

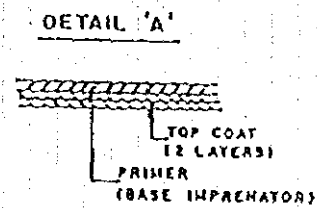
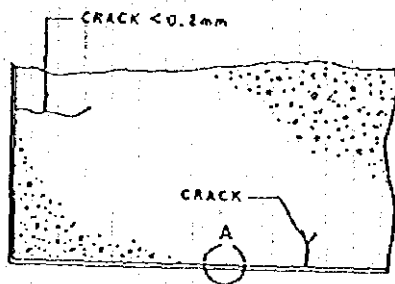
6.4 Rehabilitation Method

On the basis of the preliminary inspection on 100 bridges and detailed investigation on 10 bridges, the following rehabilitation method may be selected in Sri Lanka.

Rehabilitation Plan	Member	Rehabilitation Method
Repair	Concrete	Coating Injection of resin Patching
	Steel	Repainting Addition of cover plate Weep hole in lower chord member
	Expansion joint	Replacement of members
	Substructure	Riprap stones and gabion Filling of gap in stone pier and abutment
	Revetment	Rubble paving
Strengthening	Concrete	Pressure bonding with steel plates Additional prestressing Prepacked concrete lining with additional reinforcing bar
	Steel	Concrete lining with reinforcing bar Addition of stringer
	Slabs	Replacement to concrete slabs
	Bearing	Replacement to rubber bearing
	Expansion joint	Replacement of expansion joint
	Drainage	Enlargement of drain pipes
	Substructure	Concrete lining Additional piles with enlarged pile cap New installation of parapet
	Functional improvement	Superstructure & Substructure
<Reference>		Guniting Waterproofing of concrete slabs Guniting with additional reinforcing bars

Type of Rehabilitation : Repair of concrete members

Method of Rehabilitation : Coating



[Procedure]

1. Remove the oil, grease, loose particles from the concrete surface by means of grinder or water blasting.
2. Allow the surface to dry and apply the epoxy resin primer with a roller.
3. When the primer is dried, apply two layers of acryurethane or polyurethane resin paint.

[Cautions]

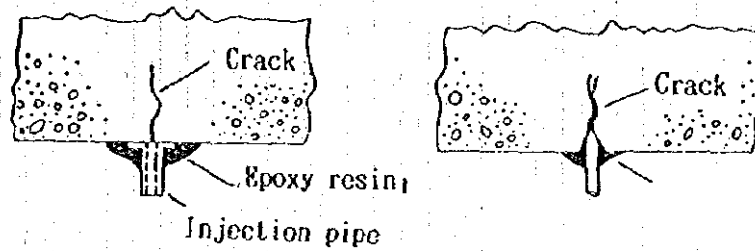
1. Minimum dry film thickness of each layer of top coat shall be 30 microns and standard unit application shall be more than 0.12 kg/m^2 .

[Conditions for Application]

1. Crack must not be progressive and have the width of 0.2 mm or less.

Type of Rehabilitation : Repair of concrete members

Method of Rehabilitation : Injection of resin



[Procedure]

1. Clean and dry the concrete surface around the crack into which the resin is to be injected.
2. Seal the cracked surface and mark injection holes in an interval shown above.
3. Insert an injection pipe and seal the area around the pipe.
4. Inject the epoxy resin. Injection must begin with the lowest hole in the vertical plane and with the most distanced hole in the horizontal plane. Cure at least 24 hours.
5. Remove the injection pipe and seal the injected portion.
6. Remove the seal from the cracked surface.

[Cautions]

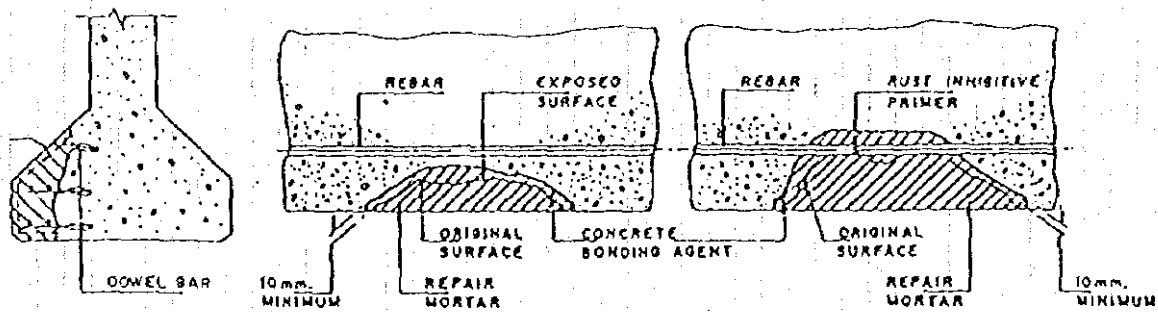
1. Epoxy resin material shall comply with the following requirements.
 - Minimum compressive strength at 7 days ----- 60N/mm^2
 - Flexural strength ----- 40N/mm^2
2. Injection pressure shall not be more than 40psi (3kgf/cm^2)

[Conditions for Application]

1. Cracks are not active and its surface width is more than 0.2 mm, but less than 3.0 mm.
2. No water leak and no liquid rust.

Type of Rehabilitation : Repair of concrete members

Method of Rehabilitation : Patching



[Procedure]

1. Chip the damaged portion till the satisfactory concrete is exposed.
2. When the reinforcing bar is exposed, remove concrete for a length of about 20 mm after reinforcing bar.
3. Remove rust from the reinforcing bar completely.
4. Apply the zinc-rich type primer to the reinforcing bar.
5. Dry patched portions and apply the bonding agent (epoxy resin, etc.).
6. Apply mortar in layers (each 10 mm) with a trowel or a gloved hand.
7. Carry out surface finishing.

[Cautions]

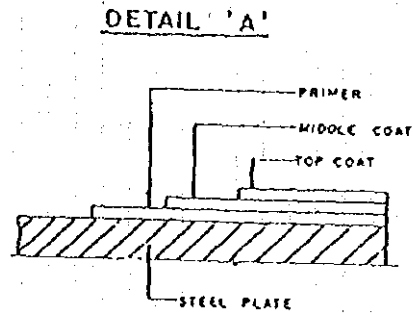
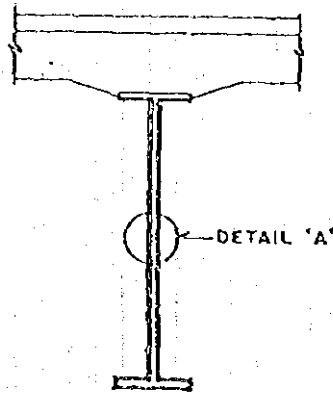
1. When the void is relatively small, inject the epoxy mortar. If it is relatively large, use the polymer cement mortar.
2. The strength of repair mortar must be 40N/mm^2 .
3. Minimum dry film thickness of steel primer shall be 40 microns.

[Conditions for Application]

1. Damages, such as honeycomb, void, separation must not be progressive.

Type of Rehabilitation : Repair of steel members

Method of Rehabilitation : Repainting



[Procedure]

1. Completely remove rust, dust, dirt and debris, oil, grease and paint that is about to be separately.
2. Apply the primer with a brush.
3. After drying of the primer, apply the middle coat with a brush.
4. After drying of the middle coat, apply the top coat with a brush.

