



QUARTERLY PROGRESS REPORT

Project Title:	Rut Testing of Hot Mix Asphalt		
RFP NUMBER:	NJDOT RESEARCH PROJECT MANAGER: Mr. Nicholas Vitillo		
TASK ORDER NUMBER/Study Number: Task Order No. 98 / 4-26677	PRINCIPAL INVESTIGATOR: Dr. Ali Maher		
Study Start Date: 01/01/2001 Study End Date: 12/31/2002	Period Covered: 3rd Quarter 2002		

Task	% of Total	% of Task this quarter	% of Task to date	% of Total Complete
Literature Search/Local Agency Survey	10%	25%	100%	10%
Lab Testing for Rutting Criteria	25%	20%	100%	25%
Lab Testing for NJ HMA Characterization	25%	10%	20%	5%
Lab Testing for SUPERPAVE vs Marshall	20%	10%	35%	7%
Field Calibration/Evaluation	10%	0%	0%	0%
Final Report	10%	0%	0%	0%
TOTAL	100%			47%

I. Progress this quarter by task:

- A. Repeated Shear at Constant Height (RSCH) tests on identical samples to the APA testing were and are being conducted. The tests will be conducted at both 52 degrees C and 64 degrees C. Although the APA test temperature is 64 C, results from the Modified Binder study show that there is a strong correlation between RSCH at 52 C and APA rutting tests at 64 C. The RSCH results will be used in an attempt to develop another method to determine if HMA mixes are rut susceptible.
- B. The APA testing has completed for the Rut Criteria. A total of 12 different mixes were evaluated. The mixes varied in gradation (above and below the restricted zone), binder type (PG64-22, PG70-22, and PG76-22), and also design traffic level (very heavy, heavy, and medium). The PG70-22 and PG76-22 were only used in the very heavy traffic levels. All samples were compacted to 7% (+/- 0.5%) air voids and tested at 64 degrees C. The samples were heated for 4 hours at 64 degrees C prior to testing and evaluated at 8,000 cycles. This conforms to typical testing protocols used throughout the United States. Based on the results, the following APA Rut Criteria was developed based on traffic levels; 1) Very Heavy traffic – 3mm of APA rutting, 2) Heavy traffic – 5 mm of APA rutting, and 3) Medium traffic – 8 mm of APA rutting. These results were found to be very similar to the current criteria of the Arkansas DOT and the Oklahoma DOT. It should be emphasized that this criteria was solely based on gyratory-laboratory prepared samples. Using cores from the field may not be suitable within this criteria. This criteria is best used as a performance-type test after a volumetric mix design has been conducted.
- C. Permeability testing was conducted on identical samples. The falling head permeability results show a strong correlation with the APA rutting, where as the permeability of the gyratory samples increases, so does the rutting. The R² value of the correlation was determined to be 0.79. This essentially shows that the NJDOT low volume roads may be highly susceptible to water infiltration. Continued evaluation of this relationship will be attempted in future work.
- D. Results from CoreLok and T166 air void comparisons show that the CoreLok consistently provides a higher air void content then the T166 method. Strong correlations were developed when evaluating the fine and coarse mixes separately, R² = 0.83 and 0.84, respectively. As with the permeability results, this type of evaluation will continue to be developed.



- E. Aggregates are being collected to produce samples for field comparison. The procedure for the development of samples for the Low Volume Road analysis will be as follows:
1. After all aggregates are collected, samples will be prepared in the gyratory compactor based on the job mix formula. These samples will essentially be Marshall design samples, however, compacted in the gyratory compactor. Enough samples will be made to conduct permeability, APA rutting, and Indirect Tensile Strength.
 2. After the Marshall design samples have been completed, the gradations provided from the job mix formulas will be used to develop a mix design under the Superpave design method. The samples will be evaluated for an N_{design} of 75. Again, enough samples will be made to conduct permeability, APA rutting, and Indirect Tensile Strength testing.
 3. Once the actual Superpave design has been finished, a second design will be conducted, however, the N_{design} will be based on the Low Volume data collected from producers in the NJ. Based on 4 different I-5 mixes, it was estimated that an $N_{design} = 50$ would provide the same compaction necessary to simulate a Marshall design. Enough samples will again be made to conduct similar performance-type testing. After evaluation of this design will determine if more samples must be constructed using either more or less gyrations.

2. Proposed activities for next quarter by task:

- A. RSCH tests for the Rutting Criteria will be tested. A correlation will be made between the results of the RSCH and the APA. Based on the correlation and the APA criteria, a rutting criteria based on the RSCH test will be proposed.
- B. Construction of the Low Volume Road samples will begin. Based on the progress in the laboratory and sample collection, both the Marshall and initial Superpave designs will be done.

3. List of deliverables provided in this quarter by task (product date):

N/A

4. Progress on Implementation and Training Activities:

N/A

5. Problems/Proposed Solutions:

N/A

6. Budget Summary*

Total Project Budget(# of years)	2 Years	\$321,867.00
Total Project Expenditure to date		\$119,287
% of Total Project Budget Expended		37%
Task Order Number/Study Number:		98 / 4-26677
Current Task Order Budget (# of years)	Year 1 and 2	\$321,867.00
Actual Expenditure to date against current task order		\$119,287
% of current task order budget expended		37%

* These are approximate expended amounts for the project; these estimates are for reference only and should not be used for official accounting purposes. For a more accurate project accounting please review the quarterly invoice for this project.