up and the budget is secured.	Preliminary phase
10	Overview of the monitoring and ex-post evaluation	Scheduled monitoring and ex-post facto evaluation regarding the livelihood after the transfer of the land for PAPs are conducted Also a new department is set up and the budget is secured for the monitoring and system of ex-post facto evaluation.	After transfer of land

Source: JICA Study Team, 2013

Appendix-26 shows the Questionnaire Sheet for RAP-related Socio-Economic Survey (Sample) for PAPs (Project Affected Persons). It is necessary to disclose the information to PAPs (Project Affected Persons) appropriately, confirm the agreement for land acquisition and prepare a correct inventory of compensation land and houses.

7.5.6 Directions for Environmental Management Program Development

Within both EIA and RAP studies, it is mandatory to include an appropriate environmental management program (EMP) for the successful project implementation. This EMP shall be developed, addressing potential negative impacts identified through the environmental scoping process

(see Table 7.5.1) and proper environmental and social considerations such as RAP-related follow-up study, mentioned earlier, shall be taken during both the construction and operation phases. Key issues of this EMP development work are summarized as follows.

- Development of Monitoring Program (e.g., roadside air quality, noise/vibration, water quality and sedimentation of nearest tributaries)
- Data processing of all monitoring results
- Framework of project-related complaints handling
- Contingency plans for accidents during construction period.
- Liaison with relevant stakeholders
- Set up of safe disposal system for lithium-ion Batteries and relevant electronic equipment
- Development of RAP study ToR with assistance from JICA
- Follow-up monitoring of PAPs, in particular, farmers who lost agricultural lands due to depot construction.
- Others

In particular, the establishment of a good liaison among PMC, PCMC, MIDC, SPCB (State Pollution Control Board), EAC (Expert Appraisal Committee), surrounding communities, relevant NGOs and others would play a vital role for the successful implementation of EMP. Figure 7.5.7 shows the schematic diagram of the EMP framework.

Within this proposed LRT project, relevant land take negotiations are to be conducted by MIDC. However, occurrences of several disputes and/or conflicts due to some development projects have been reported in Maharashtra State recently. In order to avoid and/or lessen occurrences of those undesirable events, it is important to conduct a comprehensive socio-economic study of the PAPs and establish a proper public participation process prior to the land take while conducting a relevant follow-up study to monitor the PAPs, such as farmers who are to lose their agricultural lands due to this land negotiation process (see Table 7.5.1).

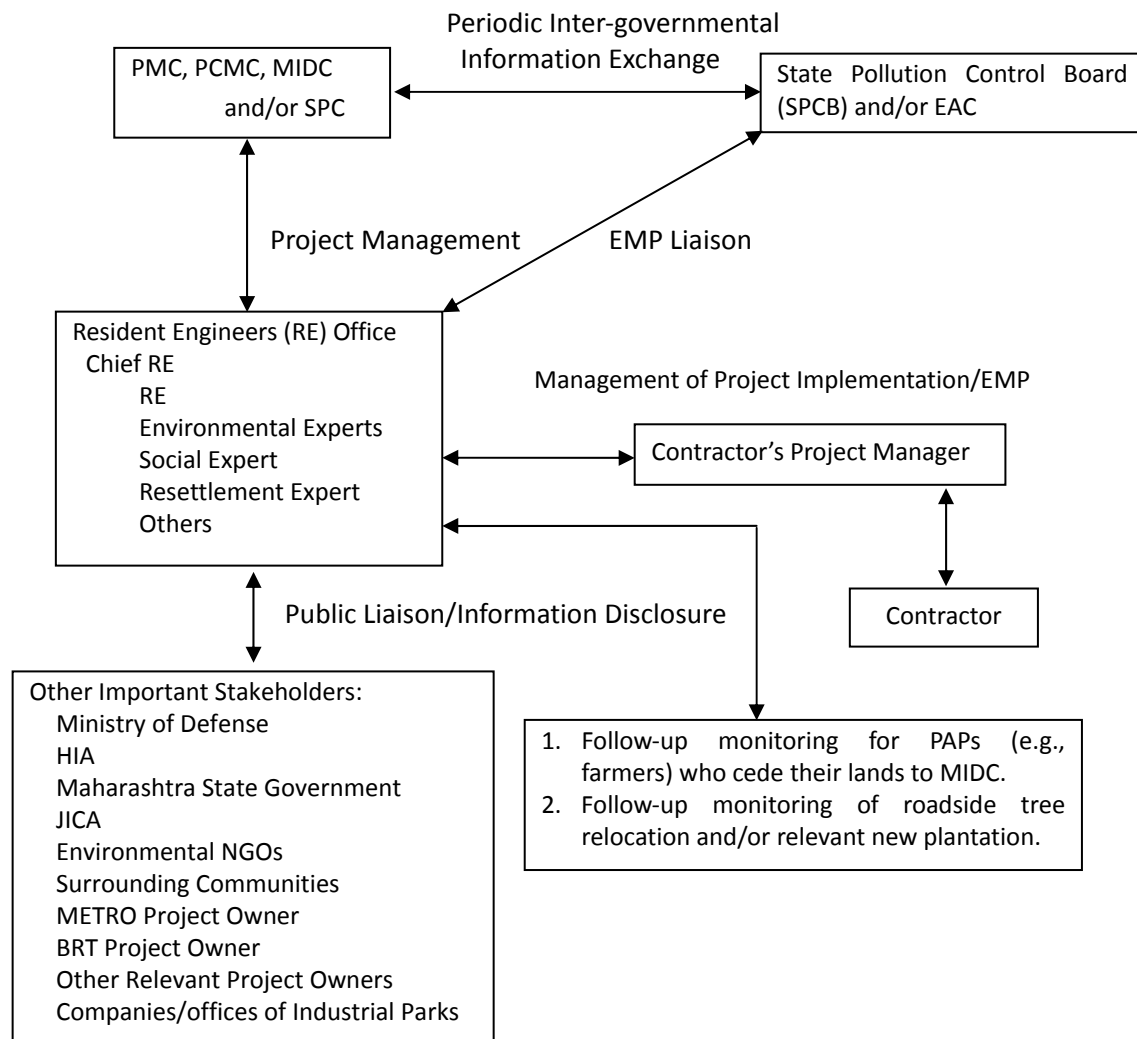


Figure 7.5.7 EMP Framework

Source, This Study, 2012

7.5.7 Environmental Consideration for Lithium-Ion Battery Cells

Lithium-Ion Battery Cells, to be used in the proposed LRT project, use flammable electrolyte inside. So that the physical crushing of this type of battery after its use may cause explosion and/or fire. Usually, this electrolyte is removed before its final disposal process and then safe waste treatment processes for each part are conducted separately in Japan. Generally, its functional lifetime is 15 years. Within the proposed LRT project, approximately 230 tons of lithium-ion battery cells (note: that there will be 82 battery units and each unit weighs 2.8 ton) are to be used in total. As of November 2012, a recycling and/or disposal system for the lithium-ion battery cell in India is at the rudimentary stage (note that its improvement in the near future is expected). So, it is reasonable to use a reliable battery disposal and/or recycling system from outside of India for the time being.

The burning point of the electrolyte of this battery is approximately 40 degrees Celsius, and is classified as a "Type IV-2 Petroleum Product" by the "Fire Protection Law" of Japan. Maximum handling (storage included) capacity limit of this product is defined as 1,000 liters in Japan. If the handling capacity of this type of product exceeds this limit, it is mandatory to set up certain facilities

as a precaution (its facility specification is determined by this law). For example, the handling of more than **500,000** units of a cylindrical lithium-ion battery cell (note that the diameter = 18 mm and the height = 65 mm) needs implementation of this safety measure in Japan.

As mentioned earlier, the handling of certain amounts of lithium-ion battery cells is regulated by the “Fire Protection Law” of Japan, so that additional precautions, safety measures and/or facilities would be necessary for its manufacturing, storage, delivery and its usage. It is noted that this rule does not match UN’s recommendation regarding the international delivery of this type of flammable product. In Japan, the delivery of the lithium-ion battery cell has to be conducted using a certain type of special transport facilities. Additionally, when the handling capacity exceeds certain limits (e.g., approximately 500 tons of lithium-ion battery cells mentioned above), it is required to send notices to relevant municipalities prior to its delivery.

Assume that the unit of weight of a cylindrical lithium-ion battery cell is 70 gram/unit, then

$$70 \text{ gram/unit} \times 500,000.00 \text{ units} = 35,000.00 \text{ kg} = 35 \text{ tons} \gg 2.8 \text{ t}$$

Within the proposed LRT project, each unit weighs of lithium-ion cells which are used in charging facilities like rolling stocks and stations are 2.8 ton. If certain precautions/safety measures and/or facilities abiding by the “Fire Protection Law” of Japan are implemented for this proposed LRT project, the amount of units is less than the designated quantity. There are 2 ways to import the lithium-ion cells, which are importing the rolling stocks and charging facilities included lithium-ion cells and importing only themselves (lithium-ion cells). In the former case, an importing unit is less than the designated quantity. However in the latter case it is possible to exceed and it is necessary to follow the “Fire Protection Law” with considering the transportation and stock. About the storage of lithium-ion cells, each rolling stock and stations have only one unit so that its amount is not exceeded in confined space.

Market size of lithium-ion battery in 2020 will be 10 times as much as that at this moment. Japan keeps 50 % of the market share. From the viewpoint of global competitiveness, it is important to confirm and recheck the safety standards in foreign countries. Japanese fire and disaster management agency should improve their techniques and collect the handling information.

In Japan, it can be said that the safety of this battery is legally guaranteed already. However, there are still some technical difficulties its disposal and/or recycling processes. In India, mass use of the lithium-ion battery cell has just started, and relevant disposal and/or recycling systems are still at the rudimentary stage. So, it is important to provide relevant technical supports and/or establish capacity development programs for safe battery product maintenance/storage and disposal processes for the time being until a proper domestic used batter disposal system is established in India. Also it is important to establish the law about lithium-ion battery such as the “Fire Protection Law” of Japan.

Upon considering these findings, it is important to incorporate relevant environmental mitigation measures for the handling of the lithium-ion battery cells to be used within this proposed LRT project into the environmental management program.

Recently, global environmental concerns for the product manufacturing have arisen, and some of them have led to the introduction of more strict rules to diminish harmful products as well as to encourage manufactures to provide more environmentally-friendly products. For example, the EU issued two directives for the electronics industry in 2003. The first one is to prohibit the usage of any toxic substances such as heavy metals within any electric and/or electronic products. The second one is to make it obligatory to establish an environmentally-friendly recycling process for electric/electronics products [Ministry of Environment, Government of Japan, 2009]. So, it is essential that battery manufacturers shall have the responsibility for their own products, covering all steps from supply and installation to the recycling and/or disposal processes for the equipment to be used.

7.5.8 E-waste Disposal Guideline of Maharashtra State

In addition to lithium-ion battery cells, several pieces of electric/electronics equipment such as 10 desktop computers (the functional lifetime of this desktop computers is approximately 10 years) are to be used for the operation control of the entire system within this proposed LRT project. In Maharashtra Province an e-waste guideline was issued in 2011, and all project owners shall register all electric/electronics equipment to be used with the state pollution control board office along with the details of a disposal and/or recycling program.

7.5.9 Basel Convention

As described in previously, safe battery disposal and/or recycling systems and the market for them have been established in India. However, the current disposal and/or recycling framework of lithium-ion battery cells in India is still at the rudimentary stage (as of November 2011), so, it is reasonable to use a reliable battery disposal and/or recycling system from outside of India for the time being. It is noted that it is probable that India will improve its capacity for used battery disposal systems in the near future.

Both Japan and India have ratified the Basel Convention that provides key directions for international delivery of toxic and/or harmful wastes. In Japan, the presiding agency for this issue is the Ministry of Environment, the Government of Japan, and supervises both the import and the export of toxic/harmful wastes based on the regulation, called the “Basel Act”.

According to the official statistics of Year 2009, the total amount of the export and the import of toxic wastes in Japan, approved based on Basel Act mentioned above, are of 84,878 tons (54,204 tons in 2008) and 4,075 tons (3,874 tons in 2008), respectively.

To establish the recycling of used lithium-ion cell batteries from India to Japan in conformance with the international standards, the project owner shall obtain the following three approvals, i.e., ① Approval for export of used lithium-ion battery cells from India, ② Approval for shipping between India and Japan, and ③ Approval for import into Japan and its domestic deliveries therein.

7.5.10 Undertaking for Indian C/P for Successful Project Implementation

Within this study, several approvals such as ① an environmental approval (ESIA/or IEE), ② land-take (RAP), and ③ relocation and/or cutting of roadside trees shall be obtained prior to beginning the construction phase. To initiate both the EIA and RAP studies smoothly, it is important to secure a sufficient budget for both studies and then select both well-qualified EIA and RAP consultants (see Section 7.1 for more detailed descriptions). Although the land-take process is one of the undertakings of MIDC, several land take-related conflicts have occurred across India within the past infrastructure development projects. So, it is essential to conduct a series of follow-up studies such as the monitoring of the land take negotiation process and a post land-take social study for PAPs such as shop owners, farmers and others as possible joint studies between JICA experts and MIDC. Table 7.5.5 summarizes the major tasks to be required for the environmental approval application process of the proposed LRT project.

Table 7.5.7 Major Tasks for Environmental Approval Application of LRT Project

	Major Tasks
Land Take	<ol style="list-style-type: none"> 1. Prepare a TOR regarding environmental studies for land acquisition and Implement the studies. Conduct the technical support by JICA experts to meet the conditions of JICA guidelines and World Bank OP4.12 as necessary. 4 Important support items are the following; <ol style="list-style-type: none"> a. Socio-economic studies regarding the resettlement b. Participation in the process of relocation by resettlement residents and the community c. Establish the mechanism for handling complaints d. Summary of monitoring and ex-post facto evaluation 2. Successful and peaceful land acquisition prior to beginning the construction phase
Preparation of EIA and RAP Studies	<ol style="list-style-type: none"> 0. Set up of an environmental division within the project owner's organization responsible for both EIA and RAP studies. 1. ToR development for both EIA and RAP 2. Securing budgets for both EIA and RAP studies. 3. Preliminary discussions with both EAC and SPCB and official application for an environmental license. 4. Tender preparation of both EIA and RAP studies 5. Selection of both EIA and RAP Consultants.
EIA and RAP Studies	<ol style="list-style-type: none"> 1. Official Discussions with both EAC and SPCB during both the EIA and RAP studies. 2. Preparation of Public Meetings 3. Public meetings. The following are major topics to be addressed within those meetings, <ul style="list-style-type: none"> • LRT Project Outline • ToR (draft) of relevant environmental and social studies • Collection of comments/opinions/questions and/or advice on ToR (draft) 4. ToR finalization and its approval from both the EAC and SPCB 5. Implementation of both the EIA and RAP studies 6. Submission of both the EIA and RAP study reports (D/F)
Examination by EAC and SPCB	<ol style="list-style-type: none"> 1. Set up of EIA Review Committee and then examinations of both reports are to be conducted by this committee. 2. Feedback committee's examination results to both the EIA and RAP D/F Reports. 3. Preparation of both the EIA and RAP Final Reports 4. Examination of both the EIA and RAP Final Reports and their approval

Source: This Study, 2012

Chapter 8 Project Implementation Scheme

The key items that this project requires in order to be implemented under a PPP scheme are summarized as follows:

- In the past, most of the public infrastructure facilities have been developed in the form of a “One-tiered System” in which the public sector undertakes the finance, plan design, construction and operation and maintenance, and it has been observed that a long time has been spent in arranging financing and also there was a long lead time in implementing the project.
- Some projects have been implemented with a PPP Scheme, where the projects were structured under either a “Two-tiered System”, or “One-tiered System”, dividing the sub-structure by the public sector whereas the super-structure was by either the private sector or by the public sector. Thus cases exist in which the private sector was responsible for finance and construction, but it has become clear that the fare box revenue did not generate sufficient revenue.
- As a project implementation scheme to improve viability, a BOT Gross Cost Scheme (Fare box revenue, collected by the public sector, is given to the private sector) is introduced. The private sector arranges financing to reduce the public burden and to raise the possibility of accelerating the project implementation and realization. Additionally, underwriting the ridership risk by the public sector will offer a favourable environment for the private sector to participate in the project.
- Effective application of Viability Gap Funding (VGF: central government financial resources managed by the Ministry of Finance and state funds managed by the state governments) facilitates both public and private financial planning.
- It is possible to consider long-term financing as a part of the private sector funding and also to consider reducing the interest rate burden.
- In order to introduce an environmental friendly railway system in India, its facility development, maintenance and operation is suited to be arranged with a PPP scheme.

8.1 Public and Private Sector Facilities

8.1.1 Public and Private Sector Roles

In this Chapter, the Public-Private Partnership policy and strategy related to infrastructure development in India are reviewed and the administrative framework in the State of Maharashtra as well as PMC and PCMC with particular focus on the urban railway projects is also summarized.

1) PPP History, Policy and Strategy in India

Infrastructure development applying a PPP framework in India was initiated in 1998, and has been increasing mainly in the road and electricity sectors since 2000. The Government has further been strongly promoting PPP policy by establishing agencies for funding. The Minister of Finance explained the need for a more comprehensive PPP policy in 2011 and its announcement is expected.

The PPP Policy and its institutional framework are overviewed that the Government set up the Committee on Infrastructure formed under the chairmanship of the Prime Minister. The Public Private Partnership Appraisal Committee (PPPAC) was established in 2008 under the chairmanship of the Prime Minister to streamline and simplify the appraisal and approval processes for PPP projects. Around the same time, an Inter-ministerial Commission for appraisal and approval of projects for availing VGF grants was set up. In 2009, the Cabinet Committee on Infrastructure was formed to approve and review policies and projects across infrastructure projects, and more recently, in 2010, the High Level Committee on Financing Infrastructure was established to review existing policies and suggest necessary changes in the investment framework for the high-priority infrastructure.

Evolution of Key PPP Institutions

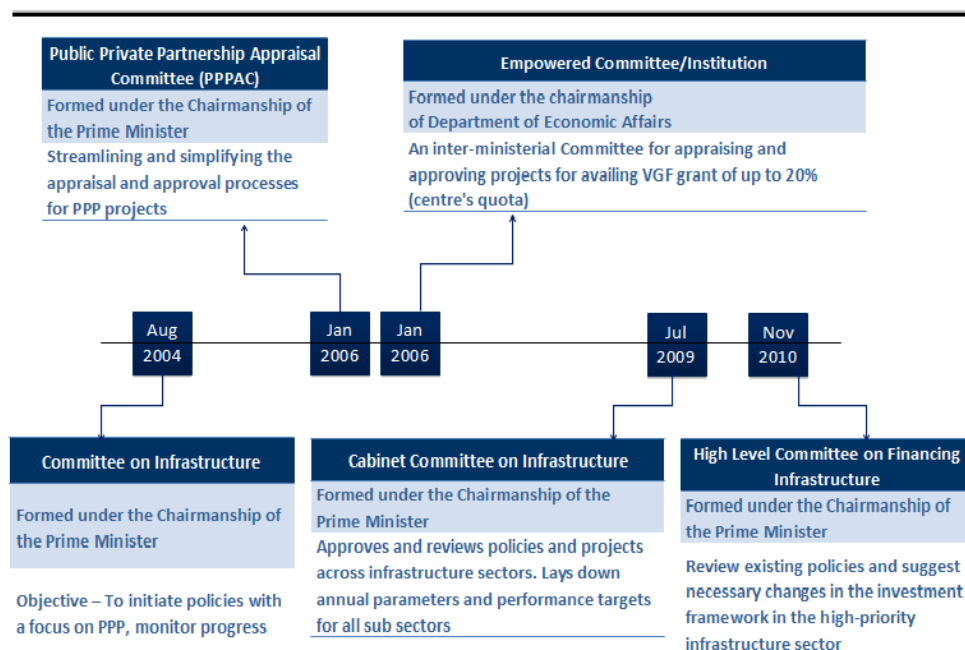
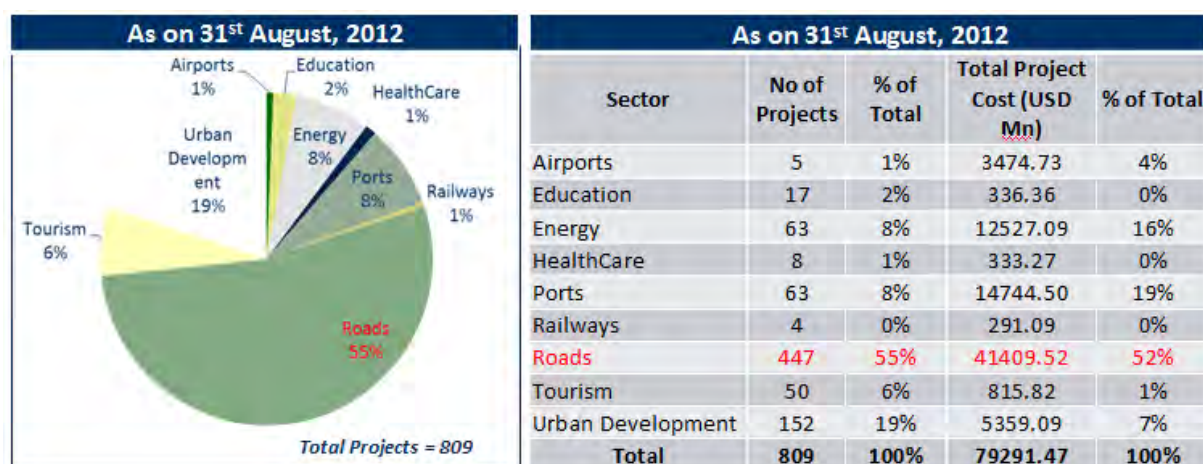


Figure 8.1.1 Institutional Framework Development of PPP in India

Source: JICA Study Team

Looking at the PPP projects that have been approved broken down by the infrastructure sector shows that of the total 809 projects worth INR4,361 billion, the road sector has the largest share with 447 projects, which is 55% in terms of the number and INR2,277.5 billion or 52% in terms of value. As for the urban transport, they have 152 projects, which is 19% and INR2497 billion for a 7% share.

Table 8.1.1 PPP Projects Approval by Sector

Source: PPP India

PPP in the Urban Railway Sector

Urbanization has been taking place rapidly in India and the related infrastructure cannot keep pace with the speed of urbanization. The Ministry of Urban Development (MoUD) announced a National Urban Transport Policy (NUTP) in 2006 and urged the transformation towards a human-oriented society from a car-oriented one.

On the basis of NUTP 2006, the Government requests, that cities having over a million population establish a Unified Metropolitan Transport Authority (UMTA) to plan, coordinate and administer the urban transport in a consolidated manner. In response to this, each city has been accelerating its implementation of urban transport and thus 19 urban railway projects from cities with over 2 million population have announced that they will conduct DPR preparation among which seven projects are planned in the form of PPP.

Table 8.1.2 PPP Projects in Urban Railway Sector

	City	km	Route	Situation
1	Mumbai	12	Versova-Andheri-Ghatkopar	Under construction
2	Delhi	23	New Delhi to Delhi Airport	Completed
3	Bangalore	40	Phase 2 -Gottigere to Nagawara, RV Road to Bommasandra	DPR Approved ,Design completed by Sep 2012
4	Hyderabad	71	All routes	Under construction
5	Pune	15	Vanaz-Ramvadi	Waiting for State gov't approval
6	Jaipur	23	Sitapura-Ambabari	RFQ announced in May 2012
7	Patna	40	Dak bunglow Square-Saguna Morh, Danapur-Patna city	Waiting for State gov't approval

Source: JICA Study Team

Another 12 cities, Kolkata, Chennai, Ahmedabad, Surat, Kanpur, Lucknow, Nagpur, Ghaziabad, Indore, Coimbatore, Kochi and Kozhikode, have plans for their projects in the form of city/state-led public sector projects.

Recommendation in NUTP 2006 to mobilize land and real estate

It is worthwhile to pay attention to The NUTP 2006 because it strongly recommends the mobilization of land and enhancement of the value of land as ways to introduce PPP approaches by considering the infrastructure development.

It is considered that it would be difficult for urban transport to solely rely on the railway operations *per se*, whereas from the point of lesser financial burden on the public sector, the land nearby the stations could be effectively mobilized or developed by the private sector and that would promote PPP approaches but the time has not sufficiently elapsed yet and the views are divided on this real estate development to be integrated into the urban railway operations.

In relation to this project, some analytical reviews have been completed on whether the real estate development should be included as an auxiliary operation of the main railway business. The Study team has concluded that the risk profiles are quite different from each other. It also considers that the participation from the private sector can be expected in securing feasibility by expecting support and cooperation from the public sector in the form of VGF when this railway project is implemented under a PPP scheme. With the foregoing in mind, the real estate operation is separately pursued on its own.

Recommendations from Planning Commission to limit PPP application to Urban Railways

The Working Group on Urban Transport for the 12th Five Year Plan under the Planning Commission has recently reported that the PPP method is not the best way for the urban railways. According to the Working Group report, among 113 cities around the world operating urban railways, 88% of them are operated by the public sector and only 12% are run by the private sector. It further suggests that, whether PPP is implemented or not, the project implementation body needs to review the passenger demand as well as whether the land usage should be limited to railway operation purposes only.

The Working Group recommends using public funds in densely populated areas and suggests regarding the funding:

- 30% of the cases will be supported by the central and the state governments at 20% each,
- 70% of the cases will be supported by the central government at 20% (or exceptionally 30%) in the form of equity, sub-ordinate loan or grant, and 20% by the state governments, 5% from the real estate development, 5% from the development agencies, and the remaining from financial institutions.

The Study team will continue to examine the project implementation structure, feasibility and funding.

2) PPP Institutional Framework

Central Government Level PPP Institutional Framework

With a view to create cross-sectoral high level committees to handle PPP procurement and monitoring process, the Planning Commission, Cabinet Committee on Infrastructure (CoI), High Level Committee on Financing Infrastructure and the PPP Appraisal Committee (PPPAC) have been established.

PPP Regulatory Institutional Structure
Central Government Level

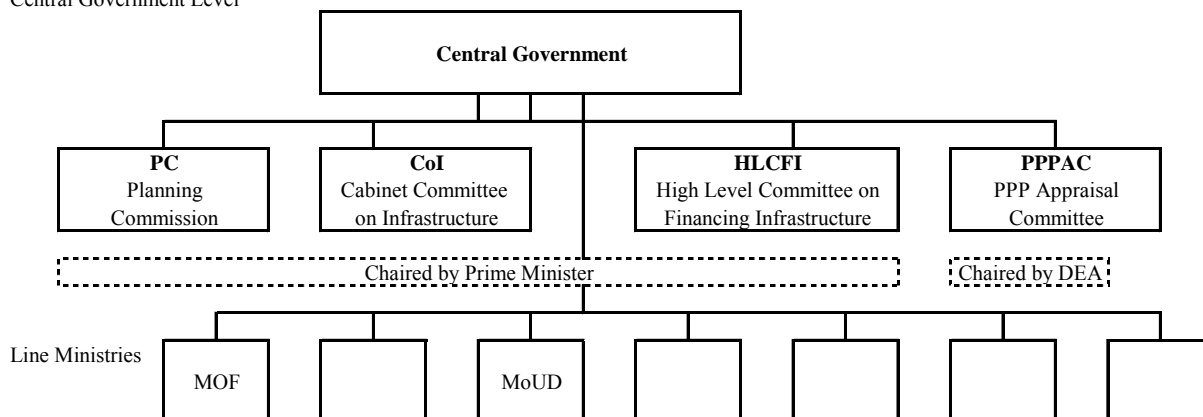


Figure 8.1.2 PPP Regulatory Institutional Structure at Central Government Level

Source: JICA Study Team

The role of each agency or organization is explained as follows.

Planning Commission (PC)

The highest level organization established in August 2004 within the Government on the national level. The PC appraises necessary changes and informs PPPAU of the need for those changes. PC sets policies across all the infrastructure sectors.

Committee on Infrastructure (CoI)

CoI was formed in August 2004 with an objective to initiate policies that enable creation and management of infrastructure, facilitate mechanisms for PPP, and monitor the progress of key infrastructure projects. The committee has since issued guidelines for implementation of PPP projects including bidder selection guidelines, specifications and standards for projects, model concession agreements, and financing plans.

High Level Committee on Financing Infrastructure (HLCFI)

HLCFI was formed in November 2010 and reviews the investment framework and makes recommendations on the high priority projects.

PPP Appraisal Committee (PPPAC)

PPPAC was established in 2005 and in principle gives approval to a project put forth by a central government ministry and sends it to DEA, the Planning Commission and concerned line ministries for approval. Subsequent to their approval, PPPAC gives final approval to the project.

State Level PPP Institutional Structure on Urban Transport

Each city has an autonomous organization to regulate, supervise, operate and manage their urban transport projects.

Table 8.1.3 Urban Transport Project Regulating and Operating Bodies

Metro project under development	Authority	Key Stakeholders
Kolkata Metro	Indian Railways	Government of India
Delhi Metro	Delhi Metro Rail Corporation**	Govt of India and Govt of NCTD
Mumbai Metro	MMRDA*	Urban Development Authority
Hyderabad Metro	Hyderabad Metro Rail Ltd*	Govt of Andhra Pradesh
Pune Metro	Pune Metro Rail Corporation	Govt of Maharashtra
Jaipur Metro	Jaipur Metro Rail Corporation**	Govt of Rajasthan
Bangalore Metro	Bangalore Metro Rail Corporation	Govt of Karnataka
Chennai Metro	Chennai Metro Rail Corporation	Govt of India and Govt of Tamil Nadu
Kochi Metro	Kochi Metro Rail Ltd	Govt of India and Govt of Kerala

Source: PPP India

Only two cases as stated below are identified with foreign private sector participation in urban transport.

Table 8.1.4 Urban Transport Projects with Foreign Private Sector Participation

Project	Delhi Airport Metro Express Line	Mumbai Metro Line 1
Project length	23km	12km
Concessioneing authority	DMRC	MMRDA
Private player	Reliance Infrastructure	Reliance Infrastructure
Foreign partner	CAF, Spain	Veolia, France
Stake of foreign partner	5%	5%
Role of foreign partner	Technical eligibility for the SPV, and technical support during construction	Technical eligibility for the SPV, and technical support during construction
Concession type	BOOT- 30 years	BOOT - 35 years
Project status	Operations started in Feb 2011 and suspended from July 2012 due to structural faults leading to safety concerns	Construction started in Oct 2008 with Dec '10 deadline. Three deadlines have been missed & a fourth one has been set for March 2013

Source: PPP India

The preceding projects are few but the Government has been making an effort to facilitate bidding, implementation and operations by foreign companies. One of the examples is found in the case of Delhi Metro where the technical requirements are experience with the urban transport projects

(development, O&M, equipment supply), supply of railway systems, operational experience in urban railway operations in major cities, supply of E&M, signalling, rolling stock, and civil work over INR3 billion.

PPP Model Concession Agreement not Fixed for Urban Railway

The Planning Commission (PC) publishes Master Concession Agreements for several sectors. This is aimed to regulate a good balance between risks and obligations and also to secure the development of PPP projects in a transparent manner. The MCA framework is comprehensive and follows the internationally accredited principles as well as the best practices. The MCA for the urban transport has not been fixed yet and it is expected to be put in place in the near future with a view to accelerated project implementation with PPP approaches.

3) PPP Project Application and Approval Process

When a PPP project is planned, the Project promoter is required to submit a feasibility study (F/S) to the central line ministry or the state government concerned. In addition to a detailed F/S, the procurement process and preparation for bidding documents are also required. It is also required to indicate whether a VGF is needed and the reasoning as well as the validity explanation of Value for Money (VFM).

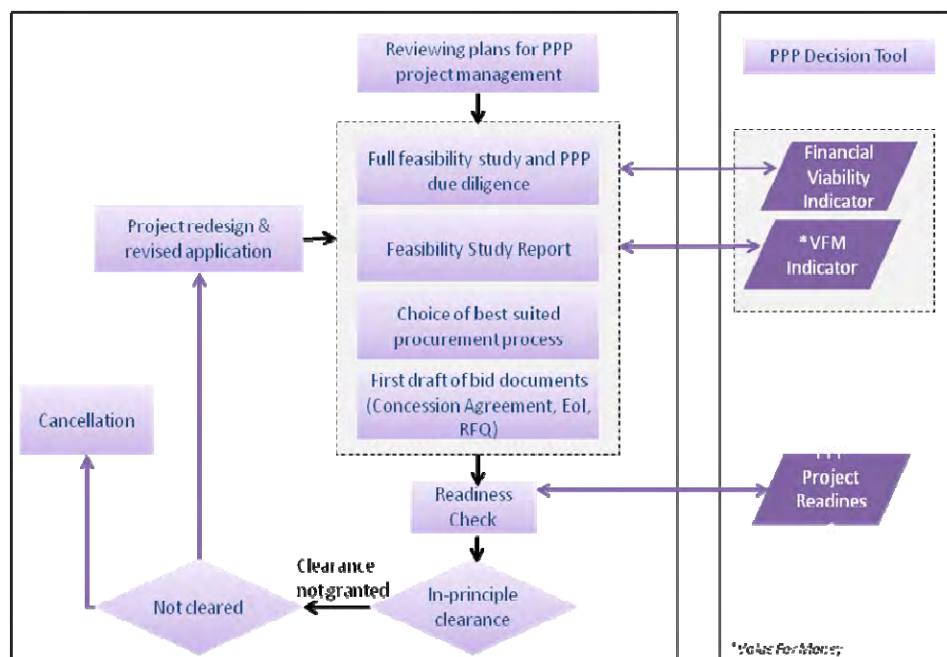


Figure 8.1.3 PPP Project Application / Approval Flow

Source: PPP India

An F/S should include the following contents;

- Project necessity, project outline, social and environmental assessment, technical explanations, cost/benefit analysis, financial and economic analysis and project implementation schedule

- Risk analysis, public-private risk allocations, PPP types, funding, government support such as VGF, and capacity assessment of the implementation body

Project Approval for Bidding and Selection Flow

The responsible ministry will send the project proposal, if it exceeds INR1 billion, to PPPAC and the Standing Finance Committee (SFC) / Expenditure Finance Committee (EFC). Once an approval is granted in principle, the responsible ministry announces a Request for Quotation (RFQ) and a short listing of bidders is conducted. The responsible ministry submits an RFP draft and the contract draft to PPPAC as well as SFC/EFC. Once the final approvals are granted the RFP is announced. After the issuance of the RFP by the line ministry / department, preferential bidders are identified and negotiations start. With successful negotiations, the private developer is appointed.

