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.

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 Intersection Traffic Count Survey	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) <u>Outside Metro Manila</u> 16 hours and 24 hours : 7 locations (on selected bridge*8 bridges) <u>Inside Metro Manila</u> 24 hours : 12 locations (at road intersections of the bridge, one for selected bridge and one each for upstream and downstream of 5 bridges) <u>Outside Metro Manila</u> 12 hours and 24 hours : 3 locations (one intersection per selected bridge*8 bridges)	Traffic Survey Report
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 Topographic Survey About 38.5ha (Inside Cross section (@50m) 8.9km (Inside MM: 3 Temporary bench marking the section of the	.5km, Outside MM: 5.5km) MM: 19.0ha, Outside MM: 19.5ha) .6km, Outside MM: 5.3km) ((one of either bank) I: 10, Outside MM: 14) ver .0km, Outside MM: 2.0km) e MM: 3.8km, Outside MM: 10.8km) urvey)	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 (1/2)

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 Scoping Prediction of Natural a Consideration of Altern Consideration of Mitig Consideration of Envir Support for Stakeholde Support for Preparing t 	of data and information nd Social Environmental Impact of Selected Bridges natives ation Method onmental Management Plan and Monitoring Plan rs' Meeting he 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 Insp Visual Inspection/ Compressive Stren Neutralization Test Detection (Electron Measurement/ Scon Natural Vibration 7	ection/Test Shape and Dimension Measurement/ Crack Inspection/ gth Test (Core sample, Schmidt hammer rebound test)/ (Concrete chipping, Coring, Drilling)/ Reinforcing Bar nagnetic wave radar method)/ Shape and Dimension uring Measurement Fest/ 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: 230) Standard Penetration T 810 m (Inside MM: 230) Laboratory Tests Classifications/ Spe Grain Size Downhole Shear Wave Analysis 	m, Outside MM: 580m) ests Dm, Outside MM: 580m) ecific gravity/ Natural moisture contents/ Atterberg Limit/ Test	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 spe PGA contour map for H (equivalent to 15% pro Contour maps of spectr site class B correspond of exceedance in 75 ye 	ectra (L1, L2) for 7 bridge sites Philippine rock sites corresponding to 475-year return period bability of exceedance in 75 years) ral acceleration at PGA, 0.2 sec, and 1.0 sec for Philippine ing to 1000-year return period (equivalent to 7% probability ars).	Report

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

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.

No.	Category	Evaluation Criteria	Maximum Score
1		Construction Year & Applied	10
1.		Specification	
2.	Physical Factors (50 points)	Vulnerability of Bridge	30
3.		Road Importance	5
4.		Load Carrying Capacity	5
5.		Seating Length	10
6	Seismic Performance Factors	Fall-down Prevention	10
0.	(30 point)	Apparatus	
7.		Type of Bridge	10
8.		Liquefaction Potential	10
9.	Geotechnical Factors (20 points)	Soil Classification	5
10.		Impact to Environment	5
	Total Point	100	

Table 11.4.1-1 Evaluation Criteria of First Screening

Table 11.4.1-2 Scoring System for Evaluation Criteria

Descri	ption	Construction Applied Speci	Year & ification	Conditions of Bridge	e	Loading Ca	pacity	Bridge Impor	tance	Seating Le	ngth
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)	Туре	(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				
Inte: A: AASHTO	B: ID A				

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	Tuna I			
Stiff Clay	Type-II	Type-T			
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.

				· • ·	
Evoluction	Bridge Co	ondition			
Components	Seismic Vulnerability	Structural Soundness	Importance	Total	
Rating Weight	60 % (points)	20 % (points)	20 % (points)	100 % (points)	

Table 11.5.3-1 Components for Evaluation and Rating Weight

(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	1. Difference in soil types between adjacent piers	2		
Resisting	2. Continuous or simply supported bridge	3		
System	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	7. Unseating/Fall-down prevention devices (both longitudinal and	5		
Fall-down	transverse directions)			
Prevention	8. Bearing	5		
System	9. Seat length			
	Sub-total (2)	15 points		
	10. Foundation type (known or unknown)	3		
Foundation	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		
Earthquake1. Differend(1) Same(2) Soil Type(3) Soil Type	Resisting System (20 Points) ce in soil types between adjacent piers (2 points) pe I (or II) and II (or III) pe I and III	0 1 2		
2. Continue (1) Continue (2) Simply	bus or simply supported bridge (3 points) tous supported	0 3		

3. Eccentric loads (longitudinal and transverse directions) (5 points)	1
(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 eccentricit	y (i.e. eccentr
columns and span length ratio (similar to Lambingan Bridge with adjacent spa	n length ratio
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" e	ven though the
consist of more than one column.	C
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
(2) 1))2 and carner	5
7. Unseating/Fall-down prevention devices (longitudinal and transverse direction	ons) (5 points)
 7. Unseating/Fall-down prevention devices (longitudinal and transverse directio (1) Good (Seismic restrainers are installed for both directions & functionable.) (2) Fair (Seismic restrainers are installed for one direction & functionable.) (3) Poor (Seismic restrainers are installed, but not functionable enough.) (4) None (No seismic restrainers are installed.) 	0 0 1 3 5 5
 7. Unseating/Fall-down prevention devices (longitudinal and transverse direction (1) Good (Seismic restrainers are installed for both directions & functionable.) (2) Fair (Seismic restrainers are installed for one direction & functionable.) (3) Poor (Seismic restrainers are installed, but not functionable enough.) (4) None (No seismic restrainers are installed.) 	ons) (5 points) 0 1 3 5
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 7. Unseating/Fall-down prevention devices (longitudinal and transverse direction (1) Good (Seismic restrainers are installed for both directions & functionable.) (2) Fair (Seismic restrainers are installed for one direction & functionable.) (3) Poor (Seismic restrainers are installed, but not functionable enough.) (4) None (No seismic restrainers are installed.) 8. Bearing (5 points) (1) Minimal (Seismically resistible type & in good condition) (2) Moderate (Seismically resistible type, but in inappropriate condition) 	$ \begin{array}{r} \text{ons} (5 \text{ points}) \\ \hline 0 \\ 1 \\ 3 \\ \hline 5 \\ \hline 0 \\ 3 \\ \hline 3 \\ \hline 0 \\ 3 \\ \hline \end{array} $
 7. Unseating/Fall-down prevention devices (longitudinal and transverse direction (1) Good (Seismic restrainers are installed for both directions & functionable.) (2) Fair (Seismic restrainers are installed for one direction & functionable.) (3) Poor (Seismic restrainers are installed, but not functionable enough.) (4) None (No seismic restrainers are installed.) 8. Bearing (5 points) (1) Minimal (Seismically resistible type & in good condition) (2) Moderate (Seismically resistible type, but in inappropriate condition) (3) Serious (Seismically vulnerable type or/and severely damaged/corroded) 	$\begin{array}{r} \text{ons} (5 \text{ points}) \\ \hline 0 \\ \hline 1 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$
 7. Unseating/Fall-down prevention devices (longitudinal and transverse direction (1) Good (Seismic restrainers are installed for both directions & functionable.) (2) Fair (Seismic restrainers are installed for one direction & functionable.) (3) Poor (Seismic restrainers are installed, but not functionable enough.) (4) None (No seismic restrainers are installed.) 8. Bearing (5 points) (1) Minimal (Seismically resistible type & in good condition) (2) Moderate (Seismically resistible type, but in inappropriate condition) (3) Serious (Seismically vulnerable type or/and severely damaged/corroded) 	$\begin{array}{c} \text{ons} (5 \text{ points}) \\ \hline 0 \\ \hline 1 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$
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 7. Unseating/Fall-down prevention devices (longitudinal and transverse direction (1) Good (Seismic restrainers are installed for both directions & functionable.) (2) Fair (Seismic restrainers are installed for one direction & functionable.) (3) Poor (Seismic restrainers are installed, but not functionable enough.) (4) None (No seismic restrainers are installed.) 8. Bearing (5 points) (1) Minimal (Seismically resistible type & in good condition) (2) Moderate (Seismically resistible type, but in inappropriate condition) (3) Serious (Seismically vulnerable type or/and severely damaged/corroded) 9. Seat length (5 points) (1) Enough (The seat lengths satisfy JRA criteria.) 	$ \begin{array}{r} \text{ons)} (5 \text{ points}) \\ \hline 0 \\ \hline 1 \\ \hline 3 \\ \hline 5 \\ \hline 0 \\ \hline \end{array} $
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 7. Unseating/Fall-down prevention devices (longitudinal and transverse direction (1) Good (Seismic restrainers are installed for both directions & functionable.) (2) Fair (Seismic restrainers are installed for one direction & functionable.) (3) Poor (Seismic restrainers are installed, but not functionable enough.) (4) None (No seismic restrainers are installed.) 8. Bearing (5 points) (1) Minimal (Seismically resistible type & in good condition) (2) Moderate (Seismically resistible type, but in inappropriate condition) (3) Serious (Seismically vulnerable type or/and severely damaged/corroded) 9. Seat length (5 points) (1) Enough (The seat lengths satisfy JRA criteria.) (2) Short (The seat lengths satisfy AASHTO criteria.) (3) Very Short (Some of seat lengths don't satisfy AASHTO criteria.) 	$\begin{array}{r} 0\\ \hline 0\\ \hline 1\\ \hline 3\\ \hline 5\\ \hline \end{array}$ $\begin{array}{r} 0\\ \hline 3\\ \hline 5\\ \hline \end{array}$ $\begin{array}{r} 0\\ \hline 3\\ \hline 5\\ \hline \end{array}$ $\begin{array}{r} 0\\ \hline 3\\ \hline 5\\ \hline \end{array}$
 7. Unseating/Fall-down prevention devices (longitudinal and transverse direction (1) Good (Seismic restrainers are installed for both directions & functionable.) (2) Fair (Seismic restrainers are installed for one direction & functionable.) (3) Poor (Seismic restrainers are installed, but not functionable enough.) (4) None (No seismic restrainers are installed.) 8. Bearing (5 points) (1) Minimal (Seismically resistible type & in good condition) (2) Moderate (Seismically resistible type, but in inappropriate condition) (3) Serious (Seismically vulnerable type or/and severely damaged/corroded) 9. Seat length (5 points) (1) Enough (The seat lengths satisfy JRA criteria.) (2) Short (The seat lengths satisfy AASHTO criteria.) (3) Very Short (Some of seat lengths don't satisfy AASHTO criteria.) 10 Foundation (15 points) (10 Foundation type (known or unknown) (3 points) 	$\begin{array}{c} \text{ons} (5 \text{ points}) \\ \hline 0 \\ \hline 1 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{c} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{c} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$
 7. Unseating/Fall-down prevention devices (longitudinal and transverse direction (1) Good (Seismic restrainers are installed for both directions & functionable.) (2) Fair (Seismic restrainers are installed for one direction & functionable.) (3) Poor (Seismic restrainers are installed, but not functionable enough.) (4) None (No seismic restrainers are installed.) 8. Bearing (5 points) (1) Minimal (Seismically resistible type & in good condition) (2) Moderate (Seismically resistible type, but in inappropriate condition) (3) Serious (Seismically vulnerable type or/and severely damaged/corroded) 9. Seat length (5 points) (1) Enough (The seat lengths satisfy JRA criteria.) (2) Short (The seat lengths satisfy AASHTO criteria.) (3) Very Short (Some of seat lengths don't satisfy AASHTO criteria.) 10 Foundation type (known or unknown) (3 points) (1) Known (identified type and seismic capacity sufficient) 	$\begin{array}{c} \text{ons} (5 \text{ points}) \\ \hline 0 \\ \hline 1 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{c} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{c} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{c} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$
 7. Unseating/Fall-down prevention devices (longitudinal and transverse direction (1) Good (Seismic restrainers are installed for both directions & functionable.) (2) Fair (Seismic restrainers are installed for one direction & functionable.) (3) Poor (Seismic restrainers are installed, but not functionable enough.) (4) None (No seismic restrainers are installed.) 8. Bearing (5 points) (1) Minimal (Seismically resistible type & in good condition) (2) Moderate (Seismically resistible type, but in inappropriate condition) (3) Serious (Seismically vulnerable type or/and severely damaged/corroded) 9. Seat length (5 points) (1) Enough (The seat lengths satisfy JRA criteria.) (2) Short (The seat lengths satisfy AASHTO criteria.) (3) Very Short (Some of seat lengths don't satisfy AASHTO criteria.) 10 Foundation type (known or unknown) (3 points) (1) Known (identified type and seismic capacity sufficient) (2) Unknown (unidentified) 	$\begin{array}{r} \text{ons} (5 \text{ points}) \\ \hline 0 \\ \hline 1 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$
 7. Unseating/Fall-down prevention devices (longitudinal and transverse direction (1) Good (Seismic restrainers are installed for both directions & functionable.) (2) Fair (Seismic restrainers are installed for one direction & functionable.) (3) Poor (Seismic restrainers are installed, but not functionable enough.) (4) None (No seismic restrainers are installed.) 8. Bearing (5 points) (1) Minimal (Seismically resistible type & in good condition) (2) Moderate (Seismically resistible type, but in inappropriate condition) (3) Serious (Seismically runerable type or/and severely damaged/corroded) 9. Seat length (5 points) (1) Enough (The seat lengths satisfy JRA criteria.) (2) Short (The seat lengths satisfy AASHTO criteria.) (3) Very Short (Some of seat lengths don't satisfy AASHTO criteria.) (4) Foundation type (known or unknown) (3 points) (1) Known (identified type and seismic capacity sufficient) (2) Unknown (unidentified) 	$\begin{array}{r} \text{ons} (5 \text{ points}) \\ \hline 0 \\ \hline 1 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$
 7. Unseating/Fall-down prevention devices (longitudinal and transverse direction (1) Good (Seismic restrainers are installed for both directions & functionable.) (2) Fair (Seismic restrainers are installed for one direction & functionable.) (3) Poor (Seismic restrainers are installed, but not functionable enough.) (4) None (No seismic restrainers are installed.) 8. Bearing (5 points) (1) Minimal (Seismically resistible type & in good condition) (2) Moderate (Seismically resistible type, but in inappropriate condition) (3) Serious (Seismically resistible type or/and severely damaged/corroded) 9. Seat length (5 points) (1) Enough (The seat lengths satisfy JRA criteria.) (2) Short (The seat lengths satisfy AASHTO criteria.) (3) Very Short (Some of seat lengths don't satisfy AASHTO criteria.) (4) Foundation type (known or unknown) (3 points) (1) Known (identified type and seismic capacity sufficient) (2) Unknown (unidentified) 	$\begin{array}{r} \begin{array}{c} 0\\ 0\\ 1\\ 3\\ 5\\ \end{array} \end{array}$
 7. Unseating/Fall-down prevention devices (longitudinal and transverse direction (1) Good (Seismic restrainers are installed for both directions & functionable.) (2) Fair (Seismic restrainers are installed for one direction & functionable.) (3) Poor (Seismic restrainers are installed, but not functionable enough.) (4) None (No seismic restrainers are installed.) 8. Bearing (5 points) (1) Minimal (Seismically resistible type & in good condition) (2) Moderate (Seismically resistible type, but in inappropriate condition) (3) Serious (Seismically resistible type or/and severely damaged/corroded) 9. Seat length (5 points) (1) Enough (The seat lengths satisfy JRA criteria.) (2) Short (The seat lengths satisfy AASHTO criteria.) (3) Very Short (Some of seat lengths don't satisfy AASHTO criteria.) (4) Vory Short (Some of seat lengths don't satisfy AASHTO criteria.) (2) Unknown (identified type and seismic capacity sufficient) (2) Unknown (unidentified) 11. Scouring (3 points) (1) None 	$\begin{array}{r} 0\\ 0\\ 1\\ 3\\ 5\\ \hline \end{array}$ $\begin{array}{r} 0\\ 3\\ \hline \end{array}$ $\begin{array}{r} 0\\ 3\\ \hline \end{array}$
 7. Unseating/Fall-down prevention devices (longitudinal and transverse direction (1) Good (Seismic restrainers are installed for both directions & functionable.) (2) Fair (Seismic restrainers are installed for one direction & functionable.) (3) Poor (Seismic restrainers are installed, but not functionable enough.) (4) None (No seismic restrainers are installed.) 8. Bearing (5 points) (1) Minimal (Seismically resistible type & in good condition) (2) Moderate (Seismically resistible type, but in inappropriate condition) (3) Serious (Seismically vulnerable type or/and severely damaged/corroded) 9. Seat length (5 points) (1) Enough (The seat lengths satisfy JRA criteria.) (2) Short (The seat lengths satisfy AASHTO criteria.) (3) Very Short (Some of seat lengths don't satisfy AASHTO criteria.) (4) Very Short (Isome of seat lengths don't satisfy AASHTO criteria.) (2) Unknown (unidentified) 11. Scouring (3 points) (1) None (2) Unknown (Ex. conditions of piers in water) 	$\begin{array}{r} \text{ons} (5 \text{ points}) \\ \hline 0 \\ \hline 1 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$
 7. Unseating/Fall-down prevention devices (longitudinal and transverse direction (1) Good (Seismic restrainers are installed for both directions & functionable.) (2) Fair (Seismic restrainers are installed for one direction & functionable.) (3) Poor (Seismic restrainers are installed, but not functionable enough.) (4) None (No seismic restrainers are installed.) 8. Bearing (5 points) (1) Minimal (Seismically resistible type & in good condition) (2) Moderate (Seismically resistible type, but in inappropriate condition) (3) Serious (Seismically vulnerable type or/and severely damaged/corroded) 9. Seat length (5 points) (1) Enough (The seat lengths satisfy JRA criteria.) (2) Short (The seat lengths satisfy AASHTO criteria.) (3) Very Short (Some of seat lengths don't satisfy AASHTO criteria.) Foundation (15 points) (1) Known (identified type and seismic capacity sufficient) (2) Unknown (unidentified) 11. Scouring (3 points) (1) None (2) Unknown (Ex. conditions of piers in water) (3) With evidence or potential for scouring 	$\begin{array}{r} \text{ons} (5 \text{ points}) \\ \hline 0 \\ \hline 1 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$ $\begin{array}{r} 0 \\ \hline 3 \\ \hline 5 \\ \hline \end{array}$

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 pc						
(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)

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 (1. Primary memb	ers (10 points)	
(1) Good or Sma	all (No need for repair)	0
(2) Moderate (R	epair work is necessary.)	3
(3) Serious (Add	litional reinforcement is recommended.)	5
2. Secondary mer	nbers (2 points)	
(1) Good or Sma	all (No need for repair)	0
(2) Moderate (R	epair work is necessary.)	1
(3) Serious (Add	litional reinforcement is recommended.)	2
3. Deck slab (3 p	pints)	
(1) Good or Sma	all (No need for repair)	0
(2) Moderate (R	epair work is necessary.)	1
(3) Serious (Rep	placement is recommended.)	3

Table 11.5.3-3 Evaluation Items and Rating Weight

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.	3
(The structural soundness can be improved by repair works.)	
(3) Serious: Severe damages such as cracks/hanycomb are inspected.	5
(Damages are too severe to improve the structural soundness by repair works.)	

(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.

Component	Evaluation Item	We	eight for Rating		
1 Traffic volume	1 Traffic volume Traffic volume (pcu) (AADT)				
2 Alternative bridge(s)	Existence of alternative bridge(s)		15		
	Total		20 points		
1.1 Traffic volume (Packa	ge B) (5 points) (AADT)				
(1) Less than 50,000 pcu			0		
(2) 50,000 - 100,0000 pc	u		3		
(3) Over than 100,000 pc	cu		5		
1.2 Traffic volume (Packa	ge 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) (1	5 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 r	no alternate bridge		15		

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

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

Bridge Member			Datas	[Severity	of Dama	ige	Doting of	Accumrated	
Common and	Matarial	Type of Damages/	Rating	Good	Fair	Poor	Bad	domogo	Rating of	Remarks
Component	wateriai		Score	0%	30%	60%	100%	uamaye	damage	
(50) Deck Slab	Concrete	Cracking	10		0			3		
(Primary)		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10	0						
		Delamination	10						1	
		Hanycomb	10						1	
		Waterleaking	10		0			3	6	
(51) Concrete Beam/	Prestressed	Cracking	10			0		6		
Girder	Concrete	Exposure/Corrosion of Rebars	10	0						
(Primary)	Reinforced	Spalling, Scaling, Disintegration	10	0		[1	
	Concrete	Delamination	10						1	
		Hanycomb	10						1	
		Waterleaking	10			0		6	12	
(52) Steel Beam/		Corrosion	10							
Truss Members		Cracking	10			· · · · ·			1	
(Bracings, etc.)		Deformation/Buckling	10						1	
(Primary)		Abnormal Vibrations	10						1	
. ,,		Loose Connection	10						1	
		Paint Peel off	10						0	
(53) Shoe/Bearing	Steel	Waterleaking	10			0		6		
		Abnormal Space/Noise	10			<u> </u>			1	
		Difference in elevation	10							
		Displacement	10	0						
(Primary)	Rubber	Cracking/Rupture	10						6	
(54) Abutments	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling, Disintegration	10							
		Cracking concrete	10	0					1	
		Exposure/Corrosion of Reinf.	10	0			1		1	
		Honeycomb	10			1			0	
(55) Piers	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10							
	Others	Delamination	10						1	
		Scouring	10						1	
		Spalling, Scaling, Disintegration	10							
		Cracking concrete	10		0		1	3	1	
		Exposure/Corrosion of Reinf.	10	0						
		Honeycomb	10						3	
(56) Curb and Railing	Concrete	Cracking	5	l	0			3		
(Secondary)		Exposure/Corrosion of Reinf.	5			[1	
. ,,		Spalling	5		0			3	1	
		Impact Damaged	5		Ó			3	9	

Bridge Me	mber		Define		Severity	of Dama	ige	Dating of	Accumrated	
Component	Matorio	Type of Damages/	Raung	Good	Fair	Poor	Bad	domogo	Rating of	Remarks
Component	ivialeria		Score	0%	30%	60%	100%	uamage	damage	
(57) Expansion Joint	Steel	Waterleaking	10							
(Primary)	Others	 Abnormal Space/Noise	10							Expansion of L
		 Difference in elevation	10							cirder
		Displacement	10			0		6		gilder
		Cracking/Rupture	10	0					6	
(58) Painting Cond.		Discoloration	10							
(Primary)		Rust	10						1	
		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			1			1	
		Cracks	5							
		Others							0	
(61) Approach Road	Concrete	Cracking	5			0		3		
(Secondary)	Asphalt	Pot-holes	5			0		3		
		Others							6	
(62) River Condition		Scouring	5							
(Secondary)		Sedimentation	5							
		Others							0	
(63) Total Condition Rating			540						48	

2) Jones Bridge

Bridge Member			D 1	Severity of Damage			Doting of	Accumrated			
	<u> </u>		Type of Damages/	Rating	Good	Fair	Poor	Bad	Rating of	Rating of	Remarks
	Component	Material	51 5	Score	0%	20%	50%	100%	damage	damage	
(50)	Deck Slab	Concrete	Cracking	10		0				, ,	
È	(Primary)		Exposure/Corrosion of Rebars	10		1					
			Scaling/Spalling	10		1				1	
			Delamination	10							
			Honevcomb	10						1	
			Waterleaking	10	0					0	
(51)	Concrete Beam/	Prestressed	Cracking	10					1		
(,	Girder	Concrete	Exposure/Corrosion of Rebars	10		<u> </u>				1	
	(Primary)	Reinforced	Spalling, Scaling, Disintegration	10							
	(Concrete	Delamination	10		<u> </u>	i				
		·· ··· ·· ··	Honeycomb	10		<u> </u>					
			Waterleaking	10						0	
(52)	Steel Beam/		Corrosion	10		0					
(02)	Truss Members		Cracking	10							
	(Bracings etc.)		Deformation/Buckling	10							
	(Primary)		Abnormal Vibrations	10							
	(i minary)		Loose Connection	10							
			Paint Peel off	10			0			0	
(53)	Shoe/Rearing	Steel	Corrosion	10			ŏ		1	v	
(00)	Shocibeding	JICCI	Loose Connection	10			- -				
			Abnormal Displacement			1					
			Bulging/Runture								
	(Primary)	Rubber	Bed (Support) Damage	10		1				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		t – Č					
			Honeycomb	10						0	
(55)	Piers	Concrete	Settlement	10							
(00)	(Primary)	Masonry	Movement	10		<u> </u>					
	(1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Others	Delamination	10							
			Scouring	10							
			Spalling, Scaling, Disintegration	10						1	
			Cracking concrete	10	0						
			Exposure/Corrosion of Reinf.	10	Ĕ	<u> </u>					
			Honevcomb	10		<u> </u>			1	0	
(56)	Curb and Railing	Concrete	Cracking	5		0			1	_	
Ľ ″	(Secondary)		Exposure/Corrosion of Reinf.	5					1	1	
1			Spalling	5					1	1	
			Impact Damaged	5					1	0	

Bridge Member			Dating	Severity of Damage					Accumrated	
Component	Matoria	Type of Damage	es/ Scoro	Good	Fair	Poor	Bad	damago	Rating of	Remarks
Component	ivialeria		Score	0%	20%	50%	100%	uainaye	damage	
(57) Expansion Joint	Steel	Waterleaking	10			0				
(Primary)	Others	Abnormal Space/Noi	se 10							
		Difference in elevatio	n <u>10</u>							
		Displacement				0				
		Cracking/Rupture							0	
(58) Painting Cond.		Discoloration	10							
(Primary)		Rust	10							No Drain Pipe
		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							
		Others							0	
(62) River Condition		Scouring	5							
(Secondary)		Sedimentation	5							
		Others							0	
(63) Total Condition R	ating		<i>490</i>						0	

3) McArthur Bridge

Bridge Member			Dating		Severity	of Dama	ge	Dating of	Accumrated		
Car	manant	Matarial	Type of Damages/	Raung	Good	Fair	Poor	Bad	- Rauny Or	Rating of	Remarks
Cor	mponent	wateriar	51 0	Score	0%	20%	50%	100%	uamage	damage	
(50) Dec	ck Slab	Concrete	Cracking	10		0					
(Pri	rimary)		Exposure/Corrosion of Rebars	10						1	
			Scaling/Spalling	10						1	
			Delamination	10						1	
			Hanycomb	10						1	
			Waterleaking	10						0	
(51) Con	ncrete Beam/	Prestressed	Cracking	10							
Girc	der	Concrete	Exposure/Corrosion of Rebars	10						1	
(Pri	rimary)	Reinforced	Spalling, Scaling, Disintegration	10		l				1	
,	. ,,	Concrete	Delamination	10							
			Hanycomb	10							
			Waterleaking	10						0	
(52) Stee	el Beam/		Corrosion	10		0					
Tru	iss Members		Cracking	10							
(Bra	acings etc.)		Deformation/Buckling	10	0						
(Pri	rimary)		Abnormal Vibrations	10	- ×						
(, , ,			Loose Connection	10							
			Paint Peel off	10			0			0	
(53) Sho	pe/Bearing	Steel	Corrosion	10		0	- -	-			
(00) 0110	sorbouring	0.001	Loose Connection			- -					
			Abnormal Displacement		0						
			Bulaina/Rupture								
(Pri	rimarv)	Rubber	Bed (Support) Damage	10						0	
(54) Abu	utments	Concrete	Settlement	10							
(Pri	rimary)	Masonry	Movement	10							
	51	Others	Delamination	10							
			Scouring	10							
			Spalling, Scaling, Disintegration	10		1					
			Cracking concrete	10		0				1	
			Exposure/Corrosion of Reinf.	10						1	
			Honeycomb	10	0					0	
(55) Pier	rs	Concrete	Settlement	10	<u> </u>						
(Pri	rimary)	Masonry	Movement	10						1	
		Others	Delamination	10						1	
			Scouring	10						1	
			Spalling, Scaling, Disintegration	10	0					1	
			Cracking concrete	10		0				1	
			Exposure/Corrosion of Reinf.	10			0			1	
			Honeycomb	10		1				0	
(56) Cur	rb and Railing	Concrete	Cracking	5					1		
(Se	econdary)		Exposure/Corrosion of Reinf.	5						1	
	2.		Spalling	5						1	
			Impact Damaged	5						0	

Bridge Mer	mber			Dating		Severity	of Dama	ge	Dating of	Accumrated	
Component	Matorio	Туре	of Damages/	Railiy	Good	Fair	Poor	Bad	damaga	Rating of	Remarks
Component	IVIALEI IA			Score	0%	20%	50%	100%	uamaye	damage	
(57) Expansion Joint	Steel	Waterleaki	ng	10		0					
(Primary)	Others	Abnormal	Space/Noise	10							
		Difference	in elevation	10							
		Displacem	ent				0				
		Cracking/F	Rupture							0	
(58) Painting Cond.		Discolorati	on	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)		Sedimenta	tion	5							
		Others								0	
(63) Total Condition R	ating			490						0	

4) Quezon Bridge

Bridge Me	mber		D .		Severity	of Dama	ge	Doting of	Accumrated	
Commonant	Matarial	Type of Damages/	Rating	Good	Fair	Poor	Bad	- Raing of	Rating of	Remarks
Component	waterial	51 0	Score	0%	20%	50%	100%	uamage	damage	
(50) Deck Slab	Concrete	Cracking	10		0					
(Primary)		Exposure/Corrosion of Rebars	10						1	
		Scaling/Spalling	10						1	
		Delamination	10						1	
		Hanycomb	10						1	
		Waterleaking	10		0				0	
(51) Concrete Beam/	Prestressed	Cracking	10			0				
Girder	Concrete	Exposure/Corrosion of Rebars	10			1			1	
Approach Bridge	Reinforced	Spalling, Scaling, Disintegration	10						1	
,,, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Concrete	Delamination	10			1			1	
	·· ··· ·· ·· ··	Hanvcomb	10			1			1	
		Waterleaking	10						0	
(52) Steel Beam/		Corrosion	10	0						
Truss Members		Cracking	10						1	
(Bracings, etc.)		Deformation/Buckling	10	0						
(Primarv)		Abnormal Vibrations	10							
		Loose Connection	10	0					1	
		Paint Peel off	10		0				0	
(53) Shoe/Bearing	Steel	Corrosion	10							
		Loose Connection								
		Abnormal Displacement								
	ĺ	Bulging/Rupture								
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10			1				
		Spalling, Scaling, Disintegration	10							
		Cracking concrete	10	0					1	
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(55) Piers	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10						1	
	Others	Delamination	10]	
		Scouring	10]	
		Spalling, Scaling, Disintegration	10						1	
		Cracking concrete	10							
		Exposure/Corrosion of Reinf.	10			[
		Honeycomb	10						0	
(56) Curb and Railing	Concrete	Cracking	5							
(Secondary)		Exposure/Corrosion of Reinf.	5						1	
		Spalling	5						1	
		Impact Damaged	5						0	

Bridge Me	mber		Dofing		Severity	of Dama	ge	Dating of	Accumrated	
Component	Matarial	Type of Damages/	Raung	Good	Fair	Poor	Bad	domogo	Rating of	Remarks
Component	IVIALEI IAI		Score	0%	20%	50%	100%	uamaye	damage	
(57) Expansion Joint	Steel	Waterleaking	10			0				
(Primary)	Others	Abnormal Space/Noise	10							
		Difference in elevation	10							
		Displacement		0						
		Cracking/Rupture							0	
(58) Painting Cond.		Discoloration	10							
(Primary)		Rust	10	0						
		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						1	
		Others							0	
(62) River Condition		Scouring	5							
(Secondary)		Sedimentation	5							
		Others							0	
(63) Total Condition R	ating		<i>490</i>						0	

5) Ayala Bridge

E	Bridge Men	nber		D. 1		Severity	of Dama	ge	Doting of	Accumrated	
Comm	ononi	Matarial	Type of Damages/	Rating	Good	Fair	Poor	Bad	- Raung of	Rating of	Remarks
Compo	onent	wateria	51 0	Score	0%	20%	50%	100%	uamage	damage	
(50) Deck S	Slab	Concrete	Cracking	10		0				Ů	
(Prima	ary)		Exposure/Corrosion of Rebar	s 10							
	5.		Scaling/Spalling	10		0					
			Delamination	10		<u> </u>					
			Hanvcomb	10							
			Waterleaking	10		0				0	
(51) Concre	ete Beam/	Prestressed	Cracking	10		—					
Girder		Concrete	Exposure/Corrosion of Rebar	s 10							
(Prima	arv)	Reinforced	Spalling, Scaling, Disintegratio	1 10							
		Concrete	Delamination	10		<u> </u>	i				
			Hanycomb	10		<u> </u>					
			Waterleaking	10						0	
(52) Steel B	Beam/		Corrosion	10			0	-			
Truss	Members		Cracking	10	0		- v				
(Bracin	nas etc.)		Deformation/Buckling	10		0					
(Prima	arv)		Abnormal Vibrations	10		- -					
(, , , , , , , , , , , , , , , , , , ,			Loose Connection	10			0				
			Paint Peel off	10			ŏ			0	
(53) Shoe/F	Bearing	Steel	Corrosion	10			- -	0			
()	9		Loose Connection								
			Abnormal Displacement				0				Section Loss
			Bulaina/Rupture								
(Prima	arv)	Rubber	Bed (Support) Damage	10						0	
(54) Abutme	ents	Concrete	Settlement	10							
(Prima	ary)	Masonry	Movement	10		1					
	5.	Others	Delamination	10		1					Connecto
			Scouring	10		1					Concrete
			Spalling, Scaling, Disintegratio	ו 10		0	1				Sirengin
			Cracking concrete	10		1	0				uegraceu
			Exposure/Corrosion of Reinf.	10		1					
			Honeycomb	10						0	
(55) Piers		Concrete	Settlement	10							
(Prima	ary)	Masonry	Movement	10		l					
	5.	Others	Delamination	10		1					
			Scouring	10		1					
			Spalling, Scaling, Disintegratio	n 10		0					
			Cracking concrete	10		0					
			Exposure/Corrosion of Reinf.	10		1	1				
			Honeycomb	10		1				0	
(56) Curb a	and Railing	Concrete	Cracking	5							
(Secor	ndary)		Exposure/Corrosion of Reinf.	5							
			Spalling	5							
			Impact Damaged	5						0	

Bridge Mer	mber		Dating		Severity	of Dama	ge	Pating of	Accumrated	
Component	Matoria	Type of Damages/	Scoro	Good	Fair	Poor	Bad	damago	Rating of	Remarks
Component	ivialeria		Score	0%	20%	50%	100%	uainaye	damage	
(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							
		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 R	ating		490						0	

