CHAPTER 2

CONTENTS OF THE PROJECT

Chapter 2 Contents of the Project

2.1 Basic Concept of the Project

2.1.1 Overall Goal & Purpose

The Seventh 5-Year National Development Plan, which covers the period from 2001 to 2005, states a concern for the widening disparity in the standard of living between urban and rural areas in Vietnam. This topic is originally from the Sixth 5-Year National Plan and, together with the revitalization of rural villages, is considered an important issue on the national development.

In response to the National Development Plan, the Ministry of Transport established in 1998 the "Strategy for Transport Development in Vietnam by the Year 2020", which focused on developing three areas of the road network: (1) the northern mountainous area, (2) the central mountainous area, and (3) the Mekong Delta area.

After carefully considering its policies, the Vietnamese Government requested that the reconstruction of high-priority bridges in the central area of the country be carried out via Japan's Grant Aid Scheme. In response to the request, the Japanese Government conducted a basic design study (hereafter referred to as the BD study) for the *Project for Reconstruction of Bridges in the Central District* in 2001. As a result of the BD study, 45 bridges were selected from among 84 candidate bridges to be reconstructed or newly constructed under Japan's Grant Aid Scheme, with the aim of ensuring the safe and smooth passage of road traffic for small- to medium-sized bridges on rural roads in 18 different provinces in Vietnam's central area. In regards to the type of work for the 45 bridges, 22 bridges were to be newly constructed with the Facility Construction type and 23 were to be improved with the Girder Supply type. Note that the work for the 23 bridges was completed in Phase 1 of the Project, with work for 14 of the 22 bridges requiring new construction to be completed by the end of March 2006 in Terms 1 and 2 of Phase 2. The remaining 7 bridges are to be taken up in Term 3 of Phase 2.

In Term 3 of Phase 2 of the Project (hereafter referred to as the Project), the same overall goal and purpose hitherto is applied in consideration of consistency and their importance. Accordingly, the Project defines its overall goal as "improving the standard of living of rural people in the central area and narrowing the disparity in poverty levels between urban and rural areas", with the Project purpose being the "reconstruction of all-weather bridges that will continuously provide safe and smooth passage for road traffic throughout a year".

2.1.2 Outline of the Project

In order to achieve the defined overall goal and purpose of the Project, the Project will replace the narrow existing temporary bridges in the central area, which have vehicle weight limits and are subject to closure from frequent flooding, with permanent bridges having a formation width greater than 5.5m, an improved live load level, and which are passable even with past flood levels. Note that the Project, which as mentioned before is to be implemented via Japan's Grant Aid Scheme, will be carried out under a Japanese contractor.

This Implementation Review Study (hereafter referred to as "the Study") executed a review of the basic design (BD), which was produced in 2001, and carried out additional site investigations in order to reflect the results in a detailed design of the proposed bridges together with re-estimating Project cost. The condition of the existing bridges and the results of the BD are indicated in Table 2.1.1.

Table 2.1.1 Condition of Existing Bridges & Basic Design Results

Bridge Name	Location (Province)	Existing Condition (m)		BD Results (m)	
		Br. L (Span)	Width	Br. L (Span)	Width
Da Dung Br.	Binh Thuan	73.0(13+3x20)	4.4	92.3(3x30)	5.5
Tran Br.	Ninh Thuan	21.0(12+9)	3.4	65.3(3x21)	5.5
Tam Ngan Br.	Ditto	60.0(60.0)	1.4	71.3(21+27+21)	5.5
Tan Van Br.	Lam Dong	71.0(6x11.5)	5.5	80.3(24+30+24)	5.5
Ea Soup Br.	Dac Lak	46.0(3x15.3)	4.4	59.3(18+21+18)	5.5
Krong K'Mar Br	Ditto	66.0(3x22))	4.4	71.3(21+27+21)	5.5
Ngoi Ngan Br.	Khanh Hoa	47.0(8x6.0)	3.5	49.5(2x24)	5.5

2.2 Basic Design of the Requested Japanese Assistance

2.2.1 Design Policy

(1) Basic Concept

The basic concept for the Project is as follows:

- The seven bridges in Table 1.1 have been confirmed as still requiring implementation under Japan's Grant Aid Scheme, because their importance has increased due to the improvement in access roads and because there is no improvement plan for the proposed bridges by other donors or the Vietnamese Government.
- The basic concepts established in the BD stage are basically applied consistently for the Project. However, Items to be modified because of the change of the socio-economic conditions, including establishment of regional

development plan, an increase of traffic volume, improvement of the access road conditions etc., as well as requests for revisions from the Vietnamese Government to the BD results, will be included in the Project if those are confirmed as appropriate from both a technical and Japan Grant Aid Scheme viewpoint.

- Resent hike of steel and oil prices in the worldwide shall be reflected in the Project cost in order to secure the smooth implementation.

(2) Natural Condition Policy

The central area of Vietnam often experiences damage from flooding due to great amounts of rainfall. Accordingly, appropriate bridge length and clearance should be set in order to secure sufficient capacity for flood discharges.

It is difficult to determine the water level or discharge of the rivers for the proposed bridges, as there are no observatories. Accordingly, design high water level (HWL) was established based on interviews of residents living nearby regarding historical maximum HWL. In addition, the appropriateness of the interview results were confirmed by estimating maximum HWL on the basis of past rainfall data. Note that since the Study confirmed that there has been no severe flooding since the BD study was completed in 2001, the design HWL estimated in the BD study will be applied for the detailed design.

As for protection work, this will be executed with riprap or gabion around abutments, or for embankment sections adjacent to abutments, in order to prevent erosion from flooding. In addition, piers will be protected with boulders or gabion where river flow velocity increases during flooding. Note that protection work will not be carried out where shallow bedrock was found in the riverbed in the geotechnical survey.

The Study area is mainly covered with metamorphic, igneous, or sedimentary rock, with the lower plain near the sea being covered with alluvial sedimentary rock. The bearing strata at the proposed bridge sites are located 3-22m deep near abutments, and 0-17m deep around piers, consisting of gravel or the rock layers just mentioned. Note basically that a spread foundation is applied at places where there is a shallow bearing stratum and a pile foundation at places where there is a deep bearing stratum.

Countermeasures against soft ground will be planned for the high embankment adjacent to the abutment at Krong K'Mar Bridge, as the embankment will cause either consolidation settlement or sliding failure of the existing ground.

As for earthquakes, as no severe earthquake has been recorded in the southern area of the

Indochina Peninsula, only minimum effects will be considered in the design of the bridge structures.

(3) Social Policy

The issues of resettlement and land acquisition for the proposed bridges were found to be minor. The Study team confirmed that the Vietnamese Government has been implementing land acquisition and resettlement based on the BD drawings under an agreement with affected people and that this would be completed by May 2006.

The site investigations of the Study found that access from houses to the new approach roads of bridges should be provided at embankment sections where the road elevation rises due to an increase in bridge elevation. Furthermore, drainage facilities should be provided along new approach roads at the toes of embankment slopes in order to catch water from the roads (see Table 2.2.6).

(4) Policy for Construction Conditions in Vietnam

It is necessary for Project implementation to obtain approval from the Vietnamese Government, but since this has already been achieved in the BD stage, it is no longer required.

The same design standards and specifications established in the BD, which are in accordance with Vietnamese standards and specifications, will be applied for the detailed design of the Study. Below, in (6), the “ Facility Grade Setting Policy ” elaborates the design standards and specifications for roads and bridges.

The capacity of local contractors has improved regarding bridge construction due to their experience with donor-funded projects or projects funded by the Vietnamese Government. As a result, it has been determined that they are capable of constructing simple small- to medium-sized bridges with little problem. However, on-site Study Team visits of Phase I bridges found that there is still a little problem with quality control, such as the smoothness of the bridge’s road surface and the linkage of mortal paste on girders when slab concrete is placed. Accordingly, Japanese engineers dispatched on site for this Project will train the engineers of the local sub-contractor in quality control throughout the construction.

Construction equipment and materials for the Project should be procured from the domestic market as much as possible. Note that the site surveys of the Study Team found that some of the equipment and materials that were to be procured from Japan or third countries in the BD study are now available from the domestic market because of the increase in road and bridge construction projects. Such equipment and materials include truck cranes with more than 50 tons of lift or concrete mixing plants.

Careful attention should be given to the use of oil products and reinforcement materials, which have experienced drastic price hikes in recent years, as this will have a significant impact on Project cost.

(5) Local Contractor Policy

The Japanese contractor who has worked in Terms 1 and 2 of the Phase2 Project to be completed in March 2006 has actively utilized local contractors, and this practice should continue in Term 3. The Japanese contractor is expected to transfer skills and knowledge in construction site quality control and safety management.

(6) Operation & Maintenance Policy

After implementation of the Project by Project Management Unit18 (PMU18) and the MOT, which includes both the tendering and construction stages, all 7 proposed bridges will be transferred to the relevant provincial Department of Transport (DOT), which will be responsible for the operation and maintenance of these structures.

The basic procedure for road and bridge maintenance consists of the provincial DOTs periodically inspecting the relevant roads and bridges, providing annual maintenance plans based on the inspection results, and submitting a maintenance budget plan to the provincial government. After the budget is allocated, provincial DOTs contract out work to semi-government firms that specialize in maintenance. Note that in each province there are about one or two semi-governmental road maintenance companies and, according to interviews with provincial DOTs, approximately 1million VND per km is allocated for routine maintenance activities annually.

The quality of maintenance by the provincial DOTs has not been confirmed, since the bridges constructed in Terms 1 and 2 will start being maintained from 2006, due to their liability period ending this year. However, the Study Team has deemed the provincial DOTs capable of maintaining the system of roads and structures for the proposed bridges, given that the maintenance system at the provincial level has been standardized with support from foreign donors and that maintenance work itself does not required a high level of skill.

However, it is necessary for the Japanese side to monitor the performance of maintenance activities by the provincial DOTs and to impress upon them the importance of maintenance whenever possible, as the Vietnamese Government has been struggling with properly satisfying the needs of road maintenance in recent years.

(7) Facility Grade Setting Policy

The scope of the Project includes 7 bridges with approach roads and the necessary accompanying facilities. Although the grade of these facilities will basically be the same as that determined in the BD study in 2001(see below), requests from the Vietnamese Government through this Study will be incorporated into the Project scope if the request is determined to be appropriate from both a technical and Japan Grant Aid Scheme viewpoint.

- Design Standard: Vietnamese Design Standards and Specifications
- Live Load: H-13-X60
- Bridge Clearance Width: 5.5m
- Road Class: Class IV & V

(8) Construction Methodology & Scheduling Policy

A review will be undertaken of both the bridge erection method planned in the BD stage and the construction yard for the Tan Van Bridge. The former will be examined on the basis of experience in Terms 1 and 2 of the Project. Since truck cranes with more than 50 tons of lift are now available on the domestic market, the possibility of a crane erection method should be explored as this can minimize girder erection time. As for the latter item, the possibility of utilizing a newly proposed yard on the left bank will be examined due to safety issues with the original yard, which is located in front of a school. The construction yards for the other 6 bridges can be utilized as planned in the BD study, and it has been confirmed with the Vietnamese Government that land acquisition has proceeded without any problems.

Careful attention should be given to the natural conditions, work items and movement of equipment for sites in order to determine an appropriate construction period. Firstly, the duration of the rainy season and rainfall intensity should be considered, because the rainy season in the Project area, which is mountainous, is slightly different from that of the costal area. Although the rainy season in both areas continues from May to November, the rain in the mountain side of the Project area is heavier. Secondly, some work items such as the substructure, embankment and soft ground treatment can only be executed in the dry season. Finally, the efficient movement of equipment and machinery from site to site for both girder fabrication and erection works should be carefully considered, as the Project bridges are located over a wide area and the amount of equipment procured has a significant impact on Project cost.

