

DEPARTMENTAL INFORMATION EXCHANGE



In cooperation with
Texas Department of Transportation
and the FHWA

Summary Report

Office of Research and
Technology Transfer

P.O. Box 5080 Austin, Texas 78763-5080

Phone 512-465-7644

FAX 512-465-7486

Summary Report 1229-1S
August 1993

REHABILITATING FM HIGHWAYS IN TEXAS

PROBLEM STATEMENT

When the Farm-to-Market (FM) system was originally built in Texas, some districts tried to conserve resources by building as much mileage as possible using as little right of way (ROW) and highway surface as possible, a design standard and accepted practice of that time period. However, according to current federal and state design criteria, these roads, now considered substandard and deficient, are in need of rehabilitation. For example, out of 3000 total miles in District 14 (Austin District), about 1000 miles are substandard 2-lane highways, and another 500 miles are substandard 4-lane highways. This deficiency is a problem which significantly strains the budget in some districts. In order to keep the road operational without engaging in expensive rehabilitation projects, they are forced to use their maintenance funds.

Currently, rehabilitating substandard FM highways with FHWA approval usually requires that the local government unit (city or county) purchase additional ROW so that the improvement can meet certain design standards. For example, if a district needs to construct a wider shoulder, the side slope next to the shoulder must meet a certain angle requirement. If there is not enough county land to meet this requirement, then the local government must buy more ROW. Since the state is not allowed to help in the ROW purchases for low-volume FM highways, the cost burden lies solely with the county. Most counties find it difficult to justify the expense of purchasing additional ROW for improving such low-volume roads; yet, because the roads are still in service and carrying traffic, they must continue to use maintenance money to patch holes and fill cracks. So—even though the Rehabilitation Program in Texas is a positive step toward improving the safety of the highway system—is it always cost-effective to require the full upgrade to standards for FM highways in need of major improvements?

OBJECTIVES

The Texas Transportation Institute (TTI) conducted study 1229, *The Costs and Effectiveness of Upgrade to Standards as Part of the TxDOT Rehabilitation Program*, for the Texas Department of Transportation (TxDOT) in cooperation with the Federal Highway Administration (FHWA) to evaluate the cost-effectiveness of proposed strategies for upgrading substandard highways and to suggest alternative strategies and policies concerning the TxDOT Rehabilitation Program.

The report contains a literature review on the cost, design recommendations, and effectiveness of upgrade to standard programs;

a survey of districts affected; procedures and problems concerning design exceptions; and estimated costs, both to TxDOT and to motorists, of not upgrading a representative 2-lane highway. Researchers used HEEM-III, a PC program developed by TTI for TxDOT, to develop a life-cycle cost estimation procedure which relies on previous work in highway improvement evaluation, user costs, and pavements in Texas.

FINDINGS

Rehabilitation and Upgrade Strategies

Researchers combined case study data on twelve different sites to create a representative substandard highway section. This data was then used to make cost and benefit estimates of various rehabilitation and upgrade strategies and to determine the cost-effectiveness of each strategy as it relates to the highways' Average Daily Traffic (ADT).

Four different maintenance, rehabilitation, and upgrade strategies were examined:

- 1) Continue to use heavily routine maintenance money (to keep the highway in service) with no pavement rehabilitation or upgrade work done over the analysis period.
- 2) Perform minimal pavement rehabilitation (with no upgrade of substandard geometrics) at the beginning of the analysis period and maintain this minimal rehabilitation through the analysis period.
- 3) Perform pavement rehabilitation (with upgrade of some

SHORT-TERM ALTERNATIVES

1. Create clear design exception guidelines.
2. Restructure design exception process.
3. Modify design standards for low-volume rural highways.

LONG-TERM ALTERNATIVES

1. Allow state participation in FM Right of Way acquisition.
2. Have legislature provide funds for ROW acquisition.
3. Use local option highway improvement funds (local gas tax).

substandard geometrics) at the beginning of the analysis period and maintain this rehabilitation with routine maintenance through the analysis period.

4) Perform pavement rehabilitation and full upgrade to standards at the beginning of the analysis period and maintain this full upgrade with routine maintenance through the analysis period.