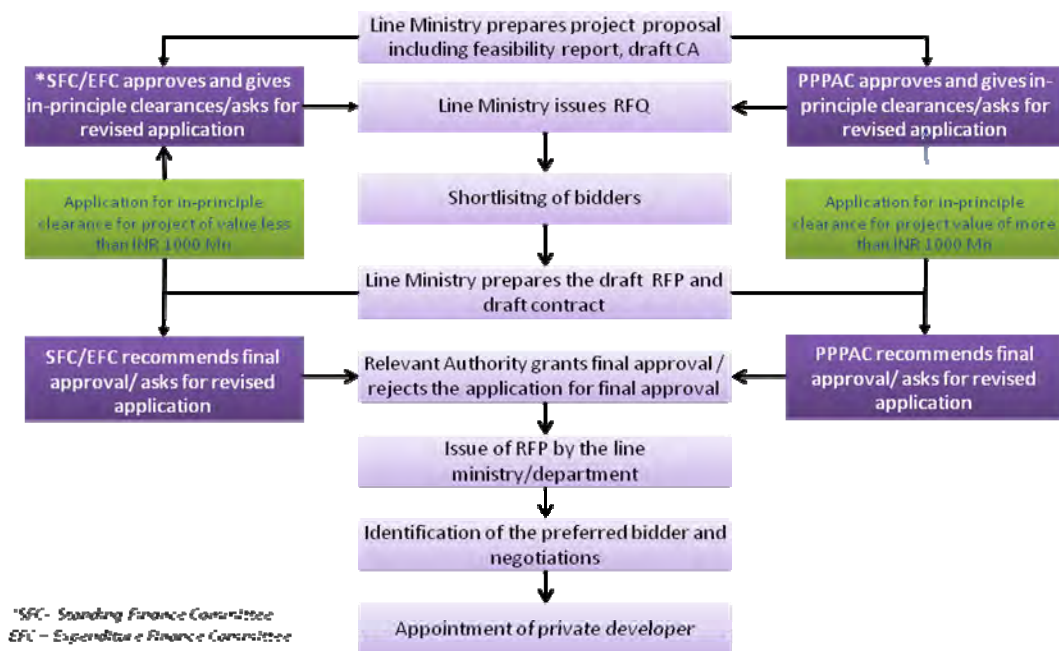


Figure 8.1.4 PPP Project Bidding and Selection Flow

Source: PPP India

State of Maharashtra Level PPP Project Approval Flow

In relation to this Project, the approval flow goes through the line ministry, MoUD, the State Government and Urban Local Bodies, PMC and PCMC as shown below.

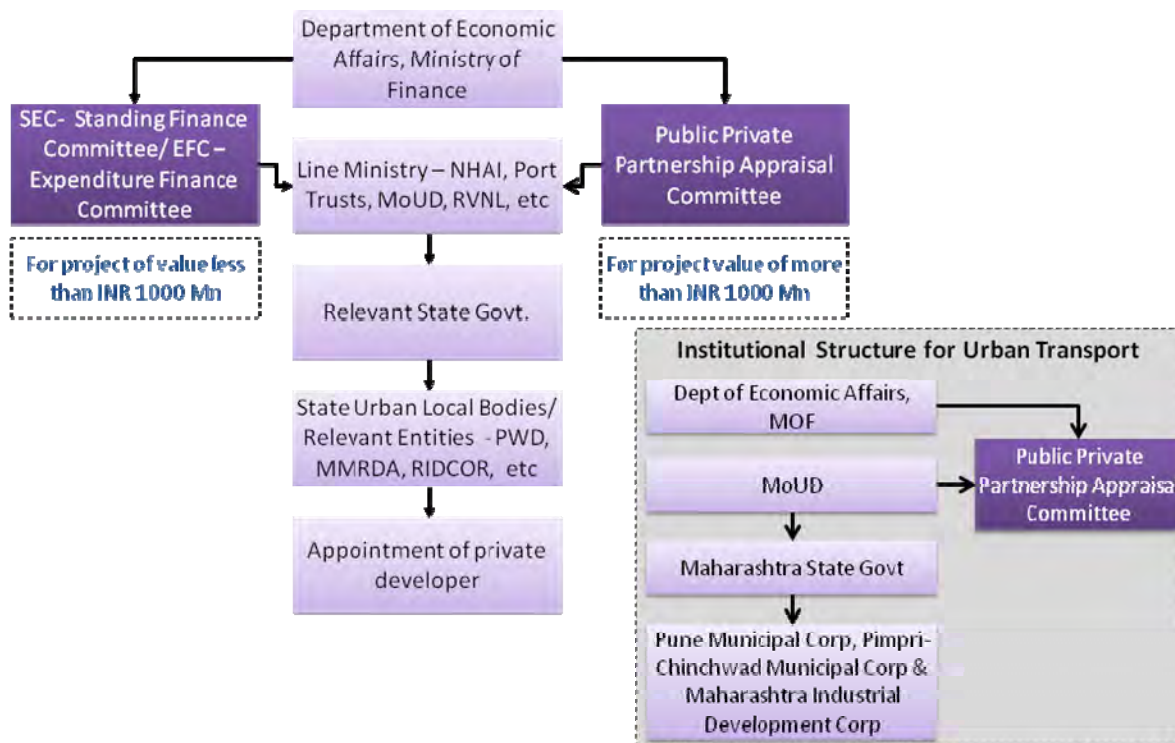


Figure 8.1.5 Maharashtra State PPP Selection Flow

Source: JICA Study Team

PPP Project Participation by Foreign Capital

Participation by foreign capital direct investment does not offer any restrictions in principle. Most of the sectors fall under the Reserve Bank of India type application with an automatic approval except for airports with limited foreign participation, or nuclear power, railway and real estate are prohibited to foreign capital. Obviously the railway is defined as those under the Ministry of Railway and the urban railway falling under the Ministry of Urban Development is not included.

Table 8.1.5 Foreign Direct Investment Regulations

RBI Automatic route	FIPB route	Prohibited sectors
<ul style="list-style-type: none"> •Greenfield Airport •Existing airports (upto 74%) •Townships •Industrial Parks •Power (except nuclear) •Water supply •Metro-Rail •Roads and Highways •Ports 	<ul style="list-style-type: none"> •Existing airports (beyond 74%) 	<ul style="list-style-type: none"> •Nuclear power •Railways •Real Estate

Source: JICA Study Team

8.1.2 Public Private Role Allocations

Risk Identification

When developing and implementing PPP Projects, detailed risk identification as well as its allocation among the related parties are critical and essential. What is important when analysing a PPP project is quantifying the risks. Effective allocation of risks is assumed on the basis that the risk allocation management should be borne by either the Public or the Executing Agency, or risks are to be managed by the risk allocation system.

Before analysing individual risks at each stage of the project implementation, some points to be considered as key approaches are as follows.

- **Not all risks can be foreseen**

It is taken for granted that not all the risks can be foreseen. Not all the legal framework issues can be cited nor is it possible to depend on the PPP agreement to cover all possible scenarios. However, one should include some mechanisms to deal with unforeseeable and unpredictable or unmanageable matters. These mechanisms are best implemented by incorporating into an agreement among the parties concerned clauses regarding the force majeure and other unforeseeable matters..

- **One-sided risk aversion is not desirable**

It has been pointed out that during the PPP project implementation processes the economically, socially or politically stronger position parties have a tendency to avoid undesirable risks for them and to allocate those to the weaker parties.

- **One-tiered system or Two-tiered system (Sub-/Super-Structure) PPP Approach**

Although the public and private partners are responsible, on each side, for a given portion of the PPP agreement, it may be implemented as a single PPP agreement with a single counterparty, the developer, who is solely responsible for the full implementation of the PPP agreement regardless of the internal risk allocation among the different parties. This arrangement is known as a “One-tiered system” in the PPP agreement. An alternative to this approach may be the “Two-tiered system” or sub- and super- structure approach, in which the project may be split among two or more separate PPP agreements addressing the construction of infrastructure, the procurement of rolling stock, and the operation of the system.

- **Ability to Manage Risks**

Risk allocation could quite often be agreed as outcomes of discussions and negotiations but it will be equally important that the parties must analyse the strengths of each party to which a specific risk is allocated and that party’s ability to manage the consequences of the risk if it should occur.

Project Risks are divided into 1) those which should be considered to cover the whole period of a project, 2) the ones that should be considered during the designing and construction stage, 3) the ones

during the operation and maintenance period, and 4) those which should be considered at the completion stage of the project.

1) Risks in common throughout the Project Period

(1) Political Risks

Political risks are defined as traditional political risks including nationalization, new tax regimes, and other events that affect debt service and profits. Regulatory risks include the imposition of new standards or the introduction of competition, whereas quasi-commercial risks include breaches by the grantor or interruptions because of changes in the grantor's plan. Other political risks include acts of war, rebellion, default, and failure of public sector entities. The public sector is normally the project participant with the greatest ability to manage the risk of change in the political climate and therefore often takes this responsibility.

(2) Change of Law Risk

Changes-of-law risk is defined as adoption, modification, or repeal that may occur during the PPP contract period. Developers are concerned with future changes in any law or regulations possibly affecting the development and operation. It is essential to have an effective mechanism to deal with the consequences of any change of law after the bid date, particularly if this change requires the developer to incur costs or if it results in a decrease in profits.

Significant changes in law include

- Currency or capital repatriation limitations, moratorium or strong restriction on foreign exchange
- Nationalization or confiscation of developed assets
- Import and export prohibitions or strict employment of foreign currency allocation
- Deprivation of the developer's rights

However, 1) when the change of laws covers a wide range of area and are considered to be general, 2) in the case where operators could accept the impact of cost increase, or 3) when the cost increase could be transferred on to the users, the risks could be considered to be the responsibility of the operators.

(3) Economic risks

Economic risks are applied for changes in interest rates, inflation and foreign exchange. The public sector is responsible for the cases attributed to the public as well as risks before the operation starts, and the private sector is responsible for changes after the operational commencement. Price changes exceeding a certain range during both the construction period and operation period are considered in the setting of reasonable cost allocation rules.

(4) Interest Rate Change Risks

Loans for funding this Project are provided with floating rates and the public sector will not assume risks associated with this risk and rates are dependent on the market trend. However, it is expected that an agreement will be made that applies when the interest rates are raised in an excessive manner under circumstances such as financial crisis.

(5) Inflation Risk

Inflation may have a substantial impact on the project cost. Typical PPP projects tend to have a long period between the tender and the operation and maintenance phase, and inflation may cause a large accumulated impact.

(6) Foreign Exchange Rate Change Risk

Depending on the project, necessary equipment and financing may be affected by foreign exchange rate changes. PPP projects often are funded by ODA loans, bond issuance, loans from commercial banks and are sometimes in foreign currencies. On the other hand, revenue from PPP projects is raised in domestic currency and thus the foreign exchange change may affect the planned revenue level.

(7) Social Risks (Risk involving residents and environmental risk)

Social risks are the risks considered to be those risks regarding the relocation of residents and traffic detours and management during the construction period, and environmental risks are those which might have natural environment impacts such as on air, sunshine, water and noise. These matters and risks up to a time before the facilities are opened for use should be secured by the public sector. After the facilities are opened for use, these will become the risks of the operator.

(8) Force majeure risks

Risks beyond the control of the operator include natural disasters that are not anticipated at the planning stage, such as strong winds, heavy rains, flooding, storm surges, earthquakes, landslides, cave-ins, and lightning, as well as anthropogenic events such as wars and riots. It is generally appropriate for the public sector to assume such risks. However, in order to promote more efficient recovery, it is desirable for the operator to assume a portion of the risk of losses such as construction delays and damage due to force majeure.

2) Risks during Design and Construction phases

It is considered that the public sector will assume the risks involving investigations, instructions, changes, and construction work, etc., implemented by the public sector. In particular, it is considered that the public sector will assume the risks of existing soil pollution and underground obstacles at the construction site. Risks other than the above which are attributable to the operator are considered to be risks of the operator.

3) Risks during Maintenance and operation phases

It is considered that the public sector will assume the risks of matters attributable to the public sector. However, there are some risks that the tenant share and the rental rate level will become lower than the assumed level. These are considered to be risks of the operator. And, it is necessary to divide the risks of facility damage due to accidents, fire, etc., and facility damage caused by third parties (including facility users) based on attribution of responsibility. It is considered that the public sector will assume the risks of obsolescence due to technological innovations and the like in those facilities and equipment whose development was directed by the public sector, while the private sector will assume the risks of increased expenses from obsolescence of other facilities and equipment due to technological innovations and the like.

4) PPP Public and Private roles

Public-Private risk allocations can be made as shown in the table below by taking the analyses above.

Table 8.1.6 PPP Public-Private Risk Allocation

Phase	Type of Risk	Content of Risk	Allocation		Remarks	
			Public	Private		
All Phases	Selection procedure risks	Selection procedure risk	●		Additional costs, etc. resulting from errors in documentation prepared by the public sector and relating to selection of private operators or errors in such procedures, etc.	
		Application risk		●		
		Contract conclusion risk	●	●	Applicant operators that do not receive a contract will be responsible for their respective expenses up to that point.	
	Institutional change risks	Legislative risk	Risk related to new or changed legislation, etc., directly affecting the project	●		It specifies in the PPP contracts that these are public risks.
			Risk related to new or changed legislation that is broad and general in scope and does not involve the project		●	It specifies in the PPP contracts that these are private risks.
		Risk of tax changes	Risk related to new or changed tax regulations that directly impact the project	●		It is considered that this risk should basically be assumed by the public sector. However, such risks should be assumed by the operator in cases where [1] the subject of a legislative change is broad and general, [2] the impact of increased expenses can be controlled by creativity and ingenuity on the part of the operator, or [3] cost increases due to legislative changes can be transferred to general public.
	Risk related to changes in the scope of consumption tax or changes in tax rates		●			
	Risk related to other changes in tax regulations (such as new or changed corporate taxation on corporate profits)			●		

Phase	Type of Risk	Content of Risk	Allocation		Remarks		
			Public	Private			
All Phases	Institutional change risks	Licensing risk	●				
			Risk related to delays in licensing (to be acquired from other sources than the public sector)		●		
		Political risk	Risk related to change, suspension, termination, etc., of the project due to political reasons or changes in public policies	●			
		Public support risk	Risk related to increased expenses on the operator's side if the public support specified in laws, agreements, or contracts is not implemented	●			
	Economic risks	Fundraising risk	Risk related to obtaining capital which the public sector needs to procure	●		*It specifies in the PPP contracts that it is a public risk.	
				Risk related to obtaining VGF in a timely mannrr	●		*It specifies in the PPP contracts that it is a public risk for both construction and operation periods. A description of funding support to make fund flow available by central government guarantee to support in case when timely supply of VGF is not assured.
				Risk related to obtaining capital which the operator needs to procure		●	*It specifies in the PPP contracts that it is a private risk.
		Price fluctuation risk		Risk related to changed expenses of operator due to material price fluctuations beyond a certain level during the construction period	●	●	*Cost-sharing rules are specified in the PPP contracts.
				For the service purchasing portion the public sector side has ownership rights and property management is consigned to the private sector, risks related to changed expenses of operator due to commodity price fluctuations (inflation/deflation) beyond a certain level during the operation and maintenance period	●	●	*Cost-sharing rules are specified in the PPP contracts.
				For the areas where the private side has ownership rights risks related to changed expenses of operator due to commodity price fluctuations (inflation/deflation) during the operation and maintenance period		●	
		Interest change risk		Risk related to interest fluctuations before obtaining base rate	●		
				Risk related to interest fluctuations after obtaining base rate		●	

Phase	Type of Risk		Content of Risk	Allocation		Remarks	
				Public	Private		
All Phases	Social risks	Resident response risk	Risk related to lawsuits or demands from opposition movement to establishment and operation of this facility	●		*It specifies in the PPP contracts that these are public risks.	
			Risk other than the above (related to investigation, construction, or maintenance and operation by operator)		●	*It specifies in the PPP contracts that these are private risks.	
		Environmental risk	Risk related to sunshine and view obstructions, emissions or leaks of toxic substances, noise, vibrations, ground settlement, groundwater interruption, odor emissions, etc. caused by operations conducted by the operator		●	*It specifies in the PPP contracts that these are private risks.	
			Third party indemnification and compensation risk	Risk related to third party damages due to accidents attributable to the public sector	●		The public sector, which is the facility manager, is liable for indemnification of damages. *The above is specified in the PPP contracts.
		Risk related to third party damages due to accidents attributable to operations conducted by the operator, inadequacies in maintenance and management operations by the operator, etc.			●	The public sector, which is the facility manager, is liable for indemnification of damages, but it will demand compensation from the operator in cases where the operator is at fault. *The above is specified in the PPP contracts.	
		Default risks	Risk related to debt default for reasons attributable to the public sector	●		*It specifies in the PPP contracts that these are public risks.	
			Risk related to business abandonment or financial failure of the operator		●	*It specifies in the PPP contracts that these are private risks.	
			Risk related to failure by operator to provide services of the quality level specified in the requirements document		●	*It specifies in the PPP contracts that these are private risks.	
	Force majeure risks	Risk related to increased costs due to <i>force majeure</i> , increased costs due to project suspension, or other damages, beyond the scope of damages up to a certain amount or reasonably covered by insurance, etc.	●		Because <i>force majeure</i> risks are risks beyond the control of the operator, it is generally appropriate for the public sector to assume such risks. Meanwhile, in order to promote more efficient recovery, it is desirable for the operator to assume a portion of the risk of losses such as construction delays and damage due to <i>force majeure</i> . *Cost-sharing rules are specified in the PPP contracts.		
		Risk related to increased costs due to <i>force majeure</i> , increased costs due to project suspension, or other damages, within the scope of damages up to a certain amount or reasonably covered by insurance, etc.		●			
	eDesign and Construction	Design and investigation risks	Surveying and investigation risk	Risks due to inadequacies in surveying and investigations performed by the public sector	●		*It specifies in the PPP contracts that these are public risks.
				Risks due to surveying and investigations other than the above		●	*It specifies in the PPP contracts that these are private risks.
Design risk		Risk related to inadequacies in basic designs, execution designs, etc., performed by the public sector	●		*It specifies in the PPP contracts that these are public risks.		

Phase	Type of Risk		Content of Risk	Allocation		Remarks
				Public	Private	
eDesign and Construction	Design and investigation risks	Design risk	Risk related to inadequacies in the content of facility design requirements, design preconditions, etc., by the public sector	●		*It specifies in the PPP contracts that these are public risks.
			Risk related to inadequacies in designs performed by the operator		●	*It specifies in the PPP contracts that it is a private risk.
			Risk related to inadequacies and changes in instructions and judgments by the public sector (cost increases and delays in completion)	●		*It specifies in the PPP contracts that these are public risks.
			Risk related to inadequacies and changes due to other causes than the above (cost increases and delays in completion)		●	*It specifies in the PPP contracts that these are private risks.
	Land acquisition risks		Risk related to acquisition of planned construction site	●		*It specifies in the PPP contracts that it is a public risk.
			Risk related to temporary structures and material storage areas related to construction		●	*It specifies in the PPP contracts that these are private risks.
	Geological and ground risks (handling of existing buried objects)		Risk related to soil pollution, underground obstacles, unexploded ordnance, etc., at the planned site (not including soil pollution and underground obstacles which are indicated in informational materials published by the public sector, or whose presence may be reasonably predicted from such informational materials)	●		*It specifies in the PPP contracts that these are public risks.
			Risk related to soil pollution and underground obstacles, etc. at the plan site, other than the above		●	*It specifies in the PPP contracts that these are private risks.
	Construction and supervision risks	Outsourcer responsibility risk	Risk related to the content of construction contracts at the request of the public sector as well as changes in such content	●		*It specifies in the PPP contracts that these are public risks.
			Risk related to the content of construction contracts based on orders by the operator as well as changes in such content		●	*It specifies in the PPP contracts that these are private risks.
		Construction delay and incompleteness risk	Risk related to incompleteness or delays from the work schedule specified in the contract due to design changes at the request of the public sector	●		*It specifies in the PPP contracts that these are public risks.
			Risk related to incompleteness or delays from the work schedule specified in the contract due to other reasons than the above		●	*It specifies in the PPP contracts that these are private risks, and attributed to EPC contractor.
		Construction supervision risk	Risk related to problems with the content, schedule, etc. of construction work due to inadequacies in construction supervision performed by the operator		●	*It specifies in the PPP contracts that these are private risks.

Phase	Type of Risk	Content of Risk	Allocation		Remarks	
			Public	Private		
eDesign and Construction	Outsourcer responsibility risk	Risk related to increases in construction costs due to instructions from the public sector	●		*It specifies in the PPP contracts that it is a public risk.	
		Risk related to increases in construction costs due to other reasons than the above		●	*It specifies in the PPP contracts that it is a private risk, and attributed to EPC contractor.	
	Risk of failure to attain required performance	Risk related to non-compliance with performance requirements or faulty execution after facility completion		●	*It specifies in the PPP contracts that these are private risks.	
	Risk of facility damage	Risk related to damage occurring in relation to the object of construction, materials, or other related construction work prior to use		●	*It specifies in the PPP contracts that these are private risks, and attributed to EPC contractor.	
Maintenance and Operation	Construction and supervision risks	Risk of failure to attain required levels		●	*It specifies in the PPP contracts that these are private risks.	
		Maintenance and operation cost risk	Risk related to increases in work volume or expenses due to changes in project content or purpose, attributable to the public sector	●		*It specifies in the PPP contracts that these are public risks.
		Outsourcer responsibility risk	Increases in work volume or expenses due to other reasons than the above		●	There are some risks that the tenant occupation and the rental rate level will become lower than the assumed level. *It specifies in the PPP contracts that these are private risks.
		Repair cost risk	Risk related to repair costs during the project period, exceeding the repair costs initially anticipated by the operator		●	*It specifies in the PPP contracts that it is a private risk.
		Risk of facility damage	Risk due to operator's failure to perform appropriate maintenance operations or inadequacies in maintenance with regard to facility deterioration		●	*It specifies in the PPP contracts that it is a private risk.
			Risk related to facility damage due to accidents or fire, etc.	●	●	Risk is allocated according to fault. *Cost-sharing rules are specified in the PPP contracts. *insurance against fire and indemnity should be made
		Risk of facility damage	Risk related to facility damage by third parties (including facility users)	●	●	The operator assumes the risk of facility damage by third parties occurring due to the operator's failure to exercise the duty of care of a good manager or neglect of its management obligations, and the public sector assumes the risk of facility damage by third parties due to other reasons. *Cost-sharing rules are specified in the PPP contracts. *insurance against fire and indemnity should be made in case when the private sector is responsible.

Phase	Type of Risk		Content of Risk	Allocation		Remarks
				Public	Private	
Maintenance and Operation	Risk of facility defects	Risk of facility defects	Risk related to discovery of hidden defects in the facility during the defect guarantee period		●	*It specifies in the PPP contracts that it is a private risk.
			Risk related to discovery of hidden defects in the facility outside the defect guarantee period	●		The operator assumes the risk of defects which are attributable to the operator. *It specifies in the PPP contracts that it is a public risk.
			Risk related to defects in the private facility portion		●	*It specifies in the PPP contracts that it is a private risk.
	Technological innovation risk	Risk of obsolescence	Risk related to obsolescence of facilities and equipment due to technological innovations, etc., when cost increases are due to instructions from the public sector	●		*It specifies in the PPP contracts that these are public risks.
			Risk related to obsolescence of facilities and equipment due to technological innovations, etc., when cost increases are due to other reasons than the above		●	*It specifies in the PPP contracts that these are private risks.
	After End of Project	Risk of early project termination	Contract cancellation caused by failure of the public sector to fulfill its contractual obligations	●		*Rules of damages are specified in the PPP contracts.
Contract cancellation caused by failure of the operator to fulfill its contractual obligations (including partial cancellation)				●	*Rules of damages are specified in the PPP contracts.	
Facility performance risk		Risk related to ensuring facility performance at the time of project termination		●	*Rules of facility performance are specified in the PPP contracts.	
Transfer procedures risk		Risk related to costs of transfer procedures and business continuation and operator liquidation procedures at the time of project contract expiration		●	*It specifies in the PPP contracts that these are private risks.	

Source: JICA Study Team

8.2 Project Program

8.2.1 Project program

The core of this Project is defined as an urban railway operation connecting the central business district of Pune with Hinjawadai IT Park under a PPP scheme. PPP projects can be classified by the level of private sector involvement. Several options are considered including the Design-Build scheme where the public sector is responsible in principle and a scheme that entails complete privatization by the private sector. It is notable that the risk sharing between the public and private sectors are different for the various schemes.

For example, under the BOT (Build-Operate-Transfer), generally speaking, the public sector will acquire the land, whereas the private sector will arrange financing, construct civil and track work, procure E&M and rolling stock, and conduct operation and maintenance. The public and private sector responsibility is classified into a “One-Tiered model” and a “Two-tiered model” The project operator

will implement both the sub-structure and super-structure under the One-tiered model. On the other hand, under the Two-tiered model, the public sector will conduct civil and track or “Sub-structure” work whereas the private sector will procure E&M and rolling stock. In addition, BLT (Build-Lease-Transfer), BTO (Build-Transfer- Operate), BOO (Build-Own-Operate) are other forms that can be implemented.

Table 8.2.1 Table PPP schemes in Railway Projects in Several Countries

Scheme	BOT			BLT	BTO	BOO	Others
	Without Subsidy	With Subsidy	Civil Works /EM Split				
Project	BK BTS	KLIA Xpress	BK MRT	MNL MRT3	-	UK CTL	UK CRL
Implementing Agency	Pub.	Pub.	Pub.	Pub.	Pub.	Pub.	Pub.
Executing/Operating Body (EOB)	Prv.	Prv.	Prv.	Pub./Prv.	Prv.	Prv.	Prv./Pub.
Financing	Prv.	Pub./Prv.	Pub./Prv.	Prv.	Prv.	Pub./Prv.	Pub./Prv.
Capital Investment	Civil Works	Prv.	Prv.	Prv.	Prv.	Prv.	Prv.
	E&M	Prv.	Prv.	Prv.	Prv.	Prv.	Prv.
O&M	Operation	Prv.	Prv.	Prv.	Pub. ¹	Prv. ¹	Prv. ¹
	Maintenance	Prv.	Prv.	Prv.	Pub. ¹	Prv. ¹	Prv. ¹
Subsidy	on Capital Investment	None	None	None	None	None	Yes
	on O&M	None	Yes ¹	None	None	None	None
Levy	by Pub.	None	Yes ²	Lease Fee	None	None	None
	by Prv./EOB	None	None	-	Lease Fee	Lease Fee	None
Source of Investment Recovery	by Pub.	-	from Levy ²	Lease Fee and share in the profit	Operation and associated business	Operation and associated business	None other than economic benefit
	by Prv./EOB	Operation	Operation and associated business	Operation and associated business	Lease Fee	Lease Fee and share in the profit	Operation and associated business
Remarks		1: from Airport Operation Company 2: share in the operation profit		1: outsourcing to a private 3rd party	1: may be outsourcing to a 3rd party	1: may be outsourcing to a 3rd party	1: may be outsourcing to a 3rd party

Source: JICA Study Team

1) PPP Urban Railway Projects in India

In India, there are seven PPP urban railway projects that are being implemented or planned.

Table 8.2.2 PPP Urban Railway Projects

City	km	Project route	Project status
Mumbai	12	Versova-Andheri-Ghatkopar	Under construction
Delhi	23	New Delhi to Delhi Airport	Completed
Bangalore	40	Phase 2 -Gottigere to Nagawara, RV Road to Bommasandra	DPR approved, Design tenders floated and designing to be completed by September 2012
Hyderabad	71	All routes	Under construction
Pune	15	Vanaz-Ramvadi	State govt has approved
Jaipur	23	Sitapura-Ambabari	4 bidders qualified the RFQ floated in May 2011
Patna	40	Dak bungalow Square-Saguna Morh, Danapur-Patna city	State govt has approved. RFP to be floated in Oct 2012

Source: JICA Study Team

With a view to benefit this project, the Delhi Airport Metro already opened and Mumbai Metro Line 1 and Hyderabad Metro under construction are the three identified cases.

Table 8.2.3 India PPP Urban Railway three projects

	Delhi Airport Metro	Mumbai Metro Line 1	Hyderabad Metro
Project length	23km	12km	71km
Concessioneing authority	Delhi Metro Rail Corporation	Mumbai Metropolitan Region Development Authority	Hyderabad Metro Rail Ltd
SPV	Delhi Airport Metro Express Pvt Ltd	Mumbai Metro One Pvt Ltd	L&T Metro Rail (Hyderabad) Ltd
SPV partners	Reliance Infrastructure (95%) CAF, Spain (5%)	Reliance Infrastructure (59%) MMRDA (26%) Veolia, France (5%)	SPV is a subsidiary of L&T Infrastructure Development Projects Ltd
Concession type	BOOT- 30 years	BOOT - 35 years	DBFOT – 35 years (extendable)
Bidding Criteria	Highest Annual Concession Fee (INR 510 Mn)	Lowest Viability Gap Funding (INR 6.5 Bn)	Lowest Viability Gap Funding (INR 14.6 Bn)
Bid Award Date	January 2008	May 2006	July 2010
Tot Project Cost	INR 28.85 Bn	INR 23.56 Bn	INR 141.32 Bn
Financing details	95% equity from R Infra	70% debt, 30% equity	77% debt, 23% equity
Project status	Completed	Under Construction	Under Construction
Completion	February 2011	March 2013(deadline)	July 2017 (deadline)

Source: JICA Study Team

Delhi Metro Airport Metro Express

Delhi Airport Metro Express was founded with DMRC investing in a 51%share, whereas 49% was invested by the private sector consortium named Delhi Metro Airport Express Line Pvt Ltd. (DMAEL). DMRC did the alignment planning and designing, received all the approvals required for construction, conducted its construction work as well as the financing, and finally hired its personnel. On the other hand, DMAEL pays the concession fee, a part of its revenue and the licensing fee. DMAEL directly receives the fare box revenue, advertising and space rentals. DMAEL is responsible for passenger ridership and receives a fixed fee from DMRC.

Delhi Airport Metro Express Line

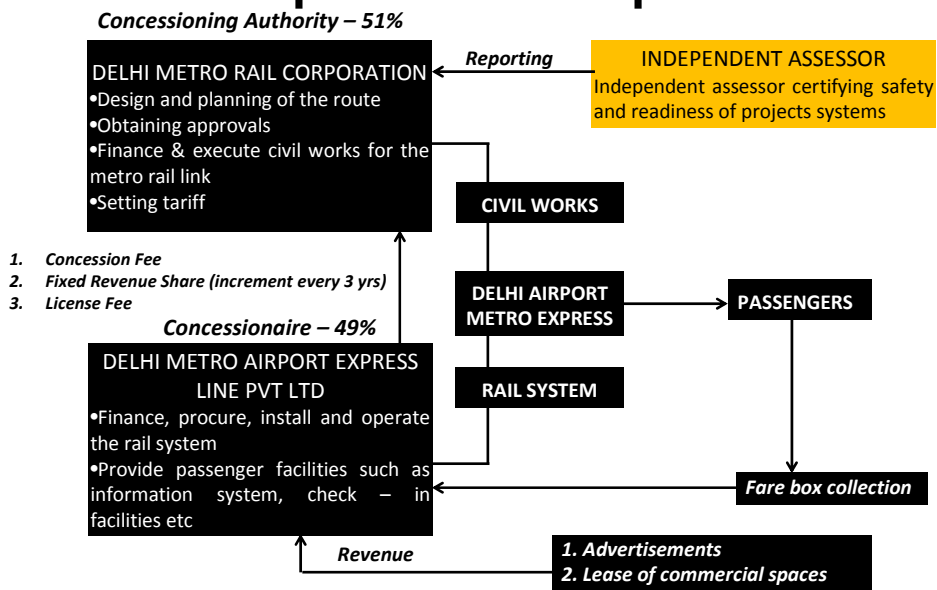


Figure 8.2.1 Delhi Metro Airport Metro Express PPP Scheme

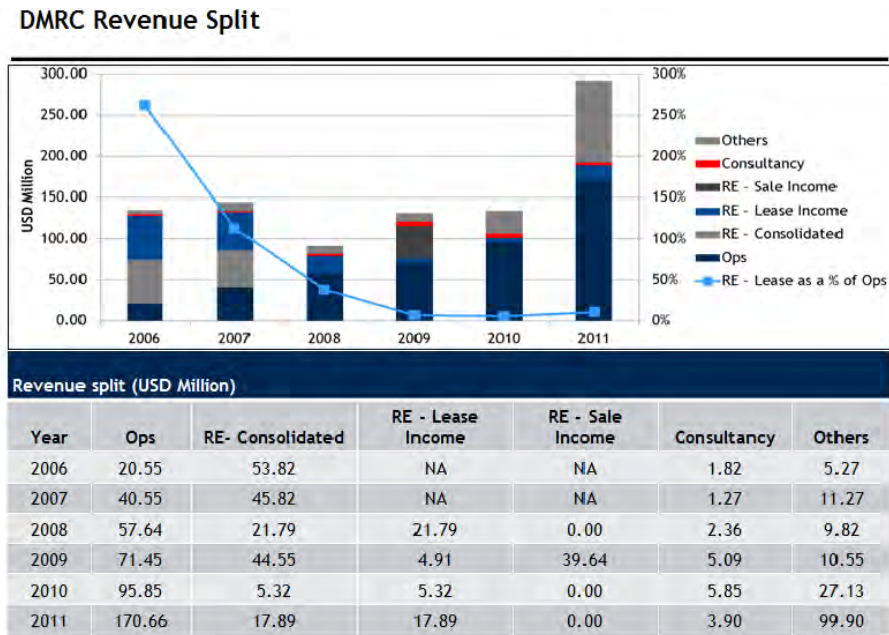
Source: JICA Study Team

DMRC itself has been operating several lines connecting Delhi and the neighbouring states but at the beginning of its operations the real estate revenue contributed substantially.

It registered operating revenue of USD 170.66 million in 2011 and the real estate revenue was USD17.89 million, representing just over 10% of total revenue.

