5.2.5. Matraman Bridge

(1) General

The present bridge will be reconstructed under the project, as the present clearance over road is 3.5m. The new structure will increase the clearance by 1.6m and will provide the standard headroom of 5.1m. The Main Line is at a higher level because of the flyover of the Commuter Line. There is the new Matraman station to be constructed with a station plaza at ground level. The Commuter Line structures are separated as the station has an island platform. The determination of beam lengths and spans are controlled by consideration of the station structure and station plaza plan.

(2) Considerations

A drainage culvert lies under the existing bridge pier and it is difficult to construct a central pier. The aesthetics from the road is not good because of the different levels for the bridge beams. During construction it is essential that construction activity does not conflict with road transport and Traffic Management is essential for control of the conflicts. The commuter line will pass below the Main Line so there is a critical lowest level for the beams.

(3) Resolution

The span arrangement of three spans (20m+25m+20m) is considered not to interfere with the culvert. The 65m total length of the bridge provides room for access to the station plaza and road width. The PC-'I' shape beams (8 in total) are selected for limitation in girder depth. The incremental launching method is recommended for installation. Matraman Bridge is shown in Figure 5.2-4.

5.2.6. Main Line Flyover over Commuter and East Lines

(1) General

The characteristics of steel girder bridges are described below. When selecting the type of construction, it is important to consider:

Favourable

- beam depth can be reduced;
- the girder weight is light;
- material is uniform because of the factory production; and
- excellent fabrication

Unfavourable

- corrosion repairs are necessary.
- structural noise is larger than a RC structure.

(2) Alignment condition

Alignment conditions are:

- The lower Bekasi Line (Commuter Line) has an improved radius of curvature to 300m (present is 250m), and this line passes under the Main Line.
- The upper Main Line has a radius of 400m.
- The vertical alignment of the Main Line climbs at a rate of approximately 13.8 per mill, to the East line flyover, then level, and then down at 16 per mill to Jatinegara station.
- Railway track intersection angle between Main and Commuter Lines is about ten degrees.
- It is necessary to reduce the beam depth, to consider the economy of approach spans before and after the structure and the stability of the bridge.

(3) Selection of girder length

The span layout is compared on the drawings with spans selected at 25m, 30m, and 35m. In case of 25m the number of special piers is eight. In case of 30m the number of the special piers is six. In case of 35m the number of the special piers is five but the girder depth is larger.

In consideration the alignment condition with a radius of 350m and a vertical curve of 3000m, the span of 30m is selected.

(4) Selection of girder

In consideration of the curved girder and the limitation of beam depth a double-track steel box girder is selected with an RC slab deck. The girders are 5 spans continuous and 3 spans continuous for beam stability and to provide improvement in rigidity. In the area of the flyovers, single piers are not possible due to the required clearances (h=5.1 m) from the rail tracks. The support structure comprises a steel horizontal beam supported on concrete columns. The ends of the steel box beams are built into the cross beam to reduce construction depth.

Double-track steel twin box girder

- There are a 5 span and a 3 span continuous box girders built into the horizontal beam of the support structure because of the beam depth limitation and alignment.
- It is a box form section, because it improves the beam depth limitation and provides good torsional resistance. (Rail level to underside of beam is about 2.6m).
- The girder has an RC slab deck and ballast floor in consideration of ease of track maintenance, and reduction of noise.
- Erection of the girders will probably be the longitudinal launching method using a launching nose beam.
- It is aesthetically excellent though maintenance painting is required.

Through-steel girder with ballast floor

- It is difficult to unite the girder with the support beam of substructure.
- To cut the edge of the girder and lowering girder level, the girder end is a complex structure and weak point.
- Unless uniting the girder with the support beam the distance from rail level of the girder to the bottom of the support beam is large at 3.0m.
- Rail level is high and the approach gradients are steep.
- The superstructure requires maintenance such as painting and is not aesthetically pleasing.

PC concrete single box beam.

- The beam weight is heavy and support beam is large.
- The substructure is steel and is not maintenance free.
- The possibility of a special erection method like the incremental launching method etc. is high.
- The transmitted noise is the least.

(5) Resolution

The 5 and 3 span continuous steel box girders have been selected as flyover bridges for this section. Although a periodical maintenance of the girder will be required, i.e. re-painting works on the steel surface, thin layer of continuous girder height will provide a light impression to surrounding inhabitants. See Figure 5.2-5.

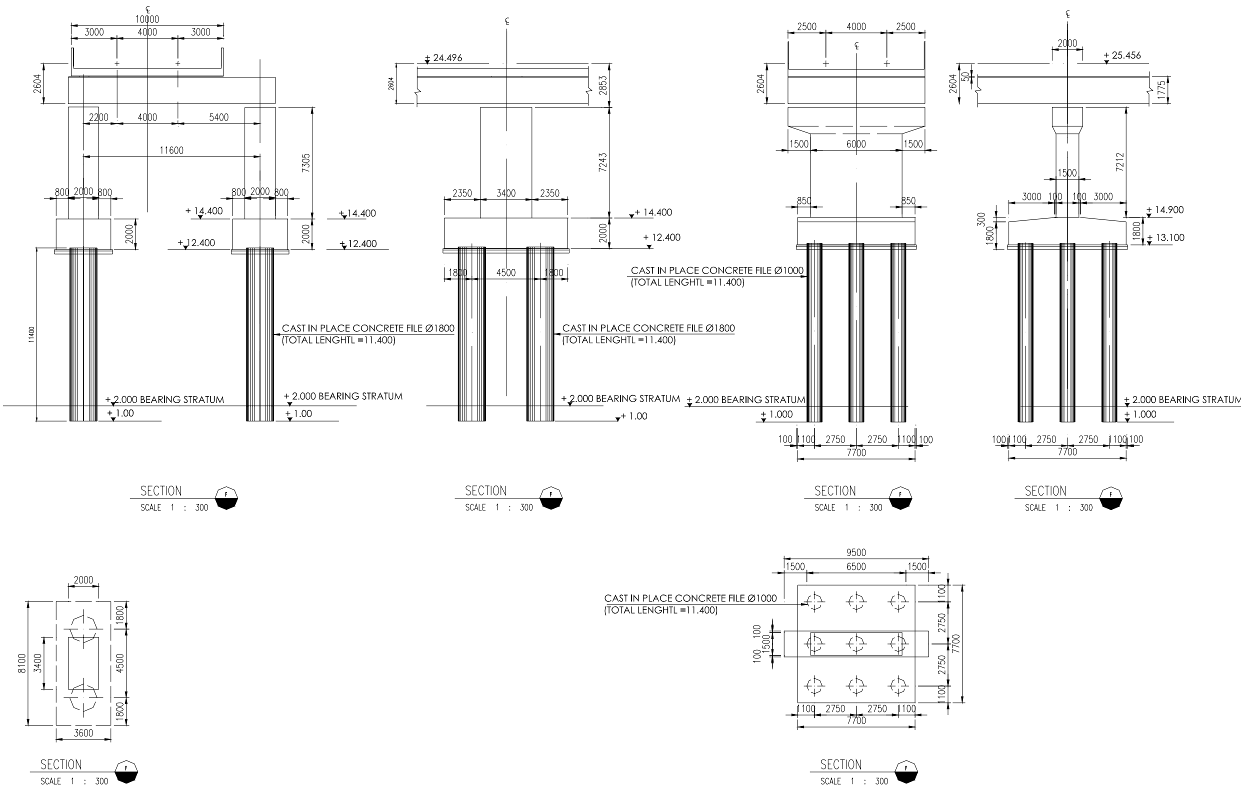


Figure 5.2-5 Typical Steel Deck Bridge

5.2.7. Small Bridges between Jatinegara and Bekasi

Due to the modifications of alignment mentioned in Chapter 4, there are some changes in the structures, such as bridges of the Main and Commuter Lines between Jatinegara and Bekasi. Table 5.2-2 shows the summarized difference in quantities between previous Basic Design and this Detailed Design. Table 5.2-3 shows the detailed differences between the Bridges in the Previous BD and the current DD. The previous BD List has information only about the Main Line bridges, but the new DD List has information about both the Commuter and Main Lines.

- Superstructure concrete volume of Main Line and Commuter Line bridges decreases 460 m3
- Substructure concrete volume of Main Line and Commuter Line bridges increases 470 m3
- Foundation pile length of Main Line and Commuter Line bridges decreases 150 m

There are two locations that are discussed in more detail:

A. Eastern Banjer Canal

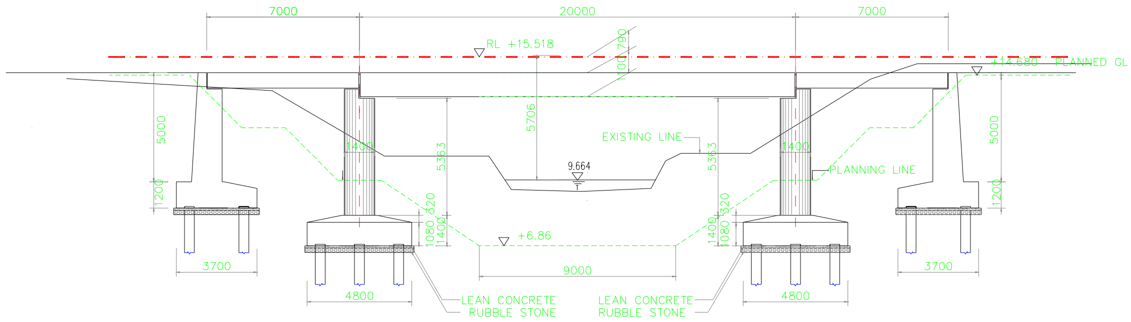
The planned Eastern Banjer Canal crosses the main line in the neighbourhood of Cakung station (20K+600M) and excavation work has commenced previously. The construction of canal has started in several places, and excavation finishes near the existing track. The bridge construction is not included in the Implementation Programme or in the Answers to the Questionnaire. The Study Team found the adjoining expressway has already constructed a bridge at the planned location. Moreover, the existing track passes the potential bridge site on an embankment and the canal cannot be completed until the bridge is constructed.

The Study Team has information about the Eastern Banjer Canal plan as prepared by DPU. The plan includes a roadway on both banks of the canal. The Study Team recommended the preparation of a bridge design for Main Line and Commuter Line by the Canal Project. The Commuter Line bridge construction should also be considered at the same time, because the new Main Line track is able to provide a temporary diversion whilst the Commuter Line bridge is constructed.

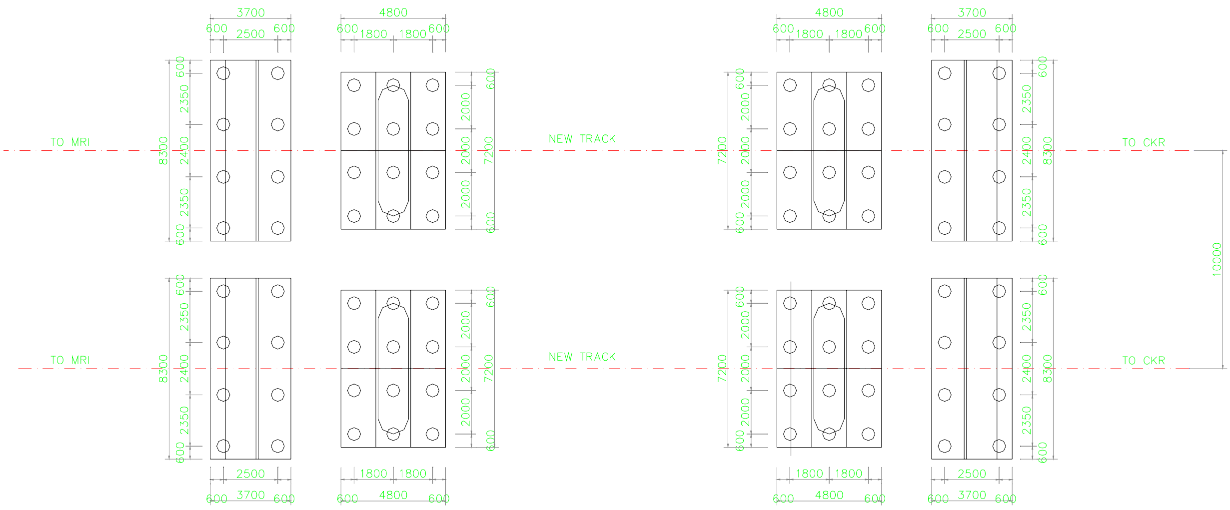
B. Cakung River Bridge

12m span beams are planned for the bridge to cross Cakung River between Cakung and Kranji (22K+910M). There is a river improvement project for a 20 m widening of the river, and also for a deepening. The structural plan for this bridge has been changed to meet the new river dimensions.

The Study Team has information concerning the Cakung river improvement plan and has prepared a basic design on the basis of this information. The high water level of the river will be lower than the present condition. The design will not only consider the improved river condition but also the present river condition. The proposed steel beam in concrete is the selected superstructure. Figure 5.2-6 provides an overview of Cakung River Bridge.



SECTION B- B
SCALE 1 : 100



PILING PLAN
SCALE 1 : 100

Figure 5.2-6 Cakung River Bridge (BH 110 @ 22k913)

Table 5.2-2 Difference of Bridge Quantities between BD and DD

	Bridge					
	Superstructure (m^3)		Substructure (m^3)		Foundation Pile (m)	
	Main	Com	Main	Com	Main	Com
Previous BD	1,479	–	2,517	–	2,808	–
This DD	756	255	2,040	953	1,656	1,001
Difference	(723)	255	(477)	953	(1,152)	1,001
	(468)		476		(151)	

Table 5.2-3 Difference of Small Bridges between BD and DD

No.	Km	Bridge name	Previous B/D				This D/D			
			bridge length	girder length	Structure Type	Track Number	Com Line Track shift	Main Line Track shift	Com Line Structure alteration	Main Line Structure alteration
1	14K214M	BH. 67A	18.2	18.2	RC composition	2	no	Shift to south side by 4m	no	Shift to south side by 4m
2	14K582M	BH. 68	18.2	18.2	RC composition	2	no	Shift to south side by 4m	no	Shift to south side by 4m
3	16K160M	BH. 73A	2.5*4+2*1		Box culvert	2	no	Shift to south side by 2m	no	Shift to south side by 2m
4	17K804M	BH. 80	19.2	19.2	RC composition	2	Shift to south side by very little	Shift to south side by 2m	Modify south side	Shift to south side by 2m
5	17K804M	(ROAD near. BH 80)	19.2 (W=10.0)	19.2	RC composition	ROAD	Needless according to relocation of substation			
6	17K950M	BH. 81	13	13	RC composition	2	Shift to south side by very little	Shift to south side by 2m	Modify south side	Shift to south side by 2m
7	19K100M	BH. 85			demolition		no	Shift to south side by 2m	no	no
8	20K160M	BH. 93	3*3.0		Box culvert	2	South side track shift to south side 1.7m	Shift to south side by 2m	Extend to south side by 1.7m	Shorten north side by 2m
9	21K142M	BH. 99	2.5		Box culvert	2	Both side tracks shift to south side 4m	Shift to south side by 6m	Extend to south side by 4m	Shorten north side by 6m
10	21K636M	BH. 104	2.0		Box culvert	2	Both side tracks shift to south side 4m	Shift to south side by 6m	Extend to south side by 4m	Shorten north side by 6m
11	21K786M	BH. 106	2.0		Box culvert	2	Both side tracks shift to south side 4m	Shift to south side by 6m	Extend to south side by 4m	Shorten north side by 6m
12	22K913M	BH. 110	34	7 20 7	RC T-beam PCI simple RC T-beam	2	Both side tracks shift to south side 4m	Shift to south side by 6m	Construct Rridge strucure the same as Main Line condition	Shift to south side by 2m
13	24K146M	BH. 117	9	9	RC T-beam	2	North side track shift to south side 4m South side track shift to south side 4.7m	Shift to south side by 6m	Costruct Bridge structure the same as Main Line condition	Shift to south side by 2m
14	26K236M	BH. 129	22	22	RC composition	3	Shift on the site of a demorished Coal Line	Shift on the site of a demorished Existing Line	Costruct Box culvert 13*3.3*23 (m)	Change to Box culvert 13*3.3*23 (m) Modify 13m 1tr Existing Bridge
15			13	13	RC composition	1				
16	26K236M	(ROAD near BH. 129)	22 (W=10.0)	22	PCI simple	ROAD			Needless	Needless

5.2.8. Bekasi Bridge

(1) General

The existing railway bridge across the Bekasi River consists of two parallel bridges for the up and down-tracks. Both spans of L=72.0m length are supported by abutments of the spread foundation design. The spans are single-track through-truss bridges of the open floor type.
A tied-arch bridge carries the down-track (downstream side) and a truss bridge carries the up-track side (upstream side).
The tied-arch bridge located on the downstream side was built over 80 years ago. The Study Team considers that the bridge should be replaced as it is now approaching life-expiry and its structure does not satisfy the construction gauge of the future electric trains.
In addition, two more new truss bridges should be also built to complete the double-double track until this section.
The layout of the replacement span is shown in Figure 5.2-7.

(2) Examination Policy

The existing bridge was closely examined and the current status confirmed. From the data collected as part of the examination policy of the bridge a replacement concept evolved. The superstructure is designed to secure safety through the use of the established design criteria.

The Study Team evaluated that the substructure of the existing bridge deck to be demolished, the tied-arch bridge, can be reused if the new bridge loading is less than the present loadings. The abutments are safe for vertical dead loads, if the weight of planned bridge is less than the weight of the existing bridge. It must be confirmed that the new train design load is less than old train design load. The existing abutments are shown in Figure 5.2-8.

The level of the track, the height of bearings and the height of the existing substructures are checked. In the case of using the existing abutments, if the level of the bearing bed is not same, it is necessary to adjust this level. It is possible that the substructure will not be safe if the height of bearing bed has to be raised.

The schedule of construction is considered as follows:

(a) build a new bridge, single track, up-stream of the existing bridges, and move the operation of the down-track to this new bridge.

(b) demolish old existing bridge superstructure

(c) build new superstructure on location of demolished bridge superstructure; keep substructure

(d) build new bridge down-stream

(3) Result of Examination

a) Weight of Existing Span

Based on the existing drawings the weight of the span superstructure was determined to be W=281.59t (2815.9kN). The weight of the future superstructure is W=2460.0kN based on the design drawings.

The plans, the shape and dimension of superstructure, and the height of the substructure, are also shown in Figure 5.2-7.

b) Determination

The future span could be confirmed as of less dead load than the weight of existing bridge.

The existing substructures heights were carefully measured at site, drawings prepared on the recorded dimensions, and the level of the existing bearing bed was confirmed. As a result, there is a need to raise the bearing bed by about 20cm.

Considering the effect of raising the bearing bed level by 20cm, calculations showed that the future conditions are below the current state, thus, it can be confirmed that a more safe condition arises than the current position.

c) Conclusion

It was considered to remove the tied-arch bridge on the down-track side (downstream side) as described in the examination conditions above.

As a result of the weight of the new through-truss bridge with live loading being less than the weight of the existing tied-arch bridge, the working load on substructure is less than the existing load, consequently the abutment is safe to be reused for the new bridge superstructure.

Two more bridges of 72 metres of span will be built. The general view of the girder is shown in Figure 5.2-9.

5.2.9. Cikarang Bridge

(1) General

As a result of the change of track alignment at the Cikarang Station, where a new platform and two new tracks are built, a new bridge for the new two tracks should be built over the river in front of this station.

(2) Design

The type of bridge selected is a double track of through steel truss bridge, with an effective Span of 50.00m. The general view of the girder is shown in Figure 5.2-10.

5.2.10. Bekasi Timur Pedestrian Bridge

(1) Bridge Purpose

Because Bekasi Timur St. is new it does not have railway track crossing facilities such as a level crossing, it is necessary to improve the benefit and convenience to railway users and the general public.

Access to the station is only from the south of the railway track; the main purpose of the Pedestrian Bridge is to provide access for railway users to the north side of the line.

(2) Design

It is 2.25m in width in consideration of 0.75m of space to those who have luggage to provide the necessary width of 1.5m for pedestrians to walk in opposite directions. The general view of the bridge is shown in the Figure 5.2-11.

