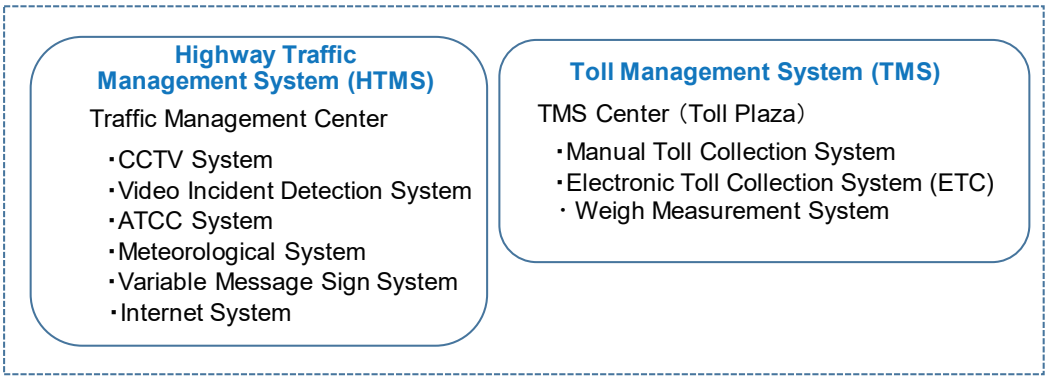
CHAPTER 7 PRELIMINARY DESIGN OF CHENNAI PERIPHERAL RING ROAD INTELLIGENT TRANSPORT SYSTEM (CPRR ITS)

7.1 General

7.1.1 Scope and Objectives of Preliminary Design of the Chennai Peripheral Ring Road Intelligent Transport System (CPRR ITS)

The scope of the CPRR ITS Project, which will be introduced to CPRR by Japanese official development assistance (ODA) loan, was determined based on the studies carried out so far and discussions with Tamil Nadu State as shown in Figure 7.1.1. There are two components, i.e., Highway Traffic Management System (HTMS) and Toll Management System (TMS), and each is composed of some subsystems. The preliminary design of these components, including identifying the quantity of equipment and cost estimation, was carried out for the formulation of this Japanese ODA Loan Project.



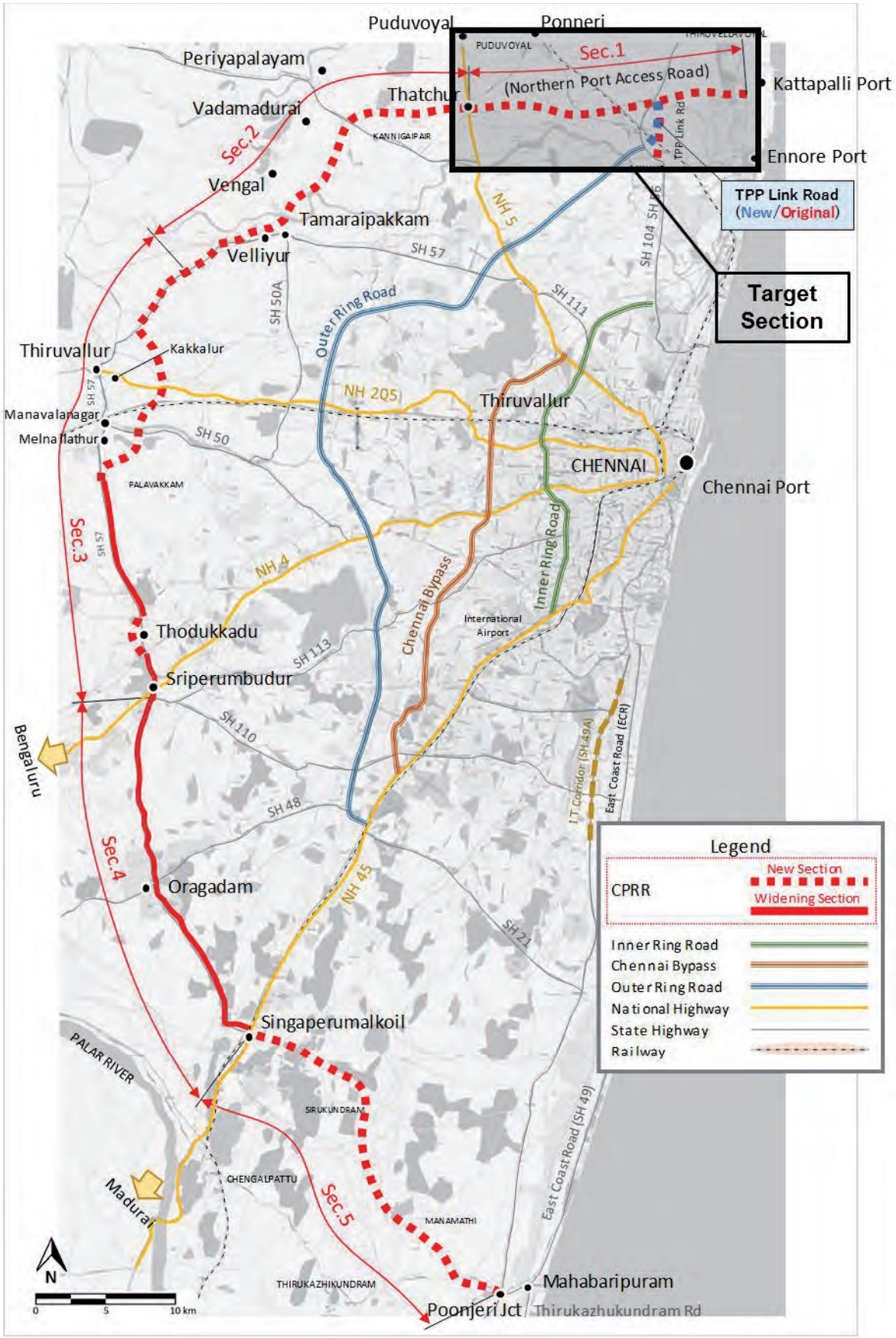
Source: JICA Study Team

Figure 7.1.1 Scope of CPRR ITS for the Project

7.1.2 Target Section for CPRR ITS and Overall System Configuration

(1) Target Section of CPRR ITS for the Project

The target section for the CPRR ITS Project is Section 1 of CPRR. After the completion of construction of CPRR and the introduction of CPRR ITS on Section 1, the remaining sections will then be constructed. However, the financial sources for these sections have not been determined. The target section for the project is shown in the figure in the next page.

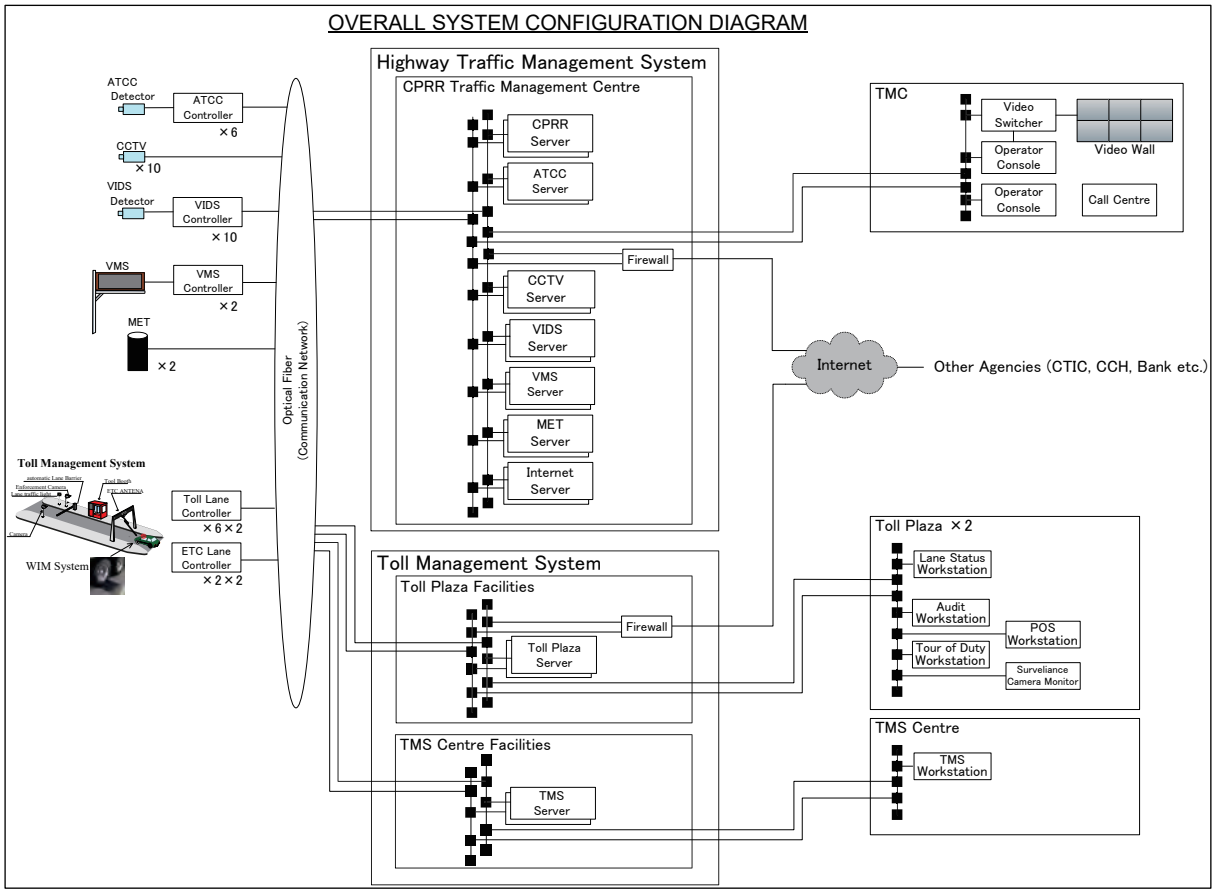


Source: JICA Study Team

Figure 7.1.2 Target Section of CPRR ITS for the Project

(2) Overall System Configuration of CPRR ITS

The CPRR ITS is basically composed of the center system and the roadside equipment. The servers of the center system will be located in the center of HTMS. The overall system configuration of the components of CPRR ITS is shown in Figure 7.1.3.



Source: JICA Study Team

Figure 7.1.3 Overall System Configuration of the Components of CPRR ITS

7.2 Highway Traffic Management System (HTMS)

The design concept of HTMS is shown in Table 7.2.1.

Table 7.2.1 Design Concept of HTMS

Subsystem	Design Concept
CCTV System (CCTV)	・It monitors the traffic situation on CPRR from the center. ・The details of the traffic event detected by VIDS are confirmed from the center using the PTZ function (*); accordingly, the necessary actions are to be taken, e.g., dispatching the patrol cars, and informing the relevant organizations. ・The film footages taken are kept in the server for a certain period and are shared to the relevant organizations upon request, e.g., traffic police. ・The operation status of the facilities and system are monitored, and the maintenance team is dispatched in case of failure.
Video Incident Detection System (VIDS)	・It detects incidents occurred on CPRR, and an alarm is automatically issued. ・The video is automatically taken when detected and kept in the server for a certain period. ・The number/frequency of occasion of the incident is summarised and reported to TNRDC in such format as weekly, monthly, and yearly report. ・The operation status of the facilities and system are monitored, and the maintenance team is dispatched in case of failure.
Automatic Traffic Counter Cum System (ATCC)	・It counts traffic volume by vehicle type. ・The measured data is kept in the server for a certain period and summarised by time and day. ・The result is reported to TNRDC in such format as weekly, monthly, and yearly report. ・The operation status of the facilities and system are monitored, and the maintenance team is dispatched in case of failure.
Meteorological System (MET)	・It measures precipitation, wind velocity, and visibility, and the alarm is automatically issued when the measured results reach the threshold value. ・The alarm messages are provided to road users through VMS and internet in case the threshold value is reached. ・The measured data which reached the threshold value is kept in the server for a certain period, and the number/frequency of occurrence of reaching the threshold value is summarised. ・The operation status of the facilities and system are monitored, and the maintenance team is dispatched in case of failure.
Variable Message Sign Board System (VMS)	・Information, such as accidents, road work, lane restrictions, and actions that need to be taken by the road users, is provided. ・The provided information is updated every five minutes as necessary. ・Information to be provided is made by combining the preset messages that are prepared by the operators in advance. Free messaging can also be provided. ・The languages to be used are selected from English, Hindu or Tamil, or automatically switched. ・The operation status of the facilities and system are monitored, and the maintenance team is dispatched in case of failure.
Internet System	・Information, such as accidents, road work, lane restrictions, and actions that need to be taken by the road users, is provided. ・The provided information is updated every five minutes as necessary. ・The languages to be used are selected from English, Hindu or Tamil by the internet users. ・The operation status of the facilities and system are monitored, and the maintenance team is dispatched in case of failure.

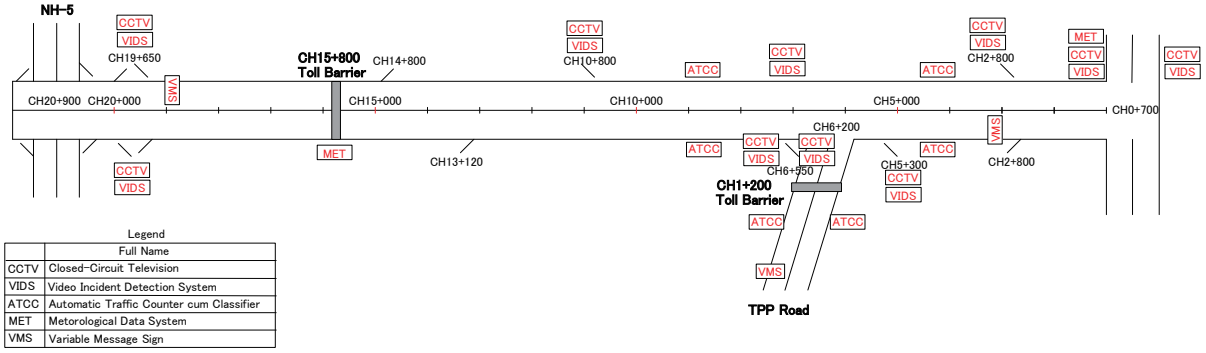
(*) PTZ Function: PTZ is an abbreviation of 'Pan' which means moving the camera lens to the direction of right or left, 'Tilt' which means moving the camera lens to the direction of up and down and 'Zoom' which means zooming. PTZ Function refers to those functions of CCTV.

Source: JICA Study Team

(1) Location Plan and Quantity of Roadside Equipment of HTMS

CCTV and VIDS are proposed to be installed at the merging point of on/off ramps to/from the carriage way of CPRR and the merging point between CPRR and Tiruvottiyur Ponneri Pancheti (TPP) Link Road. The measurement equipment of the meteorological system is proposed to be installed on both ends of CPRR. The sensors of the Automatic Traffic Counter cum Classifier (ATCC) are proposed to be installed between (i) the toll barrier of CPRR (Ch.15+800) and the junction of TPP Link Road (Ch.6+200), (ii) the junction of TPP Link Road (Ch.6+200) and the end point of CPRR near the port (Ch.0+700), and (iii) the junction of TPP Link Road (Ch.6+200) and the start point of TPP Link Road, for a total of three locations. VMS boards are proposed to be installed between (i) NH5 and the toll barrier of CPRR (Ch.15+800), (ii) the end point of CPRR near the port (Ch.0+700) and the junction of TPP Link Road (Ch.6+200), and (iii) the start point of TPP Link Road and the toll barrier on TPP Link Road (Ch.1+200), for a total of three locations.

The locations of roadside equipment of the HTMS and the location plan concept and quantity of equipment are shown in Figure 7.1.3 and Table 7.2.2, respectively.



Source: JICA Study Team

Figure 7.2.1 Location Plan of Roadside Equipment of HTMS

Table 7.2.2 Location Plan Concept and Quantity of Roadside Equipment of HTMS

Facilities	Location Plan Concept	Quantity
CCTV System (CCTV)	It will be installed to confirm the situation, e.g., accident at site detected by VIDS, equipped with PTZ function.	10
Video Incident Detection System (VIDS)	It will be installed at black-spot locations, i.e., merging points of service roads entering CPRR and around the junction of CPRR and TPP Link Road.	10
Automatic Traffic Counter Cum System (ATCC)	It will be installed to measure the traffic volume by section. The proposed locations are between (i) the end point of CPRR near the port and TPP Link Road junction, (ii) the TPP Link Road junction and CPRR toward NH5, and (iii) the TPP-link junction and start point of TPP Link Road. The sensors are proposed to be installed at one location in both directions at those places.	6
Meteorological System (MET)	It will be installed to measure the precipitation, wind direction/velocity, and visibility at two locations, i.e., both ends of CPRR. The alarm messages will be issued in case the measured data reaches the threshold value.	2
Variable Message Sign System (VMS)	It will be installed to provide information on the traffic situation ahead of the vehicles entering CPRR and TPP Link Road. The information to be provided are accident, congestion, road work, lane restrictions, etc.	3

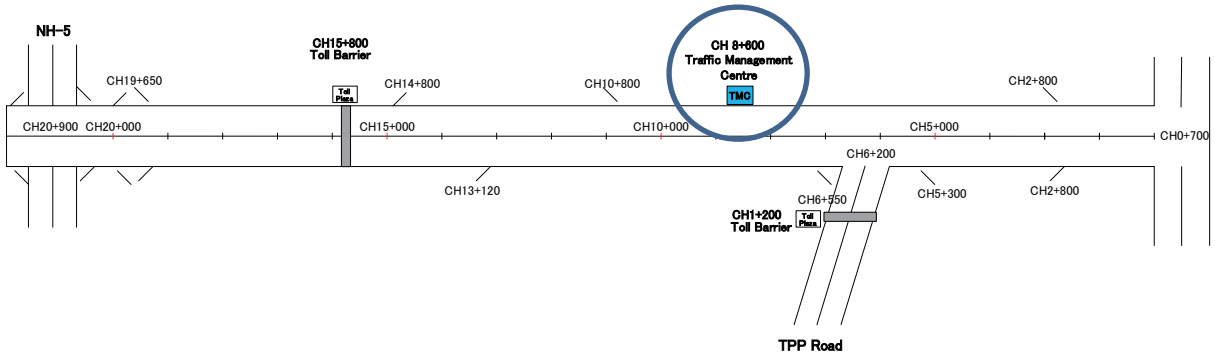
Source: JICA Study Team

Fiber optic cables will be laid on the shoulders on both sides of the CPRR, and the roadside equipment will be connected by this communication network exclusive for CPRR.

(2) Center for HTMS: Traffic Management Center

The Center for HTMS: Traffic Management Center, is proposed to be located at a different location from the toll plaza because of the different natures of work. The Traffic Management Center will be for highway management, whereas the toll plaza will be engaged in handling the toll. It is proposed that the Traffic Management Center will be constructed at Ch.8+600, which satisfies the conditions that (i) it is almost at the mid-point of Section 1 from a viewpoint of operation and management for the target section, (ii) there is sufficient space for the Center in terms of right of way (ROW), and (iii) it does not affect the parking area for the large vehicles planned nearby.

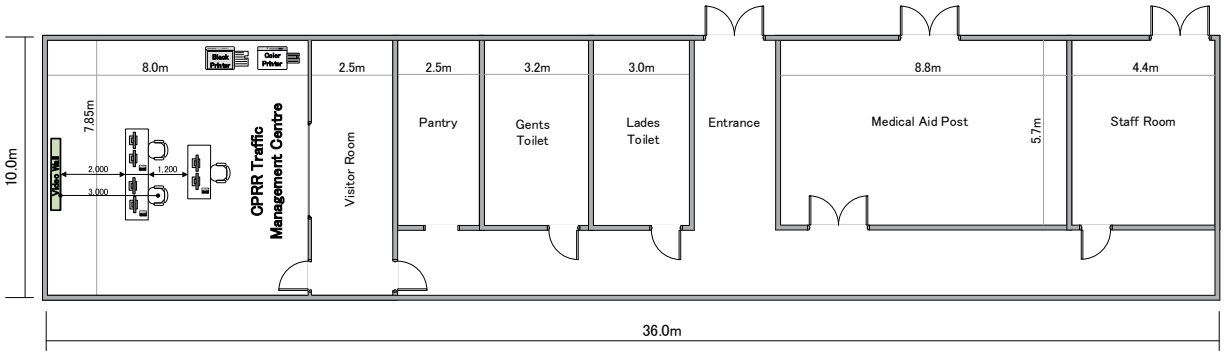
Figure 7.2.2 shows the location plan for the Traffic Management Center.



Source: JICA Study Team

Figure 7.2.2 Location Plan for Traffic Management Center (HTMS)

The building plan of the Traffic Management Center is proposed as shown in Figure 7.2.3. The medical aid post, where the ambulance crews will be stationed, and staff rooms, where the patrol stand-by team and maintenance team will stay, are also planned in addition to the control room of HTMS.



Source: JICA Study Team

Figure 7.2.3 Building Plan of Traffic Management Center (HTMS)

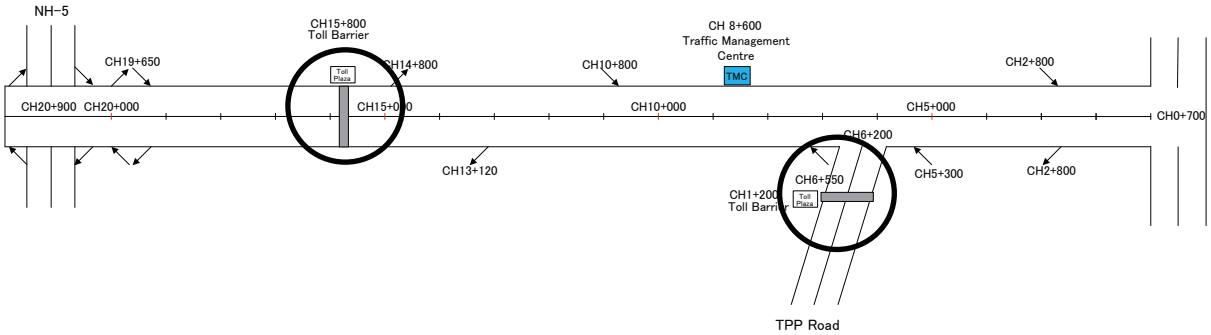
7.3 Toll Management System (TMS)

(1) Toll Collection Method

Manual toll collection and electronic toll collection (ETC) (RFID method: FASTag) will be adopted. The Touch-and-Go system using an interchange (IC) card will not be adopted because the plan towards realizing the common mobility card or electronic settlement, which can be used across different transport modes, is still under discussion in Chennai, and it is not clear when such payment method will become available in Chennai. Thus, it is anticipated that sufficient increase of Touch-and-Go usage cannot be expected and that the convenience for road users are limited by the IC card, which can be used only for Section 1 of CPRR. Regarding the tariff system, the distance-based system will be adopted. (More details are given in Chapter 8.)

(2) Locations of Toll Plazas

According to discussions with Tamil Nadu Road Development Company (TNRDC), it has been determined that toll plazas will be constructed in two locations as shown in Figure 7.3.1. As shown below, the toll barriers will be located on the main carriageway of CPRR (Ch.15+800) and TPP Link Road (Ch.1+200). (The reasons of determining those locations are given in Chapter 8)



Source: JICA Study Team

Figure 7.3.1 Locations of Toll Plazas

(3) Toll Lane Composition at Toll Plaza

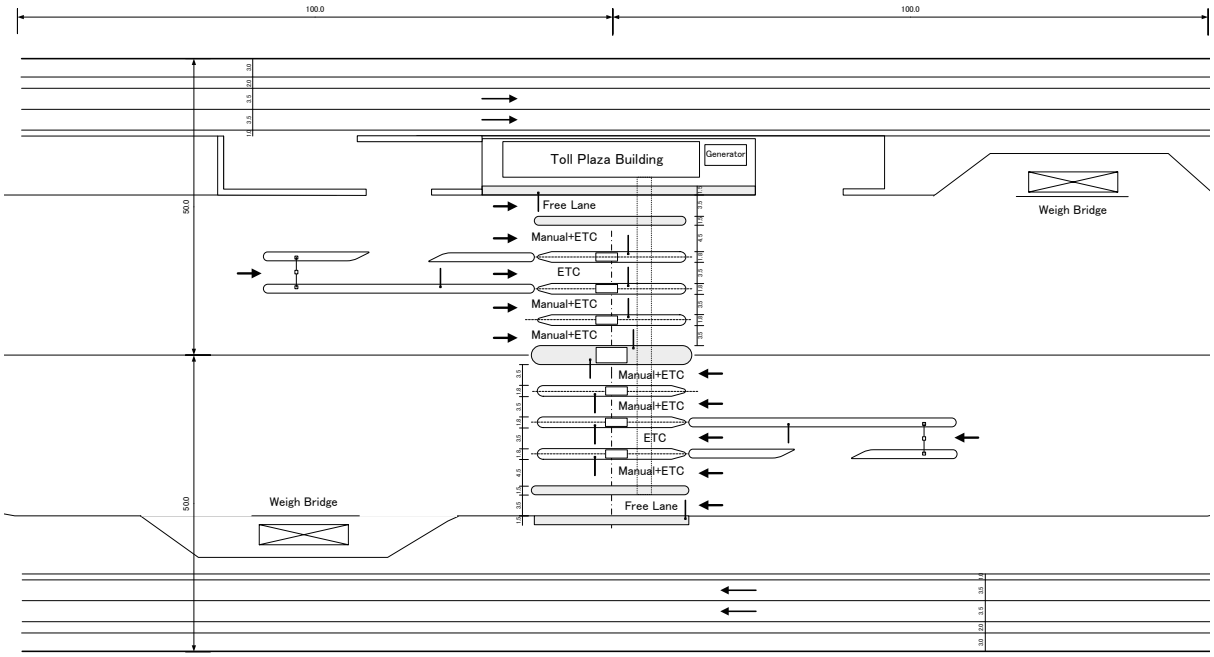
Five toll lanes for entrance and exit at both CPRR and TPP Link Road are proposed, taking into consideration the available land. Their compositions are shown in Table 7.3.1.

Table 7.3.1 Toll Lane Composition

Toll Plaza	Lane Type	No. of Lanes	Purpose
CPRR at Ch.15+800 and TPP Link Road at Ch.1+200	ETC Lane (RFID:FASTag)	1	Exclusively for ETC
	Manual Lane	3	For both ETC and Manual Toll Collection (Hybrid Lane)
	Free Lane	1	For toll free vehicles, i.e., VIP vehicle, ambulance, two-wheeler, and three wheelers

Source: JICA Study Team

Figure 7.3.2 shows the entire location plan of the toll plaza incorporating the above considerations. It is applied to the toll plazas at both the CPRR and the TPP Link Road.



Source: JICA Study Team

Figure 7.3.2 Entire Location Plan of the Toll Plaza

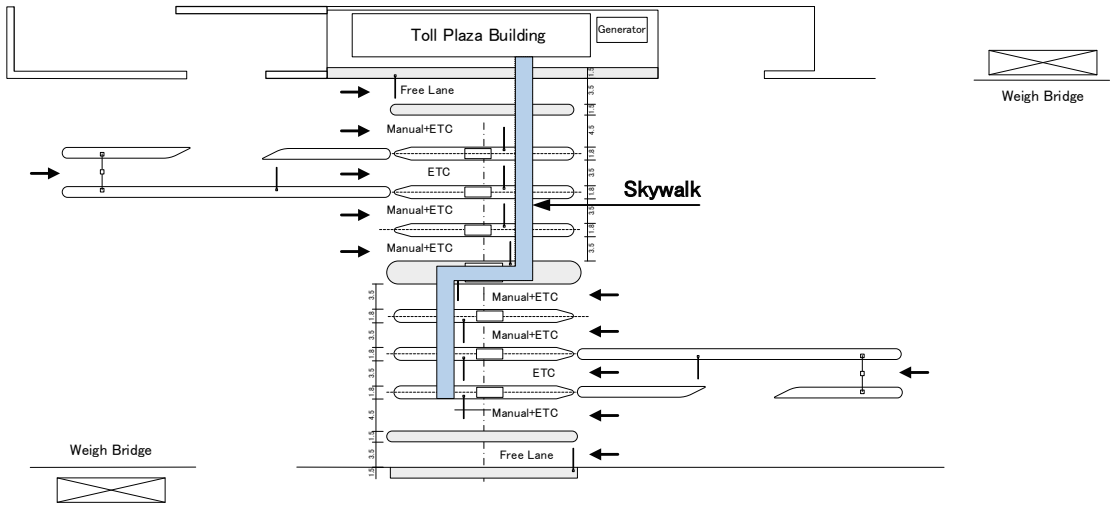
ETC lanes longer than other lanes are planned. This is for the purpose of constructing the open space to allow the large vehicles to pass on occasion where non-ETC vehicles or ETC vehicles with invalid Radio Frequency Identifier (RFID) tags enter the ETC lanes by mistake and need to be redirected to the neighboring non-ETC lanes.

(4) Other Facilities

a) Skywalk

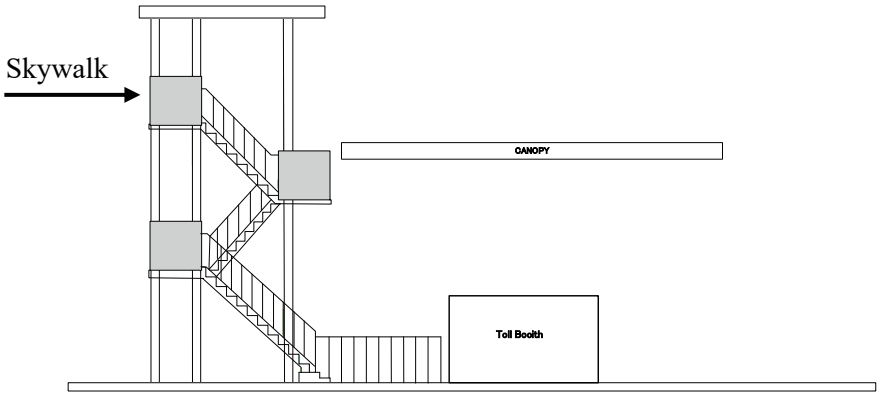
The general practice is that an underground passage is constructed so that toll collectors can walk between the toll plaza building and the toll booths safely and securely, i.e., assuring their safety and protecting the collected cash in the case of the toll barrier. However, it has been determined based on discussions with TNRDC that the skywalk, instead of an underpass, will be constructed because there is a high possibility that the underground passage may be water-logged in the flood plain area. The skywalk is to be constructed above the canopy so that the staff can directly access the cash room located on the first floor of the toll plaza building.

Horizontal and vertical images of the skywalk are illustrated in Figure 7.3.3 and Figure 7.3.4, respectively.



Source: JICA Study Team

Figure 7.3.3 Horizontal Image of the Skywalk



Source: JICA Study Team

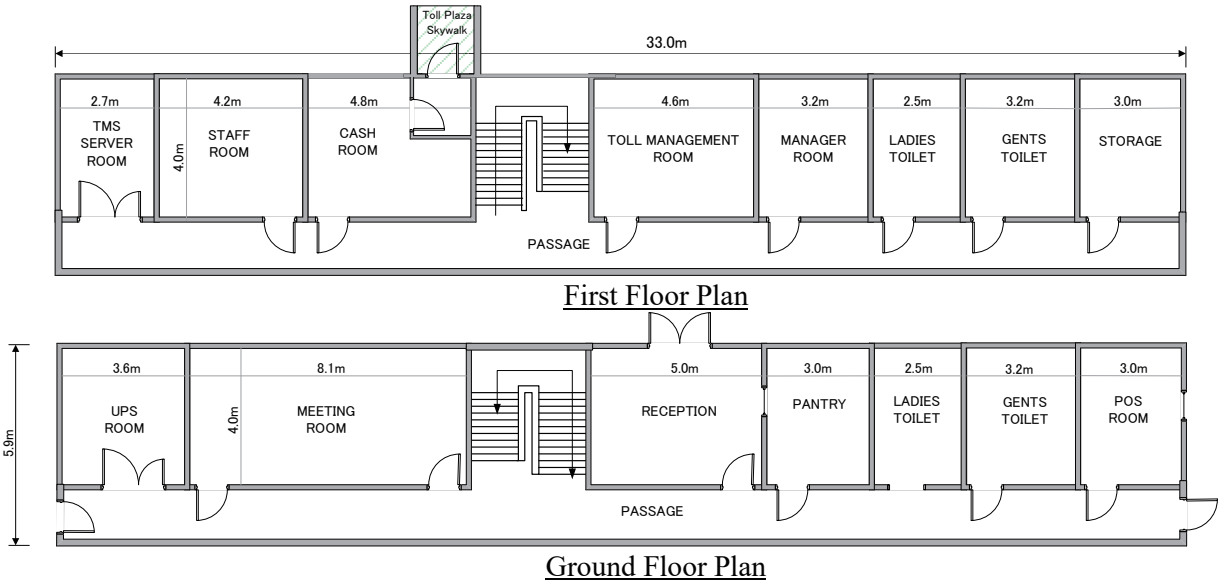
Figure 7.3.4 Vertical Image of the Skywalk

b) Weigh-in-Motion and Weigh Bridge

The weigh-in-motion facilities will be installed at all toll lanes, and the weigh bridge will be located at the left side after the exit of the toll lanes. The weigh-in-motion facilities measure the weight when the vehicle enters the toll lane and issues alarm messages in case the vehicle is overweight. The overweight vehicle is to be lead to the weigh bridge, where its actual weight is measured for the fine.

c) Toll Plaza Building

The plan of the toll plaza building is shown in Figure 7.3.5. The cash room is planned to be located on the first floor of the toll plaza building to allow direct, safe, and secure access for the toll collector from the skywalk, as mentioned before. Accordingly, the monitoring room of TMS and other associated rooms are planned on the first floor. Other rooms such as rooms for visitors, Point of Sales (POS), meetings, etc., are planned on the ground floor. The POS room is for the sales of RFID Tag, recharging, etc.



Source: JICA Study Team

Figure 7.3.5 Plan of Toll Plaza Building

CHAPTER 8 IMPLEMENTATION ORGANIZATION FOR CPRR ITS

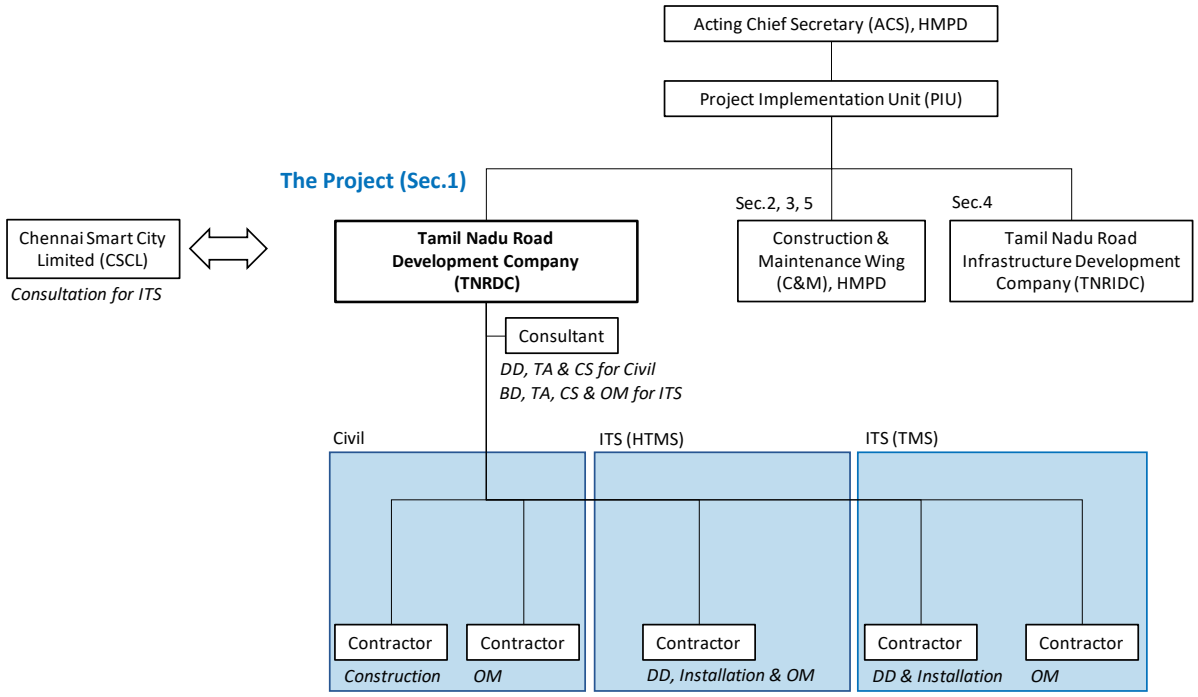
8.1 Organizational Framework of Project

The following figure shows the organizational framework of the Intelligent Transport System (ITS) Project for Chennai Peripheral Ring Road (CPRR).

The Tamil Nadu Road Development Company (TNRDC) will be responsible for the implementation of Section 1 of the Project as shown in the figure below. Under TNRDC, the Consultants for civil construction and ITS will be procured. The Consultant for ITS will be in-charge of basic design, tender assistance, and supervision of construction and operation and maintenance (O&M).

The O&M for the Highway Traffic Management System (HTMS) will be carried out by the supplier of the system who is in-charge of the detailed design and installation. As for the Toll Management System (TMS), the detailed design and installation will be completed by the supplier of the system, but the O&M contractor will be procured separately.

The Chennai Smart City Limited (CSCL) will engage in the Project, taking an advisory role and assisting as necessary.



(BD: Basic Design, DD: Detailed Design, TA: Tender Assistance, CS: Construction Supervision, OM: Operation and Maintenance)

Source: JICA Study Team

Figure 8.1.1 Organizational Framework of ITS Project for CPRR

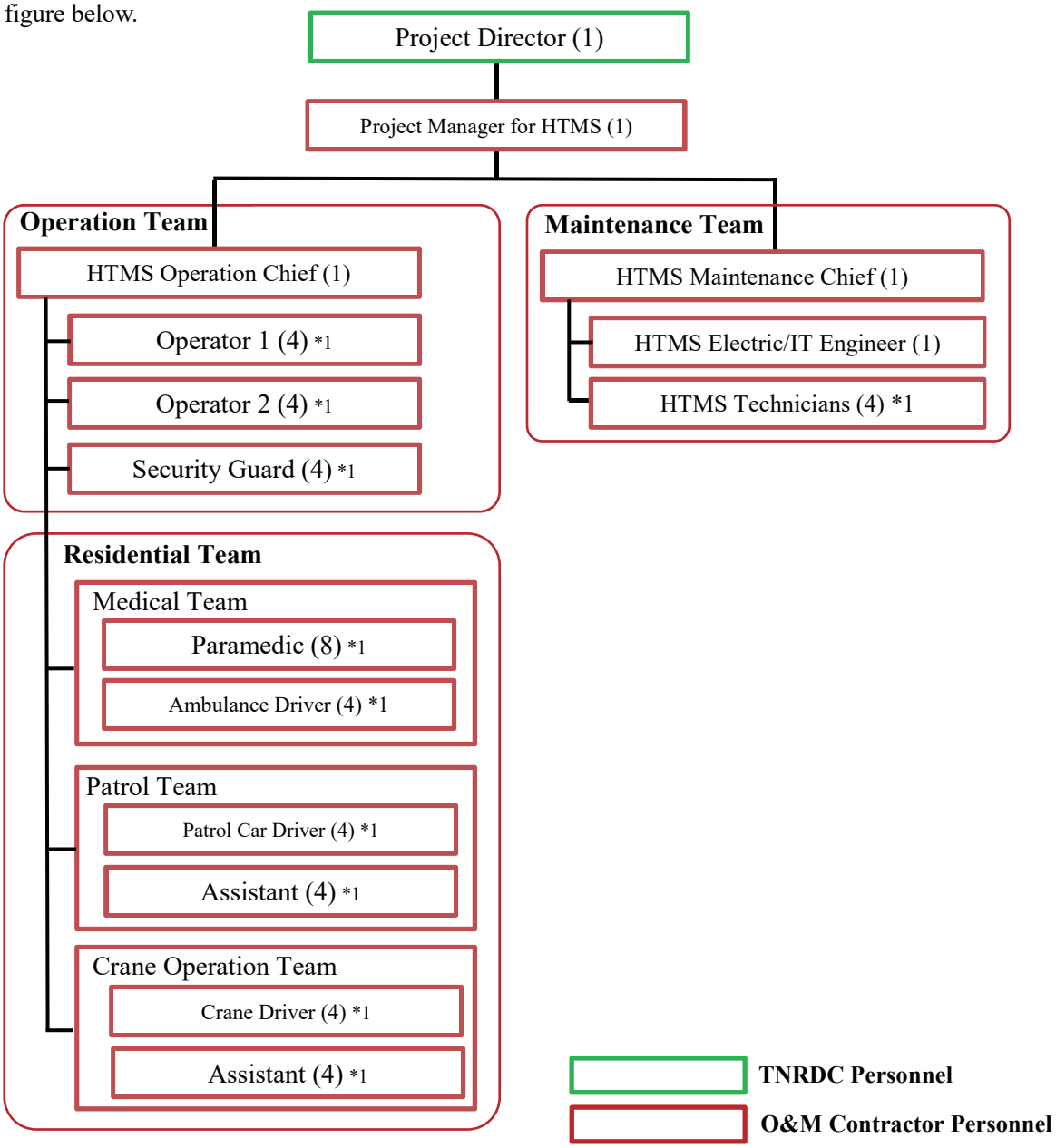
8.2 Operation and Maintenance (O&M) Plan for Chennai Peripheral Ring Road Intelligent Transport System (CPRR ITS)

CPRR ITS has two ITS components, i.e., HTMS and TMS. This clause describes the required ITS O&M structure, roles, number of staff, and their shift arrangement. TNRDC, which is the responsible organization for tender and O&M, intends to hire two different O&M companies for HTMS and TMS, respectively. Therefore, the O&M plans for HTMS and TMS were considered separately.

8.2.1 Highway Traffic Management System (HTMS)

(1) Organizational Structure for O&M of HTMS

The organizational structure for O&M of the HTMS and the required number of staff are shown in the figure below.



*1: The number of staff in the figure above indicates the total number including shifts. The shift plans are described in the subsequent clauses.

Source: JICA Study Team

Figure 8.2.1 Organizational Structure and Number of Staff for O&M of HTMS

The HTMS O&M Team consists of the staff of the O&M contractor which will be formed under the Project Director of TNRDC. All staff of the HTMS O&M Team will work in the Traffic Management Center building.

(2) HTMS: Roles of Staff

The roles of the Project Director, which will be arranged by TNRDC, are shown in the table below.

Table 8.2.1 Roles of the Project Director

Position	Roles
Project Director (TNRDC)	♦ Supervising and controlling all activities of HTMS ♦ Coordinating and handling issues arising among the road maintenance contractor, TMS O&M contractor, HTMS O&M contractor, and other related organisations ♦ Providing data/information to the related organisations upon request ♦ Informing the expected passing time and instructing necessary correspondence to the HTMS O&M Contractor when VIP or military convoy passes through CPRR/TPP Link Road

Source: JICA Study Team

The roles of the staff of the HTMS O&M Team are shown in the table below.

Table 8.2.2 Roles of the Staff of the HTMS O&M Team

Position	Roles	Working Hours
Project Manager for HTMS	♦ Supervising and managing the entire activities of operation and maintenance of HTMS ♦ Coordinating matters arising with the related organizations, especially Chennai Traffic Information Center (CTIC), as necessary ♦ Checking the report generated by the system ♦ Analysing the processed data/information and submitting to the project director as necessary ♦ Maintaining the inventory of the spare parts ♦ Confirming the traffic event, impact of the event on traffic, and the information provided to the users, which are reported by the HTMS Operation Chief ♦ Analysing the statistics of the causalities, transportation time of the injured, and cause of the accident in case the medical team is dispatched; proposing and submitting the measures to the Project Director, as necessary, when the cause of the black spot is identified ♦ Instructing the HTMS maintenance chief to take response when damage to the roadside equipment is reported by the HTMS operation chief ♦ Checking the daily, weekly, monthly, and annual report and submitting them to the project director ♦ Coordinating and handling issues arising between the HTMS operation team and the maintenance team, as necessary ♦ Contacting the system integrator of the HTMS for prompt resolution in case of system failure occurs beyond the handling capacity of the HTMS	Daytime only

	maintenance team	
Operation Team		
HTMS Operation Chief	♦ Supervising and managing the activities of the HTMS operation ♦ Recording the daily events, impact of the events on traffic, and the information provided to the users, the contents of the question-and-answer with the public and related organizations handled by the operators, etc., and reporting them to the HTMS project manager ♦ Preparing the daily, weekly, monthly and annual report and submitting them to the HTMS project manager ♦ Reporting to the HTMS project manager in case damage to the roadside equipment is reported by the patrol team ♦ Requesting the HTMS maintenance chief to take response in case failure is found through the monitor in the Traffic Management Center of HTMS ♦ Preparing the shift plan for the operators, security guards, and residential team every month	Daytime only
Operator 1	♦ Providing information to the government organisations as necessary ♦ Requesting information to be provided by government organisations as necessary ♦ Confirming the details of the traffic event using CCTV in case the Video Incident Detection System (VIDS) detects the event and issues the alarm; requesting Operator 2 to provide the information to the users, if necessary ♦ Confirming the details of the weather condition using CCTV in case any of the visibility, precipitation, or wind speed exceeds the threshold value; requesting Operator 2 to provide information to the users, if necessary ♦ Monitoring the traffic condition on CPRR and TPP Link Road through CCTV on continuously ♦ Reporting to the HTMS operation chief in case significant difference to the traffic volume is found between the image captured by CCTV and the data measured by Automatic Traffic Counter cum Classifier (ATCC) ♦ Preparing the daily report on the activities of the operators ♦ Taking the roles of the Operator 2 when s/he is absent	3 shifts and 1 standby (1 staff for 1 shift with 1 standby party of 1 staff, total of 4 staff)
Operator 2	♦ Providing the necessary information to the users through Variable Message Sign (VMS) and internet as per request made by Operator 1 ♦ Responding to the inquiries from the public and from related government organisations ♦ Confirming and updating the displayed information on the large video wall in the Traffic Management Center of HTMS ♦ Informing the HTMS operation chief in case failure of system or equipment occurs ♦ Asking the HTMS operation chief to request the system integrator to upgrade the system, if necessary ♦ Taking the role of Operator 1 when s/he is absent	3 shifts and 1 standby (1 staff for 1 shift with 1 standby party of 1 staff, total of 4 staff)

Security Guard		• Carrying out security activities for the Traffic Management Center of HTMS, parking lot, and related facilities	3 shifts and 1 standby (1 staff for 1 shift with 1 standby party of 1 staff, total of 4 staff)
Residential Team			
Medical Team	Paramedic	• Scrambling to the site in an ambulance in case accidents with casualties is reported to the Traffic Management Center of HTMS • Carrying out rescue activities for the casualties on the site • Informing the conditions of the casualties to the medical institution • Providing first aid for the casualties while rushing them in an ambulance to the medical aid post or medical institution • Recording the condition of the accident and casualties on the daily report and reporting it to the HTMS operation chief	3 shifts and 1 standby (2 staff for 1 shift with 1 standby party of 2 staff, total of 8 staff)
	Ambulance Driver	• Driving the ambulance • Working together with the paramedic and assisting them consistently	3 shifts and 1 standby (1 staff for 1 shift with 1 standby party of 1 staff, total of 4 staff)
Patrol Team	Patrol Car Driver	• Scrambling to the site in case an accident, fallen object, broken-down vehicle, etc., is reported to the Traffic Management Center of HTMS • Closing the traffic lane, if necessary • Patrolling the CPRR and TPP Link Road according to the determined times of the patrol per day • Contacting the traffic police when the accident occurs • Contacting the medical team when there are casualties • Contacting the fire department when there is fire • Confirming the damage to the equipment caused by the accident and reporting to the HTMS operation chief, as necessary • Recording the time of occurrence, clearance time, cause and effect of the event, and lane regulating time, and reporting them to the HTMS operation chief	3 shifts and 1 standby (1 staff for 1 shift with 1 standby party of 1 staff, total of 4 staff)
	Assistant	• Working together with the patrol car driver and assisting her/him consistently	3 shifts and 1 standby (1 staff for 1 shift with 1 standby party of 1 staff, total of 4 staff)

Crane Team	Crane Driver	• Scrambling to the site upon request to dispatch a crane in such occasions as the occurrence of accidents, fallen object, broken-down vehicles, etc. • Securing smooth traffic flow by removing the stopped vehicles, fallen objects, etc., to the shoulder or outside the main carriageway of CPRR/TPP Link Road • Recording the operating time, causes, types of event, and reporting them to the HTMS operation chief	3 shifts and 1 standby (1 staff for 1 shift with 1 standby party of 1 staff, total of 4 staff)
	Assistant	• Working together with the crane driver and assisting her/him consistently	3 shifts and 1 Standby (1 staff for 1 shift with 1 standby party of 1 staff, total of 4 staff)
Maintenance Team			
HTMS Maintenance Chief		• Supervising and managing the activities of the HTMS maintenance team • Dispatching the HTMS electric/IT engineer when receiving information on failure or damage of system/equipment if necessary • Preparing the preventive maintenance inspection plan and submitting them to the HTMS project manager • Preparing the maintenance work report and submitting them to the HTMS project manager • Preparing the shift arrangement plan of HTMS technicians every month	Daytime only
HTMS Electric/IT Engineer		• Carrying out the preventive maintenance inspection • Repairing the equipment and systems in case of failure • Replacing the malfunctioning equipment/parts, if necessary	Daytime only
HTMS Technicians		• Assisting the HTMS electric/IT engineer • Managing the inventory of the spare parts	3 shifts and 1 standby (1 staff for 1 shift with 1 standby party of 1 staff, total of 4 staff)

Source: JICA Study Team

(3) Shift Arrangement for HTMS O&M Team

HTMS shall function for 24 hours a day and 7 days a week. Thus, the operators, the security guard, the staff for residential team, and the HTMS technicians shall be arranged in three shifts and one party as standby. The table below shows an example of the shift arrangement for the HTMS O&M Team.

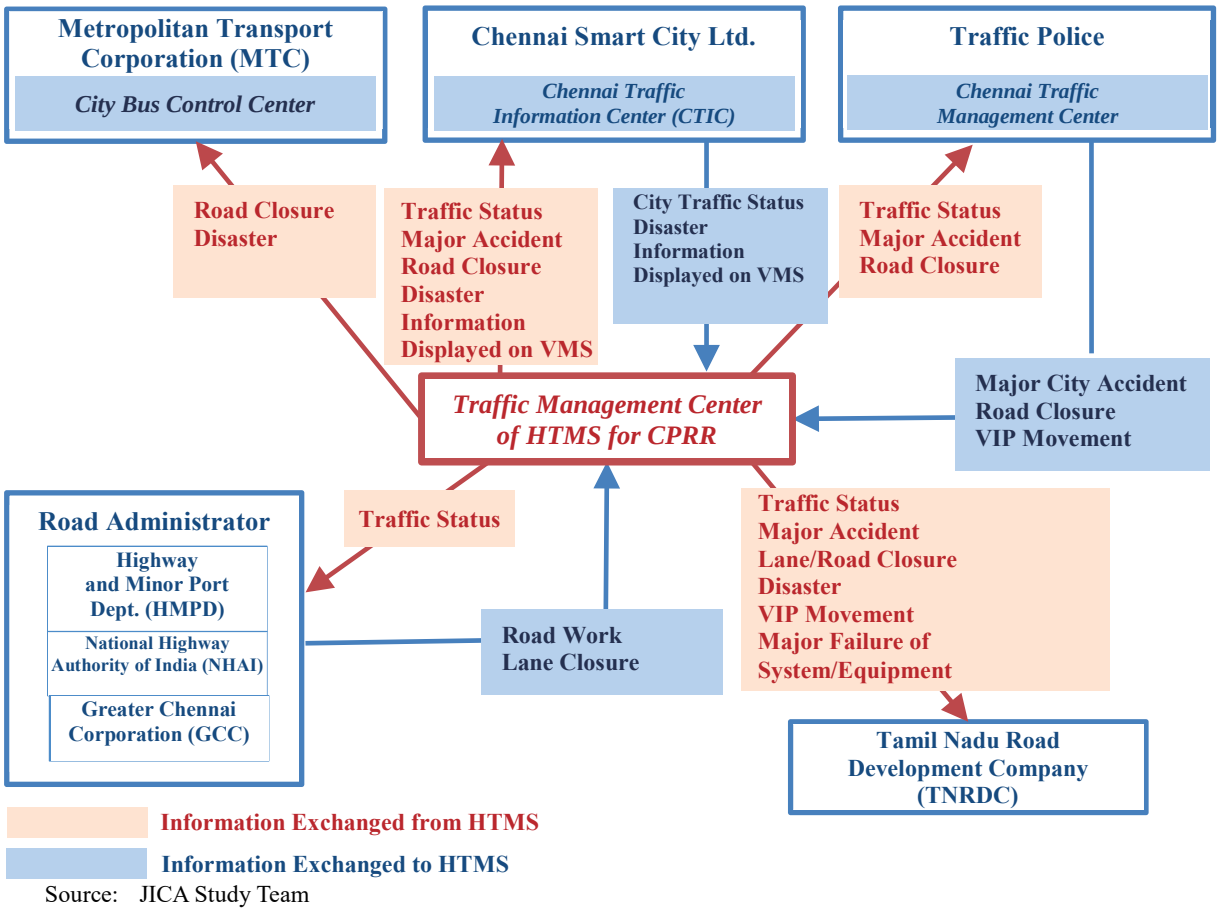
Table 8.2.3 Example of Shift Arrangement of HTMS O&M Team

Group	Shift-1 (06:00-14:00)	Shift-2 (14:00-22:00)	Shift-3 (22:00-06:00)	Remarks
Party 1	On-duty	Off-duty	Off-duty	
Party 2	Off-duty	On-duty	Off-duty	
Party 3	Off-duty	Off-duty	On-duty	
Party 4	Off-duty	Off-duty	Off-duty	Stand By

Source: JICA Study Team

(4) Collaboration with Other Related Organizations in the Transport Sector in Chennai

The planned route of CPRR will connect industrial parks in the suburbs, such as Oragadam and Mahindra World City, and the ports, such as Ennore Port and Kattupalli Port, and will contribute to the mitigation of the incoming flow of large vehicles into the city. The coordination of traffic information between CPRR ITS and City ITS and the collaboration with related organisations are vitally important to control the traffic flow, maximizing the efficient use of the road network in Chennai. The figure below shows the examples of information exchange between CPRR ITS, i.e., Traffic Management Center of HTMS, and the related organisations. The collaboration shall be executed among the related organisations and centers in Chennai as shown below.



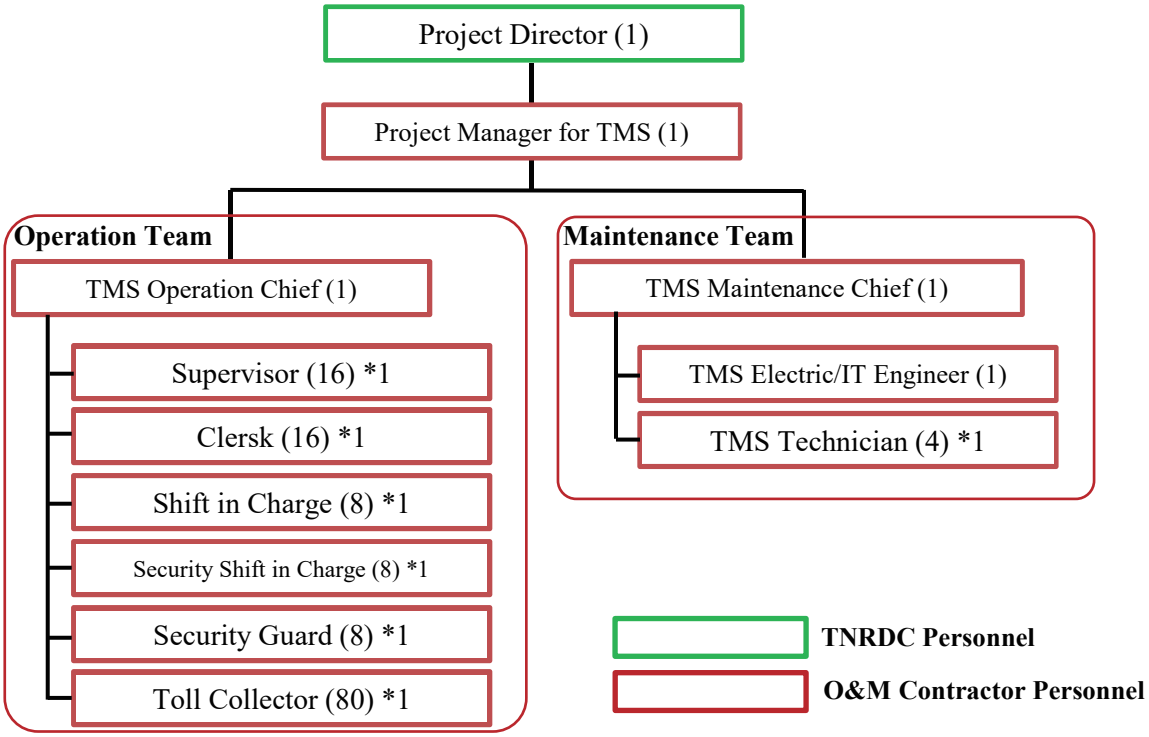
Source: JICA Study Team

Figure 8.2.2 Examples of Information Exchange between Traffic Management Center of HTMS for CPRR and Related Organizations

8.2.2 Toll Management System (TMS)

(1) Organizational Structure for O&M of TMS

The organisational structure for the O&M of TMS and the required number of staff are shown below.



*1: The number of staff in the figure above indicates the total number including the shifts. The shift plans are described in the subsequent clauses.

Source: JICA Study Team

Figure 8.2.3 Organization Structure and Number of Staff for O&M of TMS

The TMS O&M Team consists of the staff of the O&M contractor, which will be formed under the project director of TNRDC. All the staff of the TMS O&M will work in the two toll plazas.

(2) Required Number of Staff and Shift Arrangement for O&M of TMS

The required number of staff and the shift arrangement for the O&M of TMS for two toll plazas are summarised in the table below.

Table 8.2.4 Required Number of Staff and Shift Arrangement for O&M of TMS for Two Toll Plazas

Position	Required Number of Staff for 2 Toll Plazas		Shift Arrangement
	Toll Plaza	For Entry and Exit Lanes	
Project Manager for TMS	1 staff		Daytime work
TMS Operation Chief	1 staff		Daytime work
Supervisor		16 staff	1 staff for entry gate and 1 staff for exit gate for 1 shift, 3 shifts per day with 1 standby party of 2 staff, total of 16 staff for two toll plazas
Clerk	16 staff		2 staff for 1 shift, 3 shifts per day with 1 standby party of 2 staff, total of 16 staff for two toll plazas
Shift In-Charge	8 staff		1 staff for 1 shift, 3 shifts per day and 1 standby party of 1 staff, total of 8 staff for two toll plazas
Security Shift In-Charge	8 staff		1 staff for 1 shift, 3 shifts per day and 1 standby party of 1 staff, total of 8 staff for two toll plazas
Security Guard	8 staff		1 staff for 1 shift, 3 shifts per day and 1 standby party of 1 staff, total of 8 staff for two toll plazas
Toll Collector		80 staff	10 staff for 1 shift (8 staff for on duty and 2 staff for standby), 3 shifts per day and 1 standby party of 10 staff, total of 80 staff for two toll plazas (no staff is assigned to ETC lane)
TMS Maintenance Chief	1 staff		Daytime work and on call at night
TMS Electric/IT Engineer	1 staff		Daytime work and on call at night
TMS Technicians	4 staff		1 staff for 1 shift, 3 shifts per day and 1 standby party of 1 staff, total of 4 staff
Total	48 staff	96 staff	
Grand Total	144 staff		

Source: JICA Study Team

(3) TMS: Roles of Staff

The roles of the Project Director which will be arranged by TNRDC are shown in the table below.

Table 8.2.5 Roles of the Project Director

Position	Roles and Responsibilities
Project Director (TNRDC)	♦ Supervising and controlling all activities of TMS ♦ Coordinating and handling the issues raised among the road maintenance contractor, HTMS O&M contractor, TMS O&M contractor, and other related organisations ♦ Providing data/information to the related organisations based on request ♦ Informing the expected passing time and instructing the necessary correspondence to the TMS O&M Contractor when VIP or military convoy passes through CPRR

Source: JICA Study Team

The roles of staff of TMS O&M Team are shown in the table below.

Table 8.2.6 Roles of Staff of TMS O&M Team

Position	Roles	Working Hours
Project Manager for TMS O&M	♦ Supervising and managing the entire activities of operation and maintenance of TMS ♦ Coordinating matters arising with the related organisations as necessary ♦ Checking the report generated by the system ♦ Analysing the processed data/information and submitting to the project director as necessary ♦ Maintaining the inventory of the spare parts ♦ Auditing and confirming daily the amount of the collected toll reported by the TMS operation chief ♦ Instructing the TMS maintenance chief to respond in case damage to the toll plaza facilities is reported ♦ Checking the daily, weekly, monthly, and annual reports and submitting them to the project director ♦ Coordinating and handling issues arising between the TMS operation team and maintenance team as necessary ♦ Contacting the system integrator of the TMS for prompt resolution in case system failure occurs, beyond the handling capacity of the TMS maintenance team	Daytime only
Operation Team		
TMS Operation Chief	♦ Supervising and managing the activities of the TMS operation team ♦ Auditing, confirming, and recording daily the amount of collected toll and the content of the correspondence made by the toll collector for the users, and reporting them to the TMS project manager ♦ Preparing the daily, weekly, monthly, annual reports and submitting them to the TMS project manager ♦ Requesting the TMS maintenance chief to respond in case failure is	Daytime only

	found through the center monitor or is reported by the toll collector • Preparing the shift arrangement plan for the supervisor, clerk, and security shift in-charge every month	
Supervisor	• Supervising the activities of toll collectors at the toll gate • Taking necessary actions at the site in case special vehicles such as VIP, convoy, etc., pass the toll gate • Taking necessary actions on site in such cases as illicit payment, damages to the toll gate facilities, driver complaints, etc. • Confirming the amount of the collected toll when the toll collector completes her/his shift • Report system failure to the TMS operation chief immediately upon receipt of the failure report from the toll collector • Preparing the shift arrangement plan for the toll collectors every month • During the night shift, one of the supervisors takes on the role of the TMS operation chief • Preparing the daily report on her/his own assigned work	3 shifts and 1 standby
Clerk	• Calculating and confirming the amount of the collected toll for both cash and ETC • Selling the RFID tag in the POS room at the toll plaza • Reporting the total amount of sales of the RFID tag and the collected toll to the TMS operation chief • Preparing the daily report on her/his assigned work	3 shifts and 1 standby
Security Shift In-Charge	• Supervising the activities of the security guard • Preparing the shift arrangement plan for the security guard every month • Preparing the daily report on the assigned work	3 shifts and 1 standby
Security Guard	• Carrying out the security activities at toll plazas and parking lots, and securing the collected toll amount, etc.	3 shifts and 1 Standby
Toll Collector	• Collecting toll fees at the toll booth • Determining the vehicle type which passes the gate and inputting it on the monitor installed at the toll booth • Reporting the amount of collected toll to the Supervisor • Reporting to the Supervisor in case equipment/system failure occurs • Closing the toll gate when necessary • Preparing the daily report on her/his assigned work	3 shifts and 1 standby
Maintenance Team		
TMS Maintenance Chief	• Supervising and managing the activities of the TMS maintenance team • Dispatching the TMS electric/IT engineer as necessary in case failure or damage to the equipment/system is reported • Preparing the preventive maintenance inspection plan and submitting it	Daytime only

	to the TMS project manager • Preparing the maintenance work report and submitting it to the TMS project manager	
TMS Electric/IT Engineer	• Carrying out the preventive maintenance inspection • Repairing the equipment and systems in case of failure • Replacing the malfunctioning equipment/parts if necessary	Daytime only
TMS Technicians	• Assisting the TMS electric/IT engineer • Managing the inventory of the spare parts	3 shifts and 1 standby

Source: JICA Study Team

(4) Shift Arrangement for the TMS O&M Team

The Toll Management System (TMS) shall function for 24 hours a day and seven days a week. Thus, some positions of the TMS O&M Team shall be arranged in three shifts and one party as standby. The table below shows an example of a shift arrangement for the TMS O&M Team.

Table 8.2.7 Example of Shift Arrangement of TMS O&M Team

Group	Shift-1 (06:00-14:00)	Shift-2 (14:00-22:00)	Shift-3 (22:00-06:00)	Remarks
Party 1	On-duty	Off-duty	Off-duty	
Party 2	Off-duty	On-duty	Off-duty	
Party 3	Off-duty	Off-duty	On-duty	
Party 4	Off-duty	Off-duty	Off-duty	Stand By

Source: JICA Study Team

(5) Toll Fare System (Distance Based Toll Collection) and Toll Collection Method

As a result of discussions with TNRDC, it was decided to adopt Distance Based Toll Collection as the toll fare system based on the TNRDC policy for the target section of the Project. It was also agreed with TNRDC that toll barriers will be installed at two locations, i.e., on the west side of CPRR main carriageway and on TPP Link Road, with consideration of the following matters:

- A part of the toll plaza to be constructed should be on the embankment.
- Sufficient space should be secured next to a toll plaza for the toll plaza building and parking.
- Enough space for the toll plaza square should be secured.
- The longitudinal gradient should be less than 3%.
- A certain distance should be secured from the edge of the toll plaza square to the entrance/exit ramp.
- The distance between the grade junction point and the taper end of toll plaza square should be more than 600 m (by IRC).

The Distance Based Toll Collection method was considered for cash and ETC payments, on the condition that two toll barriers will be constructed. The explanatory image for consideration is shown in Figure 8.2.4, where the letters A, B, C, and D are given to explain the relation between the traveling section of vehicles and the toll fare for each case where E and F represent Toll Barriers on CPRR and TPP Link Road, respectively. The results of the consideration for the toll collection method are shown in Table 8.2.8 and Table 8.2.9.

There are many entrance/exit ramps where the vehicles can enter the target section for free from the parallel service roads. The toll fare for these vehicles is also compiled in Table 8.2.8 and Table 8.2.9.

Source: JICA Study Team

Figure 8.2.4 Explanatory Figure for Toll Collection Method and Location of Toll Plazas

1) Toll Collection Method by Cash

Toll collection method by cash for each case of vehicle traveling is shown in the table below.

Table 8.2.8 Cash Collection: Toll Collection Method for Each Case of Vehicle Traveling

End / Start	A	B	C
A	-	● Toll collectors receive toll fare for distance AC from all vehicles at the entrance of Toll Plaza E and issue receipts to drivers. ● Toll collectors check whether drivers have receipts at the exit of Toll Plaza F before allowing them to pass through. If there are no receipts, drivers pay toll fare for distance CD+DB. ● Amount: AC	● Toll collectors receive toll fare for distance AC from all vehicles at the entrance of Toll Plaza E and issue receipts to drivers. ● Amount: AC
B	● Toll collectors receive toll fare for distance BD+DC from all vehicles at the entrance of Toll Plaza F and issue a receipt to drivers. ● Toll collectors check whether drivers have receipts at the exit of Toll Plaza E. For vehicles with receipts, drivers pay toll fare for distance AD-DC (the difference between AD and DC). Otherwise, drivers pay toll fare for distance AC. ● Amount: BD+DA	-	● Toll collectors collect toll fare for the distance of BD+DC at the entrance of Toll Plaza F for all vehicles. ● Amount: BD+DC
C	● Toll collectors receive toll fare for distance CA at the exit of Toll Plaza E. There are no vehicles with receipts. ● Amount: CA	● Toll collectors receive toll fare for distance CD+DB at the exit of Toll Plaza F. There are no vehicles with receipts. ● Amount: CD+DB	-

Source: JICA Study Team

In the table, the Distanced Based Toll Collection method is allowed for all cases of traveling, except for the case of A to B. Precisely speaking, the toll fare for distance AB will be more than that of the actual charge that is equivalent to about 2 km for the difference between DC and DB as shown in Figure 8.2.4. The

difference needs to be refunded by toll collectors manually at Toll Plaza F in order to resolve this issue, but this may cause traffic congestion at the gate. Thus, this difference was judged to be acceptable by TNRDC, and it was agreed with TNRDC to adopt the toll collection method above.

2) Toll Collection Method by ETC

Toll collection method by ETC for each case of vehicle traveling is shown in the table below.

Table 8.2.9 ETC: Toll Collection Method for Each Case of Vehicle Traveling

End / Start	A	B	C
A	-	● Aerials installed at both Toll Plazas E and F detect Tag ID as vehicles enter and exit. The toll fare for the traveled distance will be charged by the Clearing House. ● Amount: AD+DB	● Aerials installed at Toll Plaza E detect Tag ID when vehicles enter, but there are no exit records; thus, the traveled section will be determined as distance AC. The toll fare for this distance will be charged by the Clearing House. ● Amount: AC
B	● Aerials installed at both Toll Plazas E and F detect Tag ID as vehicles enter and exit. The toll fare for the traveled distance will be charged by the Clearing House. ● Amount: BD+DA	-	● Aerials installed at Toll Plaza F detect Tag ID when vehicles enter, but no exit records exist; thus, the traveled section will be determined as distance BC. The toll fare for the traveled distance will be charged by the Clearing House. ● Amount: BD+DC
C	● Aerials installed at Toll Plaza E detect Tag ID when vehicles exit. The traveled section will be determined as distance CA since there are no entry records, and the toll fare for the traveled distance will be charged by the Clearing House. ● Amount: CD+DA	● Aerials installed at Toll Plaza F detect Tag ID when vehicles exit. The traveled section will be determined as distance CB since there are no entry records, and the toll fare for the traveled distance will be charged by the Clearing House. ● Amount: CD+DB	-

Source: JICA Study Team

As for ETC, Distance Based Toll Collection is available for all cases.

CHAPTER 9 PROCUREMENT PLAN, CONSTRUCTION PLAN, AND COST ESTIMATE

9.1 Review of DPR Cost Estimate (All Sections)

9.1.1 Target of Review

Cost estimates in the Detailed Project Report (DPR) available at the time of review are provided as follows.

DPR VOLUME VIII [COST ESTIMATE] / Rev: R0 (Submission for Approval on 09 January 2017)

The main report of DPR and Volume VIII [Cost Estimate] is not consistent with the contents and the results of the cost estimate. Therefore, Volume VIII, which was published in a new period, is regarded as a review subject in this study. It is noted that the Intelligent Transport System (ITS) component is not included in the breakdown of Volume VIII, as described in 9.2.1.

Table 9.1.1 Component and Cost Estimate in DPR

Unit: crore

	Total Civil Construction Cost	Land Acquisition Cost	Other Cost	Total Cost
Main Report	6,175	4,855	921 / for ITS component cost	12,301
			350 / Minjur Bypass	
Volume VIII	**6,508**	**4,951**	**68 / for Utility Shifting**	**11,528**

Source: DPR, summarised by JICA Study Team

9.1.2 Summary of Project Cost in DPR

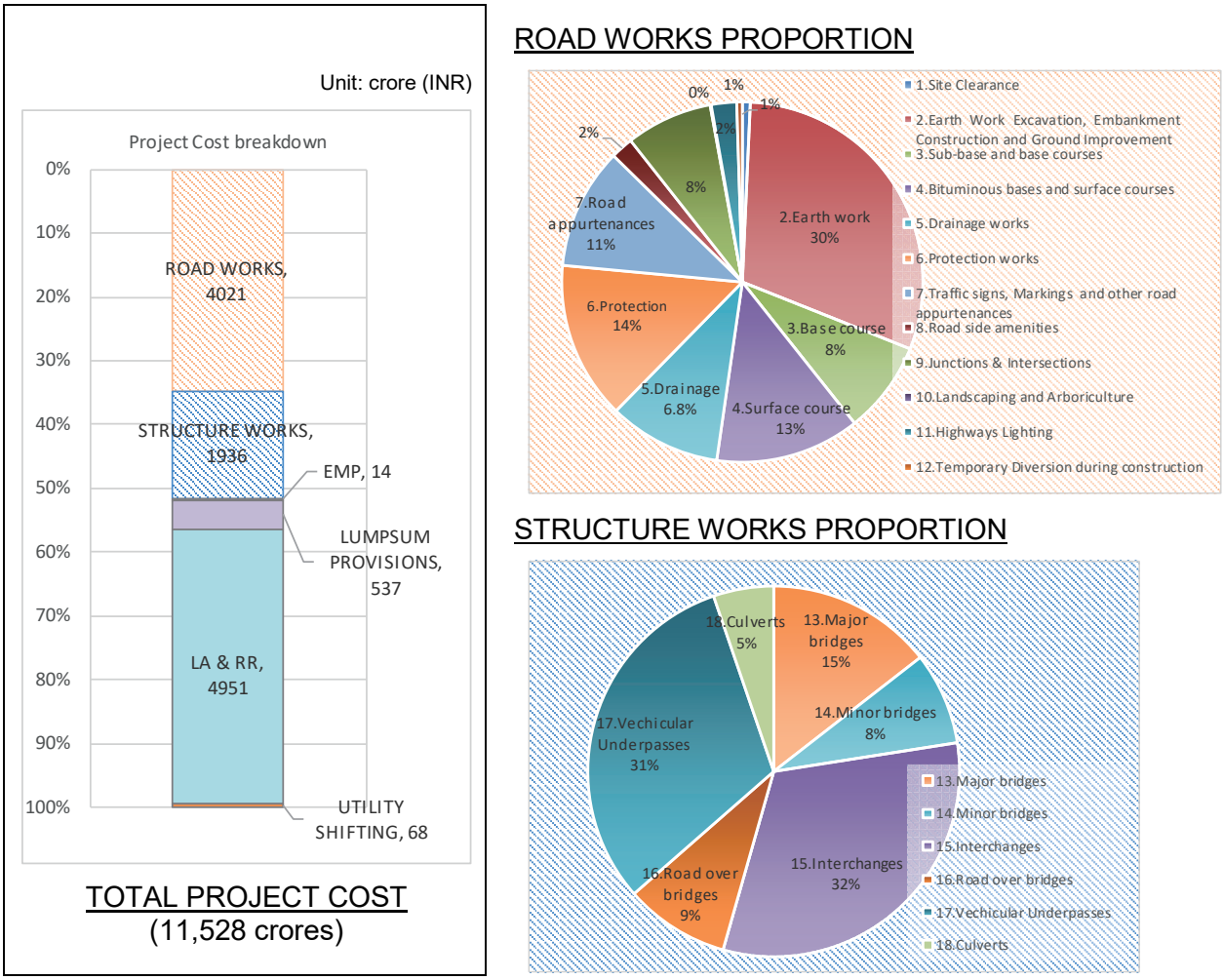
Table 9.1.2 Summary of Civil Work Direct Cost

Bill Nos.	Description	Total in INR	%
A	**ROAD WORKS**	**40,210,372,627**	67%
1	Site clearance	284,592,656	0%
2	Earthwork excavation, embankment construction, and ground improvement	12,198,573,710	20%
3	Sub-base and base courses	3,331,745,672	6%
4	Bituminous bases and surface courses	5,204,298,360	9%
5	Drainage works	4,042,577,426	7%
6	Protection works	5,693,320,374	10%
7	Traffic signs, markings, and other road appurtenances	4,375,290,564	7%
8	Road side amenities	809,595,539	1%
9	Junctions and intersections	3,119,450,566	5%
10	Landscaping and arboriculture	38,289,570	0%
11	Highways lighting	912,586,585	2%
12	Temporary diversion during construction	200,051,605	0%
B	**STRUCTURES**	**19,357,114,231**	32%
13	Major bridges	2,798,518,388	5%
14	Minor bridges	1,559,810,833	3%
15	Interchanges	6,171,345,278	10%
16	Road over bridges	1,768,355,375	3%
17	Vehicular underpasses	6,043,789,411	10%
18	Culverts	1,015,294,946	2%
C	**EMP**		
19	Cost for EMP implementation	**140,005,800**	0%
	Construction Cost Total (A)+(B)+(C)	**59,707,492,658**	**100%**

Source: DPR VOLUME VIII

9.1.3 Sharing Ratio of DPR Project Cost

The construction cost ratio for each type of work is shown below.



Source: DPR summarised by JICA Study Team

Figure 9.1.1 Project Cost Proportion of DPR

Table 9.1.3 Cost Summary, Section 1 to 5 in DPR

Bill Nos.	Description	Section 1			Section 1 Link			Section 1 Total			Section 2			Section 3			Section 4			Section 5			Total in Rs.		
A	**ROAD WORKS**																							
1	Site Clearance	6,205,789	0%	0%	3,129,327	0%	0%	9,335,116	0%	0%	7,040,177	0%	0%	42,930,340	0%	0%	215,319,269	4%	6%	9,967,754	0%	0%	284,592,656	0%	1%
2	Earth Work Excavation, Embankment Construction and Ground Improvement	2,658,819,921	28%	42%	515,951,318	27%	45%	3,174,771,239	28%	42%	3,182,121,176	23%	31%	2,402,857,548	14%	26%	885,525,601	16%	24%	2,553,298,146	21%	27%	12,198,573,710	20%	30%
3	Sub-base and base courses	468,985,026	5%	7%	106,533,932	5%	9%	575,518,958	5%	8%	688,613,804	5%	7%	852,522,952	5%	9%	408,615,290	7%	11%	806,474,668	6%	9%	3,331,745,672	6%	8%
4	Bituminous bases and surface courses	718,252,758	8%	11%	164,631,918	8%	14%	882,884,676	8%	12%	1,137,253,287	8%	11%	1,227,903,635	7%	13%	875,446,555	16%	24%	1,080,810,207	9%	11%	5,204,298,360	9%	13%
5	Drainage works	329,528,750	4%	5%	41,707,610	2%	4%	371,236,360	3%	5%	1,244,880,050	9%	12%	1,205,553,510	7%	13%		0%	0%	1,220,907,506	10%	13%	4,042,577,426	7%	10%
6	Protection works	698,194,135	7%	11%	33,749,642	2%	3%	731,943,777	6%	10%	2,049,936,401	15%	20%	1,460,113,489	9%	16%		0%	0%	1,451,326,707	12%	15%	5,693,320,374	10%	14%
7	Traffic signs, Markings and other road appurtenances	742,981,737	8%	12%	164,784,523	8%	14%	907,766,260	8%	12%	940,785,096	7%	9%	946,434,615	6%	10%	534,294,546	10%	15%	1,046,010,047	8%	11%	4,375,290,564	7%	11%
8	Road side amenities	172,854,054	2%	3%	21,374,351	1%	2%	194,228,405	2%	3%	198,588,934	1%	2%	212,465,283	1%	2%		0%	0%	204,312,917	2%	2%	809,595,539	1%	2%
9	Junctions & Intersections	355,488,357	4%	6%	44,485,521	2%	4%	399,973,878	4%	5%	709,633,011	5%	7%	650,134,382	4%	7%	548,027,495	10%	15%	811,681,800	7%	9%	3,119,450,566	5%	8%
10	Landscaping and Arboriculture	7,875,500	0%	0%	1,538,650	0%	0%	9,414,150	0%	0%	7,728,480	0%	0%	8,345,520	0%	0%	5,346,720	0%	0%	7,454,700	0%	0%	38,289,570	0%	0%
11	Highways Lighting	163,791,154	2%	3%	32,969,802	2%	3%	196,760,956	2%	3%	144,003,244	1%	1%	195,668,296	1%	2%	160,880,678	3%	4%	215,273,411	2%	2%	912,586,585	2%	2%
12	Temporary Diversion during construction	31,614,886	0%	0%	5,654,283	0%	0%	37,269,169	0%	0%	51,552,918	0%	0%	46,024,648	0%	0%	18,167,281	0%	0%	47,037,589	0%	0%	200,051,605	0%	0%
	Sub Total (A)	**6,354,592,067**	68%	**100%**	**1,136,510,877**	58%	**100%**	**7,491,102,944**	66%	**100%**	**10,362,136,578**	75%	**100%**	**9,250,954,218**	55%	**100%**	**3,651,623,435**	66%	**100%**	**9,454,555,452**	76%	**100%**	**40,210,372,627**	67%	**100%**
B	**STRUCTURES**																							
13	Major bridges	1,143,351,126	12%	38%		0%	0%		0%	0%	833,420,293	6%	25%	821,746,969	5%	11%		0%	0%		0%	0%	2,798,518,388	5%	14%
14	Minor bridges	96,658,172	1%	3%	14,545,716	1%	2%	111,203,888	1%	3%	356,306,865	3%	11%	24,851,294	0%	0%		0%	0%	1,067,448,786	9%	37%	1,559,810,833	3%	8%
15	Interchanges		0%	0%		0%	0%		0%	0%	798,328,752	6%	24%	4,913,149,207	29%	66%		0%	0%	459,867,319	4%	16%	6,171,345,278	10%	32%
16	Road over bridges	625,768,997	7%	21%	620,152,504	32%	77%	1,245,921,501	11%	33%		0%	0%	522,433,874	3%	7%		0%	0%		0%	0%	1,768,355,375	3%	9%
17	Vechicular Underpasses	850,398,342	9%	28%	132,055,576	7%	16%	982,453,918	9%	26%	1,076,374,301	8%	32%	913,207,670	5%	12%	1,866,531,163	34%	100%	1,205,222,359	10%	41%	6,043,789,411	10%	31%
18	Culverts	277,079,095	3%	9%	37,722,911	2%	5%	314,802,006	3%	8%	281,602,016	2%	8%	228,022,862	1%	3%		0%	0%	190,868,062	2%	7%	1,015,294,946	2%	5%
	Sub Total (B)	**2,993,255,732**	32%	**100%**	**804,476,707**	41%	**100%**	**3,797,732,439**	34%	**100%**	**3,346,032,227**	24%	**100%**	**7,423,411,876**	44%	**100%**	**1,866,531,163**	34%	**100%**	**2,923,406,526**	24%	**100%**	**19,357,114,231**	32%	**100%**
C	**EMP**																							
19	Cost for EMP implementation	**24,290,569**	0%		**4,892,981**	0%		**29,183,550**	0%		**23,856,800**	0%		**36,241,150**	0%		**20,705,300**	0%		**30,019,000**	0%		**140,005,800**	0%	
	Construction Cost Total (A)+(B)+(C)	**9,372,138,368**	**100%**		**1,945,880,565**	**100%**		**11,318,018,933**	**100%**		**13,732,025,605**	**100%**		**16,710,607,244**	**100%**		**5,538,859,898**	**100%**		**12,407,980,978**	**100%**		**59,707,492,658**	**100%**	
	Say in Crores	**937**			**195**			**1,132**			**1,373**			**1,671**			**554**			**1,241**			**5,971**		
D	**LUMPSUM PROVISIONS**																							
20	Project Management charges at 4 % on Construction cost	374,885,535			77,835,223			452,720,758			549,281,024			668,424,290			221,554,396			496,319,239			2,388,299,707		
21	Labour Welfare fund@1.0 %	93,721,384			19,458,806			113,180,190			137,320,256			167,106,072			55,388,599			124,079,810			597,074,927		
22	Quality Control at 1%	93,721,384			19,458,806			113,180,190			137,320,256			167,106,072			55,388,599			124,079,810			597,074,927		
23	Contingencies at 3.0%	281,164,151			58,376,417			339,540,568			411,960,768			501,318,217			166,165,797			372,239,429			1,791,224,779		
	Total (D)	**843,492,454**			**175,129,252**			**1,018,621,706**			**1,235,882,304**			**1,503,954,651**			**498,497,391**			**1,116,718,288**			**5,373,674,340**		
	Total (A+B+C+D)	**10,215,630,822**			**2,121,009,817**			**12,336,640,639**			**14,967,907,909**			**18,214,561,895**			**6,037,357,289**			**13,524,699,266**			**65,081,166,998**		
	Say in Crores	**1,022**			**212**			**1,234**			**1,497**			**1,821**			**604**			**1,352**			**6,508**		
E	**LA & RR**																							
24	Land Acquisition	9,988,052,569			2,011,947,431			12,000,000,000			3,950,000,000			22,650,000,000						9,950,000,000			48,550,000,000		
25	Resettlement & Rehabilitation Cost	202,642,744			40,819,424			243,462,168			67,504,770			408,399,675						243,462,168			962,828,781		
	Sub Total (E)	**10,190,695,313**			**2,052,766,855**			**12,243,462,168**			**4,017,504,770**			**23,058,399,675**						**10,193,462,168**			**49,512,828,781**		
F	**UTILITY SHIFTING**																							
26	TANGEDCO Cost	179,255,200			63,851,040			243,106,240			78,112,842			85,767,158						79,255,200			486,241,440		
27	TWAD Cost	26,738,600			5,347,720			32,086,320			15,575,074			18,052,926						26,738,600			92,452,920		
28	BSNL Cost	22,758,570			4,551,714			27,310,284			21,872,087			25,351,737						22,758,570			97,292,678		
		228,752,370			**73,750,474**			**302,502,844**			**115,560,003**			**129,171,821**						**128,752,370**			**675,987,038**		
	GRAND TOTAL (A+B+C+D+E+F)	**20,635,078,505**			**4,247,527,146**			**24,882,605,651**			**19,100,972,682**			**41,402,133,391**			**6,037,357,289**			**23,846,913,804**			**115,269,982,817**		
	Say in Crores	**2,064**			**425**			**2,489**			**1,910**			**4,140**			**604**			**2,385**			**11,528**		

Source: DPR summarised by JICA Study Team

9.1.4 Establishment of Work Item and Application Status to Each Section

Work items that are set with unit prices in the DPR are diverse. There are 470 types in total as follows.

Table 9.1.4 Work Items and Application Status of Each Section

Bill No.		Typical Item	No. of Item	Applied in Each Section					
				1	Link	2	3	4	5
1	Site clearance	Clearing and grubbing of land, cutting of trees	10	✓	✓	✓	✓	✓	✓
2	Earthwork excavation, embankment construction, and ground improvement	Excavation, embankment, subgrade geotextile	5	✓	✓	✓	✓	✓	✓
3	Sub-base and base courses	Granular sub-grade, graded stone aggregate	3	✓	✓	✓	✓	✓	✓
4	Bituminous bases and surface courses	Primer coat, tack coat, dense graded bituminous macadam, bituminous concrete	5	✓	✓	✓	✓	✓	✓
5	Drainage	Brick lined drain masonry, surface lined pitched drain, shoulder drain, vertical drain	10	✓	✓	✓	✓		✓
6	Protection works (retaining wall)	Excavation, reinforced/plain cement concrete, reinforced bar	6	✓	✓	✓	✓		✓
7	Traffic signs, markings, and other road appurtenances	Footpath, kerb, informatory stone, pavement marking, sign board, delineator, metal beam barrier	20	✓	✓	✓	✓	✓	✓
8A	Road side amenities (truck parking)	Earthwork, pavement, pole, street light	25	✓	✓	✓	✓		✓
8B	Road side amenities (entry and exit ramps)	Earthwork, pavement, pole, street light	23	✓	✓	✓	✓		✓
8C	Road side amenities (rest area)	Earthwork, pavement, pole, street light, turfing, planting trees	34	✓		✓	✓		✓
9A	Junctions and intersections (junctions)	Earthwork, pavement, pole, street light	31	✓	✓	✓	✓	✓	✓
9B	Junctions and intersections (intersections)	Earthwork, pavement, pole, street light	29	✓		✓	✓	✓	✓
10	Landscaping and arboriculture	Planting of trees and maintenance	2	✓	✓	✓	✓	✓	✓
11	Highways lighting	Pole, LED light, control system	5	✓	✓	✓	✓	✓	
12	Temporary diversion during construction	Temporary diversion during construction	1	✓	✓	✓	✓	✓	✓
13	Structures - major bridge	RCC pile, sub-structure, super-structure, protection work, approach portion	42	✓		✓	✓		
14 A	Structures - minor bridge in major bridge portion	RCC pile, sub-structure, super-structure, protection work	25			✓			
14 B	Structures - minor bridge	RCC pile, sub-structure, super-structure, protection work	29	✓		✓	✓		✓
14 C	Structures - minor bridge box type	Earthwork, plain/reinforced cement concrete, rebar	15		✓	✓			
15	Structures - interchanges	Earthwork, plain/reinforced cement concrete, rebar	39			✓	✓		✓
16	Structures - Railway Over Bridge (ROB)	Earthwork, plain/reinforced cement concrete, geotextile, high strength flexible geogrids, steel structure	18	✓	✓		✓		
17 A	Structures - vehicular underpasses (major bridge portion)	Earthwork, pile, plain/reinforced cement concrete, PVC pipes, RE wall	29			✓			

Bill No.		Typical Item	No. of Item	Applied in Each Section					
				1	Link	2	3	4	5
17 B	Structures - vehicular underpasses	Earthwork, pile, plain/reinforced cement concrete, PVC pipes, geotextile	37	✓	✓	✓	✓	✓	✓
18	Structures - culverts	Reconstruction and renew box/pipe culvert, earthwork, pile, plain/reinforced cement concrete,	27	✓	✓	✓	✓		✓
			470						

Source: JICA Study Team

9.1.5 Review of DPR Unit Price

(1) Rationale for Setting Unit Prices

Among major work items, which has high sharing of cost estimate in DPR, the "Tamil Nadu Highways Dept. SOR 2016-2017" is mainly applied for roadwork and the "Tamil Nadu PWD SOR 2016-2017" is for construction works. Work items not described in the schedule of rates (SOR) is said to be based on the market price. The basis of unit prices in the DPR is shown in the table below.

Table 9.1.5 Basis of Base Cost of DPR

Item		Basis
Material	Sand, gravel, stone aggregate, cement, steel, brick	Highway Department SOR 2016-2017 Tamil Nadu PWD SOR 2016-2017
	Bitumen, emulsion	Indian Oil Corporation Ltd. (IOCL) latest rates of Chennai refinery
Labor		Tamil Nadu PWD SOR 2016-2017
Machinery	Typical machines	MORTH design data book including escalation of 5%/year calculated from 2001-2002 up to 2016-2017
	Non-listed machines	Market rates

Source: JICA Study Team

However, DPR Volume VI [Rate Analysis] has not been provided to the Japan International Cooperation Agency (JICA) Study Team and the basis for setting each unit price was unknown as of December 2017. For this reason, the unit price review of this survey was conducted to refer to the material above and to check whether there is any obvious mistake in the unit price setting.

(2) Evaluation of Validity

The JICA Study Team rebuilt unit prices based on the estimate materials of the MORTH Standard DATA Book for major work items with a high proportion of the overall project cost, such as borrow material and rebars. Because of evaluating the appropriateness of DPR's unit price setting by comparing the unit price of each, it was considered that there is no obvious error in DPR because none of them have a large deviation.

Table 9.1.6 Basis of Base Cost of DPR

Item	Total Cost Share	Unit	Unit Price		
			(1) DPR	(2) Rebuild for Review	Ratio (1) / (2)
Filling with approved earth from borrow areas	14.1%	cum	514	594	87%
Providing and laying bituminous concrete	2.4%	cum	6,878	7,555	91%
Providing and laying dense graded bituminous macadam	5.7%	cum	6,305	6,661	95%
W-shaped metal beam crash barrier	5.4%	m	4,581	4,686	98%
HYSD Reinforced steel	14.2%	ton	65,122	74,649	87%
Reinforced Earth Facia wall in approached	3.9%	sqm	5,150	5,066	102%

Source: JICA Study Team

9.1.6 Updated Project Cost

(1) Updated DPR Unit Prices

As a result of comparing FY2016/17 and FY2017/18 of the PWD SOR where updated versions are issued annually, prices are rising at the following rates shown in Table 9.1.7.

Table 9.1.7 Ratio of Unit Price Inflation

Rate Item	Description	(FY2017/18) / (FY2016/17)
Labour	-	110 %
Material	Brick and Tiles	104 %
	Stone and Road Materials	105 %
	Lime, Timber, and Roofing Materials	100 %
	Metal and Iron Items	105%
Work	Clearing the Site, Dismantling, Quarrying and Blasting, Earthwork, Concrete, Brick or Stone Masonry, Concrete Vibrators, Miscellaneous, Cutting and Threading of GI Pipe	110%

Source: JICA Study Team based on PWD SOR

(2) Renewal of the Project Cost Estimate

Based on SOR's inflation rate, the JICA Study Team updated the cost estimate base year from 2016 to 2017, the surveyed year.

9.2 General Procurement Situation in Tamil Nadu

9.2.1 Outline of Procurement Situation

(1) Road Development in Chennai

Chennai is a major metropolis with highway connections to other state capitals and commercial centers. It has two sea ports and an airport. Transportation, especially road transportation, plays a key role in construction commerce and in citizens' daily activities, and it is assumed to become outstanding in the future.

In addition to the implementation of arterial road construction, ITS would help in the effective utilization of transport infrastructure in terms of roads and fleet.

(2) Procurement Situation

As archived, higher education enrolment ratio in Tamil Nadu State has increased to 44.3% over and above the national average of 24.5% as of 2017. In the state, there are many institutions in the city offering degrees in engineering, management, and law, among others. A large section of population is well educated in these fields. Likewise, there are institutes offering diplomas or certificates in trades like electrical, mechanical, civil, automobile, plumbing, and HVAC. There is a demand for experienced skilled and semi-skilled workers in trades like plumbing, electrical work, etc. In general, obtaining technical personnel or skilled artisans is thought to be easy and smooth.

1) Labour Jurisdiction Organizations and Labor Relations Regulations

In India, labour laws enacted are in line with the conditions and salient features of the International Labour Organization (ILO). For example, it restricts the maximum working hours in a day. It protects the workers in terms of minimum wages. Workers are to participate in Employees State Insurance scheme that serves their health care. Trade unionism is encouraged. Equal wages are assured for similar jobs. It takes care of compensation in case of injury or death.

An employment contract stipulates the following:

- Period of validity of contract
- Hours of work
- If transferable – benefits
- Travel assistance to work place
- House rent assistance
- Annual leave

In other matters, the contract law and the relevant labour laws will be applicable.

The number of holidays for employees is intimated by the company at the beginning of the year. The government also announces official holidays before the new year commences.

Table 9.2.1 Employment Labour Relations Laws

Central Labour Laws Applicable in Tamil Nadu	State Acts (Tamil Nadu)
· The Workmen's Compensation Act 1923 · The Trade Unions Act 1926 · The Payment of Wages Act 1936 · The Industrial Employment (Standing Order) Act 1946 · The Industrial Disputes Act 1947 · The Minimum Wages Act 1948 · The Plantations Labour Act 1951	· The Tamil Nadu Shops and Establishments Act, 1947 · The Tamil Nadu Catering Establishments Act 1958 · The Tamil Nadu Industrial Establishments (National and Festivals Holidays) Act 1958 · The Tamil Nadu Labour Welfare Fund Act 1972 · Tamil Nadu Contract Labour (Regulation and

Central Labour Laws Applicable in Tamil Nadu	State Acts (Tamil Nadu)
· The Working Journalists and Other Newspaper Employees (Conditions of Services and Miscellaneous Provisions) Act 1955 · The Motor Transport Workers Act 1961 · The Maternity Benefit Act 1961 · The Payment of Bonus Act 1965 · The Beedi and Cigar Workers (Conditions of Employment) Act 1966 · The Contract Labour (Regulation and Abolition) Act 1970 · The Contract Labour (Regulation and Abolition) Central Rules, 1971 · The Payment of Gratuity Act 1972 · The Equal Remuneration Act 1976 · The Sales Promotion Employees (Conditions of Service) Act 1976 · Standards of Weights and Measures Act 1976 · Standards of Weights and Measures (Packaged Commodities) Rules 1977 · Interstate Migrant Workmen (Regulation of Employment and Conditions of Service) Act 1979 · The Cine Workers and Cinema Theatre Workers (Regulation of Employment) Act 1981 · The Standards of Weights and Measures (Enforcement) Act 1985 · The Child Labour (Prohibition and Regulation) Act 1986 · Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act 1996	Abolition) Rules, 1975 · The Tamil Nadu Industrial Establishments (conferment of Permanent Status to Workmen) Act 1981 · The Tamil Nadu Payment of Subsistence Allowance Act, 1981 · The Tamil Nadu Manual Workers (Regulation of Employment and Conditions of work) Act, 1982 · Tamil Nadu Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Rules, 2006

Source: JICA Study Team

2) Scale of Construction Companies, Construction Record, Status of Ownership of Construction Machinery

The whole country experience and the upsurge of infrastructure and housing development have resulted in growth of number of construction companies. New companies have also come to utilise this growth.

Construction companies have varied structures where there are big corporations as well as individually-owned companies. All construction equipment required for road or building projects are easily available for rent or purchase. Major companies own most of the equipment required for their projects. These equipment become an asset for their future projects.

3) Working Hours, Labor Practices, Public Holiday

Regulated working hours are from 9:00 am to 5:00 pm in general, but construction companies work at a different pace. Their workforce and working hours will depend on the targets set for their project. Some projects may go on for three shifts. However, the Administrative and Human Resources Wing will have normal office hours.

The number of paid holidays in the private sector is limited. It is normally limited to 10 days per calendar year. Among them are Republic Day–January 26, Independence Day–August 15, and Gandhi Jayanthi–October 2, which are declared as paid national holidays.

Workers in the construction industry are not well-organised in terms of union activity. Therefore, they do

not get as much benefits as their counterparts in other organised industrial sectors.

4) Difficulty of Procurement of Rural Workers and Skilled Workers

Globally, people migrate from rural to urban areas. It tends to be more acute in India. Although the living conditions in cities are not as good, there is a general and strong tendency to keep away from agriculture. This has led to a general decline in the agricultural sector. An unemployed population in the rural area was created due to weather and water problems. In the construction industry, these people would be considered as unskilled workers. It will be more difficult to procure skilled personnel. Therefore, in any large project, it may be necessary to employ such workers and train them in the required trade.

5) Procurement of Equipment and Materials Means of Transport, Imported Equipment and Materials, Presence or Absence of Local Agents, etc.

Procurement of typical construction materials in Tamil Nadu is simple. Majority of equipment such as trucks, tippers, loaders, hot mix plants, paver finishers, rollers, pile boring machines, prestressing equipment, and cranes are readily available.

For construction of roads and bridges, the main materials, like aggregate, sand, cement, steel, brick, and lime, are easily available within the state. However, among these, the procurement of sand remains difficult. The growth of unrestricted sand mining has affected water bodies. Therefore, the government imposed a partial ban on sand mining in some important water bodies. Illegal sand mining is rampant. The ban has reduced the supply. Sand price increases enormously as the demand keeps increasing. The Government of India (GOI) is importing sand to ease the scarcity. The increase in the price of sand had shot up the cost of all projects involving sand.

There are agencies that can obtain permission from government departments to import the required items. There is also a choice for the contractor to import directly. In such case, the actual user needs to get prior permit to import an item. For this also, there are agencies who can act on behalf of the company.

Some unusual equipment such as sensors for ITS, machines to work in marshy areas, and surveillance equipment may have to be imported.

(3) Tax

Until recently in India, there were many kinds of taxes like excise duty, customs duty, sales tax of state and center, value added tax, service tax, and many such taxes in the commercial field. In addition, there was income tax for individuals and companies.

From 1 July 2017, the number of main taxes for commercial establishments is reduced to just one called the goods and services tax (GST) which covers all items of transaction whether they are goods or services. The government has categorized items in five major slabs - 0%, 5%, 12%, 18%, and 28%.

Table 9.2.2 Classification of GST

	Goods	Service
No tax (0%)	Food items such as fresh meat, fish, chicken, eggs, milk, butter milk, curd, natural honey, fresh fruits and vegetables, flour, bean, bread, all kinds of salt, jaggery, and hulled cereal grains Drawing or coloring books alongside stamps, judicial papers, printed books, and newspapers	Hotels and lodges with tariff below INR 1,000 and grandfathering service has been exempted under GST; rough precious and semi-precious stones will attract GST rate of 0.25 %, admission to "protected monuments"
(0.25%)	Rough industrial diamonds including unsorted rough diamonds to face 0.25% instead of 3% GST	
5%	Items such as fish fillet, apparel below INR 1,000, packaged food items, footwear below INR 500. An array of food items such as fish fillet, packaged food items, cream, skimmed milk powder, branded paneer, frozen vegetables, coffee, tea, spices, pizza bread, rusk, sabudana, and cashew nut	All restaurants, restaurants of hotels with room tariff of less than INR 7,500, food parcels, textile job work, transport services (railways, air transport), supply of e-waste

	Goods	Service
12%	Edibles like frozen meat products, butter, cheese, ghee, dry fruits in packaged form, animal fat, sausage, fruit juices, and ketchup and sauces Cellphones Cutlery items like spoons, forks, ladles, skimmers, cake servers, fish knives, and tongs Ayurvedic medicines and all diagnostic kits and reagents Utility items like tooth powder, umbrella, sewing machine and spectacles and indoor game items like playing cards, chess board, carom board, and other board games like ludo are in this slab Apparel above INR 1,000	State-run lotteries, non-AC hotels, business class air ticket, fertilizers, work contracts
18%	Consumables - biscuits, flavored refined sugar, pasta, cornflakes, pastries and cakes, preserved vegetables, jams, sauces, soups, ice cream, instant food mixes, curry paste, mayonnaise and salad dressings, mixed condiments and mixed seasonings and mineral water Footwear costing more than INR 500 Items like printed circuits, camera, speakers and monitors, printers (other than multi-function printers), electrical transformer, CCTV, and optical fiber Other items in this slab include bidi leaves, tissues, envelopes, sanitary napkins, note books, steel products, kajal pencil sticks, headgear and its parts, aluminum foil, weighing machinery (other than electric or electronic weighing machinery), bamboo furniture, swimming pools, and padding pools	Restaurants in hotel premises having room tariff of INR 7,500 and above, telecom services, IT services, branded garments, financial services, and outdoor catering
28%	In total 50 luxury and sin products which includes bidis, molasses, pan masala, aerated water, paint, sunscreen, wallpaper, ceramic tiles, water heater, dishwasher, weighing machine, washing machine, ATM, vending machines, vacuum cleaner, automobiles, motorcycles, and aircraft for personal use	Private-run lotteries authorized by the states, race club betting, and cinemas

Source: JICA Study Team based on articles of The Times of India and The Economic Times

Income tax remains the same. There are various classes with the corresponding tax percentage.

(4) Customs Clearance

The authority to accord sanction for customs and to fix tariff is the Chief Commissioner of Customs. This comes under the Department of Revenue, Ministry of Finance, and the Government of India (GOI). There are set rules for customs clearance and customs duty. There are agencies that will take care of such clearance. The tariff of customs duty depends on the equipment being imported.

The department is called Central Board of Excise and Customs. The relevant rules are:

- Customs Act, 1962
- Customs Tariff Act, 1975
- Foreign Trade Act, 1992
- Taxation Law, 2006

9.2.2 Influence of Procurement Circumstances on the Project

Generally, the civil works planned for the Chennai Peripheral Ring Road (CPRR) are composed of construction of a similar level of primal roads such as Outer Ring Road (ORR) and Chennai Bypass. Therefore, difficulty is not expected for the implementing organization and local contractors. On the other hand, regarding the introduction of ITS in CPRR and Chennai City, there is no similar case and most contractors are not familiar with the installation and effective operation of equipment. Therefore, project management and technical support through official development assistance (ODA) loan project are considered indispensable.

9.3 Cost Estimate for CPRR (Sec-1)

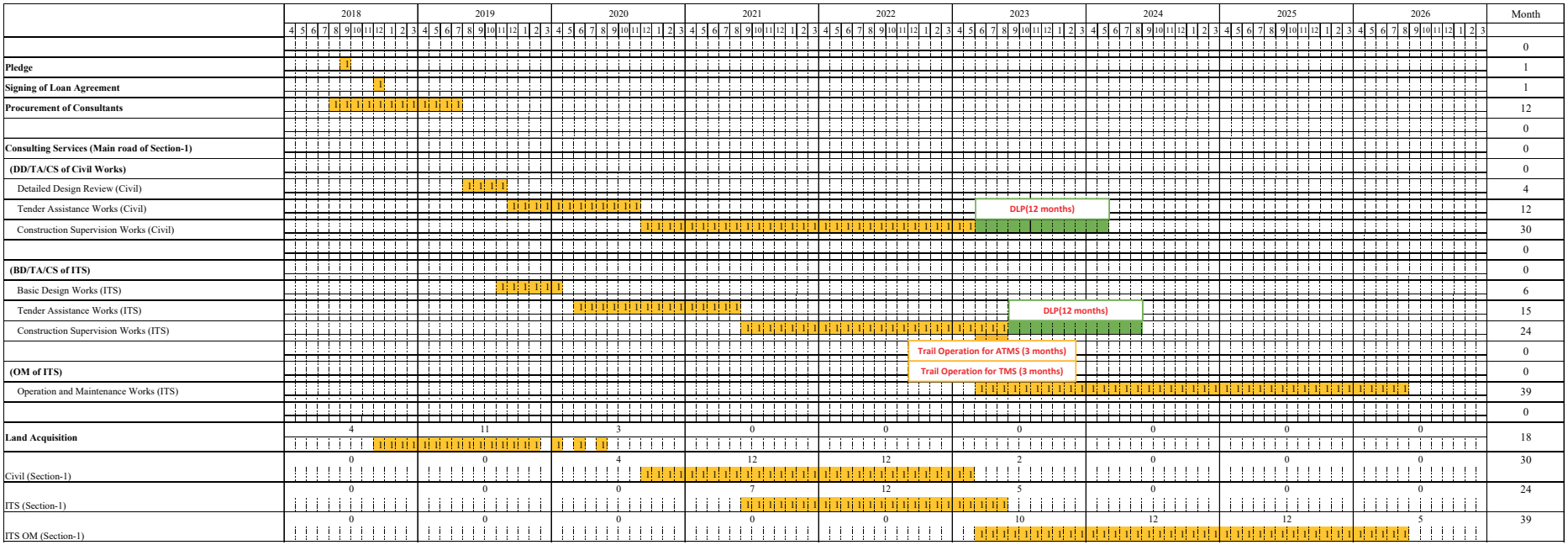
9.3.1 Procurement and Construction Plan

(1) General

Section 1 is evaluated to be a top priority among the entire CPRR and the most appropriate for a Japanese ODA Loan Project. As explained earlier, the civil works planned for CPRR are composed of the construction of a similar level of primal roads such as ORR and Chennai Bypass. Therefore, no difficulty is expected in carrying out the civil works for the implementing organisation and local contractors. However, the project component includes ITS facilities along CPRR such as the Highway Traffic Management System (HTMS) and the Toll Management System (TMS). Appropriate introduction, operation, and management of such ITS systems must require technical support through a Japanese ODA Loan Project.

(2) Implementation Schedule

The implementation process chart is described in the next page.



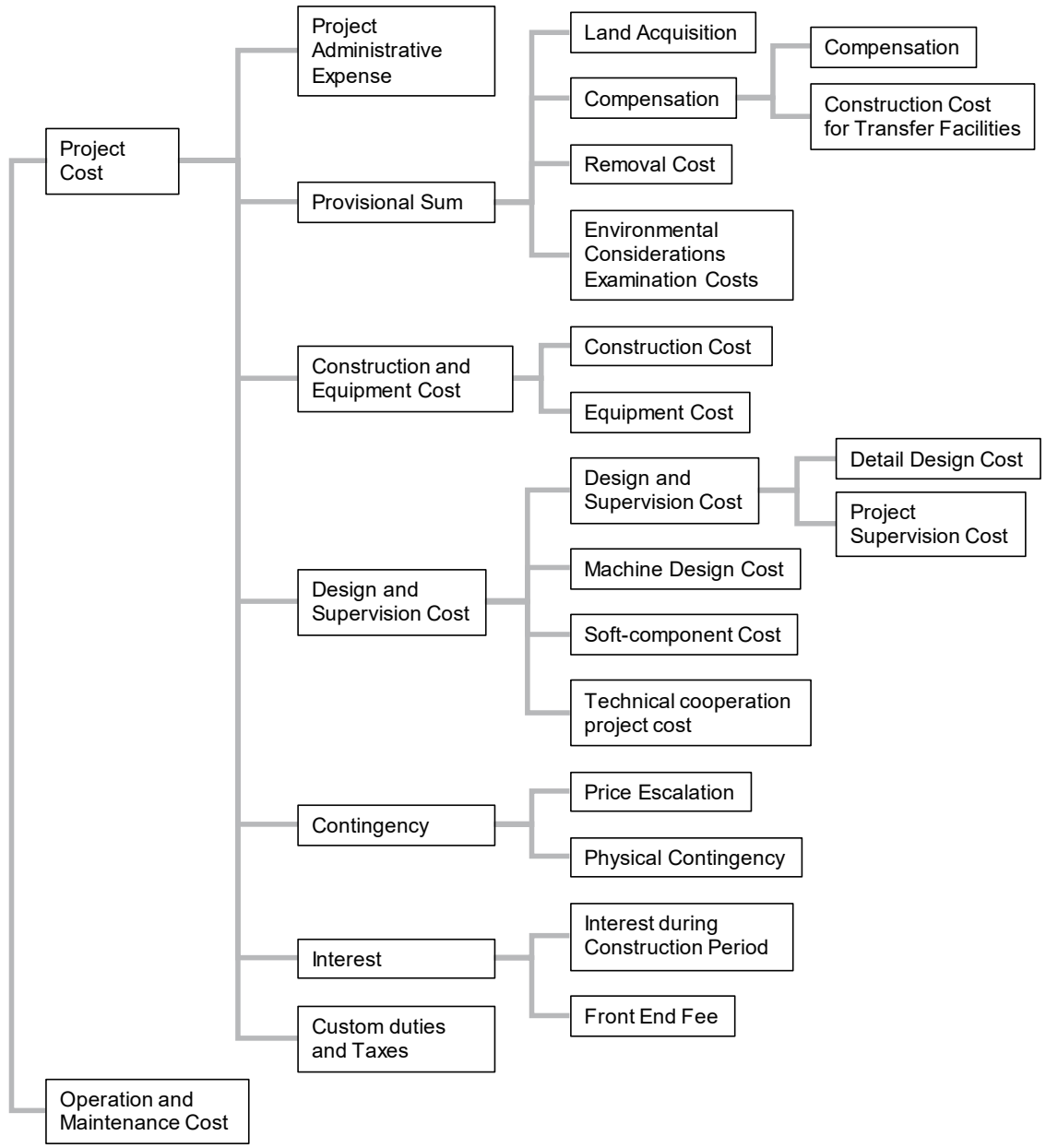
Source: JICA Study Team

Figure 9.3.1 Project Schedule of CPRR Section-1

9.3.2 Summary of Project Cost (Sec-1)

The approximate project cost was estimated as follows, based on the approximate construction quantity, which was updated by DPR review, the content of the consulting service, and the implementation schedule.

(1) Composition of Project Budget



Source: JICA Study Team, based on "Design and Cost Estimate Manual for JICA Preparatory Survey"

Figure 9.3.2 Composition of Project Budget

(2) Project Cost Item and Coverage of Japanese Loan

Table 9.3.1 Project Cost Item and Coverage of Japanese Loan

Cost	Item	Description	Japanese Loan	GOI
Project Administrative Expense		Cost of project executive management by the implementing organization of GOI Cost of check and approval of detail design documents, supervision as employer (site visiting, attendance for inspections, approval of design modifications, administration, meeting, etc.)		✓
Provisional Sum	Land Acquisition	Cost of land acquisition for project ROW		✓
	Compensation	Cost of compensation for moving residents, protection of envelopment, and others that necessitates land acquisition, diversion road, etc.		✓
	Removal Cost	Cost of removal and/or replacement for existing utilities and structures at project area.	✓	✓
	Environmental Considerations Examination Costs	Expenses that help to properly implement environmental and social considerations by GOI, in compliance with the JICA's environmental and social considerations manual, and the law on environmental impact assessment of GOI		✓
Construction and Equipment Cost	Construction Cost	Construction of civil works and ITS system works	✓	
	Equipment Cost	ITS equipment cost including procurement management cost and administrative expenses	✓	
Design and Supervision Cost	Detail Design Cost	Cost of consultants for technical services and produce detail design and tender documents, including the assistance of tendering and evaluations	✓	
	Project Supervision Cost	Cost of technical services by consultants, with project control during construction; including the cost for safety control, if necessary	✓	
Contingency	Price Escalation	Cost to deal of price escalation during construction period	✓	
	Physical Contingency	Cost to cover the uncertainty items which cannot predict during the detailed design stage	✓	
Interest	Interest during Construction Period	Interest of Japanese loan during construction period		✓
	Front End Fee	To abolish the commitment charge, to collect 0.2% of the loan amount at the time of ODA loans		✓
Custom Duties and Taxes		Custom duties and taxes according to the procurement of materials and equipment shall be exempt; GST shall be consulted with GOI		✓
Operation and Maintenance Cost		To make sure that there is enough budget for the implementing organization of India	✓	✓

Source: JICA Study Team

(3) Cost Estimate Condition

1) Conditions

Basic conditions of cost estimate are summarised below.

Table 9.3.2 Pre-condition of Cost Estimate for CPRR

Item	Condition
Currency	USD = JPY 106.0
	USD = INR 65.6
	INR = JPY 1.62
Price escalation	FC (JPY) : 1.83%
	LC (INR) : 4.13%
Physical contingency	Construction : 5.0%
	Consultant : 5.0%
Base year and month	March 2018
Consultant billing rate	Pro-(A) : JPY 3,246,000
	Pro-(B) : INR 389,259
	Supporting staff : INR 50,000
Project administrative expense	3.0%
Interest during construction	Construction: 1.50%
	Consultant: 0.01%
Front end fee	0.2%
Tax	GST 18.0%
	Import tax 0.0%

Source: JICA Study Team

2) Price Escalation Ratio

Price escalation is to be added to construction, and consultant costs for each year during the project implementation period and the ratio of price escalation is calculated by the following formula.

((1 + A) ^ (B - C)) -1

A: Basic ratio (F/C: 1.83%, L/C: 4.13%)

B: Target year

C: Base year (2018)

Below is a list of the price escalation for each fiscal year calculated using the formula as shown above.

Table 9.3.3 Price Escalation

Currency	Price Escalation							
	2019	2020	2021	2022	2023	2024	2025	2026
Foreign currency	1.8%	3.7%	5.6%	7.5%	9.5%	11.5%	13.5%	15.6%
Local currency	4.1%	8.4%	12.9%	17.6%	22.4%	27.5%	32.7%	38.2%

Source: JICA Study Team

3) Import Tax

Every material and equipment can be procured from local suppliers. Therefore, the import tax for the CPRR Project is not envisioned at the current stage.

(4) Cost Estimate

The above-mentioned overall project cost is reorganised into the JICA appraisal form, which was arranged in JPY. Project cost is summarised in the tables below.

1) Consultant Fee

The cost breakdown of the consultant fee is calculated as shown below.

Table 9.3.4 Cost Breakdown of Consultant Fee for CPRR

			Unit	Qty.	Foreign Portion (JPY) Rate	Foreign Portion (JPY) Amount ('000)	Local Portion INR Rate	Local Portion INR Amount ('000)	Combined Total ('000) JPY
A	Remuneration								
	1	Professional (A) for Civil	M/M	194.0	3,246,000	629,724	0	0	629,724
		Professional (A) for ITS	M/M	240.0	3,246,000	779,040	0	0	779,040
	2	Professional (B) for Civil	M/M	398.5	0	0	389,259	155,120	251,294
		Professional (B) for ITS	M/M	243.0	0	0	389,259	94,590	153,236
	3	Supporting Staffs	M/M	968.0	0	0	50,000	48,400	78,408
		Subtotal of A				1,408,764		298,110	1,891,702
B	Direct Cost								
	1	International Airfare	Trip	72	396,000	28,644		0	28,644
	2	Domestic Airfare		359		0	16,296	5,842	9,464
	3	Domestic Travel		0		0	0	0	0
	3	Accommodation Allowance (Pro-A)	Month	434	396,000	171,864	244,444		171,864
		(Pro-B)	Month	641.5		0	81,481	52,270	84,678
		(SS)	Month	968.0		0	40,741	39,437	63,888
	4	Vehicle Rental	Month	358.5		0	122,222	43,817	70,983
	5	Office Rental	Month	90.0		0	203,704	18,333	29,700
	6	International Communications	Month	90.0		0	20,370	1,833	2,970
	7	Domestic Communications	Month	90.0		0	2,037	183	297
	8	Office Supply	Month	90.0		0	101,852	9,167	14,850
	9	Office Furniture and Equipment	Month	90.0		0	101,852	9,167	14,850
	10	Report Preparation for Civil	Month	90.0		0	101,852	9,167	14,850
		Report Preparation for ITS	Month	0.0		0		0	0
	11	Overseas Training Cost	LS	1.0	3,960,000	3,960		0	3,960
	12	Topographic Suvey	LS	1.0		0	4,277,778	4,278	6,930
	13	Geotechnical Survey	LS	1.0		0	7,590,000	7,590	12,296
	14	Traffic Survey	LS	1.0		0	407,407	407	660
	15	Hydrological Survey	LS	1.0		0	814,815	815	1,320
	16	Material Availability Survey	LS	1.0		0	1,629,630	1,630	2,640
	17	Social /Environmental Survey	LS	1.0		0	3,055,556	3,056	4,950
	18	Survey for ITS Works	LS	1.0		0	26,481,481	26,481	42,900
	19	Hotel Cost during DLP for Civil	MM	1.0	396,000	396		0	396
		Hotel Cost during DLP for Civil	MM	2.0	396,000	792		0	792
		Subtotal of B				205,656		233,473	583,882
		Total				1,614,420		531,583	2,475,584

Source: JICA Study Team

2) Construction Cost

The construction cost of CPRR civil works and ITS installation works is summarised below.

Table 9.3.5 Construction Cost Summary of CPRR (Civil Works)

Civil (Section-1) Loan Coverage Ratio 100

item	Cost		Total
	Foreign	Local	
	JPY	INR	JPY
I. ROAD WORKS	2,151,783,902	7,515,594,320	14,327,046,701
1. Site Clearance	2,184,045	7,628,272	14,541,846
2. Earth Work Excavation, Embankment Construction and Ground Improvement	840,745,112	2,936,493,382	5,597,864,392
3. Sub-base and base courses	150,085,853	524,208,951	999,304,353
4. Bituminous bases and surface courses	230,027,028	803,421,673	1,531,570,138
5. Drainage works	101,639,031	354,997,415	676,734,844
6. Protection works	209,058,742	730,185,170	1,391,958,717
7. Traffic signs, Markings and other road appurtenances	285,617,051	997,582,465	1,901,700,644
8. Road side amenities	53,256,705	186,011,147	354,594,764
9. Junctions & Intersections	109,587,472	382,759,153	729,657,300
10. Landscaping and Arboriculture	2,491,507	8,702,156	16,588,999
11. Highways Lighting	51,928,936	181,373,610	345,754,184
12. Temporary Diversion during construction	9,941,580	34,723,226	66,193,205
13. Toll Plaza including Fastag equipments	105,220,841	367,507,700	700,583,315
II. STRUCTURES	2,255,972,115	7,879,495,331	15,020,754,551
14. Major bridges	582,509,578	2,034,547,091	3,878,475,866
. Elevated Road	742,061,947	2,591,820,000	4,940,810,347
15. Minor bridges	74,436,123	259,985,077	495,611,947
16. Interchanges (NH5)	234,440,678	818,837,348	1,560,957,182
17. Road over bridges	265,961,177	928,929,858	1,770,827,547
18. Vechicular Underpasses	274,109,229	957,388,778	1,825,079,049
19. Culverts	82,453,383	287,987,179	548,992,613
III. EMP	0	30,642,727	49,641,218
20. Cost for EMP implementation	0	30,642,727	49,641,218
V. UTILITY SHIFTING	0	317,627,987	514,557,339
29. TANGEDCO Cost	0	255,261,552	413,523,714
30. TWAD Cost	0	33,690,636	54,578,830
31. BSNL Cost	0	28,675,799	46,454,794
Total	4,407,756,017	15,743,360,365	29,911,999,809

Source: JICA Study Team

Table 9.3.6 Cost Summary of CPRR (ITS for CPRR)

ITS (Section-1) Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			JPY	INR	JPY	INR	JPY
Highway Traffic Management Sytem (HTMS)	LS	1	221,977,949	310,199,296	221,977,949	310,199,296	724,500,808
Toll Management System (TMS)	LS	1		226,095,881	0	226,095,881	366,275,327
Toll Plaza Building	LS	1		118,588,434	0	118,588,434	192,113,264
					0	0	0
Total					221,977,949	654,883,611	1,282,889,399

Source: JICA Study Team

3) Operation and Maintenance Cost (ITS for CPRR)

As a part of technical transfer, operation and maintenance (O&M) activities for three years will be commenced after ITS installation. It is noted that the O&M cost is not financed by JICA loan, but by GOI. The summarised cost is shown below.

Table 9.3.7 Cost Summary of Operation and Maintenance of ITS for CPRR

ITS OM (Section-1) Loan Coverage Ratio 0

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			JPY	INR	JPY	INR	JPY
Toll Management System (TMS)	Year	3		122,100,429	0	366,301,287	593,408,085
Highway Traffic Management Sytem (HTMS)	Year	3		73,920,429	0	221,761,287	359,253,285
Cars of O&M	LS	1		8,831,500	0	8,831,500	14,307,030
Total					0	596,894,074	966,968,400

Source: JICA Study Team

4) Summary of Project Cost (Sec-1)

The summarised project cost for section 1 is shown below.

Table 9.3.8 Summary of Project Cost CPRR (Sec-1)

Breakdown of Cost	Foreign Currency Portion (million JPY)			Local Currency Portion (millon INR)			Total (million JPY)		
	Total Cost	JICA Portion	Others	Total Cost	JICA Portion	Others	Total Cost	JICA Portion	Others
Civil (Section-1)	4,466	4,466	0	15,743	15,743	0	29,970	29,970	0
ITS (Section-1)	238	238	0	1,252	655	597	2,266	1,299	967
Civil Works Sub Total	**4,704**	**4,704**	**0**	**16,995**	**16,398**	**597**	**32,236**	**31,269**	**967**
Price Escalation	299	299	0	2,594	2,424	170	4,501	4,226	276
Physical Contingency	250	250	0	979	941	38	1,837	1,775	62
Consulting Services	1,786	1,786	0	628	628	0	2,804	2,804	0
Land Acquisition	0	0	0	12,723	0	12,723	20,611	0	20,611
Administration Cost	0	0	0	1,148	0	1,148	1,860	0	1,860
VAT	0	0	0	4,598	0	4,598	7,448	0	7,448
Import Tax	0	0	0	0	0	0	0	0	0
Interest during Construction	3,119	0	3,119	0	0	0	3,119	0	3,119
Front End Fee	80	0	80	0	0	0	80	0	80
Total	**10,239**	**7,039**	**3,199**	**39,666**	**20,392**	**19,274**	**74,497**	**40,074**	**34,423**

Source: JICA Study Team

9.3.3 Summary of Project Cost (Sec-2 to Sec-5)

The summarised project cost for section 2 to 5 is shown below. It is noted that the project period, direct cost and pre-conditions are equal to that of cost estimate for the section 1.

Table 9.3.9 Summary of Project Cost CPRR (Sec-2)

Breakdown of Cost	Foreign Currency Portion (million JPY)			Local Currency Portion (millon INR)			Total (million JPY)		
	Total Cost	JICA Portion	Others	Total Cost	JICA Portion	Others	Total Cost	JICA Portion	Others
Civil (Section-2)	3,689	3,689	0	12,826	12,826	0	24,467	24,467	0
ITS (Section-2)	16	16	0	1,116	507	609	1,823	837	986
Civil Works Sub Total	**3,705**	**3,705**	**0**	**13,942**	**13,333**	**609**	**26,290**	**25,304**	**986**
Price Escalation	234	234	0	2,144	1,970	174	3,706	3,425	281
Physical Contingency	197	197	0	804	765	39	1,500	1,436	63
Consulting Services	1,786	1,786	0	628	628	0	2,804	2,804	0
Land Acquisition	0	0	0	4,384	0	4,384	7,102	0	7,102
Administration Cost	0	0	0	767	0	767	1,242	0	1,242
VAT	0	0	0	3,811	0	3,811	6,174	0	6,174
Import Tax	0	0	0	0	0	0	0	0	0
Interest during Construction	2,527	0	2,527	0	0	0	2,527	0	2,527
Front End Fee	66	0	66	0	0	0	66	0	66
Total	**8,514**	**5,921**	**2,593**	**26,480**	**16,697**	**9,783**	**51,412**	**32,970**	**18,442**

Source: JICA Study Team

Table 9.3.10 Summary of Project Cost CPRR (Sec-3)

Breakdown of Cost	Foreign Currency Portion (million JPY)			Local Currency Portion (millon INR)			Total (million JPY)		
	Total Cost	JICA Portion	Others	Total Cost	JICA Portion	Others	Total Cost	JICA Portion	Others
Civil (Section-3)	4,158	4,158	0	14,492	14,492	0	27,635	27,635	0
ITS (Section-3)	16	16	0	1,268	567	701	2,070	934	1,135
Civil Works Sub Total	**4,174**	**4,174**	**0**	**15,760**	**15,059**	**701**	**29,705**	**28,569**	**1,135**
Price Escalation	264	264	0	2,425	2,225	200	4,192	3,868	324
Physical Contingency	222	222	0	909	864	45	1,695	1,622	73
Consulting Services	1,786	1,786	0	628	628	0	2,804	2,804	0
Land Acquisition	0	0	0	25,163	0	25,163	40,763	0	40,763
Administration Cost	0	0	0	1,466	0	1,466	2,375	0	2,375
VAT	0	0	0	4,266	0	4,266	6,911	0	6,911
Import Tax	0	0	0	0	0	0	0	0	0
Interest during Construction	2,853	0	2,853	0	0	0	2,853	0	2,853
Front End Fee	74	0	74	0	0	0	74	0	74
Total	**9,372**	**6,445**	**2,927**	**50,617**	**18,777**	**31,840**	**91,371**	**36,863**	**54,508**

Source: JICA Study Team

Table 9.3.11 Summary of Project Cost CPRR (Sec-4)

Breakdown of Cost	Foreign Currency Portion (million JPY)			Local Currency Portion (millon INR)			Total (million JPY)		
	Total Cost	JICA Portion	Others	Total Cost	JICA Portion	Others	Total Cost	JICA Portion	Others
Civil (Section-4)	1,468	1,468	0	4,947	4,947	0	9,482	9,482	0
ITS (Section-4)	16	16	0	1,086	496	591	1,776	819	957
Civil Works Sub Total	**1,484**	**1,484**	**0**	**6,033**	**5,442**	**591**	**11,258**	**10,301**	**957**
Price Escalation	94	94	0	980	811	168	1,681	1,408	273
Physical Contingency	79	79	0	351	313	38	647	585	61
Consulting Services	1,786	1,786	0	628	628	0	2,804	2,804	0
Land Acquisition	0	0	0	0	0	0	0	0	0
Administration Cost	0	0	0	304	0	304	492	0	492
VAT	0	0	0	1,821	0	1,821	2,950	0	2,950
Import Tax	0	0	0	0	0	0	0	0	0
Interest during Construction	1,026	0	1,026	0	0	0	1,026	0	1,026
Front End Fee	30	0	30	0	0	0	30	0	30
Total	**4,499**	**3,443**	**1,056**	**10,117**	**7,195**	**2,922**	**20,888**	**15,098**	**5,790**

Source: JICA Study Team

Table 9.3.12 Summary of Project Cost CPRR (Sec-5)

Breakdown of Cost	Foreign Currency Portion (million JPY)			Local Currency Portion (millon INR)			Total (million JPY)		
	Total Cost	JICA Portion	Others	Total Cost	JICA Portion	Others	Total Cost	JICA Portion	Others
Civil (Section-5)	3,503	3,503	0	12,197	12,197	0	23,262	23,262	0
ITS (Section-5)	16	16	0	1,189	536	653	1,942	884	1,058
Civil Works Sub Total	**3,519**	**3,519**	**0**	**13,386**	**12,733**	**653**	**25,204**	**24,146**	**1,058**
Price Escalation	222	222	0	2,069	1,883	186	3,574	3,272	302
Physical Contingency	187	187	0	773	731	42	1,439	1,371	68
Consulting Services	1,786	1,786	0	628	628	0	2,804	2,804	0
Land Acquisition	0	0	0	11,124	0	11,124	18,020	0	18,020
Administration Cost	0	0	0	945	0	945	1,531	0	1,531
VAT	0	0	0	3,669	0	3,669	5,944	0	5,944
Import Tax	0	0	0	0	0	0	0	0	0
Interest during Construction	2,411	0	2,411	0	0	0	2,411	0	2,411
Front End Fee	63	0	63	0	0	0	63	0	63
Total	**8,188**	**5,714**	**2,474**	**32,594**	**15,975**	**16,619**	**60,989**	**31,593**	**29,396**

Source: JICA Study Team

CHAPTER 10 IMPLEMENTATION SCHEDULE OF SECTION 1

10.1 General

The subject of this study was originally the Chennai Peripheral Ring Road (CPRR) Project and the Chennai City Intelligent Transport System (ITS) Project. However, the procedure for environmental social consideration of CPRR was delayed. For this reason, JICA decided to separate the Chennai City ITS Project from the CPRR Project and aimed only for the Chennai City ITS Project as the initial goal of the March 2018 loan agreement (L/A). The Tamil Nadu Infrastructure Development Board (TNIDB) applied to the DEA to list Chennai City ITS Project separately from CPRR Project and to list it in the rolling plan independently. The study for the CPRR project will be continued aiming the Japanese ODA Loan.

Based on the above, the project implementation schedule of the CPRR Project and the Chennai City ITS Project was independently examined. Regarding the Chennai City ITS project, the study results are compiled in Vol. 2 of this report.

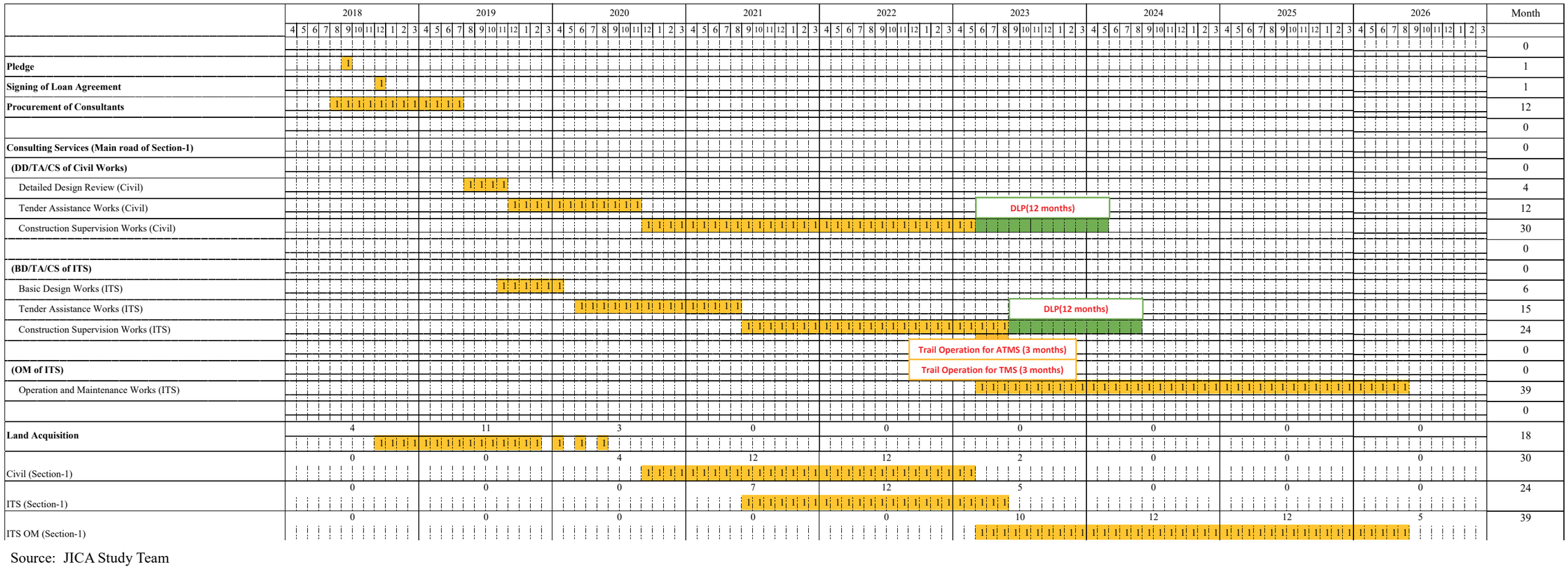
10.2 Tentative Implementation Schedule for CPRR

In consultation with Japan International Cooperation Agency (JICA), Highways and Minor Ports Department (HMPD) expressed their aim to exchange L/A for Section 1, which had high economic validity, most advanced land acquisition progress, and highest priority among sections.

During consultation with inhabitants around the site of the Tiruvottiyur Ponneri Pancheti (TPP) Link Road (Original Alignment), it was found that it is important to obtain social consensus for the road construction. As an alternative solution to minimise the social impact, the south end of TPP Link Road is to be shifted approximately 1.5 km west from the original alignment. This new alternative alignment totals 3.6 km from the connecting point with Northern Port Access Road (NPAR) to the southern end. The 1.65-km section in the northern part is the same as the original alignment, and the remaining 1.95 km in the southern part is different from the original alignment. Through an additional survey at the alternate site, social consensus was confirmed for the new alignment. Therefore, it is expected that NPAR and TPP Link Road (New Alignment) will become the object of the Japanese official development assistance (ODA) loan project as Section 1.

Sections 2, 3, and 4 are also confirmed for economic validity of the project in "4.3 Prioritization of Components for Implementation ".

Figure 10.2.1 shows the proposed project schedule of CPRR Section 1.



