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DIRECTORATE FOR ROADS OF VIETNAM
MINISTRY OF TRANSPORT
THE SOCIALIST REPUBLIC OF VIET NAM



THE PROJECT FOR CAPACITY ENHANCEMENT IN ROAD MAINTENANCE PHASE-II

Final Report

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Note

Photo Album for Road Facility Defects (Photo Album) was not a formal product stipulated in the Work Plan of this JICA Project, but a reference material to the Guideline for Road Facility Inspection.

Photo Album was developed in order to show sample photos on road facility defects to the engineers involved in road facility inspection and to help support their evaluation on the defects

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1. SCOPE OF APPLICATIONS

- (1) Photo Album for Road Facility Defects (Photo Album) was not a formal product stipulated in the Work Plan of this JICA Project, but a reference material to the Guideline for Road Facility Inspection.
- (2) Photo Album was developed in order to show sample photos on road facility defects to the engineers involved in road facility inspection and to help support their evaluation on the defects.
- (3) Photo Album can be also used as a database for road facility defects to be used in the routine road maintenance or as a training material for human resource development in DRVN.
- (4) The Project has assembled sample photos in cooperation with road operators, research institute and universities in Japan and in Viet Nam. The Project would like to express sincere appreciation to these organizations which offered photos to this Project.
- (5) Photo Album shall be developed by the joint effort between DRVN and JICA Project Team. DRVN is kindly requested to continue efforts to complete this Photo Album.

2. ROAD SLOPE

2.1 General Slope



2.1.1 Summary

Table 2.1-1 Summary of General Slope Defects



Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
GS-1	General slope	Whole parts of the slope	Collapse	-----	Small slope failure which has less potential of progressing	Slope failure which has high potential for expansion
GS-2	General slope	Whole parts of the slope	Cracks / swelling /settlement	-----	Minor cracks, swelling or settlement which may not lead to slope failure	Cracks, swelling or settlement which may lead to slope failure
GS-3	General slope	Whole parts of the slope	Surface erosion	-----	Partial erosion which may not spread	Wide area surface erosion which has high potential of spread.
GS-4	General slope	Whole parts of the slope	Piling of Debris on slope steps	Piling of debris which may not hinder the drain function on the steps.	Deposits of soil and stone which do not hinder the drainage installed on the slope steps	Deposits of soil and stone hinder the drainage installed on the slope steps.
GS-5	General slope	Whole part of the slope	Spring water	Spring water which is small potential for causing slope failures.	Spring water which increases in volume when rain falls, but does not have high potential of slope failures.	Spring water which increases in volume when raining and has high potential for causing slope failures.
GS-6	General slope	Whole part of the slope	Tree fall	Weeds which overran a wide area of slopes	Fallen or tilted trees, but do not lead to slope failures.	There are fallen or tilted trees, making holes around roots which can induce water infiltration into the slopes and cause slope failures.
GS-7	General slope	Whole part of the slope	Plant death	Lawn coverage more than 30% and less than 70%	Lawn coverage less than 30%	-----
GS-8	General slope	Whole part of the slope	Unstable stone/ rolling stone	-----	Unstable stones or rolling stones, but not so many.	Many unstable stones or rolling stones.

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
GS-9	General slope	Whole part of the slope	Growing of hydrophilic plants	-----	Slopes are weakened by spring water and covered with hydrophilic plants. Detail inspection is needed to identify underground water conditions.	Slopes weakened by spring water and covered with hydrophilic plants which have high potential of slope failures.


2.1.2 Collapse

Element	Defect	Defect rating	Element	Defect	Defect rating
General slope	Collapse	C	General slope	Collapse	D
Local collapse of slope			Large-scale collapse of slope (repair work done)		
					



2.1.3 Cracks

Element	Defect	Defect rating	Element	Defect	Defect rating
General slope	Cracks	C	General slope	Cracks	D
Surface minor cracks			Deep cracks which may lead to slope failure		
					



2.1.4 Swelling

Element	Defect	Defect rating	Element	Defect	Defect rating
General slope	swelling	C	General slope	swelling	D
Small-scale swelling					
					



2.1.5 Settlement

Element	Defect	Defect rating	Element	Defect	Defect rating
General slope	settlement	C	General slope	settlement	D
Small-scale settlement at the side of drainage			Large-scale settlement at the side of drain ditch on berm		
					


2.1.6 Surface Erosion

Element	Defect	Defect rating	Element	Defect	Defect rating
General slope	Surface erosion	C	General slope	Surface erosion	D
Narrow are surface erosion			Wide area surface erosion		
					



2.1.7 Piling of debris on slope steps

Element	Defect	Defect rating	Element	Defect	Defect rating
General slope	Piling of Debris on slope steps	B	General slope	Piling of Debris on slope steps	C
Small-scale piling of debris on slope steps			Deposits of soil and stone which do not hinder the drain ditch on berm		
					


2.1.8 Piling of debris on Slope steps

Element	Defect	Defect rating	Element	Defect	Defect rating
General slope	Piling of Debris on slope steps	D			
Deposits of soil and stone hinder the drain ditch on berm					
					


2.1.9 Spring water

Element	Defect	Defect rating	Element	Defect	Defect rating
General slope	Spring water	B	General slope	Spring water	C
Small amount of spring water on the slope			Some amount of spring water on the slope from limited range		
					

2.1.10 Spring water

Element	Defect	Defect rating	Element	Defect	Defect rating
General slope	Spring water	D			
Much of spring water in entire slope when rain falls					
					



2.1.11 Tree fall

Element	Defect	Defect rating	Element	Defect	Defect rating
General slope	Tree fall	B	General slope	Tree fall	C
Weeds which overran a wide area of slopes			Fallen tree		
					

2.1.12 Tree fall

Element	Defect	Defect rating	Element	Defect	Defect rating
General slope	Tree fall	D			
There are fallen or tilted trees, making holes around roots which can induce water infiltration into the slopes and cause slope failures.					

2.1.13 Plant death

Element	Defect	Defect rating	Element	Defect	Defect rating
General slope	Plant death	B	General slope	Plant death	C
Lawn coverage more than 30% and less than 70%			Lawn coverage less than 30%		
					

2.1.14 Unstable stone/rolling stone

Element	Defect	Defect rating	Element	Defect	Defect rating
General slope	Unstable stone/ rolling stone	C	General slope	Unstable stone/ rolling stone	D
Unstable stones or rolling stones, but not so many.			Many unstable stones or rolling stones.		

2.1.15 Crowing of hydrophilic plant

Element	Defect	Defect rating	Element	Defect	Defect rating
General slope	Growing of hydrophilic plants	C	General slope	Growing of hydrophilic plants	D
Slopes are weakened by spring water and covered with hydrophilic plants. Detail inspection is needed to identify underground water conditions.			Slopes weakened by spring water and covered with hydrophilic plants which have high potential of slope failures.		



2.2 Protected Slope - Concrete block frame in site and Precast concrete frame

2.2.1 Summary

Table 2.2-1 Summary of Protected Slope -Concrete block and Precast concrete frame- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
PS-1	Concrete frame (in Site/Precast)	Whole parts of the slope	Cracks/ peeling	Cracks or concrete peeling which spread over part of the area.	Cracks or concrete peeling which widespread over the area.	Severe cracks or concrete peeling, which may cause falling of concrete or collapse
PS-2	Concrete frame (in Site/Precast)	Whole parts of the slope	Looseness/ Swelling/ Settlement	-----	Looseness, swelling or settlement is seen on the facilities, but they may not lead to failures.	Serious looseness, swelling or settlement seen on the facilities which may lead to failures.
PS-3	Concrete frame (in Site/Precast)	Whole parts of the slope	Spring water/ Drain water	Spring water from facility joints or drain pipes, but they do not lead to slope failures.	-----	A large amount of spring water from facility joints and drain malfunction by drain pipes filled with soil which has high potential of causing slope failures.



2.2.2 Cracks

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete frame (in Site/Precast)	Cracks	B	Concrete frame (in Site/Precast)	Cracks	C
Cracks which spread over part of the area			Cracks which widespread over the area.		
					


2.2.3 Cracks

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete frame (in Site/Precast)	Cracks	D			
Severe cracks or concrete peeling, which may cause falling of concrete or collapse					


2.2.4 Peeling

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete frame (in Site/Precast)	Peeling	B	Concrete frame (in Site/Precast)	Peeling	C
Concrete peeling which spread over part of the area.			Cracks or concrete peeling which widespread over the area.		
					

2.2.5 Peeling

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete frame (in Site/Precast)	Peeling	D			
Severe cracks or concrete peeling, which may cause falling of concrete or collapse					



2.2.6 Looseness

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete frame (in Site/Precast)	Looseness	C	Concrete frame (in Site/Precast)	Looseness	D
Looseness is seen on the facilities.			Serious looseness is seen on the facilities which may lead to failures.		
					


2.2.7 Swelling

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete frame (in Site/Precast)	Swelling	C	Concrete frame (in Site/Precast)	Swelling	D
Swelling is seen on the facilities, but they may not lead to failures.			Serious swelling is seen on the facilities which may lead to failures.		

2.2.8 Settlement

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete frame (in Site/Precast)	Settlement	C	Concrete frame (in Site/Precast)	Settlement	D
Settlement is seen on the facilities.			Serious settlement is seen on the facilities which may lead to failures.		
					

2.2.9 Spring water/ Drain Water

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete frame (in Site/Precast)	Spring water/ Drain water	B	Concrete frame (in Site/Precast)	Spring water/ Drain water	D
Spring water from facility joints			A large amount of spring water from facility joints and drain malfunction by drain pipes filled with soil which has high potential of causing slope failures.		
					



2.3 Protected Slope - Mortal spray and Concrete spray

2.3.1 Summary

Table 2.3-1 Summary of Protected Slope -Mortal spray and Concrete spray- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
MS/CS-1	Mortal spray/Concrete spray	Whole part of the slope	Cracks/ peeling	Small cracks, peeling is seen over part of the area which may not lead to slope failure	Cracks, peeling which may not lead to slope failures soon, but may lead to the failure in the long run.	Severe cracks, peeling which may lead to slope failure
MS/CS-2	Mortal spray/Concrete spray	Whole part of the slope	Loosening / swelling/ settlement	Slope edge push-out, swelling and shear gaps at construction joints, but they may not lead to slope failures.	-----	Slope edge push-out, swelling and shear gaps at construction joints which may lead to slope failures.
MS/CS-3	Mortal spray/Concrete spray	Whole part of the slope	Voids	A trace of soil flow-out from drain pipes after rainfalls, and hammering inspection detects the existence of voids behind the surface concrete or mortar.	-----	-----
MS/CS-4	Mortal spray/Concrete spray	Whole part of the slope	Spring water/ Drain water	Spring water from facility joints or drain pipes, but they do not lead to slope failures.	-----	A large amount of spring water from facility joints and drain malfunction by drain pipes filled with soil which has high potential of causing slope failures.