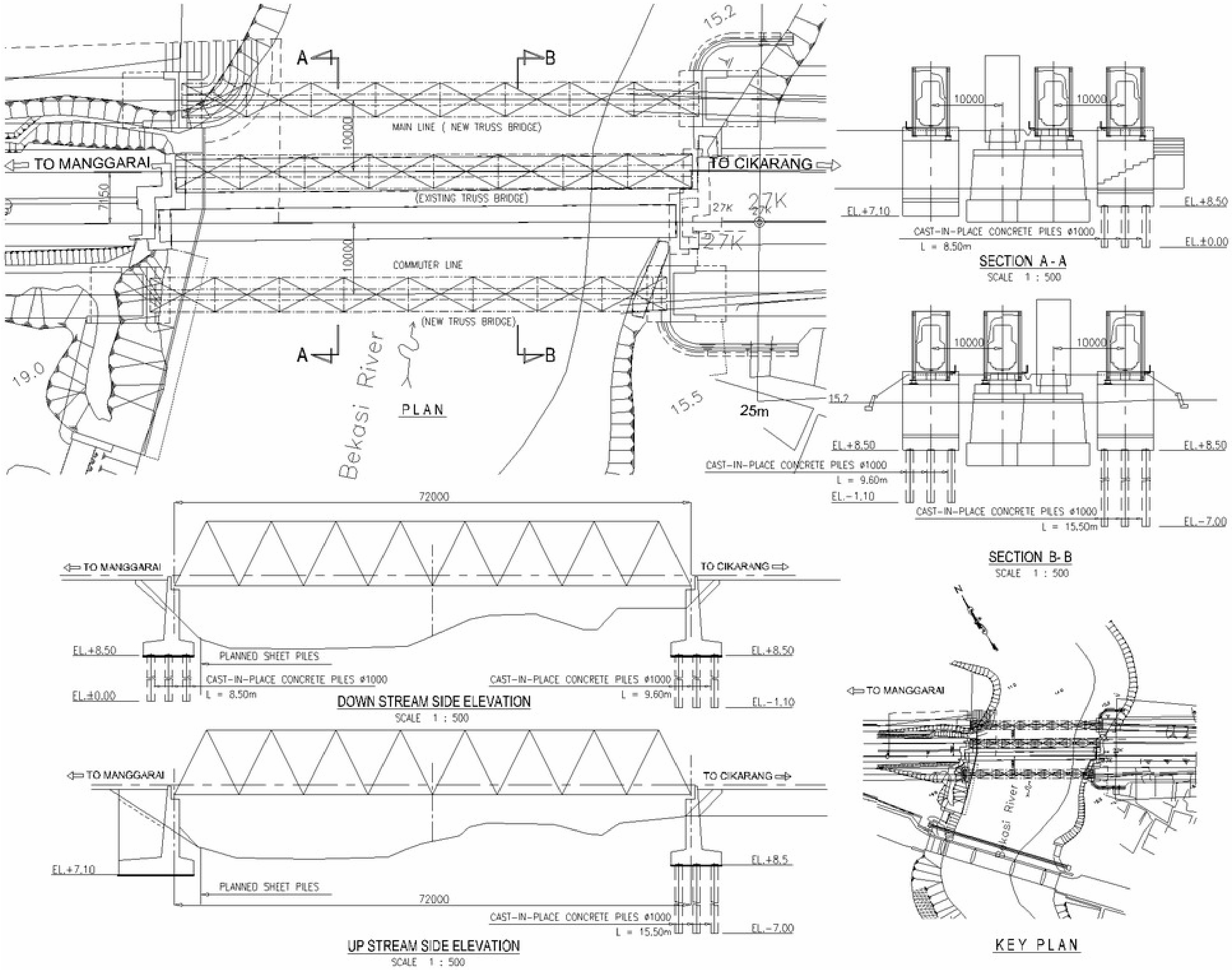


Figure 5.2-7 Bekasi Bridge General Arrangement

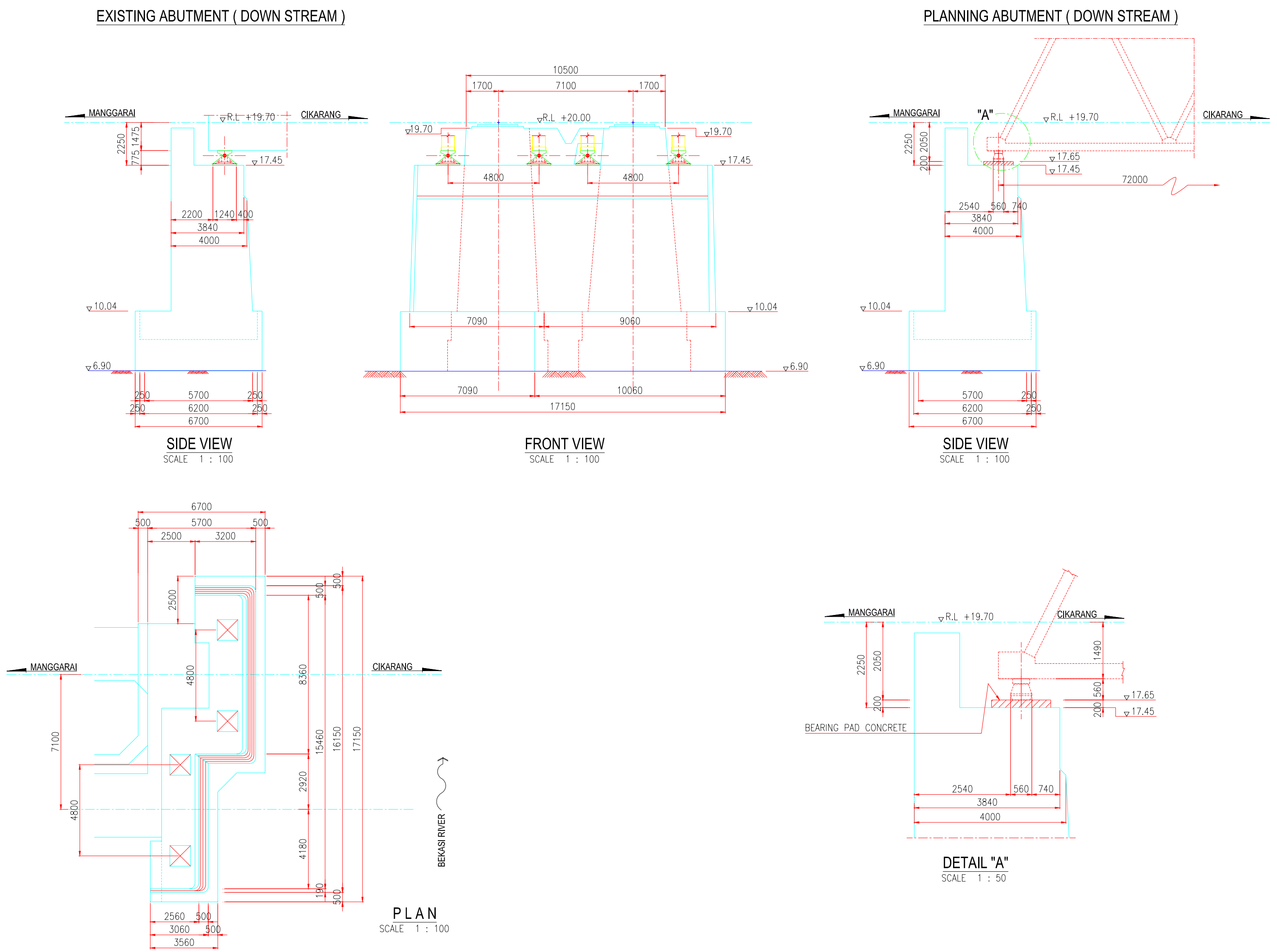


Figure 5.2-8 Bekasi Bridge Existing Abutment

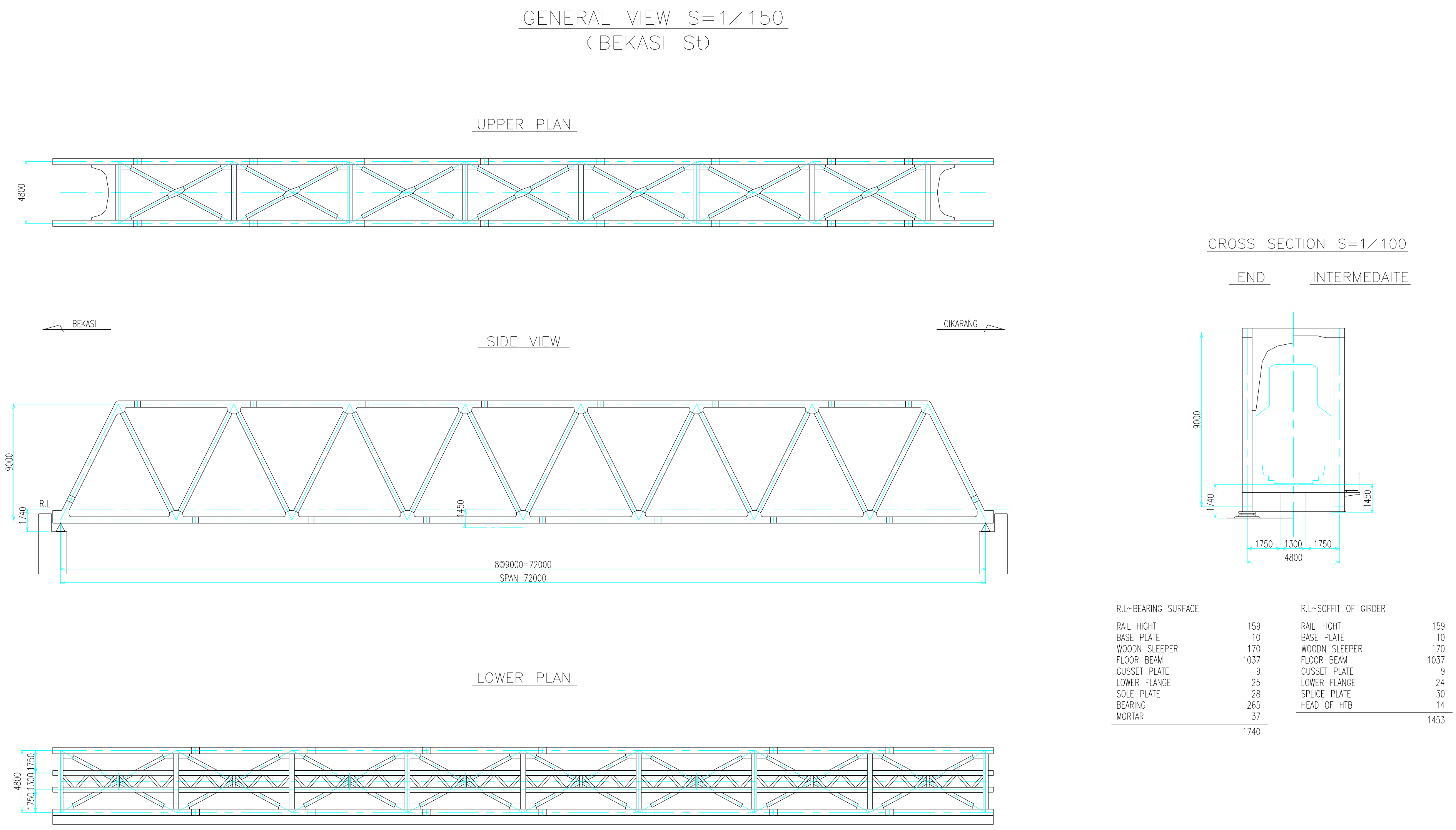


Figure 5.2-9 Bekasi Bridge Through Truss Span

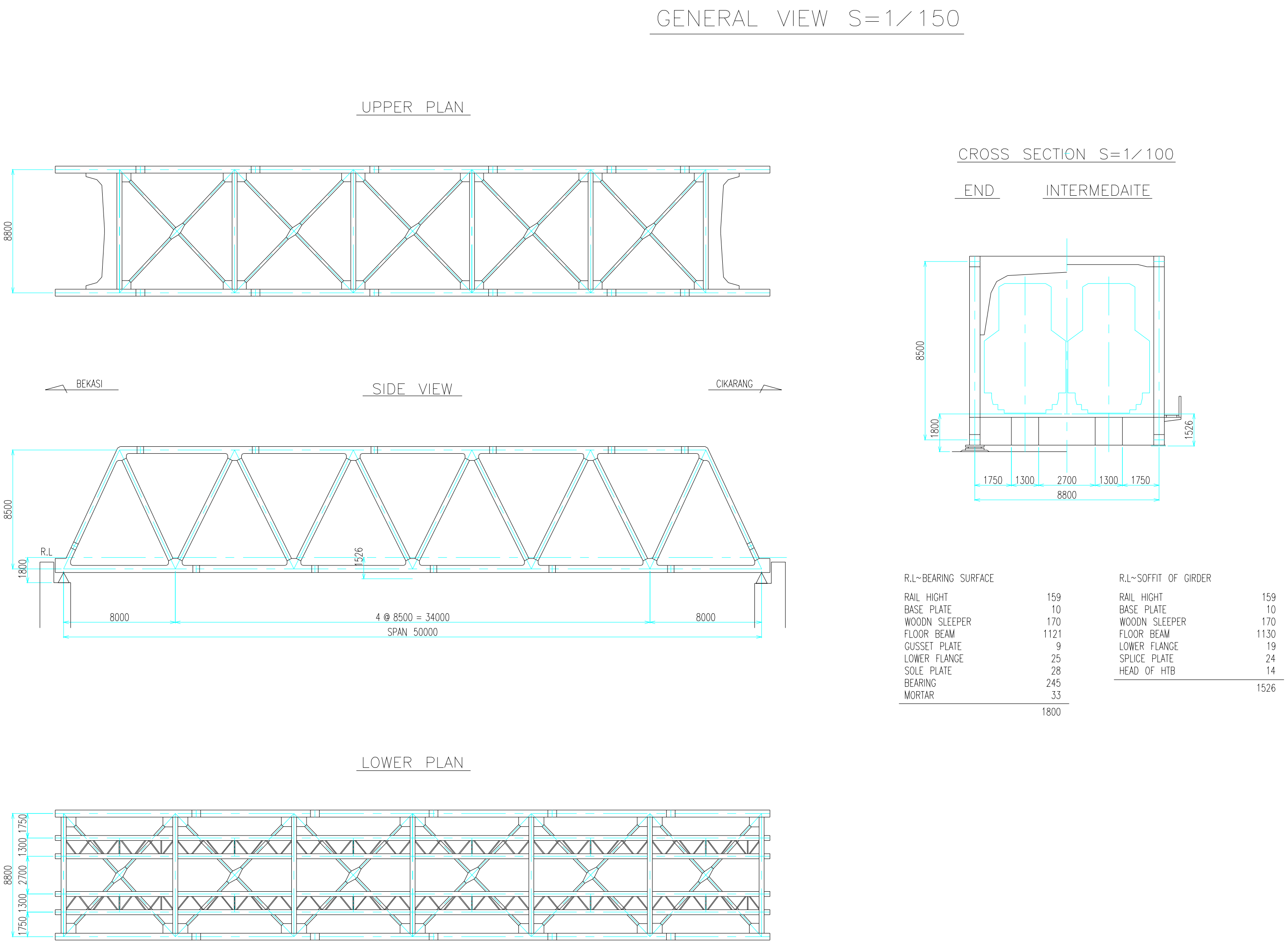


Figure 5.2-10 Cikarang Bridge Through Truss Span

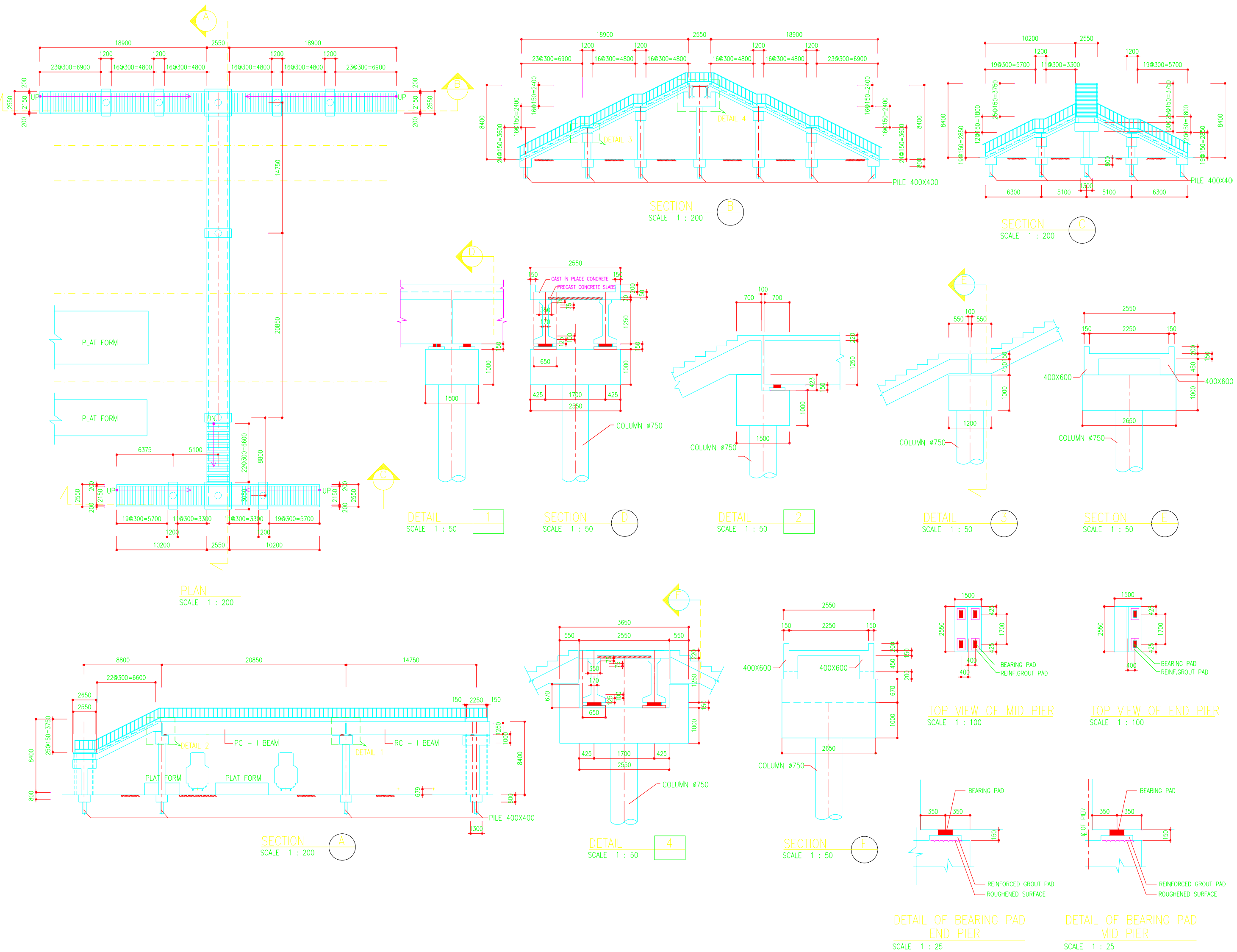


Figure 5.2-11 Bekasi Timur Footbridge General Arrangement

5.3. Civil - Viaducts

5.3.1. Deck Design

(1) Viaduct Design Aesthetics

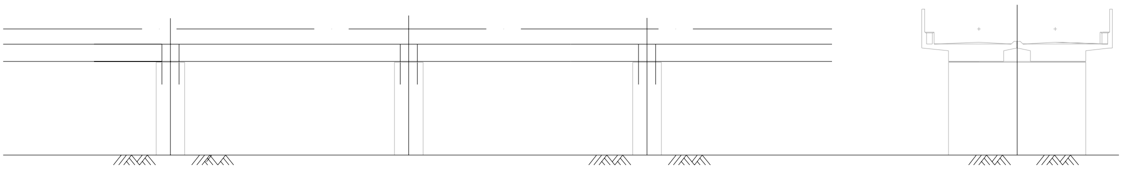
The design of an engineering structure requires that the demands of the structure’s function, strength, durability, and beauty be satisfied. Generally, beauty is disregarded when economy of the constructed price is of major importance. However, when it is adjacent to a local population’s living space in the city and is a new engineering structure, beauty is one of the most important elements. The structure is acceptable to the local resident in the region when it has a pleasing design. It should be of universal acceptance to the local population to whom the beauty of the structure is part of their environment, to the person who sees it from a distance, to the person who is visiting the district, and to the person who will live 100 years from now.

An elevated viaduct in a city shows the bottom surface of the beam, depriving the city’s view of the sky. Thus, it is important to make the appearance of the viaduct as clean and simple as possible in all aspects, because a viaduct does not have a clear starting point nor end point.