Source: JICA Study Team

Figure 10.2.1 Project Schedule of CPRR Section 1

CHAPTER 11 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

The Chennai Peripheral Ring Road (CPRR) Project is divided into five sections in the Detailed Project Report (DPR). The first stage of this study reviewed all the sections and finally selected Section 1 as priority section. After the selection of the priority smection, Section 1 was examined in detail. Therefore, the main scope of the Project is Section 1.

Section 1 consists of the Northern Port Access Road (NPAR) and the TPP Link Road. After the detailed survey and consultation with local residents, it was concluded that social consensus was not yet formed on the TPP Link Road. The Highways and Minor Ports Department (HMPD) moved the southern end of the TPP Link Road about 1.5 km west of the original alignment. The length of the new alignment is 3.6 km, with the original 1.65 km in the north and the new 1.95 km in the south. Social consensus on TPP Link Road (new alignment) was confirmed. It is expected, therefore, that Section 1 (main road (Northern Port Access Road) and TPP Link Road (new alignment)) will be the target of the Japanese ODA Loan Project.

Chapter 11 consists of the following sections: objectives of the environmental and social considerations are explained in Section 11.1, existing reports on all the road sections are reviewed in Section 11.2, study results on Section 1 (Main Road and TPP Link Road (Original Alignment)) are explained from Sections 11.3 to 11.5, while the study results on Section 1 (Main Road and TPP Link Road (New Alignment)) are explained in Section 11.6.

The scope of Section 1 is summarized in Table 11.0.1.

Table 11.0.1 Scope of Section 1

Civil works	**Section 1 Main Road** Length: 21.5 km Start (Ennor Port), End (NH5, Thatchur) TPP Link Road （Original Alignment）: Length 4.21 km, ROW 100 m （New Alignment） : Length 3.60 km, ROW 45–100 m = Original Alignment Section 1.65 km + New Alignment Section 1.95 km
ITS	**Highway Traffic Management System (HTMS):** Monitoring, collection, and processing of data on road traffic situation including accidents; and provision of information to road users
	Toll Management System (TMS) (including weigh-in-motion): Efficient and reliable toll collection and control of overloaded vehicles

Source: JICA Study Team

11.1 Objectives of Environmental and Social Considerations

11.1.1 Basic Principles Regarding Environmental and Social Considerations

While project proponents bear the ultimate responsibility for the environmental and social considerations of projects, Japan International Cooperation Agency (JICA) supports and examines appropriate environmental and social considerations undertaken by project proponents to avoid or minimize development projects' impacts on the environment and on local communities, and to prevent the occurrence of unacceptable adverse impacts. JICA thus promotes sustainable development in developing countries.

In these guidelines, JICA has created clear requirements regarding environmental and social considerations, which project proponents must meet. JICA provides support to project proponents in order to facilitate the achievement of these requirements through the preparation and implementation of cooperation projects. JICA examines the undertakings by project proponents in accordance with the requirements, and makes adequate decisions regarding environmental and social considerations on the basis of examination results.

JICA recognizes seven principles in Table 11.1.1 to be very important.

Table 11.1.1 Seven Principles of JICA Environmental and Social Consideration

1. A wide range of impacts must be addressed.	The types of impacts addressed by JICA cover a wide range of environmental and social issues.
2. Measures for environmental and social considerations must be implemented from an early stage to a monitoring stage.	JICA applies a Strategic Environmental Assessment (SEA) when conducting master plan studies, and encourages project proponents to ensure environmental and social considerations from an early stage to a monitoring stage.
3. JICA is responsible for accountability when implementing cooperation projects.	JICA ensures accountability and transparency when implementing cooperation projects.
4. JICA asks stakeholders for their participation.	JICA incorporates stakeholder opinions into decision-making processes regarding environmental and social considerations by ensuring the meaningful participation of stakeholders in order to have consideration for environmental and social factors and to reach a consensus accordingly. JICA replies to stakeholders' questions. Stakeholders who participate in meetings are responsible for what they say.
5. JICA discloses information.	JICA itself discloses information on environmental and social considerations in collaboration with project proponents in order to ensure accountability and to promote the participation of various stakeholders.
6. JICA enhances organizational capacity.	JICA makes efforts to enhance the comprehensive capacity of organizations and operations in order for project proponents to have consideration for environmental and social factors, appropriately and effectively, at all times.
7. JICA makes serious attempts at promptness.	JICA addresses request of acceleration for the prompt implementation of projects while undertaking environmental and social considerations.

Source: JICA Guidelines for Environmental and Social Consideration 2010

The objective of this study is for the JICA Study Team 1) to review the environmental impact assessment (EIA) and resettlement action plan (RAP) reports prepared by HMPD, 2) to study the gaps between the above reports and the requirements of the JICA guidelines, and 3) to conduct additional studies to fill in the gap if there is any.

This study covers not only the information on the main scope (Section 1), but also includes initial review of other sections and study of the Indian legal frameworks. The final outcome of the study done by JICA Study Team will be shared with HMPD, the counterpart. The JICA Study Team advised HMPD that the final report will be shared to other agencies by HMPD in case part of the CPRR Project will be the subject of a study by other partner agencies.

11.2 Review of the DPR EIA/SIA/RAP for All Sections

11.2.1 Analysis for Alternative Plans

(1) Consideration and Evaluation of Alternative Plans and Proposed Plan for CPRR

The Government of Tamil Nadu proposed a draft alignment of the Chennai Peripheral Road, herein after called the Original Plan, which had a total length of 162.1 km consisting of 85.1 km new installation and 77.0 km existing road improvement as described in Figure 11.2.1.

The DPR does not contain information on the timing of the start of the study on the Original Plan. On the other hand, DPR states that the New Plan (Current Plan), shown in red in Figure 11.2.1, was approved by HMPD in July 2014. Therefore, it is assumed that the Original Plan was studied by June 2014 or before. The major characteristics of the Original Plan are as follows:

- The point of origin in the Original Plan was set in Mahabalipuram in the south of Chennai, and the end point was set in Kattupalli in the north. In the New Plan, Mahabalipuram is set as the end point, while Kattupalli is set as the point of origin.
- Maximum utilization of the existing road for improvement.
- Bypassing the major residential areas from south to north, a total of about 26 km:

- Sriperumbudur Bypass about 4 km,
- Thiruvallur Bypass about 12 km,
- Thamaraipakkam Bypass about 2 km,
- Vengal Bypass about 3 km,
- Vadamadurai Bypass about 2 km, and
- Periyapalayam Bypass about 3 km.

- The new installation sections, a total of about 58 km, except for the bypass, consist of:
  - 1) from the point of origin in Mahabalipuram to Singaperumalkoil for about 27 km, and
  - 2) from Kattupalli to the end point in Puduvoyal for about 31 km.

The Government of Tamil Nadu sets up three committees, namely the Steering Committee, the Technical Committee, and the Sub-technical Committee, for assessing the Original Plan. The Steering Committee assessed the plan from the political aspect, while the Technical Committee and Sub-technical Committee assessed the plan from the technical aspect and delivered the following comments for the improvement of the plan:

- The point of origin in Mahabalipuram is in the World Heritage sites, where alterations to existing conditions are not permitted by the Archaeological Survey of India.
- The proposed Sriperumbudur Bypass passes through built-up sections and water bodies and wet lands of Sriperumbudur Lake and surrounding areas.
- The proposed Thiruvallur Bypass starts/passes through built-up sections and industrial areas.
- The section between NH5 in Thatchur and the Ennore Port is a new road alignment.

(2) Consideration of Avoidance, Mitigation, and Minimization of Impacts in the New Plan

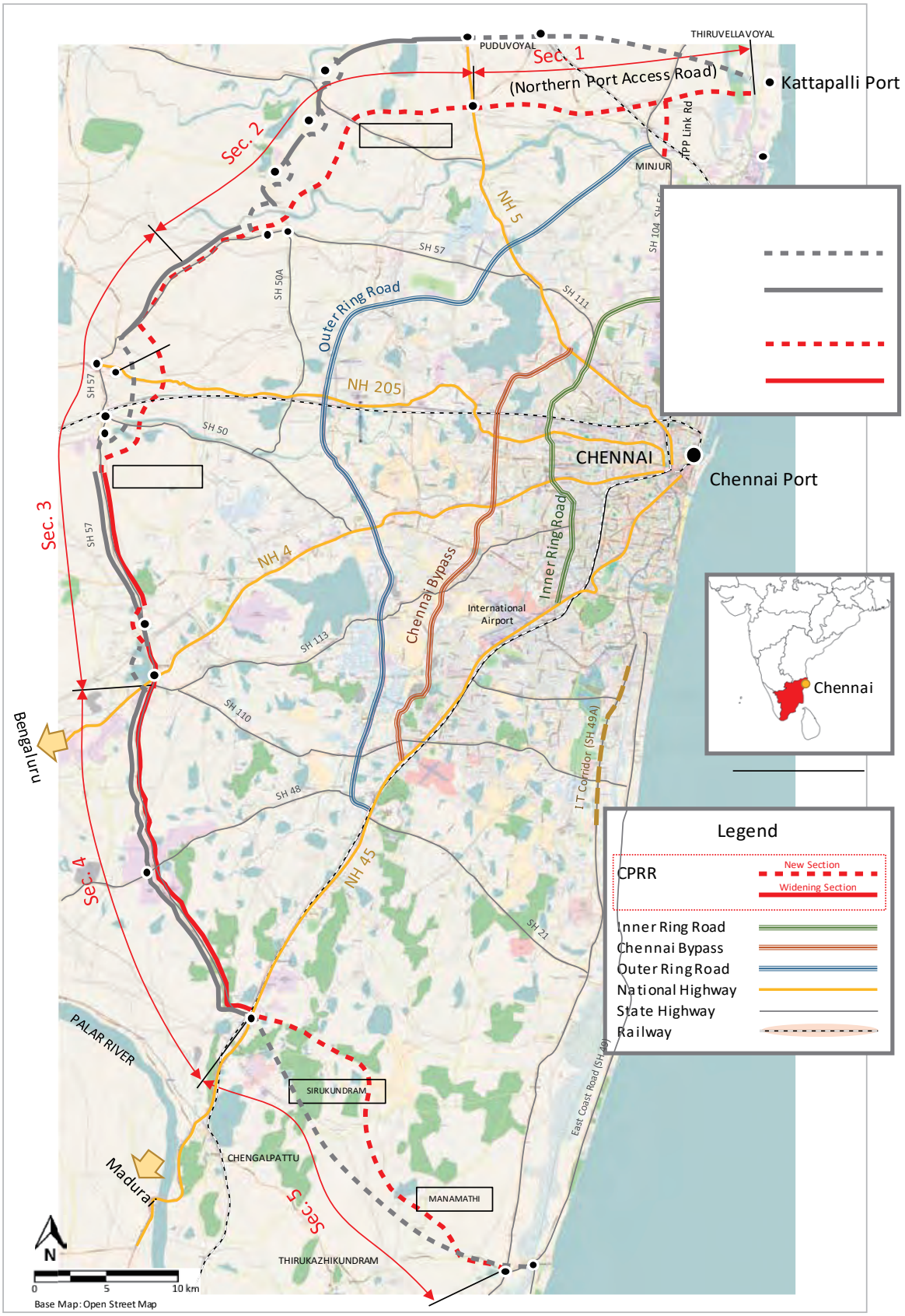
Considering the items pointed out by the committees as described above, HMPD prepared the DPR with the New Plan. The New Plan was approved by the Principal Secretary of HMPD on 9 July 2014.

The outline of the major characteristics and mitigation measures by section of the New Plan (Current Plan) are described in Table 11.2.1. Section-wise comparisons of the Original Plan and the New Plan are shown in Figure 11.2.2 and Figure 11.2.3.

Table 11.2.1 Consideration of Avoidance, Mitigation, and Minimization of Impacts in the New Plan

Sec. 1	・ The alignment of the Main Road and the TPP Link Road, which had been prepared by NHAI independently, is also followed in the New Plan. ・ The alignment of the Main Road and the TPP Link Road passes south of the Original Plan to avoid residential areas such as Puduvoyal, Ponneri, and others.
Sec. 2	(North of Tamaraipakkam) ・ The New Plan avoids residential areas, such as Vengal, Vadamadurai, and Periyapalayam. The Vengal Bypass Road and the Vadamadurai Bypass Road are no longer necessary. (South of Tamaraipakkam) ・ Not by improving the existing road but by constructing a new bypass road, the New Plan avoids the residential areas, such as Tamaraipakkam and Velliyur, as well as religious facilities, such as Hindu temples and Christian churches.
Sec. 3	・ The New Plan avoids the residential areas, such as Thiruvallur, Kakkalur, and Manavalangar, as well as Melnallathur industrial area in order to minimize the adverse impacts. ・ For the area close to Sriperumbudur residential area and Srperubudur Lake, the adverse impacts are minimized by improving the existing road rather than installing a new road.
Sec. 4	・ Improvement of the existing road is planned for this section, so there is no difference between the Original Plan and the New Plan.
Sec. 5	・ By traversing the north of Singaperumalkoi through farmlands as well as paddy fields, the New Plan avoids adverse impacts to the residential area. ・ By moving the end point to the cross point of NH49 close to Poonjeri, the New Plan avoids adverse impacts on the World Heritage sites. The end point, originally set up as the start point, is at Thirukazhukundram Road in Mahabalipuram.

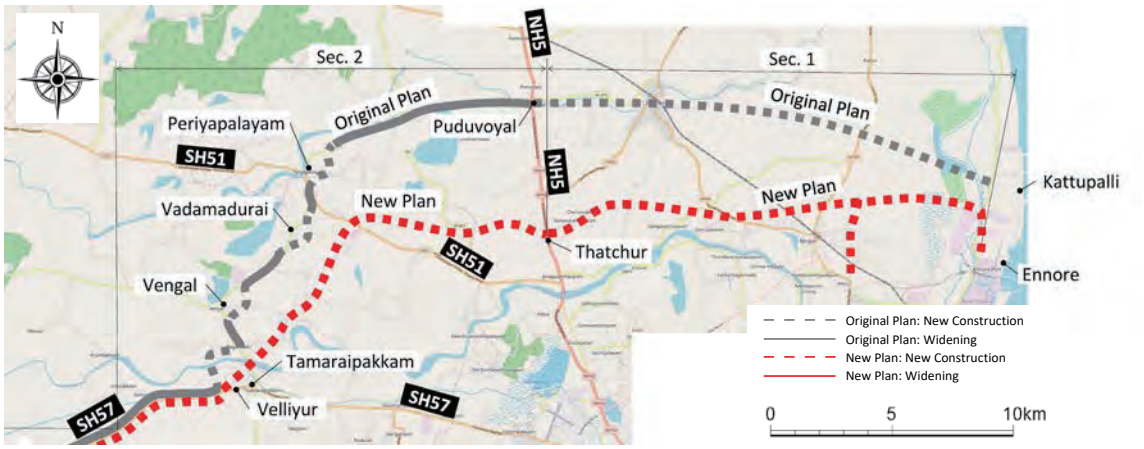
Source: JICA Study Team



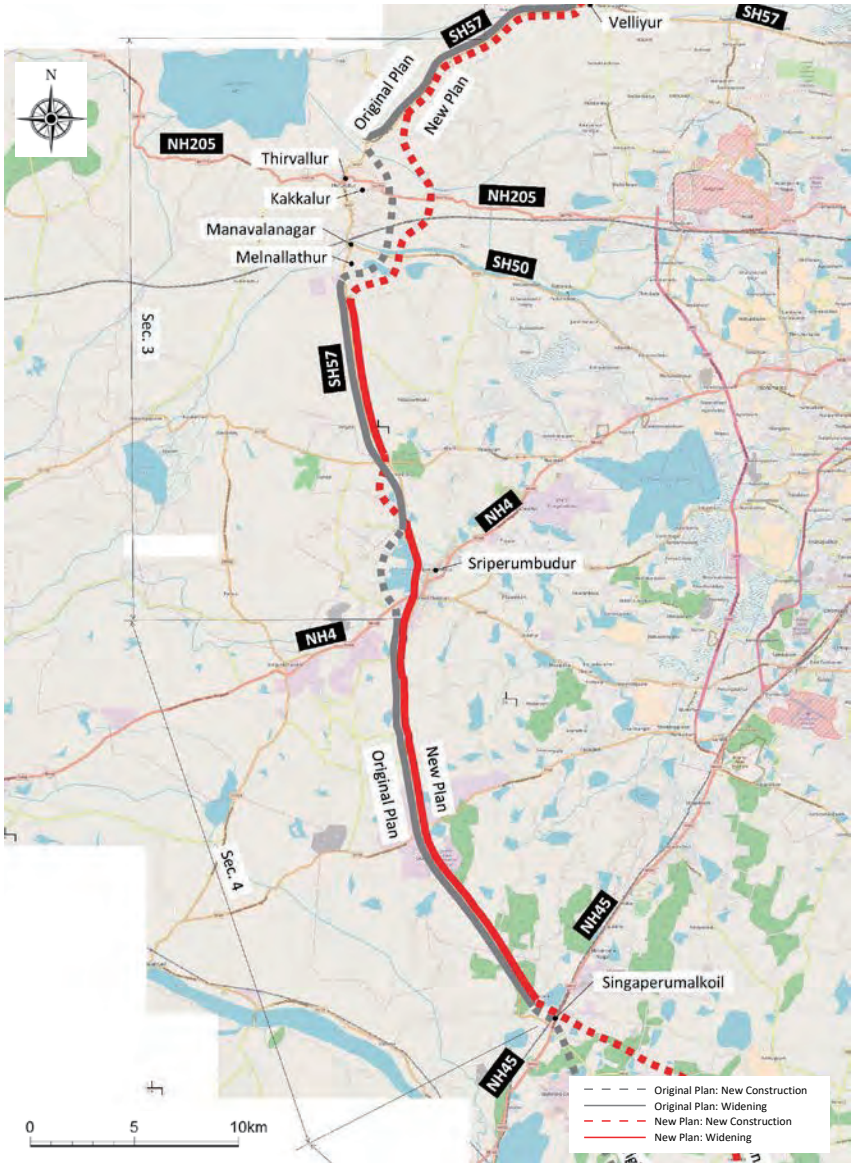
Note: *The new installation intervals are expressed in gray line while the existing road improvement intervals are in gray dotted line.*

Source: JICA Study Team

Figure 11.2.1 Original Plan and New Plan of CPRR



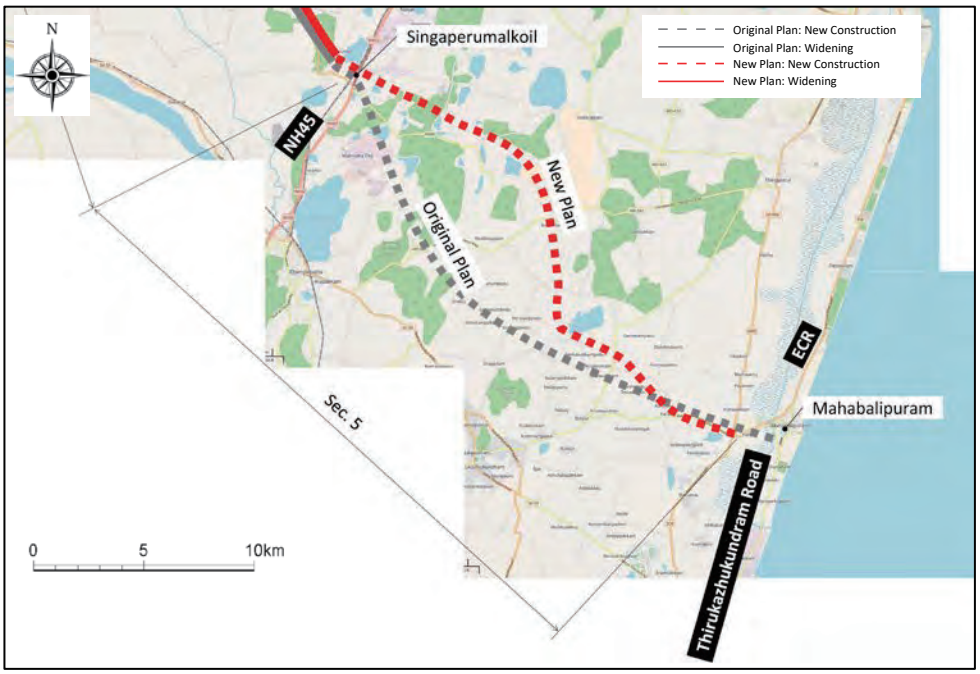
Section 1 and Section 2



Section 3 and Section 4

Source: JICA Study Team

Figure 11.2.2 Comparison of the Original Plan and the New Plan (1)



Source: JICA Study Team

Figure 11.2.3 Comparison of the Original Plan and the New Plan (2)

The JICA Study Team compared five alternative plans, namely the zero-option (no project option), the Original Plan, the New Plan, the New Plan without ITS, and the New Plan without TPP Link Road. Table 11.2.2 shows the comparison of alternative plans. The JICA Study Team concluded that the New Plan is the most reasonable plan among the alternatives.

Table 11.2.2 Comparison of Alternative Plans

Compared Items	Plan-0 **Zero-Option** -without any project-	1.Original Plan	2.Proposed Plan (New Plan)	3.New Plan (without ITS)
Outline	・ The peripheral road is not implemented while the existing road network handles the expected traffic demand. ・ The current road network as well as the current traffic conditions are maintained.	・ In addition to the existing road network, the peripheral road with original alignment handles the expected traffic demand. Peripheral Ring Road: ・ L = 162 km ・ Main road with 4-6 lanes with one-lane service roads on both sides and a total length of 162 km consisting of 85.1 km of new installation intervals and 77.0 km of improvement (widening) intervals ・ Maximize the use of the existing road while bypasses are installed to avoid passing through the residential area along the suburbs of Chennai Metropolitan Area (CMA)	・ In addition to the existing road network, the peripheral road with the current proposed alignment and ITS facilities handle the expected traffic demand. Peripheral Ring Road: L=133 km ・ Main road with 4-6 lanes with one-lane service road on both sides and a distance of 133 km consisting of 96.2 km of new construction intervals 36.5 km of improvement (widening) intervals ITS Facilities: ・ Traffic control system covering the project proposed intervals consists of traffic management system and toll collection system ・ Traffic information system covers the whole CMA, City Bus Management System, and Traffic Control System in CMA ・ The alignment of Plan-2 is approved by the committees set by the state government.	・ In addition to the existing road network, the peripheral road with current proposed alignment and ITS facilities handle the expected traffic demand. Peripheral Ring Road: L=133 km ・ Main road with 4-6 lanes with one-lane service road on both sides and a distance of 133 km consisting of 96.2 km of new construction intervals 36.5 km of improvement (widening) intervals. ・ The alignment of Plan-2 is approved by the committees set by the state government.
Improvement of the traffic condition	× ・ Without the project the traffic condition is expected to be worsen according to the social and economic growth of Chennai area.	○ ・ The Peripheral Ring Road is expected to properly allocate the incoming traffic to Chennai by working as a ring road, and is expected to alleviate traffic congestion in the city in a certain level.	◎ ・ The Peripheral Ring Road is expected to properly allocate the incoming traffic to Chennai by working as ring road, and is expected to alleviate traffic congestion in the city in a certain level.	○ ・ The Peripheral Ring Road is expected to properly allocate the incoming traffic to Chennai by working as ring road, and is expected to alleviate traffic congestion in the city in a certain level.

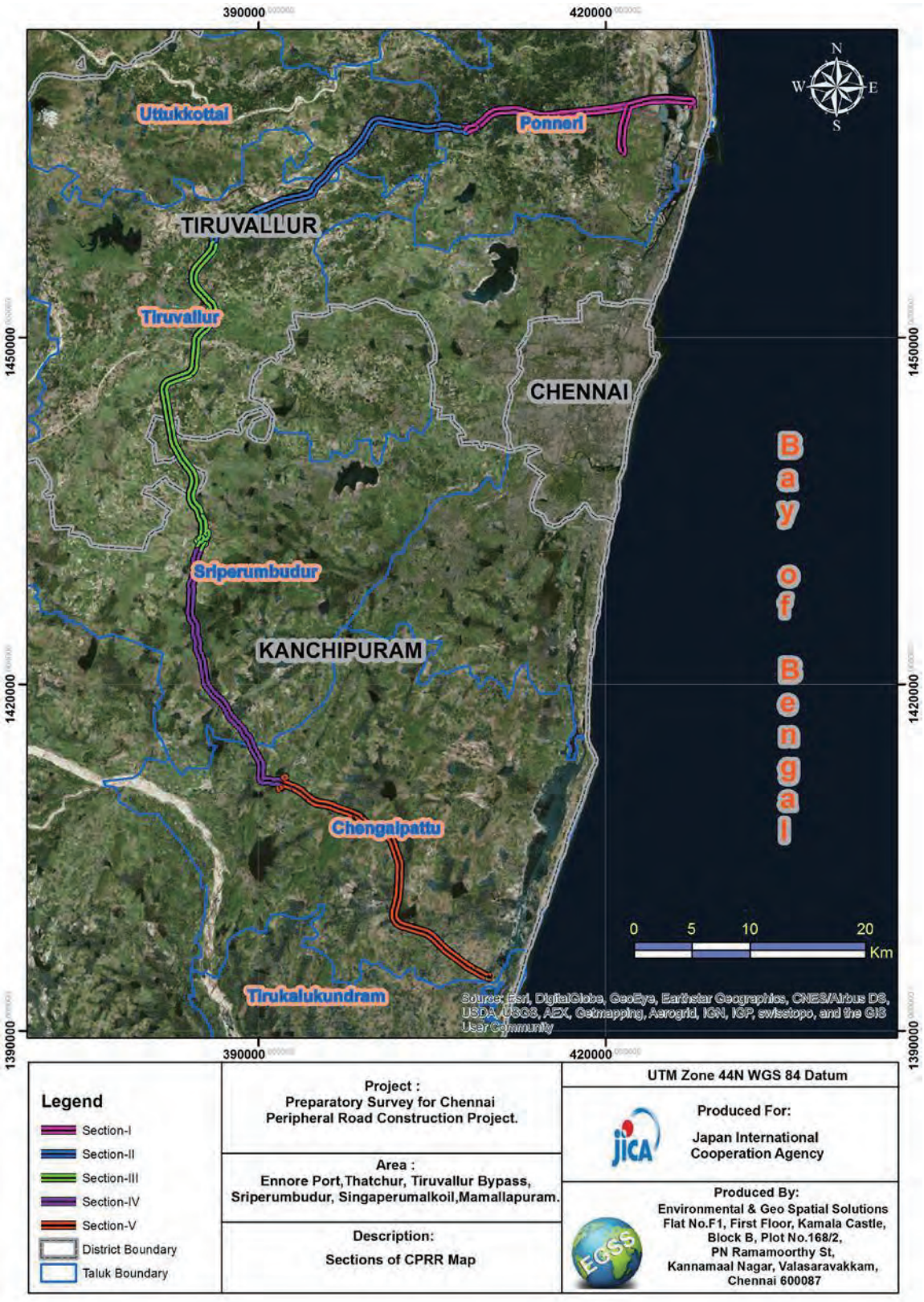
Compared Items	Plan-0 **Zero-Option** -without any project-	1.Original Plan	2.Proposed Plan (New Plan)	3.New Plan (without ITS)
			・ By including the TPP Link Road in this project and ITS implementation, systematic utilization of the road network in Chennai area becomes available; thus, the effects of traffic congestion alleviation are expected to be maximised. ・ The distance to the Ennore/Katapari Port from the industrial zone is shorter than that of Plan-1; thus, this plan contributes greatly to the improvement of accessibility to the ports. ・ By having longer new installation intervals, the flexibility of designing the alignment is increased. This leads to better traveling performance and road safety compared with those of Plan-1.	・ By including the TPP Link Road in this project, systematic utilization of the road network in Chennai area becomes possible; thus, the effects of traffic congestion alleviation are expected to be better than those of Plan-1. ・ The distance to the Ennore/Katapari Port from the industrial zone is shorter than that of Plan-1; thus, this plan contributes greatly to the improvement of accessibility to the ports. ・ By having longer new installation intervals, the flexibility of designing the alignment is increased. This leads to better traveling performance and road safety compared with those of Plan-1.
Impact on living and local conditions	△ ・ The degraded traffic condition leads to the disturbance of community life, such as commuting to work, offices, and hospitals. In addition, the possibility of having health deterioration is expected to be higher due to the increase of exhaust gases from increased traffic. ・ No fragmentation of the community is expected.	△ ・ Traffic congestion is expected to be alleviated, and the possibility of health deterioration due to exhaust gas will be decreased. ・ By having a service road on both sides of the highway, the fragmentation of the local area will be alleviated to a certain degree.	△ ・ Traffic congestion is expected to be alleviated, and the possibility of health deterioration due to exhaust gas will be decreased. ・ By having a service road on both sides of the highway, the fragmentation of the local area will be alleviated to a certain degree.	△ ・ Traffic congestion is expected to be alleviated, and the possibility of health deterioration due to exhaust gas will be decreased. ・ By having a service road on both sides of the highway, the fragmentation of the local area will be alleviated to a certain degree.
Adverse impacts on natural environment and mitigation measures	◎ ・ Neither direct adverse impact nor any change by the project is expected.	△ ・ There is a possibility of having adverse impact on the natural environmental by altering the land use of the CRZ area and the reserved forest partially.	○ ・ There is a possibility of having adverse impact on the natural environmental by altering the land use of the CRZ area and the reserved forest partially.	○ ・ There is a possibility of having adverse impact on the natural environment by altering the land use of the CRZ area and the reserved forest partially.

Compared Items	Plan-0 **Zero-Option** -without any project-	1.Original Plan	2.Proposed Plan (New Plan)	3.New Plan (without ITS)
			・ The length of intervals passing through the reserved forest is shorter than that of Plan-1.	・ The length of intervals passing through the reserved forest is shorter than that of Plan-1.
Adverse impacts on social environment and mitigation measures	△ ・ No change regarding illegal occupation in the right-of-way (ROW) is expected while no resettlement occurs. ・ The degree of traffic congestion is expected to worsen.	× ・ Land acquisition and resettlement are required, which may cause adverse effects on the livelihood of the residents. ・ The total length of the proposed alignments is 162 km; therefore, the area for land acquisition becomes bigger than that of Plan-2. ・ In addition, the interval of the improvement by widening the existing road is 77 km long; therefore, the expected number of residents for resettlement becomes larger than that of Plan-2. ・ There is a gap between the JICA guideline and the Indian legal system regarding resettlement. This can be filled by conducting gap analysis and proper countermeasures. ・ Traffic congestion in the central area will be alleviated.	○ ・ Land acquisition and resettlement are required, which may cause adverse effects on the livelihood of the residents. ・ The total length of the proposed alignment is 133 km; therefore, the area for land acquisition becomes smaller (255 ha) than that of Plan-1. ・ In addition, the intervals of the improvement by widening the existing road is 37 km long; therefore, the expected number of residents for resettlement becomes smaller than that of Plan-1. ・ The shape of the alignment avoids the existing residential areas which is reasonable. ・ With the above reasons, the residential resettlement (198 households) is smaller than that of Plan-1. ・ Although the length of the new installation intervals is longer than that of Plan-1, the expected adverse impacts can be smaller than that of Plan-1 as long as proper compensation for farmland, wasteland, and paddy field is done where the alignment passes. ・ There is a gap between the JICA guideline and the Indian legal	○ ・ Land acquisition and resettlement are required, which may cause adverse effects on the livelihood of the residents. ・ The total length of the proposed alignment is 133 km; therefore, the area for land acquisition becomes smaller (255 ha) than that of Plan-1. ・ In addition, the intervals of the improvement by widening the existing road is 37 km long; therefore, the expected number of residents for the resettlement becomes smaller than that of Plan-1. ・ The shape of the alignment avoids the existing residential areas which is reasonable. ・ With the above reasons, the residential resettlement (198 households) is smaller than that of Plan-1. ・ Although the length of the new installation intervals is longer than that of Plan-1, the expected adverse impacts can be smaller than that of Plan-1 as long as proper compensation for farmland, wasteland and paddy field is done where the alignment passes. ・ There is a gap between the JICA guideline and the Indian legal

Compared Items	Plan-0 **Zero-Option** -without any project-	1.Original Plan	2.Proposed Plan (New Plan)	3.New Plan (without ITS)
			system regarding resettlement, but this gap can be filled by conducting gap analysis and proper countermeasures. ・ Traffic congesion in the central area will be alleviated.	system regarding resettlement, but this gap can be filled by conducting gap analysis and proper countermeasures. ・ Traffic congestion in the central area will be alleviated to a certain extent.
Economic Performance	○ ・ Initial cost and any operational costs are not required. ・ Social loss due to traffic congestion becomes worst.	△ ・ It is necessary to secure the cost as initial investment for equipment, construction, and its management and supervision, land acquisition and resettlement, compensation, as well as operation and maintenance cost for road and ITS. ・ Social loss due to traffic congestion becomes less than that of Plan-0.	△ ・ It is necessary to secure the cost as initial investment for equipment, construction, and its management and supervision, land acquisition and resettlement, compensation, as well as operation and maintenance cost for road and ITS. ・ Social loss due to traffic congestion becomes less than that of Plan-1.	△ ・ It is necessary to secure the cost as initial investment for equipment, construction, and its management and supervision, land acquisition and resettlement, compensation. ・ Social loss due to traffic congestion becomes less than that of Plan-1.
Total Evaluation*	△ ・ Due to the non-implementation of any project activity, no budget is required and no direct adverse impact on the environmental and social conditions is expected, but there are economical and social losses due to worst traffic condition.	○ ・ Although the initial cost and the operational costs are required, positive impacts on social environment are expected due to the alleviation of traffic congestion. ・ This plan may cause adverse impacts on both natural and social environments; thus, mitigation measures and monitoring activities are required.	◎ -Proposed plan- ・ Although the initial cost and the operational costs are required, positive impacts on social environment are expected due to the alleviation of traffic congestion over a side range. ・ This plan may cause adverse impacts, which are lesser than those of Plan-1, on both natural and social environments; thus, mitigation measures and monitoring activities are required.	○ ・ Although the initial cost and the operational costs are required, positive impacts on social environment are expected due to the alleviation of traffic congestion to a certain extent. ・ This plan may cause adverse impacts, which are lesser than those of Plan-1, on both natural and social environments; thus, mitigation measures and monitoring activities are required.

Source: JICA Study Team

The district boundary and the sections of the CPRR Project are shown in Figure 11.2.4.



Source: JICA Study Team

Figure 11.2.4 District Boundary and Sections of the CPRR Project

11.2.2 Screening

(1) JICA Guidelines

The Project is categorized A according to the JICA Environmental and Social Guidelines 2010 because the road sector is likely to have significant adverse impacts on the environment, and its components are likely to have significant adverse impacts on the society regarding large-scale involuntary resettlement. (Table 11.2.3)

Table 11.2.3 Categorization Criteria of the JICA Guidelines

Category	Categorization Criteria
Category A	● Proposed projects are classified as Category A if they are likely to have significant adverse impacts on the environment and society. ● Projects with complicated or unprecedented impacts that are difficult to assess, or projects with a wide range of impacts or irreversible impacts, are also classified as Category A. ● These impacts may affect an area broader than the sites or facilities subject to physical construction. ● Category A, in principle, includes projects in sensitive sectors, projects that have characteristics that are liable to cause adverse environmental impacts, and projects located in or near sensitive areas.

Source: JICA Guideline 2010

A project categorized A requires an Environmental Impact Assessment (EIA) study that fulfills the requirement of the JICA guideline and the local legal framework, if it exists. The EIA study shall be reviewed by the JICA Advisory Committee at the scoping phase and at the draft final report phase. Local stakeholder meetings are also required at the scoping phase and at the draft final report phase. Furthermore, a record of the meetings must be included in the report submitted to the Advisory Committee. The final EIA report, together with an official approval certificate or letter from the recipient government if any, must be published for review and commenting on the website of JICA and of the recipient government.

(2) Indian Legal Framework

Environmental Notification 2006, with its amendment in 2009, 2011, and 2013, stipulates the conduction of EIA, Environmental Clearance (EC), and their procedures according to the type, size, and location of the proposed project. The proposed project can start only after the EC is granted.

For a State Highway (SH) project, acquiring an EC is stipulated as shown in Table 11.2.4. The proposed project includes new construction highway intervals; therefore, the Project is categorized B in 7(f) (i) wherein an EC is required.

The HMPD (Chengalpattu Divisional Engineer (H)) has applied for EIA TOR for the CPRR Project on 26 October 2017. The Tamil Nadu State Environmental Impact Assessment Authority (TNSEIAA) issued the EIA TOR on 5 March 2018 to HMPD. HMPD submitted the draft EIA report to Tamil Nadu State Pollution Control Board (TNSPCB) on 11 April 2018. TNSPCB called for public comments, then, conducted public consultation meetings in Kancheepuram District on 10 July 2018 and in Thiruvallur District on 12 July 2018. The collected comments/opinions and records of the meeting were reflected on the final EIA report, and the report was submitted to TNSEIAA on 20 July 2018.

Table 11.2.4 Highway Project that Requires an EIA Report and Its Approval

Project or Activity		Category with Threshold Limit	
(1)	(2)	(3) Category A: Reviewed by Central Government	(4) Category B: Reviewed by State Government
7(f)	Highways	(i) New National Highways; and (ii) Expansion of National Highways greater than 100 km involving additional right of way or land acquisition greater than 40 m on existing alignments and	(i) All New State Highway Projects; and (ii) State Highway expansion projects in hilly terrain (above 1,000 m AMSL) and or ecologically sensitive areas. (2011) Provided that the following shall not require Scoping. - (i) *Omitted.* (ii) all Highway expansion projects covered under entry (ii) of column (3) and column (4) under sub-item (f) of item 7 of the Schedule: Provided further that--- A. *Omitted.*

Project or Activity		Category with Threshold Limit	
(1)	(2)	(3) Category A: Reviewed by Central Government	(4) Category B: Reviewed by State Government
		60 m on re-alignments or by-passes.	B. The projects referred to in clause (ii) shall prepare EIA and EMP ·report on the basis of' model TOR specified by Ministry of Environment and Forests; (2013)

Source: Notification under Sub-rule (3) of Rule 5 of the Environment (Protection) Rules, 1986 (Gazette of India, Extraordinary, Part-II, and Section 3, Sub-section (ii), New Delhi 14 September 2006 (2009, 2011, 2013 amendment), http://envfor.nic.in/legis/eia/so1533.pdf

11.2.3 Review of the DPR EIA and SIA/RAP

During the development of the DPR, initial environmental evaluation was conducted. Public consultations were also implemented to disseminate the Project, the survey results on environmental and social impacts, plan and policy on land acquisition, and framework of compensation and other assistances.

(1) Review of DPR EIA

Table 11.2.5 shows the summary of environmental and social impacts described in the EIA report attached to the DPR.

The environmental impacts expected to be caused by the CPRR are the same as those caused by the ordinal road construction works and existence of artery roads. In this sense, the prediction of impacts described in the DPR EIA was agreed in principle by the JICA Study Team.

A different impact assessment was proposed by the JICA Study Team on the following points after site visits and review of design and necessary construction works:

- **Water Resources**: For most parts of the area, the CPRR Project Road is planned without or with minimal piped water system. Use of surface or groundwater for the CPRR Project may cause competition with local water use. The JICA Study Team decided to purchase water from private water tankers for construction works, office, and other facilities.
- **Regional Economy of Employment and Livelihood**: Negative impacts, such as road closure and traffic control, at the crossing point between the existing road and the planned new road can be avoided or minimized by proper planning of construction works. On the other hand, impacts on economic activities and daily life of local businesses and residents are expected due to the expansion of existing SHs since the relocation or setback of various roadside businesses and commercial structures.
- **Transmittable Diseases Including HIV/AIDS**: The CPRR Project Road is the outer ring road of the Chennai Metropolitan Area (CMA). The construction of the CPRR Project Road will not directly strengthen the connection between CMA and outside areas. The road, therefore, will not especially cause large migration of people or facilitate transmission of diseases.

Table 11.2.5 Summary of Environmental and Social Impacts Described in DPR EIA Report

Pollution control	**Ambient air quality**: The construction stage activities include removal of trees present in the corridor of impact (CoI), transportation of man and material, and installation of construction plants. There will be impacts on air quality (CO_2 and NOx). Various construction activities would result in increase of SPM levels during the construction phase. Emission of CO_2 and NOx due to the combustion of diesel will be a principal cause of air pollution during the construction phase. However, because of the short duration, the impact will be less. The project will have beneficial impact on the air quality of the region during the operation phase as the proposed project aims to provide a road corridor which will ensure smooth and fast traffic flow. **Noise environment**: The major sources of noise pollution during the construction phase of the project would be the piling activities, vehicular movement and mixing, casting, and material movement. The operation of the proposed project would result in uninterrupted movement of heavy and light vehicles at high

<table>
<tr><td></td><td>speeds, which may cause an increase in ambient noise levels along the project corridor. On the other hand, within the already congested central Chennai area, improvement of noise environment can be expected through the implementation of the Project since the traffic movement in general is expected to improve.
Water resources: The impacts of the construction phase of the project will be over-exploitation of groundwater. Water requirements for the project will be sourced from surface water bodies. In these water bodies, pumping will be allowed only from the surface without boring of any tube wells within surface water bodies. When water for the construction phase is purchased from the market, such as private water tankers, competition of water use in the locality shall be mitigated.
Water quality: Disposal of construction debris and soil erosion from the embankments may contaminate nearby water bodies. Spillage of petroleum and other hazardous materials used during construction may pollute nearby water bodies. The lack of adequate sanitary facilities, drainage, and appropriate refuse collection and disposal system in the camps of the construction workers during construction may pollute the nearby water bodies. In addition, where the project road crosses existing rivers and canals, muddy water will be generated during the construction phase.
Soil: Road construction from activities should be collected from approved quarry sites to minimize the negative impact of resource deprivation.</td></tr>
<tr><td>Natural environment</td><td>Wildlife: No wildlife crossing is found along the project corridor. The proposed road is not within 10 km radius of the ecological sensitive area.
Trees: The total number of trees is estimated at 806. Trees with girth size larger than 90 cm will be cut during the project.
Section 1 - 181 trees Section 2 - 18 trees Section 3 - 561 trees Section 5 - 46 trees
RF: The construction of the proposed road will pass through three reserve forests which affect forest land that is bound to change for land use promotion.
<table>
<tr><th>Section</th><th>District</th><th>RF</th><th>Length</th><th>ROW</th></tr>
<tr><td>3</td><td>Kancheepuram</td><td>Mannur</td><td>0.2 km</td><td>60 m</td></tr>
<tr><td>5</td><td>Kancheepuram</td><td>Thirutteri</td><td>0.5 km</td><td>60 m</td></tr>
<tr><td>5</td><td>Kancheepuram</td><td>Sirukundram</td><td>1.26 km</td><td>60 m</td></tr>
</table></td></tr>
<tr><td>Socioeconomic environment</td><td>The summary of resettlement is described in Section 11.4 of this report.
Temporal Lease of Land: In the construction phase, land for the detour road, workers camp, stock yard, etc., shall temporally be leased.
Vulnerable PAHs: Around 216 vulnerable Project Affected Households (PAHs) are eligible for special assistance (RAP p. 9-6). Vulnerable PAHs are those living below poverty line. Scheduled Caste/Scheduled Tribe (SC/ST) families, women-headed households, widows, physically-challenged persons, and elderly persons above 60 years of age are among the affected families. (RAP p. 3-14)
Regional Economy of Employment and Livelihood: In the construction phase, traffic regulation on existing roads may affect daily lives and economic activities of local residents. In the operation phase, significant positive impact on local economy is expected as a result of the implementation of the Project.
Public Utilities and Amenities: As common property resources (CPRs), three schools (one out of three will lose part of the school building) and one primary health center are likely to be affected. As for the utilities, telephone poles, low tension electric lines, high tension towers, OFC cable stones, lamp poles, and wells are likely to be affected. In addition, 18 temples may necessarily be relocated. Bus bays at 11 locations along the existing road shall be removed and rebuilt. When a large number of labourers are hired, there is a possibility of shortage of electricity and water services.
Historical and Cultural Resources: There are no monuments of historical or archeological significance within the influence area of the project corridor as per the Archaeological Protection Act. Hence, no impacts on these properties are anticipated due to the project.</td></tr>
</table>

	Transmittable Diseases Including HIV/AIDS: Unsanitary conditions in the labour camps might also result in negative impacts on the health of labourers, as well as the local population. Transmission of diseases is also facilitated by the migration of people. **Accidents and Crime**: The arrival of migrant labourers may cause trouble among local residents in the area near the labour camp due to the difference in cultural and religious backgrounds. Traffic jams and congestion, loss of access, and other road accident risks are results of the diversion of traffic and the road construction works.
Climate change	**Impact on Climate Change**: Impacts may occur from construction activities during the construction phase and from vehicular traffic in the operation phase. However, those impacts shall be limited to the local area, and the impacts on the global condition shall be minimal.

Source: JICA Study Team based on DPR EIA and DPR RAP, 2017

(2) Review of DPR RAP 2017

1) Necessity of Land Acquisition and Resettlement in the Project

The CPRR requires land for the New Alignment and for the expansion of the existing SH. (Table 11.2.6) The New Alignment is located mainly on agricultural and vacant land to minimize resettlement. In Section 3, the expansion of the existing highway requires relocation or set-back of existing commercial and residential structures, while Section 4 is already in use.

Table 11.2.6 Planned Length of Project Road by Section

	Section 1	Section 2	Section 3	Section 4	Section 5
New alignment	25.22 km	26.25 km	19.95 km	0 km	25.50 km
Expansion of existing SH	0 km	0 km	9.6 km	24.85 km	2 km
Total length	25.22 km	26.25 km	29.55 km	24.85 km	27.50 km
Width of ROW	100 m	60 m	60 m	60 m	60 m
Planned area for land acquisition	255.00 ha	187.66 ha	208.04 ha	0.00 ha	162.83 ha

Source from area for land acquisition: STUP Consultants Letter to DE (Chengalpattu) HMPD, E/14518/149/NJW/GK/0132, 11 August 2017
Other sources: DPR, HMPD

2) Review of DPR RAP 2017

The structures and other properties and PAPs/PAHs related to those were counted for Sections 2, 3, and 5 in the 2014-2016 DPR study conducted by HMPD (Table 11.2.7). The number of PAHs is largest in Section 3. The survey was finished on 30 July 2016.

For Section 1, an update of the DPR/SIA was conducted in 2017. The census survey started on 18 August 2018. The results of the survey are summarised in Table 11.2.7.

The land acquisition for Section 4 was already finished by 2008 and was not included in the survey.

By the review of the DPR SIA/RAP, missing information and gaps in the policies between the DPR and the JICA guidelines were found as listed below. Additional survey was conducted by HMPD to fill the information gap, and official requests from the JICA Study Team and JICA negotiations were made to bridge the policy gap.

- The target of the census and socio-economic survey is limited to owners and tenants, including non-title holders of the structures within the ROW and Project Affected Persons (PAPs), whose land will be affected or whose land will be used in ROW such as agriculture tenants.
  - The JICA Study Team requested HMPD to conduct an additional survey on the absentee land owners and land users.
- The location of the alternate housing to be offered as an option for title holders to be relocated will be decided after the PAH chooses between cash or alternate housing. The information given to the PAHs to make a decision is insufficient.
  - The JICA Study Team issued an official letter dated 20 April 2018 to CE requesting HMPD to provide information on the location of alternative housing to be offered should the eligible PAHs decide on that option.

Table 11.2.7 Summary of Existing Preliminary RAP Survey in DPR

		Section 1			Section 2			Section 3			Section 5		
		Land title	No land title Squatter/ tenant	Total	Land title	No land title Squatter/ tenant	Total	Land title	No land title Squatter/ tenant	Total	Land title	No land title Squatter/ tenant	Total
Required for Relocation/Resettlement		PAF	PAF	PAF	PAF	PAF	PAF	PAF	PAF	PAF	PAF	PAF	PAF
1	HH with structures on government land (Residence) Encroacher	-	0	0	-	0	0	-	3	3	-	0	0
2	HH to lose residence on private land (Structure Owner)	157	20	177	36	18	54	196	223	419	68	38	106
3	HH to lose residence on private land (Tenant)	(Lessor 21)	21	21	(Lessor 3)	3	3	(Lessor 26)	70	70	(Lessor 11)	29	29
4	HH to lose residence on private land (Tenant in Squatter Structure)	(Lessor 0)	0	0	26								
		Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit
5	Structure on government land (Commercial) Encroacher	-	0	0	-	0	0	-	1	1	-	0	0
6	Land owner who lose commercial structure (Structure Owner)	14	0	14	1	0	1	20	14	34	37	4	41
7	Tenant who lose commercial structure	(Lessor 4)	4	4	(Lessor 4)	5	5	(Lessor 16)	22	22	(Lessor 21)	75	75
8	Tenant of squatter who lose commercial structure	(Lessor 0)	0	0	0								
9	Community-owned structure, religious structure	16	0	16	4	0	4	58	0	58	11	0	11
Not required for relocation/resettlement		PAF	PAF	PAF	PAF								
10	Those who lose a minor portion (less than 1/3) of residence	5	-	5	49								
11	Those who lose a significant portion of non-residential structure	26	-	26	350								
12	Absentee land owners (preliminary, based on LPS)	Approx. 1,600	-	Approx. 1,600	Not counted	-	Not counted	Not counted	-	Not counted	Not counted	-	Not counted
13	Workers	(11 businesses)	6	6	(1 business)	1	1	(20 businesses)	208	208	(37 businesses)	241	241

Source: DPR 2017（Sec.2, 3, 5）, DPR 2017 (Sec. 1), HMPD, 2018 (Sec. 1)

(3) Public Consultations

Public consultations for the Project were held in July 2014, during the drafting of the DPR. The consultations were held once at five different locations along the project road. Information on the Project and related issues were provided, and opinions were collected. (Table 11.2.8, Figure 11.2.5)

Table 11.2.8 Summary of Implementation of Public Consultations

Section	Date 2014	Locations	Stakeholders (Number of Villages)	Participants	Suggestions/ Comments
1, 2	24 July	Panchetti	8	51	33
3 (1)	26 July	Melnallathur	7	53	28
3 (2)	31 July	Sriperumpudur	19	250	235
4	23 July	Oragadam	7	25	16
5	21 July	Manamathi	19	70	57

Source: DPR EIA 2017 p.10-7 - 39

The information disseminated in the public consultation is listed in Table 11.2.9, while the record photos are shown in Figure 11.2.6. The summary of opinions and suggestions orally presented is shown in Table 11.2.10.

Source: DPR SIA p.6-2, EIA p.10-6.

Figure 11.2.5 Location Map of Public Consultation Meeting 2014

Sections 1 and 2 | Section 3 (1) | Section 3 (2)

Section 4 | Section 5 (Design drawing on the wall, video recording) | Section 5

Source: DPR EIA

Figure 11.2.6 Photos from Public Consultations in 2014

Table 11.2.9 Information Disseminated in Public Consultation

- Project description: need for the project, alternative options, and alignment changes and benefits of the project, etc.;
- Social and Environmental Assessment vis-a-vis the Government of Tamil Nadu (GoTN) requirement;
- The extent and nature of negative social and environmental impact and the need for rehabilitation and resettlement in the project. Avoidance, mitigation, and enhancement aspects in the project;
- Dissemination of R&R policy formulated for the project prescribing various R&R options; and
- People's participation in planning, implementation, and monitoring and evaluation stage.

Source: DPR EIA

Table 11.2.10 Opinions and Suggestions Expressed in Public Consultations in 2014

Suggestions/Comments	Reply to Comments
Sec. 1, 2	
Engineering Aspects	
Service road is essential for this section.	Service road with foot path is proposed throughout the project road.
Village roads need to be linked with this new road.	Service road is proposed on both sides to provide access and underpasses are proposed for crossing the project road.
At km 29/000 of NH-5, what is proposed area required for construction of Interchange? Is there any option to shift this?	Exact plan showing the Interchange with proposed RoW and affected buildings are displayed. The location cannot be shifted due to the site condition.
List of survey nos. Affected due to this project is need to be informed.	Land plan schedule is under preparation. Affected registered survey numbers will be disseminated after completion of LPS.
Requested to use the already available roads under this project.	Project road will be developed with 60m right of way. Widening of existing roads requires land acquisition on both sides which will cause major social impacts on the adjoining villages.
Social Aspects	

Suggestions/Comments	Reply to Comments
What is the compensation for agricultural lands?	Compensation will be made as per latest LA & Rehabilitation & Resettlement Act '2013.
Market value should be considered for LA.	Compensation will be made as per latest LA & RR Act '2013.
What is the compensation for the buildings affected at Vishuvakkam?	No buildings are affected at this locality, only lands are affected and adequate compensation will be made as per latest LA & RR Act '2013.
Sec. 3 (1)	
Engineering Aspects	
Representative from Putlur village requested the details of survey numbers along the proposed road alignment and the ongoing surveys for NABARD work at the adjoining river side /land.	Land plan schedule is under preparation. Affected RS Nos. will be disseminated after completion of LPS. ADE explained them about on-going NABARD scheme.
Representative from Melnallathur village requested the department to widen the existing road to avoid frequent fatal accidents.	The peripheral road have a bypass proposal for Thiruvallur which reduces the traffic on the existing internal roads. Widening of existing roads will be considered in the separate project.
Details about the proposed alignment and request a copy of alignment plan for the public.	The alignment plan is displayed in the hall. The same will be available at Highways Division/Sub-division offices for reference.
Tentative time line fixed to commence and complete the project.	DPR is under preparation. On approval of the report, implementation will be decided by the Government.
Environmental Aspects	
Requested the project authority to protect the settlements at river bund and lake bund.	Project alignment is finalised in view of minimising social and environmental impacts.
Social Aspects	
Details of LA and Compensation packages are to be informed to the public in advance.	Compensation for the PAFs will be made as per latest LA & RR Act '2013.
Sec. 3 (2)	
Engineering Aspects	
Representative requested the proposed right of way of project road.	Proposed right of way is 60m whereas it is reduced to 40m at the stretch along Sriperumbudur lake to avoid social impact. No further land acquisition is proposed for the existing road stretch from Singaperumalkoil to Sriperumbudur except interchange and underpass locations.
When this scheme will be commenced.	DPR is under preparation. On approval of the report, implementation will be decided by the Government.
What is the distance from lake bund to the proposed project road?	The project road will be road adjacent to the lake bund.
What is width of the proposed RoW in the section along lake?	Proposed RoW will be around 40m from the lake bund.
What is the proposed width of each carriageway along the Lake?	Each carriageway will be 4 lane configuration.
Suggested to construct bridge on the Sriperumbudur Lake to avoid impact to residences in the town.	In order to avoid impact on water body, alignment is proposed along the bund.
Suggested to implement by-pass to the town without affecting public.	The proposed alignment will be a bypass for the town. Due to the presence of lake and ribbon development along NH-4, other alternatives were dropped to avoid environmental and social impact.
Social Aspects	
Requested to clarify on the residences affected in the Sriperumpudur area.	No pacca buildings were affected on the stretch along Sriperumpudur Lake bund. Some properties around NH4-SH57 junction will be affected due to construction of Interchange.
Suggested that, no public should be affected in the Sriperumpudur area.	Minor social impact will be there i.e. encroachments on Sriperumpudur Lake bund and buildings around NH4-

Suggestions/Comments	Reply to Comments
	SH57 junction.
Livelihood of people living along the lake bund need to be protected and hence requested for by-pass road.	No pacca buildings were affected on the stretch along Sriperumpudur Lake bund. Encroachments will be affected. Modification of alignment will cause major impact on other areas.Compensation will be made as per latest LA & RR Act '2013.
What about impact to the residential buildings near the lake bund?	As the project road will have no major impact on the residential building along lake bund.
Sec. 4	
Engineering Aspects	
What are the likely land acquisitions in this section?	As this section is under widening to 6- laning, no further land acquisition is proposed. Minor land acquisition may be required for improvements like construction of underpasses, etc.
Requested for a separate meeting at Sriperumpudur town.	Exclusive meeting will be conducted at Sriperumpudur town giving prior information.
Is there any option to reduce the proposed road width of 100 m?	Proposed right of way is 60m whereas it is reduced at this project section and stretch along Sriperumpudur lake to avoid social impact. Proposed road width is different for each section based on the traffic requirements.
What type of improvement works suggested in this section?	In order to improve the safety, underpasses are proposed at built-up sections and important junction.
Crossing facility is required at this section.	Vehicular underpasses are proposed wherever required in this section.
Bus Stop is required at Oragadam junction.	Underpass is proposed at this location as part of improvement of this section.
Vehicular underpass is required at Vallakottai temple road.	Underpass is proposed at this location as part of improvement of this section.
Environmental Aspects	
The proposed alignment can be within the Sriperumpudur lake to avoid social impact.	In order to avoid impact on water body, the alignment is proposed along the bund of Sriperumpudur lake which may cause minor social impact.
Irrigation supply channels should not be blocked due to road formation.	Necessary cross drainage structures are proposed on the new alignment sections. The existing structures should be maintained on existing road sections.
Social Aspects	
Requested to implement the project without affecting public.	As this section is under widening to 6- laning, no further land acquisition is proposed. Minor land acquisition may be required for improvements for which compensation will be made as per latest LA & RR Act '2013.
In village natham area, lands are registered but patta is not available. How compensation will be paid to the affected land owners?	Land ownership will be verified in natham area and procedure will be adopted in consultation with revenue department.
Sec. 5	
Engineering Aspects	
Whether the project is a Toll road.	The proposals on tolls will be finalised at the subsequent stages by the government.
Whether the proposed Sub-way across railway line at Singaperumalkoil will be affected by this project.	No. It is proposed to modify the geometry of Railway Over Bridge under construction at Singaperumalkoil.
Social Aspects	
Representative wanted to know the number of villages is proposed to be passing through the project road.	Study team listed the name of villages through which the project road is passing through in this section.
Representatives enquired about the compensation for affected agricultural lands in the project.	Compensation will be determined as per latest LA & RR Act '2013.

Suggestions/Comments	Reply to Comments
People also enquired about the compensation for affected wells in the agricultural lands.	Compensation will be determined as per latest LA & RR Act '2013.
Representative wanted to know the strategies going to be adopted for payment of compensation to the losses.	The compensation package matrix for the losses will be prepared as per the latest LA & RR Act '2013 and disclosed by the project authority.
Entire cultivation land is likely to be affected due to this project which has been the only source for livelihood. Hence requested the team to mitigate LA over cultivable lands.	Project alignment is finalised in view of minimising social and environmental impacts. Compensation will be paid for the affected land as per latest LA & RR Act '2013.
Representative wanted to know whether the project affects the commercial stretches at Karanai and wanted the RS Nos. of all the likely affected areas.	It is replied that, no commercial stretches would be affected. Land plan schedule is under preparation. Affected RS Nos. will be disseminated after completion of LPS.
Wanted to know is there a provision for alternate cultivable land for the loss of same.	Possibilities of providing alternate land will be evaluated and compensation packages will be determined as per latest LA & RR Act '2013.

Source: DPR RAP 2017

11.3 Environmental and Social Considerations in Section 1 (Main Road and TPP Link Road (Original Alignment))

11.3.1 General Condition of the Project Area

As explained in Section 11.6 of this report, the alignment of the link road is not significantly changed. The general condition of the Project area described below applies also to Section 1 (Main Road and TPP Link Road (New Alignment)).

(1) Geology and Topography

The study area is located on the east coastal plain of India. The topography of the area is almost flat. The geology of the area is Archaean sandstone and shale, covered by thick alluvium deposits.

Rivers in the study area flow eastward to the Bay of Bengal. There are three major rivers, namely the Kosasthalaiyar River, the Cooum River, and the Adyar River. The Buckingham Canal was constructed along the coast for water transport in the 1800s and beyond, and runs across these three rivers.

(2) Existing Land Use

Table 11.3.1 shows the land use composition of each district. The Thiruvallur District is located in Section 1, the share of wasted land and unculturable land is 46.1%, and the other 34% is agriculture and pasture land.

Land use of Section 1 ROW shows the same components with that of the district in general.

Table 11.3.1 Current State of Land Use

	Thiruvallur District	Chennai District	Kancheepuram District
Area (km^2)	3,394	175	4,483
Urban (%)	14.3	87.3	15.2
Agriculture, pastureland, etc. (%)	34.1	0.6	31.6
Forest (%)	5.5	1.5	6.1
Waste land, unculturable, fallow soil (%)	46.1	10.6	47.1

Source: Second Master Plan for CMA 2026, Chennai Metropolitan Development Authority (2008)
District Census Handbook (Thiruvallur, Kancheepuram)

Figure 11.3.1 shows images of the land use on ROW of Section 1 and nearby area.

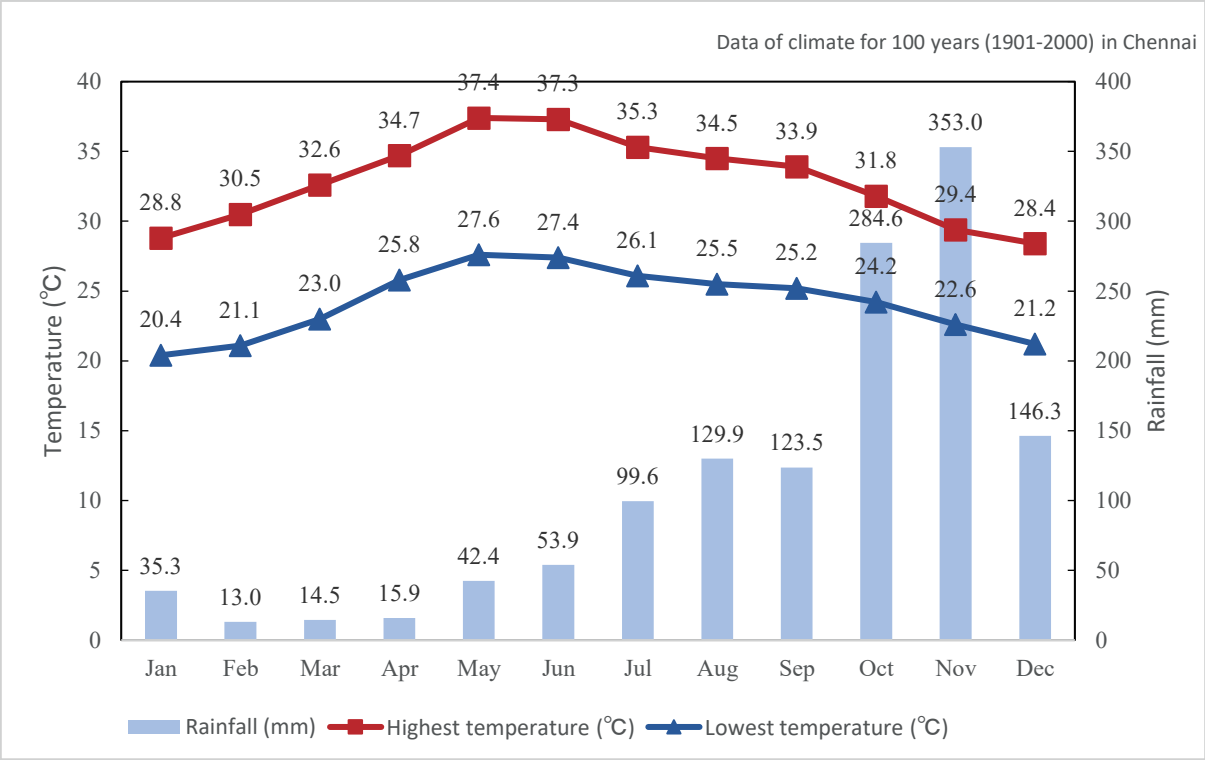
		
Power plant and industry near the start point	Wet land and abandoned land	Farming land (rice) and hamlet
		
Pasture land, fallow land	Waste land	Area near the planned NH5 Interchange

Source: JICA Study Team

Figure 11.3.1 Images of the Land Use on ROW of Section 1 and Nearby Area

(3) Climate

The study area falls in a region with tropical climate. The amount of rainfall increases owing to the southwest monsoon from June to September and the northeast monsoon from October to December. The annual monthly average lowest temperature is 20.4 ℃ in January. On the other hand, the highest temperature is 37.4 ℃ in May. (Figure 11.3.2)



Source: World Weather Information Service (http://worldweather.wm9o.int/en/city.html?cityId=527)

Figure 11.3.2 Average Monthly Rainfall and Highest and Lowest Temperature in Chennai

(4) Ambient Air

The Tamil Nadu State Pollution Control Board (TNSPCB) regularly monitors ambient air quality at designated stations under the National Air Quality Monitoring Programme. The measured items are SO_2, NOx, and suspended particulate matter (SPM).

No monitoring points are established near the planned Section 1 ROW. The nearest monitoring data available is from the four monitoring points in Chennai City. According to the monitoring results at the stations in 2014 and 2015, all SO_2 and NOx values were under the National Environmental Standard. On the other hand, SPM values tended to exceed the standard value of 100 μ g/m^3 from June to September, and the reason is more due to the dusty southwest monsoon rather than urban air pollution.

(5) Flora, Fauna, and Ecology of the Study Area

The eastern end of Section 1 is located about 1.8 km from the coast. The environment near the start point of the project road consists of a canal and the Kosasthalaiyar River in the tidal zone, salt pans, large-scale factories, and unused land lots. Narrow strip of mangrove vegetation (*Barringtonia acutangula*) is seen at points on the bank of the Kosasthalaiyar River as shown in Figure 11.3.3 and Figure 11.3.4.

Section 1 runs toward the western inland, and the interchange with NH5 about 20 km from the start is the planned end point. Landform is generally flat with an altitude of about 0 to 10 m. The inland environment around Section 1 consists of residential houses and isolated villages surrounded by rice paddies, swamps, and grasslands where cattails and flats edges grow, pasture, and wasted lands where alien *Prosopis juliflora* dominates. As for the agriculture area, besides various types of rice paddies, corn, mango, coconut, vegetables, and flowers are cultivated.

There are no designated areas near Section 1 as important wildlife habitat. There are no areas within 10 km from the project road that are recognized as ecologically sensitive areas.

Source: JICA Study Team (taken on August 5, 2017)

Figure 11.3.3 Mangrove Vegetation on the Kosasthalaiyar River

Source: JICA Study Team (taken on August 5, 2017)

Figure 11.3.4 Mangrove Vegetation on Kosasthalaiyar River (Close-up)

(6) Historical and Cultural Heritages

There are no nationally or state-designated historical and cultural heritages to be affected by the Project in Sections 1, 2, 3, and 5.

The Group of Monuments in Mahabalipuram, located about 2 to 4 km east of the southern endpoint of the project road in Section 5, is a UNESCO World Heritage site.

(7) Socioeconomic Conditions

1） Population and Household

Section 1, Section 2, and part of Section 3 are located in Thiruvallur District. The rest of Section 3, Section 4, and Section 5 are located in Kancheepuram District. Table 9.3.3 shows the population of these districts with Chennai District, which is surrounded by the two districts. (See also Figure 11.2.4)

The population growth rate in Thiruvallur District and Kancheepuram District in the same period was over 30% for a decade, from 2001 to 2011. The population in Tamil Nadu is about 72 million, and the population growth rate in the same period is about 15%. The growth rate in Chennai District was as low as 7.0%, but the population density was already surprisingly high at 26,552 person/km^2, the fourth highest city in India. The average number of household members is about four persons per household in all three districts (Table 11.3.2).

Table 11.3.2 Population and Household

	Tamil Nadu State	Thiruvallur District	Kancheepuram District	Chennai District
Population (×1000)	72,147	3,728	3,998	4,647
Population growth rate from 2001 to 2010 (%)	15.6	35.3	39.0	7.0
Area (km^2)	130,058	3,394	4,483	175
Population density (person/km^2)	554	1,098	892	26,552
Number of households	18,525	946	1,006	1,155

	Tamil Nadu State	Thiruvallur District	Kancheepuram District	Chennai District
(×1,000)				
Average number of household members (person)	3.9	3.9	3.9	4.0
Literacy rate (%)	80.09	84.03	84.49	90.18

Source: District Census Handbook (Chennai, Thiruvallur, and Kancheepuram), Census of India 2011

2）Housing

Conditions of houses in the study area are shown in Figure 11.3.5, Figure 11.3.6, and Figure 11.3.7.

Housing structures in the study area are classified into two types depending on used materials. A pucca is constructed from durable materials such as stone, metal plate, cement, and concrete. On the other hand, a kutcha is constructed using degradable materials such as straw or bamboo and thin plastics. Houses are classified into three categories according to the types of roof and wall materials: pucca, semi-pucca, or kutcha.

Table 11.3.3 shows the statistical condition of the housing environment in the study area. In Thiruvallur District where Section 1 is located, about 80% of the houses are pucca, while 10% are kutcha. In Kancheepuram District, about 40% of the houses are kutcha, and the ratio of kutcha house is highest in the three districts.

Source: JICA Study Team

Figure 11.3.5 Pucca House Example

Source: JICA Study Team

Figure 11.3.6 Semi-Pucca House Example

Source: JICA Study Team

Figure 11.3.7 Kutcha House Example

As shown in Table 11.3.3, about 40% of households in Thiruvallur District are living in a house with only one room. About 20% of households are living in houses with more than three rooms. Looking at the tenure status, about 70% of households are owners, while about 30% are renters.

Table 11.3.3 Housing Environment

	Thiruvallur District		Kancheepuram District		Chennai District	
Ratio of house types (%)	Roof	Wall	Roof	Wall	Roof	Wall
Pucca	77.5	86.0	53.9	64.6	93.1	96.8
Kutcha	22.3	13.9	46.0	35.3	6.5	3.0
Others	0.2	0.1	0.1	0.1	0.4	0.2
Ratio of number of rooms in a household (%)						
No exclusive rooms		3.3		5.2		2.3
1 room		37.7		40.9		38.5
2 rooms		34.8		36.2		30.8
More than 3 rooms		24.2		17.7		28.5
Ownership status (%)						
Owner		67.7		88.9		45.8
Rented		31.0		9.9		52.3
Others		1.3		1.2		1.9

Source: Percentage of Households to Total Households by Amenities and Assets, Census India 2011

3) Major Economic Activities and Economic Conditions

Table 11.3.4 shows the economic condition in Tamil Nadu in fiscal year 2014-2015. In Tamil Nadu, major industries are the tertiary sector (service) and the secondary sector (manufacture). The per capita gross domestic product (GDP) is INR 66,635. The tertiary sector contributes about 70% of the state net production.

Table 11.3.4 Economic Condition in Tamil Nadu State in 2014/2015

State net production	INR 4,589,866,300,000 (approx. USD 7,171,666,093)
Per capita GDP	INR 66,635 (approx. USD 1,041)
Industry composition of state net production	
Primary Sector	7.6%
Secondary Sector	25.1%
Tertiary Sector	67.3%

USD 1 = about INR 64 (rupees)
Source: Statistical Handbook of Tamil Nadu 2016

11.3.2 Legal Framework of the Environmental and Social Safeguards

(1) Governance and Management of Environment

India is a federal parliamentary democratic republic, in which the President of India is the head of state, while the Prime Minister of India is the head of the central government. India consists of 28 states and 7 union territories. Each state is administered by the Chief Minister selected through direct election. Under the Indian Constitution Article 246 with 7th Additional Rule, the administrative system under the state is the district in which various departments are installed. Large urban areas are designated as municipalities, which are separated from the district and governed by the urban management department of the state government. The structure of the municipality government differs by state, but is mainly concentrated on services to the residents and businesses such as registration of birth and death.

The Ministry of Environment, Forest and Climate Change (MOEFCC) manages the environmental administration in India. MOEFCC holds jurisdiction over climate change, green technologies, pollution control, natural environmental protection, desertification prevention, environmental education, environmental impact assessment, hazardous material control, river environment management, wildlife protection, and international cooperation related to these fields. MOEFCC has ten regional offices facilitating cooperation with the state environmental administrative office. In Tamil Nadu, MOEFCC has one of the regional offices, i.e., Southern Zone Office, in Chennai.

The Environment and Forest Department of Tamil Nadu State Government holds jurisdiction over the local environmental administration. In addition, TNSPCB is in-charge of pollution control and monitoring, while TNSEIAA and Tamil Nadu State Environmental Appraisal Committee (TNSEAC) are in-charge of appraising the EIA of the project proponent.

Chennai City is the oldest city in India and was established in 1688, with a population of 7.1 million, an area of 426 km^2, and 200 assembly members. The city government provides services to local residents and businesses such as waste management, drinking water and sewerage management, parks, sanitary and health services, drainage, land registration, and urban planning.

(2) Rules and Regulations for Development Project

1） Environmental Clearance for Developing Project

Environmental Notification 2006, with its amendment in 2009, 2011, and 2013, stipulates the conduction of EIA, EC, and their procedures according to the type, size, and location of the proposed project. The proposed project can start only after the EC is granted.

For the SH Project, acquiring EC is stipulated as in Table 11.3.5. The proposed project includes new construction highway intervals; therefore, the Project is categorized B in 7(f) (i), in which EC is required.

Table 11.3.5 Highway Project that Requirs an EIA Report and Its Approval

Project or Activity		Category with Threshold Limit	
(1)	(2)	(3) Category A: Reviewed by the Central Government	(4) Category B: Reviewed by State Government
7(f)	Highways	(i) New National Highways; and (ii) Expansion of National Highways greater than 100 km involving additional right of way or land acquisition greater than 40 m on existing alignments and 60 m on re-alignments or by-passes.	(i) All New State Highway Projects; and (ii) State Highway expansion projects in hilly terrain (above 1,000 m AMSL) and or ecologically sensitive areas. (2011) Provided that the following shall not require Scoping . - (i) *Omitted.* (ii) all Highway expansion projects covered under entry (ii) of column (3) and column (4) under sub-item (f) of item 7 of the Schedule: Provided further that--- A. *Omitted.* B. The projects referred to in clause (ii) shall

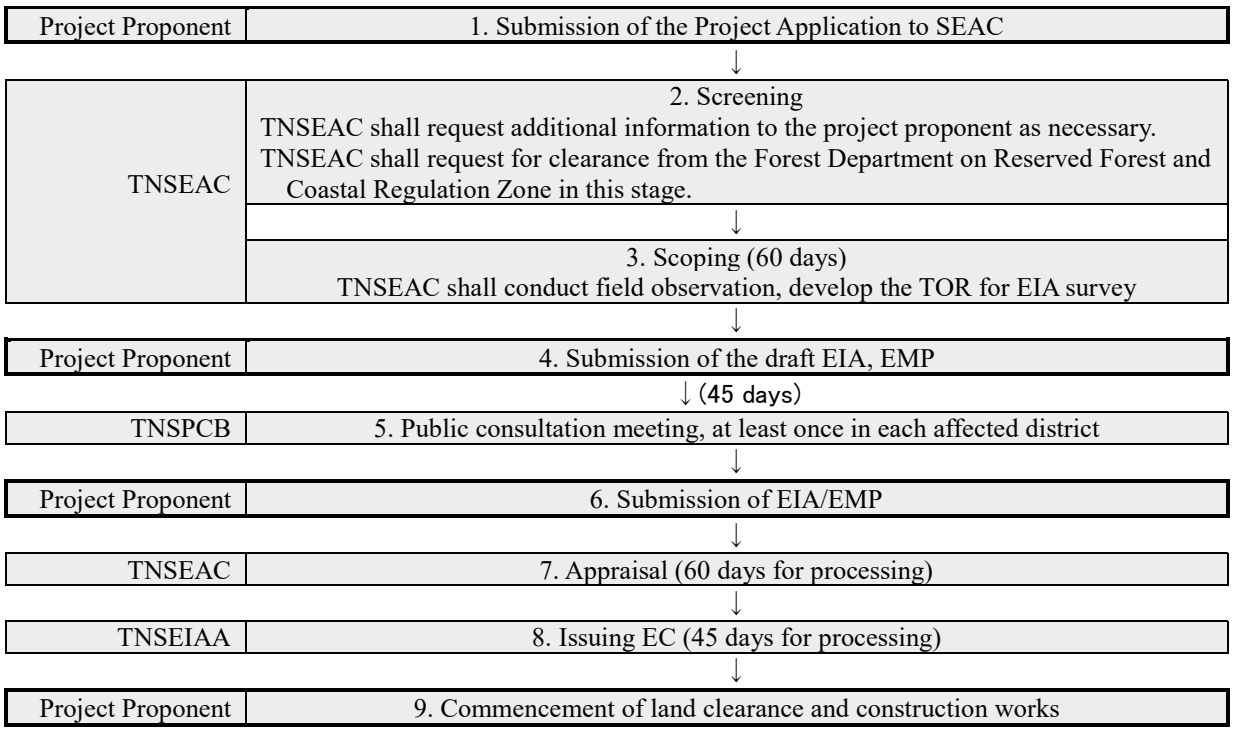
Project or Activity		Category with Threshold Limit	
(1)	(2)	(3) Category A: Reviewed by the Central Government	(4) Category B: Reviewed by State Government
			prepare EIA and EMP ·report on the basis of' model TOR specified by Ministry of Environment and Forests; (2013)

Source: Notification under sub-rule (3) of Rule 5 of the Environment (Protection) Rules, 1986 (Gazette of India, Extraordinary, Part-II and Section 3, Sub-section (ii), New Delhi 14 September 2006 (2009, 2011, 2013 Amendment), http://envfor.nic.in/legis/eia/so1533.pdf

The flowchart to acquire an environmental clearance under the EIA Notification 2006 is described in Figure 11.3.8.

Holding of public consultation meeting targeting stakeholders of the district is stipulated in Article 7, Clause (i) III, as well as Appendix IV in the EIA Notification. In addition, hearing opinions through the submission of document forms from wider areas is also stipulated. In both cases, the SPCB requested the project proponent to hold a meeting within 45 days from the receipt of the request from the project proponent. For the meeting, the draft EIA/EMP is disclosed on the homepage of SPCB. The meeting is video and audio recorded. The record and minutes prepared by SPCB are submitted to concerned institutions and the project proponent. The name and contacts of all participants will also be recorded and attached to the audio record. The finalized version of the EIA/EMP shall reflect the submitted opinions and concerns properly.

HMPD, represented by Chengalpattu Divisional Engineer (H), submitted the project application for the CPRR Project for EIA TOR on 26 October 2017. The CPRR Project was reviewed by TNSEAC on 23 February 2018. SEIAA issued the EIA TOR on 5 March 2018. HMPD submitted the draft EIA Report to TNSPCB on 11 April 2018. TNSPCB invited public comments then conducted public consultations in Kancheepuram District on 10 July 2018 and in Thiruvallur District on 12 July 2018. The final EIA report was submitted to SEIAA on 20 July 2018 with records and reflections of those opinions presented.



Source:JICA Study Team based on EIA Notice 2006 and interview with DOE

Figure 11.3.8 Flowchart to Obtain EC in Tamil Nadu

2）Gaps between the JICA Guidelines and the Indian System, and Bridging Measures

Table 11.3.6 summarizes key differences between the JICA Guidelines and the Indian EIA Notification 2006 and its amendments. The policy of the Project to bridge the gaps are also explained in Table 11.3.6.

Table 11.3.6 Gaps between JICA Guidelines and Indian System, and Bridging Measures

	JICA Guidelines	EIA Notification 2006 including its Amendments in 2009, 2011 and 2013	Gaps Between JICA Guidelines and EIA Notification	Bridging Measures
1	When assessment procedures already exist in host countries, and projects are subject to such procedures, project proponents, etc. must officially finish those procedures and obtain the approval of the government of the host country.	EIA notification stipulates the processes of EIA, and the SH is categorized for EIA conduction while EIA was not conducted for several HMPD projects in the past.	No gap exists. However, HMPD has to ensure the conduct of necessary procedures as stipulated.	The JICA Study Team helped promote HMPD to conduct necessary procedures, including related clearances and EIA study as stipulated in EIA notification. The JICA Study Team also monitored the HMPD actions.
2	JICA classifies projects into four categories according to the outline, scale, location, and environmental and social impacts. JICA requires the project proponent to conduct proper environmental and social procedures according to the above categories.	EIA notification stipulates either the category and necessary environmental and social procedures according to the categories. However, in Tamil Nadu, there are several cases in which no EIA study was conducted while the project category falls under the one in which EIA is required.	No institutional gap exists while proceeding with the project, all the necessary procedures stipulated shall be completed before the start of construction.	The JICA Study Team promoted HMPD to conduct all necessary procedures assuming EC acquisition is mandated. The JICA Study Team also monitored the HMPD actions.
3	Consultations with relevant stakeholders, such as local residents, should take place if necessary throughout the preparation and implementation stages of a project. Especially, holding consultation meetings in both stages of TOR and draft EIA report preparation is highly desirable.	EIA notification requires holding of public consultation meetings as the draft of EIA report is prepared at least at one place in every affected district. For CPRR Project, HMPD has conducted public consultations to disseminate project information and the preliminary survey results on environmental impact and land acquisition in 2014, while finalizing the DPR, at five locations, once each.	The Indian system does not require the project proponent or the reviewing institution to hold consultations at the scoping phase before commencement and decision of the TOR of the EIA study.	The JICA Study Team requested HMPD to conduct the scoping and the draft phases meetings, and the request was accepted. Public consultation meetings were held at two places in two phases. In addition, TNSPCB will hold consultation meetings on draft EIA based on the EIA Notification.
4	EIA reports (which may be referred to differently in different systems) must be written in the official language or in a language widely used in the country where the project is to be implemented. When explaining projects to local residents, written materials must be provided in a language and form	EIA Notification 2006 stipulates the preparation of EIA as well as disclosure of the EIA report including the works of consultants, while no clear rule is stipulated regarding the language.	No gap exists. The DPR EIA report was prepared in English as second language in Tamil Nadu, and the explanation for the study was conducted in Tamil.	The EIA report for this Project will be prepared in English and executive summary in Tamil. Explanation also is planned to be conducted in Tamil in principle for better understanding of the residents.

	JICA Guidelines	EIA Notification 2006 including its Amendments in 2009, 2011 and 2013	Gaps Between JICA Guidelines and EIA Notification	Bridging Measures
	understandable to them.			
5	The EIA reports are required to be available at all times for perusal by project stakeholders such as local residents, and copying must be permitted.	In EIA notification, the EIA reports are planned to be disclosed at the office of the project proponent. In addition to this, the report is disclosed on the website and can be downloaded	No	EIA/EMP to be disclosed as stipulated in EIA notification.
6	It is desirable that EIA reports cover the items enumerated in the following: Executive summary: Policy, legal, and administrative framework; Project description; Baseline data; Environmental impacts; Analysis of alternatives; Environmental Management Plan (EMP); and Consultation.	EIA notification also stipulates to include the contents described in the left column.	No	EIA/EMP will include contents directed in the EIA notification, including the following: Summary, Policy framework, Legal framework, Institutional framework, Description of the Project, Baseline information, Impacts on the environment, Analysis of alternate plan, EMP, and Consultation.

Source: JICA Study Team

(3) Laws and Regulations on Designated Areas such as Protected Areas in Section 1

The ROW of Section 1 is not located in or near any protected areas designated by Tamil Nadu or Indian governments.

The eastern part of the ROW of Section 1 is located in the Coastal Regulation Zone.

1）Coastal Regulation Zone (CRZ)

The Coastal Regulation Zone Notification 2011 was enacted to ensure livelihood security to the fisher communities and other local communities living in the coastal areas; to conserve and protect coastal stretches, its unique environment, and its marine area; and to promote development through sustainable manner based on scientific principles, taking into account the dangers of natural hazards in the coastal areas and sea level rise due to global warming. (Table 11.3.7)

Each state is expected to designate CRZs and management plans for the above described purpose. Articles 3 and 4 of the notification stipulate prohibited activities and permissible activities as well as permission procedures.

In India, national parks and wildlife sanctuaries are designated for the areas where there are certain necessities for natural environment protection under the Wildlife Protection Act 1972. The CRZ within the project area is not designated as such and is not classified as 'Protected Area' according to the definition of the JICA Guidelines.

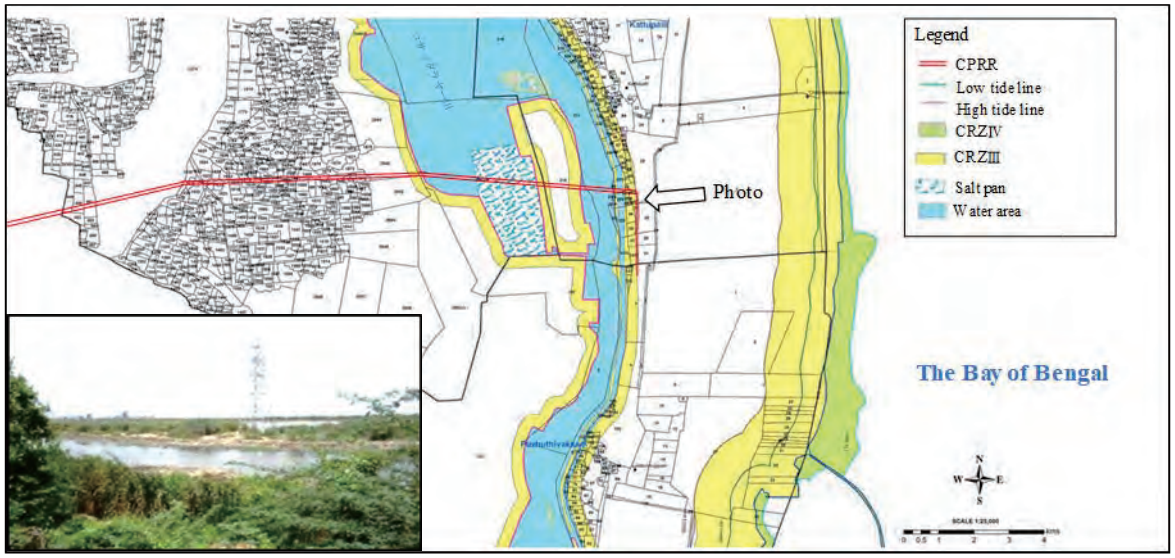
Table 11.3.7 Summary of the CRZ Objectives and Relevance to Section 1

Area with Development Regulation	Objective	Relevance to Section 1
Coastal Regulation Zone (CRZ)	Under the Environment (Protection) Act of 1986 for the whole coast in India, the Coastal Regulation Zone Notification 2011 was issued to ensure livelihood	The east end of Section 1 will pass through zone classified as CRZ-III.

Area with Development Regulation	Objective	Relevance to Section 1
	security to the fisher communities and other local communities living in the coastal areas; to conserve and protect coastal stretches, its unique environment, and its marine area; and to promote development through a sustainable manner based on scientific principles, taking into account the dangers of natural hazards in the coastal areas and sea level rise due to global warming. To pursue the purpose of the notification, each state has a designated CRZ.	

Source : JICA Study Team

Figure 11.3.9 shows the location of Section 1 and the CRZ.



Source: Coastal Zone Management Plan of Tamil Nadu Thiruvallur District Sheet No. 2, Department of Environment

Figure 11.3.9 Section 1 and CRZ

CRZs are designated in the area shown in Table 11.3.8. In addition, designated CRZs are classified into four types as shown in Table 11.3.9. The eastern end of Section 1 passes the CRZ Class III.

Table 11.3.8 Area to be Designated as Coastal Regulation Zone

1) Land area	Along the sea front	From High Tide Line (HTL) to 500 m on the landward side.
	Along the tidal influenced water bodies	Between HTL to 100 m or width of the creek, whichever is less on the landward side
2) Intertidal zone		Land area between HTL and Low Tide Line (LTL) which will be termed as
3) Ocean area		The water and the bed area between the LTL to the territorial water limit (12 nautical mile)

Source: Coastal Regulation Zone Notification, Preface

Table 11.3.9 Classification of Coastal Regulation Zone

Classification	Definition
CRZ I	・The area between low tide line and high tide line The areas that are ecologically sensitive and the geomorphological features which play a role in maintaining the integrity of the coast (mangroves, in case mangrove area is more than 1,000 m^2, corals and coral reefs and associated

Classification	Definition
	biodiversity, sand dunes, salt marshes, etc.)
CRZ II	・ The areas that have been developed up to or close to the shoreline.
CRZ III	・ Areas that are relatively undisturbed and those that do not belong to either CRZ I or II
CRZ IV	・The water area from the LTL to twelve nautical miles on the seaward side ・ The water area of the tidal influenced water body from the mouth of the water body at the sea up to the influence of tide which is measured as five parts per thousand during the driest season of the year.

Source: Coastal Regulation Zone Notification, Article 7

Among the four types of the CRZ, CRZ I is given to areas with ecological values. CRZ III, wherein Section 1 is classified, is the area designated aiming the monitoring and control of sustainable development in the coastal area. CRZ III is not, therefore, considered as 'Protected Areas' in the definition of the JICA Guidelines. Existing environment in the CRZ area on ROW consists of dredged canals and roadside vegetation in the industrial area.

HMPD submitted the Project Application to Thiruvallur Coastal Zone Management Authority (Member secretary: District PCB) on 9 January 2018. The application was accepted by the District Authority and is expected to be approved by State Authority in July.

2）Other Environmental Laws

In India, national parks and wildlife sanctuaries are designated for areas where there are certain necessities of natural environment protection under the Wildlife Protection Act 1972. The RFs and CRZs within the project area are not designated as such areas.

In India, prevention of pollution and monitoring of businesses are implemented based on the Water (Control of Pollution) Act 1974 amended in 1988, the Air (Prevention and Control of Pollution) Act 1981 amended in 1986, and the Environment (Protection) Act 1986 (defines noise pollution) amended in 1991.

Additionally, the Municipal Solid Waste Management and Handling Rules 2000, and the Hazardous Wastes (Management and Handling) Rules 1989 are implemented. Collection, treatment, and disposal of wastes are the responsibility of the local government. In the Project area, the Greater Chennai Corporation, and *Panchayat* in other parts, shall serve as counterparts for negotiation on the disposal of construction wastes in the construction phase of the Project.

11.3.3 Expected Impacts (Scoping) for Section 1 (Main Road and TPP Link Road (Original Alignment))

(1) Project Components and Typically Expected Environmental and Social Impacts

The possible environmental and social impacts from Section 1 are listed in Table 11.3.10. The project components will not differ greatly between sections.

Table 11.3.10 Project Components and Typically Expected Environmental and Social Impacts

Phase	Project Components and Activities		Typical Impacts from Project Components and Activities
Planning Phase	Demarcation of work area	● Notification of the Project and restriction of land use ● Land acquisition ● Staking and construction of border fence ● Decision of trees to be felled ● Lease contract of land parcel(s) for stockyard, site office, etc.	● Notification of stoppage and relocation of existing land use and trespassing (vendor shack, utilities (electric poles, underground utilities, utilities attached to the existing bridge structure), road and footpath, footpath to the river, etc.) ● Notification of loss of private properties ● Temporary stoppage of use of land parcel(s) selected for stockyard, etc..
Construction Phase	Preparation		
	Set up of stockyard	● Set up of concrete yard ● Set up of asphalt plant ● Storage of oils and chemicals ● Machine repair, re-fueling	● Risk of oil and chemical spill (soil contamination) ● Generation of water demand for the concrete plant ● Storage of asphalt materials ● Concrete and asphalt may be procured from the market
		● Storage of other materials and tools	● Risk of robbery (crime)
	Set up of office	● Existence of engineers and office staff	● Water demand ● Generation of wastewater ● Generation of sewer ● Generation of wastes
	Set up of workers camp	● Existence of work crew	● Water demand ● Generation of wastewater ● Generation of sewer ● Generation of wastes
	Set up of work area	● Existence of work crew	● Water demand ● Generation of wastewater ● Generation of sewer ● Generation of wastes
	Removal works (existing road, bridge, etc.)	● Removal of existing structures and vegetation ● Removal and relocation of groundwater pumps and irrigation canals in ROW	● Generation of construction waste ● Generation of needs for alternate water sources
	Set up and removal of temporal structures (Detour road, etc.)	● Slow speed at the detour road ● Removal of existing structures and vegetation	● Increased risk of local occurrence of traffic jam ● Increased risk of occurrence of traffic accidents ● Generation of construction waste
	Earthworks Bank/berm construction Excavation for bridge structure	● Alteration of land form (fill, excavation) ● Alteration of land form near water storage lakes (tanks) ● Procurement of fill material	● Erosion (generation of muddy water) (on-site, off-site) ● Alteration of land form (at the quarry site) ● Alteration of capacity of water storage lakes (tanks)
		● Generation of transportation vehicle (mainly to transport fill material)	● Generation of exhaust gas (off-site) ● Generation of noise (off-site) ● Generation of traffic jam (off-site) ● Increased risk of accidents (off-site)
	Construction general	● Operation of construction machinery and vehicles ● Use of generators	● Emission of exhaust ● Emission of noise

Phase	Project Components and Activities		Typical Impacts from Project Components and Activities
		● Disposal of construction wastes	● Disposal of construction wastes
		● Generation of employment ● Procurement of materials, etc.	● Direct and indirect positive impact to local economy
Maintenance Phase	Opening of new road sections Existence of upgraded road and bridges		● Improved traffic network in Greater CMA, that leads to less emission of exhaust gas and noise along the existing arterial road ● Increased generation of exhaust gas ● Increased generation of noise ● Existence of major bridge in tidal area

Source: JICA Study Team

(2) Expected Impacts (Scoping)

With the expected source of impacts listed in Table 11.3.10, and with the results of field surveys, information collections and review of HMPD DPR volumes, the JICA Study Team summarized the expected impacts of Section 1 according to the JICA Guideline format (Table 11.3.11).

In case the scoping is different for other sections, the section number and corresponding evaluation is specified in Table 11.3.11.

Table 11.3.11 Scoping of Potential Impacts

	Impacts	Planning Construction	Operation	Reasons for Evaluation
	Pollution Control			
1	Air Pollution	B-	B±	**Construction Phase:** Operation of construction equipment and vehicles may cause air pollution due to the emission of exhaust gas; and dusts may be generated in the construction, boring, and excavation sites. **Operation Phase:** Increased number of vehicles is expected; thus, increase of pollution load is also expected. At the same time, smoother traffic flow is expected by the Project resulting to decrease of the total pollution load as a whole in Chennai area.
2	Water Pollution	B-	B-	**Construction Phase:** Excavation works and casting bridge pier in the drainages and rivers along the proposed intervals may cause increase of turbidity. **Operation Phase:** Soil runoff from the embankment may cause water pollution in drainages and rivers.
3	Waste	B-	D	**Construction Phase**: Wastes such as excavated soil, pavement materials, steel-frame, used fuel canister, and others are expected to be generated.
4	Soil Contamination	B-	D	**Construction Phase**: Fuel, oil, and chemical leakage from construction sites as well as stockyard may cause soil contamination.
5	Noise and Vibration	B-	B±	**Construction Phase**: Operation of construction equipment and generator may generate noise and vibration. **Operation Phase:** Increase in the number of vehicles in the proposed alignment may cause increase of noise and vibration, while a more efficiently distributed traffic by the Project may alleviate noise condition in the whole area of Chennai.
6	Ground Subsidence	C-	C-	**Construction and Operation Phase**: By the geological survey for DPR, thin layers of soft soil were found at several points. No subsidence is expected at the bridge section when the piers are placed on bearing ground. The embankment section, however, may cause subsidence if it is located on soft soil. In the scoping phase, no specific data on locations and characteristics on such soil is

	Impacts	Planning Construction	Operation	Reasons for Evaluation
				available. The possibility and significance of impact are unknown.
7	Offensive Odor	D	D	No construction component which may cause offensive odour is expected in Section 1.
8	Bottom Sediment	D	D	No construction component which may cause pollution of bottom sediment by heavy metals and dioxin is expected for Section 1.
	Natural Environment			
9	Sanctuary	D	D	Section 1 is not located in or near the designated areas for nature conservation or protection of historical and cultural heritages. No negative impact is expected in those areas. The CRZ within the project area is not designated under the Wildlife Protection Act 1972 and is not classified as 'Protected Area' according to the definition of the JICA Guidelines.
10	Ecosystem	B−	B−	**Construction Phase**: Although no protected areas and habitats are located in or near the ROW of Section 1, the Project requires felling of 181 trees with girth above 90 cm (18 trees for Sec. 2, 561 trees for Sec. 3, and 46 trees for Sec. 5), according to the existing DPR EIA. Soil runoff from embankment and work areas may cause negative impacts on the habitat near the ROW. **Operation Phase:** Environmental change such as change in land use, increase of traffic volume may affect the habitat and ecosystem of existing plants and animals. Soil runoff from embankment and work areas may cause negative impacts on the habitat near the ROW.
11	Hydrological Situation	B−	B−	**Construction Phase:** Relocation of drainage as well as removal of ground water pumping facilities are planned to be conducted, while no significant adverse impact for hydrological situation and water level is expected. **Construction and Operation Phase:** On the other hand, there are some ponds working as storage reservoir which are close to the proposed alignment which may be affected by the construction work as well as the road existence.
12	Topography and Geographical Features	B−	D	**Construction Phase:** For the embankment of the proposed alignment in Section 1, large-scale soil excavation is expected; thus, some change of topography is expected around the borrow pit. In addition, soil erosion may be caused from the embankment.
	Social and Economic Environment			
13	Involuntary Resettlement, Loss of Land and Asset, Business Relocation	A−	D	**Planning Phase:** Private lands used for farming, residence, and commercial purpose shall be acquired and shall cause relocation and resettlement. **Construction Phase:** Temporal lease of land shall be necessary for the site office, stockyard, and other facilities.
14	The Poor	B−	D	**Planning and Construction Phase:** In case the compensation and assistances are not provided justly in Section 1, the relocated or affected poor may experience difficulty in recovering the livelihood.
15	Ethnic Minorities, Indigenous Peoples	D	D	Tamil Nadu designates homelands of the ethnic minorities and indigenous peoples. Such homelands are not located in the CMA including the project area.
16	Local Economy, Employment and Living, Livelihood	Section 1 B+ Section 2 B+	B+	**Construction Phase:** In Section 1 (same as Section 2), procurement of the construction materials, services and needs for food and drinks of the workers shall be generated with employment opportunities. On the other hand, at the section where the existing SH (Section 3 and Section 5) is to be expanded, the road side businesses need to be relocated or set back. This impact may negatively affect the business owners and customers.

	Impacts	Planning Construction	Operation	Reasons for Evaluation
		Section 3,5 B±		**Operation Phase:** The residents and businesses near the road shall enjoy easier access to the employment and customers in CMA. The positive economic impact shall be generated in the whole metro area since the traffic network and transportation of goods shall be improved by the Project.
17	Land Use, Local Resource Use	D	D	Section 1 shall mainly change the agriculture land and vacant land to road and related facilities. In the long term, the road side area shall be urbanized. Existing land use or local resource use, however, shall not be affected in drastic or negative manner.
18	Water Use, Water Rights	B-	B-	**Construction and Operation Phase:** There is possibility that public and private groundwater pump facilities for irrigation and drinking water are located on or near the ROW of Section 1. Section 1 may cause negative impacts to water users by the loss of these facilities.
19	Existing Public Facilities, Road and Transportation Facilities, Social Infrastructure, Social Services	B-	B±	**Construction Phase:** Temporal road closure or traffic control may be necessary at the crossing points with the existing roads. **Construction and Operation Phase:** Public facilities to be affected by Section 1 include schools, temples, and graveyards. In case adequate consultation, negotiation, compensation, and assistances are not conducted, those facilities may need to stop their services. **Operation Phase:** The project road shall connect the local area with other parts of the metropolitan area. Improved connectivity may lead to modernization and renovation of existing social infrastructures and services.
20	Social Capitals, Local Decision Making Systems, Social Organizations	D	D	Section 1 is to develop a SH at the periphery of CMA. There are no negative impacts expected on social capitals such as NGOs or decision making systems of districts and villages.
21	Uneven Distribution of the Project Impact and Benefit	D	D	No uneven distribution of project impact and benefit is expected in the Project area/Section 1.
22	Local Conflicts of Interest	D	D	No local conflicts of interest among the communities in the Project area/Section 1.
23	Split of Community	Section 1 D Section 2 D Section 3,5 B-	Section 1 D Section 2 D Section 3,5 B-	**Construction and Operation Phase:** No impact is expected since the alignment of Section 1 is not located in the existing built-up areas. (same with Section 2) Expansion of existing roads in Section 3 and Section 5 may generate difficulty of crossing during or after the construction works, wherein difficulty may cause some separation of community.
24	Historical Heritage, Cultural Resources	D	D	No nationally, state-, or district-designated historical and cultural resources are located on the ROW of Section 1 or in nearby areas.
25	Landscape	D	D	Section 1 will develop a SH at the periphery of CMA. No specific landscape resources or tourism activities are recognized. The project does not cause any specific negative impacts on landscape.
26	Gender	D	D	Section 1 does not cause any specific negative impacts on gender-related issues.
27	Children's Rights	B-	B-	**Construction and Operation Phase:** Section 1 will affect one school building including classrooms. In case adequate consultation, negotiation, compensation, and assistances are not conducted, and in case the school finds it difficult to continue its services, negative impacts on the right to education of the students shall be observed.
28	Sanitation, Public Health, Transmittable Diseases including HIV/AIDS	B-	D	**Construction Phase:** Stagnant water at the work areas and stockyards may become a breeding spot for mosquitoes that spread diseases.

	Impacts	Planning Construction	Operation	Reasons for Evaluation
				The workers to be employed in the Project may include migrant workers. There is a possibility that the number of patients of sexually transmitted diseases, including HIV, will increase. **Operation Phase:** The project road/Section 1 is the outermost circular road in CMA. Completion of the project road does not generate wider, cross-border movement of population. No significant risk of spread of diseases is expected.
29	Work Environment, Occupational Safety and Health	B-	B-	**Construction Phase:** Occupational accidents may occur at the work areas. **Operation Phase:** Workers shall be deployed for daily works, such as maintenance and toll station, and for periodic repair works. Those workers may be susceptible to accidents.
	Other			
30	Accidents, Crime	B-	B±	**Construction Phase:** Traffic control will be needed at cross sections with existing roads, and may cause traffic accidents in Section 1 (same in Section 2). For Section 3 and Section 5, accidents may increase at areas to expand the existing road, in addition to the cross sections with existing roads in the new construction areas. **Operation Phase:** Accidents shall be observed on the new road sections. On the other hand, however, reduction of traffic accidents is also expected by securing pedestrians safety by construction of footpaths and by reducing traffic jams in Section 1.
31	Climate Change, Cross-border Impacts	B-	B±	**Construction Phase:** Greenhouse gas (CO_2) shall be generated from the operation of construction machineries and transportation vehicles. **Operation Phase:** Increase of traffic volume shall result in increased emission of greenhouse gases. At the same time, the improved traffic condition of the road network, including the project road, shall lead to reduction of emission of greenhouse gas.

A+/-: Remarkable positive/serious negative impact is predicted.
B+/-: Positive/negative impact is expected to some extent.
C: Extent of impact is unknown (rurther study is necessary).
D: Impact is very small or nil, and further survey is not required.
Source: JICA Study Team

11.3.4 TOR for Further EIA Study

The following studies are planned to be conducted for items rated A, B, and C in scoping. The TOR of the study is described in Table 11.3.12.

To assist HMPD in EC process, the JICA Study Team conducted one season of surveying on flora and fauna species and local ecosystem, and two seasons (wet and dry) of baseline monitoring of air, noise, vibration, and water quality along all five sections of the CPRR Project (Table 11.3.13). The survey results will be used to evaluate the impacts during the construction and operation phases.

Table 11.3.12 Item, Content, and Method for Environmental and Social Study

Items evaluated as A-, B-, and C are selected for further study.

No.	Impacts	Study Item	Method
1	Air Pollution	1. Confirmation of ambient air standard 2. Survey on current condition of air quality 3. Assessment of expected impact of construction works	1. Research on the existing data and resources and field measurement as necessary. 2. Collection and confirmation of information on the project works: description, method, period, location/area and equipment including setting position, term, and pathway.

No.	Impacts	Study Item	Method
2	Water Pollution	1. Confirmation of ambient and effluent water standard 2. Survey on current condition of water quality 3. Assessment of expected impacts of construction works	1. Research on the existing data and resources and field measurement as necessary 2. Collection and confirmation of information on the project works: description, method, period, location/area and equipment including setting position, term, and pathway
3	Waste	1. Confirmation of the process of construction wastes and their destination	1. Hearing survey of related organizations, site reconnaissance in the project area, inventory survey for the type of wastes expected to be generated in the Project, and information collection regarding permits and approvals
4	Soil Contamination	1. Confirmation of the construction area	1. Collection and confirmation of information on the project works: description, method, period, location/area and equipment including setting position, term, and pathway
5	Noise and Vibration	1. Confirmation of environmental standards 2. Confirmation of the extent of impact during the construction of the Project	1. Research on existing data and resources 2. Field reconnaissance 3. Collection and confirmation of information on the project works: description, method, period, location/area and equipment including setting position, term, and pathway
6	Ground Subsidence	1. Confirmation of soft-soil distribution range 2. Confirmation of the extent of impact in the construction phase, as well as the operational phase of the Project	1. Research on the existing data and resources 2. Field reconnaissance 3. Collection and confirmation of information on the project works: description, method, period, and location/area
10	Ecosystem	1. Confirmation of the distribution range of vegetation and rare flora and fauna within the extent of impact of the Project	1. Research on the existing data and resources 2. Field survey, interview survey, and analysis of satellite image 3. Habitat, species, and ecosystem survey on field. 4. Collection and confirmation of information on the project works: description, method, period, and location/area
11	Hydrological Situation	1. Understanding hydrological situation in the project area	1. Hearing survey of related organizations 2. Confirming the current conditions of vegetation by field survey
12	Topography and Geographical Features	1. Understanding the topography and geographical features in and around the borrowing pit and planned embankment sites	1. Hearing survey of related organizations and collecting the list of borrowing contractors with official approval 2. Confirming the current conditions of borrowing pits and planned embankment sites by field survey
13	Involuntary Resettlement, Loss of Land and Asset, Business Relocation	1. Number and significance of the affected residents and businesses who are to be relocated because of the Project	1. Understanding the characteristics of those who are to be relocated 2. Understanding the types and significance of the impact 3. Understanding the size and types of compensation and assistance to be provided by the Project
14	The Poor	1. Number, type, and significance of the impact on the poor caused by the Project	1. Understanding the characteristics of the poor who are to be affected

No.	Impacts	Study Item	Method
			2. Understanding the types and significance of the impact 3. Understanding the size and types of compensation and assistances to be provided by the Project
16	Local Economy, Employment and Living, Livelihood	1. Number, type, and significance of the impact on the commercial and residential facilities along the existing road to be affected by the Project	1. Field counting, observation, and interviews 2. Understanding the size and types of compensation and assistances to be provided by the Project
18	Water Use, Water Rights	1. Number, type, and significance of the impact on the water use facilities and activities to be affected by the Project	1. Study of the laws and regulations related to water use and water rights 2. Existing water use conditions (groups, purposes, depth of bore wells, price for irrigation pumps, etc.) 3. Understanding the alternatives for mitigation measures and acceptance by the affected parties, such as provision of alternative water source facilities
19	Existing Public Facilities, Road and Transportation Facilities, Social Infrastructure, Social Services	1. Size, types, duration, and significance of the impacts on the public facilities to be affected by the Project	1. Location and characters of the facilities to be affected 2. Understanding the construction plan Types, technologies, timing, duration, location and area, types of machineries and vehicles, transportation routes, etc. 3. Possibility of occurrence of stoppage of services 4. Understanding the alternatives for mitigation measures and acceptance by the affected parties, such as relocation within the remaining land parcel
23	Split of Community	1. Name and location of the community to be affected, and types of activities and people to be affected	1. Understanding the locations of entry/exit to the main road and the convenience of access from existing community 2. Observation of existing small roads and footpaths that will be crossed by the project road and comparison of locations of planned crossing facilities
27	Children's Rights	1. Size, types, duration, and significance of the impacts on the educational facilities to be affected by the Project	1. Location and characters of the facilities to be affected 2. Understanding the construction plan types, technologies, timing, duration, location and area, types of machineries and vehicles, transportation routes, etc. 3. Possibility of occurrence of stoppage of services 4. Understanding the alternatives for mitigation measures and acceptance by the affected parties, such as relocation within the remaining land parcel
28	Sanitation, Public Health, Transmittable Diseases including HIV/AIDS	1. Diseases prevention measures Laws, governmental programs, international and NGO programs, etc.	1. Literature survey, including internet research 2. Finding institutions that provide lectures and pamphlets on the topics 3. Experience of HMPD and its contractors using services of above institutions
29	Work Environment,	1. Occupational safety and health measures	1. Literature survey, including internet research

No.	Impacts	Study Item	Method
	Occupational Safety and Health	Laws, governmental programs, international and NGO programs, etc.	2. Rules, standards, guidelines and experience of HMPD and its contractors in similar construction works for securing occupational safety and health
30	Accidents, Crime	1. Prevention measures against traffic accidents, laws, standards, etc.	1. Literature survey, including internet research 2. Rules, standards, guidelines, and experience of HMPD and its contractors in similar construction works to prevent traffic accidents
31	Climate change, Cross-border impacts	1. Assessment of emission of greenhouse gas (Construction Phase/Operation Phase)	1. Literature survey including internet research 2. Understanding the construction plan Types and number of machineries and vehicles, length of transportation routes, etc.

Note: Items of the impact are selected from the scoping item which were rated A, B, and C

Source: JICA Study Team

Table 11.3.13 Environmental Baseline Monitoring Plan

Pollutant	Major Source	Item	Sampling Duration	Frequency
Air Quality	Vehicle Traffic	SO_2, NO_2, PM_{10}, CO	24 hours Continuous 7 days	2 (November (rainy season) and January-March (dry season))
	Construction, Stocked Fuel	SPM, HC	24 hours Continuous 7 days	
Noise	Vehicle Traffic and Construction		24 hours	2 (November (rainy season) and January-March (dry season))
Vibration	Vehicle Traffic and Construction		24 hours	2 (November (rainy season) and January-March (dry season))
Water Quality	Construction in the River	PH SS	1 time	2 (November (rainy season) and January-March (dry season))

Source: JICA Study Team

11.3.5 Survey Results

(1) Survey Results

The survey results are given in Table 11.3.14.

Table 11.3.14 Summary of Survey Results

No.	Items	Results
1	Air Pollution	● Air quality monitoring results in Section 1 (Figure 11.3.12 to Figure 11.3.15) showed that all SO_2, NO_2, PM_{10}, $PM_{2.5}$, CO, and HC values were below the standard in the rainy season (November). On the other hand, all $PM_{2.5}$ values in the dry season (March) exceeded the standard. There is no road with high traffic volume existing near Section 1. Therefore, thermal power plants and chemical plants along the coastal area are assumed to be the main sources of $PM_{2.5}$. ● In Section 1, air pollution, noise, and vibration are likely to be generated from embankment works. Embankment volume for formation of the roadway including subgrade is estimated to be 5 million m^3. Assuming that 300 m^3 of embankment with average 20 machines

No.	Items	Results
		(backhoe, bulldozer, etc.) to be used per day, it will take approximately 800 days to complete the earthworks. It is necessary to continue control of dust generation and pollution from heavy machineries and transportation vehicles.
2	Water Pollution	● According to the water quality monitoring results in Section 1 (Table 11.3.16), pH and suspended solids (SS) values were below the standards for tolerant maximum standards for industrial effluents to surface water (BIS:2490). There is no water quality standard for public water bodies in India. ● The construction of the bridge across the Buckingham Canal in Section 1 will generate muddy water from excavation for the foundations in the canal course (Figure 11.3.9). Mitigation measures, such as silt fencing and sedimentation tank, must be installed. ● Since major bridges cross large rivers, no diversion of river water is planned. The piers will be constructed in phases keeping the cross-sectional area of rivers.
3	Waste	● Wastes discharged from public works needs to be separated and treated adequately according to the Construction and Demolition Waste Management Rules (2016), Hazardous and Other Wastes (Management and Transboundary Movement) Rules (2016), Solid Waste Management Rules (2016) and Municipal Solid Wastes (Management and Handling) Rules (2000). Specifically, under the District PCB instruction, wastes which are segregated and stored in the work area by the Contractor will be collected, transported by contracted licensed operators, and disposed of at the disposal site which will be specified by the District PCB. Recyclable materials are also collected for reuse by contracted private recycling companies. The toxic waste treatment facility of Tamil Nadu is located in Ranipet, about 80 km west from Chennai. ● In the construction of Section 1, major wastes to be generated will be soft soil, excavated soil which is not suitable for filling of embankment, plant waste, waste materials from the affected structures (if owner does not salvage them), and other containers and packing materials used for construction works (Figure 11.3.17). ● Top organic soil not exceeding 15 cm will be removed, stored, and then used as the top cover of the embankment in Section 1. The excavated soil, estimated at 23,000 m^3, is planned to be reused as material for embankment and subgrades. Incompatible soil for reuse will be spread over the ROW so that no disposal of waste soil is necessary. ● Domestic wastes will be generated from the temporary office of the Japanese consultants, local consultants, contractors, and construction supervisors.
4	Soil Contamination	● In Section 1, stockyard, repair shop, asphalt plant, and concrete plant will be established. Fuels, chemicals, bitumen, and oils stored at those facilities may contaminate soil and groundwater if spilled. ● There is no plan to use other heavy metals and chemicals, and no natural toxic matter is recorded in the local soil. ● No soil contamination from discharging oil was observed at similar construction works in CMA during the field survey. ● The facilities listed above will be established on the land designated by HMPD or on private land near the ROW by obtaining permission for establishing and operating in accordance

No.	Items	Results
		with the local laws.
5	Noise and Vibration	● According to the results of noise and vibration monitoring (Figure 11.3.19, Figure 11.3.20), values of noise in Section 1 were below but close to the standard values (55 dB(A) in the daytime, 45 dB(A) at night). Values of vibration were below the standards throughout the day. ● The most populated areas along Section 1 are at TPP Link Road between Ch.2+500 and Ch.4+560 and at the interchange with NH5 between Ch.20+600 and Ch.21+200. In the construction phase, HMPD and the Contractor must provide information on the working plan to local residents, implement individual explanation and hearing to schools and hospitals which need special care, and clarify the contact point for complaints and grievances.
6	Ground Subsidence	● For the DPR, the boring geological survey was conducted at 20 points in total for 1 bridge, 2 railway bridges, and 6 vehicle underpasses. According to the results, soft soil (sand soil with N value under 5) was found at nine points at the bridge crossing Buckingham Canal. The bridge piers are designed to reach to the support layer underneath of the soft soil. The negative impact of ground subsidence that require mitigation measures, therefore, is not expected. ● Also, the roadbed survey at 1-km intervals for the new construction section in DPR did not find any soft soil that require mitigation measures. The design CBR of 8% is applied in the pavement design. From the above two reasons, soft soil that requires a large-scale countermeasure will not exist along the Project/Section 1. ● With above condition, it is concluded that Section 1 will not cause ground subsidence.
10	Ecosystem	● In November 2017, an ecological survey was conducted at representative environments (one each from land and water area) (Figure 11.3.21, Figure 11.3.22, and Table 11.3.17-Table 11.3.25). The results showed that both land and water areas are heavily affected by human activities such as deforestation and dredging. Species ranked between VU and CR in the IUCN Red List were not found along Section 1. ● With regard to road construction within the CRZ, HMPD submitted the project application to CZMA in Thiruvallur District, Secretariat held at District PCB, in January 2018. The application passed the District review in March 2018, and is now waiting for state approval. ● With the construction works in Section 1, 217 trees below 90 cm girth size (Table 11.3.26) shall be transplanted near the original location within the ROW under supervision of the Thiruvallur District Forest Officer (DFO). Other 120 larger trees shall be felled under DFO supervision, and 1,200 trees (10 times of 120) shall be compensated by HMPD budget and planted in the area proposed by the DFO (DPR EIA 2017 p. 9-6), most likely on the ROW. The DPR recommends local tree species such as *Polyaifolia longifolia* (Nettilingham) and *Azadirachita indica* (Neem) for compensation trees (DPR EIA 2017 p. 7-12). Consequently, trees will be planted near the original location or in connected habitats under the direction of the DFO. Biodiversity in the project area, therefore, will be conserved in the long-term basis. ● Runoff soil from berm to outside of the ROW in the construction and operation phases may negatively affect roadside habitat. ● There are no natural reserves or naturally valuable species and habitats in the project area.

No.	Items	Results
		In the operation phase, environmental change such as change in land use and increase of traffic volume may negatively affect roadside ecosystem of the area consisted mainly of residential area, farming area, and abandoned farmland.
11	Hydrological Situation	● Section 1 will cross or pass near four water bodies (one salt pan and three ponds) (Table 11.3.27). In the construction and operation phases, the road may affect hydrological situation of those water bodies such as discharge, storage, and groundwater recharge capacities. ● In the planning phase, HMPD must discuss and agree with PWD, the management authority of water bodies, about necessary mitigation measures such as compensatory dredging plans where reclamation of water area is needed, and the agreed measures must be included in the work plan.
12	Topography and Geographical Features	● Stone and sand for embankment and materials for road construction such as aggregate will be purchased from licensed providers. Section 1 will not develop a new quarry. Impacts for topography and geographical feature, therefore, are not expected.
13	Involuntary Resettlement and/or Loss of Properties	● In developing Section 1, 250 ha of land acquisition is necessary. The affected structures are 206 residential structures (not including residential structures with minor impact and other structures such as wells) and 24 commercial structures (including nine residential and commercial structures). ● The average number of persons per household is 4.1, and the total number of persons in 206 structures is estimated to be about 845 (206 x 4.1 = 844.6). ● In addition, a stockyard, repair shop, asphalt plant, and concrete plant are to be established for the construction works of Section 1. Therefore, in the construction phase, the contractor will find suitable sites from the land designated by HMPD or on private land near the ROW, obtain proper land-lease contract from landowners, and obtain permission for establishing and operating such facilities from respective authorities in accordance with the local laws. After completion of construction works, the Contractor shall restore the site to the original state before returning the land to the owner.
14	The Poor	● The survey showed that 54% of the PAHs are earning between INR 15,000-25,000. The average monthly household income is INR 17,582. Since the average number of persons per household is 4.1, the average monthly income per capita is estimated as INR 4,288. ● According to the 'Report of the Expert Group to Review the Methodology for Measurement of Poverty' published by the Indian Planning Commission in 2014, the poverty line of urban area in Tamil Nadu was INR 1,380.36 per capita per month in fiscal year 2011-2012. With average household size of 4.1, the households with monthly income below INR 5,659 are considered below poverty line. ● In Section 1, 14% of surveyed households are earning between INR 0-5,000, and 8% are earning between INR 5,000-10,000. Therefore, there is a possibility that slightly more than 14% of PAHs may be earning below poverty line.
16	Local Economy such as Employment and Livelihood	● Since Section 1 will be newly constructed, the location of potential negative impacts on the existing economic activities will be limited to the intersections with existing roads. Therefore, there will be no adverse impact on the village-level or regional-level economy. ● In the construction of Section 1, approximately 50 skilled workers and 250 unskilled workers

No.	Items	Results
		are expected to be hired, and this will have direct and indirect positive economic impacts.
18	Water Rights/ Water Use	● Section 1 will affect six hand pumps, one open well, and one borewell. HMPD must consult and agree with owners to provide alternative water sources prior to the construction works. ● No negative impact on groundwater level is expected from the construction works. Most of the residents in the project area, however, rely on groundwater. In case unforeseen condition caused by the Project affects groundwater level, residents nearby will be negatively affected. ● Water will be necessary for the facilities in the construction phase such as concrete plant, temporary office (with capacity of about 50 consultants and 80 contractors, for about 100 months), workers' camp (with maximum capacity of 100 workers for about 36 months). All necessary construction water and drinking water will be procured from the market using water tankers to minimize the competition for water needs with the local residents.
19	Existing Infrastructure and Social Services	● Section 1 will affect six temples, two private tombs, two schools, and one each of village administration office (VAO), community hall, medical clinic, telephone exchange facility, and fair price shop (ration shop). (Refer to Section 11.4) ● HMPD and District Revenue Office (DRO) must discuss and agree with the owner/manager of those facilities about mitigation measures, such as on-site relocation and assistances for securing alternative site and rebuilding, to prevent occurrence of service suspension during the construction phase.
23	Physical Splits of Communities	● The alignment of Section 1 is planned to avoid existing built-up areas and to prevent physical split of communities. ● Section 1 is planned to intersect with existing roads by an overpass. The current condition of existing roads will be saved. Access from existing roads to Section 1 is secured by the service road along Section 1. Therefore, Section 1 will not cause negative impacts on existing traffic flow.
27	Children`s Rights	● Section 1 will affect two schools ((Main Road Ch.16+200 (Amur Village), Ch.20+800 (Panchetti Village)). HMPD and DRO must discuss and agree with the owner/manager of the schools about mitigation measures, such as on-site relocation and assistances for securing alternative site and rebuilding, to prevent stoppage of service during the construction phase. ● According to the Child and Adolescent Labour (Prohibition & Regulation) Act (1986), employment of person younger than 14 years is prohibited. It is necessary to comply with the law during the construction of Section 1.
28	Sanitation, Public, Health Condition, Infectious Diseases (including HIV/AIDS)	● Diseases such as malaria and dengue fever transmitted by mosquitoes are observed in CMA. In recent years, the number of patients infected by dengue fever has been increasing. In the construction phase of Section 1, if garbage and stagnant water at the construction sites, stockyards, and offices are left without proper management, such places may become breeding spots for mosquitoes and may cause diseases on and near the sites. ● According to the survey of UNAIDS in 2012/2013, HIV-infected people accounted for 0.35% of total population in India. The groups which showed relatively high infection rate are spouses of truck drivers (0.87%), skilled and semi-skilled workers (0.72%), and housekeepers (0.6%). ● According to the 2018 RAP survey, all respondents (183 households) answered that they are aware about the precautionary measures of HIV/AIDS. The major information sources are

No.	Items	Results
		television, government campaign, and radio.
29	Industrial Safety and Health, Working Environment	● India is one of the founding members of the International Labour Organization (ILO). The Ministry of Labour and Employment is committed to legislate labor safety at workplaces and to provide measures to ensure safe and healthy working conditions for every working woman and child. Domestic legislations regarding working environment and safety, however, are limited to the fields such as factory, mine, and shipbuilding industry as of 2018. ● In Tamil Nadu, the Directorate of Industrial Safety and Health is committed to develop and publicize safety guidance in construction sites. https://dish.tn.gov.in/information.html#safetybuilding ● The construction works of Section 1 must follow state guidance, ILO guidance, and safety standards in Japan to keep healthy working environment, to secure occupational safety, to prevent accidents, and to prepare for emergencies.
30	Accidents, Crime	● In India, there is the standard manual on road safety published by the Road Congress. Section 1 is designed in conformity with the standards. ● Although most of Section 1 is a new construction project, there are several intersections with existing roads, such as the ones at the east end of the start point, at the west end of the end point, and at places in the middle. At these locations, traffic congestion and traffic accidents may increase due to traffic control and detour routes during the construction phase. Locations where heavier traffic congestions may occur include places, such as at the starting point along the canal, at the flat crossing in the south end of TPP Link, and at the overpasses of the state and national highways. ● In the operation phase, an arterial road exists in the area where there was no such road before. An increase in traffic accidents, therefore, is expected. On the other hand, pedestrian safety will have positive impact due to existence of sidewalks on the service road. Also, traffic congestion and traffic accidents on existing roads that will receive less traffic due to opening of Section 1 is expected to decrease.
31	Border–crossing Impacts and Global Warming	● During the construction phase, greenhouse gas (CO_2) will be generated from the operation of the transportation vehicles and construction machineries. Also, carbon sink decreases by felling trees. ● In the operation phase, the existence of arterial roads in the area where there was no such road will cause local increase of emission of greenhouse gases. On the other hand, traffic congestion and emission of greenhouse gases will decrease on the existing roads that will receive less traffic due to opening of Section 1. In addition, the number of tree saplings to be planted will be 10 times the number of felled trees. As the planted trees grow, the trees will be a larger carbon sink will be created compared to the one before.

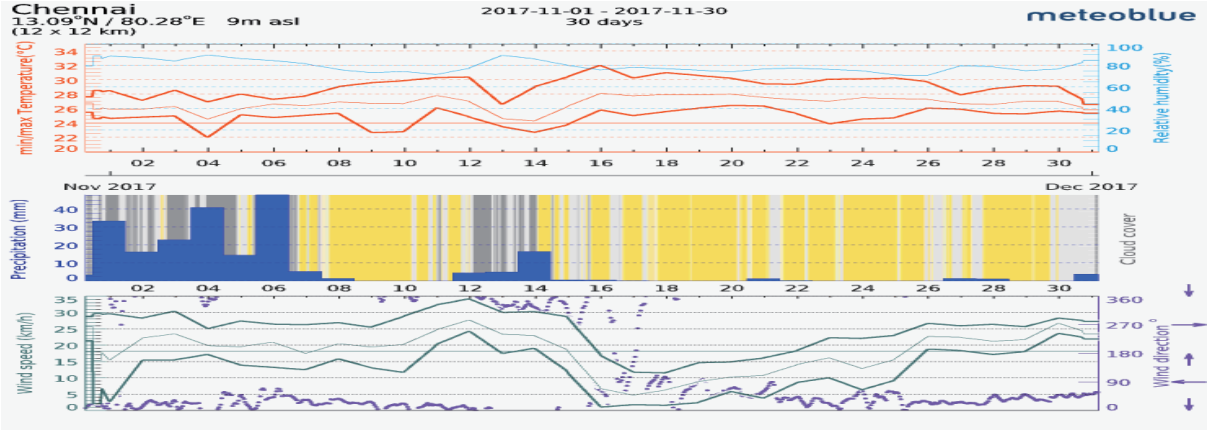
Source: JICA Study Team

(2) Meteorology

Baseline environmental data were collected for one monsoon month (November) and one non-monsoon month (March) to analyse the variation of the environmental parameters over the seasons. The meteorology of Chennai in November 2017 is shown in Figure 11.3.10, while the one in March 2018 is shown in Figure 11.3.11.

In Chennai, the period between June and November is regarded as the monsoon season (rainy season).

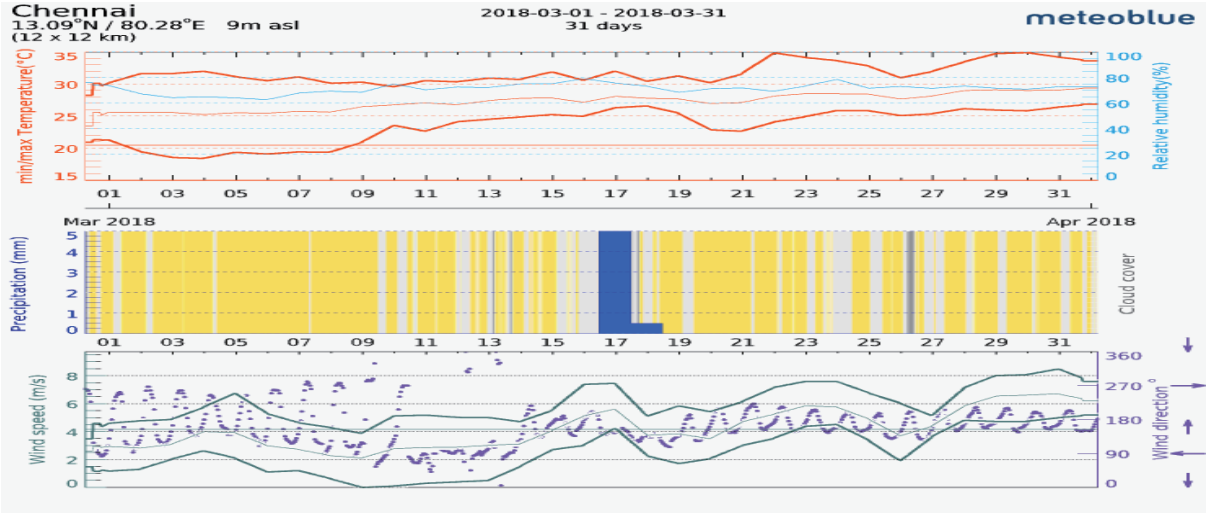
However, it rained from 01 to 14 November 2017 (when monitoring at Sections 1 and 2 was conducted). After that, clear days continued. In March 2018, it was sunny except for 17th and 18th.



	Relative Humidity		Minimum cloud
	Min/Max Temperature		Sunny
	Precipitation in mm		Wind direction
	Dense cloud		Wind speed

Source: JICA Study Team

Figure 11.3.10 Weather Data for Chennai (November 2017)



	Relative Humidity		Minimum cloud
	Min/Max Temperature		Sunny
	Precipitation in mm		Wind direction
	Dense cloud		Wind speed

Source: JICA Study Team

Figure 11.3.11 Weather Data for Chennai (March 2018)

(3) Ambient Air Quality

Air quality monitoring was conducted at four locations along Section 1. Table 11.3.15 and Figure 11.3.12 show the locations of the monitoring points. Monitoring points were selected from representative environments (urban, rural, and public facilities), within 500 m from the ROW, and considered security (equipment management) during the night hours. The results are shown in Figure 11.3.13 to Figure 11.3.16.

Air quality monitoring results in Section 1 showed that all SO_2, NO_2, PM_{10}, $PM_{2.5}$, CO, and HC values were below standards in the rainy season (November). On the other hand, all $PM_{2.5}$ values in the dry season (March) exceeded the standards. There is no road with high traffic volume existing near Section 1. Therefore,

the thermal power plant and the chemical plant along the coastal area are assumed to be the main sources of $PM_{2.5}$.

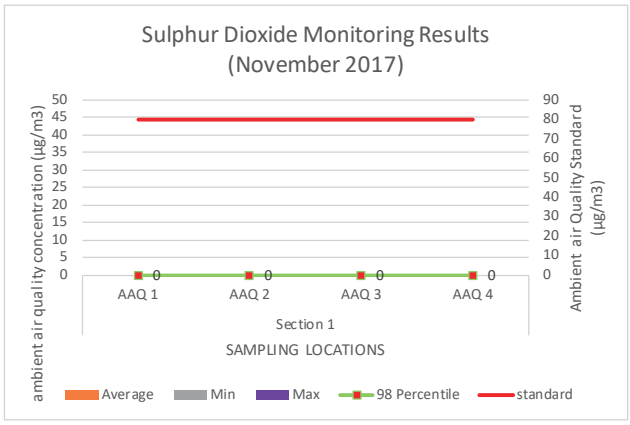
Table 11.3.15 Air, Noise, and Vibration Monitoring Sites

	Site No.	Sampling Location	Sampling Point	Coordinates
Section 1	AAQ1 N1	Kattupalli	Kattupalli Government High School, Kattupalli	13°19'48.92"N 80°20'9.30"E
	AAQ2 N2	Neithavayal	House in Neithavayal	13°17'32.56"N 80°16'0.28"E
	AAQ3 N3	Vannipakkam	House in Vannipakkam	13°17'15.53"N 80°13'10.55"E
	AAQ4 N4	Nandiyambakkam	Venkatesh Vidyalaya Matriculation School, Nandiyambakkam	13°16'27.37"N 80°16'23.08"E

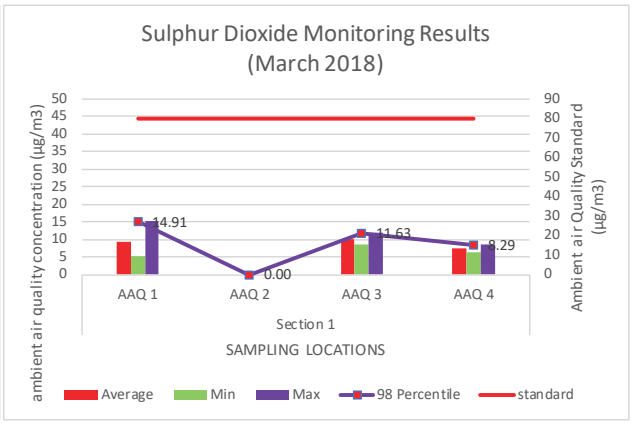
Source: JICA Study Team

Source: JICA Study Team

Figure 11.3.12 Air, Noise, and Vibration Monitoring Locations



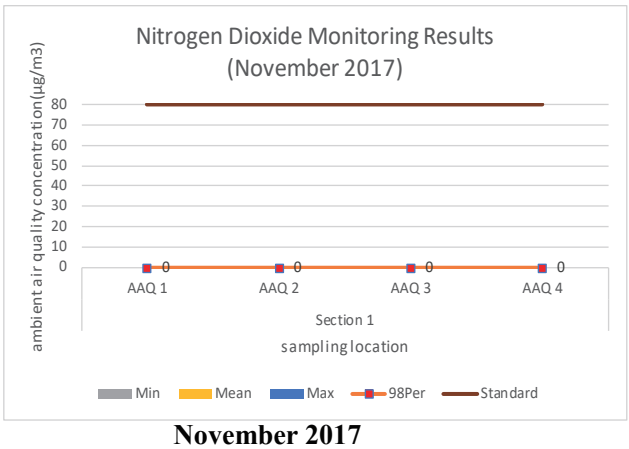
November 2017



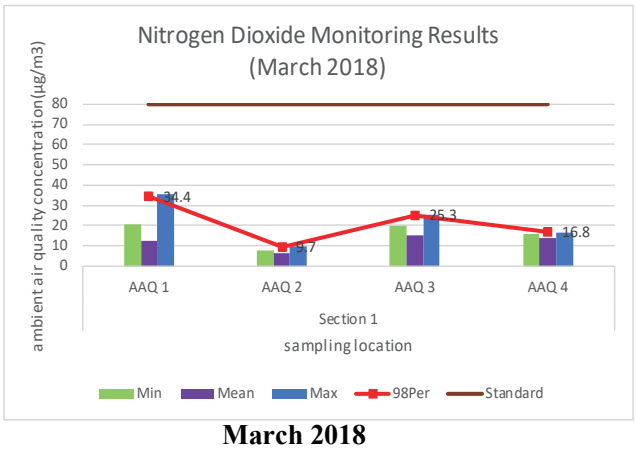
March 2018

Source: JICA Study Team

Figure 11.3.13 Sulphur Dioxide Monitoring Results



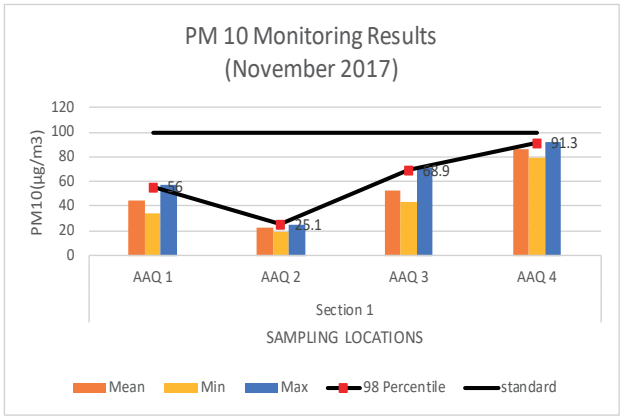
November 2017



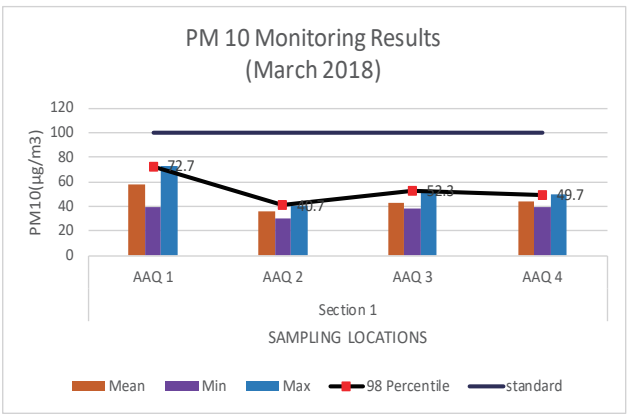
March 2018

Source: JICA Study Team

Figure 11.3.14 Nitrogen Dioxide Monitoring Results



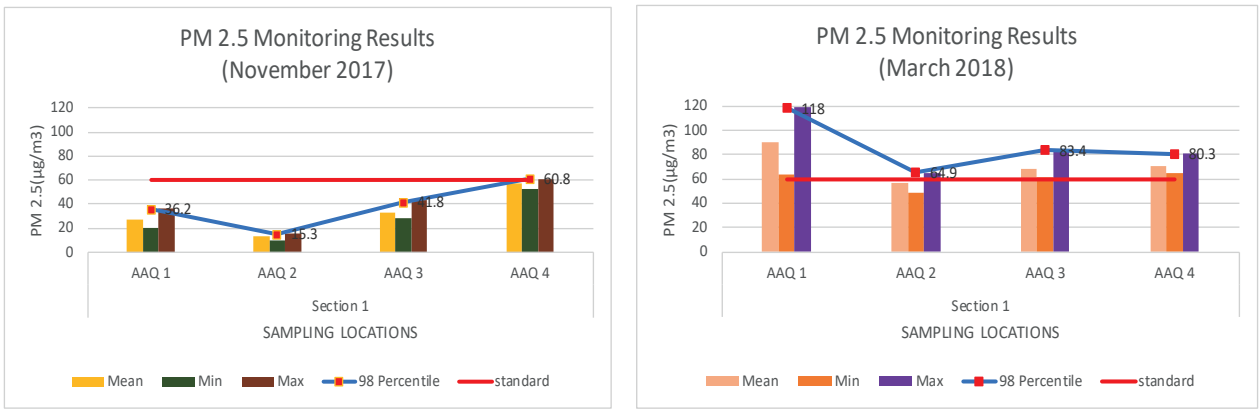
November 2017



March 2018

Source: JICA Study Team

Figure 11.3.15 PM_{10} Monitoring Results



November 2017 **March 2018**

Source: JICA Study Team

Figure 11.3.16 $PM_{2.5}$ Monitoring Results

(4) Water quality

Figure 11.3.18 shows the location of water quality monitoring points in Section 1.

