



1. GENERAL

1.1 Outline

1.1.1 Purpose of pirot project

The Pilot Project for rehabilitation of bridges located in the pilot provinces of Vientiane and Savannakhet (hereinafter referred to as “the Pilot Project”) was conducted under the Project for Capacity Development on Bridge Maintenance and Management (JICA-BMM) in Lao PDR (hereinafter referred to as “the Project”) which has been extended by the Government of Japan (hereinafter referred to as “the GOJ”) as a technical cooperation to the Government of the Lao People’s Democratic Republic (hereinafter referred to as “the GOL”). Target Bridges were Xe Bangnouan bridge and Nam Mone bridge located in Savannakhet Province and Vientiane Province respectively. The Pilot Project commenced in October 2022 and completed in May 2023 under a contract with a local contractor. The inventory data of the respective bridges are shown in Figure 1.1.1.

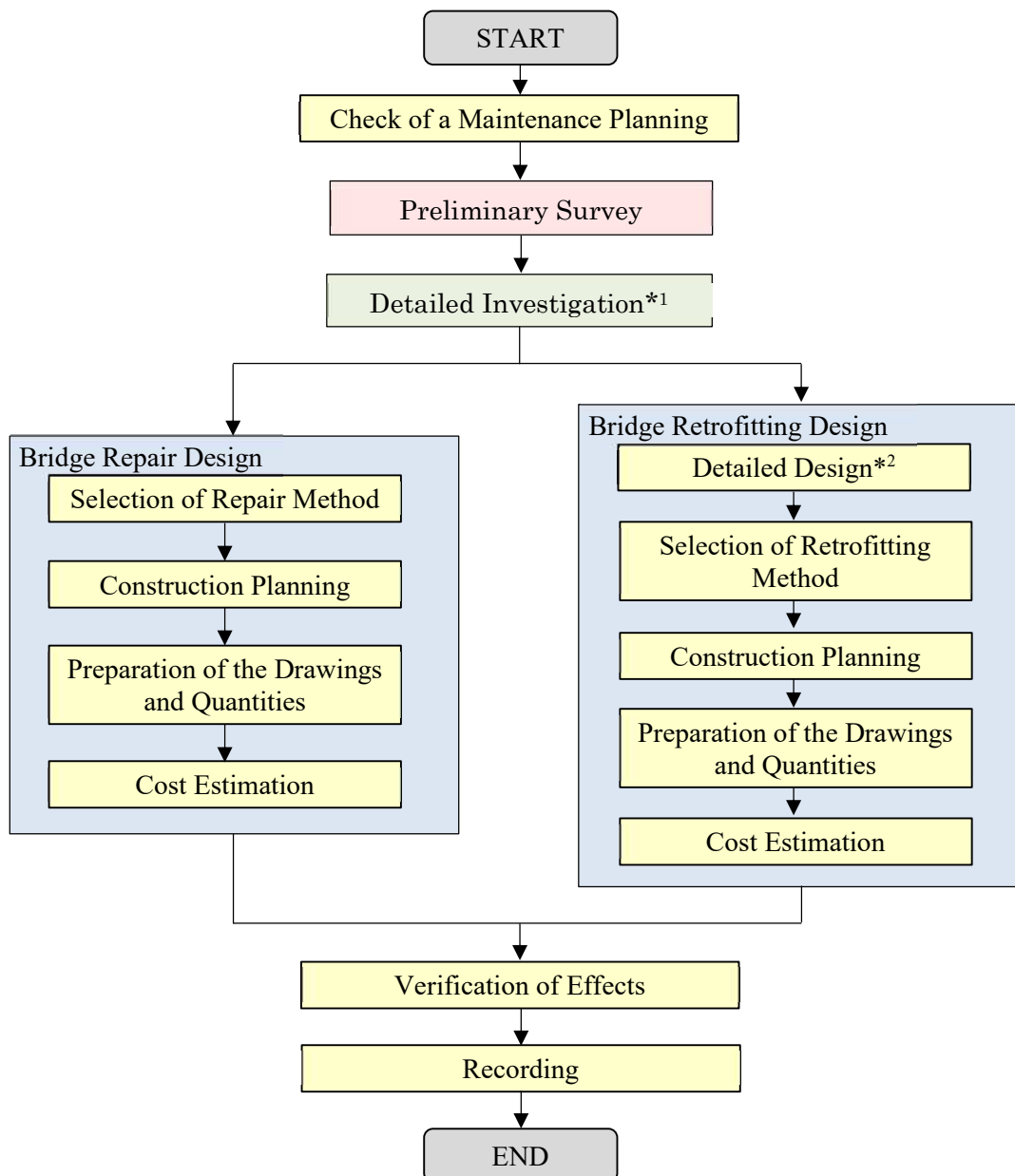
XE BANGNOUAN BRIDGE	NAM MONE BRIDGE
	
Construction year: 1998	Construction year: 1990
Steel girder composite	PC I-girder
Bridge length: 140.00m	Bridge length: 46.08m
Bridge width: 10.00m	Bridge width: 7.68m
Span number: 3spans	Span number: 2spans
Location: (X: 105.47936, Y:16.00274)	Location: (X: 102.52950, Y:18.856716)

Source: Bridge Maintenance System

Figure 1.1.1 Inventory Data of Pirot Bridges

1.1.2 Procedure of works

The inspection and diagnosis manual and the repair and retrofitting manual provided by the project were adopted to carry out the Pilot Project. For the detail on each of the inspection and diagnosis methods, refer the Inspection and Diagnostic Manual. Hereby mainly describes repair and retrofitting methods. The repair and retrofitting materials used in the Pilot Project are introduced at the end of this report. The whole procedure of the Pirot Project are shown in Figure 1.1.2



*1: Result of detailed investigation is shown as an appendix

*2: Consideration of the retrofitting method based on a structural analysis

Figure 1.1.2 Work Flow of Pirot Project

1.2 Implementation items