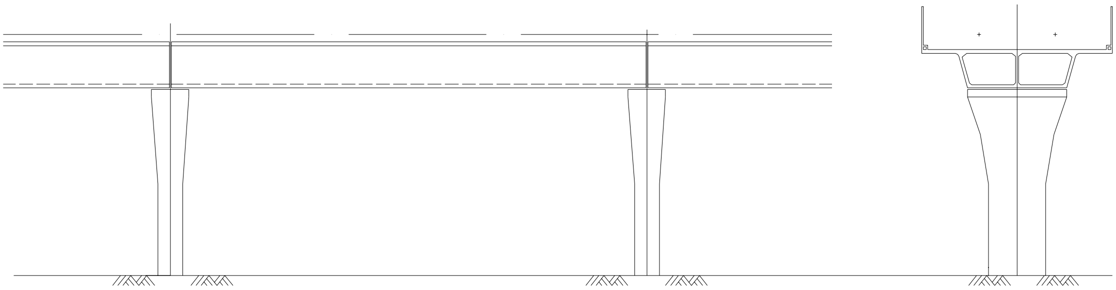
(2) Selection of Structure Type

This section describes the selection of the type of deck or superstructure viaduct and.

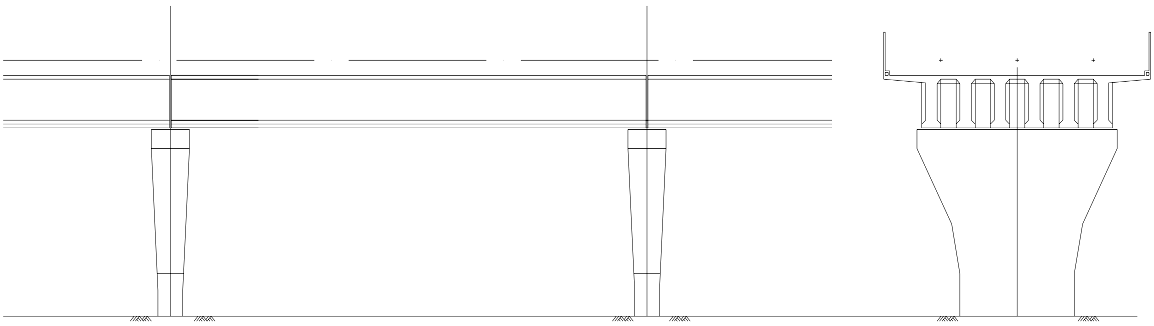
There are two forms of concrete elevated bridges: one is the “beam” type and the other is the “beam slab” type. Most of the viaduct is designed as beam type. However, the beam slab type is adopted at portions of the stations and on other elevated portions of the Commuter Line near Matraman Station. Figure 5.3-1 shows typical elevations of the two types. Table 5.3-1 shows a comparison of both types.



BEAM-SLAB TYPE STRUCTURE



BEAM TYPE STRUCTURE (PC BOX CASE)



BEAM TYPE STRUCTURE (PC I BEAM CASE)

Figure 5.3-1 Typical Elevation of Viaducts Types

Table 5.3-1 Comparison of Elevated Bridge Types

	Beam type	**Beam-slab type**
Feature	Beam and pier Fewer number of columns (piers).	There are many columns.
Construction	Favourable. The beam can be precast. It is easy to perform quality control under factory conditions.	Not favourable The formwork and the arrangement of bars are complex. All members are cast in-situ. The site quality control is inferior.
Construction Period	Less Production process is possible because of the adoption of a precast beam.	Longer. Because of stage construction, continuous work process cannot be done.
Aesthetics	Excellent. Structural beauty is expressible by unity of the span and beam depth.	Inferior. There are many columns. Beam depths become easily disunited.
Use under the elevated spans	It is possible to use the space under elevated beam spans as a parking lot and a park.	It is suitable for securing and dividing the space under the elevated structure as a building. It is suitable for station offices.
Cost of construction	Generally, it is higher than the beam slab type, but when a large number of precast beams are constructed, almost becomes equal.	Cheaper.

A. Beam Type

The beam type selection for this project is done by giving importance to:

- Aesthetics;
- manufacturing conditions, quality control, and factory production;
- transportation conditions; and
- site conditions and reduction in construction period, and maintenance free.

Thus, the beam type selection for this project is done by the following standards:

- 20m or less span is RC beam.
- 20m or more span is PC beam.
- In the station structure, the section where the beam arrangement is complex the RC beam is used

B. Beam-slab Type

(i) List of available Beam Deck types

The two types of beam slab, namely, simple beam viaduct, and rigid frame beam viaduct (T-section). The standard cross sections are shown in Figure 5.3-2.

(ii) Selection of Beam-slab structures

Beam slab type structure is selected for the section where the existing track is on an embankment and where a large track lift is required. Rigid frame will be selected in portions of stations where the concourse area is located, and also at the switch over section connecting the Commuting Line to the Main Line.

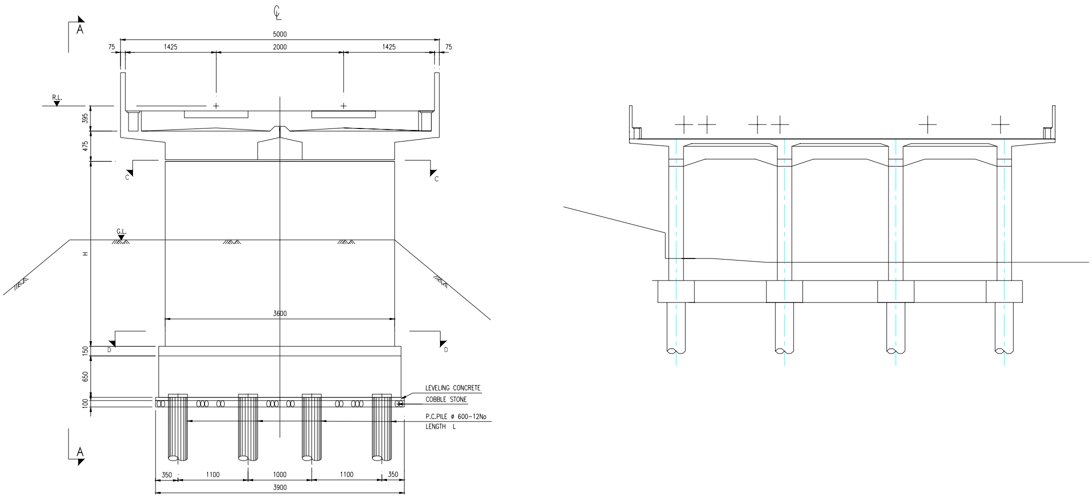


Figure 5.3-2 Standard Cross Section of Beam-slab

(3) Outline of Elevated Structures

The range of structures where the elevated bridge can be employed can be divided into six sections of the Main Line:

- Manggarai Station storage track;
- Manggarai Station;
- Manggarai Station approach;
- Switch-over section between Main Line and Commuter Line;
- Matraman Station West Approach; and
- Commuter Line & East Line flyover approach.

Similarly it is possible to divide into four sections the Commuter Line:

- Bogor Line flyover approach;
- Switch-over section between the Main Line and Commuter Line;
- Matraman Station approach; and
- Matraman Station.

5.3.2. Main Line

(i) Manggarai Station storage track

a. Because this section is for the short-term stabling of passenger cars, rail level is same as the station section. This section includes the West Line flyover, and its description will be included herein. The difference with the rail level of the West Line is about 13m, and so there is no limitation on beam depth. Therefore, the standard structure would be a PC box beam with 25m of beam span.

b. Problems:

- The construction gauge of the West Line limits the position of pier of the flyover section for the West Line.
- A portion of this section has three (3) tracks, then, the standard PC box beam is not recommendable.

c. Resolution

- An inverted U type of pier is envisaged for the flyover. More detailed explanation in section 5.4.1.
- The standard structure will be a PC box beam with 25m of beam span. However, due to space limitation and span adjustment, three spans will be of 20 metres.
- The section with three tracks will be designed as a 14 metres wide structure with PC I beams.
- Figures will be shown in section 5.4.1.

(ii) Manggarai Station

a. Design Conditions

The station is divided in three different sections according to shape and function. The first one corresponds to the considerable widening of cross section due to the increase of the number of tracks. The second section corresponds to the platform area which does not have station building and the tracks are almost parallel to each other, and the third section corresponds to the main building area which contains the concourse area.

For the main building area, the arrangement of columns is decided according to the column footprint required by the arrangement the architectural layout. Architectural roofs cover both the low level (Commuter Line) and high level (Main Line) platforms with the same longitudinal arrangement of columns between low level and high level platforms. A two level rigid frame structure type is designed for this section.

b. Problem

- Steep change in width within one span in the first section. Moreover, the arrangement of piers is asymmetric due to the existence of temporary tracks during construction and rolling stock factory tracks. However, no restrictions in the span length.

- No major issues in second section
- In the third section (Main Building), it will be necessary to provide room for a future at-grade line under the elevated tracks of the Main Line. Moreover, necessary provisions for the location of elevators, escalator, stairs, concourse area, etcetera should be considered.
- Also in the third section, there are tracks leading to a rolling stock factory.

c. Resolution

- First section is designed with RCT beams with 20 metres span, due to the flexibility of arrangement in a span.
- The second section will be designed with PC box beams with span of 25 metres.
- Two rigid frames, separated by a PC I beam of 23 metre span for the track floor, are proposed for the third section. To allow the structure gauge of the factory tracks, one of the frames has an asymmetry. This rigid frame is shown in Figure 5.3-3. The overview of Manggarai Station is shown in Figure 5.3-4.

(iii) Manggarai Station South Approach

From the end of the platforms up to the crossing the Bogor Line flyover, the gradient of Main Line is -5‰. In this section, the existence of three tracks led to the decision of designing a deck structure consisting of PC I beams, with uniform spans of 25 metres each.

After the Bogor Line Flyover, PC Box beams of spans of 25 and 30 metres are used. The different span length is the product of restrictions from the existence of the JL. Manggarai Selatan, and aesthetical match arrangement of spans between Main and Commuter Lines.

(iv) Switch-over between Main Line and Commuter line

a. This section connects the Main Line with the Commuter Line. The construction of the Commuter Line from this point to Jatinegara Station becomes possible through this temporary track connection. The Commuter trains are diverted to the Main Line whilst the Commuter Line structures are constructed. The rail levels of the Main Line and rail level of the Commuter Line are the same for the temporary connection.

b. Problem

- The railway track for a temporary connection is diagonally connected between elevated bridges.

c. Resolution

- This section is an elevated rigid frame structure, in which it is relatively easy to arrange beams to support the switch tracks.

(v) Matraman Station West Approach

The Matraman Station West Approach which corresponds to the section between the above mentioned switch and Matraman Station, except for the Ciliwung River Bridge, is designed with the standard viaduct, i.e. PC box beam of 25 metres span.

(vi) Commuter Line flyover and East Line Approach

The standard PC Box beam of span 25m is also arranged between Matraman and Jatinegara Stations, except for the East Line flyover. In this section there is requirement to match, for aesthetical reasons, the spans of the Commuter Line and the Main Line because the south side of the Commuter line is in embankment.

5.3.3. Commuter Line

(i) Bogor Line flyover approach (North & South)

The gradient is up 18‰ from the end of the ground level platform at Manggarai Station. An embankment is selected until only 50 metres before the Bogor Line because it is necessary to allow the junction between the Commuter Line and a future line. Thus, the remaining 50 metres to the flyover are saved by two spans of 25 metres of PC box.

For the south approach a PC Box beam of spans 20, 25, and 30m are arranged for the same reason stated in the above 5.3.2-(iii).

(ii) Switch-over Section between Main Line and Commuter Line

This section is an elevated rigid frame which joins with to the Main Line. See also 5.3.2-(iv) above.

(iii) Matraman Station approach

a. The new tracks of the Commuter Line will be constructed a few metres over the site of the existing approaches of Matraman.

There are two methods to build the new structure, one is to fill the height gap between the existing and the new tracks with embankment, the other method is by making a RC viaduct structure.

b. Problem

- The toe of slope on the north side of the fill of the existing line is approaching the artificially excavated river or an excavation site in this section. An Anchor type retaining wall is needed to stabilize a new fill.

c. Resolution

- A beam type elevated bridge or a piled beam and slab structure were considered for an RC structure.
- As a result of the study of the duration of execution period and the evaluation of durability of structure, the RC structure is selected over an earth fill structure. The beam type structure, which has high durability, is adopted from the RC

designs.

(iv) Matraman Station

a. Outline

The original design concept for a new station at Matraman was for the station structure to be built alongside the existing embankment. However, the available space was inefficient and insufficient for a beneficial access between the trunk road and the new station buildings. Structurally the application of a rigid-frame construction provides flexibility for station layouts and access to platforms as the staircases can be built through the structure without loss of structural restraint. The new station and offices will be built at ground level, but under the viaduct. For the structural form a rigid-frame viaduct is adopted so that the space under the viaduct can be utilised.

The elevation of viaducts is determined by the elevation of Matraman Bridge. The length of viaduct to be used is 61.3 metres. However, this length is insufficient for the station so a simple 10 metres slab deck is used at both ends of the rigid-frame structure to extend the structure length to meet to the requirements of the station. The space beneath the first span of the viaduct at the Jatinegara end will be used as the approach to the station plaza. The flexibility in the structural design allows for two – direction stairs to be installed to cope with the anticipated passenger demand in the future.

The layout of this structure is shown in Figure 5.3-5.

b. Problems

Rigid-Frame structures inherently have many different types of construction processes compared with the Box Beam and the Piled Slab and Deck structures. This slows construction and increases costs.

c. Solutions

The design flexibility of the rigid-frame for a station structure outweighs the costs of the alternatives. Therefore, rigid frame structures are adopted