6) Nagtahan Bridge

Br	ridge Mer	nber		D <i>i</i>		Severity	of Dama	qe	Dating of	Accumrated	
-			Type of Damages/	Rating	Good	Fair	Poor	Bad	Raing of	Rating of	Remarks
Compor	nent	iviateriai		Score	0%	20%	50%	100%	- damage	damage	
(50) Deck Sla	ab	Concrete	Cracking	10		0					
(Primar	V)		Exposure/Corrosion of Rebars	10						1	
			Scaling/Spalling	10		1					
			Delamination	10		İ				1	
			Hanycomb	10		1					
			Waterleaking	10		0				0	
(51) Concrete	e Beam/	Prestressed	Cracking	10			0				
Girder		Concrete	Exposure/Corrosion of Rebars	10		1	1			1	
(Primar	v)	Reinforced	Spalling, Scaling, Disintegration	10		0				1	Approach
```	,,	Concrete	Delamination	10		Ō					Bridge
			Hanvcomb	10						1	
			Waterleaking	10						0	
(52) Steel Be	am/		Corrosion	10		0					
Truss M	lembers		Cracking	10		- <b>-</b>					
(Bracino	is. etc.)		Deformation/Buckling	10		h					
(Primar	v)		Abnormal Vibrations	10		<u> </u>					Main Bridge
(111111)	,,		Loose Connection	10		1					
			Paint Peel off	10		<u> </u>		0		0	
(53) Shoe/Be	earing	Steel	Corrosion	10		0	1				
, í	5		Loose Connection			<u> </u>				1	
			Abnormal Displacement			1				1	
			Bulging/Rupture			1				1	
(Primar	v)	Rubber	Bed (Support) Damage	10		İ				0	
(54) Abutmer	nts	Concrete	Settlement	10							
(Primar	y)	Masonry	Movement	10		1				1	
		Others	Delamination	10		1	1			1	
			Scouring	10		1	1			1	Not visible
			Spalling, Scaling, Disintegration	10		1	1			1	NUL VISIDIE
			Cracking concrete	10							
			Exposure/Corrosion of Reinf.	10							
			Honeycomb	10		1				0	
(55) Piers		Concrete	Settlement	10							
(Primar	y)	Masonry	Movement	10		1				1	
		Others	Delamination	10		[				1	
			Scouring	10		1	1			1	
			Spalling, Scaling, Disintegration	10	0	1				1	
			Cracking concrete	10		0				1	
			Exposure/Corrosion of Reinf.	10		0				1	
			Honeycomb	10						0	
(56) Curb an	d Railing	Concrete	Cracking	5							
(Second	dary)		Exposure/Corrosion of Reinf.	5						1	
	-		Spalling	5						1	
			Impact Damaged	5						0	

Bridge Mer	mber		Dating		Severity	of Dama	ge	Dating of	Accumrated	
0	Material	Type of Damages/	Raing	Good	Fair	Poor	Bad	domogo	Rating of	Remarks
Component	Material		Score	0%	20%	50%	100%	uamage	damage	
(57) Expansion Joint	Steel	Waterleaking	10			0				
(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							
		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		1					
		Others			1				0	
(63) Total Condition R	ating		<i>490</i>						0	

# 7) Pandacan Bridge

Bridge Me	mber		Defer		Severity	of Damag	ge	Dating of	Accumrated	
0	Material	Type of Damages/	Rating	Good	Fair	Poor	Bad	Raing of	Rating of	Remarks
Component	wateriai		Score	0%	20%	50%	100%	uamage	damage	
(50) Deck Slab	Concrete	Cracking	10	0						
(Primary)		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10	0						
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10	0					0	
(51) Concrete Beam/	Prestressed	Cracking	10	Õ						
Girder	Concrete	Exposure/Corrosion of Rebars	10		0					
(Primary)	Reinforced	Spalling, Scaling, Disintegration	10							
(	Concrete	Delamination	10							
		Hanycomb	10							
		Waterleaking	10						0	
(52) Steel Beam/		Corrosion	10							
Truss Members		Cracking	10							
(Bracings, etc.)		Deformation/Buckling	10							
(Primary)		Abnormal Vibrations	10							
(		Loose Connection	10							
		Paint Peel off	10						0	
(53) Shoe/Bearing	Steel	Corrosion	10						-	
( , , , , , , , , , , , , , , , , , , ,		Loose Connection								
		Abnormal Displacement					· · · · ·			Not visible
		Bulaina/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	0						
		Exposure/Corrosion of Reinf.	10	Õ						
		Honevcomb	10						0	
(55) Piers	Concrete	Settlement	10						-	
(Primary)	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling, Disintegration	10		0					
		Cracking concrete	10	0						
		Exposure/Corrosion of Reinf.	10	<b>–</b>	0					
		Honeycomb	10		Ť				0	
(56) Curb and Railing	Concrete	Cracking	5						, v	
(Secondary)		Exposure/Corrosion of Reinf	5							
(000011001))		Spalling	5							
		Impact Damaged	5						0	

Bridge Mer	mber			Defer		Severity	of Dama	ge	Dating of	Accumrated	
0	Matada		Type of Damages/	Rating	Good	Fair	Poor	Bad	Rainy O	Rating of	Remarks
Component	iviateria			Score	0%	20%	50%	100%	uamage	damage	
(57) Expansion Joint	Steel		Waterleaking	10		0					
(Primary)	Others		Abnormal Space/Noise	10							
			Difference in elevation	10		0					
			Displacement								
			Cracking/Rupture							0	
(58) Painting Cond.			Discoloration	10							
(Primary)			Rust	10		1					
			Exfoliation	10						0	
(59) Drainage Pipe	PVC		Clogged	5							
(Secondary)	Steel	-	Cracks	5		1					
			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		0					
			Others							0	
(62) River Condition			Scouring	5							
(Secondary)			Sedimentation	5							
			Others							0	
(63) Total Condition R	ating			490						0	

# 8) Lambingan Bridge

Bridge Mer	mber		D. /		Severity	of Dama	qe	Defense of	Accumrated	
<u> </u>		Type of Damages/	Rating	Good	Fair	Poor	Bad	Rating or	Rating of	Remarks
Component	Material	51 5	Score	0%	30%	60%	100%	damage	damage	
(50) Deck Slab	Concrete	Cracking	10			0		6	ÿ	
(Primary)		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10							
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10		0			3	9	
(51) Concrete Beam/	Prestressed	Cracking	10				0	10		
Girder	Concrete	Exposure/Corrosion of Rebars	10							Defrection at
(Primary)	Reinforced	Spalling, Scaling, Disintegration	10		0		1	3		center and
1	Concrete	Delamination	10							shear cracking
		Hanycomb	10		0			3		at hinge portion
		Waterleaking	10						16	
(52) Steel Beam/		Corrosion	10							
Truss Members		Cracking	10							
(Bracings, etc.)		Deformation/Buckling	10							
(Primary)		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	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling, Disintegration	10	0						
		Cracking concrete	10		0			3		
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						3	
(55) Piers	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling, Disintegration	10	0						
		Cracking concrete	10		0			3		
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						3	
(56) Curb and Railing	Concrete	Cracking	5		0			3		
(Secondary)		Exposure/Corrosion of Reinf.	5							
		Spalling	5				1			
		Impact Damaged	5						3	

Bridge Mei	Bridge Member			Define		Severity	of Dama	ge	Dating of	Accumrated	
Company	Mataria		Type of Damages/	Raung	Good	Fair	Poor	Bad	Raung O	Rating of	Remarks
Component	IVIALEI IA			Score	0%	30%	60%	100%	uamaye	damage	
(57) Expansion Joint	Steel		Waterleaking	10			0		6		
(Primary)	Others		Abnormal Space/Noise	10		1		1			
			Difference in elevation	10		0			3		
			Displacement								
			Cracking/Rupture							9	
(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							
			Others							0	
(62) River Condition			Scouring	5							
(Secondary)			Sedimentation	5							
			Others							0	
(63) Total Condition R	ating			490						43	

# 9) Makati Mandalyong Bridge

	Bridge Mer	nber		Datas		Severity	of Dama	qe	Doting of	Accumrated	
	Q	Material	Type of Damages/	Raing	Good	Fair	Poor	Bad	- Raung or	Rating of	Remarks
	Component	iviateriai	51 0	Score	0%	20%	50%	100%	damage	damage	
(50)	Deck Slab	Concrete	Cracking	10			0			-	
	(Primary)		Exposure/Corrosion of Rebars	10							
			Scaling/Spalling	10							
			Delamination	10							
			Hanycomb	10							
			Waterleaking	10						0	
(51)	Concrete Beam/	Prestressed	Cracking	10			0				
• •	Girder	Concrete	Exposure/Corrosion of Rebars	10	0			1			
	(Primarv)	Reinforced	Spalling, Scaling, Disintegration	10	0			1			
		Concrete	Delamination	10							
			Hanycomb	10		0					
			Waterleaking	10						0	
(52)	Steel Beam/		Corrosion	10						-	
(/	Truss Members		Cracking	10							
	(Bracings, etc.)		Deformation/Buckling	10							
	(Primary)		Abnormal Vibrations	10							
			Loose Connection	10							
			Paint Peel off	10						0	
(53)	Shoe/Bearing	Steel	Corrosion	10			0				
• •	5		Loose Connection								Outsian st
			Abnormal Displacement		0						bulyiny ai
			Bulging/Rupture			0					approach bhuge
	(Primary)	Rubber	Bed (Support) Damage	10				1		0	
(54)	Abutments	Concrete	Settlement	10							
	(Primary)	Masonry	Movement	10							
		Others	Delamination	10							
			Scouring	10							
			Spalling, Scaling, Disintegration	10							
			Cracking concrete	10		0					
			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	0						
			Cracking concrete	10	0						
			Exposure/Corrosion of Reinf.	10	0						
			Honeycomb	10						0	
(56)	Curb and Railing	Concrete	Cracking	5							
Ľ	(Secondary)		Exposure/Corrosion of Reinf.	5							
1	2.		Spalling	5		İ	· · · · · ·	İ		1	
			Impact Damaged	5				1		0	

Bridge Mei	mber		Dating		Severity	of Dama	ge	Pating of	Accumrated	
Component	Matorio	Type of Damages/	Raung	Good	Fair	Poor	Bad	damaga	Rating of	Remarks
Component	IVIAIELIA		Score	0%	20%	50%	100%	uamaye	damage	
(57) Expansion Joint	Steel	Waterleaking	10	0						
(Primary)	Others	 Abnormal Space/Noise	10				1		1	
		 Difference in elevation	10			0	1			
		Displacement								
		Cracking/Rupture							0	
(58) Painting Cond.		Discoloration	10							
(Primary)		Rust	10				1			
		Exfoliation	10						0	
(59) Drainage Pipe	PVC	Clogged	5			0				
(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			0				
(Secondary)	Asphalt	Pot-holes	5							
		Others							0	
(62) River Condition		Scouring	5							
(Secondary)		Sedimentation	5							
		Others							0	
(63) Total Condition R	ating		490						0	

# 10) Guadalupe Bridge

Bridge Mer	mber		Defer		Severity	of Dama	ge	Dating of	Accumrated	
0	Mahadal	Type of Damages/	Rating	Good	Fair	Poor	Bad	- Kaung Ui	Rating of	Remarks
Component	wateriai		Score	0%	30%	60%	100%	uamage	damage	
(50) Deck Slab	Concrete	Cracking	10			0		6		
(Primary)		Exposure/Corrosion of Rebars	10						1	
		Scaling/Spalling	10							
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10	0					6	
(51) Concrete Beam/	Prestressed	Cracking	10				0	10		
Girder	Concrete	Exposure/Corrosion of Rebars	10			1				
(Primary)	Reinforced	Spalling, Scaling, Disintegration	10			1				Shear crack at
	Concrete	Delamination	10	0		1			0	hinge
		Hanycomb	10							
		Waterleaking	10						10	
(52) Steel Beam/		Corrosion	10							
Truss Members		Cracking	10							
(Bracings, etc.)		Deformation/Buckling	10							
(Primary)		Abnormal Vibrations	10							
		Loose Connection	10	0						
		Paint Peel off	10		0	1		3	3	
(53) Shoe/Bearing	Steel	Corrosion	10							
		Loose Connection				1				
		Abnormal Displacement								
		Bulging/Rupture								
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10							
	Others	Delamination	10	0						
		Scouring	10							
		Spalling, Scaling, Disintegration	10							
		Cracking concrete	10	0						
		Exposure/Corrosion of Reinf.	10			1				
		Honeycomb	10			1			0	
(55) Piers	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling, Disintegration	10			0		6		
		Cracking concrete	10		0			3		
		Exposure/Corrosion of Reinf.	10			0		6		
		Honeycomb	10						15	
(56) Curb and Railing	Concrete	Cracking	5	l		0		3		
(Secondary)	· · · · · · · · · · · · · · · · · · ·	Exposure/Corrosion of Reinf.	5							
		Spalling	5	0	· · · · · ·				1	
		Impact Damaged	5		· · · · ·	1			3	

Bridge Mei	mber		Dafaa		Severity	of Dama	je	Dating of	Accumrated	
Company	Mataria	Type of Damages/	Raung	Good	Fair	Poor	Bad	damaga	Rating of	Remarks
Component	ivialeria		Score	0%	30%	60%	100%	uamaye	damage	
(57) Expansion Joint	Steel	Waterleaking	10		0			3		
(Primary)	Others	Abnormal Space/Noise	10	0						
		 Difference in elevation	10							
		Displacement								
		Cracking/Rupture							3	
(58) Painting Cond.		Discoloration	10		0			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		0			2		
		Others							2	
(61) Approach Road	Concrete	Cracking	5			0		3		
(Secondary)	Asphalt	Pot-holes	5							
		Others							3	
(62) River Condition		Scouring	5							Prevent shin
(Secondary)		Sedimentation	5							from collision
		Others				0		3	3	nom comsion
(63) Total Condition R	ating		490						51	

# 11) C-5 Bridge

Bridge Mer	mber		Defer		Severity	of Dama	ge	Dating of	Accumrated	
0	Maturial	Type of Damages/	Raing	Good	Fair	Poor	Bad	Raing of	Rating of	Remarks
Component	iviateriai	5. 0	Score	0%	20%	50%	100%	- damage	damage	
(50) Deck Slab	Concrete	Cracking	10	0					Ű	
(Primary)		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10							
		Delamination	10							
		Hanvcomb	10							
		Waterleaking	10	0					0	
(51) Concrete Beam/	Prestressed	Cracking	10							
Girder	Concrete	Exposure/Corrosion of Rebars	10	0						
(Primary)	Reinforced	Spalling, Scaling, Disintegration	10	Õ	1		1			
(11 mary)	Concrete	Delamination	10							
		Hanycomb	10	0						
		Waterleaking	10						0	
(52) Steel Beam/		Corrosion	10							
Truss Members		Cracking	10							
(Bracings etc.)		Deformation/Buckling	10							
(Drimary)		Abnormal Vibrations	10							
(i riinai y)		Loose Connection	10							
		Paint Peel off	10						0	
(53) Shoe/Rearing	Steel	Corrosion	10							
(00) Shoci Bearing	Dicci	Loose Connection								
		Abnormal Displacement								
		Bulaina/Runture								
(Primary)	Rubber	Bed (Sunnort) Damage	10						0	
(54) Abutments	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10							
(r rindi y)	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							
(r rindi y)	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling, Disintegration	10		0					
		Cracking concrete	10		ŏ					
		Exposure/Corrosion of Reinf.	10		- Ŭ					
		Honeycomb	10						0	
(56) Curb and Railing	Concrete	Cracking	5	0					v	
(Secondary)		Exposure/Corrosion of Reinf	5	- <u> </u>						
(Secondary)		Snalling	5							
		Imnact Damaged	5		 				0	
1	1	impact Damayeu	<i>.</i>		I				v	

Bridge Mei	mber		Dofing		Severity	of Dama	ge	Pating of	Accumrated	
Component	Matorial	Type of Damages/	Raing	Good	Fair	Poor	Bad	damago	Rating of	Remarks
Component	IVIAIELIAI		Score	0%	20%	50%	100%	uamaye	damage	
(57) Expansion Joint	Steel	Waterleaking	10		0					
(Primary)	Others	Abnormal Space/Noise	10	0	1		1			
		Difference in elevation	10		1		1			
		Displacement		0						
		Cracking/Rupture							0	
(58) Painting Cond.		Discoloration	10							
(Primary)		Rust	10		1					
		Exfoliation	10		1				0	
(59) Drainage Pipe	PVC	Clogged	5							
(Secondary)	Steel	Cracks	5		1					
		Others			1				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 R	ating		490						0	

# 12) Bambang Bridge

Bridge Mer	nber				Severity	of Dama	je	Dafa a cf	Accumrated	
<u> </u>		Type of Damages/	Rating	Good	Fair	Poor	Bad	Rating or	Rating of	Remarks
Component	Material	51 5	Score	0%	20%	50%	100%	damage	damage	
(50) Deck Slab	Concrete	Cracking	10			0				
(Primary)		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10		0					
		Delamination	10							
		Hanvcomb	10							
		Waterleaking	10						0	
(51) Concrete Beam/	Prestressed	Cracking	10							
Girder	Concrete	Exposure/Corrosion of Rebars	10	0						
(Primarv)	Reinforced	Spalling, Scaling, Disintegration	10	0						
1	Concrete	Delamination	10	Õ						
		Hanvcomb	10							
		Waterleaking	10						0	
(52) Steel Beam/		Corrosion	10							
Truss Members		Cracking	10							
(Bracings, etc.)		Deformation/Buckling	10							
(Primarv)		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	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							Cracks on
		Spalling, Scaling, Disintegration	10		0					Retining wall
		Cracking concrete	10		0					
		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							
		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 Mei	mber			Dofing		Severity	of Dama	ge	Pating of	Accumrated	
Component	Motorio		Type of Damages/	Raing	Good	Fair	Poor	Bad	damaga	Rating of	Remarks
Component	IVIALEI IA			Score	0%	20%	50%	100%	uamaye	damage	
(57) Expansion Joint	Steel		Waterleaking	10							
(Primary)	Others		Abnormal Space/Noise	10		1		1			
			Difference in elevation	10		1					
			Displacement								
			Cracking/Rupture							0	
(58) Painting Cond.			Discoloration	10							
(Primary)			Rust	10		1					
			Exfoliation	10		1				0	
(59) Drainage Pipe	PVC		Clogged	5							
(Secondary)	Steel		Cracks	5		1					
			Others			1				0	
(60) Slope Protection	Gabions		Settlement	5							
(Secondary)	Others		Erossion	5				0			
			Scouring	5		1					
			Cracks	5		0					
			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 R	ating			<i>490</i>						0	

# 13) Vargas Bridge

# **13-1 Vargas Bridge (Upstream)** H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Me	mber		Dating		Severity	of Dama	ge	Rating of	Accumrated	
Component	Matorial	Type of Damages/	Cooro	Good	Fair	Poor	Bad	damago	Rating of	Remarks
Component	IVIAIELIAI		Score	0%	20%	50%	100%	uamaye	damage	
(50) Deck Slab	Concrete	Cracking	10		0					
(Primary)		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10							
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10			0			0	
(51) Concrete Beam/	Prestressed	Cracking	10							
Girder	Concrete	Exposure/Corrosion of Rebars	10							
(Primary)	Reinforced	Spalling, Scaling, Disintegration	10							
	Concrete	Delamination	10							
		Hanycomb	10						1	
		Waterleaking	10						0	
(52) Steel Beam/		Corrosion	10	0						
Truss Members		Cracking	10						1	
(Bracings, etc.)		Deformation/Buckling	10		·				1	
(Primarv)		Abnormal Vibrations	10							
		Loose Connection	10	0						
		Paint Peel off	10			0			0	
(53) Shoe/Bearing	Steel	Corrosion	10			-				
· , 3		Loose Connection								
		Abnormal Displacement							1	
		Bulging/Rupture							1	
(Primary)	Rubber	Bed (Support) Damage	10						0	
(54) Abutments	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10						1	
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling, Disintegration	10							
		Cracking concrete	10							
		Exposure/Corrosion of Reinf.	10						1	
		Honeycomb	10						0	
(55) Piers	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10						1	
	Others	Delamination	10							
		Scouring	10						1	
		Spalling, Scaling, Disintegration	10							
		Cracking concrete	10	0			ĺ		1	
		Exposure/Corrosion of Reinf.	10				1		1	
		Honeycomb	10				ĺ		0	
(56) Curb and Railing	Concrete	Cracking	5					1		
(Secondarv)		Exposure/Corrosion of Reinf.	5						1	
(		Spalling	5						1	
		Impact Damaged	5						0	

Bridge Mei	mber			Dating		Severity	of Damag	ge	Pating of	Accumrated	
Component	Motoria		Type of Damages/	Rainy	Good	Fair	Poor	Bad	damago	Rating of	Remarks
Component	ivialeria	I		Score	0%	20%	50%	100%	uamaye	damage	
(57) Expansion Joint	Steel		Waterleaking	10							
(Primary)	Others	-	Abnormal Space/Noise	10						1	
		German	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			0				
			Scouring	5							
			Cracks	5							
			Others							0	
(61) Approach Road	Concrete		Cracking	5							
(Secondary)	Asphalt		Pot-holes	5							
			Others		0					0	
(62) River Condition			Scouring	5							
(Secondary)			Sedimentation	5							
			Others							0	
(63) Total Condition R	ating			<i>490</i>						. 0	

# 13-2 Vargas Bridge (Downstream) H. STRUCTURAL CONDITIONS OF BRIDGE COMPONENTS

Bridge Me	mber		Dofes		Severity	of Dama	ge	Dating of	Accumrated	
Component	Matorial	Type of Damages/	Raing	Good	Fair	Poor	Bad	damago	Rating of	Remarks
Component	wateriar		Score	0%	20%	50%	100%	uamaye	damage	
(50) Deck Slab	Concrete	Cracking	10	0						
(Primary)		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10	0						
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10						0	
(51) Concrete Beam/	Prestressed	Cracking	10	0						
Girder	Concrete	Exposure/Corrosion of Rebars	10							
(Primary)	Reinforced	Spalling, Scaling, Disintegration	10	0						
	Concrete	Delamination	10							
		Hanycomb	10							
		Waterleaking	10						0	
(52) Steel Beam/		Corrosion	10							
Truss Members		Cracking	10							
(Bracings, etc.)		Deformation/Buckling	10							
(Primary)		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	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling, Disintegration	10							
		Cracking concrete	10	0						
		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		0					
		Exposure/Corrosion of Reinf.	10	0						
		Honeycomb	10						0	
(56) Curb and Railing	Concrete	Cracking	5							
(Secondary)		Exposure/Corrosion of Reinf.	5							
		Spalling	5							
		Impact Damaged	5						0	

Bridge Mei	mber			Dofing		Severity	of Dama	ge	Pating of	Accumrated	
Common ant	Mataria		Type of Damages/	Raing	Good	Fair	Poor	Bad	damaga	Rating of	Remarks
Component	ivialeria	I		Score	0%	20%	50%	100%	uamaye	damage	
(57) Expansion Joint	Steel		Waterleaking	10		0					
(Primary)	Others	-	Abnormal Space/Noise	10		1	<u> </u>				
			Difference in elevation	10		1		1			
			Displacement			1					
			Cracking/Rupture			1				0	
(58) Painting Cond.			Discoloration	10							
(Primary)			Rust	10		1					
			Exfoliation	10		1				0	
(59) Drainage Pipe	PVC		Clogged	5							
(Secondary)	Steel	-	Cracks	5		1	<u> </u>				
			Others			1				0	
(60) Slope Protection	Gabions		Settlement	5							
(Secondary)	Others		Erossion	5		1					
		-	Scouring	5		1		ĺ			
			Cracks	5		1					
			Others			1	0			0	
(61) Approach Road	Concrete		Cracking	5							
(Secondary)	Asphalt	-	Pot-holes	5		1					
			Others			0				0	
(62) River Condition			Scouring	5	0						
(Secondary)			Sedimentation	5							
			Others							0	
(63) Total Condition R	ating			490						0	

# 14) Rosario Bridge

Bridge Mer	mber		Dafaa		Severity	of Dama	je	Dating of	Accumrated	
Common and	Material	Type of Damages/	Raing	Good	Fair	Poor	Bad	Rainy O	Rating of	Remarks
Component	ivialeriai		Score	0%	20%	50%	100%	uamage	damage	
(50) Deck Slab	Concrete	Cracking	10			0			-	
(Primary)	· · · · · · · · · · · · · · · ·	Exposure/Corrosion of Rebars	10		0					
		Scaling/Spalling	10		0					
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10						0	
(51) Concrete Beam/	Prestressed	Cracking	10			0				
Girder	Concrete	Exposure/Corrosion of Rebars	10		0					
(Primarv)	Reinforced	Spalling, Scaling, Disintegration	10							
1	Concrete	Delamination	10	0						
		Hanycomb	10							
		Waterleaking	10						0	
(52) Steel Beam/		Corrosion	10							
Truss Members		Cracking	10							
(Bracings etc.)		Deformation/Buckling	10							
(Primary)		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	Concrete	Settlement	10							
(Primary)	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling, Disintegration	10	0						
		Cracking concrete	10		0					
		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		0					
		Exposure/Corrosion of Reinf.	10	0						
		Honeycomb	10						0	
(56) Curb and Railing	Concrete	Cracking	5							
(Secondary)		Exposure/Corrosion of Reinf.	5							
		Spalling	5		ĺ					
		Impact Damaged	5	0					0	

Bridge Mei	mber		Dofer		Severity	of Dama	ge	Dating of	Accumrated	
Component	Matorial	Type of Damages/	Raing	Good	Fair	Poor	Bad	damaga	Rating of	Remarks
Component	IVIAIELIAI		Score	0%	20%	50%	100%	uamaye	damage	
(57) Expansion Joint	Steel	Waterleaking	10							
(Primary)	Others	Abnormal Space/Noise	10		1		1			
		Difference in elevation	10		1					
		Displacement								
		Cracking/Rupture							0	
(58) Painting Cond.		Discoloration	10							
(Primary)		Rust	10		1		1			
		Exfoliation	10						0	
(59) Drainage Pipe PVC		Clogged	5							
(Secondary)	Steel	Cracks	5		1		1			
		Others			1		1		0	
(60) Slope Protection	Gabions	Settlement	5							
(Secondary)	Others	Erossion	5			0				
		Scouring	5		1					
		Cracks	5		1					
		Others/Material Loss			0				0	
(61) Approach Road	Concrete	Cracking	5			0				
(Secondary)	Asphalt	Pot-holes	5							
		Others							0	
(62) River Condition		Scouring	5							
(Secondary)		Sedimentation	5							
		Others							0	
(63) Total Condition R	ating		<b>490</b>						0	

# 15) Marcos Bridge

Bridge Me	Bridge Member				Severity	of Dama	je	Defense of	Accumrated	
		Type of Damages/	Rating	Good	Fair	Poor	Bad	- Rating or	Rating of	Remarks
Component	Material	51 0	Score	0%	20%	50%	100%	damage	damage	
(50) Deck Slab	Concrete	Cracking	10			0				
(Primary)		Exposure/Corrosion of Rebars	10	0						
		Scaling/Spalling	10							
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10			0			0	
(51) Concrete Beam/	Prestressed	Cracking	10							
Girder	Concrete	Exposure/Corrosion of Rebars	10							
(Primary)	Reinforced	Spalling, Scaling, Disintegration	10							
	Concrete	Delamination	10							
		Hanvcomb	10		0					
		Waterleaking	10		-				0	
(52) Steel Beam/		Corrosion	10							
Truss Members		Cracking	10							
(Bracings, etc.)		Deformation/Buckling	10							
(Primary)		Abnormal Vibrations	10							
		Loose Connection	10							
		Paint Peel off	10						0	
(53) Shoe/Bearing	Steel	Corrosion	10							
-		Loose Connection								
		Abnormal Displacement								
		Bulging/Rupture		0						
(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			0				
		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				0	

Bridge Mei	mber			Defer		Severity	of Dama	ge	Rating of Accumrated		
Common and	Mataria		Type of Damages/	Raing	Good	Fair	Poor	Bad	Raung O	Rating of	Remarks
Component	ivialeria			Score	0%	20%	50%	100%	uamage	damage	if Remarks
(57) Expansion Joint	Steel		Waterleaking	10							
(Primary)	(Primary) Others		Abnormal Space/Noise	10							
			Difference in elevation	10	0						
			Displacement			0					
			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							
			Others							0	
(62) River Condition			Scouring	5							
(Secondary)			Sedimentation	5							
			Others							0	
63) Total Condition Rating			490						0		

# 16) Marikina Bridge

Bridge Member			Defer		Severity	of Dama	je	Doting of	Accumrated	
0	Mahadal	Type of Damages/	Raing	Good	Fair	Poor	Bad	Raing of	Rating of	Remarks
Component	Material	51 5	Score	0%	20%	50%	100%	damage	damage	
(50) Deck Slab	Concrete	Cracking	10			0			-	
(Primary)		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10			0				
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10		0				0	
(51) Concrete Beam/	Prestressed	Cracking	10							
Girder	Concrete	Exposure/Corrosion of Rebars	10			0				Creation because
(Primarv)	Reinforced	Spalling, Scaling, Disintegration	10							Cross beam
	Concrete	Delamination	10							neavily
	L	Hanvcomb	10		0					damaged
		Waterleaking	10						0	
(52) Steel Beam/		Corrosion	10							
Truss Members		Cracking	10							
(Bracings, etc.)		Deformation/Buckling	10							
(Primary)		Abnormal Vibrations	10							
		Loose Connection	10							
		Paint Peel off	10						0	
(53) Shoe/Bearing	Steel	Corrosion	10							
, , j		Loose Connection								
		Abnormal Displacement								
		Bulging/Rupture			0					
(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		0					
		Cracking concrete	10			0				
		Exposure/Corrosion of Reinf.	10							
		Honeycomb	10						0	
(56) Curb and Railing	Concrete	Cracking	5					1		
(Secondary)		Exposure/Corrosion of Reinf.	5							
. ,		Spalling	5							
		Impact Damaged	5						0	

Bridge Mei	mber		Defer		Severity	of Dama	ge	Dating of	Accumrated	
Component	Matorial	Type of Damages/	Raing	Good	Fair	Poor	Bad	damaga	Rating of	Remarks
Component	IVIALEI IAI		Score	0%	20%	50%	100%	uamaye	damage	
(57) Expansion Joint	Steel	Waterleaking	10		0					
(Primary)	Others	Abnormal Space/Noise	10		1		1			
		Difference in elevation	10				1			
		Displacement			0					
		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							
		Others							0	
(62) River Condition		Scouring	5							
(Secondary)		Sedimentation	5							
		Others							0	
(63) Total Condition Rating			<i>490</i>						0	

# 17) San Jose Bridge

Bridge Mer	nber		Datina	:	Severity	of Dama	ge	Rating of	Accumrated	
Companant	Motorial	Type of Damages/	Raung	Good	Fair	Poor	Bad	damaco	Rating of	Remarks
Component	ivialerial		Score	0%	20%	50%	100%	uamage	damage	
(50) Deck Slab	Concrete	Cracking	10							
(Primary)		Exposure/Corrosion of Rebars	10							
		Scaling/Spalling	10			1				
		Delamination	10							
		Hanycomb	10							
		Waterleaking	10						0	
(51) Concrete Beam/	Prestressed	Cracking	10		0					
Girder	Concrete	Exposure/Corrosion of Rebars	10			1				
(Primarv)	Reinforced	Spalling, Scaling, Disintegration	10	0		1				Cracking on
( )	Concrete	Delamination	10	<u> </u>		İ				outside girder
		Hanvcomb	10							
		Waterleaking	10						0	
(52) Steel Beam/		Corrosion	10							
Truss Members		Cracking	10							
(Bracings, etc.)		Deformation/Buckling	10							
(Primary)		Abnormal Vibrations	10							
( )		Loose Connection	10							
		Paint Peel off	10						0	
(53) Shoe/Bearing	Steel	Corrosion	10			0				
(,		Loose Connection			0					<i>a</i> , , ,
		Abnormal Displacement				i				Clean around
		Bulaina/Rupture				<u> </u>				bearing
(Primarv)	Rubber	Bed (Support) Damage	10			1			0	
(54) Abutments	Concrete	Settlement	10			1				
(Primary)	Masonry	Movement	10							
	Others	Delamination	10							
		Scouring	10							
		Spalling, Scaling, Disintegration	10							
		Cracking concrete	10							
		Exposure/Corrosion of Reinf.	10							
		Honevcomb	10						0	
(55) Piers	Concrete	Settlement	10							
(Primarv)	Masonry	Movement	10							
(	Others	Delamination	10	0						
		Scouring	10							
		Spalling, Scaling, Disintegration	10			0				
		Cracking concrete	10		0	۲Ť-			1	
		Exposure/Corrosion of Reinf.	10		Ĕ				1	
		Honeycomh	10						0	
(56) Curb and Railing	Concrete	Cracking	5						v	
(Secondary)		Exposure/Corrosion of Reinf	5						1	
(Occondary)		Snalling	5					·····		
		Impact Damaged	5					·····	0	
1		mpact DamayCu	J					1		

Bridge Mer	mber			Dafaa		Severity	of Dama	ge	Pating of	Accumrated	
Company	Mataria		Type of Damages/	Raung	Good	Fair	Poor	Bad	damaga	Rating of	Remarks
Component	ivialeria			Score	0%	20%	50%	100%	uamaye	damage	
(57) Expansion Joint	Steel		Waterleaking	10				0			
(Primary)	(Primary) Others		Abnormal Space/Noise	10			0				
			Difference in elevation	10			1				
			Displacement				1				
			Cracking/Rupture				1			0	
(58) Painting Cond.	ng Cond.		Discoloration	10							
(Primary)			Rust	10			1				
			Exfoliation	10			1			0	
(59) Drainage Pipe	PVC		Clogged	5			0				
(Secondary)	Steel		Cracks	5			1				
			Others				1			0	
(60) Slope Protection	Gabions		Settlement	5							
(Secondary)	Others		Erossion	5			1				
			Scouring	5							
			Cracks	5			1				
			Others				T			0	
(61) Approach Road	Concrete		Cracking	5							
(Secondary)	Asphalt		Pot-holes	5							
			Others				1			0	
(62) River Condition			Scouring	5				0			
(Secondary)			Sedimentation	5			1				
			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.

	2	3	0	0	0	0	2	9	9	4	0	7	с	č	8	2	0	ŝ	
Others	1									1									
Bearing/ Expansion	12	18	12	9	12	9	9	6	15	3	3	0	0	3	0	3	9	21	
Substructure	3	3	12	0	15	9	9	6	3	15	9	9	0	9	9	9	6	6	
Superstructure	12	6	6	6	21	25	3	16	6	13	0	0	9	0	6	3	6	3	
Slab	6	3	3	9	6	9	3	9	9	9	0	6	6	3	12	12	15	0	: Urgent Repair
Total Score	45	36	36	21	57	43	20	46	39	51	6	22	18	15	35	26	42	36	
Bridge Name	Delpan Bridge	Jones Bridge	McArthur Bridge	Quezon Bridge	Ayala Bridge	Nagtahan Bridge	Pandacan Bridge	Lambingan Bridge	Makati-Mandaluyong Bridge	Guadalupe Bridge	C-5 Bridge	Bambang Bridge	Vargas Bridge-1	Vargas Bridge-2	Rosario Bridge	Marcos Bridge	Marikina Bridge	San Jose Bridge	
No.	1	2	31	4 (	5	9	7	8	6	10	11 (	12	13-1	13-2	14	15	16	17	

Table 12.1.1-1 Bridge Condition Based on Visual Inspection for Package-B
		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	Ι	-	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 12.1.1-2
 Major Defect Analysis for Each Bridge

	Evaluation Items	Max. Point	Delpan Bridge		Jones Bridge		McArthur Bridge	
Si	de ∕Under∕ On the road v	riew	Lide view		side view		tide view	
			Eader view		soler vare	when the		
			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	
	Construction Age &		Construction Year 1965 Seismic Design No Seismic Consideration		Construction Year 1948 Seismic Design No Seismic Consideration		Construction Year 1948 Seismic Design No Seismic Consideration	-
; (50)	Applied Design Specification	10	AASHTO Standard Specification (8th Edition) was applied	6	AASHTO Standard Specification (4th Edition) was applied	10	AASHTO Standard Specification (4th Edition) was applied	10
iical Factors	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.	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.	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.	9
Phy≋	Loading Capacity	5	Raung Score 45	0	20ton		20ton	
			Bridge is located in port area and road to access to	Ū	Bridge is located on arterial road to connect south and	Ľ	Bridge is located on arterial road to connect south and	Ť
	Bridge Importance	5	port. (Very Important)	5	north. (Important)	3	north. (Important)	3
c nce	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
Seismi erforma	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.	14
<u>а</u>	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
actors	Liquefaction	10	Liquefaction Potential : High	10	Liquefaction Potential : High	10	Liquefaction Potential : High	10
phical F (20)	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
Geogra	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 (Betrofitting)	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.	48

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

	Evaluation Items	Max. Point	Quezon Bridge		Ayala Bridge		Nagtahan Bridge		
si	te /linder/ On the road b	iew	side view		side view		ride view		
		NCW.	Euder tier		Exader view and the road view		where 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	_	
(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	
/sical Factors	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.	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	
РЧ	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	
c nce	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	
Seismi	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.	1 6	
<u>ц</u>	Type of Bridge	10	Arched Truss Bridge	6	Single Span Truss Bridge	10	Continuous Steel Truss Bridge	4	
actors	Liquefaction	10	Liquefaction Potential : High	10	Liquefaction Potential : High	10	Liquefaction Potential : High	10	
phical F (20)	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	
Geogra	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.	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.	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.	57	
			Continuous Maintenance		Reconstruction by Local Funds		Candidate for the Second Screening (retrofitting)		

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

	Evaluation Items	Max. Point	Pandacan Bridge		Lambingan Bridge		Makati-Mandaluyong Bridge		
Sid	le ∕Under∕ On the road v	view	side tiew		side tiew	ade view			
			under view on the read view		Ender view on the road view	substries and the			
			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	_	
	Construction Age &		Construction Year 1977 Seismic Design Seismic Design Force		Construction Year 1975 Seismic Design Seismic Design Force		Construction Year 1986 Seismic Design Seismic Design Force	-	
(20)	Applied Design Specification	10	AASHTO Standard Specification (11th Edition) was applied	6	AASHTO Standard Specification (11th Edition) was applied	6	AASHTO Standard Specification (13th Edition) was applied	6	
ical Factors	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.	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.	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.	9	
hys		-	Rating Score 20		Rating Score 46		Rating Score 39		
	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	
uce uce	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	
Seismi erforma	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	
ď	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	
actors	Liquefaction	10	Liquefaction Potential : High	10	Liquefaction Potential : Moderate	6	Liquefaction Potential : Moderate	6	
phical F. (20)	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	
Geogra,	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.	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.	73	Severe cracking on box girders is urgently maintained and lubber pads ruptured are replaced to adjust uneven level of carriageway.	49	
1			Fall Prevent Apparatus		Candidate for the Second Screening (Reconstruction)		Urgent Maintenance	1	

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

Side	>/Under/ On the road v	riew	side view		ade view		side view		
			Image: Control of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the sector of the				10.35		
			Construction Year 1962	_	Construction Year 1998	.7111	Construction Year 1991	10.331	
	Construction Age &	10	Seismic Design No seismic Consideration	10	Seismic Design R-Factor Based Design	2	Seismic Design Seismic Design Force		
(20)	Specification	10	AASHTO Standard Specification (11th Edition) was applied	10	AASHTO LRFD Specification (1st Edition) was applied	3	AASHTO Standard Specification (14th Edition) was applied	0	
al Factors (	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.	30	Some cracks on piers and waterleaking from a few expansion joints are observed but global bridge condition in very good.	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.	9	
