LAO PEOPLE'S DEMOCRATIC REPUBLIC
PEACE INDEPENDENCE DEMOCRACY UNITY PROSPERITY

MINISTRY OF PUBLIC WORKS AND TRANSPORT

DEPARTMENT OF ROADS

Lao Road Sector Project2 (LRSP2)

Consulting Services for Conceptual Engineering Design of
Improvement & Maintenance of NR 13 South from KM 71 to KM 346

VOLUME 4

PART 4 : CONCEPTUAL DESIGN

SECTION XI.C

SUPPLEMANTARY TECHNICAL SPECIFICATIONS FOR BRIDGE INSPECTION AND MAINTENANCE

(FINAL)

CONSULTANT:

ISO 9001:2015 CERTIFIED

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May, 2020

LTEC CODE: SD-283-19

List of Package Number

Package No.	From KM to KM	Length (KM)	In the Area of Province
1	KM 71.30 to KM 111	39.70	Bolikhamxay
2	KM 111 to KM 190	79	Bolikhamxay
3	KM 190 to KM 268	78	Bolikhamxay and Khammouan
4	KM 268 to KM 346	78	Khammouan

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CHAPTER I:
OVERVIEW OF BRIDGE MAINTENANCE OF NH13 FROM KM71 TO KM 346

1.1 Scope of application

This procedure defines the content of the management, exploitation and maintenance of Bridge and applies to related organizations and individuals relating to the management, exploitation and use of Bridges on Highway 13, from Km71 to Km346, Lao People's Democratic Republic.

1.2 Interpretation of Words

1.2.1. Bridge management agency is the agency performing specialized state management functions of the Department of Road, the Ministry of Transport.

1.2.2. The unit managing, exploitation and maintaining the Bridge regularly is a road repair management company or a competent company with a business license in the field of construction and maintenance of assigned traffic Bridge or winning contracts for regular management, operation and maintenance contracts.

1.2.3. Bridge inspection means visual inspection or specialized equipment to assess the status of Bridge in order to detect signs of damage to bridge.

1.2.4. Bridge maintenance is a collection of activities to maintain normal operation and ensure the safety of the use of bridge in accordance with the design throughout the use time, bridge maintenance includes regular maintenance, Regular repairs and unexpected repairs.

1.2.5. Regular maintenance is the technical operation carried out regularly to prevent and timely correct minor damages of construction structures and equipment. Regular maintenance to minimize the development from minor damage to major damage. These tasks are carried out regularly and continuously to ensure Safe, clearly and smooth transportation. Regular maintenance includes preventive and minor repairs.

1.2.6. Minor repair is overcoming minor failures of construction structures and equipment.

1.2.7. Periodic repair is to fix the damage to the works within the prescribed time limit, combining with fixing a number of defects of the works appearing during the exploitation process, in order to restore the original technical condition and improve the exploitation conditions of the work (if necessary). Periodic repairs include medium repair work and overhaul work.

1.2.8. Medium repair is the repair of damage, repairing the deterioration of structures and structure of the Bridge, which may affect the quality of exploitation and cause unsafe exploitation.

1.2.9. Overhaul is the repair work carried out in the event of damage or deterioration in many structures of the work in order to restore the original quality of the Bridge.

1.2.10. Unexpected repair is the repair of a Bridge that is subject to unexpected impacts such as storms, floods, earthquakes, impacts, fires or other unexpected impacts that lead to damage or deterioration which need to be repaired in time to ensure continuous traffic.

1.2.11. Bridge monitoring means the observation and measurement of technical parameters of a work according to the design's requirements during use.

1.3 Facility for making process

At the request of the Ministry of Transport of Laos

1.4 The main information about the Bridge project on Highway 13, from Km71 to Km346

1.4.1. Bridge on National Highway 13, from Km71 to Km346

1.4.1.1. General information

Many bridges along National Highway No.13 from Km71 to Km346 were built after 1995, currently some arch bridges have been degradation, some bridges the deck slab have been cracked, some bridges expansion joints have been damaged, some bridges no pedestrian, some bridges the slope protection of abutment have been damaged, all bridges have no information for Live load

1.4.1.2. Information of Existing Bridges

No	Bridge name		Structural Type					
		Chainage	Structure	Bridge Length (m)	Span	Abutment	Pier/Foundation	Design Road
1	Nam Hong	Km72+648	Simple span RC T girder	22	1	RC wall		No information
2	Houay sai phay Bridge	Km73+750	Two spans Arch Bridge	15	2	RCwith stone masonry		No information
3	Nam He	Km91+335	Simple PC-T girder	77.1	3	RC wall	RC two columns Piers with sheet pile foundation	No information
4	Nam Mang Bridge	Km92+218	Simple PC-I girder	125	5	RC wall	RC two columns Piers with sheet pile foundation	No information
5	Nam Ching	Km106+460	Simple PC-I girder	66.8	3	RC wall	RC two columns Piers with sheet pile foundation	No information
6	Nam Lo	Km109+890	Simple PC-I girder	68.9	3	RC wall	RC two columns Piers	No information
7	Nam Kap	Km117+032	Simple PC-I girder	78.9	3	RC wall	RC two columns Piers	No information
8	Nam Thoay	Km121+959	Simple PC-I girder	72.9	3	RC wall	RC two columns Piers with sheet pile foundation	No information
9	Houay Dong Kam	Km124+127	Simple PC-I girder	28	1	RC wall		No information
10	Nam Ngiap	Km140+162	Simple PC-I girder	120	5	RC wall	RC two columns Piers	No information

No	Bridge name		Structural Type					
		Chainage	Structure	Bridge Length (m)	Span	Abutment	Pier/Foundation	Design Road
11	Nam Xan	Km146+642	Simple PC-I girder	113.5	5	RC wall	RC two columns Piers with sheet pile foundation	No information
12	Houay Nong Poung	Km151+052	Two spans Arch Bridge	14.3	2	RC with stone masonry		No information
13	Nam Kadan	Km169+850	Simple PC-I girder	60.9	3	RC wall	RC two columns Piers	No information
14	Nam Sa	Km180+580	Simple PC-I girder	79.9	3	RC wall	RC two columns Piers with sheet pile foundation	No information
15	Nam Kading	Km189+040	4 simple PC-T girder & 3 continuous combination steel girders	354	7	RC wall	RC one, three columns Piers	No information
16	Houay Ngou Gnai	Km193+000	Simple composite I steel girder	25.5	1	RC wall		No information
17	Houay Ngou Noi	Km194+000	Simple composite I steel girder	20.4	1	RC wall		No information
18	Had sai kham	Km195+000	Simple composite I steel girder	25.4	1	RC wall		No information
19	Houay nang Mong	Km202+400	Continuous composite I steel girder	52.2	3	RC wall	RC wall	No information
20	Xam boun Gnai	Km204+400	Simple composite I steel girder	25.4	1	RC wall		No information
21	Houay Deua2	Km218+000	Continuous composite I steel girder	60.9	3	RC wall	RC wall	No information
22	Houay Nathat	Km220+080	Simple composite I steel girder	25.5	1	RC wall		No information
23	Nam Khou	Km221+600	Simple PC-I girder	54	3	RC wall	RC one columns Piers	No information
24	Nam Sang	Km231+700	Simple composite I steel girder	20.3	1	RC wall		No information
25	Nam Thone	Km239+700	Simple PC-I girder	78.4	3	RC wall	RC one columns Piers	No information
26	Houay Meng	Km257+400	Simple PC-I girder	53.6	2	RC wall	RC one columns Piers	No information
27	Houay He	Km267+700	Simple PC-I girder	36	2	RC wall	RC one columns Piers	No information
28	Nam Hin Boun	Km285+400	Continuous composite I steel girder	124	3	RC wall	RC wall	No information

No	Bridge name		Structural Type					
		Chainage	Structure	Bridge Length (m)	Span	Abutment	Pier/Foundation	Design Road
29	Nam Pakan	Km294+900	Simple PC-I girder	78.4	3	RC wall	RC one columns Piers	No information
30	Houay Aek	Km307+900	Simple composite I steel girder	25.5	1	RC wall		No information
31	Nam Don	Km319+500	Simple PC-I girder	78.5	3	RC wall	RC one columns Piers	No information

1.5 The content of the management of Bridges on Highway 13, from Km71 to Km346

1.5.1 Manage construction records

Store and manage the exploitation of construction records, structural structures improvement, renovated, periodically repaired, unexpected repair.

1.5.2 Update construction management records

Bridge construction management documents: Including documents extracted from the completed works such as the state of the bridge, elevation system records, plan, Profile, bridge cross section, geological section, land clearance compensation dossiers, landmarks, safety corridors, inspection report, construction licensing dossiers; set up a bridge record book, update the results of inspections, regular and irregular repair projects; book of patrolling and checking bridges; plan the area of the bridge within the R.O.W.

Road work management documents: Including documents extracted from construction completion records such as plan, vertical section, cross section, geological section, drainage system, compensation and ground clearance compensation dossier, landmarks, construction permit records; mapping straightening and updating changes in traffic organization and land use for roads; patrol record; update data on vehicle counting (traffic, vehicle load); update results of Inspections, periodic repair projects, irregular repairs;

1.5.3 Organization of project management and protection; coordinate with the Police and the People's Committees at all levels in managing and protecting the bridge structure and road traffic infrastructure.

1.5.4 Inspection regularly, monitor the situation of work damage; patrol, detect in time damage and violations of the structure of the Bridge on Highway 13, from Km71 to Km346, the Lao People's Democratic Republic, handle according to its competence or propose People's Committees at all levels shall handle according to regulations.

1.5.5 Periodical technical inspection, detailed inspection; Special inspection after each flood, storm or other abnormal impacts.

1.6 The content of the Bridge exploitation on Highway 13, from Km71 to Km346, Lao People's Democratic Republic.

1.6.1 Vehicle counting, data analysis and assessment of traffic growth, type of road motor vehicles.

1.6.2 Management of vehicle load and gauge size; organize the issuance of circulation permits for caterpillars, vehicles of limited size, or overloaded road works; check vehicle load at vehicle load checking stations permanently or temporarily and handle it according to regulations; analyze and assess the impact of the operation of oversized and overloaded vehicles on the sustainability of the Bridge on Highway 13, from Km71 to Km346, Lao People's Democratic Republic.

1.6.3 Make a form to track the number of accidents, identify the initial cause of each accident, and damage caused by an accident. Coordinate with police, local authorities to solve traffic accidents according to their competence.

1.6.4 Lane separation, channeling and organizing traffic; regularly review and adjust the road signal system accordingly;

1.6.5 Direct traffic assurance; monitoring weather, floods, construction incidents, Evaluation of and reporting according to regulations;

1.6.6 Control not to permit the means of waterway transport to violate the protection area under the bridge;

1.6.7 Regular and extraordinary reports according to the regulations of the Ministry of Transport and the Road Administration of Laos.

1.6.8 Transport safety appraisal is decided and implemented by the Ministry of Transport with the Bridge project on National Highway 13, from Km71 to Km346, Lao People's Democratic Republic.

1.7 Contents of the maintenance work of the Bridge on Highway 13, from Km71 to Km346, Lao People's Democratic Republic

1.7.1 Regular maintenance

Minor repairs are presented with regular inspections of all work items in each subsequent chapter.

1.7.2 Periodic repair work

Periodically repair work items according to the evaluation results of periodic inspection and inspection results.

Periodically repair as prescribed in the next chapters for each section of the item following the periodic inspection work.

1.7.3 Unexpected repair work

Units managing, exploiting and regularly maintaining works must take initiative in elaborating plans and urgently mobilizing all human resources, equipment and supplies to organize channeling, troubleshooting, and ensuring traffic and quick report to road authorities for assistance.

The content of irregular repair depends on the specific characteristics of each specific work item. Unexpected repair is possible but is not limited to the following two steps:

Step 1: Repair and restore emergency works, ensure the fasInspection traffic and limit damage to works. Step 1 is carried out at the same time processing and preparing documents to complete procedures as a basis for settlement.

Step 2: Further treatment Step 1, in order to restore works according to the scale and technical standards as before the incident or solidify and solidify the work. Step 2 is carried out according to the order and procedures prescribed for basic construction works.