Values of pH and suspended solids (SS) were below the tolerant maximum standards for industrial effluents to surface water (BIS:2490) (Table 11.3.16).

Table 11.3.16 Water Sampling Results

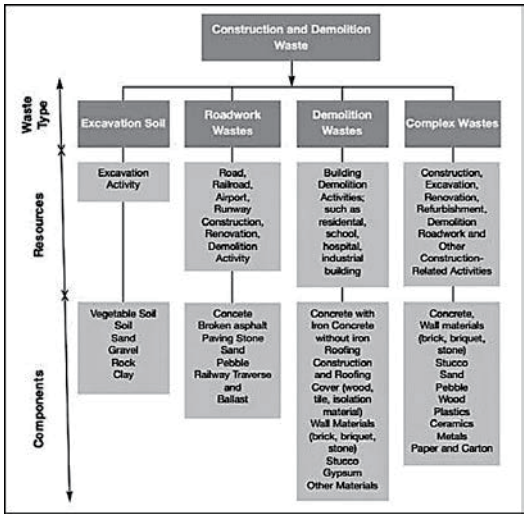
Section	No	Sampling Location	pH			SS (mg/L)		
			November 2017	March 2018	BIS (Reference)	November 2017	March 2018	BIS (Reference)
1	1	Buckingham Canal	7.09	7.59	5.5～9.0	23.2	10.8	100

Note: BIS: Bureau of Indian Standards 2490, PART-I-1981

Source: JICA Study Team

(5) Waste

Types of waste usually generated from construction and demolition works are given in Figure 11.3.17.



Source: JICA Study Team

Figure 11.3.17 Types of Waste Expected to be Generated from Section 1

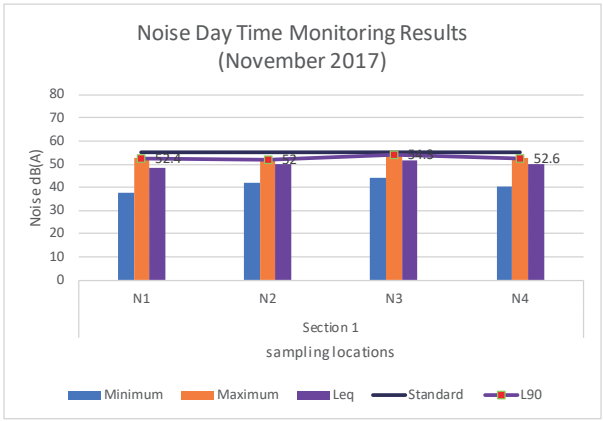
Source: JICA Study Team

Figure 11.3.18 Water Sampling Locations

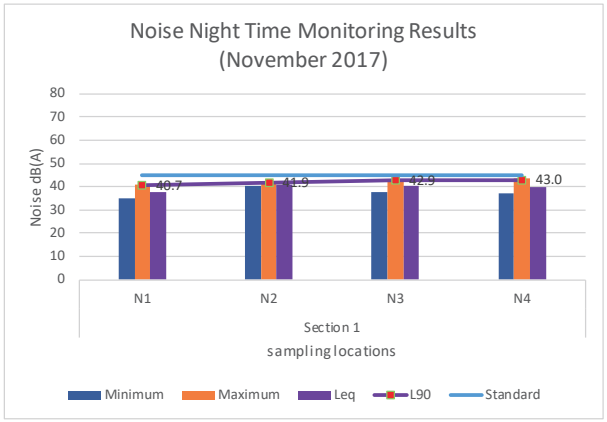
(6) Noise and Vibration

Noise and vibration monitoring was conducted in the same location with air quality monitoring (Figure 11.3.12, Table 11.3.15).

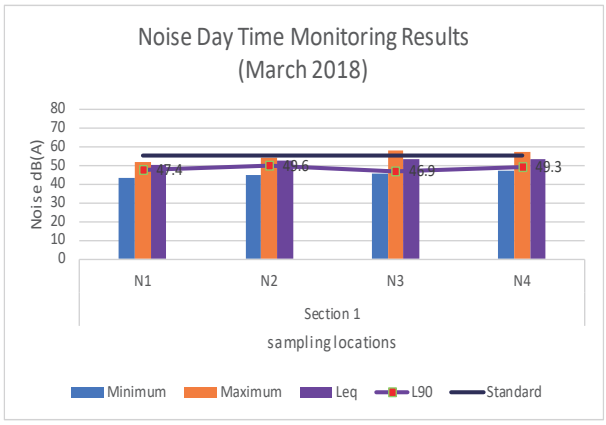
According to the results of the noise and vibration monitoring (Figure 11.3.19, Figure 11.3.20), noise levels in Section 1 were below but close to the standard values (55 dB(A) in the daytime, 45 dB(A) at night). Values of vibration were below the standards throughout the day.



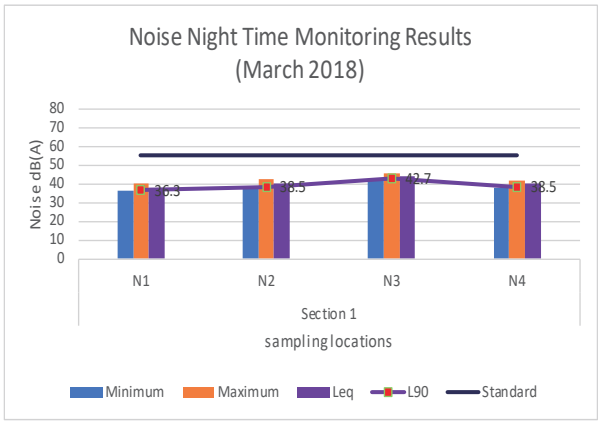
November 2017 (day)



November 2017 (night)



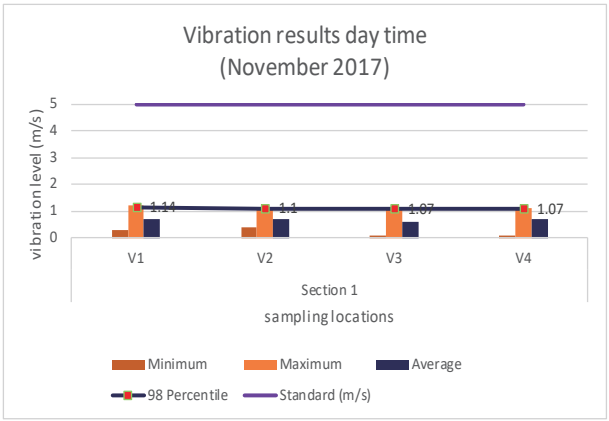
March 2018 (day)



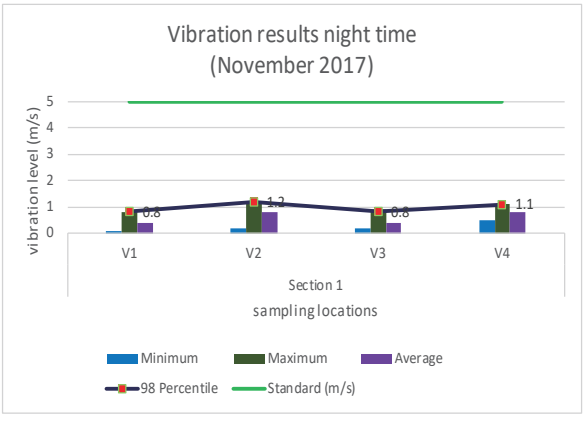
March 2018 (night)

Source: JICA Study Team

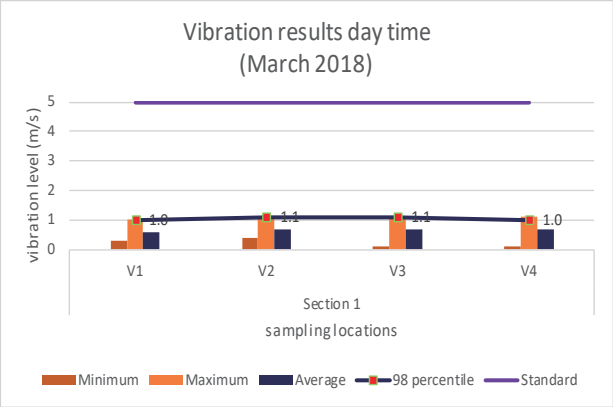
Figure 11.3.19 Noise Monitoring Results



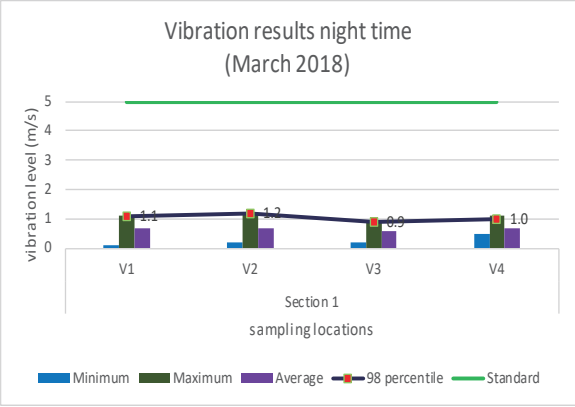
November 2017 (day)



November 2017 (night)



March 2018 (day)



March 2018 (night)

Source: JICA Study Team

Figure 11.3.20 Vibration Monitoring Results

(7) Ecosystem

1） Ecological Survey

All sections, including Section 1, are located on the East Coastal Plain in India, which is almost flat. Same species were found in Section 1 and in other sections due to minimal difference in land type, land use, and meteorological conditions. Therefore, the ecological survey contains results from all the monitoring points in and around the five sections of the CPRR Project.

Table 11.3.17 and Figure 11.3.21 show the locations of the ecological survey. Site photos are provided in Figure 11.3.22.

Table 11.3.17 Section-wise Details of Ecological Monitoring Stations

Sections	No.	Monitoring Stations	Coordinates
Section 1	1	Kattupalli	13.182000N, 80.195100E
	2	Backingham Canal	13.180122N, 80.194807E
Section 2	3	Kannigaipair Tank	13.165367N, 80.44128E
	4	Kosasthalaiyar River	13.134074N, 80.21408E
Section 3	5	Coum River	13.63411N, 79.553712E
	6	Mannur RF	13.05750N, 79.553907E
	7	Sriperumbhudur Tank	12.575344N, 79.562553E
Section 4	8	Vattambakkam RF	12.50082N, 79.57072E
	9	Appur RF	12.474626N, 79.584494E
Section 5	10	Tirutteri RF	12.452925N, 80.12684E
	11	Sengundram RF	12.45437N, 80.22353E
	12	Sirukundram RF	12.423818N, 80.41144E
	13	Manamathi Tank	12.394359N, 80.61072E
	14	Poonjeri Tank	12.37004N, 80.10530E

Source: JICA Study Team

Source: JICA Study Team

Figure 11.3.21 Ecological Monitoring Stations

1. Kattupalli

2.Backingham Canal

3.Kannigaipair Tank

4.Kosasthalaiyar River

5.Cooum River




6. Mannur RF




7.Sriperumbhudur Tank




8.Vattambakkam RF




9.Appur RF




10.Tirutteri RF




11.Sengundram RF




12.Sirukundram RF

13.Manamathi Tank

14.Poonjeri Tank

Source: JICA Study Team

Figure 11.3.22 Site Photos

Listed in Table 11.3.18 to Table 11.3.25 are the species found during the survey. Results show that both land and water areas are heavily affected by human activities, such as deforestation and dredging. Species ranked between Vulnerable (VU) and Critical (CR) in the IUCN Red List were not found along Section 1.

Table 11.3.18 List of Tree Species Recorded in the Ecological Survey

NO	Scientific Name	Local Name, English Name	IUCN*
1	*Abutilon indicum*	Indian mallow	
2	*Acacia auriculformis*	Golden shower	
3	*Acacia nilotica*	Babool	
4	*Acalypha indica*	Indian copper leaf	
5	*Achyranthes aspera*	Prickly chaff flower	
6	*Aerva lanata*	Mountain knot grass	
7	*Albizia lebbek*	Vakai	
8	*Annona squamosa*	Seethapal	
9	*Areca catechu L*	Pakkumara	
10	*Artocarpus integrifolia*	Jack	
11	*Azadirachta indica*	Veppa maram	
12	*Bambusa arudinaceae*	Bamboo	
13	*Banhinia purpurea*	Mandari	
14	*Borassus flabellifer*	Palmyra tree	
15	*Butea monosperona*	Flame of the forest	
16	*Calotropis gigantea R.Br.*	Erukku	
17	*Carica papaya L.*	Pappalimaram	
18	*Cascabela thevitia*	Arali psidium guajava	
19	*Cassia alata*	Candle bush	
20	*Cassia auriculata*	Tanners cassia	
21	*Cassia fistula L.*	Konrai	

NO	Scientific Name	Local Name, English Name	IUCN*
22	*Casuarina equisetifolia Forst.*	Cavukkumaram	
23	*Ceiba pentandra L.) Gaertn*	Ilavam	
24	*Citrus limonia Thespenia populnea*	Puvarasam	
25	*Cocos nucifera L.*	Tennaimaram	
26	*Datura metal*	Downy thorn apple	
27	*Decalepis hamiltonii Wight & Arn.*	Mahali-Kizhangu, Mavilang Kizhangu	EN in Kancheepuram district
28	*Delonix regia.*	Gulmohar	
29	*Derris scandens*	Jewel vine	
30	*Diplocyclos palmatus*	Lollipop climber	
31	*Dipterocarpus indicus Bedd.*	Ennai, Vel ennai	EN in Kancheepuram district
32	*Dolicas lab lab*	Garden bean	
33	*Eichhornia crassipes*	Water hyacinth	
34	*Emblica officinalis*	Indian gooseberry	
35	*Eucalyptus lanceolatus*		
36	*Euphorbia hirta*	Asthma weed	
37	*Euphorbia tirucalli*	Pencil plant	
38	*F. Religiosu*	Arasa Maram	
39	*Ficus benghalensis*	Ala maram	
40	*Ficus benghalensis*	Ala maram	
41	*Hibiscus spp.,*	Sembaruthi	
42	*Ipomoea alba*	Moon vine	
43	*Ipomoea carnea*	Blush morning glory	
44	*Jatropha*	Kattamanakku	
45	*Leucas aspera*	Common leucas	
46	*Mangifera indica*	Mango	
47	*Moringa concanensis*	Kattu murungai	
48	*Nelumbo nucifera*	Lotus	
49	*Nymphaea pubescens*	Common water lily	
50	*Ocimum canum*	Hoary basil	
51	*Parthenium hysterophorus*	Carrot grass	
52	*Phoenix sp*	Palmyra	
53	*Pithecellobium dulce*	Kodukka puli	
54	*Polyathia longifolia*	Ashoka	
55	*Pongamia glabra*	Poonga	
56	*Punicia granatum*	Pomegranate	
57	*Ricinus communis*	Castor	
58	*Samanea saman*	Rain tree	
59	*Spathodea campanulata*	Tulip tree	
60	*Tamarindus indica*	Puliya maram	
61	*Thespesia populnea*	Puvarasu	
62	*Tridax procumbens*	Tridax daisy	
63	*Ziziphus oenoplea*	Jackal jujumbe	

*: Species ranked as VU (Vulnerable) or higher in the IUCN Red List are marked. EN: Endangered
Source：JICA Study Team

Table 11.3.19 List of Mammals Recorded in the Ecological Survey

S.No.	Scientific Name	Local Name, English Name	IUCN*
1	*Macaca radiata*	Bonnet Macaque	
2	*Canis aureus*	Jackal	
3	*Funambulus palmarum*	Indian palm squirrel	
4	*Herpestes edwardsii*	Grey mongoose	

S.No.	Scientific Name	Local Name, English Name	IUCN*
5	*Lepus nigricollis*	Black naped hare	
6	*Pteropus giganteus*	Indian flying fox	
7	*Synopterus sphinx*	Short nosed fruit bat	
9	*Tatera indica*	Indian gerbils	
10	*Bandicota indica*	Large bandicoot – rat	
11	*Rattus rattus*	House rat	

*: Species ranked as Vulnerable (VU) or higher in the IUCN Red List are marked.
Source：JICA Study Team

Table 11.3.20 List of Birds Recorded in the Ecological Survey

S.No	Scientific Name	Local Name, English Name	Profile	IUCN*
Kingfishers				
1	*Alcedoatthis*	Common Kingfisher	C,R	
2	*Halcyon smynensis*	White-Throated Kingfisher	C,R	
3	*Cerylerudis*	Pied Kingfisher	C,R	
Peafowl				
	Pavocristatus		C,R,Br	
Bee-Eaters				
4	*Merops orientalis*	Pied Kingfisher	C,R	
5	*Merops philippinus*	Blue-Tailed Bee-Eater	C,M	
Cuckoos and Coucals				
6	*Clamator jacobinus*	Pied Cuckoo	C,R,Br	
7	*Hierococcyx varius*	Common Hawk Cuckoo	C,R	
8	*Eudynamys scolopacea*	Asian Koel	C,R,Br	
9	*Phaenicophaeus tristis*	Green-Bellied Malkoha	C,R	
10	*Centropus sinensis*	Greater Coucal	C,R	
Parakeets				
11	*Psittacula krameri*	Rose-Ringed Parakeet	C,R, Br	
Swifts				
12	*Cypsiurus balasiensis*	Asian Palm Swift	C,R,Br	
13	*Apusaffinis*	House Swift	C,R	
Owls				
14	*Tyto alba*	Barn Owl	C,R	
15	*Otus bakkamoena*	Collared Scops Owl	O,R	
16	*Athene brama*	Spotted Owl	C,R	
Eagles				
17	*Milvus migrans*	Black Kite	C,R,Br	
18	*Haliastur indus*	Brahminy Kite	C,R,Br	
19	*Circus aeruginosus*	Marsh Harrier	C,M	
20	*Accipiter badius*	Shikra	C,R,Br	
21	*Pandion haliaetus*	Osprey	Rare	
Pigeons				
22	*Columba livia*	Rock Pigeon	C,R	
Doves				
23	*Streptopelia senegalensis*	Laughing Dove	C,R,Br	
24	*Streptopelia chinensis*	Spotted Dove	C,R,Br	
25	*Streptopeliat ranquebarica*	Red Collared Dove	C,R,Br	
26	*Streptopelia decaocto*	Eurasian Collared Dove	C,R,Br	
Crakes and Rallids				
27	*Porphyrio porphyrio*	Purple Swamphen	C,R,Br	
28	*Gallinula chloropus*	Common Moorhen	C,R	
29	*Fulica atra*	Common Coot	C,R,Br	
Ducks				
30	*Anas porcilorhyncha*	Spot Billed Duck	C,R,Br	
31	*Anas querquedula*	Garganey	C,M	
Waders				

S.No	Scientific Name	Local Name, English Name	Profile	IUCN*
32	*Tringa totanus*	Common Redshank	O,M	
33	*Tringa nebularia*	Common Green Shank	O,M	
34	*Tringa ocropus*	Green Sandpiper	O,M	
35	*Tringa glareola*	Wood Sandpiper	C,M	
36	*Actitis hypoleucos*	Common Sandpiper	C,M	
Waders and Jacanas				
37	*Himantopus himantopus*	Black-Winged Stilt	C,R, Br	
Plovers				
38	*Charadrius dubius*	Little Ringed Plover	O,M	
Lapwings				
39	*Vanellus malarbaricus*	Yellow-Wattled Lapwing	C,R,Br	
40	*Vanellus indicus*	Red-Wattled Lapwing	C,R, Br	
Flamingos, Ibises and Spoonbill				
41	*Plegadis falcinellus*	Glossy Ibis	C,SM	
42	*Threskiornis melanocephalus*	Black-Headed Ibis	C,R,Br	
43	*Platalea leucorodia*	Eurasian Spoonbill	C,R,Br	
Pelicans				
44	*Pelecanus philippensis*	Spot-Billed Pelican	Re,SM, Br	
Storks				
45	*Mycteria leucocephala*	Painted Storks	Re,SM,Br	
46	*Anastomus oscitans*	Asian Openbill	C,R,Br	
47	*Ciconia episcopus*	Woolly-Necked Stork	O,M	VU** Observed at Sriperumbhudur Tank (Sec. 3)
Shrikes				
48	*Dendrocitta vagabunda*	Rufous Treepie	C,R	
49	*Corvuss plendens*	House Crow	C,R	
50	*Corvus macrorhynchos*	Large-Billed Crow	C,R	
Orioles and Cuckooshrikes				
51	*Artamus fuscus*	Ashy Woodswallow	O,SM	
52	*Oriolus oriolus*	Eurasian Golden Oriole	C,M	
53	*Coracina melanoptera*	Black-Headed Cuckooshrike	O,SM	
Drongos				
54	*Dicrurus macrocercus*	Black Drongo	C,R,Br	
55	*Dicrurus leucophaeus*	Ashy Drongo	O,M	
56	*Terpsiphone paradisi*	Asian Paradise-Flycatcher	C,M	
57	*Aegithina tiphia*	Common Iora	C,R	
58	*Tephrodornis pondicerianus*	Common Woodshrike	C,R	
Mynas				
59	*Acridotheres tristis*	Common Myna	C,R,Br	

Profile:
C – Common R – Resident M, SM – Seasonal Migrant Br - Breeding O – Occassional Ra – Rare

*: Species ranked as Vulnerable (VU) or higher in the IUCN Red List are marked.
**: Found out of the distribution area map shown on the IUCN website. (http://maps.iucnredlist.org/map.html?id=22727255)
Source: JICA Study Team

Table 11.3.21 List of Amphibians and Reptiles Recorded in the Ecological Survey

S.No.	Scientific Name	Local Name, English Name	IUCN*
Amphibians			
1	*Ranacyanophlyctis*	Skittering frog	
2	*Hoplobatrachustigerinus*	Indian bull frog	
3	*Kaloulataprobanica*	Painted kaloula	
4	*Bufomelanostictus*	Common Indian toad	
5	*Ranahexadactylus*	Indian Pond frog	
Reptiles			
1	*Mabuyacarinata*	Common skink	
2	*Ptyasmucosus*	Indian rat snake	
3	*Ahaetullanasurta*	Common vine snake	

S.No.	Scientific Name	Local Name, English Name	IUCN*
4	*Amphiesmastolata*	Buff-striped keelback water snake	
5	*Chamaleozeylanicus*	Indian chameleon	
6	*Varanusbengalensis*	Montior lizard	
7	*Lissemyspunctata*	Indian mud turtle	
8	*Melanochelystrijuga*	Indian pond terrapin	

*: Species ranked as Vulnerable (VU) or higher in the IUCN Red List are marked.
Source：JICA Study Team

Table 11.3.22 List of Insects Recorded in the Ecological Survey

S.No	Scientific Name	Local Name, English Name	IUCN*
Butterflies			
SKIPPERS			
1	*Parnara bada*	Ceylon swift/African straight swift	
2	*Borbo cinnara*	Rice swift	
3	*Pseudoborbo bevani*	Bevan's swift	
4	*Suastus gremius*	Indian palm bob	
Swallowtails			
5	*Graphium doson*	Common jay	
6	*Graphium agamemnon*	Tailed jay	
7	*Atrophaneura aristolochiae*	Common rose	
8	*Atrophaneura hector*	Crimson rose	
Yellows and Whites			
9	*Eurema hecabe*	Common grass yellow	
10	*Eurema laeta*	Spotless grass yellow	
11	*Catopsilia pomona*	Common emigrant	
12	*Ixias pyrene*	Yellow orange tip	
13	*Colotis danae*	Crimson tip	
14	*Hebomoia glaucippe*	Great orange tip	
15	*Appias albina*	Common albatross	
16	*Appias libythea*	Western striped albatross	
17	*Cepora nerissa*	Common gull	
18	*Delias eucharis*	Common jezebel	
Blues			
19	*Catochrysops strabo*	Forget-me-not	
20	*Pseudozizeeria maha*	Pale grass blue	
21	*Zizina otis*	Lesser grass blue	
22	*Zizula hylax*	Tiny grass blue	
23	*Freyeria putli*	Eastern grass jewel	
24	*Everes lacturnus*	Indian cupid	
25	*Chilades lajus*	Lime blue	
26	*Azanus jesous*	African babul blue	
Brush Footed			
27	*Danaus chrysippus*	Plain tiger	
28	*Tirumala limniace*	Blue tiger	
29	*Charaxes solon*	Black rajah	
30	*Melanitis leda*	Common evening brown	
31	*Mycalesis perseus*	Common bush brown	
32	*Acraea violae*	Tawny coster	
33	*Phalanta phalantha*	Common leopard	
34	*Ariadne merione*	Common castor	
35	*Ariadne ariadne*	Angled castor	
Other Insects			
1	*Musca domestica*	House fly	
2	*Gastrimargus marmoratus*	Common grasshopper	
3	*Cleoboracrassa*	Painted grasshopper	
4	*Dysdercus cingulatus*	Red cotton bug	
5	*Coridiapetivariana*	White spotted cockroach	

S.No	Scientific Name	Local Name, English Name	IUCN*
6	*Periplanata americana*	House cockroach	
7	*Apis indica*	Honey bee	
8	*Apis florea*	Small honey bee	
9	*Anopheles meigen*	Anopheles mosquito	
10	*Nepa cinerea*	Water scorpion	
11	*Gongylus gongiloides*	Praying mantis	
12	*Gerris gracilicornis*	Water strider	

*: Species ranked as Vulnerable (VU) or higher in the IUCN Red List are marked.
Source：JICA Study Team

Table 11.3.23 List of Fishes Recorded in the Ecological Survey

S.No.	Scientific Name	Local Name, English Name	IUCN*
1	*Channa punctatus*	Spotted snake head, green snake head	
2	*Glossogobius giuris*	Tank-goby	
3	*Labeo bata*	Minor carp	
4	*Oreochromis mossambicus*	Mozambique Tilapia	
5	*Anabas testudineus*	Climbing perch	
6	*Cyprinus catla*	Catla	
7	*Cyprinus carpio*	Common Carp	
8	*Cirrhinus molitorella*	Mud Carp	
9	*Pethia sharmai*	Chennai Sawfin Barb	EN (Recorded based on information from local residents)

*: Species ranked as Vulnerable (VU) or higher in the IUCN Red List are marked. EN: Endangered
Source：JICA Study Team

Table 11.3.24 List of Molluscans, Crabs and Shrimps Recorded in the Ecological Survey

S.No.	Scientific Name	Local Name, English Name	IUCN*
1	*Pilaglobosa*	Apple snail	
2	*Lamellidens corrianus*	Fresh water mussel	
3	*Parreysia favidens*	Fresh water mussel	
4	*Planorvis gyrautus*	Wheel snail	
5	*Lymnaea peregra*	Tower snail	
6	*Lymnaea truncatula*	Cone snail	
7	*Parathelphusa convexa*	Freshwater crab	
8	*Macrobrachium rosenbergii*	Shrimp	

*: Species ranked as Vulnerable (VU) or higher in the IUCN Red List are marked.
Source：JICA Study Team

Table 11.3.25 List of Planktons Recorded in the Ecological Survey

S. No.	Plankton	Manampathy	Kosasthalaiyar	Sriperumbudur	Poonjeri
1	Calamus	√	√	√	√
2	Cyclops	√	√	√	√
3	Daphnia	√	√	√	√
4	Moina	√	√	√	√
5	Nauplius	√	√	√	√
6	Rotifer	√		√	√
7	Notonecta	√	√	√	√
8	Streptocephalus	√	√	√	√
9	Conocostrachan	√	√	√	√
10	Dysticus	√	√	√	√
11	Dragonfly nymph	√	√	√	√
12	Chironomous	√	√	√	√

Source：JICA Study Team

2）Trees to be Affected

Table 11.3.26 shows the number of trees to be affected by Section 1.

Those 250 trees located outside of the planned service road and between the main road and the service road will be conserved at the existing locations.

In the construction phase of Section 1, 217 trees with girth below 90 cm will be transplanted on the ROW near the original location under the supervision of the Thiruvallur District Forest Officer (DFO).

Other 120 larger trees will be felled under DFO supervision, and 1,200 trees (10 times of 120) will be planted on the ROW or in the area proposed by the DFO (DPR p. 9-8) as compensation by HMPD. Majority of the trees to be felled are shading trees, such as *Millettia pinnata* (Pongam Tree). Other species include the mango tree, flower tree *Cassia fistula* (Konrai Tree), and *Alangium Salvifolium*.

Consequently, trees will be planted near the original location or in the connected habitat. Biodiversity in the project area, therefore, will be conserved in the long-term basis.

Table 11.3.26 Details of the Number of Trees to be Affected

S. No.	Description	Section 1		Total
		Ennore NH5 Road	TPP Link	
Saving at existing location		**250**	**0**	**250**
Transplanting		**208**	**9**	**217**
1	Girth above 30 cm and up to 60 cm	60	1	60
2	60 cm to 90 cm	148	8	156
Cutting		**118**	**2**	**120**
3	90 cm to 180 cm	9	1	10
4	Girth above 180 cm	109	1	110

Source：DPR 2016

(8) Hydrological Situation

Water resources that are likely to be affected by Section 1 are listed in Table 11.3.27.

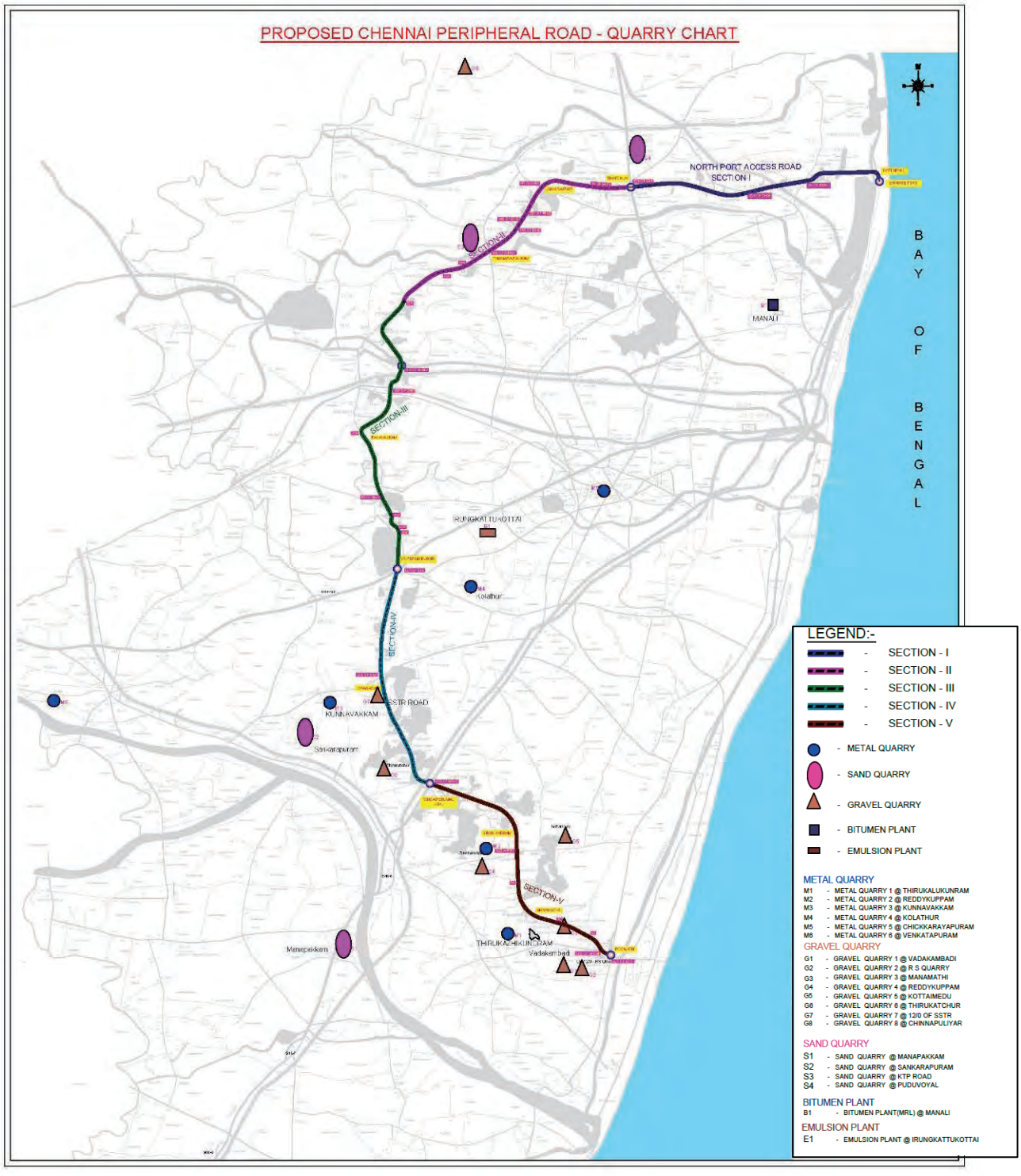
Table 11.3.27 Water Resources- Section 1

No.	Intersection Details (500 m)	Approximate Coordinates	Distance from ROW
1	Crossing salt pan	13°18'20.00"N 80°19'51.00"E	Crossing
2	Nalur Pond	13°17'28.87"N 80°13'51.46"E	less than 150 m
3	Neithavayal Lake	13°18'8.68"N 80°17'40.06"E	Crossing
4	Amoor Lake	13°17'37.49"N 80°11'4.23"E	less than 150 m

Source: JICA Study Team

(9) Topography and Geographical Features

Government-approved quarries which are likely to be used in Section 1 are shown in Figure 11.3.23.



Source: JICA Study Team

Figure 11.3.23 Location of Approved Quarry Sites

11.3.6 Impact Assessment

Based on the survey results, final impact assessment in the planning, construction, and operation phases are described in Table 11.3.28. The table explains the impact assessment for Section 1, together with specific considerations necessary for other sections.

Table 11.3.28 Impact Assessment and Evaluation

	Impacts	Scoping of Potential Impacts		Impact Assessment based on Baseline survey		Reasons for Evaluation
		Planning Construction	Operation	Planning Construction	Operation	
	Pollution Control					
1	Air Pollution	B-	B±	B-	B±	**Construction Phase:** The operation of construction equipment and vehicles for earthworks will be the main causes of air pollution due to the emission of exhaust gases and dusts. **Operation Phase:** An increase in the number of vehicles is expected; thus, an increase in pollution load is also expected. At the same time, smoother traffic flow is expected from the Project, so a general decrease in the total pollution load in the Chennai area is expected.
2	Water Pollution	B-	B-	B-	B-	**Construction Phase:** Excavation works and casting bridge pier in the drainages and rivers along the proposed intervals may cause increase in turbidity. **Operation Phase:** Soil runoff from the embankment may cause water pollution in drainages and rivers.
3	Waste	B-	D	B-	D	**Construction Phase**: Wastes such as removed vegetation and structures, used fuel canister, and others are expected to be generated.
4	Soil Contamination	B-	D	B-	D	**Construction Phase**: Fuel, oil, and chemical leakage from construction sites as well as stockyards may cause soil contamination.
5	Noise and Vibration	B-	B±	B-	B±	**Construction Phase:** The operation of construction equipment and vehicles mainly used for earthworks will be the main sources of noise and vibration. Limited sections of the work area are located near the population or schools. Special care will be necessary at those locations. **Operation Phase:** An increase in the number of vehicles in the proposed alignment may cause increase in noise and vibration, while a more efficiently distributed traffic as a result of the Project may alleviate the noise condition in the entire Chennai area.
6	Ground Subsidence	C	C	D	D	**Construction Phase and Operation Phase:** Soft soil (sand soil with N value under 5) was found at the bridge crossing Buckingham Canal. The bridge piers are designed to reach the support layer underneath the soft soil. The roadbed survey at 1-km intervals for the new construction section in the DPR did not find any soft soil that requires mitigation measures. The negative impact of ground subsidence that require mitigation measures, therefore, is not expected.
7	Offensive Odor	D	D	D	D	No construction component, which may cause offensive odour, is expected in this Project (Section 1).
8	Bottom Sediment	D	D	D	D	No construction component, which may cause pollution of bottom sediment by heavy metals and dioxin, is expected from this Project (Section 1).
	Natural Environment					
9	Sanctuary	D	D	D	D	Section 1 is not located in or near the designated areas for nature conservation or protection of

	Impacts	Scoping of Potential Impacts		Impact Assessment based on Baseline survey		Reasons for Evaluation
		Planning Construction	Operation	Planning Construction	Operation	
						historical and cultural heritages. No negative impact is expected in those areas. The CRZ area to be affected is not considered as a sanctuary or protected area under JICA guidelines.
10	Ecosystem	B-	B-	B-	B-	**Construction Phase**: There is no protected wildlife habitat on or near Section 1. However, there are 120 trees with girth over 90 cm that need to be felled. (17 trees at Section 2, 246 trees at Sections 3; and 43 trees at Section 5 are expected to be cut down as shown in Table 11.8.6.) The habitat next to the ROW may be negatively affected by runoff soil from work areas. **Operation Phase:** The habitat next to the ROW may be negatively affected by runoff soil from the ROW. Environmental changes, such as change of land use and increased traffic volume, may negatively affect the roadside ecosystem.
11	Hydrological Situation	B-	B-	B-	B-	**Construction Phase:** Relocation of drainage as well as removal of ground water pumping facilities is to be conducted. There is no significant adverse impact expected for the hydrological situation and the water level. **Construction and Operation Phase:** On the other hand, there are some ponds working as storage reservoirs, which are close to the proposed alignment, that may be affected by the construction work as well as the road existence.
12	Topography and Geographical Features	B-	D	D	D	Construction materials, including filling soil, will be procured from existing and licensed providers. Negative impacts from the change of topography are not expected.
	Social and Economic Environment					
13	Involuntary Resettlement, Loss of Land and Asset, Business Relocation	A-	D	A-	D	**Planning Phase:** Private lands used for farming, residence, and commercial purpose will be acquired and will cause relocation and resettlement, which includes about 845 PAHs. **Construction Phase:** The temporal lease of land may be necessary for the site office, stockyard, and other facilities.
14	The Poor	B-	D	B-	D	**Construction Phase:** At least 14% of PAHs earned below poverty line. In case the compensation and assistances are not provided justly, the relocated or affected poor may experience difficulty in recovering their livelihood.
15	Ethnic Minorities, Indigenous Peoples	D	D	D	D	Tamil Nadu designates homelands of the ethnic minorities and indigenous peoples. Such homelands are not located in the CMA including the project area.
16	Local Economy, Employment and Living, Livelihood	B±	B+	Section 1 B+ Section2 B+ Section3, Section5 B±	B+	**Construction Phase:** Procurement of the construction materials, services, and needs for food and drinks of the workers will be generated with employment opportunities. In Section 1, there is no widening on the existing road, and impact on the commercial and service industries along the roadway occurs only at cross sections with the new road. Negative impact to the local economy, therefore, is not expected. (Same with Section 2) On the other hand, the improvement of existing road sections of Section 3 and Section 5 will require relocation and setback of the existing commercial and service industries along the road. Such changes may cause negative impacts to the service providers and customers in the locality.

	Impacts	Scoping of Potential Impacts		Impact Assessment based on Baseline survey		Reasons for Evaluation
		Planning Construction	Operation	Planning Construction	Operation	
						Operation Phase: Businesses near the road will enjoy easier access to employment and customers in the CMA. Positive economic impact will be generated in CMA since the traffic network and the transportation of goods will be improved by Section 1.
17	Land Use, Local Resource Use	D	D	D	D	Section 1 will mainly change the agriculture land and vacant land to road and related facilities. In the long term, the road side area will be urbanized. Existing land use or local resource use, however, will not be affected in a drastic or negative manner.
18	Water Use, Water Rights	B-	B-	B-	B-	**Planning Phase:** Eight wells and hand pumps in Section 1 will be affected. **Operation Phase:** When compensation and reconstruction of water facilities are not sufficient, negative impact will be felt by water users. No impacts on groundwater level are expected from the Project. When unforeseen impacts cause decline of the groundwater level, majority of population in the affected area is expected to suffer since most of the regional population depends on groundwater.
19	Existing Public Facilities, Road and Transportation Facilities, Social Infrastructure, Social Services	B-	B±	B-	B±	**Construction Phase and Operation Phase:** Public facilities to be affected by Section 1 include schools, temples, and graveyards. In case adequate consultation, negotiation, compensation, and assistances are not conducted, those facilities may need to stop their services in the construction phase and operation phase. **Operation Phase:** The project road will connect the local area with other parts of CMA. Improved connectivity may lead to modernization and renovation of existing social infrastructures and services.
20	Social Capitals, Local Decision-making Systems, Social Organizations	D	D	D	D	Section 1 will develop a SH at the periphery of CMA. There are no negative impacts expected on social capitals such as NGOs or decision-making systems of districts and villages.
21	Uneven Distribution of Project Impact and Benefit	D	D	D	D	No uneven distribution of project impact and benefit is expected in the project area.
22	Local Conflicts of Interest	D	D	D	D	No local conflicts of interest among the communities in the project area are expected.
23	Split of Community	B-	C	B-	Section 1 D Section2 D Section3 Section5 B-	**Construction Phase:** The existing road that crosses Section 1 may be temporarily closed or restricted at the work area. **Operation Phase:** The Section 1 alignment is planned to minimize the length passing through the built-up areas. Access from the existing roads to Section 1 will be easy through the service road to be developed parallel to Section 1. Therefore, a split of community due to Section 1 is not expected. (Same with Section 2.) **Construction and Operation Phase:** The improvement of existing road sections of Section 3 and Section 5 will require relocation and set back of the existing commercial and service industries along the road to develop an artery road in between. In such area, crossing the ROW will become difficult compared to the present condition even with crossing facilities and service roads.
24	Historical Heritage, Cultural Resources	D	D	D	D	There are no nationally, state-, or district-designated historical and cultural resources located on the ROW or in nearby areas.

	Impacts	Scoping of Potential Impacts		Impact Assessment based on Baseline survey		Reasons for Evaluation
		Planning Construction	Operation	Planning Construction	Operation	
25	Landscape	D	D	D	D	Section 1 will develop a SH at the periphery of CMA. No specific landscape resources or tourism activities are recognized. The project does not cause any specific negative impacts on landscape.
26	Gender	D	D	D	D	Section 1 does not cause any specific negative impacts on gender-related issues.
27	Children's Rights	B-	B-	B-	B-	**Construction Phase and Operation Phase:** Section 1 will affect two schools. In case adequate consultation, negotiation, compensation, and assistances are not conducted, and in case the school finds it difficult to continue its services, negative impacts on the students' right to education will be observed. **Construction Phase:** There is a possibility of illegal employment of labourers under 14 years old.
28	Sanitation, Public Health, Transmittable Diseases including HIV/AIDS	B-	D	B-	D	**Construction Phase:** Stagnant water at the work areas and stockyards may become breeding spots for mosquitoes that spread diseases. The workers to be employed in the Project may include migrant workers. Although all the surveyed PAHs answered how to prevent infection with HIV/AIDS, there is a possibility that the number of patients of sexually transmitted diseases, including HIV, will increase. The project road is the outer most circular road in CMA. The completion of the project road does not generate a wider cross-border movement of the population. No significant risk of spread of diseases is expected.
29	Work Environment, Occupational Safety and Health	B-	B-	B-	B-	**Construction Phase:** Although Tamil Nadu has safety guidelines for construction works, the national level standard is not yet prepared. Occupational accidents may occur at work areas. **Operation Phase:** Workers will be deployed for daily works, such as maintenance and toll station, and for periodic repair works. Those workers may be susceptible to accidents.
	Other					
30	Accidents, Crime	B-	B±	B-	B±	**Construction Phase:** In Section 1, traffic regulation at the intersections with existing roads may lead to an increase in traffic accidents. (Same with Section 2.) At the improvement section of the existing road in Section 3 and Section 5 (9.6 km for Secion 3, 2.0 km for Section 5), traffic regulation and detour may lead to more frequent traffic jams and accidents. **Operation Phase:** Accidents will be observed on the new road sections. However, reduction of traffic accidents is also expected by securing pedestrians safety through the construction of footpaths and by reducing traffic jams.
31	Climate Change, Cross-border Impacts	B-	B±	B-	B±	**Construction Phase:** Greenhouse gases (CO_2) will be generated from the operation of construction machineries and transportation vehicles. **Operation Phase:** An increase in traffic volume will result in increased emission of greenhouse gases. At the same time, the improved traffic condition of the road network, including the project road, will lead to reduced of emission of greenhouse gases.

A+/-: Remarkably positive/serious negative impact is predicted.
B+/-: Positive/negative impact is expected to some extent.
C: Extent of impact is unknown. (Further study is necessary.)
D: Impact is very small or nil, and further survey is not required.
Source: JICA Study Team

11.3.7 Mitigation Measures and Implementation Budget

The Environmental Mitigation Plan (EMP) is shown in Table 11.3.29. Necessary budgets for installation and operation of facilities for pollution prevention, for transplanting and compensation planting of trees, and for staff training are estimated and noted in the table. The total budget for the implementation of mitigation measures is estimated to be INR 20 million. Out of the total, INR 19 million will be used for the construction of noise barriers.

Budgets for other mitigation measures to be implemented daily at work areas and other places, such as spraying of water for dust prevention and appropriate maintenance of vehicles and machineries, are described as 'Included in construction cost'.

Other budgets that need information in the detailed design phase for cost estimation, such as waste management and sewer treatment facilities at the workers camp, are also described as 'Included in construction cost'.

(Underlined items are newly added based on the HMPD draft EIA report. The JICA Study Team will check the implementation plan of HMPD and modify the EMP when necessary and appropriate.)

Table 11.3.29 Environmental Mitigation Plan

No.	Items	Mitigation Measures	Implementation	Supervision	Cost (INR)
Construction					
1	Air Pollution	(Dust) ・ All earthworks will be protected in a manner acceptable to the engineer to minimize generation of dust. Areas under construction will be covered and equipped with dust collector. ・ During sub-grade construction, sprinkling of water should be carried out at least twice a day on a regular basis during the entire construction period, especially in the winter and summer seasons. (Emission) ・ All precautions to reduce the level of dust emissions from the hot-mix plants will be taken. The hot-mix plants should be at least 500 m from the nearest habitation and from major water bodies. They should be fitted with dust extraction units. ・ All vehicles, equipment, and machinery used for construction should be fitted with the latest air pollution control equipment and should be regularly maintained to ensure that the emission levels are as per norms of PCB. ・ Idling of delivery trucks or other equipment should not be permitted during periods of unloading or when they are not in active use.	Contractor	HMPD	Included in construction cost

No.	Items	Mitigation Measures	Implementation	Supervision	Cost (INR)
2	Water Pollution	・ No labour camps, stone crushers, hot-mix plants, and other heavy machinery should be located near water bodies. No discharge from such establishments should flow directly into nearby water bodies. ・ No discharge from such establishments should flow into nearby water bodies.	Contractor	HMPD	5,563,000 (Oil interceptors, recharge pits, deepening of ponds)
		・ Silt fence and other measures should be applied to prevent muddy water from riverbed excavation.	Contractor	HMPD	Included in construction cost
3	Waste	・ The selection of disposal sites will be carried out in consultation with the State Pollution Control Board. ・ All newly constructed bus stops will be furnished with dust bins. ・ Waste bins will be provided within the precincts of every workplace, latrine, and urinal in an accessible place, and the accommodation, unless otherwise arranged for by the local sanitary authority, and arrangement for proper disposal of excreta by incineration at the workplace will be made by means of a suitable incinerator approved by the local medical health or municipal authorities.	Contractor	HMPD、SPCB	Included in construction cost
4	Soil Contamination	・ Silt fencing is to be provided. ・ Oils and chemicals will be stored indoors. ・ Generators and machineries will be equipped with oil guards that will prevent oil leaks. ・ Oil interceptor will be provided for accidental spill of oil and diesel. ・ Fuel storage and fueling areas will be located at least 300 m from all cross-drainage structures and significant water bodies.	Contractor	HMPD	Included in construction cost
5	Noise and Vibration	・ Noisy construction operations in residential and sensitive areas should be done only between 7:30 am and 6:00 pm. ・ Sound barriers will be	Contractor	HMPD	Noise barrier walls: Cost will be calculated after final locations and sizes are

No.	Items	Mitigation Measures	Implementation	Supervision	Cost (INR)
		installed during the construction phase to protect the inhabited areas from noise from construction activities. ・ Idling of temporary trucks or other equipment should not be permitted during periods of loading/unloading or when they are not in active use. ・ Stationary construction equipment will be kept at least 500 m away from sensitive receptors. ・ Noise barrier walls 500 m high will be constructed at 9 locations (total 4,500 m) where residences are near Section 1.			decided. Other measures: Included in construction cost
10	Ecosystem (Trees)	・ The number of saplings to be planted will be 10 times the number of felled trees. ・ The felling of 181 trees will be for budget allocation. The unit cost is INR 1,500. ・ Felling of 120 trees will have additional mitigation measures.	Contractor/DFO	HMPD	2,715,000
		・ Affected trees with girth size below 90 cm will be transplanted to nearby places. ・ Transplanting 406 trees will be for budget allocation. The unit price is INR 6,000. ・ Transplanting 217 trees will have additional mitigation measures.	Contractor/DFO	HMPD	2,436,000
		・ (Section 5) Secure the double size of the RF area to be converted by Section 5, and provide afforestation fee.	HMPD/DRO/ DFO	HMPD	Included in the land acquisition cost
	(Ecosystem)	(Pre-construction) ・ Efficient drainage plan is to be designed based on the field observation of watershed and topography to avoid and minimize impacts by runoff soil on surrounding habitats in the operation phase. ・ Stable slopes, efficient drainage facilities, and plant cover on the berm are to be designed and constructed to avoid/minimize impacts by	Contractor/ Construction supervision consultant	HMPD	Included in the land acquisition cost

No.	Items	Mitigation Measures	Implementation	Supervision	Cost (INR)
		runoff soil on surrounding habitats in the operation phase. （Construction） ・ During construction phase, the berm is to be covered with protective mat/sheet, especially in the rainy season and temporal drainage ditches are to be constructed to avoid/minimize impacts by runoff soil on surrounding habitats.			
11	Hydrological Situation	・ HMPD/Contractor will discuss, agree with PWD, and implement the agreed plan to secure the water storage capacity of the affected water bodies, such as by compensatory digging where water area is to be filled.	HMPD/Contractor	HMPD	Included in construction cost
13	Involuntary Resettlement Loss of Land and Asset, Business Relocation	・ Compensation for loss, assistance for relocation, and livelihood assistance will be implemented through discussion and consultation with PAHs in a transparent procedure.	Project Implementation Team (PIT) in TNRDC/ NGO (Consultant)	HMPD	Included in the RAP implementation cost
		・ The Contractor shall set up the stockyard, repair shop, asphalt plant, concrete plant, and other facilities. The land may be private land near the work area or land provided by HMPD. The Contractor will avoid land which results to involuntary resettlement or loss of assets. The Contractor shall obtain necessary permissions and lease contract required by local laws and regulations. After the completion of works, the Contractor shall return the land to the owner after restoring it to the original state.	Contractor	HMPD	Included in construction cost
14	The Poor	・ Compensation for loss, assistance for relocation, and livelihood assistance will be implemented through discussion and consultation with PAHs in a transparent procedure.	PIT in TNRDC/ NGO (Consultant)	HMPD	Included in the RAP implementation cost
16	Local Economy, Employment and Living, Livelihood	・ (Section 1) No negative impact ・ (Sections 2,3, and 5) Negative impact on local economy caused by the stoppage of road side	PIT in TNRDC/ NGO (Consultant)	HMPD	Included in construction cost and RAP implementation cost

No.	Items	Mitigation Measures	Implementation	Supervision	Cost (INR)
		business operations should be minimized by encouraging earlier setback in the house lot and concentrating construction works on one side of the road.			
18	Water Use, Water Right	· Wastage of water during the construction should be minimized. In case of tapping water from community sources, consent has to be obtained from local administration. · Arrangement for supply and storage of water will be made by the Contractor in such a way that the water availability and supply to nearby communities remain unaffected. If a new tube-well is to be bored, proper sanction and approval by the Ground Water Department is needed.	Contractor	HMPD, Ground Water Department	Included in construction cost
19	Existing Public Facilities, Road and Transportation Facilities, Social Infrastructure, Social Service	· Identify the common utilities that would be affected such as: telephone cables, electric cables, electric poles, water pipelines, public water taps, etc.	Contractor	HMPD, electricity company, water company, telephone company, etc.	Included in construction cost
		· Schools and other public facilities will be relocated before the clearance to avoid stoppage of service provision of those facilities.	HMPD/DRO	HMPD	Included in RAP implementation cost
27	Children's Right	· Schools will be relocated within the site or to other locations prior to clearance to avoid stoppage of service provision.	HMPD/DRO	HMPD	Included in RAP implementation cost
		· The Contractor will not employ any person below the age of 14 years for any work, and no woman will be employed in works involving painting with products containing lead in any form.	Contractor	HMPD	Included in construction cost
28	Sanitation, Public Health, Transmittable Diseases including HIV/AIDS	· Eliminate environment for mosquito breeding at work areas, yards, offices, and camps. · The staff of the Project will be provided with information on transmittable diseases including HIV/AIDS (included in Item 29).	Contractor	HMPD	Included in construction cost
29	Work	· Protective footwear and	Contractor	HMPD	Included in

No.	Items	Mitigation Measures	Implementation	Supervision	Cost (INR)
	Environment, Occupational Safety and Halth	protective goggles will be provided to all workers employed in mixing of materials like cement, concrete, etc. · No one below 18 years old and no woman will be employed in works involving painting with products containing lead in any form.			construction cost
		· The staff of the Project will be provided with three capacity building workshops on the following topics (considering that the workers may come and go seasonally): ➢ Reporting System ➢ Work Safety ➢ Sanitation, Public Health, and Transmittable Diseases including HIV/AIDS	Consultant/NGOs	HMPD	300,000
30	Accidents, Crime	· The construction area should be barricaded at all times with adequate marking, flags, reflectors, etc. for the safety of general traffic and pedestrians · Accidents involving humans, animals, or vehicles falling or accidents during construction period should be prevented. This needs to be ensured with proper barricading, signage boards, lighting, etc. · The project engineer of HD will plan and direct the Contractor to execute the work progressively so that the length of the open excavated trench is minimized, thus reducing possible accidents. · All machines used will be confirmed to the relevant Indian standards and codes, and will be regularly inspected by the HD · The Contractor will arrange the following: a readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone; and availability of suitable	Contractor	HMPD	Included in construction cost

No.	Items	Mitigation Measures	Implementation	Supervision	Cost (INR)
		transport at all times to take injured or sick person(s) to the nearest hospital. ・ An emergency response team has to be created. The team will contain members of the district and police administration and also have specialists in remediation. The responsibility of the concessionaire is to inform the team to take actions. The roles and responsibility of the members of the team will be framed in conjunction with all the parties to address the situation arising out of accidental spills resulting in situations like water and soil contamination, health hazards in the vicinity of the accident spot, fire, explosions, etc. ・ Workplaces that are remote and far away from regular hospitals will have indoor health units with one bed for every 250 workers.			
31	Climate Change, Cross-border Impacts	・ Construction machineries, generators, and transport vehicles will be kept in good condition.	Contractor	HMPD	Included in construction cost
Total Mitigation Cost for Construction Phase				**INR**	**200,054,000**
Operation					
1	Air Pollution	・ Broad-leaved pollution-resistant species, which can grow in high pollutant concentrations or which can even absorb pollutants, will be planted as they help settle particulates due to their higher surface areas and thick foliage, reducing the distance particulates are carried from the road. ・ The air and noise levels in the project area should be periodically monitored by HD. If the observed level is more than the permissible limits, suitable mitigation measures should be taken.	HMPD	HMPD	Included in the monitoring cost
2	Water Pollution	・ Water quality will be monitored regularly, and preventive measures will be taken where pollution caused by the Project is reported.	HMPD	HMPD	Included in the monitoring cost
5	Noise and Vibration	・ Noise condition will be monitored regularly.	HMPD	HMPD	Included in the monitoring cost
10	Ecosystem （Roadside	・ When negative impacts on the ecosystem are results of	HMPD	HMPD	Included in the regular road

No.	Items	Mitigation Measures	Implementation	Supervision	Cost (INR)
	Ecosystem)	the Project, remove the negative causes.			management and maintenance cost
11	Hydrological Situation	・ Suitable measures will be discussed and implemented with PWD when flooding or drainage problem caused by the Project occurs.	HMPD/PWD	HMPD/PWD	Included in the regular road management and maintenance cost
18	Water Use, Water Rights	・ When any negative impacts caused by the Project are reported by water users, issues will be solved through the Grievance Redress Mechanism. ・ Since majority of the population in the region depends on groundwater, the Project will monitor the groundwater level near the ROW. When groundwater level decline is too low to fetch water as a result of the Project, HMPD will negotiate with the affected parties and PWD to plan and implement measures such as increasing the depth of the affected wells to minimize and mitigate the impact.	HMPD/PWD	HMPD	Included in the regular road management cost
19	Local Economy, Employment and Living, Livelihood	・ When any negative impacts caused by the Project are reported by water users, issues will be solved through the Grievance Redress Mechanism. ・ The project proposes to provide the minimum required public conveniences such as toilets and drinking water facilities at each of the rest areas.	HMPD	HMPD	Included in the regular road management cost
27	Children's Rights	・ When any negative impacts caused by the Project are reported, issues will be solved through the Grievance Redress Mechanism.	HMPD	HMPD	Included in the regular road management cost
29	Work Environment, Occupational Safety and Health	・ Staff and contractors will be provided with safety education to minimize work accidents at toll plazas and regular repair and maintenance work.	HMPD	HMPD	Included in the regular road management cost
30	Accidents, Crime	・ Road safety facilities will be provided and constructed, such as sidewalks (along the service road), street lights, median strips, shoulder stones, guard rails, warning signs, visual guide lights, and road studs.	Contractor	HMPD	Included in construction cost

No.	Items	Mitigation Measures	Implementation	Supervision	Cost (INR)
31	Climate Change, Cross-border Impacts	・ Road surface will be kept in good condition so that vehicles will run smoothly in good speed emitting smaller amount of CO_2.	HMPD	HMPD	Included in the regular road maintenance cost

Source：JICA Study Team, DPR

11.3.8 Monitoring Plan

The environmental monitoring plan for Section 1 is shown in Table 11.3.30. A licensed environmental consultant will be hired by the Contractor or HMPD for the measurement of environment parameters, for which the cost estimation is shown in the table. The budget for the implementation of the monitoring plan was estimated at INR 6.48 million for the pre-construction and construction phases, and INR 4 million for the operation phase. The total cost was estimated at INR 10.48 million.

Monitoring activities which will be covered by ordinary personnel expenses, such as daily patrol for waste segregation at work areas and monthly monitoring of progress of transplanting and compensation planting, are described as 'Included in construction cost'.

Table 11.3.30 Environmental Monitoring Plan

Component	Parameters	Location	Frequency	Monitoring Implementation	Supervision	Cost (INR)
【Pre- construction and Construction Phase】						
Air Pollution	PM_{10} $PM_{2.5}$ SO_2 NOx CO	5 locations	Pre-construction : Once Construction : Once in a season (3 years)	Contractor through approved monitoring agency	HMPD	1,300,000
		2 locations at hot-mix plant	Construction : Once in a season (2 years)	Contractor through approved monitoring agency	HMPD	320,000
Water Pollution	【Surface Water】 pH, BOD COD, TDS Pb, oil and grease, and detergents 【Ground Water】 pH, TDS, total hardness, sulphate, chloride, Fe, Pb, and coliform count	5 locations	Pre-construction : Once Construction : Once in a season (3 years)	Contractor through approved monitoring agency	HMPD	1,300,000
		2 locations at hot-mix plant	Construction : Once in a season (2 years)	Contractor through approved monitoring agency	HMPD	320,000
Waste	Monitor acceptable segregation, storage, handling, and disposal	Work area, yard, plant, office, and camp	Daily (patrol)	Contractor/ Construction supervision consultant	HMPD	Included in construction cost
Soil Quality	Pb, sodium absorption ratio, oil and grease, grain size, texture, pH, conductivity, Ca, Mg, N	5 locations	Pre-construction : Once Construction : Once in a season (3 years)	Contractor through approved monitoring agency	HMPD	1,300,000
		2 locations at hot-mix plant	Construction : Once in a season (2 years)	Contractor through approved monitoring agency	HMPD	320,000
Noise and Vibration	dB(A)	5 locations	Pre-construction :	Contractor through approved	HMPD	1,300,000

Component	Parameters	Location	Frequency	Monitoring Implementation	Supervision	Cost (INR)
			Once Construction : Once in a season (3 years)	monitoring agency		
		2 locations at hot-mix plant	Construction : Once in a season (2 years)	HMPD	HMPD	320,000
Ecosystem (Plantation)	Progress of compensation plantation for felled trees	Location as instructed by Thiruvallur DFO	Every month	PIT in TNRDC	HMPD	Included in construction cost
	Progress of transplanting of trees with girth smaller than 90 cm	Near the ROW	Every month	PIT in TNRDC	HMPD	Included in construction cost
	Securing compensation land for RF conversion	Kancheepuram District	Every month	HMPD	HMPD	Included in the regular HMPD personnel cost
(Roadside Ecosystem)	<Pre-construction> Confirm the design and construction plan to avoid and minimize soil runoff during construction and operation phases	Near the ROW	Every month	Construction supervision consultant	HMPD	Included in construction cost
	<Construction> Implementation of preventive measures. No soil runoff outside the ROW	Near the ROW	Every month	Contractor/ Construction supervision consultant	HMPD	Included in construction cost
Hydrological Situation	Confirmation of progress with PWD	Near the ROW	Every month	Contractor/ Construction supervision consultant	HMPD	Included in construction cost
Topography and Geographical Features	No procurement from informal quarries or sources	Work area, yard, plant	Every month	Contractor/ Construction supervision consultant	HMPD	Included in construction cost
Involuntary Resettlement Loss of Land and Asset, Business Relocation	Progress of compensation and assistance; Progress of relocation; Progress of land acquisition	Near the ROW	Every month	RAP Implementation consultant /NGOs	HMPD	Included in RAP implementation cost
	Confirmation at the sites for facilities A. No resettlement or loss of assets is caused. B. Proper	Sites for yards and other facilities	A. After informal selection of the sites B. Before commencement of works C. After completion	Contractor/ Construction supervision consultant	HMPD	Included in construction cost

Component	Parameters	Location	Frequency	Monitoring Implementation	Supervision	Cost (INR)
	contract and permissions are obtained. C. Original state of the site is recovered and the land is returned to the owner.		of works			
Water Use, Water Rights	Payment for the affected wells, construction of alternative facilities	Near the ROW	Every month	RAP Implementation Consultant/ NGOs	HMPD	Included in RAP implementation cost
Existing Public Facilities, Road and Transportation Facilities, Social Infrastructure, Social Service	Proper relocation of the affected public and community facilities	Near the ROW	Every month	RAP Implementation Consultant/ NGOs HMPD/DRO	HMPD	Included in RAP implementation cost
Split of Community	Received grievances and complaints for difficulty of moving	Near the ROW	Every month	RAP Implementation Consultant/ NGOs	HMPD	Included in RAP implementation cost
Children's Rights	Age of workers must be 15 and over	Work area, yard, plant	Every month	Contractor/ Construction supervision consultant	HMPD	Included in construction cost
Sanitation, Public Health, Transmittable Diseases including HIV/AIDS	Occurrence of transmittable diseases such as dengue fever near the work area	Near work area	Every month	Construction supervision consultant	HMPD	Included in construction cost
Work Environment, Occupational Safety and Health	Compliance with work safety standards	Work area, yard, plant, office, camp	Every day (patrol)	Contractor/ Construction supervision consultant	HMPD	Included in construction cost
	Training and capacity building	Office	Orientation Programme Awareness Programme Orientation Programme	Construction supervision consultant	HMPD	Included in construction cost
Accidents, Crime	Implementation and effectiveness of traffic control and accident prevention at the work area	Work area and near area	Every day (patrol)	Contractor/ Construction supervision consultant	HMPD	Included in construction cost
Climate Change, Cross-border Impacts	Maintenance condition of the construction machineries and transportation vehicles	Work area, yard, plant	Every day (patrol)	Contractor/ Construction supervision consultant	HMPD	Included in construction cost
				Subtotal	**INR**	**6,480,000**

Component	Parameters	Location	Frequency	Monitoring Implementation	Supervision	Cost (INR)
【Operation Phase】						
Air Pollution	PM_{10} $PM_{2.5}$ SO_2 NOx CO	5 locations	4 times for 1 year	Approved monitoring agency	HMPD	400,000
Water Pollution	【Surface Water】 pH, BOD COD, TDS Pb, oil and grease, detergents 【Ground Water】 pH, TDS total hardness, sulphate, chloride, Fe, Pb, coliform count	5 locations	4 times for 1 year	Approved monitoring agency	HMPD	400,000
Soil Quality	Pb, sodium absorption ratio, oil and grease	5 locations	4 times for 1 year	HMPD/ Approved monitoring agency	HMPD	400,000
Noise and Vibration	dB(A)	5 locations	4 times for 1 year	HMPD/ Approved monitoring agency	HMPD	400,000
Ecosystem (Roadside Ecosystem)	Negative impacts by soil runoff from ROW. Implementation of impact mitigation measures.	Near ROW	Every month for 1 year	HMPD/ Approved monitoring agency	HMPD	Included in regular road maintenance cost
	Negative impacts by land use change and increased traffic volume. Implementation of impact mitigation measures.	Near ROW	Every month for 1 year	HMPD/ Approved monitoring agency	HMPD	Included in regular road maintenance cost
Water Use	Decline of groundwater level	Existing wells near ROW	Every month for 1 year	HMPD/ Approved monitoring agency	HMPD	Included in regular road maintenance cost
Monitoring of Management and Operational Performance Indicators	Reporting all monitoring items		10 months	HMPD/ Foresters	HMPD	400,000
Monitoring and Evaluation External Agency	Outsourcing			External Agency (Independent Expert)	HMPD	2,000,000
				Subtotal	**INR**	**4,000,000**
				Grand Total	**INR**	**10,480,000**

Source：JICA Study Team, DPR, Draft EIA

11.3.9 Implementation Mechanism of Mitigation and Monitoring Measures

(1) Implementation Structure During the Construction Phase

HMPD will assign TNRDC to implement the Project in Section 1. TNRDC will form the Project Implementation Team (PIT) within its organization. The Project Director will be the focal person in supervising and reporting the implementation of Mitigation Plan and Monitoring Plan to HMPD Divisional Engineer (DE) every month. After reviewing the reports from DE, the HMPD Chief Engineer instructs the Project Director to report to the line departments, including JICA.

The monthly monitoring report will be combined and submitted to JICA quarterly. According to the EIA Notification 10(i), monitoring reports must be submitted to the State DOE on June 1st and December 1st of every year.

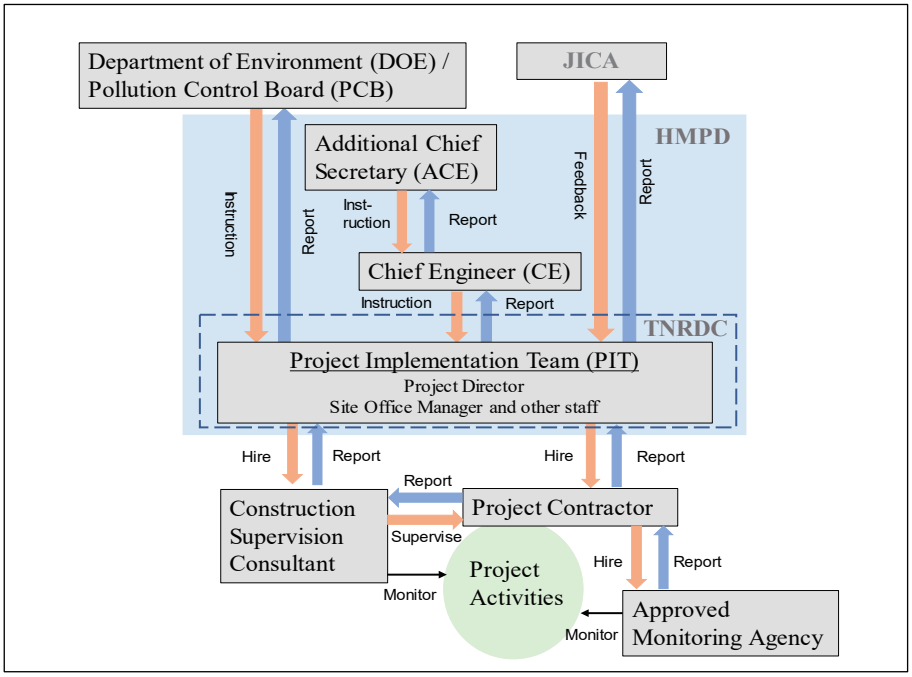
Table 11.3.31 shows the items to be included in the monitoring reports and the frequency of reporting.

Implementation structure in the construction phase is shown in Figure 11.3.24.

Table 11.3.31 Summary Details of Reporting Formats

No.	Item	Stage	Contractor	Forest Wing	Supervision Consultant (SC)/Concessionaire		Project Implementation Team (PIT)
			Implementation and Reporting to SC	Implementation and Reporting to PIT	Supervision	Reporting to PIT	Oversee / Field Compliance Monitoring
1	Identification of Dumping Locations	Pre-construction	Once	—	Once	Once	Once
2	Setting up of Construction Camp	Pre-construction	Once	—	Once	Once	Once
3	Borrow Area Identification	Pre-construction	Once	—	Once	Once	Once
4	Tree Cutting	Pre-construction	—	Monthly	—	—	Quarterly
5	Tree Plantation	Construction	—	Monthly	—	—	Quarterly
6	Top Soil Monitoring	Construction	Quarterly	—	Continuous	Quarterly	Quarterly
7	Pollution Monitoring	Pre-construction/Construction/ Operation	As Per Monitoring Plan	—	Quarterly	Quarterly	Quarterly/As per Monitoring Plan
8	Survival Rate of Trees	Operation	—	Quarterly	—	—	Quarterly
9	Status regarding Rehabilitation of Borrow Areas	Operation	—	—	—	—	Semi-annually

Source： DPR, Draft EIA

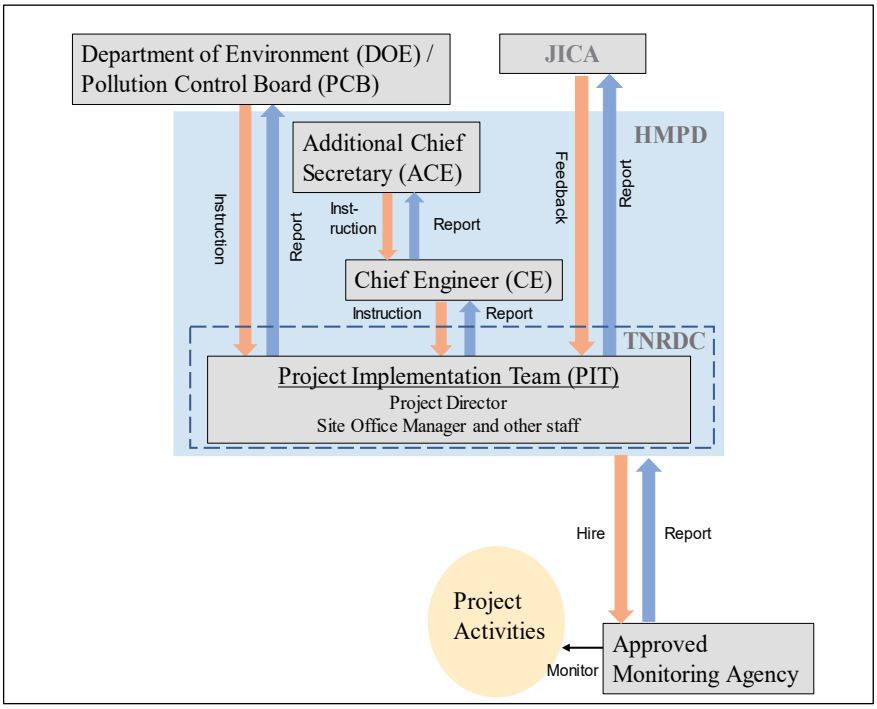


Source: JICA Study Team

Figure 11.3.24 Implementation Structure during the Construction Phase

(2) Implementation Structure During the Operation Phase

In the operation phase, the Project Director of the PIT in TNRDC will still be the focal person in supervising and reporting the implementation of EMP and EMoP (Figure 11.3.25).



Source: JICA Study Team

Figure 11.3.25 Implementation Structure During the Operation Phase

(3) Line Department and Stakeholders

The roles and responsibility of line departments and stakeholders involved in environmental management are shown in Table 11.3.32.

Table 11.3.32 Roles and Responsibility of Line Departments and Stakeholders

Line Departments and Stakeholders	Roles
State Pollution Control Board (SPCB)	SPCB will be responsible for matters related to air, water, and noise pollution during the construction and operational stages. Matters related to these may be brought under their notice for solution.
Forest Department	Matters related to social forestry, forests, wildlife, and trees should be consulted with the local DFO or Forest Range Officer, Forest Department depending on the advice required.
HMPD	HMPD is responsible for the implementation and supervision of the road works.
Final Design Consultant	The consultant will be responsible for the preparation of final road designs and contract documentation based on the preliminary road designs, and formulation of the Environmental Management Plan and Environmental Management Action Plan recommendations.
Environmental Specialist of HD(ES)	ES will be responsible for all matters concerning environmental monitoring and inter-governmental coordination.
Traffic Police and State Police	Matters related to traffic and violation of traffic and other law and order issues may be taken up with the Traffic Police and State Police.
Tamil Nadu Water Supply and Drainage Board (TWAD)	TWAD will be responsible for matters related to water supply, water taps, borewells, and tube wells along the sides of the roads.
Local Bodies (Municipal Authorities/ Village Administration)	Village administration/municipal authorities will be responsible for local bus waiting sheds, *panchayat,* and municipal public wells.
Motor Vehicle Department	This department is responsible for issues and matters related to pollution under control certificates, driving licenses, etc.
Fire Force and Fire Station	Matters related to safety, especially fire safety, may be taken up with the Fire Force.
Archaeological Department	All matters related to ancient archaeological structures and historical monuments that may be encountered during construction works or identified during pre-construction stage.
Mining and Geology Department	All matters related to quarry and sand materials may be referred to the State Mining and Geology Department.

Source: DPR EIA 2017, p.11-3,11-4

11.3.10 Grievance Redress Mechanism

The implementation structure of the grievance redress mechanism is shown in Table 11.3.33 and Figure 11.3.26. Firstly, grievances are received and reviewed by the Project Level Grievance Redressal Committee (PLGRC). PLGRC consists of Divisional Engineer (DE), Superintending Engineer (SE) from HMPD, one elected representative, and a person who is publicly known in the local area. Preferably one of the members should be a female.

When the grievance is not solved at the PLGRC, the Appellate Level Grievance Redressal Committee

(ALGRC) will be held, which consists of the Superintending Engineer (SE) and the HMPD Chief Engineer.

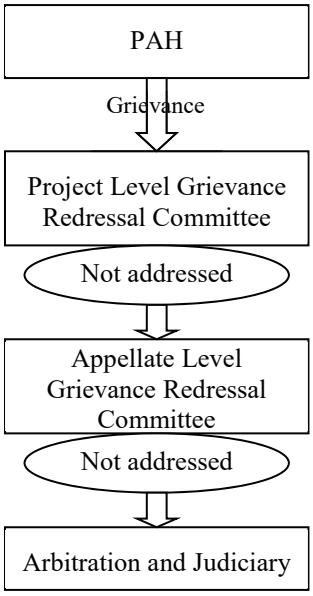
Each committee must solve the grievance within three months from the date of receipt.

Reports of grievance registration from each committee will be submitted together with the project progress report and monitoring reports to JICA and other concerned organizations.

Table 11.3.33 Grievance Redressal Mechanism

Dealing Organization	Members
Project Level Grievance Redressal Committee (PLGRC)	The members are as follows (preferably one of them is a female): ・Divisional Engineer (DE) ・One elected representative ・A person who is publicly known in the local area ・Superintending Engineer (SE)
Appellate Level Grievance Redressal Committee, (ALGRC)	・Chief Engineer（HMPD） ・Superintending Engineer (SE)

Source：DPR EIA 2017, p.11-4,11-5



Source: JICA Study Team based on DPR EIA 2017 p.11-4,11-5

Figure 11.3.26 Steps of Grievance Redress on EIA

11.3.11 Consultation with Stakeholders and Concerned Public

Public consultations following JICA guidelines are held twice. Summaries are described in the following Sections (1) and (2).

Various methods of notification of meetings are taken. Firstly, by handing out the notice and explaining the contents orally to all the accessible households in the ROW, it was made sure that all the affected are treated equally, no matter the social status or gender, and that those who have difficulty in movement, including elderlies, do not miss out on the announcement of the meeting as well as the Project/Section 1.

According to the Socio-economic Survey, 89% of PAHs answered that they belonged to the Scheduled Caste, the Most Backward Class, or other Backward Class. Additional advice was given by the local Social Specialist that in urban CMA, people do not hesitate or are not prohibited from attending such meeting because of their community background. With such observation, the notice was also displayed in places visited by all groups of society in the area, such as school entrances and bus stops, to disseminate the information of the meeting widely and to encourage vulnerable people to attend the meeting in person.

The HMPD Consultant also visited all related VAOs and asked the officers to directly invite residents if they think their attendance in the meeting is important and necessary. In addition, invitation letters were sent to non-government organizations (NGOs) in Chennai area acting in the fields of social improvement, gender issues, and environmental conservation, asking for their attendance in the meeting and expressing their opinions from their specialized field.

Besides the above consultations, TNSPCB held public consultations on the draft EIA report submitted by HMPD in the Kancheepuram District on 10 July 2018 and in Thiruvallur District on 12 July 2018. The summary of discussions is described in Section (3).

(1) First Public Consultation Based on JICA Guidelines

The first consultations on the EIA survey based on the JICA Guidelines were conducted in the form of public consultations in Minjur, the southernmost point of the TPP Link Road, on 9 April 2018 (Monday), and in Panchetti on the Main Road of Section 1 on 10 April 2018 (Tuesday). The number of attendants in Minjur was about 250, including 45 women, and in Panchetti was about 90, including 4 women.

In the two meetings, many attendants raised questions and objections about land acquisition and resettlement, and the attempts of the HMPD consultant to separate the EIA meeting and RAP meeting failed. Details of the public consultations are explained in Section 11.5.

Queries, suggestions, and replies about environmental conservation in both meetings are shown in Table 11.3.34 and Table 11.3.35.

Table 11.3.34 Queries, Suggestions, and Replies in the Minjur First Meeting

No.	Name	Queries/Suggestions	Replies
1	Mr. Vinayagamoorthi, PattamandhiriVillage.	Ensure the environmental safeguards during project implementation.	The EMP is prepared and will be implemented.
13	Mrs. Nariyini, Environmental Expert	What mitigation is proposed for the affected water bodies and trees?	Bridges proposed for water body crossings and compensatory trees will be planted at the rate of 1:10 for affected trees.
15	Mr. Elumalai, Pattamandiri	The environmental status of the region will be affected due to the project.	EMP is prepared which will be implemented to mitigate/ minimize the impacts.

Source: HMPD

Table 11.3.35 Queries, Suggestions and Replies in Panchetti First Meeting

No.	Name	Queries/Suggestions	Replies
6	Mr. Paneerselvam, Panchetti Village	Will subway/pedestrian road crossing facilities be provided at appropriate locations?	The project includes underpasses at appropriate locations.
12	Mr. Babu, Athipedu Village	What arrangements will be made for relocating cultural properties?	The cultural properties will be relocated within the same location.

Source: HMPD

(2) Second Public Consultations Based on JICA Guidelines

The second consultations on the draft EIA based on the JICA Guidelines were conducted in the form of public consultations in Minjur on 11 May 2018 (Friday) and in Panchetti on 12 May 2018 (Saturday). The number of attendants in Minjur was about 200, with 22 women, and in Panchetti was about 75, with 1 woman.

On both days, after the explanation and conference of EIA, RAP was planned, however, from the beginning of meetings, attendants voiced out their questions and agitations about land, relocation, expropriation, etc. Therefore, the explanation on the environment and social aspect were conducted in parallel. More details of the stakeholder meetings are described in Section 11.5.

Queries, suggestions, and replies about environmental conservation in the Panchetti meeting are shown in Table 11.3.36. In Minjur, environment-related queries were not raised.

Table 11.3.36 Queries, Suggestions, and Replies in Panchetti Second Meeting

No.	Name	Queries/Suggestions	Replies
3	Mr. Mahesh, Panchetti Village	Who is the prime beneficiary of the project? The general public or private ports in Ennore?	The project will decongest the traffic within CMA and provide connectivity to the villages along the alignment. The Ennore Kamarajar Port connectivity will accelerate the economic growth of the state.
5	Mr. Paneerselvam, Panchetti Village	Will subway/pedestrian road crossing facilities be provided at appropriate locations?	The project includes vehicular underpasses (VUPs) and light vehicular underpasses (LVUPs) at appropriate locations.
6	Mr. Manikandan, Athipedu Village	The agricultural land is affected by the project wherein loss of livelihood of the local people is expected. The project seems to be affecting the agricultural activities of the region.	As the project is a linear one, there will be not much impact on agricultural activities in the region. Culverts are proposed at 150 m (approximately) intervals to facilitate agricultural activities.
9	Mr. Palayam, Moolathangal Village	What arrangements will be made for relocating cultural properties? What will be the relocation arrangements for the affected school and temple at Moolathangal Village?	The cultural properties and schools will be relocated within the same village.
10	Mr, Abubakkar, Media Reporter, Panchetti Village	What arrangements will be made to assess the environmental condition, and how will it be protected during the construction phase?	Baseline environmental monitoring has been carried out for air, noise, soil, and water parameters and will be checked during and post-construction stages. The EMP has been prepared to mitigate issues observed during construction. JICA-assisted projects will consider social and environmental safeguards as major components in the road project.

Source: HMPD

(3) TNSPCB Public Consultations

Based on the Indian 2006 EIA Notice, TNSPCB held public consultations on the draft EIA report submitted by HMPD for all sections in Chengalpattu, Kancheepuram District on 10 July 2018, and at Thamaraipakkam in Thiruvallur District on 12 July 2018. Discussions are summarized in Table 11.3.38 and Table 11.3.39.

Table 11.3.37 TNSPCB Consultations

Dates	Locations
10 July 2018	Divisional Engineers Office, Chengalpattu, Kancheepuram District
12 July 2018	S.V. Rajammal Marriage Hall, Thamaraipakkam, Thiruvallur District

Source : http://www.environmentclearance.nic.in/writereaddata/FormB/EC/Public_Hearing/20072018CDTZ15DIAnnexure-DocumentofPublicHearing.pdf

Table 11.3.38 Discussions in Kanheepuram District

Sl.no	Name	Question/Suggestion	Reply
1	Mr. Sudhakar, Padur, OMR	Why is this road being planned?	This road is being constructed considering the growth of Chennai's economy and trade.
		I have my agricultural land at Manamadhi Village, will it get affected?	The land will be acquired only after paying the compensation as prescribed in the law.
2	Mr. Radhakrishnan, Sengundram Village	There is a government land available near my land. Is it possible to shift the alignment there?	A six-lane road has been planned. It is not possible to change the alignment at a particular point.
		Will I be compensated enough?	The land will be acquired only after paying the compensation as prescribed in the law.
3	Mr. Nagarajan, Sengadu, Kandamangalam	How will the compensation be fixed for the existing buildings?	Buildings will be valuated and compensated as per the schedule of rates of PWD.
		Will I be compensated for the loss of trees in my plot?	Yes. The trees owned by the plot owner will be compensated.
4	Mr. Jayakumar, (Maya Appliances Pvt Limited) Sirukundram	There are 1,000 people working in my factory. Is it possible to change the alignment so that my factory is not disturbed?	A six-lane road has been planned. It is not possible to change the alignment at a particular point.
5	Mr. Seenivasan, Sengundram	There is a government land available near my land. Is it possible to shift the alignment there?	A six-lane road has been planned. It is not possible to change the alignment at a particular point.
6	Mr. Devarajan, Sriperambudur	In this place, nearly 400 houses will be affected. If this road is fully-designed as elevated, it will solve our problem.	Along the Sriperambudur Lake, a 2-km shore elevated bridge has been planned.
7	Mr. Babu, Sriperambudur	At Veerasami Pillai Street, 100 houses will be affected. If this road is fully-designed as elevated, it will solve our problem.	Along the Sriperambudur Lake, a 2-km shore elevated bridge has been planned.
8	Mr. Sudhakar, Padur, OMR	My land is grama Natham. Will I be compensated?	The land will be acquired only after paying the compensation as prescribed in the law.
		Where should I go to know the details of the project?	To know the details of the project, the HMPD Office may be approached.
9	Mr. Baskar, Thiruporur	My Patta land is getting affected due to this project. Is it	A six-lane road has been planned. It is not possible to change the alignment at a particular point.

Sl.no	Name	Question/Suggestion	Reply
		possible to change the alignment?	
10	Mr. Vetrimaran, Thiruporur, Manamadhi	Approximately 50 houses will get affected, so is it possible to change the alignment?	A six-lane road has been planned. It is not possible to change the alignment at a particular point.
11	Mr. Elumalai and Mrs. Suguna, Royal Silks	Will the government bare the charges of shifting the electric connection of my agricultural lands?	Matters regarding this issue will be decided later.
		How will I access my land that is on the other side of the road?	Road Over Bridges will be constructed at specific intervals to cross the road.

Source : http://www.environmentclearance.nic.in/writereaddata/FormB/EC/Public_Hearing/20072018CDTZ15DIAnnexure - DocumentofPublicHearing.pdf

Table 11.3.39 Discussions in Kanheepuram District

Sl.no	Name	Question/Suggestion	Reply
1	Mr. Kannan, Pungamedu, Minjur	A link road has been planned through the residence; hence, the environment will get affected. Kindly change the alignment.	We already received this request of changing the alignment of the Link Road from the public. Hence, HMPD is finding an alternate alignment. Pollution will not happen.
2	Mr. Arumugam, Bharathi Nagar, Minjur	There is a lot of unauthorized settlement near the lake. Required action must be taken to vacate them.	Required action will be taken to vacate them.
3	Mr. Duraiarasu, Putlur	Along the proposed corridor, there are few species like the green snake, monitor lizard, and rat snake. Also, there are ancient markings on stones - please work without disturbing them.	There are no ancient stone markings at the site. These endangered species and animals will not be affected.
4	Mr. Adhisheshan, Pungambedu, Minjur	Why has this road been planned as a 400-ft road? It is requested to change the alignment to shift to government lands.	Considering the growth of Chennai, this road has been planned and this road will be shortened to 150 ft when it is passing through the Minjur residential areas.
5	Mr. Sampath, Thamaraipakkam	Without extending the existing roads, why is this new road being planned?	Extending the existing road will affect the existing residence and will damage the environment to a greater extent. Hence, a new road has been planned.
		Damaging the agricultural lands and cutting the existing trees are affecting the environment. How are you going to compensate for it?	We prepared plans to mitigate the environmental and social impacts.
6	Mr. Kannan, Athaiyakavunur	We need clear information about the agricultural lands that are going to be affected.	To know the details of the project, you may approach the HMPD Office.
		I understand that small farmers getting affected by this project will get alternate land. But I want to know how will the water wells be compensated?	Land that is to be acquired and water bodies in these lands will be compensated as per the law.
7	Mr. Sadhisana Ramanujar Dasan	Why is this 5-km road being made? Is it possible to change the alignment?	This road will link the TPP and the NPAR roads. Due to this, the villages will be linked to the city. Also, considering the growth of

Sl.no	Name	Question/Suggestion	Reply
			Chennai's economy and trade, this road is being made. It is not possible to change the alignment.
8	Mr. Venugopal	Due to this project, our water sources and agricultural lands are getting affected. Is it possible to change the alignment?	A six-lane road has been planned. It is not possible to change the alignment at a particular point.
		It is kindly requested to share the details of the extent of land that will be acquired in detail.	To know the details of the project, you may approach the HMPD office.
9	Mr. Ramalingam, Natham Village, Ponneri	Due to this road at Natham Village, at survey no. 91 to 112, the existing borewells are getting affected. Hence, it is kindly requested to shift the alignment.	Care will be taken to avoid the borewell.
10	Mr. Kuppan, Punnampakkam	1) I need ten times compensation for the land. 2) Also, a government job must be given to one family member of the affected agriculturalist. 3) Also, we need an undertaking from the government saying that we will not acquire land nearby for any other purpose. 4) Acquire government land, not the lands that are used for agriculture. 5) Also, provide compensation before acquiring the land.	The land will be acquired only after paying the compensation as prescribed in the law. The compensation will be paid as per prescribed rules and laws.
11	Mr. Elangovan, Putlur	In my village, there are more government lands (55 acres) than agricultural lands. Why not shift the alignment there?	A six-lane road has been planned. It is not possible to change the alignment at a particular point.
		When are you acquiring my land, and will you provide an equivalent government land in exchange?	The land will be acquired only after paying the compensation as prescribed in the law. The compensation will be paid as per prescribed rules and law.
12	Mr. Sasikumar, Minjur	Where should I go to know the details of the project?	To know the details of the project, you may approach the HMPD Office.
13	Mr. Sureshkumar, Vishnuvakkam	There is a lot of government land available near my land. Instead of choosing that, why is our private land being targeted?	A six-lane road has been planned. It is not possible to change the alignment at a particular point.
		What is the compensation for our livelihood?	Care will be taken so that livelihood is not lost.
		Where should I go to know the details of the project?	To know the details of the project, you may approach the HMPD office.
14	Mr. Devendran, Punnambakkam	Environmental and social impacts are affecting us. Kindly change the alignment.	A six-lane road has been planned. It is not possible to change the alignment at a particular point.
15	Mr. Palani, Ammanambakkam	Will this project be made without affecting agriculture and our jobs?	This project will be executed without affecting the agriculture and job opportunities.
		Instead of the Revenue Department paying us the compensation as cash,	For the land that is being acquired, compensation will be made as per prescribed rules and laws.

Sl.no	Name	Question/Suggestion	Reply
		can we get alternate land or jobs as compensation?	
16	Mr. Vivekanandhan, Nandhiyambakkam Village	There is a government land available near my land. Is it possible to shift the alignment there?	A six-lane road has been planned. It is not possible to change the alignment at a particular point.
		Where should I go to know the details of the project?	To know the details of the project, you may approach the HMPD Office.
17	Mrs. Sujatha, Pungambedu	There is a government land available near my land. Is it possible to shift the alignment there?	We have already received this request of changing the alignment of the Link Road from the public. Hence, HMPD is finding an alternate alignment.
18	Mr. Jayakumar, Putlur	Please give details on the extent of lands that will be acquired.	To know the details of the project, you may approach the HMPD Office.
		What is the compensation for loss of our livelihood?	This road will be made without affecting the livelihood.
		Please give us the compensation details.	To know the details of the project, you may approach HMPD Office.
19	Mr. Gunashekaran, Eranavakkam	There is a lot of government land available near my land. Instead of choosing that, why is our private land being targeted?	A six-lane road has been planned. It is not possible to change the alignment at a particular point.
20	Mrs. Kesavammal, Pungambedu	There will be more environmental impact, and our livelihood will get affected. Hence, alternate alignment is requested.	We have already received this request of changing the alignment of the Link road from the public. Hence, HMPD is finding an alternate alignment. Care will be taken so that environmental and social impacts are reduced.
21	Mr. Gokulraj-NGO	There will be more environmental impact, and our livelihood will get affected. Hence, alternate alignment is requested.	Care will be taken so that environmental and social impacts are reduced.
22	Mr. Vijayaragavan	Without extending the existing roads, why is this new road been planned?	Extending the existing road will affect the existing residence and will damage the environment to a greater extent. Hence, a new road has been planned.

Source : http://www.environmentclearance.nic.in/writereaddata/FormB/EC/Public_Hearing/20072018CDTZ15DIAnnexure - DocumentofPublicHearing.pdf

11.4 Land Acquisition and Resettlement of Section 1

The following sections explain the details of project affected persons (PAPs), assets, and socio-economic conditions of PAPs to be affected by Section 1 (Main Road and TPP Link Road (Original Alignment)). Impacts of Section 1 (Main Road and TPP Link Road (New Alignment)) are described in Section 11.6.4.

11.4.1 Necessity of Land Acquisition and Resettlement in the Project

The CPRR requires land for new alignment and for expansion of existing State Highway (Table 11.4.1). The new alignment was located mainly on agriculture and vacant lands to minimize resettlement. In Section 3, the expansion of existing highway requires relocation or set back of existing commercial and residential structures. Section 4 is already in use.

Table 11.4.1 Planned Length of Project Road by Section

	Section 1			Section 2	Section 3	Section 4	Section 5
	Total	Main Road	TPP Link Road (Original Alignment)				
New aAlignment	25.72 km	21.51 km	4.21 km	25.61 km	19.95 km	0 km	25.50 km
Expansion of Existing SH	0 km	0 km	0 km	0 km	9.6 km	24.85 km	2 km
Total Length	25.72 km	21.51 km	4.21 km	25.61 km	29.55 km	24.85 km	27.50 km
Width of ROW	100 m	100 m	100 m	60 m	60 m	60 m	60 m
Planned Area for Land Acquisition	250.59 ha	226.32 ha	24.27 ha	187.66 ha	208.04 ha	0.00 ha	162.83 ha

Source from area for land acquisition: Section 1=TNRDC (16 May 2018) , Other sections=STUP Consultants Letter to DE (Chengalpattu) HMPD, E/14518/149/NJW/GK/0132, 11 August 2017
Other sources: DPR 2017, HMPD

11.4.2 Legal Framework of Land Acquisition and Resettlement

(1) Legal Framework in India and Tamil Nadu

The system, target, and process of compensation and assistances defined by the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (LARRA 2013) are summarized in Table 11.4.2.

Section 26 of LARRA 2013 defines the method of determination of market value of land by the collector. This section discusses the two methods to find the market price for similar types of lands situated in nearby areas. Whichever is higher is selected as the market value.

The market value of the building and other immovable properties or assets attached to the land, or building which are to be acquired, will be calculated using the same method of PWD that is used for procurement of construction of building and other facilities, with unit price that is updated every year by the state government. Therefore, the estimated value for the building and other assets will be equal to the market value.

The First Schedule of LARRA 2013, as explained in Section 30 (2), clarifies the solatium added to the land value and the value of assets attached to the land or building as shown in Table 11.4.2. In total, the land title holders will receive the cash amount calculated using the equation below.

Compensation for Land Owners = (market value of land x 2 (urban) or x 2.5 (within 30 km from urban))
+ (market value of assets attached to land or building x 2)

The squatters and encroachers without land title will receive only the assets portion of the above equation.

With the above arrangement, the size of compensation based on LARRA 2013 will be larger than the replacement cost for similar land or replacement cost for similar assets attached to the land or building. HMPD, TNRDC, and local social development consultants agreed with this conclusion.

Table 11.4.2 System, Target, and Process of Compensation and Assistances Defined by LARRA 2013

Topic	
a. Establishment of a specialized body	・Establishment of the national and state monitoring committees to monitor the process of land acquisition (Section 48) ・LARR Authority(s) for speedy redressal of disputes relating to land acquisition (LA) and rehabilitation and resettlement (R&R) (Section 51)
b. Eligibility	・Title holders (land owner and registered tenants) are eligible for compensation. ・Those who lose their basis of livelihood by LA are eligible for rehabilitation and resettlement.
c. Properties for compensation	・Land, buildings attached to the land, and other things attached to the land or building
d. Consultation process	・Except under urgent acquisition (Section 9) and exempt cases (Section 105), the government will follow a series of steps, including social impact assessment study and public hearing to ascertain the views of affected families to be recorded and included in the report (Sections 4 and 5).
e. Determination of market value of land by the District Collector	・The District Collector, when assessing and determining the market value of the land, will adopt the higher value of the following (Section 26): a) The market value specified in the Indian Stamp Act 1899 in the area where the land is situated; and b) The average sale price for similar type of land situated in the nearest village or nearest vicinity area.
f. Determination of market value of assets attached to land or building	・The market value will be calculated using the same method of PWD that is used for procurement of construction of buildings and other facilities, with unit price that is updated every year by the state government.
g. Compensation for land owners	・(Market value of land x 1 (urban) or x 1.25 (within 30 km from urban))＋(Solatium for land (Equivalent to 100% of above))＋(Market value of buildings and other things attached to the land) + (Solatium for buildings (Equivalent to 100% of above)) In total, 【Market value of land x 2 or x 2.5】+【Market value of attached assets x 2】 will be paid to the land owners. (LARRA 2013, Section 30, Schedule 1) (Tamil Nadu Rules 2017 to LARRA 2013) (G.O. (Ms). No. 300 Revenue and Disaster Management, dated 20.09.2017, No. SRO A41 (c-3)/ 2017)
h. Rehabilitation and resettlement	・Eleven types of elements are listed in the Second Schedule. ・Awards include provision of housing units, land for land, choice of annuity or employment, subsistence grant for displaced families for one year, transportation cost for displaced families, one-time grant to small traders, one-time resettlement allowance, stamp duty, and registration fee.

Source: Land Acquisition Act 1894、Right to Fair Compensation and Transparency in LARRA 2013

Section 105 of LARRA 2013 states that the act will not be applied in certain cases or will be applied with certain modifications. Based on Section 105, the Government of Tamil Nadu enacted the amendment of LARRA 2013 on 1 January 2014, and the LA based on TNHA 2001 was exempted from application of LARRA 2013 or modified application was legalized.

On September 21, 2017, Tamil Nadu Rules 2017 to the LARRA 2013 were enacted. The rules are based on Section 109 of LARRA 2013. The rules were notified by the Ministry of Revenue and Disaster Management. The contents are listed in Table 11.4.3. The rules directs procedures, institutions, and roles to implement LARRA 2013 in Tamil Nadu. The contents do not contradict with or overrule those of LARRA 2013.

The JICA Study Team confirmed and agreed with HMPD that the land acquisition process of Section 1 will follow the process determined by the Tamil Nadu Highways Act and LARRA 2013, while the JICA Guidelines and WB O.P. 4.12 will be used in determining the size of compensation, validating the eligible

persons, and the contents of compensations and assistances offered for each eligible person/household. (Figure 11.4.1)

Table 11.4.3 Structure and Contents of Tamil Nadu Rules 2017 to LARRA 2013

Chapter 1	General, Definitions (The area within Chennai Metropolitan Development Authority is defined as urban area)
Chapter 2	Process of Land Acquisition for Public Purpose
Chapter 3	SIA Study Process and Related Institutions
Chapter 4	Process of Obtaining prior Consent of PAFs on PPP Projects
Chapter 5	Preliminary Notification and Hearing of Objections for Land Acquisition and Rehabilitation and Resettlement Scheme
Chapter 6	Rehabilitation and Resettlement Scheme
Chapter 7	Execution, Rehabilitation and Resettlement Committee and State Monitoring Committee
Chapter 8	Land Acquisition, Rehabilitation and Resettlement Authority

Source: Tamil Nadu LARR Rules 2017, GO Ms No.298, 20 Septemberr 2017

Line	Month	
1		HMPD, with the assistance of the consultant, prepares the land plan schedule (LPS) that contains information of ROW, chainage, parcel boundary, and land owner. HMPD submits the LPS to the District Collector.
		↓
2		District Revenue Officer (DRO), a staff of the Department of Home, conducts a field survey based on the LPS, develops field measurement books (FMB), and determines the area to be acquired.
		↓
3		For large-scale projects, a Special District Revenue Officer (SDRO) is appointed by a State Order to handle all land acquisition for the Project. The SDRO becomes the head of the Land Acquisition Unit under the DRO.
		↓
4		The SDRO and the Land Acquisition Unit will verify information in FMB.
		↓
5	1	HMPD publishes 15(2) Notification of intention of land acquisition once in two major newspapers, and individual title holders are notified by letter. DRO conducts a meeting in each village to meet with the title holders to explain land acquisition and confirm the ownerships and location of their titles.
	2	30 days ↓
6	3	Title holders are asked to show the reasons why their land should not be acquired.
		30 days ↓
7	4	Upon receipt of complaints, the SDRO orders the District Engineer to conduct interviews and report within 15 days.
		30 days ↓
8	5	SDRO decides on land for acquisition.
		30 days ↓
9	6, 7	SDRO prepares for the 15 (1) Notification publication.
		30 days ↓
10	8	DRO submits the draft of 15 (1) Notification to the state government.
		↓
11	9	The 15 (1) Notification is published in the Tamil Nadu Government Gazette.
		↓
12	10	Owners of the land and property to be affected are called for award enquiry by SDRO.
		15 days ↓
13	10	SDRO, with information from the owner, calculate the amount of compensation as directed in LARRA 2013. The Government of Tamil Nadu will make a final decision based on the report submitted by DRO.
		↓
14	11	Payment of compensation.
		↓
15	12	Possession of land seven days after payment of compensation of land and structures.

Source：DPR, HMPD

Figure 11.4.1 Procedure of Land Acquisition Based on TN Highways Act 2001

For Section 1, village-wise publication of the 15 (2) Notification based on Tamil Nadu Highways Act (Line 5 of Figure 11.4.1) is ongoing based on the Land Plan Schedule issued in June 2016. (Table 11.4.4) In the meeting between JICA and HMPD held on 28 March 2018, it was agreed that the gazetting of the 15(1) Notification (Line 11 of Figure 11.4.1) will be done after the signing of LA because the issuance of the gazette announces that land parcels will be legally owned by the government.

Table 11.4.4 First Publication Dates of 15(2) Notification Based on Tamil Nadu Highways Act

District	Taluka		Village	Publication Dates of 15(2) Notification
Main Road				
Thiruvallur	Ponneri	1	Kattupalli	13 September 2016
		2	Voyalur	08 October 2016
		3	Neidhavoyal Block 1 Block 2	 22 January 2017 26 December 2016
		4	Kalpakkam	27 July 2017
		5	Nalur	In preparation
		6	Anuppampattu	06 June 2018
		7	Vannipakkam	14 April 2018
		8	Amur	21 July 2018
		9	Thatchur	In preparation
		10	Panjetty	In preparation
TPP Link Road				
Thiruvallur	Ponneri		Neidhavayal Block 3	 22 January 2017
		11	Kollati	04 March 2017
		12	Nandiyampakkam	27 May 2017
		13	Minjur Block 1 Block 2	 07 October 2017 25 December 2017
		14	Vallur B	30 August 2017

Source: TNRDC, as of 23 July 2018

Yet in the Tamil Nadu Road Sector Project (TNRSP), assisted by the World Bank (WB), WB required application of LARRA 2013 in the Project. HMPD decided, therefore, to mix the procedure of TNHA 2001 (white lines) and the whole process instructed by LARRA 2013 (gray lines), including census survey, SIA study, development of compensation and assistance framework, information dissemination, and public consultation before the physical acquisition of land and property, as shown in Table 11.4.5.

Legal verification of the PAPs and assets to be affected, including absentee land owners is done in at least 140 days, between the first publication of the 15 (2) Notification, village-wise meeting held at the DRO gathering all concerned property owners, and publication of the amendment of the Notice, when necessary. （Table 11.4.6 SL No. 5 and 23）

Therefore, the identification of PAPs, Census and Socioeconomic Survey based on the JICA Guidelines will be most effectively conducted in parallel with the 15 (2) Notification publication in the highways project in Tamil Nadu.

Table 11.4.5 Procedure of SIA and Land Acquisition in TNRSP

	Tasks	Completion Dates	Page
1.	Screening of road project and stakeholder identification	January to February 2014	p.50
2.	Census Survey	May and July 2014	p. 16
3.	Socioeconomic Surveys		
4.	Consultations and discussions with potential PAPs and other stakeholders		p.37
5.	SIA Consultations and discussions with PAPs		p.37

	Tasks	Completion Dates	Page
6.	Consultation meetings were held with the displaced households and other stakeholders in 23 locations along the 11 road stretches	April to June 2014	p. 38-42
7.	Section 15(2) Notification	15 September 2014	
8.	Public Notification for LA	September	p.50
9.	Web disclosure of the Resettlement Policy Framework (RPF) / Resettlement Plan (RP)	September to October 2014	p.50
10.	Period for receiving objections	15 October 2014	
11.	Hearing of objections	21 October 2014	
12.	RP disclosure meetings	3 and 16 December 2014	p.37, 50
13.	Preparation of draft 15(1)	26 January 2015	
14.	Submission of draft 15(1) to GoTN	16 February 2015	
15.	Consultative meetings on resettlement mitigation measures outline in the RPF/RP. After RPF/RP approval by GoTN	January to February 2015	p.50
16.	RPF/RP information dissemination	January to February 2015	p.50
17.	Project information dissemination	January to February 2015	
18.	15(1) Publication in Gazette	16 March 2015	
19.	Award enquiry /hearing objections	27 April 2015	p.50
20.	Award preparation	18 May 2015	
21.	Passing of award	19 May 2015	
22.	Payment of compensation for land and structure	22 May 2015	
23.	Possession of land	01 June 2015	
24.	Consultation with DPs	Throughout RP implementation	p.50
25.	Dissemination of monitoring reports	Throughout RP implementation	p.50
26.	Dissemination of GRC actions	Throughout RP implementation	p.50

Note: The procedure of TNHA 2001 (white lines) shows the expected dates.
Source: Second Tamil Nadu Road Sector Project (TNRSP-II), Resettlement Plan for 11 Roads under EPC Project Implementation Unit, TNRSP-II, Highways Department, Government of Tamil Nadu, February 2015

Table 11.4.6 Procedure of Land Acquisition and Minimum Days Required in TNRSP

NO	Activity sequence	Activity to be Performed	Duration/ Days required	Cumulative Days	Remarks
1	1	Receipt of LPS from Divisional Engineer	0	0	
2	2	Verification of LPS by Special Tahsildar and Surveyors along with the representative of requisition body	15	15	
3	3	Preparation of draft 15(2) by Special Tahsildar (Land Acquisition)	10	25	
4	4	Approval of 15(2) by Special DRO and send for publication	7	32	
5	5	Publication of 15(2) in the newspaper (Two dailies)	5	37	
6	6	Communication of Published 15(2) Notification to DE, Tahsildar, VAO (Concerned)	3	40	Simultaneous activity
7		Issue I Service of show-cause notice to the land owners	3	40	
9	7	Receipt of objections from land owners	30	70	
10	8	Forwarding the objections to the requisition body for remarks (DE concerned)	3	73	
		Receipt of replies from the requisition body to the objections	7	80	
11		Fixing the date for hearing/sending notice to objectors and informing DE about enquiry date	15	95	
12	9	Date 61competion of hearing u/s 15(3)	2	97	
13	10	Passing orders on objections u/s 15(3) (Proposed	7	104	

NO	Activity sequence	Activity to be Performed	Duration/ Days required	Cumulative Days	Remarks
		decision by the government)			
14	11	Revised LPS if any, received from DE based on Objection I field visits	10	114	
15	12	Preparation of subdivision records	15	129	
16	13	Pre-scrutiny of SD records	15	144	Simultaneous activity
17	14	Collection of sale statistics	7	144	
18		Collection of guideline value and EC from SR office	7	144	
20	15	Receipt of valuation trees in LA area from departments	15	159	Simultaneous activity
21		Obtaining NOC from Land Reform Dept.	15	159	
22		Obtaining NOC from HR and C Dept.	15	159	
23	16	Publication of smendment to 15(2) published in dailies, if any	15	174	
24	17	Preparation and sending 15(1) proposal to government	30	204	
25	18	Approval of 15(1) by Govt	60	264	
26	19	Publication of 15(1) in TNG Gazette	7	271	
27	20	Publication of 15(1) in TNG Gazette in the locality	5	276	
28	21	Receipt of valuation for the structures in LA area from DE	15	291	
29	22	Enquiry under 19(2) with land owners for negotiation of compensation amount	25	316	
30	23	Permission under l9(3) to determine of land value as per 19(6) from CLA	30	346	
31	24	Preparation of enjoyment sketch by DIS (Based on documents, enjoyment and village a/ cs)	30	376	
35	25	Preparation of valuation proposal by the Study Team	30	406	
36	26	Pre-valuation proposal to CLA for approval (If the value exceeds INR 50.00 lakh)	20	426	
37	27	Fixing date for award enquiry/ sending notice to the land owners and interested persons informing about enquiry date and place	2	428	
38	28	Award enquiry	7	435	
39	29	Preparation of draft award	30	465	
40	30	Approval of draft award by SDRO / CLA/ Govt	15	480	
41	31	Passing of award	2	482	
42	32	Payment of compensation to the awardees	7	489	
43	33	Handing over of possession of land to DE	7	496	
		Post Award Activities			

Source: TNRSP (obtained on 27 February 2018)

(2) Gaps between the JICA Guideline and the Standard Land Acquisition of HMPD

Gaps among the JICA Guideline, TNHA 2001, and LARRA 2013 are summarized in Table 11.4.7.

The Entitlement Matrix in the DPR shown in Table 11.4.62 was prepared to bridge most of the gaps. This was also explained and discussed in Tamil in the public consultations in 2014, and was approved by HMPD.

In the meeting with the HMPD Superintending Engineer (SE) on 21 December 2017, the JICA Study Team explained the Entitlement Matrix and matched the budget described in the DPR. SE stated that he is well aware that the Entitlement Matrix is similar to the one used for the World Bank assisted TNRSP. The JICA Study Team expressed concern on securing sufficient budget for asset compensation for non-title holders and additional assistance in the Entitlement Matrix, which is not the standard practice in LA based on the Tamil Nadu Highways Act. SE acknowledged the concern and said to work on the matter with TNRDC so that sufficient budget will be allocated. The Resettlement Framework Policy and the Resettlement Plan, including the Entitlement Matrix and the budget same with that in DPR, were approved by the state by Government Order (Ms). No. 75 dated 9 May 2018.

Table 11.4.7 Gaps Between JICA Guideline and Standard Land Acquisition of HMPD and Policies Taken in Project

	JICA Guidelines, WB OPs	TNHA 2001	LARRA 2013	Gap	Policies approved in the 2016 DPR Entitlement Matrix et al.
1	Involuntary resettlement and loss of means of livelihood are to be avoided, when feasible, by exploring all viable alternatives.	16. If before actual possession of such land it appears to the government that the land is not required for the purpose of this Act, the government may withdraw the land from acquisition. On the publication of such notice, the land will revest with retrospective effect in the person from whom it was divested of.	8. (1) (c) The government will ensure that only the minimum area of land required for the project is proposed to be acquired. 8. (2) The government will examine the report of the Collector and the report of the Expert Group on the SIA study, and will recommend such area for acquisition which would ensure minimum displacement of people, minimum disturbance to the infrastructure, ecology, and minimum adverse impact on the individuals affected.	No gap (LARRA 2013)	During the DPR study, social analysis is made for the Project area and alternative alignment and design were examined in such a way to the extent possible, adverse impacts are avoided/reduced at the design stage itself to make the Project road people and environment friendly. (RAP p. 2-2)
2	When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken.	15. (2) The government will call upon the owner and any other person having interest in such land to show why the land should not be acquired. 18. Every owner or person interested in any land (includes benefits to arise out of land and things attached to the earth or permanently fastened to the earth) acquired under this act will be entitled to receive and be paid an amount.	4. (1) (4). Whenever the government intends to acquire land for public purposes, it will carry out an SIA study that contains information on minimization of the impact, extent of remaining impact, and measures to compensate for losses.	No gap (LARRA 2013)	The final alignment was chosen to minimize the displacement by avoiding existing built-up areas. The compensation for loss of assets will be done based on the LARRA 2013.
3	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported so that they can improve or at least restore their standard of living, income	2. (15) The definition of 'Land', the target of compensation, includes benefits to arise out of land and things attached to the earth or permanently fastened to anything attached to the earth.	3. (p), 27. 29. The definition of 'Land', the target of compensation, includes benefits to arise out of land and things attached to the earth or permanently fastened to anything attached to the earth.	No gap (LARRA 2013)	Those who were counted on the cut-off date and are to be relocated by the Project implementation, no matter whether he/she is a title or non-title holder, will be eligible to subsistence allowance,

	JICA Guidelines, WB OPs	TNHA 2001	LARRA 2013	Gap	Policies approved in the 2016 DPR Entitlement Matrix et al.
	opportunities, and production levels to pre-project levels.		26. Land value will be the higher value of the following: a) the market value specified in the Indian Stamp Act 1899 in the area where the land is situated, or b) the average sale price for similar type of land situated in the nearest village or nearest vicinity area. 28. In determining the amount of compensation to be awarded for land, the Collector will take into consideration the expenses to change the residence or place of business. Second Schedule. Eleven types of entitlement for R&R are listed to be given in addition to the award provided by the First Schedule.		resettlement allowance, and shifting allowance. Vulnerable households will be eligible for vulnerable assistance and skills training. (RAP Table 3.3 - 3.9) Responding to the request from the JICA Study Team, HMPD agreed in May 2018 that any PAHs who opted for the skills training will be provided the same.
4	Compensation must be based on the full replacement cost as much as possible.	19 (6) In determining the amount for such acquisition, the Collector will be guided by the provisions of the Land Acquisition Act 1894. In the factual HMPD projects, the formula and multiplier in the LARRA 2013, including the award of solatium, are applied.	26. Land value will be the higher value of the following: a) the market value specified in the Indian Stamp Act 1899 in the area where the land is situated, or b) the average sale price for similar type of land situated in the nearest village or nearest vicinity area. 29. In determining the market value of the standing crops or trees, the Collector used the services of a competent engineer or any other specialist in the relevant field. 30. The Collector having determined the total compensation to be paid (land and other added), will impose a 'Solatium' amount equivalent to 100% of the compensation amount.	The compensation is to be based on market value, not exactly the replacement cost. However, the total compensation value must be doubled by adding 100% solatium. (LARRA 2013)	The replacement value of houses, buildings, and other immovable properties will be determined on the basis of latest PWD Standard Schedule of Rates (SSR) as on the date without depreciation and 100% solatium will be added to the structure compensation. (RAP p. 7-5) Compensation of the land will be calculated by an equation directed by the LARRA 2013, which provides 100% solatium added to the land value. It can be concluded, therefore, that the size of compensation

	JICA Guidelines, WB OPs	TNHA 2001	LARRA 2013	Gap	Policies approved in the 2016 DPR Entitlement Matrix et al.
					will surpass the full replacement cost.
5	Compensation and other kinds of assistance must be provided prior to displacement.	16 (2) The government may direct any person who may be in possession of the land to surrender or deliver possession within 30 days of the service of the order under subsection (1) of Section 15.	46. (4) No land use change will be permitted if rehabilitation and resettlement is not compiled fully.	No gap (LARRA 2013)	According to HMPD, standard operation of possession of land occurs usually four weeks or more after payment of compensation of land and structures. The JICA Study Team requested HMPD on the same operation to be applied. The Resettlement Policy Framework that include the same policy is already approved by the state government on 9 May 2018.
6	For projects that entail large-scale involuntary resettlement, RAPs must be prepared and made available to the public.	-	105. Schedule 4. The provisions of this act will not apply to the land acquisition based on the National Highways Act 1956. LARR (TN Amendment) Act 2014. The provisions of LARRA 2013 will not apply to the LA based on the TNHA 2001. 2017 TN Rule to LARRA 2013. 15. The draft Rehabilitation and Resettlement Scheme will be widely published in the affected areas through the Official Gazette, newspapers, in the local government offices, the website of the government, and on a public notice in the affected areas.	In the Indian legal system, highway projects are exempted from preparation of resettlement action plans. In the World Bank assisted TNRSP, on the other hand, HMPD has experience on the preparation of RAPs and publication of it by combining required process of TNHA 2001 and LARRA 2013.	HMPD, in the same manner with TNRSP, conducted identification of necessary land using LPS data, developed a Rehabilitation and Resettlement Policy, and explained the policy in public consultations in 2014. For Section 1, SIA survey updates similar to the one conducted for other sections were implemented in 2017. Public consultations were held in April and May 2018 at two locations on Section 1. Draft resettlement action plan and plan on compensations and assistances were explained, and opinions were requested. A handbook of the plans in Tamil was distributed in the meetings.

	JICA Guidelines, WB OPs	TNHA 2001	LARRA 2013	Gap	Policies approved in the 2016 DPR Entitlement Matrix et al.
7	In preparing RAPs, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance.	-	4. (2) The notification (to carry out an SIA) will be made available in the local language and will be published in the affected areas and uploaded on the website of the government. 5. Whenever an SIA is required, the government will ensure that a public hearing is held at the affected area after giving adequate publicity about the date, time, and venue for the public hearing.	Since the LA for public purpose is governed by the District Collector, it is not clear whether the detailed project information is shared at the early stage of consultation to the affected people. (LARRA 2013)	Engineers from HMPD gave a presentation on the Project in the public consultations in 2014. The surveys on PAFs and assets in the ROW and socio-economic conditions of the PAFs were implemented in 2016, 2017, and 2018 by consultants procured by HMPD. During the surveys, the consultants, in person, provided information on the Project and collected opinions on the Project from the interviewees. Public consultations were held in April and May 2018 at two locations on Section 1. Invitation activities, including visits at houses and VAOs and oral explanation of the Project, were actively implemented. Draft RAP and plan on compensations and assistances were explained, and opinions were invited in the meetings. A handbook of the plans in Tamil was distributed in the meetings.
8	When consultations are held, explanations must be given in a form, manner, and language that is understandable to the affected people.	-	5. Whenever an SIA is required, the government will ensure that a public hearing is held at the affected area to ascertain the views of the affected families to be recorded and included in the SIA report.	No gap (LARRA 2013)	Tamil and English are the most common languages in the Project area. The Entitlement Matrix in Tamil and English was prepared, distributed, and explained in the public

	JICA Guidelines, WB OPs	TNHA 2001	LARRA 2013	Gap	Policies approved in the 2016 DPR Entitlement Matrix et al.
			6. The SIA report is prepared and made available in the local language and will be published in the affected areas and uploaded on the website of the government.		consultations in 2014 and 2018.
9	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of RAPs.	-	5. Whenever an SIA is required, the government will ensure that a public hearing is held at the affected area to ascertain the views of the affected families to be recorded and included in the SIA report. 50. The state government will constitute a State Monitoring Committee for review and monitoring the implementation of R&R schemes. Notification No. SRO A-41 (c-8) of 2017 TN Rule to LARRA 2013 Implementation authorities of land acquisition, R&R are formed in each district in the state.	No clear indication of PAPs participation in the implementation and monitoring phase.	In the planning phase, public consultations were held at the affected area in 2014 and 2018. PAHs had an opportunity to be heard during the SIA survey in 2016, 2017, and 2018. In the implementation phase, the implementing NGO/ Consultant will meet with each PAH, and custom-made micro RAP with all the needs and requests reflected will be developed and implemented. In the monitoring phase, an External Monitoring Specialist will facilitate the participatory research, target group monitoring and sample survey. With the above record and planning, opportunities for participation of the PAPs are secured.
10	Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.	15. The government (District Collector) will call upon the owner and any other person having interest in such land to show the reasons why the land should not be acquired.	7. The government will ensure that the SIA report is evaluated by an independent Expert Group, including two representatives of *Panchayat.* 15. Any person may object to the area, justification for public purpose, and the findings of the SIA report to the Collector. 16. (4) (5) (6) The draft Rehabilitation and Resettlement	The mechanisms of land acquisition based on the TNHA 2001 have a long history and are well recognized by the local society, but they only target title holders. The LARRA 2013 does not give clear structure of grievance mechanisms.	The NGO/Consultant that assists the implementation of the RAP will assist PAHs throughout the RAP implementation and monitoring phase. (RAP p. 10-11) According to the Tamil Nadu Highways Act, three levels of Grievance Redress

	JICA Guidelines, WB OPs	TNHA 2001	LARRA 2013	Gap	Policies approved in the 2016 DPR Entitlement Matrix et al.
			scheme will be made known locally by wide publicity in the affected area. A public hearing will be conducted. The claims and objections raised in the public hearing will be reported to the Collector. 44. The Commissioner for Rehabilitation and Resettlement will be responsible for the post-implementation social audit. 45. Where land proposed to be acquired is equal to or more than 100 acres, the Rehabilitation and Resettlement Committee will be constituted. The committee will include a representative of women residing in the affected area and a voluntary organization working in the area.	The 2017 TN Rule to LARRA 2013 has been enacted, while there is no particular project which has a track record of following the new rule. yet.	Committees will be formed. The Project Level Committee will be attended by the NGO/ Consultant as well as representatives of local residents. The District Level Committee will be chaired by the District Collector. State Level Committee will be chaired by the Secretary of HMPD. If not solved yet, the issue will be referred to the arbitration and legal system.
11	Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as **an eligibility cut-off date**, asset inventory, and socio-economic survey), preferably at the project identification stage, **to prevent a subsequent influx of encroachers** of others who wish to take advantage of such benefits. (WB OP4.12, Para. 6)	16. (1) When a notice under subsection (1) of Section 15 is published in the Official Gazette, the land to which the said notice shall, on and from the date of such publication, vest absolutely in the government, free from all encumbrances. (Issuance of a notice under subsection (2) of Section 15 serves as a cut-off date and any change of existing condition of the land and attached assets is prohibited.) 28. (1) The Highways Authority or any person	4. (1) Whenever appropriate government intends to acquire land for public purpose, it shall consult the concerned *Panchayat*, municipality, or municipal corporation, as the case may be, at the village level or ward level, in the affected area and carry out a Social Impact Assessment Study in consultation with them, in such manner and from such date as may be specified by such government by notification.	The DRO is under process of issuance of the notice under sub-section (2) of Section 15 of the Tamil Nadu Highways Act to the land and asset owners to be affected by Section 1. In this study phase, therefore, it is difficult to confirm all the PAHs (asset owners). At the same time, HMPD is not authorized to legally identify the PAHs. LARRA 2013 does not specify the timing to carry out the baseline surveys.	Following WB and JICA Guidelines, HMPD conducted baseline surveys listed below at an earlier project phase compared with their ordinary practice in order to identify and record the PAPs and PAHs. 2016: Identification of assets (structures) and residents (owners) within the ROW 2017: Identification of squatters and their assets within the ROW 2018: Identification of absentee land owners and PAPs (including absentee land owners) in the TPP

	JICA Guidelines, WB OPs	TNHA 2001	LARRA 2013	Gap	Policies approved in the 2016 DPR Entitlement Matrix et al.
		authorised on his/her behalf shall, at such time as may be considered necessary, conduct such checks and periodical inspection of the highway boundaries, with the view to ensure the prevention of unauthorised encroachment and the removal of such encroachment. (After the 15(2) Notice, HMPD/TNRDC has power to prevent influx of unauthorised encroachment.)		In the past HMPD projects, PAPs and PAHs are confirmed by the joint survey conducted by DRO, PIT/PIU, and NGO in the RAP implementation phase. In this study phase, therefore, it is difficult to confirm all the PAPs and PAHs.	Link Road (New Alignment) Also, HMPD sets the cut-off date as the start date of the baseline survey following the JICA Guidelines, and announced that the structures built after the cut-off date and any structures build up after the Census Survey shall not be eligible for compensation and assistance. (RAP 25/07/2018 p.viii) At the Census 2018, it was announced to individual survey respondents and the VAO that the cut-off date was the start date of the survey which is 20 April 2018 for Section 1. Afterwards, due to the alignment change of the TPP Link Road, the additional survey was conducted and it was announced individually to the additional PAHs that the cut-off date in the TPP Link Road (New Alignment) is 13 July 2018.
12	Eligibility of benefits includes the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who do not have formal legal rights to land at the time of census but have a claim to such land or assets, and the	15. (2) The government will call upon the owner and any other person having interest in such land to show the reasons why the land should not be acquired. 18. Every owner or person interested in any land (includes benefits to arise	3. (c) 'Affected Family' includes (i) a family whose land or other immovable property has been acquired; (ii) a family which does not own any land, but a member or members of such family may be working in the affected area for three years prior to the acquisition of land, whose	PAPs need to be located at least three years before the cut-off date to be eligible, and whose primary source of livelihood stand affected by the acquisition of land.	DPR SIA/RAP Entitlement Matrix 4 provides compensation and assistances to the tenants, and Matrix 7 and Matrix 8 provide special care and assistances to the non-title holders.

	JICA Guidelines, WB OPs	TNHA 2001	LARRA 2013	Gap	Policies approved in the 2016 DPR Entitlement Matrix et al.
	PAPs who have no recognizable legal right to the land they are occupying. (WB OP4.12 Para. 15)	out of land and things attached to the earth or permanently fastened to anything attached to the earth) acquired under this act will be entitled to receive and be paid an amount. In factual HMPD projects, only legal title holders of land or leaseholders with contract documents are paid for the compensation.	primary source of livelihood is affected by the acquisition of land. 4. (4) The SIA study will include (b) estimation of affected families and the number of families likely to be displaced.		The JICA Study Team officially requested HMPD in a letter dated 27 March 2018 to eliminate the length of tenancy in the eligibility for compensations and assistances. The request was accepted, and the Resettlement Policy Framework was approved by the state government on 9 May 2018. The cut-off date for eligible persons is the starting date of the Joint Verification Survey to be conducted in the implementation phase of the RAP. The cut-off date for land and assets and their owners is the publication date of the 15 (2) Notification based on TNHA 2001.
13	Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based. (WB OP4.12 Para. 11)	-	The Second Schedule. Land for land-type compensation is made available for land owners for affected families owning agricultural land in the affected area and whose land has been acquired or lost.	An agricultural tenant who does not have official contract with the land owner is not eligible for assistance in finding another tenant opportunity.	The DPR compensation plan proposes cash compensation for the loss of land for land owners, and three months (90 days) advance notification for the harvesting of standing crops, or lump sum equal to the market value of the yield of the standing crop lost determined by Agricultural Department. (RAP Table 3.3, 3.8)

	JICA Guidelines, WB OPs	TNHA 2001	LARRA 2013	Gap	Policies approved in the 2016 DPR Entitlement Matrix et al.
					In May 2018, the JICA Study Team requested HMPD to add an option to the Entitlement Matrix for agriculture tenants, which is under negotiation. The requested policy is to provide assistance in the implementation, such as NGO/ Consultant available for agriculture tenant PAH to be affected in finding an alternative farming land.
14	Provide support for the transition period (between displacement and livelihood restoration). (WB OP4.12 Para. 6)	-	The Second Schedule. As the support for the transition period, all the affected families will be eligible for the following: choice of annuity or employment (employment in the project, one-time payment, and annuity policies per month for 20 years), subsistence grant for displaced families for a period of one year (monthly subsistence), and one-time resettlement allowance.	No gap (LARRA 2013)	Those who were counted on the cut-off date and who need to be relocated due to the Project implementation, regardless if he/she is a title holder or non-title holder, will be eligible to subsistence allowance, resettlement allowance, and shifting allowance. Vulnerable households will be eligible for vulnerable assistance and skills training. (RAP Table 3.3 - 3.9)
15	Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women, children, ethnic minorities, etc. (WB OP4.12 Para. 8)	-	41. As far as possible, no acquisition of land will be made in the scheduled areas. In case of acquisition, special provisions will be provided for Scheduled Castes and Scheduled Tribes.	The definition of vulnerable group is limited in the LARRA 2013.	Vulnerable PAPs are defined based on the WB OP as those living below poverty line. SC/ST families and women-headed households, widows, physically challenged persons, and elderly persons above the age of 60 years are among the affected families. (RAP p. 3-14)

Source: JICA Study Team

11.4.3 Size and Target of Land Acquisition and Resettlement

(1) Project Affected Structures, Households and Businesses in Section 1

Project affected households and businesses in Section 1 are shown in Table 11.4.8. In total, 206 structures and households, 24 businesses, and 16 public facilities are to be displaced. The Census Survey by HMPD in 2017 recorded the number of households and businesses within the ROW. The size of a household was asked in the Socio-economic Survey which resulted to an average household size of 4.1 persons. The number of persons to be displaced was estimated at 845 persons by multiplying the number of PAH by 4.1 (206 x 4.1 = 844.6).

Table 11.4.8 Project Affected Assets in Section 1 (Main Road and TPP Link Road (Original Alignment))

			Displaced			Non-displaced		
Ownership	Category		Main Road	TPP Link Road (Original Alignment)	Total	Main Road	TPP Link Road (Original Alignment)	Total
Owner	Residential	a	15	135	150	0	0	0
	Commercial	b	4	9	13	0	0	0
	Residential and Commercial	c	2	7	9	0	0	0
	Others	d	-	-	-	9	2	11
	Abandoned	e	-	-	-	8	2	10
	Under construction	f	0	5	5	0	0	0
	Structures to be affected with minor impact (less than 1/3)	g	-	-	-	0	4	4
	Subtotal		21	156	177	17	4	21
Squatters	Residential	h	17	2	19	0	0	0
	Commercial	i	1	0	1	0	0	0
	Residential and Commercial	j	0	0	0	0	0	0
	Others	k	-	-	-	0	0	0
	Abandoned	l	-	-	-	0	0	0
	Subtotal		18	2	20	0	0	0
Tenants	Residential	m	0	8	8	-	-	-
	Commercial	n	1	0	1	-	-	-
	Residential and Commercial	o	0	0	0	-	-	-
	Subtotal		1	8	9	-	-	-
Total Structures and Households		p	40	166	206	17	4	21
Business Total b+c+i+j+n+o		q	8	16	24	0	0	0
Public Facilities		r	11	5	16	0	0	0
Non-residential Land Owners		s	-	-	-	448	549	997
Workers		t	-	-	-	5	6	11

Squatter: Illegal occupants of private and public land
Source：DPR RAP July 2018 Table 5.40, Table 5.41

Among the 206 structures to be displaced, 40 structures are located on the ROW of the Main Road, and 166 structures are located on the ROW of the TPP Link Road (Original Alignment) as shown in Table 11.4.9.