Iysic		-	Rating Score 51	•	Rating Score 9	•	Rating Score 22		
à -	Loading Capacity	5	2Uton (	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	
c nce	Seating Length	10	a: Minimum Required Seating Length (AASHTO) : 52cm b: Minimum Required Seating Length (JRA): 88cm 1 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	
Seismi erforma	Fall Prevent Apparatus	10	Vertical restrainers are installed but not sufficient functions longitudinally. Especially, at hinge 1 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	
<u>م</u>	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	
actors	Liquefaction	10	Liquefaction Potential : Low (	3	Liquefaction Potential : Moderate	6	Liquefaction Potential : Moderate	6	
phical F (20)	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	
Geogra	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 8 Piers are damaged due to impact of ship.	85	Bridge is relatively good condition and to continue periodical maintenance especially for cracking and damaged railing due to impact of car.	23	Bridge is relatively good condition and to continue periodica maintenance especially for cracking and erosion of slope protection of left abutment.	39	

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

	Evaluation Items	Max. Point	Vargas Bridge - 1		Vargas Bridge - 2		Rosario Bridge			
Sic	le∕Under∕ On the road ∿	view	Sid View		Site Ver		Ede Ver			
			Under Vew		Differ Verse	Under View Circle Text				
			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			
			Construction Yea 1973		Construction Yea 1992		Construction Year 1952	_		
(20)	Applied Design Specification	10	AASHTO Standard Specification (10th Edition) was applied	6	AASHTO Standard Specification (14th Edition) was applied	6	AASHTO Standard Specification (5th Edition) was applied	10		
cal Factors	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.	0	Some cracks on piers and waterleaking from a few expansion joints are observed but global bridge condition in very good.	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.	9		
ysic			Rating Score 18		Rating Score 15		Rating Score 35			
à	Loading capacity	5	20ton	0	20ton		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		
c nce	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		
Seismi erforma	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		
а.	Type of Bridge	10	Continuous Steel I-Girder Bridge	4	Continuous PC Girder Bridge	4	Simple PC I-girder Bridge	10		
actors	Liquefaction	10	Liquefaction Potential : Moderate	6	Liquefaction Potential : Moderate	6	Liquefaction Potential : Moderate	6		
phical F (20)	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		
Geogra	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 12.1.1-7 Global Evaluation for Bridge Seismic Performance in 1st Screening of Package-B (5/6)

-						<u> </u>				
	Evaluation Items	Max. Point	Marcos Bridge		Marikina Bridge		San Jose Bridge			
Si	de ∕Under∕ On the road	view	sile view		Ade view	where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view         where view				
			when they are the stand years		uder view 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=19.1	m		
			Construction Year 1978		Construction Year 1980		Construction Year 1980			
(20)	Applied Design Specification	10	AASHTO Standard Specification (11th Edition) was applied	6	AASHTO Standard Specification (12th Edition) was applied	6	AASHTO Standard Specification (12th Edition) was applied	6		
ical Factors	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.	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 girde girders and piers are detected. Bearings are damaged.	18	Cracking & Scaling on PC girders and piers are observed. Steel bearings are severely corroded due to waterleaking fro from expansion joints. Local scoring is occurred around piers.	ər 9		
hys		_	Rating Score 26		Rating Score 42		Rating Score 36	+		
٩.	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		
c	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		
Seismi	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		
۵.	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		
actors	Liquefaction	10	Liquefaction Potential : Moderate	6	Liquefaction Potential : Moderate	6	Liquefaction Potential : Low	3		
phical F (20)	Soil Classification	5	AASHTO Classification : Type-III (JRA Classification : Type-II)	AASHTO Classification : Type-III 3 (JRA Classification : Type-II) 3			AASHTO Classification : Type-II (JRA Classification : Type-I)	2		
Geogra	Impact to Environment	5	Traffic disturbance and is considered for impact of environment	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.	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.	65	Bridge is relatively good condition and to continue periodica maintenance especially for cracking and scoring. Since longitudinal fall prevent apparatus is not provided, detail inspection is required in the second screening.	51		
1		1	Urgent Maintenance		Candidate for the Second Screening (Retrofitting)		Fall Prevent Apparatus			

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

#### 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.

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

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

Candidate for the Second Screening

			Physical Factors (5	i0)		Seismic I	Performance Fa	ctors (30)	Geog	graphical Factors	(20)			
No.	Name of Bridge	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	Total Rating	Recommended Method	
		(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	

Table 12.1.2-2	Results o	f Rating	Analysis in tl	he 1st Screen	ing	
						_

## 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

Bridge Mer	mber		Dating		Severity	of Dama	ge	Dating of	Accumrated	
Component	Motorial	Type of Damages/	Rating	Good	Fair	Poor	Bad	damaga	Rating of	Remarks
Component	wateriai	5. 0	Score	0%	30%	60%	100%	uamage	damage	
(50) Deck Slab	Concrete	Cracking	10	0				0		
(Primary)		Exposure/Corrosion of Rebars	10					0	1	
		Scaling/Spalling	10					0	1	
		Delamination	10					0		
		Honeycomb	10	0				0	1	
		Waterleaking	10					0	0	
(51) Concrete Beam/	Prestressed	Cracking	10			1		0		
Girder	Concrete	Exposure/Corrosion of Rebars	10	0				0		
(Primary)	Reinforced	Spalling, Scaling, Disintegration	10			<u> </u>		0		Black stain by fire at the concrete box
(	Concrete	Delamination	10		-			0		girder
		Honeycomb	10	0	-	-		0		
		Waterleaking	10		-			0	0	
(52) Steel Beam/	1	Corrosion	10	1				0		
Truss Members		Cracking	10					0		
(Bracings, etc.)		Deformation/Buckling	10					0		
(Primary)		Abnormal Vibrations	10		-			0		
(1.1.1.0.))		Loose Connection	10		-			0		
		Paint Peel off	10					0	0	
(53) Shoe/Bearing	Steel	Corrosion	10					0	-	
(00) 01100, 200111.9	Rubber	Loose Connection	10		+			0	1	
		Abnormal Displacement	10					0		
		Bulaing/Rupture	10		+			Ŭ 0		
(Primary)		Bed (Support ) Damage	10			1		0	0	
(54) Abutments	Concrete	Settlement	10		+			0		
(Primary)	Masonry	Movement	10					0		
(//////////////////////////////////////	Others	Delamination	10		-			0		
	0 11010	Scouring	10		-			0		
		Spalling, Scaling, Disintegration	10		-	-		0		
		Cracking concretre	10		+	<u> </u>		0		
		Exposure/Corrosion of Reinf.	10		-			Ő		
		Honeycomb	10		-			0	n	
(55) Piers	Concrete	Settlement	10		-	<u> </u>		ő	· ·	
(Job) Ficial (Drimary)	Masonry	Movement	10			<u> </u>		Ő		
(1 111121 y)	Othors	Delamination	10		-			0	-	
	Outers	Scouring	10					ŏ		Piers are coated with mortar;
		Spalling, Scaling, Disintegration	10		+			0		impossible to evaluate crack
		Cracking concrete	10		+			0		condition.
		Evposure/Corrosion of Reinf	10	<del> </del>	+	<del> </del>		0		
		Lapovcomb	10					0	0	
(E() Curb and Dailing	Concrete	Creeking	10					0	U	
(56) Curb and Railing	Concrete	Cracking	5			<u> </u>		0		
(Secondary)		Exposure/Corrosion of Reini.		——		<u> </u>	Ļ	U		
		Spalling	5	——		<u> </u>		U		
		Impact Damaged	5					0	0	

Bridge Mer	mber		Dating		Severity	of Dama	ge	Dating of	Accumrated	
Component	Matorial	Type of Damages/	Cooro	Good	Fair	Poor	Bad	damago	Rating of	Remarks
Component	Iviaterial		Score	0%	30%	60%	100%	uamaye	damage	
(57) Expansion Joint	Steel	Waterleaking	10				0	10		
(Primary)	Others	Abnormal Space/Noise	10					0		
		Difference in elevation	10					0		
		Displacement	10					0		
		Cracking/Rupture	10		0			3	13	
(58) Painting Cond.		Discoloration	10					0		
(Primary)		Rust	10					0	1	
		Exfoliation	10					0	0	
(59) Drainage Pipe	PVC	Clogged	5		0			2		
(Secondary)	Steel	Cracks	5					0		Small drainage holes:stuffed
		Others							2	onnan alamago noios,sianoa
(60) Slope Protection	Gabions	Settlement	5					0		
(Secondary)	Others	Erossion	5					0		A1/D) Databaga Mall
		Scouring	5					0		A1(R):Retaining Wall
		Cracks	5					0		rr(E).masoniy Embankinen
		Others							0	
(61) Approach Road	Concrete	Cracking	5					0		
(Secondary)	Asphalt	Pot-holes	5					0		
		Others							0	
(62) River Condition		Scouring	5					0		
(Secondary)		Sedimentation	5	0				0	1	Debris flow between P1& P2, P5 & P6
		Others							0	
63) Total Condition Rating			540						15	

# 2) Buntun Bridge

Bridge Me	mber		Dating		Severity	of Dama	ge	Pating of	Accumrated	
Component	Matorial	Type of Damages/	Scoro	Good	Fair	Poor	Bad	damago	Rating of	Remarks
Component	Wateria		Score	0%	30%	60%	100%	uanaye	damage	
(50) Deck Slab	Concrete	Cracking	10	0				0		
(Primary)		Exposure/Corrosion of Rebars	10					0		
		Scaling/Spalling	10					0		
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10		0			3	3	
(51) Concrete Beam/	Prestressed	Cracking	10					0		
Girder	Concrete	Exposure/Corrosion of Rebars	10					0		
(Primary)	Reinforced	Spalling, Scaling, Disintegration	10					0		
, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Concrete	Delamination	10					0		
	- ·	Honeycomb	10					0		
		Waterleaking	10					0	0	
(52) Steel Beam/		Corrosion	10					0		
Truss Members		Cracking	10					0		
(Bracings, etc.)		Deformation/Buckling	10	0				0		
(Primarv)		Abnormal Vibrations	10			0		6		
		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				0		
		Bulging/Rupture	10					0		
(Primarv)		Bed (Support ) Damage	10					0	0	
(54) Abutments	Concrete	Settlement	10					0		
(Primary)	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		
		Honevcomb	10					0	0	
(55) Piers	Concrete	Settlement	10					0		
(Primary)	Masonry	Movement	10					0		
(, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Others	Delamination	10					0		
		Scouring	10		0			3		
		Spalling, Scaling, Disintegration	10					0		
		Cracking concrete	10		0			3		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	6	
(56) Curb and Pailing	Concrete	Cracking	5	I				1 0		1
(Socondary)	Solicicic	Exposure/Corrosion of Reinf	5	l				n n		
(Secondary)	1	Spalling	5	I						
	1	Impact Damaged	5	I				2	2	
								• •		

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

## 3) Lucban Bridge

н	STRUCTURAL	CONDITIONS OF	BRIDGE	COMPONENTS
	JINUCIUNAL	COMDITIONS OF	DIVIDUE	COMPONENTS

Bridge Mer	mber		Dating		Severity	of Dama	qe	Detine	Accumrated	
Component	Matarial	Type of Damages/	Rauny	Good	Fair	Poor	Bad	Rating or	Rating of	Remarks
Component	waterial	5.	Score	0%	30%	60%	100%	damage	damage	
(50) Deck Slab	Concrete	Cracking	10					0		
(Primary)		Exposure/Corrosion of Rebars	10					0		
		Scaling/Spalling	10	0				0		
		Delamination	10					0		
		Honeycomb	10		0			3		
		Waterleaking	10		0			3	6	
(51) Concrete Beam/	Prestressed	Cracking	10					0		
Girder	Concrete	Exposure/Corrosion of Rebars	10					0		
(Primary)	Reinforced	Spalling, Scaling, Disintegration	10					0		
(1 111111))	Concrete	Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10					0	0	
(52) Steel Beam/		Corrosion	10		0			3		
Truss Members		Cracking	10					0		
(Bracings etc.)		Deformation/Buckling	10					0		
(Drimary)		Abnormal Vibrations	10					Ő		
(i iiiidi y)		Loose Connection	10					0		
		Paint Peel off	10		0			3	6	
(53) Shoe/Bearing	Steel	Corrosion	10		ŏ			3	· ·	
(55) Shoc/Dearing	Rubber	Loose Connection	10					n n		
	Rubbei	Abnormal Displacement	10		0			3		
		Bulging/Runture	10		- <b>-</b>			0		
(Drimary)		Bed (Support ) Damage	10	0				0	6	
(54) Abutments	Concrete	Settlement	10	- <b>-</b>				0	· ·	
(Primary)	Masonry	Movement	10					0		
(i iiiidi y)	Others	Delamination	10					0		
	Outers	Scouring	10					0		
		Spalling, Scaling, Disintegration	10			0		6		
		Cracking concretre	10					0		
		Exposure/Corrosion of Reinf	10					0		
		Honeycomb	10					0	6	
(55) Diore	Concrete	Settlement	10					0		
(JJ) FIELS	Maconny	Movement	10							
(Philidiy)	Othors	Delamination	10							
	Others	Scouring	10							
		Scouling Scaling Disintegration	10							
		Spanning, Scanny, Disintegration	10							
		Cracking concrete	10					0		
		Exposure/Corrosion of Reinf.	10					U	_	
	-	Honeycomb	10					0	0	
(56) Curb and Railing	Concrete	Cracking	5			0		3		
(Secondary)		Exposure/Corrosion of Reinf.	5					0		
		Spalling	5					0		
	1	Impact Damaged	5					0	3	

Bridge Mer	mber		Dating		Severity	of Dama	ge	Dether	Accumrated	
Component	Motorial	Type of Damages/	Rating	Good	Fair	Poor	Bad	Rating or	Rating of	Remarks
Component	watena		Score	0%	30%	60%	100%	uamage	damage	
(57) Expansion Joint	Steel	Waterleaking	10				0	10		
(Primary)	Others	Abnormal Space/Noise	10	0				0		
		Difference in elevation	10					0		
		Displacement	10					0		
		Cracking/Rupture	10					0	10	
(58) Painting Cond.		Discoloration	10					0		
(Primary)		Rust	10		0			3		
		Exfoliation	10		0			3	6	
(59) Drainage Pipe	PVC	Clogged	5					0		
(Secondary)	Steel	Cracks	5					0		
		Others							0	
(60) Slope Protection	Gabions	Settlement	5					0		
(Secondary)	Others	Erossion	5					0		
		Scouring	5					0		
		Cracks	5			0		3		
		Others							3	
(61) Approach Road	Concrete	Cracking	5					0		
(Secondary)	Asphalt	Pot-holes	5					0		
		Others							0	
(62) River Condition		Scouring	5					0		
(Secondary)		Sedimentation	5					0		
		Others							0	
(63) Total Condition Ra	ating		<i>540</i>						46	

## 4) Magapit Bridge

Bridge Mer	mber		Dating		Severity	of Dama	ge	Dating of	Accumrated	
Common and	Matadal	Type of Damages/	Rating	Good	Fair	Poor	Bad	Rating of	Rating of	Remarks
Component	waterial	5. 0	Score	0%	30%	60%	100%	damage	damage	
(50) Deck Slab	Concrete	Cracking	10		0			3		
(Primary)		Exposure/Corrosion of Rebars	10					0	1	
		Scaling/Spalling	10					0	1	
		Delamination	10					0	1	
		Honeycomb	10					0	1	
		Waterleaking	10					0	3	
(51) Concrete Beam/	Prestressed	Cracking	10					0		
Girder	Concrete	Exposure/Corrosion of Rebars	10					0		
(Primary)	Reinforced	Spalling, Scaling, Disintegration	10					0		
(i iiiidi y)	Concrete	Delamination	10					0		
		Honeycomb	10					Ő		
		Waterleaking	10					0 0	0	
(52) Steel Beam/		Corrosion	10		0			3	v	
Truss Members		Cracking	10		<u> </u>			Ő		
(Bracings etc.)		Deformation/Buckling	10					0		
(Drimony)		Abnormal Vibrations	10					0		
(FTIITIALY)		Loose Connection	10		0			2		
		Daint Dool off	10		× ×			2	0	
(E2) Shoo/Dooring	Stool	Corrosion	10		<b>U</b>			0	,	
(33) SHOE/Dealing	Dubbor	Loose Connection	10					0		
	Rubbei	Abpormal Displacement	10	-	0			2		
		Abriorital Displacement	10		<u> </u>			0		
(Drim on d		Bulging/Ruplure	10					0	2	
(P1IIIdIy)	Conorata	Settlement	10					0	3	
(54) ADUIMENIS	Concrete	Movement	10					0		
(Philidiy)	Othors	Delamination	10					0		
	Others	Scouring	10					0		
		Spalling Scaling Disintogration	10					0		
		Cracking concrete	10					0		
		Cracking Concretien	10					0		
		Exposure/Corrosion or Reini.	10					0		
		Honeycomb	10	0				0	0	
(55) Piers	Concrete	Settlement	10					0		
(Primary)	Masonry	Novement	10					U		
	Others	Delamination	10					U		
		Scouring	10					U		
		Spalling, Scaling, Disintegration	10					0		
		Cracking concrete	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	0	
(56) Curb and Railing	Concrete	Cracking	5					0		
(Secondary)		Exposure/Corrosion of Reinf.	5					0		
		Spalling	5					0		
1		Impact Damaged	5					0	0	

Bridge Mer	nber		Dating		Severity	of Dama	ge	Dating of	Accumrated	
Component	Matorial	Type of Damages/	Score	Good	Fair	Poor	Bad	Rating U	Rating of	Remarks
Component	iviaterial		Score	0%	30%	60%	100%	uamaye	damage	
(57) Expansion Joint	Steel	Waterleaking	10			0		6		
(Primary)	Others	Abnormal Space/Noise	10					0		
		Difference in elevation	10					0		
		Displacement	10					0		
		Cracking/Rupture	10					0	6	
(58) Painting Cond.		Discoloration	10					0		
(Primary)		Rust	10					0		
		Exfoliation	10		0			3	3	
(59) Drainage Pipe	PVC	Clogged	5					0		
(Secondary)	Steel	Cracks	5					0		
		Others							0	
(60) Slope Protection	Gabions	Settlement	5					0		
(Secondary)	Others	Erossion	5					0	1	
		Scouring	5					0		
		Cracks	5			0		3		
		Others							3	
(61) Approach Road	Concrete	Cracking	5					0		
(Secondary)	Asphalt	Pot-holes	5					0		
		Others							0	
(62) River Condition		Scouring	5					0		
(Secondary)		Sedimentation	5					0		
		Others							0	
(63) Total Condition Ra	ating		540						27	

# 5) Sicsican Bridge

Bridge Mer	mber				Severity	of Dama	qe			
¥			Rating				Ĭ	Rating of	Accumrated	
Component	Material	Type of Damages/	Score	Good	Fair	Poor	Bad	damage	Rating of	Remarks
oomponone	matorial		00010	0%	30%	60%	100%	5-	damage	
(50) Deck Slab	Concrete	Cracking	10					0		Cast in place deak dab at sidewalk
(Primary)		Exposure/Corrosion of Rebars	10	0				0		Casi-III-place deck slab at sidewalk
(, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		Scaling/Spalling	10	-				0		Replacement of the deck slab with the
		Delamination	10					0		precast deck slab
		Honevcomb	10					0		, at carriageway
		Waterleaking	10		0			3	3	
(51) Concrete Beam/	Prestressed	Cracking	10					0	-	
Girder	Concrete	Exposure/Corrosion of Rebars	10					0		
(Primary)	Reinforced	Spalling, Scaling Disintegration	10					0		
(i iiiidi y)	Concrete	Delamination	10					0		
		Honeycomb	10					Ő		
		Waterleaking	10					0	0	
(52) Steel Beam/		Corrosion	10	0				Ő		
Truss Members		Cracking	10					0		
(Bracings, etc.)		Deformation/Buckling	10		0			3		
(Primary)		Abnormal Vibrations	10		ŏ			3		
(, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		Loose Connection	10					0		
		Paint Peel off	10	0				0	6	
(53) Shoe/Bearing	Steel	Corrosion	10					0		
(00) onoo, boaring	Rubber	Loose Connection	10					0		
		Abnormal Displacement	10		0			3		Debris flow around bearings of A2
		Bulaina/Rupture	10					0		<b>.................................................................................................................................................................................................................................................................................................................</b> <i>.</i> <b>.</b> <i>.</i> <b>.</b> <i>.</i> <b>.</b> <i>.</i> <b>.</b> <i>..</i> <b>.</b> <i>.</i> <b>.</b> <i>..</i> <b>.</b> <i>.</i> <b>.</b> <i>..</i> <b>.</b> <i>..</i> <b>.</b> <i>..</i> <b>.</b> <i>.</i> <b>.</b> <i>..</i> <b>.</b> <i>..</i> <b>.</b> <i>.</i> <b>.</b> <i>..</i> <b>.</b> <i>..</i> <b>.</b> <i>.</i> <b>.</b> <i>..</i> <b>.</b> <i>...</i> <b>.</b> <i>..</i> <b>.</b> <i>.</i> <b>.</b> <i>..</i> <b>.</b> <i>..</i> <b>.</b> <i>.</i> <b>.</b> <i>..</i> <b>.</b> <i>....</i> <b>.</b> <i>.</i> <b>.</b> <i>.</i> <b>.</b> <i>..............</i>
(Primary)		Bed (Support ) Damage	10	0				0	3	
(54) Abutments	Concrete	Settlement	10					0		
(Primarv)	Masonry	Movement	10					0	1	
	Others	Delamination	10					0	1	
		Scouring	10		0			3	1	Maior cracks (over 1mm in width) &
		Spalling, Scaling, Disintegration	10					0	1	scouring at A1
		Cracking concretre	10				0	10	1	
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10					0	13	
(55) Piers	Concrete	Settlement	10					0		
(Primary)	Masonry	Movement	10					0		
. , ,,	Others	Delamination	10					0	1	
		Scouring	10					0	1	
		Spalling, Scaling, Disintegration	10					0	1	
		Cracking concrete	10					0		
		Exposure/Corrosion of Reinf.	10					0	1	
		Honevcomb	10					0	0	
(56) Curb and Railing	Concrete	Cracking	5				1	0		1
(Secondary)		Exposure/Corrosion of Reinf.	5					0	1	
(0000/100/1)		Spalling	5					0	1	
		Impact Damaged	5		0			2	2	

Bridge Member			Pating	• •	Severity	of Dama	ge	Dating of	Accumrated	
Component	Matorial	Type of Damages/	Score	Good	Fair	Poor	Bad	damago	Rating of	Remarks
Component	Iviaterial		Score	0%	30%	60%	100%	uamaye	damage	
(57) Expansion Joint	Steel	Waterleaking	10			0		6		
(Primary)	Others	Abnormal Space/Noise	10					0		
		Difference in elevation	10					0		
		Displacement	10					0		
		Cracking/Rupture	10					0	6	
(58) Painting Cond.		Discoloration	10					0		
(Primary)		Rust	10					0		
		Exfoliation	10					0	0	
(59) Drainage Pipe	PVC	Clogged	5					0		
(Secondary)	Steel	Cracks	5					0		
		Others							0	
(60) Slope Protection	Gabions	Settlement	5					0		
(Secondary)	Others	Erossion	5					0	1	
		Scouring	5					0	1	
		Cracks	5					0	1	
		Others							0	
(61) Approach Road	Concrete	Cracking	5					0		
(Secondary)	Asphalt	Pot-holes	5					0		
		Others							0	
(62) River Condition		Scouring	5		0			2		
(Secondary)		Sedimentation	5					0	1	
		Others							2	
(63) Total Condition Ra	ating		540						35	

## 6) Bamban Bridge

Bridge Me	mber				Severity	of Dama	qe			
		Turne of Demonstration	Rating		T Ó		Ĭ	Rating of	Accumrated	Demeric
Component	Material	Type of Damages/	Score	Good	Fair	Poor	Bad	damage	Rating of	Remarks
				0%	30%	60%	100%	Ĩ	damage	
(50) Deck Slab	Concrete	Cracking	10					0		
(Primary)		Exposure/Corrosion of Rebar	s <b>10</b>					0	1	
. ,,		Scaling/Spalling	10					0		
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10					0	0	
(51) Concrete Beam/	Prestressed	Cracking	10					0		
Girder	Concrete	Exposure/Corrosion of Rebar	s <u>10</u>					0	1	
(Primary)	Reinforced	Spalling, Scaling, Disintegration	n <i>10</i>					0		
(	Concrete	Delamination	10					0		
		Honevcomb	10					0		
		Waterleaking	10					0	0	
(52) Steel Beam/		Corrosion	10		0			3		
Truss Members		Cracking	10					0		
(Bracings, etc.)		Deformation/Buckling	10					0	1	
(Primarv)		Abnormal Vibrations	10					0	1	
		Loose Connection	10		0			3	1	
		Paint Peel off	10					0	6	
(53) Shoe/Bearing	Steel	Corrosion	10					0		
()g	Rubber	Loose Connection	10					0		
		Abnormal Displacement	10					0	1	
		Bulging/Rupture	10					0	1	
(Primarv)		Bed (Support ) Damage	10					0	0	
(54) Abutments	Concrete	Settlement	10					0		
(Primarv)	Masonry	Movement	10					0	1	
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling, Disintegration	n <u>10</u>					0	1	
		Cracking concretre	10		0			3	1	
		Exposure/Corrosion of Reinf.	10					0	1	
		Honevcomb	10					0	3	
(55) Piers	Concrete	Settlement	10					0		
(Primarv)	Masonry	Movement	10					0	1	
	Others	Delamination	10					0	1	
		Scouring	10					0	1	
		Spalling, Scaling, Disintegration	n <u>10</u>					0	1	
		Cracking concrete	10					0		
		Exposure/Corrosion of Reinf.	10					0	1	
		Honeycomb	10					0	0	
(56) Curb and Railing	Concrete	Cracking	5	1	1	1		0	-	
(Secondary)	2 31101 010	Exposure/Corrosion of Reinf.	5					Ŏ	1	
(Secondary)		Spalling	5					0	1	
		Impact Damaged	5	1	0	1		2	2	

Bridge Mer	mber			Dating		Severity	of Dama	ge	Doting of	Accumrated	
Component	Matoria	1	Type of Damages/	Cooro	Good	Fair	Poor	Bad	Rating O	Rating of	Remarks
Component	Wateria			Score	0%	30%	60%	100%	uamaye	damage	
(57) Expansion Joint	Steel		Waterleaking	10					0		
(Primary)	Others		Abnormal Space/Noise	10					0		
			Difference in elevation	10					0		
			Displacement	10					0		
			Cracking/Rupture	10					0	0	
(58) Painting Cond.			Discoloration	10					0		
(Primary)			Rust	10					0		
			Exfoliation	10					0	0	
(59) Drainage Pipe	PVC		Clogged	5					0		
(Secondary)	Steel		Cracks	5					0		
			Others							0	
(60) Slope Protection	Gabions		Settlement	5					0		
(Secondary)	Others		Erossion	5					0		
			Scouring	5					0		
			Cracks	5					0		
			Others							0	
(61) Approach Road	Concrete		Cracking	5					0		
(Secondary)	Asphalt		Pot-holes	5					0		
			Others							0	
(62) River Condition			Scouring	5					0		
(Secondary)			Sedimentation	5					0		
			Others							0	
(63) Total Condition Ra	ating			540						11	

# 7) 1st Mandaue-Mactan Bridge

Bridge Me	mber				Severity	of Dama	ge		Accumrated	
		Tupo of Domogood	Rating					Rating of	Accumitated	Domarka
Component	Material	Type of Damages/	Score	Good	Fair	Poor	Bad	damage	Rating of	Rellidiks
				0%	30%	60%	100%		damage	
(50) Deck Slab	Concrete	Cracking	10			1		0		
(Primarv)		Exposure/Corrosion of Rebars	10		0			3		
		Scaling/Spalling	10					0	1	Rebar exposure due to spalling at the
		Delamination	10					0		overhanging deck slab (A2 side)
		Honeycomb	10					0		
		Waterleaking	10		0			3	6	
(51) Concrete Beam/	Prestressed	Cracking	10					0		
Girder	Concrete	Exposure/Corrosion of Rebars	10					0		
(Primary)	Reinforced	Spalling, Scaling Disintegration	10					0		
(i i iiiiai y)	Concrete	Delamination	10					0		
	Condicio	Honeycomb	10					0		
		Waterleaking	10					0	n	
(52) Steel Beam/		Corrosion	10		0			3	•	
Truss Members		Cracking	10		ŏ			3		
(Bracings etc.)		Deformation/Buckling	10		- <b>·</b>			0		
(Primary)		Abnormal Vibrations	10					0		
(i iiiiaiy)		Loose Connection	10					0		
		Paint Peel off	10					0	6	
(53) Shoo/Boaring	Steel	Corrosion	10	0				0		
(55) Shoe/Bearing	Dubbor	Loose Connection	10	- <u> </u>				0		
	Rubbel	Abnormal Displacement	10					0		
		Bulging/Runture	10					0		
(Drimany)		Bed (Support ) Damage	10					0	0	
(54) Abutmonts	Concrete	Settlement	10	- ×				0	•	
(J4) Abuinenis	Maconny	Movement	10					0	1	
(Filinary)	Othors	Delamination	10					0		
	Outers	Scouring	10					0		
		Spalling Scaling Disintegration	10					0		
		Cracking concretre	10					3		
		Exposure/Corrosion of Reinf	10		- <b>v</b>			0		
		Honovcomb	10					0	2	
(55) Diore	Concroto	Settlement	10					0	5	
(JJ) FIELS	Macoppy	Movement	10					0		
(Filinary)	Othors	Delamination	10					0		
	Others	Scouring	10					0		
		Scoling Scaling Disintogration	10	- <u> </u>				0		
		Cracking concrete	10					0	-	
		Exposure/Corresion of Point	10				0	10		
	1	Laposuce/Corrosion or Rellin.	10				- U	0	10	
(E() Queb and D. "	Conorata	nuneycomp Graaking	10	l				U	10	
(56) Curb and Railing	Concrete		5	I						
(Secondary)	1	Exposure/Corrosion or Reint.	2					U	1	
	1	Spailing	5					U		
1	1	Impact Damaged	5	1	1	1	1	1 0		1

Bridge Mer	nber		Dating		Severity	of Dama	ge	Dether of	Accumrated	
Component	Motorial	Type of Damages/	Raing	Good	Fair	Poor	Bad	Rating of	Rating of	Remarks
Component	wateria	51 0	Score	0%	30%	60%	100%	damage	damage	
(57) Expansion Joint	Steel	Waterleaking	10				0	10		
(Primary)	Others	Abnormal Space/Noise	10					0		
		Difference in elevation	10					0		
		Displacement	10					0		
		Cracking/Rupture	10	0				0	10	
(58) Painting Cond.		Discoloration	10					0		
(Primary)		Rust	10					0		
		Exfoliation	10	0				0	0	
(59) Drainage Pipe	PVC	Clogged	5					0		
(Secondary)	Steel	Cracks	5					0		
		Others							0	
(60) Slope Protection	Gabions	Settlement	5					0		
(Secondary)	Others	Erossion	5					0		
		Scouring	5					0		
		Cracks	5					0		
		Others							0	
(61) Approach Road	Concrete	Cracking	5					0		
(Secondary)	Asphalt	Pot-holes	5					0		
		Others							0	
(62) River Condition		Scouring	5					0		
(Secondary)		Sedimentation	5					0		
		Others							0	
(63) Total Condition Ra	ating		<i>540</i>						35	

# 8) Marcelo Ferman Bridge

Bridge Me	mber				Severity	of Dama	qe			
Component	Material	Type of Damages/	Rating	Good	Fair	Poor	Bad	Rating of	Accumrated Rating of	Remarks
Component	Wateria		50010	0%	30%	60%	100%	damage	damage	
(50) Deck Slab	Concrete	Cracking	10					0		
(Primary)		Exposure/Corrosion of Reba	rs 10					0		
(, , , , , , , , , , , , , , , , , , ,		Scaling/Spalling	10					0		
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10					0	0	
(51) Concrete Beam/	Prestressed	Cracking	10					0		
Girder	Concrete	Exposure/Corrosion of Reba	rs 10					0		
(Primary)	Reinforced	Spalling, Scaling, Disintegrati	on <u>10</u>					0		
(, , , , , , , , , , , , , , , , , , ,	Concrete	Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10					0	0	
(52) Steel Beam/		Corrosion	10					0		
Truss Members		Cracking	10					0		
(Bracings, etc.)		Deformation/Buckling	10					0		
(Primary)		Abnormal Vibrations	10					0		
. ,,		Loose Connection	10			1		0		
		Paint Peel off	10					0	0	
(53) Shoe/Bearing	Steel	Corrosion	10					0		
., ,	Rubber	Loose Connection	10			1		0		
		Abnormal Displacement	10					0		
		Bulging/Rupture	10			1		0		
(Primary)		Bed (Support ) Damage	10			1		0	0	
(54) Abutments	Concrete	Settlement	10					0		
(Primary)	Masonry	Movement	10					0	1	
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling, Disintegrati	on <u>10</u>					0		
		Cracking concretre	10					0		
		Exposure/Corrosion of Reinf	10					0		
		Honeycomb	10					0	0	
(55) Piers	Concrete	Settlement	10					0		
(Primary)	Masonry	Movement	10					0		
	Others	Delamination	10					0		Hanycomb & cracks at piers
		Scouring	10					0		Cracking at pylons
		Spalling, Scaling, Disintegrati	on <u>10</u>					0		(considered to be alkali - aggregate
		Cracking concrete	10		0			3		reaction)
		Exposure/Corrosion of Reinf	10					0		
		Honeycomb	10	0				0	3	
(56) Curb and Railing	Concrete	Cracking	5					0		
(Secondary)		Exposure/Corrosion of Reinf	5					0	]	
		Spalling	5					0	1	
	1	Impact Damaged	5	1		1	1	0	1 0	

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

## 9) Palanit Bridge

Bridge Mer	mber				Severity	of Dama	ge		Annuality	
Component	Material	Type of Damages/	Rating Score	Good	Fair 30%	Poor 60%	Bad	Rating of damage	Accumrated Rating of damage	Remarks
(50) Deck Slah	Concrete	Cracking	10	070	3070	0070	00%	10		
(Primary)	001101010	Exposure/Corrosion of Rebars	10		0			3		
(i iiiidi y)		Scaling/Spalling	10		-		0	10		
		Delamination	10					0		
		Honeycomb	10	-				0		
		Waterleaking	10			0		6	29	
(51) Concrete Beam/	Prestressed	Cracking	10			- <b>-</b>		0		
Girder	Concrete	Exposure/Corrosion of Rebars	10					0		
(Primary)	Reinforced	Spalling, Scaling Disintegration	10					0		
(i iiiidi y)	Concrete	Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10					0	0	
(52) Steel Beam/		Corrosion	10		0			3		
Truss Members		Cracking	10	0				0		
(Bracings, etc.)		Deformation/Buckling	10	ŏ				0		
(Primary)		Abnormal Vibrations	10	-				0		Main span
(		Loose Connection	10					0		
		Paint Peel off	10					0	3	
(53) Shoe/Bearing	Steel	Corrosion	10		0			3		
(,g	Rubber	Loose Connection	10					0	1	
		Abnormal Displacement	10					0		
		Bulging/Rupture	10					0		
(Primary)		Bed (Support ) Damage	10					0	3	
(54) Abutments	Concrete	Settlement	10					0		
(Primary)	Masonry	Movement	10					0	1	
	Others	Delamination	10					0		
		Scouring	10					0	1	
		Spalling, Scaling, Disintegration	10					0		
		Cracking concretre	10					0		
		Exposure/Corrosion of Reinf.	10					0	1	
		Honeycomb	10					0	0	
(55) Piers	Concrete	Settlement	10					0		
(Primary)	Masonry	Movement	10					0	1	
	Others	Delamination	10					0	1	
		Scouring	10					0		
		Spalling, Scaling, Disintegration	10					0		
		Cracking concrete	10					0		
		Exposure/Corrosion of Reinf.	10					0	1	
		Honeycomb	10					0	0	
(56) Curb and Railing	Concrete	Cracking	5					0		
(Secondary)		Exposure/Corrosion of Reinf.	5					0	1	
		Spalling	5					0	1	
		Impact Damaged	5					0	0	

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

# 10) Jibatang Bridge

Bridge Me	mber					Severity	of Dama	ge	1		
			Type of Damages/	Rating				ľ	Rating of	Rating of	Remarks
Component	Material		1 Jpo of Damagoor	Score	Good	Fair	Poor	Bad	damage	damage	Romano
	Conorata	-	Creeking	10	0%	30%	60%	100%			
(50) Deck Slab	Concrete		Cracking	10							
(Primary)			Exposure/Corrosion or Rebars	10					0	-	
			Scaling/Spalling	10		0			3	-	Section loss due to spalling at the end
			Delamination	10					0	-	OI DECK SIAD
			Honeycomb	10					0	_	
(		_	Waterleaking	10					0	3	
(51) Concrete Beam/	Prestressed		Cracking	10					0		
Girder	Concrete		Exposure/Corrosion of Rebars	10					0		
(Primary)	Reinforced		Spalling, Scaling, Disintegration	10					0		
	Concrete		Delamination	10					0		
			Honeycomb	10					0		
			Waterleaking	10					0	0	
(52) Steel Beam/			Corrosion	10			0		6		
Truss Members			Cracking	10					0		
(Bracings, etc.)			Deformation/Buckling	10					0		
(Primary)			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		
(Primarv)			Bed (Support ) Damage	10					0	0	
(54) Abutments	Concrete		Settlement	10					0		
(Primarv)	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		6	6	
(55) Piers	Concrete		Settlement	10			- <b>-</b>		0		
(Primary)	Masonry		Movement	10					0		
(i minary)	Others		Delamination	10					0		
	Outers		Scouring	10					0	-	
			Spalling Scaling Disintegration	10			0		6	-	
			Cracking concrete	10			- <b>-</b>			-	
			Exposure/Corresion of Point	10						-	
				10			+				
(F() Quebers d.D. "	Conorate		Honeycomb	10						0	
(56) Curb and Railing	Concreté	I		5						-	
(Secondary)			Exposure/Corrosion or Reint.	2 F						4	
			Spailing	5				L			
1	1		Impact Damaged	5	1	1	1	1	0	0	1

Bridge Mer	mber			Dating		Severity	of Dama	ge	Dating of	Accumrated	
Component	Motorio		Type of Damages/	Caara	Good	Fair	Poor	Bad	Rating Or	Rating of	Remarks
Component	Wateria	1		Score	0%	30%	60%	100%	uamaye	damage	
(57) Expansion Joint	Steel		Waterleaking	10			0		6		
(Primary)	Others		Abnormal Space/Noise	10					0		
			Difference in elevation	10					0		
			Displacement	10					0		
			Cracking/Rupture	10		0			3	9	
(58) Painting Cond.			Discoloration	10					0		
(Primary)			Rust	10					0		
			Exfoliation	10					0	0	
(59) Drainage Pipe	PVC		Clogged	5					0		
(Secondary)	Steel		Cracks	5					0		
			Others							0	
(60) Slope Protection	Gabions		Settlement	5					0		
(Secondary)	Others		Erossion	5					0		
			Scouring	5					0		
			Cracks	5		0			2		
			Others							2	
(61) Approach Road	Concrete		Cracking	5					0		
(Secondary)	Asphalt		Pot-holes	5					0		
			Others							0	
(62) River Condition			Scouring	5					0		
(Secondary)			Sedimentation	5					0		
			Others							0	
(63) Total Condition Ra	ating			540						32	

# 11) Mawo Bridge

Bridge Mer	mber					Severity	of Dama	qe			
			<b>T</b> (D )	Rating		L Ó		Ĭ	Rating of	Accumrated	
Component	Materia		Type or Damages/	Score	Good	Fair	Poor	Bad	damage	Rating of	Remarks
					0%	30%	60%	100%	Ů	damage	
(50) Deck Slab	Concrete		Cracking	10					0		
(Primary)			Exposure/Corrosion of Rebars	10		0			3	1	
			Scaling/Spalling	10		0			3		
			Delamination	10					0		
			Honeycomb	10		0			3		
			Waterleaking	10		0			3	12	
(51) Concrete Beam/	Prestressed		Cracking	10					0		
Girder	Concrete		Exposure/Corrosion of Rebars	10					0		
(Primary)	Reinforced		Spalling, Scaling, Disintegration	10					0		
, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Concrete		Delamination	10					0		
			Honeycomb	10					0		
			Waterleaking	10					0	0	
(52) Steel Beam/			Corrosion	10			0		6		
Truss Members			Cracking	10					0		
(Bracings, etc.)			Deformation/Buckling	10					0		
(Primary)			Abnormal Vibrations	10		0			3		
			Loose Connection	10					0		
			Paint Peel off	10		0			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	Concrete		Settlement	10					0		
(Primary)	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	Concrete		Settlement	10					0		
(Primary)	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	Concrete		Cracking	5					0		
(Secondary)		-	Exposure/Corrosion of Reinf.	5					0	1	
			Spalling	5					0	1	
			Impact Damaged	5		0			2	2	

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

# 12) Biliran Bridge

Bridge Mer	mber				Severity	of Dama	qe			
¥			Rating				Ĭ	Rating of	Accumrated	
Component	Material	Type of Damages/	Score	Good	Fair	Poor	Bad	damage	Rating of	Remarks
				0%	30%	60%	100%	Ű	damage	
(50) Deck Slab	Concrete	Cracking	10					0		
(Primary)		Exposure/Corrosion of Rebars	10		0			3	1	
, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		Scaling/Spalling	10					0		
		Delamination	10					0		Overnanging deck slab
		Honeycomb	10		0			3	1	
		Waterleaking	10		0			3	9	
(51) Concrete Beam/	Prestressed	Cracking	10					0		
Girder	Concrete	Exposure/Corrosion of Rebars	10					0	1	
(Primary)	Reinforced	Spalling, Scaling, Disintegration	10					0		
(	Concrete	Delamination	10					0		
		Honevcomb	10					0		
		Waterleaking	10					0	0	
(52) Steel Beam/		Corrosion	10		0			3		
Truss Members		Cracking	10					0	1	
(Bracings, etc.)		Deformation/Buckling	10	0				0		
(Primary)		Abnormal Vibrations	10					0		
, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		Loose Connection	10					0	1	
		Paint Peel off	10					0	3	
(53) Shoe/Bearing	Steel	Corrosion	10		0			3		
, , , , , , , , , , , , , , , , , , ,	Rubber	Loose Connection	10					0		
		Abnormal Displacement	10					0		
		Bulging/Rupture	10					0	1	
(Primary)		Bed (Support ) Damage	10					0	3	
(54) Abutments	Concrete	Settlement	10					0		
(Primary)	Masonry	Movement	10					0	1	
	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	Concrete	Settlement	10		0			3		
(Primary)	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		Sottlement at B2
		Spalling, Scaling, Disintegration	10					0		Semement at PS
