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STEERING COMMITTEE MEMBERSHIP

Mr. Ara Arman, LTRC
Mr. John Stevens, LAPA
Mr. Al Dunn, DOTD
Mr. Earl Cryar, DOTD
Mr. Richard Richardson, LAPA
Mr. J. B. Esnard, DOTD
Mr.Leo LeBourgeois, LAPA
Mr. William Hickey, DOTD
Mr. Courtney Fenet, LAPA
Mr. Joe Baker, LTRC
Mr. Barry Moore, LAPA
Mr. Jarvis Poche, DOTD
Mr. William Temple, LTRC
Mr. William Drake, DOTD
Mr. Harold Paul, LTRC
Mr. Donald Carey, DOTD

CONSTRUCTION PRACTICES

INTRODUCTION

Membership:

Mr. Donald Carey, DOTD,co-chairman
Mr. Courtney Fenet, R. E. Heidt Construction Co.,co-chairman
Mr. Robert Dale Martin, DOTD
Mr. Don Tolar, DOTD
Mr. Roy Robinson, Barriere Construction Co.
Mr. Ed Pittman, T. L. James Co.

The Construction Practices sub-committee met on four occasions to "brainstorm" current construction procedures, practices, specifications, etc. with the intent of recommending revisions that would yield a better asphaltic concrete pavement. In addition to the sub-committee members the following industry manufacturing representatives participated:

Mr. Lou Fairchild, Chief Engineer, Cedarapids Mobile Equipment
Mr. Tom Bonnecase, Midco Louisiana Co.
Mr. Douglas Miller, Regional Sales Mgr., Barber-Greene Co.
Mr. John Guzman, Regional Service Mgr., Barber-Greene Co.
Mr. Jack Clements, Standard Havens Co.
Mr. Tom Baugh, Astec Co.

IDENTIFIED PROBLEM AREAS

1. Revision of 15-Foot Outside Lane Design Requirement

Problem: Current design practice for interstate type facilities requires that the outside lane of a flexible pavement be constructed 15-feet wide. This practice results in a 7-foot outside shoulder section which cannot effectively be constructed with basic 8-foot paver screeds or with haul trucks rolling on the edge of the previously placed 15 foot outside lane.

Solution: It is recommended that the design typical section for asphaltic pavements be revised to require a 13-foot outside lane with a 9-foot outside shoulder. Such a revision would enable standard pavers to pave the outside shoulder at 9-foot while the 13-foot driving lane would allow room to place the white pavement marking stripe at a location other than on the longitudinal joint. It is also estimated that the reduction in the driving lane from 15 to 13 feet will reduce the tonnage necessary to develop the 0.025 cross slope significantly over a construction season.

Problem: Deficiencies in the joint at the pavement/shoulder interface can occur when the contractor waits until the end of a project to place the shoulder mix which requires a new mix design. Often the outside edge of the wearing course mix on the travel lane will deteriorate prior to shoulder placement such that a well bonded joint cannot be formed. Slippage planes are created which in time will allow the longitudinal joint to open promoting moisture problems and ravelling. In most cases, this allowance will additionally permit the completion of an overlay project with less interference to the travelling public by not requiring an additional pass of the paver or shoulder widener. Also, for narrow shoulders (i.e. 4-foot inside shoulders) this allowance will result in a smoother shoulder surface.

Solution: For those narrow shoulders (7-foot or less) revise specification language to permit a shoulder wearing course mix to be the same type mix as the main roadway wearing course provided the shoulders are paved at the same time and through the same paver as the adjacent travel lane (See Appendix A, Item CP-1). It was also recommended that the department should consider allowing the same type mix to be used on wearing courses and shoulders regardless of shoulder width.

