Pavement Degradation
How Other Cities Are Dealing With It

Presented to the

2002 APWA International Public Works Congress and Exposition
Kansas City, Missouri
September 23, 2002

Introduction

The Construction Practices Subcommittee was asked by the UPROW Committee to research available documents related to pavement degradation and to identify good examples. The request initiate from the report Recommendation to Establish a New Professional / Education / Technical Committee for Utility and Public Right-of-Way Issues, prepared by the Utility and Right-of-Way Task Force, dated April 13, 1998.

The documents were to be evaluated on several factors starting with the assessment of the long-term maintenance impacts on existing pavements due to cuts made by utility contractors. The evaluation also looked into the cost impacts associated with the accelerated maintenance associated with the pavement cuts and recommendations for detailed specifications and drawings to improve the life of the patch.

This report documents the process the subcommittee followed to gather the information, assess and evaluate the data and the results of our findings.

Data Collection

Requests were made to local governments and other agencies around the United States and Canada for samples of reports dealing with pavement degradation. The subcommittee also used the APWA’s InfoNow feature on their webpage to reach out to the right-of-way community. A total of ten documents were received and evaluated. Some of the submittals included detailed structural analysis, drawings, pictures, specifications, codes and cost estimates. Each report was reviewed and evaluated by members of the subcommittee.

Analysis and Evaluation

Prior to receiving the reports, the committee members developed a table of criteria to use to evaluate the information and data. These criteria included the following factors:

1.) References: Does the report include references? Details of references? Number of references?
2.) Fee Schedule: Does the report include a fee schedule for the pavement restoration which outlines cost per unit (i.e. $/lf. or $/s.y., etc.)?

3.) Pictures: Does the report include pictures that show actual patches in field conditions? If so, rate the quality of the pictures.

4.) Cost Analysis: Does the report include a cost analysis that supports the fee schedule in item No. 2?

5.) Field Test: Does the report include an outline of the field test required?

6.) Specification: Does the report include standard industry accepted specification requirements such as ASTM, ANSI, etc.?

7.) Roadway Classification: Does the report address the different types (classifications) of roads (i.e. local, collector, arterial, etc.)?

8.) Location of Roadway: Does the report address the requirements of the location in the roadway where the field test shall be made?

9.) Sample Ordinance: Does the report include the legislative ordinance number and specific text which supports the findings of the report?

Findings

Various factors influence how well a pavement system (and consequent patch) will perform. These factors include the pavement material, soil conditions, climate, traffic volumes, and repair practices. The reports evaluated by the committee mostly considered one material, asphalt concrete over an aggregate base. The reports did not include any significant discussion about soil conditions even though pavement systems are strongly influenced by the underlying supporting soils. Since the reports were primarily prepared for certain cities around the US, the effect of climatic conditions is “local” to each report.

Long time performance of pavement systems and the effect of cuts depend on water infiltration, quality of materials and construction practices. Rainfall or snowmelt can infiltrate pavement at the junction of the patch and the existing pavement section. Water weakens the pavement layers and reduces the life of the pavement section or patch. Ice compounds the problem. Poor construction techniques can damage the area adjacent to the cut and further degrade the patch and surrounding pavement. Likewise, if the quality of materials used to repair the cut is less than equivalent to the existing pavement section, problems will likely occur. And to compound this issue all of these factors are interrelated to each other, which was not specifically addressed in the reports.

Other significant findings include:

Pavement Degradation.doc
• Pavement cuts made using quality materials and sound engineering and construction techniques tend to perform as well as the surrounding pavement. Good practices means using quality materials at least equal to the surrounding pavement structure (surface course, base and sub-base) and proper compaction techniques. The sides of the excavation need to be kept stabilized or repaired to properly restore the cut. The pavement section needs to be sufficient for the intended traffic loads and the joint between the patch and existing pavement section needs to be properly constructed and sealed.

• If the pavement cut is not properly restored, the studies indicate there is an adverse impact to the surrounding pavement section, which may extend up 1.5 to 6 feet beyond the edge of the patch.

• Proper sealing of the joint is important. If the joint is not sealed correctly, using a T-section repair may not prevent moisture undermining the pavement section. If proper construction methods and materials are used, a T-section repair may not be necessary.