		Cracking concrete	10					0		
		Exposure/Corrosion of Reinf.	10					0		
		Honeycomb	10	0				0	3	
(56) Curb and Railing	Concrete	Cracking	5					0		
(Secondary)		Exposure/Corrosion of Reinf.	5					0	]	
		Spalling	5					0	1	
1	1	Impact Damaged	5					0	0	

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

## **13)** San Juanico Bridge

Bridge Mer	mber					Severity	of Dama	qe			
			Turne of Domograph	Rating				Ĭ	Rating of	Accumrated	Demortes
Component	Materia		Type or Damages/	Score	Good	Fair	Poor	Bad	damage	Rating of	Remarks
					0%	30%	60%	100%	Ť	damage	
(50) Deck Slab	Concrete		Cracking	10	0				0		
(Primary)			Exposure/Corrosion of Rebars	10					0		
			Scaling/Spalling	10					0	1	Question de la dela
			Delamination	10					0	1	Overnanging deck siab
			Honeycomb	10	0				0	1	
			Waterleaking	10			0		6	6	
(51) Concrete Beam/	Prestressed		Cracking	10					0		
Girder	Concrete		Exposure/Corrosion of Rebars	10					0	1	
(Primary)	Reinforced		Spalling, Scaling, Disintegration	10					0		
(1 111111))	Concrete		Delamination	10					0		
			Honeycomb	10					Ő		
			Waterleaking	10					Ő	0	
(52) Steel Beam/			Corrosion	10	0				0		
Truss Members			Cracking	10	- ×				0		
(Bracings, etc.)			Deformation/Buckling	10					0		
(Primary)			Abnormal Vibrations	10					0		Seel members over the sea water
(1 111161 y)			Loose Connection	10					0		
			Paint Peel off	10					0	0	
(53) Shoo/Boaring	Steel		Corrosion	10					0	U	
(55) Shoerbearing	Rubber		Loose Connection	10					0	1	
	Rubbei		Abnormal Displacement	10					0	1	
			Bulging/Punture	10					0		
(Drimon)			Bod (Support) Damage	10					0	0	
(F1)(Idly)	Concrata	1	Settlement	10					0	v	
(04) Abutilients	Macopru		Movement	10					0		
(Filliary)	Othoro		Delamination	10					0		
	Others		Scouring	10					0		
			Scoling Scaling Disintogration	10					0		
			Cracking concretro	10					0		
				10					0	-	
			Exposule/Corrosion or Reini.	10					0		
		-	Honeycomb	10					U	U	
(55) Piers	Concrete		Settlement	10					0		
(Primary)	Masonry		Novement	10					0		
	Others		Delamination	10					0		
			Scouring	10					0		Piers near sea water
			Spailing, Scaling, Disintegration	10	0				0		
			Cracking concrete	10	I				0		
			Exposure/Corrosion of Reinf.	10					0		
			Honeycomb	10					0	0	
(56) Curb and Railing	Concrete		Cracking	5					0		
(Secondary)			Exposure/Corrosion of Reinf.	5					0		
			Spalling	5					0		
			Impact Damaged	5					0	0	

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

## 14) Lilo-an Bridge

Bridge Mer	nber				Severity	of Dama	je			
		Transformer	Rating					Rating of	Accumrated	Demedia
Component	Materia	Type or Damages/	Score	Good	Fair	Poor	Bad	damage	Rating of	Remarks
				0%	30%	60%	100%		damage	
(50) Deck Slab	Concrete	Cracking	10	0				0		
(Primary)		Exposure/Corrosion of Rebars	10					0	1	
(		Scaling/Spalling	10				-	0		
		Delamination	10					0		
		Honeycomb	10		0			3		
		Waterleaking	10		Ō			3	6	
(51) Concrete Beam/	Prestressed	Cracking	10					0		
Girder	Concrete	Exposure/Corrosion of Rebars	10					0		
(Primary)	Reinforced	Spalling, Scaling, Disintegration	10					0		
(1 111101))	Concrete	Delamination	10					0		Approach span
		Honeycomb	10					0	1	
		Waterleaking	10		0			3	3	
(52) Steel Beam/		Corrosion	10			0		6		
Truss Members		Cracking	10			-		0		
(Bracings, etc.)		Deformation/Buckling	10					0		Main span
(Primary)		Abnormal Vibrations	10					0	1	(primary steel members)
(		Loose Connection	10		0			3	1	• • •
		Paint Peel off	10		_			0	9	
(53) Shoe/Bearing	Steel	Corrosion	10		0			3		
()	Rubber	Loose Connection	10					0		
		Abnormal Displacement	10	0				0	1	
		Bulging/Rupture	10					0		
(Primary)		Bed (Support ) Damage	10					0	3	
(54) Abutments	Concrete	Settlement	10					0		
(Primary)	Masonry	Movement	10					0	1	
	Others	Delamination	10					0	1	
		Scouring	10					0	1	Section loss due to disintegration at
		Spalling, Scaling, Disintegration	10		0			3	1	A2
		Cracking concretre	10					0	1	
		Exposure/Corrosion of Reinf.	10					0	1	
		Honeycomb	10					0	3	
(55) Piers	Concrete	Settlement	10					0		
(Primary)	Masonry	Movement	10					0	1	
	Others	Delamination	10					0	1	
		Scouring	10					0	1	Major cracking at some piers (over
		Spalling, Scaling, Disintegration	10					0	1	1mm)
		Cracking concrete	10			0		6	1	
		Exposure/Corrosion of Reinf.	10					0	1	
		Honeycomb	10					0	6	
(56) Curb and Railing	Concrete	Cracking	5					0		
(Secondary)		Exposure/Corrosion of Reinf.	5					0	1	
		Spalling	5					0	1	
		Impact Damaged	5					0	0	

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

## 15) Wawa Bridge

Bridge Mer	mber					Severity	of Dama	qe			
			T (D )	Rating		,		Ĭ	Rating of	Accumrated	
Component	Material		Type of Damages/	Score	Good	Fair	Poor	Bad	damage	Rating of	Remarks
					0%	30%	60%	100%		damage	
(50) Deck Slab	Concrete	Ci	racking	10			0		6		
(Primarv)		E)	xposure/Corrosion of Rebars	10					0		
		S	caling/Spalling	10		0			3		Abnormal vibration at the deck slab on
		D	elamination	10					0		A1 side
		H	oneycomb	10		0			3		
		W	/aterleaking	10				0	10	22	
(51) Concrete Beam/	Prestressed	Ci	racking	10					0		
Girder	Concrete	E)	xposure/Corrosion of Rebars	10					0		
(Primary)	Reinforced	St	palling, Scaling, Disintegration	10					0		
(1 111111))	Concrete	D	elamination	10					0		
		H	onevcomb	10					0		
		W	/aterleaking	10					0	0	
(52) Steel Beam/		C	orrosion	10		0			3		
Truss Members		Ci	racking	10					0		
(Bracings, etc.)		D	eformation/Buckling	10		0			3		Deformation due to impact damage at
(Primary)		A	bnormal Vibrations	10					0		cross beams
		Lo	pose Connection	10					0		
		Pa	aint Peel off	10					0	6	
(53) Shoe/Bearing	Steel	C	orrosion	10		0			3		
(**/ * *** · · · · · · · · · · · · · · ·	Rubber	Lo	pose Connection	10					0		
		Al	bnormal Displacement	10		0			3		
		Bi	ulging/Rupture	10					0		
(Primary)		Be	ed (Support ) Damage	10					0	6	
(54) Abutments	Concrete	Se	ettlement	10					0		
(Primary)	Masonry	M	lovement	10					0		
	Others	D	elamination	10					0		
		So	couring	10					0		
		Sp	palling, Scaling, Disintegration	10					0		
		Ci	racking concretre	10					0		
		E۶	xposure/Corrosion of Reinf.	10					0		
		H	oneycomb	10					0	0	
(55) Piers	Concrete	Se	ettlement	10					0		
(Primary)	Masonry	М	lovement	10					0		
	Others	D	elamination	10					0		
		So	couring	10					0		
		Sp	palling, Scaling, Disintegration	10					0		
		Ci	racking concrete	10					0		
		E)	xposure/Corrosion of Reinf.	10					0		
		H	oneycomb	10					0	0	
(56) Curb and Railing	Concrete	Ci	racking	5					0		
(Secondary)		E)	xposure/Corrosion of Reinf.	5					0	1	
		S	palling	5					0	1	
		In	npact Damaged	5		0			2	2	

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

# 16) 2nd Magsaysay Bridge

Bridge Mer	mber		1	1	Severity	of Dama	qe	1		
		— <b>—</b> (D )	Rating		<u> </u>		Ĭ	Rating of	Accumrated	
Component	Material	Type of Damages/	Score	Good	Fair	Poor	Bad	damage	Rating of	Remarks
			000.0	0%	30%	60%	100%	5-	damage	
(50) Deck Slab	Concrete	Cracking	10					0		
(Primary)		Exposure/Corrosion of Rebars	10					0	1	
(1 111111))		Scaling/Spalling	10					0		
		Delamination	10					0		
		Honeycomb	10					0		
		Waterleaking	10					0	0	
(51) Concrete Beam/	Prestressed	Cracking	10					ő	, v	
Girder	Concrete	Exposure/Corrosion of Rebars	10					Ő		
(Drimany)	Doinforced	Spalling Scaling Disintegration	10					0 0		
(Phillary)	Concrete	Dolomination	10					0		
	Concrete	Honovcomb	10					0		
		Honeycomb	10					U O	0	
(F2) Stool Doom/			10	I				U	U	
(52) Steel Beam/		Corrosion	10					0	-	
(Dreeinge etc.)		CidCKIIIy Deformation/Duckling	10					0	-	
(Diacinys, etc.)		Abserved Vibrations	10					0		
(Primary)		Abnormal vibrations	10					0		
		Loose Connection	10					U		
		Paint Peel off	10					0	0	
(53) Shoe/Bearing	Steel	Corrosion	10					0		
	Rubber	Loose Connection	10					0		Abnormal Displacement of rubber
		Abnormal Displacement	10		0			3		bearings at abutments and nearby
		Bulging/Rupture	10					0		piers
(Primary)		Bed (Support ) Damage	10					0	3	
(54) Abutments	Concrete	Settlement	10					0		
(Primary)	Masonry	Movement	10					0		
	Others	Delamination	10					0		
		Scouring	10					0		
		Spalling, Scaling, Disintegration	n <b>10</b>					0		
		Cracking concretre	10	Γ				0	1	
		Exposure/Corrosion of Reinf.	10					0	1	
		Honeycomb	10					0	0	
(55) Piers	Concrete	Settlement	10					0		
(Primary)	Masonry	Movement	10					0	1	
	Others	Delamination	10					0	1	
		Scouring	10					0	1	
		Spalling, Scaling, Disintegration	1 <b>0</b>					0	1	
		Cracking concrete	10					0	1	
		Exposure/Corrosion of Reinf.	10					0	1	
		Honeycomb	10					0	0	
(56) Curb and Pailing	Concrete	Cracking	5					Ő		
(Socondary)	ouncrote	Exposure/Corrosion of Reinf	5					0		
(Secondary)		Spalling	5					0	-	
		Impact Damaged	5					0	0	
	1	IIIINALI DAIIIAUEU			1	1	1	I U	· ·	

Bridge Mer	mber		Dating		Severity	of Dama	ge	Dating of	Accumrated	
Component	Matorio	Type of Damages/	Rainy	Good	Fair	Poor	Bad	Rating of	Rating of	Remarks
Component	Wateria		Score	0%	30%	60%	100%	uamage	damage	Remarks  Settlement of approach road (A2 side about 20cm)
(57) Expansion Joint	Steel	Waterleaking	10		0			3		
(Primary)	Others	Abnormal Space/Noise	10					0		
		Difference in elevation	10					0		
		Displacement	10					0		
		Cracking/Rupture	10					0	3	
(58) Painting Cond.		Discoloration	10					0		
(Primary)		Rust	10					0		
		Exfoliation	10					0	0	
(59) Drainage Pipe	PVC	Clogged	5					0		
(Secondary)	Steel	Cracks	5					0		
		Others							0	
(60) Slope Protection	Gabions	Settlement	5		0			2		
(Secondary)	Others	Erossion	5					0	1	
		Scouring	5					0		
		Cracks	5		0			2		
		Others							4	
(61) Approach Road	Concrete	Cracking	5				0	5		Cottlement of annual to a d (A2 olds
(Secondary)	Asphalt	Pot-holes	5					0		Settlement of approach road (A2 side, about 20cm)
		Others							5	10001 200Ny
(62) River Condition		Scouring	5					0		
(Secondary)		Sedimentation	5					0		
		Others							0	
(63) Total Condition Ra	ating		540						15	

# (2) Results of the First Screening

Following are the results of the first screening.

: Urgent Repair

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

						-
		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 12.2.1-2
 Defect Score Analysis for Each Bridge

	Evaluation Items	uation Items Max. Badiwan Bridge					Buntun Bridge		Lucban Bridge		
				side view	A STATE		side view		side view	Nov and	
	Side /Under/ On the road vie	ew.	under view	on the road view		under view	on the road view	8400GE	under view on the road view		
				L=519m, W=10.4m			L=1102m, W=9.1m		L=502m, W=8.9m		
	Construction Are &		Construction Year	2002 B-Easter Read Design	_	Construction Year	1975 Seiemie Design Fores		Construction Year 1968	_	
: (50)	Applied Design Specification	10	AASHTO LRFD Speci	ification (2nd Edition) was applied	0	AASHTO Standard Sp	pecification (11th Edition) was applied	6	AASHTO Standard Specification (9th Edition) was applied	6	
sical Factors	Conditions of Bridge Based on Visual Inspection	30	The total bridge condi expansion joints again system, and protectio	ition is good. However, the repair of ist water leaking, improvement of drainage n for debris flow are necessary.	0	Damages are confirme water leaking at the o secondary steel mem scouring at P4, and co	ed all over the bridge. Major damages are overhanging, abnormal vibration at bers, water leaking at expansion joint, racking at piers.	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 expansion joints.	18	
Phys	Loading Canacity	5	Rating Score	15ton	2	Rating Score	18ton	2	Raung Score 40	5	
	Bridge Importance	5	Bridge is located on M	Marcos Highway. (Important)	3	Bridge is located on a (Important)	arterial road to connect south and north.	3	Bridge is located on arterial road to connect south and north. (Important)	I road to connect south and north. 3	
mance 0)	Seating Length	10	a: Minimum Required 3 b: Minimum Required 3 Existing Seating Lengt	Seating Length (AASHTO) : 42cm Seating Length (JRA) : 86cm th (N) : 200cm	0	a: Minimum Required b: Minimum Required Existing Seating Leng	Seating Length (AASHTO) : 48cm Seating Length (JRA) : 95cm th (N) : 60cm	6	a: Minimum Required Seating Length (AASHTO) : 43cm b: Minimum Required Seating Length (JRA) : 85cm Existing Seating Length (N) : 45cm	6	
Perfor	Fall Prevent Apparatus	10	Both longitudinal and t bridge is continuous.	taransverse restrainers are provided. The	0	Neither longitudinal ne The bridge is disconti	or taransverse restrainers are provided. nuous.	10	Neither longitudinal nor taransverse restrainers are provided. Th bridge is discontinuous.	e 10	
Seismic	Type of Bridge	10	Continuous PC box gi	irder bridge(Partially rigid frame)	4	Simply supported stee Simply supported stee	el truss bridge el I-girder bridge	10	Simply supported steel truss bridge Simply supported steel I-girder bridge(Partially continuous)	10	
actors	Liquefaction	10	Liquefaction Potential	I : None	0	Liquefaction Potentia	I : Moderate	6	Liquefaction Potential : High	10	
phical F	Soil Classification	5	AASH (JRA	ITO Classification : Type-II A Classification : Type- I)	2	AASH (JRA	TO Classification : Type-IV A Classification : Type-III)	5	AASHTO Classification : Type-III (JRA Classification : Type-II)	3	
Geogra	Impact to Environment	5	"Resettlement of Buil Disturbance" are cons (moderate)	lding & Inhabitant" and "Traffic sidered for the impact to the environment	. 3	"Traffic Disturbance" environment. (Small)	is considered for the impact to the	2	"Resettlement of Building & Inhabitant" and "Traffic Disturbance" are considered for the impact to the environment. (moderate)	3	
	Evaluation	100	(moderate)         The total bridge condition is good, and the seismic capacity is         high. However, the repair of detected defects and continuous         0         maintainance are necessary.		Damages are confirm capacity is low. The r retrofit are necessary screening.	ed all over the bridge, and the seismic epair of detected defects and the seismic /. The bridge is selected for the 2nd	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.	74		
1			Co	Continuous Maintenance			Retrofitting	1	(Under the plan of Reconstruction by DPWH)		

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

	Evaluation Items	Max. Point	Magapit Bridge		Sicsican Bridge		Bamban Bridge		
Side /Under/ On the road view			side view side view under view under view on the road view		side view wide view under view under view an the road view	side view under view L=174m, W=9m			
	Construction Age & Applied Design Specification	10	L=410m, W=8.9m Construction Year 1979 Seismic Design Seismic Design Force AASHTO Standard Specification (12th Edition) was applied	6	L=148m, W=7.4m Construction Year Seismic Design No Seismic Consideration AASHTO Standard Specification (8th Edition) was applied	10	L=174m, W=9m Construction Year 1998 Seismic Design R-Factor Based Design AASHTO LRFD Specification (1st Edition) was applied	3	
ysical Factors (50)	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, abnorm displacement at bearings, water leaking at expansion joints, an cracks at slope protection of A2.	al d 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.	9	The total bridge condition is good, but damages are observed a 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.	nt k 0	
Ч	Laadina Caassitu	F	Rating Score 27		Rating Score 30	0	Rating Score 11	2	
	Loading Capacity	5	Ioton Bridge is located on Pan-Philippine Highway (Important)	2	Bridge is located on Pan-Philippine Highway (Important)	2	14ton Bridge is located on Mac Arthur Highway (Important)	3	
	Bridge Importance	5	Bridge is located of Fair Filippine Fighway. (important)	3	Bridge is located off an Thinppine Fighway. (Inpol cant)	3	bridge is located on wae Arthur Fighway. (inportant)	3	
mance 0)	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	
c Perfor ctors (3	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	
Seismi Fa	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	
actors	Liquefaction	10	Liquefaction Potential : Moderate	6	Liquefaction Potential : None	0	Liquefaction Potential : None	0	
phical F (20)	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	
Geogra	Impact to Environment	5	"Resettlement of Building & Inhabitant" and "Traffic Disturbance" are considered for the impact to the environmer (moderate)	it. 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)	t. 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 2r screening.	id 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.	52	The total bridge condition is good, and the seismic capacity is high. However, the repair of detected defects and continuous maintainance are necessary.	25	
1			(Under Repair Work by DPWH)		(Under the plan of Repair work by DPWH)	1	Continuous Maintenance		

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

	Evaluation Items	Max. Point	1st Mandaue-Mactan Bridge		Marcelo Feman Bridge		Palanit Bridge			
	Side /Under/ On the road vie	ew	side view under view on the road view		side view ander view under view on the road view	-	wider view             wider view			
			L=859m, W=9.1m		L=1237m, W=16.6m		L=150m, W=8.9m			
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		
ysical Factors (	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.	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.	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 expansion joints are observed.	18		
Ę	Les dian Oscercitor	F	Nating Store 55	2	Naung Score 19	2		-		
		5	None Bridge is located on the road which connects Mandaue City and	3	None Bridge is located on the road which connects Mandaue City and	3	/ton Bridge is located on Pan-Philippine Highway. (Important)	5		
mance 0)	Seating Length	10	Lapu-lapu City. (Very Important) a: Minimum Required Seating Length (AASHTO) : 45cm b: Minimum Required Seating Length (JRA) : 89cm Existing Seating Length (N) : 100cm	0	Lapu-lapu City. (Very Important) a: Minimum Required Seating Length (AASHTO) : 46cm b: Minimum Required Seating Length (JRA) : 90cm Existing Seating Length (M) : 90cm	6	a: Minimum Required Seating Length (AASHTO) : 48cm b: Minimum Required Seating Length (JRA) : 95cm Existing Seating Length (N) : 75cm	6		
: Perfori ctors (3	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		
Seismic Fa	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		
ctors	Liquefaction	10	Liquefaction Potential : Low	3	Liquefaction Potential : Low	3	Liquefaction Potential : None	0		
hical Fa (20)	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		
Geograp	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.	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.	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.	64		
			Retrofitting	1	Continuous Maintenance		Retrofitting/Reconstruction	1		

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

Evaluation Items		Max. Point	Jibatang Bridge		Mawo Bridge	Biliran Bridge				
Side /Under/ On the road view			side view side view under view under view L=130m W=8.3m		side view under view I=259m W=8.8m	side view under view under view				
0	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		
sical Factors (50	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. Pating 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.	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			
Phys	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		
mance 0)	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			
Perfor tors (3	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		
Seismic Fac	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		
ctors	Liquefaction	10	Liquefaction Potential : Moderate	6	Liquefaction Potential : None	0	Liquefaction Potential : None	0		
ohical Fa (20)	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		
Geogra	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		ion 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.		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.	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.	36		
			(Under Repair Work by DPWH)	1	Retrofitting	1	Retrofitting			

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

Evaluation Items		Max. Point	. San Juanico Bridge			Lilo-an Bridge		Wawa Bridge			
Side /Under/ On the road viv			under view	side view		side view under view under view	side view wider view under view on the road view				
				L=2162m, W=8.9m		L=298m, W=8.9m		L=228m, W=8.9m			
	Construction Age & Applied Design Specification	10	Construction Year Seismic Design AASHTO Standard Spe	1972 Seismic Design Force ecification (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		
ysical Factors (50	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.			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.	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.			
Ph			Rating Score	12		Rating Score 33	<u> </u>	Rating Score 40			
	Loading Capacity	5	None			20ton	2	10ton	3		
	Bridge Importance	5	Bridge is located on Pan-Philippine Highway. There's no detour near the bridge. (Very Important)			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		
nance 0)	Seating Length	10	a: Minimum Required Seating Length (AASHTO) : 46cm b: Minimum Required Seating Length (JRA) : 91cm Fixisting Seating Length (N) : 75cm			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			
ctors (3	Fall-down Prevention Devices	10	Both longitudinal and taransverse restrainers are provided. However, the bridge is discontinuous except for the steel box- grider range			Neither longitudinal nor taransverse restrainers are provided. The bridge is discontinuous.	10	Neither longitudinal nor taransverse restrainers are provided. The bridge is discontinuous.			
Seismic	Type of Bridge	10	Simply supported steel truss bridge Simply supported steel I-girder bridge Continuous steel box-gieder bridge			Simply supported steel arch bridge Simply supported steel I-girder bridge	10	Simply supported steel truss bridge Simply supported steel I-girder bridge	10		
s (20)	Liquefaction	10	Liquefaction Potential : Low			Liquefaction Potential : None	0	Liquefaction Potential : None	0		
I Factor	Soil Classification	5	AASHTO Classification : Type-II (JRA Classification : Type- I )			AASHTO Classification : Type-II (JRA Classification : Type- I )	2	AASHTO Classification : Type-III (JRA Classification : Type-II)	3		
Geographics	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.			"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 environmen (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.		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.		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.	67		
			Co	ntinuous Maintenance		Retrofitting	1	Retrofitting/Reconstruction			

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

					5		
Evaluation Items Max. Point		Max. Point	Macapagal Bridge (2nd Magsaysay)				
Point Side /Under/ On the road view			side view				
			under view on the road view				
1			L=882m, W=9.6m				
			Construction Year 2007				
	Construction Age &		Seismic Design R-Factor Based Design				
(20)	Applied Design Specification	10	AASHTO LRFD Specification (3rd Edition) was applied	0	0		
sical Factors	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 observer at A2 slope protection. Also, settlement of approach road is observed on A2 side.	i 0	0		
ĥ		-	Rating Score 13			+	
ш	Loading Capacity	5	None	3	3		
	Bridge Importance	5	Bridge is located on Pan-Philippine Highway. The road is used for the transportation of timbers. (Very Important)	5	5		
mance	Seating Length	10	a: Minimum Required Seating Length (AASHTO) : 47cm b: Minimum Required Seating Length (JRA) : 93cm Existing Seating Length (N) : 85cm	6	6		
: Perfor	Fall Prevent Apparatus	10	Both longitudinal and taransverse restrainers are provided. Th bridge is continuous.	e 0	D		
Seismic	Type of Bridge	10	Continuous steel cabled stayed bridge Continuous steel I-girder bridge RCIG	4	4		
actors	Liquefaction	10	Liquefaction Potential : High	10	0		
phical F (20)	Soil Classification	5	AASHTO Classification : Type-IV (JRA Classification : Type-III)	5	5		
Geogra	Impact to Environment	5	"Traffic Disturbance" is considered for the impact to the environment. (Small)	2	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.		15		
		1	Continuous Maintenance			1	

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

#### 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.

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	50	Retrofitting
	Bridge		
10	Magapit Bridge	43	(Under Repair Work by DPWH)
12	Biliran Bridge	36	Retrofitting

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

			Physical Factor	rs (50)		Seismic Performance Factors (30)			Geo	graphical Factor			
No.	Name of Bridge	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	Total Rating	Recommended Method
		(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
g	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

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

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	Traffic Load Regulation	20 tons
Year Built	1965 (1988)	Soil Profile Type (JRA)	Left Bank: Type III, Right Bank: Type II
Bridge Type	PCBG (PC Box Girder)	Liquefaction Potential	Very High
	PCDG (PC Deck Girder)	As Built Drawing	None







#### 2) Bridge Condition

				Structural S		
	Items Results of Surveys Analyses/Comments					Results of Surveys
	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)		1 Primary	PC girders
Earthquake Resisting	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		Members	
	3.EccentricLoads(longitudinalandtransverse dir.)	Maximum span ratio: $(2^{nd} \text{ span length}): (3^{rd} \text{ span length})$ =1.0:1.3	<ul><li>The span ratio is between 1.0 and 1.5.</li><li>Possibility of eccentric loads in both directions</li></ul>	structures	2. Secondary	Expansion joint Sidewal
System	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.	Super	Members	
	5. Height of Abutment (Embankment)	Height of Embankments - Abut-A: 3m - Abut-B: 3m	<ul> <li>Height of embankments is below 5m.</li> <li>Lower risk of abutments' collapse under earthquake</li> </ul>		3. Deck Slab	1. Cracking 2. Water
	6. Built Year	1965 (Constructed before 1992)	<ul><li>Possibility of confinement loss of pier walls</li><li>Lack of seismic capacities of all the members</li></ul>			
Unseating/ Fall-down Prevention System	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	<ul> <li>Longitudinal dir.: Restrainers (Some of them are broken.)</li> <li>Transverse dir.: Shear keys</li> </ul>	- Possibility of unseating due to insufficient seismic restrainers for the longitudinal direction	uctures	4. Deterioration of Columns/ Walls	Cracking
		1. Steel bearing (Fixed)       2. Plate support type (Fixed or movable)         Image: Construction of the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second seco	<ol> <li>Steel bearings at abutments         <ul> <li>Condition: Corroded</li> </ul> </li> <li>Steel bearing (Plate support type) at piers         <ul> <li>Condition: Good</li> </ul> </li> <li>Steel bearing (pin type) at piers</li> </ol>			
	8. Bearing	3. Pin type (Hinge)	<ul> <li>Condition: Good</li> <li>Possibility of unseating at abutments due to corroded bearings</li> <li>Overall vulnerability: Moderate</li> </ul>	<ol> <li>Seismic Vulnerability         <ul> <li>Vulnerability of pier</li> <li>Vulnerability of four scouring)</li> <li>High possibility of u restrainers, short sea</li> </ul> </li> <li>Structural Soundness</li> </ol>		columns/walls to large scale of dations to large scale earthquenseating (simply supported at t length, corroded bearings & (Superstructures)
	9. Seat Length	<ol> <li>Abut-A: 85cm</li> <li>Minimum Required Seat Length</li> <li>JRA: 98cm , AASHTO: 55cm</li> <li>Pier-2: 56cm</li> <li>Minimum Required Seat Length</li> <li>JRA: 95cm , AASHTO: 53cm</li> </ol>	<ul> <li>The seat lengths of abutments &amp; piers don't satisfy JRA's minimum required seat length.</li> <li>Possibility of unseating at piers due to the short seat length</li> </ul>	<ul> <li>2. Structural Soundness (Superstructures)</li> <li>- Cracking at PC girders</li> <li>- Deterioration of the deck slab (cracking)</li> <li>- Water leaking at expansion joints</li> <li>3. Structural Soundness (Substructures)</li> <li>- Minor cracking at piers</li> </ul>		
	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure		Profile	300 26200 45800 15500
Foundation	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		Diar	E to
Seismic Hazard	14. Distance from Active Faults	- Distance: 11.1km - Active Fault Name: Marikina Valley Fault	<ul><li>The distance is over 10km.</li><li>Small effect of the active fault movement</li></ul>		rian	



#### 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.

Ŗ

5 000

- Peak Hour



* Analysis by AADT traffic volume

* VCR: Volume/Capacity Ratio

Figure 13.1.1-2 Location of Delpan Bridge



Direction 2

-D-Both

Figure 13.1.1-3 Hourly Traffic Volume

#### **Table 13.1.1-1 Daily Traffic Volume**

Unit: Veh/Day Car / Taxi / Motorcycle / 2-Axle 3-Axle Truck Pick-up / Jeepney Large Bus Sub-Total Total Tricycle Truck Truck trailer Van Day 1 27,175 31,835 2,065 33 2,340 1,581 6.595 44,449 71,624 1,833 39 1,637 Day 2 22,636 24,662 2,151 8,719 39,041 61,677 36 AADT 24,906 28,249 1,949 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

	Peak Hour Traffic Volume	5,566 Veh/hour
	Road Type	Urban Road
LOS: E	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 approa
- There are many informal settlers' houses along the approach roa
- The number of informal settlers is about 300. And 55 informal s
under the Bridge. Some informal settlers were already resettled
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 Pollutio
- Environmental condition is very bad for the pollution brought al
vibration and air pollution.
Environmental Protection Area (national park, reserves and desig
- The Bridge is not located in a cultural property or a natural reser
Existence on Location Map of Valuable Ecological Habitats, Hist
- The Bridge is not located in Historical and Cultural area, but al
and Santiago Fort Area.

ch road)

ad and crossing road on north side.

settlers with number of PAPs over 200 are

on the south side of the Bridge.

on and Water contamination.)

bout by the traffic flow such as noise,

nated wet land)

rve area.

torical and Cultural Assets

bout 300 meter s to south-east is Intramuros

#### (2) Nagtahan Bridge

#### 1) Current Bridge Condition

Bridge length/width	L=202.9m, W=20.52m	Traffic Load Regulation	20 tons
Year Built	1965 (1988)	Soil Profile Type (JRA)	Left Bank: Type II, Right Bank: Type II
Bridge Type	CBG (Concrete Box Girder) PCDG (PC Deck Girder)	Liquefaction Potential	High
		As Built Drawing	None



Figure 13.1.1-4 Current Bridge Condition of Nagtahan Bridge

13-5

#### 2) Bridge Condition

		Structural S					
	Items	Results of Surveys	Analyses/Comments		Items	Results of Surveys	
	1. Difference in soiltypes between adjacentpiers2. Continuous orSimplySupported	Soil Type is consistent along with the entire bridgeMain Spans: Continuous bridge.	<ul> <li>No soil type difference between adjacent piers</li> <li>Continuous structure is advantageous against large earthquakes</li> </ul>		1. Primary Members	Steel Truss	
	SimplySupportedBridge3.EccentricLoads	Maximum span ratio:	- The span ratio is between 1.0 and 1.5.	s			
Earthquake Resisting	(longitudinal and transverse dir.)	(1 st span length): (4 th span length) =1.0:1.3	- Possibility of eccentric loads in both directions	ructure	2. Secondary	Steel Truss	
System	column/wall or multiple columns)	while wan type	than multiple column type is less advantageous in terms of structural redundancy.	Superst	Members		
	5. Height of Abutment (Embankment)	Height of Embankments - Abutment A: 3m - Abutment B: 3m	<ul> <li>Height of embankments is below 5m.</li> <li>Lower risk of abutments' collapse under earthquake</li> </ul>			1. Cracking 2. Water 1	
	6. Built Year	1966 (Constructed before 1992)	<ul> <li>Possibility of confinement loss of pier columns/walls</li> <li>Lack of seismic capacities of all the members</li> </ul>		3. Deck Slab		
	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	<ul> <li>Longitudinal dir.: Restrainers at Pier-8 &amp; 11; insufficiently installed</li> <li>Transverse dir.: Shear keys</li> </ul>	- Possibility of unseating due to insufficient seismic restrainers for the longitudinal direction	uctures	4. Deterioration of Columns/ Walls	Secton loss & rebar exposure	
		1. Steel bearing (Movable or Fixed )2. Roller type (Fixed)(Fixed)	<ol> <li>Steel bearing at abutments         <ul> <li>Condition: Not functional without bolts</li> </ul> </li> <li>Steel bearing (Fixed) at piers         <ul> <li>Condition: Anchor bolt is missing.</li> </ul> </li> <li>Repaired steel bearing (Fixed) at piers         <ul> <li>Condition: Inappropriately repaired</li> </ul> </li> <li>Possibility of unseating at all the piers due to corroded bearings         <ul> <li>Overall preparities Series</li> </ul> </li> </ol>				
						Summary of Structu	
Unsepting/					<ul> <li>1. Seismic Vulnerability</li> <li>Vulnerability of pier columns/walls to large scale ea</li> <li>Vulnerability of foundations to large scale earthquadeen scouring)</li> </ul>		
Fall-down	8. Bearing						
Prevention		3. Repaired steel bearing					
System		(Fixed)	- Overall vulnerability: Serious	- High possibility of unseating (insufficient seismic)			
				2. Structural Soundness (Superstructures)		(Superstructures)	
				<ul> <li>Cracks at the bottom of deck slab through the en</li> <li>Water leaking at the joint of deck slabs</li> <li>Structural Soundness (Substructures)</li> </ul>			
		Pier 8 &11: 100cm	- The seat lengths of piers satisfy JRA's	- 5	Section loss & rebar	exposure at pier columns	
		Minimum Required Seat Length	minimum required seat length.			148930	
	9. Seat Length				Profile	45600	
		N					
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		Plan	THE HUUSSIAL SAM	
	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	<ul><li>The distance is between 5.0km and 10km.</li><li>Moderate effect of the active fault movement</li></ul>				

Soundness	5
S	Analyses/Comments
t.	<ul><li>Paint deterioration on entire steel truss members</li><li>Overall damage degree: Moderate</li></ul>
	<ul> <li>Paint deterioration on entire steel truss members</li> <li>Overall damage degree: Moderate</li> </ul>
r leaking	<ul> <li>Cracking at the bottom of the deck slab through the entire bridge (Crack width range: 0.1-0.2mm)</li> <li>Water leaking at the joint of two deck slabs</li> </ul>
	- Overall damage degree: Moderate
ure.	- Section loss & rebar exposure at pier
	- Overall damage degree: Moderate
	- Overan dunage degree. Moderate
ctural Defi	ciencies
earthquak uakes (liqu	es (confinement loss, deterioration) efaction potential, unknown structure,
c restrainer	rs, corroded bearings)
ire bridge	
lie blidge	
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#### 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 Car / Taxi / Motorcycle / 2-Axle 3-Axle Truck Pick-up / Jeepney Large Bus **Sub-Total** Total Tricycle Truck Truck trailer Van 97,270 23,150 63,932 1,748 350 4,252 1,979 1,859 74,120 Day 1 337 5,734 2,084 19,114 64,988 1,561 1,787 76,491 95,605 Day 2 21,132 64,460 1.655 344 4.993 2.032 1.823 75.306 96.438 AADT

* 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						
	Peak Hour Traffic Volume	6,566 Veh/hour				
	Road Type	Urban Road				
LOS: F	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 approac
- There are many informal settlers including various shops alongsid
- Fire disaster occurred on 13th July 2012, after the accident some
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 an
a high quality life with large-size TV and PC. On south side alc
community facility such as basketball court.
- Some area under the viaduct on the south side is used for army fa
Bridge is closed as a restricted Malacañan Area.
Existing Environmental Condition (Noise, Vibration, Air Pollution
- Environmental condition is bad brought about by pollution of traff
pollution.
Environmental Protection Area (national park, reserves and designation
- The Bridge is not located in cultural property or natural reserve an
Existence on Location Map of Valuable Ecological Habitats, Histo
- South-west area of the Bridge is designated as Malacañan Area.

ch road)

le the Bridge.

of informal settlers moved to other places, but

nd industrial purposes. People on north side live ong the river are well-maintained sidewalk and

acilities and car parking. South-west area of the

and Water contamination.) fic flow such as noise, vibration and air

ated wet land)

ea.

orical and Cultural Assets

#### (3) Lambingan Bridge

#### 1) Current Bridge Condition

Bridge length/width	L=98.1m, W=24m		Traffic Load Regulation	15 tons
