

## 5.7 Construction Plan

### 5.7.1 Elevated Area

For the elevated area, the main issues and subject location are pointed out as follows;

- Erection method for PC-Box Girders
- Construction Plan for Typical Elevated Station
- Station-5 adjacent to Road Flyover Structure
- Intersection with National Highway-4
- MULA River Bridge

#### 1) Erection Method for PC Girders

Basically, the Cast-on-stage method and pre-cast segment method will be employed for the construction of the PC girders. And also the track crane method or other method will be adapted depending on site condition.

##### (1) Cast-on-stage Method

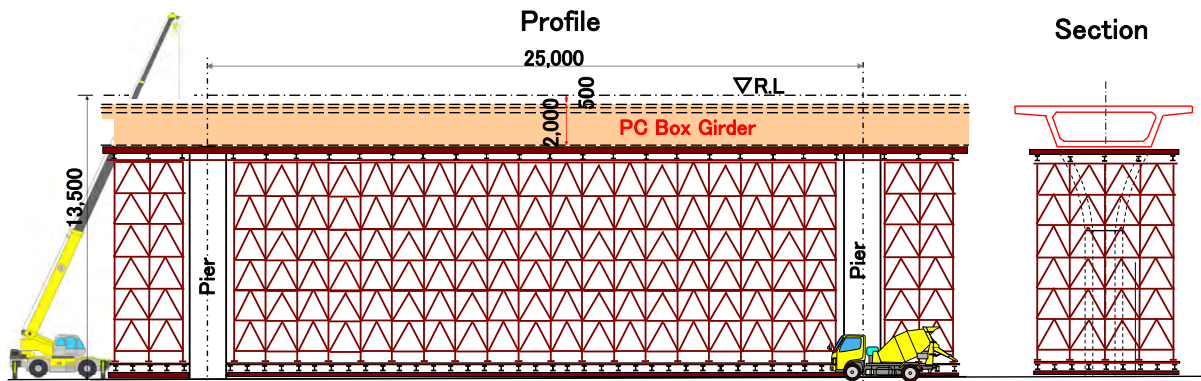
###### Technical Features

- ✓ The method is carried out by installing a stage supporting the cast-in-place girder on the ground. It is the most popular erection method.
- ✓ Assembling of a temporary stage, fabrication girder, and dismantling of the stage are repeated for each interval construction section which contains a single or multi span.
- ✓ The method can be used to fabricate curved girders.
- ✓ Suitable in the conditions where there are no obstacles below the girders.
- ✓ Stiff ground condition which is able to support the temporary stage is required.



**Figure 5.7.1 Image of Construction by Cast-on-stage method**

Source: Japan Hopepage of Civil Engineering Contractors Association, Inc. /  
Building of the Pier in the Project of Purple-Line, Bangkok



**Figure 5.7.2 Profile and Section of Cast-on-stage method**

Source: JICA Study Team

## (2) Pre-cast Segment Method

### Technical Features

- ✓ The method is employed to relatively large-sized bridges, such as long length viaducts in urban areas or expressways. The method requires preparation of a fabrication yard which can intensively produce numerous precast segments in a short period.
- ✓ Segment fabrication and erection work are a constant repetition of the cycle, therefore, over time an increase in the workmen's skill can be expected.
- ✓ From division of labor between mechanized production and girder erection, significant reduction in the erection period is possible
- ✓ The Central Control by mechanized erection equipment can ensure consistent quality.
- ✓ Since there is a standard post-fabrication period for the segments, deformation by dry-shrinkage and creep can be reduced after erection of the girder.
- ✓ Also in the report of the Pune Metro plan, the method has been proposed for elevated sections

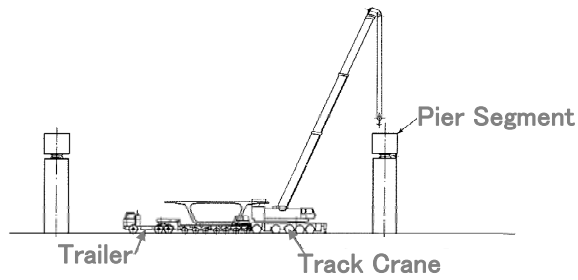


**Figure 5.7.3 Image of construction by precast segment method**

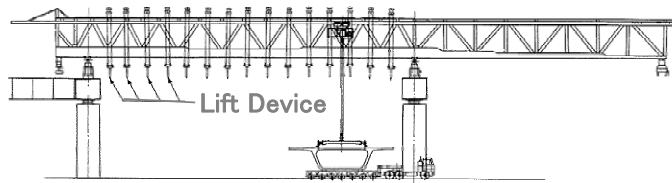
Source: FUJI P.S CORPORATION HomePage/Building of Nabeta Bridge in the Second Tokyo-Nagoya Expressway, 2000 Japan

**Procedure of Girder Erection**

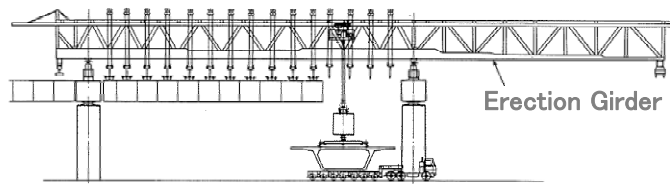
**Stet 1 : Install Pier Segment**



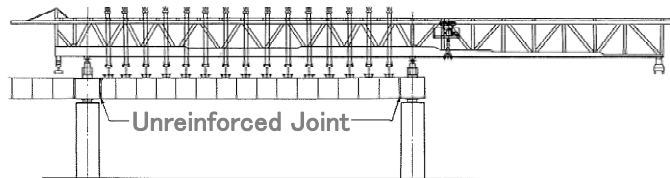
**Stet 2 : Transport and Set Erection Girder**



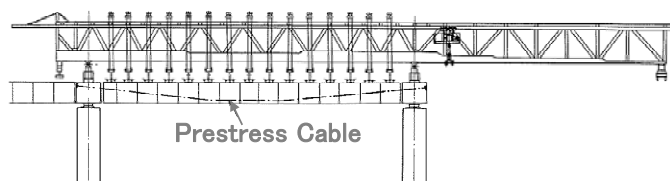
**Stet 3 : Lift Segment**



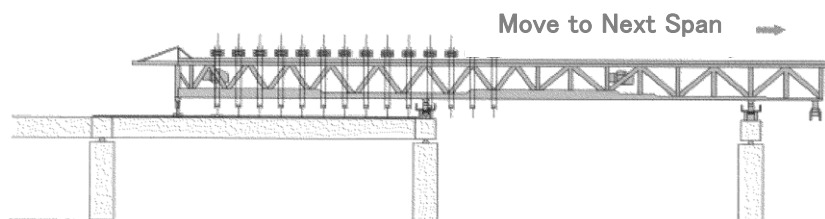
**Stet 4 : Arrange Alignment of Segments, Work of Unreinforced**



**Stet 5 : Tensioning**

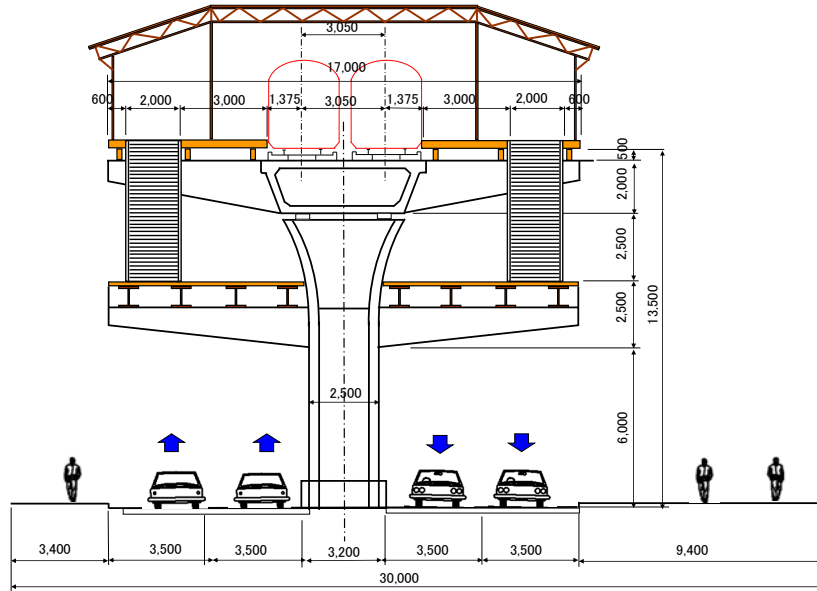


**Stet 6 : Transport Erection Girder for Next Span**



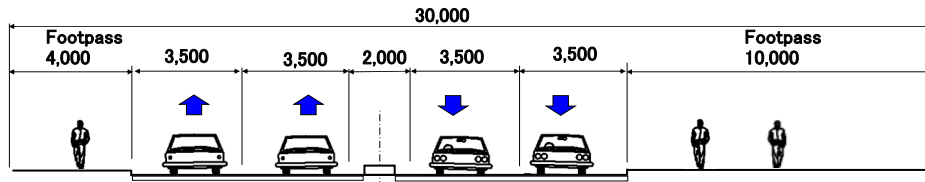
## 2) Construction Plan for Typical Elevated Station

The typical elevated station is planned to be built in a widened space in the road median strip. The section of elevated station and road lane after completion are shown below.

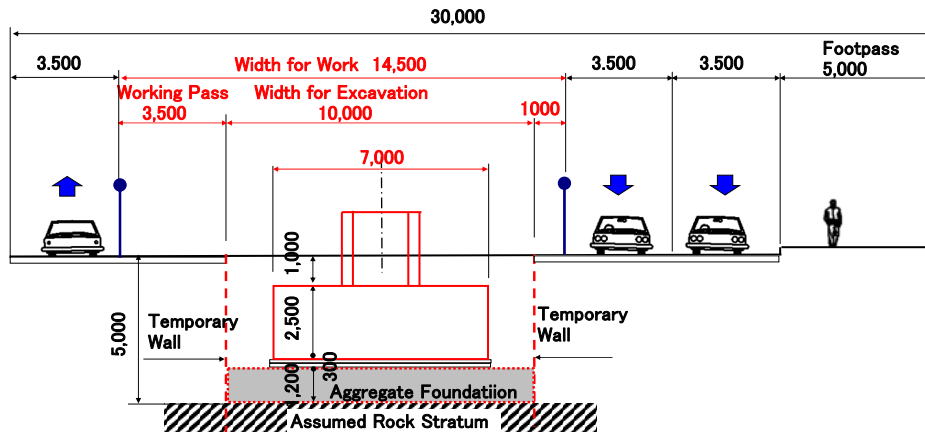


For example, Construction procedure on the Station-9 is examined as follows.

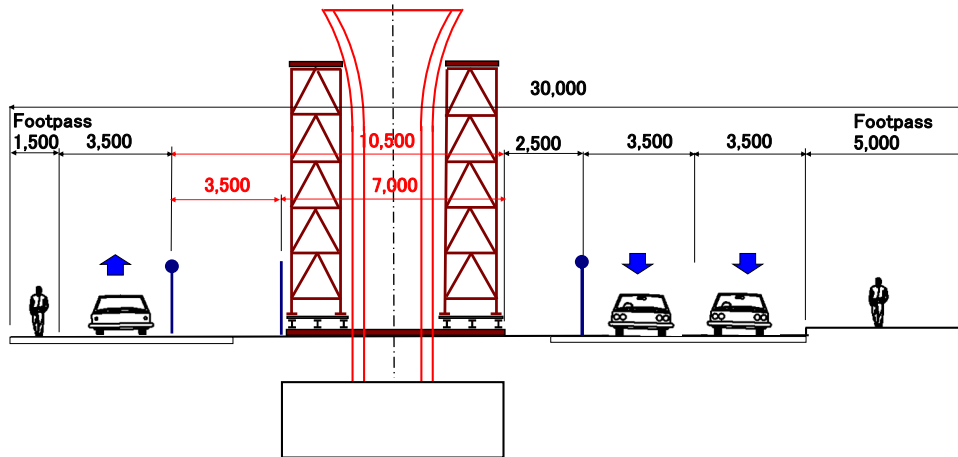
### (1) Existing Condition



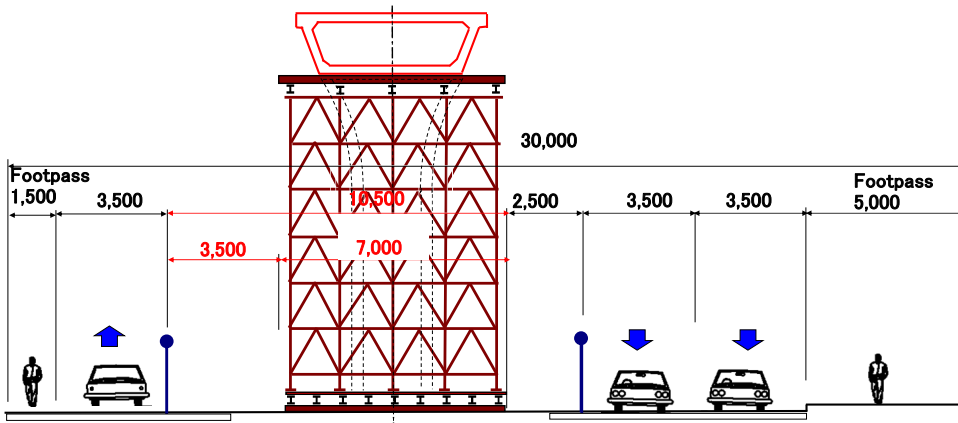
### (2) Excavation, Build Footing and Leg of Column



