

MEMORANDUM



DATE: May 2, 2005
TO: House Appropriations Subcommittee on Transportation
FROM: William E. Hamilton
RE: I-75 Pavement Demonstration Project

This memo discusses a 1993 "European" pavement design demonstration project.

Background – A test section using a European pavement design was included as part of a 1993 reconstruction project of I-75 in downtown Detroit. The pavement design was described as "European" because it assimilated features from designs used in Germany, Austria, and Belgium.

The total project involved the reconstruction of 2.3 miles of I-75 (Chrysler Freeway) between I-375 and I-94 (Edsel Ford Freeway). The European pavement design was used for approximately one mile of the northbound section, from the Warren Avenue exit ramp northerly to Piquette Avenue. The remaining portion of the northbound section (from Piquette to I-375) was constructed using a standard 1993 MDOT pavement design. As a result, the approximately one mile of test pavement could be directly compared with approximately one mile of a standard pavement design.¹

Interest in using a European pavement design was an outgrowth of a 1992 Federal Highway Administration (FHWA) "scanning tour" study of European concrete pavements. The I-75 demonstration project was constructed in conjunction with the 1993 national convention of the American Association of State Highway and Transportation Officials (AASHTO).

The Michigan Department of Transportation identified the following major differences between the two designs:

The European pavement demonstration project structural section consisted of:

- 10 inches of two layer concrete pavement with a special exposed aggregate surface texture
- Doweled transverse joints at 15 foot spacing
- 6 inch lean concrete base with 6 inch underdrains
- 16 inches of aggregate subbase placed on an existing prepared subgrade

The typical 1993 MDOT section consisted of:

- 11 inches of single layer concrete pavement with standard surface texture (transverse tinning into the plastic concrete)
- Doweled transverse joints at 41 foot spacing
- 4 inches of open graded drainage course with 6 inch underdrains
- 12 inches of sand subbase placed on existing prepared subgrade

Note that there are a number of elements in pavement design including but not limited to: type of materials used, pavement thickness, subbase, placement of joints, drainage, and construction process. One of the unique elements in the I-75 European test design was the use of a "two-lift" pavement construction method. This process involves placing two layers of concrete pavement, one over another, while the base pavement is still wet. The finished top layer of pavement, the wearing surface, is made

¹ In addition, the southbound section of I-75 was paved under the same contract. This southbound section was constructed using standard 1993 MDOT concrete pavement design.

from a special concrete mix incorporating an extra hard aggregate. This hard aggregate is left exposed in the finished pavement surface.

The department indicates that the cost of constructing the test section was \$87.76 per square yard; the cost of the standard section was \$37.58 per square yard. The department believes that the two-lift method was the primary reason the contractor-bid costs for constructing the test section were significantly higher than for the standard design section. To place two concrete mixes wet on wet, the contractor had to set up two paving plants and use two paving crews, resulting in additional labor and equipment costs. The department believes that other elements affecting the cost of the test section included the use of an enhanced base and premium quality joint seals.

Performance Trends – Since construction, the department has monitored the performance of the test and control sections. The last formal study appears to be a report prepared by Michigan State University under contract with the department. The report, dated May 2000, was titled "*Cost Effectiveness of European Pavement Demonstration Project: I-75 Detroit.*" The report found that neither the test section nor the control section showed enough pavement distress to estimate the remaining service life. In other words, after seven years, neither section showed distress trends that would allow the researchers to predict how long either section would last. The department continues to make visual surveys of the sections and has found that both sections show little material or structural distress. There is currently no evidence from the I-75 study to indicate that the European pavement test design as used on I-75 is worth the additional construction costs.

Improving Pavement Design – Discussions of the I-75 European pavement demonstration project, including a recent Detroit Free Press article,² often suggest that the department does not routinely use the European pavement design simply because of the higher construction costs. However, it is important to keep in mind that the department has already incorporated cost-effective elements from innovative pavement designs, including European pavement designs, in current design specifications. One of those elements is the use of a Jointed Plain Concrete Pavement (JPCP) design.³

Other pavement design elements incorporated by the department since 1993 include the use of a deeper subbase, the use of higher quality concrete mix, and the use of higher quality aggregates with better freeze/thaw durability.

The I-75 pavement demonstration project is just one of many studies of pavement performance conducted cooperatively by a number of organizations including the FHWA, AASHTO, construction industry trade groups, engineering schools, and the Transportation Research Board, a part of the National Academy of Sciences. The department works with these groups in an effort to improve pavement design and long-term pavement performance.

Statutory Requirements – Since 1997 the department has been required to develop and implement a life-cycle cost analysis for all projects with total paving costs in excess of \$1.0 million. This legislative requirement was added by amendment (PA 79 of 1997) to Public Act 51 of 1951.

² "European-style paving strictly experimental," by Matt Helms, Detroit Free Press, February 21, 2005.

³ The department adopted JPCP as the standard concrete design in January 2005. Prior to that date, the MDOT standard was Jointed Reinforced Concrete Pavement (JRCP). The JRCP design uses steel mesh reinforcement and makes contraction joint cuts at 27 foot intervals. The JPCP is a non-reinforced pavement with contraction joint cuts every 15 feet. The European pavement design is a type of jointed plain pavement. It should be noted that the department has experienced success with both pavement designs and will consider use of JRCP when it believes that design is appropriate for a particular project.