Table 11.4.9 Location of PAFs to be Relocated

		Main Road			TPP Link Road			Total
		With Land Title	Without Land Title Squatter/Tenant	Sub total	With Land Title	Without Land Title Squatter/Tenant	Sub total	
To be Relocated		PAF	PAF	PAF	PAF	PAF	PAF	PAF
1	HH to lose residence on private land (structure owner)	21	18	39	156	2	158	197
2	HH to lose residence on private land (tenant in the owner's structure)	-	1	1	-	8	8	9
	No. of HH to be Relocated (PAFs)	21	19	40	156	10	166	206

Source: JICA Study Team, DPR RAP July 2018

(2) Land and Asset Survey Results

The land area necessary for Section 1 is shown in Table 11.4.10. The classification in Table 11.4.10 is used to decide the immovable asset tax. Actual land use for 'Wet Land' and 'Dry Land' include various land uses, such as rice paddies and orchard, fallow lands, culturable waste lands, and barren and unculturable lands.

Table 11.4.10 Village-wise Land Area to be Acquired

Sl. No.	Village	Private (m^2)			Government (m^2)	Total in m^2
		Wet	Dry	Manavari		
Main Road						
1	Kattupalli	2,742	0	0	69,270	72,012
2	Voyalur	138,224	0	3,271	258,628	400,123
3.a	Neidhavoyal Block 1	66,900	11,296	15,201	117,142	210,539
3.b	Neidhavoyal Block 2	93,842	9,633	15,520	74,723	193,718
4	Kalpakkam	27,981	0	11,860	77,510	117,351
5	Nalur	196,720	1,065	53,398	35,642	286,825
6	Anuppampattu	73,460	24,785	50,083	10,518	158,846
7	Vannipakkam	104,656	6,112	62,517	19,098	192,383
8	Amur	144,569	3,423	42,554	39,226	229,772
9	Thatchur	31,298	22,018	117,505	29,472	200,293
10.a	Panjetty (eastern side)	0	28,262	0	2,818	31,080
10.b	Panjetty (western side)	53,986	0	0	2,830	56,816
11	Jaganathapuram	307	41,565	69,463	1,985	113,320
Subtotal						2,263,168
TPP Link Road (Original Alignment)						
3.c	Neidhavayal Block 3	23,148	0	0	0	23,148
12	Kollati	58,295	0	1,960	0	60,255
13	Nandiyampakkam	4,410	0	49,171	16,249	69,830
14.a	Minjur Block 1	39,276	5,526	0	5,240	50,042
14.b	Minjur Block 2	30,625	773	0	0	31,398
15	Vallur B	7,050	0	0	1,028	8,078
Subtotal						242,752
Grand Total (m^2)						2,505,920
Grand Total (ha)						250.59

Source: TNRDC (16 May 2018)

Private structures to be affected by Section 1 are summarized in Table 11.4.11. About 80% of the structures usage is either residential or residential and commercial. About 3/4 of the affected structures is located at the TPP Link Road (Original Alignment).

Majority of the structures are permanent with ground floor only.

Table 11.4.11 Use, Types, and Number of Floors of Structures to be Affected

	No.		Main Road	TPP Link (Original Alignment)	Total	Percent (%)
Use	1	Residential use	32	136	168	82
	2	Residential and commercial use	2	7	9	4
	3	Commercial use	6	10	16	8
	4	Agricultural use	0	0	0	0
	5	Industrial use	0	0	0	0
	6	Vacant house	0	0	0	0
	7	Others (hand pump, boundary wall, open well, borewell)	0	13	13	6
	Total		40	166	206	100
Type	1	Concrete (pucca)	14	123	137	67
	2	Semi-concrete (semi-pucca)	22	31	53	26
	3	Mainly using non-permanent materials (kutcha)	4	10	14	6
	4	Other (toilet, shed, pump room)	0	2	2	1
No. of Floors	1	Ground floor	35	133	168	82
	2	Ground floor +1	2	32	34	17
	3	Ground floor +2	3	1	4	1

The above numbers include five residential structures to be affected with minor impact (less than 1/3), and 26 structures other than residential.
Source: DPR RAP July 2018 Table 5.31, Table 5.32, Table 5.36, DPR RAP 2017 Table 5.6, Table 5.7, Table 5.11

Severity of impacts is summarized in Table 11.4.12. Out of 206 structures to be affected, only nine structures will have minor impact. The rest of the 197 structures will have major impact between 33.3% to 100%.

Table 11.4.12 Impacts on Structure - Tenure Wise

No	Tenure	Main Road			TPP Link Road (Original Alignment)			Total		
		Subtotal	Major	Minor	Subtotal	Major	Minor	Total	Major	Minor
1	Owner	22	21	1	164	156	8	186	177	9
2	Squatter	18	18	0	2	2	0	20	20	0
	Total	40	39	1	166	158	8	206	197	9

Source: DPR RAP July 2018 Table 5.31, Table 5.32, Table 5.36, DPR RAP 2017 Table 5.6, Table 5.7, Table 5.11

The extent of loss of floor area is summarized in Table 11.4.13. Majority of structure will lose about less than 50 m^2. It is assumed that the ratio of structures smaller than the 50 m^2 floor area is common, especially along the main road. However, along the TPP Link Road (Original Alignment), larger houses will lose more than 100 m^2 of floor area.

Table 11.4.13 Extent of Loss - Floor Area

Sl.No	Floor Area to be Affected	Main Road	TPP Link Road (Original Alignment)	Total	%
1	Less than 50 m^2	31	102	133	65%
2	50 to 100 m^2	5	43	48	24%
3	100 to 150 m^2	3	15	18	9%
4	150 to 200 m^2	1	3	4	1%
5	200 to 250 m^2	0	3	3	1%
6	250 m^2 and above	0	0	0	0%
	Total	**40**	**166**	**206**	**100%**

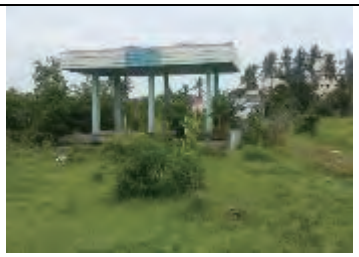
Source: DPR RAP July 2018 Table 5.35, DPR RAP 2017 Table 5.10

The common property resources to be affected by Section 1 are shown in Table 11.4.14 and Figure 11.4.2. Various facilities such as schools, VAOs, and dispensaries are located at the planned site for interchange with NH5 at Ch.20+800 (21+800 according to the DPR RAP 2017). Special attention will be necessary for the relocation of facilities before the clearance of site so that services will not be stopped due to those facilities.

Table 11.4.14 Common Property Resources to be Affected

No.	Types	Main Road		TPP Link Road (Original Alignment)	
		Number	Chainage	Number	Chainage
1	Temple	2	16+200 17+100	4	2+800 4+000 4+200 4+200
2	Crematorium Ground	0		1	3+700
3	Tomb (individual or household)	2	16+200 19+000	0	
4	School	2	16+200 20+800	0	
5	Village Administration Office (VAO)	1	20+800	0	
6	Community Hall	1	20+800	0	
7	Dispensary (Primary Care Centre)	1	20+800	0	
8	Fair Price Shop (Ration shop)	1	20+800	0	
9	Telephone Facility (BSNL)	1	20+800	0	
	Subtotal	11		5	
	Grand total	16			

Source: DPR RAP July 2018 Table 5.48, DPR RAP 2017 Annexure No.4 Common Property Resource

 Temple (Main Road)	 Temple (Main Road)	 Temple（TPP Link Road (Original Alignment)）
 Temple（TPP Link Road (Original Alignment)）	 Crematorium Ground（TPP Link Road (Original Alignment)）	 Tomb (individual or household) (Main Road)
 School (Main Road)	 Village Administration Office (Main Road)	 Community Hall (Main Road)
 Dispensary (Main Road)	 Fair Price Shop (Main Road)	 Telephone Facility (BSNL) (Main Road)

Source: DPR RAP 2017 Annexure No.4

Figure 11.4.2 Common Property Resources to be Affected

Table 11.4.15 shows the number of trees to be felled by Section 1, owned by the 222 structure owners. Those trees are included in the count of trees to be affected as summarized in Table 11.3.26.

Table 11.4.15 Trees Owned by PAH and to be Affected

No.	Types	Number
1	Fruit trees	45
2	Timber trees	265
Total		310

Source: DPR RAP July 2018 Table 5.38

(3) Vulnerable PAH to be Affected

A total of 247 HHs and businesses in Section 1 were censused, including tenants and 21 PAHs who are not to be relocated. The number of vulnerable PAH is shown in Table 11.4.16.

Table 11.4.16 Vulnerable PAH to be Affected

No.	Types	HH Number	Percent (%)
1	HH belongs to Scheduled Caste/Scheduled Tribe	61	24.7%
2	Women-headed HH	4	1.6%
3	HH below poverty line * (Estimated as 14%)	35	14.0%
4	Elderly HH over 60 years old without support from other family members	3	1.2%
5	HH with differently-abled person	0	-
	Total	247	100%

*: Refer to Table 11.4.24. Poverty Line 2011/2012 is INR 1380.36 in Urban, INR 1081.94 in Rural Tamil Nadu
Source: DPR RAP July 2018 Table 5.46

(4) Willingness to Cooperate for Resettlement Process

According to the Census 2017, 92% of the owners and tenants (except squatters) expressed their willingness to cooperate. The remaining 8% expressed their opposition or postponed their decision (Table 11.4.17).

Table 11.4.17 Willingness to Cooperate for Resettlement Process

		Main Road	TPP Link Road	Total	Percent (%)
1	Willing	38	166	204	99
2	Not willing, no decision	2	0	2	1
	Total	40	166	206	100

Source: DPR RAP July 2018 Table 5.45

(5) Socioeconomic Profile of PAHs

Out of the 1,798 land parcels likely to be affected due to the project, 20% or 360 land parcel owners were surveyed on their socio-economic profile. The target number of households to be surveyed is 183, including 109 surveyed during August 2017 and 74 surveyed from April to May 2018.

1）Household Profiles

The share of households headed by male persons was 88% (161 HH), and woman-headed households was 12% (22 HH). The total number of household members was 752, and the average size of households was 4.1 persons per household. The age of the members in the PAHs is shown in Table 11.4.18. Persons under 35 years old account for nearly 70%.

Table 11.4.18 Age Classification

Sl.No	Age Classification	No. of Persons	Percent (%)
1	Below 18 Year	177	24%
2	19 to 24 years	170	23%
3	25 to 35 years	146	19%
4	36 to 45 years	160	21%
5	46 to 60 years	130	17%
6	Above 60 years	82	11%
	Total	752	100%

Source: DPR RAP July 2018 Table 5.50

The findings of the social survey showed that 81% of the PAHs are Tamil speaking, followed by 15% Telugu speakers, and 4% of them speak Urdu, as shown in Table 11.4.19.

Table 11.4.19 Mother Tongue

Sl.No	Mother Tongue	No. of Households	Perrcent (%)
1	Tamil	148	81%
2	Telugu	27	15%
3	Urdu	8	4%
	Total	**183**	**100%**

Source: DPR RAP July 2018

Table 11.4.20 depicts that 93% of the PAHs are Hindus, followed by 5% Muslim and 2% Christians.

Table 11.4.20 Religion

Sl.No	Religion	Nos	Percent (%)
1	Hindu	169	93%
2	Muslim	10	5%
3	Christian	4	2%
4	Other	0	0%
	Total	**183**	**100%**

Source: DPR RAP July 2018

Table 11.4.21 portrays that 43% of PAHs belongs to the Schedule Caste. Therefore, the budget for assistance for vulnerable households needs to cover at least 43% of all PAHs.

Table 11.4.21 Social Stratification

Sl.No	Social Stratification	Nos	Percent (%)
1	Other Community/General	21	11%
2	Backward Community	54	30%
3	Most Backward Community	29	16%
4	Scheduled Caste	79	43%
5	Scheduled Tribe	0	0%
	Total	**183**	**100%**

Source: DPR RAP July 2018 Table 5.56

The education level of the household members is shown in Table 11.4.22. Those who may be illiterate, meaning without education, comprises 9% of the total. On the other hand, those who received higher than 10^{th} standard education consists of 38% of all members.

Table 11.4.22 Education Profile of the PAH Members

Sl.No	Educational Status	Nos	Percent (%)
1	Up to 5^{th}	108	14%
2	6^{th} to 8^{th}	112	15%
3	9^{th} to 10^{th}	184	24%
4	11^{th} to 12^{th}	74	10%
5	Diploma	39	5%
6	Graduate	125	17%
7	Postgraduate	45	6%
8	None	65	9%
	Total	**752**	**100%**

Source: DPR RAP July 2018

The occupation profile of the PAH members is summarized in Table 11.4.23. About 60% of the total are those who are not in the workforce, including school-age children, elderlies, and housemakers. Of the 309 members who are in the workforce, 36% are salaried or pensioned, 14% are casual labourers, 11% are agricultural labourers, 10% are cultivators, 10% are industrial workers, and 5% are unemployed.

Since 309 persons from 183 households are in the workforce, the average number of persons in the workforce per household is 1.7 persons/household.

Out of the 183 PAHs surveyed, 73 households cultivated rice (main crops), and 40 households cultivated other supplementary crops such as vegetables.

Table 11.4.23 Occupation Profile of the PAH Members

Sl.No	Main Occupation	Nos	Nos	%	Percentage (%) Among Workers
1	Not in the workforce	443	443	59%	
2	Salaried/pensioned	112			36%
3	Casual labourer	42			14%
4	Agricultural labourer	35			11%
5	Cultivator	32			10%
6	Industrial worker	32			10%
7	Self Employed	20			6%
8	Business/trade	10	309	41%	3%
9	Professional	10			23%
10	Repair/spare parts	2			1%
11	Unemployed	14			5%
	Total	752		100%	100%

Source: DPR RAP July 2018 Table 5.52

Monthly family income is shown in Table 11.4.24. Out of the total surveyed, 54% households earned between INR 15,000 and INR 25,000 per month. The average monthly household income is INR 17,582. Since the average size of a household is 4.1, average monthly income per capita is INR 4,288.

Table 11.4.24 Monthly Family Income

Sl.No	Monthly Family Income (INR)	Nos	Percent (%)
1	Less than INR 5,000	26	14%
2	5,000 to 10,000	15	8%
3	10,000 to 15,000	14	8%
4	15,000 to 20,000	53	29%
5	20,000 to 25,000	46	25%
6	25,000 to 30,000	15	8%
7	30,000 to 35,000	10	5%
8	35,000 to 40,000	1	1%
9	40,000 to 45,000	3	2%
10	45,000 to 50,000	0	0%
11	Above 50,000	0	0%
	Total	**183**	**100%**
	Average monthly household income		**17,582**

Source: DPR RAP July 2018 Table 5.57

According to the 'Report of the Expert Group to Review the Methodology for Measurement of Poverty' published by the Planning Commission in 2014, the poverty line in the urban area of Tamil Nadu in fiscal year 2011-2012 was INR 1,380.36 per person per month. With an average household size of 4.1, those households with monthly income below INR 5,659 were below poverty line.

In this Project (Section 1), assistances for vulnerable households below poverty line will be planned to cover slightly more than 14% of PAHs, considering the sample survey results of the number below monthly family income of INR 5,000.

2）Period of Stay, Housing Facilities, Owned Assets

About 30% of the households lived in their houses for more than 30 years, which made up the largest group. The second largest group consisted of 19% who have resided from 10 to 15 years. The average length of stay in the dwelling units is 21.29 years.

Looking at the tenure, 153 households or 84% lived in their own houses, and 30 households or 16% reside in rented houses.

Table 11.4.25 Period of Stay

Sl.No	Stay in the Structure	Number	Percent (%)
1	Less than 5 years	10	5%
2	5 to 10 years	22	12%
3	10 to 15 years	35	19%
4	15 to 20 years	13	7%
5	20 to 25 years	17	9%
6	25 to 30 years	27	15%
7	More than 30 years	59	32%
	Total	**183**	**100%**

Source: DPR RAP July 2018 Table 5.60

The condition of housing facilities is summarized in Table 11.4.26. Basic facilities for a sanitary lifestyle are available for most of the PAHs. Piped water and connection to sewer system are, however, not available in the area.

Table 11.4.26 Housing Facilities

	Housing Facilities	Number	Percent (%)
1	Having separate kitchen	176	96%
2	Having separate toilet	175	96%
3	Having separate bathroom	176	96%
4	Having electricity	182	99%
5	With a drinking water source	183	100%
6	LPG	172	94%
		183	100%

Source: DPR RAP July 2018 Table 5.82

When asked about owned assets, as shown in Table 11.4.27, majority of households owned TV sets, mobile phones, bicycles, refrigerators, and motorcycles. On the other hand, cars and washing machines have low penetration rates.

Table 11.4.27 Household Assets

	Household Assets	Number	Percent (%)
1	Motorcycle, scooter	134	73%
2	Car	15	8%
3	Television	181	99%
4	Refrigerator	135	74%
5	Washing machine	89	49%
6	Telephone (Landline)	8	4%
7	Mobile phone	174	95%
8	Bicycle	157	86%
	Total Surveyed	183	100%

Source: DPR RAP July 2018 Table 5.82

3）House Expenditure and Access to Infrastructure

The average expense on different items such as rental, health, education, transport, and food is around INR 13,725.5 per month. Maximum expenditure goes to food, while least is education. (Table 11.4.28)

When asked about health conditions, 9 out of 183 PAHs were affected with major health ailments in the last year. The source of treatment showed that eight of them were treated from government hospitals and one from a private clinic.

The survey showed that 23% of the PAHs were covered by insurance, with 21% under government insurance and 2% under private insurance. Majority, or 77% of PAHs, are not covered by health insurance.

Table 11.4.28 Average Monthly Expenditure of a Household

Sl.No	Monthly Expenditure	Average (INR)(A)	Main Road(B)	TPP Link Road(B) (Original Alignment)
1	Food	6,083.5	5,750	6,400
2	Education	1,327.0	1,300	1,350
3	Health	2,205.0	2,300	2,100
4	Others	4,181.5	4,100	4,300
5	House rent	1,100.0	500	1,200
	Average Monthly Expenditure	13,725.5	13,400	14,000

Source: (A) DPR RAP July 2018 Table 5.65, (B) HMPD 2/8/2018

The drinking water source, in Table 11.4.29, shows that 42% households rely on public taps, while 33% on other sources like water cans and water tankers. Of the total, 20% of households answered that women needed to cross roads to get water. It can be concluded that access to water is difficult in this region.

On the other hand, 94% of PAHs used LPG as their source of energy for cooking.

Table 11.4.29 Source of Drinking Water

Sl.No	Source of Drinking Water	Nos	Percent (%)
1	Public tap/hand pump	76	42%
2	HSC tank	43	23%
3	Own borewell/open well	7	4%
4	Common well	0	0%
5	Pond/lake	0	0%
6	Others	61	33%
	Total	**183**	**100%**

Source: DPR RAP July 2018 Table 5.66

Among the modes of transportation, as shown in Table 11.4.30, the use of public buses is the most popular, followed by motorcycles, private share autos, and bicycles.

Table 11.4.30 Mode of Transport

Sl.No	Mode of Transport	Number	Percent (%)
1	Public Buses	167	90%
2	Motorcycle	93	82%
3	Private Share Auto	86	41%
4	Bicycle	83	72%
5	Private Buses	70	11%
6	Walk	17	11%
7	Taxi	3	2%
8	Others	17	16%
	Total Surveyed	183	

Source: DPR RAP July 2018 Table 5.67

4）Profile of Businesses and Commerce

Out of the 18 operating units within the ROW, 11 businesses were surveyed. (Table 11.4.31) These units are located in the land for interchange that will connect N55 and the Main Road.

Table 11.4.31 Business and Commerce to be Affected by Section 1

Sl.No	Nature of Business	Number	Percent (%)
1	Eatery	5	45%
2	Repair/Workshop	3	27%
3	Petty Shop	2	18%
4	Gym	1	9%
	Total	**11**	**100%**

Source: DPR RAP 2017 Table 5.43

When asked about the annual net income from business, as shown in Table 11.4.32, about half answered between INR 120,000 and INR 180,000. The average annual income from the business is INR 139,091 or a monthly average of INR 11,591. The average loan dues only for businesses is INR 260,000 per unit.

Only one out of 11 businesses answered that they hold records of proof for business income, while the remaining 10 businesses do not have any official record.

Table 11.4.32 Annual Net Income from Business

Sl.No	Annual Net Income from Business	Number	Percent (%)
1	Less than 60,000	2	18%
2	60,000 to 120,000	1	9%
3	120,000 to 180,000	5	45%
4	180,000 to 240,000	3	27%

Source: DPR RAP 2017 Table 5.46

Out of the total 11 units, eight units answered that income from the business is the secondary income of the households. (Table 11.4.33)

Table 11.4.33 Business is the Primary Source of Income

Sl.No	Business is the Primary Source of Income	Number	Percent (%)
1	Primary	3	27%
2	Secondary	8	73%
	Total	**11**	**100%**

Source: DPR RAP 2017 Table 5.48

Other sources of income, besides the business unit to be affected by Section 1, include agriculture, rental income, and income from other business. (Table 11.4.34)

Table 11.4.34 Other Sources of Income Besides Businesses to be Affected

Sl.No	Other Sources of Income	Number	Percent (%)
1	Agriculture	8	73%
2	Rental from properties	2	18%
3	Business	1	9%
4	**Total**	**11**	**100%**

Source: DPR RAP 2017 Table 5.49

5）Perception towards Section 1

PAHs are asked about the positive and negative impacts perceived due to Section 1 as shown in Table 11.4.35 and Table 11.4.36.

High expectation on positive impacts is expressed in increase of transport facility, increase of land value, and better access to employment and markets.

Table 11.4.35 Perceived Positive Impacts

Sl.No	Perceived Positive Benefits	Number	Percent (%)
1	Increased Transport Facility	173	95%
2	Increase in Land Value	156	85%
3	Access to Employment	121	66%
4	Access to Markets	116	63%
5	Reduced Travel Time	113	62%
6	Access to Health Care	96	52%
7	Lesser Accidents/Safety	80	44%
		183	100%

Source: DPR RAP 23/05/2018 Table No.32

Concern on loss of assets and structure was raised by 90% of the PAHs. Other perceived negative impacts raised by majority of PAHs are accidents due to high speed, noise, air pollution, and road crossing difficulty.

Table 11.4.36 Perceived Negative Impacts

No	Perceived Negative Impacts	Number	Percent (%)
1	Loss of Asset/Structure to People	164	90%
2	Accidents due to High Speed	122	67%
3	Noise/Air Pollution	119	65%
4	Road Crossing Difficulty	98	54%
5	Others (Road to pass through is now a quiet residential area)	11	6%

Source: DPR RAP 23/05/2018 Table No. 33

(6) Census Survey for the Absentee land owners

An additional Census Survey was carried out from 20 April to 8 May 2018 on the non-resident land and asset owners likely to be affected by Section 1.

There are 448 absentee land owners (982 land parcels) on the Main Road, 549 absentee land owners (816 land parcels) on the TPP Link Road (Original Alignment), and a total of 997 absentee land owners hold 1,798 land parcels on Section 1. The Census Survey was carried out for 545 affected land parcels owned by 204 absentee land owners. Out of these 204 owners, a socio-economic survey was carried out on 183 absentee land owners covering 351 affected land parcels.

Information on all the names of absentee land owners and land areas to be affected by Section 1 was collected from land registration documents. Contacting all the absentee land owners, however, was not achieved during this study. Since in the implementation phase of RAP, DRO, HMPD, and NGO will conduct a thorough survey and confirmation of absentee land owners and existence of missing information at this study phase will not negatively affect the entitlement of PAHs. Best effort was paid to invite opinions and suggestions from absentee land owners at the two public consultations, described in Section 11.5, by publishing the notice of meetings on major newspapers and by posting the notice in public places.

1) Census of Population

Out of the 204 absentee land owners, there are 154 males (75%) and 50 females.

Table 11.4.37 Gender - Absentee Land Owners

Sl. No	Gender	Main Road and TPP Link (Original Alignment) Total	Percent (%)
1	Male	154	75
2	Female	50	25
	Total	**204**	**100**

Source：DPR RAP July 2018 Table 5.4

The age distribution shows that senior citizens over 60 years old make the largest group. Otherwise, the those in their late 30s up to 60 years old are distributed almost evenly.

Table 11.4.38 Age Distribution - Absentee Land Owners

Sl. No.	Age	Main Road and TPP Link (Original Alignment) Total	Percent (%)
1	Below 18 years	0	0
2	19 to 25	1	0
3	26-30	1	0
4	31 to 35	11	5
5	36 to 40	24	12
6	41 to 45	26	13
7	46 to 50	25	12
8	51 to 55	26	13
9	56 to 60	31	15
10	Above 60	59	29
	Total	**204**	**100**

Source：DPR RAP July 2018 Table 5.5

In relation to religion, majority practice Hindu, while Christians and Muslims are also included.

Table 11.4.39 Religion - Absentee Land Owners

Sl. No.	Religion	Main Road and TPP Link (Original Alignment) Total	Percent (%)
1	Hindu	192	94
2	Christian	7	3
3	Muslim	5	2
	Total	**204**	**100**

Source：DPR RAP July 2018 Table 5.6

When asked about affiliated social strata, 130 persons or 64% answered that they belonged to the Backward Community, followed by 39 persons belonging to the Schedule Caste.

Table 11.4.40 Social Strata - Absentee Land Owners

Sl. No.	Social Strata	Main Road and TPP Link (Original Alignment) Total	Percent (%)
1	General	16	8
2	Backward Community	130	64
3	Most Backward Community	19	9
4	Scheduled Caste	39	19
5	Scheduled Tribe	0	0
	Total	**204**	**100**

Source：DPR RAP July 2018 Table 5.7

When asked about occupations, 16 persons are not in the work force, are retired, or are pensioners. Of the remaining 188 persons, 107 persons are cultivators.

Table 11.4.41 Occupation Pattern - Absentee Land Owners

Sl. No.	Occupation	Small Classification	Large Classification
1	Not in the work force	4	Non-labour force
2	Pensioner	6	16
3	Retired	6	
4	Casual Labour	10	
5	Private Job	18	
6	Agriculture labourer	11	Labour force
7	Business	3	188
8	Self-employed	10	
9	Goverment Service	6	
10	Service	3	
11	Cultivator	107	
12	Homemaker	13	
13	Professional	7	
		204	204

Source：DPR RAP July 2018 Table 5.8

In relation to sources of income, 107 persons answered that they do not have any other source of income other than agriculture. There are 80 persons that answered that they have income from other available sources.

Table 11.4.42 Sources of Income - Absentee Land Owners

Sl. No.	Sources of Income	Main Road and TPP Link（Original Alignment） Total
1	No other source of income other than agriculture	107
2	Income from other available sources	80
3	Not in the work force	17
Total		**204**

Source：DPR RAP July 2018 Table 5.9

When asked about the amount of income from the affected land, about 40% of the land owners do not get any monthly income from the land. Among the persons who gain income from the land are those who earned between INR 5,000 and 10,000, which accounted for 13% and made the largest group. Only 10% earned between INR 10,000 to 20,000. Only one person earns more than INR 40,000 per month.

Table 11.4.43 Income Pattern from Agricultural Source- Absentee Land Owners

Sl.No	Income from Affected Land (INR)	Main Road and TPP Link（Original Alignment） Total	Percent (%)
1	Below INR 5,000	1	0%
2	INR 5,000 to 10,000	26	13%
3	INR 10,000 to 15,000	8	4%
4	INR 15,000 to 20,000	12	6%
5	INR 20,000 to 25,000	5	2%
6	INR 25,000 to 30,000	0	0%
7	INR 30,000 to 35,000	0	0%
8	INR 35,000 to 40,000	0	0%
9	Above INR 40,000	1	0%
10	No answer	54	26%
11	Not in the work force	17	8%
12	Income from other source	80	39%
Total		**204**	**100%**

Source：DPR RAP July 2018 Table 5.10

When asked about the location of affected land parcel and location of residence, 136 persons reside in the same village, while 68 persons reside in different villages.

Table 11.4.44 Place of Stay - Absentee Land Owners

Sl. No	Place of Stay	Main Road and TPP Link (Original Alignment) Total
1	Within the Village	136
2	Outside the Village	68
	Total	**204**

Source：DPR RAP July 2018 Table 5.11

2) Census of Land

Below is an information about the 545 land parcels owned by the 204 surveyed absentee land owners.

In relation to the registered type of land, 236 parcels of wet land usable for rice paddies make the majority. Dry land usable for vegetables and irrigated field is the second largest group with 169 parcels. There are a total of 140 parcels to be used for non-agricultural purposes, such as homes, temples, and businesses.

Table 11.4.45 Type of Land - Absentee Land Owners

Sl. No.	Type of Land	Main Road and TPP Link (Original Alignment) Total
1	Dry	169
2	Wet	236
3	Homestead land	81
4	Trust/Private Temple Land/ Private Companies	59
	Total	**545**

Source：DPR RAP July 2018 Table 5.13

When asked about the number of owned land parcels, 57% of absentee land owners only owned one land parcel. In case major parts of the only land parcel will be taken by the ROW, HMPD must avoid the negative impact on such absentee land owners by careful consultation and negotiation. The next largest group is 16% with owners having two land parcels. Three persons have more than ten land parcels.

Table 11.4.46 Holding of Land Parcels - Absentee Land Owners

Sl. No.	No of Land Parcels Owned	Main Road and TPP Link (Original Alignment) Total	Percent (%)
1	1 subdivision	117	57
2	2 subdivision	33	16
3	3 subdivision	13	6
4	4 subdivision	15	7
5	5 subdivision	9	4
6	6 subdivision	3	1
7	7 subdivision	5	2
8	8 subdivision	4	2
9	9 subdivision	1	0
10	10 subdivision	2	1
11	More than 10 subdivision	3	1
	Total	**204**	**100**

Source：DPR RAP July 2018 Table 5.14

Out of the total 545 land parcels, 64% (349 parcels) are irrigated. All these irrigated parcels are located on the ROW of the Main Road. It is assumed that the remaining 196 parcels are not used for agriculture purposes.

Table 11.4.47 Irrigated Land

Sl.No	Use of Land	Main Road and TPP Link (Original Alignment) Total	Percent (%)
1	Irrigated	349	64%
2	Unirrigated	56	10%
3	Not applicable	140	26%
Total		**545**	**100%**

Source：DPR RAP July 2018 Table 5.15

All owners of 349 irrigated parcels answered that they cultivate major crops (various rice varities).

Table 11.4.48 Cropping Pattern

Sl. No.	Cropping Pattern	Main Road and TPP Link (Original Alignment) Total
1	Major Crops	349
2	Supplementary Crops	0
	Total	**349**

Source：DPR RAP July 2018 Table 5.16

The source of irrigation water is groundwater from wells. There are no parcels using canal water.

Table 11.4.49 Irrigation Source

Sl.No	Source of Irrigation	Main Road and TPP Link (Original Alignment) Total	Percent (%)
1	Open well	71	20%
2	Borewell	278	80%
3	Canal	0	0%
Total		**349**	**100%**

Source：DPR RAP July 2018 Table 5.17

Nearly half of the irrigated land parcels are used for triple-cropping. About 40% of land parcels are for single-cropping, while 14% are for double-cropping.

Table 11.4.50 Harvesting Times in a Year

Sl.No	No. of Sown Seasons	Main Road and TPP Link (Original Alignment) Total	Percent (%)
1	Once a year	131	38%
2	Twice a year	50	14%
3	Thrice a year	168	48%
	Total	**349**	**100%**

Source：DPR RAP July 2018 Table 5.18

When asked about the cropping area ratio of irrigated land parcels, only 7% of land parcels are 100% cultivated. The largest group, around 60% of land parcels, are cultivated between 50% and 75% of the area. On the other hand, there is no irrigated parcels cultivated less than 25% of the area.

Table 11.4.51 Cropping Area Ratio of Irrigated Land

Sl.No	Cropping Area	Main Road and TPP Link (Original Alignment) Total	Percent (%)
1	Less than 25%	0	0%
2	25% to 50%	65	19%
3	50% to 75%	203	58%
4	75% to 100%	56	16%
5	100%	25	7%
	Total	**349**	**100%**

Source：DPR RAP July 2018 Table 5.19

With regard to the consumption pattern of produce, about 30% of the land is used for self-consumption, 3% of the land is used for market sales only. Another 30% of the land is used for both self-consumption and market sales. There are 196 parcels (36%), including 56 unirrigated parcels and 140 residential parcels, are not used for cultivation.

Table 11.4.52 Consumption Pattern of Produce from Land

Sl.No	Produce from Land	Main Road and TPP Link (Original Alignment) Total	%
1	Self-consumption	169	31%
2	Sold out	17	3%
3	Both	163	30%
4	Not Applicable	196	36%
	Total	**545**	**100%**

Source：DPR RAP July 2018 Table 5.20

When asked about lease and tenant contract, it was found that no such contract exists for 545 surveyed land parcels.

Table 11.4.53 Leased Land

Sl. No.	Land for Lease	Main Road and TPP Link (Original Alignment) Total
1	Leased	0
2	Not Leased	545
	Total	**545**

Source：DPR RAP July 2018 Table 5.21

When asked about the presence of any structure assets within ROW, it was found that seven agricultural facilities such as pump house, generator yard, and resting place are in the ROW owned by absentee land owners.

3) Impacts of Land Acquisition on Absentee Land Owners

It was surveyed how the size of owned lands will change before and after the Project. It was found that most of all absentee land owners are classified as small farmers if they owned the land within the ROW only. After the Project, 79 absentee land owners will become landless. Not all of them may be cultivators, but 60% of absentee land owners cultivate crops for self-consumption or for market income. It is necessary for HMPD to maintain their livelihood with careful consultation on compensation and assistance package.

Table 11.4.54 Size of Owned Land Before and After the Project

Sl. No.	Total Land Extent	Existing Condition	After Project Condition
1	Landless	0	79
2	Small farmer Less than 2.5 acres (less than 1 ha)	196	115
3	Marginal farmer 2.5 to 5 acres (1 to 2 ha)	3	9
4	More than 5 acres (more than 2 ha)	5	1
	Total	**204**	**204**

1 acre = 4,047 m^2

Source：DPR RAP July 2018 Table 5.22, 23

4) Awareness Level of Land Acquisition Process

When asked if they are aware that their land is subject to land acquisition by HMPD project, 134 persons of the total 204 absentee land owners already knew the information, while the other 70 persons did not know the information.

Table 11.4.55 Awareness on Loss of Land Conducted by Government

Sl. No.	Aware of Land Acquisition	Main Road and TPP Link (Original Alignment) Total
1	Aware	134
2	Not Aware	70
	Total	**204**

Source：DPR RAP July 2018 Table 5.24

The awareness level on the land acquisition process and the resettlement and rehabilitation assistances showed that about half were aware, while the rest were not aware.

Table 11.4.56 Awareness on Land Acquisition Process and R&R Benefits

Sl. No.	Aware of Land Acquisition Compensation and Resettlement & Rehabilitation Assistance	Main Road and TPP Link (Original Alignment) Total
1	Aware	104
2	Not Aware	100
	Total	**204**

Source：DPR RAP July 2018 Table 5.25

Out of the 104 PAHs aware of the land acquisition process, 52 persons answered that they got the information through public consultation meetings, 51 persons knew through the notice from the DRO, and one person was informed through the government officials.

Table 11.4.57 Sources of Awareness on LA Process and R&R Benefits

Sl. No.	Source of Awareness on Land Acquisition	Main Road and TPP Link (Original Alignment) Total
1	Government Official	1
2	15 (2) Notice Issued	51
3	Public Consultation Meeting	52
	Total	104

Source：RAP DPR RAP July 2018 Table 5.26

11.4.4 Plan for Compensation and Assistance

(1) Compensation for Loss of Assets

1) Cut-off Date

The Detailed Project Report (DPR) update survey on Section 1 was conducted on 18 August 2017 on residents and assets within the right-of-way (ROW). The survey did not include counts of project affected persons (PAPs), absentee land owners, and land lessees.

Another DPR update survey was conducted on 20 April 2018 to identify the number of PAPs. The cut-off date for PAPs of Section 1 is, therefore, 20 April 2018.

The legal determination of project affected lands and assets and their owners is the first publication date of the 15 (2) Notification based on the Tamil Nadu Highways Act. The final determination date for project affected squatters and tenants will be the start date of the Joint Verification Survey conducted by the District Revenue Officer (DRO), the Highways and Minor Ports Department (HMPD), and the Resettlement Action Plan (RAP) Implementing Non-Governmental Organization (NGO)/Consulting Firm.

Table 11.4.58 summarizes the first publication date of the 15 (2) Notification as of April 2018. For the villages, 15 (2) Notification are published after the second public consultation based on the Japan International Cooperation Agency (JICA) Guidelines. On 11-12 May 2018, it is necessary that the DRO or Divisional Engineer of HMPD distribute the Policy Framework Handbook given in the public consultation to the owners and concerned parties so that information about compensations and assistances is shared and explained in a fair and equal manner.

Table 11.4.58 Dates of the First Publication of the 15 (2) Notification on Papers

District	Taluka		Village	Publication Dates of 15 (2) Notification
Main Road				
Thiruvallur	Ponneri	1	Kattupalli	13 Sep. 2016
		2	Voyalur	08 Oct. 2016
		3	Neidhavoyal Block 1 Block 2	 22 Jan. 2017 26 Dec. 2016
		4	Kalpakkam	27 Jul. 2017
		5	Nalur	Under preparation
		6	Anuppampattu	06 Jun. 2018
		7	Vannipakkam	14 Apr. 2018
		8	Amur	21 Jul. 2018
		9	Thatchur	Under preparation
		10	Panjetty	Under preparation
TPP Link Road (Original Alignment)				
Thiruvallur	Ponneri		Neidhavayal Block 3	 22 Jan. 2017
		11	Kollati	04 Mar. 2017
		12	Nandiyampakkam	27 May 2017
		13	Minjur Block 1 Block 2	 07 Oct. 2017 25 Dec. 2017
		14	Vallur B	30 Aug. 2017

Source: TNRDC, 23 July 2018

The final determination date of the eligible PAP or project affected household (PAH) for assistances will be done by the Joint Verification Survey that will be organized with DRO, HMPD, and the Project Implementation Team (PIT) during the implementation phase of the RAP. As shown in Table 11.4.65, the survey is scheduled in the first four months of the RAP implementation. There will be a village-wise start date for the survey which will be used as the final determination date of the eligible PAP/PAH for assistances.

2）Plan of Compensation for Loss of Assets

Compensation for the loss of assets of Section 1 is planned as shown in Table 11.4.59.

Table 11.4.59 Plan of Compensation for Loss of Assets

SNo	Impact Category	Entitlements	
Section I. Title Holders - Loss of Private Property			
1	Loss of land (agricultural, homestead, commercial, or otherwise)	a.	Land will be acquired on payment of compensation as per RFCTLARR Act 2013.
2	Loss of residential structure	a.	**In addition to compensation for land and assistances listed above under S.No.1** Cash compensation at Public Works Department (PWD) plinth area rates for structure without depreciation and with 100% solatium
		b.	Right to salvage affected materials
		c.	One-time assistance of INR 25,000 to all households who lose a cattle shed
		e.	An alternative house as per Indira Awaas Yojana (IAY) specifications in rural areas and a constructed house/flat of minimum 50 m^2 in urban areas, or cash in lieu of house if opted (the cash in lieu of house will be INR 70,000/- in line with Government of India IAY standards in rural areas and INR 150,000 in urban areas), for those who do not have any homestead land and for those who have to relocate
		g.	Shifting assistance of INR 50,000/- for those who have to relocate
		h.	One-time resettlement allowance of INR 50,000/- for those who have to relocate
3	Loss of commercial structure	a.	**In addition to compensation for land and assistances listed above under S.No.1** Cash compensation at PWD plinth area rates for structure without depreciation and with 100% solatium
		b.	Right to salvage affected materials
		c.	One-time grant of INR 25,000/- for loss of trade/self-employment for the business owner
		e.	One-time resettlement allowance of INR 50,000/- for those who have to relocate

SNo	Impact Category	Entitlements	
4	Impact to tenants (residential/ commercial/agricultural)	c.	Shifting assistance of INR 10,000/-
		d.	Commercial tenants will receive the one-time grant of INR 25,000/- for loss of trade/self-employment provided under 3(c) above in lieu to the owner
		4.3 a	**Agricultural tenants** In case of agricultural tenants, advance notice to harvest crops or compensation for lost crop at market value of the yield determined by the Agricultural Department
5	Impact to trees, standing crops, other properties, perennial, and non-perennial crops	a.	Three months (90 days) advance notification for the harvesting of standing crops or lump sum equal to the market value of the yield of the standing crop lost determined by the Agricultural Department
		b.	Compensation for trees based on timber value at market price to be determined by the Forest Department for timber trees and for other trees (perennial trees) by the Horticultural Department with 100% solatium
		c.	Loss of other properties, such as irrigation wells, will be compensated at scheduled rates of PWD with 100% solatium.
Section II. Additional Assistance for Women (Title and Non-Title Holders)			
6		a	Reimbursement of stamp duty and registration charges for purchase of property out of the compensation/resettlement and rehabilitation (R&R) assistance in the name of women within three years from loan agreement (LA) award/R&R award
Section III. Non-Title Holders - Impact to Squatters/Encroachers			
7	Impact to squatters	**7.1** a	**Loss of house** Compensation at PWD plinth area rates without depreciation for structure
		b.	Right to salvage the affected
			House construction grant of INR 70,000 for all those who have to relocate; additional house site grant of INR 50,000 to those who do not have a house site
			Shifting assistance of INR 10,000/-
		7.2 a	**Loss of shop** Compensation at PWD plinth area rates without depreciation for structure
		b.	Right to salvage the affected materials
		c.	One-time rehabilitation grant of INR 20,000 for reconstruction of affected shop
		e	Shifting assistance of INR 10,000/-
8	Impact to encroachers	b.	Compensation at PWD plinth area rates without depreciation for the affected portion of the structure

Squatter: Illegal occupants on private and public land
Encroacher: Illegal occupants on government land who extend structure from own private land
Source: DPR RAP 2017 Annexure 3

(2) Livelihood Rehabilitation Assistances

The 2017 Socio-Economic Survey on the PAHs living within the ROW found that among a total of 109 households, there were eight households involved in agriculture, and three households answered their main occupation as agriculture labourer. No household answered their main occupation as cultivator. Majority had other occupations, such as salaried/pensioned, industrial labourer, and casual labourer, which do not get serious negative impact by the location of residence or land asset.

In the 2018 Socio-Economic Survey, 32 persons, or 10% of the total workforce surveyed, including the 109 surveyed in 2017, answered their main occupation as cultivator. There were 35 persons, or 11% of the workforce, who answered their main occupation as agriculture labourer. Still in the 2018 Socio-Economic Survey, the largest group, or 36% of the workforce, are salaried/pensioned, and the second largest, or 23%, are professionals.

With the above profile of the PAHs, main emphasis of the livelihood rehabilitation assistance is placed on the shifting assistances and the subsistence allowances to cover the cost of relocation activities in cash. In addition to the cash assistances, during the implementation phase of the RAP, occupational training will be given to vulnerable households, as well as to all PAHs who wish to receive such training, according to the discussion between HMPD and the JICA Study Team in May 2018.

The Plan of Livelihood Rehabilitation Assistances is summarized in Table 11.4.60.

Table 11.4.60 Plan of Livelihood Rehabilitation Assistances

SNo	Impact Category	Entitlements	
Section I. Title Holders - Loss of Private Property			
1	Loss of land (agricultural, homestead, commercial, or otherwise)	b.	Agricultural land owners: (i) who are marginal farmers and (ii) who become marginal farmers or landless due to the land acquisition for this project will be entitled for INR 50,000/- as interim payment in lieu of the annuity policy
2	Loss of residential structure	d.	One-time assistance of INR 25,000 for each affected family of an artisan or self-employed person and who has to relocate
		f.	One-time subsistence allowance of INR 36,000/- for affected households who need to relocate due to the project
3	Loss of commercial structure	d.	One time subsistence allowance of INR 36,000/- for affected households who need to relocate due to the project; shifting assistance of INR 50,000/- for those who have to relocate
4	Impact to tenants (residential/ commercial)	**4.1** a.	**Residential** One-month notice to vacate the rental premises
		b.	Rental allowance at INR 3,000/- per month in rural areas and INR 4,000/- per month in urban areas, for six months
		4.2 a	**Commercial** One-month notice to vacate the rental premises
		b.	Rental allowance at INR 4,000/- per month in rural areas and INR 6,000/- per month in urban areas, for six months
Additional	PAH who opt for skill development training	a	Training for skill development, wherein assistance includes cost of training and financial assistance for travel/conveyance and food
Section III. Non-Title Holders - Impact to Squatters/Encroachers			
7	Impact to squatters	d.	One-time subsistence allowance of INR 18,000/-
		7.3 a	**Cultivation** Two-month notice to harvest standing crops or market value of compensation for standing crops
8	Impact to encroachers	**8.1** a	**Cultivation** Two-month notice to harvest standing crops or market value of compensation for standing crops, if notice is not given
		8.2 a	**Structure** One-month notice to demolish the encroached structure
Additional	PAH who opt for skill development training	a	Training for skill development, wherein assistance includes the cost of training and financial assistance for travel/conveyance and food
Section IV. Loss of Livelihood Opportunities			
9	Loss of employment in non-agricultural activities or daily agricultural wages or other wage workers	a	Subsistence allowance equivalent to minimum agricultural wages for three months
Additional	PAHs who opt for skill development training	a	Training for skill development, wherein assistance includes cost of training and financial assistance for travel/conveyance and food
	Section V. Impact to Vulnerable DPs		
10	Vulnerable households	a	Training for skill development, wherein assistance includes cost of training and financial assistance for travel/conveyance and food
		b.	One-time assistance of INR 5,000 for all major impacted households
		c.	Displaced vulnerable households will be linked to the government welfare schemes, if found eligible and not having availed the scheme benefit until a specific date.

Squatter: Illegal occupants on private and public land
Encroacher: Illegal occupants on government land who extend structure from own private land
Source: DPR RAP 2017 Annexure 3

(3) Resettlement Site

The title holders to lose residential structure are entitled for 1) cash compensation at PWD plinth area rates for structure without depreciation and with 100% solatium (Entitlement Matrix 2a), and 2) a constructed house/flat with a minimum of 50 m^2 in urban areas or cash in lieu of house if opted (the cash in lieu of house will be INR 150,000 for urban areas), for those who do not have any homestead land and who have to relocate (Entitlement Matrix 2e).

In the RAP implementation schedule, PAHs are to be asked first whether they opt for the alternate housing or cash in lieu of the house, before PIT and DRO start the selection of a potential site for collective resettlement. The JICA Study Team has, therefore, has been negotiating with HMPD so that the potential location of the alternate housing can be informed to eligible PAHs when they are asked to make a choice.

In addition to the above assistances, PAHs who opt for the cash in lieu, instead of alternative housing, can

ask the RAP Implementing NGO/Consulting Firm for assistance in finding and purchasing a house available in the ordinary housing market with the cash paid as compensations for land and structure.

Table 11.4.61 is the detailed checklist for the selection of resettlement site in the DPR 2017.

Table 11.4.61 Detailed Checklist for Selection of Resettlement Site

1. Name of the Village	21. Distance from Nearest School; Distance from Primary School; Distance from Middle School; Distance from High School; Distance from Higher Secondary School
2. Name of the Project Road (specify start point – end point)	22. Distance from Religious/Culturally-important Places (specify distance); Distance from Place of Worship; Distance from Graveyard
3. Survey Number of Proposed Resettlement Site	23. Does the site require any earthwork? If yes, what would be the extent of work? (specify)
4. Type of Land: Agriculture (Wet/Dry)/Vacant Land	24. Distance of Nearest Water Bodies: Tank/Pond/Lake/River/Steam/Seashore (specify distance, area, depth)
5.A Land Ownership: Private/Government/Local Panchayat/Trust	25. Availability of Borrow Areas (Location/Distance) km ( )
5.B Name of the Land Owner	26. Is there any major pollution complaint within 1-km radius of proposed site?
6. Availability of Land for Development	27. Is there any industry near the site? (specify distance and direction from site)
7. Soil Type: Red-1/Sandy-2/Clay-3/Rocky-4	28. Location for Disposal of Soiled Waste from Households
8. Soil Stability: Unsuitable/Better/Good	29. If the site is a private property, specify the following details:
9. Drainage Network Connectivity	Occupation of the Land Owner, Caste of the Land Owner, Income of the Land Owner
10. Water Logging at Site During Monsoon	
11. Water Logging in the Surroundings of the Site	Name and Signature of Village Administration Officer (VAO)
12. Distance from Main Road/Project Corridor	
13. Is there any access road to the proposed site? If yes: Cart Track/Metal Road/BT Road	Name and Signature of the LA Tehsildar
14. Distance from Nearest Electricity Pole	Include details of the "A" register with the Field Measurement Book (FMB); Include the village map with land use for 500 m radius from the resettlement site
15. Nearest Drinking Water Sources: Bore Well/Water Tap (specify distance)	
16. Approximate Ground Water Table	
17. Distance from the Nearest Settlement	
18-A Distance from Nearest Bus Stop	
18-B Distance from Nearest Post Office	
18-C Access for Telephone from Site	
18-D Distance from Market/Shops	
19. Distance from Shopping Place/Daily Market/Weekly Market	
20. Distance from Nearest Medical Facility: Medicine Shop Primary Health Centre Child Care and Maternity Centre Veterinary Hospital	

Source: DPR RAP 2017 Annexure 12

(4) Entitlement Matrix

All the compensation and assistance plans are compiled in the Entitlement Matrix shown in Table 11.4.62.

Table 11.4.62 Entitlement Matrix

(Imp. N/C=RAP Implementing NGO/Consulting Firm)

No	Impact Category	Entitlements		Implementation Guidelines	Implementation Agency	Assisting Agency
Section I. Title Holders - Loss of Private Property						
1	Loss of land (agricultural, homestead, commercial, or otherwise)	a.	Land will be acquired on payment of compensation as per RFCTLARR Act 2013	Higher of (i) market value as per Indian Stamp Act, 1899 for the registration of sale deed or agreements to sell, in the area where land is situated; or (ii) average sale price for similar type of land, situated in the nearest village or nearest vicinity area, ascertained from the highest 50% of sale deeds of the preceding three years; plus 100% solatium and 12% interest from date of 15 (2) Notification to award.	Thiruvallur District Revenue Office (validation and payment)	HMPD (Budget) Imp. N/C (Communication w/ PAPs)
		b.	Agricultural land owners (i) who are marginal farmers and (ii) who become marginal farmers or landless due to the land acquisition for this project will be entitled to INR 50,000/- as interim payment in lieu of annuity policy.	As and when the Government of Tamil Nadu (GoTN) issues rules regarding one-time/annuity payment towards economic rehabilitation, the difference, if any, will be paid to the affected land owner.	Thiruvallur District Revenue Office (payment) in coordination with PIT, TNRDC (validation)	HMPD (Budget) Imp. N/C (Communication w/ PAPs)
2	Loss of residential structure	a.	**In addition to compensation for land and assistances listed above under S.No.1** Cash compensation at PWD plinth area rates for structure without depreciation and with 100% solatium	For partly-affected structures, the DP will have the option of claiming compensation for the entire structure, if the remaining portion is unviable.	Thiruvallur District Revenue Office (validation and payment)	HMPD (Budget) Imp. N/C (Communication w/ PAPs)
		b.	Right to salvage affected materials		Property owner	Imp. N/C (Communication w/ PAPs)
		c.	One time assistance of INR 25,000 to all households who lose a cattle shed		Thiruvallur District Revenue Office (payment) in coordination with PIT, TNRDC (validation)	HMPD (Budget) Imp. N/C (Communication w/ PAPs)
		d.	One time assistance of INR 25,000 for each affected family of an artisan or self-employed person who has to relocate			HMPD (Budget) Imp. N/C (Communication w/ PAPs)
		e.	An alternative house as per IAY specifications in rural areas and a constructed house/flat of minimum 50 m^2 in urban areas or cash in lieu of house if opted (the cash in lieu of house will be INR 70,000/- in line with the Government of India IAY standards in rural areas and INR.150,000 in urban areas), for those who do not have any homestead land and who have to relocate	Stamp duty and registration charges will be borne in case of new houses or sites. Patta will be issued in the name of the wife/women of the household.*		HMPD (Budget) Imp. N/C (Communication w/ PAPs)
		f.	One-time subsistence allowance of INR 36,000/- for affected households		Thiruvallur District	HMPD (Budget) Imp. N/C

No	Impact Category	Entitlements		Implementation Guidelines	Implementation Agency	Assisting Agency
			who must relocate due to the project		Revenue Office (payment) in coordination with PIT, TNRDC (validation)	(Communication w/ PAPs)
		g.	Shifting assistance of INR 50,000/- for those who have to relocate			
		h.	One time resettlement allowance of INR 50,000/- for those who have to relocate			
3	Loss of commercial structure	a.	**In addition to compensation for land and assistances listed above under S.No.1** Cash compensation at PWD plinth area rates for structure without depreciation with 100% solatium	If the affected structure is not viable for continuing business, DP has the option to offer the entire structure for acquisition. If the business owner is different from the structure owner, the one-time grant for loss of trade/self-employment, will be paid to the business owner.	Thiruvallur District Revenue Office (validation and payment)	HMPD (Budget) Imp. N/C (Communication w/ PAPs)
		b.	Right to salvage affected materials		Property owner	Imp. N/C (Communication w/ PAPs)
		c.	One-time grant of INR 25,000/- for loss of trade/self-employment for the business owner	If the business owner is different from the structure owner, the one-time grant for loss of trade/self-employment, will be paid to the business owner.	Thiruvallur District Revenue Office (payment) in coordination with PIT, TNRDC (validation)	HMPD (Budget) Imp. N/C (Communication w/ PAPs)
		d.	One-time subsistence allowance of INR 36,000/- for affected households who require to relocate due to the project; shifting assistance of INR 50,000/- for those who have to relocate			
		e.	One-time resettlement allowance of INR 50,000/- for those who have to relocate			
4	Impact to tenants (residential/commercial /agricultural)	**4.1** a.	**Residential** One-month notice to vacate the rental premises		Thiruvallur District Revenue Office in coordination with PIT, TNRDC	Imp. N/C (Communication w/ PAPs)
		b.	Rental allowance at INR 3,000/- per month in rural areas and INR 4,000/- per month in urban areas, for six months		Thiruvallur District Revenue Office (payment) in coordination with PIT, TNRDC (validation)	HMPD (Budget) Imp. N/C (Communication w/ PAPs)
		c.	Shifting assistance of INR 10,000/-			
		4.2 a	**Commercial tenants** One-month notice to vacate the rental premises		Thiruvallur District Revenue Office in coordination with PIT, TNRDC	Imp. N/C (Communication w/ PAPs)
		b.	Rental allowance at INR 4,000/- per month in rural areas and INR 6,000/- per month in urban areas, for six months		Thiruvallur District Revenue Office (payment)	HMPD (Budget) Imp. N/C (Communication w/ PAPs)

No	Impact Category	Entitlements		Implementation Guidelines	Implementation Agency	Assisting Agency
		c.	Shifting assistance of INR 10,000/-		in coordination with PIT, TNRDC (validation)	
		d.	Commercial tenants will receive the one time grant of INR 25,000/- for loss of trade/self-employment provided under 3(c) above in lieu to the owner			
		4.3 a	**Agricultural tenants** In case of agricultural tenants, advance notice to harvest crops or compensation for lost crop at market value of the yield determined by the Agricultural Department		Thiruvallur District Revenue Office in coordination with PIT, TNRDC	HMPD (Budget) Agricultural Department (Appraisal) Imp. N/C (Communication w/ PAPs)
5	Impact to trees, standing crops, other properties, perennial, and non-perennial crops	a.	Three months (90 days) advance notification for the harvesting of standing crops (or) lump sum equal to the market value of the yield of the standing crop lost determined by the Agricultural Department		Thiruvallur District Revenue Office in coordination with PIT, TNRDC	HMPD (Budget) Agricultural Department (Appraisal) Imp. N/C (Communication w/ PAPs)
		b.	Compensation for trees based on timber value at market price to be determined by the Forest Department for timber trees and for other trees (perennial trees) by the Horticultural Department with 100% solatium		Thiruvallur District Revenue Office in coordination with PIT, TNRDC	HMPD (Budget) Forest & Horticultural Departments (Appraisal) Imp. N/C (Communication w/ PAPs)
		c.	Loss of other properties, such as irrigation wells, will be compensated at scheduled rates of PWD with 100% solatium		Thiruvallur District Revenue Office in coordination with PIT, TNRDC	HMPD (Budget) Public Works Department (Appraisal) Imp. N/C (Communication w/ PAPs)
Additional	PAHs who opt for skill development training	a	Training for skill development, wherein assistance includes cost of training and financial assistance for travel/conveyance and food	* One adult member of the displaced household, whose livelihood is affected, will be entitled for skill development.	PIT, TNRDC and Imp. N/C	HMPD (Budget) Local training institutions (provision of trainers and resources)
Section II. Additional Assistance for Women (Title and Non-Title Holders)						
6	Loss of land/house/shop	a	Reimbursement of stamp duty and registration charges, for purchase of property out of the compensation/R&R assistance in the name of women within three years from LA award/R&R award		Thiruvallur District Revenue Office	HMPD (Budget) Imp. N/C (Communication w/ PAPs)
Section III. Non-Title Holders - Impact to Squatters/Encroachers						
7	Impact to squatters	**7.1** a	**Loss of house** Compensation at PWD plinth area rates without depreciation for structure		Thiruvallur District Revenue Office (validation and payment)	HMPD (Budget) Public Works Department (Appraisal) Imp. N/C (Communication w/ PAPs)
		b.	Right to salvage the affected materials		Property owner	Imp. N/C (Communication w/ PAPs)
		c.	House construction grant of INR 70,000 for all those who have to relocate;		Thiruvallur District	HMPD (Budget) Imp. N/C

No	Impact Category	Entitlements		Implementation Guidelines	Implementation Agency	Assisting Agency
			additional house site grant of INR 50,000 to those who do not have a house site		Revenue Office (payment) in coordination with PIT, TNRDC (validation)	(Communication w/ PAPs)
		d.	One-time subsistence allowance of INR 18,000/-			
		e.	Shifting assistance of INR 10,000/-			
		7.2 a	**Loss of shop** Compensation at PWD plinth area rates without depreciation for structure		Thiruvallur District Revenue Office (validation and payment)	HMPD (Budget) Public Works Department (Appraisal) Imp. N/C (Communication w/ PAPs)
		b.	Right to salvage the affected materials		Property owner	Imp. N/C (Communication w/ PAPs)
		c.	One-time rehabilitation grant of INR 20,000 for reconstruction of affected shop		Thiruvallur District Revenue Office (payment) in coordination with PIT, TNRDC (validation)	HMPD (Budget) Imp. N/C (Communication w/ PAPs)
		d.	One-time subsistence allowance of INR 18,000/-			
		e	Shifting assistance of INR 10,000/-			
		7.3 a	**Cultivation** Two-month notice to harvest standing crops or market value of compensation for standing crops		Thiruvallur District Revenue Office in coordination with PIT, TNRDC	HMPD (Budget) Agricultural Department (Appraisal) Imp. N/C (Communication w/ PAPs)
8	Impact to encroachers	**8.1** a	**Cultivation** Two-month notice to harvest standing crops or market value of compensation for standing crops, if notice is not given	Market value for the loss of standing crops will be decided by the Spl. DRO in consultation with the Agriculture or Horticulture Department.	Thiruvallur District Revenue Office in coordination with PIT, TNRDC	HMPD (Budget) Agricultural & Horticulture d epartments (Appraisal) Imp. N/C (Communication w/ PAPs)
		8.2 a	**Structure** One-month notice to demolish the encroached structure		Village Administration Office and Thiruvallur District Revenue Office	Imp. N/C (Communication w/ PAPs)
		b.	Compensation at PWD plinth area rates without depreciation for the affected portion of the structure		Thiruvallur District Revenue Office (validation and payment)	HMPD (Budget) Public Works Department (Appraisal) Imp. N/C (Communication w/ PAPs)
Additional	PAH who opt for skill development training	a	Training for skill development, wherein assistance includes cost of training and financial assistance for travel/conveyance and food	* One adult member of the displaced household, whose livelihood is affected, will be entitled for skill development.	PIT, TNRDC and Imp. N/C	HMPD (Budget) Local training institutions (Provision of trainers and resources)
Section IV. Loss of Livelihood Opportunities						
9	Loss of employment in non-agricultural activities or daily agricultural wages or other wage workers	a	Subsistence allowance equivalent to the minimum wages in Tamil Nadu which is paid for unskilled workers under MGNREGS Schemes, for three months	Only agricultural labourers who are in full time/permanent employment of the land owner, or those affected full time employees of the business, will be	Thiruvallur District Revenue Office (payment) in coordination with PIT,	HMPD (Budget) Imp. N/C (Communication w/ PAPs)

No	Impact Category	Entitlements		Implementation Guidelines	Implementation Agency	Assisting Agency
				eligible for this assistance. Seasonal agricultural labourers will not be entitled for this assistance.	TNRDC (validation)	
Additional	PAH who opt for skill development training	a	Training for skill development, wherein assistance includes cost of training and financial assistance for travel/conveyance and food	* One adult member of the displaced household, whose livelihood is affected, will be entitled for skill development.	PIT, TNRDC and Imp. N/C	HMPD (Budget) Local training institutions (Provision of trainers and resources)
Section V. Impact to Vulnerable DPs						
10	Vulnerable households	a	Training for skill development, wherein assistance includes cost of training and financial assistance for travel/conveyance and food	* One adult member of the displaced household, whose livelihood is affected, will be entitled for skill development. * The LARRU with support from the NGO will identify the number of eligible vulnerable displaced persons based on the 100% census of the displaced persons and will conduct training need assessment in consultation with the displaced persons so as to develop appropriate training programmes suitable to the skill and the region. * Suitable trainers or local resources will be identified by LARRU and NGO in consultation with local training institutes.	PIT, TNRDC and Imp.N/C	HMPD (Budget) Local training institutions (Provision of trainers and resources)
		b.	One-time assistance of INR 5,000 for all major impacted households		Thiruvallur District Collector in coordination with PIT, TNRDC	HMPD (Budget) Imp. N/C (Communication w/ PAPs)
		c.	Displaced vulnerable households will be linked to the government welfare schemes, if found eligible and not having availed the scheme benefit until specified date.			
Section VI. Unforeseen Impacts						
Unforeseen impacts encountered during implementation will be addressed in accordance with the principles of this policy						

* In accordance with GO Ms.No.1763 of Revenue Department dated 19 Nov. 1987

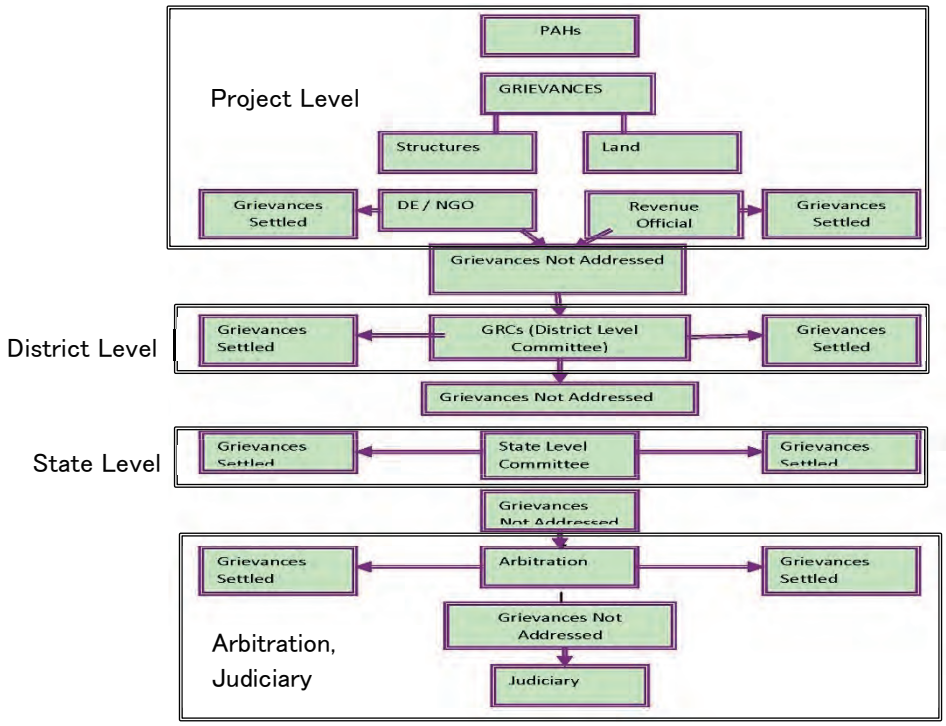
Squatter: Illegal occupants on private and public land

Encroacher: Illegal occupants on government land who extend structure from own private land

Source: JICA Study Team based on DPR RAP 2017 Annexure 3

11.4.5 Grievance Redress Mechanism

Grievances and complaints will be reviewed by the Project Level Committee (PLC), the District Level Committee (DLC), and the State Level Committee (SLC), as shown in Figure 11.4.3. If the grievance cannot be addressed at the SLC, the issue will be handed to arbitration and judiciary process.



Source: DPR RAP 2017 12.5, p.12-4

Figure 11.4.3 Process of Grievance Redressal Mechanism

The members, roles, and power of the committee at each level is shown in Table 11.4.63. The representatives of local residents are the members of the PLC. At the SLC, the Secretary of HMPD will have the power to make the final decision, considering the opinion of NGO members. The decision of the Secretary will be implemented by the Project Director of PIT, who is also the member of the SLC. With such structure of grievance handling, it is expected that the analysis of the grievance will be fair and equitable, and the system has sufficient power to implement the decisions of the committees.

Table 11.4.63 Roles and Responsibility of the Committees

Committee	Member	Roles and Responsibilities
Project Level Grievances Committees	One Official/ Resettlement and Rehabilitation (R&R) Manager/ Social Manager from HMPD/ Implementing Agency (Convener)	● Conveys the DLC meeting ● Records the enquiry report of PLC ● Conducts consultation and counselling of PAPs ● Redresses the grievances at the project level ● Provides the final decision of the committee that will be delivered to the PAPs ● Provides directions and issues orders to concerned departments for further actions ● Transfers unsettled issues to the DLC for settlement
	Any elected representative	● Initiates discussion with affected PAHs ● Clarifies the provisions of RAP ● Examines the scope for redressing with approved policy frame work ● Directs the HMPD to undertake the recommendations of PLC ● Prepares the report of PLC

Committee	Member	Roles and Responsibilities
		● Participates in all PLCs ● For unsettled issues at PLC, recommends for settling in DLC
	A person who is publicly known in the local area	● Engages in discussion with affected PAHs ● Clarifies the provisions of RAP ● Examines the scope for redressing with approved policy frame work ● Directs HMPD to undertake the recommendations of PLC ● Prepares the report of PLC ● Participates in all PLCs ● For unsettled issues at PLC, recommends for settling in DLC
District Level Grievances Committees	District Collector	● Chairs the DLC ● Receives direction of HD on RAP ● Verifies all entitlements to assistance and compensation ● Advices the Project Head on the commitment of project funds ● Verifies community status ● Supports the rehabilitation cell ● Establishes coordination among different agencies ● Approves list of beneficiaries, identifies project affected assets, releases funds stipend, provides training facilities ● Reviews the progress of RAP ● Does technical sanction for all works other than village ponds and temple tanks, inspection works, and marking of sites for foundations ● Prepares proposal for renovation of village ponds and temple tanks ● Identifies employment prospects, business opportunities, and local training needs ● Prepares proposals for replacement of affected community assets and execution of works ● Conducts consultation and counselling of PAPs ● Redresses the grievances at the district level ● Provides the final decision of the committee which will be delivered to the PAPs ● Provides directions and issues orders to concerned departments for further actions ● Makes decisions on financial matters up to INR 20 lakh ● Transfers unsettled issue to the SLC for settlement
	District Revenue Officer (DRO)	● Coordinates the activities of the LA Officers from PIT and the Revenue Officials from the department at the field level ● In the absence of the District Collector, DRO is designated to perform his duties ● Addresses issues related to Land Records and Revenue Department ● Addresses Law and Order issues due to the project as per the directions of the District Collector
	Project Officer, District Rural Development Agency (DRDA)	● Provides instruction to the DRDA in developing the resettlement sites ● Addresses issues pertaining to facilities in the resettlement sties and provides directions to the concerned departments ● In the absence of the District Collector and the DRO, the Project Officer may be designated to perform the roles of the District Collector.
	Divisional Engineer, authorized by the District Collector	● Provides clarification to the committees in technical matters ● Coordinates monthly meetings in consultation with other members and concerned departments ● Reports to the PIT ● Forwards unresolved cases to the SLC through District Collector for seeking decisions ● Coordinates with officials in implementing the awards of the

Committee	Member	Roles and Responsibilities
		committee ● Estimates the replacement cost of affected structures and other community assets
	Tahsildars (Land Acquisition), authorized by the District Collector	● Provides details of land acquisition and delivery of compensation ● Implements the awards pertaining to land acquisition and delivery of compensation ● Estimates land value in coordination with the Revenue Department and Sub-Register Office ● Estimates structure values, including community assets in consultation with the Executive Engineer, PWD, and Divisional Engineer (Highways Department)
State Level Grievances Committees	Secretary, HMPD	● Chairs the SLC ● Issues direction to the PIT based on the decision of the committee ● Decides on unsettled grievance cases referred by the DLC
	Secretary, Revenue Department	● Provide opinions in revenue issues and land matters
	Project Director, PIT (Member Secretary)	● Forwards issues to the committee and the decision of the committee to the field level ● Organizes periodical meetings in consultation with other members of the committee ● Coordinates overseeing of activities of the PIT and field level staff in implementing the committee decisions ● Submits status report to the committee for reviewing of R&R implementation ● Make decisions on financial matters up to INR 10 crore
	State Level NGOs	● Provide their opinions to the committee in the process of resolving issues forwarded to the SLC for decisions

Source: DPR Table 12.1

11.4.6 Institutional Arrangement in the Implementation of RAP

The Resettlement and Rehabilitation (R&R) activities are going to be implemented by the PIT, which will be set up within TNRDC. According to the G.O. (Ms). No. 76 dated 09 May 2018 and issued by HMPD, HMPD has assigned TNRDC as the Managing Associate of HMPD to implement Section 1.

Institutional arrangement and responsibilities in the implementation of RAP is summarized in Table 11.4.64. The draft Terms of Reference (TOR) for outsourcing the R&R Specialist, RAP Implementation NGO/Consulting Firm, and External Impact Evaluation Agency are attached to this report as Appendix-4, Appendix-5, and Appendix-6, respectively.

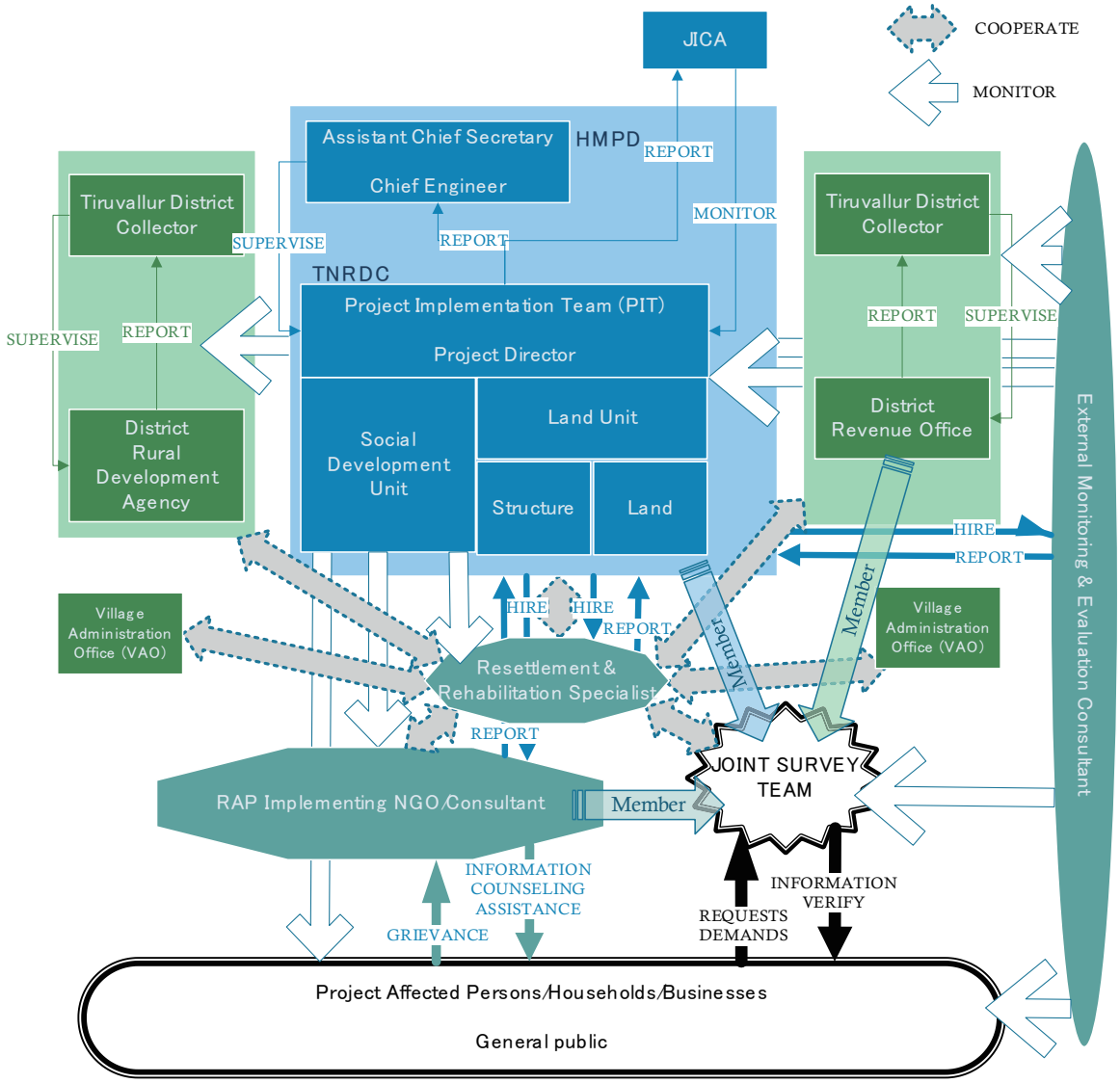
The coordination of the institutions is visualized in Figure 11.4.4. The outsourced R&R Specialist and his/her staff, which is composed of about four persons, will be the focal point that connects all institutions. Most of the implementation works will be the responsibility of the RAP Implementation NGO/Consulting Firm, which is also outsourced by the PIT.

Table 11.4.64 Institutional Arrangement in the Implementation of RAP

HMPD	Secretary		● Overall in-charge of all final HMPD decisions on the Project ● Coordinates with other state level agencies
HMPD	Chief Engineer		● Oversees the periodic progress of the Project ● Implements the decisions made by the Secretary
TNRDC	Chief General Manager		● Responsible for implementation of the Project as the Managing Associate assigned by HMPD
TNRDC (PIT)	Project Director		● Overall in-charge of all project activities ● Oversees the progress of land acquisition and R&R activities ● Participates as Member Secretary in the State Level Grievance Redressal Committee ● Participates in SLC to facilitate land acquisition ● Deals with contracts of NGOs for implementation of RAP and external Impact Evaluation Agency ● Facilitates periodic appraisal of the progress and reports to JICA and the government in the form of monthly reports ● Makes decisions on financial matters
	Social Development Unit	Assistant Project Director	● Coordinates implementation of R&R activities with HMPD and field staff ● Approves the entitlements/microplans prepared by the NGOs to implement RAP ● Monitors the progress of R&R implementation and reports to the Project Head
	Land Unit	Land Acquisition Officer (Deputy Collector) (Assigned by District Revenue Office)	● Coordinates the land acquisition process with Tahsildars at the field ● Prepares guidelines and procedures to be adopted for the land acquisition ● Interacts with DROs and other stakeholders to quicken the land acquisition process ● Monitors and reports the progress of land entry upon permission to the Assistant Project Head ● Participates in the DLCs and PLCs
		Structure Valuation Officer (Assistant Divisional Engineer, HMPD)	● Coordinates preparation of valuation of structures ● Assists in the preparation of estimates of structure and compensated community assets ● Participates in the Grievances Committees.
	Assistant Engineer		● Assists the R&R specialist in the implementation of R&R ● Assists the R&R specialist in the report preparation for the Social Development Unit (SDU) and Land Acquisition Unit
	Database Management System Analyst		● Maintains the database of the PAPs and PAHs ● Maintains the database of overall physical and financial progresses ● Maintains records of the Grievance Redressal Committee
HMPD Site Unit			● Coordinates with PIT, outsourced parties, villages, districts, and PAHs
Outsourced	R&R Specialist/Social Manager		● Participates in the SLCs, DLCs, and PLCs ● Coordinates the implementation of R&R activities with corporate and field staff ● Reviews the work in finalization of resettlement site development ● Prepares Terms of Reference (TOR) for any study to be carried out by external agencies ● Prepares monthly progress reports for the SDU and the land acquisition unit
	Implementing NGOs/Consulting Firms		● Coordinate with the Tahsildars and Extension Officers at the field to implement RAP activities ● Verify and identify PAHs; issue identification cards; counsel; and disseminate project policies, documents, etc.

		● Prepare microplans per household for implementation of R&R ● Generate awareness on livelihood restoration activities and help PAHs make informed choices ● Consult PAHs on acceptance to resettlement areas ● Identify training needs of PAHs for income generation activities and ensure that they are adequately supported ● Put forth the grievances of PAHs to the filed HMPD units and the GRC ● Assist the Social Development Unit, PIT in disbursement of cheque ● Periodic R&R implementation report should be submitted to the Social Development Unit
	External Impact Evaluation Agency	● Works out indicators to evaluate R&R implementation ● Tracks the resettled and affected population in order to assess the restoration of income and standards of living ● Provides suggestions and inputs in the form of remedial measures to the PIT in implementing the RAP
	Database Management System Specialist	● Develop DBMS for R&R ● Develops formats for Data Entry ● Develops formats of output data for periodic reports ● Trains the R&R staff of the PIT in using the database
Thiruvallur District	District Collector	● Gives final approval of the target PAHs/PAPs eligible for compensations and assistances ● Plans the relocation of common property resources and implements the relocation
	District Revenue Officer (DRO)	● Determines the boundary of land to be acquired ● Verifies the lands and assets to be acquired and their owner ● District level Tahsildars will coordinate with HMPD and village level Tahsildars to implement the RAP activities ● Selects the potential site for collective resettlement sites when necessary
	District Rural Development Agency (DRDA)	● Prepares collective resettlement sites with HMPD budget, when necessary
Revenue Village	Village Administration Office	● Village level Tahsildars will coordinate with HMPD and district level Tahsildars to implement the RAP activities ● Assists DRO in determining the boundary of land to be acquired and in verifying the land and assets to be acquired and their owners ● Assists PIT/NGO and HMPD in verifying the squatters and encroachers who may be eligible for compensations and assistances

Source: DPR RAP 2017 Table 10.1



Source: JICA Study Team based on DPR and interviews with related agencies and consultants

Figure 11.4.4 Institutional Arrangement in the Implementation of RAP

11.4.7 Implementation Schedule

As shown in Table 11.4.65, after the approval, the PIT will be established and will outsource the works to specialists, NGOs, and/or consultants. Verification of the PAH, PAP, and affected assets will be followed by notification and agreement on entitlement. The payment of relocation and rehabilitation (R&R) assistances are planned in the 6th and 7th months. Physical relocation of residents is planned to start from the 8th month. Tendering and contract awards for contractors is planned in the 11th month.

Table 11.4.65 RAP Implementation Schedule

No.	Months	1	2	3	4	5	6	7	8	9	10	11	12	DPR Line No.
	Institutional Arrangement and Monitoring													
1	PIT R&R cell and other institutional arrangements	■	■	■										16
a	Establishment	■	■	■										16a
b	Capacity building	■	■	■										16b
c	Formation of GRC committees	■	■	■										16c
d	Link to government programs		■	■	■									16d
2	Appointment of Social Manager	■	■	■	■									4
3	Monthly report from Social Manager	■	■	■	■	■	■	■	■	■	■	■	■	5
4	Appointment of M&E agency	■	■											22
5	Impact monitoring and evaluation			■	■	■	■	■	■	■	■	■	■	21
6	Updating RAP based on M&E report										■	■		23
	Final Verification to Clearance													
7	Public consultations													17
a	Pre-implementation	■	■	■	■	■	■	■	■					17a
b	During implementation	■	■	■	■	■	■	■	■					17b
8	Verification of properties	■	■	■	■									3
a	Verification	■	■	■	■									3a
b	Distribution of identification cards	■	■	■	■									3b
9	Notification of entitlements	■	■	■	■									6
10	Agreement on entitlements	■	■	■	■									7
11	Selection and training of PAPs	■	■	■	■									15
12	Finalization of Entitlement Policy by HMPD	■	■	■	■									1
13	Negotiation for relocation sites (where needed)					■	■							10
14	Confirmation of relocation sites (where needed)					■	■							11
15	Development of community infrastructure						■	■						20
16	Disbursement of compensation and R&R assistance						■	■						18
17	Disbursement of entitlement for indirect losses						■	■						19
18	Notification of demolition							■						9
19	Relocation of displaced PAPs, movement of PAPs to new sites								■					12, 14
20	Demolition of old structures								■					13
	Grievance Redressal													
21	Initiate grievance redressal mechanism	■	■	■	■									8
a	Receipt of complaints	■	■	■	■	■	■	■	■	■	■	■	■	8a
b	Committee meetings	■	■	■	■	■	■	■	■	■	■	■	■	8b
c	Resolution	■	■	■	■	■	■	■	■	■	■	■	■	8c
	Tendering to Start of Works													
22	Civil work contracts											■		24
a	Tendering and contract awards for contractors											■		24a
b	Commencement of works												■	24b

Source: JICA Study Team based on DPR 2017 Table 7.2

11.4.8 Budget and Funding

The funding for land acquisition of Section 1 has been approved through Government Order No. 33, dated 16 February 2016, as INR 9,510 million. The JICA Study Team estimated the necessary cost for land acquisition as INR 5,060 million (Table 11.4.67). It is concluded that Section 1 has sufficient funding for land acquisition.

As shown in Table 11.4.77, the cost estimation for the implementation of RAP, covering all items listed in Section 11.4.4, is estimated as INR 243 million, including the 10% contingency in the DPR 2017. The Resettlement Policy Framework with all those cost estimates was already approved by the State Government by G.O.(Ms). No.75, dated 09 May 2018, issued by HMPD. Therefore, it is concluded that Section 1 has sufficient funding for RAP implementation.

(1) Land Acquisition Cost

The funding for land acquisition of Section 1 has been approved through Government Order No. 33, dated 16 February 2016 as INR 9,510 million.

The necessary cost for land acquisition was estimated using the Guideline Values of the land parcels to be acquired from the State website, and village-wise land areas to be acquired listed in the 2014 TNRDC document. HMPD provided the latest land acquisition plan as shown in Table 11.4.10. The latest requirement is 250.59 ha. The following cost estimate, however, was made for 255.0 ha as described in the 2014 TNRDC document, using the latest (2017) direct land cost.

The direct land costs for private and government lands were estimated as shown in Table 11.4.66.

Table 11.4.66 Estimate of Direct Land Cost

Village	Private Land (m^2)	Cost (crores INR)	Government Land (m^2)	Cost (crores INR)
Kattupalli	1,643.84	0.07	75,707.09	3.13
Neidavayal (Link Road (Original))	47,195.54	3.42	126,513.67	9.17
Voyalur	236,005.90	4.68	169,301.20	3.36
Kollati (Link Road (Original))	60,899.27	13.18	0.00	0.00
Minjur (Link Road (Original))	75,739.06	27.34	6,157.78	2.22
Nandiyampakkam (Link Road (Original))	56,795.03	41.02	13,490.85	4.87
Vallur (Link Road (Original))	5,518.03	1.99	420.76	0.15
Amur	204,980.14	7.94	42,647.22	1.77
Anuppampattu	144,095.16	15.11	13,549.19	1.96
Kalpakkam	37,542.60	1.48	80,980.43	3.35
Nallur	249,803.78	24.26	36,529.23	3.93
Neidavayal (Main Road)	181,190.61	5.97	184,079.32	6.10
Panjetti	84,092.15	3.72	14,196.88	1.03
Thatchur	194,145.46	12.16	46,644.98	3.38
Vannipakkam	166,902.41	17.01	22,307.49	3.22
Total	1,746,548.98	179.35	832,526.09	47.65

Crores: INR 10 million
Source: JICA Study Team based on TNRDC, 2014
Guideline Values: http://www.tnreginet.net/GuidelineValue_2014/greportvillagenew2017.asp?ltype=cat&sroc=55

Table 11.4.67 shows the cost estimate for land acquisition with solatium for private land based on the 2013 LARR Act and management cost. The total cost was estimated as INR 5,060 million. It is concluded that the secured budget of INR 9,510 million is sufficient for land acquisition.

Table 11.4.67 Cost Estimate for Land Acquisition

	Description	Private Land	Government Land
a.	Cost of land based on the Guideline Values (crores)	179.35	47.65
b.	Cost of land under the new LA Act (crores) (multiplier factor 2.5 for private, 1.0 for government)	448.37	47.65
c.	Tentative cost of structures (included in compensation cost)	0.00	
	(b+c) (crores)	496.02	
d.	Management Associate Fee @ 2% x (b+c) (crores)	9.92	
	Total (b+c+d) (crores)	505.94	

Crores: INR 10 million
Source: JICA Study Team based on TNRDC, 2017

(2) Structure Compensation Cost

To calculate the structure compensation cost, the PWD plinth area rate and scheduled rates are used as the unit price as shown in Table 11.4.68. The cost for private structure was calculated as INR 93.65 million (Table 11.4.70), and the cost for common property resources was calculated as INR 28 million (Table 11.4.71).

Table 11.4.68 Unit Cost Used for Estimation of Structure Compensation

No.	Category of Structure	Description	Scheduled Rates (m^2)
1	Pucca	Under Class E – RCC Structures	7,180
2	Semi–Pucca	Under Class B	3,785
3	Thatched	Roofing with coconut leaves/palmyra leaves or bamboo sheet	2,100
4	Others	Compound wall in running meters	925
5	Septic Tank	Septic tanks	7,615/cum approx.- INR 45,694 for average 6 cum
6	Open Well	Open well – 2.5*7.5 m – each unit cost	23,750
7	Borewell	Borewell – 100*200 m depth	146/RM – INR 29,200 for an average of 200 m depth borewell
8	OHT	Overhead tank – PVC	2.4/litres
9	Miscellaneous	Sanitary fittings	7.5% of the structure cost
10	Miscellaneous	Electricity fittings	7.5% of the structure cost
11	Miscellaneous	Water supply fittings	7.5% of the structure cost

Source: PWD Plinth Area Rate

Table 11.4.69 Type-wise Floor Area to be Affected

No	Description	Extent of Affected portion (m^2)					No. of Assets		
		Pucca	Semi Pucca	Kutcha	Others	Total	Main Road	TPP Link (Original)	Total
1	Title Holders - Major Affected Assets	1,008	1,282	169	28.7	2,487.7	38	159	197
2	Title Holders - Minor Affected Assets	143	0	0	0	143	5	0	5
3	Non-Title Holders - Squatters - Major Affected Assets	60	523	0	0	583	18	2	20
4	Non-Title Holders - Squatters - Minor Affected Assets	0	0	0	0	0	0	0	0
5	Non-Title Holders - Encroachers	0	0	0	0	0	0	0	0
	Total	**19,104**	**1,805**	**169**	**28.7**	**3,213.7**	**61**	**161**	**222**

Source: DPR RAP 2017 Table 9.3

Table 11.4.70 Compensation Cost for Structures to be Affected

No	Description	Structural Cost		
		Main Road	**TPP Link** (Original)	**Total**
	Loss of Assets			
1	Title Holders - Major Affected Assets	9,450,113	73,053,794	82,503,906
2	Title Holders - Minor Affected Assets	0	1,026,740	1,026,740
3	Non-Title Holders – Squatters - Major Affected Assets	4,811,139	316,638	5,127,777
4	Non-Title Holders – Squatters - Minor Affected Assets	0	0	0
5	Non-Title Holders - Encroachers	0	0	0
	Subtotal	**14,261,252**	**74,397,172**	**88,658,424**
	Loss of Other Assets			
6	Open Well	23,750	380,000	403,750
7	Bore well	0	700,800	700,800
8	Others	0	3,883,990	3,883,990
	Subtotal	**23,750**	**4,964,790**	**4,988,540**
	Total	**14,285,002**	**79,361,962**	**93,646,964**

Source: DPR RAP 2017 Table 9.4

Table 11.4.71 Compensation Cost for Common Property Resources

S.No	Description	Nos	Unit Cost	Amount
1	Burial Ground	0	2,000,000	0
2	Tomb*	2		0
3	Crematorium Ground	1	2,000,000	2,000,000
4	Gov't Building	5	2,000,000	10,000,000
5	Dispensary	1	2,000,000	2,000,000
6	School	1	2,000,000	2,000,000
7	Temples	6	2,000,000	12,000,000
8	Well	0	2,000,000	0
9	OHT	0	2,400,000	0
	Sub Total	**16**		**28,000,000**

*: During the DPR survey by HMPD, no owner or relatives were found for those tombs. Since nobody could be identified as the recipient of compensation, the unit cost is not shown in the table. In case any eligible person is identified in the implementation phase, compensation will be negotiated and paid from the land acquisition budget.

Source: DPR RAP 2017 Table 9.11

(3) Resettlement and Rehabilitation Cost

The following tables are the cost estimates for resettlement and rehabilitation in the DPR 2017. The Resettlement Policy Framework with all the cost estimates was already approved by the State Government by G.O. (Ms). No.75, dated 09 May 2018 and issued by HMPD. Therefore, it is concluded that Section 1 has sufficient funding for RAP implementation. Specifically, in Table 11.4.75, the budget for vulnerable assistance and skill training is prepared to cover not only the number of vulnerable households but all households and businesses affected.

Table 11.4.72 Resettlement and Rehabilitation Cost for Land Title Holders

No	Description of R&R Assistance for Title Holders	Main Road	TPP Link	Total	Unit Cost	Amount
1	One-time Cattle Shed	21	152	173	25,000	4,325,000
2	One-time Resettlement Assistance	21	152	173	50,000	8,650,000
3	Shifting Assistance	21	152	173	50,000	8,650,000
4	House Construction Grant	17	143	160	70,000	11,200,000
5	Subsistence Assistance	21	152	173	36,000	6,228,000
6	Economic Rehabilitation Grant	6	16	22	25,000	550,000
	Total					**39,603,000**

Source: DPR RAP 2017 Table 9.5

Table 11.4.73 Resettlement and Rehabilitation Cost for Non-Title Holders - Squatters

No	Description of R&R Assistance for Non-Title Holders – Squatters	Main Road	TPP Link	Total	Unit Cost	Amount
1	Shifting Assistance	2	18	20	10,000	200,000
2	Subsistence Assistance	2	18	20	18,000	360,000
3	Economic Rehabilitation Grant	0	1	1	15,000	15,000
4	House Construction Grant*	2	18	20	70,000	1,400,000
5	Additional House Site Grant*	2	18	20	50,000	1,000,000
	Total					**2,975,000**

Note House Construction Grant *and Additional House Site Grant* will be provided for residential squatters and residential cum commercial squatters.

Source: DPR RAP 2017 Table 9.6

Table 11.4.74 Resettlement and Rehabilitation Cost for Non-Title Holders - Tenants (Residential and Commercial)

No	Description of R&R Assistance for Non-Title Holders – Tenants	Main Road	TPP Link	Total	Unit Cost	Amount
1	Shifting Assistance	1	24	25	10,000	250,000
2	Tenants	0	20	20	18,000	360,000
3	Rental Allowance Commercial Tenants	1	4	5	24,000	120,000
4	Economic Rehabilitation Grant	1	20	21	25,000	525,000
	Total					**1,255,000**

Source: DPR RAP 2017 Table 9.8

Table 11.4.75 Assistance for Vulnerable Households

No	Vulnerable Assistance	No. of PAHs	Unit Cost	Amount
1	Vulnerable Assistance	247	5000	1235000
2	Skill Training	247	5000	1235000

Source: DPR RAP 2017 Table 9.9

Table 11.4.76 Resettlement and Rehabilitation Cost for Non-Title Holders - Workers

S.No	Description of R&R Assistance for Workers	No. of PAHs	Unit Cost	Amount
1	Subsistence Allowance - at minimum wages for three months	6	18,450	110,700

Note ; The minimum wages in Tamil Nadu is INR 205 per day, which is paid for unskilled workers under the MGNREGS Scheme

Source: DPR RAP 2017, Table 9.10

(4) Management and Operation Cost

Table 11.4.77 shows the management and operation cost for RAP implementation, together with the total cost for RAP implementation. Ten percent of the estimated total cost is added as contingency.

Table 11.4.77 Management and Operation Cost and Total Cost of RAP Implementation

No	Description	Amount	Total in Lakhs
	R&R Cost		
1	Structure Cost	93,646,963	936.5
2	R&R Cost	46,413,700	464.1
3	CPR Relocation Cost	44,000,000	440.0
	Total R&R Cost	**184,060,663**	**1,840.6**
	Management and Operation Cost		
1	NGO Appointment	3,500,000	35.0
2	Monitoring and Evaluation	3,500,000	35.0
3	Appointment of Social and Environmental Expert PMC	7,000,000	70.0
4	Appointment of Social and Environmental Associates PMC	5,000,000	50.0
5	Training Program	2,000,000	20.0
6	IEC Materials and Awareness	2,500,000	25.0
7	Road Safety	2,500,000	25.0
8	Focus Group Discussion/Consultation	2,500,000	25.0
9	ID Card to PAHs	1,250,000	12.5
10	ID Card - Vendor for Biometric Card	1,750,000	17.5
11	Women Development/Gender Issues Development Program	2,500,000	25.0
12	Documentation	3,200,000	32.0
	Subtotal for Institutional Arrangements	**37,200,000**	**372**
	Total R&R Cost for Subproject	**221,260,663**	**2,213**
	10% Contingency	22,126,066	22
	Total R&R Budget	**243,386,729**	**2,435**

Source: DPR RAP 2017 Table 9.12

11.4.9 Monitoring and Evaluation

As described in Section 11.4.6: Institutional Arrangement, the implementation of the RAP will undergo internal monitoring through the R&R Specialist hired in the PIT and external monitoring through external experts contracted by the PIT. According to Appendix 6, the draft TOR states that the external experts will be hired for 30 months.

To encourage involvement of PAPs in the monitoring, HMPD will, through PIT, invite PAPs' active involvement in the cooperative relocation planning for each household in the meeting with the R&R Specialist and his/her staff, in the public consultation discussions, and in the monitoring activities of external experts such as surveys, interviews, and group discussions.

Indicators suggested for internal and external monitoring are shown in Table 11.4.78 and Table 11.4.79.

Table 11.4.78 Indicators Suggested for Internal Monitoring

Physical Progress	1 Land acquisition (ha) from government sources 2 Wet land acquired (ha) from private owners 3 Dry land acquired (ha) from private owners 4 Urban land (including homestead) acquired (ha) from private owners 5 No. of PAHs paid compensation for acquisition of private land properties 6 Areas of pucca structures acquired (m^2) from private owners 7 No. of PAHs paid compensation for acquisition of private pucca properties 8 Area of semi-pucca structures acquired (m^2) from private owners 9 No. of PAHs paid compensation for acquisition of private semi-pucca properties 10 Area of kutcha structures acquired (m^2) from private owners 11 No. of PAHs paid compensation for acquisition of private kutcha properties 12 Other assets (wells) acquired (no.) from private owners 13 No. of PAHs paid compensation for acquisition of other private assets (wells) 14 No. of PAHs provided with assistance (additional 25%) for severance of land

	15 No. of PAHs opted for alternative houses 16 No. of PAHs opted for alternative shops 17 No. of PAHs provided with land purchase grant at 25% of the compensation received to buy alternative agriculture land 18 No. of PAHs provided with shifting allowance 19 No. of PAHs provided with rental allowance 20 No. of PAHs provided with subsistence allowance for six months 21 No. of PAHs provided with subsistence allowance for three months 22 No. of vulnerable squatter PAHs provided with alternative built houses 23 No. of vulnerable squatter PAHs provided with alternative built shops 24 No. of PAHs provided with employment generation asset grant (from PAHs losing shops) 25 No. of PAPs provided with livelihoods training assistance (two adults from each PAH losing shops) 26 No. of PAPs provided with self-employment training (two adults from each vulnerable squatter PAH) 27 No. of PAPs provided with self-employment training and assistance for purchase of employment generation asset 28 No. of man-days of employment under contractors 29 No. of community properties re-established 30 No. of SDU staff in position 31 No. of SDU staff trained in R&R activities 32 No. of implementing NGO staff in position 33 No. of implementing NGO staff trained in R&R activities
Financial Progress	1 Compensation (including solatium) paid for wet land acquired from private owners including assistance towards registration charges and taxes 2 Compensation (including solatium) paid for dry land acquired from private owners including assistance towards registration charges and taxes 3 Compensation (including solatium) paid for urban land (including homestead) acquired from private owners including assistance towards registration charges and taxes 4 Compensation paid for severance of land (additional 25% of the compensation paid) 5 Compensation paid for loss of perennial crops 6 Compensation paid for loss of non-perennial crops 7 Compensation paid for acquiring pucca structures from private owners 8 Compensation paid for acquiring semi-pucca structures from private owners 9 Compensation paid for acquiring kutcha structures from private owners 10 Compensation paid for acquiring other assets (wells) from private owners 11 Expenditure on providing shifting allowances 12 Expenditure on providing rental allowances 13 Expenditure on providing subsistence allowances (for six months) 14 Expenditure on providing subsistence allowances (for three months) 15 Expenditure on providing self-employment training assistance (two adults from each PAH losing shops) 16 Expenditure on providing self-employment training assistance (two adults from each vulnerable squatter PAH losing shops) 17 Expenditure on providing self-employment training and purchase of employment generation asset assistance (to all employees losing employment due to the project) 18 Expenditure on providing alternatives-built houses to vulnerable squatter PAHs 19 Expenditure on providing alternatives-built shops to vulnerable squatter PAHs 20 Expenditure on preparing resettlement sites ready with infrastructure facilities 21 Expenditure on re-establishing community properties/cultural properties 22 Expenditure on staffing of SDU (salary) 23 Expenditure on providing training to SDU staff in R&R activities 24 Expenditure on engaging implementation NGOs 25 Expenditure on engaging Impact Evaluation Agency/NGO/Academic Institution 26 Expenditure on continued public consultation 27 Expenditure on strengthening the SDU

	28 R&R cost for maintenance corridors (1.5% of the treatment cost of INR 3 million) 29 Expenditure on unquantified impacts (10% of total R&R cost)
Social Condition	· Area and type of house and facility · Morbidity and mortality rates · Communal harmony · Dates of consulting project and DLC
Grievance Redress	· Number of times the GRC and DLCs met · Number of appeals placed before the grievance redressal cell · Number of grievances referred and addressed by DLCs · Number of cases referred by arbitration · Number of cases addressed by arbitration · Number of PAHs that approached the court · Cases of land acquisition referred to the court, pending and settled · Number of grievance cell meetings · Number of village level meetings · Number of field visits by SDU · Number of cases disposed by PIT to the satisfaction of EPs

Source: DPR RAP 2017 Annexure No.8, Table 11.1

Table 11.4.79 Indicators and Methods Suggested for External Monitoring

Objectives	● To assess whether the implementation of the RAP is in accordance with the R&R policy and the RAP ● To monitor the schedule and the achievement of targets ● To evaluate whether the outcomes of the social development objectives of the project are being achieved
Suggested Indicators	Process of implementation of the RAP Process of consultation Transparency Process of delivery of the R&R services within the timeframe Process of grievance redress Process related to DLCs Process of disbursement of compensation and assistance Process of relocation Process of rehabilitation, which includes restoration of livelihood Progress of training staff of PIT and entitled PAPs Institutional arrangement and capacity to implement the RAP Financial and physical progress Any deviation from RAP
Suggested Evaluations to be Included in the Final Report	● Evaluation of progress in achieving the goal mentioned in the R&R policy on improving or restoring livelihoods of the PAPs ● Evaluation of the consultation process and participation of the people in the implementation of RAP ● Evaluation of the benefits received by PAPs under vulnerable group ● Evaluation of the R&R policy of HD and the RAP in the context of the diverse sociocultural groups ● Evaluation of the impact of the project specific measure on (a) quality of life of the PAPs, (b) gender sensitivity and empowerment, (c) people below poverty line , (d) interaction with the host communities, (e) redressing grievances, and (f) utilizing the service of the NGOs, etc. ● The Consulting Agency will evaluate people's perception about the processes adopted for (a) disbursement of compensation and/or assistance, (b) selection of resettlement and relocation sites, (c) interactions with the host communities,

	(d) redressing grievance, and (e) utilizing the services of the NGOs, etc.
Suggested Methods to be Taken	Rapid assessment Focus group discussion Social mapping Questionnaire In-depth interview

Source: DPR RAP 2017 Annexure No. 8 TOR

11.4.10 Consultations with PAPs

Public consultations were conducted twice during the RAP survey following the JICA Guidelines at two locations. Details of the public consultations are explained in Section 11.5.

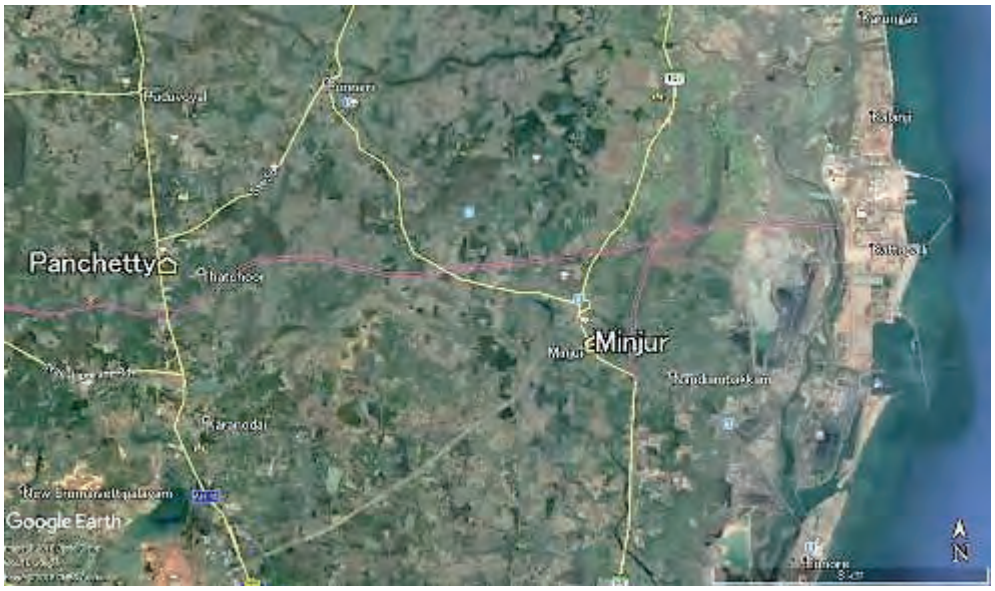
11.5 Stakeholder and Public Consultation on Environmental Impact Assessment (EIA) and RAP for Section 1

11.5.1 First Public Consultation Following JICA Guidelines

(1) Planning and Notices

In 2014, the public consultation for Section 1 of PAH was held once at the west end of the Main Road of Section 1. In the planning phase of the consultation in 2018, the JICA Study Team requested HMPD to hold two meetings, one at Minjur or any place near the TPP Link Road where the number of PAHs is large, and the other in the same area where the 2014 meeting was held at or near Panchetti (Figure 11.5.1). HMPD accepted the request. The venues were chosen from local public offices so that as many people as possible will join the meetings held at familiar locations with good transportation access.

Notifications on the meeting were distributed through various means, such as handing out a notice paper, posting notices at popular places, explaining orally to local key persons, and notifying NGOs working in the fields of environmental conservation and social improvement. Those notifications were given out starting Tuesday, 3 April 2018. Advertisements of the meetings were published in newspapers on Saturday, 7 April 2018. Advertisements were published on one Tamil newspaper and one English newspaper, both of which circulate in the Thiruvallur District and the Chennai District. (Figure 11.5.2)



Source: JICA Study Team

Figure 11.5.1 Locations of Stakeholders and Public Consultation Meetings in 2018

Figure 11.5.4 shows the various means and activities taken for notification of the meetings.

First, the HMPD consultant handed out the notice paper and explained the contents orally to all the accessible households in the ROW. The consultant put best efforts to ensure that all the affected PAHs are informed and treated equally regardless of their social status, gender, age, and disabilities.

Second, the notice was also displayed in public places frequented by residents in the area, such as school entrances and bus stops, to widely disseminate information about the meeting. According to the local Social Specialist, little discriminatory behavior is observed; thus, people in the area do not hesitate or are not prohibited to attend such meeting regardless of their background, while 89% of PAHs belong to the Scheduled Caste (Table 11.4.21), most backward communities, or other backward communities. Based on this, direct attendance of the vulnerable group is assumed to be encouraged by posting the notice of the meeting and project information at public places.

Third, the HMPD consultant visited all related Village Administration Offices (VAOs) and requested the officers to invite important residents, such as the most vulnerable household among PAHs.

In addition, invitation letters were sent to 18 NGOs/experts working in the fields of social improvement,

gender issues, and environmental conservation in Chennai area. The letter is for requesting their attendance in the meetings and their opinions. As a result, ten NGOs/experts attended the two meetings (Table 11.5.1).

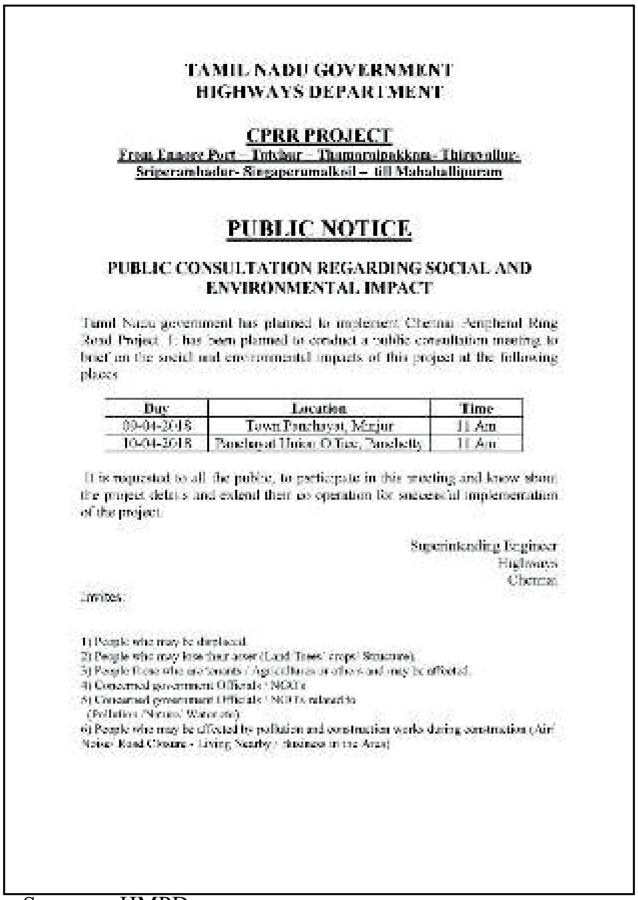
The above means were recommended by the local Social Specialist as the best strategy for the public meeting of the project. The rationale given by the Social Specialist were as follows: 1) population movement is frequent in the Chennai Metropolitan Area (CMA); 2) the residents are urban or western minded; and 3) little oppressive behaviors against lower caste groups, women, and non-Hindu population are observed in the CMA, including the project site. The JICA Study Team considers these as appropriate measures based on its own observation of the local society.

Finally, the meeting notice was also published in two popular newspapers, one in Tamil and one in English, in the area of Thiruvallur and Chennai District on Saturday, 7 April 2018. (Figure 11.5.2) The handouts explaining Section 1 were prepared in Tamil and in English, and these were handed out to participants of the meetings. The material was also used in the RAP Survey 2018 to explain Section 1. (Figure 11.5.3).

Table 11.5.1 NGOs and Specialists Invited and Participated

No	Name of the NGO /Experts Invited	Field of Operations	Participation
1	Development Management Trust	Resettlement and Rehabilitation – TNRSP Phase I - NGO	Participated
2	SCOPE India Trust	Resettlement and Rehabilitation – TNUDP III - NGO	Participated
3	CreNio	Resettlement and Rehabilitation – TNRSP Phase I - NGO	
4	DHV India	Monitoring and Social Expert – TNRSP Phase I - NGO	
5	ICWO Dep Director	Community Development NGO	Participated
6	PD Trust	SHG – Community Development NGO	Participated
7	REEDA Trust	Resettlement and Rehabilitation – TNRSP Phase I – NGO	Participated
8	DHV India	Monitoring Resettlement and Rehabilitation – TNRSP Phase I - NGO	
9	Mr. Pandian	Former Resettlement Officer R&R Projects NGO Advisor	Participated
10	Mr. Sathiaprakash	Social Activist NGO	
11	Mr. Daniel	Environmental Activist NGO	Participated
12	Mrs. Narayini	Environmental Activist NGO	Participated
13	Dr. Rajkumar	Social Activist NGO	
14	Dr. Rajkumar	Environmental Specialist	
15	Dr. Raman	Social Expert	
16	Dr. Jayanth	Social Expert NGO	
17	Uravugal Trust	Resettlement and Rehabilitation – Chennai Corporation Projects NGO	Participated
18	Forum Trust	Resettlement and Rehabilitation – Chennai Corporation Projects NGO	Participated

Source: DPR RAP July 2018 Annexure 15



TAMIL NADU GOVERNMENT
HIGHWAYS DEPARTMENT

CPRR PROJECT
From Ennore Port – Tatchur – Thamaraipakkam- Thiruvallur- Sriperambadur- Singaperumalkoil – till Mahaballipuram

PUBLIC NOTICE

PUBLIC CONSULTATION REGARDING SOCIAL AND ENVIRONMENTAL IMPACT

Tamil Nadu government has planned to implement Chennai Peripheral Ring Road Project. It has been planned to conduct a public consultation meeting to brief on the social and environmental impacts of this project at the following places

Day	Location	Time
09-04-2018	Town Panchayat, Minjur	11 Am
10-04-2018	Panchayat Union Office, Panchetty	11 Am

It is requested to all the public, to participate in this meeting and know about the project details and extend their co operation for successful implementation of the project.

Superintending Engineer
Highways
Chennai

Invites:

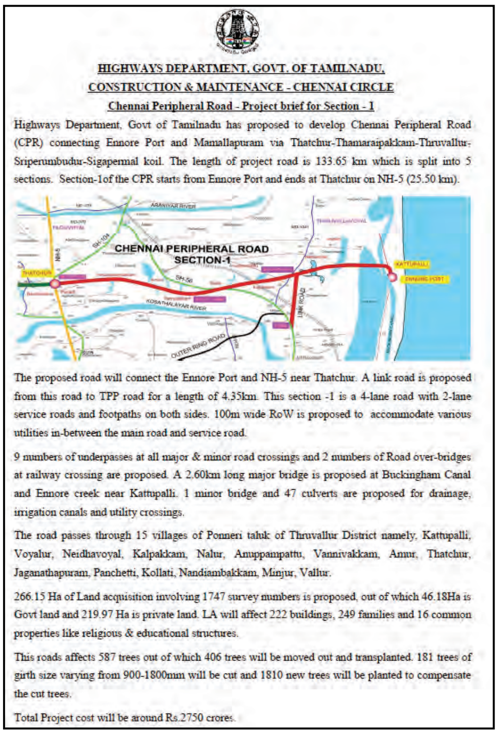
1) People who may be displaced
2) People who may lose their asset (Land/ Trees/ crops/ Structure)
3) People those who are tenants / Agriculture or others and may be affected.
4) Concerned government Officials / NGOs
5) Concerned government Officials / NGOs related to (Pollution /Nature/ Water etc)
6) People who may be affected by pollution and construction works during construction (Air/ Noise/ Road Closure - Living Nearby / Business in the Area)

தமிழ்நாடு அரசு
நெடுஞ்சாலைத்துறை
சென்னை சுற்றுவட்டச்சாலைத் திட்டம்

பொது அறிவிப்பு

Source： HMPD

Figure 11.5.2 Public Notice on English Newspaper (left) and for Tamil Paper/Posting/Handout (right)



HIGHWAYS DEPARTMENT, GOVT. OF TAMILNADU,
CONSTRUCTION & MAINTENANCE - CHENNAI CIRCLE
Chennai Peripheral Road - Project brief for Section - 1

Highways Department, Govt of Tamilnadu has proposed to develop Chennai Peripheral Road (CPR) connecting Ennore Port and Mamallapuram via Thatchur-Thamaraipakkam-Thruvallur-Sriperumbudur-Sigapermal koil. The length of project road is 133.65 km which is split into 5 sections. Section-1of the CPR starts from Ennore Port and ends at Thatchur on NH-5 (25.50 km).

The proposed road will connect the Ennore Port and NH-5 near Thatchur. A link road is proposed from this road to TPP road for a length of 4.35km. This section -1 is a 4-lane road with 2-lane service roads and footpaths on both sides. 100m wide RoW is proposed to accommodate various utilities in-between the main road and service road.

9 numbers of underpasses at all major & minor road crossings and 2 numbers of Road over-bridges at railway crossing are proposed. A 2.60km long major bridge is proposed at Buckingham Canal and Ennore creek near Kattupalli. 1 minor bridge and 47 culverts are proposed for drainage, irrigation canals and utility crossings.

The road passes through 15 villages of Ponneri taluk of Thruvallur District namely, Kattupalli, Voyalur, Neidhavoyal, Kalpakkam, Nalur, Anuppampattu, Vannivakkam, Amur, Thatchur, Jaganathapuram, Panchetti, Kollati, Nandiambakkam, Minjur, Vallur.

266.15 Ha of Land acquisition involving 1747 survey numbers is proposed, out of which 46.18Ha is Govt land and 219.97 Ha is private land. LA will affect 222 buildings, 249 families and 16 common properties like religious & educational structures.

This roads affects 587 trees out of which 406 trees will be moved out and transplanted. 181 trees of girth size varying from 900-1800mm will be cut and 1810 new trees will be planted to compensate the cut trees.

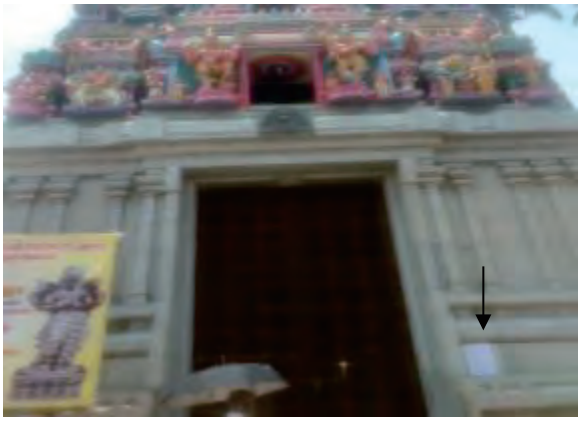
Total Project cost will be around Rs.2750 crores.

Source： HMPD

Figure 11.5.3 Handout Explaining Section 1

Display the Notice in Bus Stops

Display the Notice in Schools



Display the Notice in Temples

Display the Notice in the VAO

Inviting General Public

Inviting Government Officials

Source : HMPD

Figure 11.5.4 Publication of Information about the First Meetings

(2) Summary of the First Meetings

Table 11.5.2 shows the summary of the first public consultation meetings. Attendance at Minjur was over 250, and at Panchetti was over 90. At both meetings, lady attendants were led by the staff to front row seats saved for them. Also, elderlies were helped by the staff to secure seats.

Table 11.5.2 Summary of the First Meetings

Sl. No.	Description	Minjur	Panchetti
1	Date	11:00 to 14:00, Monday, 9 April 2018	11:00 to 14:00, Tuesday, 10 April 2018
2	Venue	Block Development Office, Minjur	Village Panchayat Office, Panchetti
3	Officials Present	● HMPD Assistant Divisional Engineer, Ponneri and Thiruvallur ● TNRDC, SM ● HMPD Consultant (STUP)	● HMPD Assistant Divisional Engineer, Ponneri and Thiruvallur ● TNRDC, SM ● HMPD Consultant (STUP)
4	No. of Participants	More than 250 including NGOs (lady participants: 45)	More than 90 including NGOs (lady participants: 4)
5	Attendance Signed	145	47

Source: HMPD

(3) Information Dissemination and Discussions in Minjur

The outline of Section 1 of the project was explained in Tamil by HMPD and TNRDC, while the design drawings were posted on the textile surrounding the meeting space.

Queries, suggestions, and replies in the Minjur first meeting are summarized in Table 11.5.3. Among the 21 speakers, two were ladies, and one of them is an Environmental Expert. It was promised that the affected land survey numbers and R&R policy draft framework will be disclosed in the next consultation meeting.

Figure 11.5.5 shows photos taken in the Minjur meeting.

Table 11.5.3 Queries, Suggestions, and Replies in the Minjur First Meeting

No.	Name	Queries/Suggestions	Replies
1	Mr. Vinayagamoorthi, Pattamandhiri Village	Ensure the environmental safeguards during project implementation.	The Environmental Management Plan (EMP) is prepared and will be implemented.
2	Mr. Aathiseshan, Mathura Nagar	The local residential area need not be displaced or relocated.	The project is designed in such a way that the identified impacts are minimized to the greatest extent possible.
3	Mr. Vivekanandhan, Pattamandhiri Village	The formation of a link road results in the loss of residential assets, which is objectionable.	The objection was noted.
4	Mr. Rajendran, Pattamandhiri Village	Compensation for the affected assets will not be sufficient. Children attending school will not be affected due to sudden relocation/displacement. The formation of a link road results in the loss of residential assets.	R&R benefits and fair compensation for the affected assets will be disclosed in the next meeting. The project affected families will not be disturbed without prior intimation. The objections were noted.
5	Mr. Sadheshan, Poongamedu Village	The improvement of the existing road is well-appreciated, rather than forming a new link road which displaces a huge number of residents and commercial units.	The objection was noted.
6	Mrs. Sujatha, Mathura Nagar	Planned RoW for the proposed road should be informed well in advance.	Planned RoW's boundary stones are laid already, which will serve as

No.	Name	Queries/Suggestions	Replies
			the proposed boundary for the project.
7	Mr. Tamilselvan, Kollatti Village	The guideline values for LA will not be sufficient considering the present cost of construction materials.	LA compensation will be paid in accordance with the LARR Act of 2013. Details will be disclosed in the next meeting.
8	Mr. Karimullah, Nandiampakkam Village	Is the Outer Ring Road (ORR) Project and the CPRR Project the same?	No. They are separate projects.
9	Mr. Sekar, Siruvakkam Village	Information related to the consultation meeting has not reached all the villages.	The DPR team explained, posters were displayed in all project villages and strategic locations, and VAOs have been contacted and informed to widely inform the meeting details.
10	Mr. Anandham, Anupampattu Village	What will be the proposed road width? What will be the LA process period and the project completion period?	The proposed road width is 100 m. The LA process will be completed in 12 months, and the project completion will be nearly three years.
11	Mr. Gowrisankar, Kesavapuram	Formation of link road results in loss of residential assets.	The objection was noted.
12	Mr. Balaji, Nandiampakkam Village	The project details will be disclosed in the website of the respective government departments.	The project details and other information will be disclosed in the website in the near future.
13	Mrs. Nariyini, Environmental Expert	What mitigation is proposed for the impacted water bodies and affected trees?	Bridges are proposed for water body crossings and compensatory trees will be planted at the rate of 1:10 for affected trees.
14	Mr. Umapathy, Ramanaa Nagar	The coordination with line departments in the road project was found to be poor in some of the ongoing projects.	As the CPRR Project is a major project, the coordination team with all line departments will be formed for smooth progress.
15	Mr. Elumalai, Pattamandiri	The environmental status of the region will be affected due to the project.	EMP is prepared which will be implemented to mitigate/minimize the impacts.
18	Mr. Venkateshwaralu, Nandiampakkam Village	What will be the compensation for the affected assets? Will there be compensation for other assets like compound wall, water sump, septic tank, and EB box?	The structural compensation for all the assets that are likely to be affected will be paid in accordance with the policy framework.
19	Mr. Jeyavel, Pattamandiri	The loss of residential assets due to a link road in Poongamedu Village and Pattamandhiri Village will be more vulnerable and may lead to suicidal attempts.	The objection was noted.
20	Secretary, Residential Association + Residents of Poongamedu	The formation of a link road results in the loss of residential assets.	The objection was noted.
21	Secretary, Residential Association + Residents of Pattamandhiri	The formation of a link road results in the loss of residential assets.	The objection was noted.

Source: HMPD

Source : HMPD

Figure 11.5.5 Photos of the Minjur First Meeting

(4) Information Dissemination and Discussions in Panchetti

The information of Section 1 was explained by HMPD, TNRDC, and HMPD Consultant using Tamil language. The design drawings were posted on the textile surrounding the meeting space.

Queries, suggestions, and replies in the Panchetti First Meeting are summarized in Table 11.5.4. All 12 speakers were men. No speaker was introduced as a representative of an NGO. It was promised that the affected land survey numbers and the R&R policy draft framework will be disclosed in the next consultation meeting. Figure 11.5.6 shows photos taken in the Panchetti meeting.

Table 11.5.4 Queries, Suggestions and Replies in the Panchetti First Meeting

No.	Name	Queries/Suggestions	Replies
1	Mr. Babu, Athipedu Village	Will the existing utilities be relocated by acquiring additional land?	No. The utilities will be relocated within the PRoW.
2	Mr. Panchu Naidu, Athipedu Village	The newspaper called "The Hindu" published news on 15 April 2015 that the width of the road has been revised. Is it so?	The width of Section 1 is not revised. The width of other sections was reduced from 75 m to 60 m due to techno-economical factors.
3	Mr. Krishnakumar, Sriperumpudur	Lots of public consultation meetings held for the CPRR Project in the past couple of years. When the project is likely to be commenced? Please disclose when the project completion is expected.	More public consultation meetings should be held to improve the project and avoid/ minimize impacts. The project is likely to be commenced soon after the LA completion, and the construction period will be three years.
4	Mr. Satyanarayanan, Kattur Village	Explain the entire CPRR and its sections details.	The details of CPRR and its five sections were explained in detail.
5	Mr. Venkatesan, Panchetti Village	The proposed interchange at NH5 is likely to affect the entire industrial unit and the agricultural activities. This will affect the livelihood of several workers in the factory. What will be the R&R compensation and benefits for the affected person?	The loss of livelihood and assets will be mitigated as per R&R policy framework.
6	Mr. Paneerselvam, Panchetti Village	Will subway/pedestrian road crossing facilities be provided at appropriate locations?	The project includes underpasses at appropriate locations.
7	Mr. Rakesh, Panchetti Village	The villagers of Panchetti will not be inclined to welcome the project, as there will be huge impacts to assets and lands.	The objection was noted.
8	Mr. Manikandan, Athipedu Village	The agricultural land will be affected, and the loss of livelihood for the local people will result in the resistance to the proposed project. The project seems to be affecting the agricultural activities of the region.	As the project is a linear one, not much impact on agricultural activities. Culverts are proposed at 150 m intervals (approximate) for facilitating agricultural activities.
9	Mr.VenkateshwaraRao, Ponneri	Will the proposed road improve the connectivity to schools located at Ponneri, so that the neighboring school goers will be benefited?	The service roads proposed on both sides, which connect all the cross roads, will improve the connectivity and accessibility of the project area.
10	Mr. Damodaran, Alenchavakkam	What is the status of the Maduravoyal elevated road?	The status of the Maduravoyal elevated road is not related to the proposed CPRR.
11	Mr. Vetrivel Anandan, Amur Village	What are all the survey numbers affected and will LA compensation be paid without any delays?	The affected survey numbers and LA compensation will be disclosed in the next meeting.
12	Mr. Babu, Athipedu Village	What arrangements will be made for relocating cultural properties?	The cultural properties will be relocated within the same location.

Source: HMPD

Source: HMPD

Figure 11.5.6 Photos of the Panchetti First Meeting

11.5.2 Second Public Consultation Based on JICA Guidelines

The second public consultation on the draft EIA and the draft RAP was held on Friday to Saturday, 11 to 12 May 2018.

(1) Planning and Notices

The same venues used for the first public consultation were selected for the second consultation. The measures for notifying about the meeting were also the same with the ones taken for the first meetings.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">Display the Notice in VAOs</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Display the Notice in Fair Price Shop (PDS)</td><td>Display the Notice in Clinics (Primary Health Centre)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Display the Notice in Bus Stops</td><td>Display the Notice in Temples</td></tr>
</table>

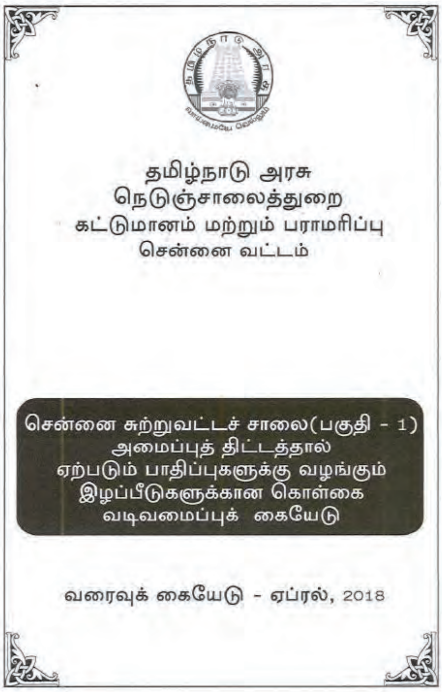
Source: HMPD

Figure 11.5.7 Publication of Information about the Second Meeting

தமிழ்நாடு அரசு, நெடுஞ்சாலைத்துறை

சென்னை சுற்றுவட்டச்சாலைத் திட்டம்

பொது அறிவிப்பு



Source: HMPD

Figure 11.5.8 Announcement to the General Public (the Notice) and the Cover Page of the Draft Handbook on Policy Framework Distributed in the Meeting (Tamil)

(2) Summary of the Second Meetings

Table 11.5.5 shows the summary of the second public consultation meetings. There were over 200 participants in Minjur, and over 90 in Panchetti. At both meetings, lady attendants were led by the staff to front rows seats saved for them. Also, elderlies were helped by the staff to secure seats.

Table 11.5.5 Summary of the Second Meetings

No.	Description	Minjur	Panchetti
1	Date	11:00 to 14:00, Friday, 11 May 2018	11:00 to 14:00, Saturday, 12 May 2018
2	Venue	Block Development Office, Minjur	Village Panchayat Office, Panchetti
3	Officials Present	● HMPD Assistant Divisional Engineer, Ponneri and Thiruvallur ● TNRDC, SM ● HMPD Consultant (STUP)	● HMPD Assistant Divisional Engineer, Ponneri and Thiruvallur ● TNRDC, SM ● HMPD Consultant (STUP)
4	No. of Participants	More than 200 including NGOs (lady participants: 22)	More than 75 including NGOs (lady participants: 1)
5	Attendance Signed	63	22

Source：HMPD

(3) Information Dissemination and Discussion in Minjur

The handbook containing information on the compensations for loss of assets, assistances for resettlement and relocation, and assistances for livelihood rehabilitation was handed to every participant (Figure 11.5.8). HMPD, TNRDC, and the HMPD Consultant explained the information in Tamil language. Ten attendants expressed their questions and opinions (Table 11.5.6). Among the ten participants, two were ladies. None of them was a representative of an NGO.

Table 11.5.6 Queries, Suggestions, and Replies in the Minjur Second Meeting

Sl. No.	Name	Queries/Suggestions	Replies
1	Mr. Vinayagamoorthi, Pattamandhiri Village	The TPP Link Road proposal affects a lot of houses. What is the response from the Government of Tamil Nadu (GoTN) for the objections raised by the residents of Poongamedu, Pattamandhiri, and Mathura Nagar to drop the TPP Link Road proposal?	The outcome of the meeting held on 09 May 2018 in Minjur has been submitted to the department, and the decision will be intimated to the residents as soon as the decision is given by GoTN.
2	Mr. Aathiseshan, Mathura Nagar	The residents constructed houses in lands approved by the Chennai Metropolitan Development Authority (CMDA). No communication is made to the public about the proposed road alignment at local/CMDA level during approvals.	The 15 (2) Notifications are already issued for nine villages and will be issued to remaining villages within two months.
3	Mr. Kannan, Pattamandhiri Village	Re-examine the possibility of removing or realigning the TPP Link Road.	The suggestion was noted.
4	Mrs. Buvaneshwari, Pungamedu Village	The proposed TPP Link Road affects houses which causes suffering from mental depression, insecure state of mind, and sleepless nights.	The objections were already communicated to the department. The decision on the TPP Link Road proposal will be communicated to the public at the earliest time.
5	Mr. Sakthikumar, Pungamedu Village	GoTN is not responding properly to the public's demand on dropping the TPP Link Road proposal. What is the action taken by GoTN for the collective agitation shown during previous meeting held in April 2018? What will be the actual land compensation value?	The objections raised by people in the consultation meeting held in April 2018 were communicated to the department. The decision will be intimated to the residents as soon as the decision is taken by GoTN. The draft hand book on policy framework for compensation to losses are issued to PAHs and are explained in the meeting.
6	Mr. Mohan, Ganga Nagar, Nandiampakkam Village	The project has been discussed three years ago, but until now, no improvement has been found on the implementation. Who is responsible for the LA in the proposed CPRR? In what way will the rights of the PAHs be secured? Which cost will be considered to arrive at the LA cost?	The project is now in its final shape and will be implemented at the earliest time. The institutional arrangements are given in the handbook which is explained in the meeting. The rights of PAHs will be safeguarded through the appointed Social Safeguard Specialist and NGO. Moreover, the JICA-funded projects will primarily focus on safeguarding the rights of the PAHs and will ensure no one will be dislocated without paying the compensation. As per the LARR Act, LA cost will be the higher of the guideline value and the market value.
7	Mr. Karthik, Pungamedu Village	Affected house is constructed on CMDA approved plot by investing all hard-earned money from Dubai. The family has six females and all are now feeling insecure. The family hesitates to send the head of the	The objections are noted and communicated already to the department. The decision on the TPP Link Road proposal will be communicated to the public at the earliest time.

Sl. No.	Name	Queries/Suggestions	Replies
		household for the job in Dubai due to this project. If asked to be displaced during the absence of the head of the family, the entire family setup will collapse. TPP Link Road will be dropped considering the socio-economic condition of PAHs.	The PAHs will not be displaced without any prior intimation.
8	Mrs. Sujatha, Retired Teacher, Pattamandhiri Village	What is the action taken by GoTN for the collective agitation shown during previous meetings held in April 2018? The residential asset was constructed by investing all hard-earned income. Difficulties were encountered in repaying the loan amount. The TPP Link Road proposal will be dropped considering the socio-economic condition of the PAHs.	The objections raised by people in the consultation meeting held in April 2018 were communicated to the department. The decision will be intimated to the residents as soon as the decision is made by GoTN.
9	Mr. Mohan Kumar, Pungamedu Village	There were phone calls received regarding the social surveys. As the project is not being accepted, why participate in the surveys?	The social surveys are conducted to understand the socio-economic profile of PAHs which will be useful to arrive at a better compensation. It is not compulsory, or the HD never forced any PAHs to provide socio-economic details.
10	Mr. Ramalingam, Nandiampakkam Village	The TPP Link Road proposal should be dropped.	The objection was noted.

Source: HMPD

Source: HMPD

Figure 11.5.9 Photos of the Minjur Second Meeting

(4) Information Dissemination and Discussion in Panchetti

1）Summary of the Meeting and Discussions

The handbook containing information on the compensation for loss of assets, assistances for resettlement and relocation, and assistances for livelihood rehabilitation was handed to every attendant (Figure 11.5.8). HMPD, TNRDC, and the HMPD Consultant explained the information in Tamil language. Ten attendants expressed their questions and opinions (Table 11.5.7). Among the ten participants, one was a lady. One speaker introduced himself as a local media reporter.