[Cautions]

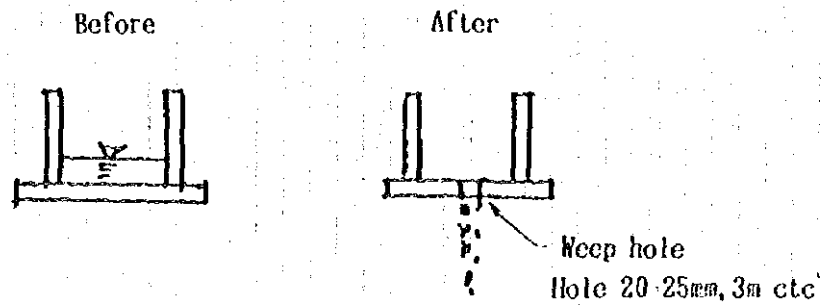
1. Where the environmental conditions are severe, use the polyurethane paint for both middle and top coats.
2. Use paints of different colors for each layer.
3. For normal protective coating, minimum dry film thickness of each layer shall be as follows:
 - Prime: 60 microns
 - Moddle and Top: 30

[Conditions for Applicaion]

1. Adequate load carrying capacity
2. Non-active corrosion

Type of Rehabilitation : Repair of steel members

Method of Rehabilitation : Weep holes on lower chord of truss



[Procedure]

1. Open 20 - 25 mm dia. holes in about 3 m pitch in the lower flange of lower chord of truss by using a drill or gas.
2. Completely remove the water, dirt and debris, separated paint and rust accumulated in the lower chord of truss.
3. Apply the primer around new holes and to portions where the paint is separated, then apply middle and top coats over the primer.

[Cautions]

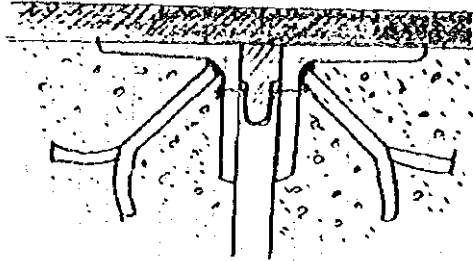
1. For the procedure and cautions for painting refer to the item describing repainting. Refer also to the item describing repainting of steel members.

[Conditions for Application]

1. Water accumulated in the lower chord of truss as shown in the figure above.

Type of Rehabilitation : Repair of expansion joint

Method of Rehabilitation : Replacement of members



[Procedure]

1. Remove members from the damaged expansion joint.
2. Carry out chipping of anchor bar embedded in concrete and the concrete around anchor bar.
3. Set the steel angle (L50 x 50) and anchor bar and place concrete.
4. Inject the sealant. Carry out patching of asphalt concrete after curing.

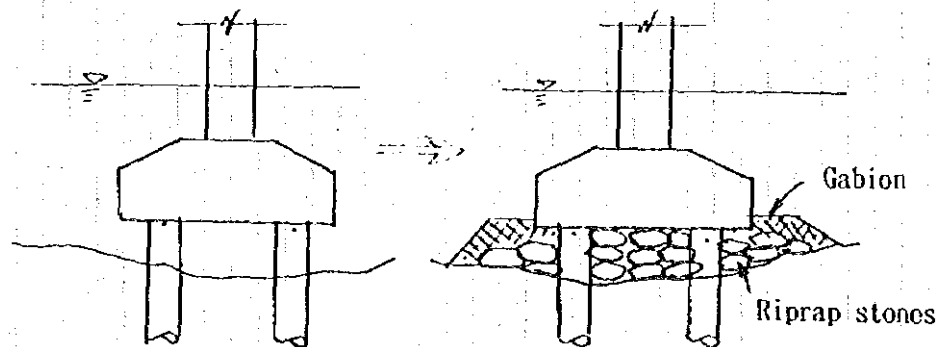
[Cautions]

1. Take necessary measures to ensure the safety of traffic during work, such as providing of rubber cones or posting of a watch.

[Conditions for Application]

Type of Rehabilitation : Repair of river bed protection

Method of Rehabilitation : Riprap stones and gabion



[Procedure]

1. Drop riprap stones into portions which are scoured deeply.
2. Install the wire mesh gabion on these portions.

[Cautions]

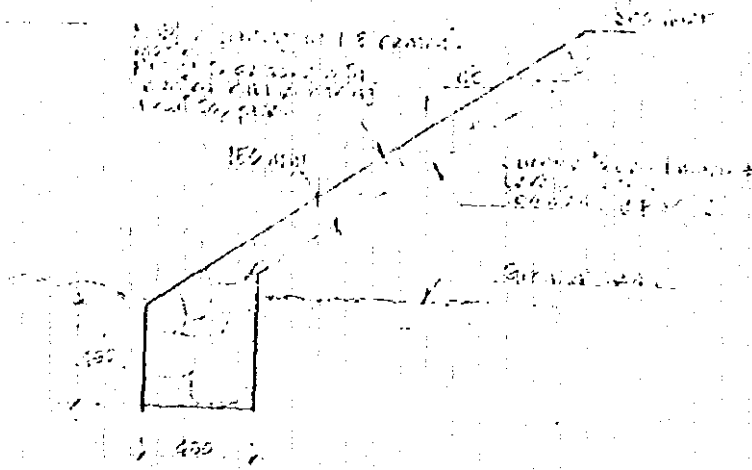
1. Typical methods to protect the area around pier and abutment from scouring or deepening of the river bed include the gabion, concrete lining, riprap, block, and dam.
2. An alternative method is to place the concrete.
3. For gabion, use the galvanized wire net to SLS493.

[Conditions for Application]

1. Scouring of pier or abutment

Type of Rehabilitation : Repair of revetment

Method of Rehabilitation : Rubble paving



[Procedure]

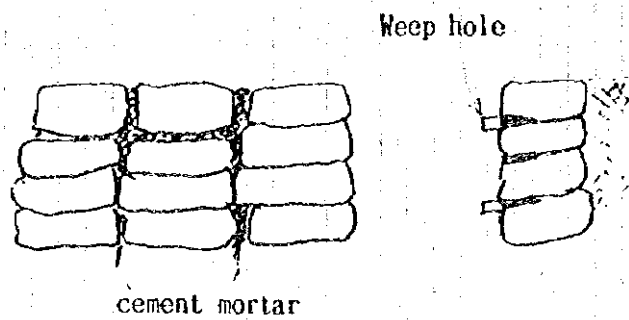
1. Remove loose soil, rock and debris from the revetment.
2. Reshape the slope of revetment and ram the surface.
3. Install riprap stone regularly and seal gaps with cement mortar from bottom to top.
4. Cure the mortar.

[Cautions]

[Conditions for Application]

Type of Rehabilitation : Repair of stone masonry piers and abutments

Method of Rehabilitation : Filling of gaps



[Procedure]

1. Remove dirt and debris from gaps by water blasting using fresh water.
2. Place spacer blocks or spacer rocks as required into portions with large gaps.
3. Fill gaps completely with cement mortar.
4. Carry out curing of the cement mortar.

