PART 3

SELECTION OF BRIDGES FOR SEISMIC CAPACITY IMPROVEMENT (PACKAGE B AND C)

CHAPTER 11 PROCEDURES FOR SELECTION OF BRIDGES FOR OUTLINE DESIGN

11.1 General

In order to determine the bridges which require retrofitting or replacement to mitigate the seismic disaster inside and outside Metro Manila, two steps of screening were employed which includes inspection of the bridge conditions, environmental and social conditions around the bridge, and undertaking traffic volume survey on the roads related to the bridges. The prioritization and selection of the bridges to be retrofitted or replaced was carried-out based on these steps of screening.

The detailed evaluation criteria of first screening and second screening are described in 11.4 Evaluation Criteria for the First Screening and 11.5 Evaluation Criteria for the Second Screening.

The first screening aims to prioritize bridges which should be widely categorized by not only physical factors due to condition of the bridge but also seismic performance factors to reduce seismic hazards and geotechnical factors. The purpose of the second screening is to select the target bridges for the outline design stage.

11.2 Flowchart for Selection

The selection of priority bridges for seismic strengthening shall be undertaken as a two-screening process as shown in Figure 11.2-1.

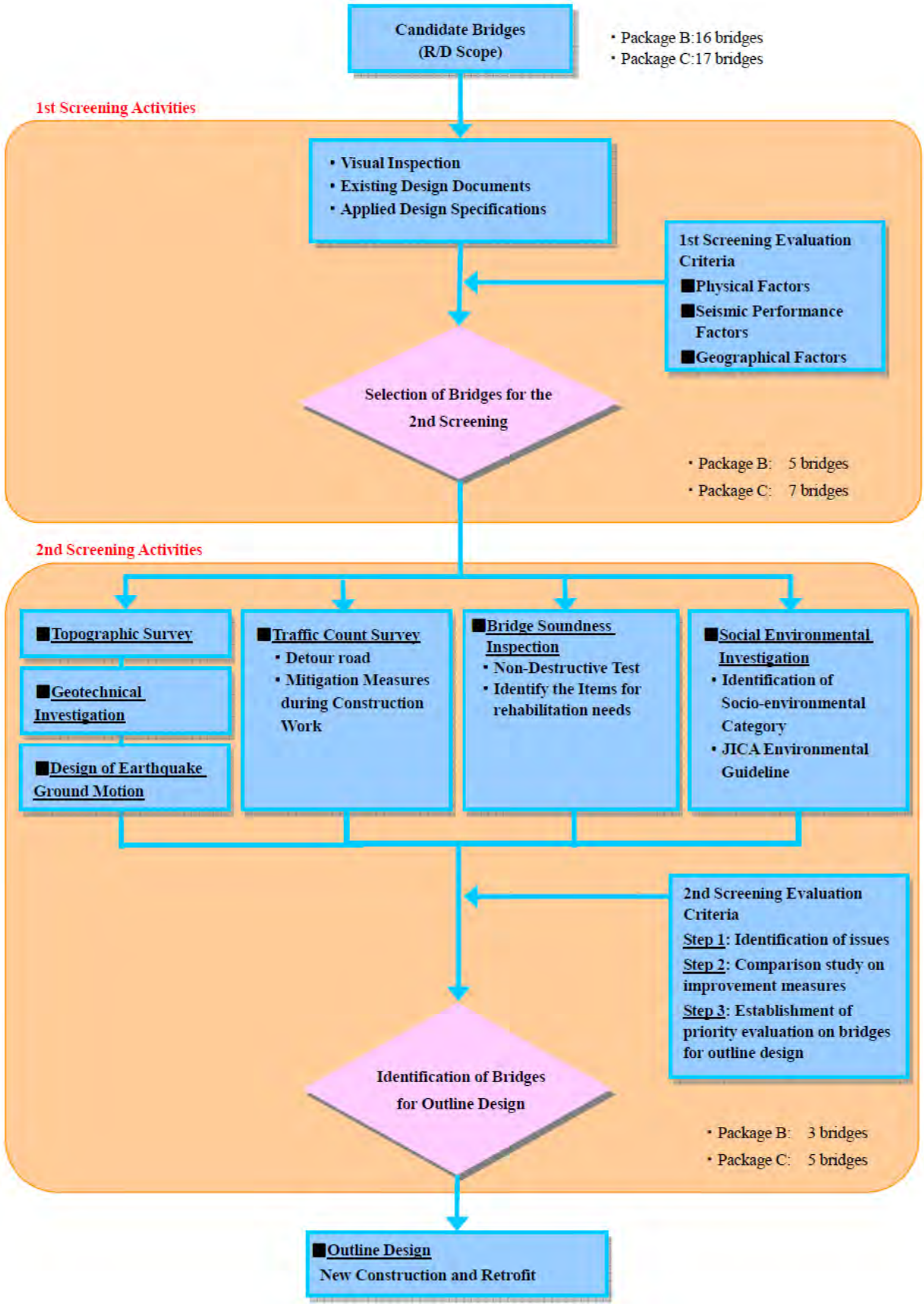


Figure 11.2-1 Procedure of Identification of Prioritized Bridges

11.3 Contents of Survey for the First and Second Screenings

The detailed scope of works and survey method for each survey work is shown in Table 11.3-1.

Table 11.3-1 Scope of Works and Survey Method for Survey Work (1/2)

Survey	Purpose	Location	Contents	Method/Quantity	Deliverable
Traffic Count Survey	• For consideration and plan of detour, the number of vehicles affected during the construction period for seismic strengthening (maintenance, repair and reinforcement) and forecasting future traffic volume • To consider the traffic volume for detour road/bridge during seismic retrofit/replacement • To forecast future traffic volume to determine necessary number of lanes	• Inside Metro Manila: 5 bridges • Outside Metro Manila: 7 bridges	• Traffic Count Survey on the Bridge	Inside Metro Manila 24 hours：12 locations (on the bridge, one each for the selected bridge and one each on the upstream and downstream of 5 bridge) Outside Metro Manila 16 hours and 24 hours：7 locations (on selected bridge*8 bridges)	Traffic Survey Report
			• Intersection Traffic Count Survey	Inside Metro Manila 24 hours：12 locations (at road intersections of the bridge, one for selected bridge and one each for upstream and downstream of 5 bridges） Outside Metro Manila 12 hours and 24 hours：3 locations (one intersection per selected bridge*8 bridges)	
Topographic Survey	• To measure the topographic condition around the bridge site for seismic retrofit/ replacement	• Inside Metro Manila: 5 bridges • Outside Metro Manila: 7 bridges	• Centerline profile ：8.0km (Inside MM: 2.5km, Outside MM: 5.5km) • Topographic Survey ：About 38.5ha (Inside MM: 19.0ha, Outside MM: 19.5ha） • Cross section (@50m) ：8.9km (Inside MM: 3.6km, Outside MM: 5.3km) • Temporary bench mark (one of either bank） ：24 places (Inside MM: 10, Outside MM: 14) • Centerline profile of river ：3.0km (Inside MM: 1.0km, Outside MM: 2.0km） • Cross section of river ：About 14.6km (Inside MM: 3.8km, Outside MM: 10.8km） • Utility survey (visual survey)		Profile (H=1/1,000,V=1/100) Cross section (1/100) Plan (1/1,000) Profile of river (H=1/1,000,V=1/100) Cross section of river (1/100)

Table 11.3-1 Scope of Works and Survey Method for Survey Work (2/2)

Survey	Purpose	Location	Contents / Method/Quantity	Deliverable
Socio Environmental Investigation	• Prediction of Natural and Social Environmental Impact of Selected Bridges including alternative measure. • Consideration of Environmental Management Plan and Monitoring Plan	• Inside Metro Manila: 5 bridges • Outside Metro Manila: 7 bridges	• Collection and analysis of data and information • Scoping • Prediction of Natural and Social Environmental Impact of Selected Bridges • Consideration of Alternatives • Consideration of Mitigation Method • Consideration of Environmental Management Plan and Monitoring Plan • Support for Stakeholders' Meeting • Support for Preparing the Draft Resettlement Action Plan	Report Environmental Check List Draft Primary Resettlement Action Plan
Bridge Soundness Inspection	• Assistance of Bridge Soundness Inspection/Test	• Inside Metro Manila: 5 bridges • Outside Metro Manila: 7 bridges	• Bridge Soundness Inspection/Test ・ Visual Inspection/ Shape and Dimension Measurement/ Crack Inspection/ Compressive Strength Test (Core sample, Schmidt hammer rebound test)/ Neutralization Test (Concrete chipping, Coring, Drilling)/ Reinforcing Bar Detection (Electromagnetic wave radar method)/ Shape and Dimension Measurement/ Scouring Measurement ・ Natural Vibration Test/ Impact Vibration Test	Bridge Inspection Report
Geotechnical Investigation	• To determine the geological/ geotechnical condition and properties at the bridge sites required for seismic design	• Inside Metro Manila: 5 bridges • Outside Metro Manila: 7 bridges	• Boring 810m (Inside MM: 230m, Outside MM: 580m) • Standard Penetration Tests 810 m (Inside MM: 230m, Outside MM: 580m) • Laboratory Tests ・ Classifications/ Specific gravity/ Natural moisture contents/ Atterberg Limit/ Grain Size • Downhole Shear Wave Test • Analysis	Geotechnical/ Soil Survey Report
Design Earthquake Ground Motion	• Assistance of determination of design earthquake load	• Inside Metro Manila: 2 bridges • Outside Metro Manila: 5 bridges • Nationwide	• Site-specific design spectra (L1, L2) for 7 bridge sites • PGA contour map for Philippine rock sites corresponding to 475-year return period (equivalent to 15% probability of exceedance in 75 years) • Contour maps of spectral acceleration at PGA, 0.2 sec, and 1.0 sec for Philippine site class B corresponding to 1000-year return period (equivalent to 7% probability of exceedance in 75 years).	Report

11.4 Evaluation Criteria for the First Screening

The evaluation criteria for the first screening to prioritize bridges should be widely categorized by not only Physical Factors due to the condition of the bridge but also Seismic Performance Factors to reduce seismic hazards and Geotechnical Factors which are weighted 50 points, 30 points and 20 points respectively. Each category has also 3 or 4 evaluation criteria as shown in Table 11.4.1-1 and Table 11.4.1-2.

Table 11.4.1-1 Evaluation Criteria of First Screening

No.	Category	Evaluation Criteria	Maximum Score
1.	Physical Factors (50 points)	Construction Year & Applied Specification	10
2.		Vulnerability of Bridge	30
3.		Road Importance	5
4.		Load Carrying Capacity	5
5.	Seismic Performance Factors (30 point)	Seating Length	10
6.		Fall-down Prevention Apparatus	10
7.		Type of Bridge	10
8.	Geotechnical Factors (20 points)	Liquefaction Potential	10
9.		Soil Classification	5
10.		Impact to Environment	5
Total Point			100

Table 11.4.1-2 Scoring System for Evaluation Criteria

Description		Construction Year & Applied Specification		Conditions of Bridge		Loading Capacity		Bridge Importance		Seating Length	
Grade	Rate	Year	(10)	Score	(30)	Ratio	(5)	Ratio	(5)	Ratio	(10)
Good	0%	After 2000	0	Under 31	0	Over 20ton	0	None	0	A and B< N	0
Fair	30%	1993 - 1999	3	31-40	9	15-19ton	2	Less	2	-	3
Poor	60%	1964 - 1992	6	41-50	18	10-14ton	3	Important	3	A < N < B	6
Bad	100%	Before 1963	10	Over 50	30	Under 10ton	5	Very	5	N < A and B	10

A: AASHTO criteria
B: JRA criteria

Description		Fall Prevent Devices		Type of Bridge		Liquefaction		Soil Classification		Impact to Environment	
Grade	Rate	Percent	(10)	Type	(10)	Class	(10)	Class	(5)	Rehabilitation	(5)
Good	0%	100% Function	0	Continuous rigid frame type bridge	0	None	0	Type-I	0	None (No impact)	0
Fair	30%	80% Function	4	Continuous bridge	4	Low	3	Type-II	2	Small (1-impact)	2
Poor	60%	50% Function	6	Hinge/ rigid frame type (Simply supported)	6	Moderate	6	Type-III	3	Moderate (2-impact)	3
Bad	100%	None	10	Simply supported	10	High	10	Type-IV	5	Large (More than 2-impact)	5

11.4.1 Construction Year and Applied Specification

Seismic resistance performance of bridges is directly related to year of construction and specifications applied in the design. That is, old bridges are more prove to earthquake than new bridges.
Construction year and applied specification fall into the following four (4) categories:

Construction Year & Applied Specification	
Year	Description
After 2000	R-Factor Design, AASHTO LRFD Specification 2nd – 4th Edition
1993 - 1999	R-Factor Design, AASHTO LRFD Specification 1st Edition
1964 - 1992	Seismic Design Force, AASHTO 9th ~14th Edition
Before 1963	No seismic consideration, AASHTO 1st ~8th Edition

11.4.2 Conditions of Bridge

Conditions of bridge members are verified by visual inspection based on the criteria of BMS using DPWH's inspection sheet modified by the JICA Study Team as shown in Appendix 5. Defective members are rated by four (4) categories such as Good, Fair, Poor and Bad and weighted 0, 3, 6, 10 points for primary members and 0, 2, 3, 5 points for secondary members respectively with a total score of 540 points. The rating scores may be slightly different between Package B and C because bridges are inspected by different inspectors even if based on the same evaluation criteria. Table 15.1.2-1 and Table 15.2.1-1 highlight the results of bridge soundness evaluation. From the results of visual inspection for each bridge, the accumulated rating score is varied from 9 to 57 points for Package B Bridges and from 11 to 46 for Package C.
Condition of Bridge is divided into the following four (4) groups:

Condition of Bridges	
Score	Description
Under 31	Good Condition
31 - 40	Fair Condition
41 - 49	Poor Condition
Over 50	Bad Condition

11.4.3 Load Capacity

Load capacity is verified from load posting signs at both ends of the bridge that regulates the maximum vehicle load.

11.4.4 Bridge Importance

Bridge is a part of the road so that the importance of the road is synonymous with Bridge Importance. All candidate Bridges in Package B and C were constructed along important roads but arterial roads and circumferential roads in Manila and roads for economics, security and defense purposes are considered to be very important as distinguished from other roads.

11.4.5 Seating Length

The seating length in AASHTO is calculated by Eq. A of N=305 +2.5L+10H (mm) considering elastic displacement of bridge members which is not enough for global displacement of bridge during seismic ground motion. On the other hand, the seating length in JRA is calculated by Eq. B of Se= 0.7 +0.005 L (m) considering not only elastic displacement of substructure but also displacement of foundation with plastic behavior in liquefaction and fault-related damage. The resulting seat length in JRA is basically greater than that of AASHTO.

Bridges constructed on soft and sanity layers, especially in large cities and along arterial roads are, in most case, easily subjected to liquefaction or horizontal and vertical displacements during earthquake. However, AASHTO LRFD specification is basically considered on the rock and modified for soft layers. In such different geological conditions between USA and the Philippines, minimum requirement of seating length should be modified toward JRA specification. Therefore, seating length is divided into the following 3 categories;

Existing Seating Length (N)	
Ratio	Description
N > A and B	SL clears both minimum required seating length of AASHTO and JRA
A < N < B	SL clears AASHTO but unclear JRA minimum required seating length
N < A and B	SL doesn't clear both minimum required seating length of AASHTO and JRA

Note: A: AASHTO B: JRA

11.4.6 Fall-down Prevention Devices

The criteria focus on the availability of fall-down prevention device and its degree of functionality. Fall-down prevention device on several bridges have been provided during the ADB Retrofitting project in the 1990's, but some of them were totally gone or partially broken. Most of them are not functioning properly.

11.4.7 Type of Bridge

The type of bridges influences the seismic performance of bridges. Continuous rigid frame bridges have the highest performance and continuous girder bridges have higher seismic performance than simply supported bridges. Even if bridges are simply supported, rigid frame/hinge type bridges have higher seismic performance than simply supported girder bridges.

11.4.8 Liquefaction Potential

Liquefaction potential is verified by geological Engineer in JICA Study Team from boring data near the bridge location or from liquefaction hazard map of PHIVOLCS and divided into the following four (4) classes such as High, Moderate, Low and None.

11.4.9 Soil Classification

Soil classification is verified by geological Engineer in JICA Study Team from boring data near the bridge location or from geological map of PHIVOLCS and divided into the following four (4) types based on AASHTO specifications such as Type-I, Type-II, Type III and Type-IV. In global evaluation table, soil classifications in JRA specification are shown comparing with AASHTO specifications. Relation between both soil classifications is roughly shown in the following table:

Soil Classification		
Class	AASHTO	JRA
Rock, Stiff Soil	Type-I	Type-I
Stiff Clay	Type-II	
Soft to medium stiff Clay and Sand	Type-III	Type-II
Soft Clay or Silts	Type-IV	Type-III

11.4.10 Impact to Environment

Seismic improvement measures for bridges will impact the surrounding environment such as 1) Resettlement of affected persons, 2) Traffic disturbance, 3) Noise & pollution 4) Restricted area for political, economic and defense purpose against the proposed rehabilitation method during implementation stage. During the 1st Screening, impact to environment is determined by the number of impacts to surrounding areas identified by site inspections. Therefore, impact to environment is divided into the following 4 categories;

Impact to Environment	
Degree	Number of Impact
None	No impact
Small	1-impact
Moderate	2-impacts
Large	More than 2-impacts

11.5 Evaluation Criteria for the Second Screening

11.5.1 Purpose of the Second Screening

The purpose of the establishment of evaluation criteria for the second screening is to select target bridges for the outline design stage. The target bridges for outline design for each Package are originally intended as follows:

- Package B: Three bridges will be selected basically with replacement options, including partial replacement (however, if Ayala Bridge is excluded, the number of target bridges becomes two).
- Package C: Five bridges will be selected basically with retrofit options.

Note: Although the number of target bridges and improvement measures have been initially decided as part of the scope of this project (as intended above), the final target bridges for Package B and C and their corresponding improvement measures for outline design will be decided after through discussions and consultations with DPWH and JICA.

11.5.2 Process of Establishment of Selection Criteria

From the above intention in Section 14.3.1, whether the bridges should be retrofitted or replaced for improvement measures in terms of seismic vulnerability should be carefully studied and determined at relatively early stage. The following selection process for second screening, therefore, is taken as shown in Figure 11.5.2-1.

Step 1: Identification of issues focusing on the following:

(1) Seismic Vulnerability

- Earthquake Resisting System (simply supported or continuous, weight balance (eccentric loads), stiffness balance between adjacent piers including difference in soil type and soft ground depth)
- Unseating/Fall-Down Prevention System (falling down prevention devices (both longitudinal and transverse directions), bearing type and damage, seat length)
- Substructures (capacity-demand ratio, deterioration or defects of columns and/or walls, height of abutment (embankment), built year)
- Foundations (foundation type is known or unknown, soil type, liquefaction potential)

(2) Structural Soundness (mainly superstructures)

- Items for rehabilitation needs (the extent of damages)
- Remaining life (built year and the extent of damages of superstructures)

(3) Seismic Hazard

- Distances from Active Faults

Step 2: Comparison study on improvement measures focusing on the following:

- Improvement measures for seismic vulnerability and structural deficiencies
- Cost comparison for two options, retrofit and replacement
- Construction difficulty and potential of PAPs

Step 3 Establishment of priority evaluation criteria and recommendation on bridges for outline design

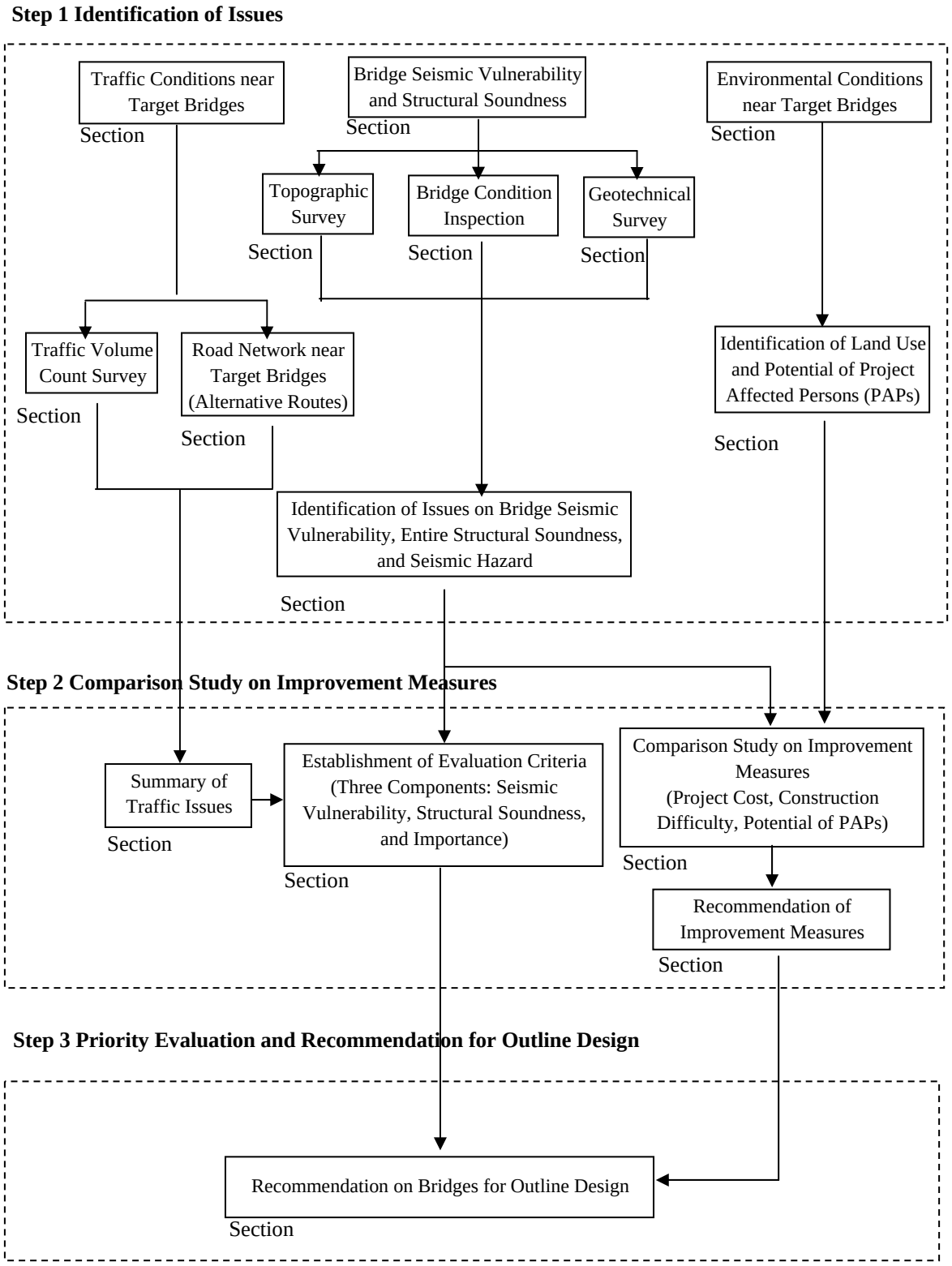


Figure 11.5.2-1 Process for Establishment of Priority Evaluation Criteria and Selection of Bridges for Outline Design

11.5.3 Priority Evaluation Criteria

(1) Components for Evaluation and Rating Weight

Evaluation components and rating weight are shown in Table 11.5.3-1.

Table 11.5.3-1 Components for Evaluation and Rating Weight

Evaluation Components	Bridge Condition		Importance	Total
	Seismic Vulnerability	Structural Soundness		
Rating Weight	60 % (points)	20 % (points)	20 % (points)	100 % (points)

(2) Evaluation Items and Weight for Seismic Vulnerability

Table 11.5.3-2 Components of Seismic Vulnerability and Rating Weight

Component	Evaluation Item	Weight for Rating
Earthquake Resisting System	1. Difference in soil types between adjacent piers	2
	2. Continuous or simply supported bridge	3
	3. Eccentric loads (longitudinal and transverse directions)	5
	4. Pier Type (single column/wall or multiple columns)	3
	5. Height of Abutment (Embankment)	2
	6. Built Year	5
	Sub-total (1)	20 points
Unseating Fall-down Prevention System	7. Unseating/Fall-down prevention devices (both longitudinal and transverse directions)	5
	8. Bearing	5
	9. Seat length	5
	Sub-total (2)	15 points
Foundation	10. Foundation type (known or unknown)	3
	11. Scouring	3
	12. Soil type	3
	13 Liquefaction potential	6
	Sub-total (3)	15 points
Seismic Hazard	14. Distance from active faults	10
	Sub-total (4)	10 points
Total		60 points

Earthquake Resisting System (20 Points)

1. Difference in soil types between adjacent piers (2 points)

(1) Same	0
(2) Soil Type I (or II) and II (or III)	1
(3) Soil Type I and III	2

2. Continuous or simply supported bridge (3 points)

(1) Continuous	0
(2) Simply supported	3

3. Eccentric loads (longitudinal and transverse directions) (5 points)

(1) Balance Ratio: 1.0	0
(2) Balance Ratio: 1.0 - 1.5	3
(3) Balance Ratio: over 1.5	5

Notes: Balance ratio can be judged from the difference in mass eccentricity (i.e. eccentric columns and span length ratio (similar to Lambingan Bridge with adjacent span length ratio of 0.3:1.0 or balance ratio of 3.33))

4. Pier Type (single column/wall or multiple columns) (3 points)

(1) Multiple columns	0
(2) Single column/wall	3

Notes: Non-rigid frame structures are not recognized as "Multiple Columns" even though they consist of more than one column.

5. Height of Abutment (Embankment) (2 points)

(1) 0 - 5.0 m	0
(2) 5.0 - 10.0 m	1
(3) Over 10.0 m	2

6. Built year (DPWH D.O.75 "Seismic Design" was issued in 1992) (5 points)

(1) After year 1992	0
(2) 1992 and earlier	5

Unseating/Fall-Down Prevention System (15 points)

7. Unseating/Fall-down prevention devices (longitudinal and transverse directions) (5 points)

(1) Good (Seismic restrainers are installed for both directions & functionable.)	0
(2) Fair (Seismic restrainers are installed for one direction & functionable.)	1
(3) Poor (Seismic restrainers are installed, but not functionable enough.)	3
(4) None (No seismic restrainers are installed.)	5

8. Bearing (5 points)

(1) Minimal (Seismically resistible type & in good condition)	0
(2) Moderate (Seismically resistible type, but in inappropriate condition)	3
(3) Serious (Seismically vulnerable type or/and severely damaged/corroded)	5

9. Seat length (5 points)

(1) Enough (The seat lengths satisfy JRA criteria.)	0
(2) Short (The seat lengths satisfy AASHTO criteria.)	3
(3) Very Short (Some of seat lengths don't satisfy AASHTO criteria.)	5

Foundation (15 points)

10 Foundation type (known or unknown) (3 points)

(1) Known (identified type and seismic capacity sufficient)	0
(2) Unknown (unidentified)	3

11. Scouring (3 points)

(1) None	0
(2) Unknown (Ex. conditions of piers in water)	2
(3) With evidence or potential for scouring	3

12 Soil type (3 points)

(1) Soil type I (Firm)	0
(2) Soil type II (Moderate)	2
(3) Soil type III (Soft)	3

13 Liquefaction potential (6 points)

(1) Firm, clayey soil or over than 30 of N value	0
(2) Low potential (Sand or silty sand (20 - 30))	2
(3) High potential (Sand or silty sand (10 - 20))	4
(4) Very high potential (Sand or silty sand (less than 10 of N value))	6

Notes: Target soil for assessment of liquefaction potential is sand or silty sand distributing under water and shallower than 20 m in depth.

Seismic Hazard (10 points)

14 Distance from active faults (based on Uniform Building Code (UBC)) (10 points)

(1) Small (Over than 10.0 km)	0
(2) Moderate (5.0 km - less than or equal 10.0 km)	3
(3) Serious (2.0 km - less than or equal 5.0 km)	6
(4) Fatal (Less than or equal 2.0 km)	10

(3) Evaluation Items and Weight for Structural Soundness (Superstructure)

Table 11.5.3-3 Evaluation Items and Rating Weight

Component	Evaluation Item	Weight for Rating
Superstructures	1. Primary members	10
	2. Secondary members	2
	3. Deck slab	3
	Sub-total (1)	15
Substructures	4. Deterioration of columns/walls	5
	Sub-total (2)	5
Total		20 points

Superstructure (15 points)

1. Primary members (10 points)

(1) Good or Small (No need for repair)	0
(2) Moderate (Repair work is necessary.)	3
(3) Serious (Additional reinforcement is recommended.)	5

2. Secondary members (2 points)

(1) Good or Small (No need for repair)	0
(2) Moderate (Repair work is necessary.)	1
(3) Serious (Additional reinforcement is recommended.)	2

3. Deck slab (3 points)

(1) Good or Small (No need for repair)	0
(2) Moderate (Repair work is necessary.)	1
(3) Serious (Replacement is recommended.)	3

Substructure (5 points)

4. Deterioration of columns/walls (5 points)

(1) Good or Small: No need for repair	0
(2) Moderate: Moderate damages such as cracks/hanycomb are inspected. (The structural soundness can be improved by repair works.)	3
(3) Serious: Severe damages such as cracks/hanycomb are inspected. (Damages are too severe to improve the structural soundness by repair works.)	5

(4) Importance

Since every target bridges are located on essential roads, road classes where bridges are located are not included in the criteria, focusing only on traffic volume passing through the bridges and existence of alternative bridges.
Traffic volume of Package C may be largely so different from that of Package B that it is better for evaluation criteria to be prepared for Package B and C separately.

Table 11.5.3-4 Components of Evaluation Criteria for Importance and Rating Weight

Component	Evaluation Item	Weight for Rating
1 Traffic volume	Traffic volume (pcu) (AADT)	5
2 Alternative bridge(s)	Existence of alternative bridge(s)	15
Total		20 points

1.1 Traffic volume (Package B) (5 points) (AADT)

(1) Less than 50,000 pcu	0
(2) 50,000 - 100,0000 pcu	3
(3) Over than 100,000 pcu	5

1.2 Traffic volume (Package C) (5 points) (AADT)

(1) Less than 2,000	0
(2) 2,000 - 5,000	3
(3) Over than 5,000	5

2. Alternative bridge(s) (15 points)

(1) Less than 1 km	0
(2) 1 km - 3 km	5
(3) 3 km - 10 km	10
(4) More than 10 km or no alternate bridge	15

CHAPTER 12 THE FIRST SCREENING

12.1 The First Screening for Package B

12.1.1 Results of the First Screening

(1) Results of the Bridge Soundness Survey

Bridge soundness surveys were conducted by visual inspection and the results of the inspection summarized in the following tables;

1) Delpan Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10		O			3		
		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10	O						
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10		O			3	6	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10			O		6		
		Exposure/Corrosion of Rebars	10	O						
	Reinforced Concrete	Spalling, Scaling,Disintegration	10	O						
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10			O		6	12	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10							
		Cracking	10							
		Deformation/Buckling	10							
		Abnormal Vibrations	10							
		Loose Connection	10							
		Paint Peel off	10						0	
(53) Shoe/Bearing	Steel	Waterleaking	10			O		6		
		Abnormal Space/Noise	10							
		Difference in elevation	10							
		Displacement	10	O						
(Primary)	Rubber	Cracking/Rupture	10						6	
(54) Abutments *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10	O						
		Exposure/Corrosion of Reinf.	10	O						
		Honeycomb	10						0	
(55) Piers *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10		O			3		
		Exposure/Corrosion of Reinf.	10	O						
		Honeycomb	10						3	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5		O			3		
		Exposure/Corrosion of Reinf.	5							
		Spalling	5		O			3		
		Impact Damaged	5		O			3	9	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10							
	Others	Abnormal Space/Noise	10							*Expansion of I-girder*
		Difference in elevation	10							
		Displacement	10			O		6		
		Cracking/Rupture	10	O					6	
(58) Painting Cond. *(Primary)*		Discoloration	10							
		Rust	10							
		Exfoliation	10						0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5							
	Steel	Cracks	5							
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5							
	Others	Erossion	5							
		Scouring	5							
		Cracks	5							
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5			O		3		
	Asphalt	Pot-holes	5			O		3		
		Others							6	
(62) River Condition *(Secondary)*		Scouring	5							
		Sedimentation	5							
		Others							0	
(63) Total Condition Rating			540						48	

2) Jones Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 20%	Poor 50%	Bad 100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10		O					
		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10							
		Delamination	10							
		Honeycomb	10							
		Waterleaking	10	O					0	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10							
		Exposure/Corrosion of Rebars	10							
	Reinforced Concrete	Spalling, Scaling,Disintegration	10							
		Delamination	10							
		Honeycomb	10							
		Waterleaking	10						0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10		O					
		Cracking	10							
		Deformation/Buckling	10							
		Abnormal Vibrations	10							
		Loose Connection	10							
		Paint Peel off	10			O			0	
(53) Shoe/Bearing	Steel	Corrosion	10			O				
		Loose Connection								
		Abnormal Displacement								
		Bulging/Rupture								
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10		O					
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(55) Piers *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10	O						
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5		O					
		Exposure/Corrosion of Reinf.	5							
		Spalling	5							
		Impact Damaged	5						0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 20%	Poor 50%	Bad 100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10			O				
	Others	Abnormal Space/Noise	10							
		Difference in elevation	10							
		Displacement				O				
		Cracking/Rupture							0	
(58) Painting Cond. *(Primary)*		Discoloration	10							
		Rust	10							No Drain Pipe
		Exfoliation	10						0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5							
	Steel	Cracks	5							
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5							
	Others	Erossion	5							
		Scouring	5							
		Cracks	5							
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5							
	Asphalt	Pot-holes	5							
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5							
		Sedimentation	5							
		Others							0	
(63) Total Condition Rating			490						0	

3) McArthur Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(50) Deck Slab	Concrete	Cracking	10		O					
(Primary)		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10							
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10						0	
(51) Concrete Beam/ Girder	Prestressed Concrete	Cracking	10							
(Primary)		Exposure/Corrosion of Rebars	10							
	Reinforced Concrete	Spalling, Scaling,Disintegration	10							
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10						0	
(52) Steel Beam/ Truss Members		Corrosion	10		O					
(Bracings, etc.)		Cracking	10							
(Primary)		Deformation/Buckling	10	O						
		Abnormal Vibrations	10							
		Loose Connection	10							
		Paint Peel off	10			O			0	
(53) Shoe/Bearing	Steel	Corrosion	10		O					
		Loose Connection								
		Abnormal Displacement		O						
		Bulging/Rupture								
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10		O					
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10	O					0	
(55) Piers	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10	O						
		Cracking concrete	10		O					
		Exposure/Corrosion of Reinf.	10			O				
		Honeycomb	10						0	
(56) Curb and Railing	Concrete	Cracking	5							
(Secondary)		Exposure/Corrosion of Reinf.	5							
		Spalling	5							
		Impact Damaged	5						0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(57) Expansion Joint	Steel	Waterleaking	10		O					
(Primary)	Others	Abnormal Space/Noise	10							
		Difference in elevation	10							
		Displacement				O				
		Cracking/Rupture							0	
(58) Painting Cond.		Discoloration	10							
(Primary)		Rust	10							
		Exfoliation	10						0	
(59) Drainage Pipe	PVC	Clogged	5							
(Secondary)	Steel	Cracks	5							*No drain pipe*
		Others							0	
(60) Slope Protection	Gabions	Settlement	5							
(Secondary)	Others	Erossion	5							
		Scouring	5							
		Cracks	5							
		Others							0	
(61) Approach Road	Concrete	Cracking	5							
(Secondary)	Asphalt	Pot-holes	5							
		Others							0	
(62) River Condition		Scouring	5							
(Secondary)		Sedimentation	5							
		Others							0	
(63) Total Condition Rating			490						0	

4) Quezon Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 20%	Poor 50%	Bad 100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10		O					
		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10							
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10		O				0	
(51) Concrete Beam/ Girder *Approach Bridge*	Prestressed Concrete	Cracking	10			O				
		Exposure/Corrosion of Rebars	10							
	Reinforced Concrete	Spalling, Scaling,Disintegration	10							
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10						0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10	O						
		Cracking	10							
		Deformation/Buckling	10	O						
		Abnormal Vibrations	10							
		Loose Connection	10	O						
		Paint Peel off	10		O				0	
(53) Shoe/Bearing	Steel	Corrosion	10							
		Loose Connection								
		Abnormal Displacement								
		Bulging/Rupture								
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10	O						
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(55) Piers *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10							
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5							
		Exposure/Corrosion of Reinf.	5							
		Spalling	5							
		Impact Damaged	5						0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 20%	Poor 50%	Bad 100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10			O				
	Others	Abnormal Space/Noise	10							
		Difference in elevation	10							
		Displacement		O						
		Cracking/Rupture							0	
(58) Painting Cond. *(Primary)*		Discoloration	10							
		Rust	10	O						
		Exfoliation	10						0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5							
	Steel	Cracks	5							
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5							
	Others	Erossion	5							
		Scouring	5							
		Cracks	5							
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5							
	Asphalt	Pot-holes	5							
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5							
		Sedimentation	5							
		Others							0	
(63) Total Condition Rating			490						0	

5) Ayala Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 20%	Poor 50%	Bad 100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10		O					
		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10		O					
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10		O				0	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10							
		Exposure/Corrosion of Rebars	10							
	Reinforced Concrete	Spalling, Scaling,Disintegration	10							
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10						0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10			O				
		Cracking	10	O						
		Deformation/Buckling	10		O					
		Abnormal Vibrations	10							
		Loose Connection	10			O				
		Paint Peel off	10			O			0	
(53) Shoe/Bearing	Steel	Corrosion	10				O			
		Loose Connection								
		Abnormal Displacement				O				Section Loss
		Bulging/Rupture								
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							Concrete Strength degraced
		Scouring	10							
		Spalling, Scaling,Disintegration	10		O					
		Cracking concrete	10			O				
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(55) Piers *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10		O					
		Cracking concrete	10		O					
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5							
		Exposure/Corrosion of Reinf.	5							
		Spalling	5							
		Impact Damaged	5						0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 20%	Poor 50%	Bad 100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10							
	Others	Abnormal Space/Noise	10							
		Difference in elevation	10							
		Displacement								
		Cracking/Rupture							0	
(58) Painting Cond. *(Primary)*		Discoloration	10							
		Rust	10							
		Exfoliation	10						0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5							
	Steel	Cracks	5							
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5							
	Others	Erossion	5							
		Scouring	5							
		Cracks	5							
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5							
	Asphalt	Pot-holes	5							
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5							
		Sedimentation	5							
		Others							0	
(63) Total Condition Rating			490						0	

6) Nagtahan Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 20%	Poor 50%	Bad 100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10		O					
		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10							
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10		O				0	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10			O				
		Exposure/Corrosion of Rebars	10							
	Reinforced Concrete	Spalling, Scaling,Disintegration	10		O					*Approach Bridge*
		Delamination	10		O					
		Hanycomb	10							
		Waterleaking	10						0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10		O					
		Cracking	10							
		Deformation/Buckling	10							*Main Bridge*
		Abnormal Vibrations	10							
		Loose Connection	10							
		Paint Peel off	10				O		0	
(53) Shoe/Bearing	Steel	Corrosion	10		O					
		Loose Connection								
		Abnormal Displacement								
		Bulging/Rupture								
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							*Not visible*
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10							
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(55) Piers *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10	O						
		Cracking concrete	10		O					
		Exposure/Corrosion of Reinf.	10		O					
		Honeycomb	10						0	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5							
		Exposure/Corrosion of Reinf.	5							
		Spalling	5							
		Impact Damaged	5						0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 20%	Poor 50%	Bad 100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10			O				
	Others	Abnormal Space/Noise	10							
		Difference in elevation	10							
		Displacement								
		Cracking/Rupture							0	
(58) Painting Cond. *(Primary)*		Discoloration	10							
		Rust	10							
		Exfoliation	10						0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5							
	Steel	Cracks	5							
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5							
	Others	Erossion	5							
		Scouring	5							
		Cracks	5							
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5							
	Asphalt	Pot-holes	5							
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5							
		Sedimentation	5							
		Others							0	
(63) Total Condition Rating			490						0	

7) Pandacan Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(50) Deck Slab	Concrete	Cracking	10	O						
(Primary)		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10	O						
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10	O					0	
(51) Concrete Beam/ Girder	Prestressed Concrete	Cracking	10	O						
(Primary)		Exposure/Corrosion of Rebars	10		O					
	Reinforced Concrete	Spalling, Scaling,Disintegration	10							
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10						0	
(52) Steel Beam/ Truss Members (Bracings, etc.)		Corrosion	10							
(Primary)		Cracking	10							
		Deformation/Buckling	10							
		Abnormal Vibrations	10							
		Loose Connection	10							
		Paint Peel off	10						0	
(53) Shoe/Bearing	Steel	Corrosion	10							
		Loose Connection								
		Abnormal Displacement								Not visible
		Bulging/Rupture								
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10	O						
		Exposure/Corrosion of Reinf.	10	O						
		Honeycomb	10						0	
(55) Piers	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10		O					
		Cracking concrete	10	O						
		Exposure/Corrosion of Reinf.	10		O					
		Honeycomb	10						0	
(56) Curb and Railing	Concrete	Cracking	5							
(Secondary)		Exposure/Corrosion of Reinf.	5							
		Spalling	5							
		Impact Damaged	5						0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(57) Expansion Joint	Steel	Waterleaking	10		O					
(Primary)	Others	Abnormal Space/Noise	10							
		Difference in elevation	10		O					
		Displacement								
		Cracking/Rupture							0	
(58) Painting Cond.		Discoloration	10							
(Primary)		Rust	10							
		Exfoliation	10						0	
(59) Drainage Pipe	PVC	Clogged	5							
(Secondary)	Steel	Cracks	5							
		Others							0	
(60) Slope Protection	Gabions	Settlement	5							
(Secondary)	Others	Erossion	5							
		Scouring	5							
		Cracks	5							
		Others							0	
(61) Approach Road	Concrete	Cracking	5							
(Secondary)	Asphalt	Pot-holes	5		O					
		Others							0	
(62) River Condition		Scouring	5							
(Secondary)		Sedimentation	5							
		Others							0	
(63) Total Condition Rating			490						0	

8) Lambingan Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	30%	60%	100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10			O		6		
		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10							
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10		O			3	9	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10				O	10		
		Exposure/Corrosion of Rebars	10							Defrection at center and shear cracking at hinge portion
	Reinforced Concrete	Spalling, Scaling,Disintegration	10		O			3		
		Delamination	10							
		Hanycomb	10		O			3		
		Waterleaking	10						16	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10							
		Cracking	10							
		Deformation/Buckling	10							
		Abnormal Vibrations	10							
		Loose Connection	10							
		Paint Peel off	10						0	
(53) Shoe/Bearing	Steel	Corrosion	10							
		Loose Connection								
		Abnormal Displacement								
		Bulging/Rupture								
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10	O						
		Cracking concrete	10		O			3		
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						3	
(55) Piers *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10	O						
		Cracking concrete	10		O			3		
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						3	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5		O			3		
		Exposure/Corrosion of Reinf.	5							
		Spalling	5							
		Impact Damaged	5						3	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	30%	60%	100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10			O		6		
	Others	Abnormal Space/Noise	10							
		Difference in elevation	10		O			3		
		Displacement								
		Cracking/Rupture							9	
(58) Painting Cond. *(Primary)*		Discoloration	10							
		Rust	10							
		Exfoliation	10						0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5							
	Steel	Cracks	5							
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5							
	Others	Erossion	5							
		Scouring	5							
		Cracks	5							
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5							
	Asphalt	Pot-holes	5							
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5							
		Sedimentation	5							
		Others							0	
(63) Total Condition Rating			490						43	

9) Makati Mandalyong Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10			O				
		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10							
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10						0	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10			O				
		Exposure/Corrosion of Rebars	10	O						
	Reinforced Concrete	Spalling, Scaling,Disintegration	10	O						
		Delamination	10							
		Hanycomb	10		O					
		Waterleaking	10						0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10							
		Cracking	10							
		Deformation/Buckling	10							
		Abnormal Vibrations	10							
		Loose Connection	10							
		Paint Peel off	10						0	
(53) Shoe/Bearing	Steel	Corrosion	10			O				
		Loose Connection								Bulging at approach bridge
		Abnormal Displacement		O						
		Bulging/Rupture			O					
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10		O					
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(55) Piers *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10	O						
		Cracking concrete	10	O						
		Exposure/Corrosion of Reinf.	10	O						
		Honeycomb	10						0	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5							
		Exposure/Corrosion of Reinf.	5							
		Spalling	5							
		Impact Damaged	5						0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10	O						
	Others	Abnormal Space/Noise	10							
		Difference in elevation	10			O				
		Displacement								
		Cracking/Rupture							0	
(58) Painting Cond. *(Primary)*		Discoloration	10							
		Rust	10							
		Exfoliation	10						0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5			O				
	Steel	Cracks	5							
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5							
	Others	Erossion	5							
		Scouring	5							
		Cracks	5							
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5			O				
	Asphalt	Pot-holes	5							
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5							
		Sedimentation	5							
		Others							0	
(63) Total Condition Rating			490						0	

10) Guadalupe Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	30%	60%	100%			
(50) Deck Slab	Concrete	Cracking	10			O		6		
(Primary)		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10							
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10	O					6	
(51) Concrete Beam/ Girder	Prestressed Concrete	Cracking	10				O	10		
		Exposure/Corrosion of Rebars	10							
(Primary)	Reinforced Concrete	Spalling, Scaling,Disintegration	10							*Shear crack at hinge*
		Delamination	10	O						
		Hanycomb	10							
		Waterleaking	10						10	
(52) Steel Beam/ Truss Members (Bracings, etc.)		Corrosion	10							
		Cracking	10							
		Deformation/Buckling	10							
(Primary)		Abnormal Vibrations	10							
		Loose Connection	10	O						
		Paint Peel off	10		O			3	3	
(53) Shoe/Bearing	Steel	Corrosion	10							
		Loose Connection								
		Abnormal Displacement								
		Bulging/Rupture								
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10							
	Others	Delamination	10	O						
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10	O						
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(55) Piers	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10			O		6		
		Cracking concrete	10		O			3		
		Exposure/Corrosion of Reinf.	10			O		6		
		Honeycomb	10						15	
(56) Curb and Railing	Concrete	Cracking	5			O		3		
(Secondary)		Exposure/Corrosion of Reinf.	5							
		Spalling	5	O						
		Impact Damaged	5						3	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	30%	60%	100%			
(57) Expansion Joint	Steel	Waterleaking	10		O			3		
(Primary)	Others	Abnormal Space/Noise	10	O						
		Difference in elevation	10							
		Displacement								
		Cracking/Rupture							3	
(58) Painting Cond.		Discoloration	10		O			3		
(Primary)		Rust	10							
		Exfoliation	10						3	
(59) Drainage Pipe	PVC	Clogged	5							
(Secondary)	Steel	Cracks	5							
		Others							0	
(60) Slope Protection	Gabions	Settlement	5							
(Secondary)	Others	Erossion	5							
		Scouring	5							
		Cracks	5		O			2		
		Others							2	
(61) Approach Road	Concrete	Cracking	5			O		3		
(Secondary)	Asphalt	Pot-holes	5							
		Others							3	
(62) River Condition		Scouring	5							*Prevent ship from collision*
(Secondary)		Sedimentation	5							
		Others				O		3	3	
(63) Total Condition Rating			490						51	

11) C-5 Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10	O						
		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10							
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10	O					0	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10							
		Exposure/Corrosion of Rebars	10	O						
	Reinforced Concrete	Spalling, Scaling,Disintegration	10	O						
		Delamination	10							
		Hanycomb	10	O						
		Waterleaking	10						0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10							
		Cracking	10							
		Deformation/Buckling	10							
		Abnormal Vibrations	10							
		Loose Connection	10							
		Paint Peel off	10						0	
(53) Shoe/Bearing	Steel	Corrosion	10							
		Loose Connection								
		Abnormal Displacement								
		Bulging/Rupture								
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10							
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(55) Piers *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10		O					
		Cracking concrete	10		O					
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5	O						
		Exposure/Corrosion of Reinf.	5							
		Spalling	5							
		Impact Damaged	5	O					0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10		O					
	Others	Abnormal Space/Noise	10	O						
		Difference in elevation	10							
		Displacement		O						
		Cracking/Rupture							0	
(58) Painting Cond. *(Primary)*		Discoloration	10							
		Rust	10							
		Exfoliation	10						0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5							
	Steel	Cracks	5							
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5							
	Others	Erossion	5							
		Scouring	5							
		Cracks	5							
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5							
	Asphalt	Pot-holes	5							
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5							
		Sedimentation	5							
		Others							0	
(63) Total Condition Rating			490						0	

12) Bambang Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10			O				
		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10		O					
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10						0	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10							
		Exposure/Corrosion of Rebars	10	O						
	Reinforced Concrete	Spalling, Scaling,Disintegration	10	O						
		Delamination	10	O						
		Hanycomb	10							
		Waterleaking	10						0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10							
		Cracking	10							
		Deformation/Buckling	10							
		Abnormal Vibrations	10							
		Loose Connection	10							
		Paint Peel off	10						0	
(53) Shoe/Bearing	Steel	Corrosion	10							
		Loose Connection								
		Abnormal Displacement								
		Bulging/Rupture								
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							*Cracks on Retining wall*
		Spalling, Scaling,Disintegration	10		O					
		Cracking concrete	10		O					
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(55) Piers *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10							
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5							
		Exposure/Corrosion of Reinf.	5							
		Spalling	5							
		Impact Damaged	5						0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10							
	Others	Abnormal Space/Noise	10							
		Difference in elevation	10							
		Displacement								
		Cracking/Rupture							0	
(58) Painting Cond. *(Primary)*		Discoloration	10							
		Rust	10							
		Exfoliation	10						0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5							
	Steel	Cracks	5							
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5							
	Others	Erossion	5				O			
		Scouring	5							
		Cracks	5		O					
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5							
	Asphalt	Pot-holes	5							
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5							
		Sedimentation	5							
		Others							0	
(63) Total Condition Rating			490						0	

13) Vargas Bridge

13-1 Vargas Bridge (Upstream)

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(50) Deck Slab	Concrete	Cracking	10		O					
(Primary)		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10							
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10			O			0	
(51) Concrete Beam/ Girder	Prestressed Concrete	Cracking	10							
(Primary)		Exposure/Corrosion of Rebars	10							
	Reinforced Concrete	Spalling, Scaling,Disintegration	10							
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10						0	
(52) Steel Beam/ Truss Members (Bracings, etc.)		Corrosion	10	O						
(Primary)		Cracking	10							
		Deformation/Buckling	10							
		Abnormal Vibrations	10							
		Loose Connection	10	O						
		Paint Peel off	10			O			0	
(53) Shoe/Bearing	Steel	Corrosion	10							
		Loose Connection								
		Abnormal Displacement								
		Bulging/Rupture								
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10							
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(55) Piers	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10	O						
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(56) Curb and Railing	Concrete	Cracking	5							
(Secondary)		Exposure/Corrosion of Reinf.	5							
		Spalling	5							
		Impact Damaged	5						0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(57) Expansion Joint	Steel	Waterleaking	10							
(Primary)	Others	Abnormal Space/Noise	10							
		Difference in elevation	10							
		Displacement								
		Cracking/Rupture							0	
(58) Painting Cond.		Discoloration	10							
(Primary)		Rust	10							
		Exfoliation	10						0	
(59) Drainage Pipe	PVC	Clogged	5							
(Secondary)	Steel	Cracks	5							
		Others							0	
(60) Slope Protection	Gabions	Settlement	5							
(Secondary)	Others	Erossion	5			O				
		Scouring	5							
		Cracks	5							
		Others							0	
(61) Approach Road	Concrete	Cracking	5							
(Secondary)	Asphalt	Pot-holes	5							
		Others		O					0	
(62) River Condition		Scouring	5							
(Secondary)		Sedimentation	5							
		Others							0	
(63) Total Condition Rating			490						0	

13-2 Vargas Bridge (Downstream)

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 20%	Poor 50%	Bad 100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10	O						
		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10	O						
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10						0	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10	O						
		Exposure/Corrosion of Rebars	10							
	Reinforced Concrete	Spalling, Scaling,Disintegration	10	O						
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10						0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10							
		Cracking	10							
		Deformation/Buckling	10							
		Abnormal Vibrations	10							
		Loose Connection	10							
		Paint Peel off	10						0	
(53) Shoe/Bearing	Steel	Corrosion	10							
		Loose Connection								
		Abnormal Displacement								
		Bulging/Rupture								
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10	O						
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(55) Piers *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10		O					
		Exposure/Corrosion of Reinf.	10	O						
		Honeycomb	10						0	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5							
		Exposure/Corrosion of Reinf.	5							
		Spalling	5							
		Impact Damaged	5						0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 20%	Poor 50%	Bad 100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10		O					
	Others	Abnormal Space/Noise	10							
		Difference in elevation	10							
		Displacement								
		Cracking/Rupture							0	
(58) Painting Cond. *(Primary)*		Discoloration	10							
		Rust	10							
		Exfoliation	10						0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5							
	Steel	Cracks	5							
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5							
	Others	Erossion	5							
		Scouring	5							
		Cracks	5							
		Others				O			0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5							
	Asphalt	Pot-holes	5							
		Others			O				0	
(62) River Condition *(Secondary)*		Scouring	5	O						
		Sedimentation	5							
		Others							0	
(63) Total Condition Rating			490						0	

14) Rosario Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10			O				
		Exposure/Corrosion of Rebars	10		O					
		Scaling/Spalling	10		O					
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10						0	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10			O				
		Exposure/Corrosion of Rebars	10		O					
	Reinforced Concrete	Spalling, Scaling,Disintegration	10							
		Delamination	10	O						
		Hanycomb	10							
		Waterleaking	10						0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10							
		Cracking	10							
		Deformation/Buckling	10							
		Abnormal Vibrations	10							
		Loose Connection	10							
		Paint Peel off	10						0	
(53) Shoe/Bearing	Steel	Corrosion	10							
		Loose Connection								
		Abnormal Displacement								
		Bulging/Rupture								
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10	O						
		Cracking concrete	10		O					
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(55) Piers *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10		O					
		Exposure/Corrosion of Reinf.	10	O						
		Honeycomb	10						0	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5							
		Exposure/Corrosion of Reinf.	5							
		Spalling	5							
		Impact Damaged	5	O					0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10							
	Others	Abnormal Space/Noise	10							
		Difference in elevation	10							
		Displacement								
		Cracking/Rupture							0	
(58) Painting Cond. *(Primary)*		Discoloration	10							
		Rust	10							
		Exfoliation	10						0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5							
	Steel	Cracks	5							
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5							
	Others	Erossion	5			O				
		Scouring	5							
		Cracks	5							
		Others/Material Loss			O				0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5			O				
	Asphalt	Pot-holes	5							
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5							
		Sedimentation	5							
		Others							0	
(63) Total Condition Rating			490						0	

15) Marcos Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10			O				
		Exposure/Corrosion of Rebars	10	O						
		Scaling/Spalling	10							
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10			O			0	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10							
		Exposure/Corrosion of Rebars	10							
	Reinforced Concrete	Spalling, Scaling,Disintegration	10							
		Delamination	10							
		Hanycomb	10		O					
		Waterleaking	10						0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10							
		Cracking	10							
		Deformation/Buckling	10							
		Abnormal Vibrations	10							
		Loose Connection	10							
		Paint Peel off	10						0	
(53) Shoe/Bearing	Steel	Corrosion	10							
		Loose Connection								
		Abnormal Displacement								
		Bulging/Rupture		O						
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10							
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(55) Piers *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10			O				
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5							
		Exposure/Corrosion of Reinf.	5							
		Spalling	5							
		Impact Damaged	5		O				0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10							
	Others	Abnormal Space/Noise	10							
		Difference in elevation	10	O						
		Displacement			O					
		Cracking/Rupture							0	
(58) Painting Cond. *(Primary)*		Discoloration	10							
		Rust	10							
		Exfoliation	10						0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5							
	Steel	Cracks	5							
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5							
	Others	Erossion	5							
		Scouring	5							
		Cracks	5							
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5							
	Asphalt	Pot-holes	5							
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5							
		Sedimentation	5							
		Others							0	
(63) Total Condition Rating			490						0	

16) Marikina Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10			O				
		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10			O				
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10		O				0	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10							
		Exposure/Corrosion of Rebars	10			O				*Cross beam heavily damaged*
	Reinforced Concrete	Spalling, Scaling,Disintegration	10							
		Delamination	10							
		Hanycomb	10		O					
		Waterleaking	10						0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10							
		Cracking	10							
		Deformation/Buckling	10							
		Abnormal Vibrations	10							
		Loose Connection	10							
		Paint Peel off	10						0	
(53) Shoe/Bearing	Steel	Corrosion	10							
		Loose Connection								
		Abnormal Displacement								
		Bulging/Rupture			O					
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10							
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(55) Piers *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10		O					
		Cracking concrete	10			O				
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5							
		Exposure/Corrosion of Reinf.	5							
		Spalling	5							
		Impact Damaged	5						0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10		O					
	Others	Abnormal Space/Noise	10							
		Difference in elevation	10							
		Displacement			O					
		Cracking/Rupture							0	
(58) Painting Cond. *(Primary)*		Discoloration	10							
		Rust	10							
		Exfoliation	10						0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5							
	Steel	Cracks	5							
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5							
	Others	Erossion	5							
		Scouring	5							
		Cracks	5							
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5							
	Asphalt	Pot-holes	5							
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5							
		Sedimentation	5							
		Others							0	
(63) Total Condition Rating			490						0	

17) San Jose Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10							
		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10							
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10						0	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10		O					
		Exposure/Corrosion of Rebars	10							
	Reinforced Concrete	Spalling, Scaling,Disintegration	10	O						*Cracking on outside girder*
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10						0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10							
		Cracking	10							
		Deformation/Buckling	10							
		Abnormal Vibrations	10							
		Loose Connection	10							
		Paint Peel off	10						0	
(53) Shoe/Bearing	Steel	Corrosion	10			O				
		Loose Connection			O					*Clean around bearing*
		Abnormal Displacement								
		Bulging/Rupture								
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling,Disintegration	10							
		Cracking concrete	10							
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(55) Piers *(Primary)*	Concrete	Settlement	10							
	Masonry	Movement	10							
	Others	Delamination	10	O						
		Scouring	10							
		Spalling, Scaling,Disintegration	10			O				
		Cracking concrete	10		O					
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5							
		Exposure/Corrosion of Reinf.	5							
		Spalling	5							
		Impact Damaged	5						0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	20%	50%	100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10				O			
	Others	Abnormal Space/Noise	10			O				
		Difference in elevation	10							
		Displacement								
		Cracking/Rupture							0	
(58) Painting Cond. *(Primary)*		Discoloration	10							
		Rust	10							
		Exfoliation	10						0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5			O				
	Steel	Cracks	5							
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5							
	Others	Erossion	5							
		Scouring	5							
		Cracks	5							
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5							
	Asphalt	Pot-holes	5							
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5				O			
		Sedimentation	5							
		Others							0	
(63) Total Condition Rating			490						0	

(2) Results of the First Screening

Global evaluation for bridge seismic vulnerability were made with not only physical factors including bridge soundness but also seismic performance and geological factors and the results of the first screening were evaluated in Table 12.1.1-1 to Table 12.1.1-8.

Table 12.1.1-1 Bridge Condition Based on Visual Inspection for Package-B

No.	Bridge Name	Total Score	Slab	Superstructure	Substructure	Bearing/ Expansion	Others
1	Delpan Bridge	45	6	12	3	12	12
2	Jones Bridge	36	3	9	3	18	3
3	McArthur Bridge	36	3	9	12	12	0
4	Quezon Bridge	21	6	9	0	6	0
5	Ayala Bridge	57	9	21	15	12	0
6	Nagtahan Bridge	43	6	25	6	6	0
7	Pandacan Bridge	20	3	3	6	6	2
8	Lambingan Bridge	46	6	16	9	9	6
9	Makati-Mandaluyong Bridge	39	6	9	3	15	6
10	Guadalupe Bridge	51	6	13	15	3	14
11	C-5 Bridge	9	0	0	6	3	0
12	Bambang Bridge	22	9	0	6	0	7
13-1	Vargas Bridge-1	18	9	6	0	0	3
13-2	Vargas Bridge-2	15	3	0	6	3	3
14	Rosario Bridge	35	12	9	6	0	8
15	Marcos Bridge	26	12	3	6	3	2
16	Marikina Bridge	42	15	9	9	9	0
17	San Jose Bridge	36	0	3	9	21	3

: Urgent Repair

Table 12.1.1-2 Major Defect Analysis for Each Bridge

		Slab	Superstructure	Substructure	Bearing/ Expansion	Others
1	Delpan Bridge	Cracking Waterleaking	Cracking, Spalling	Cracking	Waterleaking Displacement	Railing, Approach Road
2	Jones Bridge	Cracking	Corrosion, Paint Peel Off	Cracking	Corrosion Waterleaking Displacement	Curb & Railing
3	McArthur Bridge	Cracking	Corrosion, Paint Peel Off	Cracking Rebar Exposure	Corrosion Displacement	–
4	Quezon Bridge	Cracking Waterleaking	Paint Peel Off	–	Waterleaking	–
5	Ayala Bridge	Cracking, Spalling, Waterleaking	Corrosion, Deformation Paint Peel Off	Cracking Spalling	Corrosion Displacement	–
6	Nagtahan Bridge	Cracking Waterleaking	Cracking, Spalling, Corrosion	Cracking Rebar Explosure	Corrosion Waterleaking	–
7	Pandacan Bridge	Cracking	Cracking	Spalling Rebar Exposure	Waterleaking, Difference Elevation	Approach Road
8	Lambingan Bridge	Cracking Waterleaking	Cracking, Spalling, Honeycomb	Cracking	Waterleaking, Difference Elevation	Curb & Railing
9	Makati-Mandaluyong Bridge	Cracking Waterleaking	Cracking, Honeycomb	Cracking	Bulging,Waterleaking, Difference Elevation	Drainage Pipe Approach Road
10	Guadalupe Bridge	Cracking Waterleaking	Cracking, Paint Peel Off	Cracking, Spalling, Rebar Exposure	Waterleaking	Curb & Railing Slope Protection
11	C-5 Bridge	–	–	Cracking Spalling	Waterleaking	–
12	Bambang Bridge	Cracking Spalling	–	Cracking Spalling	–	Slope Protection
13	Vargas Bridge-1	Cracking Waterleaking	Paint Peel Off	–	–	Slope Protection
13	Vargas Bridge-2	Cracking	–	Cracking	Waterleaking	Slope Protection
14	Rosario Bridge	Cracking Spalling, Rebar Exposure	Cracking Rebar Exposure	Cracking	–	Slope Protection, Approach Road
15	Marcos Bridge	Cracking Waterleaking	Cracking	Cracking	Waterleaking	Curb & Railing
16	Marikina Bridge	Cracking, Spalling, Waterleaking	Rebar Exposure, Honeycomb	Cracking Spalling	Bulging, Waterleaking, Displacement	–
17	San Jose Bridge	–	Cracking	Cracking Spalling	Corrosion Waterleaking Abnormal Space	Drainage Pipe

Table 12.1.1-3 Global Evaluation for Bridge Seismic Performance in 1st Screening of Package-B (1/6)

Evaluation Items		Max. Point	Delpan Bridge		Jones Bridge		McArthur Bridge	
Side /Under/ On the road view								
			L=26.5+46.0+57.6+46.0+26.65=202.8m, W=20.52m		L=35.5+43.4+35.5=114.4m, W=21.2m		L=37.3+40.3+37.0=114.6m, W=21.2m	
Physical Factors (50)	Construction Age & Applied Design Specification	10	Construction Year: 1965 Seismic Design: No Seismic Consideration AASHTO Standard Specification (8th Edition) was applied	6	Construction Year: 1948 Seismic Design: No Seismic Consideration AASHTO Standard Specification (4th Edition) was applied	10	Construction Year: 1948 Seismic Design: No Seismic Consideration AASHTO Standard Specification (4th Edition) was applied	10
	Conditions of Bridge Based on Visual Inspection	30	Due to sharp skew (approx. 40°), bearings and expansion. joints are damaged that is caused waterleaking steel girders are corroded and concrete box girders are severe cracking on bottom slab. Rating Score: 45	18	Although it is old bridge, Steel girders are sturdy and sound except partially corrosion. But bearings are displaced and corroded that is caused by waterleaking due to damaged and displaced expansion joints. Rating Score: 36	9	Although it is old bridge, Steel girders are sturdy sound except partially corrosion. But bearings are displaced and corroded that is caused by waterleaking due to damaged and displaced expansion joints. Rating Score: 36	9
	Loading Capacity	5	20ton	0	20ton	0	20ton	0
	Bridge Importance	5	Bridge is located in port area and road to access to port. (Very Important)	5	Bridge is located on arterial road to connect south and north. (Important)	3	Bridge is located on arterial road to connect south and north. (Important)	3
Seismic Performance	Seating Length	10	a: Minimum Required Seating Length (AASHTO) : 55cm b: Minimum Required Seating Length (JRA): 98cm Existing Seating Length (N) : 130cm	0	a: Minimum Required Seating Length (AASHTO) : 47cm b: Minimum Required Seating Length (JRA): 87cm Existing Seating Length (N) : 90cm	0	a: Minimum Required Seating Length (AASHTO) : 49cm b: Minimum Required Seating Length (JRA): 90cm Existing Seating Length (N) : 120cm	0
	Fall Prevent Apparatus	10	Longitudinal restrainers were installed but some of them are stolen and not sufficient functions. Bearings on sharp skew bridge are provided with prevention works	10	Longitudinal restrainers are not provided but bridge is Continuous Steel I-girder and lateral movement is restricted by concrete blocks.	4	Longitudinal restrainers are not provided but bridge is a Continuous Steel I-girder and lateral movement is restricted by concrete blocks.	4
	Type of Bridge	10	Continuous Concrete Box Girder (new) Continuous Steel I- Girder (old)	4	Continuous Steel I- Girder Bridge	4	Continuous Steel I- Girder Bridge	4
Geographical Factors (20)	Liquefaction	10	Liquefaction Potential : High	10	Liquefaction Potential : High	10	Liquefaction Potential : High	10
	Soil Classification	5	AASHTO Classification : Type-IV (JRA Classification : Type-II)	5	AASHTO Classification : Type-IV (JRA Classification : Type-III)	5	AASHTO Classification : Type-IV (JRA Classification : Type-III)	5
	Impact to Environment	5	Traffic disturbance and noise & pollution are considered for impact of environment.	3	Traffic disturbance and noise & pollution are considered for impact of environment.	3	Traffic disturbance and noise & pollution are considered for impact of environment.	3
Evaluation		100	Delpan Bridge, which has sharp skew, is vulnerable to seismic force. Global earthquake resistant examination is required especially for bearing system and fall prevent apparatus. Candidate for the Second Screening (Retrofitting)	61	To maintain sturdy vintage steel bridge, expansion joins are urgently repaired (replaced) to stop waterleaking. Steel bearings are properly maintained and protect from water and dust and seismic lateral force with some stoppers Urgent Maintenance	48	To maintain sturdy vintage steel bridge, expansion joins are repaired because no space between steel girders and abutment. Steel girders are deformed by overstress due to temperature. Repaint is urgently required. Urgent Maintenance	48

Table 12.1.1-4 Global Evaluation for Bridge Seismic Performance in 1st Screening of Package-B (2/6)

Evaluation Items		Max. Point	Quezon Bridge		Ayala Bridge		Nagtahan Bridge	
Side /Under/ On the road view			 side view  under view  on the road view		 side view  under view  on the road view		 side view  under view  on the road view	
			L=102.4m, W=21.9m		L=61.56+73.65+(4.26)=139.47m, W=25.35m		L=45.6+57.73+45.6=148.93m, W=24.7m	
Physical Factors (50)	Construction Age & Applied Design Specification	10	Construction Year 1946 Seismic Design No Seismic Consideration AASHTO Standard Specification (4th Edition) was applied	10	Construction Year 1950 Seismic Design No Seismic Consideration AASHTO Standard Specification (4th Edition) was applied	10	Construction Year 1966 Seismic Design Seismic Design Force AASHTO Standard Specification (8th Edition) was applied	6
	Conditions of Bridge Based on Visual Inspection	30	Although it is old bridge, Steel girders are sturdy sound except partially corrosion. But expansions caused by waterleaking are repaired urgently. Rating Score 21	9	As navigation clearance is low, steel members are severely damaged due to impact of ships. Truss members are small inertia is that section loss due to corrosion are observed. Deck slab, bearings and expansion joints are damaged. Rating Score 57	30	Although it is old bridge, Steel girders are sturdy sound except partially corrosion. Overall steel members are paint peel off and corrosion is started soon. At approach bridges, cracking on deck slab and girders are severely occurred. Rating Score 43	18
	Loading Capacity	5	15ton	2	15ton	2	20ton	0
	Bridge Importance	5	Bridge is located on arterial road to connect Malate and Quezon cities. (Very Important)	5	Bridge is located near Malacanang Palace and a political road. (Very Important)	5	Bridge is located on Quirino Avenue in C2 (Very Important)	5
Seismic Performance	Seating Length	10	a: Minimum Required Seating Length (AASHTO) : 71cm b: Minimum Required Seating Length (JRA): 121cm Existing Seating Length (N) : –cm (Visual Measurement)	0	a: Minimum Required Seating Length (AASHTO) : 57cm b: Minimum Required Seating Length (JRA): 107cm Existing Seating Length (N) : 80cm	6	a: Minimum Required Seating Length (AASHTO) : 52cm b: Minimum Required Seating Length (JRA): 92cm Existing Seating Length (N) : 100cm	0
	Fall Prevent Apparatus	10	Longitudinal restrainers are not provided but Truss typed Arch is very low risk falling down.	4	Retrofitting works for bridge fall are done in 1999 but some of them are broken or not sufficient functions.	10	Prevention works for bridge fall are installed at both approach bridges. Main bridge, which is a continuous truss bridge, is very low risk falling down.	6
	Type of Bridge	10	Arched Truss Bridge	6	Single Span Truss Bridge	10	Continuous Steel Truss Bridge	4
Geographical Factors (20)	Liquefaction	10	Liquefaction Potential : High	10	Liquefaction Potential : High	10	Liquefaction Potential : High	10
	Soil Classification	5	AASHTO Classification : Type–III (JRA Classification : Type–II)	3	AASHTO Classification : Type–IV (JRA Classification : Type–III)	5	AASHTO Classification : Type–III (JRA Classification : Type–II)	3
	Impact to Environment	5	Traffic disturbance and is considered for impact of environment	2	Resettlement of building & inhabitant, traffic disturbance, Noise &pollution and politically restricted area are considered for impact of environment.	5	Traffic disturbance, noise & pollution and politically restricted area are considered for impact of environment.	5
Evaluation		100	To maintain sturdy vintage steel bridge, continuous and periodical maintenance is necessary. Especially repainting is recommended. Continuous Maintenance	51	Reconstruction is recommended because old truss bridge is not enough navigation clearance and ductility for seismic force. However, reconstruction of bridge has been funded by local fund so excluded from the second screening. Reconstruction by Local Funds	93	To maintain sturdy vintage steel bridge, repainting for main truss bridge and expel of squatters are urgently required. Inspection & Maintenance of approach bridges are difficult and safety for inhabitant is not secured in earthquake. Candidate for the Second Screening (retrofitting)	57

Table 12.1.1-5 Global Evaluation for Bridge Seismic Performance in 1st Screening of Package-B (3/6)

Evaluation Items		Max. Point	Pandacan Bridge		Lambingan Bridge		Makati-Mandaluyong Bridge	
Side /Under/ On the road view			 side view  under view  on the road view		 side view  under view  on the road view		 side view  under view  on the road view	
			L=23.8+25.0+46.0+25.1+27.5=147.4m, W=16.6m		L=18.5+61.1+18.5=98.1m, W=24.0m		L=30.0+50.0+30.0=110.0m, W=18.8m	
Physical Factors (50)	Construction Age & Applied Design Specification	10	Construction Year 1977 Seismic Design / Seismic Design Force AASHTO Standard Specification (11th Edition) was applied	6	Construction Year 1975 Seismic Design / Seismic Design Force AASHTO Standard Specification (11th Edition) was applied	6	Construction Year 1986 Seismic Design / Seismic Design Force AASHTO Standard Specification (13th Edition) was applied	6
	Conditions of Bridge Based on Visual Inspection	30	Cracklings are observed on deck slab, PC girders, abutments and piers partially. Re-bar exposure due to impact of ship is detected on pier but not serious. Rating Score 20	0	Serious shear cracks are detected on hinge connection of PC girders. Cracking on deck slab of PC girders are mostly all observed on the bottom side. Waterleaking from the damaged expansion joints are observed. Rating Score 46	18	Many cracking including shear cracks are detected on box girders, especially end portion. Lubber bearing pads are bulging so that gap is occurred at expansion joints. Waterleaking from cracks are observed partially. Rating Score 39	9
	Loading Capacity	5	20ton	0	15ton	2	20ton	0
	Bridge Importance	5	Bridge is located on Paco-Sta. Mesa Rd, is a detour of Nagtahan Br. (Important)	3	Bridge is located on New Panaderos Road. (Important)	3	Bridge is located on road to connect Makati and Mandaluyong cities. (Important)	3
Seismic Performance	Seating Length	10	a: Minimum Required Seating Length (AASHTO) : 52cm b: Minimum Required Seating Length (JRA): 93cm Existing Seating Length (N) : 100cm	0	a: Minimum Required Seating Length (AASHTO) : 52cm b: Minimum Required Seating Length (JRA): 92cm Existing Seating Length (N) : 50cm	10	a: Minimum Required Seating Length (AASHTO) :52cm b: Minimum Required Seating Length (JRA): 92cm Existing Seating Length (N) : 80cm	6
	Fall Prevent Apparatus	10	Longitudinal restrainers are not provided but lateral movement is restricted by concrete blocks.	6	Longitudinal restrainers are not provided at hinge portions. Lateral movement is restricted by concrete blocks. At hinge portion, risk falling down is very high.	10	Longitudinal restrainers are not provided at hinge portions. Lateral movement is restricted by concrete blocks. At hinge portion, prevention apparatus should be provided.	4
	Type of Bridge	10	Single Span PC I-girder	10	Single Span PC I-girder with Hinge Connection	10	Single Span PC I-girder and Concrete Box girder with Hinge Connection	10
Geographical Factors (20)	Liquefaction	10	Liquefaction Potential : High	10	Liquefaction Potential : Moderate	6	Liquefaction Potential : Moderate	6
	Soil Classification	5	AASHTO Classification : Type-II (JRA Classification : Type-I)	2	AASHTO Classification : Type-III (JRA Classification : Type-II)	3	AASHTO Classification : Type-III (JRA Classification : Type-II)	3
	Impact to Environment	5	Traffic disturbance is considered for impact of environment.	2	Resettlement of building & inhabitant, traffic disturbance, and noise & pollution are considered for impact of environment.	5	Traffic disturbance is considered for impact of environment	2
Evaluation		100	Bridge is relatively good condition and to continue periodical maintenance especially for cracking. Since longitudinal fall prevent apparatus is not provided, detail inspection is required in the second screening. Fall Prevent Apparatus	39	Irregular span proportion and hinge connection at center span are very vulnerable for large earthquake. At bridge crossing point, river course makes a tight curve so bridge should be crossing with one span to prevent impact of ship. At Center span, quite a large deflection is observed even in visual. Candidate for the Second Screening (Reconstruction)	73	Severe cracking on box girders is urgently maintained and lubber pads ruptured are replaced to adjust uneven level of carriageway. Urgent Maintenance	49

Table 12.1.1-6 Global Evaluation for Bridge Seismic Performance in 1st Screening of Package-B (4/6)

Evaluation Items		Max. Point	Guadalupe Bridge		C-5 Bridge		Bambang Bridge	
Side /Under/ On the road view			 side view  under view  on the road view		 side view  under view  on the road view		 side view  under view  on the road view	
			L=35.7+42.8+35.94=144.44m, W=25.4m		L=24.85+24.95+25.0+25.85+45.88+22.21+26.95+26.7+26.45=272.96m, W=27.7m		=(12.0+11.65+11.7)+(25.9+40.19+25.93)+(12.15+11.95+11.85)=163.32m, W=10.35r	
Physical Factors (50)	Construction Age & Applied Design Specification	10	Construction Year: 1962 Seismic Design: No seismic Consideration AASHTO Standard Specification (11th Edition) was applied	10	Construction Year: 1998 Seismic Design: R-Factor Based Design AASHTO LRFD Specification (1st Edition) was applied	3	Construction Year: 1991 Seismic Design: Seismic Design Force AASHTO Standard Specification (14th Edition) was applied	6
	Conditions of Bridge Based on Visual Inspection	30	Serious shear cracks are detected on hinge connection of PC girders. Cracking on deck slab are partially observed and waterleaking are detected at several parts. Piers are severely damaged from impact of ships. Rating Score: 51	30	Some cracks on piers and waterleaking from a few expansion joints are observed but global bridge condition in very good. Rating Score: 9	0	Cracklings on deck slab and abutments and waterleaking from cracks on deck slab are observed. Serious damages due to erosion are detected on both side of slope protection. Rating Score: 22	9
	Loading Capacity	5	20ton	0	20ton	0	20ton	0
	Bridge Importance	5	Bridge is located on Epifanio de los Santos Avenue in C-4 (Very Important)	5	Bridge is located on Carlos P. Garcia Avenue in C-5 (Very Important)	5	Bridge is located on M.Jimenez-P. Tuazon Road. (Important)	3
Seismic Performance	Seating Length	10	a: Minimum Required Seating Length (AASHTO) : 52cm b: Minimum Required Seating Length (JRA): 88cm Existing Seating Length (N) : 50cm	10	a: Minimum Required Seating Length (AASHTO) : 52cm b: Minimum Required Seating Length (JRA): 83cm Existing Seating Length (N) : 120cm	0	a: Minimum Required Seating Length (AASHTO) : 49cm b: Minimum Required Seating Length (JRA): 90cm Existing Seating Length (N) : 60cm	6
	Fall Prevent Apparatus	10	Vertical restrainers are installed but not sufficient functions longitudinally. Especially, at hinge portion, risk falling down is very high.	10	Longitudinal restrainers are not installed but bridge is a continuous PC-girder, which is low risk falling down. Lateral movement is restricted by concrete blocks.	0	Longitudinal restrainers are not installed but bridge is a continuous PC-girder, which is low risk falling down. Lateral movement is restricted by concrete blocks.	0
	Type of Bridge	10	Continuous Steel Truss Bridge Single Span PC I-girder with Hinge Connection	10	Continuous PC I-girder Bridge	4	Continuous PC I-girder Bridge	4
Geographical Factors (20)	Liquefaction	10	Liquefaction Potential : Low	3	Liquefaction Potential : Moderate	6	Liquefaction Potential : Moderate	6
	Soil Classification	5	AASHTO Classification : Type-II (JRA Classification : Type-I)	2	AASHTO Classification : Type-III (JRA Classification : Type-II)	3	AASHTO Classification : Type-III (JRA Classification : Type-II)	3
	Impact to Environment	5	Resettlement of buildings and inhabitants, traffic disturbance and noise & pollution are considered for impact of environment.	5	Traffic disturbance and is considered for impact of environment	2	Traffic disturbance and is considered for impact of environment	2
Evaluation		100	Fatal shear cracks are occurred at hinge portion of center span. Severe crackings are also detected on deck slab and PC girders, some of which are accompanied with waterleaking. Piers are damaged due to impact of ship. Candidate for Second Screening (Partial Reconstruction)	85	Bridge is relatively good condition and to continue periodical maintenance especially for cracking and damaged railing due to impact of car. Continuous Maintenance	23	Bridge is relatively good condition and to continue periodical maintenance especially for cracking and erosion of slope protection of left abutment. Continuous Maintenance	39

Table 12.1.1-7 Global Evaluation for Bridge Seismic Performance in 1st Screening of Package-B (5/6)

Evaluation Items		Max. Point	Vargas Bridge – 1		Vargas Bridge – 2		Rosario Bridge	
Side /Under/ On the road view			 Side View  Under View  On the Road View		 Side View  Under View  On the Road View		 Side View  Under View  On the Road View	
			L=30.62+30.83+50.7+30.65=142.8m, W=8.9m		L=19.3+30.5+50.6+22.04=122.44m, W=8.72m		L=25.5+31.2+31.19+30.98+31.07+25.41=175.35m, W=28.34m	
Physical Factors (50)	Constructions Age & Applied Design Specification	10	Construction Yea 1973 Seismic Design Seismic Design Force AASHTO Standard Specification (10th Edition) was applied	6	Construction Yea 1992 Seismic Design Seismic Design Force AASHTO Standard Specification (14th Edition) was applied	6	Construction Year 1952 Seismic Design Seismic Design Force AASHTO Standard Specification (5th Edition) was applied	10
	Condition of Bridge Based on Visual Inspection	30	Cracklings on deck slab and waterleaking from cracks on deck slab are observed. Paint peel off is observed on entire steel girder plate. Rating Score 18	0	Some cracks on piers and waterleaking from a few expansion joints are observed but global bridge condition in very good. Rating Score 15	0	Cracklings on deck slab and PC girders and waterleaking from cracks on deck slab are observed. Re-bar exposures are detected at the deep spalling. Serious damages due to erosion are detected on both side of slope protection. Rating Score 35	9
	Loading capacity	5	20ton	0	20ton	0	20ton	0
	Bridge Importance	5	Bridge is located on arterial road to connect Pasig city and C-5. (Very Important)	5	Bridge is located on arterial road to connect Pasig city and C-5. (Very Important)	5	Bridge is located on Ortigas Avenue. (Important)	3
Seismic Performance	Seating Length	10	a: Minimum Required Seating Length (AASHTO) : 43cm b: Minimum Required Seating Length (JRA): 95cm Existing Seating Length (N) : 70cm	6	a: Minimum Required Seating Length (AASHTO) : 49cm b: Minimum Required Seating Length (JRA): 87cm Existing Seating Length (N) : 80cm	6	a: Minimum Required Seating Length (AASHTO) : 48cm b: Minimum Required Seating Length (JRA): 85cm Existing Seating Length (N) : 100cm	0
	Fall Prevent Apparatus	10	Prevention works for bridge fall were installed but all of them are stolen and not sufficient functions. Lateral movement is restricted by concrete blocks.	10	Prevention works for bridge fall are not installed but bridge is a continuous PC-girder, which is low risk falling down. Lateral movement is restricted by concrete blocks.	0	Longitudinal restrainers are provided fixing with substructure and lateral movement is restricted by concrete blocks	0
	Type of Bridge	10	Continuous Steel I-Girder Bridge	4	Continuous PC Girder Bridge	4	Simple PC I-girder Bridge	10
Geographical Factors (20)	Liquefaction	10	Liquefaction Potential : Moderate	6	Liquefaction Potential : Moderate	6	Liquefaction Potential : Moderate	6
	Soil Classification	5	AASHTO Classification : Type-III (JRA Classification : Type-II)	3	AASHTO Classification : Type-III (JRA Classification : Type-II)	3	AASHTO Classification : Type-III (JRA Classification : Type-II)	3
	Impact to Environment	5	Traffic disturbance and is considered for impact of environment	2	Traffic disturbance and is considered for impact of environment	2	Traffic disturbance and is considered for impact of environment	2
Evaluation		100	Bridge is relatively good condition and to continue periodical maintenance especially for repainting on steel girders, slope protection eroded by strong flood and cracks accompanied. with waterleaking. Continuous Maintenance	42	Bridge is relatively good condition and to continue periodical maintenance especially for crackings and spallings on deck slab and piers and slope protection eroded by strong flood. Continuous Maintenance	32	Bridge is relatively good condition and to continue periodical maintenance. but especially for crackings on deck slab and piers and waterleaking from expansion joints are urgently repaired. Urgent Maintenance	43

Table 12.1.1-8 Global Evaluation for Bridge Seismic Performance in 1st Screening of Package-B (6/6)

Evaluation Items		Max. Point	Marcos Bridge		Marikina Bridge		San Jose Bridge	
Side /Under/ On the road view								
			L=22.03+30.0+27.5+30.15+6x30.0+22.0=311.68m, W=19.7m		L=24.2+3x30.0+24.0=138.2m, W=20.3m		L=24.9+24.97+24.95+24.97+25.0+24.97+24.96+24.95=199.67m, W=19.1m	
Physical Factors (50)	Construction Age & Applied Design Specification	10	Construction Year: 1978 Seismic Design: Seismic Design Force AASHTO Standard Specification (11th Edition) was applied	6	Construction Year: 1980 Seismic Design: Seismic Design Force AASHTO Standard Specification (12th Edition) was applied	6	Construction Year: 1980 Seismic Design: Seismic Design Force AASHTO Standard Specification (12th Edition) was applied	6
	Conditions of Bridge Based on Visual Inspection	30	Cracklings on deck slab and piers and waterleaking from cracks on deck slab are observed. Displacement of expansion joints are detected. Rating Score: 26	9	Serious cracklings on deck slab and piers and waterleaking from cracks on deck slab are observed. Spallings on concrete of deck slab and pier and re-bar exposure on PC girder girders and piers are detected. Bearings are damaged. Rating Score: 42	18	Cracking & Scaling on PC girders and piers are observed. Steel bearings are severely corroded due to waterleaking from from expansion joints. Local scoring is occurred around piers. Rating Score: 36	9
	Loading capacity	5	20ton	0	20ton	0	20ton	0
	Bridge Importance	5	Bridge is located on Marcos Highway. (Important)	3	Bridge is located on highway to connect Marikina and Quezon cities. (Important)	3	Bridge is located on E.. Rodrigues Avenue in commercial area. (Important)	3
Seismic Performance	Seating Length	10	a: Minimum Required Seating Length (AASHTO) : 48cm b: Minimum Required Seating Length (JRA): 85cm Existing Seating Length (N) : 53cm	6	a: Minimum Required Seating Length (AASHTO) : 48cm b: Minimum Required Seating Length (JRA): 85cm Existing Seating Length (N) : 65cm	6	a: Minimum Required Seating Length (AASHTO) : 47cm b: Minimum Required Seating Length (JRA): 82cm Existing Seating Length (N) : 70cm	6
	Fall Prevent Apparatus	10	Longitudinal restrainers are provided but some are stolen Lateral movement is restricted by concrete blocks	6	All piers are retrofitted with steel pipes. Fall prevent apparatus for superstructure are not provided longitudinally and laterally	10	Longitudinal restrainers are not provided longitudinally and laterally.	10
	Type of Bridge	10	Single span PC I-Girder Bridge	10	Single span PC I-Girder Bridge	10	Single span PC I-Girder Bridge	10
Geographical Factors (20)	Liquefaction	10	Liquefaction Potential : Moderate	6	Liquefaction Potential : Moderate	6	Liquefaction Potential : Low	3
	Soil Classification	5	AASHTO Classification : Type-III (JRA Classification : Type-II)	3	AASHTO Classification : Type-III (JRA Classification : Type-II)	3	AASHTO Classification : Type-II (JRA Classification : Type-I)	2
	Impact to Environment	5	Traffic disturbance and is considered for impact of environment	2	Traffic disturbance and noise & pollution are considered for impact of environment.	3	Traffic disturbance and is considered for impact of environment	2
Evaluation		100	Bridge is relatively good condition and to continue periodical maintenance. but especially for the stolen longitudinal restrainers are urgently reinstalled and maintain properly. Urgent Maintenance	51	Bridge is fairly damaged on deck slab and PC girders so that concrete material test related to deterioration is required to check vulnerability. Fall prevent apparatus shall be provided for both longitudinally and laterally. Candidate for the Second Screening (Retrofitting)	65	Bridge is relatively good condition and to continue periodical maintenance especially for cracking and scoring . Since longitudinal fall prevent apparatus is not provided, detail inspection is required in the second screening. Fall Prevent Apparatus	51

12.1.2 Selection of Target Bridges for the Second Screening

The results of the First Screening of Package-B are summarized in Table 12.1.2-1. Out of 18 rated bridges shown in the Table, the following 8 bridges listed in Table 12.1.2-2 are selected for checking seismic performance in Package B. Rank No.1 is Ayala Bridge which will be financed by local fund so that it will be deleted from the candidates for the second screening. Rank No.2 to No.6 is selected as the candidates for the second screening through the detailed inspection. Recommended rehabilitation methods are preliminary selection in consideration with rating score. Two (2) reconstruction bridges for basic design in Package-B will be selected in the second screening. Both San Jose Bridge and Pandacan Bridge, which are simply supported bridges, do not have fall-down prevention apparatus. However, it is recommended that proper apparatus be installed to prevent girders falling during large earthquake.