Table 11.5.7 Queries, Suggestions, and Replies in the Panchetti Second Meeting

Sl. No.	Name	Queries/Suggestions	Replies
1	Mr. Viswanathan, Panchetti Village	The land to be acquired for the construction of NH5 has a high commercial value. Various infrastructure projects within the vicinity of the area affect a lot of people in and around Panchetti. When will the 15 (2) Notification be issued?	The technical feasibility determines the requirement for an intersection in NH5. The 15 (2) Notification is already issued already to nine villages. The notification for the remaining villages will be issued within two months. The objections are noted.
2	Mr. Kiran Kumar, Panchetti Village	Information must be explained in Telugu language. Also, the ID cards of the team were requested to be showed. The land on NH5 is to be acquired for the interchange. How can the GoTN implement the project without getting consent from 75% of PAHs? The alignment can be changed through open lands in Kaverapettai Village. How will the affected irrigation source be compensated?	The villagers in Amur, Moolathangal, etc. welcome the project, as the proposed road will improve connectivity and access to schools, markets, and health facilities. The alignment of CPRR is finalized considering all the options. The irrigation source, like open well and borewell, will be paid as per PWD SOR rate without depreciation.
3	Mr. Mahesh, Panchetti Village	Who is the prime beneficiary of the project? The general public or private ports in Ennore.	The project will decongest the traffic within CMA and will provide connectivity to the villages along the alignment. The Ennore Kamarajar Port connectivity will accelerate the economic growth of the state.
4	Mr. Satyamurthy, Arakonam Taluk	Will the CPRR pass through Arakonam Taluk in Vellore District?	The project transverses the Thiruvallur District and the Kanchipuram District only.
5	Mr. Paneerselvam, Panchetti Village	Will subways/pedestrian road crossing facilities be provided at appropriate locations?	The project includes vehicular underpasses (VUPs) and light vehicular underpasses (LVUPs) at appropriate locations.
6	Mr. Manikandan, Athipedu Village	The agricultural land is affected by the project which in turn means loss of livelihood for the local people. The project seems to be affecting agricultural activities of the region.	As the project is linear, there is not much impact on agricultural activities in the region. Culverts are proposed at 150 m intervals (approximate) to facilitate agricultural activities.
8	Mr. Venkatesan, Panchetti Village	The people in this locality already lost considerable land in the GAIL Project, the TNEB HT Line, and the NHAI Projects. What happened to the queries raised during the last consultation meeting to avoid intersection of proposal at Panchetti? How will the loss of livelihood in the commercial units be mitigated?	The objections are noted. The objections raised by people in the consultation meeting held in April 2018 were communicated to the department. The decision made will be intimated to the residents as soon as the decision is taken by GoTN. The compensation to losses will be made as per the act. Moreover, the JICA-funded projects will primarily focus on safeguarding the rights of the

Sl. No.	Name	Queries/Suggestions	Replies
			PAHs and ensure compensation for the loss of livelihood of the affected traders.
9	Mr. Palayam, Moolathangal Village	What arrangements will be made for relocating cultural properties? What will be the relocation arrangements for the affected school and Temple at Moolathangal Village?	The cultural properties and schools will be relocated within the same village.
10	Mr., Abubakkar, Media Reporter, Panchetti Village	What arrangements will be made to assess the environmental condition and how will it be protected during the construction phase?	Baseline environmental monitoring has been carried out for air, noise, soil, and water parameters, and the same will be checked during and post-construction stages. The EMP has been prepared to mitigate any issues observed during construction. JICA assisted projects will consider social and environmental safeguards as major components of the road project.

Source: HMPD

Source: HMPD

Figure 11.5.10 Photos of the Panchetti Second Meeting

11.5.3 Focus Group Discussions with Vulnerable Groups

A total of six informal discussions were held at five villages which were to be affected by the Main Road during the surveys in 2017 and 2018.

(1) Discussions at Siruvakkam Village in 2017

Informal group discussion was held in Siruvakkam Village in September 2017, wherein all residents belonged to vulnerable groups. Around ten people participated in the session. The following information was obtained during the discussion:

- All residents in Siruvakkam Village belong to the Scheduled Caste population.
- The people in this village work as agricultural labourers.
- The houses are built under the Indravikas Awas Yojana (IAY) program, or the public housing program for lower income households
- People belonging to vulnerable groups requested resettlement houses within the same village.

(2) Focus Group Discussion with Agricultural Labourers Working on the Affected Land

Discussions with agricultural labourers were held in Amoor, Anupampattu, Siruvakkam, Moolathangal, and Jaganathapuram from May to June 2018, where around 75 workers participated. The major outputs of the discussion are described as follows:

- The agricultural labourers will not lose employment by loss of land, as the project is a linear project.
- The labourers shall get employment opportunities in other land parcels within the same village.
- The road shall improve the region by providing better access to schools, colleges, employment, and health facilities.

Source：DPR RAP July 2018

Figure 11.5.11 Focus Group Discussion with Agriculture Labourers Working on the Affected Land

11.5.4 Actions Taken Following the Results of Public Consultations

As stated above, public consensus from PAHs and local residents were not fully achieved for the TPP Link Road (Original Alignment) in the Minjur meetings. Given this condition, the project owner, HMPD, therefore, studied alternate alignments to minimize the impacts and decided to change the alignment of the TPP Link Road as explained in Section 11.6.

11.6 Environmental and Social Considerations of the TPP Link Road (New Alignment)

This section is structured as follows:

- 11.6.1 and 11.6.2 explains the process of selection of the new alignment for the TPP Link Road.
- 11.6.3 covers Environmental Impact Assessment (EIA) for Section 1 (Main Road and TPP Link Road (New Alignment)).
- 11.6.4 covers land acquisition and resettlement for Section 1 (Main Road and TPP Link Road (New Alignment)). After a short summary for entire Section 1, however, the remaining pages describe the survey results on PAHs/PAPs of the TPP Link Road (New Alignment).
- 11.6.5 describes stakeholder meetings and public consultations conducted regarding the TPP Link Road (New Alignment).

Although HMPD and the HMPD Consultant use the term 'CORR-CPR Link', this report uses 'TPP Link Road (New Alignment)'. This is because the road section connects TPP Road and CPRR, and also because it is a new alignment selected after public comments were reflected.

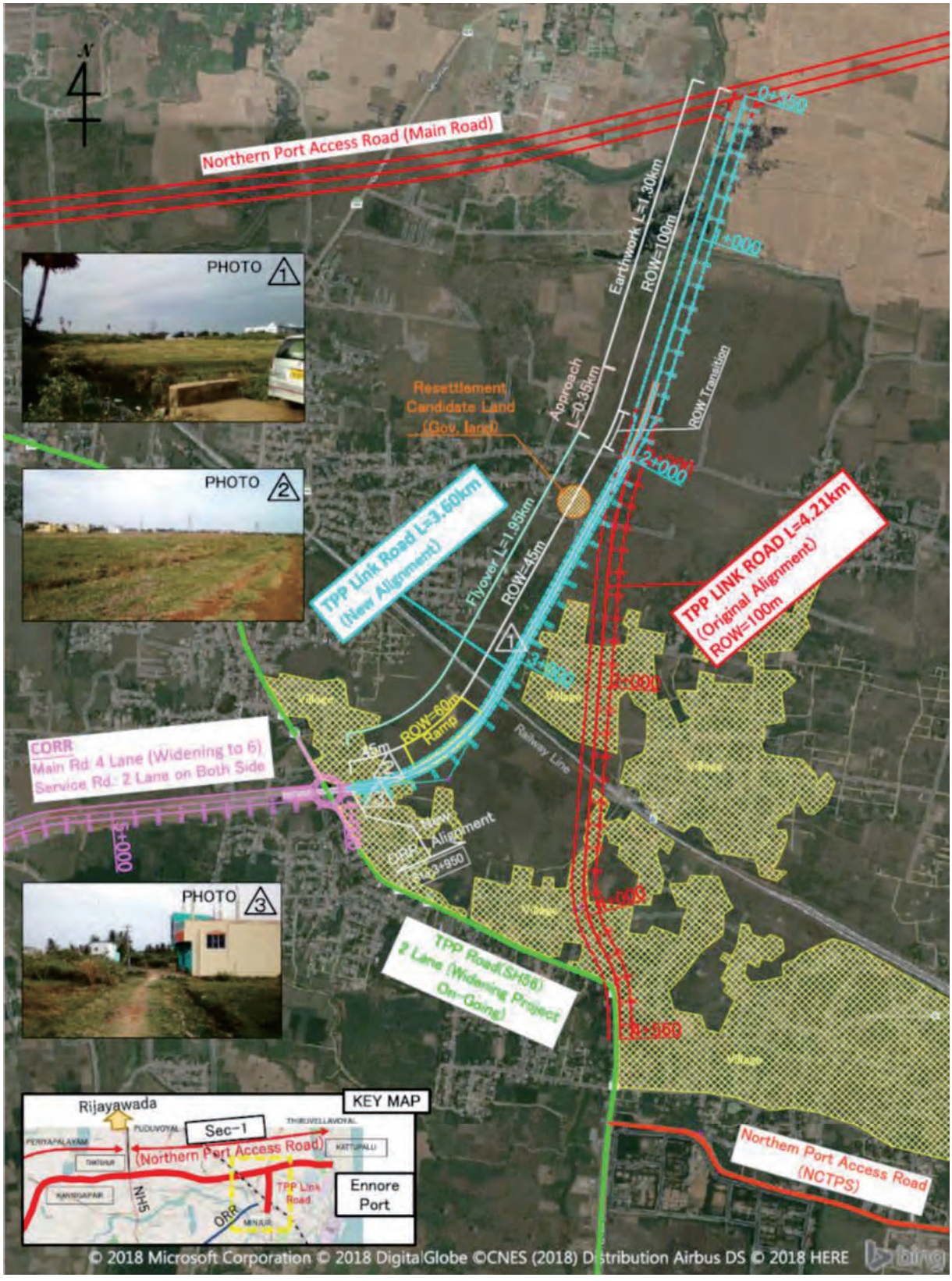
11.6.1 Outline of Alternative Alignment

(1) Background

A road stretch of about 2 km at the south end of the TPP Link Road (Original Alignment) passes through a residential area which affects around 166 structures, while causing impact on 206 structures in the entire Section 1. On the consultation with PAPs, most inhabitants expressed opposing opinions on the construction of the TPP Link Road (Original Alignment). During the public consultation meeting hosted by DRO, PAPs demanded to change the alignment. As a result, JICA requested HMPD to arrange another meeting to fully explain the project to PAPs and to examine a means of reducing social impact from the construction of Section 1 including the TPP Link Road.

(2) Outline of Alternative Alignment

As described in Section 11.6.2 Alternative Study, Alternative 1 was selected as the most appropriate. Figure 11.6.1 shows locations of the TPP Link Road (New Alignment) and vicinity roads.



Source: JICA Study Team

Figure 11.6.1 Alignment Change Plan of TPP Link Road

The selected alternative route originates at Ch.6+200 of CPRR and connects to the junction of the Outer Ring Road (ORR) and the TPP Road (SH56) at Minjur, which will be constructed in the future. The road length is 3.60 km. From comparison with the original alignment, at the southern section of Ch.2+000, a length of 1.95 km is shifted to west side and connected to Minjur. The alternative alignment is considered to minimize social and environmental impacts, especially resettlement and local community severance. To realize this, the route was shifted to avoid a built-up area and apply narrow ROW by adopting flyover structure instead of earthwork. The ROW of the new alignment is 100 m from the beginning point to Ch.1+650, and the rest of the section is basically 45 m, except for the 60 m at the ramp section.

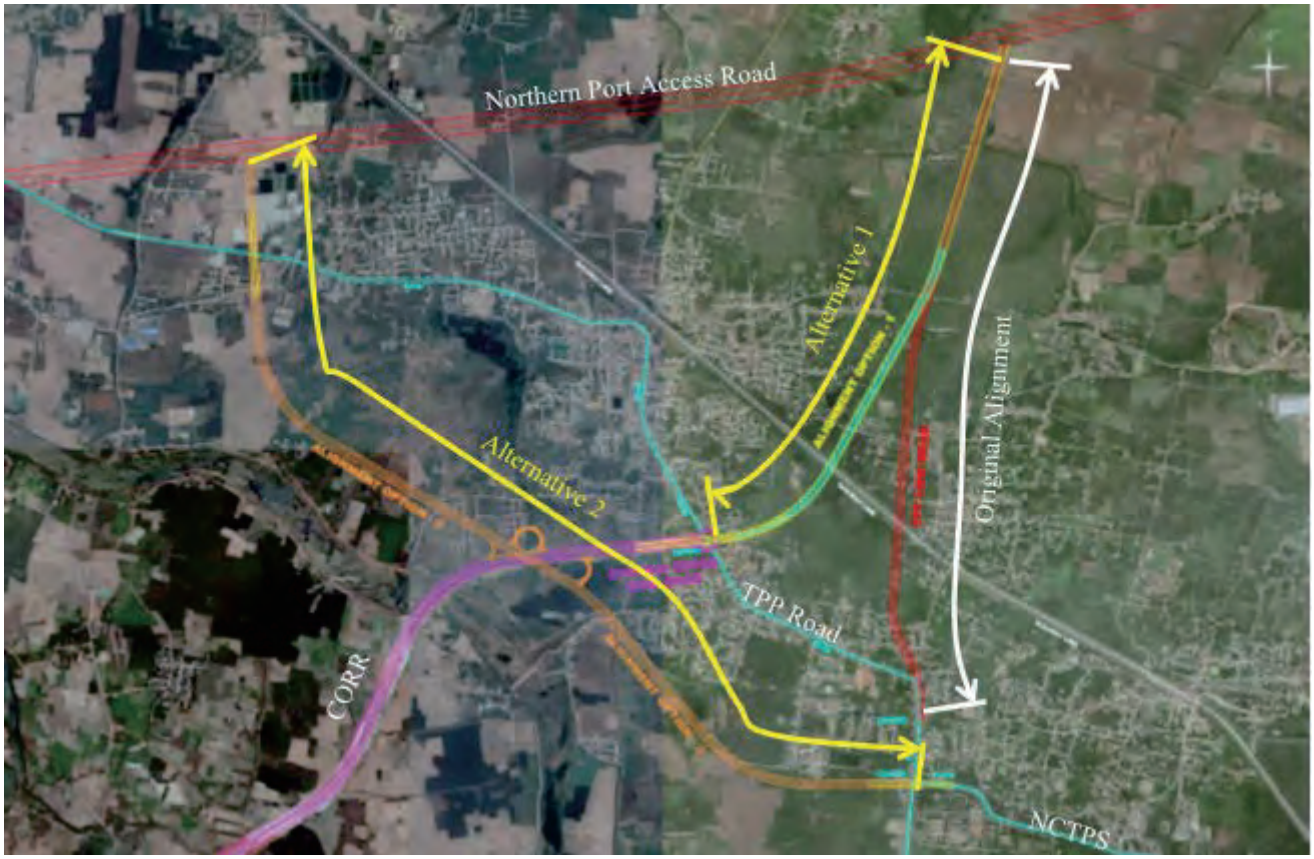
11.6.2 Alternative Study

(1) Alternative Route Comparing Study

HMPD carried out a comparative study on the two alternative routes. The outline of the alternative routes are shown in Figure 11.6.2.

Alternative 1: Connecting CPRR to the junction of ORR and TPP Road (SH56)

Alternative 2: Construct a bypass through the Minjur built-up area and make a connection from ORR to CPRR and North Chennai Thermal Power Station



Source: JICA Study Team added based on data from HMPD

Figure 11.6.2 Comparing of the Alternative Route Plan of the TPP Link Road

The results of the comparative study are shown in Table 11.6.1. Alternative 1 was selected as the most appropriate, mainly from the viewpoint of the benefits on transport.

Table 11.6.1 Comparative Route Study of the TPP Link Road

No.	Item	Alternative 1	Alternative 2	Original Alignment
1	Outline	Extend ORR from TPP Road to CPRR	Connect with New Bypass among CPRR, ORR, and NCTPS	Connect TPP Road and CPRR
2	Length	3.60 km	6.1 km	4.21 km
3	Length in Structure	1.95 km Flyover 1.65 km Earthwork	6.1 km Earthwork	4.21 km Earthwork
4	Remarkable Structure	Flyover = 1.95 km Minor Bridge (MNB) = 1 Toll Gate= 1	Interchange (partial cloverleaf) = 1 VUP/LVUP = 2 MNB = 1 Toll Gate = 1	ROB = 1 VUP/LVUP = 2 MNB = 1 Toll Gate = 1
5	Connectivity of ORR and Ennore Port	• Connect from ORR EP to CPRR to the north entrance of Ennore Port via CPRR • Connect from ORR EP to the south entrance of Ennore Port via TPP Road and NCTPS	• Connect from ORR EP to the north entrance of Ennore Port via CPRR • Connect from ORR EP to the south entrance of Ennore Port via NCTPS	• Connect from ORR EP to the north entrance of Ennore Port via TPP Road and CPRR
6	Distance to the Entrance of Ennore Port North South	(From TPP Road Connection) 9.9 km 11.6 km	(From around ORR EP) 12.7 km 10.1 km	(From TPP Road Connection) 10.9 km 12.6 km
7	Land Acquisition Area	24.50 ha	29.78 ha	38.59 ha
8	No. of Affected Private Structures	20	12	166
9	No. of Residents to be Relocated	82	49	680
10	Merit	• The shortest driving distance from ORR to Ennore Port gives the best benefit to transport. • No interchange construction is required due to direct connection with ORR. • The required land area is small compared to the all alternatives. Resettlement is also few comparing with the Original Alignment.	• There is no railway crossing. • Distance from ORR to the south entrance of Ennore Port is the shortest in all alternatives. (But it passes local road, TPP Road in most section) • Required land area and resettlement is very small relative to the Original Alignment.	-
11	Demerit	• Resettlement is slightly larger relative to Alternative 2.	• Accessibility from ORR EP to the Ennore Port entrance only by highway is relatively low because of the detour route. It gives poor economic rationality. • Route from ORR to the south entrance of Ennore Port passes TPP Road as a local road. It encounters smooth traffic and good environment. • It requires costly interchange construction because of ORR connectivity.	• The largest resettlement. • Route from ORR to the south entrance of Ennore Port passes TPP Road as a local road. It encounters smooth traffic and good environment.
12	Rank	**1st**	**2nd**	**3rd**

Source: JICA Study Team prepared based on data from HMPD

(2) Approval of New Alignment

Based on the above alternative study, the Technical Committee of HMPD carried out a site inspection on 18 June 2018 and submitted study results to the Technical Committee on 20 June 2018. The Technical Committee recommended Alternative 1 as the most appropriate plan. After this, the Chief Engineer (H), (C&M) of HMPD held a Steering Committee meeting, and the recommended plan was officially approved.

On 2 July 2018, the Technical Committee explained to the Additional Chief Secretary the results of the alternative route study and the approved plan of the Steering Committee. Alternative 1 was finally approved and decided to be reflected in the DPR.

11.6.3 Environmental and Social Considerations of TPP Link Road (New Alignment)

(1) Summary of Environmental and Social Considerations

The TPP Link Road (New Alignment) is not significantly different from the TPP Link Road (Original Alignment) with regard to the project components as well as its location, except the 1.95-km elevated section on its south end. The JICA Study Team and the HMPD DPR Consultant conducted a field observation of the TPP Link Road (New Alignment) in July 2018. The impact assessment conducted after the observation concluded that the alignment change of the TPP Link Road causes no change in the impact evaluation explained in Table 11.3.28.

(2) General Condition of the Project Area

The TPP Link Road (Original Alignment) and the TPP Link Road (New Alignment) overlap the first 1.65 km from the diverting point at the Main Road. The remaining 1.95 km section is the genuinely new part of the New Alignment. The southernmost endpoint of the New Alignment is moved about 1.5 km northwest, compared to the Original Alignment.

The land use of the ROW of the 1.95 km section consists of farming land, unused land, planned residential area, and residential area. The composition is basically the same with that of the Original Alignment.

The general condition of the Project Area, therefore, is the same as described in Section 11.3.1 of this report.

(3) Legal Framework of Environmental and Social Safeguards

The legal framework of the environmental and social safeguards for the TPP Link Road (New Alignment) is the same for TPP Link Road (Original Alignment) as described in Section 11.3.2 of this report.

HMPD had a meeting with DOE and reported to the DOE Director the change of alignment on 12 July 2018. In the meeting, the Assistant Environmental Engineer of DOE explained the following points to HMPD: 1) this is a minor alignment change, 2) HMPD must describe the New Alignment in the final EIA report, and 3) the EIA report will be reviewed with the New Alignment, and it is not necessary for HMPD to restart the Environmental Clearance process.

(4) Expected Impacts (Scope)

The project activities and potential impacts expected from the activities of the Main Road and the TPP Link Road (New Alignment) are basically the same with that of the Main Road and the TPP Link Road (Original Alignment), which are described in Section 11.3.3 and Table 11.3.11 of this report.

However, there are potentially new or different impacts caused by the new location of the 1.95-km section of the southern part of the TPP Link Road (New Alignment). There are eight environmental items (i.e., noise, ecosystem, water regime, resettlement, poor, water use, infrastructure, and accidents) were selected as shown in Table 11.6.2.

Table 11.6.2 Scope of Potential Impacts and Changes with the New Alignment of the TPP Link Road

	Impacts	Planning Construction	Operation	Reasons for Evaluation
	Pollution Control			
1	Air pollution	B-	B±	**Construction Phase:** The operation of construction equipment and vehicles may cause air pollution due to the emission of exhaust gases and dusts at the construction and excavation sites. Since the types of civil works and the project area environment are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference in the impact is expected from the alignment change. **Operation Phase:** An increase in the number of vehicles is expected; thus, an increase in the pollution load is also expected. At the same time, smoother flow of traffic is expected from the Project, so a general decrease in the total pollution load in the Chennai area is expected. Since the types of civil works and the project area environment are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.
2	Water pollution	B-	B-	**Construction Phase:** Excavation works and casting bridge piers in the drainages and rivers along the proposed intervals may cause an increase in turbidity. Since the types of civil works and the project area environment are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)) and since the TPP Link Road (New Alignment) does not cross additional water bodies, no difference of impact is expected from the alignment change. **Operation Phase:** Soil runoff from the embankment may cause water pollution in drainages and rivers. Since the types of civil works and the project area environment are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)) and since the TPP Link Road (New Alignment) does not cross additional water bodies, no difference of impact is expected from the alignment change.
3	Waste	B-	D	**Construction Phase**: Wastes, such as excavated soil, pavement materials, steel frames, and used fuel canisters, are expected to be generated. Since the types of civil works are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.
4	Soil contamination	B-	D	**Construction Phase**: Fuel, oil, and chemical leakage from construction sites and stock yards may cause soil contamination. Since the types of civil works are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.
5	Noise and vibration	B-	B±	**Construction Phase and Operation Phase:** Due to the change of alignment, locations that are vulnerable to noise pollution will be changed.
6	Ground subsidence	D	D	**Construction Phase and Operation Phase:** As explained in Table 11.3.28 (Impact Assessment), the bridge piers on soft soil are designed to reach the support layer underneath the soft soil. Soft soil that requires mitigation measures was not found in other parts of the ROW. The negative impact of ground subsidence that require mitigation measures, therefore, is not expected. Since the types of civil works and the project area environment are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.
7	Offensive odor	D	D	No construction component which may cause offensive odor is expected in Section 1. Since the types of civil works are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.
8	Bottom sediment	D	D	No construction component which may cause pollution to the bottom sediment by heavy metals and dioxin is expected for Section 1. Since the types of civil works are the same with Section 1 (Main Road and TPP Link Road (Original

	Impacts	Planning Construction	Operation	Reasons for Evaluation
				Alignment)), no difference of impact is expected from the alignment change.
	Natural Environment			
9	Sanctuary	D	D	Section 1 is not located in or near the designated areas for nature conservation or protection of historical and cultural heritages. No negative impact is expected on those areas. Since the project area environment is the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change. TPP Link Road (New Alignment) does not affect the Coastal Regulation Zone (CRZ).
10	Ecosystem	B−	B−	**Construction Phase:** Due to the change of alignment, the number of affected trees will also be changed.
11	Hydrological situation	B−	B−	**Construction Phase and Operation Phase:** Due to the change of alignment, areas that receive rain drainage, which are located at the southern end of the TPP Link Road (New Alignment), may be affected.
12	Topography and geographical features	B−	D	**Construction Phase:** For the embankment of the proposed alignment in Section 1, large-scale soil excavation is expected; thus, some change in topography is expected around the borrow pit. In addition, soil erosion may be caused by the embankment. Since the types of civil works and the project area environment are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.
	Social and Economic Environment			
13	Involuntary resettlement, loss of land and asset, business relocation	A−	D	**Pre-Construction Phase:** Due to the change of alignment, the number of affected lands, assets, households, and businesses will also be changed.
14	The poor	B−	D	**Construction Phase and Operation Phase:** Due to the change of alignment, the number of poor households to be affected will be changed.
15	Ethnic minorities, indigenous peoples	D	D	Tamil Nadu State designates homelands of the ethnic minorities and indigenous people. Such homelands are not located in the CMA, including the Project Area. Since the project area environment is the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.
16	Local economy, employment and living, livelihood	B+	B+	**Construction Phase:** The procurement of construction materials and the service needs of foods and drinks for the workers shall be generated with employment opportunities. Since the types of civil works and the project area environment are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change. **Operation Phase:** Residents and businesses near the road shall enjoy easier access to employment and customers in the CMA. Positive economic impact shall be generated in the entire CMA since the traffic network and the transportation of goods shall be improved by the Project. Since the project components and the project area environment are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.
17	Land use, local resource use	D	D	Section 1 shall mainly change agriculture lands and vacant lands to road and related facilities. In the long term, the road side area shall be urbanized. Existing land use or local resource use, however, shall not be affected in a drastic or negative manner. Since the project components and the project area environment are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.
18	Water use, water rights	B−	B−	**Construction Phase and Operation Phase:** Due to the change of alignment, the number of affected water use facilities will also be changed.

	Impacts	Planning Construction	Operation	Reasons for Evaluation
19	Existing public facilities, road and transportation facilities, social infrastructure, social services	B−	B±	**Construction Phase and Operation Phase:** Due to the change of alignment, the number of affected public and community facilities will be changed.
20	Social capitals, local decision making systems, social organizations	D	D	An objective for Section 1 is to develop a state highway (SH) at the periphery of CMA. There are no negative impacts expected on social capitals such as NGOs or decision making systems of districts and villages. Since the project components and the project area environment are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.
21	Uneven distribution of project impact and benefit	D	D	No uneven distribution of project impact and benefit is expected in the Project Area/Section 1. Since the project components and the project area environment are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.
22	Local conflicts of interest	D	D	There are no local conflicts of interest among the communities in the Project Area/Section 1. Since the project components and the project area environment are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.
23	Split of community	D	D	**Construction and Operation Phase:** No impact is expected since the alignment of Section 1 is located such that it avoids existing built-up areas. Since the types of civil works and the project area environment are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.
24	Historical heritage, cultural resources	D	D	There are no nationally, state-designated, or district-designated historical and cultural resources located on the ROW of Section 1 or nearby areas. Since the types of civil works and the project area environment are the same with Section 1 (Main Road + TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.
25	Landscape	D	D	Section 1 is to develop an SH at the periphery of the CMA. No specific landscape resources or tourism activities are recognized. The project does not cause any specific negative impacts on landscape. Since the types of civil works and the project area environment are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.
26	Gender	D	D	Section 1 does not cause any specific negative impacts on gender-related issues. Since the project components and the project area environment are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.
27	Children's rights	B−	B−	**Construction Phase and Operation Phase:** Section 1 affects one school building, including classrooms. In case adequate consultation, negotiation, compensation, and assistances are not conducted, and in case the school finds it difficult to continue its services, negative impacts on the right to education of students shall be observed. Since the New Alignment does not affect any additional schools, no difference of impact is expected from the alignment change.
28	Sanitation, public health, transmittable diseases including HIV/AIDS	B−	D	**Construction Phase:** Stagnant water in work areas and stockyards may become breeding spots for mosquitoes that spread diseases. The workers to be employed in the project may include migrant workers. There is a possibility that the number of patients with sexually transmitted diseases, including HIV, will increase. Since the types of civil works and the project area environment are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change. **Operation Phase:** The Project Road/Section 1 is the outermost circular road in CMA. Completion of the Project Road does not

	Impacts	Planning Construction	Operation	Reasons for Evaluation
				generate a wider cross-border movement of population. No significant risk of spread of diseases is expected. Since the project components are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.
29	Work environment, occupational safety, and health	B-	B-	**Construction Phase:** Occupational accidents may occur in work areas. Since the types of civil works are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change. **Operation Phase:** Workers shall be deployed for daily works, such as maintenance and toll station, and for periodic repair works. Those workers may be susceptible to accidents. Since the project components are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.
	Other			
30	Accidents, crime	B-	B±	**Construction Phase and Operation Phase:** Due to the change of alignment, locations susceptible to increase in traffic accidents may be changed. **Operation Phase:** Accidents shall be observed on the new road sections. However, reduction of traffic accidents is also expected by securing pedestrian safety through the construction of footpaths and by reducing traffic jams in Section 1. Since the project components and the project area environment are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.
31	Climate change, cross-border impacts	B-	B±	**Construction Phase:** Greenhouse gas (CO_2) will be generated from the operation of construction machineries and transportation vehicles. Since the types of civil works and the project area environment are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change. **Operation Phase:** Increase in traffic volume shall result to increase in emission of greenhouse gas. At the same time, the improved traffic condition of the road network, including the Project Road, shall lead to reduced greenhouse gas emission. Since the project components and the project area environment are the same with Section 1 (Main Road and TPP Link Road (Original Alignment)), no difference of impact is expected from the alignment change.

A+/-: Remarkable positive/serious negative impact is predicted.
B+/-: Positive/negative impact is expected to some extent,
C: Extent of impact is unknown (further study is necessary),
D: Impact is very small or nil, and further survey is not required.
Source: JICA Study Team

(5) TOR for Further EIA Study

In the TOR described in Section 11.3.4, Point No. 2 (AAQ2, N2, V2) was set up to record the baseline condition and to monitor impacts of the TPP Link Road (Original Alignment) Project.

Survey point No. 2 is located near the TPP Link Road (New Alignment), 200 m east of the ROW boundary, at Ch.2+950. The surrounding environment of Point No. 2, such as the structure density and the type of ground cover that will affect the significance of impacts of air quality, noise, and vibration, is similar to the environment along the TPP Link Road (New Alignment). With the above reasons, therefore, Point No.2 (AAQ2, N2, V2) is also suitable to record the baseline condition and to monitor impacts of the TPP Link Road (New Alignment) Project.

Based on the above analysis, it was concluded that the TOR in Section 11.3.4 and the survey results obtained and described in Section 9.3.5 are also applicable to the prediction and assessment of the environmental impacts of the Main Road and TPP Link Road (New Alignment) of Section 1.

(6) Survey Results

Environmental impacts on the eight environmental items selected were studied. The impacts were predicted in July 2018 by the JICA Study Team and the DPR Consultant. The results are summarized in Table 11.6.3.

Table 11.6.3 Summary of Survey Results after Alignment Change of the TPP Link Road

No.	Items	Results
5	Noise	● TPP Link Road (New Alignment) will run near the residential area at Ch.2+700 to Ch.3+200 and at Ch.3+700 to Ch.3+900. ● A noise barrier is planned in the above sections. ● During the Construction Phase, HMPD and the Contractor must provide information on the working plan to local residents, implement individual explanation and hearing to schools and hospitals that need special care, and clarify the contact point for complaints and grievances.
10	Ecosystem	● With the construction works of the TPP Link Road (New Alignment), nine trees with girth size below 90 cm shall be transplanted near the original location within the ROW under the supervision of the Thiruvallur District Forest Officer (DFO). ● Other two larger trees shall be felled under the DFO supervision, and 20 trees shall be compensated from the HMPD budget and planted in the area proposed by DFO, which is most likely on the ROW. ● The DPR recommends local tree species such as *Polyaifolia longifolia* (Nettilingham) and *Azadirachita indica* (Neem) for compensation. Also, trees will be planted near the original location or in a connected habitat under the direction of the DFO. Biodiversity in the Project Area, therefore, will be conserved in a long-term basis.
11	Hydrological Situation	● It was found that the TPP Link Road (New Alignment) will not cross water bodies.
13	Involuntary Resettlement and/or Loss of Properties	● It was found that land acquisition of 24.45 ha, removal of 20 residential structures, and relocation of 20 households with 67 members in total will be necessary for the construction of the TPP Link Road (New Alignment).
14	The Poor	● Results of the 17 newly surveyed PAHs of the TPP Link Road (New Alignment) shows that 53% of the PAHs are earning between INR 5,000-15,000. The average monthly household income is INR 15,147. Since the average number of persons per household is 3.9, the average monthly income per capita is estimated as INR 3,883. ● According to the 'Report of the Expert Group to Review the Methodology for Measurement of Poverty' published by the Indian Planning Commission in 2014, the poverty line of the urban area in Tamil Nadu was INR 1,380.36 per capita per month in fiscal year 2011-2012. With an average household size of 3.9, those with a monthly income below INR 5,383 are considered below poverty line. ● In the TPP Link Road (New Alignment), 12% of surveyed households are earning between INR 0-5,000, and 29% are earning between INR 5,000-10,000. Therefore, there is a possibility that slightly more than 12% of PAHs may be earning below poverty line.
18	Water Rights/ Water Use	● There are 20 borewells used by the 20 households to be relocated that will be lost due to the construction of the TPP Link Road (New Alignment). HMPD is responsible for providing sufficient access to drinking water for the relocated households.
19	Existing Infrastructure and Social Services	● No community resource structures will be affected by the TPP Link Road (New Alignment).
30	Accidents	● The TPP Link Road (New Alignment) will be connected directly to the Chennai Outer

No.	Items	Results
		Ring Road (CORR) at an elevated level. Access to the existing TPP Road will be provided with sloping ramps. ● Occurrence of traffic jams and increase in traffic accidents are expected during the construction of overpasses on the TPP Road. On the access ramps, traffic jams and increase in traffic accidents are expected during the Construction Phase and the Operation Phase.

Source: JICA Study Team

(7) Impact Assessment

The reasons for evaluation of environmental impacts of the eight environmental items selected and studied (Table 11.6.3) are summarized in Table 11.6.4. The significance of impacts on each environmental item (A to D) were re-examined. As a result, the significance of evaluation remained the same as described in Table 11.3.28.

Table 11.6.4 Impact Assessment and Evaluation

	Impacts	Scoping of Potential Impacts		Impact Assessment based on Baseline survey		Reasons for Evaluation
		Planning Construction	Operation	Planning Construction	Operation	
	Pollution Control					
5	Noise	B-	B±	B-	B±	**Construction Phase**: The operation of construction equipment and generators may generate noise and vibration. **Operation Phase:** An increase of vehicles in the proposed alignment may cause an increase in noise and vibration levels. Noise barrier at elevated roads will mitigate the negative impact on the adjacent residential area. More efficiently distributed traffic brought by the project may alleviate noise in some locations.
	Natural Environment					
10	Ecosystem	B-	B-	B-	B-	**Construction Phase**: The construction of the TPP Link Road (New Alignment) needs to fell two trees over 90 cm in girth. The same number of trees were planned to be felled by the TPP Link Road (Original Alignment). Habitats next to the ROW may be negatively affected by runoff soil from work areas. **Operation Phase:** Habitats next to the ROW may be negatively affected by runoff soil from the ROW. Environmental changes, such as that of land use and increased traffic volume, may negatively affect the roadside ecosystem.
11	Hydrological Situation	B-	B-	B-	B-	**Construction Phase and Operation Phase:** No water bodies will be crossed and no change of watershed is planned by the TPP Link Road (New Alignment). Therefore, water level or run-off speed will not be affected by the change of alignment. It is necessary to understand the existing storm water drainage and areas functioning as detention ponds so that construction works and existence of roads do not cause inundation of surrounding residences during the Construction Phase and the Operation Phase. In addition to the above evaluation, the impact from crossing of canal and other waters by the Main Road was considered. The impact for the Planning and Construction Phase was assessed as B- and for the Operation Phase as B-.
	Social and Economic Environment					
13	Involuntary Resettlement and/or Loss of Properties	A-	D	A-	D	**Planning Phase:** Private lands used for residential purposes will be acquired and will cause relocation and resettlement of 20 households on the TPP Link Road (New Alignment). The number of households to be relocated was significantly reduced from 141 households on the TPP Link Road (Original Alignment). The total number of households to be relocated by the Section 1 (Main Road and TPP Link Road (New Alignment)) Project is 60 households, with an estimated 246 household members. **Construction Phase:** Temporal lease of land may be necessary for the site office, stockyard, and other facilities. With the above evaluation, the impact assessment (Planning and Construction Phase: A-, Operation Phase: D) was not changed from that of Section 1 (Main Road and TPP Link Road (Original Alignment).
14	The Poor	B-	D	B-	D	**Construction Phase:** At least 12% of PAHs by the TPP Link Road (New Alignment), compared to 14%

	Impacts	Scoping of Potential Impacts		Impact Assessment based on Baseline survey		Reasons for Evaluation
		Planning Construction	Operation	Planning Construction	Operation	
						PAHs of Section 1 (Main Road and TPP Link Road (Original Alignment)), earn monthly income below INR 5,000. In case the compensation and assistances are not provided justly, the relocated or affected poor may experience difficulties in recovering their livelihood.
18	Water Use/ Water Rights	B-	B-	B-	B-	**Construction Phase:** Compared to the seven wells to be affected by the TPP Link Road (Original Alignment), 20 wells will be affected by the TPP Link Road (New Alignment). **Construction Phase and Operation Phase:** When compensation and reconstruction of water facilities is not sufficient, negative impact will be felt by the water users. No impact on groundwater level is expected from the project. When unforeseen impacts by the project cause decline of groundwater level, majority of the population in the affected area is expected to suffer since most of the regional population depend on groundwater.
19	Existing Infrastructure and Social Services	B-	B±	B-	B±	**Construction Phase and Operation Phase:** Compared to the five community resource structures to be affected by the TPP Link Road (Original Alignment), no such facilities will be affected by the TPP Link Road (New Alignment). Construction of the Main Road of Section 1 will affect 11 facilities. In case appropriate relocation and reconstruction is not achieved for those facilities, their service may need temporal closure. **Operation Phase:** The Project Road will connect the local area with other parts of the CMA. Improved connectivity may lead to modernization and renovation of existing social infrastructures and services.
	Other					
30	Accidents	B-	B±	B-	B±	**Construction Phase:** Traffic regulation at intersections with existing roads may lead to increase in traffic accidents in both the TPP Link Road (New Alignment) and the TPP Link Road (Original Alignment). **Operation Phase:** Accidents will be observed on the new road sections. However, reduction of traffic accidents is also expected by securing pedestrian safety through the construction of footpaths on service roads and by reducing traffic congestions through the construction of the TPP Link Road (New Alignment). In addition to the above evaluation, potential accidents as well as potential improvement of road safety at the Main Road were taken into consideration to reach the impact assessment of B- for the Planning and Construction Phase and B± for the Operation Phase.

A+/-: Remarkable positive/serious negative impact is predicted.
B+/-: Positive/negative impact is expected to some extent.
C: Extent of impact is unknown (further study is necessary).
D: Impact is very small or nil, and further survey is not required.
Source: JICA Study Team

(8) Mitigation Measures and Implementation Budget

Mitigation measures and implementation budget of Section 1 with the TPP Link Road (New Alignment) are the same as described in Section 11.3.7.

(9) Monitoring Plan

The monitoring plan of Section 1 with the TPP Link Road (New Alignment) is the same as described in Section 11.3.8.

(10) Implementation Mechanism of Mitigation and Monitoring Measures

The implementation mechanism of mitigation and the monitoring measures of Section 1 with the TPP Link Road (New Alignment) is the same as described in Section 11.3.9.

(11) Grievance Redressal Mechanism

The grievance redressal mechanism of Section 1 with the TPP Link Road (New Alignment) is the same as described in Section 11.3.10.

11.6.4 Land Acquisition and Relocation of Residents and Businesses Caused by TPP Link Road (New Alignment)

(1) Necessity of Land Acquisition and Relocation of Residents and Businesses

The construction of Section 1 (Main Road and TPP Link Road (New Alignment)) requires land acquisition for the new alignment as shown in Table 11.6.5. The new alignment is located mainly on agricultural lands and vacant lands to minimize resettlement; however, there are residents and businesses still on the ROW and must be relocated.

Table 11.6.5 Plan of Section 1 (Main Road and TPP Link Road (New Alignment))

	Section 1		
	Total	Main Road	TPP Rink Road (New Alignment)
New Alignment (length)	25.11 km	21.51 km	3.60 km
Expansion of Existing SH (length)	0 km	0 km	0 km
Total Length	25.11 km	21.51 km	3.60 km
Width of ROW (main carriage way)	45 m – 100 m	100 m	1.65 km: 100 m 1.95 km: 45 m – 60 m
Planned Area for Land Acquisition	250.81 ha	226.31 ha	24.50 ha

Source: Land area : HMPD 31 July 2018
Other information: HMPD

(2) Legal Framework of Land Acquisition and Resettlement

The legal framework of land acquisition and resettlement is the same as described in Section 11.4.2 of this report.

With the decision of alignment change, HMPD is to prepare a land plan schedule for the new ROW of the TPP Link Road (New Alignment) to be submitted to the DRO. The DRO is responsible for issuing the 15 (2) Notification under the Tamil Nadu Highways Act to the owners of lands and assets that will be affected.

Issued 15 (2) Notifications on lands and assets that is not necessary for the Project will be cancelled, and no further land acquisition will be carried out.

(3) Size and Target of Land Acquisition and Resettlement

1） Project Affected Structures, Households, and Businesses in Section 1

Project affected households and businesses in Section 1 (Main Road and TPP Link Road (New Alignment)) are shown in Table 11.6.6. In total, 60 structures and households, 8 businesses, and 11 public facilities are to be displaced. The census conducted by HMPD in 2017 recorded the number of households and businesses within the ROW. The size of a household was asked in the Socio-Economic Survey, and the average household size was determined to be 4.1 persons. The number of persons to be displaced was estimated by multiplying the number of PAH by 4.1, thus arriving at 246 persons (60 x 4.1 = 246).

Among the 60 structures to be displaced, 40 structures are located on the ROW of the Main Road and 20 structures are located on the ROW of TPP Link Road (New Alignment).

As shown in Table 11.6.14, the total number of PAPs of the TPP Link Road (New Alignment) was counted as 67 persons.

Information on all the names of absentee land owners and land areas to be affected by the TPP Link Road (New Alignment) was collected from land registration documents. However, all the absentee land owners were not contacted during this Study because of the lack of contact information. It is still possible to secure the necessary budget for land acquisition with the obtained information. In the RAP implementation phase, DRO, HMPD, and NGO will conduct a thorough survey and confirmation of absentee land owners. In case the owner could not be identified in the land acquisition process, HMPD will deposit the compensation in the account of the State Court, and the compensation will be paid to the owner as soon as the owner is identified. With the above coordination, it can be concluded that the existence of missing information at this study phase will not negatively affect the entitlement of PAHs. In addition, best effort was paid to invite absentee land owners to the two public consultations by publishing the notice of the meetings in major newspapers and by posting the notice in public places.

Table 11.6.6 Project Affected Assets in Section 1 (Main Road and TPP Link Road (New Alignment))

			Displaced			Non-Displaced		
Ownership		Category	Main Road	TPP Link Road (New Alignment)	Total	Main Road	TPP Link Road (New Alignment)	Total
Owner	a	Residential	15	12	27	0	0	0
	b	Commercial	4	0	4	0	0	0
	c	Residential and Commercial	2	0	2	0	0	0
	d	Others (i.e. wells)	–	–	–	9	0	9
	e	Abandoned	–	–	–	8	0	8
		Subtotal	21	12	33	17	0	17
Squatters	f	Residential	17	0	17	0	0	0
	g	Commercial	1	0	1	0	0	0
	h	Residential and Commercial	0	0	0	0	0	0
	i	Others	–	–	–	0	0	0
	j	Abandoned	–	–	–	0	0	0
		Subtotal	18	0	18	0	0	0
Tenants	k	Residential	0	8	8	–	–	–
	l	Commercial	1	0	1	–	–	–
	m	Residential and Commercial	0	0	0	–	–	–
		Subtotal	1	8	9	–	–	–
Structures and Households Total	n		40	20	60	17	0	17
Business Total b+c+g+h+l+m	o		8	0	8	0	0	0
Public facilities	p		11	0	11	0	0	0
Non-residential land Owners	q		–	–	–	448	296	744
Workers	r		–	–	–	5	0	5

Squatter: Illegal occupants of private and public land
Source: DPR RAP 2018 p.iv, Table 5.43

2) Census Results on Residents and Assets Owners on the ROW (Excluding Absentee Land Owners)

(a) Land and Asset Survey Results

The land area necessary for land acquisition for Section 1 (Main Road and TPP Link Road（New Alignment)) is 250.81 ha, as shown in Table 11.6.7.

Table 11.6.7 Village-wise Land Area to be Acquired

Sl. No.	Village	Info. Source	Private (m^2)			Government (m^2)	Total (m^2)
			Wet	Dry	Manavari		
	Main Road						
1	Kattupalli	15(2)	2,742	0	0	69,270	72,012
2	Voyalur	15(2)	138,224	0	3,271	258,628	400,123
3.a	Neidhavoyal Block 1	15(2)	66,900	11,296	15,201	117,142	210,539
3.b	Neidhavoyal Block 2	15(2)	93,842	9,633	15,520	74,723	193,718
4	Kalpakkam	15(2)	27,981	0	11,860	77,510	117,351
5	Nalur	LPS	196,720	1,065	53,398	35,642	286,825
6	Anuppampattu	15(2)	73,460	24,785	50,083	10,518	158,846
7	Vannipakkam	15(2)	104,656	6,112	62,517	19,098	192,383
8	Amur	15(2)	144,569	3,423	42,554	39,226	229,772
9	Thatchur	LPS	31,298	22,018	117,505	29,472	200,293
10.a	Panjetty (eastern side)	LPS	0	28,262	0	2,818	31,080
10.b	Panjetty (western side)	LPS	53,986	0	0	2,830	56,816
11	Jaganathapuram	LPS	307	41,565	69,463	1,985	113,320
Subtotal							226.31ha
TPP Link Road (New Alignment)							
3.c	Neidhavayal Block 3	15(2)	96,539	7,295	0	50,714	154,548
12	Kollati	LPS	25,369	0	360	0	25,729
13	Nandiyampakkam	LPS	9,255	1,590	1,190	1,590	13,625
14	Minjur Block 1	LPS	46,761	27	0	4,315	51,103
Subtotal							24.50 ha
Grand Total (ha)							250.81 ha

Source: HMPD, 31 July 2018

Privately-owned structures to be affected by the TPP Link Road (New Alignment) are shown in Table 11.6.8. All 20 structures are used for residence. All housing lots have boundary walls, septic tanks, and wells, which will also be affected. All houses are permanent (concrete) structures, and 14 houses only have one floor.

The TPP Link Road (New Alignment) does not affect public and community facilities such as temples and schools.

Table 11.6.8 Use, Type, and Number of Floors of Structures to be Affected

	No.		TPP Link Road (New Alignment)
Use	1	Residential use (including boundary walls, septic tanks, and wells)	20
	Total		20
Type	1	Concrete (pucca)	20
No. of Floors	1	Ground floor	14
	2	Ground floor +1	5
	3	Ground floor +2	1

Source: 25 July 2018 RAP

All 20 houses will be affected.

Table 11.6.9 Impacts on Structure

Major	Minor	Total
20	0	20

Source: DPR RAP 2018

Nine houses will lose floor areas less than 100 m^2, and 11 houses will lose more than 100 m^2.

Table 11.6.10 Extent of Loss - Floor Area

Sl.No	Floor Area to be Affected	TPP Link Road (New Alignment)
1	Less than 50 m^2	2
2	50 to 100 m^2	7
3	100 to 150 m^2	5
4	150 to 200 m^2	5
5	200 to 250 m^2	1
6	250 m^2 and above	0
	Total	20

Source: DPR RAP 2018

There will be 20 trees lost, which are mainly fruit trees, and the owner will be compensated.

Table 11.6.11 Trees Owned by PAHs and Trees to be Affected

No.	Types	TPP Link Road (New Alignment)
1	Fruit trees	19
2	Timber trees	1
	Total	20

Source: DPR RAP 2018 Table 5.38

(b) Vulnerable PAHs to be Affected

Among the 20 houses to be relocated by the TPP Link Road (New Alignment), 17 households (HHs) were surveyed, and five of the 17 are vulnerable PAHs as shown in Table 11.6.12. No household answered that they earn below poverty line. However, from the monthly HH income in Table 11.6.20, slightly more than 12% of the HHs may be earning below poverty line.

Table 11.6.12 Vulnerable PAHs to be Affected

		TPP Link Road (New Alignment)
1	HH belonging to the Scheduled Caste/Scheduled Tribe	3
2	HH headed by women	2
3	HH below poverty line	0
4	Elderly HH (over 60 years old) without support from other family members	0
5	HH with differently-abled person	0
	Total surveyed (excluding 3 HH not available)	17

Source: DPR RAP 2018 Table 5.46

(c) Willingness to be Relocated to Resettlement Site

A total of 20 structure owners were asked about their willingness to avail the resettlement site. As shown in Table 11.6.13, eight owners expressed their willingness either to be relocated or to be awarded the relocation site as part of their compensation. Nine were undecided, and three were not available for the survey.

Table 11.6.13 Willingness for Resettlement Site

	Willingness for Resettlement Site	TPP Link Road (New Alignment)	Resident Owner	Non-Resident Owner
1	Willing to move to resettlement site	8	5	3
2	Undecided	9	5	4
3	Not available (door locked)	3	2	1
	Total PAHs	20	12	8

Source: 16 July 2018 Census and Baseline Socio Economic Survey for the Alternate Alignment, Table 13, and Annexure-1

(d) Socio-Economic Survey

The Socio-Economic Survey was conducted on the 17 PAHs on the TPP Link Road (New Alignment). Out of the total 20 PAHs, three PAHs were absent and not available during the survey.

a) Household Characteristics

There are 15 HHs headed by a male HH member, and two HHs headed by a woman. There were a total of 67 HH members. The average household size is 3.9 persons per HH. The age structure of the 67 members is shown in Table 11.6.14. Majority is under 35 years old.

Table 11.6.14 Age of the PAH Members

Sl.No	Age Classification	TPP Link Road (New Alignment)
1	Below 18 years	15
2	19 to 24 years	13
3	25 to 35 years	14
4	36 to 45 years	11
5	46 to 60 years	7
6	Above 60 years	7
	Total	67
	PAHs Surveyed	17

Source: 16 July 2018 Census and Baseline Socio-Economic Survey for the Alternate Alignment, Table 16

The mother tongue in 16 HHs is Tamil, and Urdu is spoken in one HH.

Table 11.6.15 Mother Tongue

Sl.No	Mother Tongue	TPP Link Road (New Alignment)
1	Tamil	16
2	Telugu	0
3	Hindi	0
4	Malayalam	0
5	Urudhu	1
	Total	17

Source: 16 July 2018 Census and Baseline Socio-Economic Survey for the Alternate Alignment, Table 21

The practiced religion is Hindu in 15 HHs, and Muslim and Christian is practiced in one HH each.

Table 11.6.16 Religion

Sl.No	Religion	TPP Link Road (New Alignment)
1	Hindu	15
2	Muslim	1
3	Christian	1
4	Other	0
	Total	17

Source: 16 July 2018 Census and Baseline Socio-Economic Survey for the Alternate Alignment, Table 20

When asked about the social stratification, three HHs answered that they belong to the Scheduled Caste. There are 11 HHs, or 43%, that answered that they belong to the Backward Community.

Table 11.6.17 Social Stratification

Sl.No	Social Stratification	TPP Link Road (New Alignment)
1	Other community/general	1
2	Backward community	11
3	Most backward community	2
4	Scheduled Caste	3
5	Scheduled Tribe	0
	Total	17

Source: 16 July 2018 Census and Baseline Socio-Economic Survey for the Alternate Alignment, Table 22

The education profile of the family members is shown in Table 11.6.18. Those with no formal education and who may be illiterate comprise 7% of the total. Those who received higher education after 10 years of elementary and middle school comprise 48% of the total.

Table 11.6.18 Education

Sl.No	Educational Status	TPP Link Road (New Alignment)	%
1	Up to 5th grade	8	12%
2	6th to 8th grade	9	13%
3	9th to 10th grade	12	18%
4	11th to 12th grade	12	18%
5	Diploma	3	4%
6	Graduate	13	19%
7	Postgraduate	5	7%
8	None	5	7%
	Total	67	100%

Source: 16 July 2018 Census and Baseline Socio Economic Survey for the Alternate Alignment, Table 17

The occupations of the HH members is shown in Table 11.6.19. Those who are not in the workforce, including students, elderlies, and housemakers, correspond to about 40% of the total. Among those in the workforce, 14 are unemployed, seven are salaried/pensioned, seven are casual labourers, and five are self-employed.

Since 39 persons are in the workforce in 17 HHs, the average working member per HH 17 is calculated as 2.3 persons per HH.

Table 11.6.19 Occupation

Sl.No	Main Occupation	Number	Workforce/ Not in Workforce	%
1	Not in workforce	28	28	42%
2	Salaried/pensioned	7	39	58%
3	Casual labourer	7		
4	Self-employed	5		
5	Agricultural labourer	2		
6	Agricultural labourer	2		
7	Business/trade	2		
8	Professional	1		
9	Repair/spare parts	1		
10	Unemployed	14		
	Total	67	67	100%

Source: 16 July 2018 Census and Baseline Socio-Economic Survey for the Alternate Alignment, Table 18

The distribution of HH income is shown in Table 11.6.20. About 53% of the HHs falls in monthly income level between INR 5,000 and 15,000. However, there is a large variance of income level. Simple average HH income is calculated as INR 15,147. Using the average HH income of INR 15,147 for an average of 3.9 persons per HH, the average monthly income per person is calculated as INR 3,883.

Table 11.6.20 Monthly Family Income

Sl.No	Monthly Family Income	Nos.	%
1	Less than INR 5,000	2	12%
2	5,000 to 10,000	5	29%
3	10,000 to 15,000	4	24%
4	15,000 to 20,000	1	6%
5	20,000 to 25,000	1	6%
6	25,000 to 30,000	2	12%
7	30,000 to 35,000	1	6%
8	35,000 to 40,000	1	6%
	Total	17	100%
	Average monthly income		15,147

Source: 16 July 2018 Census and Baseline Socio-Economic Survey for the Alternate Alignment, Table 23

According to the 'Report of the Expert Group to Review the Methodology for Measurement of Poverty' published by the Planning Commission in 2014, the poverty line in the urban area of Tamil Nadu in fiscal year 2011-2012 is INR 1,380.36 per person per month. With an average HH size of 3.9, those with a monthly income below INR 5,383 are below poverty line.

In the TPP Link Road (New Alignment), 12% of the affected HHs earn less than INR 5,000, and 29% earn between INR 5,000 and INR 10,000. Therefore, it is assumed that slightly more than 12% of PAHs are earning below poverty line.

b) Period of Stay, Housing Facilities, and Owned Assets

The largest group composed of about 65% of the HHs, or 11 PAHs, have stayed in their homes for 15 to 20 years. The second largest group consists of 29% who have resided between 20 to 25 years. The average length of stay in the dwelling units is 18.7 years. No HH has moved in the recent 10 years.

Table 11.6.21 Stay in the Structure

Sl.No	Stay in the Structure	Nos.	%
1	Less than 5 years	0	
2	5 to 10 years	0	
3	10 to 15 years	1	6%
4	15 to 20 years	11	65%
5	20 to 25 years	5	29%
6	25 to 30 years	0	
7	More than 30 years	0	
	Total	17	100%

Source: 16 July 2018 Census and Baseline Socio-Economic Survey for the Alternate Alignment, Table 26

The conditions of housing facilities are summarized in Table 11.6.22. All HHs have access to public tap or pump and toilet with septic tank. Basic facilities for sanitation are available for all PAHs.

Table 11.6.22 Housing Facilities

	Housing Facilities	No.
1	Having separate kitchen	17
2	Having separate toilet	17
3	Having separate bathroom	17
4	House with electricity	17
5	Drinking water source	17
6	LPG	17
	Total	17

Source: 16 July 2018 Census and Baseline Socio-Economic Survey for the Alternate Alignment, Table 37, 30

All PAHs own a motorcycle, a television, and a mobile phone. Only two HHs own a car and a landline telephone.

Table 11.6.23 Owned

	Assets Owned	No.	%
1	Motorcycle	17	73%
2	Car	2	8%
3	Television	17	99%
4	Refrigerator	14	74%
5	Washing machine	11	49%
6	Telephone – landline	2	4%
7	Mobile	17	95%
8	Cycle	11	86%
	Total	17	100%

Source: 16 July 2018 Census and Baseline Socio-Economic Survey for the Alternate Alignment, Table 37

c) House Expenditure and Access to Infrastructure

The average expenditure on different items is shown in Table 11.6.24. Expense on food is largest, while expense on health is smallest. The average expenditure is INR 12,343 per month.

When asked about health conditions, one out of 17 PAHs was treated in governmental hospitals and two were treated in private clinics. The survey shows that 14 PAHs do not have health insurance. Two PAHs are covered under government insurance, and one PAH is covered under a private insurance.

Table 11.6.24 Average Monthly Expenditure of a Household

Sl.No	Monthly Expenditure	INR
1	Food	5,343
2	Education	1,344
3	Health	1,221
4	Others (rent, transportation)	2,121
	Average total expenditure	12,343

Source: 16 July 2018 Census and Baseline Socio Economic Survey for the Alternate Alignment, Table 27

Table 11.6.25 shows the source of drinking water used by the PAHs. All HHs use water from public taps. Also, six PAHs buy water bottles for drinking water. Since 20 wells are to be affected as shown in Table 11.6.8, it is assumed that public taps are provided in every homestead. No HH answered that women need to cross the road to fetch water. All HHs use LPG for cooking.

Table 11.6.25 Source of Drinking Water

Sl.No	Source of Drinking Water	Nos.
1	Public tap/hand pump	17
2	Others (bottled water, etc.)	6
	Total	17

Source: 16 July 2018 Census and Baseline Socio-Economic Survey for the Alternate Alignment, Table 30

When asked about the mode of public transportation (commute) with multiple answers, the most responses are public buses and private share autos, followed by motorcycles and private buses. (Table 11.6.26)

Table 11.6.26 Mode of Transport

Sl.No	Mode of Commutation	Nos.	%
1	Public buses	12	71%
3	Private share auto	12	71%
2	Motorcycle	11	65%
5	Private buses	10	59%
4	Cycle	4	24%
6	Walk	2	12%
7	Taxi	2	12%
8	Others (i.e., train)	6	35%
	Total	17	

Source: 16 July 2018 Census and Baseline Socio-Economic Survey for the Alternate Alignment, Table 31

d) Condition of Business and Commerce

Although the TPP Link Road (New Alignment) does not affect any business properties, the owner of eight rented houses will lose rental income. As shown in Table 11.6.27, seven out of eight houses are rented with a rate between INR 2,000 and INR 4,000. The average loss of monthly rental income is INR 2,750.

Table 11.6.27 Loss of Rental Income

Sl. No.	Loss of Rental Income	Nos.	%
1	Less than 2,000	1	13%
2	2,000 to 4,000	7	88%
3	4,000 to 6,000	0	0%
4	6,000 to 8,000	0	0%
Total		8	100%
Average loss of income from affected portion		INR 2,750	

Source: 16 July 2018 Census and Baseline Socio-Economic Survey for the Alternate Alignment, Table 10

e) Perceived Positive Benefits and Negative Impacts

The perceived positive and negative impacts of TPP Link Road (New Alignment) were recorded in Table 11.6.28 and Table 11.6.30.

Improvement of transport facility, increase in land value, and better access to employment are some of the positive impacts of the project expected by majority of PAHs.

Table 11.6.28 Perceived Positive Benefits of the TPP Link Road (New Alignment)

Sl. No	Perceived Positive Impacts	Number	%
1	Transport Facility Improvement	15	88
2	Access to Employment	12	71
3	Access to Markets	8	47
4	Access to Education and Healthcare	7	41
5	Reduced Travel Time	11	65
6	Lesser Accidents/Safety	9	53
7	Increase in Land Value	15	88
	Total Surveyed	17	100

Source: 16 July 2018 Census and Baseline Socio-Economic Survey for the Alternate Alignment, Table 35

Loss of land and asset and accidents due to high vehicular speed are some of the negative impacts anticipated by majority of PAHs.

Table 11.6.29 Perceived Negative Impacts

Sl. No	Perceived Negative Impacts	Number	%
1	Loss of Land and Asset	17	100
2	Accidents Due to High Speed	11	65
3	Noise/Air Pollution	8	47
4	Road Crossing Difficulty	8	47
	Total Surveyed	17	

Source: 16 July 2018 Census and Baseline Socio-Economic Survey for the Alternate Alignment, Table 36

3）Survey Results on Absentee Land Owners

There are 296 absentee land owners of 330 land parcels to be affected by the TPP Link Road (New Alignment). Among the total 296, census was conducted on 57 owners of 71 land parcels, and the Socio-Economic Survey was done on 37 owners of 37 land parcels.

(a) Population Census

Among the 57 absentee land owners, 44 are male and 13 are female.

Table 11.6.30 Gender of Affected Absentee Land Owners

Sl. No	Gender	Nos.
1	Male	44
2	Female	13
	Total	**57**

Source: DPR RAP 2018 Table 5.3

Seniors above 60 years old compose the largest group. Otherwise, the ages of the owners are evenly distributed between late 30s to 60 years old.

Table 11.6.31 Age Distribution

Sl. No.	Age	Nos.
1	Below 18 years	0
2	19 to 25	0
3	26 to 30	2
4	31 to 35	7
5	36 to 40	5
6	41 to 45	9
7	46 to 50	9
8	51 to 55	5
9	56 to 60	8
10	Above 60	12
	Total	**57**

Source: DPR RAP 2018 Table 5.4

Hindus comprise the largest group, but there are also Christians and Muslims included.

Table 11.6.32 Religion

Sl. No.	Religion	Nos.
1	Hindu	49
2	Christian	4
3	Muslim	4
	Total	**57**

Source: DPR RAP 2018 Table 5.5

Majority of 41 HHs belong to the Backward Community. Nine HHs belong to the Scheduled Caste.

Table 11.6.33 Social Strata

Sl. No.	Social Strata	Nos.
1	General	2
2	Backward Community	41
3	Most Backward Community	5
4	Scheduled Caste	9
5	Scheduled Tribe	0
	Total	**57**

Source: DPR RAP 2018 Table 5.6

When asked about the occupation of absentee land owners, there are a total of 14 persons who are not in the work force, who are pensioners, or who are retired. Among the 43 persons who are working, the largest group is composed of casual labourers, followed by those who have private jobs. No land owner answered their occupation as a cultivator.

Table 11.6.34 Occupations of Absentee Land Owners

Sl. No.	Occupation	Number	Work Force
1	Not in Work Force	8	14
2	Pensioner	5	
3	Retired	1	
4	Homemaker	0	
5	Casual Labourer	21	43
6	Private Job	13	
7	Agriculture Coolie	3	
6	Business	2	
8	Self-employed	2	
9	Government Service	1	
10	Service	1	
11	Cultivator	0	
12	Professional	0	
	Total	**57**	**57**

Source: DPR RAP 2018 Table 5.7

Regarding the main source of income, 44 absentee land owners answered that they have another income source besides agriculture. When asked about the amount of income from agriculture, all 57 non-resident landowners along the TPP Link Road (New Alignment) answered that they earn nothing from agriculture activities.

Table 11.6.35 Main Source of Income of Absentee Land Owners

Sl. No.	Sources of Income	Nos.
1	No other source of other income other than agriculture	0
2	Income from other sources available	44
3	Not in work force	13
	Total	**57**

Source: DPR RAP 2018 Table 5.8

When asked about the relationship between the land to be affected and the location of residence, 41 answered that they reside in the same village with the affected land. The remaining 16 reside in other villages.

Table 11.6.36 Location of Affected Land and Residence

Sl. No	Place of Stay	Nos.
1	Within the Village	41
2	Outside the Village	16
	Total	**57**

Source: DPR RAP 2018 Table 5.10

(b) Census of Land

The characteristics of 71 land parcels owned by the 57 surveyed persons are described below.

The land parcels surveyed are either dry land (36 parcels) or residential land (35 parcels). No wet land suitable for rice paddies was found.

Table 11.6.37 Type of Land to be Affected

Sl. No.	Type of Land	Nos.
1	Dry	36
2	Wet	0
3	Residential	35
4	Trust/Private Temple Land/ Private Companies	0
	Total	**71**

Source: DPR RAP 2018 Table 5.12

When asked about number of land parcels owned, 39 answered that they own only one land parcel. In case those 39 owners lose most of their property, HMPD must consult and negotiate carefully to avoid negative impacts on their livelihood as much as possible. There are 14 persons who own two parcels.

Table 11.6.38 Number of Owned Land Parcels

Sl. No.	No. of Land Parcels for Each Land Owner	Nos.
1	1 Subdivision	39
2	2 Subdivision	14
3	3 Subdivision	2
4	4 Subdivision	2
	Total	**57**

Source: DPR RAP 2018 Table 5.13

Regarding the crop types on the affected land parcels of the TPP Link Road (New Alignment), all the surveyed absentee land owners answered that they do not grow any crops.

Table 11.6.39 Crop Types

Sl. No.	Cropping Pattern	Nos.
1	Major Crops	0
2	Supplementary Crops	0
3	Not Applicable	71
	Total	**71**

Source: DPR RAP 2018 Table 5.15

No surveyed land parcel to be affected by the TPP Link Road (New Alignment) is irrigated.

Table 11.6.40 Irrigated Land

Sl. No.	Use of Land	Nos.
1	Irrigated	0
2	Unirrigated	51
3	Not Applicable	20
	Total	**71**

Source: DPR RAP 2018 Table 5.14

No land parcel surveyed was under a lease contract.

Table 11.6.41 Land Given for Lease

Sl. No.	Land Given for Lease	Nos.
1	Leased	0
2	Not Leased	51
3	Not Applicable	20
	Total	**71**

Source: DPR RAP 2018 Table 5.20

There are 20 land parcels that have assets to be affected attached to the land, such as fences and wells.

Table 11.6.42 Assets on Land Parcels in ROW Owned by Absentee Land Owners

Sl. No.	Affected Assets	Nos.
1	Assets Affected	20
2	No Assets	51
	Total	**71**

Source: DPR RAP 2018 Table 5.21

(c) Project Impacts on Absentee Land Owners

Absentee land owners are asked about the size of the affected land parcel before and after the project.

It was found that 28 parcels will be lost due to the project. No absentee land owner, however, gains income from agriculture or lease of land. When appropriate compensation is made for the land and the attached assets, negative impacts on the livelihood of absentee land owners will be avoided.

Table 11.6.43 Area of Affected Land Parcels After the Project

Sl. No.	Total Land Extent	Before Project	After Project
1	Lost	-	28
2	Less than 2.5 acres (Approx. less than 1 ha)	50	23
3	2.5 to 5 acres (Approx. 1 ha to 2 ha)	1	0
4	More than 5 acres (Approx. more than 2 ha)	0	0
5	Not applicable	20	20
	Total	**71**	**71**

1 acre = 4,047 m^2

Source: RAP 25 July 2018 Table 5.22

(d) Awareness of Land Acquisition Process

When asked whether they already knew if their land is to be affected by the HMPD Project, 31 Absentee land owners answered that they are aware, and 26 answered that they are not aware.

Table 11.6.44 Awareness on Government Intention of Land Acquisition

Sl. No.	Awareness	Nos.
1	Aware	31
2	Not Aware	26
	Total	**57**

Source: RAP 25 July 2018 Table 5.24

When asked about their awareness on the land acquisition process and the resettlement and rehabilitation benefits, the same 31 owners answered that they are aware, and 26 answered that they are not aware.

Table 11.6.45 Awareness on Land Acquisition Process and Resettlement and Rehabilitation Benefits

Sl. No.	Aware of Compensation and R&R Assistance	Nos.
1	Aware	31
2	Not Aware	26
	Total	**57**

Source: RAP 25 July 2018 Table 5.25

The source of information was asked to the 31 owners who are aware of the above information with multiple choices. Among them, 20 answered that they got the information from a public meeting, and 11 said that the notice issued by the DRO was their source, while two got the information from government officials.

Table 11.6.46 Sources of Awareness on Land Acquisition Process and R&R Benefits

Sl. No.	Source of Awareness	Nos.
1	Government Official	2
2	Notice Issued	11
3	Public Meeting	20
	Total	**31**

Source: RAP 25 July 2018 Table 5.26

(4) Plan for Compensation and Assistance

1) Cut-off Date

The cut-off date for PAHs and land and assets related to the 1.95-km stretch of the new southern part of the TPP Link Road (New Alignment) is 13 July 2018.

The cut-off date for the remaining 1.65 km of northern part of the TPP Link Road is 20 April 2018 as stated in Section 11.4.4.

2) Compensation for Loss of Assets, Livelihood Rehabilitation Assistances, and Entitlement Matrix

The compensation for loss of assets, livelihood rehabilitation assistances, and entitlement matrix for the TPP Link Road (New Alignment) are the same as described in Section 11.4.4.

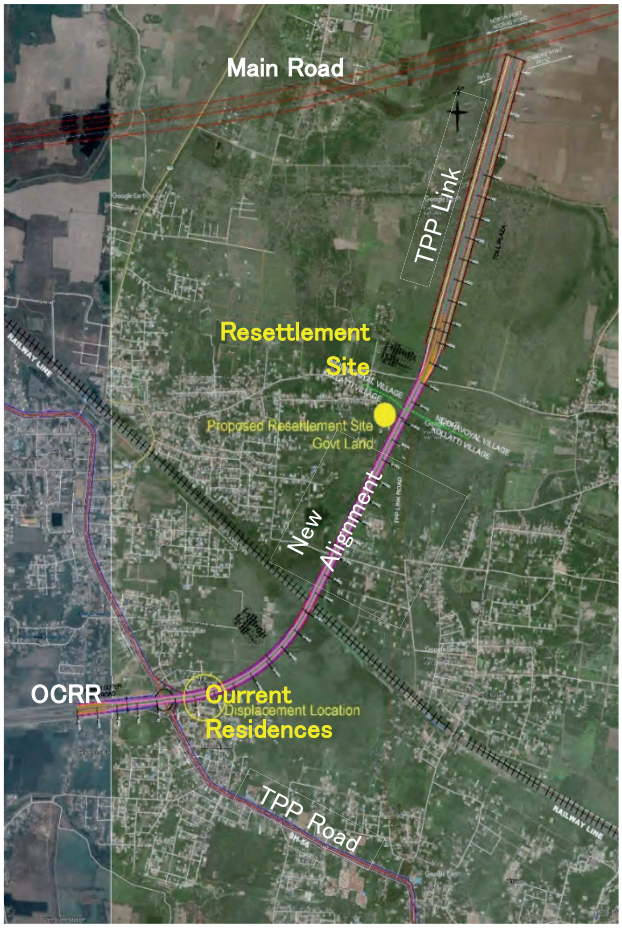
3) Proposed Resettlement Site

When HMPD chose the new alignment of the TPP Link Road, they also selected state-owned land in Kollatti Village as the potential resettlement site. This information was shared with PAHs during the consultation and survey. The location is shown in Figure 11.6.3, and details about the site are summarized in Table 11.6.47. The proposed resettlement site is located about 1.5 linear km northeast from the affected residential area, and about 3 km by road. Both sites are residential areas developed surrounding the Minjur Rail Station.

Table 11.6.47 Information on Proposed Resettlement Site

Location	Survey No. 27, Kollatti Village
Ownership	Revenue Department, Tamil Nadu
Size	9,100 m^2
Number of HHs accommodated	About 30

Source: HMPD 24 July 2018



Source: HMPD 16 July 2018

Figure 11.6.3 Locations of PAHs Residences and Proposed Resettlement Site

(5) Grievance Mechanism

The grievance mechanism for the TPP Link Road (New Alignment) is the same as described in Section 11.4.5.

(6) Institutional Arrangement for the Implementation of RAP

The institutional arrangement for the implementation of the RAP of the TPP Link Road (New Alignment) is the same as described in Section 11.4.6.

(7) Implementation Schedule

The implementation schedule of the TPP Link Road (New Alignment) is the same as described in Section 11.4.7.

(8) Budget and Funding

The number of targets for compensation and R&R assistances related to the TPP Link Road (New Alignment) is very small compared to that of the TPP Link Road (Original Alignment). HMPD has already secured a budget as described in Section 11.4.8 for Section 1 (Main Road and TPP Link Road (Original Alignment)). Therefore, the budget for the TPP Link Road (New Alignment) RAP implementation is sufficiently secured.

(9) Monitoring System and Monitoring Forms

The monitoring systems and the monitoring forms for the TPP Link Road (New Alignment) is the same as described in Section 11.4.9.

11.6.5 Stakeholder Meetings

The JICA Guidelines 2010 require two phases of public consultation. The first phase must be held after the draft scopes of EIA and RAP are developed. The second phase must be held after the draft reports of EIA and RAP are developed. The alignment of the TPP Link Road was changed after the scoping phase of the Project. The public involvement of the project, however, fulfills the requirements of JICA Guidelines, especially 2.4 Consultation with Local Stakeholders and 2.5 Concern about Social Environment and Human Rights, based on following three reasons:

1) The alignment of the southern 1.6 km of the TPP Link Road was moved, and the connection point with the existing TPP Road was moved about 1.5 km to the west. Both alignments are located basically in Minjur Village. Two public consultations on Section 1 (Main Road and TPP Link Road (Original Alignment)) （11.6.5 (1)） were held in Minjur, with wide public advertisement including the area affected by the TPP Link Road (New Alignment). Therefore, PAPs of the TPP Link Road (New Alignment) had been invited as stakeholders in the public consultation at the scoping phase.

2) Out of the total 20 PAHs at the TPP Link Road (New Alignment), 17 were individually visited for 1.5 to 2 hours for census and socio-economic survey, information dissemination on the project, RAP, compensation policy, and summary of EIA. Opinions on the project were also collected, and a separate group discussion was held after inviting the PAHs and general public in the area. The contact information of HMPD was also announced to collect suggestions and opinions after the meetings.

3) To answer the main concern of PAHs, the compensation packages for the loss of PAHs were explained with the handbook of the draft policy for compensation to losses in the same manner done with the second public consultations in the draft RAP phase. PAHs were informed in detail how the types and sizes of compensations and assistances are to be decided. HMPD consultants answered all questions until PAHs felt satisfied. PAHs were also informed that they will receive compensation with an amount larger than the replacement cost and assistances for relocation and livelihood rehabilitation.

(1) Stakeholder Meetings for Section 1 PAHs

Stakeholder meetings inviting all the PAHs of Section 1 were held twice in April and May 2018 in the form of public consultations. The meetings are described in Section 11.5. Each meeting was held at two locations. One was in the Minjur Block Development Office, about 250 m from the southern end of the TPP Link Road (New Alignment).

(2) Stakeholder Meetings for PAHs Related to the TPP Link Road (New Alignment)

1） Consultations by Door-to-Door Visit

During the census for the PAHs of the TPP Link Road (New Alignment), consultation at each house was conducted for all the 20 PAHs. Out of all the PAHs, three HHs were absent during the visit. There were four HHs represented by women during the meetings. The consultation included information dissemination about the project, free queries and answers, and question on willingness to relocate to the proposed relocation site. (Figure 11.6.4) No one raised their clear opposition against the project.

Source：DPR RAP 2018

Figure 11.6.4 Consultations by Door-to-Door Visit

The information disseminated in the door-to-door visit and in the group discussion explained in the next section included the information listed in Table 11.6.48.

Table 11.6.48 Information Disseminated in the Stakeholder Meetings

Project Summary	● The TPP Link Road (New Alignment) is an extension of ORR up to NPAR to reach Ennore Port. This ORR extension is part of Section 1 of CPRR. ● The alignment affects about 20 buildings in Bharathi Salai. The socio-economic survey was conducted to these affected assets in July 2018. ● The proposed ROW of the TPP Link Road (New Alignment) is 45 m. ✓ The road level will be about 7.5 m above ground level. ✓ A two-lane service road with a 2-m wide footpath is proposed on both sides in the at-grade level. ● The space between the outer edge of the elevated road to the ROW is 7.5 m. The space between the outer edge of the Main Road to the ROW is 39 m. ● The DPR for this extension is under preparation.
EIA Summary	● As the space between the outer edge of the elevated road to the ROW is only 7.5 m, the environmental impact to the adjoining/nearby people will be high compared to those in the Main Road, whereas the intensity of the impact will be less compared to the TPP Link Road (Original Alignment) and the proposed intersection of ORR. ✓ The main carriageway is elevated from ORR and continues as an elevated road in the residential area. ✓ A crash barrier of 1.5 m height is proposed for the elevated road. A noise barrier is proposed for the elevated road in the residential area which will considerably reduce the noise pollution. ✓ If this extension is not formed, the ORR traffic should travel on the TPP Road to reach Ennore Port, which will increase pollution levels in the stretch of the existing TPP Road. Hence, this extension road will reduce the pollution level in the locality. ✓ The proposed at-grade rotary causes more pollution due to the maneuvering of straight traffic along the TPP road and the turning traffic in ORR. As the ORR traffic is elevated, there will be less at-grade traffic movement, which will reduce pollution especially in Bharathi Nagar. Road safety will be increased as major traffic movements are separated in two levels, i.e., at-grade and elevated.
SIA/RAP Summary	● The compensation packages for the loss of PAHs were explained with the handbook of the draft policy for compensation to losses in the same manner done with the second public consultations for Section 1. ● The social surveys to the PAPs were already conducted in July 2018. ● HMPD is considering a tentative resettlement site for title holders who opt for it at Survey No. 27 in Kollati Village, which belongs to the Government of Tamil Nadu. The site is located about 2 km northeast from the displacement site. ● The exact compensation amount for each individual will be intimated separately.

Source: DPR RAP 2018 p.6-44

Queries and opinions obtained during the door-to-door consultation are shown in Table 11.6.49.

Table 11.6.49 Queries and Opinions Obtained During Door-to-Door Consultation

Sl.No	Questions/Concerns/Requests Raised	Answers Given
1	Will the people be informed about the proposed project?	People will be informed about the proposed road development. The same has been discussed through the stakeholder consultation meeting at the local level.
2	How will the compensation for the land be paid? There is concern regarding the land acquisition process and the method of assessment of land value and assets for the affected land/structures by the government.	The JICA Study Team explained that the compensation for the affected land and assets shall be made as per the LARR Act of 2013 and related rules.

Sl.No	Questions/Concerns/Requests Raised	Answers Given
3	Will the compensation for the assets be calculated with depreciation?	The consultants explained that assets valuation shall be made without depreciation.
4	Will the project provide an alternate relocation land for the displaced title holders?	The JICA Study Team explained that an alternate resettlement site will be provided to the 20 affected and displaced private land owners losing their assets.
5	What safeguard measures shall be made for the affected tenants in the displaced assets?	The consultants explained that tenants shall be paid if eligible for R&R benefits from the PIT.
6	Will intimation be given prior to demolition of the affected assets?	The JICA Study Team explained that the assets shall be dismantled only after payment of R&R assistance to the affected PAHs, and prior notice will be issued to the PAHs.

Source：31 July 2018 HMPD Report

2）Group Discussion and Site Visit

The stakeholder meeting and site visit for the PAHs of the TPP Link Road (New Alignment), including ROW title holders, absentee land owners, local residents, road users of TPP Road, and general public, was organized at the project area, or Bharathi Nagar, on 12 July 2018 from 2:00 pm to 4:00 pm. Bharathi Nagar is the residential area located at the southern end of the TPP Link Road (New Alignment). (Figure 11.6.5)

Every PAH living within the proposed ROW and part of the non-resident title holders were invited personally during the census and socio-economic survey. VAO notified other non-resident title holders, local residents, road users, and general public about the meeting. A total of 26 people participated in the meeting, and four of them were women.

Source：16 July 2018 HMPD Report

Figure 11.6.5 Group Discussion and Site Visit at Bharathi Nagar

After the explanation summarized in Table 11.6.48, the participants were invited to give their suggestions and comments on the project. The details of the queries raised by the participants and the replies given are listed in Table 11.6.50. No one raised their clear opposition against the project.

Table 11.6.50 Suggestions and Comments in the Group Discussion

Sl. No.	Name and Residence	Suggestions and Comments	Reply Given
1	Mr. Arul, Bharathi Nagar	What measures will be taken to ensure the safety of local residents during road construction?	Necessary measures shall be emphasized to ensure the safety of local residents during road construction for compliance.
2	Mr. Rajakotti, Bharathi Nagar	What arrangement will be made for the removal of trees in the project area?	It is proposed to transplant all affected trees. If unavoidable, the removed trees will be compensated by additional tree planting at 1:10 (10 saplings will be planted as compensation of 1 tree felled).
3	Mrs. Yayathi, Bharathi Nagar	What arrangement will be made if heavy traffic movement results in noise pollution?	A 1.5-m high crash barrier is proposed for the elevated road. The pollution level will be monitored during the construction and operation period. Necessary mitigation measures, like noise barriers, shall be provided, if required.
4	Mr. Syed, VOC Street	What arrangement will be made to the shifting of water pipelines, EB posts, transformers, and other similar structures?	The shifting plan shall be prepared to relocate the affected utilities in consultation with the service departments.
5	Mr. Gopalakrishnan, Bharathi Nagar	What arrangement will be made to for pedestrians and local residents during road construction? Any diversion will be made to ensure smooth traffic for local residents.	Wherever required, a temporary traffic diversion plan shall be made to ensure free flowing traffic and to ensure that local residents will not be disturbed.
6	Mr. Devendran, Thilagar Street	How will the environmental condition of the region be measured during road construction?	Periodical environmental monitoring will be made for parameters such as noise, air, and water. Necessary mitigation measures shall be provided, if required.
7	Mr. Arumugam, Bharathi Nagar	Are there any community properties that are likely to be affected? Is the school located near the proposed road likely to be affected?	No community properties are likely to be affected. The school located adjacent to the proposed road is not affected.
8	Mr. Kannan, VOC Nagar	Will the design incorporate a drainage pattern to prevent water logging problems?	The design shall include a drainage system to avoid water logging.
9	Mrs. Yamuna, Bharathi Nagar	How will the dust generated during the road construction be mitigated?	Necessary sprinkling of water and other mitigation measures will be ensured.

Source: 16 July 2018 HMPD Report

11.7 Draft Monitoring Forms

11.7.1 Environmental Monitoring Forms (Construction Phase)

(1) Permission and Authorization

Monitoring Item	Record of Conditions
Responding to issues pointed out by authorities	
Construction Workers Camp 1. An adequate no. of toilets shall be provided separately for males and females (as per EIA). 2. At every construction site, provision of a day crèche shall be made so as to enable women to leave behind their children while working. At least one attendant shall be provided to take care of the children at the crèche (as per EIA).	
Avoidance of Soil Runoff Confirmation of appropriate design and construction plan is proposed by the Consultant and the Contractor to avoid soil runoff during and after the Construction Phase.	

Add lines when necessary

(2) Pollution

- Air Quality 【Frequency: Planning Phase: Once, Construction Phase: Quarterly】

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Baseline Value	CPCB Standards	Measurement Point	Sampling Date
PM10	$\mu g/m^3$			18.8~293.1	100		
PM2.5	$\mu g/m^3$			10.2~300.8	60		
SO_2	$\mu g/m^3$			0~40.5	80		
NOx	$\mu g/m^3$			0~77.2	80		
CO	ppm			BQL	4		

Add lines when necessary

- Water Quality【Frequency: Planning Phase: Once, Construction Phase: Quarterly】

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Baseline Value	Country Standards	Measurement Point	Sampling Date
【Surface Water】							
pH	-			7.05~7.83	5.5~9.0*		
BOD	mg/L			—	<30*		
COD	mg/L			—	<250*		
TDS	ppm			—	N/A		
SS	mg/L			3.8~23.2	<100*		
Pb	mg/L			—	<0.1*		
Oil and Grease	mg/L			—	<10*		
Detergents	mg/L			—	<0.2**		
【Ground Water】							
pH	-			—	8.5**		
TDS	ppm			—	<2000**		
Tatal Hardness	mg/L			—	<300**		
Sulphate	mg/L			—	<400**		
Chloride	mg/L			—	<1000**		
Fe	mg/L			—	<1.00**		
Pb	mg/L			—	No relaxation**		
Coliform count	No/dl			—	<10**		

Add lines when necessary
* BIS: 2490, PART-I-1981
** BIS: IS: 10500, 1991 Drinking Water Standard

- Noise Levels【Frequency: Planning Phase: Once, Construction Phase: Quarterly】

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Baseline Value	Country Standards	Measurement Point	Sampling Date
Noise (day)	dB(A)			37.9~70.1	55		
Vibration (day)	m/s			0.1~2.2	5		
Noise (night)	dB(A)			34.1~60.1	55		
Vibration (night)	m/s			0.1~1.9	5		

Add lines when necessary

- Soil Quality【Frequency: Planning Phase: Once, Construction Phase: Quarterly】

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Baseline Value	Referred International Standards*	Measurement Point	Sampling Date
Pb	mg/L			—	0.01		
Sodium Absorption Ratio	—			—	N/A		
Oil and Grease	mg/L			—	N/A		
Texture				—	N/A		
Grain Size				—	N/A		
pH	—			—	N/A		
Conductivity	S/m			—	N/A		
Ca	mg/L			—	N/A		
Mg	mg/L			—	N/A		
Na	mg/L			—	N/A		
N	mg/L			—	N/A		

Add lines when necessary
* The Soil Contamination Countermeasures Act 2002, Japan

(3) Monthly Patrol, Observation, and Recording during Construction Works

- By Contractor

Date:		Location	Findings ('Approved' or 'Needs Action')	Record of Conditions	Actions Taken	Recorded By (Name)
Item	Parameters					
Ground subsidence	Progress confirmation of soft ground measure	Around the project road				
Hydrometeorology	Confirm progress with PWD	Around the project road				
Topography/ geology	Confirmation of proper material purchase situation	Storage				
Ecosystem (Impacts on habitats near ROW)	Confirmation of no soil runoff outside the ROW	Near ROW				
Children's rights	Confirmation of prevention of child labor	Office/ construction sites/camp sites				

Add lines when necessary

- By PIT (Foresters)

Date:		Location	Findings ('Approved' or 'Needs Action')	Record of Conditions	Actions Taken	Recorded By (Name)
Item	Parameters					
Ecosystem	Confirmation of trees for cutting	Around the project road				
	Confirmation of transplantation of trees with less than 90 cm in	Around the project road				

	circumference					
	Acquisition of RF substitute area	Kanchiouram district				

Add lines when necessary

- By Consultant or NGOs

Date:		Location	Findings ('Approved' or 'Needs Action')	Record of Conditions	Actions Taken	Recorded By (Name)
Item	Parameters					
Resettlement	See RAP monitoring forms	Around the project road				
Water use	Compensation for affected wells/confirm progress of construction of alternative facilities	Around the project road				
Existing social infrastructure and social services	Confirm relocation of affected public facilities	Around the project road				
Community division	Information provision, enlightenment campaigns, complaints reception	Around the project road				
Infectious diseases such as HIV/AIDS	Confirmation of the occurrence of infectious diseases, such as dengue, at construction sites	Around the project road/ camp sites				
Work environment, work safety	Capacity building workshop (1 day each) 1. For engineers including ESE 2. For skilled and unskilled laborers 3. For engineers and staff of the Contractor and PMC staff	Around the project road/ office/camp sites				

Add lines when necessary

(4) Everyday patrol, observation, and recording during the Construction Works by Contractor

Date:		Location	Findings ('Approved' or 'Needs Action')	Record of Conditions	Actions Taken	Recorded By (Name)
Item	Parameters					
Waste	Appropriate separation and storage, confirmation of appropriate treatment and disposal	Office/ construction sites/camp sites				
Work environment, work safety	Compliance to safety standards/ implementation of safety tools	Construction sites				
Accidents/crimes	Confirmation of adequate traffic guidance and accident prevention measures	Around the project road/ construction sites				
Transboundary impact and climate change	Confirmation of proper maintenance status of construction machinery/ transport vehicle party	Construction sites				

Add lines when necessary

(5) Other Coordination

Grievance concerning environmental impact

Number of Complaints	Details	Correspondence and Results

Add lines when necessary

Other Points of Attention (free writing)

11.7.2 Environmental Monitoring Forms (Operation Phase)

(1) Monitoring Report and Evaluation

Item	Parameters	Findings ('Approved' or 'Needs Action')	Record of Conditions	Actions Taken	Frequency	Recorded By (Name)
Monitoring of management and operational performance indicators	Status of redevelopment of borrow areas				For 10 months	
	Waste management quality monitoring				For 10 months	
	Monitoring environmental parameters				For 10 months	
Monitoring and evaluation external agency	Implementation					

(2) Pollution

- Air Quality【Frequency: Quarterly】

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Baseline Value	TNPCB Standards	Measurement Point	Sampling Date
PM10	μg/m³			18.8~293.1	100 (24h)		
PM2.5	μg/m³			10.2~300.8	60 (24h)		
SO_2	μg/m³			0~40.5	80 (24h)		
NOx	μg/m³			0~77.2	80 (24h)		
CO	ppm			BQL	4 (1h)		

Add lines when necessary

- Water Quality【Frequency: Quarterly】

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Baseline Value	Country Standards	Measurement Point	Sampling Date
【Surface Water】							
pH	-			7.05~7.83	5.5~9.0*		
BOD	mg/L			—	<30*		
COD	mg/L			—	<250*		
TDS	ppm			—	2100*		
SS	mg/L			3.8~23.2	<100*		
Pb	mg/L			—	<0.1*		
Oil and Grease	mg/L			—	<10*		
Detergents	mg/L			—	<1.0**		
【Ground Water】							
pH	-			—	No relaxation**		
TDS	ppm			—	<2000**		
Tatal Hardness	mg/L			—	<600**		
Sulphate	mg/L			—	<400**		
Chloride	mg/L			—	<1000**		
Fe	mg/L			—	<1.0**		
Pb	mg/L			—	No relaxation**		

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Baseline Value	Country Standards	Measurement Point	Sampling Date
Coliform count	No/dl			—	N/A		

Add lines when necessary
* BIS: 2490, PART-I-1981
** BIS: IS: 10500, 1991 Drinking water standard (Permissible Limit in the Absence of Alternate Source)

- Noise Levels【Frequency: Quarterly】

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Baseline Value	Country Standards	Measurement Point	Sampling Date
Noise (day)	dB(A)			37.9~70.1	55		
Vibration (day)	m/s			0.1~2.2	5		
Noise (night)	dB(A)			34.1~60.1	55		
Vibration (night)	m/s			0.1~1.9	5		

Add lines when necessary

- Soil Quality【Frequency: Quarterly】

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Baseline Value	Referred International Standards*	Measurement Point	Sampling Date
Pb	mg/L			—	0.01		
Sodium Absorption Ratio	—			—	N/A		
Oil and Grease	mg/L			—	N/A		
Texture				—	N/A		
Grain Size				—	N/A		
pH	—			—	N/A		
Conductivity	S/m			—	N/A		
Ca	mg/L			—	N/A		
Mg	mg/L			—	N/A		
Na	mg/L			—	N/A		
N	mg/L			—	N/A		

Add lines when necessary
* The Soil Contamination Countermeasures Act 2002, Japan

(3) Ecology and Water Use 【Frequency: Quarterly】

Item	Parameters	Findings ('Approved' or 'Needs Action')	Record of Conditions	Actions Taken	Frequency	Recorded By (Name)
Ecology	Monitoring soil runoff from ROW, affecting habitat outside ROW				Quarterly for 1 year	
	Monitoring of negative impacts on ecosystem outside ROW caused by increase of traffic and land use change				Quarterly for 1 year	
Water use	Ground water level at existing wells near the ROW (decline compared to pre-project level)				Quarterly for 1 year	

11.7.3 Land Acquisition and RAP Implementation Monitoring Forms

- Preparation of Resettlement Sites (where necessary)

No.	Explanation of the site (e.g., area, no. of resettlement HHs, etc.)	Status (Complete (Date)/ Not Complete)	Details (e.g., site selection, identification of candidate sites, discussion with PAPs, development of site, etc.)	Expected Date of Completion
1				
2				

- Sites for Yards and Other Facilities

	Conditions for the Sites	A. No resettlement or loss of assets will be caused. B. Proper contract and permissions are obtained. C. Original state of the site was recovered and the land returned to the owner.		
	Timing of monitoring the conditions for the sites	Date DD.MM.YYYY	Observation Details	Recorded By (Name)
A	After informal selection of the sites			
B	Proper contract and permissions are obtained			
C	Original state of the site was recovered and the land returned to the owner			

- Public Consultation

No.	Date	Place	Contents of the Consultation/Main Comments and Answers
1			
2			

- RAP Implementation

Resettlement Activities	Planned Total	Unit	Progress in Quantity			Progress in %		Expected Date of Completion	Responsible Organization
			During the Quarter	Until the Last Quarter	Up to the Last Quarter	Until the Last Quarter	Up to the Last Quarter		
Preparation of RAP									
Employment of Consultants		man-month							
Implementation of Census Survey (including Socioeconomic Survey)									
Approval of RAP			Date of Approval						
Finalization of PAPs List		No. of PAPs							
Progress of Compensation Payment									
Village 1		No. of HHs							
Village 2		No. of HHs							
Village 3		No. of HHs							
Village 4		No. of HHs							
Progress of Land Acquisition (All Villages)									
Village 1		ha							
Village 2		ha							
Village 3		ha							
Village 4		ha							
Progress of Asset Replacement (All Villages)									
Village 1									
Village 2									
Village 3									

Resettlement Activities	Planned Total	Unit	Progress in Quantity			Progress in %		Expected Date of Completion	Responsible Organization
			During the Quarter	Until the Last Quarter	Up to the Last Quarter	Until the Last Quarter	Up to the Last Quarter		
Village 4									
Progress of Relocation of People (All Villages)									
Village 1									
Village 2									
Village 3									
Village 4									

- Implementation Status of Livelihood Recovery Support

Implementation	Contents	Results

- Grievance from PAPs

Number of Complaints	Details	Correspondence and Results

- Other Points of Attention (Free Writing)

- Monitoring Formats for Physical Progress

No.	Monitoring Indicators for Physical Progress	Implementation Target	Revised Target	Progress this Quarter	Cumulative Progress	% against Target
1	Land acquisition (ha) from government sources					
2	Wet land acquired (ha) from private owners					
3	Dry land acquired (ha) from private owners					
4	Urban land (including homestead) acquired (ha) from private owners					
5	No. of PAHs paid compensation for acquisition of properties in private land					
6	Areas of pucca structures acquired (m^2) from private owners					
7	No. of PAHs paid compensation for acquisition of private pucca properties					
8	Area of semi-pucca structures acquired (m^2) from private owners					
9	No. of PAHs paid compensation for acquisition of private semi-pucca properties					

No.	Monitoring Indicators for Physical Progress	Implementation Target	Revised Target	Progress this Quarter	Cumulative Progress	% against Target
10	Area of kutcha structures acquired (m^2) from private owners					
11	No. of PAHs paid compensation for acquisition of private kutcha properties					
12	Other assets (wells) acquired (no.) from private owners					
13	No. of PAHs paid compensation for acquisition of other private assets (wells)					
14	No. of PAHs provided with assistance (additional 25%) for severance of land					
15	No. of PAHs opted for alternative houses					
16	No. of PAHs opted for alternative shops					
17	No. of PAHs provided with land purchase grant at 25% of the compensation received to buy alternative agriculture land					
18	No. of PAHs provided with shifting allowance					
19	No. of PAHs provided with rental allowance					
20	No. of PAHs provided with subsistence allowance for six months					
21	No. of PAHs provided with subsistence allowance for three months					
22	No. of vulnerable squatter PAHs provided with alternative built houses					
23	No. of vulnerable squatter PAHs provided with alternative built shops					
24	No. of PAHs provided with employment generation asset grant (from PAHs losing shops)					
25	No. of PAPs provided with livelihoods training assistance (two adults from each PAH losing shops)					
26	No. of PAPs provided with self-employment training (two adults from each vulnerable squatter PAH)					
27	No. of PAPs provided with self-employment training					

No.	Monitoring Indicators for Physical Progress	Implementation Target	Revised Target	Progress this Quarter	Cumulative Progress	% against Target
	and assisting for purchase of employment generation asset					
28	No. of man-days of employment under contractors (male, female) ・Male PAPs (Applied/ Hired) ・Female PAPs (Applied/ Hired) (as per RAP)					
29	No. of community properties reestablished					
30	No. of SDU staff in position					
31	No. of SDU staff trained in R&R activities					
32	No. of implementing NGO staff in position					
33	No. of implementing NGO staff trained in R&R activities					

- MONITORING INDICATORS FOR FINANCIAL PROGRESS

No	Monitoring Indicators for Financial Progress	Implementation Target (INR million)	Revised Implementation Target	Progress this Quarter	Cumulative Progress	% against Revised Implementation Target
1	Compensation (including solatium) paid for wet land acquired from private owners, including assistance in registration charges and taxes					
2	Compensation (including solatium) paid for dry land acquired from private owners, including assistance in registration charges and taxes					
3	Compensation (including solatium) paid for urban land (including homestead)					

No	Monitoring Indicators for Financial Progress	Implementation Target (INR million)	Revised Implementation Target	Progress this Quarter	Cumulative Progress	% against Revised Implementation Target
	acquired from private owners, including assistance in registration charges and taxes					
4	Compensation paid for severance of land (additional 25% of the compensation paid)					
5	Compensation paid for loss of perennial crops					
6	Compensation paid for loss of non-perennial crops					
7	Compensation paid for acquiring pucca structures from private owners					
8	Compensation paid for acquiring semi-pucca structures from private owners					
9	Compensation paid for acquiring Kutcha structures from private owners					
10	Compensation paid for acquiring other assets (wells) from private owners					
11	Expenditure on providing shifting allowances					
12	Expenditure on providing rental allowances					
13	Expenditure on providing subsistence					

No	Monitoring Indicators for Financial Progress	Implementation Target (INR million)	Revised Implementation Target	Progress this Quarter	Cumulative Progress	% against Revised Implementation Target
	allowances (for six months)					
14	Expenditure on providing subsistence allowances (for three months)					
15	Expenditure on providing self-employment training assistance (two adults from each PAH losing shops)					
16	Expenditure on providing self-employment training assistance (two adults from each vulnerable squatter PAH losing shops)					
17	Expenditure on providing self-employment training and purchase of employment generation asset assistance (to all losing employment due to the project)					
18	Expenditure on providing alternatives built houses to vulnerable squatter PAHs					
19	Expenditure on providing alternatives built shops to vulnerable squatter PAHs					
20	Expenditure on preparing resettlement sites ready with infrastructure facilities					
21	Expenditure on reestablishing					

No	Monitoring Indicators for Financial Progress	Implementation Target (INR million)	Revised Implementation Target	Progress this Quarter	Cumulative Progress	% against Revised Implementation Target
	community properties/ cultural properties					
22	Expenditure on staffing of PIT (salary)					
23	Expenditure on providing training to PIT staff in R&R activities					
24	Expenditure on engaging implementation NGOs					
25	Expenditure on engaging impact evaluation agency/NGO/ academic institution					
26	Expenditure on continued public consultation					
27	Expenditure on strengthening the SDU					
28	R&R cost for maintenance corridors (1.5% of the treatment cost of INR 3 million)					
29	Expenditure on unquantified impacts (10% of the total R&R cost)					

11.8 Environmental and Social Considerations for Section 2, Section 3, and Section 5

11.8.1 General Condition

(1) Existing Land Use

Table 11.8.1 shows the land use composition of each district. In Thiruvallur District and Kancheepuram District, the share of wasted land and unculturable land is close to 50%, and the other 30% is for agriculture and pasture land.

Table 11.8.1 Current State of Land Use

	Thiruvallur District	Kancheepuram District	Chennai District
Area (km^2)	3,394	4,483	175
Urban (%)	14.3	15.2	87.3
Agriculture, pastureland, etc. (%)	34.1	31.6	0.6
Forest (%)	5.5	6.1	1.5
Waste land, unculturable, fallow soil, etc. (%)	46.1	47.1	10.6

Source: Second Master Plan for CMA 2026, CMDA (2008)
District Census Handbook (Thiruvallur, Kancheepuram)

Figure 11.8.1 shows images of the land use at or near the planned ROW.


Urban area (Section 2)


Residential area (Section 2)


Upper section of Kosasthalaiyar River (Section 2)


Roadside business (Section 3)


Sriperumbhudur Tank (Section 3)


Forest (Mannur RF) (Section 3)


End of Section 4 and NH45


Vegetable field (Section 5)


Orchard of date palm (Section 5)

Source: JICA Study Team (taken in August and September 2017)

Figure 11.8.1 Land Use at or Near the Planned ROW

(2) Designated Areas Related to Section 2, Section 3, and Section 5

There are no nationally-designated or state-designated conservation areas in or within 10 km of the planned ROW of Section 2, Section 3, and Section 5. The Group of Monuments at Mahabalipuram, located

2 to 4 km east of the southern end of Section 5, is a UNESCO World Heritage site designated in 1984.

Section 3 and Section 5 pass other designated areas and Reserved Forests (RFs) with a total of 1.46 km (Table 11.8.2). The Indian National Forest Act of 1927 was enacted to consolidate the law relating to forests, the transit of forest produce, and the duty leviable on timber and other forest-produce. Under the act, an RF is legally defined as a forest area where certain activities are controlled and prohibited.

In India, national parks and wildlife sanctuaries are designated where there are certain necessities of natural environment protection under the Wildlife Protection Act 1972. When necessary and applicable, RFs may be designated as sanctuaries under the Act. The RFs that Section 3 and Section 5 run through are not designated by the Wildlife Protection Act, and are not applicable to the definition of "Protected Areas" in the JICA Guidelines.

Table 11.8.2 Relationship to Areas with Development Regulation and Project

Area with Development Regulation	Objective	Relevance to Sections
Reserved Forest (RF)	The Indian National Forest Act 1927 is enacted to consolidate the law relating to forests, the transit of forest produce, and the duty leviable on timber and other forest-produce. Under the act, the State Government may constitute any forest-land or waste-land, which the government owns, has proprietary rights to, or is entitled to, as an RF. In an RF, persons approved by the Forest Officer are allowed to walk through, to pasture, to use water, and to gather forest products. (Article 11) The condition of a designated area can be public woods or waste-land so that land use (landscape) is not always a forest (growth environment of many trees).	- Section 3 will pass through the Mannur RF for 0.2 km. - Section 5 will pass through the Thirutteri RF for 0.5 km and the Sengundram RF for 1.26 km.

Source：Final Detailed Project Report Volume-V EIA/EMP (2016)

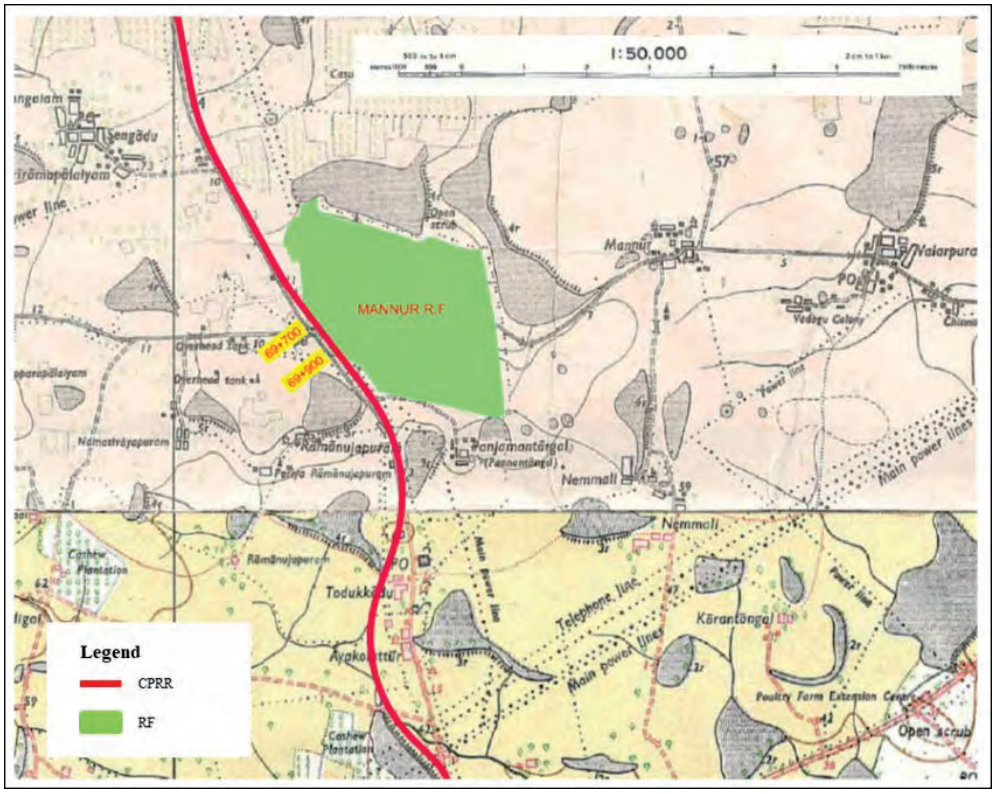
Under the Forest (Conservation) Act 1980 Article 2, it is necessary to acquire Forest Clearance through the permission process of either the Central Government or State Government to divert part of an RF to change to another land use. In case the diversion area is 40 ha or larger, the Ministry of Environment, Forest, and Climate Change (MOEFCC) in New Delhi receives and appraises the application. In the case the diversion area is smaller than 40 ha, the South Eastern Regional Office in Chennai receives and appraises the application.

On 20 February 2017, HMPD submitted to the State Forest Office the application for diversion of 10.23 ha RF land. After that, the District Forest Officer (DFO) confirmed the proposed area selected as compensation land for RF conversion in Kanchipuram by the DRO. The DFO rejected the first selected area as unsuitable land for afforestation, but approved the second selected land as suitable on 02 February 2018. The District Collector is implementing the land transfer procedure to HMPD as of May 2018. After the DFO receives the land transfer approved by the District Collector, Stage I clearance will be issued by the expert committee at the Regional Forest Office located in Chennai. Information on the RF Compensation Site approved by the Kancheepuram DFO is shown in Section 11.8.2 (6) 3).

At the meeting with Director of DOE, JICA, and the JICA Study Team on 24 October 2017, the JICA Study Team requested that the compensation land must be selected for maintaining habitat continuity and for having an equivalent biodiversity with the area to be converted by the Project or with other forest areas. The Director explained that land availability is the key issue in selecting the site, and the requested continuity with the particular RF to be converted cannot be promised. The Director, however, assured that 1) one piece of land of sufficient size, double of the planned conversion of 10.23 ha, will be selected by the DRO, 2) the

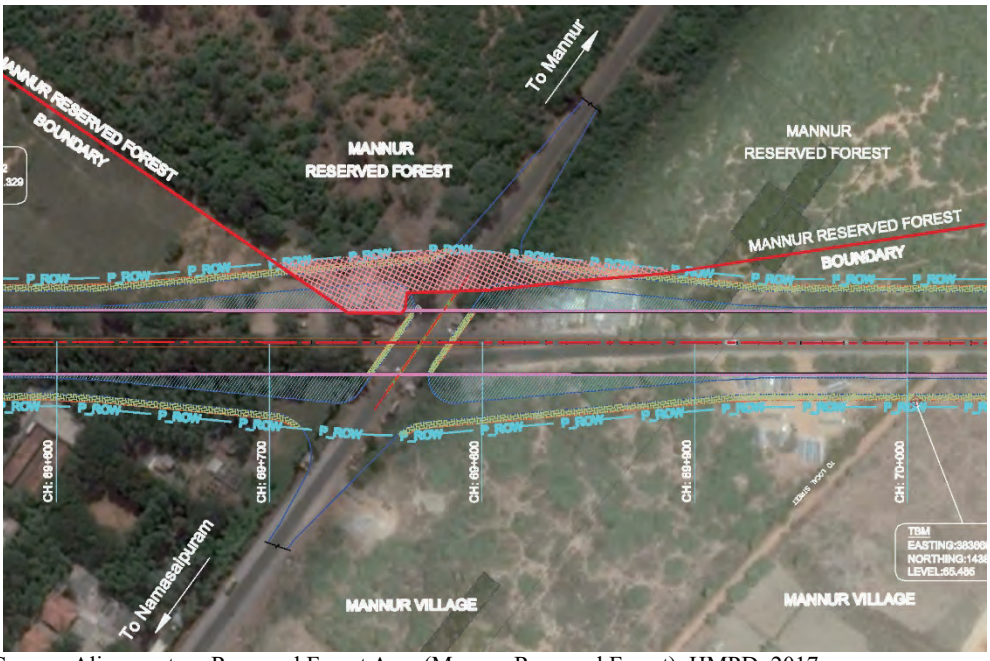
DFO will conduct a site survey and will approve only the suitable land for RF compensation land, and 3) with those conditions, therefore, biodiversity in the area or near the compensation land will be conserved in the long-term basis. According to the website of the Forest Department and information obtained from local forest consultants, the afforestation and conservation plan of a RF is prepared by DFO, including selection of suitable species. Also, the DFO will request the budget for implementation to HMPD.

Figure 11.8.2 shows the location of Section 3 and the Mannur RF. The Project Road is planned to cut the edge of the Mannur RF as shown by the red hatch in Figure 11.8.3. The existing condition of the area to be affected in the Mannur RF is shown in Figure 11.8.4. A higher layer of vegetation is dominated by eucalyptus, which is an alien species in the region. The lower tree layer consists of various species but is not very dense. The same lower tree species are also seen in waste-lands abandoned and unused by human activities.



Source: Alignment on Reserved Forest area (Mannur Reserved Forest), HMPD, 2017

Figure 11.8.2 Section 3 and Mannur RF



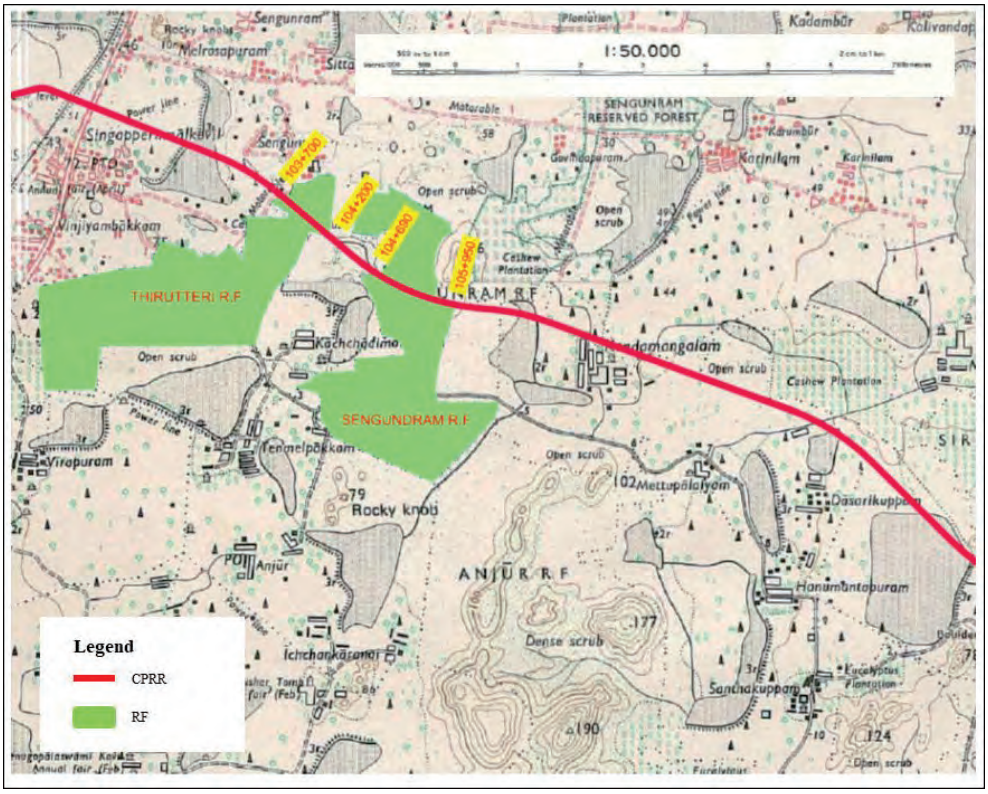
Source: Alignment on Reserved Forest Area (Mannur Reserved Forest), HMPD, 2017

Figure 11.8.3 Section 3 and Mannur RF

Source: JICA Study Team (taken on 25 August 2017)

Figure 11.8.4 Existing Condition of Mannur RF

Figure 11.8.5 shows the location of Section 5 and the Thirutteri and Sengundram RFs. Figure 11.8.6 shows the existing condition of the Thirutteri RF seen from the nearest paved road.



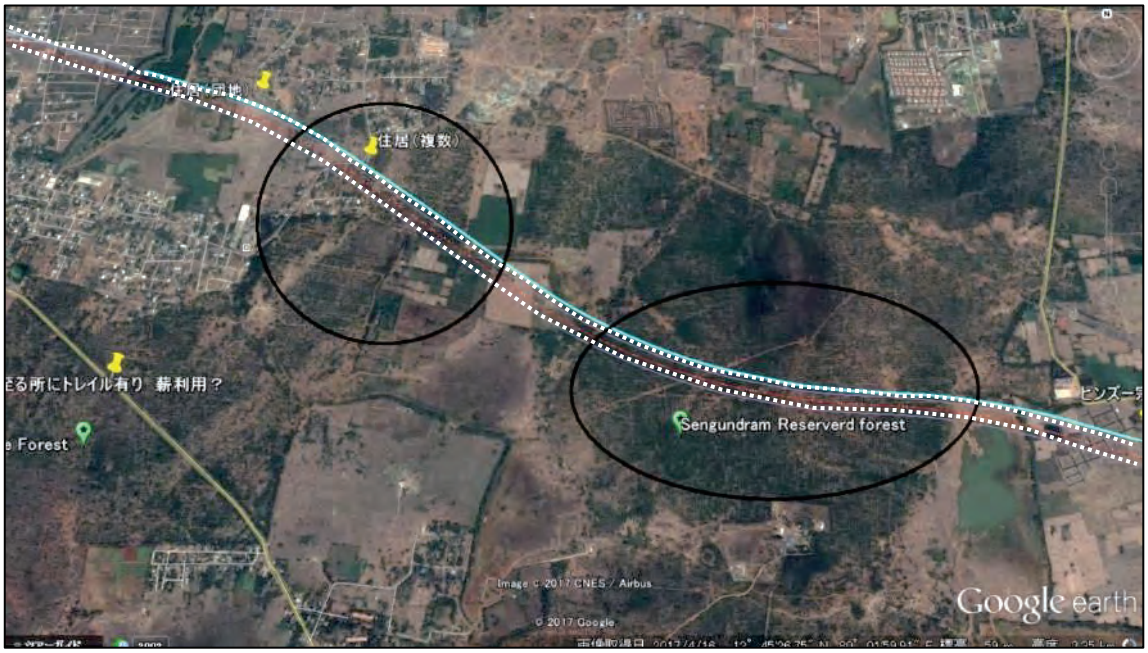
Source : Alignment on Reserved Forest Area (Thirutteri and Sengundram Reserved Forests), HMPD, 2017

Figure 11.8.5 Section 5 and Thirutteri and Sengundram RFs

Source: JICA Study Team

Figure 11.8.6 View of Thirutteri RF

From the satellite image shown in Figure 11.8.7, Figure 11.8.8, and Figure 11.8.9, it is found that the tree canopies follow straight lines in the Thirutteri RF and the Sengundram RF. On the other hand, vegetation on the hilly area seen in Figure 11.8.9 looks evenly distributed. By comparing the two photos, it can be concluded that vegetation in the Thirutteri RF and the Sengundram RFs is not a native vegetation but an afforested area.



Source: JICA Study Team

Figure 11.8.7 Relationship with Section 5 (white line), Thirutteri RF (left), and Sengundram RF

Source: JICA Study Team

Figure 11.8.8 Relationship with Section 5 (white line) and Thirutteri RF

Source: JICA Study Team

Figure 11.8.9 Relationship with Section 5 (white line), Sengundram RF, and Flora in Undulation Areas (yellow circle)

The existing condition of the hilly vegetation encircled in Figure 11.8.9 is zoomed in Figure 11.8.10. Evergreen canopy covers the hill at the back, compared to eucalyptus and other deciduous trees along the road. The distance between Section 5 and the hilly area is about 500 m.

No wildlife crossing is found around Sections 2, 3, and 5. The proposed road is not located within 10 km from the ecologically sensitive area.

Source: JICA Study Team

Figure 11.8.10 Segundram RF (front) and Native Vegetation on a Hill (back)

11.8.2 Survey Results

(1) Survey Results

The survey results are given in Table 11.8.3.

Table 11.8.3 Summary of Survey Results

No.	Items	Results
1	Air Pollution	● Air quality monitoring results in Sections 2, 3, and 4 (Figure 11.8.14 - Figure 11.8.17) show that the SO_2, NO_2, CO, and HC values were below the standard in both seasons (November and March). On the other hand, PM_{10} and $PM_{2.5}$ values in both seasons exceeded the standard. Exhaust from heavy vehicles and dust from busy and badly-paved roads are assumed to be the main cause of the suspended particles. ● The results from Section 5 show the same tendency with that of Section 4, except at the Poonjeri point. At the Poonjeri intersection, the values of SO_2 and NO_2 were near the standards, and even the minimum value of PM_{10} and $PM_{2.5}$ exceeded the standards.
2	Water Pollution	● According to the water quality monitoring results at four locations in Sections 2, 3, and 4 (● Table 11.8.5), the pH and suspended solids (SS) values were below the tolerant maximum standards for industrial effluents to surface water (BIS:2490). There is no water quality standard for public water bodies in India. ● The construction of the bridges will generate muddy water from excavation for the foundations in the canal course. Mitigation measures such as silt fencing and sedimentation tank must be installed. ● Since major bridges cross large rivers, no diversion of river water is planned. The piers will be constructed in phases keeping the cross-sectional area of rivers.
3	Waste	● Wastes discharged from public works need to be separated and treated adequately according to the Construction and Demolition Waste Management Rules (2016), Hazardous and Other Wastes (Management and Transboundary Movement) Rules (2016), Solid Waste Management Rules (2016), and Municipal Solid Wastes (Management and Handling) Rules (2000). Specifically, under district Pollution Control Board instruction, wastes which are segregated and stored in the work area by the Contractor will be collected, transported by contracted licensed operators, and disposed of at the disposal site specified by the district PCB. Recyclable materials are also collected for reuse by contracted private recycling companies. The toxic waste treatment facility of Tamil Nadu is located in Ranipet, about 80 km west from Chennai. ● In the construction of Sections 2, 3, and 5, major wastes to be generated will be soft soil, excavated soil which is not suitable for filling of embankment, plant waste, waste materials from the affected structures (if owners do not salvage them), and other containers and packing materials used for construction works. (Figure 11.3.17) ● Domestic waste will be generated from the temporary office of the Japanese consultants, local consultants, Contractors, and Construction Supervisors. ● In the construction of Sections 2, 3, and 5, major wastes to be generated will be soft soil and excavated soil which is not suitable for filling of embankment. Top organic soil will be reused for tree planting. Incompatible soil for reuse will be spread over the ROW so

No.	Items	Results
		that no disposal of waste soil is necessary.
4	Soil Contamination	● In Section 2, 3, and 5, the stock yard, repair shop, asphalt plant, and concrete plant will be established. Fuels, chemicals, bitumen, and oils stored at those facilities may contaminate the soil and ground water if spilled. ● There is no plan to use other heavy metals and chemicals, and no natural toxic matter is recorded in the local soil. ● No soil contamination from discharging oil was observed in similar construction works in CMA during the field survey. ● The facilities listed above will be established on the land designated by HMPD or on private land near the ROW by obtaining permission for establishment and operation in accordance with the local laws.
5	Noise and Vibration	● According to the results of Noise and Vibration monitoring (Figure 11.8.19, Figure 11.8.20), values of noise in Sections 2, 3, and 4 were below the standards (55 dB(A) in daytime, 45 dB(A) at night), but close to the standard values. The values of vibration were below the standards throughout the day at all points. ● At the Poonjeri intersection at the end of Section 5, noise levels exceeded the standards. Noise mainly comes from heavy vehicles on NH49, located next to the monitoring point. ● During the Construction Phase at populated areas, HMPD and the Contractor must provide information on the working plan to local residents, implement individual explanation and hearing to schools and hospitals which need special care, and clarify the contact point for complaints and grievances.
6	Ground Subsidence	● To make the DPR, the roadbed survey, done at 500 m intervals for the expansion of the existing road and 1 km for the new construction section in the DPR, did not find any soft soil that requires mitigation measures. The design CBR of 8% is applied in the pavement design. Because of this, soft soil that requires a large-scale countermeasure will not exist along Sections 2, 3, and 5. The construction of Sections 2, 3, and 5 will not cause ground subsidence.
10	Ecosystem	● In November 2017, an ecological survey was conducted in representative land and water environments (total 12 points) on and near the planned ROW of Section 2, Section 3, Section 4, and Section 5 (Figure 11.3.21, Figure 11.3.22, and Table 11.3.17 to Table 11.3.25). According to the results, terrestrial vegetation in the area was strongly affected by human activities such as afforestation and deforestation. Still, two endangered (EN) wood species listed in the IUCN Red List, *Decalepis hamiltonii* and *Depterocarpus indicus,* were found in woodlands in Kanchipuram District. At the Sriperumbhudur Tank in Section 3, wooly-necked storks, or *Ciconia episcopus*, ranked as vulnerable (VU), were observed. Local residents responded in the interview survey that Chennai sawfin barb, *Pethia sharmai,* ranked as endangered (EN), was commonly seen also in the Sriperumbhudur Tank. ● The existing condition of the RF areas to be affected by Section 3 and Section 5 were observed by the technical committee of TNSEAC in February 2018. They observed that "since it is mainly an afforested area and little natural habitats of plants and animals were recognized, the areas are not worth for conservation."

No.	Items	Results
		● The Kanchipuram DRO selected the RF Compensation Site, a 20.46-ha private land (Figure 11.8.21), in Chithamur Village, which is twice as large as the area to be converted to the ROW. The site was approved by DFO in February 2018 and the process of transferring to HMPD is ongoing as of May 2018. Also, DFO will make the afforestation plan including selecting species of trees, then demanding payment from HMPD. The location and the condition of the compensation land for RF conversion are shown in Figure 11.8.21, Figure 11.8.22 and Table 11.8.7. ● At the construction works of Sections 2, 3, and 5, a total of 1,986 trees with girth below 90 cm (Table 11.8.6) will be transplanted near the original location along the ROW under supervision of the Thiruvallur DFO. A total of 206 larger trees will be felled under DFO supervision, and ten times of the trees will be planted in the area proposed by DFO (DPR p. 9-8).
11	Hydrological Situation	● Sections 2, 3, and 5 will cross or pass near rivers, lakes, ponds, and canals (Table 11.8.8 - Table 11.8.10). ● In the Planning Phase, HMPD must discuss and agree with PWD on the management authority of water bodies and the necessary mitigation measures such as compensatory dredging plans where reclamation of water area is needed. The agreed measures must be included in the work plan.
12	Topography and Geographical Features	● Stone and sand for embankment and materials for road construction such as aggregates will be purchased from licensed providers. Sections 2, 3, and 5 will not develop a new quarry. Therefore, negative impacts on topography and geographical features are not expected (Figure 11.3.23).
13	Involuntary Resettlement and/or Loss of Properties	● According to the DPR in 2016, the number of structures to be resettled is as follows: (including 26 households of squatter residents) ➢ Section 2: 57 households and 6 businesses ➢ Section 3: 492 households and 57 businesses ➢ Section 5: 135 households and 116 businesses ➢ Total: 710 households (684+26) and 179 businesses
14	The Poor	● The Socio-Economic Survey shows that 38% of the PAHs are earning between INR 5,000 to 10,000, and 24% of the PAHs are earning between INR 10,000 to 15,000. The average monthly household income is INR 9,791. Since the average number of persons per household is 4.2, the average monthly income per capita is estimated as INR 2,895. (DPR Table 5.31) ● According to the 'Report of the Expert Group to Review the Methodology for Measurement of Poverty' published by the Indian Planning Commission in 2014, the poverty line of urban area in Tamil Nadu was INR 1,380.36 per capita per month int the fiscal year 2011-2012. With an average household size of 4.2, the households with monthly income below INR 5,797.51 are considered below poverty line.
16	Local Economy (such as Employment and Livelihood)	● Since Section 2 will be newly constructed, the location of potential negative impacts on the existing economic activities will be limited to the intersections with existing roads. Therefore, there will be no adverse impact on village level or regional level economy. ● In the development of Section 3 and Section 5, there will be an adverse impact on regional

No.	Items	Results
		level economy due to the resettlement and set back of existing economic activities. ● In the construction of about 25 km of roads, approximately 50 skilled workers and 250 unskilled workers are expected to be hired. This will have direct and indirect positive economic impacts.
18	Water Rights/ Water Use	● Section 2, Section 3, and Section 5 will affect 166 open wells (DPR RAP 2017 Table 5.8), 25 small pump rooms, and 8 water tanks. HMPD must consult and agree with owners to provide alternative water sources prior to the construction works. ● Water will be necessary for the facilities in the Construction Phase, such as concrete plant, temporary office, and workers camp. All necessary construction water and drinking water is planned to be procured from the market using water tankers to minimize the competition for water needs with the local residents.
19	Existing Infrastructure and Social Services	● Section 2, Section 3, and Section 5 will affect 14 temples, 11 bus stations, 7 public facilities, 4 churches, 2 private graveyards, and 1 school. (DPR RAP 2017 Table 5.22). ● HMPD and DRO must discuss and agree with the owner/manager of those facilities on the mitigation measures, such as on-site relocation and assistances for securing alternative site and rebuilding, to prevent occurrence of service suspension during the Construction Phase.
23	Physical Splits of Communities	● The alignment of Section 2 is planned to avoid existing built-up areas and to prevent the physical split of communities. ● Section 2 is planned to intersect with existing roads by an overpass. The current condition of existing roads will be saved. Access from existing roads to Section 2 is secured by the service road. Therefore, Section 2 will not cause negative impacts on existing traffic flow. ● An arterial road will exist between built-up areas along the existing roads of Section 3 and Section 5. Therefore, in the Construction Phase and Operation Phase, Section 3 and Section 5 will cause negative impacts on the crossing direction of traffic movement.
27	Children`s Rights	● Section 3 will affect one elementary school. HMPD and the Thiruvallur DRO must discuss and agree with the owner/manager of the facility on mitigation measures, such as on-site relocation and assistances for securing alternative site and rebuilding, to prevent occurrence of service suspension during the Construction Phase. ● According to the Child and Adolescent Labour (Prohibition and Regulation) Act (1986), employment of persons younger than 14 years of age is prohibited. It is necessary to comply with the law during the construction of Section 2, Section 3, and Section 5.
28	Sanitation, Public Health Condition, Infectious Diseases (including HIV/AIDS)	● Diseases such as malaria and dengue fever transmitted by mosquitoes are observed in CMA. In recent years, the number of patients infected by dengue fever has been increasing. Thus, in the Construction Phase of Section 2, Section 3, and Section 5, if garbage and stagnant water at the construction sites, stockyards, and offices are left without proper management, such places may become breeding spots for mosquitoes and may cause diseases on and near the sites. ● According to the survey of UNAIDS in 2012/2013, HIV-infected people accounted for 0.35% of the total population in India. The group which showed relatively high infection rates were spouses of truck drivers (0.87%), skilled and semi-skilled workers (0.72%), and housekeepers (0.6%).

No.	Items	Results
		● According to the DPR RAP 2017, 95% of all respondents (408 households) answered that they are aware of the precautionary measures of HIV/AIDS. Major information sources for them are television, government campaign, and radio. (DPR RAP 2017 Table 5.53)
29	Industrial Safety and Health, Working Environment	● India is one of the founding members of the International Labour Organization (ILO). The Ministry of Labour and Employment is committed to legislate labor safety at workplaces and to provide measures to ensure safe and healthy working conditions for every working woman and child. Domestic legislations regarding working environment and safety, however, are limited to the fields such as factory, mine, and shipbuilding industry as of 2018. ● In Tamil Nadu, the Directorate of Industrial Safety and Health is committed to develop and publicize safety guidance in construction sites. https://dish.tn.gov.in/information.html#safetybuilding ● The construction works of Section 2, Section 3, and Section 5 must follow state guidance, ILO guidance, and safety standards in Japan to keep healthy working environments, to secure occupational safety, to prevent accidents, and to prepare for emergencies.
30	Accidents, Crime	● In India, there is the standard manual on road safety published by the Road Congress. Section 2, Section 3, and Section 5 are designed in conformity with the standards. ● Although most parts of Section 2, Section 3, and Section 5 are new construction projects, there are several intersections with existing roads. At these locations, traffic congestion and traffic accidents may increase due to traffic control and detour routes during the Construction Phase. ● In the Operation Phase, an arterial road exists in the area where there was no such road before. An increase in traffic accidents, therefore, is expected. On the other hand, pedestrian safety will have a positive impact due to the existence of sidewalks on the service road. Also, traffic congestion and traffic accidents on existing roads that will receive less traffic due to the opening of Section 2, Section 3, and Section 5 are expected to decrease.
31	Border–crossing Impacts and Global Warming	● During the Construction Phase, greenhouse gas (CO_2) will be generated from the operation of transportation vehicles and construction machineries. Also, carbon sink decreases by felling trees. ● In the Operation Phase, the existence of arterial roads in the area where there was no such road will cause local increase in emission of greenhouse gases. On the other hand, traffic congestion and emission of greenhouse gases will decrease on the existing roads that will receive less traffic due to the opening of Section 2, Section 3, and Section 5. In addition, the number of tree saplings to be planted will be 10 times the number of felled trees. As the planted trees grow, a larger carbon sink will be created compared to the one before.

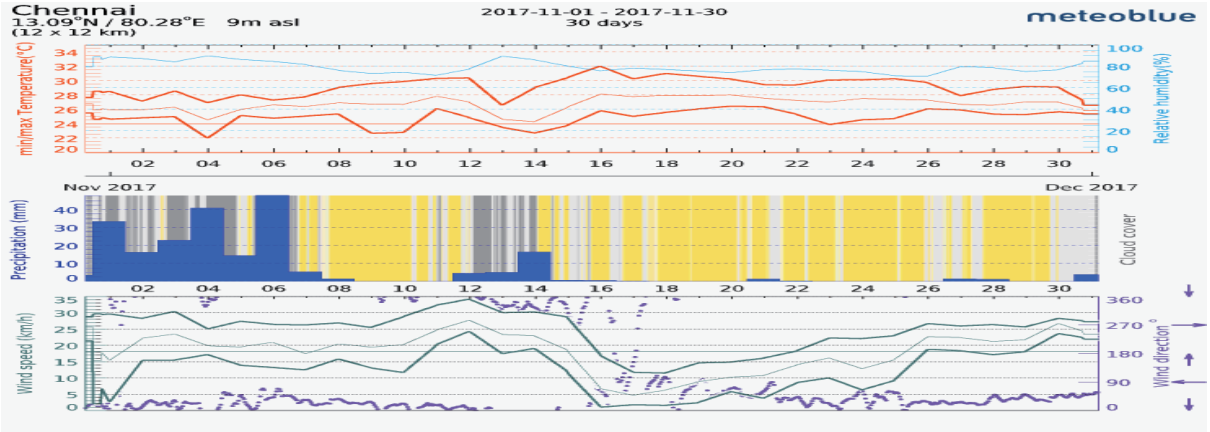
Source: JICA Study Team

(2) Meteorology

Baseline environmental data were collected during the monsoon season (November) and during the dry season (March) to analyse the variation of the environmental parameters over the seasons. Meteorology of Chennai in November 2017 is shown in Figure 11.8.11. The meteorology of Chennai in March 2018 is shown

in Figure 11.8.12.

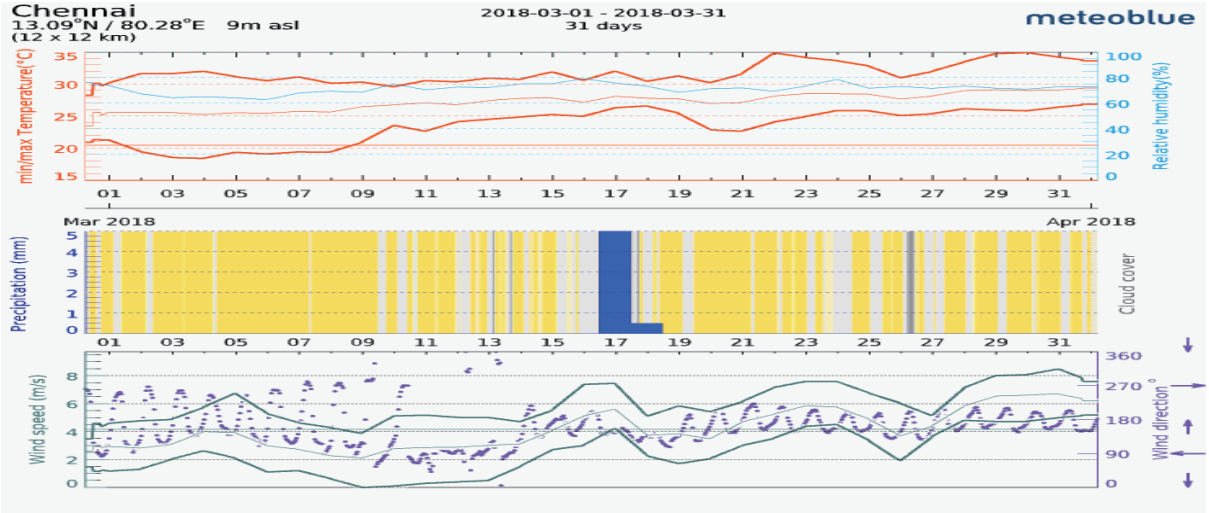
In Chennai, the period of June to November is regarded as the monsoon season (rainy season). However, it rained from 01 to 14 November 2017, during which the period for monitoring at Section 1 and Section 2 was conducted. After 15 November, sunny conditions were observed. In March 2018, it was sunny except for the 17th and 18th.



