

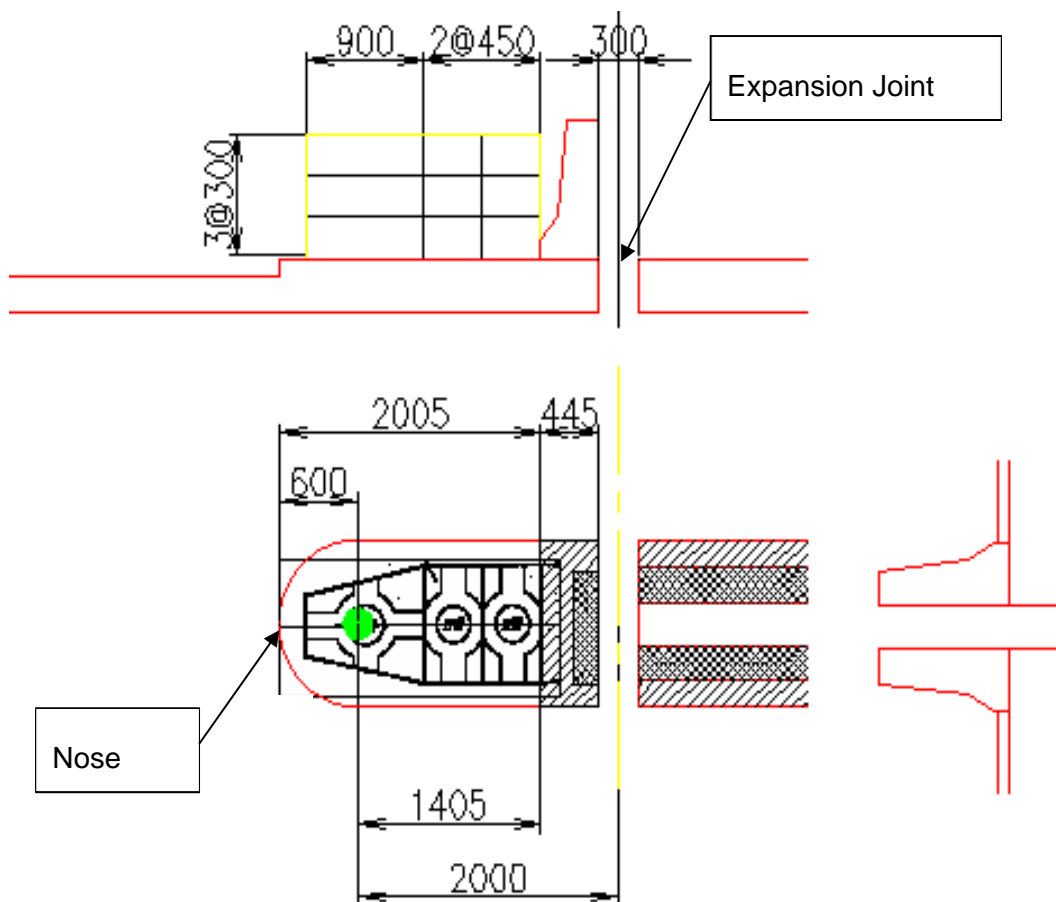
### 5.2.3 Span Arrangement

#### (1) Control Point of Span Arrangement

##### 1) Pier at Nose

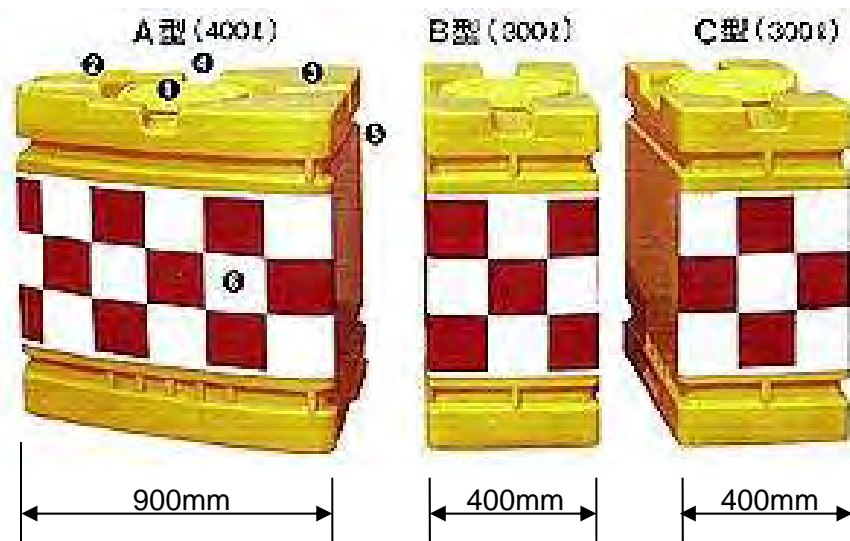
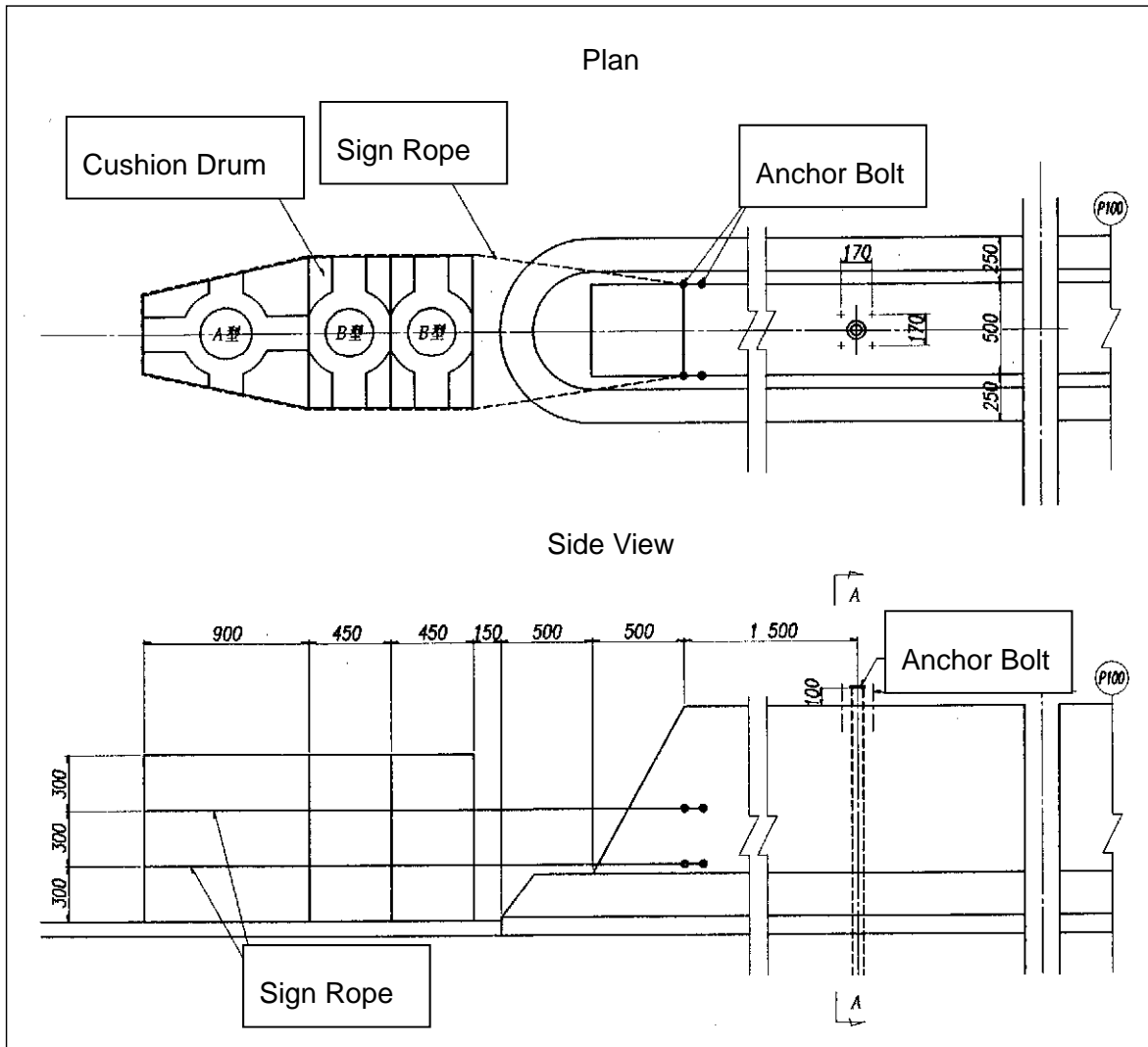
Girder divergences and bridge joints are located close to road noses. Considering construction work of nose tips, piers shall be placed 5m back from nose tips.

Nose tip construction with minimum required dimension of 2m is shown in Figure 5.2.7. Dimension of 5m is designed for better constructability.



Source: JICA Survey Team

**Figure 5.2.7 Bridge Pier at Road Nose**

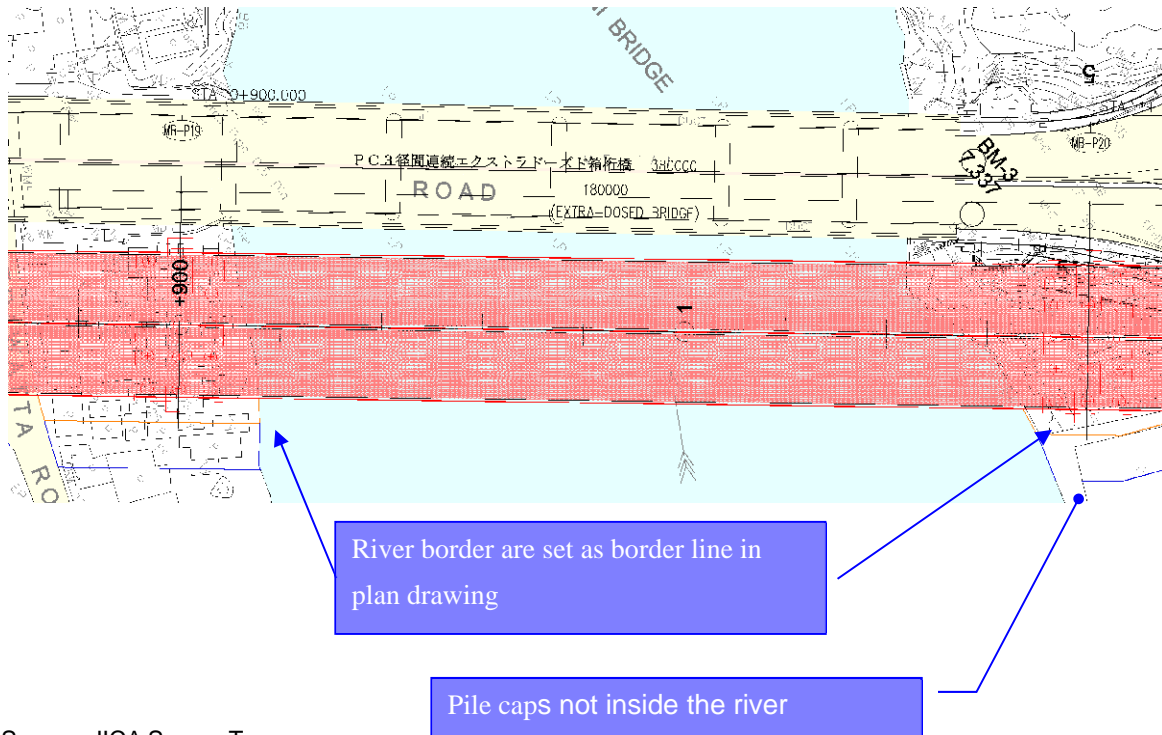


Source: JICA Survey Team

**Figure 5.2.8 Angle Cushion Drum**

## 2) Kelani River

Control point of Extra-dosed Bridge's span is that pile caps shall not be placed inside the river. The river border is based on plan drawing as below. Span length, therefore, are designed based on the calculation result of pile cap size.



Source: JICA Survey Team

**Figure 5.2.9 Control Points of Extradossed Bridge**

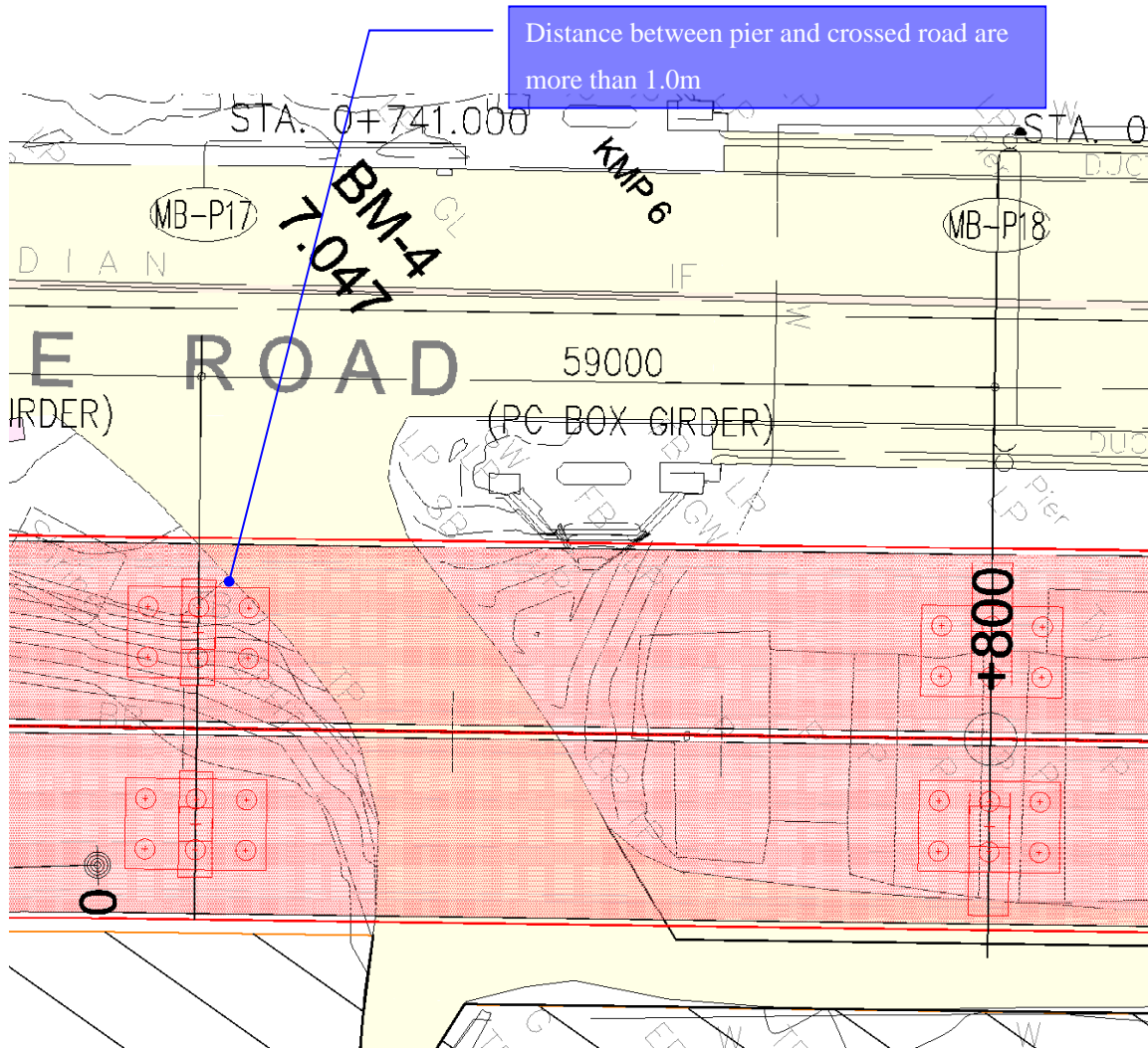
Within above control points, centre span of the bridge is set equal to 180m. Since the cantilever construction method is considered for this bridge, side spans are set equal to 100m, which brings the total length of the bridge to 380m.



3) Crossing Roads

(a) Roads Crossing the New Alignment

Secure the distance between bridge piers and crossed roads more than 1.0m

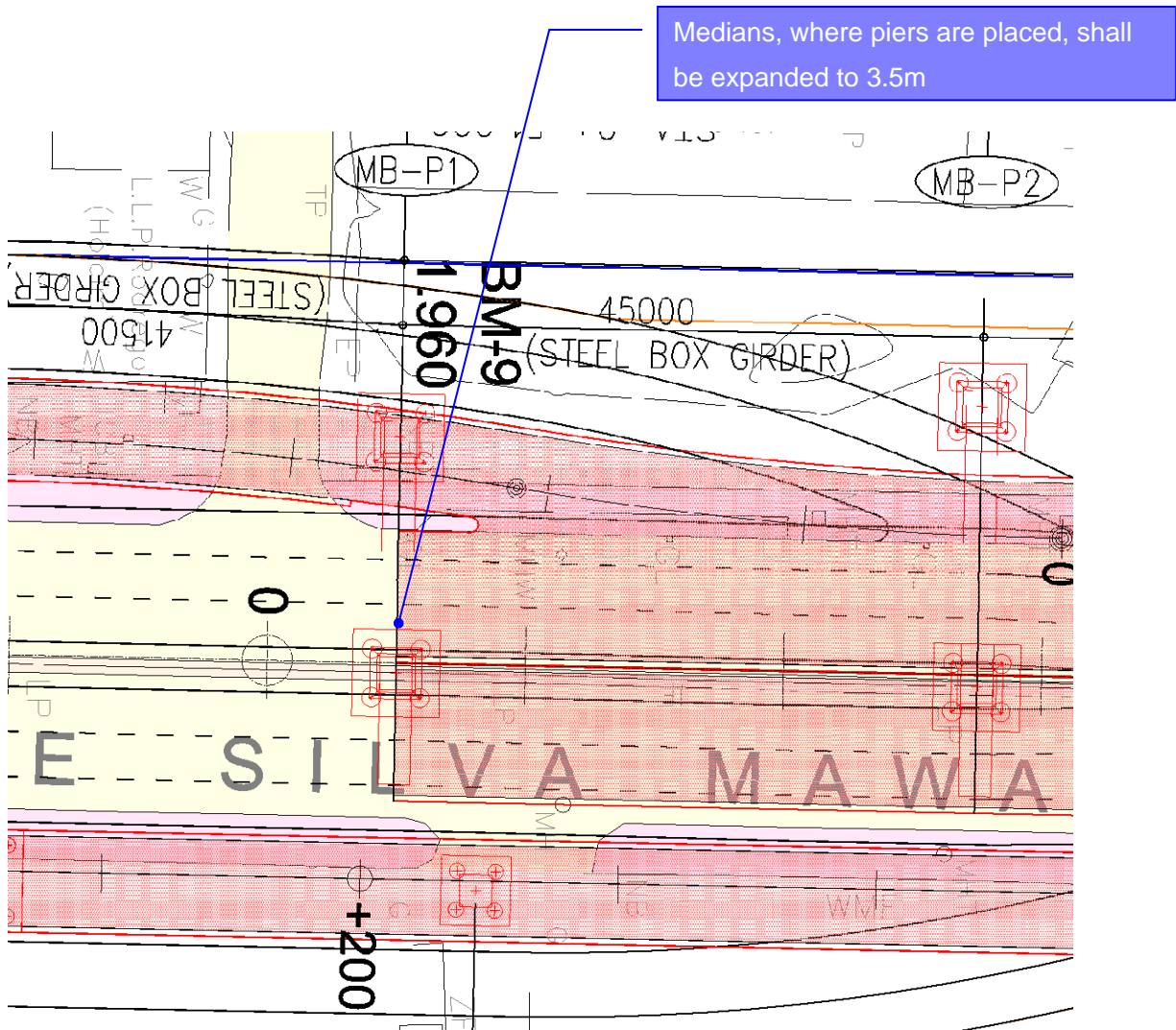


Source: JICA Survey Team

**Figure 5.2.11 Road Crossing the New Alignment**

(b) Road along the New Alignment (with median)

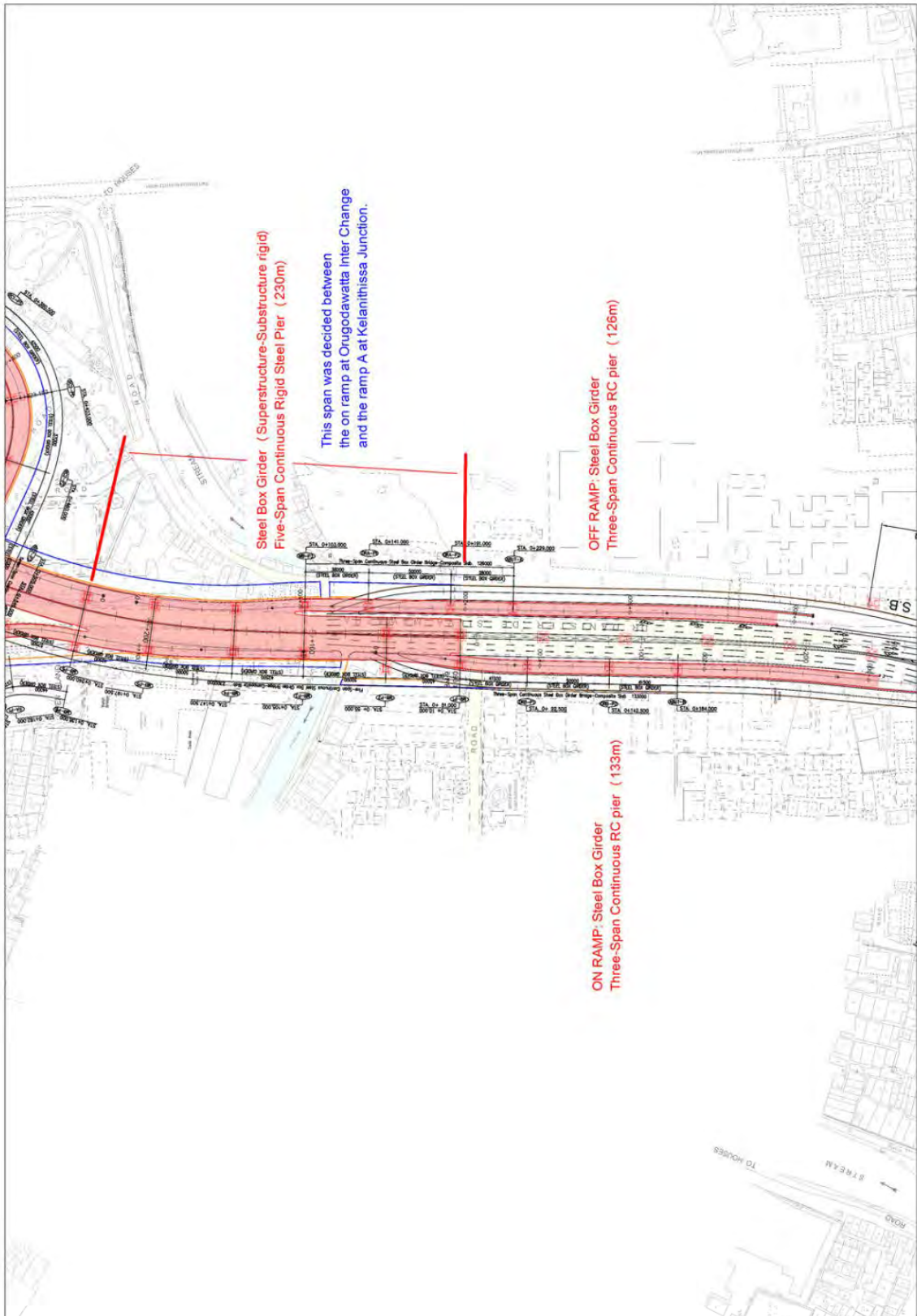
In case where the bridge piers are installed in the medians such as Port Access Road and Baseline Road, the median is required to widen in order to install the bridge piers. The median of the Baseline Road needs to widen from 1.2m to 3.5m in order to install the pier whose width is 2.5m.

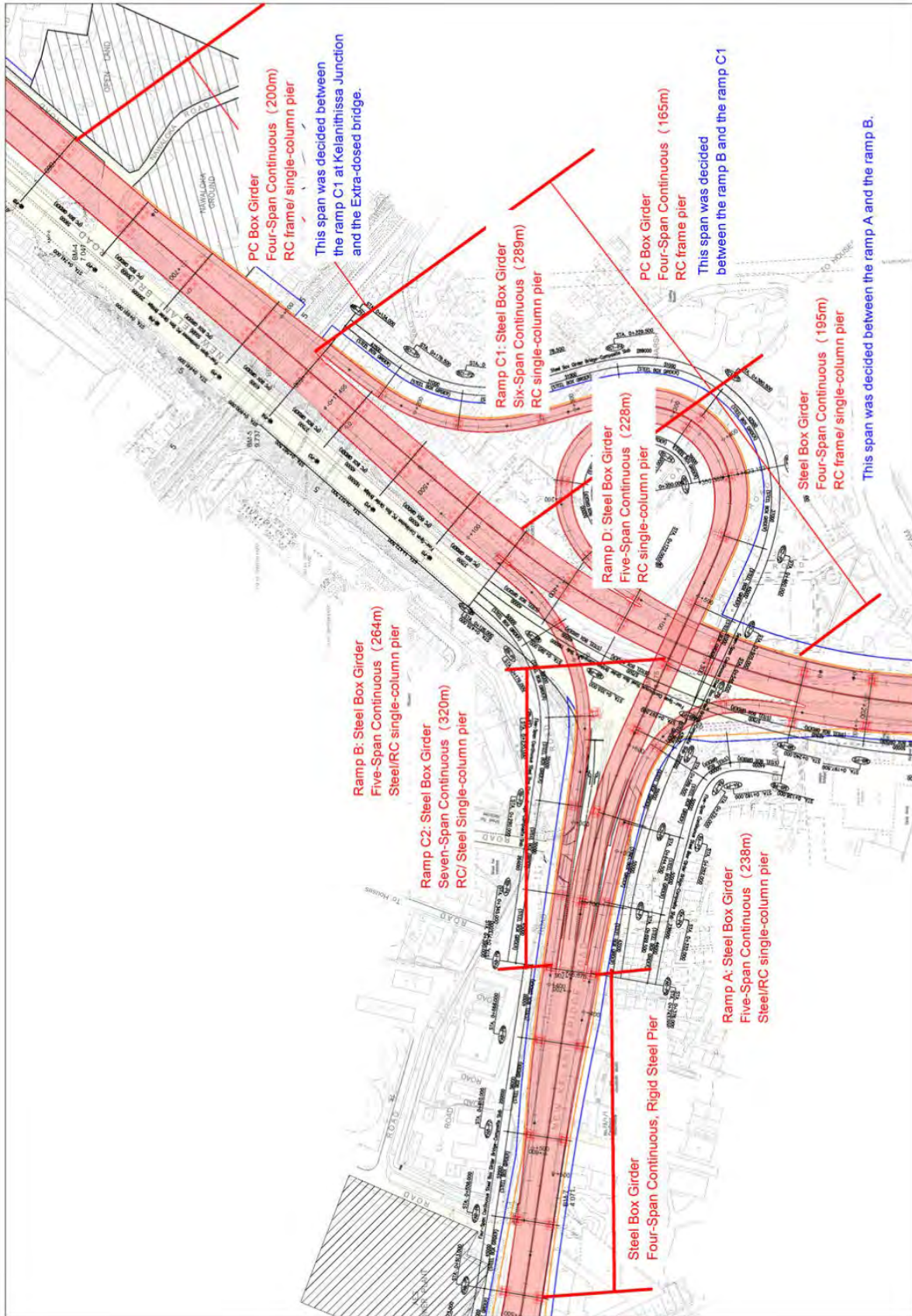


Source: JICA Survey Team

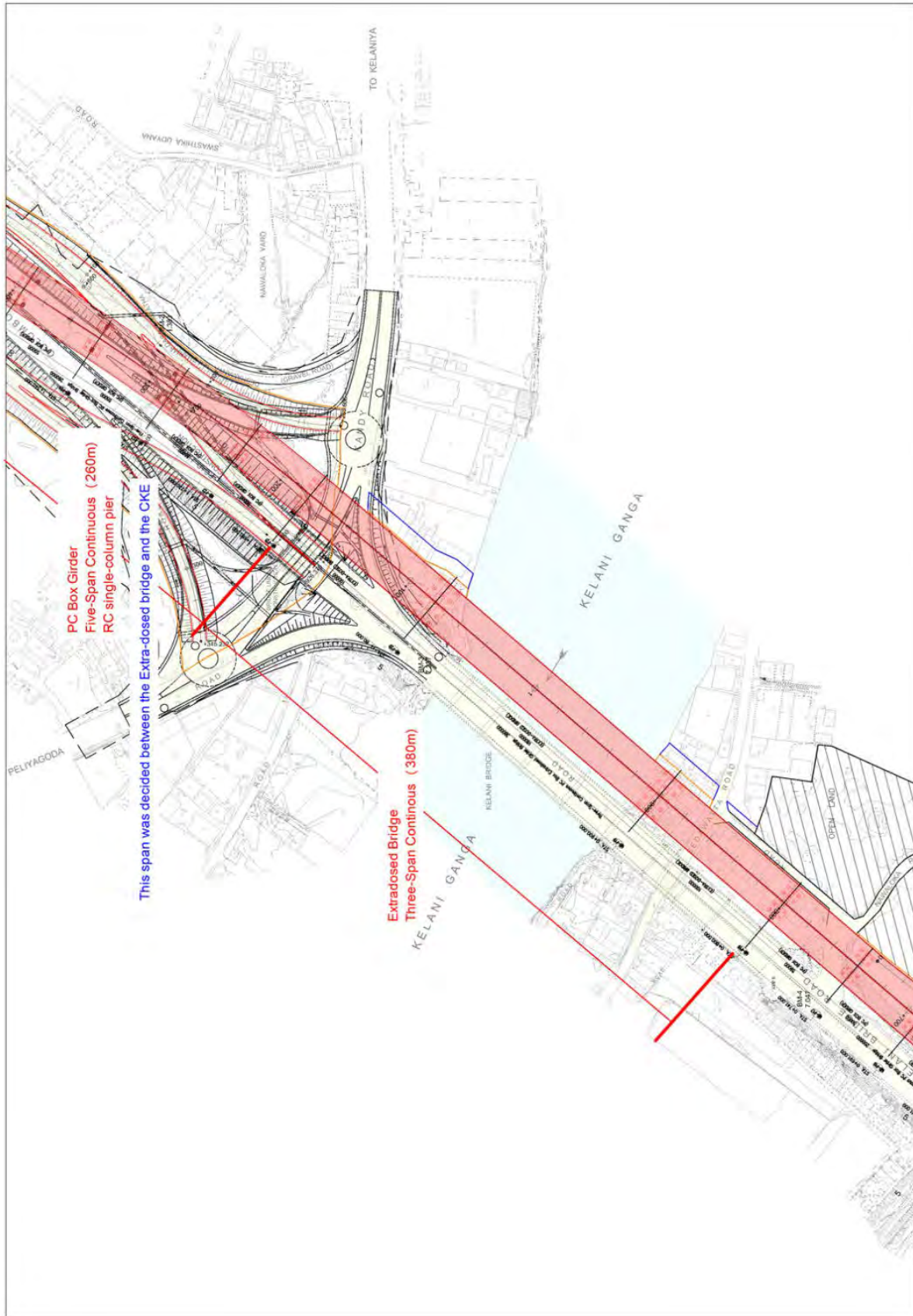
Figure 5.2.12 Road along the New Alignment

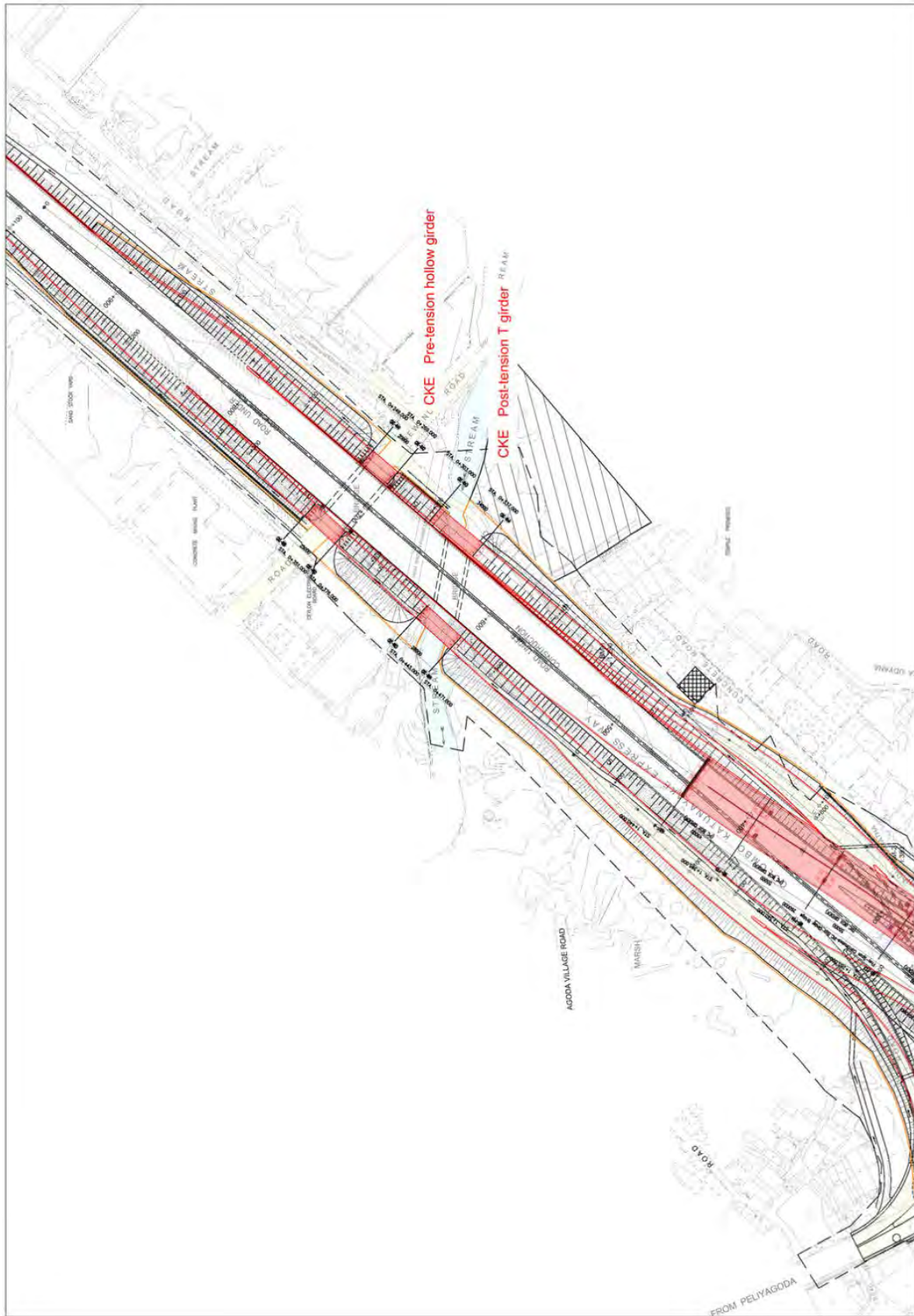
(2) Span Arrangement











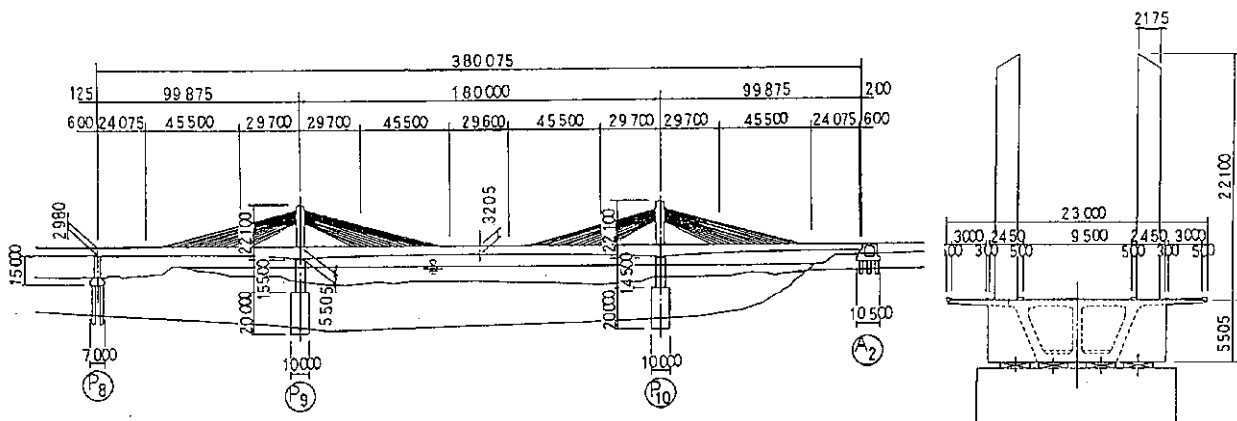


## 5.2.4 Main Bridge Design

### (1) Cross Section of Superstructure

#### 1) Girder Height

With reference to the design of Kanizawa Bridge (see Figure below), girder heights are set to 5.6 m (at bearing) and 3.3m (at centre).

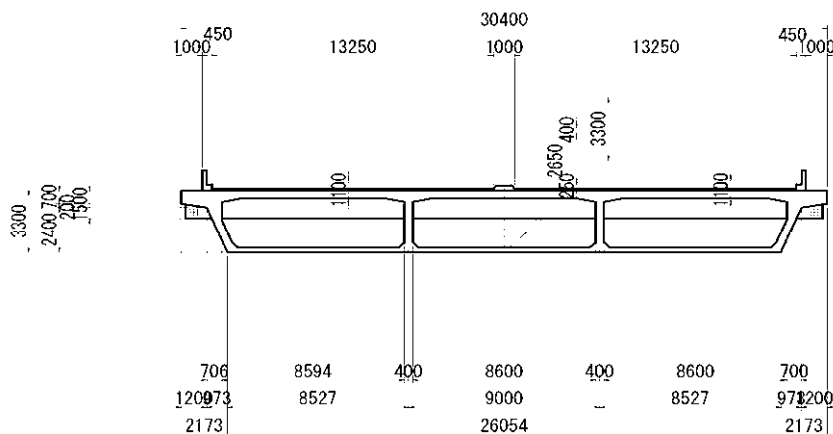


Source: The 7th Symposium on Developments in PRESTRESSED CONCRETE, Japan Prestressed Concrete Institute (October, 1997)

**Figure 5.2.13 Kanizawa Bridge General View**

#### 2) Box Girder Configuration

With reference to past record of Extra-dosed bridges of approximate 30m width, deck span is set to 8m (three-cell box).



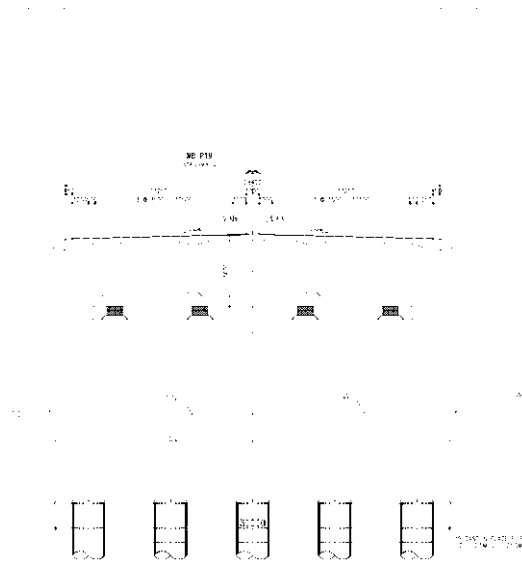
Source: JICA Survey Team

**Figure 5.2.14 Box Girder Configuration**

(2) Cross Section of Substructure

1) P19, P20

Main towers and main piers are designed as wall-type pier

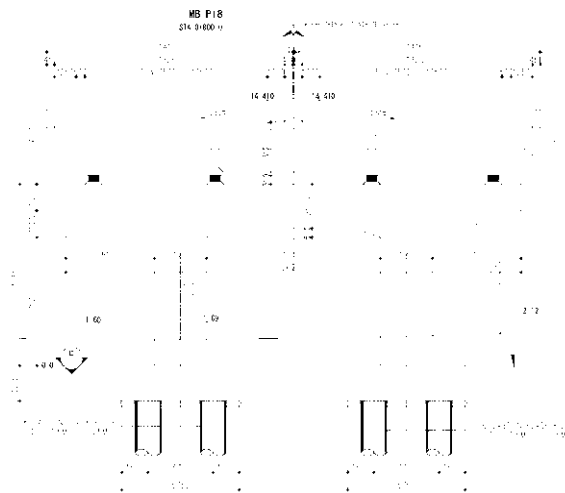


Source: JICA Survey Team

**Figure 5.2.15 Main Tower and Pier**

2) P18, P21

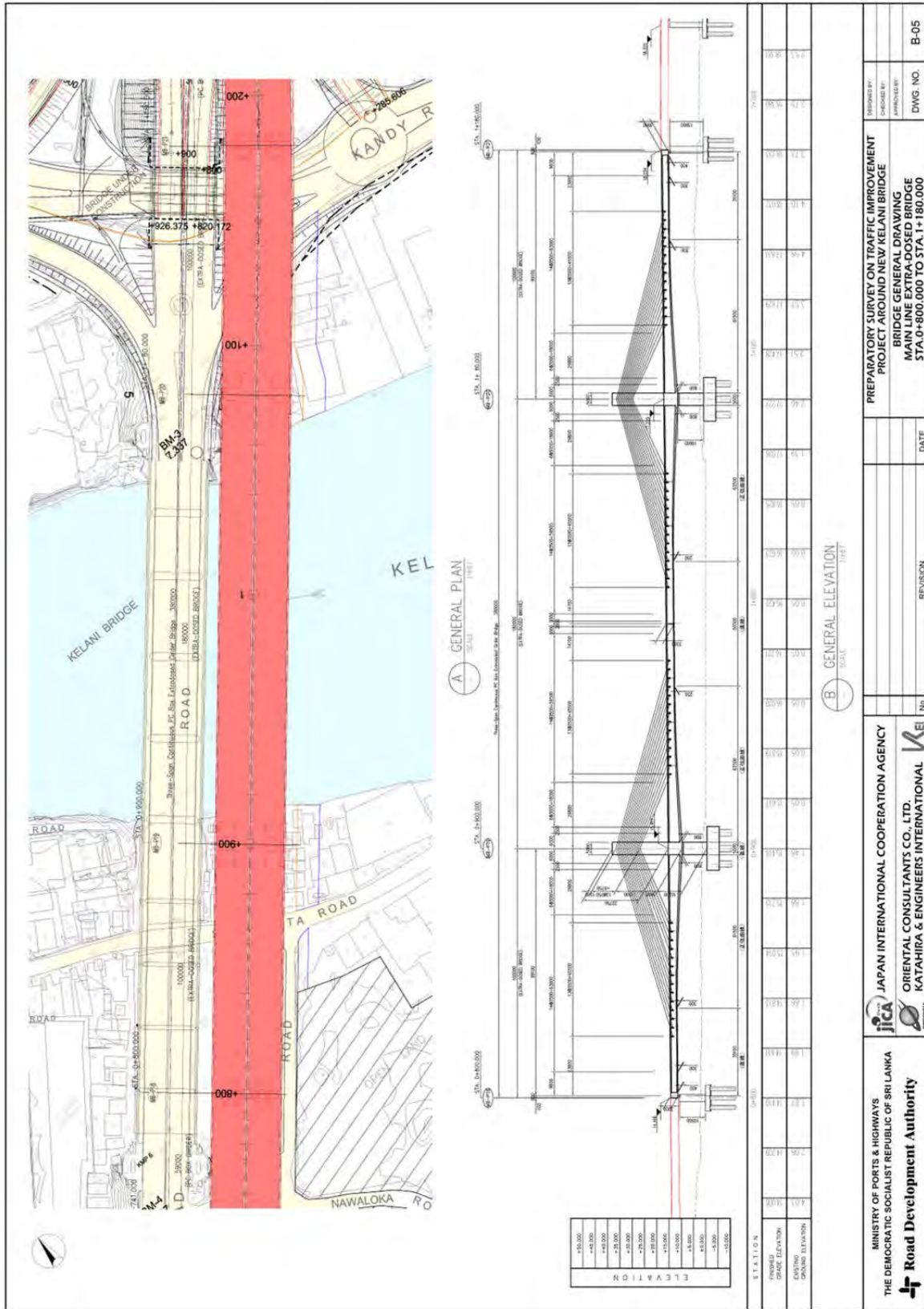
Rigid piers are selected for these locations; with beam width is adjusted to web line.

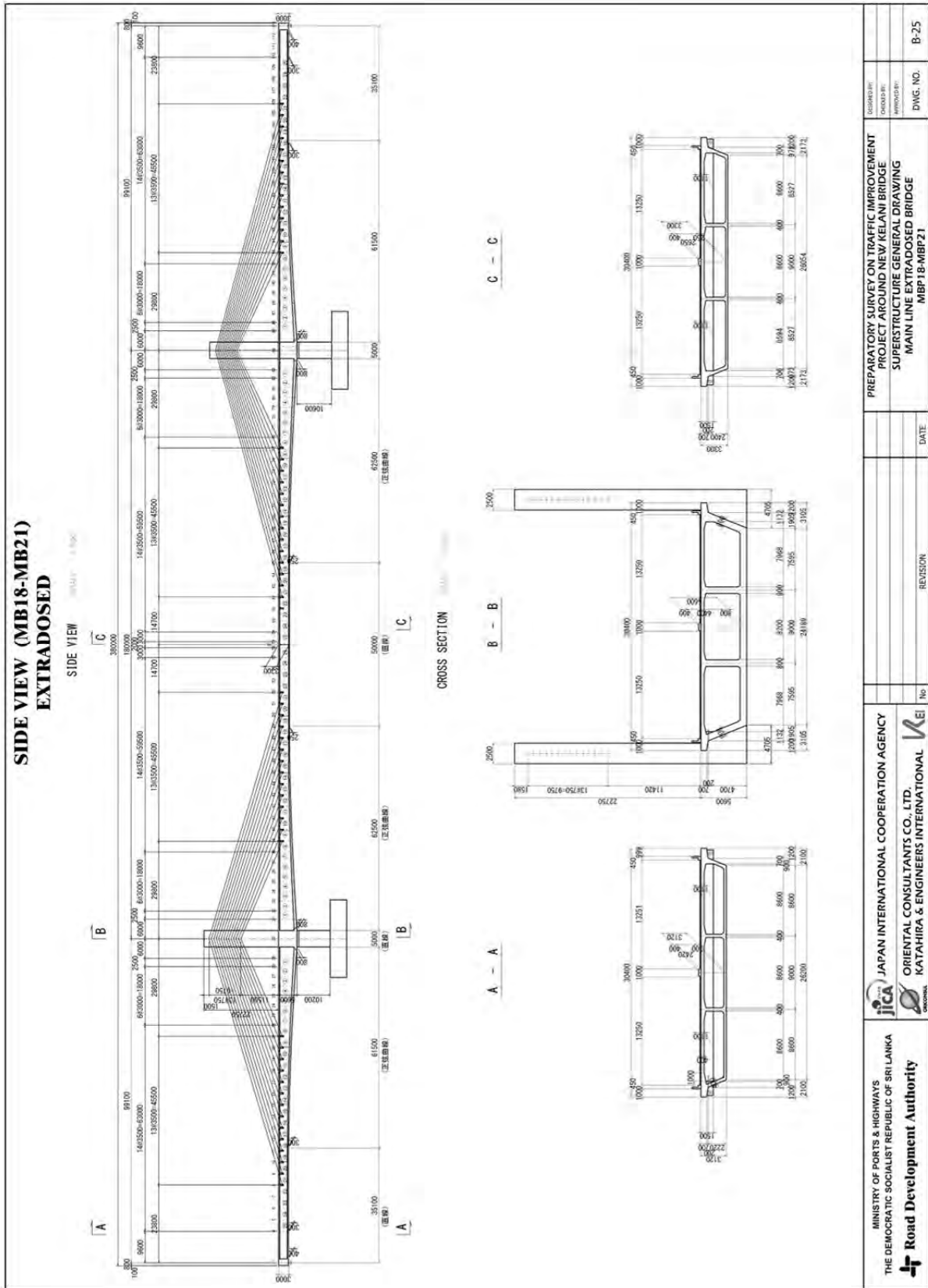


Source: JICA Survey Team

**Figure 5.2.16 Rigid Pier**

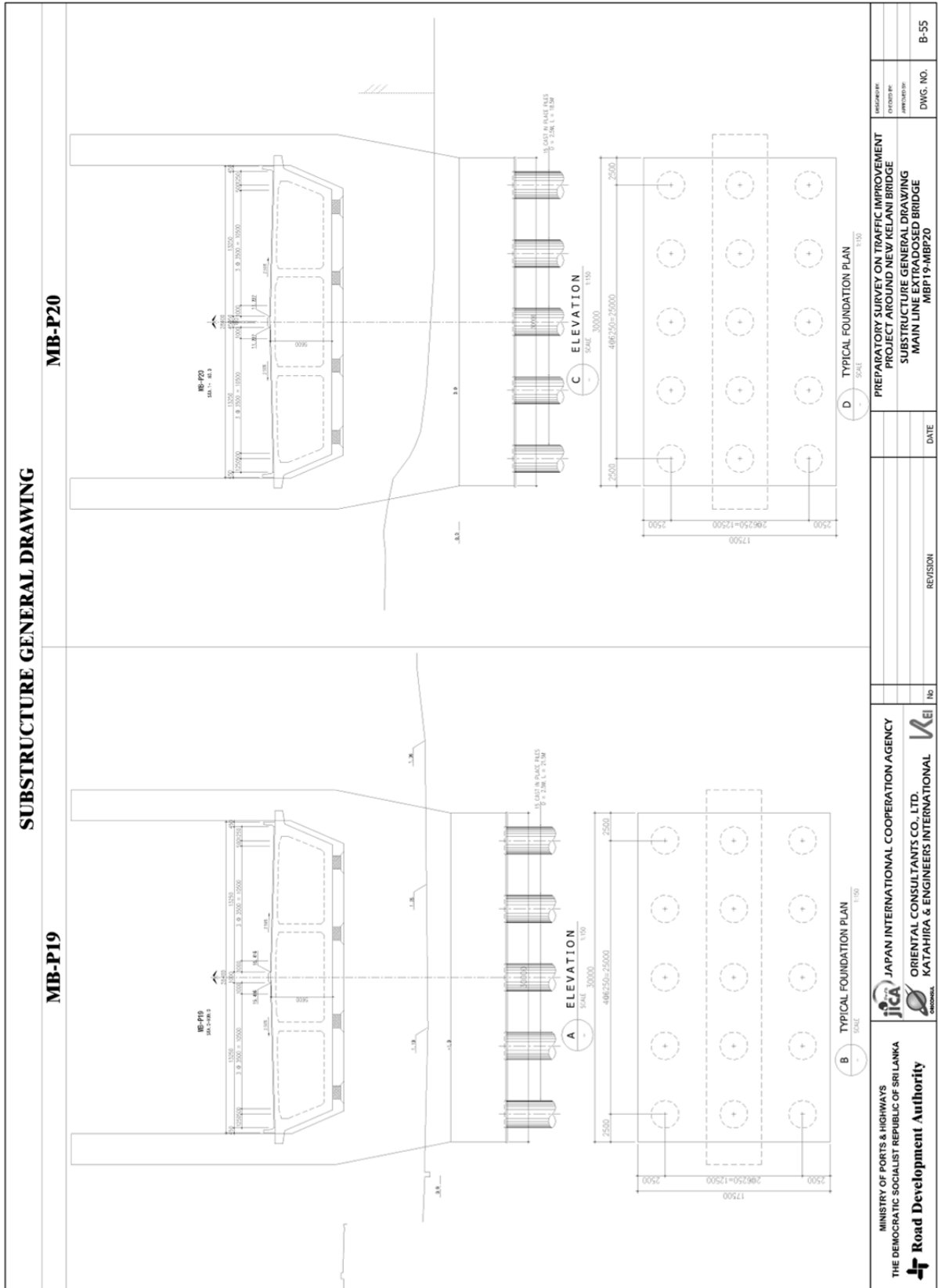
(3) General View

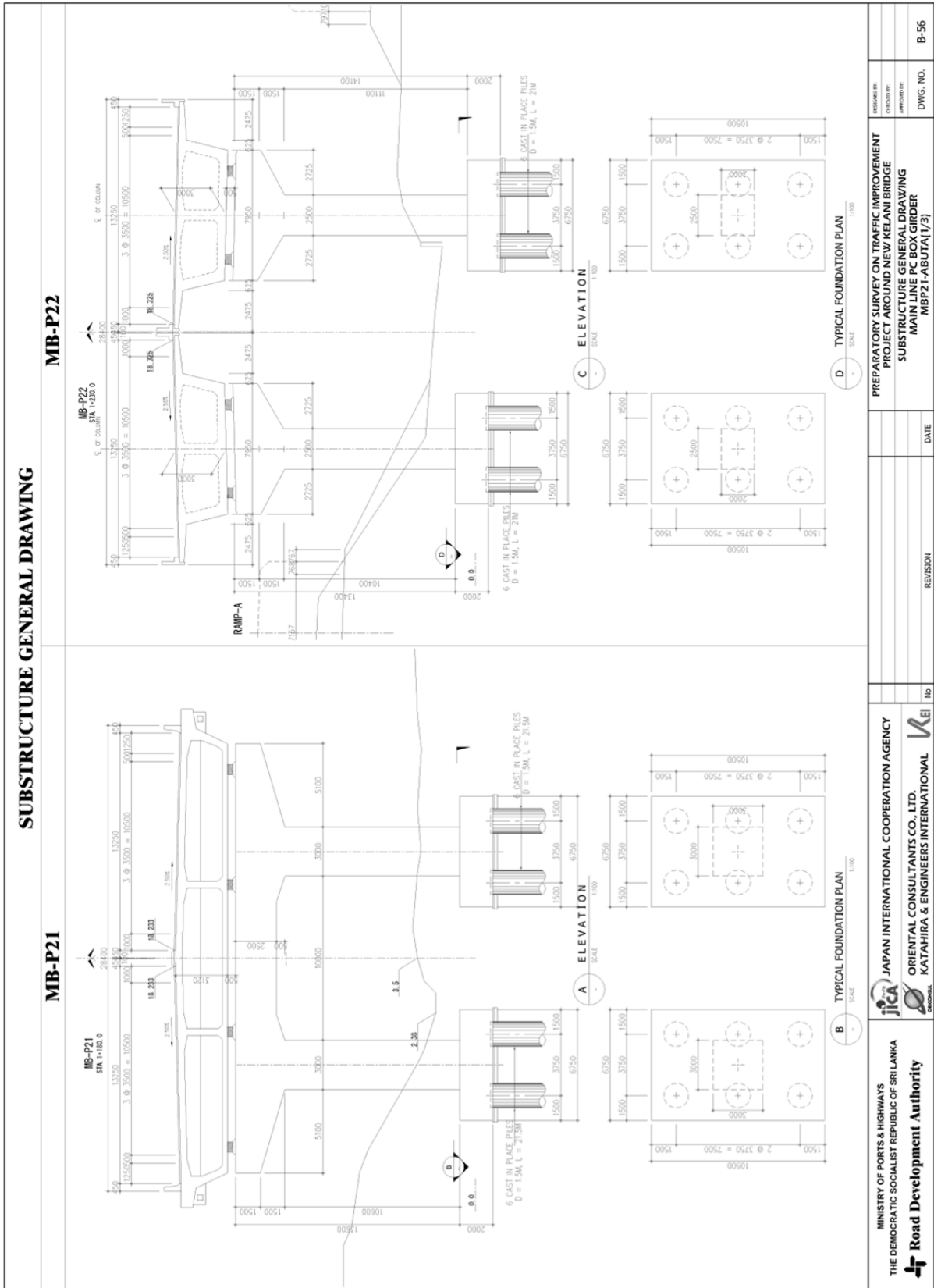










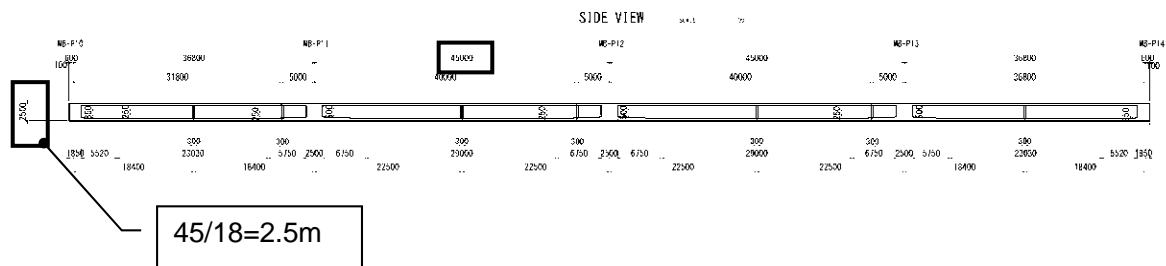


## 5.2.5 Approach Bridge (PC Box Girder Bridge, Separated Section) Design

### (1) Cross Section of Superstructure

#### 1) Girder Height

Generally, for the continuous box girder, the ratio of girder-span is from 1/15 to 1/20. This case adopted 1/18. The bridge girder is decided based on fixed height to decrease cost and reduce construction schedule.



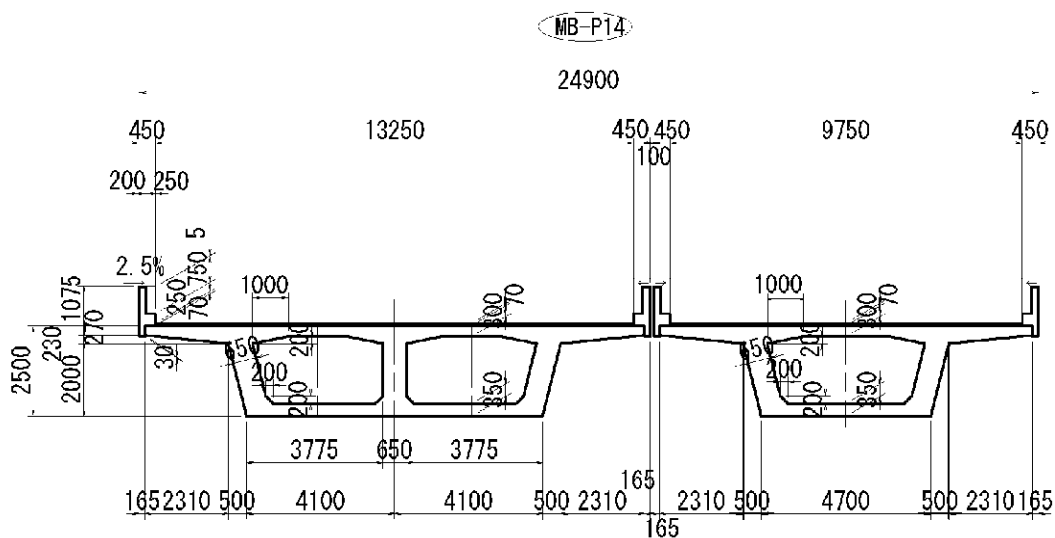
Source: JICA Survey Team

**Figure 5.2.17 Girder Height (Separated Section)**

#### 2) Deck Span, Girder Configuration

Cantilever span is designed with maximum of centre deck span set to 6.0m and the ratio of centre span to cantilever is 1:0.6.

Two-cell box girder is selected for bridge width larger than 14.1m, while one-cell box girder is for other locations.



Source: JICA Survey Team

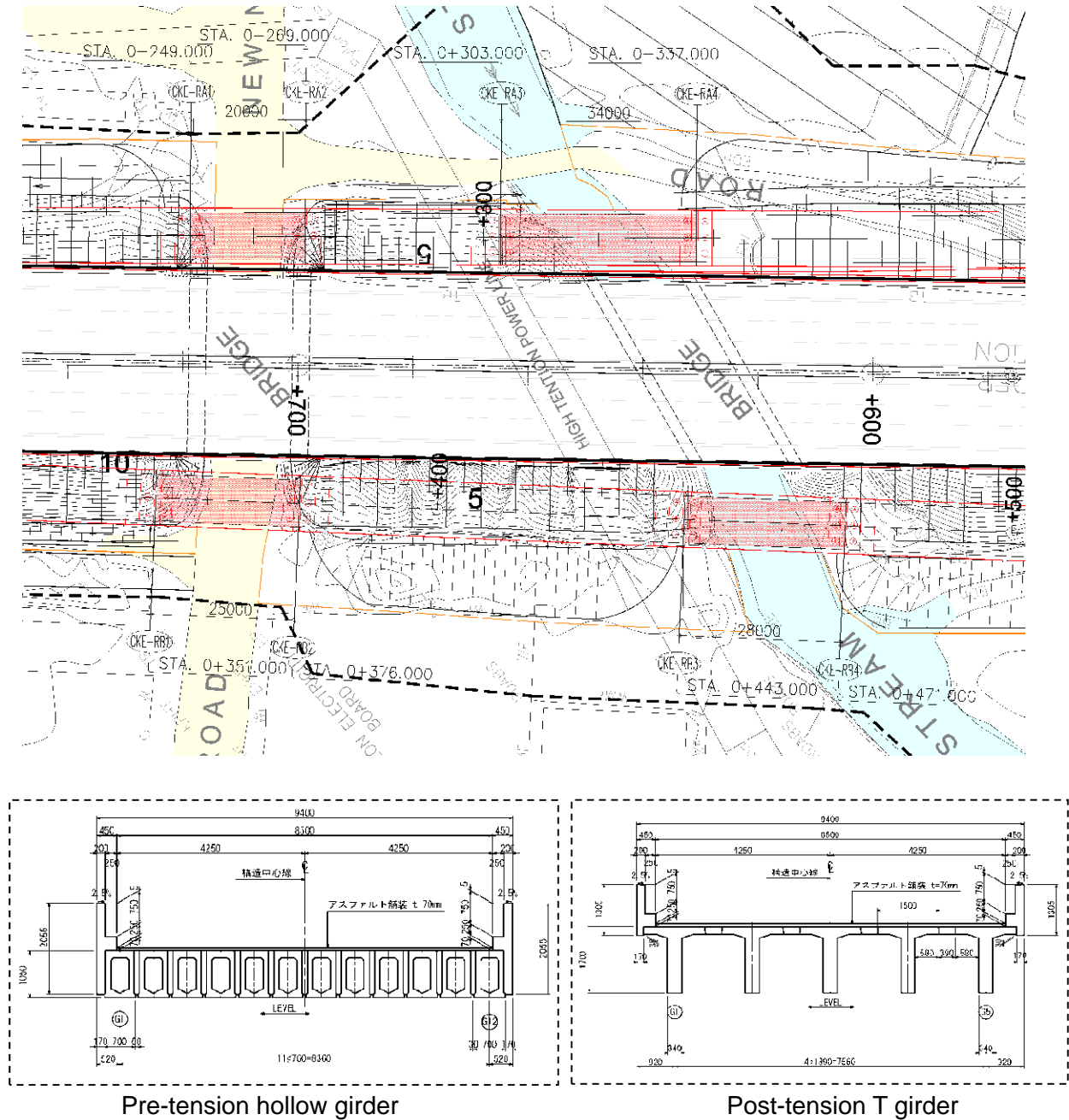
**Figure 5.2.18 Deck Span, Girder Configuration (Separated Section)**

(2) Bridge Types at CKE Section

In CKE section, span lengths are approximately 20m for bridges crossing over the existing frontage road, and approximately 35m for bridges over the canal.