DMRC opened its first Red Line in 2002, followed by the Yellow Line in 2004 and Blue Line in 2005. These lines count for just above half of the current network with 6 lines and 193km as the total length of the lines. At this point, the fare box revenue is below that from the real estate operations. DMC owned the land around the stations and also alongside its lines. The sale or leasing revenue of lands supported DMRC revenues.

Table 8.2.4 DMRC Revenue Trend



Source: JICA Study Team

Mumbai Metro Line 1

Mumbai Metro Line1 is owned by MMRDA with its 26% stake, and 74% is invested by the private sector. MMRDA conducted the land acquisition, received necessary approvals, and fixed the tariff, on the other hand the private sector has entered into a DBFOT (Design, Build, Finance, Operate and Transfer). They received the VGF at the level of 20% from the central government and 7.5% from the state government. The private sector underwrites the civil works, E’M and rolling stock procurement, financing and O&M. The private sector is also responsible for the ridership, directly receives the fare box revenue and pays a concession fee to MMRDA,

Mumbai Metro Line 1

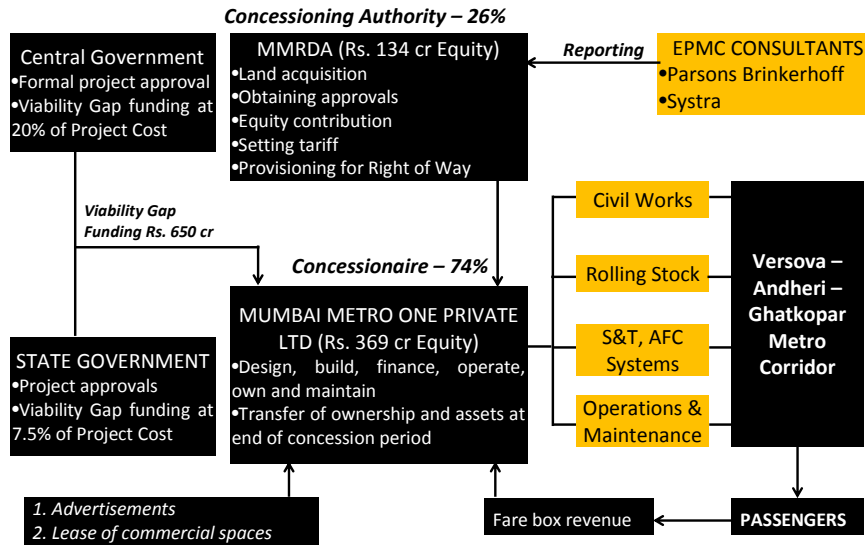


Figure 8.2.2 Mumbai Metro Line 1 PPP Scheme

Source: JICA Study Team

Hyderabad Metro

Hyderabad Metro Rail Corporation, as the Concessioneering authority, supports land acquisition and application for necessary approvals, but the land acquisition itself and its development is implemented by L&T Hyderabad Metro Rail. It has been implementing, by itself, design, construction, real estate development and financing with its own responsibility. It is also engaged in the operations and maintenance. The performance of this private sector company has been monitored by an independent engineering company.

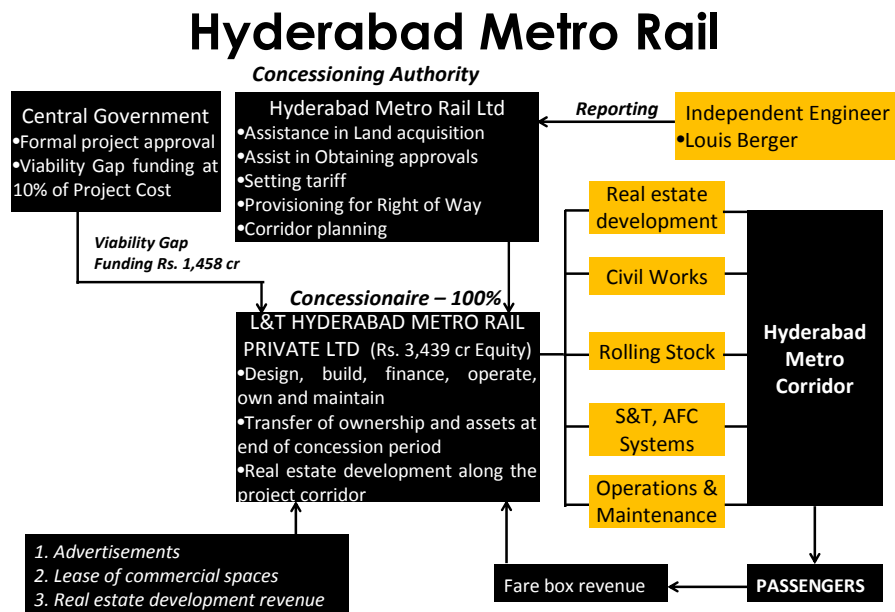


Figure 8.2.3 Hyderabad Metro PPP Scheme

Source: JICA Study Team

2) Urban Transport Administration Structure

A PPP Urban Transport System is, generally speaking, implemented and operated for railway and bus systems. The public sector assumes its role to plan, regulate and supervise, and in a case when a PPP is applied it grants the concession. MoUD recommends the establishment of a United Metropolitan Transport Authority (UMTA) in large cities but this is not always the case.

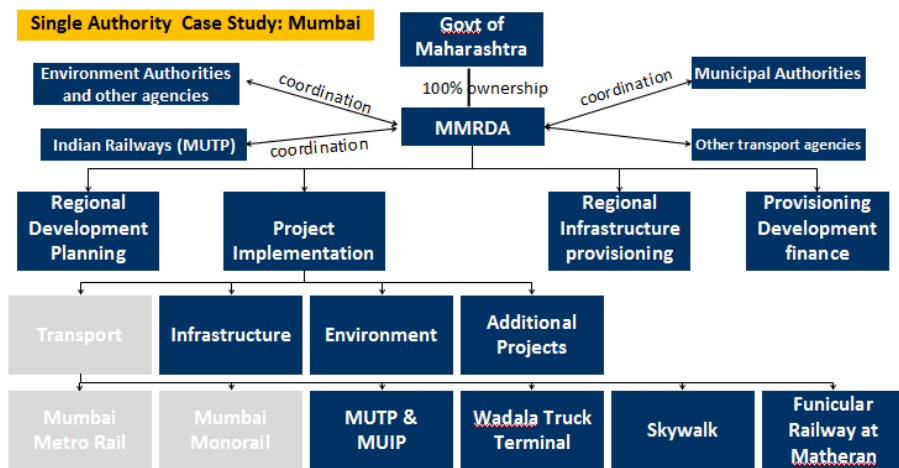


Figure 8.2.4 Mumbai – A Single Regulatory Agency

Source: JICA Study Team

Mumbai has adopted a single regulatory agency system through MMRDA to cover both metro and monorail systems. In the case of Chennai it has introduced a dual regulatory system. Chennai Metro Rail Corporation is under the central government whereas Metropolitan Transport Corporation belongs to the state government of Tamil Nadu. MMRDA in the case of Mumbai has a larger scope of activities not limited to only urban transport. It has the advantage of providing a single window but the concentration of too much authority has been pointed out as well.

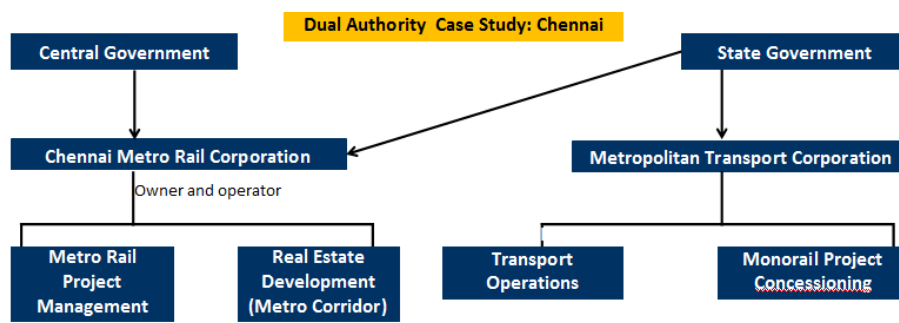


Figure 8.2.5 Chennai Dual Regulatory Authorities

Source: JICA Study Team

8.2.2 Project Program Evaluation

For urban railway programs under PPP, a wide variety of schemes are offered in India and also in other countries. Some of the lessons that can be learnt and evaluated from those cases are described below.

Whether or not to implement an urban railway project under PPP

The Indian and other country governments have been promoting PPP schemes for economic and social development to bring in the vitality of the private sector, introduce management know-how, and bring financing from the private sector and also, in return, to reduce its public spending. Looking back at the

track records, the road sector has by far the largest share in the transport sector infrastructure. The ports and airports follow the road, and thus its application to the railway sector is rather limited. The public sector has been offering the transport, by keeping its fundamental nature as the public service. However, it is worthwhile adopting a PPP scheme for the railway sector with a purpose to introduce the competition principles, management skills and the advantages in financing of the private sector.

Tariff Policy as the Public Transport

Excepting for a high speed railway system running on dedicated track and attaining fast service, the general inter-city and intra-city railays have been considered as an alternative transportation means rather than bus, motorcycle, auto-rickshaw or even walking. There are transportation modal split considerations among those means, but when deciding tariff, it tends to be fixed lower under the Transit Oriented Development. Comparing with the road or air transport, the railway is certain that its general application to the public is rather high, and thus it may offer challenges but differentiated tariffs by running local or express services or the differentiation by type of carriages are the cases already often introduced in Japan.

Substantial difference of railway vis-à-vis other transport infrastructure

Railway operations are different than other transport sector infrastructure when considering operations under PPP, the facility owner, or BOT operators are different from the beneficiaries, i.e. users. Cars are brought onto the road by car owners and the same goes for ship owners / operators in the case of a port. The beneficiaries are different from the facility owner.

Thus, the builder / concessionaire of those forms of transport infrastructure offers the sub-structure such as civil work but they do not offer equipment, materials or means to use the facility.

On the other hand, railway operators also need to further procure the super-structure like rolling stock and E&M, and more. They need to be engaged in constructing, procuring and operating the whole system.

Difficulties in Securing Viability in Urban Railway Operations

The urban railway projects under PPP schemes in India have been structured with the One-tiered System, but their performance has not been so bright. Most of them needed a lengthy period for financing and also a delay in its implementation. It has been observed in urban railway projects that the tariff is kept low to accommodate the public transportation policy in spite of the huge infrastructure construction cost. This has resulted in difficulties in securing profitability by only depending on the fare box revenue.

Expectation to Induce Real Estate Development Revenue in Railway Projects

Urban railway projects under PPP schemes in India have adopted the One-tiered System as their business model, but their operations are not performing so well. The main reason for this is that the business depends on the fare box revenue to cover the huge investment. This is in spite of the efforts

by the Ministry of Urban Development to introduce Value Capture of Property Development but its application is not so easily implemented. Station concourse commercial and parking facilities can be expected to offer higher convenience to passengers. Property development, beyond those station facilities, such as housing and office or commercial facility developments are quite different from the normal business nature of a railway. As a matter of fact, the Japanese private sector railway companies have well established their models from over 60 years of successful experience. However, it may not be directly transplanted into India considering its high risk business profile.

BOT Two-tiered System

By reflecting on those considerations, this Study considers that there would be tremendous difficulty in introducing a One-tiered system where PPP SPV fully underwrites the project, implement and operate without dividing the Sub-structure and Super-structure. The Study team hereby recommends the Two-tiered system to be most suitable. The public sector will implement the Sub-structure construction including land acquisition, civil work and track work. The private sector, in its turn, will procure rolling stock and E&M classified as the Super-structure. The financing will be separately assumed responsibilities by both the public and private sectors for their own parts. In the case of this project, without going into the detail, about 50% of the total project cost is for the sub-structure and the remaining is for the super-structure.

BOT Gross Cost Scheme

The consideration regarding the fare box revenue collection should also be carefully reviewed. Operations and maintenance will be done by a private sector operator under the BOT Net Cost Scheme where the private sector assumes the ridership risks and thus collects the fare box. Having said this, the private sector operator does not have full liberty in fixing its tariff due to the nature of public good and this will cause difficulties in securing their profitability and therefore, they are left with uncertainty.

As an example of a recent case, Thai MRT Blue Line adopted the Net Cost Scheme but the new Purple Line has adopted, based on the difficulties the preceding Blue Line faced, the Gross Cost Scheme. The public sector will fix the fare level and collect the fare box. The private sector concessionaire will receive a service fee, this is known as a Gross Cost Scheme. In France, a country advanced in terms of PPP legislation and implementation, a new law was introduced to encourage this Gross Cost Scheme.

Some preceding BOT Net Cost Schemes in India have shown difficulties when associated real estate development revenue cannot be expected. That has generated a certain level of concern on the part of Indian authorities. As a matter of fact, the Urban Transport Working Group at the Planning Commission recommended that a Gross Cost Schemes is more suitable for urban transport. It also says the private sector operator should not depend on the fare box revenue but receive a service fee from the transport authority.

Mobilizing VGF

On top of the general description of the importance of VGF, a good level of support by VGF is crucial for this Project. In general, it is understood that up to 20% will come from the central government, and another maximum 20% from the state government, and further, in relation to this Project, the related ULBs, PMC and PCMC, have expressed their support by putting aside its budget for 10% of the project cost. In the name of the Study Team, the maximum mobilization of VGF and similar support from the public sector is essential knowing the fact that railway business, particularly where the project is required to supply both sub- and super- structure, and that the tariff cannot be fixed by the SPV and rather kept low due to the public transport policy.

The PPP Cell unit at MOF expressed, as a general comment, that the VGF should be supplied first for funding the sub-structure but it also commented that each VGF application would be reviewed case by case. This Study and its subsequent DPR will reach the point where this would be given a clarification. Bearing this in mind, this Project will analyse its financial returns on the basis that both the public and private sector will receive VGF accordingly.

PPP project with Japanese company participation

One of the features of this Study is to have Japanese companies as the investors to SPV. They may stay in a minority stake but the railway operation could expect advantages.

- **Eco-friendly technology to be offered**

This project considers introducing a catenary-less LRT with lithium-ion batteries, an eco-friendly technology developed by Japanese firms.

- **Lower Life Cycle Cost**

The total cost including the whole O&M period is lower due mainly to the low maintenance expense compared with other traditional systems like the Pune Metro lines.

- **JICA PSIF to be mobilized**

Financial cost is one of the major concerns in infrastructure projects. As stated later, this Project plans to mobilize JICA PSIF as the key financial resource. It is characterized by its long period to maturity as well as its low interest rate. In fact, this lowered financial cost has a big impact on the viability of the project.

8.2.3 Project Implementation Structure

Taking the foregoing review and considerations, the Study Team now recommends an enabling project implementation structure with a private sector-led PPP, under BOT Gross Cost Scheme and funding with VGF and JICA PSIF financial arrangements. The Project also aims to introduce environmentally friendly advanced technology ending up with low life cycle cost equipment.

1) Public Sector Implantation and Supervising Structure

High Power Committee

A High Power Committee, consisting of representatives from PMC, PCMC and MIDC as well as the State government has been formed with 10 members. HPC will review and decide the key policy, give approvals for the new lines, fix tariff and other key issues.

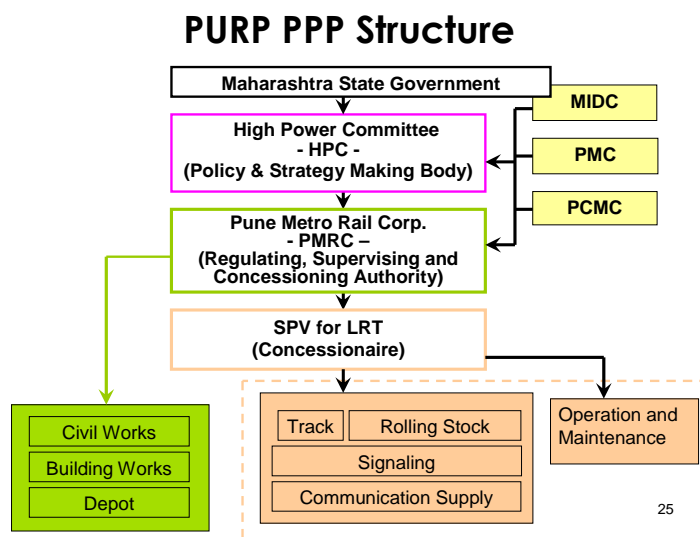


Figure 8.2.6 Pune Urban Railway PPP Scheme

Source: JICA Study Team

Pune Metro Rail Corporation (PMRC)

PMRC is the regulatory and supervising body for both Pune Metro Lines 1&2 and also this LRT project line. It plans, regulates and supervises railway operations and also proposes rules and standards to HPC.

Its organization will be different. In the planning period, planning and procurement departments are important. When coming to the construction period, the procurement and supervision departments are to play crucial roles. During the operation period, operations and maintenance departments are to primarily look after the whole of the aspects of train operations.

While PMRC looks after both Pune Metro Lines 1&2 and this LRT, the characters of MRT and LRT are different. For the benefit of SPV that requires a specific accounting, PMRC should be separately accounted for and in this way will never be comingled.

Currently, the HPC (High Power Committee) has submitted an application to the State Government for approval of the establishment of PMRC. Once the main personnel have been determined, this PMRC will be established.

Possible PMRC Organization

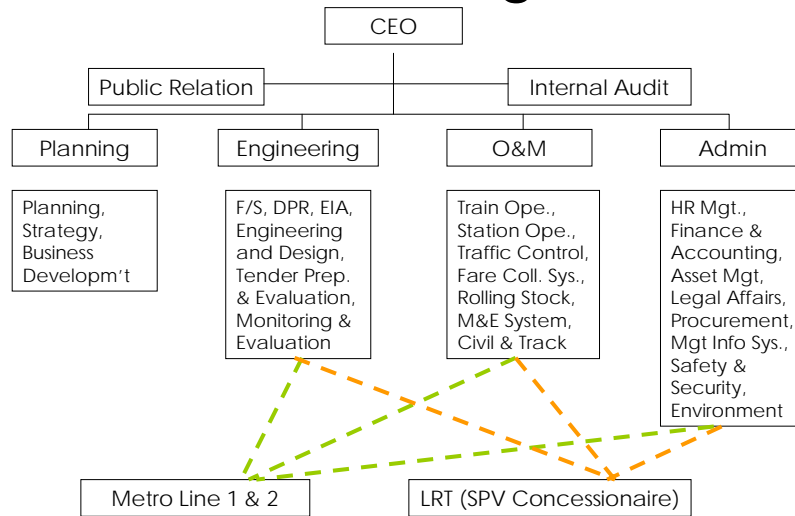


Figure 8.2.7 PMRC Possible Organization Chart

Source: JICA Study Team

BOT Gross Cost Scheme

Considering the public service nature of urban transport, which precludes the private sector operator from fixing the fare level, the project viability may be uncertain, and also taking the recent recommendation by the working group on urban transport in India, and further reviewing the recent cases in other countries, the Study Team recommends adoption of the BOT Gross Cost Scheme where the fare level and fare box collection are handled by the public sector and the private sector receives a service fee.

When drawing under Gross Cost Scheme is as follows. Fare box revenue is collected by PMRC, the SPV will receive a service fee and will pay its own operational expenses and also repayment of its debt.

PURP O&M Period Cash Flow BOT Gross Cost Scheme

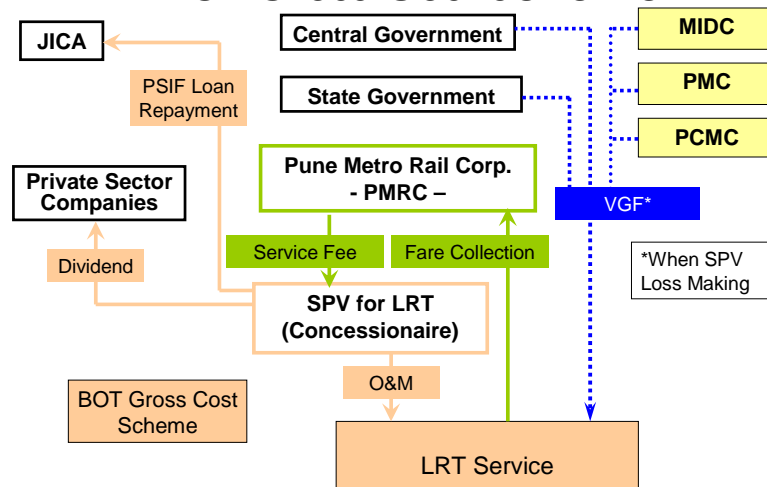


Figure 8.2.8 BOT Gross Cost Scheme Cash Flow during Operation Period

Source: JICA Study Team

Institutional and Organizational Issues for the Public Sector related to Urban Transport Projects

The project implementation structure discussions regarding PPP have so far been mainly focusing on the policy prioritization and funding assistance regarding the contents and means, or the evaluation from the macroeconomic point of view.

Urban transport, as a part of public service, should not be considered to be merely granting a concession to the private sector for the construction, procurement and O&M under the PPP contract, the public sector is required to prepare norms and standards for urban railway operations and to monitor and supervise whether the concessionaire observes those. This is not an issue of the public-private risk allocations but the public sector is ultimately held accountable for offering the citizens a secure, safe and comfortable public transport service.

More specifically, the public sector is required to present standards, norms and certifications such as on technique, safety and driving to the concessionaire and incorporate those into the PPP contract. The public sector will monitor the observance by the concessionaire. It also needs to offer capacity building and technical training.

2) Private Sector: Organization and Structure of Special Purpose Vehicle

Special Purpose Vehicle (SPV) operates the LRT business under the concession agreement with public sector as a concessionaire. It is a private company to play a role of construction, procurement, operation and maintenance management. They are comprised of the private companies from Japan, India and other foreign countries who have an interest in business operation and investment. SPV is officially established around the time of determination of the concession agreement, and then they will start operation and their business.

The SPV's organization differs according to the stage, "Construction and Procurement stage" and "Operation and Maintenance stage", although each stage has two types of division that is Business Administration Division and Technical-Operation Division. During the Construct and Procurement stage, Business Administration Division procures the systems, manages the finance and conducts a public relation, while Technical-Operation Division mainly manages the construction and procurement from technical point of view. On the other hand, during the Operation and Maintenance stage, Administration Division sets up the several departments for company management and has a responsibility to function as a stock company. To execute the concession agreement faithfully, Technical-Operation Division has functions to daily operate LRT system, maintain its system and train human resources.

SPV Configuration (Construct Stage)

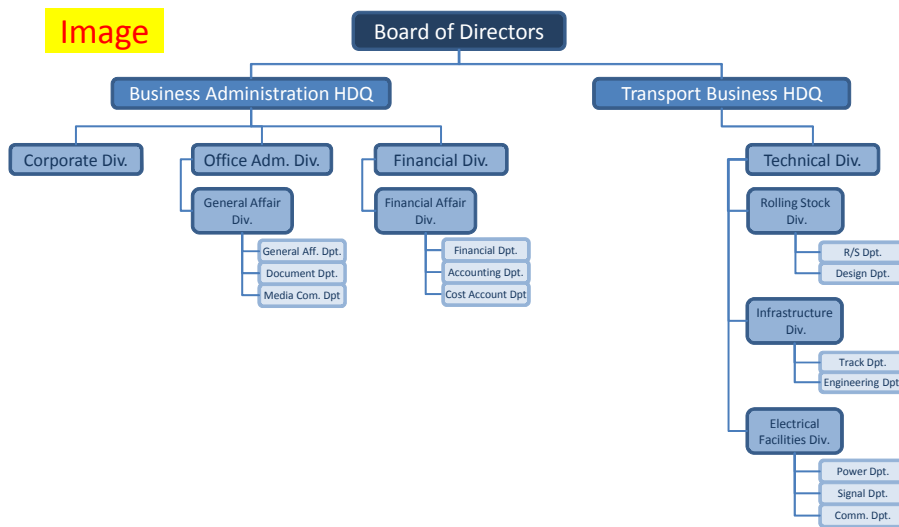


Figure 8.2.9 SPV Organization Chart (Construct Stage)

Source: JICA Study Team

SPV Configuration (Operating Stage)

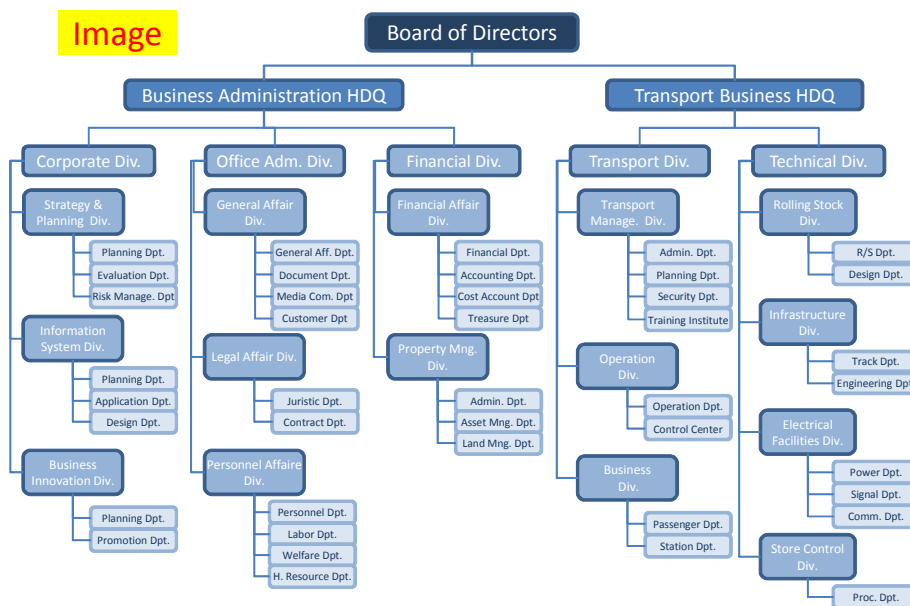


Figure 8.2.10 SPV Organization Chart (Operating Stage)

Source: JICA Study Team

8.2.4 Implementation Schedule

In this project, establishing PMRC (Pune Metro Rail Company), making DPR and EIA to submit to the state government, choosing the consultants for the next step, establishing SPV by the concession contract, implementation of construction and subsequent activities of SPV are required to coordinate with the process of the project. In consideration of this, the implementation schedule is fixed. Mainly,

- Activities of Indian Public side from 2013 to 2015
- Implementation construction from 2016 to 2020
- Activities of SPV by the concession contract during the establishing term from 2015 to 2016, during construction term from 2017 to 2020 and operation and maintenance terms
- Financing and repayment by SPV from 2016

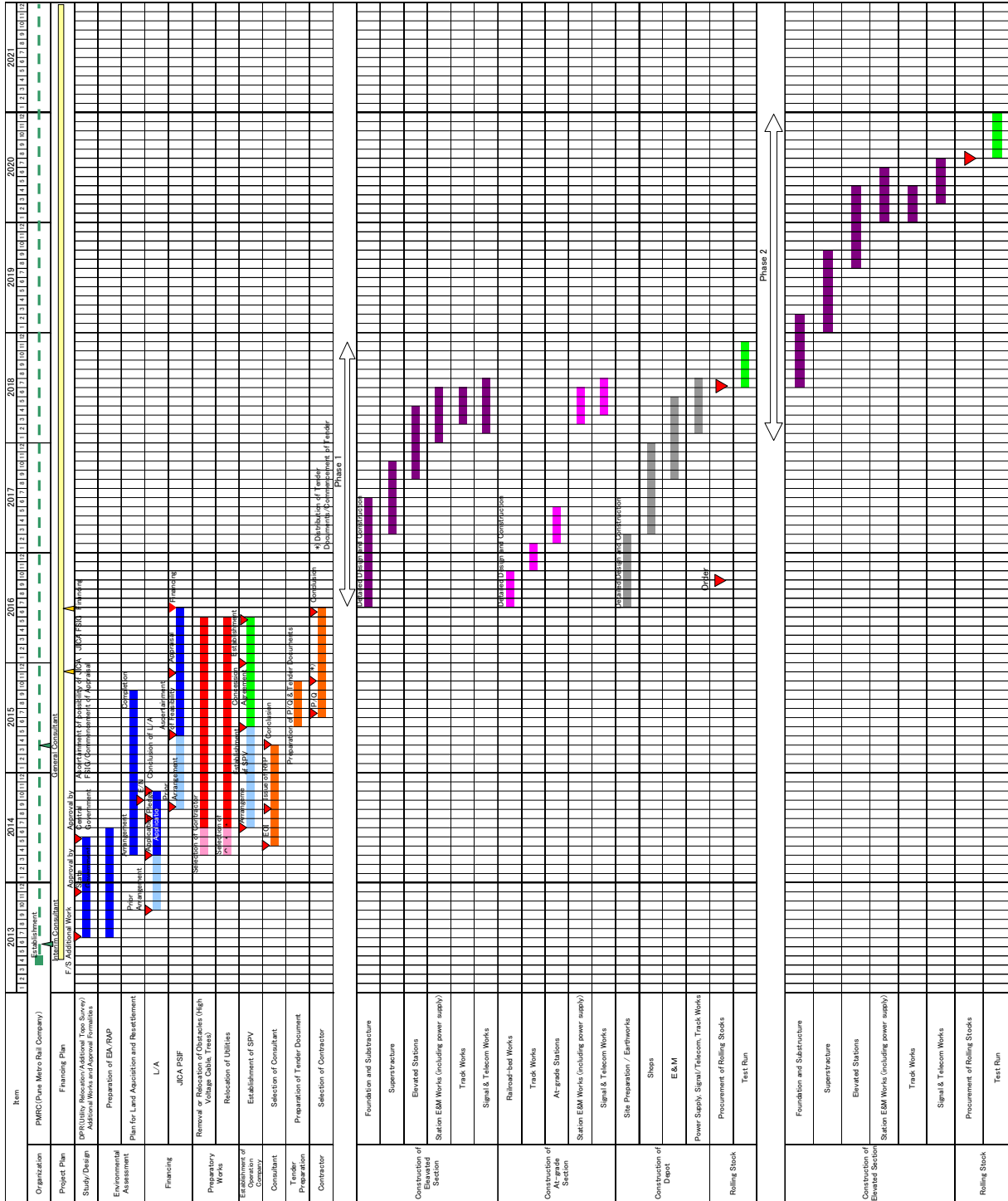


Figure 8.2.11 Project Implementation Schedule

Source: JICA Study Team

8.3 Financing Plan

This project is expected to be implemented as a PPP project. As for the financing of the project, domestic budgetary resources or overseas development assistance funding would be the least ways to be applied but the project future cash flow based financial arrangement needs to be pursued. The Indian government, on the other hand, has been promoting infrastructure development through PPP since the 1990s and has established new systems such as the India Infrastructure Project Development Fund (IIPDF), Viability Gap Funding (VGF), and India infrastructure Finance Corporation Limited (IIFCL).

1) VGF

VGF is aimed to complement the project feasibility gap for PPP projects that cannot be financially viable due to the long period for preparation and restrictions on the viability of projects. The PPP Cell at DEA is responsible for the VGF application window. It receives applications, conducts appraisals and gives approvals.

Key requirements for an application are:

- VGF is offered as a subsidy for capital investment during the construction, and is accounted as a liability with no maturity, no interest and no need to repay.
- VGF targets projects where the private sector invests more than 51% into a project.
- Eligible infrastructure sectors are roads and bridges, railways, ports, airports, irrigation, water ways, electricity, urban transport, water supply, water treatment, waste management, food cold chain transport and storage, urban infrastructure, infrastructure investment within a special economic zone, international convention centers and other tourism infrastructure.
- VGF can only be applied when the procurement is conducted with competitive bidding and the private sector is expected to finance construction, finance, and operation and maintenance.
- The project is to offer services on the basis of a fixed tariff (Value for the services rendered should be collected directly from the users)
- In addition, a confirmation and/or certificate is obtained from the government or the line ministry.
- Tariff cannot be raised to supplement the project viability.
- The project period cannot be extended to supplement the project viability.
- Capital investment expenditure is calculated in a reasonable and standard manner by referring to similar projects, and this also causes constraints for the project viability improvement.

VGF Application Requirements

VGF can be offered up to 20% of the total PPP project cost primarily by the central government and another 20% by the state government or state agency. Consequently a maximum of 40% of the project cost can be covered by VGF. For granting a VGF, the equity payment should be done by the private sector and VGF is granted in parallel to the debt finance.

VGF Application and Approval Procedure

A VGF application is initiated by the implementing agency, namely the state government (or state agency), or central government ministry (or implementation agency under the line ministry). A VGF application is reviewed and appraised by the Department of Expenditure and Planning Commission at the Ministry of Finance, an in-principle approval is given by the approving agency to the project implementation body to proceed with the project with open competitive bidding. After the selection of the winning bidder and formation of a SPV, and an approval from bank syndicate, the project implementation agency will formally apply a VGF and the approving agency will officially approve the VGF.

2) JICA Private Sector Investment Finance

JICA funds are expected in order to offer investments on favorable terms depending on the contents of the investments with attractive conditions. Some favourable terms such as maximum 25 years for repayment period, fixed interest rate and yen denominated loans compared with Indian commercial banks for development projects implemented by private sector companies in developing countries.

3) India Infrastructure Finance Company Ltd. - IIFCL

IIFCL was established in 2006 to offer direct lending to infrastructure projects, offer refinancing to banks and financial institutions to extend the maturity of loans in order to supplement the sources for infrastructure project financing. IIFCL gives priority to infrastructure projects where private sector investment is expected. IIFCL makes loans to commercially viable projects, and PPP projects implemented by the private sector selected through competitive bidding. IIFCL does not conduct appraisal by themselves but relies on those done by the major banks.

IIFCL can provide infrastructure project SPV with refinancing covering up to 20% of the capital cost or provide direct lending as long-term finance for infrastructure projects. Target sectors are roads, bridges, railways, ports, airports, irrigation, electricity, urban transport, water supply, water management, waste management and urban physical infrastructure, gas pipelines, SEZ infrastructure, international convention centres and other tourism facilities. IIFCL can also provide direct loans with a maturity of over 5 years or offer refinancing to banks and financial institutions.

IIFCL has set up, in April 2012, an infrastructure Debt Fund through its UK subsidiary with assistance from ADB. ADB and others invest in a USD 1 billion fund. With this resource, IIFCL offers refinancing of up to 85% of senior debt at Indian commercial banks on infrastructure lending.