Table 12.1.2-1 Selected Bridges for Checking Seismic Performance in Package-B

Rank	Name of Bridge	Score	Recommended Rehabilitation Method
1	Ayala Bridge	93	Reconstruction by Local Fund
2	Guadalupe Bridge	85	Retrofitting
3	Lambingan Bridge	73	Retrofitting
4	Marikina Bridge	65	Retrofitting
5	Delpan Bridge	61	Retrofitting
6	Nagtahan Bridge	57	Retrofitting
7	San Jose Bridge	51	Fall Prevent Apparatus
16	Pandacan Bridge	39	Fall Prevent Apparatus

Candidate for the Second Screening

Table 12.1.2-2 Results of Rating Analysis in the 1st Screening

No.	Name of Bridge	Physical Factors (50)				Seismic Performance Factors (30)			Geographical Factors (20)			Total Rating	Recommended Method
		Construction Age & Applied Design Specification	Conditions of Bridge Based on Visual Inspection	Loading Capacity	Bridge Importance	Seating Length	Fall Prevent Apparatus	Type of Bridge	Liquefaction	Soil Classification	Impact to Environment		
		(10)	(30)	(5)	(5)	(10)	(10)	(10)	(10)	(5)	(5)	(100)	
1	Delpan Bridge	6	18	0	5	0	10	4	10	5	3	61	Retrofitting
2	Jones Bridge	10	9	0	3	0	4	4	10	5	3	48	Urgent Maintenance
3	McArthur Bridge	10	9	0	3	0	4	4	10	5	3	48	Urgent Maintenance
4	Quezon Bridge	10	9	2	5	0	4	6	10	3	2	51	Continuous Maintenance
5	Ayala Bridge	10	30	2	5	6	10	10	10	5	5	93	Reconstruction by Local Fund
6	Nagtahan Bridge	6	18	0	5	0	6	4	10	3	5	57	Urgent Maintenance
7	Pandacan Bridge	6	0	0	3	0	6	10	10	2	2	39	Fall Prevent Apparatus
8	Lambingan Bridge	6	18	2	3	10	10	10	6	3	5	73	Reconstruction
9	Makati-Manda. Bridge	6	9	0	3	6	4	10	6	3	2	49	Urgent Maintenance
10	Guadalupe Bridge	10	30	0	5	10	10	10	3	2	5	85	Partial Reconstruction
11	C-5 Bridge	3	0	0	5	0	0	4	6	3	2	23	Continuous Maintenance
12	Bambang Bridge	6	9	0	3	6	0	4	6	3	2	39	Continuous Maintenance
13	Vargas Bridge-1	6	0	0	5	6	10	4	6	3	2	42	Continuous Maintenance
13	Vargas Bridge-2	6	0	0	5	6	0	4	6	3	2	32	Continuous Maintenance
14	Rosario Bridge	10	9	0	3	0	0	10	6	3	2	43	Urgent Maintenance
15	Marcos Bridge	6	9	0	3	6	6	10	6	3	2	51	Urgent Maintenance
16	Marikina Bridge	6	18	0	3	6	10	10	6	3	3	65	Retrofitting
17	San Jose Bridge	6	9	0	3	6	10	10	3	2	2	51	Fall Prevent Apparatus

12.2 Results of the First Screening for Package C

12.2.1 Results of the First Screening

(1) Results of the Bridge Soundness Survey

Bridge soundness survey was implemented based on the evaluation criteria for the first screening. The results of the survey are shown as below.

1) Badiwan Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10	O				0		
		Exposure/Corrosion of Rebars	10					0		
		Scaling/Spalling	10					0		
		Delamination	10					0		
		Honeycomb	10	O				0		
		Waterleaking	10					0	0	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10					0		
		Exposure/Corrosion of Rebars	10	O				0		
	Reinforced Concrete	Spalling, Scaling,Disintegration	10					0		Black stain by fire at the concrete box girder
		Delamination	10					0		
		Honeycomb	10	O				0		
		Waterleaking	10					0	0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10					0		
		Cracking	10					0		
		Deformation/Buckling	10					0		
		Abnormal Vibrations	10					0		
		Loose Connection	10					0		
		Paint Peel off	10					0	0	
(53) Shoe/Bearing	Steel	Corrosion	10					0		
	Rubber	Loose Connection	10					0		
		Abnormal Displacement	10					0		
		Bulging/Rupture	10					0		
(Primary)		Bed (Support) Damage	10					0	0	
(54) Abutments *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling,Disintegration	10					0		
		Cracking concretre	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	0	
(55) Piers *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		Piers are coated with mortar; impossible to evaluate crack condition.
		Spalling, Scaling,Disintegration	10					0		
		Cracking concrete	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	0	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5					0		
		Exposure/Corrosion of Reinf.	5					0		
		Spalling	5					0		
		Impact Damaged	5					0	0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10				O	10		
	Others	Abnormal Space/Noise	10					0		
		Difference in elevation	10					0		
		Displacement	10					0		
		Cracking/Rupture	10		O			3	13	
(58) Painting Cond. *(Primary)*		Discoloration	10					0		
		Rust	10					0		
		Exfoliation	10					0	0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5		O			2		
	Steel	Cracks	5					0		・No pipe under the drainage holes ・Small drainage holes;stuffed
		Others							2	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5					0		
	Others	Erossion	5					0		
		Scouring	5					0		A1(R):Retaining Wall A1(L):Masonry Embankment
		Cracks	5					0		
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5					0		
	Asphalt	Pot-holes	5					0		
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5					0		
		Sedimentation	5	O				0		Debris flow between P1& P2, P5 & P6
		Others							0	
(63) Total Condition Rating			540						15	

2) Buntun Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10	O				0		
		Exposure/Corrosion of Rebars	10					0		
		Scaling/Spalling	10					0		
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10		O			3	3	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10					0		
		Exposure/Corrosion of Rebars	10					0		
	Reinforced Concrete	Spalling, Scaling,Disintegration	10					0		
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10					0	0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10					0		
		Cracking	10					0		
		Deformation/Buckling	10	O				0		
		Abnormal Vibrations	10			O		6		
		Loose Connection	10					0		
		Paint Peel off	10					0	6	
(53) Shoe/Bearing *(Primary)*	Steel	Corrosion	10					0		
	Rubber	Loose Connection	10					0		
		Abnormal Displacement	10	O				0		
		Bulging/Rupture	10					0		
		Bed (Support) Damage	10					0	0	
(54) Abutments *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling,Disintegration	10					0		
		Cracking concretre	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	0	
(55) Piers *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10		O			3		
		Spalling, Scaling,Disintegration	10					0		
		Cracking concrete	10		O			3		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	6	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5					0		
		Exposure/Corrosion of Reinf.	5					0		
		Spalling	5					0		
		Impact Damaged	5			O		3	3	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10				O	10		
	Others	Abnormal Space/Noise	10					0		
		Difference in elevation	10					0		
		Displacement	10					0		
		Cracking/Rupture	10					0	10	
(58) Painting Cond. *(Primary)*		Discoloration	10					0		
		Rust	10					0		
		Exfoliation	10					0	0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5					0		
	Steel	Cracks	5					0		
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5					0		
	Others	Erossion	5					0		
		Scouring	5					0		
		Cracks	5		O			2		
		Others							2	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5					0		
	Asphalt	Pot-holes	5					0		
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5		O			2		
		Sedimentation	5					0		
		Others							2	
(63) Total Condition Rating			540						32	

3) Lucban Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10					0		
		Exposure/Corrosion of Rebars	10					0		
		Scaling/Spalling	10	O				0		
		Delamination	10					0		
		Honeycomb	10		O			3		
		Waterleaking	10		O			3	6	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10					0		
		Exposure/Corrosion of Rebars	10					0		
	Reinforced Concrete	Spalling, Scaling,Disintegration	10					0		
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10					0	0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10		O			3		
		Cracking	10					0		
		Deformation/Buckling	10					0		
		Abnormal Vibrations	10					0		
		Loose Connection	10					0		
		Paint Peel off	10		O			3	6	
(53) Shoe/Bearing	Steel	Corrosion	10		O			3		
	Rubber	Loose Connection	10					0		
		Abnormal Displacement	10		O			3		
		Bulging/Rupture	10					0		
(Primary)		Bed (Support) Damage	10	O				0	6	
(54) Abutments *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling,Disintegration	10			O		6		
		Cracking concretre	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	6	
(55) Piers *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling,Disintegration	10					0		
		Cracking concrete	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	0	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5			O		3		
		Exposure/Corrosion of Reinf.	5					0		
		Spalling	5					0		
		Impact Damaged	5					0	3	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10				O	10		
	Others	Abnormal Space/Noise	10	O				0		
		Difference in elevation	10					0		
		Displacement	10					0		
		Cracking/Rupture	10					0	10	
(58) Painting Cond. *(Primary)*		Discoloration	10					0		
		Rust	10		O			3		
		Exfoliation	10		O			3	6	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5					0		
	Steel	Cracks	5					0		
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5					0		
	Others	Erossion	5					0		
		Scouring	5					0		
		Cracks	5			O		3		
		Others							3	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5					0		
	Asphalt	Pot-holes	5					0		
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5					0		
		Sedimentation	5					0		
		Others							0	
(63) Total Condition Rating			540						46	

4) Magapit Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10		O			3		
		Exposure/Corrosion of Rebars	10					0		
		Scaling/Spalling	10					0		
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10					0	3	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10					0		
		Exposure/Corrosion of Rebars	10					0		
	Reinforced Concrete	Spalling, Scaling,Disintegration	10					0		
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10					0	0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10		O			3		
		Cracking	10					0		
		Deformation/Buckling	10					0		
		Abnormal Vibrations	10					0		
		Loose Connection	10		O			3		
		Paint Peel off	10		O			3	9	
(53) Shoe/Bearing	Steel	Corrosion	10					0		
	Rubber	Loose Connection	10					0		
		Abnormal Displacement	10		O			3		
		Bulging/Rupture	10					0		
(Primary)		Bed (Support) Damage	10					0	3	
(54) Abutments *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling,Disintegration	10					0		
		Cracking concretre	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10	O				0	0	
(55) Piers *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling,Disintegration	10					0		
		Cracking concrete	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	0	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5					0		
		Exposure/Corrosion of Reinf.	5					0		
		Spalling	5					0		
		Impact Damaged	5					0	0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10			O		6		
	Others	Abnormal Space/Noise	10					0		
		Difference in elevation	10					0		
		Displacement	10					0		
		Cracking/Rupture	10					0	6	
(58) Painting Cond. *(Primary)*		Discoloration	10					0		
		Rust	10					0		
		Exfoliation	10		O			3	3	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5					0		
	Steel	Cracks	5					0		
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5					0		
	Others	Erossion	5					0		
		Scouring	5					0		
		Cracks	5			O		3		
		Others							3	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5					0		
	Asphalt	Pot-holes	5					0		
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5					0		
		Sedimentation	5					0		
		Others							0	
(63) Total Condition Rating			540						27	

5) Sicsican Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10					0		*Cast-in-place deck slab at sidewalk*
		Exposure/Corrosion of Rebars	10	O				0		
		Scaling/Spalling	10					0		*Replacement of the deck slab with the precast deck slab at carriageway*
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10		O			3	3	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10					0		
		Exposure/Corrosion of Rebars	10					0		
	Reinforced Concrete	Spalling, Scaling,Disintegration	10					0		
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10					0	0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10	O				0		
		Cracking	10					0		
		Deformation/Buckling	10		O			3		
		Abnormal Vibrations	10		O			3		
		Loose Connection	10					0		
		Paint Peel off	10	O				0	6	
(53) Shoe/Bearing	Steel	Corrosion	10					0		
	Rubber	Loose Connection	10					0		
		Abnormal Displacement	10		O			3		*Debris flow around bearings of A2*
		Bulging/Rupture	10					0		
(Primary)		Bed (Support) Damage	10	O				0	3	
(54) Abutments *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10		O			3		*Major cracks (over 1mm in width) & scouring at A1*
		Spalling, Scaling,Disintegration	10					0		
		Cracking concretre	10				O	10		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	13	
(55) Piers *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling,Disintegration	10					0		
		Cracking concrete	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	0	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5					0		
		Exposure/Corrosion of Reinf.	5					0		
		Spalling	5					0		
		Impact Damaged	5		O			2	2	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10			O		6		
	Others	Abnormal Space/Noise	10					0		
		Difference in elevation	10					0		
		Displacement	10					0		
		Cracking/Rupture	10					0	6	
(58) Painting Cond. *(Primary)*		Discoloration	10					0		
		Rust	10					0		
		Exfoliation	10					0	0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5					0		
	Steel	Cracks	5					0		
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5					0		
	Others	Erossion	5					0		
		Scouring	5					0		
		Cracks	5					0		
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5					0		
	Asphalt	Pot-holes	5					0		
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5		O			2		
		Sedimentation	5					0		
		Others							2	
(63) Total Condition Rating			540						35	

6) Bamban Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member			Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material				Good	Fair	Poor	Bad			
					0%	30%	60%	100%			
(50) Deck Slab *(Primary)*	Concrete		Cracking	10					0		
			Exposure/Corrosion of Rebars	10					0		
			Scaling/Spalling	10					0		
			Delamination	10					0		
			Honeycomb	10					0		
			Waterleaking	10					0	0	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete		Cracking	10					0		
			Exposure/Corrosion of Rebars	10					0		
	Reinforced Concrete		Spalling, Scaling,Disintegration	10					0		
			Delamination	10					0		
			Honeycomb	10					0		
			Waterleaking	10					0	0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*			Corrosion	10		O			3		
			Cracking	10					0		
			Deformation/Buckling	10					0		
			Abnormal Vibrations	10					0		
			Loose Connection	10		O			3		
			Paint Peel off	10					0	6	
(53) Shoe/Bearing	Steel		Corrosion	10					0		
	Rubber		Loose Connection	10					0		
			Abnormal Displacement	10					0		
			Bulging/Rupture	10					0		
(Primary)			Bed (Support) Damage	10					0	0	
(54) Abutments *(Primary)*	Concrete		Settlement	10					0		
	Masonry		Movement	10					0		
	Others		Delamination	10					0		
			Scouring	10					0		
			Spalling, Scaling,Disintegration	10					0		
			Cracking concretre	10		O			3		
			Exposure/Corrosion of Reinf.	10					0		
			Honeycomb	10					0	3	
(55) Piers *(Primary)*	Concrete		Settlement	10					0		
	Masonry		Movement	10					0		
	Others		Delamination	10					0		
			Scouring	10					0		
			Spalling, Scaling,Disintegration	10					0		
			Cracking concrete	10					0		
			Exposure/Corrosion of Reinf.	10					0		
			Honeycomb	10					0	0	
(56) Curb and Railing *(Secondary)*	Concrete		Cracking	5					0		
			Exposure/Corrosion of Reinf.	5					0		
			Spalling	5					0		
			Impact Damaged	5		O			2	2	

Bridge Member			Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material				Good	Fair	Poor	Bad			
					0%	30%	60%	100%			
(57) Expansion Joint *(Primary)*	Steel		Waterleaking	10					0		
	Others		Abnormal Space/Noise	10					0		
			Difference in elevation	10					0		
			Displacement	10					0		
			Cracking/Rupture	10					0	0	
(58) Painting Cond. *(Primary)*			Discoloration	10					0		
			Rust	10					0		
			Exfoliation	10					0	0	
(59) Drainage Pipe *(Secondary)*	PVC		Clogged	5					0		
	Steel		Cracks	5					0		
			Others							0	
(60) Slope Protection *(Secondary)*	Gabions		Settlement	5					0		
	Others		Erossion	5					0		
			Scouring	5					0		
			Cracks	5					0		
			Others							0	
(61) Approach Road *(Secondary)*	Concrete		Cracking	5					0		
	Asphalt		Pot-holes	5					0		
			Others							0	
(62) River Condition *(Secondary)*			Scouring	5					0		
			Sedimentation	5					0		
			Others							0	
(63) Total Condition Rating				540						11	

7) 1st Mandaue-Mactan Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10					0		
		Exposure/Corrosion of Rebars	10		O			3		
		Scaling/Spalling	10					0		*Rebar exposure due to spalling at the overhanging deck slab (A2 side)*
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10		O			3	6	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10					0		
		Exposure/Corrosion of Rebars	10					0		
	Reinforced Concrete	Spalling, Scaling,Disintegration	10					0		
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10					0	0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10		O			3		
		Cracking	10		O			3		
		Deformation/Buckling	10					0		
		Abnormal Vibrations	10					0		
		Loose Connection	10					0		
		Paint Peel off	10					0	6	
(53) Shoe/Bearing	Steel	Corrosion	10	O				0		
	Rubber	Loose Connection	10					0		
		Abnormal Displacement	10					0		
		Bulging/Rupture	10					0		
(Primary)		Bed (Support) Damage	10	O				0	0	
(54) Abutments *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling,Disintegration	10					0		
		Cracking concretre	10		O			3		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	3	
(55) Piers *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10	O				0		
		Spalling, Scaling,Disintegration	10					0		
		Cracking concrete	10					0		
		Exposure/Corrosion of Reinf.	10				O	10		
		Honeycomb	10					0	10	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5					0		
		Exposure/Corrosion of Reinf.	5					0		
		Spalling	5					0		
		Impact Damaged	5					0	0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10				O	10		
	Others	Abnormal Space/Noise	10					0		
		Difference in elevation	10					0		
		Displacement	10					0		
		Cracking/Rupture	10	O				0	10	
(58) Painting Cond. *(Primary)*		Discoloration	10					0		
		Rust	10					0		
		Exfoliation	10	O				0	0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5					0		
	Steel	Cracks	5					0		
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5					0		
	Others	Erossion	5					0		
		Scouring	5					0		
		Cracks	5					0		
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5					0		
	Asphalt	Pot-holes	5					0		
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5					0		
		Sedimentation	5					0		
		Others							0	
(63) Total Condition Rating			540						35	

8) Marcelo Ferman Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	30%	60%	100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10					0		
		Exposure/Corrosion of Rebars	10					0		
		Scaling/Spalling	10					0		
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10					0	0	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10					0		
		Exposure/Corrosion of Rebars	10					0		
	Reinforced Concrete	Spalling, Scaling,Disintegration	10					0		
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10					0	0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10					0		
		Cracking	10					0		
		Deformation/Buckling	10					0		
		Abnormal Vibrations	10					0		
		Loose Connection	10					0		
		Paint Peel off	10					0	0	
(53) Shoe/Bearing	Steel	Corrosion	10					0		
	Rubber	Loose Connection	10					0		
		Abnormal Displacement	10					0		
		Bulging/Rupture	10					0		
(Primary)		Bed (Support) Damage	10					0	0	
(54) Abutments *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling,Disintegration	10					0		
		Cracking concretre	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	0	
(55) Piers *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		• Hanycomb & cracks at piers
		Scouring	10					0		• Cracking at pylons
		Spalling, Scaling,Disintegration	10					0		(considered to be alkali - aggregate
		Cracking concrete	10		O			3		reaction)
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10	O				0	3	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5					0		
		Exposure/Corrosion of Reinf.	5					0		
		Spalling	5					0		
		Impact Damaged	5					0	0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	30%	60%	100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10				O	10		
	Others	Abnormal Space/Noise	10					0		
		Difference in elevation	10					0		Uunder repair work by DPWH
		Displacement	10					0		
		Cracking/Rupture	10			O		6	16	
(58) Painting Cond. *(Primary)*		Discoloration	10					0		
		Rust	10					0		
		Exfoliation	10					0	0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5					0		
	Steel	Cracks	5					0		
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5					0		
	Others	Erossion	5					0		
		Scouring	5					0		
		Cracks	5					0		
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5					0		
	Asphalt	Pot-holes	5					0		
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5					0		
		Sedimentation	5					0		
		Others							0	
(63) Total Condition Rating			540						19	

9) Palanit Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member			Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material				Good 0%	Fair 30%	Poor 60%	Bad 100%			
(50) Deck Slab *(Primary)*	Concrete		Cracking	10				O	10		
			Exposure/Corrosion of Rebars	10		O			3		
			Scaling/Spalling	10				O	10		
			Delamination	10					0		
			Honeycomb	10					0		
			Waterleaking	10			O		6	29	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete		Cracking	10					0		
			Exposure/Corrosion of Rebars	10					0		
	Reinforced Concrete		Spalling, Scaling,Disintegration	10					0		
			Delamination	10					0		
			Honeycomb	10					0		
			Waterleaking	10					0	0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*			Corrosion	10		O			3		
			Cracking	10	O				0		
			Deformation/Buckling	10	O				0		Main span
			Abnormal Vibrations	10					0		
			Loose Connection	10					0		
			Paint Peel off	10					0	3	
(53) Shoe/Bearing	Steel		Corrosion	10		O			3		
	Rubber		Loose Connection	10					0		
			Abnormal Displacement	10					0		
			Bulging/Rupture	10					0		
(Primary)			Bed (Support) Damage	10					0	3	
(54) Abutments *(Primary)*	Concrete		Settlement	10					0		
	Masonry		Movement	10					0		
	Others		Delamination	10					0		
			Scouring	10					0		
			Spalling, Scaling,Disintegration	10					0		
			Cracking concretre	10					0		
			Exposure/Corrosion of Reinf.	10					0		
			Honeycomb	10					0	0	
(55) Piers *(Primary)*	Concrete		Settlement	10					0		
	Masonry		Movement	10					0		
	Others		Delamination	10					0		
			Scouring	10					0		
			Spalling, Scaling,Disintegration	10					0		
			Cracking concrete	10					0		
			Exposure/Corrosion of Reinf.	10					0		
			Honeycomb	10					0	0	
(56) Curb and Railing *(Secondary)*	Concrete		Cracking	5					0		
			Exposure/Corrosion of Reinf.	5					0		
			Spalling	5					0		
			Impact Damaged	5					0	0	

Bridge Member			Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material				Good 0%	Fair 30%	Poor 60%	Bad 100%			
(57) Expansion Joint *(Primary)*	Steel		Waterleaking	10				O	10		
	Others		Abnormal Space/Noise	10					0		
			Difference in elevation	10					0		
			Displacement	10					0		
			Cracking/Rupture	10					0	10	
(58) Painting Cond. *(Primary)*			Discoloration	10					0		
			Rust	10					0		
			Exfoliation	10					0	0	
(59) Drainage Pipe *(Secondary)*	PVC		Clogged	5					0		
	Steel		Cracks	5					0		
			Others							0	
(60) Slope Protection *(Secondary)*	Gabions		Settlement	5					0		
	Others		Erossion	5					0		
			Scouring	5					0		
			Cracks	5					0		
			Others							0	
(61) Approach Road *(Secondary)*	Concrete		Cracking	5					0		
	Asphalt		Pot-holes	5					0		
			Others							0	
(62) River Condition *(Secondary)*			Scouring	5					0		
			Sedimentation	5					0		
			Others							0	
(63) Total Condition Rating				540						45	

10) Jibatang Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member			Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material				Good 0%	Fair 30%	Poor 60%	Bad 100%			
(50) Deck Slab *(Primary)*	Concrete		Cracking	10					0		
			Exposure/Corrosion of Rebars	10					0		
			Scaling/Spalling	10		O			3		*Section loss due to spalling at the end of deck slab*
			Delamination	10					0		
			Honeycomb	10					0		
			Waterleaking	10					0	3	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete		Cracking	10					0		
			Exposure/Corrosion of Rebars	10					0		
	Reinforced Concrete		Spalling, Scaling,Disintegration	10					0		
			Delamination	10					0		
			Honeycomb	10					0		
			Waterleaking	10					0	0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*			Corrosion	10			O		6		
			Cracking	10					0		
			Deformation/Buckling	10					0		
			Abnormal Vibrations	10					0		
			Loose Connection	10					0		
			Paint Peel off	10					0	6	
(53) Shoe/Bearing	Steel		Corrosion	10					0		
	Rubber		Loose Connection	10					0		
			Abnormal Displacement	10					0		
			Bulging/Rupture	10					0		
(Primary)			Bed (Support) Damage	10					0	0	
(54) Abutments *(Primary)*	Concrete		Settlement	10					0		
	Masonry		Movement	10					0		
	Others		Delamination	10					0		
			Scouring	10					0		
			Spalling, Scaling,Disintegration	10					0		
			Cracking concretre	10					0		
			Exposure/Corrosion of Reinf.	10					0		
			Honeycomb	10			O		6	6	
(55) Piers *(Primary)*	Concrete		Settlement	10					0		
	Masonry		Movement	10					0		
	Others		Delamination	10					0		
			Scouring	10					0		
			Spalling, Scaling,Disintegration	10			O		6		
			Cracking concrete	10					0		
			Exposure/Corrosion of Reinf.	10					0		
			Honeycomb	10					0	6	
(56) Curb and Railing *(Secondary)*	Concrete		Cracking	5	O				0		
			Exposure/Corrosion of Reinf.	5					0		
			Spalling	5					0		
			Impact Damaged	5					0	0	

Bridge Member			Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material				Good 0%	Fair 30%	Poor 60%	Bad 100%			
(57) Expansion Joint *(Primary)*	Steel		Waterleaking	10			O		6		
	Others		Abnormal Space/Noise	10					0		
			Difference in elevation	10					0		
			Displacement	10					0		
			Cracking/Rupture	10		O			3	9	
(58) Painting Cond. *(Primary)*			Discoloration	10					0		
			Rust	10					0		
			Exfoliation	10					0	0	
(59) Drainage Pipe *(Secondary)*	PVC		Clogged	5					0		
	Steel		Cracks	5					0		
			Others							0	
(60) Slope Protection *(Secondary)*	Gabions		Settlement	5					0		
	Others		Erossion	5					0		
			Scouring	5					0		
			Cracks	5		O			2		
			Others							2	
(61) Approach Road *(Secondary)*	Concrete		Cracking	5					0		
	Asphalt		Pot-holes	5					0		
			Others							0	
(62) River Condition *(Secondary)*			Scouring	5					0		
			Sedimentation	5					0		
			Others							0	
(63) Total Condition Rating				540						32	

11) Mawo Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member			Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material				Good 0%	Fair 30%	Poor 60%	Bad 100%			
(50) Deck Slab *(Primary)*	Concrete		Cracking	10					0		
			Exposure/Corrosion of Rebars	10		O			3		
			Scaling/Spalling	10		O			3		
			Delamination	10					0		
			Honeycomb	10		O			3		
			Waterleaking	10		O			3	12	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete		Cracking	10					0		
			Exposure/Corrosion of Rebars	10					0		
	Reinforced Concrete		Spalling, Scaling,Disintegration	10					0		
			Delamination	10					0		
			Honeycomb	10					0		
			Waterleaking	10					0	0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*			Corrosion	10			O		6		
			Cracking	10					0		
			Deformation/Buckling	10					0		
			Abnormal Vibrations	10		O			3		
			Loose Connection	10					0		
			Paint Peel off	10		O			3	12	
(53) Shoe/Bearing	Steel		Corrosion	10					0		
	Rubber		Loose Connection	10					0		
			Abnormal Displacement	10					0		
			Bulging/Rupture	10					0		
(Primary)			Bed (Support) Damage	10					0	0	
(54) Abutments *(Primary)*	Concrete		Settlement	10					0		
	Masonry		Movement	10					0		
	Others		Delamination	10					0		
			Scouring	10					0		
			Spalling, Scaling,Disintegration	10					0		
			Cracking concretre	10					0		
			Exposure/Corrosion of Reinf.	10					0		
			Honeycomb	10					0	0	
(55) Piers *(Primary)*	Concrete		Settlement	10					0		
	Masonry		Movement	10					0		
	Others		Delamination	10					0		
			Scouring	10					0		
			Spalling, Scaling,Disintegration	10					0		
			Cracking concrete	10					0		
			Exposure/Corrosion of Reinf.	10					0		
			Honeycomb	10					0	0	
(56) Curb and Railing *(Secondary)*	Concrete		Cracking	5					0		
			Exposure/Corrosion of Reinf.	5					0		
			Spalling	5					0		
			Impact Damaged	5		O			2	2	

Bridge Member			Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material				Good 0%	Fair 30%	Poor 60%	Bad 100%			
(57) Expansion Joint *(Primary)*	Steel		Waterleaking	10					0		
	Others		Abnormal Space/Noise	10					0		
			Difference in elevation	10					0		
			Displacement	10					0		
			Cracking/Rupture	10					0	0	
(58) Painting Cond. *(Primary)*			Discoloration	10					0		
			Rust	10		O			3		
			Exfoliation	10		O			3	6	
(59) Drainage Pipe *(Secondary)*	PVC		Clogged	5					0		
	Steel		Cracks	5					0		
			Others							0	
(60) Slope Protection *(Secondary)*	Gabions		Settlement	5					0		
	Others		Erossion	5					0		
			Scouring	5					0		
			Cracks	5					0		
			Others							0	
(61) Approach Road *(Secondary)*	Concrete		Cracking	5					0		
	Asphalt		Pot-holes	5					0		
			Others							0	
(62) River Condition *(Secondary)*			Scouring	5					0		
			Sedimentation	5					0		
			Others							0	
(63) Total Condition Rating				540						32	

12) Biliran Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	30%	60%	100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10					0		
		Exposure/Corrosion of Rebars	10		O			3		
		Scaling/Spalling	10					0		
		Delamination	10					0		*Overhanging deck slab*
		Honeycomb	10		O			3		
		Waterleaking	10		O			3	9	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10					0		
		Exposure/Corrosion of Rebars	10					0		
	Reinforced Concrete	Spalling, Scaling,Disintegration	10					0		
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10					0	0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10		O			3		
		Cracking	10					0		
		Deformation/Buckling	10	O				0		
		Abnormal Vibrations	10					0		
		Loose Connection	10					0		
		Paint Peel off	10					0	3	
(53) Shoe/Bearing	Steel	Corrosion	10		O			3		
	Rubber	Loose Connection	10					0		
		Abnormal Displacement	10					0		
		Bulging/Rupture	10					0		
(Primary)		Bed (Support) Damage	10					0	3	
(54) Abutments *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling,Disintegration	10					0		
		Cracking concretre	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	0	
(55) Piers *(Primary)*	Concrete	Settlement	10		O			3		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling,Disintegration	10					0		*Settlement at P3*
		Cracking concrete	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10	O				0	3	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5					0		
		Exposure/Corrosion of Reinf.	5					0		
		Spalling	5					0		
		Impact Damaged	5					0	0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good	Fair	Poor	Bad			
				0%	30%	60%	100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10					0		
	Others	Abnormal Space/Noise	10					0		
		Difference in elevation	10					0		
		Displacement	10					0		
		Cracking/Rupture	10					0	0	
(58) Painting Cond. *(Primary)*		Discoloration	10					0		
		Rust	10					0		
		Exfoliation	10					0	0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5					0		
	Steel	Cracks	5					0		
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5					0		
	Others	Erossion	5					0		
		Scouring	5					0		
		Cracks	5					0		
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5					0		
	Asphalt	Pot-holes	5					0		
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5					0		
		Sedimentation	5					0		
		Others							0	
(63) Total Condition Rating			540						18	

13) San Juanico Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10	O				0		
		Exposure/Corrosion of Rebars	10					0		
		Scaling/Spalling	10					0		*Overhanging deck slab*
		Delamination	10					0		
		Honeycomb	10	O				0		
		Waterleaking	10			O		6	6	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10					0		
		Exposure/Corrosion of Rebars	10					0		
	Reinforced Concrete	Spalling, Scaling,Disintegration	10					0		
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10					0	0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10	O				0		
		Cracking	10					0		
		Deformation/Buckling	10					0		*Seel members over the sea water*
		Abnormal Vibrations	10					0		
		Loose Connection	10					0		
		Paint Peel off	10					0	0	
(53) Shoe/Bearing *(Primary)*	Steel	Corrosion	10					0		
	Rubber	Loose Connection	10					0		
		Abnormal Displacement	10					0		
		Bulging/Rupture	10					0		
		Bed (Support) Damage	10					0	0	
(54) Abutments *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling,Disintegration	10					0		
		Cracking concretre	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	0	
(55) Piers *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling,Disintegration	10	O				0		*Piers near sea water*
		Cracking concrete	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	0	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5					0		
		Exposure/Corrosion of Reinf.	5					0		
		Spalling	5					0		
		Impact Damaged	5					0	0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10			O		6		
	Others	Abnormal Space/Noise	10					0		
		Difference in elevation	10					0		
		Displacement	10					0		
		Cracking/Rupture	10					0	6	
(58) Painting Cond. *(Primary)*		Discoloration	10					0		
		Rust	10					0		
		Exfoliation	10					0	0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5					0		
	Steel	Cracks	5					0		
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5					0		
	Others	Erossion	5					0		
		Scouring	5					0		
		Cracks	5					0		
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5					0		
	Asphalt	Pot-holes	5					0		
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5					0		
		Sedimentation	5					0		
		Others							0	
(63) Total Condition Rating			540						12	

14) Lilo-an Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10	O				0		
		Exposure/Corrosion of Rebars	10					0		
		Scaling/Spalling	10					0		
		Delamination	10					0		
		Honeycomb	10		O			3		
		Waterleaking	10		O			3	6	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10					0		
		Exposure/Corrosion of Rebars	10					0		
	Reinforced Concrete	Spalling, Scaling,Disintegration	10					0		*Approach span*
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10		O			3	3	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10			O		6		
		Cracking	10					0		
		Deformation/Buckling	10					0		*Main span (primary steel members)*
		Abnormal Vibrations	10					0		
		Loose Connection	10		O			3		
		Paint Peel off	10					0	9	
(53) Shoe/Bearing	Steel	Corrosion	10		O			3		
	Rubber	Loose Connection	10					0		
		Abnormal Displacement	10	O				0		
		Bulging/Rupture	10					0		
(Primary)		Bed (Support) Damage	10					0	3	
(54) Abutments *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		*Section loss due to disintegration at A2*
		Spalling, Scaling,Disintegration	10		O			3		
		Cracking concretre	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	3	
(55) Piers *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		*Major cracking at some piers (over 1mm)*
		Spalling, Scaling,Disintegration	10					0		
		Cracking concrete	10			O		6		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	6	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5					0		
		Exposure/Corrosion of Reinf.	5					0		
		Spalling	5					0		
		Impact Damaged	5					0	0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10					0		
	Others	Abnormal Space/Noise	10					0		
		Difference in elevation	10					0		
		Displacement	10					0		
		Cracking/Rupture	10					0	0	
(58) Painting Cond. *(Primary)*		Discoloration	10					0		
		Rust	10		O			3		
		Exfoliation	10					0	3	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5					0		
	Steel	Cracks	5					0		
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5					0		
	Others	Erossion	5					0		
		Scouring	5					0		
		Cracks	5					0		
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5					0		
	Asphalt	Pot-holes	5					0		
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5					0		
		Sedimentation	5					0		
		Others							0	
(63) Total Condition Rating			540						33	

15) Wawa Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10			O		6		
		Exposure/Corrosion of Rebars	10					0		
		Scaling/Spalling	10		O			3		*Abnormal vibration at the deck slab on A1 side*
		Delamination	10					0		
		Honeycomb	10		O			3		
		Waterleaking	10				O	10	22	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10					0		
		Exposure/Corrosion of Rebars	10					0		
	Reinforced Concrete	Spalling, Scaling,Disintegration	10					0		
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10					0	0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10		O			3		
		Cracking	10					0		
		Deformation/Buckling	10		O			3		*Deformation due to impact damage at cross beams*
		Abnormal Vibrations	10					0		
		Loose Connection	10					0		
		Paint Peel off	10					0	6	
(53) Shoe/Bearing *(Primary)*	Steel	Corrosion	10		O			3		
	Rubber	Loose Connection	10					0		
		Abnormal Displacement	10		O			3		
		Bulging/Rupture	10					0		
		Bed (Support) Damage	10					0	6	
(54) Abutments *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling,Disintegration	10					0		
		Cracking concretre	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	0	
(55) Piers *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling,Disintegration	10					0		
		Cracking concrete	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	0	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5					0		
		Exposure/Corrosion of Reinf.	5					0		
		Spalling	5					0		
		Impact Damaged	5		O			2	2	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10				O	10		
	Others	Abnormal Space/Noise	10					0		
		Difference in elevation	10					0		
		Displacement	10					0		
		Cracking/Rupture	10					0	10	
(58) Painting Cond. *(Primary)*		Discoloration	10					0		
		Rust	10					0		
		Exfoliation	10					0	0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5					0		
	Steel	Cracks	5					0		
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5					0		
	Others	Erossion	5					0		
		Scouring	5					0		
		Cracks	5					0		
		Others							0	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5					0		
	Asphalt	Pot-holes	5					0		
		Others							0	
(62) River Condition *(Secondary)*		Scouring	5					0		
		Sedimentation	5					0		
		Others							0	
(63) Total Condition Rating			540						46	

16) 2nd Magsaysay Bridge

H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(50) Deck Slab *(Primary)*	Concrete	Cracking	10					0		
		Exposure/Corrosion of Rebars	10					0		
		Scaling/Spalling	10					0		
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10					0	0	
(51) Concrete Beam/ Girder *(Primary)*	Prestressed Concrete	Cracking	10					0		
		Exposure/Corrosion of Rebars	10					0		
	Reinforced Concrete	Spalling, Scaling,Disintegration	10					0		
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10					0	0	
(52) Steel Beam/ Truss Members (Bracings, etc.) *(Primary)*		Corrosion	10					0		
		Cracking	10					0		
		Deformation/Buckling	10					0		
		Abnormal Vibrations	10					0		
		Loose Connection	10					0		
		Paint Peel off	10					0	0	
(53) Shoe/Bearing	Steel	Corrosion	10					0		
	Rubber	Loose Connection	10					0		*Abnormal Displacement of rubber bearings at abutments and nearby piers*
		Abnormal Displacement	10		O			3		
		Bulging/Rupture	10					0		
(Primary)		Bed (Support) Damage	10					0	3	
(54) Abutments *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling,Disintegration	10					0		
		Cracking concretre	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	0	
(55) Piers *(Primary)*	Concrete	Settlement	10					0		
	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling,Disintegration	10					0		
		Cracking concrete	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	0	
(56) Curb and Railing *(Secondary)*	Concrete	Cracking	5					0		
		Exposure/Corrosion of Reinf.	5					0		
		Spalling	5					0		
		Impact Damaged	5					0	0	

Bridge Member		Type of Damages/	Rating Score	Severity of Damage				Rating of damage	Accumrated Rating of damage	Remarks
Component	Material			Good 0%	Fair 30%	Poor 60%	Bad 100%			
(57) Expansion Joint *(Primary)*	Steel	Waterleaking	10		O			3		
	Others	Abnormal Space/Noise	10					0		
		Difference in elevation	10					0		
		Displacement	10					0		
		Cracking/Rupture	10					0	3	
(58) Painting Cond. *(Primary)*		Discoloration	10					0		
		Rust	10					0		
		Exfoliation	10					0	0	
(59) Drainage Pipe *(Secondary)*	PVC	Clogged	5					0		
	Steel	Cracks	5					0		
		Others							0	
(60) Slope Protection *(Secondary)*	Gabions	Settlement	5		O			2		
	Others	Erossion	5					0		
		Scouring	5					0		
		Cracks	5		O			2		
		Others							4	
(61) Approach Road *(Secondary)*	Concrete	Cracking	5				O	5		*Settlement of approach road (A2 side, about 20cm)*
	Asphalt	Pot-holes	5					0		
		Others							5	
(62) River Condition *(Secondary)*		Scouring	5					0		
		Sedimentation	5					0		
		Others							0	
(63) Total Condition Rating			540						15	

(2) Results of the First Screening

Following are the results of the first screening.

Table 12.2.1-1 Conditions of Bridges Based on Visual Inspection for `Package C

		Total Score	Slab	Superstructure	Substructure	Bearing/ Expansion	Others
1	Badiwan Bridge	15	0	0	0	**13**	2
2	Buntun Bridge	32	3	6	6	**10**	7
3	Lucban Bridge	46	6	6	6	**16**	**12**
4	Magapit Bridge	27	3	9	0	9	6
5	Sicsican Bridge	35	3	6	**13**	9	4
6	Bamban Bridge	11	0	6	3	0	2
7	1st Mandaue-Mactan Bridge	35	6	6	**13**	**10**	0
8	Marcelo Feman Bridge	19	0	0	3	**16**	0
9	Palanit Bridge	45	**29**	3	0	**13**	0
10	Jibatang Bridge	32	3	6	**12**	9	2
11	Mawo Bridge	32	**12**	**12**	0	0	8
12	Biliran Bridge	18	9	3	3	3	0
13	San Juanico Bridge	12	6	0	0	6	0
14	Liloan Bridge	33	6	**12**	9	3	3
15	Wawa Bridge	46	**22**	6	0	**16**	2
16	Macapagal Bridge(2nd Magsaysay)	15	0	0	0	6	9

(highlighted): Urgent Repair

Table 12.2.1-2 Defect Score Analysis for Each Bridge

		Slab	Superstructure	Substructure	Bearing/ Expansion	Others
1	Badiwan Bridge	Cracking Honeycomb	Rebar Exposure Honeycomb Corrosion		Water leaking Cracking/Rupture	Drainage Pipe
2	Buntun Bridge	Cracking Water leaking	Deformation Vibrations	Scouring Cracking	Displacement Water leaking	Railing Slope Protection
3	Lucban Bridge	Spalling Honeycomb Water leaking	Corrosion Paint Peel off	Spalling	Corrosion Displacement Bed (Support) Damage Abnormal Space	Railing Slope Protection
4	Magapit Bridge	Cracking	Corrosion Loose Connection Paint Peel off	Honeycomb	Displacement Water leaking	Slope Protection
5	Sicsican Bridge	Rebar Exposure Water leaking	Corrosion Vibrations Paint Peel off	Scouring Cracking	Displacement Bed (Support) Damage Water leaking	Railing
6	Bamban Bridge		Corrosion Loose Connection	Cracking		Railing
7	1st Mandaue-Mactan Bridge	Rebar Exposure Water leaking	Corrosion Cracking	Cracking Scouring Rebar Exposure	Corrosion Bed (Support) Damage Water leaking Cracking/Rupture	
8	Marcelo Feman Bridge			Cracking Honeycomb	Water leaking Cracking/Rupture	
9	Palanit Bridge	Cracking Rebar Exposure Spalling Water leaking	Corrosion Cracking Deformation		Corrosion Water leaking	Slope Protection
10	Jibatang Bridge	Spalling	Corrosion	Honeycomb Spalling	Water leaking Cracking/Rupture	Railing Slope Protection
11	Mawo Bridge	Rebar Exposure Spalling Honeycomb Water leaking	Corrosion Vibrations Paint Peel off			Railing
12	Biliran Bridge	Cracking Honeycomb Waterleaking	Corrosion Deformation	Settlement Honeycomb	Corrosion	
13	San Juanico Bridge	Cracking Honeycomb Waterleaking	Corrosion	Spalling	Water leaking	
14	Liloan Bridge	Cracking Honeycomb Waterleaking	Corrosion Loose Connection	Spalling Cracking	Corrosion Displacement	
15	Wawa Bridge	Cracking Spalling Honeycomb Waterleaking	Corrosion Deformation		Corrosion Displacement Water leaking	Railing
16	Macapagal Bridge (2nd Magsaysay)				Displacement Water leaking	Slope Protection Approach Road

Table 15.2.1-3 Global Evaluation for Bridge Seismic Performance in 1st Screening of Package C (1/6)

Evaluation Items		Max. Point	Badiwan Bridge		Buntun Bridge		Lucban Bridge	
Side /Under/ On the road view			 side view  under view  on the road view		 side view  under view  on the road view		 side view  under view  on the road view	
			L=519m, W=10.4m		L=1102m, W=9.1m		L=502m, W=8.9m	
Physical Factors (50)	Construction Age & Applied Design Specification	10	Construction Year: 2002 Seismic Design: R-Factor Based Design AASHTO LRFD Specification (2nd Edition) was applied	0	Construction Year: 1975 Seismic Design: Seismic Design Force AASHTO Standard Specification (11th Edition) was applied	6	Construction Year: 1968 Seismic Design: Seismic Design Force AASHTO Standard Specification (9th Edition) was applied	6
	Conditions of Bridge Based on Visual Inspection	30	The total bridge condition is good. However, the repair of expansion joints against water leaking, improvement of drainage system, and protection for debris flow are necessary. Rating Score: 15	0	Damages are confirmed all over the bridge. Major damages are water leaking at the overhanging, abnormal vibration at secondary steel members, water leaking at expansion joint, scouring at P4, and cracking at piers. Rating Score: 30	9	Damages are confirmed all over the bridge. Major damages are spalling at the end of deck slab, corrosion at steel members and bearings, spalling at A1, and water leaking at expantion joints. Rating Score: 46	18
	Loading Capacity	5	15ton	2	18ton	2	8ton	5
	Bridge Importance	5	Bridge is located on Marcos Highway. (Important)	3	Bridge is located on arterial road to connect south and north. (Important)	3	Bridge is located on arterial road to connect south and north. (Important)	3
Seismic Performance Factors (30)	Seating Length	10	a: Minimum Required Seating Length (AASHTO) : 42cm b: Minimum Required Seating Length (JRA) : 86cm Existing Seating Length (N) : 200cm	0	a: Minimum Required Seating Length (AASHTO) : 48cm b: Minimum Required Seating Length (JRA) : 95cm Existing Seating Length (N) : 60cm	6	a: Minimum Required Seating Length (AASHTO) : 43cm b: Minimum Required Seating Length (JRA) : 85cm Existing Seating Length (N) : 45cm	6
	Fall Prevent Apparatus	10	Both longitudinal and taransverse restrainers are provided. The bridge is continuous.	0	Neither longitudinal nor taransverse restrainers are provided. The bridge is discontinuous.	10	Neither longitudinal nor taransverse restrainers are provided. The bridge is discontinuous.	10
	Type of Bridge	10	Continuous PC box girder bridge (Partially rigid frame)	4	Simply supported steel truss bridge Simply supported steel I-girder bridge	10	Simply supported steel truss bridge Simply supported steel I-girder bridge (Partially continuous)	10
Geographical Factors (20)	Liquefaction	10	Liquefaction Potential : None	0	Liquefaction Potential : Moderate	6	Liquefaction Potential : High	10
	Soil Classification	5	AASHTO Classification : Type-II (JRA Classification : Type- Ⅰ)	2	AASHTO Classification : Type-IV (JRA Classification : Type-III)	5	AASHTO Classification : Type-III (JRA Classification : Type-II)	3
	Impact to Environment	5	"Resettlement of Building & Inhabitant" and "Traffic Disturbance" are considered for the impact to the environment. (moderate)	3	"Traffic Disturbance" is considered for the impact to the environment. (Small)	2	"Resettlement of Building & Inhabitant" and "Traffic Disturbance" are considered for the impact to the environment. (moderate)	3
Evaluation		100	The total bridge condition is good, and the seismic capacity is high. However, the repair of detected defects and continuous maintainance are necessary. Continuous Maintenance	14	Damages are confirmed all over the bridge, and the seismic capacity is low. The repair of detected defects and the seismic retrofit are necessary. The bridge is selected for the 2nd screening. Retrofitting	59	Damages are confirmed all over the bridge, and the seismic capacity is low. However, reconstruction of the bridge is already planed by DPWH. The bridge is out of the candidate for the 2nd screening. (Under the plan of Reconstruction by DPWH)	74

Table 12.2.1-4 Global Evaluation for Bridge Seismic Performance in 1st Screening of Package C (2/6)

Evaluation Items		Max. Point	Magapit Bridge		Sicsican Bridge		Bamban Bridge	
Side /Under/ On the road view			 side view  under view  on the road view		 side view  under view  on the road view		 side view  under view  on the road view	
			L=410m, W=8.9m		L=148m, W=7.4m		L=174m, W=9m	
Physical Factors (50)	Construction Age & Applied Design Specification	10	Construction Year: 1979 Seismic Design: Seismic Design Force AASHTO Standard Specification (12th Edition) was applied	6	Construction Year: 1962 Seismic Design: No Seismic Consideration AASHTO Standard Specification (8th Edition) was applied	10	Construction Year: 1998 Seismic Design: R-Factor Based Design AASHTO LRFD Specification (1st Edition) was applied	3
	Conditions of Bridge Based on Visual Inspection	30	Damages are confirmed all over the bridge. Major damages are cracking at the deck slab, corrosion at steel members, abnormal displacement at bearings, water leaking at expansion joints, and cracks at slope protection of A2. Rating Score: 27	0	Damages are confirmed all over the bridge. Major damages are rebar exposure and water leaking at the deck slab, corrosion/section loss at secondary steel members, corrosion at bearings, cracking at A1, exposure/corrosion of reinf. at the bottom of pile caps, scouring at P10, and water leaking at expansion joints. Rating Score: 30	9	The total bridge condition is good, but damages are observed at the part of the bridge. Detected damages are corrosion at the part of primary steel members, minor cracks at abutments, lack of hand hole covers at primary steel members, and lack of covers and bolts at fall-prevention cables. Rating Score: 11	0
	Loading Capacity	5	18ton	2	15ton	2	14ton	3
	Bridge Importance	5	Bridge is located on Pan-Philippine Highway. (Important)	3	Bridge is located on Pan-Philippine Highway. (Important)	3	Bridge is located on Mac Arthur Highway. (Important)	3
Seismic Performance Factors (30)	Seating Length	10	a: Minimum Required Seating Length (AASHTO) : 49cm b: Minimum Required Seating Length (JRA) : 88cm Existing Seating Length (N) : 90cm	0	a: Minimum Required Seating Length (AASHTO) : 50cm b: Minimum Required Seating Length (JRA) : 95cm Existing Seating Length (N) : 110cm	0	a: Minimum Required Seating Length (AASHTO) : 79cm b: Minimum Required Seating Length (JRA) : 158cm Existing Seating Length (N) : 260cm	0
	Fall Prevent Apparatus	10	Neither longitudinal nor taransverse restrainers are provided. The bridge is discontinuous.	10	Neither longitudinal nor taransverse restrainers are provided. The bridge is discontinuous.	10	Longitudinal restrainers are provided. However, some of their components are stolen. The bridge is discontinuous (single-span bridge).	0
	Type of Bridge	10	Simply supported steel suspension bridge Simply supported steel truss bridge Simply supported steel I-girder bridge	10	Simply supported steel truss bridge	10	Simply supported steel arch bridge (not hingeded)	10
Geographical Factors (20)	Liquefaction	10	Liquefaction Potential : Moderate	6	Liquefaction Potential : None	0	Liquefaction Potential : None	0
	Soil Classification	5	AASHTO Classification : Type-III (JRA Classification : Type-II)	3	AASHTO Classification : Type-IV (JRA Classification : Type-III)	5	AASHTO Classification : Type-III (JRA Classification : Type-II)	3
	Impact to Environment	5	"Resettlement of Building & Inhabitant" and "Traffic Disturbance" are considered for the impact to the environment. (moderate)	3	"Resettlement of Building & Inhabitant" and "Traffic Disturbance" are considered for the impact to the environment. (moderate)	3	"Resettlement of Building & Inhabitant" and "Traffic Disturbance" are considered for the impact to the environment. (moderate)	3
Evaluation		100	Damages are confirmed all over the bridge, and the seismic capacity is low. However, retrofit of the bridge is already planed by DPWH. The bridge is out of the candidate for the 2nd screening. (Under Repair Work by DPWH)	43	Damages are confirmed all over the bridge, and the seismic capacity is low. However, retrofit of the bridge is already planed by DPWH. The bridge is out of the candidate for the 2nd screening. (Under the plan of Repair work by DPWH)	52	The total bridge condition is good, and the seismic capacity is high. However, the repair of detected defects and continuous maintainance are necessary. Continuous Maintenance	25

Table 12.2.1-5 Global Evaluation for Bridge Seismic Performance in 1st Screening of Package C (3/6)

Evaluation Items		Max. Point	1st Mandaue-Mactan Bridge		Marcelo Feman Bridge		Palanit Bridge	
Side /Under/ On the road view			 side view  under view  on the road view		 side view  under view  on the road view		 side view  under view  on the road view	
			L=859m, W=9.1m		L=1237m, W=16.6m		L=150m, W=8.9m	
Physical Factors (50)	Construction Age & Applied Design Specification	10	Construction Year: 1972 Seismic Design: Seismic Design Force AASHTO Standard Specification (10th Edition) was applied	6	Construction Year: 1999 Seismic Design: R-Factor Based Design AASHTO LRFD Specification (2nd Edition) was applied	3	Construction Year: 1972 Seismic Design: Seismic Design Force AASHTO Standard Specification (10th Edition) was applied	6
	Conditions of Bridge Based on Visual Inspection	30	Damages are confirmed all over the bridge. Major damages are rebar exposure and water leaking at the deck slab, corrosion/section loss at secondary steel members, cracking at A1, exposure/corrosion of reinf. at the bottom of pile caps, and water leaking at expansion joints. Rating Score: 35	9	The total bridge condition is good. However, hanycomb and cracks at piers, cracking at pylons, and water leaking at the expantion joints need to be repaired. Rating Score: 19	0	Damages are confirmed at superstructures, bearings, and expansion joints. Major spalling, cracks, hanycomb, water leaking, and free lime are observed at the deck slab. Also, corrosion at steel members and bearings, and water leaking at expantion joints are observed. Rating Score: 45	18
	Loading Capacity	5	None	3	None	3	7ton	5
	Bridge Importance	5	Bridge is located on the road which connects Mandaue City and Lapu-lapu City. (Very Important)	5	Bridge is located on the road which connects Mandaue City and Lapu-lapu City. (Very Important)	5	Bridge is located on Pan-Philippine Highway. (Important)	3
Seismic Performance Factors (30)	Seating Length	10	a: Minimum Required Seating Length (AASHTO) : 45cm b: Minimum Required Seating Length (JRA) : 89cm Existing Seating Length (N) : 100cm	0	a: Minimum Required Seating Length (AASHTO) : 46cm b: Minimum Required Seating Length (JRA) : 90cm Existing Seating Length (N) : 90cm	6	a: Minimum Required Seating Length (AASHTO) : 48cm b: Minimum Required Seating Length (JRA) : 95cm Existing Seating Length (N) : 75cm	6
	Fall Prevent Apparatus	10	Neither longitudinal nor taransverse restrainers are provided. However, the bridge is continuous.	10	Both longitudinal and taransverse restrainers are provided. The bridge is continuous.	0	Neither longitudinal nor taransverse restrainers are provided. The bridge is discontinuous.	10
	Type of Bridge	10	Continuous steel truss bridge Continuous steel I-girder bridge (Partially simply supported)	4	Continuous PC extradosed bridge Continuous PC I-girder bridge Continuous PC box-girder bridge	4	Simply supported steel truss bridge	10
Geographical Factors (20)	Liquefaction	10	Liquefaction Potential : Low	3	Liquefaction Potential : Low	3	Liquefaction Potential : None	0
	Soil Classification	5	AASHTO Classification : Type-IV (JRA Classification : Type-III)	5	AASHTO Classification : Type-IV (JRA Classification : Type-III)	5	AASHTO Classification : Type-III (JRA Classification : Type-II)	3
	Impact to Environment	5	The bridge is located on the road under heavy traffic. Marcelo Feman Bridge doesn't have enough capasity for the detour. For the retrofit of the bridge, the impact to the environment is assumed to be large.	5	The bridge is located on the road under heavy traffic. 1st Mandaue-Mactan Bridge doesn't have enough capasity for the detour. For the retrofit of the bridge, the impact to the environment is assumed to be large.	5	"Resettlement of Building & Inhabitant" and "Traffic Disturbance" are considered for the impact to the environment. (moderate)	3
Evaluation		100	Damages are confirmed all over the bridge, and the seismic capacity is medium. The repair of detected defects and the seismic retrofit are necessary. The bridge is selected for the 2nd screening. Retrofitting	50	The total bridge condition is good, and the seismic capacity is high. However, the repair of detected defects and continuous maintainance are necessary. Especially, cracking at pylons should be repaired immediately. Continuous Maintenance	34	Damages are confirmed at superstructures, bearings, and expansion joints. The seismic capacity is medium, but the repair of detected defects and the seismic retrofit are necessary. Additionaly, reconstruction of the bridge should be considered for the improvement of the load bearing capacity. The bridge is selected for the 2nd screening. Retrofitting/Reconstruction	64

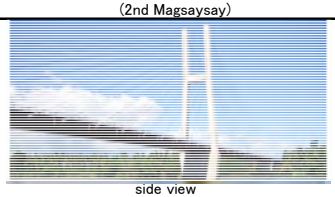
Table 12.2.1-6 Global Evaluation for Bridge Seismic Performance in 1st Screening of Package C (4/6)

Evaluation Items		Max. Point	Jibatang Bridge		Mawo Bridge		Biliran Bridge	
Side /Under/ On the road view			 side view  under view  on the road view		 side view  under view  on the road view		 side view  under view  on the road view	
			L=130m, W=8.3m		L=259m, W=8.8m		L=252m, W=8.9m	
Physical Factors (50)	Construction Age & Applied Design Specification	10	Construction Year: 1976 Seismic Design: Seismic Design Force AASHTO Standard Specification (11th Edition) was applied	6	Construction Year: 1976 Seismic Design: Seismic Design Force AASHTO Standard Specification (11th Edition) was applied	6	Construction Year: 1976 Seismic Design: Seismic Design Force AASHTO Standard Specification (11th Edition) was applied	6
	Conditions of Bridge Based on Visual Inspection	30	Damages are confirmed all over the bridge. Major damages are section loss at the end of deck slab, corrosion at steel materials, section loss at expansion joints, hanycomb at abutments & piers, spalling at piers, water leaking at expansion joints, and material loss at the slope protection. Rating Score: 32	9	Damages are confirmed at superstructures. Hanycomb, rebar exposure, and water leaking are observed at the deck slab. Also, corrosion and paint peel off at steel members, and abnormal vibration at secondary steel members are observed. Rating Score: 32	9	Damages are confirmed at superstructures. Rebar exposure, hanycomb, and water leaking are observed at the deck slab. Also, corrosion at the primary steel member and bearings, and hanycomb at piers are observed. Moreover, settlement is observed at P3. Rating Score: 18	0
	Loading Capacity	5	15ton	2	7ton	5	15ton	2
	Bridge Importance	5	Bridge is located on Pan-Philippine Highway. (Important)	3	Bridge is located on Pan-Philippine Highway. (Important)	3	Bridge is located on arterial road to connect south and north. Additionally, there's no detoure near the bridge. (Very Important)	5
Seismic Performance Factors (30)	Seating Length	10	a: Minimum Required Seating Length (AASHTO) : 40cm b: Minimum Required Seating Length (JRA) : 79cm Existing Seating Length (N) : 55cm	6	a: Minimum Required Seating Length (AASHTO) : 68cm b: Minimum Required Seating Length (JRA) : 135cm Existing Seating Length (N) : 90cm	6	a: Minimum Required Seating Length (AASHTO) : 43cm b: Minimum Required Seating Length (JRA) : 85cm Existing Seating Length (N) : 200cm	0
	Fall Prevent Apparatus	10	Neither longitudinal nor taransverse restrainers are provided. The bridge is discontinuous.	10	Neither longitudinal nor taransverse restrainers are provided. The bridge is discontinuous.	10	Longitudinal restrainers are provided at the part of the bridge. The bridge is discontinuous.	6
	Type of Bridge	10	Simply supported steel I-girder bridge	10	Simply supported steel arch bridge	10	Simply supported steel arch bridge Simply supported steel I-girder bridge	10
Geographical Factors (20)	Liquefaction	10	Liquefaction Potential : Moderate	6	Liquefaction Potential : None	0	Liquefaction Potential : None	0
	Soil Classification	5	AASHTO Classification : Type-IV (JRA Classification : Type-III)	5	AASHTO Classification : Type-II (JRA Classification : Type- Ⅰ)	2	AASHTO Classification : Type-II (JRA Classification : Type- Ⅰ)	2
	Impact to Environment	5	"Resettlement of Building & Inhabitant" and "Traffic Disturbance" are considered for the impact to the environment. (moderate)	3	"Resettlement of Building & Inhabitant" and "Traffic Disturbance" are considered for the impact to the environment. (moderate)	3	"Traffic Disturbance" and "Noise & Pollusion" are considered for the impact to the environment. Additionally, there's no detour during the repair work. (large)	5
Evaluation		100	Damages are confirmed all over the bridge, and the seismic capacity is low. The repair of detected defects and the seismic retrofit are necessary. The bridge is selected for the 2nd screening. (Under Repair Work by DPWH)	60	Damages are confirmed at superstructures, and the seismic capacity is low. The repair of detected defects and the seismic retrofit are necessary. The bridge is selected for the 2nd screening. Retrofitting	54	Damages are confirmed at superstructures, but the total condition is relatively good. Also, the seismic capacity is medium. However, DPWH requests the seismic retrofit of the bridge enphasizing the bridge importance. The bridge is selected for the 2nd screening. Retrofitting	36

Table 12.2.1-7 Global Evaluation for Bridge Seismic Performance in 1st Screening of Package C (5/6)

Evaluation Items		Max. Point	San Juanico Bridge		Lilo-an Bridge		Wawa Bridge	
Side /Under/ On the road view			 side view  under view  on the road view		 side view  under view  on the road view		 side view  under view  on the road view	
			L=2162m, W=8.9m		L=298m, W=8.9m		L=228m, W=8.9m	
Physical Factors (50)	Construction Age & Applied Design Specification	10	Construction Year: 1972 Seismic Design: Seismic Design Force AASHTO Standard Specification (10th Edition) was applied	6	Construction Year: 1979 Seismic Design: Seismic Design Force AASHTO Standard Specification (12th Edition) was applied	6	Construction Year: 1967 Seismic Design: Seismic Design Force AASHTO Standard Specification (9th Edition) was applied	6
	Conditions of Bridge Based on Visual Inspection	30	The total bridge condition is good. However, damages are conformed at superstructures and piers. Cracking, hanycomb, and water leaking are observed at the deck slab. Also, corrosion at steel members and spalling at piers are observed. Rating Score: 12	0	Damages are confirmed all over the bridge. Major damages are hanycomb and water leaking at the deck slab, water leaking at concrete girders, corrosion at primary steel members and bearings, no expansion joint at piers, major cracking at piers, and section loss at A2. Rating Score: 33	9	Damages are confirmed at superstructures, bearings, and expansion joints. Major cracking, spalling, hanycomb, water leaking, and abnormal vibration are observed at the deck slab. Also, corrosion at steel members and bearings, abnormal displacement at bearings, and water leaking at the expantion joints are observed. Rating Score: 40	18
	Loading Capacity	5	None	3	20ton	2	10ton	3
	Bridge Importance	5	Bridge is located on Pan-Philippine Highway. There's no detour near the bridge. (Very Important)	5	Bridge is located on Pan-Philippine Highway. (Important)	3	Bridge is located on Pan-Philippine Highway. The road is used for the transportation of timbers. (Very Important)	5
Seismic Performance Factors (30)	Seating Length	10	a: Minimum Required Seating Length (AASHTO) : 46cm b: Minimum Required Seating Length (JRA) : 91cm Existing Seating Length (N) : 75cm	6	a: Minimum Required Seating Length (AASHTO) : 68cm b: Minimum Required Seating Length (JRA) : 135cm Existing Seating Length (N) : 60cm	10	a: Minimum Required Seating Length (AASHTO) : 48cm b: Minimum Required Seating Length (JRA) : 95cm Existing Seating Length (N) : 45cm	10
	Fall-down Prevention Devices	10	Both longitudinal and taransverse restrainers are provided. However, the bridge is discontinuous except for the steel box-gieder range.	0	Neither longitudinal nor taransverse restrainers are provided. The bridge is discontinuous.	10	Neither longitudinal nor taransverse restrainers are provided. The bridge is discontinuous.	10
	Type of Bridge	10	Simply supported steel truss bridge Simply supported steel I-girder bridge Continuous steel box-gieder bridge	10	Simply supported steel arch bridge Simply supported steel I-girder bridge	10	Simply supported steel truss bridge Simply supported steel I-girder bridge	10
Geographical Factors (20)	Liquefaction	10	Liquefaction Potential : Low	3	Liquefaction Potential : None	0	Liquefaction Potential : None	0
	Soil Classification	5	AASHTO Classification : Type-II (JRA Classification : Type- Ⅰ)	2	AASHTO Classification : Type-II (JRA Classification : Type- Ⅰ)	2	AASHTO Classification : Type-III (JRA Classification : Type-II)	3
	Impact to Environment	5	There's no detour during the construction although traffic reguration isn't permited. For the retrofit of the bridge, the impact to the environment is assumed to be large.	5	"Resettlement of Building & Inhabitant" and "Traffic Disturbance" are considered for the impact to the environment. (moderate)	3	"Resettlement of Building & Inhabitant" and "Traffic Disturbance" are considered for the impact to the environment. (moderate)	2
Evaluation		100	The total bridge condition is good, and the seismic capacity is high. However, the repair of detected defects and continuous maintainance are necessary. Continuous Maintenance	40	Damages are confirmed at superstructures, and the seismic capacity is low. The repair of detected defects and the seismic retrofit are necessary. The bridge is selected for the 2nd screening. Retrofitting	55	Damages are confirmed all over the bridge, and the seismic capacity is low. The repair of detected defects and the seismic retrofit are necessary. Additionaly, reconstruction of the bridge should be considered for the improvement of the load bearing capacity. The bridge is selected for the 2nd screening. Retrofitting/Reconstruction	67

Table 12.2.1-8 Global Evaluation for Bridge Seismic Performance in 1st Screening of Package C (6/6)

Evaluation Items		Max. Point	Macapagal Bridge (2nd Magsaysay)			
Side /Under/ On the road view			 side view  under view  on the road view			
			L=882m, W=9.6m			
Physical Factors (50)	Construction Age & Applied Design Specification	10	Construction Year: 2007 Seismic Design: R-Factor Based Design AASHTO LRFD Specification (3rd Edition) was applied	0		
	Conditions of Bridge Based on Visual Inspection	30	The total bridge condition is good. Major damages are conformed on A2 side. Cracking due to sttelement is observed at A2 slope protection. Also, settlement of approach road is observed on A2 side. Rating Score: 15	0		
	Loading Capacity	5	None	3		
	Bridge Importance	5	Bridge is located on Pan-Philippine Highway. The road is used for the transportation of timbers. (Very Important)	5		
Seismic Performance Factors (30)	Seating Length	10	a: Minimum Required Seating Length (AASHTO) : 47cm b: Minimum Required Seating Length (JRA) : 93cm Existing Seating Length (N) : 85cm	6		
	Fall Prevent Apparatus	10	Both longitudinal and taransverse restrainers are provided. The bridge is continuous.	0		
	Type of Bridge	10	Continuous steel cabled stayed bridge Continuous steel I-girder bridge RCIG	4		
Geographical Factors (20)	Liquefaction	10	Liquefaction Potential : High	10		
	Soil Classification	5	AASHTO Classification : Type-IV (JRA Classification : Type-III)	5		
	Impact to Environment	5	"Traffic Disturbance" is considered for the impact to the environment. (Small)	2		
Evaluation		100	The total bridge condition is good, and the seismic capacity is high. However, the repair of detected defects and continuous maintainance are necessary. Especially, the approach road damage due to the settlement should be repaired immediately. Continuous Maintenance	35		

12.2.2 Selection of Target Bridges for the Second Screening

The result of the First Screening for Package C is summarized in Table 12.2.2-2 (see next page). Out of 16 rated bridges shown in Table 12.2.2-2, the following 11 bridges are selected for checking seismic performance in Package C (see Table 12.2.2-1).

First of all, Lucban Bridge, Jibatang Bridge, Sicsican Bridge, and Magapit Bridge are excluded from the candidates for the Second Screening because they are already under the DPWH plan for either reconstruction or retrofitting.

Wawa Bridge and Palanit Bridge are also selected for the Second Screening in consideration of the seismic vulnerability improvement by seismic retrofit or reconstruction. Reconstruction of those bridges should be considered for the improvement of the load bearing capacity besides the seismic capacity.

Buntun Bridge, Liloan Bridge, Mawo Bridege, 1st Mandaue-Mactan Bridge, and Bililan Bridge are selected for the Second Screening in consideration of the seismic vulnerability improvement by seismic retrofit. Bililan Bridge is selected prioritizing the bridge importance due to its function although the evaluated score is relatively lower than other selected bridges.

