

VISUAL INSPECTION OF CONCRETE BRIDGE

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ABSTRACT

Generally bridges are more exposed to severe environmental conditions than any other structures which deteriorate bridges during their serviceable life and reduce its serviceable life period. This continuous process of deterioration could lead to failure of the bridge. This induces the timely inspection or assessment of the bridge. Also most of bridges are designed for slow speed, limited traffic volume than its current utilisation. Since the environmental conditions and deterioration process goes on in its serviceable life this affects the performance of bridge. All these factors induce the need of inspection of bridge. This paper focus on the visual inspection of the concrete bridge, tools required, and things we have to visually inspect during inspection of a concrete bridge.

INTRODUCTION

Bridges are very important infrastructure and having massive investment. During last fifty years large numbers of reinforced and concrete bridges are built and also day by day there is increase in the number of bridges. These bridges have high initial investment involved in its construction so it is essential that these bridges should be serviceable for the maximum period of life and for this there should be its proper assessment and repair are very important in this,

NEED OF VISUAL INSPECTION

Visual inspection is the very first stage in the investigation of concrete bridge. This is very important stage since we get the distresses in the bridge with their proper location on the structure. Visual inspection is also helpful in deciding the places for further investigation which involves non-destructive testing and destructive testing. Visual inspect provides important information to the inspector. Observations during the inspection cover Visual features which are related to structural serviceability, workmanship, material deterioration. The inspecting engineer should be able to differentiate between the various signs of distresses which could be encountered during the inspection. These sign includes cracks, sings of corrosion, leakage or seepage marks, weathering, disintegration, spalling, staining, surface blemishes, colour change, pop-outs and lack of uniformity. Apart from this other detailed information can also be collected related to the bridge to be inspected during the time of inspection. From all these information we can easily formulate the general condition of the bridge and from this we can suggest repair methods if it is in repairable condition or to demolish the bridge if it is in non repairable condition.

TOOLS AND EQUIPMENT FOR VISUAL INSPECTION

An engineer inspecting the bridge should carry some basic and most useful tools for noting readings or observations. While carrying out a visual survey an engineer must be well equipped with tools and record books. It involve some of accessories such as measuring tapes, markers, rulers, binoculars, telescopes, borescopes and endoscopes or the more expensive fibre scopes may be useful where access is difficult. For measuring crack width; crack width microscope or a crack width gauge are very much useful, for a close examination of any distress a magnifying glass or portable microscope are very much helpful. A good camera is also useful for collection of photographic evidences with distresses which could be helpful for further study. For this the camera should be of micro lenses, necessary zooming power and other accessories, as polarized filters, camera stand if required on site. Before going for visual inspection of bridge

we should also have relevant drawings of bridge that will be helpful for deciding approach for the visual inspection.

GENERAL PROCEDURE OF VISUAL INSPECTION:

Before going on site for visual inspection of bridge, we should study all relevant structural drawings. With this all available documents and past inspection and repair records should also be studied. Method of construction and dates of constructions are also helpful in the further study.

The practice of inspection should be carried out systematically covering all the defects present in the bridge, the use of the structure in the past and now, the conditions of adjacent concrete structures having nearby same age and environmental conditions present thereby. All of the defects must be identified with their causes. The presence and extent of defects must be clearly recognized. All these observations must be recorded in the record book. For example if an inspector observes a crack then he must check if it is on structural member or non structural member with this he should also check the depth of penetration of crack and the probable cause of crack. In the visual inspection two similar members are also compared visually for getting better idea of distresses and their probable cause. This is also important in preliminary visual inspection of the concrete bridge.

The whole system of visual inspection is not limited to the surface it includes examination of bridge bearings, drainage channels, expansion joints, spouts, hand rails or parapet walls, approaches, wing walls etc. Any kind of misuse of the structure can also be found when compared to the original drawing which is designed for a particular purpose.

In the visual inspection we may also have to look for the environmental condition to which the bridge or its components are exposed. For example the frequent wetting and drying of pier of bridge at the splash zone with temperature variation could also induce the deterioration of the concrete. Settlement of surrounding soil has also to be noted during the visual inspection. Freezing and thawing effect also need to be noted during the visual inspection which is result of environmental conditions.

During the visual inspection engineer has to observe and note segregation or excessive bleeding at the joints of shutters which may reflect problems with concrete mix, whereas honeycombing could be an indication of a low workmanship during construction. Excessive deflection could also be the result of structural adequacy. Deterioration of material is also indicated by the surface cracking and spalling of the concrete. After closely examining cracks and their pattern inspector can predict the cause of cracking in the concrete. During the visual inspection observation of texture of concrete surface and variations in the colour of concrete could be a useful guide to ensure the uniformity of concrete. Change in colour of concrete indicates the extent of fire damage.

Observations to be noted during the Visual Inspection:

The main objective of carrying out visual investigation is to observe and record all the distresses with their locations, supported by sketches, photographic evidences and drawings. The visual inspection includes inspection of

- i. Identifying the visible structural damages, such as cracks in the concrete or spalling, and quality of construction.
- ii. Documentation of existing condition of the bridge with photographic evidences at key locations.
- iii. Observations of the condition of soil, its settlement and the condition of foundation.
- iv. Checking accuracy of the original drawings or if in case no drawings are available then preparation of as build drawings.
- v. Identification of major alterations not shown on the original construction documents.
- vi. Identification of non-structural but potentially falling hazards, including partitions, curtain Walls, ceilings, parapets, fixtures, and other non-structural elements.

After all this data collection and visual inspection of damages and distresses on the bridge we can easily predict the condition of bridge and we can categorise them easily based on the severity of attention for repair.

APPLICATIONS OF VISUAL INSPECTION:

The process of visual inspection is for the existing structures, presence of some distress that requiring further investigation is primarily indicated by visual inspection, and this visual inspection is most important stage in the routine repair and maintenance. Visual inspection also provides the basis for judgements related to access and safety requirements when selecting test methods and test locations. It also defines the need of further detailed non destructive and destructive testing.

Visual assessment of bridge is only qualitative assessment of the bridge. Visual inspection provides an initial idea of the condition of the bridge which helps in the preparation of the testing programme if the structure needs to be inspected in detail. Visual inspection could provide enough information regarding the condition of bridge so that we can suggest small repair works also just from the reports and photographic evidences of visual inspection.

CONCLUSION

Visual inspection is very primitive and basic step of structural assessment of bridge. Visual inspection provides base for the further detailed evaluation of the structure using non destructive and destructive testing. The study also shows some of the lacunas and shortfalls in the accuracy and reliability of the results of visual inspection. The process of visual inspection of bridge is fully depend on the experience of engineer and hence may be vary if same bridge is inspected by two different engineers. Visual inspection should be carried out by technical person only having enough of experience in same field.

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