2.2.2 Basic Plan

2.2.2.1 Request to Change in Grade of Proposed Bridges

Several requests to change the grade of the proposed bridges had been made from the Vietnamese Government in discussions with the MOT, PMU18, and the provincial DOTs of Binh Thuan, Ninh Thuan, Lam Dong, Dac Lak and Khanh Hoa, based on joint on-site investigations of the Study. The major modifications requested are as follows:

- Widening of formation for four of the bridges
- Application of a larger live load for two bridges
- Change in the end points of approach road (i.e., their total length)
- Provision of drainage facilities, etc.

Both sides confirmed the above requests by recording them in a Technical Memorandum after the site visits.

(1) Background of Formation Widening Request

The background of the request for formation widening for four of the seven bridges is as follows:

① Da Dung Bridge（Ninh Thuan Province）

- This bridge is located on PR 709 in the center of Lagi Town, which is designated as a special town by Binh Thuan Province. A comprehensive town development plan for 2006-2010 contains a residential development plan 330 ha in area both south and north of the bridge, and there is a resort development plan for the coastal area, meaning that PR 709 will become an important road connecting the town with the new developing areas.
- PR709 is also regarded as a trunk road, since it connects the provincial center of Phan Thiet via NR 55. Note that according to the provincial transport master plan there is an improvement scheme to widen PR709 to a 2-lane carriageway 6-7m in width, and portions of the road and some of its bridges have already had their formation widened to 7-7.5m.
- Heavy vehicular traffic, including trucks, buses, sedans and motorbikes, passes over the bridge.
- A new bridge, which was constructed 1km downstream of this bridge, has a 7m carriageway and a 1m wide sidewalk on either side.

② Tan Van Bridge (Lam Dong Province)

- PR 725, which Tan Van Bridge is located, runs parallel to NR20 on the mountainous side, and is expected to form a new road network by connecting NR27 with NR28. This route is also expected to provide access to the mountainous area where there is potential for development. Note that an ADB funded project is planning to extend this route to NR 28.
- This bridge is located near the district center of Dinh Van, and there are houses, shops and schools concentrated in the area surrounding it. Accordingly, this bridge has the important role of not only connecting both banks each other as well as the mountainous area with the district center.
- Relatively high traffic volume is observed because of its roles mentioned above.
- A new bridge, which is located 2km away from this bridge, was constructed with a formation width of 7.5m in accordance with a part of the improvement plan for PR725. Furthermore, bridges to be reconstructed with ADB funds are planned to have a formation width of 7m.

③ Ea Soup Bridge and Krong K'Mar Bridge (Dac Lak Province）

- The provincial transport master plan states that all bridges should be improved to have a formation width greater than 7m, and new bridges on provincial roads have been reconstructed in accordance with this policy.
- Relatively large numbers of heavy trucks pass over both Ea Soup Bridge and Krong K'Mar Brdige, carrying agricultural produce and timber.

(2) Concept of Bridge Formation Width at the BD Stage

Bridge formation width of 5.5m for both provincial and district roads has been adopted in past bridge reconstruction projects (e.g., the Project for Reconstruction of Bridges in both Northern districts and Mekong Delta Area of Vietnam). In a few cases, a formation width of 7m is applied for bridges located in a town center. The original bridge width of 5.5m consists of a one-lane carriageway of 3.5m plus a 1m shoulder on either side for bicycles or pedestrians, which means a sedan can slowly pass beside a large truck stopped on such a bridge.

(3) Criteria to Determine Increase in Bridge Formation Width

Table 2.2.1 indicates the criteria to determine the necessity of widening a bridge's formation from 5.5m, which was the width adopted in the BD stage.

Table 2.2.1 Criteria to Determine Need to Increase Bridge Formation Width

Criteria	Contents
① Existing Traffic Volume	300 PCU is the threshold for 2-lane operation according to the Vietnamese Standard
② Access Road Class & Existing Condition	- Provincial or District road? - Is carriageway more than 5.5m or to be improved to more than 5.5m?
③ Bridge Location	- Do many users pass over the bridge because it is in the vicinity of a populated area such as a district center?
④ With or Without Request to Widen from Vietnamese side.	- Is there a request to widen the bridge from the Vietnamese Government through this Study?

(4) Discussion & Conclusions

Table 2.2.2 shows the evaluation results for all proposed bridges based on the criteria in Table 2.2.1.

Da Dung and Tan Van Bridge

The request for the widening of these two bridges can be justified as appropriate for the following reasons:

- Both bridges have a higher traffic volume as compared to the other proposed bridges even at the BD stage. This is because these bridges are located in populated areas and therefore it is justifiable to have 2-lane operation.
- A large number of bicycles and motorbikes pass over the bridge because it is located on the way to a school and market.
- Access roads to the bridges on either side are being widened to 6-7m.

Ea Soup Bridge

The request for widening this bridge can be justified for the following reasons:

- Traffic volume has been significantly increasing on this link since the BD stage (by approximately 200%) and its traffic volume justifies 2-lane operation.
- The road the bridge is located on is designated as PR1 and has an important role in the road network of the province. Access roads to the bridge have already been paved, being 6m on the left bank and 14m on the right bank.
- A large number of bicycles and motorbikes use the bridge because it is located on the way to a school and market and widening will provide greater safety for such light vehicles and pedestrians.

Krong K'Mar Bridge

The request for widening this bridge can be justified for the following reasons:

- Traffic volume has significantly increased from the BD stage (by approximately 110%) and its traffic volume justifies 2-lane operation.
- A large number of bicycles and motorbikes use the bridge because it is located on the way to a school and market and widening will provide greater safety for such light vehicles and pedestrians.
- The road, which the bridge is located on, has an improvement plan that will use private funding; although, the access road on the right bank has not been paved and some of the bridges on the same route have yet to be improved.

Table 2.2.2 Evaluation Results on Necessity of Bridge Formation Widening

Bridge Name	① Traffic Volume ＞300PCU[1]		② Road Class/ Existing Conditions		③ Bridge Location (Near populated area？)		④ With Request	Evaluation
Da Dung Br.	3,600	○	-Provincial Road -Carriageway being improved to a paved 6-7m	○	Within town designated for development by provincial government	○	○	○
Tran Br.	615	○	-District Road -4m carriageway with DBST	×	7km from district center of Ma Lam	×	×	×
Tam Ngan Br	0	×	-District Road -Improved to 4m paved way in 2003	×	15km from district center of Tan Son	×	×	×
Tan Van Br.	2700	○	-Provincial Road -Carriageway being improved to 5.5m paved way	○	In district center of Dinh Van	○	○	○
Ea Soup Br.	784	○	-Provincial Road -Already improved to a 7m wide paved carriageway	○	Outer edge of district center of Ea Soup	○	○	○
Krong K'Mar Br.	1,329	○	-Provincial Road - 5.5m wide paved surface on RB but earth surface on LB - Future improvement plan	△	Outer edge of district center of Krong K'mar	○	○	○
Ngoi Ngan Br.	340	○	-District Road -Already improved as a 3.5m paved way in 2004	×	10km from district center of Vian Ninh	×	×	×

Note: D.C.: District Center

(5) Appropriate Bridge Formation Width

The appropriate bridge formation width, which is to be increased from the present 5.5m, will be determined on the basis of the new Vietnamese Road Design Standard's Specification of Road Design (22TCN-273-01). This design standard specifies that the minimum carriageway width for a 2-lane road is 6m (see Table 2.2.3). After including a minimum 0.5m for a shoulder on either side of the carriageway total width is equivalent to 7m.

[1] The Passenger Car Unit (PCU) value for a bus, truck, and motorbike is 3.0, 2.0, and 0.3, respectively, and is calculated based on the passenger car serving as the base mode with a PCU value equivalent to one.

Table 2.2.3 Necessary Carriageway Width based on Design Speed

Design Speed (Km/h)	20	30	40	50	60	70	80
Lane Width (m)	-	3.0	3.0	3.0	3.5	3.5	3.5
Carriageway Width (m)	3.5	6.0	6.0	6.0	7.0	7.0	7.0

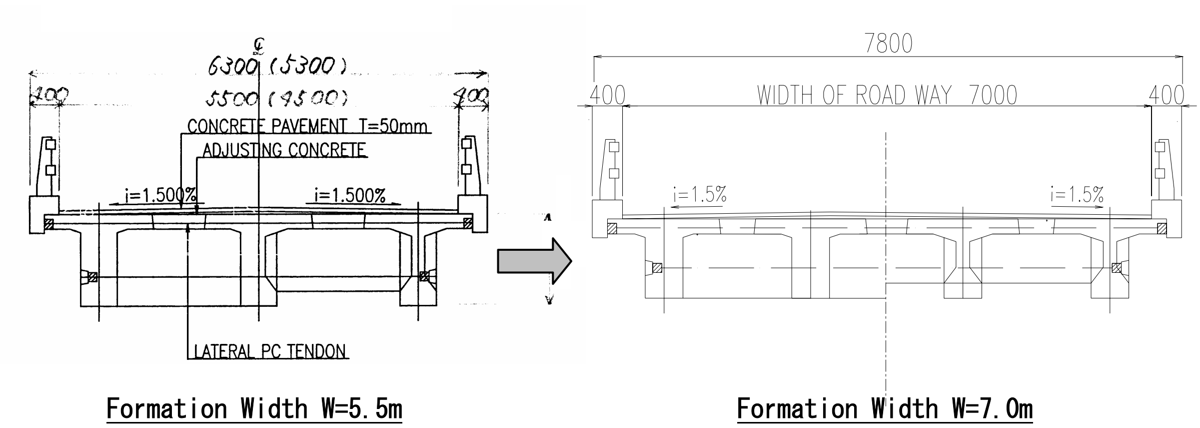


Figure 2.2.1 Widening of Bridge Formation Width

2.2.2.2 Response to Request for Higher Live Load for Bridge Design

(1) Background of Request

The DOT of Dac Lak province requested at a meeting with the Study Team to apply a higher live load (H-18) for the Ea Soup Bridge and the Krong K'Mar Bridge than the present H-13 live load that was set in the BD study. The major reasons for the request are as follows:

- The Provincial Transport Master Plan has a policy to improve all bridges on provincial roads to have a live load of H 18. This policy has been implemented for newly constructed bridges so far.
- Many heavy trucks use both bridges, which are located on the provincial trunk road of PR681 and PR692, in order to carry agricultural produce and timber.
- Current traffic operating regulations do not allow vehicles of more than 16 tons to pass over a bridge designed with a H13 live load. Accordingly, such vehicles cannot pass over these bridges and must cross in the river near the bridge when the water level is low.

(2) Reasons for Using H-13 Live Load for Bridge Design in BD Study

The Vietnamese Bridge Design Code TCN018-79, Ministry of Transport and Communication No2057 QD/Kt14 1979, specifies 5 classes of live load for bridge design (see Table 2.2.4).

Table 2.2.4 Live Load Class for Bridge Design

Live Load Class	Capacity
H-8	10.4 ton vehicle in the center and an 8 ton vehicle at the front and back
H-10	13 ton vehicles can continuously pass
H-13	16.9 ton vehicle in the center and a 13 ton vehicle at the front and back
H-18	30 ton vehicle in the center and a 16.9 ton vehicle at the front and back
H-30	30 ton vehicles can continuously pass

The final reports for the previous bridge reconstruction projects conducted under Japan's Grant Aid Scheme do not clearly describe the reasons for applying a live load of H-13. However, it is assumed that the H-13 live load was generally applied to bridges on both provincial and district roads at that time as well as a result of a similar live load being used for 2nd class bridges (TL-14) in Japan.

(3) Criteria to Determine Higher Bridge Live Load

A preliminary study on the application of a higher level of live load found that only one 30-ton vehicle at one time can pass over a bridge designed with a H-13 live load. Accordingly, there is the alternative of monitoring traffic so that only one vehicle of more than 16 tons is allowed to cross a bridge designed with a H-13 live load instead of adopting a higher level of live load. However, it is difficult to realize this without an operator on site, and the posting of sign is also insufficient assurance as it may be ignored. Consequently, it is judged that this alternative is not practical, and the following criteria shall be used to determine the application of the higher level of live load for Ea Soup Bridge .