2.3.2 Cracks

Element	Defect	Defect rating	Element	Defect	Defect rating
Mortal spray/Concrete spray	Cracks	B	Mortal spray/Concrete spray	Cracks	C
Small cracks 			Cracks which may not lead to slope failures soon, but may lead to the failure in the long run 		

2.3.3 Cracks

Element	Defect	Defect rating	Element	Defect	Defect rating
Mortal spray/Concrete spray	Cracks	D			
Severe cracks which may lead to slope failure					


2.3.4 Peeling

Element	Defect	Defect rating	Element	Defect	Defect rating
Mortal spray/Concrete spray	Peeling	B	Mortal spray/Concrete spray	Peeling	C
Small peeling 			Peeling which may not lead to slope failures soon, but may lead to the failure in the long run. 		

2.3.5 Peeling

Element	Defect	Defect rating	Element	Defect	Defect rating
Mortal spray/Concrete spray	Peeling	D			
Severe peeling which may lead to slope failure					

2.3.6 Loosening

Element	Defect	Defect rating	Element	Defect	Defect rating
Mortal spray/Concrete spray	Loosening	B	Mortal spray/Concrete spray	Loosening	D
Slope edge push-out 			Slope edge push-out at construction joints which may lead to slope failures.		


2.3.7 Swelling

Element	Defect	Defect rating	Element	Defect	Defect rating
Mortal spray/Concrete spray	Swelling	B	Mortal spray/Concrete spray	Swelling	D
Small swelling			Swelling at construction joints which may lead to slope failures.		


2.3.8 Settlement

Element	Defect	Defect rating	Element	Defect	Defect rating
Mortal spray/Concrete spray	settlement	B	Mortal spray/Concrete spray	settlement	D
Small settlement			Shear gaps at construction joints which may lead to slope failures.		

2.3.9 Voids

Element	Defect	Defect rating	Element	Defect	Defect rating
Mortal spray/Concrete spray	Voids	B			
Vids behind the surface concrete or mortar.					
					

2.3.10 Spring water / drain water

Element	Defect	Defect rating	Element	Defect	Defect rating
Mortal spray/Concrete spray	Spring water/ Drain water	B	Mortal spray/Concrete spray	Spring water/ Drain water	D
Spring water from facility joints			A large amount of spring water from facility joints and drain malfunction by drain pipes filled with soil which has high potential of causing slope failures.		
					

3. DRAINAGE SYSTEM

3.1 Drainage System


3.1.1 Summary

(Slope shoulder drainage/Slope step drainage/Vertical drainage/Catch basins)



Table 3.1-1 Summary of Drainage System Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
DS-1	Drainage system	Whole drainage body	Damages to drainage body	-----	Medium damages of drainage systems which hinder drain functions.	Heavy damage of drainage systems which cause water overflow and rain infiltration
DS-2	Drainage system	Joint	Improper drainage joints	Small water leakage which does not lead to slope failures.	-----	Heavy damage of drainage joints which cause water leakage from joints and rain infiltration into slopes
DS-3	Drainage system	Inside of drainage	Debris/ soil accumulation	Limited or partial piling of soils and debris	Piling of soil and debris which hinder drain functions.	Large piling of soil and debris
DS-4	Drainage system	Surrounding area of drainage	Hindrance of drain function by weeds	Small hindrance of drain functions	-----	Heavy hindrance of drain function by weed



3.1.2 Damages of drainage body

Element	Defect	Defect rating	Element	Defect	Defect rating
Drainage system	Damages to drainage body	C	Drainage system	Damages to drainage body	D
Medium damages of drainage systems which hinder drain functions.			Heavy damage of drainage systems which cause water overflow and rain infiltration		
					


3.1.3 Improper drainage joints

Element	Defect	Defect rating	Element	Defect	Defect rating
Drainage system	Improper drainage joints	B	Drainage system	Improper drainage joints	D
Small water leakage which does not lead to slope failures.			Heavy damage of drainage joints which cause water leakage from joints and rain infiltration into slopes		
					



3.1.4 Debris / soil accumulation

Element	Defect	Defect rating	Element	Defect	Defect rating
Drainage system	Debris/ soil accumulation	B	Drainage system	Debris/ soil accumulation	C
Limited piling of soils and debris			Piling of soil and debris which hinder drain functions.		
					

3.1.5 Debris / soil accumulation

Element	Defect	Defect rating	Element	Defect	Defect rating
Drainage system	Debris/ soil accumulation	D			
Large piling of soil and debris					
					

3.1.6 Hindrance of drain function by weeds

Element	Defect	Defect rating	Element	Defect	Defect rating
Drainage system	Hindrance of drain function by weeds	B	Drainage system	Hindrance of drain function by weeds	D
Small hindrance of drain functions			Heavy hindrance of drain function by weed		
					

4. RETAINING WALL



4.1 RC Retaining Wall

4.1.1 Summary

Table 4.1-1 Summary of RC Retaining Wall Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
RW(RC)-1	Retaining wall	Whole parts	Cracks/ corner	Small cracks running parallel with wide gaps which do not reach inner steel bars.	Small cracks running parallel with narrow gaps which reach inner steel bars.	Severe crocodile cracks which reach inner steel bars with free lime and rusty fluid.
RW(RC)-2	Retaining wall	Whole parts	Concrete Peeling	Partial peeling or creep	Extensive concrete peeling or creep	-----
RW(RC)-3	Retaining wall	Whole parts	Steel bar exposure and corrosion	Partial steel bar exposure	Severe steel bar exposure with the progress of corrosion.	-----
RW(RC)-4	Retaining wall	Whole parts	Settlement/ movement/ tilting	Settlement, movement or tilting of facilities which does not lead to collapse.	Settlement, movement or tilting of facilities which does not need further survey	Settlement, movement or tilting of facilities which does not lead to collapse.
RW(RC)-5	Retaining wall	Whole parts	Damages on structural joints	Joint gaps, but they do not lead to collapse.	Joint gaps which do not lead to collapse soon, but lead to collapse in the long run.	Large joint gaps which may lead to collapse.
RW(RC)-6	Retaining wall	Whole parts	Scouring	Limited or partial scouring at foundations or around main bodies, but progress is not expected.	Scouring at foundations or around main bodies, which may need countermeasures in the long run.	Serious scouring at foundations or around main bodies which need urgent countermeasures.
RW(RC)-7	Retaining wall	Whole parts	Drainage / spring water	Spring water from facility joints or drain malfunction by drain pipes filled with soil, but they do not lead to slope failures.	-----	A large amount of spring water from facility joints and drain malfunction by drain pipes filled with soil which has high potential of causing slope failures.



4.1.2 Cracks / Corner

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Cracks/ corner	B	Retaining wall	Cracks/ corner	C
Small cracks running parallel with wide gaps which do not reach inner steel bars. 			Small cracks running parallel with narrow gaps which reach inner steel bars. 		


4.1.3 Cracks / Corner

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Cracks/ corner	D			
Severe crocodile cracks which reach inner steel bars with free lime and rusty fluid.					

4.1.4 Concrete Peeling

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Concrete Peeling	B	Retaining wall	Concrete Peeling	C
Partial peeling 			Extensive concrete peeling or creep 		

4.1.5 Steel bar exposure and corrosion

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Steel bar exposure and corrosion	B	Retaining wall	Steel bar exposure and corrosion	C
Partial steel bar exposure 			Severe steel bar exposure with the progress of corrosion.		



4.1.6 Settlement/ movement/ tilting

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Settlement/ movement/ tilting	B	Retaining wall	Settlement/ movement/ tilting	C
Settlement, movement or tilting of facilities which does not lead to collapse.			Settlement, movement or tilting of facilities which does not need further survey		

4.1.7 Settlement/ movement/ tilting

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Settlement/ movement/ tilting	D			
Settlement, movement or tilting of facilities which does not lead to collapse.					

4.1.8 Damages on structural joints

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Damages on structural joints	B	Retaining wall	Damages on structural joints	C
Joint gaps, but they do not lead to collapse. 			Joint gaps which do not lead to collapse soon, but lead to collapse in the long run. 		

4.1.9 Damages on structural joints

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Damages on structural joints	D			
Large joint gaps which may lead to collapse.					


4.1.10 Scouring

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Scouring	B	Retaining wall	Scouring	C
Limited or partial scouring at foundations or around main bodies, but progress is not expected.			Scouring at foundations or around main bodies, which may need countermeasures in the long run.		

4.1.11 Scouring

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Scouring	D			
<p>Serious scouring at foundations or around main bodies which need urgent countermeasures.</p>					

4.1.12 Drainage / spring water

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Drainage / spring water	B	Retaining wall	Drainage / spring water	D
<p>Spring water from facility joints, but they do not lead to slope failures.</p>			<p>A large amount of spring water from facility joints and drain malfunction by drain pipes filled with soil which has high potential of causing slope failures.</p>		
					

5. CONCRETE BLOCK AND STONE MASONRY


5.1 Concrete Block and Stone Masonry

5.1.1 Summary

Table 5.1-1 Summary of Concrete Block and Stone Masonry Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
RW(CB)-1	Retaining wall	Whole parts	Cracks/ Swelling	Small cracks running parallel with wide gaps which do not reach inner steel bars.	Small cracks running parallel with narrow gaps which reach inner steel bars.	Severe crocodile cracks which reach inner steel bars with free lime and rusty fluid.
RW(CB)-2	Retaining wall	Whole parts	Settlement, movement and leaning	Settlement, movement or tilting of facilities which does not lead to collapse.	Settlement, movement or tilting of facilities which does not need further survey	Settlement, movement or tilting of facilities which does not lead to collapse.
RW(CB)-3	Retaining wall	Whole parts	Abnormal joint gap	Joint gaps, but they do not lead to collapse.	Joint gaps which do not lead to collapse soon, but lead to collapse in the long run.	Large joint gaps which may lead to collapse.
RW(CB)-4	Retaining wall	Whole parts	Scouring	Scouring around the foundation or main body, but they do not lead to collapse.	Scouring around the foundation or main body which do not lead to collapse soon, but lead to collapse in the long run.	Severe scouring around the foundation or main body which may lead to collapse.
RW(CB)-5	Retaining wall	Whole parts	Poor drainage and spring water	Spring water from facility joints or drain malfunction by drain pipes filled with soil, but they do not lead to slope failures.	-----	A large amount of spring water from facility joints and drain malfunction by drain pipes filled with soil which has high potential of causing slope failures.


5.1.2 Cracks/ Swelling

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Cracks/ Swelling	B	Retaining wall	Cracks/ Swelling	C
Small cracks running parallel with wide gaps which do not reach inner steel bars. 			Small cracks running parallel with narrow gaps which reach inner steel bars.		

5.1.3 Cracks/ Swelling

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Cracks/ Swelling	D			
Severe crocodile cracks which reach inner steel bars with free lime and rusty fluid.					