Repair/ Retrofitting method were determined based on the detailed survey and analysis. The results of the detailed survey conducted to determine the repair/reinforcement method and initial environmental examination, as well as construction drawings and photographs of the works, are summarised in the Appendix.

1.2.1 Xe Bangnouan Bridge

The items implemented as repair and retrofitting measures for the Xe Bangnouan are shown in Table 1.2.1. Implemented works were determined from the perspective of corrective and preventive maintenance and safety improvements. As the detailed design, structural analysis was carried out to confirm the bridge capacity against current loading. Regarding to the works, some repair and retrofitting materials and some devices were included from the procurement in Japan.

Table 1.2.1 Implementation Items and their perspectives for Xe Bangnouan Bridge

BoQ Item No.	Items	Perspective
X-1	Crack Injection	Repair: Repair for cracks which width 0.2mm or larger
X-2	Sectional Repair (Plastering)	Repair: Repair for partial defects
X-3.1	Removal of Existing Pavement on Bridge Surface	Retrofitting: Removal of existing pavement for casting new pavement
X-3.2	Casting New Pavement on Bridge Surface	Retrofitting: Increasing the thickness of deck slab to improve the bearing capacity
X-4	Waterproofing	Preventive maintenance: Preventing water seepage from bridge surface
X-5.1	Removal of Existing Pavement on Approach Road	Repair: Removal of existing pavement for casting new pavement
X-5.2	Casting New Pavement on Approach Road	Repair: Repair for approach road
X-6	Repainting	Safety improvements
X-7.1	Replacement of Expansion Joint at A1	Repair
X-7.2	Replacement of Expansion Joint at A2	Repair
X-8.1	Edge line marking (Solid white line) for Road Markings on Bridge Surface	Safety improvements
X-8.2	Center line marking (Solid yellow line) for Road Markings on Bridge Surface	Safety improvements
X-9	Replacement of Approach Slab with re-compaction of abutment backfill	Retrofitting
X-10	Repainting of steel handrail	Preventive maintenance
X-11	Installation of Lightening	Safety improvements