1.8 Evaluate and classify the condition of works in service of maintenance.

When inspecting a Bridge, it is necessary to draw conclusions about the work's status according to its function.

Table of criteria for evaluating and classifying structures by function

CLASSIFICATION OF STRUCTURE CAPACITY			DESCRIPTION CHARACTERISTICS
ASSESSMENT OF USE CAPACITY	AA		There is serious damage, need immediate repair to restore function
	A		There is deterioration in function. Repair required but not immediate
		A1	There is a failure of power that is not heavy but will deteriorate very quickly. Requires repair within 2 years
		A2	There are impairments of impaired performance. Requires repair within 5 years.
		A3	There are failures but the rate of functional degradation is slow, need continuous monitoring within 5 years to determine the appropriate repair time
	B		There is damage but not decline in performance. Request monitoring of damage
	C		Continued survey is required to assess structural performance
	D		No or only minor signs of damage

1.9 Construction record management

The unit directly managing the bridge must keep 1 set of construction documents as prescribed, specifically as follows:

- Documents about as build the Bridge on Highway 13, from Km71 to Km346, Lao People's Democratic Republic.
- Daily diary of the bridge protection organization.

- Monitoring record updated on water level, temperature.
- Regular inspection record.
- Periodic and detailed inspection records.
- Records of regular maintenance, periodic and irregular repairs.
- Profile classification, counting vehicles.
- Documents include:
  + Legal documents;
  + Acceptance records;
  + Video tapes, CDs, photos ...
- The records and documents must be systematically and scientifically managed; must be convenient in the process of exploitation and use; must be arranged in accordance with the standards of the storage work.
- Management conditions:
  + There is an archive;
  + Take measures to protect against damage and loss;
  + There is a specialized and professional person.
- The updating of additional data into records and documents is in accordance with regulations (regarding the time of updating, data ...);

The records are carefully kept with the marked content and against moisture, mold, termite, and kept in computers.

It is necessary to apply information technology to the management of bridges and record keeping according to the regulations of the Lao Road Administration.

CHAPTER II:

GENERAL PROVISIONS ON INSPECTION OF WORKS

2.1 Types of inspection

Bridge inspection is one of the works of construction management to ensure the safe exploitation of works. The extent of damage affecting the safe exploitation of a building component should be classified for maintenance.

Bridge inspection works are carried out in the following types.

2.1.1 Regularly inspection

Visual inspection is carried out regularly daily, weekly, and monthly to detect the damage of the project and its severity to have a timely solution to ensure traffic safety.

2.1.2 Periodic inspection

Visually inspect key components of a structure for a period of 3 months, 6 months, 2 years to 5 years, check at locations where regular inspections are not accessible to detect defects as well as quality of regular maintenance.

2.1.3 Unexpected inspection

Meticulous inspection of construction structures with a cycle of from 2 to 5 years once. When checking details, there must be means such as scaffolding to access the components to be Inspectioned. For concrete components, the detailed inspection must Inspection the strength of concrete, the surface depth of chlorinated concrete at least 10 years / time. The detailed inspection plan must ensure that each structural component is inspected at least every 20 years.

2.1.4 Special inspection

Inspection after the bridge is affected by incidents caused by natural disasters such as lightning strikes, major storm or floods, or after performing other types of inspection, detecting serious damage, the construction inspection engineer decides that Conduct special Inspections.

2.2 Inspection requirements for construction structures

Request regular inspection, periodic inspection, detailed inspection, extraordinary inspection of special inspection of construction structures. For details see the next chapter.

2.3 Responsibility to perform the inspection

Responsibility to perform the work inspection is prescribed by the road department.

2.4 Competence requirements of Inspection engineers

2.4.1 Construction inspection engineer

The regular inspection of construction structures is checked by fifth-level technical workers under the supervision of inspection engineers.

Engineers responsible for regular inspection of works must be university graduates with at least 3 years' working experience in the field of construction management,

exploitation and maintenance, having passed a course on inspection. Look up bridges and road works.

The engineers who conduct periodic inspection and detailed inspection of bridge structures must be university graduates with at least 10 years' working experience and have passed a bridge Inspection course with the following specific skills: :

- Knowledge of bridge design standards.
- Knowledge of bridge construction methods.
- Ability to analyze structures and use a structural analysis software ..

2.4.2 Engineer checks electrical and auxiliary items

Engineers responsible for inspecting electrical equipment items must comply with electrical industry regulations.

CHAPTER III:

OVERVIEW ON INSPECTION AND MAINTENANCE OF TYPES OF BRIDGE STRUCTURE

3.1 Generality

Chapter III provides general requirements for inspection and maintenance of concrete components (including reinforced concrete, pre-stressed reinforced concrete), steel structures, bearings, expansion joints.

Specific requirements for inspection and maintenance for each particular item are specified in subsequent chapters.

3.2 Inspection and maintenance of concrete components

3.2.1 Check and regular maintenance

1) Inspection object

Regular checking of concrete structures is only required for vulnerable structures such as bridge median curb, curb and panels around the pile cap.

2) Cycle

Inspectioning must be done every 1 to 90 days depending on the type of structure.

3) Report

The location of any damage must be recorded and reported for future inspection and record keeping.

4) Method inspection

Available access path for pedestrians, where inaccessible, binoculars or cameras (with adjustable zoom lens) can be used for observation.

5) Inspection issues

The visible damage on concrete surface layer.

Precast concrete components inclined.

6) Things to do

The minor damage, must be repaired immediately by plastering mortar.

For major damages, details must be checked to assess the extent of damage and determine an appropriate repair plan.

3.2.2 Periodic inspection and maintenance

1) Inspection object

Main structures of the bridge that regular inspections are inaccessible.

2) Cycle

This Inspection must be done every 1-2 years.

3) Report

After checking, there must be a brief report. The report must give an opinion on the condition of concrete, namely: "No missing" or noted any damage. Some photos may be included in the report.

The location of any damage must be recorded and reported for future inspection and record keeping.

4) Method inspection

Where it is inaccessible, you should use binoculars or a camera (with zoom unit to adjust the lens) to observe. Can use the boat to see the bottom of the girder.

5) Inspection issues

Cracked and broken concrete

Cracks with surface width> 0.2 mm.

Concrete with honeycomb, with holes.

Decayed concrete due to carbonation or chemical erosion.

Wet concrete, moisture permeates, causes moss, patchy.

Cracked or swelled due to rusted steel reinforcement.

Water leak or rust due to water.

Streaks of rust, yellow emulsion.

Any damage on the surface is recorded.

Soil, rubbish, water or other material deposited on the face.

6) Things to do

Minor damage, must be repaired immediately by plastering.

For major damage, detailed inspection is required to assess the extent of damage and determine an appropriate repair plan.

If damage is detected at any location, the same location must also be investigated during detailed inspection.

3.2.3 Unexpected inspection and maintenance

1) Inspection object

All structures are concrete.

2) Cycle

This Inspection must be done every 3-5 years.

3) Report

After checking, there must be an unexpected report. The report must give an opinion on the condition of concrete, namely: "No missing" or noted any damage. In the report attached a few pictures. Damages must be fully described in exact location and dimensions to be able to be identified on the drawing.

The Inspection results are recorded according to a set form in order to obtain continuous information, avoid omitting the inspection requirements and make it easy to compare and compare the results between Inspections.

Depending on the degree of damage and degradation of the work, conduct analysis or recalculate the structure of the building according to the survey data (subsidence, crack, sag, rust, loss of section, ...) to evaluate the exploitation ability of the work as prescribed.

4) Method inspection

Detailed inspection is similar in form to periodic inspection but must be carried out with much greater care and meticulousness. Accordingly must approach the building with the distance can touch the object to be Inspectioned. Reports in detailed inspection are recorded in more detail. An illustration of the location and size of the defect on the building, detailed description and quantification of the defects such as length, width, depth, number of defects, extent of damage and area effects of defects, etc.

In hard-to-reach locations, scaffolding, sliding frames, etc. can be used to take a closer look at the main structures of the structure.

5) Inspection issues

Check for damage like routine inspections, including:

- Cracked and broken concrete.
- Cracks> 0.2 mm.
- Concrete with honeycomb, with holes.
- Decayed concrete due to carbonation or chemical erosion.
- Wet concrete, moisture permeates, causes moss, patchy.
- Cracked or swelled due to rusted steel reinforcement.
- Water leak or rust due to water.
- Streaks of rust, yellow emulsion.
- Any damage on the surface is recorded.
- Soil, rubbish, water or other material deposited on the face.

Depending on the time of exploitation and the extent of damage of structural structures of the work, the following experiments shall be conducted:

- Determination of concrete strength by non-destructive Inspections or destructive sampling:
    - Measure the thickness of carbonization layer and assess the deterioration of concrete;
    - Inspectioning to determine the erosion of chlorine in concrete;
    - Measuring and drawing isopotential contour map assessing the ability of steel reinforcement to rust in concrete;

- Measuring the thickness of protective concrete layer, detecting reinforced steel;
- Investigate the internal quality of concrete structures, can take X-ray pictures, γ or combine drilling, screening and image transmission.

6) Things to do

- Concrete cracked, rotted, broken

The cause of cracks, rot and breakage must be clearly determined before remedial and remedial measures are taken.

- If breakage is due to mechanical causes (minor impact), repair should be carried out immediately by plastering the breakage with polymer concrete.
- If due to rusted steel reinforcement, it is required to determine the degree of rust and evaluate the bearing capacity of the structure to give a reasonable solution for the reinforcement as well as the solution for protective concrete.
- If the cause is due to overload, it is necessary to find suitable technical solution to handle the damage.

- Cracks> 0.2mm
  - Cracks wider than 0.2mm must be taken to measure the average length and width and recorded on both the Inspection slip and on the concrete surface adjacent to the crack. The crack width can be measured with a crack gauge. Or you can use a visual device to monitor fine cracks.
  - Track the development of cracks by covering plaster strips perpendicular to the crevices with a width of 30mm and a thickness of 5mm.
  - If these cracks do not develop over time, the mortar can be applied to the surface of concrete to limit the penetration of harmful agents to concrete.
  - If cracks continue to develop, it is necessary to continue monitoring, analyzing the cause and finding appropriate remedies.
- Cracks> 0.3mm
  - If the causes of cracks and cracks have been identified, the grout can be Injectioned into each crack and then the surface protection grout should be applied on the cracked surface.
  - If the crack caused by steel is rusted, the crack must be repaired immediately.
  - If the crack is caused by water leaks, the crack must be monitored. High strength cement in concrete is able to weld by itself.
  - Cracking is dry and there is no sign of rust. It should be noted and monitored. If the crack continues to develop, it must be investigated and researched so that it can identify the exact cause of the crack and propose appropriate repair plans.
  - If the crack continues to develop, it must ask the superior agency to hire specialized Inspectioning units to evaluate the cause and propose appropriate repair plans.

- Requirements for waterproofing mortar used in the treatment of reinforced concrete structures must be very fine cement mortars and additives that create bonding adhesives to prevent harmful agents from penetrating through. crack. In order to be able to Injection into very small cracks that often use mortar with special chemicals (with high flexibility and low viscosity), it is necessary to understand the properties of the grout before use. Can use mortar like polyurethane mortar, esteracrylate mortar ... to Injection into cracks.
- The construction requires careful preparation and requires highly qualified construction personnel.

- The rust marks
  - Traces of rust do not show clearly on the surface must be carefully investigated by perforating the concrete layer to check.
  - If rust marks are caused by wire rope or by a section of reinforcement near concrete surface, concrete must be removed, cleaned and holes in concrete surface must be patched with epoxy layer, or polymer concrete or High strength non-shrink cement mortar.
  - If the stain is caused by water seeping from other places to cause reinforced steel, it is required to identify the cause before Evaluation of.
  - Where there is any doubt that the protective concrete is not guaranteed, it must be checked with a cover thickness gauge (cover meter). If you find that the mantle is not thick enough, ask and consult an expert.
  - Where there is suspicion of poor quality or porous concrete layer, it is necessary to consult and consult an expert.
  - Where rust marks are clearly identified in the prestressed steel area, cable area or at anchor, this type of serious damage must be noted and fully recorded, researched, surveyed and reported at the same time. report immediately to superior agencies to find the cause and timely Evaluation of measures.
- Water stain, water stain.

