ENERGY-SECTOR BRIEF

Maintenance Division, Roadway Asset Management

16-02 SELECTION OF MAINTENANCE AND REHABILITATION STRATEGIES

One of the major issues facing TxDOT Maintenance and Construction forces is the repair of this impacted road network. Significant financial resources (several billions of dollars) have and will continue to be devoted to the repair of the road network that serves the energy sector of the state's economy. In anticipation of these large expenditures, TxDOT formed a special design and operating group within the Maintenance Division to assist Districts, manage the repair program and provide information to the administration. As part of this effort the TxDOT Maintenance Division initiated an Interagency Agreement Contract (IAC) with the Texas A&M Transportation Institute. One of the tasks of this agreement was the joint preparation of strategies/guidelines to assist Districts in their decision making relative to selecting maintenance and repair strategies for the impacted roadway network.

This Energy Sector Brief (ESB) has been prepared to summarize a methodology that can be used by the districts to assist in the selection of an appropriate maintenance or rehabilitation repair strategy. Additional Energy Sector Briefs (16-03, 16-04 and 16-05) provide information as well as other documents. These documents are listed below and all are available on the TxDOT Maintenance Division (MNT) SharePoint site at https://txdot.sharepoint.com/sites/division-mnt/SitePages/Home.aspx

Research Report RR-14-01
Maintenance and Rehabilitation Strategies for Repair of Road Damage Associated with Energy Development and Production

Implementation Report IR-14-01
Current TxDOT Practices for Repair of Road Damage Associated with Energy Development and Production

INTRODUCTION

From 10,000 to 24,000 oil/gas wells have been permitted annually in the state of Texas during the last 15 years. The development of the state's oil and gas reserves as well as its wind energy has provided a significant economic impact to the state and nation. Oil and gas development is expected to continue in Texas as it is home to the third largest known oil reserve in the world (Permian Basin in west Texas).

The rapid development of these oil and gas resources during the early 2010's required large volumes or heavily loaded trucks to develop the wells, produce the oil and gas and to develop the support infrastructure of pipelines, gathering stations, pumping stations, processing areas, etc. Continued servicing of these well also requires significant truck traffic. This truck traffic has significantly impacted the Texas Department of Transportation Farm to Market road network and some of its trunk State Highways and United States designated highways.

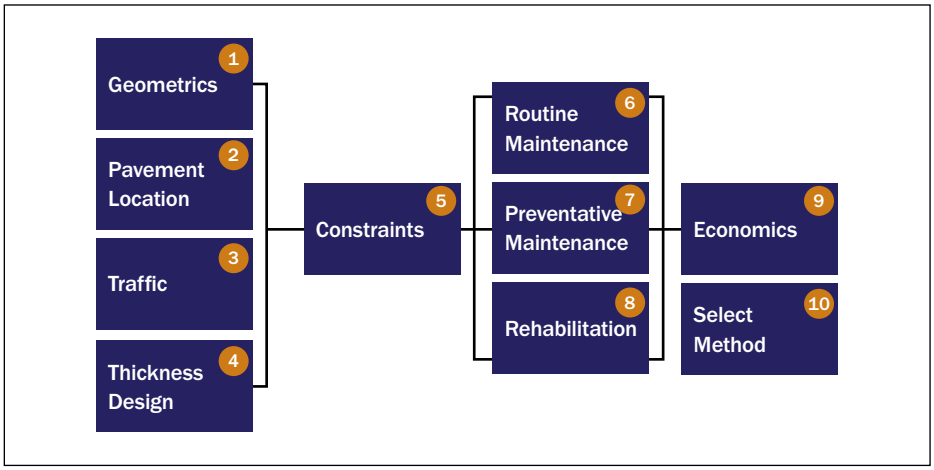

Figure 1. Flow Diagram of Key Steps to Select Maintenance/Rehabilitation Methods

GUIDELINES

Figure 1 provides a "flow diagram" indicating key steps used by Districts to select a maintenance/rehabilitation method for repairing the pavement and shoulder on a specific roadway. The key steps in the process include the following:

- Geometrics
- Condition of Existing Pavement
- Traffic Weights and Volumes
- Thickness Design
- Project Constraints
- Available Routine Maintenance, Preventive Maintenance and Rehabilitation Strategies
- Economic Analysis
- Selection of Strategy

A brief description of the activities associated with each of these key steps is provided on the next page. The amount of information and level of detail of the information collected will vary depending on a number of factors including: size of project, amount of funding available, likely repair strategy, risk reduction and equipment and workforce availability.