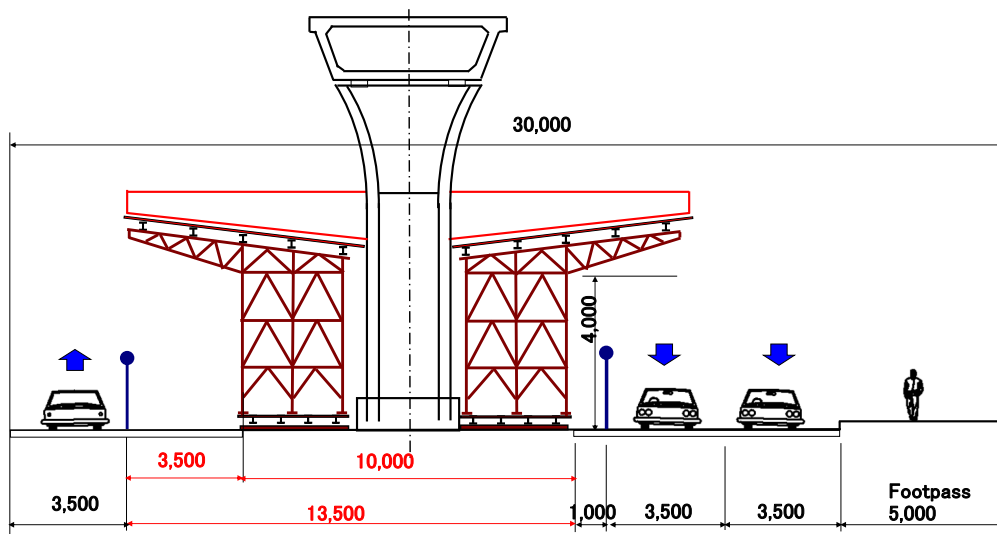
**(3) Build Column**



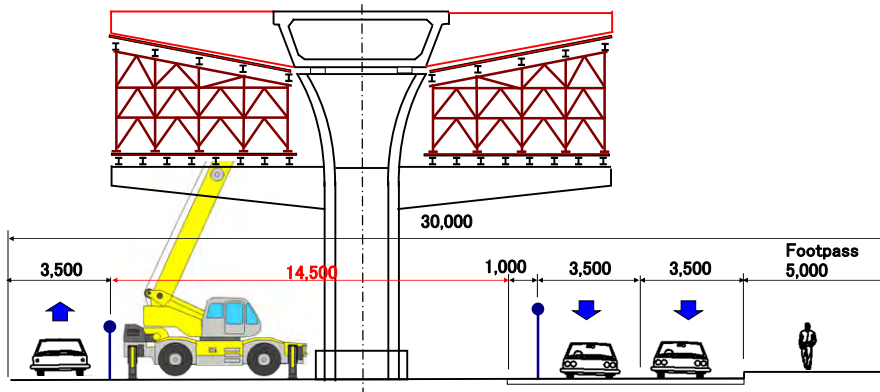
**(4) Erection of PC-Girder**



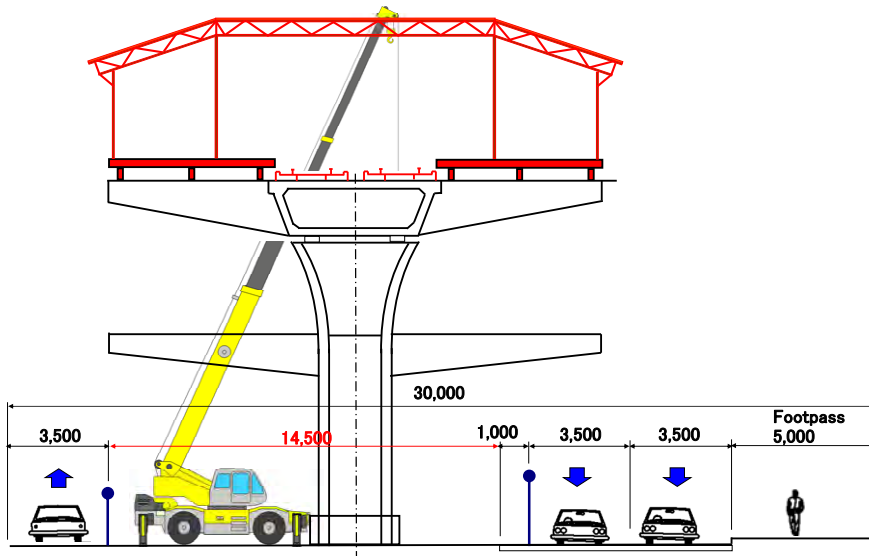
**(5) Build Concourse Beam**



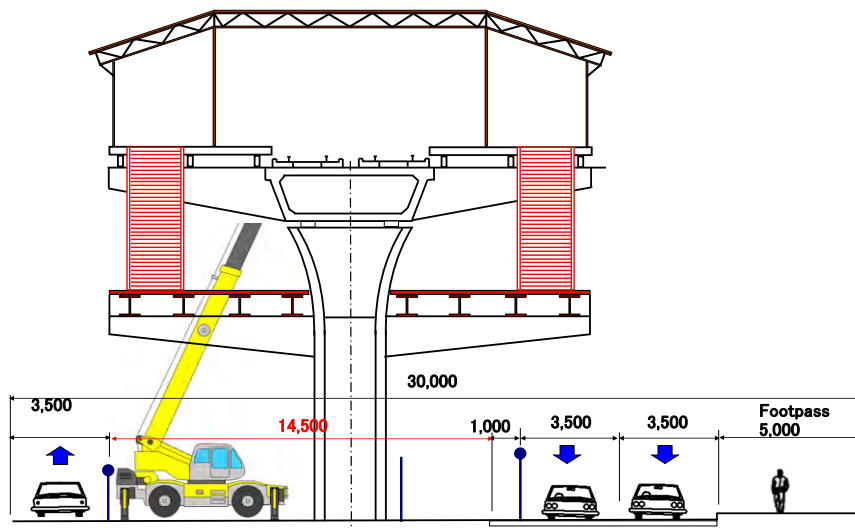
**(6) Work of Platform Beam**



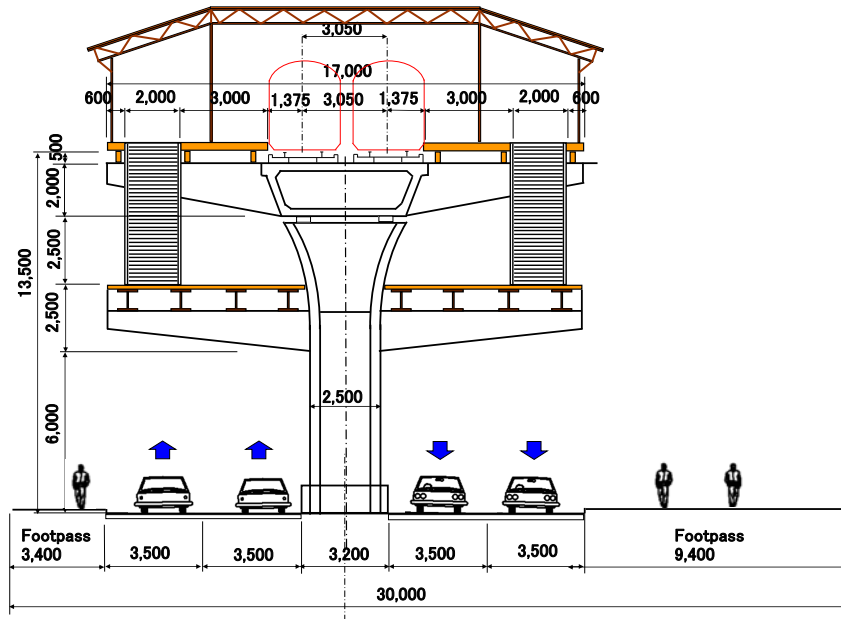
**(7) Work of Rail, Platform and Roof**



**(8) Work of Concourse floor and Lift Utilities**

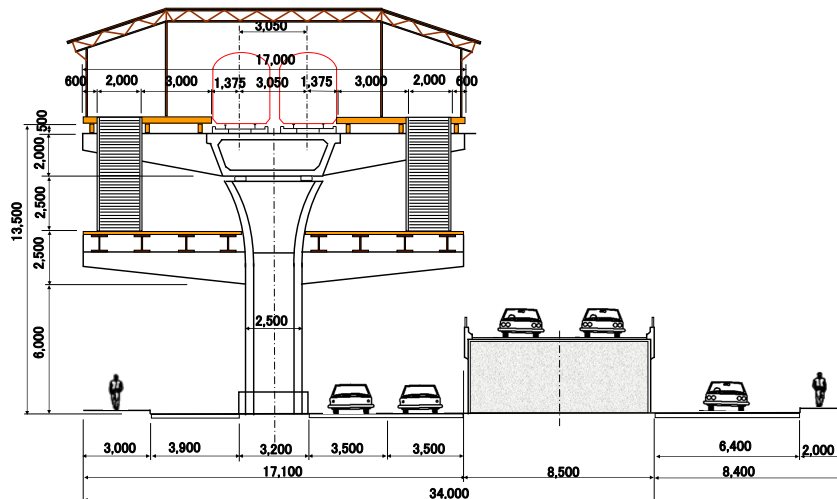


**(9) Completion**



**3) Station-5 adjacent to Road Flyover Structure**

Station-5 is planned to be located close to an existing road flyover, therefore the construction of station-5 is expected to be done in difficult and congested conditions. The section of elevated station and road lane after completion is shown below.



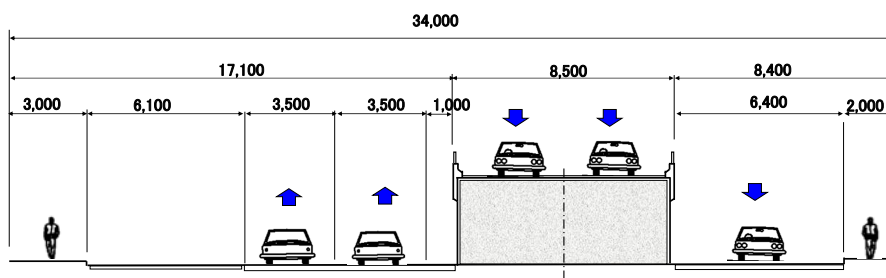
**Figure 5.7.4 Station-5**

To ensuring construction space and to make the impact on traffic as small as possible, the Construction procedure is planned as below;

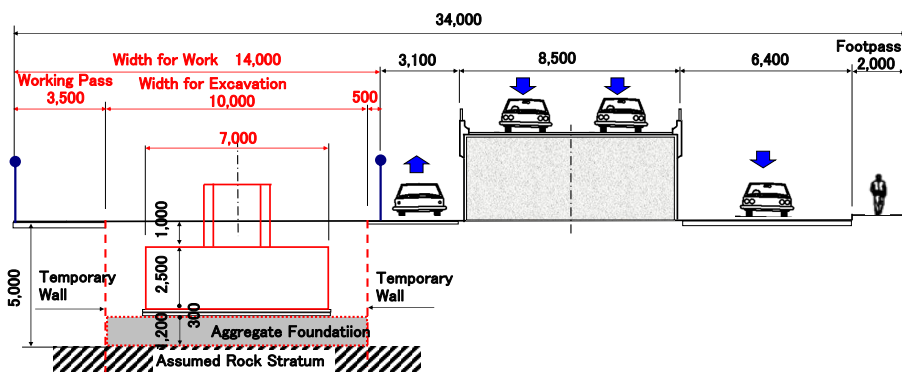
(1) Existing Condition



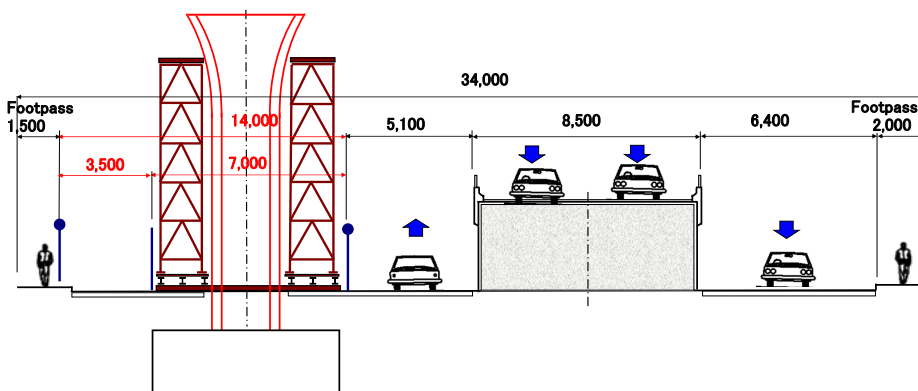
Source: JICA Study Team



(2) Excavation, Build Footing and Leg of Column

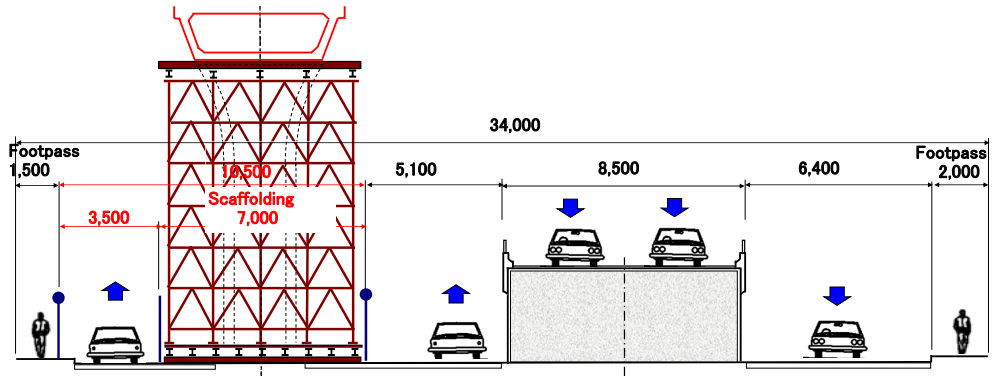


(3) Build Column

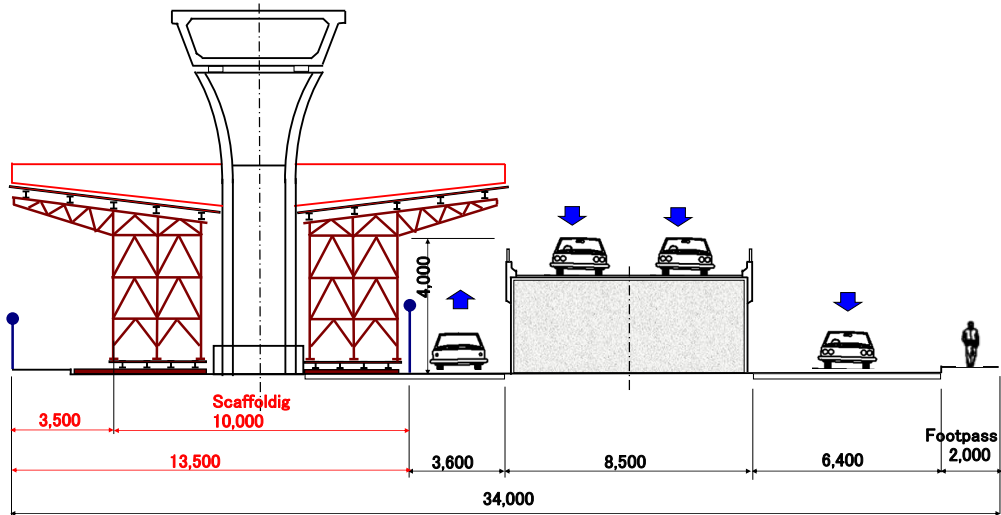




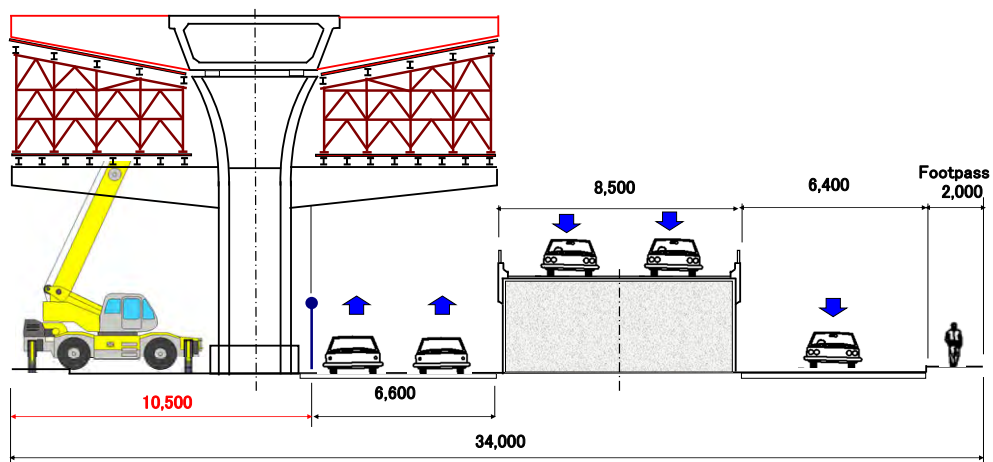
**(4) Erection of PC-Girder**



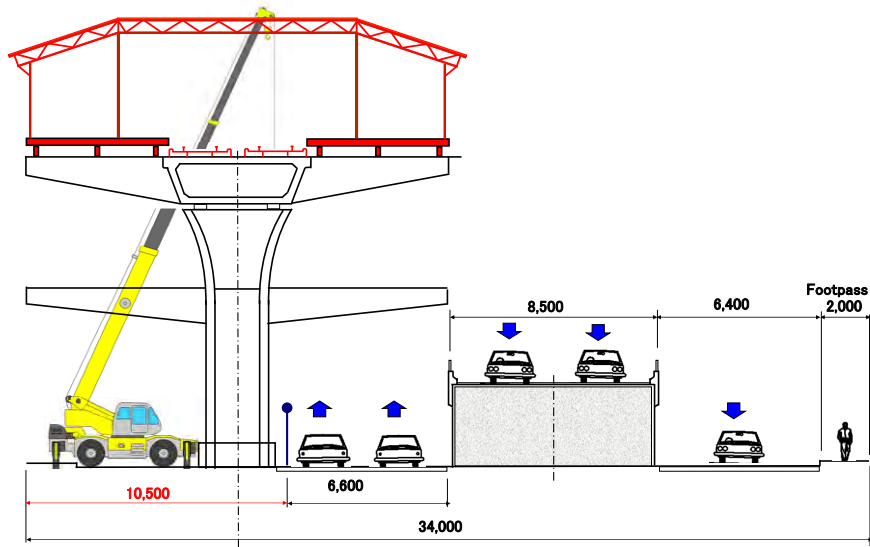
**(5) Build Concourse Beam**



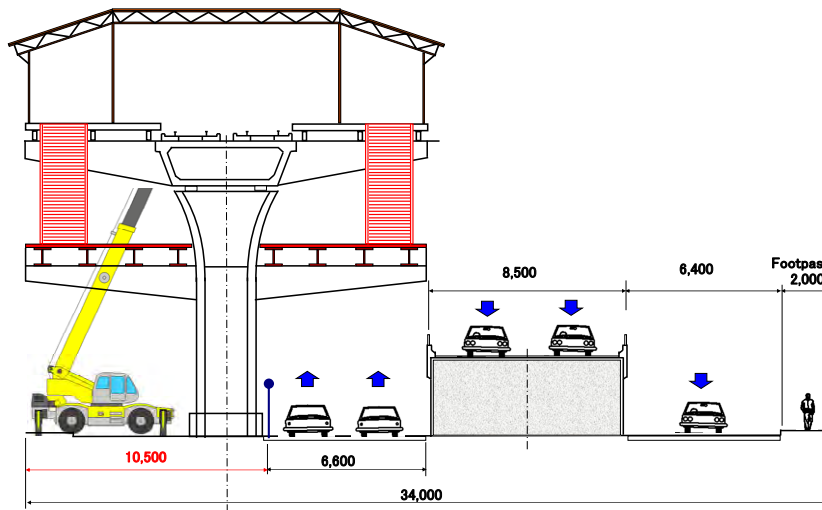
**(6) Work of Platform Beam**



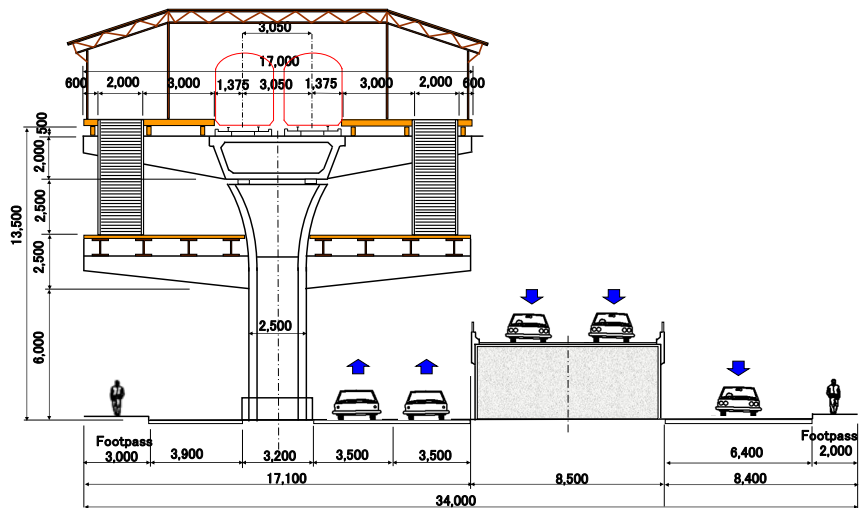
**(7) Work of Rail, Platform and Roof**



**(8) Work of Concourse floor and Lift Equipment**



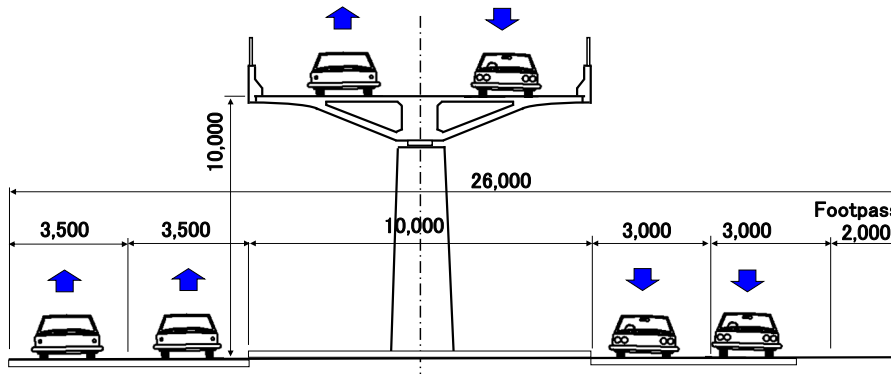
**(9) Completion**



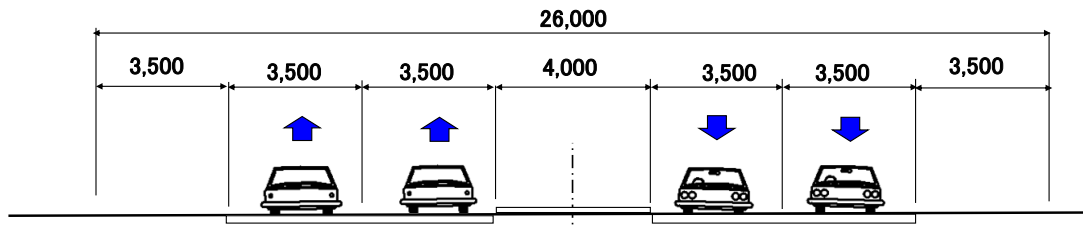
**4) Intersection with National Highway-4**

The existing road viaduct crosses over National Highway-4 at an intersection where many vehicles drive through. An elevated railway is planned to run at a higher elevation on parallel alignment with the road viaduct. Constriction is required to be planned so that it does not stop existing road traffic. Construction procedure in the intersection is planned as below;