5.1.4 Settlement, movement and leaning

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Settlement, movement and leaning	B	Retaining wall	Settlement, movement and leaning	C
Settlement, movement or tilting of facilities which does not lead to collapse. 			Settlement, movement or tilting of facilities which does not need further survey		

5.1.5 Settlement, movement and leaning

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Settlement, movement and leaning	D			
Settlement, movement or tilting of facilities which does not lead to collapse.					



5.1.6 Abnormal joint gap

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Abnormal joint gap	B	Retaining wall	Abnormal joint gap	C
Joint gaps, but they do not lead to collapse.			Joint gaps which do not lead to collapse soon, but lead to collapse in the long run.		
					


5.1.7 Abnormal joint gap

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Abnormal joint gap	D			
Large joint gaps which may lead to collapse.					


5.1.8 Scouring

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Scouring	B	Retaining wall	Scouring	C
Scouring around the main body, but they do not lead to collapse.			Scouring around the foundation which do not lead to collapse soon, but lead to collapse in the long run.		
					

5.1.9 Scouring

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Scouring	D			
Severe scouring around the main body which may lead to collapse					
					

5.1.10 Poor drainage and spring water

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Poor drainage and spring water	B	Retaining wall	Poor drainage and spring water	D
Spring water from facility joints, but they do not lead to slope failures.			A large amount of spring water from facility joints and drain malfunction by drain pipes filled with soil which has high potential of causing slope failures.		
					

6. WIRE CYLINDER AND MAT GABION MASONRY

6.1 Wire Cylinder and Mat Gabion Masonry

6.1.1 Summary

Table 6.1-1 Summary of Wire Cylinder and Mat Gabion Masonry Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
RW(WC)-1	Retaining wall	Whole parts	Deformation	Deformation of wire cylinder, but they are stable	Deformation of wire cylinder which has adverse effects to other structures.	Severe deformation of wire cylinder which may lead to collapse.
RW(WC)-2	Retaining wall	Whole parts	Wire corrosion and rupture	Wire corrosion and rupture, but stones for filling do not outflow	Wire corrosion and rupture which may lead to outflow of stones for filling	-----


6.1.2 Deformation

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Deformation	B	Retaining wall	Deformation	C
Deformation of wire cylinder, but they are stable			Deformation of wire cylinder which has adverse effects to other structures		

6.1.3 Deformation

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Deformation	D			
Severe deformation of wire cylinder which may lead to collapse.					

6.1.4 Wire corrosion and rupture

Element	Defect	Defect rating	Element	Defect	Defect rating
Retaining wall	Wire corrosion and rupture	B	Retaining wall	Wire corrosion and rupture	C
Wire corrosion and rupture, but stones for filling do not outflow			Wire corrosion and rupture which may lead to outflow of stones for filling		
					

7. ROAD PAVEMENT



7.1 Asphalt Road Pavement

7.1.1 Summary



Table 7.1-1 Summary of Asphalt Road Pavement Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
ARP-1	Asphalt road pavement	Whole paved area	Pot holes/ Peeling/ Depressions	-----	20 cm–40cm in diameter or 30 mm-40 mm in depth	Over 40 cm in diameter or Over 40 mm in depth.
ARP-2	Asphalt road pavement	Whole paved area	Crack ratio	10% - 30%	30% - 40%	Over 40 %.
ARP-3	Asphalt road pavement	Whole paved area	Rutting Depth	10mm - 30 mm	30mm - 40mm	Over 40 mm
ARP-4	Asphalt road pavement	Whole paved area	IRI	2 – 4 mm/m	4 – 6 mm/m	Over 6 mm/m
ARP-5	Asphalt road pavement	Pavement edge	corrugations	-----	Surface level difference 10 mm – 30 mm	Pavement width less than design lane width or Surface level difference over 30mm.
ARP-6	Asphalt road pavement	Whole paved area	Bump in pavement surface	-----	- 10 mm - 20 mm in depth at the connection with bridges - 10mm - 30mm in depth at crossing structures or cut/fill transition points	- Over 20mm at the connections with bridges - Over 30 mm at crossing structures or cut/fill transition points.
ARP-7	Asphalt road pavement	Whole paved area particularly traffic lanes	Skid Resistance	-----	0.25 i (V) - 0.3 i(V).	Over i (V) 0.25.

7.1.2 Pot holes/ Peeling/ Depressions

Element	Defect	Defect rating	Element	Defect	Defect rating
Asphalt road pavement	Pot holes/ Peeling/ Depressions	C	Asphalt road pavement	Pot holes/ Peeling/ Depressions	D
20 cm-40cm in diameter or 30 mm-40 mm in depth			Over 40 cm in diameter or Over 40 mm in depth.		
					

7.1.3 Crack ratio

Element	Defect	Defect rating	Element	Defect	Defect rating
Asphalt road pavement	Crack ratio	B	Asphalt road pavement	Crack ratio	C
Crack ratio : 10% - 30%			Crack ratio : 30% - 40%		
					

7.1.4 Crack ration

Element	Defect	Defect rating	Element	Defect	Defect rating
Asphalt road pavement	Crack ratio	D			
Crack ratio : 10% - 40%					
					

7.1.5 Rutting Depth

Element	Defect	Defect rating	Element	Defect	Defect rating
Asphalt road pavement	Rutting Depth	B	Asphalt road pavement	Rutting Depth	C
Rutting Depth : 10mm - 30 mm			Rutting Depth : 30mm - 40mm		

7.1.6 Rutting Depth

Element	Defect	Defect rating	Element	Defect	Defect rating
Asphalt road pavement	Rutting Depth	D			
Rutting Depth : Over 40mm					



7.1.7 IRI

Element	Defect	Defect rating	Element	Defect	Defect rating
Asphalt road pavement	IRI	B	Asphalt road pavement	IRI	C
IRI : 2 – 4 mm/m			IRI : 4 – 6 mm/m		

7.1.8 IRI

Element	Defect	Defect rating	Element	Defect	Defect rating
Asphalt road pavement	IRI	D			
IRI : Over 6 mm/m					

7.1.9 Corrugations

Element	Defect	Defect rating	Element	Defect	Defect rating
Asphalt road pavement	Corrugations	C	Asphalt road pavement	Corrugations	D
Surface level difference 10 mm – 30 mm			Pavement width less than design lane width or Surface level difference over 30mm.		
					

7.1.10 Bump in pavement surface

Element	Defect	Defect rating	Element	Defect	Defect rating
Asphalt road pavement	Bump in pavement surface	C	Asphalt road pavement	Bump in pavement surface	D
10mm - 30mm in depth at crossing structures or cut/fill transition points			Over 30 mm at crossing structures or cut/fill transition points		
					

7.1.11 Skid Resistance

Element	Defect	Defect rating	Element	Defect	Defect rating
Asphalt road pavement	Skid Resistance	C	Asphalt road pavement	Skid Resistance	D
Skid Resistance : 0.25 i (V) - 0.3 i(V)			Skid Resistance : Over i (V) 0.25		

7.2 Bituminous Surface Treatment

7.2.1 Summary

Table 7.2-1 Summary of Bituminous Surface Treatment Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
BST-1	Bituminous surface treatment	Whole paved area	Pot holes/ Peeling/ Depressions	-----	20 cm–40cm in diameter or 30 mm-40 mm in depth	Over 40 cm in diameter or Over 40 mm in depth.
BST-2	Bituminous surface treatment	Whole paved area	Crack ratio	10% - 40%	40% - 50%	Over 50 %.
BST-3	Bituminous surface treatment	Whole paved area	Rutting Depth	10mm - 40 mm	40mm - 50mm	Over 50 mm
BST-4	Bituminous surface treatment	Whole paved area	IRI	4 – 6 mm/m	6 – 8 mm/m	Over 8 mm/m
BST-5	Bituminous surface treatment	Whole paved area	Corrugations	-----	Surface level difference 10 mm – 30 mm	Pavement width less than design lane width or Surface level difference over 30mm.
BST-6	Bituminous surface treatment	Whole paved area	Bump in surface	-----	- 10 mm - 20 mm in depth at the connection with bridges - 10mm - 30mm in depth at crossing structures or cut/fill transition points	- Over 20mm at the connections with bridges - Over 30 mm at crossing structures or cut/fill transition points.
BST-7	Bituminous surface treatment	Whole paved area	Skid Resistance	-----	0.25 i (V) - 0.3 i(V).	Over i (V) 0.25.

7.2.2 Pot holes/ Peeling/ Depressions

Element	Defect	Defect rating	Element	Defect	Defect rating
Bituminous surface treatment	Pot holes/ Peeling/ Depressions	C	Bituminous surface treatment	Pot holes/ Peeling/ Depressions	D
20 cm–40cm in diameter or 30 mm-40 mm in depth			Over 40 cm in diameter or Over 40 mm in depth.		

7.2.3 Crack ratio

Element	Defect	Defect rating	Element	Defect	Defect rating
Bituminous surface treatment	Crack ratio	B	Bituminous surface treatment	Crack ratio	C
Crack ratio : 10% - 40%			Crack ratio : 40% - 50%		

7.2.4 Crack ratio

Element	Defect	Defect rating	Element	Defect	Defect rating
Bituminous surface treatment	Crack ratio	D			
Crack ratio : Over 50 %					

7.2.5 Rutting Depth

Element	Defect	Defect rating	Element	Defect	Defect rating
Bituminous surface treatment	Rutting Depth	B	Bituminous surface treatment	Rutting Depth	C
Rutting Depth : 10mm - 40 mm			Rutting Depth : 40mm - 50mm		

7.2.6 Rutting Depth

Element	Defect	Defect rating	Element	Defect	Defect rating
Bituminous surface treatment	Rutting Depth	D			
Rutting Depth : Over 50 mm					

7.2.7 IRI

Element	Defect	Defect rating	Element	Defect	Defect rating
Bituminous surface treatment	IRI	B	Bituminous surface treatment	IRI	C
IRI : 4 – 6 mm/m			IRI : 6 – 8 mm/m		

7.2.8 IRI

Element	Defect	Defect rating	Element	Defect	Defect rating
Bituminous surface treatment	IRI	D			
IRI : Over 8 mm/m					

7.2.9 Corrugations

Element	Defect	Defect rating	Element	Defect	Defect rating
Bituminous surface treatment	Corrugations	C	Bituminous surface treatment	Corrugations	D
Surface level difference 10 mm – 30 mm			Pavement width less than design lane width or Surface level difference over 30mm.		

7.2.10 Bump in surface

Element	Defect	Defect rating	Element	Defect	Defect rating
Bituminous surface treatment	Bump in surface	C	Bituminous surface treatment	Bump in surface	D
- 10 mm - 20 mm in depth at the connection with bridges - 30mm in depth at crossing structures or cut/fill transition points			- Over 20mm at the connections with bridges - Over 30 mm at crossing structures or cut/fill transition points.		