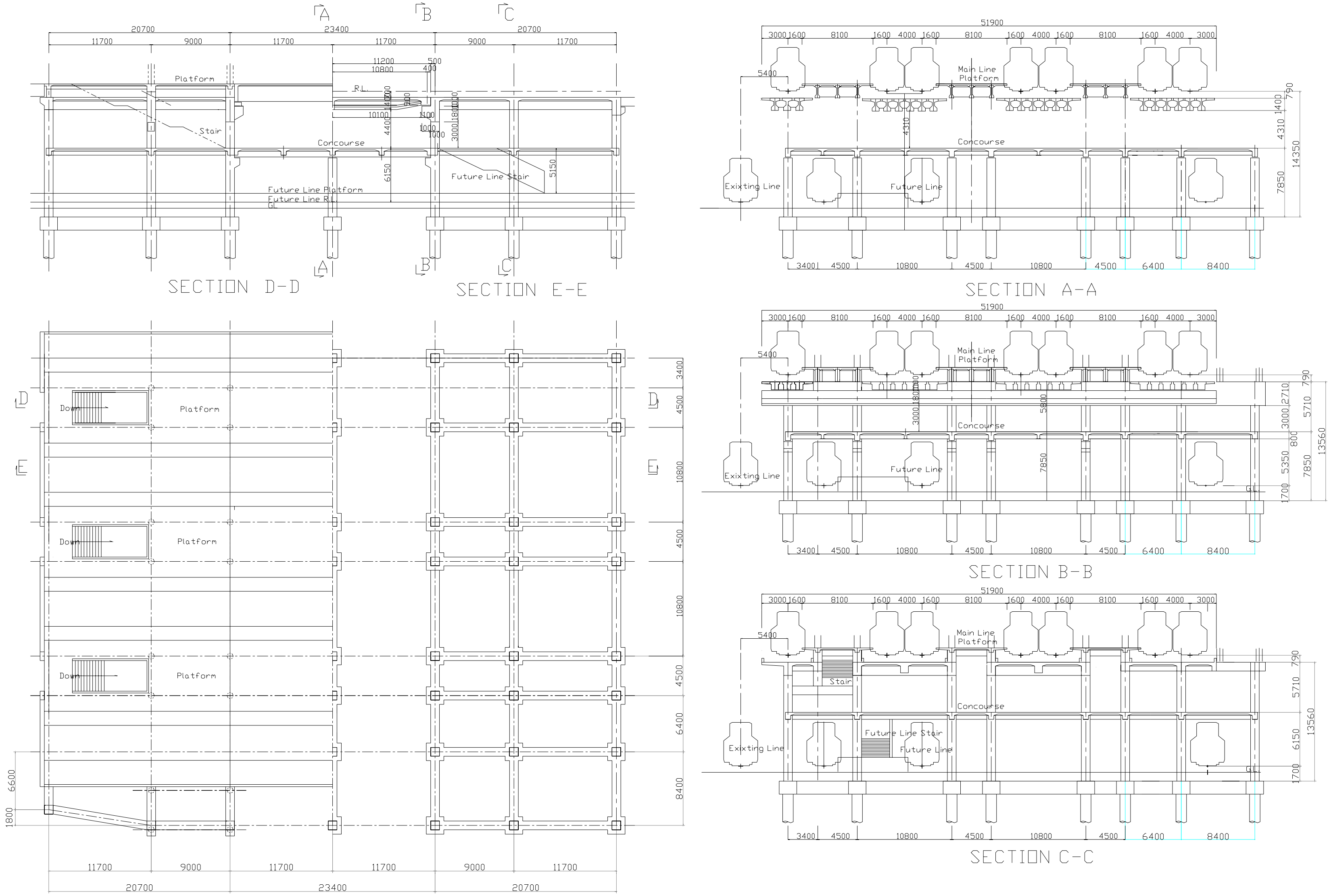


Figure 5.3-3 Manggarai Rigid Frame Structure

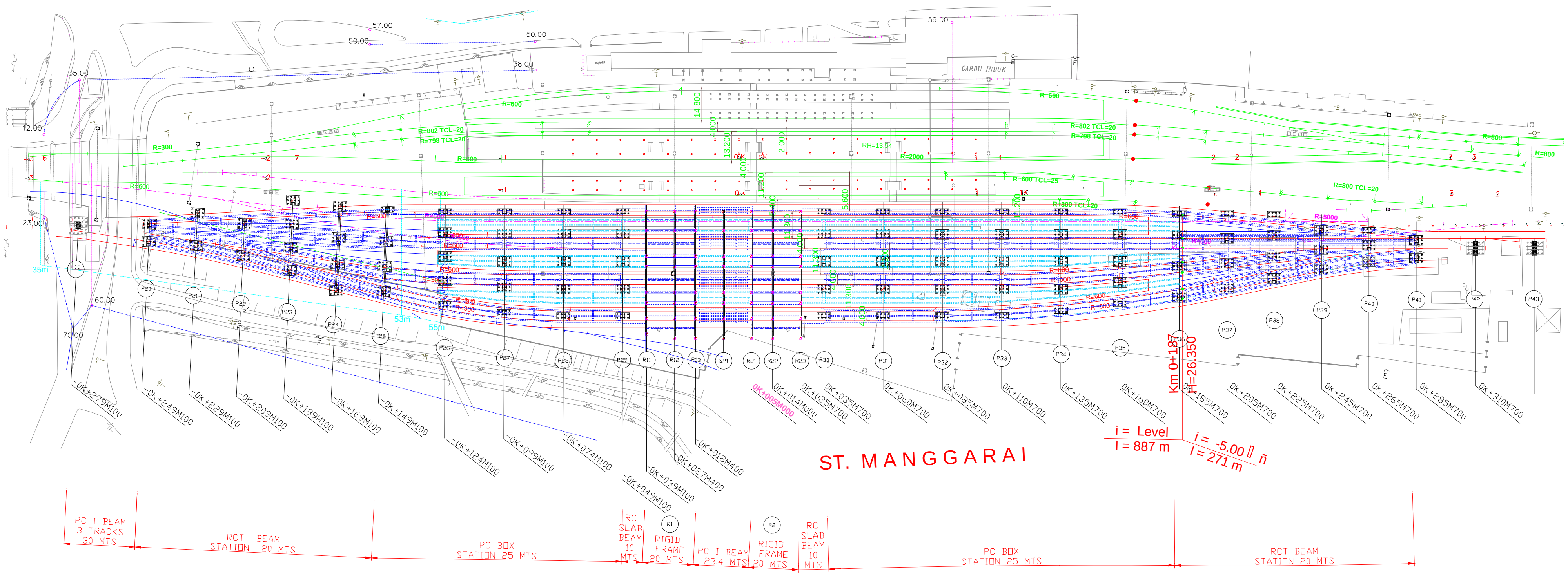


Figure 5.3-4 Overview of Structure of Manggarai Station

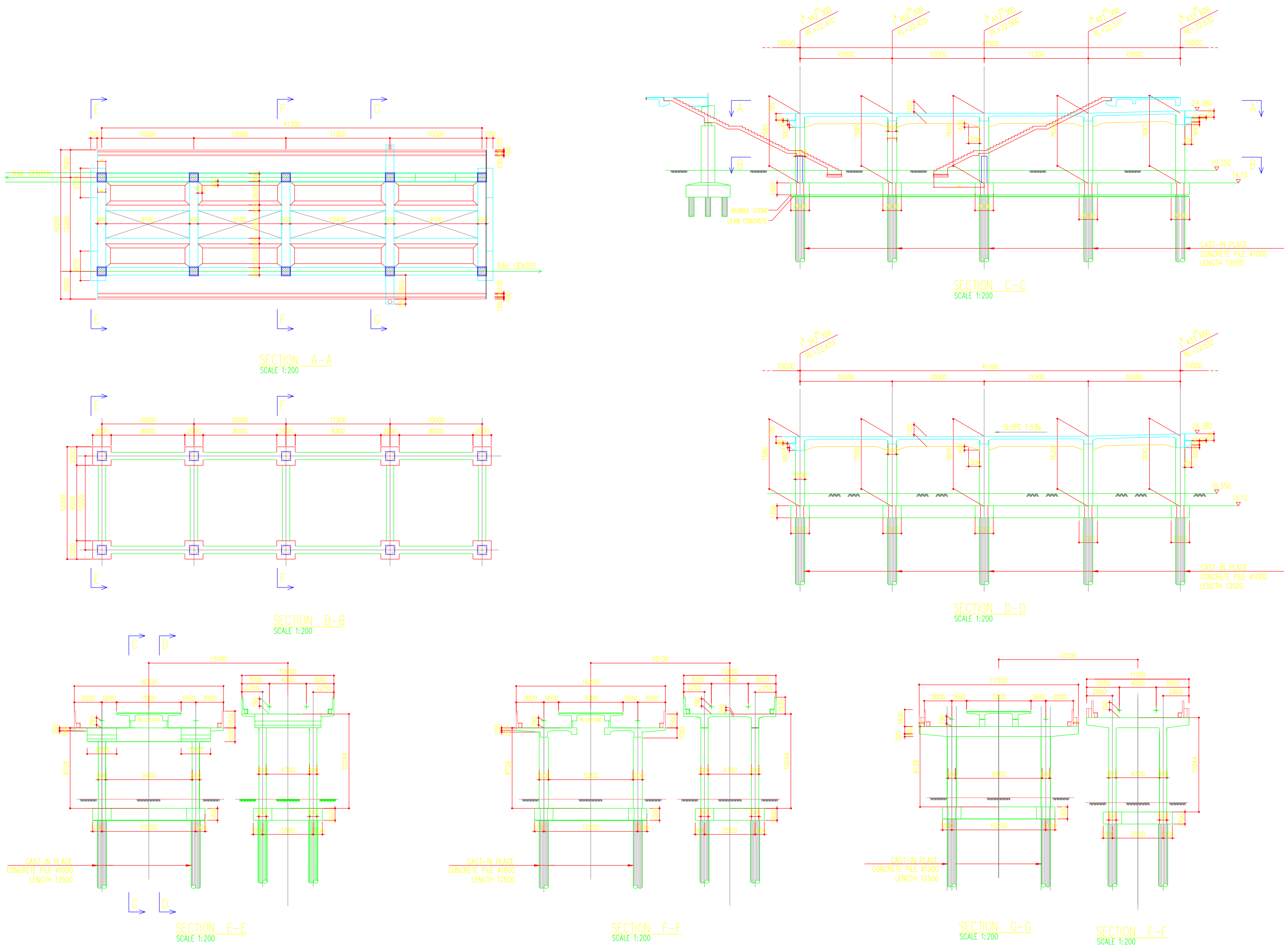


Figure 5.3-5 Overview of Matraman Station

5.4. Civil - Substructure and Others

5.4.1. Piers and Columns

(1) Outline of design

Because it is a structure that is first noticed, as well as the underside of the beam, the pier should be given a light appearance. This role, which is the design of the pier, and which appears continuously, significantly controls the image of an elevated bridge.

The structures lie from the west side of Manggarai Station, through Manggarai Station, and along the elevated structure in the general portion from Matraman to Jatinegara stations.

The material for the Piers and Columns will be reinforced concrete.

The width of the cap of Piers and Columns reflects the shape and size of the superstructure. When the superstructure is a box beam, the standard width of the pier's top is 5.2m for proposed structures. In the other hand, when the superstructure comprises PC I-beams, the standard pier will have a top width of 10.5m.

And, the shape of the surface is curved, the roundness offers a softness which is not unattractive, especially with round columns on the platforms, which do not offer sharp edges to inflict damage on passengers. Moreover, when piers should be located between railway tracks, the inverted 'U' type of substructure will be used.

(2) Main Line

A. Manggarai Station Stabling Track

The standard pier is a rectangular concrete section in the vicinity of ground level and extends up curve-like to meet the taper of the box beam. The standard pier has a cap of 5.2 metres, and a lower width of 3 metres with a curve of radius of 8000 mm in the transition zone. When piers should be located between railway tracks, the inverted 'U' type of substructure will be used with the square columns of only 1.5m side. Because of the high loads in the columns it is anticipated that the structure will have to be concrete design. These two types are shown in Figure 5.4-1.

B. Ciliwung River Bridge (Two locations)

For both locations of the Ciliwung River Bridge, i.e., north-west of Manggarai Station and west of Matraman Station, the design of the piers is different to the standard pier mentioned above, the plan view of the pier is designed in an elliptical form to allow a better flow of Ciliwung river's current. See Figure 5.2-3.

C. Manggarai Station

The pier design is segregated according to the deck design. As mentioned in 5.3, Manggarai Station is divided in 3 different structural sections. The first section with RCT beam will have square columns of side of 1.8 metres with a cap of 2 metres; the columns in the second section with PC box beams are identical to the first section, except for those columns landing in the future platform at ground level, which will be circular columns of 1.8 metres of diameter. The rigid frame will have square columns of 1.2 metre.

D. Manggarai South Approach

The deck in this section is PC I beam of 25 metres of span for three tracks, thus the pier should be wider than the standard pier of 5.2 metres wide mentioned in A. Manggarai Station Stabling Track. In this case, the pier is 12.95 metre wide on the top and 6 metres at the narrower point, also with a curve of radius of 8000 mm for the widening. Figure 5.4-2 shows an example of these piers.

E. From Bogor Fly-over to Matraman Station, East Line Fly-over approach, and Jatinegara approach

The pier design for all these sections is similar to the pier described in A. Manggarai Station Stabling Track, except for the section within the switch track.

F. Matraman Station

The structure within Matraman Station correspond to a rigid frame, thus the columns are square of 0.8 metres each side.

G. Commuter & East Line flyover

Since a few columns in this section are located between railway tracks, the standard pier for this fly-over is post type, made of concrete with rectangular section. The girder is a steel box beam. Figure 5.2-5 shows an example of this piers.

(3) Commuter Line

A. Bogor Line fly-over east approach

The pier design for all these sections is similar to the pier described in A. Manggarai Station Stabling Track.

B. From Bogor Fly-over to Matraman Station

This section has a slab beam as deck structure. Then, piers are rectangular in the plan view, and in the approach to Matraman Station the width of the piers is varying due to increase of distance between tracks, due to the proposed island type platform in Matraman Station. Figure 5.4-3 shows two examples of piers in the approach to Matraman Station. The exceptions to this design are: the Ciliwung River which was described in B. Ciliwung River Bridge (Two locations), and the switch-over from the Commuter Line to the Main Line for operation during construction period. This switch-over has a rigid frame structure, and the columns are square with a side of 1.0 metres.

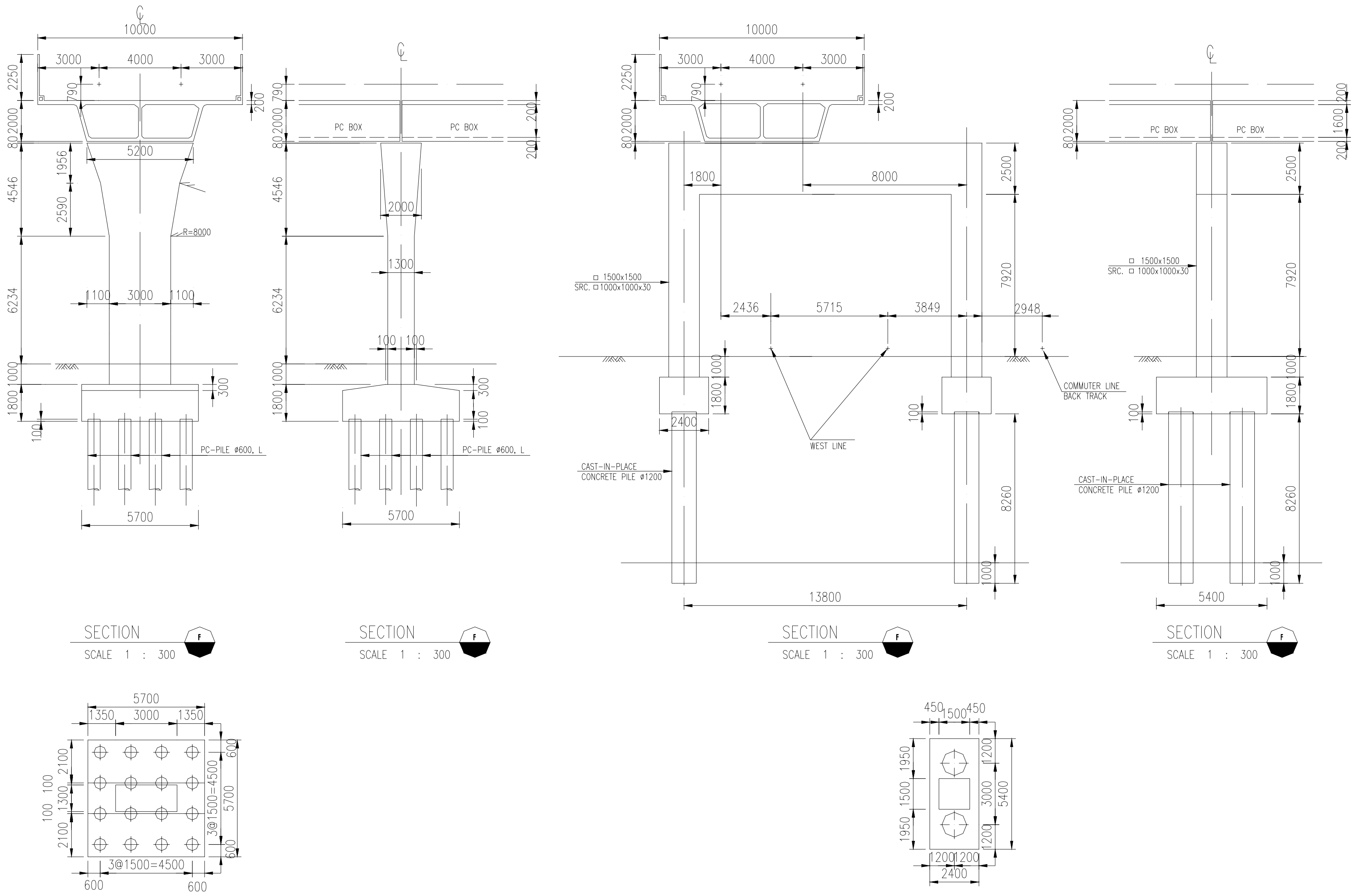


Figure 5.4-1 Example of Piers for Manggarai Stabling Track

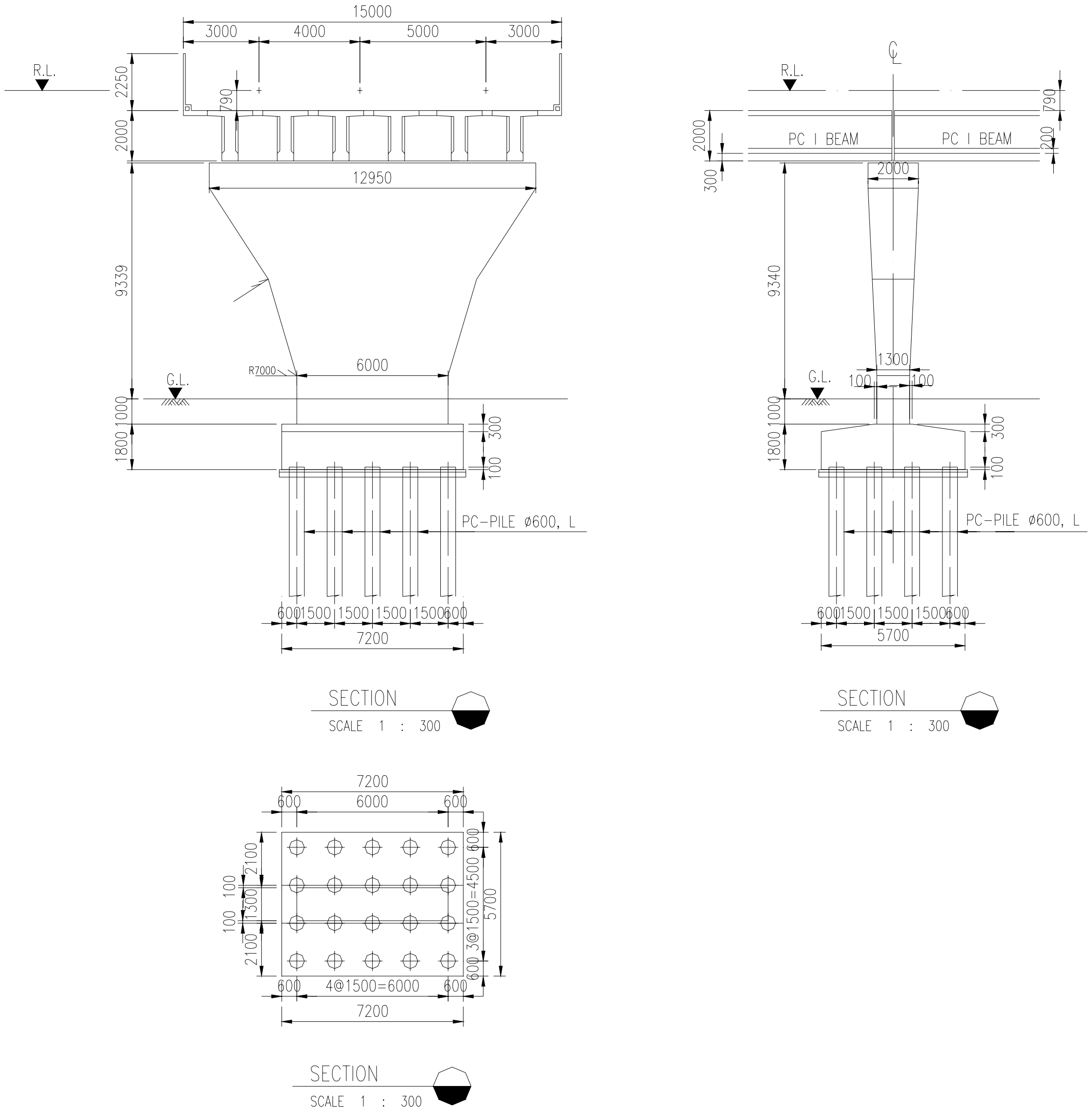


Figure 5.4-2 Example of Piers for Manggarai South Approach

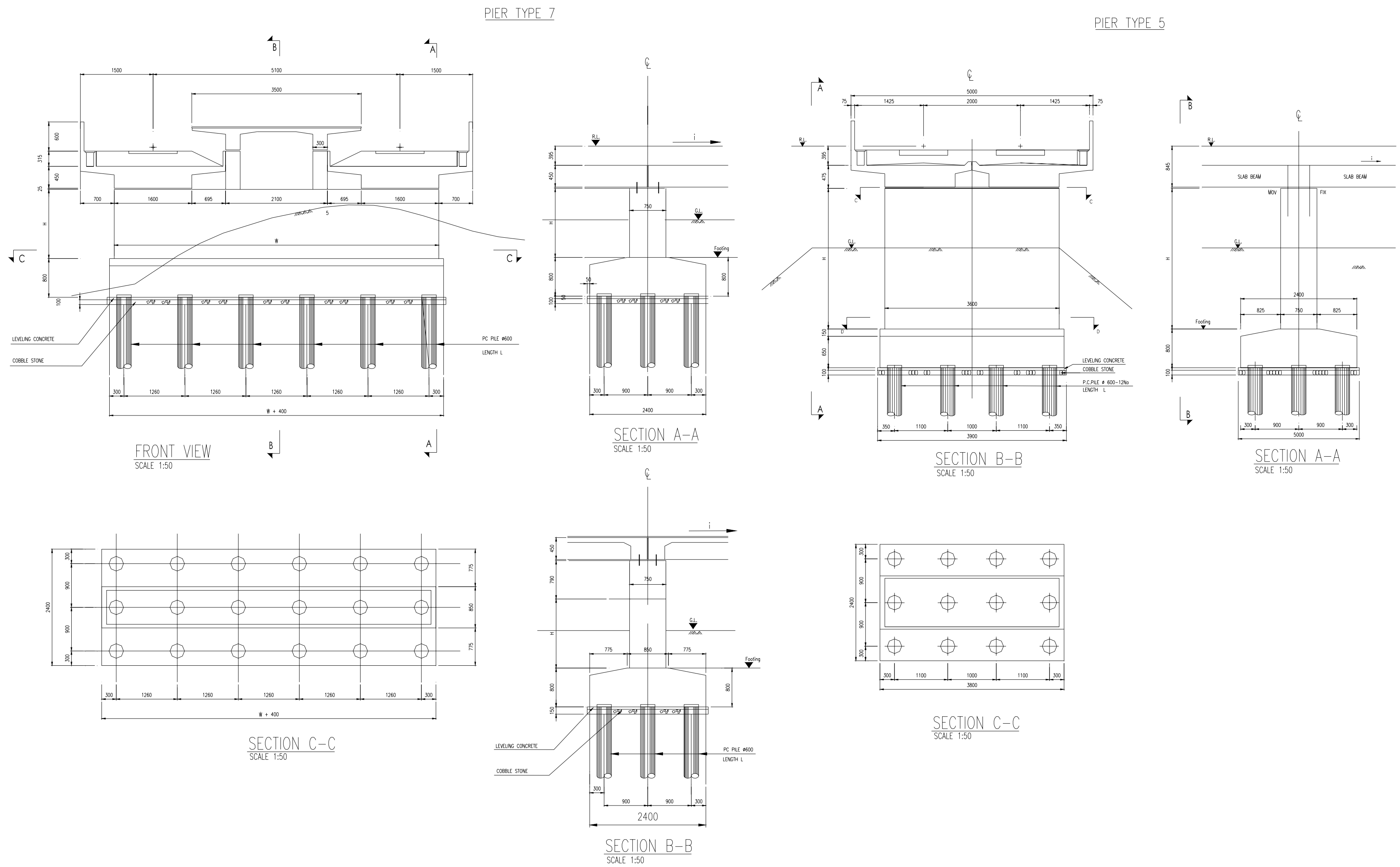


Figure 5.4-3 Example of Piers in Commuter Line, Matraman Station Approach

5.4.2. Foundations

(1) Outline of design

This section discusses the foundations required for the piers and columns between the Manggarai Station stabling track structure and Jatinegara Station.

The basic structural shape is based on the superstructure's load and the ground conditions. When the bearing stratum is generally shallow, direct bearing through a spread footing is possible, and that a pile foundation is reasonable when the bearing layer is deep. Piles are also recommended where the site conditions prevent large footings to be excavated and the foundation loads are high.

In this study only pile foundations are recommended. These pile foundations can be precast concrete or cast-in-place concrete piles. In general, the precast concrete piles are used where high quality and a short construction period is required.

Precast concrete piles are normally of 600mm diameter and the number of them is adjusted according to the load and ground conditions. Cast-in-place concrete piles are used when the piles are executed between tracks (large footing restrictions), or for large loads in restricted sites, or where it is environmentally required for there to be no vibration or noise. In that case, the pile diameter will be more than 1.0m, and it is assumed that manual excavation method or the TBH-pile method, which is a comparatively small machine, will be used.

(2) Design Examination Result

A. Manggarai Station Stabling Tracks, stations approaches, and flyovers

The bearing layer varies from approximately +5.6 m to -7.1 (from G.L = 0) in the whole section, and almost all piles are assumed as precast pile of the 600mm driven type. The piles for the foundations of the inverted 'U' substructures located between railway tracks in the West Lines fly-overs will be cast-in-situ concrete piles. East Line fly-over will also have cast-in-situ concrete piles. Figure 5.4-1 shows an example of each of these two types of piles, precast and cast-insitu.

B. Manggarai Station

The rigid frame construction part of the station will be founded on cast-insitu concrete piles 1.50m diameter. Construction will be in a narrow site where the superstructure loads are large because of the two floors.