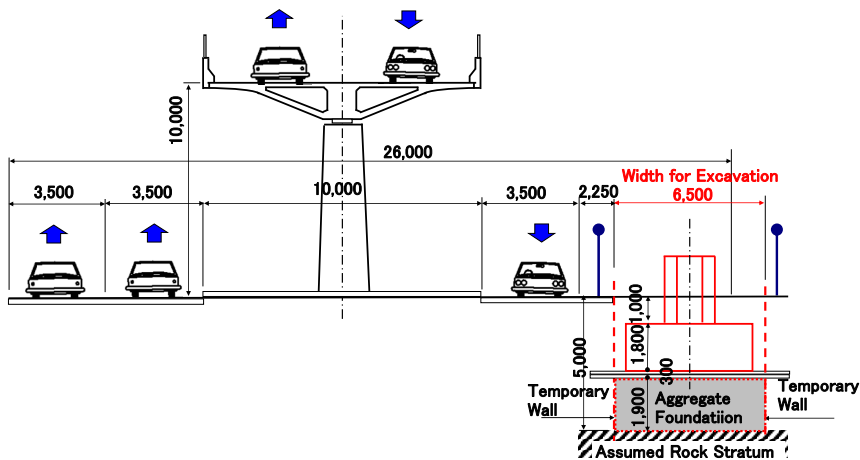
**(1) Existing Condition**



**Existing Section of NH4**

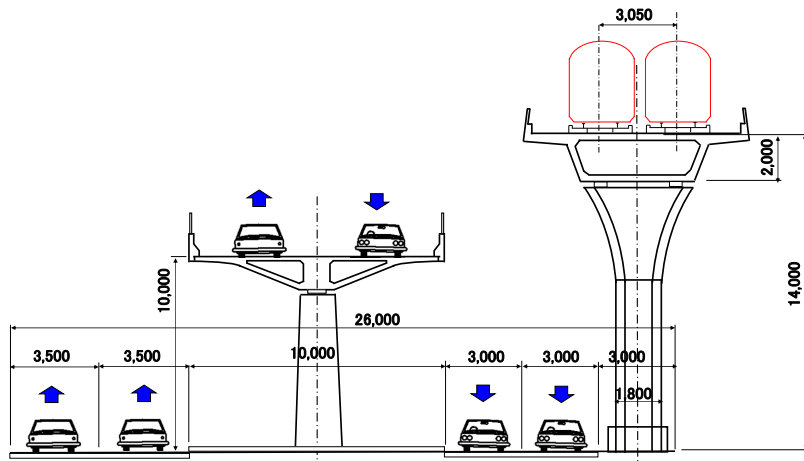


**(2) Excavation, Build Footing and Leg of Column**

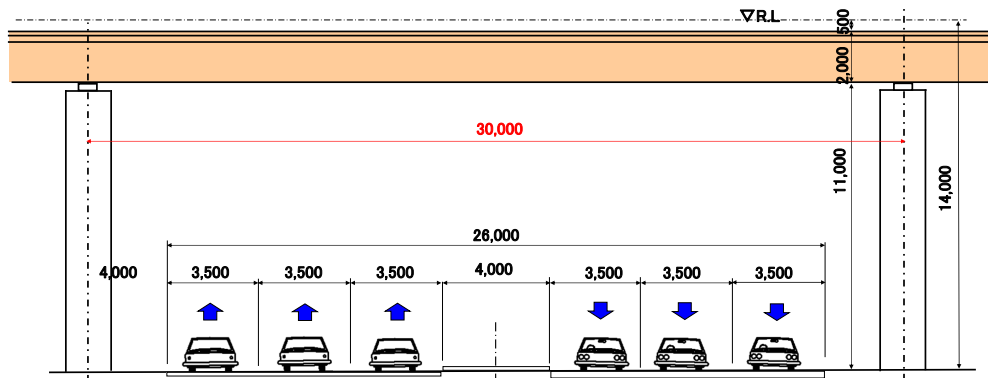




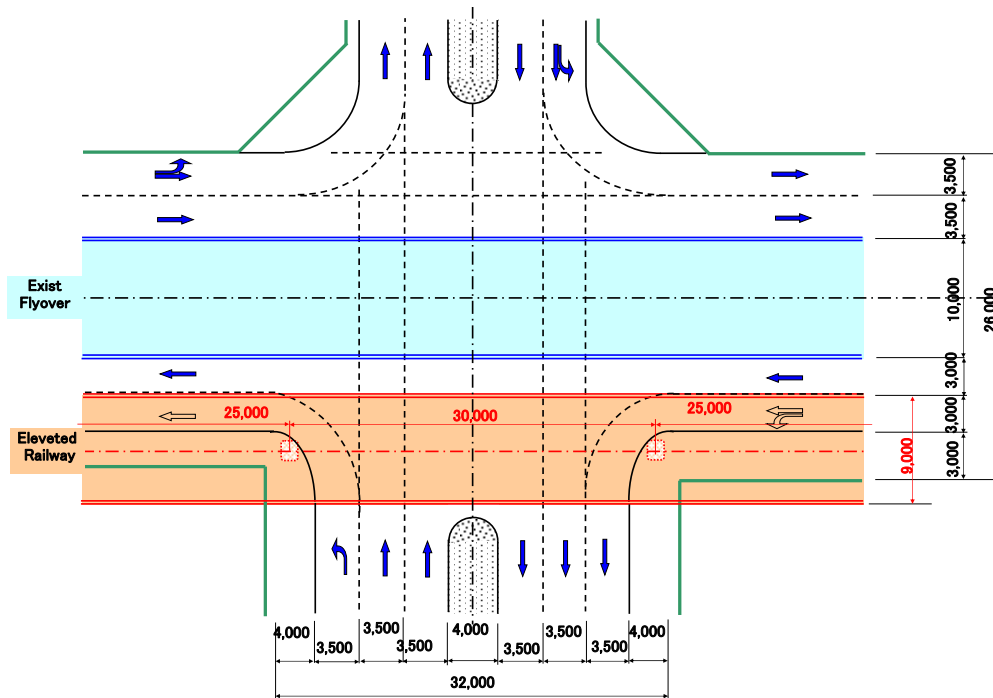
(5) Completion



Section of NH4 at Completion



Plan of NH4 at Completion



**5) MULA River Bridge**

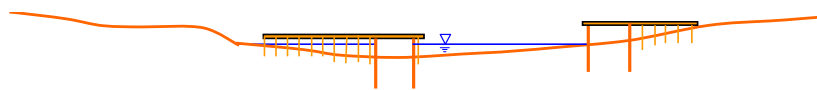
Two feasible methods can be planned. One is the plan for setting typical span girders the same as the other elevated sections, and the other is the plan for a long continuous girder for the purpose of reducing the number of piers constructed in the river. The latter construction plan using the cantilever method, which is generally employed for River Bridges, is examined below. Source: Construction Step Figures shown below are made by Study Team



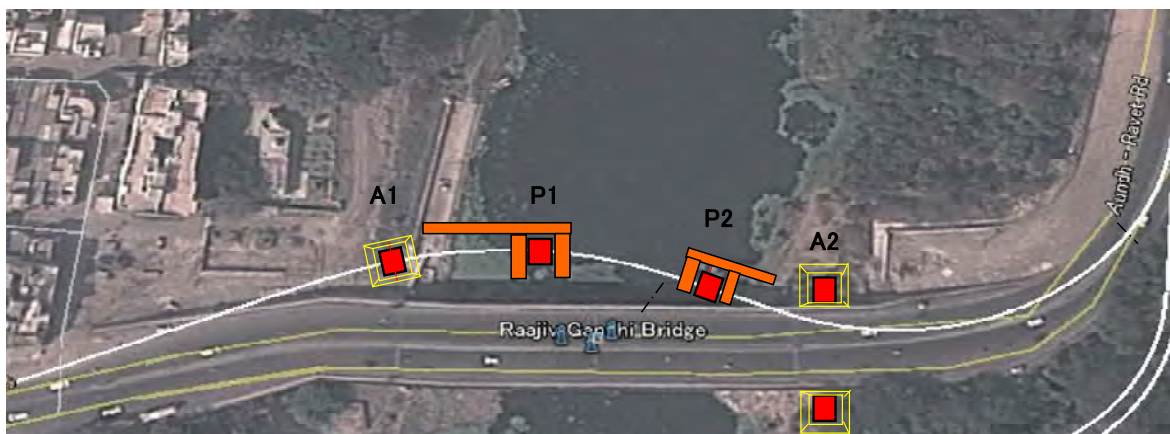
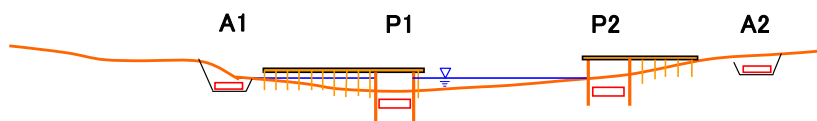
**Figure 5.7.5 Image of Cantilever method**

Source: Homepage of Simizu Corporation/  
Cantilever Erection System

**(1) Build Temporary Bridge**

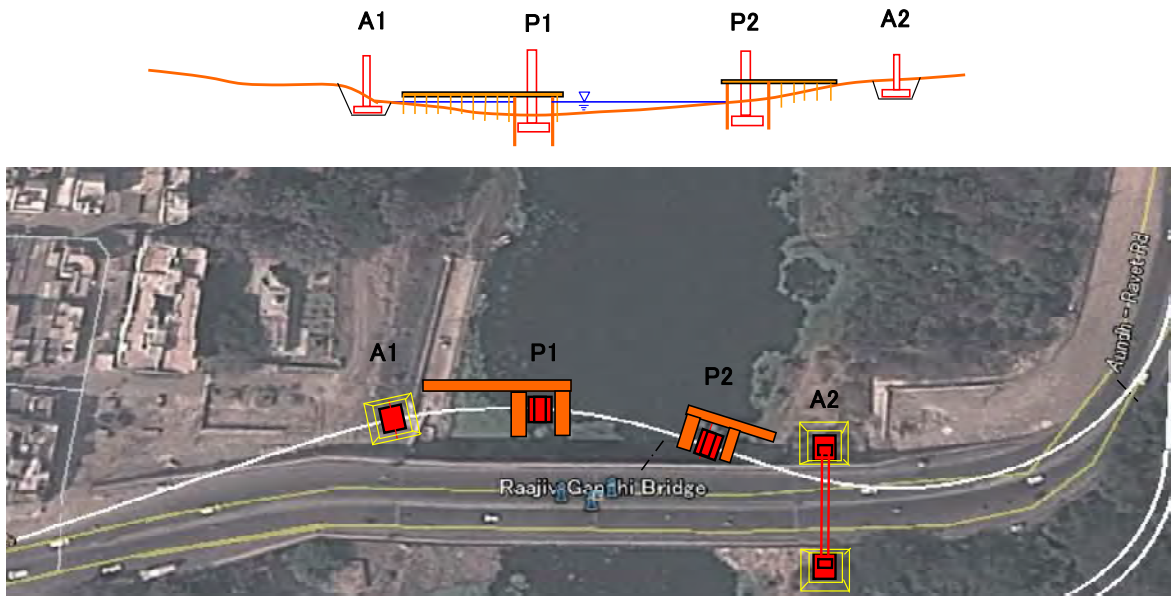


**(2) Build Temporary cofferdam and Foundation of Piers**

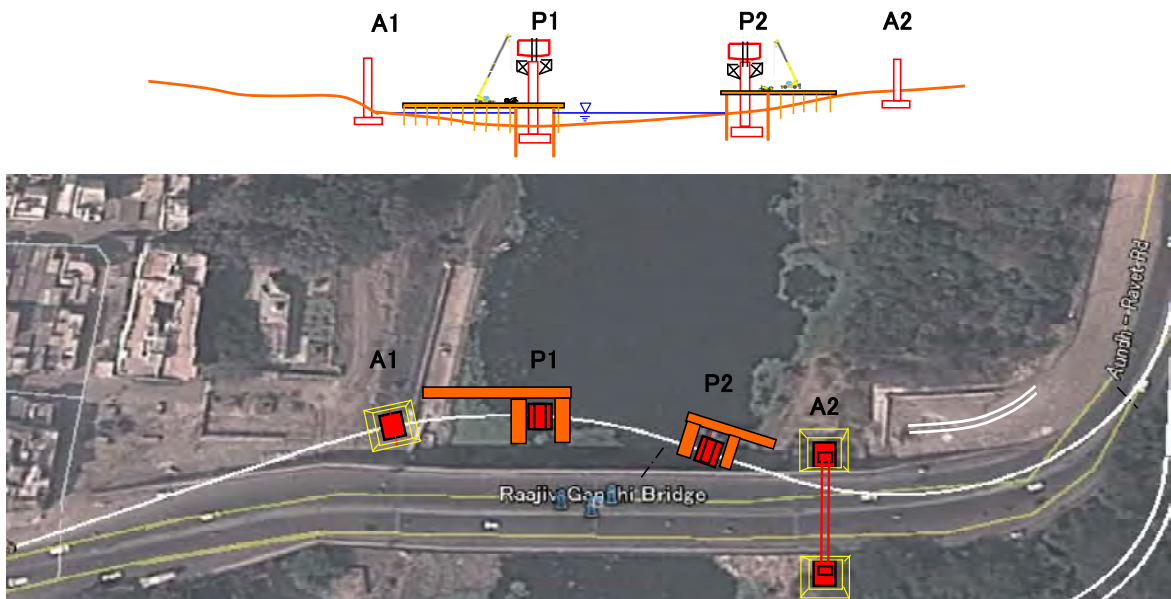




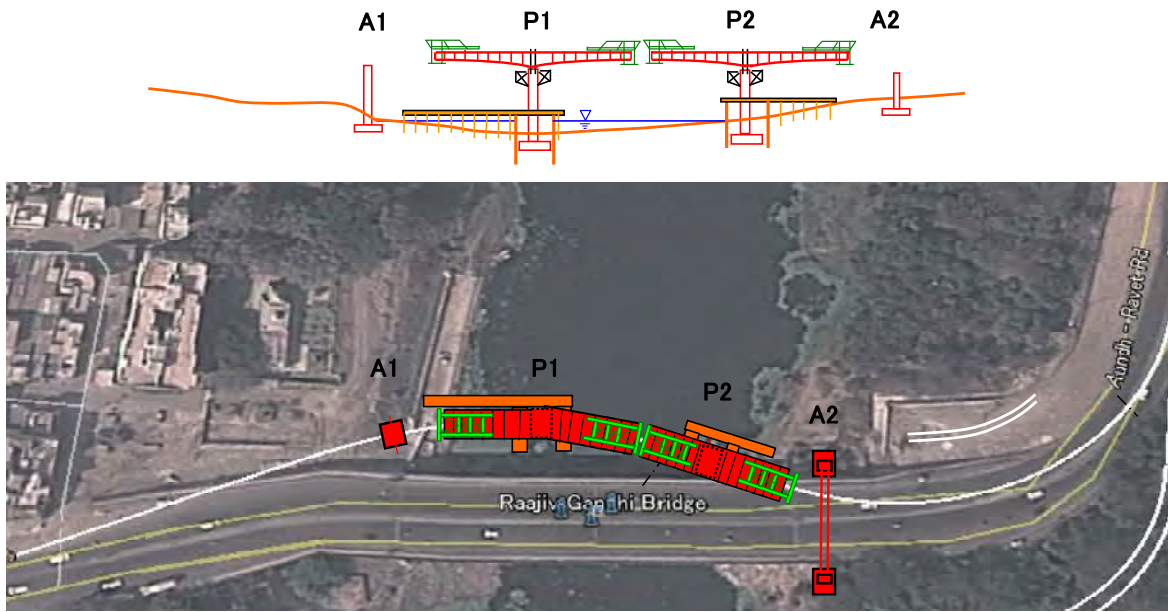
**(3) Build Pier Column**



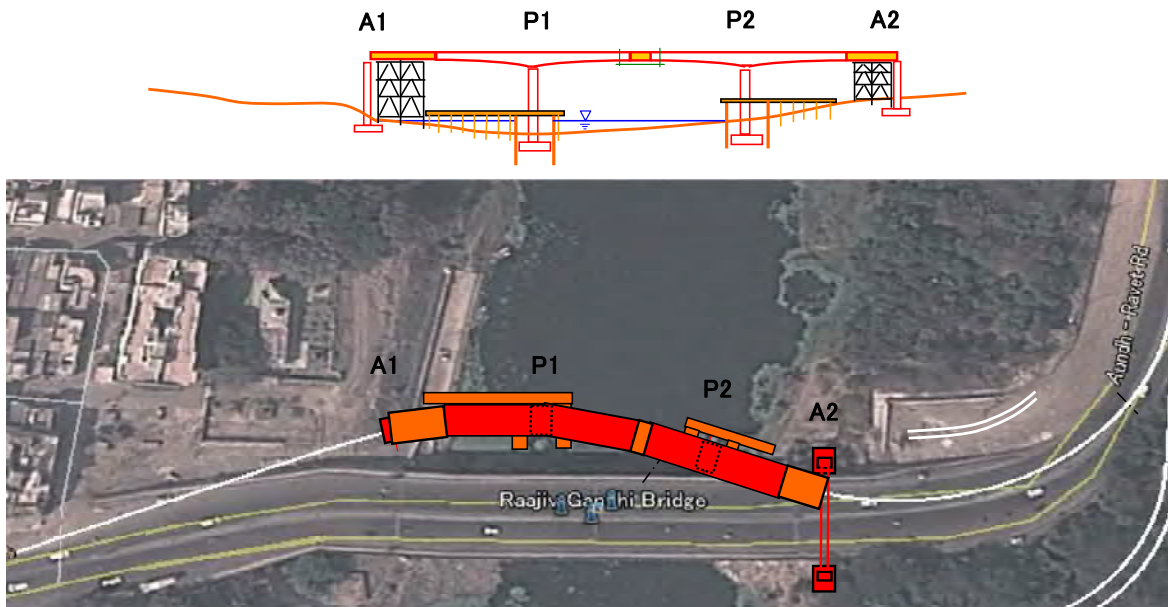
**(4) Build Segment on Pier-head**



(5) Erection by Cantilever

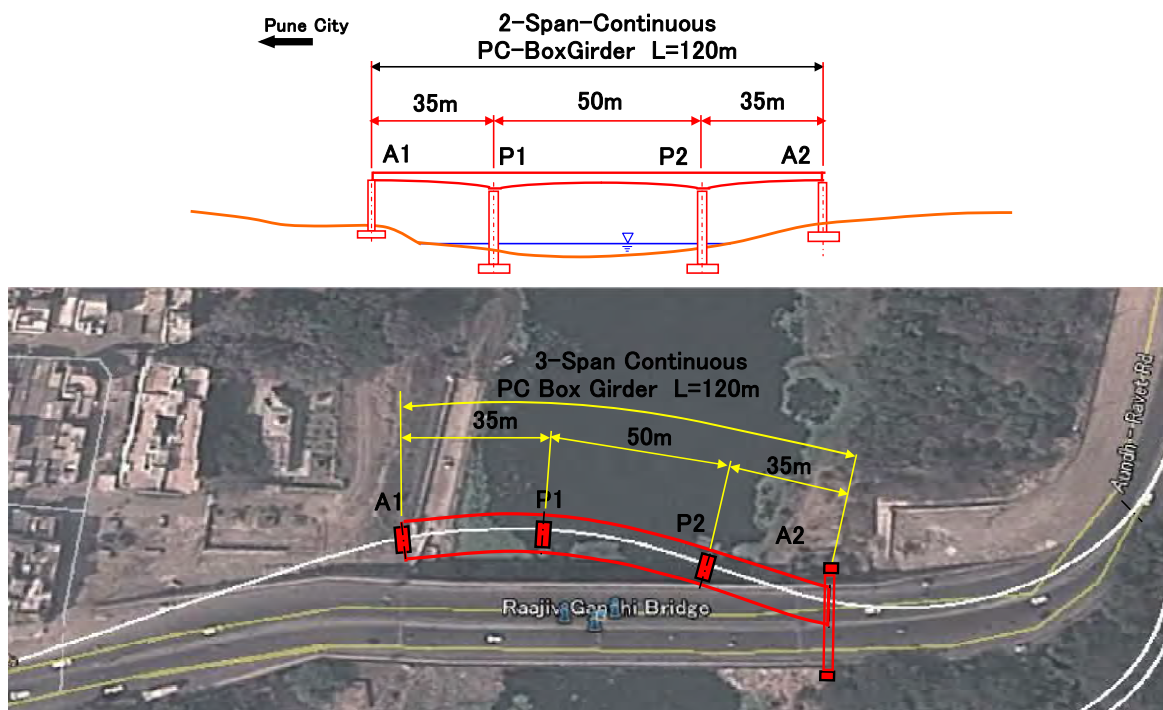


(6) Construction of side of span on temporary stage





(7) Completion



5.7.2 Land Acquisition

To implement this LRT project, land acquisition will be required and these land acquisitions are shown in Table 5.7.1