Year Built	1979		Soil Profile Type (JRA)	Left Bank: Type II, Rigl
Bridge Type	PCDG (PC Deck Girder) with Gerber Hinge		Liquefaction Potential	High
			As Built Drawing	None



Figure 13.1.1-7 Current Bridge Condition of Lambingan Bridge

#### ght Bank: Type II

#### 2) Bridge Condition (Lambingan Bridge)

Seismic Vulnerability			Structural Soundness					
	Items	Results of Surveys	Analyses/Comments		Items	Results of Surveys	Analyses/Comments	
Earthquake Resisting System	<ol> <li>Difference in soil types between adjacent piers</li> <li>Continuous or Simply Supported Bridge</li> </ol>	Soil Type is consistent along with the entire bridge Center Spans: Simply supported with two gerber hinges	<ul> <li>No soil type difference between adjacent piers</li> <li>Possibility of unseating at center spans due to simply supported structures with gerber hinges</li> </ul>		1. Primary Members	PC girders with gerber hinges	<ul> <li>Large deflection of PC girders at the center span</li> <li>Uplift at the side spans</li> <li>Major cracking at bottom face of girders due to collision of vessels</li> <li>Overall damage degree: Serious</li> </ul>	
	<ul> <li>3. Eccentric Loads (longitudinal and transverse dir.)</li> <li>4. Pier Type (single column/wall or multiple columns)</li> </ul>	Maximum span ratio: (1 st span length): (2 nd span length) =1.0:3.3 Wall type	<ul> <li>The span ratio is over 1.5.</li> <li>Possibility of uplift at both abutments due to unbalanced span arrangement.</li> <li>Single column/wall type is less advantageous than multiple column type against earthquakes in terms of structural redundancy.</li> </ul>	Superstructures	2. Secondary Members	RC Side Block	- Section loss of RC side blocks - Overall damage degree: Moderate	
	<ul><li>5. Height of Abutment (Embankment)</li><li>6. Built Year</li></ul>	Height of Embankments - Abut-A: 5m - Abut-B: 5m 1975 (Constructed before 1992)	<ul> <li>Height of embankments is below 5m.</li> <li>Lower risk of abutments' collapse under earthquake</li> <li>Possibility of confinement loss of pier columns/walls</li> <li>Lack of seismic capacities of all the members</li> </ul>	-	3. Deck Slab	1. Cracking     2. Water leaking	<ul> <li>Cracking at nearly half of the bottom face of deck slab (Crack width range: over 0.5mm)</li> <li>Water leaking at around the cracking</li> <li>Overall damage degree: Moderate</li> </ul>	
Unseating/ Fall-down Prevention System	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	<ul> <li>Longitudinal dir.: No restrainer</li> <li>Transverse dir.: Shear keys (damaged)</li> </ul>	<ul> <li>Possibility of unseating due to non-existence of seismic restrainers for the longitudinal direction</li> <li>Possibility of unseating due to insufficient seismic restrainers for transverse direction</li> </ul>	Substructur es	4. Deterioration of Columns/ Walls	Cracking & Scaling/Spalling.	<ul> <li>Minor cracking &amp; scaling/spalling at piers</li> <li>Overall damage degree: Moderate</li> </ul>	
		1. Rubber Pad2. Rubber Pad	1. Rubber pad (Movable) at abutments					
	8. Bearing	(Moveable) (Gerber Hinge) 3. Rubber Pad (Fixed)	<ul> <li>Condition: Severely deteriorated</li> <li>Rubber pad (Gerber hinge) <ul> <li>Condition: Deteriorated</li> </ul> </li> <li>Rubber pad (Fixed) at piers <ul> <li>Condition: Deteriorated</li> </ul> </li> <li>Possibility of unseating at abutments &amp; gerber hinge supports due to corroded bearings</li> <li>Overall vulnerability: Serious</li> </ul>		<ul> <li>Summary of Structural Deficiencies</li> <li>1. Seismic Vulnerability <ul> <li>Vulnerability of pier columns/walls to large scale earthquakes (confinement loss)</li> <li>Vulnerability of foundations to large scale earthquakes (liquefaction potential, unknown structure, scouring)</li> <li>High possibility of unseating (simply supported at gerber hinges, insufficient seismic restrainers, very short seat length, corroded bearings)</li> </ul> </li> <li>2. Structural Soundness (Superstructures) <ul> <li>Large deflection of PC girders at the center span</li> <li>Uplift at the side spans</li> <li>Section loss of RC side blocks</li> <li>Major cracking at bottom face of girders</li> <li>Cracking &amp; water leaking at the bottom face of deck slab</li> </ul> </li> </ul>			
	9. Seat Length	<ol> <li>Abut-A: 85cm</li> <li>Minimum Required Seat Length</li> <li>JRA: 92cm , AASHTO: 52cm</li> <li>Pier-2: 50cm</li> <li>Minimum Required Seat Length</li> <li>JRA: 92cm , AASHTO: 52cm</li> </ol>	<ul> <li>The seat lengths of abutments don't satisfy JRA's minimum required seat length.</li> <li>The seat lengths of piers don't satisfy AASHTO's minimum required seat length.</li> <li>Possibility of unseating due to the very short seat length</li> </ul>	3. St - M	ructural Soundness nor cracking & scal Profile	(Substructures) ing/spalling at piers	18500 400 10 KALINIONG	
	10. Foundation Type (known or unknown)	No available drawings Moderate scouring at Pier-2	<ul><li>Unknown structure</li><li>Stability reduction of Pier-2 under earthquake</li></ul>					
Foundation	12. Soil Type	Soil type (JRA): II	due to the scouring - Moderate ground condition					
	13. Liquefaction Potential	- Liquefiable layer type: Sand - N-Value range of the layer: 6-21, Ave.11	- High liquefaction potential		Plan			
Seismic Hazard	14. Distance from Active Faults	<ul> <li>Distance: 5.3km</li> <li>Active Fault Name: Marikina Valley Fault</li> </ul>	<ul><li>The distance is between 5 and 10km.</li><li>Moderate effect of the active fault movement</li></ul>					

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

* 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 15.1.1-0 Assumption and LOS						
	Peak Hour Traffic Volume	2,194 Veh/hour				
LOS: C	Road Type	Urban Road				
	Free Flow Speed (km/h)	40 km/h				
	No. of Lanes	6 lanes				

Table 13.1.1.6 Accumption and LOS

* 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 •

4) Socio-Environmental Assessment Conditions



Household and Structures (Area facing the Bridge and the app
- There are many houses at both sides of the approach road.
- There is one illegal household with 5 members under the bri
- There are many illegal settlers beside the Bridge at the south
Land use (Area facing the Bridge and the approach road)
- Both sides of the Bridge are used for residential and factory
Existing Environmental Condition (Noise, Vibration, Air Poll
- Environmental condition is bad brought about by the pollution
pollution.
Environmental Protection Area (national park, reserves and de
- The Bridge is not located in a cultural property or a natural r
Existence on Location Map of Valuable Ecological Habitats,
- The Bridge is not located in a cultural property or a natural r

low.

proach road) idge. h side. area. lution and Water contamination.) ion of traffic flow such as noise, vibration and air lesignated wet land) reserve area. Historical and Cultural Assets reserve area.

#### (4) Guadalupe Bridge

#### 1) Current Bridge Condition

Bridge length/width	L=144.44m, W=25.4m	Traffic Load Regulation	20 tons
Year Built	1962 (Old), 1978 (New)	Soil Profile Type	Left Bank: Type I, Right Bank: Type
Bridge Type	Continuous Steel Truss (Old)	Liquefaction Potential	High
	PC Deck Girder with Gerber Hinge (New)	As Built Drawing	None



Figure 13.1.1-10 Current Bridge Condition of Guadalupe Bridge

# III

#### 2) Bridge Condition (Guadalupe Bridge)

	Seismic Vulnerability					Structural Soundness			
	Items	Results of Surveys	Analyses/Comments		Items	Results of	f Surveys	Analyses/Comments	
1. Difference types adjacent piers2. Continu Simply2. Continu SimplySimply3. Eccentric (longitudinal transverse dir.)4. Pier column/wall or columns)5. Height of A (Embankment)6. Built Year	1. Differenceinsoiltypesbetweenadjacent piers2. ContinuousorSimplySupportedPridge	Soil Types - Left bank: Type I - Right bank: Type III Steel truss: Continuous bridge. PC girder: Simple supported with gerber binges	<ul> <li>Soil type difference among Pier-2 &amp; Abut-B (Soil type: I or III)</li> <li>Possibility of unseating at center spans due to simply supported structures with gerber hinges</li> </ul>		1. Primary Members	PC Girder	Steel Truss	<ul> <li>Major cracking at Gerber hinges area</li> <li>Paint deterioration on steel truss members</li> <li>Overall damage degree: Serious</li> </ul>	
	3.EccentricLoads(longitudinalandtransverse dir.)4.PierType(singlecolumn/wall or multiplecolumns)	Maximum span ratio: (1 st span length): (2 nd span length) =1.0:1.2 Wall type: piers for new bridges are structurally connected to the old piers	<ul> <li>The span ratio is between 1.0 and 1.5.</li> <li>Possibility of eccentric loads only in both directions.</li> <li>Single column/wall type is less advantageous than multiple column type against earthquakes in terms of structural redundancy.</li> </ul>	Superstructures	2. Secondary Members	Steel Truss Member	Expansion Joint	<ul> <li>Paint deterioration on steel truss members</li> <li>Abnormal spacing of expansion joint at gerber hinge joint of center span due to the rotation of girders</li> <li>Overall damage degree: Moderate</li> </ul>	
	<ul><li>5. Height of Abutment (Embankment)</li><li>6. Built Year</li></ul>	Height of Embankments - Abutment A: 8m - Abutment B: 8m 1962 for steel truss & 1978 for PC I- girders (Constructed before 1992)	<ul> <li>Height of embankments is betwen5 and 10m.</li> <li>Lower risk of abutments' collapse under earthquake</li> <li>Possibility of confinement loss of pier columns/walls</li> <li>Lack of seismic capacities of all the members</li> </ul>		3. Deck Slab	PC Girder	Steel Truss	<ul> <li>Cracking at the bottom of deck slab through the entire bridge (Crack width range: 0.1-0.2mm)</li> <li>Water leaking at the joint between deck slabs</li> <li>Overall damage degree: Moderate</li> </ul>	
7. Unseating/Fall         Prevention         Inseating/         Fall-down         Prevention         System         9. Seat Length	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	<ul> <li>Longitudinal dir.: Restrainers at abutments; insufficiently installed</li> <li>Transverse dir.: Shear keys</li> </ul>	- Possibility of unseating at abutments due to insufficient seismic restrainers for the longitudinal direction	structures	4. Deterioration of Columns/ Walls	Cracking, Spalling &	ż Rebar exposure	<ul> <li>Cracking, spalling, &amp; rebar exposure at piers due to collision of vessels</li> <li>Overall damage degree: Moderate</li> </ul>	
		1. Vertical Restrainer2. H-beam type(Fixed)(Fixed)	<ol> <li>Vertical Restrainer at abutments: no bearings         <ul> <li>Condition: Corroded</li> </ul> </li> <li>Steel bearing (H-beam type) at piers         <ul> <li>Condition: Corroded</li> </ul> </li> <li>Rubber pad bearing at gerber hinges         <ul> <li>Condition: Severely corroded</li> </ul> </li> <li>Possibility of unseating at abutments &amp; gerber hinges due to corroded bearings</li> <li>Overall vulnerability: Serious</li> </ol>			all all all all all all all all all all	and the		
	8. Bearing	3. Rubber pad (Gerber Hinge)			ismic Vulnerability Vulnerability of pier Vulnerability of foun eep scouring) High possibility of un eat length, corroded ructural Soundness Strengthen gerber hi Cracks at the bottom	Summary of columns/walls to large dations to large scale nseating (simply supp bearings) (Superstructures) nge portion and side l of deck slab through t	of Structural Deficien e scale earthquakes ( earthquakes (liquefac orted at gerber hinge blocks he entire bridge	cies confinement loss) ction potential, unknown structure, s, insufficient restrainers, very short	
	9. Seat Length	<ol> <li>Abut-A: 80cm</li> <li>Minimum Required Seat Length</li> <li>JRA: 88cm, AASHTO: 52cm</li> <li>Pier-2: 35cm</li> <li>Minimum Required Seat Length</li> <li>JRA: 88cm, AASHTO: 52cm</li> </ol>	<ul> <li>The seat lengths of abutments don't satisfy JRA's minimum required seat length.</li> <li>The seat lengths of piers don't satisfy AASHTO's minimum required seat length.</li> <li>High possibility of unseating due to the very short seat length</li> </ul>	<ul> <li>Water leaking at the joint between deck slabs</li> <li>Structural Soundness (Substructures)         <ul> <li>Cracking, spalling, &amp; rebar exposure at piers</li> </ul> </li> </ul>					
	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure		Profile		Et 1		
	11. Scouring	Potential of deep scouring at Pier-1 & 2	- Stability reduction of Pier-1 & 2 under earthquake due to the scouring			/ 100		10	
Foundation	12. Soil Type	Soil type (JRA): I and II	- Moderate ground condition			)))))(( <del>[]])⁽]))</del>			
	13. Liquefaction Potential	<ul> <li>Liquefiable layer type: Sand</li> <li>N-Value range of the layer: 8-28 Ave. 15</li> </ul>	- High liquefaction potential		- m				
Seismic Hazard	14. Distance from Active Faults	<ul> <li>Distance: 2.4km</li> <li>Active Fault Name: Marikina Valley Fault</li> </ul>	<ul><li>The distance is between 2 and 5km.</li><li>Serious effect of the active fault movement</li></ul>		Plan				

#### 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.





Figure 13.1.1-12 Hourly Traffic Volume

* Analysis by AADT traffic volume

* VCR: Volume/Capacity Ratio

Figure 13.1.1-11 Location of Guadalupe Bridge

Table 13.1.1-7 Daily Traffic Volume

								U	nit: 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.

T	able	13.1.1-8	Assumption	and LOS

	Peak Hour Traffic Volume	14,366 Veh/hour
	Road Type	Urban Road
LOS: F	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 app
- There are many business facilities along both sides of North a
- There are 12 unit informal settlers with 27 members at both si
Land use (Area facing the Bridge and the approach road)
- North side of the River is used for side walk with basket cour
- There are parks inside of interchange on the south side.
Existing Environmental Condition (Noise, Vibration, Air Pollu
- Environmental condition is bad brought about by the pollution
air pollution.
Environmental Protection Area (national park, reserves and des
- The Bridge is not located in a cultural property or a natural re
Existence on Location Map of Valuable Ecological Habitats, H
- The Bridge is not located in acultural property or a natural res

roach road)

approach road.

ides of north abutment and under the Bridge

t and Monument Park.

tion and Water contamination.)

n of traffic flow such as noise, vibration and

signated wet land)

eserve area.

Historical and Cultural Assets

serve area.

#### (5) Marikina Bridge

#### 1) Current Bridge Condition

Bridge length/width	L=138.2m, W=20.3m	Traffic Load Regulation	20 tons
Year Built	1980	Soil Profile Type	Left Bank: Type I, Rig
Bridge Type	PCDG (PC Deck Girder)	Liquefaction Potential	High
		As Built Drawing	None



Figure 13.1.1-13 **Current Bridge Condition of Marikina Bridge** 

## ght Bank: Type II

#### 2) Bridge Condition (Marikina Bridge)

		Seismic Vulnerability	Structural Soundness							
	Items	Results of Surveys	Analyses/Comments		Items	Results of Surveys	Analyses/Comments			
Earthquake	1. Difference in soil	Soil Type is consistent along with the	- No soil type difference between adjacent piers			PC girder bridge	- PC girders apparently in good			
Resisting	types between	entire bridge				STITLET I AND A	condition.			
System	adjacent piers				1. Primary	A DESCRIPTION OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OWNER OF THE OWNER OF THE OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER	- Overall damage degree: Good			
	2. Continuous or	Simply supported	- All spans are simply supported.		Members					
	Simply Supported		- High possibility of unseating due to simply supported structures							
	Diluge	Maximum span ratio:	- The span ratio is less than 1.5			RC Cross Beam Expansion Joint	- Deterioration at cross beams			
	3. Eccentric Loads	$(1^{\text{st}} \text{ span length}): (2^{\text{nd}} \text{ span length})$	- Possibility of eccentric loads is low in the	Ires		Re closs beam Expansion Joint	- Water leaking at expansion joins			
	(longitudinal and transverse dir.)	=1.0:1.3	transverse direction.	ucti	2. Secondary		- Overall damage degree: Moderate			
				rstr	Members					
	4. Pier Type (single	Multiple-column type	- Multiple column type is more advantageous	adn		A DESCRIPTION OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OF THE OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNER OWNE				
	column/wall or multiple		earthquakes in terms of structural redundancy	Ś		1 Cracking 2 Water leaking	- Major cracking at the bottom face			
	columns)		eurinquikes in terms of structural redundancy.				and surface of deck slab through the			
		Height of Embankments	- Lower risk of abutments' collapse under				entire bridge.			
	5. Height of Abutment	- Abut-A: 2.5m	earthquake		3. Deck Slab	a lass of the last	- Water leaking from the wide			
	(Embankment)	- Abut-B: 2.5m					cracking at the deck slab			
		1980 (Constructed before 1992)	- Possibility of confinement loss of nier				- Overan damage degree. Serious			
	6. Built Year		columns/walls		4. Deterioration	Retrofitted columns	- Pier columns are already retrofitted			
				res	of Columns/		and in good condition.			
Unseating/	7. Unseating/Fall-down	- Longitudinal dir.: No restrainer	- High possibility of unseating under earthquake	ictu	Walls		- Overall damage degree: Good			
Fall-down	Prevention Devices	- Transverse dir.: No restrainer	due to non-existence of seismic restrainers	stri	Substru					
Prevention	(both longitudinal and			Sub						
System		1 Deblemmed 2 No bearing of	1 Deller and mide and a start of shortwards							
		1. Rubber pad 2. No bearing at with angle steel piers	1. Rubber pad with angle steel at abutments - Condition: Severely deformed (angle steel)							
		(Fixed or Movable)	2. No bearing at piers	1.0		Summary of Structural Deficiencies				
	9 Dearing			1. 2	Vulnerability of four	nic Vulnerability nerability of foundations to large scale earthquakes (liquefaction potential, unknown structure, uring) h possibility of unseating (simply supported, no seismic restrainers, short seat length, deformed rings, and non-existence of bearings) ctural Soundness (Superstructures)				
	o. Dearing		- Possibility of unseating due to deformed		scouring)					
			bearings, and non-existence of bearings	-	High possibility of u					
			- Overan vunerability. Serious		bearings, and non-ex					
		1. Abut-A: 65cm	- The seat lengths of abutments don't satisfy	2.	Structural Soundness					
		Minimum Required Seat Length	JRA's minimum required seat length.		Water leaking at exp	ansion points				
	9 Seat Length	- JRA: 85cm , AASHTO: 48cm	- Possibility of unseating due to the short seat	-	Major cracking & wa	ater leaking at the bottom face of deck slab	through the entire bridge			
	9. Seat Length		length	-	Water leaking from e	expansion joints				
				3.	Structural Soundness	(Substructures)				
	10 Errentation Trans	No available drawings	- Unknown structure		INOILE					
Foundation	(known or unknown)									
						TO NURIKINA CITY PROFES	τα αικικα ω. c.			
	11. Scouring	Scouring at Pier-2 & 3	- Stability reduction of Pier-2 & 3 due to the	ne						
		Soil type (IRA): II	- Moderate ground condition		Profile					
	12. Soil Type	bil Type								
	13 Liquefaction	- Liquefiable layer type: Sand	- Very high liquefaction potential							
	Potential	- N-Value range of the layer: 7-34 Ave. 19			HC BACK		00.0 #1000 1.000 #1000 #1000 #1000 #1000 #1000 #1000 #1000 #1000 #1000 #1000 #1000 #1000 #1000 #1000 #1000 #1000 #1000 #1000			
<u> </u>		Distance: 1.0km	The distance is less than 2.0km			NUT PLAN SHOWS SUPERSTRUCTURE	. 1			
Seismic	- Distance from - Active Fault Name: Marikina Valley - The distance is less than 2.0km.									
Hazard	Active Faults	Fault	Serious effect of the active function movement		Plan					
						Confer Persona and contracting conference and contracting conference and contracting conference and contracting conference and contracting conference and contracting conference and contracting conference and contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting contracting co				

#### 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.





Figure 13.1.1-15 Hourly Traffic Volume

* Analysis by AADT traffic volume

* VCR: Volume/Capacity Ratio

Figure 13.1.1-14 Location of Marikina Bridge

**Table 13.1.1-9 Daily Traffic Volume** 

								U	nit: 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 15.1.1-10 Assumption and LOS						
	Peak Hour Traffic Volume	3,629 Veh/hour				
LOS: F	Road Type	Urban Road				
	Free Flow Speed (km/h)	60 km/h				
	No. of Lanes	4 lanes				

Table 13.1.1.10 Assumption and LOS

* 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 • 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
- 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 W
- Environmental condition is relatively good except for the pollution of tr
and air pollution along the road.
Environmental Protection Area (national park, reserves and designated w
- The Bridge is not located in a cultural property or a natural reserve area.
Existence on Location Map of Valuable Ecological Habitats, Historical a
- The Bridge is not located in a cultural property or a natural reserve area.

high with

approach road) g the approach road. ridge. roach roads.

ollution and Water contamination.)

pollution of traffic flow such as noise, vibration

designated wet land)

ts, Historical and Cultural Assets

#### 13.1.2 Comparison of Improvement Measures



f Improvement Measures & Evaluation							
acity improveme	nt of pier walls (wall retrofit)						
acity improven	nent of foundations (pile for reinforcement	& soil					
it)							
t of unseating	/fall-down prevention system (unseating pr	evention					
s, seat extender,	replacement of bearings)						
t of the deck sla	b soundness (repair)						
t of the PC girde	ers' soundness						
Concrete ja	acketing (wall retrofit)						
Steel pipe	sheet pile foundation (pile for reinforcement)						
Chemical	grouting with SPSP wall (soil improvement)						
Unseating	prevention system						
<ul> <li>Traffic cor</li> </ul>	trol during abutment retrofit works						
<ul> <li>Pile-drivin</li> </ul>	g under the existing superstructure						
Seismic	Wall retrofit						
Retrofit	Pile for reinforcement	0.52					
Works	Soil improvement	0.53					
	• Unseating prevention system						
Repair	Epoxy injection & mortar repair						
Works	• Floor slab water proof sheet						
	• Replacement of expansion joint	0.01					
Others	• Working platform on the water						
	• Temporary detour bridge	0.01					
	The second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second secon	0.55					
	Total	0.55					
ation during the	works for piers in water						
t of large constru	action yard						
letour bridge ins	tallation during abutment retrofit works						
t of temporary re	esettlement for the construction						
nended							
of existing bridge planning condition in order to confirm the cost							
s of seismic retro	ofit & repair works						
of DC girder brid	dae for advantage of less maintenance even ner	r coastal					
or i C girder blid	ige for advantage of less maintenance even nea	i coastal					

Application of steel pipe sheet pile foundation to piers in water: no need for sheet pile installation

	Continuous PC Box-girder bridge								
	• Steel pipe sheet pile foundation (for piers)								
	Cast-in-place	pile foundation (for abutments)							
	Requirement of	of long term construction period for cast-in-	place PC						
	box girders								
	Superstructure · Continuous PC box-girder bridge								
	Substructure • Wall type								
	Foundation       • Steel pipe sheet pile foundation         • Cast-in-place pile foundation         • Working platform on the water         • Temporary detour bridge								
	Total								

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

ION: Not Recommended

**Comparison of Improvement Measures for Nagtahan Bridge** 



Improvement Measures & Evaluation							
city imp	roven	nent of pier wall (wall retrofit)					
city improvement of foundations (pile for reinforcement)							
of unseating/fall-down prevention system (unseating							
nains, rep	lacer	nent of bearings)					
t of the d	eck s	lab soundness (repair)					
t of the st	teel n	nembers' soundness					
Concret	te jac	keting (wall retrofit)					
Steel pi	pe sh	eet pile foundation (pile for reinforcement)					
Unseati	ng pr	evention system					
Traffic	contr	ol in improvement of abutments.					
Pile-dri	ving	under the existing superstructure					
eismic	• W	all retrofit					
Retrofit	• Pi	le for reinforcement	0.46				
Vorks	• U	nseating prevention system	0.40				
	• R	eplacement of bearings					
Repair	• Ej	poxy injection & mortar repair					
Vorks	• Fl	oor slab water proof sheet	0.03				
	• R	eplacement of expansion joints	0.05				
	• R	epaint of steel truss members					
Others	. W	orking platform on the water	0.01				
	• Te	emporary detour bridge	0101				
	Total 0.50						
of low-i	mpac	t construction for Malacañan area					
ation duri	ing th	e works for piers in water					
etour bri	dge ir	nstallation during abutment retrofit works					
of temp	orary	resettlement for the construction: many in	nformal				
approac	h brio	lges					
mended							
of existin	g brid	lge planning condition in order to confirm	the cost				
of seism	ic ret	rofit & repair works					
of light	weig	ht & low height superstructure type in c	order to				
adequate	verti	cal clearance					
of steel p	pipe sl	heet pile foundation to piers in water: no n	need for				
tallation							
Continue	ous st	eel box-girder bridge					
Steel pip	be she	et pile foundation					
Cast-in-	place	pile foundation					
None: 7	Гуріс	al erection methods are applicable					
uperstruc	ture	Continuous steel box-girder bridge	0.38				
ubstructu	re	• Wall type	0.07				
oundation	n	<ul> <li>Steel pipe sheet pile foundation</li> </ul>	0.45				
Junuario	1	Cast-in-place pile foundation	0.45				
		• Working platform on the water					
thers		<ul> <li>Temporary detour bridge</li> </ul>	0.10				
		Approach road					
		Total	1.00				
of low-i	mpac	t construction to Malacañan area					
ation during the works for piers in water							
etour bridge installation during the whole construction							
of temporary resettlement for the construction: many informal							
approach bridges							

#### **Comparison of Improvement Measures for Lambingan Bridge**



#### **Detail of Improvement Measures & Evaluation**

• 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

• Improvement of the deck slab soundness (repair)

- Improvement of PC girders' soundness & strength
  - 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

	Traffic control during abutment retrofit works							
	• Pile-dri	iving under the existing superstructure						
	Seismic• Wall retrofitRetrofit• Pile for reinforcementWorks• Soil improvement							
		<ul> <li>Unseating prevention system</li> </ul>						
	Repair	Superstructure reinforcement						
	Works	<ul> <li>Epoxy injection &amp; mortar repair</li> </ul>		0.01				
		<ul> <li>Replacement of expansion joints</li> </ul>		0.01				
	Others	<ul> <li>Working platform on the water</li> </ul>		0.01				
		<ul> <li>Temporary detour bridge</li> </ul>		0.01				
			Total	0.77				

• 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

Application of single-span simply supported bridge for wider navigation

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

- Steel lohse arch bridge
- Cast-in-place pile foundation
- Requirement of large size crane or wire equipments for rapid erection
- Requirement of large construction yard for assembly of steel members

Superstructure	Steel lohse arch bridge	0.71
Substructure	• Wall type	0.02
Foundation	Cast-in-place pile foundation	0.12
Others	<ul><li>Working platform on the water</li><li>Temporary detour bridge</li><li>Approach road</li></ul>	0.15
	Total	1.00

• 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

**Comparison of Improvement Measures for Guadalupe Bridge** 



mprovement Measures & Evaluation						
city impro city impr nent)	ovement of pier wall (wall retrofit) rovement of foundations (pile for reinforcer	nent &				
of un	seating/fall-down prevention system (un	seating				
bles/chai	ns, replacement of bearings)	C				
of the de	eck slab soundness (repair)					
of PC gi	rders' soundness & strength					
Concrete	e jacketing (wall retrofit)					
Steel pip	pe sheet pile foundation (pile for reinforceme	ent)				
Chemica	al grouting with SPSP wall (soil improvement	nt)				
Unseatin	ng prevention system					
Traffic of	control during abutment retrofit works					
Pile-driv	ving under the existing superstructure					
eismic	• Wall retrofit Dile for minforcement					
Vorks	• File for reinforcement	0.53				
VOIKS	• Son improvement Unseating prevention system					
enair	• Steel plate bonding with PC bars					
Vorks	Epoxy injection & mortar repair	0.02				
	• Replacement of expansion joint	0.02				
Others	• Working platform on the water	0.00				
	• Temporary detour bridge	0.09				
	Total	0.64				
tion durir	ng the works for piers in water					
etour brid	lge installation during abutment retrofit work	s				
of tem	porary resettlement for the construction:	many				
ers aroun	d the bridges	-				
commend	led					
of span rat	tio of center-lane bridges					
of light w	reight & low height superstructure type in o	order to				
adequate	vertical clearance					
of steel gi	rder bridge for rapid erection method: advan	tage of				
tion & sn	naller construction yard					
of steel pi	ipe sheet pile foundation to piers in water: n	io need				
Continu	on overstaal plate deelt her, ginder bridge					
Steel pir	ous steel plate deck box-glider blidge					
Cast-in-	place pile foundation (for piers on land)					
Require	ment of large size crane or wire equipme	nts for				
rapid ere	ection	110 101				
Require	ment of large construction yard for assem	nbly of				
steel me	embers	•				
Installat	ion of temporary detour bridge: limited space	e				
inerstruct	• Continuous steel plate deck box-	0.34				
ipersuluei	girder bridge	0.54				
ubstructur	re • Wall type	0.08				
oundation	• Steel pipe sheet pile foundation	0.48				
	Cast-in-place pile foundation					
thore	• working platform on the water	0.10				
uleis	• Temporary detour bridge	0.10				
	• Approach Ioau Total	1.00				
tion durir	tion during the works for piers in water					
etour brid	lge installation during the whole construction	1				
of temporary resettlement for the construction: many						
ers aroun	d the bridges: Large impact to business area	5				

#### **Comparison of Improvement Measures for Marikina Bridge**



Improvement Measures & Evaluation	
pacity improvement of pier columns (column retrofit)	
pacity improvement of foundations (pile for reinforcement	&
rement)	
ent of unseating/fall-down prevention system (seat extend	er,
revention chains/cables, shear keys, replacement/ installati	on
)	
ent of the deck slab soundness (repair)	
ent of PC girders' soundness & strength	
. Steel pipe sheet pile foundation & steel pipe p	ile
foundation (pile for reinforcement)	
• Chemical grouting & SPSP wall (soil improvement)	
Unseating prevention system	
Traffic control during abutment retrofit works	
• Pile-driving under the existing superstructure	
Seismic · Column retrofit	
Retrofit • Pile for reinforcement	~
Works Soil improvement	)0
Unseating prevention system	
Repair • Epoxy injection & mortar repair	2
Works • Replacement of expansion joints	)2
Others • Working platform on the water	
• Temporary detour bridge	Л
Total 0.6	59

• River occupation during the works for piers in water

• Temporary detour bridge installation during abutment retrofit works

• 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

· Application of steel pipe sheet pile foundation to piers in water: no need for sheet pile installation

- Continuous PC I-girder bridge
- Steel pipe sheet pile foundation Method (in river)
- Cast-in-place pile foundation Method (on land)

• Typical erection method applicable using track cranes					
Super-	<ul> <li>Continuous PC I-girder bridge</li> </ul>	0.21			
tructure		0.21			
Substructure	• Wall type	0.08			
Foundation	• Steel pipe sheet pile foundation	0.61			
	Cast-in-place pile foundation	0.01			
)th and	• Working platform on the water	0.10			
Juners	<ul> <li>Temporary detour bridge</li> </ul>	0.10			
	Total	1.00			

• 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

#### 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

					1		
Bridge length/width	L=1102m, W=9.1m		Traffic Load Regulation	on 18 ton			
Year Built Bridge Type	190/ Main Spans: Simply supported star	l truce bridge	Soil Profile Type	Uany High (1			
bridge Type	- Approach Spans: Simply-supported stee	steel I-girder bridge	As-built drawing	None	ayer: As)		
P4	Side viewSide viewUnder the bridgeUnder the bridgeUnder the bridgeScouring	On the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second se	e bridge P7 - P15 P7 - P	Abut-A Deformed Short P16 RE	P1	P2	2 Short Seat Length
Profile \$imply-supported s 1-girder bridge	steel	Simp	1102m bly-supported steel truss bri	idge			; 
BTI –1						Liquefia	ble layer (As)
Abut-A P1 P2	P3 P4 P5	P6 P7	P8 P9	P10 P11	P12	P13 P	14 P15
As1							
As Dc	Ac2 A Ss	As					
					Note: Exis	ting foundation	structures are a
Plan (2 lanes)	Pond Pond			River			
Wall type	Rigid frame type		Rigid f	rame type with shear w	all		

Figure 13.2.1-1 Structural and Geological Outline of Buntun Bridge







#### 2) Bridge Condition

Seismic Vulnerability				Structural Soundness				
	Items Results of Surveys Analyses/Comments				Items Results of Surveys Analyses/Comments			
	1. Differenceinsoiltypesbetweenadjacent piers2. Continuous orSimplySupportedBridge	Soil Type is consistent along with the entire bridge1. Main Spans: Simply supported 2. Approach Spans: Simply supported	<ul> <li>No soil type difference between adjacent piers</li> <li>All spans are simply supported.</li> <li>High possibility of unseating due to simply supported structures</li> </ul>		1. Primary Members	Steel Truss	<ul> <li>All superstructure members were recently repainted and they are in good condition.</li> <li>Overall damage degree: Good</li> </ul>	
Earthquake Resisting System	<ul> <li>3. Eccentric Loads (longitudinal and transverse dir.)</li> <li>4. Pier Type (single column/wall or multiple columns)</li> </ul>	Maximum span ratio: (2 nd span length): (3 rd span length) = 1.0:1.7 1. Wall type 2. Rigid frame type 3. Rigid frame type with shear walls	<ul> <li>The span ratio is over 1.5</li> <li>Possibility of eccentric loads only in the transverse direction: simply supported</li> <li>13 out of 16 piers are rigid frame type</li> <li>Multiple column type is more advantageous than single column/wall type against earthquakes in terms of structural redundancy.</li> </ul>	Superstructures	2. Secondary Members	2. Secondary Members	Steel Truss	<ul> <li>All superstructure members were recently repainted and they are in good condition.</li> <li>Overall damage degree: Good</li> </ul>
	<ul><li>5. Height of Abutment (Embankment)</li><li>6. Built Year</li></ul>	Height of Embankments - Abut-A: 3m - Abut-B: 3m 1967 (Constructed before 1992)	<ul> <li>Heights of embankments are below 5m.</li> <li>Lower risk of abutments' collapse under earthquake</li> <li>Possibility of confinement loss of pier columns/walls</li> <li>Lack of seismic capacities of all the members</li> </ul>		3. Deck Slab	Cracking Water leaking	<ul> <li>Minor cracking at the bottom face of deck slab through the entire bridge (Crack width range: 0.1-0.2mm)</li> <li>Water leaking at the overhanging deck slabs</li> <li>Overall damage degree: Moderate</li> </ul>	
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	Ictures	4. Deterioration	Minor Cracking	<ul> <li>Minor cracks on some pier columns</li> <li>Overall damage degree: Small</li> </ul>	
		1. Linear type (Movable or Fixed )2. Roller type (Movable hinge)Image: Constraint of the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second se	<ol> <li>Steel bearings (linear type) at abutments         <ul> <li>Condition: Deformed (longitudinal dir.)</li> </ul> </li> <li>Steel bearings (roller type) at piers         <ul> <li>Condition: Good</li> </ul> </li> <li>Steel bearings (pin type) at piers</li> </ol>	Substru	Walls			
	8. Bearing	Bearing		1. Se - V - V s - I b 2. St	ismic Vulnerability /ulnerability of pier /ulnerability of fou: couring) High possibility of u earings) ructural Soundness Cracks at the bottor	Summary of Structural Define c columns/walls to large scale earthquak indations to large scale earthquakes (liqu inseating (simply supported, no seismi (Superstructures) in face of deck slab through the entire bi	iciencies tes (confinement loss) defaction potential, unknown structure, c restrainers, short seat length, damaged ridge	
