

# SUMMARY OF MINNESOTA RESEARCH FINDINGS

*By Minnesota Asphalt Pavement Association*

**MAPA commissioned Erland Lukanen of ERES Consultants to evaluate the performance history of HMA Pavements with Aggregate Base and of Portland Cement Concrete Pavements on the MN/DOT Highway system. The reports on both of these projects are now complete and the results are interesting indeed.**

## HMA Pavements

- Full-Depth HMA pavements have service lives similar to HMA pavement using aggregate base.
- HMA pavements have average service lives of approximately 18 years. The data indicates that pavements constructed in recent years are performing better, showing the benefit of improved design and quality control techniques.
- HMA pavements are indeed “PERPETUAL PAVEMENTS.” Performance data shows HMA pavements lasting 60 years with only periodic HMA overlays.

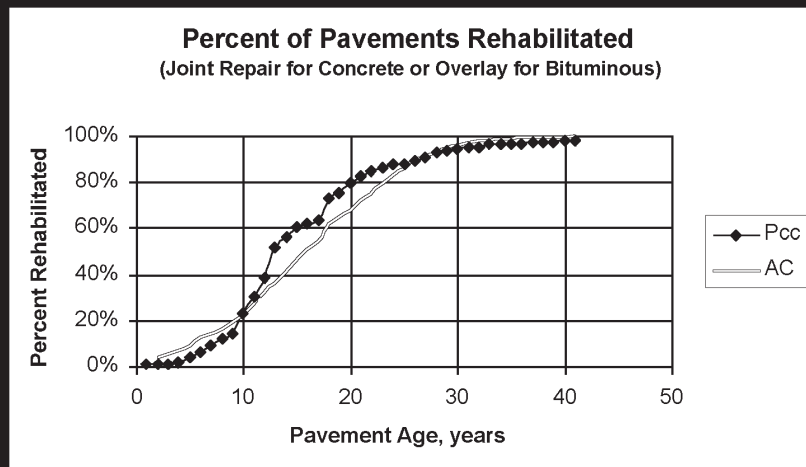
## PCC Pavements

- Fifty percent of PCC pavements are either overlaid with HMA or otherwise removed from service by the time they reach 20 years of age.
- Of the remaining fifty percent of PCC pavements, over 50 percent receive major repair work within the first 20 years.
- Mn/DOT’s PMS data shows no increase in performance of PCC pavements with time as measured by Present Serviceability Rating (PSR).

## Conclusions

- PCC Pavements have a service life similar in length to that of HMA Pavements, either Full-Depth or Aggregate base design.
- Cost data is not readily available for the various rehabilitation alternatives used on PCC & HMA pavements to allow for direct comparison of Life Cycle Cost (LCC) but the timing of rehabilitation events is similar regardless of pavement type.

### Age at First Rehabilitation



# HMA PAVEMENTS

## FACT:\*

Bituminous (HMA) pavements typically provide 40 to 60 years of service life and receive three overlays in that time frame. The first overlay, on average, occurs between 15 and 16 years after construction, but the most common age for an overlay is 18 years. High volume pavements are often overlaid in the 11 to 15 year old range that brings the average age at first overlay down to 15 to 16 years of age.

## FACT:\*

The average age of the first overlay of Bituminous Overlaid Bituminous (BOB) pavements is 14.9 years, and the median age is 15 years.

## FACT:\*

Overall, the analysis indicates that the performance of bituminous pavements has improved over the last 10 to 15 years and that pavements constructed now have the potential to provide longer lives than in the past. High severity Transverse Cracking has diminished significantly in recent years. Multiple Cracking, which was the most significant predictor of SR in 2001, is occurring at only a third of what it used to occur at during the 1970's. These types of improvements in performance are consistent with what would be expected from the changes and improvements that have been made in the 1980's and 1990's in asphalt mix design and placement practices.

## FACT:\*\*

The performance of Full-depth sections constructed under the Quality Management specifications (including modified specified density) is significantly better than sections constructed before.