Water stains can find the cause of water infiltration. If water is leaking from concrete cracks, either from construction joints or from expansion joints, the cracks or joints on the opposite side may be patched or epoxy Injections to seal up immediately in serious cases. However, it should be noted that high-grade cement contained in high-strength concrete blocks used to pour bridge concrete will expand and crack small cracks and do not need any other action. Cracks are not large, only need to be monitored for a while before making a decision to fix.

- Damage to the sidewalk surface layer

Pedestrian pavement needs to check the level of slip when it rains. If necessary, an additional layer of surface mortar or asphalt concrete can be added to create roughness.

When the concrete or mortar layer is damaged and the strength is suspected, the Inspection must be repeated with a small hammer. This type of Inspection may also be

used to determine relative strength of concrete. Poor quality concrete must be carefully studied by a concrete expert.

- Garbage, water and other materials.

When standing water must identify the cause and overcome. Garbage and other materials must be removed, as this is one of the maintenance tasks. Places often prone to contamination such as by nesting animals must be checked for precautions.

3.2.4 Special inspection

Special cases after a major impact, after an earthquake or wind damage to a work, cases of defects that contain potential development due to environmental conditions or repeated phenomena repeat cause will carry out a special Inspection.

Depending on the scale and extent of damage of the work, the management unit will propose to perform special inspection. Inspection content and equipment for inspection will be specified in a separate outline approved by the Road Administration.

3.2.5 Evaluate

Depending on the importance as well as the characteristics of each part, the evaluation is considered specifically for each individual item.

3.3 Inspection and maintenance of steel structures.

3.3.1 Check and regular maintenance.

1) Inspection object:

Regular inspection of steel structures is only required for vulnerable structures such as vehicle railings, pedestrian railings.

2) Cycle:

Inspectioning must be done every 1 to 90 days depending on the department.

3) Report:

The location of any damage must be recorded and reported for future inspection and record keeping.

4) Means of access:

Pedestrian access paths are available, where inaccessible, binoculars or cameras (with adjustable zoom lens) can be used for observation.

5) Checking issues:

* Soil, rubbish, water or other material deposited on the face.
* Warping the railing when driving.
* Lost bolts and washers.

6) The work to be done:

* Cleaning and cleaning of steel structures. Report problems that exist for treatment study.

* The small damage, warping railing must be repaired and replaced immediately.
* Replace lost bolts and washers.

3.3.2 Periodic inspections and periodic repairs.

1) Inspection object:

Periodic inspection of steel structures is visual inspection to early detect each failure phase of the protective galvanized layer or detect any damage of structures. Applicable for running handrail structures.

2) Cycle:

The inspection must be done once a year.

3) Report:

After inspection, a brief report must be drawn up with illustrations to support the periodic repair plan.

4) Means of access:

Pedestrian access paths are available, where inaccessible, binoculars or cameras (with adjustable zoom lens) can be used for observation.

5) Checking issues:

* Soil, rubbish, water or other material deposited on the face.
* Rust or spoilage.
* The paint is blistering or peeling.
* Lost or missing bolts.
* Damaged by Traffic accident
* Bending over limit.

6) The work to be done:

* Soil, rubbish, water or other material deposited on the face.

Must study stagnant water to adjust. Garbage and other materials must be clean. Locations that are often contaminated by nesting animals must study preventive measures.

* Rust or spoilage.

New traces of rust, such as freckles and spots on the face, prove that the protective layer is no longer effective. The affected area must be clean and repainted with a layer of galvanized.

The stage of rust development pores the surface or there are minor damage to each region but the chtra affects the bearing properties or use of the components, proving that the protective layer is no longer effective. If the rust layer is greater than 3% of the structure area, a protective zinc coating can be repainted.

Areas of heavy rust which cause loss of cross section must be carefully researched to determine the reduction of the strength of the components, requiring repair or replacement of damaged structures before re-covering the protective zinc layer.

* The paint is blistering or peeling.

Blistering is a warning sign that the protective paint is no longer valid. Repainting of the surface layer, before the damage starts, minimizes the cost of maintenance of steel structures.

Peeling paint proves that the protective layer is damaged. Clean and repaint the surface.

* Bolts are loose or lost.

Loose or loose bolts may be caused by incorrect installation, vibration, overload and rust. If the bolt is overloaded, the bolt hole is often stretched and deformed ... the cause of this damage must be carefully considered. In other cases, the bolt may be tightened or replaced (if necessary).

* Damaged by car collision.

Steel damage, especially pedestrian or railing, is usually caused by a collision. The minor damage, warping railing must be repaired and replaced immediately. Damages caused by a vehicle hitting a steel structure must be reported and inspected by an engineer to determine if any repairs are required. When there is a collision, the protective layer may be damaged and need to be repaired.

* Bending over limit.

Bending, buckling in excess of the limit indicates that the structure is overloaded. These findings must be recorded as important and must be investigated to determine the cause of the problem and to take corrective action immediately.

3.3.3 Extraordinary Inspection.

1) Inspection object:

Detailed inspection of steel structures is a visual inspection to identify damage to the protective galvanized layer or to detect any damage to the part. Applies to railing structures, pedestrian railings.

2) Cycle:

The check must be done every 5 years

3) Report:

After checking, the report must be clear and detailed and accompanied with illustrations. Reports in detailed inspection are recorded in more detail. An illustration of the location and size of the defect on the building, detailed description and quantification of the defects such as length, width, depth, number of defects, extent of damage and area effects of defects, etc. The report can record the overall situation of the steel structure as well as the damage. The structural failures must be fully described along with the exact measurement location to be easily found on the design drawings. The damaged protective layer shall be recorded on the report and the location fully described in the Inspection report so that it can be easily found during maintenance.

4) Method inspection:

Access walkways for pedestrians are available, where inaccessible, the need to use scaffolding, suspension frame ... to be able to observe close to the main elements of the structure.

5) Checking issues:

Irregular inspections are similar in form to regular inspections but must be carried out with a much more careful level.

See also the corresponding section in periodic inspection.

6) The work to be done:

The work is similar to the routine Inspection. Detailed inspection will be important as it has the function of re-checking and re-establishing regular maintenance plans for steel components.

3.3.4 Special inspection

In special cases after a major impact caused to the work, a special inspection will be conducted.

Depending on the scale and extent of damage of the work, the management unit will propose to perform special inspection. The content of inspection and equipment used for inspection will be specified in a separate outline approved by competent authorities

3.4 Inspection and maintenance of bridge bearings - Pot Bearings, spherical Bearings and steel Bearings.

3.4.1 Check and regular maintenance.

Unnecessary

3.4.2 Check and repair periodically.

Unnecessary

3.4.3 Detailed inspection and periodic repairs

1) Inspection object

Visually examine the damage of the Bearing as an outer surface protection.

2) Cycle

The check must be done every 2 years

3) Report

After checking, the report must be clear and detailed and accompanied with illustrations. The report may document the general condition of the bearing or any damage, if any (according to check form 3.4.3).

4) Method inspection.

Usually use crane truck with hoist or scaffolding.

5) Inspection issues.

* The screws are broken
* The scratches on the surface of sliding steel plate.
* The bulge of the PTFE layer.
* Rubber bulges.
* The paint layer is peeled or damaged
* Signs of corrosion.

6) The work to be done:

* Snail is broken

If possible, tighten loose screws by hand, using 1/4 "rotating wrench".

* The scratches on the surface of sliding steel plate.

Some slight scratches on the glossy surface are normal, but if the stainless-steel plate is severely scratched, indicating that the PTFE layer is torn, the sliding steel plate comes in contact with the top of the disc, need to take clear, colored images. The surrounding structures are mainly stainless-steel sheets and sent to the bearing manufacturer for evaluation.

* The bulge of the PTFE layer.

Typically, the PTFE layer is tightly sealed on the top of the disc and is hard to come out. If the PTFE layer is visible beyond the edge of the disc, it is likely that the PTFE layer has been pulled excessively and spilled from the cavity. If the PTFE layer is bulging, it is also possible that the bearing itself is deformed under the force of the load. Take a clear, color photograph of the surrounding structures that are primarily a bulge of the PTFE layer and send it to the Bearing manufacturer for evaluation.

* Rubber bulges.

If the ring is damaged, the rubber sheet may be under pressure from the disc. Take a clear, color photograph of the surrounding structures, primarily a rubber sheet, and send it to the bearing manufacturer for evaluation.

* The paint is peeled or damaged.

If the paint is peeled or damaged, the area must be cleaned and repainted. Avoid letting any type of paint touch the stainless-steel plate.

* Signs of corrosion.

Rusting occurs when the protective layer is damaged, either during installation or during use. Any large tear marks or deformation of the bearings should be thoroughly researched before repairing the protective covering. Corrosion must be removed with a wire brush and repainted with the correct paint that has the properties of the original paint.

3.4.4 Unexpected inspection and repair

In special cases after a major impact, after an earthquake or wind damage to a work, cases of defects that contain potential development due to environmental conditions or repeated phenomena repeat cause will carry out a special Inspection.

Depending on the scale and extent of damage of the work, the management unit will propose to perform special inspection. The content of inspection and equipment used for inspection will be specified in a separate outline approved by competent authorities.

3.4.5 Evaluate

A summary of the diagnosis and assessment of disk bearings is shown in the table.

Part	Damaged form	Evaluation criteria		
		AA	A1 to A3	B
Bearing	Damaged Bearing	Broken bolt	The paint is peeled and damaged Signs of corrosion	Scratches on sliding steel plates The bulge of a PTFE layer Rubber bulges
Mortar grout	Damaged	Crackes in Motar grout		Mild cracking or flaking

3.5 Inspection and maintenance of bridge bearings - Rubber Bearing.

3.5.1 Check and regular maintenance.

Unnecessary

3.5.2 Check and repair periodically.

Unnecessary

3.5.3 Detailed inspection and periodic repairs

1) Inspection object:

Visually check for damage or displacement beyond the limit of the bearing.

2) Cycle:

The check must be done every 1-2 years

3) Report:

After checking, the report must be clear and detailed and accompanied with illustrations. The report may document the general condition of the Bearing or any damage, if any.

4) Means of access:

Can use a lifting crane or scaffolding to get to the Inspection point.

5) Checking issues:

* Unusual bulges on the side of the Bearing.
* Cracks on the side of the Bearing.

* Relative position of the Bearing relative to the mortar or steel sheet.

* Crack the mortar layer below the Bearing.

6) The work to be done:

* Unusual bulges on the side of the Bearing.

A slight bulge between the steel plates is normal. If the larger side bulge allows the message to show that the adhesion between the rubber and the inner steel plate is damaged, the spherical bearings can still be used but should be replaced, if the adhesion continues. reduction. A color image of the bulging site should be taken and the Bearing condition monitored every 2 years.

* Cracks on the side of rubber.

Cracks or tears in the Bearing cover suggest that the rubber begins to age, which can affect the firmness of the Bearing. The Bearing can still be used but every 2 years, cracks must be checked during detailed Inspections.

* The position of the Bearing corresponds to the plaster layer below and the upper steel plate.

Bearing are usually placed in the heart of the underlying mortar and steel plate above.

Any movement must be recorded and checked during the next detailed inspection.

Wherever the bearing is within l0mm from the outer edge of the plaster or steel plate, it must be adjusted. The readjustment of bearing position must be checked in the next inspection to see if the degree of error of the bearing is still present.

* Cracking of buffer mortar layer.

Different shrinkage or load acting on the beam can cause cracks of the mortar layer beneath the package. The damage of this layer of mortar must be repaired immediately, without delay. Beams must be lifted and temporarily stored on each side of the girder to refill the new gasket. The bridge is designed to be able to replace the bridge bearing with a beam girder provided that the minimum vehicle load must be reduced while the girder is temporarily supported on the appropriate platform.

3.5.4 Unexpected inspection and repair

In special cases after a major impact, after an earthquake or wind damage to a building, the case appears to have defects that contain potential development due to environmental conditions or repeated phenomena. repeat cause will carry out a special Inspection.

Depending on the scale and extent of damage of the work, the management unit will propose to perform special inspection. The content of inspection and equipment used for inspection will be specified in a separate process approved by the competent authority.