[Cautions]

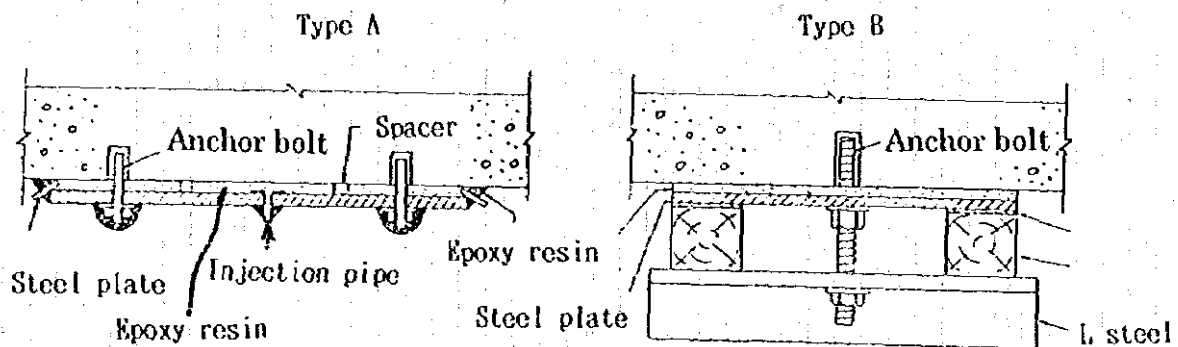
1. When the existing wing wall of abutment does not have a weep hole, provide weep hole newly.
2. Filling mortar to be Class B or in a ratio of 1:2.

[Conditions for Application]

1. Outflow of back-fill soil because of large gap in stone masonry piers or abutments

Type of Rehabilitation : Strengthening of concrete members

Method of Rehabilitation : Steel plate pressure bonding



[Procedure]

1. Clean the soffit with a power grinder.
2. Drill a hole in the slab and drive anchor bolt.
3. Clean the steel plate surface with a wire brush.

Type A

4. Drill holes for anchor bolt and injection pipe in the steel plate.
5. Install injection and air purge pipes.
6. Fix steel plates, with a gap of 3 - 5 mm, using a spacer by anchor bolts and seal the surrounding area.
7. Inject the epoxy resin.
8. Allow the epoxy resin to cure (minimum 24 hours) and carry out coating of steel plates.

Type B

4. Drill a hole for anchor bolt in the steel plate.
5. Carry out coating of concrete and steel plate surfaces with epoxy resin.
6. Pressure weld the steel plate to concrete by using L-shaped steel and anchor bolt.
7. After curing of epoxy resin, remove anchor bolt and L-shaped steel and carry out coating of the steel plate.

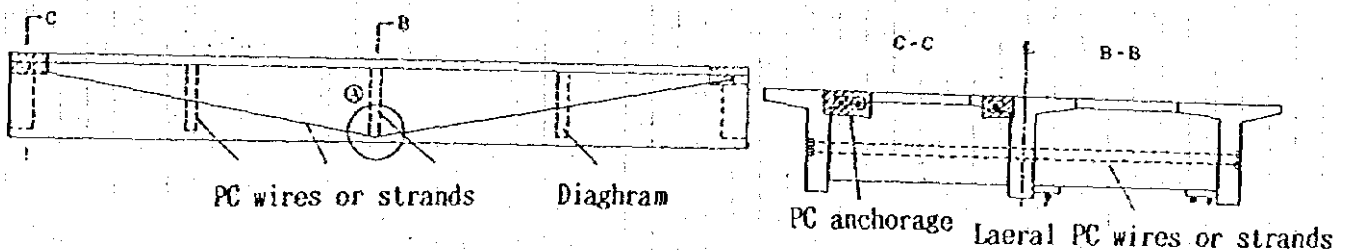
[Cautions]

[Conditions for application]

1. Inadequate load carrying capacity.
2. Various active cracks due to bending moment or shear force.

Type of Rehabilitation : Strengthening of concrete members

Method of Rehabilitation : Additional prestressing



[Procedure]

1. Chip off concrete enough for a space necessary for arrangement of PC steel wire and anchor.
2. To ensure satisfactory adhesion, carry out roughing of the existing concrete surface which is brought into contact with new concrete.
3. Fix additional reinforcing bar and dowel bar together with anchor and sheath.
4. Set the form and place concrete.
5. After curing, remove the form and carry out prestressing when the concrete has reached the required strength.
6. Carry out grouting of the sheath inside.

[Cautions]

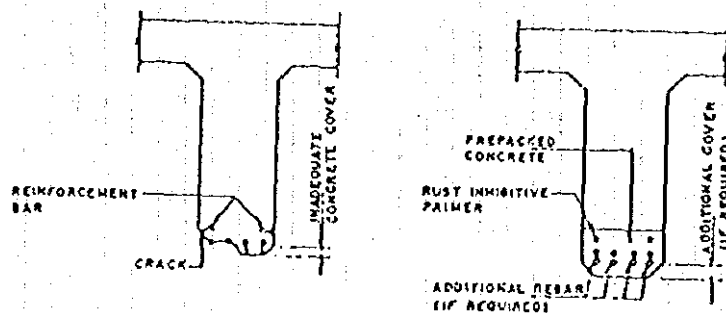
1. The concrete strength must be more than that of existing PC girder.
2. Install the graphite metal at the lower end of the cross beam A to ensure smooth restressing.
 - (1) Cross beam
 - (2) Set so that the cross beam can slide (graphite metal)
 - (3) PC steel wire

[Conditions for Application]

1. Inadequate load carrying capacity
2. Various active cracks due to bending moment or shear force

Type of Rehabilitation : Strengthening of concrete members

Method of Rehabilitation : Prepacked concrete lining with additional reinforcing bar



[Procedure]

1. Remove separated or cracked concrete till the sound concrete is exposed. If the reinforcing bar is rusted, chip off concrete to a point 20 mm behind the reinforcing bar.
2. Remove rust and foreign material from the reinforcing bar with a wire brush and apply the prime coat.
3. If necessary, arrange additional reinforcing bars.
4. Set the form so that the concrete cover becomes 30 mm.
5. Pack the space in the form with coarse aggregate.
6. Inject the epoxy resin mortar from the lower end of the form while applying the pressure.
7. After injection, carry out curing of the concrete and remove the form when the concrete has reached the required strength.

[Cautions]

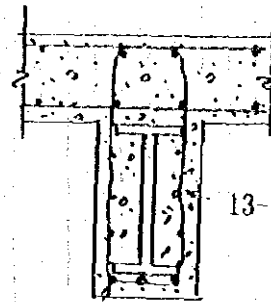
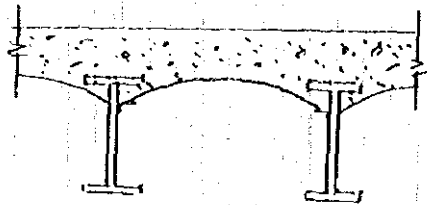
1. Use the high early strength concrete.
2. The 28-day strength of concrete must be 30 N/mm².
3. Minimum concrete cover must be 30 mm.
4. The primer must be the zinc-rich type primer complying with BS4652.
5. Mixing of epoxy resin must be 1 (resin) : 3 (silica sand) by weight.