Table 2.2.5 Criteria to Determine Higher Live Load

	Items to be Checked	Contents
National Policy & Current Situation	①Policy on Live Load Levels for Provincial Road Bridges	What is the policy of the MOT 2010 Transport Master Plan on live load levels for bridge improvement?
	②Live Load Levels Applied by Other Donors for Bridge Projects	What type of live load is applied in current ADB road improvement projects in the central area and JBIC bridge reconstruction projects?
Provincial Policy & Current Situation	③Policies & Plans for Applying Design Specifications for Bridges on same route of a proposed Bridge	What does the provincial Transport Master Plan mention about the design standards and specifications for bridges to be improved?
	④Design Specifications for Other Bridges on the Same Route of a Proposed Bridge	Existing conditions of other bridges on the same route.
	⑤No. of Trucks more than 16 Tons using Proposed Bridge	Whether or not the present traffic volume of trucks requires an increase in the live load level?
Adequacy as a Japan Grand Aid Scheme	⑥ Consistency with Previous Term 1 and 2 Bridges	Whether or not consistency with Term 1 & 2 bridges already completed is possible?
	⑦Increase in Initial Construction Cost to Improve Live Load Level	How much does initial cost increase after upgrading the live load level?

(4) Discussion & Conclusions

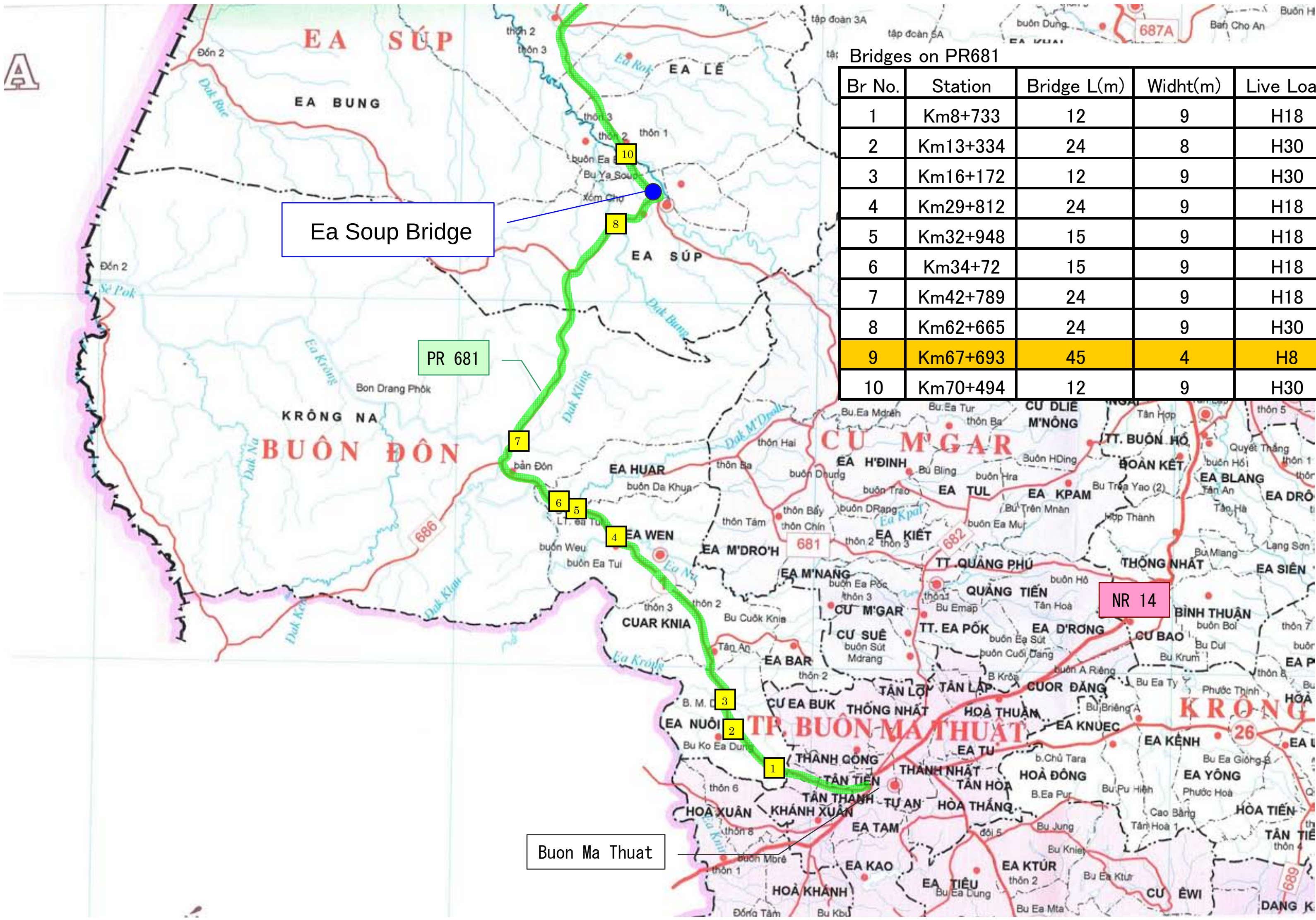
The analysis results for each item described in Table 2.2.5 are summarized in Table 2.2.6. For reference, Figure 2.2.2(1) and (2) shows the present condition of other bridges on the same route of the proposed bridges. From the analysis, it is deemed appropriate to apply a higher level of live load (H-18) for Ea Soup Bridge, because all the other bridges on the route have been improved to a live load of H-18 with a formation width of more than 6m and because the number of trucks is about 20 per day. On the other hand, it is difficult to justify the application of a higher level of live load for Krong K'Mar Bridge because: (1) overall bridge and road improvement on the route has not been progressed well, (2) there is an alternative route to the provincial center, and (3) there are few trucks.

Table 2.2.6 Study Result on Application of Higher Level of Live Load

Br.	National Policy & Current Condition		Provincial Policy & Current Conditions			Adequacy as Japan Grant Aid Scheme		Con-clusion
	National Policy	Other Donor Projects	Provincial Policy	Condition of Other Br. on Same Route	Traffic Volume (truck)	Consistency with Term 1&2 Bridges	Construction Cost	
Ea Soup Br.	Road class determines live load level Class IV: H18 Class V: H13	H30 level regardless of road class	Master plan specifies a live load of more than H18	9 other bridges improved with a live load of more than H18	1227 vpd. (21vpd)	Traffic volume larger than predicted so upgrade of live load justifiable	10% increase in super-structure cost	○
Krong K'Mar Br.	Ditto	Ditto	Ditto	3 bridges improved to a live load of H18 but remaining 6 bridges still H13	2899 vpd. (7vpd)	Difficult to justify due to delay in improvement in road and other bridges	10% increase in super-structure cost	×

(5) Effect of Higher Level of Live Load

The application of a higher level of live load for a bridge will result in a larger girder depth, and the span-girder depth ratio will change from 1/20 to 1/18 in order to secure sufficient girder stiffness for increased vehicle loading. This larger girder depth will lead to an extension in approach road length, as the location of the girder bottom is determined from the design high water level and raising the bridge surface is the only way to cope with this. However, it is possible to minimize the impact on construction cost.



Bridges on PR681

Br No.	Station	Bridge L(m)	Widht(m)	Live Load	Construction Year
1	Km8+733	12	9	H18	Unkown
2	Km13+334	24	8	H30	Unkown
3	Km16+172	12	9	H30	Unkown
4	Km29+812	24	9	H18	Unkown
5	Km32+948	15	9	H18	Unkown
6	Km34+72	15	9	H18	Unkown
7	Km42+789	24	9	H18	Unkown
8	Km62+665	24	9	H30	Unkown
9	Km67+693	45	4	H8	Unkown
10	Km70+494	12	9	H30	Unkown

Figure 2.2.1(1) Existing Conditions of Other Bridges on PR681

Bridges on PR692

Br No.	Station	Bridge L(m)	Widht(m)	Live Load	Construction Year
1	Km5+745	12+5x2	7.0	H30	2001
2	Km8+300	12+5x2	7.0	H30	2000
3	Km9+900	12+5x2	7.0	H30	2000
4	Km15+350	22x3	4.0	H10	1990
5	Km19+200	12	4.0	H15	1999
6	Km25+470	13	4.0	H15	1992
7	Km27+450	12	4.0	H15	1984
8	Km36+720	41	6.0	H15	1984
9	Km47+401	12	4.0	H15	1993

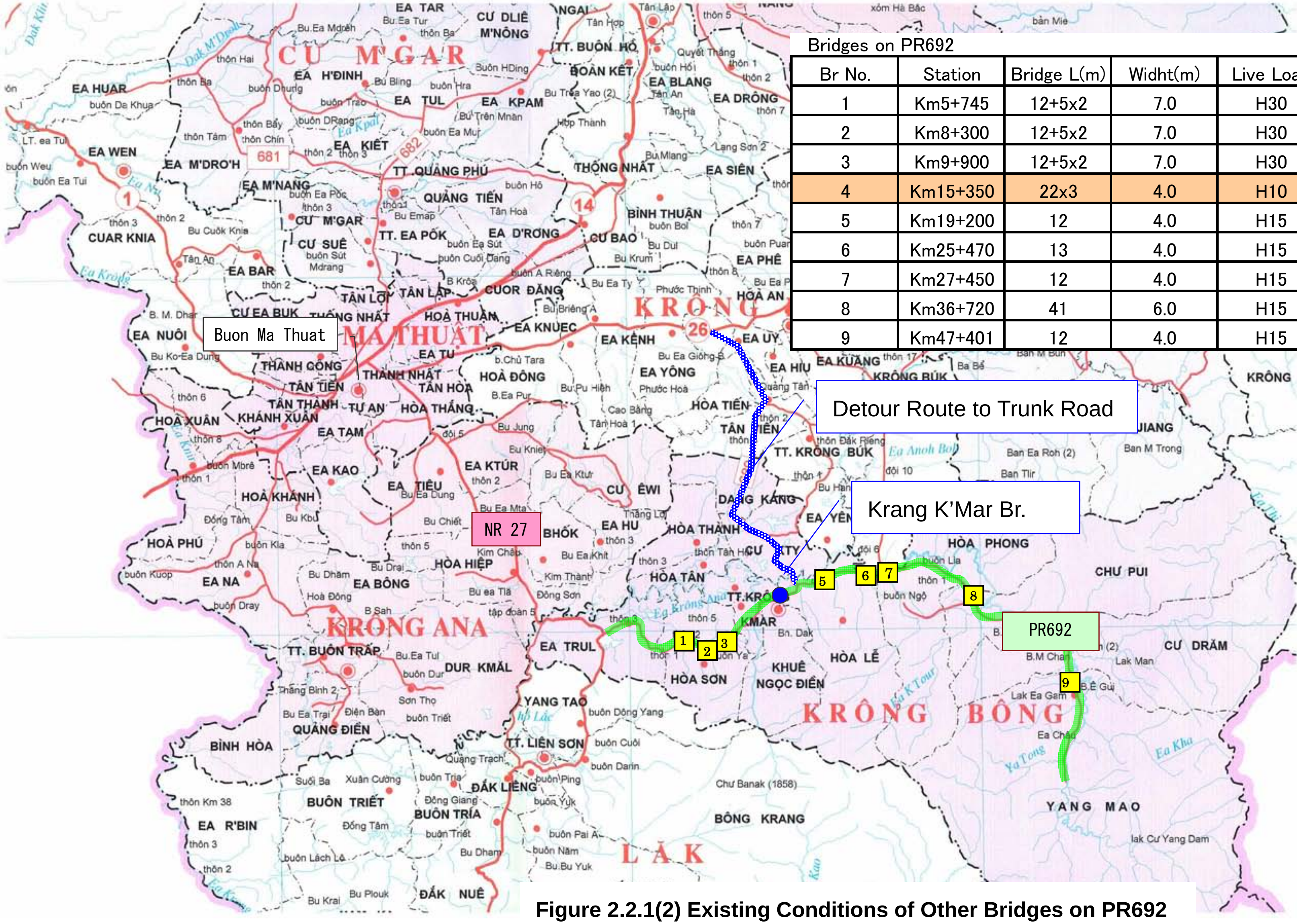


Figure 2.2.1(2) Existing Conditions of Other Bridges on PR692

2.2.2.3 Response to Other Requests

(1) Application of Steel Railing

A steel railing instead of a concrete railing shall be applied for the following reasons:

- MOT recently notified the provincial DOTs to use steel railing as the standard railing type.
- In regards to collisions with vehicles, steel railing is safer than concrete railing.
- The initial cost of railing will increased from US$30/m to US$45/m according to information from PMU18. However, its effect on total cost is minimal.
- Since steel is corrosion-prone, the steel railing should be galvanized in order to minimize maintenance.