Typically the more engineering information that is available the more likely a quality rehabilitation/repair alternative will be selected. This reduces the risk of making an incorrect decision.

KEY STEPS IN PROCESS

Geometrics-Step 1
Project geometrics including width of right-of-way, lane widths, shoulder widths, drainage conditions, horizontal and vertical curves, intersections, driveways, curbs and gutters and adjacent businesses should be obtained from as-build plans and visual project evaluations.

Condition of Existing Pavement-Step 2
Historic records from TxDOT Pavement Management Information System (PMIS) and a visual condition survey should be performed as a minimum. Ground Penetrating Radar (GPR) will help confirm pavement layer types and thicknesses.

Falling Weight Deflectometer (FWD) information will help determine the load carrying ability of individual materials that comprise the pavement structural section as well as the overall load carrying ability of the pavement. Dynamic Cone Penetration (DCP) can also be used to determine the load carrying ability of individual materials in the pavement structural section.

Boring and coring can supply materials for laboratory testing and evaluation as well as confirming depth of individual pavement layers.

Traffic Weights and Volumes-Step 3
Traffic volumes and weights for specific highway sections in Texas can be obtained from the Transportation Planning and Programming (TP&P) Division of TxDOT. Traffic growth in the oil/gas areas has been very rapid in many cases and nearly impossible to capture with conventionally performed methods historically used by TP&P. Some districts have performed special studies.

Traffic weights and volumes associated with energy development and production have been quantified as part of this project. Research Reports RR-15-01 and RR-16-01; Implementation Reports IR-16-02, IR-16-03 and IR-16-04; and Energy Sector Briefs ESB-16-06, ESB-16-07, ESB-16-08 and ESB-16-09 provide an approach for obtaining traffic based on traffic generated per well site and number of wells serviced by a particular roadway. County well location maps provide a method for estimating the number of wells served by a particular roadway. Implementation Report IR-16-01 and Energy Sector Brief ESB-16-06 provide information on well locations.

Thickness Design-Step 4
Thickness design will be dependent upon expected traffic, load carrying ability of the existing pavement and condition of the existing pavement as well as the types of materials to be used as part of the repair strategy. Thickness designs should be performed with TxDOT's Flexible Pavement Design System FPS-21). If resources are not available to use this method the design catalog tables provided in Energy Sector Briefs ESB-16-04 and ESB-16-05; Research Report RR-14-03 and Implementation Report IR-15-01 can be utilized.

Project Constraints-Step 5

Selection of maintenance and rehabilitation alternatives are based on a number of engineering factors as well as a wide variety of other factors including: financial, work force availability, equipment availability, materials availability, weather conditions, scheduling and traffic control to identify a few. The best engineering solution is not always the repair strategy selected.

Routine Maintenance-Step 6
Information has been collected from a number of TxDOT districts to define commonly used routine maintenance operations. Summaries of this information can be found in the following documents: Implementation Report IR-14-01 and Energy Sector Briefs ESB 14-03, ESB-15-02, ESB-15-03 and ESB-15-04 for shoulder/edge repair, shallow patching, deep patching and level-up patching. Other routine maintenance procedures are available for repair such as those identified in TxDOT's "Maintenance Planning Activities & Associated Function Codes."

Preventive Maintenance-Step 7
Information collected from a number of TxDOT districts was used to prepare Implementation Report IR-14-01 and Energy Sector Briefs ESB-15-05 and ESB-16-01. These reports describe practices for chip seals and surface treatments. Other preventive maintenance alternatives are available including; slurry seals, micro-seals, thin hot mix overlays, thin cold mix overlays and hot in-place recycling.

Rehabilitation-Step 8
Implementation Report IR-14-01 and Energy Sector Briefs ESB-14-02, ESB-14-04, ESB-15-06 describe pulverization, widening, stabilizing, adding flexible base, and types of processes that have been used for repair of roadways damaged by oil and gas development and production.

Economic Analysis-Step 9
A first costs and life cycle costs analysis should be performed on several alternatives that can be used to repair a given roadway. The Federal Highway Administration has a reasonably easy method to use for life cycle costing. https://www.fhwa.dot.gov/infrastructure/asstmgmt/013017.pdf

Select Strategy-Step 10
Based on available funding and with a realization of the constraints associated with the project; a repair strategy can be selected. When selecting the repair strategy, the life of the selected treatment should be considered relative to the expected time duration the oil and gas activity will be using the roadway. Development and production of oil and gas is cyclic and unpredictable and greatly dependent upon geopolitics and the world economy.

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