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16. ABSTRACT

The California Division of Highways acquired a soniscope of Canadian manufacture in 1952. It has been used intermittently since then in condition surveys of timber and concrete structures. A few examples of its use will be described.

The soniscope has been found to be useful in detecting hidden decay in wood bridge piles and timbers. Small volumes of decayed wood cause a substantial drop in pulse velocity.

Since virtually the entire member can be scanned rapidly at close intervals, pulse velocity measurements permit a more thorough survey than is practical by conventional means of boring and sounding. A disadvantage is that a hidden circumferential shake in a pile may also produce a drop in pulse velocity. As a rule, subsequent boring is necessary to establish definitely the presence of decay in piles.

The pulse velocity of concrete in sound condition may vary within the range of 12,000 to 15,000 feet per second. The interpretation of soniscope readings of old concrete is seriously handicapped unless a good value for the particular concrete in a sound condition can be established. One solution lies in assuming that the highest velocities found in protected portions of the structure represent sound concrete. In the absence of good information, velocities above 12,000 feet per second may or may not be indicative of deterioration.

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California Division of Highways

Informal report for

Highway Research Board Symposium

to be presented at

37th Annual Meeting - January 6-10, 1958

By

Bailey Tremper
Supervising Materials and Research Engineer

(HRB. BULL. 206 p. 28)

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If the velocity is lower than about 10,000 feet per second, it may be assumed that deterioration has occurred, but in such cases there is usually visible evidence of the condition. The value of the soniscope result then lies in the possibility of assigning a numerical rating to express the degree of deterioration. Unless the pulse velocity of the concrete when it was sound is known, the assumed rating may not be suitable for comparison with other concrete. Nevertheless, without knowledge of previous pulse velocity, information of value may be obtained if successive readings are taken over a period of years. Such data may indicate a trend in rate of deterioration from which estimates of useful life may be made.

Deterioration of concrete due to alkali-aggregate reaction has been studied with the soniscope on several bridges 25 to 30 years in age. The general experience has been that pulse velocities vary over considerable range within short distances, a result that is undoubtedly due to a random distribution of cracks of varying width and depth. Three successive annual readings have resulted in considerable scatter of results in velocities measured at presumably identical points. It has been impossible to forecast the probable trend of future deterioration in concrete of this age based upon three annual surveys in a span of only two years.

The use of the soniscope to estimate the depth of visible cracks in structures affected by alkali-aggregate reaction is of interest. For example, a large crack in a bridge strut had a surface width of 1/2-inch to 3/4-inch in 1953 and an indicated depth of 6 inches. Two years later the width had increased to 1-1/2 inches and the depth was estimated to be 24 inches. Demolishment of this structure because of its interference with freeway construction has prevented measurements at later dates.

The soniscope may prove to be of value in rating the deterioration of a concrete bridge over sea water where moderate sulfate attack is evident. The structure in question is over 25 years old and only one series of measurements has been made to date. The general average of pulse velocity in this concrete is about 13,000 feet per second, but at a few locations, in uncracked concrete, pulse velocities below 11,000 feet have been measured. Until succeeding tests are made over a period of years, it will be difficult to determine in what degree pulse velocity is of value in rating the present condition or the probable useful life of the structure.

A reinforced concrete bridge deck with frequent cracking visible on the surface was surveyed with the soniscope primarily because the lower side of the deck is difficult of access for visual inspection. Some difficulty was experienced in the interpretation of pulse velocities because of the presence of closely spaced reinforcing steel. However when diagonal paths were selected, low pulse velocities were believed to be reliable indications that many of the cracks visible on the surface did in fact extend the full depth of the slab.

Systematic soniscope surveys of concrete pavements have not been conducted in California. To do so would be costly because of the widespread distribution of pavements within the state and difficulties caused by interference of traffic. At the present time, it appears that distress in California pavements is the result of traffic loads, not deterioration of the concrete itself. Evidence of distress usually appears in the form of pumping, faulting or locallized cracking. These defects can be measured and recorded by means other than soniscope measurements. Although pulse velocities of pavements have not been measured extensively in California, it is not intended to imply that such measurements are regarded as being without value.

In co-operation with Southern California Edison Company and the Portland Cement Association, comparative tests for pulse velocity have been made with three soniscopes each operated by separate crews. Excellent agreement from a practical standpoint was found.

There is a need for a reliable calibration bar. It would serve a useful purpose in training soniscope operators. It would improve the accuracy of readings taken over short paths. It would provide a base for adjusting velocity measurements made several years apart, possibly with different instruments.

Periodic adjustments or the replacement of parts of the soniscope may be required. For this reason it is desirable that the operator be well trained in electronics or that he have ready access to the services of a competent technician.