Brief

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Missouri Guide for Pavement Rehabilitation

Research Development and Technology

Missouri Department of Transportation

1617 Missouri Blvd.
P.O. Box 270
Jefferson City,
Missouri 65101

Description

The Missouri Guide for Pavement Rehabilitation is an attempt to make sense of the performance of Missouri State system pavements. Pavements were evaluated by functional classification: National Highway System (NHS), remaining arterials, and collectors; and pavement type: Portland cement concrete (PCC), asphalt concrete (AC) overlaid PCC, full-depth AC, and AC overlaid AC. Special emphasis was placed on arterial routes. Pavement design and performance information from other states was also closely studied for possible application in Missouri.

Performance data consisted primarily of Automated Road Analyzer (ARAN) data accumulated during the previous five to seven years. ARAN data scores are equally split between roughness and visual distress. Guidance for acceptable/marginal/unacceptable performance scores was derived from the results of a series of public road rallies.

The Guide explains the reasons for different types of pavement deterioration in Missouri, including loading and environmental related factors. Some information is provided regarding the evolution of pavement design up to the significant design overhaul in the early 1990s. Rehabilitation strategies discussed include conventional AC overlays, stone matrix asphalt (SMA) overlays, rubblization with overlays, unbonded and bonded PCC overlays, diamond grinding, edge drain retrofit, dowel bar retrofit, full-depth repairs, and undersealing, while reconstruction strategies include jointed plain, jointed reinforced, continuously reinforced concrete and full-depth Superpave mix design asphalt. The experiences of other States using these techniques are presented along side Missouri's to provide a fuller picture of their value. The anticipated long-term benefits of increased smoothness at the time of construction are also reviewed.

Historical performance trends for PCC, AC/PCC, and AC/AC pavements in Missouri are highlighted with numerous graphs. Some explanations for different distress and roughness trends are attempted. The Guide finishes the analysis with a cursory comparison of life-cycle costs for AC and PCC pavements.

Conclusions

The following conclusions drawn are based on a combination of factual performance data trends and engineering judgment. Recognition is given to the significant modifications that have occurred to rigid and flexible pavements during the past eight years. Missouri has adopted thicker structural layers, drainable bases, JPCP design with short joint spacing and widened driving lanes, Superpave and SMA mix designs, QC/QA specifications for both industries and tightened material specifications. While the data analysis used the best performance information available at MoDOT, it could not reflect the full measure these modifications will have on future performance. Future performance data will provide that enlightenment. Also, where design and performance

information was gathered from other state DOTs, consultants, and industry sources, an educated guess was ultimately required by the MoDOT engineering staff to determine how it would apply to Missouri's highway system.

New PCC –

- ❖ PCC pavements on divided NHS routes in Missouri last an average of 25 years before rehabilitation is required
- ❖ Missouri's jointed plain concrete pavement (JPCP) design compares very favorably with other States' long life (40+ years) pavement designs.
- ❖ Continuously reinforced concrete pavement (CRCP) with specific design features has maintenance-free characteristics that, based on performance data from other States, make it an optimum design strategy for the highest volume NHS urban routes.

PCC rehabilitation –

- ❖ Rubblization of old PCC on NHS and remaining arterial routes can be a viable rehabilitation strategy under the right conditions.
- ❖ Diamond grinding existing PCC pavements with moderate faulting on NHS and remaining arterial routes is an optimum rehabilitation strategy if no subgrade stability problems are evident.
- ❖ AC overlays on PCC on divided NHS routes in Missouri last an average of 10 years before rehabilitation is required. This is congruous with other States' expected performance.
- ❖ Stone matrix asphalt (SMA) overlays on concrete have increased AC overlay lives an average of two years based on extrapolated estimated trends derived from a statistically small percentage of overlays.
- ❖ Superpave AC overlays have demonstrated improvement over conventional AC mixes, but the benefit is not yet quantifiable because of very limited performance data.
- ❖ Unbonded PCC overlays have performed very well in Missouri. Thin AC overlays may be used as short-term strategies before placement of unbonded PCC overlays.

New full-depth AC –

- ❖ Full-depth Superpave pavements have only recently been implemented in Missouri and very limited data is available, but early performance results have been good.
- ❖ Missouri's AC pavement design has common characteristics with the "perpetual pavement" concept.
- ❖ AC pavements with low stability subgrades require either a thick rock base or subgrade modification.

AC overlay on AC –

- ❖ Thin AC overlays (~ 1 ¼ inch) on AC on NHS and remaining arterial routes last an average of six years before rehabilitation is required. Similar thin AC overlays on AC on collector routes last an average of four to seven years before rehabilitation is required depending on the type of mix.

General –

- ❖ High initial smoothness on NHS and remaining arterial routes, obtained through any practical combination of construction methods, should result in extended pavement service life.
- ❖ Longitudinal drainage pipe systems can easily be modified to allow easier inspection and cleanout, which would ensure a return on the initial investment.
- ❖ General life cycle cost analysis, including present and future construction costs and their associated user costs, indicates that new AC is more cost-effective on lower arterials, while new PCC is more cost-effective on higher-volume arterials.
- ❖ General life cycle cost analysis, including present and future construction costs and their associated user costs, indicates that an AC overlay is more cost-effective on lower arterials, while an unbonded PCC overlay is more cost-effective on higher-volume arterials.
- ❖ For more information, please contact John Donahue (573) 751-526-4334, or

  e-mail: *donahj@mail.modot.state.mo.us* or

  visit our website at *http://www.modot.org/rdt/rdt.htm*.