2. Improvements to Cold Planing Operations

Problem: Cold planing operations if not properly designed, conducted and monitored can cause the planed surface to be non-uniform and have spalled areas requiring patching prior to overlay. Irregular spalling has occurred when the projects have been designed such that less than one-inch of mat remains after milling and when the milled surface is exposed to traffic for prolonged periods of time prior to overlay. These practices affect the quantity of patched areas and can adversely affect the density of the subsequent overlay.

Solutions: (1) Practice in other states and advice from equipment manufacturers indicate that final surface texture of a milled roadway is greatly impacted by forward speed of the milling machine. If the forward speed of the milling machine is not controlled the texture pattern is such that spalling can occur and that proper compaction can not be achieved on the subsequent paved layer. Also, uncontrolled speeds can dislodge chunks of existing pavement so that the milled surface is not to grade.It is recommended that maximum forward speed be restricted to 40 ft/min (See Appendix A, Item CP-2).

(2) Irregular spalling has occurred when the projects have been designed such that less than one-inch of mat remains after milling. Regardless of forward speed of the milling machine it has been found that when less than one-inch of asphaltic concrete remains the milling operation will often break the bond of the remaining material such that either during the milling process or with subsequent traffic spalling will occur in the milled surface prior to overlay. In order to overcome

these problems the Asphaltic Pavement Design Memorandum should be modified to include:

Cold Planing: Projects shall be designed to regulate the depth of milling to avoid a thin (one inch or less) mat after milling. In most cases this will be accomplished by milling 2-inches, as most wearing courses are 1.5-inches thick.

(3) Traffic on the milled surface for prolonged periods of time after milling and prior to overlay has caused spalling of the milled surface. It is recommended that specification language should restrict cold planing operations so as to not precede subsequent overlay operations by more than thirty (30) calendar days (See Appendix A, CP-2).

Problem: Present specifications and plan details call for temporary striping of 4-foot lengths spaced at 40-foot centers. The 4-foot length of tape is difficult to bond uniformly to the milled surface. This causes a safety problem as the roadway centerline is lost when the tape debonds.

Solution: A recommended option would be using 2-foot lengths of tape spaced at 20-foot centers subject to review by the Traffic and Planning Section.

Problem: Present cold milling practice does not require any longitudinal profiling or correction to existing longitudinal undulations. Current practice calls only for an average depth of cut and a transverse correction of cross slope. Consequently, the milling machine is following (at a lower grade) whatever undulations exist. It is recommended that, when deemed appropriate for a particular project, the cold milling operation be required to correct undulations that otherwise would require a hot mix leveling course.

Solution: The milling machine should be required to be capable of using a 30-foot travelling stringline. The use of such a travelling stringline should be specified on the plans when deemed appropriate (See Appendix A, CP-2 and CP-3).

Problem: It has been noted that when milling machines lose cutting teeth longitudinal ridges are formed on the roadway. These ridges create a safety hazard in the worst cases and also lead to compaction problems.

Solution: Information needs to be developed on the appropriateness of an acceptance measurement for the transverse finish of a milling operation. Transverse surface tolerance limits have been suggested for cold planed surfaces. It is recommended that a literature search or phone survey be conducted to determine the state-of-the-practice in this regard.

3. Determination of Areas to be Patched

Problem: Current identification of areas to be patched during the plan-in-hand inspections is highly dependent on the individual members of the team. Guidelines are difficult to standardize. Weak base and subbase areas are sometimes not identified until actually under construction traffic. As a result failed areas require work stoppage and cost overruns.

Solution: The equipment requirements of Section 724 should provide that the contractor furnish a loaded single axle flat bed truck. The general requirements of this same section should require proof rolling with such equipment to identify locations of base failures to be repaired (See Appendix A, CP-4).