The beam type elevated rail bridge structure assumes a footing design by virtue of the space on the construction site, and adopts a precast concrete pile of 600mm diameter.

5.4.3. Abutments

A Section between Manggarai and Bekasi

(1) Outline of design

The abutment supports a load from the bridge, and resists earth pressure. Abutments are needed where the formation changes from earth fill to a viaduct or a bridge. Thus these are needed for the Bogor Line flyover and the end of the elevated section near Jatinegara station, and all railway bridges between Jatinegara and Cikarang stations. As Ciliwung and Matraman Bridges have been described in Sections 5.2.4 and 5.2.5 their descriptions are omitted.

(2) Abutment List

These are given in Table 5.4-1 Schedule of Abutments on the next page.

(3) Design Examination

The abutment is affected by the working load as well as the type of bridge structure and the bridge span. The abutment shape is changed by the ground condition (depth etc. of the bearing stratum). If the abutment is examined based on existing soil data, the bearing strata vary from place to place, and the direct foundations become reasonable between Jatinegara and the west side of Bekasi.

The bearing stratum near to Bekasi station and from Manggarai to Jatinegara is deep, and the abutment foundations will become piled foundations.

When the river profile is considered, it is undesirable to change the river profile because it can inhibit current river flow, then the abutment has to be buried into the banking. The riverbank protection profile can be matched to the gravity type, reverse-T type, or the buttress type without a great impact so the new abutment shape is assumed to be that of the present abutments.

For those foundations that are expected to be piled, on the section between Manggarai and Jatinegara and on the West side of Bekasi Station, a precast concrete pile of 600mm diameter becomes advantageous for construction, economy, and construction period etc. There are many houses near to the construction site, and the inner excavation type offers many environmental advantages.

Table 5.4-1 Schedule of Abutments

Location	Under Structure	Span (m)	Super Structure Type	Substructure	Note
(Manggarai)					
0K440m019 (Ac1)	Railway	25.0	PC Box beam, 2 tracks	Abutment	Commuter Line
0K490m019 (Ac2)	Railway	25.0	PC Box beam, 2 tracks	Abutment	Commuter Line
0K565m0 (Ac3)	Railway	25.0	PC Box beam, 2 tracks	Abutment	Commuter Line
1K508m6 (Ac4)	Railway	20.0	PC I beam, 1 track	Abutment	Commuter Line
1K608m6 (Ac5)	Railway	12.5	RC slab beam, 1 track	Abutment	Commuter Line
2K193m4 (A1)	Railway	25.0	PC Box beam, 2 tracks	Abutment	Main line
(Jatinegara)					
(No.67A)14K214m	River	18.2	RC composite	Abutment	
(No.68)14K582m	River	18.2	RC composite	Abutment	
(Klender)					
(No.80)17K804m	River	19.2	RC composite	Abutment	
(No.81)17K950m	Road	13.0	RC composite	Abutment	
(Klender Baru)					
(Cakung)					
(No.110)22K913m	River	34.0 7.0×2 20.0×1	RC-T-beam PCI- Beam	Abutment and Normal pier	River New plan
(Kranji)					
(No.117)24K146m	River	9.0	RC-T-beam	Abutment	
(No.129)26K236m	River	13.0	RC composite, 1 track	Abutment	
(Bekasi)					

Access for a large boring rig machine is difficult, and the environment of the site make it preferable that manual excavation method is used within a steel liner tube.

(4) Examination Result

From the examinations carried out where the bearing stratum is about 2m below the riverbed a direct foundation will probably be acceptable. However, a piled foundation is anticipated if the bearing layer is more than 5m below the riverbed.
Figure 5.4-4 shows the piled foundation type abutment.

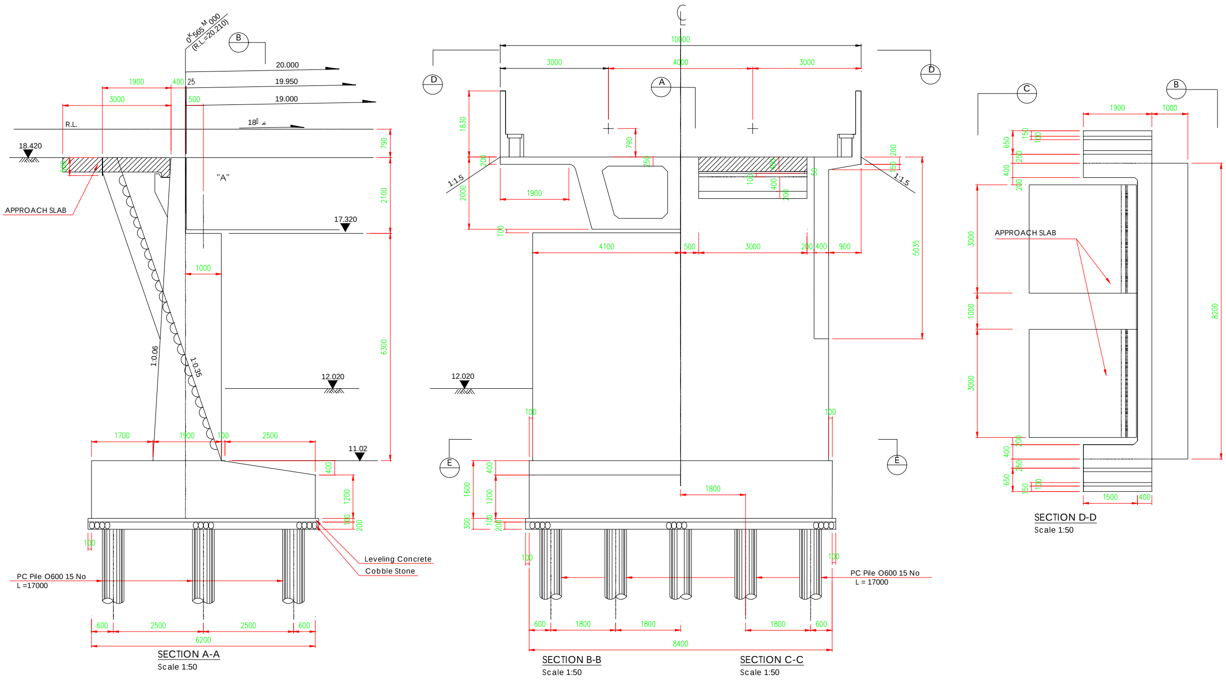


Figure 5.4-4 Abutment Type

B Section between Bekasi and Cikarang

(1) Bekasi Bridge – Abutments

Abutment Design

The construction of two pairs of abutments is required for the two new Bekasi bridges, one pair up-stream of the existing up-stream bridge and the other pair down-stream of the existing down-stream bridge. The abutments were designed based on the assumed load from bridges, including live loads, and the soil conditions at each abutment area.

The new bridges will be single-track through-truss spans similar to the existing truss bridge, which will remain in use. Overall length of each of the new bridges will be 72.0 metres similar to the existing bridges. Refer to Figure 5.2-9.

Design Considerations

a) Design Basis

- The ground will be excavated down to the level of the bottom of the existing abutment, i.e. 6.9 metres.

- Type of the abutment: Reinforced concrete inverted-T type abutment (for single track).
- Height of riverbank protection is 11.0 metres on the Bekasi bank. No work will be carried on Cikarang side bank as currently there is no riverbank.
- Although it is desirable to adopt the same foundation type for a pair of abutments for the same bridge, the foundation type was determined after considering the level of the bearing stratum. A spread foundation is adopted for the Bekasi abutment up-stream side, whereas piled foundations are adopted for other three abutments.
- As the river has curves around the bridges, it is assumed that scouring would not happen in a dramatic manner. However, there still may be a possibility of scouring in 50 - 100 years. Therefore, the level of the bottom of the abutment was set at the same level as the bottom of the river.
- Approach slab will be provided behind the abutments to avoid track settlement because:
    - the maintenance works of the structure may not be sufficiently provided in the future, and
    - the rail is installed directly onto the bridge structure, etc.
- The width of the abutment is 7.80 metres allowing for the width of bridge and bearings.
- The same basic structure design is utilized as much as possible. See Figure 5.4-5 and Figure 5.4-6.

b) Basic Abutment Design

The level of the bottom of the existing abutment:

- Level 6.9m with spread foundation

Bekasi-upstream-Bekasi side

- Bearing stratum: Level 7.1m spread foundation

Bekasi-upstream-Cikarang side

- Bearing stratum: Level -5.1m piles foundation (Diameter D=1.0m and piles length L=15.5m). This abutment has to be constructed inside a temporary cofferdam, and this is shown in Figure 5.4-7.

Bekasi-downstream-Bekasi side

- Bearing stratum: Level 3.8m piles foundation (Diameter D=1.0m and piles length L=8.5m of pile)

Bekasi-downstream- Cikarang side

- Bearing stratum: Level 3.2m pile foundation (Diameter D=1.0m and piles length L=9.6m)

(2) Cikarang Bridge – Abutments

Abutment Design

One double track bridge will be constructed up-stream of the existing bridges.

A pair of abutments will be constructed for the new double track bridge. The abutments have been designed based on the designed load from the bridge, including live loads, and based on the soil conditions for each abutment.

Distance between new track centre and the existing track centre has been changed from about 20 metres shown in the Basic Design Report to 13.5 metres after modification of the track alignments.

Length of the new bridge will be 50.0 metres, taking into consideration the requirement of the PU of not constructing any structures in the water flow area. A General Arrangement Drawing is shown in Figure 5.4-8.

Design Conditions

Structural type and general dimensions

Type of the abutment:	Reinforced concrete inverted-T type abutment for double track
Superstructure:	Double track through-truss bridge (Span length L=50.0m)
Track:	Transverse Bridge Timbers
Basic form:	Spread foundation or piled foundation
Support condition of base:	N value 40-50 of sand
Width of the abutment:	B=10.8m

Design Considerations

a) Design basis policy

- The ground will be excavated only down to the level of the bottom of the existing abutment, i.e. 7.58 metres. However, this is not applicable for Bekasi abutment as it is about 20 metres from the existing abutment.
- Height of riverbank protection will be 12.0 metres for both the Bekasi and Cikarang banks.
- Although it is desirable to adopt the same foundation type for a pair of abutments of the same bridge, the foundation type was determined according to the level of bearing stratum. A spread foundation is adopted for the Bekasi abutment, whereas a piled foundation is adopted for the Cikarang abutment.
- In the case of the piled foundation, the abutment could be located at a shallower level. However, considering the possibility of scouring in the long term, the level of the bottom of the abutment was set at the same level as the bottom of the river.
- The width of the abutment is 10.80 metres allowing for the width of bridge and bearings.

- A similar structure is used for both abutments.

b) Basic Abutment Design

The level of the bottom of the existing abutment: Level 7.58m spread foundation

Bekasi side

Bearing stratum: Level 7.0m spread foundation

Cikarang side

Bearing stratum: Level 0.0m pile foundation (Diameter D = 1.0m and piles length L = 14.3m)

Design of abutments is shown in Figure 5.4-9.

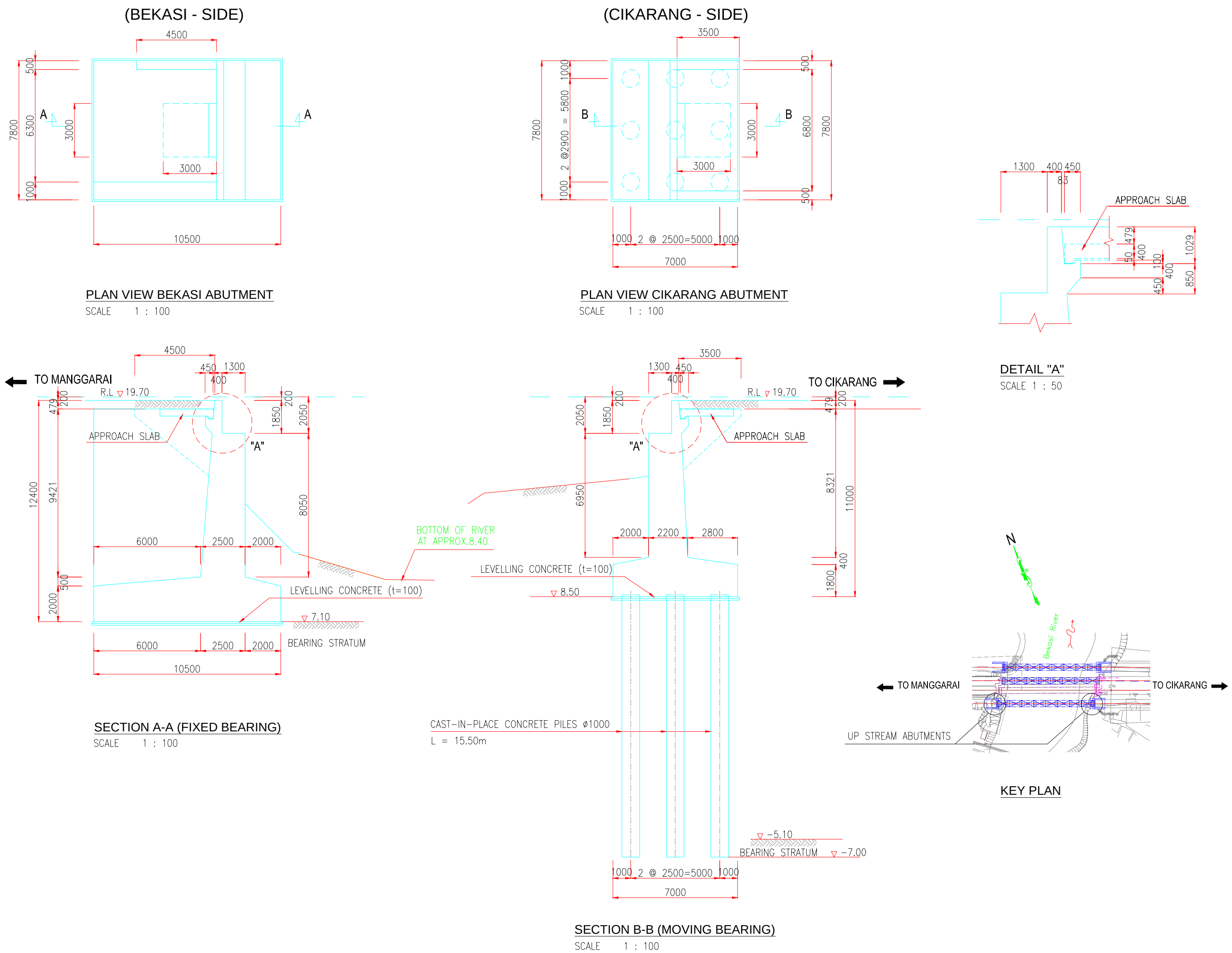


Figure 5.4-5 Bekasi Bridge – Upstream Abutments

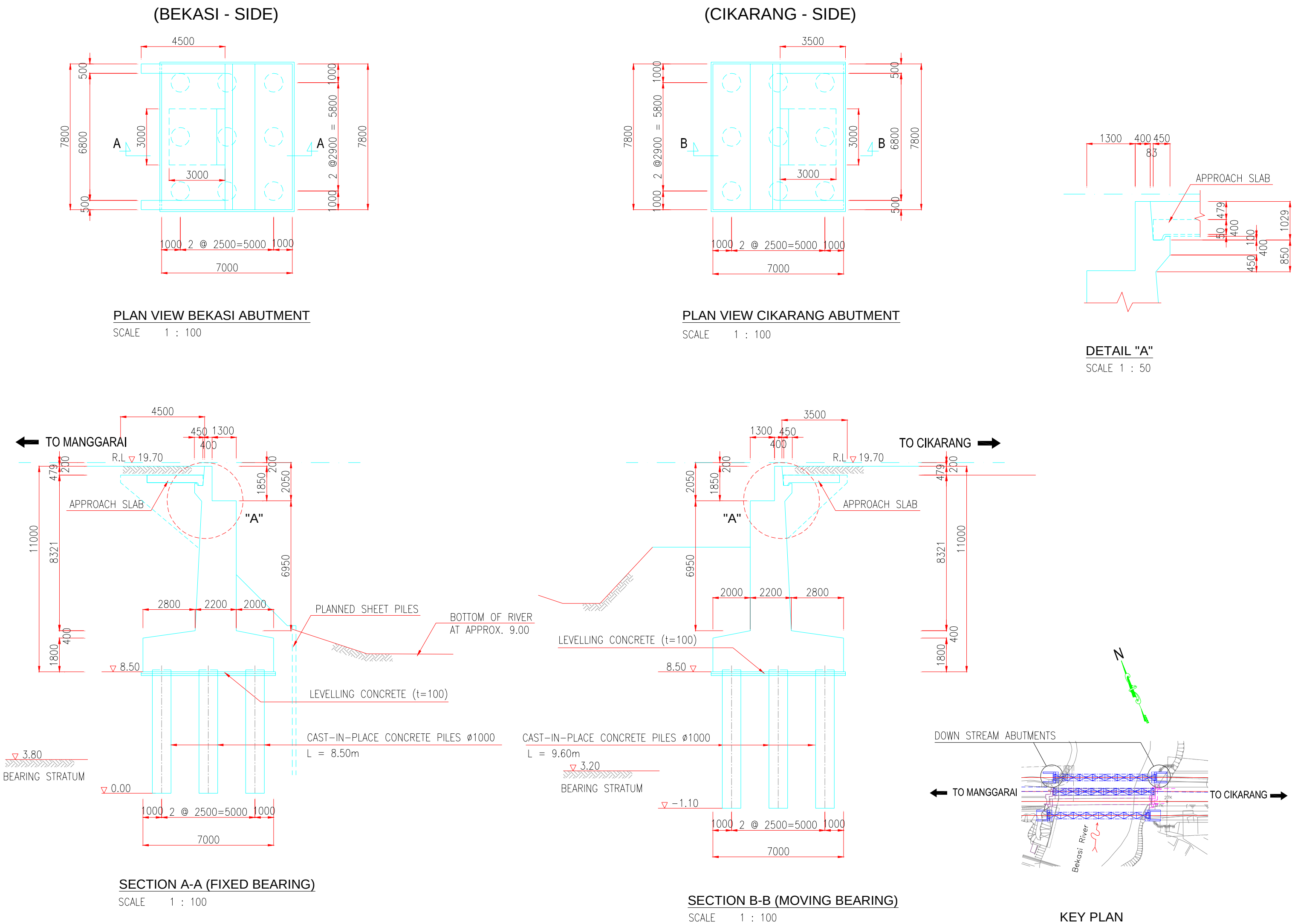
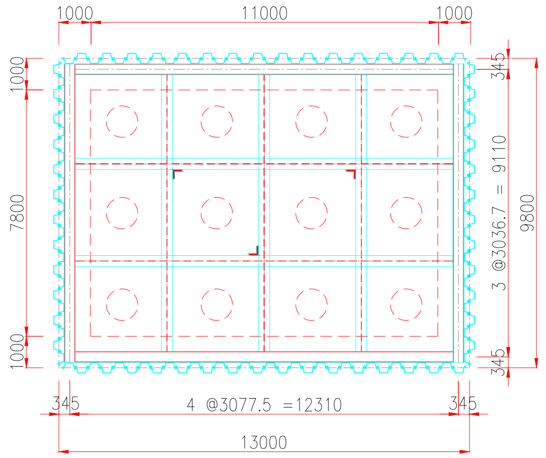
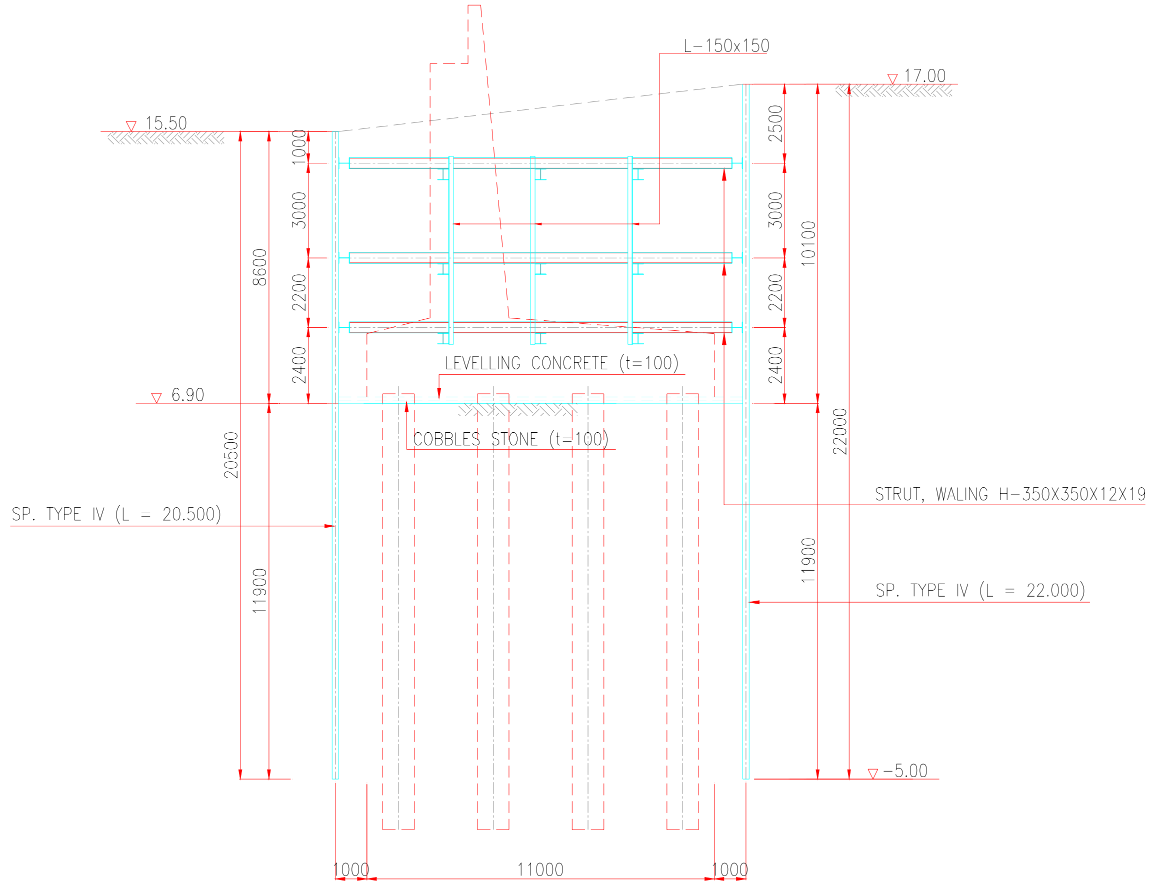