The HEEM-III PC computer program made estimates of the cost-effectiveness of the strategies by looking at changes in motorist user costs and agency costs going from strategy one, maintenance only, to each of the other three rehabilitation and upgrade strategies. In comparing it to maintenance only, the full upgrade strategy is not cost-effective until about 1500 ADT. *This means that for low-volume FM highways (usually with an ADT of 750 or less), meeting full federal design standards is not cost-effective.*

Researchers also looked at the cost-effectiveness of the

strategies by analyzing the incremental benefit-cost ratio, a commonly used practice for project prioritization and selection when there is not enough money to fund all desirable projects. These estimates clarified further that it is not cost-effective to require full upgrade design standards for all low-volume rural roads. The minimal rehabilitation strategy is most cost-effective between 500 and 1500 ADT, the partial upgrade strategy between 1500 and 2000 ADT, and the full upgrade strategy for ADT 2000 and above. *So as traffic on a road increases, higher design standards become more cost-effective.* While cost-effectiveness should not be the only criteria for setting design standards, this study's results would seem to justify some modification to consider the potential benefits of a lower cost alternative strategy.

Figures 1 and 2 give the cost-effectiveness of the full upgrade to standards strategy when compared to the maintenance only and to partial upgrade to

standards strategies respectively. Each one of the curves on the graphs represents a different construction cost-per-mile for the full upgrade. With the benefit-cost ratio on the vertical axis and the ADT on the horizontal axis, and knowing the average cost-per-mile of the proposed upgrade, one can quickly determine at what point a proposed project would become cost-effective. A benefit-cost ratio of one or more indicates the strategy is cost-effective when compared to the lower cost strategy.

Alternative Policies and Procedures

All the districts surveyed cited lack of adequate ROW as the single largest problem in rehabilitation projects. The current guidelines require newly acquired ROW to meet the costly full design standards. Although TxDOT's current design exception process allows districts the opportunity to present justification for bypassing design standards, it is generally viewed as too complex and unclear. So the much needed rehabilitation is, more often, simply not performed. Again, maintenance money is consumed which could be better used in other applications. The second phase of this study suggests a few short-term and long-term alternatives for solving the problem. Short-term options do not require changes in the law or other legislative action, while long-term alternatives, involving money and ROW, would require action by the Texas legislature.

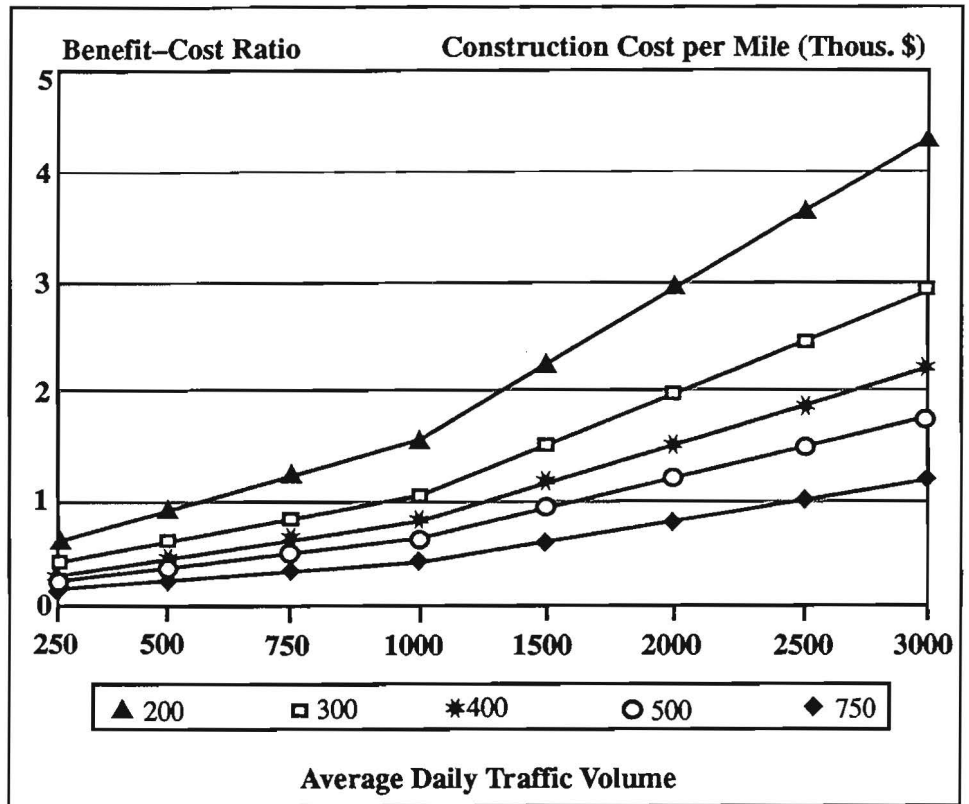


Figure 1. Cost-effectiveness of rehabilitation with Full Upgrade to Standards when compared to Maintenance Only Strategy.