3.5.5 Evaluate

A summary of the diagnostic evaluation of latex Bearings is presented in the table

Part	Damaged form	Evaluation criteria		
		AA	A1 to A3	B
Bearing	Damaged Bearing	Damage Bearing, no longer bearing capacity	Abnormal bulge, Cracks side of rubber	Abnormal bulge, Cracks side of rubber
	Movement	Close to the outer edge of the grout mortar or steel plate <10mm		
Mortar grout	Damaged	Crackes in Motar grout		Mild cracking or flaking

3.6 Inspection and maintenance of expansion joints.

3.6.1 Check and regular maintenance

1) Purpose:

Regular inspection of bridge expansion joints is a preliminary Inspection of the extent of damage of the rubber bands and gaskets between the rails.

2) Cycle:

Checks must be made daily.

3) Report:

After checking, the report must be clear and detailed and accompanied with illustrations. The report may document the general condition of the expansion joint or any failure, if any.

4) Checking issues:

* Soil, rubbish ... stagnant.
* Ponding.
* Damaged rubber strips.
* The gasket is damaged

5) The work to be done:

* Soil, rubbish ... stagnant.

Remove foreign objects such as broken glass or sharp metal that could damage the high strip.

* Ponding.
* Check the drainage system of the expansion joint, clean the water, avoid the case of standing water for a long time and then go through the damaged rubber areas affecting the other internal structures of the expansion joint.

* Damaged rubber strips.

- When the rubber band has a small hole, it can be repaired as follows:
  + The entire rubber strip must be clean and free of dust. Any dirt around the repair area must be clean using sandpaper or scrub brush to create adhesion on the surface. The entire range and top layer must be cleaned using alcohol to ensure maximum adhesion.
  + Rubber strips can be repaired with cyanoacrylate glue provided by the manufacturer. When using this glue, attention should be paid to the minimum safety. Latex gloves can tear, and oily sweat can damage the adhesion and the glue may also get on the skin.
  + Can apply a thin layer of cyanoacrylate on the glued surface and then press the two sides together for about 3 minutes to ensure strong adhesion. Rubber bands will be rechecked for stickiness and waterproof. The repair area must be clean with alcohol.
- Major damage to rubber bands must be replaced. When replacing, it must be supervised by expansion joint manufacturer

3.6.2 Check and repair periodically.

1) Purpose:

Visual inspection can identify any damage to the rubber bands or steel plates and fittings of expansion joints.

2) Cycle:

The inspection must be performed every 6 months.

3) Report:

After checking, the report must be clear and detailed and accompanied with illustrations. The report may document the general condition of the expansion joint or any failure, if any.

4) Inspection issues:

* Soil, rubbish ... stagnant.
* Damaged rubber strips.
* Water leaks through joints.
* Damage to covered steel sheets, missing or missing bolts.
* Elevation and distance difference between structures.
* Creaking due to collision or vibration.
* The gasket (at the bottom of the vertical bar) is broken or missing.

5) The work to be done:

* Soil, rubbish ... stagnant.

Cleaning and cleaning up all rubbish and soil ... such as broken glass or metal can damage the rubber strip.

* Damaged rubber strips.
  - Minor damage repaired such as regular maintenance.
  - Major damages to rubber strips must be replaced. When replacing, it must be supervised by expansion joint manufacturer.
* Water leaks through joints.

Normally, the asteroid band of the expansion joint is impermeable and always dry. Any leakage of water through the joints that flow to the Bearing will indicate that the rubber sheet has been damaged. The inspection should be carried out immediately to find out the location of the damage. Repair or replace other rubber bands as above.

* Damaged coated steel plate, loose or missing bolts.

The steel sheet covering the center separator and the sidewalk shall be checked for impact damage or corrosion and check for loss of bolts. When bolts are lost or loose, they must be replaced or tightened. Damaged steel bars must be repaired immediately according to the instructions for checking and maintaining the steel structure.

* The gasket is damaged

Gaskets that have been dropped, broken or excessively damaged must be replaced

3.6.3 Detailed inspection and periodic repairs.

1) Purpose:

Visual inspection to identify damage to rubber bands and cover plates as well as to detect new signs of tearing or other structures of the expansion joint.

2) Cycle:

The check must be done once a year.

3) Report:

After checking, the report must be clear and detailed and accompanied with illustrations. The report may document the general condition of the expansion joint or any failure, if any.

4) Inspection issues:

* Soil, rubbish ... stagnant.
* Damaged rubber strips.
* Water leaks through joints.
* Damage to covered steel sheets, missing or missing bolts.
* Elevation and distance difference between structures.
* Creaking due to collision or vibration.
* The rail and the vertical slider are rusted or corroded.

5) The work to be done:

* Elevation and distance difference between structures.

The difference in pitch and distance indicates that the internal structures of the expansion joint are damaged. The manufacturer experts should be consulted.

* Creaking due to collision or vibration.

A crack or noise indicates that the internal structures of the expansion joint are loose or broken. Must consult the manufacturers experts.

* The rail and the vertical slider are rusted or corroded

These rods are manufactured in high quality weather resistant, which is very hard to resist. Signs of corrosion and rust detected are considered serious and must be consulted with the manufacturer's experts.

* Other damages:

For other damages are instructed in regular inspection

3.6.4 Special inspection and unexpected repair

In special cases after major incidents causing damage to constructions such as earthquakes, typhoons ... special inspection will be conducted.

Depending on the process and level of damage of the process, the management unit will propose to perform special inspection. The content of inspection and equipment used for inspection will be specified in a separate process approved by the competent authority.

3.6.5 Evaluate

Summary of diagnostic evaluation is presented in the table

Part	Damaged form	Evaluation criteria		
		AA	A1 to A3	B
Expansion joint	Damaged Expansion joint	Large torn rubber strip, Rail crack and big bent	Cracks appear on all rubber strips, Rails is corroded, Rail small bent	Soil on the rubber strip
	Wet	Water flows down the gap due to the rubber seal being not atertight		
Concrete cavity expansion joints	Cracked, open	Crackes in Motar grout	There is a gap between the expansion joint and the concrete section, There is a gap between the concrete of expansion joint and the deck slab	Mild cracking or flaking
	Wet		Water penetrates through the concrete into the expansion joint cavity	
Other	Strange noise		Unusual noise when a vehicle crosses the bridge	
	Elevation and		Elevation or distance	

	distance		difference between structures	
	Hole	The hole is bigger than 20mm	The hole is from 10mm to 20mm	

CHAPTER IV:

INSPECTION AND MAINTENANCE OF BRIDGE

4.1 Generality

Information about the design, details of the structures of the bridge, construction and product suppliers for each bridge component is referenced in the dossier of completion of the Bridge on Highway 13, from Km71 to Km346, Lao People's Democratic Republic.

4.2 Regular inspection

4.2.1 General principles

Regular inspection is conducted to monitor and supervise the structure daily after the initial inspection. Management units must have specialized forces regularly interested in regular inspections.

Regular inspections are made on all structures where they can be observed. The purpose is to timely grasp the working condition of the structure, the possible breakdowns (especially in crucial and important positions) so as to take remedial measures early and avoid the situation to prolonged damage leads to more and more aggravation.

4.2.2 Contents of regular inspection

Used by management units to promptly detect signs of degradation. This task is mandatory and assigned to an appropriate professional capacity organization;

The regular inspection cycle depends on the degree of vulnerability and the frequency of impacts during mining. The stool Inspection cycle falls into the following two categories:

- Checking 01 time / week for items such as asphalt concrete surface, bridge drainage, railing (specially the details of connection between concrete columns and concrete ledges), lighting electricity, expansion joints , signal posts etc.
- Check every 3 or 6 months for all remaining items depending on the specific status of bridges, roads and capital conditions, as well as technical requirements and work conditions at the time of progress Inspection execution.

Conduct daily observation of reinforced concrete bridges by sight, when in doubt, use normal methods or direct experiments.

Regularly check the following position items:

a) Deck slab system

The common failures are as follows:

- Pavement asphalt concrete surface is cracked and flaky.
- The concrete surface of the deck is broken, resulting in damage to the bridge deck slab;
- Approach Road settlement behind Abutment and changing of profile of Bridge, elevation difference;
- Broken railing, broken railings or guardrails;

- The Surface of pavement on Bridge on the drainage system is not good, stagnant water when it rains, the drainage system is rusted, covered with sand and dust, reducing drainage capacity;
- Expansion joint is broken, concrete connecting between expansion joint and asphalt concrete are cracked, damaged, leading to water flowing down the top of girder, top of pile cap, abutment when it rains or vehicle operation is not smooth;
- Post Signal, signalboard are broken, lost, peeled paint ..;
- Near the bridge, there are building affecting drivers' vision when entering and leaving the bridge.

b) For normal reinforced concrete structure and prestressed concrete structure

The following common failures:

- Cracking of concrete, which may occur in reinforced concrete and prestressed concrete bridges. Types of cracks can often appear:
  + The vertical crack appears in the tension areas of the bending moment cross section with absolutely great value;
  + Oblique cracks appear in the moments of bending moment and the shear force is of great value;
  + Local cracks, often appearing on Bearing or cross beams, prestressed cable anchors;
  + Cracks due to shrinkage;
  + Cracks due to steel reinforcement, usually when the thickness of the protective concrete layer is not thick enough to cause vertical cracking in the structure;
- Breakage of concrete to reveal reinforcement: Often occurs in locations with large local stresses such as the location of bridges, anchor heads, mechanical collision positions caused by vehicles, boats due to low static, the location of protective concrete layer is not enough thickness, steam penetrates into concrete to make the volume expanded, causing cracking and breaking of the outer concrete layer;
- Weathered concrete, deterioration of quality: Appeared locations often wet, in concrete with impurities, quality of concrete components are not guaranteed (salt poured concrete, components not clean aggregate ..)
- Absorb water through concrete, can check this phenomenon after rain.

c) For bearings

Careful monitoring of the bearing assembly should be made due to failure of this part, which in turn may result in damage to other relevant components. Damages to be checked:

- Regularly clean the surface of the bearing, do not allow standing water to place the bearing.
- Upper, lower steel boards are rusted, painted and greased with regular requirements 1 year / 1 time;

- Determining damage if any In case the bearing is damaged or unable to continue to be operated, the unit responsible for maintenance of the bridge must report it to the competent authority to coordinate with specialized units in making a repair or replacement plan. new fit, ensure technical requirements.

d) For abutments and piers

Damaged structures and contents to be checked:

- Cracking in the abutment body, pier, footing of abutments, pier and other visible structures;
- Broken concrete, exposed steel reinforcement, rusted steel reinforcement;
- Approach slab settlement and cracked;
- Check working structures of abutments, piers and structures on abutments and piers.

In the event of abnormal incidents or severe damage, the organization shall examine in detail the damaged places and propose timely solutions. In the process of proposing a solution, it is necessary to study the demand situation in the initial inspection dossier. The Inspection content, assessment results are updated and the bridge management records.

4.2.3 Evaluation of inspection results

In case of detecting incidents or minor damage, take immediate remedial measures;

In case of detecting an incident, unusually seriously damaged, organize the detailed inspection of the damaged place and propose a timely solution. In the process of proposing a solution, it is necessary to study the structural condition in the initial inspection dossier.

Inspection results are recorded in inspection logs, work diaries or made into written reports for keeping. In case of an incident, a written report must be submitted to the Lao Road Administration.

4.3 Inspection periodic

4.3.1 General principles

Periodic inspection to detect signs of damage to the bridge and appoach road during use, which cannot be detected by the initial inspection and regular inspection. On that basis, there is a method of early detection in order to maintain the life of the work;

For bridge: Checking 2 times a year: once before the rainy season and once after the rainy season.

For road works: Check monthly and quarterly or combine with patrol of road.

All Inspection results are recorded and updated in the bridge management record. When incidents occur, signs of serious damage must be reported in writing to competent state agencies.

4.3.2 Periodic inspection measures

Periodic inspections are conducted on the whole structure. For structures that are too large, it may be periodic inspection zones, one area for each inspection.

The project owner may invite units and consultants having expertise in construction specialties and appropriate skills to conduct periodical inspections.