7.2.11 Skid Resistance

Element	Defect	Defect rating	Element	Defect	Defect rating
Bituminous surface treatment	Skid Resistance	C	Bituminous surface treatment	Skid Resistance	D
Skid wResistance : 0.25 i (V) - 0.3 i(V)			Skid Resistance : Over i (V) 0.25		

7.3 Cement Concrete Pavement

7.3.1 Summary

Table 7.3-1 Summary of Cement Concrete Pavement Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
CCP-1	Cement concrete pavement	Whole paved area	Crack ratio	-----	30% - 40%	Over 40 %.
CCP-2	Cement concrete pavement	Whole paved area	IRI	-----	-----	Over 4 mm/m
CCP-3	Cement concrete pavement	Whole paved area	Bump in pavement surface	-----	- 10 mm - 20 mm in depth at the connection with bridges - 10mm - 30mm in depth at crossing structures or cut/fill transition points	- Over 20mm at the connections with bridges - 30 mm at crossing structures or cut/fill transition points.
CCP-4	Cement concrete pavement	Whole paved area	Slab joint seal	-----	Damaged but water infiltration is not observed	Damaged and water infiltration observed
CCP-5	Cement concrete pavement	Whole paved area particularly traffic lanes	Skid Resistance	-----	0.25 i (V) - 0.3 i(V).	Over i (V) 0.25.

7.3.2 Crack ratio

Element	Defect	Defect rating	Element	Defect	Defect rating
Cement concrete pavement	Crack ratio	C	Cement concrete pavement	Crack ratio	D
Crack ratio : 30% - 40%			Crack ratio : Over 40 %		

7.3.3 IRI

Element	Defect	Defect rating	Element	Defect	Defect rating
Cement concrete pavement	IRI	D			
IRI : Over 4 mm/m					

7.3.4 Bump in pavement surface

Element	Defect	Defect rating	Element	Defect	Defect rating
Cement concrete pavement	Bump in pavement surface	C	Cement concrete pavement	Bump in pavement surface	D
<ul style="list-style-type: none"> - 10 mm - 20 mm in depth at the connection with bridges - 10mm - 30mm in depth at crossing structures or cut/fill transition points 			<ul style="list-style-type: none"> - Over 20mm at the connections with bridges - 30 mm at crossing structures or cut/fill transition points. 		

7.3.5 Slab joint seal

Element	Defect	Defect rating	Element	Defect	Defect rating
Cement concrete pavement	Slab joint seal	C	Cement concrete pavement	Slab joint seal	D
Damaged but water infiltration is not observed			Damaged and water infiltration observed		

7.3.6 Skid Resistance

Element	Defect	Defect rating	Element	Defect	Defect rating
Cement concrete pavement	Skid Resistance	C	Cement concrete pavement	Skid Resistance	D
Skid Resistance : 0.25 i (V) - 0.3 i(V).			Skid Resistance : Over i (V) 0.25.		

8. BRIDGE



8.1 Settlement, Movement

8.1.1 Summary

Table 8.1-1 Summary of Bridge -Settlement, Movement- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
SM-1	Entire bridge	Whole parts	Settlement, Movement	-----	Superstructure or substructure moved a little.	Superstructure or substructure moved extraordinary.

8.1.2 Settlement, Movement

Element	Defect	Defect rating	Element	Defect	Defect rating
Entire bridge	Settlement, Movement	C	Entire bridge	Settlement, Movement	D
<p>An abutment tilling forward a little.</p> 			<p>A girder end touching to the parapet wall of the abutment due to movement of the abutment.</p> 		

8.2 Scouring

8.2.1 Summary



Table 8.2-1 Summary of Bridge -Scouring- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
S-1	Foundation/Footing/ Pile cap/Pile	Whole parts	Scouring	Tendency scouring observed	of is Foundation/pile cap surface appeared due to scouring	Scouring depth reach below the bottom of foundation/pile cap



8.2.2 Scouring

Element	Defect	Defect rating	Element	Defect	Defect rating
Pier	Scouring	B			
Tendency of scouring is observed					

8.2.3 Scouring

Element	Defect	Defect rating	Element	Defect	Defect rating
Pier	Scouring	C	Pier	Scouring	C
Gravel/soil at surrounding area of the pier was washed away.			Gravel soil at surrounding area of the pier was washed away.		
					

8.2.4 Settlement due to scouring

Element	Defect	Defect rating	Element	Defect	Defect rating
Pier	Settlement due to scouring	D	Abutment	Tilting and exposure of piles	D
A pier sank seriously due to scouring.			An abutment tilted and piles exposed due to serious scouring.		
					



8.3 Water leakage, Puddling

8.3.1 Summary

Table 8.3-1 Summary of Bridge -Water leakage, Puddling- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
WP-1	All type of bridges	Whole parts	Water leakage, Puddling	Water leakage or puddles sometimes seen on rainy days	Water leakage or puddle is seen anytime regardless of weather conditions	-----

8.3.2 Water leakage

Element	Defect	Defect rating	Element	Defect	Defect rating
Expansion joint	Water leakage, Puddling	B	Bearing shoe bed	Water leakage, Puddling	C
Leaking water from expansion joint on rainy days.			Puddling water on the bearing shoe bed regardless of weather condition.		
					

8.4 Concrete Bridge


8.4.1 Crack

8.4.1.1 Summary

Table 8.4-1 Summary of Concrete Bridge -Crack- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
CB(C)-1	Concrete girder	Near end girder support	Crack	Small cracks extending vertically or diagonally near bearings	Large cracks extending vertically or diagonally near bearings.	Large vertical or diagonal cracks are observed near bearings with free lime or rusty fluid.
CB(C)-2	Concrete girder	Near middle support	Crack	Small cracks are observed on upper flange or main girder web.	Large cracks are observed on upper flange or main girder web.	Large vertical cracks are observed on the upper flange of a main girder with free lime and rusty fluid.
CB(C)-3	Concrete girder	Span center	Crack	Small cracks are observed on the lower flange or the web of a main girder.	Large cracks are observed on the lower flange or the web of a main girder.	Large vertical or horizontal cracks are observed on the lower flange of a main girder with free lime and rusty fluid.
CB(C)-4	Concrete girder	A quarter point between supports	Crack	Small vertical cracks are observed on the lower flange of a main girder.	Large vertical cracks are observed on the lower flange of a main girder.	Large vertical cracks are observed on the lower flange of a main girder with free lime and rusty fluid.
CB(C)-5	Concrete girder	Construction joints	Crack	Small cracks are observed near the construction joints.	Large cracks are observed near the construction joints.	Large cracks are observed near the construction joints with free lime or rusty fluid.
CB(C)-6	Concrete girder	Segment junctions	Crack	----	----	Cracks or trace of free lime are observed near the segment joints.
CB(C)-7	Concrete girder	Notch of the girder	Crack	----	----	Cracks or trace of free lime are observed near the segment joints.
CB(C)-8	Concrete girder	Near anchors	Crack	----	Crocodile cracks are observed near the anchorage.	Cracks are observed near the anchorage in shear direction
CB(C)-9	Concrete Cross beam, Diaphragm	Whole parts	Crack	Cracks at long intervals do not reached to rebar depth	Small cracks at small intervals reached to rebar depth	----
CB(C)-10	Concrete Deck slab	Whole parts	Crack	Longitudinal and transverse cracks are observed	Cracks develops to crocodile cracks	Crocodile cracks cause spalling
CB(C)-11	Abutment and wing wall	Whole parts	Crack	Crack at long intervals do not reached to rebar depth	Small cracks at small intervals reached to rebar depth	Large crack at support end or cantilevered base is observed
CB(C)-12	Pier column/Pier head beam	Whole parts	Crack	Crack at long intervals do not reached to rebar depth	Small cracks at small intervals reached to rebar depth	Large crack at support end or cantilevered base is observed
CB(C)-13	Foundation	Whole parts	Crack	Crack at long intervals do not reached to rebar depth	Small cracks at small intervals reached to rebar depth	Large crack at support end or cantilevered base is observed

8.4.1.2 Near end girder support

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder	Crack	B	Concrete girder	Crack	C
Small cracks extending vertically or diagonally near bearings			Large crack on the bearing due to load concentration.		
					

8.4.1.3 Near end girder support

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder	Crack	D			
Large vertical or diagonal cracks are observed near bearings with free lime or rusty fluid.					


8.4.1.4 Near middle support

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder	Crack	B	Concrete girder	Crack	C
Small cracks are observed on upper flange or main girder web.			Large cracks are observed on upper flange or main girder web.		

8.4.1.5 Near middle support

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder	Crack	D			
Large vertical cracks are observed on the upper flange of a main girder with free lime and rusty fluid.					

8.4.1.6 Span center

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder	Crack	B	Concrete girder	Crack	C
Small cracks are observed on the lower flange or the web of a main girder.			Large longitudinal crack at the web of the girder with rusty fluid due to rebar corrosion.		
					

8.4.1.7 Span center

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder	Crack	D			
Large vertical or horizontal cracks are observed on the lower flange of a main girder with free lime and rusty fluid.					

8.4.1.8 A quarter point between supports

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder	Crack	B	Concrete girder	Crack	C
Small vertical cracks are observed on the lower flange of a main girder.			Large vertical cracks are observed on the lower flange of a main girder,		

8.4.1.9 A quarter point between supports

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder	Crack	D			
Large vertical cracks are observed on the lower flange of a main girder with free lime and rusty fluid.					

8.4.1.10 Construction joints

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder	Crack	B	Concrete girder	Crack	C
Small cracks are observed near the construction joints.			Large cracks are observed near the construction joints		

8.4.1.11 Construction joints

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder	Crack	D			
Large cracks are observed near the construction joints with free lime or rusty fluid.					

8.4.1.12 Segment junctions

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder	Crack	D			
Cracks or trace of free lime are observed near the segment joints.					


8.4.1.13 Notch of the girder

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder	Crack	D			
Diagonal cracks are observed near the notch of a girder.					



8.4.1.14 Near anchors

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder	Crack	C	Concrete girder	Crack	D
Crocodile cracks are observed near the anchorage.			Cracks are observed near the anchorage in shear direction		


8.4.1.15 Concrete Cross beam, Diaphragm

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete Cross beam, Diaphragm	Crack	B	Concrete Cross beam, Diaphragm	Crack	C
Cracks at long intervals do not reached to rebar depth			Large crack on the diaphragm with free lime.		
					

8.4.1.16 Concrete Deck slab

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete Deck slab	Crack	B	Concrete Deck slab		C
One direction crack on a concrete deck slab due to drying shrinkage.			Large transverse crack at the bottom of the girder with free lime.		
					

8.4.1.17 Concrete Deck slab

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete Deck slab	Crack	D			
Crocodile crack losing sheering strength and become concrete blocks. These will drop at anytime. 					


8.4.1.18 Abutment and wing wall

Element	Defect	Defect rating	Element	Defect	Defect rating
Abutment and wing wall	Crack	B	Abutment and wing wall	Crack	C
Crack at long intervals do not reached to rebar depth			Small cracks at small intervals reached to rebar depth		

8.4.1.19 Abutment and wing wall

Element	Defect	Defect rating	Element	Defect	Defect rating
Abutment and wing wall	Crack	D			
Large crack at support end or cantilevered base is observed					

8.4.1.20 Pier column/Pier head beam

Element	Defect	Defect rating	Element	Defect	Defect rating
Pier column/Pier head beam	Crack	B	Pier column/Pier head beam	Crack	C
Crack at long intervals do not reached to rebar depth			Large crack at under bearing shoe of a pier head.		
					

