IMPROVING RIGID PAVEMENT SMOOTHNESS USING POLYLEVEL
Project #: RES2016-18

This study is conducted by the University of Tennessee at Chattanooga (UTC) on behalf of the Tennessee Department of Transportation (TDOT) to analyze the smoothness improvement on rigid pavements lifted using polyurethane material (PolyLEVEL).

INTRODUCTION

Concrete pavement slab drop-off is among major problems that are encountered in concrete pavements after years of service. Besides resulting in poor load transfer between slabs and eventually needing dowel retrofit and concrete slabs correction, it poses a safety hazard to motorists, more especially motor bikes. The conventional method to rectify this problem has been lifting the slabs using injected asphalt, concrete mud jacking or slab grinding. When the slabs distresses are very extensive, full depth slab repair (slab replacement) or asphalt overlay are recommended. These methods require long operational and lane closure times and sometimes even longer time for concrete to cure before the road can be opened to traffic. In recent years, a different concrete slab lifting technique, PolyLEVEL, has been used to level concrete pavement slabs. PolyLEVEL and a similar product called URETEK, are high-density compounds that use high-density polyurethane two part expanding foam to raise settled concrete in residential and commercial applications. PolyLEVEL has primarily been used in residential and commercial applications to lift sidewalks, driveways, and office floors. It has eventually found use in leveling of concrete pavement slabs. Several DOT's and the US Air Force have used PolyLEVEL/URETEK to lift pavement and airport slabs with success. The advantages of PolyLEVEL over concrete mud jacking or asphalt injection include:

- Less weight (4 – 6 pounds per cubic foot) of PolyLEVEL compared to 120 – 140 pounds per cubic foot for other materials.
- Exerts less additional load on the soil.
- PolyLEVEL can be injected and cures in shorter times with fewer lane closures, and the pavement can be opened for use within a few hours after installation.
- Densifies the ground under the slab as PolyLEVEL lifts the slab. It provides dual benefits.
- According to Bob Waldron, PolyLEVEL product line manager, the strength of PolyLEVEL ranges between 11,000 to 15,000 pounds per square foot.
- Its installation cost per sq. yd. is lower than mud jacking or slab replacement.

This study will evaluate the dependability of the material immediately after installation and in the long term. Long-term performance monitoring of the pavements will be evaluated using pavement roughness index (PRI) and international roughness index (IRI) measurements and visual inspections every 6 months. In addition, the cost of using PolyLEVEL, asphalt and mud jacking will be compared, and computational modeling of PolyLEVEL material to evaluate its response to traffic loading will be performed.

SYNOPSIS OF THE PROBLEM BEING RESEARCHED

This study is performed to evaluate the effectiveness and long-term performance of PolyLEVEL material as used for improvement of concrete pavements smoothness. The project includes:

- Extensive literature review on PolyLEVEL materials,
- Identification and selection of pavement sections to be monitored,

- Development and distribution of a questionnaire to evaluate the usage of PolyLEVEL or similar material among DOTs in US,
- Collection of the pavement condition survey data on the selected pavement sections containing PolyLEVEL application by utilizing TDOT pavement condition survey vehicle for data collection and TDOT traffic management team for traffic control when performing visual inspection on interstates.
- Evaluation of possible relationships between traffic loading and PolyLEVEL performance by using both the condition and traffic data from the sections,
- Carry out computational modeling of PolyLEVEL materials to evaluate its response to pavement loading.
- Submit a comprehensive report to TDOT with measured performance improvement of pavements with PolyLEVEL material.

Project Objectives

The objectives of this proposed study are to:

1) Evaluate the effectiveness of PolyLEVEL for slab lifting to improve pavement smoothness.
2) Monitor the condition of the selected pavement sections with PolyLEVEL to evaluate the performance of the materials.
3) With the help of TDOT Region 2, collect IRI and traffic data on the selected pavements to evaluate the performance of sections with PolyLEVEL.
4) Perform visual inspection for cracks and similar distresses that may have resulted from the PolyLEVEL installation on the slabs.
5) Use linear and/or nonlinear predictive models to estimate pavement condition deterioration in comparison to measured condition.
6) Determine the relationship between traffic and performance of PolyLEVEL (if any).
7) Perform computational modeling of PolyLEVEL material.
8) Submit quarterly and final reports to TDOT

PROJECT PROGRESS

Six sites on I-24 and I-75 in Chattanooga TN (TDOT Region 2) are being monitored after being levelled using PolyLEVEL material. Figure 1 below shows the installation of poly level on I-24 Westbound mile marker 179.5 to 178.2. Some slabs here were raised from 1.25 in to less than o.25 in.

Figure 1. Left: Before PolyLEVEL application, right after PolyLEVEL application

Figure 2 Drilling

Figure 3 PolyLEVEL Injection

Figures 2 and 3 shows hole-drilling on rigid pavement and injection of PolyLEVEL through the drilled holes. Holes are sealed after the completion of PolyLEVEL injection.

PRI data collection is performed by TDOT Region 2 and UTC uses RoadRoid App to collect IRI data on the segments. The is not direct correlation between PRI and IRI but the thresholds recommended for each method will be used to determine whether the segments are performing within acceptable limits or not. Figure 4 shows GPS pictures taken by RoadRoid app after data collection.

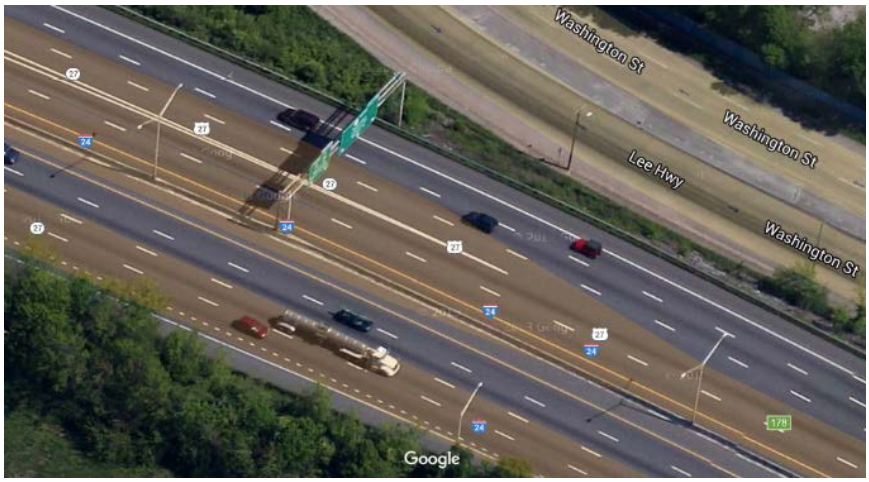

Figure 4. GPS picture from RoadRoid database after data collection