4. "Truck-End" Segregation During Placement of Asphaltic Concrete

<u>Problem</u>: In recent years noticeable segregation and surface irregularities have been observed at areas of truck/paver exchanges. These problems present an unsightly appearance, promote ravelling and create a poor riding surface. Segregation can happen at virtually any step of the material handling process including plant production, transfer to haul trucks, transfer from haul trucks to the paver and during paving operations. Continuous paving operations are essential to providing uniform surface texture and smooth riding surfaces. Stop and go paving operations have been identified as leading to segregation problems (cold mix left in hoppers, frequent folding of hopper wings, emptying of hopper exposing drag slats) and surface irregularities (indentations from screed settling and rough texture from segregation).

<u>Solutions</u>: Generally, the specifications should promote continuous paving operations and reduce the opportunity for segregation. Specific recommendations include:

(1) Wording should be added to specifications to prevent paver hoppers from running so empty that the drag slats are exposed.
This will reduce the height of drop and prevent the larger aggregate particles from preferentially filling the slats (See Appendix A, CP-5).

(2) Minimizing segregation in the haul trucks should be accomplished. By requiring that trucks be loaded with a minimum of three drops, the last of which will be in the middle, any roll-down of material should tend toward the center and should be covered by the last drop (See Appendix A, CP-5).

(3) The proper coordination of plant, haul trucks and paver should be better defined. Good coordination can eliminate cold material in the hopper, running out of mix in the hopper exposing the conveyor slats, and excessive folding of paver wings which all promote segregation. Also coordination can reduce stoppages of the paver and thereby eliminate indentations caused by the paver screed. The paver speed and /or number of haul trucks should be adjusted so as to always maintain one truck waiting, in addition to the one truck that is feeding the paver. (See Appendix A, CP-5).

So as to facilitate continuous paver operations and minimize truck exchange time, small quantities of material which cannot be dumped into the paver hopper at the end of a truck load should be permitted to be scattered between the wheels or tracks of the paver. In addition to reducing paver downtime, this action should minimize cool or segregated material from being at the surface of the finished mat at these "truck-end" locations (See Appendix A, CP-5).

(4) Current technology indicates the development and use of an intermediate piece of equipment

which would receive mix from the haul vehicles, have the capability to re-mix whatever segregation might exist and feed a constant supply of mix to the paver. It is recommended that this technology should be investigated for possible use in Louisiana (See Appendix B, PS-1).

5. Joint Construction

Problem: Ride quality and ultimately pavement service life are adversely affected by poorly constructed transverse and longitudinal joints. In addition to an inferior ride quality associated with dips or humps caused by poorly constructed transverse joints, pavement service life can also be reduced at such locations resulting in failures due to cracking and/or ravelling. Longitudinal joints if not properly constructed allow for early centerline and pavement/ shoulder interface cracking. This cracking permits water intrusion leading to stripping and ravelling.

Solutions: (1) A ten-foot static straightedge should be required for use on the cold mat to identify to what location the cold joint should be cut back so as to maintain no greater than a 1/8-inch deviation in grade. Upon renewed paving efforts the contractor should pull up and stop within 100 feet past the joint and that a stringline be used (extending from approximately 10 feet prior to the cold joint to at least one paver's length plus 10 feet onto the new mat) to assist in working to proper grade the new hot joint (See Appendix A, CP-6).

(2) The centerline joint for all wearing courses should be hand tamped with a lute) to "near vertical" and that the outside edges be either hand tamped or placed with a bevel to an approximate 45° edge (See Appendix A, CP-6).

6. Serviceability of Finished Surface

Problem: Recently an increased number of projects have had roller marks left after the final rolling. These marks decrease the rideability of the pavement.

Solution: With present pneumatic roller requirements, rollers should not be required to move around each other to "cooled" areas whenever the paver stops. It is recommended that the word "cooled" be changed to "cooler". If roller indentations should persist, the solution would be the addition of haul vehicles to keep the paver moving and the rollers in a continuous use mode (See Appendix A, CP- 7).

Problem: Reflective cracking due to thin flexible overlays on cement treated base or Portland cement concrete reduces the ultimate serviceability of the pavement. On single lift overlays this cracking initiates soon after construction; for two lift overlays, this cracking occurs within a few short years. These cracks subject the system to water intrusion which in turn can create distress conditions such as stripping, ravelling, spalling and faulting. The result is poor rideability and reduced service life.

