

0-6839: Designing Pavements to Support the Heavy Loads in the Energy Development Areas

Background

In recent years, rapid energy development in Texas has caused significant damage to many farm-to-market (FM) roads, which traditionally have a thin asphalt surface layer plus a stabilized base directly over the subgrade. These roadways were often rehabilitated with full-depth reclamation (FDR), and often 2 to 3 percent cement was added to the pulverized existing materials. These roadways performed well under normal traffic loads but failed dramatically under the energy-sector truck loads. Figure 1 shows the damaged FM roads. The impact of overloading traffic on pavement damage is not only limited to FM roads; it also has significant influence on the pavement life of state highways and even interstate highways. There is an urgent need to repair many of these badly damaged roadways in all energy development areas.

This project:

1. Determined traffic conditions (in terms of actual axle load level) for pavement designs in the energy development areas.
2. Developed material options for handling the early trafficking requirement.
3. Recommended improved pavement designs for overloaded vehicles.

What the Researchers Did

Researchers first reviewed and analyzed all the traffic data collected by the permanent weigh-in-motion (WIM) stations around Texas. Based on the analysis results, researchers selected 17 stations with adequate traffic records for developing traffic loading spectra for pavement designs. Researchers also compared the load spectrum data collected in the

energy development areas with those in the non-energy development areas. Furthermore, researchers conducted a comprehensive literature review on both pavement rehabilitation options and materials options for handling early trafficking. Researchers also surveyed the field performance of a series of field test sections including both flexible and roller-compacted concrete (RCC) pavements. Guidance for selecting optimal rehabilitation options and associated materials and their mechanical properties required by pavement designs were then recommended. Following the Texas Department of Transportation's (TxDOT's) pavement design methods, researchers developed pavement design catalogs and material options to support heavy loads in the energy development areas. Additionally, efforts were made to assist the Corpus Christi District in designing the intersection between US 281 and SH 123. A series of meetings, a field survey, coring and testing, and laboratory mix designs were performed. Based on the results, researchers recommended multiple rigid pavement design options.

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What They Found

Researchers found that the energy development areas have much heavier trucks than the non-energy development areas; one road in the non-energy development area had 2.5 times the annual average daily truck traffic as the one in the energy development area, but they both had similar accumulated equivalent single axle loads in a 20-year design period. Researchers also found that the use of RCC in heavy-traffic situations is feasible and has been done in Texas. However, certain precautions are important to take for drainage and layout of longitudinal joints relative to the location and travel paths of the heavily loaded vehicles. Specifically, the moduli of asphalt stabilized base materials were sensitive to stabilizers, curing time (i.e., days), testing temperature, and loading frequency. Overall, the dynamic modulus of asphalt-stabilized base material at 20°C and 10 Hz is comparable to the field falling weight deflectometer backcalculated modulus. Most FDR test sections with asphalt stabilization performed well, and only one section had a few cracks.

What This Means

TxDOT should start to use WIM load spectrum data for pavement designs. FDR with asphalt stabilization showed adequate performance in the energy development areas and should be widely used. The implementation of the design catalog and the guidance for selecting optimal rehabilitation options and associated materials will make pavements last longer and perform better. Additionally, the construction of the intersection between US 281 and SH 123 should be well documented for future performance evaluation.



Figure 1. Pavement Damage Caused by Overloaded Trucks in Energy Development Areas.

For More Information

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Technical reports when published are available at
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