TECHSUMMARY May 2018

State Project No. 30001440 / LTRC Project No. 14-1C

Evaluation of Dowel Bar Alignment and Effect on Long-term Performance of Jointed Pavement

INTRODUCTION

Dowel bars are the current preferred method for providing load transfer for jointed plain concrete pavements (JPCP). For proper load transfer to occur, the dowels must be placed properly in the middle of the slab, horizontal to the grade, and in the direction of traffic flow. DOTD has rarely questioned dowel bar alignment due to the inability to measure said dowel bars and due to the non-materialization of dowel bar alignment related pavement distress.

OBJECTIVE

The objective of this research was to utilize the MIT-SCAN2-BT as a non-destructive dowel bar alignment measuring device to determine the effect of dowel bar alignment and its effects on JPCP.

SCOPE

To meet the objectives of this project, eight JPCP were evaluated in the 0-10-year age range, five JPCP were evaluated in the 10-20-year age range, and four JPCP were evaluated in the 20+ year age range to determine the effects of dowel bar misalignment on pavement performance indicators such as faulting, load transfer, and ride quality. For each project, about five percent of the joints were tested, (about 15 joints per mile). The joints were tested in groups of five at 0.3, 0.3, and 0.4 mile increments. Additionally, every joint on the newly constructed I-49 corridor from LA1 to the Arkansas state line was measured.

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METHODOLOGY

The MIT-SCAN2-BT test method consists of placing the fiberglass track on the pavement and centering it over the joint using the marked track center. The MIT-SCAN2-BT is then pulled at an even pace over the length of the track recording the location of each dowel bar. The device then sends the data via a wireless Bluetooth connection to a handheld computer where an image of the dowel bar locations can be minimally processed and viewed. The file is named and stored for future processing. The field files are then transferred to a desktop computer upon returning to the office and processed further to better identify potential misalignment.

CONCLUSIONS

The results of this project warrant the following conclusions. The MIT-SCAN2-BT device is accurate, but the flexible track is fragile and will need repairs in extended testing scenarios. Testing rates range from 32-45 joints per hour for full width pavement sections in a closed road condition. The pavement surface must be free of debris and measurements should be conducted prior to application of raised pavement markers.

Figure 1
MIT-SCAN2-BT

Pavements constructed over the past 30 years that contain dowel bars in the joint detail are performing well with regards to measurable faulting. Measured joints were constructed with no horizontal skew, vertical translation, vertical tilt, or horizontal translation. The results indicated that the pavement sections should not exhibit joint lock due to dowel skew or tilt.

The MIT-SCAN2-BT device is very capable of locating and measuring dowel bars and assemblies. It is also capable of determining whether or not a bar is missing, or if the load transfer device is something other than a dowel bar. The results also indicate that the effect of longitudinally translated dowel bars is negligible. Acceptable long-term performance was observed in joints with less than 4 in. of embedment and some joints with 2.5 to 3 in. of embedment. The Department's current dowel placement specifications lead to acceptable long-term joint performance.

RECOMMENDATIONS

The following recommendations are put forth as a result of this study. In general, concerning longitudinal translation, a dowel bar embedment length of 4 in. is sufficient to provide load transfer, with several joints exhibiting good performance at 15+ years of age with 2.5-3 in. of embedment. The authors do not recommend implementing the use of the MIT-SCAN-BT for quality control or quality assurance purposes due to the findings of this study. The authors do not recommend changing the current dowel placement specifications.

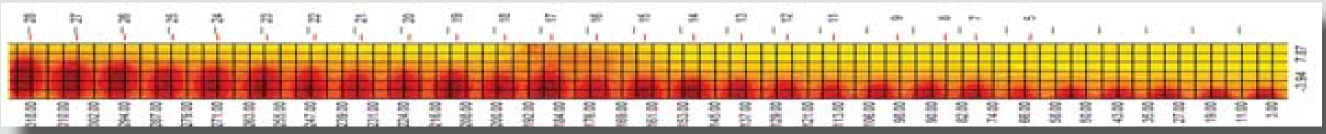

Figure 2
Contour plot exhibiting a skewed sawcut