Figure 5.4-6 Bekasi Bridge – Downstream Abutments



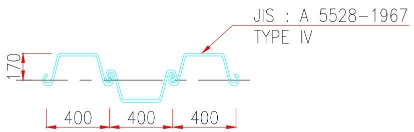
PLAN VIEW

SCALE 1 : 100



SIDE VIEW

SCALE 1 : 100



SHEET PILE

SCALE 1 : 20

Figure 5.4-7 Bekasi Bridge Temporary Cofferdam

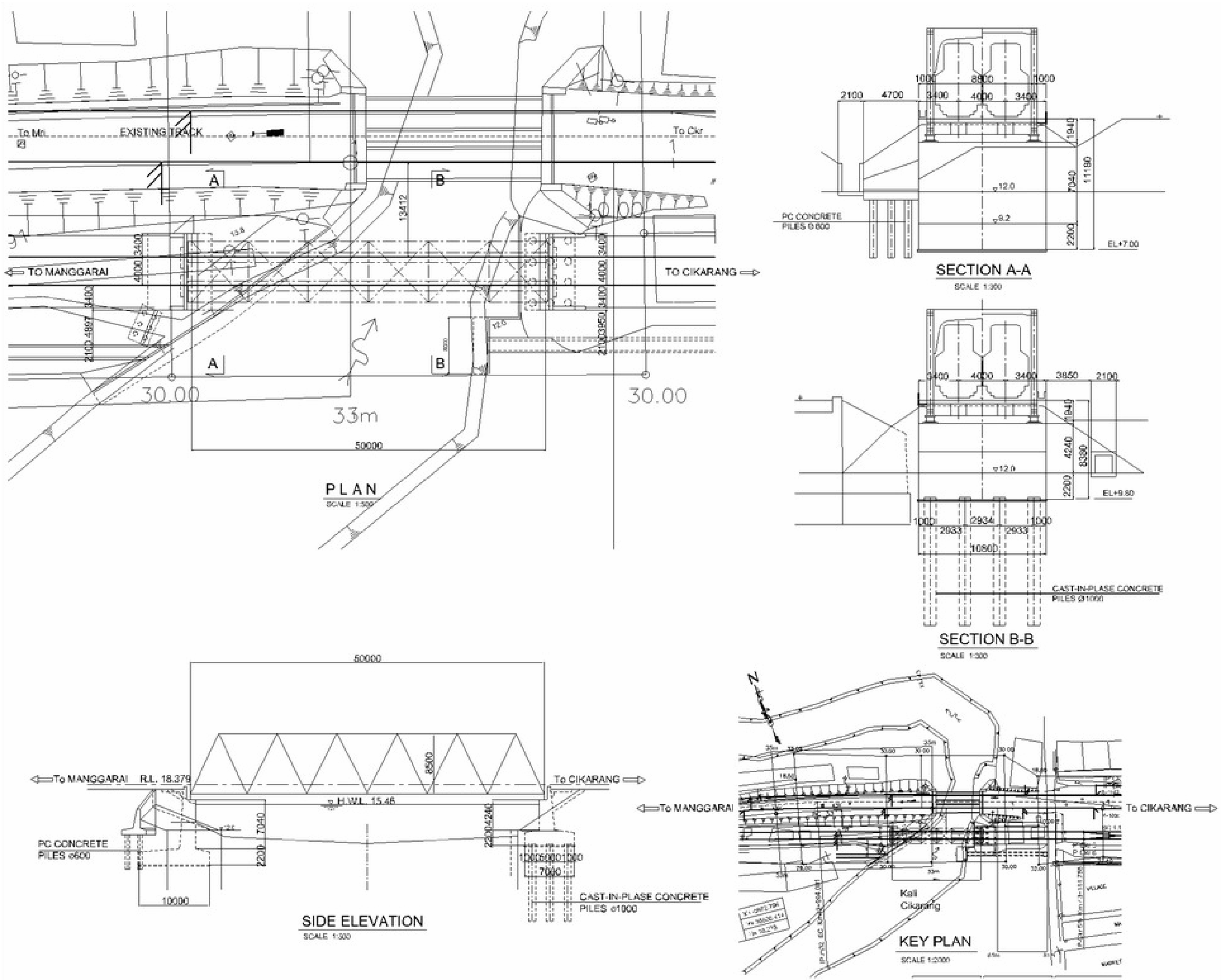


Figure 5.4-8 Cikarang Bridge General Arrangement

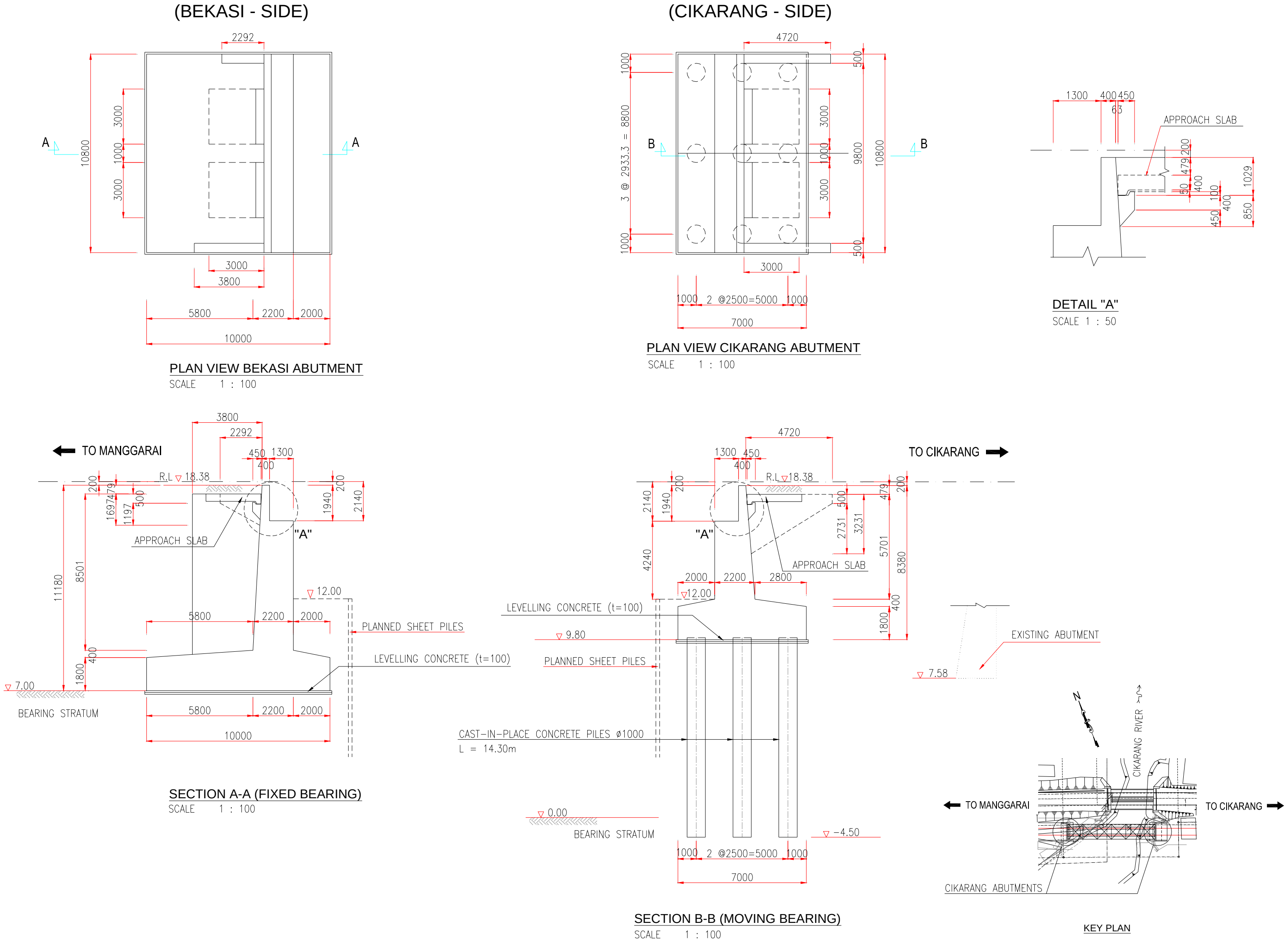


Figure 5.4-9 Cikarang Bridge Abutments

5.4.4. Culverts and Drainage.

(1) Outline of Design

The comparatively small rivers (the width of rivers about 2-4m) under embankments will be constructed as Box Culverts in all new construction activity. In this design, these rivers will be protected when the embankment will be constructed under this project.

A. Culvert Schedule

A box culvert of three spans in a single layer is set up in nearby 1K+600m between Manggarai and Jatinegara stations, and when the embankment of Commuter Line is constructed, the Box Culvert will be extended.
Box culverts will be constructed at five places between Jatinegara and Cikarang, and all these structures are shown in Table 5.4-2.

Table 5.4-2 Schedule of Culverts

Location	Under Structure	Superstructure Type	Substructure	Note
(Manggarai)				
1K650m	River	2.0×2.0×3box	Box Culvert	Commuter line
(Jatinegara)				
11'(No.73A)16K160m	River	2.5×2.5×4&1.9×1.7×1	Box Culvert	Addition
(Klender)				
(Klender Baru)				
15.(No.93)20K160m	River	2.5×2.5×3box	Box Culvert	
(Cakung)				
16.(No.99)21K142m	River	2.0×2.5×1box	Box Culvert	
17.(No.104)21K636m	River	2.0×2.0×1box	Box Culvert	
18.(No.106)21K786m	River	2.0×2.0×1box	Box Culvert	
(Kranji)				

(2) Examination Result

A. Between Manggarai and Jatinegara Station

The Commuter Line is constructed on fill consequently some countermeasures are needed for three span Box Culvert constructed near to 1K+500m. If the economy and construction are examined the Box Culvert design obviously becomes dominant over a bridge. The box culvert of three existing spans is extended preferably in the same shape.

B. Between Jatinegara and Cikarang Stations

Similarly box culverts should be extended as the existing size.

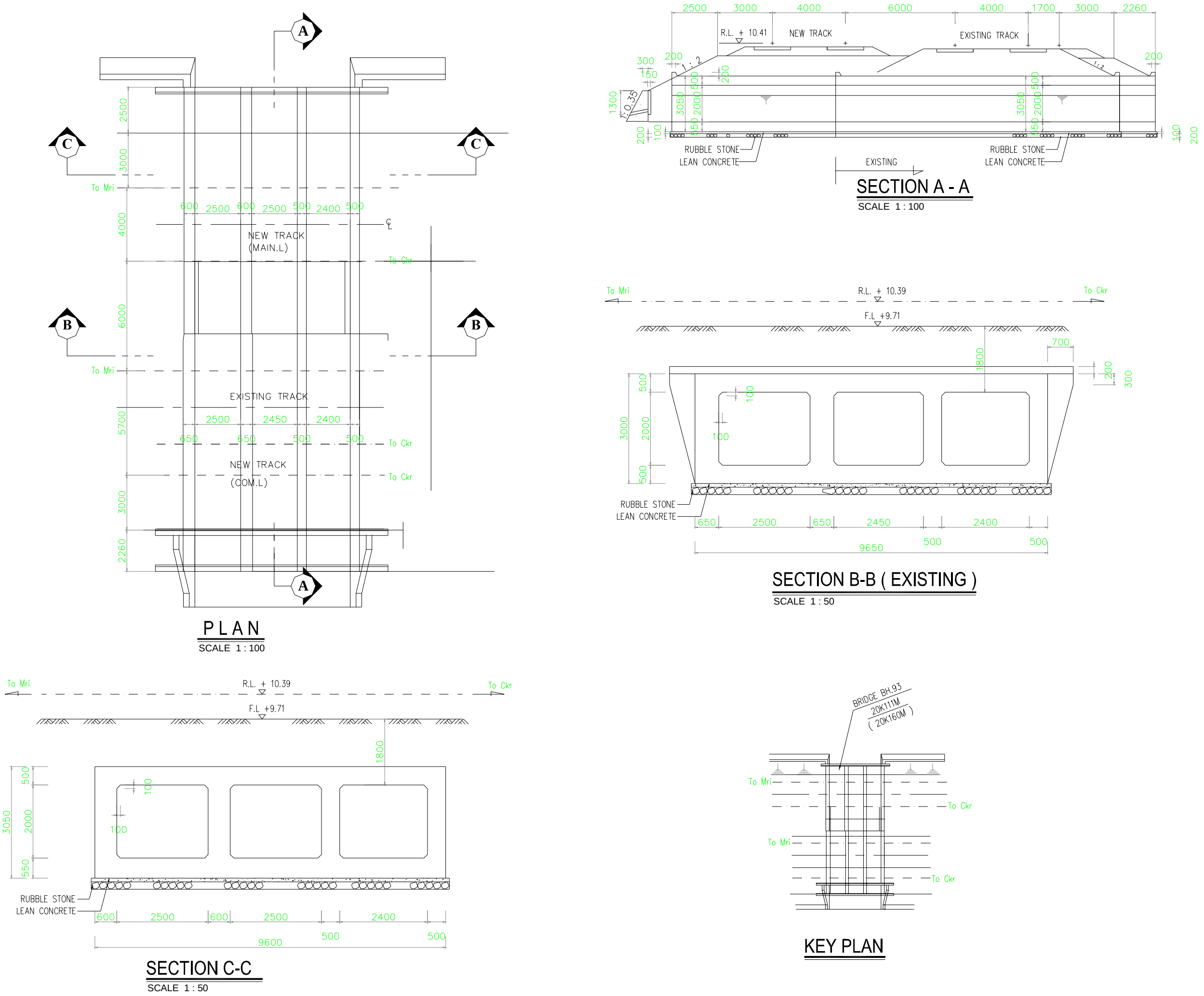


Figure 5.4-10 Typical Box Culvert (Example from No.93)

5.5. Civil - Earthworks

The design of earthworks, including retaining walls and drainage, was based on cross sections every 50 m made from topographic survey data and plans from -0K+750M at the north side of Manggarai station and 44K+000M at Cikarang Station. Cross sections, in conjunction with plans, size and location, shall specify the location and size of all earth works and minor structures including retaining wall and drainage.

Since the Project is located in a relatively good and safe ground, embankments, which are much cheaper than reinforced concrete viaducts, shall be used as much as possible. However, there are some sites where restricted working space is expected due to narrow space between working area and public area. For example, between Km. 0+945 and Km 1+608 high embankment could be expected, but viaduct composed with piers and RC beams will be constructed.

Around Km 25, there are some sections where ground surface consist of weak stratum, at these locations ground improvement is expected. The ground where ground improvement is required was defined according to the N Value. In sandy layer the N Value less than 10 and clay layer it shall be less than 4, ground improvement shall be carried out. An economical ground improvement method replacement with good soil material is recommended. This method is relatively reliable and future maintenance is also easy.

At some location the height of embankment reaches at 5 m. From the economic point of view, the arrangement of the embankment material is a key point. In principle, such material shall be obtained from structural excavation. In order to meet sufficient volume, it is necessary to find quarry at reasonable distance from the site. However the Contractor shall be required to obtain the Engineer's consent on quarry and materials to use providing enough data and so indicated in the technical specification. In addition, the transportation of embankment material is also an issue from the environmental point of view. The Contractor shall be required by the Contract to obtain the Engineer's consent on their tailor-made environment management plan which shall include noise and dust control for material transportation.

In case of embankment construction adjacent to the existing bank, in order to prevent from slope sliding benching, cut in depth 30 cm and 40 width, shall be provided in the existing bank. Strict formation is necessary to minimize future settlement and to avoid unequal sinking. The technical specification requires one layer be less than 30 cm thick and enough compaction with suitable equipment. The control of quality shall be carried out through maximum density which is generally used in Indonesia and Japan for the construction of embankment. The Contractor shall carry out trial embankment with proposed material and equipment minimum number of passes of the equipment.

With regard to gradient of embankment fill and cut, 1:1.5 and 1:1.2 were specified in the drawings. The concerned gradient was brought from previous JABOTABEK Railway and other highway project in Jakarta area. Slope shall be protected from erosion with suitable grassing. In selection of grassing material and construction method, the Contractor shall obtain the Engineer's consent. (See Figure 5.5-1 to Figure 5.5-3 Standard Cross Section (1), (2), (3) for cross sections between Manggarai and Bekasi and Figure 5.5-4 and Figure 5.5-5 Standard Cross Section (4) & (5) for cross sections between Bekasi and Cikarang)

Embankments with height of less than 1 m shall have an adequate gradient, however more than 1 m embankment shall be protected at the foot of slope by retaining wall, and more than 1.5 m high embankment will be provided with reinforced concrete retaining wall. On the other hand, less than 1.5 m embankment will be provided with only a gravity wall without reinforcement.

The lean wall (concrete wall in drawing) will be provided to the cutting section along the boundary between railway and public, in considering the stability of wall the height was restricted to 4m. In order to keep safe and stable conditions of the retaining wall and concrete wall, it is necessary to keep the pore water pressure at reasonable level. For the purpose stated above, PVC pipes shall be provided in the retaining wall and concrete wall. (See Figure 5.5-6 Retaining Wall and Figure 5.5-7 Concrete Wall)

In order to keep the track in reasonable condition, drainage system plays key role to prevent the track bed softening or mud pumping. Rain water shall be drained as soon as possible through ballast and sub-ballast. Drainage of gradient 5% as standard shall be provided to the top of sub-grade which shall be adequately compacted. Recently un-woven type of geo-textile is commonly used under the sub-ballast to prevent mud pumping. However the Project location has relatively stable ground, and the good condition can be kept by proper maintenance work. Therefore, the Study Team did not propose such geo-textile in the technical specification. In designing drainage system, the Study Team took account of area to drain, characteristic feature of surface, surrounding area geographic condition. Design volume of drain was found from the past design data adopted in the JABOTABEK Railway and Highway project, at level of 100 mm per 1 hour, therefore standard U-shape ditch 30 cm in width and 40 to 50 cm in depth is proposed. Between the main track and commuter track on embankment, French drain system shall be provided, and at every 30 m track crossing drainage shall be provided connecting to each other. (See Figure 5.5-1 Standard Cross Section (1)). Drainage system shall be terminated at rivers and canals.