Bridge crossing the frontage road: Pre-tension hollow girder

Bridge over the canal: Post-tension T girder

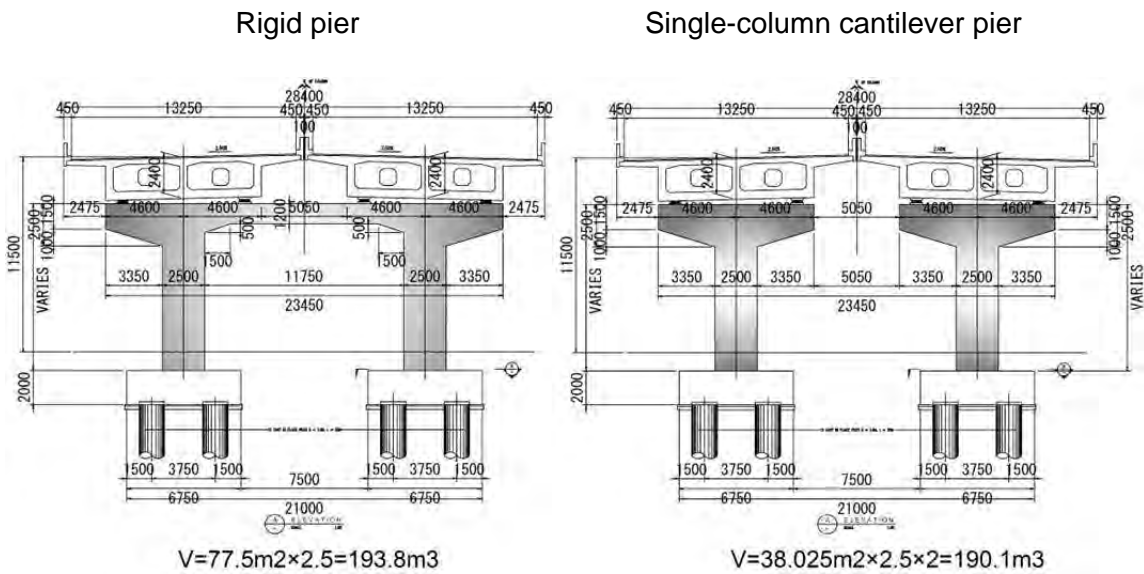


Source: JICA Survey Team

Figure 5.2.19 CKE Section

(3) Cross Section of Substructure

Single-column RC pier is selected following the comparison below.

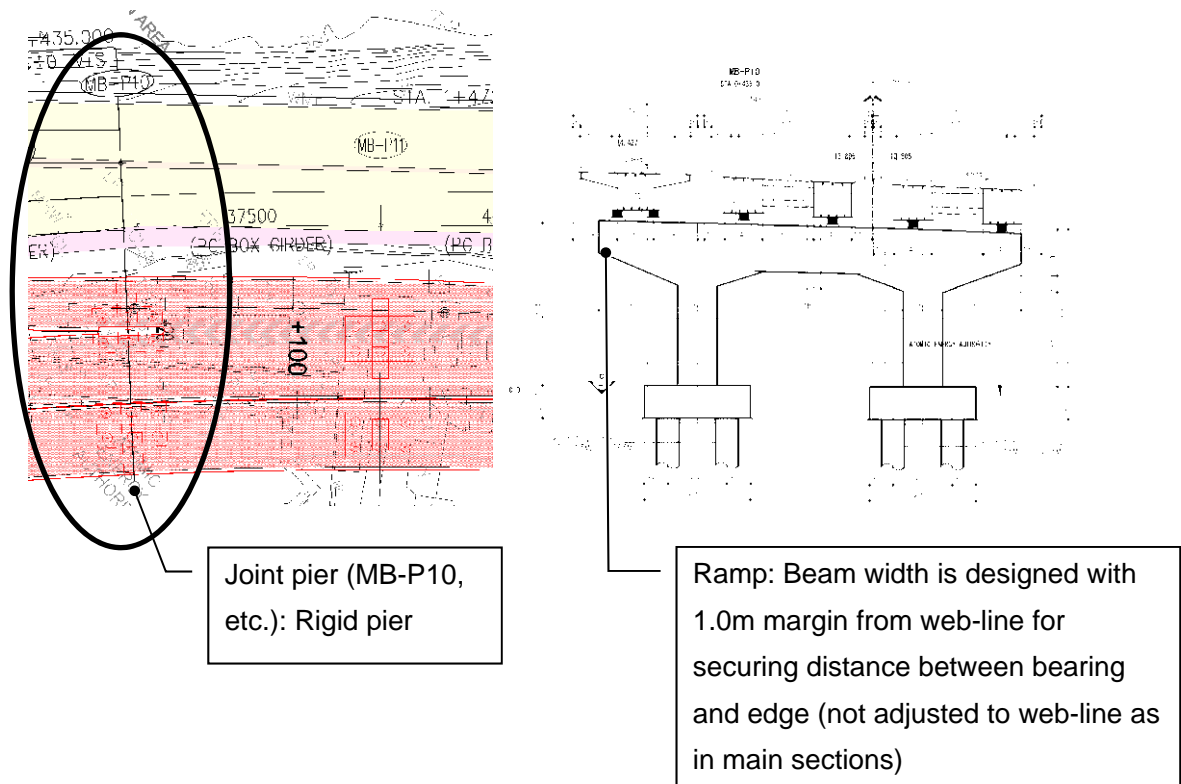


Source: JICA Survey Team

**Figure 5.2.20 Pier Type Comparison**

- Smaller volume of concrete
  - No required falsework for centre beam
- ➔ Single-column pier

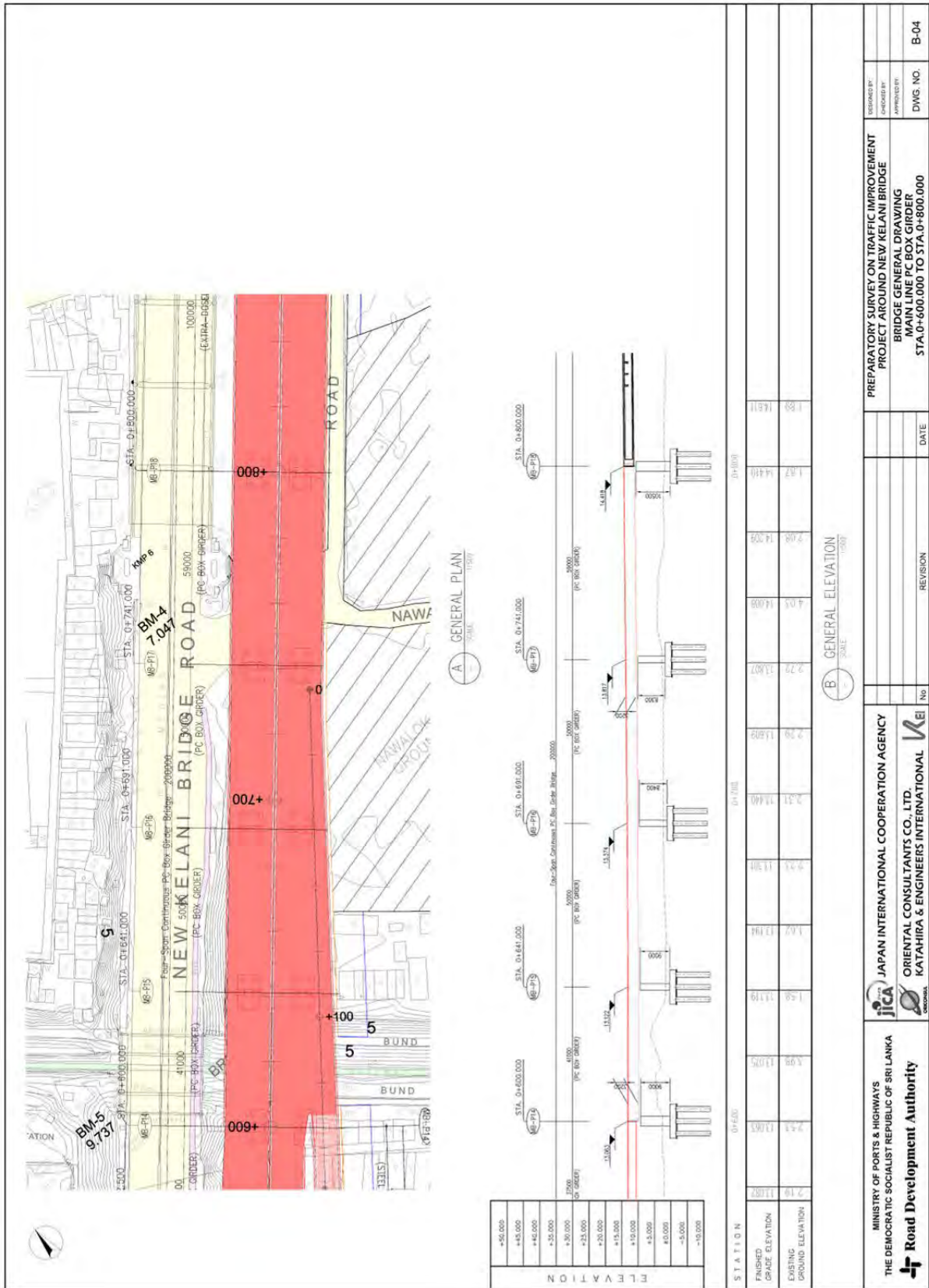
Note that at joint sections (road noses), cantilever length are usually larger than 6.0m, which means rigid piers are adopted.



Source: JICA Survey Team

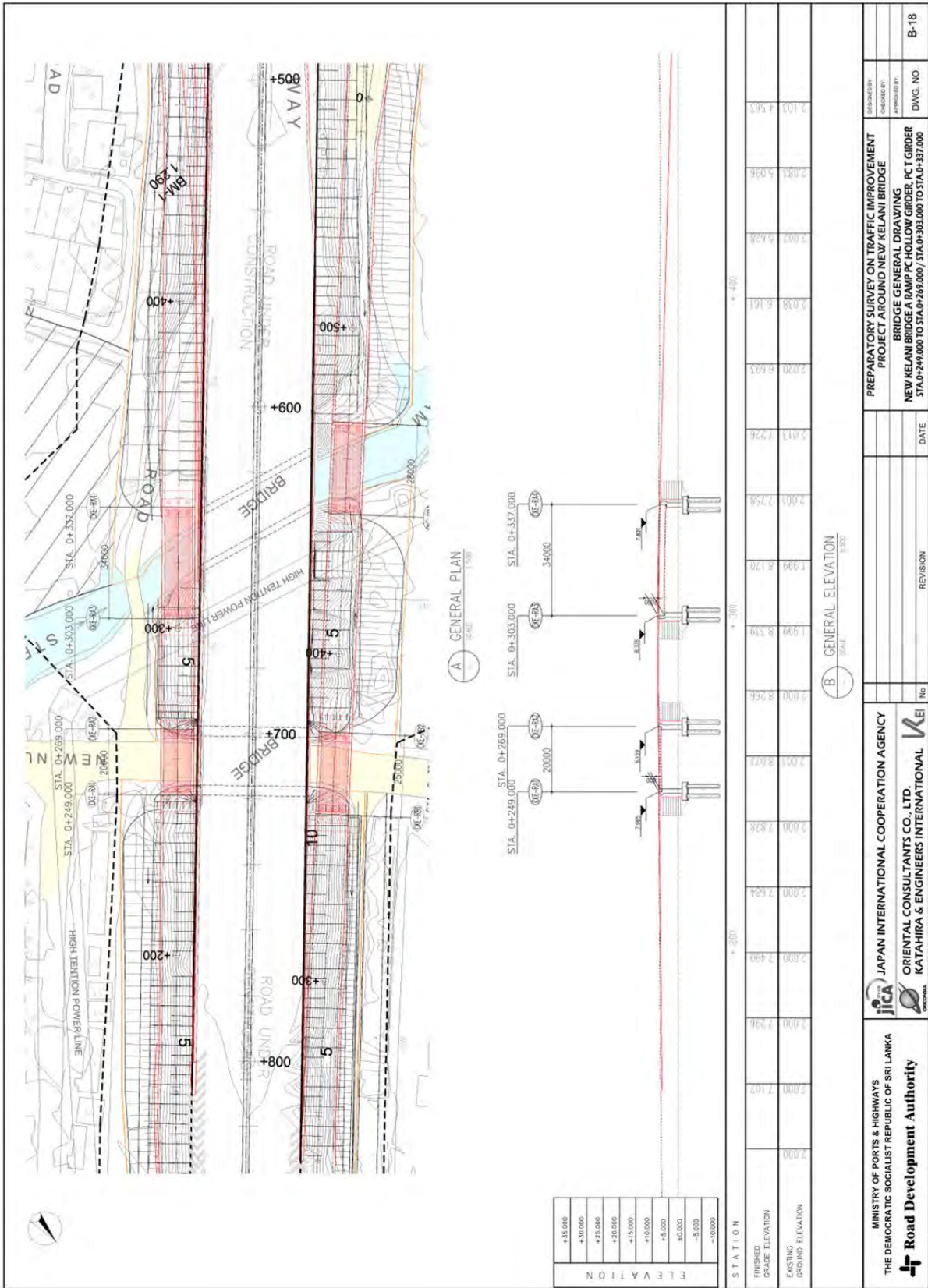
**Figure 5.2.21 Rigid Pier at Joint**










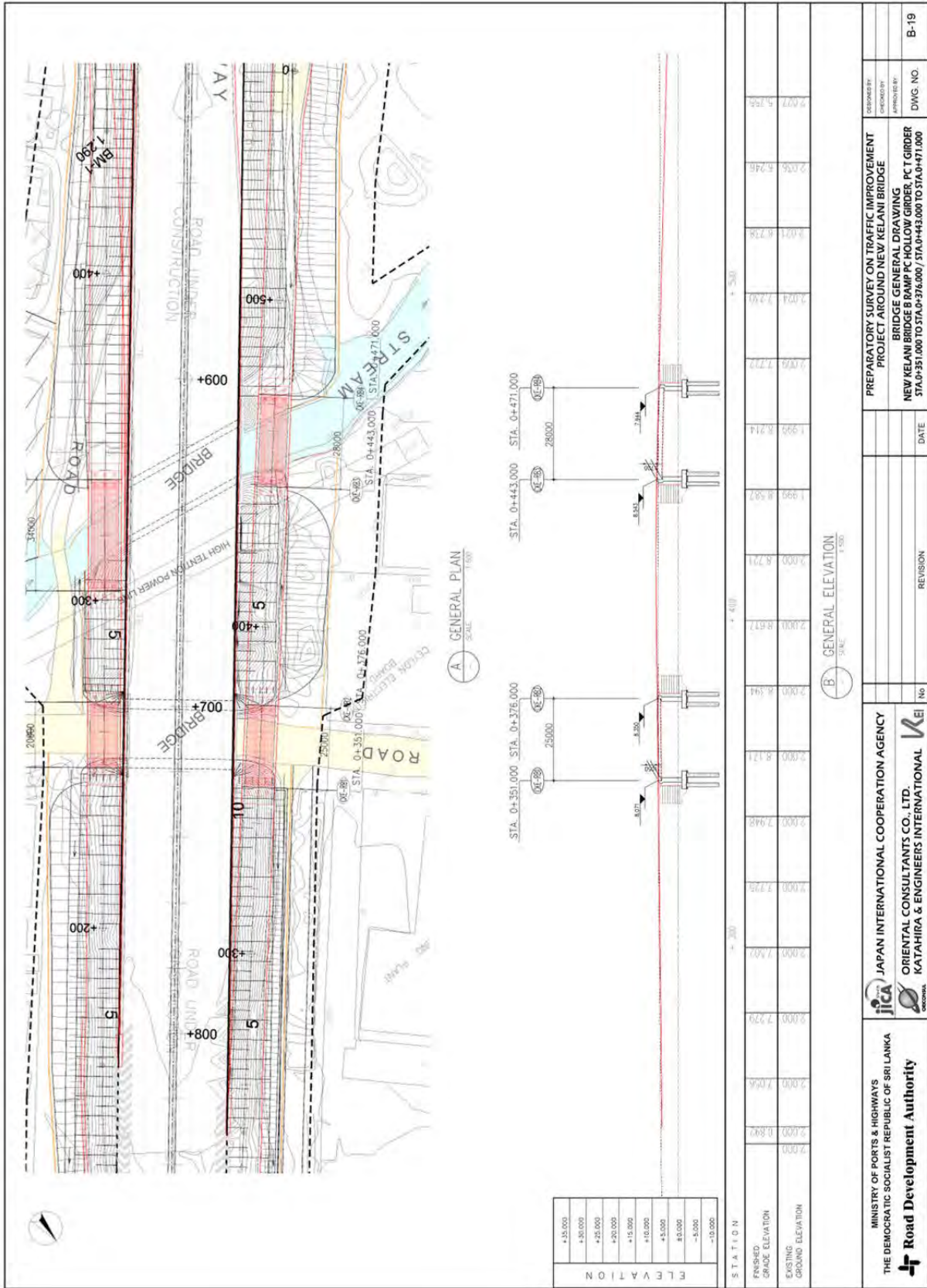




NO	REVISION	DATE

PREPARATORY SURVEY ON TRAFFIC IMPROVEMENT PROJECT AROUND NEW KELANI BRIDGE  
 BRIDGE GENERAL DRAWING  
 NEW KELANI BRIDGE A RAMP PC-HOLLOW GIRDER, P.C.T GIRDER  
 STA. 0+249,000 TO STA. 0+269,000 / STA. 0+303,000 TO STA. 0+337,000

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 APPROVED BY: \_\_\_\_\_  
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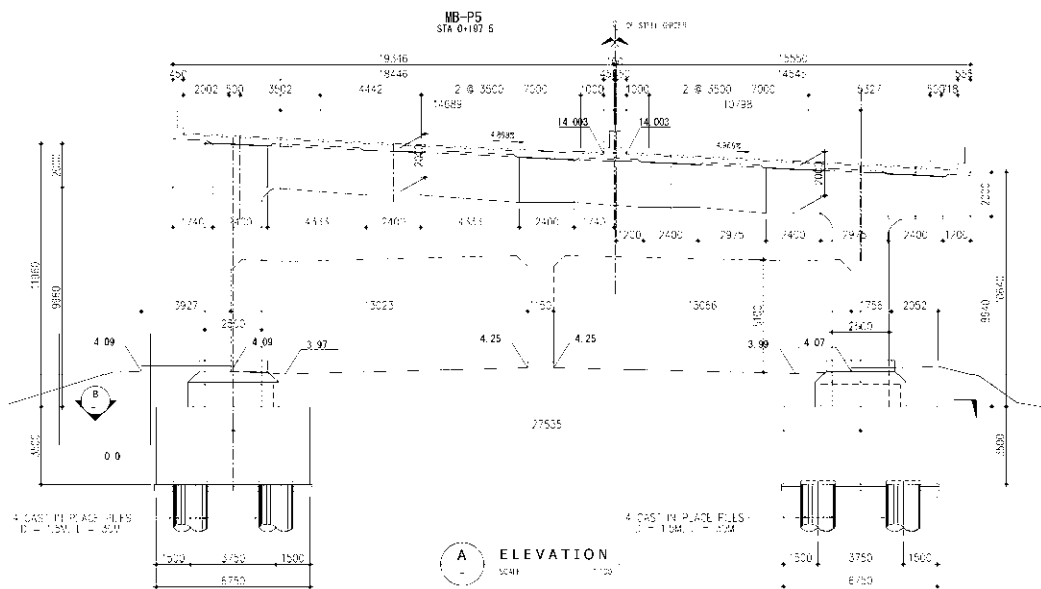


## 5.2.6 Approach Bridge (Steel Box Girder Bridge, Overlapped Section) Design

### (1) Cross Section of Superstructure

#### 1) Bearing Structure

For the section of MB-P1 to MB-P6, rigid structure is selected because of small vertical clearance. Bearing structures are for other sections.

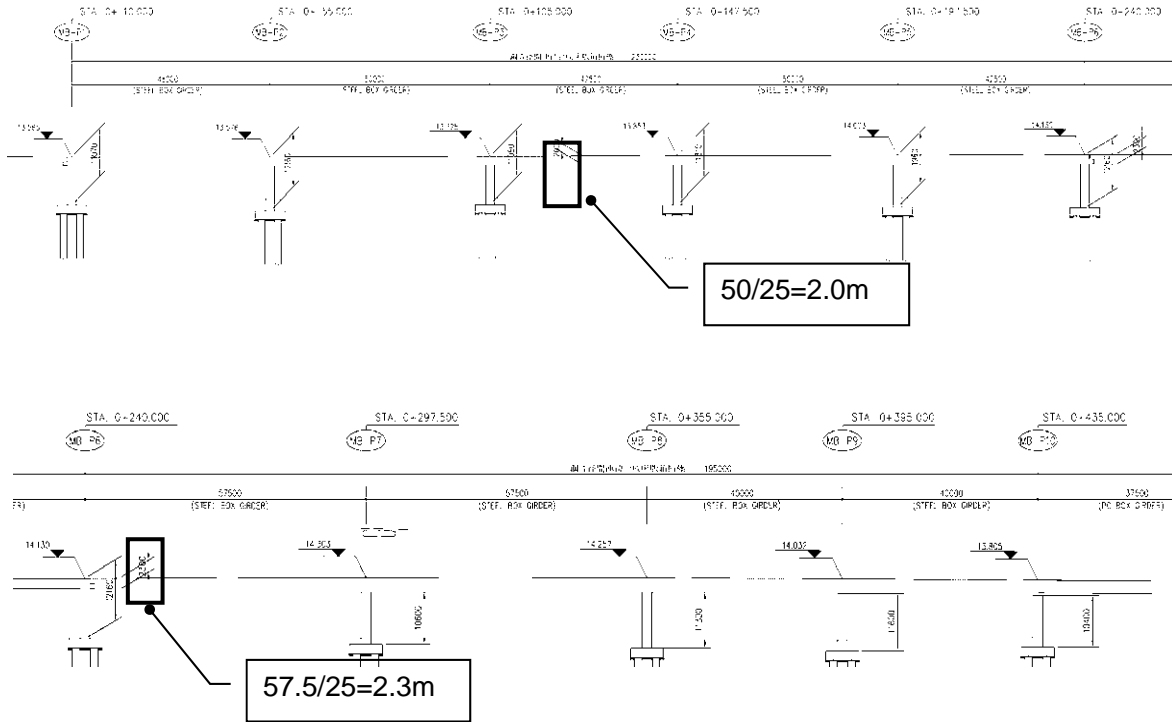


Source: JICA Survey Team

**Figure 5.2.22 Rigid Structure**

#### 2) Girder Height

Generally, for the continuous non-composite box girder, the ratio of girder-span is between 1/20 to 1/30. The ratio of 1/25 is adopted for the bridge.



Source: JICA Survey Team

**Figure 5.2.23 Girder Height (Overlapped Section)**

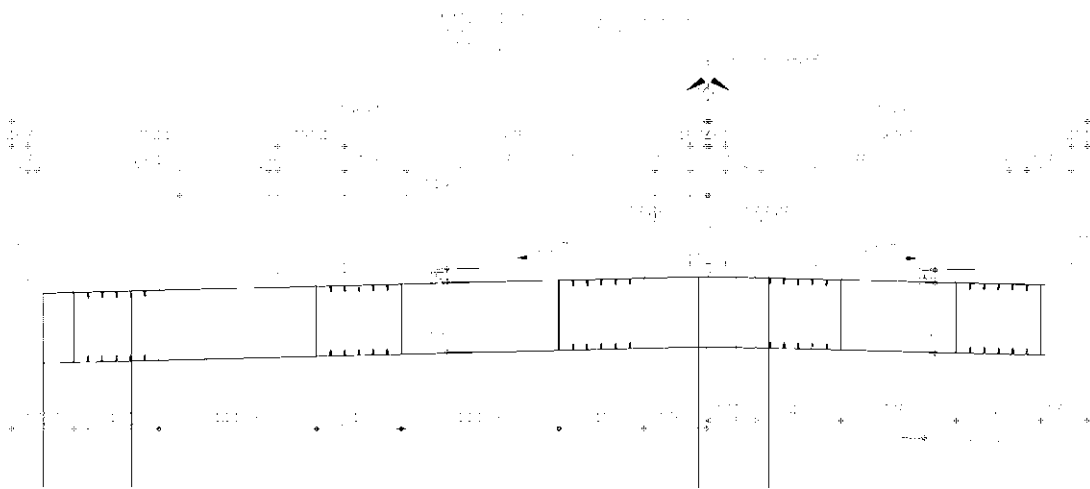
### 3) Girder Width

Transportation limit of girder is 3.5m, with web joint 0.4m at each side. 2.4m of width is adopted for the bridge.

### 4) Deck Span, Girder Configuration

With reference to past record, maximum of deck span is 8.0m, and cantilever is 2.0m.

Three-girder structure is selected for deck width larger than 16.8m; two-girder is for other locations.

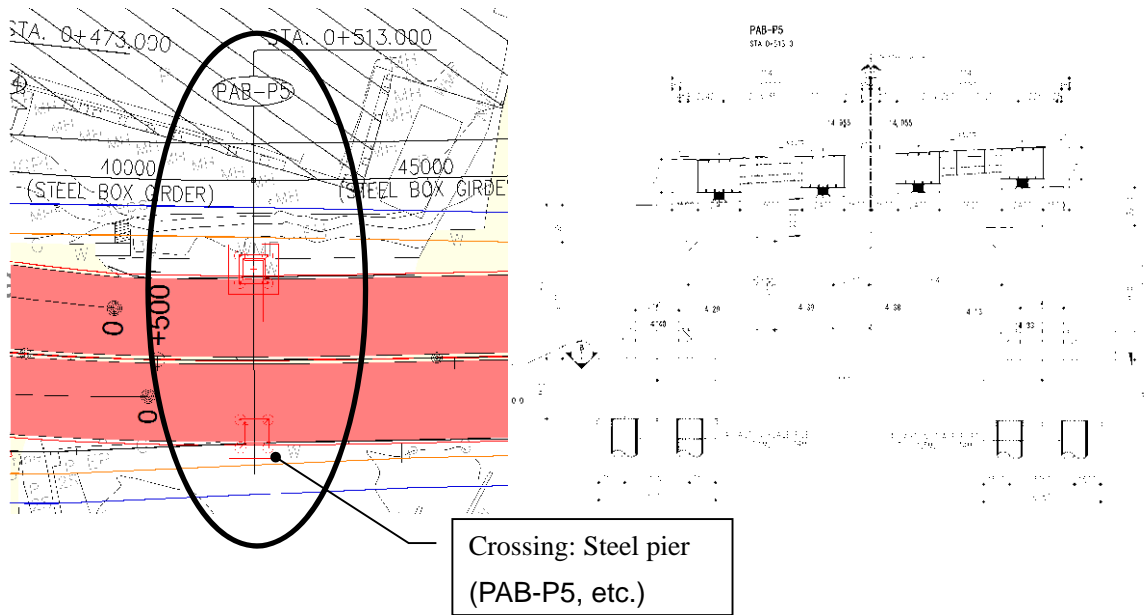


Source: JICA Survey Team

**Figure 5.2.24 Deck Span, Girder Configuration**

### (2) Cross Section of Substructure

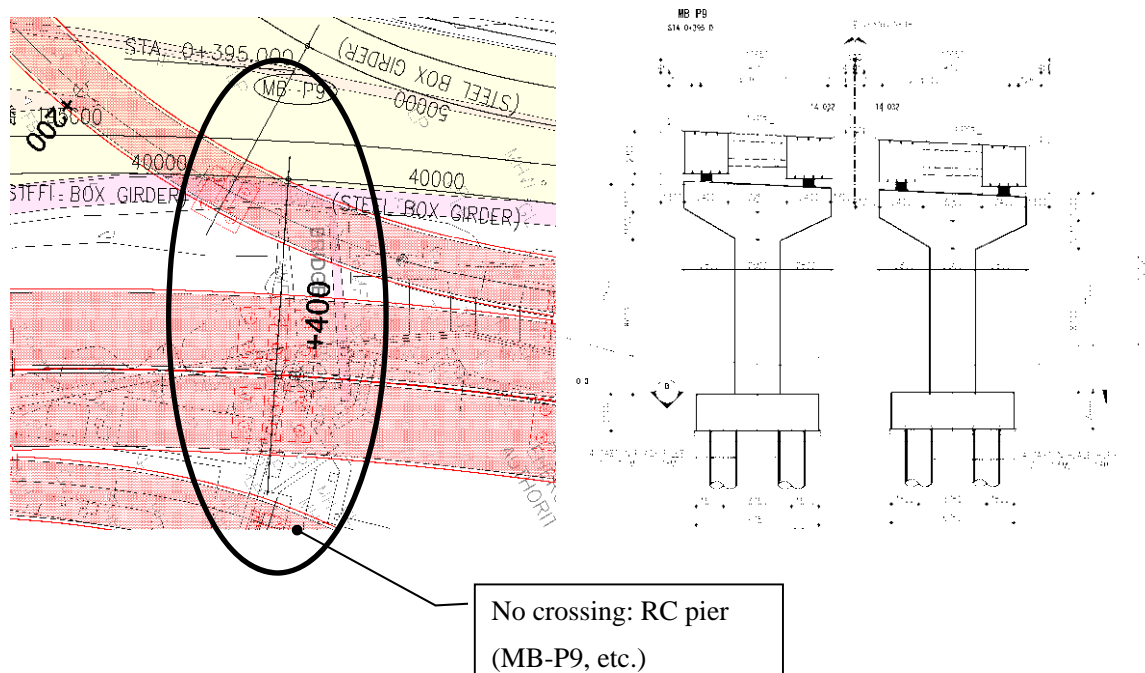
Steel piers are selected for locations which the new alignment crosses Port Access Road and Baseline Road.



Source: JICA Survey Team

**Figure 5.2.25 Steel Pier at Crossing (Overlapped Section)**

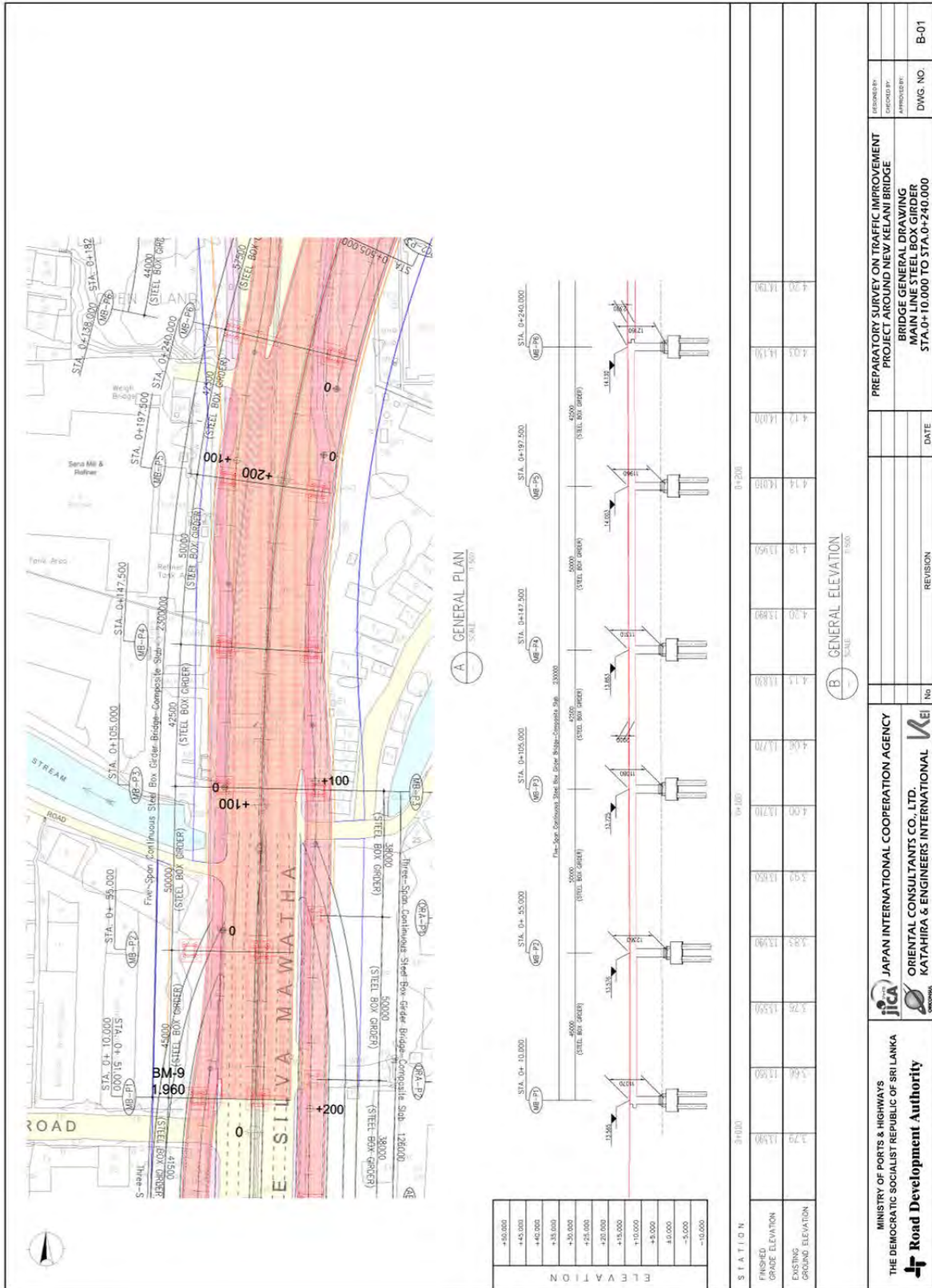
Other locations (for instance, MB-P9), RC piers are adopted. Beam widths are also adjusted to web-line.



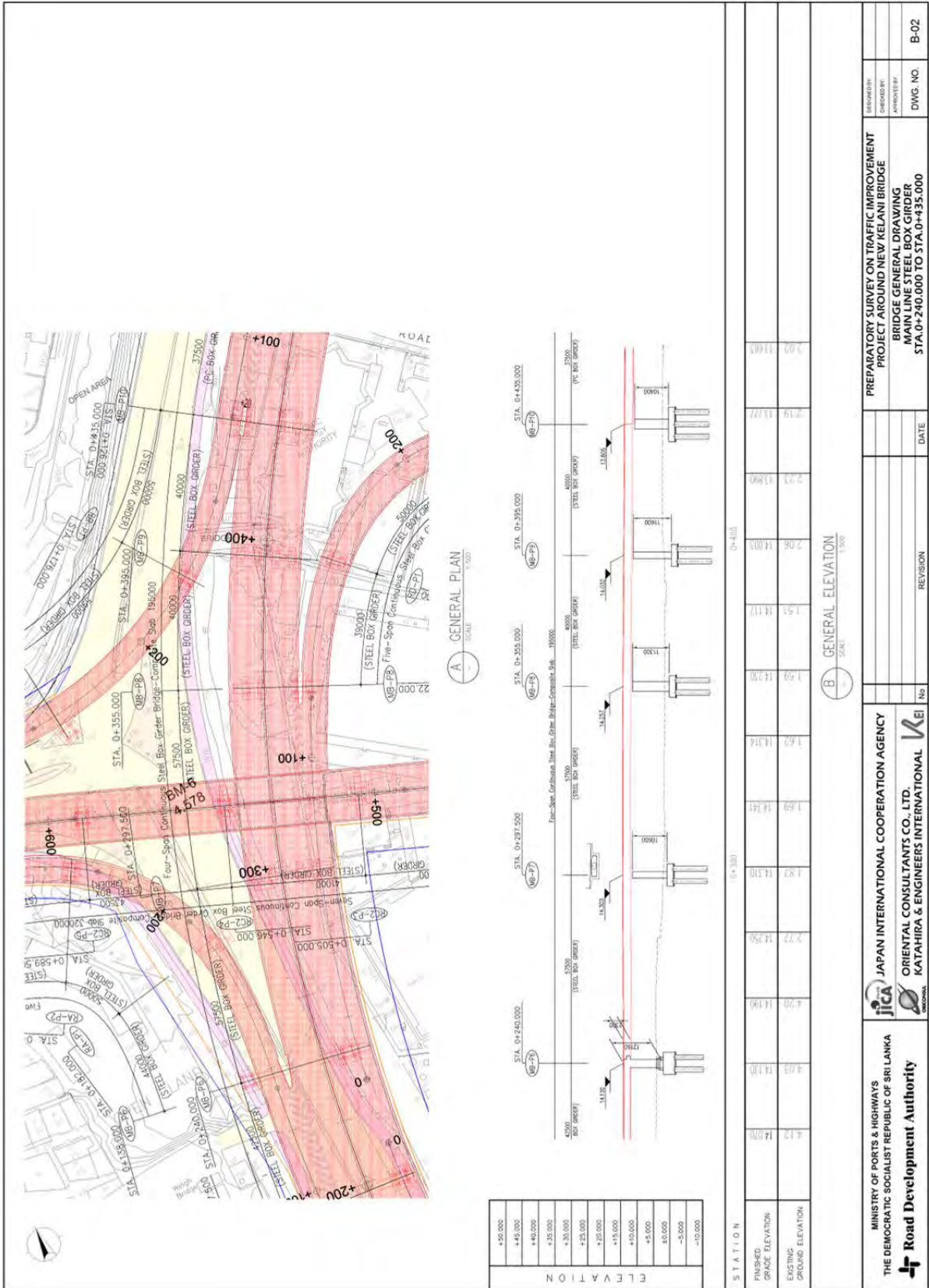
Source: JICA Survey Team

**Figure 5.2.26 RC Pier where no Crossing Present (Overlapped Section)**

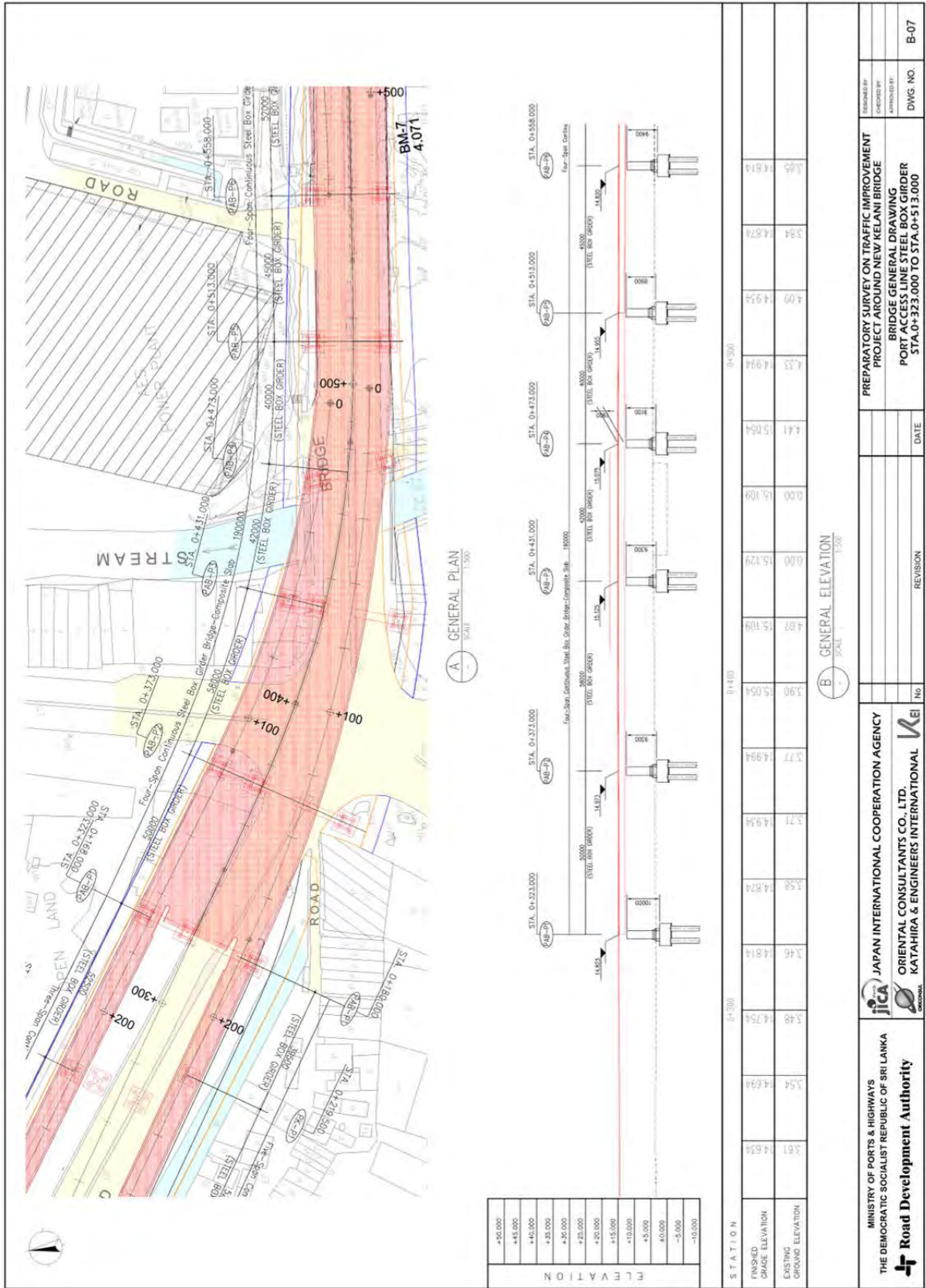
(3) General View







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CHECKED BY			
APPROVED BY			



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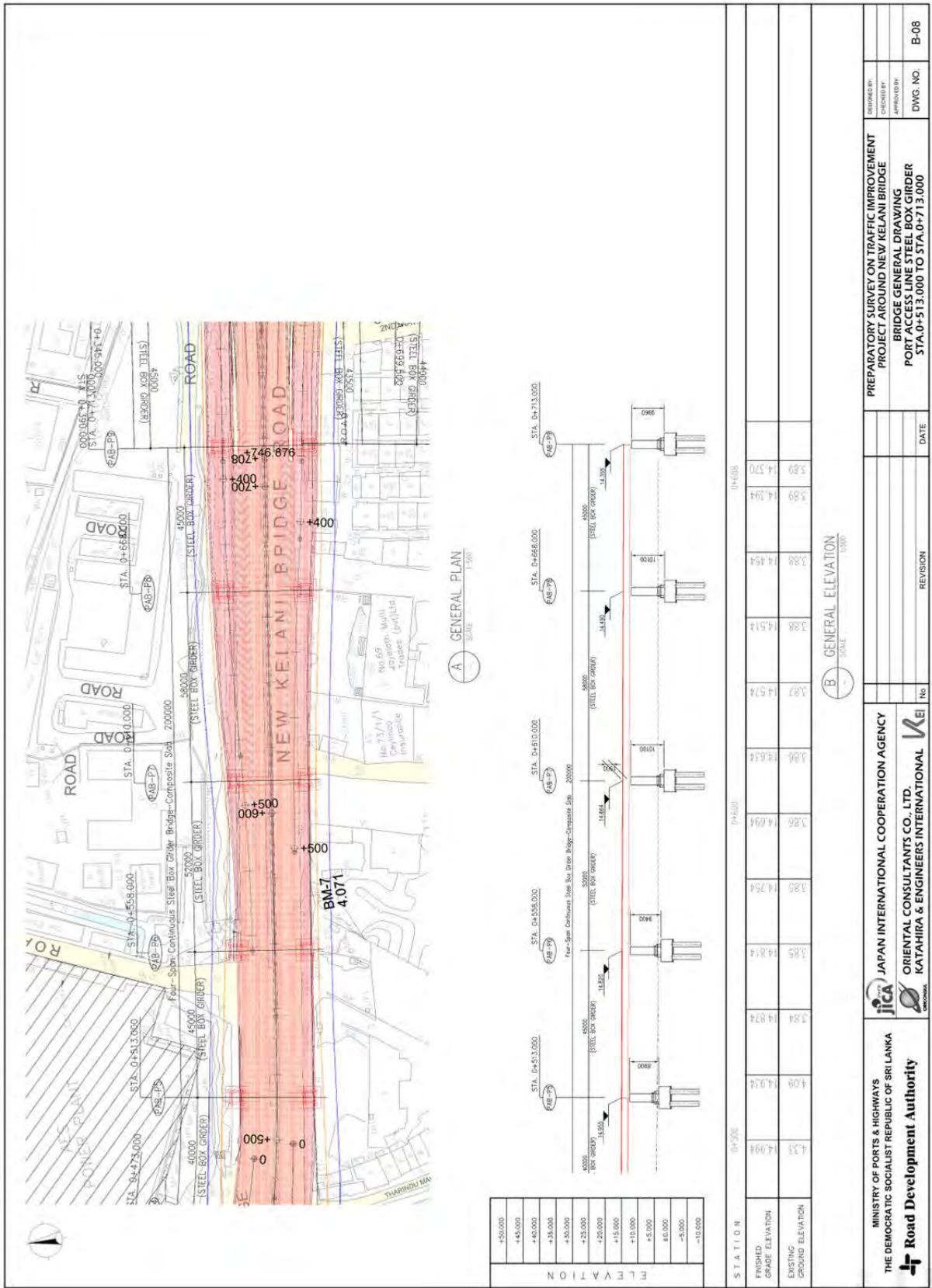
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PREPARATORY SURVEY ON TRAFFIC IMPROVEMENT PROJECT AROUND NEW KELANI BRIDGE  
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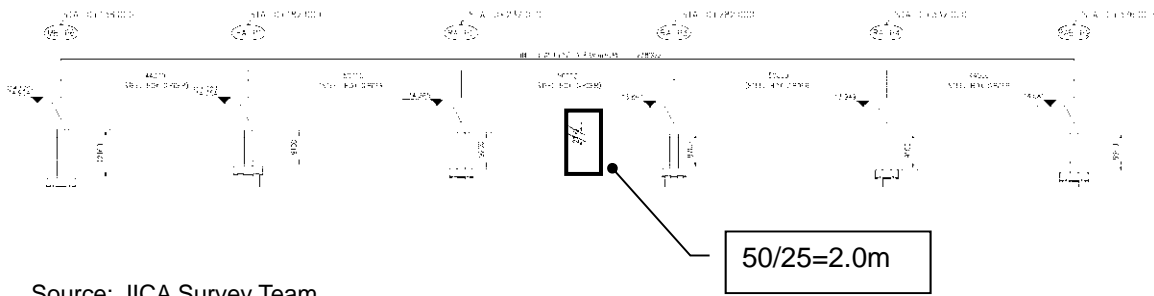


## 5.2.7 Ramp Bridge Design

### (1) Cross Section of Superstructure

#### 1) Girder Height

Similar to Overlapped Section, the ratio between girder height and span is set to 1/25.

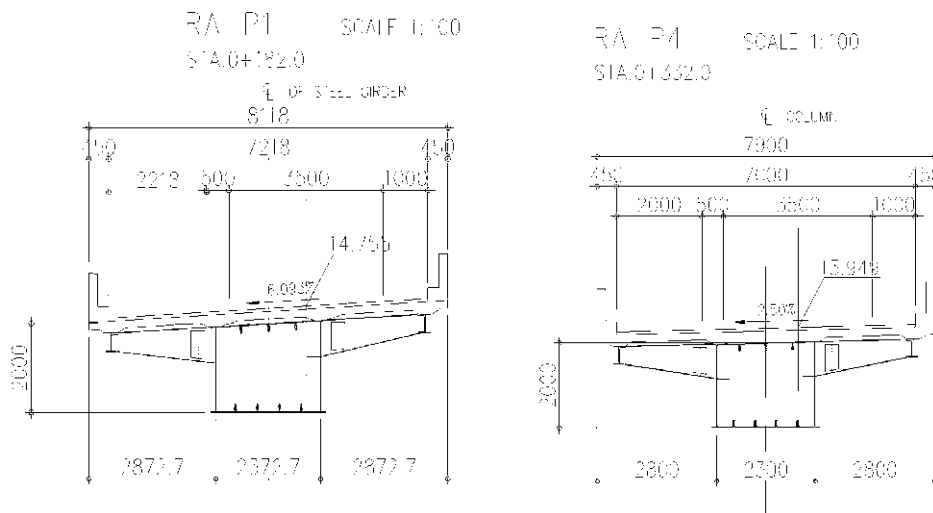


Source: JICA Survey Team

**Figure 5.2.27 Girder Height (Ramp)**

#### 2) Box Girder Width, Deck Span, Girder Configuration

Vertical girders are installed 0.5m from the edge of cantilever to equally divide box girder width and cantilever span. For widened sections, linear interpolation method is adopted.

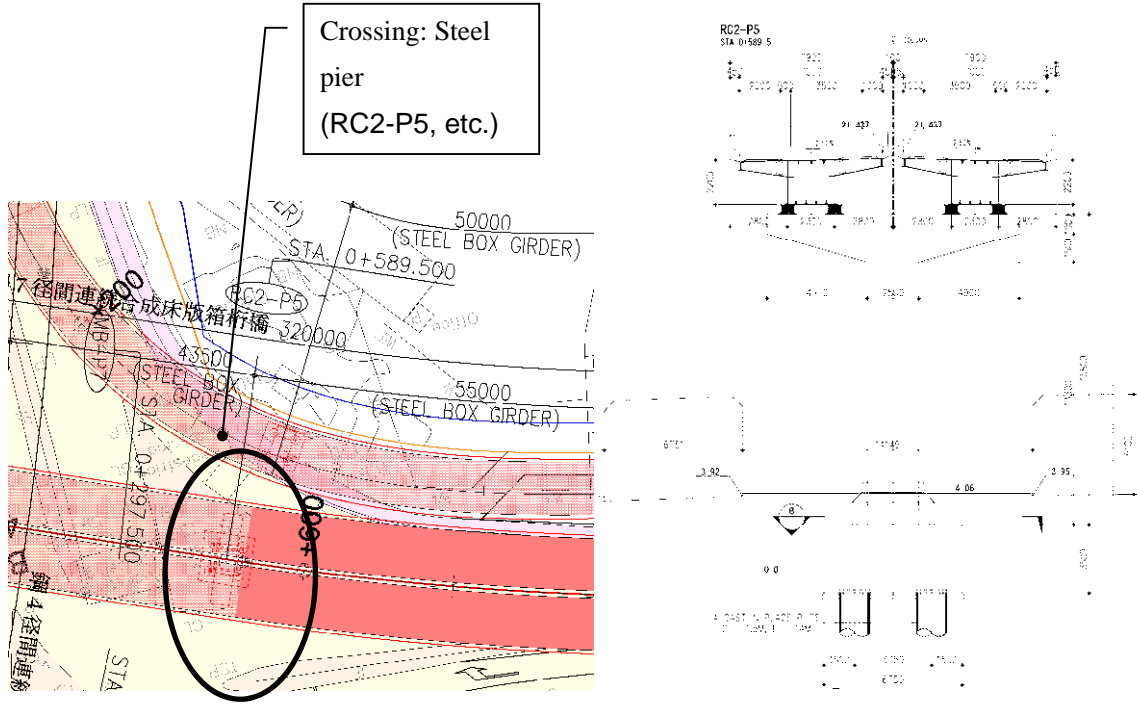


Source: JICA Survey Team

**Figure 5.2.28 Girder Width, Deck Span, Girder Configuration**

(2) Cross Section of Substructure

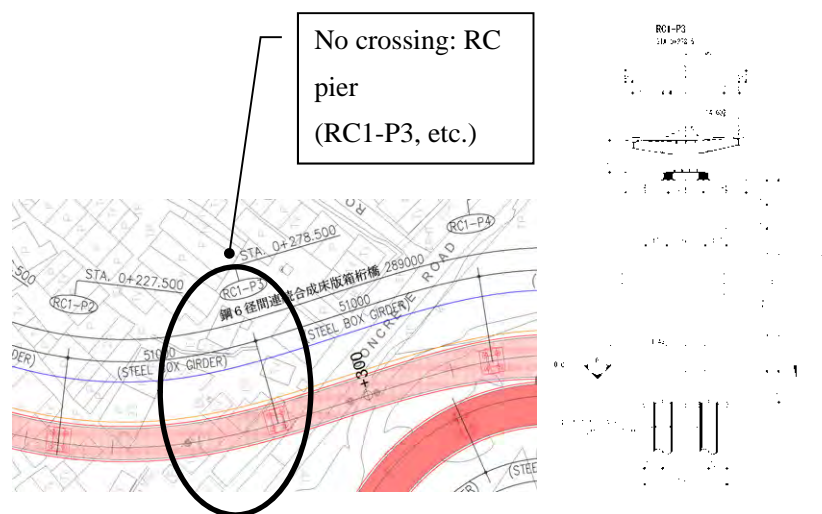
Similar to Overlapped Section, steel piers are installed at the locations crossing Port Access Road and Baseline Road. Also mentioned in Separated Section, beam widths are designed with margin of 1.0m from the web-line.



Source: JICA Survey Team

**Figure 5.229 Steel Pier at Crossing (Ramp)**

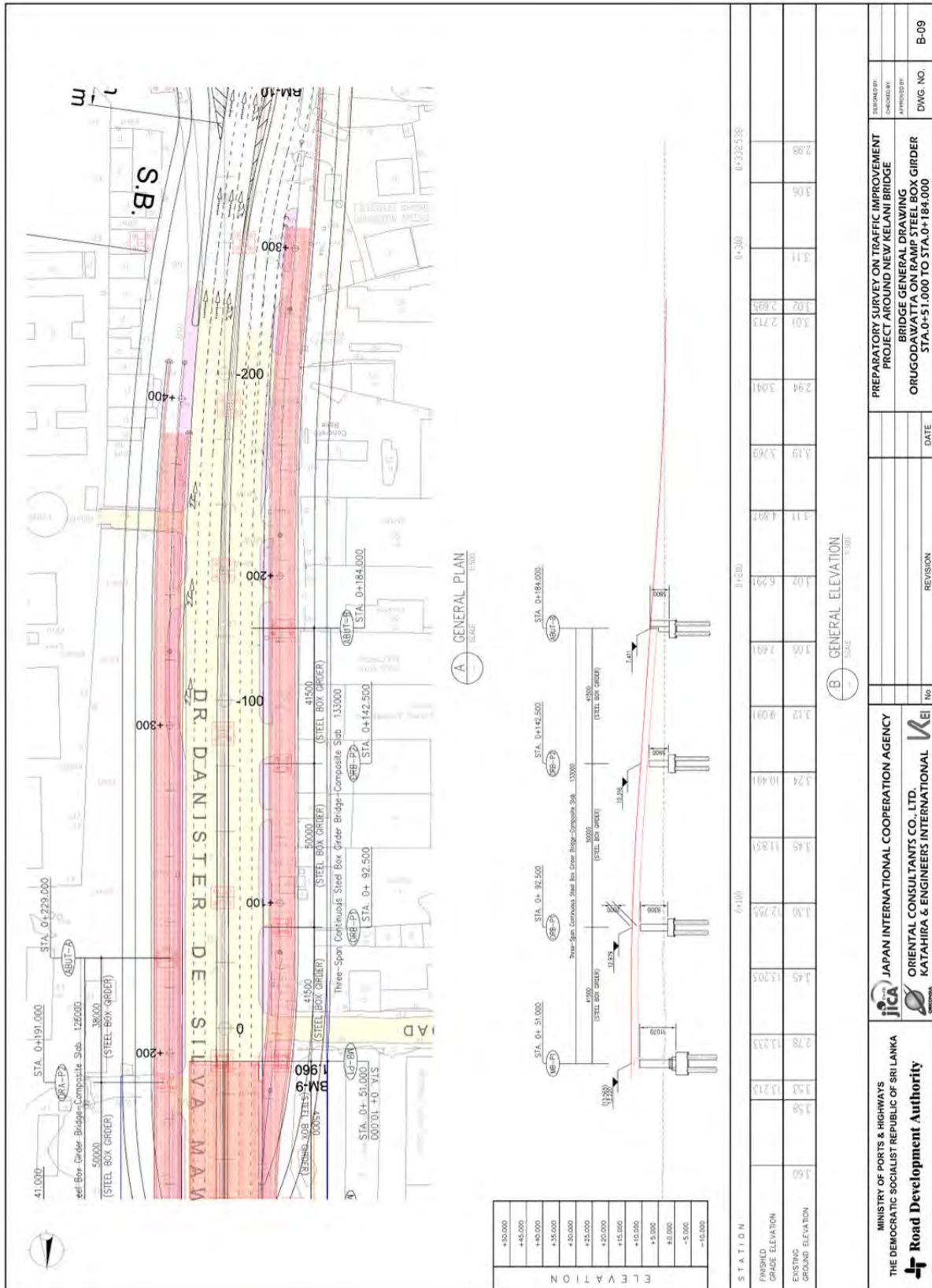
In other locations (for instance, RC1-P3), RC piers are adopted.