Table 5.7.1 Land Acquisition Plan

St. No.	Site	Kilo post	Current condition	Reasons	Size of land acquisition
1	Roadside area in PMC in southern part of Mula River	5K900M ~ 5K980M and 6K200M ~ 6K350M	There are many buildings along the two lane road.	Land acquisition is required for the construction of a flyover bridge and elevated station. Width is approx. 3.2 m and length is approx. 230 m.	Approx. 740m <sup>2</sup>
2	Around NH-4	13K020M ~ 13K520M	There are public spaces along the two lane road.	Land acquisition is required to maintain the current road lanes and for the construction of a flyover bridge. Width is approx. 8.0 m and length is approx. 500 m.	Approx. 4,000m <sup>2</sup>
3	Hinjawadi IT Park Phase 4 area	16K900M	Planned phase 4 areas are currently private areas.	Land acquisition is required for the construction of a rail yard and St. 18.	Approx. 11,000m <sup>2</sup>
4	Hinjawadi IT Park from Phase 1 to Phase 3 area	15K400M ~ 21K400M	There are two lane roads with dividing strips and pedestrian sidewalks in some portions with gaps.	Land acquisition is required for the construction of a flyover bridge and elevated station. Width is approx. 3.2 m and length is approx. 6,000 m.	Approx. 19,680m <sup>2</sup>
Total size of land acquisition					Approx. 134,420m <sup>2</sup>

Source: JICA Study Team

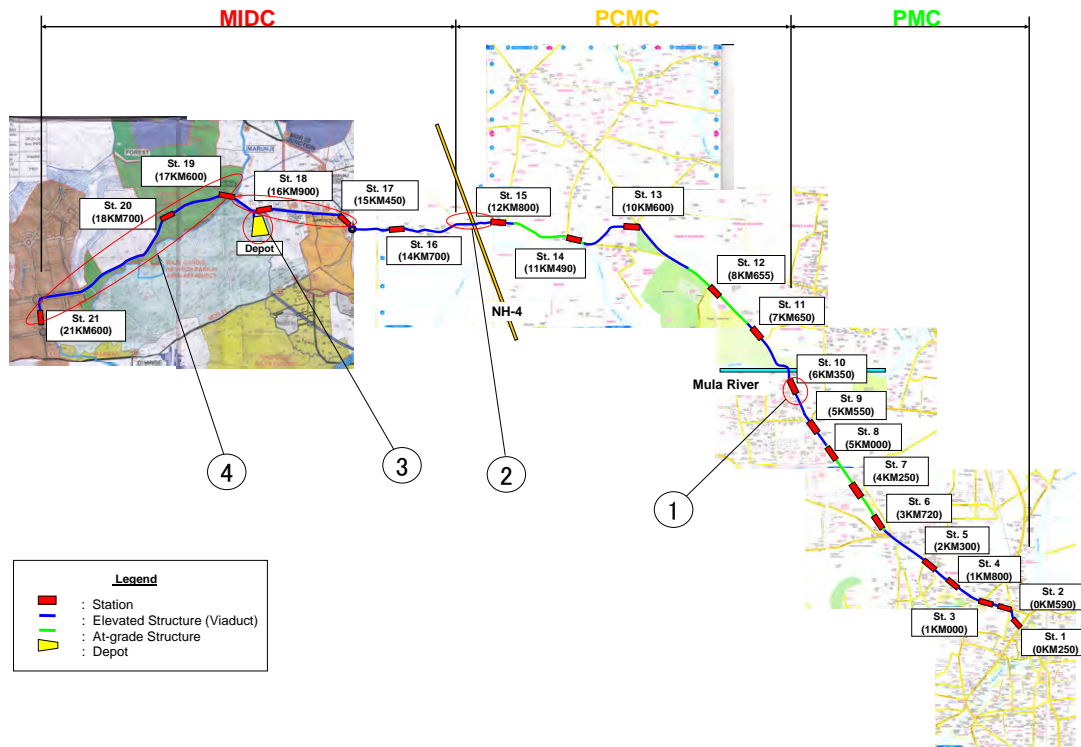


Figure 5.7.6 Location of Land Acquisition

Source: JICA Study Team

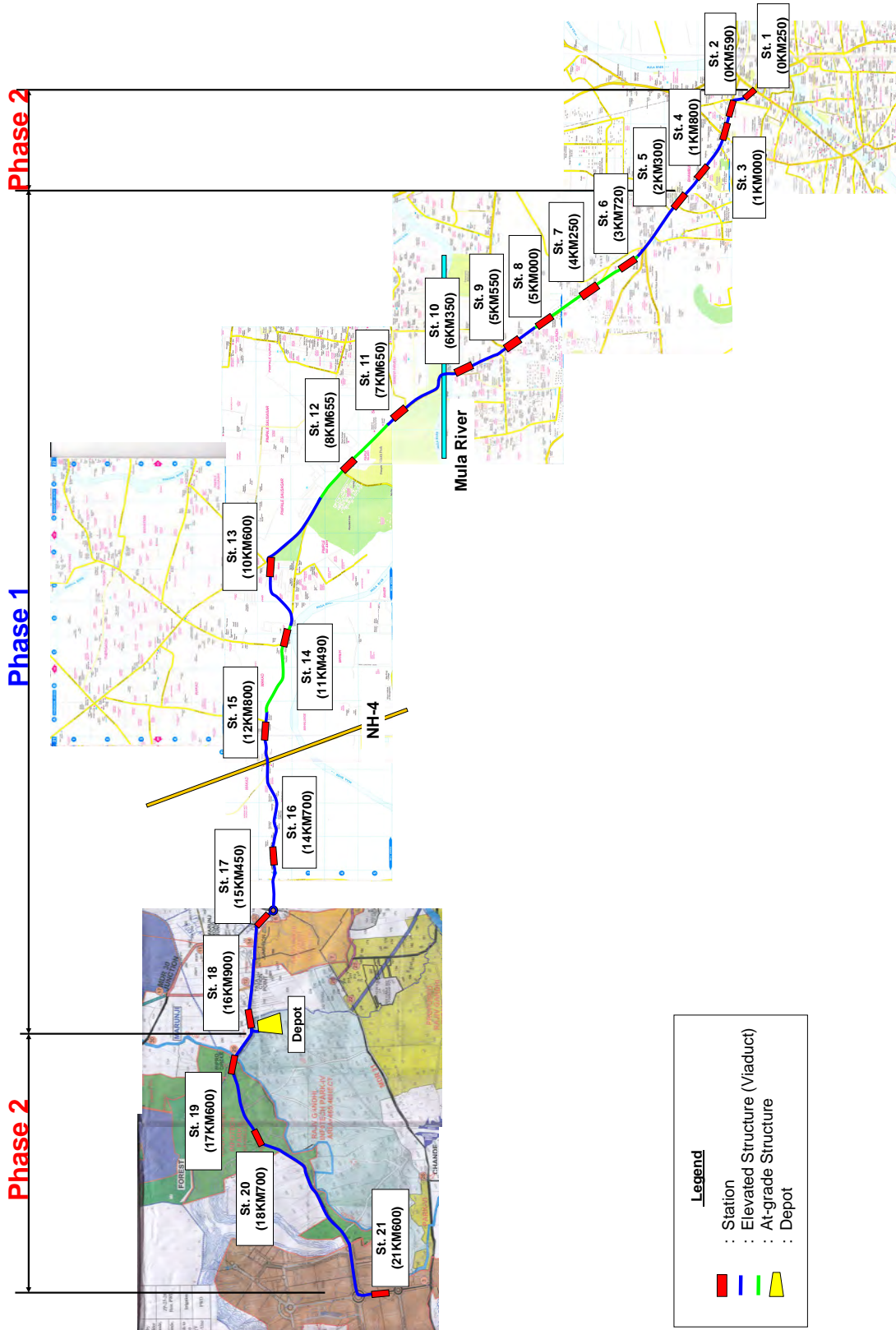
## 5.8 Schedule for Implementation

### 5.8.1 Schedule before the Construction

The items that shall be implemented before the start of construction are the Feasibility Study, Basic design, preparation of EIA, financial arrangements, preparation work, establishment of an administration organization, selection of the consultants and selection of the contractor. Some of these items will be divided into more detailed procedures. Schedules for these items are shown in Table 5.8.1. The Feasibility study, basic design and preparation of EIA are to be implemented in the middle of 2013. Selection of the contractor will be completed in the middle of 2016.

### 5.8.2 Construction Schedule

A gradual start of operation that has two phases is proposed for the targeted first operation before the end of 2018. The first phase (phase 1) is the section from St.5 to St. 18 with the length of 14.6km and construction will be started from the middle of 2016. Test runs will be completed before the end of 2018. The second phase (phase 2) are the sections from St. 1 to St. 5 and St. 18 to St. 21 with the length of 6.75km. Construction will commence in 2018 and will be completed before the end of 2020. These phase 1 and phase 2 and schedule for construction procedures are shown in Figure 5.8.1 and Table 5.8.1.



Source: JICA Study Team

Figure 5.8.1 Construction and Operation Phase

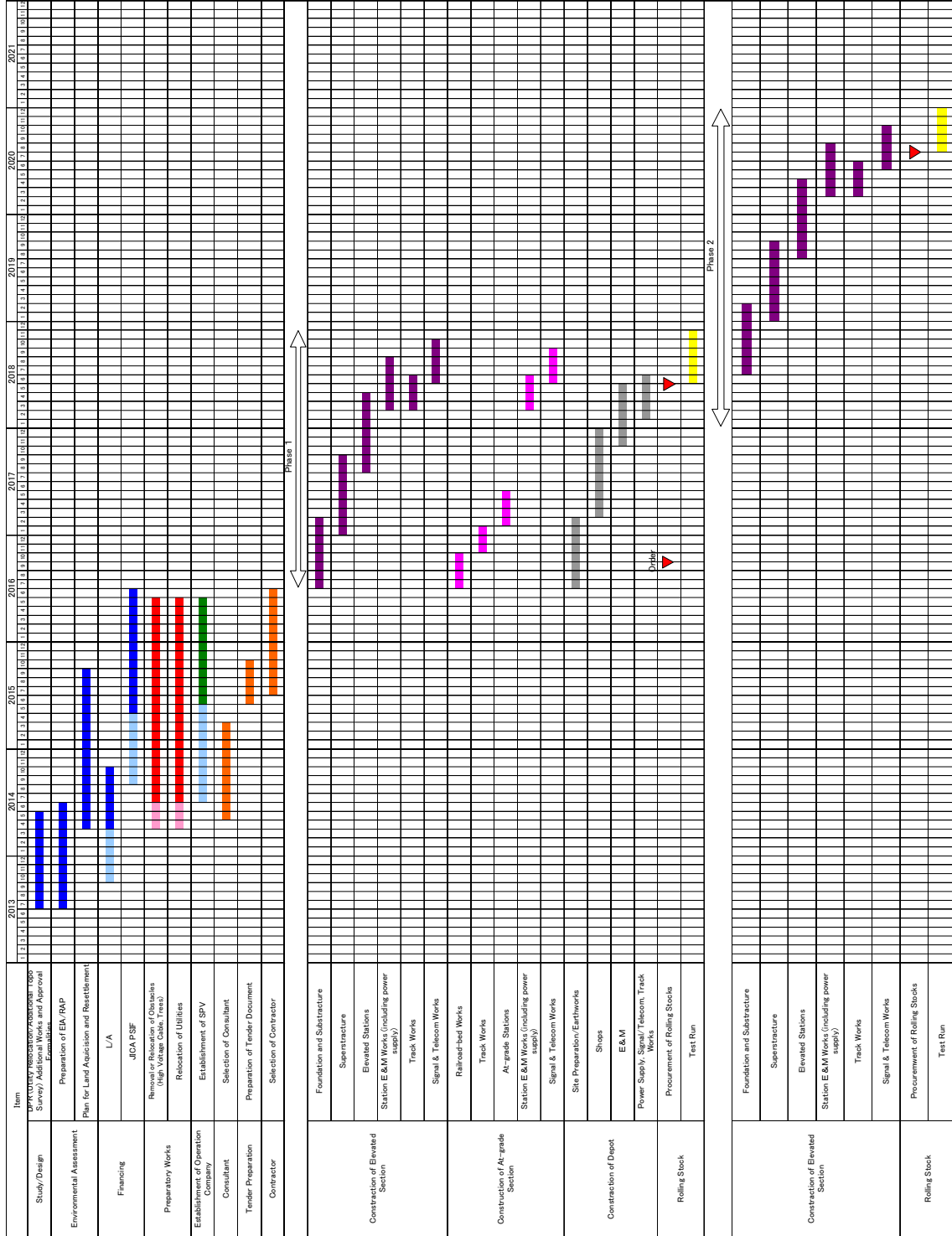


Table 5.8.1 Implementation Schedule

Source: JICA Study Team

## 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.)

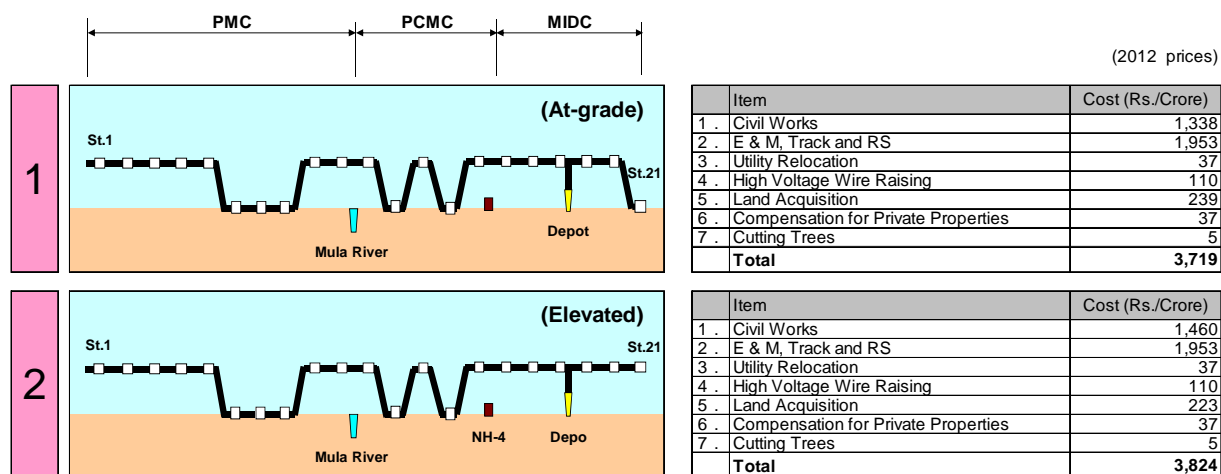
	2013-2020 Total			2023			2028			2033			Grand Total
	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total	
(1) Civil works													
Land acquisition, Utility r	0	4,662	4,662										4,662
Civil Works	0	18,377	18,377										18,377
Sub total	0	23,039	23,039										23,039
(2) E&M													
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.

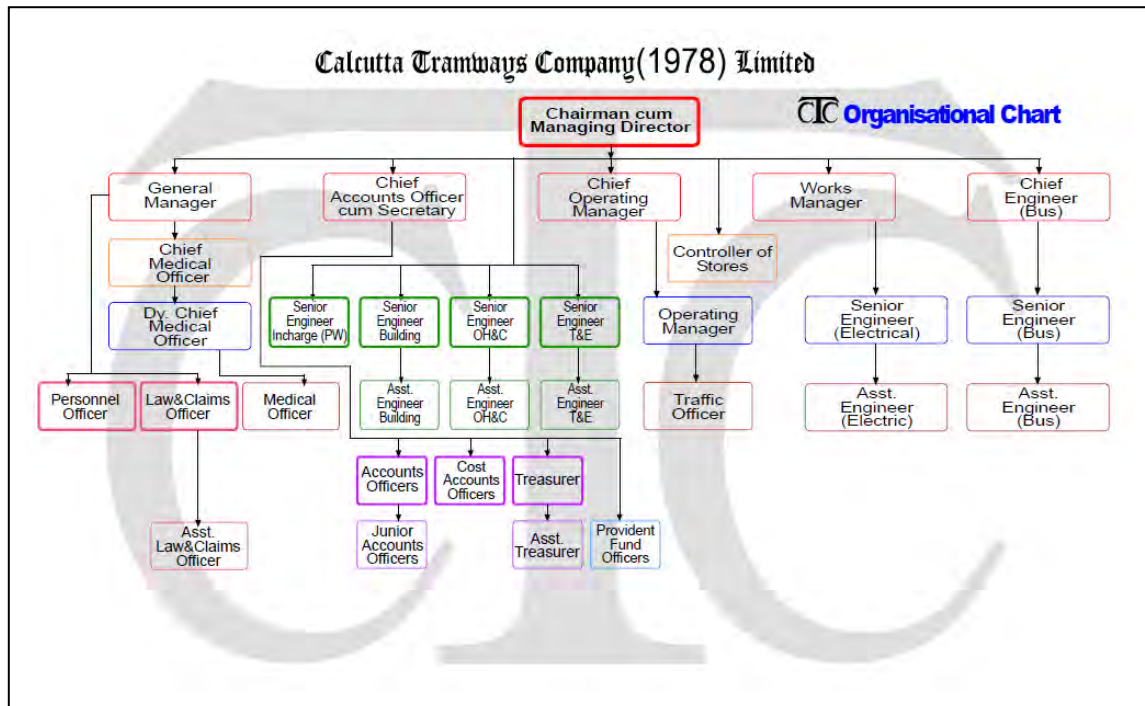
In structuring the organization, the organizational system as per the following specifications will be structured, while respecting safety first of the transportation business and considering the integrity and appropriateness of the business operation.

