SUMMARY

This investigation was initiated to determine the causes of a rutting problem that occurred on Interstate 80 in Adair County. I-80 from Iowa 25 to the Dallas County line was opened to traffic in November, 1960. The original pavement consisted of 4-1/2" of asphalt cement concrete over 12" of rolled stone base and 12" of granular subbase. A 5-1/2" overlay of asphalt cement concrete was placed in 1964. In 1970-1972, the roadway was resurfaced with 3" of asphalt cement concrete. In 1982, an asphalt cement concrete inlay, designed for a 10-year life, was placed in the eastbound lane.

The mix designs for all courses met or exceeded all current criteria being used to formulate job mixes. Field construction reports indicate that asphalt usage, densities, field voids and filler bitumen determinations were well within specification limits on a very consistent basis.

Field laboratory reports indicate that laboratory voids for the base courses were within the prescribed limits for the base course and below the prescribed limits for the surface course. Instructional memorandums do indicate that extreme caution should be exercised when the voids are at or near the lower limits and traffic is not minimal. There is also a provision that provides for field voids controlling when there is a conflict between laboratory voids and field voids. It appears that contract documents do not adequately address the directions that must be taken when this conflict arises since it can readily be shown that laboratory voids must be in the very low or dangerous range if field voids are to be kept below the maximum limit under the current density specifications.

A rut depth survey of January, 1983, identified little or no rutting on this section of roadway. Cross sections obtained in October, 1983, identified rutting which ranged from 0 to 0.9" with a general trend of the rutting to increase from a value of approximately 0.3" at MP 88 to a rut depth of 0.7" at MP 98. No areas of significant rutting were identified in the inside lane. Structural evaluation with the Road Rater indicated adequate structural capacity and also indicated that the longitudinal subdrains were functioning properly to provide adequate soil support values. Two pavement sections taken from the driving lane indicated very little distortion in the lower 7" base course. Essentially all of the distortion had occurred in the upper 2" base course and the 1-1/2" surface course.

Analysis of cores taken from this section of Interstate 80 indicated very little densification of either the surface or the upper or lower base courses. The asphalt cement content of both the Type B base courses and the Type A surface course were substantially higher than the intended asphalt cement content. The only explanation for this is that the salvaged material contained a greater percent of asphalt cement than initial extractions indicated. The penetration and viscosity of the blend of new asphalt cement and the asphalt cement recovered from the salvaged material were relatively close to that intended for this project.

The 1983 ambient temperatures were extremely high from June 20 through September 10.

The rutting is a result of a combination of adverse factors including, (1) high asphalt content, (2) the difference between laboratory and field voids, (3) lack of intermediate sized crushed particles, (4) high ambient temperatures. The high asphalt content in the 2" upper base course produced an asphalt concrete mix that did not exhibit satisfactory resistance to deformation from heavy loading. The majority of the rutting resulted from distortion of the 2" upper base lift.

Heater planing is recommended as an interim corrective action. Further recommendation is to design for a 20-year alternative by removing 2-1/2" of material from the driving lane by milling and replacing with 2-1/2" of asphalt concrete with improved stability. This would be followed by placing 1-1/2" of high quality resurfacing on the entire roadway. Other recommendations include improved density and stability requirements for asphalt concrete on high traffic roadways.

RECOMMENDATIONS

Interim corrective alternatives are recommended in the following order:

1. Heater planing
2. Rotomill planing
3. No interim treatment

Two 20-year design alternatives are recommended in the following order:

1. Remove a minimum of 2-1/2" from the driving lane by milling and replace with 2-1/2" of asphalt concrete with improved stability. Place a 1-1/2" high quality resurfacing on the entire roadway.

2. Remove a minimum of 4" from the driving lane by milling and replace with 4" of asphalt concrete with improved stability. Program a 1-1/2" resurfacing after six years.

The following specification changes should be pursued:

1. Increase density requirements to 95% for all asphalt pavements.

2. Require 97% density for all interstate work.

3. Specify Type "A" mixture for all interstate base courses.

4. Strengthen the language of Instructional Memorandum 511 to better correlate the relationship of both lab and field voids and densities.

5. Review crushed particle requirements and limits for recycled mixes and all other mixes used under heavy traffic with consideration of increasing the minimum crushed particle requirement.