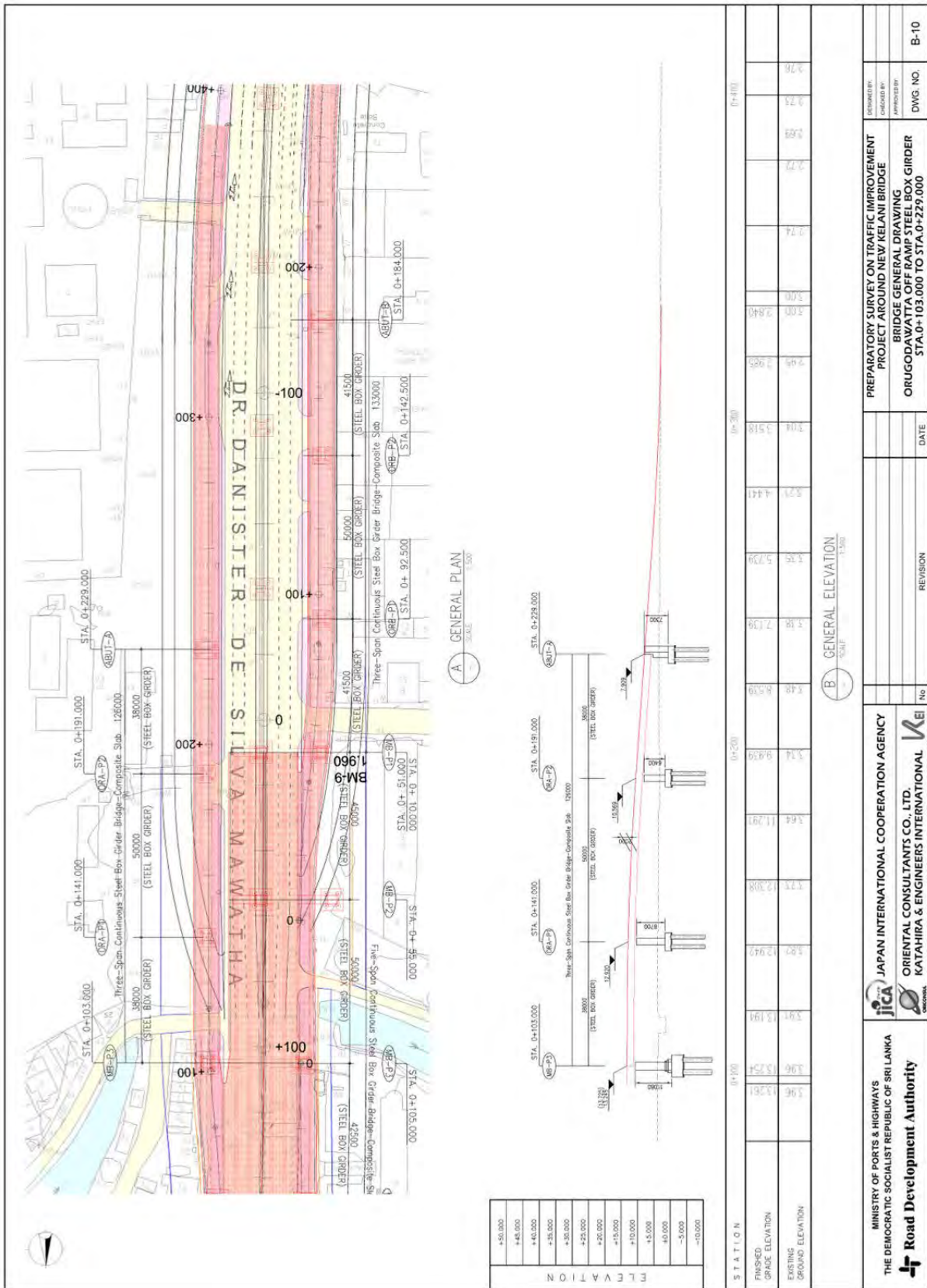


Source: JICA Survey Team

**Figure 5.230 RC Pier where no Crossing Present (Ramp)**

(3) General View







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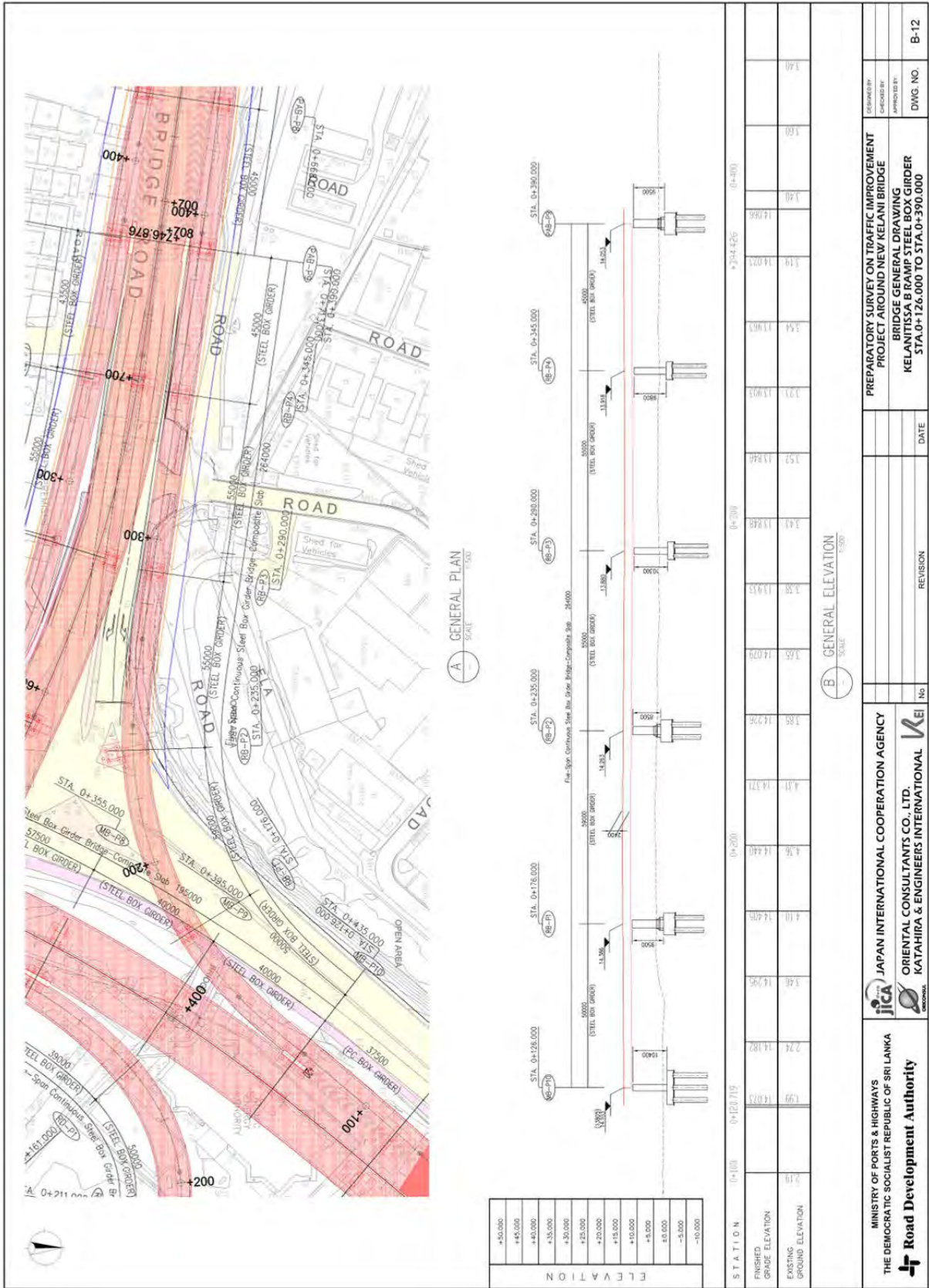
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BRIDGE GENERAL DRAWING  
KELANITISSA A RAMP STEEL BOX GIRDER  
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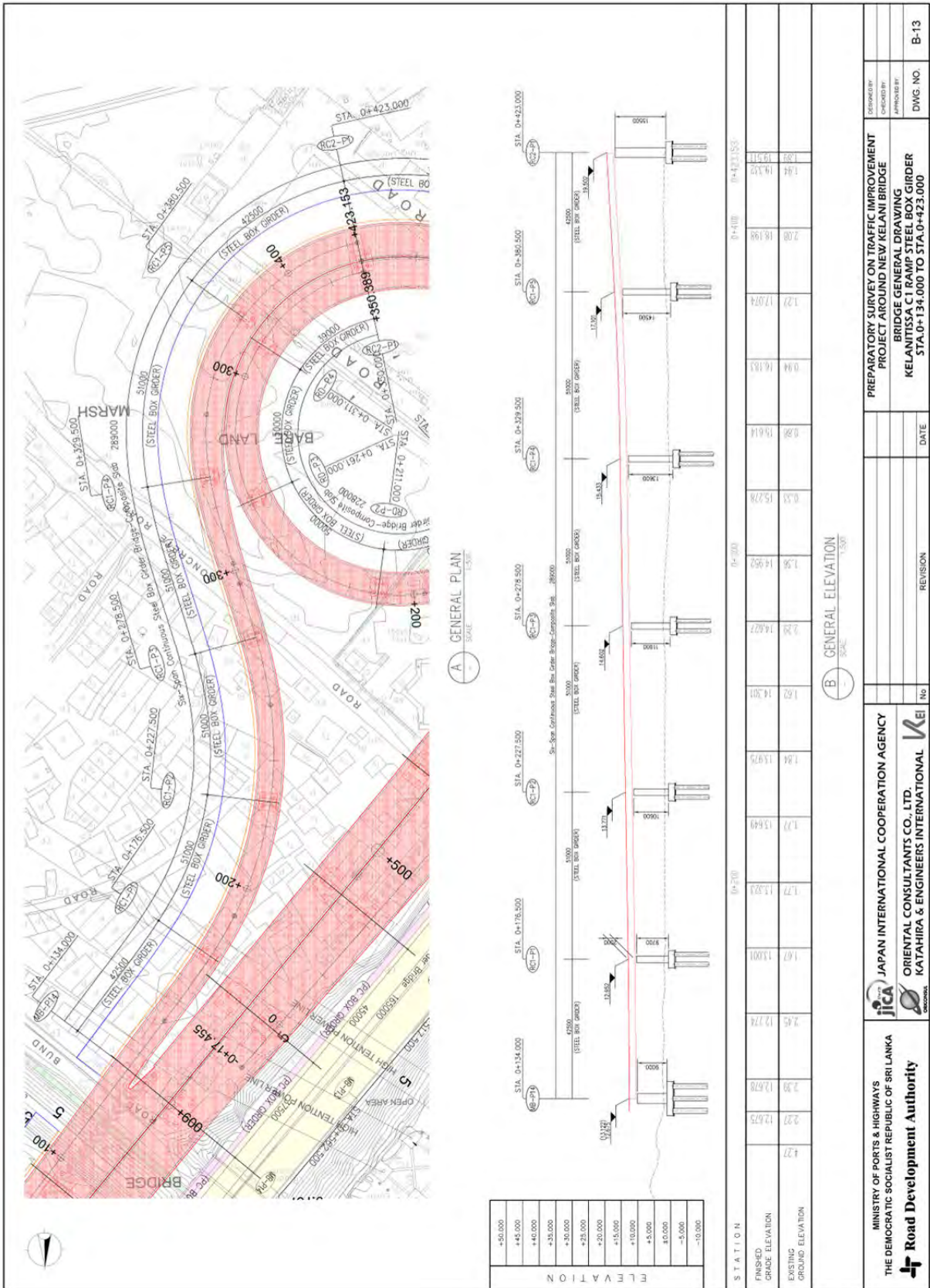
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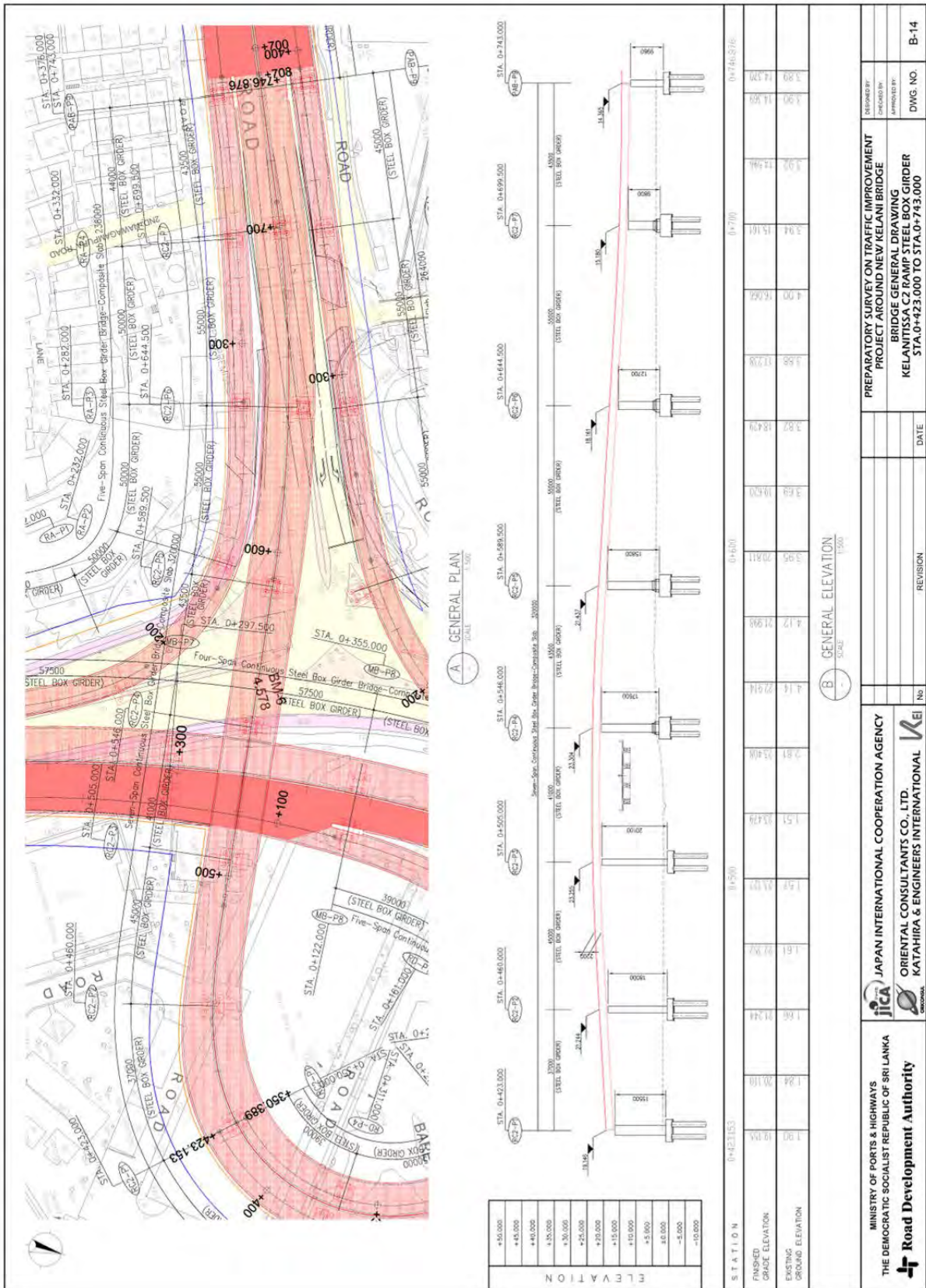
PREPARATORY SURVEY ON TRAFFIC IMPROVEMENT PROJECT AROUND NEW KELANI BRIDGE  
BRIDGE GENERAL DRAWING  
KELANITTISSA B RAMP STEEL BOX GIRDER  
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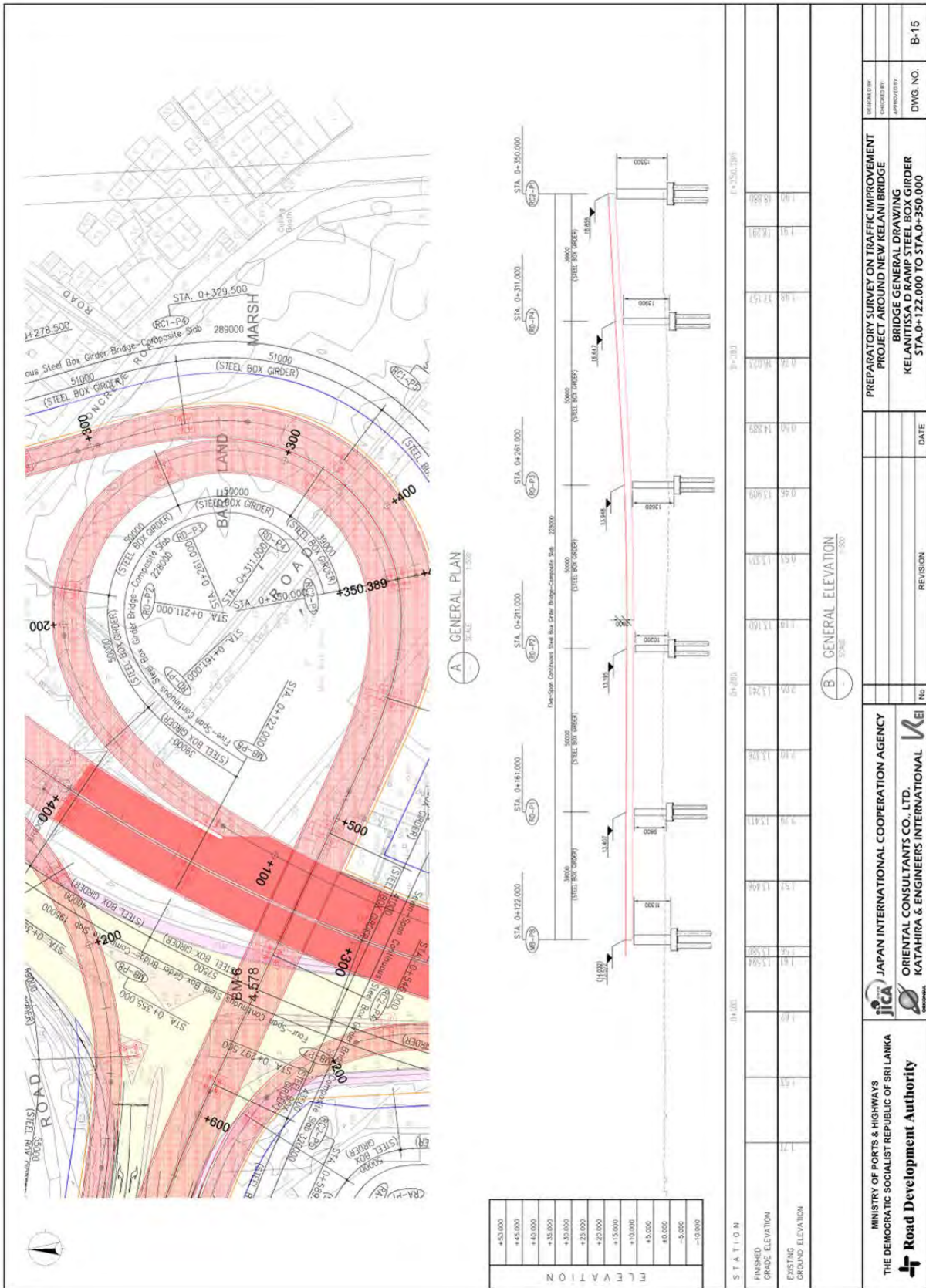
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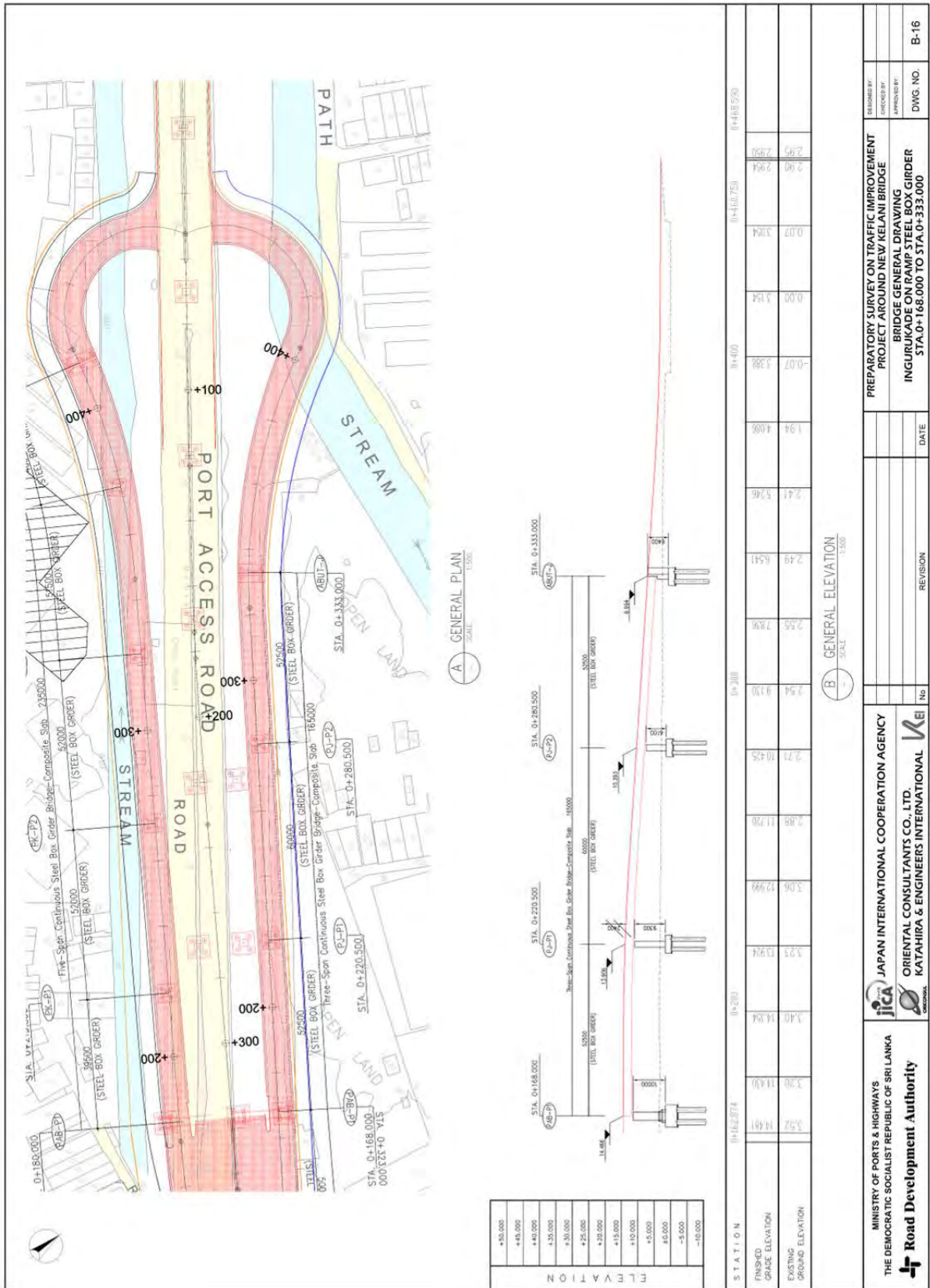
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BRIDGE GENERAL DRAWING  
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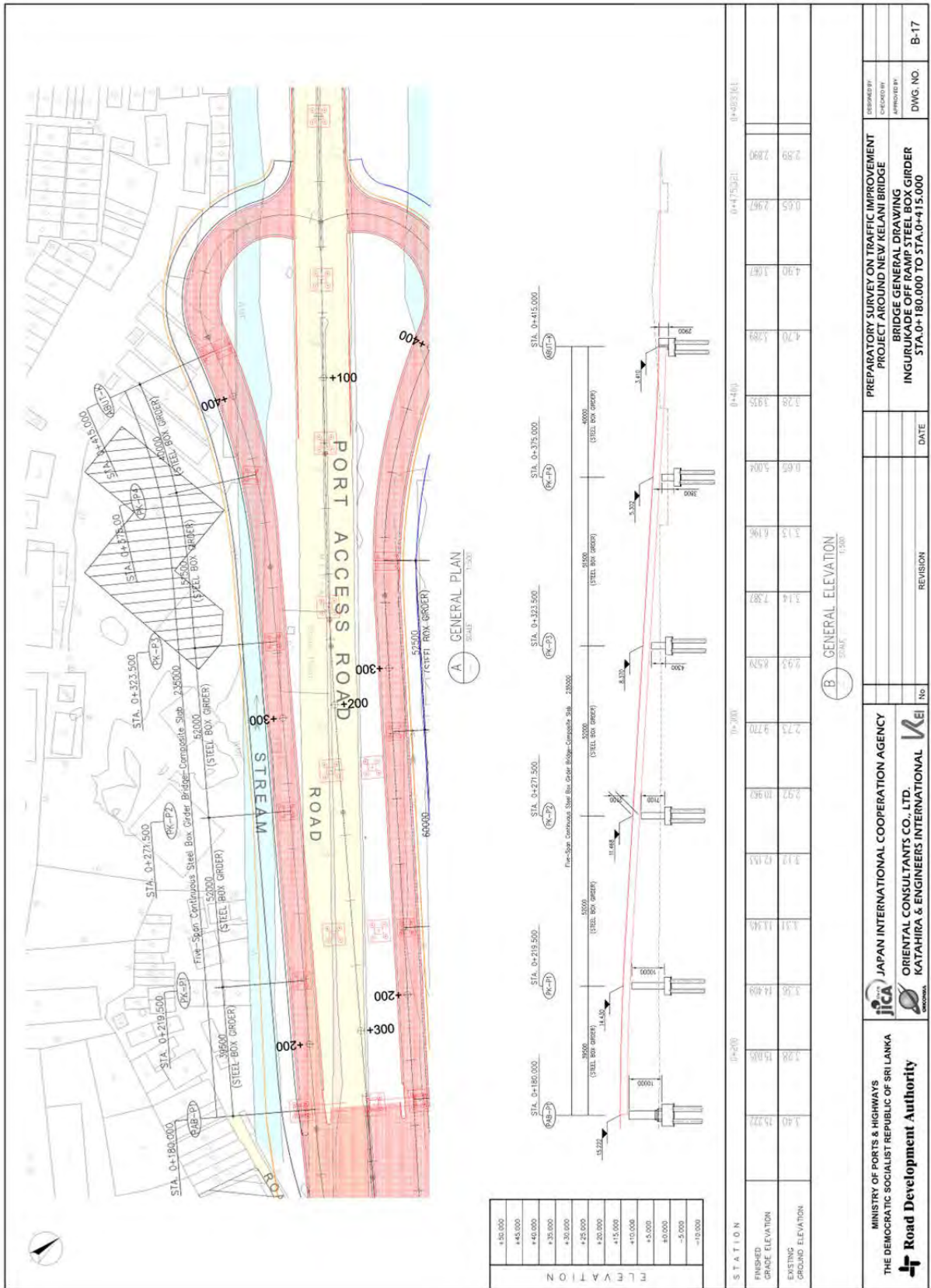
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**BRIDGE GENERAL DRAWING**  
**INGURUJADE ON RAMP STEEL BOX GIRDER**  
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INGURUKADE OFF RAMP STEEL BOX GIRDER  
STA. 0+180.000 TO STA. 0+415.000

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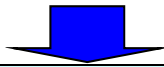
## 5.2.8 Aesthetic Design

### (1) Policy of Aesthetic Design

According to study results of “Preliminary Design for the 2<sup>nd</sup> New Kelani Bridge Project (2012: RDA), policy of aesthetic design was defined as follows;

#### **Policy of aesthetic design**

“Creating a bridge that enhances its value and triggers new developments of Sri Lanka”



#### **1. New Symbol of Sri Lanka**

- Many international visitors and tourists will pass through the route and see the bridge.
- The bridge shape shall be beautiful and symbolic to give them a good impression of Sri Lanka.

#### **2. New Landmark of City Area**

- The bridge is located in an open area across the river water.
- The bridge shape shall be remarkable with appropriate height as the new landmark of city area.

#### **3. New City Gate of Colombo**












- The bridge is located the entrance of Colombo central area.
- The bridge shall have a suitable shape as the new city gate of Colombo central area.

Source: The Pre-Preliminary Design (2012)

### (2) Local/ Cultural Contents

Sri Lankan local contents, characters and culture shall be considered for detailed aesthetic design of bridges and other items.

**Table 5.2.11 Local/ Cultural Contents**

<b>Symbols</b>			
			
-The National Flag	-The National Emblem	-The National bird	-The National Flower
<b>Heritage</b>			
			
- Chedi Anuradhapura	- Galvihara	- Sigiriya Rock	- Golden Temple
<b>Culture</b>			
			

Source: The Pre-Preliminary Design (2012)

### (3) Main Bridge

The following computer graphics are example of aesthetic design for the pylon and cable color for the double-plane Extra-dosed Bridge. Detailed aesthetic design shall be done in the detailed design stage in accordance with structural calculation of size of each member.



Source: The Pre-Preliminary Design (2012)

**Figure 5.2.31 Side View of Main Bridge**





Source: The Pre-Preliminary Design (2012)

**Figure 5.2.32 View of Main Bridge from Existing Road**

(4) Approach Bridge

Computer graphics of PC box girder and steel box girder are shown below. Detailed aesthetic design shall be done in the detailed design stage in accordance with structural calculation of size of each member.



Source: JICA Survey Team

**Figure 5.2.33 View of Approach Bridge of PC Box Girder from Existing Road**



Source: JICA Survey Team

**Figure 5.2.34 View of Approach Bridge of Steel Box Girder from Existing Road**

(5) Illumination of Main Bridge

The bridge will become a landmark in the surrounding area and a symbol of Sri Lanka. In addition, the place has many vantage points such that bridge lighting is highly critical in making the extra-dosed bridge a symbol of Colombo City. The following is a computer graphic of example of illumination. Appropriate and eco-friendly lighting shall be considered in the detailed design stage in accordance with maintenance cost.



Source: The Pre-Preliminary Design (2012)

**Figure 5.2.35 Illumination of Main Bridge**

## 5.2.9 Application of Japanese Technologies

The maintenance cost can be minimum to use Japanese technology.

(1) Extra-dosed Bridge

Many extra-dosed bridges were constructed in Japan. Extra-dosed bridge employs a structure that is frequently described as a cross between a girder bridge and a cable stayed bridge. The name comes from the French word *extradossé* which is derived from the word *extrados*, the exterior curve of an arch.

Advantages of extra-dosed bridge are as follows;

- Symbolic proportion by tower and stay cables
- Long span with reasonable construction cost

Some examples of extra-dosed bridge are shown below.

Chojyake Bridge



Haseda Bridge



Odawara Blue Way Bridge



Oumiodori Bridge



**Figure 5.2.36 Some Examples of Extra-dosed Bridges**


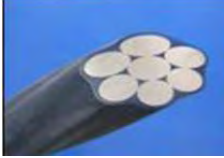

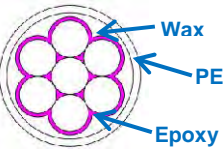
(2) Epoxy Coated and Filled Strand Cable

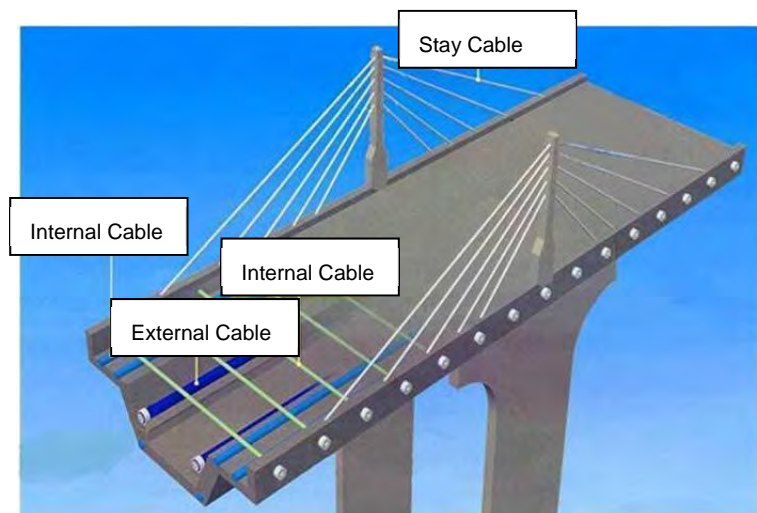
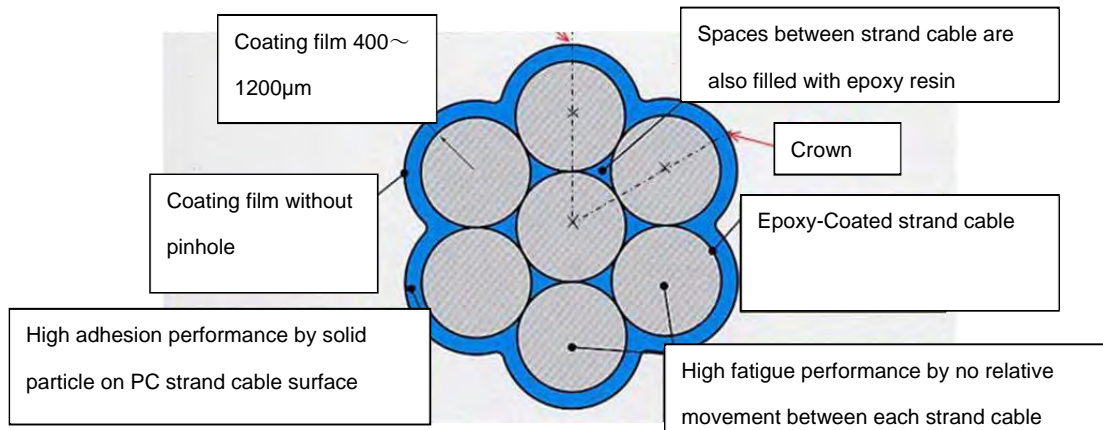
Epoxy Coated and Filled Strand Cable (ECF Strand) is PC strand cable with coating by epoxy resin. Furthermore, ECF Strand is filled spaces between each strand by epoxy material. In case of usage of ECF Strand, grouting and fabrication of PE pipe could be omitted to improve constructability and shorten construction period. This technology is registered by New Technology Information System (NETIS) in Japan.

Advantages of ECF strand are as follows;

- Long durability (anti-corrosion, resistant to ultraviolet)
- Improvement constructability
- Shortening construction period

It shall be studied in Detail Design whether the epoxy coated reinforcing bar is used or not.

Appearance	Covering Type	Main Application	Feature
	Standard type	<ul style="list-style-type: none"> <li>External Cable</li> <li>Stay Cable</li> </ul>	<ul style="list-style-type: none"> <li>High anticorrosion property</li> <li>High reliability for thick and strong coating cable</li> </ul>
	Adherence type	<ul style="list-style-type: none"> <li>Internal Cable</li> <li>Pre-tension Cable</li> <li>Stay Cable</li> </ul>	<ul style="list-style-type: none"> <li>Solid particle on PC strand cable surface</li> <li>Heavy-duty coating on PC strand cable and Pre-tension strand cable around damaged by seawater</li> </ul>
	PE (Polyethylene) Sheathing type	<ul style="list-style-type: none"> <li>External Cable</li> <li>Stay Cable</li> </ul>	<ul style="list-style-type: none"> <li>Heavy-duty coating on PC strand cable from direct ultraviolet and damaged by seawater</li> </ul>
	PE (Polyethylene) Sheathing with Wax type	<ul style="list-style-type: none"> <li>External Cable</li> <li>Stay Cable</li> </ul>	<ul style="list-style-type: none"> <li>Triple heavy-duty steel (epoxy grout, Wax, PE coating)</li> </ul>



**Figure 5.2.37 Advantages of ECF Strand**

### (3) Steel Pier and Girder

Steel viaducts are very common in Japan. Especially, in Urban Expressway many steel girders and piers are adopted because of rapid construction, narrow space construction and traffic safety of existing road. New viaduct will be constructed above existing baseline road and port access road, therefore steel structure will be very effective in the project.

Advantages of steel pier and girder are the followings;

- Rapid construction
- Traffic safety
- Minimization of traffic jam during construction

Some examples of steel pier and girder are shown below.

- Pier erection work



**Figure 5.2.38 Some Examples of Steel Pier and Girder**



**Figure 5.2.39 Some Examples of Girder Erection Work**



- Completion



**Figure 5.2.40 Some Examples of Girder Erection Completion**

(4) Loop Bridge

Road elevation must secure significant difference of height in narrow land, loop bridge with rapid vertical gradient will be effective. In Japan, many loop bridges are adopted in urban and mountain area. In Kelanittisa junction, loop bridge is also useful to minimize land acquisition . Advantages of loop bridge are the followings;

- Narrow space construction
- Minimization of land acquisition

Some examples of loop bridge are shown below.

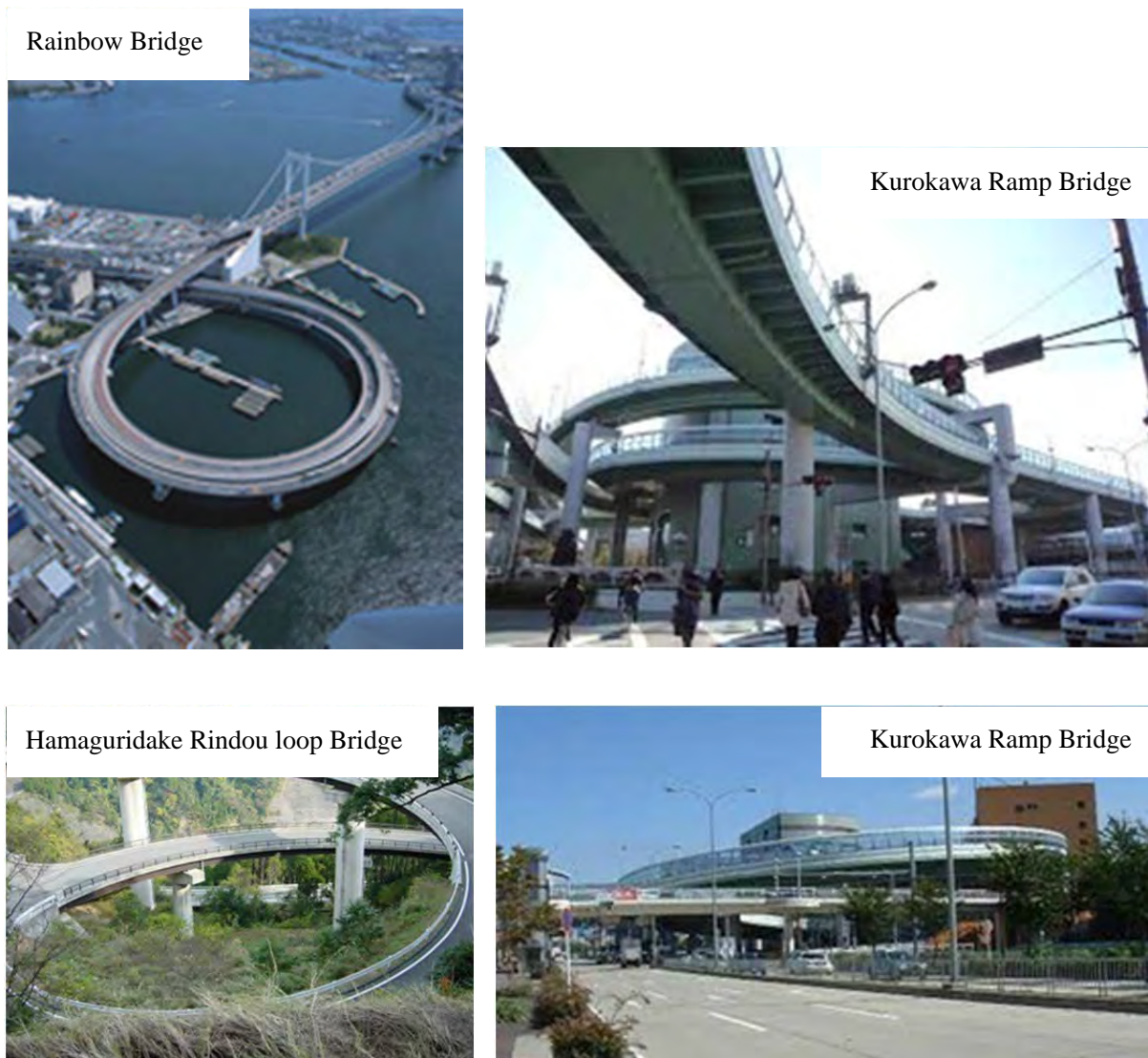


Figure 5.2.41 Some Examples of Loop Bridge

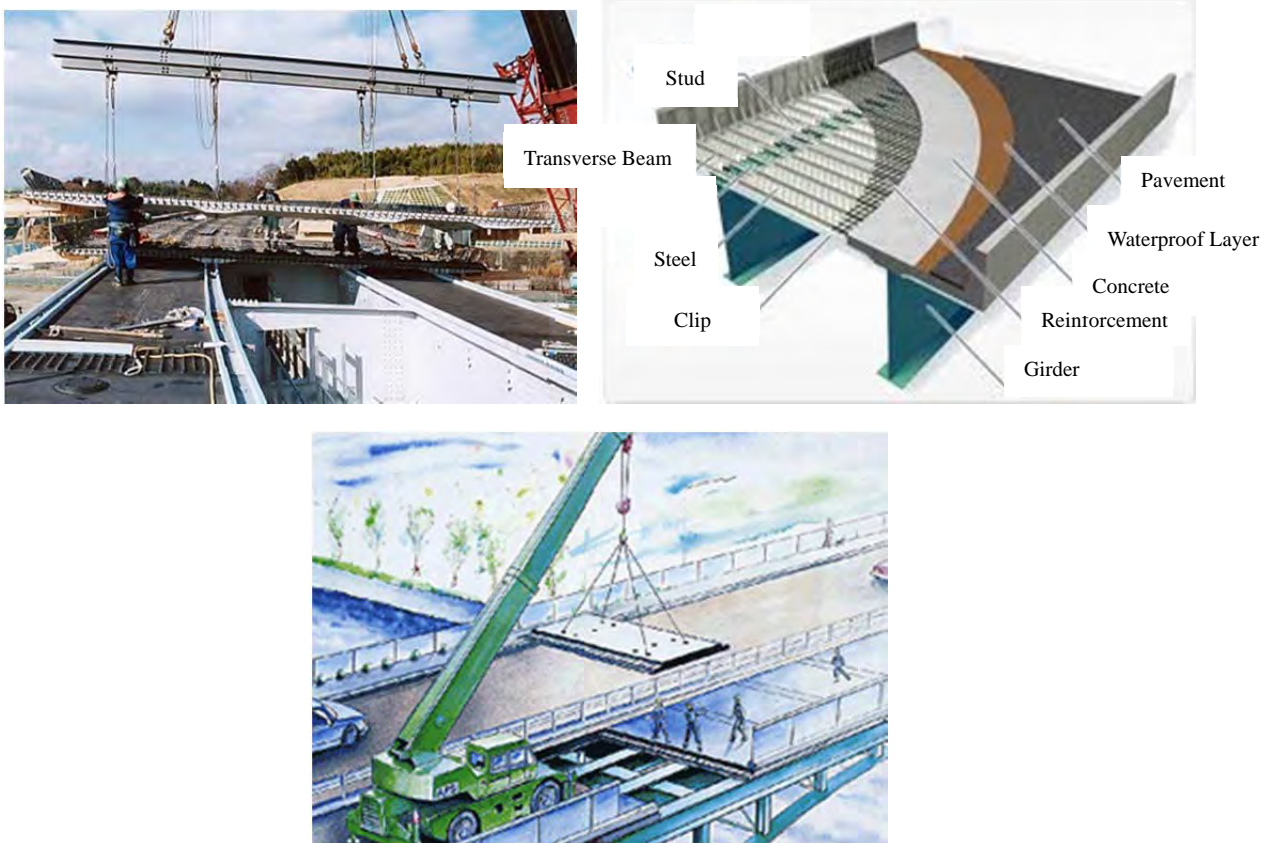
## (5) Composite Slab

Composite slab consists steel and concrete member against acting bending moment. After erection of the bottom steel plate, reinforcement will be layouted on the steel plate, and fresh concrete will be casted. The waterproof layer is put on the slab. Construction period can be shortened and safety for existing traffic under the constructing bridge can be secured. Mold and scaffolding is not required, therefore constructability will improve greatly. This technology is registered by NETIS.

Advantages of composite slab are the followings;

- Rapid construction
- Construction safety

Some examples of composite slab are shown below.



**Figure 5.2.42 Some Examples of Composite Slab**

(6) Epoxy Coated Reinforcing Bar

Epoxy coated reinforcing bar is adopted coastal area because of counter measure against salt attack. Corrosion on surface of rebar will be protected by coating epoxy resin. Water quality of Kelani River at the project site is affected by sea water, therefore some chloride ion contents shall be contained. Adoption of epoxy coated reinforcing bar will make a long durability of RC structure near Kelani river side. This technology is registered by NETIS.

Advantages of epoxy coated reinforcing bar are the followings;

- Long durability (anti-corrosion)

It shall be studied in Detail Design whether the epoxy coated reinforcing bar is used or not.

Some examples of epoxy coated reinforcing bar are shown below.

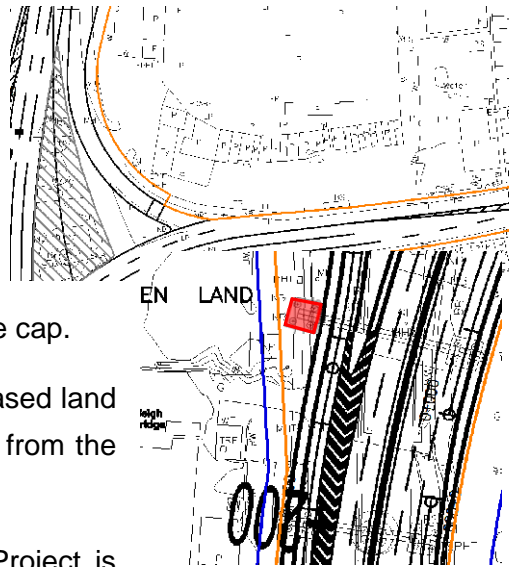


**Figure 5.2.43 Some Examples of Epoxy Coated Reinforcing**

### 5.3 Right of Way

Existing Right of Way (ROW) is set at the edge of existing roads. Right of Way (ROW) as well as leased land during construction of the Project is determined based on the following conditions:

- ROW for the Project Road is set as 1 m from the road edge.
- Leased land for the Project Road during construction is set as 5 m or 10 m from the road edge according to the site conditions.
- ROW for at-grade road (intersection improvement) is set as the road edge.
- In case pier is constructed outside of bridge, ROW at pier locations is set as 1 m from the pile cap.
- In case pier is constructed outside of bridge, leased land at pier locations during condition is set as 5 m from the pile cap.



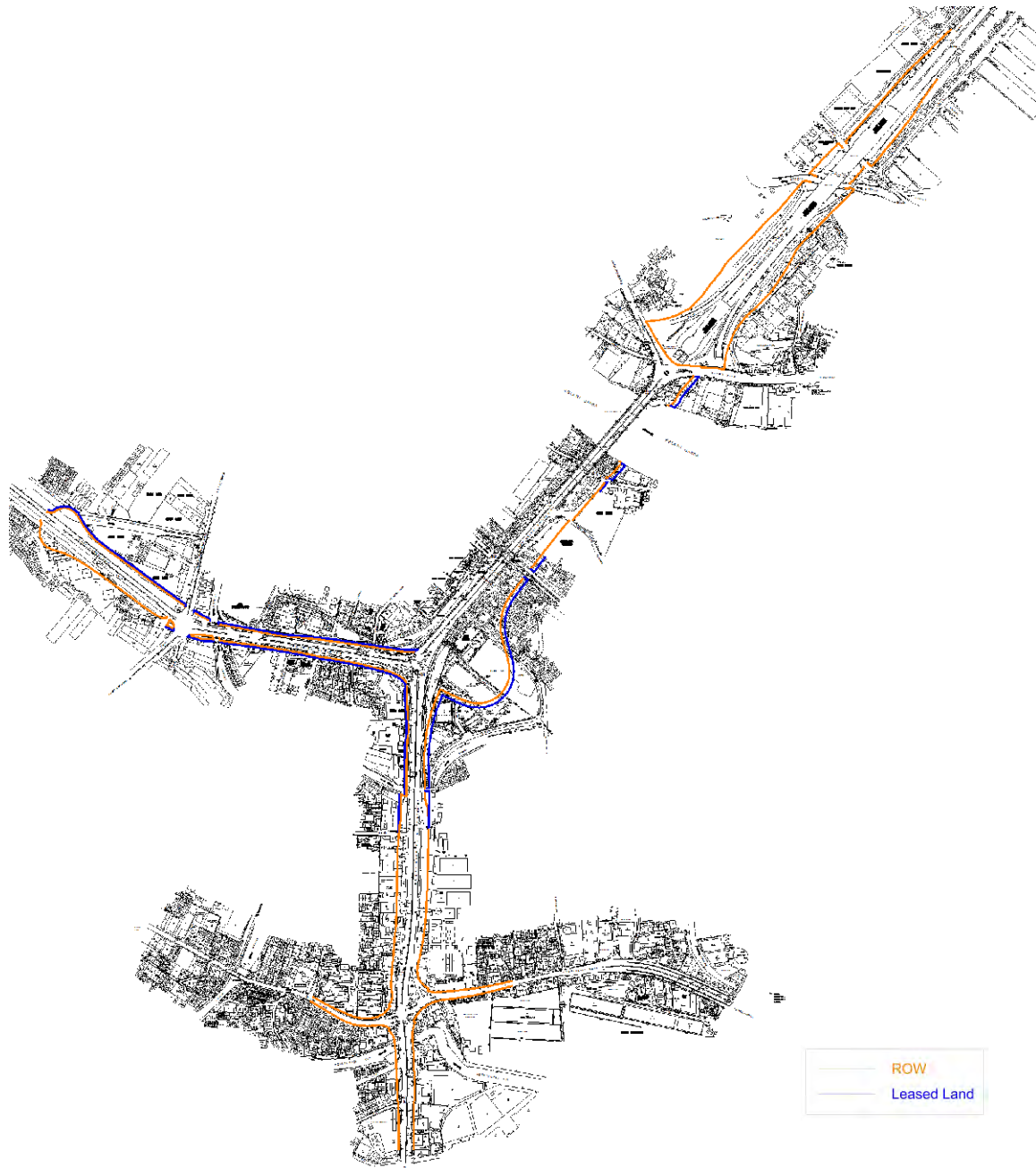
ROW and leased land during construction of the Project is shown in Figure 5.3.1.

Area of ROW and leased land during construction for each Divisional Secretariat Division is shown in Table 5.3.1.

**Table 5.3.1 Area of ROW and Leased land during Construction**

	Kelaniya	Colombo	Kolonnawa
ROW	77,200 m <sup>2</sup>	13,300 m <sup>2</sup>	67,400 m <sup>2</sup>
Leased land	700 m <sup>2</sup>	1,400 m <sup>2</sup>	11,900 m <sup>2</sup>

Source: JICA Survey Team



Source: JICA Survey Team

**Figure 5.3.1 ROW and Leased Land during Construction**

## 6. CONSTRUCTION PLAN

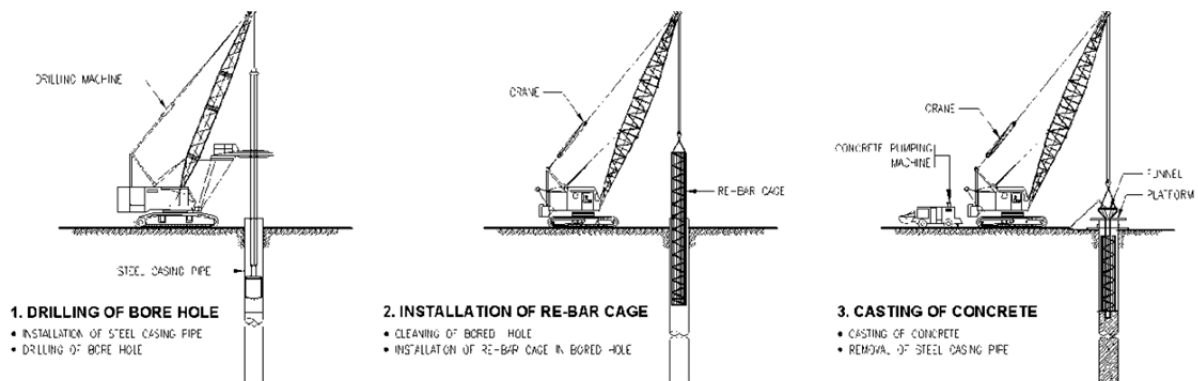
### 6.1 Construction Method

Although the project is including general construction methods such as embankment work and pavement work, only special construction work is described below.

#### 6.1.1 Bored Pile

Bored Piles will be used for the pile cap of the bridge. After installation of temporary steel casing into the ground using a vibrating machine, the soil inside the casing is removed using buckets and bentonite slurry to maintain the excavated hole from collapsing.

After installation of the reinforcement cage into the bored hole, concrete is poured in the excavated hole using a tremie pipe. At the end of the casting operation, the temporary steel casing will be removed.



Source: JICA Survey Team

**Figure 6.1.1 Construction Method of a Bored Pile**

#### 6.1.2 Substructure

##### (1) Preparatory Works

When the piers are located in the center median of the existing roads, it is necessary to secure enough space on both sides of the center median to carry out the substructure works.

Sheet piles will be used to reduce the required space for the construction yard and minimize the impact on the existing traffic flow, but the carriageway of the existing road will still have to be reduced most of the time.

## (2) Pile Cap for Separated Section

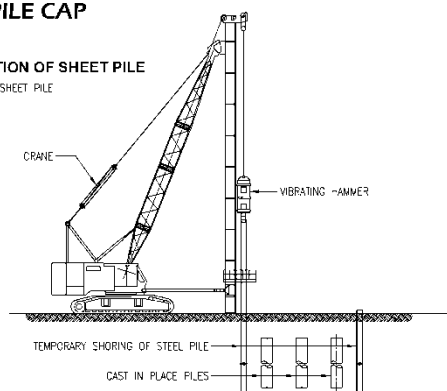
After installation of sheet piles, excavation is carried out up to the required level. The lean concrete is then cast to provide a plane surface on which the formwork and re-bar can be installed. After casting of the pile cap and removal of the formwork, backfill work will be carried out up to the top surface of the pile cap shortly afterwards.

It shall be considered regarding use of sheet piles in detail design.

### STEP 2: PILE CAP

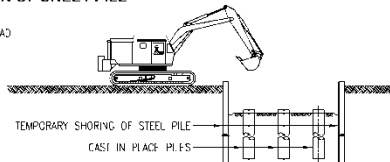
#### 1. INSTALLATION OF SHEET PILE

- INSTALLATION OF SHEET PILE



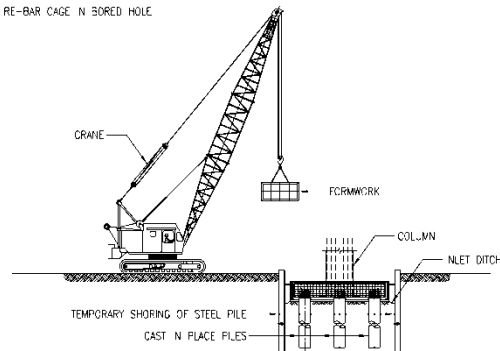
#### 2. INSTALLATION OF SHEET PILE

- EXCAVATION
- CUT OFF OF PILE HEAD



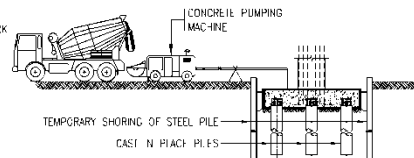
#### 3. INSTALLATION OF FORMWORK & REINFORCEMENT OF PILE CAP

- INSTALLATION OF SHEET PILE
- INSTALLATION OF RE-BAR CAGE IN BORED HOLE



#### 4. CASTING OF CONCRETE

- CASTING OF CONCRETE
- REMOVAL OF FORMWORK
- BACK-FILLING



Source: JICA Survey Team

**Figure 6.1.2 Illustration of a Pile Cap Construction for the Separated section**

## (3) Pile Cap for Overlapped section

The main difference between the pile cap of a hammerhead concrete pier and the pile cap of steel pier is the anchor frame which will be installed in the pile cap before its casting. The anchor frame will thus connect the steel pier to the pile cap, transmitting all the efforts from the pier to the pile cap.

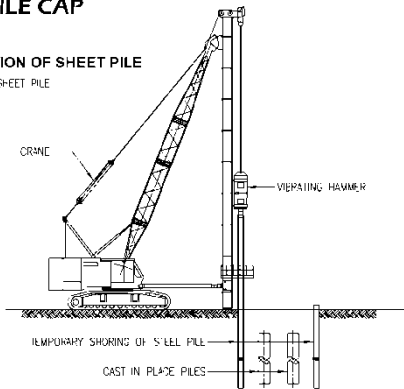
It shall be considered regarding use of sheet piles in detail design.



**STEP 2: PILE CAP**

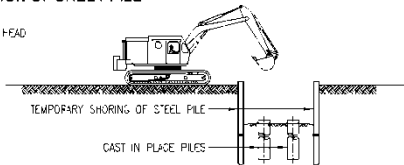
**1. INSTALLATION OF SHEET PILE**

- INSTALLATION OF SHEET PILE



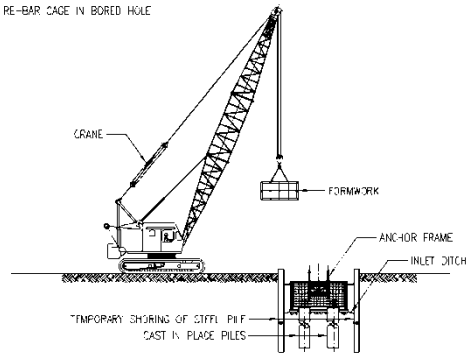
**2. INSTALLATION OF SHEET PILE**

- EXCAVATION
- CUT OFF OF PILE HEAD



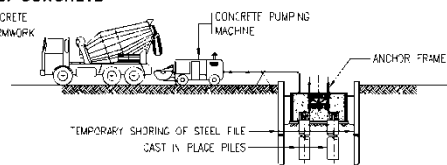
**3. INSTALLATION OF FORMWORK & REINFORCEMENT OF PILE CAP**

- INSTALLATION OF SHEET PILE
- INSTALLATION OF RE-BAR CAGE IN BORED HOLE



**4. CASTING OF CONCRETE**

- CASTING OF CONCRETE
- REMOVAL OF FORMWORK
- BACKFILLING



Source: JICA Survey Team

**Figure 6.1.3 Illustration of a Pile Cap Construction for the Overlapped Section**

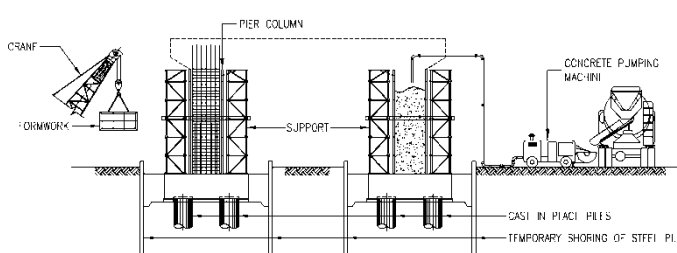
**(4) Pier of the Separated Section**

After installing re-bars overlapping the starter bars of the pile cap, vertical formwork is set up and concrete is cast.

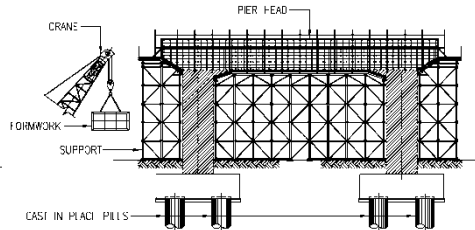
For the pier head, support is assembled from the ground and the formwork is then installed on top of it. After installation of the re-bars, the pier head is casted.

**1. INSTALL OF FORMWORK & REINFORCEMENT OF PIER COLUMN**

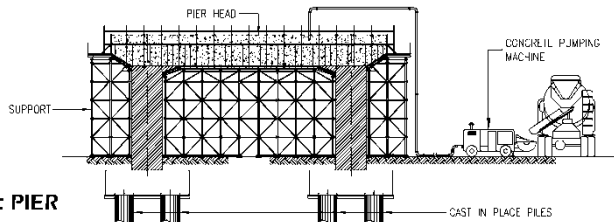
**2. CASTING OF CONCRETE OF PIER COLUMN**



**3. INSTALLATION OF FORMWORK & REINFORCEMENT OF PIER HEAD**



**4. CASTING OF CONCRETE OF PIER HEAD**



**STEP 3: PIER**

Source: JICA Survey Team

**Figure 6.1.4 Illustration of a Pile Head Construction**

(5) Pier of the Overlapped Section

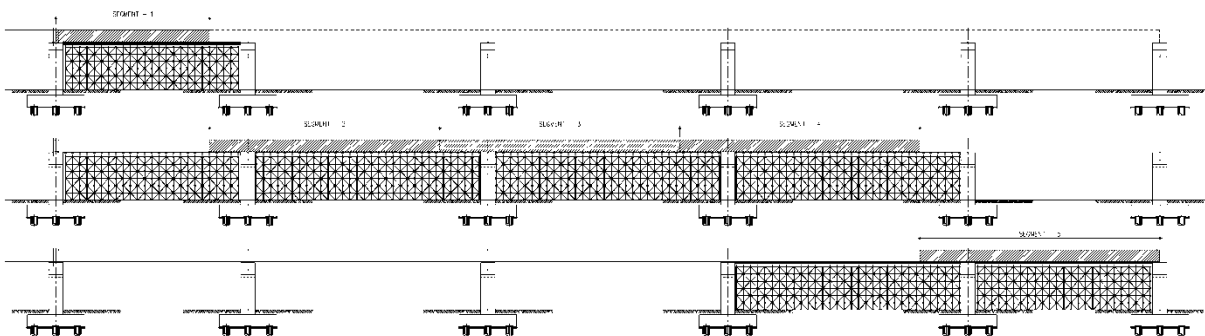
Pier of the overlapped section is installed the steel pier from the viewpoint of rapid construction. The steel pier is manufactured at Japanese factory and transported from Japan before completion of the pile cap. The steel pier and the steel girder are installed as Figure 6.1.6 after completion of the pile cap.

### 6.1.3 Approach Bridge of the Separated Section – PC Box Girder Bridge

The approach bridges of the separated section will be cast-in place using the scaffolding method, as there is no need to free the space underneath the bridge. This frequently used method requires no large equipment during construction and is thus a very economical solution.

The separated sections works will commence after completion of the land acquisition inside the ROW. After construction of the pile cap and substructure, the scaffolding will be erected from the ground level up to the required soffit level of the bridge.

The formwork is then installed above the scaffolding, followed by the re-bars. After the casting of the PC box girder and stressing of the cables, the scaffolding is dismantled.



Source: JICA Survey Team

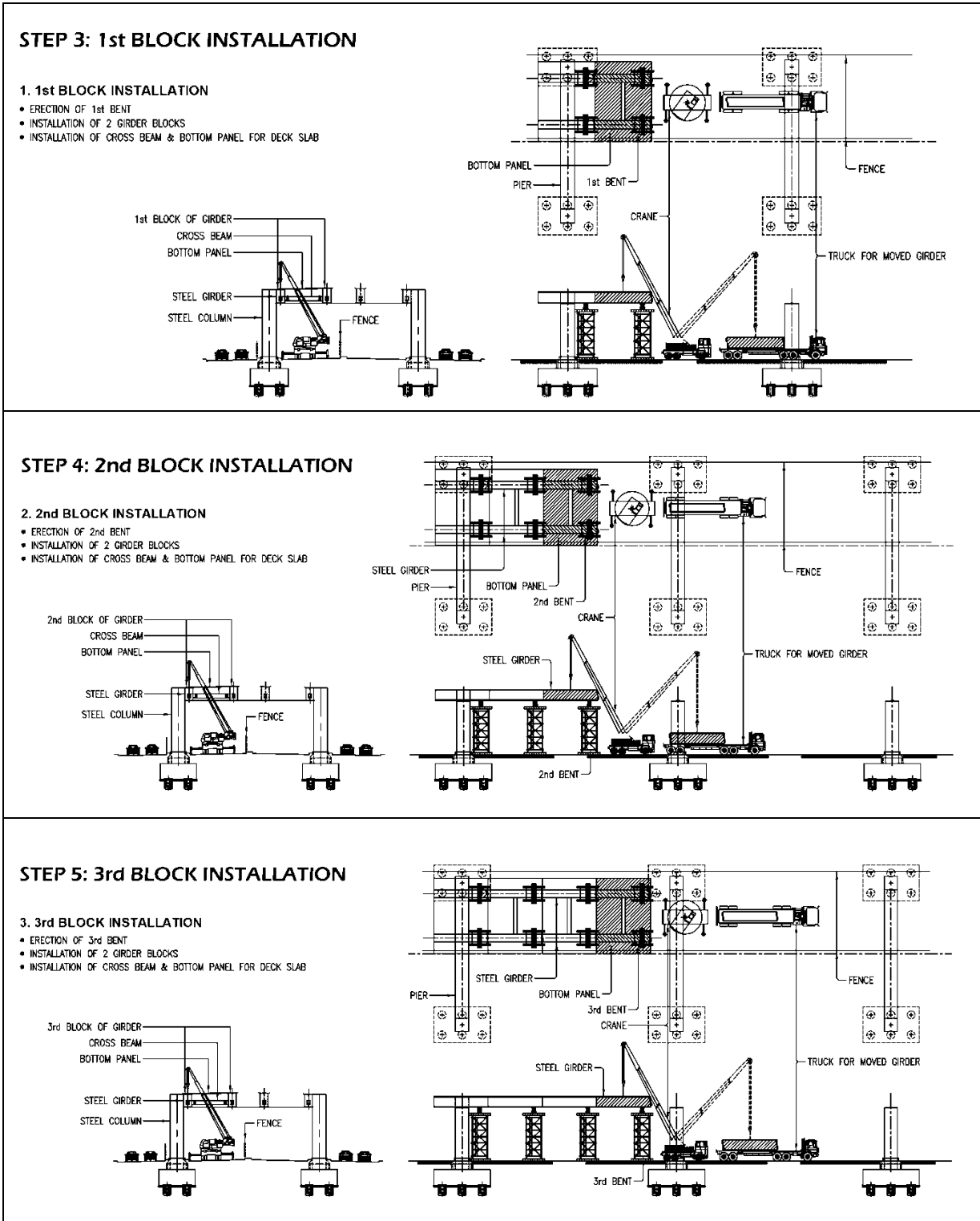
**Figure 6.1.5 Construction method of the PC Box Girder**

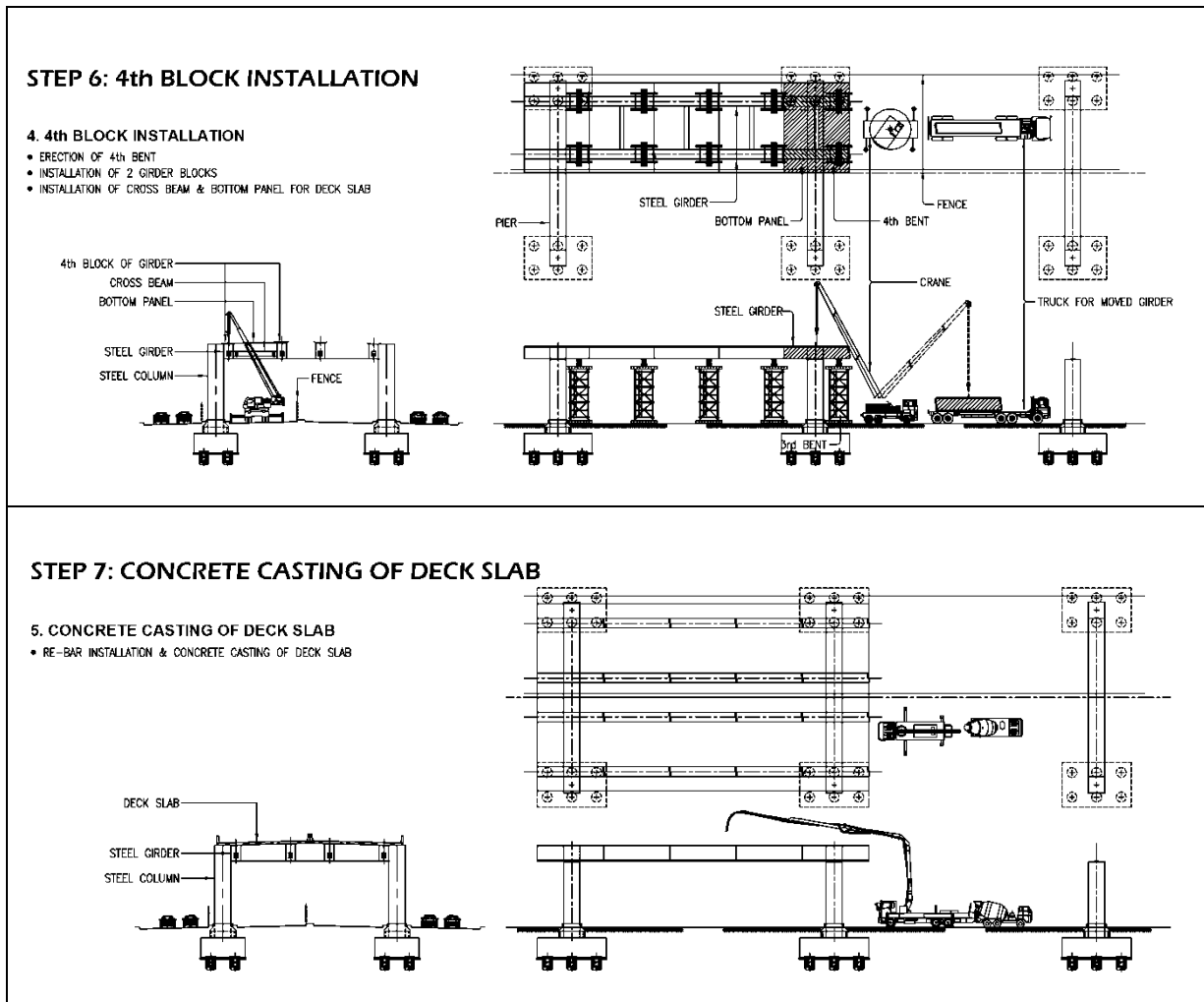
### 6.1.4 Approach Bridges of the Overlapped Section – Steel Box Girder Bridges

During the construction of the pile caps and sub-structures, steel box girder blocks are prefabricated at a manufacturing factory. When the steel piers are constructed and bents are installed along the alignment, the fabricated blocks are brought on site. The first block is anchored on the steel pier using a crane. The other blocks are then erected and bolted on the blocks already installed, supported by the bents, until the completion of one span.

When all the steel members are in their definitive position, re-bars are installed and the concrete slab of the deck is casted.

This method requires only limited bents and no whole scaffolding to erect the bridge girder, which reduces the construction yard space and the disturbance to the traffic flow of the existing roads.





Source: JICA Survey Team

**Figure 6.1.6 Construction method of the Steel Box Girder**

The structure of composite slab mentions in “5.2.9 Application of Japanese Technologies”.