IIFCL will thus succeed claims held by commercial banks who, as a matter of fact, lend to virtually all infrastructure projects so that the banks' long-term exposure will be reduced and they are encouraged to offer new loans

4) Infrastructure Debt Fund

Debt finance for infrastructure projects, however, relies on bank finance and Indian commercial banks do not have any sources for raising long-term debts, and thus fall into a mismatched situation between assets and liabilities. The Minister of Finance announced the establishment of IDF during the 2011-12 budget and its guideline in June 2011 to facilitate long term borrowing.

In response to the announcement, IIFCL, with assistance from ADB, launched an Infrastructure Debt Fund in April 2012. ADB and other institutions have invested in the USD 1 billion fund. IIFCL is to refinance up to 85% of infrastructure project funding financed by commercial banks having senior loan assets. IDF will refinance projects under the operational period, assume the claims of commercial banks to reduce their long-term exposure, and at the same time create new room for new infrastructure project commitments.

5) IDFC

IDFC was established in 1997 to take a leading role in promoting the private sector to engage in infrastructure investment. The key priority areas are energy, transport, communication, IT, SEZ, industrial parks and those categorized as industrial and commercial infrastructure but there is no track record on urban railways.

6) State Level Public Financial Institutions

In addition to those central government level supports, state governments establish and invest through their finance corporations. In the case of the State of Maharashtra, the state finance institutions mainly focus on SMEs or local enterprises, and thus are not interested in large scale infrastructure projects. There are two institutions, MUIDCL, a specialized agency for urban development, and MSRDC, a transport infrastructure agency, but both have only limited sources of funding and thus the activities are rather marginal.

7) Indian state owned commercial banks – PSU banks

Lending to large Indian enterprises is mainly channelled through PSU. SBI, PNB, which are the main players.

State Bank of India (SBI)

SBI, established in 1806 is the largest based on its revenue, assets, deposits, number of branches and personnel among Indian banks. The asset base has been well decentralized by its sectors and loan classifications such as individuals, legal entities, SMEs, international, etc.) . SBI has over 16,000 branches throughout the country and has 130 overseas branches. The Tokyo branch is one of those.

Punjab National Bank (PNB)

PNB was established in 1894 and is the second largest state owned commercial bank. PNB has an over INR 377,350 million asset base with its 5,161 branch network and 5,050 ATMs.

Industrial Development Bank of India (IDBI)

IDBI, offering long-term financing, has been playing an important role to develop the financial structure of India. As of March 2011, IDBI had 816 branches and 1,372 ATMs.

Private Equity Fund

The Private Equity (PE) market in India has been growing back due to the high borrowing interest rate. The debt finance market has concerns over the delays and long payback periods. PE has focused on the energy sector as its largest target during the last several years. USD 5,255.4 million were invested during the 2005 to 2011 period. The communication sector received USD 4,836.7 million, followed by the engineering sector with USD 3,375.8 million, marine transport / logistics with USD 1,810.1 million, and transport with USD 575.9 million.

New Financial Mechanism

The Indian government proposed, through the National Urban Transport Policy 2006 (“NUTP 2006”) by the Ministry of Urban Transport to mobilize land as the financial resources to finance infrastructure projects.

Indirect Benefit Value Capture

With the opening of an urban railway line, the land value alongside the route will increase. As a result, additional real estate tax and life betterment income will increase, and the increase in consumption will bring a tax payment increase.

Property Value Capture

Possible property mobilization will increase. New commercial property construction, as well as a new Floor-to-Space index will be introduced. The public sector will grant development rights for new commercial and residential development.

Urban Transport Fund

A new Metro Infrastructure Fund was established in Bangalore. Real Estate tax is levied additionally with a value equivalent of 5% of market price, real estate additional tax of 10% for residential property and 20% for commercial property for the portion of increase of the space coverage ratio. These new taxes are injected into the fund and mobilized for infrastructure capital expenditure by the public sector agencies such as Bangalore Metro.

8.4 Financing Plan

8.4.1 TOD Fund

PPP Business Plan

This project is expected to be implemented as a PPP project. Domestic budgetary resources or overseas development assistance funding would be the least applied but the project future cash flow based financial arrangement needs to be pursued. The Indian government, on the other hand, has been promoting infrastructure development through PPP since the 1990s and has established new systems such as India Infrastructure Project Development Fund (IIPDF), Viability Gap Funding (VGF), and India Infrastructure Finance Corporation Limited (IIFCL).

Central Government Level

1) Viability Gap Funding - VGF

VGF is aimed to improve the project feasibility gap for PPP projects that cannot be financially viable due to the long period for preparation and restrictions affecting the viability of projects.

VGF is a grant offered from the central government to cover up to 20% of the planned project cost at the beginning stage of construction for a public infrastructure project with private sector participation.

Key requirements for application are:

- VGF is offered as a subsidy for capital investment during the construction, and is accounted as a liability with no maturity, no interest and no need to repay.
- VGF targets projects where the private sector invests more than 51% into a project.
- Eligible infrastructure sectors are roads and bridges, railways, ports, airports, irrigation, water ways, electricity, urban transport, water supply, water treatment, waste management, food cold chain transport and storage, urban infrastructure, infrastructure investment within a special economic zone, international convention centers and other tourism infrastructure.
- VGF can only be applied when the procurement is conducted with competitive bidding and s private sector is expected to undertake the construction, finance, operation and maintenance.
- The project is to offer services on the basis of a fixed tariff (Value for the service rendered should be collected directly from the users)
- In addition, a confirmation and/or certificate is obtained from the government or the line ministry.
- Tariff cannot be raised to supplement the project viability.
- The project period cannot be extended to supplement the project viability.

- Capital investment expenditure is calculated in a reasonable and standard manner by referring to similar projects, and this also causes constraints for the project viability improvement.

VGF Application Requirements

VGF can be offered up to 20% of the total PPP project cost primarily by the central government and another 20% by the state government or the state agency. Consequently a maximum of 40% of the project cost can be covered by VGF. For granting a VGF, the equity payment by the private sector should be done and VGF is granted in parallel to the debt finance.

VGF Application and Approval Procedure

A VGF application is initiated by the implementing agency, namely the state government (or state agency), central government ministry (or implementation agency under the line ministry). A VGF application is reviewed and appraised by the Department of Expenditure and Planning Commission at the Ministry of Finance. An in-principle approval is given by the approving agency to the project implementation body to proceed with the project with open competitive bidding. After the selection of the winning bidder and formation of an SPV, and an approval from a bank syndicate, the project implementation agency will formally apply a VGF and the approving agency will officially approve the VGF.

2) India Infrastructure Finance Company Ltd. - IIFCL

The IIFCL was established in 2006 to make direct lending to infrastructure projects and offer refinancing to banks and financial institutions to extend the maturity of loans in order to supplement the sources for infrastructure project financing. The IIFCL gives priority to infrastructure projects where private sector investment is expected. The IIFCL makes loans to commercially viable projects, and PPP projects implemented by the private sector selected by competitive bidding. The IIFCL does not conduct appraisals by themselves but relies on those done by the major banks.

The IIFCL can provide infrastructure project SPV with refinancing covering up to 20% of the capital cost or provide direct lending as a long-term finance for infrastructure projects. Target sectors are roads, bridges, railways, ports, airports, irrigation, electricity, urban transport, water supply, water management, waste management and urban physical infrastructure, gas pipelines, SEZ infrastructure, international convention centers and other tourism facilities. The IIFCL can also provide direct loans with a maturity of over 5 years or offer refinancing to banks and financial institutions.

The IIFCL has set up, in April 2012, an infrastructure Debt Fund through its UK subsidiary with assistance from ADB. ADB and others invest in the USD 1 billion fund. With this resource, the IIFCL offers refinancing of up to 85% of senior debt at Indian commercial banks on infrastructure lending. The IIFCL will thus succeed claims held by commercial banks who, as a matter of fact, lend to virtually all infrastructure projects so that the banks' long-term exposure will be reduced and they are encouraged to offer new loans

Infrastructure Debt Fund – IDF

The first debt fund was launched in March 2012 with an amount of USD 1 billion. IIFCL, SBI, ICICI, LIC, IFFC, UTI and others are sponsors and they started to inject long term funding into infrastructure projects. Infrastructure projects require a long payback period, and require long-term funding for sustainability and from the cost and benefit point of view. Debt finance for infrastructure projects, however, relies on bank finance and Indian commercial banks do not have any sources for raising long-term debts, and thus fall into the mismatched situation between assets and liabilities. The Minister of Finance announced the establishment of IDF during the budget 2011-12 to facilitate long term borrowing and its guideline in June 2011.

3) IDFC

IDFC was established in 1997 to take a leading role to promote private sector involvement in infrastructure investment. The key priority areas are energy, transport, communications, IT, SEZ, industrial parks and those categorized as industrial and commercial infrastructure but there is no track record on urban railways.

4) State Level Public Financial Institutions

In addition to those central government level supports, state governments establish their finance corporations and invest through them. In the case of the State of Maharashtra, the state finance institutions mainly focus on SMEs or local enterprises, and thus are not interested in large scale infrastructure projects. There are two institutions, MUIDCL, a specialized agency for urban development, and MSRDC, a transport infrastructure agency, but both have only limited sources of funding and thus the activities are rather marginal.

5) Indian state owned commercial banks – PSU banks

Lending to Indian large enterprises is mainly channeled through PSU. SBI, and PNB, which are the main players.

State Bank of India (SBI)

SBI, established in 1806 is the largest among Indian banks based on its revenue, assets, deposits, number of branches and personnel. The asset base has been well decentralized by its sectors and loan classifications such as individuals, legal entities, SMEs, international, etc.) . SBI has over 16,000 branches throughout the country and has 130 overseas branches. The Tokyo branch is one of those.

Punjab National Bank (PNB)

PNB was established in 1894 and is the second largest state owned commercial bank. PNB has an over INR 3,773,50 million asset base with its 5,161 branch network and 5,050 ATMs.

Industrial Development Bank of India (IDBI)

IDBI, offering long-term financing, has been playing an important role to develop the financial structure of India. As at March 2011, IDBI had 816 branches and 1,372 ATMs.

6) Private Equity Fund

The Private Equity (PE) market in India has been growing back due to the high borrowing interest rate. The debt finance market is concerned over the delays and long payback period. PE has focused on the energy sector as its largest target during the last several years. USD 5,255.4 million were invested during the 2005 to 2011 period. The communications sector received USD 4,836.7 million, followed by the engineering sector with USD 3,375.8 million, marine transport / logistics with USD 1,810.1 million, and transport with USD 575.9 million.

7) New Financial Mechanism

The Indian government proposed, through the National Urban Transport Policy 2006 by the Ministry of Urban Transport to mobilize land as the financial resource to finance infrastructure projects.

Indirect Benefit Value Capture

With the opening of an urban railway line, the land value alongside the route will increase. As a result, there will be additional real estate tax or life betterment income will increase, or the increase in consumption will bring a tax payment increase.

Property Value Capture

Possible property mobilization will increase. New commercial property construction, as well as a new Floor-to-Space index will be introduced. The public sector will grant development rights for new commercial and residential development.

Urban Transport Fund

A new Metro Infrastructure Fund was established in Bangalore. Real Estate tax is levied additionally with a value equivalent to 5% of market price, an additional real estate tax of 10% for residential property and 20% for commercial property for the portion of increase of the space coverage ratio. These new taxes are injected into the fund and mobilized for infrastructure capital expenditure by the public sector agencies such as Bangalore Metro.

8.5 Financial Condition

See Section 9.2.3 (Financial Analysis for PPP Scenarios).

Chapter 9 Project Evaluation

9.1 Financial and Economic Analysis

9.1.1 Financial Analysis

1) Objective, Methodology and Premises

The objective of financial analysis is to evaluate the financial adequacy of the project.

In this section, based on the cost estimates and demand forecast indicated in the previous chapters, the financial adequacy of the project as a whole will be evaluated, irrespective of debt and equity. The analysis will be conducted based on the discount cash flow model, which is a common method for project evaluation. Financial Internal Rate of Return on the Project (Project FIRR) and Financial Net Present Value (FNPV) will be estimated as evaluation indexes.

This project is being formulated as a Public Private Partnership (PPP)-type project. The particular purpose of financial analysis at this stage is to examine whether the entire project will produce sufficient return based solely on the calculated cash flows, and to provide base-case information for further discussions that will be made subsequently on the relevant PPP schemes as well as financial options considering debt and equity.

Table 9.2.1 shows the premises of the financial analysis.

Table 9.1.1 Premises of Financial Analysis

Route	JM Temple – Mahindra Tech Phase 3 Total length: 21.6km
Expenditure and Revenue	Expenditure: Investment cost and O&M expenses Revenue: Fare box revenue and non-fare box revenue (relating business such as advertising at the stations)
Year of Revenue Estimation	Revenues are estimated for 2018, 2028, and 2038 according to the years of the demand forecast. Revenues between these years are calculated mostly on the assumption of a constant growth rate, while considering that the operation will start in two stages.
Period of Analysis	35 years including construction period from 2014 to 2020 and 30 years of operation from 2019 to 2048.
Project Schedule	F/S starting from 2013. Utility relocations and land acquisitions from 2014 to 2016. Two stages of construction conducted from 2016 to 2020. Initial operation starting at the end of 2018 and second in 2021.
Evaluation Measure	The Project FIRR is evaluated in comparison with the financial opportunity cost of capital (FOCC). In this analysis, 8% is set as an evaluation index from the recent rates of the 10-year Government Bond. This rate is applied to the calculation of FNPV.
Base Year for Cost	All figures are based on constant prices in 2012.
Financial Cost	The cost for domestic products is the market price including various taxes. The cost for imported products is the CIF price with import duty, inland transportation cost and other fees. In this analysis, referring to the past studies including the Detailed Project Report (DPR) of Pune Metro Project, 18% for central and state taxes are added to the estimated costs.

Inflation	Inflation is considered on investment costs including additional investments and O&M expenses. This analysis assumes the annual inflation rates of 4.2% and 2.1% for local and foreign currency portions respectively throughout the project period.
Exchange Rate	The exchange rate for 2012 is assumed to be INR 1= JPY 1.5 based on the rate of November 2012. The rate fluctuations are considered by assuming that the INR will be devaluated against JPY at the rate of 5% annually from 2012 to 2020 considering the average change rate of the past ten years.
Residual Value	The residual value of the last year of the analysis is counted as a negative investment cost. It is calculated based on the life cycle of the facilities shown below: Civil structures: 50 years Buildings: 50 years E&M system: 30 years Rolling stock: 30 years
Assumptions of expenditure items	(1) Construction and purchasing Additional investments are assumed in 2023, 2028 and 2033 according to the increase in the number of LRT train operations. (2) O&M Inflation is considered as indicated above. (3) Consulting service 5% of construction and purchasing cost is assumed as consulting service, except for additional investments. (4) Contingency 5% of construction and purchasing cost and consulting service fee is assumed as physical contingency.
Assumption of revenue items	(1) Fare box revenue Fare box revenue is calculated based on option 2 (Level 2) of fare structure set at the demand forecast in Chapter 3. (2) Non-fare box revenue 5% of fare box revenue is considered as non-fare box revenue, assuming revenues from advertising in the stations and trains, etc.

2) Calculation of Expenditure

(1) Investment cost

Table 9.2.2 indicates the yearly allocation of investment cost at 2012 prices over the construction period and for the years of additional investments, divided into local and foreign currency portions. Table 9.2.3 shows the financial price of investment cost that is calculated by considering inflation and exchange rate fluctuations to the amounts shown in Table 9.2.2.

**Table 9.1.2 Allocation of Investment Cost (at 2012 prices)
without price escalation or exchange rate changes**

(Unit: Million Rs.)												
Total Cost	2013	2014	2015	2016	2017	2018	2019	2020	2023	2028	2033	Total
(1) Construction/Procurement												
Civil Works		0	0	1,460	5,839	5,109	1,752	438	0	0	0	14,597
Track		0	0	282	564	669	209	209	0	0	0	1,933
E&M		0	0	743	1,485	2,037	552	276	0	0	0	5,093
Rolling Stock		0	0	0	3,285	3,285	1,643	0	2,746	845	704	12,508
Sub total		0	0	2,484	11,173	11,100	4,155	923	2,746	845	704	34,131
(2) Others												
Land acquisition, Utility relocation		1,112	1,894	1,112	0	0	0	0				4,118
Consulting service		0	0	124	559	555	208	46				1,492
Contingency		0	0	130	587	583	218	48	137	42	35	1,781
Sub total		1,112	1,894	1,367	1,145	1,138	426	95	137	42	35	7,391
(3) Tax												
Tax & Duty		200	341	670	2,112	2,098	785	174	494	152	127	7,153
Total		1,312	2,235	4,521	14,430	14,336	5,367	1,192	3,377	1,039	866	48,675
Foreign Currency Portion												
	2013	2014	2015	2016	2017	2018	2019	2020	2023	2028	2033	Total
(1) Construction/Procurement												
Civil Works		0	0	0	0	0	0	0	0	0	0	0
Track		0	0	66	132	157	49	49	0	0	0	453
E&M		0	0	330	660	905	245	123	0	0	0	2,262
Rolling Stock		0	0	0	3,285	3,285	1,643	0	2,746	845	704	12,508
Sub total		0	0	396	4,077	4,347	1,937	172	2,746	845	704	15,223
(2) Others												
Land acquisition, Utility relocation		0	0	0	0	0	0	0	0	0	0	0
Consulting service		0	0	20	204	217	97	9				546
Contingency		0	0	21	214	228	102	9	137	42	35	788
Sub total		0	0	41	418	446	199	18	137	42	35	1,335
(3) Tax												
Tax & Duty		0	0	75	771	822	366	32	494	152	127	2,838
Total		0	0	511	5,266	5,614	2,501	222	3,377	1,039	866	19,396
Local Currency Portion												
	2013	2014	2015	2016	2017	2018	2019	2020	2023	2028	2033	Total
(1) Construction/Procurement												
Civil Works		0	0	1,460	5,839	5,109	1,752	438	0	0	0	14,597
Track		0	0	216	432	512	160	160	0	0	0	1,480
E&M		0	0	413	826	1,132	307	153	0	0	0	2,831
Rolling Stock		0	0	0	0	0	0	0	0	0	0	0
Sub total				2,088	7,096	6,753	2,219	752	0	0	0	18,908
(2) Others												
Land acquisition, Utility relocation		1,112	1,894	1,112	0	0	0	0	0	0	0	4,118
Consulting service		0	0	104	355	338	111	38				945
Contingency		0	0	110	373	355	116	39	0	0	0	993
Sub total		1,112	1,894	1,326	727	692	227	77	0	0	0	6,056
(3) Tax												
Tax & Duty		200	341	595	1,341	1,276	419	142	0	0	0	4,315
Total		1,312	2,235	4,009	9,165	8,722	2,865	971	0	0	0	29,279

Source: Study Team

**Table 9.1.3 Allocation of Investment Cost (at 2012 prices)
with price escalation and exchange rate changes**

Total Cost												(Unit: Million Rs.)
	2013	2014	2015	2016	2017	2018	2019	2020	2023	2028	2033	Total
(1) Construction/Procurement												
Civil Works		0	0	1,721	7,172	6,539	2,336	609	0	0	0	18,377
Track		0	0	343	720	897	295	310	0	0	0	2,564
E&M		0	0	927	1,960	2,844	815	431	0	0	0	6,977
Rolling Stock		0	0	0	4,711	5,063	2,721	0	5,202	1,776	1,642	21,113
Sub total		0	0	2,990	14,563	15,343	6,167	1,350	5,202	1,776	1,642	49,032
(2) Others												
Land acquisition, Utility relocation		1,207	2,143	1,311	0	0	0	0	0	0	0	4,662
Consulting service		0	0	150	728	767	308	67	0	0	0	2,021
Contingency		0	0	157	765	805	324	71	260	89	82	2,553
Sub total		1,207	2,143	1,617	1,493	1,573	632	138	260	89	82	9,235
(3) Tax												
Tax & Duty		217	386	801	2,752	2,900	1,166	255	936	320	296	10,028
Total		1,425	2,529	5,409	18,808	19,815	7,964	1,744	6,398	2,184	2,019	68,295

Foreign Currency Portion

	2013	2014	2015	2016	2017	2018	2019	2020	2023	2028	2033	Total
(1) Construction/Procurement												
Civil Works		0	0	0	0	0	0	0	0	0	0	0
Track		0	0	88	189	241	81	87	0	0	0	688
E&M		0	0	440	946	1,394	406	218	0	0	0	3,405
Rolling Stock		0	0	0	4,711	5,063	2,721	0	5,202	1,776	1,642	21,113
Sub total		0	0	528	5,846	6,699	3,208	305	5,202	1,776	1,642	25,206
(2) Others												
Land acquisition, Utility relocation		0	0	0	0	0	0	0	0	0	0	0
Consulting service		0	0	26	292	335	160	15	0	0	0	829
Contingency		0	0	28	307	352	168	16	260	89	82	1,302
Sub total		0	0	54	599	687	329	31	260	89	82	2,131
(3) Tax												
Tax & Duty		0	0	100	1,105	1,266	606	58	936	320	296	4,686
Total		0	0	682	7,550	8,651	4,143	395	6,398	2,184	2,019	32,023

Local Currency Portion

	2013	2014	2015	2016	2017	2018	2019	2020	2023	2028	2033	Total
(1) Construction/Procurement												
Civil Works		0	0	1,721	7,172	6,539	2,336	609	0	0	0	18,377
Track		0	0	254	530	655	214	223	0	0	0	1,877
E&M		0	0	487	1,014	1,449	409	213	0	0	0	3,572
Rolling Stock		0	0	0	0	0	0	0	0	0	0	0
Sub total		0	0	2,462	8,717	8,644	2,959	1,045	0	0	0	23,826
(2) Others												
Land acquisition, Utility relocation		1,207	2,143	1,311	0	0	0	0	0	0	0	4,662
Consulting service		0	0	123	436	432	148	52	0	0	0	1,191
Contingency		0	0	129	458	454	155	55	0	0	0	1,251
Sub total		1,207	2,143	1,563	893	886	303	107	0	0	0	7,104
(3) Tax												
Tax & Duty		217	386	701	1,647	1,634	559	197	0	0	0	5,342
Total		1,425	2,529	4,726	11,258	11,163	3,822	1,349	0	0	0	36,272

Source: Study Team

(2) O&M expense

Table 9.2.4 shows the estimation of O&M cost over the operation period. Table 9.2.5 indicates the financial price of O&M expense that is calculated by considering inflation and exchange rate fluctuations to the amounts shown in Table 9.2.4.

**Table 9.1.4 Allocation of O&M Expense (at 2012 prices)
without price escalation and exchange rate changes**

Total																	(Unit: Million Rs.)
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	
Staff cost	Local	164	166	168	169	171	177	178	180	182	184	187	189	191	193	195	198
Other cost	Foreign	43	43	43	43	43	176	176	176	176	176	121	121	121	121	121	193
	Local	287	287	292	292	366	532	532	532	558	490	490	490	490	522	612	
Tax		89	89	90	91	104	159	159	160	160	165	144	144	144	145	151	181
Total		583	585	593	595	684	1,043	1,045	1,048	1,050	1,084	941	943	945	948	988	1,184
	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	Total		
Staff cost	Local	200	202	204	206	208	208	208	208	208	208	208	208	208	5,783		
Other cost	Foreign	193	193	193	193	161	161	161	161	136	136	136	136	136	4,155		
	Local	612	612	612	612	571	571	571	571	541	541	541	541	541	15,312		
Tax		181	181	182	182	169	169	169	169	159	159	159	159	159	4,545		
Total		1,187	1,189	1,192	1,194	1,109	1,109	1,109	1,109	1,109	1,045	1,045	1,045	1,045	29,794		

Source: Study Team

**Table 9.1.5 Allocation of O&M Expense (at 2012 prices)
with price escalation and exchange rate changes**

(Unit: Million Rs.)

		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Staff cost	Local	219	231	243	255	269	289	304	320	337	355	376	396	417	439	462	489
Other cost	Foreign	72	77	79	81	82	341	348	355	362	370	260	265	271	276	282	461
	Local	383	399	422	440	575	871	907	946	985	1,079	985	1,027	1,070	1,115	1,238	1,514
Tax		121	127	134	140	167	270	281	292	303	325	292	304	316	329	357	444
Total		795	834	878	916	1,092	1,771	1,840	1,913	1,988	2,128	1,913	1,991	2,073	2,159	2,338	2,908

		2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	合計
Staff cost	Local	515	542	570	600	632	658	686	715	745	776	809	843	878	915	15,286
Other cost	Foreign	470	480	490	500	424	433	442	451	461	400	408	417	426	435	10,221
	Local	1,578	1,644	1,713	1,785	1,735	1,808	1,884	1,963	2,045	2,019	2,104	2,192	2,284	2,380	41,088
Tax		461	480	499	519	502	522	542	563	585	575	598	621	646	671	11,987
Total		3,024	3,146	3,273	3,405	3,294	3,421	3,554	3,693	3,837	3,770	3,919	4,073	4,234	4,401	78,581

Source: Study Team

3) Calculation of Revenue

(1) Fare box revenue

Fare box revenue is calculated by multiplying the fare level by the number of passengers. As stated above, level-2 set in the demand forecast is adopted as the fare structure for the purpose of revenue calculation. In addition, it is taken into account that the fare level will escalate at the rate of 3.78% annually, which corresponds to 90% of the inflation rate of the local currency portion assumed in this analysis. The balance of 10% is understood as an “efficiency factor” that should be covered by the effort of the LRT operator for improved operation. Table 9.2.6 indicates the fare structures over the operation period. Table 9.2.7 shows the yearly passenger revenues calculated based on the fare structures and the forecast demand at each year of estimation presented in Chapter 3 (3.3). Passenger revenues in the years between the years of the demand forecast are calculated based on the assumption of constant growth rate in revenue, considering that the opening of the entire route is planned in the third year of operation.

Table 9.1.6 Fare Structures (2012-2048)

(Unit: Rs.)

Distance (Km)	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
<=3	12	12	13	13	14	14	15	16	16	17	17	18	19	19	20	21	22	23	23
3-6	17	18	18	19	20	20	21	22	23	24	25	26	27	28	29	30	31	32	33
6-9	21	22	23	23	24	25	26	27	28	29	30	32	33	34	35	37	38	39	41
9-12	26	27	28	29	30	31	32	34	35	36	38	39	41	42	44	45	47	49	51
12-15	32	33	34	36	37	39	40	41	43	45	46	48	50	52	54	56	58	60	62
15-18	36	37	39	40	42	43	45	47	48	50	52	54	56	58	61	63	65	68	70
18-21	41	43	44	46	48	49	51	53	55	57	59	62	64	66	69	72	74	77	80
21-24	46	48	50	51	53	55	57	60	62	64	67	69	72	75	77	80	83	86	90

Distance (Km)	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
<=3	24	25	26	27	28	29	30	31	33	34	35	37	38	39	41	42	44	46
3-6	34	36	37	38	40	41	43	45	46	48	50	52	54	56	58	60	62	65
6-9	42	44	46	48	49	51	53	55	57	59	62	64	66	69	71	74	77	80
9-12	53	55	57	59	61	63	66	68	71	73	76	79	82	85	88	92	95	99
12-15	65	67	70	72	75	78	81	84	87	90	94	97	101	105	109	113	117	122
15-18	73	76	78	81	85	88	91	94	98	102	106	110	114	118	122	127	132	137
18-21	83	86	89	93	96	100	104	108	112	116	120	125	130	134	139	145	150	156
21-24	93	97	100	104	108	112	116	121	125	130	135	140	145	151	156	162	169	175

Source: Study Team

Table 9.1.7 Estimated Yearly Passenger Revenues

(Unit: Million Rs.)

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Fare Box Revenue	772	843	2,301	2,514	2,746	2,999	3,275	3,578	3,907	4,268	4,707	5,191	5,725	6,314	6,963

	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
Fare Box Revenue	7,679	8,469	9,340	10,301	11,360	11,790	12,235	12,698	13,178	13,676	14,193	14,729	15,286	15,864	16,464

Source: Study Team

(2) Non-fare box revenue

As indicated above, 5% of fare box revenue is assumed for non-fare box revenue.

4) Result of Analysis

The Project FIRR works out to 5.2%, falling below the Financial Opportunity Cost of Capital (FOCC) of 8% set as an evaluation index. The Financial Net Present Value is found to be Rs. -16,067 Million.

In addition, a sensitivity analysis was conducted to observe variations in the results by assuming the cases of increase in investment cost, decrease in revenue and delay in commencement of operation. Table 9.2.8 shows the result of each case. The financial cash flow of the base case of the project is presented in Table 9.2.9.

Table 9.1.8 Sensitivity Analysis of Financial Cash Flow

	Base Case	Initial Investment 10% Increase	Benefit 10% Decrease	1 Year Delay in Operation
Project FIRR	5.2%	4.7%	4.4%	4.5%

Source: Study Team

From these results of the financial analysis in terms of investment efficiency of total capital irrespective of debt and equity, this project is not feasible. This indicates that from the viewpoint of PPP further consideration is needed to make the project attractive to potential investors. Issues to be considered include investment scope for the government and private partners, financial support from the government, and other possible revenue sources. The financial viability of SPV will be discussed in 9.2.3 through the evaluation of Financial Internal Rate of Return on Equity (Equity FIRR) based on the possible PPP schemes and financing scenarios.

Table 9.1.9 Financial Cash Flow (Base Case)

(Unit: Mil. Rs.)

Year		Cost (Expenditure)			Revenue			Net Cash Flow
		Investment	O&M	Total	Passenger Revenue	Off-rail Revenue	Total	
-6	2013			0			0	0
-5	2014	1,425		1,425			0	-1,425
-4	2015	2,529		2,529			0	-2,529
-3	2016	5,409		5,409			0	-5,409
-2	2017	18,808		18,808			0	-18,808
-1	2018	19,815		19,815			0	-19,815
1	2019	7,964	795	8,759	772	39	810	-7,949
2	2020	1,744	834	2,577	843	42	885	-1,692
3	2021		878	878	2,301	115	2,417	1,539
4	2022		916	916	2,514	126	2,639	1,724
5	2023	6,398	1,092	7,490	2,746	137	2,883	-4,607
6	2024		1,771	1,771	2,999	150	3,149	1,378
7	2025		1,840	1,840	3,275	164	3,439	1,599
8	2026		1,913	1,913	3,578	179	3,756	1,844
9	2027		1,988	1,988	3,907	195	4,103	2,115
10	2028	2,184	2,128	4,312	4,268	213	4,481	169
11	2029		1,913	1,913	4,707	235	4,942	3,029
12	2030		1,991	1,991	5,191	260	5,451	3,459
13	2031		2,073	2,073	5,725	286	6,011	3,938
14	2032		2,159	2,159	6,314	316	6,629	4,470
15	2033	2,019	2,338	4,358	6,963	348	7,311	2,953
16	2034		2,908	2,908	7,679	384	8,063	5,156
17	2035		3,024	3,024	8,469	423	8,892	5,868
18	2036		3,146	3,146	9,340	467	9,807	6,661
19	2037		3,273	3,273	10,301	515	10,816	7,543
20	2038		3,405	3,405	11,360	568	11,928	8,523
21	2039		3,294	3,294	11,790	589	12,379	9,086
22	2040		3,421	3,421	12,235	612	12,847	9,426
23	2041		3,554	3,554	12,698	635	13,333	9,778
24	2042		3,693	3,693	13,178	659	13,837	10,144
25	2043		3,837	3,837	13,676	684	14,360	10,523
26	2044		3,770	3,770	14,193	710	14,902	11,132
27	2045		3,919	3,919	14,729	736	15,466	11,547
28	2046		4,073	4,073	15,286	764	16,050	11,977
29	2047		4,234	4,234	15,864	793	16,657	12,423
30	2048	-13,965	4,401	-9,564	16,464	823	17,287	26,850

FIRR	5.2%
FOCC	8%
B-NPV	38,755
C-NPV	54,822
NPV	-16,067

Source: Study Team

9.1.2 Economic Analysis

1) Objective, Methodology and Premises

The objective of the economic analysis is to evaluate the viability of the project in light of the national economy. The cost-benefit analysis will be conducted based on the discount cash flow model, which is a common method for economic evaluation. Economic Internal Rate of Return (EIRR) and Economic Net Present Value (ENPV) will be estimated as evaluation indexes. Economic costs and benefits are calculated based on the comparison between the cases of executing the project (“With project case”) and not executing the project (“Without project case”).

Table 9.2.8 shows the premises of the economic analysis.

Table 9.1.10 Premises of Economic Analysis

Route	JM Temple – Mahindra Tech Phase 3 Total length: 21.6km
Cost and Benefit	Cost: Investment cost and O&M expenses Benefit: Vehicle Operating Cost (VOC) savings and Value of Travel Time (VOTT) Cost savings
Year of Benefit Estimation	Benefits are estimated for 2018, 2028, and 2038 according to the years of the demand forecast. Benefits between these years are calculated on the assumption of a constant growth rate.
Period of Analysis	35 years including construction period from 2014 to 2020 and 30 years of operation from 2019 to 2048.
Project Schedule	F/S starting from 2013. Utility relocations and land acquisitions from 2014 to 2016. Two stages of construction conducted from 2016 to 2020. Initial operation starting at the end of 2018 and second in 2021.
Evaluation Measure	The EIRR is evaluated in comparison with the Social Discount Rate (SDR). SDR is set to be 12% in this analysis. This rate is applied to the calculation of ENPV.
Base Year for Cost	All figures are based on constant prices in 2012.
Economic Cost	All costs are classified as imported products (foreign currency portion) or domestic products (local currency portion). Economic costs are calculated excluding transferable items such as various taxes, import duties and subsidies etc. from the standpoint of the national economy. In order to translate financial (market) cost into economic cost, a Standard Conversion Factor (SCF) is applied. In this analysis, 0.95 is adopted as the SCF for the local currency portion.
Inflation	Inflation is not considered in this economic analysis.
Exchange Rate	The exchange rate is assumed to be Rs.1= JPY1.5 based on the rate of November 2012. Exchange rate fluctuations are not considered.
Residual Value	The residual value of the last year of the analysis is counted as a negative investment cost. It is calculated based on the life cycle of the facilities shown below: Civil structures: 50 years Buildings: 50 years E&M system: 30 years Rolling stock: 30 years
Assumption of cost items	(1) Construction and purchasing Additional investments are assumed in 2023, 2028 and 2033 according to the increase in the number of LRT train operations. Costs for utility relocation and land acquisition are not included in the cost calculation. (2) O&M Inflation is not considered as indicated above. (3) Consulting service 5% of construction and purchasing cost is assumed as consulting service, except for additional investments. (4) Contingency 5% of construction and purchasing cost and consulting service fee is assumed as physical contingency.
Assumption of benefit items	(1) Vehicle Operating Cost (VOC) savings Refer to 3) (1) below (2) Value of Travel Time (VOTT) Cost savings Refer to 3) (2) below

Source: Study Team

2) Calculation of Cost

(1) Investment cost

The economic price of investment cost is calculated by excluding cost for land acquisition and tax and duty from the yearly allocation of investment cost indicated in Table 9.2.2, and multiplying the local currency portion by the Standard Conversion Factor (SCF). The SCF is set to be 0.95 based on the average figure of the recent trends shown in Table 9.2.11.