Solution: It is requested that research be directed toward reducing reflective cracking. This might take the form of field projects involving technologies such as geotextiles, stress absorbing membranes prior to overlay, breaking and seating, etc. (See Appendix B, PS-2).

7. Paperwork and Testing Facilitation

Problem: With current specifications and procedures, whereby a lot cannot be ended early except when more than two days pass between continuous production, acceptance testing (gradation and density) and verification testing (stability and density) cannot be accomplished as timely as otherwise would be possible. In most cases, at least one day could be saved for all such testing if a lot could be "closed out" at the end of a day's production. Additionally, present requirements for not terminating a lot until a set tonnage is produced actually could result in no stability testing for whatever tonnage is needed to complete the set tonnage when the plant does produce again.

EXAMPLE: Monday 1700 tons produced [lot size 2000 tons]
4 briquettes made (@ 350,800,1300 and 1700 tons)

Tuesday 300 tons produced at start of day to complete lot. No samples taken to represent this tonnage.

Solution: It is proposed that a lot size be permitted to be reduced by 25 percent provided that it is always represented by four samples for stability. Thus, a 2,000 ton standard lot size could be terminated after 1500 tons for rain or equipment failure (See Appendix A, CP-8).

8. Single-Lift Overlay

Problem: The current standard single-lift design, although appropriate for some projects, results in other projects being under-designed and constructed with rough rides.

Solution: It is recommended that design procedures be more flexible so as to allow for the proper structural and/or levelling tonnage for any particular project.

DESIGN

INTRODUCTION

Membership:

Mr. J. B. Esnard, DOTD, Co-chairman
Mr. Leo LeBourgeois, Louisiana Paving CO., Co-chairman
Mr. William Temple, LTRC
Mr. Blaise Carriere,
Mr. Willis Taylor, Dravo Co.
Mr. Billy Sharp, DOTD

This committee met on two occasions and identified nine areas of concern.

IDENTIFIED PROBLEM AREAS

1. Structural Coefficient for Type 8 Asphaltic Concrete

Problem: A design structural coefficient for the newly specified Type 8 asphaltic concrete needs to be determined. It is believed that the use of the non-polishing stone in these mixes is providing field strength values that are significantly higher than the previous high stability mixes.

Solution: Research is needed to identify and evaluate available data in order to characterize the field strength and design parameters associated with the Type 8 mix (See Appendix B, PS-3).

2. Revision of 15-Foot Outside Lane Design Requirement

Problem: Current design practice for interstate type facilities requires that the outside lane of a flexible pavement be constructed 15-feet wide. This practice results in a 7-foot outside shoulder section which cannot effectively be constructed with basic 8-foot paver screeds or with haul trucks rolling on the edge of the previously placed 15 foot outside lane.

Solution: It is recommended that the design typical section for asphaltic pavements be revised to require a 13-foot outside lane with a 9-foot outside shoulder. Such a revision would enable standard pavers to pave the outside shoulder at 9-foot while the 13-foot driving lane would allow room to place the white pavement marking stripe at a location other than on the longitudinal joint. It is also estimated that the reduction in the driving lane from 15 to 13 feet will reduce the tonnage necessary to develop the 0.025 cross slope significantly over a construction season.

3. Revision of "Working Table" Concept

Problem: The DOTD working table concept needs to be re-examined in terms of need and benefit. Uniform support is not being achieved along the length of a pavement on some projects due to the manner in which the working table concept is applied to soil treatment. Uniform support is critical to pavement performance whether the layer in question is counted as a contributing layer or not. In addition, construction specification requirements should be reviewed with respect to materials and procedures for various soil types.