• Poor performance of patches tends to be the result of inadequate compaction of the materials comprising the pavement section, an insufficient thickness of asphalt concrete or base, inadequate sealing of the cut edges, poor quality of materials, damage to the sides of the cut, or the sides of the trench being weakened.

• When repairing narrow trenches or when crossing other trenches backfilled with stone, it may by useful to require controlled low-strength material (flowable fill) using 1/2 or 1 sack of cement.

• Most of the reports include a cost analysis associated with utility cuts, which varied from less than $2.00 per square yard to $540 per square yard. Age of the pavement was factored into some of the fee equations. Additional penalties added fees of up to $3000 per cut.

• The estimated reduction in the life of a pavement with utility cuts varied from 20 to 56 percent. The estimate life for pavements without utility cuts ranges from 10 years to 36 years, depending on the location.

Summary of Selected Reports

Seattle, Washington

The City of Seattle submitted the report entitled “Impact of Utility Cuts on Performance of Seattle Streets”. The report was prepared by Nichols, Vallerga, and Associates, an engineering firm specializing in pavement and materials. This report is a good resource in several areas evaluated by the committee. If fact, this report had the overall highest score of all the reports submitted. Particularly, the areas of fee schedule development, field testing, and references were very informative. This report provides a detailed comparison of fee schedule development and cost analysis in several cities.

Cincinnati, Ohio

The City of Cincinnati submitted the report entitled “Impact of Utility Cuts on Performance of Street Pavements”. The City of Cincinnati and the American Public
Works Associates sponsored the report. Andrew Bodocsi, Prahlad D. Pant, Ahmet E. Aktan, and Rajagopal S. Arudi of the Cincinnati Infrastructure Institute Department of Civil & Environmental Engineering, University of Cincinnati, prepared the report. This report provides a thorough list of references, fee schedule development, and field testing. Field testing considers the measure and computed deflections at studied sites, seasonal correction coefficients, lateral damage, and traffic load influences. Data collected is displayed with graphs and charts.

**Nashville, Tennessee**

The City of Nashville/ Davidson County submitted the report entitled “Evaluation of the Effects of Pavement Excavations and the Development of a Street Damage Restoration Fee Schedule for the Metropolitan Government of Nashville and Davidson County”. Infrastructure Management Services (IMS) prepared the report. This report serves as a good resource in the areas of fee schedules, cost analysis, field testing, and documentation. Fee schedule development and cost analysis parameters considered items such as surface age, overlay unit cost, patch unit cost, age adjustment factor, adjusted unit cost, and penalty fees. Field testing was done in accordance with the 1993 AASHTO Guide of the Design of Pavement Structures. Testing sites were identified graphically with dimensions, and supported with digital pictures.

**Los Angeles, California**

“Street Damage Restoration Fee”, prepared for Los Angeles by Dr. M. Y. Shahin, dated September 3, 1996, studied 100 sections in detail. Fifty sections were studied on local streets and fifty sections were studied on major streets. Visual inspections, deflection testing and penetrometer tests were conducted on each section. Performance curves were developed for the sections, with and without patching. Significant rehabilitation cost analysis were performed and ranged from $9.39/sf to $14.08/sf for major streets, and from $3.43/sf to $5.15/sf for local streets. A copy of Ordinance 171924 was attached to the report.

**San Francisco, California**

“The Effect of Utility Cuts on the Service Life of Pavements in San Francisco”, Volume 1: Study Procedure and Findings, by Ghassan Tarakji, Ph.D., Final Report, dated May 1995 was prepared to determine if utility cuts shortened the life of asphalt pavement and if thicker overlays are required to compensate for the utility cut patches. The City’s Pavement Management System database was used to screen out streets that could bias the aging process. The remaining streets were grouped into five classes based on pavement type and the traffic characteristics. The useful life of asphalt streets were grouped in three categories: less than 3 cuts – 26 years; between 3 and 9 cuts – 18 years; and more than 9 cuts – 13 years. The results show the pavement aging process is accelerated by increased levels of utility cuts. Results show reductions in service life ranging from 30% to 50%.
City of Chandler, Arizona

Completed in 2001, “Analysis for Pavement Cut Impacts”, City of Chandler, AZ., by ASU, is a report with strengths in the areas of fee schedule, photographs, cost analysis, field tests and specifications. It contains standard details relating to backfill, pavement and surface replacement that are specific in what is required for compaction. While these details do not originate with the City of Chandler, they have taken the most stringent standard details from some surrounding municipalities and governmental agencies and combined them into this document. The fee schedules shown are taken from two municipalities in the Phoenix Metro area as well as six others from other cities outside Arizona from Massachusetts to California. Another strength of this document is the conclusion and recommendation part. It has a formula for determining the costs/fees to be charged when disturbing the existing pavement.