Concrete Railing

Steel Railing

(2) Other Requests for Approach Roads & Ancillary Facilities

Requests regarding approach roads and ancillary facilities for bridges from the Vietnamese Government are summarized in Table 2.2.6. Since all the requests are mitigation measures for affected people and efficiency of the Project implementation, these are incorporated into the detailed design.

Table 2.2.7(1) Evaluation of Other Requests for Approach Roads & Ancillary Facilities

Request	Judgment	Reason
1.Da Dung Bridge - Consideration of water pipes for detailed design	○	-Water pipes should be considered in the detailed design of the bridge -Little effect on construction cost as it is quite small compared to size of girders.
2.Tran Bridge -Improvement of ancillary facilities on left bank （BxHxL = 3mx1.5mx12m）	○	-No plan at BD stage -No improvement of the ancillary facility will result in the necessity of a retaining wall, because the approach road elevation will be raised at the crossing point with the canal. -No improvement of the ancillary facility will require excavation of a new approach road after completion, which should be avoided from the viewpoint of Project efficiency -The ancillary facility can be improved within the affected area of the Project, resulting in the minimization of cost -The impact on construction cost will be minimal.
3.Tam Ngan Bridge - Extension of approach road on left bank (approx. 30m)	○	-No detailed plan on the extension of the approach road at the BD stage -A site visit confirmed the access road plan and the necessity of connecting the approach road with the access road. Note that the required additional land is easily acquired because it is village land -The extension connects with the existing village road and improves the convenience of villagers -Additional cost is minimal
-Securing function of small canal crossing new approach road on right bank.	○	-Recognized from BD stage. -New approach road construction will require a change in structure of canal, and its replacement cost should be borne by the Japanese side. -Existing open canal to be replaced by a pipe culvert and its cost is minimal
4.Tan Van Bridge -Providing access from feeder road to new access road	○	-Recognized from BD stage -Elevating the approach road will disturb smooth access from the feeder road -Total access length will be approx. 10m and improves the convenience of surrounding residents -The cost of this work has little affect on total construction cost
5.Ea Soup Bridge -Changing access point of new approach road on left bank.	○	-Improving the access road to 14m in width on the left bank requires changing the connecting point -The length of the new approach road will be shortened and its connecting point slightly shifted to the east -This change will reduce construction cost

Table 2.2.7(2)　Evaluation of Other Requests for Approach Roads & Ancillary Facilities

Request	Judgment	Reason
6.Krong K'Mar Bridge -Installing a drainage facility along the approach road on the right bank	○	-Recognized from BD stage. -The existing drainage system will malfunction due to the change in the location of the new approach road. The new drainage system can be installed on the upstream side of the new approach road (approximately 100m). -The new drainage system does not affect any houses near the embankment because 2 houses are moving elsewhere -The additional cost will have little effect on overall construction cost.
7.Ngoi Ngan Bridge -Providing access from the new approach road to affected houses	○	-Recognized from BD stage. -Mitigation measures required for affected houses, which are not required to move, due to an increase in the elevation of the new approach road -The additional cost will have a minimum effect on overall construction cost
-Installation of drainage along the upstream side of the new approach road.	○	-Recognized from BD stage. -An increase in the elevation of the new approach road will result in drainage water flowing towards houses along the road, and a drainage system is needed to mitigate this, which will be approximately 80m in length. -Installation of a new drainage system on the downstream side not required because all the houses are moving elsewhere. -The additional cost has a minimum effect on overall construction cost.

2.2.2.4 Other Changes in Detailed Design

(1) Installation of Approach Slab

An approach slab 5m in length will be installed at the backside of abutments more than 6m in height in order to avoid sharp differences between the bridge surface and approach road (based on *Guideline for Earth Works in Japan*).

(2) Soft Ground Treatment for Krong K'Mar Bridge

The geotechnical survey and analysis executed in Term 1 and 2 of Phase II of the Project identified the necessity of soft ground treatment for Krong K'Mar Bridge, since the soil test data indicated that the existing ground is too weak to support the embankment of the new approach road. The geotechnical survey of this Study also confirmed this, with the N values of soils ranging from around 3. Accordingly, soft soil treatment will be required at the backside of abutments in order to improve the strength of the existing ground in accordance with the previous analyses in Term 1 and 2. The conditions and results of these analyses are indicated in Appendix-1. Details of the soft soil treatment method are described in Table 2.2.8.

Table 2.2.8 Outline of Soft Soil Treatment Method

Items	Contents	Remarks
1.Improvement Method	PBD（Plastic Board Drain）Method	-Applied in Term 1& 2 of Project. -Locally available materials can be utilized.
2.Area to be Strengthened	-From abutment to embankment section with critical embankment height of: Right Bank: 2.80ｍ, Left Bank: 2.95m	-The treatment length will be approximately 60m on both banks.

2.2.2.5 Basic Bridge Planning Concepts

(1) River Condition

① Design High Water Level

It was confirmed in this Study that there has been no severe flooding since the BD study. Accordingly, there is no difference in the design high water level for each of the proposed bridges. Max HWL, Ordinary HWL, and LWL were established on the basis of interview results undertaken during the surveys at the BD stage. The Max HWL applied as the design high water level is shown in Table 2.2.9. Note that the appropriateness of these design water levels were justified as appropriate calculating water level based on rainfall data near the bridge site.

Table 2.2.9 Field Survey Water Levels and Design High Water Level

Bridge Name	Water Level			Remarks （Max. Year）
	Max HWL (Design HWL)	Ord. HWL	Ord. LWL	
DA DUNG	14.70	12.00	5.90	(1999)
TRANG	61.40	60.40	55.90	(1999)
TAM NGAN	127.70	127.10	125.00	(2000)
TAN VAN	748.70	748.00	745.50	(2000)
EA SOUP	20.00	18.80	10.40	(1983)
KRONG K'MAR	12.00	10.10	5.30	(1989)
NGOI NGAN	9.80	8.80	7.90	(2000)

② **Freeboard under Girders**

Freeboard under girders shall be set based on whether there is debris observed under bridges.

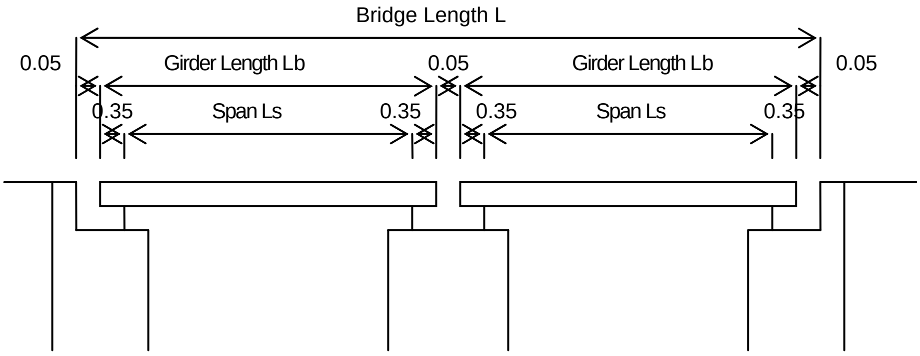
Table 2.2.10 Freeboard under Girders

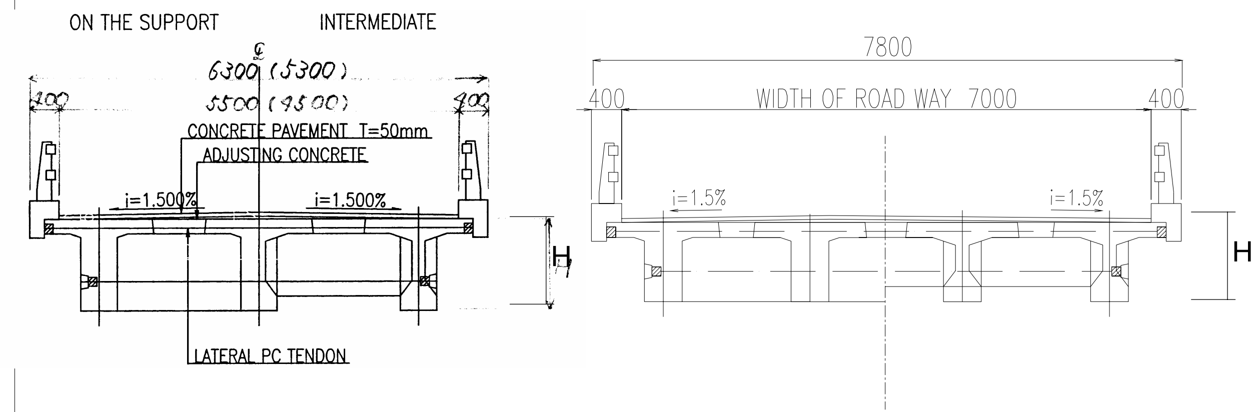
Conditions	Freeboard
Navigation clearance not required	in the flat area without debris: H=0.5m Run in the mountainous with debris: H=1.0m

(2) Superstructure Type

There is no change in the superstructure type selected in the BD stage as it has still been deemed appropriate. The BD study chose a post-tensioned PC T-girder for a 20-30m span with total bridge length ranging from 30m to 100m for the proposed bridges, taking into consideration economic aspects as well as previous experience in Vietnam. Note that the pre-tensioned PC girder type is difficult to apply due to bad road conditions. The typical PC bridge cross-section and side view are as shown in Figure 2.2.3.

In this Study, the design conditions of some of the bridges are changed. That is, the formation width of 4 bridges is increased and the live load level is upgraded from H13 to H18. In the case of the former, the girder shape is not changed although the number of girders is increased from 3 to 4. In the case of the latter, girder depth is made deeper in order to enhance girder stiffness to handle the increase in the live load level.





(Formation Width W=5.5m))　　　　（Formation Width W=7.0m）

Span Length Ls (m)		Girder Length Lb (m)	Girder Height (m)	Girder Type
H13 Live Load	18	18.700	0.90	T-Girder
	21	21.700	1.05	T-Girder
	24	24.700	1.25	T-Girder
	27	27.700	1.35	T-Girder
	30	30.700	1.40	T-Girder
H18	18	18.700	1.00	T-Girder
	21	21.700	1.15	T-Girder

Figure 2.2.3　Typical PC Girder for Study Bridges

(3) Substructure & Foundation

There is no change in the type of substructure and foundation selected in the BD stage as it has been deemed to still be appropriate. The type of substructure and foundation selected are as shown in Table 2.2.11.

Table 2.2.11 Substructure & Foundation Type

Substructure/ Foundation	Type	Reason for Selection
Abutment	Reversed T	Commonly applied for abutments for economic reasons.
Pier	Wall	Presents less obstacles to the river flow so it has an advantage against souring.
	Pile-bent	Used for economic reasons when flow velocity is slow and there is little possibility of scouring.
Foundation	Spread Foundation	Adopted when a reliable bearing layer is present at a shallow depth.
	Pile Foundation	RC 400 mm square pile adopted for economic and transportability reasons. It is difficult to drive piles a great depth or when there is a medium layer containing boulders and stones. In such cases, driven steel pipe piles 600 mm in diameter are used for depths greater than 24m.

The maximum driving length of a RC square pile will be 24m (12m x 2), because unlike the Mekong Delta there are stones and boulders on site and it will be difficult to drive concrete piles with low strength. In Term 1 and 2 of the Project pile-caps were constructed above the LWL in consideration of constructability when the water depth is relatively high even in the dry season. This time pile-cap will be built under the riverbeds for the proposed bridges because of the low LWL as well as in order to protect them from scouring.