First, the structure is visually surveyed by looking and typing. When damage or degradation is suspected, non-destructive Inspectioning equipment or drilling for concrete samples and pavement samples may be used for inspection.

4.3.3 Contents of periodical inspection before and after the rainy season

Inspectioned twice a year: 1 time before the rainy season and 1 time after the rainy season.

When periodic inspection must meticulously check the structural structures of the building. It is necessary to have specialized machines for exploration and measurement

Checking before the rainy season: the focus is to check the abutment, pier, the slope protection of abutment. Must detect promptly to repair immediately the damage to prevent and minimize incidents caused by floods.

Checking after the rainy season:

+ Check the evolutions such as landslides, scoure footings of the abutments, piers that can skew the abutments leading to the inclination of the girder, and the subsidence of the abutments directly affecting the safety of works and safety carriage.
+ Checking the change of flow compared to before the rainy season to create accretion and landslide around the abutment.

4.3.4 Other regular inspections: Conducted once a year for all girders, abutments, piers and other structures.

4.3.5 Evaluation of Inspection results

The repair of damaged structures is conducted according to the instructions of the regular inspection. Periodic inspection results must be reported to competent state agencies.

4.4. Extraordinary Inspection

4.4.1 General principles

Abnormal inspection is conducted when the structure shows signs of damage due to the sudden impact of factors such as storms, floods, earthquakes, landslides, collisions with motor vehicles, fires, etc.

The requirement of an abnormal inspection is to grasp the current state of the structural damage, and draw conclusions about the repair request.

The owner of the project may check himself / herself or hire an appropriate unit or expert to perform it.

Inspection cycle every 5 years

4.4.2 Abnormal inspection measures

Abnormal inspections are carried out on all or part of the structure, depending on the scale of the damage that has occurred and the repair request of the work owner.

Abnormal checking is done mainly by visual observation, listening and typing. You can use simple tools like ruler, plumb ball, etc.

The person performing the abnormal check should draw a conclusion as to whether or not to check the details. If not, immediately propose solutions to repair and restore structures. If necessary, carry out detailed inspection and propose solutions.

4.4.3 Content of abnormal inspection

Abnormal Inspections include the following:

Survey visually, listen and use some simple tools to identify the initial state of structural damage. The following damages should be identified:

+ Deviations from structural geometry
+ Subsidence level
+ Cracking and breaking level
+ Other visible defects
+ Status of the long-term monitoring system (if any).

Analyze the data to be surveyed to reach a conclusion whether or not to conduct a detailed Inspection, the scale of detailed inspection. If you need to check details, follow the instructions in the following section. If not, propose a solution to repair the structure in time.

For damage that is likely to endanger people and surrounding structures, emergency measures must be taken before detailed inspection and remedial measures are proposed.

4.4.4 Evaluation of Inspection results

The repair of damaged structures is conducted according to the instructions of the regular inspection.

After irregular inspection, there must be a document recording the inspection results and concurrently sending to the competent State agency.

4.5 Check the details

4.5.1 General principles

After performing the initial inspection, regular inspection, periodic inspection, irregular inspection, the Inspectioning unit finds it necessary to carefully examine the structure to assess the degree of degradation and propose solutions to fix it. cured accordingly;

Checking in detail using specialized Inspectioning equipment to assess the quality of used materials and the extent of damage of the work. Laboratory work is carried out according to current standards and regulations;

The owner of the project may conduct or hire units and individuals with appropriate competence to carry out detailed inspection.

4.5.2 Detailed inspection measures

Detailed inspection is conducted on the whole structure or a structural part depending on the scale of structural damage and the required inspection grade.

The Inspectioner needs to identify in advance the outstanding characteristics of the degradation so that there is a focus on the detailed inspection.

Detailed inspection is performed by specialized Inspectioning equipment to quantify the quality of materials used and the deterioration of the structure. Experimental methods should be carried out according to current standards and regulations.

The person performing detailed inspection must have a plan for implementation, including the size of the Inspection, the level of the results of the inspection to be achieved, the time and cost of implementation. This plan must be accepted by the project owner before being implemented.

4.5.3 Detailed inspection contents

Detailed inspection should include the following:

a, Detailed investigation of the whole or damaged structures of the structure:

The requirement of the survey is to obtain quantitative data on structural failure. Specifically quantifying by data and by image the following issues:

- Geometric deviations of bridges and bridge details, subsidence deviations;
- Degree of deformation, subsidence of bridge structures;
- Cracks: density, width, length, depth and direction of the crack;
- Fracture (characteristics, location, level of danger);
- Corrosion of reinforcement (rust density, rust level, reduction of cross-section of reinforcement strength);
- Concrete erosion (erosive corrosion, carbonate corrosion, corrosion level, depth of erosion into bridges, chemical contamination, ...);
- Quality of concrete (strength, density, blistering, ...);
- Discoloration of the exterior;
- Other visible defects;
- Ensuring the function of the bridge (waterproofing, smooth circulation on the bridge ....);
- Working status of permanent monitoring systems on bridges (if any)

The above quantitative data must be determined on the basis of current national or international Inspection method standards.

b, Analysis of degradation mechanism of structure:

Based on the above-mentioned survey data and the results of checking the archives of works, it is necessary to analyze and identify the mechanism causing each type of damage. Some of the following typical mechanisms may be inductive:

- Cracking: due to over load, thermal deformation, moisture, subsidence, concrete quality;
- Impaired concrete strength: due to concrete consistency, concrete curing and environmental impact, erosion;
- Geometric deformation: due to excess load, environmental impact, bridge stiffness;
- Rust reinforcement: erosive environment erosion. Carbonate concrete surface, crack concrete, water repellent;
- Surface discoloration: due to environmental impacts;
- Water permeability: due to the consistency of concrete, cracking, joints.

c, Assessment of deterioration of structure:

Based on the analyzed Inspection data and degraded mechanism, it is necessary to assess whether the structure needs to be repaired, and to what extent.

d, Selecting repair or reinforcement solutions:

- Repair or reinforcement solutions should be selected on the basis of the degraded mechanism that has been analyzed and evaluated. The proposed repair or reinforcement solution must meet the requirement of restoring to be equal to or higher than the original function of the structure and prevent the continuation of the degradation mechanism formation after repair.
- The repair scale depends on the importance of the structure, the remaining life of the project, the financial capability and the requirements of the work owner.

e, Repair or reinforcement:

- The owner of the project can repair, reinforce himself or select an appropriate unit to perform it.
- The repairing or reinforcing unit should have a proactive plan on materials, human resources, construction schedule and methods, and supervise quality before starting construction.
- Repair or reinforcement must ensure at least impact on the surrounding environment and the user. The necessary quality control experiments must be carried out during construction.

All developments of repair or reinforcement work must be recorded in the construction diary and kept for a long time.

4.6 Special inspection

When detecting incidents without knowing the cause, special Inspection must be carried out. It is possible to hire professional Inspectioning units or invite experienced experts along with special equipment to conduct the inspection according to the outline approved by the competent authorities.

CHAPTER V:

MONITORING WORKS

5.1 Monitoring work

Monitoring of road works means the monitoring, observation and measurement of technical parameters of works according to requirements of designs during use.

Monitoring with high reliability is extremely important. In addition to the main objective of controlling the construction process as well as detecting failures or deteriorating quality during the exploitation process, monitoring of bridge works also provides quantitative data for the bridge construction, Data can be used for research, improvement of construction methods and design. In the exploitation stage, the monitoring data are used to assess the development of the damage, degradation, assess the capacity of the structure, the ability to behave in case of abnormal accidents, construction. formulating plans for maintenance, repair and maintenance to ensure normal operation and life of the work.

5.2 Monitoring work for the bridge and bridgehead roads

Observe the bridge and the end of the bridge using accurate instruments and methods to determine the change of structure compared to the initial state. Monitoring to detect early movement, subsidence, sagging, erosion, ...

Content of observation:

+ Measurement of settlement, inclination, deflection of abutments, piers, roadbeds.
+ Measuring the height of the bridge surface, road surface, bridge sag.
+ Measurement of changes in riverbeds, erosion at piers.

The monitoring work should be carried out at the end of the first year, at the end of the second year and once every two years in the following years. In special cases such as after the structure is affected by strong impacts, earthquakes ... it is necessary to conduct monitoring as a basis for assessing the working conditions of the work.

CHAPTER VI:

ELECTRIC WORK AND MISCELLANEOUS

6.1 Generality

In the Bridge on Highway 13, from Km71 to Km346, Lao People's Democratic Republic, there is some work on electricity and auxiliary equipment. Electrical systems and fire protection are also found in the Bridge on Highway 13, from Km71 to Km346, Lao People's Democratic Republic.

Electrical and equipment work also requires regular and regular inspections and maintenance. This section clearly identifies the electrical work and equipment of the Bridge on Highway 13, from Km71 to Km346, Lao People's Democratic Republic. In addition, special maintenance requirements for these items should be obtained from the supplier's documentation.

The management process must meet the requirements to keep the electrical system in good and safe working condition, the Fire preventation and fighting system in class is always ready to work to promptly put into operation when it occurs. fire on the bridge.

Special maintenance requirements for the electrical system and fire preventation, the management unit, in addition to consulting the technical documents handed over by the contractor, must sign the contract with the installation contractors. equipment or units with functional and professional resources to perform

6.2 Inspection and operation of the electricity system

Inspection, management and operation of transformer stations and electrical systems of the building should comply with the cited documents.

Other distribution equipment such as switchgear, control cabinets ... should refer to the manufacturer's recommendations and exploitation instructions.

6.3 Check the substation during normal operation

To ensure the transformer works safely and long term, it is necessary:

* Monitor temperature, load and voltage level
* Strict supervision of oil quality and electrical insulation properties
* Preserve well cooling devices, adjust voltage, protect oil and other equipment.

6.3.1 Check the transformer regularly

Regular testing of transformers is done once a week. The content of regular inspection (outside review) of transformers includes:

* Check the surface of insulated porcelain, input porcelain (cracked, dirty, oiled or not?)
* Check the transformer casing is intact, does it leak oil?
* Check the color of oil in the auxiliary oil tank, the oil level in the secondary oil tank, the oil-bearing porcelain, the oil pressure in the high-pressure porcelain
* Check the value of the thermometer and manometer.
* Check cooling equipment and oil regeneration equipment continuously

* Check steam relays, safety valves, anti-explosion lens surface, position of relay valve and auxiliary oil tank.
* Check signaling devices.
* Check the lightning protection system
* Cleaning, cleaning transformer stations.

6.3.2 Periodic inspection of transformers

The substations installed for the bridge have a large capacity, to ensure safety for long-term work, it is necessary to check (without power cut) at least every 3 months. The content of regular inspection in addition to the contents such as regular inspection (external review) also includes:

* Check the cable ends, guides, and connection points for hot contact?
* Check the grounding system.
* Is the transformer test sound normal?
* Check the color of the desiccant in the breathing bottle
* Check the status of the substation: windows, doors, vents, lights, grilles ...
* Examining caves for Fire preventation and fighting.

6.3.3 Check transformer details

The detailed inspection of the transformer is required to be carried out once a year, including all regular and periodic inspection contents, and at the same time, test experiments should be carried out. by professional units.

6.3.4. Check out the special transformer

Special testing of transformers should be carried out (by specialized units) in the following cases:

* When the temperature of the device suddenly changes
* When the machine is cut by steam or bias relay
* After a disaster or disaster occurs.

6.4 Backup generator Fire preventation system

Backup generator is equipped for the Fire preventation system Bridge on Highway 13, from Km71 to Km346, Lao People's Democratic Republic to ensure the FIRE PREVENTATION work for the bridge in the absence of electricity. national grid.

6.4.1 Check back often

The inspection of standby generators is required to be performed once a week or it must be inspected before and after each operation, which includes:

* Lubricant ink: Lubricant ink must be within between two lines above the tree.
* Fuel ink always reserves enough for Fire station to operate continuously for 4 hours.
* Cooling water level: Maintain the coolant level in the water tank is always full.

* Battery: Check the connection of the battery and acid water in the bottle
* Exhaust system: Clean, painted silver 600 ° c
* Belt: Good and strong enough
* Electrical system: Check the protection circuit breaker.