Table 9.1.11 Estimation of Standard Conversion Factor (SCF)

(Unit: Million Rs.)

	2006-07	2007-08	2008-09	2009-10	Average
Import	8,405,063	10,123,117	13,744,356	13,637,356	11,477,473
Import Tax	858,670	1,006,480	945,830	796,797	901,944
Export	5,717,792	6,558,635	8,407,551	8,455,336	7,284,829
Export Tax	4,600	34,710	52,960	11,160	25,858
Estimated SCF	94.3%	94.5%	96.1%	96.6%	95.5%

Note: Amounts of Export Tax from 2006 to 2009 were estimated from the difference between the total custom revenue and import tax revenue.

Source: Statistical Year Book 2012; Receipt Budget, 2011-2012/2012-13

(2) O&M expense

The economic price of O&M expense is calculated by excluding tax and duty from the yearly allocation of O&M expense shown in Table 9.2.4 above, and multiplying the local currency portion by the Standard Conversion Factor (SCF).

3) Calculation of Benefit

(1) Vehicle Operating Cost (VOC) Savings

Vehicle Operating Costs are costs incurred during the usage or operation of the vehicle based on vehicle-kilometers traveled. The costs include fuel, tires, oil, repairs, maintenance, etc. The VOC savings are calculated by taking the difference in vehicle-kilometers between “With project” and “Without project”, multiplied by the unit VOC. The unit VOC for each vehicle type is indicated in Table 9.2.12.

Table 9.1.12 Unit Vehicle Operating Cost

(Unit: Rs./Km)

Type	Unit VOC
Motorbike	2.20
Car	7.70
Auto Rickshaw	4.16
Bus	23.10

Source: Estimation by Study Team

Table 9.2.13 shows the difference in total vehicle-kilometers between “With project” and “Without project” that was calculated based on the result of the demand forecast.

Table 9.1.13 Difference in Total Vehicle-Km between “With” and “Without”

(Unit: Thousand Vehicle-Km)

Type	2018	2028	2038
Motorbike	183.0	543.0	1,889.7
Car	75.0	759.7	2,297.4
Auto Rickshaw	86.5	402.7	1,050.5
Bus	10.4	11.2	16.3

Source: Estimation by Study Team

(2) Value of Travel Time (VOTT) Savings

The Value of Travel Time is defined as the maximum amount of money that travelers are willing to pay for travel time savings. The VOTT savings are calculated by taking the difference in vehicle-hours between “With project” and “Without project” multiplied by the unit VOTT. Table 9.2.14 presents the unit VOTT by vehicle type, whose real value is estimated to increase over the project period.

Table 9.1.14 Unit Value of Travel Time

(Unit: Rs./Minute)

Type	Unit VOTT			
	2012	2018	2028	2038
Motorbike	0.50	0.60	0.80	1.08
Car	0.86	1.03	1.38	1.85
Auto Rickshaw	0.50	0.60	0.80	1.08
Bus	0.36	0.43	0.58	0.78

Source: Estimation by Study Team

Table 9.2.15 shows the difference in total vehicle-hours between “With project” and “Without project” that was calculated based on the result of the demand forecast.

Table 9.1.15 Difference in Total Vehicle-Hours between “With” and “Without”

(Unit: Thousand Vehicle-Hours)

Type	2018	2028	2038
Motorbike	41.7	134.3	247.5
Car	13.5	58.3	102.7
Auto Rickshaw	7.5	29.1	58.5
Bus	0.5	0.7	0.9

Source: Estimation by Study Team

Apart from the benefits mentioned above, other direct or indirect benefits such as improvement of travelers’ comfort, decrease in traffic accidents, reduction in air pollution, and promotion of regional development can be expected from the project. The values of these benefits are not included in this analysis because of the difficulty of measuring them quantitatively. These factors should, however, be considered sufficiently in the decision-making process of the project.

4) Result of Analysis

Table 9.2.16 presents the economic cash flow of the project. The EIRR works out to 14.0%. This figure exceeds the Social Discount Rate (SDR) of 12% set as an evaluation index, and the Economic Net Present Value (ENPV) discounted at the same rate is found to be Rs. 5,300 Million. Considering the above-mentioned direct or indirect benefits that are not counted in the analysis, these results imply that the project is judged to have substantial significance from the perspective of the national economy.

Table 9.1.16 Economic Cash Flow (Base Case)

(Unit: Mil. Rs.)

Year	Cost			Benefit			Net Cash Flow
	Investment	O&M	Total	Time Value	VOC Saving	Total	
-6	2013			0			0
-5	2014			0			0
-4	2015			0			0
-3	2016	2,624		2,624			0
-2	2017	11,927		11,927			0
-1	2018	11,865	0	11,865			0
1	2019	4,459	472	4,931	886	537	1,424
2	2020	976	473	1,450	1,057	652	1,709
3	2021		480	480	1,260	791	2,051
4	2022		481	481	1,503	959	2,462
5	2023	2,883	553	3,436	1,792	1,163	2,955
6	2024		849	849	2,137	1,411	3,547
7	2025		850	850	2,548	1,711	4,259
8	2026		852	852	3,039	2,075	5,114
9	2027		854	854	3,623	2,517	6,141
10	2028	887	881	1,768	4,321	3,053	7,374
11	2029		764	764	4,728	3,403	8,131
12	2030		765	765	5,174	3,794	8,967
13	2031		767	767	5,661	4,229	9,890
14	2032		769	769	6,195	4,714	10,908
15	2033	739	802	1,541	6,779	5,254	12,033
16	2034		963	963	7,418	5,857	13,274
17	2035		965	965	8,117	6,528	14,645
18	2036		967	967	8,882	7,277	16,159
19	2037		969	969	9,719	8,112	17,830
20	2038		971	971	10,635	9,042	19,677
21	2039		901	901	10,635	9,042	19,677
22	2040		901	901	10,635	9,042	19,677
23	2041		901	901	10,635	9,042	19,677
24	2042		901	901	10,635	9,042	19,677
25	2043		901	901	10,635	9,042	19,677
26	2044		848	848	10,635	9,042	19,677
27	2045		848	848	10,635	9,042	19,677
28	2046		848	848	10,635	9,042	19,677
29	2047		848	848	10,635	9,042	19,677
30	2048	-8,070	848	-7,222	10,635	9,042	19,677

EIRR	14.0%
SDR	12%
B-NPV	25,880
C-NPV	20,580
NPV	5,300

Source: Study Team

In order to determine the stability of the project, a sensitivity analysis was conducted to observe variations in the results by assuming the cases of an increase in investment cost, decrease in revenue and delay in commencement of operation. Table 9.2.17 shows the result of each case. EIRR is the most adversely affected in the case of one-year delay in the opening of operation: however, EIRR exceeds SDR in all the variation scenarios.

Table 9.1.17 Sensitivity Analysis of Economic Cash Flow

	Base Case	Initial Investment 10% Increase	Benefit 10% Decrease	1 Year Delay in Operation
EIRR	14.0%	13.3%	13.1%	12.8%

Source: Study Team

9.1.3 Financial Analysis for PPP Scenarios

1) Objective, Methodology and Premises

In this section, for the purpose of identifying a PPP scheme that can ensure sufficient return, the financial viability of SPV will be examined through the evaluation of the Financial Internal Rate of Return on Equity (Equity FIRR) based on the possible PPP schemes and financing scenarios.

Table 9.2.18 shows the parameters and options adopted for this financial analysis of SPV. Different cash flow scenarios are considered by combining these options. The common premises in conducting the analyses are described in Table 9.2.19.

Table 9.1.18 Parameters and Options for Financial Analysis of SPV

PPP Structure (Investment scope of SPV)	a) SPV: Land acquisition, Civil Work, Track Work, E&M, Rolling Stock b) SPV: Track Work, E&M, Rolling Stock (Public: Land acquisition, Civil Work) c) SPV: E&M, Rolling Stock (Public: Land acquisition, Civil Work, Track Work) PPP Gross Cost Scheme is assumed for options b) and c).
Financing	(1) Debt-Equity Ratio: 70:30 (2) Borrowing Conditions (Interest rate and loan period) assumed a) Financing from local market (in Rupee) Interest rate: 12% Loan period: 17-19 years (including 5-7 years of grace period) b) JICA Private Sector Investment Finance (PSIF) (in Japanese Yen) Interest rate: 4% Loan period: 20-22 years (including 5 years of grace period) (3) Interest during construction: added to the principal
Government Subsidy	0-50% of initial investment cost subsidized by the Indian government through Viability Gap Funding (VGF) or other measures

Table 9.1.19 Premises of Financial Analysis of SPV

Route	JM Temple – Mahindra Tech Phase 3 Total length: 21.6km
Expenditure and Revenue	Expenditure: Investment cost and O&M expenses Revenue: Fare box revenue or service fee revenue (under Gross Cost Scheme), non-fare box revenue (advertising and other business), and revenue allocation from Floor Space Index (FSI) sales benefit
Year of Revenue Estimation	Revenues are estimated for 2018, 2028, and 2038 according to the years of the demand forecast. Revenues between these years are calculated mostly on the assumption of a constant growth rate, while considering that the operation will start in two stages.
Project Schedule	F/S starting from 2013. Utility relocations and land acquisitions from 2014 to 2016. Two stages of construction conducted from 2016 to 2020. Initial operation starting at the end of 2018 and second in 2021.
Concession Period	Construction period plus 30 years of operation from 2019 to 2048.
Evaluation Measure	Equity FIRR measures the returns for sponsors of the project (i.e. shareholders of SPV), after the debt has been paid off. It is the rate that equates the present value of cash inflows (such as dividends) to the present value of cash outflows (such as equity) for sponsors. Therefore, the rate is affected by the financial structure of SPV and borrowing conditions. Equity FIRR is evaluated in comparison with the target return rate (hurdle rate) of potential sponsors, and hence the rate can be different depending on sponsors. In this analysis, 15% is set as an evaluation index.
Base Year for Cost	All figures are based on constant prices in 2012.
Financial Cost	The cost for domestic products is the market price including various taxes. The cost for imported products is the CIF price with import duty, inland transportation cost and other fees. In this analysis, referring to the past studies including Detailed Project Report (DPR) of Pune Metro Project, 18% of central and state taxes are added to the estimated costs.
Inflation	Inflation is considered on investment costs including additional investments and O&M expenses. This analysis assumes the annual inflation rates of 4.2% and 2.1% for local and foreign currency portions respectively throughout the project period.
Exchange Rate	The exchange rate is assumed to be INR 1= JPY 1.5 based on the rate of November 2012. The rate fluctuations are considered by assuming that the INR will be devaluated against JPY at the rate of 5% annually from 2012 to 2020 considering the average change rate of the past ten years.
Residual Value	The residual value of the last year of the analysis is counted as a negative investment cost. It is calculated based on the life cycle of the facilities shown below: Civil structures: 50 years Buildings: 50 years E&M system: 30 years Rolling stock: 30 years
Assumption of expenditure items	Expenditure items are composed of the following. The amounts are adjusted according to the scenario for SPV investment scope. (1) Construction and purchasing Additional investments are assumed in 2023, 2028 and 2033 according to the increase in the number of LRT train operations. (2) O&M Inflation is considered as indicated above. (3) Consulting service 5% of construction and purchasing cost is assumed as consulting service, except for additional investments. (4) Contingency 5% of construction and purchasing cost and consulting service fee is assumed as physical contingency.
Assumption of revenue items	(1) Fare box revenue or service fee revenue Fare box revenue is calculated based on option 2 (Level 2) of the fare structure set at the demand forecast in Chapter 3. Service fee revenue is set at a certain proportion (90-100%) of fare box revenue collected by the public authority (such as PMRC). (2) Non-fare box revenue As a base case, it is assumed that SVP earns non-fare box revenue from advertising in the stations and in/on trains, which corresponds to 5% of fare box revenue. As shown above, 15% and 30% options are also considered. (3) Revenue allocation from FSI sales benefit Refer to 3) (3) below.

2) Calculation of Expenditures

Investment cost and O&M cost estimated in 9.2.1 2) are adopted.

3) Calculation of Revenue

(1) Fare box revenue or service fee revenue

SPV's main revenue item differs depending on the project structure. If it is undertaken completely by the private sector, SPV will directly collect fares paid by the passengers as fare box revenue. Fare box revenue is calculated according to the method described in 9.2.1.

If the project is conducted as a PPP project under the proposed two-tiered Gross Cost Scheme, service fee payment made by PMRC will be SPV's main source of revenue. Different levels of service fee will be tested in order to examine the impact that these options would have on SPV's equity internal rate of return (Equity IRR). In addition, it is assumed in this cash flow analysis that the SPV pre-tax losses will be covered by the public sector for the cases under the Gross Cost Scheme in accordance with the aim of the scheme, i.e. ridership risk transfer from private to public.

(2) Non-fare box revenue

As indicated above, it is assumed that SVP earns non-fare box revenue from advertising in the stations and in/on trains, which corresponds to 5% of fare box revenue.

(3) Contribution from Floor Space Index (FSI) sales benefit

As is observed in Chapter 8 (8.3), the Government of India advocates value captures from land utilization through a variety of measures including property development and increased tax revenue to fund PPP infrastructure projects. In the process of executing this survey, some of the Indian counterparts, including municipalities, suggested to the study team that increasing FSI along the LRT route may be a major option to support funding of this project. In this connection, it is assumed in this financial analysis that the SPV will receive a part of the benefits brought about by the increase of FSI. Basic assumptions for estimating the benefit are as follows:

- FSI will be increased from 1.0 (current basic figure) to 4.0 by the respective municipalities (PMC and PCMC) and MIDC in the areas within 500m on either side along the LRT alignment.
- The size of areas that can be developed was determined by excluding areas such as parks, universities, and other public land from the total areas.
- 50% of the above "developable" floor areas will be actually developed (or redeveloped) over the thirty years of LRT operation under the concession agreement.

- Developers will be allowed to develop the additional floor space by paying an “FSI premium” to PMC/PCMC/MIDC. The rate of the premium is assumed to be Rs. 5,000 /m² as adopted in the Detailed Project Report (DPR) of the Pune Metro Project.
- PMC/PCMC/MIDC will retain 40% of the total sales of additional FSI premium for providing infrastructure such as roads and utilities in the areas. The remaining 60% will be allocated to the SPV to cover a part of its financing and operating costs.
- A Bus Rapid Transit (BRT) project is underway along the LRT route in the jurisdiction of PCMC where an FSI raise to 1.8 is proposed in the current Comprehensive Mobility Plan (CMP) of PCMC. In addition, the FSI of 2.5 is already provided to companies in the IT sector located in Rajiv Gandhi Infotech Park developed by MIDC. Taking this into consideration, the SPV for LRT will be allocated half of the 60% of the sales of additional FSI premium in PCMC and MIDC.

Based on the above assumptions, the maximum amount of allocation for SPV from the FSI increase has worked out to Rs. 19,982 Million. A conservative approach is taken to estimate the possible revenue contribution to SPV: a half of the calculated maximum amount will be realized. i.e. Rs. 9,991 Million. It is further assumed that the benefits will be accrued evenly over the period of operation under the concession contract. This would make the yearly contribution to SPV revenue Rs. 333 Million. Table 9.2.20 shows the details of the calculation.

Table 9.1.20 Estimated Contribution to SPV from FSI Increase

Item		PMC	PCMC	MIDC	Total
Distance of LRT Line	km	6.5	7.1	7.8	21.4
Width of FSI Increased	m	1,000	1,000	1,000	
Available Area	m ²	2,807,000	2,212,000	1,055,000	6,074,000
Rate of (Re-)Development		0.5	0.5	0.5	
Area of (Re-)Development	m ²	1,403,500	1,106,000	527,500	3,037,000
Basic FSI		100%	100%	100%	
Proposed FSI		400%	400%	400%	
Additional FSI		300%	300%	300%	
Additional Floor Area	m ²	4,210,500	3,318,000	1,582,500	9,111,000
FSI Premium	Rs./m ²	5,000	5,000	5,000	
Total Sale of FSI Premium	Mil. Rs.	21,053	16,590	7,913	45,555
(Allocation to Infra Development)(40%)	Mil. Rs.	8,421	6,636	3,165	18,222
(Remaining Amount)(60%)	Mil. Rs.	12,632	9,954	4,748	27,333
Rate of Allocation to SPV for LRT		1	0.5	0.5	
Maximum Allocation to SPV for LRT	Mil. Rs.	12,632	4,977	2,374	19,982
Assumed Allocation to SPV for LRT	Mil.Rs.				9,991
Annual Contribution to SPV Revenue	Mil. Rs.				333

Source: Study Team

4) Analysed Cases and Result of the Analysis

Different cash flow scenarios of SPV were examined based on the parameters and options indicated in Table 9.2.18. The details of the respective cases and their calculated Equity FIRR are shown in Table 9.2.21.

Table 9.1.21 Analysed Cases and Equity FIRR

Project Structure/ Case			Equity IRR			
			Fare Box Revenue	Service Fee Revenue (% of Fare Box)		
				90%	95%	100%
1. Private Project SPV: Land acquisition, Civil Work, Track Work, E&M, Rolling Stock	1a. JICA PSIF loan	1a: No Subsidy	5.0%	-	-	-
		1a(i):Subsidy 10%	5.7%	-	-	-
		1a(iii):Subsidy 30%	7.5%	-	-	-
		1a(v):Subsidy 50%	9.8%	-	-	-
	1x. Commercial loan	1x: No Subsidy	2.3%	-	-	-
		1x(i):Subsidy 10%	2.9%	-	-	-
		1x(iii):Subsidy 30%	4.5%	-	-	-
		1x(v):Subsidy 50%	6.6%	-	-	-
2. Two-Tiered Shared Responsibility SPV: Track Work, E&M, Rolling Stock Public: Land acquisition, Civil Work	2a. JICA PSIF loan	2a: No Subsidy	-	9.4%	10.1%	10.8%
		2a(i):Subsidy 10%	-	10.2%	11.0%	11.7%
		2a(ii):Subsidy 20%	-	11.2%	12.0%	12.8%
		2a(iii):Subsidy 30%	-	12.4%	13.3%	14.1%
		2a(iv):Subsidy 40%	-	13.8%	14.7%	15.7%
	2a(v):Subsidy 50%	-	15.5%	16.6%	17.6%	
	2x. Commercial loan	2x(v):Subsidy 50%	-	13.4%	14.1%	14.8%
3. Two-Tiered Shared Responsibility SPV: E&M, Rolling Stock Public: Land acquisition, Civil Work, Track Work	3a. JICA PSIF loan	3a: No Subsidy	-	10.3%	11.1%	11.8%
		3a(i):Subsidy 10%	-	11.2%	12.0%	12.8%
		3a(ii):Subsidy 20%	-	12.2%	13.1%	13.9%
		3a(iii):Subsidy 30%	-	13.4%	14.3%	15.3%
		3a(iv):Subsidy 40%	-	14.8%	15.9%	16.9%
	3a(v):Subsidy 50%	-	16.6%	17.8%	18.9%	
	3x. Commercial loan	3x(v):Subsidy 50%	-	14.1%	14.9%	15.8%

Note: Marked cells show basic scenario cases.

Source: Study Team

The result of the analysis is summarized as follows:

- (a) All the cases where the investment is entirely undertaken by the private sector (Cases 1a and 1x) show low figures of Equity FIRR, all of which are less than the 10% level. This indicates the necessity of sharing investment between the public and private sectors.
- (b) Even in the cases where the investment cost is shared by the public and private, it is necessary to receive a certain level of government subsidy in addition to utilizing JICA PSIF in order to reach the 15% level of Equity IRR. Although the appropriate scale of the subsidy would be

different depending on the level of service fee revenue, it is considered generally that a minimum requirement for subsidy would be 30-40% of SPV initial investment cost.

- (c) There have not yet been PPP metro projects seen in India where the public has undertaken civil works and at the same time provided financial support for SPV to invest in the other part, though there is no concrete rule recognized on the matter. The feasibility of the scenario should thus be assessed through careful discussions with the Indian side. The study team has received positive comments from the Indian counterparts, such as concerned municipalities, during this survey regarding the possibility of providing a certain level of financial support to the project.

Based on the result, three cases of 2a(iii), 2a(v) and 3a(v) (with 95% of fare box as service fee) are selected as base scenarios among the cases analysed. The financial cash flow of the base scenario cases are presented in Appendix-27--1.

Table 9.1.22 Selected Cases and Equity FIRR

	Base Scenario 1	Base Scenario 2	Base Scenario 3
Case	2a(iii)	2a(v)	3a(v)
Equity IRR	13.3%	16.6%	17.8%

Source: Study Team

5) Repayment Capacity and Sensitivity Analysis of Base Scenarios

In this section, SPV's repayment capacity is examined for the three base scenarios. Then, a sensitivity analysis is conducted to observe variations in the results of investment return and repayment indexes.

The following two indexes are looked at to examine SPV's repayment capacity:

➤ Debt Service Coverage Ratio (DSCR)

DSCR is a ratio of net cash inflow before debt service (interest payment and principal repayment) to debt service needed for a certain period of time. In the case of DSCR being less than 1, cash flow is not entirely able to cover necessary debt service for the period. In this analysis, the minimum and average figures of DSCR are observed for each scenario.

$$\text{DSCR} = \frac{\text{Cash Flow Available for Debt Service}}{\text{Debt Service}}$$

➤ Loan Life Coverage Ratio (LLCR)

LLCR is the ratio of net present value of net cash inflow before debt service for the remaining loan period to debt outstanding at a certain point in time. LLCR with less than 1 means that SPV will not be able to complete repayment within the loan period. In this analysis, LLCR before the initial repayment is observed.

$$\text{LLCR} = \frac{\text{Net Present Value of Cash Flow Available for Debt Service for Remaining Loan Period}}{\text{Debt Outstanding}}$$

(1) Base Scenario 1: Case 2a(iii)

Equity IRR for this scenario (base case) is found to be 13.3%. The study team selected this scenario as a case that would provide a certain level of return allowable to potential investors even though the IRR falls below 15%, since they can expect the ridership risk to be transferred to the public sector under the Gross Cost Scheme. Average and minimum DSCR figures are 2.35 and 1.05 respectively, indicating enough cash flow is brought in for debt service. On the other hand, LLCR shows 0.93 before the first repayment starts, though the figure exceeds 1 from the next year.

Next, a sensitivity analysis was conducted assuming the cases of (A) 10% increase in initial investment, (B) 10% increase in O&M cost, (C) 10% decrease in service fee revenue, and (D) simultaneous occurrence of (A), (B) and (C). Among the cases of (A)-(C), Equity IRR is mostly affected by (C). Regarding repayment capacity indexes, minimum DSCR figures fall below 1 in the cases of (A) and (C). The results show that the financial feasibility is not ensured sufficiently against cost increase or revenue decrease for this scenario. The index figures are worsened by the cases of (A'), (B') and (C') that assume 20% of negative impact on each factor.

Table 9.1.23 Sensitivity Analysis (Base Scenario 1)

	Equity IRR	NPV(@15%)Rs. Mil.	DSCR (Average)	DSCR (Minimum)	LLCR (@15%)
Base case	13.3%	-866	2.35	1.05	0.93
(A)10% increase in initial investment	12.5%	-1,335	2.15	0.98	0.86
(B)10% increase in O&M cost	12.6%	-1,207	2.21	1.01	0.88
(C)10% decrease in service fee revenue	11.5%	-1,673	2.02	0.95	0.82
(D) Combination of (A)(B)(C)	10.3%	-2,389	1.75	0.92	0.72
(A')20% increase in initial investment	11.8%	-1,802	1.98	0.92	0.80
(B')20% increase in O&M cost	11.9%	-1,535	2.09	0.97	0.84
(C')20% decrease in service fee revenue	9.8%	-2,389	1.72	0.92	0.72
(D') Combination of (A')(B')(C')	7.9%	-3,481	1.37	0.92	0.62

Source: Study Team

(2) Base Scenario 2: Case 2a(v)

Equity IRR for this scenario (base case) was worked out to 16.6%. Average and minimum DSCR figures are 3.27 and 1.42 respectively, indicating that sufficient cash flow is coming in for debt

service. The LLCR figure shows 1.29 before the first repayment starts. This means that SPV can expect to complete repayment within the loan period.

Next, a sensitivity analysis was conducted assuming the cases of (A) 10% increase in initial investment, (B) 10% increase in O&M cost, (C) 10% decrease in service fee revenue, and (D) simultaneous occurrence of (A), (B) and (C). Cases (A) and (B) still show Equity IRR of more than 15%. In Case (C), the figure goes down to 14.5%. Regarding repayment capacity indexes, minimum DSCR figures are more than 1.2 in all cases of (A) to (C). The results show that the financial feasibility is ensured sufficiently against cost increase or revenue decrease for this scenario. It should be noted, however, that the cash flow would be affected more adversely if the negative performance were deemed to be greater than assumed for either risk factor as indicated in the cases of (A'), (B') and (C'), or two or more risk factors were realized at the same time.

Table 9.1.24 Sensitivity Analysis (Base Scenario 2)

	Equity IRR	NPV(@15%)Rs. Mil.	DSCR (Average)	DSCR (Minimum)	LLCR (@15%)
Base case	16.6%	621	3.27	1.42	1.29
(A)10% increase in initial investment	15.7%	284	2.98	1.32	1.19
(B)10% increase in O&M cost	15.7%	262	3.08	1.37	1.22
(C)10% decrease in service fee revenue	14.5%	-212	2.80	1.28	1.12
(D) Combination of (A)(B)(C)	13.0%	-841	2.41	1.15	0.98
(A')20% increase in initial investment	14.9%	-40	2.75	1.24	1.10
(B')20% increase in O&M cost	14.8%	-78	2.89	1.31	1.15
(C')20% decrease in service fee revenue	12.4%	-984	2.36	1.14	0.96
(D') Combination of (A')(B')(C')	10.3%	-1,882	1.85	1.14	0.81

Source: Study Team

(3) Base Scenario 3: Case 3a(v)

Equity IRR for this scenario (base case) was worked out to 17.8%. Average and minimum DSCR figures are 3.68 and 1.57 respectively, indicating that sufficient cash flow is coming in for debt service. The LLCR figure shows 1.45 before the first repayment starts. This means that SPV can expect to complete repayment within the loan period.

Next, a sensitivity analysis was conducted assuming the cases of (A) 10% increase in initial investment, (B) 10% increase in O&M cost, (C) 10% decrease in service fee revenue, and (D) simultaneous occurrence of (A), (B) and (C). Cases (A) and (B) both show Equity IRR of 16.8%, and Case (C) still provides a figure of more than 15%. Regarding repayment capacity indexes, minimum DSCR figures are more than 1.4 in all cases of (A) to (C). The results show that the financial feasibility is ensured sufficiently against cost increase or revenue decrease for this scenario.

The cash flow of this scenario is robust as a whole, though it should be noted that the cash flow would be affected more adversely if the negative performance were deemed to be greater than assumed for either risk factor as indicated in the cases of (A'), (B') and (C'), or two or more risk factors were realized at the same time.

Table 9.1.25 Sensitivity Analysis (Base Scenario 3)

	Equity IRR	NPV(@15%)Rs. Mil.	DSCR (Average)	DSCR (Minimum)	LLCR (@15%)
Base case	17.8%	1,013	3.68	1.57	1.45
(A)10% increase in initial investment	16.8%	716	3.36	1.45	1.33
(B)10% increase in O&M cost	16.8%	650	3.46	1.50	1.36
(C)10% decrease in service fee revenue	15.4%	162	3.15	1.40	1.25
(D) Combination of (A)(B)(C)	13.8%	-450	2.69	1.25	1.08
(A')20% increase in initial investment	16.0%	419	3.09	1.36	1.23
(B')20% increase in O&M cost	15.8%	296	3.25	1.44	1.28
(C')20% decrease in service fee revenue	13.2%	-636	2.64	1.24	1.06
(D') Combination of (A')(B')(C')	10.8%	-1,603	2.00	1.14	0.85

Source: Study Team

6) Option Scenarios

In this section, the following two option scenarios are examined:

- Upside scenario for investors by tax exemption and utility cost reduction
- Scenario considering variations in cost burden of the public sector

(1) Upside scenario by tax exemption and utility cost reduction

Base scenarios assume that the central and state government taxes are applied to all costs incurred for the project. Table 9.2.26 indicates major tax items assumed for the project.

Table 9.1.26 Major Central and State Taxes

Central Tax	State Tax
Custom duty Excise duty	VAT (Sales tax) Works contract tax

Source: Study Team

On the other hand, many major taxes including the above ones were exempted for Delhi Metro project Phases I and II. In addition, it is reported that in the Hyderabad Metro project, which is executed under the PPP scheme, the concessionaire is seeking some tax exemptions from the

Government of Andhra Pradesh as there has been a considerable increase in the project cost due to delay in the handover of land for construction by the government.

Delhi Metro Railway Corporation (DMRC) is also provided electricity at a subsidized rate. Apart from expecting subsidy, the study team received comments in the discussions with the concerned Indian counterparts that SPV could possibly consider purchasing electricity from the private power suppliers at a lower rate in an effort to reduce utility cost.

For this LRT project to be successful as a PPP project, substantial participation and commitment of qualified foreign and Indian investors with enough technical and financial capacity and/or operation know-how is important. Tax exemption could be one of the strong incentives to make the project more attractive for such investors.

For these reasons, Equity IRR is calculated assuming that tax exemption is provided to SPV to a maximum extent, and that power tariff reduction is made possible by receiving a subsidy or with SPV's cost cutting effort of its own, based on each base scenario. Table 9.2.27 shows the results.

Table 9.1.27 Equity IRR in Tax Exemption/ Utility Cost Reduction Cases

	Scenario 1	Scenario 2	Scenario 3
Base Case	13.3%	16.6%	17.8%
Tax exemption*	16.5%	20.5%	22.0%
Tax exemption + power tariff reduction**	17.3%	21.6%	23.2%

Note: * Full exemption of Central and State taxes are assumed. **Power tariff reduction by 30% is assumed.

Source: Study Team

(2) Scenario considering variations in cost burden of the public sector

In the two-tiered PPP scheme, the entire project cost is shared by the public and private sectors according to the division of responsibility. In the case that the public sector subsidizes the private sector to cover a part of its investment cost, the public shares an increased cost aggregately of the investment on its own and subsidy. On the other hand, the more subsidy potential investors receive, the greater rate of return they can expect from their investment. Thus it is crucial for the successful PPP organization to find an appropriate balance between the expected rate of return for the private sector and the acceptable cost burden for the public sector.

From this viewpoint, this section examines variations in SPV's expected rate of return and the public cost sharing rate¹, in the cases where SPV is provided tax exemption and/or utility cost reduction as discussed in (1) above, instead of giving up a certain portion of subsidy assumed in the base scenarios. Table 9.2.28 indicates the result of the analysis.

¹ The public cost sharing rate is defined here as a proportion of the sum of the investment cost for the subsectors of the public responsibility and the subsidy (such as VGF) provided to the private sector, to the total initial investment cost of the project. Costs such as opportunity cost of exempting taxes, subsidies in the operation phase, and service fee payment from the public to SPV are not considered.

Table 9.1.28 SPV Equity IRR and Public Cost Sharing Rate

I. «Service fee payment: 95% of fare box revenue»

	SPV Equity IRR			Public Cost Sharing Rate		
	Scenario 1	Scenario 2	Scenario 3	Scenario 1	Scenario 2	Scenario 3
Base case (Base Scenario)	13.3%	16.6%	17.8%	65.5%	75.3%	78.2%
No subsidy provided (A)	10.1%			50.6%		
(A)+Tax exemption*	12.7%					
(A)+Tax exemption +Power tariff reduction**	13.4%					

II. «Service fee payment: 100% of fare box revenue»

	SPV Equity IRR			Public Cost Sharing Rate		
	Scenario 1	Scenario 2	Scenario 3	Scenario 1	Scenario 2	Scenario 3
Base case (Service fee: 100% of fare box)	14.1%	17.6%	18.9%	65.5%	75.3%	78.2%
No subsidy provided (A)	10.8%			50.6%		
(A)+Tax exemption*	13.5%					
(A)+Tax exemption +Power tariff reduction**	14.2%	15.5%				

III. «Service fee payment: 95% of fare box revenue»

	SPV Equity IRR			Public Cost Sharing Rate (Subsidized SPV investment cost)		
	Scenario 1	Scenario 2	Scenario 3	Scenario 1	Scenario 2	Scenario 3
Base case (Base Scenario)	13.3%	16.6%	17.8%	65.5% (30%)	75.3% (50%)	78.2% (50%)
No subsidy provided (A)	-	-	-	-		
Tax exemption* +Necessary subsidy	15.0%	15.0%		60.8% (20%)		61.4% (10%)
Tax exemption +Power tariff reduction** +Necessary subsidy	15.0%	15.0%		57.9% (14%)		58.8% (4%)

Note: * Full exemption of Central and State taxes are assumed. **Power tariff reduction by 30% is assumed.

Source: Study Team

In the cases of SPV receiving no subsidy with the other conditions kept the same as in the base scenarios, the public cost sharing rate is 50.6% for Scenarios 1 and 2 (the public sector is in charge of land and civil works), and 56.3% for Scenario 3 (land, civil works and track works). This means that the rate has decreased by 15-25 per cent from the ones in the Base Scenarios, i.e. 65.5%, 75.3%, and 78.2% for Base Scenario 1, 2, and 3 respectively. Instead, Equity IRR of SPV drops to 10.1% for Scenarios 1 and 2 and 11.1% for Scenario 3 from 13.3%, 16.6%, and 17.8% in the Base Scenarios. Even if SPV is given tax exemption and reduced power tariff on top of the previous conditions, its Equity IRR will not reach 15% in all scenarios (Sub-table I).