- 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 5<sup>th</sup> year is indicated below. Education in and after the 6<sup>th</sup> 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 <sup>st</sup> 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 <sup>rd</sup> 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 <sup>th</sup> 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 3<sup>rd</sup> 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 4<sup>th</sup> 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 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup> and 10<sup>th</sup> 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 <sup>st</sup> 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 <sup>rd</sup> 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 <sup>th</sup> 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)

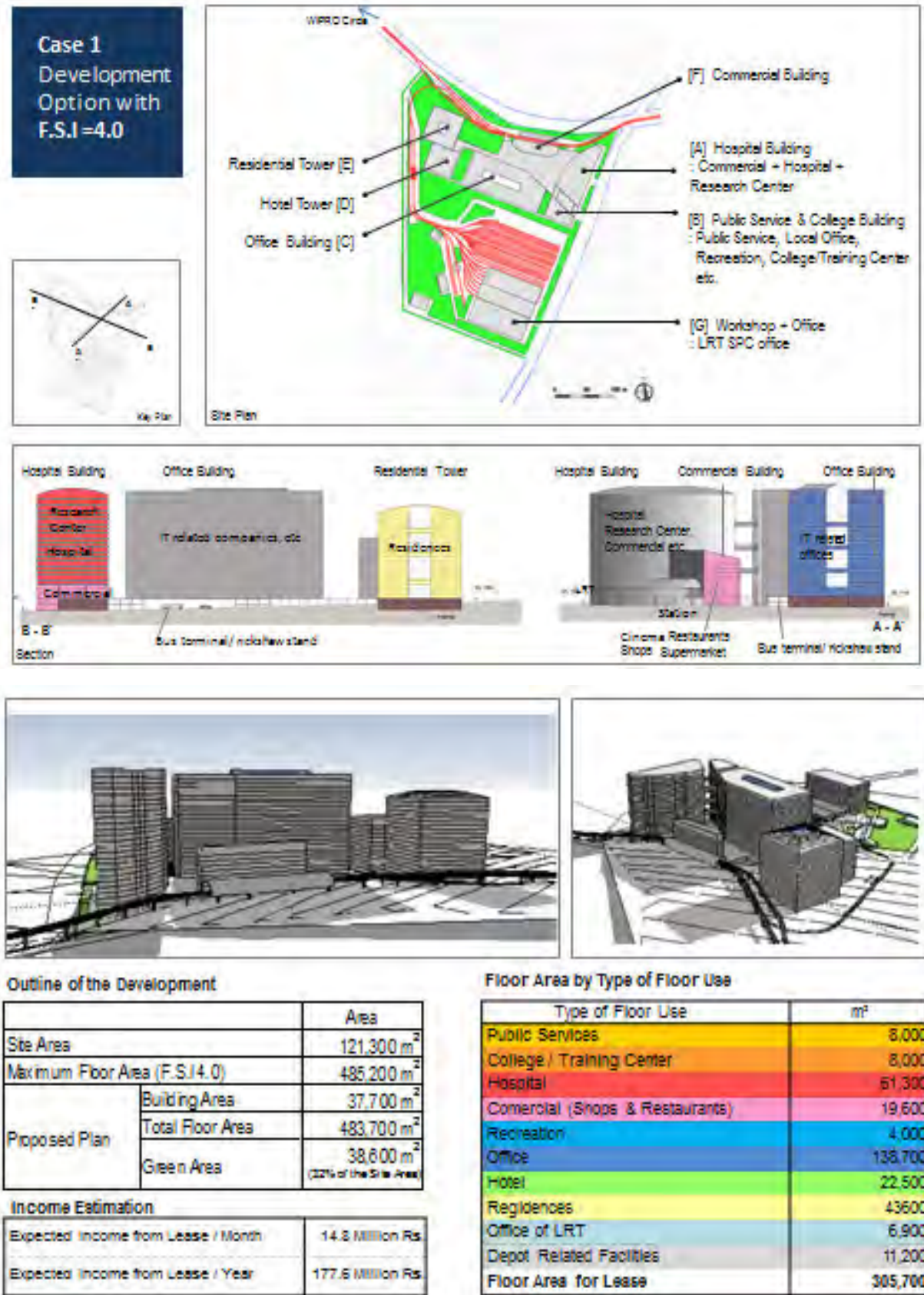
**Table 6.2.1 Comparison of two scenarios**

	Scenario 1	Scenario 2
F.S.I	400%	200%
Building Area	37,700 m <sup>2</sup>	35,000 m <sup>2</sup>
Total Floor Area	483,700 m <sup>2</sup>	241,500 m <sup>2</sup>
Green Area	38,600 m <sup>2</sup> (32% of the site area)	42,812 m <sup>2</sup> (35% of the site area)
Floor Area in Development Scenarios(Figure 6.1.1 & 6.1.2)	305,700 m <sup>2</sup>	129,500 m <sup>2</sup>
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.





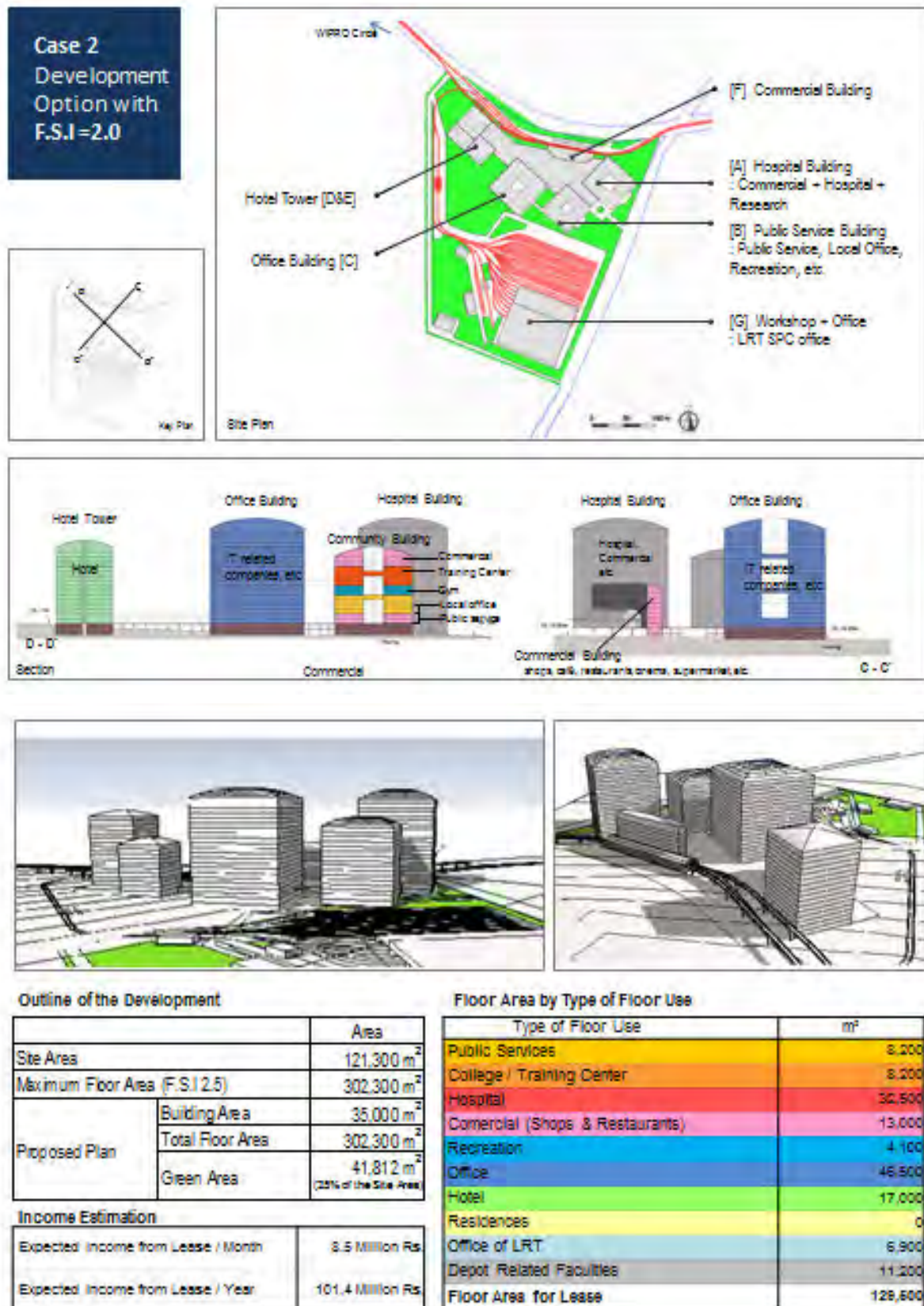


Figure 6.2.2 Development Scenario Case 2

Source: JICA Study Team

## 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	Amended in 2006
4	Individual Act	Land Acquisition	Land Acquisition Act, 1894	Amended in 1985
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	Amended in 1987
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	Amended in 1993
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**

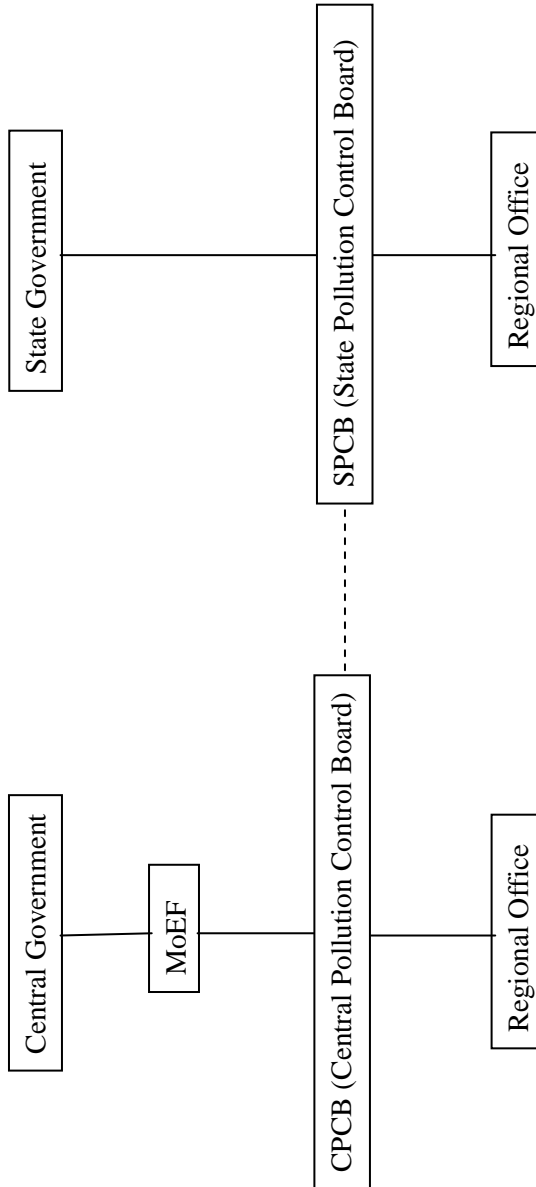
From the viewpoint of the Indian EIA, obtaining EC and implementing EIA are not required for railway projects as a general rule. Under the Indian EIA law EC and EIA are not needed but an EIA must be required because PSIF (Private Sector Investment Finance), which is JICA's fund, will be adapted to this 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."

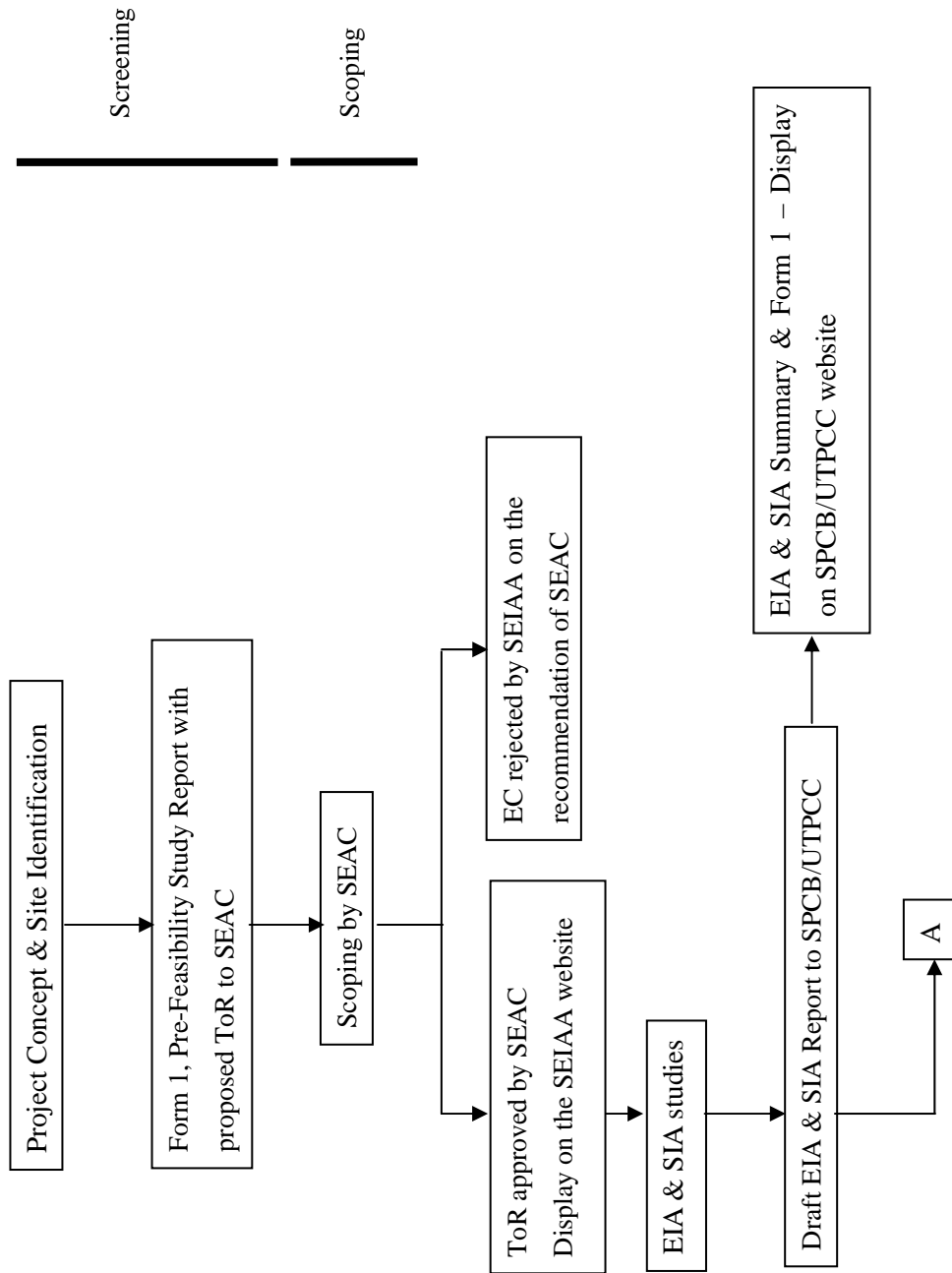
It should be noted that this foreign investment (PSIF) will be used in the project. It is necessary to confirm whether or not EIA procedures and approval authority will be the same as described for the above project even when overseas investment is used.