## FACT:\*\*

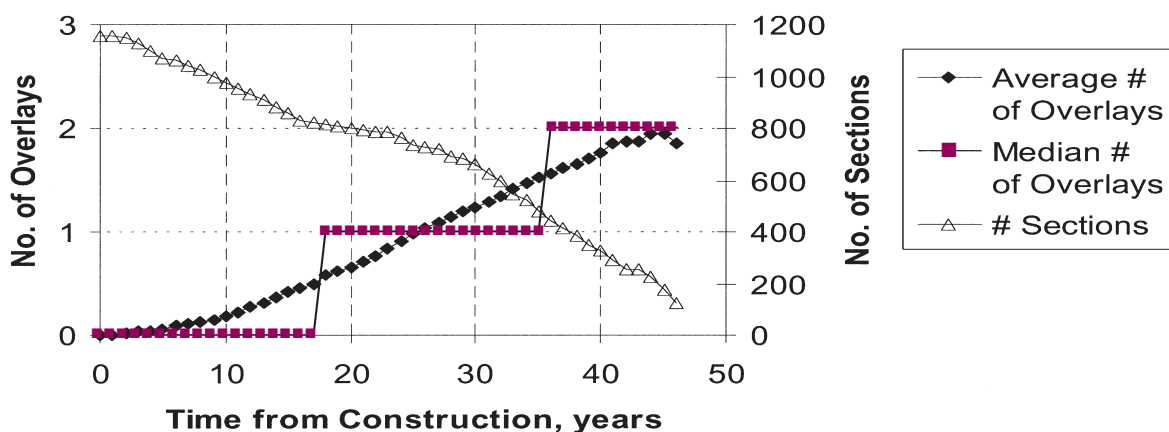
The current data indicates that the Full-depth sections now are performing better than the 1992 models predicted with regards to the SR and similar to the 1992 models for PSR.

## FACT:\*\*

The 1992 pavement management models indicated that the Full-depth and aggregate base pavements were providing similar performance.

## Rehabilitation Activities - HMA

All Bituminous (Agg. Base) Constructed since 1955



# PCC PAVEMENTS

## FACT\*\*\*

One half of the concrete pavements are overlaid or reconstructed at between 24 and 25 years of age and at 35 years of age, 88 percent are overlaid or reconstructed.

## FACT:\*\*\*

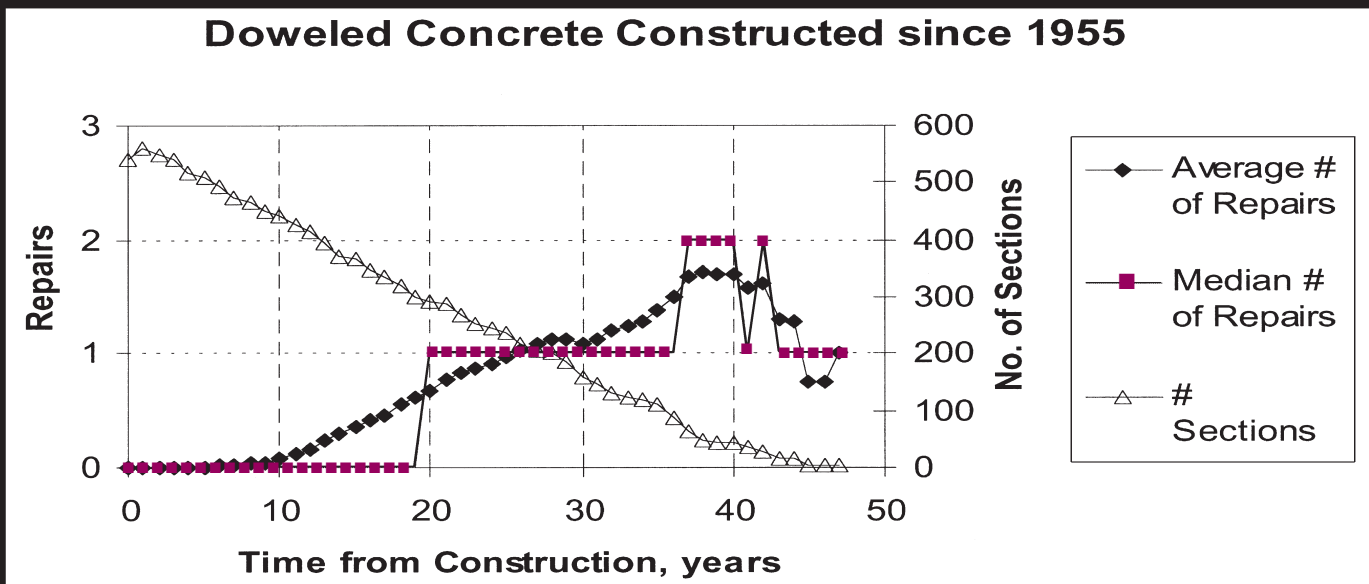
Over fifty percent of concrete pavements have received major repair work (joint repair, diamond grinding, or CPR) within the first 20 years (37 percent have had one major repair and 14 percent have had two).

## FACT:\*\*\*

Average PSR performance at 10, 15, and 20 years does not appear to be affected by the year of construction. The typical PSR trend is independent of when the pavement was built.

## Rehabilitation Activities - PCC

### Doweled Concrete Constructed since 1955



Repairs = Diamond Grinding or Joint Repairs.