Sub-table II has intended to increase SPV's Equity IRR keeping the public cost sharing rate at the same level as Sub-table I, by changing the assumption of service fee revenue where SPV now receives the amount corresponding to 100% of fare box revenue from the public (with no subsidy provided). Equity IRR somewhat increases and arrives at 15.5% in the case of tax exemption coupled with utility cost reduction in Scenario 3 (public cost sharing: 56.3%).

Sub-table III is the result of the analysis to determine the subsidy amount to make the public cost sharing rate the lowest while achieving 15% of SPV Equity IRR, with service fee payment corresponding to 95% of fare box revenue. The result shows that the public cost sharing rate is the lowest (57.9%) in the case where SPV is provided tax exemption and has reduced power tariff, receiving a subsidy to cover 14% of its investment cost.

As a conclusion of the analysis, the minimum possible level of the public cost sharing rate to ensure a certain rate of return for the private sector would be a little less than 60%. This would, however, be possible only if SPV revenue increases or cost reduction is achieved in some way (such as service fee increase or tax exemption etc.) instead of “lost” subsidy. In other words, it is important for the public sector to consider taking such measures from the perspective of reducing its own cost burden.

(3) Other scenarios

Apart from the scenarios that have been discussed in this chapter, several other scenarios assuming different conditions are examined and the results are presented in Appendix-27-2. The scenarios are as follows:

- A. Base cases including Base Scenarios
- B. Central and State tax exemption cases
- C. Central and State tax exemption plus power tariff reduction cases
- D. No FSI contribution cases
- E. No FSI contribution plus Central and State tax exemption cases

9.1.4 Financial Analysis for the Public Sector

This section will provide a financial analysis for the public sector in different cases based on the SPV scenarios analysed in 9.2.3. The purpose of the analysis is as follows:

- i) To assess the fiscal scale and timing for which the government has to consider preparing a budget to pay interest and repay a loan over the loan period, by examining cash flow of the project executing entity such as Pune Metro Railway Corporation (PMRC) in various cases.
- ii) To identify the impact that different PPP project structures will have on the public cost share in the total initial investment cost necessary for the project.

1) Selected Cases

PMRC’s financial structure is dependent on the PPP business arrangement. As the main cases to be analysed, three cases, P2a(iii), P2a(v) and P3a(v) are assumed. They have the SPV base scenarios of Cases 2a(iii), 2a(v) and 3a(v) as counterparts, respectively, in terms of financial structure such as service fee and subsidy assumptions. In addition to the three cases, the case of full public undertaking (Case P1) is also analysed for the purpose of comparing different PPP structures. These cases are further divided into ten sub-cases according to fund procurement measures (commercial loan or ODA loan) and debt equity ratio². Table 9.2.29 shows the ten cases.

² The debt ratio was calculated based on the difference between the public funding (including subsidy) and the total investment for the two-tiered PPP cases. It is assumed that VGF from the central and state governments are provided to PMRC at the same rate as the government subsidy is provided to SPV in the counterpart cases. Land related costs are excluded from the calculation of VGF.

Table 9.1.29 Selected Cases for Financial Analysis of the Public Sector

Public (PMRC)					SPV		
Case	Undertaking	Initial Investment Cost (Mil. Rs)	Financing sources (Mil. Rs)			Undertaking	Case
Case P2a(iii)-1	Land Civil work	29,235	PMC/PCMC/MIDC	5,501	18.8%	Track work E&M Rolling Stock	Case 2a(iii) * 30% of initial investment subsidized by public * 95% of fare box revenue is received as service fee SPV equity IRR: 13.3%
			VGF State government	3,560	12.2%		
			VGF Central government	3,560	12.2%		
			Debt (JICA ODA loan)	16,614	56.8%		
Case P2a(iii)-2	Land Civil work	29,235	PMC/PCMC/MIDC	5,501	18.8%	Track work E&M Rolling Stock	Case 2a(iii) * 30% of initial investment subsidized by public * 95% of fare box revenue is received as service fee SPV equity IRR: 13.3%
			VGF State government	3,560	12.2%		
			VGF Central government	3,560	12.2%		
			Debt (Commercial loan)	16,614	56.8%		
Case P2a(v)-1	Land Civil work	29,235	PMC/PCMC/MIDC	5,501	18.8%	Track work E&M Rolling Stock	Case 2a(v) * 50% of initial investment subsidized by public * 95% of fare box revenue is received as service fee SPV equity IRR: 16.6%
			VGF State government	5,933	20.3%		
			VGF Central government	5,933	20.3%		
			Debt (JICA ODA loan)	11,867	40.6%		
Case P2a(v)-2	Land Civil work	29,235	PMC/PCMC/MIDC	5,501	18.8%	Track work E&M Rolling Stock	Case 2a(v) * 50% of initial investment subsidized by public * 95% of fare box revenue is received as service fee SPV equity IRR: 16.6%
			VGF State government	5,933	20.3%		
			VGF Central government	5,933	20.3%		
			Debt (Commercial loan)	11,867	40.6%		
Case P3a(v)-1	Land Civil work Track work	32,546	PMC/PCMC/MIDC	5,501	16.9%	E&M Rolling Stock	Case 3a(v) * 50% of initial investment subsidized by public * 95% of fare box revenue is received as service fee SPV equity IRR: 17.8%
			VGF State government	6,761	20.8%		
			VGF Central government	6,761	20.8%		
			Debt (JICA ODA loan)	13,523	41.5%		
Case P3a(v)-2	Land Civil work Track work	32,546	PMC/PCMC/MIDC	5,501	16.9%	E&M Rolling Stock	Case 3a(v) * 50% of initial investment subsidized by public * 95% of fare box revenue is received as service fee SPV equity IRR: 17.8%
			VGF State government	6,761	20.8%		
			VGF Central government	6,761	20.8%		
			Debt (Commercial loan)	13,523	41.5%		
Case P1-1	Fully public undertaking	57,693	Gov. Budget (PMC/PCMC/MIDC)	17,308	30%	-	-
			Debt (JICA ODA loan)	40,385	70%		
Case P1-2	Fully public undertaking	57,693	Gov. Budget (PMC/PCMC/MIDC)	17,308	30%	-	-
			Debt (Commercial loan)	40,385	70%		
Case P1-3	Fully public undertaking	57,693	Gov. Budget (PMC/PCMC/MIDC)	5,769	10%	-	-
			Gov. Budget (State government)	11,539	20%		
			Gov. Budget (Central government)	11,539	20%		
			Debt (JICA ODA loan)	28,847	50%		
Case P1-4	Fully public undertaking	57,693	Gov. Budget (PMC/PCMC/MIDC)	5,769	10%	-	-
			Gov. Budget (State government)	11,539	20%		
			Gov. Budget (Central government)	11,539	20%		
			Debt (Commercial loan)	28,847	50%		

Source: Study Team

Table 9.2.30 indicates the two fund procurement measures and their conditions that are assumed in this analysis.

Table 9.1.30 Fund Procurement Options and Conditions of the Public Sector

Item	Procurement option/ condition	
Loan	ODA Yen Loan (general term)	Commercial bank loan
Interest rate	1.4%	12%
Loan period	30 years (including 10-year grace period)	17 years (including 5-year grace period)
Interest during construction	Paid in cash	Added to the principal
Loan proportion	40-70% of investment cost (limited to applicable portion excluding land and tax)	40-70% of investment cost

Source: Study Team

2) Results of Analysis

The results of the analysis are elaborated here for Cases P2a(iii)-1, P2a(v)-1, and P3a(v)-1, followed by a summary of the result comparing all ten cases. The financial cash flow tables of the three cases are shown in Appendix-27-3. The cash flow graphs of all ten cases are presented in Appendix-27-4.

(1) Case P2a (iii)-1

This case can be applied to the PPP structure where SPV takes Case 2a(iii) scenario. PMRC is responsible for land acquisition and civil works, and 30% of its investment cost (excluding land related cost) is subsidized by the central and state governments as VGF. The total investment cost is Rs. 29,235 Million, out of which 57% or Rs.16,614 Million is obtained from a JICA ODA loan. PMC/PCMC/MIDC fund the land related cost of Rs. 5,501.

The cash flow shows that the public sector is required to prepare a maximum of Rs. 2,800 Million annually for PMRC investment during the construction phase. The repayment of the ODA loan starts in 2026. From then up to 2045, debt service of about Rs. 1,000 Million is incurred every year. As the net revenue, which is the difference between the fare box revenue received from passengers and the service fee paid to SPV, increases over the operation phase, the net budget allocation necessary for debt service (i.e. the negative amount of net cash flow) decreases over the period. The net cash flow will turn into a positive figure after the completion of repayment. The budget appropriation should be considered in the case that PMRC acquires the assets from SPV with the completion of the concession contract.

The public cost sharing rate to the total initial investment of the entire project is 65.5%. The calculation table is shown in Appendix-27-5.

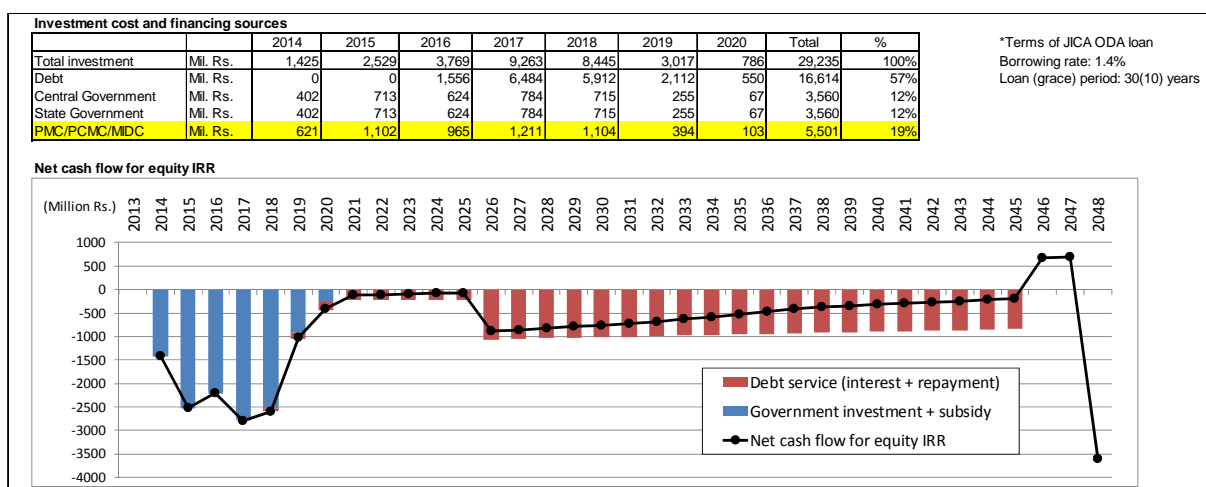


Figure 9.1.1 Financial Sources and Cash Flow of PMRC: Case P2a(iii)-1

Source: Study Team

(2) Case P2a(v)-1

This case can be applied to the PPP structure where SPV takes Case 2a(v) scenario. PMRC is responsible for land acquisition and civil works, and 50% of its investment cost (excluding land related cost) is subsidized by the central and state governments as VGF. The total investment cost is Rs. 29,235 Million, out of which 41% or Rs.11,867 Million is obtained from a JICA ODA loan. PMC/PCMC/MIDC fund the land related cost of Rs. 5,501.

The cash flow shows that the public sector is required to prepare a maximum of Rs. 4,500 Million annually for PMRC investment during the construction phase. The repayment of the ODA loan starts in 2026. From then up to 2045, debt service of about Rs. 700 Million is incurred every year. As the net revenue, which is the difference between the fare box revenue received from passengers and the service fee paid to SPV, increases over the operation phase, the net budget allocation necessary for debt service (i.e. the negative amount of net cash flow) decreases over the period. The net cash flow will turn into a positive figure one year before the completion of repayment. The budget appropriation should be considered in the case that PMRC acquires the assets from SPV with the completion of the concession contract.

The public cost sharing rate to the total initial investment of the entire project is 75.3%. The calculation table is shown in Appendix-27-5.

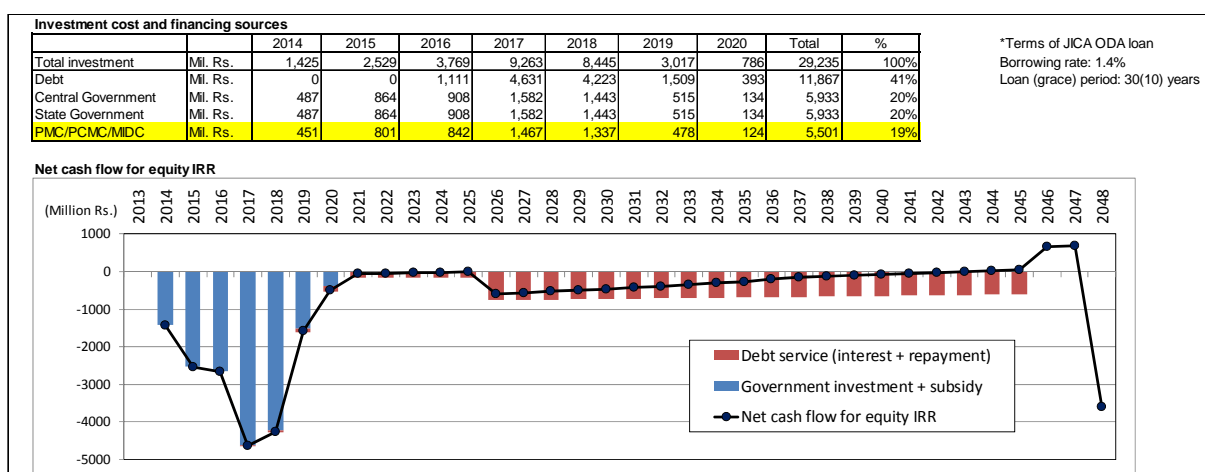


Figure 9.1.2 Financial Sources and Cash Flow of PMRC: Case P2a(v)-1

Source: Study Team

(3) Case P3a(v)-1

This case can be applied to the PPP structure where SPV takes Case 3a(v) scenario. PMRC is responsible for land acquisition, civil works and track works, and 50% of its investment cost (excluding land related cost) is subsidized by the central and state government as VGF. The total investment cost is Rs. 32,546 Million, out of which 42% or Rs.13,523 Million is obtained from a JICA ODA loan. PMC/PCMC/MDC fund the land related cost of Rs. 5,501.

The cash flow shows that the public sector is required to prepare a maximum of Rs. 5,100 Million annually for PMRC investment during the construction phase. The repayment of the ODA loan starts in 2026. From then up to 2045, debt service of about Rs. 800 Million is incurred every year. As the net revenue, which is the difference between the fare box revenue received from passengers and the service fee paid to SPV, increases over the operation phase, the net budget allocation necessary for debt service (i.e. the negative amount of net cash flow) decreases over the period. The net cash flow will turn into a positive figure after the completion of repayment. The budget

appropriation should be considered in the case that PMRC acquires the assets from SPV with the completion of the concession contract.

The public cost sharing rate to the total initial investment of the entire project is 78.2%. The calculation table is shown in Appendix-27--5.

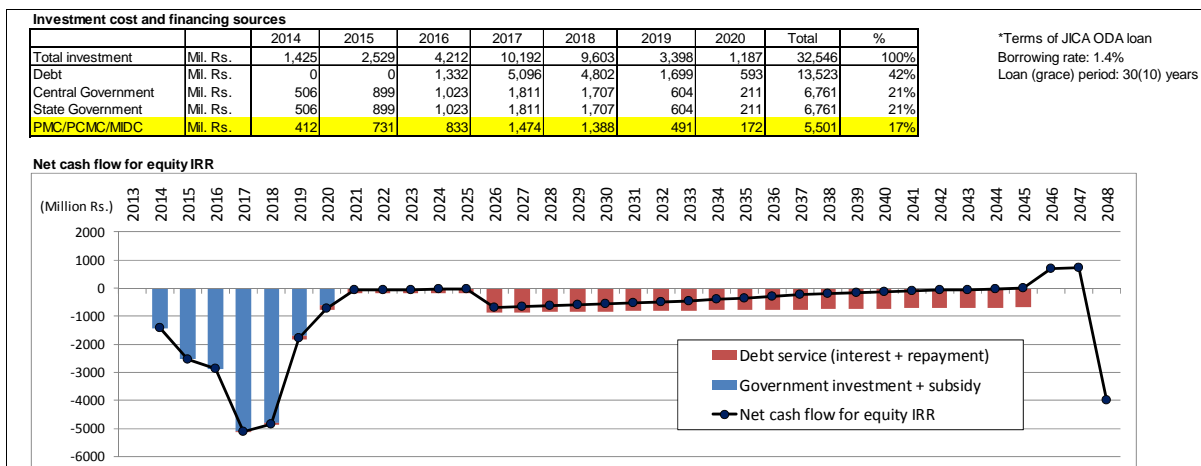


Figure 9.1.3 Financial Sources and Cash Flow of PMRC: Case P3a(v)-1

Source: Study Team

(4) Comparison among all selected cases

Table 9.2.31 indicates the result of the analysis for the selected ten cases, including the above-mentioned three base cases. The results of comparison among these cases in terms of the PPP structure (the two-tiered or fully undertaking) and fund procurement measures (ODA or commercial loan) are summarized below:

➤ **PPP structure**

- Securing necessary budget would be recognized as a greater issue in full public undertaking cases (Cases P-1, P-2, P-3, P-4) compared with the two-tiered PPP cases, since the former requires twice the initial investment cost of the latter. For instance, the public sector needs to prepare a maximum of Rs. 9,000 Million annually during the construction phase in Case P1-3 where 50% of the investment cost is obtained through an ODA loan, while it is Rs. 4,600 Million in Case P2a(v)-1.
- The loan amount would also increase to Rs. 300-400 Million in full public undertaking cases, which requires about twice the amount for debt service in the cases of the two tiered PPP scheme.
- The full public undertaking scenarios naturally require the public sector to cover 100% of the total investment cost of the project. The public cost sharing rate in the base cases under the two-tiered PPP scheme is estimated to be 65-78%.
- On the other hand, the full public undertaking cases provide positive figures of Equity IRR indicating that the return will exceed the cost in the long run though a relatively large-scale

budgetary allocation is required for investment and debt service in the first half of the project period.

➤ Fund procurement measures

- In the cases of obtaining a commercial loan (Cases P2a(iii)-2, P2a(v)-2, P3a(v)-2, P1-2, P1-4), annual debt service burden is much greater (up to around 4 times) than in the cases of an ODA loan.

(5) Public cost sharing rate

As stated above, the public cost sharing rate to the total initial investment of the entire project is calculated at 65.5%, 75.3% and 78.2% in the base cases of P2a(iii), P2a(v) and P3a(v) respectively. In order to ease the public's cost sharing burden, the study team has explored the possibilities of reducing the public subsidy provided to SPV with its investment rate of return kept at an allowable level. As described in 9.2.3 6), it was estimated that the level of the public cost sharing rate could decrease to below 60% under the condition that SPV revenue increase or cost reduction is achieved by taking measures such as tax reduction and service fee increase.

Table 9.1.31 Result of Analysis for PMRC Selected Cases

Scheme/Case	Two-Tiered BOT Gross Cost Scheme			
	Case P2a(iii)-1	Case P2a(iii)-2	Case P2a(i)-1	Case P2a(i)-2
Initial Investment Cost	29,235	29,235	29,235	29,235
Financing sources	PMRC/PCMC/MDC State 5,501 VGF 3,600 JICA ODA loan 16,614	PMRC/PCMC/MDC State 5,501 VGF 3,600 Commercial loan 16,614	PMRC/PCMC/MDC State 5,501 VGF 3,600 JICA ODA loan 11,867	PMRC/PCMC/MDC State 5,501 VGF 3,600 Commercial loan 11,867
Budget allocation necessary for PMRC initial investment (PMRC/PCMC/MDC)	12,621	12,621	17,368	17,368
Maximum yearly allocation during construction period	5,501	5,501	5,501	5,501
Maximum yearly allocation during operation period	3,600 in 2048 (for asset acquisition from SPV)	3,600 in 2048 (for asset acquisition from SPV)	3,600 in 2048 (for asset acquisition from SPV)	3,600 in 2048 (for asset acquisition from SPV)
Yearly debt service	239 (2021-25) 1,092-865 (2026-45) positive during 2046-47	4,192-1,924 (2021-32) positive during 2033-47	171 (2021-25) 780-618 (2026-45) positive during 2044-47	194 (2021-25) 888-764 (2026-45) positive during 2046-47
Net cash flow				
Public cost share	65.5%		75.3%	78.2%

Scheme/Case	Fully Public Undertaking		
	Case P1-1	Case P1-2	Case P1-3
Initial Investment Cost	57,693	57,693	57,693
Financing sources	PMRC/PCMC/MDC State 17,308 VGF 40,385 JICA ODA loan	PMRC/PCMC/MDC State 17,308 VGF 40,385 Commercial loan	PMRC/PCMC/MDC State 5,769 VGF 11,539 Central government 11,539 JICA ODA loan 28,847
Budget allocation necessary for PMRC initial investment (PMRC/PCMC/MDC)	17,308	17,308	28,847
Maximum yearly allocation during construction period	4,626 in 2018	4,483 in 2018	8,966 in 2018
Maximum yearly allocation during operation period	5,187 in 2023	13,701 in 2023	5,044 in 2023
Yearly debt service	580 (2021-25) 2,650-2,100 (2026-45) positive constantly from 2029	10,085-4,629 (2021-32) positive constantly from 2033	414 (2021-25) 1,893-1,500 (2026-45) positive constantly from 2029
Net cash flow			
Public cost share	100%		

Source: Study Team

9.2 Potential Stakeholders Survey

The investors and participants in this Project have not been fixed yet, the public sector stakeholders are in the process of establishment. As a PPP project, a few Japanese companies expressed their high interest and the expectations of Indian partners were also confirmed when the Study team organized a workshop for the private sector and its follow-up meetings. Some of them showed an interest in equipment supply and provision of services as well as investment.

Public Sector

1) PMC

The Pune Municipal Corporation (PMC) administers Pune which has an area of 710km² with a population of 3.12 million (2011 Census), located 560m above sea level. It is called the East Oxford or Indian Detroit with a number of universities and other higher education institutes as well as research and training centres. Together with the neighbouring PCMC, industrial development has been taking place, firstly automobile and machinery industries in the 1960s, and later the ICT industry since the 1990s.

Regarding Pune's fiscal situation, on the basis of the FY2012 estimate, the revenue has reached about INR 3.4 billion, and one-third comes from the octroi and toll revenue. The expenditure figures are not published but a column marked as Grant should be considered as proof that PMC is in a deficit situation. The amount of grant for the last five years represents about 17.9% of the revenue total.

Table 9.2.1 PMC Revenue Trend

(Unit: INR mio)	FY07	FY08	FY09	FY10E	FY11E	FY12E
Octroi & Tolls	5,422.22	6,845.94	6,466.56	6,328.73	9,660.00	10,801.00
Revenue Grants	637.05	3,195.01	1,803.87	4,512.92	5,464.15	6,562.00
Fees and User Charges	1,878.33	3,783.61	2,878.34	3,473.16	5,474.35	6,468.00
Property Tax	2,016.96	2,536.47	2,621.81	2,838.19	4,617.50	5,424.00
Water Tax	1,126.27	1,136.07	1,246.87	1,128.41	2,447.40	2,773.00
Others	829.30	833.52	1,252.61	1,181.84	1,598.26	1,929.28
Total	11,910.12	18,330.62	16,270.05	19,463.24	29,261.65	33,957.28

Source: PMC Website

2) PCMC

The Pimpri-Chinchwad Municipal Corporation (PCMC) administers PCMC, located to the North West of Pune, form an integrated township. Its area is about 171km² and the population is 1.73 million (2011 Census). MIDC started its development activities in the 1950s by offering several industrial parks, and by now European companies have settled in well in the area.

3) MIDC

Maharashtra Industrial Development Corporation (MIDC) was established to provide land for industrial development mainly through its industrial parks. To date, MIDC has developed over 140

parks and among others, the one which is related to the Project is Hinjawadi IT Park. The financial situation of MIDC is not disclosed but in interviews with some high ranking officials at MIDC they indicated that due to the successful development operations, MIDC has a relatively comfortable financial situation.

4) State of Maharashtra

The State of Maharashtra to which MIDC belongs is one of the 28 states in India. Mumbai is the capital and the total area is 307,000km² with 96.75 million population (2011 Census). The financial situation of the State shows that both the revenue and the expenditures have been drastically changing, but the average of the last five years till 2012 shows a positive balance of 1.30%. On the other hand, the debt ratio reaches 20%.

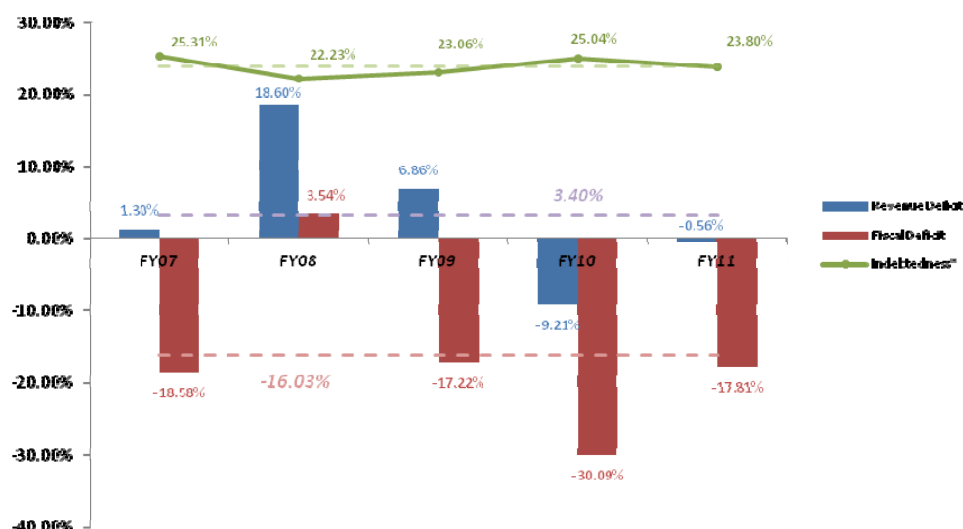


Figure 9.2.1 State of Maharashtra Financial Trend

The State of Maharashtra is considered to be the major commercial and financial state in India. Its economic and industrial developments are growing rapidly and the infrastructure development has not caught up well. Its financial situation may be comparatively low due to its active business activities. A careful monitoring of PMRC, a regulating body to be established soon, should be undertaken, particularly focusing on its budgetary allocations to determine its financial soundness.

5) PMRC

Pune Metro Rail Corporation (PMRC) will be the key organization to be responsible for the urban railway regulation and supervision, but it is not established yet. Its financial base, organization, structure and capacity are not known. When LRT SPV is established to operate under the PPP scheme, its regulatory capacity should be fully exercised, and thus its quick establishment is expected. Regarding its ability, in addition to its adequate organization and structure, a good professional level of experts is expected to be engaged.

Private Sector

6) Japanese private sector companies

There are two Japanese companies showing their interest in participating in this project.

One company is expected to contribute with its technology development, and the other one with long-term investment experience expressed their interest. The financial situation and financial capability of both companies seem to be more than adequate.

7) Indian and international companies

The Study Team organized a PPP Workshop in January 2013 and 20 companies attended. The Study Team conducted a series of interviews after the workshop and organized individual meetings to follow up. The outcomes of the statements of their interests are as follows:

Most of interviewed companies responded that they would like to participate in the discussions regarding the SPV formation. The foundation was laid for a series of substantial discussions after April 2013 among those Indian and Japanese companies.

Each company carefully follows the HPC/PMRC to be formed with an adequate organization.

- The BOT Full Concession scheme is dominant in their interests and the proposed Two-tiered scheme seemed to be considered to provide fewer project engagement opportunities. Most comments indicated a preference for a full concession including civil work by SPV.
- The Team responded, to the comments that if the project is wholly underwritten by the private sector SPV, it may be faced with an uncontrollable situation with increasing cost. The Team further explained that by adopting a Two-tiered system, SPV focuses on E&M and rolling stock and the public sector will fix the fare. By adopting those options, the feasibility will be more stabilized.
- Financial return is important when considering investing, and there is further interested in the civil work, equipment supply and if the case allows, with O&M, that being considered as the most promising area in the future.
- Some indicated that they had no experience with O&M but would like to tie up with a Japanese company for O&M.
- Having expertise in projects with coordinating investment agencies, they felt that direct investments, advisory positions, and operating leases and rentals could be areas of interest.

9.3 Overall Evaluation

9.3.1 Importance of Urban Railway Systems

India has been experiencing high growth and at the same time, it experiences fast changes in urbanization. Currently about 30% of the population lives in urban areas and this is expected to

increase further in the years ahead. Urban transport, among others, has caused traffic congestion and air pollution due to car exhaust emission. According to the 2011 Census, 13 cities, headed by Mumbai, have over 2 million population and 46 cities have over 1 million population. During the last decade, they grew by 31.9% and 53.1% respectively.

In its 12th National Five Year plan, urban transport development plans for the cities of 2 million or more population, and implementation of actual projects for the cities with over 3 million are expected. The Ministry of Urban Development (MoUD) announced a National Urban Transport Policy (NUTP) to create a more human oriented society and also to encourage Transit Oriented Development.

NUTP aims at 16 goals, some of which are:

- Monitor urban transport as one of the important indicators.
- Integrate land use and urban planning and thus mobility for education, life and other needs
- Create a TOD society

9.3.2 Requirements and Difficulties of Urban Railways

The Ministry of Urban Development (MoUD) has set up an urban transport policy but projects implemented in PPP are limited and it still continues public sector operations.

The builder / concessionaire of those transport infrastructure projects offers to undertake the sub-structure such as civil work but they do not offer equipment, materials or means to use the facilities.

On the other hand, railway operators also need to procure the super-structure like rolling stock and E&M, and more. They need to be engaged in constructing, procuring and operating the whole system.

Advantages of PPP

The Government of India has been making strong efforts to introduce Public-Private Partnerships, PPP. In addition to the road and electricity sector as popular areas, continuing urbanization will require it to expand its urban railway network. Gross Cost concession schemes with Two-tiered systems would be most desirable. The Net Cost scheme option is considered to be high in risk. The public sector will bring VGF whereas the private sector will bring effective management style.

VGF and JICA PSIF improving viability

Bearing the above in mind, the project can be considered viable if VGF and JICA PSIF are available as explained in the financial analysis.

Chapter 10 Project Effects

10.1 JICA Project Evaluation Summary

JICA project level evaluation consist of the three stepped framework of 1) Project review, 2) Evaluation based on DAC Evaluation Criteria, and 3) Drawing of recommendation and lessons to give feedback to the next stage. The JICA project evaluation uses a 5 degree evaluation as the basis for the evaluation purposes based on the OECD-DAC system recommended in 1991.

1) **Relevance**

Examine the matching level, the implemented development assistance and the target group, the country in question as well as the donors' priorities.

2) **Effectiveness**

Effectiveness is shown as the degree of achievement of the development assistance objectives.

3) **Efficiency**

Measure qualitatively and quantitatively both Inputs and corresponding Outputs. It shows that the envisaged development assistance was achieved by mobilizing the least cost resources, and compares with other approaches to confirm the most effective process was adopted.

4) **Impact**

Analyse changes direct or indirect, or voluntary or involuntary, due to the project implementation. It should include the impact or influence on the local community, economy, environment and other development indicators.

5) **Sustainability**

It measures whether the benefit will continue after the donor's assistance ends. The development assistance should be sustainable in environmental and financial aspects.

10.1.1 Summary of evaluation at each stage

These five DAC evaluation items are to evaluate the value of the project implementation from an overall view. The five item viewpoints are categorized by the timing of the evaluation, i.e. *ex ante*, during and *ex post* occasions.

1) **Ex ante Evaluation**

This is to confirm the necessity, impact and the implementation of the plan. It also sets up final goals by using quantitative indicators as much as possible and clarifies the evaluation planning at a later stage. The view point of the evaluation using the DAC five item evaluation, is to evaluate

points such as necessity, validity, purpose, contents, effectiveness, external factors and risks to examine the overall evaluation of the adequacy of the project.

2) Evaluation during the project

Review whether the project is being implemented in a manner that will produce good outcomes, and to contribute to the revision of the plan of the project being evaluated or improvement of the organizational issues. Review the project, based on the actual situation and achievements, on its relevance, effectiveness, and efficiency as well as influencing the contributions or hindrances due to the project.

3) Ex post Evaluation

Review comprehensively whether the objectives have been achieved by the end of the cooperation period, employ the assessed results to determine whether the project should end or be extended. Evaluate, based on the actual situation and the achievements, the relevance comprehensively. Review also the impact, sustainability and way forward.

10.1.2 Setting up Indicators for Continuous Evaluation

The logical framework is a well established tool for evaluation at the project level, and is used for project planning, implementation and evaluation.

The logical framework comprises;

- 1) Upper level goal (Impact) as a long-term development effect
- 2) Project goal (Outcome) as the direct benefit indicator of the project,
- 3) Output goal is the indicator of goods and services that the project produces
- 4) Activity goal is the project indicator regarding produced outputs

In addition, the environment surrounding the project and cross cutting viewpoints are analysed to capture the changes such as;

- Policy: project sector priority level, consideration of the related policies and system development status
- Economy and Fiscal: financial resources for operation and maintenance, project cost and benefit analysis
- Technology: appropriate technology, engineer availability, equipment procurement possibility
- Organization: institutions and structure, human resources, capacity and responsibilities
- Environment: natural resource management, development, environment protection, effect
- Social and culture : impact on the local society, groups (gender, race, religion)

10.2 Evaluation Framework for this Project

Considering the evaluation above, performance indicators are considered.

1) Upper Goal (Impact)

Traffic jams around Pune area are substantially reduced, the TOD transport system is well settled, and the local communities alongside the route will increase in value economically and socially.