6.4.2 Checking daily

Periodic inspection of standby generators is also required to perform with the same cycle as the entire Fire preventation and CONTROL system once a year. Checks include:

* Replace oil and filter oil periodically after every 250 hours of operation or after 12 months whichever comes first.
* Replace fuel filter, and filter water every 12 months.
* Filter, viscous and spare parts must be supplied by genuine
* (Please refer to the manufacturer's exploitation recommendations).

6.4.3 Check the details

Detailed inspection of standby generators for the Fire preventation system is required every 2 years, detailed inspections include all regular and periodic inspections.

6.4.4 Special inspection

The requirement for special inspection of standby generators is similar to the special inspection of the entire Fire preventation and fighting system.

6.5 Check the lighting system

6.5.1 Check back often

The regular checking of the lighting system is required weekly, the regular checking of the lighting system includes:

* Check the lighting bulbs, statistics on the number of burnt and shaded bulbs to plan repair and replacement
* Check electrical cabinets, automatic switching systems by optical cells, electrical relays
* Clean electrical cabinets
* Clean, wash lighting poles.

6.5.2 Checking daily

Periodic inspection of lighting systems is required to be carried out annually. Periodic inspections include regular inspections and:

* Check and tighten the bolts linking the lamppost and the sphere
* Check the lamp post and lampshade link
* Clean lampshades.

6.5.3 Check the details

Detailed inspection of the lighting system includes all regular and periodic inspections and is required to be conducted every 2 years.

6.5.4 Special inspection

The special inspection is carried out as a detailed inspection and is required to be carried out after each incident occurs due to a natural disaster or a request of the functional management agency.

CHAPTER VII:

INSPECTION AND MAINTENANCE OF TRAFFIC SAFETY SYSTEM

7.1 Traffic signs system

7.1.1 Check and regular maintenance.

1) Test object

Visually check the sign system.

2) Cycle

The check must be done every 1 week.

3) Report

After checking must report clearly. The report may document the general condition of the sign system or any damage, if any.

4) Method inspection.

Current road, use camera.

5) Examination issues.

* The sea is distorted, translucent reflective lipstick.
* Broken sea or peeling paint.
* The sea is tilted, the link is loose.

6) The work to be done:

* The sea is distorted, translucent reflective paint.

Signs when damaged such as distortion, translucent reflective paint must be replaced immediately.

* The sea is lost.

When the sign is broken or peeled, paint must be replaced immediately.

* The sea is tilted, the link is loose.

Signs when tilted, loosened, not in the right position must be installed in the right position and tightened bolts tightly and neatly. The bolts connecting the sea to the bridge must be oiled or greased to facilitate assembly.

7.1.2 Periodic inspection and repair.

Periodic inspections are similar in form to regular inspections but must be done with a much more careful level of care.

See the respective sections for regular inspection and maintenance.

1) Cycle.

The check must be done every 6 months.

7.1.3 Detailed inspection and periodic repairs.

Detailed inspection is similar in form to regular inspection but must be done with much more care and detail.

See the respective sections for regular inspection and maintenance.

1) Cycle.

The check must be done every 1 year.

7.1.3 Special inspection and unexpected repair

In special cases after a major impact, after an earthquake or wind damage to a building, the case appears to have defects that contain potential development due to environmental conditions or repeated phenomena. repeat cause will carry out a special test.

Depending on the scale and extent of damage, the management unit will propose to perform special inspection. The content of inspection and equipment used for inspection will be specified in a separate process approved by the competent authority.

7.2 Guard railing system

7.2.1 Check and regular maintenance.

1) Test object

Visually examine the damage of the railing.

2) Cycle

The check must be done every 1 day.

3) Report

After checking must report clearly. The report may document the general condition of the railing system or any damage, if any.

4) Method inspection.

Current road, use camera.

5) Examination issues.

* Railing is warped due to collision.
* Railing is covered with dirt.
* Zinc coating is lost.
* Loose, lost bolts.

6) The work to be done:

* Railing is warped due to collision.

In case of banister, the railing is distorted locally, if it can be repaired almost the same (reaching 90-95%), it must be used.

In case of serious damage to the case, a report must be promptly reported for further Evaluation of measures according to the provisions of Chapter 4 and Chapter 5.

However, while waiting for official repair, it must be temporarily repaired immediately. ensure normal and safe transportation.

* Railing is covered with dirt.

Periodically blowing, cleaning sticky dirt on the entire railing system and the separator 1 month / time with compressed air or water spray.

* Zinc coating is lost.

Galvanized paint back peeling positions.

* Loose, lost bolts.

Replace, tighten bolts.

7.2.2 Periodic inspection and repair.

Periodic inspections are similar in form to regular inspections but must be done with a much more careful level of care.

See the respective sections for regular inspection and maintenance.

1) Cycle.

The check must be done every 6 months.

7.2.3 Detailed inspection and periodic repairs.

Detailed inspection is similar in form to regular inspection but must be done with much more care and detail.

See the respective sections for regular inspection and maintenance.

1) Cycle.

The check must be done every 1 year.

7.2.4 Special inspection and unexpected repairs

In special cases after a major impact, after an earthquake or wind damage to a building, the case appears to have defects that contain potential development due to environmental conditions or repeated phenomena. repeat cause will carry out a special test.

Depending on the scale and extent of damage, the management unit will propose to perform special inspection. The content of inspection and equipment used for inspection will be specified in a separate process approved by the competent authority.

7.3 Painted line system, traffic indications

7.3.1 Check and regular maintenance.

1) Test object

Visually inspect the system of painted lines and directions.

2) Cycle

The check must be done every 1 day.

3) Report

After checking must report clearly. The report may document the overall condition of the paint line system, traffic indications or any damage, if any.

4) Method inspection.

Current road, use camera.

5) Examination issues.

* The paint line is covered with dust, dirt, and garbage.
* Paint lines are abraded and blurred.

6). Work to do:

* The paint line is covered with dust, dirt, and garbage.

Every day must be scanned to ensure the painted line is always bright and clear.

* Paint lines are abraded and blurred.

Periodically use a paint sprayer to repaint the line that overlaps the old painted line once every 1 year to ensure full clarity as designed. Before painting, remove or wipe away stains and paint only when the floor is dry and clean.

The amount of paint used for m2 is based on the approved level for each paint.

7.3.2 Check and repair periodically.

Periodic inspections are similar in form to regular inspections but must be done with a much more careful level of care.

See the respective sections for regular inspection and maintenance.

The check must be done every 6 months.

7.3.3 Detailed inspection and periodic repairs.

Detailed inspection is similar in form to regular inspection but must be done with much more care and detail.

See the respective sections for regular inspection and maintenance.

The check must be done every 1 year.

7.3.4 Special inspection and irregular repair.

In special cases, after an explosion, earthquake or wind damage to a work, special inspection will be conducted.

Depending on the scale and extent of damage, the management unit will propose to perform special inspection. The content of inspection and equipment used for inspection will be specified in a separate process approved by the competent authority.

7.4 Other traffic safety devices

Other traffic safety devices include piles, guardrails, median strips, anti-glare walls, traffic islands located in the road leading to the bridge.

7.4.1 Check and regular maintenance.

1) Test object

Visually inspect the system of marker posts, guardrails, median strips, anti-glare walls, traffic islands.

2) Cycle

The check must be done every 1 day.

3) Report

After checking must report clearly. The report may record the general condition of the system of piles, guardrails, median strips, anti-glare walls, traffic islands or any damage, if any.

4) Method inspection.

Current road, use camera.

5) Examination issues.

* Guardrail walls, marker posts, median strips, anti-glare walls, traffic islands are covered with dust, dirt and garbage.

* Guardrail wall, pepper posts are blurred, peeling paint.

* Guardrail walls, piles damaged due to traffic collisions

6) The work to be done:

* Guardrail walls, marker posts, median strips, dazzling walls, traffic islands are covered with dust, dirt and garbage.

Hygiene between and boundary median (soft guardrail) 2 times / month.

* Guardrail wall, pepper posts are blurred, peeling paint.

The guardrail wall is damaged, peeling paint must be repaired promptly.

Every year, the system of soft guardrails must be painted or replaced with the type of guardrail (corrugated iron) coated with zinc.

* Guardrail walls, piles damaged due to traffic collisions

Repair damaged posts, guardrails, median strips caused by traffic accidents.

The piles on the road leading to the bridge must always be fully and properly located as designed and constructed. Damaged Post Signal must be replaced immediately within 24 hours.

7.4.2 Check and repair periodically.

Regular inspections are in the form of regular inspections, but must be done with much greater care.

See the respective sections for regular inspection and maintenance.

The check must be done every 6 months.

7.4.3 Detailed inspection and periodic repairs.

Detailed inspection is similar in form to regular inspection but must be done with much more care and detail.

See the respective sections for regular inspection and maintenance.

The check must be done every 1 year.

7.4.4 Special inspection and unexpected repair

In special cases after an explosion, a big impact, an earthquake or wind damage to a work, special inspection will be conducted.

Depending on the scale and extent of damage, the management unit will propose to perform special inspection. The inspection content and inspection equipment will be specified in a separate process approved by the competent authority.

7.5 Signs, buoys pepper river

River signs and buoys are constructed, installed by river authorities and are responsible for the maintenance of river standards that are not within the scope of this procedure. No need to inspect and maintain these types of signs. When these signs cause risks to the project's works, it must be promptly reported to the river management unit for Evaluation of measures.

CHAPTER VIII:

EXPLOITATION AND PROTECTION

8.1 Traffic on the bridge

8.1.1 Live Load on the bridge

A motorized lane of traffic in each direction shall consist of two lanes for motor vehicles with axles manufactured according to the standard standards permitted for circulation.

Special vehicles with a large axle manufactured separately, which are circulated in mines or very heavy and oversized freight vehicles, must have a special circulation permit and comply with the provisions of the license. . At the same time subject to the inspection of the bridge management unit and traffic control force.

8.1.2 Request to the third party to join the traffic.

All means when participating in traffic on the bridge must not stop, not litter and waste on the bridge, must not rely on the details and equipment for management, ensure safety and durability of the bridge. .

All vehicles and pedestrians passing the bridge must follow the right path, speed and other instructions on the bridge.

8.2 Traffic on both aproach road

The vehicles must go in the right lane for the right direction, not park on the road, on the overpass, at either end of the bridge, thus obstructing traffic.

The means of transporting people to visit must stop and park at the prescribed place.

Prohibit littering, indiscriminate discharge on the way to the bridge in the Bridge area on Highway 13, from Km71 to Km346, Lao People's Democratic Republic

8.3 Organizing traffic, traffic safety, counting vehicles and Evaluation of when there are work incidents, traffic accidents

8.3.1 Organization of traffic

Responsibilities of road management agencies and other relevant agencies in organizing traffic and traffic organization shall comply with of the Law on Road Traffic;

Contractors managing, maintaining and exploitation road works are responsible for performing works on traffic organization in accordance with the contract for management, maintenance and operation of road works.

8.3.2 Direct traffic assurance

Road management agencies shall direct and inspect contractors managing, maintaining and exploitation road works in direct traffic assurance and taking measures to ensure traffic when traffic congestion occurs. , construction incidents;

Investors, construction contractors on roads exploitation, road construction contractors are responsible for ensuring traffic and taking measures to ensure traffic for road sections. under construction in the following cases: the road surface is narrowed, the

roads must use bypasses, temporary bridges, overflows and underground roads; dangerous locations and traffic congestion; implementation of regulations on environmental sanitation;

Relevant organizations and individuals shall be responsible for ensuring traffic safety, preventing and fighting against and overcoming flood and storm consequences in accordance with the regulations of the Ministry of Transport;

Enterprises investing in construction and management of road works and owners of special-use road works shall carry out the responsibilities as prescribed above.

8.3.3 Dealing with construction incidents and traffic accidents

When a traffic accident occurs, concerned organizations and individuals must comply with the provisions of the Road Traffic Law.

8.4 Ensure traffic safety

Regular maintenance must ensure the safety of traffic for construction workers, road users and vehicles on the road. The main safety principles applied when construction on motor roads are detailed in the Road Traffic Law, paying attention to the following points:

Construction of works on currently exploitation roads shall be carried out only after obtaining permits from competent state agencies, strictly complying with the contents of the permits and the provisions of construction law.