8.4.1.21 Pier column/Pier head beam

Element	Defect	Defect rating	Element	Defect	Defect rating
Pier column/Pier head beam	Crack	D			
Large crack at support end or cantilevered base is observed					

8.4.1.22 Foundation

Element	Defect	Defect rating	Element	Defect	Defect rating
Foundation	Crack	B	Foundation	Crack	C
Crack at long intervals do not reached to rebar depth			Small cracks at small intervals reached to rebar depth		

8.4.1.23 Foundation

Element	Defect	Defect rating	Element	Defect	Defect rating
Foundation	Crack	D			
Large crack at support end or cantilevered base is observed					

8.4.2 Peeling, Spalling, Creep

(Concrete girder, Cross beam/Diaphragm, Deck slab, Abutment and Wing wall, Pier and Pier head, Foundation)

8.4.2.1 Summary

Table 8.4-2 Summary of Concrete Bridge -Peeling, Spalling, Creep- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
CB(PSC)-1	All structures mentioned above	Whole parts	Peeling, Spalling, Creep	Partial peeling, spalling or creep is observed.	Wide concrete peeling is observed or peeling spreads.	Wide concrete peeling, spalling or creep with serious corroded rebar is observed

8.4.2.2 All structures mentioned above

Element	Defect	Defect rating	Element	Defect	Defect rating
All structures mentioned above	Peeling, Spalling, Creep	B	All structures mentioned above	Crack	C
Partial peeling, spalling or creep is observed.			Wide concrete peeling is observed or peeling spreads.		

8.4.2.3 All structures mentioned above

Element	Defect	Defect rating	Element	Defect	Defect rating
All structures mentioned above	Peeling, Spalling, Creep	D			
Wide concrete peeling, spalling or creep with serious corroded rebar is observed					

8.4.3 Rebars exposure, Corrosion



(Concrete girder, Cross beam/Diaphragm, Deck slab, Abutment and Wing wall, Pier and Pier head, Foundation)

8.4.3.1 Summary



Table 8.4-3 Summary of Concrete Bridge -Rebars exposure, Corrosion- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
CB(RC)-1	Concrete girder	Whole parts	Rebars exposure, Corrosion	Rebar exposure is observed partially	Rebar exposure is observed and rusting of rebar is progressing	Exposed rebar with serious corrosion or broken are observed.
CB(RC)-2	All structures mentioned above except Concrete girder	Whole parts	Rebars exposure, Corrosion	Rebar exposure is observed partially	Rebar exposure is observed and rusting of rebars is progressing	-----



8.4.3.2 Concrete girder

Element	Defect	Defect rating	Element	Defect	Defect rating
Deck slab	Rebar exposure, Corrosion	B	Girder	Rebar exposure, Corrosion	B
Rebars exposing on a web area of girder due to lack of concrete cover for stirrup rebars. 			Stirrup rebars and election rebars exposing at a bottom of a pier head beam due to lack of concrete cover. 		


8.4.3.3 Concrete girder

Element	Defect	Defect rating	Element	Defect	Defect rating
Deck slab	Rebar exposure, Corrosion	C	Pier head beam	Rebar exposure, Corrosion	C
Peeling concrete and rebars exposing with rusting. 			Peeling concrete at the bottom of a pier head and exposed rebars are rusting. 		

8.4.3.4 Concrete girder

Element	Defect	Defect rating	Element	Defect	Defect rating
Deck slab	Rebar exposure, Corrosion	C	Abutment wall	Rebar exposure, Corrosion	C
Exposed rebars due to peeling of concrete. Area is not large however corrosion progress is serious. 			Exposed rebars rusted in wide area. 		

8.4.3.5 Concrete girder

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder	Rebar exposure, Corrosion	D			
<p>Spalling concrete due to expanding rebar area caused by severe corrosion.</p> 					

8.4.3.6 All structures mentioned above except Concrete girder

Element	Defect	Defect rating	Element	Defect	Defect rating
All structures mentioned above except Concrete girder	Rebar exposure, Corrosion	B	All structures mentioned above except Concrete girder	Rebar exposure, Corrosion	C
Rebar exposure is observed partially			Rebar exposure is observed and rusting of rebars is progressing		

8.4.4 Water leakage, Paddling



(Concrete girder, Cross beam/Diaphragm, Deck slab, Abutment and Wing wall, Pier and Pier head, Foundation)

8.4.4.1 Summary

Table 8.4-4 Summary of Concrete Bridge -Water leakage, Paddling- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
CB(WP)-1	Concrete girder	Whole parts	Water leakage, Paddling	Rebar exposure is observed partially	Rebar exposure is observed and rusting of rebars is progressing	Exposed rebars with serious corrosion or broken are observed.

8.4.4.2 Concrete girder

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder	Water leakage, Paddling	B	Steel girder	Water leakage, Paddling	C
Trace of water leakage with free lime at the segment junction of girder during raining.			Leaked water puddle at corner of inside of box section steel girder regardless of weather.		
					

8.4.4.3 Concrete girder

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder	Water leakage, Paddling	D			
Exposed rebars with serious corrosion or broken are observed.					

8.4.5 Free lime

8.4.5.1 Summary



Table 8.4-5 Summary of Concrete Bridge -Free lime- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
CB(F)-1	Concrete girder, Cross beam, Diaphragm	Whole parts	Free lime	Free lime is observed, but no serious	Serious free lime is detected which seemingly from corroded steel members	-----
CB(F)-2	Deck slab, Abutment and Wing wall, Pier and Pier head, Foundation	Whole parts	Free lime	Free lime running in one direction is detected with color change	Free lime running in two directions is observed with color change.	Large extent of free lime running in two directions with color change is observed.



8.4.5.2 Free lime

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder, Cross beam, Diaphragm	Free lime	B	Concrete girder, Cross beam, Diaphragm	Free lime	C
Free lime is observed, but no serious			Serious free lime is detected which seemingly from corroded steel members		

8.4.5.3 Free lime

Element	Defect	Defect rating	Element	Defect	Defect rating
Deck slab	Free lime	B	Girder	Free lime	B
Free lime from construction joint of cantilever slab.			Free lime from a joint of filling concrete between girders.		
					

8.4.5.4 Free lime

Element	Defect	Defect rating	Element	Defect	Defect rating
Deck slab, Abutment and Wing wall, Pier and Pier head, Foundation	Free lime	C	Deck slab, Abutment and Wing wall, Pier and Pier head, Foundation	Free lime	C
Free lime from crack of an abutment wall. Rusty fluid is not confirmed.			Free lime from a pier head beam near shoe. It is anticipated some of cracks due to concentrated load from shoe.		
					

8.4.5.5 Free lime

Element	Defect	Defect rating	Element	Defect	Defect rating
Deck slab, Abutment and Wing wall, Pier and Pier head, Foundation	Free lime	D			
Large extent of free lime running in two directions with color change is observed.					


8.4.6 Rusty fluid

8.4.6.1 Summary

Table 8.4-6 Summary of Concrete Bridge - Rusty fluid- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
CB(R)-1	Concrete girder	Whole parts	Rusty fluid	Some rusty fluid is observed	Serious rusty fluid is observed, in particular, from rebars or PC cables.	----
CB(R)-2	Concrete Cross beam, Diaphragm	Whole parts	Rusty fluid	Some rusty fluid is observed	Serious rusty fluid is observed, in particular, from anchors of steel members or PC cables.	----
CB(R)-3	Concrete Deck slab	Whole parts	Rusty fluid	Some rusty fluid is observed	Severe rusty fluid is observed.	----
CB(R)-4	Abutment and wing wall	Whole parts	Rusty fluid	Some water leakage and rusty fluid are observed	Severe rusty fluid is observed	----
CB(R)-5	Pier and Pier	Whole parts	Rusty fluid	Some water leakage and rusty fluid are observed	Severe rusty fluid is observed	----
CB(R)-6	Foundation	Whole parts	Rusty fluid	Some water leakage and rusty fluid are observed	Severe rusty fluid is observed	----

8.4.6.2 Concrete girder

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder	Rusty fluid	B	Concrete girder	Rusty fluid	C
Rusty fluid with free lime from bottom of the girder. 			Serious rusty fluid is observed, in particular, from rebars or PC cables.		

8.4.6.3 Concrete Cross beam, Diaphragm

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete Cross beam, Diaphragm	Rusty fluid	B	Concrete Cross beam, Diaphragm	Rusty fluid	C
Some rusty fluid is observed			Serious rusty fluid is observed, in particular, from anchors of steel members or PC cables.		


8.4.6.4 Concrete Deck slab

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete Deck slab	Rusty fluid	B	Concrete Deck slab	Rusty fluid	C
Some rusty fluid is observed			Severe rusty fluid is observed.		

8.4.6.5 Abutment and wing wall

Element	Defect	Defect rating	Element	Defect	Defect rating
Abutment and wing wall	Rusty fluid	B	Abutment and wing wall	Rusty fluid	C
Some water leakage and rusty fluid are observed			Severe rusty fluid is observed		

8.4.6.6 Pier head beam

Element	Defect	Defect rating	Element	Defect	Defect rating
Pier head beam	Rusty fluid	B	Pier head beam	Rusty fluid	C
Some water leakage and rusty fluid are observed			Rusty fluid come from cracks at a bottom of pier head beam		
					

8.4.6.7 Foundation

Element	Defect	Defect rating	Element	Defect	Defect rating
Foundation	Rusty fluid	B	Foundation	Rusty fluid	C
Some water leakage and rusty fluid are observed			Severe rusty fluid is observed		

8.4.7 Deterioration, Discoloration

(Concrete girder, Cross beam, Diaphragm, Deck slab, Abutment and Wing wall, Pier and Pier head, Foundation)

8.4.7.1 Summary

Table 8.4-7 Summary of Concrete Bridge -Deterioration, Discoloration- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
CB(DD)-1	Above structures	Whole parts	Deterioration, Discoloration	Partial change in color is observed	Concrete changes its color on the surface near cracks	-----

8.4.7.2 Above structures

Element	Defect	Defect rating	Element	Defect	Defect rating
Above structures	Deterioration, Discoloration	B	Above structures	Deterioration, Discoloration	C
Partial change in color is observed			Concrete changes its color on the surface near cracks		

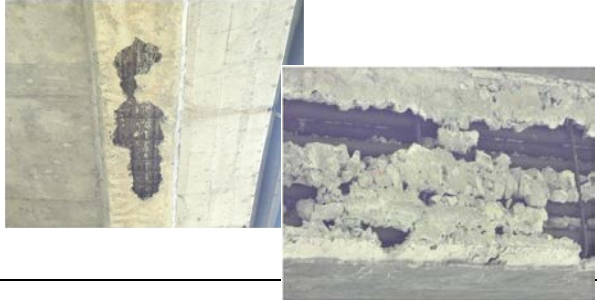
8.4.8 Honey comb, Void

8.4.8.1 Summary

Table 8.4-8 Summary of Concrete Bridge -Honey comb, Void- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
CB(HV)-1	Concrete girder, Cross beam, Diaphragm	Whole parts	Honey comb, Void	Some of honey-combs and voids are observed, but not many	Many large honey-combs and voids are observed	-----
CB(HV)-2	Deck slab	Whole parts	Honey comb, Void	Some honey combs, voids are observed.	Large honey combs, voids are observed	Voids or holes due to crocodile crack are observed
CB(HV)-3	Abutment and Wing wall, Pier and Pier head, Foundation	Whole parts	Honey comb, Void	Some honey combs, voids are observed	Large honey combs, voids are observed.	Large honey comb, voids with heavy corroded rebars are observed

8.4.8.2 Concrete girder, Cross beam, Diaphragm

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder, Cross beam, Diaphragm	Honey comb, Void	B	Above structures	Honey comb, Void	C
Some of honey-combs and voids are observed, but not many			Large honey comb at the bottom of the girder due to inadequate compaction of concrete during concrete placing work.		
					