(4) Approach Roads & Soft Ground Treatment

Approach road width is 5.5m and is the same as that in the BD study. The length, vertical gradient and horizontal alignment of approach roads are planned based on topography and existing land use conditions at each bridge site. The typical cross-section of the approach roads is 8.5m in total after adding another 1.5m for each shoulder at the sides of the carriageway. Side slopes are determined from embankment height as shown in Figure 2.2.4.

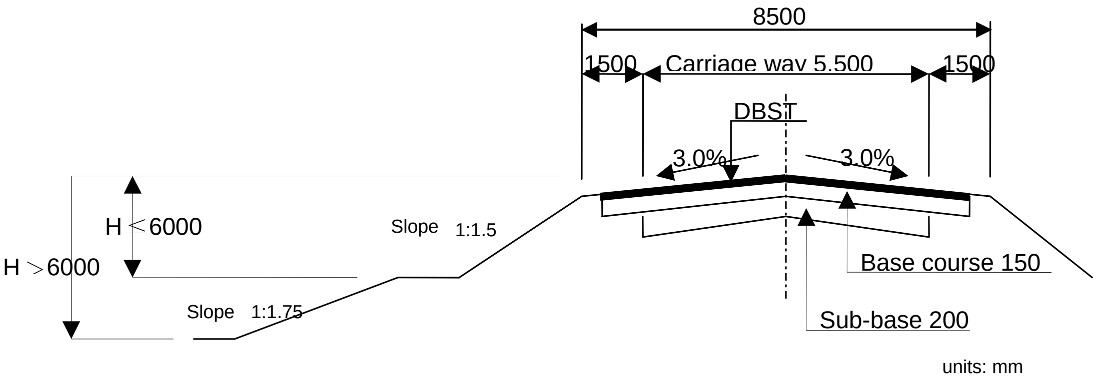


Figure 2.2.4 Typical Road Cross Section

DBST: Double Bitumen Treatment

Soft ground treatment is to be executed at Bridge No.56 (Krong K'Mar Bridge), as the necessity of strengthening the existing ground to support the high embankment was confirmed. Although there are several methods to treat soft ground, the Plastic Board Drain

(PBD) method has been deemed appropriate for this site from previous experience in Term1 and 2 of the Project as well as for economic reasons. Table 2.2.12 shows a comparison of the several methods for soft ground treatment in the BD study.

Table 2.2.12 Selection of Soft Ground Treatment Method

	Method			
	Sand Drain	Plastic Board Drain	Sand Compaction	Pre-cast pile
Diameter (mm)	400	65	700	400×400
Increase in strength of sub-soil(kg/c ㎡)	C = 0.3 ⇒ 1.0	C = 0.3 ⇒ 0.5	C = 0.3 ⇒ 3.0	—
Characteristics	Most popular	Construction speed high	Effective for sand layer	Piles support embankment load
Depth for practical application	30m	15m	35m	30m
Minimum interval	1.2m	0.9m	1.2m	1.0m
Construction speed	300m/day	2,500m/day	150m/day	120m/day
Ratio of cost	1.0	0.2	2.4	11.0
Others	Many satisfactory results in Japan	Many satisfactory results in Vietnam	-	-

(5) Revetment & Riverbed Protection

① Revetment

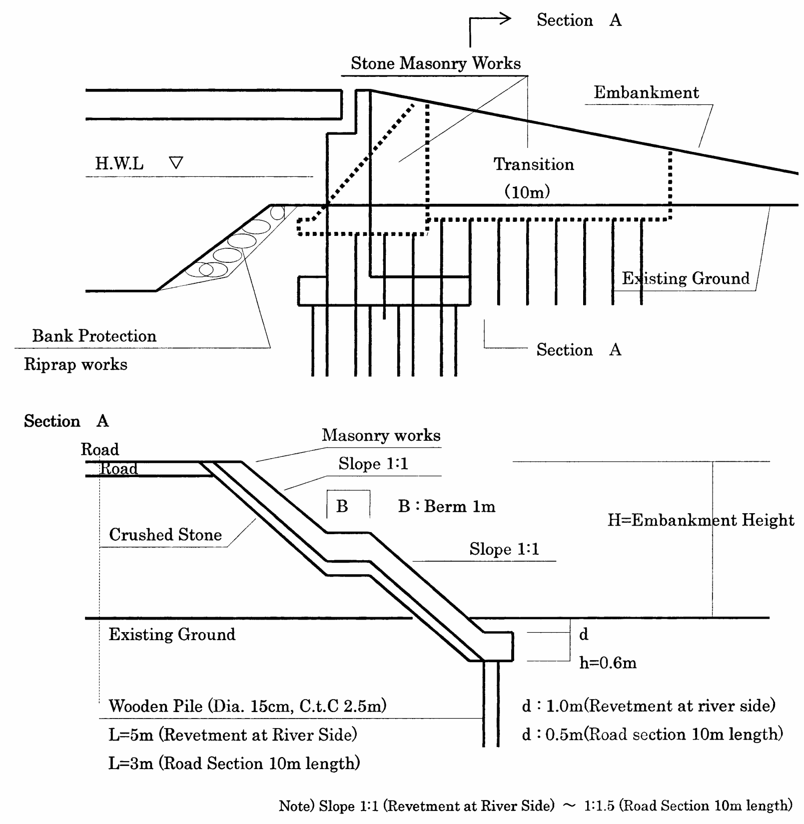


Figure 2.2.5 Slope Protection Works

The abutments of the proposed bridges are set back from the river waterline. However, in the rainy season, it is anticipated that some scouring and erosion will occur around bridges and approach embankments due to high flow velocity. To protect embankments around abutments, rip-rap is to be adopted up to the design HWL and up to 10m from abutments along approach roads. On riverbanks, gabion will be placed for protection, since it is flexible, durable and economic. A typical cross-section is illustrated in Figure 2.2.5.

② Pier Foundation Protection

When scouring is anticipated around a pier with a pile foundation, it should be protected with stone or gabion. The area indicated in Figure 2.2.6 depends on the presumed scouring depth. However, the footing is placed on bedrock and there is no protection work above the footing.

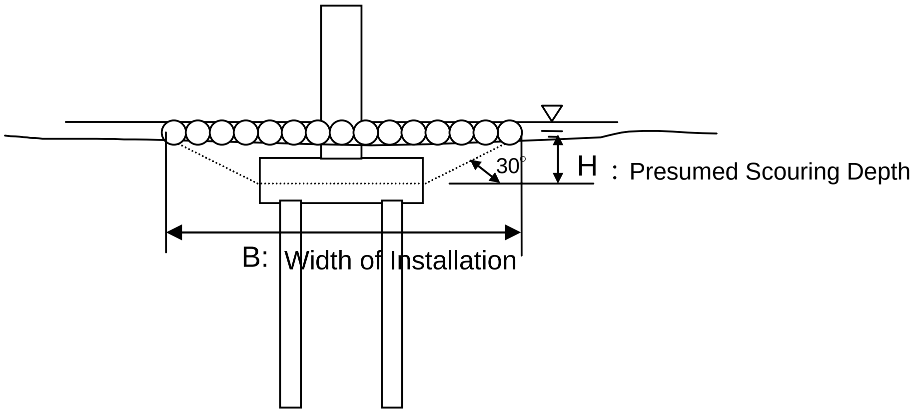


Figure 2.2.6 Pier Footing Protection

2.2.2.6 Design Criteria for Bridges & Approach Roads

(1) Design Standards

There is no change from the design standards applied for the BD study, and the following Vietnamese design standards are adopted for the Project.

- HIGHWAY SPECIFICATIONS FOR DESIGN, TCVN4054: 1998(VIETNAM)
- DESIGN SPECIFICATIONS FOR BRIDGES AND CULVERTS ON THE BASIS OF LIMIT STATES - MINISTRY OF TRANSPORT AND COMMUNICATION, No.2057 QD/Kt14, 1979(VIETNAM)
- DESIGN CRITERIA OF HIGHWAYS, TCVN4054-85 (VIETNAM)

In addition to the standards listed above, Japanese and AASHTO standards are also applied as required.

(2) Design Methodology

Structural members shall be mainly designed using the allowable stress method for a design load.

(3) Road Class & Design Speed

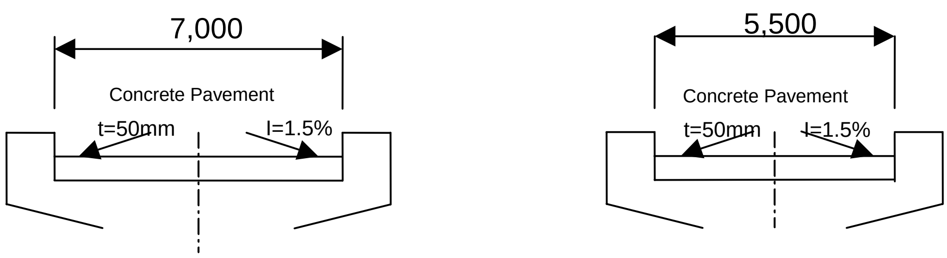
According to the Vietnamese Standard (i.e. TCVN 4054-85 and 1998), highways are classified into five categories depending on the level of importance and traffic volume. Table 2.2.13 shows the maximum design speed under normal conditions for each of these classes. Since the Project bridges are located in a rural area in central Vietnam, the road class shall be either Class IV or V depending on the traffic survey results. Basically, the design speed to be applied will be 40km/h for both provincial and district roads.

Table 2.2.13 Road Class & Design Speed

Road Class	I	II	III	VI	V
Design Speed (Km/h)	80&60	80&60	80&60	60&40	40&20
Design Traffic Volume (PCU/day)	80: ＞3000 60: ＞900	80: ＞3000 60: ＞900	80: ＞3000 60: ＞900	60: ＞900 40: ＞150	40:＞150 20: ＜150

(4) Road & Bridge Cross Sections

The formation widths of the proposed bridges are 7.0m for 4 bridges and 5.5m for 3 bridges (see analysis in 2.2.2). However, the formation width for the approach roads shall be same as that of the BD study, taking into consideration present practices in provincial road improvement projects.



Bridge No. 36, 46, 52, 56   Bridge No. 37, 43, 83

Figure 2.2.7 Cross Section of Bridge

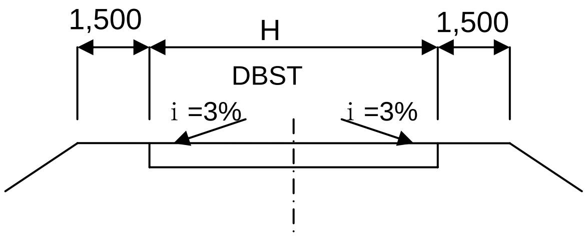


Figure 2.2.8 Cross Section of Approach Road

Note that a formation width of 5.5m is capable of having a truck and sedan pass each other on a bridge.

(5) Design Loads

① Live Load

Based on the analysis in 2.2.3, the live loads shown in Table 2.2.14 are to be adopted for the proposed bridges.

Table 2.2.14 Live Loads for Proposed Bridges

Type of Live Load	Bridge Name
H-13	Da Dung, Tran, Tam Ngan, Tan Van,Krong K'Mar, Ngoi Ngan Bridge
H-18	Ea Soup Bridge

② Seismic Horizontal Force

The same concept in the BD study for seismic horizontal force shall be applied in the detailed design. In accordance with AASHTO and Vietnamese Standard 22 TCN-221-95, the horizontal seismic coefficient 0.05 shall be adopted for the proposed 7 bridges.

Table 2.2.15 Seismic Coefficient for Bridge Design

Seismic Coefficient Indicator（SI）	Provincial Name	Design Seismic Coefficient
SI≦7	Other provinces	0.05
SI>7	Thanh Hoa & Ha Tinh Province	0.16

③ Other Loads

The following loads shall be considered when required:

- Dead load

- Impact load
- Wind load
- Influence of creep for concrete
- Influence of dry shrinkage for concrete
- Earth pressure
- Static pressure of water
- Water pressure during flood
- Buoyancy
- Settlement

(6) Material Strength

Unit weights and strength of materials are described below.

