Editor's Corner

ISSN 1997-1400 Int. J. Pavement Res. Technol. 8(2)

Updates on Two TxDOT's Research Implementation Projects

Dar Hao Chen
Professor, College of Civil Engineering & Architecture, China Three Gorges University, University Avenue, 443002, Yichang, Hubei Province, P.R. China.
Texas Department of Transportation, 4203 Bull Creek #39, Austin, TX 78731, USA
E-mail: darhao2008@gmail.com

This short note illustrates two technologies that are currently being implemented by the Texas Department of Transportation (TxDOT) to address challenges on (1) characterizing the pavement structural condition with Total Pavement Acceptance Device (TPAD) (2) Implementing Full Depth Reclamation (FDR) to Repair Road Damaged in the Energy Sector. Knowledge of the existing pavement condition is vital to the success of any rehabilitation project. A quantitative method is required to determine the severity of the cracks/ joints to determine the potential for reflective cracking. However, in reality it is difficult or sometimes impossible to determine the existing pavement conditions without the proper tools. Continuous deflection profiles provide 100 % coverage and permit pavement engineers to evaluate the entire project, locating sections where more extensive repairs are needed.

Total Pavement Acceptance Device (TPAD)

A new and multifunction pavement testing device, Total Pavement Acceptance Device (TPAD), has been acquired by the TxDOT. The predecessor of the TPAD is the Rolling Dynamic Deflectometer (RDD). Research results have demonstrated that continuous deflection was a good indicator for reflective cracking potential. RDD continuous deflection profiles can be more effectively used when combined with other nondestructive testing data such as pavement layer thicknesses and subsurface conditions from ground penetrating radar (GPR), pavement right-of-way and surface conditions from a video camera, pavement surface temperatures, and precise distance measurements. The newly acquired TPAD has the capabilities of the collecting the following data simultaneously: RDD, GPR, digital video of surface and right-of-way conditions, high-precision GPS, a pavement surface temperature measurement, and a distance measurement instrument (DMI), as shown in Fig. 1.

TxDOT have utilized RDD on selecting optimum rehabilitation strategies as the extent and degree of reflective cracking heavily depends on the underlying slab stability (vertical movements under load). For example, a TxDOT District staff has observed accelerated deterioration and poor ride quality on IH35 in the last two years, prompting a search for rehab strategies. The existing IH35 section consists of 75 mm of HMA and 250 mm of CRCP. The original CRCP was built 45 years ago. The HMA was placed approximately 10 years ago. Full depth repairs have been used through the years to fix localized failures. However, pumping and localized failures continue to occur, as shown in Fig. 2(b). The

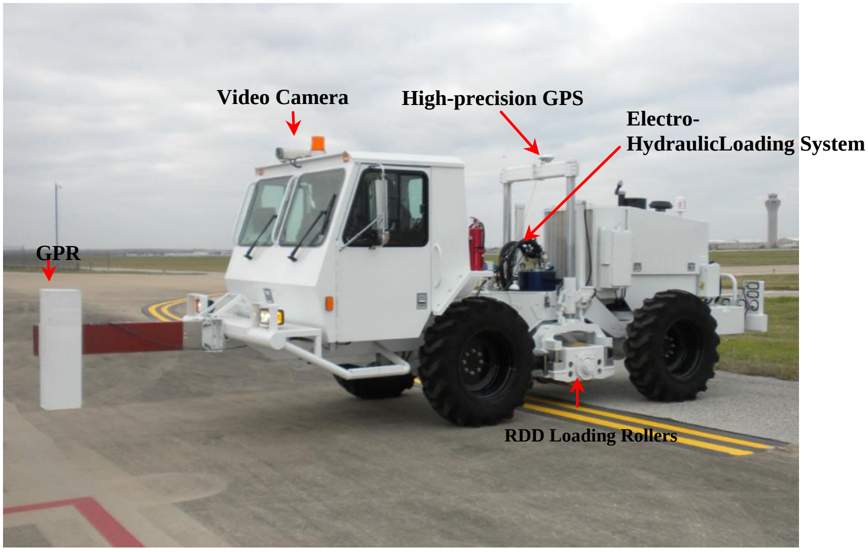

Fig. 1 Total Pavement Acceptance Device (TPAD).

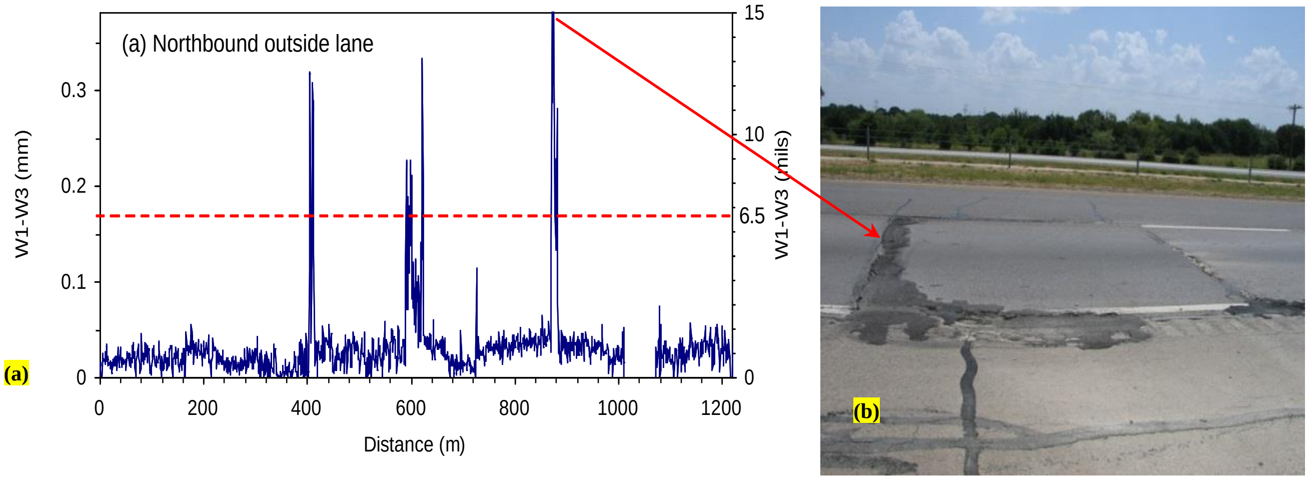

Fig. 2 IH35 near Fort Worth, TX: (a) RDD W1-W3 Deflection Profile of Southbound Outside Lane and (b) Photograph of Pavement Surface Condition At Area with W1-W3 Deflection >10 mils.