Solution: A subcommittee was formed to discuss and submit recommendations on the concept of the "working table." This committee consisted of Earl Cryar, W.D. Drake, Steven Cumbaa, William Temple, J.B. Esnard, John Stevens, Barry Moore, Curtis Dockins and Jarvis Poche. The following presents their findings:

I. From a construction point of view it was felt that this concept was difficult to construct and would not support construction traffic throughout the life of the project. When the "Working Table" is constructed on or out of in-place embankment materials, it costs the DOTD money in plan changes to repair damaged working tables (cement or lime treated) which failed during construction. Even when the working table is placed on an embankment constructed by the contractor we still get claims from the contractors alleging that the failures are not his responsibility.

II. **Recommendation:** The term "Working Table" should be replaced with "subbase." The subbase should be designed by the Department, not by the contractor, to carry construction traffic. Through experience, it was felt that an 8-1/2 inch thickness was the minimum necessary to carry construction traffic. Lime treatment should only be used to condition a soil prior to cement stabilization. A structural number should be given to the subbase and used in the pavement design.

III. As a proposed construction sequence, the committee recommends the following for existing embankments before the subbase is placed.

a. The embankment shall be scarified, disked, pulverized and the moisture adjusted to optimum before compacting to 95% of maximum density. If lime conditi oning is warran ted then a pay

item
will be
include
d for
that
item.

b. After compaction is complete the embankment shall be proof-rolled to determine bad areas. Bad areas shall be removed, replaced with suitable material and recompacted. The contractor shall obtain density or corrections made until density is achieved before proceeding with subsequent construction.

IV. As a general rule it was recommended that the asphaltic pavement thickness be equal to or greater than the cement stabilized base to reduce reflective cracking.

V. The subcommittee recommends experimental projects be constructed using the following design alternates.

a. Interstate Projects

(1) Design the subbase for flexible pavement using compacted crushed stone or crushed concrete in lieu of cement stabilized subbase.

(2) Design treated subbase, lime condition if necessary, then cement stabilize. Asphaltic pavement same thickness or greater than the cement stabilized subbase.

b. Reconstruction Projects

(1) Pulverize existing asphaltic pavement and base, add crushed stone or crushed concrete as necessary to create a flexible aggregate base and then compact to required density.

(2) Use geotextile fabric along with alternate II a. above.

VI. It was also felt by the subcommittee, the Department should place more controls on embankment material and embankment construction to eliminate weak areas in the embankment.

4. Base Course Layer Equivalencies

Problem: Current design practice is limited by the use of final elevation as a design criteria. Base course materials such as granular stone base, cement treated base and black base all have different structural characteristics yet alternate designs call for the same base thickness; this thickness is predicated on the final desired elevation.

Solution: Subbase elevations and/or surface course thicknesses should be revised based on the structural layer equivalencies of the base course materials to achieve final elevations. Such a practice would reflect true relative strengths of materials and would promote competitive alternate designs.

Problem: The design coefficient for soil stabilized-in-place of 0.15 which is based on compressive strength may be too high. Frequent, irregular cracking patterns of the cement treated bases, caused by non-uniformity of cement blending, reflect readily into the surface materials. Differential faulting reduces the serviceability of the riding surface.

Solution: It is suggested that consideration be given to adjusting the design coefficient of cement treated bases to be more consistent with its functional performance characteristics. It is further recommended that research be conducted with central plant mixing of cement stabilized materials in an effort to provide a more uniform product to improve the cracking characteristics of this type of base course (See Appendix B,PS-4).

5. Pavement Management

Problem: The department's approach to management of composite pavements needs to be examined with regard to increasing the life cycle of overlays on these pavements. This is particularly true on routes where the movement of the underlying jointed concrete pavement frequently reduces the service life of the total section. Additional deterioration on these pavements is noted along transverse joints and longitudinal widening joints which are frequently located in one of the wheelpaths.

Solution: Life cycle and performance characteristics of the major composite systems in Louisiana should be determined to provide input for pavement management decisions (See Appendix B,PS-5).