① Unit weights for materials

Table 2.2.16 Unit Weights of Materials

Designation	Self-weight kN/m^3	Designation	Self-weight kN/m^3
Steel	78.5	Cement, Mortar	21.5
Concrete reinforced	25.0	Asphalt concrete	23.0
Pre-stressed concrete	25.0	Concrete pavement	23.5
Non-reinforced concrete	23.5	Timber	8.0

② Strength of Materials

In principle, the compressive strength of concrete and reinforcement are applied as specified in the Vietnam Bridge Standard No.2057 QD/Kt14.

Table 2.2.17 Strength of Concrete

Designation	Strength (N/mm^2)
PC Girder (post tension)	35
Slab	30
Abutment & Pier	21
Concrete Pile	30

Table 2.2.18 Strength of Steel

Designation	Yield Strength (kg/cm^2)
Round Bar(A- Ⅰ)	σ py= 1,900
Deformed Bar(A-Ⅱ)	σ py= 2,400
Deformed (A-Ⅲ)	σ py= 3,000

(7) Geometric Standards

The road geometric standards set out in the 1998 Vietnam Standard TCVN 4054 were used for this Project. The major items of the standard are shown in Table 2.2.19. As mentioned in 2.2.6 (3), geometric standards based on a design speed of 40km/h are basically applied for the road design. However, the design speed can be lowered if surrounding conditions, such as the location of houses, do not permit this. In addition, the maximum longitudinal grade to be used is 6%, taking into consideration the many bicycle users.

Table 2.2.19 Geometric Design

Item	Unit	Design Standard	
Design Speed	Km/hr	40	25
Horizontal alignment			
Minimum curve radius	m	60	30
Minimum curve length	m	70	45
Minimum transition curve length	m	35	25
Super elevation runoff		1/100	1/100
Minimum sight distance	m	40	20
Vertical alignment			
Maximum gradient	%	8	9
Minimum radius of crest	m	700	200
Minimum radius of sag	m	450	100
Minimum vertical curve length	m	30	25
Cross section			
Cross fall	%	3	3
Maximum super-elevation	%	6	6

Embankment height and slope comply with the 1998 Vietnam Bridge Standard TCVN4054.

Table 2.2.20 Embankment Height & Slope

Type of Soil	Slope（H＜6m）	Slope（6m＜H＜12m）
Sand and Silt or Clay	1:1.5	1:1.75

2.2.2.7 Summary of Bridge Design

The design results of the proposed 7 bridges are summarized in Table 2.2.21.

Table 2.2.21 Summary of Bridge Design Results

	Bridge Name	Da Dung Bridge	Tran Bridge	Tam Ngan Bridge	Tan Van Bridge	Ea Soup Bridge	Krong K'Mar Bridge	Ngoi Ngan Bridge
	Photos							
Bridge Structure	Location	15m Upstream of exist. one	Same as existing one	80m Upstream of exist. one	12m Upstream of Exist.one	15m Downstream of Exist one	11m Upstream of Exist. one	5m Downstream of exist. one
		No change	No change	No change	No change	No change	No change	No change
	Bridge Length (Span Arrang.)	92.3m(30+30+30)	65.3m(21+21+21)	71.3m(21+27+21)	80.3m(24+30+24)	59.3m(18+21+18)	71.3m(21+27+21)	49.55m(24+24)
		No change	No change	No change	No change	No change	No change	No change
	Clear Width	5.5m	5.5m	5.5m	5.5m	5.5m	5.5m	5.5m
		7.0m	No change	No change	7.0m	7.0m	7.0m	No change
	Design Live Load	H-13	H-13	H-13	H-13	H-13	H-13	H-13
		No change	No change	No change	No change	H18	No change	No change
	Superstructure Type	PC Simple T Girder	PC Simple T Girder	PC Simple T Girder	PC Simple T Girder	PC Simple T Girder	PC Simple T Girder	PC Simple T Girder
		No change	No change	No change	No change	No change Girder Depth: 10cm Up	No change	No change
	Foundation Type	Spread Foundation	Spread Foundation	Spread Foundation	Spread Foundation	Spread Foundation	Pile Foundation	Pile Foundation
		No change	No change	No change	No change	No change	No change	No change
	Approach Slab (Abut. H>6m)	No Installation	No Installation	No Installation	No Installation	No Installation	Install at both banks	No Installation
		Install at both banks	Install at both banks	Install at left bank	Install at both banks	Install at both banks	No change	No change
	Railing	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete
		Steel	Steel	Steel	Steel	Steel	Steel	Steel
Approach Roads	Left Bank	L=172m, W=1.5+5.5+1.5	L=116m, W=1.5+5.5+1.5	L=157m, W=1.5+5.5+1.5	L=93m, W=1.5+5.5+1.5	L=98m, W=1.5+5.5+1.5	L=90m, W=1.5+5.5+1.5	L=92m, W=1.5+5.5+1.5
		No change	No change	L=187m, W=1.5+5.5+1.5	No change	No chage	L=116m, W=1.5+5.5+1.5	No change
	Right Bank	L=152m, W=1.5+5.5+1.5	L=116m, W=1.5+5.5+1.5	L=22m, W=1.5+5.5+1.5	L=105m, W=1.5+5.5+1.5	L=125m, W=1.5+5.5+1.5	L=125m, W=1.5+5.5+1.5	L=94m, W=1.5+5.5+1.5
		No change	No change	No change	No change	No change	No change	No change
	Provision of Access to approach Rd.	—	—	—	—	—	—	—
		No change	No change	No change	Access to feeder road at right bank (L=10m)	No change	No change	Access from houses at upstream side of right bank
Other Facilities	Protection Works	Around abutments	Around abut. & piers	Around abut. & pier/ front of A1	Around and front of abut.	Around and front of abut.	Around abut. & piers	Around abutments
		No change	Around abuts & P2 piers	Around abut & front of A1	No change	No change	No change	No change
	Channel Improvement	—	—	—	—	—	—	—
		No change	Improve channel at left bank	Improve channel at left bank	No change	No change	No change	No change
	Drainage Provision	Along embankment toe	Along embankment toe	Along embankment toe	Along embankment toe	Along embankment toe	Along embankment toe	Along embankment toe
		No change	No change	No change	No change	No change	Change the drainage route at upstream side of right bank (L=120m)	No change
	Soft Soil Treatment	—	—	—	—	—	—	—
		No change	No change	No change	No change	No change	Under the approach raods (Right Bank:42m, Left bank:71m	No change

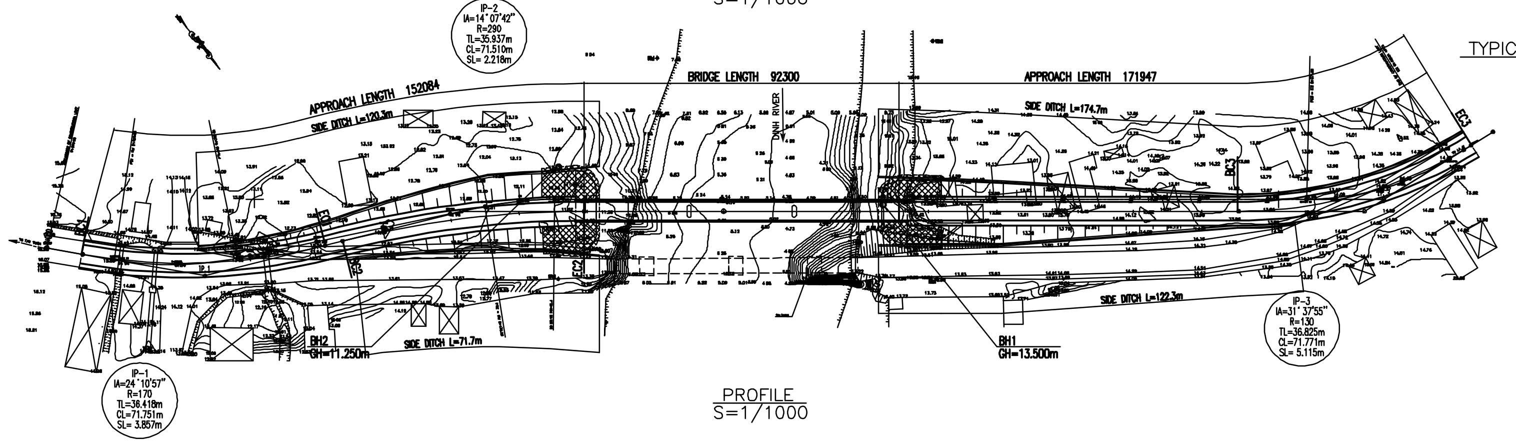
* Upper Row: BD results, Lower Row: Implementation Study Results

2.2.3 General Drawings for Proposed Bridges

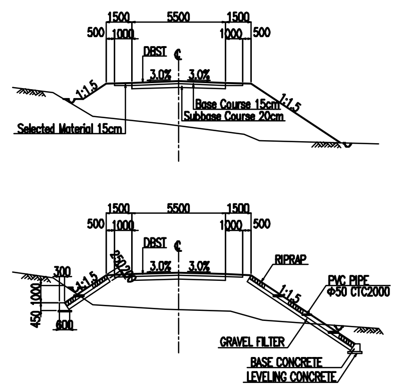
A general view of the 7 proposed bridges is attached at the end of the report and each bridge has two drawings (one for the bridge structure and one for the approach roads).

BR.NO.36 DA DUNG BRIDGE
GENERAL VIEW OF THE SITE

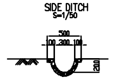
PLAN
S=1/1000



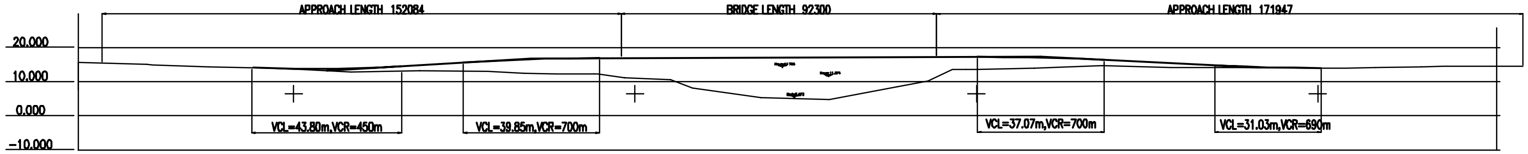
TYPICAL CROSS SECTION OF APPROACH ROAD
S=1/200



SIDE DITCH
S=1/50



PROFILE
S=1/1000



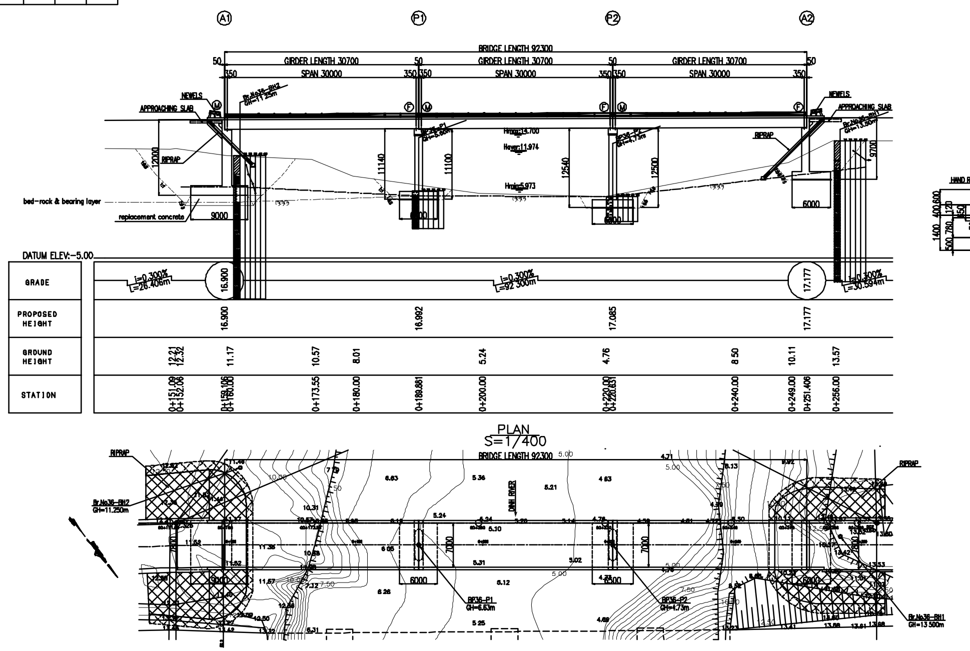
GRADE: 14.044 – 13.226 – i=6.000% L=59.924m – 16.821 – i=0.300% L=26.406m – 16.900 – i=0.300% L=92.300m – 17.177 – i=0.300% L=30.594m – 17.269 – i=5.000% L=64.369m – 14.051 – 13.967