During the construction process, the construction unit must arrange temporary signs and barriers at the construction site and take measures to ensure smooth and safe traffic.

Construction of urban roads must comply with this Article and the following provisions:

a) Only dig a road to repair works or build a new technical tunnel along the road or across the road but must have an annual plan agreed in advance with the road management agency, except in case of sudden incidents. export;

b) There must be a construction plan and execution time suitable to the characteristics of each street so as not to cause traffic congestion;

c) When the construction is completed, the road must be restored in its original state; For underground constructions, a construction completion dossier must be compiled and transferred to the road administration agency.

Construction units that fail to implement measures to ensure smooth and safe traffic according to regulations, in order to cause serious traffic accidents, traffic congestion and environmental pollution, shall have to take responsibility according to regulations. under the law.

8.5 Labor safety in regular maintenance of bridges

Labor safety in regular maintenance of works should comply with current labor safety processes and regulations. Also note the following:

People with cardiovascular disease, poor eyesight, deafness or neurasthenia, kinopathy, and alcohol consumption should not work above.

When cleaning rust, painting, repairing beams, welding, braces, frames, bearings or replacing some parts of bridges, it must necessarily be closed scaffolding for traveling and shielding fallen and spear objects. Be sure to be safe and reliable enough before use.

Hard-to-wear shoes, clogs, and sandals not allowed to work at the scene Working at a high place, wear bata shoes, scrape rust, paint, repair bridges, and wear safety belts, masks, and gloves.

CHAPTER IX:

ACCREDITATION, MAINTENANCE AND REPAIR MEASURES

9.1 Verification work

Accreditation of structures works includes activities of checking and determining quality or assessing the conformity of quality of works against requirements of designs, technical regulations and standards through consider the current status of the work visually combined with the analysis and evaluation of the construction test data.

9.2 Verification of the bridge

Verification the bridge to reassess the status quo and bearing capacity of the bridge, making recommendations on the load and the level of repair is reasonable.

a) Tasks and requirements of the inspection:

- Assess the current situation and determine the bearing capacity of the bridge; stipulating conditions when exploitation transportation.
- Evaluating the environment in the bridge area affecting the ability to exploit.
- Proposing remedial measures
- Determining effectiveness after reinforcement and repair.
- Content of inspection report:
- Name of the bridge, process, national highway and place name
- Global layout
- History and characteristics of the bridge exploitation process.
- Actual technical state of bridge
- Existencies need clarification
- Conclusion on test results, load capacity of bridge components (abutments, pillars, beams, etc.)
- Repair and repair measures

b) Duration of inspection:

The first inspection is conducted 10 years after the bridge is put into operation, then once every 5 years to conduct an inspection once to assess the extent of damage of the work and the ability of the work to be exploited.

In addition, if serious damage is detected that may affect traffic safety and safety of the work, the inspection must be carried out immediately as in the following special cases:

- After major repair or reinforcement bridge.
- When checking for deviation, damage in part or detail, the project shows signs of deterioration in quality, not guaranteed for exploitation ...
- When there is a need to allow special loads to pass through or to decide to extend the life of a project when the project expires.

c) The inspection results must be kept in the Bridge management dossier and sent to competent state agencies.

9.3. Regular maintenance

Regular maintenance of structures works means activities of monitoring, taking care of and repairing minor failures, maintaining equipment installed in road works, conducted regularly and periodically to maintain works. Roads are in the state of normal operation and use, and limit the occurrence of damage to road works.

The general requirement of regular maintenance of the bridge is to promptly repair the damage of construction structural components directly affecting work safety and traffic safety.

Regular maintenance includes maintenance and minor repairs. The content of this work complies with technical standards of regular road maintenance, need to pay attention to some specific items as follows:

9.3.1 Bridge maintenance work

9.3.1. 1 The sphere

Regular maintenance:

- Cleaning the bridge deck of motorized lanes: Using a sweeping truck, every 2 days.
- Hygiene for sidewalks: manual cleaning, every 1 day.
- Every month, use a car to spray water to wash the surface of the bridge and sidewalk once.

Depending on the extent of the damage, it may be zoned, peeled off the damaged asphalt concrete, then sanitized, irrigate and stick the damaged asphalt concrete carpet; The repair of asphalt concrete decks complies with the technological process of construction and acceptance of asphalt pavement.

9.3.1. 2 Drainage system on the bridge

Check the drainage ability, stagnant state, rust of drainage system on the bridge. Sanitary trash net, PVC water pipes: 1 week / 1 time in the rainy season and 1 month / 1 time in the dry season. If there is a phenomenon that cannot be repaired, replace to ensure the drainage ability of the sphere.

9.3.1. 3 Railing system

- Regular maintenance: monthly cleaning dust and dirt on the entire handrail, checking the working ability of the railings, railings, linked bolts. Locate rusted areas, conduct rusting, anti-corrosion painting.
- In case of severe damage, replace damaged parts.

9.3.1. 4 Signal paint

- Traffic signs must always be kept in a clear state. When the paint line is peeled or faded, it must replace paint lines with the same characteristics;
- The work of painting the bridge surface should follow the standards: Paint traffic signals in liquid form on concrete and asphalt concrete.

9.3.1. 5 Expansion joint

- Regular maintenance 1 week / 1 times the expansion joints: Clean, clean objects, hard objects falling into the expansion joints must be cleaned immediately.
- Regularly tighten expansion joint link bolts with beams, add stoppers.
- The replacement expansion joint (if necessary) must be better or equal to the existing expansion joint and comply with the current expansion joint standard.

9.3.1. 6 Bearings

- Regular maintenance: cleaning the surface of the bridge once a month, not allowing standing water to place the bearing.
- Determining damage if any In case the bearing is damaged or unable to continue to be operated, the unit responsible for maintenance of the bridge must report it to the competent authority to coordinate with specialized units in making a repair or replacement plan. new fit, ensure technical requirements.

9.3.1. 7 Bridge beams

- Regular maintenance (according to frequency of regular checking: every 3 months):
- The location where the surface concrete of the beam is aging or moldy due to the environment must be cleaned. If due to water absorption, must find out the cause to thoroughly handle by scanning the waterproofing layer for protection.
- Places where the concrete is damaged or if the regular reinforcement in concrete is exposed and rusty, the rust must be removed and plastered with the thickness of the initial protective layer. Use EPOXY-based adhesive mixed with cement (as specified by the manufacturer) for repair.
- Prestressed concrete beams, if cracks appear, must be marked, sketched and plastered with "plaster" for weekly monitoring. Based on the preliminary assessment, a higher level management report is required.
  + If the crack does not develop, then proceed to deal with the repair of the crack, the Evaluation of plan must be approved by the governing body.
  + If the crack develops, the construction maintenance unit shall have to report it to the competent authority in order to coordinate with a competent specialized agency in Evaluation of it.

9.3.1. 8 Abutment abutment

- Regular maintenance (according to frequency of regular checking: every 3 months):
- Abutment and abutment foundation: If there is a phenomenon of erosion of pier bridge than expected erosion in design dossier, consideration should be given to determining the cause of major erosion to take remedial measures. Depending on the specific situation, we propose specific remedial measures such as dropping stones around, making embankments ...
- Cleaning the surface of the top and around the abutments and piers.

- Clear the flow under the bridge, remove floating trees stuck to the abutments and piers (if any).
- Large damage cases such as displacement, cracking. The governing body should conduct a preliminary evaluation survey and submit it to the competent authorities for Evaluation of.
    + If the crack develops, the construction maintenance unit shall have to report it to the competent authority in order to coordinate with a competent specialized agency in Evaluation of it.

9.3.1. 9 Other concrete structures

- Regular maintenance (according to frequency of regular checking: every 3 months):
- Check regularly with the naked eye of concrete structures: working condition, deflection, cracking, corrosion ... Determining the scope and extent of damage;
- For minor damage to the handrail concrete or non-bearing structures, chiselling, repairing and replaying the damaged areas with medium marks higher than the damaged ones may be carried out;
- For heavily damaged concrete structures, the specific extent of damage must be inspected with corresponding Evaluation of measures;
- The repair of concrete and concrete structures complies with the construction and acceptance procedures for concrete structures and reinforced concrete.

9.4. Repair work

Repair of road works means activities of remedying damage of works discovered during the process of exploitation and use in order to ensure the normal and safe working of road works. Repair of road works includes routine and irregular repairs, specifically:

a) Periodic repair of road works means repair activities carried out in accordance with the plan in order to restore and improve the technical status of road works, which the regular maintenance of works fails to meet, including : repair damage; replacement of damaged building parts, equipment and technological equipment shall be carried out periodically according to the provisions of the process of maintenance of road works;

Routine repairs include medium and major repairs; between two major overhauls there is at least one medium repair.

* For bridges:

- Periodic repair work must be based on results of periodic inspection and inspection results.

- Irregular repair of road works means repair activities that must be performed abnormally when parts of works or works are damaged due to unexpected impacts such as storms, storms, floods, earthquakes, impacts, fire, explosion or other unexpected natural disasters, or when manifesting, may cause sudden damage, which may affect the safety of work use, operation of works or the possibility of incidents leading to disasters.

The direct road management unit must take the initiative in formulating and urgently mobilizing all human resources, equipment and supplies to organize the flow separation, overcoming traffic assurance and quickly reporting to the agency. Road management for assistance.

The irregular repair is divided into two steps as follows:

- Step 1: Repair and repair emergency roads, ensure fastest traffic and limit road damage. Step 1 is carried out at the same time processing and preparing documents to complete procedures as a basis for settlement.
- Step 2: Further treatment Step 1, to restore the road according to scale and technical standards as before the incident or solidify and solidify the work. Step 2 is carried out according to the order and procedures prescribed for basic construction works.

CHAPTER X

BRIDGE LOAD TEST

10.1 Static Load Carrying Test

10.1.1 General

Bridge Load testing consists of determining the safe load carrying capacity of structures, determining if specific legal or overweight vehicles can safely cross the structure and determining if a structure needs to be restricted and the level of posting required.

Where member strength cannot be adequately determined from the results of in situ material tests, load testing may be necessary. Static load tests are useful in determining the maximum allowable loads on bridges. They can also be useful in discovering the mechanical properties of materials. Static load tests are most likely to be needed in the following circumstances:

- Deterioration of structures, due to material degradation or physical damage.
- Structures which are substandard due to quality of design or construction.
- Non-standard design methods which may cause the designer, building authorities or other parties to require proof of the concept used.
- Change in occupancy or structural modification which may increase loading.
- Proof of performance following major repairs.

10.1.2 Test Procedures

a) Selection of Span and Method of Loading

In case of multi−span bridges, center span is chosen for load testing. The method of loading should be such as to either simulate the specific class of vehicles or induce in the members, the calculated forces or bending moments at critical sections.

Test loads may be in the form of mobile test vehicles (25 tons) and static loads.

b) Loading and Unloading Sequence

In case of static loads, the test load shall be applied in stages so that timely action such as stopping the test can be taken if any untoward distress is observed at any stage. In most cases, design live load effect would be equal to or less than that due to dead load. The suggested stages of test load placement are 30%, 50%, 70%, 80%, 90% and 100%. Unloading should also be in same stages. The next incremental loading should be added only after the deflections under the previous load have stabilized and all stipulated observations are completed

c) Preparatory Works

- All visual defects should be measured, mapped and plotted.
- It should be ensured that bearings are functional
- Expansion gaps and joints should be cleared of all debris.
- It will be useful to give the surface of the superstructure a coat of white wash, so that appearance of cracks becomes immediately perceptible.

d) Observations

The following are observed, measured and recorded at regular intervals of one hour over a period of 24 hours.

- Deflections at critical sections (for instance, for simply supported spans, at mid −span and at quarter span. In box girders, it will be useful to record deflections under each of the external ribs)
- Appearance of cracks and their development, length, width, location, and orientation correlated with lo ad.
- Deformation of bearings.
- Ambient temperature and related temperature in the body of the structure.

10.1.3 Measurement of Deflections

Deflections can be measured with the following devices:

(a) Displacement Gauge

(b) Ruler and Cursor

(c) Deflectometer

(d) Precision Level

(e) Water Level

Methods (a) to (c) are used whenever dry river/stream bed is available under the span. Otherwise methods (d) and (e) can be used by using a reference station at the nearby abutment. When girder bridges are subjected to load tests, it is essential to clear debris in the expansion gaps and to lubricate steel bearings to permit free translation and rotational movements of the spans.