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)

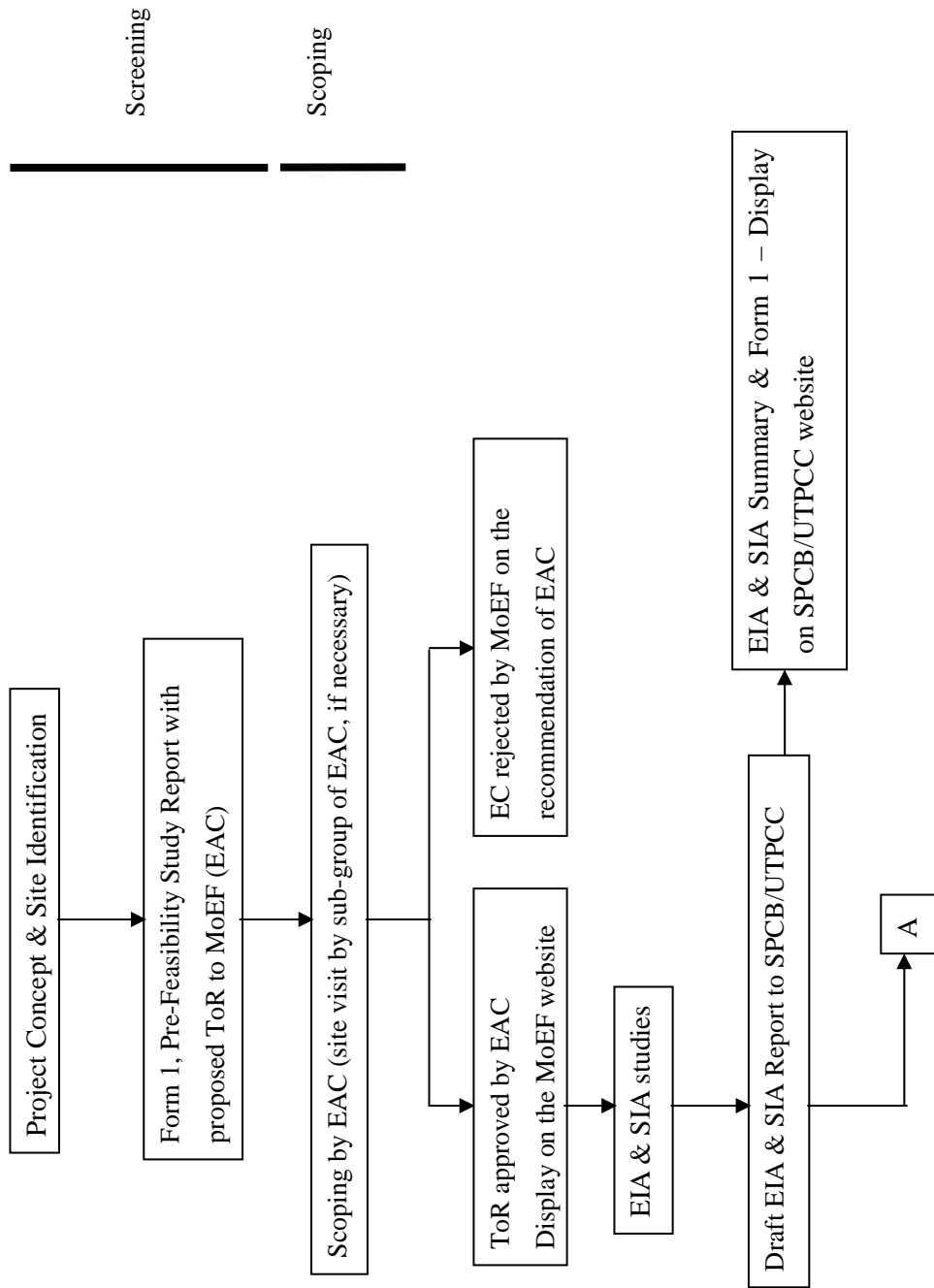
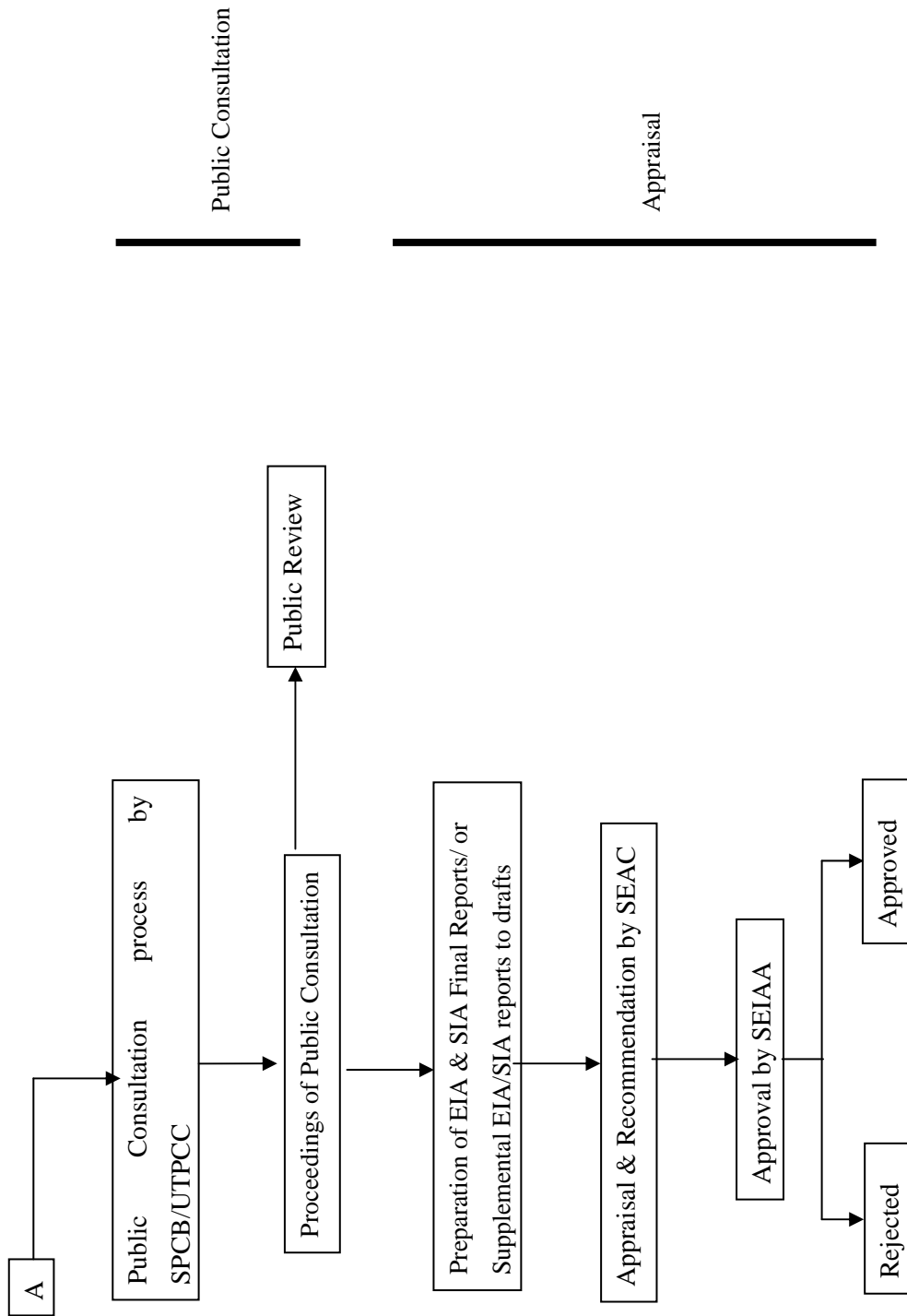


Figure 7.1.3 Flowchart of EIA Process in India (Category A)

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. Pamgrahi, S. Amirapu/Environmental Impact Assessment Review (2012)

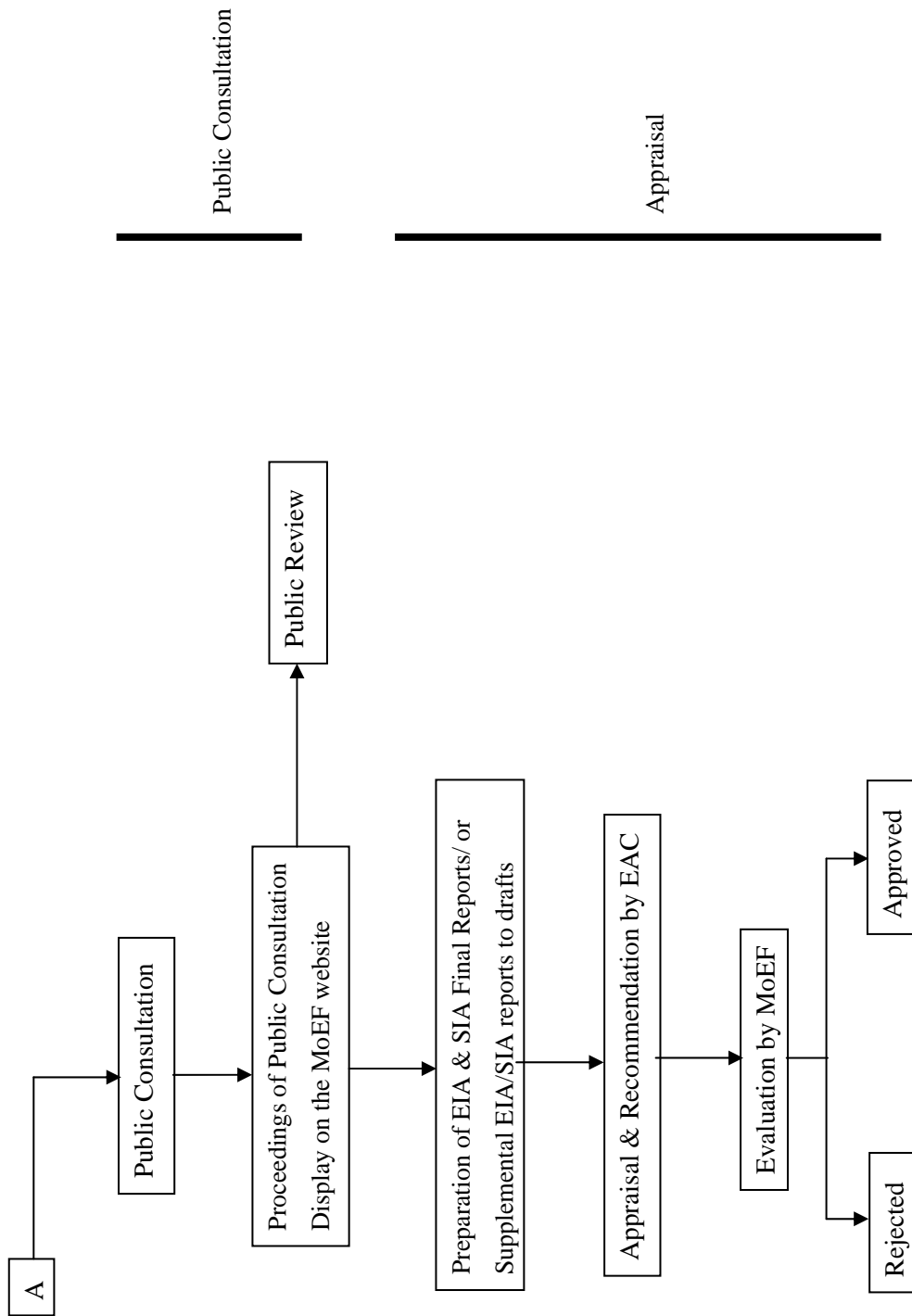
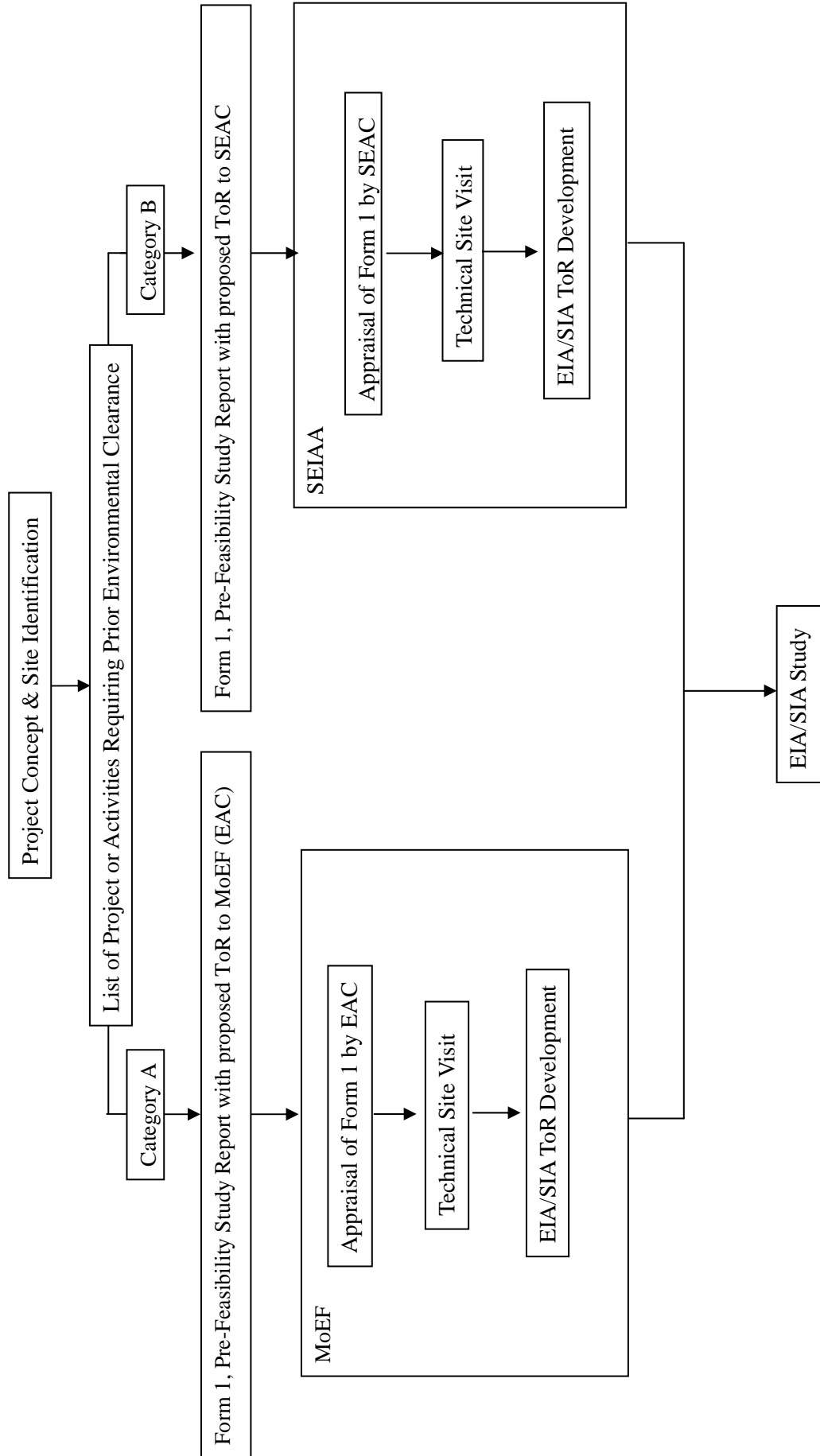


Figure 7.1.5 Procedure of EIA in India (usual projects)

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
<b>Socio-Cultural Environment</b>	
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 <sup>2</sup> 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.
<b>Bio-Physical Environment</b>	
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.
<b>Pollutions</b>	
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 / m<sup>3</sup>, 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 stakeholder 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"> <li>• 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.</li> <li>• The disposal facility should be decided.</li> </ul> (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 256m<sup>2</sup>), from St10 to Mula river (Width: about 3.2m, Distance : about 150m, Area : about 480m<sup>2</sup>) and near NH4 (Width: about 8m, Distance: about 500m, Area: about 4,000m<sup>2</sup>) 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 256m<sup>2</sup>), from St10 to Mula river (Width: about 3.2m, Distance : about 150m, Area : about 480m<sup>2</sup>) and near NH4 (Width: about 8m, Distance: about 500m, Area: about 4,000m<sup>2</sup>) 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	
<b>Socio-Cultural Env</b>					
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 <sup>2</sup> ), from St10 to Mula river (Width: about 3.2m, Distance : about 150m, Area : about 480m <sup>2</sup> ) and near NH4 (Width: about 8m, Distance: about 500m, Area: about 4,000m <sup>2</sup> ) 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 <sup>2</sup> ), from St10 to Mula river (Width: about 3.2m, Distance : about 150m, Area : about 480m <sup>2</sup> ) and near NH4 (Width: about 8m, Distance: about 500m, Area: about 4,000m <sup>2</sup> ) 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 <sup>2</sup> 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 <sup>2</sup> 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 <sub>2</sub> 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 <sub>2</sub> 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.

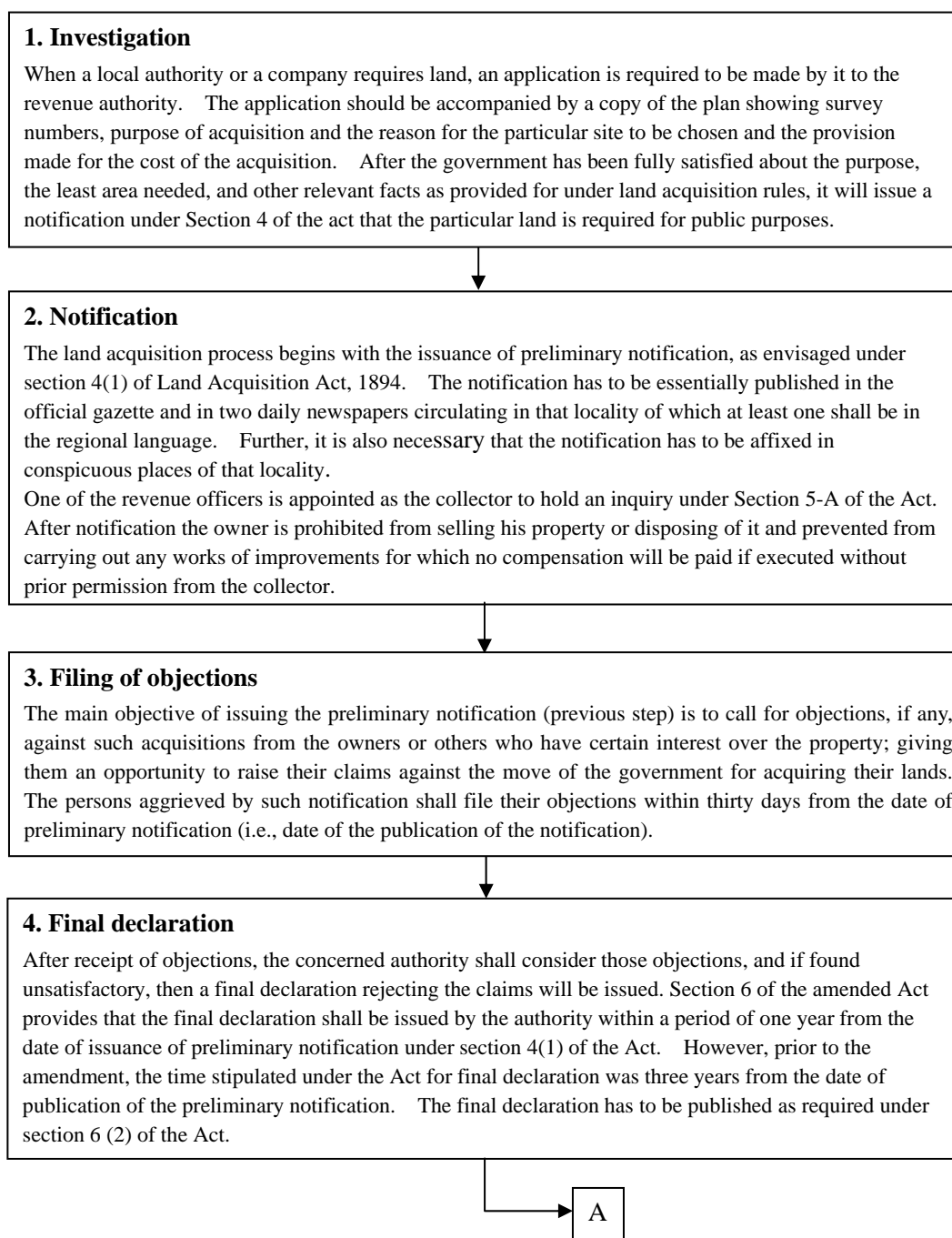
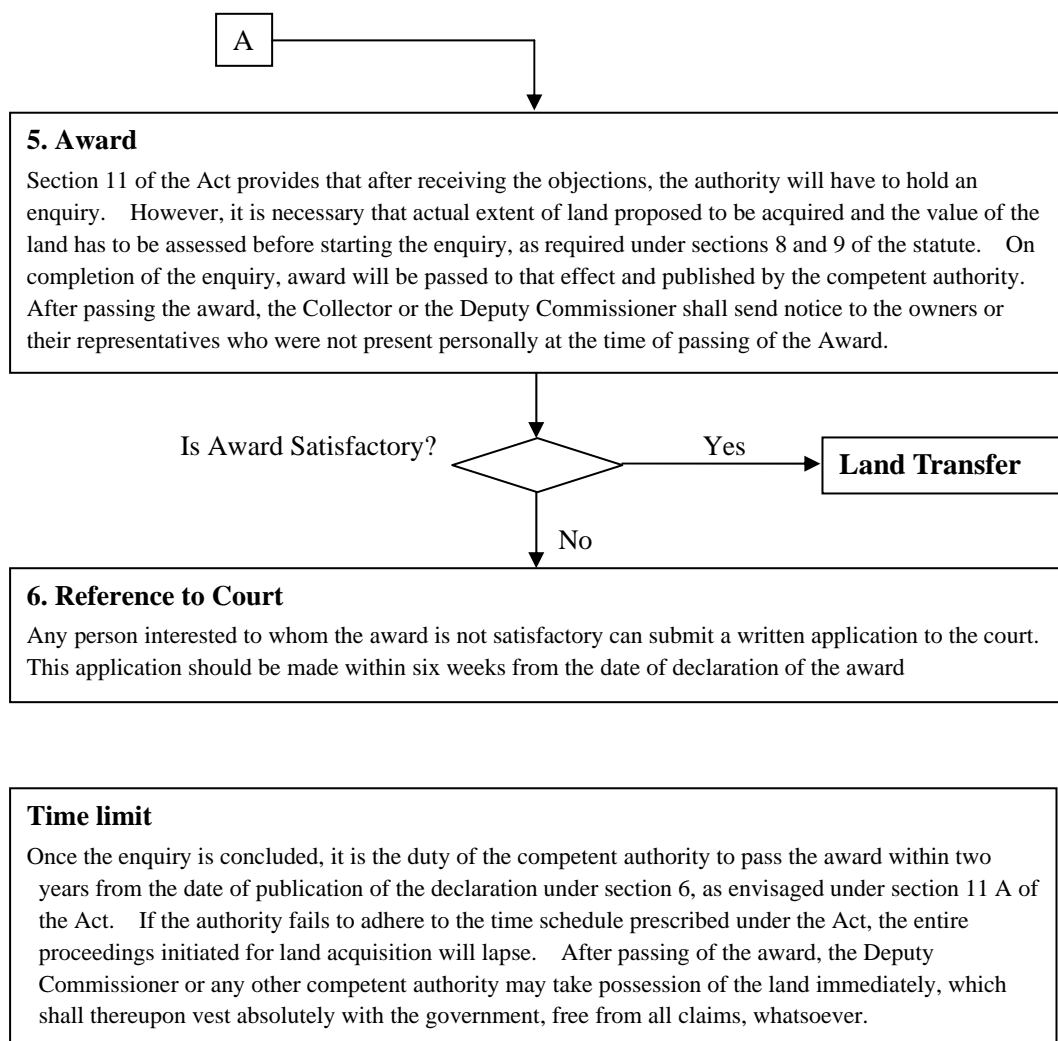