	9. Seat Length	<ol> <li>Abut-A: 48cm</li> <li>Minimum Required Seat Length</li> <li>JRA: 85cm, AASHTO: 43cm</li> <li>Pier-2: 55cm (steel I-girder side)</li> <li>Minimum Required Seat Length</li> <li>JRA: 95cm, AASHTO: 53cm</li> </ol>	<ul> <li>The seat lengths of abutments and piers don't satisfy JRA's minimum required seat length.</li> <li>Possibility of unseating due to the short seat length</li> </ul>	- V 3. St - N	Vater leaking at the ructural Soundness None: Only minor c	overhanging deck slabs (Substructures) eracks on some pier columns 1105m Simply-supported sterl true bridge	Simply-supported teel	
	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure		Abut-A P1 P2 P3	P4 P5 P6 P7 P8 P9 P10	P11 P12 P13 P14 P15 P16 Abut-B	
Foundation	11. Scouring	Moderate scouring at Pier-5	- Stability reduction of Pier-5 under earthquake due to the scouring		As Do	Se .	As DS1 Urr-ture Note: Existing feasibilities structures are summed (and accessed)	
	12. Soil Type	Soil type (JRA): 1	- Firm ground condition				COME, LANSING PROPAGATION SUBJECTS ARE ADMITTED (MARATIME).	
	13. Liquefaction Potential	- N-Value range of the layer: 6 – 9	- very high inqueraction potential				River	
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		Wall type Rig	id frame type Rigid frame t	Wall type	

#### a) Traffic Volume



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** 



#### Table 13.2.1-1 Daily 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

								τ	Jnit: 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.

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		Traffic Load Regulation	None		
Year Built	1972		Soil Profile Type	I & II (JRA)		
Bridge Type	- Main Spans: Continuou	s steel truss bridge	Liquefaction Potential	Very high (layer: As)	)	
	- Approach Spans: Contin	nuous steel I-girder bridge	As-built drawing	None		
	Note: Partially simply	supported (side spans)				Only fixed bearing
Collided by a ship (repaired)	Side view P7 Under the	bridge		Abut-A	P5 P1 - P5	P6 P7 -
P9 P9 P8	P11 P10 P10 - P11	P12 – P13 P13 P1	Abut-B	eat Length (P13)	Rebar exposure Bottom of pier ca	Water Water aps (P7)
Profile			859m			
Simply-suppo	rted 3-span-contin	nous steel	3-span-continuous steel tr	uss bridge		n-continuous steel
composite ste	el I-girder bridg	e			I-gird	ler bridge
I-girder bridg	e					2
	Only one fixed co	hridge MAN_W1 Collided	by a Only one fixed conditi	on Only or	ne fixed condition	MAN-E1
		ship (rep	aired) in the continuous brid	ge in the o	continuous bridge	0
Abut-A PI P	'Z P3 P4	P5 P6		P8 M	P9 P1	0 PH
	E MM	M M M		NAMAMA	M M	М
F MF M		Liquefiable layer (As)		Liquefiable layer	(As)	
As AC		, Elqueriable fayer (AS)				
)gs	I					
		Lm				
				0.0		
					Note: Existing for	indation structures
Plan						
(2 lanes)						
			River			
	) $\oplus$ $\bigcirc$	$\cap \cap$	$\bigcirc$	$\bigcirc$	$\square$	

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



		Seismic Vulnerability	
	Items	Results of Surveys	Analyses/Comments
	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	<ol> <li>Main Spans: Continuous</li> <li>Approach Spans: Continuous or Simply supported</li> </ol>	<ul><li>A few side spans are simply supported.</li><li>High possibility of unseating at side spans due to simply supported structures</li></ul>
Earthquake	3. Eccentric Loads (longitudinal and transverse dir.)	Maximum span ratio: ( $6^{th}$ span length): ( $7^{th}$ span length) = 1.0:2.2	<ul> <li>The span ratio is over 1.5</li> <li>Possibility of eccentric loads in both the longitudinal &amp; transverse dir.: continuous</li> </ul>
System	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	<ul> <li>Heights of Embankments are below 5m.</li> <li>Lower risk of abutments' collapse under earthquake</li> </ul>
	6. Built Year	1972 (Constructed before 1992)	<ul> <li>Possibility of confinement loss of pier columns/walls</li> <li>Lack of seismic capacities of all the members</li> </ul>
	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	<ul> <li>Longitudinal dir.: No restrainer</li> <li>Transverse dir.: No restrainer</li> </ul>	- High possibility of unseating under earthquake due to non-existence of seismic restrainers
Unseating/ Fall-down	8. Bearing	<ol> <li>Linear type (Movable or Fixed)</li> <li>Corroded</li> <li>Pivot type (Fixed hinge)</li> <li>Corroded</li> <li>Corroded</li> <li>Corroded</li> <li>Corroded</li> </ol>	<ol> <li>Steel bearings (linear type) at abutments &amp; piers of I-girder bridges         <ul> <li>Condition: Corroded, paint deterioration</li> <li>Steel bearings (roller type) at piers of the steel truss bridge             <ul> <li>Condition: Good</li> <li>Steel bearings (pivot type) at piers                     <ul> <li>Condition: Good</li></ul></li></ul></li></ul></li></ol>
System			<ul> <li>Types of existing bearing are not vulnerable to earthquakes</li> <li>Possibility of unseating at piers of simply supported steel I-girder bridges due to corroded bearings</li> <li>Overall vulnerability: Serious</li> </ul>
	9. Seat Length	<ol> <li>Abut-A: 100cm</li> <li>Minimum Required Seat Length</li> <li>JRA: 89cm, AASHTO: 44cm</li> <li>Pier-13: 65cm</li> <li>Minimum Required Seat Length</li> <li>JRA:89cm, AASHTO: 44cm</li> </ol>	<ul> <li>The seat lengths of piers don't satisfy JRA's minimum required seat length.</li> <li>Possibility of unseating at piers due to the short seat length</li> </ul>
	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
Foundation	12. Soil Type	Soil type (JRA): I & II	- Firm ground and moderate ground mix (Moderate)
	13. Liquefaction Potential	<ul> <li>Liquefiable layer type: Silty sand</li> <li>N-Value range of the layer: 7</li> </ul>	- Very high liquefaction potential
Seismic Hazard	14.DistancefromActive Faults	- Distance: 15.8km - Active Fault Name: Cebu Lineament	<ul><li>The distance is over 10km.</li><li>Small effect of the active fault movement</li></ul>



Soundness	
VS	Analyses/Comments
	- Primary steel members are apparently in good condition.
	<ul> <li>The load capacity is considered to be reduced by the damage even though</li> </ul>
	the damage was repaired. - Overall damage degree: Moderate
cion loss	<ul> <li>Heavy corrosion at most of secondary steel members</li> <li>Section loss at some of the secondary steel members</li> <li>Overall damage degree: Serious</li> </ul>
ar exposure	<ul> <li>Minor cracking at the bottom face of deck slab through the entire bridge (Crack width range: 0.1-0.4mm)</li> <li>Rebar exposure at the overhanging deck slabs</li> <li>Overall damage degree: Moderate</li> </ul>
ed by a ship ed) P7	<ul> <li>Severe rebar exposure at the bottom face of piers in the water</li> <li>Pier-7 was collided by a ship in the past.</li> <li>Overall damage degree: Serious</li> </ul>
ctural Deficien	cies
uakes (confine akes (liquefact	ment loss, deterioration) ion potential, unknown structure,
ported, no seis	mic restrainers, short seat length,
ly one fixed c	ondition in the continuous bridge;
osure)	
n the water	
859m axis stref truss bridge trud condition () imoun hridge in	3-span-continuous steel     Simply-supported     I-gender bridge     trong steel     I-gender bridge     trong steel     Ingreder bridge     Bre continuous bridge     B0 0 0 0 0 0 0 0 1 0 0 1 0 0 0 0 0 0
NAMAGAGAGAGA	DECENT M PIC PIC PIC PIC ADUC-B

Note: Existing found

#### 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

**Table 13.2.1-3 Daily Traffic Volume** 

Unit:	Veh/Day
· · · · · ·	, en 2 aj

	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
----------------	------------	---------

	Peak Hour Traffic Volume	6,741 Veh/hour
	Road Type	Urban Road
LOS: F	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 appr
- There are many illegal settlers under the Bridge on both sides
- Total number of illegal houses is 189 and number of PAPs are
Land use (Area facing the Bridge and the approach road)
- Under the Bridge is used for residential area including some k
Existing Environmental Condition (Noise, Vibration, Air Pollu
- Environmental condition is not so bad for noise, vibration and
waste effluent is bad without water and sewerage.
Environmental Protection Area (national park, reserves and des
- The Bridge is not located in a cultural property or a natural re
Existence on Location Map of Valuable Ecological Habitats, H

- The Bridge is not located in a cultural property or a natural reserve area.

roach road)

s of the strait.

re 733 at the time of survey.

kinds of shops and illegal settlers.

ution and Water contamination.)

d air pollution. But sanitary condition such as

esignated wet land)

eserve area.

Historical and Cultural Assets

#### (3) Palanit Bridge

1) Structural and Geological Outline

Bridge length/width	L=123m, W=8.9m	Traffic Load Regulation	7 ton
Year Built	1972	Soil Profile Type	I (JRA)
Bridge Type	- Main Spans: Simply supported steel truss bridge	Liquefaction Potential	None
	- Approach Spans: Simply supported steel I-girder bridge	As-built drawing	None





Figure 13.2.1-7 Structural and Geological of Palanit Bridge

Additional cross beam



		Seismic Vulnerability				Structural Soundne	ess		
	Items	Results of Surveys	Analyses/Comments		Items	Results of Surveys	f Surveys Analyses/Comments		
	1. Difference in soiltypesbetweenadjacent piers	Soil Type is consistent along with the entire bridge	- No soil type difference between adjacent piers		1. Primary	Steel Truss Section loss	<ul> <li>Severe painting deterioration and corrosion on steel members</li> <li>Section loss at some part of primary steel members</li> </ul>		
	2. Continuous or Simply Supported Bridge	<ol> <li>Main Spans: Simply supported</li> <li>Approach Spans: Simply supported</li> </ol>	<ul> <li>All spans are simply supported.</li> <li>High possibility of unseating due to simply supported structures</li> </ul>		Members	Deteriorated	<ul> <li>Low load capacity (load limit: 7t)</li> <li>Overall damage degree: Serious</li> </ul>		
Earthquake Resisting System	<ol> <li>Eccentric Loads (longitudinal and transverse dir.)</li> <li>Pier Type (single</li> </ol>	Maximum span ratio: $(1^{st} \text{ span length}): (2^{nd} \text{ span length})$ = 2.7:1.0 Wall type	<ul> <li>The span ratio is over 1.5</li> <li>Possibility of eccentric loads only in the transverse direction: simply supported</li> <li>Single column/wall type is less advantageous</li> </ul>	structures	2. Secondary Members	Steel Truss Corroded Corroded	<ul> <li>Severe painting deterioration and corrosion on steel members</li> <li>Overall damage degree: Serious</li> </ul>		
	column/wall or multiple columns)	Height of Embankments	<ul> <li>than multiple column type against earthquakes in terms of structural redundancy.</li> <li>Heights of embankments are below 5m.</li> </ul>	Supers					
	5. Height of Abutment (Embankment)	- Abut-A: 3m - Abut-B: 3m 1972 (Constructed before 1992)	<ul> <li>Lower risk of abutments' collapse under earthquake</li> <li>Possibility of confinement loss of pier</li> </ul>			Cracking & Honeycomb/ water leaking Spalling	- Major cracking & water leaking at the bottom face of deck slab through the entire bridge (Crack width range: 0.3-0.7mm)		
	6. Built Year	- Longitudinal dir : No restrainer	columns/walls - Lack of seismic capacities of all the members - High possibility of unseating due to pop-		3. Deck Slab		- Honeycomb/Spailing at the bottom face of deck slab in Span-2 & 3		
	7. Unseating/Fail-down Prevention Devices (both longitudinal and transverse dir.)	- Transverse dir.: No restrainer	existence of seismic restrainers	res	4. Deterioration		- Overall damage degree: Serious     - Rebar exposure & cracking at the bearing     base of Pier-1		
		1. Linear type (Movable or Fixed )2. Roller type (Movable hinge)	1. Steel bearings (linear type) at Abut-B, Pier-1 & 2	Sub- structu	of Columns/ Walls	Cracking	- Overall damage degree: Moderate		
		ALL GARAGE	2. Steel bearings (roller type) at Pier-1						
Unseating/ Fall-down	8. Bearing	3. Pivot type (Fixed hinge)	<ul> <li>Condition: Corroded, paint deterioration</li> <li>Steel bearings (pivot type) at Abut-A</li> <li>Condition: Good</li> </ul>	1. Se	eismic Vulnerabilit Vulnerability of pie Vulnerability of for	Summary of Structural De y er columns/walls to large scale earthquakes undations to large scale earthquakes (unkno	(confinement loss, deterioration) wn structure)		
System			<ul> <li>Types of existing bearing are not vulnerable to earthquakes</li> <li>Possibility of unseating at Abut-B, and Pier-1 &amp; 2 due to corroded bearings</li> <li>Overall vulnerability: Serious</li> </ul>	2. St - 1 - 1 - 2	Figh possibility of ructural Soundness Low load capacity Deterioration & Se Severe deterioration	unseating (simply supported, no seismic re s (Superstructures) (load limit: 7t) ction loss at steel truss members n of the deck slab (cracking, honeycomb/spa	alling, and water leaking)		
		1. Abut-A: 55cm Minimum Required Seat Length	- The seat lengths of abutments and piers don't satisfy JRA's minimum required seat length.	- ]	Rebar exposure & o	cracking at the bearing base of Pier-1			
	9. Seat Length	- JRA: 84cm, AASHTO: 41cm 2. Pier-2: 44cm Minimum Required Seat Length	<ul><li>The seat length of Pier-2 doesn't satisfy even AASHTO's criteria.</li><li>High possibility of unseating due to the very</li></ul>	[	Profile Abut-A	Simply-supported steel truss bridge	Simply-supported steel I-girder bridge		
		- JRA: 104cm, AASHTO: 51cm	short seat length						
	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure		Asg		Dsg E-3		
Foundation	11. Scouring	None	- No scouring effect			Do Ds Ps VR			
	12. Soil Type	- The ground at the site consists of	- rim ground condition		VR	un en en en en en en en en en en en en en			
	Potential	nonliquefiable layers		h	(2 lanes)	River	Note: Existing foundation structures are assumed (unknown).		
Seismic Hazard	14. Distance from Active Faults	- Distance: 7.6km - Active Fault Name: Northern Samar Lineament	<ul><li>The distance is between 5 and 10km.</li><li>Moderate effect of the active fault movement</li></ul>						

#### 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

								τ	Jnit: Veh/Da
	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
	Peak Hour Traffic Volume

	Peak Hour Traffic Volume	149 Veh/hour
	Road Type	Local Road
LOS: B	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 approa
- There are 2 houses immediately beside the Bridge. The number of
- 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 fishi
- Under the Bridge is used for shed of fishing boat, breeding place
Existing Environmental Condition (Noise, Vibration, Air Pollutio
- Environmental condition is good except for the pollution of traff
- Based on the water quality sampling analysis, some of the reside
level of contamination is under the standard.
Environmental Protection Area (national park, reserves and design
- The Bridge is not located in a cultural property or a natural reser
Existence on Location Map of Valuable Ecological Habitats, Hist
- The Bridge is not located in a cultural property or a natural reser

ach road)

of PAPs under the Bridge is 12.

ing as primary source of livelihood.

for fighting cock, and for drying area.

on and Water contamination.)

fic flow such as noise, vibration and air pollution.

ents dispose their waste through the river but the

nated wet land)

rve area.

torical and Cultural Assets

rve area.

#### (4) Mawo Bridge

#### 1) Structural and Geological Outline

Bridge length/width	L=259m, W=8.8m	Traffic l
Year Built	1976	Soil Pro
Bridge Type	Simply supported steel langer arch bridge	Liquefa
		As-built

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).



Figure 13.2.1-10 Structural and Geological Outline of Mawo Bridge





#### 2) Bridge Condition

Seismic Vulnerability			Structural Soundness				
	Items	Results of Surveys	Analyses/Comments		Items	Results of Surveys	Analyses/Comments
	1. Difference in soiltypesbetweenadjacent piers2. Continuous orSimplySupportedBridge	Soil Types are considered to be different between Pier-1 and Abut-B. (Soil type: I or III) Simply supported	<ul> <li>Soil type difference between Pier-1 and Abut- B (Soil type: I or III)</li> <li>All spans are simply supported.</li> <li>High possibility of unseating due to simply supported structures</li> </ul>		1. Primary Members	Steel langer arch Corroded	<ul> <li>Painting deterioration and corrosion on steel members</li> <li>Low load capacity (load limit: 7t)</li> <li>Overall damage degree: Moderate</li> </ul>
Earthquake Resisting System	<ul> <li>3. Eccentric Loads</li> <li>(longitudinal and transverse dir.)</li> <li>4. Pier Type (single column/wall or multiple columns)</li> </ul>	Maximum span ratio: (1 st span length): (2 nd span length) =1.0:1.0 Wall type	<ul> <li>The span ratio is 1.0.</li> <li>Little possibility of eccentric loads</li> <li>Single column/wall type is less advantageous than multiple column type against earthquakes in terms of structural redundancy.</li> </ul>	erstructures	2. Secondary Members	Steel langer arch	<ul> <li>Painting deterioration and corrosion on steel members</li> <li>Overall damage degree: Moderate</li> </ul>
	<ul><li>5. Height of Abutment (Embankment)</li><li>6. Built Year</li></ul>	- Abut-A: 2m - Abut-B: 2m 1976 (Constructed before 1992)	<ul> <li>- Heights of embankments are below 5m.</li> <li>- Lower risk of abutments' collapse under earthquake</li> <li>- Possibility of confinement loss of pier columns/walls</li> <li>- Lack of seismic capacities of all the members</li> </ul>	Supe	3. Deck Slab	Rebar exposure Honeycomb/Spalling	<ul> <li>Cracking &amp; water leaking at the bottom face of deck slab through the entire bridge (Crack width range: 0.3-0.7mm)</li> <li>Honeycomb/Spalling at the bottom face of deck slab in Span 1 &amp; 2</li> </ul>
	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	<ul> <li>Longitudinal dir.: No restrainer</li> <li>Transverse dir.: No restrainer</li> </ul>	- High possibility of unseating due to non- existence of seismic restrainers			Cracking & water leaking	<ul> <li>Rebar exposure at the overhanging deck slab</li> <li>Overall damage degree: Serious</li> </ul>
		1. Pivot type (Fixed hinge)       2. Roller type (Movable hinge)         Image: Construction of the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second seco	<ol> <li>Steel bearings (pivot type) at Abut-A, and Pier-1         <ul> <li>Condition: Corroded, paint deterioration</li> <li>Steel bearings (roller type) at Abut-B, and Pier-1             <li>Condition: Corroded, paint deterioration</li> </li></ul> </li> </ol>	Sub- structures	4. Deterioration of Columns/ Walls		<ul><li>Pier-1 is apparently in good condition.</li><li>Overall damage degree: Good</li></ul>
Unseating/	8. Bearing		······································			Summary of Structural Deficie	encies
Fall-down Prevention System		Corroded Corroded	<ul> <li>Types of existing bearing are not vulnerable to earthquakes</li> <li>Possibility of unseating at abutments, and Pier-1 due to corroded bearings</li> <li>Overall vulnerability: Moderate</li> </ul>	1. Se - V - V - F b 2. Stu	ismic Vulnerability Vulnerability of pier Vulnerability of four ligh possibility of u earings) vuctural Soundness	columns/walls to large scale earthquakes adations to large scale earthquakes (liquefa nseating (simply supported, no seismic re	(confinement loss) action potential, unknown structure) estrainers, short seat length, corroded
	9. Seat Length	<ol> <li>Abut-B: 90cm</li> <li>Minimum Required Seat Length</li> <li>JRA: 135cm, AASHTO: 66cm</li> <li>Pier-2: 90cm</li> <li>Minimum Required Seat Length</li> <li>JRA: 135cm, AASHTO: 66cm</li> </ol>	<ul> <li>The seat lengths of abutments and Pier-1 don't satisfy JRA's minimum required</li> <li>Possibility of unseating due to the short seat length</li> </ul>	- L - L - D - S 3. Stu - N	ow load capacity (I arge deflection und Deterioration at steel evere deterioration ructural Soundness Jone	oad limit: 7t), abnormal vibration of the su ler large live loads l truss members of the deck slab (cracking, honeycomb/sp. (Substructures)	iperstructure alling, water leaking, rebar exposure)
	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure		Abut	259m Simply-supported steel ranger arch bridge -A P1	Abut-B
	11. Scouring	Condition of Pier-1 is unknown.	- Unknown		-		
Foundation	12. Soil Type 13. Liquefaction	Soil type (JRA): I & III - Liquefiable layer type: Sand - N-Value range of the layer: 8-12	<ul><li>Firm ground and soft ground mix (Soft)</li><li>Very high liquefaction potential</li></ul>			As Ag Dist	isting foundation structures are assumed (unknown)
Seismic Hazard	Potential 14. Distance from Active Faults	- Distance: 1.4km - Active Fault Name: Northern Samar Lineament	<ul><li>The distance is less than 2km.</li><li>Fatal effect of the active fault movement</li></ul>			anest River	

#### 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

								τ	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.

7	Table 13.2.1-8 Assumption and LOS	
	Peak Hour Traffic Volume	432 Veh/hour
	Road Type	Urban Road
LOS: B	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



<ul> <li>Household and Structures (Area facing the Bridge and the app</li> <li>There are many houses immediately beside the Bridge.</li> <li>There are 7 informal settlers under the Bridge with 37 PAPs</li> <li>Land use (Area facing the Bridge and the approach road)</li> <li>North side area and along approach road on south side are us</li> <li>Under the Bridge is used for shed of boat, breeding place f drying area of washed clothes.</li> <li>Existing Environmental Condition (Noise, Vibration, Air Poll</li> <li>Environmental condition is good except for the pollution of</li> <li>Based on the water quality sampling analysis, some of the relevel of contamination is under the standard.</li> <li>Environmental Protection Area (national park, reserves and de</li> <li>The Bridge is not located in a cultural property or a natural r</li> <li>Existence on Location Map of Valuable Ecological Habitats, 1</li> <li>The Bridge is not located in a cultural property or a natural r</li> </ul>	
<ul> <li>There are many houses immediately beside the Bridge.</li> <li>There are 7 informal settlers under the Bridge with 37 PAPs</li> <li>Land use (Area facing the Bridge and the approach road)</li> <li>North side area and along approach road on south side are us</li> <li>Under the Bridge is used for shed of boat, breeding place f drying area of washed clothes.</li> <li>Existing Environmental Condition (Noise, Vibration, Air Poll</li> <li>Environmental condition is good except for the pollution of</li> <li>Based on the water quality sampling analysis, some of the relevel of contamination is under the standard.</li> <li>Environmental Protection Area (national park, reserves and de</li> <li>The Bridge is not located in a cultural property or a natural r</li> <li>Existence on Location Map of Valuable Ecological Habitats, I</li> </ul>	Household and Structures (Area facing the Bridge and the approac
<ul> <li>There are 7 informal settlers under the Bridge with 37 PAPs</li> <li>Land use (Area facing the Bridge and the approach road)</li> <li>North side area and along approach road on south side are us</li> <li>Under the Bridge is used for shed of boat, breeding place f drying area of washed clothes.</li> <li>Existing Environmental Condition (Noise, Vibration, Air Poll</li> <li>Environmental condition is good except for the pollution of</li> <li>Based on the water quality sampling analysis, some of the relevel of contamination is under the standard.</li> <li>Environmental Protection Area (national park, reserves and de</li> <li>The Bridge is not located in a cultural property or a natural r</li> <li>The Bridge is not located in a cultural property or a natural r</li> </ul>	- There are many houses immediately beside the Bridge.
<ul> <li>Land use (Area facing the Bridge and the approach road)</li> <li>North side area and along approach road on south side are use</li> <li>Under the Bridge is used for shed of boat, breeding place for drying area of washed clothes.</li> <li>Existing Environmental Condition (Noise, Vibration, Air Poll</li> <li>Environmental condition is good except for the pollution of</li> <li>Based on the water quality sampling analysis, some of the relevel of contamination is under the standard.</li> <li>Environmental Protection Area (national park, reserves and de</li> <li>The Bridge is not located in a cultural property or a natural relevance on Location Map of Valuable Ecological Habitats, I</li> </ul>	- There are 7 informal settlers under the Bridge with 37 PAPs.
<ul> <li>North side area and along approach road on south side are use</li> <li>Under the Bridge is used for shed of boat, breeding place for drying area of washed clothes.</li> <li>Existing Environmental Condition (Noise, Vibration, Air Poll</li> <li>Environmental condition is good except for the pollution of</li> <li>Based on the water quality sampling analysis, some of the relevel of contamination is under the standard.</li> <li>Environmental Protection Area (national park, reserves and de</li> <li>The Bridge is not located in a cultural property or a natural relevance on Location Map of Valuable Ecological Habitats, I</li> <li>The Bridge is not located in a cultural property or a natural relevance.</li> </ul>	Land use (Area facing the Bridge and the approach road)
<ul> <li>Under the Bridge is used for shed of boat, breeding place for drying area of washed clothes.</li> <li>Existing Environmental Condition (Noise, Vibration, Air Poll</li> <li>Environmental condition is good except for the pollution of</li> <li>Based on the water quality sampling analysis, some of the relevel of contamination is under the standard.</li> <li>Environmental Protection Area (national park, reserves and details)</li> <li>The Bridge is not located in a cultural property or a natural relevant of Valuable Ecological Habitats, I</li> <li>The Bridge is not located in a cultural property or a natural relevant of the standard.</li> </ul>	- North side area and along approach road on south side are used for
<ul> <li>drying area of washed clothes.</li> <li>Existing Environmental Condition (Noise, Vibration, Air Poll</li> <li>Environmental condition is good except for the pollution of</li> <li>Based on the water quality sampling analysis, some of the relevel of contamination is under the standard.</li> <li>Environmental Protection Area (national park, reserves and de</li> <li>The Bridge is not located in a cultural property or a natural r</li> <li>Existence on Location Map of Valuable Ecological Habitats, I</li> <li>The Bridge is not located in a cultural property or a natural r</li> </ul>	- Under the Bridge is used for shed of boat, breeding place for do
<ul> <li>Existing Environmental Condition (Noise, Vibration, Air Poll</li> <li>Environmental condition is good except for the pollution of</li> <li>Based on the water quality sampling analysis, some of the relevel of contamination is under the standard.</li> <li>Environmental Protection Area (national park, reserves and de</li> <li>The Bridge is not located in a cultural property or a natural r</li> <li>Existence on Location Map of Valuable Ecological Habitats, I</li> <li>The Bridge is not located in a cultural property or a natural r</li> </ul>	drying area of washed clothes.
<ul> <li>Environmental condition is good except for the pollution of</li> <li>Based on the water quality sampling analysis, some of the relevance of contamination is under the standard.</li> <li>Environmental Protection Area (national park, reserves and de</li> <li>The Bridge is not located in a cultural property or a natural reserves on Location Map of Valuable Ecological Habitats, I</li> <li>The Bridge is not located in a cultural property or a natural reserves and the standard.</li> </ul>	Existing Environmental Condition (Noise, Vibration, Air Pollution
<ul> <li>Based on the water quality sampling analysis, some of the relevance of contamination is under the standard.</li> <li>Environmental Protection Area (national park, reserves and de - The Bridge is not located in a cultural property or a natural relexistence on Location Map of Valuable Ecological Habitats, I - The Bridge is not located in a cultural property or a natural relevance on the standard of the Bridge is not located in a cultural property or a natural relevance on the standard of the Bridge is not located in a cultural property or a natural relevance on the standard of the Bridge is not located in a cultural property or a natural relevance on the Bridge is not located in a cultural property or a natural relevance on the Bridge is not located in a cultural property or a natural relevance on the Bridge is not located in a cultural property or a natural relevance on the Bridge is not located in a cultural property or a natural relevance on the Bridge is not located in a cultural property or a natural relevance on the Bridge is not located in a cultural property or a natural relevance on the Bridge is not located in a cultural property or a natural relevance on the Bridge is not located in a cultural property or a natural relevance on the Bridge is not located in a cultural property or a natural relevance on the Bridge is not located in a cultural property or a natural relevance on the Bridge is not located in a cultural property or a natural relevance on the Bridge is not located in a cultural property or a natural relevance on the Bridge is not located in a cultural property or a natural relevance on the Bridge is not located in a cultural property or a natural relevance on the Bridge is not located in a cultural property or a natural relevance on the Bridge is not located in a cultural property or a natural relevance on the Bridge is not located in a cultural property or a natural relevance on the Bridge is not located in a cultural property or a natural relevance on the Bridge is not located in a</li></ul>	- Environmental condition is good except for the pollution of traffi
<ul> <li>level of contamination is under the standard.</li> <li>Environmental Protection Area (national park, reserves and de</li> <li>The Bridge is not located in a cultural property or a natural r</li> <li>Existence on Location Map of Valuable Ecological Habitats, 1</li> <li>The Bridge is not located in a cultural property or a natural r</li> </ul>	- Based on the water quality sampling analysis, some of the resider
<ul> <li>Environmental Protection Area (national park, reserves and de</li> <li>The Bridge is not located in a cultural property or a natural r</li> <li>Existence on Location Map of Valuable Ecological Habitats, 1</li> <li>The Bridge is not located in a cultural property or a natural r</li> </ul>	level of contamination is under the standard.
<ul> <li>The Bridge is not located in a cultural property or a natural r</li> <li>Existence on Location Map of Valuable Ecological Habitats, 1</li> <li>The Bridge is not located in a cultural property or a natural r</li> </ul>	Environmental Protection Area (national park, reserves and design
<ul><li>Existence on Location Map of Valuable Ecological Habitats,</li><li>The Bridge is not located in a cultural property or a natural r</li></ul>	- The Bridge is not located in a cultural property or a natural reserv
- The Bridge is not located in a cultural property or a natural r	Existence on Location Map of Valuable Ecological Habitats, Histo
	- The Bridge is not located in a cultural property or a natural reserv

## ch road) for residential area. omestic animal such as fighting cock, pig and for and Water contamination.) ic flow such as noise, vibration and air pollution. ents dispose their waste through the river but the nated wet land) ve area. orical and Cultural Assets ve area.

#### (5) Biliran Bridge

#### 1) Structural and Geological Outline

Bridge length/width	L=252m, W=8.9m	Traffic Load Regulation	15t
Year Built	1976	Soil Profile Type	I (JRA)
Bridge Type	- Main Spans: Simply supported steel langer arch bridge	Liquefaction Potential	None
	- Approach Spans: Simply supported steel I-girder bridge	As-built drawing	None





Figure 13.2.1-13 Structural and Geological Outline of Biliran Bridge



#### 2) Bridge Condition

Seismic Vulnerability				Structural Soundness		
	Items	Results of Surveys	Analyses/Comments	Items	Results of Surveys	Analyses/Comments
Earthquake Resisting System	1. Difference in soiltypesbetweenadjacent piers2. Continuous orSimplySupported	Soil Type is consistent along with the entire bridge 1. Main Spans: Simply supported 2. Approach Spans: Simply supported	<ul> <li>No soil type difference between adjacent piers</li> <li>All spans are simply supported.</li> <li>High possibility of unseating due to simply</li> </ul>	1. Primary Members 2. Secondary Members	Steel I-girder	<ul> <li>Corrosion on steel I-girder members</li> <li>Primary members of steel langer arch are in good condition.</li> <li>Overall damage degree: Moderate</li> </ul>
	Bridge 3. Eccentric Loads	Note: Joint-less deck slab Maximum span ratio:	supported structures - The span ratio is over 1.5		Steel langer arch	- Secondary members are in good
	(longitudinal and transverse dir.)	(5 span length): (4 span length) =1.0:8.5	- Possibility of eccentric loads only in the transverse direction: simply supported			- Overall damage degree: Good
	column/wall or multiple columns)		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	<ul> <li>Heights of embankments are below 5m.</li> <li>Lower risk of abutments' collapse under earthquake</li> </ul>	3. Deck Slab	Deterioration & Water leaking	<ul> <li>The bottom face of deck slab is repaired with carbon fiber sheet.</li> <li>Spalling &amp; water leaking at the overhanging deck slab</li> <li>Overall damage degree: Moderate</li> </ul>
	6. Built Year	1976 (Constructed before 1992) Note: Pier-3 & 4 were replaced in 1990s.	<ul> <li>Possibility of confinement loss of pier columns/walls</li> <li>Lack of seismic capacities of all the members</li> </ul>			
Unseating/ Fall-down Prevention System	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	<ul> <li>Longitudinal dir.: Unseating prevention cables</li> <li>Transverse dir.: No restrainer</li> </ul>	<ul> <li>No seismic restrainers in the transverse direction</li> <li>Unseating prevention cables are installed at the deck slab: not very effective</li> <li>Possibility of unseating due to the above defects (Poor)</li> </ul>	4. Deterioration of Columns/ Walls	Cracking	<ul> <li>Cracking at piers</li> <li>Overall damage degree: Moderate</li> </ul>
	8. Bearing	1. Linear type       2. Roller type         (Movable or Fixed)       (Movable hinge)         Image: Strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of the strain of t	<ol> <li>Steel bearings (linear type) at abutments and piers         <ul> <li>Condition: Corroded and deformed</li> </ul> </li> <li>Steel bearings (roller type) at Pier-1         <ul> <li>Condition: Slightly corroded</li> <li>Steel bearings (pin type) at Abut-A             <ul> <li>Condition: Good</li> </ul> </li> <li>Types of existing bearing are not vulnerable to earthquakes</li> <li>Possibility of unseating at abutments and piers of steel I-girder bridges due to corroded bearings</li> </ul> </li> </ol>	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		
	9. Seat Length	<ol> <li>Abut-A: 60cm</li> <li>Minimum Required Seat Length</li> <li>JRA: 85cm, AASHTO: 43cm</li> <li>Pier-2: 55cm</li> <li>Minimum Required Seat Length</li> <li>JRA: 85cm, AASHTO: 55cm</li> </ol>	<ul> <li>Overall vulnerability: Serious</li> <li>The seat lengths of abutments and piers don't satisfy JRA's minimum required seat length.</li> <li>Possibility of unseating due to the short seat length</li> </ul>	Profile Simply-suppor	P1 P2 P3 P1	d steel langer arch bridge I-girder bridge BIL-N1 P4 P5 Abut-B
Foundation	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure			VR
	12. Soil Type 13. Liquefaction	Soil type (JRA): I - The ground at the site consists of	- Firm ground condition     - No liquefaction potential		Settlemont (P3)	Note: Existing foundation structures are assumed (unknown except for Pier-3 & 4)
Seismic Hazard	Potential 14. Distance from Active Faults	nonliquefiable layers - Distance: 4.3km - Active Fault Name: PFZ Central Leyte Fault	<ul> <li>The distance is between 2 and 5km.</li> <li>Serious effect of the active fault movement</li> </ul>	Plan (2 lanes)		Sea Water




#### 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
1 abic 15.2.1-10	Assumption	