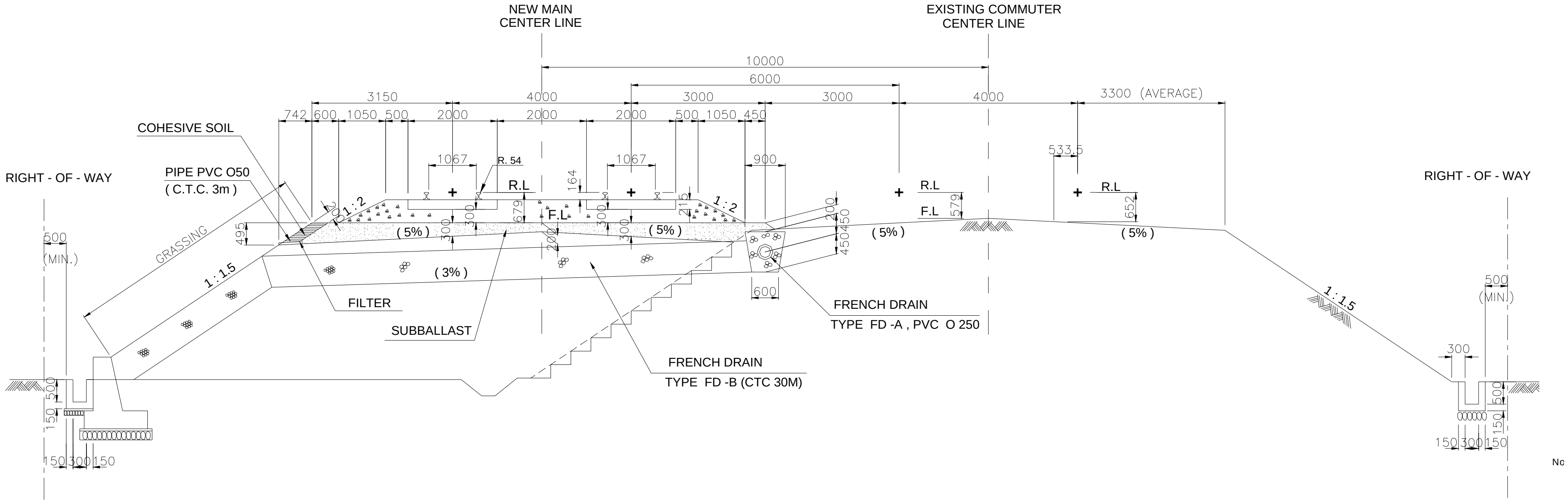


Figure 5.5-1 Standard Cross Section (1)

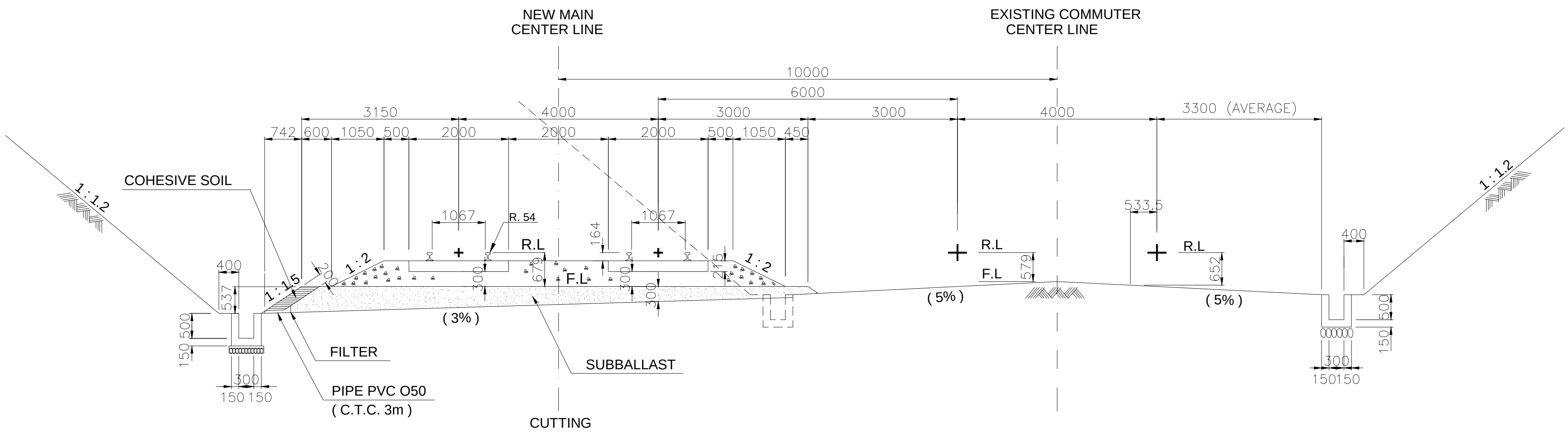
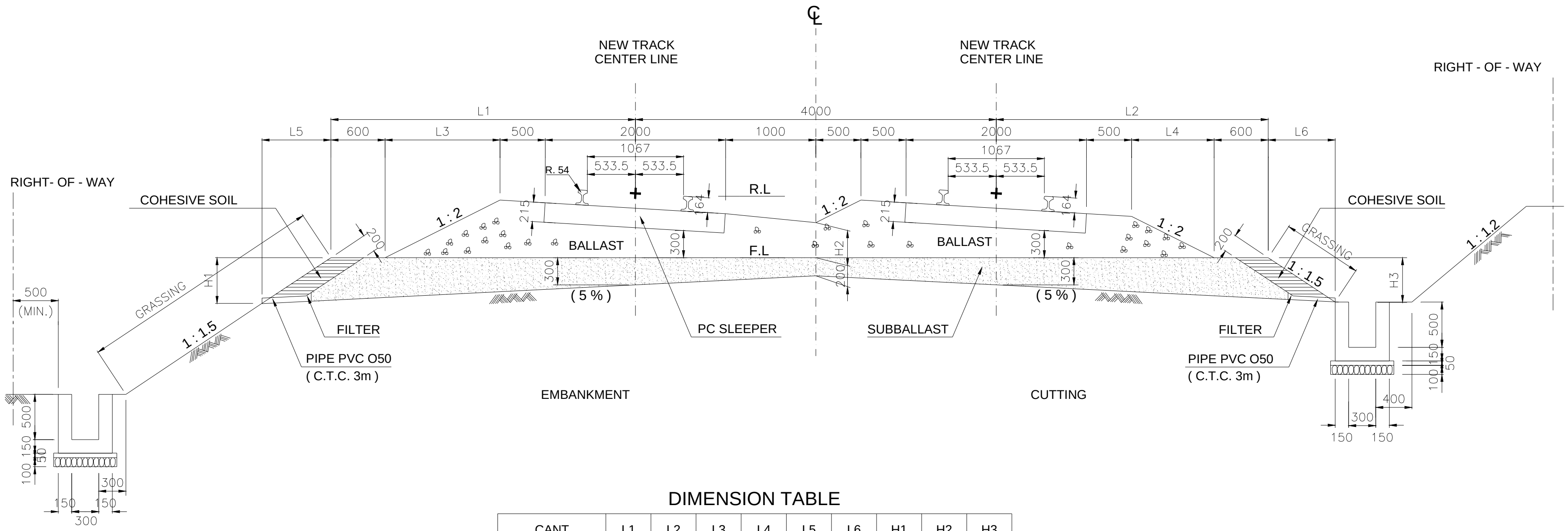


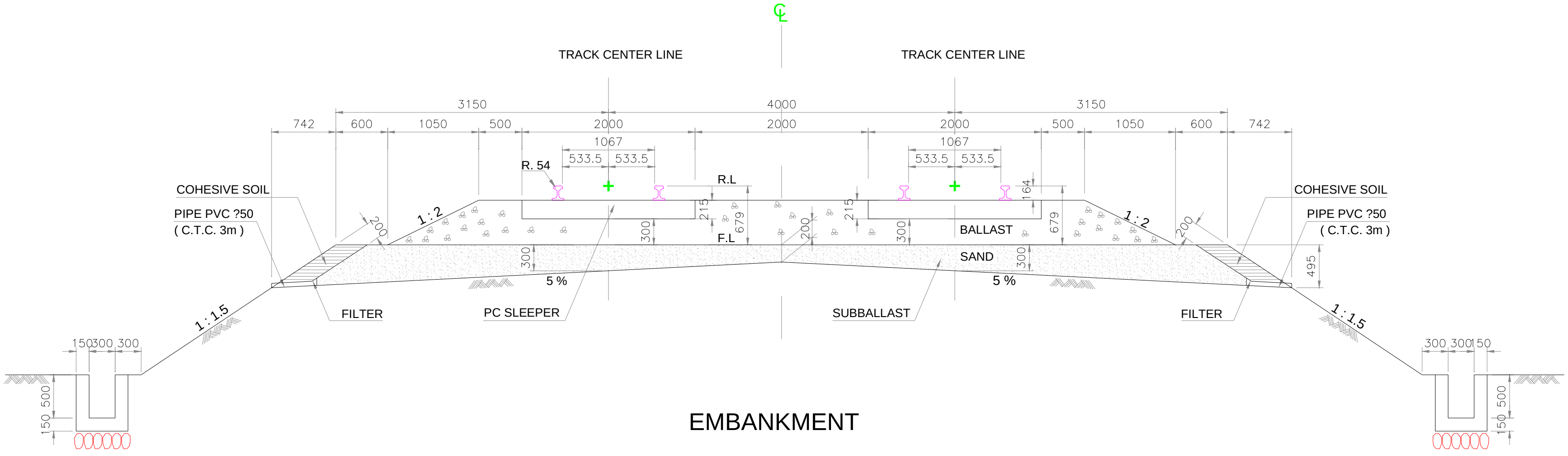
Figure 5.5-2 Standard Cross Section (2)



DIMENSION TABLE

CANT	L1	L2	L3	L4	L5	L6	H1	H2	H3
LESS THAN 30	3244	3076	3300	1144	693	681	462	474	454
35 TO 60	3359	3021	3250	1259	702	677	468	433	451
65	3378	3012	3200	1278	703	676	469	426	451

Figure 5.5-3 Standard Cross Section (3)

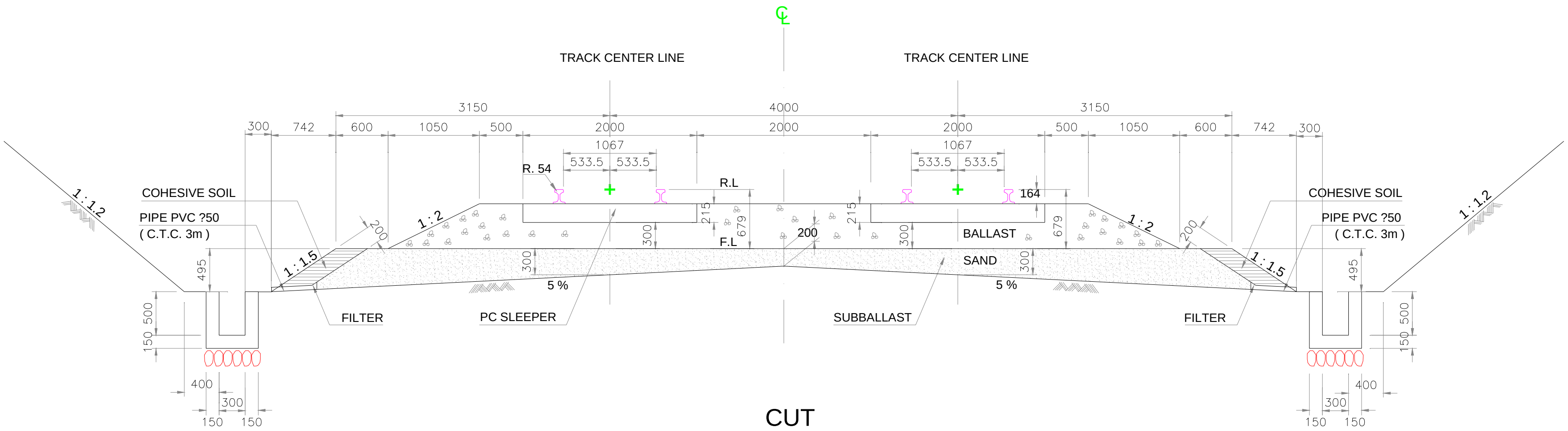


ON STRAIGHT TRACK

STANDARD CROSS SECTIONS (1)

SCALE 1 : 50

Figure 5.5-4 Standard Cross Section (4)



STANDARD CROSS SECTIONS (2)

SCALE 1 : 50

Figure 5.5-5 Standard Cross Section (5)

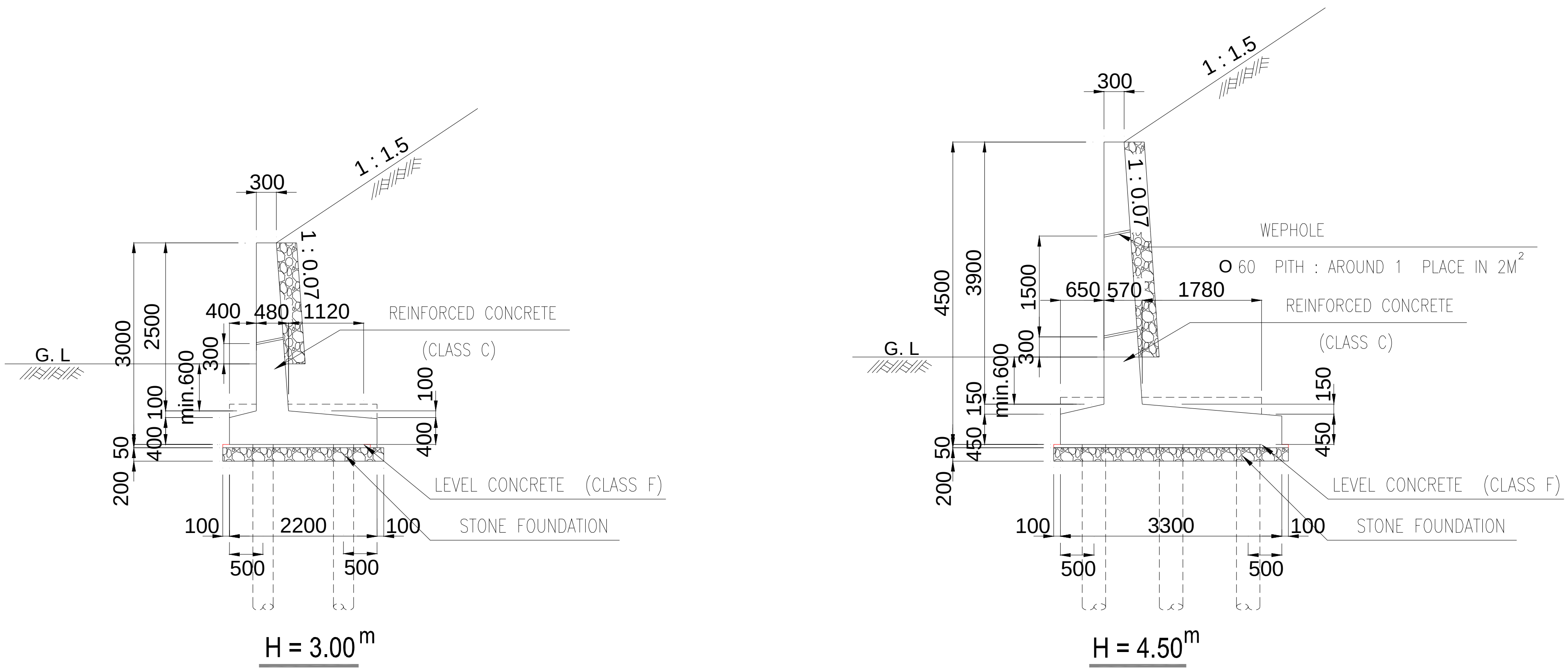
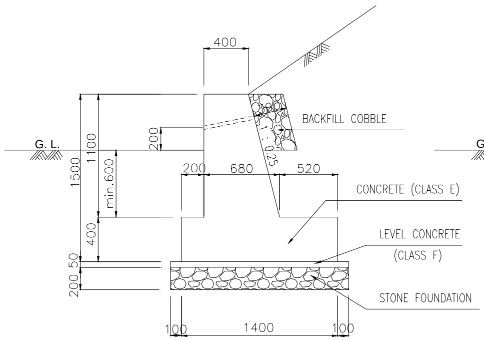
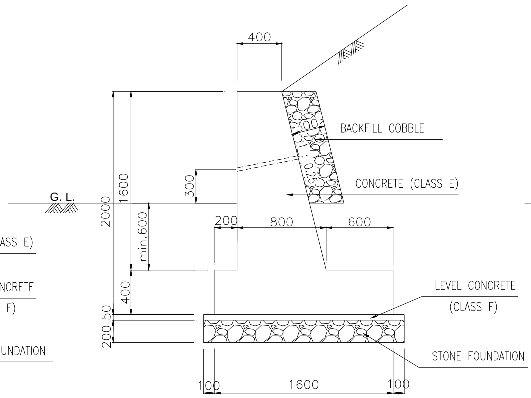


Figure 5.5-6 Retaining Wall



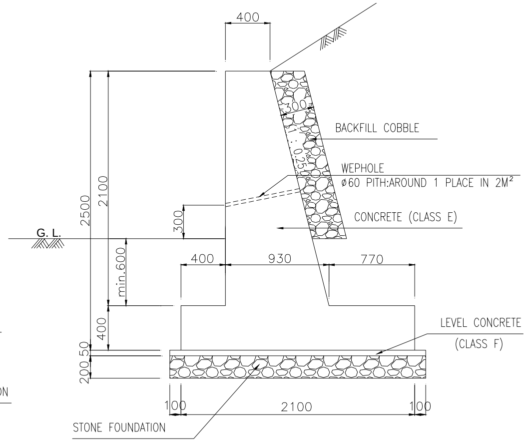
CONCRETE WALL TYPE - A (H=1.50M)

SCALE 1 : 20



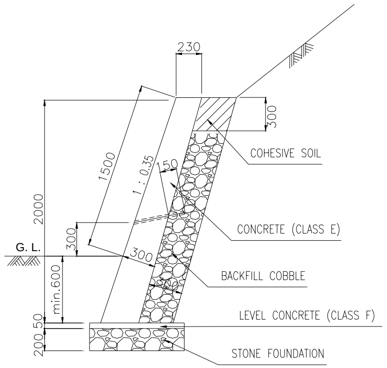
CONCRETE WALL TYPE - B (H=2.00M)

SCALE 1 : 20



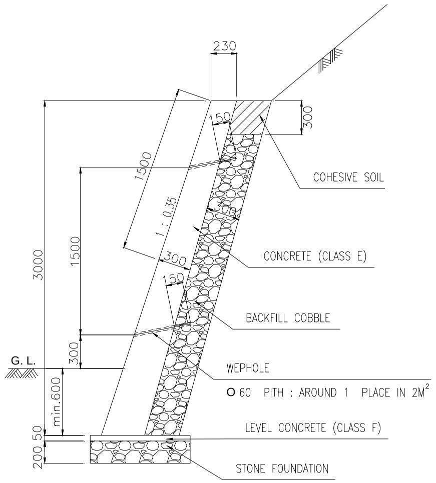
CONCRETE WALL TYPE - C (H=2.50M)

SCALE 1 : 20



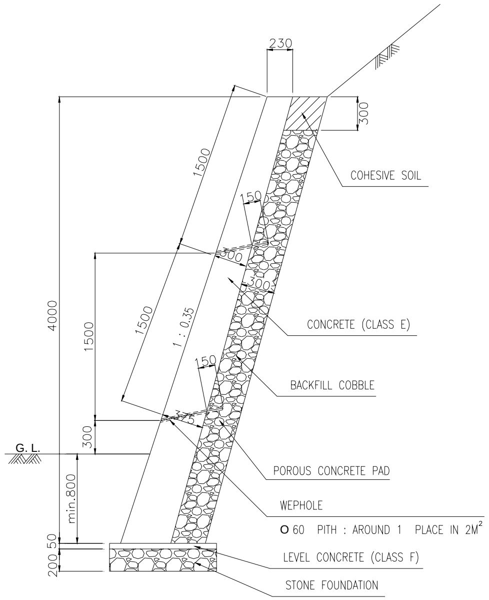
CONCRETE WALL TYPE - D (H=2.00M)

SCALE 1 : 20



CONCRETE WALL TYPE - E (H=3.00M)

SCALE 1 : 20



CONCRETE WALL TYPE - F (H=4.00M)

SCALE 1 : 20

Figure 5.5-7 Concrete Wall

5.6. Civil – River and Road Facilities

5.6.1. River Facilities

(1) Outline for Design of River Structure

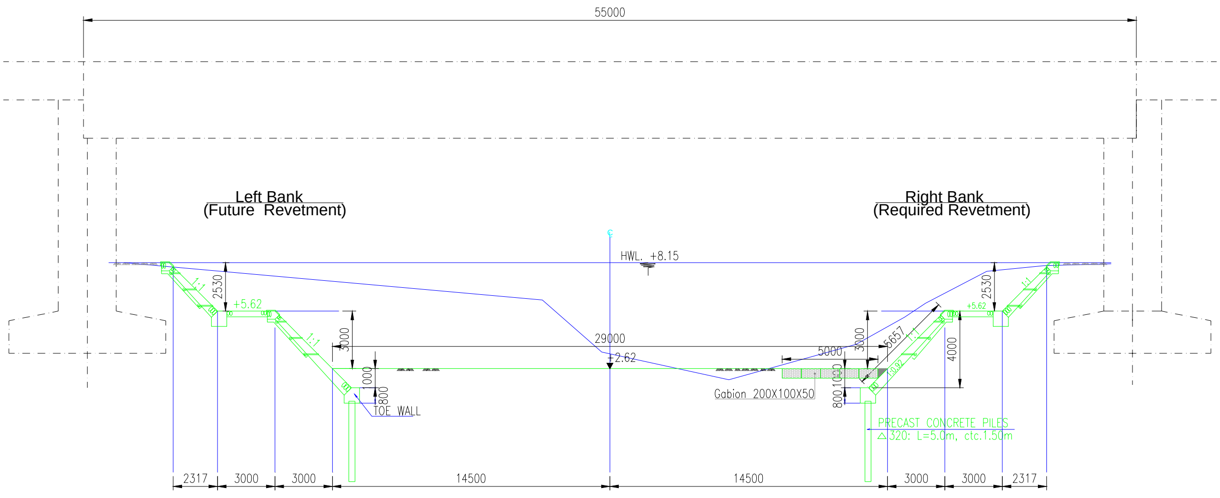
River Structure is designed from Manggarai Station to Bekasi Station.
High Water Level and Width of Bridge for each River was discussed with River Department or Irrigation Department in Indonesia (PU).
High Water Level for each bridge is mentioned on the drawings.