2) Project Goal (Outcome)

Outcome goal will be the TOC / TOV effects that are identified and measured

3) Output Goal

Passengers transported is set as the operating indicator for an LRT urban railway

4) Activities

LRT urban railway project is implemented and operated

10.2.1 Setting up Indicators for Project Impact evaluation

1) Output

Passenger traffic number is set as the operating indicator, or the output goal. This project recommends a BOT Gross Cost scheme. The public sector will fix the tariff. This system and collect fare box. Price and passenger traffic numbers could be indicators and these are reviewed in the Demand Analysis.

2) Outcome

Time saving and cost saving are considered as the outcomes.

In addition, the decrease in accidents and reduction in global warming gas emission as a result of modal shift from cars to railways could be considered. The Cost-Benefit analysis is done through time saving and cost saving.

Furthermore, the project plans to operate with a PPP framework. This will generate development impacts alongside its route. Moreover, as the development takes place, the real estate tax revenue increase will impact the fiscal situation of local governments. In the financial analysis, SPV return is considered as one of the outcome indicators.

If one considers qualitative indicators from an overarching view point, the following indicators are considered and a further analysis is expected during the next steps.

- Policy:
- Priority consideration level by the central, state and local governments, Floor to Space index changes and its related real estate policy.
- Economy and Public Finance
- VGF for operation and maintenance period and its availability in public finance
- Technology:
- Catenaryless LRT technology and its low life cycle cost advantages
- Institution and Management
- Organization and structure of PMRC as a regulatory and supervising agency. Human resources availability, capacity and responsibility
- Environment:
- EIA implementation, Impact of land acquisition on natural resource management, development, exploitation, protection and influence.
- Social and Cultural aspects
- Impact on the local communities, Level of access and improvement of life judged together with BRT MRT and other projects

10.2.2 Indicators for this project

Please see Chapter 9.2.2.

Chapter 11 Summary of the Survey Results and Future Plans

11.1 Summary of the Survey Results

This report summarizes the findings of a “Preparatory Survey on the Urban Railway Project in Pune Area” in Maharashtra. The study has been executed through 3 stakeholders of the Indian side, which are Pune city (PMC), Pimpri Chinchwad city (PCMC) and Maharashtra Industrial Development Corporation (MIDC), for making the future plans aimed at the Implementation of the Project.

Consensus forming with regard to the content of the study was conducted in a Stakeholder Meeting and the basic project planning policies shown below were finalized based on the discussions at the Stakeholder Meeting. Study Results are summarized in “Overview of Study Results” sheets.

- ✓ This project is required to consider the connection between the LRT project and Metro Line 1 for PMC and PCMC, and Line 2 for PMC. A comprehensive urban transport plan for Pune district is required.
- ✓ Development of a multi-polar urban structure is the goal for Pune and an industrial area has been developed by MIDC in the suburban area of the Pune metropolitan area. IT parks are overrepresented in the industrial development. At present, phase 1 and 2 areas are sold out. The phase 3 area, as a special economic zone, has been under construction and sold gradually. The phase 4 area was approved for announcement to the public. However, the land acquisition has bogged down. The phase 5 and 6 areas are pending approval. The area outside of the industrial area is the jurisdiction of the Pune district. This project executed by PPP scheme is an LRT development project that connects the centre of Pune city and the IT Park.

Based on these basic policies and basic surveys on site, basic preliminary design for the LRT system, the preparation of planning drawings, construction plans, and calculation of estimated project costs have been undertaken.

The study regarding environmental and social considerations will be implemented and summarized in the TOR for the next process of the EIA. The estimated area and number of houses for RAP based on discussions with relevant agencies and an on site survey and the content to be studied at the next stage will be determined.

In this study, the effectiveness of project implementation as a PPP scheme was confirmed from the stand point of financial analysis, economic analysis and equity IRR.

In the future, any necessary adjustments and an application for approval by the relevant agencies of measures that need to be taken to mitigate various risks for Pune LRT project regarding the next stage will be needed.

Overview sheets of study results are shown in Table 11.1.1.

Table 11.1.1 Overview of Study Results

	Overview	Status of Study in India	Issues	Expected Action Plan
Plan of Pune Metro Line 1 and 2	Detailed Project Report has been implemented by DMRC	Approved by State Government	No application has been submitted to the National Government	A High Power Committee has been established in the State Government. Application for the establishment of PMRC (Pune Metro Railway Cooperation) has been submitted on 28 January, 2013.
Hinjewadi IT Park	Development of Hinjewadi IT Park has been planned to Phase 6	Actually, Phase 3 as a special economic zone has been developed, a public announcement has been made for Phase 4, and Phases 5 and 6 are still planning.	The period of land acquisition for Phase 4 will require about one and a half years from end of negotiations.	Confirmation of start of land acquisition for Phase 4 by MIDC is required.
BRT planning	BRT construction in PCMC is starting with the aid of the World Bank.	Widening of the existing road to 45m in width and starting the construction of the BRT road in the middle of the widened section.	Facilities connecting between BRT's station and LRT's station and access from the sidewalk.	Mention relationship between BRT and LRT at the widened section for BRT in the Study Report
Possibility to Develop Station and Surrounding Area	- Surrounding Area of Pune Metro Line 2 - Possibility of Pedestrian Overpass to connect State Hospital from LRT station	There is no re-development activity for Pune Metro Line 1 and 2 in the area surrounding Shivaji Nagar Station.	Location of the station for Pune Metro Line 1 and 2 and planning of the entrance to the station	- Mention future development plan and future facilities plan in the Study Report - And also future connection plan from LRT station to State Hospital.
Depot and Workshop	Depot will be planned in Phase 4 in Hinjewadi IT Park	MIDC recognizes the Depot and Workshop's location as a part of the Phase 4 area.	- Approval of Pune LRT project by the State Government - And starting of land acquisition by MIDC	- Request to approve Pune LRT - Request to start land acquisition on time
Demand forecast	Demand forecast has estimated at 15,000-16,560 (PHPDT) by 10 and 20 years from 2018 by Fare Level for PPP scheme.	- Fare Level must be the same Level as DMRC - Request demand forecast to estimate after 30 years from 2018	Expectation of the same fare level as Pune Metro Lines 1 and 2	- Fare level estimated by SP survey indicated willingness to pay 1.5 times the fare of the Delhi Metro. - Demand forecast for 30 years after 2018 will be satisfied by adding 10m in length of LRT for 19,320 (PHPDT)

Overview	Status of Study in India	Issues	Expected Action Plan
<p>Planning and design for LRT system</p> <ul style="list-style-type: none"> - Implementation of urban railway from Pune to Hinjewadi will be carried out by LRT - Route alignment is planned for minimum radius 20m for LRT to avoid excessive land acquisition - Basic configuration of LRT is planned for 60m width (30m+30m) with catenary free battery system 	<ul style="list-style-type: none"> - MIDC has requested to extend line about 5km of elevated structure to Phase 3 as the special economic zone in Hinjewadi IT Park - PCMC requests to adopt elevated structure in section parallel with BRT 	<ul style="list-style-type: none"> - Increasing cost if all sections apply elevated structure - Reservation of the characteristics for LRT system 	<p>Add to Study Report the case of all elevated section</p>
<p>Implementation Schedule</p>	<p>Reservation and diversion of road during construction of foundations and piers of Urban Railway</p>	<ul style="list-style-type: none"> - Consideration to prevent road congestion during construction - Considering to avoid entering army land near Mula river during bridge construction 	<p>Mention consideration and construction plan in Study report</p>
<p>Project cost</p>	<p>Appropriation of land acquisition for Depot in Hinjewadi IT park</p>	<ul style="list-style-type: none"> - Land acquisition of depot by MIDC - Recycling of LRT batteries of in India 	<ul style="list-style-type: none"> - Confirmation of land acquisition cost by MIDC - Mention of recycling measures for batteries in Study report
<p>Development surrounding station area</p>	<ul style="list-style-type: none"> - The skywalk over the road to connect between Pune Metro Line 2 and Pune LRT station - Connection at grade between entrance of Pune Metro Line 1 and Pune LRT - Development with F.S.I 4.0 within 500m from station 	<p>No development surrounding Pune Metro Lines 1&2</p>	<p>Mention the scheme for development of Shivaji Nagar Station, State Hospital and Depot land in the Study report</p> <ul style="list-style-type: none"> - Mention benefit of increased F.S.I in the equity IRR's analysis

Overview	Status of Study in India	Issues	Expected Action Plan
<p>- Make environmental check list and preliminary environmental evaluation based on the LRT draft design. For the implementation of this project, the important environmental & social safeguard items are summarized.</p> <p>- The procedures for land acquisition and EIA are confirmed. In addition, the process for obtaining permission for cutting the trees is examined. TOR of the investigations and EMP which is needed for the next step are proposed.</p>	<p>- MIDC will conduct the land acquisition for the Depot area. Land acquisition along the LRT route shall be done by PMC and PCMC.</p> <p>- EC has not been acquired for this project.</p> <p>- MPCB recommended the implementation of an EIA.</p> <p>- The permission for cutting trees has not been acquired.</p>	<p>- Confirmation of the organization which will conduct the EIA, the budget and preparation of the tender for selection of the environmental consultant</p> <p>- The structure of the cooperation study including the monitoring with JICA must be established.</p> <p>- Planting trees are necessary due to cutting the ones along the route. Transplanted trees have to be monitored for 3-5 years. Therefore, the monitoring system should be established and related studies are expected.</p> <p>- A study of the vegetation must be completed to obtain permission to cut the trees</p> <p>- Implementation of EIA following JICA guidelines must be required if PSIF is applied.</p>	<p>- Environmental & social studies will be conducted following JICA guidelines.</p> <p>- The monitoring structure must be established by PMRC.</p> <p>- Dispatching of Specialists by JICA is planned.</p> <p>- PSIF of JICA is mentioned in the report.</p>
<p>Environmental & Social Safeguards</p>	<p>Pune Metro Lines 1&2 will be the "One tiered model" (Civil and E&M system)</p>	<p>-- Management of both One and Two tiered models in PMRC</p> <p>-- Understanding of Gross Cost Scheme as benefit to save public funds</p>	<p>-- Mention detailed Gross Cost Scheme in Study Report</p> <p>-- Making familiarity of knowledge of PPP in India</p>
<p>Project Implementation PPP Scheme</p>	<p>To save public funds, a Gross Cost Scheme has been recommended which will enable project implementation with a private sector led PPP under the "Two tiered model".</p>		

	Overview	Status of Study in India	Issues	Expected Action Plan
Economic Analysis	<p>The EIRR works out to 14.0%. This figure exceeds the Social Discount Rate (SDR) of 12%. Thus, the project is judged to have substantial significance from the perspective of the national economy.</p> <p>Project FIRR is 5.2%. This figure is normal.</p>	<p>The project has been requested to construct an entirely elevated structure.</p> <p>The project has been requested to construct an entirely elevated structure.</p>	<p>-- Improve the development along the corridor</p> <p>-- EIRR becomes 13.3% in the case of an entirely elevated structure</p>	<p>-- Mention surrounding area's development scheme in Study report</p> <p>-- Mention EIRR of entirely elevated structure in Study Report</p>
Financial Analysis	<p>Equity IRR needs to be greater than 15% in order for private investors to join the project</p> <p>Consideration of VGF.</p> <p>Consideration of Floor Space Index (FSI 4.0) increase</p>	<p>Consideration of track work to be publicly funded</p> <p>VGF is expected at the rate of 20% from the Central Government, 20% from the State Government and 10% from related cities.</p> <p>Under consideration of FSI increase along Pune Metro Line 1&2</p>	<p>Confirmation of project structure and earnings structure</p> <p>At what ratio is VGF provided to the project.</p> <p>-- Approval of increased FSI along LRT corridor and implementation of structure of profit distribution</p>	<p>-- Mention scenario of proper basic scheme based on a Gross Cost Scheme</p> <p>-- propose the consideration of tax exemption for SPV</p> <p>-- Examine VGF of each ratio from 0 to 50%.</p> <p>-- Case of 30% and 50% are mentioned as basic scenarios in the Study Report.</p> <p>-- Mention the consideration of FSI in Study Report</p>
Project Effects	<p>Consideration of financial structure and financial procurement in Government department</p> <p>Propose 4 performance indicators (Impact, Outcome, Output Goal, Activities) as evaluation framework for this project</p>	<p>Under preparation to implement PMRC (Pune Metro Railway Cooperation)</p> <p>-- Pune Metro Lines 1&2 are preceding railway project in Pune Area.</p> <p>-- HPC's implementation and PMRC's application as structure and management of Pune Metro Lines 1&2.</p>	<p>Understanding of Government section regarding financial burden</p> <p>-- Approval of Pune Metro Lines 1&2 at Central Government's level</p> <p>-- Approval of Pune LRT project</p>	<p>-- Mention measurement to reduce ratio of financial burden</p> <p>-- Propose consideration of tax exemption for SPV in Study Report</p> <p>Activity to approve Pune LRT project by State Government with DPR and EIA</p>

Source: JICA Study Team

11.2 Future response toward project implementation

Based on the results of this study, the relevant issues and the measures needed for implementation of the project in the future are shown below.

1) Implementation of DPR by PMRC (Pune Metro Railway Cooperation)

(a) Current State

Since the application for the establishment of PMRC (Pune Metro Railway Cooperation) for Pune Metro Line 1 and 2 has been submitted to the State Government, after the establishment of PMRC the application for Pune LRT will be also offered toward implementation as next step.

(b) Issues

This study is requested to address issues pointed out during the study period and to prepare the material as a report to the Civil Council and State Government through PMRC because the corridor consists of Pune City (PMC), Pimpri-Chinchwad City (PCMC) and Hinjewadi IT Park.

PMRC will conduct, as next step, preparation of documents such as DPR (Detailed Project Report) /EIA (Environment Impact Assessment), the preparation of project budget including land acquisition, procedures for implementation of the project by PPP scheme and so on.

(c) Action Plan

A Detailed Project Report (DPR) for the LRT project will be prepared by the Interim Consultant employed by PMRC implemented.

2) Land Acquisition for the Depot

(a) Current State

The public land that can be provided for the depot for the LRT is not present in the region of Pune City, Pimpri-Chinchwad City and Military land. Therefore the Hinjewadi IT Park has become a land of the candidate as a new public land.

(b) Issues

The depot for the LRT project will be located in the Phase 4 area of Hinjewadi IT Park. Land acquisition for the depot will be conducted by MIDC, actually the land acquisition cost is different from the budget prepared by MIDC due to the high cost proposed by the land owner in Hinjewadi. If the land for the depot cannot be prepared on schedule, the LRT project will be delayed. Consequently the process for land acquisition must be conducted smoothly by MIDC as a part of the industry IT Park.

(c) Action Plan

MIDC belongs to the Ministry of Industry in Maharashtra State. For this reason, discussions with the departments responsible must be held to determine how the land acquisition for the depot should be conducted. As the next step, if SPV will request the PSIF of JICA, the application of PSIF will be requested to confirm land acquisition process as EIA, consequently PMRC will monitor the land acquisition process during the land acquisition and resettlement.

3) Execution of EIA/RAP**(a) Current State**

All Railway Projects, with no exception, are totally exempted from seeking Environmental Clearance under Government regulations. But if SPV will require PSIF of JICA, the application of PSIF requests to study an EIA

(b) Issues

With regard to consideration for the environment, this study was conducted to propose the Terms of Reference (TOR) for the Environmental Impact Assessment (EIA) to take the process to the next step and estimate the area and number of houses needed for the land acquisition. The EIA will be conducted by a local consultant and the Resettlement Action Plan will be executed for the work with the land acquisition.

(c) Action Plan

Since the EIA study will be based on the State Standards, PMRC will employ an Environmental Consultant who has knowledge of the corridor and situation. The RAP will be also conducted by a Resettlement Consultant employed by PMRC who has knowledge regarding resettlement.

4) Feasibility of Project**(a) Current State**

Depending on economic analysis the project EIRR works out to 14.0%. This figure exceeds the Social Discount Rate (SDR) of 12% set as an evaluation index. To save public funds, a Gross Cost Scheme has been recommended which will enable project implementation with a private sector led PPP under the “two tiered mode”. The private investor will require achieving 15% of SPV Equity IRR. Currently regarding on subsidy the projects of Pune Metro Line 1 and 2 have requested VGF of 20% from Central Government, 20% from State Government and 10% from Cities so on.

(b) Issues

Since they can expect the ridership risk to be transferred to the public sector under the Gross Cost Scheme, the equity IRR is found to be 13.3%. In this case the subsidy required is 30% from the Central Government and the State Government. If the subsidy is 50% (20% from the Central

Government, 20% from the State Government and 10% from Cities so on), the equity IRR will become 16.6%. Consequently the issues are to select the Gross Cost Scheme and to ensure the sufficient subsidy.

(c) Action Plan

PMRC is required a sufficient explanation to ensure the subsidy from the Central Government, the State Government and Cities for the implementation of project and also requested the approval by the City Parliaments of PMC and PCMC and the State Parliament. It is also requested to understand the Gross Cost Scheme and to encourage tax exemption to the Central Government and the State Government.

5) Stake holder Meetings

To smoothly execute the study the collecting of data from interviews with related organizations and counterparts is to be conducted to facilitate this project. The team will address consensus building on major matters through "Stakeholders Meetings", Stakeholder meetings are to be held a total of three times (17th May, 2012, 6th November, 2012, 15th March, 2013), the PPP seminar is once and the PPP workshops are twice.

Table 11.2.1 Counterparts

Department	PMC	PCMC	MIDC
Urban Planning	Mr. Prashant M. Waghmare	Mr. M T Kamble	Mr. S.B. Patil
Civil Work	Mr. Shrinivas Bonala	Mr. S.S. Savane	Mr. Ulhas Kulkarni
E and M Work	Mr. Shrinivas Kandul	Mr. Milind Kapile	Mr. R.K Bhorkade
Environment	Mr. Mangesh Dighe	Mr. Nikam	Mr. P.G. Deogiri
PPP	Mr. Prashant Waghmare Mrs. Kalaskar	Mr. Deepak Shirke	Regional Officer Mr. Relekar
Operation	Mr. Satish Kulkarni	Mr. Gaikwad	Mr. S.B. Patil

Source: JICA Study Team

Table 11.2.2 First Stakeholder Meeting

Position	Name	Department
Chairman	Mr. Mahesh Pathak	PMC Commissioner
Vice-chairman	Mr. Anup Yadav	PCMC Acting Commissioner
Member	Mr. Bonala Srinivas	PMC Additional City Engineer
Member	Mr. Prashant Waghmare	PMC
Member	Mr. Sanjay Kulkarni	PMC
Member	Mr. M.T. Kamble	PCMC Joint City Engineer
Member	Mr. B. Gaikwad	PCMC junior Engineer
Member	Mr. Ulhas Kulkarni	MIDC Executive Engineer
Member	Mr. Relekar	MIDC Regional Officer
Member	Mr. Snil Pailwan	HIA Infosys

Source: JICA Study Team

Table 11.2.3 Second Stakeholder Meeting

Position	Name	Department
Chairman	Mr. Mahesh Pathak	PMC Commissioner
Vice-chairman	Mr. Anup Yadav	PCMC Acting Commissioner
Member	Mr. Bonala Srinivas	PMC Additional City Engineer
Member	Mr. Prashant Wagmare	PMC
Member	Mr. Sanjey Kulkarni	PMC
Member	Mr.M.T. Kamble	PCMC Joint City Engineer
Member	Mr.B.Gaikwad	PCMC Senior Engineer
Member	Mr.Ulhas Kulkarni	MIDC Executive Engineer
Member	Mr.Relekar	MIDC Regional Officer
Member	Mr. Snil Pailwan	HIA Infosys
JICA	Mr. Mariko Toyoda	JICA PPP Division
JICA	Mr. Yuichiro Sano	JICA India Office

Source: JICA Study Team

Table 11.2.4 Final Stakeholder Meeting

Stakeholder	Delegate Name	Designation
Chairman	Mr.Bhushan Gagrani	MIDC CEO
	Mr.Relekar	MIDC Regional Officer
	Mr.Ulhas Kulrarni	MIDC Executive Engineer (IT)
Vice chairman	Mr.Mahesh Pathak	PMC Commissioner
	Mr. Anup Yadav	Additional PMC Commissioner
Vice chairman	Dr.Shrikar Pardeshi	PCMC Commissioner
	Mrs.Pratibha Badhane	PCMC Town Planning Head
	Mr.Patil	PCMC Joint City Engineer PCMC
	Mr.B.K Gaikwad	Transport Plan
JICA	Mr.Wakabayashi	Representative
PURP	Mr.Miyata	Team Leader
	Mr.Sato	Deputy Team Leader / System Planning (1)
	Mr.Izumi	PPP scheme Expert (1)
	Dr.Hayes	Demand Forecast / PPP scheme (2)
	Mr.Aida	Cost & Implementation Plan / System Planning (2)
	Ms.Bharati	Project Co-ordinator
MGK Legal	Mr.Sameer khale	Advocate

Source: JICA Study Team

6) PPP Workshop

Table 11.2.5 PPP Workshop (Public)

Position	Name	Department
Chairman	Mr.Bhushan Gagrani	CEO MIDC
Member	Dr. P. Anbalagan	Jt. CEO MIDC
Member	Dr. V. Suryawanshi	Jt. CE IT MIDC
Vice Chairman	Dr.Shrikar Pardeshi	PCMC Commissioner
Member	Mr.B.Gaikwad	PCMC Senior Engineer
Member	Mr.Sanjay Bhesle	PCMC BRTS
Member	Mr.Ulhas Kulkarni	MIDC Executive Engineer
Member	Mr.A. Relekar	MIDC Regional Officer
JICA	Mr.Shinya Ejima	JICA Representative
JICA	Ms. Mariko Toyoda	JICA PPP Division
PURP	Mr.Munehiko Miyata	Team Leader
	Mr.Sato	Deputy Team Leader / System Planning (1)
	Mr.Izumi	PPP scheme Expert (1)
	Dr.Hayes	Demand Forecast / PPP scheme (2)
	Mr.Aida	Cost & Implementation Plan / System Planning (2)
Feedback	Ms.Ami	PPP expert
MGK Legal	Mr.Sameer khale	Advocate

Source: JICA Study Team

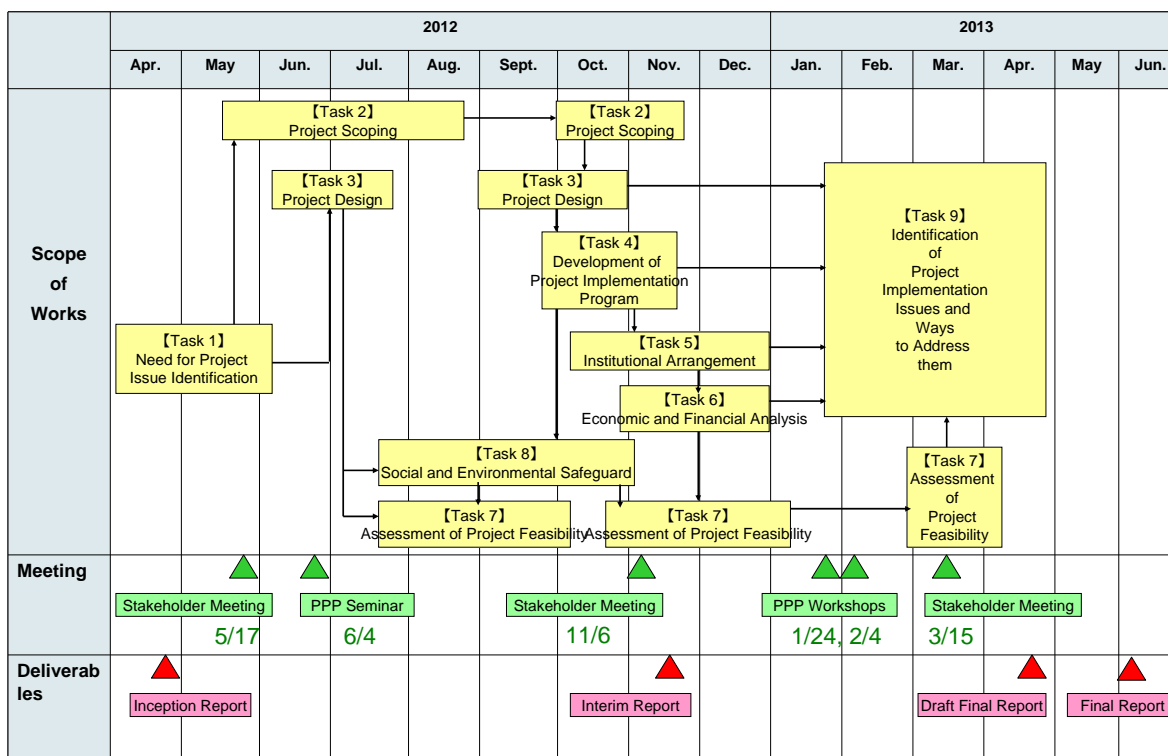


Figure 11.2.1 Schedule of Stakeholder Meetings and PPP seminar

Source: JICA Study Team

7) Next Steps for project implementation

Since the LRT project will be executed through 3 stakeholders, which are Pune city (PMC), Pimpri Chinchwad city (PCMC) and Maharashtra Industrial Development Corporation (MIDC), the next steps for project implementation will be the substantial adjustment and making consensus among stakeholders under the coordination of the State Government. The project will be needed the approval by the City Parliaments and State Parliament.

As conclusion, the following items will be required as next steps for project implementation,

- Early establishment of PMRC
- The study of DPR (Detailed Project Report) conducted by PMRC
- The study of EIA (Environment Impact Assessment) and RAP (Resettlement Action Plan) conducted by PMRC
- Preparation for the approval by the City Parliaments of PMC and PCMC
- Preparation for the approval by the State Parliament
- Explanation to the Central Government and application for ODA loan and VGF for the preparation of the project budget and so on

APPENDICES

APPENDIX-1: Road Track Layout

There are various kinds of the road track layout for LRT according to the road side condition and traffic volume and others.

1) Pattern 1: Road Center Reservation

This type of the layout locates the tracks in the center of the road. This type has little interference with the bus transport which runs in parallel with LRT, and is able to prevent the forced entry of the passengers because of the distance from the sidewalks.

On the other hand, it is necessary to locate the train stops on the center of the road and the passengers need to cross the road for approaching the train stops. And it causes congestion of the traffic with the automobile right turn lane at the crossing.

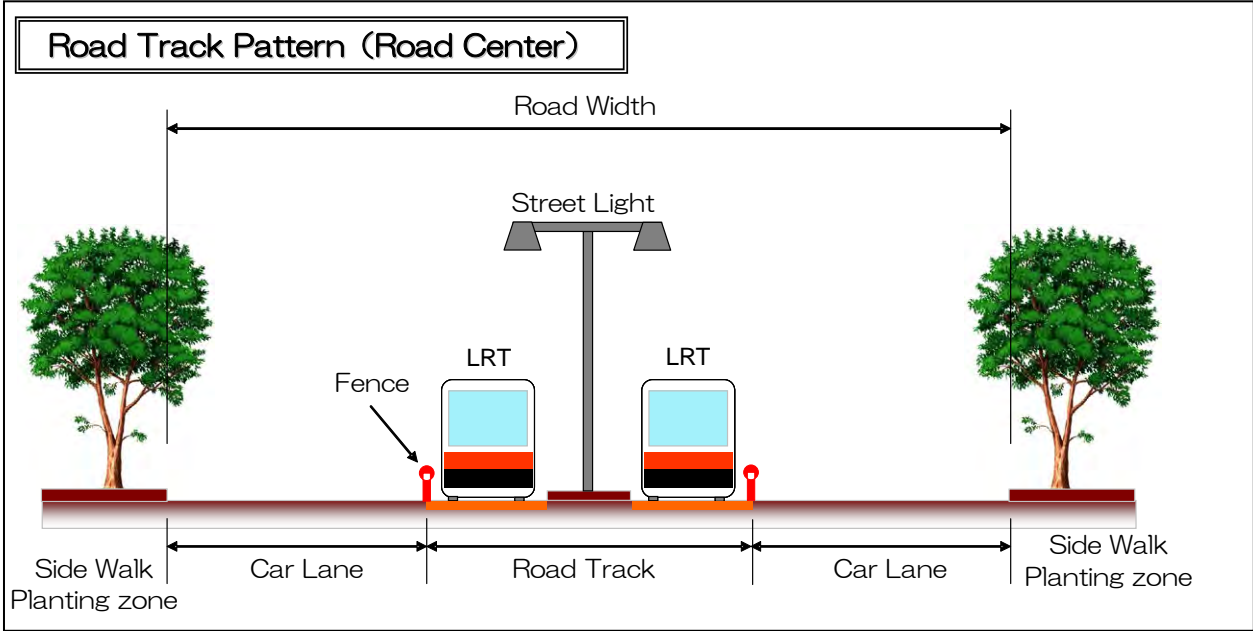


Figure A1-1 Road Track Pattern (Center Reservation : Arakawa Line: Tokyo)

Source: JICA Study Team

2) Pattern 2: Double Side Reservation

This type locates the tracks on both sides of the road. In this type, it is possible to reach to the train stops without crossing the road, and it is easy to access the road side facilities. However, there are some disadvantages, such as it is easy for unauthorized individuals get onto the track, the train stop locations are separated by driving direction, and the necessity of reconsideration of bus stop locations.

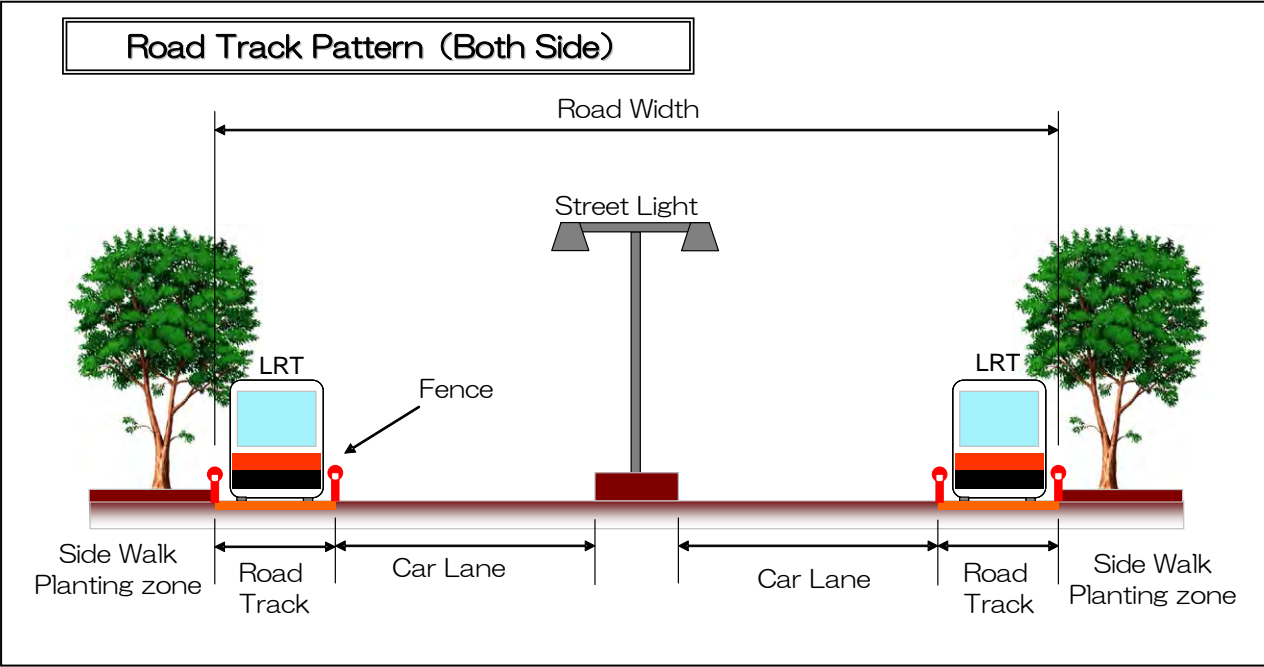


Figure A1-2 Road Track Pattern (Double Side Reservation)

Source: JICA Study Team

3) Pattern 3: Single Side Reservation

This type locates the tracks on one side of the road. In this type, it is possible to minimize the congestion with car traffic but it needs reallocation of the road space.

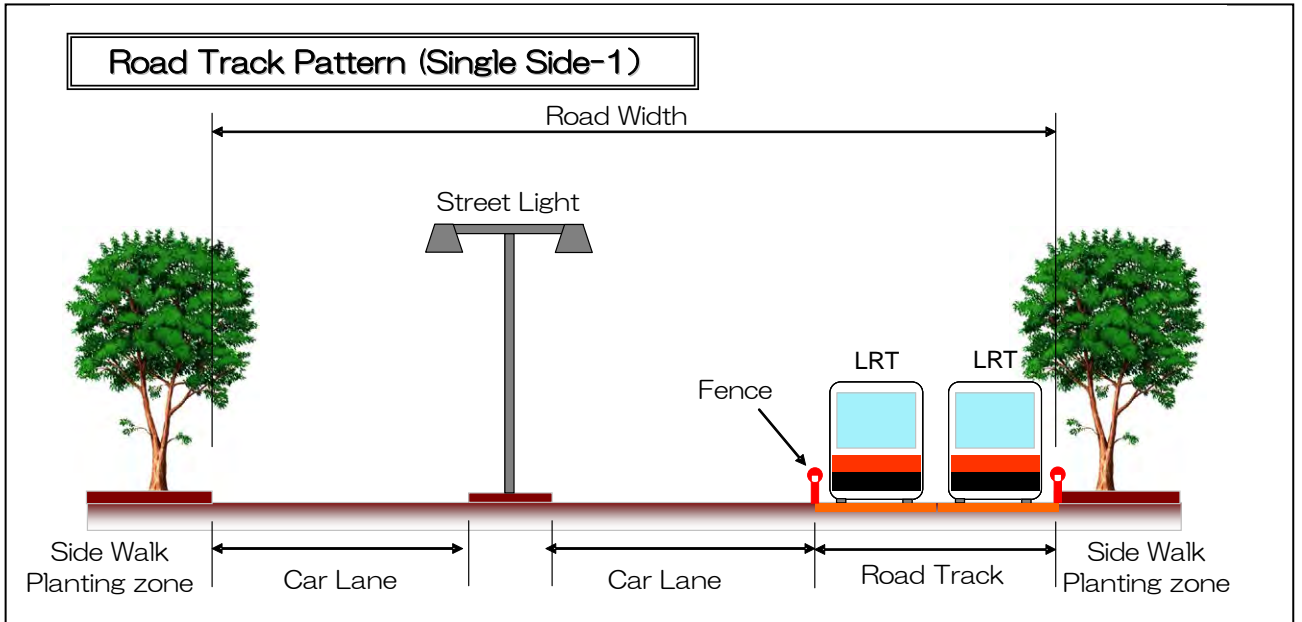


Figure A1-3 Road Track Pattern (Single Side Reservation-1)

Source: JICA Study Team

There is another type of single side reservation as in the Figure below. This type could be kept separate from car transport perfectly and have a safety advantage, but it must decrease the road space.