STATION	PROPOSED HEIGHT	GROUND HEIGHT
0.000.00	15.590	15.59
0+020.00	15.000	15.00
0+021.76	14.940	14.94
0+038.23	14.380	14.38
0+050.876	14.044	
0+056.46	13.870	13.89
0+060.00	13.796	13.79
0+065.50	13.735	13.63
0+072.776	13.759	
0+080.00	13.899	12.82
0+100.00	14.859	13.14
0+120.00	16.022	12.96
0+130.52	16.465	12.51
0+132.700	16.537	
0+140.00	16.729	12.23
0+140.80	16.745	12.32
0+151.09	16.874	12.21
0+152.06	16.879	12.33
0+159.106	16.900	
0+160.00	16.903	11.17
0+173.55	16.943	10.57
0+180.00	16.963	8.01
0+200.00	17.023	5.24
0+220.00	17.083	4.76
0+240.00	17.143	8.50
0+249.00	17.170	10.11
0+251.406	17.177	
0+256.00	17.191	13.57
0+260.00	17.203	13.57
0+263.10	17.212	13.55
0+280.00	17.068	13.90
0+282.000	17.023	
0+300.00	16.369	14.69
0+320.00	15.369	14.10
0+340.00	14.430	14.09
0+346.369	14.226	
0+360.00	13.989	13.96
0+364.064	13.967	
0+371.35	13.980	13.98
0+380.00	14.080	14.08
0+393.43	14.370	14.37
0+400.00	14.400	14.40
0+415.51	14.420	14.42

BR.NO.36 DA DUNG BRIDGE
GENERAL VIEW OF THE BRIDGE

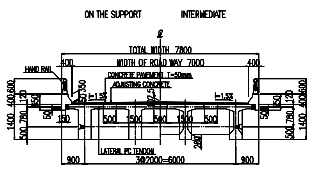
PROFILE
S=1/400

PLAN
S=1/400



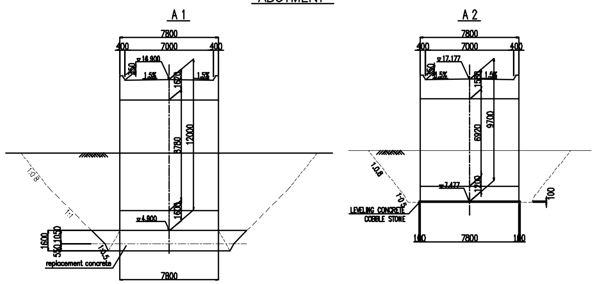
CROSS SECTION
S=1/100

GIRDER LENGTH 30700

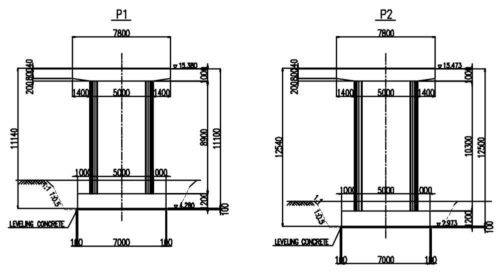


FRONT VIEW
S=1/200

ABUTMENT



PIER



DESIGN CRITERIA

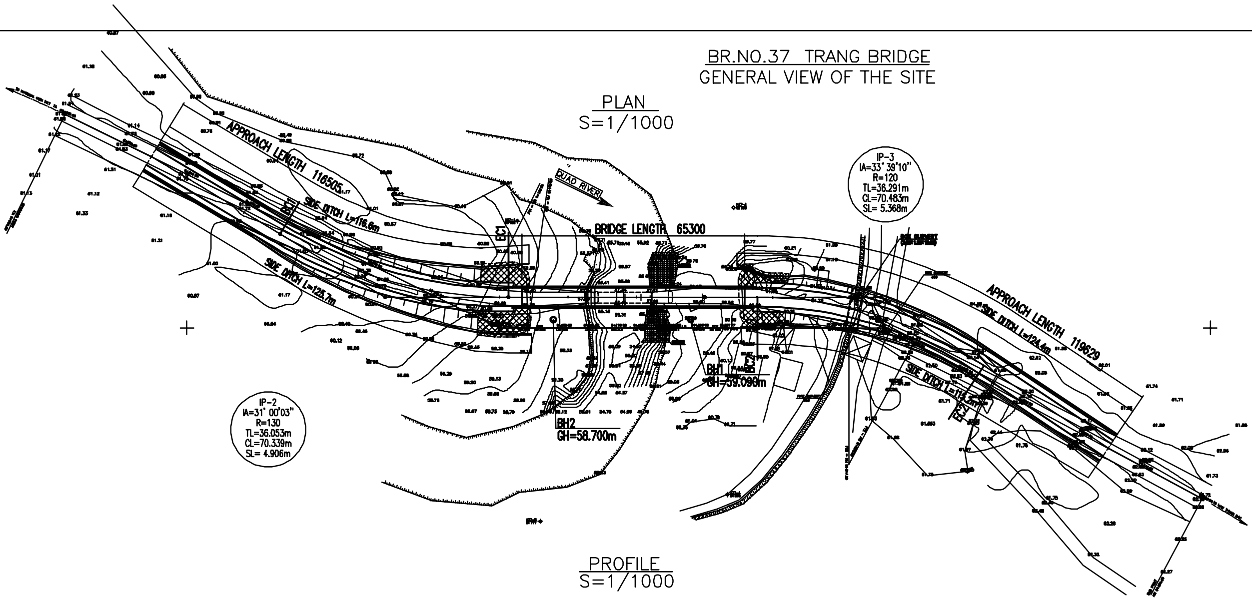
General Condition		
Design Live Load	H13,X60	
Design Speed	V=40km/h	
Bridge Length(Span Length)	92.30m(30.00m+30.00m+30.00m)	
Freeboard	0.5m	
Longitudinal Gradient	0.30 %	
Cross-fall of Carriage way	1.50 %	
Super Structure Type	Prestressed Concrete	
Sub Structure Type	Abutment	Reinforced Concrete
	Pier	Reinforced Concrete
Foundation Type	Abutment	A1.Spread foundation
		A2.Spread foundation
	Pier	P1:Spread foundation
		P2:Spread foundation
Material Strength		
Super Structure Type	Girder	$\sigma 28=35N/mm^2$
	Cross Beam	$\sigma 28=30N/mm^2$
	Slab	$\sigma 28=30N/mm^2$
Surface	Curb,Handrail	$\sigma 28=21N/mm^2$
Sub Structure Type		$\sigma 28=21N/mm^2$
Reinforcing Steel		SD295(py=295N/mm²)

THE SOCIALIST REPUBLIC OF VIETNAM
PROJECTS MANAGEMENT UNIT NO.18, MINISTRY OF TRANSPORTS

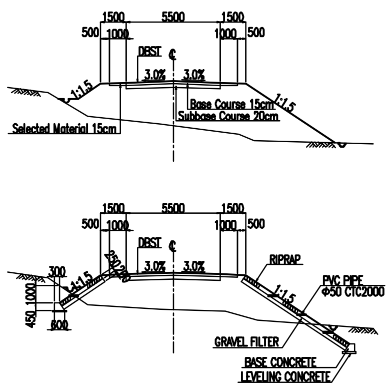
PROJECT	THE PROJECT FOR RECONSTRUCTION OF BRIDGES IN THE CENTRAL DISTRICT (PHASE II)		
CONSULTANT			
	DESIGNED BY	CHECKED BY	APPROVED BY
NAME			
SIGNATURE			
DATE			

BR.NO.37 TRANG BRIDGE
GENERAL VIEW OF THE SITE

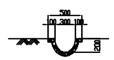
PLAN
S=1/1000



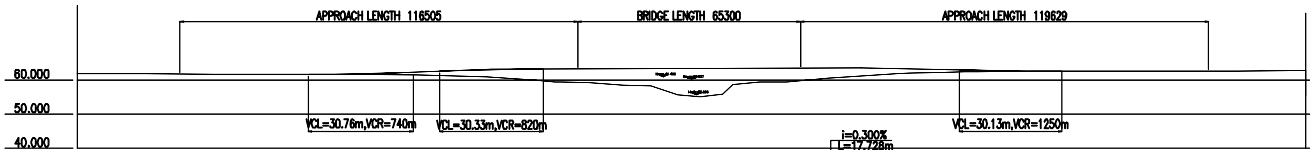
TYPICAL CROSS SECTION OF APPROACH ROAD
S=1/200



