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5.3 AUDIBLE INSPECTIONS

5.3.1 Introduction

The two most common types of audible inspections are “Chain Dragging” and “Hammer Sounding.” Chain Dragging is normally used on large concrete surface areas, such as bridge decks, while Hammer Sounding can be used on a number of materials in random locations. Both methods typically rely on the experience of the inspector to differentiate the relative sounds of similar materials.

The Chain Dragging is a simple method allowing the inspector to drag several lengths of heavy chain over a concrete surface. The chains contact the concrete surface and produce an audible indication of delaminated areas, much like tapping with a hammer. These areas are marked and mapped for further evaluation.

Hammer Sounding can be an extension of visual inspection by incorporating an additional sense, hearing. Hammer Sounding can aid in detecting impending spalls and existing delaminations, which when struck with a hammer, give off a dull sound or loud pop as opposed to the sharp ring of hard concrete without any internal discontinuities. This sound is easily noted when progressing from solid areas to delaminated areas. Similarly, hammer sounding of bolts and rivets can also serve as an aid to detecting loose fasteners. Bolts and rivets should be struck sideways as well as on their ends. In the inspection of timber elements, hammer sounding is used to detect the presence of significant decay. When a seriously decayed member is struck with the hammer, a dull or hollow sound is produced. However, when suspected decay is encountered, it must be verified by other means such as boring or coring. In general, hammer sounding can be satisfactorily accomplished using a relatively light hammer. Refer to Figure 5.3.1-1 for a view of an inspector hammer sounding a concrete abutment.

The audible inspection procedure for bridge decks is covered in American Society for Testing and Materials (ASTM) D4580-86 (1997) “Standard Practice for Measuring Delaminations in Concrete Bridge Decks by Sounding.”



Figure 5.3.1-1: Inspector Hammer Sounding a Bridge Abutment.

5.3.2 Applications

Chain Dragging is most commonly used as an aid in inspecting concrete bridge decks. However, it can be used on other horizontal surfaces. Because several chains can be incorporated into the drag, large areas can be quickly examined. This method is most efficiently conducted using a two-person team.

Hammer Sounding is most commonly used as an aid in inspecting concrete, but can also be used on metal fasteners and timber members. This technique works well on both horizontal and vertical surfaces. Large areas can be inspected in a reasonable amount of time only if spacing is random; however, the inspector should take care to thoroughly cover the entire surface of the element since the hammer only provides information on the local area under the point of impact. A single inspector can conduct this method of investigation, but access equipment may be needed.

Both techniques require minimal training; however, the inspector should be familiar with the tonal differences between sound and delaminated concrete.

5.3.3 Limitations

Chain dragging is limited to locating areas of delamination in exposed concrete bridge decks. It is not effective on asphalt-overlaid decks, since there is no difference in sounds between delaminated concrete and debonded overlays. Hammer sounding is limited to areas visually identified for possible deterioration. Deterioration may include delamination and impending spalls in exposed concrete; rotting timber; and loosened fasteners. Although chain dragging and hammer sounding are inexpensive, it can be physically demanding and time consuming. Likewise, traffic control is often needed for bridge decks. Furthermore, data recording must be done manually using field sketches and photographs.



Although the use of chain dragging and hammer sounding is relatively simple, the extent of the noted delamination is subject to the inspector's interpretation of the tonal differences in the produced sound. Likewise, areas with high levels of background noise, such as large traffic volume or adjacent airports, industry, or construction sites will make the tonal differences of the produced sounds difficult to distinguish. While the horizontal extents of a defect may be detected using chain-dragging or hammer sounding, the depth of the noted defect cannot be determined from these methods.