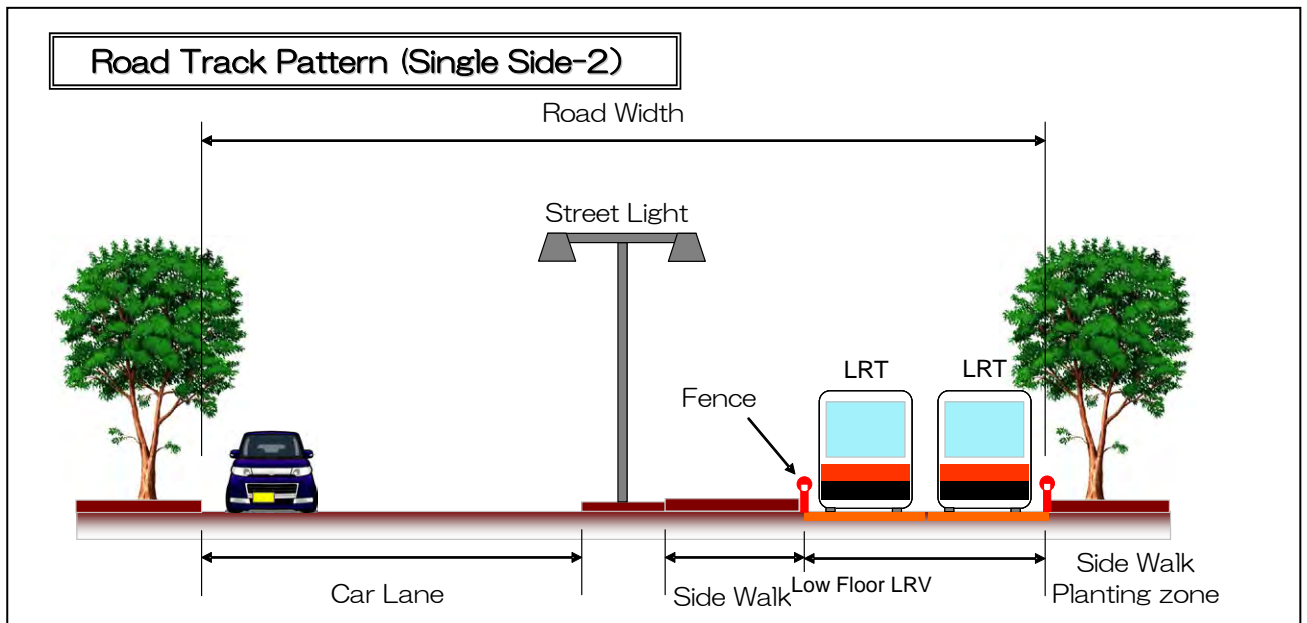


Figure A1-4 Road Track Pattern (Single Side Reservation-2)

Source: JICA Study Team

4) Review of the Road Track

For the types above, there are merits and demerits for each type. In this project, we adopt the types below for the at grade zone depending on the situation.

- Zone having various kinds of facilities along the alignment
 - ⇒Center Reservation type: Especially the areas that include shops and residences along the alignment tend to have a large number of pedestrians. So center reservation is the most suitable type from the safety viewpoint. And there are some bus stops along the road in the commercial area, so there would be a problem of accessibility to the bus with a side reservation road track.
- Zone having many sidewalks along the LRT alignment
 - ⇒Center Reservation type: In this zone, ensuring safety is difficult because the number of crossings between cars and LRT will increase. So center reservation is the best type for this zone.
- Zone having few commercial facilities and residences
 - ⇒Any type is feasible basically

5) Measures for safety during running at grade

As shown in the road track figures above, a stone wall or fence between road track and car lane is needed to separate the LRT from the cars. The measures considered for safety are listed below;

- ① Separate Fence (Car lane and Road track)
Constructing a fence between the car lane and road track to prevent the entry of cars and two wheelers. The fence will be a simple one so as to not give an oppressive feeling to the users.
- ② Coloring of the road track
For prevention of entry of the cars and two wheelers onto the road track by mistake, the area of the road track is colored to clearly show the difference between the road track and car lane.

APPENDIX-2: Fare Collection System

Fare Collection System

There are 4 kinds of fare collection methods in public transport, ①Gate system, ②Onboard fare collection system, ③Onboard ticket issue system, ④Self validation system.

Table A2-1 Outline of Fare Collection Systems

Fare Collection System	Outline	Characteristic
① Gate System	<ul style="list-style-type: none"> ✓ Checking the ticket bought at the ticket vending machine by the ticket gate on the ground ✓ Generally introduced to the railways and Metro throughout the world 	<ul style="list-style-type: none"> ✓ In case of large number of passengers, there is a separation between boarding and checking, so collecting fare is assured ✓ Supports complicated fare systems and able to avoid cheating
② Onboard fare collection system	<ul style="list-style-type: none"> ✓ Taking the numbered ticket and pay the fare at getting off or pay by cash to the driver, or check the pre issued ticket. ✓ Adopted in the tramways of Japan and Asia or in buses all over the world 	<ul style="list-style-type: none"> ✓ Supports a conductorless system ✓ There is a hard burden for the driver in collecting fare, and for users to confirm the fare
③ Onboard ticket issue system	<ul style="list-style-type: none"> ✓ Issue the ticket by the driver at getting on or issued by the officer on board ✓ Adopted in buses of Europe, Australia, Singapore, Thai and Middle America 	<ul style="list-style-type: none"> ✓ Adopted system when a conductor was onboard in the past in Japan ✓ It needs tickets
④ Self validation system	<ul style="list-style-type: none"> ✓ Buying the ticket at a ticket vending machine, or validated by oneself There is no check by officials ✓ Adopted in the road track transport system in North America, Europe and Australia 	<ul style="list-style-type: none"> ✓ System mitigated the fare collecting procedure but accept some failure for collecting fare ✓ Enforce by assessing fines

Source : Japan Transport Planning Association “Review of the elemental technology in LRT systems”

②Onboard fare collection system is of various types. It is the general system in the conductorless system, “pre-paid” as paying at boarding and “post-paid” as paying at alighting, and the detail system is related with fare structure as in the table below.

Europe and North America adopt the self validation system or ticket issue system, so it is a rare case to pay cash directly onboard like in Japan.

Table A2-2 Onboard fare collection, ticket check system

Fare Collection System		System	Example
Pre-paid	Pre-paid with one price	Pay fare at boarding	Arakawa Line:Tokyo Setagaya Line:Tokyu Bus in Tokyo 23 wards North America
	Pre-paid by declaration of the distance Pre-paid by declaration of the zone	Pay fare on boarding declaring the destination or zone	Buses in Tokyo Tama area
	Pre-paid depends on distance from the starting station	Pay fare is decreased depends on the distance from origin. Pay the fare which is displayed on the electronic signboard when onboard	Buses in Hong Kong
Post-pay	Post-pay with one price	Pay fare at alighting	Sapporo city rail City Line of Iyo Railway Tosa Railway Hong Kong Island rail
	Post-pay by declaration of the distance	Take a numbered ticket, Pay fare at alighting referring to the ticket number	Okayama Tramways Hiroshima Tramways Japanese Local bus
	Post-pay by numbered tickets	Pay fare declaring the boarding place	Some areas of the world
Mixed type paid	Mixed type paid depends on distance	No fare is collected at the terminal station, When we bound for terminal station, pre-paid is adapted. When we leave the terminal station, post-pay is adapted. It is simple system.	Chiba city bus Funabashi city bus
	Mixed type paid by area	Separate the area into two areas, a pre-paid area and post-pay area. Inside one area, pay for one area fare. Cross over into the second area, pay for both fares.	Some areas of the world

Source : Japan Transport Planning Association ” Review of the elemental technology in LRT systems”

Self validation system of fare collection is a critical system for LRT systems that is widespread in Europe and North America. The concept of the Self validation system is to manage the ticket by the user himself without checking by the driver or conductor. Generally a passenger buys the ticket in advance and validates the ticket by himself after boarding the train. By introducing this system, it is possible to drive the train by a driver only in case of a long train set. In addition to this, the driver is not involved in fare collection and there is no need for conductors, it is possible to decrease the operation cost. Also a large number of passengers can board and alight at multiple doors, so it is able to keep the operation velocity in a high speed.

On the other hand, there is a problem of fare cheating because of no check by the officials. To counter this, the operator carries out inspections without notice by plain-clothes officials. If the passenger doesn't have a ticket, he will be imposed a very high fine no matter what the reason may be.

Indian fare collection system shows below. Metro adopts the Gate system normally. In Kolkata tramways, the onboard capacity is relatively smaller than Metro, so it is able to handle an onboard ticket collecting system. The Gate system is considered in Pune Metro Project under planning in Pune district.

Table A2-3 Fare Collection Systems in India

Transport System	Fare Collection System
Metro (each city in India)	Gate system
Kolkata Tramways	Onboard fare collection system (declaration by distance)
Metro in Pune (Plan)	Gate system
Bus in Pune	Onboard fare collection system (declaration by distance)
BRT in Pune (Plan)	Not clear

Source: JICA Study Team

Table A2-4 Comparison of the Automatic Ticket Gates

	Flap-type	Turnstile	Retractable
Actual Processing Speed	60 passengers/min.	30 passengers/min.	40 passengers/min.
Width of Machine	200mm	300mm	300mm
Mean Cycle between Failure	1 million cycles ~	1 million cycles ~	1 million cycles ~
Passenger's Safety	Excellent	Good	Poor
Protection Performance (Against breaking through)	Comparatively weak compared with others	Strong	Strong

Source : JICA Study Team

APPENDIX-3: Power Substation System (Conventional Tram System)

1) General

This chapter mentions power supply systems for conventional tram systems.

It consists of a facility to receive the power from an electric power company, a substation facility to convert the received voltage to an electric voltage for the purpose of railway system usage, and distribution facilities to distribute it to each facility at the station, along the wayside and other operation-related facilities. Conventional tram systems need the traction substations for feeding the power to the trams, which is not needed for the battery tram system.

2) System Configurations

(1) BSS (Bulk Substation)

The BSS receives the electric power from MESECL in Pune. In order to supply its power to every stations and substation along the line a Bulk Substation is constructed near each end point of the route. Receiving voltage is 22kV and is converted to 6.6kV. In normal cases, the area of electric supply extends to a Switching Post (mentioned in the following (2) SW Post).

To establish redundancy, it is required to possess the ability to supply electric power from one BSS to the entire line in case of emergency.

(2) SW Post (Switching Post)

In order to establish redundancy, a Switching Post (SW Post) is constructed in the middle of the distribution line in case multiple BSS have been constructed. A circuit breaker in the SW Post is normally open. If a failure happens at one of two BSSs and it can no longer supply the power, the circuit breaker of the SW Post will be closed so that the other healthy BSS can supply the electric power. This function increases the reliability and redundancy of the system.

(3) Traction Substation

Traction Substations are installed at intervals of 2.5km to 3.0km along the route. The Traction Substation converts the AC power received from the BSS to DC power and distributes it to the catenary by 2 feeders for different directions which connect up and down the line.

(4) Depot Substation (Depot SS)

The Depot SS is a substation for supplying the electric power to the Depot. It supplies the electric power to equipment and facilities in the depot as well as feeds the power to the trams which are parked in the depot.

(5) Station Post

A Station Post is installed at each station and supplies the electricity to the load of the station such as lighting and elevators. It will distribute the electricity to the load via the breakers.

(6) Supervisory Control And Data Acquisition (SCADA)

SCADA is equipped at the Operation Control Center (OCC). It plays roles to; (a) control each piece of equipment at the station post and substation, (b) supervise the states of each post.

APPENDIX-4: Overhead Catenary System (Conventional Tram System)

1) General

The catenary type in the city where the running speed is limited is the “Direct catenary type” which supports the trolley wire directly without using the messenger wire. The direct catenary type is the standard which allows a tram speed between 50 and 80km/h (Japan Railway Construction, Transport and Technology Agent : JR TT).

It is possible to continuously draw current due to the Y structure at the support point of the catenary. The direct catenary type has only one electric wire so it will not degrade the city landscape in case of applying the center pole.

Table A4-1 Assumed catenary system

Facility/System	Detail	Remarks
Catenary mast	Center Pole type	※In case of Double side reservation type of road track layout, it will apply the side pole type
Erection type	Aerial single catenary	
Catenary type	Direct hanging type	
Feeder wire	Direct current feeder type	

Source: JICA Study Team

2) Catenary System Plan

(1) Catenary mast

There are two types of Catenary mast, the Center pole type and the Side Pole type. The Center Pole type has only one pole and is very simple and better in visual effect for the city landscape. Also it can be used for various purposes like supporting the street lights or traffic signal lights.

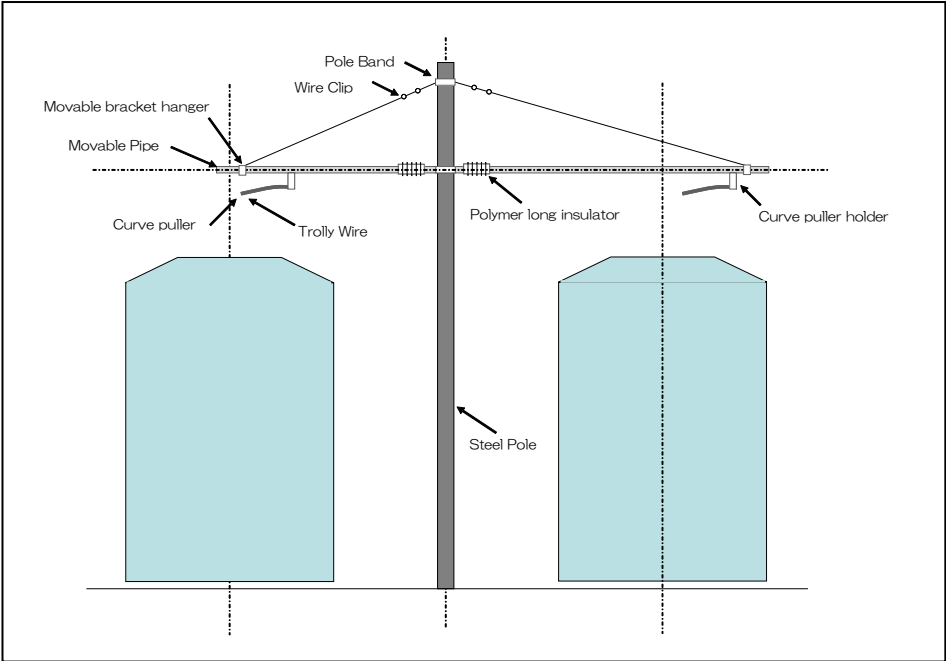


Figure A4-1 Structure of Catenary mast (Center Pole type)

Source: JICA Study Team

(2) Erection type

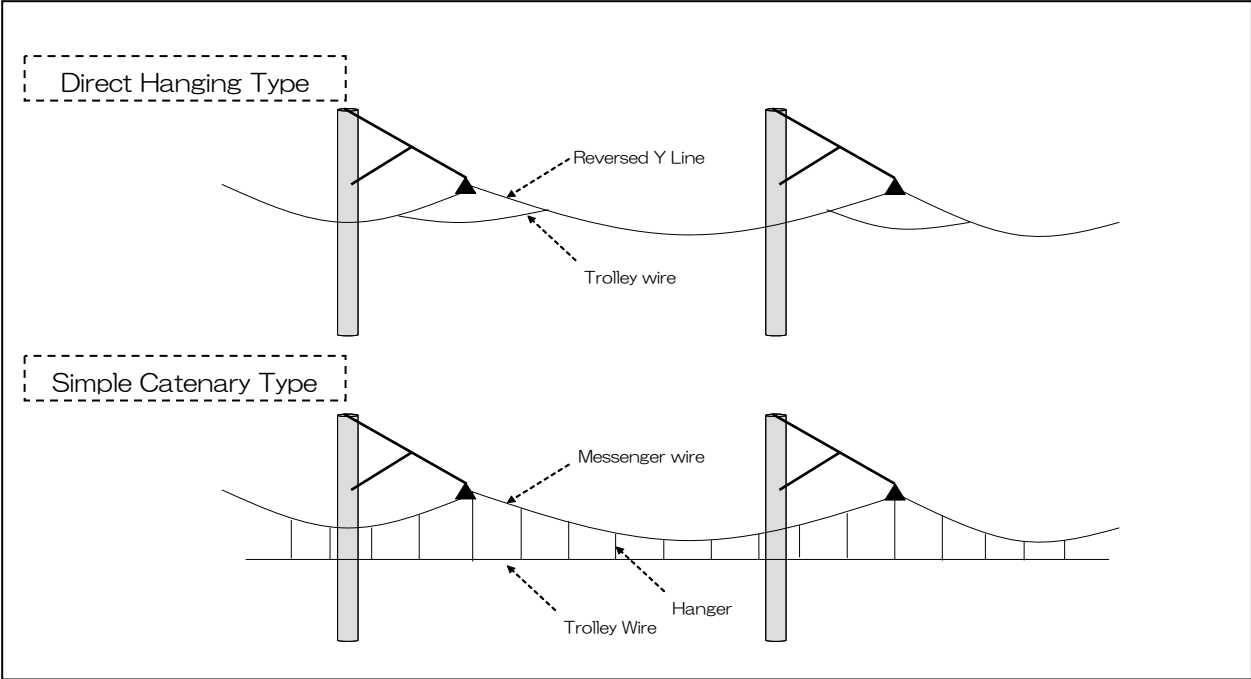


Figure A4-2 Comparison of Catenary types

Source: JICA Study Team

APPENDIX-5: Estimation of the Railway System Project Cost

1) General

Estimation of the project cost for the railway system is ① comparing between conventional LRT and Battery LRT, ② comparing with Pune Metro.

2) Comparison of the Estimation of Conventional LRT System Project

Comparing the estimation of the project cost between Conventional LRT system and Battery LRT system which is proposed in this study in Electronics and Mechanics (E&M includes Rolling Stock). Estimation conditions are summarized below;

【Preconditions for Estimation】

- On the basis of Route length 21.2km, number of tram stops 21 (Opposite side located type platform)
- Assume the system has the ability to handle the capacity of 15,000PPHPD for maximum demand
Introducing the 40 sets of 60m length train sets which connect two sets of 30m train modules to meet the conditions above
- Facility scale of the Depot is assumed to be able to handle 40 sets of 60m train sets and the headquarter office facility is constructed in the Depot area
- Rolling Stock is basically assumed to be imported from Japan
- Track at the viaduct is supposed to apply the slab track with flat-bottomed rail by direct fastened, and at grade is the resin fixed track with grooved rail
- The estimation of other sub systems which are supposed to be available locally applies the Indian localized factor setup unique to the Japanese base estimation
- Fully catenary free LRT system with battery tram is assumed to charge the batteries at all stations.
- This estimation includes only E&M cost of the LRT system with installation work cost, but does not include civil work or land acquisition Estimate the project management cost as 10% of the total amount of E&M cost
- The duty and tax for procurement of the LRT system is not considered

Table A5-1 Comparison of the system introducing cost

【Case1】Full Catenary LRT System

<System Outline>

Conventional LRT system running by collecting electric power by pantograph from feeding wire hanging over the track

<System Image>



Photo : Toyama Light Rail



Photo : Hiroshima Electric Railway

《Estimation》1.85 Bil JPY/km (Local Price) (※Length 21.2km →: approx. 28.8 Bil JPY)

【Case2】Full Catenary Free LRT System

<System Outline>

Fully catenary free LRT system running by onboard battery power, the method of charging the battery is using a pantograph at stations during the boarding and alighting time. So it is not necessary to provide a catenary wire over all the alignment.

<System Image>



イメージ

《Estimation》 1.97 Bil JPY/km (Local Price) (※Length 21.2km →: approx. 30.2 Bil JPY)

※The estimation is the capital cost excluding the O&M cost

Source: JICA Study Team

3) Estimated Project Cost Comparison with Pune Metro

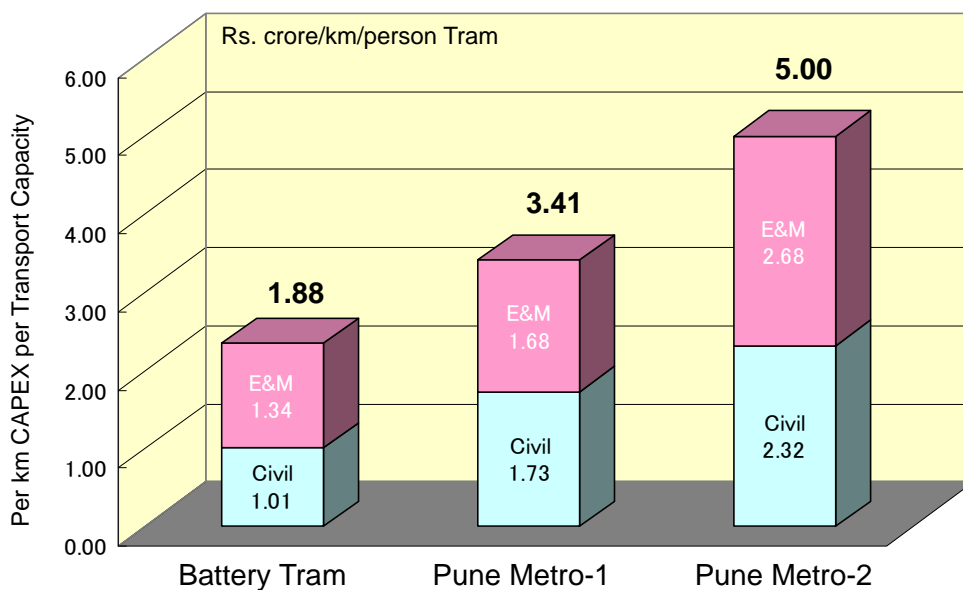
Although LRT and MRT are different transport systems, the comparison of both project costs is shown below. To compare both systems in same level, the cost of Pune metro is adjusted to the price in 2012 with the inflation rate.

The project cost per person per kilometer of LRT is the cheapest of them all, because the project scale of LRT is smaller than that of MRT.

Table A5-2 Cost Comparison with Pune Metro Project

			Battery Tram	Pune Metro 1	Pune Metro 2
Route Length (km)			21.6	16.6	14.9
Dimension of Rolling Stock			Length : 60m Width : 2.65m	Length : 84m Width : 2.9m	Length : 84m Width : 2.9m
Transport Capacity per Train Set (6 person/m ²)			690	1,034	1,034
Operation Headway (min) (Opening Year)			4.0	4.5	12.0
Transport Capacity (Opening Year) (person/hour/direction)			10,350	13,787	5,170
No. of Train Sets (Opening Year)			25	18	7
CAPEX	Per-km CAPEX (Opening Year) (Rs. Crore/km) *without Land	E&M	75.1	231.6	138.8
		Civil	104.4	239.1	119.9
		Total	179.5	470.7	258.7
	Per-km CAPEX per Transport Capacity (Rs. lakh/km/person) *without Land	E&M	0.78	1.68	2.68
		Civil	1.09	1.73	2.32
		Total	1.88	3.41	5.00

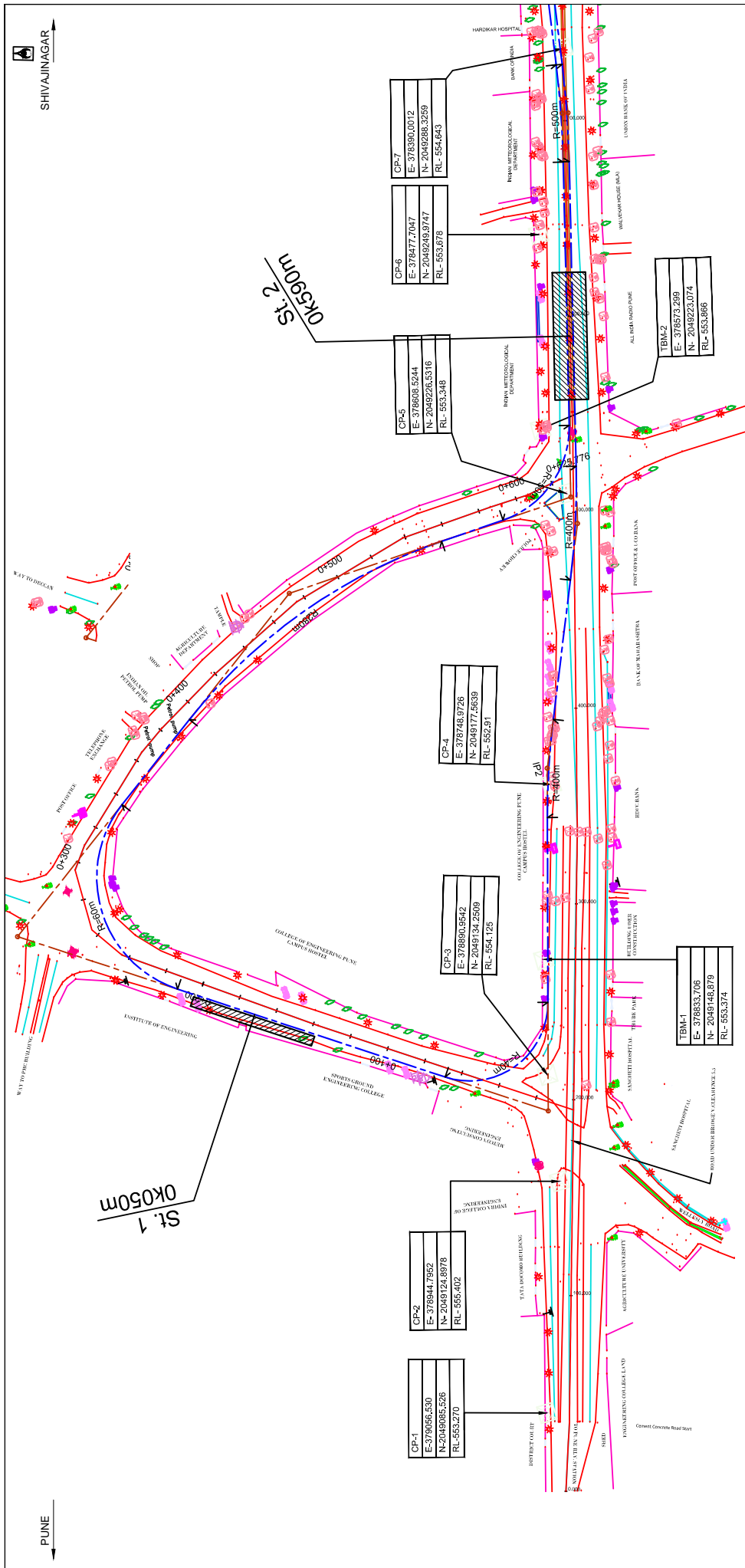
Source: JICA Study Team



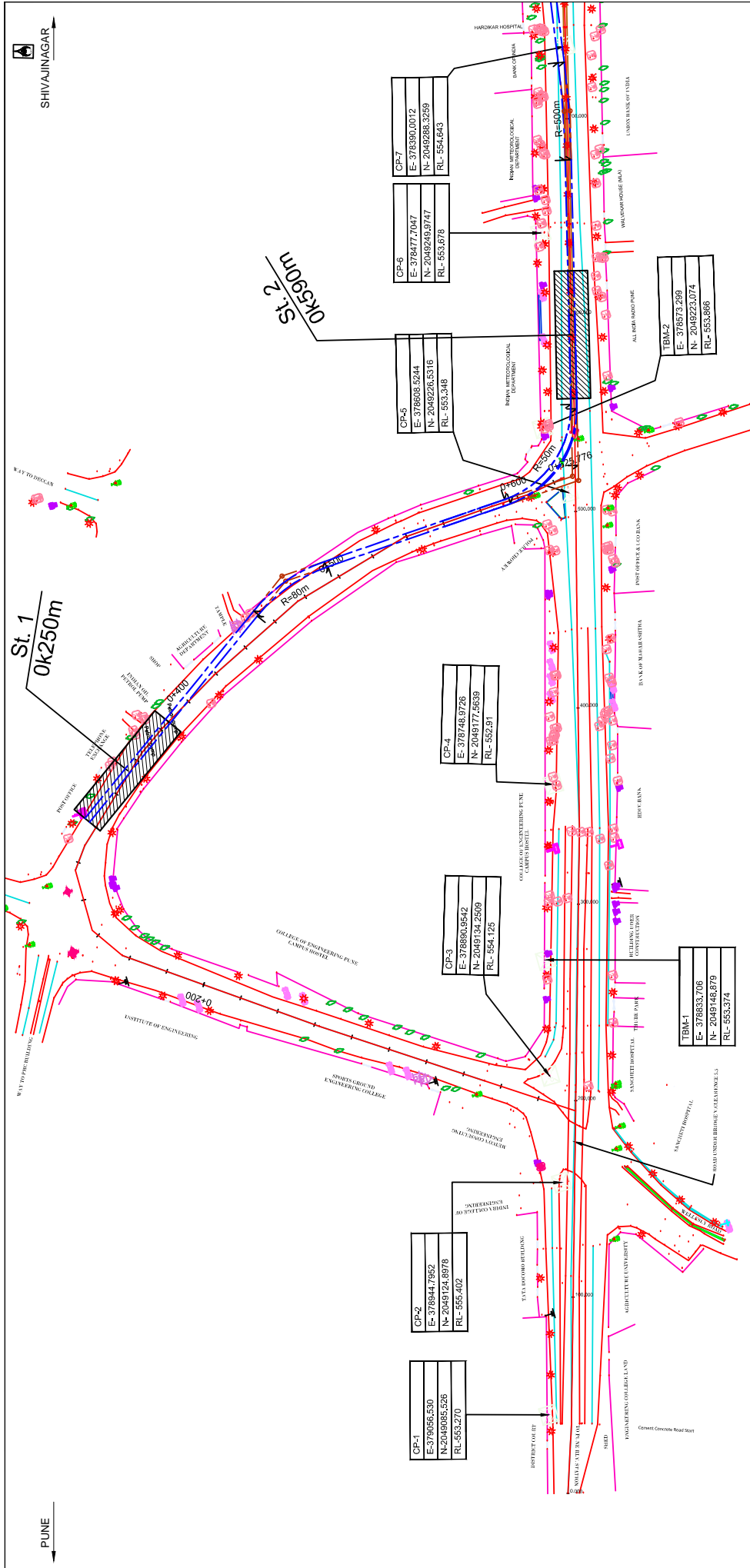
Source: JICA Study Team

Figure A5-1 Cost Comparison with Pune Metro Project

APPENDIX-6: Alignment of Pune LRT (Alternative)



APPENDIX-7: Alignment of Pune LRT modified





SHIVAJINAGAR

PUNE

LEVEL DATUM =+46.000

EX. LEVELS

CHANGE

NOTES:

1) ALL DIMENSIONS, CHANGES AND LEVELS ARE IN METRES UNLESS OTHERWISE SPECIFIED.

LEGEND:

EXISTING FLYOVER	EXISTING FLYOVER
EXISTING SUBWAY	EXISTING SUBWAY
PROPOSED CENTER LINE	PROPOSED CENTER LINE
ROAD BOUNDARY	ROAD BOUNDARY
FLYOVER	FLYOVER
UNDERPASS	UNDERPASS
DRINKING WATER	DRINKING WATER
ELECTRICITY	ELECTRICITY
SEWER	SEWER
GAS	GAS
TELEPHONE	TELEPHONE

LEGEND:

Spin Board	Spin Board
Signal Light	Signal Light
Telephone Junction Box	Telephone Junction Box
Lamp Post	Lamp Post
Water Tank	Water Tank
Petrol Pump	Petrol Pump
Mosque	Mosque
Temple	Temple
Old stone	Old stone
Other Points	Other Points

LEGEND:

Electric pole	Electric pole
Electric junction box	Electric junction box
Transformer	Transformer
Telephone pole	Telephone pole
Telephone junction box	Telephone junction box
Lamp Post	Lamp Post
Water Tank	Water Tank
Petrol Pump	Petrol Pump
Mosque	Mosque
Temple	Temple
Old stone	Old stone
Other Points	Other Points

LEGEND:

Spin Board	Spin Board
Signal Light	Signal Light
Telephone Junction Box	Telephone Junction Box
Lamp Post	Lamp Post
Water Tank	Water Tank
Petrol Pump	Petrol Pump
Mosque	Mosque
Temple	Temple
Old stone	Old stone
Other Points	Other Points

LEGEND:

Spin Board	Spin Board
Signal Light	Signal Light
Telephone Junction Box	Telephone Junction Box
Lamp Post	Lamp Post
Water Tank	Water Tank
Petrol Pump	Petrol Pump
Mosque	Mosque
Temple	Temple
Old stone	Old stone
Other Points	Other Points

LEGEND:

Spin Board	Spin Board
Signal Light	Signal Light
Telephone Junction Box	Telephone Junction Box
Lamp Post	Lamp Post
Water Tank	Water Tank
Petrol Pump	Petrol Pump
Mosque	Mosque
Temple	Temple
Old stone	Old stone
Other Points	Other Points

REV.	NO.	DATE	DESCRIPTION

DESIGNED	DEBANS
CHECKED	JAI PRAKASH
DELIVERED	PAKJAYALI
DATE	

CLIENT	JICA & ORIENTAL CONSULTANTS CO., LTD.
CONSULTANT	SOVAL Limited SOODHARJI AVENUE OFFICE NO. 6, AVINDI STREET FLOOR, PLOT NO. 01, SECTOR-44, NEERAJ ESTATE, NAYABAGAN, 400 006
PROJECT	PUNE IRT PROJECT FROM SHIVAJINAGAR TO HINSEWADI (0+000 TO 0+200)
TITLE	SURVEYING PLAN & PROFILE AT CH. 0+750 TO 1+520
SCALE	H-1:1000 V-1:200
DWG. NO.	SURVEYING /PRP/02

JOB NO.	
DATE	

DATE	
DESCRIPTION	

NO.	
DATE	
DESCRIPTION	

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DESCRIPTION	

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