Table 12.2.2-1 Selected Bridges for Checking Seismic Performance in Package C

Rank	Name of Bridge	Score	Recommended Rehabilitation Method
1	Lucban Bridge	74	(Under the plan of Reconstruction by DPWH)
2	Wawa Bridge	67	Retrofitting/Reconstruction
3	Palanit Bridge	64	Retrofitting/Reconstruction
4	Jibatang Bridge	60	(Under Repair Work by DPWH)
5	Buntun Bridge	59	Retrofitting
6	Liloan Bridge	55	Retrofitting
7	Mawo Bridge	54	Retrofitting
8	Sicsican Bridge	52	(Under the plan of Retofitting by DPWH)
9	1st Mandaue-Mactan Bridge	50	Retrofitting
10	Magapit Bridge	43	(Under Repair Work by DPWH)
12	Biliran Bridge	36	Retrofitting

Table 12.2.2-2 Results of Rating Analysis in the First Screening

No.	Name of Bridge	Physical Factors (50)				Seismic Performance Factors (30)			Geographical Factors (20)			Total Rating	Recommended Method
		Construction Age & Applied Design Specification	Conditions of Bridge Based on Visual Inspection	Loading Capacity	Bridge Importance	Seating Length	Fall Prevent Apparatus	Type of Bridge	Liquefaction	Soil Classification	Impact to Environment		
		(10)	(30)	(5)	(5)	(10)	(10)	(10)	(10)	(5)	(5)	(100)	
1	Badiwan Bridge	0	0	2	3	0	0	4	0	2	3	14	Continuous Maintenance
2	Buntun Bridge	6	9	2	3	6	10	10	6	5	2	59	Retrofitting
3	Lucban Bridge	6	18	5	3	6	10	10	10	3	3	74	(Under the plan of Reconstruction by DPWH)
4	Magapit Bridge	6	0	2	3	0	10	10	6	3	3	43	(Under Repair Work by DPWH)
5	Sicsican Bridge	10	9	2	3	0	10	10	0	5	3	52	(Under the plan of Repair work by DPWH)
6	Bamban Bridge	3	0	3	3	0	0	10	0	3	3	25	Continuous Maintenance
7	1st Mandaue-Mactan Bridge	6	9	3	5	0	10	4	3	5	5	50	Retrofitting
8	Marcelo Feman Bridge	3	0	3	5	6	0	4	3	5	5	34	Continuous Maintenance
9	Palanit Bridge	6	18	5	3	6	10	10	0	3	3	64	Retrofitting/Reconstruction
10	Jibatang Bridge	6	9	2	3	6	10	10	6	5	3	60	(Under Repair Work by DPWH)
11	Mawo Bridge	6	9	5	3	6	10	10	0	2	3	54	Retrofitting
12	Biliran Bridge	6	0	2	5	0	6	10	0	2	5	36	Retrofitting
13	San Juanico Bridge	6	0	3	5	6	0	10	3	2	5	40	Continuous Maintenance
14	Lilo-an Bridge	6	9	2	3	10	10	10	0	2	3	55	Retrofitting
15	Wawa Bridge	6	18	3	5	10	10	10	0	3	2	67	Retrofitting/Reconstruction
16	Macapagal Bridge (2nd Magsaysay)	0	0	3	5	6	0	4	10	5	2	35	Continuous Maintenance

: Candidates for the Second Screening

: Excluded from the Second Screening

CHAPTER 13 THE SECOND SCREENING

13.1 Evaluation of the Second Screening for Package B

This section summarizes 2nd screening result of Package B (selection of objective bridges inside Metro Manila for outline design). The evaluation results are explained with the following two steps.

1) Evaluation of current bridge & bridge site conditions

   Bridge condition, traffic condition, and socio-environmental condition are summarized for 5 objective bridges, based on the inspection results obtained in this project.

2) Comparative study on improvement measure schemes (replacement or seismic retrofit)

   Comparative study on two alternative improvement measure schemes (replacement or seismic retrofit) is conducted for the objective 5 bridges. As a result of the study, either replacement or seismic retrofit is recommended for each bridge. The selection of the improvement measure schemes is done in accordance with the following rule which is conventionally applied in the Philippines.

   - Recommendation of replacement: if cost of seismic retrofit plan including repair works is over or equal to 60 % of that of replacement plan, replacement is recommendable.
   - Recommendation of seismic retrofit: other than the above case, seismic retrofit cost is recommendable.

13.1.1 Results of the Second Screening

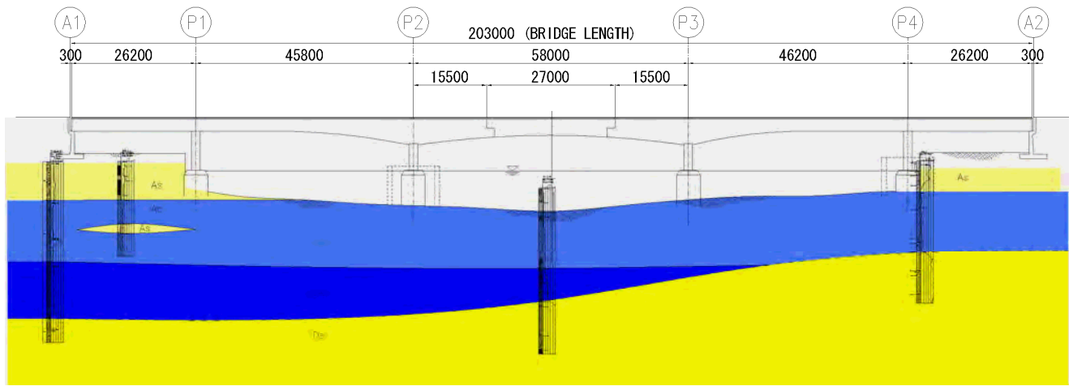
(1) Delpan Bridge

1) Current Bridge Condition

Bridge length/width	L=202.9m, W=20.52m
Year Built	1965 (1988)
Bridge Type	PCBG (PC Box Girder) PCDG (PC Deck Girder)

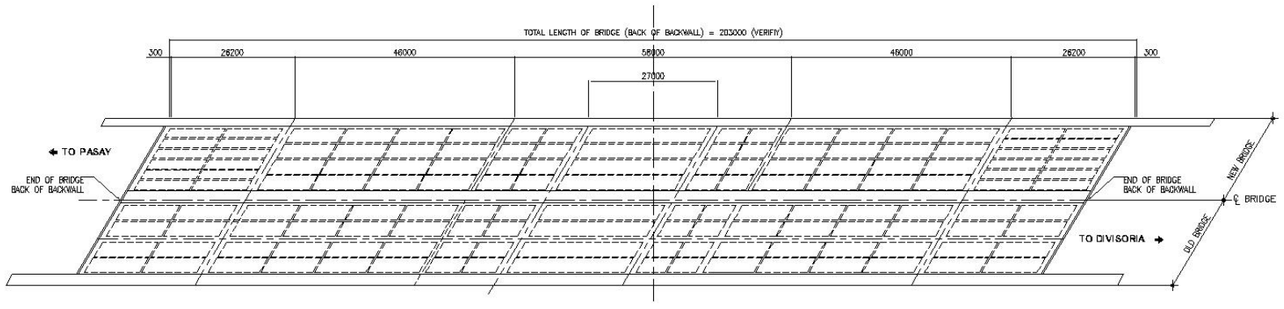
Traffic Load Regulation	20 tons
Soil Profile Type (JRA)	Left Bank: Type III, Right Bank: Type II
Liquefaction Potential	Very High
As Built Drawing	None

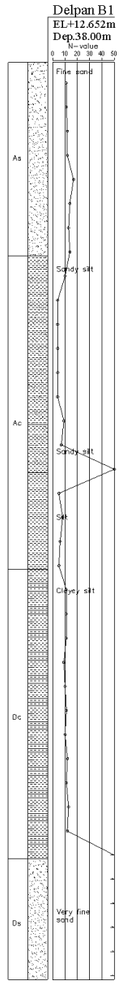
Profile



Note: Existing foundation structures are assumed (unknown).

Plan





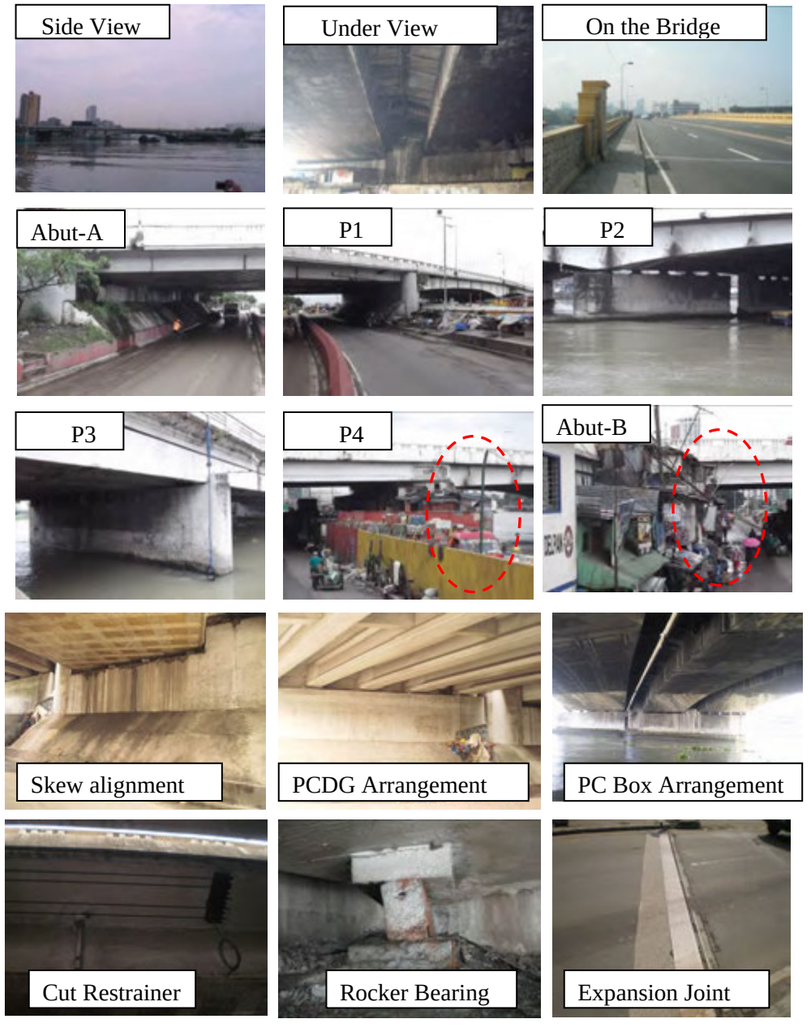
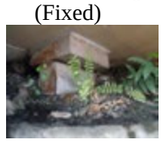


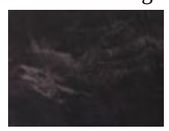
Figure 13.1.1-1 Current Bridge Condition of Delpan Bridge

2) Bridge Condition

Seismic Vulnerability

Items		Results of Surveys	Analyses/Comments
Earthquake Resisting System	1. Difference in soil types between adjacent piers	Soil Types - Left bank: Type III - Right bank: Type II	- Soil type difference among Pier-2 & 3 & 4 (Soil type: II or III)
	2. Continuous or Simply Supported Bridge	Center span & end spans are simply supported Note: Center spans: Simply supported with two gerber hinges	- Possibility of unseating at center spans & end spans due to simply supported structures
	3. Eccentric Loads (longitudinal and transverse dir.)	Maximum span ratio: (2^{nd} span length): (3^{rd} span length) =1.0:1.3	- The span ratio is between 1.0 and 1.5. - Possibility of eccentric loads in both directions
	4. Pier Type (single column/wall or multiple columns)	Wall type piers: piers of up-lanes and down-lines are structurally separated.	- Single column/wall type is less advantageous than multiple column type against earthquakes in terms of structural redundancy.
	5. Height of Abutment (Embankment)	Height of Embankments - Abut-A: 3m - Abut-B: 3m	- Height of embankments is below 5m. - Lower risk of abutments' collapse under earthquake
	6. Built Year	1965 (Constructed before 1992)	- Possibility of confinement loss of pier walls - Lack of seismic capacities of all the members
Unseating/ Fall-down Prevention System	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	- Longitudinal dir.: Restrainers (Some of them are broken.) - Transverse dir.: Shear keys	- Possibility of unseating due to insufficient seismic restrainers for the longitudinal direction
	8. Bearing	1. Steel bearing (Fixed)  2. Plate support type (Fixed or movable)  3. Pin type (Hinge) 	1. Steel bearings at abutments - Condition: Corroded 2. Steel bearing (Plate support type) at piers - Condition: Good 3. Steel bearing (pin type) at piers - Condition: Good - Possibility of unseating at abutments due to corroded bearings - Overall vulnerability: Moderate
	9. Seat Length	1. Abut-A: 85cm Minimum Required Seat Length - JRA: 98cm , AASHTO: 55cm 2. Pier-2: 56cm Minimum Required Seat Length - JRA: 95cm , AASHTO: 53cm	- The seat lengths of abutments & piers don't satisfy JRA's minimum required seat length. - Possibility of unseating at piers due to the short seat length
Foundation	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure
	11. Scouring	Moderate scouring at Pier-5	- Stability reduction of Pier-5 under earthquake due to the scouring
	12. Soil Type	Soil type (JRA): III	- Firm ground condition
	13. Liquefaction Potential	- Liquefiable layer type: Sand/Fine sand - N-Value range of the layer: 4-14 Ave. 8	- Very high liquefaction potential
Seismic Hazard	14. Distance from Active Faults	- Distance: 11.1km - Active Fault Name: Marikina Valley Fault	- The distance is over 10km. - Small effect of the active fault movement

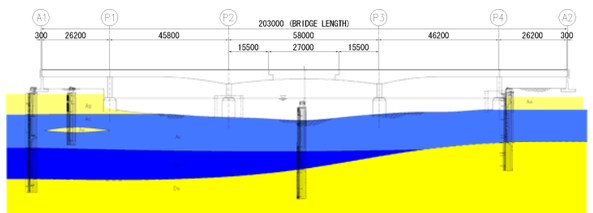
Structural Soundness

Items		Results of Surveys	Analyses/Comments
Superstructures	1. Primary Members	PC girders 	- Cracks on the entire bottom face of box girders - Deterioration of concrete surface due to water leaking from expansion joints and drain pipes. - Overall damage degree: Moderate
	2. Secondary Members	Expansion joint  Sidewalk 	- Deterioration of expansion - Major cracking on sidewalks - Overall damage degree: Moderate
	3. Deck Slab	1. Cracking  2. Water leaking 	- Cracking at half area of the bottom face of deck slab (Crack width range: 0.3mm) - Water leaking at parts of deck slabs - Overall damage degree: Moderate
Substructures	4. Deterioration of Columns/ Walls	Cracking 	- Cracking at piers - Overall damage degree: Moderate

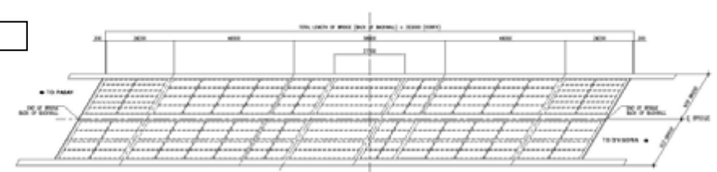
Summary of Structural Deficiencies

1. Seismic Vulnerability
   - Vulnerability of pier columns/walls to large scale earthquakes (confinement loss)
   - Vulnerability of foundations to large scale earthquakes (liquefaction potential, unknown structure, scouring)
   - High possibility of unseating (simply supported at center spans & end spans, insufficient seismic restrainers, short seat length, corroded bearings & seismically vulnerable bearing type)
2. Structural Soundness (Superstructures)
   - Cracking at PC girders
   - Deterioration of the deck slab (cracking)
   - Water leaking at expansion joints
3. Structural Soundness (Substructures)
   - Minor cracking at piers

Profile



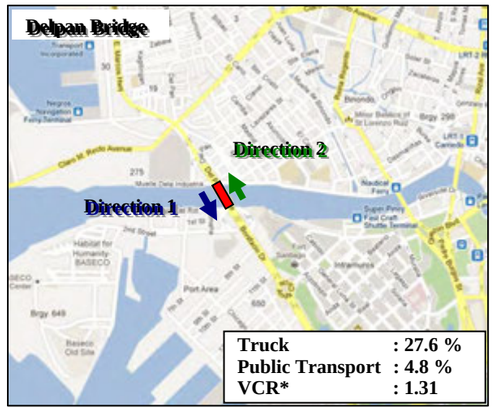
Plan



3) Traffic Conditions

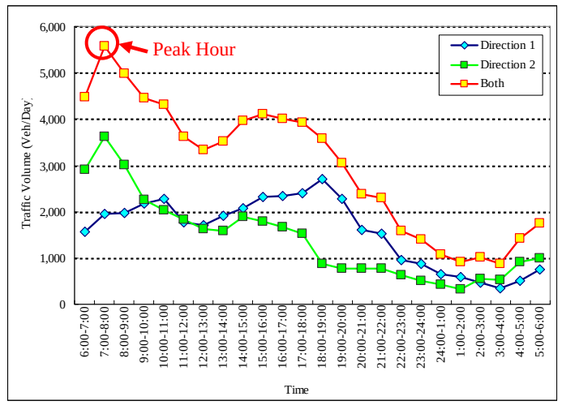
a) Traffic Volume

Daily and hourly traffic volume is shown in Figure 13.1.1-2, Figure 13.1.1-3 and Table 13.1.1-1.



* Analysis by AADT traffic volume
* VCR: Volume/Capacity Ratio

Figure 13.1.1-2 Location of Delpan Bridge



*Day 1 hourly traffic volume

Figure 13.1.1-3 Hourly Traffic Volume

Table 13.1.1-1 Daily Traffic Volume

Unit: Veh/Day

	Motorcycle / Tricycle	Car / Taxi / Pick-up / Van	Jeepney	Large Bus	2-Axle Truck	3-Axle Truck	Truck trailer	Sub-Total	Total
Day 1	27,175	31,835	2,065	33	2,340	1,581	6,595	44,449	71,624
Day 2	22,636	24,662	1,833	39	2,151	1,637	8,719	39,041	61,677
AADT	24,906	28,249	1,949	36	2,246	1,609	7,657	41,745	66,651

* Sub-total: Not including Motorcycle and Tricycle

b) Level-of-Service (LOS)

LOS is based on the traffic assumptions which are peak hour, road type, free flow speed and number of lanes.

Table 13.1.1-2 Assumption and LOS

LOS: E	Peak Hour Traffic Volume	5,566 Veh/hour
	Road Type	Urban Road
	Free Flow Speed (km/h)	60 km/h
	No. of Lanes	6 lanes

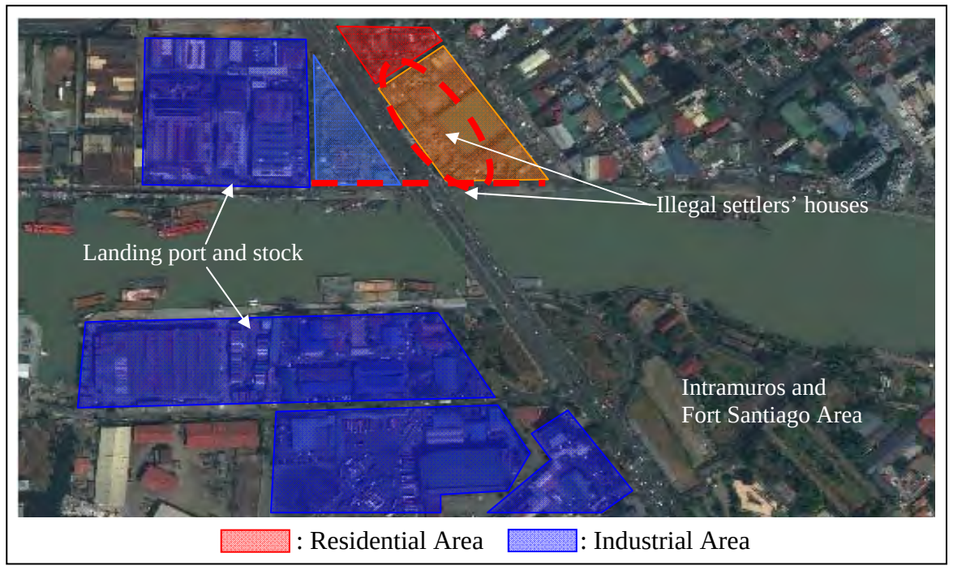
* Highway Capacity Manual, 2010

c) Traffic Condition

Analyses of the observed traffic volume condition and LOS are as follows:

- This is the first among many bridges that spans the Pasig River. It connects the Tondo/Binondo/North Harbor area to the Manila City proper. Figure 13.1.1-3 shows the hourly traffic volume by direction, for direction 1, the observed peak time in the evening is from 6 PM to 7 PM, for direction 2, the observed peak time in the morning is from 7 AM to 8 AM.
- No. of lanes is 6 lanes, AADT is 66,651 veh/day, traffic congestion occurred on this bridge in the morning.
- Public transport ratio is 4.8%. Truck ratio is 27.6% (11,509). Trucks and trailers utilize this bridge to go to Manila port (north and south port). And, the reason that congestion is stirred on this bridge, is because the trucks are waiting on this bridge to entry port,
- Peak hour traffic volume is 5,566 veh/hour. LOS is E because of peak hour traffic volume is very high and there is no available detour road for trucks and trailers.

4) Socio-Environmental Assessment Conditions



Household and Structures (Area facing the Bridge and the approach road)
- There are many informal settlers' houses along the approach road and crossing road on north side. - The number of informal settlers is about 300. And 55 informal settlers with number of PAPs over 200 are under the Bridge. Some informal settlers were already resettled on the south side of the Bridge.
Land use (Area facing the Bridge and the approach road)
- Bridge area is used for store, houses, factories and landing ports.
Existing Environmental Condition (Noise, Vibration, Air Pollution and Water contamination.)
- Environmental condition is very bad for the pollution brought about by the traffic flow such as noise, vibration and air pollution.
Environmental Protection Area (national park, reserves and designated wet land)
- The Bridge is not located in a cultural property or a natural reserve area.
Existence on Location Map of Valuable Ecological Habitats, Historical and Cultural Assets
- The Bridge is not located in Historical and Cultural area, but about 300 meter s to south-east is Intramuros and Santiago Fort Area.

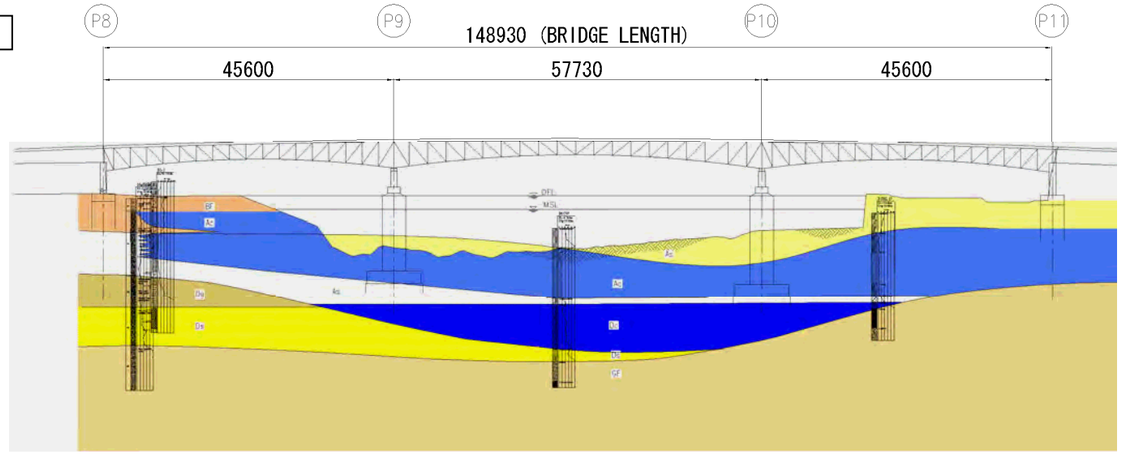
(2) Nagtahan Bridge

1) Current Bridge Condition

Bridge length/width	L=202.9m, W=20.52m
Year Built	1965 (1988)
Bridge Type	CBG (Concrete Box Girder) PCDG (PC Deck Girder)

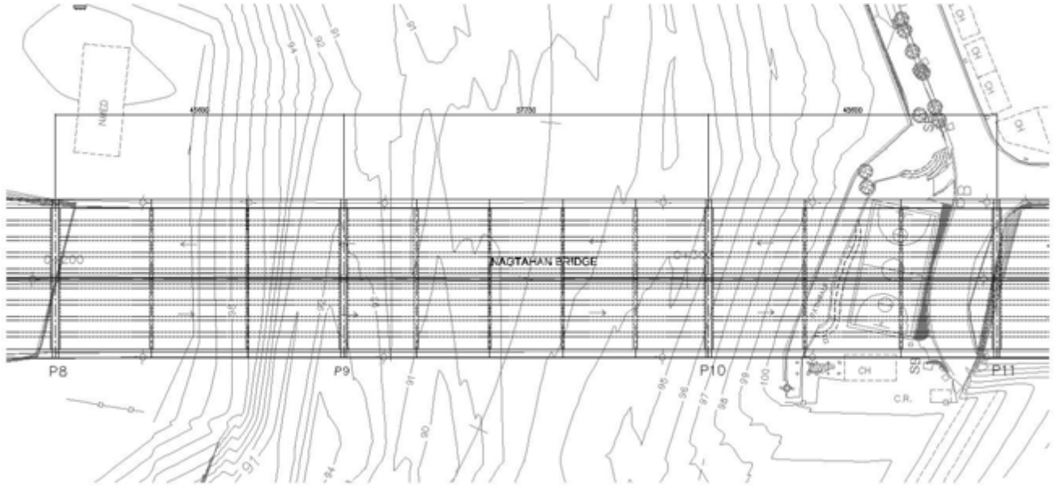
Traffic Load Regulation	20 tons
Soil Profile Type (JRA)	Left Bank: Type II, Right Bank: Type II
Liquefaction Potential	High
As Built Drawing	None

Profile



Note: Existing foundation structures are assumed (unknown).

Plan



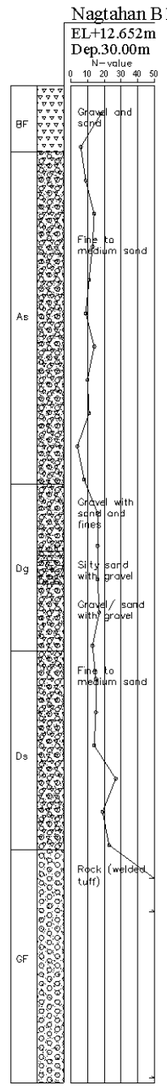
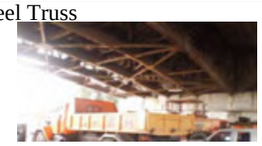


Figure 13.1.1-4 Current Bridge Condition of Nagtahan Bridge

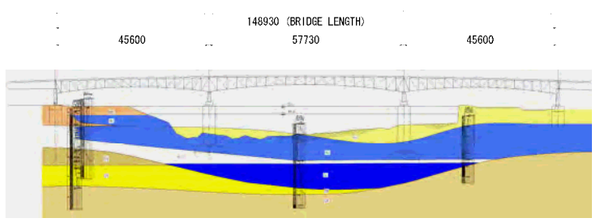
2) Bridge Condition

Seismic Vulnerability			
Items		Results of Surveys	Analyses/Comments
Earthquake Resisting System	1. Difference in soil types between adjacent piers	Soil Type is consistent along with the entire bridge	- No soil type difference between adjacent piers
	2. Continuous or Simply Supported Bridge	Main Spans: Continuous bridge.	- Continuous structure is advantageous against large earthquakes.
	3. Eccentric Loads (longitudinal and transverse dir.)	Maximum span ratio: (1^{st} span length): (4^{th} span length) =1.0:1.3	- The span ratio is between 1.0 and 1.5. - Possibility of eccentric loads in both directions
	4. Pier Type (single column/wall or multiple columns)	Wide wall type	- Single column/wall type is less advantageous than multiple column type against earthquakes in terms of structural redundancy.
	5. Height of Abutment (Embankment)	Height of Embankments - Abutment A: 3m - Abutment B: 3m	- Height of embankments is below 5m. - Lower risk of abutments' collapse under earthquake
	6. Built Year	1966 (Constructed before 1992)	- Possibility of confinement loss of pier columns/walls - Lack of seismic capacities of all the members
Unseating/ Fall-down Prevention System	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	- Longitudinal dir.: Restrainers at Pier-8 & 11; insufficiently installed - Transverse dir.: Shear keys	- Possibility of unseating due to insufficient seismic restrainers for the longitudinal direction
	8. Bearing	1. Steel bearing (Movable or Fixed) 2. Roller type (Fixed)  3. Repaired steel bearing (Fixed) 	1. Steel bearing at abutments - Condition: Not functional without bolts 2. Steel bearing (Fixed) at piers - Condition: Anchor bolt is missing. 3. Repaired steel bearing (Fixed) at piers - Condition: Inappropriately repaired - Possibility of unseating at all the piers due to corroded bearings - Overall vulnerability: Serious
	9. Seat Length	Pier 8 &11: 100cm Minimum Required Seat Length - JRA: 92cm , AASHTO: 52cm	- The seat lengths of piers satisfy JRA's minimum required seat length.
Foundation	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure
	11. Scouring	Potential of deep scouring at Pier-9 & 10	- Stability reduction of Pier-9 & 10 under earthquake due to the scouring
	12. Soil Type	Soil type (JRA): II	- Moderate ground condition
	13. Liquefaction Potential	- Liquefiable layer type: Sand - N-Value range of the layer: 4-17 Ave. 13	- High liquefaction potential
Seismic Hazard	14. Distance from Active Faults	- Distance: 7.5km - Active Fault Name: Marikina Valley Fault	- The distance is between 5.0km and 10km. - Moderate effect of the active fault movement

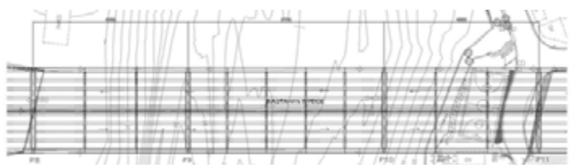
Structural Soundness			
Items		Results of Surveys	Analyses/Comments
Superstructures	1. Primary Members	Steel Truss 	- Paint deterioration on entire steel truss members - Overall damage degree: Moderate
	2. Secondary Members	Steel Truss 	- Paint deterioration on entire steel truss members - Overall damage degree: Moderate
	3. Deck Slab	1. Cracking  2. Water leaking 	- Cracking at the bottom of the deck slab through the entire bridge (Crack width range: 0.1-0.2mm) - Water leaking at the joint of two deck slabs - Overall damage degree: Moderate
Substructures	4. Deterioration of Columns/ Walls	Secton loss & rebar exposure. 	- Section loss & rebar exposure at pier columns due to deterioration - Overall damage degree: Moderate

Summary of Structural Deficiencies
1. Seismic Vulnerability - Vulnerability of pier columns/walls to large scale earthquakes (confinement loss, deterioration) - Vulnerability of foundations to large scale earthquakes (liquefaction potential, unknown structure, deep scouring) - High possibility of unseating (insufficient seismic restrainers, corroded bearings) 2. Structural Soundness (Superstructures) - Cracks at the bottom of deck slab through the entire bridge - Water leaking at the joint of deck slabs 3. Structural Soundness (Substructures) - Section loss & rebar exposure at pier columns

Profile



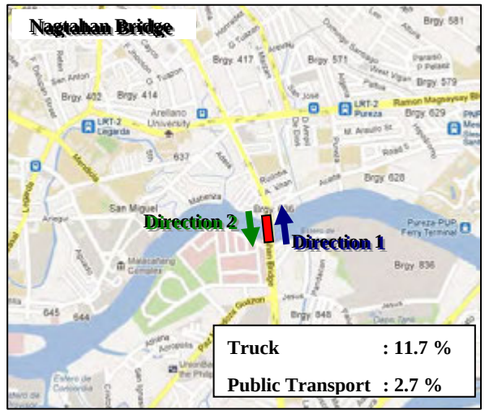
Plan



3) Traffic Conditions

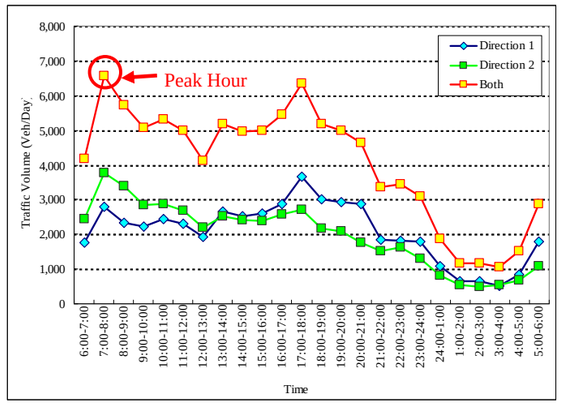
a) Traffic Volume

Daily and hourly traffic volume is shown in Figure 13.1.1-5, Figure 13.1.1-6 and Table 13.1.1-3.



* Analysis by AADT traffic volume
* VCR: Volume/Capacity Ratio

Figure 13.1.1-5 Location of Nagtahan Bridge



*Day 1 hourly traffic volume

Figure 13.1.1-6 Hourly Traffic Volume

Table 13.1.1-3 Daily Traffic Volume

Unit: Veh/Day

	Motorcycle / Tricycle	Car / Taxi / Pick-up / Van	Jeepney	Large Bus	2-Axle Truck	3-Axle Truck	Truck trailer	Sub-Total	Total
Day 1	23,150	63,932	1,748	350	4,252	1,979	1,859	74,120	97,270
Day 2	19,114	64,988	1,561	337	5,734	2,084	1,787	76,491	95,605
AADT	21,132	64,460	1,655	344	4,993	2,032	1,823	75,306	96,438

* Sub-total: Not including Motorcycles and Tricycles

b) Level-of-Service (hereafter called as LOS)

LOS is based on the traffic assumptions which are peak hour, road type, free flow speed and number of lanes.

Table 13.1.1-4 Assumption and LOS

LOS: F	Peak Hour Traffic Volume	6,566 Veh/hour
	Road Type	Urban Road
	Free Flow Speed (km/h)	60 km/h
	No. of Lanes	6 lanes

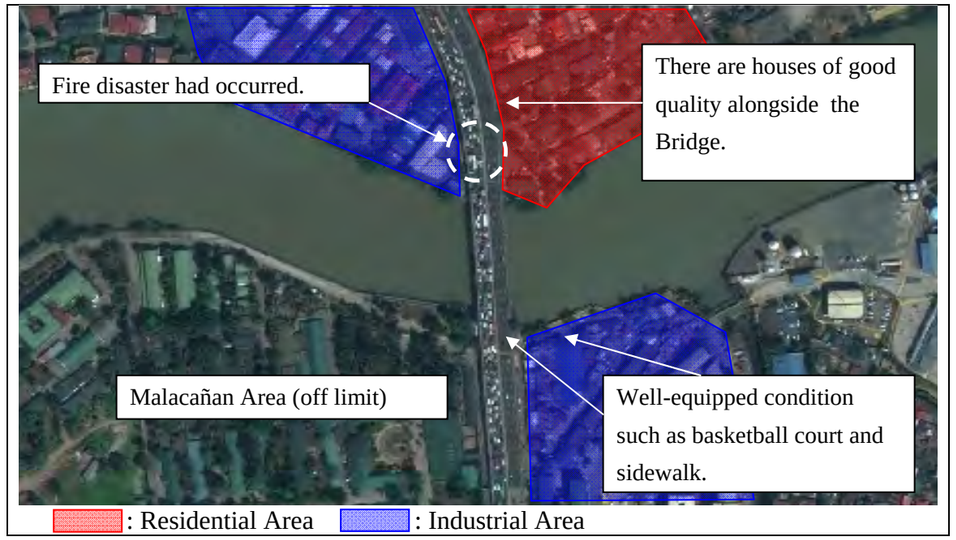
* Highway Capacity Manual, 2010

c) Traffic Condition

Analyses of the observed traffic volume condition and LOS are as follows:

- This bridge connects Sampaloc and Pandacan (North and South of Manila City). Figure 13.1.1-6 shows the hourly traffic volume by direction, for direction 1 , the observed peak time is in the evening from 5 PM to 6 PM, for direction 2, the observed peak time is in the morning from 7 AM to 8 AM.
- No. of lanes is 6 lanes, AADT is 96,438 veh/day, traffic congestion occurred on this bridge both in the morning and in the evening.
- Public transport ratio is 2.7%. Truck ratio is 11.7%.Trucks and trailers are utilising this bridge to go to Manila port (north and south port). And, the reason that large trucks and trailers cannot pass to Roxas Blvd, they must pass to Quirino Ave.
- Peak hour traffic volume is 6,566 veh/hour, LOS is F because of peak hour traffic volume is very high.

4) Socio-Environmental Assessment Conditions



Households and Structures (Area facing the Bridge and the approach road)
- There are many informal settlers including various shops alongside the Bridge. - Fire disaster occurred on 13th July 2012, after the accident some of informal settlers moved to other places, but 19 families with 89 PAPs still remain under the Bridge.
Land use (Area facing the Bridge and the approach road)
- Surrounding area of the Bridge is used for residential, business and industrial purposes. People on north side live a high quality life with large-size TV and PC. On south side along the river are well-maintained sidewalk and community facility such as basketball court. - Some area under the viaduct on the south side is used for army facilities and car parking. South-west area of the Bridge is closed as a restricted Malacañan Area.
Existing Environmental Condition (Noise, Vibration, Air Pollution and Water contamination.)
- Environmental condition is bad brought about by pollution of traffic flow such as noise, vibration and air pollution.
Environmental Protection Area (national park, reserves and designated wet land)
- The Bridge is not located in cultural property or natural reserve area.
Existence on Location Map of Valuable Ecological Habitats, Historical and Cultural Assets
- South-west area of the Bridge is designated as Malacañan Area.

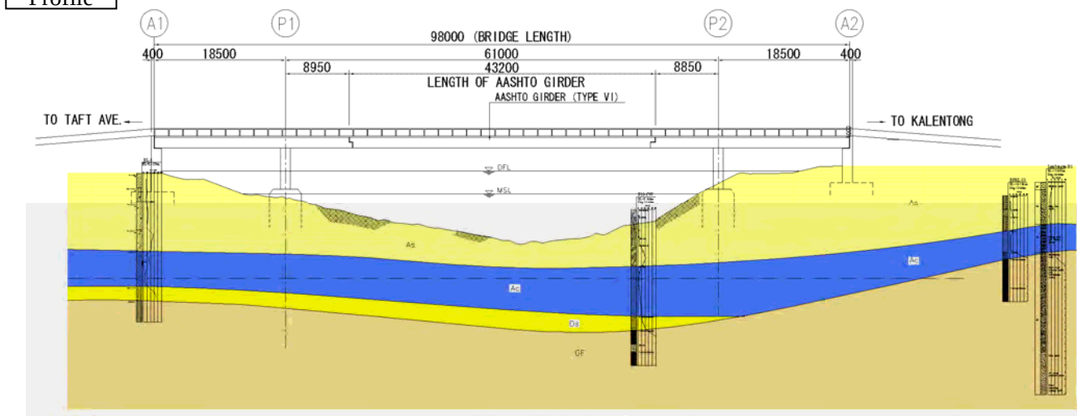
(3) Lambingan Bridge

1) Current Bridge Condition

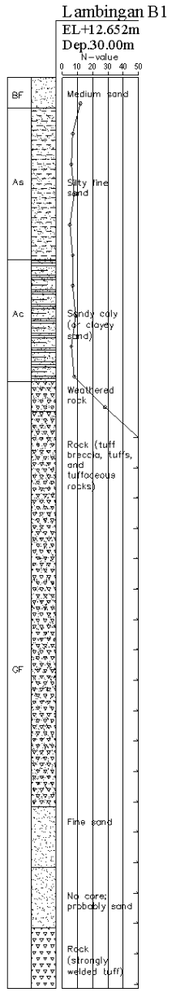
Bridge length/width	L=98.1m, W=24m
Year Built	1979
Bridge Type	PCDG (PC Deck Girder) with Gerber Hinge

Traffic Load Regulation	15 tons
Soil Profile Type (JRA)	Left Bank: Type II, Right Bank: Type II
Liquefaction Potential	High
As Built Drawing	None

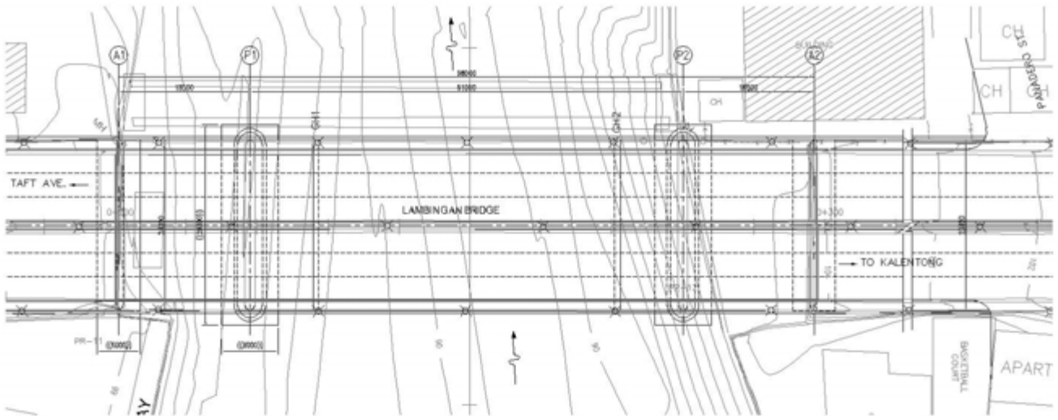
Profile



Note: Existing foundation structures are assumed (unknown).



Plan

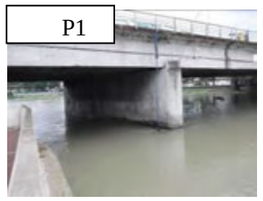


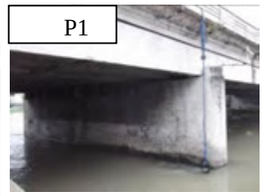

Side View


Under View


On the Bridge

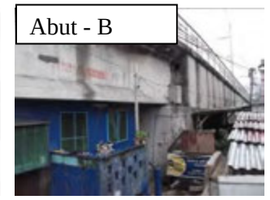

Abut-A


P1


P1


P2


P2


Abut - B


Detail of Gerber Hinge


Detail of Gerber Hinge


Detail of Gerber Hinge


Broken Concrete due to uplift


Stolen Vertical Restrainer


Collision of Vessel

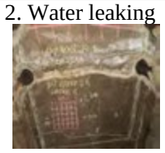
Figure 13.1.1-7 Current Bridge Condition of Lambingan Bridge

2) Bridge Condition (Lambingan Bridge)

Seismic Vulnerability

Items		Results of Surveys	Analyses/Comments
Earthquake Resisting System	1. Difference in soil types between adjacent piers	Soil Type is consistent along with the entire bridge	- No soil type difference between adjacent piers
	2. Continuous or Simply Supported Bridge	Center Spans: Simply supported with two gerber hinges	- Possibility of unseating at center spans due to simply supported structures with gerber hinges
	3. Eccentric Loads (longitudinal and transverse dir.)	Maximum span ratio: (1^{st} span length): (2^{nd} span length) =1.0:3.3	- The span ratio is over 1.5. - Possibility of uplift at both abutments due to unbalanced span arrangement.
	4. Pier Type (single column/wall or multiple columns)	Wall type	- Single column/wall type is less advantageous than multiple column type against earthquakes in terms of structural redundancy.
	5. Height of Abutment (Embankment)	Height of Embankments - Abut-A: 5m - Abut-B: 5m	- Height of embankments is below 5m. - Lower risk of abutments' collapse under earthquake
	6. Built Year	1975 (Constructed before 1992)	- Possibility of confinement loss of pier columns/walls - Lack of seismic capacities of all the members
Unseating/ Fall-down Prevention System	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	- Longitudinal dir.: No restrainer - Transverse dir.: Shear keys (damaged)	- Possibility of unseating due to non-existence of seismic restrainers for the longitudinal direction - Possibility of unseating due to insufficient seismic restrainers for transverse direction
	8. Bearing	1. Rubber Pad (Moveable)  2. Rubber Pad (Gerber Hinge)  3. Rubber Pad (Fixed) 	1. Rubber pad (Movable) at abutments - Condition: Severely deteriorated 2. Rubber pad (Gerber hinge) - Condition: Deteriorated 3. Rubber pad (Fixed) at piers - Condition: Deteriorated - Possibility of unseating at abutments & gerber hinge supports due to corroded bearings - Overall vulnerability: Serious
	9. Seat Length	1. Abut-A: 85cm Minimum Required Seat Length - JRA: 92cm , AASHTO: 52cm 2. Pier-2: 50cm Minimum Required Seat Length - JRA: 92cm , AASHTO: 52cm	- The seat lengths of abutments don't satisfy JRA's minimum required seat length. - The seat lengths of piers don't satisfy AASHTO's minimum required seat length. - Possibility of unseating due to the very short seat length
Foundation	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure
	11. Scouring	Moderate scouring at Pier-2	- Stability reduction of Pier-2 under earthquake due to the scouring
	12. Soil Type	Soil type (JRA): II	- Moderate ground condition
	13. Liquefaction Potential	- Liquefiable layer type: Sand - N-Value range of the layer: 6-21, Ave.11	- High liquefaction potential
Seismic Hazard	14. Distance from Active Faults	- Distance: 5.3km - Active Fault Name: Marikina Valley Fault	- The distance is between 5 and 10km. - Moderate effect of the active fault movement

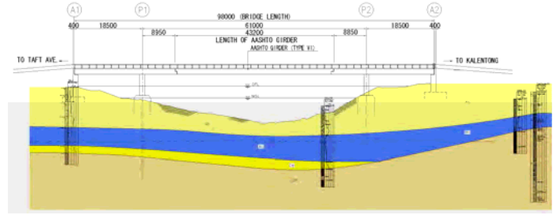
Structural Soundness

Items		Results of Surveys	Analyses/Comments
Superstructures	1. Primary Members	PC girders with gerber hinges  	- Large deflection of PC girders at the center span - Uplift at the side spans - Major cracking at bottom face of girders due to collision of vessels - Overall damage degree: Serious
	2. Secondary Members	RC Side Block 	- Section loss of RC side blocks - Overall damage degree: Moderate
	3. Deck Slab	1. Cracking  2. Water leaking 	- Cracking at nearly half of the bottom face of deck slab (Crack width range: over 0.5mm) - Water leaking at around the cracking - Overall damage degree: Moderate
Substructures	4. Deterioration of Columns/ Walls	Cracking & Scaling/Spalling. 	- Minor cracking & scaling/spalling at piers - Overall damage degree: Moderate

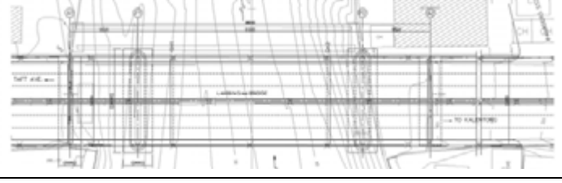
Summary of Structural Deficiencies

1. Seismic Vulnerability
   - Vulnerability of pier columns/walls to large scale earthquakes (confinement loss)
   - Vulnerability of foundations to large scale earthquakes (liquefaction potential, unknown structure, scouring)
   - High possibility of unseating (simply supported at gerber hinges, insufficient seismic restrainers, very short seat length, corroded bearings)
2. Structural Soundness (Superstructures)
   - Large deflection of PC girders at the center span
   - Uplift at the side spans
   - Section loss of RC side blocks
   - Major cracking at bottom face of girders
   - Cracking & water leaking at the bottom face of deck slab
3. Structural Soundness (Substructures)
   - Minor cracking & scaling/spalling at piers

Profile



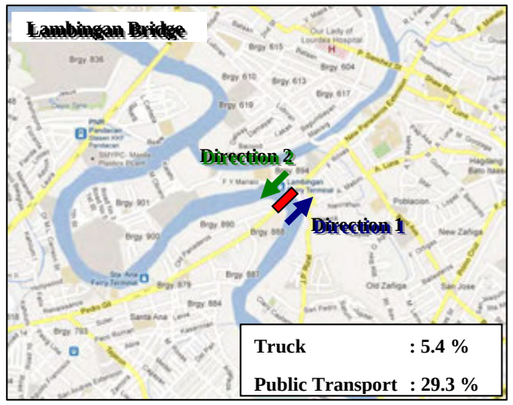
Plan



3) Traffic Conditions

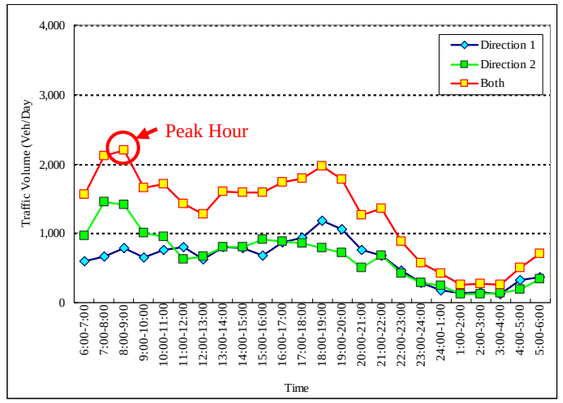
a) Traffic Volume

Daily and hourly traffic volume is shown in Figure 13.1.1-8, Figure 13.1.1-9 and Table 13.1.1-5.



* Analysis by AADT traffic volume
* VCR: Volume/Capacity Ratio

Figure 13.1.1-8 Location of Lambingan Bridge



*Day 1 hourly traffic volume

Figure 13.1.1-9 Hourly Traffic Volume

Table 13.1.1-5 Daily Traffic Volume

Unit: Veh/Day

	Motorcycle / Tricycle	Car / Taxi / Pick-up / Van	Jeepney	Large Bus	2-Axle Truck	3-Axle Truck	Truck trailer	Sub-Total	Total
Day 1	9,879	13,217	6,210	35	915	139	57	20,573	30,452
Day 2	8,878	14,034	5,975	27	971	134	39	21,180	30,058
AADT	9,379	13,626	6,093	31	943	137	48	20,877	30,255

* Sub-total: Not including Motorcycle and Tricycle

b) Level-of-Service (hereafter called as LOS)

LOS is based on traffic assumptions which are peak hour, road type, free flow speed and number of lanes.

Table 13.1.1-6 Assumption and LOS

LOS: C	Peak Hour Traffic Volume	2,194 Veh/hour
	Road Type	Urban Road
	Free Flow Speed (km/h)	40 km/h
	No. of Lanes	6 lanes

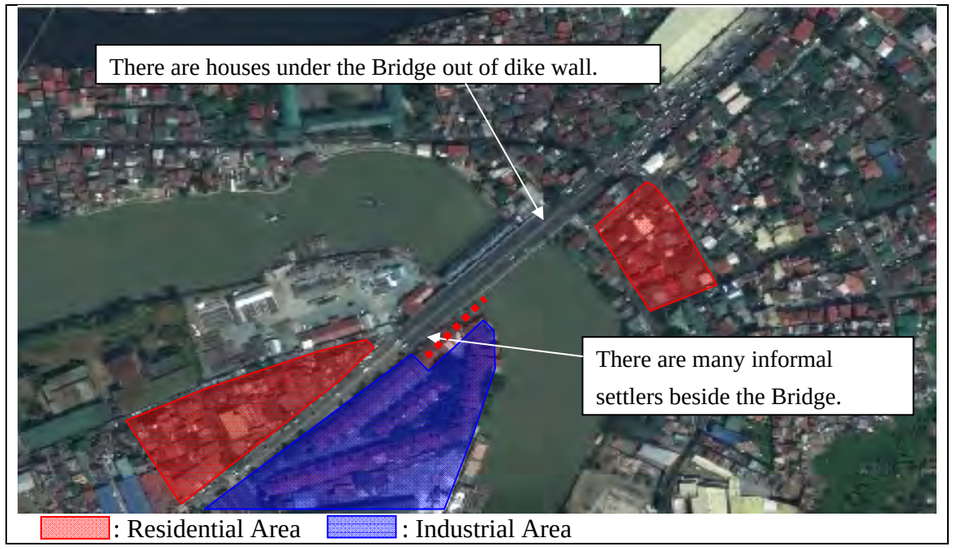
* Highway Capacity Manual, 2010

c) Traffic Condition

Analyses of the observed traffic volume condition and LOS are as follows:

- This bridge is at Sta. Ana, Manila City. Figure 13.1.1-9 shows the hourly traffic volume by direction, for direction, the observed peak time is in the evening from 6 PM to 7 PM, for direction 2, the observed peak time is in the morning from 6 PM to 7 PM.
- No. of lane is 6 lanes, AADT is 30,255 veh/day, traffic volume is only heavy for Manila City bound , Mandaluyong bound is not so much.
- Public transport ratio is 29.3%. Truck ratio is 5.4%, jeepney is too much because of there is jeepney station near this bridge. Large trucks and trailers are low because adjacent road is restricted for trucks and trailers.
- Peak hour traffic volume is 2,194 veh/hour, LOS is D because of peak hour traffic volume is low.

4) Socio-Environmental Assessment Conditions



Household and Structures (Area facing the Bridge and the approach road)
- There are many houses at both sides of the approach road. - There is one illegal household with 5 members under the bridge. - There are many illegal settlers beside the Bridge at the south side.
Land use (Area facing the Bridge and the approach road)
- Both sides of the Bridge are used for residential and factory area.
Existing Environmental Condition (Noise, Vibration, Air Pollution and Water contamination.)
- Environmental condition is bad brought about by the pollution of traffic flow such as noise, vibration and air pollution.
Environmental Protection Area (national park, reserves and designated wet land)
- The Bridge is not located in a cultural property or a natural reserve area.
Existence on Location Map of Valuable Ecological Habitats, Historical and Cultural Assets
- The Bridge is not located in a cultural property or a natural reserve area.

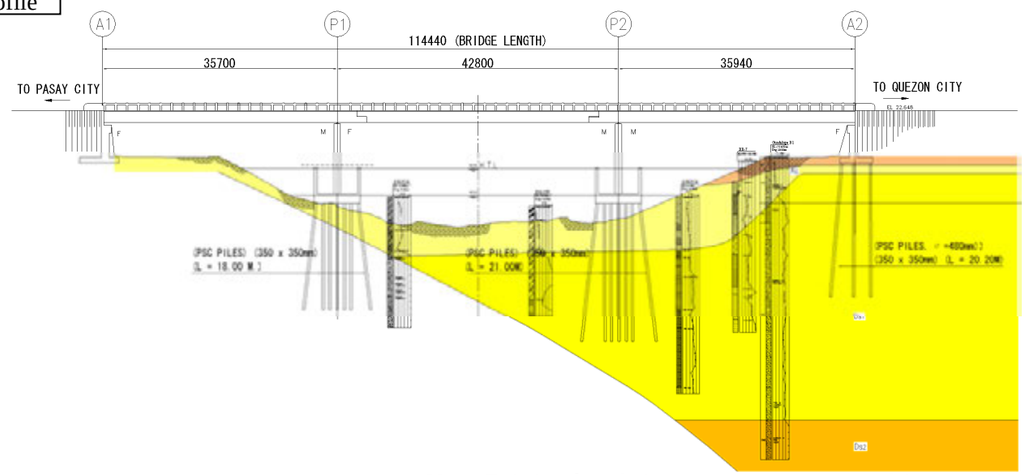
(4) Guadalupe Bridge

1) Current Bridge Condition

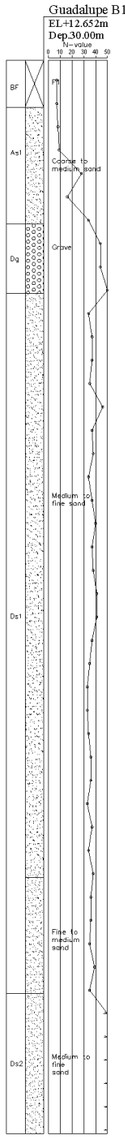
Bridge length/width	L=144.44m, W=25.4m
Year Built	1962 (Old), 1978 (New)
Bridge Type	Continuous Steel Truss (Old) PC Deck Girder with Gerber Hinge (New)

Traffic Load Regulation	20 tons
Soil Profile Type	Left Bank: Type I, Right Bank: Type III
Liquefaction Potential	High
As Built Drawing	None

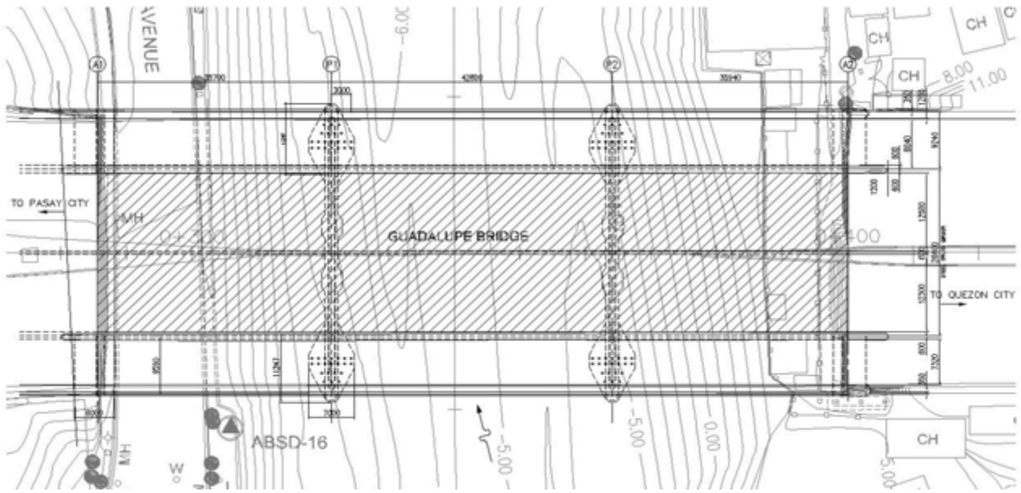
Profile



Note: Existing foundation structures are assumed (unknown).



Plan



Side View

Under View

On the Bridge

Abut-A

P1

P2

Abut-B

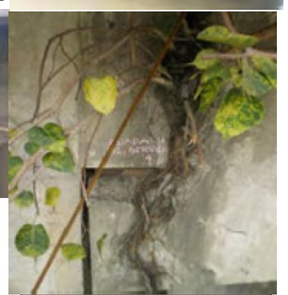
P2

Joint of New and Old Piers

View of PC Girder

Seating Length

Damaged Gerber Hinge



Bridge Attached Pipes

Figure 13.1.1-10 Current Bridge Condition of Guadalupe Bridge

2) Bridge Condition (Guadalupe Bridge)

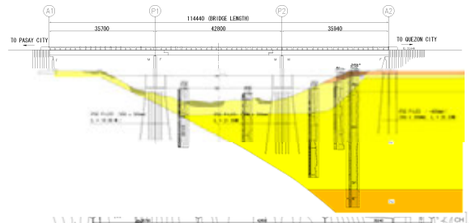
Seismic Vulnerability			
Items		Results of Surveys	Analyses/Comments
Earthquake Resisting System	1. Difference in soil types between adjacent piers	Soil Types - Left bank: Type I - Right bank: Type III	- Soil type difference among Pier-2 & Abut-B (Soil type: I or III)
	2. Continuous or Simply Supported Bridge	Steel truss: Continuous bridge. PC girder: Simple supported with gerber hinges	- Possibility of unseating at center spans due to simply supported structures with gerber hinges
	3. Eccentric Loads (longitudinal and transverse dir.)	Maximum span ratio: (1^{st} span length): (2^{nd} span length) =1.0:1.2	- The span ratio is between 1.0 and 1.5. - Possibility of eccentric loads only in both directions.
	4. Pier Type (single column/wall or multiple columns)	Wall type: piers for new bridges are structurally connected to the old piers	- Single column/wall type is less advantageous than multiple column type against earthquakes in terms of structural redundancy.
	5. Height of Abutment (Embankment)	Height of Embankments - Abutment A: 8m - Abutment B: 8m	- Height of embankments is betwen5 and 10m. - Lower risk of abutments' collapse under earthquake
	6. Built Year	1962 for steel truss & 1978 for PC I-girders (Constructed before 1992)	- Possibility of confinement loss of pier columns/walls - Lack of seismic capacities of all the members
Unseating/ Fall-down Prevention System	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	- Longitudinal dir.: Restrainers at abutments; insufficiently installed - Transverse dir.: Shear keys	- Possibility of unseating at abutments due to insufficient seismic restrainers for the longitudinal direction
	8. Bearing	1. Vertical Restrainer (Fixed)  2. H-beam type (Fixed)  3. Rubber pad (Gerber Hinge) 	1. Vertical Restrainer at abutments: no bearings - Condition: Corroded 2. Steel bearing (H-beam type) at piers - Condition: Corroded 3. Rubber pad bearing at gerber hinges - Condition: Severely corroded - Possibility of unseating at abutments & gerber hinges due to corroded bearings - Overall vulnerability: Serious
	9. Seat Length	1. Abut-A: 80cm Minimum Required Seat Length - JRA: 88cm , AASHTO: 52cm 2. Pier-2: 35cm Minimum Required Seat Length - JRA: 88cm , AASHTO: 52cm	- The seat lengths of abutments don't satisfy JRA's minimum required seat length. - The seat lengths of piers don't satisfy AASHTO's minimum required seat length. - High possibility of unseating due to the very short seat length
Foundation	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure
	11. Scouring	Potential of deep scouring at Pier-1 & 2	- Stability reduction of Pier-1 & 2 under earthquake due to the scouring
	12. Soil Type	Soil type (JRA): I and II	- Moderate ground condition
	13. Liquefaction Potential	- Liquefiable layer type: Sand - N-Value range of the layer: 8-28 Ave. 15	- High liquefaction potential
Seismic Hazard	14. Distance from Active Faults	- Distance: 2.4km - Active Fault Name: Marikina Valley Fault	- The distance is between 2 and 5km. - Serious effect of the active fault movement

Structural Soundness			
Items		Results of Surveys	Analyses/Comments
Superstructures	1. Primary Members	PC Girder  Steel Truss 	- Major cracking at Gerber hinges area - Paint deterioration on steel truss members - Overall damage degree: Serious
	2. Secondary Members	Steel Truss Member  Expansion Joint 	- Paint deterioration on steel truss members - Abnormal spacing of expansion joint at gerber hinge joint of center span due to the rotation of girders - Overall damage degree: Moderate
	3. Deck Slab	PC Girder  Steel Truss 	- Cracking at the bottom of deck slab through the entire bridge (Crack width range: 0.1-0.2mm) - Water leaking at the joint between deck slabs - Overall damage degree: Moderate
Substructures	4. Deterioration of Columns/ Walls	Cracking, Spalling & Rebar exposure 	- Cracking, spalling, & rebar exposure at piers due to collision of vessels - Overall damage degree: Moderate

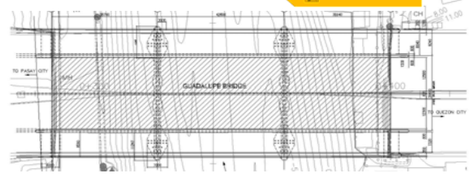
Summary of Structural Deficiencies

1. Seismic Vulnerability
   - Vulnerability of pier columns/walls to large scale earthquakes (confinement loss)
   - Vulnerability of foundations to large scale earthquakes (liquefaction potential, unknown structure, deep scouring)
   - High possibility of unseating (simply supported at gerber hinges, insufficient restrainers, very short seat length, corroded bearings)
2. Structural Soundness (Superstructures)
   - Strengthen gerber hinge portion and side blocks
   - Cracks at the bottom of deck slab through the entire bridge
   - Water leaking at the joint between deck slabs
3. Structural Soundness (Substructures)
   - Cracking, spalling, & rebar exposure at piers

Profile



Plan



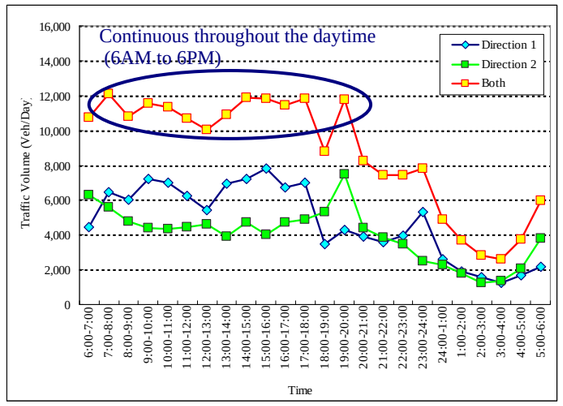
3) Traffic Conditions

a) Traffic Volume

Daily and hourly traffic volume is shown in Figure 13.1.1-11, Figure 13.1.1-12 and Table 13.1.1-7.

* Analysis by AADT traffic volume
* VCR: Volume/Capacity Ratio

Figure 13.1.1-11 Location of Guadalupe Bridge



*Day 1 hourly traffic volume

Figure 13.1.1-12 Hourly Traffic Volume

Table 13.1.1-7 Daily Traffic Volume

Unit: Veh/Day

	Motorcycle / Tricycle	Car / Taxi / Pick-up / Van	Jeepney	Large Bus	2-Axle Truck	3-Axle Truck	Truck trailer	Sub-Total	Total
Day 1	19,576	171,155	0	12,788	4,282	1,571	915	190,711	210,287
Day 2	19,538	191,000	0	13,669	3,917	1,684	837	211,107	230,645
AADT	19,557	181,078	0	13,229	4,100	1,628	876	200,909	220,466

* Sub-total: Not including Motorcycle and Tricycle

b) Level-of-Service (hereafter called as LOS)

LOS is based on traffic assumptions which are peak hour, road type, free flow speed and number of lanes.

Table 13.1.1-8 Assumption and LOS

LOS: F	Peak Hour Traffic Volume	14,366 Veh/hour
	Road Type	Urban Road
	Free Flow Speed (km/h)	60 km/h
	No. of Lanes	10 lanes

* Highway Capacity Manual, 2010

c) Traffic Condition

Analyses of the observed traffic volume condition and LOS are as follows:

- This bridge is connected with not only Makati City and Quezon City but SLEX and NLEX also. Figure 13.1.1-12 shows the hourly traffic volume by direction, hourly traffic volume which is from 6 AM to 6PM is continuously heavy throughout the daytime. Therefore, this bridge is chronically occurred.
- No. of lane is 10 lanes (of the 4 lane s is bus lane), AADT is 220,466 veh/day, this bridge is one of the most heavy traffic volume occurred road which is EDSA.
- Public transport ratio is 6.6%. Truck ratio is 3.3%, trailer is regulated in the daytime, but bus company is operated along EDSA.
- Peak hour traffic volume is 14,366 veh/hour, LOS is F because of peak hour traffic volume is very high.

4) Socio-Environment al Assessment Conditions

: Business and Industrial Area

House hold and Structures (Area facing the Bridge and the approach road)
- There are many business facilities along both sides of North approach road. - There are 12 unit informal settlers with 27 members at both sides of north abutment and under the Bridge
Land use (Area facing the Bridge and the approach road)
- North side of the River is used for side walk with basket court and Monument Park. - There are parks inside of interchange on the south side.
Existing Environmental Condition (Noise, Vibration, Air Pollution and Water contamination.)
- Environmental condition is bad brought about by the pollution of traffic flow such as noise, vibration and air pollution.
Environmental Protection Area (national park, reserves and designated wet land)
- The Bridge is not located in a cultural property or a natural reserve area.
Existence on Location Map of Valuable Ecological Habitats, Historical and Cultural Assets
- The Bridge is not located in acultural property or a natural reserve area.

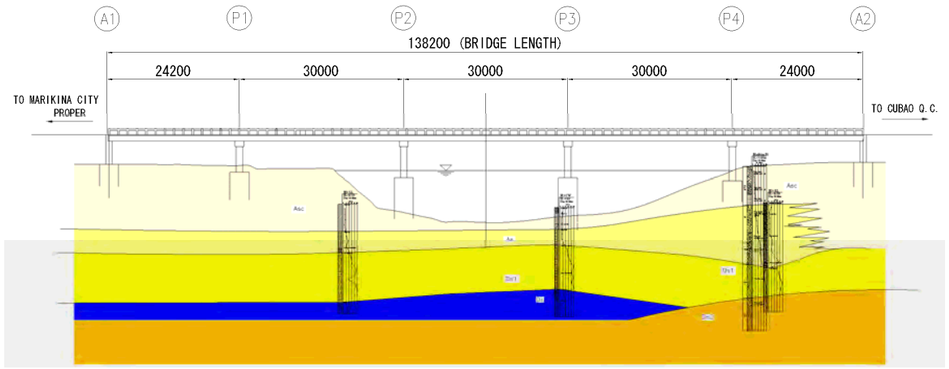
(5) Marikina Bridge

1) Current Bridge Condition

Bridge length/width	L=138.2m, W=20.3m
Year Built	1980
Bridge Type	PCDG (PC Deck Girder)

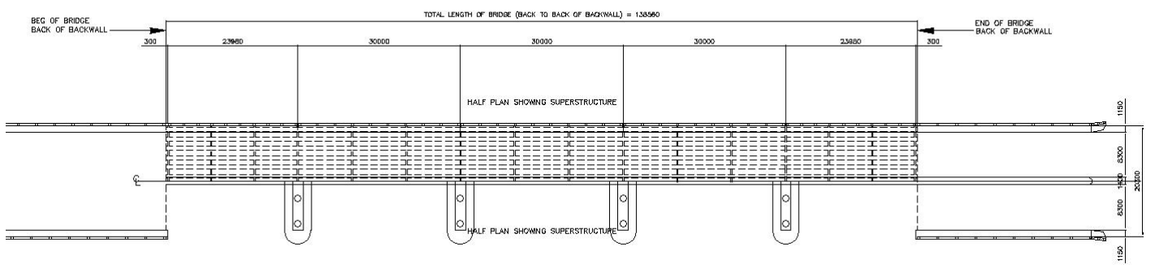
Traffic Load Regulation	20 tons
Soil Profile Type	Left Bank: Type I, Right Bank: Type II
Liquefaction Potential	High
As Built Drawing	None

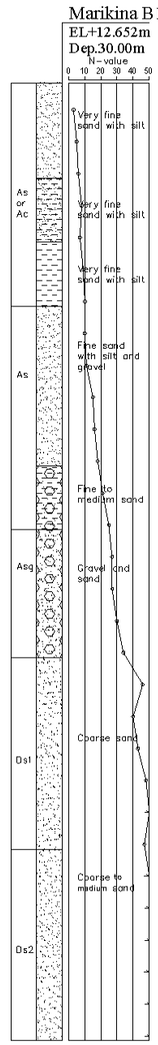
Profile



Note: Existing foundation structures are assumed (unknown).

Plan






Side View


Under View


On the Bridge


Abut-A


P1


P2


P3


P4


Abut - B


Seating Length


No Bearing Pad


Attached Pipes


Cracks on Abutment


Cracks on Deck Slab


Cracks on Pier

Figure 13.1.1-13 Current Bridge Condition of Marikina Bridge

2) Bridge Condition (Marikina Bridge)

Seismic Vulnerability			
Items		Results of Surveys	Analyses/Comments
Earthquake Resisting System	1. Difference in soil types between adjacent piers	Soil Type is consistent along with the entire bridge	- No soil type difference between adjacent piers
	2. Continuous or Simply Supported Bridge	Simply supported	- All spans are simply supported. - High possibility of unseating due to simply supported structures
	3. Eccentric Loads (longitudinal and transverse dir.)	Maximum span ratio: (1^{st} span length): (2^{nd} span length) =1.0:1.3	- The span ratio is less than 1.5 - Possibility of eccentric loads is low in the transverse direction.
	4. Pier Type (single column/wall or multiple columns)	Multiple-column type	- Multiple column type is more advantageous than single column/wall type against earthquakes in terms of structural redundancy.
	5. Height of Abutment (Embankment)	Height of Embankments - Abut-A: 2.5m - Abut-B: 2.5m Note: Pile bent abutment	- Lower risk of abutments' collapse under earthquake
	6. Built Year	1980 (Constructed before 1992)	- Possibility of confinement loss of pier columns/walls
Unseating/ Fall-down Prevention System	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	- Longitudinal dir.: No restrainer - Transverse dir.: No restrainer	- High possibility of unseating under earthquake due to non-existence of seismic restrainers
	8. Bearing	1. Rubber pad with angle steel (Fixed or Movable) 2. No bearing at piers  	1. Rubber pad with angle steel at abutments - Condition: Severely deformed (angle steel) 2. No bearing at piers - Possibility of unseating due to deformed bearings, and non-existence of bearings - Overall vulnerability: Serious
	9. Seat Length	1. Abut-A: 65cm Minimum Required Seat Length - JRA: 85cm , AASHTO: 48cm	- The seat lengths of abutments don't satisfy JRA's minimum required seat length. - Possibility of unseating due to the short seat length
Foundation	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure
	11. Scouring	Scouring at Pier-2 & 3	- Stability reduction of Pier-2 & 3 due to the scouring under earthquake
	12. Soil Type	Soil type (JRA): II	- Moderate ground condition
	13. Liquefaction Potential	- Liquefiable layer type: Sand - N-Value range of the layer: 7-34 Ave. 19	- Very high liquefaction potential
Seismic Hazard	14. Distance from Active Faults	- Distance: 1.0km - Active Fault Name: Marikina Valley Fault	- The distance is less than 2.0km. - Serious effect of the active fault movement

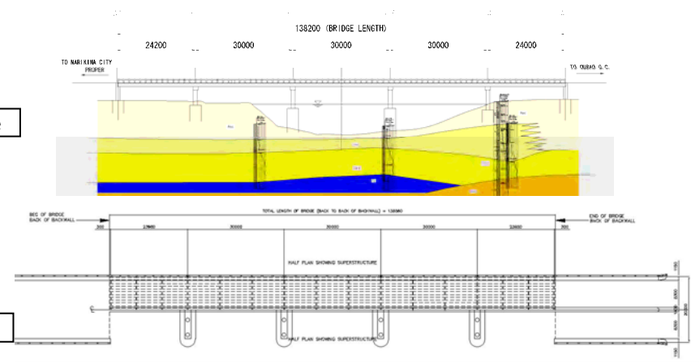
Structural Soundness			
	Items	Results of Surveys	Analyses/Comments
Superstructures	1. Primary Members	PC girder bridge 	- PC girders apparently in good condition. - Overall damage degree: Good
	2. Secondary Members	RC Cross Beam  Expansion Joint 	- Deterioration at cross beams - Water leaking at expansion joins - Overall damage degree: Moderate
	3. Deck Slab	1. Cracking  2. Water leaking 	- Major cracking at the bottom face and surface of deck slab through the entire bridge. - Water leaking from the wide cracking at the deck slab - Overall damage degree: Serious
Substructures	4. Deterioration of Columns/ Walls	Retrofitted columns 	- Pier columns are already retrofitted and in good condition. - Overall damage degree: Good

Summary of Structural Deficiencies

1. Seismic Vulnerability
   - Vulnerability of foundations to large scale earthquakes (liquefaction potential, unknown structure, scouring)
   - High possibility of unseating (simply supported, no seismic restrainers, short seat length, deformed bearings, and non-existence of bearings)
2. Structural Soundness (Superstructures)
   - Deterioration at cross beams
   - Water leaking at expansion points
   - Major cracking & water leaking at the bottom face of deck slab through the entire bridge
   - Water leaking from expansion joints
3. Structural Soundness (Substructures)
   - None

Profile

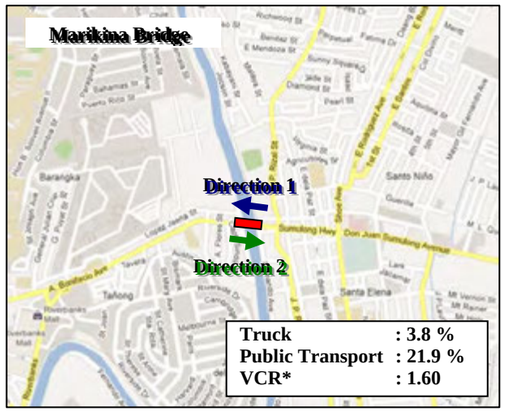
Plan



3) Traffic Conditions

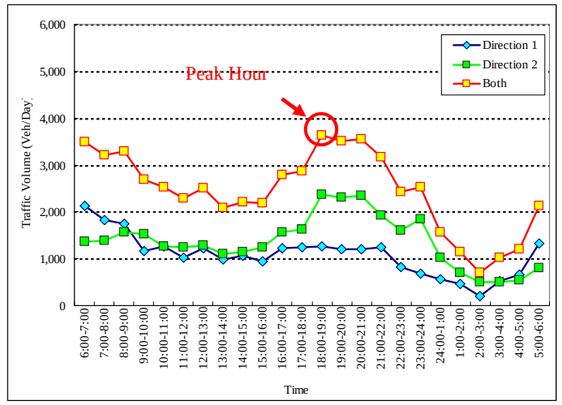
a) Traffic Volume

Daily and hourly traffic volume is shown in Figure 13.1.1-14, Figure 13.1.1-15 and Table 13.1.1-9.



* Analysis by AADT traffic volume
* VCR: Volume/Capacity Ratio

Figure 13.1.1-14 Location of Marikina Bridge



*Day 1 hourly traffic volume

Figure 13.1.1-15 Hourly Traffic Volume

Table 13.1.1-9 Daily Traffic Volume

Unit: Veh/Day

	Motorcycle / Tricycle	Car / Taxi / Pick-up / Van	Jeepney	Large Bus	2-Axle Truck	3-Axle Truck	Truck trailer	Sub-Total	Total
Day 1	16,413	29,112	8,940	85	1,453	42	12	39,644	56,057
Day 2	18,429	30,323	8,357	104	1,412	87	18	40,301	58,730
AADT	17,421	29,718	8,649	95	1,433	65	15	39,973	57,394

* Sub-total: Not including Motorcycle and Tricycle

b) Level-of-Service (hereafter called as LOS)

LOS is based on traffic assumptions which are peak hour, road type, free flow speed and number of lanes.

Table 13.1.1-10 Assumption and LOS

LOS: F	Peak Hour Traffic Volume	3,629 Veh/hour
	Road Type	Urban Road
	Free Flow Speed (km/h)	60 km/h
	No. of Lanes	4 lanes

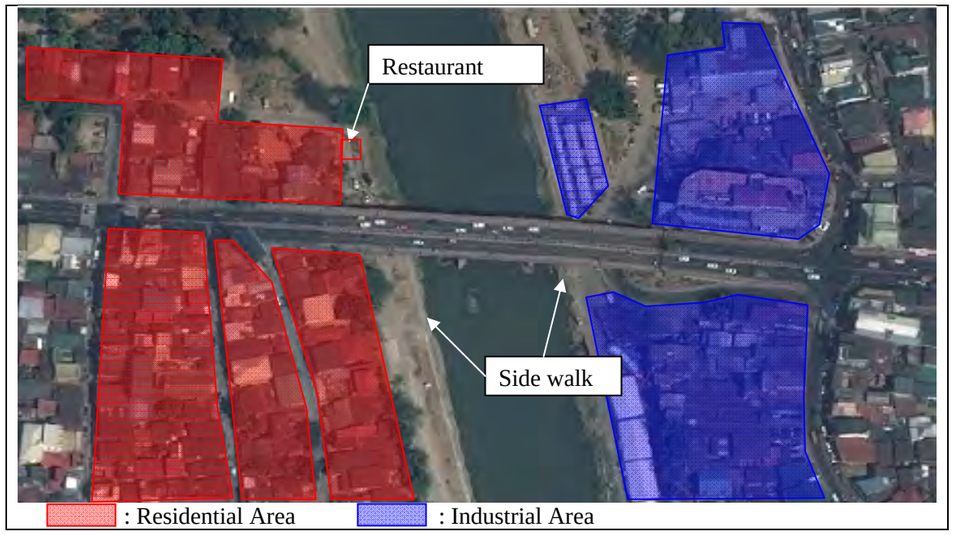
* Highway Capacity Manual, 2010

c) Traffic Condition

Analyses of the observed traffic volume condition and LOS are as follows.

- This bridge connects Antipolo City and Quezon City, it crosses the Marikina River. Figure 13.1.1-15 shows the hourly traffic volume by direction, for direction 1, the observed peak time is in the morning from 6 AM to 7 AM, for direction 2, the observed peak time is in the morning from 6 PM to 7 PM.
- No. of lane is 4 lanes, AADT is 57,394 veh/day, traffic volume is only towards Antipolo City and Manila Area.
- Public transport ratio is 21.9%. Truck ratio is 3.8%, jeepney is too much because of Antipolo City is a big residential area. Large trucks and trailers are low.
- Peak hour traffic volume is 3,629 veh/hour, LOS is F because of peak hour traffic volume is high with few no. of lanes.