SIDE DITCH
S=1/50

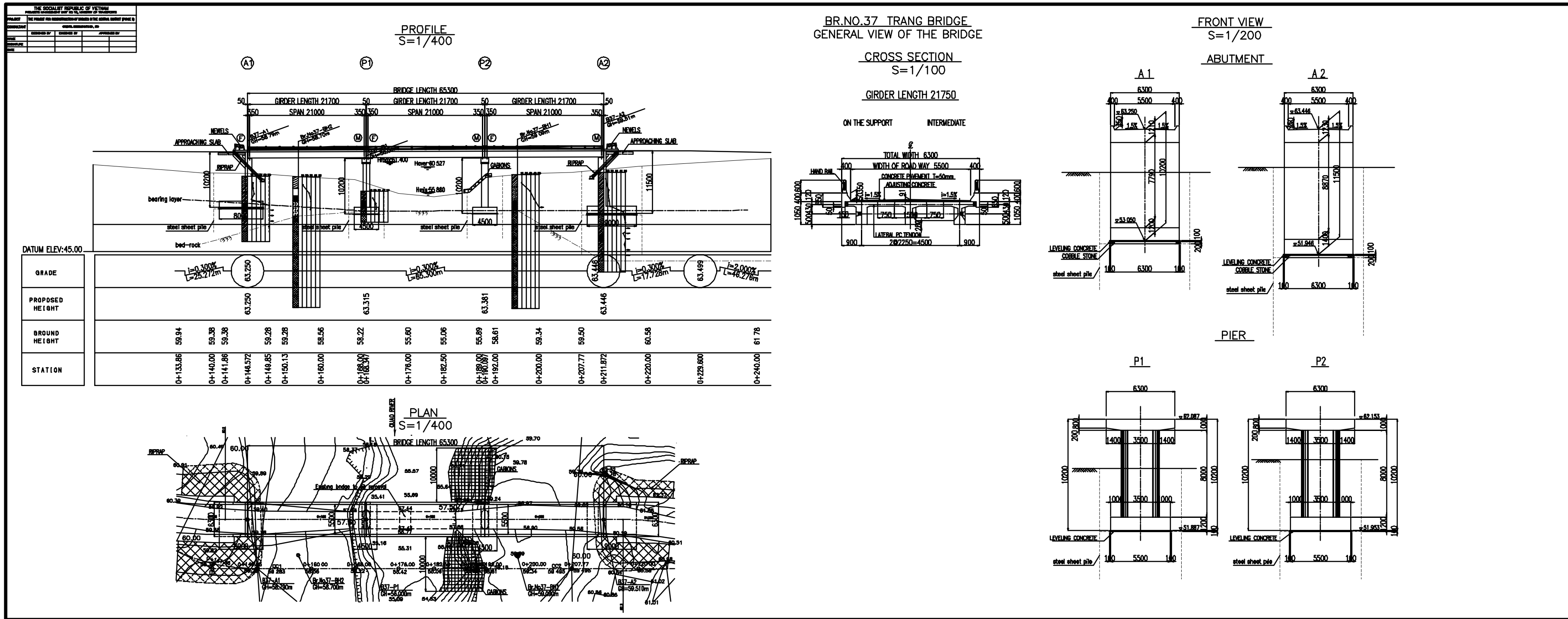


PROFILE
S=1/1000



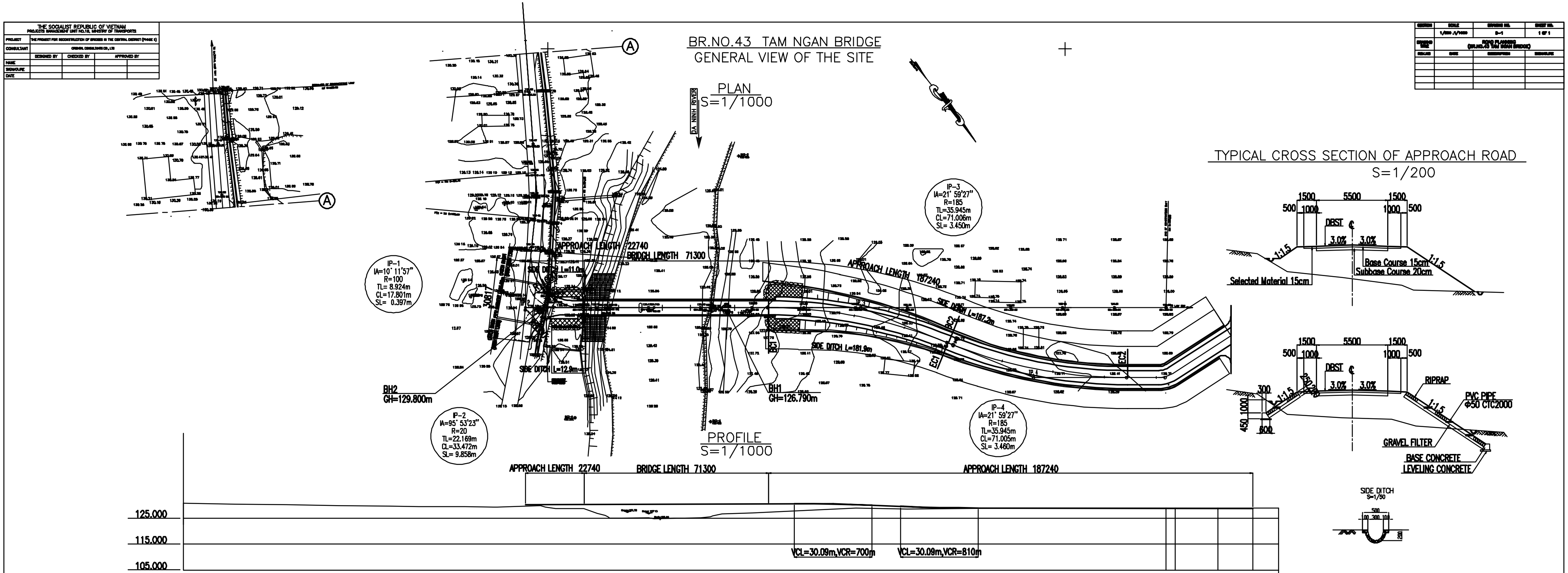
GRADE: 61.646 — 61.619 — i=4.000% L=38.888m — 63.174 — i=0.300% L=25.272m — 63.250 — i=0.300% L=65.300m — 63.446 — (i=0.300% L=17.728m) — 63.499 — i=2.000% L=46.276m — 62.573 — 62.624

STATION	PROPOSED HEIGHT	GROUND HEIGHT
0+000.00	61.880	61.88
0+020.00	61.810	61.81
0+040.00	61.720	61.72
0+060.00	61.650	61.65
0+067.653	61.646	
0+080.00	61.738	61.64
0+082.412	61.780	
0+100.00	62.322	61.42
0+120.00	63.005	60.95
0+121.300	63.034	
0+133.86	63.208	59.94
0+140.00	63.230	59.38
0+141.86	63.236	59.38
0+146.572	63.250	
0+149.85	63.260	59.28
0+150.13	63.261	59.28
0+160.00	63.290	58.56
0+168.00	63.309	58.22
0+176.00	63.314	55.60
0+182.50	63.338	55.06
0+189.00	63.377	55.89
0+192.00	63.386	58.61
0+200.00	63.410	59.34
0+207.77	63.434	59.50
0+211.872	63.446	
0+220.00	63.470	60.58
0+229.600	63.499	
0+240.00	63.291	61.78
0+244.29	63.205	62.02
0+254.14	63.008	62.28
0+260.00	62.891	62.35
0+263.99	62.815	62.42
0+275.876	62.664	
0+280.00	62.637	62.62
0+288.530	62.624	
0+300.00	62.630	62.63
0+320.00	62.690	62.69
0+340.00	62.680	62.68
0+360.00	62.730	62.73



DESIGN CRITERIA

General Condition		
Design Live Load	H13.X60	
Design Speed	V=40km/h	
Bridge Length(Span Length)	65.30m(21.00m+21.00m+21.00m)	
Freeboard	0.5m	
Longitudinal Gradient	0.30 %	
Cross-fall of Carriage way	1.50 %	
Super Structure Type	Prestressed Concrete	
Sub Structure Type	Abutment	Reinforced Concrete
	Pier	Reinforced Concrete
Foundation Type	Abutment	A1.Spread foundation
		A2.Spread foundation
	Pier	P1:Spread foundation
		P2:Spread foundation
Material Strength		
Super Structure Type	Girder	σ28=35N/mm²
	Cross Beam	σ28=30N/mm²
	Slab	σ28=30N/mm²
Surface	Curb,Handrail	σ28=21N/mm²
Sub Structure Type		σ28=21N/mm²
Reinforcing Steel		SD295(σy=295N/mm²)

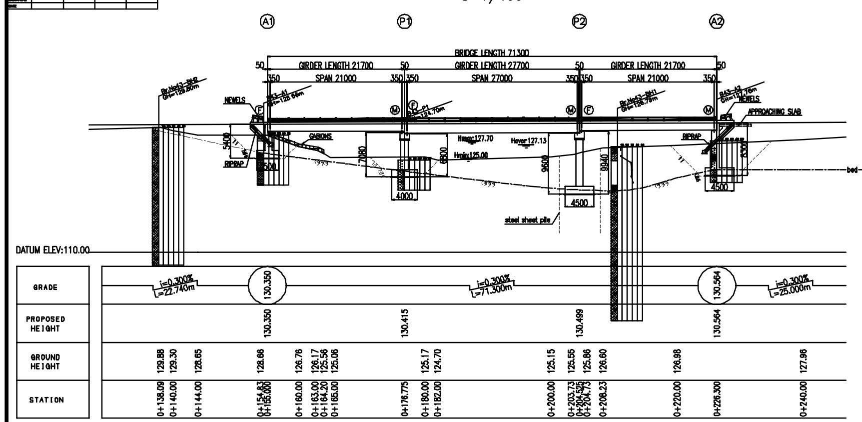


GRADE: 130.282 — i=0.300%, L=22.740m — 130.350 — i=0.300%, L=71.300m — 130.564 — i=0.300%, L=25.000m — 130.639 — i=4.000%, L=41.420m — 128.982 — i=0.300%, L=90.757m — 128.810

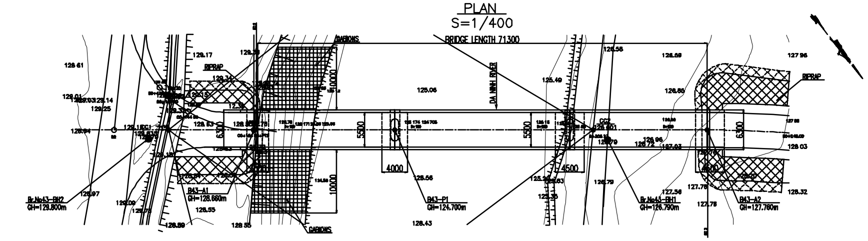
STATION	PROPOSED HEIGHT	GROUND HEIGHT
0+000.00	130.710	130.71
0+020.00	130.420	130.42
0+040.00	130.230	130.23
0+060.00	129.880	129.88
0+080.00	129.670	129.67
0+091.10	129.550	129.55
0+100.00	129.430	129.43
0+108.90	129.420	129.42
0+120.00	129.360	129.36
0+121.36	129.350	129.35
0+132.260	130.282	
0+138.09	13.0299	129.88
0+140.00	130.305	129.30
0+144.00	130.317	128.65
0+154.83	130.349	128.66
0+155.000	130.350	
0+160.00	130.365	126.76
0+163.00	130.374	126.17
0+164.20	130.378	125.56
0+165.00	130.380	125.06
0+180.00	130.425	125.17
0+182.00	130.431	124.70
0+200.00	130.485	125.15
0+203.73	130.496	125.55
0+204.73	130.499	125.86
0+208.23	130.510	126.60
0+220.00	130.545	126.98
0+226.300	130.564	
0+240.00	130.595	127.96
0+251.300	130.477	
0+260.00	130.262	128.99
0+280.00	129.494	128.50
0+292.720	129.121	
0+300.00	128.997	128.77
0+320.00	128.900	128.83
0+340.00	128.840	128.93
0+360.00	128.780	128.91
0+380.00	128.720	128.89
0+383.477	128.710	
0+400.00	128.710	128.89
0+413.54	128.710	128.89

BR.NO.43 TAM NGAN BRIDGE
GENERAL VIEW OF THE BRIDGE

PROFILE
S=1/400

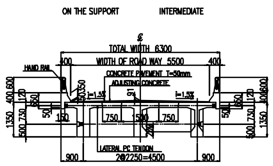


PLAN
S=1/400

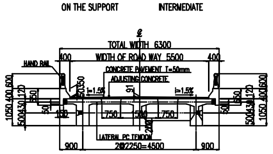


CROSS SECTION
S=1/100

GIRDER LENGTH 27700



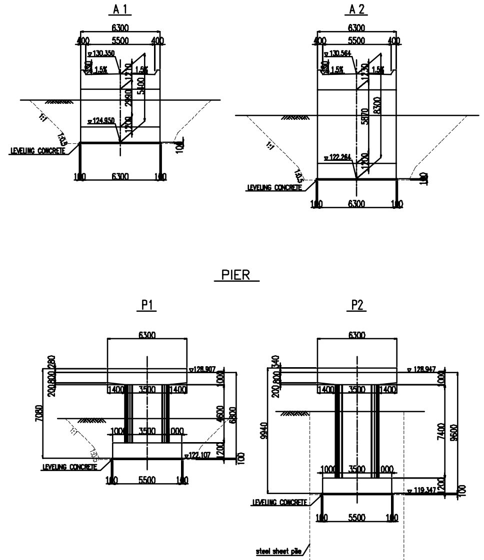
GIRDER LENGTH 21700



FRONT VIEW
S=1/200

ABUTMENT

PIER



DESIGN CRITERIA

General Condition		
Design Live Load	H13,X60	
Design Speed	V=40km/h	
Bridge Length(Span Length)	71.30m(21.00m+27.00m+21.00m)	
Freeboard	1.0m	
Longitudinal Gradient	0.30 %	
Cross-fall of Carriage way	1.50 %	
Super Structure Type	Prestressed Concrete	
Sub Structure Type	Abutment	Reinforced Concrete
	Pier	Reinforced Concrete
Foundation Type	Abutment	A1.Spread foundation
		A2.Spread foundation
	Pier	P1:Spread foundation
		P2:Spread foundation
Material Strength		
Super Structure Type	Girder	σ28=35N/mm²
	Cross Beam	σ28=30N/mm²
	Slab	σ28=30N/mm²
Surface	Curb,Handrail	σ28=21N/mm²
Sub Structure Type		σ28=21N/mm²
Reinforcing Steel		SD295(py=295N/mm²)

D-22 (Br.No.43)