	Peak Hour Traffic Volume	301 Veh/hour
	Road Type	Local Road
LOS: B	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
- There is no house and structure near the bridge except a light
Land use (Area facing the Bridge and the approach road)
- Along the road there is no house except maintenance house
Existing Environmental Condition (Noise, Vibration, Air Pol
- Environmental condition is very good, Traffic volume is lo
Environmental Protection Area (national park, reserves and o
- The Bridge is not located in a cultural property or a natural
Existence on Location Map of Valuable Ecological Habitats,
- The Bridge is not located in a cultural property or a natural

approach road)

hthouse.

with no occupant person.

llution and Water contamination.)

w.

designated wet land)

reserve area.

Historical and Cultural Assets

reserve area.

### (6) Lilo-an Bridge

#### 1) Structural and Geological Outline

Bridge length/width	L=298m, W=8.9m	Traffic Load Regulation	20t
Year Built	1979	Soil Profile Type	I (JRA)
Bridge Type	- Main Spans: Simply supported steel langer arch bridge	Liquefaction Potential	None
	- Approach Spans: Simply supported PC I-girder bridge	As-built drawing	None





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

Seismic Vulnerability					Structural Soundness				
	Items	Results of Surveys	Analyses/Comments			Items	Results of	of Surveys	Analyses/Comments
	<ol> <li>Difference in soil types between adjacent piers</li> <li>Continuous or Simply Supported Bridge</li> <li>Eccentria Loada</li> </ol>	Soil Type is consistent along with the entire bridge 1. Main Spans: Simply supported 2. Approach Spans: Simply supported	<ul> <li>No soil type difference between adjacent piers</li> <li>All spans are simply supported.</li> <li>High possibility of unseating due to simply supported structures</li> </ul>			1. Primary Members	Steel langer arch	PC I-girder	<ul> <li>Corrosion on steel langer arch members</li> <li>Water leaking on PC I-girders</li> <li>Overall damage degree: Moderate</li> </ul>
Earthquake Resisting System	<ul> <li>3. Eccentric Loads</li> <li>(longitudinal and transverse dir.)</li> <li>4. Pier Type (single column/wall or multiple columns)</li> <li>5. Height of Abutment (Embankment)</li> </ul>	Maximum span ratio.         (1 st span length): (2 nd span length)         =3.9:1.0         Multiple column type         Height of Embankments         - Abut-A: 4m         - Abut-B: 4m	<ul> <li>- The span ratio is over 1.5</li> <li>- Possibility of eccentric loads only in the transverse direction: simply supported</li> <li>- Multiple column type is more advantageous than single column/wall type against earthquakes in terms of structural redundancy.</li> <li>- Heights of embankments are below 5m.</li> <li>- Lower risk of abutments' collapse under earthquake</li> </ul>		Superstructures	2. Secondary Members	Steel langer arch Corroded	Loose connection	<ul> <li>Corrosion at bracing connections</li> <li>Loose connection due to lack of bolts at splices of steel members</li> <li>Overall damage degree: Moderate</li> </ul>
	6. Built Year	- Longitudinal dir : No restrainer	<ul> <li>Possibility of confinement loss of pier columns/walls</li> <li>Lack of seismic capacities of all the members</li> <li>High possibility of unseating due to pop-</li> </ul>			3. Deck Slab	Cracking	Honeycomb	- Cracking & honeycomb at the bottom face of deck slab through the entire bridge (Crack width range: 0.4mm)
	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	- Transverse dir.: No restrainer	existence of seismic restrainers		SS		Cracking /	Honeycomb	Overall damage degree: Moderate     Cracking & honeycomb at piers
		1. Roller type       2. Pin type         (Movable hinge)       (Fixed hinge)         Image: Constraint of the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second s	<ol> <li>Steel bearings (roller type) at Abut-A         <ul> <li>Condition: Good</li> <li>Steel bearings (Pin type) at Pier-1             <li>Condition: Corroded</li> </li></ul> </li> <li>Rubber pad with angle steel at piers &amp;</li> </ol>	Image: Second and of Columns/ Walls     Image: Second and and and and and and and and and a					- Overall damage degree: Moderate
Unseating/ Fall-down Prevention System	8. Bearing	3. Rubber pad with angle steel (Fixed)	<ul> <li>Abut-B <ul> <li>Condition: Corroded (angle steel)</li> </ul> </li> <li>Types of existing bearing are not vulnerable to earthquakes</li> <li>Possibility of unseating at Abut-B &amp; piers of steel I-girder bridges due to corroded bearings</li> <li>Overall vulnerability: Serious</li> </ul>	1.	. Seis - Vı - Vı - Hi bea . Stru - Co - W	smic Vulnerability ulnerability of pier ulnerability of foun igh possibility of un arings) uctural Soundness ( prrosion of steel la fater leaking at PC	Summary columns/walls to lar dations to large scale nseating (simply sup Superstructures) nger arch bridge I-girders	of Structural Deficie ge scale earthquakes e earthquakes (unkno ported, no seismic re	ncies (confinement loss, deterioration) wn structure) strainers, short seat length, corroded
	9. Seat Length	<ol> <li>Abut-A: 60cm</li> <li>Minimum Required Seat Length</li> <li>JRA: 135cm, AASHTO: 68cm</li> <li>Pier-1: 40cm (PC I-girder side)</li> <li>Minimum Required Seat Length</li> </ol>	<ul> <li>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.</li> <li>High possibility of unseating due to the very</li> </ul>	3.	- At - De . Stru - Cr	bnormal vibration of eterioration of the o actural Soundness ( racking & honeyco	of the steel langer arc leck slab (cracking, l Substructures) mb at piers	h bridge noneycomb, water lea	king)
	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure			Simply-support	rted steel ranger arch bridge	LIL-S1	nply-supported PC I-girder bridge
	11. Scouring	None	- No scouring effect		٨	Abut-A		P1 P2 P	3 P4 P5 P6 Abut-B
Foundation	12. Soil Type	Soil type (JRA): I	- Firm ground condition		VR - Consider Flackening.				
	13. Liquefaction Potential	- The ground at the site consists of nonliquefiable layers	- No liquefaction potential		P	lan			
Seismic Hazard	14. Distance from Active Faults	- Distance: 2.5km - Active Fault Name: PFZ Central Leyte Fault	<ul><li>The distance is between 2 and 5km.</li><li>Serious effect of the active fault movement</li></ul>			(2 lanes)	Sea Water		

#### **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.

	Peak Hour Traffic Volume	224 Veh/hour
	Road Type	Local Road
LOS: B	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 approa
- There is no house along north side of approach road.
- There are some houses along south side of the Bridge. Under the
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, chick
for boat.
Existing Environmental Condition (Noise, Vibration, Air Pollutio
- Environmental condition is good except for the pollution of traff
pollution.
Environmental Protection Area (national park, reserves and desig
- The Bridge is not located in a cultural property or a natural reser
Existence on Location Map of Valuable Habitats Ecologically, Hi
- The Bridge is not located in a cultural property or a natural reser

h road)

e Bridge near strait is used for basket court and

ken house, waste collection point and dock area

on and Water contamination.)

fic flow such as noise, vibration and air

gnated wet land)

rve area.

istorical and Cultural Assets

rve area.

### (7) Wawa Bridge

1) Structural and Geological Outline

Bridge length/width	L=228m, W=8.9m	1	Traffic Load Regulation	10t	]		
Year Built	1967	ļ	Soil Profile Type	I (JRA)			
Bridge Type	- Main Spans: Simply supported steel truss bridge	ļ	Liquefaction Potential	None			
	- Approach Spans: Simply supported steel I-girder bridge	1	As-built drawing	None			
Side view	On the bridge Under the bridge		Abut-A	Abut-A Abut-A Short seat I	lenght	P1	
P4	Abut-B Seat Length (P1)	1	Reinforced			Deck slab	-





Figure 13.2.1-19 Structural and Geological of Wawa Bridge

		Seismic Vulnerability			
	Items	Results of Surveys	Analyses/Comments		
	1. Difference in soil types between adjacent piers	Soil Type is consistent along with the entire bridge	- No soil type difference between adjacent piers		
Earthquake	2. Continuous or Simply1. Main Spans: Simply supported 2. Approach Spans: Simply suppBridge		<ul><li>All spans are simply supported.</li><li>High possibility of unseating due to simply supported structures</li></ul>		
	3.EccentricLoads(longitudinalandtransverse dir.)	Maximum span ratio: (1 st span length): (2 nd span length) =1.0:3.0	<ul> <li>The span ratio is over 1.5</li> <li>Possibility of eccentric loads only in the transverse direction: simply supported</li> </ul>		
System	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	<ul> <li>Heights of embankments are below 5m.</li> <li>Lower risk of abutments' collapse under earthquake</li> </ul>		
	6. Built Year	1967 (Constructed before 1992)	<ul> <li>Possibility of confinement loss of pier columns/walls</li> <li>Lack of seismic capacities of all the members</li> </ul>		
Unseating/ Fall-down Prevention System	7. Unseating/Fall-down Prevention Devices (both longitudinal and transverse dir.)	<ul> <li>Longitudinal dir.: No restrainer</li> <li>Transverse dir.: No restrainer</li> </ul>	- High possibility of unseating due to non- existence of seismic restrainers		
	8. Bearing	1. Rocker type (Movable hinge)       P4         Corroded, deformed       Reinforced         2. Pin type (Hinge)       3. Fixed type (Fixed)         Slightly corroded       Corroded, deformed	<ol> <li>Steel bearings (rocker type) at abutments &amp; piers         <ul> <li>Condition: Corroded, deformed</li> </ul> </li> <li>Steel bearings (pin type) at Pier-1         <ul> <li>Condition: Corroded</li> </ul> </li> <li>Steel bearings (fixed type) at Pier-4         <ul> <li>Condition: Corroded</li> </ul> </li> <li>Steel bearings (fixed type) at Pier-4         <ul> <li>Condition: Corroded</li> </ul> </li> <li>Rocker type bearings are vulnerable to seismic forces: possibility of unseating at abutments &amp; piers</li> <li>Possibility of unseating at abutments &amp; piers due to corroded bearings &amp; seismically vulnerable bearing type</li> </ol>		
	9. Seat Length	<ol> <li>Abut-A: 45cm</li> <li>Minimum Required Seat Length</li> <li>JRA: 83cm, AASHTO: 42cm</li> <li>Pier-3: 65cm</li> <li>Minimum Required Seat Length</li> <li>IRA: 108cm AASHTO: 60cm</li> </ol>	<ul> <li>Overall vulnerability: Serious</li> <li>The seat lengths of abutments and piers don't satisfy JRA's minimum required seat length.</li> <li>High possibility of unseating due to the short seat length</li> </ul>		
	10. Foundation Type (known or unknown)	No available drawings	- Unknown structure		
Foundation	11. Scouring 12. Soil Type	Condition of Pier-3 is unknown. Soil type (JRA): I	- Unknown - Firm ground condition		
roundation	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	<ul> <li>The distance is less than 2km.</li> <li>Fatal effect of the active fault movement</li> </ul>		



Soundness	3				
	Analyses/Comments				
	<ul> <li>Corrosion at the part of steel members</li> <li>Low load capacity (load limit: 10t)</li> <li>Temporary supports for steel I-girders due to the low load limit</li> <li>Overall damage degree: Serious</li> </ul>				
	<ul> <li>Corrosion at bracing members</li> <li>Overall damage degree: Moderate</li> </ul>				
aking	<ul> <li>Major cracking at the side face of the deck slab</li> <li>Water leaking along the center girder</li> <li>Overall damage degree: Serious</li> </ul>				
	<ul><li>Piers are apparently in good condition.</li><li>Overall damage degree: Good</li></ul>				
1					
ural Defi	ciencies				
earthquak akes (unk o seismic	es (confinement loss) nown structure) restrainers, short seat length, corroded				
v supports cing)	supports are used.) (ing)				
ported steel truss	bridge Simply-supported steel				
P3	P4 Abut-B Temporary support				
I					

#### 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

								τ	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 Assu	mption and	LOS
-----------	-------------	------------	-----

	Peak Hour Traffic Volume	149 Veh/hour
	Road Type	Local Road
LOS: B	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



<ul> <li>Household and Structures (Area facing the Bridge and the approach</li> <li>On the north side, there are many illegal houses along the approach</li> <li>A water pipeline is held along the Bridge.</li> <li>There is a dam for irrigation use at the downstream of the River.</li> <li>There is a cottage for maintenance of the Bridge.</li> <li>Land use (Area facing the Bridge and the approach road)</li> <li>The land use zone classification in the area is generally agriculture crop farming is a primary source of livelihood.</li> <li>Existing Environmental Condition (Noise, Vibration, Air Pollution - Environmental condition is good except for the pollution of traffice</li> <li>The Bridge is not located in a cultural property or a natural reserver</li> <li>The Bridge is not located in a cultural property or a natural reserver</li> </ul>	
<ul> <li>On the north side, there are many illegal houses along the approad</li> <li>A water pipeline is held along the Bridge.</li> <li>There is a dam for irrigation use at the downstream of the River.</li> <li>There is a cottage for maintenance of the Bridge.</li> <li>Land use (Area facing the Bridge and the approach road)</li> <li>The land use zone classification in the area is generally agricultu crop farming is a primary source of livelihood.</li> <li>Existing Environmental Condition (Noise, Vibration, Air Pollution</li> <li>Environmental Protection Area (national park, reserves and designation of the Bridge is not located in a cultural property or a natural reserver.</li> <li>The Bridge is not located in a cultural property or a natural reserver.</li> </ul>	Household and Structures (Area facing the Bridge and the approac
<ul> <li>A water pipeline is held along the Bridge.</li> <li>There is a dam for irrigation use at the downstream of the River.</li> <li>There is a cottage for maintenance of the Bridge.</li> <li>Land use (Area facing the Bridge and the approach road)</li> <li>The land use zone classification in the area is generally agricultu crop farming is a primary source of livelihood.</li> <li>Existing Environmental Condition (Noise, Vibration, Air Pollution - Environmental condition is good except for the pollution of traffic Environmental Protection Area (national park, reserves and designated on the Bridge is not located in a cultural property or a natural reserver Existence on Location Map of Valuable Ecological Habitats, Histor - The Bridge is not located in a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a natural reserver is a cultural property or a</li></ul>	- On the north side, there are many illegal houses along the approa
<ul> <li>There is a dam for irrigation use at the downstream of the River.</li> <li>There is a cottage for maintenance of the Bridge.</li> <li>Land use (Area facing the Bridge and the approach road)</li> <li>The land use zone classification in the area is generally agricultuce crop farming is a primary source of livelihood.</li> <li>Existing Environmental Condition (Noise, Vibration, Air Pollution - Environmental condition is good except for the pollution of traffice</li> <li>Environmental Protection Area (national park, reserves and designated on the Bridge is not located in a cultural property or a natural reserver.</li> <li>The Bridge is not located in a cultural property or a natural reserver.</li> </ul>	- A water pipeline is held along the Bridge.
<ul> <li>There is a cottage for maintenance of the Bridge.</li> <li>Land use (Area facing the Bridge and the approach road)</li> <li>The land use zone classification in the area is generally agricultuce crop farming is a primary source of livelihood.</li> <li>Existing Environmental Condition (Noise, Vibration, Air Pollution - Environmental condition is good except for the pollution of traffice Environmental Protection Area (national park, reserves and designated - The Bridge is not located in a cultural property or a natural reserver Existence on Location Map of Valuable Ecological Habitats, Historea - The Bridge is not located in a cultural property or a natural reserver - The Bridge is not located in a cultural property or a natural reserver - The Bridge is not located in a cultural property or a natural reserver - The Bridge is not located in a cultural property or a natural reserver - The Bridge is not located in a cultural property or a natural reserver - The Bridge is not located in a cultural property or a natural reserver - The Bridge is not located in a cultural property or a natural reserver - The Bridge is not located in a cultural property or a natural reserver - The Bridge is not located in a cultural property or a natural reserver - The Bridge is not located in a cultural property or a natural reserver - The Bridge is not located in a cultural property or a natural reserver - The Bridge is not located in a cultural property or a natural reserver - The Bridge is not located in a cultural property or a natural reserver - The Bridge is not located in a cultural property or a natural reserver - The Bridge is not located in a cultural property or a natural reserver - The Bridge is not located in a cultural property or a natural reserver - The Bridge is not located in a cultural property or a natural reserver - The Bridge is not located in a cultural property or a natural reserver - The Bridge</li></ul>	- There is a dam for irrigation use at the downstream of the River.
<ul> <li>Land use (Area facing the Bridge and the approach road)</li> <li>The land use zone classification in the area is generally agricultu crop farming is a primary source of livelihood.</li> <li>Existing Environmental Condition (Noise, Vibration, Air Pollution - Environmental condition is good except for the pollution of traffic Environmental Protection Area (national park, reserves and designated - The Bridge is not located in a cultural property or a natural reserve Existence on Location Map of Valuable Ecological Habitats, Histor - The Bridge is not located in a cultural property or a natural reserver.</li> </ul>	- There is a cottage for maintenance of the Bridge.
<ul> <li>The land use zone classification in the area is generally agricultu crop farming is a primary source of livelihood.</li> <li>Existing Environmental Condition (Noise, Vibration, Air Pollution - Environmental condition is good except for the pollution of traffic Environmental Protection Area (national park, reserves and designal - The Bridge is not located in a cultural property or a natural reserve Existence on Location Map of Valuable Ecological Habitats, Histor - The Bridge is not located in a cultural property or a natural reserve reserves.</li> </ul>	Land use (Area facing the Bridge and the approach road)
crop farming is a primary source of livelihood. Existing Environmental Condition (Noise, Vibration, Air Pollution - Environmental condition is good except for the pollution of traffic Environmental Protection Area (national park, reserves and designated) - The Bridge is not located in a cultural property or a natural reserve Existence on Location Map of Valuable Ecological Habitats, Histo - The Bridge is not located in a cultural property or a natural reserve	- The land use zone classification in the area is generally agricultu
<ul> <li>Existing Environmental Condition (Noise, Vibration, Air Pollution</li> <li>Environmental condition is good except for the pollution of traffic</li> <li>Environmental Protection Area (national park, reserves and designated on the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protection of the protecti</li></ul>	crop farming is a primary source of livelihood.
<ul> <li>Environmental condition is good except for the pollution of traffic Environmental Protection Area (national park, reserves and designated)</li> <li>The Bridge is not located in a cultural property or a natural reserve Existence on Location Map of Valuable Ecological Habitats, Histor</li> <li>The Bridge is not located in a cultural property or a natural reserve</li> </ul>	Existing Environmental Condition (Noise, Vibration, Air Pollution
Environmental Protection Area (national park, reserves and designation - The Bridge is not located in a cultural property or a natural reserver Existence on Location Map of Valuable Ecological Habitats, Historia - The Bridge is not located in a cultural property or a natural reserver.	- Environmental condition is good except for the pollution of traffi
<ul> <li>The Bridge is not located in a cultural property or a natural reserve Existence on Location Map of Valuable Ecological Habitats, Histo</li> <li>The Bridge is not located in a cultural property or a natural reserve</li> </ul>	Environmental Protection Area (national park, reserves and design
Existence on Location Map of Valuable Ecological Habitats, Histo - The Bridge is not located in a cultural property or a natural reserv	- The Bridge is not located in a cultural property or a natural reserv
- The Bridge is not located in a cultural property or a natural reserv	Existence on Location Map of Valuable Ecological Habitats, Histo
	- The Bridge is not located in a cultural property or a natural reserv

me is very small, with vehicle-capacity ratio is ke, the passing vehicles will drive about 25 km se the peak hour traffic volume is very small.

## h road)

ch road and on the dam facility.

ral, due to the soil's high fertility potential Multi-

and Water contamination.)

c flow such as noise, vibration and air pollution.

nated wet land)

ve area.

orical and Cultural Assets

ve area.

#### 13.2.2 Comparison of Improvement Measures

1) Buntun Bridge



of Impro	ovement Mea	asu	res 8	<b>Evaluation</b>	
capacity	improvement	of	pier	columns/walls	(column/wall

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)

у	<ul> <li>Concre</li> <li>Steel pi</li> <li>Unseat</li> </ul>	te jacketing (column/wall retrofit) ipe pile foundation (pile for reinforcement) ing prevention system	
	<ul><li>Installa</li><li>Pile-dri</li></ul>	tion of piles into the rock iving under the existing superstructure	
	Seismic Retrofit Works	<ul> <li>Column/wall retrofit</li> <li>Pile for reinforcement</li> <li>Unseating prevention system</li> </ul>	0.32
	Repair Works	<ul><li>Epoxy injection &amp; mortar repair</li><li>Floor slab water proof sheet</li><li>Replacement of expansion joints</li></ul>	0.04
	Others	<ul><li>Working platform on the water</li><li>Temporary detour bridge</li></ul>	0.07
		Total	0.43

· 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

· 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

у	<ul> <li>Main spans: Continuous steel truss bridge</li> <li>Approach spans: Steel I-girder bridge</li> <li>Piers in water: Steel pipe sheet pile foundation</li> <li>Piers on land: Cast-in-place pile foundation</li> </ul>			
	Requirement     steel member	nt of large construction yard for asser	nbly of	
	Super- structure	<ul> <li>Continuous steel truss bridge</li> <li>Steel I-girder bridges</li> </ul>	0.36	
	Substructure	• Wall type	0.16	
	Foundation	<ul><li>Steel pipe sheet pile foundation</li><li>Cast-in-place pile foundation</li></ul>	0.38	
	Others	<ul><li>Working platform on the water</li><li>Temporary detour bridge</li></ul>	0.10	
		Total	1.00	
ecupation during the construction of piers in water				
em	ement of large construction yard for steel truss			

members & steel pipe sheet pile . Temporary detour bridge installation during the whole



#### **Comparison of Improvement Measures for 1st Mandaue-Mactan Bridge**

#### **Detail of Improvement Measures & Evaluation**

• 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

• Improvement of the deck slab soundness (repair) • Improvement of the steel members' soundness & strength

- PC-panel jacketing (column retrofit)
- Steel pipe sheet pile foundation & steel pipe pile foundation (pile for reinforcement)
- Unseating prevention system

Installa	tion of piles into the rock		
Pile-dri	iving under the existing superstructure		
Seismic	Column retrofit		
Retrofit	Pile for reinforcement	0.48	
Vorks	<ul> <li>Unseating prevention system</li> </ul>		
Repair	<ul> <li>Epoxy injection &amp; mortar repair</li> </ul>		
Vorks	<ul> <li>Floor slab water proof sheet</li> </ul>	0.07	
	<ul> <li>Replacement of expansion joints</li> </ul>	0.07	
	<ul> <li>Repaint &amp; strengthening of steel members</li> </ul>		
Others	• Working platform on the water	0.01	
	<ul> <li>Temporary detour bridge</li> </ul>	0.01	
	Total	0.56	

• 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

· 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 • Main spans: Continuous steel truss bridge · Approach spans: Steel I-girder bridge • Multi-column foundation • Cast-in-place pile foundation • 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 Super-· Continuous steel truss bridge 0.34 · Continuous steel I-girder bridges structure 0.12 Substructure • Wall type • Spread foundation • Multi-column foundation Foundation 0.44 · Cast-in-place pile foundation • Working platform on the water Others 0.10 · Temporary detour bridge Total 1.00 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



#### **Comparison of Improvement Measures for Palanit Bridge**

Improv	ement Measures & Evaluation		
acity impr	ovement of pier walls (wall retrofit)		
acity impr	ovement of foundations (pile for reinforceme	ent)	
nt of unse	ating/fall-down prevention system (seat ex	tender,	
evention of	cables/chains, shear keys, replacement of bea	rings)	
t of the de	eck slab soundness (replacement)		
nt of the st	eel members' soundness & strength		
• Concre	ete jacketing (wall retrofit)		
• Steel p	ipe pile foundation (pile for reinforcement)		
• Streng	thening of steel members with steel plates		
Unseating prevention system			
Installation of piles into the rock			
Pile-driving under the existing superstructure			
Seismic	• Wall retrofit		
Retrofit	• Pile for reinforcement	0.34	
Works	<ul> <li>Unseating prevention system</li> </ul>		
Repair	Replacement of the deck slab		
Works	Replacement of expansion joints	0.60	
	<ul> <li>Repaint &amp; strengthening of steel</li> </ul>	0.62	
	members with steel plates		
Others	• Working platform on the water	0.09	
	Temporary detour bridge	0.08	
	Total	1.04	

• Temporary detour bridge installation during abutment retrofit works • Requirement of temporary resettlement for the construction

comn	nende	d
f DC	aindan	المساط

• 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

· Continuous PC I-girder bridge

• Requirement of large construction yard for the fabrication of PC I-girders		
Super-	• Continuous PC I-girder bridge	0.51

Buper	• Continuous I C I-giruci onuge	0.51
structure		0.51
Substructure	• Wall type	0.11
Foundation	• Spread foundation	0.23
Others	<ul><li>Working platform on the water</li><li>Temporary detour bridge</li><li>Approach road</li></ul>	0.15
	Total	1.00

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



**Comparison of Improvement Measures for Mawo Bridge** 

Improvement Measures & Evaluation								
acity improvement of pier walls (wall retrofit)								
acity impr	ovem	ent of foundations (pile for reinforceme	ent)					
nt of unse	ating	/fall-down prevention system (seat ex	tender,					
evention c	ables	s/chains, shear keys, replacement of bea	rings)					
nt of the de	eck sl	ab soundness (replacement)						
nt of the sto	eel m	embers' soundness & strength						
• Concre	te jac	cketing (wall retrofit)						
• Steel p	ipe p	offerdem						
• Sheet p	ing n	revention system						
• Uliseat	ing p bonii	ng of steel members with steel plates						
• Sucingi Installa	tion	of piles into the rock						
• Instance	nile ir	ustallation under the existing superstruct	ture					
Seismic	W	/all retrofit	luic					
Retrofit	• • •	ile for reinforcement	0.09					
Works	. U	inseating prevention system	0.07					
Renair	• 0 • R	enlacement of the deck slab						
Works	. R	eplacement of expansion joints						
() offic	St	rengthening of steel members with	0.30					
	st	eel plates						
Others	. W	Vorking platform on the water	0.04					
	• Temporary detour bridge							
Total 0.45								
ation duri	ng the	e works for piers in water						
detour bric	lge ir	stallation during abutment retrofit work	<b>KS</b>					
t of enviro	onme	ntal measures for water contamination						
t of tempo	rary	resettlement for the construction						
-	•							
ecommended								
of existing bridge planning condition in order to confirm the								
eness of seismic retrofit & repair works								
of light w	eight	t & low height superstructure type in c	order to					
adequate vertical clearance								
Steel lan	oer a	rch bridge						
· Cast-in-r	ger a dace	nile foundation						
Requirer	nent	of large construction ward for asser	bly of					
steel me	mber	s	101y 01					
. Requirer	nent	of large size crane for the superst	ructure					
installati	on	of large size chance for the superst	iucture					
Installati	on of	f niles into the rock						
• mstanan		Stool langer arch bridge						
uper-		• Steel langer arch bridge	0.77					
ubstructur	ρ	Wall type	0.03					
ubstructur	C	• Wall type	0.05					
oundation	oundation Cast-in-place pile foundation 0.10							
	Spread foundation							
thers $\cdot$ Working platform on the water $0.10$								
		Temporary detour bridge	1.00					
	-	Total	1.00					
ation durin	ng the	e works for piers in water						
t of large size crane & large construction yard								
t of environmental measures for water contamination								
detour brid	lge in	stallation during the whole construction	1 I					
t of temporary resettlement for the construction								



**Comparison of Improvement Measures for Biliran Bridge** 

Improvement Measures & Evaluation						
pacity im	provement of pier columns (concrete w	all for				
nt)						
acity imp	rovement of foundations (pile for reinforcer	nent &				
f spread fo	poting)					
nt of unse	ating/fall-down prevention system (seat ex	tender,				
evention c	ables/chains, shear keys, replacement of bea	rings)				
nt of the de	eck slab soundness (repair)	-				
nt of the st	eel members' soundness					
• Concre	ete wall for reinforcement					
• Steel p	ipe pile foundation (pile for reinforcement)					
• Unseat	ing prevention system					
Installation of piles into the rock						
• Sheet pile installation under the existing superstructure						
Seismic	Concrete wall for reinforcement					
Retrofit	• Pile for reinforcement	0.26				
Works	• Expansion of spread footing	0.26				
	<ul> <li>Unseating prevention system</li> </ul>					
Repair	<ul> <li>Epoxy injection &amp; mortar repair</li> </ul>					
Works	<ul> <li>Floor slab water proof sheet</li> </ul>	0.04				
	<ul> <li>Replacement of expansion joints</li> </ul>	0.04				
	• Repaint of steel members					
Others	• Working platform on the water	0.04				
	Temporary detour bridge	0.04				
Total 0.34						
ation duri	ng the works for piers in water					
detour brid	lge installation during abutment retrofit worl	<b>KS</b>				
t of environmental measures for water contamination						

· Application of existing bridge planning condition with better span balance in order to confirm the cost effectiveness of seismic retrofit &

Application of light weight & low height superstructure type in order to maintain the adequate vertical clearance

	Main span: - Steel langer arch bridge							
	• Approach s	Jans Steel I-gilder bildge						
	Requiremen	t of large construction yard for asser	nbly of					
	steel membe	ers	•					
	• Requirement of large size crane for the superstructure							
	installation							
	Requirement of accurate rock excavation							
	Super- • Steel langer arch bridge		0.60					
structure . Steel I-girder bridge								
	Substructure· Wall type0.13							
	Foundation • Spread foundation 0.08							
Others		• Working platform on the water	0.10					
		<ul> <li>Temporary detour bridge</li> </ul>						
	Total 1.00							
a	tion during the v	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



#### **Comparison of Improvement Measures for Lilo-an Bridge**

Improvement Measures & Evaluation									
bacity improvement of pier columns (concrete wall for nt)									
bacity improvement of foundations (expansion of spread									
t of unseating/fall-down prevention system (seat extender, evention cables/chains, shear keys, replacement of bearings)									
t of PC-I girder & the deck slab soundness (repair)									

· Improvement of the steel members' soundness

Concrete wall for reinforcement						
vall						
0.21						
0.21						
0.04						
0.04						
0.00						
0.00						
0.25						

• Requirement of temporary resettlement for the construction

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

<ul> <li>Main span: Steel langer arch bridge</li> <li>Approach spans: PC I-girder bridge</li> </ul>						
<ul> <li>Requirement of large construction yard for assembly of steel members &amp; fabrication of PC I-girder</li> <li>Requirement of large size crane for the superstructure installation</li> </ul>						
Super- structure. Steel langer arch bridge0.59. PC I-girder bridge0.59						
Substructure• Wall type0.20						
Foundation	Spread foundation	0.11				
Others • Working platform on the water • Temporary detour bridge						
Total 1.00						
ation during the works for piers in water t of large size crane & large construction yard t of environmental measures for water contamination action period for cast-in-place PC girders letour bridge installation during the whole construction t of temporary resettlement for the construction						
bohmmondod						



**Comparison of Improvement Measures for Wawa Bridge** 

#### **Detail of Improvement Measures & Evaluation**

• 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

- · Concrete wall for reinforcement
- Steel pipe pile foundation (pile for reinforcement)
- · Additional steel plates & steel I-girders (strengthening of steel members)
- Unseating prevention system

	01					
• Sheet pile installation under the existing superstructure						
Seismic	Concrete wall for reinforcement					
Retrofit	• Pile for reinforcement	0.20				
Works	<ul> <li>Expansion of spread footing</li> </ul>	0.39				
	<ul> <li>Unseating prevention system</li> </ul>					
Repair	Replacement of the deck slab					
Works	Replacement of expansion joints	0.22				
	• Repaint & strengthening of steel	0.25				
	members					
Others	• Working platform on the water	0.00				
	Temporary detour bridge	0.08				
	Total	0.70				

• River occupation during the works for piers in water

• Temporary detour bridge installation during abutment retrofit works • Requirement of environmental measures for water contamination

Application of three span continuous bridge for better span balance &

• 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

- Continuous steel plate deck box-girder bridge
- Cast-in-place pile foundation
- · 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

	2	
uper- ructure	Continuous steel plate deck box- girder bridge	0.58
ubstructure	• Wall type	0.14
oundation	<ul><li>Spread foundation</li><li>Cast-in-place pile foundation</li></ul>	0.14
others	<ul><li>Working platform on the water</li><li>Temporary detour bridge</li></ul>	0.14
	Total	1.00

· 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

# 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.

Package B											
	Bridge Condition (80 points) Importance							rtance			
		(60 p	oints)		(20 p	oints)		(20 p	oints)		
Bridge Name	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)	Sub-Total Score (80 points)	Traffic Volume (5 points)	Alternative Bridge (15 points)	Total Score (100 points)	Priority Ranking
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

	Table 14.1-1	Summary of Evaluation Results and Priority Ranking for Package B and C
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14-2

Package C											
·		Seismic Vu (60 p	Bridge Inerability oints)	Condition (80	points) Structural Soundness (20 points)		- Importance (20 points)				
Bridge Name	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)	Sub-Total Score (80 points)	Traffic Volume (5 points)	Alternative Bridge (15 points)	Total Score (100 points)	Priority Ranking
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

			Evaluation Item		Evaluation	Score	Remarks (Reasons)
			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
		Earthquake	3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: 1.0 - 1.5	3	Balance Ratio: 1.3
		Resisting System	4. Pier Type (Single column/wall or multiple columns)	3	Single column/wall	3	