### 6.1.5 Ramp Bridges – Steel Box Girder Bridges

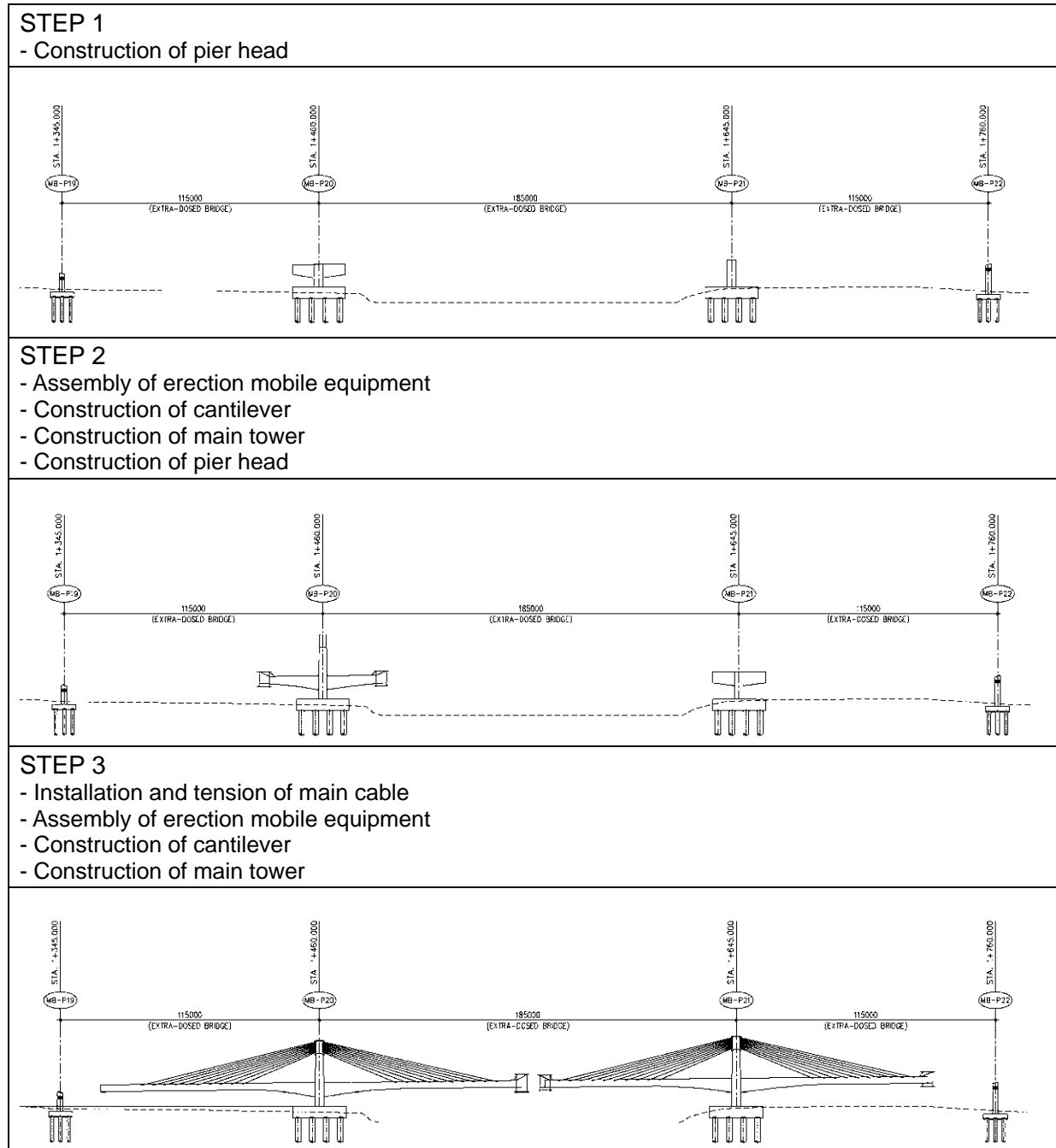
As steel box girders and steel piers will be used for the ramp bridges, the same construction method as the overlapped section will be applied.

### 6.1.6 Main Bridge (The 2nd New Kelani Bridge) – Extradosed Bridge

The Main Bridge will be constructed above the Kelani River, making it difficult to use scaffolding at ground level to cast the bridge deck. Thus, the 2nd New Kelani Bridge will be built using the balanced cantilever method, which makes it possible to build most of the bridge deck without any contact with the ground.

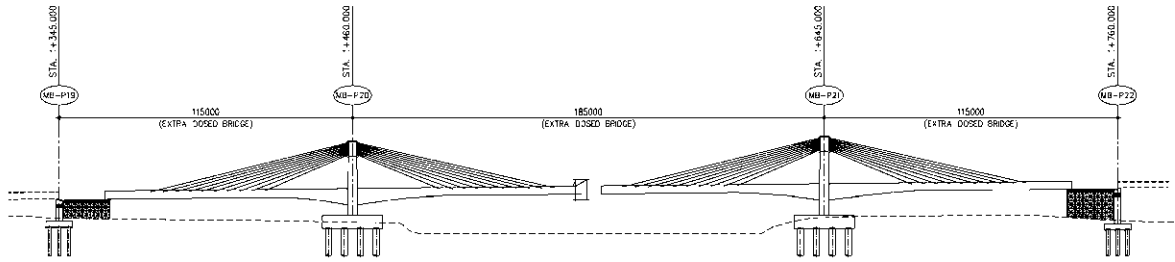
After the erection of the central piers and pylons, the construction of the bridge girder will be carried out symmetrically on either side of the piers in order to minimize the moments transmitted to the support during erection. Each segment is cast against the preceding segment and firmly attached using prestressing tendons, to form a self-supporting cantilever.

At the extremities of the side spans, the bridge deck will be cast on scaffolding.



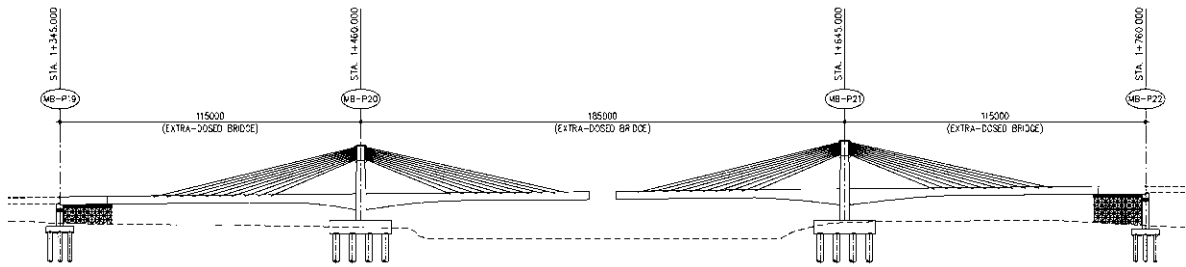
### STEP 4

- Demolition work and removal work of erection mobile equipment
- Installation and tension of main cable
- Construction of cantilever



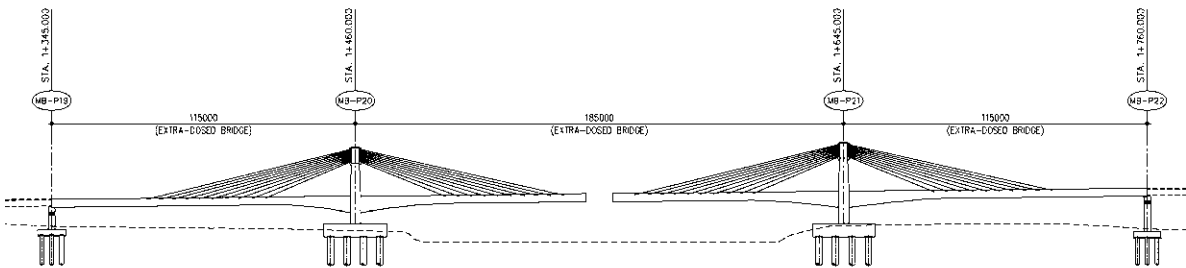
### STEP 5

- Construction of right side span
- Demolition work and removal work of erection mobile equipment



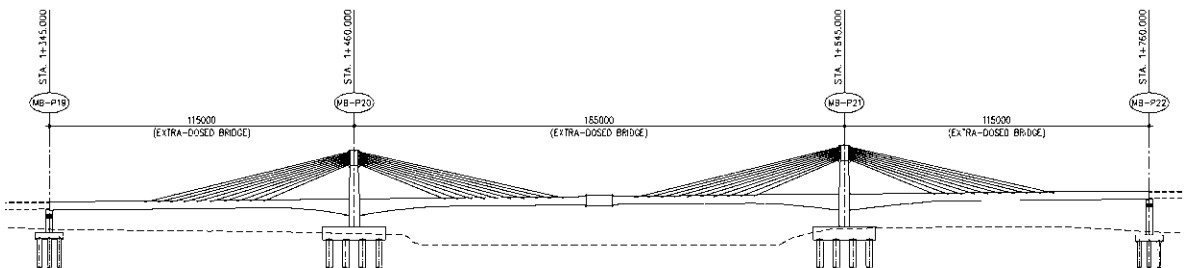
### STEP 6

- Construction of left side span



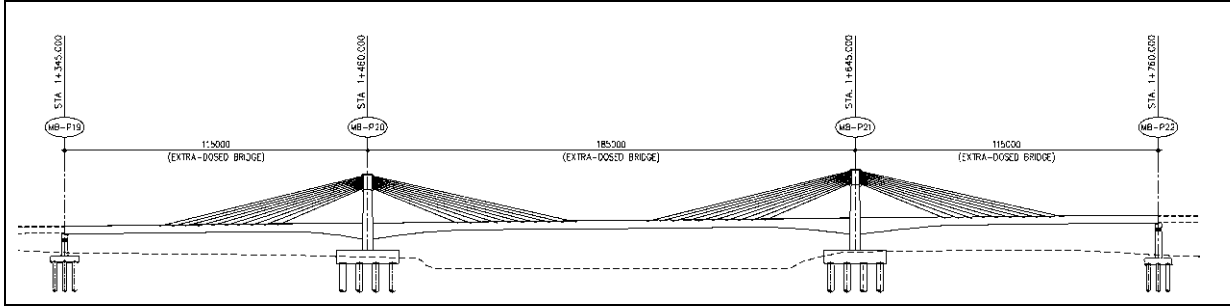
### STEP 7

- Construction of center section



**STEP 8**

- Deck work and grout work of main cable
- Finishing Work



Source: JICA Survey Team

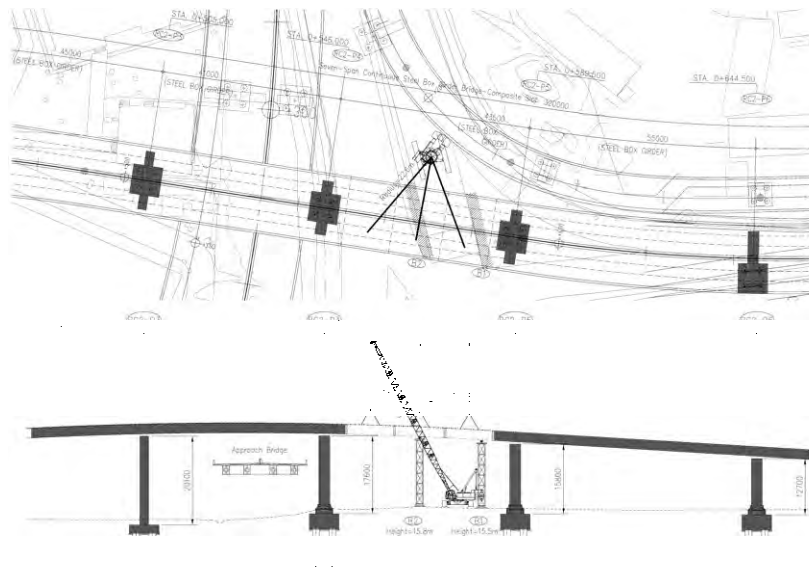
**Figure 6.1.7 Construction method of the Main Bridge**

Regarding the construction of Extradosed Bridge, the points to consider is stated below.

- To manage the shape and the stress of main tower
- To manage the temperature and the quality of concrete for main tower
- To manage the deflection of the girder during the construction of cantilever

**6.1.7 Erection at Kelanithissa Intersection**

Baseline Road and Port Access Road intersect at Kelanithissa Intersection. Erection shall be carried out as little effect as possible because this Intersection is heavily-trafficked in the daytime. Therefore, erection shall be carried out at night with closed to vehicular traffic. Besides, bent is built up in the existing median strip. Ingurukade Intersection is constructed as well as Kelanithissa Intersection.



**Figure 6.1.8 Erection at Kelanithissa Intersection**

### 6.1.8 Construction at narrow space

It is necessary to minimize the effect to the existing road such as Baseline Road and Port Access Road. Therefore, excavation and construction for foundation shall be applied the steel sheet pile.

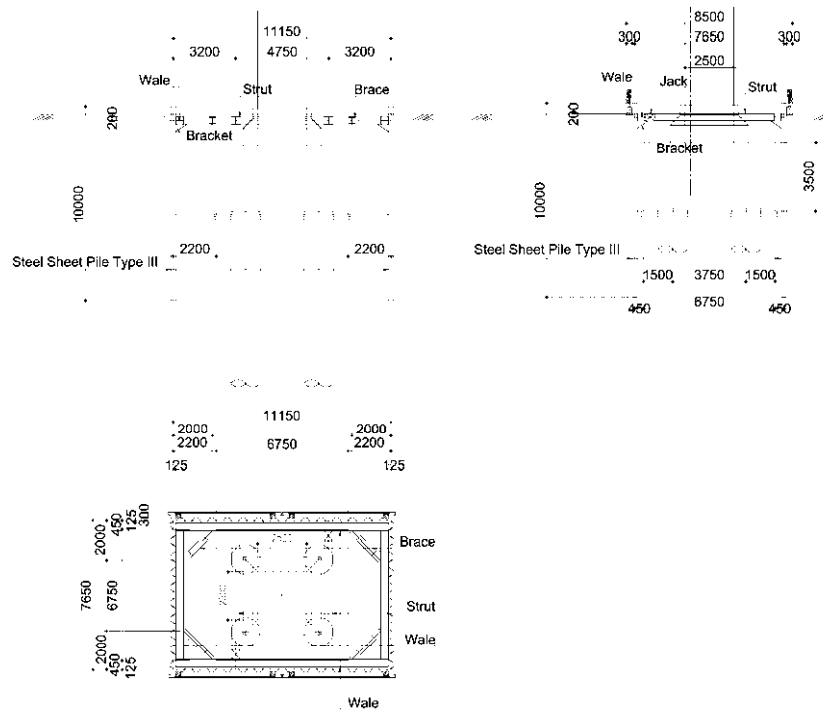


Figure 6.1.9 Construction at narrow space

### 6.1.9 Environmental Consideration during Construction

The oil and the grease traps should be installed at yard and workshop area to filter the waste oil, other petroleum products and wastewater before discharging outside the yard or workshop area. In addition, all cement, bitumen, oil and other chemicals should be stored and handled on an impervious surface above ground level. All bentonite clay and other materials will be recovered and any waste will be disposed of site in approved locations.

## 6.2 Traffic Diversion Plan

Although it is assumed in the project that the number of traffic lane is ensured without lane deduction, traffic diversion plan shall be reviewed in detail design.

### 6.2.1 Traffic Diversion Plan at CKE Interchange

By the time the 2nd New Kelani Bridge and its approach bridges will start being constructed, the CKE, which is under construction, is expected to be completed and open to traffic. Important traffic between Colombo and its International Airport will thus transit through the

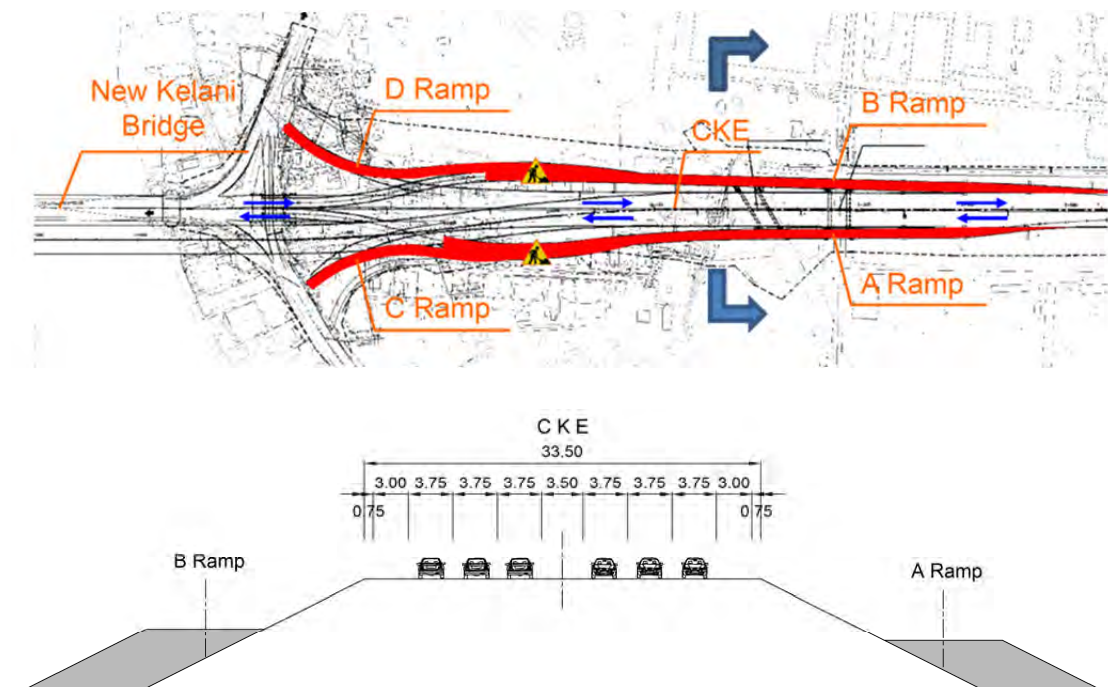


Project area. Since the construction of the new bridge requires the reconstruction of the CKE Interchange, a traffic diversion plan is necessary during the construction. In case of switching for the traffic, it shall be switched the traffic as closed to vehicular traffic in a short time at night considering safety and traffic congestion.

The reconstruction of the CKE Interchange will be carried out in 3 phases as shown below.

(1) Phase 1

- Construction of A Ramp and B Ramp on both side of the CKE up to the diverging noses.
- Construction of C Ramp and D Ramp as temporary 3-lane ramps in order to have enough capacity during CKE Main Line closure and traffic diversion.
- Construction of all the sub-structure of the approach bridge located in the vicinity of the A Ramp alignment.

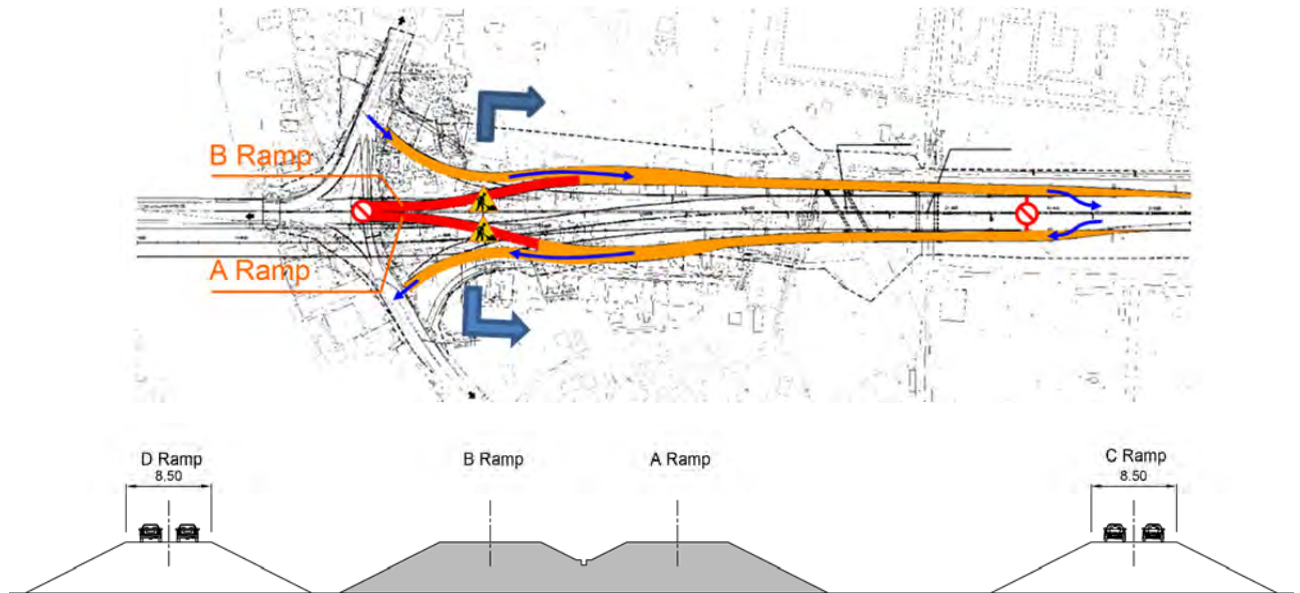


Source: JICA Survey Team

**Figure 6.2.1 Traffic Diversion Plan at CKE Interchange for Phase 1**

(2) Phase 2

- Closure of the CKE Main Line. All the traffic of the CKE is diverted onto the ramps.
- Construction of the remaining sections of Ramp A and Ramp B.
- Construction of the remaining sub-structures.

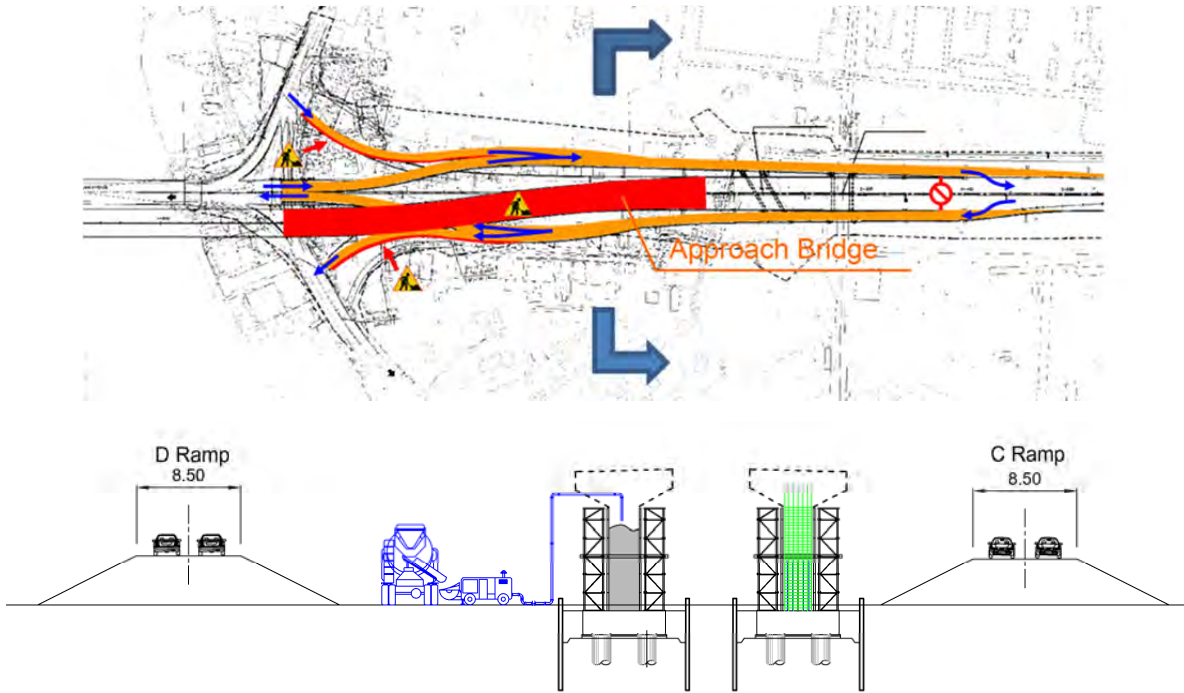


Source: JICA Survey Team

**Figure 6.2.2 Traffic Diversion Plan at CKE Interchange for Phase 2**

(3) Phase 3

- Removal of one of the 3 traffic lines of Ramp C and Ramp D to obtain their final cross section.
- Construction of the super-structure of the bridges.

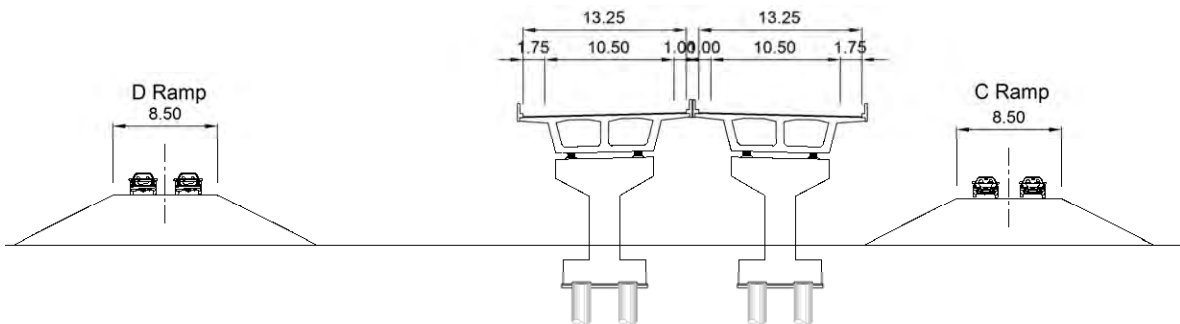


Source: JICA Survey Team

**Figure 6.2.3 Traffic Diversion Plan at CKE Interchange for Phase 3**

(4) Completion

After the construction, the approach bridge and ramp are located at the CKE Interchange as shown in Figure 6.2.4.



Source: JICA Survey Team

**Figure 6.2.4 Completion of the Approach Bridge and Ramp at CKE Interchange**

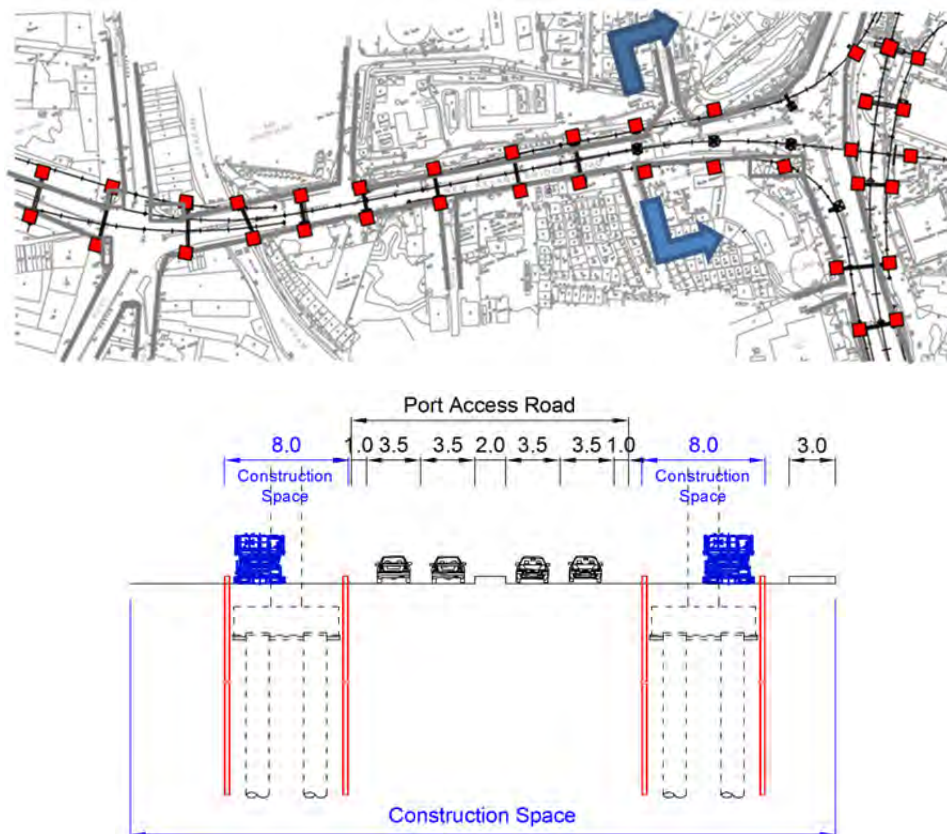
## 6.2.2 Traffic Diversion Plan at Kelanitissa Junction

At the intersection of A1 Road and Baseline Road, some of the piers of the approach bridge will have to be built in the median of the existing roads. As the intersection is already congested, it is important that traffic disruption is kept to a minimum during their construction. In case of switching for the traffic, it shall be switched the traffic as closed to vehicular traffic in a short time at night considering safety and traffic congestion.

Three-phase traffic diversion plan has been prepared to minimize the impact of the works on the traffic flow as shown below.

### (1) Phase 1

- The pile cap and sub-structure are installed outside the existing road with minor impact on the traffic flow.

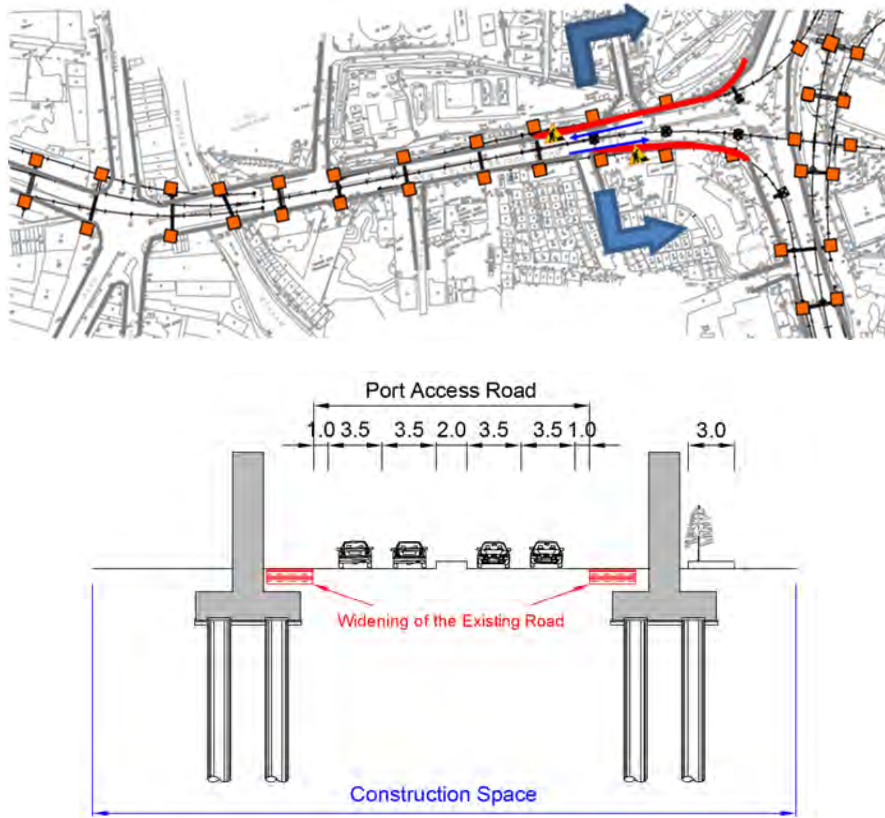


Source: JICA Survey Team

**Figure 6.2.5 Traffic Diversion Plan at Kelanitissa Junction for Phase 1**

(2) Phase 2

- Widening of the existing road in the area where the piers will be built in the median.

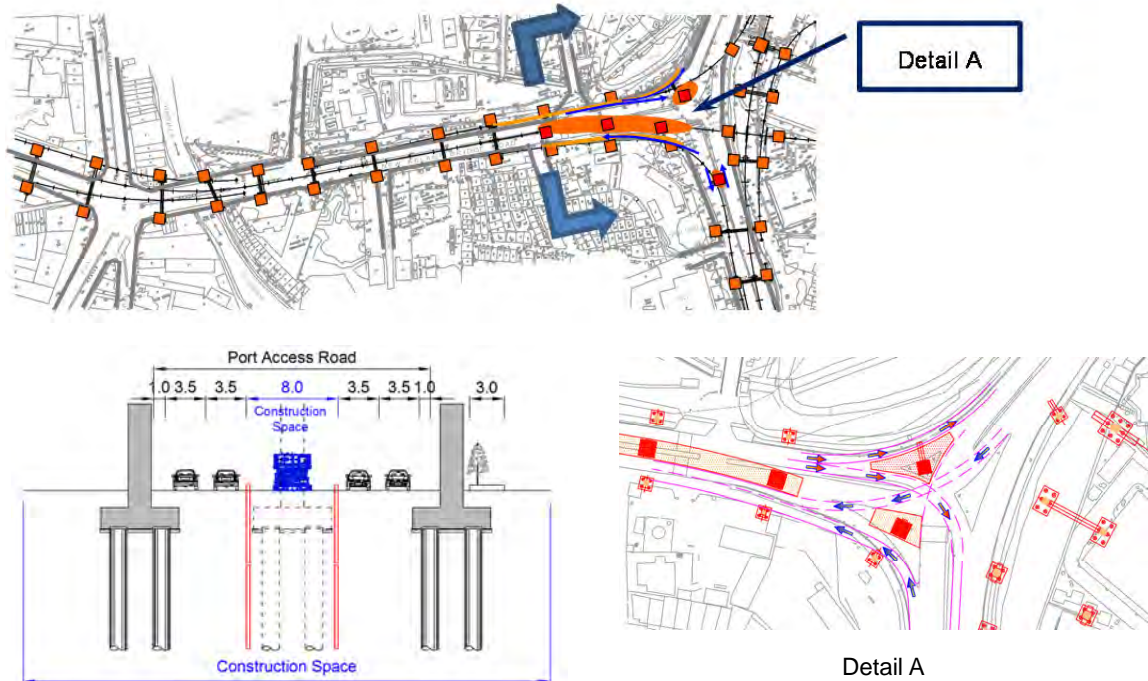


Source: JICA Survey Team

**Figure 6.2.6 Traffic Diversion Plan at Kelanitissa Junction for Phase 2**

(3) Phase 3

- The pile cap and sub-structure of the piers are installed on the median with minor impact on the traffic flow.

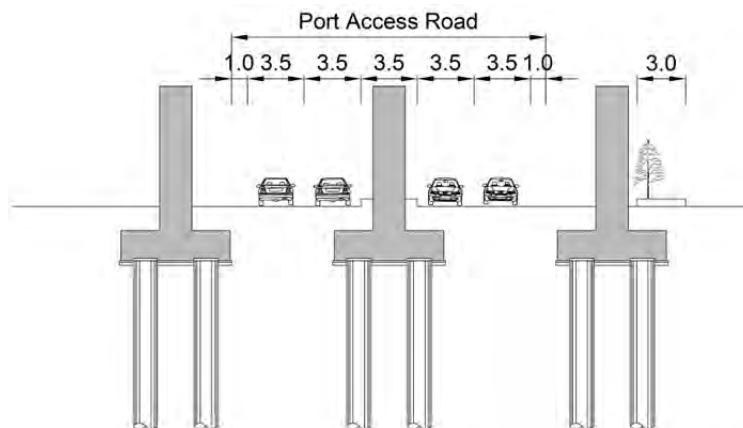


Source: JICA Survey Team

**Figure 6.2.7 Traffic Diversion Plan at Kelanitissa Junction for Phase 3**

(4) Completion

After the construction, three piers are located in the Kelanitissa Intersection as shown in Figure 6.2.8.



Source: JICA Survey Team

**Figure 6.2.8 Completion of the Piers and the Pile Caps on the Port Access Road**

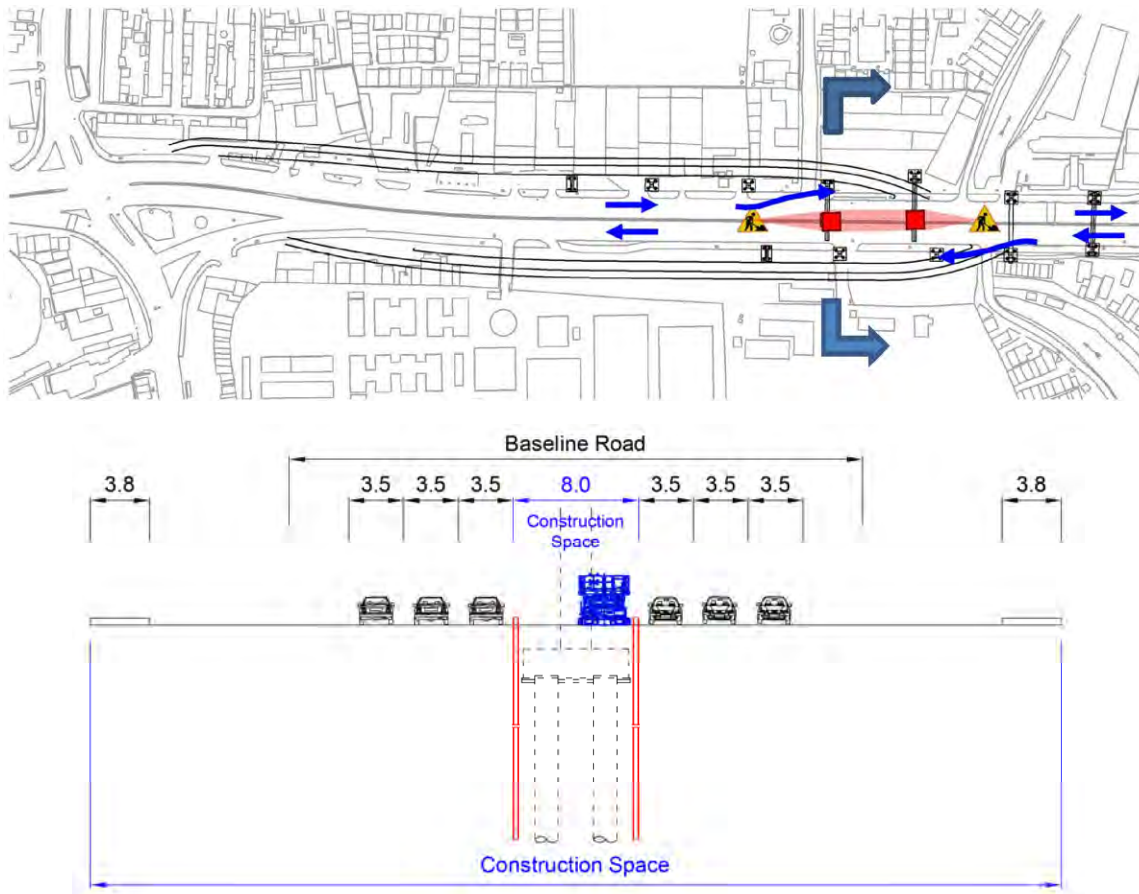
### 6.2.3 Traffic diversion plan at Orugodawatta Interchange

The Baseline Road is one of the main arterial road of the city whose capacity has to be maintained even during the construction works. In case of switching for the traffic, it shall be switched by being closed to vehicular traffic in a short time at night considering safety and traffic congestion.

A proper traffic diversion plan is thus required to ensure a smooth traffic flow during construction.

#### (1) Phase 1

- The pier of Approach Bridge is installed on the median strip of baseline road. Although the traffic needs to shift slightly, the traffic safety is secured.

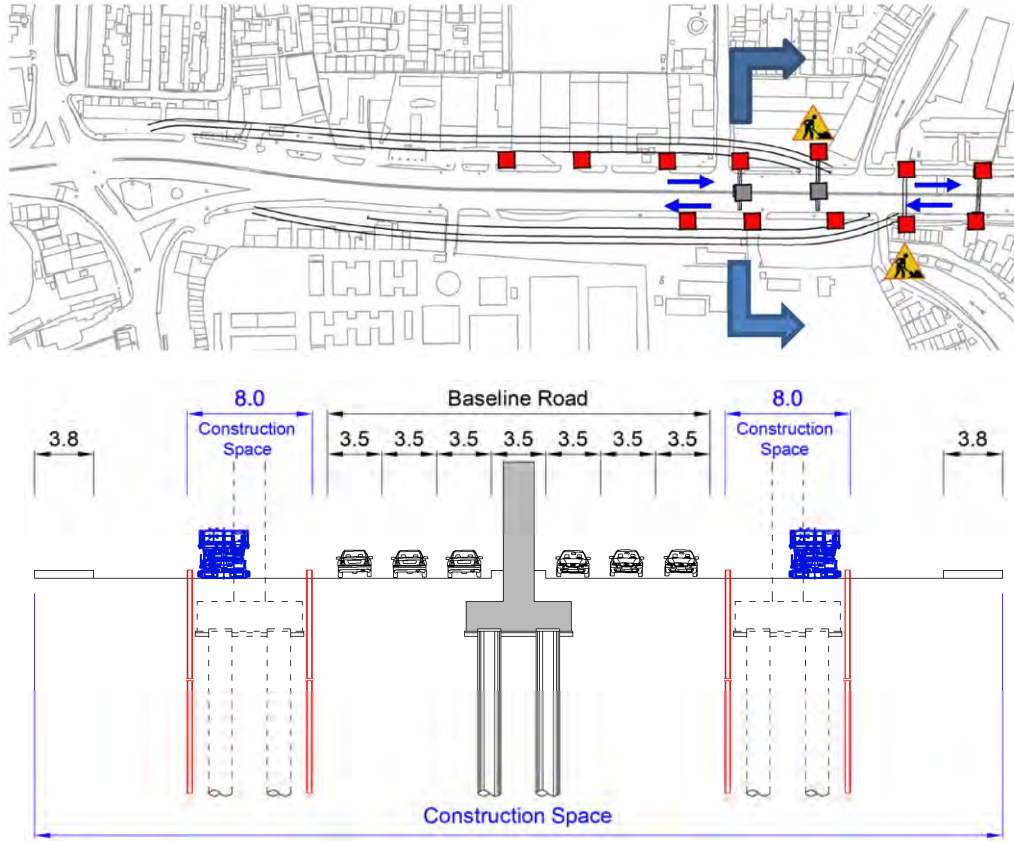


Source: JICA Survey Team

**Figure 6.2.9 Traffic Diversion Plan at Orugodawatta Interchange for Phase 1**

(2) Phase 2

- The piers of Ramp Bridge and Approach Bridge are installed respectively. And the sidewalk is installed outside of pier.

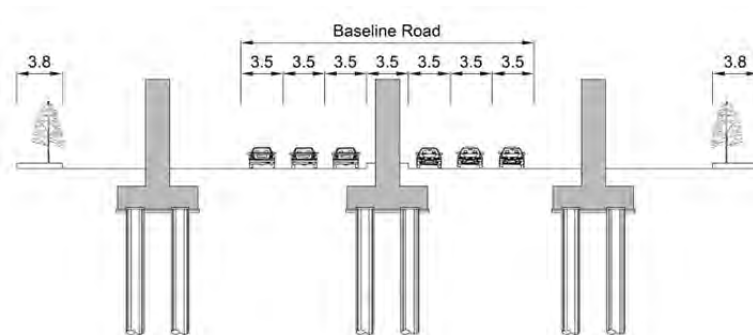


Source: JICA Survey Team

**Figure 6.2.10 Traffic Diversion Plan at Orugodawatta Interchange for Phase 2**

(3) Completion

After the construction, three piers are located on the baseline road as shown in Figure 6.2.11.



Source: JICA Survey Team

**Figure 6.2.11 Completions of the Piers and the Pile Caps on the Baseline Road**



### 6.2.4 Measure for Safety during Construction

Measure for safety during construction shall be carried out with the light and the delineator considering existing traffic. Construction at median strip and sidewalk side is indicated in Figure 6.2.12 and Figure 6.2.13 respectively.

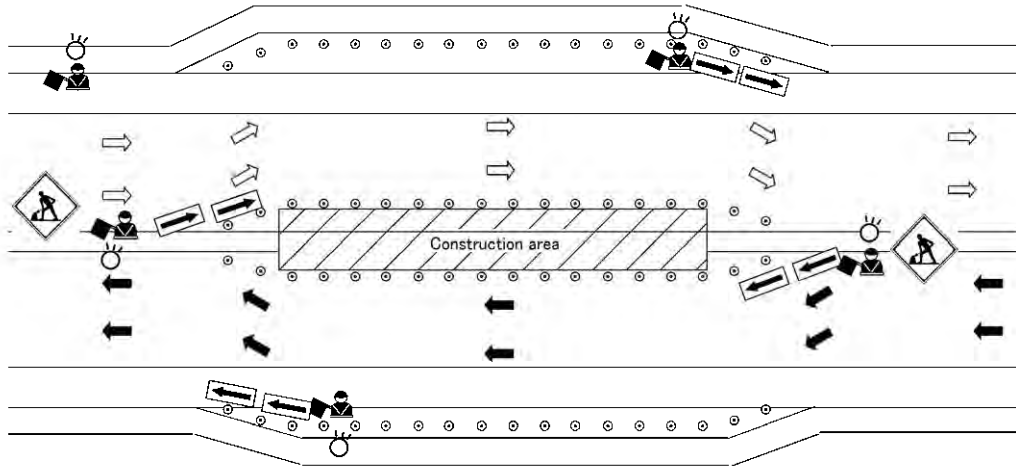


Figure 6.2.12 Construction at Median Strip

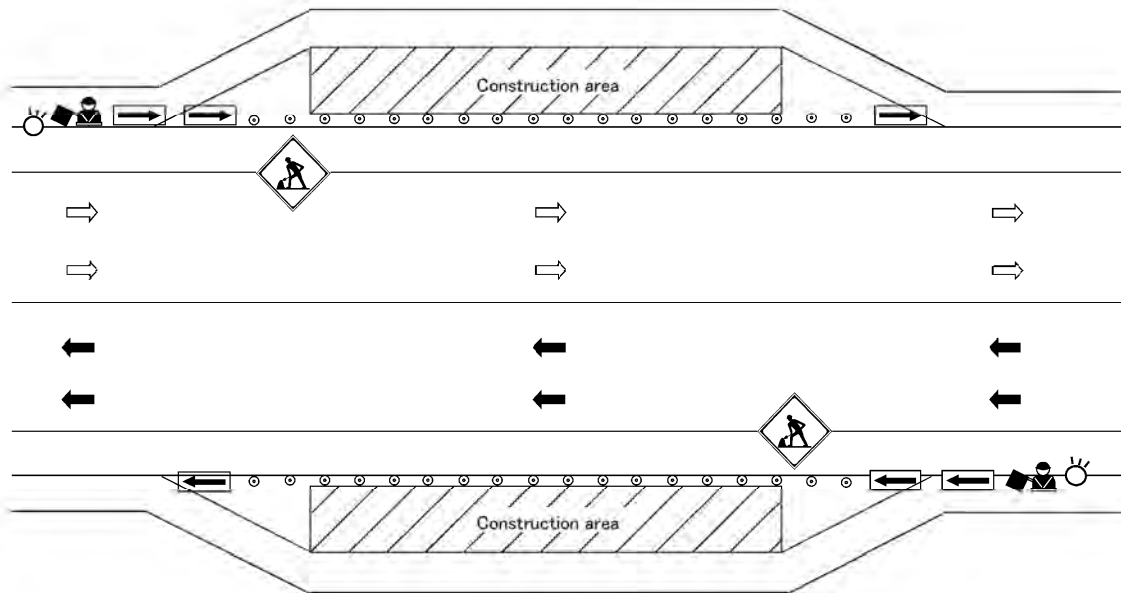
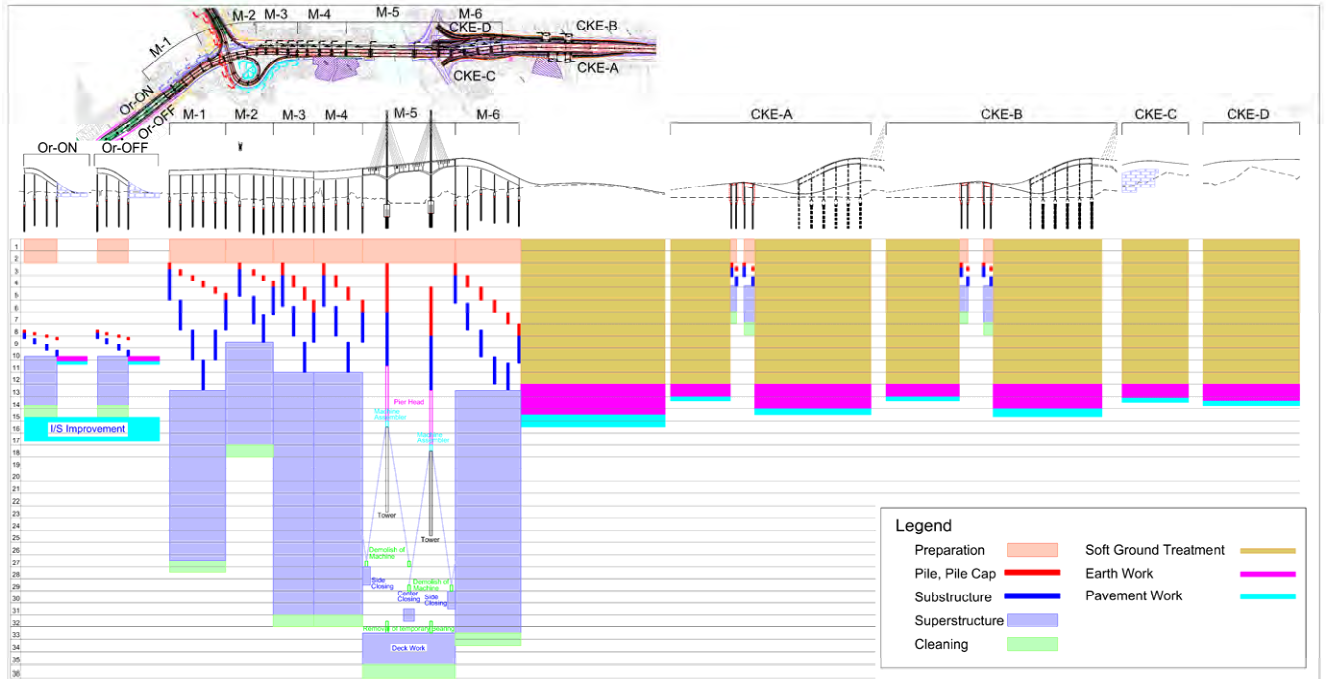


Figure 6.2.13 Construction at Shoulder

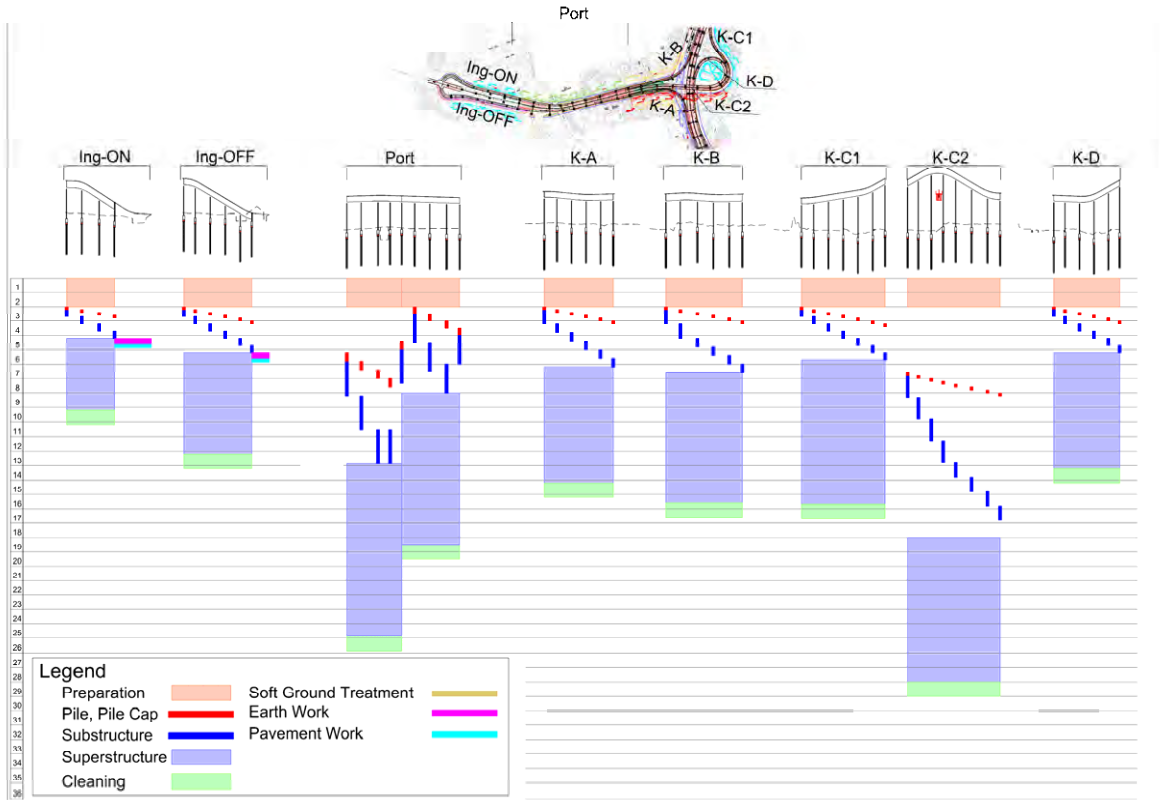
### 6.3 Construction Schedule

The construction period for the Project is 36 months due to the construction of the Extradosed Bridge. The construction schedule for Main Road, Port Access Road and each Interchange (I/C) Ramp is shown in Figure 6.3.1 and Figure 6.3.2 respectively.



Source: JICA Survey Team

**Figure 6.3.1 Construction Schedule for Main Road and Orugodawatta and CKE I/C**



Source: JICA Survey Team

**Figure 6.3.2 Construction Schedule for Port Access Road and Kelanitissa I/C**

### 6.3.1 Main Bridge

The construction period of the main Bridge is estimated at 36 months as shown in Table 6.3.1.

**Table 6.3.1 Construction Schedule for Main Bridge**

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36		
Preparation																																						
MBP19	Pile, Pile Cap																																					
	Pier																																					
	Pier Head																																					
	Machine Assembler																																					
	Cantilever																																					
MBP20	Tower																																					
	Demolish of Machine																																					
	Pile Cap																																					
	Pier																																					
	Pier Head																																					
Machine Assembler																																						
Cantilever																																						
Tower																																						
Demolish of Machine																																						
Side Closing																																						
Center Closing																																						
Removal of Temporary Bearing																																						
Deck work																																						
Cleaning																																						

Source: JICA Survey Team

### 6.3.2 Approach Bridges (Separated Section)

The construction period of the separated section (PC Box Girder) is estimated at 35 months as shown in Table 6.3.2.

**Table 6.3.2 Construction Schedule for Approach Bridge (Separated Section)**

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36		
Preparation																																							
MBP10-MBP14	Pile, Pile Cap																																						
	Pier(RC)																																						
	Erection																																						
	Cleaning																																						
MBP14-MBP18	Pile Cap																																						
	Pier(RC)																																						
	Erection																																						
	Cleaning																																						
MBP21-Abut	Pile Cap																																						
	Pier(RC)																																						
	Erection																																						
	Cleaning																																						

Source: JICA Survey Team

### 6.3.3 Approach Bridges (Overlapped Section)

The construction period of the overlapped section (Steel Box Girder) is estimated at 28 months as shown in Table 6.3.3.

**Table 6.3.3 Construction Schedule for Approach Bridge (Overlapped Section)**

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36			
Preparation																																								
MBP1-MBP6	Pile, Pile Cap																																							
	Pier(Metal)																																							
	Erection																																							
	Cleaning																																							
MBP6-MBP10	Pile Cap																																							
	Pier(RC)																																							
	Erection																																							
	Cleaning																																							
PAB1-PAB5	Pile Cap																																							
	Pier(Metal)																																							
	Erection																																							
	Cleaning																																							
PAB5-PAB9	Pile Cap																																							
	Pier(Metal)																																							
	Erection																																							
	Cleaning																																							

Source: JICA Survey Team

### 6.3.4 Ramp Bridges

The construction period of the ramp bridges (Steel Box Girder) is estimated at 24 months as shown in Table 6.3.4.

**Table 6.3.4 Construction Schedule for Ramp Bridge**

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36			
Preparation																																								
Orugodawatta	Pile, Pile Cap																																							
	Pier(RC)																																							
	Erection																																							
	Cleaning																																							
Ingurukade	Pile Cap																																							
	Pier(RC)																																							
	Erection																																							
	Cleaning																																							
Kelanitissa	Pile Cap																																							
	Pier(Metal)																																							
	Erection																																							
	Cleaning																																							

Source: JICA Survey Team

## 6.4 Procurement Plan

### 6.4.1 Procurement Plan for Main Materials

Main materials for construction of the bridge and road are shown in Table 6.4.1. Some of the main materials such as cement, aggregates and sand can be procured from the domestic market. On the other hand, some of the other materials such as steel and PC-Cable require to be imported from Japan or other foreign countries, depending on the respective contractors.

**Table 6.4.1 Procurement Plan for Main Materials**

Material	Country to be Procured	Remarks
Gasoline	Local	
Diesel	Local	
Natural Gravel	Local	
Asphalt Prime Coat	Local	
Asphalt Tack Coat	Local	
Cement	Local	
H-Shaped Steel	Local	
Reinforcement Bar	Foreign	Import raw materials
PC-Cable	Japan	Extradosed Bridge
PC-Cable	Foreign	PC Bridge
Bearing	Foreign	
Expansion Joint	Foreign	
Steel	Japan	Steel Bridge
Anchor Bolt	Japan	Steel Bridge
Guardrail	Foreign	
Delineator	Foreign	
Electric Light	Foreign	
Traffic Light	Foreign	

Source: JICA Survey Team

## 6.4.2 Procurement Plan for Main Equipment

Although there is a limited number of equipment, most equipment for construction work is available from local contractors in Sri Lanka. Table 6.4.2 shows some examples of main equipment to be mobilized for this project.

**Table 6.4.2 Procurement Plan for Main Equipment**

Equipment	Specification	Country to be Procured
Track Crane	20t (129kW)	Local (Limited Number)
Track Crane	50t (250kW)	Local (Limited Number)
Track Crane	160t (360kW)	Local (Limited Number)
Rough Terrain Crane		Local
Clamshell Grabbing Crane	Telescopic Type	Local (Limited Number)
Back Hoe	Small Type	Local
Back Hoe	Crawler Type	Local
Bulldozer	15Ton	Local (Limited Number)
Bulldozer	21Ton	Local (Limited Number)
Pneumatic Tire Roller	8-20 Ton	Local
Vibration Roller	Combined Type, 3-4t	Local
Vibration Roller	Hand Guide Type	Local
Dump Truck	Maximum Load 4 Ton	Local
Tamper	60-80kg	Local
Concrete Pumping Truck	Boom Type 90-110m <sup>3</sup> /h	Local
Crawler Crane	50-55 Ton	Local
Motor Grader		Local
Road Roller	Macadam Type 10-12t	Local
Tire Roller	8-20t	Local
Asphalt Finisher	Wheel Type	Local
Asphalt Finisher	Crawler Type	Local
Vibrating Compactor	AdvancementType,40-60kg	Local
Full-Perimeter Rotary Drills	25-47t, Max. Torque 120-370t-m	Foreign
Wagon		Foreign
Bent		Foreign

Source: JICA Survey Team

## 7. OPERATION AND MAINTENANCE PLAN

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### 7.1 Introduction

The road network is categorized into six types comprising expressway and 5 kinds of ordinary roads as defined in Table 7.1.1. The Roads Development Authority (RDA) under the Ministry of Ports and Highways (MOPH) of Sri Lanka manages expressways and national highways comprising the Trunk (A class) and Main (B class) roads. The road network RDA manages comprised 12,165km of roads (as at end of the 2012) and 4456 bridges (as at end of the 2011).

**Table 7.1.1 Ordinary Road Network category**

Category	Class	Length* (km)	Designated Function
National Highways	A Class roads	4,221	Inter-provincial trunk roads connecting major cities and ports
	B Class roads	7,943	Intra-provincial arterial roads connecting major urban areas
Provincial Roads	C Class roads	15,532	Major feeder roads and roads connecting settlements with markets
	D Class roads		Minor feeder roads & roads connecting settlement with markets, etc.
Local Authority Roads	E Class roads	64,659	Local roads providing access to specific location

\* The length of A and B Class are as of 2012, C,D and E Class are as of 2006

Source : RDA web site: [http://www.rda.gov.lk/source/rda\\_roads.htm](http://www.rda.gov.lk/source/rda_roads.htm)

RDA ,National road Master Plan, 2006

## 7.2 Ministry of Ports and Highways

### (1) Ministry of Ports and Highways

The Ministry of Ports and Highways is the apex organization in Sri Lanka for the Ports and Highways sector. One of the MOPH functions is to formulate policies ,programmes and projects relating to Ports, Highways and Expressways as well as all subjects that come under the purview of Departments and Statutory Institutions mentioned below on the basis of Mahinda Chinthna (Vision for the Future and any other over-all National Policies that may be adopted by the Government.) ;

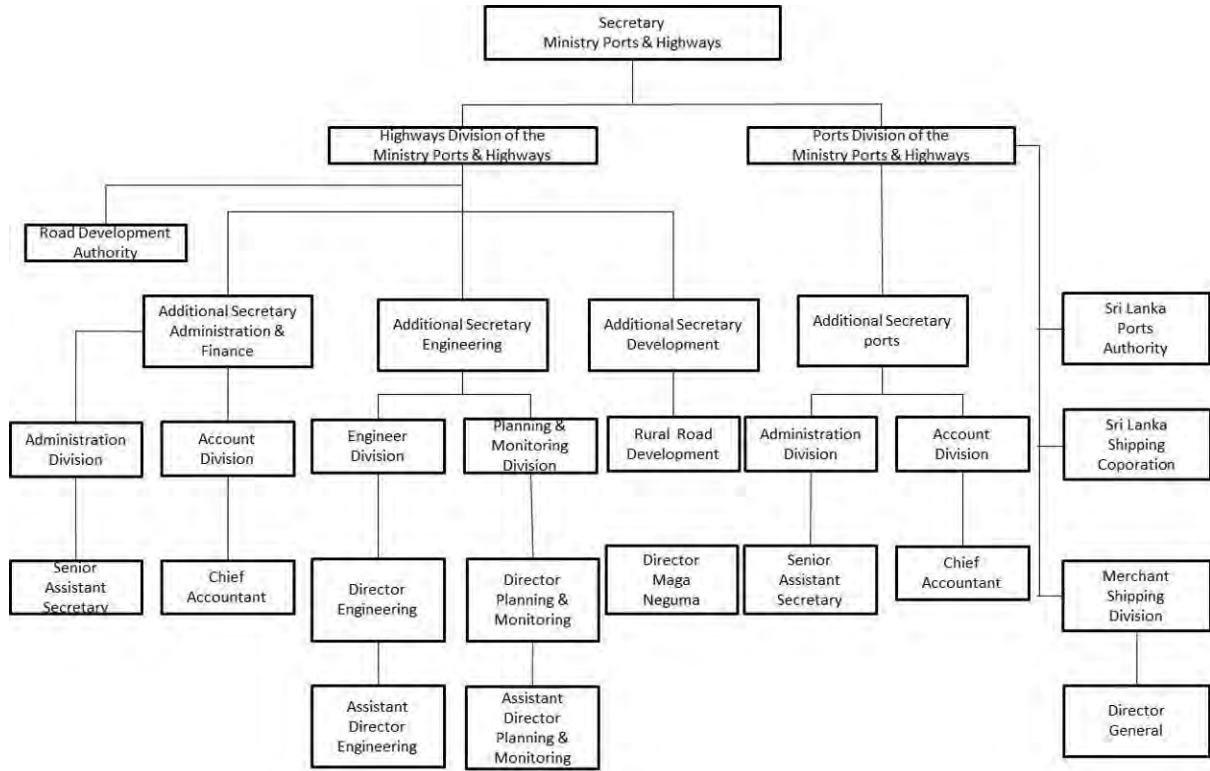
- Road Development Authority and its Subsidiaries and Associates
- Road Development Fund
- Sri Lanka Ports Authority and its Subsidiaries and Associates
- Ceylon Shipping Corporation Ltd and its Subsidiaries and Associates
- Director General Office of Merchant Shipping

MOPH mission is to formulate suitable policies and prepare efficient mechanism for the effective utilization of limited resources and modern technology to maintain the road network and marine activities in optimum level for the socio economic development of the nation.



(2) Organization Chart of MOPH

Organization Chart of the MOPH are shown Figure 7.2.1



Source: MOPH web site: <http://www.mohsl.gov.lk/>

**Figure 7.2.1 Organization Chart of MoPH**

## **7.3 Road Development Authority (RDA)**

The Road Development Authority (RDA) is the premier highway authority in the country and is responsible for the maintenance and development of the National Highway Network and expressways, design and construction of new highways, bridges and expressways to augment the existing network.