8.4.8.3 Deck slab

Element	Defect	Defect rating	Element	Defect	Defect rating
Deck slab	Honey comb, Void	B	Deck slab	Honey comb, Void	C
Some honey combs, voids are observed			Large honey combs, voids are observed		

8.4.8.4 Deck slab

Element	Defect	Defect rating	Element	Defect	Defect rating
Deck slab	Honey comb, Void	D			
Voids or holes due to crocodile crack are observed					

8.4.8.5 Abutment and Wing wall, Pier and Pier head, Foundation

Element	Defect	Defect rating	Element	Defect	Defect rating
Abutment and Wing wall, Pier and Pier head, Foundation	Honey comb, Void	B	Abutment and Wing wall, Pier and Pier head, Foundation	Honey comb, Void	C
Some honey combs, voids are observed			Large honey comb at the bottom of the girder due to inadequate compaction of concrete during concrete placing work.		

8.4.8.6 Abutment and Wing wall, Pier and Pier head, Foundation

Element	Defect	Defect rating	Element	Defect	Defect rating
Abutment and Wing wall, Pier and Pier head, Foundation	Honey comb, Void	D			
Voids or holes due to crocodile crack are observed					

8.4.9 Chemical attacks

8.4.9.1 Summary



Table 8.4-9 Summary of Concrete Bridge -Chemical attacks- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
CB(C)-1	Concrete girder, Cross beam, Diaphragm, Deck slab, Abutment and Wing wall, Pier and Pier head, Foundation	Whole parts	Chemical attacks	Tendency of chemical attack effects is observed	Chemical attacks and serious rebar corrosion are observed	-----

8.4.9.2 Concrete girder, Cross beam, Diaphragm, Deck slab, Abutment and Wing wall, Pier and Pier head, Foundation

Element	Defect	Defect rating	Element	Defect	Defect rating
Concrete girder, Cross beam, Diaphragm, Deck slab, Abutment and Wing wall, Pier and Pier head, Foundation	Chemical attacks	B			
Tendency of chemical attack effects is observed					

8.4.9.3 Concrete girder, Cross beam, Diaphragm, Deck slab, Abutment and Wing wall, Pier and Pier head, Foundation

Element	Defect	Defect rating	Element	Defect	Defect rating
Girder	Chemical (Salt) attack	C/(D)	Pier column	Chemical (Salt) attack	C/(C)
Large area of spalling caused by expansion of rebar diameter due to serious corrosion by salt attack to girders above sea water. (Rating of Chemical attack is “C”, and rating of Rebar exposure/Spalling concrete is “D”)			Spalling of pier column concrete caused by expansion of rebar diameter due to serious corrosion by salt attack. (Rating of Chemical attack is “C”, and rating of Rebar exposure/Spalling concrete is “C”)		
					

8.5 Steel Bridge



8.5.1 Deterioration of paint

8.5.1.1 Summary



Table 8.5-1 Summary of Steel Bridge -Deterioration of paint- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
SB(D)-1	All steel structures (Steel girder, Truss member, Arch member and Steel pier, Cross beam, Stringer, Diaphragm)	Whole parts	Deterioration of paint	Cracks, peeling, swollen or rust are observed in limited area.	Cracks, peeling, swelling or rust are observed over a wide area	-----

8.5.1.2 Girder

Element	Defect	Defect rating	Element	Defect	Defect rating
Girder	Deterioration of paint	B	Girder	Deterioration of paint	B
Partial rust appear due to over aged paint. 			Partial paint peeling at bottom of a lower flange. 		

8.5.1.3 Girder

Element	Defect	Defect rating	Element	Defect	Defect rating
Girder	Deterioration of paint	C	Girder	Deterioration of paint	C
Rust is spreading whole area of the lower flange of girder. 			Rusting widely spreading due to deterioration of paint. 		



8.5.2 Corrosion

8.5.2.1 Summary


Table 8.5-2 Summary of Steel Bridge -Corrosion- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
SB(Co)-1	Steel girder, Truss member, Arch member and Steel pier	Whole parts	Corrosion	Reduction in steel plate thickness is found due to corrosion partially	Reduction in steel plate thickness is observed due to corrosion at wide area	Corrosion on the main members develops significantly and gives significant negative impacts on strength of the structure
SB(Co)-2	Cross beam, Stringer, Diaphragm	Whole parts	Corrosion	Reduction in steel plate thickness is found due to corrosion partially	Corrosion on the members develops significantly and causes significant negative impacts on the strength of the member	Severe rust on over 50% of length of the member

8.5.2.2 Steel girder, Truss member, Arch member and Steel pier

Element	Defect	Defect rating	Element	Defect	Defect rating
Girder	Corrosion	B	Girder	Corrosion	C
Reduction of thickness of the lower flange and web plate partially due to severe corrosion.			Reduction of thickness of the lower flange and web plate widely due to severe corrosion.		
					

8.5.2.3 Steel girder, Truss member, Arch member and Steel pier

Element	Defect	Defect rating	Element	Defect	Defect rating
Girder	Corrosion	D			
The lower flange and other member lost section seriously due to heavy corrosion.					
					


8.5.3 Loosen and fallen of rivets, bolt-nuts

8.5.3.1 Summary


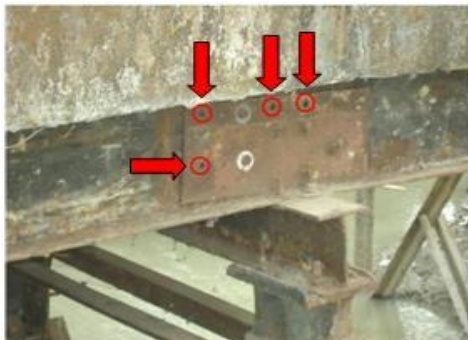
Table 8.5-3 Summary of Steel Bridge -Loosen and fallen of rivets, bolt-nuts- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
SB(L)-1	Steel girder, Truss member, Arch member and Steel pier, Steel cross beam, Stringer, Diaphragm	Whole parts	Loosen and fallen of rivets, bolt-nuts	There is one missing or loosen rivets or bolt-nuts observed on one connection plate	More than 2 rivets or bolt-nuts are missing or loosen on one connection plate	-----

8.5.3.2 Steel girder, Truss member, Arch member and Steel pier, Steel cross beam, Stringer, Diaphragm

Element	Defect	Defect rating	Element	Defect	Defect rating
Bracing	Loosen and fallen of bolt	B			
One missing bolt-nut at a connection point. 					

8.5.3.3 Steel girder, Truss member, Arch member and Steel pier, Steel cross beam, Stringer, Diaphragm

Element	Defect	Defect rating	Element	Defect	Defect rating
Girder	Loosen and fallen of bolt	C	Girder	Loosen and fallen of bolt	C
1 nut losing and 1 bolt-nut missing. 			More than half of bolt-nuts missing. 		

8.5.4 Cracks

(Steel girder, Truss member, Arch member and Steel pier)

8.5.4.1 Summary

Table 8.5-4 Summary of Steel Bridge -Cracks- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
SB(Cr)-1	Steel girder, Truss member, Arch member and Steel pier	Welding portions on sole plates	Crack	-----	Cracks appear	Cracks reached web plates
SB(Cr)-2	Steel girder, Truss member, Arch member and Steel pier	Girder end where cross section of web plate changes	Crack	-----	Cracks appear	Cracks reached web plates
SB(Cr)-3	Steel girder, Truss member, Arch member and Steel pier	Welding portions with vertical stiffeners	Crack	-----	Cracks appear	-----
SB(Cr)-4	Steel girder, Truss member, Arch member and Steel pier	Welding portions with gusset plates	Crack	-----	Paint cracks appear	Cracks progress onto web plates
SB(Cr)-5	Steel girder, Truss member, Arch member and Steel pier	Butt welding portions on lower flanges	Crack	-----	Paint cracks appear	Cracks appear
SB(Cr)-6	Steel girder, Truss member, Arch member and Steel pier	Welding portions with steel deck plate	Crack	-----	Cracks appear	Cracks extend over two thirds of welding length
SB(Cr)-7	Steel girder, Truss member, Arch member and Steel pier	Welding portions between vertical stiffeners and steel deck plates	Crack	-----	Cracks appear	Cracks appear on steel deck plates
SB(Cr)-8	Steel girder, Truss member, Arch member and Steel pier	End of stringers where cross section of the girder changes	Crack	-----	Cracks appear	Cracks progress on the stringer web extending in the direction that could break the stringer
SB(Cr)-9	Steel girder, Truss member, Arch member and Steel pier	Base of vertical members on the arch ribs	Crack	-----	There is potential of breaking vertical members	Cracks extend to arch chord or to the stiffeners of the girder
SB(Cr)-10	Steel girder, Truss member, Arch member and Steel pier	Welding portions on shoe base plates	Crack	-----	Cracks appear	-----
SB(Cr)-11	Steel girder, Truss member, Arch member and Steel pier	Corners of steel piers	Crack	-----	Cracks appear	Cracks appear and may progress
SB(Cr)-12	Steel girder, Truss member, Arch member and Steel pier	Others	Crack	-----	Cracks appear	Other locations where large cracks are found
SB(Cr)-13	Cross beam, Stringer, Diaphragm	Whole parts	Crack	-----	Some cracking	Severe cracking

8.5.4.2 Welding portions on sole plates

Element	Defect	Defect rating	Element	Defect	Defect rating
Steel girder, Truss member, Arch member and Steel pier	Crack	C	Steel girder, Truss member, Arch member and Steel pier	Crack	D
Cracks appear			Cracks reached web plates		

8.5.4.3 Girder end where cross section of web plate changes

Element	Defect	Defect rating	Element	Defect	Defect rating
Steel girder, Truss member, Arch member and Steel pier	Crack	C	Steel girder, Truss member, Arch member and Steel pier	Crack	D
Cracks appear			Cracks reached web plates		