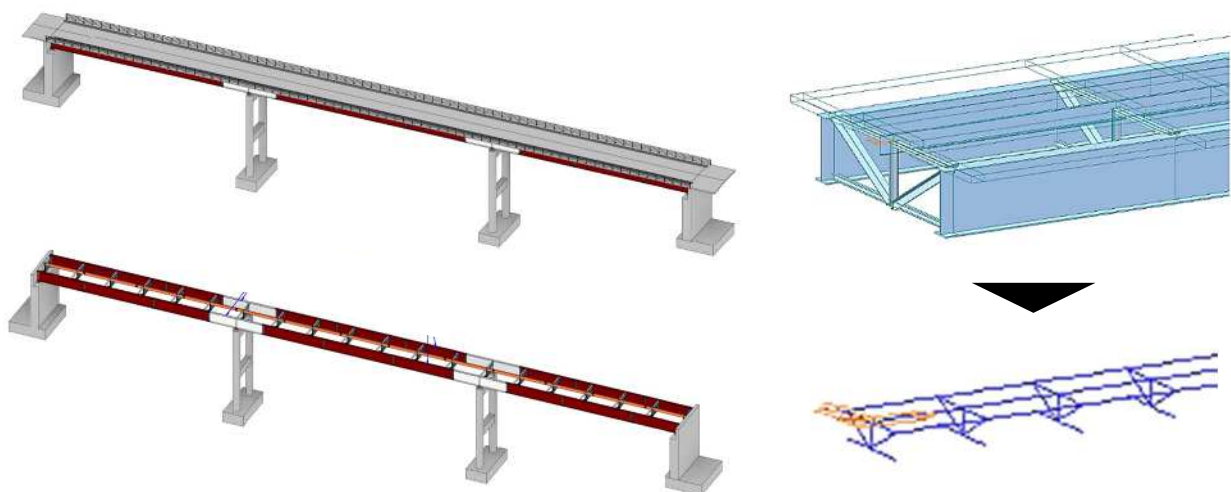


Figure 1.2.1 3D model (Left) and structural analysis model (Right) of Xe Bangnouan Bridge

1.2.2 Nam Mone Bridge

The items implemented as repair and retrofitting measures for the Nam Mone Bridge are shown in Table 1.2.2. Implemented works were determined from the perspective of corrective and preventive maintenance and safety improvements. In addition, some repair and retrofitting materials and some devices used in the works were included from the procurement in Japan.

Table 1.2.2 Implementation Items and their perspectives for Nam Mone Bridge

BoQ Item No.	Items	Perspective
N-1	Crack Injection	Repair: Repair for cracks which width 0.2mm or larger
N-2	Caulking	Repair: Repair for closing a gap
N-3	Sectional Repair (Plastering)	Repair: Repair for partial defects
N-4	Installation of Joint Sealing Material	Repair: Repair for closing a gap between PC panels on deck slab
N-5.1	Removal of Existing Pavement on Bridge Surface	Retrofitting: Removal of existing pavement for casting new pavement
N-5.2	Casting New Pavement on Bridge Surface	Retrofitting: Increasing the thickness of deck slab
N-6.1	Removal of Existing Pavement on Approach Road	Repair: Removal of existing pavement for casting new pavement
N-6.2	Casting New Pavement on Approach Road	Repair: Repair for approach road
N-7.1	Remove of Concrete Column	Repair and Safety improvements
N-7.2	Rebar for New Concrete Column	Repair and Safety improvements
N-7.3	Concrete of Column	Repair and Safety improvements
N-7.4	Handrail/Guardrail	Repair and Safety improvements
N-8	Replacement of Expansion Joint	Repair
N-9	Installation of Lightening	Safety improvements
N-10	Installation of Safety Sign Board	Safety improvements
N-11.1	Edge line marking (Solid white line) for Road Markings on Bridge Surface	Safety improvements
N-11.2	Center line marking (Solid yellow line) for Road Markings on Bridge Surface	Safety improvements
N-12	Concrete Guidepost	Safety improvements