	Relative Humidity		Minimum cloud
	Min/ Max Temperature		Sunny
	Precipitation in mm		Wind direction
	Dense cloud		Wind speed

Source: JICA Study Team

Figure 11.8.11 Weather Data for Chennai (November 2017)



	Relative Humidity		Minimum cloud
	Min/ Max Temperature		Sunny
	Precipitation in mm		Wind direction
	Dense cloud		Wind speed

Source: JICA Study Team

Figure 11.8.12 Weather Data for Chennai (March 2018)

(3) Air Quality

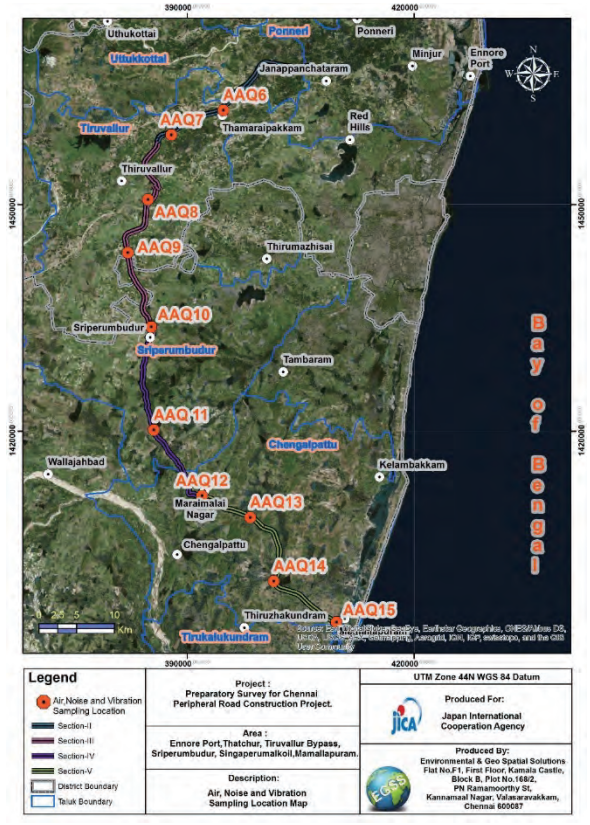
Air quality monitoring was conducted at 11 locations along Sections 2, 3, 4, and 5. Table 11.8.4 and Figure

11.8.13 show the location of the monitoring points, which were selected from representative locations (representative environment of urban and rural areas and public facilities) within 500 m from the planned ROW. Many points are set at a corner of the homestead so that the equipment will not be disturbed during the night hours. The results of air quality measurement are shown in Figure 11.8.14 to Figure 11.8.17.

Table 11.8.4 Air, Noise, and Vibration Monitoring Site

	Site No.	Sampling Location	Sampling Point	Coordinates
Section 2	AAQ5 N5	Athipedu	House at Athipedu	13°16'37.14"N 80° 9'8.25"E
	AAQ6 N6	Thamaraipakkam	House, Selliamman Nagar, Thamaraipakkam	13°13'37.68''N 80°1'43.69''E
	AAQ7 N7	Kilanur	House, Kilanoor, Thiruvallur	13°11'50.17''N 79°57'31.64''E
Section 3	AAQ8 N8	Putlur	Church, Putlur (Thozhvur)	13°7'11.50''N 79°56'14.53''E
	AAQ9 N9	Polivakkam	Ramanathan Chettiar Village Panchayat School, Polivakkam	13°03'22.37"N 79°54'46.73"E
	AAQ10 N10	Sriperumbudur	Sriperumbudur PWD Irrigation Office	12°58'2.80"N 79°56'30.73"E
Section 4	AAQ11 N11	Oragadam (Rural Point)	Panchayat Building Oragadam	12°50'38.63"N 79°56'44.56"E
	AAQ12 N12	Singaperumalkoil (Urban Point)	Primary Health Care Centre, Singaperumalkoil	12°45'56.05''N 80°0'16.94''E
Section 5	AAQ13 N13	Dasarikuppam	House, Maraimalai, Nagar	12°44'23.50"N 80° 3'49.09"E
	AAQ14 N14	Otteri	House, Oragadam Post, Otteri	12°39'49.17''N 80°5'33.38'E
	AAQ15 N15	Poonjeri	Shopping Building, Poonjeri Junction	12°36'53.55"N 80°10'9.16"E

Source: JICA Study Team

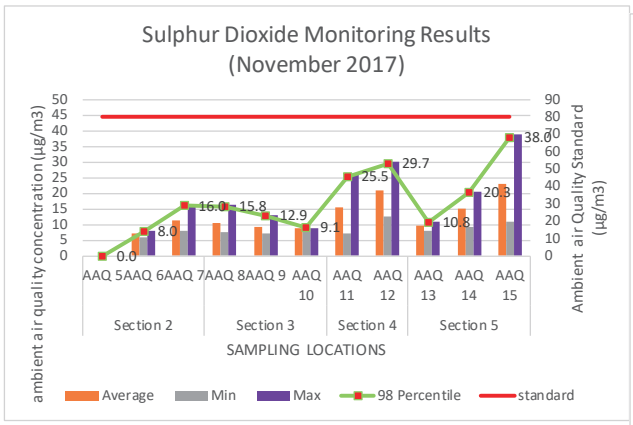


Source: JICA Study Team

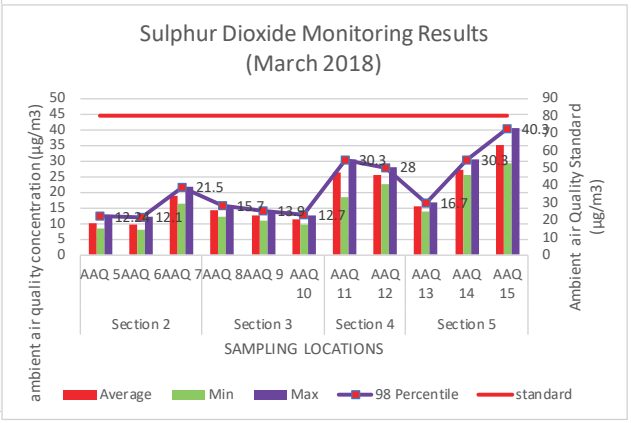
Figure 11.8.13 Air, Noise, and Vibration Monitoring Locations

Concentration of SO_2, NO_2, CO, and HC at Sections 2, 3, and 4 were below the standards in both seasons (November and March). On the other hand, values of PM_{10} and $PM_{2.5}$ exceeded the standards in both seasons. Exhaust from heavy vehicles and dust from busy and badly-paved roads are assumed to be the main cause of the suspended particles.

The results from Section 5 show the same tendency with Section 4, except the Poonjeri point. At the Poonjeri intersection, the values of SO_2 and NO_2 were near the standards, and even the minimum value of PM_{10} and $PM_{2.5}$ exceeded the standards.



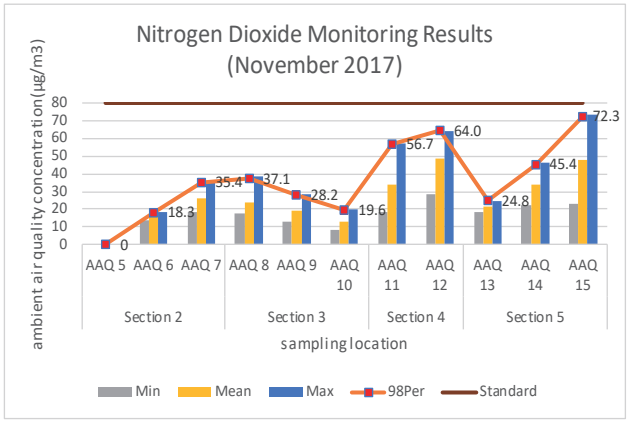
November 2017



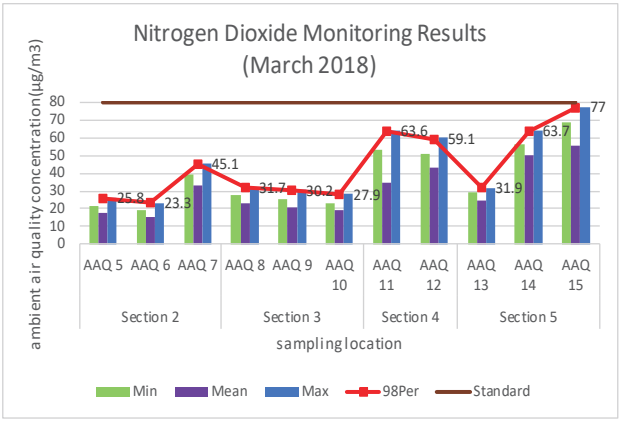
March 2018

Source: JICA Study Team

Figure 11.8.14 Sulphur Dioxide Monitoring Results



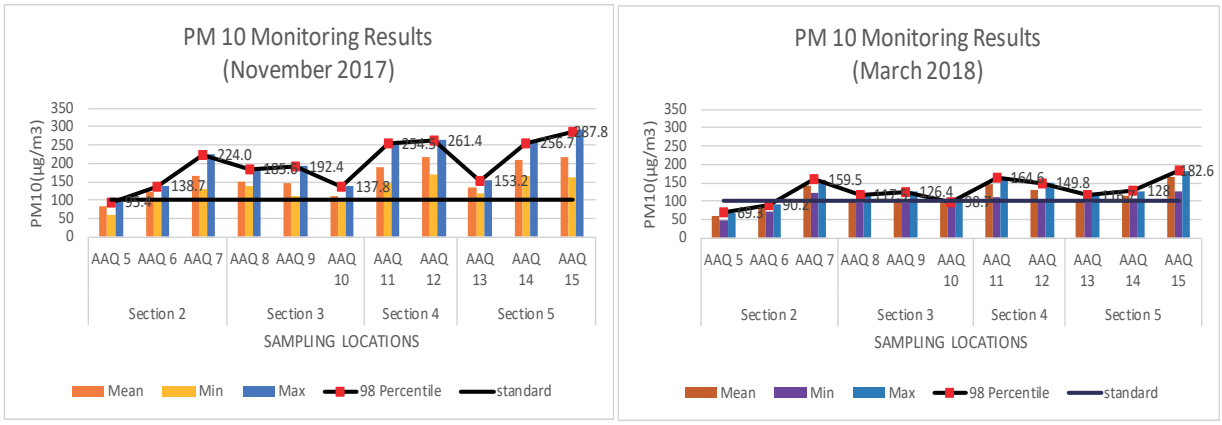
November 2017



March 2018

Source: JICA Study Team

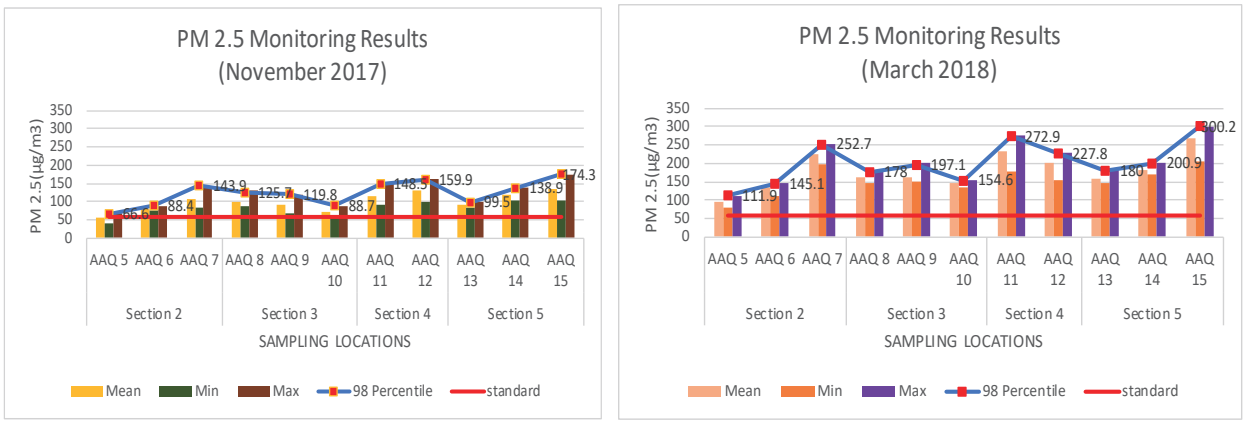
Figure 11.8.15 Nitrogen Dioxide Monitoring Results



November 2017 **March 2018**

Source: JICA Study Team

Figure 11.8.16 PM_{10} Monitoring Results



November 2017 **March 2018**

Source: JICA Study Team

Figure 11.8.17 $PM_{2.5}$ Monitoring Results

(4) Water Quality

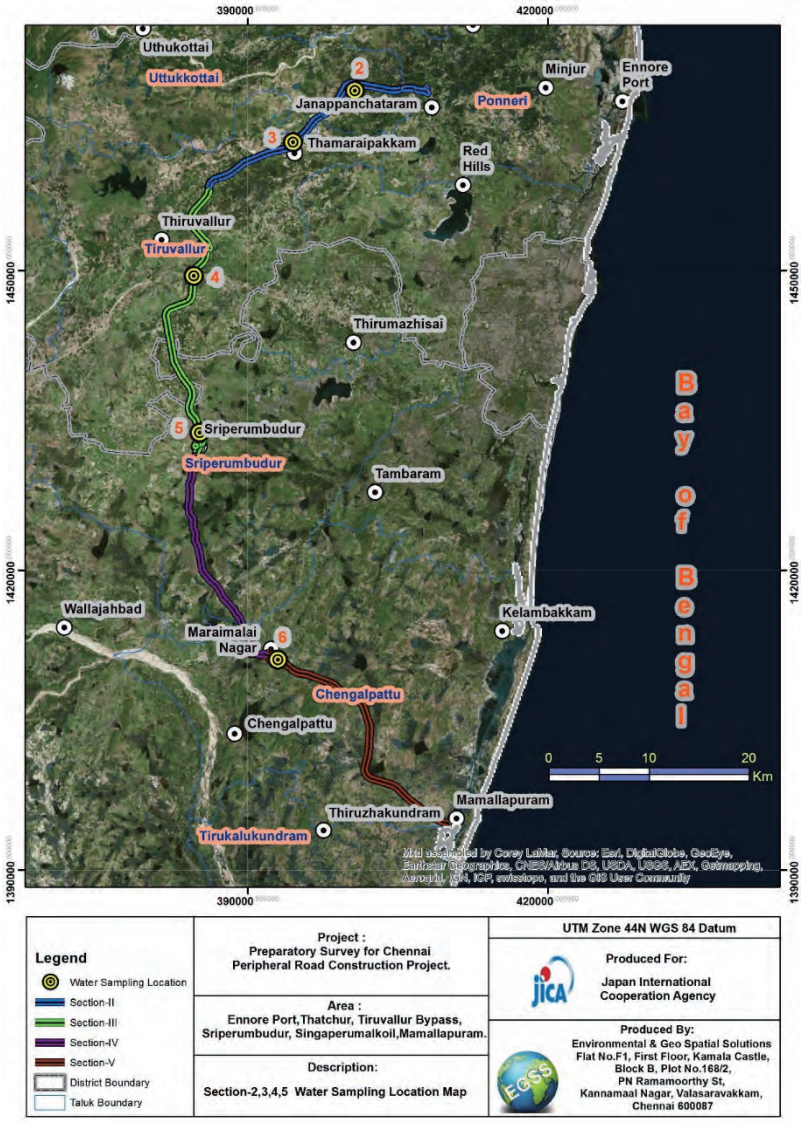
Figure 11.8.18 shows the monitoring points at Sections 2, 3, and 4. The Kannigaipair Tank at Section 2 was dry in both seasons (November and March) because of drought in 2017/2018.

Values of pH and SS at Sections 2, 3, and 4 were all below the standards for tolerant maximum standards for industrial effluents to surface water (BIS:2490) (Table 11.8.5).

Table 11.8.5 Water Sampling Results

Section	No	Sampling Location	pH			SS (mg/L)		
			November 2017	March 2018	BIS (Reference)	November 2017	March 2018	BIS (Reference)
2	2	Kannigaipair Tank	NA	NA	5.5～9.0	NA	NA	100
	3	Kosasthalaiyar River	7.2	7.83		10	BQL(LOQ2)	
3	4	Cooum River	7.63	7.05		BQL(LOQ2)	BQL(LOQ2)	
	5	Sriperumbudur Tank	7.5	7.67		3.8	4	
4	6	Tank northeast of Thangamal Colony	7.05	7.14		BQL(LOQ2)	BQL(LOQ2)	

Note: NA- Water not found in tank BQL- Below Quantifiable Limit LOQ- Limit of Quantification
BIS: Bureau of Indian Standards 2490, PART-I-1981
Source: JICA Study Team



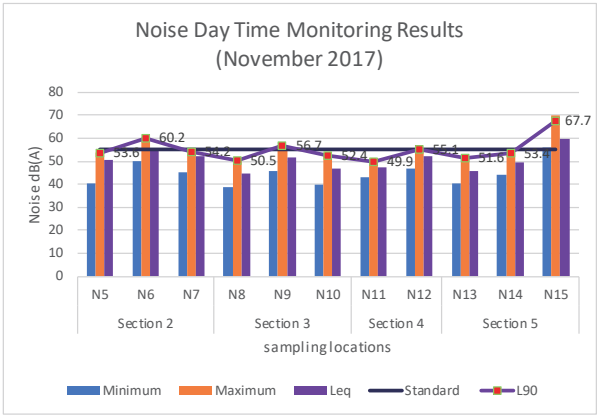
Source: JICA Study Team

Figure 11.8.18 Water Sampling Locations

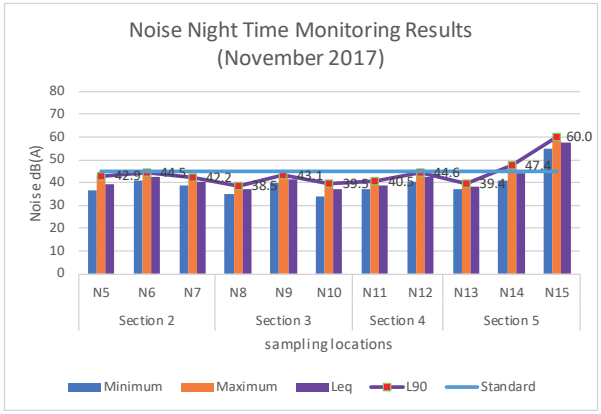
(5) Noise and Vibration

Noise and vibration monitoring was conducted at the same locations for air quality monitoring (Figure 11.8.13, Table 11.8.4)

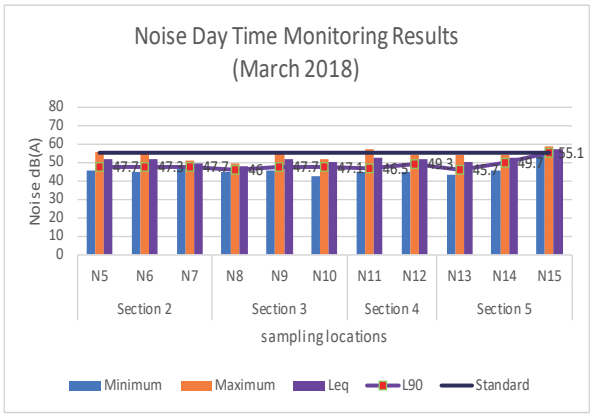
According to the results of the noise and vibration monitoring (Figure 11.8.19, Figure 11.8.20), noise levels at Sections 2, 3, and 4 were below but quite close to the standard values (55 dB(A) in the daytime, 45 dB(A) at night). At the Poonjeri intersection at the end of Section 5, noise levels exceeded the standards. Noise mainly comes from heavy vehicles on NH49, located next to the monitoring point. Observed vibration levels were far below the standards throughout the day.



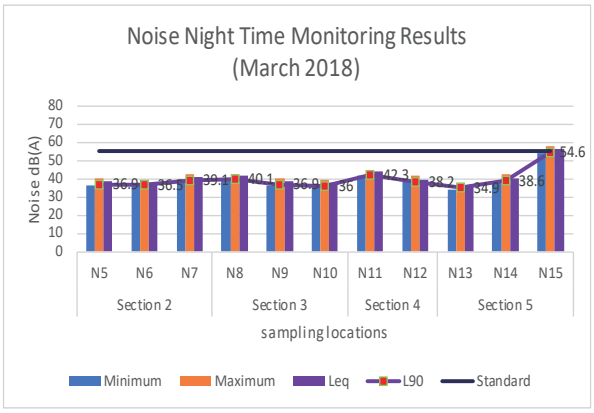
November 2017 (day)



November 2017 (night)



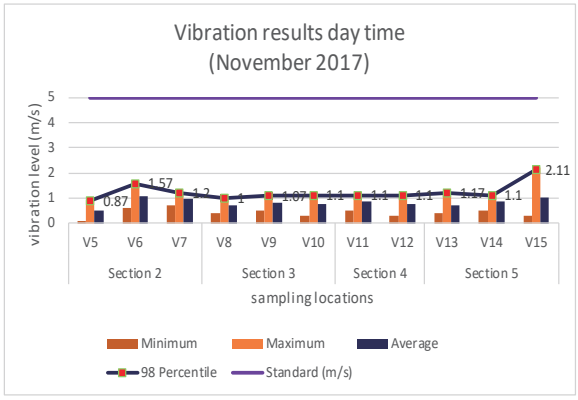
March 2018 (day)



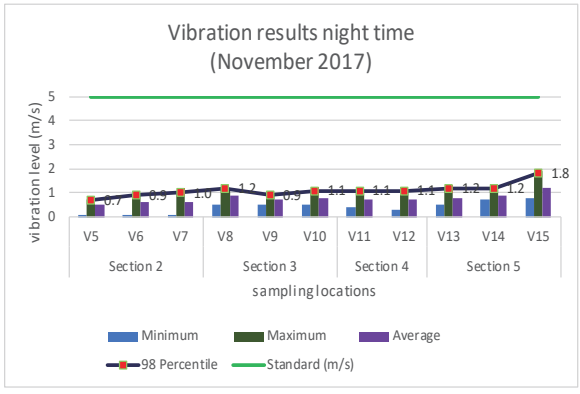
March 2018 (night)

Source: JICA Study Team

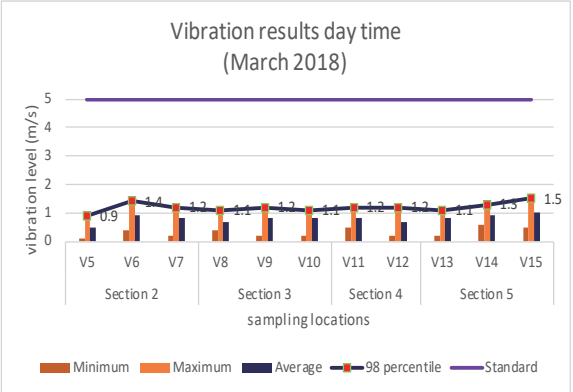
Figure 11.8.19 Noise Monitoring Results



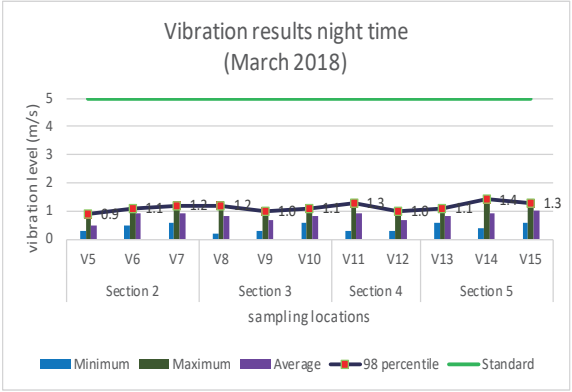
November 2017 (day)



November 2017 (night)



March 2018 (day)



March 2018 (night)

Source: JICA Study Team

Figure 11.8.20 Vibration Monitoring Results

(6) Ecosystem

1） Ecological Survey

The results of the ecological survey conducted on and near areas of Sections 2, 3, 4, and 5 are described in the Section 11.3.5 (7) (Table 11.3.18 – Table 11.3.25).

In the Kancheepuram District, two types of trees, *Decalepis hamiltonii* and *Dipterocarpus indicus* (both are included in the Red list as EN trees), were confirmed. At the Sriperumpudur Tank adjoining Section 3, *Pethia sharmai* (EN fish) was confirmed to inhabit the area based on the inquiry survey from local residents. *Ciconia episcopus* (VU bird) was also confirmed to be present in the same tank.

2） Trees to be Affected

Table 11.8.6 gives the number of trees to be affected by Sections 2, 3, 4 and 5.

Table 11.8.6 Number of Trees to be Affected

S. No.	Description	Section 2	Section 3	Section 4	Section 5	Total
Saved at the existing location		**91 trees**	**1582 trees**	**-**	**245 trees**	**1918 trees**
Transplanting		**383 trees**	**446 trees**	**-**	**1157 trees**	**1986 trees**
1	Girth above 30 cm and up to 60 cm	146	201	-	387	
2	60 cm to 90 cm	237	245	-	770	
Cutting		**17 trees**	**246 trees**	**-**	**43 trees**	**306 trees**
3	90 cm to 180 cm	17	74	-	34	
4	Girth above 180 cm	0	172	-	9	
Sectional total		**491 trees**	**2274 trees**	**-**	**1445 trees**	**4210 trees**

Source: DPR EIA 2018

3） RF Compensation Site

At the meeting with the Director of DOE, JICA, and the JICA Study Team on 24 October 2017, the JICA Study Team requested that the compensation land must be selected for maintaining habitat continuity and for having equivalent biodiversity with the area to be converted by the project or with other forest areas. The Director explained that land availability is the key issue in selecting the site and the requested continuity with the particular RF to be converted cannot be promised. The Director, however, assured that 1) one piece of land of sufficient size, double of the planned conversion of 10.23 ha, will be selected by the DRO, 2) the DFO will conduct a site survey and will approve only the suitable land for RF compensation land, and 3)

with those conditions, therefore, biodiversity in the area on or near the compensation land will be conserved in the long-term basis.

According to information from the State Forest Department website and from the interview with local consultants, the DFO will make the afforestation plan including the selection of suitable species of trees for the particular site, then will request for the necessary budget from HMPD.

The Kancheepuram DRO selected the RF Compensation Site, a 20.46-ha private land (Figure 11.8.21), in Chithamur Village, which is twice as large as the area to be converted to the ROW. The site was approved by the DFO in February 2018. This site is located about 37 km southwest from the end of Section 5. The north boundary of the site is SH115, and SH117 runs about 1 km on its west side.

GPS coordinates of the center point：12°24’17.13”N, 79°54’14.89”E
Source：JICA Study Team

Figure 11.8.21 The Location of RF Compensation Site

The condition of the RF Compensation Site is shown in Figure 11.8.22.

The RF Compensation Site is a hilly area with savanna vegetation mainly composed of bushes and grasses. It is assumed that for the last 20 to 30 years, human activities such as cutting fuel wood and grazing by local residents have become stronger. Flora found on site is shown in Table 11.8.7. Animal species found on site were mongoose, squirrel, snakes, lizards, and frogs.

Table 11.8.7 Plant Species in RF Compensation Site

Tree and bush species	*Azadirachta indica* *Punica granatum* *Tectona grandis* *Albizia zygia* *Combretum collinum* *Erythrina* *Bridelia spp.*	
Herbs, grasses	*Hypererrhenia filipendula* *Setaria sphacelata* *Setaria megaphylla* *Pennisetum spp.* *Aristida adscensionis* *Aristida funiculate* *Arundo donax* *Cynodon dactylon* *Abutilon indicum* *Acalypha indica* *Achyranthes aspera* *Aerva lanata*	*Ageratum conyzoides* *Altrernanthera sessilis* *Amaranthus spinosus* *Ammania baccifera* *Argemone mexicana* *Aristolochia bracteolate* *Jatropha glandulifera* *Cassia alata* *Calotropis gigantea* *Calotropis procera* *Ricinus communis* *Vitex negundo*

Source：JICA Study Team

Source：JICA Study Team (taken on 4 May 2018)

Figure 11.8.22 Photos of the RF Compensation Site

(7) Hydrology

Water resources which are likely to be affected by Sections 2, 3, and 5 are shown in Table 11.8.8 to Table 11.8.10. HMPD is responsible for discussing and agreeing with PWD in advance to the commencement of the construction works about the road design and necessary mitigation measures on or near the water resources.

Table 11.8.8 Water Resources - Section 2

No.	Water Body	Village	Chainage	Remarks
Crossing of Lake and Pond				
1	Kannigaipair Lake	Kannigaiper	27+600	Nearest one
2	Poorivakkam Lake	Poorivkkam	29+800	Nearest one
3	Athangi Kavanoor Canal	Athangi Kavanoor	30+800	Crossing the road
4	Pagalmedu Lake	Pagalmedu	32+400	Nearest one
5	Velliyur Lake	Velliyur	40+900	Nearest one
6	Vishnuvakkam Canal	Vishnuwakkam	44+100	Crossing the road
7	Kelanur Pond	Kelanur	45+000	Crossing the road
8	Kelanur Canal	Kelanur	45+000	Crossing the road
9	Melanur Canal	Melanur	46+500	Crossing the road
10	Kelanur Lake	Kelanur	46+800	Crossing the road
Crossing of River				
11	Kosathalaiyar River	Tamaraipakkam	36+900	—
12	Krishna River (Canal)	Thanneerkulam	53+700	—

Source: JICA Study Team

Table 11.8.9 Water Resources - Section 3

No.	Water Body	Village	Chainage	Remarks
Crossing of Lake and Pond				
1	Kalyanakuppam Lake	Kalyanakuppam	5 0+900	Crossing the road
2	Thanneerkulam Lake	Thanneerkulam	53+700	Crossing the road
3	Thanneerkulam Pond	Thanneerkulam	54+600	Crossing the road
4	Thozhvur Lake	Thozhuvur	55+600	Nearest one
5	Putlur Pond	Putlur	56+000	Nearest one
6	Putlur Lake	Putlur	57+000	Nearest one
7	Vengathur Lake	Vengathur	58+300	Nearest one
8	Aranvoyal Lake	Aranvoyal	58+3 00	Nearest one
9	Athikulam Lake	Athikulam	63+000	Crossing the road
10	Chattram Canal	Chattram	65+100	Crossing the road
11	Parangusapuram Lake	Parangusapuram	70+600	Crossing the road
12	Panithangal Lake	Panithangal	71+600	Nearest one
13	Thodukadu Lake	Thodukadu	72+200	Crossing the road
14	Thodukadu Pond	Thodukadu	72+100	Crossing the road
15	Sriperumbudur Canal	Sriperumbudur	75+000	Crossing the road
16	Sriperumbudur Lake	Sriperumbudur	76+800	Crossing the road
Crossing of River				
17	Cooum River	Putlur	57+800	—
18	Cooum River (Canal)	Janappachatram	74+000	—

Source: JICA Study Team

Table 11.8.10 Water Resources - Section 5

No.	Water Body	Village	Chainage	Remarks
Crossing of Lake and Pond				
1	Senkundram Lake	Senkundram	102+700	Crossing the one
2	Hanumanthapuram Pond	Hanumanthapuram	106+300	Nearest one
3	Sirukundram Lake	Sirukundram	110+700	Crossing the one
4	Dasarikuppam Lake	Dasarikuppam	115+300	Crossing the one
5	Manampathy Lake	Manampathy	118+100	Nearest one
6	Poonjeri Lake	Poonjeri	129/166	Nearest one
7	Mammalla Lake	Poonjeri	129/166	Nearest one
8	Perumal Eri	Perumal Eri	127/800	Nearest one
Crossing of River				
9	Kunnappattu River	Kunnappattu	123+500	Nearest one

Source: JICA Study Team

CHAPTER 12 PROJECT EVALUATION

12.1 Methodology

12.1.1 Economic Analysis

(1) General

The main objective of this economic analysis is to examine the investment efficiency of the project from the viewpoint of the national economy using cost-benefit analysis in the case where it can be applied. Market prices are converted to economic costs where the influence of market distortion is removed (so-called shadow prices). Opportunity costs are used for the costs of goods and services if their markets do not exist. Economic Internal Rate of Return (EIRR) is used as an indicator of the efficiency of a project investment.

(2) Preconditions

The following preconditions are assumed in the economic evaluation. Additional preconditions will be clarified as necessary.

1) With-Project and Without-Project

For Chennai Peripheral Ring Road (CPRR), with-project is the case where only the target section of the highway is constructed in the road network system, with Section 4 which will be used as planned. Without-project is the case where any section of the highway is not constructed in the road network system, except Section 4 which will be used as planned.

2) Evaluation Period

Evaluation period covers the whole project life from the preparation of construction. It is decided to be from 2018 to 2048 (25 years after the highway was first used) for CPRR.

3) Conversion to Economic Prices

In the stage of prioritizatn of components for inplementation, market prices are converted to economic prices by multiplying Standard Conversion Factor (SCF) = 0.90, which is used in the economic analysis of the Detailed Project Report (DPR). For the eavaluation of the prioritized section (Section 1), SCF = 0.97, which is estimated in accordance with JICA's "IRR Calculation Manual," is applied. In addition, land prices are discounted by 50% because they include the “Solatium” to the landowners as 100% of the market value in accordance with the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act of 2013.

4) Special Discount Rate

The social discount rate employed is twelve percent, which is used in the economic analysis of the DPR. It is used as the criteria for economic evaluation.

5) Price Level

Price level is set at 2017. Price data, which are not at the 2017 level, are adjusted to the 2017 level by applying the inflation rate (gross domestic product (GDP) deflator).

(3) Project Benefit

Incremental benefits are included in the evaluation by comparing with-project case and without-project case. The benefits are calculated in the form of cash inflow of each year during the evaluation period. Benefits of the CPRR Project include the reduction of vehicle operation cost (VOC) and travel time cost (TTC).

1) Vehicle Operation Cost (VOC)

VOC per unit distance is estimated by vehicle types which are categorized as two-wheeler (TW), car, three-wheeler (Auto), bus, light commercial vehicle (LCV), truck and multi-axe heavy commercial vehicle (MAV). The VOC is composed of a) fuel cost, b) tire cost, c) engine oil cost, d) other oil cost, e) greasing cost, f) spare parts cost, g) maintenance cost, h) fixed cost, and i) passenger cost.

Manual on Economic Evaluation of Highway Projects in India, Indian Road Congress (2009) presents the baseline value of VOC at free flow speed of 40 km/h by vehicle type, incorporating the above components as of 2009. In addition, VOCs at other speeds were estimated by referring to past studies. Finally, VOCs were converted to those in 2017 prices by applying GDP deflator as shown below.

Table 12.1.1 VOC by Type of Vehicle in 2009

Unit: INR per veh-km

	TW	Car	Auto	Bus	LCV	Truck	MAV
Free Flow Speed (40 km/h)	1.86	5.81	3.95	15.05	10.01	11.23	18.32

Source: Indian Road Congress, *Manual on Economic Evaluation of Highway Projects in India*, 2009

Table 12.1.2 VOC by Velocity and Type of Vehicle in 2017

Unit: INR per veh-km

Velocity (km/h)	TW	Car	Auto	Bus	LCV	Truck	MAV
5	6.51	39.88	6.51	69.99	53.16	54.65	89.15
10	4.53	22.83	4.53	46.15	35.49	37.51	61.19
15	3.81	17.09	3.81	37.08	28.36	30.51	49.78
20	3.43	14.18	3.43	31.73	23.87	26.08	42.54
25	3.27	12.58	3.27	29.21	21.31	23.43	38.23
30	3.11	11.17	3.11	26.89	19.03	21.06	34.36
35	2.96	9.92	2.96	24.76	16.99	18.93	30.88
40	2.82	8.80	2.82	22.80	15.16	17.01	27.75
45	2.83	8.85	2.83	22.91	15.23	17.09	27.88
50	2.86	8.93	2.86	23.13	15.38	17.25	28.14
55	2.90	9.06	2.90	23.46	15.60	17.50	28.55
60	2.96	9.23	2.96	23.90	15.90	17.83	29.08
65	3.03	9.45	3.03	24.48	16.28	18.26	29.78
70	3.12	9.73	3.12	25.18	16.75	18.78	30.64
75	3.22	10.05	3.22	26.01	17.30	19.41	31.66
80	3.34	10.43	3.34	27.01	17.96	20.15	32.87

Source: JICA Study Team

Table 12.1.3 GDP Deflator

2009	2010	2011	2012	2013	2014	2015	2016	2017*
6.06%	8.98%	8.54%	7.93%	6.19%	3.05%	1.79%	3.61%	2.81%

Note *: Data for 2017 is the geometric mean of 2014 to 2016.
Source: Website of the World Bank, https://data.worldbank.org/country/india?view=chart

Formula of the Benefit from the Reduction of VOC

Formula of the benefit from the reduction of VOC is shown below. The source is *the Manual for Cost-Benefit Analysis*, Ministry of Land, Infrastructure, Transport and Tourism, Japan (2008), with a minor modification by the JICA Study Team.

Benefit from the reduction of VOC: $BR = BR_O - BR_W$

Total VOC: $BR_i = \sum_j \sum_i (Q_{ijl} \times L_l \times \beta_{jv}) \times 365$

where,

BR : Benefit from the reduction of VOC (INR/year)

BR_i : Total VOC where the project *i* is implemented (INR/year)

Q_{ijl} : Traffic volume of vehicle type *j* at link *l* where the project *i* is implemented (vehicles/day)

L_l : Length of link *l* (km)

β_{jv} : VOC of vehicle type *j* (INR/vehicle per km) at an average velocity *v* (km/h)

i	:	*W* in case of implementation, *O* in case of no implementation
j	:	Vehicle type
l	:	Link ID number
v	;	Average velocity of vehicle

2) Travel Time Cost (TTC)

TTC by type of vehicle has been estimated in the JICA study on ITS Master Plan for Bengaluru Metropolitan Area. TTCs of two-wheeler, three-wheeler (auto), car, and truck were estimated based on the results of the opinion survey carried out by the JICA Study Team. TTCs were calculated by referring to the average salary (INR/month) of drivers. TTC of bus was estimated considering the average revenue and the passenger volume per hour, based on information obtained from the counterpart agency. As the JICA Study Team did not estimate TTCs for LCV and MAV, those of Auto and Truck are used respectively. In addition, TTCs were estimated in 2014 prices, which were then converted to 2017 prices by applying the GDP deflator.

Table 12.1.4 Travel Time Cost (2017)

Unit: INR per veh-min

TW	Car	Auto	Bus	LCV	Truck	MAV
1.77	3.64	1.77	21.69	1.77	1.55	1.55

Source: JICA Study Team based on JICA study on ITS Master Plan for Bengaluru Metropolitan Area, 2014

Formula of the Benefit from the Reduction of TTC

The formula of the benefit from the reduction of TTC is shown below. The source is *the Manual for Cost-Benefit Analysis*, Ministry of Land, Infrastructure, Transport and Tourism, Japan (2008).

Benefit from the reduction of TTC: $BT = BT_O - BT_W$

Total TTC: $BT_i = \sum_j \sum_i (Q_{ijl} \times T_{ijl} \times \alpha_j) \times 365$

Where,

BT	:	Benefit from the reduction of TTC (INR/year)
BT_i	:	Total TTC where the project *i* is implemented (INR/year)
Q_{ijl}	:	Traffic volume of vehicle type *j* at link *l* where the project *i* is implemented (vehicles/day)
T_{ijl}	:	Travel time of vehicle type *j* at link *l* where the project *i* is implemented (min)
α_j	:	TTC of vehicle type *j* (INR/min per vehicle)
i	:	*W* in case of implementation, *O* in case of no implementation
j	:	Vehicle type
l	:	Link ID number

(4) Project Cost

Incremental costs are included in the evaluation by comparing with-project and without-project. The costs are calculated in a form of cash outflow of each year during the evaluation period. The following cost items are considered.

1) Initial Cost

Initial cost includes the cost of construction of the facility and equipment and the cost of consulting services. Economic evaluation includes physical contingencies but excludes price escalations. Reinvestment cost of facility and equipment is calculated at the end of their effective lifespans.

2) Operation and Maintenance (O&M) Cost

O&M cost for each year is included. Price escalation is not included.

3) Depreciation

As the money allocated and subject to depreciation is not actually spent at that time, it is not included in the cost items from the viewpoint of cash flow.

12.1.2 Financial Analysis

(1) General

A main objective of this financial analysis is to examine the efficiency of a project investment from the viewpoint of the project implementation body using cost-benefit analysis. Market prices are used. An Internal Rate of Return (IRR) is used as the indicator of the efficiency of a project investment. IRR used in financial evaluation is called the Financial Internal Rate of Return (FIRR).

(2) Preconditions

The following preconditions are assumed in the economic evaluation. Additional preconditions will be clarified as necessary.

1) With-Project and Without-Project

For CPRR, with-project is the case where only the target section of the highway is constructed in the road network system, with Section 4, which will be used as planned. Without-project is the case where any section of the highway is not constructed in the road network system, except section 4 which will be used as planned.

2) Evaluation Period

The evaluation period covers the whole project life from the preparation of construction. It is decided from 2018 to 2048 (25 years after the highway started to be used) for CPRR.

3) Opportunity Cost of Capital

As no funds will be borrowed for financing, 12% is employed in accordance with the economic evaluation. This value is the same with social discount rate, which is used for the economic analysis. It is used as the criteria for the financial evaluation.

4) Price Level

Price level is set at 2017. Price data which are not at 2017 level are adjusted to 2017 level by applying the inflation rate (GDP deflator).

(3) Project Benefit

The project benefit is limited to the toll revenue collected from the users of CPRR. Other revenues such as subsidies from the government are not considered here in order to clarify whether the project itself is viable or not only with the toll revenue. Toll rates are set in accordance with the National Highways Fee (Determination of Rates and Collection) Rules of 2008 and its amendments thereafter because the toll system will be basically the same with the national rules, according to an interview with the Tamil Nadu Road Development Company Ltd. (TNRDC), which is assumed to be the management body of state highway projects.

Although the National Highways Fee (Determination of Rates and Collection) Rules of 2008 is very complicated, it can be summarised for the purpose of this study as follows:

1) No toll shall be levied on two-wheelers and three-wheelers,
2) Base rate (BR) of toll per km is set (in Rupees),
3) The rates specified in 2) shall be increased without compounding, by three percent each year,
4) The applicable base rates shall be revised annually to reflect the increase in wholesale price index (WPI), but such revision shall be restricted to 40% of the increase in wholesale price index.

The formula to determine the applicable rate of toll is given as follows:

$$\text{Applicable rate of toll per km} = (BR_0 + BR_0 \times 0.03 \times n) \times \left\{1 + \left(\frac{WPI_n - WPI_{n-1}}{WPI_{n-1}}\right) \times 0.4\right\}$$

Where,

BR_0 : Base rate in the base year (2007)

n : Number of years after the base year (2007)

WPI_n : Wholesale price index after n years from the base year (2007)

Table 12.1.5 Base Rate

Unit: INR per km

Year	TW	Car	Auto	Bus	LCV	Truck	MAV
2007	0.00	0.65	0.00	2.20	1.05	2.20	3.45

Source: National Highways Fee (Determination of Rates and Collection) Rules, 2008, and its amendments

Table 12.1.6 Applicable Rate for Toll

Unit: INR per km

Year	TW	Car	Auto	Bus	LCV	Truck	MAV
2024	0.00	0.99	0.00	3.34	1.59	3.34	5.23
2025	0.00	1.01	0.00	3.40	1.62	3.40	5.33
2026	0.00	1.02	0.00	3.47	1.66	3.47	5.44
2027	0.00	1.04	0.00	3.53	1.69	3.53	5.54
2028	0.00	1.06	0.00	3.60	1.72	3.60	5.65
2029	0.00	1.08	0.00	3.67	1.75	3.67	5.75
2030	0.00	1.10	0.00	3.73	1.78	3.73	5.85
2031	0.00	1.12	0.00	3.80	1.81	3.80	5.96
2032	0.00	1.14	0.00	3.87	1.85	3.87	6.06
2033	0.00	1.16	0.00	3.93	1.88	3.93	6.17
2034	0.00	1.18	0.00	4.00	1.91	4.00	6.27
2035	0.00	1.20	0.00	4.06	1.94	4.06	6.37
2036	0.00	1.22	0.00	4.13	1.97	4.13	6.48
2037	0.00	1.24	0.00	4.20	2.00	4.20	6.58
2038	0.00	1.26	0.00	4.26	2.03	4.26	6.69
2039	0.00	1.28	0.00	4.33	2.07	4.33	6.79
2040	0.00	1.30	0.00	4.40	2.10	4.40	6.89
2041	0.00	1.32	0.00	4.46	2.13	4.46	7.00
2042	0.00	1.34	0.00	4.53	2.16	4.53	7.10
2043	0.00	1.36	0.00	4.59	2.19	4.59	7.21
2044	0.00	1.38	0.00	4.66	2.22	4.66	7.31
2045	0.00	1.40	0.00	4.73	2.26	4.73	7.41
2046	0.00	1.42	0.00	4.79	2.29	4.79	7.52
2047	0.00	1.44	0.00	4.86	2.32	4.86	7.62
2048	0.00	1.46	0.00	4.93	2.35	4.93	7.73

Note: It is assumed that the WPI will increase every year by 1.0% after 2017, which is the arithmetic mean of 2014 to 2016.
Source: JICA Study Team based on National Highways Fee (Determination of Rates and Collection) Rules of 2008, and its amendments

Table 12.1.7 Wholesale Price Index

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017*
89.17	91.27	100.00	108.89	117.67	125.07	129.96	126.41	128.82	130.15

Note *: Data for 2017 is the arithmetic mean of 2014 to 2016.
Source: Website of the World Bank, https://data.worldbank.org/country/india?view=chart

(4) Project Cost

Costs include any money value in market prices actually spent for the project. Additional costs are

included in the evaluation by comparing with-project and without-project. The costs are calculated in a form of cash flow in each year during the evaluation period. The following cost items were considered:

1) Initial Cost

Initial cost includes costs incurred for the construction of the facility and equipment and costs for consulting services. Financial evaluation includes physical contingencies but excludes price escalations. Reinvestment cost of facility and equipment is calculated at the end of their effective lifespans.

2) O&M Cost

The O&M cost for each year is included. However, price escalations are not included.

3) Depreciation

As the money allocated to fixed assets is subject to depreciation but is not actually spent at that time from the viewpoint of cash-flow, it is not included in the cost estimates.

12.2 Project Evaluation on CPRR (Examination of Priority with Comparing All Sections)

12.2.1 Project Cost of CPRR (All Sections)

The project costs estimated in market price are shown below.

Table 12.2.1 Project Cost in Market Price (Section 1–Excluding TPP Link Road)

STAGE	YEAR NO.	CALENDAR YEAR	COST (INR CR)				REMARKS
			LA & RR UTILITY SHIFTING	CONSTRUCTION LS PROVISIONS	O&M		
					RECURRENT	PERIODIC	
Land Acquisition	1	2018	521.0	0.0			Base Year
	2	2019	521.0	0.0			
Construction	1	2020	0.0	187.2			
	2	2021	0.0	374.5			
	3	2022	0.0	374.5			
	4	2023	0.0	187.2			
Operation & Maintenance	1	2024	0.0	0.0	1.1		
	2	2025	0.0	0.0	1.1		
	3	2026	0.0	0.0	1.1		
	4	2027	0.0	0.0	1.1		
	5	2028			1.1	4.5	
	6	2029			1.1		
	7	2030			1.1		
	8	2031			1.1		
	9	2032			1.1		
	10	2033			1.1		
	11	2034			1.1	4.5	
	12	2035			1.1		
	13	2036			1.1		
	14	2037			1.1		
	15	2038			1.1		
	16	2039			1.1		
	17	2040			1.1	4.5	
	18	2041			1.1		
	19	2042			1.1		
	20	2043			1.1		
	21	2044			1.1		
	22	2045			1.1		
	23	2046			1.1	4.5	
	24	2047			1.1		
	25	2048			1.1		
		SUB TOTAL	**1,041.9**	**1,123.5**	**28.1**	**18.0**	
				2,165.4		**46.1**	
		TOTAL				**2,211.5**	

Source: JICA Study Team

Table 12.2.2 Project Cost in Market Price (TPP Link Road, Original Alignment)

STAGE	YEAR NO.	CALENDAR YEAR	COST (INR CR)				REMARKS
			LA & RR UTILITY SHIFTING	CONSTRUCTION LS PROVISIONS	O&M		
					RECURRENT	PERIODIC	
Land Acquisition	1	2018	106.3	0.0			Base Year
	2	2019	106.3	0.0			
Construction	1	2020	0.0	38.9			
	2	2021	0.0	77.8			
	3	2022	0.0	77.8			
	4	2023	0.0	38.9			
Operation & Maintenance	1	2024	0.0	0.0	0.2		
	2	2025	0.0	0.0	0.2		
	3	2026	0.0	0.0	0.2		
	4	2027	0.0	0.0	0.2		
	5	2028			0.2	0.9	
	6	2029			0.2		
	7	2030			0.2		
	8	2031			0.2		
	9	2032			0.2		
	10	2033			0.2		
	11	2034			0.2	0.9	
	12	2035			0.2		
	13	2036			0.2		
	14	2037			0.2		
	15	2038			0.2		
	16	2039			0.2		
	17	2040			0.2	0.9	
	18	2041			0.2		
	19	2042			0.2		
	20	2043			0.2		
	21	2044			0.2		
	22	2045			0.2		
	23	2046			0.2	0.9	
	24	2047			0.2		
	25	2048			0.2		
	SUB TOTAL		**212.7**	**233.3**	**5.8**	**3.7**	
				445.9		**9.6**	
	TOTAL					**455.5**	

Source: JICA Study Team

Table 12.2.3 Project Cost in Market Price (Section 2)

STAGE	YEAR NO.	CALENDAR YEAR	COST (INR CR)				REMARKS
			LA & RR	CONSTRUCTION	O&M		
			UTILITY SHIFTING	LS PROVISIONS	RECURRENT	PERIODIC	
Land Acquisition	1	2018	206.7	0.0			Base Year
	2	2019	206.7	0.0			
Construction	1	2020	0.0	274.4			
	2	2021	0.0	548.7			
	3	2022	0.0	548.7			
	4	2023	0.0	274.4			
Operation & Maintenance	1	2024	0.0	0.0	1.6		
	2	2025	0.0	0.0	1.6		
	3	2026	0.0	0.0	1.6		
	4	2027	0.0	0.0	1.6		
	5	2028			1.6	6.6	
	6	2029			1.6		
	7	2030			1.6		
	8	2031			1.6		
	9	2032			1.6		
	10	2033			1.6		
	11	2034			1.6	6.6	
	12	2035			1.6		
	13	2036			1.6		
	14	2037			1.6		
	15	2038			1.6		
	16	2039			1.6		
	17	2040			1.6	6.6	
	18	2041			1.6		
	19	2042			1.6		
	20	2043			1.6		
	21	2044			1.6		
	22	2045			1.6		
	23	2046			1.6	6.6	
	24	2047			1.6		
	25	2048			1.6		
		SUB TOTAL	**413.3**	**1,646.2**	**41.2**	**26.3**	
				2,059.5		**67.5**	
		TOTAL				**2,127.0**	

Source: JICA Study Team

Table 12.2.4 Project Cost in Market Price (Section 3)

STAGE	YEAR NO.	CALENDAR YEAR	COST (INR CR)				REMARKS
			LA & RR UTILITY SHIFTING	CONSTRUCTION LS PROVISIONS	O&M		
					RECURRENT	PERIODIC	
Land Acquisition	1	2018	1,159.4	0.0			Base Year
	2	2019	1,159.4	0.0			
Construction	1	2020	0.0	333.9			
	2	2021	0.0	667.7			
	3	2022	0.0	667.7			
	4	2023	0.0	333.9			
Operation & Maintenance	1	2024	0.0	0.0	2.0		
	2	2025	0.0	0.0	2.0		
	3	2026	0.0	0.0	2.0		
	4	2027	0.0	0.0	2.0		
	5	2028			2.0	8.0	
	6	2029			2.0		
	7	2030			2.0		
	8	2031			2.0		
	9	2032			2.0		
	10	2033			2.0		
	11	2034			2.0	8.0	
	12	2035			2.0		
	13	2036			2.0		
	14	2037			2.0		
	15	2038			2.0		
	16	2039			2.0		
	17	2040			2.0	8.0	
	18	2041			2.0		
	19	2042			2.0		
	20	2043			2.0		
	21	2044			2.0		
	22	2045			2.0		
	23	2046			2.0	8.0	
	24	2047			2.0		
	25	2048			2.0		
		SUB TOTAL	**2,318.8**	**2,003.2**	**50.1**	**32.1**	
				4,322.0		**82.1**	
		TOTAL				**4,404.1**	

Source: JICA Study Team

Table 12.2.5 Project Cost in Market Price (Section 4)

STAGE	YEAR NO.	CALENDAR YEAR	COST (INR CR)				REMARKS
			LA & RR UTILITY SHIFTING	CONSTRUCTION LS PROVISIONS	O&M		
					RECURRENT	PERIODIC	
Construction	1	2018	0.0	221.3			Base Year
	2	2019	0.0	221.3			
	3	2020	0.0	221.3			
Operation & Maintenance	1	2021	0.0	0.0	0.7		
	2	2022	0.0	0.0	0.7		
	3	2023	0.0	0.0	0.7		
	4	2024	0.0	0.0	0.7		
	5	2025	0.0	0.0	0.7	2.7	
	6	2026	0.0	0.0	0.7		
	7	2027	0.0	0.0	0.7		
	8	2028			0.7		
	9	2029			0.7		
	10	2030			0.7		
	11	2031			0.7	2.7	
	12	2032			0.7		
	13	2033			0.7		
	14	2034			0.7		
	15	2035			0.7		
	16	2036			0.7		
	17	2037			0.7	2.7	
	18	2038			0.7		
	19	2039			0.7		
	20	2040			0.7		
	21	2041			0.7		
	22	2042			0.7		
	23	2043			0.7	2.7	
	24	2044			0.7		
	25	2045			0.7		
	26	2046			0.7		
	27	2047			0.7		
	28	2048			0.7		
		SUB TOTAL	**0.0**	**663.9**	**18.6**	**10.6**	
				663.9		**29.2**	
		TOTAL				**693.1**	

Source: JICA Study Team

Table 12.2.6 Project Cost in Market Price (Section 5)

STAGE	YEAR NO.	CALENDAR YEAR	COST (INR CR)				REMARKS
			LA & RR UTILITY SHIFTING	CONSTRUCTION LS PROVISIONS	O&M		
					RECURRENT	PERIODIC	
Land Acquisition	1	2018	516.1	0.0			Base Year
	2	2019	516.1	0.0			
Construction	1	2020	0.0	247.9			
	2	2021	0.0	495.8			
	3	2022	0.0	495.8			
	4	2023	0.0	247.9			
Operation & Maintenance	1	2024	0.0	0.0	1.5		
	2	2025	0.0	0.0	1.5		
	3	2026	0.0	0.0	1.5		
	4	2027	0.0	0.0	1.5		
	5	2028			1.5	5.9	
	6	2029			1.5		
	7	2030			1.5		
	8	2031			1.5		
	9	2032			1.5		
	10	2033			1.5		
	11	2034			1.5	5.9	
	12	2035			1.5		
	13	2036			1.5		
	14	2037			1.5		
	15	2038			1.5		
	16	2039			1.5		
	17	2040			1.5	5.9	
	18	2041			1.5		
	19	2042			1.5		
	20	2043			1.5		
	21	2044			1.5		
	22	2045			1.5		
	23	2046			1.5	5.9	
	24	2047			1.5		
	25	2048			1.5		
	SUB TOTAL		**1,032.2**	**1,487.4**	**37.2**	**23.8**	
				2,519.6		**61.0**	
	TOTAL					**2,580.6**	

Source: JICA Study Team

The project cost is converted to economic price, which is shown in the cash flow table for EIRR calculation.

12.2.2 EIRR Calculation

By using the project cost in economic price and benefit mentioned so far, cash flow tables are constructed, and EIRRs are calculated. The EIRR for each case is shown below.

Table 12.2.7 EIRR for Each Case

Case No.	Case	EIRR
1	Section 4 and 1 are constructed.	18.1%
2	Section 4 and 2 are constructed.	19.7%
3	Section 4 and 3 are constructed.	20.2%
4	Section 4 and 5 are constructed.	12.8%

Source: JICA Study Team

Since the JICA Study Team sets the social discount rate at 12%, it is therefore concluded that all cases are feasible.

Cash flow tables for the cases are shown below.

Table 12.2.8 Cash Flow Table for EIRR Calculation (Case No. 1)

Section: 1

Unit: Million Rs.

Year	Cost				Toal	Benefit					Net Benefit
	Section 1					Without		With		Difference	
	Initial		O&M			VOC	TTC	VOC	TTC		
	LA & RR Utility Shifting	Construciton LS Provisions	Recurrent	Periodic							
2018	2,822.84	0.00			2,822.84						-2,822.84
2019	2,822.84	0.00			2,822.84						-2,822.84
2020	0.00	2,035.07			2,035.07						-2,035.07
2021	0.00	4,070.14			4,070.14	225,584.59	214,080.19	225,584.59	214,080.19	0.00	-4,070.14
2022	0.00	4,070.14			4,070.14	240,310.45	231,371.00	240,310.45	231,371.00	0.00	-4,070.14
2023	0.00	2,035.07			2,035.07	255,036.31	248,661.81	255,036.31	248,661.81	0.00	-2,035.07
2024	0.00	0.00	12.21	0.00	12.21	269,762.17	265,952.63	269,762.17	265,952.63	1,188.10	1,175.89
2025	0.00	0.00	12.21	0.00	12.21	284,488.03	283,243.44	284,488.03	283,243.44	2,376.20	2,363.99
2026	0.00	0.00	12.21	0.00	12.21	299,213.88	300,534.25	296,501.86	298,493.88	4,752.40	4,740.19
2027	0.00	0.00	12.21	0.00	12.21	337,860.44	346,562.56	334,905.24	344,356.83	5,160.93	5,148.72
2028			12.21	48.84	61.05	376,506.99	392,590.87	373,308.62	390,219.79	5,569.45	5,508.40
2029			12.21	0.00	12.21	415,153.54	438,619.18	411,712.00	436,082.74	5,977.98	5,965.77
2030			12.21	0.00	12.21	453,800.10	484,647.49	450,115.38	481,945.70	6,386.50	6,374.29
2031			12.21	0.00	12.21	492,446.65	530,675.79	488,518.76	527,808.66	6,795.03	6,782.82
2032			12.21	0.00	12.21	531,093.20	576,704.10	526,922.14	573,671.61	7,203.55	7,191.34
2033			12.21	0.00	12.21	569,739.76	622,732.41	565,325.52	619,534.57	7,612.08	7,599.87
2034			12.21	48.84	61.05	608,386.31	668,760.72	603,728.90	665,397.52	8,020.61	7,959.55
2035			12.21	0.00	12.21	647,032.86	714,789.03	642,132.28	711,260.48	8,429.13	8,416.92
2036			12.21	0.00	12.21	685,679.42	760,817.34	680,535.66	757,123.43	8,837.66	8,825.45
2037			12.21	0.00	12.21	685,679.42	760,817.34	680,535.66	757,123.43	8,837.66	8,825.45
2038			12.21	0.00	12.21	685,679.42	760,817.34	680,535.66	757,123.43	8,837.66	8,825.45
2039			12.21	0.00	12.21	685,679.42	760,817.34	680,535.66	757,123.43	8,837.66	8,825.45
2040			12.21	48.84	61.05	685,679.42	760,817.34	680,535.66	757,123.43	8,837.66	8,776.60
2041			12.21	0.00	12.21	685,679.42	760,817.34	680,535.66	757,123.43	8,837.66	8,825.45
2042			12.21	0.00	12.21	685,679.42	760,817.34	680,535.66	757,123.43	8,837.66	8,825.45
2043			12.21	0.00	12.21	685,679.42	760,817.34	680,535.66	757,123.43	8,837.66	8,825.45
2044			12.21	0.00	12.21	685,679.42	760,817.34	680,535.66	757,123.43	8,837.66	8,825.45
2045			12.21	0.00	12.21	685,679.42	760,817.34	680,535.66	757,123.43	8,837.66	8,825.45
2046			12.21	48.84	61.05	685,679.42	760,817.34	680,535.66	757,123.43	8,837.66	8,776.60
2047			12.21	0.00	12.21	685,679.42	760,817.34	680,535.66	757,123.43	8,837.66	8,825.45
2048			12.21	0.00	12.21	685,679.42	760,817.34	680,535.66	757,123.43	8,837.66	8,825.45
Total	**5,645.68**	**12,210.41**	**305.26**	**195.37**	**18,356.72**	**14,920,247.71**	**16,210,550.82**	**14,815,315.86**	**16,134,685.46**	**184,361.51**	**166,004.79**
										EIRR	**18.13%**

Source: JICA Study Team

Table 12.2.9 Cash Flow Table for EIRR Calculation (Case No. 2)

Section: 2

Unit: Million Rs.

Year	Cost					Benefit					Net Benefit
	Section 2				Toal	Without		With		Difference	
	Initial		O&M			VOC	TTC	VOC	TTC		
	LA & RR Utility Shifting	Construciton LS Provisions	Recurrent	Periodic							
2018	929.94	0.00			929.94						-929.94
2019	929.94	0.00			929.94						-929.94
2020	0.00	2,469.31			2,469.31						-2,469.31
2021	0.00	4,938.63			4,938.63	225,584.59	214,080.19	225,584.59	214,080.19	0.00	-4,938.63
2022	0.00	4,938.63			4,938.63	240,310.45	231,371.00	240,310.45	231,371.00	0.00	-4,938.63
2023	0.00	2,469.31			2,469.31	255,036.31	248,661.81	255,036.31	248,661.81	0.00	-2,469.31
2024	0.00	0.00	14.82	0.00	14.82	269,762.17	265,952.63	269,762.17	265,952.63	787.36	772.54
2025	0.00	0.00	14.82	0.00	14.82	284,488.03	283,243.44	284,488.03	283,243.44	1,574.71	1,559.90
2026	0.00	0.00	14.82	0.00	14.82	299,213.88	300,534.25	297,827.20	298,771.51	3,149.43	3,134.61
2027	0.00	0.00	14.82	0.00	14.82	337,860.44	346,562.56	336,075.29	344,424.38	3,923.32	3,908.50
2028			14.82	59.26	74.08	376,506.99	392,590.87	374,323.39	390,077.26	4,697.21	4,623.13
2029			14.82	0.00	14.82	415,153.54	438,619.18	412,571.48	435,730.14	5,471.10	5,456.29
2030			14.82	0.00	14.82	453,800.10	484,647.49	450,819.57	481,383.02	6,244.99	6,230.18
2031			14.82	0.00	14.82	492,446.65	530,675.79	489,067.67	527,035.90	7,018.88	7,004.07
2032			14.82	0.00	14.82	531,093.20	576,704.10	527,315.76	572,688.77	7,792.77	7,777.96
2033			14.82	0.00	14.82	569,739.76	622,732.41	565,563.85	618,341.65	8,566.66	8,551.85
2034			14.82	59.26	74.08	608,386.31	668,760.72	603,811.95	663,994.53	9,340.56	9,266.48
2035			14.82	0.00	14.82	647,032.86	714,789.03	642,060.04	709,647.41	10,114.45	10,099.63
2036			14.82	0.00	14.82	685,679.42	760,817.34	680,308.13	755,300.29	10,888.34	10,873.52
2037			14.82	0.00	14.82	685,679.42	760,817.34	680,308.13	755,300.29	10,888.34	10,873.52
2038			14.82	0.00	14.82	685,679.42	760,817.34	680,308.13	755,300.29	10,888.34	10,873.52
2039			14.82	0.00	14.82	685,679.42	760,817.34	680,308.13	755,300.29	10,888.34	10,873.52
2040			14.82	59.26	74.08	685,679.42	760,817.34	680,308.13	755,300.29	10,888.34	10,814.26
2041			14.82	0.00	14.82	685,679.42	760,817.34	680,308.13	755,300.29	10,888.34	10,873.52
2042			14.82	0.00	14.82	685,679.42	760,817.34	680,308.13	755,300.29	10,888.34	10,873.52
2043			14.82	0.00	14.82	685,679.42	760,817.34	680,308.13	755,300.29	10,888.34	10,873.52
2044			14.82	0.00	14.82	685,679.42	760,817.34	680,308.13	755,300.29	10,888.34	10,873.52
2045			14.82	0.00	14.82	685,679.42	760,817.34	680,308.13	755,300.29	10,888.34	10,873.52
2046			14.82	59.26	74.08	685,679.42	760,817.34	680,308.13	755,300.29	10,888.34	10,814.26
2047			14.82	0.00	14.82	685,679.42	760,817.34	680,308.13	755,300.29	10,888.34	10,873.52
2048			14.82	0.00	14.82	685,679.42	760,817.34	680,308.13	755,300.29	10,888.34	10,873.52
Total	**1,859.88**	**14,815.89**	**370.40**	**237.05**	**17,283.22**	**14,920,247.71**	**16,210,550.82**	**14,818,623.43**	**16,104,307.34**	**210,229.83**	**192,946.61**
										EIRR	**19.66%**

Source: JICA Study Team

Table 12.2.10 Cash Flow Table for EIRR Calculation (Case No. 3)

Section: 3

Unit: Million Rs.

Year	Cost					Benefit					Net Benefit
	Section 3				Toal	Without		With		Difference	
	Initial		O&M			VOC	TTC	VOC	TTC		
	LA & RR Utility Shifting	Construciton LS Provisions	Recurrent	Periodic							
2018	5,217.20	0.00			5,217.20						-5,217.20
2019	5,217.20	0.00			5,217.20						-5,217.20
2020	0.00	3,004.81			3,004.81						-3,004.81
2021	0.00	6,009.62			6,009.62	225,584.59	214,080.19	225,584.59	214,080.19	0.00	-6,009.62
2022	0.00	6,009.62			6,009.62	240,310.45	231,371.00	240,310.45	231,371.00	0.00	-6,009.62
2023	0.00	3,004.81			3,004.81	255,036.31	248,661.81	255,036.31	248,661.81	0.00	-3,004.81
2024	0.00	0.00	18.03	0.00	18.03	269,762.17	265,952.63	269,762.17	265,952.63	2,731.97	2,713.94
2025	0.00	0.00	18.03	0.00	18.03	284,488.03	283,243.44	284,488.03	283,243.44	5,463.94	5,445.92
2026	0.00	0.00	18.03	0.00	18.03	299,213.88	300,534.25	293,851.42	294,968.82	10,927.89	10,909.86
2027	0.00	0.00	18.03	0.00	18.03	337,860.44	346,562.56	332,271.77	340,834.10	11,317.13	11,299.10
2028			18.03	72.12	90.14	376,506.99	392,590.87	370,692.11	386,599.38	11,706.37	11,616.22
2029			18.03	0.00	18.03	415,153.54	438,619.18	409,112.45	432,564.66	12,095.61	12,077.58
2030			18.03	0.00	18.03	453,800.10	484,647.49	447,532.80	478,429.94	12,484.85	12,466.82
2031			18.03	0.00	18.03	492,446.65	530,675.79	485,953.14	524,295.22	12,874.09	12,856.06
2032			18.03	0.00	18.03	531,093.20	576,704.10	524,373.48	570,160.49	13,263.33	13,245.30
2033			18.03	0.00	18.03	569,739.76	622,732.41	562,793.83	616,025.77	13,652.57	13,634.54
2034			18.03	72.12	90.14	608,386.31	668,760.72	601,214.17	661,891.05	14,041.81	13,951.66
2035			18.03	0.00	18.03	647,032.86	714,789.03	639,634.51	707,756.33	14,431.05	14,413.02
2036			18.03	0.00	18.03	685,679.42	760,817.34	678,054.86	753,521.61	14,820.29	14,802.26
2037			18.03	0.00	18.03	685,679.42	760,817.34	678,054.86	753,521.61	14,820.29	14,802.26
2038			18.03	0.00	18.03	685,679.42	760,817.34	678,054.86	753,521.61	14,820.29	14,802.26
2039			18.03	0.00	18.03	685,679.42	760,817.34	678,054.86	753,521.61	14,820.29	14,802.26
2040			18.03	72.12	90.14	685,679.42	760,817.34	678,054.86	753,521.61	14,820.29	14,730.14
2041			18.03	0.00	18.03	685,679.42	760,817.34	678,054.86	753,521.61	14,820.29	14,802.26
2042			18.03	0.00	18.03	685,679.42	760,817.34	678,054.86	753,521.61	14,820.29	14,802.26
2043			18.03	0.00	18.03	685,679.42	760,817.34	678,054.86	753,521.61	14,820.29	14,802.26
2044			18.03	0.00	18.03	685,679.42	760,817.34	678,054.86	753,621.61	14,820.29	14,802.26
2045			18.03	0.00	18.03	685,679.42	760,817.34	678,054.86	753,621.61	14,820.29	14,802.26
2046			18.03	72.12	90.14	685,679.42	760,817.34	678,054.86	753,621.61	14,820.29	14,730.14
2047			18.03	0.00	18.03	685,679.42	760,817.34	678,054.86	753,621.61	14,820.29	14,802.26
2048			18.03	0.00	18.03	685,679.42	760,817.34	678,054.86	753,621.61	14,820.29	14,802.26
Total	**10,434.41**	**18,028.86**	**450.72**	**288.46**	**29,202.45**	**14,920,247.71**	**16,210,550.82**	**14,757,324.36**	**16,054,015.74**	**327,654.34**	**298,451.89**
										EIRR	**20.22%**

Source: JICA Study Team

Table 12.2.11 Cash Flow Table for EIRR Calculation (Case No. 4)

Section: 5

Unit: Million Rs.

Year	Cost					Benefit					
	Section 5				Toal	Without		With		Difference	Net Benefit
	Initial		O&M								
	LA & RR Utility Shifting	Construciton LS Provisions	Recurrent	Periodic		VOC	TTC	VOC	TTC		
2018	2,322.50	0.00			2,322.50						-2,322.50
2019	2,322.50	0.00			2,322.50						-2,322.50
2020	0.00	2,231.08			2,231.08						-2,231.08
2021	0.00	4,462.17			4,462.17	225,584.59	214,080.19	225,584.59	214,080.19	0.00	-4,462.17
2022	0.00	4,462.17			4,462.17	240,310.45	231,371.00	240,310.45	231,371.00	0.00	-4,462.17
2023	0.00	2,231.08			2,231.08	255,036.31	248,661.81	255,036.31	248,661.81	0.00	-2,231.08
2024	0.00	0.00	13.39	0.00	13.39	269,762.17	265,952.63	269,762.17	265,952.63	138.84	125.46
2025	0.00	0.00	13.39	0.00	13.39	284,488.03	283,243.44	284,488.03	283,243.44	277.69	264.30
2026	0.00	0.00	13.39	0.00	13.39	299,213.88	300,534.25	299,459.13	299,733.63	555.38	541.99
2027	0.00	0.00	13.39	0.00	13.39	337,860.44	346,562.56	337,812.41	345,354.90	1,255.69	1,242.30
2028			13.39	53.55	66.93	376,506.99	392,590.87	376,165.68	390,976.18	1,956.00	1,889.07
2029			13.39	0.00	13.39	415,153.54	438,619.18	414,518.96	436,597.45	2,656.31	2,642.92
2030			13.39	0.00	13.39	453,800.10	484,647.49	452,872.24	482,218.73	3,356.62	3,343.23
2031			13.39	0.00	13.39	492,446.65	530,675.79	491,225.51	527,840.00	4,056.93	4,043.54
2032			13.39	0.00	13.39	531,093.20	576,704.10	529,578.79	573,461.28	4,757.24	4,743.85
2033			13.39	0.00	13.39	569,739.76	622,732.41	567,932.07	619,082.55	5,457.55	5,444.16
2034			13.39	53.55	66.93	608,386.31	668,760.72	606,285.34	664,703.83	6,157.86	6,090.93
2035			13.39	0.00	13.39	647,032.86	714,789.03	644,638.62	710,325.10	6,858.17	6,844.78
2036			13.39	0.00	13.39	685,679.42	760,817.34	682,991.90	755,946.38	7,558.48	7,545.09
2037			13.39	0.00	13.39	685,679.42	760,817.34	682,991.90	755,946.38	7,558.48	7,545.09
2038			13.39	0.00	13.39	685,679.42	760,817.34	682,991.90	755,946.38	7,558.48	7,545.09
2039			13.39	0.00	13.39	685,679.42	760,817.34	682,991.90	755,946.38	7,558.48	7,545.09
2040			13.39	53.55	66.93	685,679.42	760,817.34	682,991.90	755,946.38	7,558.48	7,491.55
2041			13.39	0.00	13.39	685,679.42	760,817.34	682,991.90	755,946.38	7,558.48	7,545.09
2042			13.39	0.00	13.39	685,679.42	760,817.34	682,991.90	755,946.38	7,558.48	7,545.09
2043			13.39	0.00	13.39	685,679.42	760,817.34	682,991.90	755,946.38	7,558.48	7,545.09
2044			13.39	0.00	13.39	685,679.42	760,817.34	682,991.90	755,946.38	7,558.48	7,545.09
2045			13.39	0.00	13.39	685,679.42	760,817.34	682,991.90	755,946.38	7,558.48	7,545.09
2046			13.39	53.55	66.93	685,679.42	760,817.34	682,991.90	755,946.38	7,558.48	7,491.55
2047			13.39	0.00	13.39	685,679.42	760,817.34	682,991.90	755,946.38	7,558.48	7,545.09
2048			13.39	0.00	13.39	685,679.42	760,817.34	682,991.90	755,946.38	7,558.48	7,545.09
Total	**4,645.00**	**13,386.51**	**334.66**	**214.18**	**18,580.35**	**14,920,247.71**	**16,210,550.82**	**14,874,564.95**	**16,120,905.60**	**135,744.51**	**117,164.16**
										EIRR	**12.82%**

Source: JICA Study Team

12.3 Project Evaluation on Priority Section (Section 1) of CPRR

12.3.1 Project Cost of Section 1

Project cost of Section 1 examined in Section 9.3 is converted to economic one to be used for EIRR calculation. Standard Conversion Factor (SCF) = 0.97 is employed here, which is estimated in accordance with the "IRR Calculation Manual" of JICA.

12.3.2 Traffic Volume

Traffic demand forecast is carried out with the following conditions for project evaluation of Section 1:

(1) Method of Traffic Demand Forecast

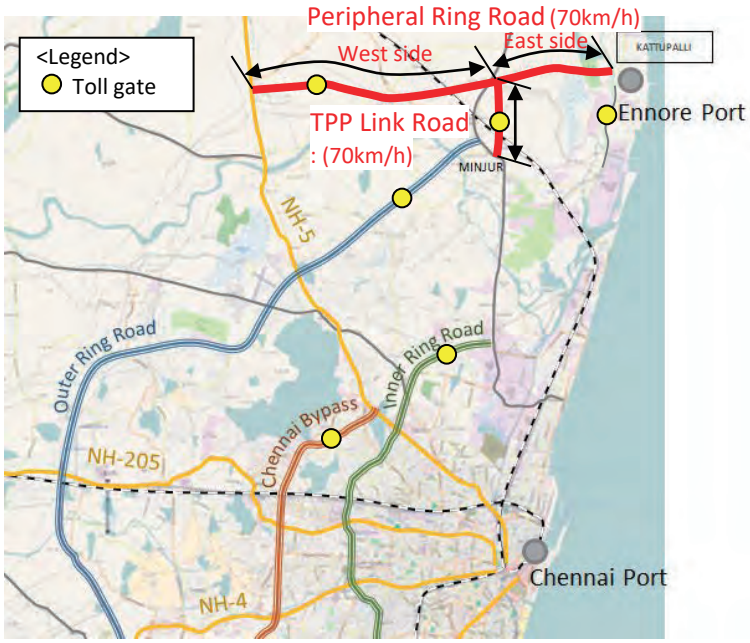
- ✓ Four-Step Method with JICA STRADA
- ✓ Traffic assignment is calculated with a multi-step distribution (divided into five)
- ✓ Vehicle Class: 7 Types (Motorcycle, Passenger Auto, Auto Rickshaw, Bus, LCV, Truck, MAV)

(2) Toll Gate Location (See Figure 12.3.1)

- ✓ Outer Ring Road (under TNRDC)
- ✓ Chennai Bypass (under NHAI)
- ✓ Port access section in Kattupalli Road (under Ennore Port)
- ✓ Inner Ring Road

(3) Conditions of CPRR

- ✓ Design speed: 70 km/h (mixed-traffic to be considered on multiple lanes)
- ✓ Toll gate: On the west side section and TPP Link Road, distance-based toll collection system is introduced.
- ✓ Section 1 (TPP Link Road, Original Alignment)



Source: JICA Study Team

Figure 12.3.1 Location Map of CPRR and Toll Gate

The results of traffic demand forecast are summarised in the following tables:

Table 12.3.1 Future Traffic Demand Forecast (2024, 2030, 2040) TPP Link Road (Original Alignment)

	Year	2024 (Start of operation)	2030	2040
West Side	Daily vehicle (numbers)	23,314	27,510	34,505
	Daily vehicle (PCU*)	56,657	65,459	80,129
TPP Link	Daily vehicle (numbers)	19,504	24,891	33,869
	Daily vehicle (PCU*)	41,285	53,909	74,948
East Side	Daily vehicle (numbers)	11,958	17,391	26,447
	Daily vehicle (PCU*)	35,658	50,514	75,273

* Passenger Car Unit

Source: JICA Study Team

Table 12.3.2 Future Traffic Demand Forecast (2024, 2030, 2040) TPP Link Road (New Alignment)

	Year	2023 (Start of operation)	2030	2040
West Side	Daily vehicle (numbers)	22,937	31,550	43,853
	Daily vehicle (PCU*)	54,592	66,258	82,924
TPP Link	Daily vehicle (numbers)	16,822	28,929	46,225
	Daily vehicle (PCU*)	34,279	58,021	91,939
East Side	Daily vehicle (numbers)	13,163	22,197	35,101
	Daily vehicle (PCU*)	35,881	57,667	88,789

* Passenger Car Unit

Source: JICA Study Team

12.3.3 EIRR Calculation

Cash flow table is shown in Table 12.3.3 for Section 1 after the alignment change. As the JICA Study Team sets the social discount rate at 12%, Section 1 is deemed feasible.

There are such bad environmental influences that come about even if planned environmental mitigation measures are taken. As it is difficult to quantify them, they are not included in the EIRR calculation. Such bad influences, however, will be minimized due to the environmental mitigation measures including noise control. Thus, EIRR calculation result would not change so much as to alter the feasibility of the project even if they were included in the calculation.

12.3.4 FIRR Calculation

FIRR was calculated with market price of cost and toll revenue. Cash flow table is shown in Table 12.3.4 for Section 1 after the alignment change. As FIRR is negative, Section 1 is not feasible enough financially, that is, from the viewpoint of a private project or an independent one. On the other hand, it is socially significant from the viewpoint of public works conducted by a public organization since EIRR is more than the social discount rate set by the JICA Study Team.

Table 12.3.3 Cash Flow Table for EIRR Calculation (Section 1; After the Alignment Change)

EIRR Calculat Foreign = 100% Local = 97%
70 km/h Cost = 100% Benefit = 100%

Section: 100%

Unit: Million INR

	Year	Cost														Benefit					
		Procurement/Construction					Consulting Services	Physical Cont.	Land Acquisition	Admin.	O&M			ITS Replacement	Total	Without		With		Difference	Net Benefit
		Civil	ITS	DB for Civil	DB for ITS	Total					Civil		ITS			VOC	TTC	VOC	TTC		
											Recurrent	Periodic									
	2018	0.00	0.00	0.00	0.00	0.00	0.00	251.32	1,256.58	82.93					1,590.83						-1,590.83
	2019	0.00	0.00	0.00	0.00	0.00	444.54	713.35	3,455.60	241.79					4,855.28						-4,855.28
	2020	3,838.27	0.00	7.67	0.00	3,845.94	259.58	586.06	942.44	196.55					5,830.57						-5,830.57
	2021	6,117.24	268.68	12.22	3.44	6,401.59	281.84	654.25	0.00	218.99					7,556.67	222,964.44	213,446.31	222,964.44	213,446.31	0.00	-7,556.67
	2022	6,117.24	328.21	12.22	4.20	6,461.88	293.11	660.84	0.00	221.31					7,637.15	237,621.52	230,630.52	237,621.52	230,630.52	0.00	-7,637.15
	2023	1,469.34	156.06	2.94	2.00	1,630.33	122.96	188.33	0.00	63.66					2,005.28	252,278.60	247,814.72	252,278.60	247,814.72	0.00	-2,005.28
1	2024	449.80	19.31	0.90	0.25	470.25	58.04	65.96	0.00	22.52	17.91		193.00		827.68	266,935.68	264,998.93	266,935.68	264,998.93	1,876.93	1,049.25
2	2025	0.00	0.00	0.00	0.00	0.00	35.30	17.80	0.00	6.38	17.91		193.00		270.38	281,592.76	282,183.14	281,592.76	282,183.14	3,753.86	3,483.48
3	2026	0.00	0.00	0.00	0.00	0.00	16.81	7.52	0.00	2.72	17.91		193.00		237.96	296,249.83	299,367.35	292,688.42	295,421.04	7,507.73	7,269.77
4	2027	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.91		193.00		210.91	334,225.21	344,881.42	330,495.25	340,872.91	7,738.48	7,527.57
5	2028	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.91	71.64	193.00		282.55	372,200.58	390,395.49	368,302.08	386,324.77	7,969.22	7,686.68
6	2029	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.91		193.00		210.91	410,175.96	435,909.56	406,108.91	431,776.64	8,199.97	7,989.07
7	2030										17.91		193.00		210.91	448,151.33	481,423.63	443,915.74	477,228.50	8,430.72	8,219.81
8	2031										17.91		193.00		210.91	486,126.71	526,937.69	481,722.57	522,680.37	8,661.47	8,450.56
9	2032										17.91		193.00		210.91	524,102.08	572,451.76	519,529.40	568,132.23	8,892.21	8,681.31
10	2033										17.91		193.00		210.91	562,077.45	617,965.83	557,336.23	613,584.10	9,122.96	8,912.06
11	2034										17.91	71.64	193.00	740.40	1,022.94	600,052.83	663,479.90	595,143.06	659,035.96	9,353.71	8,330.77
12	2035										17.91		193.00		210.91	638,028.20	708,993.97	632,949.89	704,487.83	9,584.46	9,373.55
13	2036										17.91		193.00		210.91	676,003.58	754,508.04	670,756.72	749,939.69	9,815.21	9,604.30
14	2037										17.91		193.00		210.91	676,003.58	754,508.04	670,756.72	749,939.69	9,815.21	9,604.30
15	2038										17.91		193.00		210.91	676,003.58	754,508.04	670,756.72	749,939.69	9,815.21	9,604.30
16	2039										17.91		193.00		210.91	676,003.58	754,508.04	670,756.72	749,939.69	9,815.21	9,604.30
17	2040										17.91	71.64	193.00		282.55	676,003.58	754,508.04	670,756.72	749,939.69	9,815.21	9,532.66
18	2041										17.91		193.00		210.91	676,003.58	754,508.04	670,756.72	749,939.69	9,815.21	9,604.30
19	2042										17.91		193.00		210.91	676,003.58	754,508.04	670,756.72	749,939.69	9,815.21	9,604.30
20	2043										17.91		193.00		210.91	676,003.58	754,508.04	670,756.72	749,939.69	9,815.21	9,604.30
21	2044										17.91		193.00		210.91	676,003.58	754,508.04	670,756.72	749,939.69	9,815.21	9,604.30
22	2045										17.91		193.00		210.91	676,003.58	754,508.04	670,756.72	749,939.69	9,815.21	9,604.30
23	2046										17.91	71.64	193.00	740.40	1,022.94	676,003.58	754,508.04	670,756.72	749,939.69	9,815.21	8,792.26
24	2047										17.91		193.00		210.91	676,003.58	754,508.04	670,756.72	749,939.69	9,815.21	9,604.30
25	2048										17.91		193.00		210.91	676,003.58	754,508.04	670,756.72	749,939.69	9,815.21	9,604.30
	Total	17,991.90	772.26	35.95	9.88	18,809.99	1,512.19	3,145.43	5,654.63	1,056.86	447.76	286.56	4,824.89		37,219.11	14,720,829.69	16,089,484.71	14,609,421.83	15,987,833.96	218,689.41	181,470.30
																				EIRR	15.64%

Source: JICA Study Team

Table 12.3.4 Cash Flow Table for FIRR Calculation (Section 1; After the Alignment Change)

FIRR Calculation

70km/h

Section	1															100%		100%	100%	100%	100%				
Unit: Million INR																									
Year	Cost															Benefit (Toll Revenue)									Net Benefit
	Procurement/Construction					Consulting Services	Price Escalation	Physical Contingency	Land Acquisition	Admin.	VAT	O&M			ITS Replacement	Total	TW	CAR	AUTO	BUS	LCV	Truck	MAV	Toal	
	Civil	ITS	DB for Civil	DB for ITS	Total							Civil		ITS											
												Recurrent	Periodic												
2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	129.54	2,590.89	81.61	0.00					2,802.05								0.00	-2,802.05
2019	0.00	0.00	0.00	0.00	0.00	448.88	305.80	393.98	7,124.96	248.21	87.02					8,608.84								0.00	-8,608.84
2020	3,939.03	0.00	7.67	0.00	3,946.70	262.17	482.45	331.72	1,943.17	208.99	855.70					8,030.89								0.00	-8,030.89
2021	6,277.83	275.52	12.22	3.44	6,569.01	285.23	799.85	382.70	0.00	241.10	1,446.62					9,724.51								0.00	-9,724.51
2022	6,277.83	336.56	12.22	4.20	6,630.81	296.60	1,098.69	401.30	0.00	252.82	1,516.93					10,197.15								0.00	-10,197.15
2023	1,507.91	160.03	2.94	2.00	1,672.87	124.22	403.73	119.91	0.00	75.55	453.27					2,849.55								0.00	-2,849.55
1 2024	461.60	19.80	0.90	0.25	482.55	58.47	175.42	44.09	0.00	27.77	166.65	18.46		198.96		1,172.37	0.00	22.36	0.00	26.92	21.58	259.30	164.12	494.26	-678.10
2 2025	0.00	0.00	0.00	0.00	0.00	35.63	61.10	13.10	0.00	8.25	49.52	18.46		198.96		385.04	0.00	22.80	0.00	27.45	22.01	264.45	167.38	504.08	119.04
3 2026	0.00	0.00	0.00	0.00	0.00	16.95	30.06	5.79	0.00	3.65	21.90	18.46		198.96		295.79	0.00	23.25	0.00	27.99	22.43	269.60	170.64	513.90	218.11
4 2027	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.46		198.96		217.43	0.00	25.16	0.00	30.30	25.70	287.45	175.38	543.99	326.56
5 2028	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.46	73.86	198.96		291.29	0.00	27.14	0.00	32.67	29.07	305.78	180.17	574.84	283.55
6 2029	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.46		198.96		217.43	0.00	29.16	0.00	35.11	32.55	324.59	185.02	606.45	389.02
7 2030												18.46		198.96		217.43	0.00	31.25	0.00	37.62	36.14	343.87	189.93	638.81	421.38
8 2031												18.46		198.96		217.43	0.00	33.39	0.00	40.20	39.83	363.63	194.89	671.94	454.51
9 2032												18.46		198.96		217.43	0.00	35.58	0.00	42.84	43.63	383.86	199.91	705.83	488.40
10 2033												18.46		198.96		217.43	0.00	37.83	0.00	45.55	47.54	404.58	204.99	740.48	523.05
11 2034												18.46	73.86	198.96	759.26	1,050.54	0.00	40.13	0.00	48.32	51.55	425.76	210.11	775.88	-274.66
12 2035												18.46		198.96		217.43	0.00	42.49	0.00	51.16	55.67	447.43	215.30	812.05	594.62
13 2036												18.46		198.96		217.43	0.00	44.91	0.00	54.07	59.89	469.57	220.54	848.98	631.55
14 2037												18.46		198.96		217.43	0.00	45.63	0.00	54.94	60.85	477.10	224.08	862.60	645.17
15 2038												18.46		198.96		217.43	0.00	46.35	0.00	55.81	61.81	484.63	227.61	876.22	658.79
16 2039												18.46		198.96		217.43	0.00	47.07	0.00	56.68	62.77	492.17	231.15	889.84	672.41
17 2040												18.46	73.86	198.96		291.29	0.00	47.79	0.00	57.54	63.74	499.70	234.69	903.46	612.17
18 2041												18.46		198.96		217.43	0.00	48.51	0.00	58.41	64.70	507.23	238.23	917.08	699.65
19 2042												18.46		198.96		217.43	0.00	49.23	0.00	59.28	65.66	514.77	241.77	930.70	713.27
20 2043												18.46		198.96		217.43	0.00	49.95	0.00	60.15	66.62	522.30	245.31	944.32	726.89
21 2044												18.46		198.96		217.43	0.00	50.67	0.00	61.01	67.58	529.83	248.84	957.94	740.51
22 2045												18.46		198.96		217.43	0.00	51.39	0.00	61.88	68.54	537.37	252.38	971.56	754.13
23 2046												18.46	73.86	198.96	759.26	1,050.54	0.00	52.11	0.00	62.75	69.50	544.90	255.92	985.18	-65.37
24 2047												18.46		198.96		217.43	0.00	52.83	0.00	63.62	70.46	552.43	259.46	998.80	781.37
25 2048												18.46		198.96		217.43	0.00	53.55	0.00	64.48	71.42	559.96	263.00	1,012.42	794.99
Total	18,464.20	791.91	35.95	9.88	19,301.94	1,528.14	3,357.09	1,822.15	11,659.02	1,147.96	4,597.61	461.60	295.43	4,974.12		50,663.58	0.00	1,010.52	0.00	1,216.74	1,281.25	10,772.25	5,400.81	19,681.58	-30,982.00
																								FIRR	-6.51%

Source: JICA Study Team

CHAPTER 13 CONCLUSIONS AND RECOMMENDATIONS

13.1 Necessity and Effect of the Chennai Peripheral Ring Road (CPRR) Project Section 1

With regard to the necessity and development effect of Chennai Peripheral Ring Road (CPRR) Project, the effects of traffic congestion mitigation and economic validity were examined and evaluated taking into account the traffic situation as of 2017. As a result, this project diverts through traffic as a peripheral ring road forming a ring and radial road network constituting the Chennai Metropolitan Area (CMA), and by provision of access between industrial area and regional transportation facilities, and improvement of the urban environment in CMA. It was confirmed that this project greatly contributes to economic development of CMA.

As a result of economic analysis based on the future traffic demand and project cost of each sections, the Economic Internal Rate of Return (EIRR) of this project was calculated as follows: Section 1: 18.1%, Section 2: 19.7%, Section 3: 20.2%, and Section 5: 12.8%. Regarding Section 4, development was implemented by the state government's own funds, and as a subject for loan project, a comprehensive evaluation including the degree of environmental and social impact is added to the economic analysis, resulting in the table below.

Table 13.1.1 Result of Prioritization

Criteria		Indicator		Sec.1	Sec.2	Sec.3	Sec.5
1	Effect on Improvement of Traffic Situation	Traffic Volume (pcu/day)		58,324	31,184	89,528	43,282
			SCORE	**8**	**6**	**9**	**7**
		Reduction in Total Travel Time (vehicle hour)		54,871	45,192	67,494	26,239
			SCORE	**8**	**7**	**8**	**5**
		Large Vehicle Rate (%)		76	13	25	27
			SCORE	**10**	**4**	**6**	**7**
2	Magnitude of Environmental and Social Impact	Impact on Reserved Forest and Coastal Regulation Zone		RF: - CRZ: Cat..III	RF: - CRZ: -	RF: 0.28 CRZ: -	RF: 9.95 CRZ: -
			SCORE	**7**	**10**	**7**	**5**
		Area of Land to be Acquired (ha)		255	188	208	163
			SCORE	**5**	**7**	**6**	**7**
3	Economic Rationality	EIRR (%)		18.1	19.7	20.2	12.8
			SCORE	**7**	**7**	**7**	**5**
TOTAL SCORE				45	41	43	36
PRIORITY				**1**	**3**	**2**	**4**

Source: Land Acquisition Area: STUP's Letter E/14518/149/NJW/GK/0132 dated 11 Aug 2017,
Project Cost: Construction Cost shown in DPR Main Report, P9-3

1st **2nd** **3rd**

Source: JICA Study Team

With respect to Tiruvottiyur Ponneri Pancheti (TPP) Link Road, Highways and Minor Ports Department (HMPD) conducted a survey on the alternate alignment from May to June of 2018, as inhabitants' opposition was given to the original alignment. In early July, the government decided a new alignment of 3.6 km from the TPP Link Road around Minjur to Northern Port Access Road (NPAR) (as a main line of Section 1). Also, the new alignment connects to the Outer Ring Road (ORR) near Minjur.

13.2 Confirmation of Appropriateness of the Project Components

As a result of the review on the Detailed Project Report (DPR) and social environmental-related reports of CPRR, some issues were found. To be appropriate project under the official development assistance (ODA) scheme, the DPR of CPRR needs to consider the following:

(1) Horizontal Alignment

Significant issues are not found for the horizontal curve radius. However, the spiral length is not sufficient in some sections. Thus, it is desirable to improve those sections.

(2) Vertical Alignment

There is no issue with the gradient since all the applied values meet the Indian Road Congress (IRC)

requirement throughout the route. However, the vertical curve length is not sufficient in some sections. Thus, it is desirable to improve those sections.

(3) Entry/Exit and Service Road

Two-lane service roads that are to be operated as two-way roads are proposed on both sides of the main road. This system requires crossing at entries to enter the main road, and there is a concern of incursions and collisions at exits. Therefore, it is recommended to have a one-way operation on the service road at least in the vicinity of entries and exits.

(4) Junctions

Traffic jam is expected at the at-grade intersection because of the increase in future traffic volume (large vehicles such as trailers) at the beginning point. It is proposed to have a separation of road for the through traffic (south to north) and left turn (south to west and west to north) and right turn (west to south and north to west).

Traffic jam is expected at the at-grade intersection between the main line and the TPP Link Road because of increase in future traffic volume (large vehicles such as trailers). To increase the capacity of the intersection, an exclusive lane for left turn (free left turn) is proposed instead of a left turn (east to south).

Traffic flow at the intersection of the ending point is complicated due to a roundabout. The installation of traffic signals is proposed at the crossing point to improve safety at the intersection.

(5) Interchanges

Four interchanges are planned to connect the project road and the national roads.

As for interchanges (IC) 1, 2, and 3, left-turning traffic on the project road exit to the service road before the interchange. Vehicles enter the project road from the service road. Therefore, it takes a longer time and causes congestion on the service road. Additional direct ramps for left-turning traffic and a service road located outside of the ramps are proposed.

As for IC-1, 2, 3, the curve radius of the loop rampway is 70 m. However, the transition curve is not inserted between the straight line and curve. Therefore, the horizontal alignment and transition of super-elevation is not smooth. It is desirable to insert the transition curve between straight line and curve (R=70 m, e=5%).

As for IC-1, 2, 3, the weaving is occurred between the merging point and the diverging point at the connected section of the main road and the rampway. There are four lanes in this section (W=16 m), including the rampway (one lane). The distance between the merging point and the diverging point is 240 m. It is expected that congestion is caused by the decrease of running speed considering the future traffic volume (weaving traffic and non-weaving traffic). It is recommended to increase the rampway width (one more lane) outside of the main road. The total width becomes 19.5 m (five lanes).

As for IC-2, the curve radius of the ramp terminal of the beginning side of the project road is 525 m. It has a small and steep super-elevation (5%). It is dangerous for cars passing with high speed, even with the installation of speed limitation signs (80 km/h). To improve safety, it is recommended to apply a radius bigger than 700 m, which is prescribed in the Road Structure Ordinance Standards of Japan. The curve radius of the ramp terminal of the main road follows a design speed of 80 km/h.

As for IC-3, the shape of this interchange is not symmetrical, avoiding the Hinduism Temple. Therefore, the distance between the merging nose and the diverging nose is short, and the weaving becomes difficult. Also, it is difficult to guide, and safety is low. It is recommended to provide the distributing lane (design speed 40 km/h), which is parallel to NH5 at the end point side, and to connect the distributing lane and rampway. Moreover, the weaving distance becomes longer because the rampway alignment is changed.

As for IC-4, the elevated roundabout type is adopted, and the shape of the roundabout is an ellipse. The small radius is 35 m and big radius is 100 m. The distance between the merging nose and the diverging nose is longer, and the on-ramp and off-ramp are separated in order to decrease the influence of weaving. However, it is expected that congestion is caused by weaving, considering the future traffic volume. It is recommended to add the separated left-turn rampway outside of the roundabout in order to increase the capacity of the roundabout.

(6) Major Bridge Design

There are piers planned as hybrid structures (bridge piers + reinforced earth walls) and piers planned as abutments (from Plan & Profile, Drawing). Hybrid structures are being constructed in many places in India. However, in areas affected by running water, maintenance and management will be a concern from the viewpoint of anti-erosion and protection from running water. The substructure at the ends of the bridge subject to the impact of flowing water is proposed to be constructed as an abutment type for the purpose of protecting from erosion and protecting the back soil from the reinforced earth wall.

(7) Minor Bridge Design

The minimum span of several minor bridges (MNBs) is set as 10 m. The DPR considers improving the accuracy of the bridge plan, including structural investigation at the time of the detailed design by setting the short span and economical reinforced concrete slab bridge as the design standard. Investigation to increase economic efficiency by lengthening the span and reducing the number of piers, study to improve the river flow and constructability by reducing pier on the river, and confirmation of bridge plan details by consultation with environmental authorities should be examined and confirmed at the time of detailed design.

Also, about bridge piers in the DPR drawing, there is no width allowance for the superstructure's bearing in the substructure's coping. It is preferable to provide an allowance in case unexpectedly large forces, such as earthquakes, occur. The width of the substructure, bearing width allowance, and other details must be reconsidered in the detailed design.

(8) Interchange Bridge

The sectional view of a reinforced earth wall is in the drawing, and “Terre Armee” is placed between the northbound and southbound lanes. The total count is four planes. However, for bridges other than ICs, there is no cross-section drawing, but the number is counted in two-surface construction where no reinforced earth wall is placed between the northbound and southbound lanes.

The distance between the northbound and southbound lanes is about 4 m. If the reinforcing earth wall is arranged at the back of the bridge end, two sides can be constructed, and the structure is economical. Therefore, a plan for the reinforced earth wall of the IC with two-side construction is proposed.

There is a concern that the cantilever length of the slab is large and does not have sufficient reaction against the assumed dead load and live load. (The cantilever slab length is about 4 m based on the scale of the drawing.)

It is generally preferable that the cantilever length of the PC slab is within 3 m, and a review of the structure of the PC box girder for the purpose of reducing the cantilever length is proposed.

It is better to plan a three-box girder because the space is wide. In addition, concerning the width of the beam of piers, it is necessary to revise the structure as well as review the box girder.

The position of the bearing that supports the superstructure is based on the cross beams, and the spacing of the outer main girders is greater than the width of the beam of the pier.

To ensure that the vertical load is supported and to preserve the rigidity of the main girder, it is proposed that the beam width be larger than the outer main girder spacing and that the bearing be placed under the main girders.

(9) Box Culvert

There is a part where the connection between the box culvert and the retaining wall structure on the box is simplified and integrated. Since the collision load of the guardrail vehicle may act on the top of the retaining wall. Attention should be focused on the following:

In order to ensure the rigidity of the end of the retaining wall, it is preferable to separate the box and retaining walls at the ends of the foundation.

The base of the retaining wall should be a spread foundation after carrying out the member calculation and stability calculation as a protective fence foundation.

(10) Cost Estimate

The main report of DPR and Volume VIII [Cost Estimate] is not consistent with the contents and the results of the cost estimate. Therefore, Volume VIII, which was published in a new period, is regarded as a

review subject in this study. It is noted that the ITS component is not included in the breakdown of Volume VIII.

DPR Volume VI [Rate Analysis] has not been provided to the Japan International Cooperation Agency (JICA) Study Team, and the basis for setting each unit price was unknown as of December 2017. For this reason, the unit price review of this survey was conducted to refer to the material above and to check whether there is any obvious mistake in the unit price setting. The JICA Study Team rebuilt unit prices based on the estimate materials of the Ministry of Road Transport and Highways (MORTH) Standard DATA Book for major work items with a high proportion of overall project cost such as borrow material and rebars. Because of evaluating the appropriateness of the DPR's unit price setting by comparing the unit price of each, it was considered that there is no obvious error in DPR because none of them have large deviations.

(11) ITS for CPRR

As the ITS component for CPRR is not included in the cost breakdown of Volume VIII. The ITS component for CPRR should be examined and included in the DPR.

(12) Project Scheme

HMPD expressed that the project scheme of CPRR is not PPP, and HMPD will prepare and implement the project, complying with JICA procurement guidelines, namely the “Guidelines for the Employment of Consultants under Japanese ODA Loans” dated April 2012 and the “Guidelines for Procurement under Japanese ODA Loans” dated April 2012.

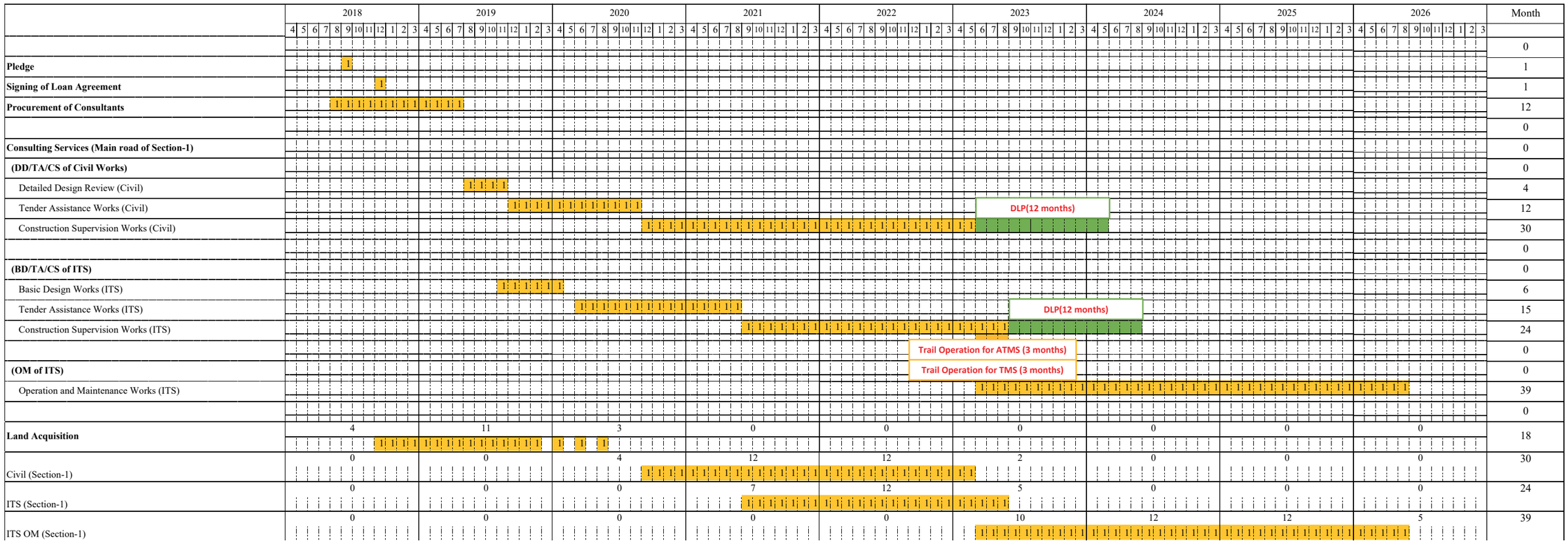
HMPD agreed in principle to apply Standard Bidding Documents (SBD) issued by JICA for the contract for Section 1 though HMPD, and JICA is discussing which particular SBD is to be applied for the project.

(13) Project Implementation Schedule

The road stretch of Section 1 consists of Northern Port Access Road (NPAR) and TPP Link Road.

During consultation with inhabitants around the site of the TPP Link Road (Original Alignment), it was found that it is important to obtain social consensus for the road construction. As an alternative solution to minimise the social impact, the south end of the TPP Link Road is to be shifted approximately 1.5 km west from the original alignment. This new alternative alignment has a total length of 3.6 km from the connecting point with the NPAR to the southern end. The 1.65 km stretch in the northern part is the same as the original alignment, and the remaining 1.95 km in the southern part is different from the original alignment. Through an additional survey at the alternate site, social consensus was confirmed for the new alignment. Therefore, it is expected that NPAR and TPP Link Road (New Alignment) will become the Section 1 of the Japanese ODA Loan Project.

The proposed implementation schedule of Section 1 of the project is shown in Figure 13.2.1.



Source: JICA Study Team

Figure 13.2.1 Implementation Schedule of Section 1 of the Project

(14) O&M

The Highways Division of the Construction and Maintenance Wing responsible for each area of CPRR will takeover the O&M.

Section 1, Section 2, and a part of Section 3 of the CPRR will fall under the jurisdiction of Thiruvallur Highways Division. The remaining portions of Section 3, Section 4, and Section 5 will fall under the jurisdiction of the neighbouring Chengalpattu Highways Division. It is assumed that Performance Based Maintenance Contract (PBMC) will be introduced to the Chengalpattu Highways Division by the time the CPRR is completed. If the introduction should be delayed, the single-year maintenance contract will be used.

The structure of the Thiruvallur Highways Division consists of one divisional engineer, six assistant divisional engineers, and eight assistant engineers. This Highways Division will outsource the work of maintenance/patrol/traffic control with PBMC to an O&M contractor. There is a plan to collect toll for Section 1, and when it is carried out, toll collection will also be outsourced to a contractor. There is one field office for the divisional engineer and six field offices for the assistant divisional engineers taking charge of road construction other than large-scale projects and maintenance for state highways and major district roads.

(15) Environmental and Social Considerations

HMPD agreed to implement land acquisition and resettlement process, complying with the “JICA Guidelines for Environmental and Social Considerations” dated April 2010.

Appendix-1: Minutes of Meeting with Concerned Agencies

Consulting Services for
Preparatory Study for Chennai Peripheral Ring Road Development in India
NIPPON KOEI CO., LTD. / EAST NIPPON EXPRESSWAY CO., LTD. / CTI ENGINEERING INTERNATIONAL CO., LTD. / PADECO CO., LTD.

Project Office

Tel. :
Fax. :

Ref. No. :CPRR-L-HMPD-01
Date :July 24, 2017

Mr. G.R. RAJENDRAN,
Chief Engineer (H), Construction and Maintenance,
Integrated Chief Engineers' office,
HRS Campus, 76 Sardar Patel Road, Guindy,
Chennai - 600 025.
E-mail: dcehplanning@gmail.com

Subject: Minutes of Kick-off Meeting for Preparatory Study for Chennai Peripheral Ring Road Development in India

Dear Sir,

JICA Study Team sincerely appreciate you for sharing your valuable time for the kick-off meeting held on 19th July 2017. We would like to submit the minutes of the kick-off meeting.

With regard to the following our requests made at the meeting that affect schedule of this study as well as appraisal work for the loan assistance, we would like you to kindly respond the requests urgently.

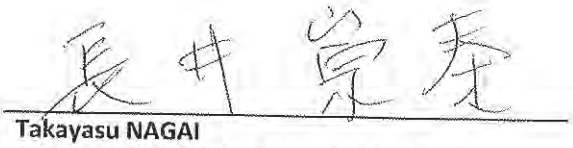
1. Provision of full set of the DPR reports
2. Provision / Introduction of office space inside or near HMPD or TNIDB (for 20 staffs)

As for the organizational structure for consensus building and decision making of the project, we discussed this matter at the kick-off meeting with TNIDB held on 20th July 2017. As a result, the Empowered Committee is recommended to be established after approval of the project by state and the Steering Committee is more suitable to accelerate the consensus building and decision-making at this stage. It was further confirmed with TNIDB that one Steering Committee for the matters of both CPRR and ITS will be established.

Therefore, we would like to propose the members of the Steering Committee as attached for your review and comment.

Your kind attention on the above would be highly appreciated.

Sincerely yours,



Takayasu NAGAI
Team Leader of the JICA Study Team
The Preparatory Study for Chennai Peripheral Ring Road Development in India

Attachment:

1. Minutes of Kick-off Meeting (HMPD)
2. Minutes of Kick-off Meeting (TNIDB)
3. Proposed Members of Steering Committee

c.c.

1) Mr. Rajeev Ranjan I.A.S, Additional Chief Secretary, HMPD (E-mail: hwaysec@tn.gov.in)
2) Mr. S. Krishnan I.A.S, Principal Secretary (Planning and Development), CEO- TNIDB (E-mail: plansec@tn.gov.in, Tel: 44-25674310)
3) Ms.Pooja Kulkarni I.A.S, Additional Secretary, Finance Department.
4) Mr. P. T. Mohan, Assistant Chief Engineer, HMPD, (E-mail: ptmohan1973@gmail.com, j.rammawia@nic.in, Tel: 9444476854)
5) Mr. K. S. Sadananda, Assistant Chief Engineer, HMPD (Tel:9884254774)
6) Mr. H. Ramesh, Divisional Engineer (Div-4), Chengalpattu, HMPD (Tel: 9677039979)
7) Mr. Hidenobu Fujiwara, South Asia Dept., JICA Head Office (E-mail: Fujiwara.Hidenobu@jica.go.jp)
8) Office Copy

Project Office

Tel. :
Fax. :

Ref. No. :CPRR-MOM-HMPD-01
Date :July 19, 2017

Annexure - 1

MEETING RECORD

Title	Kickoff Meeting			
Date	Wednesday 19 July 2017		**Time**	15:00 – 17:00
Venue	1st Floor, Conference Hall, Highways Research Station Campus, 76, Sardar Patel Road, Guindy (Opposite to Raj Bhavan)			
Participants	**No.**	**Name**	**Position**	**Phone Number**
HMPD	1	Palanivel	Chief Engineer	
	2	P.T.Mohan	Assistant Chief Engineer	9444476854
	3	H.Ramesh	Divisional Engineer (Div-4), Chengalpattu	9677039979
	4	K.S.Sadananda	Assistant Chief Engineer	9884254774
	5	K.Vanathi	Divisional Engineer, TNRDC	9444272519
	6	V.Pugazhendhi	Junior Engineer (Roads)	9952797229
	7	S.r.Prabakaran	Assistant Engineer (Roads)	9786438553
	8	R.Ramyasri	Assistant Engineer	9566143585
	9	R.Sathiya	Assistant Engineer	9444888781
	10	P.Madhan kumar	Assistant Engineer	9952075411
	11	G.Vijayalakshmi	Assistant Chief Engineer - Bridges	9442558793
DPR Consultant	1	N.j.Wesley	Team leader - STUP Consultant	9444020665
	2	Gobi k.	Sr. Designer - Highways- STUP Consultant	9884431161
	3	V.Krishnamoorthi	Sr. Consultant- STUP Consultant	9841184804
JICA	1	Hidenobu Fujiwara	South Asia division 1	9958295176
JICA Study Team	1	Takayasu Nagai	Team Leader / Road Planning	9786171898
	2	Ippei Iwamoto	Deputy Team Leader / Road Planning 2 / Road Design	
	3	Hiroya Totani	ITS Planning / Design 1	8978435175
	4	Noboru Kondo	ITS Planning / Design 2	8978435175
	5	Eiji Wakatsuki	ITS Operation	8586000395
	6	Kiyoshi Dachiku	Road Operation and Maintenance Planning	8588097983
	7	Kenichi Moritani	Natural Conditions Survey	
	8	Nawaz	Engineer	9840692739
	9	Rajesh	Secretary	9176646383
Others	1	Shinji Tsuboi	Nippon Koei India	9871248249
References		Inception Report (Draft)		

Agenda:

No.	Items for discussion	Conclusion – Agreement
1	**Self Introduction**	• The JICA Study team, STUP Consultants and members from HMPD were introduced to each other
2	**Explanation of Outline of the Study based on Inception Report (Draft)**	• TL gave a brief presentation on the objectives, schedule, members and work scope of this project. A copy of the inception report and presentation was shared with the members. • Same has been attached herewith for reference
2.1	Project to be subjected to the Study	• The details of the proposed study were explained to HMPD in detail.
2.2	Objective of the JICA Preparatory Survey	• The objectives of this study were discussed briefly.
2.3	Typical Process of the Loan Project	• The overall process of yen loan was explained by JICA expert. • Mr.Sadananda enquired if the project has been added in rolling plan 2017 ?. Representative of JICA replied that this project is not in rolling plan. However, decision for adding this project to the rolling plan 2017 by DEA is anticipated and envisaged date for this is around mid of August 2017. Also JICA appraisal mission is expected in December 2017.
2.4	Schedule of the JICA Preparatory Survey	• The schedule of the survey was shared with HMPD. It was also explained that this project takes about 6 months for submission of the draft report.
2.5	Member of JICA Study Team	• Members of the team were introduced. It was also informed that these members would be closely working with various stakeholders for successful completion of this study. • Members from HPDM informed that they will extended their full support for this study.
2.6	Work Scope for Mile Stone -1	• The miles stones- 1 of the project were explained in detailed and accepted.
2.7	Work Scope for Mile Stone -2	• The miles stones- 2 of the project were explained in detailed and accepted • It was also informed that Preliminary design, cost estimate and implementation plan preparation would be carried out by end of December 2017.
3	**Discussions**	
3.1	Proposal of Establishment of Steering Committee	• Mr.Sadananda suggested that empowerment committee may be formed with Minister of Highways, Finance Secretary, Highways Secretary, Project Director and other stakeholders related to this project. • Mr.Sadananda also suggested that steering committee may be formed with Chief Secretary, Finance Secretary, Highways Secretary, ,Project director and other stakeholders related to this project. • Mr.Sadananda requested the JICA Study Team to inform this matter to HMPD after consultation with TNIDB by letter.
4	**Others**	
4.1	Request for Office Space	• The TL requested HMPD for providing office space for the study team. HMPD informed JICA Study Team that it will consider the request and will inform about the availability within a week. They also requested JICA study team to discuss about this with Chief Executive Officer, TNIDB.
4.2	Request for sharing CPRR study reports	• The TL requested HMPD and STUP Consultants to share the reports and annexure related to CPRR Study. • It was decided that Mr.Sadananda, ACE-HMPD would

No.	Items for discussion	Conclusion – Agreement
		provide written confirmation to STUP Consultants to share the data within a week
4.3	Organizational framework for project implementation	• It was informed that organizational framework for project implementation would be decided as the survey proceeds further.
4.4	Assignment of Counterpart staff from HMPD	• TL requested HMPD to assign counterpart staff. • Mr. Ramesh, Divisional Engineer (Div-4), Chengalpattu was assigned for coordinating technical and implementation issues. • Mr.P.T.Mohan, ACE- HMPD informed that he may be contacted for all required support.
4.5	Permission for Traffic Surveys	• The JICA Survey Team explained HMPD that as a part of this study. It is required to conduct traffic surveys at few points to validate the traffic data. • HMPD informed that they will provide the necessary permissions for conducting the traffic surveys.
4.6	Status of the reports	• STUP consultants shared the status of the project as below. • It was informed that Detailed Project Report has been completed with estimates and drawings. • Land acquisition plan is also ready. • Preparation of major parts of the EIA reports have been completed. • JICA Survey team requested to share the reports for reviewing the same at the earliest.
4.7	Progress of works at CPRR	• The following updates were given by members of HMPD and STUP Consultants. • Public consultation has been done at all 5 sections as per the guidelines of Pollution Control Board. • Clearance from various departments have been initiated. • Approval for construction of Rail over bridge at the road and rail intersections have been obtained from Railways and Public Works Department. • Approval from forest department is awaited for section 3 & 5. • Costal regulation zone is not applicable in this project. • Other necessary approvals from various other departments would be obtained by concessioner or contractor at the later stages. • At Section 1 - Northern port access road, land acquisition is in progress. • Land acquisition for the section where construction has not been commenced in Section-4 has been initiated. Land acquisition is being carried by land revenue department. Land is acquired based on TamilNadu highways land acquisition act. Preliminary land acquisition notification has been issued, which will be followed by final notification to acquire the land.
4.8	Mode of implementation	• The mode of implementation i.e hybrid annuity or EPC or Item Rate would be decided after getting approval from the state government • Also the decision of introducing the toll plazas is government level decision and will be decided at the later stages.
4.9	Meeting with EIA Experts	• It was decided that Environmental expert from JICA Study team would meet the concerned EIA expert from STUP consultants. To discuss and understand the present status.
4.10	Section Prioritization	• JICA Survey Team enquired about the section prioritization they would be following in CPRR project. • HMPD replied that the prioritization would be in the

No.	Items for discussion	Conclusion – Agreement
		following order • Section 1 • Section 2 & 3 • Section 5 • And Section 4 (As road widening has been completed 90% already)

Attachment: Inception Report (Draft)

Project Office

Tel. :
Fax. :

Ref. No. :CPRR-MOM-TNIDB-01
Date :July 20, 2017

Annexure - 2

MEETING RECORD

Title	Kickoff Meeting			
Date	Thursday 20 July 2017		**Time**	15:00 – 15:45
Venue	Secretariat			
Participants	**No.**	**Name**	**Position**	
TNIDB	1	S. Krishnan I.A.S	Principle Secretary , CEO Finance Department	
	2	Pooja Kulkarni I.A.S	Additional Secretary, Finance Department	
	3	M.Raja	Deputy Secretary, TNIDB	
	4	N.Ganesan	Section Officer – Infra cell	
JICA	1	Hidenobu Fujiwara	South Asia Department	
JICA Study Team	1	Takayasu Nagai	Team Leader / Road Planning	
	2	Ippei Iwamoto	Deputy Team Leader / Road Planning 2 / Road Design	
	3	Hiroya Totani	ITS Planning / Design 1	
	4	Noboru Kondo	ITS Planning / Design 2	
	5	Eiji Wakatsuki	ITS Operation	
	6	Kiyoshi Dachiku	Road Operation and Maintenance Planning	
	7	Kenichi Moritani	Natural Conditions Survey	
	8	Nawaz	Engineer	
	9	Rajesh	Secretary	
Others	1	Dr. Sampath Kumar	Nippon Koei India	
	2	Raj Cherubal	CEO, Smart City Company	
References	Inception Report (Draft)			

Agenda:

No.	Items for discussion	Conclusion – Agreement
1	**Self Introduction**	• The JICA Study team was introduced to TNIDB. Many of the JICA Study Team members were familiar as they had worked in the previous study – Data collection survey for ITS in Chennai.
2	**Project to be subjected to the Study**	• Mr. Fujiwara, JICA explained that this preparatory survey is to review the CPRR & ITS project in detail and to formulate the implementation scheme for the loan project .
3	**Object of JICA Preparatory Survey**	• It was explained that the main objective of this preparatory survey is to review and update the DPR of CPRR and ITS. It was also explained that this project takes about 6 months for submission of the draft report.
4	**Process of the Loan Project (Tentative)**	• Mr. Fujiwara, JICA also explained that after update of the DPR based on suggestions and supplemental works by JICA Study Team, HMPD will appraise the results. After which Jica will conduct appraisal Mission for Loan Agreement with TN Government. This is expected to made by the end of December 2017.

No.	Items for discussion	Conclusion – Agreement
5	**Decision – Making Structure (Tentative)**	• Team Leader, JICA Survey Team gave a detailed presentation and CEO ,TNIDB gave the following suggestions, • CEO, TNIDB suggested that Empowerment committee may be formed at the implementation stages. For now it is suggested that a steering committee will be formed with finance secretary or Chief Secretary as chairman. This would expedite the process of getting various technical approvals at this planning stage of the study. • CEO, TNIDB suggested there is no need for separate committees for CPRR and ITS. They can be combined as one. • The empowered committee may be formed to get various financial approvals for the appraisal process of extending loan to the project and subsequent procedures. • CEO TNIDB requested Mr. Raj Cherubal CEO, Smart city Company – To monitor, co ordinate and share the plans related to ITS. It was decided that members from ITS Study Team would meet CEO, Smart City company & Project Management Consultants -PWC on 21st July 2017 at 2.00 pm to update on the status of smart city mission and various other plans related to ITS. • CEO, TNIDB suggested that the following members to be added to the steering committee 1) Transport Commissioner 2) Municipal Administrations and water supply department and 3) Tamil Nadu Infrastructure Financial Management company. • CEO TNIDB, informed the JICA Survey Team that the CPRR project has to go through MORTH where as the ITS project would be through MOUD. Hence he request the JICA Survey Team to explore the possibility of linking ITS project as a part of Tamil Nadu Investment promotion program- phase 2 which might expedite the implementation procedures as CPRR project has slowed down due to various reasons.
6	**Request of Important Facilities from Counterpart Side**	
	Request for Office Space	• The TL requested CEO, TNIDB for providing office space for the study team. CEO, TNIDB informed that they will consider the request and will inform about the availability shortly. • CEO, TNIDB will discuss regarding this issue with highways secretary
	Request for sharing CPRR study reports	• The TL requested CEO,TNIDB to co ordinate in getting complete set of study reports related to CPRR form HPMD. • CEO, TNIDB informed that he will discuss this issue with highways secretary.
	Discussions on ITS Components	• Mr.Totani briefed about the various objectives of this survey. It was explained that more detailed study would be conducted with various stakeholders and updates would be made to the detailed specifications

No.	Items for discussion	Conclusion – Agreement
		and estimates. Also the ITS components would be prioritized for implementation. • CEO, TNIDB will share the details about the agencies related to ITS implementation. • CEO, TNIDB requested JICA Survey Team to calculate the environmental benefits that would occur in shifting of private vehicle to public vehicles. • The present condition of ITS financing was enquired to CEO, TNIDB. It was informed that no financing has been tied up to any of the ITS components for implementation. And they are looking for the loan.

Attachment: Inception Report (Draft)

Annexure – 3

Proposed Members of the Steering Committee

No	Name of Organization
1	Highways & Minor Ports Department
2	Tamil Nadu Infrastructure Development Board
3	Municipal Administration and Water Supply Department
4	Housing & Urban Development Department
5	Chennai Metropolitan Development Authority
6	Chennai Traffic Police
7	Transport Department
8	Transport Commissioner
9	Greater Chennai Corporation
10	Chennai Smart City Corporation Limited
11	Tamil Nadu Road Development Corporation
12	Metropolitan Transport Corporation
13	Tamil Nadu State Data Centre
14	Chennai Metro Rail Limited
15	National Highway Authority of India
16	Tamil Nadu Infrastructure Finance Management Corporation
17	Tamil Nadu Urban Finance and Infrastructure Development Corporation Ltd.
18	Tamil Nadu Urban Infrastructure Financial Service Limited
19	Indian Institute of Technology, Madras
20	Anna University

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Consulting Services for

Preparatory Study for Chennai Peripheral Ring Road Development in India

NIPPON KOEI CO., LTD. / EAST NIPPON EXPRESSWAY CO., LTD. / CTI ENGINEERING INTERNATIONAL CO., LTD. / PADECO CO., LTD.

Project Office

Tel. :
Fax. :

Ref. No. :CPRR-MOM-NHAI-01
Date :July 24, 2017

Title	Meeting with Project Director- NHAI			
Date	Wednesday 24 July 2017		**Time**	11:00 – 12:00
Venue	Project Directors Office, 2 nd floor, Butt Road, SRI Tower, SP Industrial area, St. Thomas Mount, Chennai.			
Participants	**No.**	**Name**	**Position**	**Phone Number**
NHAI	1	Mr.Adhipadhi	Project Director – NHAI- Chennai	**9442527805**
JICA Study Team	1	Hiroya Totani	ITS Planning / Design 1	8978435175
	2	Noboru Kondo	ITS Planning / Design 2	8978435175
	3	Eiji Wakatsuki	ITS Operation	8586000395
	4	Nawaz	Engineer	9840692739
References				

No.	Items for discussion	Conclusion – Agreement
1	**Explanation of Outline of the Study based on Inception Report**	• The JICA Study team and NHAI were introduced to each other.
		• The Project Director, NHAI informed that the starting point of operational Stretches of NHAI starts from ▪ NH 45 – At Tambaram (At Km 28) ▪ NH 4 – At Maduravoil ▪ NH 205 – Poonamalle ▪ NH 5 – Madhavaram (At km 11) • The Project Director, NHAI informed that The roads within the city are maintained by State PWD (may not be all).
2	Toll Management.	The following information's were provided related to toll management. • The toll is being collected based of the National tolls act. • Car was charged .65 paisa per Km and now it's being charged at 1.54 per km. • These fares are fixed based on the wholesale price index. • There is no comprehensive smart card available for fare collection. FasTag is being used for this purpose. • NHAI informed that they are not planning to introduce any smart card fare payment system besides manual and FasTag system.
3	Visit to Toll Plaza	• NHAI would arrange a visit to the plaza at Sriperambadur on the request of study Team because IHMCL person is working there who should have a knowledge of FasTag system,
4	RFID working issues	• The miscommunication between antenna and tag happens often and it's more affected during the times of rain. • NHAI requested the study team to visit Mr. Palekar – (9871656694) Indian Highways Management Company Limited for information related to RFID. at Delhi

No.	Items for discussion	Conclusion – Agreement
5	FASTag System	The procedure for obtaining FASTag System is explained below • The documents required for obtaining FASTAG are ➢ Registration Certificate (RC) of the vehicle. ➢ Passport size photograph of the vehicle owner ➢ KYC documents as per the category of the vehicle owner • The registration fees for FAS Tag System is Rs.200 • FasTag to be obtained from various authorized banks (approx.10banks). • Net connectivity and Software issues. • Planning to have separate servers.
6	Installing ATCC along Chennai Bypass	• NHAI informed that ATCC may be installed at Chennai Bypass. Formal Government level approval might be required.
7	Toll fare collection at Radial Roads	NHAI informed that construction of CPRR will reduce the revenue of NHAI road Concessionaire which managing the roads are crossing CPRR. In order to avoid revenue reduction, NHAI want to relocate the plazas and modify the existing boundaries from inside of CPRR to outside the CPRR . However, road administrator of inside of CPRR need to change from NHAI to State road administrator.
8	Contact information.	• The Project Director, NHAI Shared his e mail id and phone number and informed that he may be contacted for further queries. ➢ Email : chennaipiu@gmail.com ➢ Mobile: 9442527805

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NIPPON KOEI CO., LTD. / EAST NIPPON EXPRESSWAY CO., LTD. / CTI ENGINEERING INTERNATIONAL CO., LTD. / PADECO CO., LTD.

Project Office

Tel. :
Fax. :

Ref. No. :CPRR-MOM-CMRL-01
Date :July 25, 2017

MEETING RECORD

Date	Friday 25th July 2017		**Time**	14:00 – 15:00
Venue	CMRL Office, Koyembedu			
Participants	**No.**	**Name**	**Position**	**Phone Number**
CMRL	1.	Mr.Krishnan	GM- Technical	
	2.	Mr. Narendra	AGM – Technical	9445868247
	3	Mr. Ravi Maduraikannan	Manager - Technical	9445868308
JICA Study Team	1	Hiroya Totani	ITS Planning / Design 1	8978435175
	2	Nawaz	Engineer	9840692739
References		Questioner for meeting		

Agenda:

No.	Items for discussion	Conclusion – Agreement
1	**Self Introduction**	• The team was introduced to the CMRL.
2	**Progress and status of Chennai Metro project**	• Mr.Totani gave a brief explanation on the objectives, schedule, members and work scope of this project. • A copy of the questionnaire was shared with the officials and was requested for replies. CMRL officials gave the following replies :
	CMRL Operational Stretches	• The following stretches are currently operational o Airport to Little mount (Corridor 1) o St Thomas mount to Nehru park (Corridor 2)
	Ridership at airport stretch	• CMRL officials informed that the stretch from airport to little mount has been opened recently. • This stretch of corridor 1 is in partial operations and the ridership is slowly increasing.
	Completion of Metro Phase 1	• CMRL Officials informed that the Metro Phase 1- 45 Kms stretch including the underground stretch is expected to be completed by mid of 2018. • 98 % of tunneling work has been completed at all the stretches. • Small section of tunneling work at Gemini flyover is pending and it's expected to get completed shortly. • The construction work at Station is in different stages of completion and work is in progress.
	Approval of Mero phase 2	• Government of Tamil Nadu has approved Metro Phase 2 and approval from Central Government is pending.
	Intermodal connectivity	• CMRL informed that they are the SPV for implementation of metro rail. Where ever possible inter modal connectivity has been provided. • In phase1 of the metro all the major terminals have been connected (Intercity and Intra city Bus terminal, Rail network and Airport). • The connectivity with sub urban railways has been provided at St Thomas mount and Guindy.

No.	Items for discussion	Conclusion – Agreement
		• Parking facility for cars and Tw's has been provided at metro stations where ever land is available. • Feeder buses are being run from metro stations by MTC. Taxi operators such as Ola and Uber are also placed at important stations. Same strategy will be followed in the next phase of study also. • In Phase 2 of Metro DPR, a separate component (estimate) has been added for Multi Modal Integration. In the DPR, 2 % of the entire project cost has been added as the budget for Multi Modal Integration, Which will be used by CMRL for implementing various plans of Multi Modal Integration.
	Agencies responsible for Inter modal connectivity.	• CMRL informed that the agencies responsible for inter modal connectivity are GCC, MTC, CMDA and Highways.
	Punctuality of Metro Operations	• It was informed that metro rail runs on schedule and is 99 % punctual. • As a part of clean development mechanism a study is being carried out. The study would identify and measure the before and after benefits of introducing Metro. The Study would also calculate the carbon credits.
	Update on Common Mobility Card	• CMRL has introduced Metro Travel Card and they use both TYPE A and TYPE C – Felica Card. The card reader is capable of reading both TYPE A and TYPE C card. • Initially 3 Lakhs Type A cards was issued. Later 2 Lakh cards have been issued recently due to the shortage of TYPE A cards. • The collaboration between various stakeholders is still pending to arrive on a common platform for usage of the Common Mobility card. • MTC has to confirm to CMRL that the ETM is capable of reading both Type A and Type C Cards. • CMRL has started to issue Travel Cards and the usage of tokens has been reduced. It is estimated that 90% of the Payments are now through cards.
	Metro Travel Card for CPRR	• CMRL informed that clearing house of Metro is capable of handling 32 Operators. And hence the travel card can be programmed to be used at CPRR toll plazas for toll Collection (Touch and Go system). • As CMRL has already issued cards and a mechanism for operations, the toll operator may not introduce a new back end system or issue new cards. They may set up the card reading machine and start the operations.
	Reason to use Type A cards	• The technical requirements of the cards are accessed based on factors such as – Data security Measures and Card reading speed. • CMRL informed that TYPE –A (NXP) cards are Cheaper. • They are pick products which are not single source monopoly products.
	Banks role in Metro Cards	• Metro Travel cards are also issued through State Bank of India. • The State bank of India card which can be used as Debit card and Metro travel card.

Project Office

Tel. :
Fax. :

Ref. No. :CPRR-MOM-IHMCL-01
Date : August, 2nd , 2017

MEETING RECORD

Title	Meeting with Mr.Palekar – IHMCL – NHAI – New Delhi			
Date	2nd August 2017		**Time**	15:00 – 17:30
Venue	Mr. Palekars Cabin, IHMCL office, New Delhi			
Participants	**No.**	**Name**	**Position**	**Phone Number**
IHMCL	1	Mr. Palekar	Project Director - IHMCL	
JICA Study Team	1	Hiroya Totani	ITS Planning / Design 1	8978435175
	2	Mr. Okuda		
	3	Varun Agarwal	ITS Operation	8586000395
	4	Nawaz	Engineer	9840692739
References		Questioner		

Agenda:

No.	Items for discussion	Conclusion – Agreement
1	**Self Introduction**	• The Study team was introduced to Mr. Palekar, it was also informed that the formal study by JICA has not been commenced yet and the team is here to collect preliminary information for the study.
2	**FASTAG Card System**	Mr. Palekar gave the following updates: A. Dissemination ratio is around 13 to 14 %. B. The issuer and acquirer of FASTag cards are banks. C. There are around 400 Toll Plazas operating FASTag card system. **<u>Business Model Prior to April 2015:</u>** D. Prior to April 2015, ICICI bank (Single entity) was the only acquirer and issuer for the FASTag card system. They issued around 7000 FASTag tags. **<u>The business model from May 2015:</u>** E. From May 2015 the number of issuers and acquirers has been increased. Issuer banks are nearly 10 Nos and acquirer banks are almost 7 Nos. F. SBI and ICICI Bank are the most active players in the business. G. The percentage share of handing the FASTag is ➢ 80% by ICICI ➢ 10 % by SBI (State Bank of India) ➢ And 10 % other banks. H. Around .5 Million Tags have been issued till date by various issuer banks.
3	**How the current**	• NPCI (National Payments Corporation of India) is the body formed by

No.	Items for discussion	Conclusion – Agreement
	business model works?	under Reserve Bank of India for handling e payments at the National level. This acts as National Clearing House. • All toll Plazas are connected to acquiring entities (which are banks) • One plaza will connect with one bank only. • The acquirer has the business rules (which are toll rates basically). • When a user uses the FASTag system. The tag reader at the toll plaza reads the detail and the information is sent to the acquirer. The Acquire gets transaction details to the server and sends to NPCI for settlement. • The acquiring bank has the traffic table (Business rules) which are provided by the governor of the toll plazas. • NPCI will check card details and check the issuer bank. • An individual tag is connected to a single bank only. The respective amount of toll is debited online. • Within 24 hrs the amount is credited to the concessioner account. • The procedure is very similar to the credit & debit card.
4	**NPCI – Fees structure**	• With a vision to promote online payments, Government of India is providing subsidiary for the users. • For example: When a user pays Rs.100 at a toll plaza. The concessioner gets Rs.100 where as 4 % of it, which is Rs.4, is paid by Government as fees for online transfer and service charge. • The amount sharing of the 4 % is ▪ 1 % of IHMCL ▪ 1.5 % to issuer ▪ 1.25 to acquire ▪ .25 to NPCI • Gov is paying this 4% to NHAI and NHAI will pay to IHMCL. • IHMCL will give the money to NPCI.
5	**Incentive schemes**	• GOV is spending a lot to promote ETC. • The Government is providing cash back at the end of the month to the FASTag Users. ➢ April 2015 to March 2016 - 10 % cash back. ➢ April 2016 to March 2017 - 7.5% cash back. ➢ April 2017 to March 2017 - 5% cash back.
6	**Linking FASTag System to Common Mobility Card**	• Linking Common Mobility card with the FASTag system is possible, provided same architecture is used. • For CPRR to be connected with the FASTag scheme. Decision at government level has to be taken. Interoperability has to be decided. State government can send the request to all agencies within the state and decide on this. • If the smart card is issued by Chennai Metro. The time to pay the concessioner can be adjusted even to 48 Hrs as the decision is within the state government.