[Conditions for Application]

1. Inadequate load carrying capacity
2. Various active cracks due to bending moment or shear force
3. Inadequate concrete cover to reinforcing bars

Type of Rehabilitation : Strengthening of steel girders

Method of Rehabilitation : Concrete lining with reinforcing bar



13-16mm dia. 30cm etc

3x25mm dia.

[Procedure]

1. Chip off concrete from steel plate covered with plain concrete and existing RC slab.
2. Clean rust, paint and dirt and debris from steel girders.
3. Set the rubber bearing.
4. Assemble main and hoop reinforcements with reinforcing bars of slabs.
5. Set the form.
6. Place the concrete (grade 30/20) and allow it to cure.

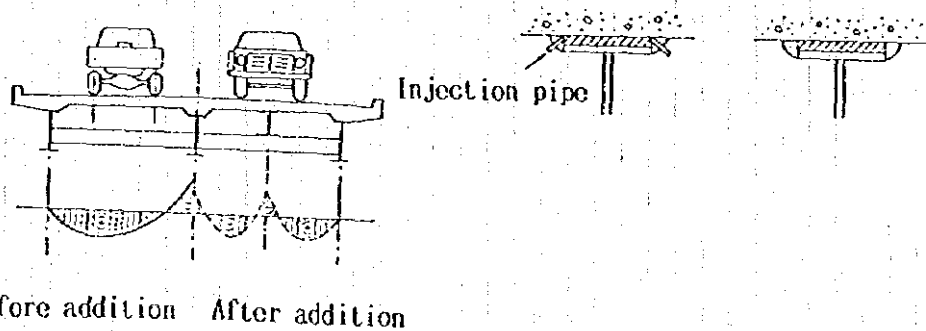
[Cautions]

[Conditions for application]

1. The substructure and foundation must have the strength enough to carry the load of steel girder with new lining.

Type of Rehabilitation : Strengthening of reinforced concrete slabs

Method of Rehabilitation : Addition of stringer



[Procedure]

1. Clean the soffit surface (to which the upper flange of stringer contacts) of the concrete slabs with a power grinder.
2. Fabricate the stringer appropriate to the position and space and install it onto the cross beam. Be sure to secure a 4 - 6 mm space for resin injection between the slab and stringer upper flange.
3. Set injection and air purge pipes and seal the area surrounding the steel plate and pipe.
4. Inject the epoxy resin through the injection pipe. To avoid vibration by traffic, close the traffic till the epoxy resin is completely cured.
5. After curing of the resin, carry out coating of steel members.

{Cautions}

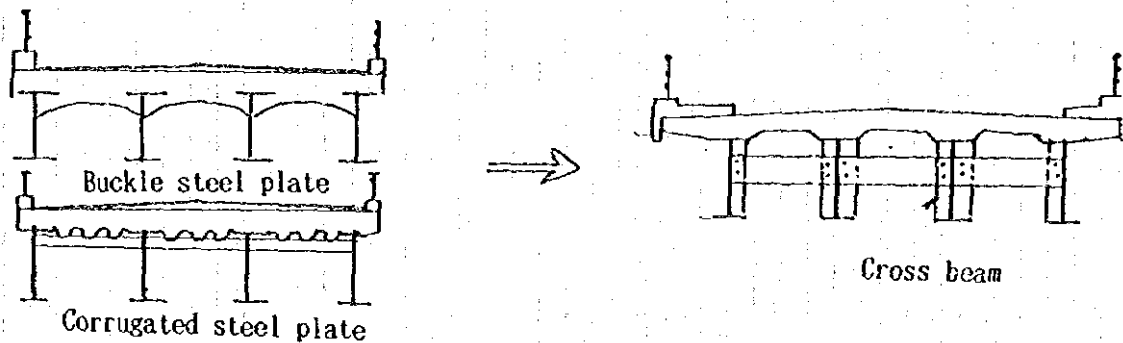
1. As a rule, the traffic must be completely stopped for this work. If this is impossible, drive spacers in a 25 - 30 cm interval between the slab soffit and stringer as shown in the figure left.
2. Allow the epoxy resin to cure for minimum 24 hours.

[Conditions for application]

1. Excess bending stress of deck slab is more than 20% of the allowable stress.

Type of Rehabilitation : Strengthening of superstructure

Method of Rehabilitation : Replacement of buckle and corrugated plates to reinforced concrete slab



[Procedure]

1. Construct a detour road.
2. Remove carefully existing buckle plate or corrugated steel plate as well as deck slabs on the plate to prevent damage to the main girders.
3. Completely remove paint, rust and dirt and debris from the area around the upper flange of main girder by a grinder and brush.
4. If necessary, install a new cross beam.
5. Set the form. The form must ensure the concrete cover of 30 mm and must be strong enough to achieve the required slab thickness and shape.
6. Arrange reinforcing bars.
7. Place and cure the grade 30/20 concrete.

[Cautions]

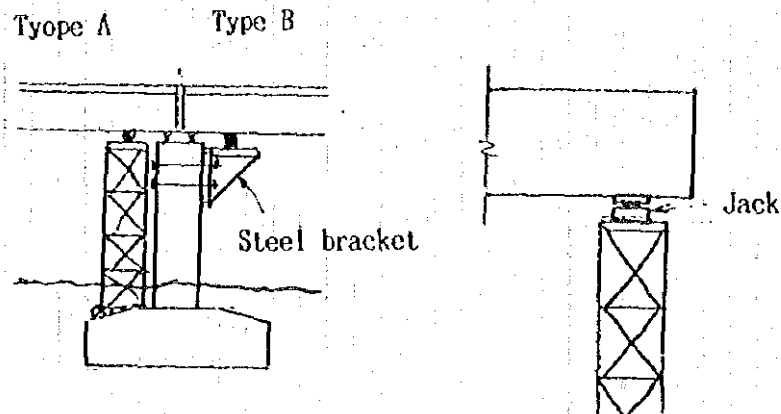
1. The 28-day cube strength must be 30 N/mm².
2. The reinforcing bars must be high yield steel complying with BS4449 or equivalent.
3. External steel girders are often corroded by rainwater. It is necessary for re-decking to arrange drip grooves at a time of widening.

[Conditions for application]

1. Existing buckle plate or corrugated steel plate is suffering excessive damage.
2. The existing RSJ (rolled steel joist) must be strong enough to carry the load of newly provided RC slabs.

Type of Rehabilitation : Strengthening of bearings

Method of Rehabilitation : Replacement of bearings



[Procedure]

1. Provide Type A or B temporary support.
2. Set jacks of sufficient capacity and jack up the girder for the equal amount. It is essential that the girder is jacked up by operating all jacks simultaneously to prevent unexpected stress on the deck slab.
3. Replace the damaged bearing with a new rubber bearing.
4. Lower the girder evenly.
5. Remove the jack, then the support.