Problem: Over the past several years minimum asphaltic concrete overlays - 1.5 inches - have been utilized extensively as an interim solution to the economic situation. In the long run however such a solution may not prove beneficial.

Solution: It is recommended that each overlay project be designed to a proper thickness based on the structural and serviceability needs of the roadway. This practice should be maintained at the expense of postponing some projects until the following year. Projects constructed at minimum thickness over the last several years should be evaluated for performance to determine the cost benefit of this type of construction (See Appendix B, PS-6).

Problem: Generally, while full depth asphaltic concrete pavements can perform for the designed

20 year life from a structural perspective, the wear characteristics of the aggregate materials are such that remedial action is required prior to the end of the design period.

Solution: Staged construction is a possible solution to such a problem. Recognizing that a recent federal register severely restricts staged construction on federal aid projects, staged construction should be considered on state owned roadways. It is recommended that this approach be evaluated utilizing an annualized cost analysis and life cycle basis for comparison purposes.

6. Pavement Rehabilitation

Problem: Reflection cracking in overlays on jointed and cracked PCC pavements or cement treated bases can severely reduce the useful service life of a roadway.

Solutions: (1) Methods of minimizing reflective cracking such as waterproofing tape, geotextiles and controlled cracking through joint sawing should be evaluated. One project utilizing several of these techniques is already under evaluation.

(2) A pre-overlay technique of cracking and seating existing PCC pavements should be examined on non-reinforced jointed concrete pavement. Four methods of crack and seating have been examined throughout the country: (1) Minnesota method - transverse cracking only with 12 - 36 inch crack spacing; (2) California method - transverse and longitudinal cracking; (3) Kentucky method - cracking to achieve 12 - 36 inch diameter size pieces; and, (4) complete rubblizing. A suitable pavement should be selected of sufficient length so that various overlay thicknesses and a control section can be evaluated (See Appendix B, PS-7).

MATERIALS

INTRODUCTION

Membership:

Mr. Jarvis Poche, DOTD, Co-chairman
Mr. Barry Moore, Moore and Associates, Co-chairman
Ms. Dee Jones, LTRC
Mr. M. M. Cryer, DOTD
Mr. George Greenup, Exxon
Mr. Bruce Granger, Louisiana Industries
Mr. Don Tolar, DOTD
Mr. Don Carey, DOTD
Mr. Harold Paul, LTRC
Mr. Steve Strickland, Cook Construction Co.
Mr. Billy Bisher, Delta Construction Co.
Mr. Joe Lively, Ingram Aggregates

The subcommittee on Materials held four meetings and thoroughly discussed the topics proposed by the co-chairmen as listed below. The proposed agenda was distributed to each member so that the committee members could prepare adequate responses to the topics.

A. Aggregates
1. Crushed requirement for different type mixes
2. Skid resistance
3. Reclaimed asphaltic concrete and PCC
4. Sands
5. Mineral filler
6. Screenings
7. Absorption factors
8. Stripping

B. Asphalt Cement
1. Improve specifications to identify poor performance
2. Increase range of viscosities
3. Improve performance with modifiers
4. Mixing asphalt cements from different sources
5. AC compatibility with aggregates and additives

C. Test Methods
1. ASTM vs. DOTD for stability
2. Specific gravity of aggregates
3. briquette and pavement core gravities
4. Theoretical gravity of mix

D. Mix Designs
1. Review MS-2 method and compare to DOTD method
2. Mix design limits for different type mixes
3. Mix design with absorptive aggregates
4. Review of all different type mixes and possible reduction
5. Use of additives or modifiers in mix designs
6. Lab vs. plant mix design
7. Validation of mix design
8. Changing mix design during project
9. Control of mix temperature for mix design points
10. Control of gradation of design points and plant production
11. Mix designs with reclaimed hot mix or PCC
12. Evaluation of mix design performance on roadway

