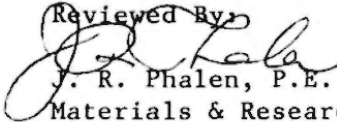



MATERIALS & RESEARCH DIVISION

Reviewed By:

J. R. Phalen, P.E.
Materials & Research
Engineer



Prepared By: 
Peter C. Winters
May 23, 1988
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RESEARCH UPDATE

NUMBER U88-12

FIELD VERIFICATION OF THERMOGRAPHIC SURVEY RESULTS

REFERENCE:

Work Plan No. 87-R-2

HISTORY:

The cost for rehabilitation of Vermont's older concrete bridge decks represents a significant amount of taxpayer dollars. It is essential to protect the public's investment through timely rehabilitation of aging bridges, thus extending their useful life. In Vermont it has been found that removal of delaminated concrete, repair of deteriorated reinforcing steel and application of a waterproof membrane is a cost effective rehabilitation technique.* This process requires accurate information on the quantity of delaminated concrete one to two years prior to removal of the pavement. This lead time allows the planning/design/financial management process to occur in an orderly and effective manner.

One of the methods proposed to determine the amount of delamination in advance is Infra-Red Thermography (IRT). The process is available commercially from two or more contractors. In 1986 it was known that Bridge No. 58S on Interstate 89 in the Town of Richmond would be rehabilitated under contract IR 089-2(11) during the 1987-88 construction season. A contract was let to Donohue & Associates Inc., Engineers and Architects of Waukesha, Wisconsin for thermographic survey of several bridges including 58S on I89. Donohue completed the survey of the southbound travel lane of this structure on October 1, 1986, and their report was submitted in November 1986. Two hundred and one (201) square feet of delamination was found which represented 2.4% of the 8250 sq. ft. area checked. There were 129 separate delaminations.

STATUS:

In May of 1988 the bituminous concrete pavement was removed revealing many visible spalls and delaminations. A detailed survey using chain drag and hammer was made which identified 448 sq. ft. of delamination in 260 locations. Of these locations 90+% were visibly apparent. The delaminations found represented 5.4% of the 8250 sq. ft. surveyed. Donohue's report provided a plot of the delaminations found. The audible delaminations were plotted, transferred to clear plastic and overlaid atop Donohue's plot. Due, at least partially, to the continued corrosion in the intervening 20 months, there were twice as many delaminations found with chain drag and hammer as were found thermographically. Most of these delaminations were 6/8" to 1-1/2" in depth.

Field Verification of Thermographic Survey Results

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Copper-copper sulphate 1/2-cell potential readings were taken on this deck. Fifty four percent of the deck had readings greater than -0.35 V. Thirty percent of the deck had readings greater than -0.40 V.

Fifteen cores were taken in this deck by VT AOT personnel. Three were taken in areas where soundings had indicated delaminations existed. All three confirmed the delaminations. The others were taken in areas where potential readings were greater than -0.40 V. Removal of the cores was accomplished with a hammer and chisel. None of the remaining 12 cores evidenced significant visible corrosion on the recovered reinforcing steel and only one core revealed delamination. The depth of the top mat of reinforcing steel varied from 6/8" to 1-7/16".

CONCLUSION

From the overlay of the plotted locations it appears that 92% of the delaminations found by thermography were also found by manual sounding. Many of the delaminations found by IRT have enlarged. It is assumed that some portion of the "new" delaminations found by sounding have developed in the two years since the Donohue survey was completed. Due to the two year delay, the verification of the accuracy of the IRT method was not possible in this study.

FOLLOW UP

Similar comparisons are currently in progress on I-91 bridges in Springfield and Windsor, Vermont. As more data is gathered more definitive conclusions may become possible.

* U87-4; U87-8; U88-11

DIST: A, B, C, D, E