

Safety Procedure for Bridge Inspection in Sarawak, Malaysia

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Abstract: A study has been made on the scenario of safety procedure of bridge inspection in Sarawak, Malaysia. This project involved the gathering of information regarding the safety precaution taken during the inspection procedures of bridges in Sarawak.

Key Words: Safety, Procedures, Bridge, Inspection, Sarawak

Introduction

Bridges plays a vital role in our Sarawak road network. Undoubtfully, a good road network is essential to support the economic activities as well as the well being of the people. To continually provide such facility, the existing bridges need to be upkeep and properly maintained. However, it cannot be denied that bridges deteriorating more rapidly than it can be maintain, repair, rehabilitated or replaced. Damages normally observed at a bridge structure will eventually impaired if further action is not taken. The number of bridges in Sarawak is so enormous that the Bridge Unit at the state Public Work Department (PWD) Headquarters is unable to inspect the condition of these bridges regularly. There are presently about 800 to 900 bridges on the state and federal roads. Bridge Inspection Manual (1994) However this is not the exact number due to the lack of information at the state PWD Headquarters. In order to ease the burden of the Bridge Unit, it is essential that the inspection team to be set up at the district level under the Road Section. In Sarawak, each PWD district has its own inspection team under the responsibility of the road engineer or if necessary under the district engineer. This is in order to ensure that all bridges within their jurisdiction are structurally safe and fit for its designated use. For safety reasons a qualified personnel should be used in conducting bridge inspections. The team should always comprise of a trained bridge inspector, two labourers and one driver.

Materials and Methods

For the purpose of this study, the data was collected from the government sector such as PWD. The data needed for this project consists of guidelines, manual, case study and specification. Meanwhile for further understanding, an interview was carried out between the researcher and the PWD staffs. The information gather from this method is based on the working and training experience. As an addition, some of the information was also taken from PWD manuals and preliminary report.

The Bridge Inspector: The individual that in charge of the inspection team that has been delegated the responsibilities for bridge inspection, reporting and inventory is called bridge inspector. A bridge inspector is a person that has been chosen by the engineer to acts as the leader. This position requires the bridge inspector to understand all aspects of the bridge engineering such as design, load rating, new construction, various types and cause of bridge deterioration, rehabilitation and maintenance.

In order to carry out the task sufficiently, a bridge inspector should be able to identify the bridge components as well as understanding the material types and damages that usually observed on the bridge structure. However the most important thing is he should be able to differentiate between the major and minor damages. He also must be someone that the engineer can depend on to carry out a task according to the instruction given and record any defects found at the bridge as clearly as possible.

Good judgement is needed during bridge inspection in order to determine the urgency of problems so that the necessary actions can be carried out. A good bridge inspector is someone that will never take unnecessary risks and possess good qualities such as a responsible person, physically fit, good attitude and a qualified person.

Safety During Inspection: Bridge Inspection Manual (1994); Bridge Inspection Technical Committee of Bridge Unit (1995) and Bridge Maintenance (1994). During bridge inspection, it is essential that all necessary safety measure be taken. The safety of each individual and his fellow team members depends upon they own actions. However some fail to observe safe working practices due to bad attitudes and carelessness. Consequently, accident may happen. An accident can be defined as an unexpected, unplanned or undesirable event. This may be partly due to human nature such as ill health, bad temper, frustration, worry, grief or other physical and mental states. Whatever the conditions, accident may have happen even under the safest possible conditions if all the inspection team members do not assume responsibility for his own safety. On another hand, a person who willing to accept responsibility for his own safety can avoid accidents even when working under less than ideal safety conditions. The improper attitude towards safety are too great to be ignore because it will lead to following consequence:

- i. Death: Loss of life and usually cause hardship for the family that left behind.
- ii. Permanent total disability: Any injury that causes
- iii. Permanent partial disability: Any injury that causes the complete loss of use of any member or part of the body function.
- iv. Temporary total disability: Any injury that causes temporarily.
- v. Temporary partial disability

The failures to prevent accidents will costs time and money in terms of lost time on the job, medical insurance costs, workers compensation, disability insurance unemployment compensation and legal fees for court cases.

a. Personnel Safety: Personal protective equipment is not a substitute for engineering controls, work practice or administrative procedures. It should be used in conjunction with these controls to provide for employee safety and health in the work place. Personal protective equipment includes all clothing and other work accessories. The clothing shall be suitable and appropriate for the hazard involved and the duties performed. During inspection, personal protective equipment such as safety glass, hard hats, overall and appropriate footwear should be worn at all times.

To reduce the possibility of failure, all equipment must be properly fitted and maintained in a clean and serviceable condition. Selection of the proper personal protective equipment for a job is important. The inspection team members must understand the equipment's purpose and its limitations. The equipment must not be altered or removed even though the inspection team members may find it uncomfortable. Meanwhile worn or damaged equipment shall not be used and should be discarded. Due to the nature of the work, the inspection team members

b. Traffic Safety: Inspector should be alert and maintain strict safety practices when working near the traffic areas such as on top of the bridge and its road approaches. During inspection, inspector might not notice oncoming traffic and he must assume that the driver may not always be alert or careful. Therefore on arrival at the bridge site, inspector must make sure proper warning signboards are posted or placed a distant away from the bridge approaches warning signboards are put out in order to warn road-users to be cautioned.