\*From "Bituminous Over Aggregate Base Pavement and Overlaid Bituminous Pavement Performance Study" report by E. Lukanen

\*\*From "Full-Depth Asphalt Pavement Performance Study" by E. Lukanen

\*\*\*From "Doweled Concrete Pavement Performance Study" by E. Lukanen

Additional information at MAPA's Website: [www.asphaltisbest.com](http://www.asphaltisbest.com)



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# THE FACTS ABOUT PAVEMENT LIFE

***The following article was published in the MAPA Paving Progress Newsletter, March 2002.***

## Pavement Life - What is the Truth?

*Submitted by Dave Holt, Executive Vice President, Special Projects*

If you have been in the Twin Cities of Minneapolis/St. Paul during the last several months and listened to drive time radio, you likely have heard commercial messages comparing the service lives of Concrete and Hot Mix Asphalt (HMA) pavements. Data from undisclosed sources mentions pavement life for Asphalt is from 7 to 10 years and that the future for Concrete is 60 years or longer.

The Minnesota Asphalt Pavement Association (MAPA) has not publicly responded to this misinformation because we believe thinking people will realize how outlandish these claims are and dismiss them as such.

Mn/DOT makes decisions about pavement surface type using the principals of Life Cycle Costing (LCC). The major determining factor in LCC is the life of the initial pavement constructed. Mn/DOT has, for over 30 years, used a design life of 20 to 35 years. During this 35-year period, an Asphalt Pavement is charged with an overlay and the Concrete Pavement with a crack sealing process.

The Flexible Pavement Design procedure presently used by Mn/DOT is based on research on Minnesota highways. The Research Projects were Inv. 183 and Inv. 195 conducted by Dr. Gene Skok and others. The premise of this procedure is to design a pavement for the soils involved and for a 20-year projected traffic loading expressed in Equivalent Single Axle Loads (ESALs) to maintain a serviceable Pavement.

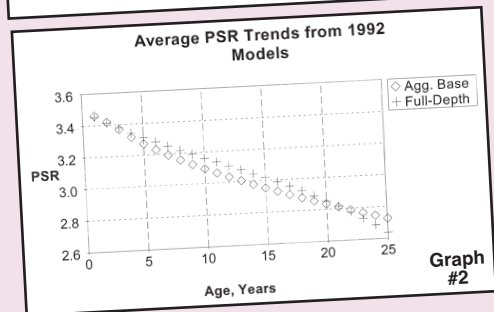
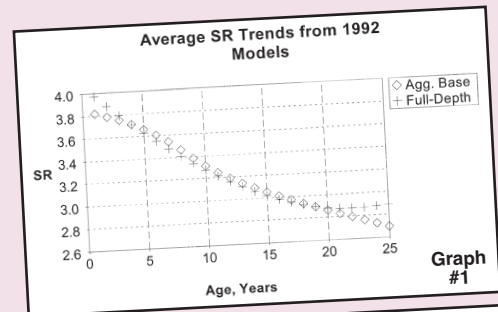
This Design Procedure has been verified based on the performance of actual in-service pavements twice in recent times. In 1992, Erland Lukanen, in a contract through Braun Intertec, developed algorithms that showed both full-depth and granular base HMA pavements maintain both a Structural Rating (SR) (graph #1) and Present Serviceability Rating (PSR) (graph #2) ratings in excess of 2.5 beyond the 20-year design life, in fact, the pavement life under this definition approaches 25 years.

This past year, Mn/DOT and MAPA jointly conducted another Pavement Life Analysis for Full-Depth Asphalt Pavements. Mn/DOT provided the data from their Pavement Management System and MAPA provided the funding for the data analysis, which was conducted by Erland Lukanen of ERES Consultants. This research effort was guided by a joint committee from Mn/DOT and MAPA. The analysis shows that full-depth pavements perform as well or better than granular base HMA pavements and, on the average, last three to five years longer than the anticipated 20-year design life.

An unexpected sidelight to this research is documentation that the Quality Management process has extended the service life of HMA pavements. It is too early in the lives of pavements constructed using the SUPERPAVE design procedure for definitive data to be

developed but an additional increase can be anticipated.

In an ancillary analysis, overlays on full-depth pavement have a service life in excess of 15 years. Using the data from this study, full-depth HMA pavements, with a resurfacing at the 20-year design life, provide a highly serviceable pavement for an excess of 35 years.



MAPA intends to continue research efforts to verify the service life of granular base pavements and concrete pavements as well. There is presently no analysis available to document the claim that concrete pavements last 35 years, much less 60 years. The Data exists; the public deserves to know the Facts! ■



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