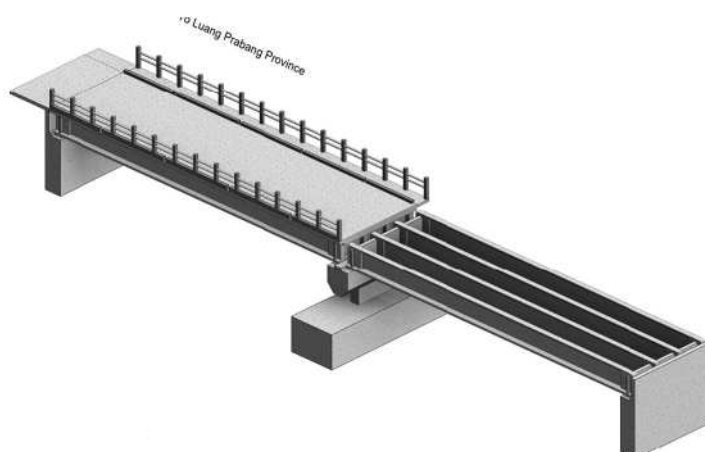


Figure 1.2.2 3D model of Nam Mone Bridge

2. CONSTRUCTION NOTES

2.1 Expansion Joint

(1) Preparation

- Before replacing an EJ, digging the existing deck slab should be carried out to check;
 - ✓ The Replacement method of the existing EJ
 - ✓ Existence of interfering objects
- The height of the existing slab was measured using an automatic level and the installation height of the EJ was determined taking into account the water gradient.



(2) Removal of Existing EJ

- To ensure that the cross-sectional dimensions are sufficient for the installation of the EJ.
- Anchors and other components of the existing EJ must be removed.



(3) Installation of EJ

- Back-up material is necessary to set in the intervals between the slab and parapet to prevent backfilling material from flowing into the intervals.
- Level and leveling strings were used to improve installation accuracy.



2.2 Crack Injection

(1) Measurement and Marking

- Cracks wider than 0.2 mm should be surveyed using a crack gauge.
- When chalking along cracks, keeping distance from the cracks to avoid disappearing the line in surface preparation.



(2) Injection Material Agitation

- The amount of agitation is determined according to the quantity of construction.



(3) Sealing and Injection

- Sealing must be done carefully, or the injected material will leak.
- Consider the usable time of epoxy materials, as they cure faster and are more difficult to handle in high temperature environments.



2.3 Rust-proofing paint

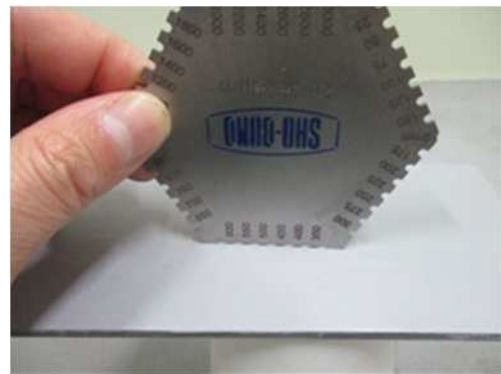
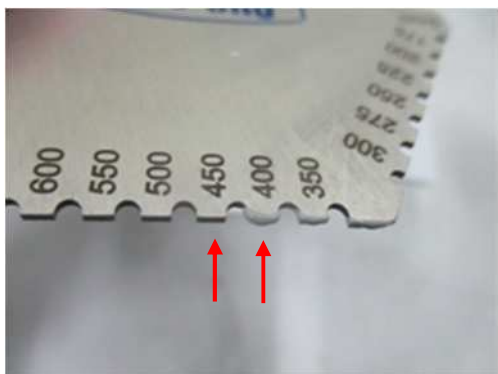
(1) Surface Preparation

- In consideration of preventive maintenance, the surface should be prepared by disc sander and sand paper.



(2) Painting

- To ensure proper coating thickness, a wet coating thickness gauge was used to obtain a certain thickness.



2.4 Ultra-Fast Hardened Concrete (Compact Jet: CPJ)

(1) Primer

- The amount of primer used must be determined according to the amount of CPJ casting. For this reason, the application area must be determined in accordance with the progress of the CPJ casting.
- In order to control the specified application volume, the area applied with one can was chalked on the deck slab surface.