4) Socio-Environment al Assessment Conditions



Households and Structures (Area facing the Bridge and the approach road)
- There is no house, shop or factory around the Bridge along the approach road. - There is no any illegal structure on both sides under the Bridge.
Land use (Area facing the Bridge and the approach road)
- There are many houses, shops and factories along the approach roads. - Both sides of the river banks are used for recreation area and side walk.
Existing Environmental Condition (Noise, Vibration, Air Pollution and Water contamination.)
- Environmental condition is relatively good except for the pollution of traffic flow such as noise, vibration and air pollution along the road.
Environmental Protection Area (national park, reserves and designated wet land)
- The Bridge is not located in a cultural property or a natural reserve area.
Existence on Location Map of Valuable Ecological Habitats, Historical and Cultural Assets
- The Bridge is not located in a cultural property or a natural reserve area.

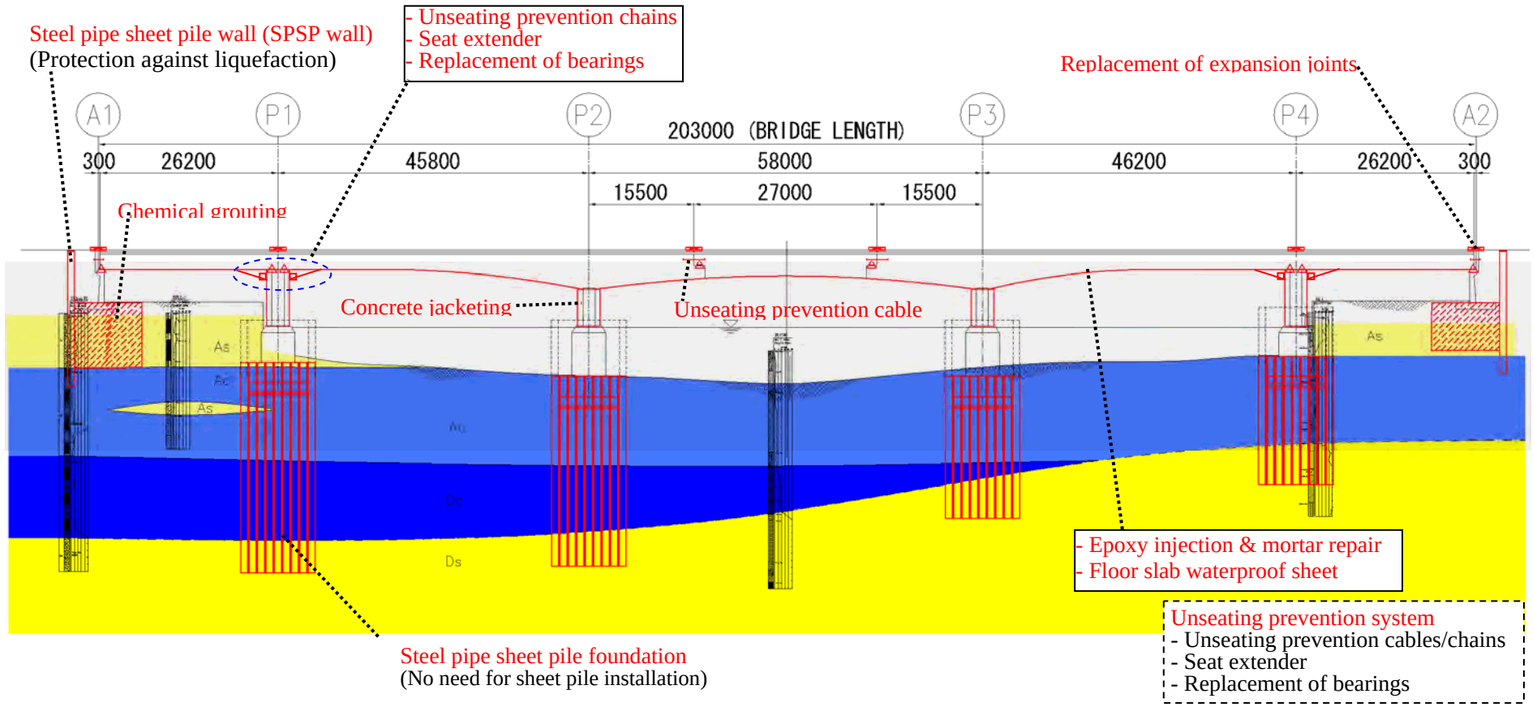
13.1.2 Comparison of Improvement Measures

1) Delpan Bridge

Comparison of Improvement Measures for Delpan Bridge

Alternative 1 - Seismic Retrofit and Repair

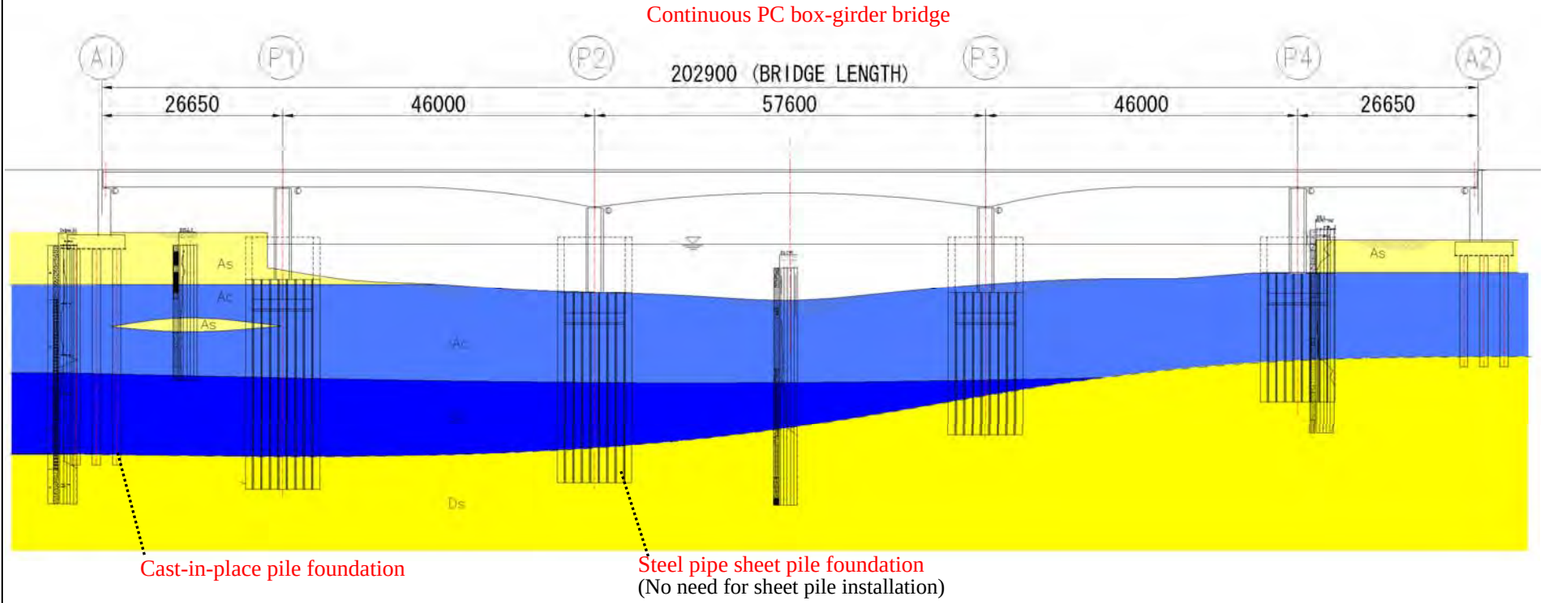
Improvement Measure Scheme



Detail of Improvement Measures & Evaluation

Description/ Design Concept	• Seismic capacity improvement of pier walls (wall retrofit) • Seismic capacity improvement of foundations (pile for reinforcement & soil improvement) • Improvement of unseating/fall-down prevention system (unseating prevention cables/chains, seat extender, replacement of bearings) • Improvement of the deck slab soundness (repair) • Improvement of the PC girders' soundness			
Construction	Method/ Technology	• Concrete jacketing (wall retrofit) • Steel pipe sheet pile foundation (pile for reinforcement) • Chemical grouting with SPSP wall (soil improvement) • Unseating prevention system		
	Difficulty	• Traffic control during abutment retrofit works • Pile-driving under the existing superstructure		
	Cost	Seismic Retrofit Works	• Wall retrofit • Pile for reinforcement • Soil improvement • Unseating prevention system	0.53
		Repair Works	• Epoxy injection & mortar repair • Floor slab water proof sheet • Replacement of expansion joint	0.01
		Others	• Working platform on the water • Temporary detour bridge	0.01
			Total	0.55
Potential Impact to Environment	• River occupation during the works for piers in water • Requirement of large construction yard • Temporary detour bridge installation during abutment retrofit works • Requirement of temporary resettlement for the construction			
EVALUATION: **Recommended**				

Alternative 2 - Replacement



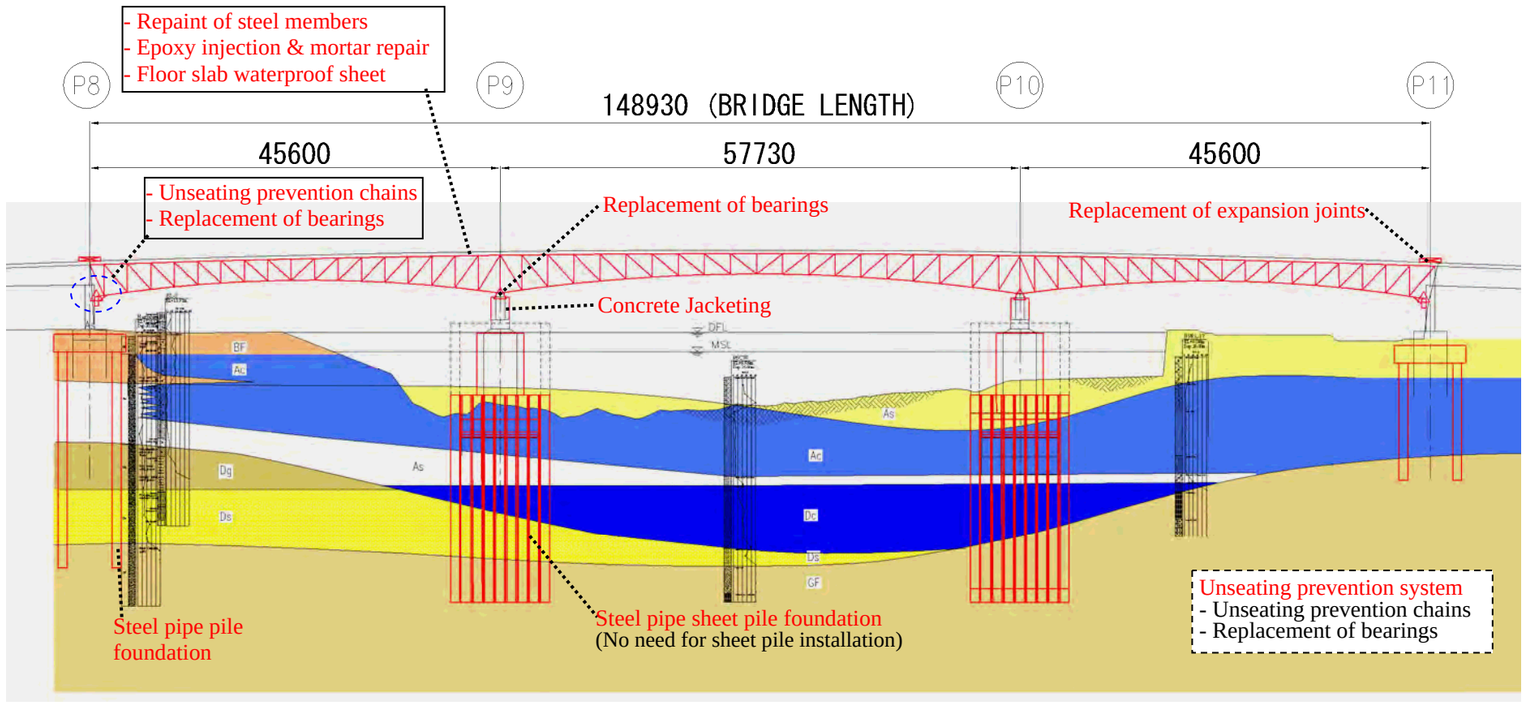
Description/ Design Concept	• Application of existing bridge planning condition in order to confirm the cost effectiveness of seismic retrofit & repair works • Application of PC girder bridge for advantage of less maintenance even near coastal areas • Application of steel pipe sheet pile foundation to piers in water: no need for sheet pile installation			
Construction	Method/ Technology	• Continuous PC Box-girder bridge • Steel pipe sheet pile foundation (for piers) • Cast-in-place pile foundation (for abutments)		
	Difficulty	• Requirement of long term construction period for cast-in-place PC box girders		
	Cost	Superstructure	• Continuous PC box-girder bridge	0.40
		Substructure	• Wall type	0.07
		Foundation	• Steel pipe sheet pile foundation • Cast-in-place pile foundation	0.43
		Others	• Working platform on the water • Temporary detour bridge	0.10
			Total	1.00
Potential Impact to Environment	• River occupation during the works for piers in water • Long construction period for cast-in-place PC girders • Temporary detour bridge installation during the whole construction • Requirement of temporary resettlement for the construction			
EVALUATION: **Not Recommended**				

2) Nagtahan Bridge

Comparison of Improvement Measures for Nagtahan Bridge

Alternative 1 - Seismic Retrofit and Repair

Improvement Measure Scheme

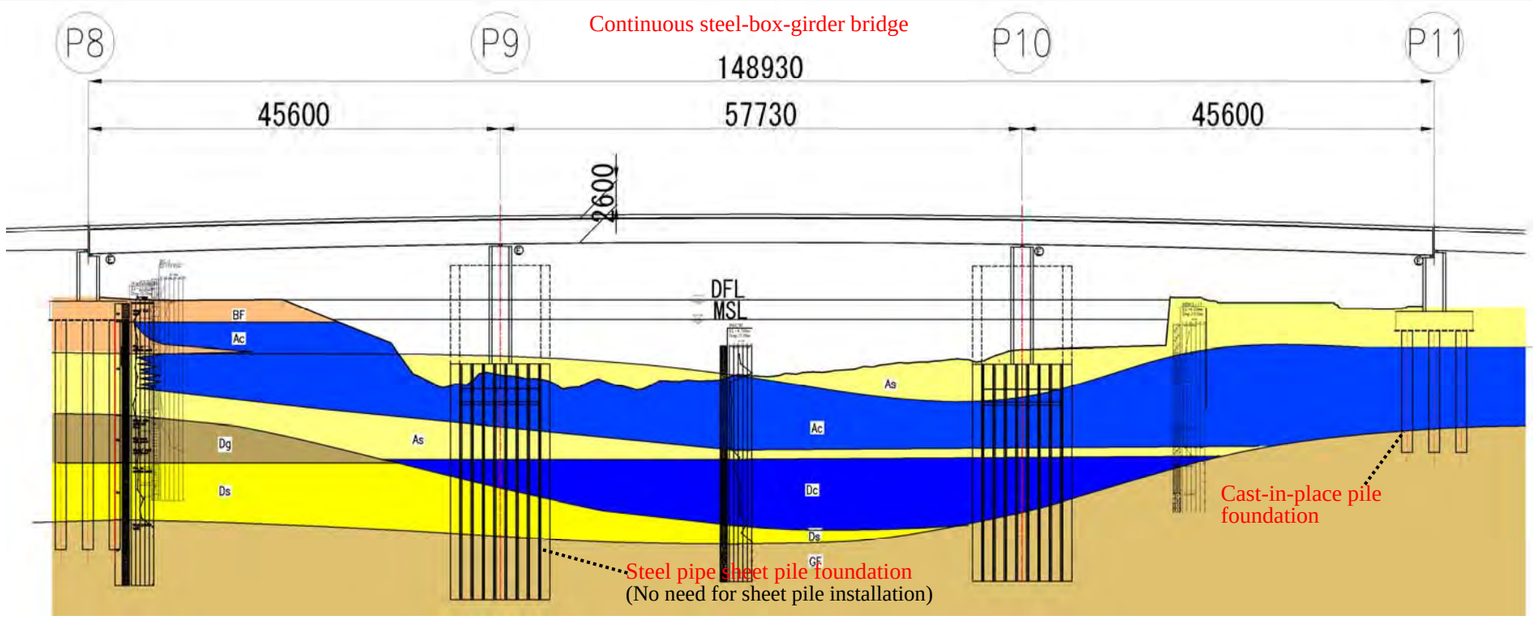


Detail of Improvement Measures & Evaluation

Description/ Design Concept	• Seismic capacity improvement of pier wall (wall retrofit) • Seismic capacity improvement of foundations (pile for reinforcement) • Improvement of unseating/fall-down prevention system (unseating prevention chains, replacement of bearings) • Improvement of the deck slab soundness (repair) • Improvement of the steel members' soundness			
Construction	Method/ Technology	• Concrete jacketing (wall retrofit) • Steel pipe sheet pile foundation (pile for reinforcement) • Unseating prevention system		
	Difficulty	• Traffic control in improvement of abutments. • Pile-driving under the existing superstructure		
	Cost	Seismic Retrofit Works	• Wall retrofit • Pile for reinforcement • Unseating prevention system • Replacement of bearings	0.46
		Repair Works	• Epoxy injection & mortar repair • Floor slab water proof sheet • Replacement of expansion joints • Repaint of steel truss members	0.03
		Others	• Working platform on the water • Temporary detour bridge	0.01
			Total	0.50
Potential Impact to Environment	• Requirement of low-impact construction for Malacañan area • River occupation during the works for piers in water • Temporary detour bridge installation during abutment retrofit works • Requirement of temporary resettlement for the construction: many informal settlers under approach bridges			
EVALUATION: **Recommended**				

Alternative 2 - Replacement

Improvement Measure Scheme



Detail of Improvement Measures & Evaluation

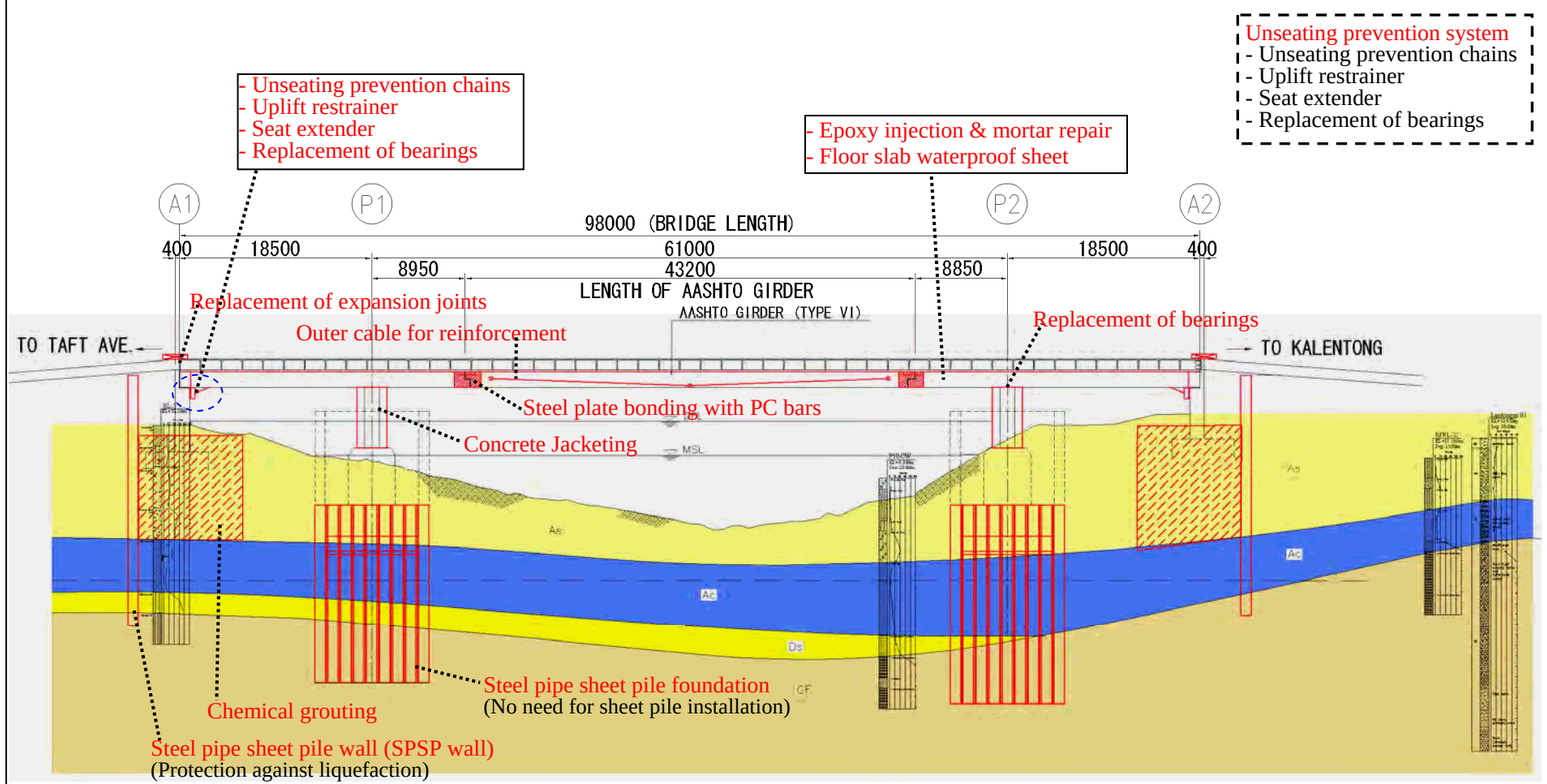
Description/ Design Concept	• Application of existing bridge planning condition in order to confirm the cost effectiveness of seismic retrofit & repair works • Application of light weight & low height superstructure type in order to maintain the adequate vertical clearance • Application of steel pipe sheet pile foundation to piers in water: no need for sheet pile installation			
Construction	Method/ Technology	- Continuous steel box-girder bridge - Steel pipe sheet pile foundation - Cast-in-place pile foundation		
	Difficulty	• None: Typical erection methods are applicable		
	Cost	Superstructure	• Continuous steel box-girder bridge	0.38
		Substructure	• Wall type	0.07
		Foundation	• Steel pipe sheet pile foundation • Cast-in-place pile foundation	0.45
		Others	• Working platform on the water • Temporary detour bridge • Approach road	0.10
			Total	1.00
Potential Impact to Environment	• Requirement of low-impact construction to Malacañan area • River occupation during the works for piers in water • Temporary detour bridge installation during the whole construction • Requirement of temporary resettlement for the construction: many informal settlers under approach bridges			
EVALUATION: **Not Recommended**				

3) Lambingan Bridge

Comparison of Improvement Measures for Lambingan Bridge

Alternative 1 - Seismic Retrofit and Repair

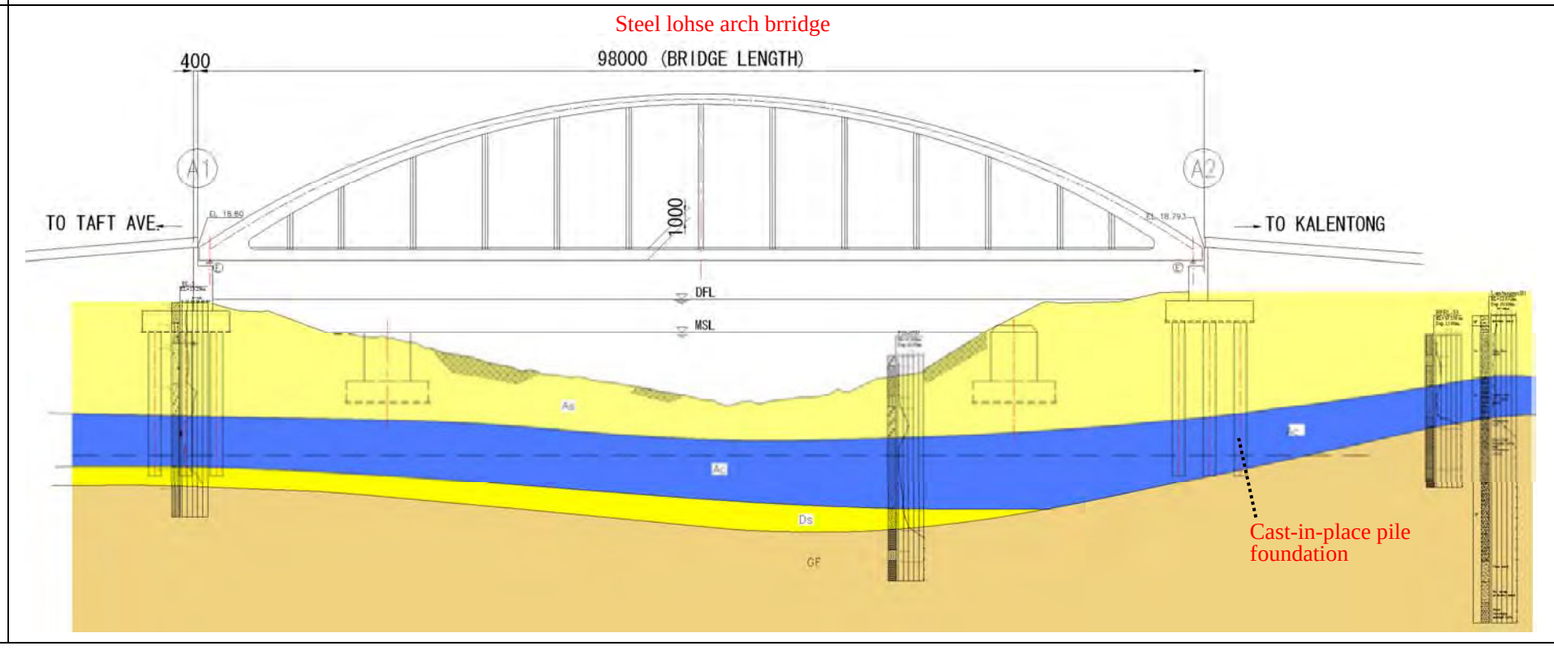
Improvement Measure Scheme



Detail of Improvement Measures & Evaluation

Description/ Design Concept	• Seismic capacity improvement of pier wall (wall retrofit) • Seismic capacity improvement of foundations (pile for reinforcement) • Improvement of unseating/fall-down prevention system (unseating prevention cables/chains, uplift restrainer, seat extender, replacement of bearings) • Improvement of the deck slab soundness (repair) • Improvement of PC girders' soundness & strength			
Construction	Method/ Technology	• Concrete jacketing (wall retrofit) • Steel pipe sheet pile foundation (pile for reinforcement) • Chemical grouting with SPSP wall (soil improvement) • Outer cable for reinforcement & Steel plate bonding with PC bars (superstructure reinforcement) • Unseating prevention system		
	Difficulty	• Traffic control during abutment retrofit works • Pile-driving under the existing superstructure		
	Cost	Seismic Retrofit Works	• Wall retrofit • Pile for reinforcement • Soil improvement • Unseating prevention system	0.75
		Repair Works	• Superstructure reinforcement • Epoxy injection & mortar repair • Replacement of expansion joints	0.01
		Others	• Working platform on the water • Temporary detour bridge	0.01
			Total	0.77
Potential Impact to Environment	• Traffic condition is very bad for the pollution of traffic flow • River occupation during the works for piers in water • Requirement of environmental measures for water contamination • Temporary detour bridge installation during abutment retrofit works • Requirement of temporary resettlement for the construction: many informal settlers along the approach roads			
EVALUATION: **Not Recommended**				

Alternative 2 - Replacement



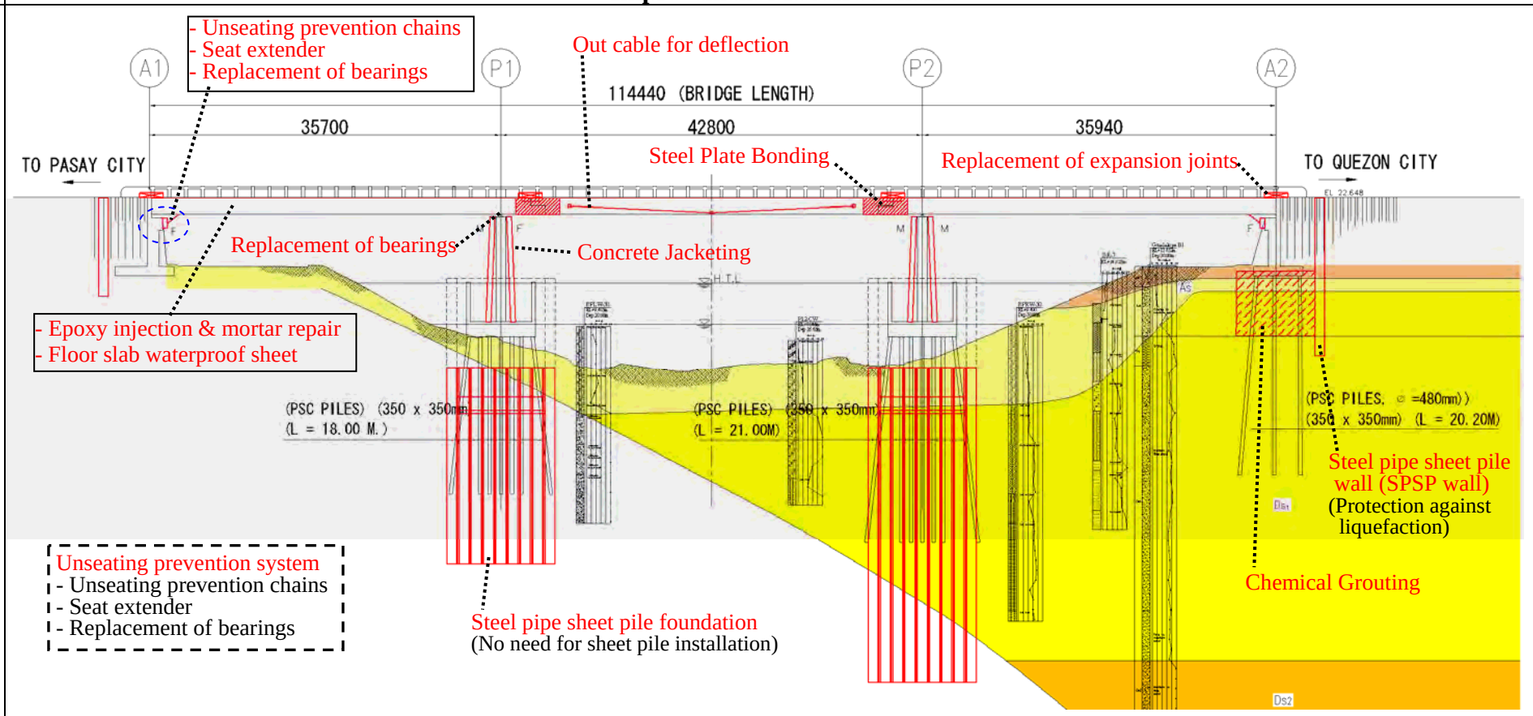
Description/ Design Concept	• Application of single-span simply supported bridge for wider navigation clearance • Application of light weight & low height superstructure type in order to maintain the adequate vertical clearance • Application of steel girder bridge for rapid erection method: advantage of faster installation & smaller construction yard			
Construction	Method/ Technology	• Steel lohse arch bridge • Cast-in-place pile foundation		
	Difficulty	• Requirement of large size crane or wire equipments for rapid erection • Requirement of large construction yard for assembly of steel members		
	Cost	Superstructure	• Steel lohse arch bridge	0.71
		Substructure	• Wall type	0.02
		Foundation	• Cast-in-place pile foundation	0.12
		Others	• Working platform on the water • Temporary detour bridge • Approach road	0.15
			Total	1.00
Potential Impact to Environment	• River occupation during the works for piers in water • Temporary detour bridge installation during the whole construction • Requirement of temporary resettlement for the construction: many informal settlers under approach roads			
EVALUATION: **Recommended**				

4) Guadalupe Bridge

Comparison of Improvement Measures for Guadalupe Bridge

Alternative 1 - Seismic Retrofit and Repair

Improvement Measure Scheme



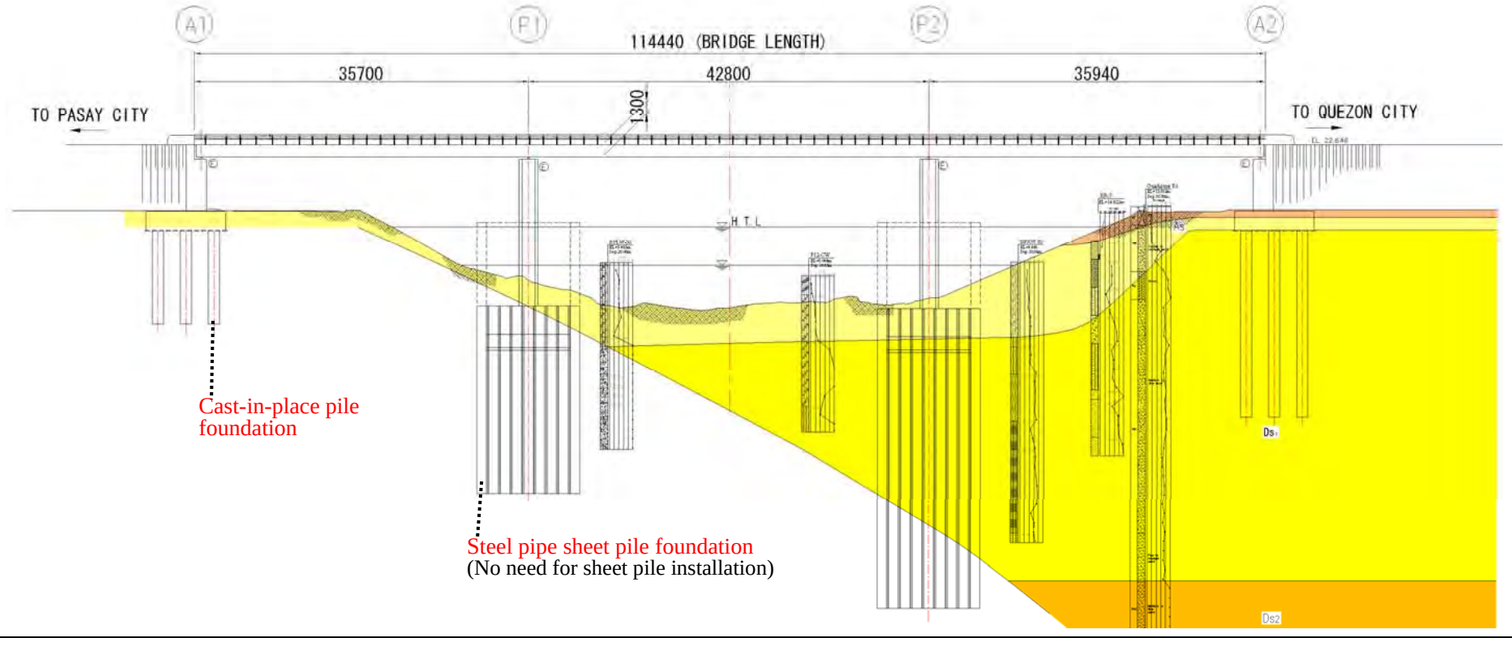
Detail of Improvement Measures & Evaluation

Description/ Design Concept	• Seismic capacity improvement of pier wall (wall retrofit) • Seismic capacity improvement of foundations (pile for reinforcement & soil improvement) • Improvement of unseating/fall-down prevention system (unseating prevention cables/chains, replacement of bearings) • Improvement of the deck slab soundness (repair) • Improvement of PC girders' soundness & strength			
Construction	Method/ Technology	• Concrete jacketing (wall retrofit) • Steel pipe sheet pile foundation (pile for reinforcement) • Chemical grouting with SPSP wall (soil improvement) • Unseating prevention system		
	Difficulty	• Traffic control during abutment retrofit works • Pile-driving under the existing superstructure		
	Cost	Seismic Retrofit Works	• Wall retrofit • Pile for reinforcement • Soil improvement • Unseating prevention system	0.53
		Repair Works	• Steel plate bonding with PC bars • Epoxy injection & mortar repair • Replacement of expansion joint	0.02
		Others	• Working platform on the water • Temporary detour bridge	0.09
			Total	0.64
Potential Impact to Environmen	• River occupation during the works for piers in water • Temporary detour bridge installation during abutment retrofit works • Requirement of temporary resettlement for the construction: many informal settlers around the bridges			
EVALUATION: **Not Recommended**				

Alternative 2 - Replacement

Continuous steel plate deck box-girder bridge

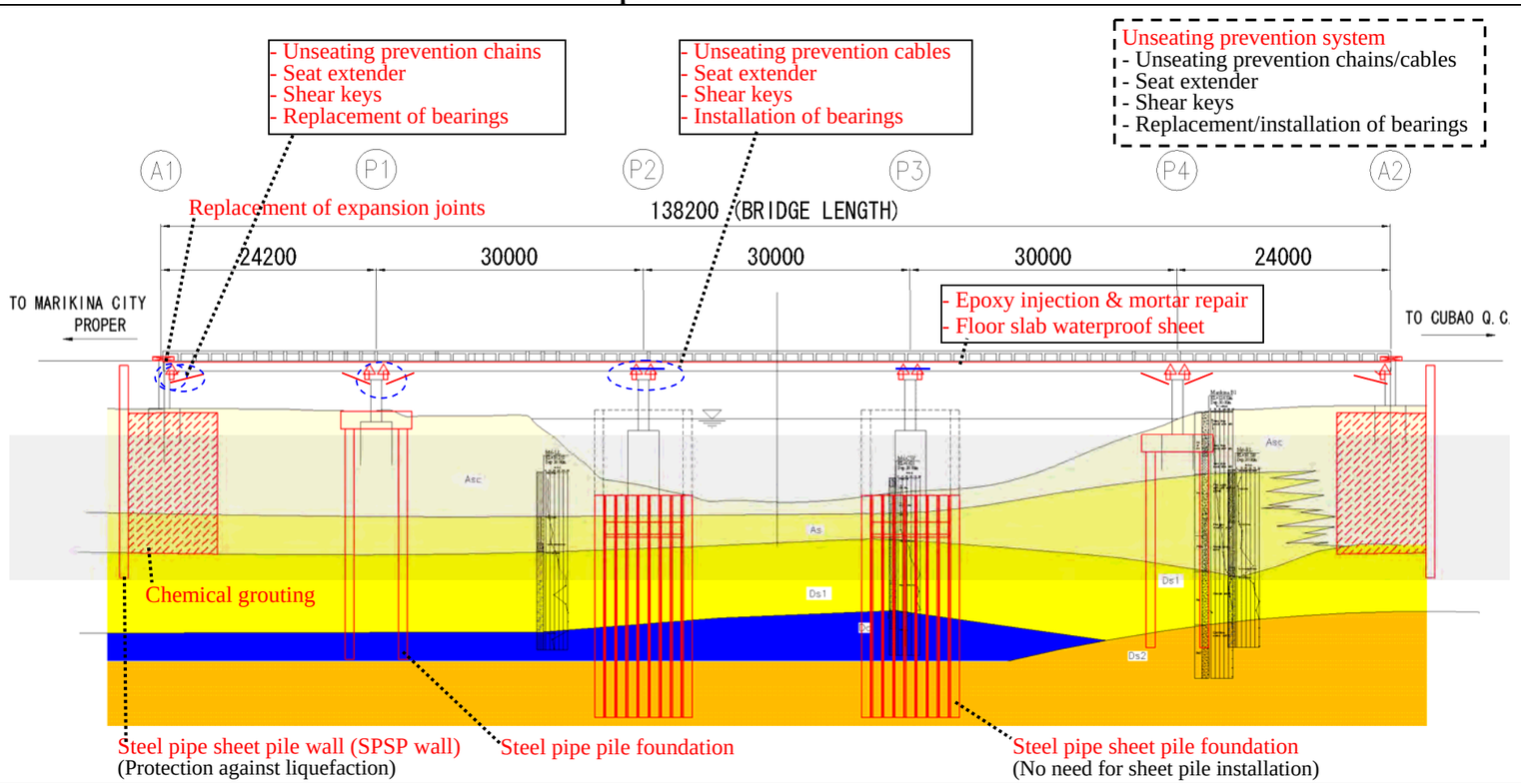
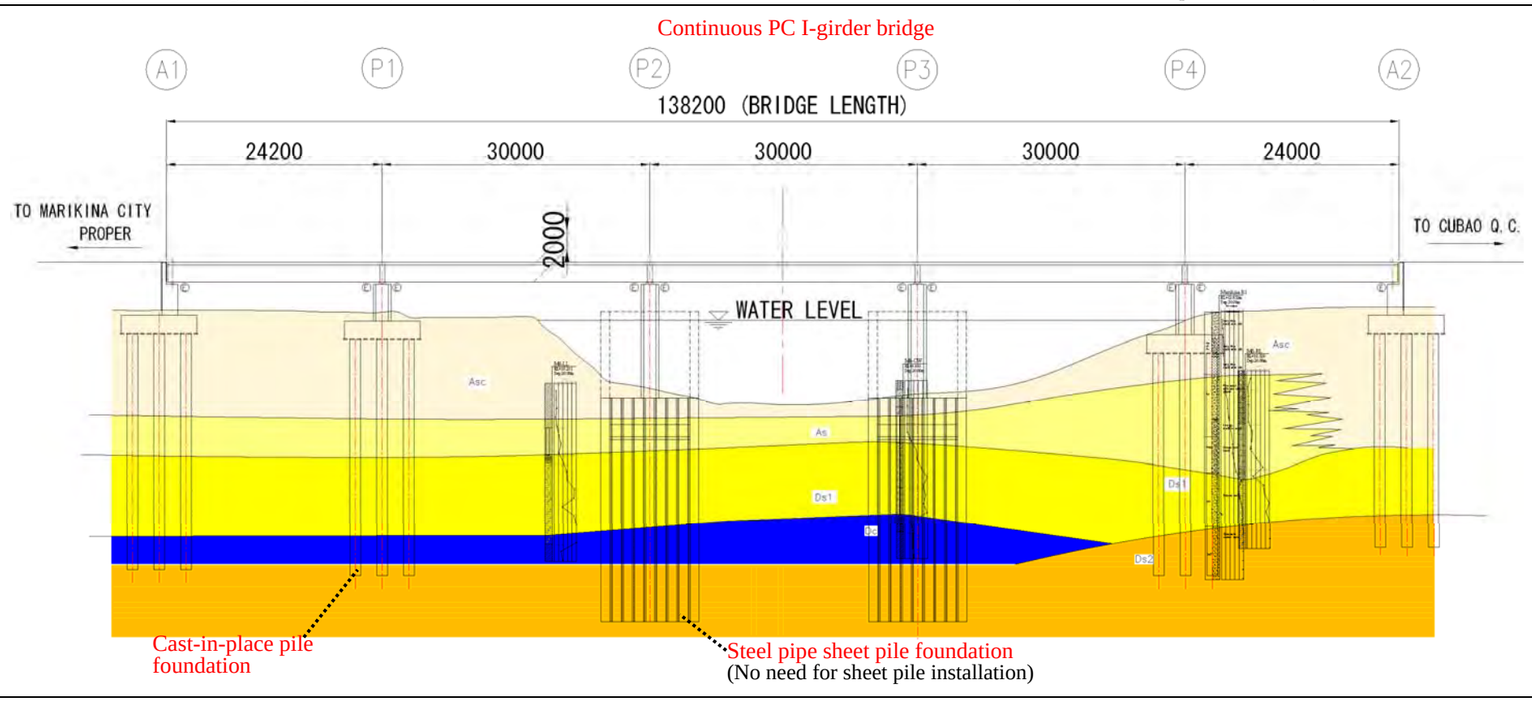
Note: Target of replacement is only both side-lane bridges



Description/ Design Concept	• Application of span ratio of center-lane bridges • Application of light weight & low height superstructure type in order to maintain the adequate vertical clearance • Application of steel girder bridge for rapid erection method: advantage of faster installation & smaller construction yard • Application of steel pipe sheet pile foundation to piers in water: no need for sheet pile installation			
Construction	Method/ Technology	• Continuous steel plate deck box-girder bridge • Steel pipe sheet pile foundation (for piers in water) • Cast-in-place pile foundation (for piers on land)		
	Difficulty	• Requirement of large size crane or wire equipments for rapid erection • Requirement of large construction yard for assembly of steel members • Installation of temporary detour bridge: limited space		
	Cost	Superstructure	• Continuous steel plate deck box-girder bridge	0.34
		Substructure	• Wall type	0.08
		Foundation	• Steel pipe sheet pile foundation • Cast-in-place pile foundation	0.48
		Others	• Working platform on the water • Temporary detour bridge • Approach road	0.10
			Total	1.00
Potential Impact to Environmen	• River occupation during the works for piers in water • Temporary detour bridge installation during the whole construction • Requirement of temporary resettlement for the construction: many informal settlers around the bridges: Large impact to business area			
EVALUATION: **Recommended**				

5) Marikina Bridge

Comparison of Improvement Measures for Marikina Bridge

	Improvement Measure Scheme	Detail of Improvement Measures & Evaluation			
Alternative 1 - Seismic Retrofit and Repair		**Description/ Design Concept**			
			• Seismic capacity improvement of pier columns (column retrofit) • Seismic capacity improvement of foundations (pile for reinforcement & soil improvement) • Improvement of unseating/fall-down prevention system (seat extender, unseating prevention chains/cables, shear keys, replacement/ installation of bearings) • Improvement of the deck slab soundness (repair) • Improvement of PC girders' soundness & strength		
		Construction	Method/ Technology		• Steel pipe sheet pile foundation & steel pipe pile foundation (pile for reinforcement) • Chemical grouting & SPSP wall (soil improvement) • Unseating prevention system
			Difficulty		• Traffic control during abutment retrofit works • Pile-driving under the existing superstructure
			Cost	Seismic Retrofit Works	• Column retrofit • Pile for reinforcement • Soil improvement • Unseating prevention system — 0.66
				Repair Works	• Epoxy injection & mortar repair • Replacement of expansion joints — 0.02
				Others	• Working platform on the water • Temporary detour bridge — 0.01
					Total — 0.69
		Potential Impact to Environment			• River occupation during the works for piers in water • Temporary detour bridge installation during abutment retrofit works
		EVALUATION: **Not Recommended**			
Alternative 2 - Replacement		**Description/ Design Concept**			
			• Application of existing bridge planning condition in order to confirm the cost effectiveness of seismic retrofit & repair works • Application of PC girder bridge for advantage of less maintenance even near coastal areas • Application of steel pipe sheet pile foundation to piers in water: no need for sheet pile installation		
		Construction	Method/ Technology		• Continuous PC I-girder bridge • Steel pipe sheet pile foundation Method (in river) • Cast-in-place pile foundation Method (on land)
			Difficulty		• Typical erection method applicable using track cranes
			Cost	Super-structure	• Continuous PC I-girder bridge — 0.21
				Substructure	• Wall type — 0.08
				Foundation	• Steel pipe sheet pile foundation • Cast-in-place pile foundation — 0.61
				Others	• Working platform on the water • Temporary detour bridge — 0.10
					Total — 1.00
		Potential Impact to Environment			• River occupation during the works for piers in water • Temporary detour bridge installation during the whole construction • Long construction period for cast-in-place PC girders
		EVALUATION: **Recommended**			

13.2 Evaluation of the Second Screening for Package C

This section summarizes 2nd screening result of Package C (selection of objective bridges outside Metro Manila for outline design). The evaluation results are explained with the following two steps, as well as Package B.

1) Evaluation of current bridge & bridge site conditions

   Bridge condition, traffic condition, and socio-environmental condition are summarized for 7 objective bridges, based on the inspection results obtained in this project.

2) Comparative study on improvement measure schemes (replacement or seismic retrofit)

   Comparative study on two alternative improvement measure schemes (replacement or seismic retrofit) is conducted for the objective 7 bridges. As a result of the study, either replacement or seismic retrofit is recommended for each bridge. The selection of the improvement measure schemes is done in accordance with the following rule which is conventionally applied in the Philippines.

   - Recommendation of replacement: if cost of seismic retrofit plan including repair works is over or equal to 60 % of that of replacement plan, replacement is recommendable.
   - Recommendation of seismic retrofit: other than the above case, seismic retrofit cost is recommendable.

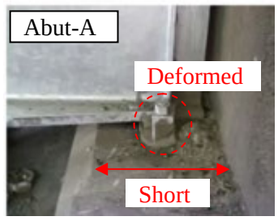
13.2.1 Results of the Second Screening

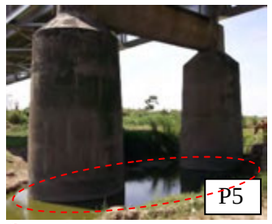
(1) Buntun Bridge

1) Structural and Geological Outline

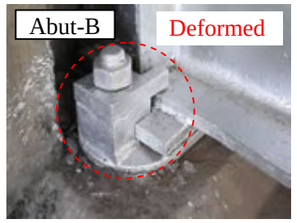
Bridge length/width	L=1102m, W=9.1m
Year Built	1967
Bridge Type	- Main Spans: Simply-supported steel truss bridge - Approach Spans: Simply-supported steel I-girder bridge

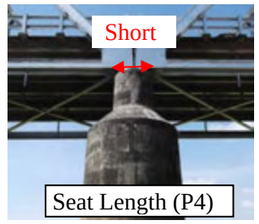
Traffic Load Regulation	18 ton
Soil Profile Type	II (JRA)
Liquefaction Potential	Very High (layer: As)
As-built drawing	None

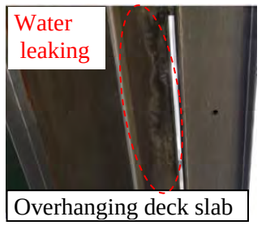




Scouring







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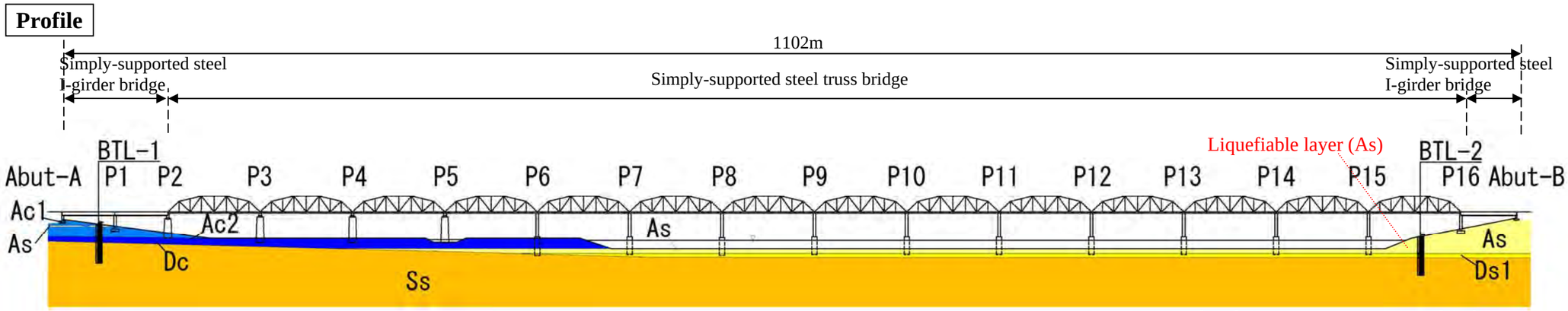
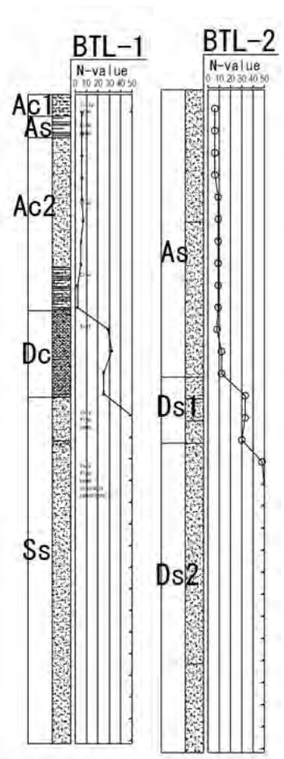


Note: Existing foundation structures are assumed (unknown).



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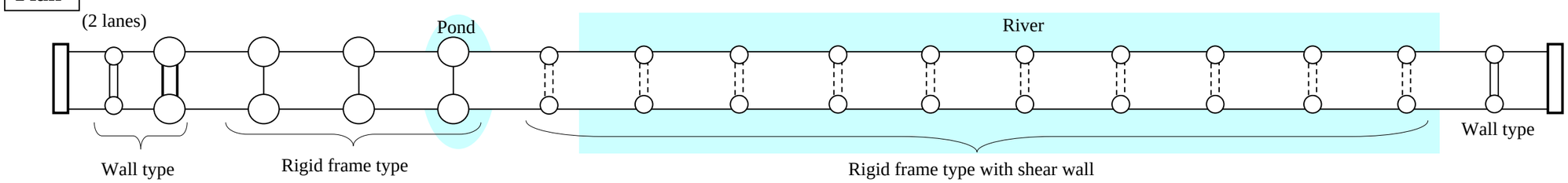


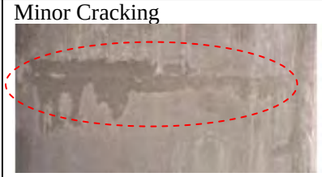
Figure 13.2.1-1 Structural and Geological Outline of Buntun Bridge

2) Bridge Condition

Seismic Vulnerability

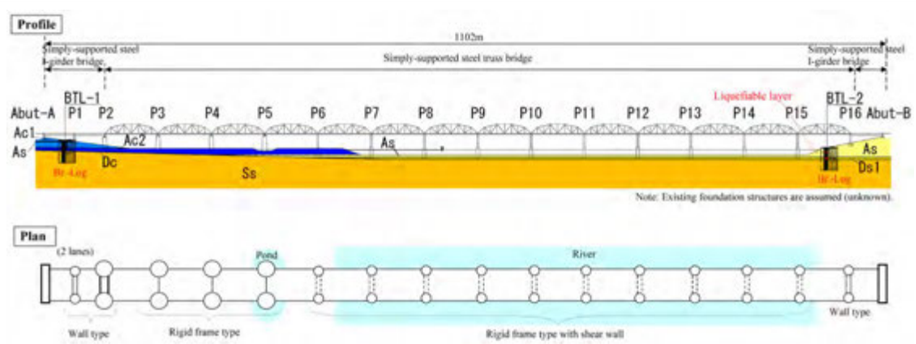
Items		Results of Surveys	Analyses/Comments
Earthquake Resisting System	1. Difference in soil types between adjacent piers	Soil Type is consistent along with the entire bridge	- No soil type difference between adjacent piers
	2. Continuous or Simply Supported Bridge	1. Main Spans: Simply supported 2. Approach Spans: Simply supported	- All spans are simply supported. - High possibility of unseating due to simply supported structures
	3. Eccentric Loads (longitudinal and transverse dir.)	Maximum span ratio: (2^{nd} span length): (3^{rd} span length) = 1.0:1.7	- The span ratio is over 1.5 - Possibility of eccentric loads only in the transverse direction: simply supported
	4. Pier Type (single column/wall or multiple columns)	1. Wall type 2. Rigid frame type 3. Rigid frame type with shear walls	- 13 out of 16 piers are rigid frame type - Multiple column type is more advantageous than single column/wall type against earthquakes in terms of structural redundancy.
	5. Height of Abutment (Embankment)	Height of Embankments - Abut-A: 3m - Abut-B: 3m	- Heights of embankments are below 5m. - Lower risk of abutments' collapse under earthquake
	6. Built Year	1967 (Constructed before 1992)	- Possibility of confinement loss of pier columns/walls - Lack of seismic capacities of all the members
Unseating/ Fall-down Prevention System	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	- Longitudinal dir.: No restrainer - Transverse dir.: No restrainer	- High possibility of unseating due to non-existence of seismic restrainers
	8. Bearing	1. Linear type (Movable or Fixed) 2. Roller type (Movable hinge)   3. Pin type (Fixed hinge)  	1. Steel bearings (linear type) at abutments - Condition: Deformed (longitudinal dir.) 2. Steel bearings (roller type) at piers - Condition: Good 3. Steel bearings (pin type) at piers - Condition: Good except for Pier-11 bearing: Pin portion is lost. - Types of existing bearing are not vulnerable to earthquakes - Possibility of unseating at Pier-11 due to damaged bearings - Overall vulnerability: Serious
	9. Seat Length	1. Abut-A: 48cm Minimum Required Seat Length - JRA: 85cm, AASHTO: 43cm 2. Pier-2: 55cm (steel I-girder side) Minimum Required Seat Length - JRA: 95cm, AASHTO: 53cm	- The seat lengths of abutments and piers don't satisfy JRA's minimum required seat length. - Possibility of unseating due to the short seat length
Foundation	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure
	11. Scouring	Moderate scouring at Pier-5	- Stability reduction of Pier-5 under earthquake due to the scouring
	12. Soil Type	Soil type (JRA): I	- Firm ground condition
	13. Liquefaction Potential	- Liquefiable layer type: Sand - N-Value range of the layer: 6 – 9	- Very high liquefaction potential
Seismic Hazard	14. Distance from Active Faults	- Distance: 15.9km - Active Fault Name: Taboan River Fault	- The distance is over 10km. - Small effect of the active fault movement

Structural Soundness

Items		Results of Surveys	Analyses/Comments
Superstructures	1. Primary Members	Steel Truss 	- All superstructure members were recently repainted and they are in good condition. - Overall damage degree: Good
	2. Secondary Members	Steel Truss 	- All superstructure members were recently repainted and they are in good condition. - Overall damage degree: Good
	3. Deck Slab		- Minor cracking at the bottom face of deck slab through the entire bridge (Crack width range: 0.1-0.2mm) - Water leaking at the overhanging deck slabs - Overall damage degree: Moderate
Substructures	4. Deterioration of Columns/ Walls	Minor Cracking 	- Minor cracks on some pier columns - Overall damage degree: Small

Summary of Structural Deficiencies

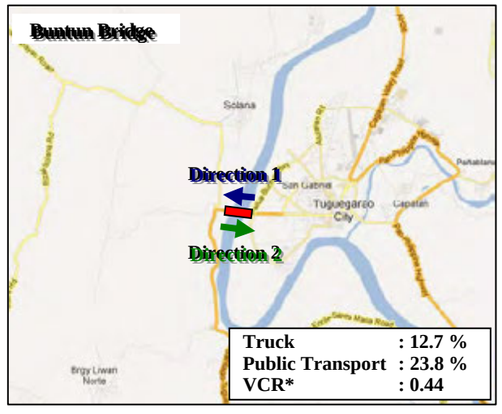
1. Seismic Vulnerability
   - Vulnerability of pier columns/walls to large scale earthquakes (confinement loss)
   - Vulnerability of foundations to large scale earthquakes (liquefaction potential, unknown structure, scouring)
   - High possibility of unseating (simply supported, no seismic restrainers, short seat length, damaged bearings)
2. Structural Soundness (Superstructures)
   - Cracks at the bottom face of deck slab through the entire bridge
   - Water leaking at the overhanging deck slabs
3. Structural Soundness (Substructures)
   - None: Only minor cracks on some pier columns



3) Traffic Condition

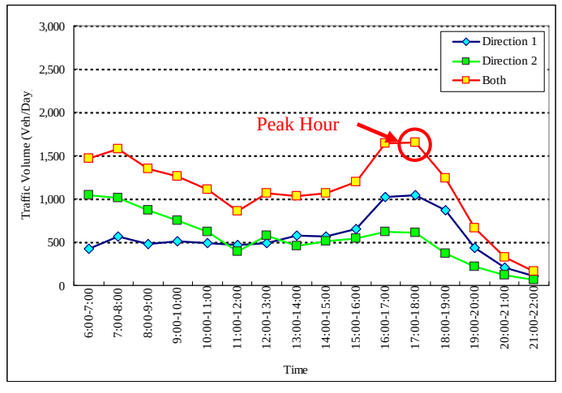
a) Traffic Volume

Daily and hourly traffic volumes are shown in Figure 13.2.1-2., Figure 13.2.1-3 and Table 13.2.1-1. Analyses of the observed traffic condition are shown in “3) Traffic Condition”.



* Analysis by AADT traffic volume
* VCR: Volume/Capacity Ratio

Figure 13.2.1-2 Location of Buntun Bridge



*Day 1 hourly traffic volume

Figure 13.2.1-3 Hourly Traffic Volume

Table 13.2.1-1 Daily Traffic Volume

Unit: Veh/Day

	Motorcycle / Tricycle	Car / Taxi / Pick-up / Van	Jeepney	Large Bus	2-Axle Truck	3-Axle Truck	Truck trailer	Sub-Total	Total
Day 1	10,794	4,463	1,325	79	776	155	81	6,879	17,673
Day 2	11,109	13,969	1,154	601	785	148	232	16,889	29,153
AADT	9,908	4,357	1,573	59	676	115	83	6,862	16,770

* Sub-total: Not including Motorcycle and Tricycle

b) Level-of-Service (hereafter called as LOS)

LOS is assumed, based on the following traffic conditions namely; peak hour, road type, free flow speed and number of lanes.

Table 13.2.1-2 Assumption and LOS

LOS: C	Peak Hour Traffic Volume	1,650 Veh/hour
	Road Type	Rural Road
	Free Flow Speed (km/h)	30 km/h
	No. of Lanes	2 lanes

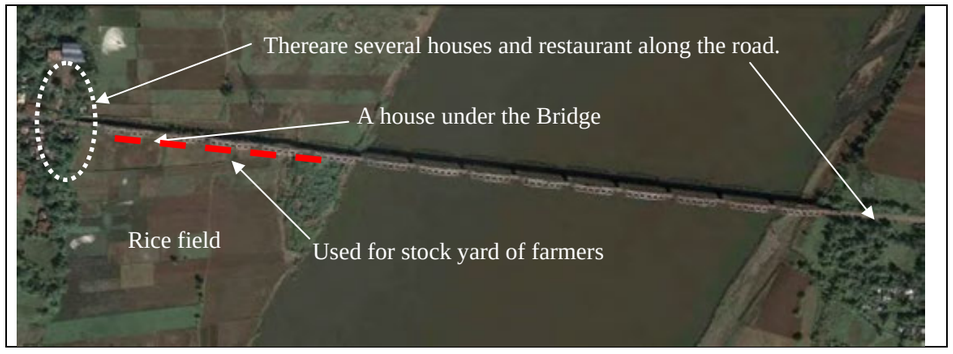
* Highway Capacity Manual, 2010

c) Traffic Condition

Analyses of the observed traffic volume condition and LOS are as follows.

- Buntun bridge connects Tugegarao City proper to Cagayan and Apayao Provinces. Figure 13.2.1-3 shows the hourly traffic volume by direction, for direction 1, the observed peak time is in the evening from 5 PM to 6 PM as both direction peak hour, for direction 2, the observed peak time is in the morning from 6 AM to 7 PM.
- Public transport ratio is 23.8% of daily traffic volume which is 16,770 veh/day without motorcycle, is high volume.
- Buntun bridge is used as a commuter road.
- LOS is C because of peak hour traffic volume is high and no passing lane.

4) Socio-Environmental Assessment Conditions



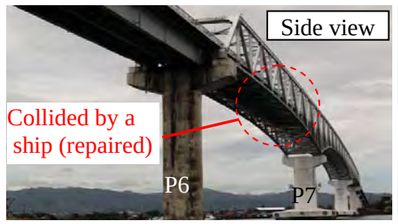
Household and Structures (Area facing the Bridge and the approach road)
- There are several houses surrounding the Bridge and along the approach road. - (East side of under the Bridge) Slope of abutment bank is very steep, there is no structure. - At the second pier of trussed girder there is a temporary house used for watching field during daytime.
Land use (Area facing the Bridge and the approach road)
- Dry riverbed of west side is used for agriculture such as rice crop. - Some areae under the Bridge on dry riverbed are used for stock yard of farmers. - There are some houses but not facing directly to the road in the West side of the approach. - There are some vendors facing the road in the East side of the approach.
Existing Environmental Condition (Noise, Vibration, Air Pollution and Water contamination.)
- Environmental condition is good except for the pollution of traffic flow such as noise, vibration and air pollution.
Environmental Protection Area (national park, reserves and designated wet land)
- The Bridge is not located in a cultural property or a natural reserve area.
Existence on Location Map of Valuable Ecological Habitats, Historical and Cultural Assets
- The Bridge is not located in a cultural property or a natural reserve area.

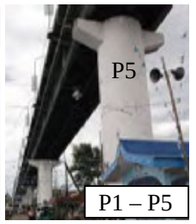
(2) 1st Mandaue-Mactan Bridge

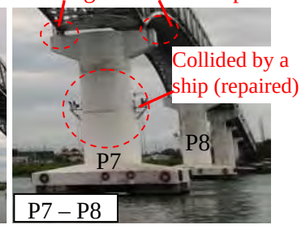
1) Structural and Geological Outline

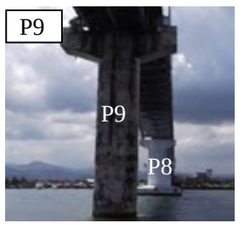
Bridge length/width	L=859m, W=9.1m
Year Built	1972
Bridge Type	- Main Spans: Continuous steel truss bridge - Approach Spans: Continuous steel I-girder bridge Note: Partially simply supported (side spans)

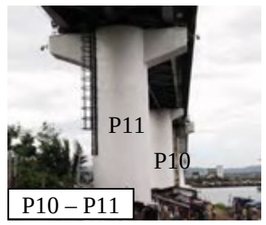
Traffic Load Regulation	None
Soil Profile Type	I & II (JRA)
Liquefaction Potential	Very high (layer: As)
As-built drawing	None

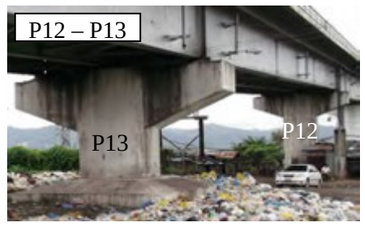


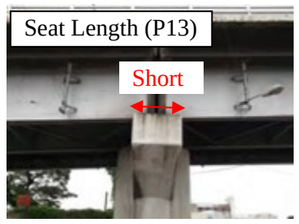


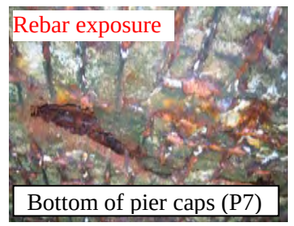


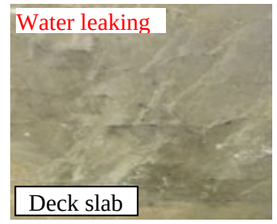


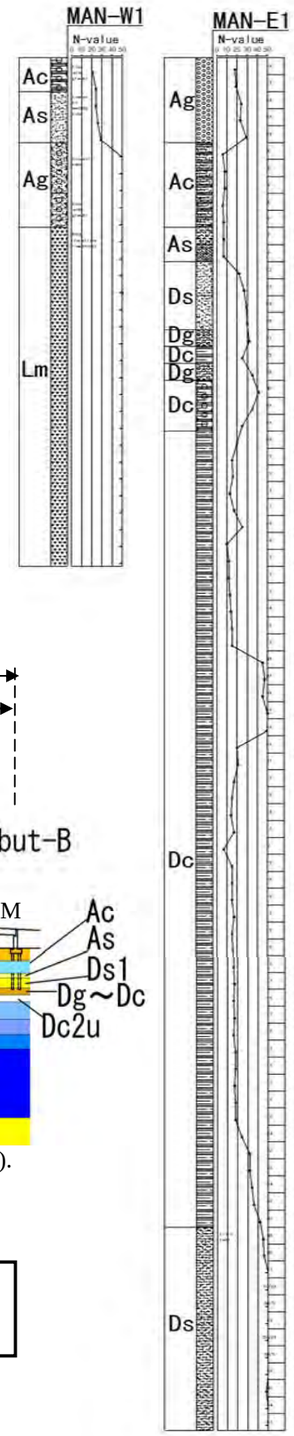












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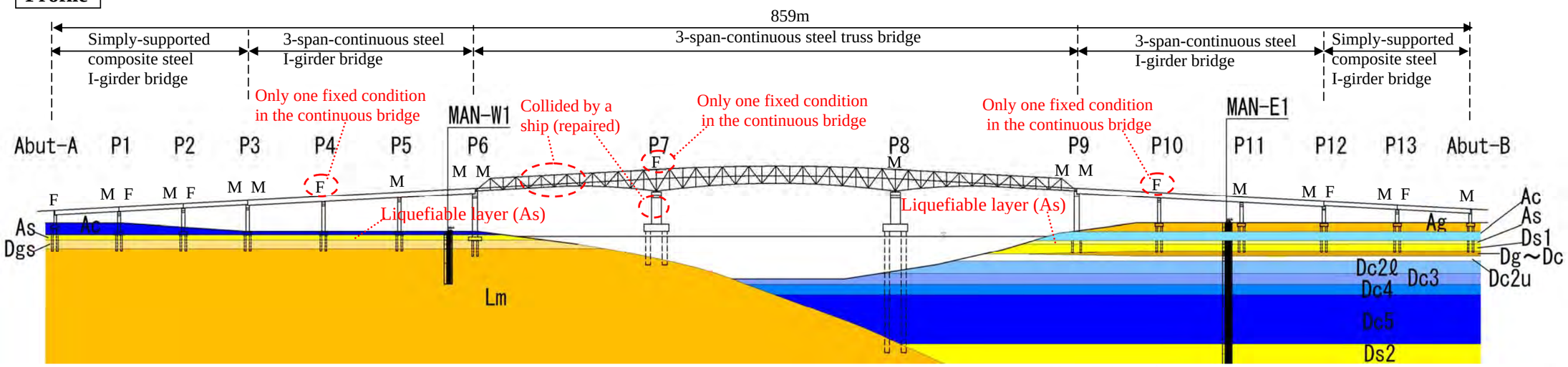


Note: Existing foundation structures are assumed (unknown).

Plan

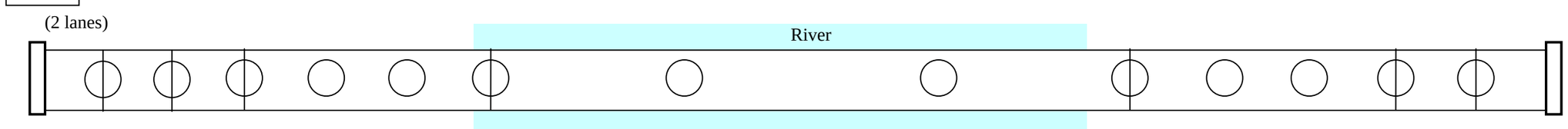
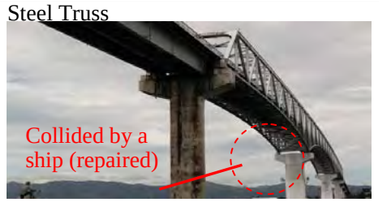
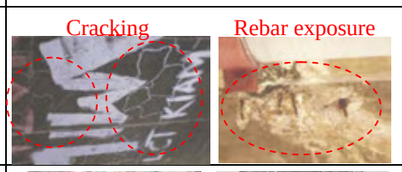


Figure 13.2.1-4 Structural and Geological of 1st Mandaue Mactan Bridge

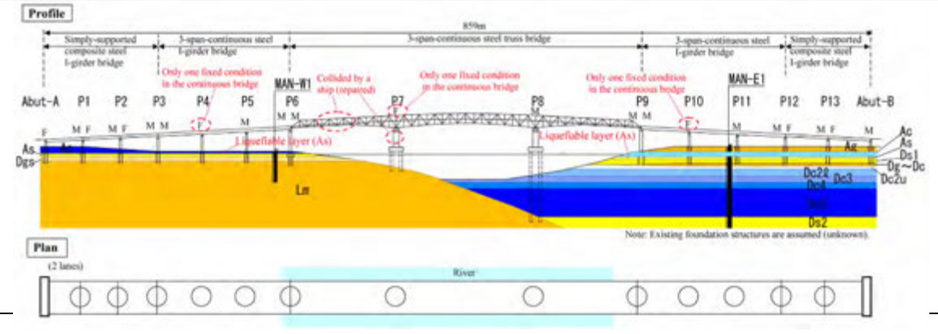
2) Bridge Condition

Seismic Vulnerability			
Items		Results of Surveys	Analyses/Comments
Earthquake Resisting System	1. Difference in soil types between adjacent piers	Soil Types are considered to be different among Pier-6, Pier-7, and Pier-8. (Soil type: I or II)	- Soil type difference among Pier-6, Pier-7, and Pier-8 (Soil type: I or II)
	2. Continuous or Simply Supported Bridge	1. Main Spans: Continuous 2. Approach Spans: Continuous or Simply supported	- A few side spans are simply supported. - High possibility of unseating at side spans due to simply supported structures
	3. Eccentric Loads (longitudinal and transverse dir.)	Maximum span ratio: (6^{th} span length): (7^{th} span length) = 1.0:2.2	- The span ratio is over 1.5 - Possibility of eccentric loads in both the longitudinal & transverse dir.: continuous
	4. Pier Type (single column/wall or multiple columns)	Single column type	- Single column/wall type is less advantageous than multiple column type against earthquakes in terms of structural redundancy.
	5. Height of Abutment (Embankment)	Height of Embankments - Abut-A: 4m - Abut-B: 4m	- Heights of Embankments are below 5m. - Lower risk of abutments' collapse under earthquake
	6. Built Year	1972 (Constructed before 1992)	- Possibility of confinement loss of pier columns/walls - Lack of seismic capacities of all the members
Unseating/ Fall-down Prevention System	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	- Longitudinal dir.: No restrainer - Transverse dir.: No restrainer	- High possibility of unseating under earthquake due to non-existence of seismic restrainers
	8. Bearing	1. Linear type (Movable or Fixed)  2. Roller type (Movable hinge)  3. Pivot type (Fixed hinge) 	1. Steel bearings (linear type) at abutments & piers of I-girder bridges - Condition: Corroded, paint deterioration 2. Steel bearings (roller type) at piers of the steel truss bridge - Condition: Good 3. Steel bearings (pivot type) at piers - Condition: Good except - Types of existing bearing are not vulnerable to earthquakes - Possibility of unseating at piers of simply supported steel I-girder bridges due to corroded bearings - Overall vulnerability: Serious
	9. Seat Length	1. Abut-A: 100cm Minimum Required Seat Length - JRA: 89cm, AASHTO: 44cm 2. Pier-13: 65cm Minimum Required Seat Length - JRA:89cm, AASHTO: 44cm	- The seat lengths of piers don't satisfy JRA's minimum required seat length. - Possibility of unseating at piers due to the short seat length
Foundation	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure
	11. Scouring	Moderate scouring at Pier-10	- Stability reduction of Pier-10 under earthquake due to the scouring
	12. Soil Type	Soil type (JRA): I & II	- Firm ground and moderate ground mix (Moderate)
	13. Liquefaction Potential	- Liquefiable layer type: Silty sand - N-Value range of the layer: 7	- Very high liquefaction potential
Seismic Hazard	14. Distance from Active Faults	- Distance: 15.8km - Active Fault Name: Cebu Lineament	- The distance is over 10km. - Small effect of the active fault movement

Structural Soundness			
Items		Results of Surveys	Analyses/Comments
Superstructures	1. Primary Members	Steel Truss 	- Primary steel members are apparently in good condition. - 1st span of steel truss bridge was collided by a ship in the past . - The load capacity is considered to be reduced by the damage even though the damage was repaired. - Overall damage degree: Moderate
	2. Secondary Members	Steel Truss 	- Heavy corrosion at most of secondary steel members - Section loss at some of the secondary steel members - Overall damage degree: Serious
	3. Deck Slab		- Minor cracking at the bottom face of deck slab through the entire bridge (Crack width range: 0.1-0.4mm) - Rebar exposure at the overhanging deck slabs - Overall damage degree: Moderate
Substructures	4. Deterioration of Columns/ Walls		- Severe rebar exposure at the bottom face of piers in the water - Pier-7 was collided by a ship in the past. - Overall damage degree: Serious

Summary of Structural Deficiencies

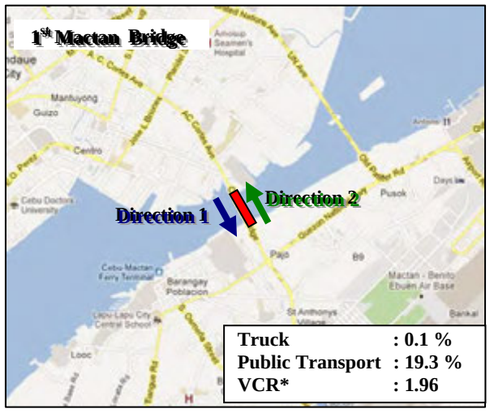
1. Seismic Vulnerability
   - Vulnerability of pier columns to large scale earthquakes (confinement loss, deterioration)
   - Vulnerability of foundations to large scale earthquakes (liquefaction potential, unknown structure, scouring)
   - High possibility of unseating (Partially simply supported, no seismic restrainers, short seat length, corroded bearings)
   - Vulnerability of bearings to large earthquakes (Only one fixed condition in the continuous bridge; Pier-4 & 7 & 10)
2. Structural Soundness (Superstructures)
   - Low load capacity due to a ship collide in the past
   - Deterioration of the deck slab (cracking, rebar exposure)
3. Structural Soundness (Substructure)
   - Severe rebar exposure at the bottom face of piers in the water
   - Experience of ship collision at Pier-7



3) Traffic Condition

a) Traffic Volume

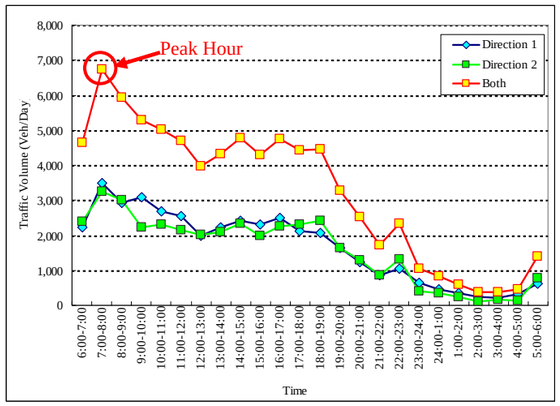
Daily and hourly traffic volume is shown in Figure 13.2.1-5, Figure 13.2.1-6 and Table 13.2.1-3



* Analysis by AADT traffic volume

* VCR: Volume/Capacity Ratio

Figure 13.2.1-5 Location of 1st Mandaue-Mactan Bridge



*Day 1 hourly traffic volume

Figure 13.2.1-6 Hourly Traffic Volume

Table 13.2.1-3 Daily Traffic Volume

Unit: Veh/Day

	Motorcycle / Tricycle	Car / Taxi / Pick-up / Van	Jeepney	Large Bus	2-Axle Truck	3-Axle Truck	Truck trailer	Sub-Total	Total
Day 1	27,215	30,073	7,220	8	52	4	0	37,357	64,572
Day 2	29,779	39,072	9,349	15	46	7	2	48,491	78,270
AADT	28,497	34,573	8,285	12	49	6	1	42,924	71,421

* Sub-total: Not including Motorcycle and Tricycle

b) Level-of-Service (hereafter called as LOS)

LOS is assumed, based on the following traffic conditions namely; peak hour, road type, free flow speed and number of lanes.