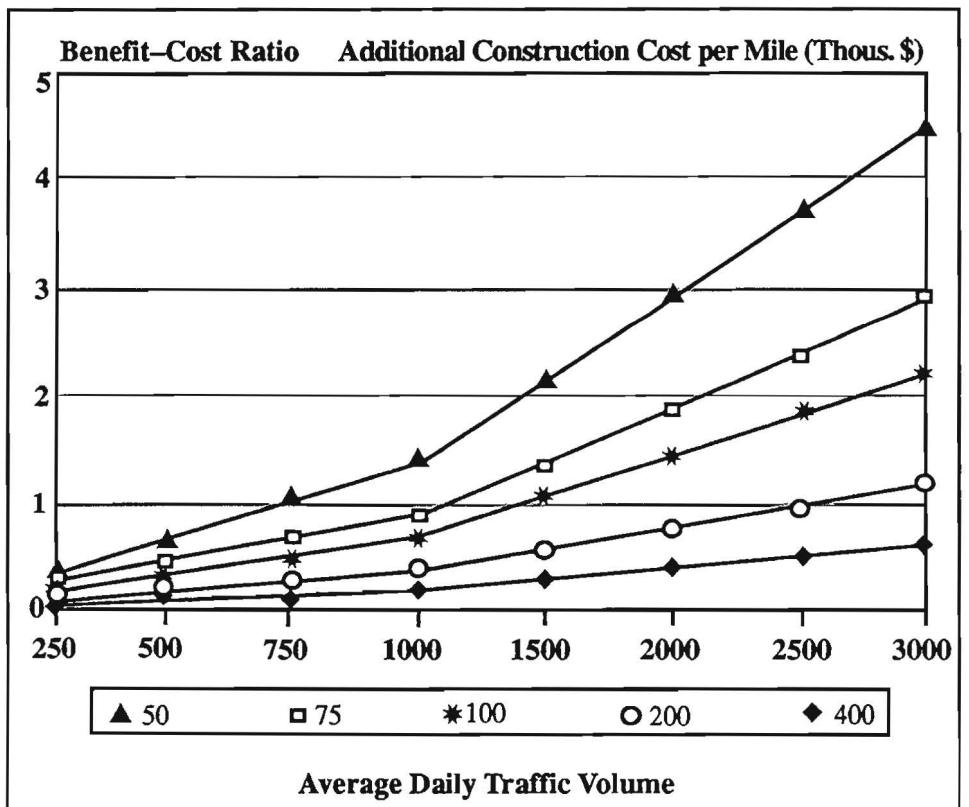


Figure 2. Cost-effectiveness of rehabilitation with Full Upgrade to Standards when compared to Partial Upgrades to Standards Strategy.

CONCLUSIONS

Something should be done about the inability of districts to acquire ROW when it is needed to rehabilitate a highway. Several options are presented in the report, but the one that seems to have the greatest likelihood of success is for TxDOT to be given the authority to participate in FM ROW acquisition through a matching money program (similar to existing programs for other highway classes). This would give the districts the flexibility to make the tradeoffs between rehabilitation and continued use of maintenance money on these

substandard FM highways.

The department may choose to use the study's recommended cost-effectiveness estimation procedures (with Heem III) to determine additional costs of upgrade to standard requirements. These procedures would enhance the department's ability to develop alternative strategies and policies for upgrading FM highways and to evaluate their cost-effectiveness. In the meantime, TxDOT and the Federal Highway Administration should consider variable design standards for different traffic volumes, a better defined design exception process, and latitude for the *dis-*

tricts to document and approve some design waivers.

Prepared by Kelly West, Science & Technology Writer, Texas Transportation Institute.

The contents of this summary are reported in detail in TTI Research Report 1229-1F, "Evaluation of Upgrade to Standards Requirements for FM Highways in Texas," by Jeffrey L. Memmott and James W. Hanks, November 1992. Contents of the summary do not necessarily reflect the views of the FHWA or TxDOT.