### **7.3.1 Organization**

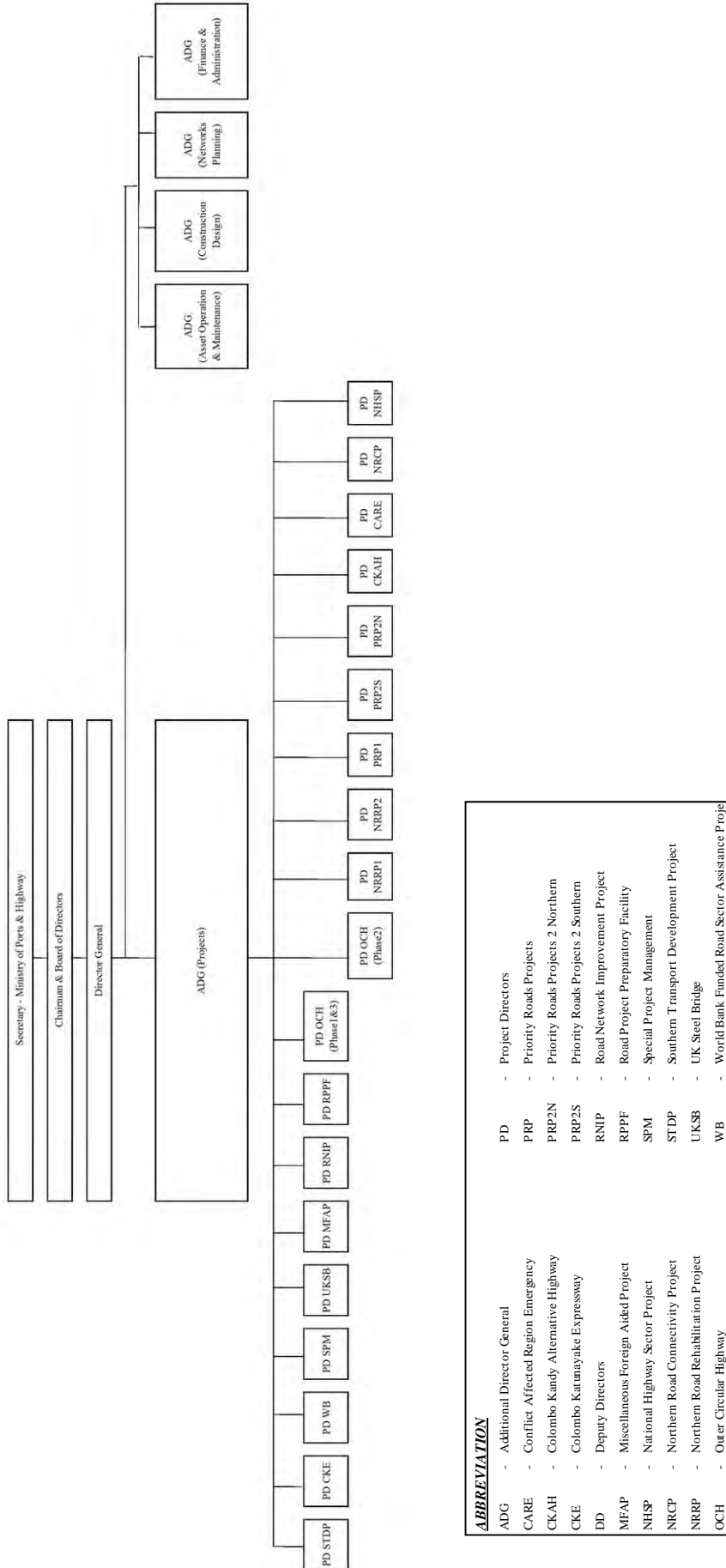
#### **(1) Organization Chart of RDA**

The RDA organization under the Board of management has the Director General as the Chief Executive Officer. Under the newly approved organizational structure the Director General is assisted by 5 Additional Director Generals and 17 Directors to carry out various functions.

In addition there are 19 Project Director Generals and Project Management Units under the Ministry of Ports & Highways which are appended to the RDA through the Chairman. The organizational chart of the RDA is given in Figure 7.3.1 and Figure 7.3.2.

There is Expressway Operation, Maintenance & management Division (EOM & M) in RDA. Operation, maintenance and management works of New Kelani Bridge and its approach road are conducted by this division.





**ABBREVIATION**

ADG	- Additional Director General	PD	- Project Directors
CARE	- Conflict Affected Region Emergency	PRP	- Priority Roads Projects
CKAH	- Colombo Kandy Alternative Highway	PRP2N	- Priority Roads Projects 2 Northern
CKE	- Colombo Katunayake Expressway	PRP2S	- Priority Roads Projects 2 Southern
DD	- Deputy Directors	RNIP	- Road Network Improvement Project
MEAP	- Miscellaneous Foreign Aided Project	RPPF	- Road Project Preparatory Facility
NHSP	- National Highway Sector Project	SPM	- Special Project Management
NRCP	- Northern Road Connectivity Project	STD	- Southern Transport Development Project
NRRP	- Northern Road Rehabilitation Project	UKSB	- UK Steel Bridge
OCH	- Outer Circular Highway	WB	- World Bank Funded Road Sector Assistance Project

Source: RDA  
**Figure 7.3.2 Organization Chart of Project Management Units**

(2) Personel of RDA

The RDA has a workforce of 5,962 employees on permanent and contract basis comprising engineering, technical, administrative, accounting and other support staff. In addition it has 4,024 permanent and 2,428 contract based labourers employed for routine maintenance work as at end of 2011. The total approved cadres under different service categories is given in the Table 7.3.1.

**Table 7.3.1 Summary of the Approved Cadre of RDA**

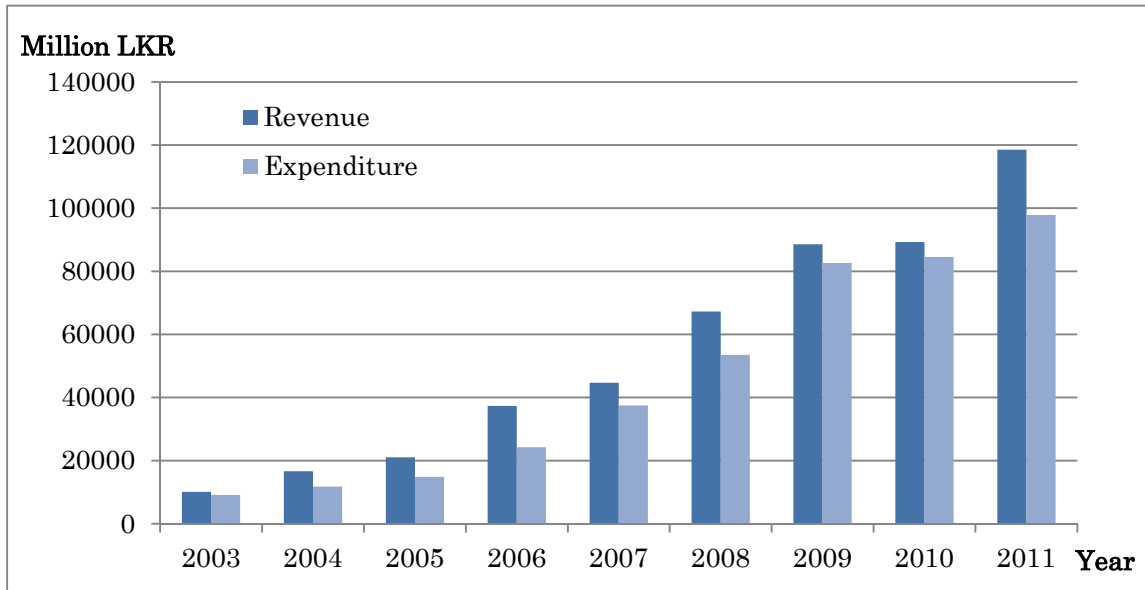
Service Category	Approved Cadre
Senior Management Service	84
Engineering Service	583
Administrative Service	143
Information Technology Service	17
Accounting Service	97
Legal Service	6
Technical Service1	102
Technical Service2	832
Clerical Service	1497
Supportive Staff	2601
Labourer	4024
Total	9986

Source: RDA annual report 2011

### 7.3.2 Budget Situation

(1) Trend on the Revenue and Expenditure of the RDA

Trend on the Revenue and Expenditure of RDA in the past ten years is shown in Figure 7.3.3 and Table 7.3.2. The revenue has been increasing every year at an average growth ratio of 38% per year.



Source :RDA

**Figure 7.3.3 Trend on the Revenue and Expenditure of RDA**

**Table 7.3.2 Trend on the Revenue and Expenditure of RDA**

year	Revenue (Million LKR)	Expenditure (Million LKR)
2003	10077	9110
2004	16610	11759
2005	21064	14863
2006	37350	24254
2007	44672	37455
2008	67254	53520
2009	88540	82600
2010	89249	84559
2011	118,531	97,817

Source :RDA

In all RDA revenue, the foreign funds contributed more than 50% of the total funding. The source of funds is shown in Table 7.3.3.

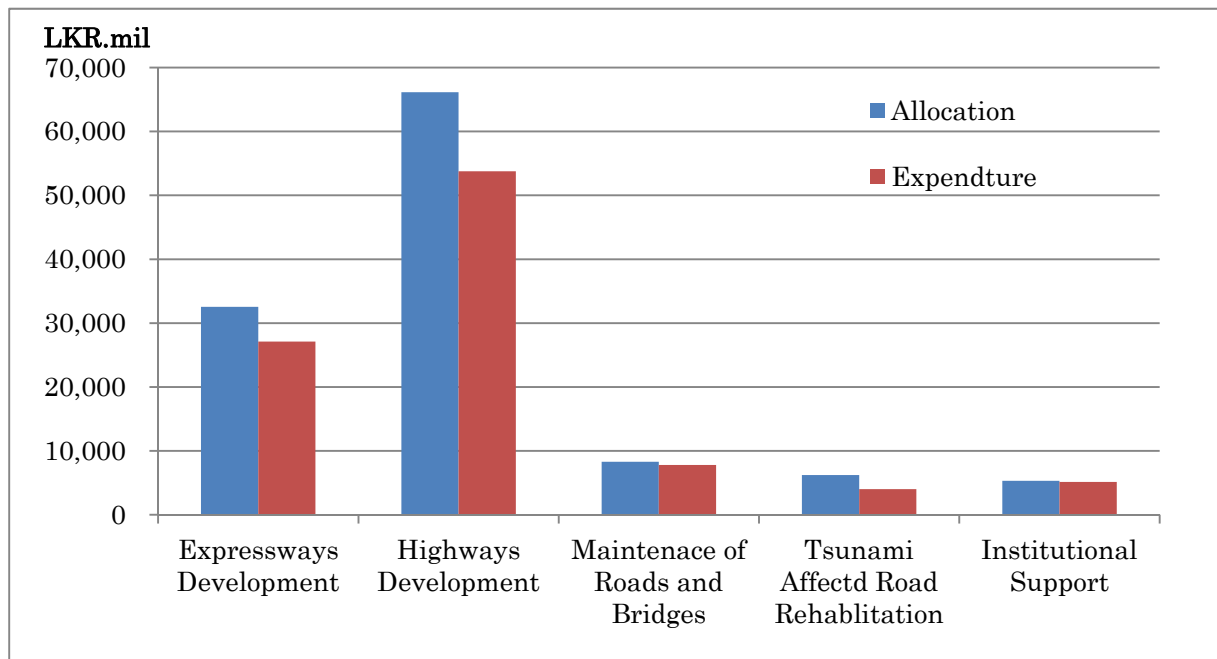
**Table 7.3.3 The Source of Funds**

Source of fund	Allocation (LKR Million)	Expenditure (LKR million)
Domestic Funds	34,365	31,453
Foreign Aid Loan	61,685	46,173
Foreign Aid Grant	1,810	1,379
Reimbursable Foreign Aid-Loan	1,250	920
Reimbursable Foreign Aid-Grant	200	1
Counterpart Fund	0	0
Foreign Aid related Domestic Funds	19,221	17,892
<b>Total</b>	<b>118,531</b>	<b>97,817</b>

Source :RDA annual report 2011

(2) The Allocation of RDA Budget

The allocation of RDA budget at 2011 is shown in Figure 7.3.4 and Table 7.3.4 .The allocation of maintenance of roads and bridges accounts for 7% of total revenue of RDA.



Source :RDA annual report 2011

**Figure 7.3.4 The Allocation of the RDA Budget at 2011**

**Table 7.3.4 The Allocation of the RDA Budget at 2011**

Activity	Allocation (LKR.Million)	Expenditure (LKR.Million)	Annual Financial Performance (%)
Expressways Development	32,557	27,101	83
Highways Development	66,156	53,778	81
Maintenance of Roads and Bridges	8,291	7,800	94
Tsunami Affected Road Rehabilitation	6,223	4,015	65
Institutional Support	5,304	5,123	97
<b>Total</b>	<b>118,531</b>	<b>97,817</b>	<b>83</b>

Source :RDA annual report 2011

### 7.3.3 Current Operation and Maintenance Conditions

#### (1) Operation and Maintenance Structure of RDA

The following 4 divisions are responsible for implementing roads and bridges maintenance:

- Maintenance Management & Construction Division
- Expressway Operation, Maintenance & Management Division
- Planning Division
- Engineering Services Division

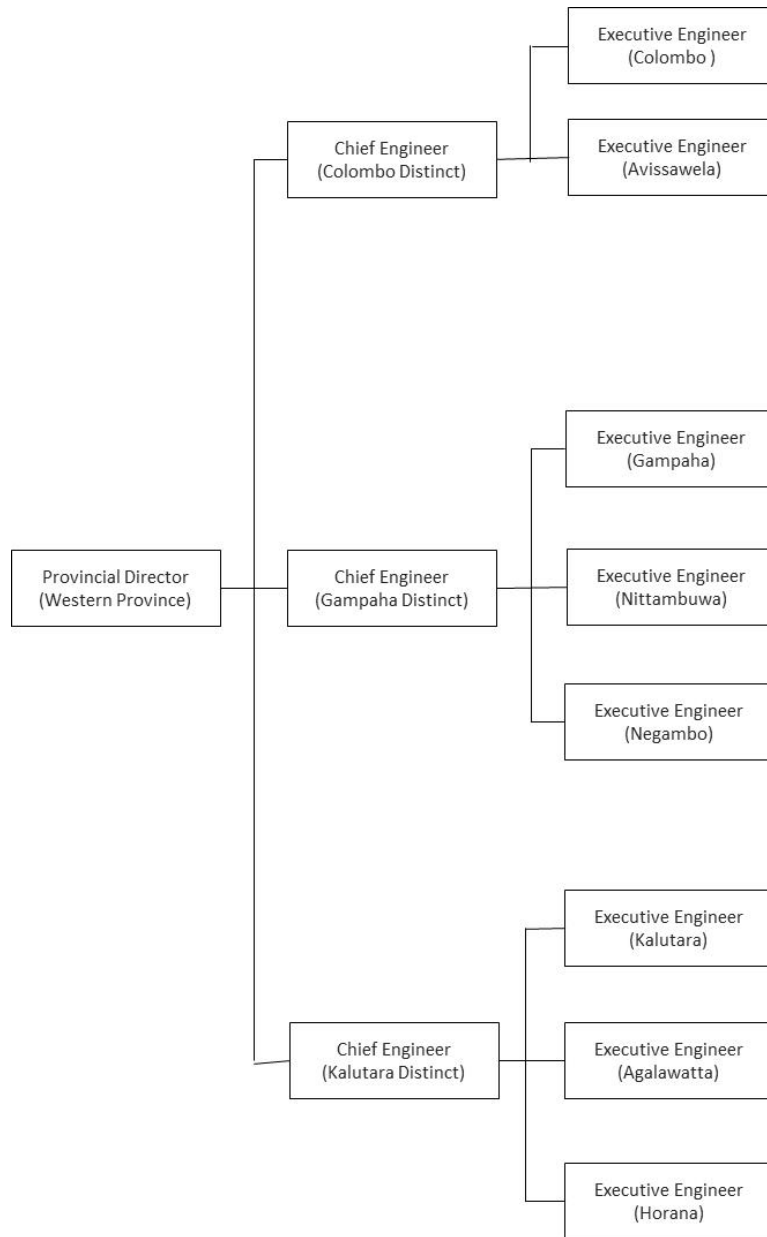
##### 1) Maintenance Management & Construction Division

Maintenance Management and Construction Division is responsible for the maintenance activities of the road (A and B Class), and the construction of non RDA roads and bridges which are also carried out in the provinces as assigned by other agencies time to time. The Maintenance Management & Construction Division manages 3 kinds of offices i.e PD(Provincial Director)office, CE(Chief Engineer) office and EE(Executive Engineer )office defined as follows:

- PD office manages maintenance work of roads and bridges in the province. Principal work is to supervise the inspection of roads and bridges, procure budget of the middle scale construction and employ site staff.
- CE office manages maintenance work of roads and bridges in the district. Principal work is to supervise the inspection of roads and bridges, procure budget of the small scale construction and pay salaries for site staff.
- EE office manages maintenance works of roads and bridges for partial section(the span is about 100km~200km). Principal work are inspection of bridges, preparation of inspection forms and supervision of road/bridge inspection work.



The structure chart of PD,CE, EE in the Western state are shown in Figure 7.3.5.



Source :RDA

**Figure 7.3.5 The Structure Chart of PD, CE, EE in Western**

## 2) Expressway Operation, Maintenance & Management Division (EOM&M)

Southern Expressway is the first access control expressway in Sri Lanka which connects Kottawa and Matara. Expressway Operation Maintenance and Management Division under the Road Development Authority is directly responsible for the maintenance and management operations of the expressway network in Sri Lanka. EOM&M Division is operating under six main sections as follows.

- User fee collection section
- Traffic controlling section
- Maintenance section
- Mechanical section
- Electrical and electronic section
- IT section

## 3) Planning Division

The Planning division is one of the main function divisions of RDA that is responsible for planning of the short, medium and long term programmes for implementation. The annual work programme is prepared based on the information collected from the provinces and divisions and the action plan is prepared based on the availability of funds allocation. The Road inspection data which the Maintenance Management and Construction division collects is analysed by this division.

## 4) Engineering Services Division

The Engineering Services division is responsible for the design of bridges and approach roads in bridge improvement and rehabilitation projects. In addition, this division is responsible for checking - existing bridges to ascertain the suitability of laying water pipes along bridges for National Water Supply & Drainage Board and to ascertain the suitability of arrangements to lay telecom cable along existing bridges for Dialog TTelecom.

## (2) Current Maintenance Cost

The budget of maintenance work at 2011 is shown in Table 7.3.5. The RDA has spent LKR 2,142 million for routine maintenance and Rs.852 million for periodic maintenance during the year 2011.

**Table 7.3.5 The Budget of Maintenance at 2011**

Description	Allocation for the year 2011(LKR.Mn)	Expenditure as at December 2011(LKR.Mn)
Project 01 - Routine Recurrent Maintenance Maintain of Roads, rehabilitation under Foreign Funds(Kuwait,JBIC,ADB&EDCF)	2,605.00	2,141.90
Project 02 – Continuation work	700.00	568.03
Project 03 – Periodic maintenance (Surface application / Minor improvement)	1050.00	1,023.85
Rehabilitation of Navathkuli – keathivu – Mannar Road under minor improvement	180.00	169.70
Project 04 – Structure Improvement (Bridges, Culverts, Drainages)	175.00	164.68
Project 05 – Maintenance of Lights ,Signal Lights , Road Marking & installation of Road Furniture)	430.00	402.50
Project 06 – Emergency work /Disaster work	2,600.00	2,631.66
Project 07 – Operation and Maintenance of Ferries	15.00	10.46
Project 08 – Asphalt Plant	920.61	687.58
<b>Total</b>	<b>8,291.11</b>	<b>7800.36</b>
Allocation for the year 2011 Rs:5000mn Additional Allocation received on 20.09.2011 Supplementary No:574 Rs:1000Mn Additional Allocation received on 30.12.2011 Supplementary No:860 Rs:1000Mn Transfer of Fund under FR66 on 30.12.2011 Rs:291.11Mn		

Source :RDA annual report 2011

### (3) Maintenance Manual

Roads and bridges maintenance manuals are provided by RDA as follows

#### 1) Bridge Maintenance Manual

Bridge Maintenance Manual was published in 1997. This Manual adopts a rating system for the bridge condition as given below:

“Good” Rating 4 - Element is new or in good condition with no repairs necessary

“Fair” Rating 3 - Element is in need of minor repair

“Poor”Rating 2 - Element is in need of major repair. If necessary speed restriction or complete closure of bridge should be implemented

“Critical”Rating 1 - Element has failed to perform the function intended for and is of critical nature that such a bridge should be closed and immediate repairs undertaken

2) Road Maintenance Manual

Road Maintenance Manual was published in 1989. It outlines road, bridge and culvert maintenance methods.

3) Visual Road Condition Surveys Guidelines

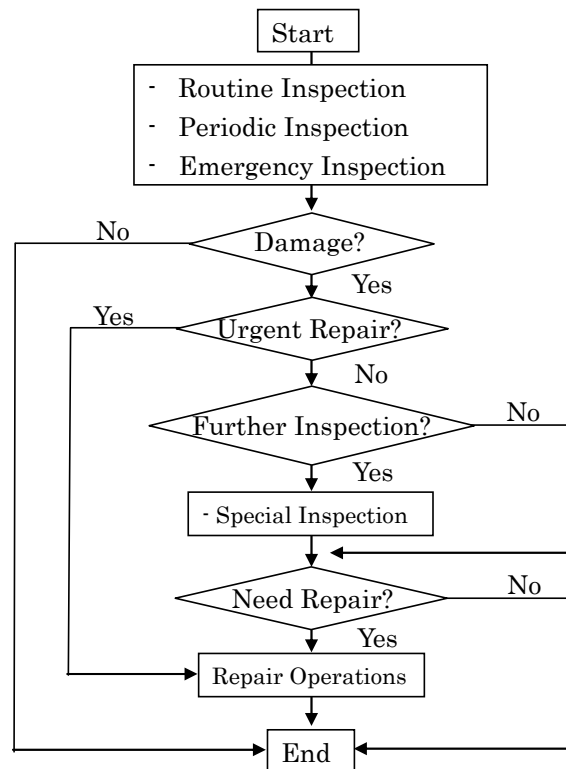
Visual road Condition Survey Guidelines provide guidelines for field survey teams engaged in measuring and recording road defects and conditions of roads under the RDA in Sri Lanka. The data collected is recorded in field sheets and then entered into a database. This manual is accompanied by inspection sheets.

## **7.4 Operation and Maintenance Plan for the Project**

### **7.4.1 General**

The New Kelani Bridge should be maintained in sound conditions to sustain smooth and safe traffic flow. In general, bridges are being administered by road/bridge Management System which consists of such major activities as “Preparation of Inventory Data”, “Inspection”, and “Rating and Prioritization based on inspection results for actual Maintenance (Repair) work”, and also documentation of all the records of the activities.

Figure 7.4.1 shows the procedure of the maintenance system from Inspection to Repair/Maintenance Operation. Maintenance operation includes Repair work, Routine and Periodic Maintenance work.



Source :JICA Survey Team

**Figure 7.4.1 Procedure from Inspections to Maintenance (Repairs)**

Routine Inspection may be conducted by RDA itself, while heavier inspections such as Periodic or Emergency Inspection will be carried out by out-sourced experts contracted by RDA. Also, the costs of inspection and maintenance are estimated, based on certain assumptions.

## 7.4.2 Inspection

### (1) Purpose of Inspection

- To determine the damages in the road/bridge
- To identify the location of damages and their deterioration level, urgency for repairing

### (2) Type of Inspection

- The type of inspection shall be divided as follows:

**Table 7.4.1 Classification of Inspection Work**

Inspection Type		Major objects	Purpose	Methods	
Routine	Daily	Once or twice	Road surface	Road safety	Visual inspection from vehicle-on board
		Morning & evening	Doors / hatches of girder	Security	Visual and physical inspection on foot
	Every 3 months	Cable surface	Cable surface	Damage	Visual inspection
		Cable anchor	Cable anchor	Water leakage	Visual inspection inside girder
Periodic	Every 1 year	All components	Damage and Safety	Visual inspection by min. equipment (crack scale, hand tape, etc.)	
	Every 5years	All components	Damage and Safety	<ul style="list-style-type: none"> <li>• Visual inspection by Equipment</li> <li>• Testing (by equipment)</li> </ul>	
Non-periodic	Emergency (at the time of accident/disaster)	All damaged components	Damage and Safety	Visual inspection by equipment	
	Special (as required)	Defective portions Discovered by above inspections	<ul style="list-style-type: none"> <li>• to grasp detailed behavior of defects/ actions needed</li> <li>• to monitor progress of damage</li> <li>• to investigate cause of damage</li> </ul>	<ul style="list-style-type: none"> <li>• Visual inspection</li> <li>• Inspection using equipment</li> <li>• Testing (by equipment)</li> </ul>	

Source: JICA Survey Team

The Inspection work should be conducted by Expressway Operation, Maintenance & Management Division. When detailed inspection is required, it will be carried out by out-sourced experts.

1) Routine inspection

In order to get to know the current situation of the structures, routine inspection is undertaken visually from road patrol on the shoulder or left-most lane. Accordingly, inspections are confined to those which can be observed from the moving vehicle. They include the following:

- Pavement condition, water-logging (drainage), condition of embankment/cut slope, appurtenant facilities (guard rail, lighting facilities, traffic information devices, etc.)

2) Periodic inspection

In order to grasp the overall status of the structure, a distant visual inspection should be undertaken from a short distance visual inspection. Furthermore, prior to initiating inspection work, several field work such as traffic control, preparation and arrangement of transportation are required.

3) Non periodic inspection (if necessary)

Beyond the daily inspection, sometimes an additional inspection is necessary if any structural damage is suspected to be caused by severe weathering action. In that case, the BIV or temporary scaffolding should be used, if it is deemed necessary.

4) Inspection for Extra dosed bridge

Inspection for Extra dosed bridge is stated here, since the main bridge constructed in the Project is the first Extra dosed bridge in Sri Lanka.

Commonly, daily visual inspection is conducted from the vehicle-on-board to secure road safety. However, as an Extra dosed bridge is adopted for the main bridge, checking of the entrance facilities towards the girder is recommended to confirm whether or not doors or hatches are locked. All stay cables will be anchored inside the girder, and the tendon anchorages are very significant structural elements of the Extra dosed bridge. So, these doors and hatches should be checked not only visually but also by feel inspection every morning and evening.

Also, the 3-month interval inspection is recommended for the checking of the surface of the stay-cables whether or not there is water leakage of the tendon anchorages inside the girder.

### **7.4.3 Maintenance**

(1) Purpose of Maintenance

- To secure traffic safety and monitor the bridge health condition under current traffic loading.

(2) Bridge Maintenance

Cleaning the carriage way of the bridge such as removing trash or debris on road surface and cleaning the drainage are conducted as Routine maintenance.

After completion of the Project Road, maintenance (repair) work will be planned and conducted based on rating and prioritization of inspection results.

The Project Road has three bridge types, namely PC bridge, steel bridge and extra doped bridge. For all bridge types, following deteriorations or damages are anticipated.

- Wave, Rutting, Cracking and potholes of the pavement (Resurface ; every 10 years)
- Cracks of the slab, girder, pylon, pile-cap of the pier and abutment
- Paint Peeling of the guardrails
- Damage to expansion joints (Replacement ; every 20 years)
- Damage to the bearing of the girder (Replacement ; every 40 years)

In addition, following deteriorations or damages are anticipated for steel and extra doped bridge.

For steel bridge

- Paint Peeling of the steel piers, girder (Repainting ; every 20 years)

For extra doped bridge

- Deterioration or damage of polyethylene pipe surface of the stay cables
- Water-leakage of the Tendon anchorage
- Deterioration or damage of the stay cables (Replacement ; 75 years)

(3) Road Maintenance

Usually, road maintenance work are categorized into the following three types.

- (i) Routine maintenance
- (ii) Periodic maintenance
- (iii) Emergency maintenance

1) Routine maintenance

Routine maintenance includes road cleaning: removal of trash, debris, soil, stone etc. including mowing of slopes and cleaning of drainage facilities. The frequency may vary from once a day to once a year, according to necessity. Localized repairs of pavement and shoulder damages, such as pothole patching, reshaping of side drains, repairing and cleaning of culverts and retaining wall are included. Also, repainting of road markings, repairing and replacing of road signs, lighting and guardrails should be undertaken.



## 2) Periodic maintenance

Periodical maintenance includes the following features:

- (i) Longer interval of implementation,
- (ii) Relatively large in scale requiring closure of lane(s), and
- (iii) The interval of implementation is influenced by traffic volume, especially that for heavy vehicles.

Periodic maintenance includes full-width resurfacing or treatment of the existing pavement or roadway to maintain surface features and structural integrity for continued serviceability. Specific activities after 10 years of operation include the removal of damaged surface course and laying of new surface course, as well as localized considerably damaged base course reconstruction.

## 3) Emergency maintenance

Emergency maintenance mainly refers to the urgent repair of the road structure damaged by natural disasters or large-scale accidents. There are various forms of such damage and it is very difficult to anticipate what will happen. The followings are some examples of such damages:

- (i) Failure of embankment/cut slope during/after heavy rain
- (ii) Damage due to earthquake (Bridge/viaduct, cut/embankment slope, retaining wall, pavement, etc.)

To minimize traffic disturbance, repair work of damages are often implemented in two stages, i.e. urgent temporary repair to secure traffic flow, and full-scale repair including some strengthening to prevent recurrence in the future. The work items for maintenance are listed in Table 7.4.2.

**Table 7.4.2 Items of Road Maintenance**

Maintenance Type		Purpose	Maintenance Work
Routine	Every day	Road cleaning	Removal of trash, debris, soil, stone, etc.
	Every 3 months	Mowing on slopes	Mowing grass on slopes; frequency depends on weather condition
		Drainage facilities cleaning	Removal of trash and sediment in side ditch, culvert etc.
	After defects found	Repair of minor defects on pavement	Patching potholes, sealing cracks etc.
		Soundness of appurtenant road facility/device	Repair/changing parts of lighting, road sign, lane marking etc.
Periodic	Every 10 years	Rehabilitation of pavement	Removal of damaged surface course and laying new one
Emergency	At the time of accident/disaster	Repair of the damaged portions	Repair of pavement, structure, slope, etc.

Source: JICA Survey Team

The maintenance works on Table 7.4.2 should be conducted by Expressway Operation, Maintenance & Management Division.

#### **7.4.4 Operation and Maintenance Cost**

After the New Kelani Bridge is opened to service, costs of inspection and repair are estimated as shown in Table 7.4.3. The cost is estimated assuming life span of the bridge is 100 years. The average annual cost for the first 30 years is estimated LKR 48 million. This amount which is 0.6% of maintenance budget of RDA at the 2011(LKR 8,291 million) will be covered by RDA budget.

**Table 7.4.3    Operation and Maintenance Cost**

Items	Interval	Cost(LKR)
Routine Maintenance	Every year	1,373,627
<b>Highways</b>		
Inspection work		
Periodic Inspection	Every year	157,248
Repair work		
Pavement	10years	383,387,293
<b>Steel Bridge</b>		
Inspection work		
Periodic Inspection	5years	157,248
Repair work		
Painting	20years	43,601,605
Expansion Joint	20years	267,858,360
<b>PC Bridge</b>		
Inspection work		
Periodic Inspection	5years	157,248
Repair work		
Expansion Joint	20years	236,714,940
Bearing	40years	380,880,000
<b>Extradosed Bridge</b>		
Inspection work		
Periodic Inspection	5years	157,248
Repair work		
Expansion Joint	20years	86,088,600
Bearing	40years	27,600,000
PC Cable	75years	1,114,878,900

Source: JICA Survey Team

## **8. COST ESTIMATES**

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### **8.1 General Conditions of Cost Estimates**

#### **8.1.1 Term of Cost Estimation**

The unit prices of resources (materials, equipment and labours) adopted for this cost estimation are those prices at the time of November, 2013.

#### **8.1.2 Exchange Rate**

The exchange rates adopted for this cost estimate are shown below.

US\$ 1 = 99.2 Yen

US\$ 1 = 132.4 LKR

LKR 1= 0.749 Yen

#### **8.1.3 Price Escalation**

The price escalation is set at 1.3 % for Local Currency and 1.3 % for Foreign Currency.

#### **8.1.4 Physical Contingency**

Although the physical contingency is generally applied 5.0%, it is set at 10 % of the construction and 10 % of the consultant service considering cost overrun and the delay of construction and resettlement.

#### **8.1.5 Administration Cost**

The administration cost incurred for establishment of the organization in RDA is set at 8 % of construction cost and consultant service.

### **8.1.6 Taxes and Duties**

(1) VAT (Value Added Tax)

VAT rate of Sri Lanka is 12% as of November, 2013.

(2) Import Tariff

The import tariff which is from 5% to 30 % is different item by item. The target items of import duty are as follows.

**Table 8.1.1 The List of Import Tariff**

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### **8.1.7 Rate of Interest during Construction**

0.1% for the construction work and 0.01% for the consultant work will be applied.

### **8.1.8 Rate of Front-end Fee**

Rate of front-end fee will be 0.2% for the first year.

### **8.1.9 Cost for Dispute Board**

Dispute board is set out for the conflict resolution between the contractor and the engineer. Therefore, the cost of dispute board is including the project cost.

## 8.2 Cost Estimates

### 8.2.1 Construction Cost

The construction cost estimation is performed, based on the study results of Highway Design and Bridge Type Study which are already explained in previous chapter. Regarding Orugodawatta Intersection, it is required to improve in order to avoid the traffic congestion.

The following Construction Cost is estimated excluding the price escalation and physical contingency.

**Table 8.2.1 Construction Cost**

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Source: JICA Survey Team

### 8.2.2 Consulting Services Cost

The following items are estimated as the Consulting Services Cost.

- Detailed Design
- Tender Assistance
- Construction Supervision

The following Consulting Services Cost is estimated excluding the price escalation and physical contingency.

**Table 8.2.2 Consulting Services Cost**

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Source: JICA Survey Team

### 8.2.3 Operation and Maintenance Cost

The operation and maintenance cost shall include the following items.

**Table 8.2.3 Operation and Maintenance Cost**

Items	Interval	Cost (LKR)
Routine Maintenance	Every year	1,373,627
<b>Highways</b>		
<b>Inspection work</b>		
Periodic Inspection	Every year	157,248
<b>Repair work</b>		
Pavement	10years	383,387,293
<b>Steel Bridge</b>		
<b>Inspection work</b>		
Periodic Inspection	5years	157,248
<b>Repair work</b>		
Painting	20years	43,601,605
Expansion Joint	20years	267,858,360
<b>PC Bridge</b>		
<b>Inspection work</b>		
Periodic Inspection	5years	157,248
<b>Repair work</b>		
Expansion Joint	20years	236,714,940
Bearing	40years	380,880,000
<b>Extradosed Bridge</b>		
<b>Inspection work</b>		
Periodic Inspection	5years	157,248
<b>Repair work</b>		
Expansion Joint	20years	86,088,600
Bearing	40years	27,600,000
PC Cable	75years	1,114,878,900

Source: JICA Survey Team



## 8.2.4 Land Acquisition Cost

The land acquisition cost shall include the following items.

**Table 8.2.4 Land Acquisition Cost**

Item No.	Item	No.	Unit	LKR/unit	Total LKR
Compensation for Lands	Residential Lands (by GND)				
	Peliyagoda Gangabada East	13.8	Perch	975,000	13,455,000
	Bloemendhal	1.2		1,125,000	1,350,000
	Nawagampura	7.9		1,125,000	8,887,500
	Orugodawatta	0		1,125,000	0
	Sedawatta	26.3		875,000	23,012,500
	Wadullawatta	1.8		875,000	1,575,000
	Residential land				
	Commercial land (by GND)				
	Bloemendhal	32.3	Perch	1,237,000	39,955,100
	Nawagampura	5.4		1,237,000	6,679,800
	Grandpass	4		1,237,000	4,948,000
	Sedawatta	9		963,000	8,667,000
	Wadullawatta	44.8		963,000	43,142,400
Commercial land					103,392,300
Sub-total					151,672,300
Resette ment/ Relocation	KOVIL	1	set		13,000,000
	NAITA	1	set	-	850,000,000
	AEA	1	set		500,000,000
	AH titled Op 1 (50%)	23	No.	1,322,500	30,417,500
	AH titled Op 2 (50%) (Pay UDA)	23	No.	685,000	15,755,000
	AH No Title Op 1(20%)	70	No.	1,322,500	92,575,000
	AH No Title Op 2 (80%) (Pay UDA)	279	No.	685,000	191,115,000
	Sub Family	29	No.	275,000	7,975,000
	Comm with title/no title	54	No.	933,750	50,422,500
					1,751,260,000
Loss of Income:	Business Income	54	No.	15,000	3,240,000
	Loss of Wage/Salary	118	Worker	15,000	1,770,000
	Sub-total				2,580,000
Trees:	Fruit Trees	143	No	2,000	286,000
	Timber	5		5,000	25,000
	Sub-total				311,000

Item No.	Item	No.	Unit	LKR/unit	Total LKR
Allowances	Vocational Training Grant	100		15,000	1,500,000
	Special grants for VP	102		15,000	1,530,000
	Temporary Accommodation (Tenants)	38	No	45,000	1,710,000
	Sub-total				4,740,000
Shifting of Utility Services	Transmission lines	1	set	-	1,240,880,000
	Telecommunication posts	43	Nos.	50,000	2,150,000
	Electricity posts	40	Nos.	50,000	2,000,000
	Lamp posts	132	Nos.	75,000	9,900,000
	Name boards and Sign boards	70	Nos.	50,000	3,500,000
	Manholes	61	Nos.	45,000	2,745,000
	Telecom cable box	7	Nos.	70,000	490,000
	Sub-total				1,261,665,000
External Monitoring		36	Months	250,000	9,000,000
Total					3,181,228,300
Administration Cost & IRP Planning (1.5%)					47,718,425
Contingency 5%					159,061,415
<b>TOTAL (LKR)</b>					<b>3,388,008,140</b>
<b>TOTAL (LKR.)-Rounded</b>					<b>3,388,000,000</b>

Source: JICA Survey Team

### 8.2.5 Environmental Management Plan (EPM) and Environmental Monitoring Plan (EMoP)

The EMP cost and EMoP cost are as follows.

**Table 8.2.5 EMP Cost**

Item	Cost (LKR)	
	Environmental Management Plan (EMP) Cost	EMP
Construction		202,100,000
Consultant		4,000,000
Environmental Monitoring Plan (EMoP) Cost		6,067,500

Source: JICA Survey Team

### 8.2.6 Total Project Cost

The total project cost that includes construction, consulting services, environment monitoring, RAP implementation, physical contingencies, price escalation, VAT and others is estimated as below.

**Table 8.2.6 Total Project Cost**

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Source: JICA Survey Team

As stated in “4.4.4 Kelanithissa Junction” and “4.4.5 CKE Interchange”, the construction of A and D ramps in Kelanithissa Junction and CKE Interchange is not cost-effective.

For reference, project cost and cost benefit analysis in case that above-mentioned interchanges (ramps) are not constructed are shown in Table 8.2.7 and 8.2.8, respectively.

**Table 8.2.7 Total Project Cost in case A and D Ramps in Kelanithissa Junction and CKE Interchange is not constructed (For Reference)**

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Source: JICA Survey Team

**Table 8.2.8 Summary of Cost Benefit Analysis in case A and D Ramps in Kelanithissa Junction and CKE Interchange is not constructed (For Reference)**

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Source: JICA Survey Team

In addition, project cost and cost benefit analysis in case that A and D ramps in Kelanithissa Junction is not constructed is shown in Table 8.2.9 and 8.2.10, respectively.

**Table 8.2.9 Total Project Cost in case A and D Ramps in Kelanithissa Junction is not constructed (For Reference)**

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Source: JICA Survey Team

**Table 8.2.10 Summary of Cost Benefit Analysis in case A and D Ramps in Kelanithissa Junction is not constructed (For Reference)**

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Source: JICA Survey Team

In addition, project cost and cost benefit analysis in case that CKE Interchange is not constructed is shown in Table 8.2.11 and 8.2.12, respectively.

**Table 8.2.11 Total Project Cost in case CKE Interchange is not constructed (For Reference)**

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Source: JICA Survey Team

**Table 8.2.12 Summary of Cost Benefit Analysis in case CKE Interchange is not constructed (For Reference)**

Confidential
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Source: JICA Survey Team

### **8.3 Goods and Services Procured from Japan**

This Project is expected to apply STEP scheme. Therefore, the ratio of goods and services procured from Japan is estimated in this Study.

The procurement ratio from Japan is shown in Table 8.3.1.

**Table 8.3.1 Procurement Ratio from Japan**

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Source: JICA Survey Team

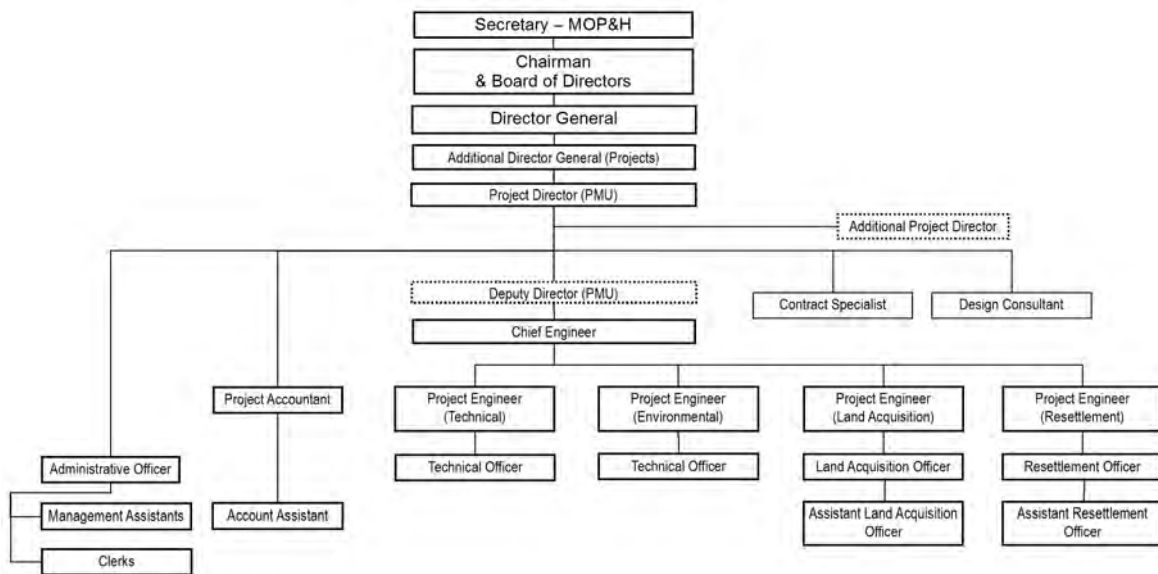
## 9. IMPLEMENTATION PLAN

### 9.1 Implementation Organization

The project organization will be organized so that the GOSL can implement the Project smoothly and effectively as well as coordinate with project stakeholders.

It is recommended that the Project Management Unit (PMU) for the Project will be organized under the Ministry of Ports and Highways (MOPH).

The proposed organization of PMU is shown in Figure 9.1.1.



Source: JICA Survey Team

**Figure 9.1.1 Organization of Project Management Unit (PMU)**

PMU will be established before the commencement of detailed design. All tasks to be carried out for the Project will be managed by the PMU. The Project is divided into following two stages.

- Detailed design and tender stage (1st stage)
- Construction stage (2nd stage)

Detailed design, tender procedure and compensation work including the relocation will be carried in the 1st stage. Construction management will be carried out in the 2nd stage.

## **9.2 Implementation Schedule**

The implementation plan is established based on the month/year for the milestones of key events of the Project. The plan includes the stage of detailed design, tender procedure and construction work. The construction period was estimated as 3 years in Chapter 6.

It is assumed that International Competitive Bidding (ICB) is applied for procurement of contractor and consultant for the Project. The time required for the procurement is assumed based on the procedures for a financing scheme of Japanese ODA Loan.

In addition, Right of Way (ROW) for the Project was determined in this Survey. RDA will be able to commence the land acquisition and compensation procedure soon, and the procedure will be completed by the commencement of the construction.

Implementation schedule for the Project is shown in Figure 9.2.1.

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Source: JICA Survey Team

**Figure 9.2.1 Implementation Schedule**

### **9.3 Contract Package**

The project consists of construction of earthwork (access from CKE), concrete bridge including 2nd New Kelani Bridge of extradosed type bridge and steel bridge overlapping on the existing Baseline & A1 Road (south face of Kelanithissa Power Station). The earthwork construction should be implemented with ensuring existing traffic service. The northern side span of the extradosed bridge and the steel bridge should be constructed above A1 Road and Baseline & A1 Road (south face of Kelanithissa Power Station), respectively. The connectivity of three portions should be taken care as a continuous road structure. And also the steel bridge construction work should be conducted in narrow space on minimizing disturbance to existing heavy traffic with safety.

The package of the project components should be carefully considered according to the scope of works required for each work. The comparative analysis for packaging of the contract is to be conducted taking into account the benefits of overall project implementation, especially focused on procurement arrangements and control of works to ensure smooth implementation of the project (see Table 9.3.1).

As a result of analysis for each optional packaging, it is recommended that the project should be implemented with a sole contract package in order to ensure smooth implementation under simple project management. The management of a sole contract has various advantageous, especially the merit of ease of coordination with the stakeholders including traffic flow arrangement during steel bridge construction work and simple contract management in conformity with contract requirement.

In addition, when some troubles such as construction accident occur, it will be difficult to clarify where responsibility lies in case of two-package.



RDA does not have an experience to manage such big one package project. However RDA will be able to manage it, since specific management will not be required in the Project.

**Table 9.3.1 Summary of the Approved Cadre of RDA**

Item	One (1) - Package		Two (2) - Package	
	E + C + S		E + C	S
Combination of sections	E + C + S		E + C	S
Cost scale (hundred million Yen)	Confidential		Confidential	
Incl. procurement cost	(+0.5%)		(+1.0%)	
Characteristic of package	- Integrated control is possible for all sections and extent.	- Divided into concrete bridge and steel bridge sections. - Concrete bridge section includes earthwork section because of its small construction scale.		
Advantage or disadvantage of package	- Integrated control is possible for all three sections which are conducted continuously in narrow construction space with traffic congestion.	- Control is difficult for separate contract sections which are conducted in narrow construction space with traffic congestion.		
Benefit for material & equipment sharing	- Sharing for material and equipment is possible in a sole contract.	- Sharing for material and equipment is impossible (difficult) in individual contract.		
Procurement of contract	- Shortest procurement period. - One set of contract documents.	- Slightly longer procurement period. - Two sets of contract documents.		
Work management & supervision	- Integrated control is possible for the works. - One supervision team for a sole contract.	- Separate management is required for individual contract, and control for the works are complicated. - Two supervision teams responding to two different contracts.		
Overall evaluation	<b>Recommended</b> - Minimum cost and time consuming for management of a sole contract.		- Slightly higher cost and longer time consuming required for managing two individual contracts.	

Note: E: Earthwork (CKE) section, C: Concrete bridge section (including 2nd New Kelani Bridge),  
S: Steel bridge section

## 10. PROJECT EFFECT

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### 10.1 Introduction

After the Project has been completed, it is expected to improve the traffic conditions at spot area/ road sections around the target area.

In order to understand the project effect of this Project, it is necessary to estimate the effects of improvements at spot area/ road sections quantitatively. Therefore, the Study team recognized that a micro-scopic traffic simulation would be more appropriate for this purpose than application to conventional road network analysis because it enable to forecast and examine how the traffic improvement at spot area will be effective or not.

The micro-scopic traffic simulation can also evaluate whether the expressway connected to urban area can secure the smooth traffic flow or not with planned connection method and traffic/lane management.

The micro-scopic traffic simulation was applied to the VISSIM (Verkehr In Städten – SIMulationsmodell, German for "Traffic in cities - simulation model"), which is widely used for transport plan and traffic operation plan in many countries, taking the driving behaviour of motor cycle and 3-wheeler or the real situation like a number of vehicles running into one lane (Figure 10.1.1). So that it is appropriate to re-create and evaluate the traffic conditions which would occur in the Project.



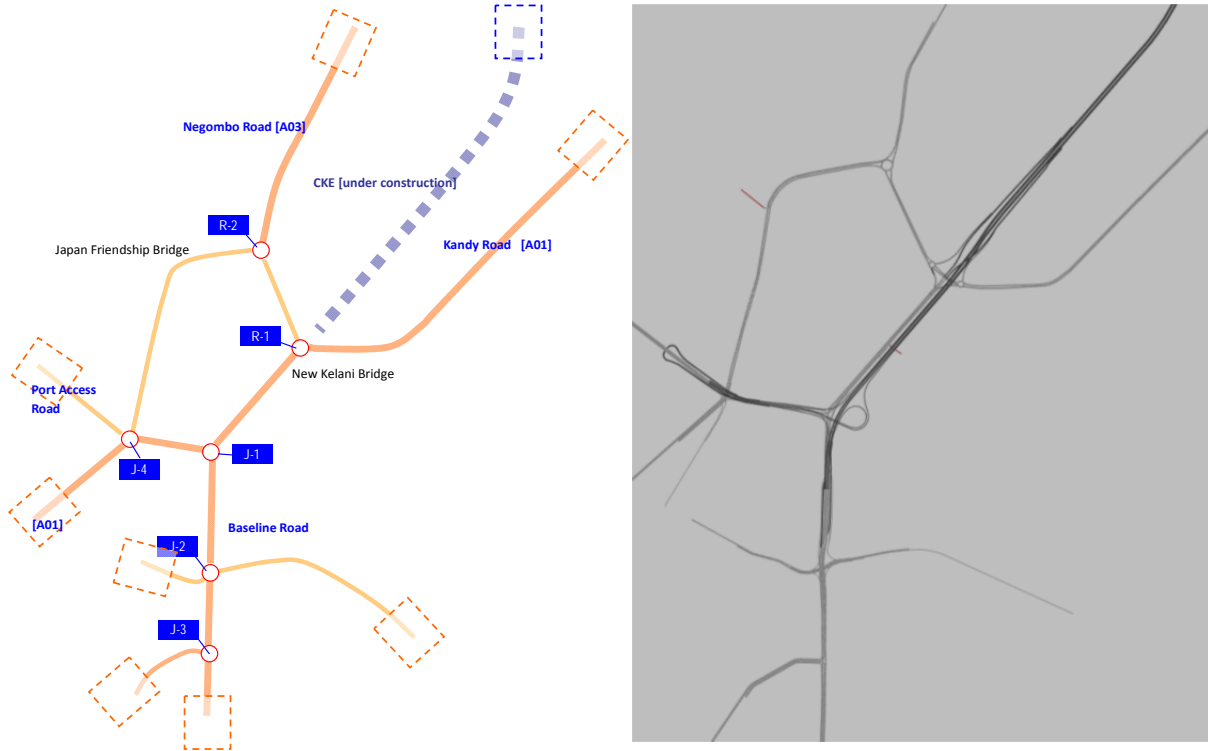
**Figure 10.1.1 Image of Micro-Scopic Traffic Simulator (VISSIM)**

Four analysis cases are prepared to estimate project benefits for with and without of the project implementation in 2020 and 2035.

## 10.2 Microscopic Traffic Simulation

### 10.2.1 Preparation of Datasets for Simulation

The road network developed on the simulator shows as follow.



Source: JICA Survey Team

**Figure 10.2.1 Road Network on VISSIM for Micro-Scopic Traffic Simulation**

The alignment and traffic/lane management of the current condition was set up based on the results of previous study results, drawings, and the survey results of traffic/lane management and conditions at site. Based on the designed drawings of the CKE and the planned drawings of the Project road, the future detailed road alignment and traffic/lane managements were inputted into the simulator (Figure 10.2.2).

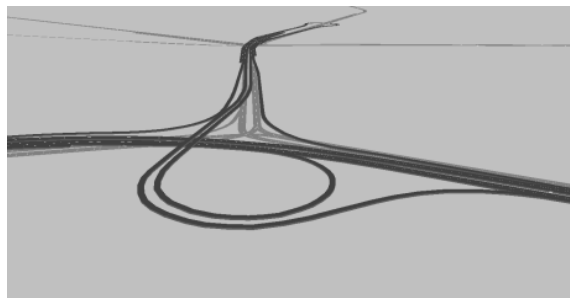




With Project (CKE connected both Baseline and Project Road)



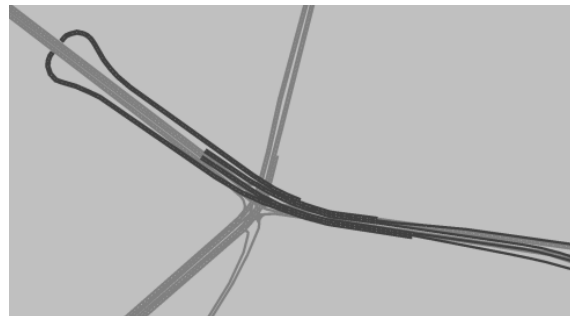
Kelanithissa Junction (Current Condition)



Kelanithissa Junction (Future Condition)



Ingurukade Interchange (Current Condition)



Ingurukade Interchange (Future Condition)



Orugudawatta Intersection (Current)



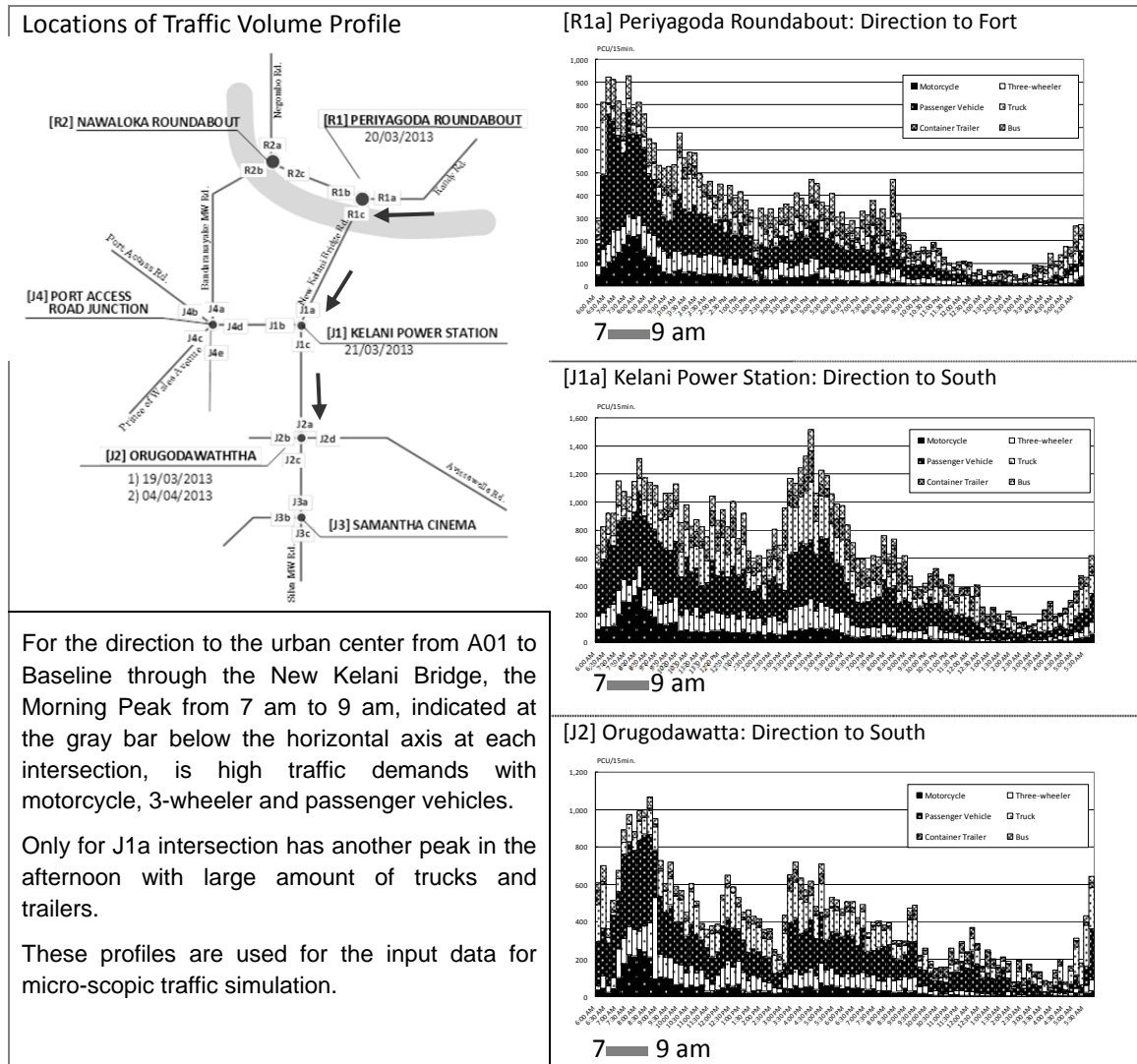
Orugudawatta I/S + I/C (Future Condition)

Source: JICA Survey Team

**Figure 10.2.2 Developed Road Network for Micro-Scopic Traffic Simulation  
(Traffic/ Lane Management)**

After understanding the designed traffic signal phasing in each signal and instruction of the police control by his manual at the site survey, these understandings can help to simulate current traffic conditions with these signal phasing conditions.

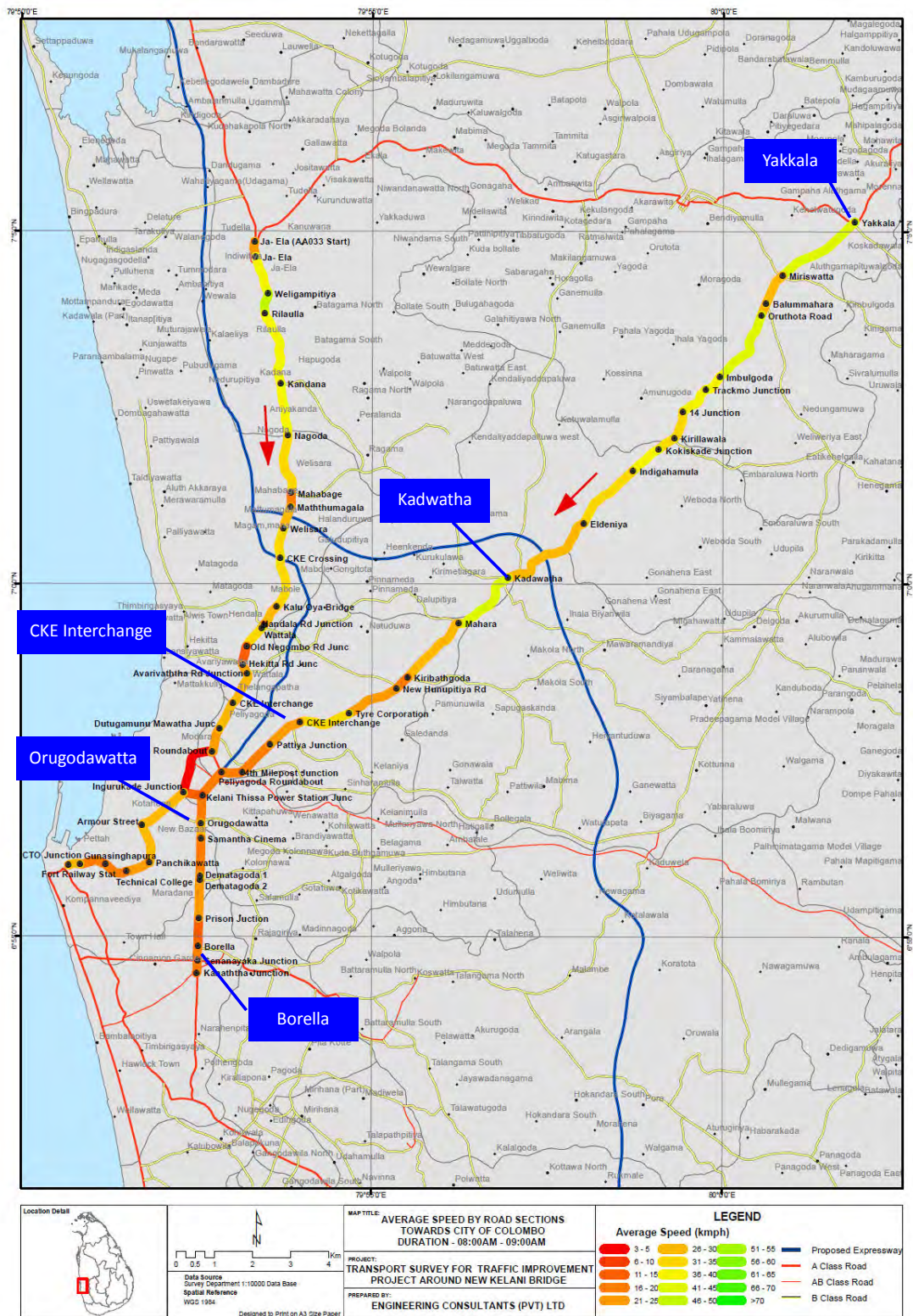
The current traffic volume was counted on site for every 15 minutes at each intersection. This data was used for setting up the traffic volume and the ratio for turning traffic volume at intersection which input into the simulator. Figure 10.2.3 shows the results of survey for inflow traffic volume from A01 to roundabout of R1 and intersections of J1 and J2.