[Cautions]

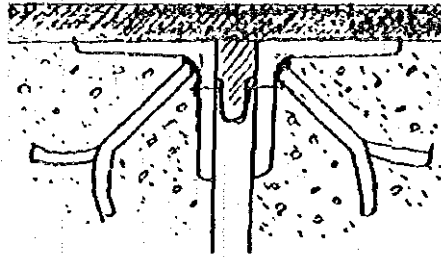
1. Use Type A support when the height from the girder soffit to the local ground level is 5 m or less and the local ground is strong enough or when there is the footing to carry the support.
2. In other cases, fix the steel bracket to the pier with anchor bolts.

[Conditions for application]

1. There is no bearing or the bearing, if any, does not function.

Type of Rehabilitation : Strengthening of expansion joint

Method of Rehabilitation : Replacement of expansion joint



[Procedure]

1. Remove asphalt pavement from the damaged expansion joint.
2. Completely remove damaged expansion joint and anchor bar.
3. Completely remove loose concrete and dirt and debris.
4. Set a new expansion joint and set the form.
5. Place the concrete.
6. Fill the sealant and carry out asphalt pavement.

[Cautions]

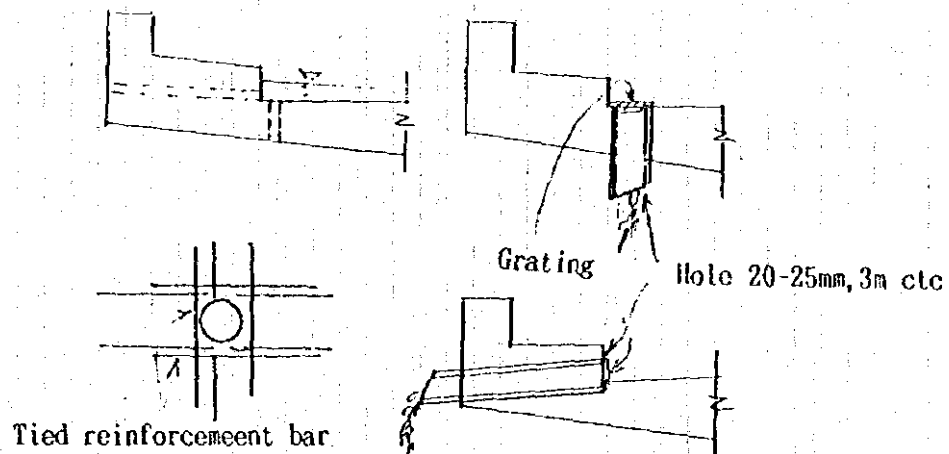
1. Steel member to comply with SLS73.
2. For filler, bitumen impregnated felt elastometer must be used.

[Conditions for application]

1. Critical defects such as water leakage, abnormal noise, different level of expansion joints

Type of Rehabilitation : Strengthening of drain

Method of Rehabilitation : Enlargement of drain pipes



[Procedure]

Type A:

1. When the sidewalk section is made from precast concrete panels, remove them. For sidewalk section made from cast in-situ concrete, carry out chipping.
2. Set new drain pipes.
3. Set grating made from reinforcing bars or others.

Type B

1. Chip off concrete from the position concerned by a concrete breaker.
2. Remove dirt and debris and set the PVC or steel pipe.
3. Fill a space around drain pipe with concrete or mortar.
4. Set the grating.

[Cautions]

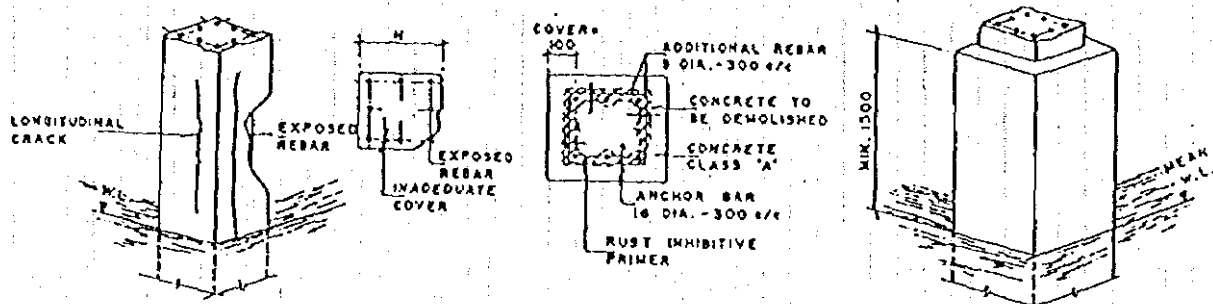
1. When existing reinforcing bar need be cut for chipping of the concrete, provide new reinforcing bars around this place, as shown above.

[Conditions for application]

1. Drain hole is small causing flooding of the bridge road surface immediately after rain.

Type of Rehabilitation : Strengthening of substructure

Method of Rehabilitation : Concrete lining



[Procedure]

1. Chip off any separated or loosened concrete as well as oil, grease, and dirt and debris. Remove laitance by water blasting. Roughen the concrete surface which is brought into contact with new lining.
2. Drill 20 mm dia. holes in a 30 cm interval.
3. Insert 16 mm dowel bar into a hole and fix it with non-shrink grout.
4. Fix 10 mm hoop bars in a 30 cm pitch around the 16 mm dowel bar by using tie wire.
5. Set the firm form to secure the minimum concrete cover of 60 mm.
6. Place the concrete and carry out curing.
7. Remove the form when the concrete reaches the required strength.

[Cautions]

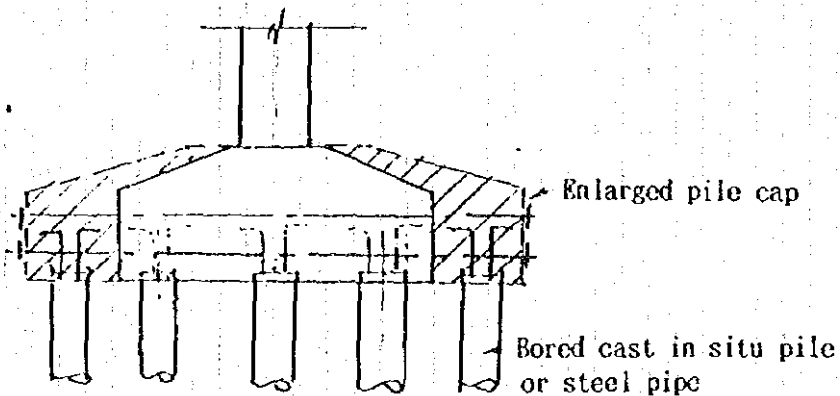
1. Use normal Portland cement.
2. The cement amount must be 300 kg/m³.
3. The 28-day strength of concrete must be 30 N/mm².

[Conditions for application]

1. Concrete cover is not sufficient.
2. Reinforcing bar is exposed.

Type of Rehabilitation : Strengthening of foundation

Method of Rehabilitation : Additional piles with enlarged pile cap



[Procedure]

1. To drive additional piles during enlarging the pile cap, construct the cofferdam with sheet piles or embankment,
2. Drive additional new piles in specified position.
3. Carry out treatment of pile top.
4. Chip off old pile caps in contact with new pile caps and expose reinforcing bars.
5. Erect the form and place concrete in the extended footing.