		(20 points)	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
	y		Sub-Total	20	15		
	rabilit ts)	Unseating/Fall-	7. Unseating/Fall-down Prevention Devices	5	Poor	3	Seismic restrainers are installed, but not functionable enough.
	oin	down Prevention	8. Bearing	5	Moderate	3	Deterioration of bearings
	Vu 0 p	(15 points)	9. Seat Length	5	Short	3	The seat lengths satisfy AASHTO criteria.
uc	mic (6	(15 points)	Sub-Total	15	9		
litic ts)	eisı		10. Foundation Type (known or unknown)	3	Unknown	3	
onc	S	Foundation (15 points)	11. Scouring	3	With evidence or potential for scouring	3	Scouring at Pier-5
e C 0 p	·		12. Soil Type	3	Soil type III (Soft)	3	
gbi (8		(15 points)	13. Liquefaction Potential	6	Very high	6	Sand or silty sand (less than 10 of N value)
Bı			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			39		
	SSS		1. Primary Members	10	Moderate (Need for repair work)	5	Cracking
	idne	Superstructures	2. Secondary Members	2	Moderate (Need for repair work)	1	Water leaking at expansion joints
	our	(15 points)	3. Deck Slab	3	Moderate (Need for repair work)	1	Cracking & water leaking
	al S poj		Sub-Total	15	7		
	tura (20	Substructures	4. Deterioration of Columns/Walls	5	Moderate (Repairable)	3	Cracking
	ruc	(5 points)	Sub-Total	5	3		
	St		Sub-Total (Structural Soundness)	20	10		
			Sub-Total (Bridge Condition)	80	49		
1. Traffic Volume		5	50,000 - 100,0000 pcu	3	Evaluated by the criteria for Package B		
Importance (20 points)       2. Alternative Bridge		15	1 km - 3 km away	5	Distance to the altenative bridge: 1.7km		
Sub-Total (Importance)					8		
			Grand Total	100	57		

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

Evaluation Item					Evaluation	Score	Remarks (Reasons)
			1. Difference in soil types between adjacent piers	2	Same	0	Consistent soil type
			2. Continuous or Simply Supported Bridge	3	Continuous	0	
		Earthquake	3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: 1.0 - 1.5	3	Balance Ratio: 1.3
		Resisting System	4. Pier Type (Single column/wall or multiple columns)	3	Single column/wall	3	
		(20 points)	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
	y		Sub-Total	20	11		
	rabilit ts)	Unseating/Fall-	7. Unseating/Fall-down Prevention Devices	5	Poor	3	Seismic restrainers are installed, but not functionable enough.
	ulne oin	down Prevention	8. Bearing	5	Serious	5	Loose connection of bearings
	Vı 0 p	(15 points)	9. Seat Length	5	Enough	0	The seat lengths satisfy JRA criteria.
uc	mic (6	(15 points)	Sub-Total	15	8		
litic ts)	eis		10. Foundation Type (known or unknown)	3	Unknown	3	
oin	<b>S</b> 2	Foundation (15 points)	11. Scouring	3	With evidence or potential for scouring	3	Potential of deep scouring at Pier-9 & 10
e C 0 p	•		12. Soil Type	3	Soil type II (Moderate)	2	
idg (8		(15 points)	13. Liquefaction Potential	6	High	4	Sand or silty sand (10 - 20)
Bı			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			34		
	SSS		1. Primary Members	10	Moderate (Need for repair work)	5	Paint deterioration
	idne	Superstructures	2. Secondary Members	2	Moderate (Need for repair work)	1	Paint deterioration
	oun	(15 points)	3. Deck Slab	3	Moderate (Need for repair work)	1	Cracking & water leaking
	ıl S poi		Sub-Total	15	7		
	tura (20	Substructures	4. Deterioration of Columns/Walls	5	Moderate (Repairable)	3	Section loss & rebar exposure
	nc	(5 points)	Sub-Total	5	3		
	St		Sub-Total (Structural Soundness)	20	10		
			Sub-Total (Bridge Condition)	80	44		
1. Traffic Volume		5	50,000 - 100,0000 pcu	3	Evaluated by the criteria for Package B		
Importance (20 points)   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 14.1-3 Nagtahan Bridge (Package B)

Evaluation Item					Evaluation	Score	Remarks (Reasons)
			1. Difference in soil types between adjacent piers	2	Same	0	Consistent soil type
		Earthquake	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
		Resisting System	4. Pier Type (Single column/wall or multiple columns)	3	Single column/wall	3	
		(20 points)	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
	y		Sub-Total	20	17		
	rabilit ts)	Unseating/Fall-	7. Unseating/Fall-down Prevention Devices	5	Poor	3	Seismic restrainers are installed, but not functionable enough.
	oin	down Prevention	8. Bearing	5	Serious	5	Deterioration of bearings
	υ ν υ p	(15 points)	9. Seat Length	5	Very Short	5	Some of seat lengths don't satisfy AASHTO
uc	mic (6	(15 points)	Sub-Total	15	13		
litic ts)	eis		10. Foundation Type (known or unknown)	3	Unknown	3	
onc	<i>S</i> 2	Foundation (15 points)	11. Scouring	3	With evidence or potential for scouring	3	Scouring at Pier 2
e C 0 p			12. Soil Type	3	Soil type II (Moderate)	2	
gbi (8		(15 points)	13. Liquefaction Potential	6	High	4	Sand or silty sand (10 - 20)
Bı			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		
	SSS		1. Primary Members	10	Serious (Need for reinforcement)	10	Large deflection, uplift, & cracking
	idne	Superstructures	2. Secondary Members	2	Moderate (Need for repair work)	1	Section loss of RC side blocks
	oun	(15 points)	3. Deck Slab	3	Moderate (Need for repair work)	1	Cracking & water leaking
	ul S. poi		Sub-Total	15	12		
	tura (20	Substructures	4. Deterioration of Columns/Walls	5	Moderate (Repairable)	3	Cracking and scaling/spalling
	ruci	(5 points)	Sub-Total	5	3		
	St		Sub-Total (Structural Soundness)	20	15		
			Sub-Total (Bridge Condition)	80	60		
Importance (20 points)     1. Traffic Volume       2. Alternative Bridge		5	Less than 50,000 pcu	0	Evaluated by the criteria for Package B		
		15	3 km - 10 km away	10	Distance to the altenative bridge: 3.7km		
Sub-Total (Importance)				20	10		
			Grand Total	100	70		

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

Evaluation Item					Evaluation	Score	Remarks (Reasons)
			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
		Earthquake	3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: 1.0 - 1.5	3	Balance Ratio: 1.2
		Resisting System	4. Pier Type (Single column/wall or multiple columns)	3	Single column/wall	3	
		(20 points)	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
	y		Sub-Total	20	17		
	rabilit ts)	Unseating/Fall-	7. Unseating/Fall-down Prevention Devices	5	Poor	3	Seismic restrainers are installed, but not functionable enough.
	line	down Prevention	8. Bearing	5	Serious	5	Deterioration of bearings
	Vu 0 pe	(15 points)	9. Seat Length	5	Very Short	5	Some of seat lengths don't satisfy AASHTO
	nic (6	(15 points)	Sub-Total	15	13		
uc	eisı		10. Foundation Type (known or unknown)	3	Unknown	3	
ditio ts)	S	Foundation	11. Scouring	3	With evidence or potential for scouring	3	Potential of deep scouring at Pier-1 & 2
ono		(15 points)	12. Soil Type	3	Soil type II (Moderate)	2	
ie C 0 p		(15 points)	13. Liquefaction Potential	6	High	4	Sand or silty sand (10 - 20)
gpi 3)			Sub-Total	15	12		
B		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			48		
	ss		1. Primary Members	10	Serious (Need for reinforcement)	10	<ul> <li>Paint deterioration on steel truss members</li> <li>Major cracking at gerber hinge area of PCDG</li> </ul>
	oundne nts)	Superstructures (15 points)	2. Secondary Members	2	Moderate (Need for repair work)	1	<ul><li>Paint deterioration on steel truss members</li><li>Abnormal spacing of an expansion joint</li></ul>
	l Sc poi		3. Deck Slab	3	Moderate (Need for repair work)	1	Cracking & water leaking
	ura 20		Sub-Total	15	12		
	uct (	Substructures	4. Deterioration of Columns/Walls	5	Moderate (Repairable)	3	Cracking, spalling, and rebar exposure
	Stı	(5 points)	Sub-Total	5	3		
			Sub-Total (Structural Soundness)	20	15		
Sub-Total (Bridge Condition)		80	63				
1. Traffic Volume         Importance (20 points)         2. Alternative Bridge		5	Over 100,000 pcu	5	Evaluated by the criteria for Package B		
		15	3 km - 10 km away	10	Distance to the altenative bridge: 3.7km		
	Sub-Total (Importance)				15		
			Grand Total	100	78		

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

			Evaluation Item		Evaluation	Score	Remarks (Reasons)
			1. Difference in soil types between adjacent piers	2	Same	0	Consistent soil type
			2. Continuous or Simply Supported Bridge	3	Simply supported	3	
		Earthquake	3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: 1.0 - 1.5	3	Balance Ratio: 1.3
		Resisting System	4. Pier Type (Single column/wall or multiple columns)	3	Multiple columns	0	
		(20 points)	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
	lity		Sub-Total	20	11		
	abi]	Unseating/Fall-	7. Unseating/Fall-down Prevention Devices	5	None	5	No seismic restrainers are installed.
	ner ints	down Prevention	8. Bearing	5	Serious	5	No bearings at piers
	Vul po	System	9. Seat Length	5	Short	3	The seat lengths satisfy AASHTO criteria.
	iic ) (60	(15 points)	Sub-Total	15	13		
on	ism		10. Foundation Type (known or unknown)	3	Unknown	3	
diti tts)	Se	Foundation (15 points)	11. Scouring	3	With evidence or potential for scouring	3	Scouring at Pier-2 & 3
Con			12. Soil Type	3	Soil type II (Moderate)	2	
se ( 80 p		(15 points)	13. Liquefaction Potential	6	High	4	Sand or silty sand (10 - 20)
ridş (8			Sub-Total	15	12		
В		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		
	s		1. Primary Members	10	Good or small (No need for repair)	0	
	ndnes s)	Superstructures	2. Secondary Members	2	Moderate (Need for repair work)	1	<ul><li>Deterioration of cross beams</li><li>Water leaking at expansion joint</li></ul>
	Sou	(15 points)	3. Deck Slab	3	Serious (Need for replacement)	3	Cracking & water leaking
	ral : ) po		Sub-Total	15	4		
	ctuı (2(	Substructures	4. Deterioration of Columns/Walls	5	Moderate (Repairable)	3	
	stru	(5 points)	Sub-Total	5	3		
	01		Sub-Total (Structural Soundness)	20	7		
			Sub-Total (Bridge Condition)	80	53		
1. Traffic Volume		5	50,000 - 100,0000 pcu	3	Evaluated by the criteria for Package B		
Importance (20 points) 2. Alternative Bridge		15	3 km - 10 km away	10	Distance to the altenative bridge: 3.7km		
Sub-Total (Importance)					13		
			Grand Total	100	66		

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

			Evaluation Item		Evaluation	Score	Remarks (Reasons)
			1. Difference in soil types between adjacent piers	2	Same	0	Consistent soil type
			2. Continuous or Simply Supported Bridge	3	Simply supported	3	
		Earthquake	3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: over 1.5	5	Balance Ratio: 1.7
		Resisting System	4. Pier Type (Single column/wall or multiple columns)	3	Multiple columns	0	
		(20 points)	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
	ity		Sub-Total	20	14		
	abil	Unseating/Fall-	7. Unseating/Fall-down Prevention Devices	5	None	5	No seismic restrainers are installed.
	nera	down Prevention	8. Bearing	5	Serious	5	Pin portion of bearing is missing at Pier-11.
	Vul po	System	9. Seat Length	5	Short	3	The seat lengths satisfy AASHTO criteria.
L	nic ) (60	(15 points)	Sub-Total	15	13		
tioi ()	isn	Foundation (15 points)	10. Foundation Type (known or unknown)	3	Unknown	3	
ints	Se		11. Scouring	3	With evidence or potential for scouring	3	Scouring at Pier-5
CC Do			12. Soil Type	3	Soil type III (Soft)	3	
dge (8(		(15 points)	13. Liquefaction Potential	6	Very high	6	Sand or silty sand (less than 10 of N value)
Bri			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		
	SSS		1. Primary Members	10	Good or small (No need for repair)	0	
	) idne	Superstructures	2. Secondary Members	2	Good or small (No need for repair)	0	
	oun	(15 points)	3. Deck Slab	3	Moderate (Need for repair work)	1	Minor cracking & water leaking
	al S poj		Sub-Total	15	1		
	tura (20	Substructures	4. Deterioration of Columns/Walls	5	Good or small (No need for repair)	0	
	ruc	(5 points)	Sub-Total	5	0		
	St		Sub-Total (Structural Soundness)	20	1		
Sub-Total (Bridge Condition)			Sub-Total (Bridge Condition)	80	43		
1. Traffic Volume		5	Over 5,000 pcu	5	Evaluated by the criteria for Package C		
Importance (20 points)     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 14.1-7 Buntun Bridge (Package C)

			Evaluation Item		Evaluation	Score	Remarks (Reasons)
1. Difference in soil types between adjacent piers					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	
		Earthquake	3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: over 1.5	5	Balance Ratio: 2.2
		Resisting System	4. Pier Type (Single column/wall or multiple columns)	3	Single column/wall	3	
		(20 points)	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
	ity		Sub-Total	20	18		
	abil )	Unseating/Fall-	7. Unseating/Fall-down Prevention Devices	5	None	5	No seismic restrainers are installed.
	ner	down Prevention	8. Bearing	5	Serious	5	Deterioration of bearings
	Vul po	System	9. Seat Length	5	Short	3	The seat lengths satisfy AASHTO criteria.
	iic ⁷ (60	(15 points)	Sub-Total	15	13		
ion	isn		10. Foundation Type (known or unknown)	3	Unknown	3	
iditi ats)	Se	Foundation (15 points)	11. Scouring	3	With evidence or potential for scouring	3	Scouring at Pier-10
Con poii			12. Soil Type	3	Soil type II (Moderate)	2	
ge ( 80 ]		(15 points)	13. Liquefaction Potential	6	Very high	6	Sand or silty sand (less than 10 of N value)
3rid (			Sub-Total	15	14		
H		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			45		
	ss		1. Primary Members	10	Moderate (Need for repair work)	5	Experience of ship crush
	lnes	Superstructures	2. Secondary Members	2	Serious (Need for reinforcement)	2	Heavy corrosion & section loss
	unc its)	(15 points)	3. Deck Slab	3	Moderate (Need for repair work)	1	Minor cracking & rebar exposure
	So		Sub-Total	15	8		
	ural 20 J	Substructures	4. Deterioration of Columns/Walls	5	Serious (Not repairable)	5	- Experience of ship crush at Pier-7
	ucti (;	(5 points)	Sub Total	5	5		- Severe rebar exposure at pile caps in water
	Str		Sub-10tal	20	12		
			Sub-Total (Structural Soundness)	20	59		
			1 Traffic Volume	5	0vor 5 000 pou	5	Evaluated by the criteria for Backage C
I. I raffic Volume		15	1 km 3 km away	5	Distance to the alterative bridge: 1.3km		
Importance (20 points) 2. Alternative Diluge			2. Anomative Bruge Sub-Total (Importance)	20	1 KIII - 5 KIII away 10	5	Distance to the anchative offuge. 1.3km
			Grand Total	100	68		
			Utaliu Totai	100	00		

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

			Evaluation Item		Evaluation	Score	Remarks (Reasons)
			1. Difference in soil types between adjacent piers	2	Same	0	Consistent soil type
			2. Continuous or Simply Supported Bridge	3	Simply supported	3	
		Earthquake	3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: over 1.5	5	Balance Ratio: 2.7
		Resisting System	4. Pier Type (Single column/wall or multiple columns)	3	Single column/wall	3	
		(20 points)	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
	ity		Sub-Total	20	17		
	abil	Unseating/Fall-	7. Unseating/Fall-down Prevention Devices	5	None	5	No seismic restrainers are installed.
	ner	down Prevention	8. Bearing	5	Serious	5	Deterioration of bearings
	Vul po	System	9. Seat Length	5	Very Short	5	Some of seat lengths don't satisfy AASHTO
	iic [`] (60	(15 points)	Sub-Total	15	15		
u	isn		10. Foundation Type (known or unknown)	3	Unknown	3	
litic ts)	Se	Foundation	11. Scouring	3	None	0	
onc		(15 points)	12. Soil Type	3	Soil type I (Firm)	0	
e C 0 p		(10 points)	13. Liquefaction Potential	6	None	0	Firm, clayey soil or over than 30 of N value
idg (8			Sub-Total	15	3		
Br		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		
	SSS	<b>G</b>	1. Primary Members	10	Serious (Need for reinforcement)	10	<ul> <li>Severe corrosion &amp; section loss</li> <li>Low load capacity (load limit: 7t)</li> </ul>
	idne	Superstructures	2. Secondary Members	2	Serious (Need for reinforcement)	2	Severe corrosion
	oun	(15 points)	3. Deck Slab	3	Serious (Need for replacement)	3	Major cracking, water leaking, & hanycomb
	ul S poi		Sub-Total	15	15		
	uctura (20	Substructures	4. Deterioration of Columns/Walls	5	Moderate (Repairable)	3	Rebar exposure & cracking at the bearing base of Pier-1
	Str	(5 points)	Sub-Total	5	3		
		Sub-Total (Structural Soundness)		20	18		
Sub-Total (Bridge Condition)		80	56				
1. Traffic Volume		5	Less than 2,000 pcu	0	Evaluated by the criteria for Package C		
Importance (20 points)   2. Alternative Bridge		15	More than 10 km away or no alternate bridge	15	Distance to the altenative bridge: 20km		
Sub-Total (Importance)					15		
			Grand Total	100	71		

### Table 14.1-9 Palanit Bridge (Package C)

			Evaluation Item		Evaluation	Score	Remarks (Reasons)
			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	
		Earthquake	3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: 1.0	0	Balance Ratio: 1.0
		Resisting System	4. Pier Type (Single column/wall or multiple columns)	3	Single column/wall	3	
		(20 points)	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
	ity		Sub-Total	20	14		
	abil (	Unseating/Fall-	7. Unseating/Fall-down Prevention Devices	5	None	5	No seismic restrainers are installed.
	ner	down Prevention	8. Bearing	5	Moderate	3	Deterioration of bearings
	Vul po	System	9. Seat Length	5	Short	3	The seat lengths satisfy AASHTO criteria.
	iic ⁷ (60	(15 points)	Sub-Total	15	11		
ų	isn	Foundation (15 points)	10. Foundation Type (known or unknown)	3	Unknown	3	
s) (s	Se		11. Scouring	3	Unknown	2	Condition of Pier-1 in water is unknown.
onc			12. Soil Type	3	Soil type III (Soft)	3	
e C 0 p		(19 points)	13. Liquefaction Potential	6	Very high	6	Sand or silty sand (less than 10 of N value)
gbi (8			Sub-Total	15	14		
Br		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		
	SSS		1. Primary Members	10	Moderate (Need for repair work)	5	<ul> <li>Painting deterioration &amp; corrosion</li> <li>Low load capacity (load limit: 7t)</li> </ul>
	dne (	Superstructures	2. Secondary Members	2	Moderate (Need for repair work)	1	Painting deterioration & corrosion
	Soun soints)	(15 points)	3. Deck Slab	3	Serious (Need for replacement)	3	Cracking, water leaking, hanycomb, & rebar exposure
	ural 20 f		Sub-Total	15	9		
	ucti (3	Substructures	4. Deterioration of Columns/Walls	5	Good or small (No need for repair)	0	
	Str	(5 points)	Sub-Total	5	0		
	Sub-Total (Structural Soundness)			20	9		
Sub-Total (Bridge Condition)		80	58				
1. Traffic Volume		5	2,000 - 5,000 pcu	3	Evaluated by the criteria for Package C		
Importance (20 points)   2. Alternative Bridge		15	More than 10 km away or no alternate bridge	15	Distance to the altenative bridge: 20km		
Sub-Total (Importance)					18		
			Grand Total	100	76		

#### Table 14.1-10 Mawo Bridge (Package C)

Evaluation Item					Evaluation	Score	Remarks (Reasons)
			1. Difference in soil types between adjacent piers	2	Same	0	Consistent soil type
		Earthquake	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
		Resisting System	4. Pier Type (Single column/wall or multiple columns)	3	Multiple columns	0	
		(20 points)	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
	ý		Sub-Total	20	14		
	rabilit s)	Unseating/Fall-	7. Unseating/Fall-down Prevention Devices	5	Poor	3	Seismic restrainers are installed, but not functionable enough.
	ulne oint	down Prevention	8. Bearing	5	Serious	5	Deterioration of bearings
	Vu 0 pe	System	9. Seat Length	5	Short	3	The seat lengths satisfy AASHTO criteria.
u	nic (6	(15 points)	Sub-Total	15	11		
litic ts)	eisı		10. Foundation Type (known or unknown)	3	Unknown	3	
onc	S	Foundation (15 points)	11. Scouring	3	None	0	
e C 0 p	4		12. Soil Type	3	Soil type I (Firm)	0	
idg (8		(15 points)	13. Liquefaction Potential	6	None	0	Firm, clayey soil or over than 30 of N value
Br			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		
	SSS		1. Primary Members	10	Moderate (Need for repair work)	5	Corrosion on steel I-girder members
	) idne	Superstructures	2. Secondary Members	2	Good or small (No need for repair)	0	
	oun	(15 points)	3. Deck Slab	3	Moderate (Need for repair work)	1	Spalling & water leaking
	al S poj		Sub-Total	15	6	-	
	tura (20	Substructures	4. Deterioration of Columns/Walls	5	Moderate (Repairable)	3	Cracking
	Inc	(5 points)	Sub-Total	5	3		
	St		Sub-Total (Structural Soundness)	20	9		
			Sub-Total (Bridge Condition)	80	43		
Importance (20 points)       1. Traffic Volume         2. Alternative Bridge		5	2,000 - 5,000 pcu	3	Evaluated by the criteria for Package C		
		15	More than 10 km away or no alternate bridge	15	Distance to the altenative bridge: No altenative		
	Sub-Total (Importance)				18		
			Grand Total	100	61		

#### Table 14.1-11 Biliran Bridge (Package C)

Evaluation Item					Evaluation	Score	Remarks (Reasons)
			1. Difference in soil types between adjacent piers	2	Same	0	Consistent soil type
			2. Continuous or Simply Supported Bridge	3	Simply supported	3	
		Earthquake	3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: over 1.5	5	Balance Ratio: 3.9
		Resisting System	4. Pier Type (Single column/wall or multiple columns)	3	Multiple columns	0	
		(20 points)	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
	ity		Sub-Total	20	14		
	abil )	Unseating/Fall-	7. Unseating/Fall-down Prevention Devices	5	None	5	No seismic restrainers are installed.
	ner: ints	down Prevention	8. Bearing	5	Serious	5	Deterioration of bearings
	Vul po	System	9. Seat Length	5	Very Short	5	Some of seat lengths don't satisfy AASHTO
	nic ' (60	(15 points)	Sub-Total	15	15		
ion	isn	Foundation (15 points)	10. Foundation Type (known or unknown)	3	Unknown	3	
ndit nts)	Se		11. Scouring	3	None	0	
Cor poi			12. Soil Type	3	Soil type I (Firm)	0	
ge 80		(15 points)	13. Liquefaction Potential	6	None	0	Firm, clayey soil or over than 30 of N value
3rid (			Sub-Total	15	3		
I		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		
	less	<b>G</b>	1. Primary Members	10	Moderate (Need for repair work)	5	<ul> <li>Corrosion on steel ranger arch members</li> <li>Water leaking on PC-I girder members</li> </ul>
	ndr s)	Superstructures	2. Secondary Members	2	Moderate (Need for repair work)	1	Corrosion & loose connection
	Sou	(15 points)	3. Deck Slab	3	Moderate (Need for repair work)	1	Cracking & hanycomb
	ral : D po		Sub-Total	15	7		
	ctui (2)	Substructures	4. Deterioration of Columns/Walls	5	Moderate (Repairable)	3	Cracking & hanycomb
	tru	(5 points)	Sub-Total	5	3		
	01		Sub-Total (Structural Soundness)	20	10		
Sub-Total (Bridge Condition)		80	48				
1. Traffic Volume		5	2,000 - 5,000 pcu	3	Evaluated by the criteria for Package C		
Importance (20 points) 2. Alternative Bridge		2. Alternative Bridge	15	More than 10 km away or no alternate bridge	15	Distance to the altenative bridge: No altenative	
Sub-Total (Importance)			Sub-Total (Importance)	20	18		
			Grand Total	100	66		

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

Evaluation Item					Evaluation	Score	Remarks (Reasons)
			1. Difference in soil types between adjacent piers	2	Same	0	Consistent soil type
			2. Continuous or Simply Supported Bridge	3	Simply supported	3	
		Earthquake	3. Eccentric Loads (longitudinal and transverse dir.)	5	Balance Ratio: over 1.5	5	Balance Ratio: 3.0
		Resisting System	4. Pier Type (Single column/wall or multiple columns)	3	Single column/wall	3	
		(20 points)	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
	y		Sub-Total	20	17		
	silit	Unsepting/Fall	7. Unseating/Fall-down Prevention Devices	5	None	5	No seismic restrainers are installed.
	erał (ts)	down Prevention	8 Bearing	5	Serious	5	Seismically vulunerable bearing type &
	uln(	System	o. Dearing	5	Schous	5	Deterioration of bearings
	N 00 P	(15 points)	9. Seat Length	5	Short	3	The seat lengths satisfy AASHTO criteria.
c c	ui €	(15 points)	Sub-Total	15	13		
tioi	eis	Foundation (15 points)	10. Foundation Type (known or unknown)	3	Unknown	3	
ints	01		11. Scouring	3	Unknown	2	Condition of Pier-3 in water is unknown.
Po Po			12. Soil Type	3	Soil type I (Firm)	0	
dge (80		(15 points)	13. Liquefaction Potential	6	None	0	Firm, clayey soil or over than 30 of N value
Brie			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		
	less	_	1. Primary Members	10	Serious (Need for reinforcement)	10	<ul> <li>Low load capacity (load limit: 10t)</li> <li>Temporary suports for steel I-girders</li> </ul>
	ndn (s	Superstructures	2. Secondary Members	2	Moderate (Need for repair work)	1	Corrosion
	sou	(15 points)	3. Deck Slab	3	Serious (Need for replacement)	3	Major cracking & water leaking
	al S ) po		Sub-Total	15	14		
	ctur (20	Substructures	4. Deterioration of Columns/Walls	5	Good or small (No need for repair)	0	
	true	(5 points)	Sub-Total	5	0		
	S		Sub-Total (Structural Soundness)	20	14		
			Sub-Total (Bridge Condition)	80	59		
1. Traffic Volume		5	2,000 - 5,000 pcu	3	Evaluated by the criteria for Package C		
Importance (20 points) 2. Alternative Bridge		15	3 km - 10 km away	10	Distance to the altenative bridge: 6km		
Sub-Total (Importance)			Sub-Total (Importance)	20	13		
			Grand Total	100	72		

#### Table 14.1-13 Wawa Bridge (Package C)

### 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.

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. 1 st 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								

 Table 14.2.1-1 Recommendation of Target Bridges for Outline Design

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.

#### **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 nonseismic 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-hingesupported 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.



Note: underground structures are unknown: assumed

Restrictive conditions of **Inner Bridge** 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

Restrictive conditions of **Outer Bridges** are: 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.

	Motorcycle	Car / Taxi /	Joonnov	Large	2-Axle	3-Axle	Truck	Sub-	Total
	/ Tricycle	Pick-up / Van	Jeephey	Bus	Truck	Truck	trailer	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



#### 16,000 Continuous heavy traffic for 12 hours Direction 14,000 Direction - Both 12,000 Cib Traffic Volume (Veh/Day 10,000 8.000 Direct 6,000 4.000 2,00 2:00-3:00 1:00-2:00 3:00-4:0 18:00-19: **Guadalupe Bridge** -00-14 19:00-20: 20:00-21: :00-22 4:00-5: 2:00-13 6:00-1-00:1 24:00--00-7:00-1 00 Time ati City

Hourly Traffic Volume

Definition of traffic direction

Extremely heavy traffic

(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.



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.


- (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.



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.



Evaluation	1			
nic Retrofit Works	0.56			
ir Works	0.03	Negative		
S	0.21			
Total Cost	0.80			
f the Law for ge Preservation	-	-		
y entation)	Less than 30 years	Negative		
our Bridge equisition)	No need	Positive		
ion	Little	Positive		
th: 40.8 (m)	+4.8 (m)	Positive		
Ratio: 5.2 (%)	-12.9 (%)	Positive		
Evaluation	Not Recommended			
rstructure	0.42			
ructure	0.42			
rstructure ructure dation	0.42 0.13 0.32	Positive		
rstructure cructure dation rs	0.42 0.13 0.32 0.13	Positive		
rstructure ructure dation rs Total Cost	0.42 0.13 0.32 0.13 <b>1.00</b>	Positive		
rstructure ructure dation rs Total Cost f the Law for ge Preservation	0.42 0.13 0.32 0.13 <b>1.00</b> -	Positive -		
rstructure ructure dation rs Total Cost f the Law for ge Preservation y entation)	0.42 0.13 0.32 0.13 <b>1.00</b> - 75 years	Positive - Positive		
rstructure ructure dation rs Total Cost f the Law for ge Preservation y entation) our Bridge equisition)	0.42 0.13 0.32 0.13 <b>1.00</b> - 75 years No need	Positive - Positive Positive		
rstructure ructure dation rs Total Cost f the Law for ge Preservation y entation) our Bridge equisition) ion	0.42 0.13 0.32 0.13 <b>1.00</b> - 75 years No need 1-lane Closure	Positive - Positive Positive Negative		
rstructure ructure dation rs Total Cost f the Law for ge Preservation y entation) our Bridge equisition) ion th: 40.8 (m)	0.42 0.13 0.32 0.13 <b>1.00</b> - 75 years No need 1-lane Closure +4.8 (m)	Positive Positive Positive Negative Positive		
rstructure ructure dation rs Total Cost f the Law for ge Preservation y entation) our Bridge equisition) ion lth: 40.8 (m) a Ratio: 5.2 (%)	0.42 0.13 0.32 0.13 <b>1.00</b> - 75 years No need 1-lane Closure +4.8 (m) -12.9 (%)	Positive - Positive Positive Negative Positive Positive		
rstructure ructure dation rs Total Cost f the Law for ge Preservation y entation) our Bridge equisition) ion lth: 40.8 (m) a Ratio: 5.2 (%) Evaluation	0.42 0.13 0.32 0.13 <b>1.00</b> - 75 years No need 1-lane Closure +4.8 (m) -12.9 (%) <b>Recomm</b>	Positive Positive Positive Negative Positive Positive Positive Positive		



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(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.



Evaluation	1			
nic Retrofit Works	0.59			
ir Works	0.04	Negative		
ſS	0.25			
Total Cost	0.88			
f the Law for ge Preservation	Applied	Positive		
y entation)	Less than 20 years	Negative		
our Bridge iisition)	No need	Positive		
ion rement work)	1-lane Closure	Positive		
lth: 40.8 (m)	Same	Positive		
n Ratio: 4.9 (%)	Same	Positive		
Evaluation	Recommended			
rstructure	0.47			
rstructure	0.47 0.14			
rstructure tructure dation	0.47 0.14 0.27	Positive		
rstructure tructure dation rs	0.47 0.14 0.27 0.12	Positive		
rstructure tructure dation rs <b>Total Cost</b>	0.47 0.14 0.27 0.12 <b>1.00</b>	Positive		
rstructure dation rs <b>Total Cost</b> of the Law for ge Preservation	0.47 0.14 0.27 0.12 <b>1.00</b> Applied	Positive Negative		
rstructure dation rs <b>Total Cost</b> of the Law for ge Preservation	0.47 0.14 0.27 0.12 <b>1.00</b> Applied 75 years	Positive Negative Positive		
rstructure dation cs Total Cost of the Law for ge Preservation y eentation) our Bridge hisition)	0.47 0.14 0.27 0.12 <b>1.00</b> Applied 75 years Needed	Positive Negative Positive Negative		
rstructure dation rs <b>Total Cost</b> of the Law for ge Preservation y eentation) our Bridge hisition)	0.47 0.14 0.27 0.12 <b>1.00</b> Applied 75 years Needed 1-lane Closure	Positive Negative Positive Negative Negative		
rstructure dation rs Total Cost of the Law for ge Preservation y mentation) our Bridge hisition) ion struction period) lth: 40.8 (m)	0.47 0.14 0.27 0.12 <b>1.00</b> Applied 75 years Needed 1-lane Closure Same	Positive Negative Positive Negative Negative Positive		
rstructure dation rs Total Cost of the Law for ge Preservation y entation) our Bridge hisition) ion struction period) Ith: 40.8 (m) h Ratio: 4.9 (%)	0.47 0.14 0.27 0.12 <b>1.00</b> Applied 75 years Needed 1-lane Closure Same Same	Positive Negative Positive Negative Negative Positive Positive		

## 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.

 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)

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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



Figure 14.2.2-18 Construction Steps of Inner Bridge

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

Step-5: Demolition of existing piers



**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.

**Improvement Measure Scheme Detail of Im**  Seismic capacit 259 m Description/ Design Concept Seismic capacit Type-2 • Improvement Type-1 P1 Abut-A Abut-B extender, unsea of bearings) MAN-12 MAW-L1 . Improvement of Seismic Retrofit and Repair . Improvement of . ( Ag • S Method/ • 5 Ac2 Technology . 1 Ds1 • • Ds2 VR • ] Difficulty Construction Sei Ret Repaint& strengthening of steel **Unseating Prevention System** Wo members with steel plates .Unseating prevention cable Type-1 Re ..... - Replacement of the deck slab Alternative 1 -Wo Replacement of bearings Cost •Replacement of expansion joints Installation of shear keys ---Seat extender (concrete jacketing) Pier Oth As [•]Concrete jacketing As Type-2 Replacement of bearings Installation of shear keys Potential Impact to Environment Ag · River occupation Ag υu . Temporary deto Steel pipe pile foundation .. Unseating prevention chain Requirement of Abut ... Seat extender Requirement of Abutments (Abut-A) P1 **EVALUATION: Not Reco** Application of 259 m Description/ Design Concept Steel Langer arch bridge the cost effectiv 129.5m 129.5m • Application of to maintain the **P1** Abut-B Abut-A MAW-LT MAW-L Method/ • Ste Technology • Ca 2 - Replacement • Re Ag ste Difficulty • Re ins Construction . Ins VR Ds2 VR (bearing layer) Super struct Alternative Subst Ð Cost Found Ø Other Spread foundation VR (bearing layer) Cast-in-place pile, Potential Impact to Environment · River occupatio foundation Abut-B . Requirement of . Requirement of . Temporary deto · Requirement of P1 Abut-A **EVALUATION:** Recomm

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

provement Measures & Evaluation		
ty improve	ment of pier walls (wall retrofit)	
ty improve	ment of foundations (pile for reinforce	ement)
or unsea	ating/fall-down prevention system	(seat
iting preve	ntion cables/chains, shear keys, replac	cement
f the deck	slab soundness (replacement)	
f the steel	members' soundness & strength	
Concrete ia	cketing (wall retrofit)	
Steel pipe	bile foundation (pile for reinforcement	)
Sheet pile o	cofferdam	
Unseating _J	prevention system	
Strengtheni	ing of steel members with steel plates	
Installation	of piles into the rock	
Sheet pile i	nstallation under the existing superstr	ucture
ismic · V	Vall retrofit	
trofit • P	ile for reinforcement	0.09
orks · U	nseating prevention system	
pair R	eplacement of the deck slab	
orks · R	deplacement of expansion joints	0.30
5	trengthening of steel members with	
St hore V	Verking platform on the water	
	Cemporary detour bridge	0.06
• 1	Total	0.45
on during t	he works for piers in water	0.45
our bridge	installation during abutment retrofit w	orks
f environm	ental measures for water contamination	n
f temporary	y resettlement for the construction	
1.		
ommended	1	
existing bi	ridge planning condition in order to c	onfirm
veness of s	eismic retrofit & repair works	
light weight	ht & low height superstructure type in	1 order
adequate v	vertical clearance	
aal Langar	arah hridga	
eer Langer	a nile foundation	
equirement	of large construction yard for assen	bly of
eel membe	rs	1019 01
equirement	of large size crane for the superst	ructure
stallation	······································	
stallation c	of piles into the rock	
r-	• Steel Langer arch bridge	0.77
ture	2000 Zunger uren erruge	0.77
tructure	• Wall type	0.03
	• Cast-in-place pile foundation	
dation	• Spread foundation	0.10
	• Working platform on the water	
rs	• Temporary detour bridge	0.10
	Total	1.00
on during t	he works for piers in water	
f large size	crane & large construction vard	
f environmental measures for water contamination		
bur bridge installation during the whole construction		
f temporary	resettlement for the construction	
ended (Fu	irther 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.



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.



# 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)

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1	۰		

,				
provement Measures & Evaluation				
ty imp	rove	ment of pier walls (wall retrofit)		
ty imp	rove	ment of foundations (pile for reinforce	ement)	
of u	insea	ting/fall-down prevention system	(seat	
ating p	oreve	ntion cables/chains, shear keys, repla	cement	
of the c	leck	slab soundness (replacement)		
of the s	teel	members' soundness & strength		
Concre	ete ja	cketing (wall retrofit)		
Steel p	pipe p	bile foundation (pile for reinforcement	.)	
Sheet	pile c	cofferdam		
Unsea	ting _l	prevention system		
Streng	theni	ing of steel members with steel plates		
Install	ation	of piles into the rock		
Sheet	pile i	nstallation under the existing superstr	ucture	
1smic	• V	vall retrofit	0.12	
orks	• F T	Insecting prevention system	0.15	
onair	• C	enlacement of the deck slab		
orks	• R	eplacement of expansion joints		
01110	S	trengthening of steel members with	0.43	
	st	eel plates		
hers	. V	Vorking platform on the water	0.00	
	• T	emporary detour bridge	0.08	
		Total	0.64	
on dur	ing t	he works for piers in water		
our br	idge	installation during abutment retrofit w	vorks	
t envii	ronm	ental measures for water contamination	on	
t temp	orary	y resettlement for the construction		
ommo	ndod	l		
vridge	leng	th by relocation of abutments (5/m)		
PC h	ridge	for its cost-effectiveness and maint	enance	
100	nuge	for its cost-effectiveness and manit	chance	
low h	eioht	superstructure type in order to maint	ain the	
al clea	aranc	e		
ui 0100	uune			
C fin b	ack l	bridge		
ast-in-	place	e pile foundation		
eed of	acci	aracy for the prestressing work and co	oncrete	
aceme	ion o	f pilos into the rock		
r	1011 0	PC fin back bridge		
ture		• PC III back blidge	0.67	
tructu	re	. Wall type	0.09	
uctu		Cast_in_place pile foundation	0.07	
dation	l	Spread foundation	0.03	
		Working platform on the water		
rs		Temporary detour bridge	0.21	
		Total	1.00	
on dur	ino tl	he works for piers in water	1.00	
f envir	onm	ental measures for water contamination	m	
our bridge installation during the whole construction				
f temporary resettlement for the construction				
1 5				