ride quality is very poor, with average IRI exceeding 200 in/mile (3.16 m/km). District personnel have expressed a desire to improve the ride quality and to rehab the section by overlaying it. So the RDD was utilized to identify the weak spots that need to be treated separately before using an overlay to improve ride quality. Otherwise, the untreated weak spots will fail prematurely. Fig. 2(a) shows continuous W1-W3 deflection profiles with a few locations exceeding 10 mils (0.25 mm). W1-W3 denotes the difference in deflection between sensors 1 and 3. In general, higher W1-W3 values can be interpreted as poorer load transfer. Also, larger W1-W3 corresponds to large W1. It was found that W1-W3 was a good indicator for reflective cracking potential. Fig. 2(b) shows the surface distress conditions at a location where deflection exceeds 10 mils (0.25 mm). A recommendation was provided to the District to repair the locations where W1-W3 deflections exceed 6.5 mils (0.165 mm), and then overlay the entire section with HMA. RDD data provided quantifiable and defensive data for selecting the weak spots for separate treatments before the overlay to minimize premature failures.

Implementing Full Depth Reclamation (FDR) to Repair Road Damaged in the Energy Sector

TxDOT now faces major pavement rehabilitation and funding problems with the roadways all over Texas which have been severely damaged by energy development activities. These are often low volume roadways with thin weak pavements with often marginal materials which were never designed to carry these large numbers of very heavy trucks. Rehabilitating the roadways in the energy sector is one of TxDOT's top priority activities and is also a high profile activity attracting a lot of legislative oversight. Many districts including Corpus Christi, Laredo, San Antonio, San Angelo, Odessa and several others have hundreds of miles of totally destroyed roadways. Adding to this problem is that many of these roadways are often in remote areas where there is no access to quality paving materials. In addition, there is no detour and the roadway must be opened at end of work day. The FDR offers great potential to stabilize roadways in-place making use of existing materials and determining the optimal stabilizing agent to make these roadways structurally adequate. Although TxDOT has utilized the FDR for several decades, the performance results vary. Some FDR projects last over 10 years without any distress. For example, Beaumont District has used emulsion FDR in 2004 to rehabSH87 and the pavement condition is excellent as evident in Fig. 3 with IRI in the range of 80 in/mile (1.26 m/km). The same district also used emulsion FDR in 2004 to rehab the frontage road of IH35. The premature failure occurred within one

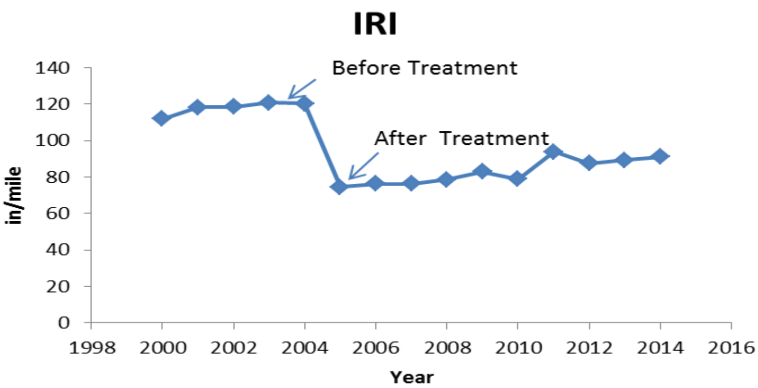

Fig. 3 Successful FDR Project That Maintain Low IRI for the Last 10 Years.

month of trafficking. There was a recent premature failure (deep rutting) due to insufficient early strength to handle heavy loads from oil field truck traffic. District indicated that it would cost additional $2 million dollars for traffic control to allow FDR section to cure for 1 week. It means the pavement section would need traffic control personal at the job site for 24/7 during the 3-month construction period. The maximum FWD deflections (normalized to 9000 lb) in the deep rutting area are in the range of 50 mils (1.27 mm). Base on the empirical experience, it needs the maximum deflection in the range of 20 mils (0.508 mm) to provide sufficient structural capacity to handle such heavy truck traffic load. It means the constructed roadway has deflection 2.5 times higher than the desirable.

Texas is a big state with regions of different climates and local materials. Districts in wet regions expressed concerns for cement only FDR because frequent rains disrupt constructions before FDR being compacted to shape. Emulsion FDR has been successful for several projects in wet regions but premature failures do occur from time to time. Districts need guidelines on how to take existing roadways thru the FDR process to make long lasting structurally adequate roadways able to carry overloaded vehicles. Correctly applying the FDR techniques to these roadways can save TxDOT many millions of dollars. Recently, over $500 million dollars were appropriated for conducting these repairs and more money is urgently needed. It is estimated that applying these FDR techniques will generate a 20% cost saving over traditional methods in terms of reduced haul distances and improved pavement life. Best practices and guidelines for cement, lime, emulsion, foam asphalt, and different combinations will be established and verified through field projects.