Source: JICA Survey Team (2013)

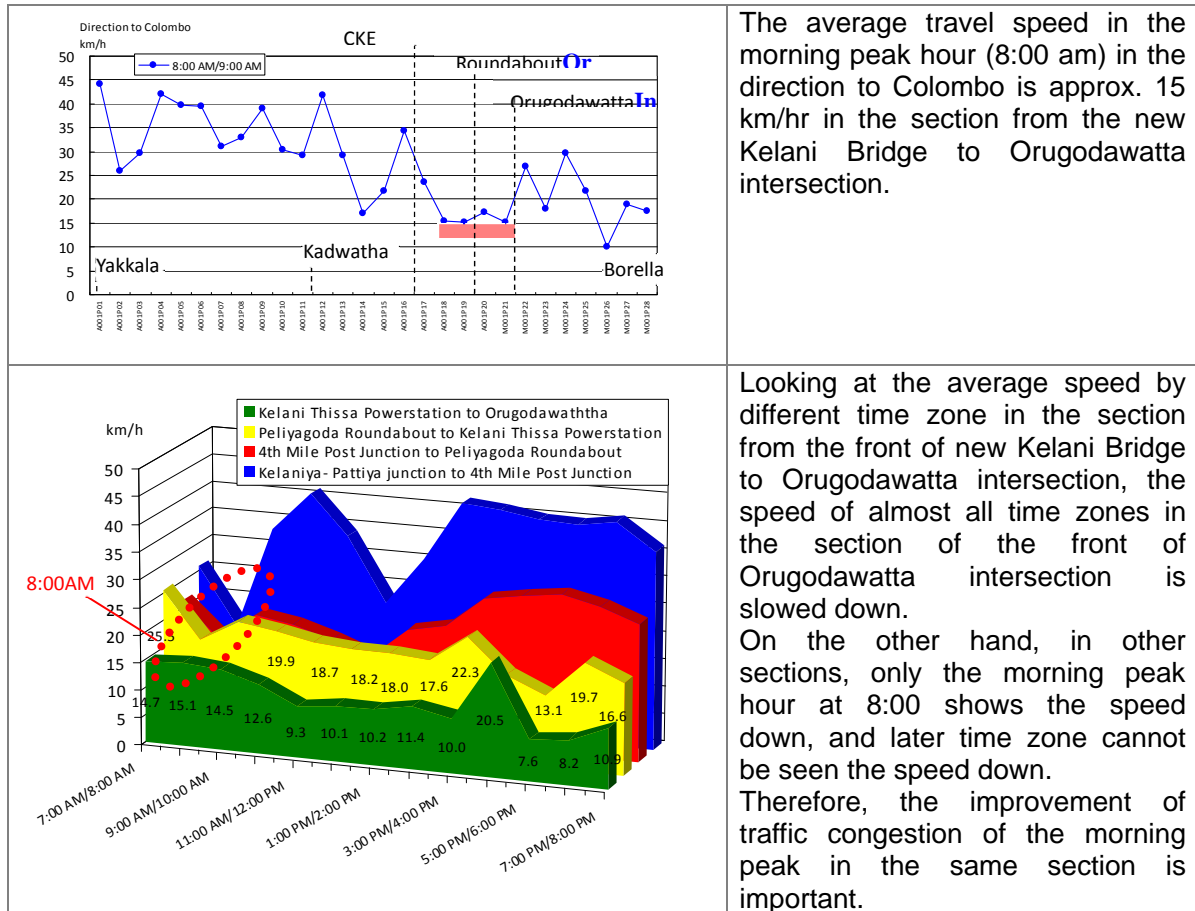
**Figure 10.2.3 Current Traffic Condition of each Intersection (PCU/15minutes, by vehicle category)**

As the indicator for validation of simulated traffic condition compared by the observed traffic condition, the current average travel speed of vehicle is measured, which are passing through from Kandy road to the Baseline Road. Figure 10.2.4 and 10.2.5 show the result of travel speed survey links and results



Source: JICA Survey Team (2013), March and April, 2013

**Figure 10.2.4 Result of Travel Speed Survey  
(8:00 am – 9:00 am towards City of Colombo)**



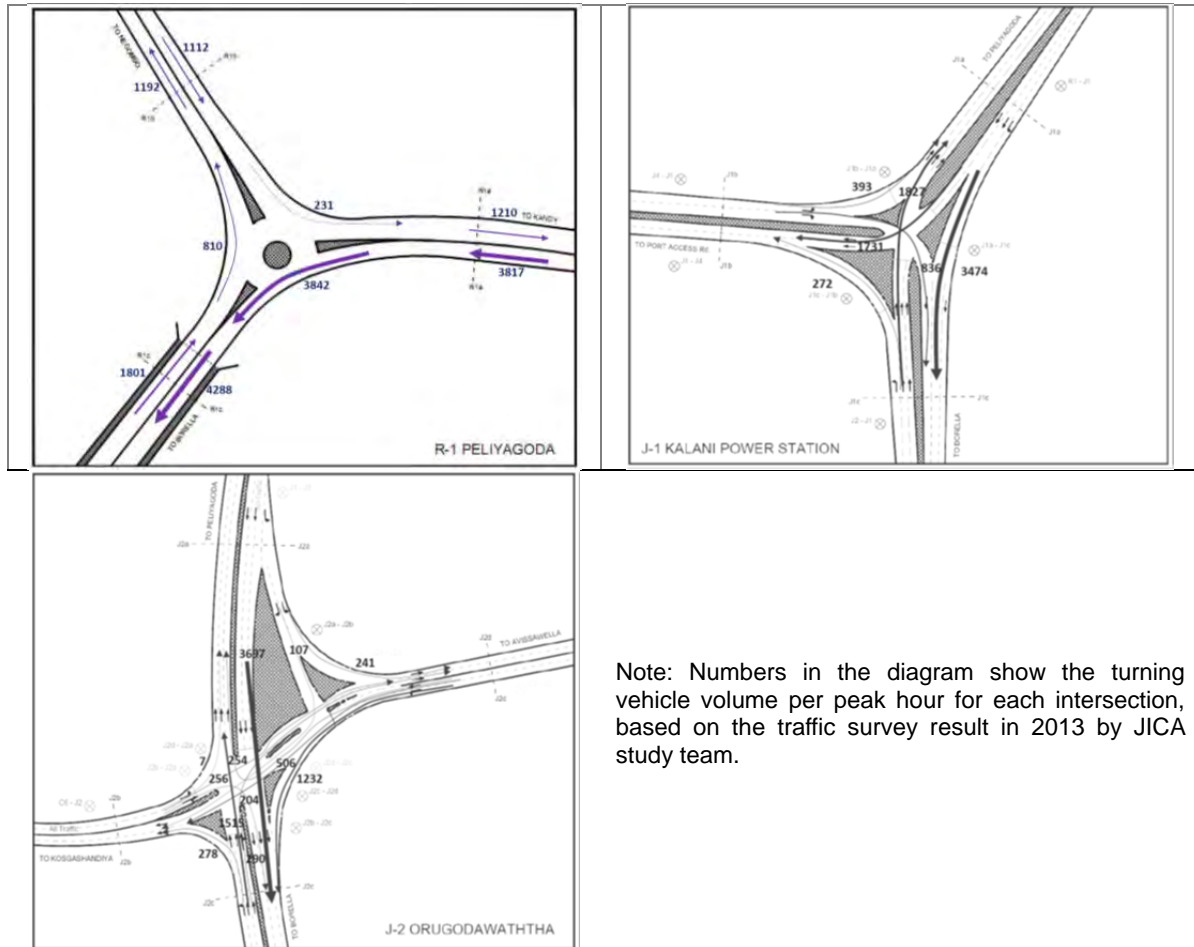
Source: JICA Survey Team (2013), March and April, 2013

**Figure 10.2.5 Current Travel Speed Condition around the Project Road**

The vehicle types for the simulation consist of i) motor cycle, ii) 3-wheeler, iii) car, iv) bus, v) truck and vi) trailer. This simulator has the 3D model and vehicle characteristics, such as body size and engine power etc., of 3-wheeler and bus developed by the India's products. Therefore, the Study team used this 3D model and adjusted the driving behaviour and other parameters in accordance with the Sri Lankan situation based on the site survey done by the traffic engineering specialists of micro-scopic traffic simulation.

In order to conduct the simulation, the input traffic volume data for simulation for three hours in the morning peak (6:00 am to 9:00 am) were estimated with every 15 minutes at each intersection, based on the same method of traffic demand forecast mentioned in 3.2.1 to 3.3.3.

For the reference of current traffic condition, the Figure 10.2.6 shows the hourly peak traffic turning volume for each intersection.



Note: Numbers in the diagram show the turning vehicle volume per peak hour for each intersection, based on the traffic survey result in 2013 by JICA study team.

Source: JICA Survey Team (2013), March 2013

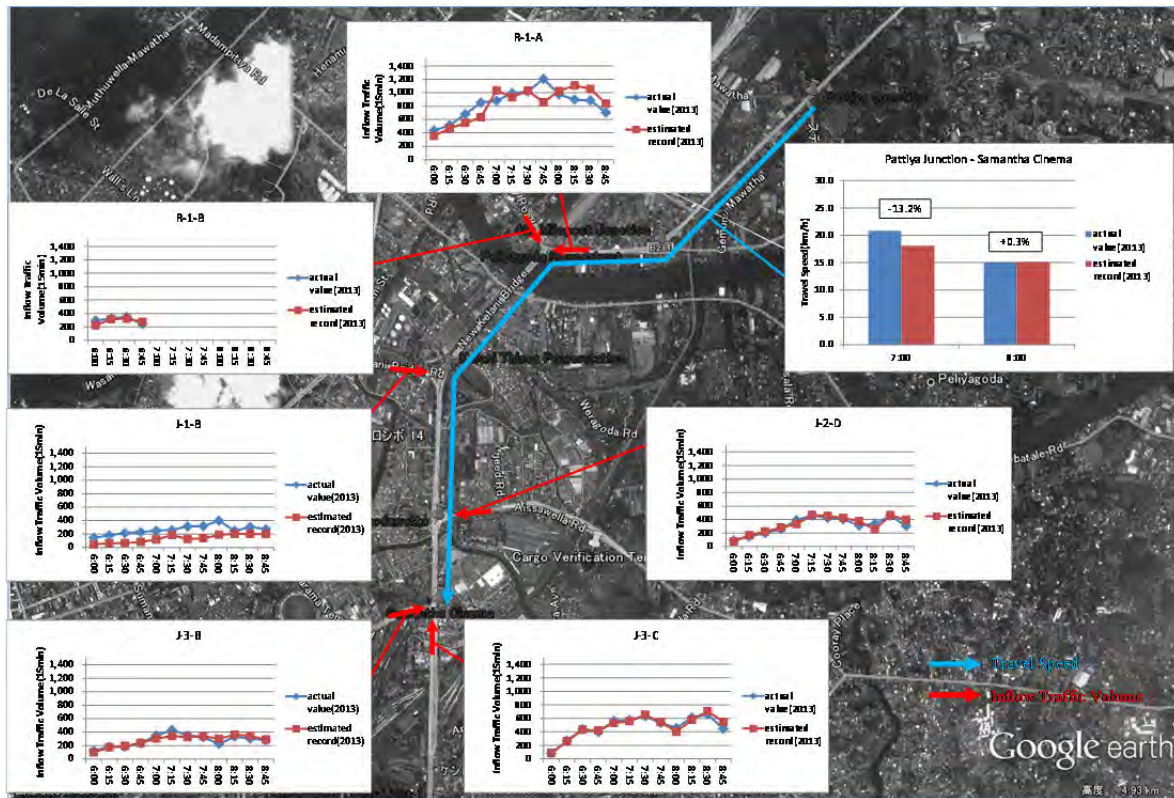
**Figure 10.2.6 Peak Hour Turning Volume at each Intersection**

### 10.2.2 Validation on Current Traffic Situation

Based on the above preparation for simulation, the Study team examined the validation of traffic model with comparing observed traffic volume and simulated traffic volume.

Traffic volume and traffic signal phasing which were acquired from the traffic survey were inputted into the simulator. The observed traffic volume and simulation volume was compared, using the traffic volume and average speed for three hours from 6:00 am to 9:00 am in every 15 minutes (Kandy Road (A01) - Kelani Bridge - Base line Road - Orugodawatta Intersection). The Figure 10.2.7 shows the results of both traffic volume and travel time.





Source: JICA Survey Team

**Figure 10.2.7 Comparison of Simulated vs. Observed Traffic Volume and Travel Speed for Traffic Model Validation**

Based on the observed traffic volume and simulation volume at total 156 points, which consist of 13 points at 4 intersections for 12 observed periods (for each 15 minutes) for each vehicle type (6 vehicle type: motor cycle, 3-wheeler, car, truck, trailer and bus), 85% of the total target points are less than 5.0 of GEH Static<sup>5</sup>.

Considering that the input data for traffic volume was made by the different traffic survey date, the developed traffic model was assessed to be enough accuracy for forecasting future traffic condition evaluated by traffic engineering points of view.

### 10.2.3 Future Traffic Condition simulated by Micro-scopic Traffic Simulator

The future traffic volumes for inputting into the micro-scopic traffic simulator developed with the traffic model were estimated with the same procedure as described in 10.2.1. After inputting in the simulator, the future traffic conditions in following cases were simulated.

There are four cases in the table below in order to estimate project benefits.

<sup>5</sup> The Highways Agency's Design Manual for Roads and Bridges (DMRB) advises that the match to traffic model shall be considered that more than 85% of traffic volume points in target network shows less than 5.0 of GEH Static.

**Table 10.2.1 Simulation Cases**

Year	With/Without Project	Note
2020	With Project case	Project section is developed
	Without Project case	Project section is not developed, only CKE direct connection.
2035	With Project case	Project section is developed
	Without Project case	Project section is not developed, only CKE direct connection.

Source: JICA Survey Team

The simulation was made at 8:00 morning peak hour's traffic situations for both "with the project" and "without the project" cases. As the result of simulation in each case, the traffic condition to the city center at the peak hour (8:00 am) shows the following results.

**Table 10.2.2 Simulation Results for each Cases at 8:00 hour's Morning Peak in the Direction towards the City Center**

Year With/Without Project		Average Speed (km/h)			Travel Time from 4 <sup>th</sup> mile Post on A01 road to Orugodawatta Intersection (min.), (approx. 2.0 km)
		New Kelani Bridge (Current Bridge)	Project Section [Elevated]	Baseline Road	
Present year of 2013		18.0	N/A	13.6	7.7
2020	With	45.5	42.4	21.3	3.5
	Without	9.4	N/A	5.2	19.1
2035	With	45.5	16.9	17.8	4.1
	Without	3.5	N/A	8.9	44.6

Source: JICA Survey Team

The future traffic conditions around the new Kelani Bridge (C-1) in the year of 2020 are simulated in the both case of "with the project" and "without the project" and examined by not only numerical indicators such as average travel speed and traffic volume but also watch the vehicle movements in the network and the intersection with 3D animation. The results of this simulation are summarised as follows;

In the case of "without the project" in year of 2020, the traffic condition which merges the flow from the CKE and interflow from A01 road is over capacity around the new Kelani Bridge (existing bridge). This causes the traffic congestion at R-1 and the intersection at J-1 is






Source: JICA Survey Team

**Figure 10.2.8 Simulation Results in 2020, Without Case at Kelani Bridge**

also over capacity. Especially the future traffic management at two small roundabouts near R-1 may cause serious traffic congestion to North

bound due to limited traffic capacities.

In the case of “with the project” in the year of 2020, because there are options to use both existing road and the Project road and reduce the frictions at intersections, the traffic becomes smoothly distributed to Project road and the existing bridge. Therefore, the traffic congestion is not seen at the same point. The figure below shows the comparison of simulated traffic conditions between “without” project and “with” project. Both are simulation results after inputted same number of traffic volume in the whole of network in the peak hour.

“Without” Project	“With” Project
<p data-bbox="331 674 651 703">New Kelani Bridge, CKE, A01</p> 	<p data-bbox="836 674 1362 703">New Kelani Bridge, CKE, A01 and Project Bridge</p> 
<p data-bbox="411 1032 571 1061">Baseline Road</p> 	<p data-bbox="943 1032 1257 1061">Baseline Road, Project Road</p> 
<p data-bbox="316 1384 667 1413">Baseline Road, Orugodawatta I/S</p> 	<p data-bbox="826 1384 1369 1413">Baseline Road, Orugodawatta I/S, Project Road I/C</p> 

Source: JICA Survey Team

**Figure 10.2.9 Comparison of Simulated Traffic Condition in 2020**

At Orugodawatta intersection, after the improvement of lane management and signal phasing control, serious traffic congestion does not occur compared with without project case since the capacity of traffic volume is secured by the improvement. Note that the simulator advises

to require the proper traffic signal phasing control actuated by dynamic traffic volume on the Baseline Road and merging traffic volume from off-ramp of elevated road.

The project road also eases the traffic congestion at Japan Friendship Bridge and major roads inside CMC because of shifting from Negombo road of A03 to CKE.

The simulation results for the year 2035 seem to manage the flow of future traffic volume by optimized dynamic traffic signal control at Orugodawatta intersection, however, it might be advised as further treatment to provide separated road network without direct connection to the Baseline Road. Once the extension of urban expressway (elevated road) for south bound is realised in the future, the current plan of intersection improvement is enough to manage the traffic.

#### **10.2.4 Findings**

The developed micro-scopic traffic simulation model in this Study can help to understand the difference on traffic condition in both “with” and “without” the Project roads cases by checking the simulated vehicle level (Micro level) movements.

Also in terms of traffic condition around the Project area, the developed simulator can evaluate the impacts and changes by changing the condition of traffic volume, traffic/lane management and traffic signal phasing.

As mentioned in 10.2.3, the Project road makes significant improvements for easing of the current traffic congestion around the new Kelani Bridge simulated by the Micro-scopic traffic simulator.

### **10.3 Estimation of Project Benefits**

#### **10.3.1 Methodology for Estimation of Benefits**

While “With Project” means implementation of the proposed project, “Without Project” stands for the situation without such an investment. The economic benefits to be achieved by implementation of the project are defined as the difference of vehicle operation costs and passenger travel time costs.

The following quantified benefits are expected under the Project.

- Savings of vehicle operating costs (VOC)
- Savings of traveler’s time costs (TTC)  
(Savings of passenger travel time and savings in the opportunity cost of capital caused by the delayed freight by trucks)

### 10.3.2 Items for Project Benefits

Vehicle operation costs (VOC): VOC by vehicle types was estimated by updating the value based on the “Assessing Public Investment in the Transport Sector 2010” by Ministry of Finance and Planning, using the consumer price index (CPI). The VOC includes maintenance cost, tyre cost, fuel and oil cost, the depreciation cost, crew costs and overhead cost.

**Table 10.3.1 Vehicle Operation Cost (VOC)**

Unit: Rs./Vehicle•km (2013 Economic Prices)

Speed (km/hour)	Motor Cycle	3W	Car+Van	Medium Bus + Large Bus	Medium 2-Axle Lorry + Large 2-Axle Lorry	Large 3-Axle Lorry
0-10	9.28	24.32	36.56	75.89	65.03	94.38
10-20	7.81	18.96	28.68	53.81	46.54	71.31
20-30	7.13	16.18	24.72	42.28	36.93	59.31
30-40	6.86	14.95	23.01	37.14	32.71	54.03
40-50	6.76	14.30	22.19	34.38	30.49	51.29
50-60	6.82	14.07	21.90	32.82	29.31	49.86
60-70	6.90	13.93	21.77	31.99	28.79	49.30
70-80	6.98	13.86	21.79	31.67	28.74	49.40
80-90	7.05	13.85	21.91	31.80	29.13	50.10
90-100	7.14	13.86	22.11	32.29	29.93	

Source: Based on “Assessing Public Investment in the Transport Sector 2001” by Ministry of Finance and Planning, 2013 economic price was estimated.

Traveler’s time cost (TTC): TTC was estimated by updating the value of working time of passenger based on the “Urban Transport Development of the Colombo Metropolitan Region, 2006” of JICA report, using the CPI, and converted to the time value by vehicle type by multiplying by vehicle occupancy rate and the rate of work trips. In terms of the vehicle occupancy, the driver of 3-wheelers and bus is not counted since their time values are already included in VOC. The unit time value is assumed to increase in accordance with the growth of per capita Gross Domestic Products (GDP). Therefore, the GDP growth rate until 2017 was referred to the forecast by IMF and Central Bank of Sri Lanka (AAGR = 6.5%), and the forecast after 2018 was set up by the survey team (AAGR = 5.5 % from 2017 to 2020 and AAGR = 4.0% from 2020 to 2035).

Freight time cost was estimated by updating the average value of freight truck per ton based on the “Outer Circular Highway to the City of Colombo, 2000” of JICA report, using the CPI. The short-term interest value<sup>6</sup> of the freight is considered as the opportunity cost to invest for

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<sup>6</sup> By shortening the transport time of the freight, the freight will be treated in the market as early as possible, and the revenue can be used for new investment. It is general way of estimation based on the interest cost of freight. (Land, Infrastructure and Transportation Ministry Japan, 2009)

the freight. Based on this value, the time value of freight was estimated, assuming annual economic activity hours of 2,500 hours<sup>7</sup>.

**Table 10.3.2 Time Value by Vehicle Type**

(2013 Economic Prices)

Type of Vehicle	Motorbike	3-Wheeler	Car	Bus
Value of Working Time of Passengers (Rs) <sup>1</sup>	372.9	108.0	372.9	108.0
Ratio of Work Trip <sup>2</sup>	0.50	0.17	0.30	0.06
Vehicle Occupancy <sup>3</sup>	1.20	1.10	2.58	38.80
Vehicle VOT (Rs/hr)	223.8	20.2	288.7	251.4

Source: 1. Based on the "Urban Transport Development of the Colombo Metropolitan Region, 2006". 2013 economic price was estimated.  
2. Refer to "Urban Transport Development of the Colombo Metropolitan Region, 2006"  
3. Refer to RDA 2004.

**Table 10.3.3 Time Value of Freight**

(2013 Economic Prices)

Vehicle type	Truck (10 ton)	Trailer (20 ton)
Freight Value (Rs/vehicle) <sup>1</sup>	4,856,870	9,713,740
Interest Value 10% (Rs/vehicle) <sup>2</sup>	485,687	971,374
Time Value of Freight (Rs/vehicle · hr)	194	389

Source: 1. Based on the "study on the outer circular highway of the City of Colombo, 2000", 2013 economic price was estimated.  
2. Refer to "Economic and Social Statistics of Sri Lanka 2013"

### 10.3.3 Results of Project Benefits

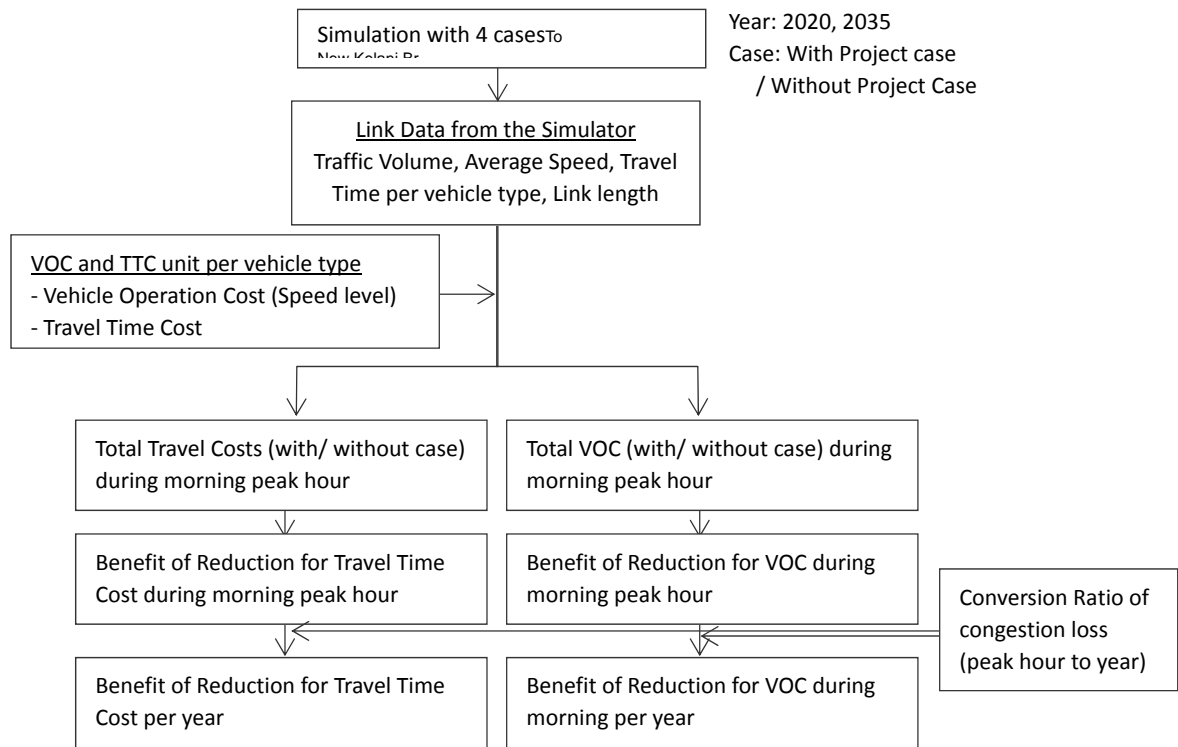
By using a micro-scopic traffic simulation, the project benefits are estimated with the following procedure. The simulator can record the both inflow time and out-flow time for each identified link by passing each vehicle. Therefore, vehicle operation cost and travel time cost for each vehicle can be calculate and accumulated in total costs for each simulation case.

- The VOC and traveller's time cost for the 8:00 morning peak hour's vehicles was calculated for both "with project case" and "without project case" from the records of traffic simulation.
- The project benefits are difference of these costs, though the benefit is estimated only in the morning peak hour. Therefore, the annual benefits are estimated, using the conversion factors from the peak hour benefit<sup>8</sup>.

<sup>7</sup> "Assessing Public Investment in the Transport Sector 2001" by Ministry of Finance and Planning

<sup>8</sup> The daily benefit is applied to multiply of 12 times to simulated value of benefits at the morning peak hour, which was assumed with the reference of calculated ratio of 8.49 which is congested loss at 8:00-9:00 am per 12 hours congested loss between 8:00 to 20:00 estimated by the vehicle speed survey in 2013. The expansion factor to annual benefits is used as working days of 260 days.

- The estimation of benefits is conducted in the target year of 2020 for the micro-scopic traffic simulation and planned target year of 2035.



Source: JICA Survey Team

**Figure 10.3.1 Estimation Method of Project Benefits**

Based on the above procedure, estimated project benefits are shown in Table 10.3.4.

**Table 10.3.4 Project Benefits**

Unit: Rs million /year (2013 Economic Price)

Year	Benefits	Reduction of Travel Time Costs (TTC) (Rs./year)	Reduction of Vehicle Operation Costs (VOC) (Rs./year)	Benefits in total (TTC+VOC) (Rs./year)
2020		2,879.20	982.09	3,861.29
2035		12,965.45	723.32	13,688.78

Source: JICA Survey Team

## 11. ECONOMIC EVALUATION

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### 11.1 Purpose and Methodology of Economic Evaluation

The main purpose of economic evaluation for the project is to show the effects of the implementation of the project from the viewpoint of the national economy and evaluate the economic validity of project implementation. Economic evaluation estimates the degree to which the New Kelani Bridge is a project that benefits the national economy by analyzing the consumption of the resources that stimulate the national economy.

Economic internal rate of return (EIRR), net present value (NPV), and benefit-cost ratio (B/C ratio) will be used to evaluate the economic evaluation results as evaluation indicators. The economic evaluation uses discounted cash flow analysis for cost-benefit analysis. This method compares economic benefits and economic costs.

### 11.2 Basic Assumption

The following basic assumptions are set up for the economic evaluation

- Project life: 21 years after the start of construction(until the target year of the long-term plan in CoMTrans)
- Implementation schedule: Construction period from 2017 to 2020. Begin operation from 2020.
- Residual value: An undepreciated cost will be earmarked as a negative investment cost in the last year of evaluation 2035.
- Opportunity cost (discount rate): 12%
- Inflation: no consideration in economic evaluation
- Exchange rate: USD1=Rs.99.2, USD1=Rs.132.4, Rs.1 =JPY0.749

### 11.3 Costs and Benefits

#### 11.3.1 Economic Price

For the economic evaluation, financial costs are converted to economic costs by deducting the tax and subsidies portion, and applying a standard conversion factor (SCF) to the portion of non-trade goods. Based on data from the Monthly Bulletin of Statistics Online by United

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Nations and Economic and Social Statistics of Sri Lanka 2013, SCF was estimated 0.972 which was average value from 2008 to 2011, and applied to the local portion of costs in order to adjust the price.

**Table 11.3.1 Standard Conversion Factor**

Unit: Rs million

	2008	2009	2010	2011
1 Total import (CIF)	1,511,528	1,154,630	1,527,667	2,205,098
2 Total export (FOB)	881,481	814,067	939,189	1,132,458
3 Import customs	63,844	79,560	64,163	75,974
1+2	2,393,010	1,968,697	2,466,856	3,337,555
1+2+3	2,456,854	2,048,257	2,531,019	3,413,529
SCF (1+2/1+2+3)	0.974	0.961	0.975	0.978

Source: United Nations "Monthly Bulletin of Statistics Online",  
Economic and Social Statistics of Sri Lanka (Central Bank of Sri Lanka, 2013)

### 11.3.2 Economic Costs (Construction costs and operation and maintenance costs)

The construction costs of the project and the operation and maintenance costs are shown as follow.

**Table 11.3.2 Construction Costs of the Project**

(2013 Economic Price)

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Source: JICA Survey Team

**Table 11.3.3 Operation and Maintenance Cost**

Unit: Rs. Million

Items	Interval	Financial Cost	Economic Cost
Routine Maintenance	Every year	1.37	1.34
Highways			
Periodic Inspection	Every year	0.16	0.15
Pavement	10	383.39	372.65
Steel Bridge			
Periodic Inspection	5	0.16	0.15
Painting	20	43.60	42.38
Expansion Joint	20	267.86	260.36
PC Bridge			
Periodic Inspection	5	0.16	0.15
Expansion Joint	20	236.71	230.09
Bearing	40	380.88	370.22
Extradosed Bridge			
Periodic Inspection	5	0.16	0.15
Expansion Joint	20	86.09	85.12
Bearing	40	27.60	26.83
PC Cable	75	1,114.88	1,090.89

Source: JICA Survey Team

### 11.3.3 Economic Benefits

The estimation of project benefits is described in 10.3.3.

## 11.4 Cost Benefit Analysis

Based on the above estimated economic costs and benefits, the cost benefit analysis is conducted. The calculation results are summarized as follow.

EIRR shows 13.6% which is over the opportunity cost 12% and NPV is positive. It means that the project implementation is assessed the economic validity from the view point of national economy.

**Table 11.4.1 Summary of Cost Benefit Analysis**

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Source: JICA Survey Team

**Table 11.4.2 Cash Flow of Cost Benefit Analysis**

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Source: JICA Survey Team

## 11.5 Sensitivity Analysis

Sensitive analysis for a 10% increase in project cost as well as a 10% decrease in estimated benefits is implemented.

**Table 11.5.1 Results of Sensitive Analysis**

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Source: JICA Survey Team

## **11.6 Operation and Effect Indicators**

### **11.6.1 General**

JICA introduced operation and effect indicators from 2000 as performance indicators to enable project monitoring and evaluation through comparison with data that has been consistently measured in previous pre- and post-stages of a project. Operation and effect indicators are comparable to outcome indicators used by the World Bank. In the log frame for the ODA loan project, they are recorded as indicators for “Project purpose”.

Operation and effect indicators are used to evaluate the performance of facilities, the effectiveness of the functions of the Project, and the efficiency of operation and maintenance activities after the Project implementation.

### **11.6.2 Operation and Effect Indicators**

The definitions of operation and effect indicators are as follows

- 1) Operation indicator: An indicator to quantitatively measure the operational status of a project.
- 2) Effect indicator: An indicator to quantitatively measure the effects generated by a project.

In order to evaluate the achievements of the Project quantitatively, the benchmarks of operation and effect indicators are set up based on the current available data. The target sections for the observed traffic volume (baseline) are selected as the following three main lines. The year of monitoring and evaluation for the Project is 2 years after the operation of the Project in 2022.

- A. New Kelani Bridge (Peliyagoda Roundabout JCT – Kelani Thissa Powerstation)
- B. Project Section (Elevated)
- C. Base Line (Kelani Thissa Powerstation – Orugodawatta I/S)



Source: JICA Survey Team

**Figure 11.6.1 Target Sections for the Observed Traffic Volume**

**Table 11.6.1 Operation and Effect Indicators (Proposal)**

Indicator		Section	Current (2013)	2 years after operation (2022)
Operation	Traffic Volume (vehicle/day)	Cross-section at New Kelani Bridge (in total) 2013: New Kelani Bridge Only 2022: New Kelani Bridge and Project Road	92,700	126,000 (67,900+58,100)
	Traffic Volume (vehicle/day)	Cross-section at New Kelani Bridge (in total) 2013: New Kelani Bridge Only 2022: New Kelani Bridge and Project Road	92,700	126,000 (67,900+58,100)
Effect	Traveler's Time at morning peak hour at 8:00 am (minutes)	From Peliyagoda Roundabout JCT – Orugodawatta I/S (approx. 1.3km) *	5.8	2.0
	Average speed at morning peak hour at 8:00am (km/hour)	From Peliyagoda Roundabout JCT – Orugodawatta I/S (approx. 1.3km) **	18.0	New Kelani Bridge 40.0
		Project Road 40.0		

\*: While the route of "Current (2013)" runs on New Kelani Bridge and Baseline road, the route of "2 years after operation (2022)" runs through the CKE direct connection, the Project roads and off-ramp to Baseline.

Source: JICA Survey Team

## **12. ENVIRONMENTAL IMPACT ASSESSMENT**

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### **12.1 Generals**

In general, the purposes of environmental impact assessment (EIA) are to ensure that development options under consideration are environmentally sound and sustainable and that environmental consequences are recognized and taken into account early in the project design.

The EIA process is conducted to help public officials make decisions that are based on an understanding of environmental consequences, and take actions that protect, restore and enhance the environment.

### **12.2 Summary of EIA**

#### **12.2.1 General**

The EIA report was prepared on the basis of proposed engineering works, field study, stakeholder consultation, primary and secondary data collection, screening of all baseline environmental items, existing environmental quality measurement, and review of the relevant EIA and IEE report in Sri Lanka. The study was taken up during February to June, 2013.

The EIA covers the general environmental profile of the Project area including physical environment, biological environment and socio-cultural environment. The existing environment quality measurement was carried out on the water (surface and ground), air quality, noise, vibration, flora & fauna. The EIA includes an overview of the potential environmental impacts and their assessment, and propose necessary mitigation measures and an environmental management plan for each of the identified impacts. And more, two times of stakeholder meetings were conducted as part of the EIA.

The EIA report has been prepared based on the Terms of Reference (ToR) issued by the Central Environmental Authority (CEA), 05.03, 2013, while conforming to the JICA Guidelines for Environmental and Social Considerations, April.2010.

The report will also enable the project proponent (the Road Development Authority (RDA) to obtain the approval from CEA as well as from JICA for the execution of the project.

The general methodology adopted in the EIA study is as follows;

- Analysis and understanding of the ToR issued by CEA
- Identification of potential impacts
- Survey and collection of available information
- Identifying the data to be collected and procedures to be adopted
- Conducting physical, biological and socio-cultural field surveys.
- Conducting water (surface and ground) quality, air quality, noise level, vibration level measurement and flora & fauna field survey
- Analysis of air quality, noise and vibration were carried out
- Identification of significant impacts
- Comparison of Alternatives
- Recommending mitigation measures
- Formulating an environmental monitoring plan
- Preparing recommendations on environmental feasibility of the project

The EIA report was submitted to RDA on August 26, 2013 and It was submitted to the CEA immediately.

### **12.2.2 Policy, Legal and Administrative Framework**

According to the provisions of the National Environmental Act (NEA) regulations, the construction of national and provincial highways involving a length exceeding 10 km is listed as a prescribed project which requires an Environmental Assessment (EA), but construction of a new bridge or renovation or expansion of an existing bridge has not been listed as a prescribed project. At the same time, in accordance with NEA, the project has been listed as the category of “Involuntary resettlement exceeding all families, other than resettlement effected under emergency situations”.

The RDA is the implementing agency of the project while the Environmental and Social Development Division (ESD) under the RDA and CEA are the supervising agencies for environmental protection.

### 12.2.3 Existing Gaps of Relevant Regulations of Sri Lanka and JICA Guidelines (EIA)

The main difference between NEA and JICA guidelines is that under the NEA bridge construction projects do not fall within the category of “Prescribed Projects” where as in JICA guidelines it will be either category A or B project. Also JICA guidelines stipulate that public consultations need to be carried out from the beginning of the project but as per the NEA the EIA report is to be disclosed for public for a 30 day period for comments. Other differences between JICA guidelines and NEA are listed below.

**Table 12.2.1 Existing Gaps of Sri Lanka Laws and JICA Guidelines**

Item	JICA Guideline	Sri Lanka	Gap
Environmental Items	The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, including air, water and soil. Waste generation, accidents, changes in water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts also need to be addressed. Social impacts, including migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children’s rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety.	[Socio-cultural environment] Existing house ,buildings, Socio economic status, Economic activity, Planned development activities, Infrastructure facilities, Cultural, historical and archeological, objects, Hospitals, schools, etc., Exiting environmental considerations area, etc.,	Designation of the item is different, the content is similar
		[Biological environment] Present ecological status, including sensitive habitats,	
		[Physical environment] Topography, geology, soil, climate and meteorology etc. Surface and groundwater, drainage, Water quality, Land use, Air quality and noise, Natural disasters,	



Screening	Taking into consideration the project outline, size, and location, JICA will conduct the categorization of four (4) according to the degree of environmental and social impacts. Category A project proponent shall submit an EIA report.	There is no procedure for categorization. Whether an EIA is required or not (if not, an IEE is required) is determined not by categories stipulated, but by the PAA according to Preliminary Information submitted by a project proponent.	There are differences in methodology, stepping on a similar process
Scoping	It is to determine how to study and scope of the assessment items of environmental and social considerations on that seems and scoping is an important key in the JICA guidelines, project implementing bodies to create a TOR.	Is performed so that on the basis of the preliminary information (BIQ) to project proponent submitted, PAA sets the TOR.	There are differences in methodology, but is the same procedure both.
Alternative study	In the JICA guidelines, study of alternatives are required  its contents are project course, potential impact, mitigatory measure, suitability to area & reliability, etc.  For alternative study, is asked also consider cases that do not implement the project.	No stated in the Government Laws However, alternative study is required in TOR of EA study by CEA.  Its contents are project course, potential impact, mitigatory measure & reliability etc.  The consideration of the case of without a project in alternatives study is not required.	There is a difference for alternative study  Regarding contents, almost similar.
Disclosure	JICA encourages project proponents to disclose accepted the EIA report on their project that 120 days before the signing of the L/A.  In case of Category A project, JICA discloses information on its website in Japanese, English, and/or local languages.	After the EIA report has been submitted to PAA, is to be disclosed 30 business days under the laws of Sri Lanka. The general in the form of a Public Inspection.  If PAA finds it necessary, a public hearing will be held after the period of Public inspection. Procurement of report copy is available, but requester need a cost burden.	There is a provision of information disclosure, but the methodology is different.
Stakeholders meeting	At the stage of scoping and draft EIA report, JICA guidelines require to hold Stakeholder meetings (SHM), in the case of category A project.	No stated in the Government Laws	There are differences between the provisions of stakeholder meeting.

Source; JICA Guidelines for environmental and Social Considerations, 2010  
The National Environmental Act, 1988 and related laws and regulations

#### **12.2.4 Baseline Environmental Condition**

From the natural environment viewpoint, fruit trees, shade tree and ornamental tree was confirmed in the project area, endemic and endangered species are not found. The status of the fauna is similar to the flora.

Air quality at the boundary with Port access road and Baseline Road is lower than the environmental standards of Sri Lanka, and the WHO guideline. Road vibration is allowable value of Sri Lanka. Road side noise level at the almost measure location has over 70 dB(A) (daytime), 60dB (A)(night time) that is the permissible noise level of Sri Lanka. At same time has over 70dB(A) (day, night time) by EHS general guidelines.

Regarding water quality, there is a location that exceeds the reference value of BOD, DO values have been prepared by the CEA of Sri Lanka, and turbidity is significantly higher than the guideline value of the WHO.

In the social environment, the number of structures to be relocated is 449, and 395 households, affected persons are 1743 (male 848, female 895) Among them, governmental building of the Atomic Energy Authority and Automobile Training Center would be affected, the Buddhist temple and the Hindu temple also would be affected.(Details are described in “13.2.5 Resettlement measure”)

#### **12.2.5 Alternative analysis**

The project is aimed at untying of traffic congestion around the New Kelani bridge as well as CKE scheduled to open in 2013 and the Urban highway of Colombo metropolitan. This proposed new road plan is including a new bridge to crossing the Kelani River.

Alternative route to conduct a comparative analysis for four (4) alternative route with the aim to minimize as much as possible the number of resettlement, in consequence Alternative-B was selected.

#### **12.2.6 Initial Environmental Examination**

##### **(1) Screening**

Screening is the first step to categorize the project and Activities based on degree of environmental impacts caused by the project.

The project was classified as “EIA required” by the Project Approval Agencies of Sri Lanka and “A” according to the JICA Environmental Guidelines, and thus EIA must be conducted.

## (2) Scoping

The aim of scoping is to find out possible ecological, environmental and social impacts caused by the implementation of the proposed project and determine Terms of Reference (ToR) for EIA.

The ToR for EIA presented based on the results of scoping made by CEA, and the scoping results which were performed by the project proponent in accordance with the JICA guidelines, is shown below.

### **EIA Report ToR by CEA**

#### 1. EIA Report Contents

##### Executive Summary

- (1) Introduction
- (2) Description of the Project and reasonable alternatives
- (3) Description of the existing environment
- (4) Anticipated environmental impacts of proposed projects
- (5) Proposed mitigatory measures
- (6) Cost-benefit Analysis
- (7) Monitoring program
- (8) Conclusion and Recommendation

##### Annexures

#### 2. Study area

The study area for the assessment shall include the following;

- i) Project site (area within the proposed Right of Way) and 100m either side of the project site
- ii) Any area beyond the above corridor, where there is potential for environmental impact due to the project

Assemble, evaluate and present available baseline data on the relevant environmental characteristic of the study area.

### 3. Study Items

#### (1) Physical Environment

- Topography, geology, soil, climate and meteorology
- Surface and ground water hydrology and drainage
- Water quality, sources of water pollution (if any)
- Existing land use
- Ambient air quality and noise
- Records on natural disasters occurred

#### (2) Biological Environment

- An assessment of the present ecological status including the presence of sensitive habitats and their importance

#### (3) Socio-cultural Environment

- Existing houses, commercial and governmental buildings within the direct impact area and the surroundings
- Socio Economic status of populations
- Principal economic activities
- Planned development activities
- Availability of infrastructure facilities
- Culturally, historically and archaeologically important objects/places
- Noise sensitive receptors such as hospitals, schools, etc.
- Existing environmental considerations, problems or issues prevailing in the area

### 4. Anticipated Environmental Impact of Proposed Project

#### (1) Socio economic impacts

- Number of settlements and other institutions to be affected
- Impacts of relocation
- Impact on livelihood and economic activities
- Impact due to disruption of existing infrastructure facilities

- Possible nuisance to neighborhoods during construction and operation
- Health and safety impacts
- Any other socio economic issues

(2) Hydrological impacts

- Impacts on natural flow / pattern of the Kelani river
- Impacts on the drainage pattern of the area
- Impacts on flood protection schemes
- Availability of infrastructure facilities
- Impacts during floods due to loss of retention / detention area and blockage of drainage pathways
- Impacts on the natural drainage system

(3) Air quality, noise and vibration impacts during construction and operation

(4) Traffic congestion

(5) Impact on aquatic / terrestrial habitats

**Scoping results based on JICA Guidelines**

**Table 12.2.2 Scoping results based on JICA Guidelines**

	No	Impacts	Rating		Brief Description
			Before/ During constructi on	During operatio n	
Pollution	1	Air pollution	B-	C/B+	[During construction] Emission of air pollutant from construction equipment and traffic congestion [During operation] The project may give positive impacts since driving speed will increase and exhaust gas from vehicles will be diffused at 10m above the ground. However on the other hand, increase in exhaust gas is concentrated by the road to be a two-layer structure
	2	Water pollution	C-	C-	[During construction] The drainage of the sewage from the construction base is possible [during operation] Possibility of outflow of oil and dust from the road surface when it rains
	3	Waste	C-	D	[During construction] Waste concrete, soil and cut trees may be generated by clearance work.
	4	Soil Contamination	D	D	This project does not have significant negative impacts on this item because earthwork is limited in case of bridge.
	5	Noise and Vibration	B-	C/B+	[During construction] During construction, noise from the construction area and operation of construction machine will be generated. [During operation] The project may have positive impacts since driving speed will increase and noise decay distance is extended. However on the other hand, increase in noise and/or vibration is concerned by the road to be a two-layer structure.
	6	Ground Subsidence	D	D	This project does not have negative impacts on this item basically
	7	Offensive odor	D	D	This project does not have negative impacts on this item basically
	8	Bottom sediment	D	D	This project does not have negative impacts on this item basically
Natural Environment	9	Protective area	D	D	A national park and the sanctuary do not exist around this project
	10	Biodiversity	B-	D	[During construction] Trees along the existing road may be cut down by the project
	11	Water form	D	D	This project does not have negative impacts on this item basically
	12	Topography and Geographical features	D	D	This project does not have negative impacts on this item basically
Social Environment	13	Resettlement	A-	D	[Before construction] There are residential area in the construction area, so loss of approximately 500 houses and small stores
	14	Poverty group	C-	D	[Before construction] The poor may be included in inhabitants targeted for a relocation
	15	Indigenous and ethnic people	D	D	This project does not have negative impacts on this item basically
	16	Local economy such as employment and livelihood, etc.	A-/B+	C+	[During construction] Negative impact on the livelihood due to the relocation and positive impact due to the increase of local employment opportunities [During operation] Local economy can be activated

	17	Land use and utilization of local resources	D	C-/C+	[During operation] Conversion of the land use by the land expropriation, and shifting of the neighboring land use by the road service are expected
	18	Water usage	C-	D	[During construction] For an flyover and bridge construction, the some impact on groundwater is possible
	19	Existing social infrastructures and services	C-	C-/C+	[During construction] Possibility that due to the construction work, impact on existing infrastructure usage [During operation] Although lines such as power, gas, water and other cables area running underground along the road, such facilities will be replaced in an appropriate way. However on the other hand, approach to existing facilities and services may be improved by improvement of the road traffic
	20	Social institutions and local decision-making institutions	C-	C-	[During construction/During operation] This project may have negative impact, such as the regional division
	21	Misdistribution of benefits and damage	C-	C-/C+	[During construction/During operation] This project may be bring about a change of land values around the road
	22	Local conflict of interests	C-	C-/C+	[During construction/During operation] This project may be bring about a change of land values around the road
	23	Cultural heritage	D	D	The cultural assets may do not located in the project outskirts
	24	Landscape	B-	C-/C+	[During construction/ During operation] Some impact may be expected because large-scale bridge and flyover are planned
	25	Gender	D	D	This project does not have negative impacts on this item basically
	26	Children's Rights	D	D	This project does not have negative impacts on this item basically
	27	Infectious diseases such as HIV/AIDS	D	D	This project does not have negative impacts on this item basically
	28	Labor environment (including work safety)	B-	D	[During construction] During construction, consideration is necessary for the labor environment and work safety
Other	29	Accidents (including traffic accidents)	B-	B-	[During construction] Construction works may cause additional congestion during construction due to reduction of traffic capacity [During operation] Possibility that the increase in traffic speed and the volume induced traffic accidents"
	30	Global Warming and Climate change*1	C-	C+	[During construction] Possibility that the impact by congestion due to construction and construction equipment [During operation] The project may have positive impacts since driving speed will increase at the target intersections. However, the degree of the affect is unclear.

Rating A+/-: Significant positive/negative impact is expected

B+/-: Positive/negative impact is expected to some extent

C+/-: Extent of positive/negative impact is unknown (A future examination is needed, and the impact could be clarified as the study progresses)

D: No impact is expected

\*1: For this item, have been compared with project and without project

Source: JICA Survey Team

## 12.2.7 Survey & Estimation Methodology

The tables below shows the Survey methodology and the Estimation methodology.

**Table 12.2.3 Survey Methodology**

Item	Physical Site Survey Methodology	Forecast Site Survey Area/Point
<b>Socio economic Environment</b>		
Land acquisition and resettlement	<ul style="list-style-type: none"> <li>In principle, refer to the survey results regarding RAP</li> </ul>	<ul style="list-style-type: none"> <li>In principle, refer to the survey results regarding RAP</li> </ul>
Livelihood and economic activities	<ul style="list-style-type: none"> <li>In principle, refer to the survey results regarding RAP</li> </ul>	<ul style="list-style-type: none"> <li>In principle, refer to the survey results regarding RAP</li> </ul>
Disruption of Existing Infrastructure facilities (Utilities)	<ul style="list-style-type: none"> <li>List all infrastructure through interview with local authority and site survey</li> </ul>	<ul style="list-style-type: none"> <li>Within the project site</li> </ul>
Nuisance to neighborhood	<ul style="list-style-type: none"> <li>Interview with local people, local authority and site survey</li> </ul>	<ul style="list-style-type: none"> <li>Within the project site and vicinity</li> </ul>
Violation Children's rights	<ul style="list-style-type: none"> <li>Interview with relevant governmental section and anecdotal survey</li> </ul>	<ul style="list-style-type: none"> <li>Not define the area</li> </ul>
Spreading of HIV/AIDs	<ul style="list-style-type: none"> <li>Interview with local authority and relevant governmental section</li> </ul>	<ul style="list-style-type: none"> <li>Not define the area</li> </ul>
Impacts from construction waste and other waste disposal	<ul style="list-style-type: none"> <li>Interview with local authority and anecdotal survey</li> </ul>	<ul style="list-style-type: none"> <li>Not define the area</li> </ul>
Impacts extraction and transportation of materials	<ul style="list-style-type: none"> <li>Interview with local authority and anecdotal survey</li> </ul>	<ul style="list-style-type: none"> <li>Not define the area</li> </ul>
Health and safety impairment	<ul style="list-style-type: none"> <li>Interview with relevant governmental section</li> </ul>	<ul style="list-style-type: none"> <li>Not define the area</li> </ul>
Archaeological sites	<ul style="list-style-type: none"> <li>Literature survey and interview survey with specialist and relevant authority</li> <li>Assessment by Department of Archaeology</li> </ul>	<ul style="list-style-type: none"> <li>Within the project site</li> </ul>
Damage to existing New Kelani Bridge	<ul style="list-style-type: none"> <li>Interview with expert and relevant authority</li> </ul>	<ul style="list-style-type: none"> <li>Within the project site</li> </ul>
<b>Physical Environment</b>		
Existing landscape	<ul style="list-style-type: none"> <li>Taking picture from major viewpoints</li> </ul>	<ul style="list-style-type: none"> <li>Within the project site and vicinity</li> </ul>
<b>Hydrological Environment</b>		
River flow and canal flow	<ul style="list-style-type: none"> <li>Literature survey and interview with specialist and relevant authority</li> </ul>	<ul style="list-style-type: none"> <li>Within the project site and vicinity</li> </ul>
Local drainage pattern	<ul style="list-style-type: none"> <li>Literature survey and interview with specialist and relevant authority</li> </ul>	<ul style="list-style-type: none"> <li>Within the project site and vicinity</li> </ul>



Flood protection scheme	<ul style="list-style-type: none"> <li>Literature survey and interview with specialist and relevant authority</li> </ul>	<ul style="list-style-type: none"> <li>Within the project site and vicinity</li> </ul>
Flood propagation	<ul style="list-style-type: none"> <li>Literature survey and interview with specialist and relevant authority</li> </ul>	<ul style="list-style-type: none"> <li>Within the project site and vicinity</li> </ul>
<b>Physio-Chemical Environment</b>		
Water quality	<ul style="list-style-type: none"> <li>Collect existing measured data</li> <li>Measure BOD, SS, DO, Turibidiry, Total colifrm, pH, temperature (2 points, 2 times)</li> <li>Site survey and interview from professional person and inhabitants (Kelani water utilization)</li> </ul>	<ul style="list-style-type: none"> <li>Crossing point proposed New bridge (Upstream side 1 point, downstream site 1 point), 2 times</li> </ul>
Air quality	<ul style="list-style-type: none"> <li>Collect existing measured data</li> <li>Quantitave measurement of NO2, SO2, CO, CO2, SPM, Dust, PM10 (9 points and all together weather observation)</li> </ul>	<ul style="list-style-type: none"> <li>Sensitive are (ex.residential area, religious site, etc) along the Baseline and Port access road (5 points) <ul style="list-style-type: none"> <li>For judging project effectiveness (3 points)</li> </ul> </li> </ul>
Noise	<ul style="list-style-type: none"> <li>Collect existing measured data</li> <li>Measure traffic noise road side noise) and ambient noise (9 points, 4times/day and together weather observation)</li> </ul>	<ul style="list-style-type: none"> <li>Sensitive area (ex. residential area, religious site, etc) along the Baseline and Port access road (7 points) <ul style="list-style-type: none"> <li>For judging project effectiveness (3 points)</li> </ul> </li> </ul>
Vibration	<ul style="list-style-type: none"> <li>Collect existing measured data</li> <li>Measure road side vibration (6 points, 4times/day)</li> </ul>	<ul style="list-style-type: none"> <li>Sensitive area (ex. residential area, religious site,etc) along the Baseline and Port access road (6 points)</li> </ul>
Global Warming and Climate change	<ul style="list-style-type: none"> <li>Literature survey and interview with specialist and relevant authority</li> </ul>	<ul style="list-style-type: none"> <li>Not define the area</li> </ul>
Soil contamination	<ul style="list-style-type: none"> <li>Literature survey and interview with specialist and relevant authority</li> </ul>	<ul style="list-style-type: none"> <li>Within the project site and vicinity</li> </ul>
Ground subsidence	<ul style="list-style-type: none"> <li>Literature survey and interview with specialist and relevant authority</li> </ul>	<ul style="list-style-type: none"> <li>Within the project site and vicinity</li> </ul>
Bottom sediment	<ul style="list-style-type: none"> <li>Literature survey and interview with specialist and relevant authority</li> </ul>	<ul style="list-style-type: none"> <li>Within the project site and vicinity</li> </ul>
Traffic congestion	<ul style="list-style-type: none"> <li>Literature survey and interview with relevant authority and police station</li> </ul>	<ul style="list-style-type: none"> <li>Within the project site and vicinity</li> </ul>
<b>Terrestrial and Aquatic Ecology</b>		
Fauna & Flora, Biodiversity	<ul style="list-style-type: none"> <li>Literature survey and interview survey with specialist and inhabitants</li> <li>Site survey</li> </ul>	<ul style="list-style-type: none"> <li>Within the project site and vicinity</li> </ul>

Source: JICA Survey team

**Table 12.2.4 Estimation Methodology**

Item	Estimation Methodology	Criteria or aim
<b>Socio economic Environment</b>		
Land acquisition and resettlement	-In principal, refer to the RAP	-Avoid or reduce as much as possible the impact
Livelihood and economic activities	-In principal, refer to the RAP	-Avoid or reduce as much as possible the impact
Disruption of Existing Infrastructure facilities (Utilities)	-Give a description of magnitude of impact	-Avoid or reduce as much as possible the impact
Nuisance to neighborhood	-Give a description of magnitude of impact	-Avoid or reduce as much as possible the impact
Spreading of HIV/AIDS	-Give a description of magnitude of impact	-Avoid or reduce as much as possible the impact
Impacts from construction waste and other waste disposal	-Give a description of magnitude of impact	-Avoid or reduce as much as possible the impact
Impacts extraction and transportation of materials	-Give a description of magnitude of impact	-Avoid or reduce as much as possible the impact
Health ans safety impairment	-Give a description of magnitude of impact	-Avoid or reduce as much as possible the impact
<b>Physical Environment</b>		
Existing landscape	-Give a description of magunitude of impact	-Avoid or reduce as much as possible the impact
<b>Hydlogical Environment</b>		
River flow and canal flow	-Give a description of magnitude of impact	-Avoid or reduce as much as possible the impact
Local drainage pattern	-Give a description of magnitude of impact	-Avoid or reduce as much as possible the impact
Flood protection scheme	-Give a description of magnitude of impact	-Avoid or reduce as much as possible the impact
Flood propagation	-Give a description of magnitude of impact	-Avoid or reduce as much as possible the impact
<b>Physio-Chemical Environment</b>		
Water quality	-Give a description of magnitude of impact	-CEA water quality regulation
Air quality	-Prediction of SO <sub>2</sub> , CO, NO <sub>2</sub> , SPM due to the project (Plume & Puff Model)	-National Ambient Air Quality standard of Sri Lanka
Noise	-Prediction of traffic noise level and construction noise level due to the project (ASJ-RTN Model 2008)	-CEA Regulations on Ambient Noise Level
Vibration	-Prediction of vibration level due to the project (Estimation by traffic volume and travel speed)	-Maximum Permissible Interim Levels stipulated by CEA

Global Warming and Climate change	Calculate degree of change for volume of greenhouse gas (CO <sub>2</sub> )(Formula of CO <sub>2</sub> emission factor of vehicle type)	-Avoid or reduce as much as possible the impact
Soil contamination	-Give a description of magnitude of impact	-Avoid or reduce as much as possible the impact
Ground subsidence	-Give a description of magnitude of impact	-Avoid or reduce as much as possible the impact
Bottom sediment	-Give a description of magnitude of impact	-Avoid or reduce as much as possible the impact
Traffic congestion	-Give a description of magnitude of impact	-Avoid or reduce as much as possible the impact
<b>Terrestrial and Aquatic Ecology</b>		
Fauna & Flora, Biodiversity	-Give a description regarding might be affect endemic species and ecosystem -Give a description regarding might be affect trees species and quality	-Avoid or reduce as much as possible the impact
Damage to existing New Kelani Bridge	-Give a description of magnitude of impact	-Avoid or reduce as much as possible the impact

Source: JICA Survey team

### 12.2.8 Environmental Impacts

Environmental impact is defined as any change from the existing condition to the condition of “with Project”. However, it is defined as the difference of impact between “with Project” and “without Project” for global warning, since it is difficult to measure existing CO<sub>2</sub> emission from whole project area, and impact on global warming is generally evaluated by comparing the difference between “with Project” and “without Project”. The findings of the assessment are presented according to before construction, during construction and operation stage. The impact will be determined the rating score, positive and negative.