No.	Items for discussion	Conclusion – Agreement
7	**Using NHAI cards in State level plazas:**	• For the users to have seamless travel, NHAI is in touch with the various state-level agencies to standardize the card. Example: Madhya Pradesh. But there is no policy available with NHAI to standardize this. But may happen in future. • But for now, NHAI is focusing mainly on toll collections through various modes such as FASTag/ mobile wallets. • Locally available tags are being used at many state level toll plazas which are under the discretion of State Government. MORTH can request the state government be a part of FASTag program. • For any state level plaza to go with the FASTag system, the national level standard procedures have to be followed.

8	**Other details about the FASTag system:**	• Presently FASTag system has been tied up with PAYTM (Mobile Wallet for payments through QR codes).
		• There are 2 lanes available in the toll plazas.
		  • ETC lane only for vehicles with FAS TAG
		  • And Hybrid lanes are for payments through credit/debit card/cash/ mobile wallet.
		• When required to give some kind of discount to some categories of the vehicle. It can be provided through adjusting the business rules at the toll plazas (May be done at both state level and Central level). The backend system can be programmed as required.

9	**Types are tolling at plazas**	There are two types are tolling being followed: • **Open road tolling**: The user has to pay the entire fees when he crosses two specified points, which is irrespective of the distance. • **Closed road tolling**: Every exit and entry point will have toll plaza and the user are made to pay based on the distance.

10	**Exempted vehicles at toll plazas**	• Two kinds of exceptions are available at toll plazas. They are Person based and Vehicle based discounts.
		  o Person based vehicles: President of India, Chief Justice
		  o Vehicle-based: Fire Vehicle, Ambulance
		• Discounts on a monthly basis for locals are being provided at toll plazas.

11	**Data Flow in BOT or EPC projects:**	• The data Flow in BOT or EPC procedure is same. The standards and equipment to be placed at the toll booths have been defined. i.e Tags& Readers • The only difference is in BOT the bank account number is same for the entire project, Whereas in EPC project every year the operator changes and hence the bank account number changes.
12	**Non-ETC vehicle entering an ETC lane.**	Ejection lanes are not possible because of the vehicular system in the toll plazas. NHAI is planning to increase dedicated lanes. It has also been planned to introduce an ETC reader in the non ETC lane so that when an ETC vehicle enters the non etc lane. The reader can read it easily. The idea is to increase the number of ETC lanes basically. NHAI is also planning for penalizing normal vehicles entering into the ETC lanes.
13	**Technical details**	• The basic specification (Data structure, security aspects, and

No.	Items for discussion	Conclusion – Agreement
		encryptions) of the FASTag has been continuously updated based on the experience. Mr. Palekar informed he will share the latest details.
14	**Design scope for road administrators:**	• The ETC information is presently sent in batches. It has been planned to make it online as and when a transaction happens. It is possible with strong data backing. As many plazas are in the remote area. The government is working on improving the connectivity which will, in turn, make the system work in online mode.
15	**Data base of Black listed vehicles:**	• The issuer banks create and store the information related to the defaulters and blacklisted users. The blacklisted categories includes users with wrong class of vehicles, cloned cards cases etc • The ticket created by toll is sent to NPCI and the information sent is checked and verified by NPCI. And if found guilty the user is added to the blacklist and the information is shared to all the toll plazas at the national level.
16	**Linking Vehicular data Base to the Toll Plazas:**	• The Vehicle data base which is available at the state level is not linked to the toll systems for now. But will be done at the later stages. • Vaahan – Online vehicle data base is available under MORTH and its standalone system.
		• Mr. Palekar informed he may be contacted in future for more queries.

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Ref. No. :CPRR-MOM-TRAFFIC POLICE-01
Date :August 3, 2017

MEETING RECORD

Title	Meeting with Commissioner of Police			
Date	Wednesday 3rd August 2017		**Time**	11:00 – 14:00
Venue	Office of Commissioner of Police, Vepery, Chennai			
Participants	**No.**	**Name**	**Position**	**Phone Number**
Police Department	1	Dr.A.K.Viswanathan IPS	Commissioner of Police	
	2	Mr. K.Periaiyah IPS	Additional Commissioner of Police-Traffic	9443388003
	3	Mr.Jayakumar	Deputy Commissioner - Planning	
	4	Mr.Julius Christopher	Assistant Commissioner of Police - Traffic (Planning)	
	5	Mr.Najmul Hoda	Joint commissioner of Police- North	
	6	Mr.Michel	Pa to DC Planning	9444330046
JICA Study Team	1	Takayasu Nagai	Team Leader	
	2	Hiroya Totani	ITS Planning / Design 1	8978435175
	3	Noboru Kondo	ITS Planning / Design 2	8978435175
	4	Eiji Wakatsuki	ITS Operation	8586000395
	5	Nawaz	Engineer	9840692739
References		Questioner for Traffic Police		

Agenda:

No.	Items for discussion	Conclusion – Agreement
1	Self Introduction	• The JICA Study team was introduced to the officials of Police Department.
2	Explanation of Outline of the Study based on Inception Report (Draft)	• TL gave a brief presentation on the objectives, schedule, and work scope of this project. A copy of questioner was circulated and answers were obtained on various subjects. • Same has been attached herewith for reference
3	E Challan System	• It was informed that there are 33 different sections under which the traffic police are charging the public for their traffic offences. Some of them are drunk and drive, over Speeding, driving without a valid license etc. • Fine amount varies as per the offence made. • At Present 409 E- Challan Machines are being used for collection of fines. • Also card swiping machines have been newly introduced with which the offenders can pay their fine with their credit or debit cards. • Total Fine amount of 12 Crores and 59 Lakhs has been collected this year.
4	Intelligent Traffic Management System	• It was informed that ITMS tender was awarded to Purple Info Tech Ltd and later terminated as project was not completed on time. • The matter is under litigation in court and is pending for disposal.

<table>
<tr><th>No.</th><th>Items for discussion</th><th>Conclusion – Agreement</th></tr>
<tr><td>5</td><td>Area Traffic Information System</td><td>• A pilot project has been done by IIT and after successful implementation; the project has been handed over to traffic police.</td></tr>
<tr><td>6</td><td>Other ITS components in Use</td><td>The following updates were provided to the study team
• No vehicle detectors or other road side equipment is being used.</td></tr>
<tr><td>7</td><td>Visit to traffic Control Room</td><td>• The traffic control room was visited. The control room serves for north and south portion of Chennai.
• The control room operates various toll free help line numbers. Some of them are
<table>
<tr><td>Police</td><td>100</td></tr>
<tr><td>Traffic Police</td><td>103</td></tr>
<tr><td>Child Line</td><td>1098</td></tr>
<tr><td>Women Help Line</td><td>1091</td></tr>
<tr><td>Senior Citizens help line</td><td>1253</td></tr>
</table>
• Police are using walky talky to communicate with each other.
• The updates on traffic are provided to public through Face book and Twitter.</td></tr>
<tr><td>8</td><td>Traffic Signal System</td><td>• There are 385 signals in Chennai. The lists of signals were provided as annexure.
• The traffic signals have separate controllers and the signals are stand alone signals.
• There is no signal co ordination system available. The existing signals are being operated manually by traffic constable available at the location.
• The Annual Maintenance Contract is usually for 12 months.
• The major player for signal installation are M/s CMS and M/S Analog systems Pvt Ltd.
• The cost of each signal is about 6 lakh rupees. Currently Traffic police are spending 8 to 10 % of the purchase amount as AMC amount.</td></tr>
<tr><td>**9**</td><td>VMS system</td><td>• The list of locations which have installed VMS was provided.
• Currently VMS boards are used to display traffic awareness messages and traffic diversions information to the general public.
• Messages are displayed in English and Tamil.</td></tr>
<tr><td>10</td><td>Judistriction of Chennai Traffic Police.</td><td>• It was explained that CPRR falls under the judistriction boundary of 3 districts. They are
➢ Chennai,
➢ Kanchipuram and
➢ Chengalpattu.
• Additional Police Commissioner gave the following divisional demarcation of various sections of CPRR
<table>
<tr><th>Sections in CPRR</th><th>Location</th><th>Within the Administrative boundary of</th></tr>
<tr><td>Section 1</td><td>Ennore</td><td>Chennai Police</td></tr>
<tr><td>Section 2</td><td>Tathchur</td><td>Tiruvallur</td></tr>
<tr><td>Section 3</td><td>Tatchur to Tiruvallur Bypass</td><td>Tiruvallur and Kanchipuram</td></tr>
<tr><td>Section 4</td><td>Sriperambudur to Singaperumal Koil</td><td>Kanchipuram</td></tr>
<tr><td>Section 5</td><td>Singaperumal Koil to Mahaballipuram</td><td>Kanchipuram</td></tr>
</table>
• The list of signals will be prepared in an image format and shared.
• The judistriction map was shown and photos of the same were documented.</td></tr>
<tr><td>11</td><td>Suggestions from Commissioner of Police.</td><td>Commissioner of police gave the following inputs after discussions with JICA study Team.
1) The study team to be updated with the plans related to Smart city proposal of Chennai.</td></tr>
</table>

No.	Items for discussion	Conclusion – Agreement
		2) It has been proposed by police to install 3200 cameras in the city. Fund for procuring the same has been allotted (Approximately 100 Crores). Now tender has to be invited for implementation of the same. The JICA study team can look on this. 3) JICA study team can look on how to add the intelligence components to the cameras. 4) Good network of signals to be introduced.It was recommended that a pilot project for signal co ordination may be tried before the actual implementation of the bigger project. The Stretch from Muthusamy point to Poonamallie may be tried. 5) JICA study team was requested to meet Mr.Amresh Pujari (9442223377) ADGP – State Traffic Planning Cell for information regarding all the districts related plans.

Attachment: Reply to Questioners.

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Ref. No. :CPRR-MOM-MTC-01
Date :September 05, 2017

Title	Meeting with Managing Director of Metropolitan Transport Corporation (MTC)			
Date	5 (Tuesday) September 2017		**Time**	11.00 – 12:30
Venue	Metropolitan Transport Corporation, HQ			
Participants	**No.**	**Name**	**Position**	**Phone Number**
MTC	1	Thiru V.Krishnamoorthy	Managing Director	
		Other many MTC personals		
SMART CITY Limited	1	Mr. Raj Cherubal	CEO, Smart City Corporation	
	2	Mr. Daniel Robinson	Consultant - C40 - NGO	9940652815
JICA Study Team	1	Hiroya Totani	ITS Planning / Design 1	8978435175
	2	Noboru Kondo	ITS Planning / Design 2	8978435175
	3	Eiji Wakatsuki	ITS Operation	8586000395
References		Discussion Paper of Bus System, Common Mobility Card and Schedule		

No.	Items for discussion	Conclusion – Agreement
1	Confirming procurement methodology of Bus ITS projects	• Mr. Raj Cherubal mentioned that some of the high level of T.N. government has following opinions. ✓ Both Bus Monitoring System and Passenger Information System should be implemented by one contractor as JICA ITS project rather than a pilot basis. ✓ All the systems of smart city should be implemented by single contractor. ✓ As the project funded by JICA takes time to implement, T.N.State procured contractor first and JICA's fund will be put in later. . • JICA Study Team explained followings. ✓ JICA aims to contribute to solve traffic problems in this ODA loan project. For this reason, it is impossible to fund all required systems for Smart City. ✓ JICA can fund only projects which follows JICA guidelines, but it is impossible to fund prior project.

No.	Items for discussion	Conclusion – Agreement
2	Confirming current status of MTC ITS project	• MTC is considering to use smartphone for GPS device instead of installing dedicated GPS device on the bus. • If these smartphones will be installed on bus for collecting location data, it matches the purpose of JICA ODA. • MTC prepared RFP for both Bus Monitoring System and Passenger Information System. So MTC requested to check the content of RFP. • MTC need advices from JICA Study Team like what kinds of information need to be collected for Bus Monitoring System. • JICA Study Team agreed to advise to MTC.
3	Current status of electronic ticket management system	• MTC introduced electronic ticket management system three years back for all MTC buses already. Now, MTC has 8000 numbers of handy electronic ticketing devices. • These devices are interoperable with Chennai Metro Card since it can read Type A card but not Felica card. (CMRL issued two million of Felica card already.)※ • JICA Study Team explained necessity of establishment of new state government organisation which will manage the clearing house and common mobility cards between MTC, CMRL and other public transportations.
4	Procurement schedule	• Time schedule of JICA ITS Project is too long. In order to shorten the project, we should discuss with TNRDB. • Since Specification and RFP were already made, we should utilize these documentations to shorten the schedule. In order to utilize these documentations, MTC & CSCL requested JICA Study Team to confirm the content of these documentations and give the necessary advices. • JICA Study Team agreed to check these documentations.
5	Necessary materials	• MTC will provide RFP and technical specifications (Bus Monitoring System, Passenger Information System, and Electronic Ticket Management System) to JICA Study Team. • In order to offer the materials to MTC, JICA Study Team need to send a letter to Mr. Davidar (Additional Chief Secretary, Transport Department) and cc. to Managing Director MTC.

Note: ※ JICA Study Team confirmed the current status of MTC Electronic Ticket Management System to Sony (Felica Manufacture).

- Handy devices which MTC introduced does not have a read/write function of IC card.
- However, it will be functional for read/write of both Mifare and Felica card by installing software and key, since antenna and chip for read/write are embedded.
- This software need to develop. Probably Nippon Signal will be selected to develop the software, since Nippon Signal is the contractor of CMRL ticketing system.
- In this case, asset of software will be belonged CMRL. So, the cost of development of software (or cost of license) need to coordinate between MTC and CMRL.
- Several years ago, Sony demonstrated whether Handy device would be functional for CMRL Mifare card to MTC by installing software.

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Ref. No. :CPRR-MOM-Smart City-01
Date :September 05, 2017

Title	Meeting with CEO of Chennai Smart City Limited			
Date	5 (Tuesday) September 2017		**Time**	12.00 – 12:30
Venue	Metropolitan Transport Corporation, HQ			
Participants	**No.**	**Name**	**Position**	**Phone Number**
SMART CITY Limited	1	Mr. Raj Cherubal	CEO, Smart City Corporation	
	2	Mr. Daniel Robinson	Consultant - C40 - NGO	9940652815
JICA Study Team	1	Hiroya Totani	ITS Planning / Design 1	8978435175
	2	Noboru Kondo	ITS Planning / Design 2	8978435175
	3	Eiji Wakatsuki	ITS Operation	8586000395
References				

No.	Items for discussion	Conclusion – Agreement
1	Confirming responsible organization for each project stage of JICA ITS project	• JICA Study Team requested to clarify the responsible organization for Chennai Traffic Information Centre (C-TIC) • Mr. Raj explained that Chennai Smart City Limited (CSCL) is the most suitable organization for taking charge of JICA ITS project, since ITS project will relate to various organizations. And CSCL is the only organization enable to traverse various organizations. • O&M period is five years and CSCL is also responsible for this stage. • However, we need to discuss with high level officers of T.N. state. • A High Powered Committee which compose of executives of related Gov. organizations, is formed above the CSCL. The role of High Powered Committee is to decide important matters.
2	Jurisdiction of Flood Monitoring System	• JICA study team asked the jurisdiction of Flood Monitoring system since Tamil Nadu Urban Finance and Infrastructure Development Corporation (TUFIDCO) is planning to install flood monitoring system. JICA study team explained that the Flood Monitoring System of JICA ITS project is to monitor the underpass and warn the vehicles not to pass through.

No.	Items for discussion	Conclusion – Agreement
		• Mr. Raj Cherubal said if the difference of both systems are clear, JICA ITS project should cover your Flood Monitoring System. The Flood Monitoring System what TUFIDCO is planning is to monitor wide flooding area. • CSCL will confirm what kinds of system is TUFIDCO planning and inform the result.
3	Future meeting with Chennai Traffic Police (CTP)	• Whenever JICA study Team need to discuss with .CTP, CSCL will attend with JICA team. Following is a key person of CTP for ITS. Mr. Ren, Joint Commissioner of Chennai Traffic Police: North Section Mobile No.; 9940113111

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Ref. No. :CPRR-MOM-TRAFFIC POLICE–02
Date :September 15, 2017

MEETING RECORD

Title	Meeting with Commissioner of Police			
Date	Friday 15 September 2017		**Time**	15:00 – 17:00
Venue	Office of Additional Commissioner of Police, Vepery, Chennai			
Participants	**No.**	**Name**	**Position**	**Phone Number**
Police Department	1	Mr. K.Periaiyah IPS	Additional Commissioner of Police- Traffic	9443388003
		Many other Polie Officer		
	3	Mr.Jayakumar	Deputy Commissioner - Planning	
	4	Mr.Julius Christopher	Assistant Commissioner of Police -Traffic (Planning)	
	5	Mr.Najmul Hoda	Joint commissioner of Police- North	
	6	Mr.Michel	Pa to DC Planning	9444330046
Smart City	1	Mr. Raj	CEO	
PWC	2	Mr. Arun		
JICA Study Team	1	Hiroya Totani	ITS Planning / Design 1	8978435175
	2	Noboru Kondo	ITS Planning / Design 2	8978435175
	3	Eiji Wakatsuki	ITS Operation	8586000395
References		- Questioner for Traffic Police - Discussion Paper 002 Responsible Organisation for VMS - Discussion Paper 006 Area Traffic Signal Control System		

Agenda:

No.	Items for discussion	Conclusion – Agreement
1	Coverage area of signal system for JICA ITS Project	• Time schedule of JICA ITS Project is too long. • ITMS project to implement camera monitoring system and signal system will resume soon. This project is planning to cover signals at 100 junctions. • Locations of 100 targeted junctions are still adjustable presently. • In particular, junctions on NH-4, NH-45, and OMR need to be installed at early stage. • According to the ITMS Contractor, service can be started within one year. →Based on above, Traffic Police want to proceed 100 junctions which locate in core area by ITMS. JICA Study Team requested CTP to specify the core area.
2	Center location for both CTP and C-TIC (JICA ITS Project)	• CTP recommended to establish the both C-TIC and Traffic Management System at 7 the floor of CTP HQ since there is a big empty space. • JICA Study Team will measure the exact size of above empty space later. • Call center and ITMS center for CTP are already established same floor. Thus, all information can gather same floor. In addition to this, the Contractor can reduce the number of employer for O&M.
3	Jurisdiction of Variable Message Sign (VMS)	• Some VMS which JICA Study Team is planning will place outside of CTP's jurisdiction. • CTP has a strong will to manage all VMS, since CTP is normally coordinate various matters with neighbouring Traffic Police. • Thus, CTP can handle necessary management even O&M stage.

No.	Items for discussion	Conclusion – Agreement
4	Traffic enforcement	• Major missions of Traffic Police are Traffic Management and Traffic Enforcement. • The targets for Traffic Enforcement are signal jumping, over speed, mobile talking etc. CTP demands the systems can handle these violated vehicles. Automatic Number Plate Recognition System (ANPR) is one of the major system for Traffic Enforcement. Thus, CTP requested to JICA Study Team to consider introducing ANPR for CTP.
5	Others	• CTP also consider that announcement function for pedestrians to inform green phase is very important. This system is not necessary for all junctions but required for key junctions.

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Ref. No. :CPRR-MOM-Smart City-02
Date :September 18, 2017

Title	Meeting with CEO of Chennai Smart City Limited			
Date	18 (Monday) September 2017		**Time**	14:30 – 15:30
Venue	Metropolitan Transport Corporation, HQ			
Participants	**No.**	**Name**	**Position**	**Phone Number**
SMART CITY Limited	1	Mr. Raj Cherubal	CEO, Smart City Corporation	
	2	Mr. Arun	PMC (PWC)	
JICA Study Team	1	Hiroya Totani	ITS Planning / Design 1	8978435175
	2	Noboru Kondo	ITS Planning / Design 2	8978435175
	3	Eiji Wakatsuki	ITS Operation	8586000395
References				

No.	Items for discussion	Conclusion – Agreement
1	Confirming role of Chennai Smart City Limited (CSCL) during ITS project	• CDCL currently has 59 projects. (Including concept). Among them, Contractors were selected for 2 projects, 8 projects are bidding stage, 20 projects were under making DPR, and others were under DPR preparation. • CSCL was established for taking care of Smart City Projects from planning, implementation to O&M. • Currently, CSCL has six divisions under CEO. Among them, PMC is responsible for everystages from bidding to implementation. • Currently, PricewaterhouseCooper (PWC) has a contract with CSCL by winning the bid and contract period is four years. Five members are working as PMC at CSCL office. ✓ (Leader（Mr.Arun） ✓ Transport Expert ✓ Urban Expert . ✓ Financial Expert ✓ Procurement Expert Organization Chart is attached this MoM. • PMC explained followings ✓ When JICA ITS project start, a consultant for JICA ITS Project will be placed under PMC and PMC will be the counterpart ✓ Procurement, Implementation and O&M of JICA ITS Projects (Chennai Traffic Information System, Traffic

No.	Items for discussion	Conclusion – Agreement
		Management System and Bus System) will be under jurisdiction of CSCL ✓ The asset of both Traffic Management System and Bus System will be handed over to CTP and MTC after completion of acceptance test. ✓ However, payment and confirming Service Level Agreement (SLA) will be carried out by CSCL during O&M stage.
2	High Powered Committee	• High Powered Committee consists of Principle Secretaries of various related department. Chairman is a commissioner of GCC and MD is a Deputy Commissioner of GCC. Board Member list will be sent later. (Act Paper when Smart City's SPV is established) ※
3	Definition of ITMS	• ITMS is an abbreviation of Integrated Traffic Management System. CSCL and related organizations are using this name for all transported system for Chennai Smart City.

Note: ※ This Act does not shows any member list. JICA Study Team is keep requesting to provide necessary materials to CSCL.

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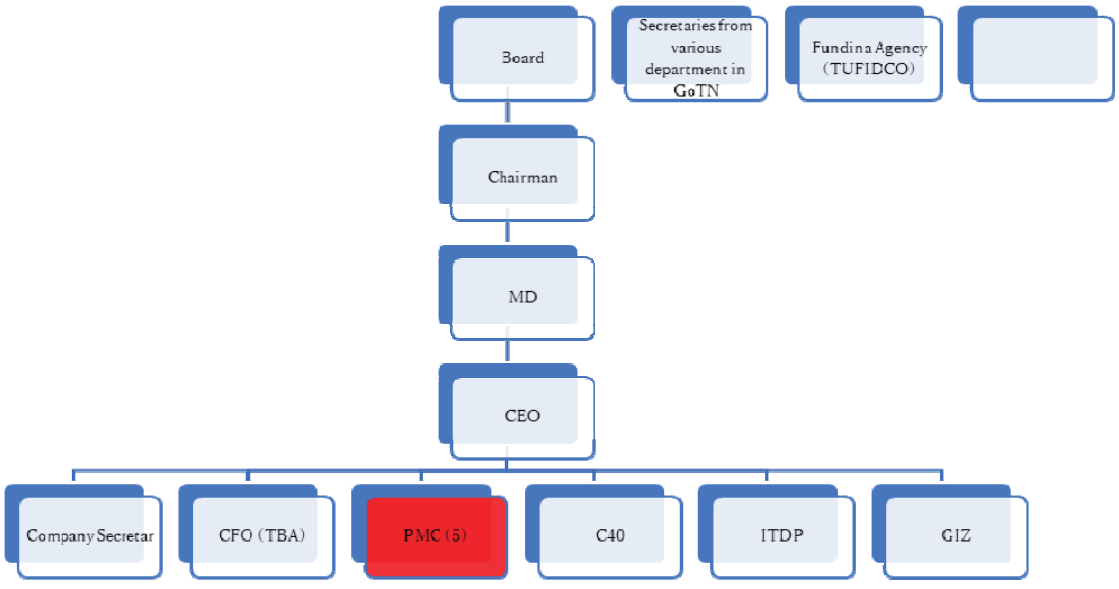

Project Office:
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Ref. No. :CPRR-MOM-Transport Dept -01
Date :September 26, 2017

Title	Meeting with P.W.C Davidar, IAS, Additional Chief Secretary to Government – Transport Department			
Date	26 (Monday) September 2017		**Time**	15.00 – 16:00
Venue	Transport Secretary Cabin, Secretariat, 4th Floor, Chennai.			
Participants	**No.**	**Name**	**Position**	**Phone Number**
Transport Department	1	P.W.C Davidar, IAS	Additional Chief Secretary to Government – Transport Secretary	
SMART CITY	1	Mr. Raj Cherubal	CEO, Smart City Corporation	
JICA Study Team	1	Hiroya Totani	ITS Planning / Design 1	8978435175
	2	Noboru Kondo	ITS Planning / Design 2	8978435175
	3	Eiji Wakatsuki	ITS Operation	8586000395
	4	Nawaz	Engineer	9840692739
References		Discussion Paper on Bus Tracking System, Common Mobility Card, VMS boards location information.		

No.	Items for discussion	Conclusion – Agreement
1	Reporting to Mr. Davidar on the study activities carried out so far and sharing major points raised	• Mr. Raj Cherubal briefed Mr.Davidar that the JICA Study Team has been closely working with MTC and Smart City Company and has prepared the implementation plan and various discussion papers. • JICA Study Team shared the proposed implementation schedule for Chennai City ITS and explained them in detail. • It was explained that the three components that have been finalized related to bus systems are o Bus Monitoring System o Passenger Information System o Bus ticketing System ❖ **Bus Monitoring System:** This system shows the current location of the Bus. The tracking is carried out either with a GPS Device or a GPS enabled Smart Phone. ❖ **Passenger Information System**: It is to display the information to the road users through Variable Message sign board. The Information can also be provided in a mobile app format. ❖ **Bus ticketing System:** Bus Tickets are provided using a electronic Ticketing machine.

No.	Items for discussion	Conclusion – Agreement
2	Current Condition of MTC	• Currently MTC is using electronic Ticketing machine to issue Tickets. MTC is paying 13.3 paisa as transaction fees to the vendor for every ticket they are issuing. • 95 % of the Electronic Ticketing machines are operational now. • Mr. Davidar informed that in the past 12 years MTC has revised its Bus Travel fare only 2 times where as BMTC has revised its fare 11 times. • MTC has plans of adding 2000 electric buses to the fleet.
3	Necessity of Expediting Project Implementation	• Mr. Davidar informed that he will retire by October 2018 and he has to bring some system in place before that as the successor might not be interested. • He also informed that the JICA Timeline may be a problem he has to show immediate results.
4	Development plans of Transport Secretary	• There are around 4000 buses in Chennai and around 18000 buses in other cities of TamilNadu. • Mr. Davidar informed that his vision is to replicate the same business model and technology (software) which will be adopted for MTC in the other smart cities of TamilNadu. Some of the other smart cities include Coimbatore, Thirunelveli, Madurai, Tirchy and Tanjore. • Mr. Davidar suggested that they are looking for a system which will develop Bus Monitoring software at a particular region and that can be used for other cities as well. This will solve the recurring licensing fees issues and duplication of the work. The idea is to make the software open source saving a huge amount of development and licensing fees. Where as they are ready to invest in devices.
5	Action Plans of Transport Secretary	• Mr. Davidar informed that he is happy to have a mobile application which provides the expected arrival time of the bus. He also informed that he is in discussion with local companies which are ready to provide solution for Passenger Information System. • Mr. Davidar also informed that a company has provided them with a quote of Rs.5 Crores for Bus Monitoring System and Passenger Information System (App Based) with operation and maintenance for 4 Years and 1 Cr per year after that as Maintenance and operational charge. • Companies like Map Unity are providing the framework required as open source. The data input for this system has to be provided. (http://ctis.in/)

No.	Items for discussion	Conclusion – Agreement
		• Mr. Davidar also indicated that given a budget of Rs.10cr with an estimate of Rs.4000 per bus, all the buses in the Tamilnadu can be provided with GPS units. • Mr. Davidar (Additional Chief Secretary Transport) informed that his plan is to commence the app based Passenger Information System by the end of January 2018.
6	Common card issues.	• Mr. Davidar (Additional Chief Secretary Transport), informed JICA Study Team that he has meeting with MD, CMRL and it was decided that all the issues related to common mobility card would be discussed and concluded in the table as they both want the end users to benefit.
7	Conclusion	• It was decided that Bus Monitoring System can be done by JICA in a larger scale where as App based Passenger Information System will be done by MTC immediately.

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Ref. No. :CPRR-MOM-TNIDB-02
Date :September 27, 2017

Title	Meeting with Mr. Krishnan IAS – Principle Secretary – Planning and Development			
Date	Tuesday 27 September 2017		**Time**	11:30 – 12:00
Venue	Conference Hall, Secretariat, 2nd Floor, Chennai			
Participants	**No.**	**Name**	**Position**	**Phone Number**
TNIDB	1	Mr.Krishnan IAS	CEO- TNIDB	
	2	Ms.Pooja Kulkarni IAS	Additional Secretary - Finance	
SMART CITY	1	Mr. Raj Cherubal	CEO	
JICA Study Team	1	Hiroya Totani	ITS Planning / Design 1	8978435175
	2	Noboru Kondo	ITS Planning / Design 2	8978435175
	3	Eiji Wakatsuki	ITS Operation	8586000395
	4	Nawaz	Engineer	9840692739
References		Discussion Paper on Bus Tracking System, Variable Message Board, Organization for ATCC,Common Mobility Card, Area Traffic Signal Control System and Proposed Implementation Schedule.		

No.	Items for discussion	Conclusion – Agreement
1	**Background of the study**	• Mr. Raj Cherubal briefed Mr.Krishnan that the JICA Study Team has met various stakeholders and has prepared an implementation plan and various discussion papers. • JICA Study Team (JST) shared the proposed implementation schedule for Chennai City ITS.
2	Mr.Krishnan gave the following informations	• Mr.Krishnan indicated that they are very keen on starting the project at the earliest. • Chennai Smart city Limited has some budgetary allocations and is planning to implement few projects by themselves. • Mr.Krishnan requested JICA study team to request JICA to expedite the loan process. • Mr.krishnan suggested that the bid documents for project implementation to be ready in advance for project implementation and it is not necessary to wait till loan agreement is signed. This will expedite the implementation process.
3	Mr.Krishnan gave the following suggestions to Mr.Raj and Ms.Pooja	• Mr.Krishnan requested Ms.Pooja Kulkarni, Additional Secretary, Finance department to write a formal letter

No.	Items for discussion	Conclusion – Agreement
	Kulkarni.	requesting JICA for faster approvals. • Mr.Krishnan requested Mr. Raj to share the documents prepared by smart city with JICA for review of the save. This would in turn save time and duplication of work. • The junction improvements to be done in a phased manner as doing all together is not possible. • Consultant procurement may be planned well in advance. The budget for preparatory studies may be funded through smart city funds if necessary. • The actual site implementation to be taken in the year 2018 – 2019
4	Conclusion	• A meeting with members from JICA, GCC, MTC and Traffic Police will be convened to finalize on the plan. Raj to internally discuss and clear all approvals necessary from TNIDB
		• JICA study Team also requested Mr. Krishna to find out if funding is necessary for any projects related to transportation. • JST informed Mr.Krishnan that JICA is planning to meet him on October 2017.

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Ref. No. :CPRR-MOM-BMTC-01
Date :November 30, 2017

Title	Meeting with Chief System Manager of Bengaluru Metropolitan Transport Corporation （BMTC）			
Date	30 (Thursday) November 2017		**Time**	15:50– 16：20
Venue	Bengaluru Metropolitan Transport Corporation, HQ			
Participants	**No.**	**Name**	**Position**	**Phone Number**
BMTC	1	Mr. Nagendra	Chief System Manager	
JICA Study Team	1	Noboru Kondo	ITS Planning / Design 2	8978435175
References				

No.	Items for discussion	Conclusion – Agreement
1	Organization Structure of BMTC for Operation of City Bus System (Bus Monitoring system, Passenger Information System and Electronic Ticketing System)	• Over all responsible position of BMTC ITS project is Chief Traffic Manager and responsible position for technical part of project is Chief System Manager (Mr.Nagendra). • BMTC center carries out bus operation management. • BMTC buses are operated for 24 hours a day (the number of buses operated at night becomes small). • All operators working in BMTC center are permanent employees of BMTC. • The operation service is offered for 24 hours a day and 7 days a week, covered by 3 shifting arrangement per day. • Two-shift covers day-time shift and one shift consists of 11 operators. One shift covers night time and it consists of 4 operators. In total, 26 operators work for 24 hours by 3 shifts. • Each operator is in charge of 4 bus depots (Total number of depots is 43). In the night shift, 4 operators are in charge of all depots. • Shift timing ✓ Day shift 1 (6：00AM～2：00PM) ✓ Day shift 2 (2：00PM～10：00PM) ✓ Night shift (10：00PM～6：00AM) • Beside operators, 9 BMTC employees are working in BMTC center. Among them, 5 employees are in charge of handling bus schedule and remaining 4 employees are supervisor. • Total number of monitors is 20 and 1 operator uses one monitor. • The roles of employees working in BMTC center are

No.	Items for discussion	Conclusion – Agreement
		✓ Operator : Monitoring bus operation such as deviation from predetermined bus route, skipping bus stop, departing time, arriving time, reporting etc. ✓ 5 employees for day work: Handling bus schedule ✓ 4 supervisors: Supervising performance and instruction of employees in BMTC center. • 43 depots also have one ITS personnel in charge respectively. The job at the depot are mainly for ETM (Electric Ticketing Machine). The depot also has a 3-shift arrangement.
2	Maintenance works	• When failure of equipment happens, ITS personnel in charge or operator in BMTC center contact to contractor (TRIMAX). • TRIMAX is deploying two staff in BMTC center for 24 hours by 3 shifts. • One system engineer of TRIMAX stations in BMTC center on day time basis. • Major roles of TRIMAX are maintenance work for equipment/system and development of applications. • TRIMAX carries out periodic inspection for weekly basis. • Responsibility of system of TRIMAX is UPS to system • TRIMAX regularly staying in BMTC center. In case of handling system failure found remotely, TRIMAX staff is dispatched to the site. • BMTC will send SLA documents to JICA study team later.
3	Others	• LED boards are installed in BMTC buses but this is not the part of ITS project. • Next bus stop which LED boards shows are controlled by geofence. • All related technical specifications for bus ITS are available through internet (Website of MOUD: UBS2)

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Ref. No. :CPRR-MOM-BMTC-01
Date :December 06, 2017

Title	Meeting with Manager Contracts (Smart World & Communication) of Larsen & Toubro Construction			
Date	6 (Wednesday) December 2017		**Time**	14:15– 16 : 00
Venue	Larsen & Toubro Construction, HQ			
Participants	**No.**	**Name**	**Position**	**Phone Number**
L&T	1	Mr. Kathikeyan	Contracts Manager	
JICA Study Team	1	Mr. Noboru Kondo	ITS Planning / Design 2	8978435175
	2	Mr. Eiji Wakatsuki	ITS Operation	
References				

No.	Items for discussion	Conclusion – Agreement
1	O&M for Chennai City ITS	• 5 years of O&M term for ITS projects is common practice in India. • Cost estimation of O&M staff will be shared soon.
2	Signal	• L&T does not have an experience of introducing the wireless signal communication system at junction, but this method has increasingly become common as pilot basis in India. • The reason is that the Employer intends to avoid road works as much as possible. • However OFC network is usually used for communication between junction (controller) and sensors or junctions (controller) and center. • OFC covers almost entire area. The aerial wiring is not used for the communication between junctions (controllers) or between junction (controller) and center. • ZIGBEE protocol, not the Wi-Fi, is adopted for the communication in junction. • The communication between junction to junction and between the center to the junction is based on the optical cable and becomes a contract with MPLS Link.
3	Solar power source	• The solar power is popular practice for signal power supply in India due to the reason that the Employer wishes to avoid road works, similar to the case of wireless communication at junction. • In case of introducing solar power source, the capacity of the accumulator battery depends on the load of signal. It depends

No.	Items for discussion	Conclusion – Agreement
		on the adopted signal system. The capacity of controller is usually 600 VA to 800 VA at a maximum of 1000 VA, and the traffic light is 50 VA to 100 VA. • The life of the accumulator battery is up to 2 years. It becomes shorter depending on various conditions such as weather.
4	Automated Number Plate Recognition System （ANPR）	• The accuracy of ANPR is usually 80 to 85% in the daytime and 70% or more in the night-time. In the specification, it is usually described as 90% or more. • L&T uses a system with a normal camera in the daytime and an infrared camera in the night-time, with two cameras installed in one console (one lens).
5.	Installation cost	• Approximately, the cost of signal system is around 20～25Lahk per junction. • The approx. prices of ANPR are as follows (Note: it varies, depending on the quantity) ✓ Software :5 Lahk per unit ✓ Normal camera : Rs 50,000 ✓ Infrared camera : Rs 30,000
6	City bus system	• L&T won the Hubli BRT system in Karnataka State (bid price: 100 Cr., NEC 112 Cr) for 440 buses. • ITS components of Hubli BRT are: ✓ GPS/OBU+Inbus camera ✓ Central software ✓ PIS ✓ Dept/Transit Management System (PTS, Human Resource, Finance, 等) ✓ ERP (SAP) * ERP（Enterprise Resource Planning）is a package system that centrally manages the resources and information to support the administrative activities of company. It manages such items as order management / sales management, stock management, production management, financial accounting, etc., personnel salary, expense adjustment, fixed assets, project management, management accounting, customer management, budget management and so on. * SAPERP SAP SAP Inc.is one of the famous packages of ERP.
7.	Others related to ITS	• The vehicle count data is considered more important than categorizing vehicle type (as an opinion of L&T). • It would be better to adopt deep learning for Predictive

No.	Items for discussion	Conclusion – Agreement
		Analysis of traffic flow in the city (Traffic Pattern). • If the camera has capability to count up to 3 lanes, a cantilever type should be sufficient, not a gantry. • L&T has a strong intension to join tender of Chennai City ITS.
8	Others（Contract）	• L&T is currently preparing for re-bidding of the introduction of signal system for 353 junctions in Pune. In first bid, only IBI and L&T remained after PQ, But, the employer decided to carry out re-bid by some political reason. • The comprehensive evaluation method is adopted to this tender. • Order books can be found by searching ATCS on the Pune Municipal Corp. or Pune Smart City website.

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Ref. No. :CPRR-MOM-Smart City-04
Date :December 13, 2017

Title	Meeting with CEO of Chennai Smart City Limited			
Date	13 (Wednesday) December 2017		**Time**	17:30 – 19 : 00
Venue	JICA Study Team Office			
Participants	**No.**	**Name**	**Position**	**Phone Number**
SMART CITY Limited	1	Mr. Raj Cherubal	CEO, Smart City Corporation	
JICA Study Team	1	Hiroya Totani	ITS Planning / Design 1	8978435175
	2	Noboru Kondo	ITS Planning / Design 2	8978435175
	3	Eiji Wakatsuki	ITS Operation	8586000395
	4	Nawaz	Engineer	9840692739
References				

No.	Items for discussion	Conclusion – Agreement
1	Confirmation of demarcation of the related organizations for City ITS	• CSCL(Chennai Smart City Corp.) will be the responsible organization for JICA City ITS project for procurement and installation stage. • In O&M stage, CSCL will be the responsible for maintenance of all systems but operation will be managed by following organizations. ✓ Chennai Traffic Information System: CSCL ✓ Traffic Management System: Chennai Traffic Police (CTP) ✓ City Bus System: Metropolitan Transport Corp. (MTC) • The ownership of each system will be the same as above. • Regarding the responsible organization of O&M and ownership of city ITS after the completion of contract term of City ITS system integrator, T.N.State Gov. will make a decision.
2	High Powered Committee	• There are two different High-Powered Committees. • One of them is responsible for approval of project in case of large size project, of which project cost exceeds 10 crores. • The other is responsible for coordination across the related organizations.
3	Confirmation of decision making flow of the project	• The decision-making flow for requesting budget, making payment, procuring new project, system upgrade for the on-going project, etc. were confirmed.

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Ref No: CPRR-MOM-TRAFFIC POLICE - 6

MEETING RECORD

Title	Meeting with Additional Commissioner of Police- Traffic			
Date	Wednesday 19th December 2017		Time	11:00 – 12:00
Venue	Office of Commissioner of Police, Vepery, Chennai			
Participants	No.	Name	Position	
Chennai Traffic Police	1	Mr. A.Arun IPS	Additional Commissioner of Police- Traffic	
	2	Mr.Prem Anandh Sinha	Joint Commissioner - Traffic	
	3	Mr.Jayakumar	Deputy Commissioner - Planning	
	4	Mr.Julius Christopher	Assistant Commissioner of Police -Traffic (Planning)	
	5	Mr.Najmul Hoda	Joint commissioner of Police- Traffic	
	6	Ms.Shanmuga Priya	Joint commissioner	
	7	Mr.Eshwaran	Joint commissioner	
JICA Study Team	1	Mr.Takayasu Nagai	Team Leader	
	2	Mr.Hiroya Totani	ITS Planning / Design 1	
	3	Mr.Noboru Kondo	ITS Planning / Design 2	
	4	Mr.Eiji Wakatsuki	ITS Operation	
	5	Mr.Nawaz	Engineer	
JICA	1 2	Mr.Kenji Isomoto Mr.Fujiwara		
Smart City	1 2	Mr.Raj Cherubal Mr.Yashyeshwini, Smart City	CEO Associate	
PWC Consultants	1	Mr.Gowind Agarwal	Consultant	

Agenda:

No.	Items for discussion	Conclusion – Agreement
1	Introduction and phasing of the project	• Mr.Prem Anandh Sinha made a brief presentation on the list of signals that are currently available in Chennai. The total signals were categorized into three phases and it was presented that the implementation of these signals may be carried out in phases. The details are as follows ✓ Phase I to include 160 junctions in the core city area. ✓ Phase II to include 101 junctions. ✓ 174 junctions to be included in Phase III of which 132 are from Chennai District (Western, Northern, Southern suburbs) and 42 junctions from Kancheepuram District.
2	Coverage Area	• JICA Study Team mentioned that ECR & OMR cannot be included in Phase I as it is designed for core city. JICA study team also commented that the distance between signals shall be less than 500 meters for signal synchronization.
3	Additional Facilities at Junctions	• Additional Commissioner of Police-Traffic suggested placing Emergency Call Box at Traffic Signals. Mr. Raj Cherubal (CSCL) agreed and informed that it is under

No.	Items for discussion	Conclusion – Agreement
		planning at some locations/ signals already under Smart City Initiative and these will be implemented by Smart City Mission Project, not JICA project.
4	Relocation of the signals for assuring visibility	• JICA Study Team observed that the existing traffic signals are not visible at many junctions because of the trees and landscape. • JICA Study Team suggested that trees may need to be cut or relocation of the signals may be needed. Chennai Traffic police informed that cutting trees are not permitted as it involves necessity of obtaining the permission from other departments. • Additional Commissioner of Police-Traffic requested to consider the design avoiding cutting trees. However, he agreed that trees could be pruned for the sake of placing signals. Mr. Raj Cherubal added that depending on the design, JICA may consider installing the signals at appropriate locations avoiding cutting the trees as much as possible.
5	Wire-based Communication for Signal	• JICA Study Team informed that the wire-based communication is better than wireless communication for the signal. JICA Study Team requested to adopt the duct based wiring at the junctions instead of wireless communication due to technical reason. Chennai Traffic Police agreed to the suggestion. • Mr. Raj Cherubal suggested that pipe jacking could also be considered as an option. It was agreed that this issue will be finalized in the basic design stage. • Chennai Traffic Police assured that once the Implementation plan is finalized, Chennai Traffic Police will accord approval for cutting the roads for laying cables, if necessary.
6	Available Space for Center	• JICA Study Team provided a layout plan for Chennai Traffic Command Centre and requested to provide the additional 50% of the existing floor area or one more another floor. • Mr. Raj Cherubal informed that the layout plan for the Chennai Traffic Command Centre will be done by the system Integrators of the project. • JICA Study Team recommended to have a space for the meeting in the center and pointed out that the present Traffic Command Centre does not have such spaces. Chennai Traffic Police assured that it can be worked out according to the plan.
7	Number of signals to be taken for Phase 1 of the project	• Additional Commissioner of Police-Traffic informed that M/S Purple Infotech has already initiated the ITMS project and has set up traffic monitoring cameras at 10 junctions. Due to some issues between Chennai Traffic Police and M/s Purple Technologies, the project has been put on hold and a case has been filed at court. • Additional Commissioner of Police-Traffic informed that they are trying to sort the issues with M/S Purple InfoTech on ITMS project and start the implementation of the project as soon as possible. It was also informed that the decision on this issue will be taken in a month. • Additional Commissioner of Police-Traffic informed that they will try to replace the 100 ITMS locations provided to M/S Purple InfoTech from within the city to outside the city limits. • Additional Commissioner of Police-Traffic suggested that ITMS Project by Purple

No.	Items for discussion	Conclusion – Agreement
		Technologies and Project by JICA must be integrated. JICA Study Team explained that the signal systems by different projects, i.e. ITMS project and JICA project, will not be integrated and Chennai Traffic Police understood.
8	CCTV Cameras at Junctions	• JICA Study Team stated that the identified 159 junctions will include improvement of Traffic Signals and Sensors. • JICA Study Team suggested that the CCTV cameras for these areas be taken up by Chennai Police. Chennai Police stated that 200 CCTV cameras are to be installed under Nirbhaya Scheme – (A Scheme by Government of India for ensuring safety of women). • Mr. Raj Cherubal added that it has been planned by Chennai Smart City Limited to install 50 Cameras under the Surveillance plan of Chennai Smart City.

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Ref No: CPRR-MOM-MTC - 7

MEETING RECORD

Title	Meeting with MTC				
Date	Wednesday 19th December 2017			Time	15:00 – 15:30
Venue	MTC Head Quarters, Pallavan House, Anna Salai				
Participants	No.	Name	Position		
MTC	1	Mr.Thanigailingam	Joint Managing Director		
	2	Mr.Neduncheliyan	Deputy Manager – Commercial		
	3	Mr.Swaminathan	Assistant Manager – Pallavan Transport Consultancy Services		
	4	Mr.Prakasam	Project Officer, Pallavan Transport Consultancy Services		
	5	Mr.Bennet Rajan	Assistant Manager , Planning & Development		
	6	Mr.Manikkam	Assistant Manager , EDP		
	7	Mr.Manivannan	IT Manager, Electronic Data Processing		
JICA Study Team	1	Mr.Takayasu Nagai	Team Leader		
	2	Mr.Hiroya Totani	ITS Planning / Design 1		
	3	Mr.Noboru Kondo	ITS Planning / Design 2		
	4	Mr.Eiji Wakatsuki	ITS Operation		
	5	Mr.Nawaz	Engineer		
JICA	1 2	Mr Kenji Isomoto Mr.Fujiwara			
Smart City	1	Mr.Raj Cherubal	CEO		

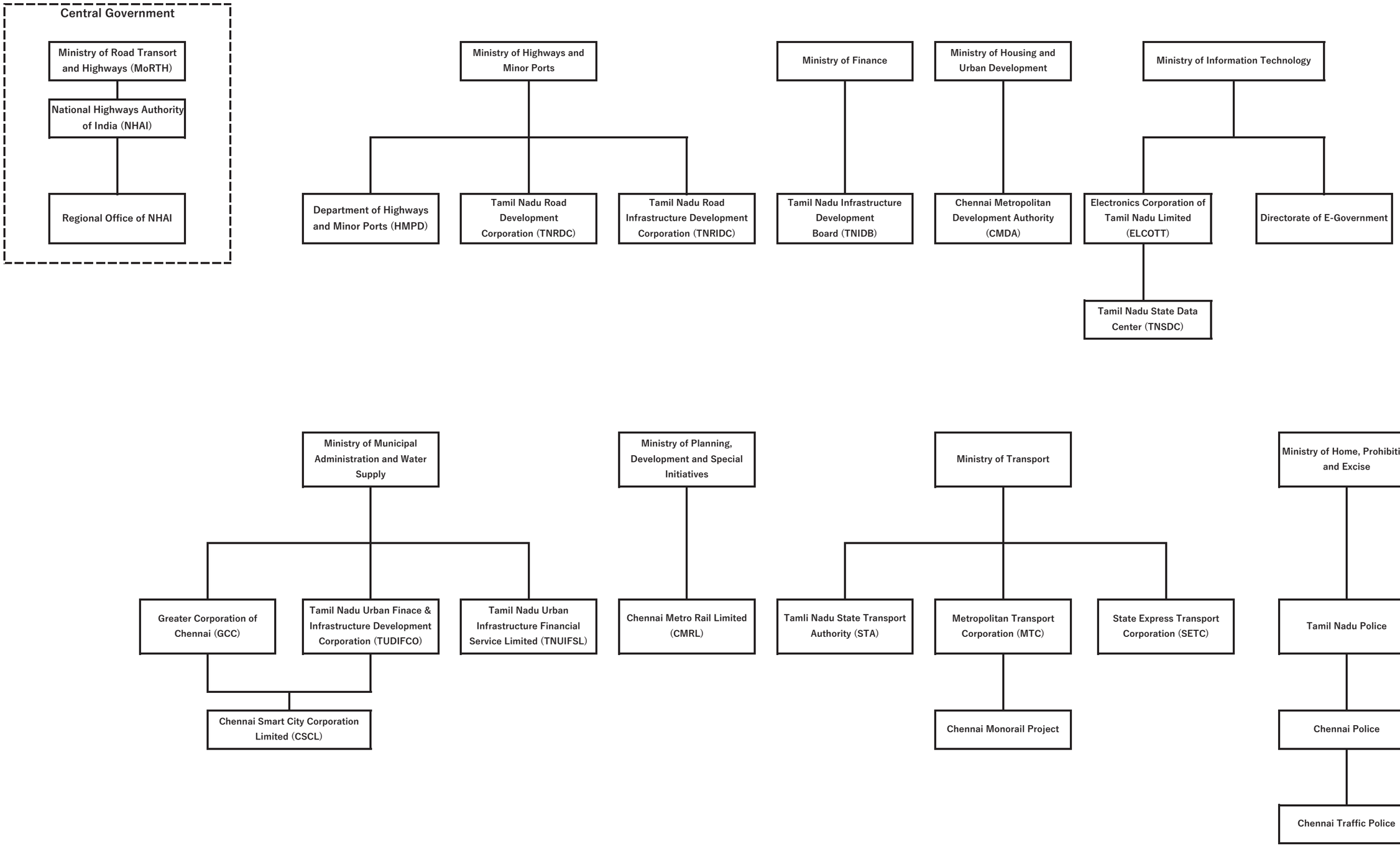
Agenda:

No.	Items for discussion	Conclusion – Agreement
1	Confirmation on the Number of Buses	• MTC confirmed the following ✓ 3,774 (total number of MTC buses) ✓ 3,475 (in operation) • MTC also confirmed that the number of MTC buses is planned to be increased.
2	Large Bus Terminals	• MTC informed the Large Bus Terminals where the information boards are required to be installed are 1)Broadway 2)Avadi 3)Thiruvanmiyur 4)Tambaram 5) Poonamalle 6)CMBT • MTC confirmed that Tambaram & Poonamalle bus terminals are being maintained by Local Municipality. MTC confirmed that when VMS boards are installed in these Bus terminals, it will be owned by MTC. • JICA Study Team suggested that the Bus Bay Terminals such as Tambaram shall

No.	Items for discussion	Conclusion – Agreement
		not be included in the Project due to the reason that there is not proper locations for installation of information board. • It was agreed that the following bus terminals will be included for installation of the information board by the Project 1) Broadway 2) Avadi 3)Thiruvanmiyur 4) Poonamalle 5) T. Nagar 6) CMBT 7) Vadapalani • It was agreed that; ✓ One large information board will be installed at one bus terminal of above except CMBT ✓ Two large information boards will be installed at CMBT ✓ Small information boards at each plat form of the bus terminal will not be installed
3	Confirmation on the Number of Equipment	• It was agreed as follows: ✓ GPS Devices – 4000 Buses ✓ In Vehicle Camera- 1000 Buses ✓ In Vehicle LED Display – 1000 Buses • JICA suggested and MTC agreed that depending on the feedback from public, the number of in vehicle cameras, LED Displays will be increased at later stage. At first stage, MTC evaluates the effect of in-vehicle camera and LED board.
4	Mobile Application Development.	• MTC requested that a mobile application shall be developed by JICA project for the passengers to provide the expected arrival time of the bus at bus stops. JICA informed that it has not been considered as a part of this study. Smart city informed that it will consider with their own funds.
5	Data Storage and Hosting	• CSCL informed that the big data collected shall be stored in the cloud. JICA study team commented that TNSDC is proposed for data storage. CSCL mentioned comparing cost is important and will be finalized in the basic design stage.
6	Space for Control Center	• MTC confirmed the available space for Control Center. The space was inspected by JICA Study Team and required minor renovations were discussed. MTC also informed that if more space is required, it will be arranged. • Both parties agreed that the existing two rooms will be renovated to make it one large room for the command control center of city bus system.

Appendix-2: Correlation Ship of Concerned Organisations

Ministries and Related Organisations



Appendix-3: Traffic Demand Forecast for Pavement Design

Table Traffic Demand Forecast for Pavement Design of JICA Consultant (Case 1)

Resource	JICA Study Result																											
Made by	JICA Consultant																											
Case	Case 1																											
Section	Section 1						Section 2						Section 3						Section 4						Section 5			
Year	Bus	LCV	Truck	2 Axle	3 Axle	MAV	Bus	LCV	Truck	2 Axle	3 Axle	MAV	Bus	LCV	Truck	2 Axle	3 Axle	MAV	Bus	LCV	Truck	2 Axle	3 Axle	MAV	Bus	LCV	Truck	2 Axle	3 Axle	MAV
2017																												
2018																												
2019																												
2020																												
2021																			2,070	2,043	4,828	3,363	1,021	1,628						
2022																			2,236	2,345	5,024	3,499	1,062	1,794						
2023																			2,401	2,646	5,221	3,636	1,104	1,960						
2024	108	42	2,689	1,503	1,186	1,200													2,567	2,947	5,417	3,773	1,145	2,126						
2025	215	84	5,379	3,007	2,372	2,400													2,732	3,249	5,613	3,909	1,187	2,292						
2026	323	127	8,068	4,511	3,558	3,600													2,898	3,550	5,809	4,046	1,228	2,459						
2027	319	230	8,725	4,878	3,847	3,624													3,112	4,373	6,152	4,285	1,301	2,666						
2028	314	333	9,381	5,245	4,136	3,649													3,327	5,197	6,495	4,524	1,373	2,874						
2029	310	436	10,038	5,612	4,425	3,674													3,541	6,020	6,839	4,763	1,446	3,081						
2030	306	539	10,694	5,980	4,715	3,699	328	1,542	50	28	22	16	442	1,428	1,284	777	507	416	3,756	6,844	7,182	5,002	1,518	3,289	668	1,539	397	268	129	129
2031	302	642	11,351	6,347	5,004	3,723	656	3,085	101	56	44	32	884	2,856	2,569	1,554	1,015	831	3,970	7,667	7,525	5,241	1,591	3,496	1,336	3,078	793	536	257	257
2032	298	745	12,008	6,713	5,294	3,748	984	4,627	151	84	67	47	1,326	4,284	3,853	2,331	1,522	1,247	4,185	8,490	7,868	5,480	1,663	3,703	2,004	4,616	1,190	804	386	386
2033	294	848	12,664	7,081	5,584	3,773	1,312	6,170	201	113	89	63	1,767	5,712	5,137	3,108	2,029	1,663	4,399	9,314	8,212	5,719	1,736	3,911	2,672	6,155	1,587	1,072	514	515
2034	290	951	13,321	7,447	5,873	3,798	1,640	7,712	252	141	111	79	2,209	7,140	6,422	3,885	2,537	2,079	4,613	10,137	8,555	5,958	1,808	4,118	3,340	7,694	1,984	1,340	643	644
2035	285	1,054	13,977	7,815	6,163	3,822	1,968	9,255	302	169	133	95	2,651	8,569	7,706	4,662	3,044	2,494	4,828	10,961	8,898	6,197	1,881	4,326	4,008	9,233	2,380	1,608	772	772
2036	281	1,157	14,634	8,181	6,452	3,847	2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,551	2,910	5,042	11,784	9,241	6,436	1,954	4,533	4,676	10,771	2,777	1,877	900	901
2037	281	1,157	14,634	8,182	6,452	3,847	2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,551	2,910	5,042	11,784	9,241	6,436	1,954	4,533	4,676	10,771	2,777	1,877	900	901
2038	281	1,157	14,634	8,181	6,452	3,847	2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,551	2,910	5,042	11,784	9,241	6,436	1,954	4,533	4,676	10,771	2,777	1,877	900	901
2039	281	1,157	14,634	8,181	6,453	3,847	2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,551	2,910	5,042	11,784	9,241	6,436	1,954	4,533	4,676	10,771	2,777	1,877	900	901
2040	281	1,157	14,634	8,181	6,453	3,847	2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,551	2,910	5,042	11,784	9,241	6,436	1,954	4,533	4,676	10,771	2,777	1,877	900	901
2041	281	1,157	14,634	8,181	6,453	3,847	2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,551	2,910							4,676	10,771	2,777	1,877	900	901
2042	281	1,157	14,634	8,181	6,453	3,847	2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,551	2,910							4,676	10,771	2,777	1,877	900	901
2043	281	1,157	14,634	8,181	6,453	3,847	2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,551	2,910							4,676	10,771	2,777	1,877	900	901
2044							2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,551	2,910							4,676	10,771	2,777	1,877	900	901
2045							2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,551	2,910							4,676	10,771	2,777	1,878	899	901
2046							2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,551	2,910							4,676	10,771	2,777	1,878	899	901
2047							2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,551	2,910							4,676	10,771	2,777	1,878	899	901
2048							2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,551	2,910							4,676	10,771	2,777	1,878	899	901
2049							2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,551	2,910							4,676	10,771	2,777	1,878	899	901

Table Traffic Demand Forecast for Pavement Design of JICA Consultant (Case 2)

Resource	JICA Study Result																													
Made by	JICA Consultant																													
Case	Case 2																													
Section	Section 1						Section 2						Section 3						Section 4						Section 5					
Year	Unit : vehicle/day						Unit : vehicle/day						Unit : vehicle/day						Unit : vehicle/day						Unit : vehicle/day					
	Bus	LCV	Truck	2 Axle	3 Axle	MAV	Bus	LCV	Truck	2 Axle	3 Axle	MAV	Bus	LCV	Truck	2 Axle	3 Axle	MAV	Bus	LCV	Truck	2 Axle	3 Axle	MAV	Bus	LCV	Truck	2 Axle	3 Axle	MAV
2017																														
2018																														
2019																														
2020																														
2021																			2,070	2,043	4,828	3,363	1,465	1,628						
2022																			2,162	2,335	5,937	4,135	1,802	2,430						
2023																			2,253	2,626	7,046	4,907	2,139	3,233						
2024	29	29	3,425	1,915	1,510	1,967	278	831	1,964	1,098	866	1,367	265	813	2,203	1,333	870	1,388	2,345	2,918	8,155	5,679	2,475	4,036	454	1,618	950	642	308	332
2025	58	59	6,850	3,829	3,021	3,933	555	1,663	3,928	2,196	1,732	2,733	530	1,627	4,405	2,665	1,740	2,775	2,436	3,209	9,263	6,451	2,812	4,838	908	3,236	1,899	1,284	615	665
2026	87	88	10,275	5,744	4,531	5,900	833	2494	5892	3,294	2,598	4100	795	2,440	6,608	3,998	2,610	4,163	2,528	3,501	10,372	7,223	3,149	5,641	1,362	4,854	2,849	1,926	923	997
2027	106	195	10,711	5,988	4,723	5,695	979	3,324	5,338	2,984	2,354	3,701	1,025	3,196	6,846	4,142	2,704	4,038	2,779	4,329	10,259	7,145	3,114	5,530	1,693	5,446	2,842	1,921	921	987
2028	126	302	11,147	6,231	4,916	5,489	1,126	4,155	4,784	2,674	2,110	3,302	1,255	3,951	7,084	4,286	2,798	3,912	3,031	5,158	10,146	7,066	3,080	5,419	2,025	6,037	2,835	1,915	919	978
2029	145	409	11,583	6,475	5,108	5,284	1,272	4,985	4,230	2,365	1,866	2,903	1,484	4,707	7,323	4,430	2,892	3,787	3,282	5,986	10,033	6,987	3,045	5,309	2,356	6,629	2,827	1,911	917	968
2030	165	516	12,018	6,718	5,300	5,079	1,418	5,815	3,676	2,055	1,621	2,504	1,714	5,463	7,561	4,574	2,986	3,662	3,534	6,814	9,920	6,909	3,011	5,198	2,830	7,475	2,817	1,904	913	955
2031	184	623	12,454	6,963	5,492	4,874	1,564	6,646	3,122	1,746	1,377	2,105	1,944	6,218	7,799	4,718	3,081	3,537	3,785	7,643	9,807	6,830	2,977	5,087	3,303	8,320	2,807	1,897	909	941
2032	204	730	12,890	7,206	5,684	4,668	1,711	7,476	2,568	1,436	1,132	1,706	2,174	6,974	8,037	4,862	3,175	3,411	4,037	8,471	9,694	6,751	2,942	4,976	3,776	9,165	2,797	1,890	906	927
2033	223	837	13,326	7,450	5,876	4,463	1,857	8,306	2,014	1,126	888	1,307	2,404	7,730	8,276	5,006	3,269	3,286	4,288	9,299	9,581	6,673	2,908	4,866	4,250	10,011	2,786	1,883	903	913
2034	242	943	13,762	7,693	6,068	4,258	2,003	9,137	1,460	816	644	908	2,633	8,485	8,514	5,147	3,367	3,161	4,539	10,127	9,467	6,594	2,873	4,755	4,723	10,856	2,776	1,876	900	900
2035	262	1,050	14,198	7,937	6,261	4,052	2,149	9,967	906	507	400	509	2,863	9,241	8,752	5,295	3,458	3,035	4,791	10,956	9,354	6,515	2,839	4,644	5,197	11,701	2,766	1,870	896	886
2036	281	1,157	14,634	8,181	6,453	3,847	2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,552	2,910	5,042	11,784	9,241	6,437	2,805	4,533	4,676	10,771	2,777	1,877	900	901
2037	281	1,157	14,634	8,181	6,453	3,847	2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,552	2,910	5,042	11,784	9,241	6,437	2,805	4,533	4,676	10,771	2,777	1,877	900	901
2038	281	1,157	14,634	8,182	6,452	3,847	2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,552	2,910	5,042	11,784	9,241	6,437	2,805	4,533	4,676	10,771	2,777	1,877	900	901
2039	281	1,157	14,634	8,182	6,452	3,847	2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,551	2,910	5,042	11,784	9,241	6,437	2,805	4,533	4,676	10,771	2,777	1,878	899	901
2040	281	1,157	14,634	8,182	6,452	3,847	2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,551	2,910	5,042	11,784	9,241	6,437	2,805	4,533	4,676	10,771	2,777	1,878	899	901
2041	281	1,157	14,634	8,182	6,451	3,847	2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,551	2,910							4,676	10,771	2,777	1,878	899	901
2042	281	1,157	14,634	8,182	6,452	3,847	2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,551	2,910							4,676	10,771	2,777	1,878	899	901
2043	281	1,157	14,634	8,182	6,452	3,847	2,296	10,797	352	197	155	110	3,093	9,997	8,990	5,439	3,551	2,910							4,676	10,771	2,777	1,878	899	901
2044																														
2045																														
2046																														
2047																														
2048																														
2049																														

Appendix-4: TOR for Social and Environmental Managers

住民移転・生計回復支援スペシャリスト　サービス TOR 案

Terms of Reference for Social and Environmental Managers

The following terms of reference is suggested for the E&S Manager to be hired by PIU.

1. To verify periodically that all sub-projects are in line with the prevailing national, state and local legislation on the one hand, and the World Bank policies on the other.
2. To ensure that ESMF is being fully integrated with the sub-project appraisal cycle within TNUIFSL, by identifying the project category before issuing the Terms of Reference to the design consultants and evaluating the proposals with respect to their completeness and compliance to ESMF.
3. To carry out Site Visits to sub-project implementation sites to monitor as well as provide onsite training as required. Prepare reports on visits / training to document the visit, observations for improvement required, need for follow-up　etc.
4. To co-ordinate closely with the external capacity-building consultants for the conduct of training of ULBs, and orientation programmes for the design consultants, project management consultants and contractors.
5. To provide necessary documents to the external auditors for carrying out annual E&S audit.
6. To arrange to conduct analytical studies based on sub-project experience in order to influence policy changes that will lead to better management of environmental and social / R&R issues in the urban sector as a whole.
7. To retain documents, reports and other records pertaining to ESMF.
8. To prepare and submit quarterly progress reports to the GoTN, the World Bank and other agencies as required.
9. To function as a single-point contact on ESMF matters for HMPD/TNRDC and external agencies.
10. To update and maintain ESMF on an ongoing basis.
11. To report to Project Director, PIU, on all matters pertaining to ESMF

List of key positions, whose CV and experience would be evaluated.

No	Key Professional	No. of persons	Qualification and Experience
1	Environmental Specialist	1	Post Graduate in Environmental or Public Health Engineering Environmental Planning/ Environmental Science with about 7 years of experience in preparation of EIA Reports, carrying out Environmental Audit etc or completed atleast two similar assignments.
2	Social Development Specialist	1	Post Graduate in any of Social Sciences work with 7 years of experience preferably in social auditing, experience in land acquisition and resettlement issues in development projects or completed atleast two similar assignments.

Necessary support staff as required shall be engaged by the consultant in order to achieve the objective of the assignment.

Appendix-5: Sample TORs for INGO/EMA

RAP 実施 NGO またはコンサルタント会社　サービス TOR 案

Sample ToRs for INGO/EMA

1. Terms of References for appointment of NGO for implementing RAP

The project authority the Project Implementation Unit (PIU) under HD is committed to resettle and rehabilitate the affected household in accordance with the RAP provisions. To ensure fair and efficient disbursement of the entitlements proposed and to ensure that the PAHs are bettered off as a result of the project, the TNHD shall called in for the service of local NGOs / experienced consulting firms experienced in carrying out such activities at the grassroots level. The agencies will be assigned with RAP implement activities for each contract package.

Selection of Agencies for Implementation of RAP:

The selection of suitable agencies /NGOs will be made depending upon their credibility to carry out implementation activities expressed through their previous experience, registration under the Societies Act, registered with service tax number, consulting companies, in-house capacity evident through number of staff with required qualification and experience, and logistic potentials.

Objectives

The objectives of this assignment is that the NGOs selected for providing implementation support will ensure that PAPs obtain their full entitlement as described in RAP and assist them in improving their overall living standards

Scope of Work

The present assignment is limited to assistance in implementation of RAP in the project area for up gradation under contract package from Trichy to Chidambaram. In order to realize the above objective, the scope of implementation support to be provided by the NGOs include but not limited to the following:

1) Develop rapport between the PAPs and the project authorities. This will be achieved through regular interactions with both the PIU staff and the PAPs. All meetings and decisions taken are to be documented:

2) Assist PIU to undertake a public information campaign at the commencement of the project to inform the affected communities about the following:

- Need for land acquisition
- Need for relocation of squatters and encroachers
- Likely consequences of the project on the livelihoods of PAHs
- R&R policy and entitlement package

3) Develop micro-plan for resettlement and rehabilitation (R&R) in consultation with the PIU staff. A plan shall be prepared and agreed for each PAP and will include such items as list of option open to and the choices made by the PAP. The NGOs will explain to the PAPs the options available for their resettlement and rehabilitation and assist them in making their choice in fixing the following:
   - Site for relocation
   - A list of benefits due to PAPs with options where available
   - Arrangements for moving
   - Proposed utilization of any allowance due to them and
   - Income restoration mechanisms including any self employment training programs.

4) Carry out a joint verification of assets within the proposed Corridor of Impact (CoI) along with TNHD and revenue department staff to determine the final list of PAPs to be affected by the project.

5) Identify PAPs and verify their losses on the basis of the census survey carried out and register against their names the compensation and assistances due to them.

6) To update the list of PAHs and PAPs as required at the time of the implementation and carry out census surveys for those portions where such surveys are not carried out and wherever census data is likely to be more than 2 year old at the time of impact and carryout fresh socio economic survey wherever data not available or inadequate to decide the compensation mechanisms viz income & expenditure, occupation, housing and its basic amenities and ownership of land material assets.

7) Distribute the identity cards to the eligible PAPs mentioning compensation and assistance due to them on the cards.

8) Assist PAPs in getting the compensation for their land and properties acquire for the project and educate them on their rights, entitlement, obligations under RAP. The NGO

will assist the PAPs in negotiating the land acquisition price through negotiation process and ensure the receipt of timely compensation and issues raised to the grievance redress mechanism.

9) Determine the entitlement of each EP and compare it to the offer being made by the project. If there is a discrepancy, between the two, assist the EP in coming to some agreement with the SDU and, if necessary, pursue the matter through the grievance redress mechanism.

10) If there is any complaint / dissatisfaction among PAPs paid off with compensation in connection with the already initiated land acquisition through private negotiation process, assist the PAPs in taking up the issues to the grievance redress committee and in receiving satisfactory compensation as per replacement cost / market price against acquisition of their properties.

11) Ensure all benefits due to the PAPs under the R&R policy are provided to them.

12) Help PAPs to identify suitable land for resettlement and for agricultural purposes. Identify suitable government land with HD and Revenue Department and assist in negotiating its transfer to the PAPs. Where suitable government land is not available, assist the PAPs to locate a land owner willing to sell his land and assist in the land in consultation with PAPs for acquiring the alternative agriculture land in case land for land is required to be implemented.

13) Carry out consultation with host population wherever required and include the agreed measures for host population in the implementation plan.

14) Help project authorities in making arrangement for the smooth relocation of the PAPs and their business. This will involve close consultation with the PAPs to ensure that the arrangement are acceptable to them

15) Ensure proper utilization by the PAPs of various grants available under the R&R package. Advice the PAPs on how best to use any cash that may be provided under the RAP. Emphasis should be placed on using such funds in a sustainable way e.g. purchasing replacement land for that acquired.

16) Co-ordinate training programs for sustainable livelihood and assist in developing the required skills for livelihood rehabilitation.

17) NGOs will identify alternative suitable location in consultation with local villagers on the relocation of various community assists to be affected by the project.

18) NGOs in close association with PAPs and local villagers will interact closely with those undertaking the construction of resettlement sites and community assets in order to ensure that the construction takes place in accordance with the provisions mentioned in RAP

19) Help PAPs in redressing their grievances. Make PAPs aware of the grievance mechanism set out in the RAP and assist PAPs who have grievance to pursue a suitable remedy.

20) Update information available on PAPs and collect information on PAHs coming in this project due to any changes.

21) PIU will be monitoring the implementation of the non-eligible RAPs and will require data from the NGO to provide inputs for periodical progress reports.

22) NGOs should assists PIU in serving notices on the non-eligible PAPs for vacating the COI with in a notice period.

23) Any other responsibility as may be assigned for the welfare of the affected community.

The support role that the NGO has to perform the following duties for livelihood restoration activities for sustainable economic life in consultation with the project affected people.

24) Identification of locally suitable income generating or enterprises development

25) Establishing linkage for skilled development, credit availability and marketing, ensuring that the grants received for such purpose from the project will be used for skill development training to upgrade existing skills of entitled persons, purchase of small scale capital assets for them etc.

26) Designing alternative livelihood schemes as per the felt needs of the target group population that will prioritized through participatory process.

27) Helping PAPs to choose suitable alternative livelihood schemes, where training on skill development, capital assistance and assistance in the forward-backward

linkage can be provided for making these pursuits sustainable for the beneficiaries.

The activities that the NGO has to perform to address gender issues in the project include:

Making an inventory of the socio-economic status of women of the study area in general, to be revealed through information gathered on women headed households during joint verification survey.

28) Preparing a profile of women PAPs from the information gathered and making inventory on the concerns and preference of women of the study area, especially on the livelihood sources, decision making and other issue related to women.

29) Consulting women groups to identify their needs and resource requirements to address the needs.

30) Identifying women focused activities based on the inventories and consultation and incorporating those in the micro-plans for implementing the R&R provisions.

31) Encouraging women PAPs to form self-help groups and assisting them in availing institutional credit facilities for enterprises development or income generation activities.

Methodology

1. The NGO will work as a link between PIU, the Grievance Redress Committee (GRC) and the project affected people. The NGO will be responsible for assisting the PAHs during the resettlement and rehabilitation process and shall ensure that all PAPs have been provided with appropriate compensation and assistance as per the entitlement framework of the RAP.

2. In order to carry out the above tasks, employees of NGOs are to be stationed in the project area. Besides contracting PAPs on an individual basis to regularly update the baseline information group meeting at village level will be conducted by the NGOs on a regular basis. The frequency of such meetings will depend on the requirements of the PAPs but should occur at least once a month, to allow the PAPs to remain up-to-date on project development. NGOs will encourage participation of individual PAPs in such meetings by discussing their problems regarding LA, R&R and other aspects relating to

their socio-economic aspects of life. Such participation will make it easier to find a solution acceptable to all involved.

Deliverables /Reporting:

- Inception report
- Updated missing and additional Census survey report.
- Quarterly report

Time frame:

It is estimated that the NGO services will be required for about 24 months to participate in the implementation of RAP. The time scheduled for completion of each task is given below.

NO	Task Description	Time for Completion
1	Inception Report	At the end of 1st month after commencement of services
2	a. Joint verification, issue of Identity Cards and submission of final data analysis report b. Additional and /or missing census survey including profiles of PAHs in such survey.	At the end of 4th month after commencement of services. At the end of 6th month after commencement of services
3	Quarterly progress report covering the activities in the scope of works and corresponding deliverables.	At the end of each quarter
4	Disbursement of the entitlement for 25% of total PAHs	At the end of 8th month after commencement of service
5	Disbursement of the entitlement for another 25% of total PAHs	At the end of 12th month after commencement of service
6	Disbursement of the entitlement for another 25% of total PAHs	At the end of 16th month after commencement of service
7	Disbursement of the entitlement for remaining 25% of total PAHs	At the end of 20th month after commencement of service
8	Draft final report summarizing the action taken and other resettlement works to be fulfilled by the NGO	One month before the service / 23rd month after commencement of services
9	Final report summarizing the action taken and other resettlement works to be fulfilled by the NGO	At the end of service / 24th month after commencement of services

NGOs Input:

The NGO team should consist of three following core professionals out of which one of the core team members must be a women professional, with appropriate support staff. The core

team should have a combined professional experience in the areas of social mobilization, community development, land acquisition & resettlement, census & socio-economic surveys and participatory planning & consultations.

1. Team Leader cum Sr. Social Development Officer
2. Resettlement Officer
3. Community Development Officer

Qualification and Experience:

Team leader cum Sr. Social Development Officer: He should possess the post graduate qualification in the Sociology/ Social science and have total experience of about 12 years, of which about 5 years professional experience in social development with 3 year of specific experience in similar position.

Resettlement officer: He shall be a post graduate preferably in Sociology / Social science and have total experience of about 10 years, of which about 5 years professional experience in Rehabilitation & Resettlement measures.

Community Development officer: He shall be a post graduate preferably in Sociology / Social science and have total experience of about 10 years, of which about 5 years professional experience in Rural development or community development programme.

Appendix-6: TOR for Appointment of External Monitoring and Avaluation Agency

外部評価機関　サービス TOR 案

Terms of References for appointment of External Monitoring and Evaluation Agency

The project authority the Project Implementation Unit (PIU) under TNHD is committed to resettle and rehabilitate the affected household in accordance with the RAP provisions. To ensure fair and efficient disbursement of the entitlements proposed and to ensure that the PAHs are bettered off as a result of the project, the HD shall call in for the service of M&E experience in carrying out such activities at the grassroots level.

Objective of appointing M&E Consultancy services:

The objective of the M&E consultancy services are:

- To assess whether the implementation of the RAP is as per the R&R policy and the RAP.
- To monitor the scheduled and the achievement of targets.
- To evaluate whether the outcomes of social development objectives of the project are being achieved.

Scope of Services

Scope of the M&E consultancy services are as listed below:

The Consulting Agency (CA) shall undertake the finalization of the indicators for monitoring and conduct baseline assessment.

- The CA shall undertake annual and end-term evaluation of the R&R components of the project.
- The CA shall computerize the available database to monitor the progress of the R&R activities against the targeted performance of the project.
- The CA shall develop formats for monitoring on the basis of indicators for all the R&R activities included in the RAP and other required indicators.
- The CA shall collect data from secondary and primary sources, which shall include field visits and interviews with a section of the project affected persons (PAPs)

- The CA shall undertake annual evaluation of the R&R components of the project, which shall include but not limited to the following aspects:
  - Process of implementation of the RAP
  - Process of consultation
  - Transparency
  - Process of delivery of the R&R services within the timeframe
  - Process of grievance redress
  - Process related to district level committee (DLCs)
  - Process of disbursement of compensation and assistance
  - Process of relocation
  - Process of rehabilitation, which includes restoration of livelihood
  - Progress of training staff of PIU and the entitled PAPs
  - Institutional arrangement and capacity to implement the RAP
  - Financial and physical progress
  - Any deviation from RAP
- The CA shall undertake an end-term evaluation of the R&R components of the project, which includes but is not limited to the following:
  - Evaluation of progress in achieving the goal mentioned in the R&R policy on improving or restoring livelihoods of the PAPs
  - Evaluation of the consultation process and participation of the people in the implementation of RAP
  - Evaluation of the benefits received by PAPs under vulnerable group
  - Evaluation of the R&R policy of HD and the RAP in the context of the diverse socio-cultural groups
  - Evaluation of the impact of the project specific measure on

(a) quality of life of the PAPs,

(b) gender sensitivity and empowerment,

(c) people below poverty line (BPL) and (c)

interaction with the host communities, (d)

redressing grievances,

(e) utilizing the service of the NGOs, etc.

- The CA shall evaluate people's perception about the processes adopted for

(a) disbursement of compensation and/or assistance,

(b) selection of resettlement and relocation sites,

(c) interactions with the host

communities, (d) redressing grievance,

(e) utilizing the services of the NGOs etc.

Methodology

The methods to be followed for Monitoring and Evaluation have been suggested below

- ✓ Rapid assessment
- ✓ Focus group discussion
- ✓ Social mapping
- ✓ Questionnaire
- ✓ In-depth interview

Deliverable of M&E consultant:

The CA shall submit the PIU following reports:

- Initiation report including the indicators for M&E and baseline assessment
- Draft and final annual evaluation report, and
- Draft and final End-term evaluation report.

Time Frame

The M&E consultancy services are required for 30 months

Team for the Assignment

The CA shall deploy a team of which the positions and minimum qualification are stated as follows:

1. Team Leader: S/he should be post graduate in social sciences with at least 10 year of experience in the field of social development. s/he should have monitoring and evaluation experience of more than 5 projects, and should have held responsible positions in the previous assignments including as team leader. S/he should have adequate managerial skill and should be conversant with the region and the regional language.

2. Sub-professional: S/he should be graduate in social sciences with at least 7 years of experience in the field of social development. S/he should have adequate knowledge of computers and should be conversant with the region and the regional language.

3. Sub-professional II: S/he should be graduate in social sciences with at least 7 year of experience in the field of participatory rural appraisal. S/he should have adequate knowledge of computers and should be conversant with the region and the regional language.

4. Sub-professional III: S/he should be graduate in statistic with a good knowledge of computers and should be conversant with region and the regional language.

5. Sub-professional IV: S/he should be graduate in civil engineering with at least 7 years of experience in the of construction/maintenance of National/State Highways. S/he should have adequate knowledge of land measurement and should be conversant with region and the regional language.

Appendix-7: List of Bridge Structures

Appendix-7　List of Bridge Structures (1/17) *Prepared by JST

Sec.1　　CPRR

STRUCTURE CODE	CHAINAGE		STRUCTURE	CROSS	TYPE OF STRUCTURE	COMMENTS
	BP	EP				
RE-WP	0+313.450	0+425.450	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=112.00m	・There is no N value of geological survey. ・Structure detail is not displayed.
MJB101-1 Str.No.1/1	0+425.450	1+046.166	MJB	Buckingham Canal, korttalaiyar River,Kattupali Road	2xPC BOX GIRDER L=620.716m、 4span x 2 + 1span x 4 + 4span + 3span x 2	・There is no N value of geological survey. ・Structure detail is not displayed. (Ex.Height : Column Pier,Capping Beam,Plle,Frame) ・LP8～LP17 : Span is not displayed. ・River condition is not clear. ・Unnecessary symbol (RP16),There is no leader line(RP17) : Drawing MJB101 ・Changing the substructure format. (LA3,RA3 : pier→abat) ・Consultation with relevant organizations.
RE-WP	1+046.166	1+200	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=153.834m	・Same as other RE-WALL(MJB).
MJB101-2 Str.No.1/1	0+224.543	0+660.450	MJB	-	2xPC BOX GIRDER L=230.000m、 3span x 2 + 1span x 2	・Same as other Str.(MJB).
RE-WP	0+399.19	0+224.534	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=174.647m	・Same as other RE-WALL(MJB).
BC-Str.No.2/1	1+400	-	BOX CULVERT	-	1 x 2.0 × 2.0 m, L=40.50m	・Wall on the boxculvert is not displayed. ・Conecting detail and foundation of wall on boxculvert are not clear. ・The volume of Water in culvert is not clear. ・Retaining wall on BOX makes spread foundation.
BC-Str.No.2/2	1+650	-	BOX CULVERT	-	1 x 2.5 × 2.5 m, L=40.50m	・Same as other BOX CULVERT.
BC-Str.No.2/3	1+820	-	BOX CULVERT	-	1 x 2.5 × 2.5 m, L=40.50m	・Same as other BOX CULVERT. ・Plan & Profile Str.No. is different.
BC-Str.No.3/1	2+080	-	BOX CULVERT	-	1 x 2.5 × 2.5 m, L=40.50m	・Same as other BOX CULVERT.
MNB101 Str.No.3/2	2+465	2+485	MNB	Canal	RCC SOLID SLAB L=20.00m (2@10.00)	・There is no N value of geological survey. ・Foudation detail (pile length) is not displayed. ・It is better to have less piers in the river. (Review of span , namber of pier.) ・Consultation with relevant organizations.
BC-Str.No.3/3	2+750	-	BOX CULVERT	-	1 x 2.5 × 2.5 m, L=40.50m	・Same as other BOX CULVERT.
BC-Str.No.4/1	3+020	-	BOX CULVERT	-	1 x 2.5 × 2.5 m, L=40.50m	・Same as other BOX CULVERT.
BC-Str.No.4/2	3+280	-	BOX CULVERT	-	1 x 2.0 × 2.0 m, L=40.50m	・Same as other BOX CULVERT.
BC-Str.No.4/3	3+540	-	BOX CULVERT	-	1 x 2.0 × 2.0 m, L=40.50m	・Same as other BOX CULVERT.
BC-Str.No.4/4	3+780	-	BOX CULVERT	-	1 x 2.5 × 2.5 m, L=40.50m	・Same as other BOX CULVERT.
BC-Str.No.5/1	4+010	-	BOX CULVERT	-	1 x 2 × 2 m, L=40.50m	・Same as other BOX CULVERT.
BC-Str.No.5/2	4+240	-	BOX CULVERT	-	1 x 2 × 2 m, L=40.50m	・Same as other BOX CULVERT.
BC-Str.No.5/3	4+490	-	BOX CULVERT	-	1 x 2 × 2 m, L=40.50m	・Same as other BOX CULVERT.
BC-Str.No.5/4	4+710	-	BOX CULVERT	-	1 x 2 × 2 m, L=40.50m	・Same as other BOX CULVERT.
BC-Str.No.5/5	4+950	-	BOX CULVERT	-	1 x 2 × 2 m, L=40.50m	・Same as other BOX CULVERT.
BC-Str.No.6/1	5+230	-	BOX CULVERT	-	1 x 2 × 2 m, L=40.50m	・Same as other BOX CULVERT.
BC-Str.No.6/2	5+542	-	BOX CULVERT	-	1 x 1.5 × 1.5 m, L=40.50m	・Same as other BOX CULVERT.
BC-Str.No.6/3	5+788	-	BOX CULVERT	-	1 x 1.5 × 1.5 m, L=40.50m	・Same as other BOX CULVERT.
BC-Str.No.7/1	6+048	-	BOX CULVERT	-	1 x 1.5 × 1.5 m, L=40.50m	・Same as other BOX CULVERT. ・Plan & Profile Str.No. is different.
BC-Str.No.7/1	6+500	-	BOX CULVERT	-	1 x 1.5 × 1.5 m, L=40.50m	・Same as other BOX CULVERT. ・Plan & Profile Str.No. is different.
BC-Str.No.7/1	6+800	-	BOX CULVERT	-	1 x 1.5 × 1.5 m, L=40.50m	・Same as other BOX CULVERT. ・Plan & Profile Str.No. is different.
MNB103 Str.No.8/1	7+163	7+193	MNB	korttalaiyar River	RCC SOLID SLAB L=30.00m (3@10.00)	・Paln&Profile is mistake.(BOX CULVERT) ・Same as other MNB. ・It is better to have less piers in the river. (Review of span , namber of pier.) ・Consultation with relevant organizations.
BC-Str.No.8/2	7+578	-	BOX CULVERT	-	1 x 2.5 × 2.5 m, L=59.04m	・Same as other BOX CULVERT.

Appendix-7 List of Bridge Structures (2/17) *Prepared by JST

STRUCTURE CODE	CHAINAGE		STRUCTURE	CROSS	TYPE OF STRUCTURE	COMMENTS
	BP	EP				
RE-WP	7+528	7+834.7	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=305.80m	・There is no N value of geological survey. ・Structure detail is not displayed. ・The wall of VUP is no anchor type.
VUP101 Str.No.8/3	7+836.6	7+849.4	VUP	Route 104	1xRCC Soild slab L=12.80m	・There is no N value of geological survey. ・Structure detail is not displayed. ・Underpass detail (clearance,width) is not displayed.
RE-WP	7+851.3	8+161	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=310.20m	・Same as other RE-WALL(VUP, LVUP).
BC-Str.No.9/1	8+250	-	BOX CULVERT	-	2 @ 3 × 2 m, L=46.50m	・Same as other BOX CULVERT.
BC-Str.No.9/2	8+550	-	BOX CULVERT	-	1 x 2 × 2 m, L=46.50m	・Same as other BOX CULVERT.
BC-Str.No.9/3	8+758	-	BOX CULVERT	-	1 x 2 × 2 m, L=46.50m	・Same as other BOX CULVERT.
BC-Str.No.10/1	9+038	-	BOX CULVERT	-	2 × 2 m, L=46.50m	・Same as other BOX CULVERT.
BC-Str.No.10/2	9+318	-	BOX CULVERT	-	2 × 2 m, L=50.55m	・Same as other BOX CULVERT.
RE-WP	9+230	9+681	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=521.00m	・There is no N value of geological survey. ・Structure detail is not displayed. ・The wall is anchor type.
ROB101 Str.No.10/3	9+681	9+819	ROB	Railway Track	PC I-GIRDER+CONPOSIT STEEL GIRDER L=138.00m 21.0+2@48.0+21.0)	・Detail of Plan & Profile are different. ・Structure detail of bothside span is not displayed. ・There is no N value of geological survey. ・Consultation with relevant organizations. (Ex. Clearlance of railway) ・Top of beam (pier) is wide. (Protruding than end of curb.)
RE-WP	9+819	10+292	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=473.00m	・Same as other RE-WALL(ROB)
BC-Str.No.11/1	10+310	-	BOX CULVERT	-	1 x 2 × 2 m, L=46.50m	・Same as other BOX CULVERT.
BC-Str.No.11/2	10+588	-	BOX CULVERT	-	1 x 2 × 2 m, L=46.50m	・Same as other BOX CULVERT.
BC-Str.No.11/3	10+888	-	BOX CULVERT	-	1 x 2 × 2 m, L=46.50m	・Same as other BOX CULVERT.
RE-WP	10+960	11+263.7	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=303.60m	・Same as other RE-WALL(VUP, LVUP).
VUP102 Str.No.12/1	11+265.6	11+278.4	VUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	11+280.3	11+595	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=314.60m	・Same as other RE-WALL(VUP, LVUP).
BC-Str.No.12/2	11+350	-	BOX CULVERT	-	1 x 3 × 1.5 m, L=71.49m	・Same as other BOX CULVERT.
BC-Str.No.12/3	11+698	-	BOX CULVERT	-	1 x 1.5 × 1.5 m, L=46.50m	・Same as other BOX CULVERT.
BC-Str.No.12/4	11+968	-	BOX CULVERT	-	1 x 1.5 × 1.5 m, L=50.55m	・Same as other BOX CULVERT.
RE-WP	11+978	12+301.7	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=323.40m	・Same as other RE-WALL(VUP, LVUP).
VUP103 Str.No.13/1	12+303.6	12+316.4	VUP	Route 56	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	12+318.3	12+635	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=316.80m	・Same as other RE-WALL(VUP, LVUP).
BC-Str.No.13/2	12+700	-	BOX CULVERT	-	1 x 1.5 × 1.5 m, L=46.50m	・Same as other BOX CULVERT.
BC-Str.No.13/3	12+900	-	BOX CULVERT	-	1 x 1.5 × 1.5 m, L=46.50m	・Same as other BOX CULVERT.
BC-Str.No.14/1	13+315	-	BOX CULVERT	-	1 x 2.5 × 2.5 m, L=49.49m	・Same as other BOX CULVERT.
BC-Str.No.14/2	13+638	-	BOX CULVERT	-	1 x 1.5 × 1.5 m, L=46.50m	・Same as other BOX CULVERT.
RE-WP	13+778	14+145.7	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=367.40m	・Same as other RE-WALL(VUP, LVUP).
VUP104 Str.No.15/1	14+147.6	14+160.4	VUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	14+162.3	14+501	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=338.80m	・Same as other RE-WALL(VUP, LVUP).
BC-Str.No.15/2	14+510	-	BOX CULVERT	-	1 x 2 × 2 m, L=50.55m	・Same as other BOX CULVERT.
BC-Str.No.15/3	14+778	-	BOX CULVERT	-	1 x 2 × 2 m, L=46.50m	・Same as other BOX CULVERT.
BC-Str.No.15/4	14+928	-	BOX CULVERT	-	1 x 1.5 × 1.5 m, L=46.50m	・Same as other BOX CULVERT.

Appendix-7 List of Bridge Structures (3/17) *Prepared by JST

STRUCTURE CODE	CHAINAGE		STRUCTURE	CROSS	TYPE OF STRUCTURE	COMMENTS
	BP	EP				
BC-Str.No.16/1	15+158	-	BOX CULVERT	-	1 x 2 × 2 m, L=46.50m	・Same as other BOX CULVERT.
BC-Str.No.16/2	15+418	-	BOX CULVERT	-	1 x 2 × 2 m, L=46.50m	・Same as other BOX CULVERT.
BC-Str.No.16/3	15+778	-	BOX CULVERT	-	1 x 2 × 2 m, L=46.50m	・Same as other BOX CULVERT.
BC-Str.No.17/1	16+288	-	BOX CULVERT	-	1 x 1.5 × 1.5 m, L=46.50m	・Same as other BOX CULVERT.
BC-Str.No.17/2	16+508	-	BOX CULVERT	-	1 x 1.5 × 1.5 m, L=46.50m	・Same as other BOX CULVERT.
BC-Str.No.17/3	16+778	-	BOX CULVERT	-	1 x 1.5 × 1.5 m, L=46.50m	・Same as other BOX CULVERT.
RE-WP	16+797	17+078.7	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=281.60m	・Same as other RE-WALL(VUP, LVUP).
LVUP101 Str.No.18/1	17+080.6	17+093.4	LVUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	17+095.3	17+379	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=283.80m	・Same as other RE-WALL(VUP, LVUP).
BC-Str.No.18/2	17+200	-	BOX CULVERT	-	1 x 1.5 × 1.5 m, L=71.49m	・Same as other BOX CULVERT.
PC-Str.18/3	17+440	-	PIPE CULVERT	-	1 x 1.2 m φ, L=46.50m	・The volume of Water in culvert is not clear.
PC-Str.18/4	17+670	-	PIPE CULVERT	-	1 x 1.2 m φ, L=46.50m	・Same as other PIPE CULVERT.
PC-Str.18/5	17+900	-	PIPE CULVERT	-	1 x 1.2 m φ, L=46.50m	・Same as other PIPE CULVERT.
PC-Str.19/1	18+130	-	PIPE CULVERT	-	1 x 1.2 m φ, L=46.50m	・Same as other PIPE CULVERT.
PC-Str.19/2	18+360	-	PIPE CULVERT	-	1 x 1.2 m φ, L=46.50m	・Same as other PIPE CULVERT.
PC-Str.19/3	18+590	-	PIPE CULVERT	-	1 x 1.2 m φ, L=46.50m	・Same as other PIPE CULVERT.
RE-WP	18+618	18+959.7	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=341.00m	・Same as other RE-WALL(VUP, LVUP).
VUP105 Str.No.19/4	18+961.6	18+974.4	VUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	18+976.3	19+256	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=280.20m	・Same as other RE-WALL(VUP, LVUP).
PC-Str.20/1	19+360	-	PIPE CULVERT	-	1 x 1.2 m φ, L=46.50m	・Same as other PIPE CULVERT.
PC-Str.20/2	19+560	-	PIPE CULVERT	-	1 x 1.2 m φ, L=46.50m	・Same as other PIPE CULVERT.
PC-Str.20/3	19+810	-	PIPE CULVERT	-	1 x 1.2 m φ, L=46.50m	・Same as other PIPE CULVERT.
PC-Str.20/4	19+960	-	PIPE CULVERT	-	1 x 1.2 m φ, L=46.50m	・Same as other PIPE CULVERT.
PC Str.21/1	20+160		PIPE CULVRET	-	1 x 1.2 m φ L=46.50m (10.25+26.00+10.25)	・The volume of Water in culvert is not clear.

Appendix-7 List of Bridge Structures (4/17) *Prepared by JST

Sec.1 **TPP Link**

STRUCTURE CODE	CHAINAGE		STRUCTURE	CROSS	TYPE OF STRUCTURE	COMMENTS
	BP	EP				
BC-Str.No.1/1	0+625		BOX CULVERT	-	1 x 2.50 x 2.50m, L=46.50m	・Wall on the boxculvert is not displayed. ・Conecting detail and foundation of wall on boxculvert are not clear. ・The volume of Water in culvert is not clear. ・Retaining wall on BOX makes spread foundation.
BC-Str.No.1/2	0+752		BOX CULVERT	-	1 x 2.50 x 2.50m, L=46.50m	・Same as other BOX CULVERT.
BC-Str.No.2/1	1+070		BOX CULVERT	-	1 x 2.50 x 2.50m, L=46.50m	・Same as other BOX CULVERT.
BC-Str.No.2/2	1+260		BOX CULVERT	-	1 x 1.50 x 1.50m, L=46.50m	・Same as other BOX CULVERT.
PC-Str.No.2/3	1+445		PIPE CULVERT	-	1.20m ϕ ,L=46.50m	・The volume of Water in culvert is not clear.
PC-Str.No.2/4	1+685		PIPE CULVERT	-	1.20m ϕ ,L=46.50m	・Same as other PIPE CULVERT.
MNB102 Str.No.3/1	2+013		BOX CULVERT	-	3 @ 5.00 x 2.50m, L=47.22m	・This box is MNB. ・Plan & profile is misteke : BOX ・Consultation with relevant organizations.
RE-WP	2+070	2+293.7	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=223.70m	・There is no N value of geological survey. ・Structure detail is not displayed. ・The wall of LVUP is no anchor type.
LVUP101 Str.No. 3/2	2+295.6	2+308.4	LVUP	Exting Road	1xRCC Soild slab L=12.80m	・There is no N value of geological survey. ・Structure detail is not displayed. ・Underpass detail (clearance,width) is not displayed.
RE-WP	2+310.3	2+590	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=279.70m	・Same as other RE-WALL(VUP, LVUP).
BC-Str.No.3/3	2+775		BOX CULVERT	-	1 x 2.00 x 2.00m, L=46.50m	・Same as other BOX CULVERT.
BC-Str.No.3/4	2+925		BOX CULVERT	-	1 x 2.50 x 2.50m, L=46.50m	・Same as other BOX CULVERT.
RE-WP	2+834.5	3+023.7	RE-WALL PROTECTION	-	Reinforced soil wall L=189.20m	・Same as other RE-WALL(VUP, LVUP).
LVUP (within ROB102) Str.No. 4/1	3+025.6	3+038.4	LVUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	3+040.3	3+307	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=266.70m	・There is no N value of geological survey. ・Structure detail is not displayed. ・The wall is anchor type.
ROB102 Str.No.4/2	3+307	3+449	ROB	Railway Track	PC I-GIRDER+CONPOSIT STEEL GIRDER L=142.00m (21.0+30.0+40.0+30.0+21.0)	・Detail of Plan & Profile are different. ・Structure detail of bothside span is not displayed. ・There is no N value of geological survey. ・Consultation with relevant organizations. (Ex. Clearlance of railway) ・Top of beam (pier) is wide. (Protruding than end of curb.)
RE-WP	3+449	3+864.8	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=415.80m	・Same as other RE-WALL(ROB)
BC-Str.No.1/5	4+100		BOX CULVERT	-	1 x 1.50 x 1.50m, L=46.50m	・Same as other BOX CULVERT. ・Drawing is Nothing.

Appendix-7 List of Bridge Structures (5/17) *Prepared by JST

Sec.2 **CPRR**

STRUCTURE CODE	CHAINAGE		STRUCTURE	CROSS	TYPE OF STRUCTURE	COMMENTS
	BP	EP				
RE-WP	20+246	20+742	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=497.00m	・There is no N value of geological survey. ・Structure detail is not displayed. ・The wall-panel is four.
IC/NH5 Str.21/2	20+743	21+043	IC/NH5	NH5	2xPC BOX GIRDER L=300.00m (30.00+2@15.00+6@30.00+2@15.00+30.00)	・Abutment and pire structure detail are not displayed. ・There is no N value of geological survey. ・Detaile of conection for rampway are not displayed. ・Overhanging of slab is too long. →Changing the format. (Ex: number of box, format of pier.)
RE-WP	21+043	21+506	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=463.00m	・Same as other RE-WALL(IC)
IC/NH5 Entry R01	20+803	0+120	IC/NH5 (Rampway)	NH5	1xRC BOX GIRDER L=120.00m (6@20.00)	・Same as other Str. (IC)
RE-WP	0+120	0+000	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=142.375m	・Same as other RE-WALL(IC)
RE-WP	0+288.479	0+120	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=168.479m	・Same as other RE-WALL(IC)
IC/NH5 Exit R02	0+120	0+000	IC/NH5 (Rampway)	NH5	1xRC BOX GIRDER L=120.00m (6@20.00)	・Same as other Str. (IC)
RE-WP	0+288.479	0+120	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=168.479m	・Same as other RE-WALL(IC)
IC/NH5 Exit R01	0+120	0+000	IC/NH5 (Rampway)	NH5	1xRC BOX GIRDER L=120.00m (6@20.00)	・Same as other Str. (IC)
RE-WP	0+262.375	0+120	RE-WALL PROTECTION	-	Anchor type reinforced soil wall L=142.375m	・Same as other RE-WALL(IC)
IC/NH5 Entry R04	0+120	0+000	IC/NH5 (Rampway)	NH5	1xRC BOX GIRDER L=120.00m (6@20.00)	・Same as other Str. (IC)
PC Str.22/1	21+451		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC Str.22/2	21+652		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC Str.23/1	22+153		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC Str.23/2	22+353		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC Str.23/3	22+553		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC Str.23/4	22+753		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC Str.23/5	22+953		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
RE-WP	23+097	23+306	RE-WAL PROTECTION	-	Anchor type Anchor type reinforced soil wall L=209.00m	・There is no N value of geological survey. ・Structure detail is not displayed.
LVUP Str.No.24/1	23+307.6	23+320.4	LVUP	Exting Road	1xRCC Soild slab L=12.80m	・There is no N value of geological survey. ・Structure detail is not displayed. ・Underpass detail (clearance,width) is not displayed.
RE-WP	23+322.3	23+566	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=244.20m	・Same as other RE-WALL(VUP, LVUP).
BC-Str.No.24/2	23+623		BOX CULVERT	-	2@3.00x2.00m, L=54.00m	・Wall on the boxculvert is not displayed. ・Conecting detail and foundation of wall on boxculvert are not clear. ・The volume of Water in culvert is not clear. ・Retaining wall on BOX makes spread foundation.
PC-Str.No.24/3	23+853		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.25/1	24+053		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
RE-WP	24+207	24+482.7	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=275.00m	・Same as other RE-WALL(VUP, LVUP).
LVUP Str.No.25/2	24+484.6	24+495.4	LVUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	24+499.3	24+816	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=316.80m	・Same as other RE-WALL(VUP, LVUP).
PC-Str.No.25/3	24+853		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.26/1	25+153		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.26/2	25+353		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.26/3	25+520		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.26/4	25+780		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.26/5	25+953		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.27/1	26+153		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.27/2	26+353		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.

Appendix-7 List of Bridge Structures (6/17) *Prepared by JST

STRUCTURE CODE	CHAINAGE		STRUCTURE	CROSS	TYPE OF STRUCTURE	COMMENTS
	BP	EP				
MNB201 Sta.No.27/3	26+522		BOX CULVERT	Canal	3@5.00x2.50m, L=54.00m	・This box is MNB. ・Conecting detail and foundation of wall on boxculvert are not clear.
PC-Str.No.27/4	26+753		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.27/5	26+953		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.28/1	27+153		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.28/2	27+353		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
RE-WP	27+376	27+683.7	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=308.00m	・Same as other RE-WALL(VUP, LVUP).
VUP201 Str.No.28/3	27+685.6	27+698.4	VUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	27+700.3	28+008	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=308.00m	・Same as other RE-WALL(VUP, LVUP).
PC-Str.No.29/1	28+040		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.29/2	28+290		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.29/3	28+453		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.29/4	28+653		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
VUP Str.No.30/1	29+172		VUP	SH51	Bridge	・This VUP there are plan and profile, However this one detail is not displaned. Maybe unnecessary.
RE-WP	28+820	29+128	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=308.00m	・There is no N value of geological survey. ・Structure detail is not displayed.
MJB202 Str.No.30/3	29+128	29+308	MJB	SH51, Kannigaipper Tank	2xPC BOX GIRDER L=180.00m (2 x 3@30.00)	・There is no N value of geological survey. ・Structure detail is not displayed. ・Detail of Plan & Profile are different. ・Consultation with relevant organizations.
RE-WP	29+308	29+468	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=160.00m	・Same as other Str.(MJB).
MNB Str.No.30/2 (Within MJB202)	29+248	29+308	MNB	Kannigaipper Tank	RCC SOLID SLAB L=60.00m (6@10.00)	・There is no N value of geological survey. ・Foudation detail (pile length) is not displayed. ・It is better to have less piers in the river. (Review of span , namber of pier.)
PC-Str.No.30/4	29+553		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.30/5	29+753		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.30/6	29+953		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.31/1	30+153		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.31/2	30+398		BOX CULVERT	-	1.5x1.5m, L=63.00m	・Same as other BOX CULVERT.
BC-Str.No.31/3	30+483		BOX CULVERT	-	1.5x1.5m, L=63.00m	・Same as other BOX CULVERT.
MNB202 Str.31/4	30+735	30+765	MNB	River	RCC SOLID SLAB L=30.00m (3@10.00)	・Same as other Str. (MNB).
PC-Str.No.32/1	31+270		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.32/2	31+553		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.32/3	31+753		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.32/4	31+953		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.33/1	32+153		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.33/2	32+403		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.33/3	32+648		BOX CULVERT	-	1.5x1.5m, L=63.00m	・Same as other BOX CULVERT.
RE-WP	32+480	32+853.7	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=347.00m	・Same as other RE-WALL(VUP, LVUP).
VUP202 Str.No.33/4	32+855.6	32+868.4	VUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	32+870	33+147	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=277.20m	・Same as other RE-WALL(VUP, LVUP).
PC-Str.No.34/1	33+303		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.34/2	33+503		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.34/3	33+753		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.34/4	33+953		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.35/1	34+133		BOX CULVERT	-	1.5x1.5m, L=54.00m	・Same as other BOX CULVERT.
BC-Str.No.35/2	34+393		BOX CULVERT	-	2@3.0x2.0m, L=63.00m	・Same as other BOX CULVERT.
PC-Str.No.35/3	34+653		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.35/4	34+770		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.36/1	35+053		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.36/2	35+253		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.

Appendix-7 List of Bridge Structures (7/17) *Prepared by JST

STRUCTURE CODE	CHAINAGE		STRUCTURE	CROSS	TYPE OF STRUCTURE	COMMENTS
	BP	EP				
RE-WP	35+264	35+473.4	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=209.00m	・Same as other RE-WALL(VUP, LVUP).
LVUP203 Str.No.36/3	35+475.6	35+488.4	LVUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	35+490.3	35+716	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=226.00m	・Same as other RE-WALL(VUP, LVUP).
PC-Str.No.36/4	35+753		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.36/5	35+953		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.37/1	36+153		BOX CULVERT	-	2@3.0x2.0m, L=63.00m	・Same as other BOX CULVERT.
PC-Str.No.37/2	36+353		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.37/3	36+653		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
RE-WP	36+640	36+781.103	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=141.10m	・There is no N value of geological survey.
MJB201 Str.No.37/4	36+781.103	36+991.103	MJB for main road	Korattalaiyar River	2xPC BOX GIRDER L=300.00m(10@30.00)	・There is no N value of geological survey. ・Structure detail is not displayed. ・Detail of Plan & Profile are different. ・Changing the substructure format. (RA2,LA2：pier→abat) ・Consultation with relevant organizations.
MJB201 Str.No.37/4	36+781.103	36+991.103	MJB for service road		2xPC BOX GIRDER L=210.00m(7@30.00)	
RE-WP	37+083.103	37+213.300	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=130.20m	・Same as other RE-WALL(VUP, LVUP).
VUP Str.No.38/1 (Within MJB201)	37+215.200	37+240.800	VUP	Exting Road	1xRCC Soild slab L=25.6m(2@12.80)	・Same as other Str. (VUP, LVUP)
RE-WP	37+242.700	37+342.000	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=99.30m	・Same as other RE-WALL(VUP, LVUP).
MNB Str.38/2 (Within MJB201)	37+345	37+435	MNB for main road	River	2xPC BOX GIRDER L=90.00m(3@30.00)	・Same as other Str. (MNB).
RE-WP	37+438	37+740	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=302.00m	・Same as other RE-WALL(VUP, LVUP).
MNB-203 Str.38/2	37+375	37+405	MNB for service road	River	RCC SOLID SLAB L=30.00m (3@10.00)	・Same as other Str. (MNB).
PC-Str.No.38/3	37+853		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.39/1	38+053		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.39/2	38+253		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.39/3	38+453		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.39/4	38+653		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.39/5	38+853		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.40/1	39+003		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.40/2	39+219		BOX CULVERT	-	1 x 1.50x1.50m, L=57.45m	・Same as other BOX CULVERT.
BC-Str.No.40/3	39+486		BOX CULVERT	-	1 x 1.50x1.50m, L=57.45m	・Same as other BOX CULVERT. ・Plan & Profile Str.No. is different.
PC-Str.No.40/4	39+703		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.40/5	39+853		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.41/1	40+053		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.41/2	40+253		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.41/3	40+420		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.41/4	40+680		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.41/5	40+853		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.42/1	41+132		BOX CULVERT	-	1 x 2.0x2.0m, L=76.365m	・Same as other BOX CULVERT. ・Plan & Profile Str.BOX size is different.
BC-Str.No.42/2	41+573		BOX CULVERT	-	2 x 3.00x2.00m, L=54.00m	・Same as other BOX CULVERT.
PC-Str.No.42/3	41+753		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.42/4	41+943		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.43/1	42+103		BOX CULVERT	-	1 x 1.50x1.50m, L=54.0m	・Same as other BOX CULVERT.

Appendix-7 List of Bridge Structures (8/17) *Prepared by JST

STRUCTURE CODE	CHAINAGE		STRUCTURE	CROSS	TYPE OF STRUCTURE	COMMENTS
	BP	EP				
RE-WP	41+960	42+233.3	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=272.80m	・Same as other RE-WALL(VUP, LVUP).
VUP203 Str.No.43/2	42+235.2	42+260.8	VUP	Exting Road	1xRCC Soild slab L=25.60m(2@12.80m)	・Same as other Str. (VUP, LVUP)
RE-WP	42+262.7	42+535.0	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=272.80m	・Same as other RE-WALL(VUP, LVUP).
PC-Str.No.43/3	42+553		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.43/4	42+753		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.43/5	42+953		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.44/1	43+130		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.44/2	43+370		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.44/3	43+553		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.44/4	43+753		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.44/5	43+953		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
MNB-204 Str.No.45/1	44+135		MNB	River	3x5.00x2.50m, L=61.16m	・This box is MNB. ・Conecting detail and foundation of wall on boxculvert are not clear.
PC-Str.No.45/2	44+353		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.45/3	44+553		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.45/4	44+753		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.45/5	44+933		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.46/1	45+253		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.46/2	45+510		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.46/3	45+800		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.46/4	45+953		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.47/1	46+153		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.47/2	46+353		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.47/3	46+523		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.47/4	46+753		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.47/5	46+883		PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.48/1	47+013		BOX CULVERT	-	1 x 2.00x2.00m, L=54.00m	・Same as other BOX CULVERT.
RE-WP	46+951	47+257.3	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=305.80m	・There is no N value of geological survey. ・Structure detail is not displayed. ・The wall of VUP is no anchor type.
VUP204 Str.No.48/2	47+259.2	47+284.8	VUP	Route 114	1xRCC Soild slab L=25.60m(2@12.80m)	・There is no N value of geological survey. ・Structure detail is not displayed. ・Underpass detail (clearance,width) is not displayed.
RE-WP	47+286.7	47+557	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=270.60m	・Same as other RE-WALL(VUP, LVUP).

Appendix-7　List of Bridge Structures (9/17) *Prepared by JST

Sec.3　**CPRR**

STRUCTURE CODE	CHAINAGE		STRUCTURE	CROSS	TYPE OF STRUCTURE	COMMENTS
	BP	EP				
BC-Str.No.48/3	47+593	-	BOX CULVERT	-	1x2.50x2.50m, L=54.00m	・Wall on the boxculvert is not displayed. ・Conecting detail and foundation of wall on boxculvert are not clear. ・The volume of Water in culvert is not clear. ・Retaining wall on BOX makes spread foundation.
BC-Str.No.48/4	47+803	-	BOX CULVERT	-	2x3.00x2.00m, L=54.00m	・Same as other BOX CULVERT.
PC-Str.No.49/1	48+053	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・The volume of Water in culvert is not clear.
PC-Str.No.49/2	48+253	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.49/3	48+470	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.49/4	48+653	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.49/5	48+853	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.50/1	49+053	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.50/2	49+253	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.50/3	49+420	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.50/4	49+680	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.50/5	49+853	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.51/1	50+003	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.51/2	50+213	-	BOX CULVERT	-	1x2.50x2.50m, L=54.00m	・Same as other BOX CULVERT.
PC-Str.No.51/3	50+353	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.51/4	50+553	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
RE-WP	50+574	50+899.7	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=325.60m	・Same as other RE-WALL(VUP, LVUP).
VUP-301 Str.No.51/5	50+901.6	50+914.4	VUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	50+916.3	51+218	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=332.2m	・Same as other RE-WALL(VUP, LVUP).
PC-Str.No.52/1	51+353	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.52/2	51+611	-	BOX CULVERT	-	2x3.00x2.00m, L=54.00m	・Same as other BOX CULVERT.
PC-Str.No.52/3	51+803	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.52/4	51+953	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.53/1	52+153	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.53/2	52+280	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.53/3	52+678	-	BOX CULVERT	-	1x2.50x2.50m, L=54.00m	・Same as other BOX CULVERT.
PC-Str.No.53/4	52+853	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.54/1	53+053	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.54/2	53+253	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.54/3	53+393	-	BOX CULVERT	-	1x2.50x2.50m, L=59.58m	・Same as other BOX CULVERT.
BC-Str.No.54/4	53+518	-	BOX CULVERT	-	1x2.50x2.50m, L=54.00m	・Same as other BOX CULVERT.
RE-WP	53+617	53+740	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=123.00m	・There is no N value of geological survey. ・Structure detail is not displayed. ・The wall-panel is four.
IC/NH205 M01	53+740	53+840	IC/NH205(Main Road)	PWD CANAL	2xPC BOX GIRDER L=100.00m (30.00+40.00+30.00)	・Abutment and pire structure detail are not displayed. ・There is no N value of geological survey. ・Detaile of conection for rampway are not displayed.
IC/NH205 S01	53+740	53+840	IC/NH205 (Service Road)	PWD CANAL	2xPC BOX GIRDER L=100.00m (30.00+40.00+30.00) Both side	・Same as other Str. (IC)
RE-WP	53+840	54+080	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=240.00m	・Same as other RE-WALL(IC)
IC/NH205 M02	54+090	54+840	IC/NH205 (Main Road)	NH205 & Thanneerkulam Tank	2xPC BOX GIRDER L=600.00m (3@30.00+2@15.00+6@30.00+2@15.00+9@30.00)	・Same as other Str. (IC)
RE-WP	54+840	54+944	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=264.00m	・Same as other RE-WALL(IC)
IC/NH205 S02	54+530	54+620	IC/NH205 (Service Road)	Thanneerkulam Tank	RCC SOLID SRAB L=90.00m(9@10.00)	・Same as other Str. (IC)
IC/NH205 R01	0+000	0+120	IC/NH205 (On Ramp)	-	1xBOX GIRDER L=120.00m(6@20.00)	・Same as other Str. (IC)
RE-WP	0+120	0+273	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=153.00m	・Same as other RE-WALL(IC)
IC/NH205 R02	0+000	0+120	IC/NH205 (Off Ramp)	-	1xBOX GIRDER L=120.00m(6@20.00)	・Same as other Str. (IC)
RE-WP	0+120	0+278.282	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=158.28m	・Same as other RE-WALL(IC)
IC/NH205 R03	0+000	0+120	IC/NH205 (On Ramp)	-	1xBOX GIRDER L=120.00m(6@20.00)	・Same as other Str. (IC)
RE-WP	0+120	0+278.626	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=158.62m	・Same as other RE-WALL(IC)
IC/NH205 R04	0+000	0+120	IC/NH205 (Off Ramp)	-	1xBOX GIRDER L=120.00m(6@20.00)	・Same as other Str. (IC)
RE-WP	0+120	0+278.485	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=158.49m	・Same as other RE-WALL(IC)

Appendix-7　List of Bridge Structures (10/17) *Prepared by JST

STRUCTURE CODE	CHAINAGE		STRUCTURE	CROSS	TYPE OF STRUCTURE	COMMENTS
	BP	EP				
PC-Str.No.56/1	55+053	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.56/2	55+303	-	BOX CULVERT	-	1x3.00x1.50m, L=54.00m	・Same as other BOX CULVERT.
RE-WP	54+781.505	55+142.835	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=361.95m	・There is no N value of geological survey. ・Structure detail is not displayed.
ROB301 Str.No.56/3	55+142.835	55+509.085	ROB	Rail Way	COMPOSITE STEEL GIRDER L=366.50m(8@30.00+22.00+52.50+22.00+30.00)	・Detail of Plan & Profile are different. ・Structure detail of bothside span is not displayed. ・There is no N value of geological survey. ・Consultation with relevant organizations. (Ex. Clearlance of railway) ・Top of beam (pier) is wide. (Protruding than end of curb.)
RE-WP	55+509.085	55+869.370	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=362.289m	・Same as other RE-WALL(ROB)
PC-Str.No.56/4	55+753	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.56/5	55+953	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.57/1	56+353	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT. ・Same as No.6, Plan & Profile Str.No. is different.
BC-Str.No.57/2	56+553	-	BOX CULVERT	-	1x2.00x2.00m, L=54.00m	・Same as other BOX CULVERT.
RE-WP	56+423	56+744.5	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=321.20m	・Same as other RE-WALL(VUP, LVUP).
VUP-302 Str.No.57/3	56+746.4	56+759.2	VUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	56+761.1	57+126	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=365.20m	・Same as other RE-WALL(VUP, LVUP).
PC-Str.No.58/1	57+053	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.58/2	57+253	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
RE-WP	57+292	57+352	RETAINING WALL	-	T-TYPE RC RETAINING WALL (Both side) L=60.00m	・There is no N value of geological survey. ・Structure detail is not displayed.
MJB301 Str.No.58/3-1	57+352	57+772	MJB (Main Road)	Cooum River	2xBOX DIRDER L=420.00m (14@30.00)	・There is no N value of geological survey. ・Structure detail is not displayed. (Ex.Pllc,Frame) ・River condition is not clear. ・Changing the substructure format. (LA1,RA1 ; pier→abat) ・Consultation with relevant organizations.
MJB301 Str.No.58/3-2	57+352	57+652	MJB (Service Road)	Cooum River	2xBOX DIRDER L=300.00m (10@30.00) Both side	・Same as other Str.(MJB).
RE-WP	57+772	58+172	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=400.00m	・Same as other RE-WALL(MJB).
PC-Str.No.59/1	58+053	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.59/2	58+303	-	BOX CULVERT	-	2x3.00x2.00m, L=54.00m	・Same as other BOX CULVERT.
PC-Str.No.59/3	58+653	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT. ・Str.No.is mistake.
PC-Str.No.59/4	58+890	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT. ・Str.No.is mistake.
PC-Str.No.60/1	59+053	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
RE-WP	59+072	59+441.7	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=369.60m	・Same as other RE-WALL(VUP, LVUP).
VUP-303 Str.No.60/2	59+443.6	59+456.4	VUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	59+458.3	59+711	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=253.00m	・Same as other RE-WALL(VUP, LVUP).
PC-Str.No.60/3	59+753	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.60/4	59+953	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.61/1	60+153	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.61/2	60+353	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.61/3	60+553	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.61/4	60+753	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.61/5	60+953	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.62/1	61+120	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.62/2	61+380	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.62/3	61+553	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.62/4	61+753	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.62/5	61+953	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.63/1	62+153	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.63/2	62+338	-	BOX CULVERT	-	1x2.50x2.50m, L=54.00m	・Same as other BOX CULVERT.
BC-Str.No.63/3	62+717	-	BOX CULVERT	-	1x1.50x1.50m, L=54.00m	・Same as other BOX CULVERT.

Appendix-7　List of Bridge Structures (11/17) *Prepared by JST

STRUCTURE CODE	CHAINAGE		STRUCTURE	CROSS	TYPE OF STRUCTURE	COMMENTS
	BP	EP				
RE-WP	62+525	62+779.8	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=253.00m	・Same as other RE-WALL(VUP, LVUP).
VUP-304 Str.No.63/4	62+781.2	62+806.8	VUP	Exting Road	1xRCC Soild slab L=25.60m (2@12.80m)	・Same as other Str. (VUP, LVUP)
RE-WP	62+809.9	63+091	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=281.60m	・Same as other RE-WALL(VUP, LVUP).
BC-Str.No.63/5	62+890	-	BOX CULVERT	-	1x3.00x2.00m, L=54.00m	・Detail isdifferent Plan&profile to Drawinng. ・Str.No.is mistake.
PC-Str.No.64/1	63+053	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
MNB-301 Str.No.64/2	63+340	-	BOX CULVERT	POND	3x5.00x2.50m.L=59.60m	・This box is MNB. ・Conecting detail and foundation of wall on boxculvert are not clear.
RE-WP	64+684	64+954.7	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=270.80m	・Same as other RE-WALL(VUP, LVUP).
LVUP-301 Str.No.65/1	64+956.6	64+969.4	LVUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	64+971.3	65+316	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=354.40m	・Same as other RE-WALL(VUP, LVUP).
BC-Str.No.66/1	65+038	-	BOX CULVERT	-	1x2.00x2.00m, L=54.00m	・Same as other BOX CULVERT.
BC-Str.No.66/2	65+133	-	BOX CULVERT	-	2x3.00x2.00m, L=54.00m	・Same as other BOX CULVERT.
PC-Str.No.67/1	66+503	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
						・Nothing Str.No. from 68 to 69. Crossing drainage system between length too long.
PC-Str.No.70/1	69+503	-	PIPE CULVERT	-	1 x 1.2 m φ L=54.00m	・Detail of 1.2 m φ is not displayed.
RE-WP	69+300	69+760.3	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=459.80m	・Same as other RE-WALL(VUP, LVUP).
VUP-305 Str.No.70/2	69+762.2	69+787.8	VUP	Exting Road	1xRCC Soild slab L=25.6m(2@12.80)	・Same as other Str. (VUP, LVUP)
RE-WP	69+789.7	70+133	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=343.20m	・Same as other RE-WALL(VUP, LVUP).
PC-Str.No.71/1	70+143	-	PIPE CULVERT	-	1 x 1.2 m φ L=54.00m	・Detail of 1.2 m φ is not displayed.
PC-Str.No.71/2	70+455	-	PIPE CULVERT	-	1 x 1.2 m φ L=54.00m	・Detail of 1.2 m φ is not displayed.
PC-Str.No.72/1	71+053	-	PIPE CULVERT	-	1 x 1.2 m φ L=54.00m	・Detail of 1.2 m φ is not displayed.
PC-Str.No.72/2	71+253	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
RE-WP	71+235	71+567.7	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=332.20m	・Same as other RE-WALL(VUP, LVUP).
VUP-306 Str.No.72/3	71+569.6	71+582.4	VUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	71+584.3	71+875	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=290.40m	・Same as other RE-WALL(VUP, LVUP).
PC-Str.No.72/4	71+953	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.73/1	72+163	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.73/2	72+298	-	BOX CULVERT	-	1 x 3.00m x 1.50m	・Same as other BOX CULVERT.
PC-Str.No.73/3	72+503	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.73/4	72+718	-	BOX CULVERT	-	2 x 3.00m x 2.00m, L=54.00m	・Same as other BOX CULVERT.
PC-Str.No.73/5	72+903	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.74/1	73+183	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.74/2	73+453	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.74/3	73+583	-	BOX CULVERT	-	2 x 2.00m x 2.00m, L=54.00m	・Same as other BOX CULVERT.
PC-Str.No.74/4	73+803	-	PIPE CULVERT	-	1 x 1.5 m φ L=76.36m	・Same as other PIPE CULVERT.
PC-Str.No.75/1	74+003	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.75/2	74+190	-	BOX CULVERT	-	1 x 2.50m x 2.50m, L=54.00m	・Same as other BOX CULVERT.
PC-Str.No.75/3	74+403	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
PC-Str.No.75/4	74+653	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・Same as other PIPE CULVERT.
BC-Str.No.75/5	74+843	-	BOX CULVERT	-	1 x 2.00m x 2.00m, L=54.00m	・Same as other BOX CULVERT.
RE-WP				-		
VUP	around	75+020	VUP	Exting Road	1xRCC Soild slab L=12.80m	・Plan is nothing. At this point the road intersects.
RE-WP				-		

Appendix-7 List of Bridge Structures (12/17) *Prepared by JST

STRUCTURE CODE	CHAINAGE		STRUCTURE	CROSS	TYPE OF STRUCTURE	COMMENTS
	BP	EP				
RE-WP	74+633	74+998	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=365.23m	・Same as other RE-WALL(IC)
IC/NH4 M01	74+998	77+253	IC/NH4	NH4, Sriperumbudur Tank	2xPC BOX GIRDER L=2,254.77m (n @ 15.00 ~30.00m) 2 ways	・Same as other Str. (IC)
RE-WP	77+253	77+865	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=365.23m	・Same as other RE-WALL(IC)
IC/NH4 R01	0+000	0+300	IC/NH4 (On Ramp)	Sriperumbdur Tank	1 x RC BOX GIERDER L=300.00m (15@20.00m)	・Same as other Str. (IC)
RE-WP	0+300	0+383	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=83.00m	・Same as other RE-WALL(IC)
IC/NH4 R02	0+000	0+160	IC/NH4 (Off Ramp)	-	1 x RC BOX GIERDER L=160.00m (8@20.00m)	・Same as other Str. (IC)
RE-WP	0+160	0+270	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=160.00m	・Same as other RE-WALL(IC)
IC/NH4 R03	0+000	0+180	IC/NH4 (On Ramp)	-	1 x RC BOX GIERDER L=180.00m (9@20.00m)	・Same as other Str. (IC)
RE-WP	0+180	0+192	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=12.00m	・Same as other RE-WALL(IC)
IC/NH4 R04	0+000	0+160	IC/NH4 (Off Ramp)	Sriperumbdur Tank	1 x RC BOX GIERDER L=160.00m (8@20.00m)	・Same as other Str. (IC)
RE-WP	0+160	0+233.3	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=73.30m	・Same as other RE-WALL(IC)
IC/NH4 R05	0+000	0+140	IC/NH4 (On Ramp)	-	1 x RC BOX GIERDER L=140.00m (7@20.00m)	・Same as other Str. (IC)
RE-WP	0+140	0+364	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=224.00m	・Same as other RE-WALL(IC)
IC/NH4 R06	0+000	0+140	IC/NH4 (Off Ramp)	-	1 x RC BOX GIERDER L=140.00m (7@20.00m)	・Same as other Str. (IC)
RE-WP	0+140	0+412	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=272.00m	・Same as other RE-WALL(IC)

Appendix-7 List of Bridge Structures (13/17) *Prepared by JST

Sec.4 **CPRR**

STRUCTURE CODE	CHAINAGE		STRUCTURE	CROSS	TYPE OF STRUCTURE	COMMENTS
	BP	EP				
RE-WP	77+916	78+185.3	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=268.40m	・There is no N value of geological survey. ・Structure detail is not displayed. ・Plan & Profile Str.No. is different.
VUP401 Str.No.79/1	78+187.2	78+212.8	VUP	Exting Road	1xRCC Soild slab L=25.60m(2@12.80m)	・There is no N value of geological survey. ・Structure detail is not displayed. ・Underpass detail (clearance,width) is not displayed.
RE-WP	78+214.7	78+600	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=385.00m	・Same as other RE-WALL(VUP, LVUP).
RE-WP	80+505	80+985.3	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=479.60m	・ Same as other RE-WALL(VUP, LVUP). ・ Plan & Profile Str.No. is different.
VUP402 Str.No.82/1	80+987.2	81+012.8	VUP	Exting Road	1xRCC Soild slab L=25.60m(2@12.80m)	・Same as other Str. (VUP, LVUP)
RE-WP	81+014.7	81+286	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=270.60m	・Same as other RE-WALL(VUP, LVUP).
RE-WP	82+359	82+746.7	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=387.20m	・ Same as other RE-WALL(VUP, LVUP). ・ Plan & Profile Str.No. is different.
LVUP402 Str.No.83/1	82+748.6	82+761.4	LVUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	82+763.3	83+175	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=411.40m	・Same as other RE-WALL(VUP, LVUP).
RE-WP	84+953	85+320.7	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=367.40m	・ Same as other RE-WALL(VUP, LVUP). ・ Plan & Profile Str.No. is different.
VUP403 Str.No.86/1	85+322.6	85+335.4	VUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	85+337.3	85+643	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=305.80m	・Same as other RE-WALL(VUP, LVUP).
RE-WP	86+144	86+649.7	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=506.00m	・ Same as other RE-WALL(VUP, LVUP). ・ Plan & Profile Str.No. is different.
LVUP402 Str.No.87/1	86+651.6	86+664.4	LVUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	86+666.3	86+910	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=244.20m	・Same as other RE-WALL(VUP, LVUP).
RE-WP	87+800	88+245.3	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=444.40m	・ Same as other RE-WALL(VUP, LVUP). ・ Plan & Profile Str.No. is different.
VUP404 Str.No.89/1	88+247.2	88+272.8	VUP	EXTING ROAD	1xRCC Soild slab L=25.60m(2@12.80m)	・Same as other Str. (VUP, LVUP)
RE-WP	88+274.7	88+557	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=281.60m	・Same as other RE-WALL(VUP, LVUP).
RE-WP	89+273	89+584.3	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=310.20m	・ Same as other RE-WALL(VUP, LVUP). ・ Plan & Profile Str.No. is different.
VUP405 Str.No.90/1	89+586.2	89+611.8	VUP	Exting Road	1xRCC Soild slab L=25.60m(2@12.80m)	・Same as other Str. (VUP, LVUP)
RE-WP	89+613.7	89+909	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=294.80m	・Same as other RE-WALL(VUP, LVUP).
RE-WP	90+684	90+933.3	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=248.60m	・Same as other RE-WALL(VUP, LVUP).
VUP406 Str.No.91/1	90+935.2	90+960.8	VUP	Exting Road	1xRCC Soild slab L=25.60m(2@12.80m)	・Same as other Str. (VUP, LVUP)
RE-WP	90+962.7	91+381	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=418.00m	・Same as other RE-WALL(VUP, LVUP).
RE-WP	92+314	92+644.3	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=330.00m	・ Same as other RE-WALL(VUP, LVUP). ・ Plan & Profile Str.No. is different.
VUP407 Str.No.93/1	92+646.2	92+671.8	VUP	Exting Road	1xRCC Soild slab L=25.60m(2@12.80m)	・Same as other Str. (VUP, LVUP)
RE-WP	92+673.7	93+074	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=400.40m	・Same as other RE-WALL(VUP, LVUP).
RE-WP	93+336	93+610.7	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=275.00m	・ Same as other RE-WALL(VUP, LVUP). ・ Plan & Profile Str.No. is different.
LVUP403 Str.No.94/1	93+612.6	93+625.4	LVUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	93+627.3	93+882	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=255.20m	・Same as other RE-WALL(VUP, LVUP).
RE-WP	94+992	95+429.7	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=437.80m	・ Same as other RE-WALL(VUP, LVUP). ・ Plan & Profile Str.No. is different.
VUP408 Str.No.96/1	95+431.6	95+444.4	VUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	95+446.3	95+864	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=418.00m	・Same as other RE-WALL(VUP, LVUP).
RE-WP	99+495	99+829.7	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=334.40m	・ Same as other RE-WALL(VUP, LVUP). ・ Plan & Profile Str.No. is different.
VUP409 Str.No.100/1	99+831.6	99+844.4	VUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP)
RE-WP	99+846.3	100+176	RE-WAL PROTECTION	-	Anchor type reinforced soil wall L=330.00m	・Same as other RE-WALL(VUP, LVUP).
BC,WP & MJB	101+000	101+650				・Box culverts, Wall protection and Bridge constructed on site. However drawings are nothing.

Appendix-7 List of Bridge Structures (14/17) *Prepared by JST

Sec.5 **CPRR**

STRUCTURE CODE	CHAINAGE		STRUCTURE	CROSS	TYPE OF STRUCTURE	COMMENTS
	BP	EP				
RE-WP	0+060	0+183.790	APROCH PROTECTION	NH45	Anchor type reinforced soil wall L=123.79m	・There is no N value of geological survey. ・The wall-panel is four.
IC/NH45 R01	0+183.790	0+731.21	IC/NH45 (Ramp-1)	NH45	3xRCC T-GIRDER L=547.420m (10@20.0+2@20.0+21.71+24.0+21.71+2@20.0+10@20.0) , A1～A2	・There is no N value of geological survey. ・Detaile of conection for rampway are not displayed. ・Main beam is not on the beam of pier. ・Superstructure format is different from another Ramp. (This IC : RC-T, Another IC : RC-box)
RE-WP	0+731.21	0+875	APROCH PROTECTION	NH45	Anchor type reinforced soil wall L=143.79m	・Same as other RE-WALL(IC)
RE-WP	0+891	0+734.57	APROCH PROTECTION	NH45	Anchor type reinforced soil wall L=156.43m	・Same as other RE-WALL(IC)
IC/NH45 R02	0+734.57	0+187.15	IC/NH45 (Ramp-2)	NH45	3xRCC T-GIRDER L=547.420m (10@20.0+2@20.0+21.71+24.0+21.71+2@20.0+10@20.0) , A4～A3	・Same as other Str. (IC)
RE-WP	0+187.15	0+060	APROCH PROTECTION	NH45	Anchor type reinforced soil wall L=127.15m	・Same as other RE-WALL(IC)
IC/NH45 Str.102/1	101+837.22	102+097.55	IC/NH45 (Main Road)	NH45	1xPC BOX GIRDER L=263.409m (20.00+20.33+11@20.00)	・Same as other Str. (IC)
RE-WP	102+097.55	102+243.33	APROCH PROTECTION	NH45	Anchor type reinforced soil wall L=145.783m	・Same as other RE-WALL(IC)
PC-Str.103/1	102+506	-	PIPE CULVERT	-	1 x 1.5 m φ L=54.00m	・The volume of Water in culvert is not clear.
RE-WP				-		・Drawing nothing
MJB501 Str.No.103/2	102+670	103+150	MJB	Sengunram tank,Pond	2xPC BOX GIRDER L=480.00m (4 x 4@30.00)	・Detail of Plan & Profile are different. ・There is no N value of geological survey. ・Consultation with relevant organizations.
RE-WP				-		・Drawing nothing
PC-Str.104/1	103+156	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.104/2	103+356	-	BOX CULVERT	-	1.5 × 1.5 m, L=54.0m	・Wall on the boxculvert is not displayed. ・Conecting detail and foundation of wall on boxculvert are not clear. ・The volume of Water in culvert is not clear. ・Plan&Profile is PIPE. ・Retaining wall on BOX makes spread foundation.
RE-WP	103+330	103+574.7	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=244.2m	・There is no N value of geological survey. ・Structure detail is not displayed.
LVUP501 Str.104/3	103+577.6	103+589.4	LVUP	Exting Road	1xRCC Soild slab L=12.80m	・There is no N value of geological survey. ・Structure detail is not displayed. ・Underpass detail (clearance,width) is not displayed.
RE-WP	103+591.3	103+854	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=272.8m	・Same as other RE-WALL(VUP, LVUP).
PC-Str.104/4	103+956	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
BC-Str.No.105/1	104+336	-	BOX CULVERT	-	2.5 × 2.5 m, L=54.0m	・Same as other BOX CULVERT.
PC-Str.105/2	104+556	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.105/3	104+756	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.106/1	105+006	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.106/2	105+256	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.106/3	105+506	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.106/4	105+756	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
MNB501 Str.107/1	106+101	106+151	MNB	Pond	RCC SOLID SLAB L=50.00m (5@10.00)	・There is no N value of geological survey. ・Foudation detail (pile length) is not displayed. ・It is better to have less piers in the river. (Review of span , namber of pier.) ・Consultation with relevant organizations.
RE-WP	106+362	106+769.7	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=413.6m	・ Same as other RE-WALL(VUP, LVUP). ・ Plan & Profile Str.No. is different.
LVUP502 Str.107/2	106+771.6	106+784.4	LVUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP) ・Foudation detail is not displayed.
RE-WP	106+786.3	107+091	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=299.2m	・Same as other RE-WALL(VUP, LVUP).