E. Additives and Modifiers
1. Antistrip additives
(a) Source approval
(b) JMF approval
(c) Proper rates
2. Modifiers
(a) Different types
(b) Where to be used
(c) Performance
3. Lime
4. Rubber
5. Mineral Filler

IDENTIFIED PROBLEM AREAS

1. Skid Resistant Surfaces

Problem: Currently, while still under the moratorium on Asphaltic Concrete Friction Courses, the department only specifies one other wearing surface for high speed, high volume roadways, the Type 8 Wearing Course. This wearing course mix utilizes non-polishing aggregates for 50 to 100 percent of the coarse fraction in the final aggregate blend. These aggregates are generally imported from out of state and are sometimes difficult to acquire in a timely fashion. This situation provides hardship to both gravel aggregate suppliers and those contractors who cannot acquire the imported materials. On the other hand it is recognized that there has been a reduction in the friction numbers of dense graded gravel mix such that less than desirable roadway surfaces have been found shortly after construction.

Solutions: (1) The subcommittee recommended that alternate designs with skid resistent aggregate be evaluated. This evaluation should include performance and cost effectiveness. Alternative surface sources to be considered should include:

(a) Type 8 with skid resistant aggregate
(b) Asphaltic Concrete Friction Course with a new mix design procedure or modifiers to insure extended life
(c) Type 8 mix without the skid resistant aggregate in combination with an ACFC
(d) Sprinkle Treatment
(e) Staged construction to renew surfacing using additional hot mix or chip seal (See Appendix B, PS-8)

Several of these recommended practices are already under evaluation by LTRC. A three year performance evaluation report should be published this fall.

(2) It has been postulated that one of the differences between gravel mixes produced today and mixes of twenty years ago which did have good frictional properties is the size of aggregate prior to crushing. Gravel sources today, particularly in south Louisiana, are producing smaller top sized aggregate such that upon crushing, the number and quality of the crushed face(s) are not adequate. Studies have shown that increasing the number of crushed faces will increase both the stability and the frictional properties of the mixture. The subcommittee recommended that a correlation study be conducted to compare the percentage of aggregates having one versus two or more mechanically induced fractured faces (See Appendix B, PS-9).

2. Absorptive Aggregates

Problem: Over the last several years Louisiana has seen an increase in the use of aggregates which are highly absorptive in nature. Many of these are imported into the state and are aggregates for which the department has not had historical usage. While the department has a procedure to account for the absorption of asphalt when the water absorption is greater than 2.5% (TR 302), the newer aggregates have demonstrated the ability to absorb a much higher percentage of asphalt at lower than experienced water absorption rates (ie. some stones have demonstrated the ability to absorb 0.5% asphalt but only 1.5% water so that TR 302 would not apply). This circumstance has posed a problem as the department's design procedure to determine the optimum asphalt content for a mix design does not account for the asphalt absorbed into the aggregate. This practice results in a reduction of asphalt film thickness on the aggregate. With a reduced film thickness, the in-place hot mix is subject to higher than designed air void content and loss of service life through stripping, ravelling and cracking due to excessive aging and embrittlement of the asphalt cement.

Solution: The department has made several changes in test procedures which should address at least partially the absorption of asphalt by aggregates:

(a) Water absorption rates will be included in the Qualified Poducts List for each aggregate source.

(b) The implementation of two test procedures to determine the asphalt absorption factor:

DOTD Designation: TR-300 (revised 11/87), Determination of Specific Gravity of Aggregate and Mineral Filler for Asphaltic Mixtures; and,

DOTD Designation: TR-320 (Adopted 11/87), Determination of Asphalt Absorption Factor of Aggregate and Effective Asphalt Content for Asphaltic Mixtures.

The subcommittee made no additional recommendations at this time. However, it agreed that these test procedure changes will require evaluation with respect to field performance. In fact it was noted that some aggregates could absorb so much asphalt that they would be impractical to use with respect to optimization of asphalt content and field performance.