#### Summary of Environmental Impacts

**Table 12.2.5 Summary of Environmental Impacts**

Impact Theme	Impact Rating		Reasons for attributed impact rating
	Pre-Construction or Construction	Operation	
<b>Socio Economic</b>			
Land acquisition and resettlement	A-	D	<b>Pre-Construction or Construction</b> The number of affected dwellings and small business structure within the proposed ROW and service corridor are 449 and demolition/resettlement causes significant negative impacts. <b>Operation</b> No operational impact

Impact Theme	Impact Rating		Reasons for attributed impact rating
	Pre-Construction or Construction	Operation	
Livelihood and economic activities	A-	D	<p><b>Pre-Construction or Construction</b> Livelihood of people will be affected once the land is acquired for the project. This will cause significant negative impacts as the livelihood of some community members will be temporarily lost.</p> <p><b>Operation</b> No operational impact</p>
Disruption of Existing Infrastructure facilities(Utilities )	A-	D	<p><b>Pre-Construction or Construction</b> Shifting of the existing high-tension (32kW) power line, Atomic Energy Authority, the Automobile Training Institute will have temporary adverse impacts as shifting may cause inconvenience to the residents and building occupants and public users. (Details are described in “13.2.5) Existing oil pipeline will get affected by construction machinery etc. It is also considered necessary to relocate electricity power lines, telecommunication lines, water supply lines located within the project area during construction causing temporary adverse impacts such as power outage, water shortages etc. As far as possible constructions near oil pipeline should be done carefully without damaging it resulting in oil leakages.</p> <p><b>Operation</b> No operational impact</p>
Nuisance to neighborhood	C-	D	<p><b>Pre-Construction or Construction</b> Loss of access to residences and to social and administrative institutes could be considered as a nuisance to neighborhood during construction. This impact is temporary.</p> <p><b>Operation</b> No operational impact</p>
Violation Children's Rights	D	D	<p><b>Pre-Construction or Construction</b> There is no significant impact as child labor is prohibited by laws of Sri Lanka.</p> <p><b>Operation</b> No operational impact</p>
Spreading of HIV/AIDS	C-	D	<p><b>Pre-Construction or Construction</b> There could be some impact from workers coming from outside the project area. But the effects are minimal as they will be commuting rather than living in the project site. There is only one recorded case of HIV among affected people who will be shifted out before commencement of construction.</p> <p><b>Operation</b> No operational impact</p>
Impacts from construction waste and other waste disposal	C-	D	<p><b>Pre-Construction or Construction</b> Loss of retention in marshes , odor emanation, blockage of drainage paths, water stagnation</p> <p><b>Operation</b> No impact</p>
Impacts extraction and transportation of materials	C-	D	<p><b>Pre-Construction or Construction</b> Dust , vibration, public nuisance , drainage congestion, disturbance to landscape</p> <p><b>Operation</b> No impact</p>
Health and safety impairment	C-	C-	<p><b>Pre-Construction or Construction</b> Presence of respiratory diseases because of dust. Spread of communicable diseases because improper solid waste and wastewater disposal. Construction related accidents</p> <p><b>Operation</b> Probable accidents with high vehicular speed</p>

Impact Theme	Impact Rating		Reasons for attributed impact rating
	Pre-Construction or Construction	Operation	
Archaeological sites disturbance	D	D	<p><b>Pre-Construction or Construction</b> Not impact is expected as no archeological sites have been found during the archeological assessment.</p> <p><b>Operation</b> No impacts</p>
Damages to existing New Kelani Bridge	C-	D	<p><b>Pre-Construction or Construction</b> There could be damages to existing New Kelani bridge by construction equipment or piling activities causing vibration</p> <p><b>Operation</b> No impact</p>
<b>Physical Environment</b>			
Change of Existing landscape	B-	C+	<p><b>Pre-Construction or Construction</b> The existing landscape of the proposed construction area will be temporarily altered by construction activities causing fair negative impacts.</p> <p><b>Operation</b> The iconic nature of the proposed bridge will enhance the future landscape</p>
<b>Hydrological</b>			
River flow and canal flow obstruction	C-	D	<p><b>Pre-Construction or Construction</b> There could be temporary negative impacts during construction because of small coffer dams, sheet piles and such obstructions etc.</p> <p><b>Operation</b> There will not be any significant negative impacts as there will not be any piers inside Kelani River or canals for crossings.</p>
Alteration of the local drainage pattern	C-	C-	<p><b>Pre-Construction or Construction</b> Drainage pattern of the area could be temporarily altered by piles of construction materials causing negative impacts.</p> <p><b>Operation</b> There could be blockage of gullies , inlets etc. causing drainage congestion but this impact will not be prominent as there will be regular maintenance</p>
Damages to flood protection scheme	C-	D	<p><b>Pre-Construction or Construction</b> There could be damages to the flood bund from construction equipment</p> <p><b>Operation</b> No impact</p>
Hindrance to flood propagation	C-	D	<p><b>Pre-Construction or Construction</b> There could be hindrances to flood propagation because of material stockpiles, construction yards on the flood plain. This impact is temporary.</p> <p><b>Operation</b> There will not be any significant impact as the structures will be elevated.</p>
<b>Physio-Chemical Environment</b>			
Water quality (Contamination)	B-	D	<p><b>Pre-Construction or Construction</b> There is a possibility that the loose soil, sewage, oil and grease, bentonite or other chemicals etc. may enter water bodies or penetrate to groundwater causing water quality degradation. However Contractor will have to meet the procedures outlined in the Environmental Management Plan to avoid these effects</p> <p><b>Operation</b> Not significant impact is expected</p>

Impact Theme	Impact Rating		Reasons for attributed impact rating
	Pre-Construction or Construction	Operation	
Air quality degradation	C-	C-	<p><b>Pre-Construction or Construction</b> Emission of air pollutant from construction equipment and traffic congestion may cause minor negative impacts temporarily.</p> <p><b>Operation</b> Due to an increase in traffic volume, air quality degradation level will increase slightly but, this does not significantly deviate from current air quality levels.</p>
Noise (Public nuisance)	B-	C+	<p><b>Pre-Construction or Construction</b> During construction, noise in the construction area will be generated by the operation of construction machines causing public nuisance.</p> <p><b>Operation</b> The project may have modest positive impacts since driving speed will increase and noise decay distance is extended.</p>
Vibration (Public nuisance & structure cracks )	B-	C-	<p><b>Pre-Construction or Construction</b> During construction vibration in the construction area will be generated by the operation of construction machines causing public nuisance. Cracks may appear in nearby structures</p> <p><b>Operation</b> Vibration levels could be increased because of enhanced vehicular speed.</p>
Global warming	D	C+	<p><b>Pre-Construction or Construction</b> Construction machines and vehicles generate greenhouse gases, and quantities of generating gases do not give serious impact as quantities are relatively low according to numerical studies carried out.</p> <p><b>Operation</b> After implementation of the project, the amount of CO2 emission will be decreased with some positive contribution to global warming issue.</p>
Soil Contamination	C-	D	<p><b>Pre-Construction or Construction</b> Soil contamination could take place from oil, grease and wastewater from construction area and this might give a minor negative impact.</p> <p><b>Operation</b> Not impact is expected</p>
Ground subsidence	C-	C-	<p><b>Pre-Construction or Construction</b> Ground subsidence not expected as there is no driven piling. Ground subsidence could take place in river and canal banks</p> <p><b>Operation</b> Long term minor settlements within specified tolerance limits could take place</p>
Bottom sediment disturbances	D	D	<p><b>Pre-Construction or Construction</b> No significant impact expected ,because pier is not constructed in Kelani river</p> <p><b>Operation</b> No significant impact expected after river bed stabilization</p>
Traffic congestion	C-	A+	<p><b>Pre-Construction or Construction</b> Traffic congestion may be strictly temporarily</p> <p><b>Operation</b> Traffic congestion will definitely be reduced when new bridge, access roads are operated</p>
<b>Terrestrial and Aquatic Ecology</b>			
Aquatic habitat destruction	D	D	<p><b>Pre-Construction or Construction</b> There is no significant impact as rare, threatened or endemic aquatic fauna or flora species does not exist.</p> <p><b>Operation</b> Not impact is expected</p>

Impact Theme	Impact Rating		Reasons for attributed impact rating
	Pre-Construction or Construction	Operation	
Terrestrial habitats destruction	C-	D	<p><b>Pre-Construction or Construction</b> Rare threatened or endemic flora species do not exist, however about 260 trees may be removed from the project area.</p> <p><b>Operation</b> No impact is expected</p>

Rating; A;/- : Significant positive/negative

B+/- : Moderate positive/negative

C+/- : Minor positive/negative

D : No impact

Source: JICA Survey Team

### 12.2.9 Mitigation Measure

**Table 12.2.6 Summarized Significant Potential Negative Impact and Mitigation measures**

Item	Proposed Mitigation Measures	
	Before construction	During construction
<b>Social Environment</b>		
Involuntary Resettlement (impacts of relocation)	<ul style="list-style-type: none"> <li>• Minimizing the affected area in the design.</li> <li>• Developing awareness among the public about the project.</li> <li>• Carry out census survey on all affected persons and developing a Resettlement Plan with a project specific "Entitlement Matrix".</li> <li>• Acquiring land and paying compensation as per Land Acquisition act, Regulations 2008 and entitlement matrix of the project."</li> </ul>	<ul style="list-style-type: none"> <li>• Further assistance to affected persons as per guidelines of "entitlement matrix" (if required).</li> <li>• Not required.</li> </ul>
Local economy such as employment and livelihood etc.	<ul style="list-style-type: none"> <li>• Payment of compensation as per the entitlement matrix.</li> <li>• Assisting Affected persons to restore the livelihood activities through Income Restoration Programs.</li> </ul>	<ul style="list-style-type: none"> <li>• Providing adequate parking areas for private institutions which lose land from their parking lots.</li> <li>• Vocational training, income restoration</li> <li>• Providing adequate parking areas for private institutions which lose land from their parking lots.</li> <li>• Not required.</li> </ul>
Disruption of existing infrastructure facilities	<ul style="list-style-type: none"> <li>• Relocation of Automobile Training Institute, Atomic Energy Authority Building, 132 KV power lines in consultation and satisfaction of relevant line agencies.</li> </ul>	<ul style="list-style-type: none"> <li>• Risks of accidental disruption can be reduced by ensuring that machinery such as excavators, cranes are operated by trained personnel and that operations are adequately supervised.</li> <li>• A layout plan having location details of all utility lines should be given to the work supervisor/s.</li> <li>• Not required.</li> </ul>
Possible nuisance to neighborhood	<ul style="list-style-type: none"> <li>• Not required.</li> </ul>	<ul style="list-style-type: none"> <li>• Strict labor supervision will be implemented to avoid any conflicts arising due to migrant labor.</li> <li>• Awareness programs will be conducted at worker camps on sanitation and diseases to avoid any worker camp waste being disposed near settlement areas.</li> <li>• Not required.</li> </ul>



Item	Proposed Mitigation Measures		
	Before construction	During construction	During operation
Material transportation	<ul style="list-style-type: none"> <li>• Not required.</li> </ul>	<ul style="list-style-type: none"> <li>• Providing temporary bypasses during construction, advance notice to the public will reduce the inconvenience caused to the public during the construction stage.</li> <li>• To avoid nuisance to neighbors, will be study the traffic diversion plan</li> <li>• Use of covers over transported materials to guard against dust blow.</li> </ul>	<ul style="list-style-type: none"> <li>• Not required.</li> </ul>
<b>Natural Environment</b>			
Hydrological situation	<ul style="list-style-type: none"> <li>• Planning of construction schedule coinciding with the dry flow period of Kelani river.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor to continually liaise with Irrigation Department and obtain their flood warnings for the use of evacuation and withdrawal from the site.</li> </ul>	<ul style="list-style-type: none"> <li>• Maintenance of all drainage structure such as canals, culverts so as to avoid any blockage of drainage</li> </ul>
Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> <li>• Not required</li> </ul>	<ul style="list-style-type: none"> <li>• Replant adequate number of trees based on recommendation from a landscape specialist.</li> <li>• The timing of the felling of trees due to construction, to select the most appreciate time to as mitigate of wildlife as possible</li> <li>• Efforts to prevent contamination by exotic species</li> </ul>	<ul style="list-style-type: none"> <li>• Study of recovery degree of the natural environment</li> </ul>
Landscape	<ul style="list-style-type: none"> <li>• Not required</li> </ul>	<ul style="list-style-type: none"> <li>• Adoption of a design that matches the existing landscape</li> </ul>	<ul style="list-style-type: none"> <li>• Maintaining the green belt</li> </ul>
<b>Pollution</b>			
Water quality (surface/ground water)	<ul style="list-style-type: none"> <li>• Not required.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor will make employees aware on water conservation and waste minimization in the construction process.</li> <li>• The contractor shall protect sources of water (portable or otherwise) such as water sources used by the community so that continued use these water sources will not be disrupted by the work.</li> <li>• Installation of oil and grease traps at vehicle service station and</li> </ul>	<ul style="list-style-type: none"> <li>• Not required.</li> </ul>

Item	Proposed Mitigation Measures	
	Before construction	During construction
		<p>yard.</p> <ul style="list-style-type: none"> <li>• Avoid any direct discharge of waste water from worker camps on to nearby water bodies.</li> <li>• All cement, bitumen (barrels), oil and other chemicals will be stored and handled on an impervious surface (concrete slab) above ground level with roof and ridge around the structure to avoid any storm water flowing in to the facility.</li> </ul>
Air quality	<ul style="list-style-type: none"> <li>• Not required.</li> </ul>	<ul style="list-style-type: none"> <li>• Construction vehicles to be serviced and maintained on a regular basis.</li> <li>• Regular sprinkling of water over construction surface.</li> <li>• Transporting aggregate, gravel and other construction material with proper cover.</li> <li>• Storage of cement and other chemicals in an enclosed environment with adequate ventilation</li> <li>• Use of tarpaulin to separate construction area from residential areas and other sensitive areas such as temple, Hindu Kovil.</li> <li>• All plants to be operated as per the stipulated guidelines in EPL.</li> </ul>
Noise and vibration	<ul style="list-style-type: none"> <li>• Not required.</li> </ul>	<ul style="list-style-type: none"> <li>• All machinery and equipment will be well maintained and fitted with noise reduction devices in accordance with manufacturer's instructions.</li> <li>• Construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing and batching, mechanical compaction, etc., will be stopped between 20.00 hours to 06.00 hours. In silence zone (areas up to 100 m around such premises as schools and religious places) no hot-mix, batching or aggregate crushing plant will be allowed. No construction shall take place within 100m around noise sensitive sites, such as educational institutional religious places, noisy equipment shall not be used during noise sensitive times of the day.</li> <li>• Noise limits for construction equipment used in this project</li> </ul>
		<ul style="list-style-type: none"> <li>• Regular cleaning of road surface to remove dust.</li> </ul>
		<ul style="list-style-type: none"> <li>• Not required.</li> </ul>

Item	Proposed Mitigation Measures		
	Before construction	During construction	During operation
		<p>(measured at one meter from the edge of the equipment in free field) such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB(A).</p> <ul style="list-style-type: none"> <li>• All vehicles and equipment used in construction shall be fitted with exhaust silences. During routine servicing operations, the effectiveness of exhaust silencers shall be checked and if found to be defective shall be replaced.</li> <li>• Workers in vicinity of strong noise, and workers working with or in crushing, compaction, batching or concrete mixing operations shall be provided with protective gear.</li> <li>• Contractor shall take appropriate action to ensure that construction works do not result in damage to adjacent properties due to vibration.</li> <li>• Contractor shall carry out monitoring at the nearest vibration sensitive receptor during blasting or when other equipment causing vibrations are used.</li> <li>• The contractor shall modify the method of construction until compliance with the criteria, if vibration levels exceed the relevant vibration criteria.</li> </ul>	
Contamination of soil and ground subsidence	<ul style="list-style-type: none"> <li>• A precondition survey of the properties within a 25 m corridor on either side to the proposed ROW to be carried out before the construction works.</li> </ul>	<ul style="list-style-type: none"> <li>• Vehicles/ machinery and equipment servicing and maintenance work shall be carried out only in designated locations/ service stations approved by the engineer.</li> <li>• Bentonite used for pile operations will not be disposed on to nearby lands and surface water bodies.</li> <li>• Waste oil, other petroleum products and untreated wastewater shall not be discharged to the ground so that to avoid soil pollution. Adequate measures shall be taken against pollution of soil by spillage of petroleum/oil products from storage tanks and containers.</li> </ul>	<ul style="list-style-type: none"> <li>• Not required</li> </ul>
Accidents, worker health and safety	<ul style="list-style-type: none"> <li>• Informing the public about the project.</li> </ul>	<ul style="list-style-type: none"> <li>• Awareness programs for all worker groups on sanitation and diseases.</li> </ul>	<ul style="list-style-type: none"> <li>• Not required</li> </ul>

Item	Proposed Mitigation Measures	
	Before construction	During construction
		<ul style="list-style-type: none"> <li>At every workplace, first aid kit shall be provided as per the regulations. At every workplace an ambulance room containing the prescribed equipment and nursing staff shall be provided.</li> <li>Contractor shall comply with the provisions in Health and Safety regulations under the Factory Ordinance with regard to provision of health and safety measures and amenities at work place(s).</li> <li>All workers employed in hazardous activities shall be provided with the necessary protective gear. These activities include mixing asphalt material, cement, lime mortars, concrete etc., welding work, work at crushing plants, blasting work, operators of machinery and equipment such as power saws, etc.</li> <li>All electrical wiring and supply related work will conform to British Standards (BS) or relevant Sri Lankan Standards. Adequate precautions will be taken to prevent danger of electrocuting from electrical equipment and power supply lines including distribution boards, transformers, etc. Measures such as danger signboards, danger/red lights, fencing and lights will be provided to protect the public and workers.</li> </ul> <p>Enforcement of traffic control plan.</p>
Waste	<ul style="list-style-type: none"> <li>Not required</li> </ul>	<ul style="list-style-type: none"> <li>Contractor prior to the commencement of work shall provide lists of harmful, hazardous and risky chemicals/ material that will be used in the project work to the Engineer.</li> <li>Labor camps shall be provided with adequate and appropriate facilities for disposal of sewerage and solid waste. The sewage systems shall be properly designed, built and operated so that no pollution to ground or adjacent water bodies/watercourses takes place.</li> <li>Waste, oil and grease from service yards and workshop area should only be disposed at approved locations after treatment.</li> <li>Used cement bags should not be burned, they should be returned to the manufacturer.</li> <li>Contractor shall also provide the list of places where such</li> </ul>
		<ul style="list-style-type: none"> <li>Not required</li> </ul>

Item	Proposed Mitigation Measures		
	Before construction	During construction	During operation
		chemicals/materials or their containers or other harmful materials have been dumped as waste at the end of the project. <ul style="list-style-type: none"> <li>The contractor shall clean up any area including water-bodies affected/contaminated (if any) as directed by the engineer at his own cost.</li> </ul>	
Traffic congestion	<ul style="list-style-type: none"> <li>Not required</li> </ul>	<ul style="list-style-type: none"> <li>Setup diversion for minimization of construction traffic congestion</li> <li>Setup of sidewalk along the construction area</li> <li>The contractor shall follow the relevant labor law</li> </ul>	<ul style="list-style-type: none"> <li>Not required</li> </ul>
Purchase of the Construction Materials	<ul style="list-style-type: none"> <li>Not required</li> </ul>	<ul style="list-style-type: none"> <li>Contractor shall confirm to purchase construction materials only from the companies who have appropriate approval/permit</li> </ul>	<ul style="list-style-type: none"> <li>Not required</li> </ul>

### **12.2.10 Environmental Management Plan**

At this stage of the project an estimation of 5% of the total construction cost is set out as environmental cost, including the mitigatory costs and monitoring costs.

Environmental Management plan proposed in the following table.

This Environmental Management Plan (EMP) is developed based on the information available at Feasibility Study stage of the project. This EMP to be updated during the Detail Design stage especially with location details before incorporating it to the tender documents of the project. Environmental and Social Development Division of RDA will assist the Detail design team to incorporate such information to update the EMP.

#### **EMP Corrective Action**

The procedure for the case when the mitigation measures specified in the EMP are not executed properly is as follows.

1. To identify non-compliance with the mitigation measures in EMP
2. To report identified non-compliance to CEA
3. To investigate the cause of non-compliance
4. To develop the corrective action plan for non-compliance
5. To implement the corrective action
6. To record and report the implemented corrective action

Procedure of the EMP corrective action is shown in Table 12.2.7

**Table 12.2.7 Flow of the EMP Corrective Action**

Procedure	Before Construction		Under Construction		Under Operation	
	Implementa tion Agency	Responsibl e Agency	Implementa tion Agency	Responsibl e Agency	Implementa tion Agency	Responsibl e Agency
1. To identify non-compliance with the mitigation measures in EMP ↓	Contractor	PMU Consultant ESD	Contractor	PMU Consultant ESD	RDA/ESD	RDA/ESD
2. To report identified non-compliance to CEA ↓	Contractor	PMU Consultant ESD	Contractor	PMU Consultant ESD	RDA/ESD	CEA
3. To investigate the cause of non-compliance ↓	Contractor	PMU Consultant ESD	Contractor	PMU Consultant ESD	RDA/ESD	RDA/ESD
4. To develop the corrective action plan for non-compliance ↓	PMU	PMU Consultant ESD	PMU	PMU Consultant ESD	RDA/ESD	RDA/ESD
5. To implement the corrective action ↓	Contractor	PMU Consultant ESD	Contractor	PMU Consultant ESD	RDA/ESD	RDA/ESD
6. To record and report the implemented corrective action	PMU	CEA	PMU	CEA	RDA/ESD	CEA

**Source: JICA Survey Team**

**Table 12.2.8 Environmental Management Plan (EMP)**

**During Construction**

No.	Environmental Issue	Mitigation Measures	Implementing Party	Cost
<b>Social Environment</b>				
1)	Involuntary Resettlement (impacts of relocation)	<ul style="list-style-type: none"> <li>• Further assistance to affected persons as per guidelines of "entitlement matrix" (if required).</li> </ul>	RDA	
2)	Local economy such as employment and livelihood etc.	<ul style="list-style-type: none"> <li>• Providing adequate parking areas for private institutions which lose land from their parking lots.</li> <li>• Vocational training, income restoration</li> </ul>	RDA	LKR 10 million
3)	Disruption of existing infrastructure facilities	<ul style="list-style-type: none"> <li>• Risks of accidental disruption can be reduced by ensuring that machinery such as excavators, cranes are operated by trained personnel and that operations are adequately supervised.</li> <li>• A layout plan having location details of all utility lines should be given to the work supervisor/s.</li> </ul>	RDA through Contractor	Included in Engineering cost
4)	Possible nuisance to neighborhood	<ul style="list-style-type: none"> <li>• Strict labor supervision will be implemented to avoid any conflicts arising due to migrant labor.</li> <li>• Awareness programs will be conducted at worker camps on sanitation and diseases to avoid any worker camp waste being disposed near settlement areas.</li> <li>• Providing temporary bypasses during construction, advance notice to the public will reduce the inconvenience caused to the public during the construction stage.</li> <li>• To avoid nuisance to neighbors, will be study the traffic diversion plan</li> </ul>	RDA through Contractor	Provisional sum Rs. 500,000 per month  ( Some costs are included in Engineering Cost)



No.	Environmental Issue	Mitigation Measures	Implementing Party	Cost
5)	Material transportation	<ul style="list-style-type: none"> <li>Use of covers over transported materials to guard against dust blow.</li> </ul>	RDA through Contractor	Costs are included in Engineering Cost)
<b>Natural Environment</b>				
6)	Hydrological situation	<ul style="list-style-type: none"> <li>Contractor to continually liaise with Irrigation Department and obtain their flood warnings for the use of evacuation and withdrawal from the site.</li> </ul>	RDA through Contractor	Rs. 5,000 per month as the cost of the coordinator's input
7)	Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> <li>Replant adequate number of trees based on recommendation from a landscape specialist.</li> <li>The timing of the felling of trees due to construction, to select the most appropriate time to as mitigate to impacts of wildlife as possible.</li> <li>Efforts to prevent contamination by exotic species</li> </ul>	RDA through Contractor	Rs. 5,000,000 as provisional sum
8)	Landscape	<ul style="list-style-type: none"> <li>Adoption of a design that matches the existing landscape</li> </ul>	RDA through design Contractor	Included in design consultancy cost
<b>Pollution</b>				
9)	Water quality (surface/ground water)	<ul style="list-style-type: none"> <li>Contractor will make employees aware on water conservation and waste minimization in the construction process.</li> <li>The contractor shall protect sources of water (potable or otherwise) such as water sources used by the community so that continued use these water sources will not be disrupted by the work.</li> <li>Installation of oil and grease traps at vehicle service station and yard.</li> <li>Avoid any direct discharge of waste water from worker camps on to nearby water bodies.</li> </ul>	RDA through Contractor	Rs, 50,000 per month as a provisional sum ( Some costs are included in Engineering Cost)

No.	Environmental Issue	Mitigation Measures	Implementing Party	Cost
10)	Air quality	<ul style="list-style-type: none"> <li>All cement, bitumen (barrels), oil and other chemicals will be stored and handled on an impervious surface (concrete slab) above ground level with roof and ridge around the structure to avoid any storm water flowing in to the facility.</li> <li>Construction vehicles to be serviced and maintained on a regular basis.</li> <li>Regular sprinkling of water over construction surface.</li> <li>Transporting aggregate, gravel and other construction material with proper cover.</li> <li>Storage of cement and other chemicals in an enclosed environment with adequate ventilation</li> <li>Use of tarpaulin to separate construction area from residential areas and other sensitive areas such as temple, Hindu Kovil.</li> <li>All plants to be operated as per the stipulated guidelines in EPL.</li> </ul>	RDA through Contractor	Rs.50,000 per month  ( Some costs are included in Engineering Cost)
11)	Noise and vibration	<ul style="list-style-type: none"> <li>All machinery and equipment will be well maintained and fitted with noise reduction devices in accordance with manufacturer's instructions.</li> <li>Construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing and batching, mechanical compaction, etc., will be stopped between 20.00 hours to 06.00 hours. In silence zone (areas up to 100 m around such premises as schools and religious places) no hot-mix, batching or aggregate crushing plant will be allowed. No construction shall take place within 100m around noise sensitive sites, such as educational institutional religious places, noisy equipment shall not be used during noise sensitive times of the day.</li> <li>Noise limits for construction equipment used in this project (measured at one meter from the edge of the equipment in free field) such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75</li> </ul>	RDA through Contractor  Contractor also to take insurance against vibration damage	Rs.100,000 per month as costs for GSMB etc.  ( Some costs are included in Engineering Cost)

No.	Environmental Issue	Mitigation Measures	Implementing Party	Cost
12)	Contamination of soil and ground subsidence	<p>dB(A).</p> <ul style="list-style-type: none"> <li>All vehicles and equipment used in construction shall be fitted with exhaust silencers. During routine servicing operations, the effectiveness of exhaust silencers shall be checked and if found to be defective shall be replaced.</li> <li>Workers in vicinity of strong noise, and workers working with or in crushing, compaction, batching or concrete mixing operations shall be provided with protective gear.</li> <li>Contractor shall take appropriate action to ensure that construction works do not result in damage to adjacent properties due to vibration.</li> <li>Contractor shall carry out monitoring at the nearest vibration sensitive receptor during blasting or when other equipment causing vibrations are used.</li> <li>The contractor shall modify the method of construction until compliance with the criteria, if vibration levels exceed the relevant vibration criteria.</li> </ul>	RDA through Contractor	Rs.100,000 per month as costs for GSMB etc.  ( Some costs are included in Engineering Cost)
13)	Accidents, worker health and safety	<ul style="list-style-type: none"> <li>Vehicles/ machinery and equipment servicing and maintenance work shall be carried out only in designated locations/ service stations approved by the engineer.</li> <li>Bentonite used for pile operations will not be disposed on to nearby lands and surface water bodies.</li> <li>Waste oil, other petroleum products and untreated wastewater shall not be discharged to the ground so that to avoid soil pollution. Adequate measures shall be taken against pollution of soil by spillage of petroleum/oil products from storage tanks and containers.</li> </ul>	RDA through Contractor	Rs.200,000 per month.

No.	Environmental Issue	Mitigation Measures	Implementing Party	Cost
		<p>the prescribed equipment and nursing staff shall be provided.</p> <ul style="list-style-type: none"> <li>Contractor shall comply with the provisions in Health and Safety regulations under the Factory Ordinance with regard to provision of health and safety measures and amenities at work place(s).</li> <li>All workers employed in hazardous activities shall be provided with the necessary protective gear. These activities include mixing asphalt material, cement, lime mortars, concrete etc., welding work, work at crushing plants, blasting work, operators of machinery and equipment such as power saws, etc.</li> <li>All electrical wiring and supply related work will confirm to British Standards (BS) or relevant Sri Lankan Standards. Adequate precautions will be taken to prevent danger of electrocuting from electrical equipment and power supply lines including distribution boards, transformers, etc. Measures such as danger signboards, danger/red lights, fencing and lights will be provided to protect the public and workers.</li> </ul> <p>Enforcement of traffic control plan.</p>		( Some costs are included in Engineering Cost)
14)	Waste	<ul style="list-style-type: none"> <li>Contractor prior to the commencement of work shall provide lists of harmful, hazardous and risky chemicals/ material that will be used in the project work to the Engineer.</li> <li>Labor camps shall be provided with adequate and appropriate facilities for disposal of sewerage and solid waste. The sewage systems shall be properly designed, built and operated so that no pollution to ground or adjacent water bodies/watercourses takes place.</li> <li>Waste, oil and grease from service yards and workshop area should only be disposed at approved locations after treatment.</li> <li>Used cement bags should not be burned, they should be returned to the manufacturer.</li> <li>Contractor shall also provide the list of places where such chemicals/materials or their containers or other harmful materials</li> </ul>	RDA through Contractor	Rs.300,000 per month.  ( Some costs are included in Engineering Cost)

No.	Environmental Issue	Mitigation Measures	Implementing Party	Cost
		<p>have been dumped as waste at the end of the project.</p> <ul style="list-style-type: none"> <li>The contractor shall clean up any area including water-bodies affected/contaminated (if any) as directed by the engineer at his own cost.</li> </ul>		
15)	Traffic Congestion	<ul style="list-style-type: none"> <li>Setup diversion for minimization of construction traffic congestion</li> <li>Setup of sidewalk along the construction area</li> <li>The contractor shall follow the relevant labor law</li> </ul>	RDA through Contractor	Rs.1,000,000 per month.  ( Some costs are included in Engineering Cost)
16)	Purchase of the construction Materials	<ul style="list-style-type: none"> <li>Contractor shall confirm to purchase construction materials only from the companies who have appropriate approval/permit.</li> </ul>	RDA through Contractor	Included in Engineering Cost

**During Operation**

	Environmental Issue	Mitigation Measures	Implementing Party	Cost
	<b>Social Environment</b>			
1)	Involuntary Resettlement (impacts of relocation)	<ul style="list-style-type: none"> <li>Not required.</li> </ul>		
2)	Local economy such as employment and livelihood etc.	<ul style="list-style-type: none"> <li>Providing adequate parking areas for private institutions which lose land from their parking lots.</li> </ul>	RDA in Consultation with UDA	Rs. 10,000,000 as a provisional sum

	Environmental Issue	Mitigation Measures	Implementing Party	Cost
3)	Disruption of existing infrastructure facilities	<ul style="list-style-type: none"> <li>• Not required.</li> </ul>		
4)	Possible nuisance to neighborhood	<ul style="list-style-type: none"> <li>• Not required.</li> </ul>		
5)	Material transportation	<ul style="list-style-type: none"> <li>• Not required.</li> </ul>		
<b>Natural Environment</b>				
6)	Hydrological situation	<ul style="list-style-type: none"> <li>• Maintenance of all drainage structure such as canals, culverts so as to avoid any blockage of drainage</li> </ul>	RDA through Chief Engineer	Rs. 50,000 per month as maintenance cost
7)	Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> <li>• Study of recovery degree of the natural environment</li> </ul>	ESD, RDA	Rs. 400,000 for the study cost
8)	Landscape	<ul style="list-style-type: none"> <li>• Maintaining the green belt</li> </ul>	RDA	Rs. 50,000 per month as maintenance cost
<b>Pollution</b>				
9)	Water quality (surface/ground water)	<ul style="list-style-type: none"> <li>• Not required.</li> </ul>		
10)	Air quality	<ul style="list-style-type: none"> <li>• Regular cleaning of road surface to remove dust.</li> </ul>	RDA through Chief Engineer	Rs. 200,000 per month as maintenance cost
11)	Noise and vibration	<ul style="list-style-type: none"> <li>• Not required.</li> </ul>		

	Environmental Issue	Mitigation Measures	Implementing Party	Cost
12)	Contamination of soil and ground subsidence	<ul style="list-style-type: none"> <li>• Not required</li> </ul>		
13)	Accidents, worker health and safety	<ul style="list-style-type: none"> <li>• Not required</li> </ul>		
14)	Waste	<ul style="list-style-type: none"> <li>• Not required</li> </ul>		
15)	Traffic congestion	<ul style="list-style-type: none"> <li>• Not required</li> </ul>		

**Notes**

1. As this EMP has been prepared using the details available at the feasibility study stage without detailed BoQs for work items, the provided costs are tentative and most of them have been indicated as provisional sums.
2. This EMP should be further revised, updated and upgraded once the detailed designs are complete before awarding the work to a construction contractor.

RDA= Road Development Authority  
ESD= Environmental and Social Division, WRB= Water Resources Board, PMU= Project Management Unit, CEA= Central Environmental Authority  
SLLRDC= Sri Lanka Land Reclamation and Development Corporation

Table 12.2.9 Environmental Monitoring Plan (EMoP)

Before Construction							
Items	Parameters to be Monitored	Location	Frequency	Standards	Rate (Rs.)	Amount (Rs.)	Implementation and Supervision
Air Quality	SPM, PM10, NO <sub>2</sub> , CO, SO <sub>2</sub> , Pb (including wind direction and velocity at time of measurement)	8 locations (Sri Bhoopala Vinayaker Kovil, Peliyagoda; Sri Lanka Cement Cooperation Outlet, Peliyagoda; Jayantha saw mills, Sedawatta road; Premises of Minimuthu Suppliers, Wellampitiya; Shanchi Viharaya, New Kanani Bridge Road; Near premises of	Once	NAAQS of Sri Lanka	Per sample 40,000	320,000	Contractor under supervision of the Consultant and PMU with close consultation with ESD Division
		Near premises of					
Water Quality	Temperature, pH, Electrical Conductivity, DO, BOD, Total Suspended Solids, Oil and grease, Total Coliform count.	Near premises of Sri Somaloka Viharaya, No. 150, States Road) Note: Baseline monitoring of air quality parameters was done at the above locations.	Once	CEA Water Quality Regulation	Per sample 10,000	50,000	Contractor under supervision of the Consultant and PMU with close consultation with ESD Division
		5 locations including 2 locations on Kelani river (upstream and downstream)					



Items	Parameters to be Monitored	Location	Frequency	Standards	Rate (Rs.)	Amount (Rs.)	Implementation and Supervision
Noise and vibration	LAeq, L90 and L 50 values for noise in dB(A) and ground vibration frequency levels in Hz and PPV in mm/sec	8 locations (Sri Bhoopala Vinayaker Kovil, Peliyagoda; Sri Lanka Cement Cooperation Outlet, Peliyagoda; Jayantha saw mills, Sedawatta road; Premises of Minimuthu Suppliers, Wellampitiya; Shanchi Viharaya, New Kanani Bridge Road; Near premises of  Near premises of  Near premises of Sri Somaloka Viharaya, No. 150, States Road) Note: Baseline monitoring of noise levels and vibration were done at above locations.	Once	CEA Regulation on ambient noise levels and permissible ground vibration levels	Per sample 10,000	80,000	Contractor <u>under supervision of the Consultant and</u> with close consultation with ESD Division
<b>Total Cost</b>						<b>450,000</b>	

Note:

Item "Monitoring of Construction Waste" was added from EIA disclosed in public in Sri Lanka, since this item should be monitored.

CO=carbon monoxide, HC=hydrocarbons

LA= Local authority, NAAQS= National Air Quality Standards, NO<sub>2</sub>= Nitrogen Dioxide, Pb=lead, PM10= Reparable particulate matter<10micrometers diameter, RDA=Road Development Authority, SO<sub>2</sub>=Sulphur dioxide, SPM= suspended particulate matter.

Above Environmental Monitoring Plan should be updated during project detail design stage before including into tender documents. The update EMoP should include rates and total cost for the monitoring program during the construction period. The contractor should secure monetary budget to cover the expenses for carrying out the monitoring program during the construction period.

During Construction							
Items	Parameters to be Monitored	Location	Frequency	Standards	Rate (Rs.)	Amount (Rs.)	Implementation and Supervision
Monitoring of Construction Waste	Construction waste types ( debris, soil, steel pieces and othe "Scheduled Waste" ) and quantities	At different places of construction site and disposal sites	Regularly	CEA Guidelines for "Scheduled Waste"	Cost of supervisors and overhead	Cost per day for 10 supervisors +25% overhead Rs. 1.25*10*3000 = 37,500	Contractor under supervision of the Consultant and PMU with close consultation with ESD Division
Air Quality	SPM, PM10, NO <sub>2</sub> , CO, SO <sub>2</sub> , Pb (including wind direction and velocity at time of measurement)	8 locations (Sri Bhoopala Vinayaker Kovil, Peliyagoda; Sri Lanka Cement Cooperation Outlet, Peliyagoda; Jayantha saw mills, Sedawatta road; Premises of Minimuthu Suppliers, Wellampitiya; Shanchi Viharaya, New Kelani Bridge Road; Near premises of of Near premises of of Sri Somaloka Viharaya, No. 150, States Road) .	Construction - 4 times/Yr for 3 Yrs (however, additional measurements may need to be taken in case there are complaints of deterioration of air quality)	NAAQS of Sri Lanka	Per sample 40,000	3,840,000	Contractor under supervision of the Consultant and PMU with close consultation with ESD Division
Noise and vibration	LAeq, L90 and L50 values for noise in dB(A) and ground vibration	8 locations (Sri Bhoopala Vinayaker Kovil, Peliyagoda; Sri Lanka Cement Cooperation Outlet, Peliyagoda; Jayantha	Construction - 4 times/Yr for 3 Yrs (however, additional	CEA Regulations on ambient noise levels	Per sample 10,000	960,000	Contractor under supervision of the Consultant and PMU with close

Items	Parameters to be Monitored	Location	Frequency	Standards	Rate (Rs.)	Amount (Rs.)	Implementation and Supervision
	frequency levels in Hz and PPV in mm/sec	saw mills, Sedawatta road; Premises of Minimuthu Suppliers, Wellampitiya; Shanchi Viharaya, New Kanani Bridge Road; Near premises of of Near premises of Sri Somaloka Viharaya, No. 150, States Road)	measurements may need to be taken in case there are complaints of high noise and vibration levels).	and permissible ground vibration levels			consultation with ESD Division
Flora, Fauna & Biodiversity	Diversity of species	50 m up and down stream of the new bridge construction location. Area within ROW for the new approach roads	2 visits/year for 3yrs		Per sample 30,000	180,000	Contractor <u>under supervision of the Consultant and PMU</u> with close consultation with ESD Division
Water Quality	Temperature, pH, Electrical Conductivity, DO, BOD, Total Suspended Solids, Oil and grease, Total Coliform count.	5 locations including 2 locations on Kelani river (upstream and downstream)	4times/year for three years	CEA Water Quality Regulations	Per sample 10,000	600,000	Contractor <u>under supervision of the Consultant and PMU</u> with close consultation with ESD Division
<b>Total Cost</b>						<b>5,617,500</b>	

Note:1

CO=carbon monoxide, HC=hydrocarbons

LA= Local authority, NAAQS= National Air Quality Standards, NO<sub>2</sub>= Nitrogen Dioxide, Pb=lead, PM10= Reparable particulate matter<10micrometers diameter, RDA=Road Development Authority, SO<sub>2</sub>=Sulphur dioxide, SPM= suspended particulate matter.

Above Environmental Monitoring Plan should be updated during project detail design stage before including into tender documents. The update EMoP should include rates and total cost for the monitoring program during the construction period. The contractor should secure monitory budget to cover the expenses for carrying out the monitoring program during the construction period.

**Note 2**

This EMoP should be further revised, updated and upgraded once the detailed designs are complete before awarding the work to a construction contractor.

## During Operation

Items	Parameters to be Monitored	Location	Frequency	Standards	Rate (Rs.)	Amount (Rs.)	Implementation and Supervision
Air Quality	SPM, PM10, NO <sub>2</sub> , CO, SO <sub>2</sub> , Pb (including wind direction and velocity at time of measurement)	3 locations (Should be decided during detail design stage)	On any complaint basis	NAAQS of Sri Lanka	Per sample 40,000	120,000	<u>RDA/ESD</u>
Water Quality	Temperature, pH, Electrical Conductivity, DO, BOD, Total Suspended Solids, Oil and grease, Total Coliform count.	5 locations including 2 locations on Kelani river (upstream and downstream) –Should be decided during detail design stage	On any complaint basis	CEA Water Quality Regulations	Per sample 10,000	50,000	<u>RDA/ESD</u>
Noise and vibration	LAeq, L90 and L50 values in dB(A) and ground vibration frequency levels in Hz and PPV in mm/sec	3 locations (Should be decided during detail design stage)	On any complaint basis	CEA Regulations on ambient noise levels and permissible ground vibration levels	Per sample 10,000	30,000	<u>RDA/ESD</u>

Items	Parameters to be Monitored	Location	Frequency	Standards	Rate (Rs.)	Amount (Rs.)	Implementation and Supervision
Flora, Fauna & Biodiversity	Growth of newly planted trees	An inventory of newly planted trees in place of trees cut in the land available within interchange areas	12 visits/year for 2 years	Tree growth details	Per visit 30,000	720,000	Chief Engineer's office RDA/ESD Division
<b>Total Cost</b>						<b>920,000</b>	
<b>Grand Total</b>						<b>6,987,500</b>	

Note:

CO=carbon monoxide, HC=hydrocarbons,

LA= Local authority, NAAQS= National Air Quality Standards, NO2= Nitrogen Dioxide, Pb=lead, PM10= Reparable particulate matter<10micrometers diameter,

RDA=Road Development Authority, SO2=Sulphur dioxide, SPM= suspended particulate matter.

Above Environmental Monitoring Plan should be updated during project detail design stage before including into tender documents. The update EMoP should include rates and total cost for the monitoring program during the construction period. The contractor should secure monitory budget to cover the expenses for carrying out the monitoring program during the construction period.

### 12.2.11 Public Participation

Accordance with JICA guidelines, twice a stakeholder meeting has held.

The overview will be present below. In the stakeholders meeting, the local people mostly did not have any comments, opinions, suggestions or questions relating to the environment. They had interested regarding the date of resettlement and contents of compensation.

**Table 12.2.10 Brief Overviews of the “1st Stakeholders’ meeting”**

Date	25 <sup>th</sup> March 2013
Time	9.30 am
Venue	Auditorium of Sri Lanka Foundation Institute, Colombo 7
Method of consultation	Verbal explanation first in general by the host and individual question/answers by the host and participants
Language spoken	Sinhalese
Agenda of the presentation	<ol style="list-style-type: none"> <li>1. Brief of the Project Purpose, by Director General RDA, Mr. W A S Weerasinghe</li> <li>2. Contents of the Projects, by Director ,Planning division RDA, Mr. Bandara</li> <li>3. EIA survey items and survey methods, RAP survey contents, by ESD-RDA Director, Mr. Hudson de Silva</li> <li>4. Q and A</li> </ol>
Q and A	<ol style="list-style-type: none"> <li>1. Regarding resettlement, affected area and contents, transfer destination</li> <li>2. Convenience of the under construction., Ensure safety</li> <li>3. Regarding After the project, the need for further measures to eliminate road congestion</li> <li>4. Implementation structure of the field survey work</li> <li>5. etc.</li> </ol>
Entry	Supposedly, 70 attendances

Source: JICA Survey Team

**Table 12.2.11 Brief Overviews of the “2nd Stakeholders’ meeting”**

Date	11 <sup>th</sup> July 2013
Time	9.30 am
Venue	Auditorium of Sri Lanka Foundation Institute, Colombo 7
Method of consultation	Verbal explanation first in general by the host and individual question/answers by the host and participants
Language spoken	Sinhalese
Agenda of the presentation	<ol style="list-style-type: none"> <li>1. Brief of the Project Purpose, by Cabinet Minister Mr.A H M Fowzie and Secretary to the Ministry of Ports and Highways Mr. R W R Premasiri</li> <li>2. Contents of the Project, by Director ,Planning division RDA, Mr. H M K G G Bandara</li> <li>3. Regarding EIA study results and results of RAP study methods, by ESD-RDA Director, Mr. Hudson de Silva</li> <li>4. Q and A</li> </ol>
Q and A	<ol style="list-style-type: none"> <li>1. Regarding 25 families affected due to the shifting of Amman kovil.</li> <li>2. Regarding resettlement location, stakeholders want a close location with facilities</li> <li>3. Regarding the purpose of this project</li> <li>4. Regarding proposed relocation site and relocation plan by the Atomic Energy Authority</li> <li>5. Regarding the project schedule and the affected area</li> <li>6. Starting date of construction and compensation payment time</li> </ol>
Entry	329 participants

Source: JICA Survey Team

### 12.3 Atomic Energy Authority

It is required to relocate Atomic Energy Authority (AEA) in the Project. The major work of the AEA is to promote peaceful applications of nuclear technology conforming to international standards on radiation safety and security.

The relocation of AEA is discussed in detail in “13. Involuntary Resettlement”.

### 12.4 Recommendation

1. In Sri Lanka, there is the regulation of vehicle horn volume already. Well-known of this regulation and awareness of prohibited acts of sounding the horn improperly is required.
2. In order to suppress an increase of noise level or exhaust gas, it is necessary to introduce the proper inspection system of vehicles.
3. In response to the increase of traffic volume, it is important to execute constant monitoring for exhaust gas and noise.
4. It is important to plant trees as many as possible in the Project.



## **13. INVOLUNTARY RESETTLEMENT**

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### **13.1 General**

JICA indicates clearly the basic principle on involuntary Resettlement in the “JICA guidelines for Environmental and Social Considerations” (April 2010, hereinafter “JICA Guidelines”) that “People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported by project proponents etc.in a timely manner”.

The JICA requests borrowers to submit the Resettlement Action Plan (herein after “RAP”) for the development Projects that contain large scale involuntary resettlement prior to the JICA appraisals for the project. Note that the RAP shall meet the requirements of the JICA Guidelines and WB OP.4.12 properly.

The RAP was prepared since the “Traffic Improvement Project around New Kelani Bridge Project” (herein after “Project”) was anticipated involuntary resettlement of more than 300 households based on the selected optimal plan of route alternative (referred to Volume 4). The RAP was established based on the sub-contract with local RAP consulting firm under JICA’s financial assistance and the summary of the RAP is described in this Chapter

### **13.2 Summary of the RAP**

#### **13.2.1 Census and Socioeconomic Study**

##### **(1) Methodology for Census and Socioeconomic Survey**

Resettlement action plan is prepared to overcome adverse effects caused by land acquisition to the people living in project affected areas. This plan has to be based on a systematic assessment on the impact caused by the project to people and properties, representing their basic socioeconomic information. This assessment is made by conducting a census survey and a Socio Economic Survey (SES) simultaneously. The census and SES cover every person affected living in the area. The both, the census and the SES use structured questionnaires develop to suit specific objectives of the resettlement plan and the socioeconomic characteristics of the project area.

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## 1) Questionnaire Forms of the Survey

The census and socioeconomic survey (SES) was conducted to collect all information on socio-economic information of all affected people (AP) and their movable and immovable properties in the project area. Identification of APs and their structures (houses and other buildings) for data collection were based on the preliminary designs provided by the JICA survey team (JST).

The scope of data collection in the SES included the following;

- Household head: name, sex, age, livelihood or occupation, income, education and ethnicity;
- Household members: number, livelihood or occupation, school age children and school attendance, and literacy, disaggregated by gender;
- Summary data on Affected Houses (AHs), by ethnicity, gender of head of household, household size primary and secondary source of household income viz-a-viz poverty line, income level, whether household is headed by women, elderly, disabled, poor or indigenous peoples;
- Living conditions: access to water, sanitation and energy for cooking and lighting; ownership of durable goods;
- Legal status of affected land and structure assets, and duration of tenure and ownership;
- AP knowledge of the project and preferences for compensation and, as required, relocation sites and rehabilitation measures;
- Identify whether affected land or source of income is primary source of income;

An Inventory of Losses (IOL) Survey was also conducted based on the preliminary designs to identify the impact on the structures in the project area.

The data collected through the IOL survey included the following;

- Total and affected areas of land, by type of land assets;
- Total and affected areas of structures, by type of structure (main or secondary) including wells and cemeteries;
- Quantity and types of affected crops and trees;
- Quantity of other losses, e.g., business or other income, jobs or other productive assets; estimated daily net income from informal shops;
- Quantity/area of affected common property, community or public assets, by type.

A separate common property survey was carried out simultaneously to identify all affected common properties. All common properties were listed out with their location details.

## 2) Field Activities

The representatives from related GND and the member in charge of CAD of the RAP team visited the PAPs which were identified in advance based on the preliminary design drawing provided by JST. They confirmed the location of each structure affected by the project based on the drawing and pasted stickers on entrances to the structures showing that they will be counted as PAPs. The interview team followed them and interviewed PAPs. The census survey was carried out during the months of April and May of 2013. Leaflets prepared in local language which included project related information were distributed to the PAPs before starting the interview.



Representatives of GND and the member of the RAP team



Sticker showing the eligibility



Source: JICA Survey Team



**Figure 13.2.1 Photographs taken during the Census Survey**

## 3) Data Analysis

Completed and filtered questionnaires were sent to computer data processing and analyzing.

Data gathered through filtered questionnaires were put in MS-excel sheets. Data was processed using an algorithm developed using SQL server package in order to obtain all necessary data tables of the RAP.

(2) Results of the Census Survey

A total of 395 residential households and 54 business owners will be affected due to the project interventions as shown in the Table 13.2.1. Note that the table contains the information on the status of land title.

**Table 13.2.1 The Number of the AHs and APs**

No of AHs					No of APs					No of AHs/APs				
Title Holder	Rent	Untitled Holder	Others	Sub-Total	Title Holder	Rent	Untitled Holder	Others	Sub-Total	Title Holder	Rent	Untitled Holder	Others	Total
35	10	346	4	395	11	28	13	2	54	46	38	359	6	449

Source: JICA Survey Team,

Note:

- "Rent" means titled properties and eligible for full compensation.
- "Others" include those who didn't answer and/or who were not clear of the status of ownership

Regarding the number of the project affected persons (PAPs) and business population, 1743 residential people and 172 business population (54 owners and 118 workers) will be affected due to the project interventions as shown in the Table 13.2.2.

**Table 13.2.2 The Number of the Project Affected Persons (PAPs) and Business Population**

Residential					Business Population							Total No. of PAPs/Business Population					
No. of PAPs					No. of APs(Business Owners)					Employees	Total						
Title Holder	Rent	Untitled Holder	Others	Total	Title Holder	Rent	Untitled Holder	Others	sub-total			Title Holder	Rent	Untitled Holder	Others	Employee	Total
189	51	1491	12	1743	11	28	13	2	54	118	172	200	79	1504	14	118	1915

Source: JICA Survey Team,

Given that the affected employees are not necessary to relocate, the number of those who are necessary to relocate is as shown in the Table 13.2.3.

**Table 13.2.3 The Number of Persons Necessary to Relocate**

	Total No. of PAPs/Business Population					
	Title Holder	Rent	Untitled Holder	Others	Employee	Total
Persons to be Relocated	200	79	1504	14	0	1797
PAPs without Relocation	0	0	0	0	118	118
<b>Total</b>	<b>200</b>	<b>79</b>	<b>1504</b>	<b>14</b>	<b>118</b>	<b>1915</b>

Source: JICA Survey Team,

(3) Results of the Inventory of Losses

1) Land

Total area of land surrounding to impact corridor and total land area affected in each GND are shown in the Table 13.2.4.

**Table 13.2.4 Total and Affected Land Area in Each GND**

GN Division	Total land area (Perch)	Affected land area (perch)
PeliyagodaGangabada east	26.61	26.61
Bloemendhal	67.28	66.06
Nawagampura	59.82	54.80
Orugodawatta	7.63	6.89
Sedawatta	150.21	150.18
Wadullawatta	308.81	308.05
Grandpass	8.36	7.85
<b>Total area</b>	<b>628.72</b>	<b>620.44</b>

Note: 1 Perch= 25.3 m<sup>2</sup>

Source: JICA Survey Team, 2013

2) Structures

Total area of structures within the impact corridor and the total structural area affected in each GND are presented in the Table 13.2.5 below. This includes both residential and commercial structures.

**Table 13.2.5 Total and Affected Area of Structures in each GND**

GN Division	Residential structure		Commercial structure		Total	
	Total area (m <sup>2</sup> )	Affected area (m <sup>2</sup> )	Total area (m <sup>2</sup> )	Affected area (m <sup>2</sup> )	Total area (m <sup>2</sup> )	Affected area (m <sup>2</sup> )
Peliyagoda Gangabada east	984.909	984.909	0	0	984.909	984.909
Bloemendhal	810.31	810.31	990.028	990.028	1800.338	1800.338
Nawagampura	735.778	735.778	240.941	240.941	976.719	976.719
Orugodawatta	191.95	191.95	0	0	191.95	191.95
Sedawatta	3232.162	3232.162	246.31	246.31	3478.472	3478.472
Wadullawatta	4780.128	4780.128	399.575	399.575	6189.978	6189.978
Grandpass	0	0	228.826	228.826	228.826	228.826
<b>Total area</b>	<b>10735.2</b>	<b>10735.2</b>	<b>2105.68</b>	<b>2105.68</b>	<b>12840.92</b>	<b>12840.92</b>

Source: JICA Survey Team, 2013

### 3) Public Utilities

The following public utilities will be affected by the Project.

**Table 13.2.6 Affected Public Utilities**

Items	Affected Numbers
Lamp posts	132 posts
Name board& sign board	48 boards
Telecommunication posts	43 posts
Electricity distribution line	40 lines
Manhole	61 manholes
Telecom Cable Box	7 boxes

Source: JICA Survey Team, 2013

### 4) Trees

As the project is located within a highly urbanized area, there were not many trees with timber value.

### (4) Results of Socioeconomic Survey

The Socioeconomic survey covered 449 households (HHs) consisting of 395 residential and 54 business units. The total project affected population are 1915.

The project area is a multi-ethnic area within the capital city of the country. Out of 449 HH heads, almost a half of the population (46.5%) is Tamils, 43.9% is Sinhalese (the country

majority ethnic community) and 8.9% is Moors. There is a high degree of ethnic harmony in the area as commonly seen in highly urbanized areas.

Out of the total population of 1743 excluding business population, Hindu accounts for 38.1%, Buddhist for 36.2%, Christians for 15.9% and Moors for 9.7% respectively. Hindus are exclusively Tamils and Buddhists are Sinhalese. Christians includes Tamils and Sinhalese both. Muslims are exclusively Moors.

Out of 449 HH heads, 52 people (12%) are illiterate, 110 people (24.5%) have primary level education and 250 people (55.6%) are little more than a half have secondary and higher level of education.

Out of 449 HH heads, 53 people (11.8%) have salary employment opportunities, 131 people (29%) are reported as casual labors and 54 people (12%) household heads are involved in business. There are 94 people (20.9%) self-employed persons, mainly with boutiques, home-based small scale manufacturing ventures, saloons, dress making and food preparations etc. The unemployment rate among heads of household is as 28 or 6.2%.

Out of 395 residential HHs, 15 families (3.7%) receive income less than Rs. 10,000 per month, and 342 families (82.7%) receive income between Rs. 15,000 - Rs. 60,000/- per month, and 53 (13.4%) HHs receives a monthly income between Rs. 60,000 and Rs. 100,000/-. There are 12 HHs receive a monthly income more than Rs. 100,001.

The vulnerable household heads include; people over 60 years of age, household heading women, physically disabled persons, chronically ill persons, widows/widowers and poor.

There are 102 vulnerable HHs among 395 household heads, representing 25.8% of the total number of family heads. A half of the vulnerable persons are widows. Next is the physically disabled persons (22), and the chronically ill (19) persons. There are only 6 HHs over 60 years of age.

### **13.2.2 Legal and Policy Framework for Land Acquisition and Involuntary Resettlement**

#### **(1) Land Acquisition Act (1950)**

The Land Acquisition Act (LAA) of 1950 is the most important legal provision which spells out the Land acquisition process in Sri Lanka. It provides the payment of compensation at market rates for lands, structures and crops.

The operational procedures of the LAA (1950) are as shown in the Table 13.2.7.

**Table 13.2.7 Procedures for Land Acquisition**

Activity	Agency in Charge
Preparation and submission of land acquisition proposal	Project executing/implementing agency
Issuance of order to survey (LAA S. 2)	Ministry of Land and Land Development
Preparation and posting of notices (S. 2)	Divisional Secretary
Preparation of advance tracing	Survey Department
Issuance of order to acquire the land (S. 4)	Ministry of Land and Land Development
Section 04 posting and publication of notices(S. 4)	Divisional Secretary, Government Press
Objection inquiries	Project executing/implementing agency
Gazette notification (S. 5)	Divisional Secretary, Department of Government Printing
Preparation of preliminary plan	Survey Department
Gazette notification (S. 7)	Divisional Secretary
Inquiries (S. 9)	Divisional Secretary
Decision (S. 10-1)	Divisional Secretary
Valuation	Valuation Department
Award (S. 17)	Divisional Secretary
Payment of compensation	Divisional Secretary
Order (S. 38a)	Ministry of Land and Land Development, Department of Government Printing
Provision (S. 38a)	Ministry of Land and Land Development, Department of Government Printing
Taking over the vacant possession	Divisional Secretary, Project executing/implementing agency
Registration of land	Divisional Secretary, Project executing/implementing agency

Source: Social Assessment and Involuntary Resettlement Compliance Manual, Road Development Authority of the Ministry of Highways and Road Development, 2009

(2) LAA Regulations in 2008

Although, LAA valuation of properties based on market value, there was a wide spread general opinion that compensation paid for land through LAA process was very much less than the prevailing market values. This had very destructive elements as public objections, distrust, and misgiving negatively affected the development process of the country.

The regulation notified by Ministry of Land and Land Development in 2008(herein after “LAA 2008 regulations”) is an attempt to resolve underpayment for land and structures.

The LAA 2008 regulations have following considerations;

- a) In case of land, when a part of land acquired, it has to be assessed considering the market value of the total land, and give proportionate value to the acquired portion.



- b) When a building is used for residence or business purpose or intended to do so, difference between the cost of re-construction and the value of building base on market value has to be paid.
- c) For paddy lands, development potential could be considered if permission to use paddy lands for development purposes is given by the Commissioner General of Agrarian services.
- d) In case of buildings occupied by tenants protected by the provisions of Rent Act, tenants will have proportion of compensation
- e) Injurious affections and severance- damages caused by any severance and injurious affection are fully paid
- f) In paying compensation, disturbances and other expenses are considered.

(3) National Environmental Act, No. 47 (1980)

These are some provisions in the NEA Act No.47 of 1980, which refers to Involuntary Resettlement. The Act stipulates the types of projects which need the approval under the terms of the NEA. The schedule includes item 12 which refers to “involuntary resettlement exceeding 100 families”.

(4) National Involuntary Resettlement Policy (2001)

Land Acquisition Act provides compensation only for land, structures, and crops and provisions are not available to address key resettlement issues to mitigate or avoid impacts on people resulting from land acquisition. In addition non titled people and other dependents on land cannot be assisted under the LAA.

To address the current gaps in the LAA in addressing the key resettlement issues such as exploring alternative project options that avoid or minimize impacts on people the government of Sri Lanka (through the cabinet of Ministers) adopted the National Policy on Involuntary Resettlement (NIRP) on the 24th May 2001. The NIRP also highlighted the need for consultation of APs and their participation in the resettlement process actively.

The basic principles of the NIRP are as followings.

- a) Involuntary resettlement should be avoided or reduced as much as possible by reviewing alternatives to the project as well as alternatives within the project.
- b) Where involuntary resettlement is unavoidable, affected people should be assisted to re-establish themselves and improve their quality of life.
- c) Gender equality and equity should be ensured and adhered to throughout the policy.
- d) Affected persons should be fully involved in the selection of relocation sites, livelihood compensation and development options at the earliest opportunity.

- e) Replacement land should be an option for compensation in the case of loss of land; in the absence of replacement land cash compensation should be an option for all affected persons
- f) Compensation for loss of land, structures, other assets and income should be based on full replacement cost and should be paid promptly. This should include transaction costs.
- g) Resettlement should be planned and implemented with full participation of the provincial and local authorities.
- h) To assist those affected to be economically and socially integrated into the host communities; participatory measures should be designed and implemented.
- i) Common property resources and community and public services should be provided to affected people.
- j) Resettlement should be planned as a development activity for the affected people.
- k) Affected persons who do not have documented title to land should receive fair and just treatment.
- l) Vulnerable groups should be identified and given appropriate assistance to substantially improve their living standards.
- m) Project Executing Agencies should bear the full costs of compensation and resettlement.

NIRP requires that a comprehensive Resettlement Action Plan (RAP) be prepared where 20 or more families are displaced. In case where less than 20 families are displaced, the NIRP still requires a RAP with lesser level of detail. NIRP applies to all projects irrespective of source of funding.

#### (5) JICA Policies on Involuntary Resettlement

Regarding the involuntary resettlement, the JICA guidelines for Confirmation of Environmental and Social Considerations (April 2010) indicates the following principles.

- It is desirable that the resettlement action plan include elements laid out in the World Bank Safeguard Policy, OP 4.12, Annex A.
- Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. When, after such an examination, avoidance is proved unfeasible, effective measures to minimize impact and to compensate for losses must be taken upon with the people who will be affected.
- People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported by project proponents etc. in a timely manner. Compensation at full replacement cost and other kinds of assistance must be provided prior to displacement. Host countries must make efforts to enable people affected by projects and to improve their standard of living, income opportunities, and production levels, or at least to restore these to pre-project levels.

Measures to achieve this may include: providing land and monetary compensation for losses (to cover land and property losses), supporting means for an alternative sustainable livelihood, and providing the expenses necessary for the relocation and re-establishment of communities at resettlement sites.

- Appropriate participation by affected people and their communities must be promoted in the planning, implementation, and monitoring of resettlement action plans and measures to prevent the loss of their means of livelihood. In addition, appropriate and accessible grievance mechanisms must be established for the affected people and their communities.
- For projects that will result in large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people
- Above principles are complemented by World Bank OP 4.12, since it is stated in JICA Guideline that “JICA confirms that projects do not deviate significantly from the World Bank’s Safeguard Policies”.

(6) Operational Policy of World Bank on Involuntary Resettlement (OP.4.12)

The JICA requests that the borrower follows the OP.4.12 of World Bank for addressing individual issues on involuntary resettlement.

The World Bank experience indicates that involuntary resettlement under development projects, if unmitigated, often gives rise to severe economic, social, and environmental risks. The policy includes safeguards to address and mitigate these impoverishment risks. Following are the key principles in the Bank’s policy on involuntary resettlement.

- a) Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project designs.
- b) Displaced persons are to be provided prompt and effective compensation at full replacement cost for losses of assets attributable directly to the project.
- c) Resettlement activities should be conceived and executed as sustainable development programs
- d) Displaced persons should be meaningfully consulted and should have opportunities to participate in planning and implementing resettlement programs.
- e) Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.
- f) The absence of a formal legal title to land is not a bar to WB policy entitlements.

- g) Particular attention is paid to the needs of vulnerable groups among those displaced, especially those below the poverty line, the landless, the elderly, women and children, indigenous peoples, ethnic minorities, or other displaced persons who may not be protected through national land compensation legislation.
- h) The full costs of resettlement activities necessary to achieve the objectives of the project are included in the total costs of the project.
- i) Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey.
- j) Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based.

(7) Existing Gaps of Sri Lankan Laws and JICA Policies (WB.OP.4.12)

Regarding the approach to land acquisition and payment of compensation, although the WB.OP.4.12 and NIRP are more or less similar, there are differences when compared with the LAA and WB.OP.4.12. The Legislative Gap Analysis between the GOSL Laws/Policies and the WB.OP.4.12 are shown in the Table 13.2.8.

**Table 13.2.8 Legislative Gap Analysis between the GOSL Laws/Policies and the WB.OP.4.12**

Aspect	GOSL Laws/Policies	WB.OP.4.12	Measures to Bridge the GAP
Requirement of a RAP	<ul style="list-style-type: none"> <li>• Does not require under the LAA, NIRP requires that a comprehensive RAP for projects exceeding displacement of more than 20 families.</li> <li>• A project affecting 100 families is considered as a prescribed project under the NEA.</li> </ul>	<ul style="list-style-type: none"> <li>• RAP is required for the project exceeding displacement of more than 200 people.</li> </ul>	<ul style="list-style-type: none"> <li>• Project Management Unit (PMU) for the Project follow the NIRP which spell out the type of RAP to be prepared.</li> </ul>
Minimizing involuntary resettlement with exploring alternative project designs	<ul style="list-style-type: none"> <li>• Does not require under the LAA, NIRP requires to avoid involuntary resettlement by reviewing alternatives</li> </ul>	<ul style="list-style-type: none"> <li>• Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project designs</li> </ul>	<ul style="list-style-type: none"> <li>• PMU follow the NIRP and OP.4.12 indicated in the RAP</li> </ul>
Encouragement of compensation of "land for land" base	<ul style="list-style-type: none"> <li>• Replacement land should be an option for compensation in the case of loss of land; in the absence of replacement land, cash compensation should be an option for all affected persons.</li> </ul>	<ul style="list-style-type: none"> <li>• Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based.</li> </ul>	<ul style="list-style-type: none"> <li>• PMU follow the NIRP and OP.4.12 indicated in the RAP</li> </ul>
Compensation for non-title holders	<ul style="list-style-type: none"> <li>• LAA consider only titleholders and tenants protected under Rent Act 1972</li> <li>• NIRP policy principles states that affected persons who do not have documented titles to land should receive fair and just treatment.</li> </ul>	<ul style="list-style-type: none"> <li>• The entitlements will be provided to those who have no-title for the land or structures in the project area prior to the cut-off date for eligibility or resettlement assistance.</li> </ul>	<ul style="list-style-type: none"> <li>• Project Management Unit (PMU) for the Project follow the NIRP Entitlement matrix is a part of RAP</li> </ul>

Aspect	GOSL Laws/Policies	WB.OP.4.12	Measures to Bridge the GAP
Consultation with stake holders	<ul style="list-style-type: none"> <li>Does not require under LAA, it is a requirement under NIRP,</li> </ul>	<ul style="list-style-type: none"> <li>Consultation is required with displaced persons (Same as NIRP)</li> </ul>	<ul style="list-style-type: none"> <li>PMU follow the NIRP and OP.4.12 indicated in the RAP</li> </ul>
Participation of PAPs to planning, implementation and monitoring of involuntarily resettlement	<ul style="list-style-type: none"> <li>Does not require under LAA, the full participation of the provincial and local authorities in the planning and implementing process is a requirement under NIRP ,</li> </ul>	<ul style="list-style-type: none"> <li>Participation of PAPs to planning, implementation and monitoring of involuntarily resettlement is encouraged.</li> </ul>	<ul style="list-style-type: none"> <li>PMU follow the OP.4.12 indicated in the RAP</li> </ul>
Identification of affected people through initial baseline survey	<ul style="list-style-type: none"> <li>No stipulation for the Identification of affected people through initial baseline survey</li> </ul>	<ul style="list-style-type: none"> <li>Identification of affected people through initial baseline survey is required.</li> </ul>	<ul style="list-style-type: none"> <li>PMU follow the OP.4.12 indicated in the RAP</li> </ul>
Cut-off date	<ul style="list-style-type: none"> <li>No stipulation for the cut-off date</li> </ul>	<ul style="list-style-type: none"> <li>The establishment of the eligibility cut-off date is required.</li> </ul>	<ul style="list-style-type: none"> <li>PMU follow the OP.4.12 indicated in the RAP</li> </ul>
Public disclosure including RAP	<ul style="list-style-type: none"> <li>LAA statutorily imposes all communication to be publicly announced through legal notifications in print media, and through GN officers</li> <li>Provided in the NEA If the project is subject to an IEE or EIA, the report should be available for the information of the public or public comments respectively.</li> <li>No stipulation on the public release of RAP is found.</li> </ul>	<ul style="list-style-type: none"> <li>Public disclosure is required</li> </ul>	<ul style="list-style-type: none"> <li>RAP will be disclosed to the public and will be available in the web site of RDA and JICA.</li> <li>The entitlement matrix will be translated in local language and distributed to PAPs.</li> </ul>
Income Restoration	<ul style="list-style-type: none"> <li>LAA regulation 2008 has considerations for transition period, like paying expenses for finding alternative accommodation etc and other payments for disturbances</li> <li>NIRP Provides. Income should be restored and livelihood be re-established and standard of living improved.</li> </ul>	<ul style="list-style-type: none"> <li>Income should be restored</li> </ul>	<ul style="list-style-type: none"> <li>PMU follow the NIRP and OP.4.12 indicated in the RAP</li> </ul>
Taking over possession before Payment of compensation	<ul style="list-style-type: none"> <li>LAA provide, NIRP does not allow</li> <li>RDA's customary practice is not to remove APs before paying compensation and other concessions.</li> </ul>	<ul style="list-style-type: none"> <li>Does not allow</li> </ul>	<ul style="list-style-type: none"> <li>PMU follow the NIRP and OP.4.12 indicated in the RAP</li> </ul>
Grievance Redress Mechanism	<ul style="list-style-type: none"> <li>LAA has provisions for formal appeals in the country's legal system.</li> <li>Establishment of a project based GRM is an explicit objective of NIRP.</li> </ul>	<ul style="list-style-type: none"> <li>Requirement under the OP.4.12</li> </ul>	<ul style="list-style-type: none"> <li>Provided in the RAP</li> </ul>
Replacement Cost	<ul style="list-style-type: none"> <li>LAA new regulations (2008) have provisions</li> <li>Provided in the NIRP</li> </ul>	<ul style="list-style-type: none"> <li>The borrower will compensate them for the loss of assets other than land such as dwellings and also for any other improvements to the land at the full replacement cost.</li> </ul>	<ul style="list-style-type: none"> <li>Project will follow the NIRP and entitlement matrix provided in the RAP.</li> </ul>

Aspect	GOSL Laws/Policies	WB.OP.4.12	Measures to Bridge the GAP
Assistance for vulnerable people	<ul style="list-style-type: none"> <li>• LAA is silent on this aspect. NIRP require special treatment for the vulnerable groups.</li> </ul>	<ul style="list-style-type: none"> <li>• OP.4.12 requires a special assistance for the vulnerable people.</li> </ul>	<ul style="list-style-type: none"> <li>• Provision is available in the RAP.</li> </ul>

Source: JICA Survey Team based on the LAA, NIRP and WBOP.4.12

### 13.2.3 Institutional Arrangement

#### (1) General

The Land Division (LD) of RDA headed by a director is the main division that deals with land acquisition and payment of compensation as per the RAP. However, under certain conditions Project Management Units (PMUs) responsible for specific projects are entrusted to carry out land acquisitions related to their projects in consultation with LD, to expedite the land acquisition process. It is therefore necessary that PMU effectively and efficiently coordinate with these agencies, so that land acquisition and involuntary resettlement activities are carried out properly and expeditiously.