Cones, drums or barricades are used to funnel traffic into the appropriate lane and to keep work force within protected area. However, make sure that traffic lanes are closed "gradually" with enough room so that cars can merge with no problems. If necessary, control the traffic with the help of the others team members or close the road for a short time. As a safety precaution a coloured 'warning' jacket should be worn at all times especially on busy roads and narrow bridges.

c. Dangerous Places: Safety programs provide a guide to inspection personnel but do not substitute for good judgement and common sense. It should be recognised that each bridge site is unique and different from one another. During inspection, bridge inspectors may have to go into dangerous places where proper safety precautions may be required. In situation where dangerous conditions may exist, bridge inspectors should always bring an assistant, a rope and safety harness with him.

Proper safety precaution should be employed when entering confined spaces such as the interior of a box girder. Air testing, air changes or the use of air pack may be required due to the knowledge that people have died going into spaces where the air is bad. Apart from inspection work, bridge inspectors should also remain alert all times for animals and insects that may harm them. Bridges provide lots of places where animals and insects can build nests. As a safety precaution, never go down a bridge alone and always have someone else as assistant.

d. Access Safety: Bridge inspection can be dangerous if the job is not done in an orderly manner. If the inspector has no idea where he is going or what he should do, this will not only endanger his life but also cause him to be unable to complete the inspection on time. Ladders should be used for it intended purposes and when necessary only. When such situation arises, the inspector who climbs must have complete control of his emotional. To be safe, there should always be someone holding the ladder for the inspector.

A short ladder should not be used to reach an object that is clearly too high. Any equipment required for inspection should be properly slung from shoulder in carrying cases so as to leave both hands free for climbing the ladders. Before each use, ladders should be inspected for cracked or weak areas. However, the biggest problems with ladders are rungs that break when least expected and bottoms that slip so that the ladders fall.

e. Equipment: Bridge Inspection Manual (1994); Bridge Inspection Technical Committee of Bridge Unit (1995) and Bridge Maintenance (1994). To properly inspect a bridge, a bridge inspector should not only familiarize them self with the different types of tools and equipment but also how to use them. The variation in types of structures to be inspected required the bridge inspector to use a broad range of techniques and equipment. The equipment to be employed will depend on the type inspection as describe above.

In order to carry out an efficient inspection, the equipment should be thoroughly checked before and after each job. In addition, all tools and equipment should be kept in the best possible operating condition. However the bridge inspector can used other equipment not listed below which is useful to them. The following are the basic tools and equipment:

i. Safety Equipment:

- a. Goggles. Goggles are used as eye protection during inspection.
- b. Safety helmet. Safety helmet should be worn at all times during inspection in order to protect the upper part of the head.
- c. Safety belts. Safety belts are used when climbing the structure for safety reasons.
- d. Safety jacket. Safety jacket should be worn at all times during inspection for safety reasons.
- e. Safety boots. Safety boots should be worn at all times during inspection in order to protect the lower part of the body especially the foot.
- f. Overalls. Overalls are used as protective clothing.
- g. Life jacket. Life jacket should be worn when inspecting over waterways.
- h. First-aid kit. First-aid kit is used for treating any injuries due to accidents during inspection.

ii. Measurement Equipment:

- a. 5m and 50m measuring tapes. The measuring tapes are used for measuring short and longer (span length, width, etc) dimensions.
- b. Plum Bob. The plum bob is used to determine vertical alignment of a vertical member or for measuring degree of tilting.
- c. Callipers. The calliper is used for measure the thickness of steel in various bridge elements and connections.

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- d. Crack scale. The crack scale is used for measuring crack width.
- e. Spirit Level. The spirit level is used for measuring perpendicular distance to any structural member.
- f. Ranging rods. The ranging rods are used for probing and measuring scour under culvert, piers and abutments.
- g. Deep sounding apparatus. The deep sounding apparatus is used for measuring river depth, local scour depth and tilt of pier.

iii. Access Equipment:

- a. Flashlights. Flashlight is useful for checking into darkened corners that are inaccessible.
- b. Shoulder bag. Shoulder bag is used for holding all the necessary equipment.
- c. Binoculars. Binoculars are used when there is no access to the structure.
- d. Parang. Parang is used for clearing bushes, weeds, branches, etc.
- e. Ladder. Ladders provide access to locations not easily accessible during inspection.
- f. Tapping hammer. The tapping hammer is used for sounding bridge elements for structural continuity.
- g. Ropes and harness. Ropes and harness is used for tying and climbing.
- h. Boats or inflatable dinghy. Boats or inflatable dinghy is used as a means of reaching various bridge components.

iv. Recording Equipment:

- a. Camera (preferably with flash and zoom lens). The camera is used for taking photographs of defect or damage to the structures.
- b. Clipboard. A clipboard is used to record the results of inspection observations.
- c. Blackboard. The blackboard is used for recording the bridge number or name.
- d. Writing paper. Writing paper is used for drawing sketches.
- e. Pencils, pens and markers. Pencils, pens and marker are used for writing and marking.

Conclusion

As a whole, in Sarawak, it was found that there are safety precaution or procedures followed by the inspectors during the bridge inspection and maintenance and it is always done systematically in accordance to the manual.

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