Figure 7.3.1 Land Acquisition process in India 1 (1894)

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 : 6<sup>th</sup> 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.

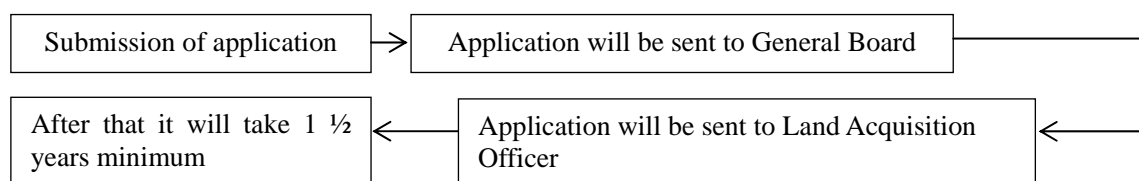
**(2) Compensation Cost of PMC**

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

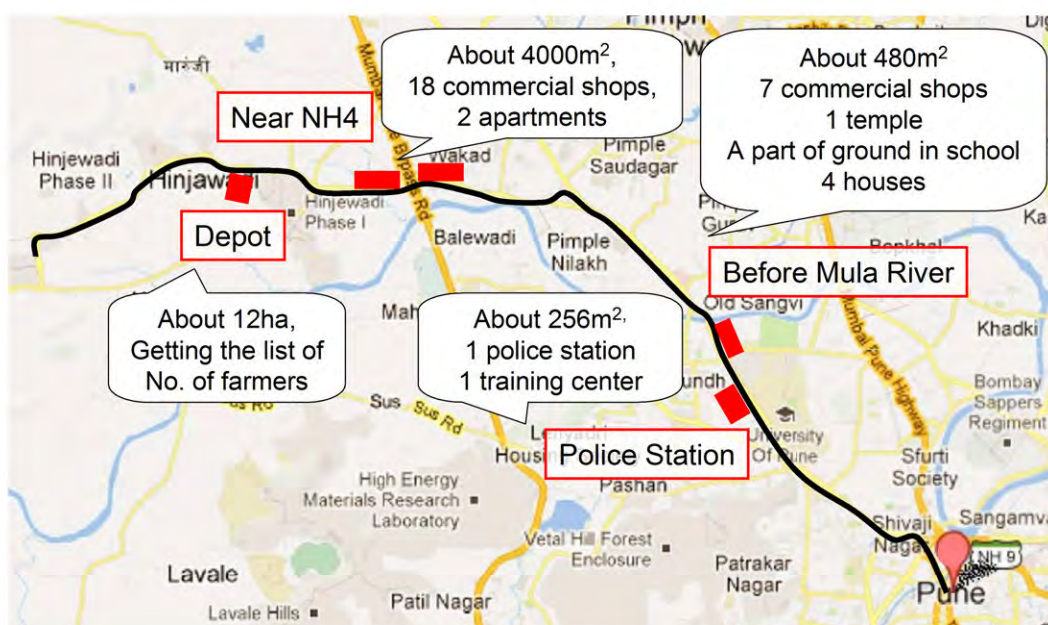
**(4) Compensation Cost of PCMC**

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 256m<sup>2</sup>), St10 to Mula river (Width: about 3.2m, Distance: about 150m, Area: about 480m<sup>2</sup>) and near NH4 (Width: about 8m, Distance: about 500m, Area: about 4,000m<sup>2</sup>) 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 <sup>2</sup> : a police station and a police training centre
2	From St10 to Mula river	480m <sup>2</sup> : retail businesses, residencies, temples and a school
3	Near NH4	4000m <sup>2</sup> : 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 <sup>2</sup> , 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
<b>A. Definition</b>		
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>B. Objective</b>		
Heritage Grade-I richly deserves careful preservation.	Heritage Grade-II deserves intelligent conservation.	Heritage Grade-III deserves protection of unique features and attributes.
<b>C. Scope for Changes</b>		
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.
<b>D. Procedure</b>		
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.
<b>E. Vistas/ Surrounding development</b>		
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

14

A

**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)



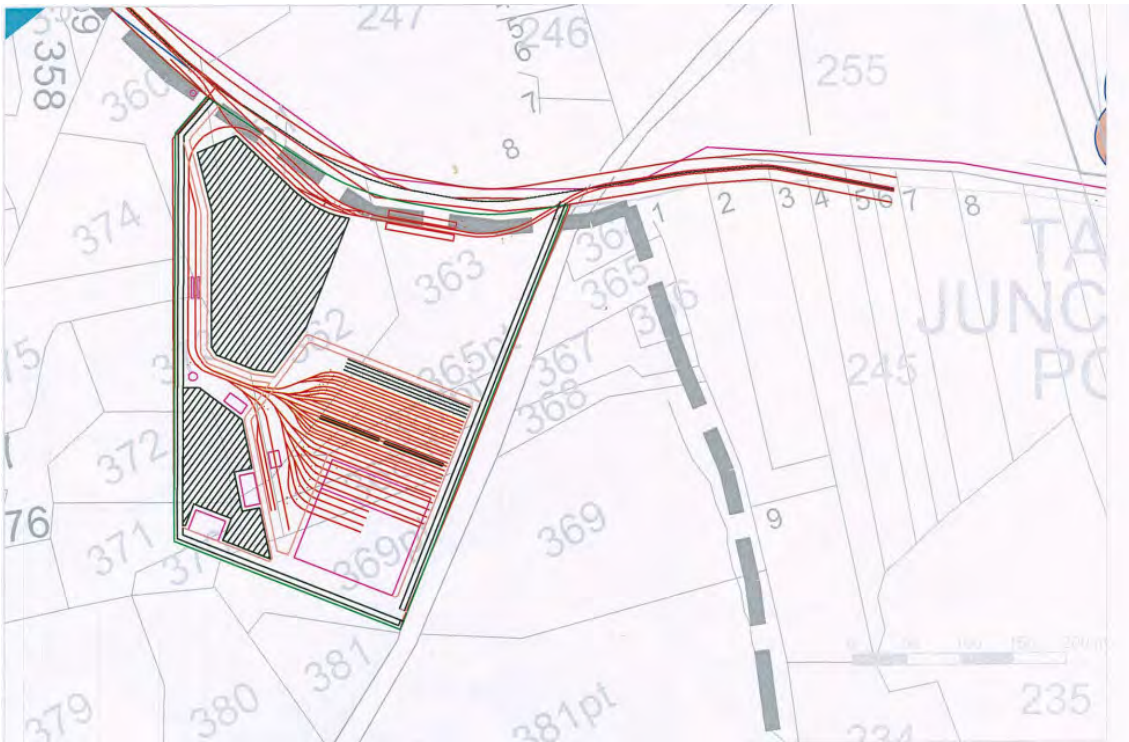
Picture 2 (Temple 2)

### **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



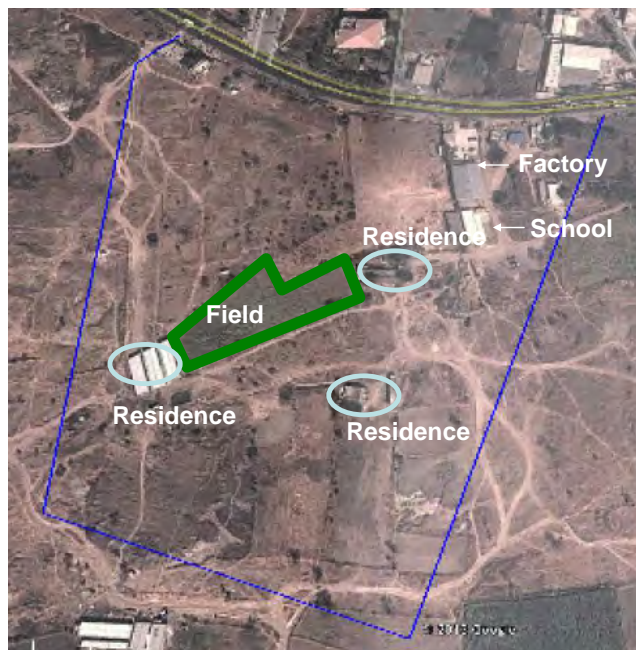
land from farming to other purposes. After that, the state government leases the land to private companies (for example, lease period is for 99 years.)



**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 4,500m<sup>2</sup>. 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 (CO<sub>2</sub>) Study

### 7.4.1 Introduction

City-wide CO<sub>2</sub> 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 CO<sub>2</sub> emission loading from both airplanes and the railways are excluded from this study. The computation of CO<sub>2</sub> 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 CO<sub>2</sub> loadings for (i) With LRT Scenario, and (ii) Without LRT Scenario, respectively. As shown in these figures, the magnitude of CO<sub>2</sub> loadings emitted from both passenger cars and motor bikes are dominant.

Figure 7.4.3 shows achievement rates of CO<sub>2</sub> 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 CO<sub>2</sub> emission loading from both rickshaws and feeder buses are significant but not for the loading from motor bikes.

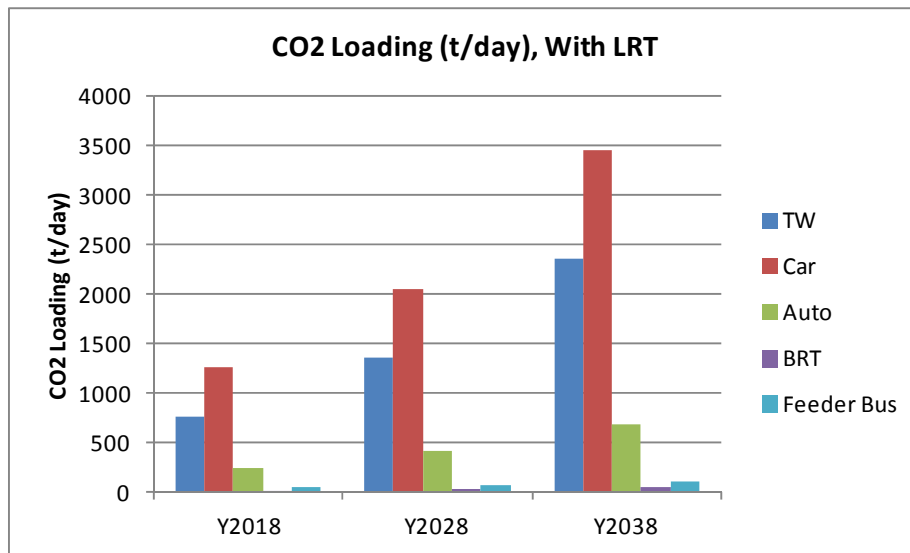


Figure 7.4.1 CO<sub>2</sub> Emission Loading by vehicle Type (With LRT Project)

Source: This Study, 2012

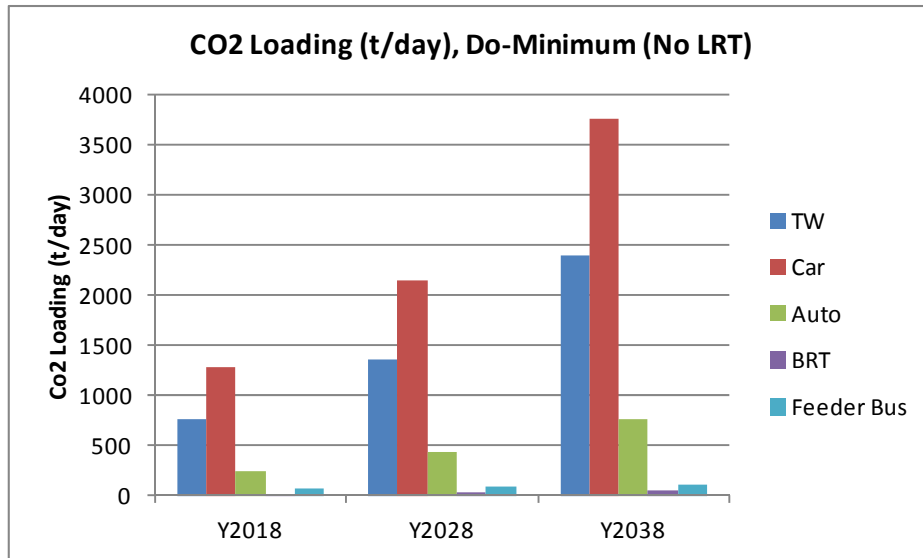


Figure 7.4.2 CO<sub>2</sub> Emission loading by vehicle Type (Without LRT Project)

Source: This Study, 2012

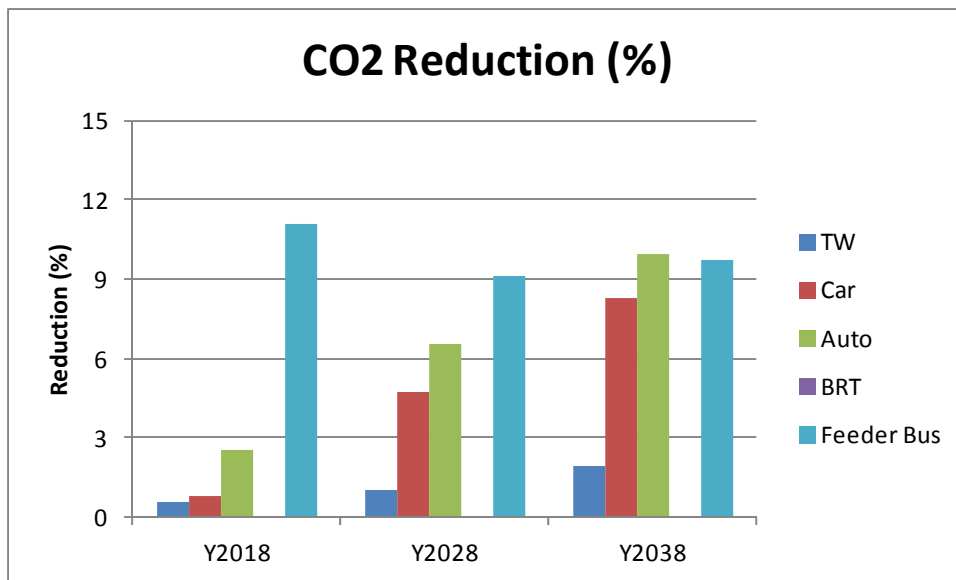


Figure 7.4.3 CO<sub>2</sub> Reduction Rates

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.

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.