Table 13.2.1-4 Assumption and LOS

LOS: F	Peak Hour Traffic Volume	6,741 Veh/hour
	Road Type	Urban Road
	Free Flow Speed (km/h)	40 km/h
	No. of Lanes	2 lanes

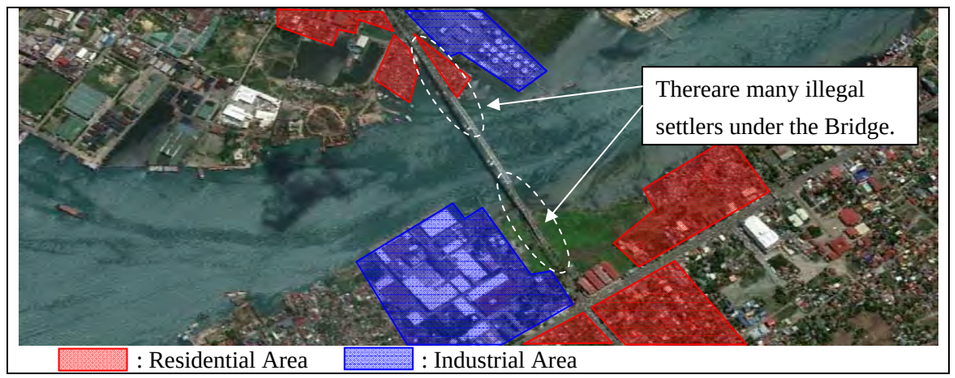
* Highway Capacity Manual, 2010

c) Traffic Condition

Analyses of the observed traffic volume condition and LOS are as follows:

- This bridge connects Mactan Island and Cebu Cityspanning across the Mactan Channel. Figure 13.2.1-6 shows the hourly traffic volume by direction, for both direction 1 and 2, the observed peak time is in the morning from 7 AM to 8 AM.
- No. of lane is 2 lanes, AADT is 71,421 veh/day, traffic congestion chronically occurrs on this bridge.
- Public transport ratio is 19.3%, jeepneys are passing this bridge to go to Mactan Island and Cebu City. And, truck ratio is 0.1%, because truck entry is regulated on this bridge. However, in the 2nd Mactan Bridge, which is the next bridge large trucks and trailers can pass.
- Peak hour traffic volume is 6,741 veh/hour, LOS is F because of peak hour traffic volume is very high and there is no passing lane.

4) Socio-Environmental Assessment Conditions



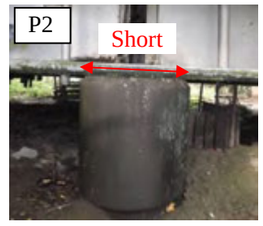
Household and Structures (Area facing the Bridge and the approach road)
- There are many illegal settlers under the Bridge on both sides of the strait. - Total number of illegal houses is 189 and number of PAPs are 733 at the time of survey.
Land use (Area facing the Bridge and the approach road)
- Under the Bridge is used for residential area including some kinds of shops and illegal settlers.
Existing Environmental Condition (Noise, Vibration, Air Pollution and Water contamination.)
- Environmental condition is not so bad for noise, vibration and air pollution. But sanitary condition such as waste effluent is bad without water and sewerage.
Environmental Protection Area (national park, reserves and designated wet land)
- The Bridge is not located in a cultural property or a natural reserve area.
Existence on Location Map of Valuable Ecological Habitats, Historical and Cultural Assets
- The Bridge is not located in a cultural property or a natural reserve area.

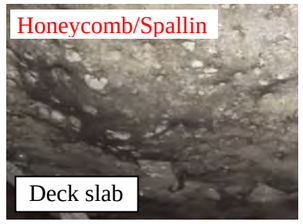
(3) Palanit Bridge

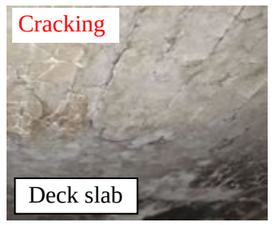
1) Structural and Geological Outline

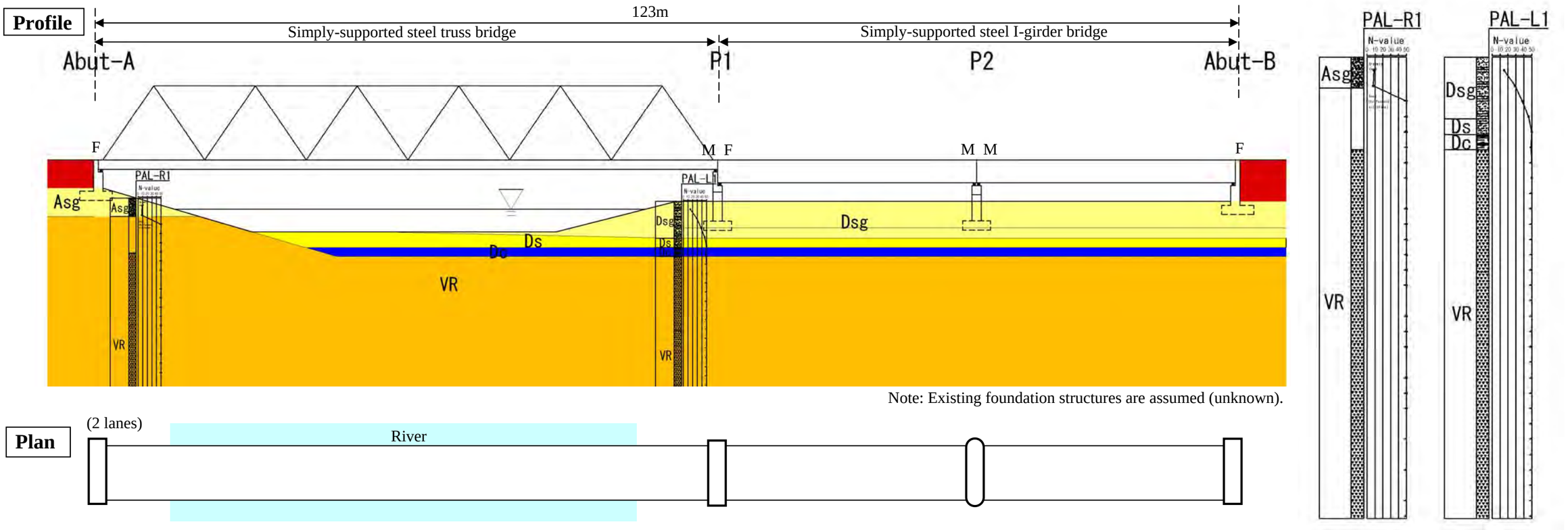
Bridge length/width	L=123m, W=8.9m
Year Built	1972
Bridge Type	- Main Spans: Simply supported steel truss bridge - Approach Spans: Simply supported steel I-girder bridge

Traffic Load Regulation	7 ton
Soil Profile Type	I (JRA)
Liquefaction Potential	None
As-built drawing	None







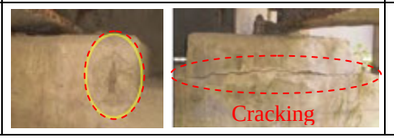


Note: Existing foundation structures are assumed (unknown).

Figure 13.2.1-7 Structural and Geological of Palanit Bridge

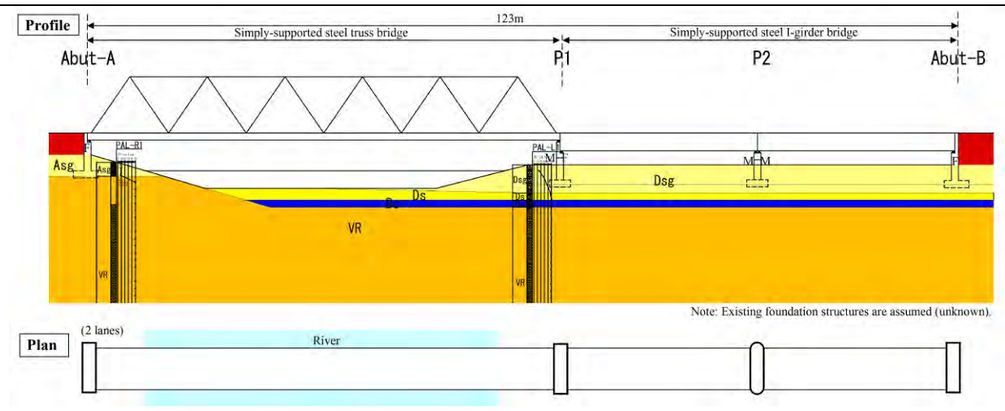
2) Bridge Condition

Seismic Vulnerability			
Items		Results of Surveys	Analyses/Comments
Earthquake Resisting System	1. Difference in soil types between adjacent piers	Soil Type is consistent along with the entire bridge	- No soil type difference between adjacent piers
	2. Continuous or Simply Supported Bridge	1. Main Spans: Simply supported 2. Approach Spans: Simply supported	- All spans are simply supported. - High possibility of unseating due to simply supported structures
	3. Eccentric Loads (longitudinal and transverse dir.)	Maximum span ratio: (1^{st} span length): (2^{nd} span length) = 2.7:1.0	- The span ratio is over 1.5 - Possibility of eccentric loads only in the transverse direction: simply supported
	4. Pier Type (single column/wall or multiple columns)	Wall type	- Single column/wall type is less advantageous than multiple column type against earthquakes in terms of structural redundancy.
	5. Height of Abutment (Embankment)	Height of Embankments - Abut-A: 3m - Abut-B: 3m	- Heights of embankments are below 5m. - Lower risk of abutments' collapse under earthquake
	6. Built Year	1972 (Constructed before 1992)	- Possibility of confinement loss of pier columns/walls - Lack of seismic capacities of all the members
Unseating/ Fall-down Prevention System	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	- Longitudinal dir.: No restrainer - Transverse dir.: No restrainer	- High possibility of unseating due to non-existence of seismic restrainers
	8. Bearing	1. Linear type (Movable or Fixed) 2. Roller type (Movable hinge)   3. Pivot type (Fixed hinge) 	1. Steel bearings (linear type) at Abut-B, Pier-1 & 2 - Condition: Heavily corroded 2. Steel bearings (roller type) at Pier-1 - Condition: Corroded, paint deterioration 3. Steel bearings (pivot type) at Abut-A - Condition: Good - Types of existing bearing are not vulnerable to earthquakes - Possibility of unseating at Abut-B, and Pier-1 & 2 due to corroded bearings - Overall vulnerability: Serious
	9. Seat Length	1. Abut-A: 55cm Minimum Required Seat Length - JRA: 84cm, AASHTO: 41cm 2. Pier-2: 44cm Minimum Required Seat Length - JRA: 104cm, AASHTO: 51cm	- The seat lengths of abutments and piers don't satisfy JRA's minimum required seat length. The seat length of Pier-2 doesn't satisfy even AASHTO's criteria. - High possibility of unseating due to the very short seat length
Foundation	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure
	11. Scouring	None	- No scouring effect
	12. Soil Type	Soil type (JRA): I	- Firm ground condition
	13. Liquefaction Potential	- The ground at the site consists of nonliquefiable layers	- No liquefaction potential
Seismic Hazard	14. Distance from Active Faults	- Distance: 7.6km - Active Fault Name: Northern Samar Lineament	- The distance is between 5 and 10km. - Moderate effect of the active fault movement

Structural Soundness			
Items		Results of Surveys	Analyses/Comments
Superstructures	1. Primary Members	Steel Truss  	- Severe painting deterioration and corrosion on steel members - Section loss at some part of primary steel members - Low load capacity (load limit: 7t) - Overall damage degree: Serious
	2. Secondary Members	Steel Truss  	- Severe painting deterioration and corrosion on steel members - Overall damage degree: Serious
	3. Deck Slab	Cracking & water leaking Honeycomb/ Spalling 	- Major cracking & water leaking at the bottom face of deck slab through the entire bridge (Crack width range: 0.3-0.7mm) - Honeycomb/Spalling at the bottom face of deck slab in Span-2 & 3 - Overall damage degree: Serious
Sub-structures	4. Deterioration of Columns/ Walls		- Rebar exposure & cracking at the bearing base of Pier-1 - Overall damage degree: Moderate

Summary of Structural Deficiencies

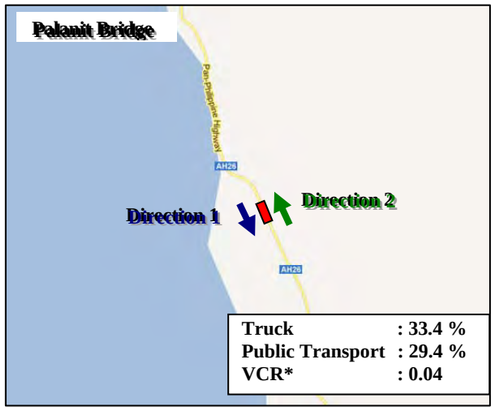
1. Seismic Vulnerability
   - Vulnerability of pier columns/walls to large scale earthquakes (confinement loss, deterioration)
   - Vulnerability of foundations to large scale earthquakes (unknown structure)
   - High possibility of unseating (simply supported, no seismic restrainers, short seat length, corroded bearings)
2. Structural Soundness (Superstructures)
   - Low load capacity (load limit: 7t)
   - Deterioration & Section loss at steel truss members
   - Severe deterioration of the deck slab (cracking, honeycomb/spalling, and water leaking)
3. Structural Soundness (Substructures)
   - Rebar exposure & cracking at the bearing base of Pier-1



3) Traffic Conditions

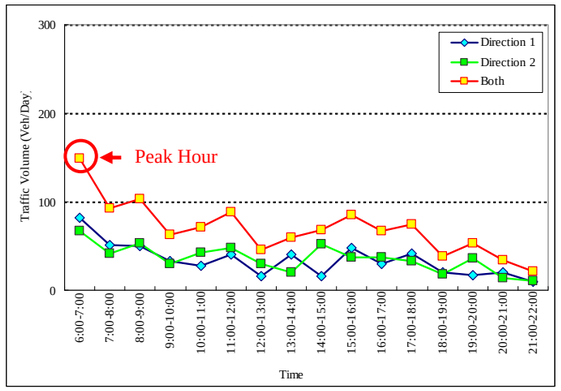
a) Traffic Volume

Daily and hourly traffic volume is shown in Figure 13.2.1-8, Figure 13.2.1-9 and Table 13.2.1-5.



* Analysis by AADT traffic volume
* VCR: Volume/Capacity Ratio

Figure 13.2.1-8 Location of Palanit Bridge



*Day 1 hourly traffic volume

Figure 13.2.1-9 Hourly Traffic Volume

Table 13.2.1-5 Daily Traffic Volume

Unit: Veh/Day

	Motorcycle / Tricycle	Car / Taxi / Pick-up / Van	Jeepney	Large Bus	2-Axle Truck	3-Axle Truck	Truck trailer	Sub-Total	Total
Day 1	562	184	64	70	90	42	10	460	1,022
Day 2	632	154	69	87	99	67	6	482	1,224
AADT	730	199	65	93	93	76	10	536	1,265

* Sub-total: Not including Motorcycle and Tricycle

b) Level-of-Service (hereafter called as LOS)

LOS is based on traffic assumptions which are peak hour, road type, free flow speed and number of lanes.

Table 13.2.1-6 Assumption and LOS

LOS: B	Peak Hour Traffic Volume	149 Veh/hour
	Road Type	Local Road
	Free Flow Speed (km/h)	30 km/h
	No. of Lanes	2 lanes

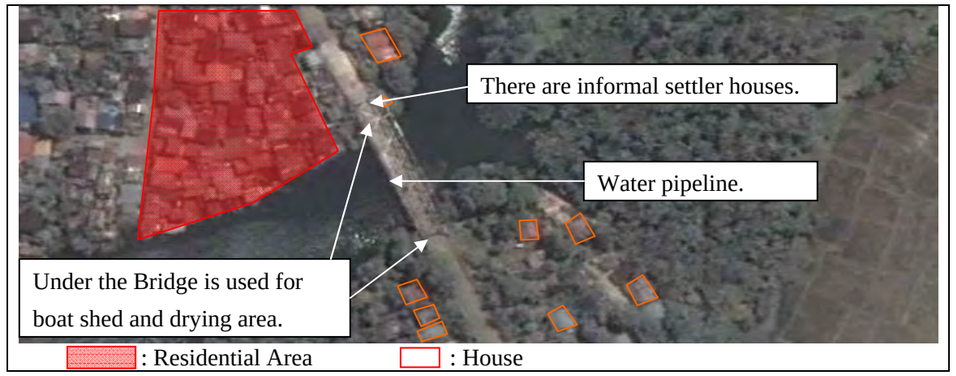
* Highway Capacity Manual, 2010

c) Traffic Condition

Analyses of the observed traffic volume condition and LOS are as follows:

- This is the only bridge is which connects Calbayog City and Allen City in Samar Island. Figure 13.2.1-9 shows the hourly traffic volume by direction, for both direction 1 and 2, the observed peak time is in the morning from 6 AM to 7 AM.
- No. of lane is 2 lanes, AADT is 1,265 veh/day, traffic volume is too small, thus vehicle capacity ratio is 0.04.
- If this bridge will be destroyed as a result of large earthquake, the passing vehicles will have to drive long distance detour through the center island.
- Peak hour traffic volume is 149 veh/hour, LOS is B because of peak hour traffic volume is very small.

4) Socio-Environmental Assessment Conditions



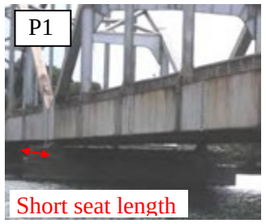
Household and Structures (Area facing the Bridge and the approach road)
- There are2 houses immediately beside the Bridge. The number of PAPs under the Bridge is 12.
- Water pipeline is held by the Bridge.
Land use (Area facing the Bridge and the approach road)
- The area is generally agricultural with coconut farming and fishing as primary source of livelihood.
- Under the Bridge is used for shed of fishing boat, breeding place for fighting cock, and for drying area.
Existing Environmental Condition (Noise, Vibration, Air Pollution and Water contamination.)
- Environmental condition is good except for the pollution of traffic flow such as noise, vibration and air pollution.
- Based on the water quality sampling analysis, some of the residents dispose their waste through the river but the level of contamination is under the standard.
Environmental Protection Area (national park, reserves and designated wet land)
- The Bridge is not located in a cultural property or a natural reserve area.
Existence on Location Map of Valuable Ecological Habitats, Historical and Cultural Assets
- The Bridge is not located in a cultural property or a natural reserve area.

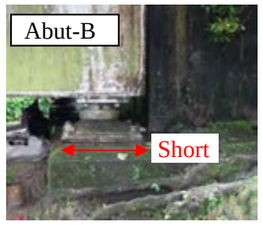
(4) Mawo Bridge

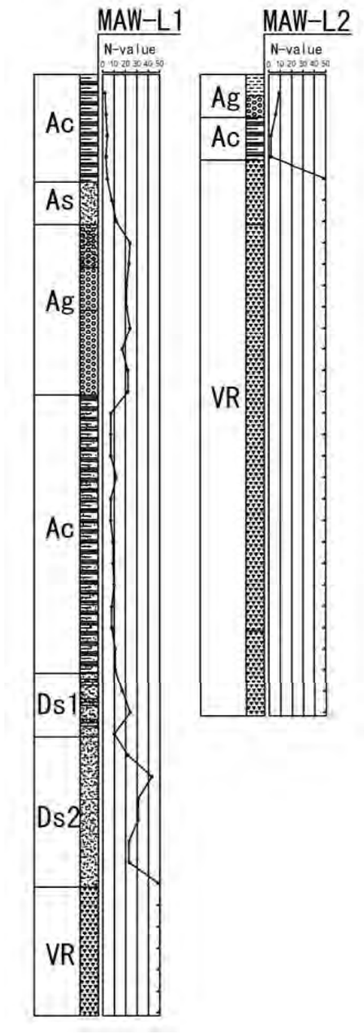
1) Structural and Geological Outline

Bridge length/width	L=259m, W=8.8m
Year Built	1976
Bridge Type	Simply supported steel langer arch bridge

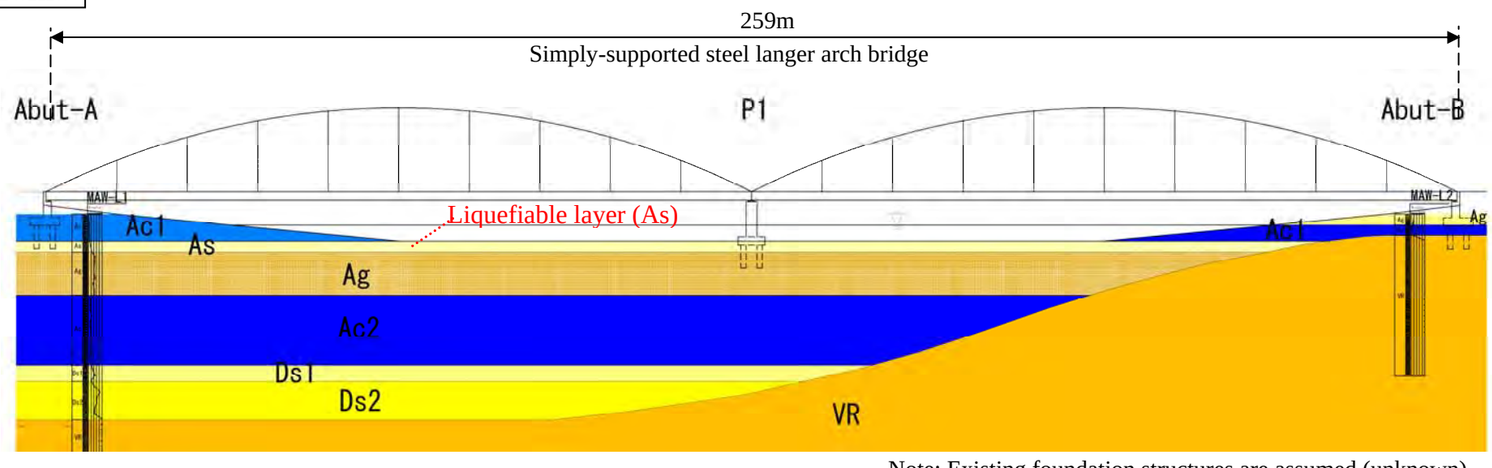
Traffic Load Regulation	7t
Soil Profile Type	I & III (JRA)
Liquefaction Potential	Very high (layer: As)
As-built drawing	None







Profile



Note: Existing foundation structures are assumed (unknown).

Plan

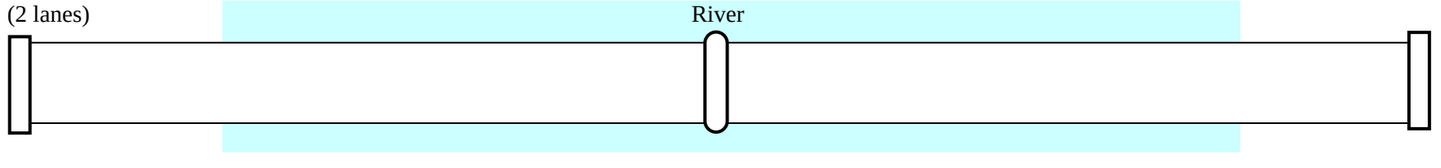


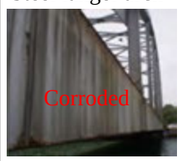
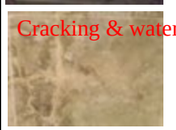
Figure 13.2.1-10 Structural and Geological Outline of Mawo Bridge

2) Bridge Condition

Seismic Vulnerability

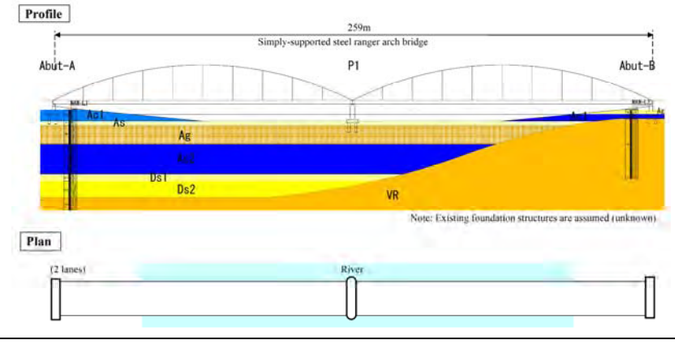
Items		Results of Surveys	Analyses/Comments
Earthquake Resisting System	1. Difference in soil types between adjacent piers	Soil Types are considered to be different between Pier-1 and Abut-B. (Soil type: I or III)	- Soil type difference between Pier-1 and Abut-B (Soil type: I or III)
	2. Continuous or Simply Supported Bridge	Simply supported	- All spans are simply supported. - High possibility of unseating due to simply supported structures
	3. Eccentric Loads (longitudinal and transverse dir.)	Maximum span ratio: (1st span length): (2nd span length) =1.0:1.0	- The span ratio is 1.0. - Little possibility of eccentric loads
	4. Pier Type (single column/wall or multiple columns)	Wall type	- Single column/wall type is less advantageous than multiple column type against earthquakes in terms of structural redundancy.
	5. Height of Abutment (Embankment)	Height of Embankments - Abut-A: 2m - Abut-B: 2m	- Heights of embankments are below 5m. - Lower risk of abutments' collapse under earthquake
	6. Built Year	1976 (Constructed before 1992)	- Possibility of confinement loss of pier columns/walls - Lack of seismic capacities of all the members
Unseating/ Fall-down Prevention System	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	- Longitudinal dir.: No restrainer - Transverse dir.: No restrainer	- High possibility of unseating due to non-existence of seismic restrainers
	8. Bearing	1. Pivot type (Fixed hinge)  Corroded 2. Roller type (Movable hinge)  Corroded	1. Steel bearings (pivot type) at Abut-A, and Pier-1 - Condition: Corroded, paint deterioration 2. Steel bearings (roller type) at Abut-B, and Pier-1 - Condition: Corroded, paint deterioration - Types of existing bearing are not vulnerable to earthquakes - Possibility of unseating at abutments, and Pier-1 due to corroded bearings - Overall vulnerability: Moderate
	9. Seat Length	1. Abut-B: 90cm Minimum Required Seat Length - JRA: 135cm, AASHTO: 66cm 2. Pier-2: 90cm Minimum Required Seat Length - JRA: 135cm, AASHTO: 66cm	- The seat lengths of abutments and Pier-1 don't satisfy JRA's minimum required - Possibility of unseating due to the short seat length
Foundation	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure
	11. Scouring	Condition of Pier-1 is unknown.	- Unknown
	12. Soil Type	Soil type (JRA): I & III	- Firm ground and soft ground mix (Soft)
	13. Liquefaction Potential	- Liquefiable layer type: Sand - N-Value range of the layer: 8-12	- Very high liquefaction potential
Seismic Hazard	14. Distance from Active Faults	- Distance: 1.4km - Active Fault Name: Northern Samar Lineament	- The distance is less than 2km. - Fatal effect of the active fault movement

Structural Soundness

Items		Results of Surveys	Analyses/Comments
Superstructures	1. Primary Members	Steel langer arch  Corroded  Corroded	- Painting deterioration and corrosion on steel members - Low load capacity (load limit: 7t) - Overall damage degree: Moderate
	2. Secondary Members	Steel langer arch  Corroded	- Painting deterioration and corrosion on steel members - Overall damage degree: Moderate
	3. Deck Slab	 Rebar exposure  Honeycomb/Spalling  Cracking & water leaking	- Cracking & water leaking at the bottom face of deck slab through the entire bridge (Crack width range: 0.3-0.7mm) - Honeycomb/Spalling at the bottom face of deck slab in Span-1 & 2 - Rebar exposure at the overhanging deck slab - Overall damage degree: Serious
Sub-structures	4. Deterioration of Columns/ Walls		- Pier-1 is apparently in good condition. - Overall damage degree: Good

Summary of Structural Deficiencies

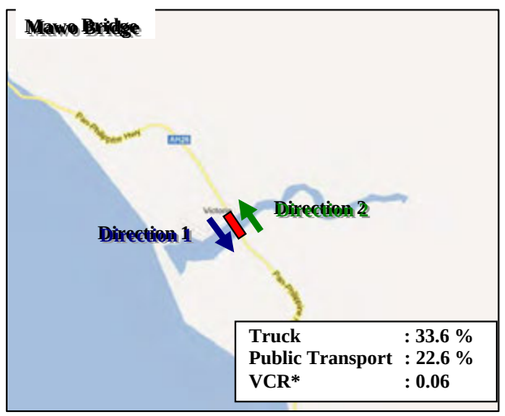
1. Seismic Vulnerability
   - Vulnerability of pier columns/walls to large scale earthquakes (confinement loss)
   - Vulnerability of foundations to large scale earthquakes (liquefaction potential, unknown structure)
   - High possibility of unseating (simply supported, no seismic restrainers, short seat length, corroded bearings)
2. Structural Soundness (Superstructures)
   - Low load capacity (load limit: 7t), abnormal vibration of the superstructure
   - Large deflection under large live loads
   - Deterioration at steel truss members
   - Severe deterioration of the deck slab (cracking, honeycomb/spalling, water leaking, rebar exposure)
3. Structural Soundness (Substructures)
   - None



3) Traffic Conditions

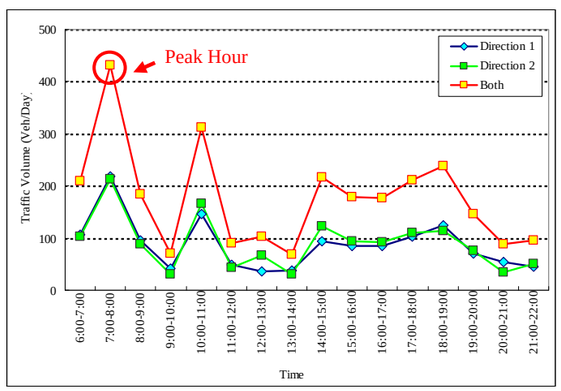
a) Traffic Volume

Daily and hourly traffic volume is shown in Figure 13.2.1-11, Figure 13.2.1-12 and Table 13.2.1-7.



* Analysis by AADT traffic volume
* VCR: Volume/Capacity Ratio

Figure 13.2.1-11 Location of Mawo Bridge



*Day 1 hourly traffic volume

Figure 13.2.1-12 Hourly Traffic Volume

Table 13.2.1-7 Daily Traffic Volume

Unit: Veh/Day

	Motorcycle / Tricycle	Car / Taxi / Pick-up / Van	Jeepney	Large Bus	2-Axle Truck	3-Axle Truck	Truck trailer	Sub-Total	Total
Day 1	2,193	275	75	70	130	71	12	633	2,826
Day 2	2,534	270	75	87	135	83	11	661	3,526
AADT	2,889	322	73	93	130	102	14	735	3,625

* Sub-total: Not including Motorcycle and Tricycle

b) Level-of-Service (hereafter called as LOS)

LOS is based on traffic assumptions which are peak hour, road type, free flow speed and number of lanes.

Table 13.2.1-8 Assumption and LOS

LOS: B	Peak Hour Traffic Volume	432 Veh/hour
	Road Type	Urban Road
	Free Flow Speed (km/h)	30 km/h
	No. of Lanes	2 lanes

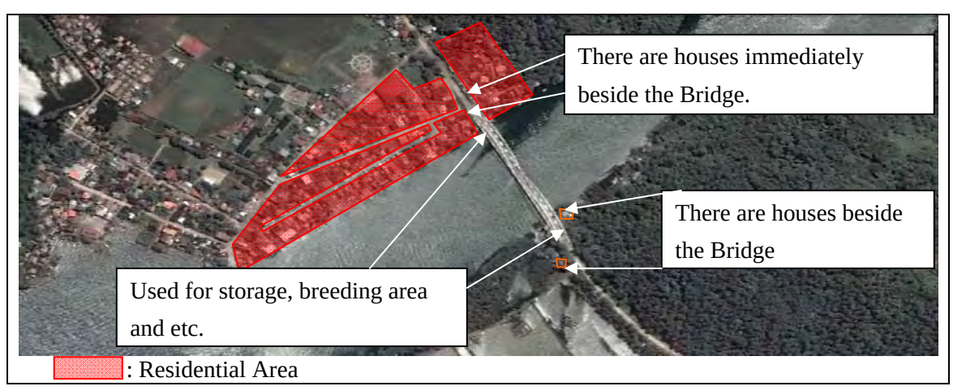
* Highway Capacity Manual, 2010

c) Traffic Condition

Analyses of the observed traffic volume condition and LOS are as follows:

- This bridge is the only bridge that connects Calbayog City and Allen City in Samar Island. Figure 13.2.1-12 shows the hourly traffic volume by direction, for both direction 1 and 2 , the observed peak time is in the morning from 7 AM to 8 AM.
- No. of lane is 2 lanes, AADT is 3,625 veh/day, traffic volume is too small, thus vehicle capacity ratio is 0.06.
- If this bridge will be destroyed as result of large earthquake, passing vehicles will drive a long distance detour through the center island.
- Peak hour traffic volume is 432 veh/hour. LOS is B because the peak hour traffic volume is very small.

4) Socio-Environmental Assessment Conditions



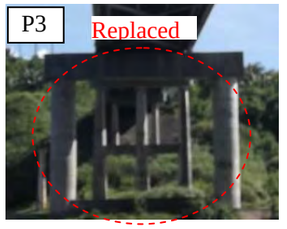
Household and Structures (Area facing the Bridge and the approach road)
- There are many houses immediately beside the Bridge. - There are 7 informal settlers under the Bridge with 37 PAPs.
Land use (Area facing the Bridge and the approach road)
- North side area and along approach road on south side are used for residential area. - Under the Bridge is used for shed of boat, breeding place for domestic animal such as fighting cock, pig and for drying area of washed clothes.
Existing Environmental Condition (Noise, Vibration, Air Pollution and Water contamination.)
- Environmental condition is good except for the pollution of traffic flow such as noise, vibration and air pollution. - Based on the water quality sampling analysis, some of the residents dispose their waste through the river but the level of contamination is under the standard.
Environmental Protection Area (national park, reserves and designated wet land)
- The Bridge is not located in a cultural property or a natural reserve area.
Existence on Location Map of Valuable Ecological Habitats, Historical and Cultural Assets
- The Bridge is not located in a cultural property or a natural reserve area.

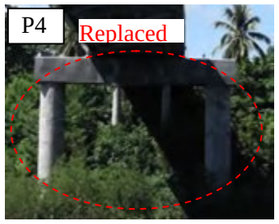
(5) Biliran Bridge

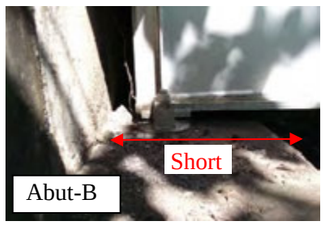
1) Structural and Geological Outline

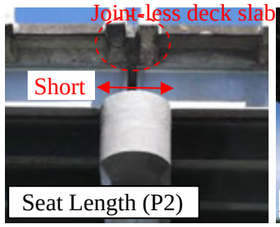
Bridge length/width	L=252m, W=8.9m
Year Built	1976
Bridge Type	- Main Spans: Simply supported steel langer arch bridge - Approach Spans: Simply supported steel I-girder bridge

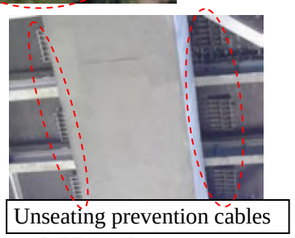
Traffic Load Regulation	15t
Soil Profile Type	I (JRA)
Liquefaction Potential	None
As-built drawing	None

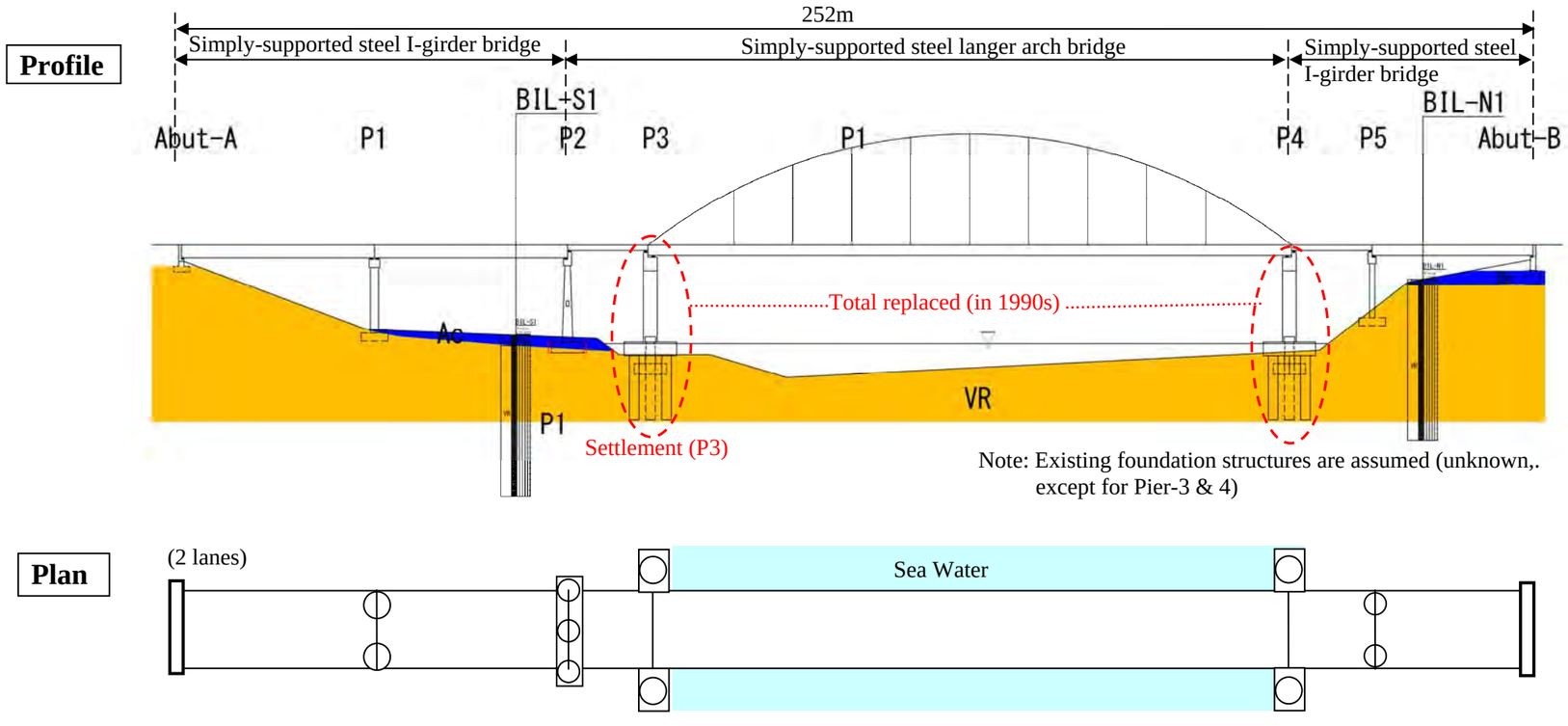












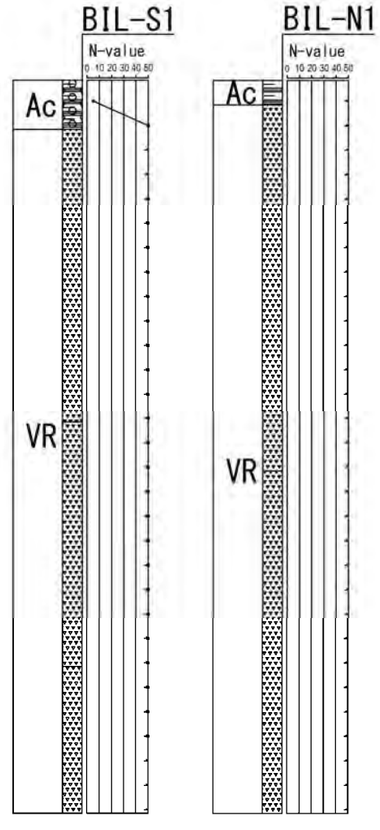
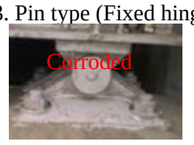


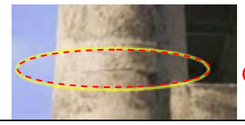
Figure 13.2.1-13 Structural and Geological Outline of Biliran Bridge

2) Bridge Condition

Seismic Vulnerability

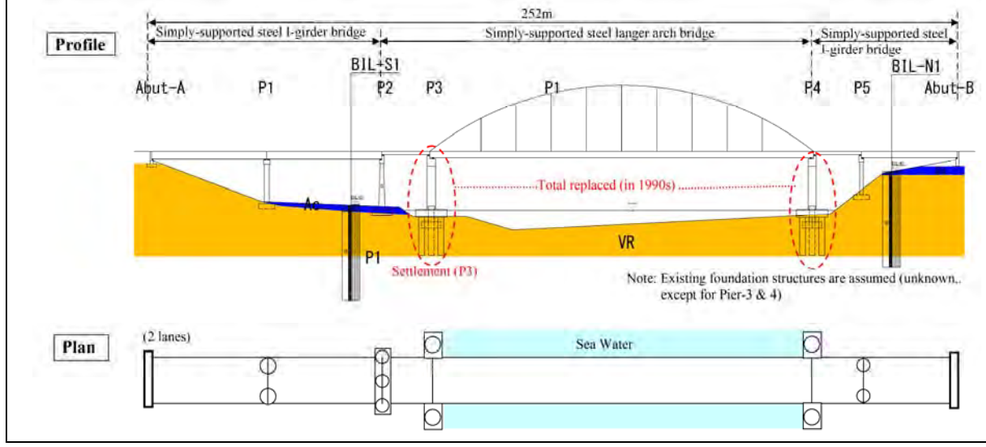
Items		Results of Surveys	Analyses/Comments
Earthquake Resisting System	1. Difference in soil types between adjacent piers	Soil Type is consistent along with the entire bridge	- No soil type difference between adjacent piers
	2. Continuous or Simply Supported Bridge	1. Main Spans: Simply supported 2. Approach Spans: Simply supported Note: Joint-less deck slab	- All spans are simply supported. - High possibility of unseating due to simply supported structures
	3. Eccentric Loads (longitudinal and transverse dir.)	Maximum span ratio: (3^{rd} span length): (4^{th} span length) =1.0:8.5	- The span ratio is over 1.5 - Possibility of eccentric loads only in the transverse direction: simply supported
	4. Pier Type (single column/wall or multiple columns)	Multiple column type	- Multiple column type is more advantageous than single column/wall type against earthquakes in terms of structural redundancy.
	5. Height of Abutment (Embankment)	Height of Embankments - Abut-A: 4m - Abut-B: 4m	- Heights of embankments are below 5m. - Lower risk of abutments' collapse under earthquake
	6. Built Year	1976 (Constructed before 1992) Note: Pier-3 & 4 were replaced in 1990s.	- Possibility of confinement loss of pier columns/walls - Lack of seismic capacities of all the members
Unseating/ Fall-down Prevention System	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	- Longitudinal dir.: Unseating prevention cables - Transverse dir.: No restrainer	- No seismic restrainers in the transverse direction - Unseating prevention cables are installed at the deck slab: not very effective - Possibility of unseating due to the above defects (Poor)
	8. Bearing	1. Linear type (Movable or Fixed)  2. Roller type (Movable hinge)  3. Pin type (Fixed hinge) 	1. Steel bearings (linear type) at abutments and piers - Condition: Corroded and deformed 2. Steel bearings (roller type) at Pier-1 - Condition: Slightly corroded 3. Steel bearings (pin type) at Abut-A - Condition: Good - Types of existing bearing are not vulnerable to earthquakes - Possibility of unseating at abutments and piers of steel I-girder bridges due to corroded bearings - Overall vulnerability: Serious
	9. Seat Length	1. Abut-A: 60cm Minimum Required Seat Length - JRA: 85cm, AASHTO: 43cm 2. Pier-2: 55cm Minimum Required Seat Length - JRA: 85cm, AASHTO: 55cm	- The seat lengths of abutments and piers don't satisfy JRA's minimum required seat length. - Possibility of unseating due to the short seat length
Foundation	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure
	11. Scouring	None	- No scouring effect
	12. Soil Type	Soil type (JRA): I	- Firm ground condition
	13. Liquefaction Potential	- The ground at the site consists of nonliquefiable layers	- No liquefaction potential
Seismic Hazard	14. Distance from Active Faults	- Distance: 4.3km - Active Fault Name: PFZ Central Leyte Fault	- The distance is between 2 and 5km. - Serious effect of the active fault movement

Structural Soundness

Items		Results of Surveys	Analyses/Comments
Superstructures	1. Primary Members	Steel I-girder 	- Corrosion on steel I-girder members - Primary members of steel langer arch are in good condition. - Overall damage degree: Moderate
	2. Secondary Members	Steel langer arch 	- Secondary members are in good condition - Overall damage degree: Good
	3. Deck Slab	Deterioration & Spalling  Water leaking 	- The bottom face of deck slab is repaired with carbon fiber sheet. - Spalling & water leaking at the overhanging deck slab - Overall damage degree: Moderate
Sub-structures	4. Deterioration of Columns/ Walls		- Cracking at piers - Overall damage degree: Moderate

Summary of Structural Deficiencies

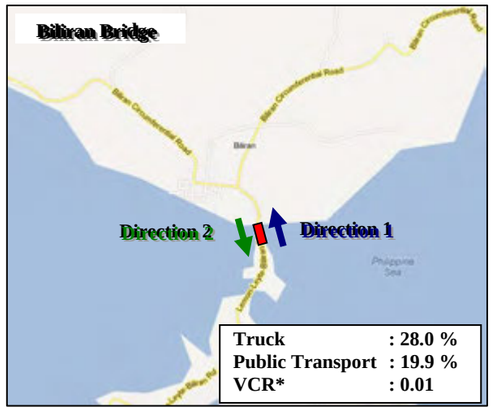
1. Seismic Vulnerability
   - Vulnerability of pier columns/walls to large scale earthquakes (confinement loss, deterioration)
   - Vulnerability of foundations to large scale earthquakes (unknown structure)
   - High possibility of unseating (simply supported, insufficient seismic restrainers, short seat length, corroded bearings)
2. Structural Soundness (Superstructures)
   - Corrosion of steel I-girders.
   - Deterioration of the overhanging deck slab (spalling, water leaking)
   - Abnormal vibration of the steel langer arch bridge
3. Structural Soundness (Substructure)
   - Cracking at piers



3) Traffic Conditions

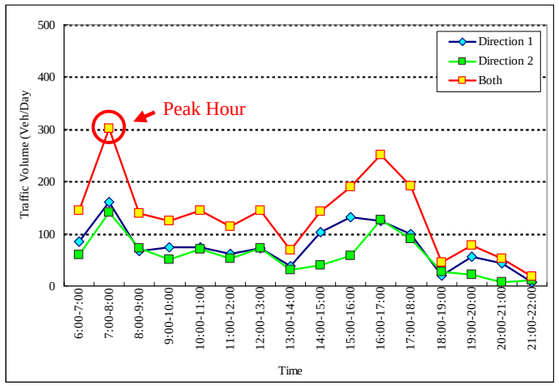
a) Traffic Volume

Daily and hourly traffic volume is shown in Figure 13.2.1-14, Figure 13.2.1-15 and Table 13.2.1-9.



* Analysis by AADT traffic volume
* VCR: Volume/Capacity Ratio

Figure 13.2.1-14 Location of Biliran Bridge



*Day 1 hourly traffic volume

Figure 13.2.1-15 Hourly Traffic Volume

Table 13.2.1-9 Daily Traffic Volume

Unit: Veh/Day

	Motorcycle / Tricycle	Car / Taxi / Pick-up / Van	Jeepney	Large Bus	2-Axle Truck	3-Axle Truck	Truck trailer	Sub-Total	Total
Day 1	1,564	345	49	72	85	24	4	579	2,143
Day 2	1,379	335	29	48	86	30	1	529	2,055
AADT	1,718	276	49	57	124	23	2	530	2,248

* Sub-total: Not including Motorcycle and Tricycle

b) Level-of-Service (hereafter called as LOS)

LOS is based on traffic assumptions which are peak hour, road type, free flow speed and number of lanes.

Table 13.2.1-10 Assumption and LOS

LOS: B	Peak Hour Traffic Volume	301 Veh/hour
	Road Type	Local Road
	Free Flow Speed (km/h)	30 km/h
	No. of Lanes	2 lanes

* Highway Capacity Manual, 2010

c) Traffic Condition

Analyses of the observed traffic volume condition and LOS are as follows:

- This bridge is the only bridge that connects Biliran Island and Leyte Island. Figure 13.2.1-15 shows the hourly traffic volume by direction, for both direction 1 and 2 the observed peak time is in the morning from 7 AM to 8 AM.
- No. of lane is 2 lanes, AADT is 2,248 veh/day, traffic volume is too small, thus vehicle capacity ratio is 0.01.
- If this bridge will be destroyed as a result of large earthquake, the island's residents will be isolated due to no detour road.
- Peak hour traffic volume is 301 veh/hour, LOS is B because of peak hour traffic volume is too small.

4) Socio-Environment Assessment Conditions

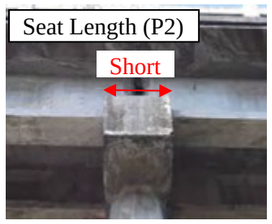
Household and Structures (Area facing to the Bridge and the approach road)
- There is no house and structure near the bridge except a lighthouse.
Land use (Area facing the Bridge and the approach road)
- Along the road there is no house except maintenance house with no occupant person.
Existing Environmental Condition (Noise, Vibration, Air Pollution and Water contamination.)
- Environmental condition is very good, Traffic volume is low.
Environmental Protection Area (national park, reserves and designated wet land)
- The Bridge is not located in a cultural property or a natural reserve area.
Existence on Location Map of Valuable Ecological Habitats, Historical and Cultural Assets
- The Bridge is not located in a cultural property or a natural reserve area.

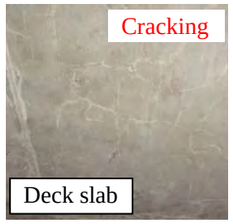
(6) Lilo-an Bridge

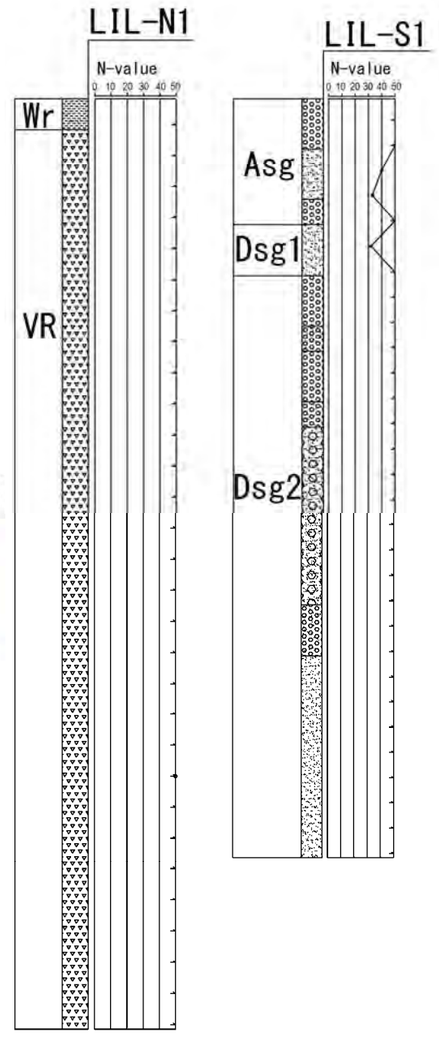
1) Structural and Geological Outline

Bridge length/width	L=298m, W=8.9m
Year Built	1979
Bridge Type	- Main Spans: Simply supported steel langer arch bridge - Approach Spans: Simply supported PC I-girder bridge

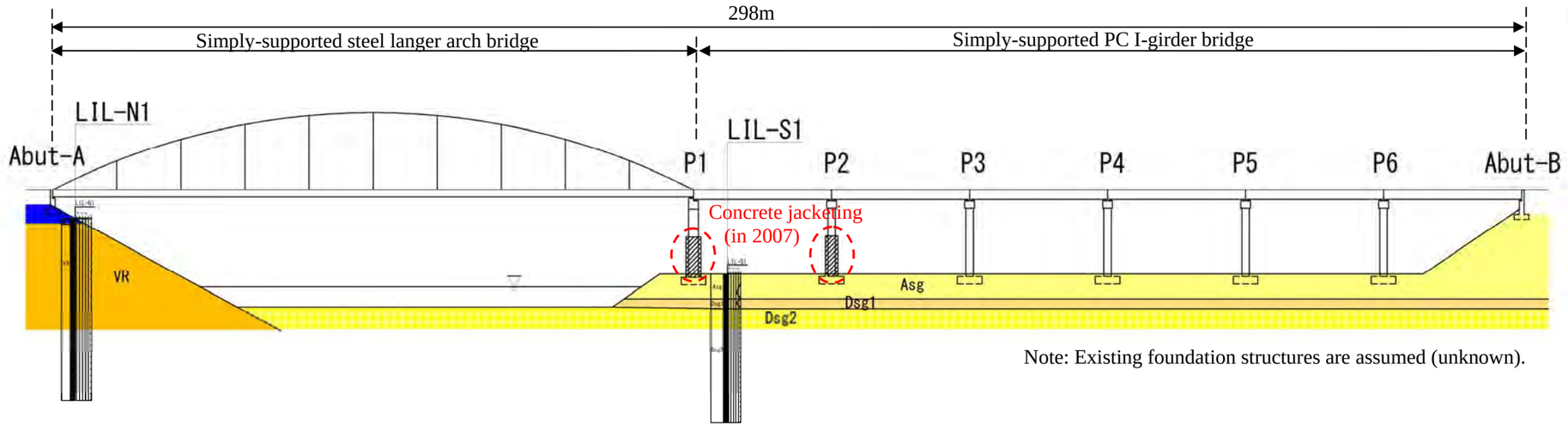
Traffic Load Regulation	20t
Soil Profile Type	I (JRA)
Liquefaction Potential	None
As-built drawing	None







Profile



Note: Existing foundation structures are assumed (unknown).

Plan

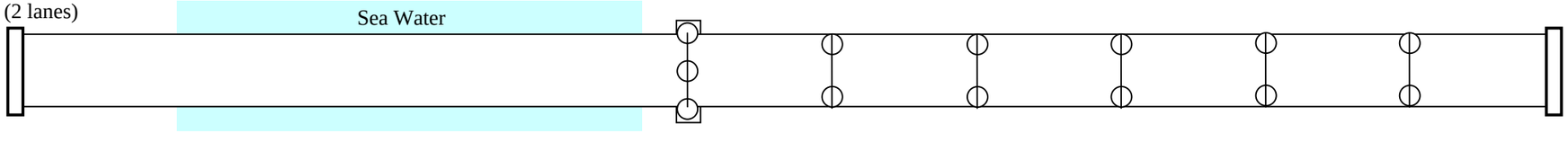


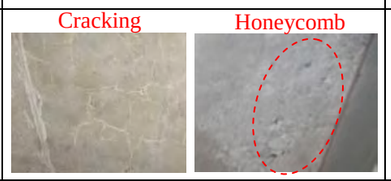
Figure 13.2.1-16 Structural and Geological Outline of Lilo-an Bridge

2) Bridge Condition

Seismic Vulnerability

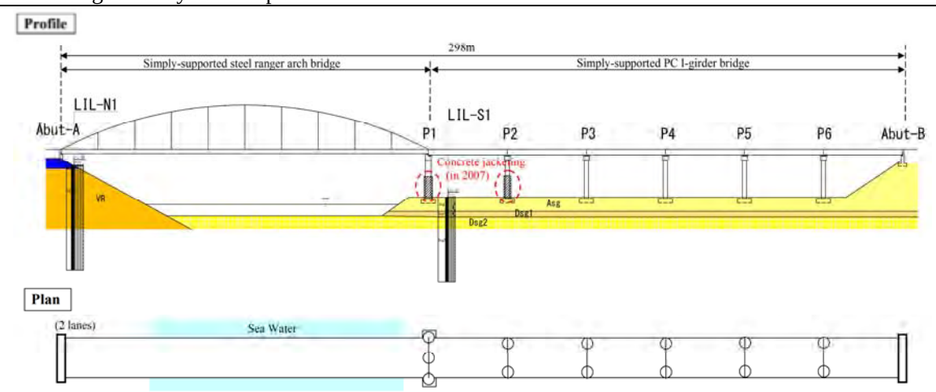
Items		Results of Surveys	Analyses/Comments
Earthquake Resisting System	1. Difference in soil types between adjacent piers	Soil Type is consistent along with the entire bridge	- No soil type difference between adjacent piers
	2. Continuous or Simply Supported Bridge	1. Main Spans: Simply supported 2. Approach Spans: Simply supported	- All spans are simply supported. - High possibility of unseating due to simply supported structures
	3. Eccentric Loads (longitudinal and transverse dir.)	Maximum span ratio: (1st span length): (2nd span length) =3.9:1.0	- The span ratio is over 1.5 - Possibility of eccentric loads only in the transverse direction: simply supported
	4. Pier Type (single column/wall or multiple columns)	Multiple column type	- Multiple column type is more advantageous than single column/wall type against earthquakes in terms of structural redundancy.
	5. Height of Abutment (Embankment)	Height of Embankments - Abut-A: 4m - Abut-B: 4m	- Heights of embankments are below 5m. - Lower risk of abutments' collapse under earthquake
	6. Built Year	1979 (Constructed before 1992)	- Possibility of confinement loss of pier columns/walls - Lack of seismic capacities of all the members
Unseating/ Fall-down Prevention System	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	- Longitudinal dir.: No restrainer - Transverse dir.: No restrainer	- High possibility of unseating due to non-existence of seismic restrainers
	8. Bearing	1. Roller type (Movable hinge)  2. Pin type (Fixed hinge)  3. Rubber pad with angle steel (Fixed) 	1. Steel bearings (roller type) at Abut-A - Condition: Good 2. Steel bearings (Pin type) at Pier-1 - Condition: Corroded 3. Rubber pad with angle steel at piers & Abut-B - Condition: Corroded (angle steel) - Types of existing bearing are not vulnerable to earthquakes - Possibility of unseating at Abut-B & piers of steel I-girder bridges due to corroded bearings - Overall vulnerability: Serious
	9. Seat Length	1. Abut-A: 60cm Minimum Required Seat Length - JRA: 135cm, AASHTO: 68cm 2. Pier-1: 40cm (PC I-girder side) Minimum Required Seat Length - JRA: 135cm, AASHTO: 78cm	- The seat lengths of abutments and piers don't satisfy JRA's minimum required seat length. The seat length of Pier-1 doesn't satisfy even AASHTO's criteria. - High possibility of unseating due to the very short seat length
Foundation	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure
	11. Scouring	None	- No scouring effect
	12. Soil Type	Soil type (JRA): I	- Firm ground condition
	13. Liquefaction Potential	- The ground at the site consists of nonliquefiable layers	- No liquefaction potential
Seismic Hazard	14. Distance from Active Faults	- Distance: 2.5km - Active Fault Name: PFZ Central Leyte Fault	- The distance is between 2 and 5km. - Serious effect of the active fault movement

Structural Soundness

Items		Results of Surveys	Analyses/Comments
Superstructures	1. Primary Members	Steel langer arch / PC I-girder 	- Corrosion on steel langer arch members - Water leaking on PC I-girders - Overall damage degree: Moderate
	2. Secondary Members	Steel langer arch 	- Corrosion at bracing connections - Loose connection due to lack of bolts at splices of steel members - Overall damage degree: Moderate
	3. Deck Slab		- Cracking & honeycomb at the bottom face of deck slab through the entire bridge (Crack width range: 0.4mm) - Overall damage degree: Moderate
Sub-structures	4. Deterioration of Columns/ Walls		- Cracking & honeycomb at piers - Overall damage degree: Moderate

Summary of Structural Deficiencies

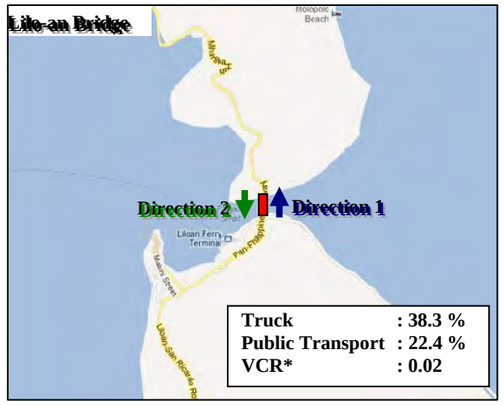
1. Seismic Vulnerability
   - Vulnerability of pier columns/walls to large scale earthquakes (confinement loss, deterioration)
   - Vulnerability of foundations to large scale earthquakes (unknown structure)
   - High possibility of unseating (simply supported, no seismic restrainers, short seat length, corroded bearings)
2. Structural Soundness (Superstructures)
   - Corrosion of steel langer arch bridge
   - Water leaking at PC I-girders
   - Abnormal vibration of the steel langer arch bridge
   - Deterioration of the deck slab (cracking, honeycomb, water leaking)
3. Structural Soundness (Substructures)
   - Cracking & honeycomb at piers



3) Traffic Conditions

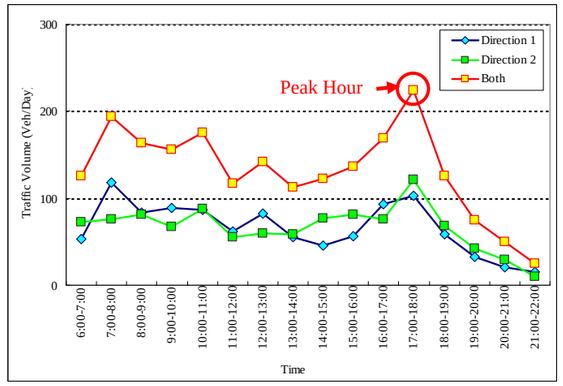
a) Traffic Volume

Daily and hourly traffic volume is shown in Figure 13.2.1-17, Figure 13.2.1-18 and Table 13.2.1-11.



* Analysis by AADT traffic volume
* VCR: Volume/Capacity Ratio

Figure 13.2.1-17 Location of Lilo-an Bridge



*Day 1 hourly traffic volume

Figure 13.2.1-18 Hourly Traffic Volume

Table 13.2.1-11 Daily Traffic Volume

Unit: Veh/Day

	Motorcycle / Tricycle	Car / Taxi / Pick-up / Van	Jeepney	Large Bus	2-Axle Truck	3-Axle Truck	Truck trailer	Sub-Total	Total
Day 1	1,543	199	50	77	170	46	30	572	2,115
Day 2	1,623	177	36	65	160	28	4	470	2,243
AADT	1,979	226	45	84	180	25	15	575	2,554

* Sub-total: Not including Motorcycle and Tricycle

b) Level-of-Service (hereafter called as LOS)

LOS is based on traffic assumptions which are peak hour, road type, free flow speed and number of lanes.

Table 13.2.1-12 Assumption and LOS

LOS: B	Peak Hour Traffic Volume	224 Veh/hour
	Road Type	Local Road
	Free Flow Speed (km/h)	30 km/h
	No. of Lanes	2 lanes

* Highway Capacity Manual, 2010

c) Traffic Condition

Analyses of the observed traffic volume condition and LOS are as follows:

- This bridge is the only bridge which connects Panaon Island and Leyte Island. Figure 13.2.1-18 shows the hourly traffic volume by direction, for direction 1, the observed peak time is in the morning from 7 AM to 8 AM, for direction 2, the observed peak time is in the evening from 5 PM to 6 PM.
- No. of lane is 2 lanes, AADT is 2,554 veh/day, traffic volume is very small, with a vehicle capacity ratio of 0.02.
- If this bridge will be destroyed as a result of large earthquake, the island's residents will become isolated due to no detour road.
- Peak hour traffic volume is 224 veh/hour, LOS is B because of very small peak hour traffic volume.

4) Socio-Environmental Assessment Conditions

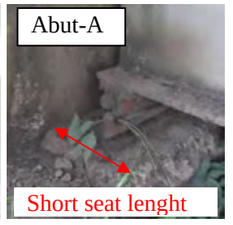
Household and Structures (Area facing the Bridge and the approach road)
- There is no house along north side of approach road. - There are some houses along south side of the Bridge. Under the Bridge near strait is used for basket court and there are two vendors.
Land use (Area facing the Bridge and the approach road)
- On south side of the Bridge is a residential area. - Under the Bridge are used for orchard, block storage site, chicken house, waste collection point and dock area for boat.
Existing Environmental Condition (Noise, Vibration, Air Pollution and Water contamination.)
- Environmental condition is good except for the pollution of traffic flow such as noise, vibration and air pollution.
Environmental Protection Area (national park, reserves and designated wet land)
- The Bridge is not located in a cultural property or a natural reserve area.
Existence on Location Map of Valuable Habitats Ecologically, Historical and Cultural Assets
- The Bridge is not located in a cultural property or a natural reserve area.

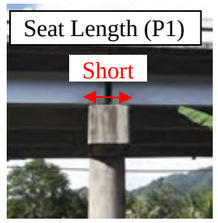
(7) Wawa Bridge

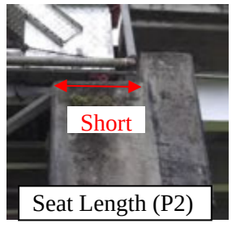
1) Structural and Geological Outline

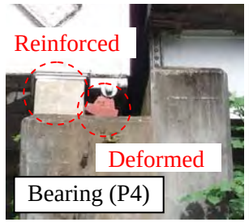
Bridge length/width	L=228m, W=8.9m
Year Built	1967
Bridge Type	- Main Spans: Simply supported steel truss bridge - Approach Spans: Simply supported steel I-girder bridge

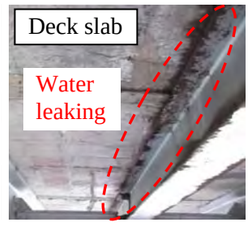
Traffic Load Regulation	10t
Soil Profile Type	I (JRA)
Liquefaction Potential	None
As-built drawing	None

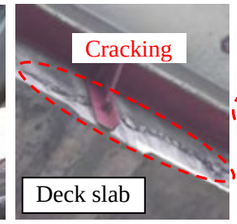


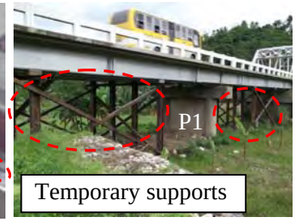




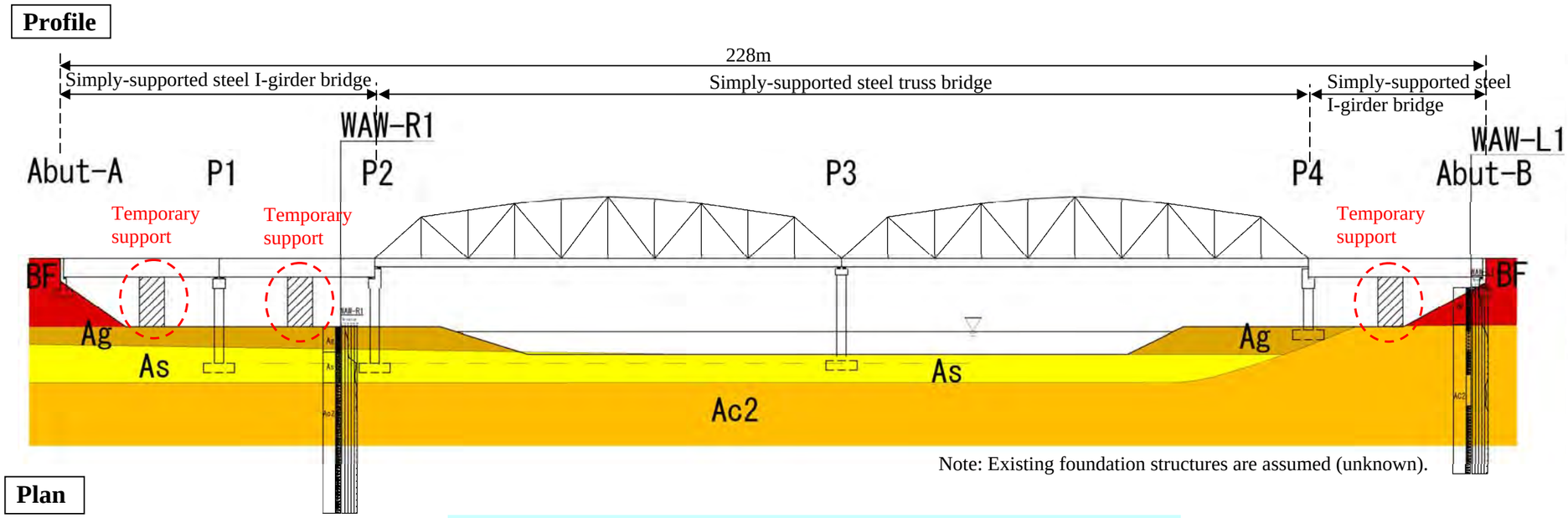




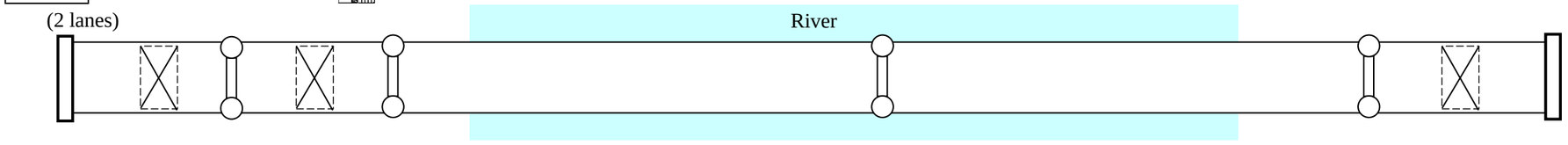




Profile



Plan



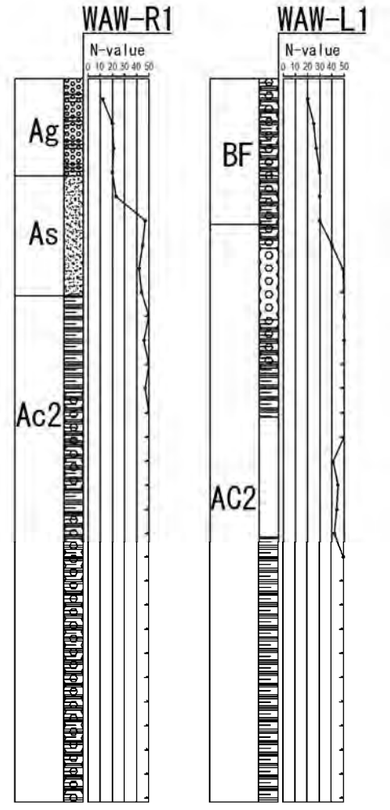
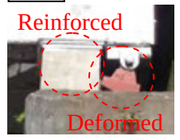
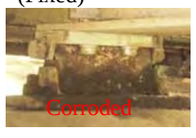
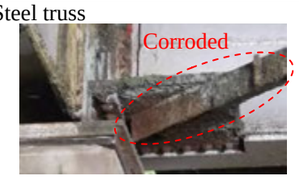


Figure 13.2.1-19 Structural and Geological of Wawa Bridge

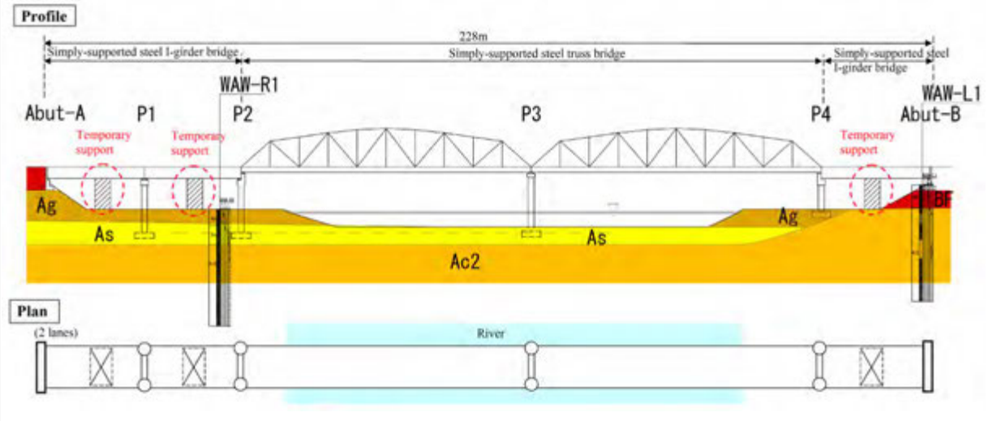
2) Bridge Condition

Seismic Vulnerability			
Items		Results of Surveys	Analyses/Comments
Earthquake Resisting System	1. Difference in soil types between adjacent piers	Soil Type is consistent along with the entire bridge	- No soil type difference between adjacent piers
	2. Continuous or Simply Supported Bridge	1. Main Spans: Simply supported 2. Approach Spans: Simply supported	- All spans are simply supported. - High possibility of unseating due to simply supported structures
	3. Eccentric Loads (longitudinal and transverse dir.)	Maximum span ratio: (1st span length): (2nd span length) =1.0:3.0	- The span ratio is over 1.5 - Possibility of eccentric loads only in the transverse direction: simply supported
	4. Pier Type (single column/wall or multiple columns)	Wall type	- Single column/wall type is less advantageous than multiple column type against earthquakes in terms of structural redundancy.
	5. Height of Abutment (Embankment)	Height of Embankments - Abut-A: 4m - Abut-B: 4m	- Heights of embankments are below 5m. - Lower risk of abutments' collapse under earthquake
	6. Built Year	1967 (Constructed before 1992)	- Possibility of confinement loss of pier columns/walls - Lack of seismic capacities of all the members
Unseating/ Fall-down Prevention System	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	- Longitudinal dir.: No restrainer - Transverse dir.: No restrainer	- High possibility of unseating due to non-existence of seismic restrainers
	8. Bearing	1. Rocker type (Movable hinge) P4  Corroded, deformed  Reinforced Deformed 2. Pin type (Hinge)  Slightly corroded 3. Fixed type (Fixed)  Corroded	1. Steel bearings (rocker type) at abutments & piers - Condition: Corroded, deformed 2. Steel bearings (pin type) at Pier-1 - Condition: Corroded 3. Steel bearings (fixed type) at Pier-4 - Condition: Corroded - Rocker type bearings are vulnerable to seismic forces: possibility of unseating at abutments & piers - Possibility of unseating at abutments & piers due to corroded bearings & seismically vulnerable bearing type - Overall vulnerability: Serious
	9. Seat Length	1. Abut-A: 45cm Minimum Required Seat Length - JRA: 83cm, AASHTO: 42cm 2. Pier-3: 65cm Minimum Required Seat Length - JRA: 108cm, AASHTO: 60cm	- The seat lengths of abutments and piers don't satisfy JRA's minimum required seat length. - High possibility of unseating due to the short seat length
Foundation	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure
	11. Scouring	Condition of Pier-3 is unknown.	- Unknown
	12. Soil Type	Soil type (JRA): I	- Firm ground condition
	13. Liquefaction Potential	- The ground at the site consists of nonliquefiable layers	- No liquefaction potential
Seismic Hazard	14. Distance from Active Faults	- Distance: 1.4km - Active Fault Name: PFZ Eastern Mindanao Fault	- The distance is less than 2km. - Fatal effect of the active fault movement

Structural Soundness			
Items		Results of Surveys	Analyses/Comments
Superstructures	1. Primary Members	Temporary supports  P1	- Corrosion at the part of steel members - Low load capacity (load limit: 10t) - Temporary supports for steel I-girders due to the low load limit - Overall damage degree: Serious
	2. Secondary Members	Steel truss  Corroded	- Corrosion at bracing members - Overall damage degree: Moderate
	3. Deck Slab	Cracking Water leaking 	- Major cracking at the side face of the deck slab - Water leaking along the center girder - Overall damage degree: Serious
Substructures	4. Deterioration of Columns/ Walls	 P1	- Piers are apparently in good condition. - Overall damage degree: Good

Summary of Structural Deficiencies

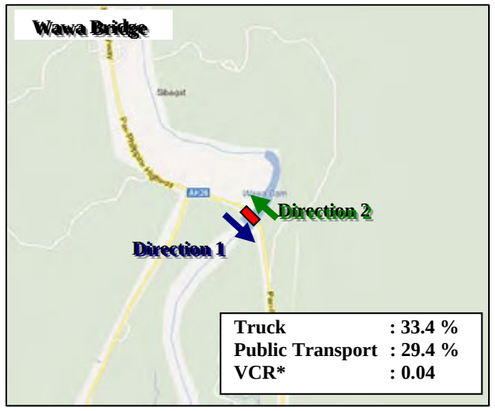
1. Seismic Vulnerability
   - Vulnerability of pier columns/walls to large scale earthquakes (confinement loss)
   - Vulnerability of foundations to large scale earthquakes (unknown structure)
   - High possibility of unseating (simply supported, no seismic restrainers, short seat length, corroded bearings & seismically vulnerable bearing type)
2. Structural Soundness (Superstructures)
   - Low loading capacity (Load limit: 10t.; Temporary supports are used.)
   - Deterioration of the deck slab (cracking, water leaking)
3. Structural Soundness (Substructures)
   - None



3) Traffic Conditions

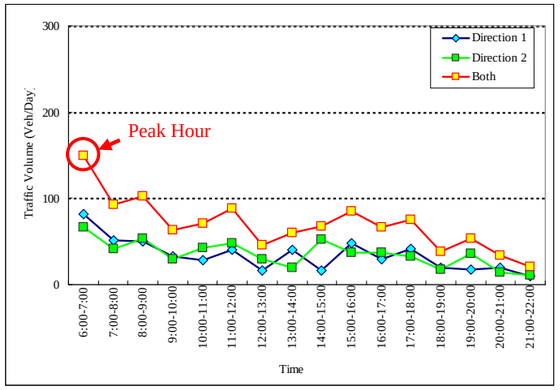
a) Traffic Volume

Daily and hourly traffic volume is shown in Figure 13.2.1-20, Figure 13.2.1-21 and Table 13.2.1-13.



* Analysis by AADT traffic volume
* VCR: Volume/Capacity Ratio

Figure 13.2.1-20 Location of Wawa Bridge



*Day 1 hourly traffic volume

Figure 13.2.1-21 Hourly Traffic Volume

Table 13.2.1-13 Daily Traffic Volume

Unit: Veh/Day

	Motorcycle / Tricycle	Car / Taxi / Pick-up / Van	Jeepney	Large Bus	2-Axle Truck	3-Axle Truck	Truck trailer	Sub-Total	Total
Day 1	562	184	64	70	90	42	10	460	1,022
Day 2	632	154	69	87	99	67	6	482	1,224
AADT	730	199	65	93	93	76	10	536	1,265

* Sub-total: Not including Motorcycle and Tricycle

b) Level-of-Service (hereafter called as LOS)

LOS is based on traffic assumptions which are peak hour, road type, free flow speed and number of lanes.