Temperature [°C]	25	30	35
Pot life [minutes]	90	70	55
Valid time to place fresh concrete or mortar [hours]	6	3	2

(2) Mixing

- The mixing of CPJ was carried out as follows;
 - ✓ To feed ready-mixed concrete into drum type mixer (The volume of ready-mixed concrete to be fed must be determined in advance by trial mixing)
 - ✓ It will be more efficient to mix CPJ if preparing the measuring equipment as shown in the picture when measuring the ready-mixed concrete.
 - ✓ CPJ and admixture were added into drum type mixer and mixed. (Mixing time must be determined by trial mix).



(3) Casting

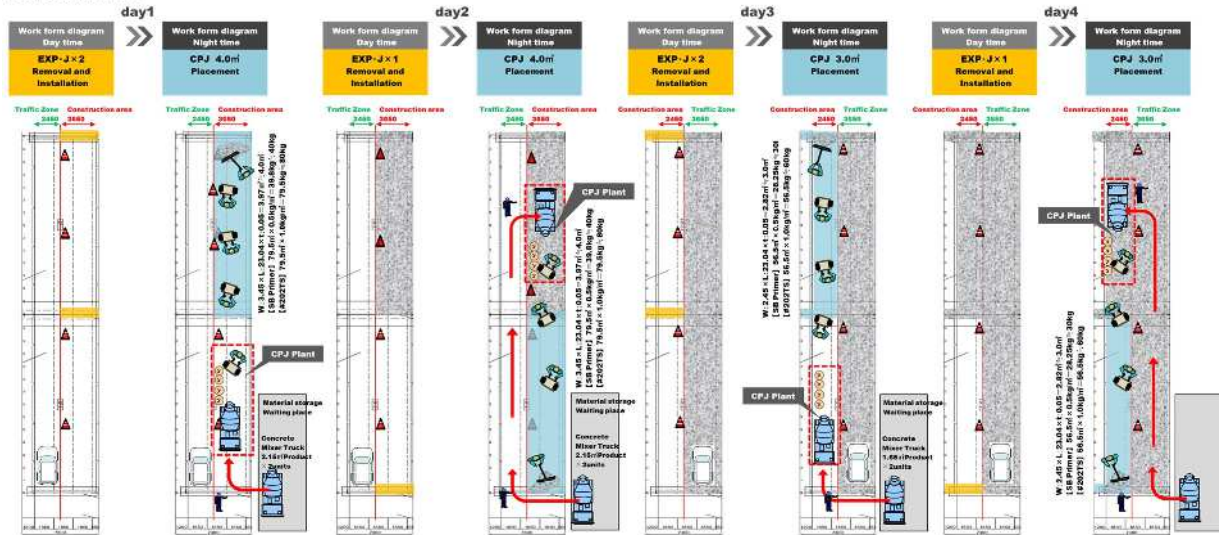
- To make a casting plan of the day in advance and to cast CPJ according to the plan.



2.5 Casting Plan

- The casting plan should carefully take into account the casting location, the duration, the amount, the traffic situation, the number of workers, etc.
- Workers' roles, a daily time schedule should be confirmed during a meeting before the work helps the efficiently work.

Date Schedule



Time Schedule



3. PRODUCT USED

3.1 Expansion Joint

(1) Cut of Joint SS

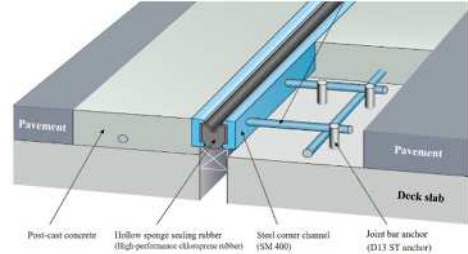
Supplier: SHO-BOND MATERIAL CO., LTD.