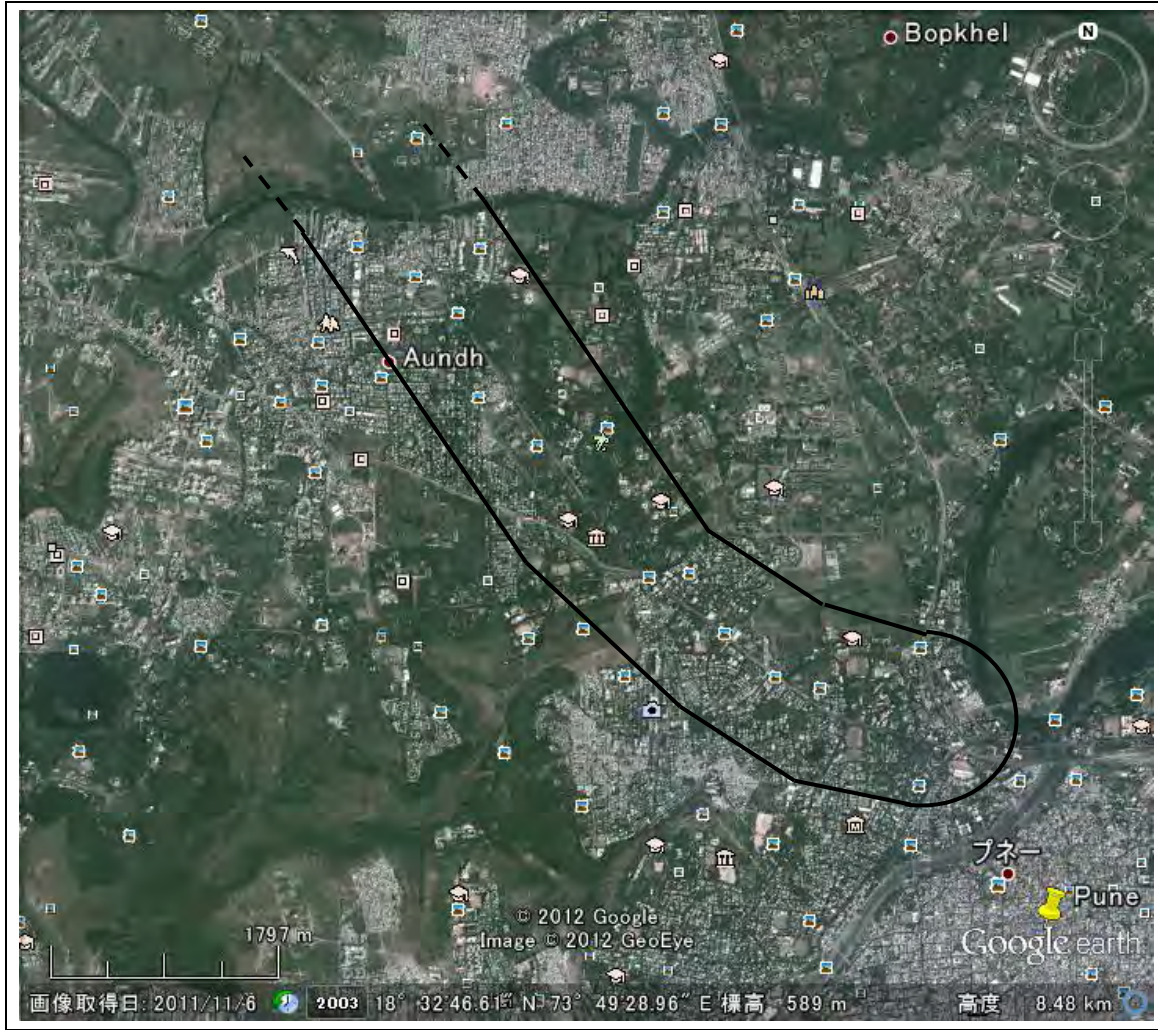
	Env. Factors	Environmental Management Directions
16	Hydrology	It is likely to have a large-scale ground surface physical change due to LRT depot construction. This may cause impacts on local hydrological and weather conditions, in particular, sites around the depot construction site. Flood risk of Mula 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.

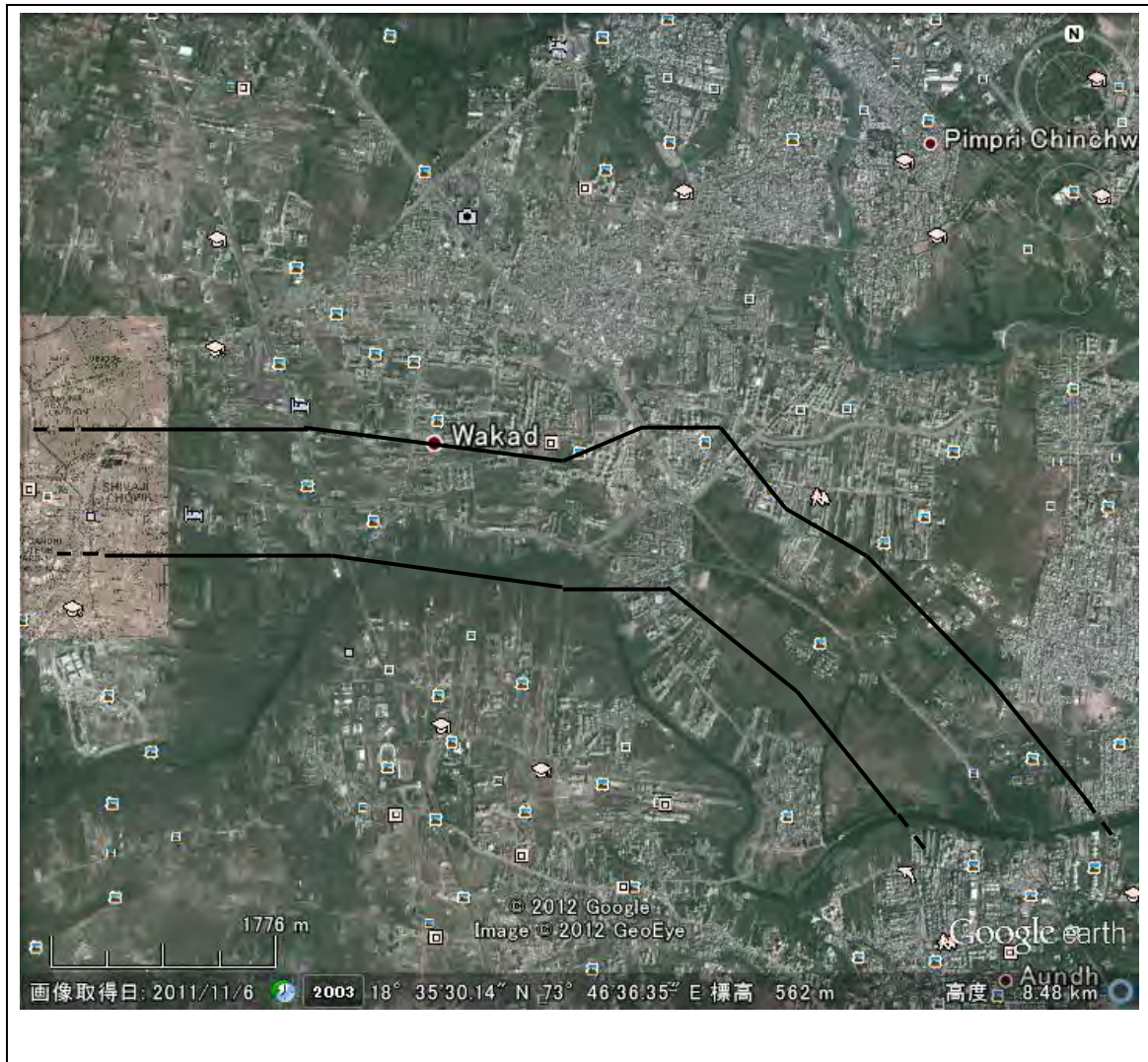
There is no specific direction for AOC demarcation in India, yet. Within EIA studies for the BRT extension projects of Pune, boundaries of the “directly influenced” area are set at 500 meters from both sides of the project centreline. As a result, a narrow strip with a total band width of 1,000 meters 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.

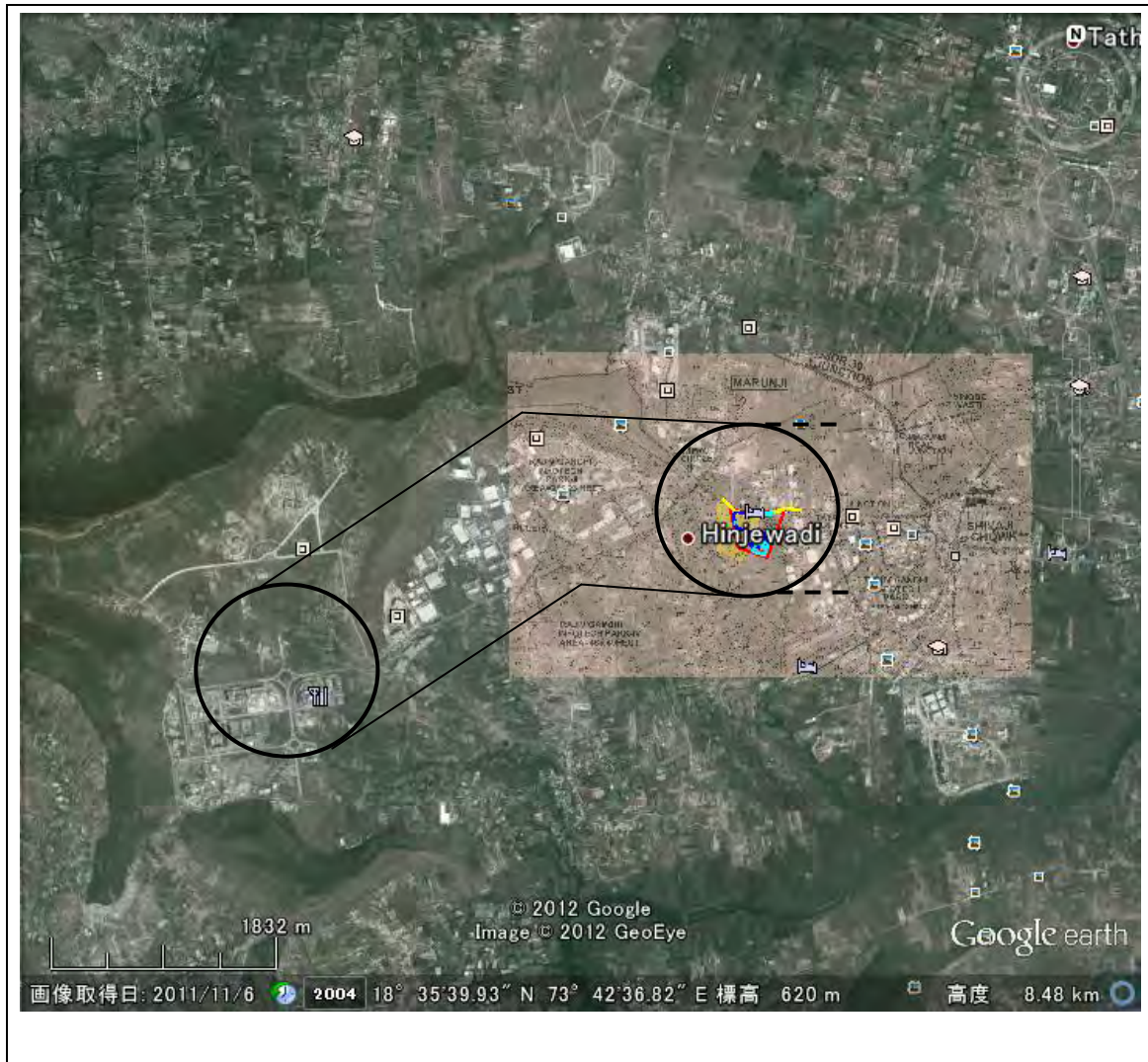




**Figure 7.5.2 AOC of Relevant EIA Study (estimated, part 2, PCMC Area: Station 10 - 18)**

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)**

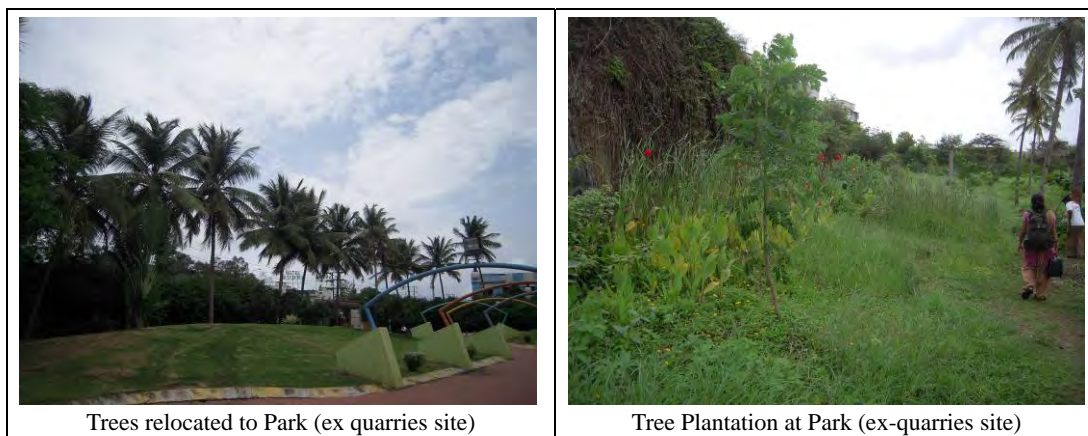
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
	(month)														
1. EIA Tender Preparation.	_____														
2. Selection of EIA Consultants	_____														
3. EIA Study	_____														
4. EIA Examination												_____			
5. Public Consultation												_____			
6. EIA Approval														☆	
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 2,000m<sup>2</sup>. Additionally, it is specified that one tree shall be planted for every 80 m<sup>2</sup>. 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

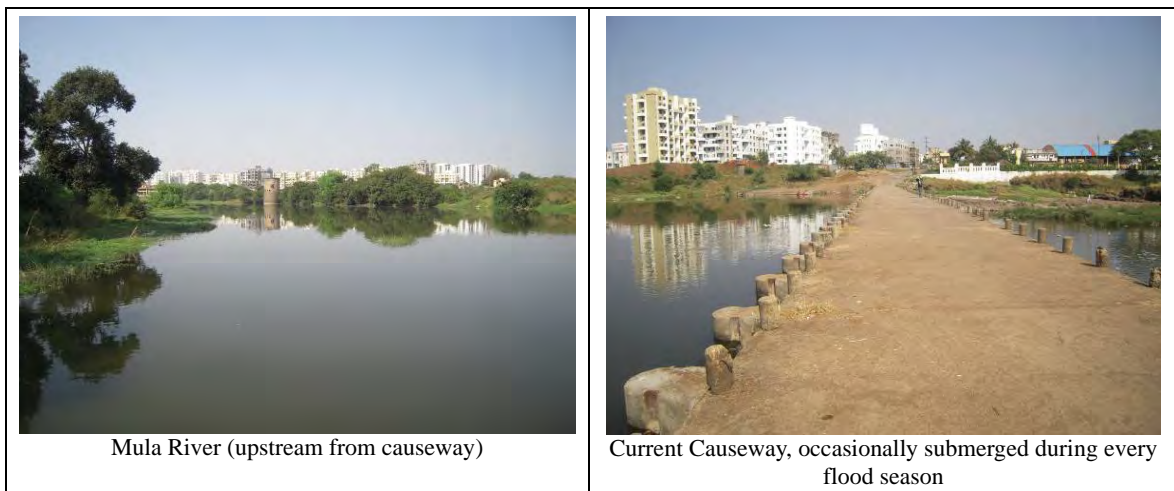
Figure 7.5.5 shows the local geomorphology of the Mula River running through Wakad, PCMC. As shown in this figure, the project alignment is only approximately 30 meters from the riverbank of the Mula River around the river bending point, circled within this figure. The Mula River is meandering (i.e., 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

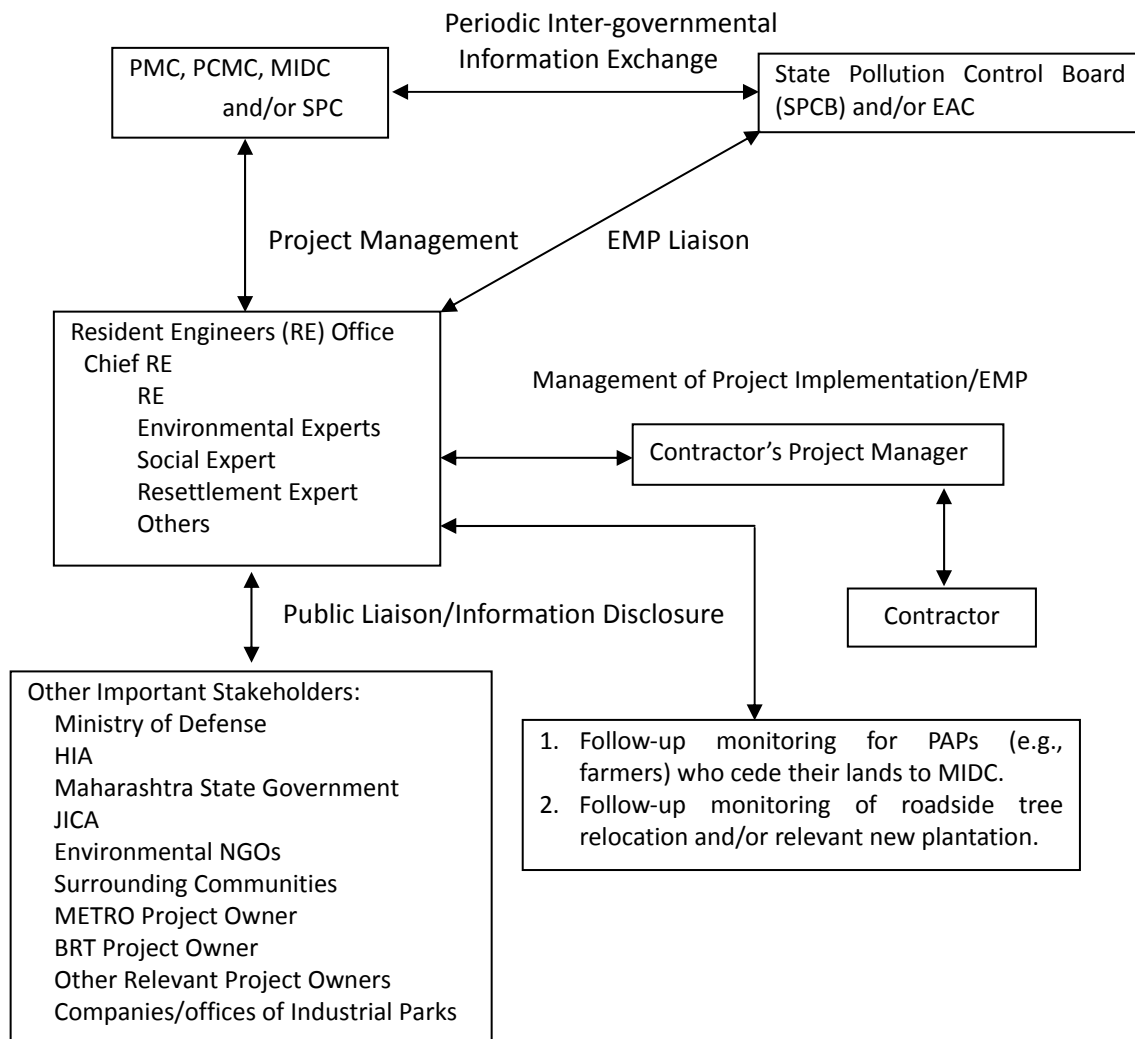


(see Table 7.5.1) and proper environmental and social considerations such as RAP-related follow-up study, mentioned earlier, shall be taken during both the construction and operation phases. Key issues of this EMP development work are summarized as follows.

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

Source: This Study, 2012

## Chapter 8 Project Effects

### 8.1 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.

#### 8.1.1 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.

### 8.1.2 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)

## 8.2 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

## 8.2.1 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