(2) Requirement by PU

During the discussion with PU, following items were requested.

A. Minimum Span for Abutment at Ciliwung River (Km1+135)

Span for new bridge at Ciliwung River should be longer than existing bridge span. According to this request, the span for design is 55m length.



CROSS SECTION

Figure 5.6-1 Cross Section of Plan River

B. Design discharge for Box Culvert at Km26+246

Design Discharge of box culvert at km26+264 requested by Irrigation Department (PU), is 18.968m^3/sec. The depth of water for box culvert was calculated as below:

$$Q = A \cdot V$$

$$V = R^{2/3} \cdot S^{1/2} / n$$

Where Q: discharge (m^3/sec)
V: mean velocity of flow (m/sec)
R: hydraulic radius =A/P
A: area of cross section of flow (m^2)
P: wetted perimeter of cross-section of flow
S: slope(=0.15/56.28=0.0026)
n: Manning roughness coefficient (0.015: Lined Concrete)

In case of B(width)=11.50m, D(depth)=0.75m

$$V = 0.595^{2/3} \cdot 0.0026^{1/2} / 0.015 = 2.41 \text{(m/sec)}$$
$$Q = 2.41 \cdot 8.625 = 20.74 \text{(m}^3\text{/sec)} > 18.968 \text{(m}^3\text{/sec)}$$

Required depth of water for the box culvert is 0.75m

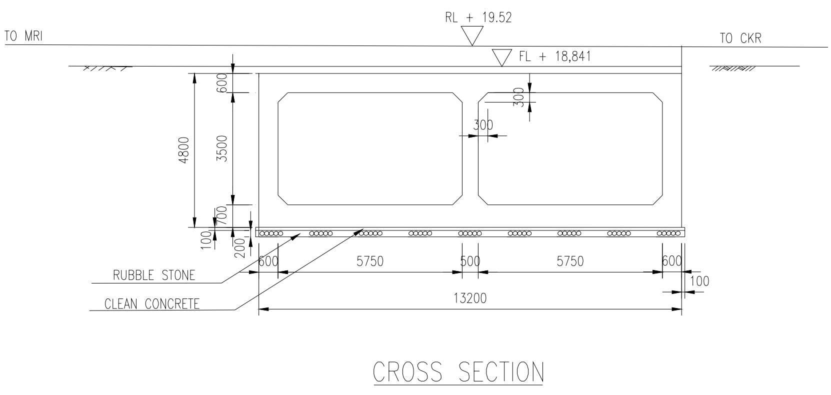


Figure 5.6-2 Railway Cross Section of River

5.6.2. Drawdown

Two conditions that could lead to drawdown conditions arise. Firstly by dewatering to lower ground water, and secondly the condition of piling when adjacent piles are drawn down by the effects of piling creating negative friction.
In both conditions it is considered that the soil conditions are good enough to avoid having to takes these effects into consideration.

5.6.3. Road Facilities

This section describes road facilities, level crossings and pedestrian bridges.

(1) Road facilities

Road Facilities mean that rehabilitated road and others facilities by constructing Double-Double Tracking of Java Main Line. Table 5.6-1 shows locations and kind of facility and map as shown in Figure 5.6-3 to Figure 5.6-7.

Table 5.6-1 Location of Road Facilities

No.	Location	Kind of Facilities	Replace or New	Comment
1	Km 12+000 to Km12+110 (Left side)	Existing road width 1.5+4.5+2.0(side walk)	Replace road Width 0.5+1.5+4.5+2.0 Length 60m	-
2	Km 12+274 to Km12+334 (Left side)	Existing road width 4.5m	Removal road Width 4.5m Length 60m	-
3	Km 13+660 to Km13+676 (Both side)	Existing road (JL.Bekasi Timur Raya)	New pipe culvert (600) underneath of existing road	-
4	Km 22+948 to Km22+700 (Right side)	There is future road Plan	New road plan Width 23m	Letter submitted to DGLC for discussion.
5	Km 22+200 to Km22+750 (Right side)	transference of U-turn road under existing elevated bridge(Jl.Sultan Agung)	Transference of existing U-turn road.	

No. 1, 2 and 3 in the Table 5.6-1 are designed in the plan and cross sections as shown in Drawing Volume IV of the Tender Document (Plan and Cross Section of Civil Works). Items 4 and 5 in the Table 5.6-1 are not final design because the query raise by the Study Team is still under consideration by DGLC.
No. 5 in the Table 5.6-1 is shown the below for the item of coordination.

No. 5, from Km 22+200 to Km22+750 (Right side)

Double-Double Tracking of Java Main Line is planned at the south of existing railway. At this site south side of the existing railway, there is an existing U-turn road under existing elevated bridge at Jl.Sultan Agung. Thus, another U-turn is proposed south of this location.

Item of adjustment

There is a problem for establishing the extra vertical clearance available for this new U-turn road.

- At the planned location for the new U-turn the current vertical clearance is 3.4 metres, which is not enough.
- In order to have a minimal clearance of 4.7 metres, the planned ground level should be lowered in 1.3 metres.
- However, at this location there is an existing pier, and the level of the top of the footing is unknown. Thus, it would be possible to secure vertical clearance 4.7m if the distance between existing top of footing by cutting existing ground is 1.3m or more. A letter requesting the as-built drawing of the structures of the said location has been submitted to DGLC.
- Establish whether or not the vertical clearance of 4.7m is enough for Indonesian standard
- In case of lowering the ground level by1.3m, it is necessary to have discussions with the owners of properties adjacent to this site.
- It needs adjustment between item 4 of Table 5.6-1, which proposed road km 22+948 to km22+700 and item 5 of the same table, which is at Km 22+200 to Km22+750.

(2) Level Crossings

Improvement of level crossing facility such as new pavement and separation of pedestrian way and vehicle way is recommended for 7 level crossing facilities as shown in Table 5.6-2. Details are shown in Drawing Volume IV.

Table 5.6-2 Level Crossing

No.	# of Level Crossing	Location, Street Name	Nearest Station	Width (m)	Length (m)	Track Line	
						Track	Station
1	50	Jl. Kebon Sereh	Jatinegara St.	8.40	35.50	7	12+047
2	52	Jl. Pisangan Lama	Cipinang Yard	10.00	22.50	4	12+659.4
3	55	Jl. Bekasi Timur Raya	Cipinang Yard	42.60	31.00	4	13+707.6
4	56	Jl.Pertanian / Pendidikan	Klender St.	5.40	28.00	4	14+785.14
5	63	Jl. Penggilingan	Klender Baru St.	10.00	26.50	4	19+455.2
6	66	Jl. Stasion Cakung	Cakung St.	8.60	38.00	6	20+799.3
7	78	Jl. Perjuangan	Bekasi St.	16.00	46.50	8	26+677.5

(3) Pedestrian Bridge

1) Location

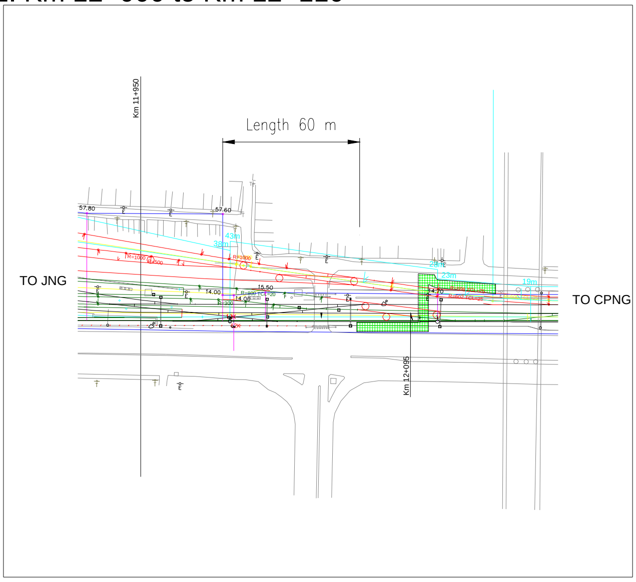
Pedestrian bridge is recommended at 3 locations as shown in Table 5.6-3.

Table 5.6-3 Proposed Pedestrian Bridge

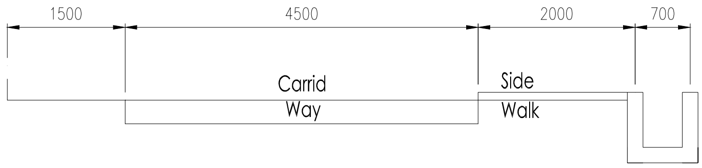
No.	Location	Pedestrian width	Bridge span	User
1	Km 0+600	2.0m	43.35m	pedestrian
2	Km 2+405	2.0m	61.685m	pedestrian
3	Km 12+101.209	2.02m (0.63+0.76+0.63)	28.43m	pedestrian and motorcycle

Pedestrian bridge width is 2.02m for pedestrian and motorcycle, without any new land acquisition. Details are shown in Drawing Volume IV.

1. Km 12+000 to Km 12+110



Existing Road



Proposed Road

Pendestrian Bridge

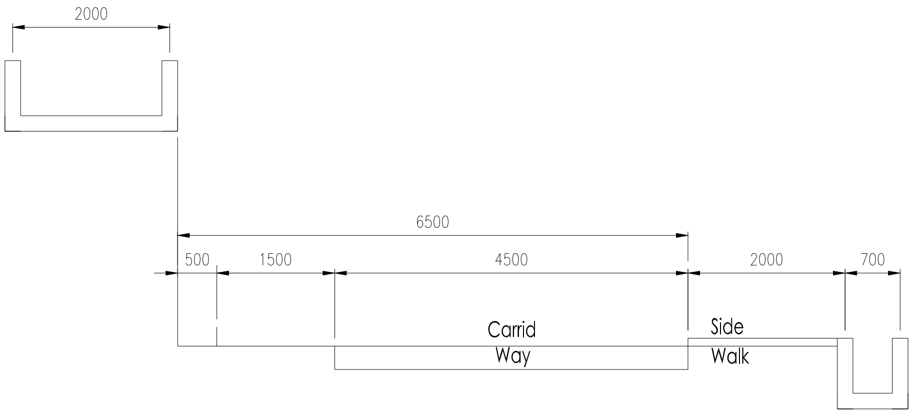
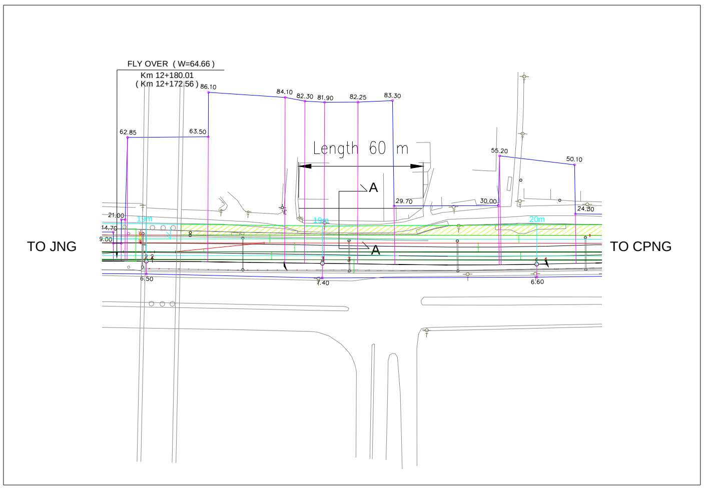
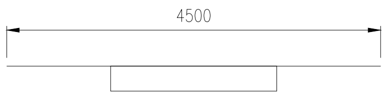


Figure 5.6-3 Road Facilities (1)

2. Km 12+274 to Km 12+334





(A - A)

Figure 5.6-4 Road Facilities (2)

3. Km 13+660 to Km 13+676

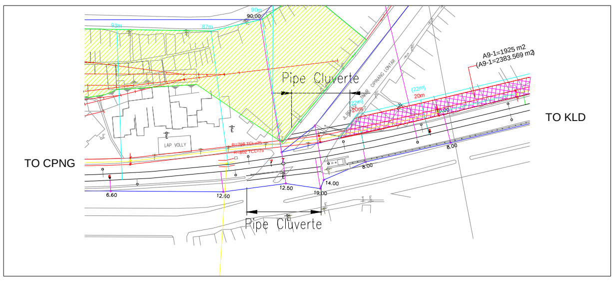


Figure 5.6-5 Road Facilities (3)

4. Km 22+948 to Km 22+700

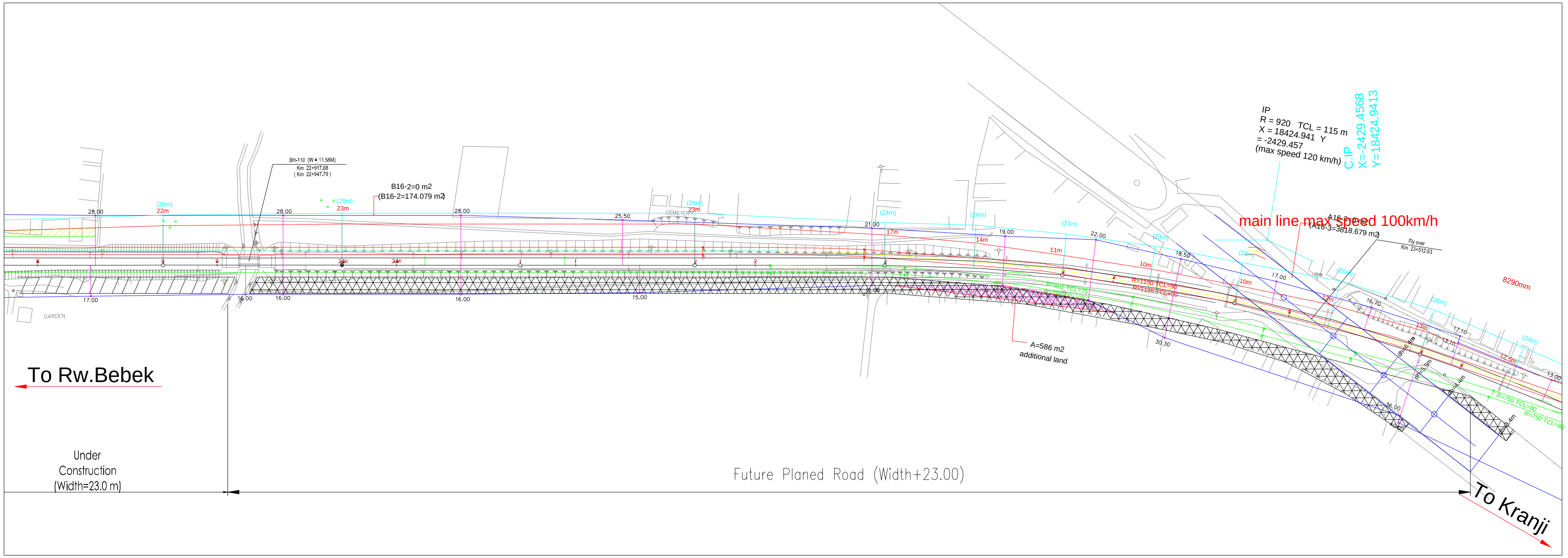


Figure 5.6-6 Road Facilities (4)

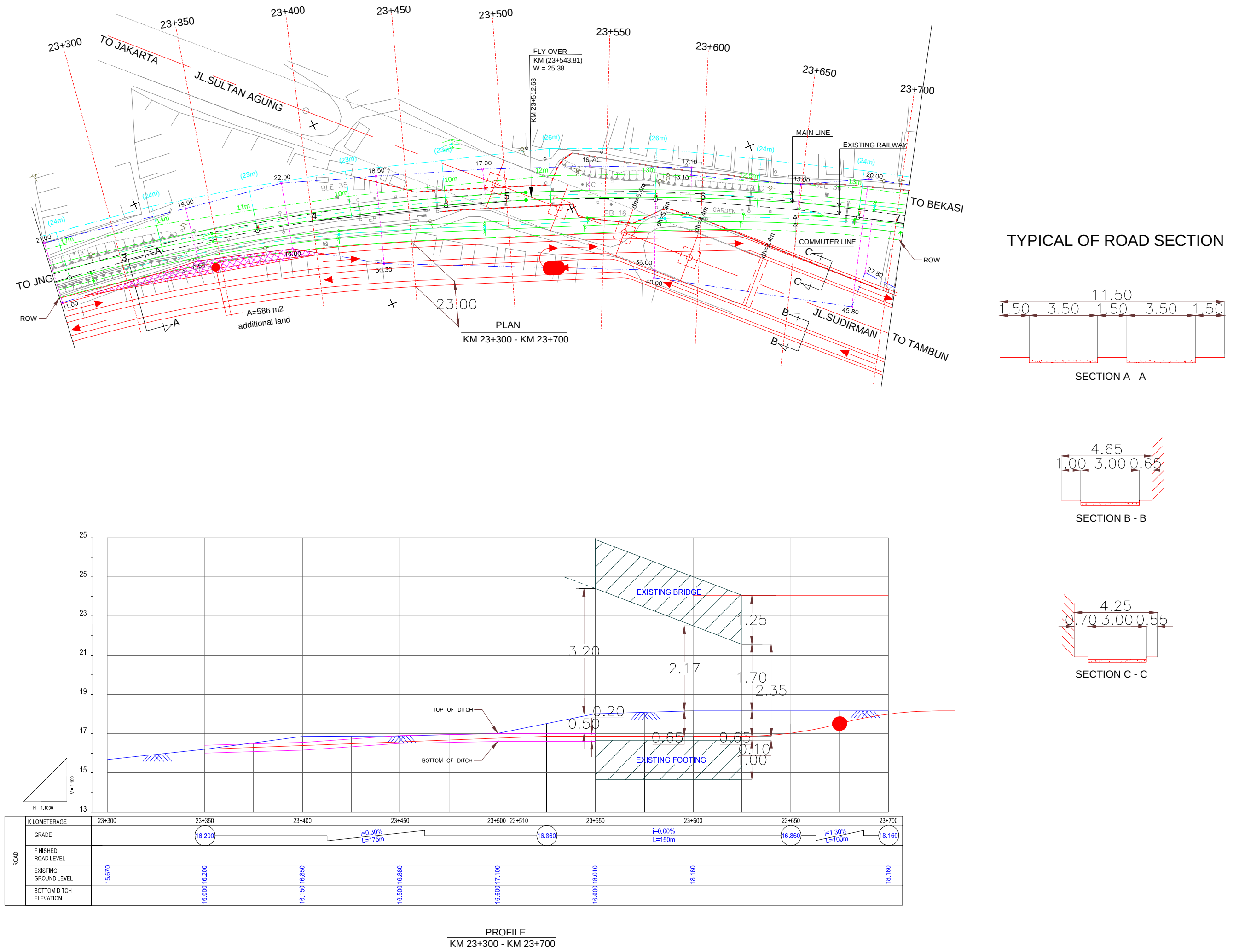


Figure 5.6-7 Road Facilities (5)