Table 13.2.1-14 Assumption and LOS

LOS: B	Peak Hour Traffic Volume	149 Veh/hour
	Road Type	Local Road
	Free Flow Speed (km/h)	30 km/h
	No. of Lanes	2 lanes

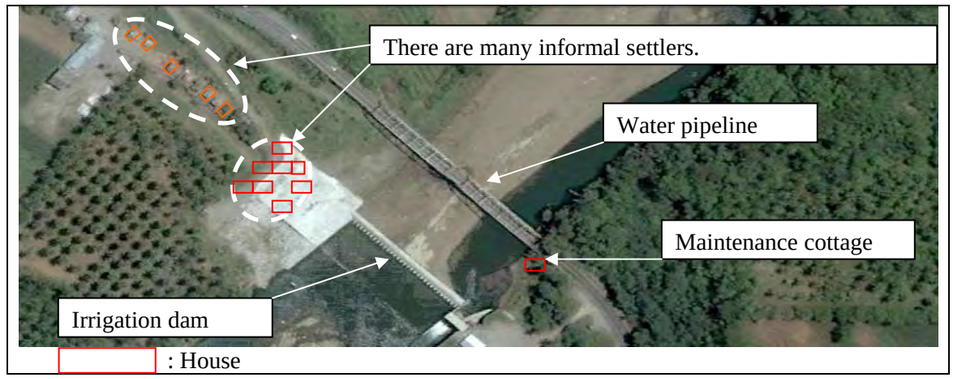
* Highway Capacity Manual, 2010

c) Traffic Condition

Analyses of the observed traffic volume condition and LOS are as follows:

- This bridge connects Panaon Island to mainland Leyte. Figure 13.2.1-21 shows the hourly traffic volume by direction, for both directions 1 and 2, the observed peak time is in the morning from 6 AM to 7 AM.
- No. of lane is 2 lanes, AADT is 1,265 veh/day, traffic volume is very small, with vehicle-capacity ratio is 0.04.
- If this bridge will be destroyed as result of strong earthquake, the passing vehicles will drive about 25 km long distance detour.
- Peak hour traffic volume is 149 veh/hour, LOS is B because the peak hour traffic volume is very small.

4) Socio-Environmental Assessment Conditions



Household and Structures (Area facing the Bridge and the approach road)
- On the north side, there are many illegal houses along the approach road and on the dam facility. - A water pipeline is held along the Bridge. - There is a dam for irrigation use at the downstream of the River. - There is a cottage for maintenance of the Bridge.
Land use (Area facing the Bridge and the approach road)
- The land use zone classification in the area is generally agricultural, due to the soil's high fertility potential Multi-crop farming is a primary source of livelihood.
Existing Environmental Condition (Noise, Vibration, Air Pollution and Water contamination.)
- Environmental condition is good except for the pollution of traffic flow such as noise, vibration and air pollution.
Environmental Protection Area (national park, reserves and designated wet land)
- The Bridge is not located in a cultural property or a natural reserve area.
Existence on Location Map of Valuable Ecological Habitats, Historical and Cultural Assets
- The Bridge is not located in a cultural property or a natural reserve area.

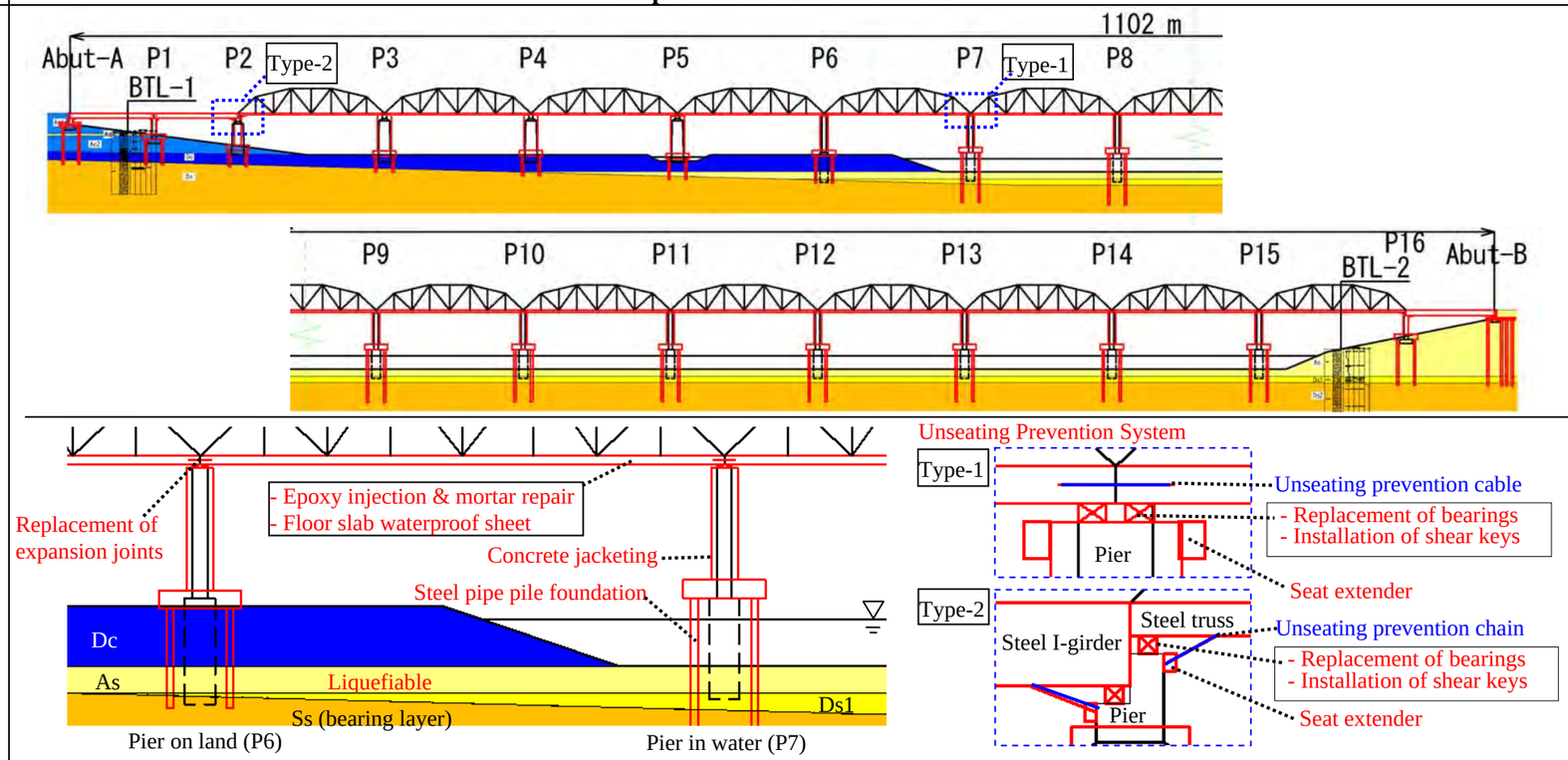
13.2.2 Comparison of Improvement Measures

1) Buntun Bridge

Comparison of Improvement Measures for Buntun Bridge

Alternative 1 - Seismic Retrofit and Repair

Improvement Measure Scheme



Detail of Improvement Measures & Evaluation

Description/ Design Concept

- Seismic capacity improvement of pier columns/walls (column/wall retrofit)
- Seismic capacity improvement of foundations (pile for reinforcement)
- Improvement of unseating/fall-down prevention system (seat extender, unseating prevention cables/chains, shear keys, replacement of bearings)
- Improvement of the deck slab soundness (repair)

Construction

Method/ Technology		• Concrete jacketing (column/wall retrofit) • Steel pipe pile foundation (pile for reinforcement) • Unseating prevention system	
Difficulty		• Installation of piles into the rock • Pile-driving under the existing superstructure	
Cost	Seismic Retrofit Works	• Column/wall retrofit • Pile for reinforcement • Unseating prevention system	0.32
	Repair Works	• Epoxy injection & mortar repair • Floor slab water proof sheet • Replacement of expansion joints	0.04
	Others	• Working platform on the water • Temporary detour bridge	0.07
		Total	0.43

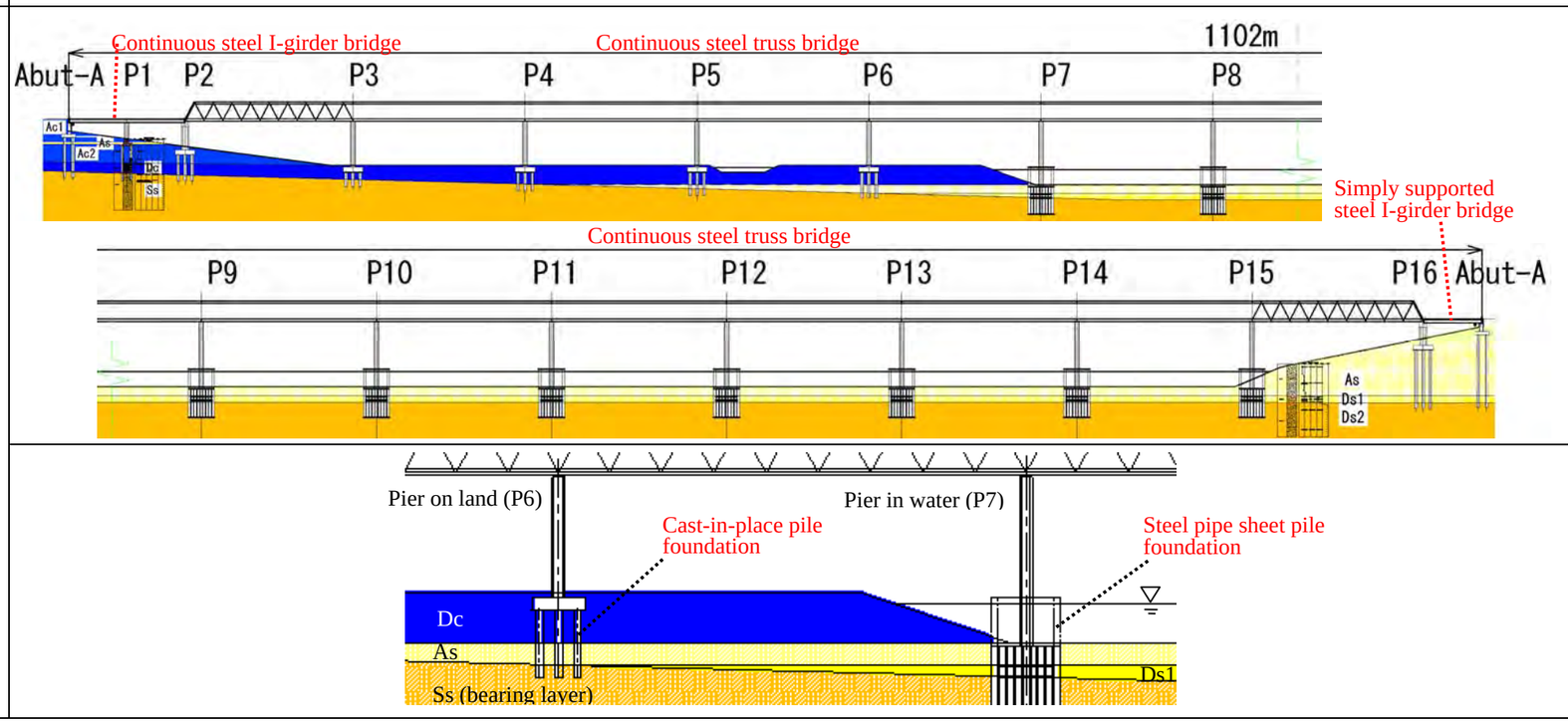
Potential Impact to Environment

- River occupation during the retrofit works for piers in water
- Requirement of environmental measures for water contamination
- Temporary detour bridge installation during abutment retrofit works

EVALUATION: **Recommended**

Alternative 2 - Replacement

Improvement Measure Scheme



Description/ Design Concept

- Application of existing bridge planning condition in order to confirm the cost effectiveness of seismic retrofit & repair works
- Application of light weight & low height superstructure type in order to maintain the adequate vertical clearance
- Application of steel pipe sheet pile foundation to piers in water: no need for sheet pile installation

Construction

Method/ Technology		• Main spans: Continuous steel truss bridge • Approach spans: Steel I-girder bridge • Piers in water: Steel pipe sheet pile foundation • Piers on land: Cast-in-place pile foundation	
Difficulty		• Requirement of large construction yard for assembly of steel members	
Cost	Super-structure	• Continuous steel truss bridge • Steel I-girder bridges	0.36
	Substructure	• Wall type	0.16
	Foundation	• Steel pipe sheet pile foundation • Cast-in-place pile foundation	0.38
	Others	• Working platform on the water • Temporary detour bridge	0.10
		Total	1.00

Potential Impact to Environment

- River occupation during the construction of piers in water
- Requirement of large construction yard for steel truss members & steel pipe sheet pile
- Temporary detour bridge installation during the whole construction

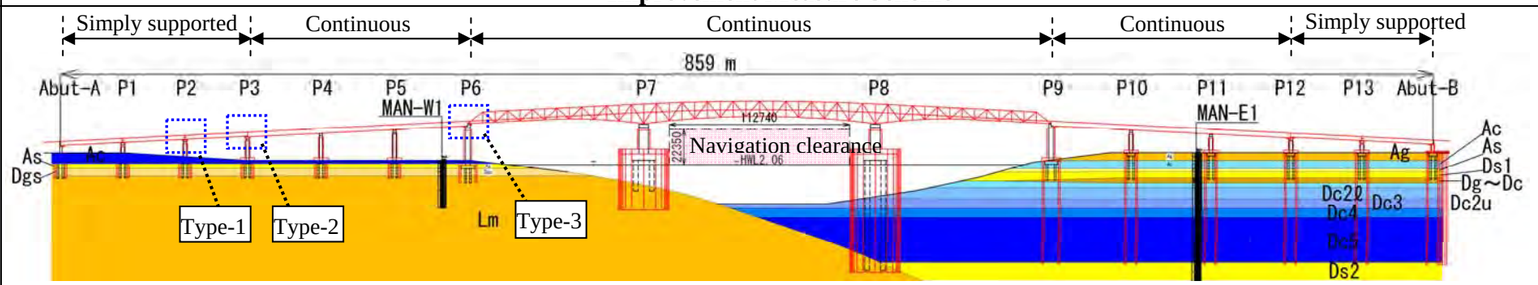
EVALUATION: **Not Recommended**

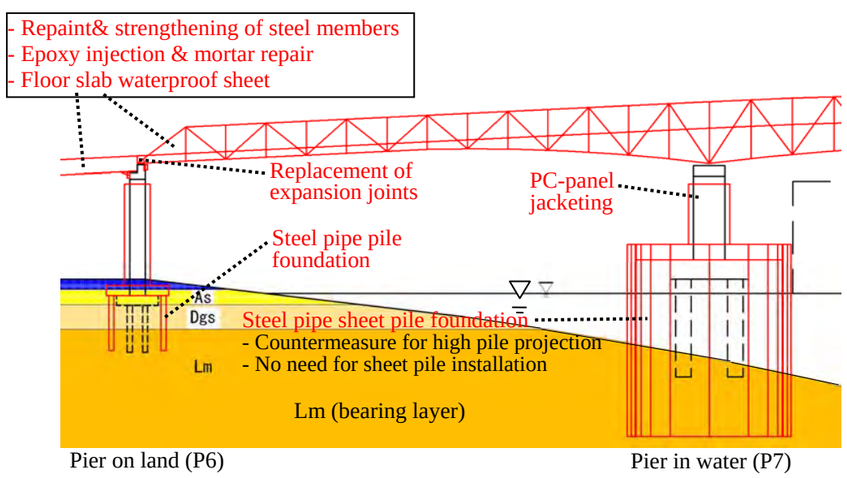
2) 1st Mandaue-Mactan Bridge

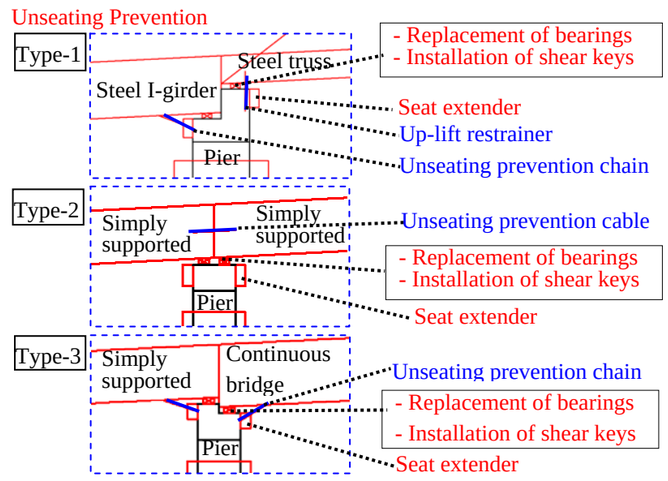
Comparison of Improvement Measures for 1st Mandaue-Mactan Bridge

Alternative 1 - Seismic Retrofit and Repair

Improvement Measure Scheme



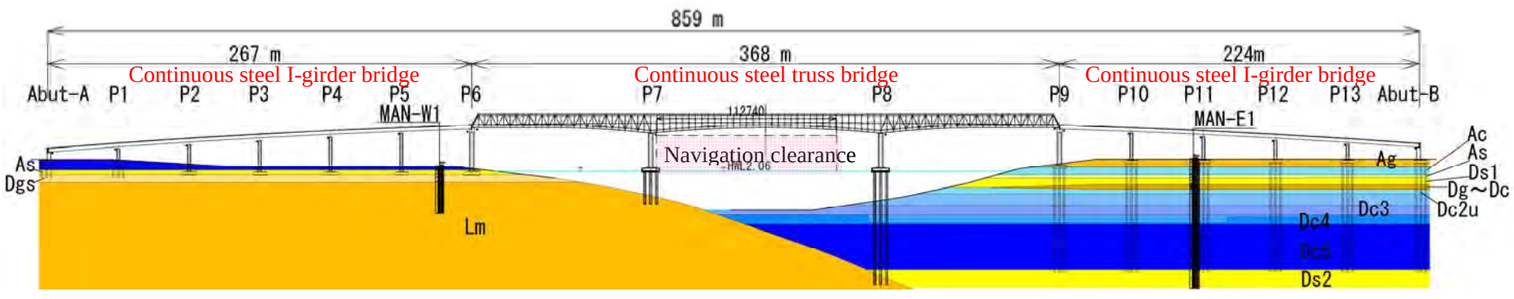


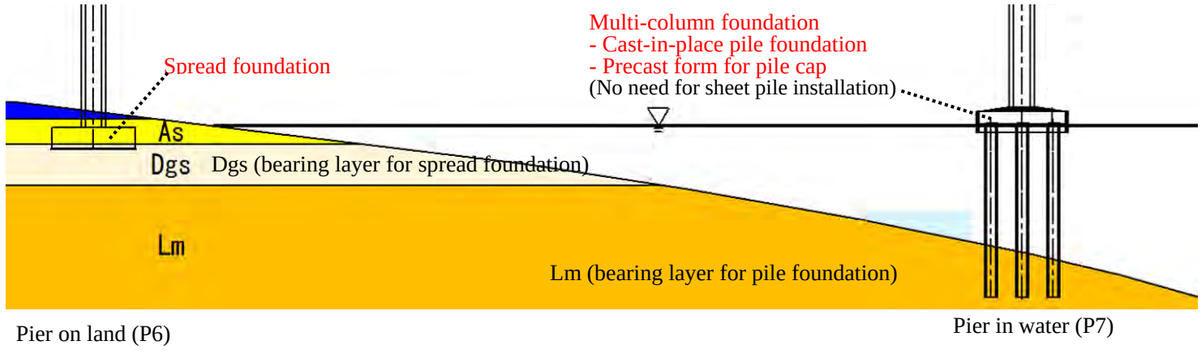


Detail of Improvement Measures & Evaluation

Description/ Design Concept	• Seismic capacity improvement of pier columns (column retrofit) • Seismic capacity improvement of foundations (pile for reinforcement) • Improvement of unseating/fall-down prevention system (seat extender, unseating prevention cables/chains, up-lift restrainer, shear keys, replacement of bearings) • Improvement of the deck slab soundness (repair) • Improvement of the steel members' soundness & strength			
Construction	Method/ Technology	• PC-panel jacketing (column retrofit) • Steel pipe sheet pile foundation & steel pipe pile foundation (pile for reinforcement) • Unseating prevention system		
	Difficulty	• Installation of piles into the rock • Pile-driving under the existing superstructure		
	Cost	Seismic Retrofit Works	• Column retrofit • Pile for reinforcement • Unseating prevention system	0.48
		Repair Works	• Epoxy injection & mortar repair • Floor slab water proof sheet • Replacement of expansion joints • Repaint & strengthening of steel members	0.07
		Others	• Working platform on the water • Temporary detour bridge	0.01
			Total	0.56
Potential Impact to Environment	• River occupation during the construction of piers in water • Requirement of large construction yard • Temporary detour bridge installation during abutment retrofit works • Requirement of temporary resettlement for the construction			
EVALUATION: **Recommended**				

Alternative 2 - Replacement





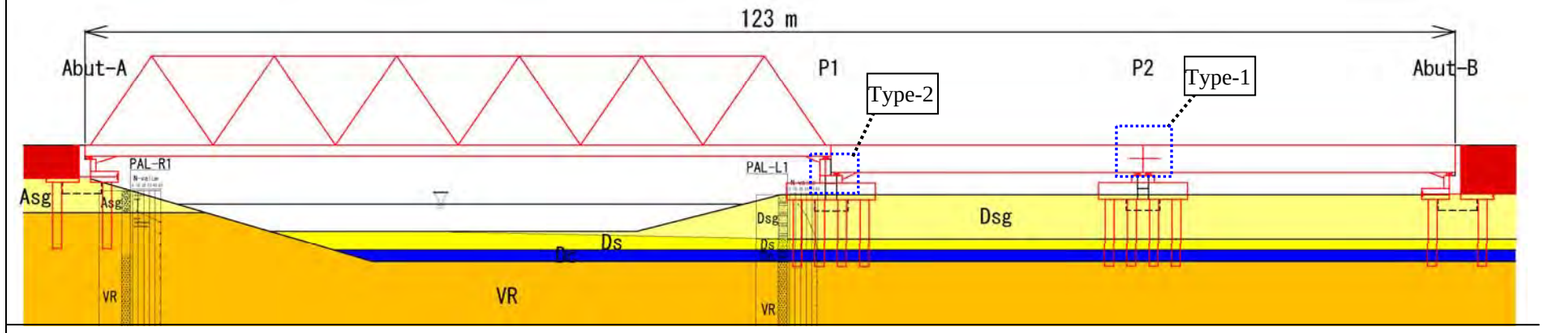
Description/ Design Concept	• Application of existing bridge planning condition in order to confirm the cost effectiveness of seismic retrofit & repair works • Application of light weight & low height superstructure type in order to maintain the adequate vertical clearance • Application of multi column foundation to piers in deep water			
Construction	Method/ Technology	• Main spans: Continuous steel truss bridge • Approach spans: Steel I-girder bridge • Multi-column foundation • Cast-in-place pile foundation		
	Difficulty	• Requirement of large construction yard for assembly of steel members • Requirement of large size crane for the superstructure installation • Installation of piles into the rock		
	Cost	Super-structure	• Continuous steel truss bridge • Continuous steel I-girder bridges	0.34
		Substructure	• Wall type	0.12
		Foundation	• Spread foundation • Multi-column foundation • Cast-in-place pile foundation	0.44
		Others	• Working platform on the water • Temporary detour bridge	0.10
			Total	1.00
Potential Impact to Environment	• River occupation during the works for piers in water • Requirement of large construction yard • Requirement of environmental measures for water contamination • Temporary detour bridge installation during the whole construction • Requirement of temporary resettlement for the construction			
EVALUATION: **Not Recommended**				

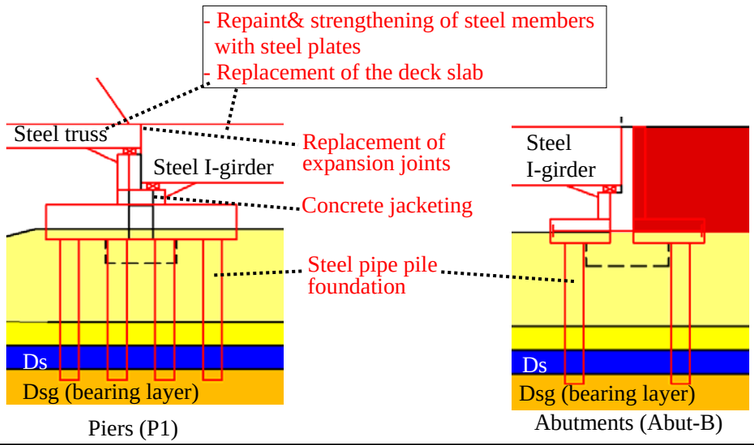
3) Palanit Bridge

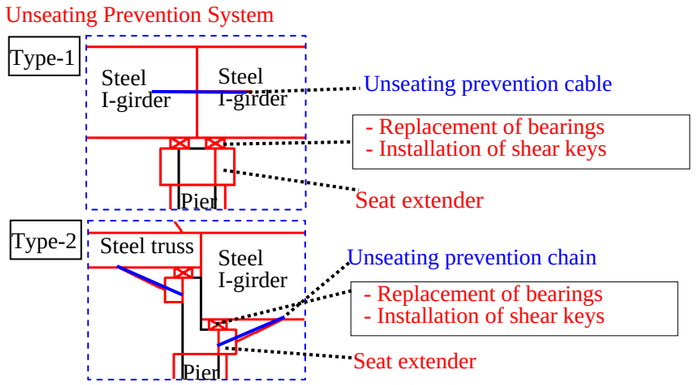
Comparison of Improvement Measures for Palanit Bridge

Alternative 1 - Seismic Retrofit and Repair

Improvement Measure Scheme





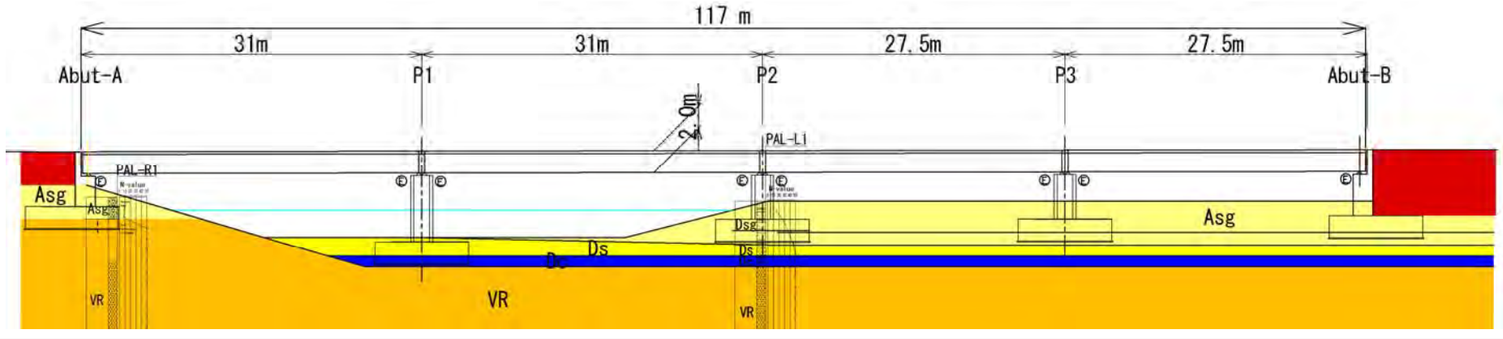


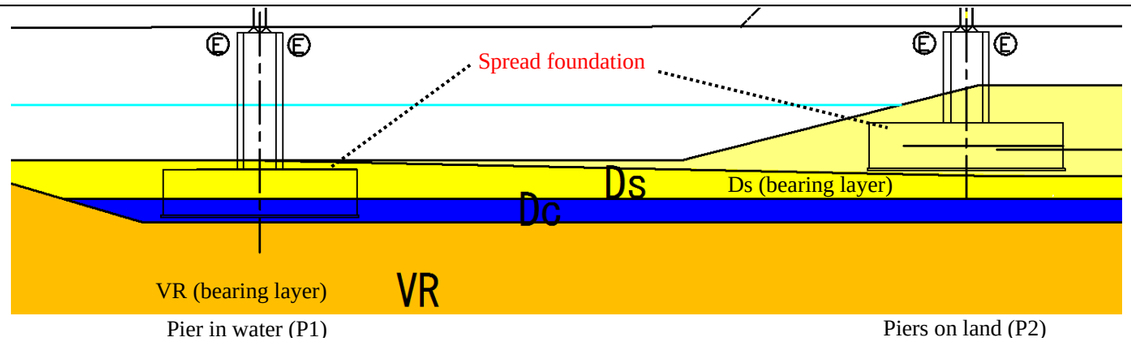
Detail of Improvement Measures & Evaluation

Description/ Design Concept	・Seismic capacity improvement of pier walls (wall retrofit) ・Seismic capacity improvement of foundations (pile for reinforcement) ・Improvement of unseating/fall-down prevention system (seat extender, unseating prevention cables/chains, shear keys, replacement of bearings) ・Improvement of the deck slab soundness (replacement) ・Improvement of the steel members' soundness & strength			
Construction	Method/ Technology	・Concrete jacketing (wall retrofit) ・Steel pipe pile foundation (pile for reinforcement) ・Strengthening of steel members with steel plates ・Unseating prevention system		
	Difficulty	・Installation of piles into the rock ・Pile-driving under the existing superstructure		
	Cost	Seismic Retrofit Works	・Wall retrofit ・Pile for reinforcement ・Unseating prevention system	0.34
		Repair Works	・Replacement of the deck slab ・Replacement of expansion joints ・Repaint & strengthening of steel members with steel plates	0.62
		Others	・Working platform on the water ・Temporary detour bridge	0.08
			Total	1.04
Potential Impact to Environment	・Temporary detour bridge installation during abutment retrofit works ・Requirement of temporary resettlement for the construction			
EVALUATION: **Not Recommended**				

Alternative 2 - Replacement

Continuous PC I-girder bridge





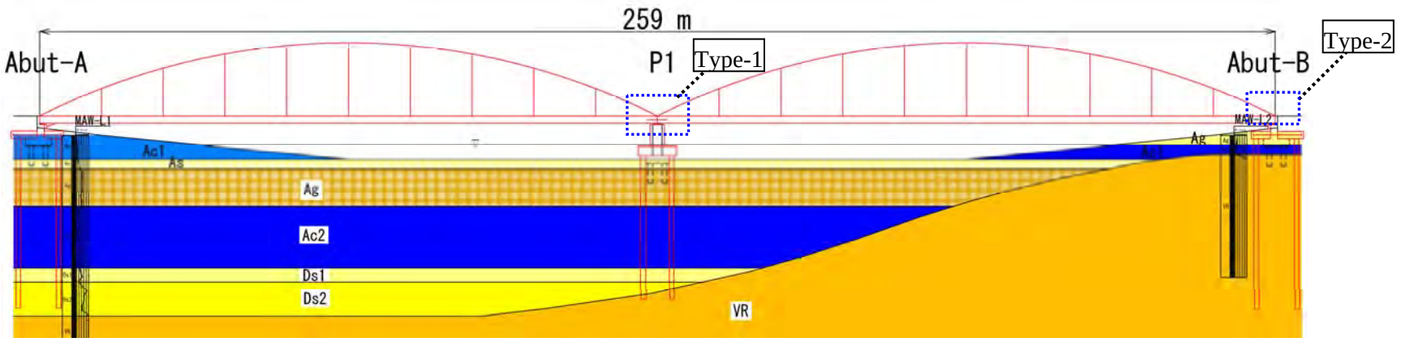
Description/ Design Concept	・Application of PC girder bridge for; - advantage of less maintenance even near coastal areas, and - better cost performance compared to other bridge types ・Application of spread foundation for; - better cost performance, and - requirement of shorter construction period compared to other foundation types			
Construction	Method/ Technology	・Continuous PC I-girder bridge		
	Difficulty	・Requirement of large construction yard for the fabrication of PC I-girders		
	Cost	Super-structure	・Continuous PC I-girder bridge	0.51
		Substructure	・Wall type	0.11
		Foundation	・Spread foundation	0.23
		Others	・Working platform on the water ・Temporary detour bridge ・Approach road	0.15
			Total	1.00
Potential Impact to Environment	・River occupation during the works for piers in water ・Requirement of large construction yard ・Requirement of environmental measures for water contamination ・Long construction period for cast-in-place PC girders ・Temporary detour bridge installation during the whole construction ・Requirement of temporary resettlement for the construction			
EVALUATION: **Recommended**				

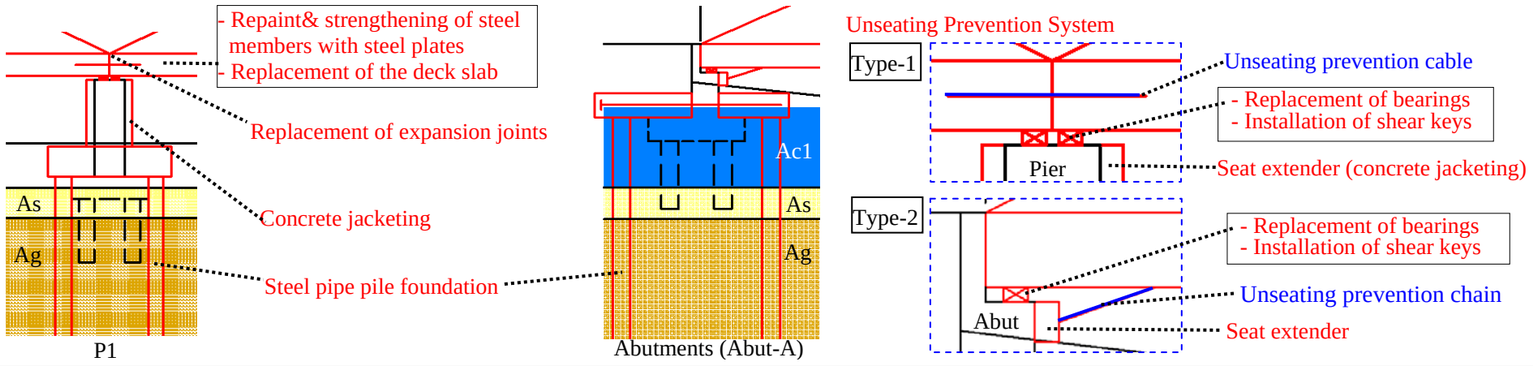
4) Mawo Bridge

Comparison of Improvement Measures for Mawo Bridge

Alternative 1 - Seismic Retrofit and Repair

Improvement Measure Scheme



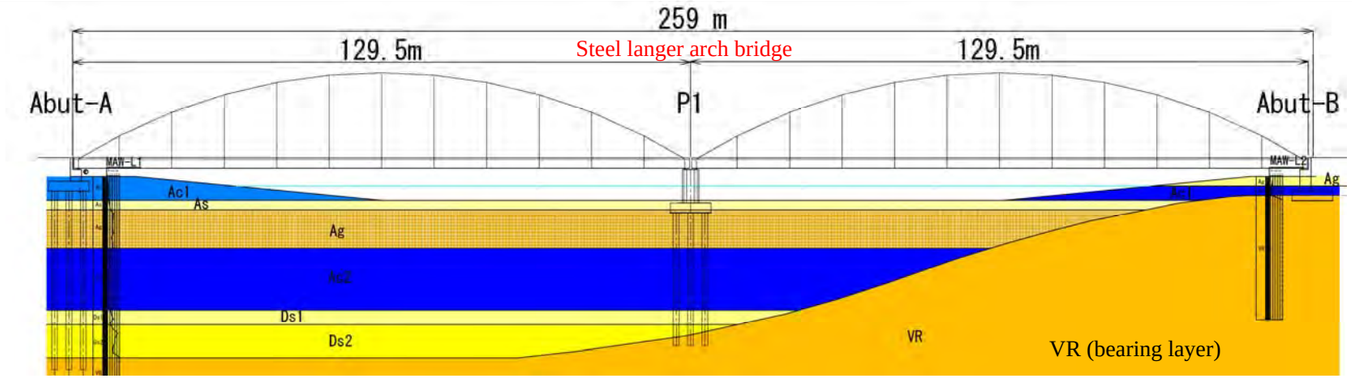


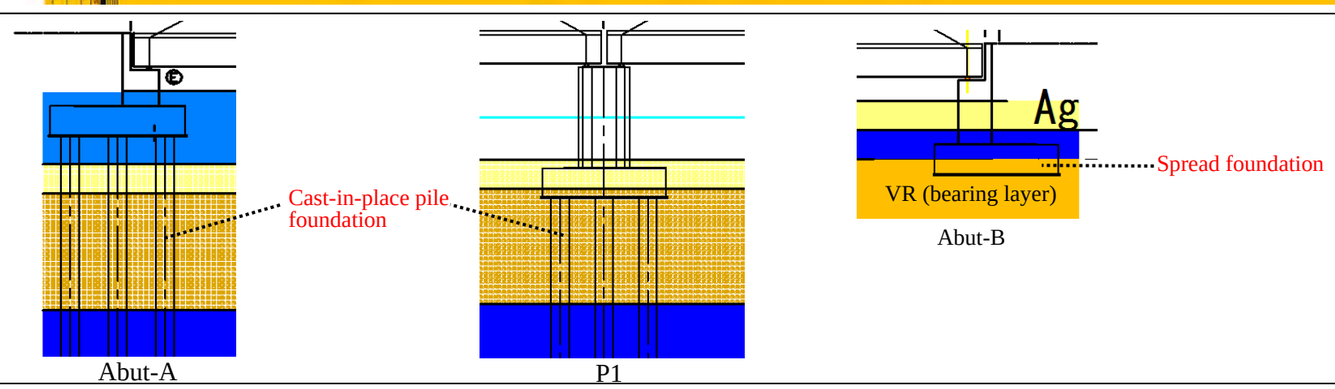
Detail of Improvement Measures & Evaluation

Description/ Design Concept	・Seismic capacity improvement of pier walls (wall retrofit) ・Seismic capacity improvement of foundations (pile for reinforcement) ・Improvement of unseating/fall-down prevention system (seat extender, unseating prevention cables/chains, shear keys, replacement of bearings) ・Improvement of the deck slab soundness (replacement) ・Improvement of the steel members' soundness & strength			
Construction	Method/ Technology	・Concrete jacketing (wall retrofit) ・Steel pipe pile foundation (pile for reinforcement) ・Sheet pile cofferdam ・Unseating prevention system ・Strengthening of steel members with steel plates		
	Difficulty	・Installation of piles into the rock ・Sheet pile installation under the existing superstructure		
	Cost	Seismic Retrofit Works	・Wall retrofit ・Pile for reinforcement ・Unseating prevention system	0.09
		Repair Works	・Replacement of the deck slab ・Replacement of expansion joints Strengthening of steel members with steel plates	0.30
		Others	・Working platform on the water ・Temporary detour bridge	0.06
			Total	0.45
Potential Impact to Environment	・River occupation during the works for piers in water ・Temporary detour bridge installation during abutment retrofit works ・Requirement of environmental measures for water contamination ・Requirement of temporary resettlement for the construction			
EVALUATION: **Not Recommended**				

Alternative 2 - Replacement

Improvement Measure Scheme





Detail of Improvement Measures & Evaluation

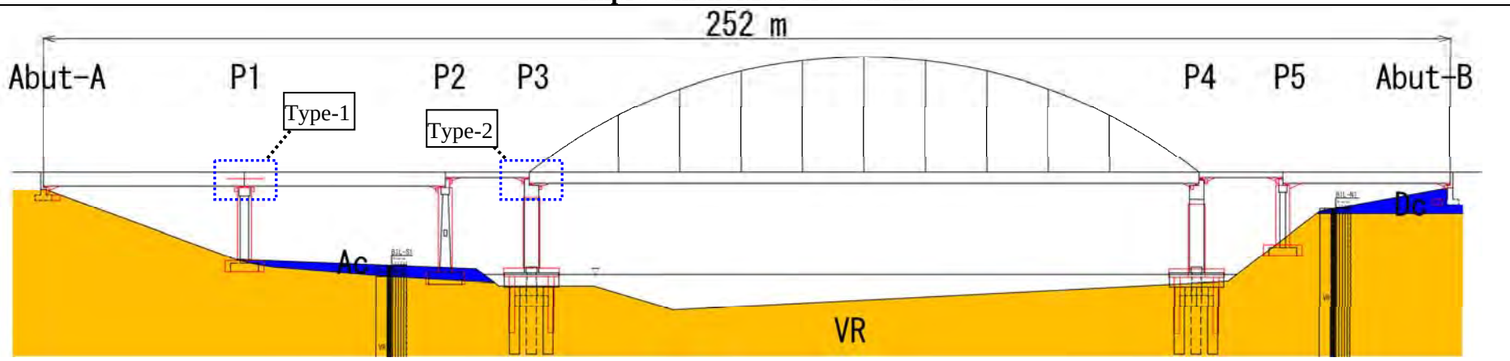
Description/ Design Concept	・Application of existing bridge planning condition in order to confirm the cost effectiveness of seismic retrofit & repair works ・Application of light weight & low height superstructure type in order to maintain the adequate vertical clearance			
Construction	Method/ Technology	・Steel langer arch bridge ・Cast-in-place pile foundation		
	Difficulty	・Requirement of large construction yard for assembly of steel members ・Requirement of large size crane for the superstructure installation ・Installation of piles into the rock		
	Cost	Super-structure	・Steel langer arch bridge	0.77
		Substructure	・Wall type	0.03
		Foundation	・Cast-in-place pile foundation ・Spread foundation	0.10
		Others	・Working platform on the water ・Temporary detour bridge	0.10
			Total	1.00
Potential Impact to Environment	・River occupation during the works for piers in water ・Requirement of large size crane & large construction yard ・Requirement of environmental measures for water contamination ・Temporary detour bridge installation during the whole construction ・Requirement of temporary resettlement for the construction			
EVALUATION: **Recommended (Further study is necessary.)**				

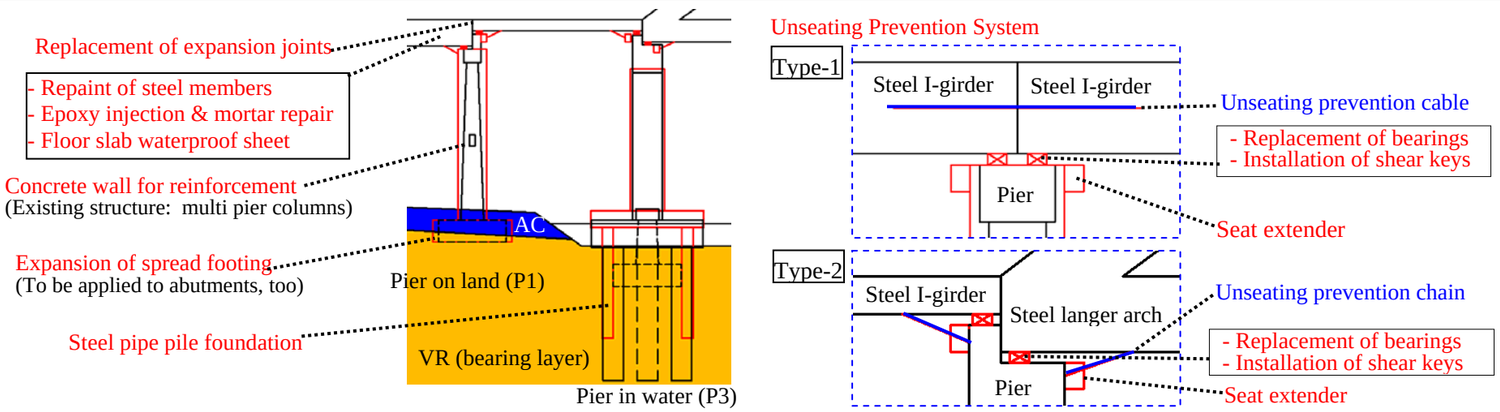
5) Biliran Bridge

Comparison of Improvement Measures for Biliran Bridge

Alternative 1 - Seismic Retrofit and Repair

Improvement Measure Scheme



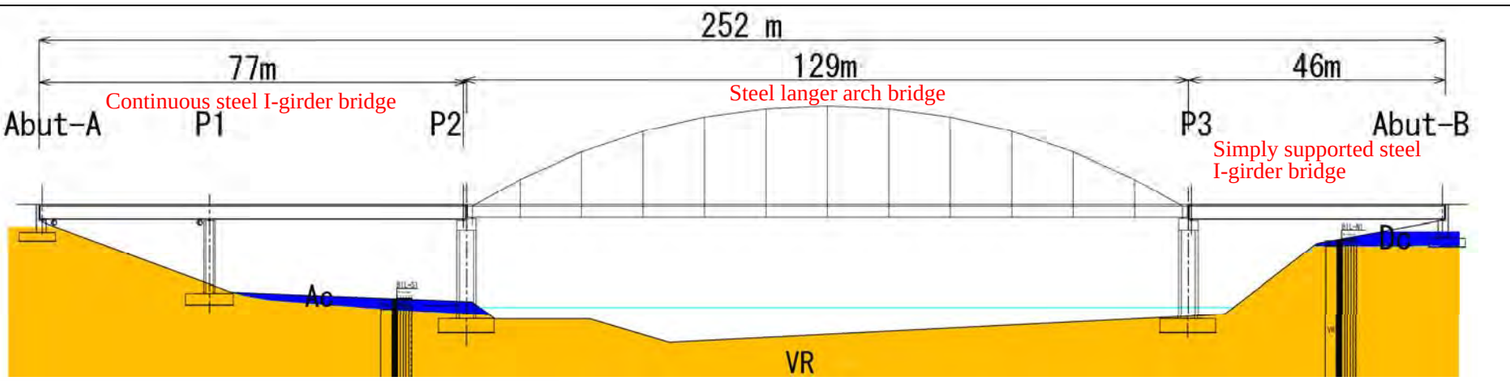


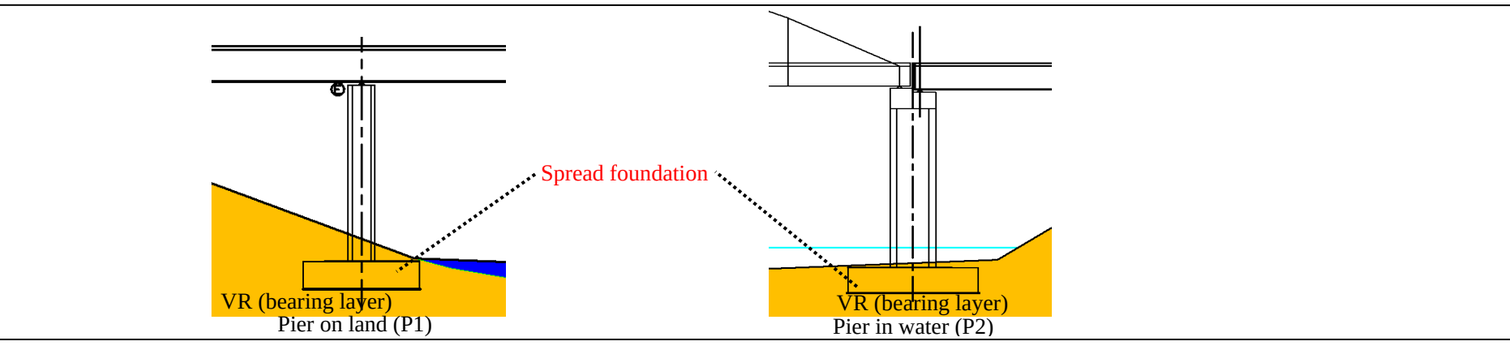
Detail of Improvement Measures & Evaluation

Description/ Design Concept	• Seismic capacity improvement of pier columns (concrete wall for reinforcement) • Seismic capacity improvement of foundations (pile for reinforcement & expansion of spread footing) • Improvement of unseating/fall-down prevention system (seat extender, unseating prevention cables/chains, shear keys, replacement of bearings) • Improvement of the deck slab soundness (repair) • Improvement of the steel members' soundness			
Construction	Method/ Technology	• Concrete wall for reinforcement • Steel pipe pile foundation (pile for reinforcement) • Unseating prevention system		
	Difficulty	• Installation of piles into the rock • Sheet pile installation under the existing superstructure		
	Cost	Seismic Retrofit Works	• Concrete wall for reinforcement • Pile for reinforcement • Expansion of spread footing • Unseating prevention system	0.26
		Repair Works	• Epoxy injection & mortar repair • Floor slab water proof sheet • Replacement of expansion joints • Repaint of steel members	0.04
		Others	• Working platform on the water • Temporary detour bridge	0.04
			Total	0.34
Potential Impact to Environment	• River occupation during the works for piers in water • Temporary detour bridge installation during abutment retrofit works • Requirement of environmental measures for water contamination			
EVALUATION: **Recommended**				

Alternative 2 - Replacement

Improvement Measure Scheme





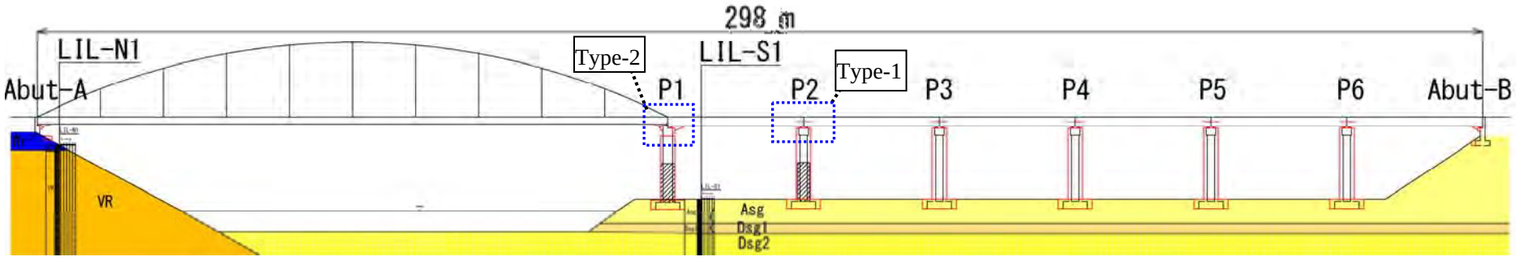
Description/ Design Concept	• Application of existing bridge planning condition with better span balance in order to confirm the cost effectiveness of seismic retrofit & repair works Application of light weight & low height superstructure type in order to maintain the adequate vertical clearance			
Construction	Method/ Technology	• Main span: - Steel langer arch bridge • Approach spans: - Steel I-girder bridge		
	Difficulty	• Requirement of large construction yard for assembly of steel members • Requirement of large size crane for the superstructure installation • Requirement of accurate rock excavation		
	Cost	Super-structure	• Steel langer arch bridge • Steel I-girder bridge	0.69
		Substructure	• Wall type	0.13
		Foundation	• Spread foundation	0.08
		Others	• Working platform on the water • Temporary detour bridge	0.10
			Total	1.00
Potential Impact to Environment	• River occupation during the works for piers in water • Requirement of large size crane & large construction yard • Requirement of environmental measures for water contamination • Temporary detour bridge installation during the whole construction			
EVALUATION: **Not Recommended**				

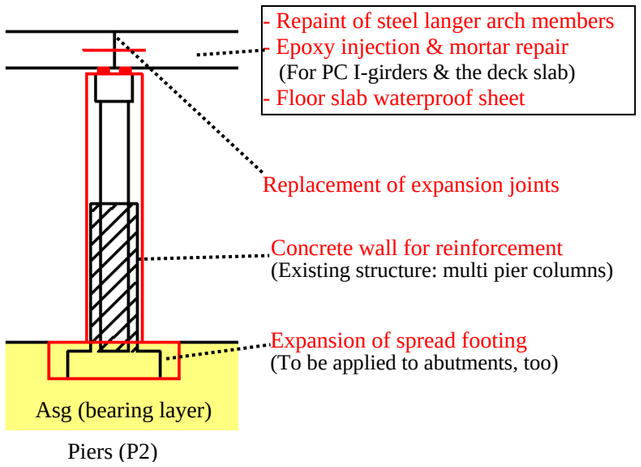
6) Lilo-an Bridge

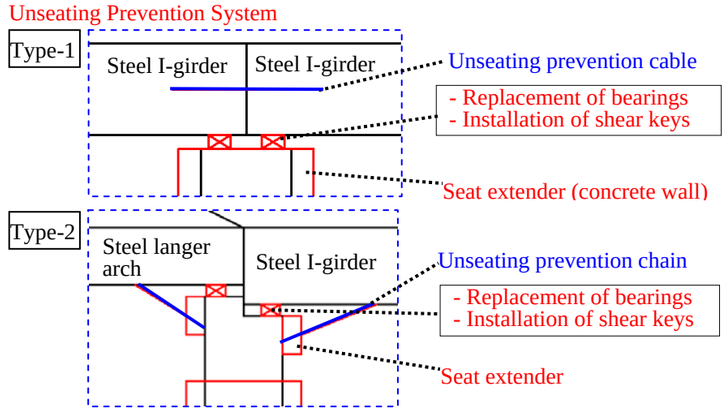
Comparison of Improvement Measures for Lilo-an Bridge

Alternative 1 - Seismic Retrofit and Repair

Improvement Measure Scheme







Detail of Improvement Measures & Evaluation

Description/ Design Concept

- Seismic capacity improvement of pier columns (concrete wall for reinforcement)
- Seismic capacity improvement of foundations (expansion of spread footing)
- Improvement of unseating/fall-down prevention system (seat extender, unseating prevention cables/chains, shear keys, replacement of bearings)
- Improvement of PC-I girder & the deck slab soundness (repair)
- Improvement of the steel members' soundness

Construction

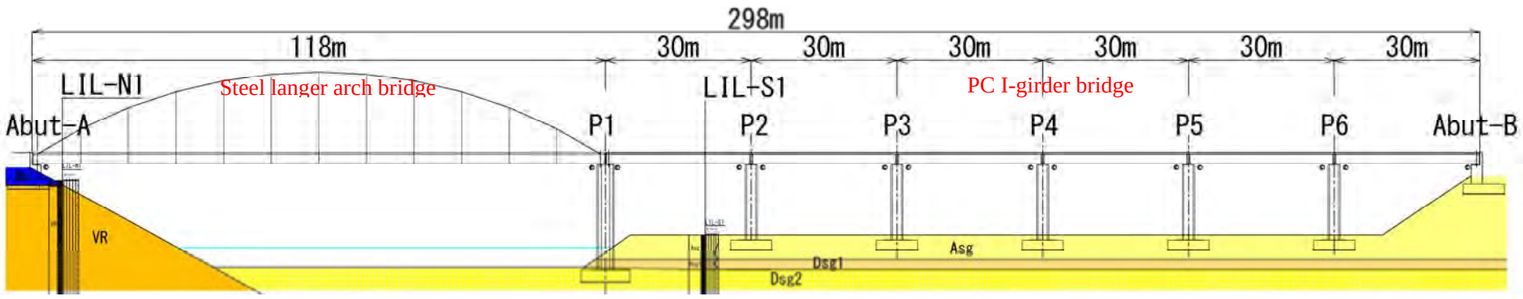
Method/ Technology		• Concrete wall for reinforcement • Unseating prevention system	
Difficulty		• Incorporation of existing columns and additional wall	
Cost	Seismic Retrofit Works	• Concrete wall for reinforcement • Pile for reinforcement • Expansion of spread footing • Unseating prevention system	0.21
	Repair Works	• Epoxy injection & mortar repair • Floor slab water proof sheet • Replacement of expansion joints • Repaint of steel members	0.04
	Others		0.00
		Total	0.25

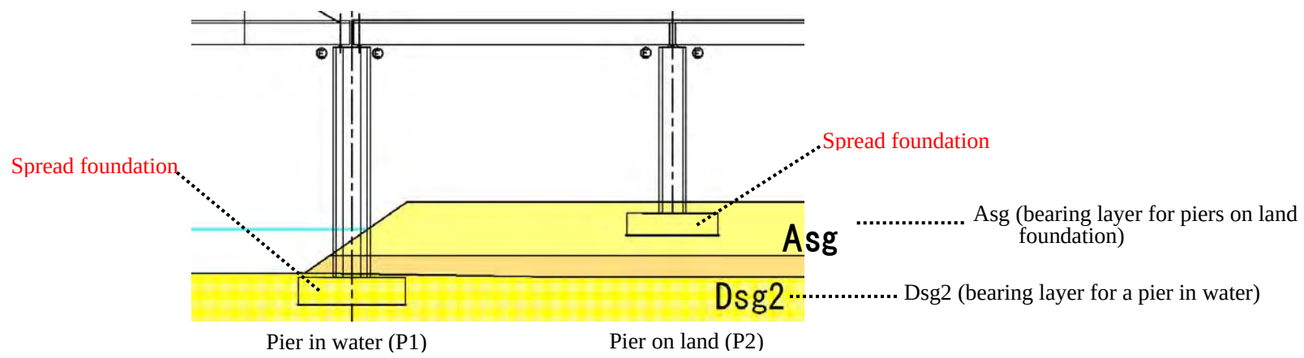
Potential Impact to Environment

- Requirement of temporary resettlement for the construction

EVALUATION: **Recommended**

Alternative 2 - Replacement





Description/ Design Concept

- Application of existing bridge planning condition in order to confirm the cost effectiveness of Seismic retrofit & repair works
- Application of low height superstructure type in order to maintain the adequate vertical clearance

Construction

Method/ Technology		• Main span: Steel langer arch bridge • Approach spans: PC I-girder bridge	
Difficulty		• Requirement of large construction yard for assembly of steel members & fabrication of PC I-girder • Requirement of large size crane for the superstructure installation	
Cost	Super-structure	• Steel langer arch bridge • PC I-girder bridge	0.59
	Substructure	• Wall type	0.20
	Foundation	• Spread foundation	0.11
	Others	• Working platform on the water • Temporary detour bridge	0.10
		Total	1.00

Potential Impact to Environment

- River occupation during the works for piers in water
- Requirement of large size crane & large construction yard
- Requirement of environmental measures for water contamination
- Long construction period for cast-in-place PC girders
- Temporary detour bridge installation during the whole construction
- Requirement of temporary resettlement for the construction

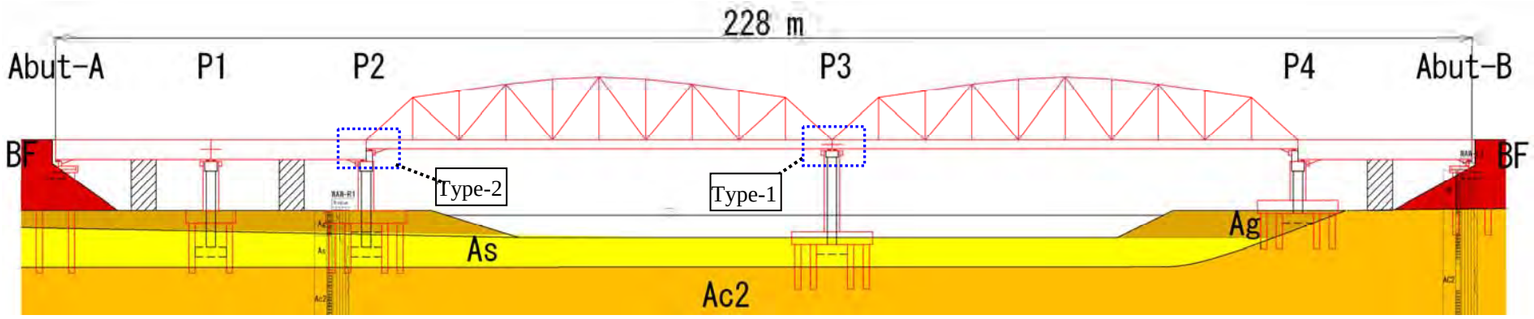
EVALUATION: **Not Recommended**

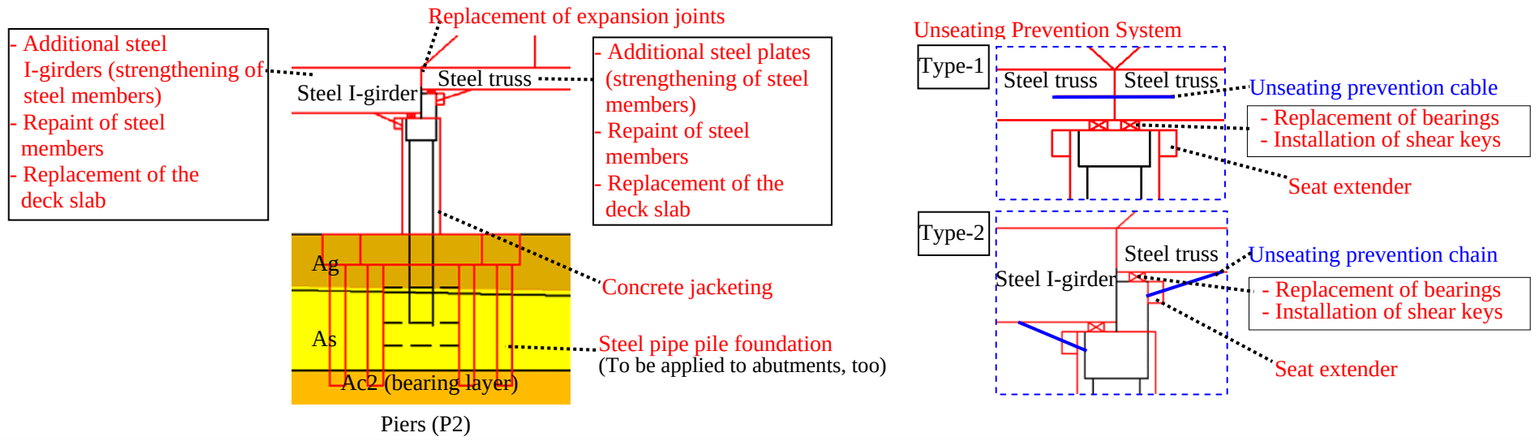
7) Wawa Bridge

Comparison of Improvement Measures for Wawa Bridge

Alternative 1 - Seismic Retrofit and Repair

Improvement Measure Scheme





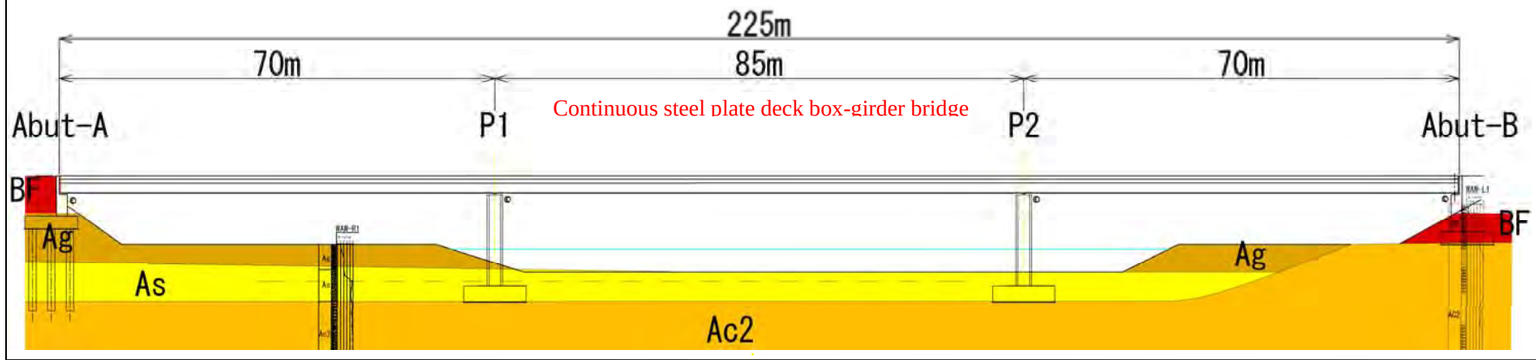
Detail of Improvement Measures & Evaluation

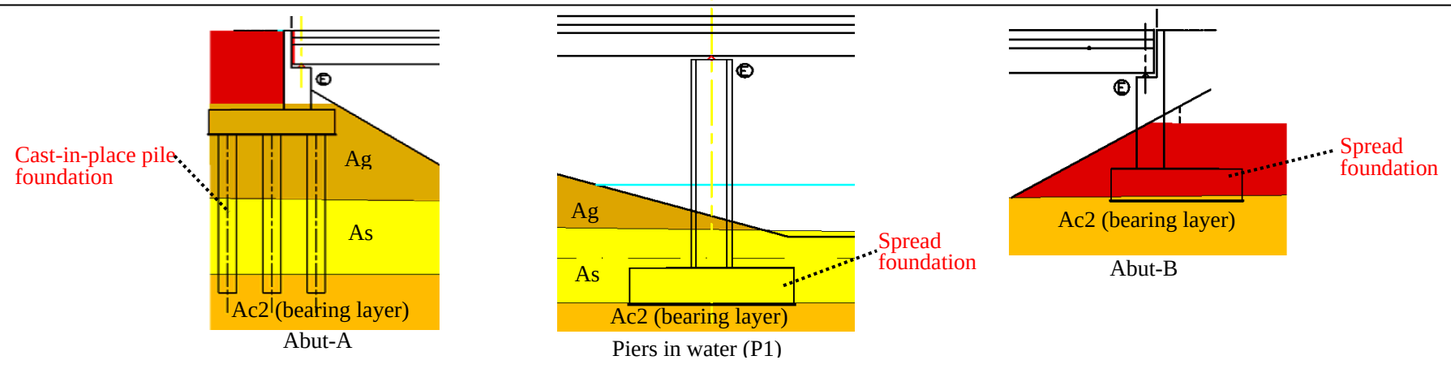
Description/ Design Concept	• Seismic capacity improvement of pier walls (wall retrofit) • Seismic capacity improvement of foundations (pile for reinforcement) • Improvement of unseating/fall-down prevention system (seat extender, unseating prevention cables/chains, shear keys, replacement of bearings) • Improvement of the deck slab soundness (replacement) • Improvement of the steel members' soundness & strength			
Construction	Method/ Technology	• Concrete wall for reinforcement • Steel pipe pile foundation (pile for reinforcement) • Additional steel plates & steel I-girders (strengthening of steel members) • Unseating prevention system		
	Difficulty	• Sheet pile installation under the existing superstructure		
	Cost	Seismic Retrofit Works	• Concrete wall for reinforcement • Pile for reinforcement • Expansion of spread footing • Unseating prevention system	0.39
		Repair Works	• Replacement of the deck slab • Replacement of expansion joints • Repaint & strengthening of steel members	0.23
		Others	• Working platform on the water • Temporary detour bridge	0.08
			Total	0.70
Potential Impact to Environment	• River occupation during the works for piers in water • Temporary detour bridge installation during abutment retrofit works • Requirement of environmental measures for water contamination			

EVALUATION: **Not Recommended**

Alternative 2 - Replacement

Improvement Measure Scheme





Description/ Design Concept	• Application of three span continuous bridge for better span balance & seismic capacity • Application of light weight & low height superstructure type in order to maintain the adequate vertical clearance • Application of steel girder bridge for rapid erection method: advantage of faster installation & smaller construction yard			
Construction	Method/ Technology	• Continuous steel plate deck box-girder bridge • Cast-in-place pile foundation		
	Difficulty	• Requirement of large construction yard for assembly of steel members • Requirement of large size crane for the superstructure installation • Requires foundation construction in the dry season		
	Cost	Super-structure	• Continuous steel plate deck box-girder bridge	0.58
		Substructure	• Wall type	0.14
		Foundation	• Spread foundation • Cast-in-place pile foundation	0.14
		Others	• Working platform on the water • Temporary detour bridge	0.14
			Total	1.00
Potential Impact to Environment	• River occupation during the works for piers in water • Requirement of large size crane & large construction yard • Requirement of environmental measures for water contamination • Temporary detour bridge installation during the whole construction			

EVALUATION: **Recommended**

CHAPTER 14 RECOMMENDATION ON TARGET BRIDGES FOR THE OUTLINE DESIGN

14.1 Prioritization of Bridges with Evaluation Criteria for the Second Screening

With the evaluation criteria for the second screening established in Section 11.5, evaluation for each bridge was carried out as shown in Table 14.1-2 - Table 14.1-13. Table 14.1-1 shows summary of evaluation results with priority ranking for each bridge.