League of Arizona Cities and Towns and Association of Public-Private Utility Service Providers

Completed in 2002 – “Evaluation of Pavement Cut Impacts”, prepared for League of Arizona Cities by AMEC, dated January 7, 2002, is a compilation of studies completed by other investigators. No original investigations were completed in this study. This study is applicable to all Arizona conditions, including high-altitude, moisture available, freeze-thaw conditions. There is also a tabulation and review of existing pavement cut repair standards that have been adopted by Arizona municipalities or agencies, and development of an interim “best practice” repair standard. The conclusion and recommended interim standards and impacts section are detailed and thorough.

Attachments

Evaluation Matrix
Table 1 - List of Submittals/Publications Evaluated in this Paper
Table 2 - Additional References
Table 3 - 2002 Construction Practices Sub-Committee
### Evaluation Matrix

<table>
<thead>
<tr>
<th>Publication</th>
<th>References</th>
<th>Fee Schedule</th>
<th>Pictures</th>
<th>Cost Analysis</th>
<th>Field Tests</th>
<th>Spec</th>
<th>Roadway Classification</th>
<th>Location in Roadway</th>
<th>Sample Ordinance</th>
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Score: 1= worst , 5= best

Definitions:

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Table 1
List of Submittals/Publications Evaluated in this Paper


Table 2 – Additional References
As Listed in
“Evaluation of Pavement Cuts
League of Arizona Cities and Towns and
Association of Public-Private Utility Service Providers”
Prepared by
AMEC Earth & Environmental, Inc.
January 7, 2002


8. Transtec, Inc., 1995, City of Austin Utility Cut Study, Development of a Street Repair Cost Schedule for the City of Austin Department of Public Works, a final report submitted to the City of Austin, Department of Public Works, Street and Bridge Division, Austin, Texas, May 9.


14. Springsted Incorporated, Public Right-of-Way Cost Recovery Plan, Mid-Atlantic Regional Council, May. (Note: the 12 exhibits attached to the report were not provided for review.)

16. Mergent Company, FIS, Inc., 1999, Mergent Bond Record, Vol. 66, No.12, December. (This reference was not provided for review.)

17. Todres, H. A. undated, Critical Analyses of San Diego Report, prepared for San Diego Gas and Electric. (This reference was not provided for review.)


21. U. S. Army Corps of Engineers and National Research Council, Canada's Institute for Research in Construction, undated, study currently in progress. (This reference was not provided for review.)


30. Todres, H.A. and P.E. Baker, 1996, Utility Research in Pavement Restoration, study presented at the APWA International Public Works Congress and Exposition, Washington, D.C., August 24-28. (Note: a reprint of this study published in the APWA Reporter, November, 1996, also was provided for review.)

31. Todres, H.A., undated, Review of The Impact of Excavation on San Francisco Streets, report by DPW and the Blue Ribbon Panel, dated September, 1998. (Note: a draft of this reference was provided for review.)


35. Proposed Street Damage Restoration Fee, City of Los Angeles, Results of City Street Study, City Administrative Officer (CAO) File No. 0610-03571-0000, August 27, 1996.

36. The Department of Public Works, City and County of San Francisco and The Blue Ribbon Panel on Pavement Damage, 1998, The Impact of Excavation on San Francisco Streets, September.

37. Tarakji, G., 1995, The Effect of Utility Cuts on the Service Life of Pavements in San Francisco, Volume I: Study Procedure and Findings, final report by Engineering Design Center, San Francisco State University for the Department of Public Works, City and County of San Francisco, San Francisco, CA. May. (The appendices for this study were not included.)
Table 3
2002 Construction Practices Sub-Committee

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Address/Contact Details</th>
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