Used: Nam Mone Bridge_A1, P1, A2
Xe Bangnouan Bridge_A1

Weight: Approximately 20 kg/m

Thickness: 75mm (Installed in pavement)

Notes: Lightweight, multipurpose and economical



(2) Smart Joint

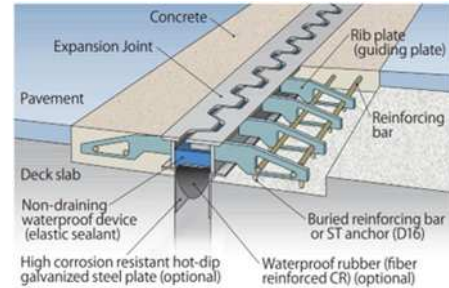
Supplier: SHO-BOND MATERIAL CO., LTD.

Used: Xe Bangnouan Bridge_A2

Weight: Approximately 72 kg/m

Thickness: 110mm (Installed in pavement)

Notes: Steel components are durable



3.2 Crack Injection

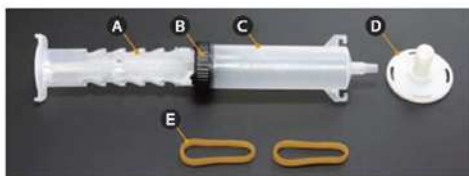
Name: LL-Injector, BL Grout TS

Supplier: SHO-BOND MATERIAL CO., LTD.

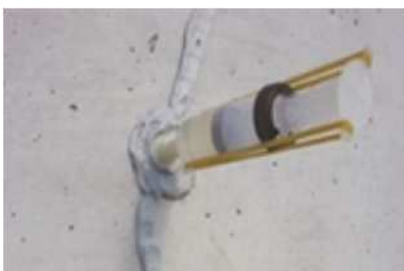
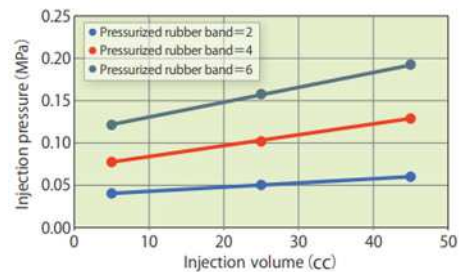
Used: Nam Mone Bridge_Deck Bottom, Xe Bangnouan Bridge_Deck Surface

Notes: Automatic low-pressure resin injection for repairing cracks in concrete.

Injected agent has low viscosity and suitable for crack widths from 0.2 to 1.0mm



Component parts : LL INJECTOR is comprised of **A** piston, **B** stopper, **C** cylinder, **D** injection-washer, and **E** pressurized rubber band.



3.3 Rust-proofing paint

(1) Termarust

Supplier: SHO-BOND MATERIAL CO., LTD.

Used: Xe Bangnouan Bridge_Railing, Girder

Notes: One-component, one-layer, long-term anti-corrosion paint

Hardened by oxygen (2-3 days to dry to touch, 30 days to fully harden)

Surface preparation is easy



(2) PatinaLock

Supplier: Kyoto Materials Co. Ltd.

Used: Xe Bangnouan Bridge_Railing, Girder

Notes: Three-layer, long-term anti-corrosion by reactive paint



3.4 Primer for Ultra-Fast Hardened Concrete

Name: SB Primer, #202

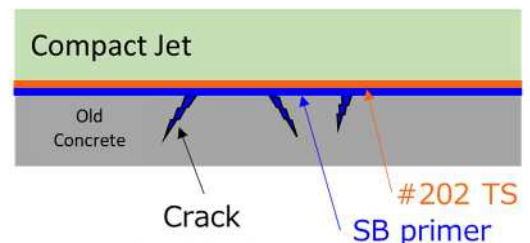
Supplier: SHO-BOND MATERIAL CO., LTD.

Used: Nam Mone Bridge_Casting New Pavement

Notes: SB prime_ Epoxy resin adhesive with excellent penetration into fine cracks (0.2mm or less)

#202TS_ Epoxy resin adhesives for bonding old and new concrete

Both easy application by brush or roller



3.5 Ultra-Fast Hardened Concrete

Name: Compact Jet (CPJ)

Supplier: SHO-BOND MATERIAL CO., LTD.

Used: Nam Mone Bridge_Casting New Pavement

Notes: Compressive strength of 24 N/mm² in 3 hours

Enable for early traffic open

Mixing with a simple mixer