Table 14.1-1 Summary of Evaluation Results and Priority Ranking for Package B and C

Package B											
Bridge Name	**Bridge Condition (80 points)**							**Importance (20 points)**		**Total Score (100 points)**	**Priority Ranking**
	Seismic Vulnerability (60 points)				**Structural Soundness (20 points)**		**Sub-Total Score (80 points)**				
	Earthquake Resisting System (20 points)	Unseating/ Fall-down Prevention System (15 points)	Foundation (15 points)	Seismic Hazard (10 points)	Super-structures (15 points)	Sub-Structures (5 points)		Traffic Volume (5 points)	Alternative Bridge (15 points)		
1. Delpan Br.	15	9	15	0	7	3	49	3	5	57	4
2. Nagtahan Br.	11	8	12	3	7	3	44	3	5	52	5
3. Lambingan Br.	17	13	12	3	12	3	60	0	10	70	2
4. Guadalupe Br.	17	13	12	6	12	3	63	5	10	78	1
5. Marikina Br.	11	13	12	10	4	3	53	3	10	66	3

Package C											
Bridge Name	**Bridge Condition (80 points)**							**Importance (20 points)**		**Total Score (100 points)**	**Priority Ranking**
	Seismic Vulnerability (60 points)				**Structural Soundness (20 points)**		**Sub-Total Score (80 points)**				
	Earthquake Resisting System (20 points)	Unseating/ Fall-down Prevention System (15 points)	Foundation (15 points)	Seismic Hazard (10 points)	Super-structures (15 points)	Sub-Structures (5 points)		Traffic Volume (5 points)	Alternative Bridge (15 points)		
1. Buntun Br.	14	13	15	0	1	0	43	5	15	63	6
2. 1st Mandaue-Mactan Br.	18	13	14	0	8	5	58	5	5	68	4
3. Palanit Br.	17	15	3	3	15	3	56	0	15	71	3
4. Mawo Br.	14	11	14	10	9	0	58	3	15	76	1
5. Biliran Br.	14	11	3	6	6	3	43	3	15	61	7
6. Lilo-an Br.	14	15	3	6	7	3	48	3	15	66	5
7. Wawa Br.	17	13	5	10	14	0	59	3	10	72	2

Table 14.1-2 **Delpan Bridge (Package B)**

Evaluation Item					Evaluation	Score	Remarks (Reasons)
Bridge Condition (80 points)	Seismic Vulnerability (60 points)	Earthquake Resisting System (20 points)	1. Difference in soil types between adjacent piers	2	Soil Type I (or II) and II (or III)	1	Soil type: II or III
			2. Continuous or Simply Supported Bridge	3	Simply supported	3	Center span with gerber hinges & end spans
			3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: 1.0 - 1.5	3	Balance Ratio: 1.3
			4. Pier Type (Single column/wall or multiple columns)	3	Single column/wall	3	
			5. Height of Abutment (Embankment)	2	0 - 5.0 m	0	Embankment height: 8.0m
			6. Built Year	5	1992 and earlier	5	Built year: 1965
			Sub-Total	20	15		
		Unseating/Fall-down Prevention System (15 points)	7. Unseating/Fall-down Prevention Devices	5	Poor	3	Seismic restrainers are installed, but not functionable enough.
			8. Bearing	5	Moderate	3	Deterioration of bearings
			9. Seat Length	5	Short	3	The seat lengths satisfy AASHTO criteria.
			Sub-Total	15	9		
		Foundation (15 points)	10. Foundation Type (known or unknown)	3	Unknown	3	
			11. Scouring	3	With evidence or potential for scouring	3	Scouring at Pier-5
			12. Soil Type	3	Soil type III (Soft)	3	
			13. Liquefaction Potential	6	Very high	6	Sand or silty sand (less than 10 of N value)
			Sub-Total	15	15		
		Seismic Hazard (10 points)	14. Distance from Active Faults	10	Small (Over 10.0 km)	0	Distance to the active fault: 11.1km
		Sub-Total (Seismic Vulnerability)		60	39		
	Structural Soundness (20 points)	Superstructures (15 points)	1. Primary Members	10	Moderate (Need for repair work)	5	Cracking
			2. Secondary Members	2	Moderate (Need for repair work)	1	Water leaking at expansion joints
			3. Deck Slab	3	Moderate (Need for repair work)	1	Cracking & water leaking
			Sub-Total	15	7		
		Substructures (5 points)	4. Deterioration of Columns/Walls	5	Moderate (Repairable)	3	Cracking
			Sub-Total	5	3		
		Sub-Total (Structural Soundness)		20	10		
	Sub-Total (Bridge Condition)			80	49		
Importance (20 points)			1. Traffic Volume	5	50,000 - 100,0000 pcu	3	Evaluated by the criteria for Package B
			2. Alternative Bridge	15	1 km - 3 km away	5	Distance to the altenative bridge: 1.7km
			Sub-Total (Importance)	20	8		
Grand Total				100	57		

Table 14.1-3 **Nagtahan Bridge (Package B)**

Evaluation Item					Evaluation	Score	Remarks (Reasons)
Bridge Condition (80 points)	Seismic Vulnerability (60 points)	Earthquake Resisting System (20 points)	1. Difference in soil types between adjacent piers	2	Same	0	Consistent soil type
			2. Continuous or Simply Supported Bridge	3	Continuous	0	
			3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: 1.0 - 1.5	3	Balance Ratio: 1.3
			4. Pier Type (Single column/wall or multiple columns)	3	Single column/wall	3	
			5. Height of Abutment (Embankment)	2	0 - 5.0 m	0	Embankment height: 3.0m
			6. Built Year	5	1992 and earlier	5	Built year: 1966
			Sub-Total	20	11		
		Unseating/Fall-down Prevention System (15 points)	7. Unseating/Fall-down Prevention Devices	5	Poor	3	Seismic restrainers are installed, but not functionable enough.
			8. Bearing	5	Serious	5	Loose connection of bearings
			9. Seat Length	5	Enough	0	The seat lengths satisfy JRA criteria.
			Sub-Total	15	8		
		Foundation (15 points)	10. Foundation Type (known or unknown)	3	Unknown	3	
			11. Scouring	3	With evidence or potential for scouring	3	Potential of deep scouring at Pier-9 & 10
			12. Soil Type	3	Soil type II (Moderate)	2	
			13. Liquefaction Potential	6	High	4	Sand or silty sand (10 - 20)
			Sub-Total	15	12		
		Seismic Hazard (10 points)	14. Distance from Active Faults	10	Moderate (5.0 km - less than or equal 10.0 km)	3	Distance to the active fault: 7.5km
		Sub-Total (Seismic Vulnerability)		60	34		
	Structural Soundness (20 points)	Superstructures (15 points)	1. Primary Members	10	Moderate (Need for repair work)	5	Paint deterioration
			2. Secondary Members	2	Moderate (Need for repair work)	1	Paint deterioration
			3. Deck Slab	3	Moderate (Need for repair work)	1	Cracking & water leaking
			Sub-Total	15	7		
		Substructures (5 points)	4. Deterioration of Columns/Walls	5	Moderate (Repairable)	3	Section loss & rebar exposure
			Sub-Total	5	3		
		Sub-Total (Structural Soundness)		20	10		
	Sub-Total (Bridge Condition)			80	44		
Importance (20 points)			1. Traffic Volume	5	50,000 - 100,0000 pcu	3	Evaluated by the criteria for Package B
			2. Alternative Bridge	15	1 km - 3 km away	5	Distance to the altenative bridge: 2.4km
			Sub-Total (Importance)	20	8		
Grand Total				100	52		

Table 14.1-4 **Lambingan Bridge (Package B)**

Evaluation Item					Evaluation	Score	Remarks (Reasons)
Bridge Condition (80 points)	Seismic Vulnerability (60 points)	Earthquake Resisting System (20 points)	1. Difference in soil types between adjacent piers	2	Same	0	Consistent soil type
			2. Continuous or Simply Supported Bridge	3	Simply supported	3	Center span with gerber hinges
			3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: over 1.5	5	Balance Ratio: 3.3
			4. Pier Type (Single column/wall or multiple columns)	3	Single column/wall	3	
			5. Height of Abutment (Embankment)	2	5.0 - 10.0 m	1	Embankment height: 5.0m
			6. Built Year	5	1992 and earlier	5	Built year: 1975
			Sub-Total	20	17		
		Unseating/Fall-down Prevention System (15 points)	7. Unseating/Fall-down Prevention Devices	5	Poor	3	Seismic restrainers are installed, but not functionable enough.
			8. Bearing	5	Serious	5	Deterioration of bearings
			9. Seat Length	5	Very Short	5	Some of seat lengths don't satisfy AASHTO
			Sub-Total	15	13		
		Foundation (15 points)	10. Foundation Type (known or unknown)	3	Unknown	3	
			11. Scouring	3	With evidence or potential for scouring	3	Scouring at Pier 2
			12. Soil Type	3	Soil type II (Moderate)	2	
			13. Liquefaction Potential	6	High	4	Sand or silty sand (10 - 20)
			Sub-Total	15	12		
		Seismic Hazard (10 points)	14. Distance from Active Faults	10	Moderate (5.0 km - less than or equal 10.0 km)	3	Distance to the active fault: 5.3km
		Sub-Total (Seismic Vulnerability)		60	45		
	Structural Soundness (20 points)	Superstructures (15 points)	1. Primary Members	10	Serious (Need for reinforcement)	10	Large deflection, uplift, & cracking
			2. Secondary Members	2	Moderate (Need for repair work)	1	Section loss of RC side blocks
			3. Deck Slab	3	Moderate (Need for repair work)	1	Cracking & water leaking
			Sub-Total	15	12		
		Substructures (5 points)	4. Deterioration of Columns/Walls	5	Moderate (Repairable)	3	Cracking and scaling/spalling
			Sub-Total	5	3		
		Sub-Total (Structural Soundness)		20	15		
	Sub-Total (Bridge Condition)			80	60		
Importance (20 points)			1. Traffic Volume	5	Less than 50,000 pcu	0	Evaluated by the criteria for Package B
			2. Alternative Bridge	15	3 km - 10 km away	10	Distance to the altenative bridge: 3.7km
			Sub-Total (Importance)	20	10		
Grand Total				100	70		

Table 14.1-5 **Guadalupe Bridge (Package B)**

Evaluation Item					Evaluation	Score	Remarks (Reasons)
Bridge Condition (80 points)	Seismic Vulnerability (60 points)	Earthquake Resisting System (20 points)	1. Difference in soil types between adjacent piers	2	Soil Type I and III	2	Soil type: I or III
			2. Continuous or Simply Supported Bridge	3	Simply supported	3	Center span with gerber hinges
			3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: 1.0 - 1.5	3	Balance Ratio: 1.2
			4. Pier Type (Single column/wall or multiple columns)	3	Single column/wall	3	
			5. Height of Abutment (Embankment)	2	5.0 - 10.0 m	1	Embankment height: 8.0m
			6. Built Year	5	1992 and earlier	5	Built year: Steel truss: 1962, PC girders: 1978
			Sub-Total	20	17		
		Unseating/Fall-down Prevention System (15 points)	7. Unseating/Fall-down Prevention Devices	5	Poor	3	Seismic restrainers are installed, but not functionable enough.
			8. Bearing	5	Serious	5	Deterioration of bearings
			9. Seat Length	5	Very Short	5	Some of seat lengths don't satisfy AASHTO
			Sub-Total	15	13		
		Foundation (15 points)	10. Foundation Type (known or unknown)	3	Unknown	3	
			11. Scouring	3	With evidence or potential for scouring	3	Potential of deep scouring at Pier-1 & 2
			12. Soil Type	3	Soil type II (Moderate)	2	
			13. Liquefaction Potential	6	High	4	Sand or silty sand (10 - 20)
			Sub-Total	15	12		
		Seismic Hazard (10 points)	14. Distance from Active Faults	10	Serious (2.0 km - less than or equal 5.0 km)	6	Distance to the active fault: 2.4km
		Sub-Total (Seismic Vulnerability)		60	48		
	Structural Soundness (20 points)	Superstructures (15 points)	1. Primary Members	10	Serious (Need for reinforcement)	10	- Paint deterioration on steel truss members - Major cracking at gerber hinge area of PCDG
			2. Secondary Members	2	Moderate (Need for repair work)	1	- Paint deterioration on steel truss members - Abnormal spacing of an expansion joint
			3. Deck Slab	3	Moderate (Need for repair work)	1	Cracking & water leaking
			Sub-Total	15	12		
		Substructures (5 points)	4. Deterioration of Columns/Walls	5	Moderate (Repairable)	3	Cracking, spalling, and rebar exposure
			Sub-Total	5	3		
		Sub-Total (Structural Soundness)		20	15		
	Sub-Total (Bridge Condition)			80	63		
Importance (20 points)			1. Traffic Volume	5	Over 100,000 pcu	5	Evaluated by the criteria for Package B
			2. Alternative Bridge	15	3 km - 10 km away	10	Distance to the altenative bridge: 3.7km
			Sub-Total (Importance)	20	15		
Grand Total				100	78		

Table 14.1-6 **Marikina Bridge (Package B)**

Evaluation Item					Evaluation	Score	Remarks (Reasons)
Bridge Condition (80 points)	Seismic Vulnerability (60 points)	Earthquake Resisting System (20 points)	1. Difference in soil types between adjacent piers	2	Same	0	Consistent soil type
			2. Continuous or Simply Supported Bridge	3	Simply supported	3	
			3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: 1.0 - 1.5	3	Balance Ratio: 1.3
			4. Pier Type (Single column/wall or multiple columns)	3	Multiple columns	0	
			5. Height of Abutment (Embankment)	2	0 - 5.0 m	0	Embankment height: 2.5m
			6. Built Year	5	1992 and earlier	5	Built year: 1980
			Sub-Total	20	11		
		Unseating/Fall-down Prevention System (15 points)	7. Unseating/Fall-down Prevention Devices	5	None	5	No seismic restrainers are installed.
			8. Bearing	5	Serious	5	No bearings at piers
			9. Seat Length	5	Short	3	The seat lengths satisfy AASHTO criteria.
			Sub-Total	15	13		
		Foundation (15 points)	10. Foundation Type (known or unknown)	3	Unknown	3	
			11. Scouring	3	With evidence or potential for scouring	3	Scouring at Pier-2 & 3
			12. Soil Type	3	Soil type II (Moderate)	2	
			13. Liquefaction Potential	6	High	4	Sand or silty sand (10 - 20)
			Sub-Total	15	12		
		Seismic Hazard (10 points)	14. Distance from Active Faults	10	Fatal (Less than or equal 2.0 km)	10	Distance to the active fault: 1.0km
		Sub-Total (Seismic Vulnerability)		60	46		
	Structural Soundness (20 points)	Superstructures (15 points)	1. Primary Members	10	Good or small (No need for repair)	0	
			2. Secondary Members	2	Moderate (Need for repair work)	1	- Deterioration of cross beams - Water leaking at expansion joint
			3. Deck Slab	3	Serious (Need for replacement)	3	Cracking & water leaking
			Sub-Total	15	4		
		Substructures (5 points)	4. Deterioration of Columns/Walls	5	Moderate (Repairable)	3	
			Sub-Total	5	3		
		Sub-Total (Structural Soundness)		20	7		
	Sub-Total (Bridge Condition)			80	53		
Importance (20 points)			1. Traffic Volume	5	50,000 - 100,0000 pcu	3	Evaluated by the criteria for Package B
			2. Alternative Bridge	15	3 km - 10 km away	10	Distance to the altenative bridge: 3.7km
			Sub-Total (Importance)	20	13		
Grand Total				100	66		

Table 14.1-7 **Buntun Bridge (Package C)**

Evaluation Item					Evaluation	Score	Remarks (Reasons)
Bridge Condition (80 points)	Seismic Vulnerability (60 points)	Earthquake Resisting System (20 points)	1. Difference in soil types between adjacent piers	2	Same	0	Consistent soil type
			2. Continuous or Simply Supported Bridge	3	Simply supported	3	
			3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: over 1.5	5	Balance Ratio: 1.7
			4. Pier Type (Single column/wall or multiple columns)	3	Multiple columns	0	
			5. Height of Abutment (Embankment)	2	5.0 - 10.0 m	1	Embankment height: 3.0m
			6. Built Year	5	1992 and earlier	5	Built year: 1967
			Sub-Total	20	14		
		Unseating/Fall-down Prevention System (15 points)	7. Unseating/Fall-down Prevention Devices	5	None	5	No seismic restrainers are installed.
			8. Bearing	5	Serious	5	Pin portion of bearing is missing at Pier-11.
			9. Seat Length	5	Short	3	The seat lengths satisfy AASHTO criteria.
			Sub-Total	15	13		
		Foundation (15 points)	10. Foundation Type (known or unknown)	3	Unknown	3	
			11. Scouring	3	With evidence or potential for scouring	3	Scouring at Pier-5
			12. Soil Type	3	Soil type III (Soft)	3	
			13. Liquefaction Potential	6	Very high	6	Sand or silty sand (less than 10 of N value)
			Sub-Total	15	15		
		Seismic Hazard (10 points)	14. Distance from Active Faults	10	Small (Over 10.0 km)	0	Distance to the active fault: 15.9km
		Sub-Total (Seismic Vulnerability)		60	42		
	Structural Soundness (20 points)	Superstructures (15 points)	1. Primary Members	10	Good or small (No need for repair)	0	
			2. Secondary Members	2	Good or small (No need for repair)	0	
			3. Deck Slab	3	Moderate (Need for repair work)	1	Minor cracking & water leaking
			Sub-Total	15	1		
		Substructures (5 points)	4. Deterioration of Columns/Walls	5	Good or small (No need for repair)	0	
			Sub-Total	5	0		
		Sub-Total (Structural Soundness)		20	1		
	Sub-Total (Bridge Condition)			80	43		
Importance (20 points)			1. Traffic Volume	5	Over 5,000 pcu	5	Evaluated by the criteria for Package C
			2. Alternative Bridge	15	More than 10 km away or no alternate bridge	15	Distance to the altenative bridge: 13km
			Sub-Total (Importance)	20	20		
Grand Total				100	63		

Table 14.1-8 1st Mandaue-Mactan Bridge (Package C)

Evaluation Item					Evaluation	Score	Remarks (Reasons)
Bridge Condition (80 points)	Seismic Vulnerability (60 points)	Earthquake Resisting System (20 points)	1. Difference in soil types between adjacent piers	2	Soil Type I (or II) and II (or III)	1	Soil type: I or II
			2. Continuous or Simply Supported Bridge	3	Simply supported	3	
			3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: over 1.5	5	Balance Ratio: 2.2
			4. Pier Type (Single column/wall or multiple columns)	3	Single column/wall	3	
			5. Height of Abutment (Embankment)	2	5.0 - 10.0 m	1	Embankment height: 4.0m
			6. Built Year	5	1992 and earlier	5	Built year: 1972
			Sub-Total	20	18		
		Unseating/Fall-down Prevention System (15 points)	7. Unseating/Fall-down Prevention Devices	5	None	5	No seismic restrainers are installed.
			8. Bearing	5	Serious	5	Deterioration of bearings
			9. Seat Length	5	Short	3	The seat lengths satisfy AASHTO criteria.
			Sub-Total	15	13		
		Foundation (15 points)	10. Foundation Type (known or unknown)	3	Unknown	3	
			11. Scouring	3	With evidence or potential for scouring	3	Scouring at Pier-10
			12. Soil Type	3	Soil type II (Moderate)	2	
			13. Liquefaction Potential	6	Very high	6	Sand or silty sand (less than 10 of N value)
			Sub-Total	15	14		
		Seismic Hazard (10 points)	14. Distance from Active Faults	10	Small (Over 10.0 km)	0	Distance to the active fault: 15.8km
		Sub-Total (Seismic Vulnerability)		60	45		
	Structural Soundness (20 points)	Superstructures (15 points)	1. Primary Members	10	Moderate (Need for repair work)	5	Experience of ship crush
			2. Secondary Members	2	Serious (Need for reinforcement)	2	Heavy corrosion & section loss
			3. Deck Slab	3	Moderate (Need for repair work)	1	Minor cracking & rebar exposure
			Sub-Total	15	8		
		Substructures (5 points)	4. Deterioration of Columns/Walls	5	Serious (Not repairable)	5	- Experience of ship crush at Pier-7 - Severe rebar exposure at pile caps in water
			Sub-Total	5	5		
		Sub-Total (Structural Soundness)		20	13		
	Sub-Total (Bridge Condition)			80	58		
Importance (20 points)			1. Traffic Volume	5	Over 5,000 pcu	5	Evaluated by the criteria for Package C
			2. Alternative Bridge	15	1 km - 3 km away	5	Distance to the altenative bridge: 1.3km
			Sub-Total (Importance)	20	10		
Grand Total				100	68		

Table 14.1-9 Palanit Bridge (Package C)

Evaluation Item					Evaluation	Score	Remarks (Reasons)
Bridge Condition (80 points)	Seismic Vulnerability (60 points)	Earthquake Resisting System (20 points)	1. Difference in soil types between adjacent piers	2	Same	0	Consistent soil type
			2. Continuous or Simply Supported Bridge	3	Simply supported	3	
			3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: over 1.5	5	Balance Ratio: 2.7
			4. Pier Type (Single column/wall or multiple columns)	3	Single column/wall	3	
			5. Height of Abutment (Embankment)	2	5.0 - 10.0 m	1	Embankment height: 3.0m
			6. Built Year	5	1992 and earlier	5	Built year: 1972
			Sub-Total	20	17		
		Unseating/Fall-down Prevention System (15 points)	7. Unseating/Fall-down Prevention Devices	5	None	5	No seismic restrainers are installed.
			8. Bearing	5	Serious	5	Deterioration of bearings
			9. Seat Length	5	Very Short	5	Some of seat lengths don't satisfy AASHTO
			Sub-Total	15	15		
		Foundation (15 points)	10. Foundation Type (known or unknown)	3	Unknown	3	
			11. Scouring	3	None	0	
			12. Soil Type	3	Soil type I (Firm)	0	
			13. Liquefaction Potential	6	None	0	Firm, clayey soil or over than 30 of N value
			Sub-Total	15	3		
		Seismic Hazard (10 points)	14. Distance from Active Faults	10	Moderate (5.0 km - less than or equal 10.0 km)	3	Distance to the active fault: 7.6km
		Sub-Total (Seismic Vulnerability)		60	38		
	Structural Soundness (20 points)	Superstructures (15 points)	1. Primary Members	10	Serious (Need for reinforcement)	10	- Severe corrosion & section loss - Low load capacity (load limit: 7t)
			2. Secondary Members	2	Serious (Need for reinforcement)	2	Severe corrosion
			3. Deck Slab	3	Serious (Need for replacement)	3	Major cracking, water leaking, & hanycomb
			Sub-Total	15	15		
		Substructures (5 points)	4. Deterioration of Columns/Walls	5	Moderate (Repairable)	3	Rebar exposure & cracking at the bearing base of Pier-1
			Sub-Total	5	3		
		Sub-Total (Structural Soundness)		20	18		
	Sub-Total (Bridge Condition)			80	56		
Importance (20 points)			1. Traffic Volume	5	Less than 2,000 pcu	0	Evaluated by the criteria for Package C
			2. Alternative Bridge	15	More than 10 km away or no alternate bridge	15	Distance to the altenative bridge: 20km
			Sub-Total (Importance)	20	15		
Grand Total				100	71		

Table 14.1-10 Mawo Bridge (Package C)

Evaluation Item					Evaluation	Score	Remarks (Reasons)
Bridge Condition (80 points)	Seismic Vulnerability (60 points)	Earthquake Resisting System (20 points)	1. Difference in soil types between adjacent piers	2	Soil Type I and III	2	Soil type: I or III
			2. Continuous or Simply Supported Bridge	3	Simply supported	3	
			3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: 1.0	0	Balance Ratio: 1.0
			4. Pier Type (Single column/wall or multiple columns)	3	Single column/wall	3	
			5. Height of Abutment (Embankment)	2	5.0 - 10.0 m	1	Embankment height: 2.0m
			6. Built Year	5	1992 and earlier	5	Built year: 1976
			Sub-Total	20	14		
		Unseating/Fall-down Prevention System (15 points)	7. Unseating/Fall-down Prevention Devices	5	None	5	No seismic restrainers are installed.
			8. Bearing	5	Moderate	3	Deterioration of bearings
			9. Seat Length	5	Short	3	The seat lengths satisfy AASHTO criteria.
			Sub-Total	15	11		
		Foundation (15 points)	10. Foundation Type (known or unknown)	3	Unknown	3	
			11. Scouring	3	Unknown	2	Condition of Pier-1 in water is unknown.
			12. Soil Type	3	Soil type III (Soft)	3	
			13. Liquefaction Potential	6	Very high	6	Sand or silty sand (less than 10 of N value)
			Sub-Total	15	14		
		Seismic Hazard (10 points)	14. Distance from Active Faults	10	Fatal (Less than or equal 2.0 km)	10	Distance to the active fault: 1.4km
		Sub-Total (Seismic Vulnerability)		60	49		
	Structural Soundness (20 points)	Superstructures (15 points)	1. Primary Members	10	Moderate (Need for repair work)	5	- Painting deterioration & corrosion - Low load capacity (load limit: 7t)
			2. Secondary Members	2	Moderate (Need for repair work)	1	Painting deterioration & corrosion
			3. Deck Slab	3	Serious (Need for replacement)	3	Cracking, water leaking, hanycomb, & rebar exposure
			Sub-Total	15	9		
		Substructures (5 points)	4. Deterioration of Columns/Walls	5	Good or small (No need for repair)	0	
			Sub-Total	5	0		
		Sub-Total (Structural Soundness)		20	9		
	Sub-Total (Bridge Condition)			80	58		
Importance (20 points)			1. Traffic Volume	5	2,000 - 5,000 pcu	3	Evaluated by the criteria for Package C
			2. Alternative Bridge	15	More than 10 km away or no alternate bridge	15	Distance to the altenative bridge: 20km
			Sub-Total (Importance)	20	18		
Grand Total				100	76		

Table 14.1-11 Biliran Bridge (Package C)

Evaluation Item					Evaluation	Score	Remarks (Reasons)
Bridge Condition (80 points)	Seismic Vulnerability (60 points)	Earthquake Resisting System (20 points)	1. Difference in soil types between adjacent piers	2	Same	0	Consistent soil type
			2. Continuous or Simply Supported Bridge	3	Simply supported	3	
			3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: over 1.5	5	Balance Ratio: 8.5
			4. Pier Type (Single column/wall or multiple columns)	3	Multiple columns	0	
			5. Height of Abutment (Embankment)	2	5.0 - 10.0 m	1	Embankment height: 4.0m
			6. Built Year	5	1992 and earlier	5	Built year: 1976
			Sub-Total	20	14		
		Unseating/Fall-down Prevention System (15 points)	7. Unseating/Fall-down Prevention Devices	5	Poor	3	Seismic restrainers are installed, but not functionable enough.
			8. Bearing	5	Serious	5	Deterioration of bearings
			9. Seat Length	5	Short	3	The seat lengths satisfy AASHTO criteria.
			Sub-Total	15	11		
		Foundation (15 points)	10. Foundation Type (known or unknown)	3	Unknown	3	
			11. Scouring	3	None	0	
			12. Soil Type	3	Soil type I (Firm)	0	
			13. Liquefaction Potential	6	None	0	Firm, clayey soil or over than 30 of N value
			Sub-Total	15	3		
		Seismic Hazard (10 points)	14. Distance from Active Faults	10	Serious (2.0 km - less than or equal 5.0 km)	6	Distance to the active fault: 4.3km
		Sub-Total (Seismic Vulnerability)		60	34		
	Structural Soundness (20 points)	Superstructures (15 points)	1. Primary Members	10	Moderate (Need for repair work)	5	Corrosion on steel I-girder members
			2. Secondary Members	2	Good or small (No need for repair)	0	
			3. Deck Slab	3	Moderate (Need for repair work)	1	Spalling & water leaking
			Sub-Total	15	6		
		Substructures (5 points)	4. Deterioration of Columns/Walls	5	Moderate (Repairable)	3	Cracking
			Sub-Total	5	3		
		Sub-Total (Structural Soundness)		20	9		
	Sub-Total (Bridge Condition)			80	43		
Importance (20 points)			1. Traffic Volume	5	2,000 - 5,000 pcu	3	Evaluated by the criteria for Package C
			2. Alternative Bridge	15	More than 10 km away or no alternate bridge	15	Distance to the altenative bridge: No altenative
			Sub-Total (Importance)	20	18		
Grand Total				100	61		

Table 14.1-12 Lilo-an Bridge (Package C)

Evaluation Item					Evaluation	Score	Remarks (Reasons)
Bridge Condition (80 points)	Seismic Vulnerability (60 points)	Earthquake Resisting System (20 points)	1. Difference in soil types between adjacent piers	2	Same	0	Consistent soil type
			2. Continuous or Simply Supported Bridge	3	Simply supported	3	
			3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: over 1.5	5	Balance Ratio: 3.9
			4. Pier Type (Single column/wall or multiple columns)	3	Multiple columns	0	
			5. Height of Abutment (Embankment)	2	5.0 - 10.0 m	1	Embankment height: 4.0m
			6. Built Year	5	1992 and earlier	5	Built year: 1979
			Sub-Total	20	14		
		Unseating/Fall-down Prevention System (15 points)	7. Unseating/Fall-down Prevention Devices	5	None	5	No seismic restrainers are installed.
			8. Bearing	5	Serious	5	Deterioration of bearings
			9. Seat Length	5	Very Short	5	Some of seat lengths don't satisfy AASHTO
			Sub-Total	15	15		
		Foundation (15 points)	10. Foundation Type (known or unknown)	3	Unknown	3	
			11. Scouring	3	None	0	
			12. Soil Type	3	Soil type I (Firm)	0	
			13. Liquefaction Potential	6	None	0	Firm, clayey soil or over than 30 of N value
			Sub-Total	15	3		
		Seismic Hazard (10 points)	14. Distance from Active Faults	10	Serious (2.0 km - less than or equal 5.0 km)	6	Distance to the active fault: 2.5km
		Sub-Total (Seismic Vulnerability)		60	38		
	Structural Soundness (20 points)	Superstructures (15 points)	1. Primary Members	10	Moderate (Need for repair work)	5	- Corrosion on steel ranger arch members - Water leaking on PC-I girder members
			2. Secondary Members	2	Moderate (Need for repair work)	1	Corrosion & loose connection
			3. Deck Slab	3	Moderate (Need for repair work)	1	Cracking & hanycomb
			Sub-Total	15	7		
		Substructures (5 points)	4. Deterioration of Columns/Walls	5	Moderate (Repairable)	3	Cracking & hanycomb
			Sub-Total	5	3		
		Sub-Total (Structural Soundness)		20	10		
	Sub-Total (Bridge Condition)			80	48		
Importance (20 points)			1. Traffic Volume	5	2,000 - 5,000 pcu	3	Evaluated by the criteria for Package C
			2. Alternative Bridge	15	More than 10 km away or no alternate bridge	15	Distance to the altenative bridge: No altenative
			Sub-Total (Importance)	20	18		
Grand Total				100	66		

Table 14.1-13 Wawa Bridge (Package C)

Evaluation Item					Evaluation	Score	Remarks (Reasons)
Bridge Condition (80 points)	Seismic Vulnerability (60 points)	Earthquake Resisting System (20 points)	1. Difference in soil types between adjacent piers	2	Same	0	Consistent soil type
			2. Continuous or Simply Supported Bridge	3	Simply supported	3	
			3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: over 1.5	5	Balance Ratio: 3.0
			4. Pier Type (Single column/wall or multiple columns)	3	Single column/wall	3	
			5. Height of Abutment (Embankment)	2	5.0 - 10.0 m	1	Embankment height: 4.0m
			6. Built Year	5	1992 and earlier	5	Built year: 1967
			Sub-Total	20	17		
		Unseating/Fall-down Prevention System (15 points)	7. Unseating/Fall-down Prevention Devices	5	None	5	No seismic restrainers are installed.
			8. Bearing	5	Serious	5	Seismically vulunerable bearing type & Deterioration of bearings
			9. Seat Length	5	Short	3	The seat lengths satisfy AASHTO criteria.
			Sub-Total	15	13		
		Foundation (15 points)	10. Foundation Type (known or unknown)	3	Unknown	3	
			11. Scouring	3	Unknown	2	Condition of Pier-3 in water is unknown.
			12. Soil Type	3	Soil type I (Firm)	0	
			13. Liquefaction Potential	6	None	0	Firm, clayey soil or over than 30 of N value
			Sub-Total	15	5		
		Seismic Hazard (10 points)	14. Distance from Active Faults	10	Fatal (Less than or equal 2.0 km)	10	Distance to the active fault: 5.5km
			Sub-Total (Seismic Vulnerability)	60	45		
	Structural Soundness (20 points)	Superstructures (15 points)	1. Primary Members	10	Serious (Need for reinforcement)	10	- Low load capacity (load limit: 10t) - Temporary suports for steel I-girders
			2. Secondary Members	2	Moderate (Need for repair work)	1	Corrosion
			3. Deck Slab	3	Serious (Need for replacement)	3	Major cracking & water leaking
			Sub-Total	15	14		
		Substructures (5 points)	4. Deterioration of Columns/Walls	5	Good or small (No need for repair)	0	
			Sub-Total	5	0		
			Sub-Total (Structural Soundness)	20	14		
			Sub-Total (Bridge Condition)	80	59		
Importance (20 points)			1. Traffic Volume	5	2,000 - 5,000 pcu	3	Evaluated by the criteria for Package C
			2. Alternative Bridge	15	3 km - 10 km away	10	Distance to the altenative bridge: 6km
			Sub-Total (Importance)	20	13		
			Grand Total	100	72		

14.2 Recommendation of Target Bridge Selection for the Outline Design

14.2.1 Recommendation of Target Bridge Selection Based on the Second Screening

As the result of the 2nd screening evaluation, priority ranks and improvement measures of the target bridges are suggested as shown in Table 14.2-1. Based on the priority rank in the table, two bridges from Package B and five bridges from Package C are chosen with recommended improvement measures for outline design. However, further study on the comparison of improvement measures is necessary for Guadalupe Bridge and Mawo Bridge in the beginning of the outline design stage.

- Guadalupe Bridge -
The bridge ranked first in the 2nd screening of Package B. Immediate implementation of the appropriate improvement measure is recommended. Based on the result of improvement measure comparison, replacement is recommended for its cost-effectiveness. However, both the traffic regulation and the installation of temporary detour bridges for the replacement seem to be extremely difficult, considering the current traffic condition on the bridge. Further study should be taken in order to confirm the reality/unreality of the replacement.

- Mawo Bridge -
The bridge ranked first in the 2nd screening of Package C. Immediate implementation of the appropriate improvement measure is recommended. Based on the result of improvement measure comparison, seismic retrofit is more cost-effective than replacement. However, the replacement of Mawo Bridge is strongly recommended for the severe superstructure deterioration and the lack of load capacity. Further study should be taken in order to optimize the cost performance of the bridge replacement.

Table 14.2.1-1 Recommendation of Target Bridges for Outline Design

Package B			
Bridge Name	Priority Rank based on Seismic Vulnerability, Structural Soundness and Importance	Recommended Improvement Measures	Recommendation for Outline Design
1. Delpan Br.	4	Seismic Retrofit	
2. Nagtahan Br.	5	Seismic Retrofit	
3. Lambingan Br.	2	Replacement	Recommended
4. Guadalupe Br.	1	Replacement / Seismic Retrofit*	Recommended
5. Marikina Br.	3	Replacement	
Package C			
Bridge Name	Priority Rank based on Seismic Vulnerability, Structural Soundness and Importance	Recommended Improvement Measures	Recommendation for Outline Design
1. Buntun Br.	6	Seismic Retrofit	
2. 1st Mandaue-Mactan Br.	4	Seismic Retrofit	Recommended
3. Palanit Br.	3	Replacement	Recommended
4. Mawo Br.	1	Replacement / Seismic Retrofit*	Recommended
5. Biliran Br.	7	Seismic Retrofit	
6. Lilo-an Br.	5	Seismic Retrofit	Recommended
7. Wawa Br.	2	Replacement	Recommended

Note: * indicates the necessity of further study on the comparison of improvement measures.

14.2.2 Detail Comparative Study on Improvement Measure Scheme Selection for Guadalupe Bridge & Mawo Bridge

(1) Background and Objective of the Study

As the result of the 2nd screening evaluation, seven target bridges were selected for outline design, based on their priority ranks. While five target bridges out of seven were selected with recommended improvement measure schemes (i.e. either replacement or seismic retrofit) at the time, improvement measure schemes of Guadalupe Bridge and Mawo Bridge remained undecided, for the two target bridges needed more detail study for the decision. The objectives of comparative studies for the two bridges are as follows.

- Guadalupe Bridge -

Based on the result of the 2nd screening evaluation, replacement is recommended as the improvement measure scheme of Guadalupe Bridge for its cost-effectiveness: the cost of seismic retrofit plan is assumed to be over 60% of the cost of replacement plan. However, both the traffic regulation and the installation of temporary detour bridges for the replacement seem to be extremely difficult, considering the current traffic condition of EDSA Ave. and the condition of neighborhood with buildings lined close together. The objective of detail comparative study here is to select the realistic improvement measure scheme for the bridge in consideration of construction planning and other restrictive conditions.

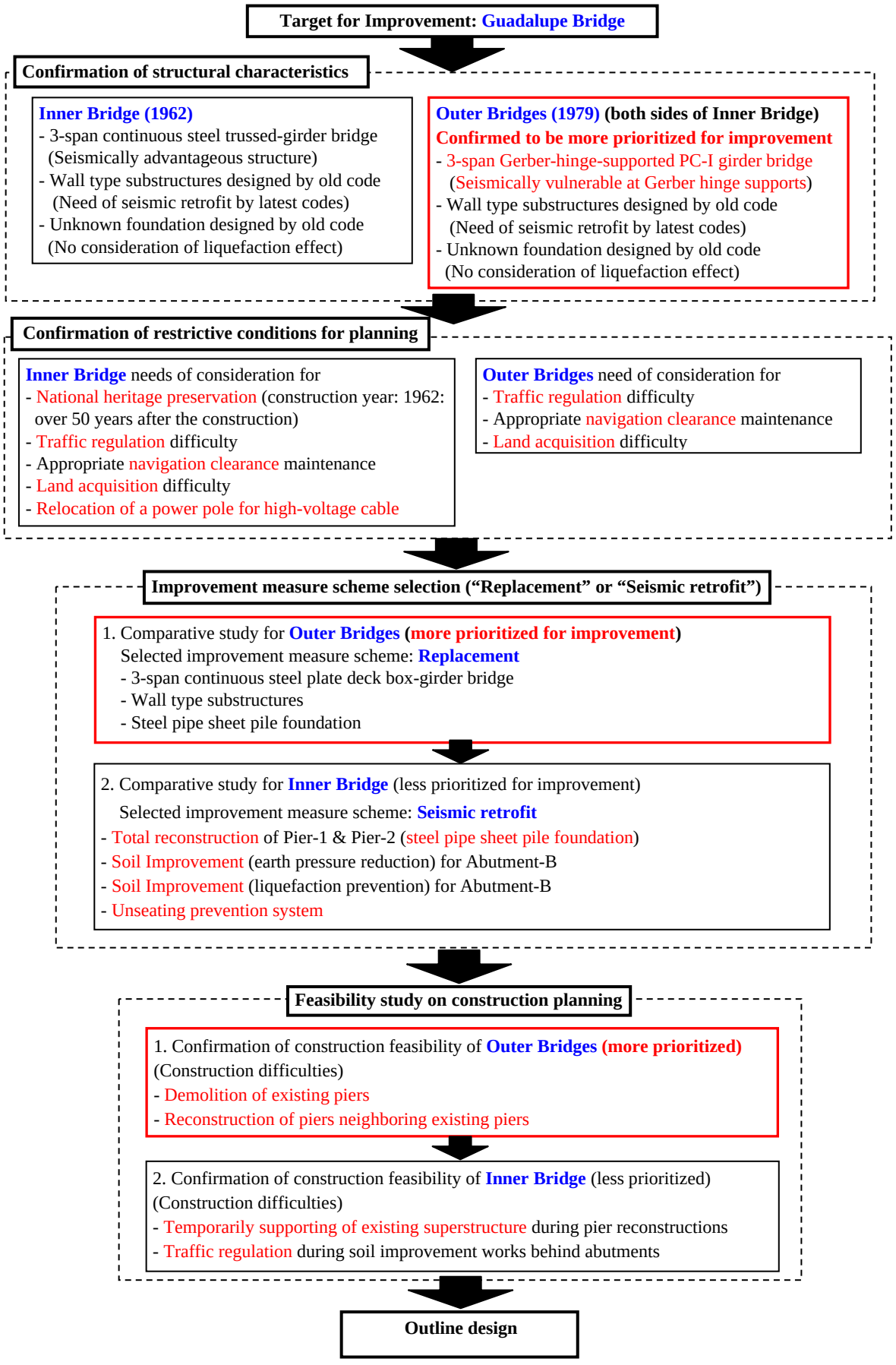
- Mawo Bridge -

Based on the result of the 2nd screening evaluation, seismic retrofit is more cost-effective than replacement for the improvement measure scheme of Mawo Bridge. However, the replacement of Mawo Bridge is strongly recommended for the severe superstructure deterioration and the lack of load capacity. Also, it's better to change the bridge type from existing steel type to concrete type for the advantage of maintenance-free structure, which is the request from DPWH district office in charge of the bridge. The objective of detail comparative study here is to optimize the bridge type of the replacement plan and confirm its cost-effectiveness for the implementation.

(2) Detail Comparative Study on Improvement Measure Scheme Selection for Guadalupe Bridge

1) Outline of the Comparative Study

The outline of the comparative study on improvement measure schemes for Guadalupe Bridge is shown in the following flowchart.



Note: The above plans will be examined and optimized in outline design.

Figure 14.2.2-1 Flowchart of Comparative Study on Improvement Measure Scheme Selection

2) Confirmation of Structural Characteristics of Inner Bridge and Outer Bridges

As a first step to selection of improvement measure schemes, structural characteristics of Inner Bridge and Outer Bridges are confirmed. As a result, Outer Bridges are found to be more prioritized for structural improvement than Inner Bridge for more sever structural deficiencies and higher risks for unseating under large-scale earthquakes. The structural characteristics of Inner Bridge and Outer Bridges are summarized as follows.

Structural Characteristics	
Inner Bridge (1962) - 3-span continuous steel trussed girder bridge (Seismically advantageous structure) - Wall type substructures designed by old code (Need of seismic retrofit by latest codes) - Unknown foundation designed by old code (No consideration of liquefaction effect)	**Outer Bridges (1979) (both sides of Inner Bridge)** **Confirmed to be more prioritized for improvement** - 3-span Gerber-hinge-supported PC I-girder bridge (Seismically vulnerable at Gerber hinge supports) - Wall type substructures designed by old code (Need of seismic retrofit by latest codes) - Unknown foundation designed by old code (No consideration of liquefaction effect)

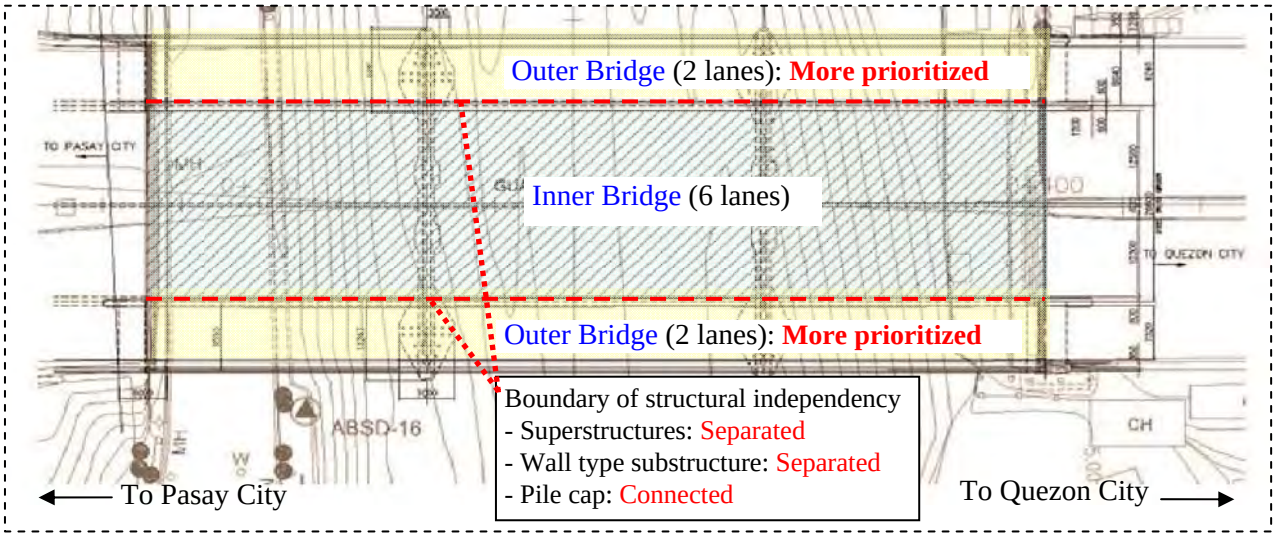
Inner Bridge was constructed in 1962. The bridge type is “3-span continuous steel trussed girder bridge”, which is seismically advantageous structure except for only bearing restraint condition of Pier-1 is “Fixed”: Pier-1 undertakes all the superstructure weight under earthquake. The superstructure soundness is relatively acceptable and can be used for some more decades. Substructures are wall type with unknown foundation structures and were designed by non-seismic design code. What is worse, the site has a liquefiable layer and the effect was not considered in the design. The substructures need improvement works for thin wall bodies and unknown foundations. Moreover, unseating prevention system should be installed for “earthquake-proof safety” just in case of substructures’ collapse.

Inner Bridge was constructed in 1962.

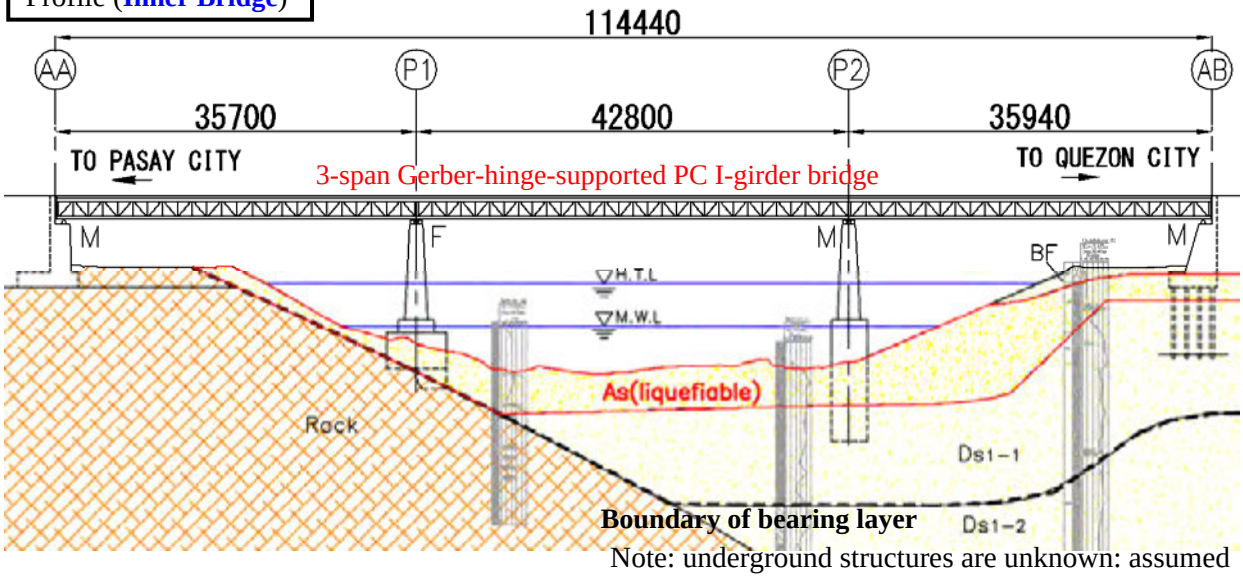
Outer Bridges were constructed in 1979 on both sides of Inner Bridge in order to increase number of lanes and mitigate traffic congestion. The bridge type is 3-span Gerber-hinge-supported PC-I girder bridge, which is seismically advantageous structure except for only bearing restraint condition of Pier-1 is “Fixed” as well as Inner Bridge. The difference is that the concrete structure has serious shear cracks in Gerber hinge portions, which could cause bridge fall-down under large-scale earthquakes. Need of improvement work for the serious shear cracks makes Outer Bridges more prioritized for structural improvement planning than Inner Bridge. The characteristics and structural problems of substructures are same as those of Inner Bridge. However, piers in the river have cracks and section-loss around the bottom of columns hit by vessels barges. The column damages could induce collapse of piers pushed by large seismic inertial force. This is also the reason to make Outer Bridges more prioritized.

Based on the above structural differences, the improvement measure schemes of Inner Bridge and Outer Bridges will be studied separately, prioritizing the planning of Outer Bridges. The structural characteristics of Inner Bridge and Outer Bridges are illustrated in the next page.

Plan

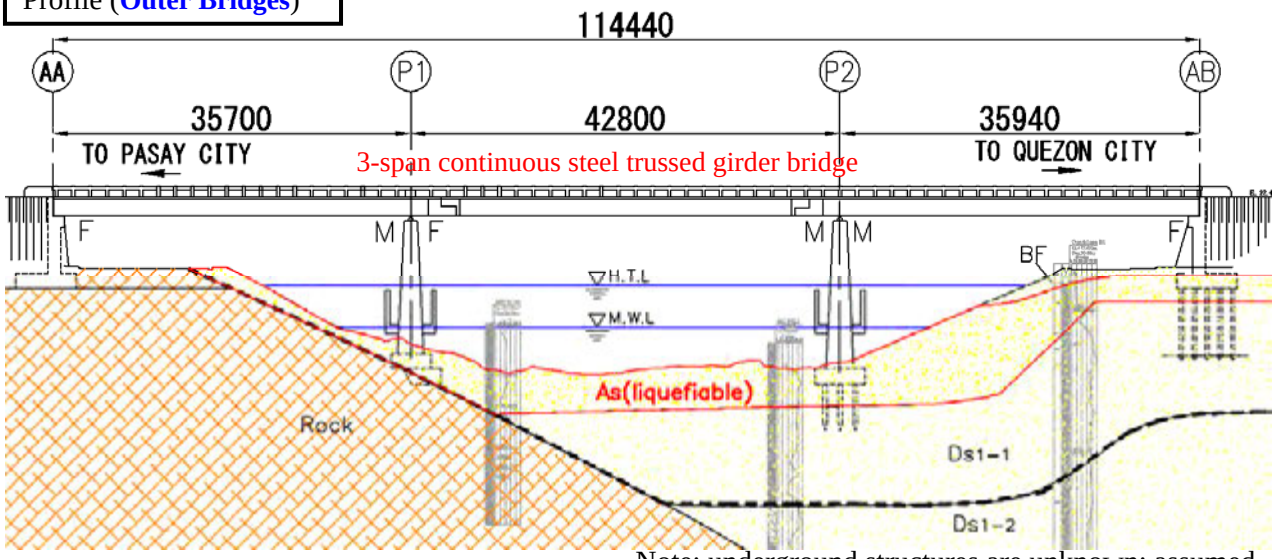


Profile (**Inner Bridge**)



Note: underground structures are unknown: assumed

Profile (**Outer Bridges**)



Note: underground structures are unknown: assumed

Restrictive conditions of **Inner Bridge** are:	Restrictive conditions of **Outer Bridges** are:
1) National heritage preservation (construction year: 1962: over 50 years after the construction) 2) Traffic regulation difficulty 3) Appropriate navigation clearance maintenance 4) Land acquisition difficulty 5) Relocation of a power pole for high-voltage cable	1) Traffic regulation difficulty 2) Appropriate navigation clearance maintenance 3) Land acquisition difficulty

b) Restrictive Conditions for Planning of Inner Bridge

In the Inner Bridge planning, the following restrictive considerations must be considered.

(I) National heritage preservation (construction year: 1962: over 50 years after the construction)

As shown below, a law for national heritage preservation was enforced in 2009. For the purpose of protecting bridges as cultural properties against modification or demolition, bridges older than 50 years old are strongly recommended for retrofitting instead of replacement. If replacement is demanded for those bridges, approval from the authorized organization is required. In case of Guadalupe Bridge, the law shall be applied to Inner Bridge, which was constructed in 1962.

Republic Act No. 10066

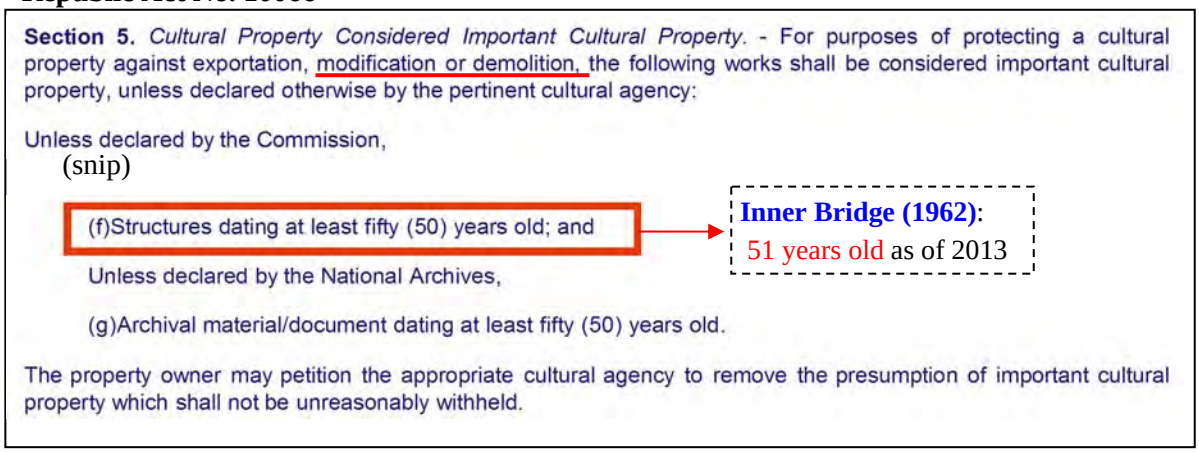


Figure 14.2.2-3 Law for National Heritage Preservation (Section 5)

(II) Traffic regulation difficulty

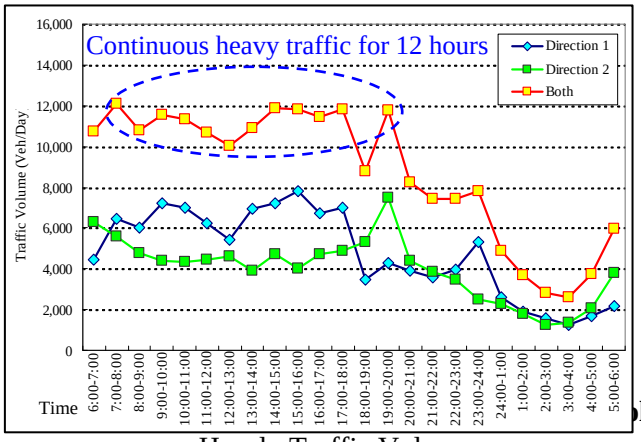
As shown in the next table, traffic condition of Guadalupe Bridge, which consists of 10 lanes including 4 bus lanes, is extremely heavy thorough whole the day. As a result of traffic count survey conducted in this project, Annual Average Daily Traffic (AADT) is 220,446 veh/day and peak hour traffic volume is 14,366 veh/hour. As you can see in the following figure, hour traffic volume is constantly over 10,000veh/hour from 6:00am to 8:00pm. Based on the survey results, Level-of-Service (LOS) of the bridge is evaluated as “E”.

According to the survey results, traffic regulation for Guadalupe Bridge improvement work seems to be extremely difficult. Construction planning with less effect on the traffic condition shall be considered.

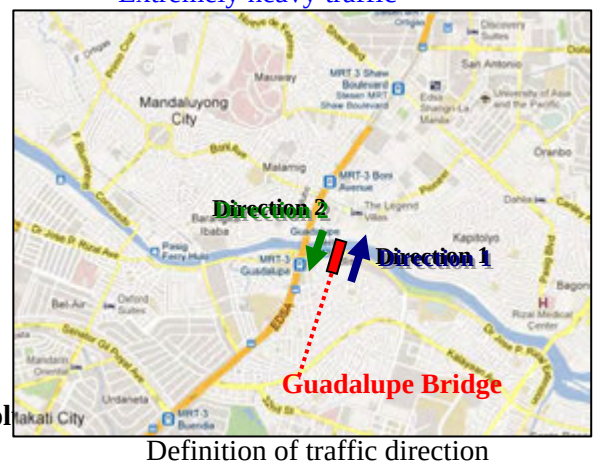
Table 14.2.2-1 AADT Based on Traffic Count Survey Results

	Motorcycle / Tricycle	Car / Taxi / Pick-up / Van	Jeepney	Large Bus	2-Axle Truck	3-Axle Truck	Truck trailer	Sub-Total	Total
Day 1	19,576	171,155	0	12,788	4,282	1,571	915	190,711	210,287
Day 2	19,538	191,000	0	13,669	3,917	1,684	837	211,107	230,645
AADT	19,557	181,078	0	13,229	4,100	1,628	876	200,909	220,466

Extremely heavy traffic



Hourly Traffic Volume

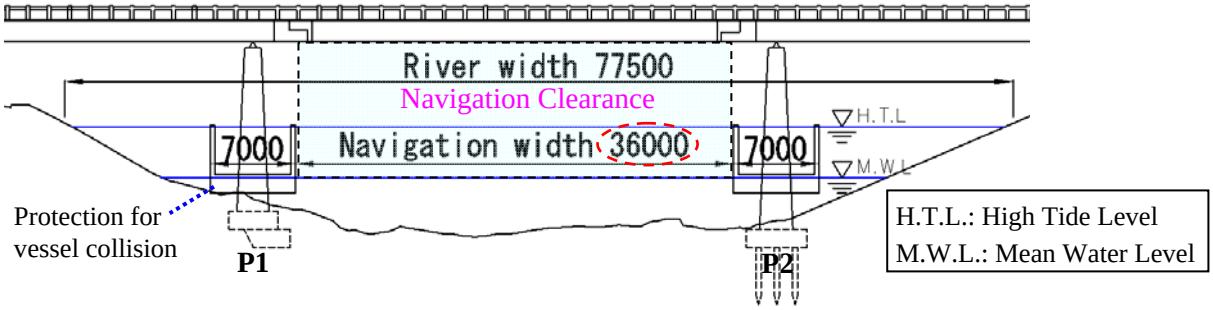


Definition of traffic direction

(III) Appropriate navigation clearance maintenance

The current navigation clearance is better to be maintained for vessels and barges going under the bridge. Even with the current condition, so many vessels have been hitting the bridge piers. Reduction of navigation clearance implies more collision of vessels to the piers in the future.

If there's any change of the clearance in "improvement measure planning", approval from Coast Guard will be required. The current hydrological condition of Guadalupe Bridge is explained in detail below.



$$(\text{River Inhibition Ratio}) = \frac{(\text{Total Structure Width})}{(\text{River Width})} \times 100 = \frac{7000 \times 2}{77500} \times 100 = 18.1(\%)$$

Note: - River Inhibition ratio is expected to be no more than 5% in the Japanese specification

- The above figure illustrates the condition of Outer Bridges: the condition of Inner Bridge is different without vessel protection structure. The navigation width and river inhibition of Inner Bridge are 40,8m and 4.9 %, respectively.

Figure 14.2.2-5 Current Hydrological Condition of Guadalupe Bridge

(IV) Land acquisition difficulty, and

(V) Relocation of a power pole for high-voltage cable

There're so many potential obstacles for construction around Guadalupe Bridge. The vicinity of the bridge is very crowded with buildings and houses. Moreover, public structures such as power poles and large sign boards stand nearby the bridge. Therefore, installation of detour bridges can't be done without temporary land acquisition. "The number of lanes during construction" and "degree of traffic regulation" must be carefully balanced in construction planning so as to prevent as much land acquisition as possible, which could result in the delay of project implementation.

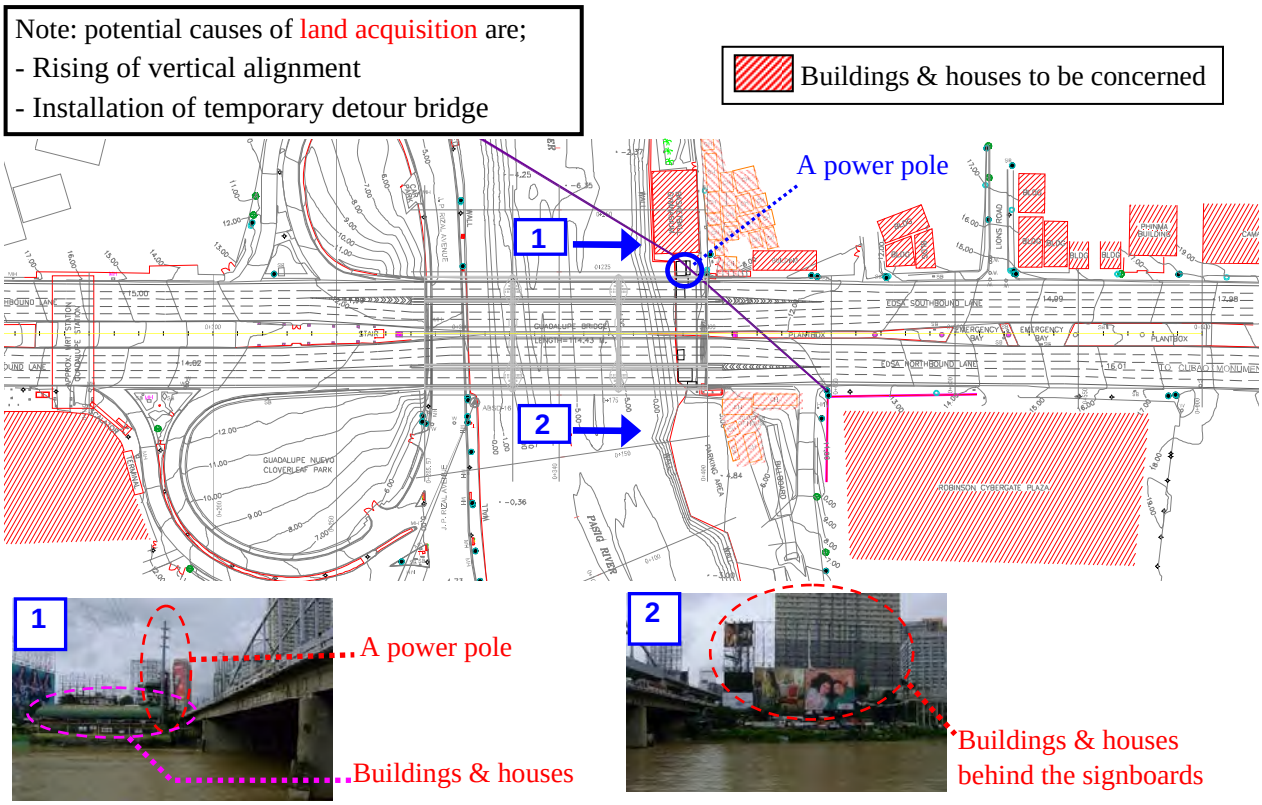


Figure 14.2.2-6 Flowchart of Comparative Study on Improvement Measure Scheme Selection

c) Restrictive Conditions for Planning of Outer Bridges

In the Outer Bridge planning, the following restrictive considerations must be considered.

i) Traffic regulation difficulty: same as Inner Bridge
ii) Appropriate navigation clearance maintenance: same as Inner Bridge
iii) Land acquisition difficulty: same as Inner Bridge

4) Improvement Measure Scheme Selection ("Replacement" or "Seismic Retrofit")

a) Comparative Study Procedure for the Selection

Comparative studies for improvement measure scheme selection were conducted with the following procedure, considering the improvement priorities of Inner Bridge and Outer Bridges. Outer Bridges are more prioritized than Inner Bridge, for their serious structural deficiencies in both superstructure and substructures must be urgently solved by improvement works. Therefore, construction results of Outer Bridges become one of restrictive conditions of planning for Inner Bridge: construction planning of Inner Bridge must be done in consideration of renewed shapes of Outer Bridges.

1. Comparative study for **Outer Bridges (more prioritized for improvement)**

↓ Selection of improvement measure scheme: either "replacement" or "seismic retrofit"

2. Comparative study for **Inner Bridge** (less prioritized for improvement)
Note: renewed shapes of Outer Bridges must be considered in the improvement measure planning of Inner Bridge

b) Evaluation Items Considered in the Selection

The comparative studies were conducted, evaluating the following seven items. Each item was evaluated as either "Positive" or "Negative" in the study, corresponding to the following definitions.

(I) Cost

Basically, cost-effectiveness is the most important of all the items for the selection.

- Positive: If cost of seismic retrofit works including repair works is less than 60 % of replacement, seismic retrofit cost is evaluated as "Positive". If the seismic retrofit cost is over or equal to 60 %, replacement cost is evaluated as "Positive".
- Negative: Other than the above case

(II) Consideration of the Law for National Heritage Preservation

- Positive: It won't take much time for the approval of the plan.
- Negative: It will take much time for the approval of the plan.

Note: If bridges are less than 50 years old, this item will be ignored.

(III) Life Expectancy (after the implementation)

- Positive: The life expectancy after the construction is considered to be more than 50 years.
- Negative: Other than the above case

Note: expected life - new bridge: 75 years
- old bridge: 50 years from the construction year
- retrofitted bridge: 30years plus remaining life

(IV) Temporary Detour Bridge (Large Land Acquisition)

- Positive: No need of temporary detour bridge for the implementation.
- Negative: Temporary detour bridge installation is required for the implementation: negotiation for the land acquisition is needed.

(V) Traffic Regulation

- Positive: No/Little need of traffic regulation for the implementation.
- Negative: Some traffic regulation is required for the implementation.

(VI) Navigation Width
- Positive: Navigation width will be same or increased.
- Negative: Navigation width will be reduced.

(VII) River Inhibition Ratio
- Positive: River Inhibition ratio will be “equivalent to/less than 5%” or same as the existing condition
- Negative: Other than the above case

c) Results of the Comparative Studies

(I) Outline of comparative study results

As a result of the comparative studies, “replacement” is recommended for Outer Bridges, which are more prioritized than Inner Bridge while “seismic retrofit” is recommended for Inner Bridge.

Results of the comparative studies are as follows.

1. Comparative study for **Outer Bridges** (**more prioritized for the improvement**)
   Selected improvement measure scheme: **Replacement**
   - 3-span continuous steel plate deck box-girder bridge
   - Wall type substructures
   - Steel pipe sheet pile foundation

2. Comparative study for **Inner Bridge** (less prioritized for the improvement)
   Selected improvement measure scheme: **Seismic retrofit**
- Total reconstruction of Pier-1 & Pier-2 (steel pipe sheet pile foundation)
- Soil Improvement (earth pressure reduction) for Abutment-B
- Soil Improvement (liquefaction prevention) for Abutment-B
- Unseating prevention system

Note: The detail of the plans will be examined and optimized in outline design.

It needs to be noted that in the comparative studies for both Inner Bridge and Outer Bridges, “total reconstruction of piers” was applied as an improvement method for piers. The main concept of the improvement work is to maintain the navigation clearance. If the pier foundations were retrofitted with additional structures to existing one, the navigation width would be remarkably reduced by expanded foundation structure which would appear over water surface level. Additionally, entire bridge structure, especially superstructure, would be strongly affected by force of river flow. For the above reason, “total reconstruction of piers” was selected as an improvement method for piers. The structural difference of “retrofitted structure” and “reconstructed structure” is illustrated in the next page with the explanation of effect of the structural difference on the navigation width.

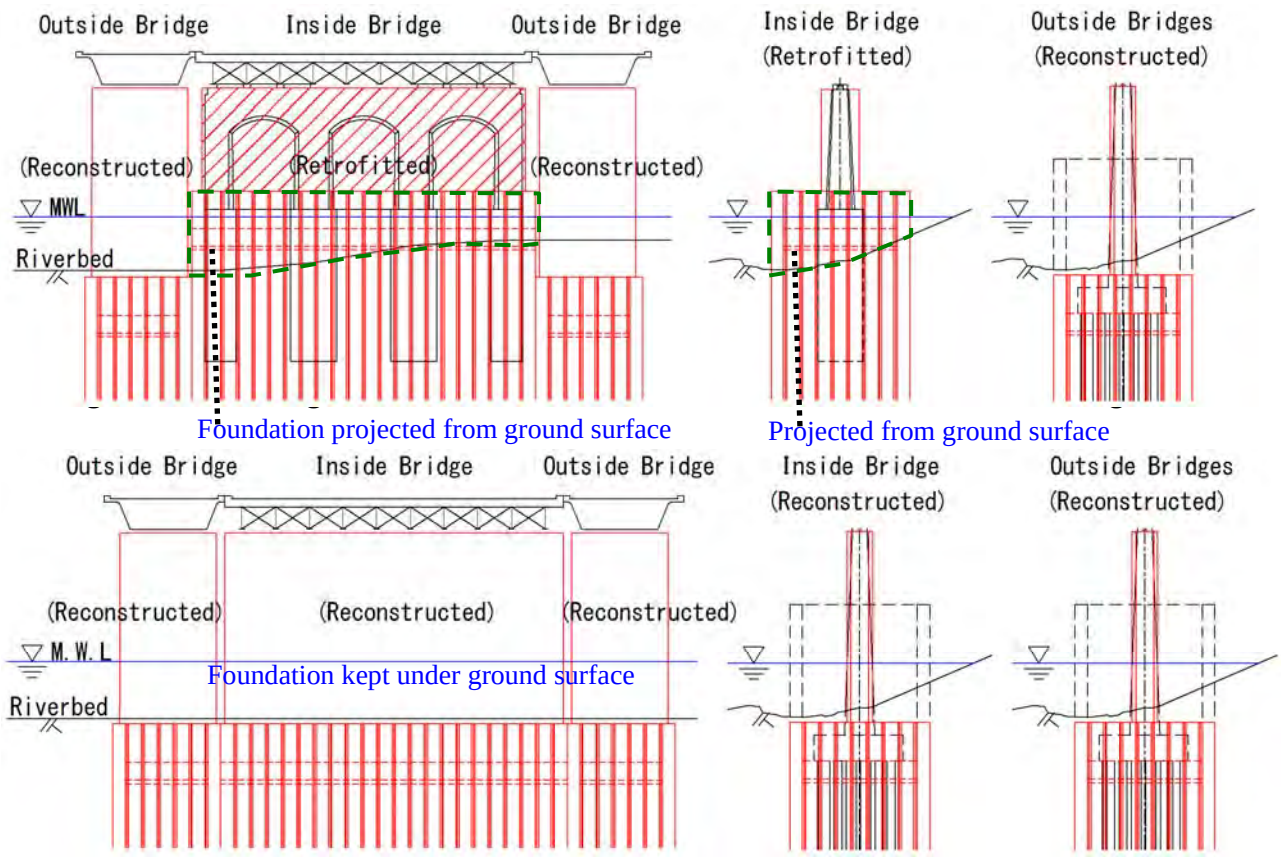
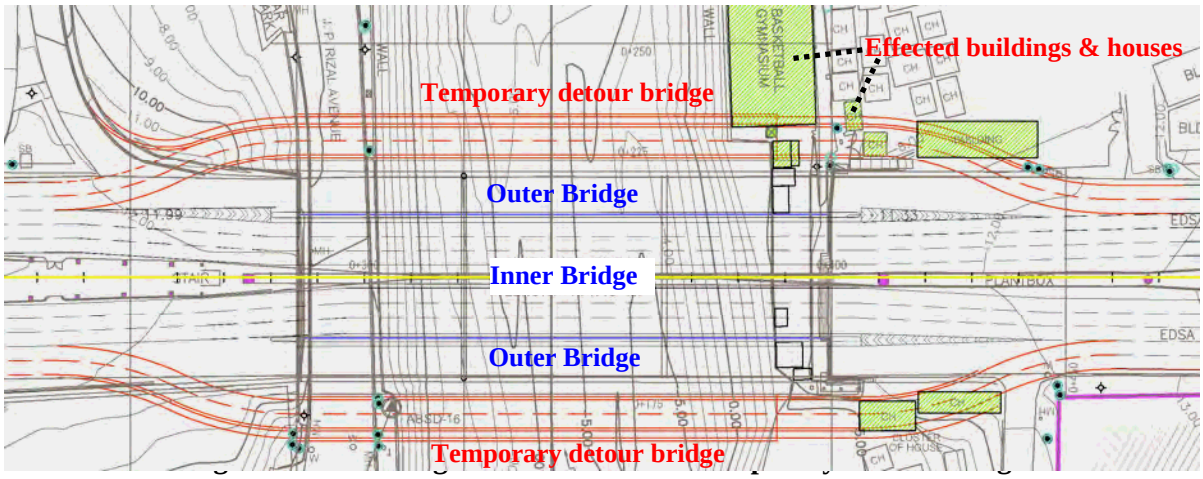


Figure 14.2.2-8 Images of "Seismic Retrofit by Reconstruction" of Inner Bridge

Another significant issue for the implementation of improvement measure scheme, especially for replacement plan, is installation of temporary detour bridge. As illustrated in the following figure, if current traffic capacity is maintained by the temporary bridge installation, several buildings around the bridge need to be resettled during the construction. It will take much time and effort for the land acquisition.



In order to avoid the land acquisition due to the temporary bridge installation, the following traffic control scheme was adopted for the replacement work of Outer Bridges. During the replacement work of Outer Bridges, 1 lane will be added in Inner Bridge range by removing median. By the application of this method, the replacement work can be implemented with only 1-lane closure.

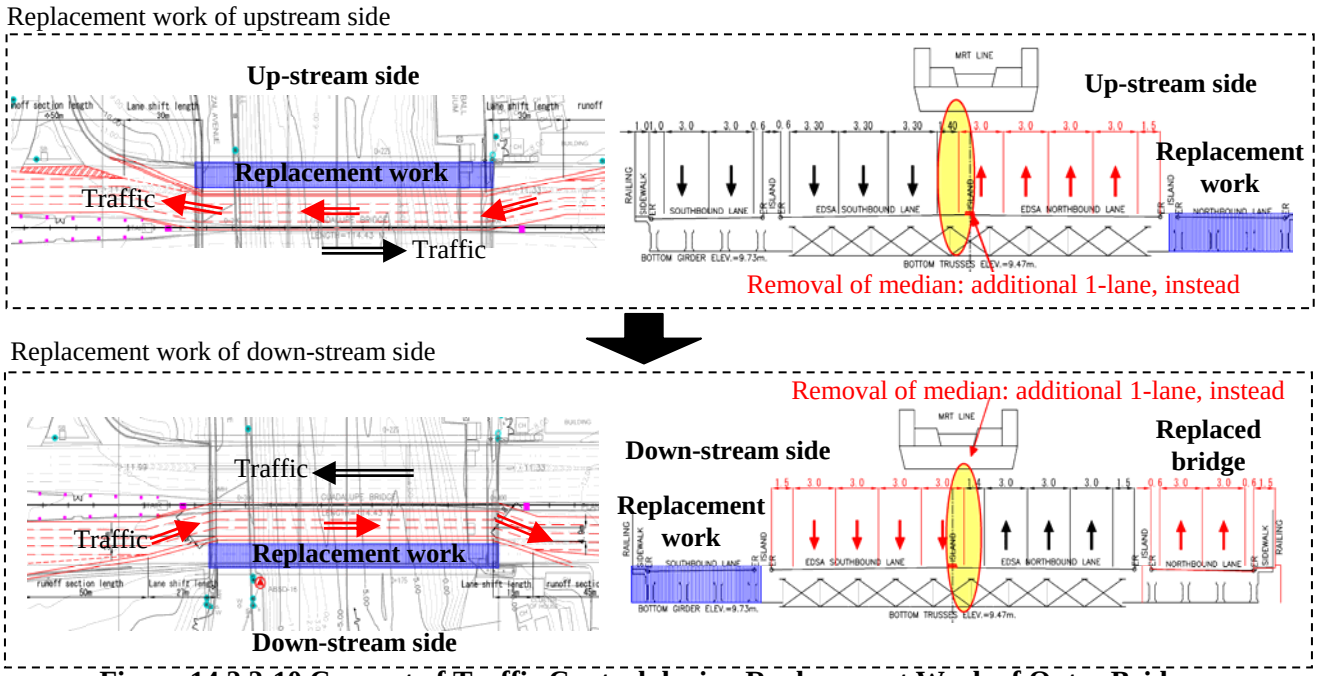


Figure 14.2.2-10 Concept of Traffic Control during Replacement Work of Outer Bridges

(II) Comparative study result of Outer Bridges

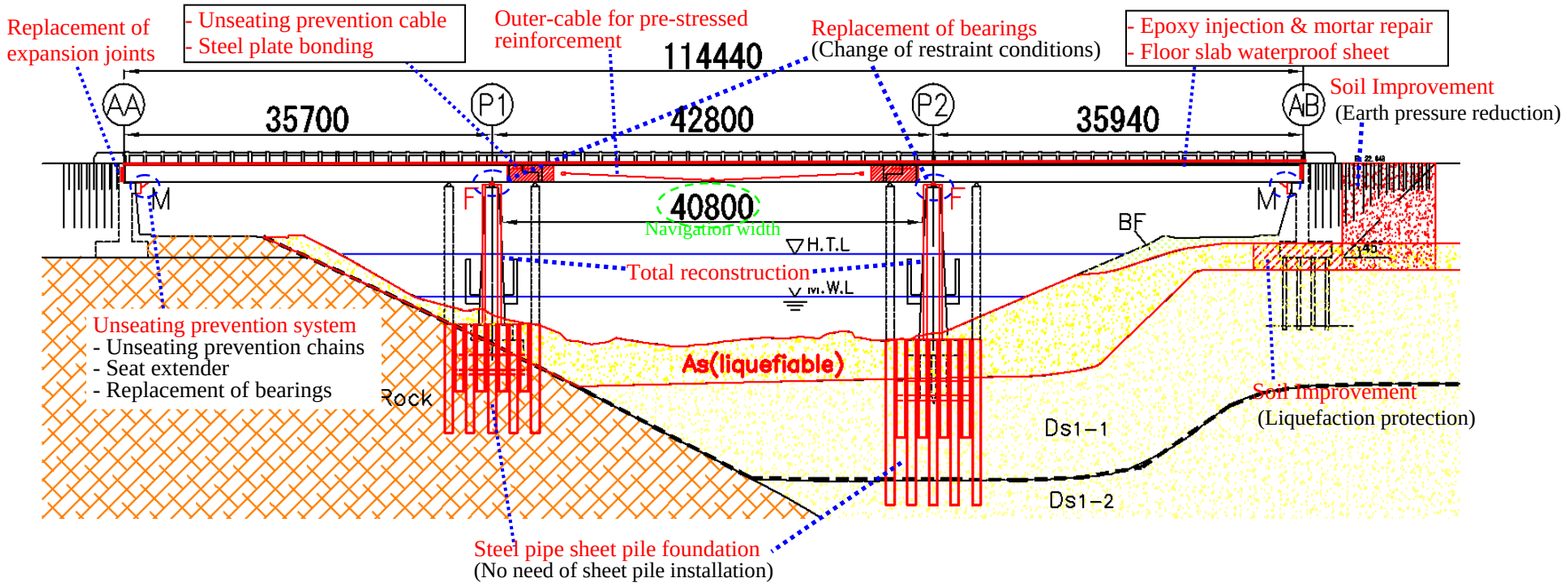
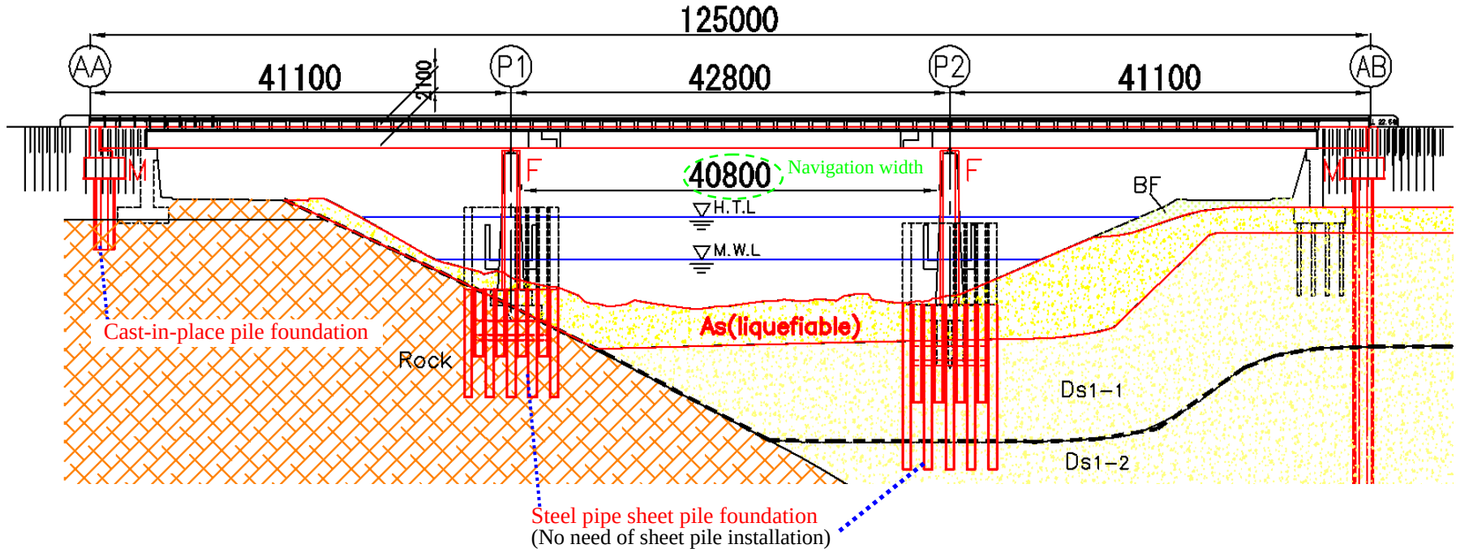
As a result of overall evaluation, Outer Bridges are recommended to be replaced for the cost-effectiveness and overall suitability for the implementation. Out of seven evaluation items, only “Traffic regulation” was evaluated as “Negative”. During the construction, at least 1 lane must be kept closed.

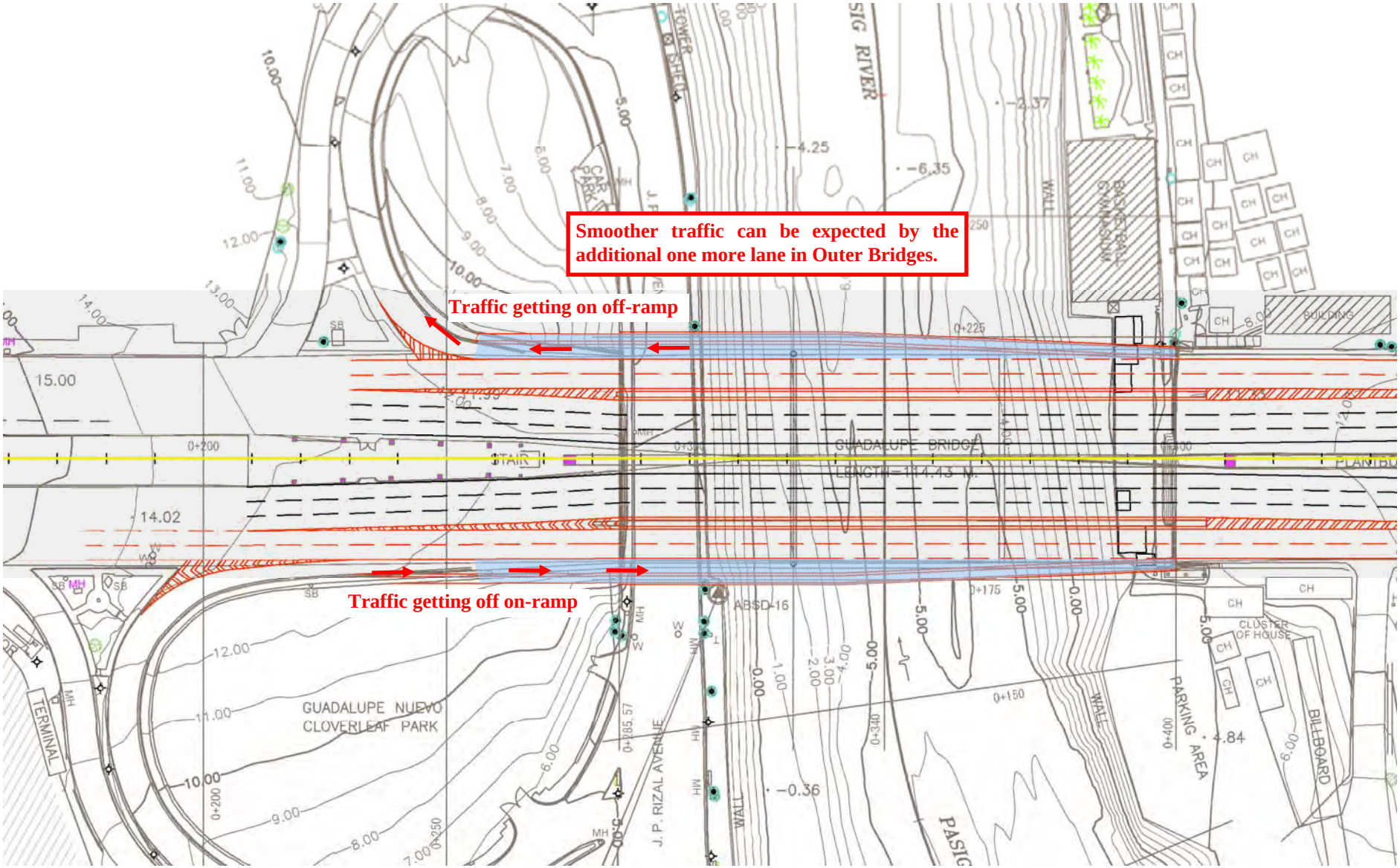
First of all, cost-effectiveness of replacement plan was proved by the fact that the seismic retrofit cost is considered to be 80 % of replacement cost. Also, the bridges are still less than 50 years old, so there is no problem with “Consideration of the Law for National Heritage Preservation”.

Secondary, the replacement plan needs 1-lane closure during the construction if no detour bridge is installed. In other words, the replacement plan is considered to be implemented if 1-lane closure is allowed. Construction with 1-lane closure is recommended because large land acquisition is required for the installation of temporary detour bridge. Construction feasibility of the replacement plan is studied in the next step.

The detail of the comparative studies is shown in the next page. Additionally, optional advantage of replacement plan is introduced after the comparative table. By adding one more lane in Outer Bridges, traffic on on-ramp and off-ramp is expected to be smoother. The additional one more lane has possibility for mitigation of traffic congestion.

Table 14.2.2-2 Comparative Study on Improve Measurement Schemes for Outer Bridges

	Improvement Measure Schemes for Outer Bridges	Evaluation			
Alternative-1: Seismic Retrofit		**COST**	Seismic Retrofit Works	0.56	Negative
			Repair Works	0.03	
			Others	0.21	
			Total Cost	**0.80**	
		Consideration of the Law for National Heritage Preservation		-	-
		Life Expectancy (after the implementation)		Less than 30 years	Negative
		Temporary Detour Bridge (Large Land Acquisition)		No need	Positive
		Traffic Regulation		Little	Positive
		Navigation Width: 40.8 (m)		+4.8 (m)	Positive
		River Inhibition Ratio: 5.2 (%)		-12.9 (%)	Positive
		Overall Evaluation		Not Recommended	
Alternative-2: Replacement	**3-span continuous steel plate deck box-girder bridge** 	**COST**	Superstructure	0.42	Positive
			Substructure	0.13	
			Foundation	0.32	
			Others	0.13	
			Total Cost	**1.00**	
		Consideration of the Law for National Heritage Preservation		-	-
		Life Expectancy (after the implementation)		75 years	Positive
		Temporary Detour Bridge (Large Land Acquisition)		No need	Positive
		Traffic Regulation		1-lane Closure	Negative
		Navigation Width: 40.8 (m)		+4.8 (m)	Positive
		River Inhibition Ratio: 5.2 (%)		-12.9 (%)	Positive
		Overall Evaluation		**Recommended**	


Smoother traffic can be expected by the additional one more lane in Outer Bridges.
Traffic getting on off-ramp
Traffic getting off on-ramp
GUADALUPE BRIDGE
LENGTH = 114.43 M.
GUADALUPE NUEVO CLOVERLEAF PARK
J. P. RIZAL AVENUE
PASIG RIVER
TERMINAL
PARKING AREA
CLUSTER OF HOUSE
BILLBOARD
BUILDING
ABSD-16
0+225
0+200
0+175
0+150
0+340
0+385.57
15.00
14.02
4.84
-0.36
-4.25
-6.35
-4.37

(III) Comparative study result of Inner Bridge

As a result of comparative study, Inner Bridge is recommended to be seismically retrofitted, for there's no need of the following three items namely;

- consideration of the law for national heritage preservation,
- installation of temporary detour bridge, and
- 1-lane closure during construction.