8.5.4.4 Welding portions with vertical stiffeners

Element	Defect	Defect rating	Element	Defect	Defect rating
Steel girder, Truss member, Arch member and Steel pier	Crack	C			
Cracks appear					

8.5.4.5 Welding portions with gusset plates

Element	Defect	Defect rating	Element	Defect	Defect rating
Steel girder, Truss member, Arch member and Steel pier	Crack	C	Steel girder, Truss member, Arch member and Steel pier	Crack	D
Paint cracks appear			Cracks progress onto web plates		

8.5.4.6 Butt welding portions on lower flanges

Element	Defect	Defect rating	Element	Defect	Defect rating
Steel girder, Truss member, Arch member and Steel pier	Crack	C	Steel girder, Truss member, Arch member and Steel pier	Crack	D
Paint cracks appear			Cracks appear		

8.5.4.7 Welding portions with steel deck plate

Element	Defect	Defect rating	Element	Defect	Defect rating
Steel girder, Truss member, Arch member and Steel pier	Crack	C	Steel girder, Truss member, Arch member and Steel pier	Crack	D
Cracks appear			Cracks extend over two thirds of welding length		

8.5.4.8 Welding portions between vertical stiffeners and steel deck plates

Element	Defect	Defect rating	Element	Defect	Defect rating
Steel girder, Truss member, Arch member and Steel pier	Crack	C	Steel girder, Truss member, Arch member and Steel pier	Crack	D
Cracks appear			Cracks appear on steel deck plates		

8.5.4.9 End of stringers where cross section of the girder changes

Element	Defect	Defect rating	Element	Defect	Defect rating
Steel girder, Truss member, Arch member and Steel pier	Crack	C	Steel girder, Truss member, Arch member and Steel pier	Crack	D
Cracks appear			Cracks progress on the stringer web extending in the direction that could break the stringer		

8.5.4.10 Base of vertical members on the arch ribs

Element	Defect	Defect rating	Element	Defect	Defect rating
Steel girder, Truss member, Arch member and Steel pier	Crack	C	Steel girder, Truss member, Arch member and Steel pier	Crack	D
There is potential of breaking vertical members			Cracks extend to arch chord or to the stiffeners of the girder		

8.5.4.11 Welding portions with gusset plates Welding portions on shoe base plates

Element	Defect	Defect rating	Element	Defect	Defect rating
Steel girder, Truss member, Arch member and Steel pier	Crack	C			
Cracks appear					



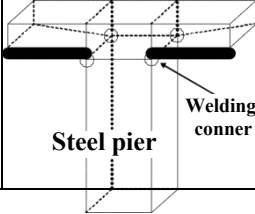
8.5.4.12 Corners of steel piers

Element	Defect	Defect rating	Element	Defect	Defect rating
Steel girder, Truss member, Arch member and Steel pier	Crack	C	Steel girder, Truss member, Arch member and Steel pier	Crack	D
Cracks appear			Cracks appear and may progress		


8.5.4.13 Others

Element	Defect	Defect rating	Element	Defect	Defect rating
Steel girder, Truss member, Arch member and Steel pier	Crack	C	Steel girder, Truss member, Arch member and Steel pier	Crack	D
Cracks appear			Other locations where large cracks are found		

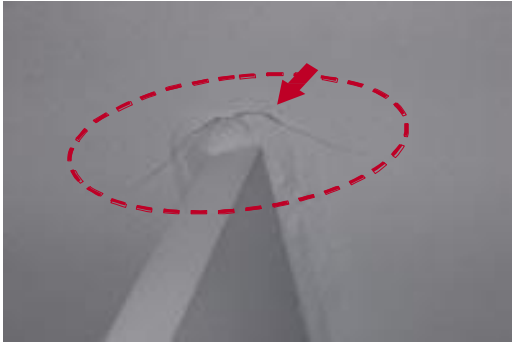

8.5.4.14 Cross beam, Stringer, Diaphragm

Element	Defect	Defect rating	Element	Defect	Defect rating
Gusset plate for bracing	Crack	C	Pier head beam	Crack	C
Crack at the welding portion with gusset plate for bracing.			Progressing crack at welding portion of rounding corner of steel pier head.		
			 		


8.5.4.15 Cross beam, Stringer, Diaphragm

Element	Defect	Defect rating	Element	Defect	Defect rating
Girder	Crack	C			
Crack at the welding portion with vertical stiffener.					
					

8.5.4.16 Cross beam, Stringer, Diaphragm

Element	Defect	Defect rating	Element	Defect	Defect rating
Vertical stiffener	Crack	D	U section stiffener for steel deck	Crack	D
Crack reaches to the steel deck plate from welding portion.			Full length of crack at the bud welding portion of the U section stiffener for steel deck plate.		
					

8.5.4.17 Cross beam, Stringer, Diaphragm

Element	Defect	Defect rating	Element	Defect	Defect rating
Girder	Crack	D			
Crack at the lower flange above the sole plate reaches to the web plate.					

8.5.5 Deformation and buckling

8.5.5.1 Summary



Table 8.5-5 Summary of Steel Bridge -Deformation and buckling- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
SB(DB)-1	All steel structures	Whole parts	Deformation and buckling	Slight deformation or buckling arises	Deformation or buckling arises and brings negative impacts on strength of the structure.	Significant deformation or buckling arises and bring significant negative impacts on strength of the structure.



8.5.5.2 All steel structures

Element	Defect	Defect rating	Element	Defect	Defect rating
All steel structures	Deformation and buckling	B			
Slight deformation or buckling arises					

8.5.5.3 All steel structures

Element	Defect	Defect rating	Element	Defect	Defect rating
Truss frame	Deformation and buckling	C	Upper lateral bracing	Deformation and buckling	C
Truss frame tilting significantly due to settlement of substructure.			Missing of upper lateral bracing members by collision of tall vehicle.		
					

8.5.5.4 All steel structures

Element	Defect	Defect rating	Element	Defect	Defect rating
Diagonal member of truss	Deformation and buckling	C	Bailey bridge	Deformation and buckling	C
Deformation of a diagonal member due to vehicle collision.			Horizontal deformation due to over load. Vehicle weight shall be controlled.		
					

8.5.5.5 All steel structures

Element	Defect	Defect rating	Element	Defect	Defect rating
All steel structures	Deformation and buckling	D			
Significant deformation or buckling arises and bring significant negative impacts on strength of the structure.					

8.6 Bridge Accessories


8.6.1 Bearing shoe

8.6.1.1 Summary

Table 8.6-1 Summary of Bridge Accessories -Bearing shoe- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
BA(BS)-1	Bearing shoe body	Whole parts	Breakage, Crack of bearing shoe body	Movement or rotation function slight malfunction	Shoe body moves up and down due to improper friction against horizontal movement. Cracks are detected on the members supporting a vertical load.	Vertical load support function does not function well due to breakdown of shoe materials by loading
BA(BS)-2	Bearing shoe body	Whole parts	Deterioration of rubber (Loose of elastic, deformation, spalling, blister)	No cracking, some deformed	Cracked, deformed, sagged rubber bearing	Rubber bearing excessively deformed or with severe cracking. Severe rust on steel plates
BA(BS)-3	Bearing shoe body	Whole parts	Corrosion	Moving and rolling functions are declining due to corrosion.	Vertical load support function declines due to corrosion.	Vertical load support function does not function well due to serious corrosion.
BA(BS)-4	Bearing shoe body	Whole parts	Displacement	Movement sometimes reaches beyond design values.	Movement reaches beyond the allowable level, like collision with stopper.	Upper and lower shoe move significantly so that vertical load supporting function does not function well.
BA(BS)-5	Bearing shoe attachments, anchor bolt-nuts	Whole parts	Damages to attachments, anchor bolt-nuts	Looseness of set bolts, side block and anchor bolt nuts.	Breakdown of set bolts and anchor bolts. Damages on side block and pinch plates.	-----
BA(BS)-6	Bearing shoe grout concrete or mortar	Attachments of the bearing shoe including anchor bolt-nuts	Damages to grout concrete or mortar	-----	Some breakdown of base concrete or mortar is detected.	Vertical load supporting function does not work well due to breakdown of base concrete or mortar.
BA(BS)-7	Bearing shoe body	Grouting parts	Abnormal sounds	Shoe generated sound.	Loud crashing sound is generated.	-----
BA(BS)-8	Bearing shoe bed	Whole parts	Piling of dust and sand	-----	Shoe is filled with soil or debris	Debris or soil is piled around shoe.
BA(BS)-9	Bearing shoe pad	Bearing shoe bed	Sweating, damping on bearing the pad	Some dampness	Standing water. Dampness. Dust. Vegetation	Dampness and spalling of concrete on bearing shelf


8.6.1.2 Breakage, Crack of bearing shoe body

Element	Defect	Defect rating	Element	Defect	Defect rating
Bearing shoe body	Breakage, Crack of bearing shoe body	B	Bearing shoe body	Breakage, Crack of bearing shoe body	C
Movement or rotation function slight malfunction			Breakage of a bearing shoe which will no longer support load.		
					

8.6.1.3 Breakage, Crack of bearing shoe body

Element	Defect	Defect rating	Element	Defect	Defect rating
Bearing shoe body	Breakage, Crack of bearing shoe body	D			
Vertical load support function does not function well due to breakdown of shoe materials by loading					

8.6.1.4 Deterioration of rubber (Loose of elastic, deformation, spalling, blister)

Element	Defect	Defect rating	Element	Defect	Defect rating
Bearing shoe body	Deterioration of rubber (Loose of elastic, deformation, spalling, blister)	B	Bearing shoe body	Deterioration of rubber (Loose of elastic, deformation, spalling, blister)	C
No cracking, some deformed			Rubber bearing shoe with losing load bearing and movement function		
					


8.6.1.5 Deterioration of rubber (Loose of elastic, deformation, spalling, blister)

Element	Defect	Defect rating	Element	Defect	Defect rating
Bearing shoe body	Deterioration of rubber (Loose of elastic, deformation, spalling, blister)	D			
Rubber bearing excessively deformed or with severe cracking. Severe rust on steel plates					

8.6.1.6 Corrosion

Element	Defect	Defect rating	Element	Defect	Defect rating
Bearing shoe body	Corrosion	B	Bearing shoe body	Corrosion	C
Moving and rolling functions are declining due to corrosion.			Vertical load support function declines due to corrosion.		


8.6.1.7 Corrosion

Element	Defect	Defect rating	Element	Defect	Defect rating
Bearing shoe body	Corrosion	D			
Steel bearing shoe which lost load supporting and movement function due to serious corrosion.					
					


8.6.1.8 Displacement

Element	Defect	Defect rating	Element	Defect	Defect rating
Bearing shoe body	Displacement	B	Bearing shoe body	Displacement	C
Movement sometimes reaches beyond design values.			Movement reaches beyond the allowable level, like collision with stopper.		