[Cautions]

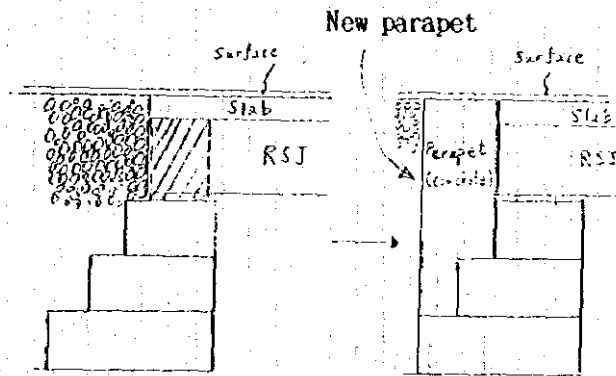
1. There is alternative method of prestressing to obtain more perfect pile caps.

[Conditions for application]

1. Progressive settlement of the substructure due to insufficient load capacity of existing footing.

Type of Rehabilitation : Strengthening of abutment

Method of Rehabilitation : New installation of parapet



[Procedure]

1. Remove soil from the portion of approach road, which is behind the abutment and over the main girder and necessary for this work, and clean this portion completely.
2. Carry out roughing of the existing abutment top surface which is brought into contact with new concrete. At the same time, carry out chipping to expose reinforcing bars.
3. Bind or weld (according to the electric arc method) reinforcing bars of new parapet wall to exposed reinforcing bars.
4. Set the form, place concrete (Grade 30/20), and carry out curing.
5. Carry out back-filling while performing the required compaction.

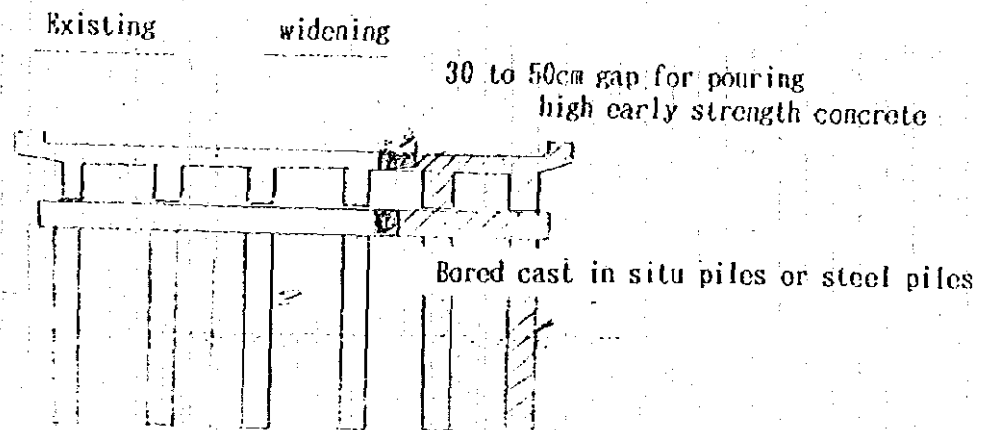
[Cautions]

[Conditions for application]

1. Rainwater enters this section to cause damage to the bearing, due to lack of parapet wall in the rear of the main girders on the abutment and because back-fill is made using soil.

Type of Rehabilitation : Functional improvement

Method of Rehabilitation : Widening of carriageway



[Procedure]

1. If necessary, construct the detour route and temporary cofferdam.
2. Drive additional piles into the specified position. To minimize the effect on existing piles, either cast-in-place or steel piles must be used.
3. Carry out the required substructure work. In the joint surface of new and old concrete, carry out chipping of old concrete till reinforcing bar is exposed. Set the required number of dowel bars.
4. Carry out the required superstructure work. The new superstructure should be the same in type as the existing one. Provide a gap of 30 - 50 cm as shown above between new and old superstructures.
5. Fill the gap with high early strength concrete containing expansive admixture and allow the concrete to cure.
6. When the superstructure concrete reaches the required strength, carry out asphalt concrete pavement of the carriageway.

[Cautions]

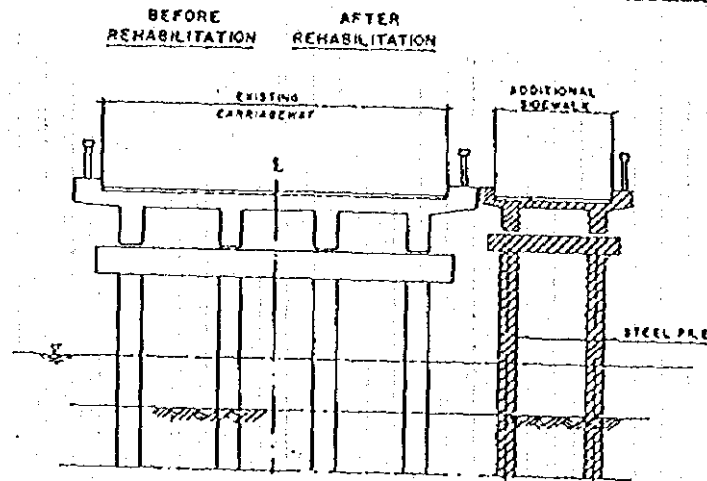
1. To avoid harmful vibration during placement of superstructure and substructure concrete, direct the traffic to the detour route and close the traffic through the existing bridge.

[Conditions for application]

1. The carriageway width of existing bridge is insufficient.
2. The existing substructure is not strong enough to carry the expanded superstructure.

Type of Rehabilitation : Functional improvement

Method of Rehabilitation : Addition of sidewalk



[Procedure]

1. Drive pile into the specified position. To minimize the effect on existing piles, either cast-in-place or steel piles must be used.
2. Carry out construction of the required substructure.
3. When the substructure concrete reaches the required strength, carry out construction of the required superstructure.

[Cautions]

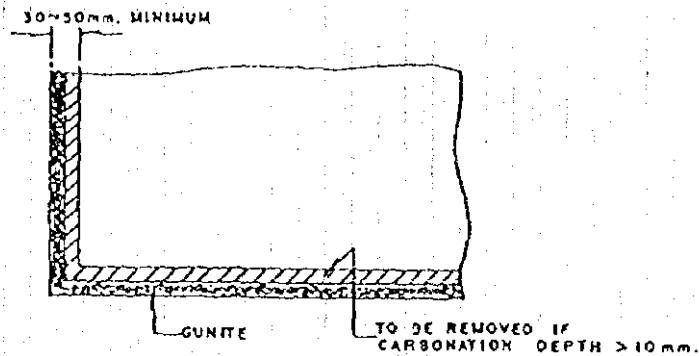
[Conditions for application]

1. The existing bridge has no sidewalk.
2. The existing substructure is not strong enough to carry the superstructure of a new pedestrian crossing bridge.

Type of Rehabilitation : Repair of concrete members

<Reference>

Method of Rehabilitation : Guniting



[Procedure]

1. Remove loose particles from the concrete surface mechanically. If the surface carbonation depth is 10 mm or more, remove the damaged portion.
2. Wet the concrete with fresh water.
3. Keep the surface in the dry condition during guniting.
4. Carry out guniting tightly and evenly under sufficient pressure.
5. Guniting must be made in two layers separately. Before guniting of a new layer, wash the previous layer with water.