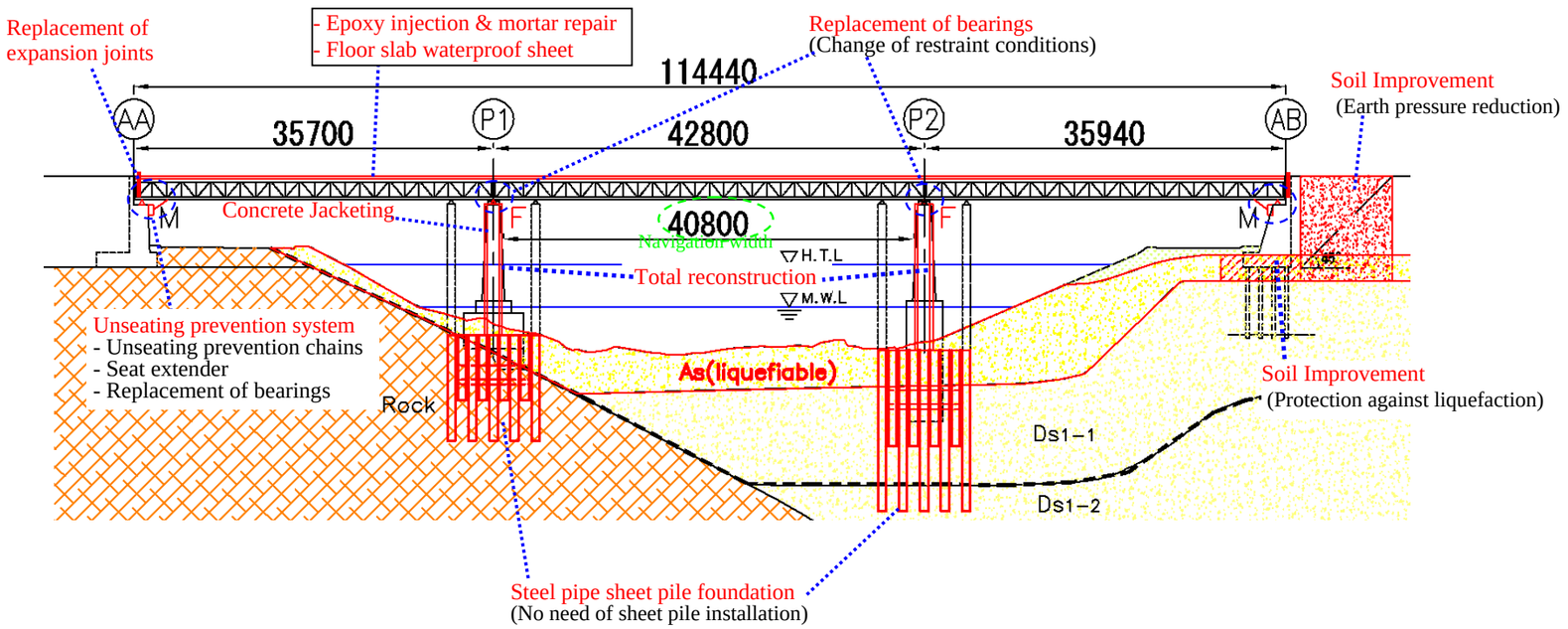
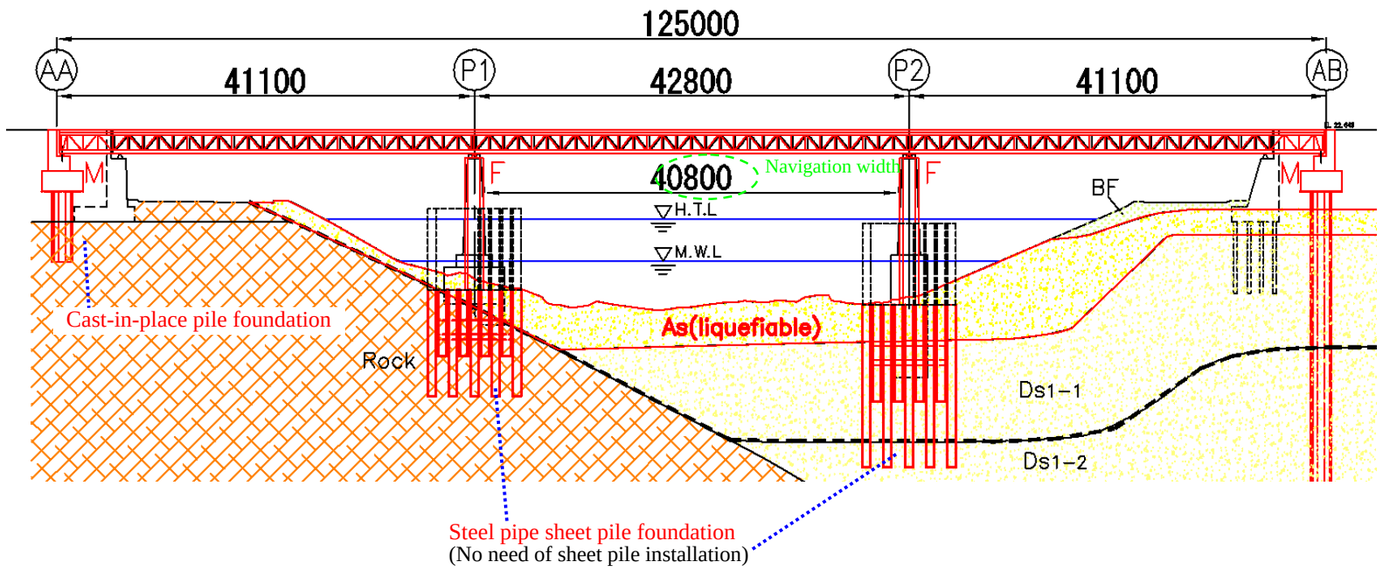
On the other hand, the seismic retrofit plan got two "Negative" evaluation items. The first item is cost-effectiveness. Although replacement plan is more cost-effective than seismic retrofit plan, the above three items are regarded as more important factors than cost-effectiveness. The second item is "life expectancy after the improvement work". According to old AASHTO codes, the bridge life expectancy is considered to be about 50 years although the bridge is already 51 years old as of 2013.

First of all, Inner Bridge is recommended for seismic retrofit in consideration of the following three items. The first item is "consideration of the law for national heritage preservation". In 2009, the republic of the Philippines enforced the law that to preserve historical structures including bridges older than 50 years old as national heritages. The law is applied to Inner Bridge which is already 51 years old. The second item is "installation of temporary detour bridge". Unlike the case of Outer Bridges, temporary detour bridge installation is required for replacement of Inner Bridge to maintain at least 9 lanes during replacement work. It seems to be extremely difficult and will take long to acquire land for the temporary bridge in the crowded urban area. The third item is "1-lane closure during construction". Even with the temporary detour bridge, 1-lane closure during construction is required for the replacement work.

Secondary, the seismic retrofit plan has two negative items. The first "Negative" item is cost-effectiveness. The above three evaluation items were regarded more important than cost-effectiveness although cost-effectiveness of replacement plan was proved by the fact that the seismic retrofit cost is considered to be 88 % of replacement cost. Therefore, Inner Bridge is decided to be seismically retrofitted prioritizing the above three factors. The second "Negative" is "life expectancy". Old AASHTO codes indicate 50-year- life-expectancy of bridges. However, the bridge is already 51 years old as of 2013. Therefore, Inner Bridge will need constant maintenance and repair works even after the retrofit works.

The detail of the comparative studies is shown in the next page.

Table 14.2.2-3 Comparative Study on Improve Measurement Schemes for Inner Bridge

	Improvement Measure Schemes for Inner Bridge	Evaluation			
Alternative-1: Seismic Retrofit		**COST**	Seismic Retrofit Works	0.59	Negative
			Repair Works	0.04	
			Others	0.25	
			Total Cost	**0.88**	
		Consideration of the Law for National Heritage Preservation		Applied	Positive
		Life Expectancy (after the implementation)		Less than 20 years	Negative
		Temporary Detour Bridge (large land acquisition)		No need	Positive
		Traffic Regulation (for soil improvement work)		1-lane Closure	Positive
		Navigation Width: 40.8 (m)		Same	Positive
		River Inhibition Ratio: 4.9 (%)		Same	Positive
		Overall Evaluation		**Recommended**	
Alternative-2: Replacement	**3-span continuous steel plate deck trussed-girder bridge** 	**COST**	Superstructure	0.47	Positive
			Substructure	0.14	
			Foundation	0.27	
			Others	0.12	
			Total Cost	**1.00**	
		Consideration of the Law for National Heritage Preservation		Applied	Negative
		Life Expectancy (after the implementation)		75 years	Positive
		Temporary Detour Bridge (large land acquisition)		Needed	Negative
		Traffic Regulation (Whole the construction period)		1-lane Closure	Negative
		Navigation Width: 40.8 (m)		Same	Positive
		River Inhibition Ratio: 4.9 (%)		Same	Positive
		Overall Evaluation		Not Recommended	

5) Feasibility Study on Construction Planning

Feasibility of construction planning for Inner Bridge and Outer Bridges was confirmed with the following procedure. Also, major construction difficulties were found out through the study as shown below.

1. Confirmation of construction feasibility of **Outer Bridges (more prioritized)**
(Construction difficulties)
- Demolition of existing piers
- Reconstruction of piers neighboring existing piers

↓

2. Confirmation of construction feasibility of **Inner Bridge** (less prioritized)
(Construction difficulties)
- Temporarily supporting of existing superstructure during pier reconstructions
- Traffic regulation during soil improvement works behind abutments

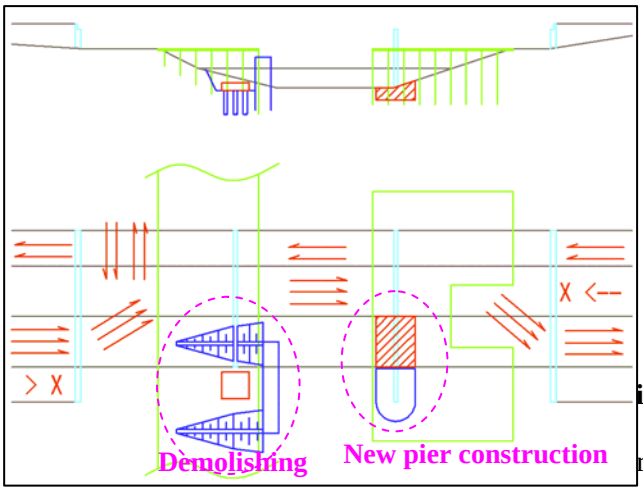
Note: Construction planning will be examined and optimized in outline design stage.

a) Construction Difficulties of Outer Bridges

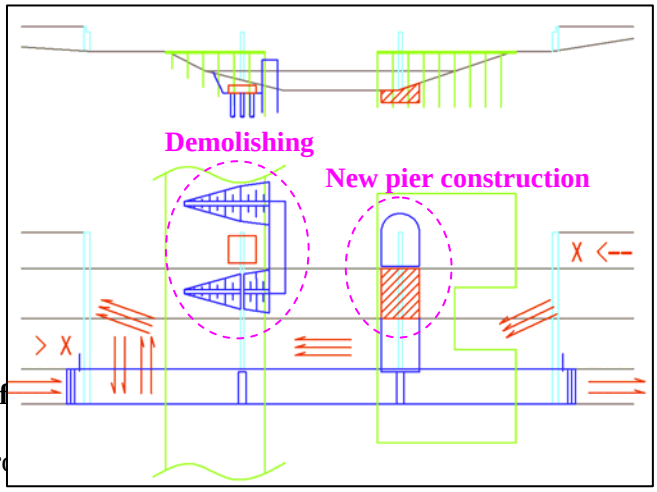
Feasibility of construction planning for Outer Bridges was confirmed with the following two major construction difficulties found out.
The first difficulty is demolition of existing piers. The demolition work must be carefully done without damaging neighboring existing piers of Inner Bridge.
The second difficulty is reconstruction of piers. The reconstruction work must be carefully done not to harm the existing pier conditions of Inner Bridge.

Difficulty-1: Demolition of existing piers
Difficulty-2: Reconstruction of piers neighboring existing piers

(STEP-6 of construction planning: demolition and reconstruction of piers on downstream side)



(STEP-16 of construction planning: demolition and reconstruction of piers on upstream side)



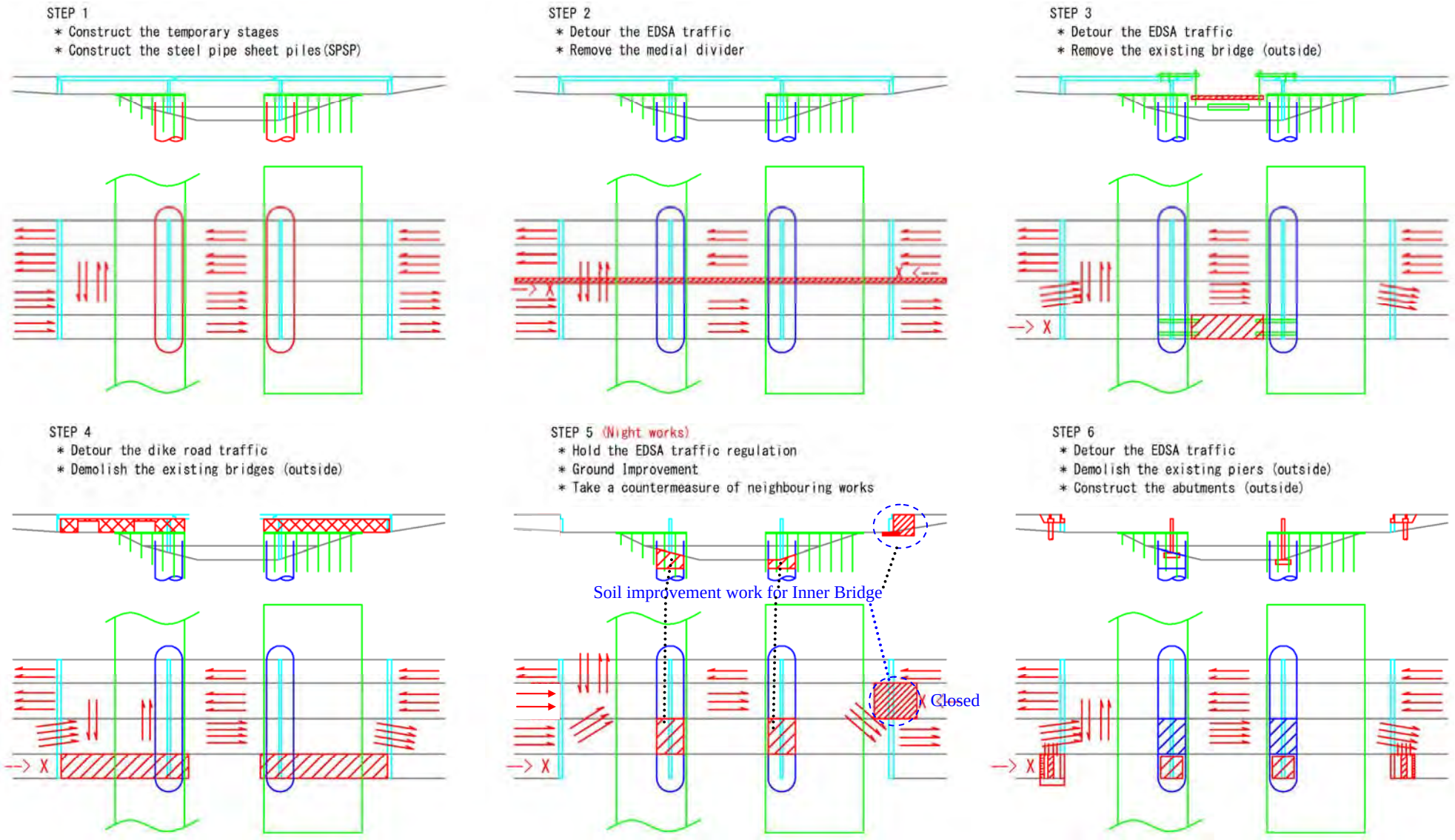


Figure 14.2.2-13 Construction Steps of Outer Bridges (1)

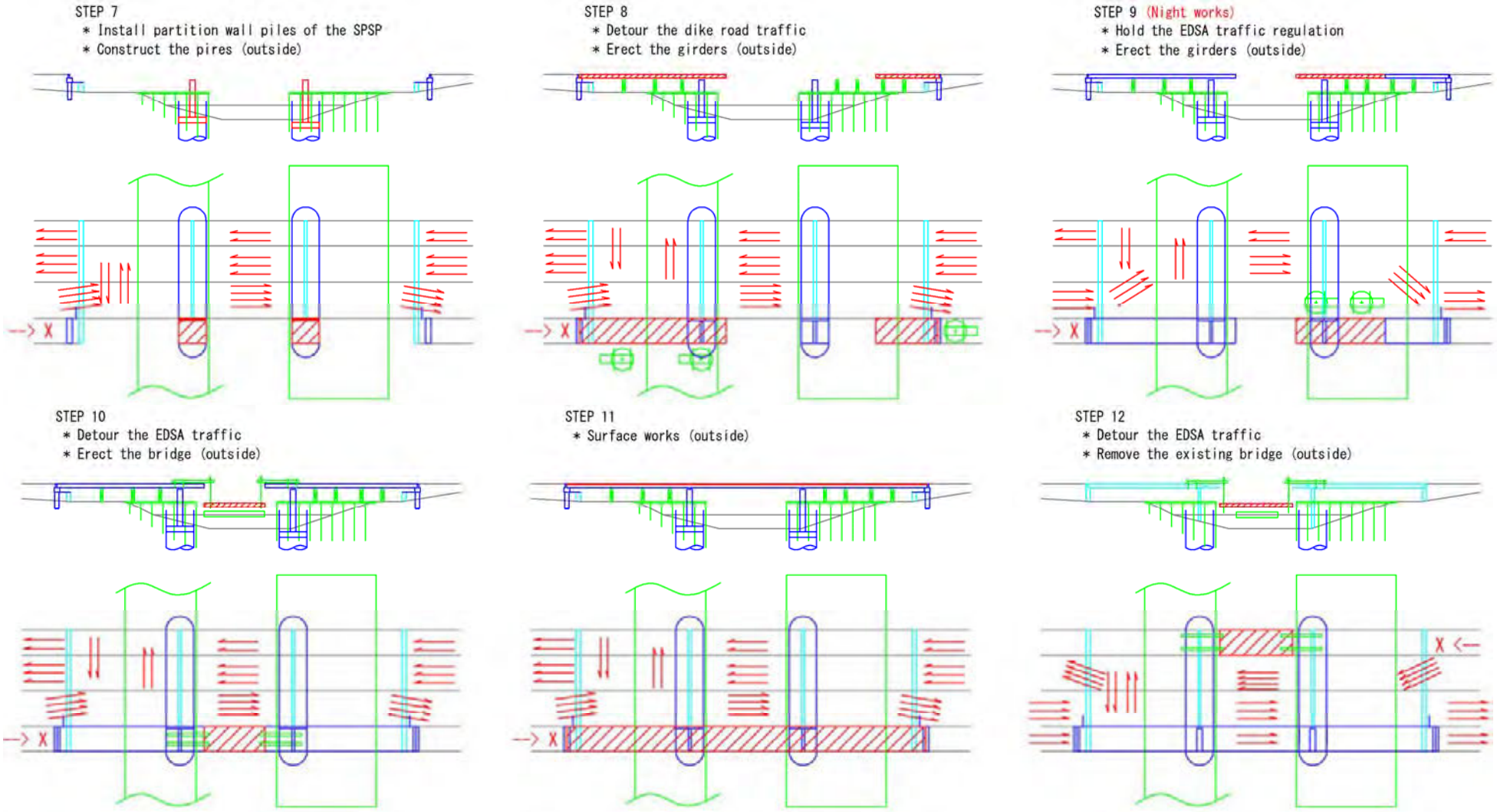


Figure 14.2.2-14 Construction Steps of Outer Bridges (2)

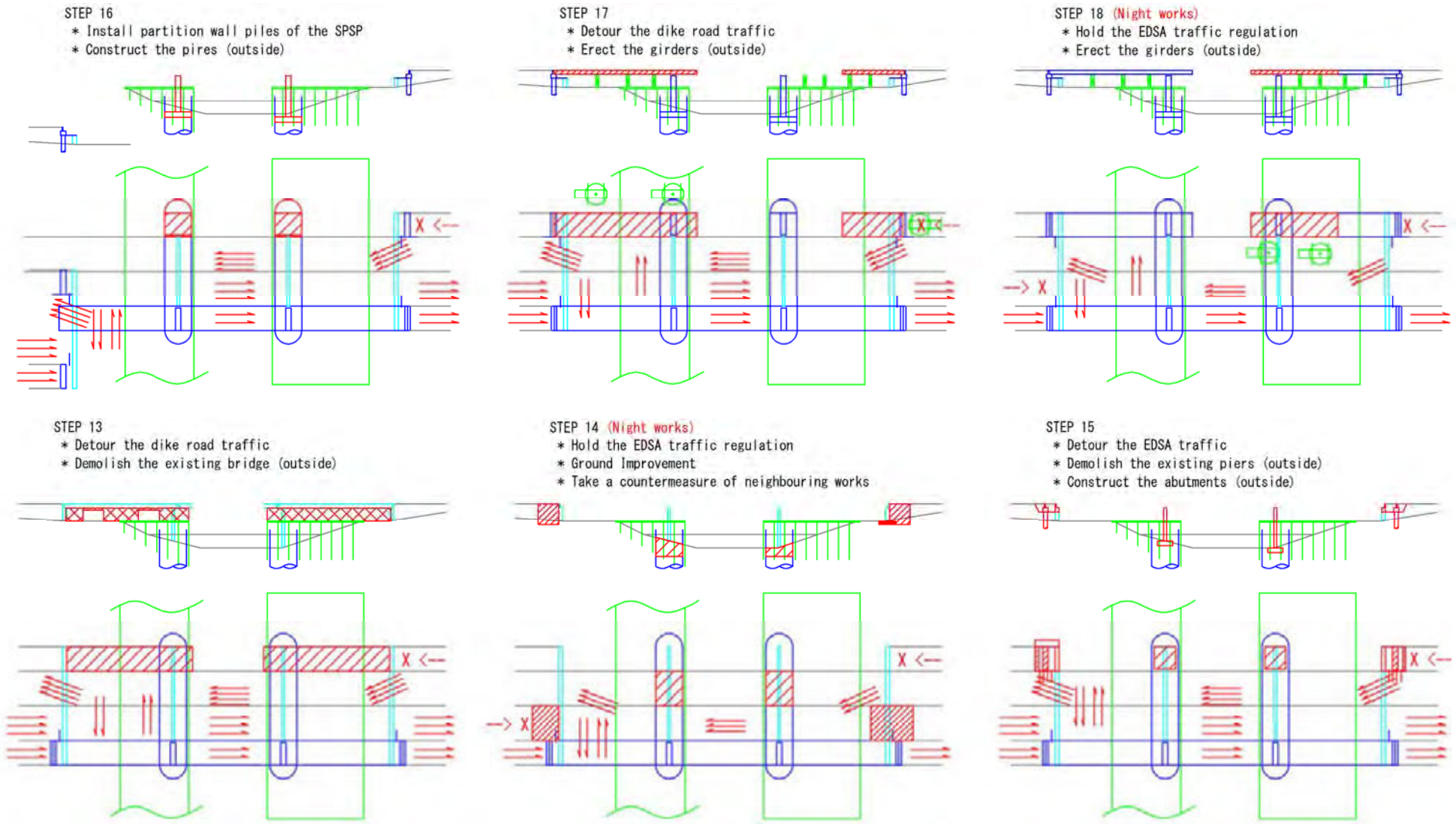


Figure 14.2.2-15 Construction Steps of Outer Bridges (3)

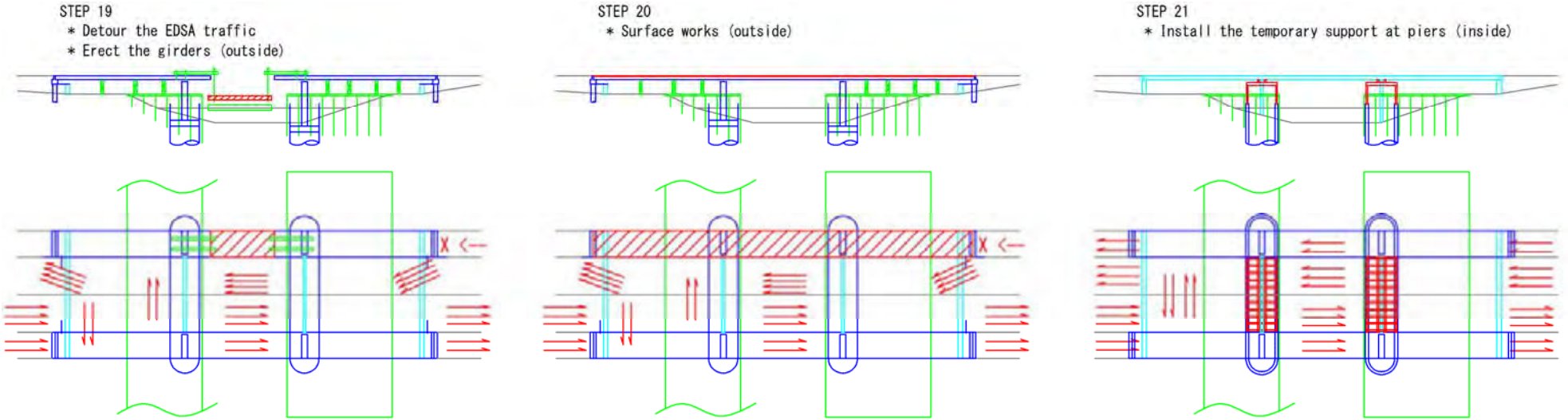


Figure 14.2.2-16 Construction Steps of Outer Bridges (4)

b) Construction Difficulties of Inner Bridge

Feasibility of construction planning for Inner Bridge was confirmed with the following two major construction difficulties found out.

The first difficulty is temporarily supporting of existing superstructure during pier reconstructions. The most difficult part of this is to keep stability of temporary supports during the demolishing and reconstruction of piers. If the temporary supports lose their balance, supported superstructure will be severely damaged. The possible locations of temporary supports are limited so the demolishing and reconstruction work must be done in extremely limited construction space.

The second difficulty is traffic regulation during soil improvement works behind Abutment-B. To install sand piles behind abutments, pile driving machine must occupy the space behind the abutment. Therefore, at least 1-lane of Inner Bridge must be closed during the soil improvement work. Moreover, MRT above the Inner Bridge limits the vertical clearance of soil improvement work.

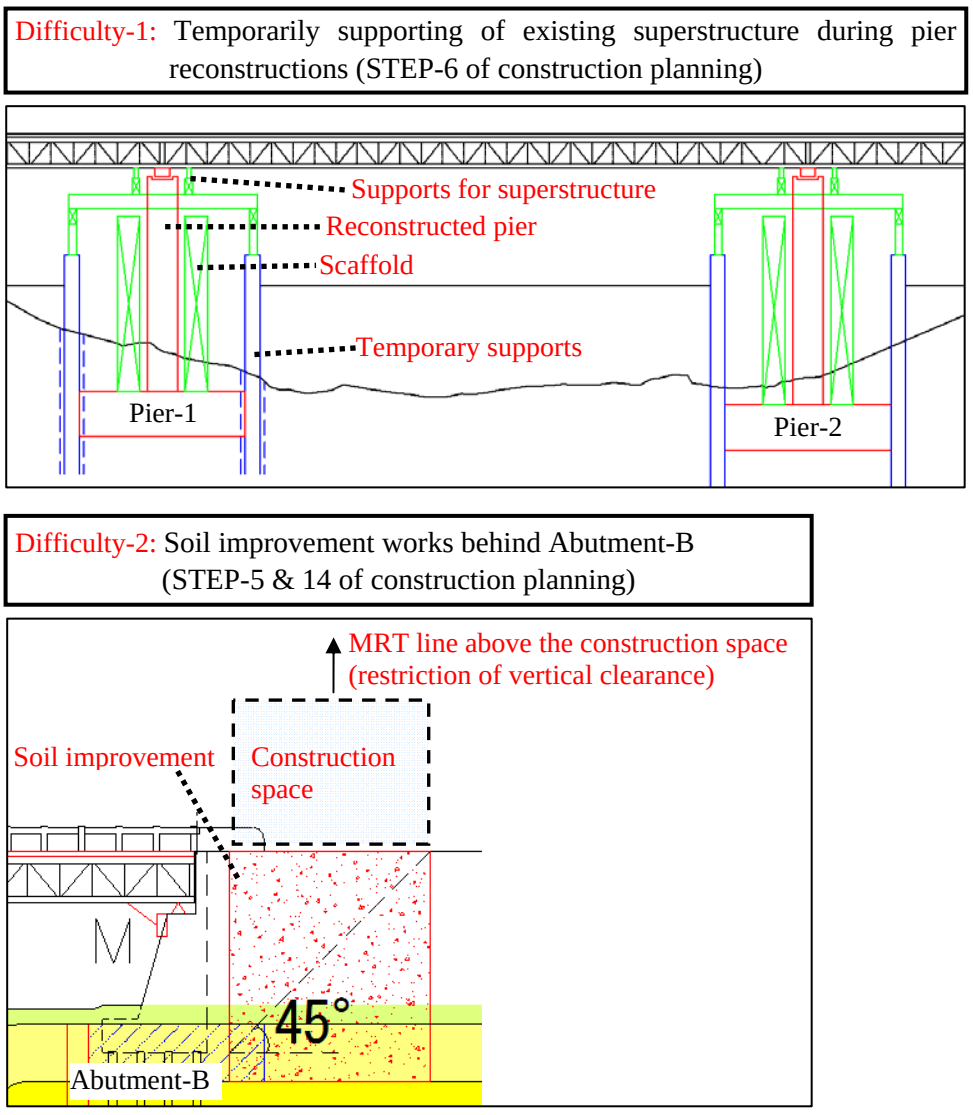
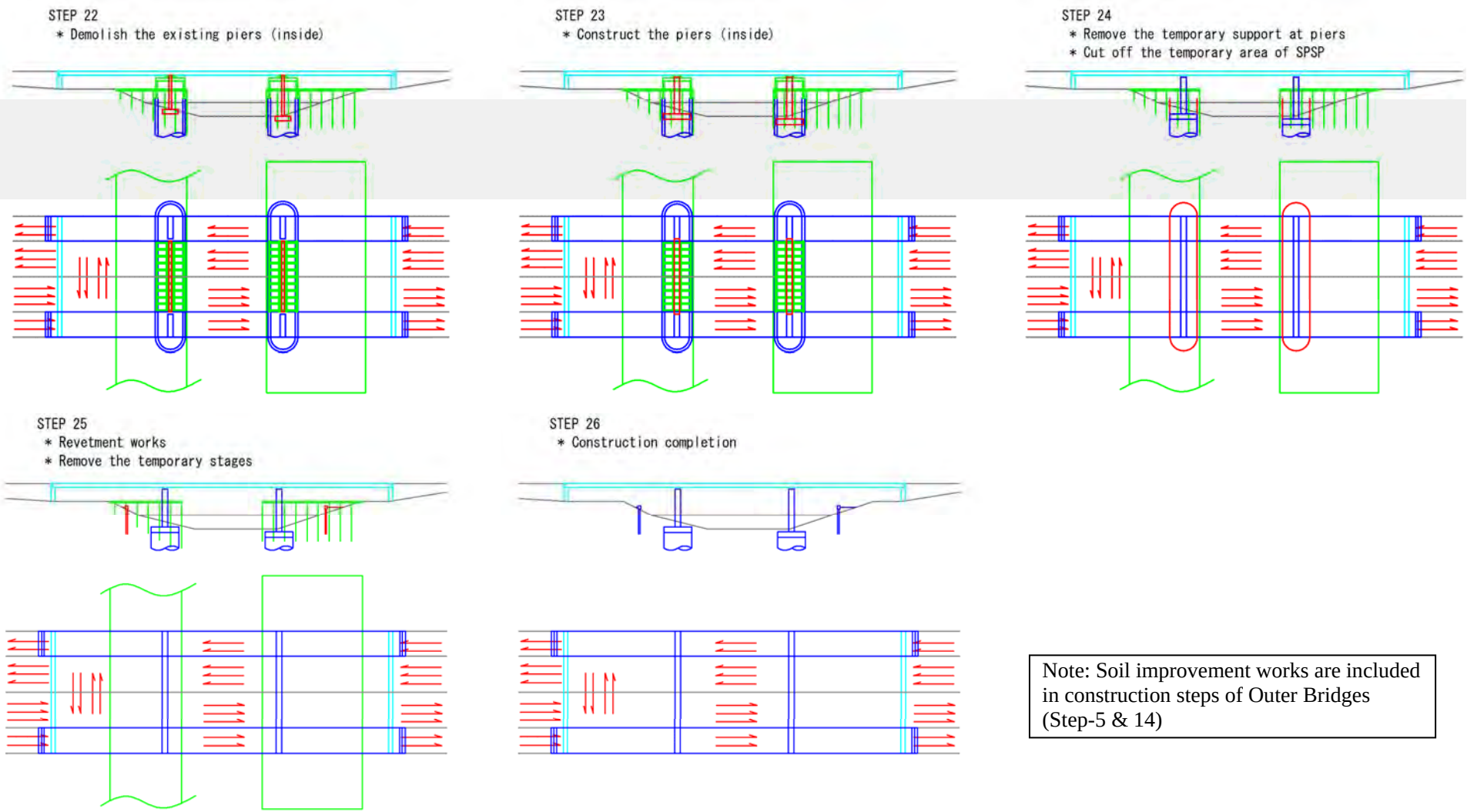


Figure 14.2.2-17 Construction Difficulties of Inner Bridge

The detail of the construction steps is shown from the next page.

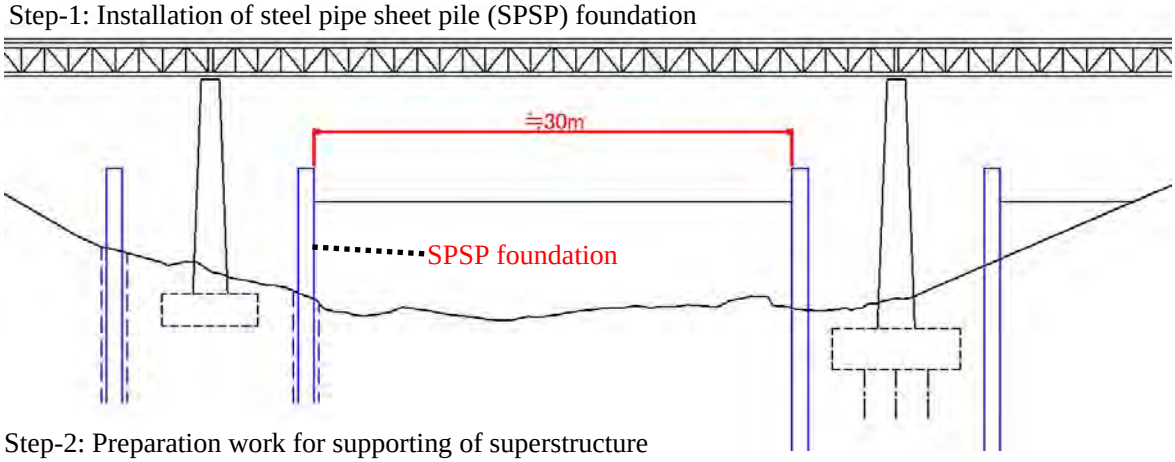
Continued from the construction steps of Outer Bridges



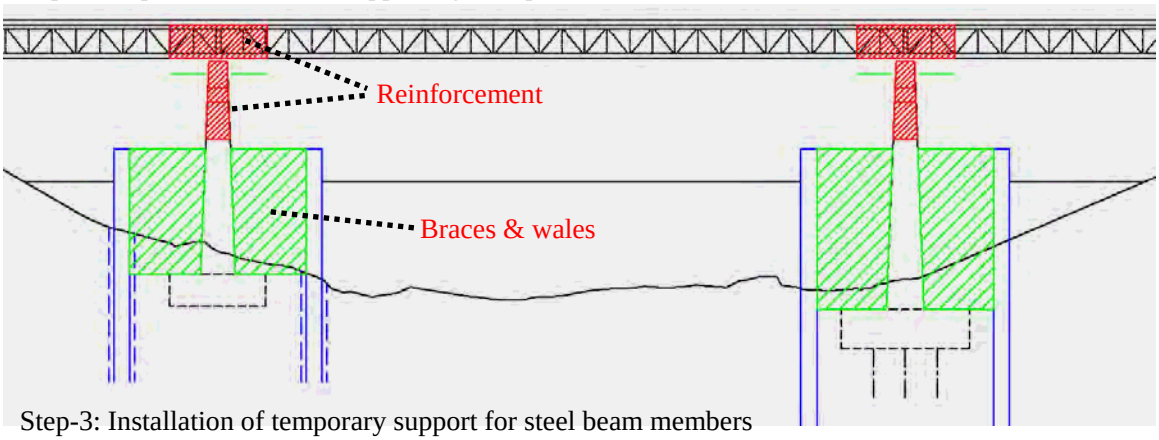
Note: Soil improvement works are included in construction steps of Outer Bridges (Step-5 & 14)

Figure 14.2.2-18 Construction Steps of Inner Bridge

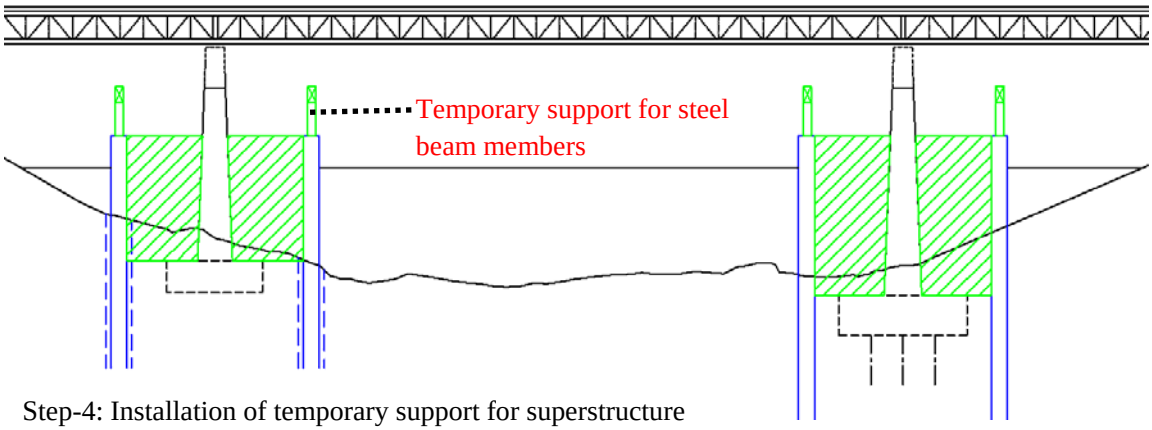
Step-1: Installation of steel pipe sheet pile (SPSP) foundation



Step-2: Preparation work for supporting of superstructure



Step-3: Installation of temporary support for steel beam members



Step-4: Installation of temporary support for superstructure

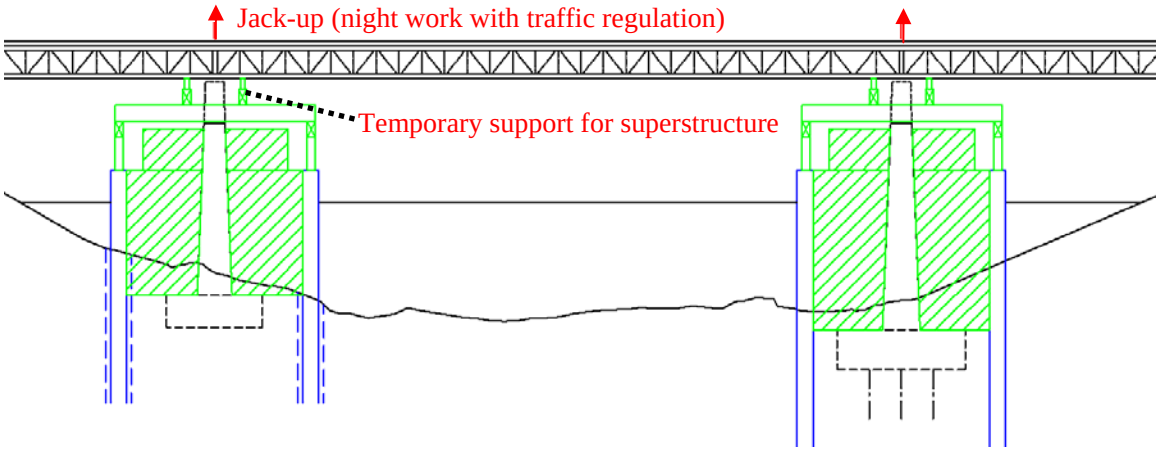
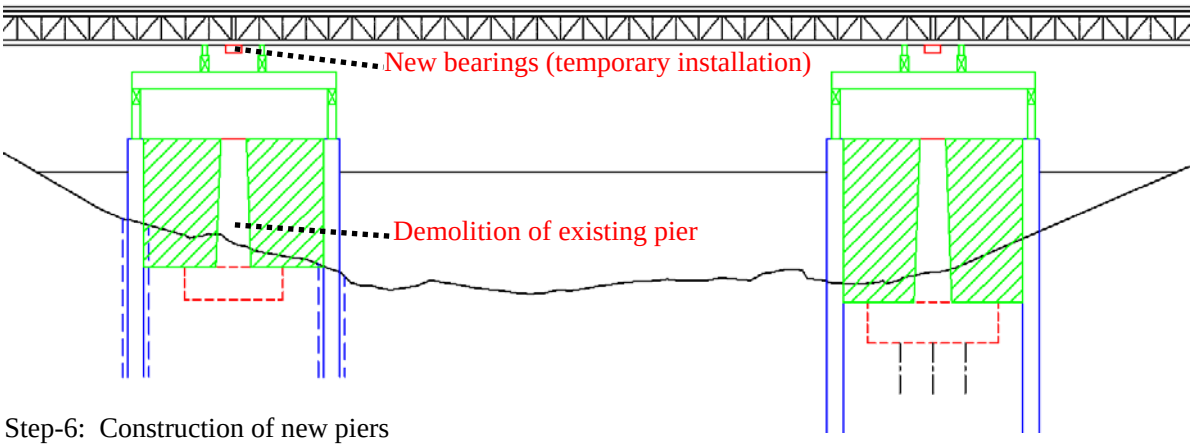
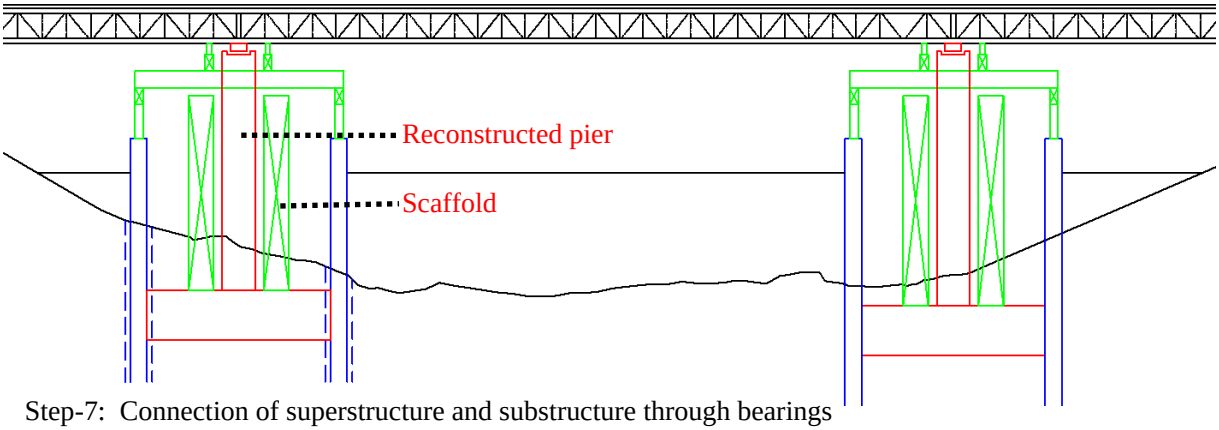


Figure 14.2.2-19 Pier reconstruction Steps of Inner Bridge (1)

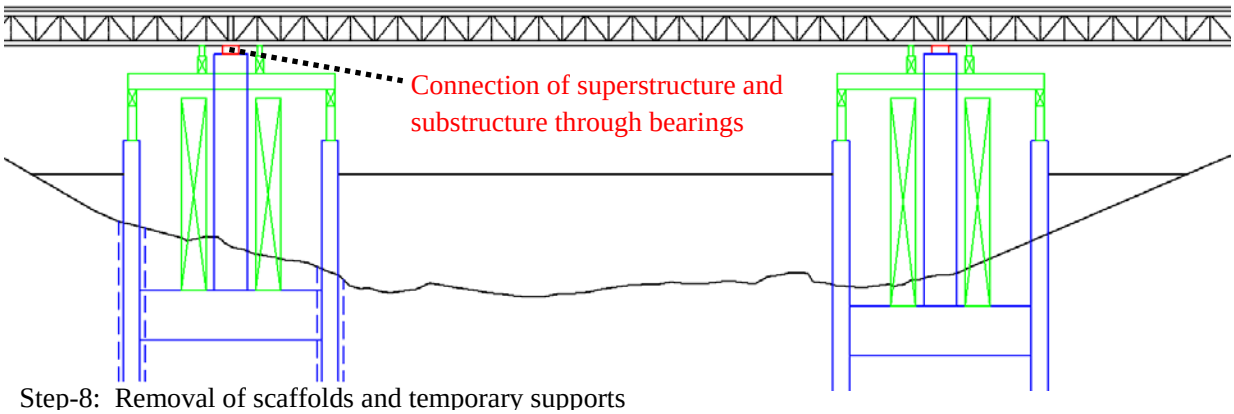
Step-5: Demolition of existing piers



Step-6: Construction of new piers



Step-7: Connection of superstructure and substructure through bearings



Step-8: Removal of scaffolds and temporary supports

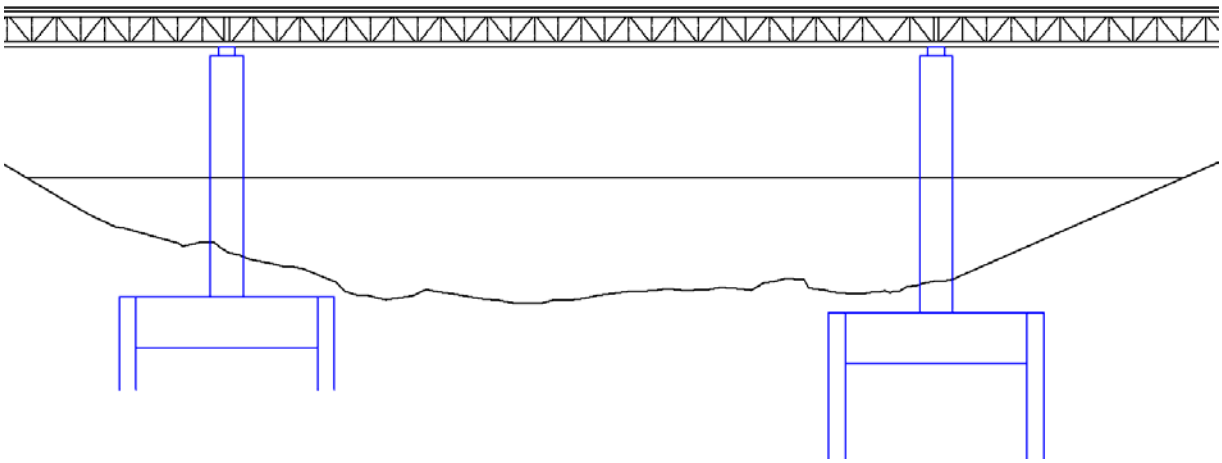
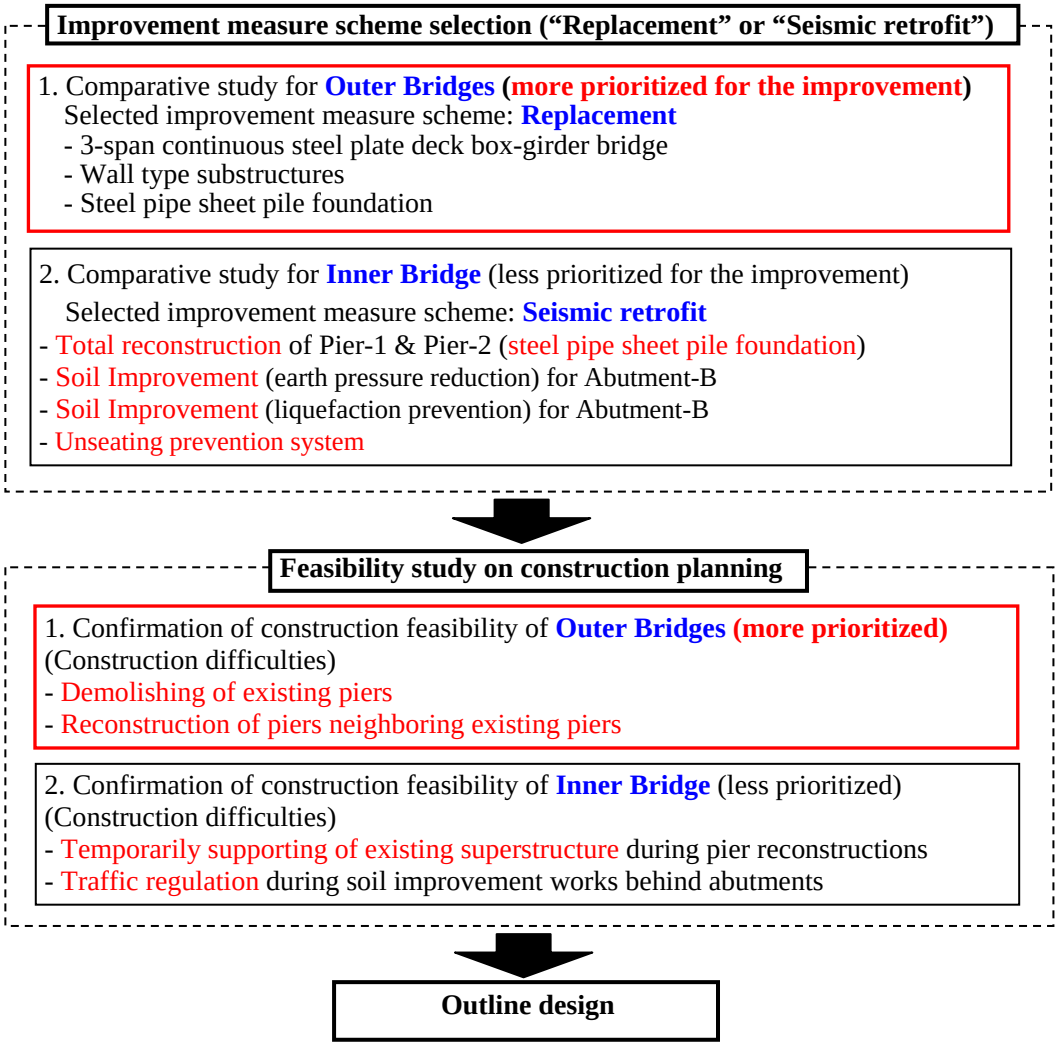


Figure 14.2.2-20 Pier Reconstruction Steps of Inner Bridge (2)

6) Conclusion of the Comparative Studies

As summarized below, recommendation of improvement measure schemes for Outer Bridges is replacement, and seismic retrofit for Inner Bridge, as the result of comparative studies and feasibility study on construction planning. The study on Guadalupe Bridge will proceed to outline design stage with the selected improvement measure schemes. The detail of the improvement measures and construction planning will be finalized in the outline design.



Note: The above plans will be examined and optimized in outline design.

Figure 14.2.2-21 Conclusion of Comparative Study on Improvement Measure Scheme Selection

14.2.3 Detail Comparative Study on Improvement Measure Scheme Selection for Mawo Bridge

(1) Outline of the Comparative Study

The outline of the comparative study on improvement measure schemes for Mawo Bridge is shown in the following flowchart.

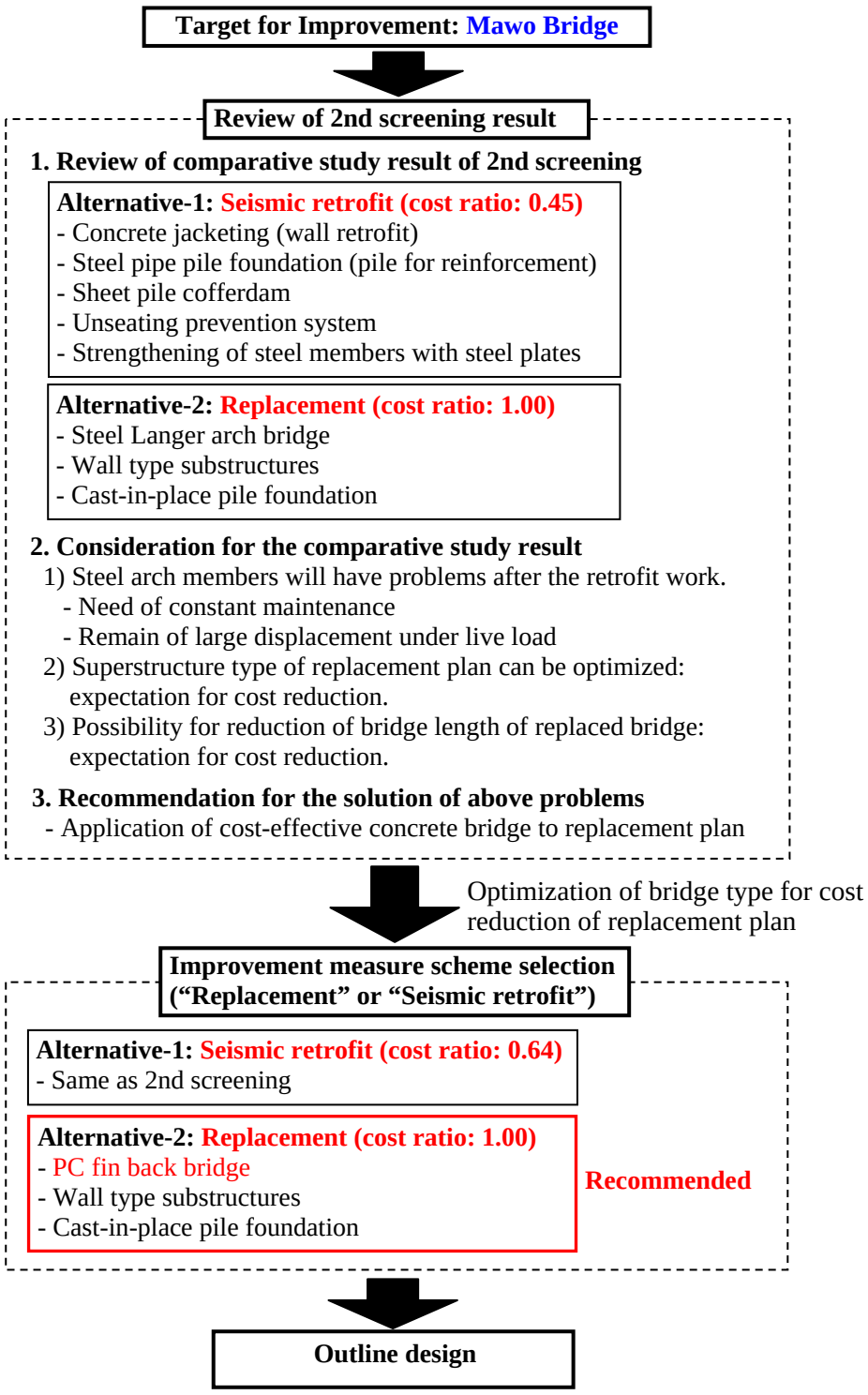


Figure 14.2.3-1 Flowchart of Comparative Study on Improvement Measure Scheme Selection

(2) Review of 2nd Screening Result

1) Review of Comparative Study Result of 2nd Screening

In the 2nd screening, the following two alternatives were compared. As a result, the cost ratio of seismic retrofit plan to replacement plan was found out to be 0.45. The detail of the comparative table is shown again in the next page.

Alternative-1: Seismic retrofit (cost ratio: 0.45)
- Concrete jacketing (wall retrofit)
- Steel pipe pile foundation (pile for reinforcement)
- Sheet pile cofferdam
- Unseating prevention system
- Strengthening of steel members with steel plates

Alternative-2: Replacement (cost ratio: 1.00)
- Steel Langer arch bridge
- Wall type substructures
- Cast-in-place pile foundation

2) Consideration for the Comparative Study Result

Based on the result of the 2nd screening evaluation, seismic retrofit plan is more cost-effective than replacement plan: the cost ratio of ratio of the seismic retrofit plan to the replacement plan became less than 0.60. However, further study on the improvement measure selection was taken for the following three reasons.

a) Steel arch members will have problems despite the retrofit work:

Mawo Bridge has severe superstructure deterioration and the lack of load capacity. Even after the retrofit work, need of constant maintenance and remain of large displacement under live load can't be solved.

b) Superstructure type of replacement plan can be optimized:

In the 2nd screening, steel arch bridge was used as existing bridge planning condition in order to confirm the cost effectiveness of seismic retrofit & repair works. Therefore, large cost reduction can be expected by optimizing the superstructure type.

c) Possibility for reduction of bridge length of replaced bridge:

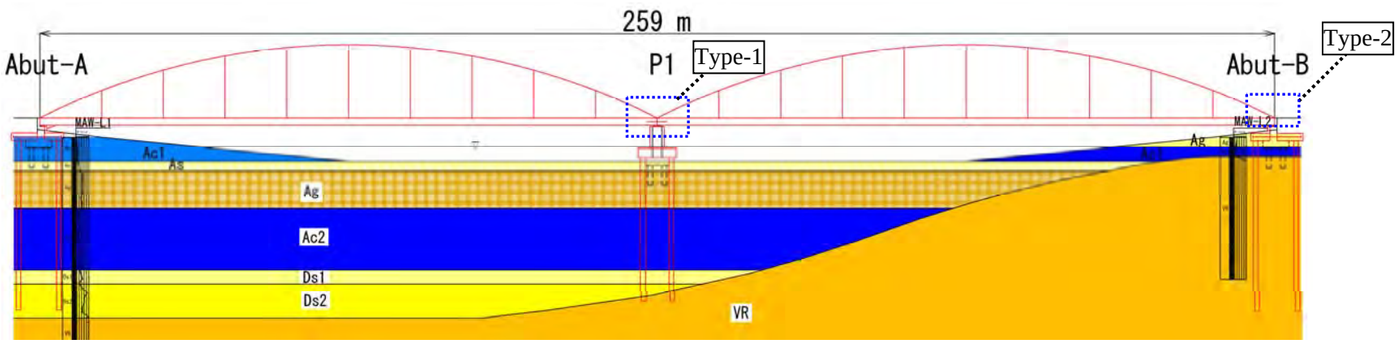
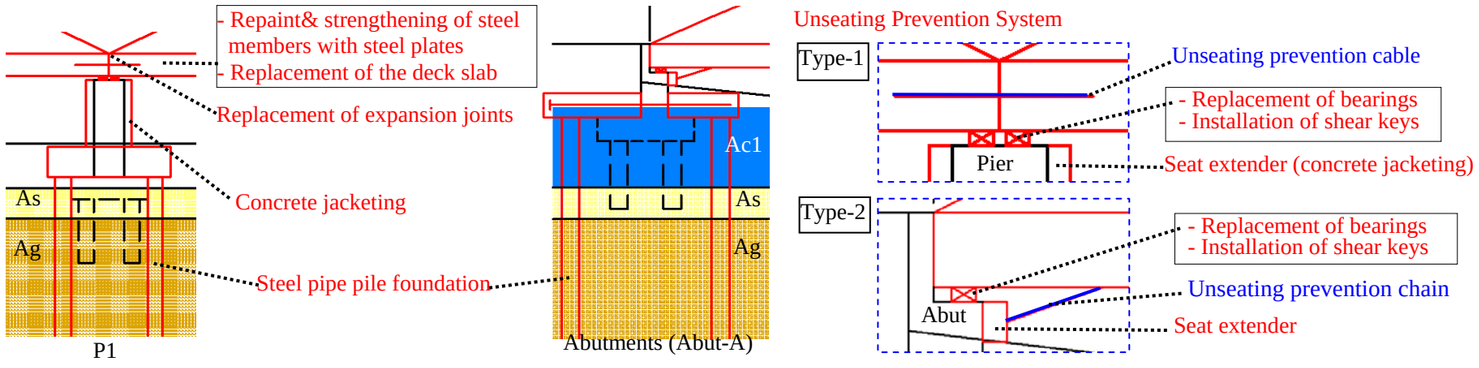
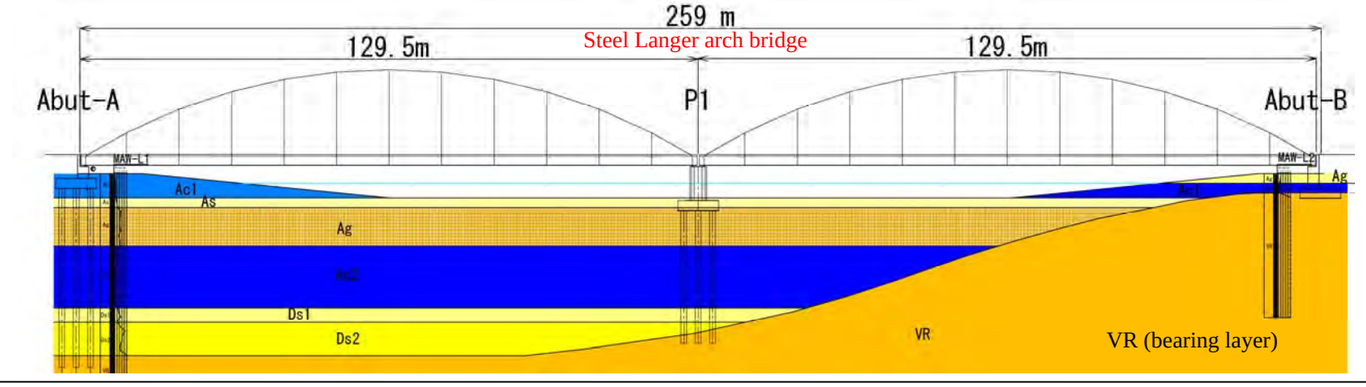
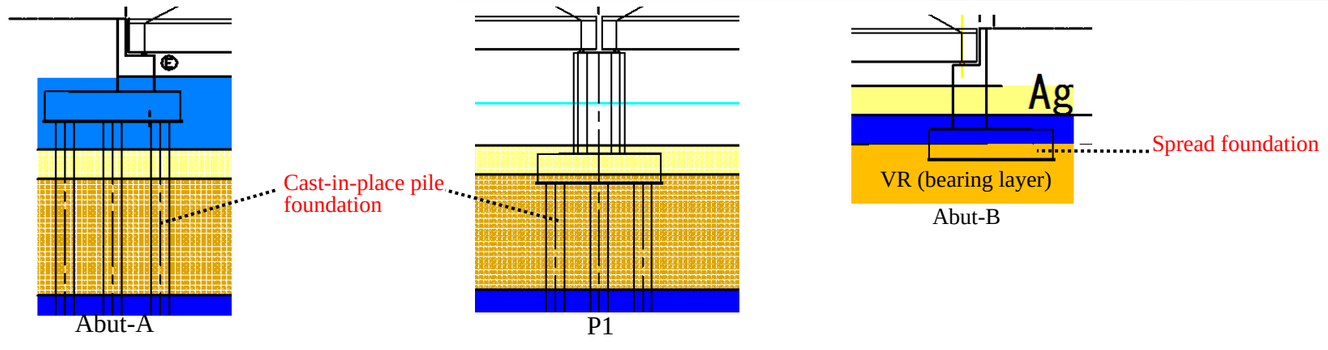
Besides the change of superstructure type, there's a possibility of shortening of bridge length. More cost reduction can be expected for the bridge length reduction.

Figure 14.2.3-2 Current Condition of Mawo Bridge

3) Recommendation for the solution of above problems

Considering the above three factors, replacement of Mawo Bridge with concrete type superstructure is strongly recommended for the advantage of maintenance-free structure, which is the request from DPWH district office in charge of the bridge. The cost-effectiveness of the concrete structure will be verified by optimizing the bridge type of the replacement plan.

Table 14.2.3-1 Comparative Study on Improve Measurement Schemes for Mawo Bridge (2nd Screening result)

	Improvement Measure Scheme	Detail of Improvement Measures & Evaluation				
Alternative 1 - Seismic Retrofit and Repair	 	**Description/ Design Concept**	• Seismic capacity improvement of pier walls (wall retrofit) • Seismic capacity improvement of foundations (pile for reinforcement) • Improvement of unseating/fall-down prevention system (seat extender, unseating prevention cables/chains, shear keys, replacement of bearings) • Improvement of the deck slab soundness (replacement) • Improvement of the steel members' soundness & strength			
		Construction	Method/ Technology	• Concrete jacketing (wall retrofit) • Steel pipe pile foundation (pile for reinforcement) • Sheet pile cofferdam • Unseating prevention system • Strengthening of steel members with steel plates		
			Difficulty	• Installation of piles into the rock • Sheet pile installation under the existing superstructure		
			Cost	Seismic Retrofit Works	• Wall retrofit • Pile for reinforcement • Unseating prevention system	0.09
				Repair Works	• Replacement of the deck slab • Replacement of expansion joints Strengthening of steel members with steel plates	0.30
				Others	• Working platform on the water • Temporary detour bridge	0.06
					Total	0.45
		Potential Impact to Environment	• River occupation during the works for piers in water • Temporary detour bridge installation during abutment retrofit works • Requirement of environmental measures for water contamination • Requirement of temporary resettlement for the construction			
		EVALUATION: **Not Recommended**				
Alternative 2 - Replacement	 	**Description/ Design Concept**	• Application of existing bridge planning condition in order to confirm the cost effectiveness of seismic retrofit & repair works • Application of light weight & low height superstructure type in order to maintain the adequate vertical clearance		
		Construction	Method/ Technology	• Steel Langer arch bridge • Cast-in-place pile foundation		
			Difficulty	• Requirement of large construction yard for assembly of steel members • Requirement of large size crane for the superstructure installation • Installation of piles into the rock		
			Cost	Super-structure	• Steel Langer arch bridge	0.77
				Substructure	• Wall type	0.03
				Foundation	• Cast-in-place pile foundation • Spread foundation	0.10
				Others	• Working platform on the water • Temporary detour bridge	0.10
					Total	1.00
		Potential Impact to Environment	• River occupation during the works for piers in water • Requirement of large size crane & large construction yard • Requirement of environmental measures for water contamination • Temporary detour bridge installation during the whole construction • Requirement of temporary resettlement for the construction			
		EVALUATION: **Recommended (Further study is necessary.)**				

(3) Improvement Measure Scheme Selection ("Replacement" or "Seismic retrofit")

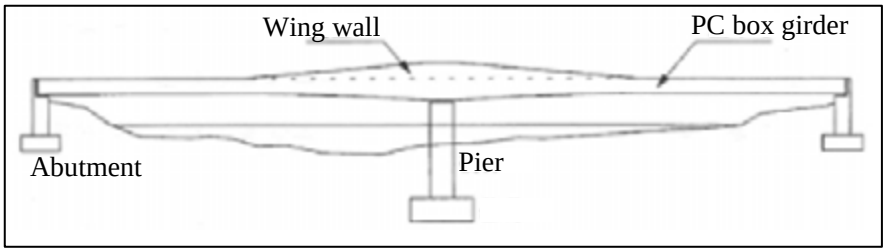
As a result of further comparative study on the improvement measure scheme selection, Mawo Bridge is recommended to be replaced with "PC fin back bridge" for its cost-effectiveness and the advantages for the maintenance-free and low height structure.
The bridge type was optimized with "PC fin back bridge". As shown below, the superstructure consists of PC box girders with wing wall whose height is relatively low with large eccentricities. The applicable span length is from the range of 50 to 80m, which is relatively longer than typical bridge types.

Outline

- Bridge type: PC fin back bridge
- Structural characteristics: low-height PC box girders with large eccentricities
- Applicable span length: 50 to 80m

Structural image

Profile



Cross-section

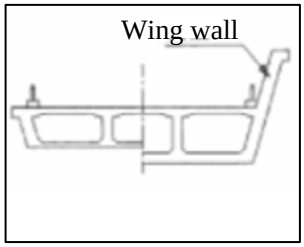
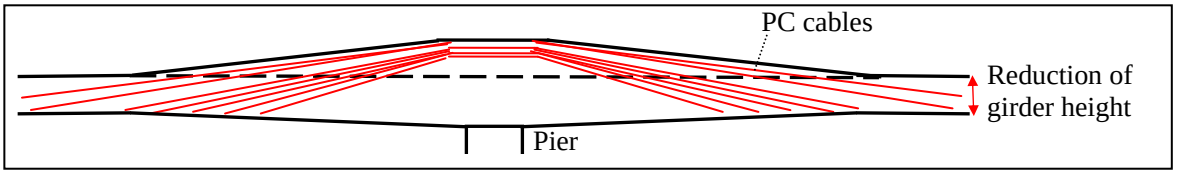


Image of PC cable layout



Source: Japan Prestressed Concrete Contractors Association

Figure 14.2.3-3 Outline of "PC Fin Back Bridge"

As shown below, by optimizing the bridge type of replacement plan, seismic retrofit cost reached 60% of replacement cost. Moreover, life cycle cost (LCC) of the concrete structure with maintenance-free advantage is expected to be much less than the existing steel structure. Mawo Bridge will proceed to the outline design stage with the replacement plan.

Alternative-1: Seismic retrofit (cost ratio: 0.64)
- Same as 2nd screening

Alternative-2: Replacement (cost ratio: 1.00)
- PC fin back bridge
- Wall type substructures
- Cast-in-place pile foundation

Recommended

Outline design

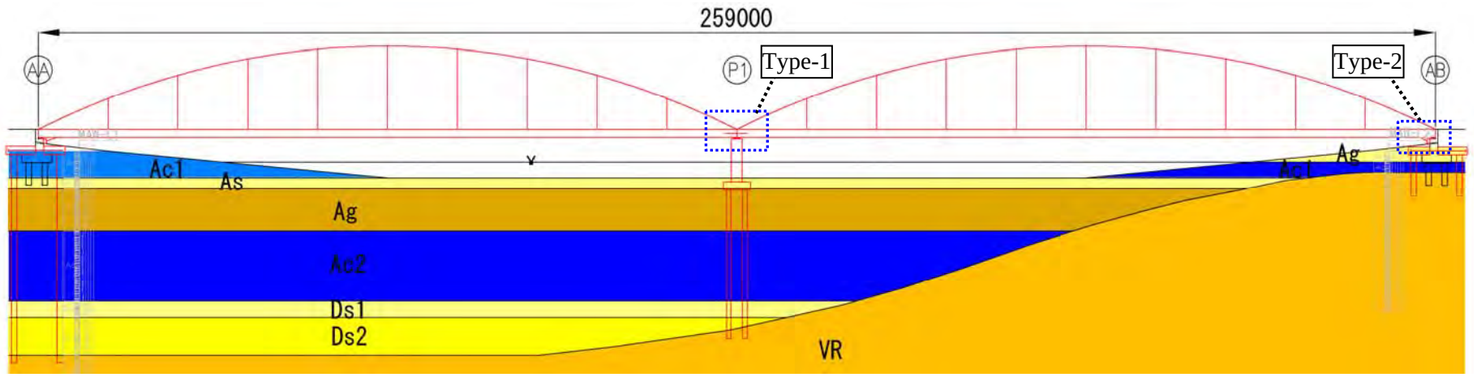
Figure 14.2.3-4 Conclusion of Comparative Study on Improvement Measure Scheme Selection

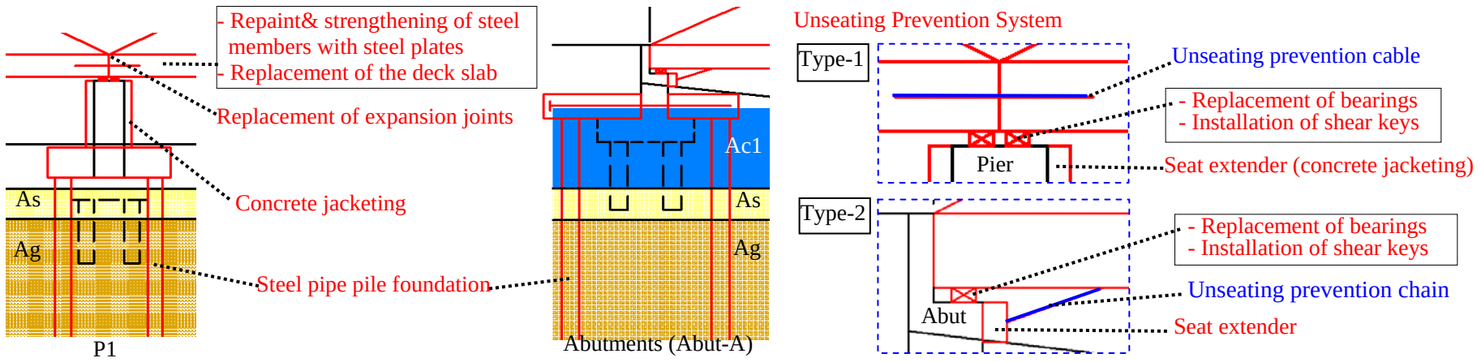
The detail of the comparative study is shown in the next page.

Table 14.2.3-2 Detail Comparative Study on Improve Measurement Schemes for Mawo Bridge (Optimization of Replacement Plan)

Alternative 1 - Seismic Retrofit and Repair

Improvement Measure Scheme



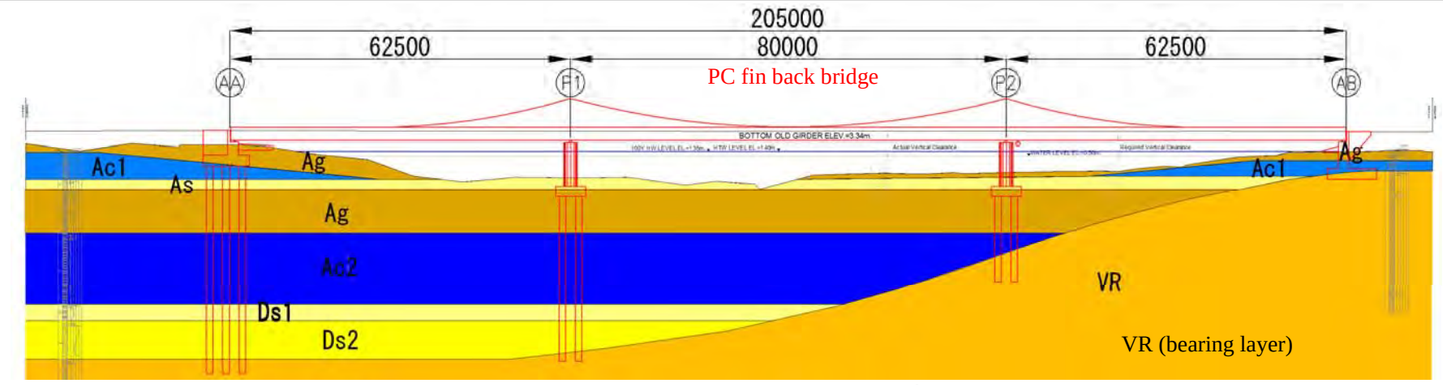


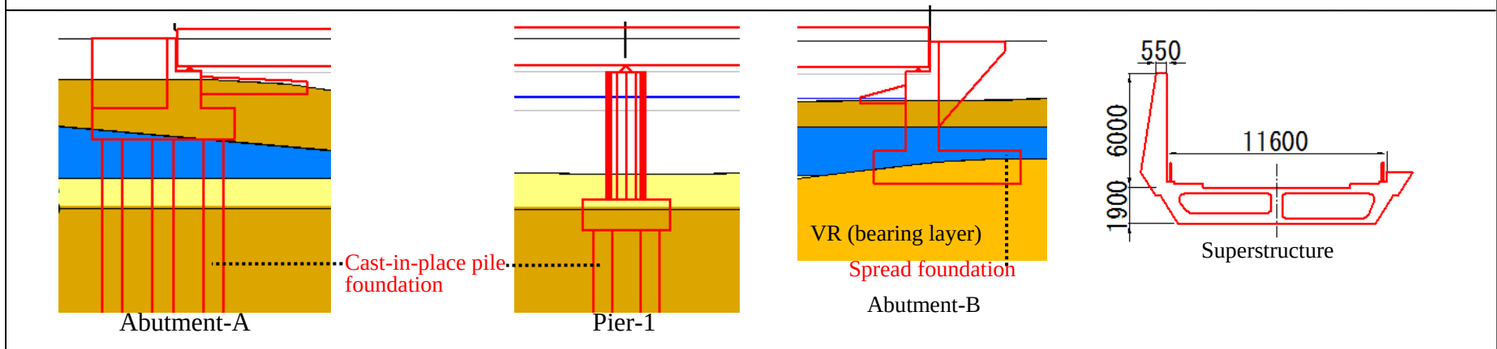
Detail of Improvement Measures & Evaluation

Description/ Design Concept	• Seismic capacity improvement of pier walls (wall retrofit) • Seismic capacity improvement of foundations (pile for reinforcement) • Improvement of unseating/fall-down prevention system (seat extender, unseating prevention cables/chains, shear keys, replacement of bearings) • Improvement of the deck slab soundness (replacement) • Improvement of the steel members' soundness & strength			
Construction	Method/ Technology	• Concrete jacketing (wall retrofit) • Steel pipe pile foundation (pile for reinforcement) • Sheet pile cofferdam • Unseating prevention system • Strengthening of steel members with steel plates		
	Difficulty	• Installation of piles into the rock • Sheet pile installation under the existing superstructure		
	Cost	Seismic Retrofit Works	• Wall retrofit • Pile for reinforcement • Unseating prevention system	0.13
		Repair Works	• Replacement of the deck slab • Replacement of expansion joints Strengthening of steel members with steel plates	0.43
		Others	• Working platform on the water • Temporary detour bridge	0.08
			Total	0.64
Potential Impact to Environment	• River occupation during the works for piers in water • Temporary detour bridge installation during abutment retrofit works • Requirement of environmental measures for water contamination • Requirement of temporary resettlement for the construction			
EVALUATION: **Not Recommended**				

Alternative 2 - Replacement

Improvement Measure Scheme





Detail of Improvement Measures & Evaluation

Description/ Design Concept	• Shortening of bridge length by relocation of abutments (54m) • Application of PC bridge for its cost-effectiveness and maintenance structure • Application of low height superstructure type in order to maintain the adequate vertical clearance			
Construction	Method/ Technology	• PC fin back bridge • Cast-in-place pile foundation		
	Difficulty	• Need of accuracy for the prestressing work and concrete placement • Installation of piles into the rock		
	Cost	Super-structure	• PC fin back bridge	0.67
		Substructure	• Wall type	0.09
		Foundation	• Cast-in-place pile foundation • Spread foundation	0.03
		Others	• Working platform on the water • Temporary detour bridge	0.21
			Total	1.00
Potential Impact to Environment	• River occupation during the works for piers in water • Requirement of environmental measures for water contamination • Temporary detour bridge installation during the whole construction • Requirement of temporary resettlement for the construction			
EVALUATION: **Recommended**				