Appendix-7 List of Bridge Structures (15/17) *Prepared by JST

STRUCTURE CODE	CHAINAGE		STRUCTURE	CROSS	TYPE OF STRUCTURE	COMMENTS
	BP	EP				
PC-Str.108/1	107+256	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.
PC-Str.108/2	107+456	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.
PC-Str.108/3	107+656	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.
PC-Str.108/4	107+956	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.
PC-Str.109/1	108+156	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.
BC-Str.No.109/2	108+381	-	BOX CULVERT	-	2 @ 3 × 2 m, L=54.0m	・Same as other BOX CULVERT.
PC-Str.109/3	108+566	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・ Same as other PIPE CULVERT. ・ Plan & Profile Str.No. is different.
RE-WP	108+608	108+908.7	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=310.2m	・Same as other RE-WALL(VUP, LVUP).
VUP501 Str.109/4	108+920.6	108+933.4	VUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP) ・Foudation detail is not displayed.
RE-WP	108+935.3	109+265	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=330.0m	・Same as other RE-WALL(VUP, LVUP).
BC-Str.No.110/1	109+116	-	BOX CULVERT	-	3 × 1.5 m, L=54.0m	・Same as other BOX CULVERT.
PC-Str.110/2	109+306	-	BOX CULVERT	-	1.5 × 1.5 m, L=54.0m	・Plan&profile is Pipecalvert.
PC-Str.110/3	109+506	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.
BC-Str.No.110/4	109+706	-	BOX CULVERT	-	2 × 2 m, L=54.0m	・Same as other BOX CULVERT.
PC-Str.110/5	109+990	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.
MNB502 Str.111/1	110+261	110+311	MNB	Sirukundram Tank	RCC SOLID SLAB L=50.00m (5@10.00)	・Same as other Str. (MNB).
MNB503 Str.111/2	110+618	110+668	MNB	Sirukundram Tank	RCC SOLID SLAB L=50.00m (5@10.00)	・Same as other Str. (MNB).
PC-Str.111/3	110+856	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.
BC-Str.No.111/4	110+999	-	BOX CULVERT	-	2 × 2 m, L=54.0m	・Same as other BOX CULVERT.
BC-Str.No.112/1	111+206	-	BOX CULVERT	-	1.5 × 1.5 m, L=54.0m	・Same as other BOX CULVERT.
BC-Str.No.112/2	111+406	-	BOX CULVERT	-	1.5 × 1.5 m, L=54.0m	・Same as other BOX CULVERT.
RE-WP	111+182	111+492.7	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=310.2m	・Same as other RE-WALL(VUP, LVUP).
LVUP503 Str.112/3	111+494.6	111+507.4	LVUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP). ・Foudation detail is not displayed.
RE-WP	111+509.3	111+870	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=360.8m	・Same as other RE-WALL(VUP, LVUP).
BC-Str.No.112/4	111+700	-	BOX CULVERT	-	1.5 × 1.5 m, L=54.0m	・Same as other BOX CULVERT.
BC-Str.No.112/5	111+856	-	BOX CULVERT	-	1.5 × 1.5 m, L=54.0m	・Same as other BOX CULVERT.
PC-Str.113/1	112+056	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.
PC-Str.113/2	112+256	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.
PC-Str.113/3	112+456	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.
PC-Str.113/4	112+656	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.
PC-Str.113/5	112+856	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.
PC-Str.114/1	113+020	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.
PC-Str.114/2	113+280	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.
PC-Str.114/3	113+706	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.
BC-Str.No.114/4	113+932	-	BOX CULVERT	-	1.5 × 1.5 m, L=54.0m	・Same as other BOX CULVERT.
RE-WP	113+815	114+008.9	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=193.6m	・Same as other RE-WALL(VUP, LVUP).
VUP502 Str.115/1	114+010.8	114+037.2	VUP	Exting Road	1xRCC Soild slab L=25.6m(2@12.80)	・Same as other Str. (VUP, LVUP).
RE-WP	114+039.1	114+356	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=316.8m	・Same as other RE-WALL(VUP, LVUP).
BC-Str.No.115/2	114+250	-	BOX CULVERT	-	1.5 × 1.5 m, L=54.0m	・Same as other BOX CULVERT.
BC-Str.No.115/3	114+382	-	BOX CULVERT	-	2 × 2 m, L=54.0m	・Same as other BOX CULVERT.
PC-Str.115/4	114+606	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.
PC-Str.115/5	114+756	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.
PC-Str.115/6	114+956	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.
PC-Str.116/1	115+106	-	PIPE CULVERT	-	1 x 1.5 m φ, L=54.0m	・Same as other PIPE CULVERT.

Appendix-7 List of Bridge Structures (16/17) *Prepared by JST

STRUCTURE CODE	CHAINAGE		STRUCTURE	CROSS	TYPE OF STRUCTURE	COMMENTS
	BP	EP				
MNB504 Str.116/2	115+266	115+296	MNB	Nalloh	RCC SOLID SLAB L=30.00m (3@10.00)	・Same as other Str. (MNB).
MNB505 Str.116/3	115+468	115+498	MNB	Nalloh	RCC SOLID SLAB L=30.00m (3@10.00)	・Same as other Str. (MNB).
PC-Str.116/4	115+656	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.116/5	115+800	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.117/1	116+080	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.117/2	116+256	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.117/3	116+456	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.117/4	116+610	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT. ・Plan & Profile Str.No. is different.
PC-Str.118/1	117+056	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.118/2	117+256	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.118/3	117+456	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
BC-Str.No.118/4	117+600	-	BOX CULVERT	-	1.5 × 1.5 m, L=54.0m	・Same as other BOX CULVERT.
RE-WP	117+510	117+787.7	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=277.2m	・Same as other RE-WALL(VUP, LVUP).
LVUP504 Str.118/5	117+789.6	117+802.4	LVUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP).
RE-WP	117+804.3	118+018	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=213.4m	・Same as other RE-WALL(VUP, LVUP).
MNB506 Str.119/1	118+028	118+058	MNB	Nalloh	RCC SOLID SLAB L=30.000m (3@10.00)	・Same as other Str. (MNB).
PC-Str.119/2	118+256	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
MNB507 Str.119/3	118+510	118+530	MNB	Nalloh	RCC SOLID SLAB L=20.000m (2@10.00)	・Same as other Str. (MNB).
PC-Str.119/4	118+756	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
BC-Str.No.119/5	118+956	-	BOX CULVERT	-	1.5 × 1.5 m, L=54.0m	・Same as other BOX CULVERT.
RE-WP	118+929	119+254.7	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=325.6m	・Same as other RE-WALL(VUP, LVUP).
VUP503 Str.120/1	119+256.6	119+269.4	VUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP).
RE-WP	119+271.3	119+550	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=279.4m	・Same as other RE-WALL(VUP, LVUP).
BC-Str.No.120/2	119+356	-	BOX CULVERT	-	1.5 × 1.5 m, L=54.0m	・Same as other BOX CULVERT.
BC-Str.No.120/3	119+556	-	BOX CULVERT	-	2 × 2 m, L=54.0m	・Same as other BOX CULVERT.
BC-Str.No.120/4	119+756	-	BOX CULVERT	-	2 × 2 m, L=54.0m	・Same as other BOX CULVERT.
MNB508 Str.120/5	119+931	119+981	MNB	Manamathi Tank	RCC SOLID SLAB L=50.00m (5@10.00)	・Same as other Str. (MNB).
PC-Str.121/1	120+166	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT. ・Plan & Profile Str.No. is different.
BC-Str.No.121/2	120+376	-	BOX CULVERT	-	2 @ 3 × 2 m, L=54.0m	・Same as other BOX CULVERT.
BC-Str.No.121/3	120+656	-	BOX CULVERT	-	1.5 × 1.5 m, L=60.0m	・Same as other BOX CULVERT.
RE-WP	120+528	120+755.7	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=237.6m	・Same as other RE-WALL(VUP, LVUP).
LVUP505 Str.121/4	120+767.6	120+780.4	LVUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP).
RE-WP	120+782.3	121+141	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=358.6m	・Same as other RE-WALL(VUP, LVUP).
PC-Str.No.122/1	121+106	-	PIPE CULVERT	-	1 × 1.5 m, L=54.0m	・Same as other PIPE CULVERT.
MNB509 Str.122/2	121+403	121+423	MNB	Nalloh	RCC SOLID SLAB L=20.000m (2@10.00)	・Same as other Str. (MNB).
PC-Str.112/3	121+656	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
MNB510 Str.122/4	121+953	122+003	MNB	Nalloh	RCC SOLID SLAB L=50.00m (5@10.00)	・Same as other Str. (MNB).
BC-Str.No.123/1	122+160	-	BOX CULVERT	-	1.5 × 1.5 m, L=54.0m	・Same as other BOX CULVERT. ・Plan & Profile Str.No. is different.
RE-WP	122+083	122+353.9	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=270.6m	・Same as other RE-WALL(VUP, LVUP).
VUP504 Str.123/2	122+355.8	122+382.2	VUP	Exting Road	1xRCC Soild slab L=25.6m(2@12.80)	・Same as other Str. (VUP, LVUP).
RE-WP	122+384.1	122+698	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=314.6m	・Same as other RE-WALL(VUP, LVUP).
BC-Str.No.123/3	122+836	-	BOX CULVERT	-	2 × 2 m, L=54.0m	・Same as other BOX CULVERT.
PC-Str.124/1	123+116	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.124/2	123+406	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
MNB511 Str.124/3	123+523	123+543	MNB	Nalloh	RCC SOLID SLAB L=20.000m (2@10.00)	・Same as other Str. (MNB).
PC-Str.124/4	123+696	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
BC-Str.No.124/5	123+920	-	BOX CULVERT	-	1.5 × 1.5 m, L=54.0m	・Same as other BOX CULVERT.

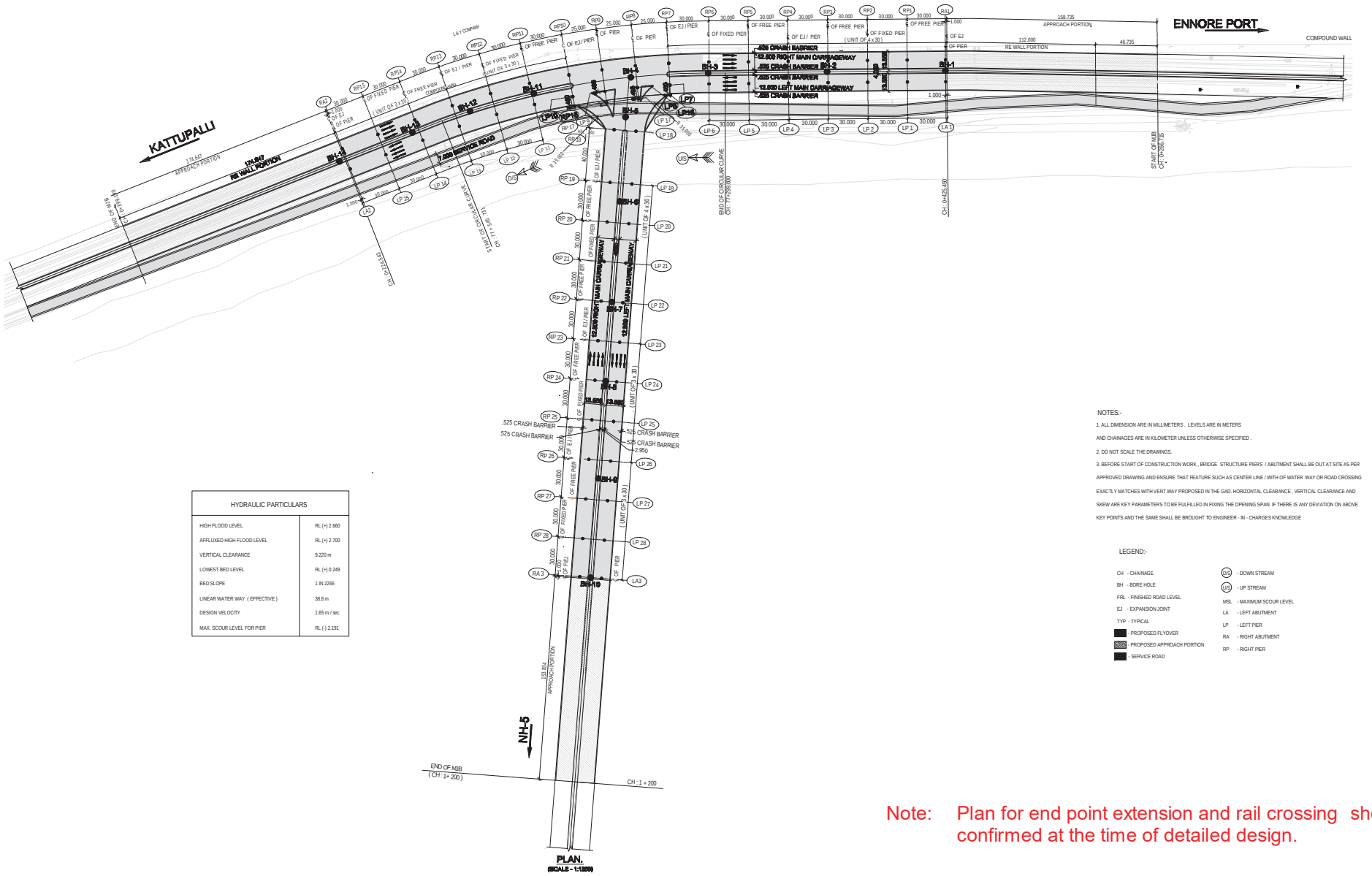
Appendix-7 List of Bridge Structures (17/17) *Prepared by JST

STRUCTURE CODE	CHAINAGE		STRUCTURE	CROSS	TYPE OF STRUCTURE	COMMENTS
	BP	EP				
RE-WP	123+820	124+039.7	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=220.0m	・Same as other RE-WALL(VUP, LVUP).
LVUP506 Str.125/1	124+041.6	124+054.4	LVUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP).
RE-WP	124+056.3	124+296	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=237.6m	・Same as other RE-WALL(VUP, LVUP).
PC-Str.125/2	124+306	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.125/3	124+446	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
BC-Str.No.125/4	124+620	-	BOX CULVERT	-	2 × 2 m, L=54.0m	・Same as other BOX CULVERT.
PC-Str.125/5	124+956	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.126/1	125+106	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
RE-WP	125+183	125+473.7	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=290.4m	・Same as other RE-WALL(VUP, LVUP).
VUP505 Str.126/2	125+475.6	125+488.4	VUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP).
RE-WP	125+490.3	125+754	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=264.0m	・Same as other RE-WALL(VUP, LVUP).
BC-Str.No.126/3	125+706	-	BOX CULVERT	-	1.5 × 1.5 m, L=54.0m	・Same as other BOX CULVERT.
PC-Str.126/4	125+906	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.127/1	126+106	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.127/2	126+220	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.127/3	126+506	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
PC-Str.127/4	126+706	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
RE-WP	126+770	127+062.3	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=292.6m	・Same as other RE-WALL(VUP, LVUP).
VUP506 Str.128/1	127+064.2	127+089.7	VUP	Exting Road	1xRCC Soild slab L=25.6m(2@12.80)	・Same as other Str. (VUP, LVUP).
RE-WP	127+091.7	127+345	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=250.8m	・Same as other RE-WALL(VUP, LVUP).
PC-Str.128/2	127+356	-	PIPE CULVERT	-	1 x 1.5 m φ, L＝54.0m	・Same as other PIPE CULVERT.
BC-Str.No.128/3	127+536	-	BOX CULVERT	-	2 × 2 m, L=54.0m	・Same as other BOX CULVERT.
RE-WP	127+658	127+862.7	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=204.6m	・Same as other RE-WALL(VUP, LVUP).
LVUP507 Str.128/4	127+864.6	127+877.4	LVUP	Exting Road	1xRCC Soild slab L=12.80m	・Same as other Str. (VUP, LVUP).
RE-WP	127+879.3	128+112	APPROACH PROTECTION	-	Anchor type reinforced soil wall L=233.2m	・Same as other RE-WALL(VUP, LVUP).
BC-Str.No.129/1	128+103	-	BOX CULVERT	-	1.5 × 1.5 m, L=54.0m	・Same as other BOX CULVERT.
BC-Str.No.130/1	129+006	-	BOX CULVERT	-	2 × 2 m, L=54.0m	・Same as other BOX CULVERT.

Appendix-8: General Drawings of Bridge Works

1	MJB	MJB101: Bridge General Drawing (1/3)
2		MJB101: Bridge General Drawing (2/3)
3		MJB101: Bridge General Drawing (3/3)
4	MNB	MNB101Bridge General Drawing
5	ROB	ROB101: Bridge General Drawing (1/2)
6		ROB101: Bridge General Drawing (2/2)
7	VUP	VUP102: Bridge General Drawing
8	BC/PC	Box Culvert General Drawing
9		Pipe Culvert General Drawing
10	IC	IC/NH5: Bridge General Drawing (1/3)
11		IC/NH5: Bridge General Drawing (2/3)
12		IC/NH5: Bridge General Drawing (3/3)

Note: These drawings are submitted to HMPD at the time of review of this study.



HYDRAULIC PARTICULARS	
HIGH FLOOD LEVEL	RL (+) 2.660
AFFLUXED HIGH FLOOD LEVEL	RL (+) 2.700
VERTICAL CLEARANCE	9.220 m
LOWEST BED LEVEL	RL (+) 0.249
BED SLOPE	1 IN 2265
LINEAR WATER WAY (EFFECTIVE)	38.8 m
DESIGN VELOCITY	1.65 m / sec
MAX. SCOUR LEVEL FOR PIER	RL (-) 2.191

NOTES:-

1. ALL DIMENSION ARE IN MILLIMETERS , LEVELS ARE IN METERS AND CHAINAGES ARE IN KILOMETER UNLESS OTHERWISE SPECIFIED .
2. DO NOT SCALE THE DRAWINGS.
3. BEFORE START OF CONSTRUCTION WORK , BRIDGE STRUCTURE PIERS / ABUTMENT SHALL BE OUT AT SITE AS PER APPROVED DRAWING AND ENSURE THAT FEATURE SUCH AS CENTER LINE / WITH OF WATER WAY OR ROAD CROSSING EXACTLY MATCHES WITH VENT WAY PROPOSED IN THE GAD. HORIZONTAL CLEARANCE , VERTICAL CLEARANCE AND SKEW ARE KEY PARAMETERS TO BE FULFILLED IN FIXING THE OPENING SPAN. IF THERE IS ANY DEVIATION ON ABOVE KEY POINTS AND THE SAME SHALL BE BROUGHT TO ENGINEER - IN - CHARGES KNOWLEDGE

LEGEND:-

CH - CHAINAGE
BH - BORE HOLE
FRL - FINISHED ROAD LEVEL
EJ - EXPANSION JOINT
TYP - TYPICAL
PROPOSED FLYOVER
PROPOSED APPROACH PORTION
SERVICE ROAD

DS - DOWN STREAM
US - UP STREAM
MSL - MAXIMUM SCOUR LEVEL
LA - LEFT ABUTMENT
LP - LEFT PIER
RA - RIGHT ABUTMENT
RP - RIGHT PIER

Note: Plan for end point extension and rail crossing should be confirmed at the time of detailed design.

PREPARED BY :

Japan International Cooperation Agency (JICA)

JICA Study Team constituted by
NIPPON KOEI CO., LTD.
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PADECO CO., LTD.

PROJECT :

PREPARATORY STUDY FOR CHENNAI PERIPHERAL RING ROAD DEVELOPMENT IN INDIA

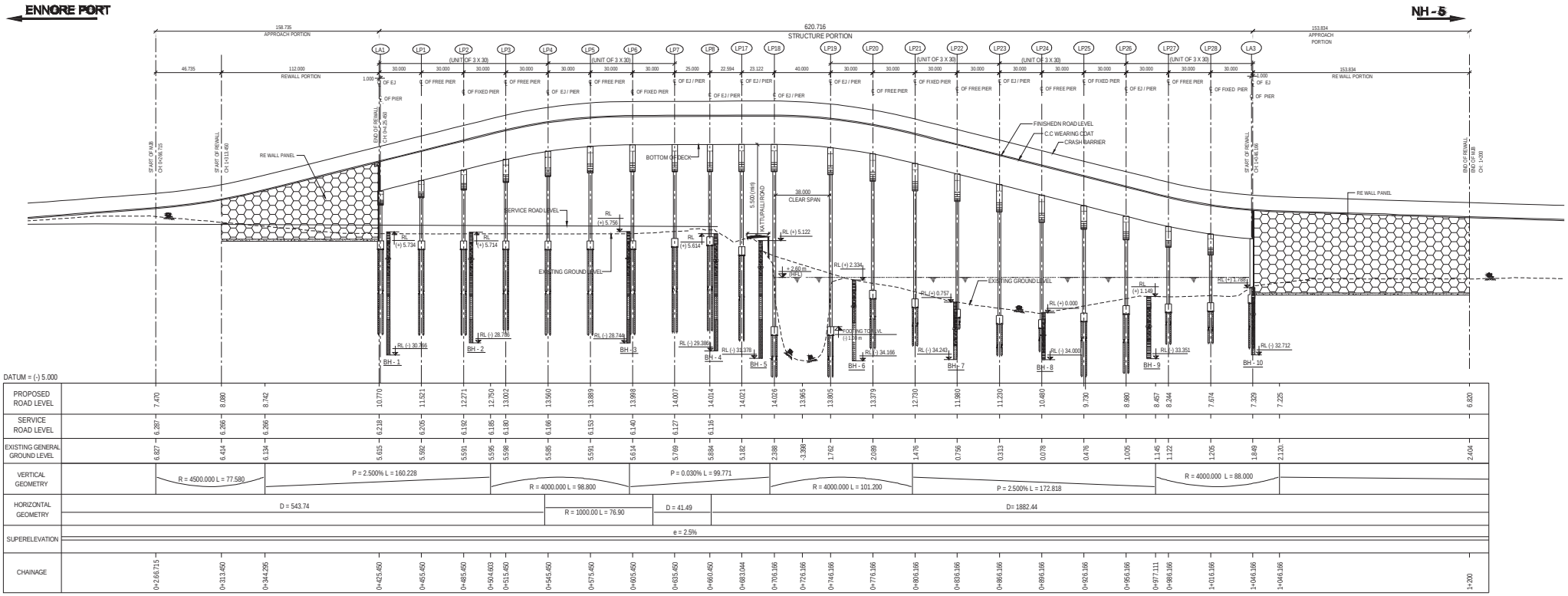
TITLE :

SECTION - 1

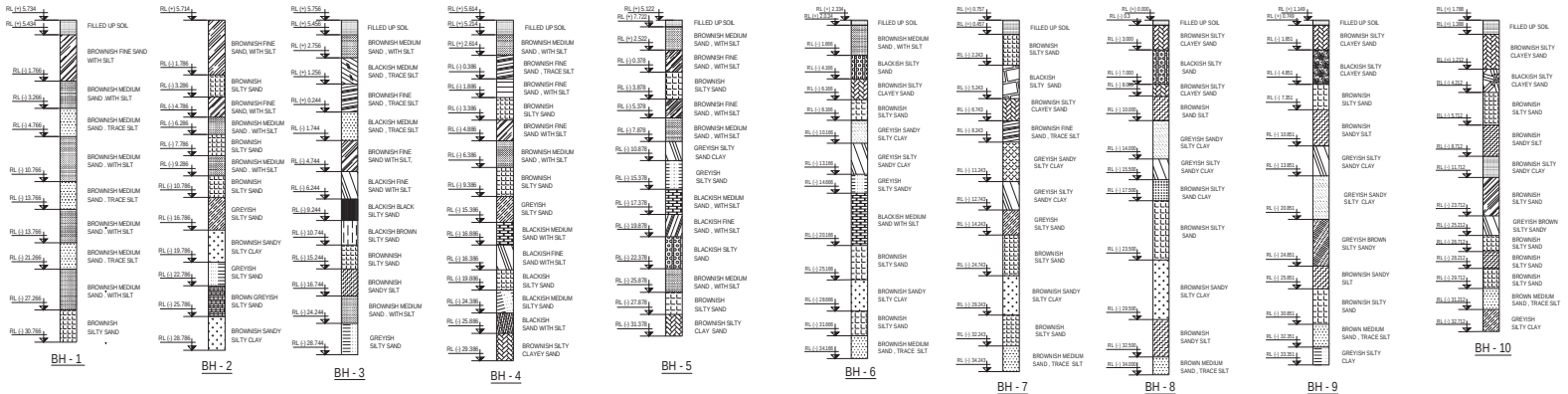
GENERAL ARRANGEMENT DRAWING OF

MAJOR BRIDGE (MJB) AT CH: 0 + 622

DRAWN		
CHECKED		
APPROVED		
SCALE : 1:100		SHEET NO : 3 / 1
DATE : Jan. 2018		
DRG NO: 17104/E/S1/MJB		



LONGITUDINAL ELEVATION



NOTES:-

1. ALL DIMENSION ARE IN MILLIMETERS , LEVELS ARE IN METERS AND CHAINAGES ARE IN KILOMETER UNLESS OTHERWISE SPECIFIED .
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LEGEND:-

CH	- CHAINAGE	DNS	- DOWN STREAM
BH	- BORE HOLE	UPS	- UP STREAM
FRL	- FINISHED ROAD LEVEL	MSL	- MAXIMUM SCOUR LEVEL
EJ	- EXPANSION JOINT	LA	- LEFT ABUTMENT
TYP	- TYPICAL	LP	- LEFT PIER
		RA	- RIGHT ABUTMENT
		RP	- RIGHT PIER

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PADECO CO., LTD.

PROJECT :

PREPARATORY STUDY FOR CHENNAI PERIPHERAL RING ROAD DEVELOPMENT IN INDIA

TITLE :

SECTION - 1

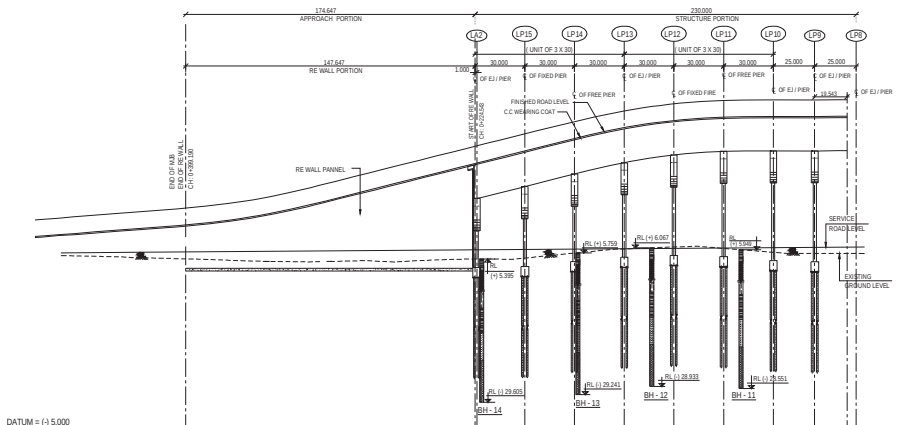
GENERAL ARRANGEMENT DRAWING OF

MAJOR BRIDGE (MJB) AT CH: 0+622

DRAWN		
CHECKED		
APPROVED		
SCALE :	1:100	SHEET NO : 3 / 2
DATE :	Jan. 2018	
DRG NO:	17105/E/S1/MNB	

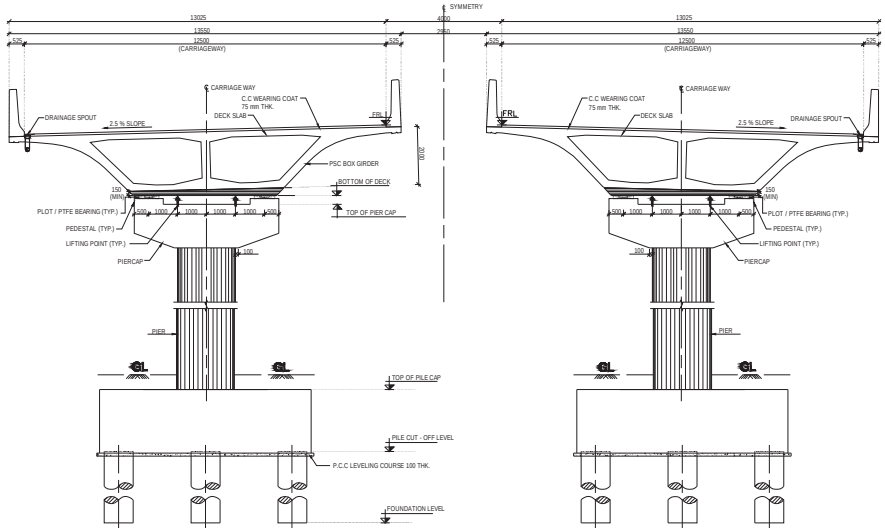
KATTUPALLI

ENNORE PORT

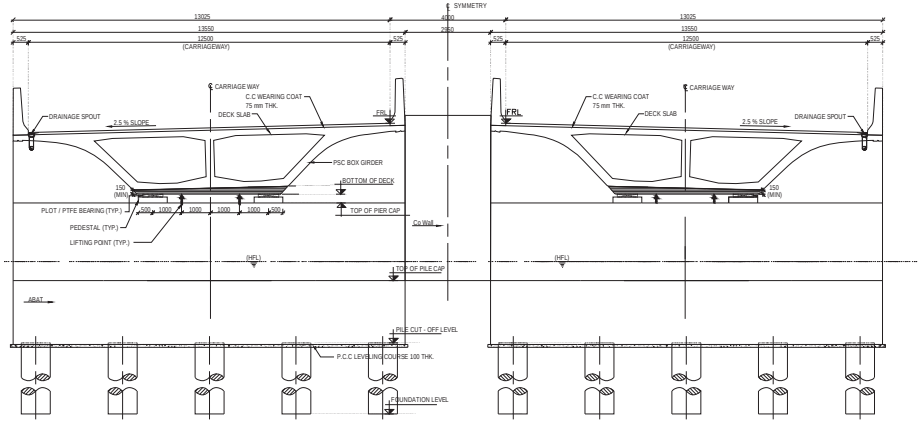


LONGITUDINAL ELEVATION

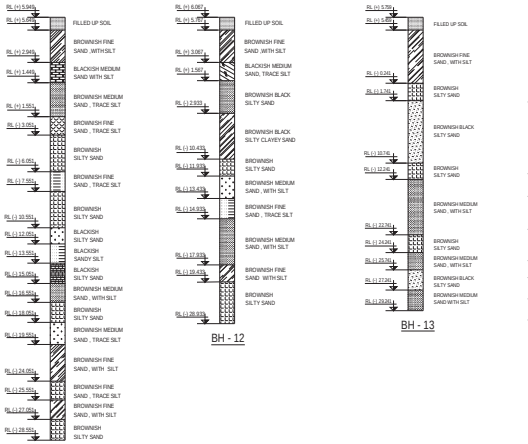
PIER



ABAT(LA3)



SECTION AT PIER LOCATION



NOTES:-

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AND CHAINAGES ARE IN KILOMETER UNLESS OTHERWISE SPECIFIED .
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LEGEND:-

CH - CHAINAGE
BH - BORE HOLE
FRL - FINISHED ROAD LEVEL
EJ - EXPANSION JOINT
TYP - TYPICAL

D/S - DOWN STREAM
U/S - UP STREAM
MSL - MAXIMUM SCOUR LEVEL
LA - LEFT ABUTMENT
LP - LEFT PIER
RA - RIGHT ABUTMENT
RP - RIGHT PIER

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PROJECT :	PREPARATORY STUDY FOR CHENNAI PERIPHERAL RING ROAD DEVELOPMENT IN INDIA
TITLE :	SECTION - 1 GENERAL ARRANGEMENT DRAWING OF MAJOR BRIDGE (MJB) AT CH: 0+622
DRAWN	
CHECKED	
APPROVED	
SCALE : 1:100	SHEET NO : 3 / 3
DATE : Jan. 2018	
DRG NO: 17106/E/S1/MJB	

A B C D E F G H I J K L

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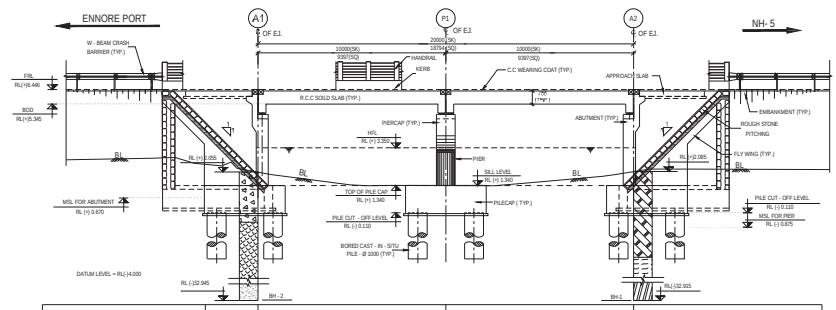
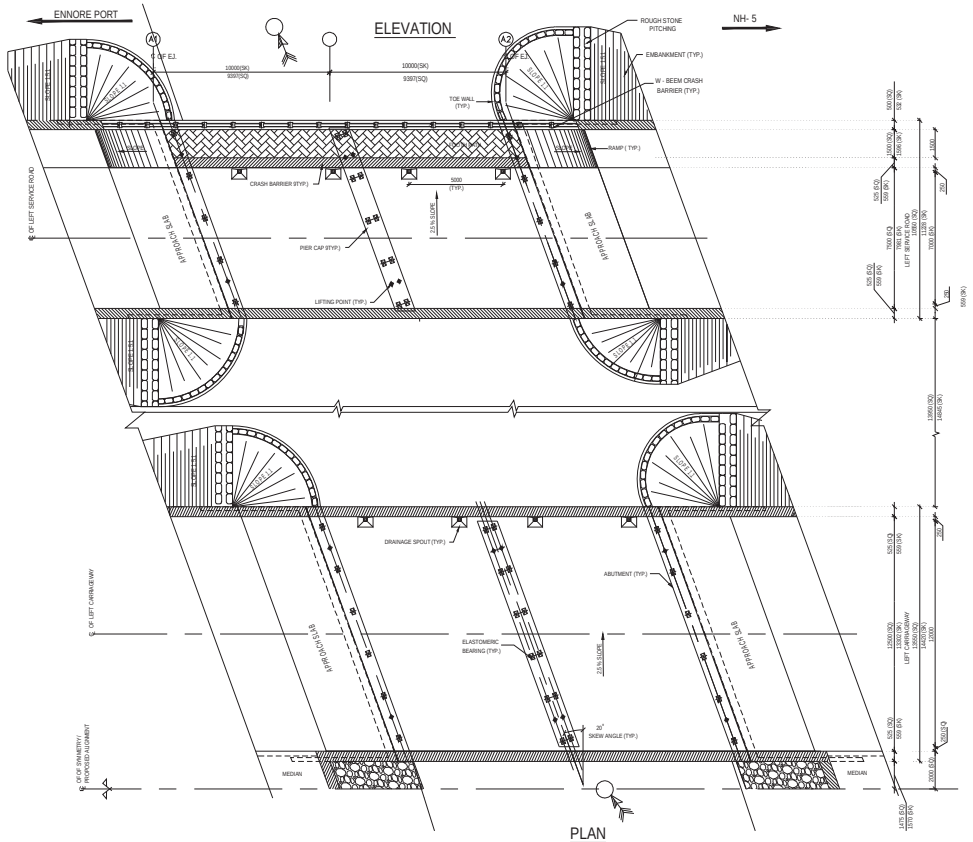
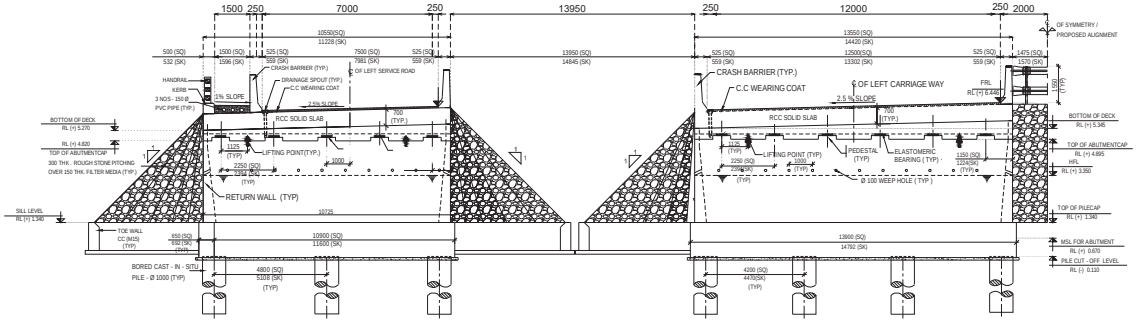
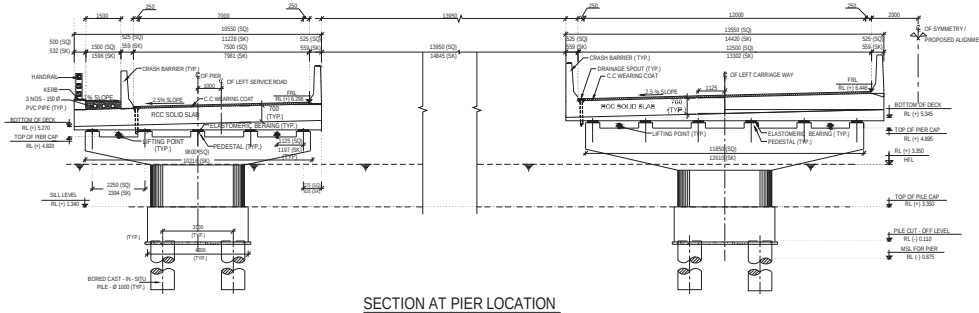


FINISHED ROAD LEVEL (MAIN) RL (+)	6.446	6.446	6.446
FINISHED ROAD LEVEL (SERVICE) RL (+)	6.296	6.296	6.296
BED LEVEL RL (+)	2.055	1.340	2.085
CHAINAGE (KM)	2+465	2+475	2+485

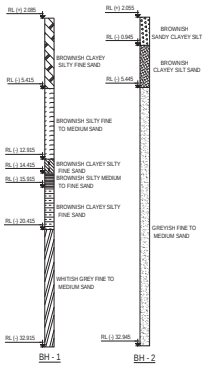




SECTION AT ABUTMENT LOCATION



SECTION AT PIER LOCATION



HYDRAULIC PARTICULARS

HIGH FLOOD LEVEL	RL(+)3.350
LOWEST BED LEVEL	RL(+)1.340
SILL LEVEL	RL(+)1.340
VERTICAL CLEARANCE	0.900 m
VELOCITY	1.79 m/sec
DESIGN DISCHARGE	46.45 cumecs
BED SLOPE	1 in 1320
LINEAR WATER WAY	20.000m
LINEAR WATER WAY (EFFECTIVE)	17.800 m
AFFLUX (DESIGN)	0.100 m
AFFLUXED HFL	RL(+)3.450
MAXIMUM SCOUR LEVEL FOR ABUTMENT	RL(+)0.670
MAXIMUM SCOUR LEVEL FOR PIER	RL(−)0.875

LEGEND: –

- ▲ – LIFTING POINT (ELEVATION)
- ⊕ – LIFTING POINT (PLAN)
- HFL – HIGH FLOOD LEVEL
- FRL – FINISHED ROAD LEVEL
- EJ – EXPANSION JOINT
- BL – BED LEVEL
- TYP – TYPICAL
- D/S – DOWN STREAM
- U/S – UP STREAM
- BH – BORE HOLE
- MSL – MAXIMUM SCOUR LEVEL

NOTES: –

1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METRES UNLESS OTHERWISE SPECIFIED.
2. DIMENSION ARE NOT TO BE SCALED. ONLY WRITTEN DIMENSION ARE TO BE FOLLOWED.
3. FOR DETAILED NOTES REFER SEPARATE DRAWING.
4. BEFORE START OF CONSTRUCTION WORK, BRIDGE PIER AND ABUTMENT SHALL BE SET OUT AT SITE AS PER APPROVED DRAWING AND ENSURE THAT FEATURES SUCH AS CENTER LINE, WIDTH OF WATER WAY OR ROAD CROSSING EXACTLY MATCHES WITH VENT WAY PROPOSED IN THE GAD. HORIZONTAL CLEARANCE, VERTICAL CLEARANCE AND SKEW ARE KEY PARAMETERS TO BE FULFILLED IN FIXING THE OPENING SPAN. IF THERE IS ANY DEVIATION ON ABOVE KEY POINTS, THE SAME SHALL BE BROUGHT TO THE ATTENTION OF ENGINEER-IN-CHARGE AND EXECUTED AS DIRECTED BY HIM.

PREPARED BY :

Japan International Cooperation Agency (JICA)

JICA Study Team constituted by
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PADECO CO., LTD.

PROJECT :

Note: MNB 101 may become unnecessary due to the end point extension of MJB 101 (to be confirmed at detailed design stage)

PREPARATORY STUDY FOR CHENNAI PERIPHERAL RING ROAD DEVELOPMENT IN INDIA

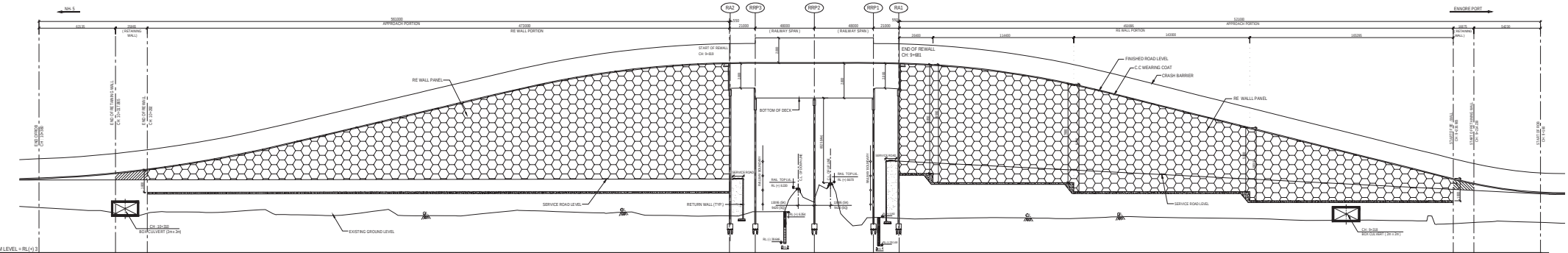
TITLE :

SECTION - 1

GENERAL ARRANGEMENT DRAWING OF

MINOR BRIDGE (MNB) AT CH: 2+475

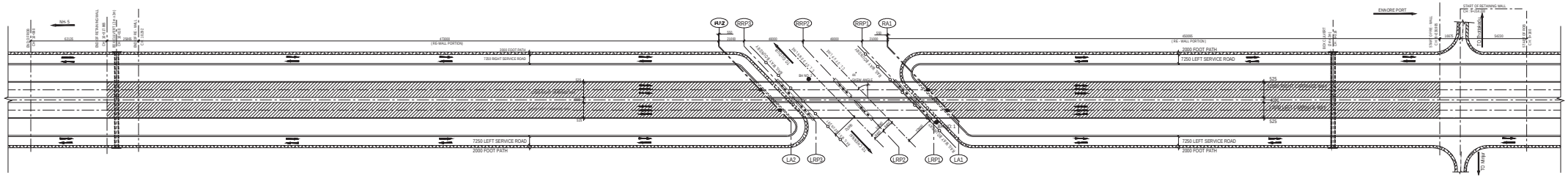
DRAWN		
CHECKED		
APPROVED		
SCALE : 1:100		SHEET NO : 1 / 1
DATE : Jan. 2018		
DRG NO: 17103/E/S1/MNB		



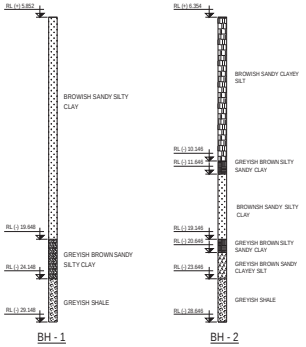
DATUM LEVEL = RL(+) 3

FINISHED ROAD LEVEL	9.045	9.476	9.769	10.560	11.386	11.813	12.754	13.935	15.117	16.296	17.291	17.973	18.403	18.415	18.415	18.435	18.387	17.861	17.087	15.980	14.730	13.480	12.230	10.980	9.730	9.003	8.619	7.902
SERVICE ROAD LEVEL	8.877	8.887	8.890	8.898	8.904	8.907	8.913	8.920	8.928	8.935	8.943	8.950	8.960				10.410	10.049	9.795	9.541	9.287	9.033	8.779	8.525	8.271	8.123	8.018	7.762
EXISTING GROUND LEVEL	6.645	6.154	6.182	6.237	6.470	6.074	5.998	6.117	5.968	6.417	6.253	6.007	5.965	6.307	8.400	5.852	5.772	5.822	5.722	5.870	5.825	5.768	5.638	5.618	5.563	5.344	5.428	5.437
VERTICAL GEOMETRY	R = 10000.000 L = 266.257		P= 2.363% L = 187.037		R= 8000.000 L = 189.005										R= 8000.000 L = 189.005		R= 7500.000 L = 187.500				P= 2.500% L = 285.076						R= 3500.000 L =98.000	
HORIZONTAL GEOMETRY	D = 5298.54																											
CHAINAGE	10+380	10+317.865	10+292	10+240	10+198.5	10+179.8	10+140	10+090	10+040	9+990	9+940	9+890	9+819	9+798	9+750	9+702	9+681	9+610	9+560	9+510	9+460	9+410	9+360	9+310	9+260	9+230.905	9+214.230	9+160

LONGITUDINAL ELEVATION



PLAN



LEGEND:-

- ● - BORE HOLE
- ↑ - LIFTING POINT

BOD	- BOTTOM OF DECK
BH	- BORE HOLE
CH	- CHAINAGE
EJ	- EXPANSION JOINT
FRL	- FINISHED ROAD LEVEL
GL	- GROUND LEVEL
RTL	- RAIL TOP LEVEL
RLY	- RAILWAY
RB	- RAILWAY BOUNDARY
TYP	- TYPICAL
RP	- RAILWAY PIER

PREPARED BY :

Japan International Cooperation Agency (JICA)
JICA Study Team constituted by
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PADECO CO., LTD.

PROJECT :

PREPARATORY STUDY FOR CHENNAI PERIPHERAL RING ROAD DEVELOPMENT IN INDIA

CHENNAI DIVISION

CHENNAI - GUDUR SECTION

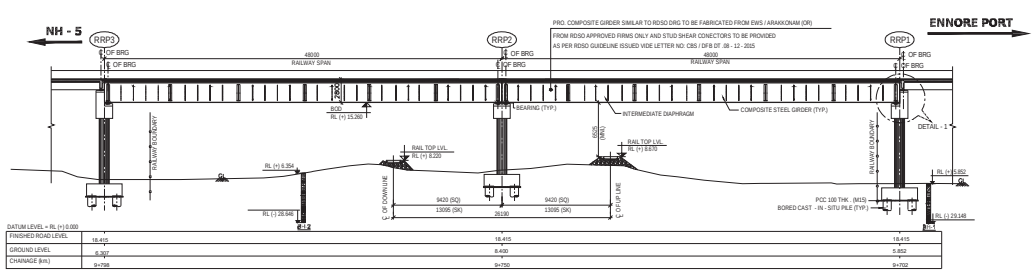
BETWEEN MINJUR AND ANUPPAMBATTU SATATIONS
PROPOSED 2 X 3 LINE ROB AT 26 / 530

TITLE :

SECTION - 1

GENERAL ARRANGEMENT DRAWING OF
ROAD OVER BRIDGE (ROB) AT CH : 9+750

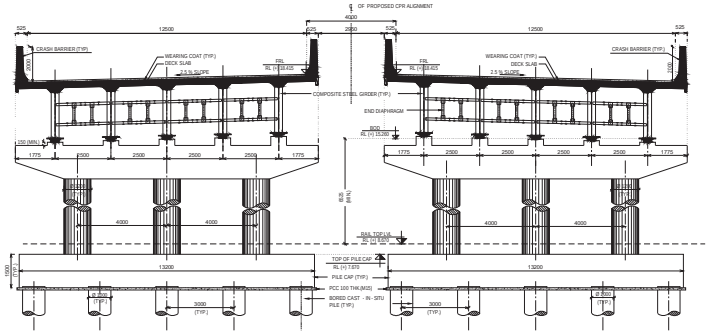
DRAWN		
CHECKED		
APPROVED		
SCALE :	1:100	SHEET NO : 2 / 1
DATE :	Jan. 2018	
DRG NO:	17116/E/S1/ROB	



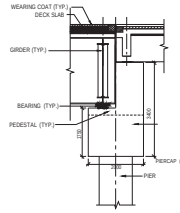
SECTIONAL ELEVATION

DERIVATION OF DECK TOP LVL OF ROB PROPER .

1. RL (RAIL TOP) = 8.670
2. CLEAR HEAD ROOM FROM RAIL TOP = 6.625 (min)
3. DEPTH OF ROAB SUPERSTRUCTURE = 2.8 + 0.075 + 281
4. PROPOSED ROAD LVL = 18.415



SECTION A-A



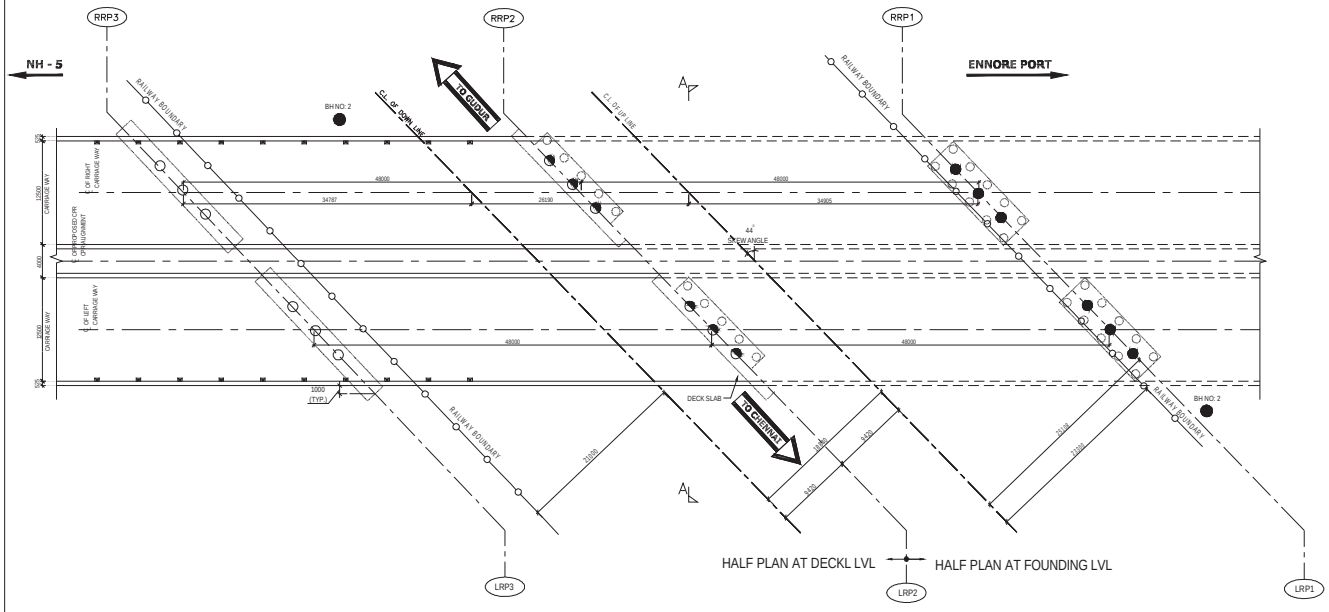
DETAIL - 1

INSPECTION PLATFORM FOR ROUTINE INSPECTION AND MAINTENANCE OF BEARINGES SHOULD BE PROVIDED

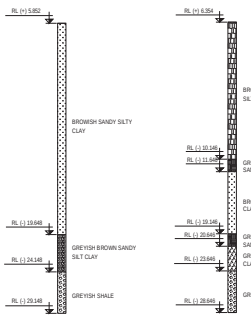
SPECIAL NOTES FOR 25 KV AC ELECTRIFICATION SYSTEM: -

1. ALL NECESSARY PROTECTIVE ARRANGEMENTS SHALL BE MADE TO AVOID ANY ELECTRICAL INDUCTION DURING CASTING AND LAUNCHING.
2. OHE TRACTION CONDUCTIONS SHALL BE SUITABLY LOWERED BEFORE THE COMMENCEMENT OF TEMPORARY STAGING SHALL WORK SO THAT VERTICAL CLEARANCE BETWEEN THE TOP MOST OHE CONDUCTOR AND THE BOTTOM OF FRP SHEET UNDER TEMPORARY STAGING SHALL NOT BE LESS THAN 320 mm
3. THE CATENERY WIRE UNDER THE PRPOSED ROB SHALL BE PROVIDED WITH INSULATED CATENARY WIRE BY TRD / CN BRANCH BEFORE COMMENCEMENT OF ANY TEMPORARY STAGING WORK.
4. SINCE CLEARANCE BETWEEN THE TOP MOST OHE CONDUCTOR AND THE PROPOSED BOTTOM MOST GIRDER DURING THE CONSTRUCTION STAGE IS LESS THAN 2.0 m FRP SHEETS OF 3 mm TK. SHALL BE PROVIDED UNDER THE ROB FOR PROTECTION OF MEN MATERIAL . IT SHALL BE ENSURED THAT THE FRP SHEETS COVER OHE UPTO 1.0 m ON BOTH SIDES OF ROB. (FOR DETAILS OF FRP SHEET ARRANGEMENTS REFER CAO / CN). DRG . NO . 3013 / TW CFT / 001 SHEET 1 & 2).
5. WHILE ERECTING TEMPORARY GIRDERS ABOVE THE OHE AND ALSO DURING ANY WORK INVOLVING LESS THAN 2.0 m WORKING CLEARANCE FROM THE OGE . THE WORK SHALL BE CARRIED OUT ONLY NDER POWER BLOCK CONDITION BY OBTAINING PERMIT TO WORK FROM AUTHORIZED CN / TRO BRANCH OFFICIALS
6. ALL STEEL STRUCTURES AND TEMPORARY GIRDERS INVOLVING THE ABOVE WORK SHALL BE SUITABLY EARTHED TO THE TRACTION RAILS / SEPARATE EARTH PIPE FOR SAFETY OF WORKING STAFF .
7. INSULATING PAINT SHOULD BE APPLIED UNDERNEATH OF THE ROB (1 m WITH 0.5 m BOTH SIDE OF THE CONDUCTOR) AFTER COMPLETION OF THE WORK.
8. FRP SHEET FIXING TO TOP SUPPORTS SHOULD BE DONE USING STRONG INSULATING MATERIAL ONLY .
9. GIRDERS WILL BE LAUNCHED WITHOUT DISTURBING OHE .

1. ALL DIMENSION ARE IN MILLIMETERS AND LEVELS ARE IN METERS
2. LOADING : IRC CLASS 'A' 3 LANE / CLASS 'A' 1 LANE + 70R (W)CLASS 70R(W) 3 LANE WHICHEVER GOVERNS THE DESIGN
3. GRADE OF STRUCTURAL STEEL : GRADE B,FE 410WB, YIELD STRENGTH 250 Mpa, COMFORMING TO IS: 2062 (WELDABLE QUALITY)
4. PLAIN CONCRETE SHALL BE MINIMUM OF M 15.
5. REINFORCEMENT CEMENT CONCRETE WORKS TO BE MINIMUM M 125 WITH 20 mm GRADED STONE AGGREGATE.
6. HIGH STRENGTH DEFORMED BAR (TMT) SHALL CONFORM TO IS: 1786 - 2008 (Fe 500).
7. BAR BENDING SHALL CONFORM TO IS: 2502.
8. STRUCTURE PROPER ONLY WITH IN RAILWAY LIMITS WILL BE MAINTAINE BY RAILWAYS
9. NECESSARY GUARD RAILS SHALL BE PROVIDED IN THE TRACKS AT ROB LOCATION.
10. THE SIZE OF THE PILE CAP, PIER AND ARE TENTATIVELY INDICATED. THIS HAS TO BE DECIDED BASED ON DETAILED DESIGN CALCULATION HOWEVER THE BOTTOM OF GIRDER LEVEL INDICATED IS FINAL.
11. POT PTFE BEARING SHALL BE USED FOR THE COMPOSITE GIRDER SUPER STRUCTURE.
12. DECK SLAB SHALL ONLY BE CONCRETED WITH FORM WORK SUPPORTED FROM ERCTED STEEL GIRDERS.
13. ALL STRUCTURAL STEEL MEMBERS SHALL BE PAINTED WITH ONE COAT OF EPOXY PAINT OR EQUIVALENT.
14. ALL THE WORKS ARE TO BE CARRIED OUT AS PER THE STANDARD SPECIFICATION FOR ROAD AND BRIDGE.
15. EXISTING TELEGRAPH POSTS , ELECTRIC POSTS , SINGLE CABLES & WATER MAIN ETC. IF ANY AFFECTED BY THE PROPOSALS WITH IN THE RAILWAY BOUNDARY TO BE SHIFTED SUITABLY BY THE RESPECTIVE DEPARTMENTS BY THE ROAD AUTHORITY.
16. SUITABLE DRAINAGE ARRANGEMENTS IN SIDE & OUTSIDE THE RAILWAY LIMITS .
17. NO CONSTRUCTION JOINTS SHALL BE NORMALLY ALLOWED IN CONNCRETE WORKS WITHOUT SPECIAL PRECAUTIONS AS PER RELEVANT BRIDGE CODE AND SUITABLE PROTECTIVE PAINTING OF APPROVED MAKE SHOULD BE USED TO PAINT FOR UNDERSIDE OF CONCRETE / STEEL GIRDER .
18. MAINTENANCE OF ROAD SURFACE AFTER THE COMPLETION OF THE ROB TO BE DONE BY ROAD AUTHORITIES IN SIDE AND OUTSIDE THE RAILWAY LIMITS.
19. NO CONSTRUCTION JOINTS SHALL BE ALLOWED IN P.S.C (OR) R.C.C SLAB (OR) GIRDER AND CURING OF ALL CONCRETE AND MASONRY WORK AS PER THE RELEVANT CODE PRACTICE SHALL BE ENSURED BEFORE USE.
20. THE CONTROLLED CONCRETE WITH WEIGH BATCHING SHALL BE USED AND THE WORK SHALL BE SUPERVISED BY ABE or AEN HAVING EXPERIENCE IN BRIDGE CONSTRUCTION.
21. MAINTENANCE OF ROAD OUTSIDE SURFACE AFTER COMPLETION OF THE ROAD OVER BRIDGE TO BE DONE BY ROAD AUTHORIZED INSIDE AND OUTSIDE THE RAILWAY LIMITS.
22. STRRUCTURE PROPER ONLY WITH IN RAILWAY LIMITS WILL BE MAINTAINED BY RAILWAYS AS PER MOU DATED 10.11.2014 AND THE REST WILL BE MAINTAINED BY ROAD AUTHORITIES.
23. IF THE APPROACHES INFRINGE ANY EXISTING STRUCTURES SUCH AS CANAL ETC. THE SAME SHOULD BE REBUILT AT NH COST.
24. SPECIAL NOTE : - PRECAUTIONARY MEASURES ISSUED BY ADVISOR (CIVIL ENGG) RLY BD LETTER NO: 97 / CE - 1 /158 (POLICY) / PT II DT 16 / 07 / 2009 FOR CONSTRUCTION OF ROB ON DEPOSIT TERMS SHALL BE ENSURED .
25. CRS SANCTION MUST BE TAKEN BEFORE STARTING WORKSAFFECTING SAFETY OF PASSENGER RUNNING LINES.
26. SUITABLE SPEED RESTRICTION , IF REQUIRED SHOULD BE IMPOSED BEFORE TAKING UP THE EXECUTION OF WORK WITH THE APPROVAL OF DIVISION ENGINEER IN CHARGE
27. DURING THE CONSTRUCTION OF ROB , ALL THE EXISTING STRUCTURE / TRACK SHALL BE PROTECTED BY PROVIDING PROPER SHORING ARRANGEMENT . IF REQUIRED WITH THE APPROVAL OF DIVISION ENGINEER - IN - CHARGE
28. ALL THE PRE FABRICATED STEEL GIRDERS SHOULD BE LAUNCHED WITH SUITABLE . LAUNCHING SCHEME AS PER SITE REQUIREMENT . WITH THE APPROVAL OF RAILWAY AND AFTER OBTAINING CRS SANCTION
29. ROAD AUTHORITY SHOULD ENSURE THAT BEFORE LAYING ANY NEW WEARING COAT IN FUTURE . EXISTING WEARING COAT SHOULD BE COMPLETELY REMOVED
30. THE FORM WORK FOR CASTING DECK SLAB CAN BE SUPPORTED ON STEEL GIRDER WITH OUT ANY PROPS ON GROUND
31. IN CASE CRANES ARE USED FOR PLACEMENT OF COMPOSITE SPAN AND APPROACH SLAB THE CAPACITY OF THE CRANE AT REQUIRED RADIUS SHALL BE VERIFIED AND RECONCILED BEFORE EXECUTION OF WORK
32. SAFETY PRECAUTION & MEASURES ADVISED VIDE RLY BOARDS LETTER NO:97 /CE - 1 / 1 / BRO / 15B (POLICY) PT - II . DATED 16 - 07- 2009 &29 -09 -2009 SHALL BE ENSURED
33. IN THIS DRAWING THE MAXIMUM REDUCED LEVEL OF RAIL TOP IS TAKEN AS RL : 41.00 m WHICH IS W.R.T GST BENCH MARK.
34. THE PIER AND ABUTMENT POSITIONS SHOWN IN PLAN MAY NOT MATCH WITH POSITIONS SHOWN IN THE ELAVATION DE TO CURVES ALONE THE ALIGNMENT
35. COMPOSITE GIRDERS SHALL BE CONSTRUCTED AS PER RDSO GUIDELINES ISSUED VIDE LETTER NO: CBS / DFB DT . 8.12.2015.



HALF PLAN AT DECKL LVL — HALF PLAN AT FOUNDING LVL



LEGEND:-
- BORE HOLE
- LIFTING POINT
BOD - BOTTOM OF DECK
BH - BORE HOLE
CH - CHAINAGE
EJ - EXPANSION JOINT
FRL - FINISHED ROAD LEVEL
GL - GROUND LEVEL
RTL - RAIL TOP LEVEL
RLY - RAILWAY
RB - RAILWAY BOUNDARY
TYP - TYPICAL
RP - RAILWAY PIER

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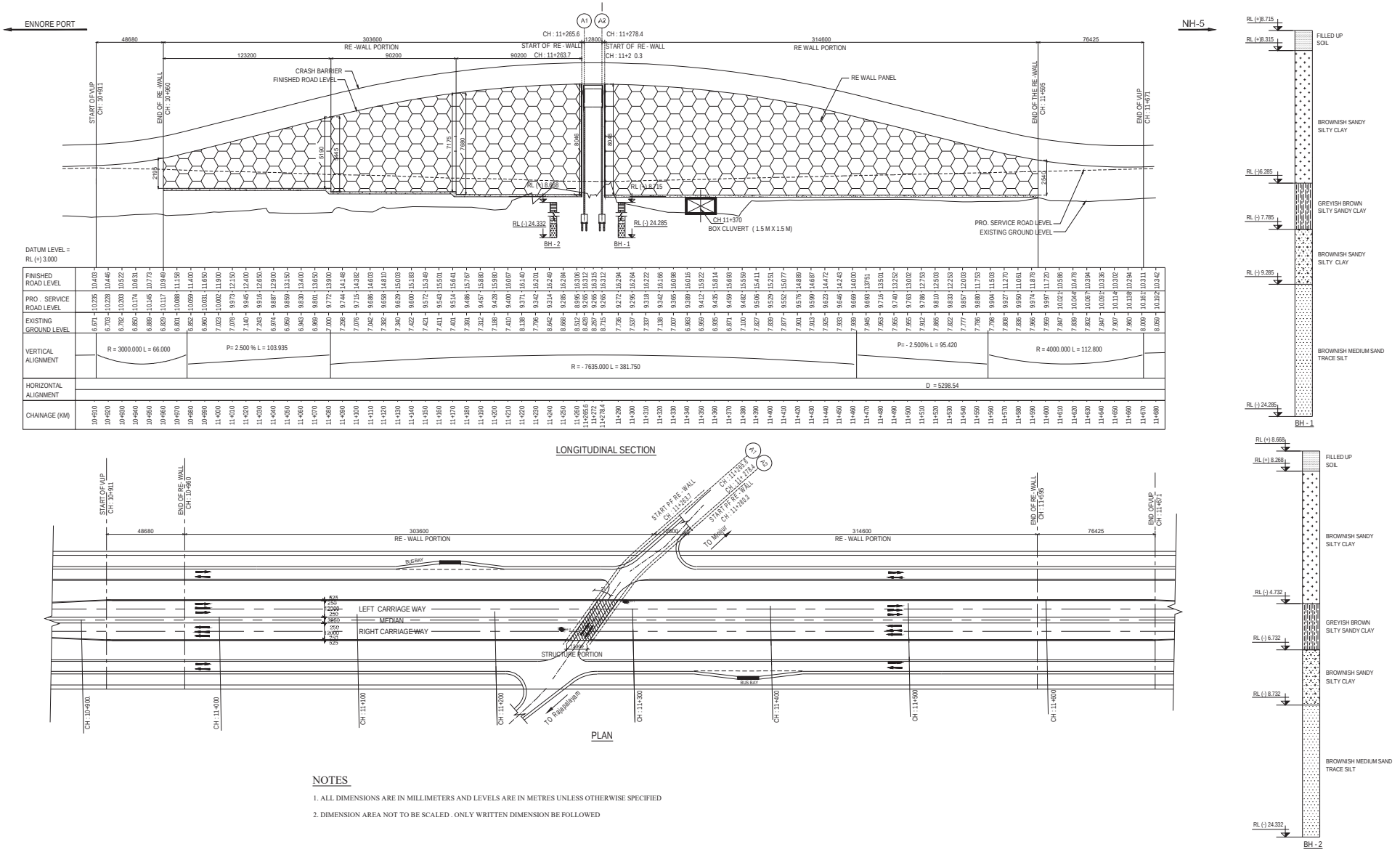
DRAWN		
CHECKED		
APPROVED		
SCALE :	1:200	SHEET NO : 2 / 2
DATE :	Jan. 2018	
DRG NO:	17117/E/S1/ROB	



NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METRES UNLESS OTHERWISE SPECIFIED
2. DIMENSION AREA NOT TO BE SCALED . ONLY WRITTEN DIMENSION BE FOLLOWED

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PROJECT :

PREPARATORY STUDY FOR CHENNAI PERIPHERAL RING ROAD DEVELOPMENT IN INDIA

TITLE :

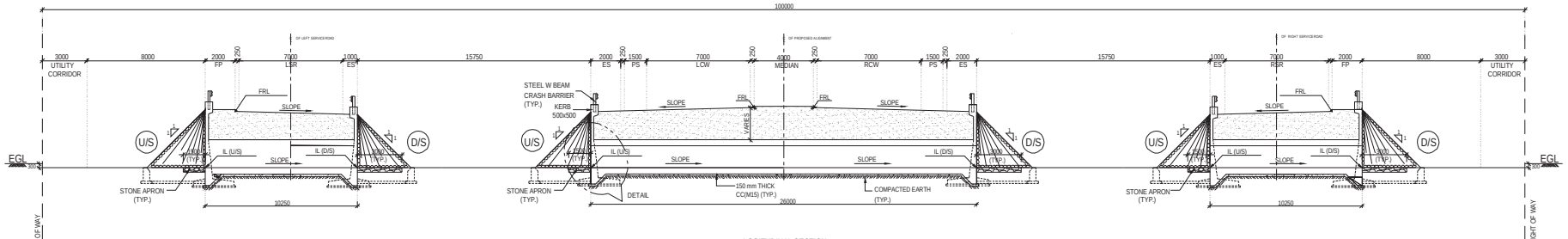
SECTION - 1

GENERAL ARRANGEMENT DRAWING OF

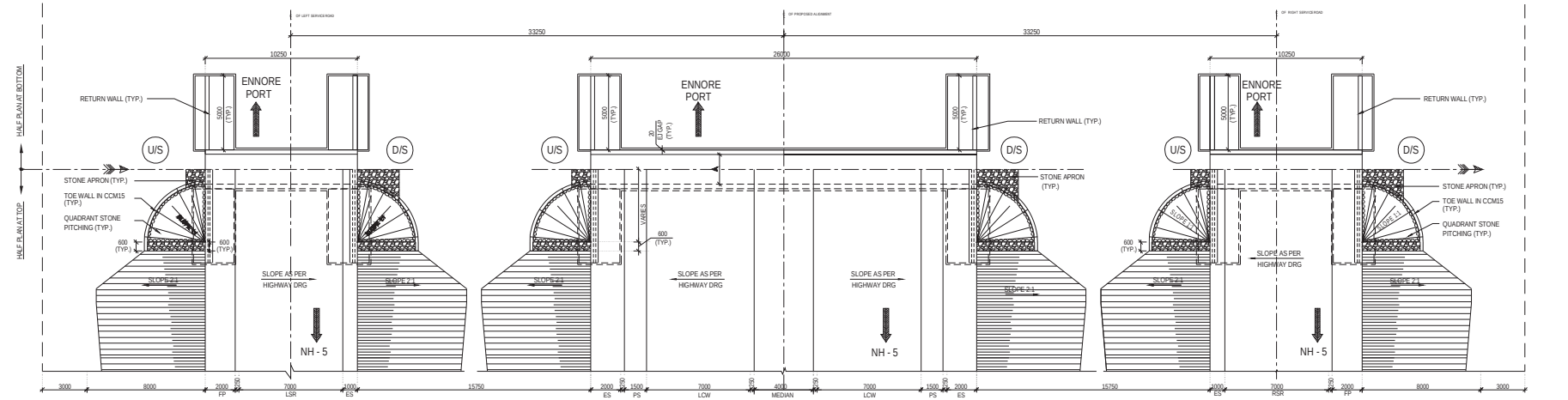
VEHICULAR UNDERPASS

(VUP) AT CH : 11+272

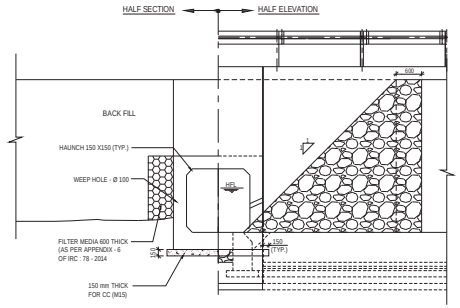
DRAWN	
CHECKED	
APPROVED	
SCALE : 1:100	SHEET NO : 1 / 1
DATE : Jan. 2018	
DRG NO: 17102/E/S1/VUP	



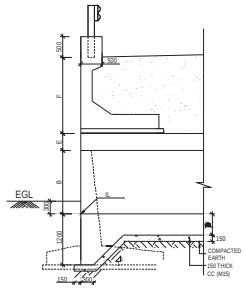
LOGITUDINAL SECTION



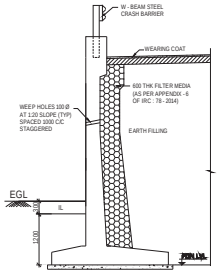
PLAN



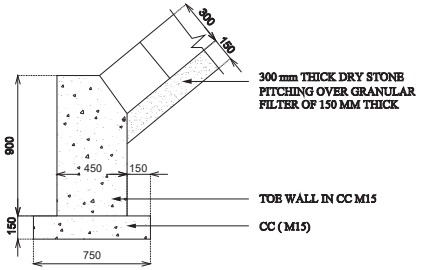
SECTIONAL ELEVATION



LOGITUDINAL SECTION OF BOX - DETAIL AT END



C/S OF RETURN WALL (TYP.)



DETAILS OF TOE WALL

LEGEND:-

- LCW - LEFT CARRIAGE WAY
- RCW - RIGHT CARRIAGE WAY
- LSR - LEFT SERVICE ROAD
- RSR - RIGHT SERVICE ROAD
- U/S - UP STREAM
- D/S - DOWN STREAM
- FRL - FINISHED ROAD LEVEL
- IL - INVERT LEVEL
- FP - FOOT PATH
- PS - PAVED SHOULDER
- ES - EARTHEN SHOULDER
- EGL - EXISTING GROUND LEVEL
- HFL - HIGH FLOOD LEVEL
- FDN LVL - FOUNDING LEVEL
- TYP - TYPICAL

NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METRES UNLESS OTHERWISW SPECIFIED.
2. FOR DETAILED NOTE SREFER SEPARATE DRAWING
3. FRL AND SLOPE OF ROADS SHALL BE AS PER RELEVANT HIGHWAY DRAWING
4. FOR LEVELS , DIMENSIONS AND BE DSLOPE OF BOX CULVERT REFER DRAWING NO: 14518 / E / S1 / BC/ DD / - 003 (SH2 OF 2)
5. FOR DETAILS OF RETURN WALL REFER DRAWING NO: 14518 / E / S1 / BC / DD - 011

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PROJECT :

PREPARATORY STUDY FOR CHENNAI PERIPHERAL RING ROAD DEVELOPMENT IN INDIA

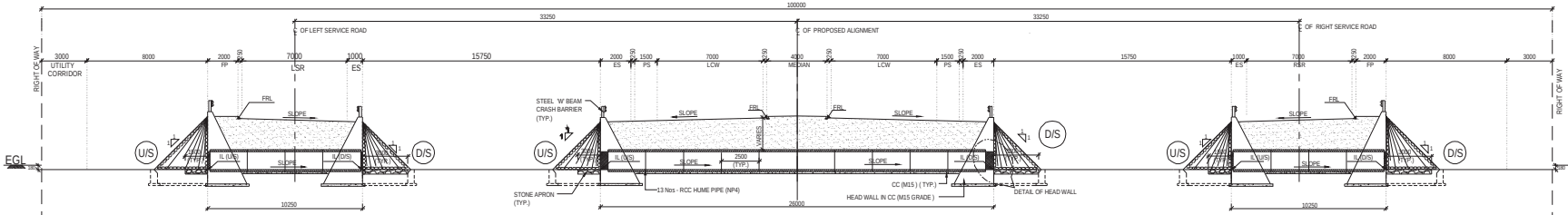
TITLE :

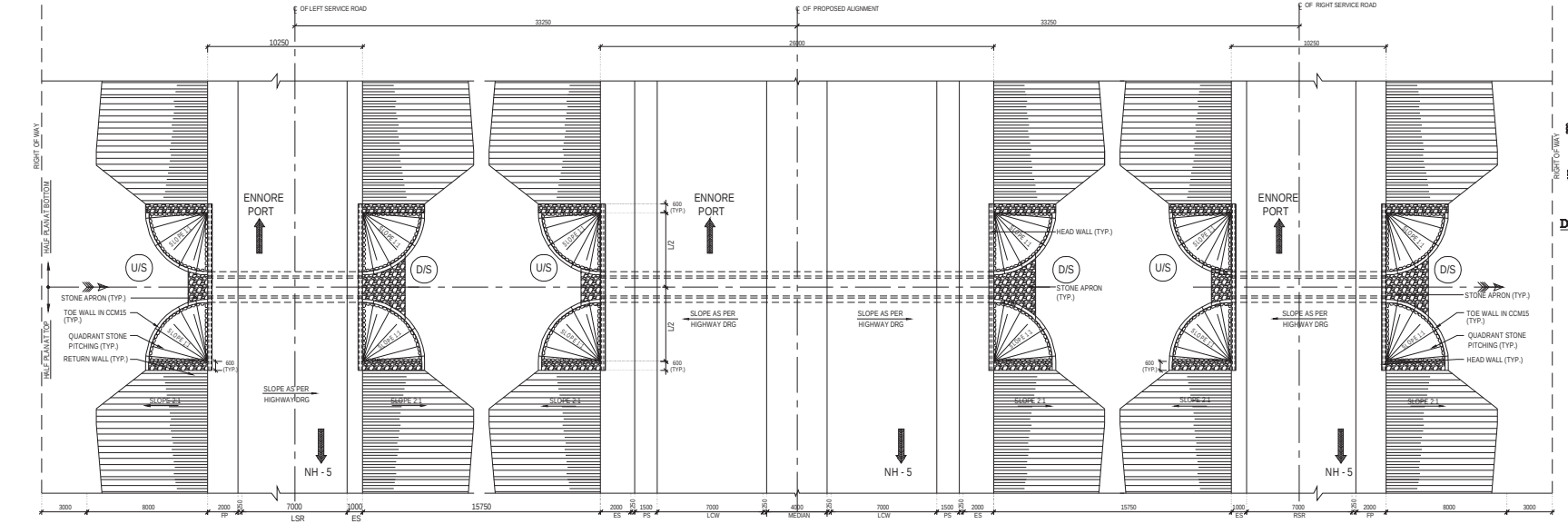
SECTION - 1

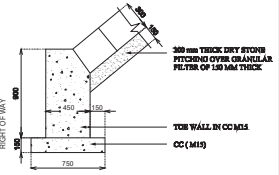
GENERAL ARRANGEMENT DRAWING OF

BOX CULVERT (BC) AT EMBANKMENT LOCATION

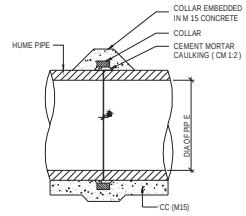
DRAWN	
CHECKED	
APPROVED	
SCALE : 1:100	SHEET NO : 2 / 1
DATE : Jan. 2018	
DRG NO: 14518/E/S1/BC/DD - 003	







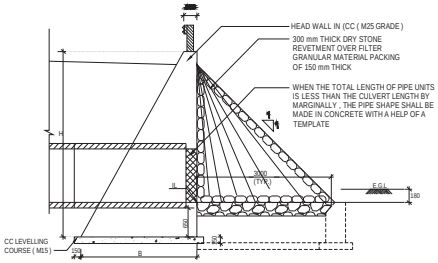
DETAILS OF TOE WALL



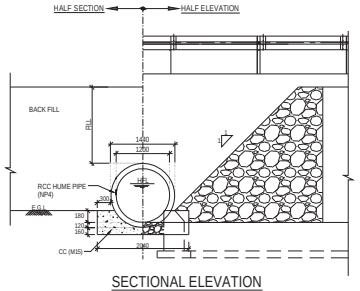
DETAILS OF PIPE JOINT

DETAILS OF PIPE CULVERT :

S.NO	CHAINAGE (km)	LEVELS									OTHER INFORMATION					
		LEFT SERVICE ROAD			MAIN CARRIAGEWAY			RIGHT SERVICE ROAD								
		FRL	IL (U/S)	IL (D/S)	FRL	IL (U/S)	IL (D/S)	FRL	IL (U/S)	IL (D/S)	FILL	BED SLOPE	DIRECTION OF FLOW	H	B	L/2
1	18+360	16.361	13.579	13.576	16.511	13.570	13.562	16.361	13.556	13.553	1555	1 IN 3000	LEFT TO RIGHT	4000	2550	3625
2	18+590	15.873	14.016	14.002	16.323	13.979	13.942	15.873	13.920	13.905	985	1 IN 700	LEFT TO RIGHT	3500	2200	3000
3	19+360	17.312	14.854	14.820	17.463	14.767	14.681	17.312	14.628	14.594	1390	1 IN 300	LEFT TO RIGHT	3500	2200	3375
4	19+560	16.712	14.514	14.488	16.863	14.449	14.384	16.712	14.345	14.319	1085	1 IN 400	LEFT TO RIGHT	3500	2200	3125
5	19+810	17.108	14.349	14.332	17.258	14.306	14.262	17.108	14.236	14.219	1600	1 IN 600	LEFT TO RIGHT	4000	2550	3625



DETAIL OF HEAD WALL



SECTIONAL ELEVATION

LEGEND:-

LCW - LEFT CARRIAGE WAY
RCW - RIGHT CARRIAGE WAY
LSR - LEFT SERVICE ROAD
RSR - RIGHT SERVICE ROAD
U/S - UP STREAM
D/S - DOWN STREAM
FRL - FINISHED ROAD LEVEL
IL - INVERT LEVEL
FP - FOOT PATH
PS - PAVED SHOULDER
ES - EARTHEN SHOULDER
EGL - EXISTING GROUND LEVEL
HFL - HIGH FLOOD LEVEL
TYP - TYPICAL

NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METRES UNLESS OTHERWISW SPECIFIED.
2. FOR DETAILED NOTES REFER SEPARATE DRAWING
3. DIRECTION OF FLOW SHALL BE READ FROM THE TABLE WITH RESPECT TO INCREASING CHAINAGE .
4. FRL AND SLOPE OF ROADS SHALL BE AS PER RELEVANT HIGHWAY DRAWINGS .
5. FOR DETAILS OF RETURN WALL REFER DRAWING NO: 14518 / E / S1 / BC / DD - 011

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PROJECT :

PREPARATORY STUDY FOR CHENNAI PERIPHERAL RING ROAD DEVELOPMENT IN INDIA

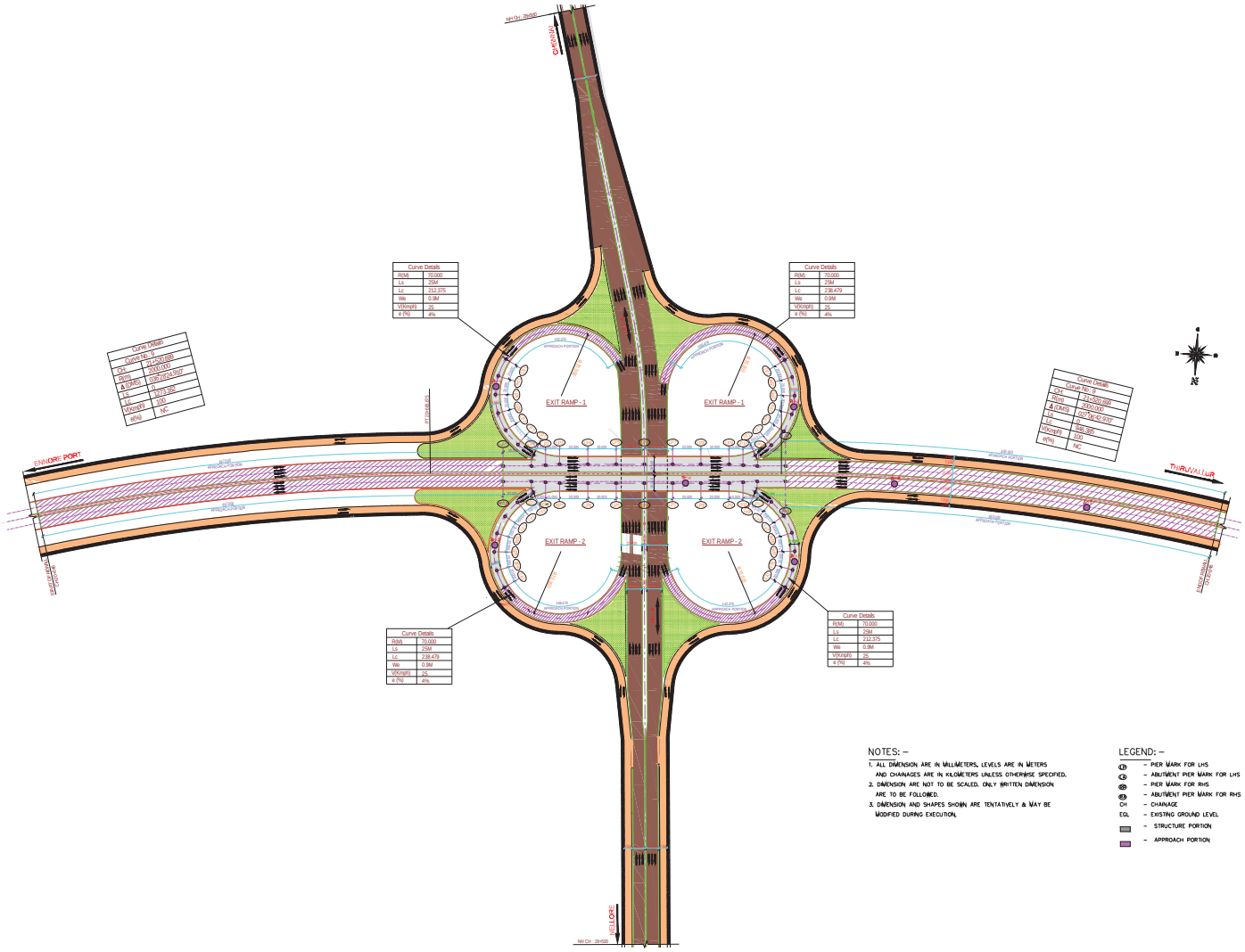
TITLE :

SECTION - 1

GENERAL ARRANGEMENT DRAWING OF

PIPE CULVERT (PC) TYPE - 1

DRAWN	
CHECKED	
APPROVED	
SCALE : 1:100	SHEET NO : 2 / 2
DATE : Jan. 2018	
DRG NO: 14518/E/S1/PC/DD-001	



NOTES: –

1. ALL DIMENSION ARE IN MILLIMETERS, LEVELS ARE IN METERS AND CHAINAGES ARE IN KILOMETERS UNLESS OTHERWISE SPECIFIED.
2. DIMENSION ARE NOT TO BE SCALED. ONLY WRITTEN DIMENSION ARE TO BE FOLLOWED.
3. DIMENSION AND SHAPES SHOWN ARE TENTATIVELY & MAY BE MODIFIED DURING EXECUTION.

LEGEND: –

- – PIER MARK FOR LHS
- – ABUTMENT PIER MARK FOR LHS
- – PIER MARK FOR RHS
- – ABUTMENT PIER MARK FOR RHS
- CH – CHAINAGE
- EGL – EXISTING GROUND LEVEL
- – STRUCTURE PORTION
- – APPROACH PORTION

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PROJECT :

PREPARATORY STUDY FOR CHENNAI PERIPHERAL RING ROAD DEVELOPMENT IN INDIA

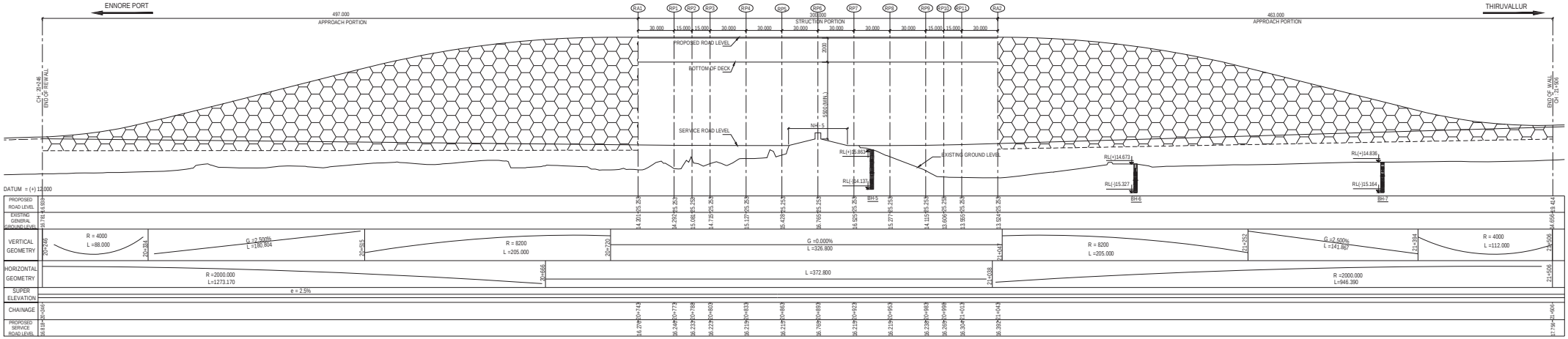
TITLE :

SECTION - 1

GENERAL ARRANGEMENT DRAWING OF

INTER CHANGE AT km 20 + 893 OF NH - 5

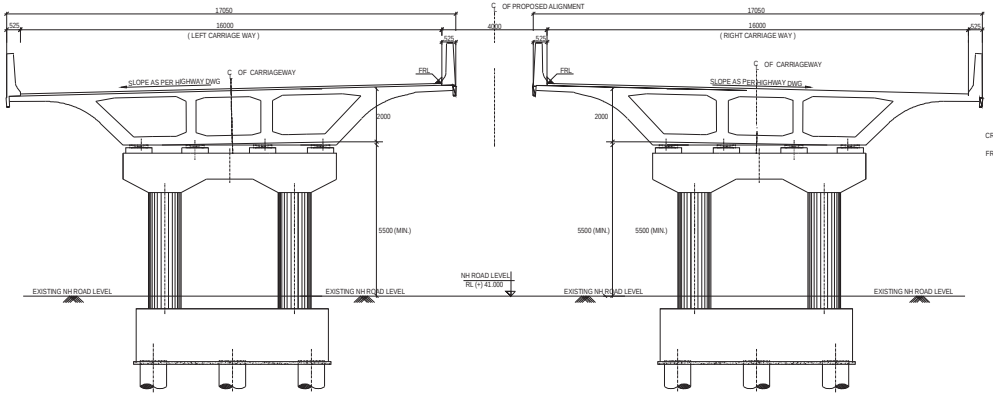
DRAWN	
CHECKED	
APPROVED	
SCALE : 1:100	SHEET NO : 3 / 1
DATE : Jan. 2018	
DRG NO: 14518/E/IC/NH5/DD - 001	



LONGITUDINAL ELEVATION

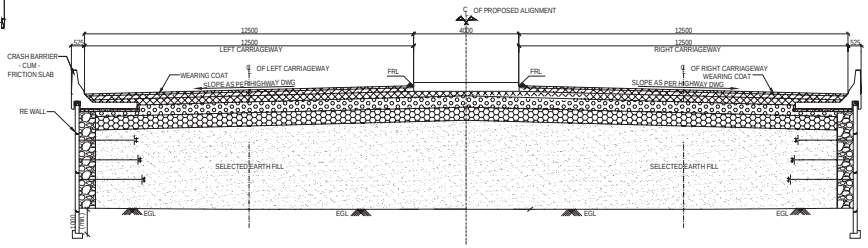
SCALE (H = 1: 1000)

SCALE (V = 1: 100)



TYPICAL CROSS SECTION FOR OBLIGATORY SPAN

(SCALE - 1: 75)



TYPICAL CROSS SECTION AT APPROACH PORTION

(SCALE - 1: 75)

NOTES:-

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LEGEND:-

- P1 - PIER MARK FOR LHS
- A1 - ABUTMENT PIER MARK FOR LHS
- P2 - PIER MARK FOR RHS
- A2 - ABUTMENT PIER MARK FOR RHS
- CH - CHAINAGE
- EGL - EXISTING GROUND LEVEL
- DWG - DRAWING
- STRUCTURE PORTION
- APPROACH PORTION

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CTI ENGINEERING INTERNATIONAL CO., LTD.
PADECO CO., LTD.

PROJECT :

PREPARATORY STUDY FOR CHENNAI PERIPHERAL RING ROAD DEVELOPMENT IN INDIA

TITLE :

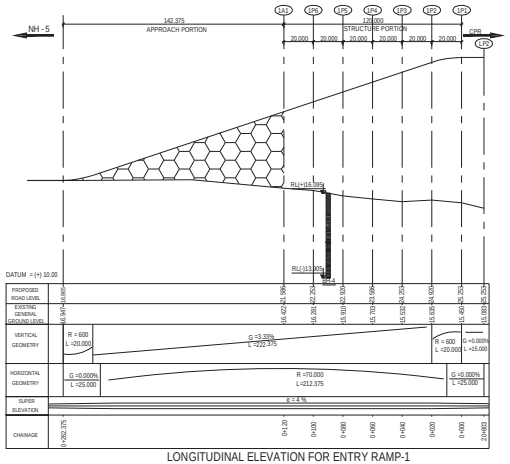
SECTION - 1

GENERAL ARRANGEMENT DRAWING OF

INTER CHANGE AT km 20 + 893 OF NH - 5

DRAWN		
CHECKED		
APPROVED		
SCALE :	1:100	SHEET NO : 3 / 2
DATE :	Jan. 2018	
DRG NO:	14518/E/IC/NH5/DD - 001	

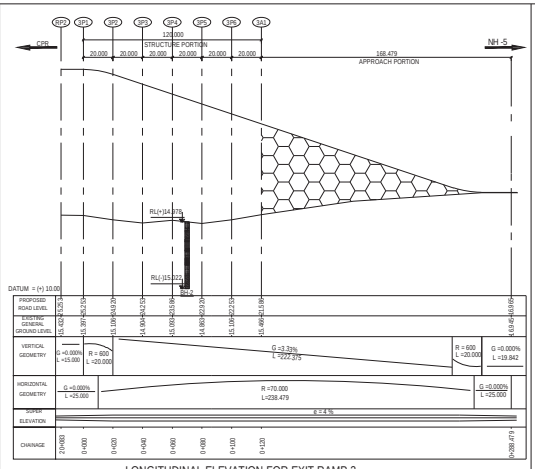
PIER



LONGITUDINAL ELEVATION FOR ENTRY RAMP-1

SCALE (H = 1:1000)

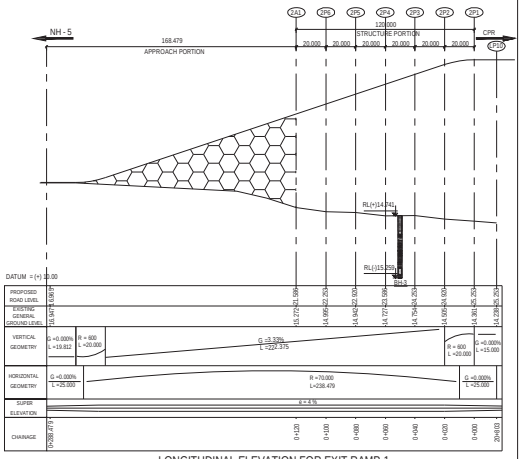
SCALE (V = 1:100)



LONGITUDINAL ELEVATION FOR EXIT RAMP-2

SCALE (H = 1:1000)

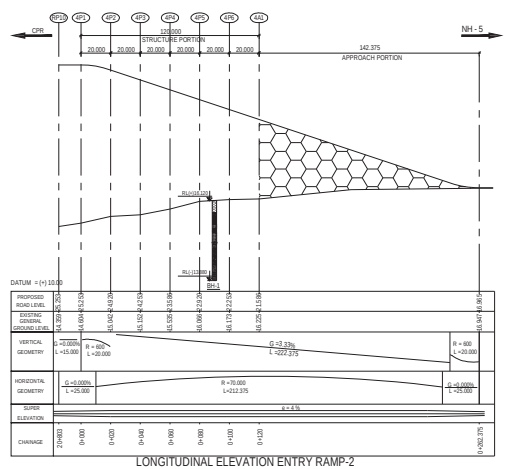
SCALE (V = 1:100)



LONGITUDINAL ELEVATION FOR EXIT RAMP-1

SCALE (H = 1:1000)

SCALE (V = 1:100)



LONGITUDINAL ELEVATION ENTRY RAMP-2

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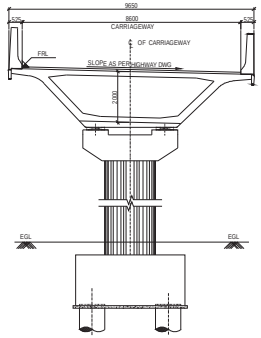
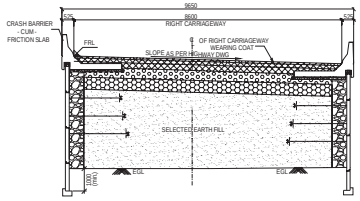
SCALE (V = 1:100)



TYPICAL CROSS SECTION

(SCALE - 1: 75)



TYPICAL CROSS SECTION AT APPROACH PORTION

(SCALE - 1: 75)

NOTES:-

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LEGEND:-

- 1P - PIER MARK FOR LHS
- 1A - ABUTMENT PIER MARK FOR LHS
- 2P - PIER MARK FOR RHS
- 2A - ABUTMENT PIER MARK FOR RHS
- CH - CHAINAGE
- EGL - EXISTING GROUND LEVEL
- DWG - DRAWING
- - STRUCTURE PORTION
- - APPROACH PORTION

PREPARED BY :

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PADECO CO., LTD.

PROJECT :

PREPARATORY STUDY FOR CHENNAI PERIPHERAL RING ROAD DEVELOPMENT IN INDIA

TITLE :

SECTION - 1

GENERAL ARRANGEMENT DRAWING OF

INTER CHANGE AT km 20 + 893 OF NH - 5

DRAWN		
CHECKED		
APPROVED		
SCALE :	1:100	SHEET NO :
DATE :	Jan. 2018	3 / 3
DRG NO:	14518/E/IC/NH5/DD - 001	

Appendix-9: Documents for Environmental and Social Considerations

1	Environmental Management Plan
2	Environemental Monitoring Plan
3	Environemental Monitoring Form
4	RAP Monitoring Form

Environmental Management Plan

Environmental Management Plan is shown in following Table. Underlined items are not included in the DPR 2017, but added in the Draft EIA Report submitted to TNSPCB in April.

Table Environmental Management Plan

No.	Items	Mitigation Measures	Implementation	Supervision	Cost(INR)
Construction					
1	Air Pollution	(Dust) ・ All earth work will be protected in manner acceptable to the engineer to minimize generation of dust. Area under construction will be covered & equipped will dust collector. ・ During sub grade construction, sprinkling of water should be carried out at least twice a day on a regular basis during the entire construction period especially in the winter and summer seasons. (Emission) ・ All precautions to reduce the level of dust emissions from the hot mix plants will be taken. The hot-mix plants should be sited at least 500 m from the nearest habitation and from major water bodies. They should be fitted with dust extraction units. ・ All vehicles, equipment and machinery used for construction should be fitted with latest air pollution control equipment and should be regularly maintained to ensure that the emission levels are as per norms of PCB.	Contractor	HMPD	Included in construction cost

No.	Items	Mitigation Measures	Implementation	Supervision	Cost(INR)
		· Idling of delivery trucks or other equipment should not be permitted during periods of unloading or when they are not in active use.			
2	Water Pollution	· No labor camps, stone crushers, hot mix plants and other heavy machinery should be located near to water bodies. No discharge from such establishments should follow their path into nearby water bodies · No discharge from such establishments should follow their path into nearby water bodies.	Contractor	HMPD	5,563,000 (Oil Interceptors, Recharge pits, Deepening of ponds)
3	Waste	· Selection of the disposal sites will be carried out in consultation with the State Pollution Control Board · Every newly constructed bus stops will be furnished with dust bins · There will be provided within the precincts of every workplace, latrines and urinals in an accessible place, and the accommodation, Unless otherwise arranged for by the local sanitary authority, arrangement for proper disposal of excreta by incineration at the workplace will be made by means of a suitable incinerator approved by the local medical health or municipal authorities.	Contractor	HMPD、SPCB	Included in construction cost
4	Soil	· Silt fencing to be provided.	Contractor	HMPD	Included in construction

No.	Items	Mitigation Measures	Implementation	Supervision	Cost(INR)
	Contamination	· Oils and chemicals will be stored indoor. · Generators and machineries will be equipped with oil guard that will prevent oil leaks. · Oil Interceptor will be provided for accidental spill of oil and diesel. · Fuel storage and fueling areas will be located at least 300m from all cross drainage structures and significant water bodies			cost
5	Noise and Vibration	· Noisy construction operations in residential and sensitive areas should be done only between 7.30 am and 6.00 pm. · Sound barriers will be installed during the construction phase to protect the inhabited areas from the noise from construction activities. · Idling of temporary trucks or other equipment should not be permitted during periods of loading / unloading or when they are not in active use. · Stationary construction equipment will be kept at least 500 m away from sensitive receptors. · Noise barrier walls of 500 m will be constructed at 9 locations (total 4,500 m) where residences are near to Section 1.	Contractor	HMPD	Noise barrier walls : Cost will be calculated after final locations and sizes are decided. Other measures: Included in construction cost
10	Ecosystem	· Plant saplings 10 times of the number of felling trees.	Contractor /DFO	HMPD	2,715,000

No.	Items	Mitigation Measures	Implementation	Supervision	Cost(INR)
		・ Felling 181 trees. Unit cost INR 1,500.			
		・ Transplanting affected trees girth size below 90 cm to nearby places. ・ Transplanting 406 trees. Unit price INR 6,000	Contractor /DFO	HMPD	2,436,000
		・ （Section 5） Secure the double size of the RF area to be converted by the Section 5, and provide afforestation fee.	HMPD/DRO/ DFO	HMPD	Included in the land acquisition cost
		・ Design an efficient drainage plan based on the field observation of watershed and topography to avoid and minimize impacts by runoff soil on surrounding habitats in Operation Phase. ・ Design and construct stable slopes, efficient drainage facilities and plant cover on the berm to avoid / minimize impacts by runoff soil on surrounding habitats in Operation Phase.	Construction Supervision Consultant/ Contractor	HMPD	Included in construction cost
		・ During Construction Phase, cover the berm with protective mat/sheet especially in rainy season and construct temporal drainage ditches to avoid / minimize impacts by runoff soil on surrounding habitats.	Contractor/ Construction Supervision Consultant	HMPD	Included in construction cost
11	Hydrological Situation	・ HMPD/Contractor will discuss, agree with PWD, and implement the agreed plan, to secure the water storage capacity of the affected water bodies by such as compensatory digging where	HMPD/ Contractor	HMPD	Included in construction cost

No.	Items	Mitigation Measures	Implementation	Supervision	Cost(INR)
		water area is to be filled.			
13	Involuntary resettlement loss of land and asset, business relocation	· Compensation for loss, assistance for relocation and livelihood assistance will be implemented with good discussion and consulting with PAHs and transparent procedure.	Project Implementation Team (PIT) in TNRDC / NGO(Consultant)	HMPD	Included in the RAP implementation cost
14	The poor	· Compensation for loss, assistance for relocation and livelihood assistance will be implemented with good discussion and consulting with PAHs and transparent procedure.	PIT in TNRDC / NGO(Consultant)	HMPD	Included in the RAP implementation cost
16	Local economy, employment and living, livelihood	· (Section 1) No negative impact · (Sections2,3,5) Minimize negative impact on local economy caused from stoppage of road side business operations, by means such as encouraging earlier set-back in the house lot, concentrating construction works on one side of the road.	PIT in TNRDC / NGO(Consultant)	HMPD	Included in construction cost and RAP implementation cost
18	Water use, water right	· The wastage of water during the construction should be minimized. In case of tapping water from community sources, consent to be obtained from local Administration for the same. · Arrangement for supply and storage of water will be made by the contractor in such a way that the water availability and supply to nearby communities remain unaffected. If a new tube-well is to be bored, proper	Contractor	HMPD, Ground Water Department	Included in construction cost

No.	Items	Mitigation Measures	Implementation	Supervision	Cost(INR)
		sanction and approval by Ground Water Department is needed.			
19	Existing public facilities, road and transportation facilities, social infrastructure, social service	· Identify the common utilities that would be affected such as: telephone cables, electric cables, electric poles, water pipelines, public water taps, etc.	Contractor	HMPD, electricity company, water company, telephone company, etc.	Included in construction cost
		· Schools and other public facilities will be relocated before the clearance to avoid stoppage of the service provision of those facilities.	HMPD/DRO	HMPD	Included in RAP implementation cost
27	Children's right	· Schools will be relocated within the site or to other location prior to the clearance to avoid stoppage of the service provision.	HMPD/DRO	HMPD	Included in RAP implementation cost
		· The contractor will not employ any person below the age of 14 years for any work and no woman will be employed on the work of painting with products containing lead in any form	Contractor	HMPD	Included in construction cost
28	Sanitation, public health, transmittable diseases including HIV/AIDS	· Eliminate environment for mosquito breeding at work areas, yards, office and camp. · Staff of the Project will be provided information on transmittable diseases including HIV/AIDS (included in Item 29)	Contractor	HMPD	Included in construction cost
29	Work environment, occupational safety and health	· Protective footwear and protective goggles to all workers employed on mixing of materials like cement,	Contractor	HMPD	Included in construction cost

No.	Items	Mitigation Measures	Implementation	Supervision	Cost(INR)
		concrete etc. · No man below the age of 18 years and no woman will be employed on the work of painting with products containing lead in any form.			
		· Staff of the Project will be provided 3 capacity building workshops on following topics (considering that the workers may come and go seasonally) ➢ Reporting System ➢ Work safety ➢ Sanitation, public health, transmittable diseases including HIV/AIDS	Consultant/NGOs	HMPD	300,000
30	Accidents, crime	· The construction area should be barricaded at all time in a day with adequate marking, flags, reflectors etc. for safety of general traffic movement and pedestrians · Prevention of accidents involving human beings, animals or vehicles falling or accidents during construction period. This needs to be ensured with proper barricading, signage boards and lighting etc. · The project engineer of HD will plan and direct the contractor to execute the work progressively so that the length of the open excavated trench is minimized in order to reduce possible accidents. · All machines used will	Contractor	HMPD	Included in construction cost

No.	Items	Mitigation Measures	Implementation	Supervision	Cost(INR)
		confirm to the relevant Indian standards Code and will be regularly inspected by the HD · The contractor will arrange for: A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital. · An emergency response team to be created. The team will contain members of the district and police administration and also have specialist in remediation. Responsibility of Concessionaire to inform the team to take actions. The roles and responsibility of the members of the ram will be framed in conjunction with all the parties to address the situation arising out of the accidental spills resulting in situation like water and soil contamination, health hazards in the vicinity of the accident spot, fire and explosions etc. · Workplaces remote and far away from regular hospitals will have indoor heath units with one bed for every 250 workers.			
31	Climate change, cross border impacts	· Construction machineries, generators, transport vehicles will be kept in good condition	Contractor	HMPD	Included in construction cost

No.	Items	Mitigation Measures	Implementation	Supervision	Cost(INR)
Operation					
1	Air Pollution	· Broad-leaved pollution resistant species, which can grow in high pollutant concentrations or even absorb pollutants, will be planted as they help settle particulates with their higher surface areas along with thick foliage, which can reduce the distance for which particulates are carried from the road itself. · The air and noise level in the project area should be periodically monitored by HD. If the observed level is more than the permissible limits, suitable mitigation measures should be taken.	HMPD	HMPD	Included in the Monitoring Cost
2	Water Pollution	· Water quality will be monitored regularly and preventive measures will be taken where pollution caused from the project is reported.	HMPD	HMPD	Included in the Monitoring Cost
3	Noise and Vibration	· Noise condition will be monitored regularly.	HMPD	HMPD	Included in the Monitoring Cost
4	Ecology	· When negative impacts on ecosystem are resulted from the Project, remove the negative causes.	HMPD	HMPD	Included in the regular management and maintenance cost
5	Hydrological Situation	· Suitable measures will be discussed and implemented with PWD when flooding or drainage problem that is caused by the Project occurs.	HMPD/PWD	HMPD/PWD	Included in the regular management and maintenance cost
6	Water use, water rights	· When any negative impacts caused by the Project are reported by water users, issues will be solved through the	HMPD/PWD	HMPD	Included in the regular management cost

No.	Items	Mitigation Measures	Implementation	Supervision	Cost(INR)
		Grievance Redress Mechanism.			
		· Since majority of the population in the region depends on groundwater, the Project will monitor groundwater level near ROW. When groundwater level declines too far to fetch water because of the Project, HMPD will negotiate with the affected parties and PWD to plan and implement measures such as increasing the depth of the affected wells to minimize and mitigate the impact.	HMPD/PWD	HMPD	Included in the regular management cost
7	Local economy, employment and living, livelihood	· When any negative impacts caused by the Project are reported by water users, issues will be solved through the Grievance Redress Mechanism. · The project proposes to provide the minimum required public conveniences such as toilets and drinking water facilities at each of the rest areas.	HMPD	HMPD	Included in the regular management cost
8	Children's rights	· When any negative impacts caused by the Project are reported, issues will be solved through the Grievance Redress Mechanism.	HMPD	HMPD	Included in the regular management cost
9	Work environment, occupational safety and health	· Staff and contractors will be provided safety education to minimize work accidents at toll plaza and regular repair and maintenance work.	HMPD	HMPD	Included in the regular management cost
10	Accidents, crime	· Following road safety facilities	Contractor	HMPD	Included in construction

No.	Items	Mitigation Measures	Implementation	Supervision	Cost(INR)
		will be equipped and constructed, such as; Sidewalk (along the service road), street lights, median strip, shoulder stones, guard rails, warning signs, visual guide light, road studs.			cost
11	Climate change, cross border impacts	・ Road surface will be kept in good condition so that vehicles will move smoothly with good speed and with emitting smaller amount of CO2.	HMPD	HMPD	Included in the regular maintenance cost

Source：JICA study team, DPR

Environmental Monitoring Plan

Environmental Monitoring Plan is shown in following Table. Underlined items are not included in the DPR 2017, but added in the Draft EIA Report submitted to TNSPCB in April.

Table Environmental Monitoring Plan

Component	Parameters	Location	Frequency	Monitoring Implementation	Supervision	Cost (INR)
【Construction】						
Air Pollution	PM10 P.M. SO2 NOx CO	5 locations	Pre Construction : Once Construction : Once in a season (3 years)	Contractor through approved monitoring agency	HMPD	1,700,000 (Including Operation phase)
		2 locations at hot-mix plant	Construction : Once in a season (2 years)	Contractor through approved monitoring agency	HMPD	320,000
Water Pollution	【Surface Water】 pH, BOD COD, TDS Pb, Oil & Grease, Detergents 【Ground Water】 pH, TDS Total Hardness, Sulphate, Chloride, Fe, Pb, Coliform count	5 locations	Pre Construction : Once Construction : Once in a season (3 years)	Contractor through approved monitoring agency	HMPD	1,700,000 (Including costs for operation phase 4 times per year for 3 years)
		2 locations at hot-mix plant	Construction : Once in a season (2 years)	Contractor through approved monitoring agency	HMPD	320,000
Waste	Monitor acceptable segregation, storage, handling and disposal	Work area, yard, plant, office, camp	daily (patrol)	Contractor/ Construction supervision consultant	HMPD	Included in construction cost

Component	Parameters	Location	Frequency	Monitoring Implementation	Supervision	Cost (INR)
Soil Quality	Pb, Sodium Absorption Ratio, Oil & Grease, Grain Size, Texture, pH, Conductivity, Calcium, Magnesium, Nitrogen	5 locations	Pre Construction : Once Construction : Once in a season (3 years)	Contractor through approved monitoring agency	HMPD	1,700,000 (Including costs for operation phase 4 times per year for 3 years)
		2 locations at hot-mix plant	Construction : Once in a season (2 years)	Contractor through approved monitoring agency	HMPD	320,000
Noise and Vibration	dB(A)	5 locations	Pre Construction : Once Construction : Once in a season (3 years)	Contractor through approved monitoring agency	HMPD	1,700,000 (Including costs for operation phase 4 times per year for 3 years)
		2 locations at hot-mix plant	Construction : Once in a season (2 years)	HMPD	HMPD	320,000
Ecosystem (Plantation)	Progress of compensation plantation for felled trees	Location instructed by Tiruvallur District Forest Officer	Every month	PIT in TNRDC	HMPD	Included in construction cost
	Progress of transplanting of trees girth smaller than 90 cm	Near the ROW	Every month	PIT in TNRDC	HMPD	Included in construction cost
	Securing Compensation Land for RF conversion	Kancheepuram Dist.	Every month	HMPD	HMPD	Included in the regular personnel cost
(Roadside habitat)	Confirmation of mitigation design to avoid soil runoff	N/A	Pre Construction : Once	PIT in TNRDC	HMPD	Included in the regular personnel cost
	Observation	Near the ROW	Construction:	PIT in TNRDC	HMPD	Included in

Component	Parameters	Location	Frequency	Monitoring Implementation	Supervision	Cost (INR)
	of soil runoff outside of ROW		Every month			construction cost
Hydrological Situation	Confirmation of progress with PWD	Near the ROW	Every month	Contractor / Construction supervision consultant	HMPD	Included in construction cost
Topography and Geographical Features	No procurement from informal quarries or sources	Work area, yard, plant	Every month	Contractor / Construction supervision consultant	HMPD	Included in construction cost
Involuntary resettlement loss of land and asset, business relocation	Progress of compensation and assistances Progress of relocations Progress of land acquisition	Near the ROW	Every month	RAP Implementation consultant /NGOs	HMPD	Included in RAP implementation cost
Water use, water rights	Payment for the affected wells, construction of alternative facilities	Near the ROW	Every month	RAP Implementation consultant /NGOs	HMPD	Included in RAP implementation cost
Existing public facilities, road and transportation facilities, social infrastructure, social service	Proper relocation of the affected public and community facilities	Near the ROW	Every month	RAP Implementation consultant /NGOs HMPD/DRO	HMPD	Included in RAP implementation cost
Split of community	Received grievances and complaints for difficulty of moving	Near the ROW	Every month	RAP Implementation consultant /NGOs	HMPD	Included in RAP implementation cost

Component	Parameters	Location	Frequency	Monitoring Implementation	Supervision	Cost (INR)
Children's rights	Age of workers must be 15 and over	Work area, yard, plant	Every month	Contractor / Construction supervision consultant	HMPD	Included in construction cost
Sanitation, public health, transmittable diseases including HIV/AIDS	Occurrence of transmittable diseases such as Dengue Fever near work area	Near work area	Every month	Construction supervision consultant	HMPD	Included in construction cost
Work environment, occupational safety and health	Compliance with work safety standards	Work area, yard, plant, office, camp	Every day (patrol)	Contractor / Construction supervision consultant	HMPD	Included in construction cost
	Training and Capacity Building	Office	Orientation Programme Awareness programme Orientation Programme	Construction supervision consultant	HMPD	Included in construction cost
Accidents, crime	Implementation and effectiveness of traffic control and accident prevention at work area	Work area and near area	Every day (patrol)	Contractor / Construction supervision consultant	HMPD	Included in construction cost
Climate change, crossborder impacts	Maintenance condition of the construction machineries and transportation vehicles	Work area, yard, plant	Every day (patrol)	Contractor / Construction supervision consultant	HMPD	Included in construction cost
【Operation】						
Air Pollution	PM10 PM2.5	5 locations	Once in a season (3 years)	Approved monitoring agency	HMPD	(Included in the cost for

Component	Parameters	Location	Frequency	Monitoring Implementation	Supervision	Cost (INR)
	SO2 NOx CO					Construction Phase)
Water Pollution	【Surface Water】 pH, BOD COD, TDS Pb, Oil & Grease, Detergents 【Ground Water】 pH, TDS Total Hardness, Sulphate, Chloride, Fe, Pb, Coliform count	5 locations	Once in a season (3 years)	Approved monitoring agency	HMPD	(Included in the cost for Construction Phase)
Soil Quality	Pb, Sodium Absorption Ratio, Oil & Grease,	5 locations	Once in a season (3 years)	HMPD/ Approved monitoring agency	HMPD	(Included in the cost for Construction Phase)
Noise and Vibration	dB(A)	5 locations	Once in a season (3 years)	HMPD/ Approved monitoring agency	HMPD	(Included in the cost for Construction Phase)
Ecosystem	Negative impacts on natural habitat caused by soil runoff from ROW	Near the ROW	Every month (1 year)	HMPD/ Approved monitoring agency	HMPD	Included in regular road maintenance cost
	Negative impacts on pre-project ecosystem caused by increase of traffic and	Near the ROW	Every month (1 year)	HMPD/ Approved monitoring agency	HMPD	Included in regular road maintenance cost

Component	Parameters	Location	Frequency	Monitoring Implementation	Supervision	Cost (INR)
	land use change					
Water use, water rights	Decline of groundwater level at existing wells near the ROW compared to the pre-project condition	Near the ROW	Every month (1 year)	HMPD/ Approved monitoring agency	HMPD	Included in regular road maintenance cost
Monitoring of Management & Operational Performance Indicators	Reporting all monitoring items		10 months	HMPD/ Foresters	HMPD	400,000
Monitoring and Evaluation External Agency	Outsourcing			External Agency (Independent Expert)	HMPD	2,000,000

Source：JICA study tem, DPR, Draft EIA

Environmental Monitoring Form

Monitoring Form (Planning and Construction phase)

(1) Permission and authorization

Monitoring Item	Record of conditions
Responding to issues pointed out by authorities	
Construction Workers Camp 1. Adequate no. of toilets shall be provided separately for males and females (as per EIA) 2. At every construction site, provision of a day crèche shall be made so as to enable women to leave behind their children while going to work. At least one attendant shall be provided to take care of the children at the crèche. (as per EIA)	
Avoidance of Soil Runoff Confirm appropriate design and construction plan is proposed by the Consultant and the Contractor to avoid soil runoff during and after the Construction Phase	

Add lines when necessary

(2) Pollution

-Air Quality 【Frequency:(Planning phase) Once, (Construction phase) Quarterly】

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Base line Value	CPCB Standards	Measurement Point	Sampling date
PM10	µg/m3			18.8~293.1	100		
PM2.5	µg/m3			10.2~300.8	60		
SO2	µg/m3			0~40.5	80		
NOx	µg/m3			0~77.2	80		
CO	ppm			BQL	4		

Add lines when necessary

-Water Quality【Frequency:(Planning phase) Once, (Construction phase) Quarterly】

Item	Unit	Measured Value	Measured Value	Base line Value	Country's Standard	Measurement Point	Sampling date

		(Mean)	(Max.)		s		
【Surface Water】							
pH	-			7.05~7.83	5.5~9.0*		
BOD	mg/L			—	<30*		
COD	mg/L			—	<250*		
TDS	ppm			—	N/A		
SS	mg/L			3.8~23.2	<100*		
Pb	mg/L			—	<0.1*		
Oil & Grease	mg/L			—	<10*		
Detergents	mg/L			—	<0.2**		
【Ground Water】							
pH	-			—	8.5**		
TDS	ppm			—	<2000**		
Tatal Hardness	mg/L			—	<300**		
Sulphate	mg/L			—	<400**		
Chloride	mg/L			—	<1000**		
Fe	mg/L			—	<1.00**		
Pb	mg/L			—	No relaxation**		
Coliform count	No/dl			—	<10**		

Add lines when necessary

* BIS: 2490, PART-I-1981

** BIS: IS: 10500, 1991 Drinking water standard

-Noise Levels【Frequency:(Planning phase) Once, (Construction phase) Quarterly】

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Base line Value	Country's Standards	Measurement Point	Sampling date
Noise (DAY)	dB(A)			37.9~70.1	55		
Vibration (DAY)	m/s			0.1~2.2	5		
Noise (Night)	dB(A)			34.1~60.1	55		
Vibration (Night)	m/s			0.1~1.9	5		

Add lines when necessary

-Soil Quality【Frequency:(Planning phase) Once, (Construction phase) Quarterly】

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Base line Value	Referred International Standards*	Measurement Point	Sampling date
Pb	mg/L			－	0.01		
Sodium Absorption Ratio	－			－	N/A		
Oil & Grease	mg/L			－	N/A		
Texture				－	N/A		
Grain Size				－	N/A		
pH	－			－	N/A		
Conductivity	S/m			－	N/A		
Calcium	mg/L			－	N/A		
Magnesium	mg/L			－	N/A		
Sodium	mg/L			－	N/A		
Nitrogen	mg/L			－	N/A		

Add lines when necessary

* The Soil Contamination Countermeasures Act 2002, Japan

(3) Monthly patrol, observation, and recording during the Construction Works

-By Contractor

Date:		Location	Findings (Enter either 'Approved' or 'Need action')	Record of conditions	Actions taken	Recorded by (Name)
Item	Parameters					
Ground subsidence	Progress confirmation of soft ground measure	Around the project road				
Hydrometeorology	Confirm progress with PWD	Around the project road				
Topography / Geology	Confirmation of proper material purchase situation	Storage				
Ecosystem (Impacts on habitats near ROW)	Confirmation of no soil runoff outside of ROW	Near ROW				
Children's rights	Confirmation of prevention of child labor	Office/ Construction sites / Camp sites				

Add lines when necessary

-By PIT (Foresters)

Date:		Location	Findings (Enter either 'Approved' or 'Need action')	Record of conditions	Actions taken	Recorded by (Name)
Item	Parameters					
Ecosystem	Confirmation of cutting trees for cutting trees	Around the project road				
	Confirmation of transplantation of trees less than 90 cm in circumference	Around the project road				
	Acquisition of RF substitute area	Kanchipuram district				

Add lines when necessary

-By Consultant or NGOs

Date:		Location	Findings (Enter either 'Approved' or 'Need action')	Record of conditions	Actions taken	Recorded by (Name)
Item	Parameters					
Resettlement	See RAP monitoring forms	Around the project road				
Water use	Compensation for affected wells/Confirm progress of construction of alternative facilities	Around the project road				
Existing social infrastructure	Confirm relocation of affected public	Around the project				

and social services	facilities etc.	road				
Community division	Information provision, Enlightenment Campaigns, Complaints reception	Around the project road				
Infectious diseases such as HIV / AIDS etc.	Confirmation of the occurrence of infectious diseases such as dengue at construction sites	Around the project road/ Camp sites				
Work environment, Work safety	Capacity building Workshop (1 day each) For engineers including ESE For Skilled and unskilled laborers for Engineers and staff of the contractor office and PMC staff	Around the project road/ Office/ Camp sites				

Add lines when necessary

(4) Everyday patrol, observation, and recording during the Construction Works by Contractor

Date:		Location	Findings (Enter either 'Approved' or 'Need action')	Record of conditions	Actions taken	Recorded by (Name)
Item	Parameters					
Waste	Appropriate separation and storage, confirmation of appropriate treatment and disposal	Office/ Construction sites / Camp sites				
Work environment, Work safety	Compliance to safety standards/ Implementation of safety tools	Construction sites				
Accidents / crimes	Confirmation of adequate traffic guidance and accident prevention measures	Around the project road/ Construction sites				
Transboundary impact and climate change	Confirmation of proper maintenance status of construction machinery / transport vehicle party	Construction sites				

Add lines when necessary

(5) Other coordination

Grievance concerning environmental impact

Number of complaints	Detail	Correspondence and Results

Add lines when necessary

Other Points of Attention (free writing)

Monitoring Form (Operation phase)

(1) Monitoring report and evaluation

Item	Parameters	Findings (Enter either 'Approved' or 'Need action')	Record of conditions	Actions taken	Frequency	Recorded by (Name)
Monitoring of Management & Operational Performance Indicators	Status of Redevelopment of Borrow Areas				For 10 months	
	Waste Management Quality Monitoring				For 10 months	
	Monitoring environmental parameters				For 10 months	
Monitoring and Evaluation External Agency	Implementation					

Add lines when necessary

(2) Pollution

-Air Quality【Frequency: Quarterly】

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Base line Value	CPCB Standards	Measurement Point	Sampling date
PM10	µg/m3			18.8~293.1	100		
PM2.5	µg/m3			10.2~300.8	60		
SO2	µg/m3			0~40.5	80		
NOx	µg/m3			0~77.2	80		
CO	ppm			BQL	4		

Add lines when necessary

-Water Quality【Frequency: Quarterly】

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Base line Value	Country's Standards	Measurement Point	Sampling date
【Surface Water】							
pH	-			7.05~7.83	5.5~9.0*		
BOD	mg/L			—	<30*		
COD	mg/L			—	<250*		
TDS	ppm			—	N/A		
SS	mg/L			3.8~23.2	<100*		
Pb	mg/L			—	<0.1*		
Oil & Grease	mg/L			—	<10*		
Detergents	mg/L			—	<0.2**		
【Ground Water】							
pH	-			—	8.5**		
TDS	ppm			—	<2000**		
Tatal Hardness	mg/L			—	<300**		
Sulphate	mg/L			—	<400**		
Chloride	mg/L			—	<1000**		
Fe	mg/L			—	<1.00**		
Pb	mg/L			—	No relaxation**		
Coliform	No/dl			—	<10**		

count							

Add lines when necessary

* BIS: 2490, PART-I-1981

** BIS: IS: 10500, 1991 Drinking water standard

-Noise Levels【Frequency: Quarterly】

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Base line Value	Country's Standards	Measurement Point	Sampling date
Noise (DAY)	dB(A)			37.9~70.1	55		
Vibration (DAY)	m/s			0.1~2.2	5		
Noise (Night)	dB(A)			34.1~60.1	55		
Vibration (Night)	m/s			0.1~1.9	5		

Add lines when necessary

-Soil Quality【Frequency: Quarterly】

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Base line Value	Referred International Standards*	Measurement Point	Sampling date
Pb	mg/L			—	0.01		
Sodium Absorption Ratio	—			—	N/A		
Oil & Grease	mg/L			—	N/A		
Texture				—	N/A		
Grain Size				—	N/A		
pH	—			—	N/A		
Conductivity	S/m			—	N/A		
Calcium	mg/L			—	N/A		
Magnesium	mg/L			—	N/A		
Sodium	mg/L			—	N/A		
Nitrogen	mg/L			—	N/A		

Add lines when necessary

* The Soil Contamination Countermeasures Act 2002, Japan

(3) Ecology and water use 【Frequency: Quarterly】

Item	Parameters	Findings (Enter either 'Approved' or 'Need action')	Record of conditions	Actions taken	Frequency	Recorded by (Name)
Ecology	Monitoring soil runoff from ROW affecting habitat outside of ROW				Quarterly for 1 year	
	Monitoring of negative impacts on ecosystem outside of ROW caused by increase of traffic and land				Quarterly for 1 year	

	use change					
Water use	Ground water level at existing wells near the ROW (Decline compared to pre-project level)				Quarterly for 1 year	

The RAP Monitoring Form

-Preparation of Resettlement Sites (where necessary)

No.	Explanation of the site (e.g. Area, no of resettlement HH, etc.)	Status (Complete (date)/not complete)	Details (e.g. Site selection, identification of candidate sites, discussion with PAPs, Development of the site, etc.)	Expected Date of Completion
1				
2				

-Public Consultation

No.	Date	Place	Contents of the consultation/ main comments and answers
1			
2			

-RAP implementation

Resettlement Activities	Planned Total	Unit	Progress in Quantity			Progress in %		Expected Date of Completion	Responsible Organization
			During the Quarter	Till the Last Quarter	Up the Last Quarter	Till the Last Quarter	Up the Last Quarter		
Preparation of RAP									
Employment of Consultants		Man-month							
Implementation of Census Survey (including Socioeconomic Survey)									
Approval of RAP			Date of Approval						
Finalization of PAPs List		No. of PAPs							
Progress of Compensation Payment									
Village 1		No. of HHs							
Village 2		No. of HHs							
Village 3		No. of HHs							
Village 4		No. of HHs							
Progress of Land									

Acquisition (All Villages)									
Village 1		ha							
Village 2		ha							
Village 3		ha							
Village 4		ha							
Progress of Asset Replacement (All Villages)									
Village 1									
Village 2									
Village 3									
Village 4									
Progress of Relocation of People (All Villages)									
Village 1									
Village 2									
Village 3									
Village 4									

- Implementation status of livelihood recovery support

Implementation	Contents	Results

- Grievance from PAPs

Number of complaints	Detail	Correspondence and Results

- Other Points of Attention (free writing)

- Monitoring Formats for Physical Progress

No	Monitoring Indicators for Physical Progress	Implementation Target	Revised Target	Progress this Quarter	Cumulative Progress	% against Target
1	Land acquisition (ha) from Govt. sources					
2	Wet land acquired (ha) from private owners					
3	Dry land acquired (ha) from private owners					
4	Urban land (including homestead)					

No	Monitoring Indicators for Physical Progress	Implementation Target	Revised Target	Progress this Quarter	Cumulative Progress	% against Target
	acquired (ha) from private owners					
5	No. of PAHs paid compensation for acquisition of private landed properties					
6	Areas of pucca structures acquired (sq m) from private owners					
7	No. of PAHs paid compensation for acquisition of private pucca properties					
8	Area of semi-pucca structures acquired (sq m) from private owners					
9	No. of PAHs paid compensation for acquisition of private semi-pucca properties					
10	Area of kutcha structures acquired (sq m) from private owners					
11	No. of PAHs paid compensation for acquisition of private kutcha properties					
12	Other assets (wells) acquired (No) from private owners					
13	No. of PAHs paid compensation for acquisition of other private assets (wells)					
14	No. of PAHs provided with assistance (additional 25%) for severance of land					
15	No. of PAHs opted for alternative houses					
16	No. of PAHs opted for alternative shops					
17	No. of PAHs provided with land purchase grant @25% of the compensation received to buy alternative agriculture land					
18	No. of PAHs provided with shifting allowance					
19	No. of PAHs provided with rental allowance					
20	No. of PAHs provided with subsistence allowance for 6 months					
21	No. of PAHs provided with subsistence allowance for 3 months					
22	No. of Vulnerable Squatter PAHs provided with alternative built houses					
23	No. of Vulnerable squatter PAHs provided with alternative built shops					
24	No. of PAHs provided with employment generation asset grant (from PAHs losing shops)					
25	No. of PAPs provided with livelihoods training assistance (2 adult from each PAH losing shops)					
26	No. of PAPs provided with self employment training (2 adult from each vulnerable squatter PAH)					

No	Monitoring Indicators for Physical Progress	Implementation Target	Revised Target	Progress this Quarter	Cumulative Progress	% against Target
27	No. of PAPs provided with self employment training and assisting for purchase of employment generation asset					
28	No. of man-days of employment under contractors (Male, Female) ・Male PAP (Applied/ Hired) ・Female PAP (Applied/ Hired) (as per RAP)					
29	No. of community properties reestablished					
30	No. of SDU staff in position					
31	No. of SDU staff trained in R&R activities					
32	No. of implementing NGO staff in position					
33	No. of implementing NGO staff trained in R&R activities					

- Monitoring Indicators for Financial Progress

No	Monitoring Indicators for Financial Progress	Implementation Target (Rs. Million)	Revised Implementation Target	Progress this Quarter	Cumulative Progress	% against Revised Implementation Target
1	Compensation (including solatium) paid for wet land acquired from private owners including assistance towards registration charges and taxes					
2	Compensation (including solatium) paid for dry land acquired from private owners including assistance towards registration charges and taxes					
3	Compensation (including solatium) paid for urban land (including homestead) acquired from private owners including assistance towards registration charges and taxes					
4	Compensation paid for severance of land (additional 25% of the compensation paid)					
5	Compensation paid for loss of perennial crops					
6	Compensation paid for loss of non-perennial crops					
7	Compensation paid for					

No	Monitoring Indicators for Financial Progress	Implementation Target (Rs. Million)	Revised Implementation Target	Progress this Quarter	Cumulative Progress	% against Revised Implementation Target
	acquiring pucca structures from private owners					
8	Compensation paid for acquiring semi-pucca structures from private owners					
9	Compensation paid for acquiring Kutcha structures from private owners					
10	Compensation paid for acquiring other assets (wells) from private owners					
11	Expenditure on providing shifting allowances					
12	Expenditure on providing rental allowances					
13	Expenditure on providing subsistence allowances (for 6 months)					
14	Expenditure on providing subsistence allowances (for 3 months)					
15	Expenditure on providing self employment training assistance (2 adult from each PAH losing shops)					
16	Expenditure on providing self employment training assistance (2 adult from each vulnerable squatter PAH losing shops)					
17	Expenditure on providing self employment training and purchase of employment generation asset assistance (to all employees losing employment due to the project)					
18	Expenditure on providing alternatives built houses to vulnerable squatter PAHs					
19	Expenditure on providing alternatives					

No	Monitoring Indicators for Financial Progress	Implementation Target (Rs. Million)	Revised Implementation Target	Progress this Quarter	Cumulative Progress	% against Revised Implementation Target
	built shops to vulnerable squatter PAHs					
20	Expenditure on preparing resettlement sites ready with infrastructure facilities					
21	Expenditure on reestablishing community properties/ cultural properties					
22	Expenditure on staffing of PIT (salary)					
23	Expenditure on providing training to PIT staff in R&R activities					
24	Expenditure on engaging implementation NGOs					
25	Expenditure on engaging Impact Evaluation Agency / NGO / Academic Institution					
26	Expenditure on continued public consultation					
27	Expenditure on strengthening Social Development Unit					
28	R&R cost for maintenance corridors (1.5% of the treatment cost of Rs.3 million)					
29	Expenditure on unquantified impacts (10% of total R&R cost)					