8.6.1.9 Displacement

Element	Defect	Defect rating	Element	Defect	Defect rating
Bearing shoe body	Displacement	D			
Tilting of bearing shoe roller and lost supporting function of virtual load and movement.					

8.6.1.10 Damages to attachments, anchor bolt-nuts

Element	Defect	Defect rating	Element	Defect	Defect rating
Bearing shoe attachments, anchor bolt-nuts	Damages to attachments, anchor bolt-nuts	B	Bearing shoe attachments, anchor bolt-nuts	Damages to attachments, anchor bolt-nuts	C
Looseness of set bolts, side block and anchor bolt nuts.			Corrosion of anchor bolt nuts of the bearing shoe.		
					



8.6.1.11 Damages to grout concrete or mortar

Element	Defect	Defect rating	Element	Defect	Defect rating
Bearing shoe grout concrete or mortar	Damages to grout concrete or mortar	C	Bearing shoe grout concrete or mortar	Damages to grout concrete or mortar	D
Spalling concrete and exposed rebars of the bearing shoe bed			Fully crashed base mortar of the bearing shoe bed.		
					

8.6.1.12 Abnormal sounds

Element	Defect	Defect rating	Element	Defect	Defect rating
Bearing shoe body	Abnormal sounds	B	Bearing shoe body	Abnormal sounds	C
Shoe generated sound.			Loud crashing sound is generated.		

8.6.1.13 Piling of dust and sand

Element	Defect	Defect rating	Element	Defect	Defect rating
Bearing shoe bed	Piling of dust and sand	C	Bearing shoe bed	Piling of dust and sand	D
Mounted bird waste near shoe bed.			Buried and displaced bearing shoe by piling soil and dust.		
					

8.6.1.14 Sweating, damping on bearing the pad

Element	Defect	Defect rating	Element	Defect	Defect rating
Bearing shoe pad	Sweating, damping on bearing the pad	B	Bearing shoe pad	Sweating, damping on bearing the pad	C
Some dampness			Standing water. Dampness. Dust. Vegetation		

8.6.1.15 Sweating, damping on bearing the pad

Element	Defect	Defect rating	Element	Defect	Defect rating
Bearing shoe pad	Sweating, damping on bearing the pad	D			
Dampness and spalling of concrete on bearing shelf					


8.7 Expansion Joint

8.7.1 Summary

Table 8.7-1 Summary of Expansion Joint Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
BA(EJ)-1	Rubber expansion joint	Face parts	Crack, Torn, Splitting:	Torn around, no crack, not splitting	Torn cracks, splitting around	Deep torn or crack, splitting and ageing
BA(EJ)-2	Steel expansion joint	Face plates	Deformation	Deformation, no bent	Much deformation and bent	Serious deformation, bent over the limit
BA(EJ)-3	Expansion joint	Anchor bolt nuts	Loosen, Missing anchor bolt nut	Some of anchor bolt-nuts are missing	Many anchor bolt-nuts are missing	-----
BA(EJ)-4	Expansion joint	Drain gutter of an expansion joint	Drainage damage	Drain gutter is broken partially	Drain gutter broken widely	-----
BA(EJ)-5	Expansion joint	Face plates	Leveling gap	Tilt appeared	Tilted out of position	Tilt caused danger to traffic
BA(EJ)-6	Road surface	Filling mortal/concret	Spalling, Breakage of Filling mortal/concrete	Some spalling, components intact and well anchored	Severe spalling, components damaged or torn loose anchor	Severe spalling, sections of Exp. J come loose and danger to traffic

8.7.2 Crack, Torn, Splitting:

Element	Defect	Defect rating	Element	Defect	Defect rating
Rubber expansion joint	Crack, Torn, Splitting:	B	Rubber expansion joint	Crack, Torn, Splitting:	C
Torn around, no crack, not splitting			Crack of rubber expansion joint due to deterioration by over aging.		
					

8.7.3 Crack, Torn, Splitting:

Element	Defect	Defect rating	Element	Defect	Defect rating
Rubber expansion joint	Crack, Torn, Splitting:	D			
Deep torn or crack, splitting and ageing					

8.7.4 Deformation

Element	Defect	Defect rating	Element	Defect	Defect rating
Steel expansion joint	Deformation	B	Steel expansion joint	Deformation	C
Deformation, no bent			Much deformation and bent		


8.7.5 Deformation

Element	Defect	Defect rating	Element	Defect	Defect rating
Steel expansion joint	Deformation	D			
Serious deformation, bent over the limit					


8.7.6 Loosen, Missing anchor bolt nut

Element	Defect	Defect rating	Element	Defect	Defect rating
Expansion joint	Loosen, Missing anchor bolt nut	B	Expansion joint	Loosen, Missing anchor bolt nut	C
Some of anchor bolt-nuts are missing			Many anchor bolt-nuts are missing		

8.7.7 Drainage damage

Element	Defect	Defect rating	Element	Defect	Defect rating
Expansion joint	Drainage damage	B	Expansion joint	Drainage damage	C
Drain gutter is broken partially			Pilling of debris in the ditch below the expansion joint.		
					

8.7.8 Leveling gap

Element	Defect	Defect rating	Element	Defect	Defect rating
Expansion joint	Leveling gap	B	Expansion joint	Leveling gap	C
Tilt appeared			Dangerous elevation gap due to pier sank.		
					

8.7.9 Leveling gap

Element	Defect	Defect rating	Element	Defect	Defect rating
Expansion joint	Leveling gap	D			
Tilt caused danger to traffic					

8.7.10 Spalling, Breakage of Filling mortar/concrete

Element	Defect	Defect rating	Element	Defect	Defect rating
Road surface	Spalling, Breakage of Filling mortar/concrete	B	Road surface	Spalling, Breakage of Filling mortar/concrete	C
Some spalling, components intact and well anchored			Severe spalling, components damaged or torn loose anchor		

8.7.11 Spalling, Breakage of Filling mortar/concrete

Element	Defect	Defect rating	Element	Defect	Defect rating
Road surface	Spalling, Breakage of Filling mortar/concrete	D			
Severe spalling, sections of Exp. J come loose and danger to traffic					


9. APPROACH ROAD

9.1.1 Summary

Table 8.7-1 Summary of Approach Road Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
BA(AR)-1	Embankment	All section	Settlement, movement or deformation	Settlement, movement - no signs of new movements	Major settlement, movement or deformation	Settlement and deformation with scour and slip
BA(AR)-2	Pavement	All section	Spalling/ Pothole on pavement	Some spalling, no potholes	Some spalling and potholes	Major spalling, many potholes
BA(AR)-3	Pavement	All section	Crack on pavement	Some cracking	Severe localized cracking	Severe cracking all over
BA(AR)-4	Embankment foundation	Riprap, Gabion	Riprap, Gabion	—	Tension crack in approach embankment slope. Some scour but embankment slope stable, breakage of gabion net	Fully developed slip failure. Major scour and unstable embankment slope including serious breakage of gabion net/ missing of riprap stone


9.1.2 Settlement, movement or deformation

Element	Defect	Defect rating	Element	Defect	Defect rating
Embankment	Settlement, movement or deformation	B	Embankment	Settlement, movement or deformation	C
Settlement, movement - no signs of new movements			Spillage out of backfill soil of the abutment causes settlement of approach road. The settlement will develop if any counter measure taken immediately due to spillage is still continuing.		
					

9.1.3 Settlement, movement or deformation

Element	Defect	Defect rating	Element	Defect	Defect rating
Embankment	Settlement, movement or deformation	D			
Settlement and deformation with scour and slip					


9.1.4 Spalling/ Pothole on pavement

Element	Defect	Defect rating	Element	Defect	Defect rating
Pavement	Spalling/ Pothole on pavement	B	Pavement	Spalling/ Pothole on pavement	C
Some spalling, no potholes			Some spalling and potholes		
					

9.1.5 Spalling/ Pothole on pavement

Element	Defect	Defect rating	Element	Defect	Defect rating
Pavement	Spalling/ Pothole on pavement	D			
Major spalling, many potholes					

9.1.6 Crack on pavement

Element	Defect	Defect rating	Element	Defect	Defect rating
Pavement	Crack on pavement	B	Pavement	Crack on pavement	C
Some cracking			Severe localized cracking		
					

9.1.7 Crack on pavement

Element	Defect	Defect rating	Element	Defect	Defect rating
Pavement	Crack on pavement	D			
Severe cracking all over					

9.1.8 Riprap, Gabion

Element	Defect	Defect rating	Element	Defect	Defect rating
Embankment foundation	Riprap, Gabion	C	Embankment foundation	Riprap, Gabion	D
Tension crack in approach embankment slope. Some scour but embankment slope stable, breakage of gabion net			Fully developed slip failure. Major scour and unstable embankment slope including serious breakage of gabion net/ missing of riprap stone		

9.2 Other Facility -Drainage System-

(Shoulder drainage, Median drainage, Rolled Gutter, Drain pipes, Catch basin, Manhole)

9.2.1 Summary


Table 9.2-1 Summary of Other Facility -Drainage System- Defects

Code	Element	Part	defect	Criteria of Diagnosis		
				B	C	D
BA(OD)-1	Drainage	All section/parts	Damages of drainage facilities	-----	Degradation of drain function due to the damages of drain facilities	Water leakage. Serious degradation of drain functions.
BA(OD)-2	Joint of drainage	All section/parts	Joint damages	Leakage of water, but no degradation of drain functions.	Leakage of water from joint gaps and scouring around drain facilities	Water infiltration into pavement from widened joint gaps
BA(OD)-3	Drainage	All section/parts	Piling of debris	Slight surface water flow due to the degradation of drain functions.	Serious surface water flow caused by the degradation of drain functions	Serious scouting around pavement facilities due to overflow or degradation of drain functions

9.2.2 Damages of drainage facilities

Element	Defect	Defect rating	Element	Defect	Defect rating
Drainage	Damages of drainage facilities	C	Drainage	Damages of drainage facilities	D
Degradation of drain function due to the damages of drain facilities			Water leakage. Serious degradation of drain functions.		


9.2.3 Joint damages

Element	Defect	Defect rating	Element	Defect	Defect rating
Joint of drainage	Joint damages	B	Joint of drainage	Joint damages	C
Leakage of water, but no degradation of drain functions.			Vertical drainage facility was scored at surrounding area.		
					

9.2.4 Joint damages

Element	Defect	Defect rating	Element	Defect	Defect rating
Joint of drainage	Joint damages	D			
Water infiltration into pavement from widened joint gaps					

9.2.5 Piling of debris

Element	Defect	Defect rating	Element	Defect	Defect rating
Drainage	Piling of debris	B	Drainage	Piling of debris	C
Slight surface water flow due to the degradation of drain functions.			Serious surface water flow caused by the degradation of drain functions		
					

9.2.6 Piling of debris

Element	Defect	Defect rating	Element	Defect	Defect rating
Drainage	Piling of debris	D			
Serious scouting around pavement facilities due to overflow or degradation of drain functions					