

Base Course Design Proposal by Jim Huddleston

Proposal: Design and construct base courses to optimize durability and fatigue performance. Mix design criteria will be adjusted so that mixes can be constructed to in-place air voids averaging 5%. The base course generally will be defined as below 4 inches however in some cases it may be applied to all mix below the top 2 inches.

Logic: The current mix design procedure and criteria were developed to optimize rutting resistance. Research both at test tracks and at project sites has demonstrated conclusively that rutting in thick pavements is confined to the top 2-4". Research has also demonstrated conclusively that increased binder content and density (lower in-place air voids) can significantly improve durability and fatigue resistance, decrease permeability, and reduce oxidation rates. It follows that base courses should be designed and constructed to optimize durability and fatigue resistance not rutting resistance.

Methodology: The basic process will be to design and produce the base course mix so that it can be compacted in the field with "normal" rollers operations to average in-place air voids of 5%. We suggest that the specification require a minimum density of 93.5%. The mix design criteria will be 100 gyrations (level 3) and 3% air voids. The mix may be adjusted in the field if necessary so that the required minimum density is achievable.

Cost/impacts: the only anticipated direct cost will be the cost of additional binder. We anticipate that on average the binder content will be 0.4% higher. This will cost around \$0.6-0.7/ton. In some cases this may also impact how a job can be paved because currently with only one mix design a contractor may pave base and wearing at the same time out of the same plant.

Benefits: The potential long term benefits are very significant. The concept of perpetual pavements has significant long term cost benefits to the state however it relies on the base course maintaining its integrity over a very long period. Several recent rehabilitation projects on the interstate resulted in early failure due to apparent moisture damage in the base. We believe that if those bases had been designed and built according to this proposal that the failures would not likely have occurred.

Steps required for implementation: We recommend the following steps are prudent in order to fully adopt and implement this proposal:

- 1) approval by the QIC
- 2) draft the needed specification language including definitions for base and wearing courses
- 3) select one or more jobs currently under contract and incorporate the changes by change order. The purpose will be to demonstrate the viability of the methodology.
- 4) Incorporate any needed changes identified in the pilot jobs and utilize on all future projects where appropriate.