10.1.4 Percentage Recovery of Deflection

The percentage recovery is calculated for values of deflection. The percentage recovery is calculated at 24 hours after removal of the load. The calculation is done after applying temperature and rotation corrections to the deflection data.

10.1.5 Evaluation and Recommendations

Static load test can be direct calculation of the load capacity from the test results. It is assumed that the bridge assessment is carried out using the partial safety factor format and the load capacity is the value for which the rating live load should be multiplied to reach the failure limit state.

10.2 Dynamic Load Carrying Test

10.2.1 Purpose

As a complement to static load carrying test, dynamic tests provide useful information about the actual behavior of the bridge under traffic. Dynamic load tests are identified in the following circumstances:

- Deterioration of structures, due to material degradation or physical damage.
- Structures which are substandard due to quality of design or construction.
- Non−standard design methods which may cause the designer, building

authorities or other parties to require proof of the concept used.

- Change in occupancy or structural modification which may increase loading.
- Proof of performance following major repairs.

10.2.2 Test Procedures

Dynamic load testing is performed by exciting vibration of the bridge and by measuring its properties after the excitation vibration has ceased. Several methods are available to generate vibration on the bridge, in particular the passage of a loaded truck. This method is often preferred for the dynamic load testing of bridges because it gives, along with reasonably accurate values of the above mentioned quantities, a good approximation of the effect of the actual traffic on the structure. By varying the speed of the truck on the bridge, the full range of traffic speeds can be investigated. Furthermore, this method is easily implemented.

The measurements are taken and recorded by a dynamic data acquisition system, allowing an immediate interpretation of the results during the test. The trucks used for the dynamic excitation of the bridge are usually 3− axle trucks, with a total weight of 250 kN (total mass of 25 metric tons), traveling on the bridge at several speeds. The effect of a deterioration of the pavement is simulated by the introduction of a wood plank on the path of the truck. This induces a strong impact when the trucks pass at mid-span, that represents the effect of a pothole in the pavement, or the irregularity of the surface. The dynamic tests can be performed using the following loadings:

- Norma1traffic, test vehic1e or engine
- Sudden re1ease of deflection by rea1izing a load attached to the structure
- Sinusoida1 exciter, energy input device, breaking a vehic1e or engine on the bridge
- Impact produced by a vehic1e running through the standard bar (in case of highway)
- In general, the tests are most often performed under normal traffic or under the test vehicles.

10.2.3 Recommendations

Dynamic load testing is usually performed on bridges that have also been subjected to static load testing, comparisons can be made between the behavior of a bridge under static and dynamic loading.

By using a truck to induce vibrations on the bridge, it is possible to simulate the effects of pavement deterioration. Bridges that are especially sensitive to pavement deterioration are identified, and this information can then be used in establishing the maintenance program of the structure. Truck speed is shown as having a great importance on the dynamic response of the bridge, especially in the case of a deteriorated riding surface. There is correlation between the span and the natural frequency of a bridge and in a similar manner, there is some correlation between the bridge stiffness observed in a static load test and the dynamic properties of the bridge.

APPENDICES

APPENDIX 1

BIRIDGE INVESTIGATION

Company :.....
Bridge Inspection Form
Bridge Location: , Name of bridge:
Observed by: Supervised by: ……
Type of structure:
Year of construction: Date of inspection: Sheet:……1…./……

I. Super Structure

No.	Element	Unit	Type of Material	Qty of Size	Condition (G,F,P,V)	Proposed Repair/ Comment/ Remark
1	2	3	4	5	6	7
1	Wearing Surface Material	sq.m				
2	Deck/Slab	sq.m				
3	Deteriorated deck/slab	sq.m				
4	Carriageway width	m				
5	Sidewalk width (on each side)	m				
6	Total width of bridge	m				
7	Deck joint/Expansion joint	m				
8	Curb	m				
9	Railing Post	No.				
10	Railing	m				
11	Deck drainage holes	No.				
12	Lamp post	No.				
13	Painting	sq.m				
14	No. of spans	No.				
15	Span length	m				
16	Length of bridge	m				
17	Bearings	No.				
18	Deck underside	sq.m				
19	Girder/Beam (concrete)	No.				
20	Diaphragm/Cross beams (conc.)	No.				
21	Girder/Beam (steel trusses)	No.				
22	Diaphragm/Cross beams (steel)	No.				
23	Pain of beams/trusses structure	sq.m				
24	Cleaning of deck	sq.m				
25	Repair/maintainance (please note)					

Note:

1). In column 6, insert evaluation of existing condition: G = Good, F = Fair, P = Poor, V = Very poor

2). In column 7, insert propose of repair or recommendation to be conducted, and remark (if any)

3). Write some information and note in additional pages

Bridge Inspection Form

Bridge Location:……...…., Name of bridge: ……...

Observed by: ……., Supervised by: …….

Type of structure: ……...

Year of construction: ……..…, Date of inspection: ……, Sheet:…2……./……

II. Sub Structure

No.	Element	Unit	Type of Material	Qty of Size	Condition (G,F,P,V)	Proposed Repair/ Comment/ Remark
1	2	3	4	5	6	7
1	Pier cap No….	m				
2	Pier cap No….	m				
3	Pier cap No….	m				
4	Pier cap No….	m				
5	Column No….	m				
6	Column No….	m				
7	Column No….	m				
8	Column No….	m				
9	Abutment A	m				
10	Abutment B	m				
11	Pile cap/Footing	cu.m				
12	Pile cap/Footing	cu.m				
13	Pile cap/Footing	cu.m				
14	Pile cap/Footing	cu.m				
15	Pile cap/Footing	cu.m				
16	Pile cap/Footing	cu.m				
17	Approach slab at Abutment A	sq.m				
18	Approach slab at Abutment B	sq.m				
19	Wingwall at Abutment A	sq.m				
20	Wingwall at Abutment B	sq.m				
21	Scour protection at pier No ….	cu.m				
22	Scour protection at pier No ….	cu.m				
23	Scour protection at pier No ….	cu.m				
24	Scour protection at pier No ….	cu.m				
25	Slope protection at Abutment A	sq.m				
26	Slope protection at Abutment B	sq.m				
27	River bank protection	sq.m				
28	Other required cleaning					

Note:

1). In column 6, insert evaluation of existing condition: G = Good, F = Fair, P = Poor, V = Very poor

2). In column 7, insert propose of repair or recommendation to be conducted, and remark (if any)

3). Write some information and note in additional page

TABLE1.1

REGULAR INSPECTION

Items	Detail of Items	Quantity	Cycle	Notes
Deck slab	Pavement	100%	Weekly	
	Road marking	100%	Weekly	
	Curb, Railing	100%	Weekly	
	Draining hole	100%	Weekly	
	Lighting system	100%	daily	Check at night
	Traffic signs	100%	daily	
	Expansion joint	100%	Weekly	
Bearing	Bearings	100%	1 year / times	
Drainage System	Bridge drainage system	100%	1 week / times	
	Road drainage system	100%	1 week / times	
Other	Transformers	100%	1 week / times	
	Fire protection system	100%	1 week / times	
	Lighting systems	100%	1 week / times	
	Traffic signs system	100%	1 week / times	
	Railing system	100%	1 day / times	

TABLE 1.2

PERIODIC INSPECTION

Items	Detail of Items	Quantity	Cycle	Notes
Deck slab	Pavement	100%	1 year / times	
	Road marking	100%	1 year / times	
	Curb, Railing	100%	1 year / times	
	Draining hole	100%	1 year / times	
	Lighting system	100%	1 year / times	
	Expansion joint	100%	1 year / times	
Bearing	Bearing	100%	1 year / times	
Bridge structure	Box girder	100%	1 year / times	
	Super T beams	100%	1 year / times	
	I Beam	100%	1 year / times	
	Pier	100%	1 year / times	
	Abutment	100%	1 year / times	
Other	Transformers	100%	3 months / times	
	Fire protection system	100%	1 year / times	
	Lighting systems	100%	1 year / times	
	Traffic signs system	100%	6 months / times	
	Railing system	100%	6 months / times	
	Other traffic safety devices	100%	6 months / times	

TABLE 1.3

UNEXPECTED INSPECTION

Items	Detail of Items	Quantity	Cycle	Notes
Deck slab	Pavement	100%	5 years / times	Check immediately for signs of damage
	Road marking	100%	5 years / times	
	Curb, Railing	100%	5 years / times	
	Draining hole	100%	5 years / times	
	Lighting system	100%	5 years / times	
	Expansion joint	100%	5 years / times	
Bearing	Bearing	100%	2 years / times	
Bridge structure	Box girder	50%	5 years / times	Check immediately for signs of damage
	Super T beams	25%	5 years / times	
	I beam	25%	5 years / times	
	Pier	100%	5 years / times	
	Abutment	50%	5 years / times	
Other	Road surface	100%		Check immediately for signs of damage or require inspection
	Transformers	100%		
	Fire protection system	100%		
	Lighting systems	100%		
	Traffic signs system	100%		
	Railing system	100%		
	Vach Son guides traffic	100%		
	Other traffic safety devices	100%		

TABLE 1.4

SPECIAL INVESTIGATION

Items	Detail of Items	Quantity	Cycle
Bearing	Bearing	100%	Check for abnormal signs
Bridge structure	Box girder	50%	Check when required
	Super T beams	25%	
	I beam	25%	
	Pier	100%	
	Abutment	50%	
Drainage sýtem	Drainage system	100%	Check when required
	Transformers	100%	
	Fire protection system	100%	
	Lighting systems	100%	
	Traffic signs system	100%	
	Railing system	100%	
	Other traffic safety devices	100%	

APPENDIX 2

VEHICLE COUNTING AND VEHICLE CLASSIFICATION

Bridge …….

Station: .....
Direction:.....

Time:

1. Bicycle
2. Hand tractor
3. Motorcycle
4. Tuk Tuk, Jambo
5. Car/ Taxi/Jip
6. Pickup, Van
7. Mini Bus
8. Light Truck
9. Medium Truck & Bus
10. Heavy Truck & Bus
11. Semi-Trailer

Inspector

Leader team

APPENDIX 3

SUMMARY OF MONTHLY TRAFFIC ACCIDENTS

Bridge ……. Station: .....

Location	Number of traffic accidents	The cause (according to the conclusion of the police)			Damages				Note
					Amount of people		Velue (milion kip)		
		by the way	by humans	by the Equipment	Death	Injured	Bridge	Equipment	

Comments and recommendations

APPENDIX 4

Hydrological monitoring and temperature
From month to month

Date	Hour	Water Level	Temperature	Notes	Inspector

APPENDIX 5

INSTRUCTIONS FOR CLASSIFYING STRUCTURE AFTER INSPECTION

5.1 Classification of structural damage

The degree of damage of a component showing its status after being inspected and evaluated by the person carrying out the inspection must fill in the prescribed form, expected to be divided into four basic types stated in the table. 5.1-c.

5.2 Classification of damaged components

The convention of dividing into 4 types of scale of damage is A, B, c, D corresponding to the description in Table 5.1-a

Table 5.1-a

A	B	C	D
There are no significant defects	Small defects, not bigger than 5% of the length or area	Minor defects within 5% of the length or area	Severe disability is greater than 20% of the length or area

The extent and extent of failure can be combined as shown in Table 5.1-b

Table 5.1-b

Level of damage	Damaged scale
1	A
2	B, C or D
3	B, C or D
4	D

5.3 Assessment of priority

Conventional priorities are as follows:

- High priority level (C): The work will be carried out immediately to ensure the safety of public transport as well as the safety of the structure.
- Medium priority (V): The work will be carried out the next year after the inspection year.
- Low priority (T): The work will be carried out after two years from the inspection time.

When considering the priority level, it is also necessary to pay attention to the importance of the structure in the overall structure of the bridge according to the planning order as follows: Air traffic safety light system—> Cable-stayed system, concrete beams, pillars towers, pillars anchoring - »Drainage system, expansion joints, bridge bearings—> Car barrier, railing -» Signs of all kinds.