[Cautions]

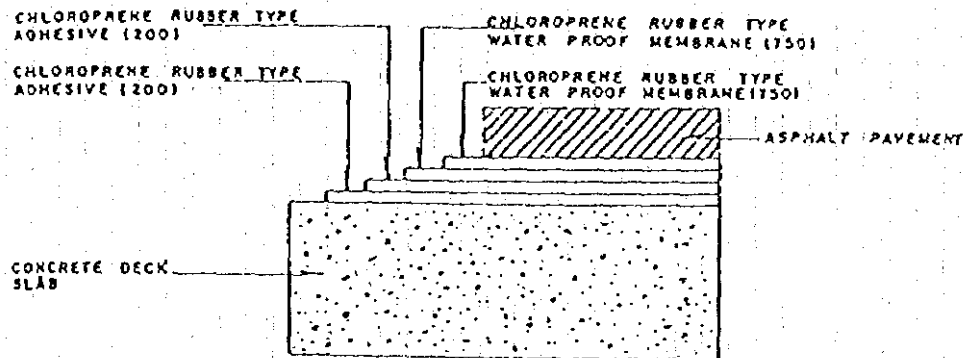
1. Crack width must be 0.2 mm or less.
2. Concrete cover of reinforcing bars is insufficient.
3. The guniting strength must be 300 kg/cm².
4. The guniting thickness must be 30 - 50 mm.
5. Allow guniting to cure for minimum 3 days.
6. Addition of water/cement ratio.

[Conditions for application]

Type of Rehabilitation : Repair of concrete members

<Reference>

Method of Rehabilitation : Waterproofing



NOTE: FIGURE IN 1-1 SHOWS STANDARD UNIT RUBBER SOLVENT CONTENT (g/m²).
STANDARD THICKNESS OF WATER PROOF LAYER IS 0.4 ~ 1.5 mm.

[Procedure]

1. Remove the asphalt pavement.
2. Clean the slab surface with a grinder.
3. Lay mortar of 1 (cement) : 4 (sand) ratio with a metal trowel.
4. Lay two layers of chloroprene rubber type adhesive, then two layers of chloroprene rubber type water proof membrane.
5. Allow each layer to cure for minimum 2 hours.
6. Lay the new asphalt.

[Cautions]

1. The shearing strength must be 1.5 kg/cm² or more at 20 °C.
2. The shearing elongation must be 1.0% or more at 20 °C.
3. The adhesive strength must be 6 kg/cm² or more at 20 °C.

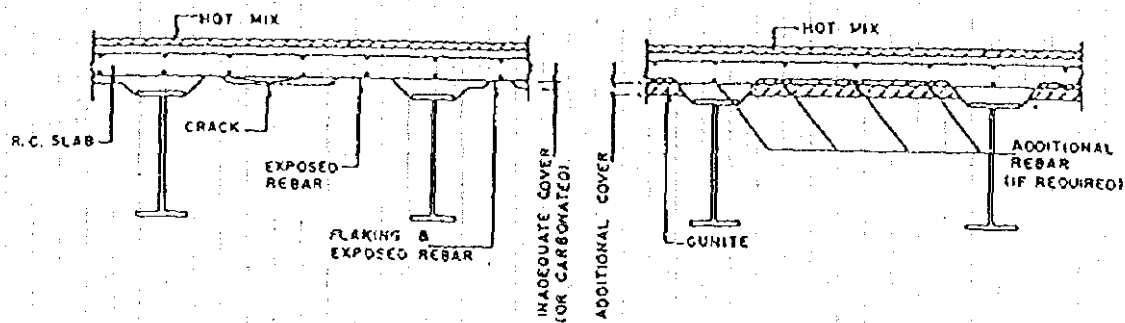
[Conditions for application]

1. Water stain, water leakage or free lime are observed at the slab soffit.

Type of Rehabilitation : Strengthening of concrete members

<Reference>

Method of Rehabilitation : Guniting with additional reinforcing bars



[Procedure]

1. Chip off separated or loose and damaged concrete till the sound concrete is exposed. If the reinforcing bar is rusted, chip off concrete to a point 20 mm in the rear of reinforcing bar.
2. Clean the exposed reinforcing bar surface with a wire brush.
3. In 2 hours after cleaning of reinforcing bars, carry out prime coating.
4. Arrange additional reinforcing bars.
5. Wet concrete with fresh water. But the concrete surface must be dry when guniting is to be started.
6. Spray mortar with sufficient pressure to ensure tight and even cover. Spray must be made in two or more layers separately. Before application of the next layer, wash the previous layer surface with water.
7. Allow gunit to cure for minimum 3 days under water spray.

[Cautions]

1. Normal Portland cement must be used.
2. The 28-day strength of concrete must be 300 kgt/cm².
3. Minimum concrete cover of reinforcing bar must be 30 mm.

[Conditions for application]

1. Inadequate load carrying capacity

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for transparency and accountability, particularly in financial matters. The text notes that without clear documentation, it becomes difficult to track expenses, revenues, and other critical data points.

2. The second section focuses on the role of technology in streamlining operations. It highlights how digital tools and software can significantly reduce manual errors and improve efficiency. By leveraging automation, organizations can save time and resources while ensuring that all processes are consistent and up-to-date.

3. The third part of the document addresses the need for regular communication and collaboration among team members. It states that effective teamwork is the foundation of any successful project or organization. Regular meetings, clear communication channels, and a shared vision are all necessary to ensure that everyone is working towards the same goals.

4. The fourth section discusses the importance of staying updated on industry trends and regulations. The text explains that the business environment is constantly evolving, and organizations must adapt to new challenges and opportunities. Staying informed about the latest developments can help companies make strategic decisions and maintain a competitive edge.

5. The fifth part of the document covers the topic of risk management. It emphasizes that identifying potential risks early on and implementing mitigation strategies can prevent significant losses and disruptions. A proactive approach to risk management is crucial for ensuring the long-term stability and success of any organization.

6. The sixth section discusses the value of customer feedback and satisfaction. It notes that understanding the needs and preferences of your customers is key to providing high-quality products and services. Regularly soliciting feedback and acting on it can lead to improved customer loyalty and overall business performance.

7. The seventh part of the document addresses the importance of financial planning and budgeting. It explains that having a clear financial roadmap is essential for managing resources effectively and achieving long-term financial goals. Regular budget reviews and adjustments are necessary to stay on track and avoid overspending.

8. The eighth section discusses the role of leadership in driving organizational success. It emphasizes that strong leaders inspire and motivate their teams, set clear expectations, and provide the necessary support and resources. Effective leadership is a key factor in creating a positive work environment and achieving high levels of productivity.

9. The ninth part of the document covers the topic of innovation and continuous improvement. It states that organizations must embrace change and seek out new ways to improve their processes and products. Encouraging a culture of innovation and experimentation can lead to breakthrough ideas and sustained growth.

10. The final section of the document provides a summary of the key points discussed and offers some concluding thoughts. It reiterates the importance of maintaining accurate records, leveraging technology, fostering collaboration, staying updated on industry trends, managing risks, valuing customer feedback, planning financially, and embracing innovation. The text concludes by expressing confidence in the organization's ability to overcome challenges and achieve its goals.