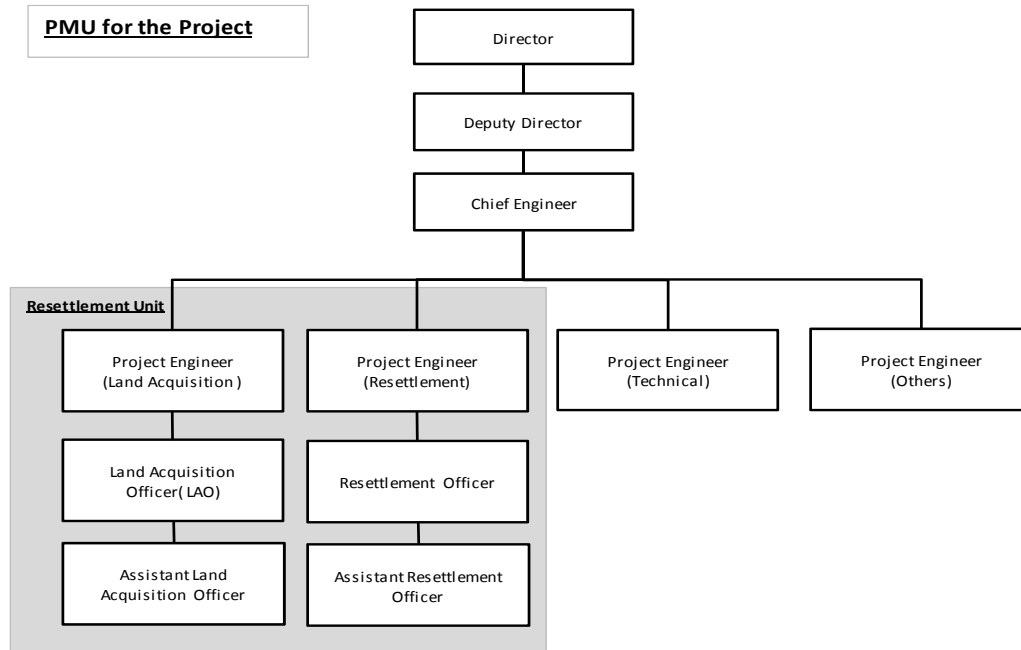
Presently, the Chief engineering office (CEO), Colombo, in addition to its normal work, has been attending to the Preparatory Survey as a counterpart of the JICA Survey Team. In the near future, the CEO will face the serious capacity issues with increase of Project work. In order to handle the Project work after establishment of the loan agreement with JICA, the PMU for the Project will be established. The tasks which are conducted by the CEO will be shifted to the newly established PMU.

#### (2) RDA

##### 1) Project Management Unit (PMU) for the Project

The responsibility of implementing the RAP will rest with the RDA, and its direct responsibility lie with the PMU established for implementation of the Project. The resettlement unit (RU) will be established in the PMU under Project engineer. The LD assigns staff to the PMU as Land acquisition officer (LAO) and assistant LAO to be entrusted with day-to-day monitoring and implementation of projects' land acquisition and resettlement activities.

The organization of the PMU including RU is as shown in the Figure 13.2.2.



Source: JICA Survey Team, 2013

**Figure 13.2.2 Organization Chart of PMU**

2) Environmental and Social Division (ESD)

The ESD oversees land acquisition and resettlement planning and monitoring implementation of safeguards compliance under various RDA projects. In the absence of skills and expertise in most PMUs, the ESD provides the necessary expertise to the respective PMU. ESDD assist all projects in RDA currently to maintain land acquisition database.

(3) Divisional Secretaries (DS)

After approving proposed land acquisition by MLLD, DS initiates land acquisition process as per the RAP until possession of land taken as the acquisition officer. In the RAP implementation, DS is an important position as the coordinator of all development programs in the division. Information available at DS office could be used to verify AP profiles with regard to their encroacher, tenant or lessee situation, vulnerability, income levels, employment etc.

(4) Survey Department

In the land acquisition process, Survey Department has a statutory role as per the RAP to survey land and prepare survey plans. On the formal request issued by acquisition officer (DS), Survey Department conducts survey on the lands and prepared survey plans and the list of persons claiming ownership for land/structures.

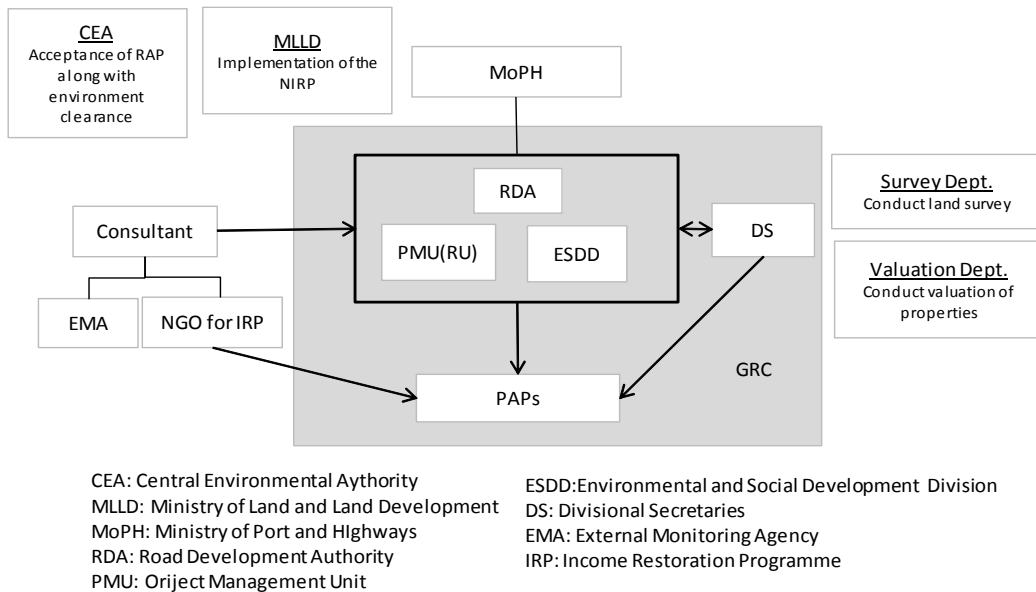
(5) Dept. of Valuation

On the request of acquisition officer of DS, Valuation Department assigned their staff to value properties to be acquired and report to acquisition officers through Chief Valuer. The Chief Valuer endorses the results of the valuation as the statutory commitment of the Department of Valuation.

(6) RAP Approval Process

The Ministry of Ports and Highways (MOPH) is the national agency responsible for approving RAPs prepared for road development projects of RDA. Although NIRP has assigned approval of RAPs to CEA in its section on 'Institutional Responsibilities', this has to be taken as an implicit approval rather than a formal approval by CEA.

The RAP implementation mechanism for the Project is shown in the Figure 13.2.3.



Source: JICA Survey Team, 2013

**Figure 13.2.3 RAP Implementation Mechanism**

**13.2.4 Eligibility**

(1) Basic Principles of the RAP

As shown in the Table 13.2.8, the WB.OP.4.12 and NIRP are more or less similar in terms of the approach to land acquisition and payment of compensation. Therefore, the RAP for the Project will be prepared based on the NIRP.



(2) Cut-off Date of Eligibility

The cut-off-date of eligibility refers to the date prior to which the occupation or use of the project area makes residents/users of the same eligible to be categorized as PAP and be eligible to Project entitlements. The establishment of the eligibility cut-off date is intended to prevent the influx of ineligible non-residents who might take advantage of Project entitlements.

For this Project, the cut-off date was discussed at “DS Level Awareness Creation Meeting” held in the related DS offices from 8th to 10th April before the commencement day of the socioeconomic survey.

The chief engineering office of RDA issued the request letter to the related DS offices to declare “Cut –off date” based on the results of the meeting.

**Table 13.2.9 Cut-off Date in Each DS**

Divisional Secretary	Date
Kolonnawa Divisional Secretary Division	8 April 2013
Colombo Divisional Secretary Division	9 April 2013
Kelaniya Divisional Secretary Division	10 April 2013

Source: JICA Survey Team, 2013

Based on the request, each DS issue an official announcement in local language on the cut-off date for the Project. The official announcement was posted at DS offices and GN offices.

It is indispensable to conduct systematic and continuous dissemination of “Cut-off date” for prevention of further population influx into the Project area.



Source: JICA Survey Team

**Figure 13.2.4 Posting of cut-off date notice at Kelaniya DS Division**

(3) Replacement Cost Survey

Replacement costs are the method of valuation of assets which helps determine the amount sufficient to replace lost assets and cover transaction costs. In applying this method of valuation, depreciation of structures and assets should not be taken into account.

The replacement cost survey (RCS) was carried out in parallel with Socio-Economic Survey and IOL surveys during May 15<sup>th</sup> and 16<sup>th</sup> June 2013.

The RCS team consisting of the member of JST and local RAP consultants tried to obtain the information of replacement cost for land and structure from Dept. of Valuation. Based on the official request by RDA, the preliminary discussion with the responsible person of the Department was made on 15th May 2013.

At the meeting, it was revealed that at this level of operations (Feasibility study), actual valuation values can't be taken from the Dept. of Valuation without an official request made under LAA.

#### 1) RCS for Land Value

Land values for the in the area was obtained from two real estate and property developers. One company which did not wish to reveal their company name indicated the land value for Orugodawatta(Kolonnawa DS) as Rs.1, 600,000/Perch. And the information from other company being "Prime Lands" is as shown in the Table 13.2.10.

**Table 13.2.10 Land Value for Each GN**

Location	Residential	Commercial
Orugodawatta	390,000-650,000	
Bloemandal	750,000-10,500,000	1,600,000 – 2,200,000
Wadullawatta /Sedawatta	650,000 – 850,000	1,000,000 -1,600,000

Source: JICA Survey Team, 2013

In order to obtain land values for Peliyagoda Gangabada East, the RCS team did a study on paper advertisements on real estate where land values with acreage. According to the information, the referential land value in Kelaniya DS considered as Rs.4,000,000 - 5,700,000/perch. The advertised selling value seemed to be considerable expensive because the land is suitable for business.

The RCS team also made informal references to land acquisition of CKE (especially close to Peliyagoda Gangabada East) which revealed a land value of about Rs. 800,000 /perch.

Then the RCS team visited the Grama Niladaris of respective GNDs to obtain their data of land values. The land values stated by the GNs are based on the actual transaction in the area as listed below.

**Table 13.2.11 Land Values Stated by the GNs**

GN Division	Minimum land value (LKR/ perch)	Maximum land value (LKR/ perch)
Peliyagoda Gangabada east	550,000	1,500,000
Bloemandhal	800,000	1,650,000
Nawagampura	900,000	1,500,000
Grandpass	900,000	1,500,000
Orugodawatta	850,000	1,600,000
Sedawatta	750,000	1,000,000
Wadullawatta	750,000	1,000,000

Source: JICA Survey Team, 2013

The RCS team made sure that these values were checked with the three divisional secretaries; 1) Colombo, 2) Kolonnawa and 3) Kelaniya. Their interpretation on tentative land values were more or less the same to the values stated by GNs. However, they indicated that the commercial land values may be 5-10% more than the average residential land values of the area.

Finally the RCS team prepared replacement cost for residential and commercial land with comprehensive considerations into the results of the RCS as shown in the Table 13.2.12.

**Table 13.2.12 Land Value in Project Area based on RCS**

Location / GN Division	Land value obtained in the RCS(LKR/Perch)		Average value (LKR.)	Value of commercial land (LKR)
	Minimum	Maximum		
Peliyagoda Gangabada east	850,000	1,100,000	975,000	1,073,000
Bloemandhal	1,000,000	1,250,000	1,125,000	1,237,000
Nawagampura	1,000,000	1,250,000	1,125,000	1,237,000
Grandpass	1,000,000	1,250,000	1,125,000	1,237,000
Orugodawatta	950,000	1,250,000	1,100,000	1,210,000
Sedawatta	750,000	1,000,000	875,000	963,000
Wadullawatta	750,000	1,000,000	875,000	963,000

Source: JICA Survey Team, 2013

## 2) Rates for calculation of approximate replacement cost of affected structures

The types of buildings are broadly categorized to 5 types based on the construction materials used and the quality of construction. Irrespective of the current facilities the replacement structure was assumed to have basic facilities such as electricity, water and a proper toilet. A 20 ft X 15 ft (300 sq. m) building was considered and the cost was calculated using the Building Schedule of Rates (BSR) of the Engineering Organization of the Western Provincial Council, 01.08.2010. The rate per sq. meter was then calculated and adjusted upwards by 20% to obtain 2013 rates.

The Table 13.2.13 shows rates to be used for preparing the resettlement budget.

**Table 13.2.13 Structural Values Estimated by Private Property Developers**

Structure Type	Material	Unit	Amount (LKR)
Type 1	Asbestos, tiled or concrete roof, Brick wall with plaster, Tile or terrazzo floor, wooden doors and windows, Ceilings	Square meter	33,000
Type 2	Asbestos or tiled roof, Brick or wall with plaster, Cement floor, wooden doors and windows	Square meter	29,000
Type 3	Tin sheet roof, Brick or cement block wall with plaster, Cement floor, Doors and windows wood or plastic	Square meter	20,000
Type 4	Tin sheet roof, Brick or cement block wall without plaster, Cement floor, Doors and windows wood or plastic	Square meter	17,000
Type 5 (Other)	Tin sheet or cadjan roof, Wood plank walls, Cement or mud floor, Doors and windows plastic or other material	Square meter	16,000

Source: JICA Survey Team, 2013

#### (4) Entitlement Matrix

The project entitlements were developed and presented in the entitlement matrix corresponding to the potential impacts identified during the census, socio-economic survey and inventory of loss survey.

The summary of the type of loss in the matrix is shown in the Table 13.2.14.

**Table 13.2.14 Summary of the Type of Loss**

Type of Loss		Entitled Persons
<b>A. Residential Land and Structures</b>		
A1	Loss of residential land and structure	Titled owner with deeds
A2	Loss of residential land and structure	Non Titled owner
A3	Loss of residential land and structure	Sub family
<b>B. Commercial Land and Structures</b>		
B1	Loss of commercial land and structure	Titled owner with deeds
B2	Loss of commercial land and structure	Non Titled owner
B3	Loss of business	Affected business owners with registration for business(regardless of the ownership of land)
B4	Loss of business	Affected business owners without registration for business(regardless of the ownership of land)
B5	Loss of business	Tenant of the affected commercial structure with registration for business
<b>C. Rental Accommodation</b>		
C1	Loss of rental accommodation	Person renting in a residential structure owned by a titled owner

Type of Loss		Entitled Persons
<b>D. Other Private Properties or Secondary Structures</b>		
D1	Partial or complete loss of other property or secondary structure	Owners of structures (regardless of the ownership of land)
<b>E. Loss of Income of Employees or Hired Labourers</b>		
E1	Loss of Income of Employees or Hired Labourers	People losing wage employment
<b>F. Trees with Timber Value and Standing Crops</b>		
F1	Loss of crops, fruit trees and trees with timber value	Person who cultivates crops and/or owns trees (regardless of the ownership of land)
<b>G. Livelihood Restoration and Rehabilitation Assistance</b>		
<b>G1. Materials Transport Allowance</b>		
G1.1	Materials Transport Allowance	APs reorganizing or rebuilding residential / commercial structures on site
G1.2	Materials Transport Allowance	Households or business owners who will be relocated (regardless of the ownership of land)
<b>G2. Transition Subsistence Allowance</b>		
G2	Transition Subsistence Allowance	Each member of severely affected household
<b>G3. Livelihood Restoration (Grant and Training)</b>		
G3	Livelihood restoration assistance	Household having permanent effect on livelihood (those who are resettled, loose job, etc.)
<b>H. Special Assistance/ Allowances</b>		
H1	Special Assistance / Allowances for Vulnerable APs	Households having vulnerable APs
<b>I. Community Assets</b>		
I1	Loss of small scale community buildings and other structures such as shrines, temples, Kovils etc.	DS, urban ward, local community or local authority owning or benefiting from community property. Chief priest of the religious place.
I2	Loss of local infrastructure	DS, urban ward, local community or local authority owning or benefiting from community property.
I3	Shifting of common resources	Utility agency who owns the facility
<b>J. Unanticipated Adverse Impacts</b>		
J1	Any unanticipated adverse impact due to project intervention	

Source: JICA Survey Team, 2013

#### (5) Income Restoration Program (IRP)

The National Involuntary Resettlement Policy (NIRP), World Bank OP.4.12 and JICA guidelines on resettlement recognizes the need for re-establishing livelihoods of displaced persons and improving their standard of living; avoiding impoverishment of people as a result of compulsory land acquisition for development purposes; and providing livelihood compensation and development options at the earliest opportunity to APs.

## 1) Strategies of Livelihood and Income Restoration

There are different types of livelihood and income restoration strategies as followings.

- a) Cash-based assistance: Cash-based assistance is primarily a short-term strategy. It could take different forms according to the context within which it is applied.
- b) Land-based assistance: A land-based income restoration strategy can either be a short term or a long-term strategy. A long-term strategy will include providing of replacement land or assistance to purchase new land.
- c) Non-land based assistance: A variety of assistance can be provided to APs under a non-land based income restoration strategy which is usually a long-term strategy. It could provide technical and vocational skills development training; access to micro-finance; business development support services such as assistance for product development and quality improvement, business planning, financial management and accounting; support for accessing markets; and placements in suitable employment in both government and private sector.

## 2) Livelihood and income restoration Program for the Project

### IRP for labours and self-employed persons

The income restoration programs (IRP) for them will be conducted as follows.

- The NGO will be hired by the Consultant after establishment of L/A for the Project
- PMU/RDA with assistance of the NGO will carry out the preference survey of the AHs in terms of contents of the program and establish the detailed IRP based on the results of the updated RAP. The IRP will be undertaken based on the detailed IRP.

### Assistance for Vulnerable Persons

There are 102 vulnerable HHs among 395 household heads, representing 24.3% of the total number of family heads. These vulnerable people receive a special restoration allowance once in addition to other entitlements. In addition to this, PMU will support them to prepare for land acquisition inquiries and other assistance they need for smooth transition. PMU will maintain close contact with vulnerable populations throughout the project implementation.

## **13.2.5 Resettlement Measures**

The NIRP indicates that “Replacement land should be an option for compensation in the case of loss of land; in the absence of replacement land cash compensation should be an option for all affected persons.” In order to ensure the principle, it is necessary to consider the mechanism for providing relocation site for all AHs.

(1) Basic Information Resulting From SES

According to the results of SES, No. of affected households and populations are 449HHs and 1,915 and out of 449 AHs, 359 HHs are untitled holders and 46HHs are titleholders.

(2) Issues

The 46 title holders will be compensated for their land and structures by way of cash compensation.

As per the entitlement matrix for the project, the non-title holders are not eligible for land compensation but they are entitled for receiving compensation for their affected structures.

This means that the non-title holders have nowhere to go without any cash compensation for land or provision of alternative land even if they receive compensation for affected structures.

Therefore, the Project Executing Agency (RDA) will take all efforts to provide cash and land based resettlement assistance to Aps.

In addition, the SES revealed that following large scale buildings belong to Government Agencies/Institutes and Centres of Worship will be severely affected. Considering the magnitude of the impact, the relocation of these structures is not avoidable.

**Table 13.2.15 No. Government Agencies/Institutes and Centres of Worship**

Structures	Magnitude of Impact
Atomic Energy Authority	The entire building is affected.
Automobile Training Institute under National Apprentice and Industrial Training Authority (NAITA)	The main workshop is affected.
Kovil(Hindu Temple)	Around 40% of the structure will be affected

Source: JICA Survey Team, 2013

(3) Proposed Compensation Package

The methodologies for relocation of AHs have been discussed with stakeholders at length. RDA has considered three options for the relocation, i.e. (i) cash compensation, (ii) providing a plot of land at Attidiya and (iii) providing housing unit from the UDA housing projects closer to the current settlements. The option of providing a plot of land from Attidiya was dropped as this will result in relocating the affected people in a distant place and they will find difficulties in carrying out their livelihoods as well as the schooling of the children.

Consequently RDA prepared the proposal on the compensation policy mainly consisting of two options as following.

1) Relocation for AHs (Potential Relocation Scheme for AHs)

(a) Self-Relocation (Option 1)

RDA will pay to PAPs compensations for “self- relocation” as detailed in the compensation policy in addition to the compensation for land and structures they are entitled in accordance with the relevant legislation and other government policy. Note that the compensation cost for land and structures calculated in the RAP was based on the replacement cost survey done in the process of RAP preparation.

The compensation policy has identified different schemes for title holders and non-title holders. The entitlements will also vary depending on whether the premises are residential or commercial.

For commercial premises only option considered is cash compensation for self relocation as the Government does not have any projects which provide commercial space.

(b) Housing unit from the UDA housing schemes (Option 2)

The affected residents will have the option of moving to housing unit built by the UDA close to the project site as part of the “Urban Regeneration Project”. RDA will transfer part of their land at Attidiya to UDA as payment to UDA and also make the APs relocation entitlements and allowances direct to UDA as initial payments towards the housing unit.

(c) Public Meeting for Establishment of Basic Agreement on the Compensation Policy with Stakeholders

A public meeting with stakeholders was organized and held at the Sri Lanka Foundation Institute on 28<sup>th</sup> September 2013 and attended by a majority of the affected people, Elected Representatives at National and Provincial Levels relevant to the project area, Project Minister for Ports and Highways, Secretary to the Ministry of Ports and Highways and Officials from RDA, Valuation Department and other relevant agencies. Representatives from JICA office in Colombo were also invited and attended this meeting.

The basic agreement on the compensation policy with related community was established through the discussion at the meeting. Note that this policy will need approval of the Cabinet of Ministers before being adopted.



2) Relocation of Government Agencies/Institutes and Kovil

(a) NAITA

The part of the workshop of NAITA will be affected by the Project. It was decided to relocate them to the part of the land of “Vocational Training Center”. The area of Vocational Training Center consisting of training facilities, accommodation for students, canteen and so on is approximately 6 acres.

RDA has entered in to a Memorandum of Understanding with National Apprentice and Industrial Training Authority (NAITA), the institution to be relocated, and The Vocational Training Authority (VTA), the institution providing the land for relocation. The location of the relocation site is shown in Figure 13.2.5. The cost of reconstruction and relocation of NAITA is LKR 850 million. The breakdown of the cost is shown in the Table 13.2.16.

**Table 13.2.16 Relocation of NAITA**

Items	Amount(LKR)
Building Construction	778,945,000
Relocation of Machinery	13,970,000
Miscellaneous	60,400,000
Total Cost	853,315,000
(Rounded)	850,000,000

Source: JICA Survey Team

The source of funds will be GOSL and it is proposed to construct the necessary facilities before the facilities existing structures are demolished so that there will be minimal disturbance to the students and trainees.



Source: RDA

**Figure 13.2.5 Location of the Relocation Site for NAITA**

(b) Relocation of Kovil (Hindu Temple)

A focus group meeting regarding the relocation of the Hindu Kovil was held on 19th July 2013 at the Kalibadra Amman Hindu Kovil premises attended by all devotees of the surrounding area. At this meeting it was decided not to shift the Kovil to any new premises but retain the balance portion after renovating. The Minutes of the Meeting is referred to Appendix 6.

The chief priest of the Kovil issued the official letter to RDA to express agreement for the arrangement on 24th July (referred to Appendix 7).

The cost for the reconstruction of the Kovil is approximately LKR 13million as shown in Table 13.2.17. Actual rehabilitation assistance will be based on the valuation by the Chief Valuer and will be met from GOSL funds. Since only about 40% of the structure is affected the Kovil can be rehabilitated in the balance premises. It is proposed to release funds progressively during construction to the legal entity in charge the Kovil.

**Table 13.2.17 Reconstruction Cost for KOVIL**

Items	Original Cost for new Kovil	Reconstruction Cost
Cost of new building and services	LKR. 16,907,510	LKR 8,453,755
Cost of New statue moulding	LKR. 20,591,700	LKR 4,118,340
Total cost for reconstruction		LKR 12,572,095

Source: JICA Survey Team

(c) Atomic Energy Authority (AEA)

The Atomic Energy Authority (AEA) is affected by the construction of Kelanithissa Junction. The buildings of AEA and radioactive materials stored in AEA must be relocated, since it is difficult to change the location of Kelanithissa Junction.

Outline of AEA

- Outline of organization -

- Enforcement: Established by the Atomic Energy Authority Act No.19 of 1969
- Major Work: Promotion of peaceful applications of nuclear technology conforming to international standards on radiation safety and security
- Responsible Ministry: Ministry of Technology Research and Atomic Energy
- Location: Orgodawatta ,Wellampitiya

- Number of Staff -

- 80 (As of end of 2010 citing from Annual Report and Organization Chart)

**Table 13.2.18 Divisions and their Work in Charge**

No.	Division	Work in charge
1	R.P (Radiation Protection) & Regulatory	Implementation of regulations of radiation protection and licensing and inspection for facilities where radiation is used.
2	General Scientific Service	Management of radiation monitoring devices. Monitoring of radiation environment in Sri Lanka.
3	Life Sciences	Provision of Analytical Services to Customers, R&D.
4	NCNDT	Non-Destructive Testing (NDT). Preparation for establishment of National Center for NDT (NCNDT).
5	Industrial Applications	Provision of radiation processing services.
6	MGIF (referred as Radiation Processing Section in Annual Report)	Management of Multi-purpose Gamma Irradiation Facility (MGIF) to be built in Biyagama, the Export Processing Zone.
7	International Cooperation	To liaise with International Atomic Energy Agency (IAEA)..

Source: AEA

- Equipment List -

- Equipment lists of the AEA are shown in Appendix 8.

How Radioactive Materials Are Stored

- The radioactive materials that AEA now stores are shown in Appendix 9. They are radioactive wastes originated from medical, research and industrial use. No wastes from power generation and military use are stored.
- All radioactive materials are stored in the storage facility which is situated inside the AEA's premise. Radiation dose at the right front of the storage is 0.28 $\mu$ Sv per hour, which is below the standard value for tolerance dose regulated in Sri Lanka. The Japanese standard value for tolerance dose regulated by Ministry of Environment of Japan is set 0.23 $\mu$ Sv per hour estimating 8 hours daily outdoor for 365 days. Conversion of 1mSv per year. Although the value exceeds the Japanese standard, it meets the Sri Lankan standard (0.5 $\mu$ Sv per hour, 1.0mSv per year).
- Radioactive materials are stored in storage cell with containers which is placed in the storage room of the storage facility (see Figure 13.2.6, Figure 13.2.7). These containers are made from lead and kept in hollow shape concrete. In this way, double wrapped structure for sealed containers in the storage is adopted to prevent radioactive materials from diffusing to its surrounding. At this moment, there are no radioactive materials except for waste are stored in the storage room where radiation level is 7.9 $\mu$ Sv per hour.

- Spent radioactive materials are stored in containers in storage room in storage facility (see Figure 13.2.8). Radiation dose was 16 $\mu$ Sv per hour at the room door of the storage room, 75 $\mu$ Sv per hour at the right above the container.



**Figure 13.2.6 Storage Facility**



**Figure 13.2.7 Storage Container**



**Figure 13.2.8 Inside Storage Facility**

### Relocation Site

- AEA will be relocated to a site within the Information Technology Park in Malabe provided by the Urban Development Authority. RDA is in the process of entering into a Memorandum of Understanding (MOU) with AEA for the relocation the facilities. The area proposed covers an area of 3 acres (1.2 Ha.) and is barren land. There are no houses or buildings in the vicinity.
- Other Institutions already established at the IT Park include Neville Fernando Sri Lanka Russia Friendship Teaching Hospital, CINEC Maritime Campus of the Colombo International Maritime Engineering College and South Asian Institute of Technology and Medicine.
- A location map is shown in Figure 13.2.9. A survey plan of the area prepared by the Department of Surveys is shown in Figure 13.2.10. Photographs of the field visit are given in Figure 13.2.11 and Figure 13.2.12.



Figure 13.2.9 Location of the Relocation site for AEA in Malabe





**Figure 13.2.11 Photo of Field Visit (1)**



**Figure 13.2.12 Photo of Field Visit (2)**

#### Facilities after Relocation

- As for facilities after relocation, likewise the existing facilities, office building, laboratory, and storage facility for radioactive wastes are to be constructed in the relocation site. The storage facility for radioactive wastes will conform to Atomic Energy Regulations No.1-O-1999, in which the facility clear all requirements pertaining to storage process, thickness of concrete, distance to boundary of the premise. Provisions for newly build facilities conform to “Reference design for a centralized spent sealed sources facility (IAEA 1995)” and “Reference design for a centralized waste processing and storage facility (IAEA 1994).



- All existing radioactive wastes stored in AEA are to be transferred to the newly constructed storage facility. Radioactive wastes after transfer will be properly managed in accordance with “Atomic Energy Authority Act of 1969” and “WS-G--6.1. Storage of Radioactive Waste” by IAEA.
- Domestic laws or regulations setting standard value for annual space radiation dose at normal period outside the premise are 1mSv per year. The standard value set by International Commission on Radiological Protection (ICRP) is also 1mSv per year. At the boundary of the premise the standard value will be cleared.
- At the relocation site any effluents containing radioactive materials will not drain outside of the premise. Final disposal of radioactive materials will not be carried out as well.

#### Methods of Transportation of Radioactive Materials

- Transportation of the materials will appropriately be carried out by AEA in accordance with the IAEA standard. Special security arrangements will not be required for the transportation. Domestic laws/ regulations require special security arrangements at transport when the amount of radioactivity is more than 10,000 curie. Since AEA facilities only contain less than 5 curie, no special security arrangement is required for the transportation.
- Regarding the transportation of the materials, in addition to domestic laws or regulations, IAEA's "TS-R-1 Regulation for the Safe Transport of Radioactive Material 2009" will be applied.

#### Demolition of Existing Facility

- Radioactive materials are stored in double encapsulated seal sources and are not emitted outside of sources. As the materials are strictly managed by AEA, it is unlikely that radioactive materials adhere to the buildings and facilities in AEA. Therefore on the demolition of the existing facilities, generation of radioactive waste will not be expected.
- Before demolition of existing facilities, AEA will survey contamination at existing facilities. Survey includes background radiation level outside area of facilities and radiation tests of existing soil and building materials of the storage facility as well as other facilities, to compare those values with the ones after demolition to check contamination. Only after the confirmation of safety from result of survey will allow AEA to transport radioactive materials.

- If no contamination is found by the survey, scrap from demolition will be disposed to dumping sites selected by contractor on approval from municipal government in charge.
- If contamination is found by the survey, in accordance with "Handling conditions and Storage of spent sealed radioactive sources (IAEA 2000)", decontaminate it in accordance with IAEA. After decontamination the materials as radioactive wastes are stored in the storage of AEA in accordance with IAEA's "WS-G--6.1. Storage of Radioactive Waste". Also water and chemicals used for decontamination will be treated as radioactive wastes and stored in the storage of AEA.
- For the site after demolish, AEA will conduct a survey for soil contamination. If the soil is found to have radioactive dose more than standard value, AEA will decontaminate the soil and water used for decontamination and treat them as radioactive wastes and store them in the storage of AEA in accordance with procedures suggested by IAEA's standard.

#### Relocation Schedule

- Confirmation of relocation site: by 30th Oct. 2013
- Design: July 2014 to December 2014
- Construction: July 2015 to June 2016
- Completion of facilities: June 2016
- Relocation: August 2016 to September 2016
- Survey at demolition and after demolition: October 2016 to November 2016

#### Necessity of EIA for Relocation of AEA

Central Environmental Authority in Sri Lanka (CEA) confirmed that according to Sri Lankan laws it is not necessary to conduct an Environmental Impact Assessment (EIA) pertaining to relocation of AEA including construction of new facilities in the relocation site and demolition of existing facilities.

#### Relocation Cost

The relocation cost estimated is LKR 500 million. Breakdown of the cost is shown in Table 13.2.19.

**Table 13.2.19 Relocation Cost for AEA**

	Year	Book Value (LKR)	Current Cost
Land Value	1996	9,800,000.00	Land to be provided
Buildings	2001	100,000,000.00	389,597,599.25
Specific Structures	2001	25,000,000.00	97,399,399.81
Machinery Equipment	2008	5,000,000.00	Existing machinery to be shifted
Cost of Relocation mf Machinery and Equipment			4,000,000.00
Total Replacement Cost			490,966,999.07 -> 500 million

Source: JICA Survey Team

### Conclusion

From the description aforementioned, radioactive materials that AEA possesses are used for medicals, research and industrials with limited small amounts, it is not anticipated that adverse impact on environment and society as relocation of AEA facilities will be conducted in accordance with domestic law and regulations which conform to international standards suggested by IAEA and ICRP.

However, the surveys, investigations and other procedures required for demolition and relocation of AEA facilities and transportation of radioactive materials must be carried out in accordance with domestic and international laws/regulations/standards in the detailed design and construction stages.

#### (4) Relocation of other Public Utilities and Payment for disturbance

RDA will meet the relocation cost of all public utilities destructed, while respective state agencies that are specialized in such functions undertake construction/relocation responsibility of them under PMU's monitoring to ensure continuation of such utilities.

#### (5) Environmental Protection and Management

The project is located within the flood plain of Kelani River and a lot of man made changes have modified the natural environment in the area. RDA has conducted environmental impact assessment (EIA) Study including environmental protection and management plan.

### **13.2.6 Community Participation**

Information dissemination, consultation and participation process involved with APs and other stakeholders maintained transparency throughout the RAP process. This openness reduces potential conflicts; minimize risk of project delays and help RDA/PMU to formulate resettlement and rehabilitation to suit the needs of APs.

(1) 1<sup>st</sup> Stakeholder Meeting

This series of meetings commenced first with the national level stakeholder information sharing meeting held on 25th March 2013 at Sri Lanka Foundation Institute, Independent Square, Colombo 7. The summary of the discussion is as shown in the Table 13.2.20.

**Table 13.2.20 Summary of the Discussion**

Comments and/or Questions	Replies by RDA Officials	Points reflected to the RAP
<ul style="list-style-type: none"> <li>• I am often asked by local people about the compensation package for land acquisition applying to this Project.</li> <li>• Most of the people living in Wadullawatte are working in Pettah, Colombo, so they hesitate to move to remote place from the original location.</li> <li>• There should be some action to preserve the acquired land for the project. If not people will encroach the acquired site according to past experience</li> <li>• Also the people ask about the width of the affected areas for the road Project in terms of land acquisition?</li> </ul> <p>(GN of Wadullawatte of Kolonnawa DS.)</p>	<ul style="list-style-type: none"> <li>• Feasibility studies have just been started and exact widths of the roadway has not been decided as yet. Surveys will be conducted to obtain information to arrive at decisions. Access is needed for surveys.</li> <li>• Socio economic data will be collected with the help of GN.</li> <li>• Resettlement method will be decided after socio economic surveys which will be done house to house.</li> <li>• Further discussions will be held with the affected parties after socio economic data collection.</li> </ul>	<ul style="list-style-type: none"> <li>• Consideration on the daily paid workers was made in the IRP.</li> </ul>
<ul style="list-style-type: none"> <li>• I use the bridge daily.</li> <li>• I think that the reason of traffic congestion from Dematagoda to Kiribathgoda is due to poor road condition which induces the decreasing vehicle speed.</li> <li>• Given that the project will be completed at least 2 years ahead, short term mitigation measures for the traffic jam should be proposed, for example the introduction of passage control by “One way operation”.</li> </ul> <p style="text-align: right;">(Local resident)</p>	<ul style="list-style-type: none"> <li>• RDA has been already conducting study on solutions for traffic congestion under JICA's assistance to formulate short, medium and long term plans.</li> <li>• Land acquisition for widening of Mattakkuliya Bridge is underway.</li> <li>• At present any container truck that goes to the ports have to move along this road section twice as the weigh bridge is located on Orrugodawatte – Ambatale road.</li> <li>• This is greatly affecting the traffic movement along this road.</li> <li>• A plan is discussed to shift this weigh bridge to a location close to Colombo port.</li> <li>• The road condition at the Peliyagoda side will be improved immediately.</li> </ul>	-
<ul style="list-style-type: none"> <li>• It is important to consider loss of employment as there could be pavement hawkers etc.</li> <li>• It is important also to consider the construction of the Lake line Road which will connect with the Project road ahead in order to avoid</li> </ul>	<ul style="list-style-type: none"> <li>• The survey and initial work for constructing the Lake line road is being done and the project will be implemented according to the finances available.</li> </ul>	<ul style="list-style-type: none"> <li>• Consideration on the daily paid workers was made in the IRP.</li> </ul>

Comments and/or Questions	Replies by RDA Officials	Points reflected to the RAP
<p>additional traffic congestions.. (A representative from Dematagoda Gana Saba and Secretary of Independent Self-employed Persons Organization)</p>		
<ul style="list-style-type: none"> <li>• The some affected people are renting their shops or bearing a load of debt for their small business. The Project should consider the restoration of the livelihood of those people. Sedawatte timber mill operators should be especially considered.</li> <li>• The local transportation of surround area of the Project road is in very dangerous condition presently, especially for pedestrians. So, the safety of pedestrians should be considered, for example, the establishment of pedestrian way at the side of the road.</li> <li>• Municipality Counsels will help to implement the project but trust should be established. Many people are squatters and may not have formal land deeds. There are also a number of people who are tenants and they will be severely affected. (representing Kolonnawa, Municipal Council)</li> </ul>	<ul style="list-style-type: none"> <li>• Resettlement will be done based on JICA and Government Policy. Voter's list will be examined to ascertain the nature of residents. Help from GN is needed in this regard. Loss of business etc. will be studied case by case.</li> <li>• The necessity of having a pedestrian crossing was noted and will be included in to the designs.</li> <li>• A series of pocket group meetings will be held within the project influence area with the assistance from local politicians and community leaders to socialize the project.</li> </ul>	<ul style="list-style-type: none"> <li>• The restoration of the livelihood of small scale self-employed was considered in the IRP.</li> </ul>
<ul style="list-style-type: none"> <li>• According to the notions of the President of the Country all resettlers will have better living condition after resettlement than before as was done in past projects.</li> <li>• Discussion with AP's and line agencies before finalizing the project is an excellent measure on the part of RDA.</li> <li>• Better to resettle people at a closer location to the original site in a flat etc. or provide money to resettle at a place on their own choice. A market complex a new city is needed in parallel with the proposed project.</li> <li>• It is appropriate to do social consultations in a place closer to their residences. (Member of Provincial Council, Western Province)</li> </ul>	<ul style="list-style-type: none"> <li>• No party will be let down in the process of resettlement. RDA will take all steps towards ensuring better living conditions to all affected communities.</li> <li>• Resettlement options will be discussed with affected communities, local politicians and community leaders.</li> </ul>	<ul style="list-style-type: none"> <li>• The livelihood and income restoration was considered in the IRP.</li> <li>• In order to avoid inconvenienced of PAPS, their preference on resettlement method was interview in the SES.</li> </ul>
<ul style="list-style-type: none"> <li>• I would like to propose that the RDA coordinates closely with DSs and GNs when the socio-economic field survey will be carried out to avoid unnecessary social friction with local people. (Member of Provincial Council, Western Province)</li> </ul>	-	<ul style="list-style-type: none"> <li>• The SES for the RAP was conducted through close cooperation with related DSs and GNs.</li> </ul>

Source: JICA Survey Team

(2) 2<sup>nd</sup> Stakeholder Meeting

The second stakeholder meeting was held on 11th July 2013 at Sri Lanka Foundation Institute, Independent Square, Colombo 7. The summary of the discussion is as shown in the Table 13.2.21.

**Table 13.2.21 Summary of the Discussion**

Views Expressed by Participants	Replies by RDA Officials etc.	Points Reflected to the RAP
<ul style="list-style-type: none"> <li>• It is said that extra 25 houses will be affected because of the shifting of Amman Kovil. Has a decision been taken yet regarding this?.</li> <li>• People will be inconvenienced because of this later development.</li> <li>• In the affected area there are title holders, persons with no land titles, rentees etc. and all of them should be suitably considered.</li> <li>• Rentees should be especially considered as they are very innocent people.</li> </ul> <p>Residents of Navagampura Stage 2</p>	<ul style="list-style-type: none"> <li>• No firm decision has been taken yet regarding the demolition of extra 25 houses.</li> </ul>	<ul style="list-style-type: none"> <li>• Although an idea to resettle surrounding 25 houses to set back Kovil was considered once, taking into account the comments obtained from the stakeholder meeting, it was changed to rebuild Kovil on site without relocation of surrounding houses.</li> </ul>
<ul style="list-style-type: none"> <li>• We do not know exactly how many houses will be affected in Kamkarupura.</li> <li>• Resettlement should be at close proximity. If resettled at a far off place our livelihood will be affected. Please relocate us around Orugodawatte Junction.</li> <li>• Residents Kamkarupura</li> </ul>	<ul style="list-style-type: none"> <li>• None will be resettled at far off places. All will be resettled at close proximity according to the decision taken by the Ministry of Port and Highways.</li> </ul>	-
<ul style="list-style-type: none"> <li>• We need resettlement at a nearby place. If we will be resettled at Homagama (according to unconfirmed information) our livelihood would be affected our children's schooling will be affected. Some houses are divided houses running up to 4 divisions and those should be considered. We need resettlement in Kollonnawa electorate itself. We need facilities like electricity, toilets ware supply etc.</li> <li>• Residents Wadullawatte</li> </ul>	<ul style="list-style-type: none"> <li>• None will be resettled at far off places. All will be resettled at close proximity according to the decision taken by the Ministry of Port and Highways. Title holders and non-title holders will be suitably considered.</li> </ul>	<ul style="list-style-type: none"> <li>• The FGD with PAPs was conducted continuously in the process of RAP preparation.</li> </ul>
<ul style="list-style-type: none"> <li>• Many fuel bowzers ply this road and wanted to check whether there is a solution for that from this road improvement. Ceylon petroleum corporation.</li> </ul>	<ul style="list-style-type: none"> <li>• However this matter has to be taken up in the District Development Meeting</li> </ul>	-
<ul style="list-style-type: none"> <li>• We would like to be relocated in the land at Malabe and not in Homagama. Atomic Energy Authority</li> </ul>	<ul style="list-style-type: none"> <li>• This has to be resolved through UDA</li> </ul>	<ul style="list-style-type: none"> <li>• The consultation with AEA was conducted continuously in the process of RAP preparation.</li> </ul>

Views Expressed by Participants	Replies by RDA Officials etc.	Points Reflected to the RAP
<ul style="list-style-type: none"> <li>It is said that extra 25 houses will be affected because of the shifting of Amman Kovil. Has a decision been taken yet regarding this?</li> <li>People will be inconvenienced because of this later development.</li> <li>In the affected area there are title holders, persons with no land titles, rentees etc. and all of them should be suitably considered.</li> <li>Rentees should be especially considered as they are very innocent people.</li> </ul> <p>Residents of Navagampura Stage 2</p>	<ul style="list-style-type: none"> <li>No firm decision has been taken yet regarding the demolition of extra 25 houses.</li> </ul>	<ul style="list-style-type: none"> <li>Although an idea to resettle surrounding 25 houses to set back Kovil was considered once, taking into account the comments obtained from the stakeholder meeting, it was changed to rebuild Kovil on site without relocation of surrounding houses.</li> </ul>
<ul style="list-style-type: none"> <li>They wanted to know approximately when the project start. If the affected area could be marked it will be better. <ul style="list-style-type: none"> <li>Affected Businessman</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Only preliminary designs are available now. Exact boundaries will be marked after the detailed designs.</li> </ul>	<ul style="list-style-type: none"> <li>The preliminary project information was informed with distribution of project leaflet when SES study was conducted.</li> </ul>
<ul style="list-style-type: none"> <li>Twenty one houses will be affected. Land titles will be available. Wanted to know the starting date of construction and compensation payment time.</li> </ul> <p>Residents Sedawatte 3rd Stage</p>	<ul style="list-style-type: none"> <li>No concrete answer could be provided as the project is still in feasibility stages. Address of RDA Environmental and Resettlement Division was provided to the participants to direct any grievance or a complaint regarding any issue affecting them.</li> </ul>	<ul style="list-style-type: none"> <li>The preliminary project information was informed with distribution of project leaflet when SES study was conducted.</li> </ul>

Source: JICA Survey Team

### (3) 3<sup>rd</sup> Stakeholder Meeting

The Third stakeholder meeting was held on 28th September 2013 at Sri Lanka Foundation Institute, Independent Square, Colombo 7. The summary of the discussion is as shown in the Table 13.2.22.

**Table 13.2.22 Summary of views expressed by the participants and responses agencies**

Views Expressed by Participants	Replies by RDA Officials etc.	Points reflected to the RAP
<ul style="list-style-type: none"> <li>Whether Kamkarupura flat will be affected for this project ?</li> </ul> <p>Resident of Kamkarupura Flats</p>	<ul style="list-style-type: none"> <li>Kamkarupura flats will not be largely affected according to the project design . However RDA will conduct a detailed site inspection and the status will be made known.</li> </ul>	-
<ul style="list-style-type: none"> <li>I want to minimise the effects on Sanchi Viharaya, the Buddhist Temple.</li> </ul> <p>Resident</p>	<ul style="list-style-type: none"> <li>Only the parapet wall and the entrance structure will be affected which will be compensated by the project.</li> </ul>	<ul style="list-style-type: none"> <li>The concern has been already incorporated into the RAP.</li> </ul>

Views Expressed by Participants	Replies by RDA Officials etc.	Points reflected to the RAP
<ul style="list-style-type: none"> <li>● Replacement house will be preferred to cash compensation as they are working, schooling and conducting business in the area. Resident of Wadullawatte</li> </ul>	<ul style="list-style-type: none"> <li>● Affected parties will be given the option of obtaining a house from one of the proposed UDA Housing Complexes.</li> </ul>	<ul style="list-style-type: none"> <li>● The alternatives for the compensation were prepared in the RAP.</li> </ul>
<ul style="list-style-type: none"> <li>● Will the amount of compensation be paid at once? Resident of Sedawatte</li> </ul>	<ul style="list-style-type: none"> <li>● All amounts of compensation will be paid in one instalment after assessment except for the additional 25% incentive payment</li> </ul>	<ul style="list-style-type: none"> <li>● The payment procedure will be conducted base on the LAA.</li> </ul>
<ul style="list-style-type: none"> <li>● I will lose his business, how will they be treated. Businessman from Sedawatte</li> </ul>	<ul style="list-style-type: none"> <li>● Affected businesses will be compensated.</li> </ul>	<ul style="list-style-type: none"> <li>● The compensation for income loss was incorporated into the RAP.</li> </ul>
<ul style="list-style-type: none"> <li>● We badly need replacement houses as at present we do not have proper toilets or garbage disposal facilities in some of our houses. We will not be able to self relocate. Resident of Wadullawatte</li> </ul>	<ul style="list-style-type: none"> <li>● Option for a housing unit with good basic facilities from UDA housing complexes will be available for affected people.</li> </ul>	-
<ul style="list-style-type: none"> <li>● I have given my house on rent and information regarding my house has been taken from my tenant. Will I get any compensarion? Resident of Wadullawatte</li> </ul>	<ul style="list-style-type: none"> <li>● If the ownership could be proved compensation will be offered to the landlord. Tenants will also receive assistance.</li> </ul>	<ul style="list-style-type: none"> <li>● The compensation for rent was incorporated into the RAP.</li> </ul>
<ul style="list-style-type: none"> <li>● How will the 25% incentive be assessed ? Resident</li> </ul>	<ul style="list-style-type: none"> <li>● This will be paid based on the legal compensation amount for the structure and this will be paid only when the possession of the cleared land was handed over to the project before the designated date.</li> </ul>	<ul style="list-style-type: none"> <li>● The process will be monitored through monitoring proposed in the RAP.</li> </ul>
<ul style="list-style-type: none"> <li>● Please provide good explanations regarding the compensation package . Please conduct a house to house campaign in this regard Private Secretary , of Honourable MP Duminda Silva</li> </ul>	<ul style="list-style-type: none"> <li>● A form will be distributed among the affected parties in Sinhala and Tamil indicating the compensation payment options and the affected parties will be given an opportunity state their preference.</li> </ul>	<ul style="list-style-type: none"> <li>● The explanations will be conducted continuously in the process of RAP updating.</li> </ul>

Source: JICA Survey Team, 2013



(4) Other

Other related meetings including focus group discussions (FGDs) were held as follows.

**Table 13.2.23 Summary of the Other Discussion**

Meeting	Date	Objectives
Meeting on Impacted Properties of Public Sector and Religious Organizations	10th May 2013	To make affected public sector agencies and religious institutions aware about the Project, and To share information with everyone to have best possible solutions to overcome hardships caused by the project
Focus Group Discussion (FGD) at Wadullawatta	25th April 2013	To promote the understanding of ordinary APs making necessary linkages between RDA officers and APs in the dialogue
FGD at Amman Hindu Kovil	26th May 2013.	To provide information and discuss the issues of relocation of Kovil
FGD with Women in Wadullawatta GND	11th June 2013	To provide project information and obtain the comments from women group

Source: JICA Survey Team

### 13.2.7 Grievance Procedures

The LAA provides a limited redress mechanism that only addresses issues pertaining to compensation. The NIRP recommends the establishment of an internal monitoring system by project executing agencies to monitor the implementation of Resettlement Action Plans and handling of grievances. One of the key policy objectives is making all affected persons aware of processes that are easily accessible and immediately responsive for grievance redress.

(1) Grievance Redress Committee

RDA has established the Grievance Redress Committee (GRC) well defined functions, composition, and a procedure to redress grievances during the implementation of road development projects. A GRC can deal with complaints relating to unaddressed losses or social and environment issues resulting from project implementation.

(2) Composition of GRC

The GRC will be a five member committee headed by the Assistant Divisional Secretary of the relevant division, Project director /Resettlement Officer, Site Engineer and two civil society representatives (who may be chosen from among the recognized NGOs/ CBOs, clergy, persons representing DPs groups and women). The Resettlement Officer/ Resettlement Assistant of the RDA/ PMU will function as the Secretary of the GRC and will be responsible for keeping record of all grievances registered and action taken on them. When required, the GRC can seek the assistance of other persons/institution. For the Project, three GRCs will be established for Colombo, Kolonnawa and Kelaniya divisions.

### **13.2.8 Implementation Schedule**

A time bound implementation plan is envisaged to be implemented for each activity of land acquisition and resettlement. This implementation schedule is based on the assumption that project related construction work will commence in year 2017 by which all resettlement activities need to be completed.

The Implementation Schedule for the Project is presented in the Table 13.2.24.





### 13.2.9 Cost and Budget

#### (1) Rates Used in the Resettlement Budget

The cost of land and structures used in the resettlement budget has been based on the results of the RCS. Other allowances and incentives were based on the project entitlement matrix. A provision for an IRP is included in the cost and budget.

#### (2) Total Cost for Land Acquisition and Resettlement

Total cost of land acquisition and resettlement will be approximately LKR 2,599million equivalent to US\$20.5million (at an exchange rate of LKR 127 for 1US\$). This amount includes provisions for income restoration including training and contingencies.

In preparing the budget it was assumed that 50% of the titled Residents and 20% of the non titled residents will opt for cash compensation. This figure is subject to change after the individual public consultation the RDA plans to undertake by distributing forms to the APs and getting their preference for mode of compensation.

**Table 13.2.25 Estimated Cost of Land Acquisition and Resettlement**

Item No.	Item	No.	Unit	LKR/unit	Total LKR
Compensation for Lands	Residential Lands (by GND)				
	Peliyagoda Gangabada East	13.8	Perch	975,000	13,455,000
	Bloemendhal	1.2		1,125,000	1,350,000
	Nawagampura	7.9		1,125,000	8,887,500
	Orugodawatta	0		1,125,000	0
	Sedawatta	26.3		875,000	23,012,500
	Wadullawatta	1.8		875,000	1,575,000
	Residential land				48,280,000
	Commercial land (by GND)				
	Bloemendhal	32.3	Perch	1,237,000	39,955,100
	Nawagampura	5.4		1,237,000	6,679,800
	Grandpass	4		1,237,000	4,948,000
	Sedawatta	9		963,000	8,667,000
	Wadullawatta	44.8		963,000	43,142,400
Commercial land					103,392,300
Sub-total					151,672,300
Resettlement/Relocation	KOVIL	1	set		13,000,000
	NAITA	1	set	-	850,000,000
	AEA	1	set		500,000,000
	AH titled Op 1 (50 %)	23	No.	1,322,500	30,417,500
	AH titled Op 2 (50%) (Pay UDA)	23	No.	685,000	15,755,000
	AH No Title Op 1(20%)	70	No.	1,322,500	92,575,000
	AH No Title Op 2 (80%) (Pay UDA)	279	No.	685,000	191,115,000
	Sub Family	29	No.	275,000	7,975,000
	Comm with title/ no title	54	No.	933,750	50,422,500
					1,751,260,000

Item No.	Item	No.	Unit	LKR/unit	Total LKR
Loss of Income:	Business Income	54	No.	15,000	3,240,000
	Loss of Wage/Salary	118	Worker	15,000	1,770,000
	Sub-total				2,580,000
Trees:	Fruit Trees	143	No	2,000	286,000
	Timber	5		5,000	25,000
	Sub-total				311,000
Allowances	Vocational Training Grant	100		15,000	1,500,000
	Special grants for VP	102		15,000	1,530,000
	Temporary Accommodation (Tenants)	38	No	45,000	1,710,000
	Sub-total				4,740,000
Shifting of Utility Services	Transmission lines	1	set	-	1,240,880,000
	Telecommunication posts	43	Nos.	50,000	2,150,000
	Electricity posts	40	Nos.	50,000	2,000,000
	Lamp posts	132	Nos.	75,000	9,900,000
	Name boards and Sign boards	70	Nos.	50,000	3,500,000
	Manholes	61	Nos.	45,000	2,745,000
	Telecom cable box	7	Nos.	70,000	490,000
	Sub-total				1,261,665,000
External Monitoring		36	Months	250,000	9,000,000
<b>Total</b>					3,181,228,300
Administration Cost & IRP Planning (1.5%)					47,718,425
Contingency 5%					159,061,415
<b>TOTAL (LKR)</b>					3,388,008,140
<b>TOTAL (LKR.)-Rounded</b>					3,388,000,000

Source: JICA Survey Team

### 13.2.10 Monitoring and Evaluation

The objectives of monitoring and evaluation are to:

- Collect, analyze, report and use information about progress of resettlement;
- Ensure that inputs are being provided, procedures are being followed and outputs are monitored and verified;
- Ensure timely management action if there appears to be any failure in system due to management lapse; and
- Ensure necessary corrective measures at policy level, if it is seen that there is a failure in system due to flaw in the design i.e. wrong theory, hypothesis or assumption, to ensure necessary corrective action at policy level; and
- To build a benchmark database for the purpose of evaluation

For the Project, it is proposed to implement (1) internal monitoring by RDA and (2) external monitoring by an independent party such as local/international consultants, NGO or university hired by the Construction Supervision Consultant (CSC).

The RAP implementation will be supervised by the Project Director of PMU. Resettlement Unit (RU) under PMU will conduct the day to day activities regarding the RAP implementation with assistance of CSC. RU, with assistance of CSC will prepare and submit reports on monthly basis as a part of the progress report of whole project.

## 14. CONCLUSION AND RECOMMENDATIONS

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### 14.1 Conclusion

Conclusion of the Preparatory Survey is as follows:

- The Project is technically and economically feasible and environmentally sound.
- Hence, it is justified to implement the Project for national and people's benefits.
- The Project Road is comprised of the Main Line and the Port Access Road, and two roads are connected by a junction.
- The alignment of the Main Line begins at north of Orugodawatta Intersection and connects to CKE at end point.
- The alignment of the Port Access Road begins at Kelanithissa Junction and connects to existing port access road at end point
- Three types of bridge are constructed in the Project, namely, extra-dozed bridge for main bridge, steel box girder bridge above the existing road and for ramps, and PC box girder bridge along the existing road.

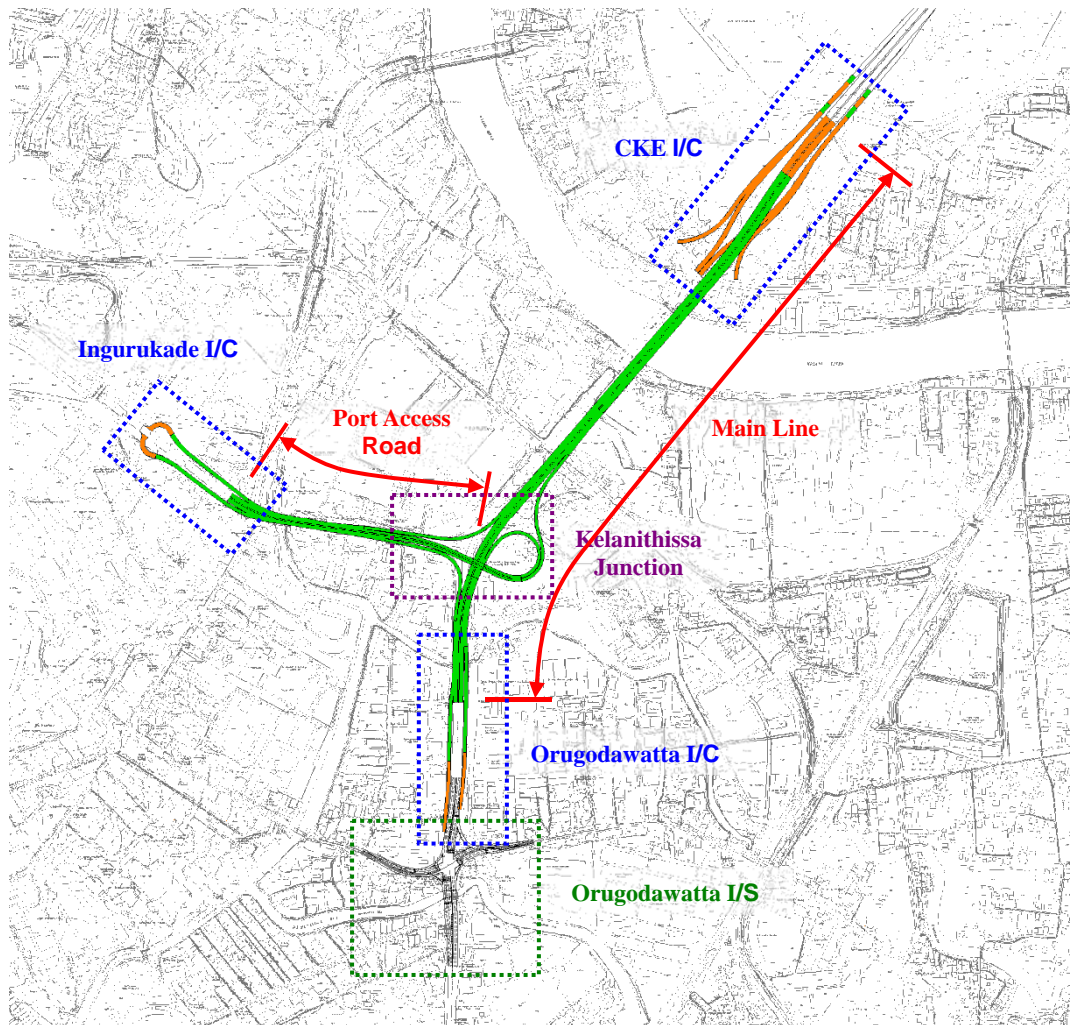
Summary of the Project is shown in Table 14.1.1 and Figure 14.1.1.



**Table 14.1.1 Summary of the Project**

Component	Summary
1. Construction of the Project Road, Main Line	<ul style="list-style-type: none"> <li>• Design Speed: 60 km/h</li> <li>• Road Length: 1,580 m</li> <li>• Cross Section: <ul style="list-style-type: none"> <li>- Main Bridge (6-lane): 27.5 m</li> <li>- Approach Bridge (6-lane): 27.5 m</li> <li>- Approach Bridge (4-lane): 20.5 m</li> <li>- Earth Work (6-lane): 30.5 m</li> </ul> </li> <li>• Bridge Type: <ul style="list-style-type: none"> <li>- Main Bridge (L=380 m): Extra-dozed</li> <li>- Approach Bridge (L=625 m): PC Box Girder</li> <li>- Approach Bridge (L=425 m): Steel Box Girder</li> </ul> </li> <li>• Others <ul style="list-style-type: none"> <li>- Soft Soil Treatment in Earth Work Section</li> </ul> </li> </ul>
2. Construction of the Project Road, Port Access Road	<ul style="list-style-type: none"> <li>• Design Speed: 60 km/h</li> <li>• Road Length: 390 m</li> <li>• Cross Section: 20.5m (4-lane)</li> <li>• Bridge Type: Steel Box Girder (L=390 m)</li> </ul>
3. Construction of Interchanges and Junction	<ul style="list-style-type: none"> <li>• Design Speed: 40 km/h</li> <li>• Ramp Length: <ul style="list-style-type: none"> <li>- Orugodawatta I/C <ul style="list-style-type: none"> <li>&gt; Orugodawatta On: 333 m</li> <li>&gt; Orugodawatta Off: 411 m</li> </ul> </li> <li>- CKE I/C <ul style="list-style-type: none"> <li>&gt; CKE A: 820 m</li> <li>&gt; CKE B: 926 m</li> <li>&gt; CKE C: 286 m</li> <li>&gt; CKE D: 345 m</li> </ul> </li> <li>- Ingurukade I/C <ul style="list-style-type: none"> <li>&gt; Ingurukade On: 469 m</li> <li>&gt; Ingurukade Off: 483 m</li> </ul> </li> <li>- Kelanithissa JCT <ul style="list-style-type: none"> <li>&gt; Kelanithissa A: 501 m</li> <li>&gt; Kelanithissa B: 562 m</li> <li>&gt; Kelanithissa C-1: 423 m</li> <li>&gt; Kelanithissa C-2: 324 m</li> <li>&gt; Kelanithissa D: 350 m</li> </ul> </li> </ul> </li> <li>• Cross Section: <ul style="list-style-type: none"> <li>- Orugodawatta I/C: 7.0 m (Temporary 2-lane)</li> <li>- CKE I/C: 7.0 m (1-lane), 8.5 m (2-lane)</li> <li>- Ingurukade I/C: 7.0 m (Temporary 2-lane)</li> <li>- Kelanithissa JCT: 7.0 m (1-lane)</li> </ul> </li> <li>• Bridge Type: Steel Box Girder (L=1,998 m)</li> </ul>
4. Improvement of At-grade Road	<ul style="list-style-type: none"> <li>• Orugodawatta Intersection <ul style="list-style-type: none"> <li>- Road Length: <ul style="list-style-type: none"> <li>&gt; North Bound: 249 m</li> <li>&gt; South Bound: 113 m</li> <li>&gt; East Bound: 191 m</li> <li>&gt; West Bound: 210 m</li> </ul> </li> <li>- Cross Section: <ul style="list-style-type: none"> <li>&gt; North Bound: 8-lane</li> <li>&gt; South Bound: 7-lane</li> <li>&gt; East Bound: 4-lane</li> <li>&gt; West Bound: 5-lane</li> </ul> </li> </ul> </li> <li>• Kelanithissa Intersection <ul style="list-style-type: none"> <li>- 1.5 m widening in 100 m</li> </ul> </li> </ul>

Source: JICA Survey Team



Source: JICA Survey Team

**Figure 14.1.1 Summary of the Project**

## 14.2 Recommendations

Recommendations for further studies and tasks are as follows:

- The master plan study for Colombo metropolitan region and the suburbs (CoMTrans) is going on now, and will be completed in April 2014. Some project will be proposed in Colombo as a result of the master plan. It is recommended that the design of this Project will be modified in the detailed design stage in consideration of the projects proposed by CoMTrans, if necessary.
- Public utilities such as waterworks, telephone line, electricity line, power line, etc. were identified based on the topographic survey and existing documents in the Preparatory Survey. The preliminary design was carried out in consideration of the information. However, it is recommended that detailed survey for the public utilities should be carried

out in the detailed design stage, and the design will be reviewed based on the detailed survey result.

- It is recommended that RDA will undertake the tasks for the EIA and RAP during the entire project period in order to implement the Project successfully.
- It is recommended to inform the public of JICA Grievance Mechanism effectively.
- It is recommended that the information such as participants, opinions, etc. in further focus group discussions will be recorded in detail.