PERFORMANCE OF POLYMER MODIFIED ASPHALT CONTAINING FIBERS IN NORTHERN ARIZONA

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“Road fix package balloons”  Arizona Daily Sun – 03-09-2014

Initial estimate $50 million
New estimates have now projected the following cost:
  $82.6M
  $135.3M
  $117.6M
  194.6M

The Cost have elevated due to “other interest”
There are three types of “general” roadway maintenance
  1. Preservation Seals - $2.50/Yard^2
  2. Overlay - $13.50/Yard^2 (Concrete, re-striping… not included)
  3. Remove and replace - $67.00/Yard^2
General Pavement Lifecycle

Pavement Condition vs Time

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Quality of Asphalt Pavement
(Pavement Condition Index)

Time (years)

75% Time

40% Quality Drop

12% Time
Lifecycle with Rehabilitation
Climate in Flagstaff

- Climate in Flagstaff (2012):
  - Annual mean 200-250 freeze-thaw cycles.
  - Annual average snowfall of 108 inches
  - Average minimum temperatures were below freezing point from Oct. to the following May

- Major pavement distresses: reflective cracking, thermal cracking, fatigue cracking
Use of polymer modified asphalt in Flagstaff

- Polymer modified asphalt concrete has been used in Flagstaff for 15 years to address major pavement deterioration.
Could we add fibers in polymer modified asphalt mix

- The cost of polymer modified binder has been increased due to shortage...

- Could the use of fiber in mix design be a part of solution?
A testing section was selected in Havasupai st. and a paving project was constructed in June 3 2013
Preliminary study

- It is of interest to understand the effectiveness of using the fiber in polymer modified asphalt mixtures in improving the performance of thermal cracking
- Fiber+ polymer modified asphalt concrete (FPMAC) vs polymer modified asphalt concrete (PMAC)
Fiber Polymer Modified Asphalt Concrete (FPMAC)
Sample collection

Figure 2(a) Asphalt sampling locations

Legend:
- Dashed boundary where FPMAC were paved. The rest of area were built of control mixtures (PMAC)
- FPMAC sampling locations
- PMAC sampling locations
All samples were shipped back to the Construction Materials Lab at NAU where they were reheated and compacted to a 150mm in diameter and 110mm in height specimen.
Beading beam rheometer (BBR) was used to obtain creep compliance data of asphalt specimens. Specimens were tested at three temperatures (-12C, -18C, -24C).
Test results

Sample ID Number, Paved on June 3, 2013 in Flagstaff
Test results

FPMAC

PMAC
Viscoelastic modeling result (relaxation modulus analysis)
Viscoelastic modeling result
(thermal induced stress prediction)
Pavement conditions were assessed on 11/15/2013 and 02/25/2014. No cracks were found on both lanes.
Pavement condition assessment was performed on 03/11/2014. No cracks were found on the FRAM land while two major cracks were identified on the RAM lane.
Conclusions

- FPMAC appears to be having a higher relaxing capacity than PMAC at low temperatures suggesting FPMAC will have less thermal induced stress as opposed to PMAC. This is validated by a field observation on March 11, 2014.

- The addition of fibers in PMAC has increased the entire viscoelastic responses of the mix under cold climatic conditions.
Recommendations

- Continuous monitoring on the performance of both mixes is needed to further confirm the prediction.
- Fibers are recommended to be added in conventional asphalt mixtures to compare the performance with PMAC.
Questions?