CHAPTER 7 BRIDGE MAINTENANCE AND MANAGEMENT SYSTEM

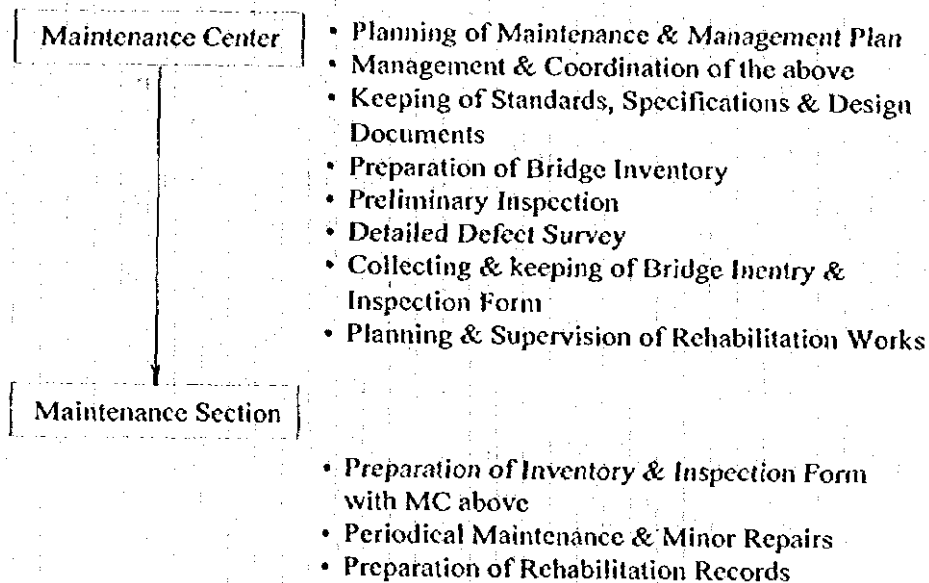
In this chapter 7 the system will be discussed and recommended, while other chapters described the technical aspects.

Chapter 17 of Main Text deals the details of system. Therefore this chapter will describe a outline only.

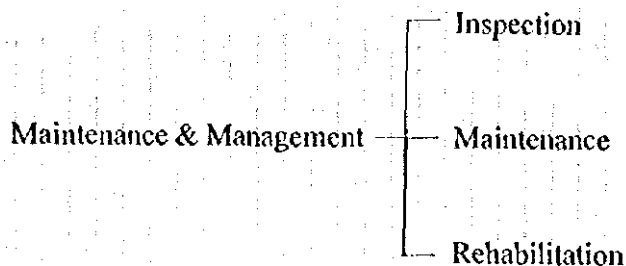
7.1 Basic Plan of Proposed Maintenance and Management System

7.1.1 New System of Bridge Maintenance and Management Activities

(A) Duties and Responsibilities



(B) Systems and Work Items of Maintenance & Management



(1) Inspection

Target	Number
1) Preliminary Inspection (Visual inspection with preparation of bridge inventory and Inspection forms (w/photos) up to year 2010, if possible as soon as possible.	4,430 bridges
2) Detailed Inspection More careful inspection of specific defects.	
3) Detailed Survey (Detailed Structural Investigation) up to year 2010.	about 440 bridges

(2) Maintenance

Periodical or daily maintenance work including minor repair.

- Cleaning----- Road surface, drainage, piers and abutments top, around bearings, grasses on main girders, grasses in water course, etc.
- Pavement ----- Potholes patching, pavement replacement
- Minor repair----- Replacement of damaged railing, expansion joints, patch paint or repainting

(3) Rehabilitation (to be executed as contract base)

Major repair (Remedy)

Strengthening

Functional improvement ----- Widening carriageway and sidewalk adding

(C) New Proposed Organization

1. Set up Maintenance Center at RDA (possibly under Engineering Services Division)

Personnel

(Maintenance Center)

Chief Engineer	1
Engineer	2

Technical Officer	3	
Draftsman	1	
Clerk	1	
Operator for Inspection Vehicle	1	
Record Keeper	1	Total cost 2 mil. Rs./year

(Each Provincial Office)

Engineer	9	
Technical Officer	9	Total cost 4 mil. Rs./year

Equipment

(Maintenance Center at Colombo)

Bridge Inspection Vehicle

Tadano BT-100	12,000	Thousand Rs.
Ditto Freight	1,000	Thousand Rs.

Inspection Tools for detailed investigation

Ultrasonic Steel thickness meter	100	Thousand Rs.
Ultrasonic hardness meter	100	Thousand Rs.
Schmidt hammer etc.	100	Thousand Rs.

Total cost 13,3000 Thousand Rs.

2. Set up Maintenance Team consisting of 1 Engineer and 1 Technical officer at each Provincial office.

Duties

1. Visual inspection and preparing bridge inventory and inspection forms for 4,430 bridges.
2. Minor repair on defects by RDA's own works.

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for transparency and accountability, particularly in financial matters. The text notes that without clear documentation, it becomes difficult to track expenses and revenues, which can lead to misunderstandings and disputes.

2. The second section focuses on the role of communication in organizational success. It highlights that effective communication is not just about conveying information but also about listening and understanding the needs of others. The author suggests that regular meetings and open channels of communication can help in identifying potential issues before they escalate.

3. The third part of the document addresses the challenges of time management. It acknowledges that everyone faces time constraints, but it offers several strategies to optimize productivity. These include prioritizing tasks, delegating responsibilities, and avoiding multitasking. The text stresses that time is a finite resource, and using it wisely is crucial for achieving long-term goals.

4. The fourth section discusses the importance of continuous learning and professional development. In a rapidly changing world, staying updated with the latest trends and technologies is essential. The author encourages individuals to invest in their education and skills, as this not only enhances their personal growth but also makes them more valuable to their organizations.

5. The final part of the document touches upon the importance of maintaining a positive attitude and resilience. It notes that setbacks and challenges are inevitable, but it is how one responds to them that matters. The text suggests that a positive mindset and the ability to bounce back from adversity are key to long-term success.

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is crucial for ensuring transparency and accountability in the organization's operations. The records should be kept up-to-date and accessible to all relevant personnel.

2. The second part of the document outlines the various methods and tools used to collect and analyze data. This includes the use of surveys, interviews, and focus groups to gather qualitative information, as well as the use of statistical software and data visualization techniques to analyze quantitative data. The goal is to identify trends and patterns that can inform decision-making.

3. The third part of the document describes the process of interpreting the data and drawing conclusions. This involves comparing the results of the data collection against the organization's goals and objectives, and identifying areas where improvements can be made. It also discusses the importance of communicating the findings to all stakeholders in a clear and concise manner.

4. The fourth part of the document discusses the challenges and limitations of data collection and analysis. It notes that there are often many factors that can affect the accuracy and reliability of the data, such as sampling bias and measurement error. It also discusses the importance of being transparent about these limitations and taking steps to minimize their impact.

5. The fifth part of the document discusses the future of data collection and analysis. It notes that there are many new technologies and techniques being developed that will make it easier and more efficient to collect and analyze data. It also discusses the importance of staying up-to-date on these developments and incorporating them into the organization's data collection and analysis processes.

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