Problem: The two, newly implemented test procedures account for the amount of asphalt absorbed by aggregates impacting the determination of air void content and voids filled with asphalt criteria in the asphalt content optimization procedure. These two procedures do this by allowing the produced asphaltic mixture to sit in an oven at high temperature for a period of time which simulates the time that asphalt would be absorbed during the production and paving of mix on the roadway. However, the compaction of absorptive aggregate mixes and the stability testing still do not account for the absorption of asphalt and the subsequent or final compaction of mix containing an absorptive aggregate in the field as this testing is accomplished on the freshly produced mix. As the mix lies in the haul trucks and goes through the paving machine, the asphalt is continually absorbed thereby reducing the film thickness on the aggregate such that the final in-place product will not be similar to the product that was tested at the plant. Therefore, two points of the Marshall design procedure do not account for absorbed asphalt.

Solution: It was recommended that additional research be conducted to modify the design procedure such that all properties of the mix account for the absorbed asphalt. It was recognized that such a procedure may be difficult to achieve for those aggregates which absorb a very high quantity of asphalt. Those aggregates may have to be removed from the Qualified Products List (See Appendix B, PS-10).

3. Stripping

Problem: In the early 1980's research indicated that the state had a problem with stripping in its asphaltic pavements due to a non-compatibility of materials. Pavements were providing less than desirable and planned service life.

Solution: DOTD Designation: TR-317 (revised 11/87) was implemented to test the actual materials being used for water susceptibility prior to being placed on the roadway. Also, specifications were modified to allow a range of 0.5% - !.2% antistrip by weight of asphalt to be utilized. While this has attenuated the problem to some extent, the test procedure is still not satisfactory as it only tests the coarse aggregate and its results can be subjective. A three year test program to develop a more objective test procedure which examines all component materials is nearing completion. Final data analysis is currently underway which will establish limits for a modified Lottman procedure to determine the water susceptibility of the total mixture. The subcommittee recommends that this test be approved for use as soon as possible.

4. The Use of Reclaimed Asphaltic Concrete and PCC Materials

Problem: There were no reports of problems with the use of reclaimed hot mix. Presently, however reclaimed PCC can only be used in base course and shoulder course mixes. It was requested that its use be permitted in all mix types.

Solution: Reclaimed PCC has been used in binder and wearing course mixes on an experimental basis due to the highly absorptive nature of the material. It was recommended that no changes be made to current policy until such time as a mix design procedure has been developed for absorptive aggregate mixtures.

5. The Limitation of 35% Maximum Allowable Sands

Problem: An adjustment of the requirement limiting natural sands to a maximum of 35% in binder and wearing course mixes was requested. This requirement was imposed in the same specification revisions that reduced the maximum top sized aggregate in the wearing course mixes to provide a non-segregated and tighter surface course mixture. Higher percentages of sands in these mixes could lead to rutting and reduce skid resistance. It was noted that the Federal Highway Administration in their Technical Advisory 5040.24, "Asphalt Concrete Mix Design and Field Control," recommended that "the amount of natural sand as a general rule should be limited to 15 to 20 percent for high volume pavements and 20 to 25 percent for medium to low volume pavements." The contractors indicated that the increased use of coarse materials could lead to additional segregation particularly in mixes which contained stone. Further, stone mixes with greater than 35% sands could provide high stabilities to withstand rutting along with skid resistant properties.

Solution: The committee believed that no change should be made at this time for the wearing course specifications, but that this problem should be further evaluated. It was recommended that the requirement of 35% maximum sands in binder and shoulder mixes should be changed as this requirement could lead to segregation in these mix types. Also, there should be no limitation on the amount of limestone screenings as in the current specifications. By eliminating the restriction on limestone screenings it is believed that screenings will be used for a portion of the coarse sand fraction in order to meet gradation requirements while at the same time providing increased stability. In addition, it is believed that this change will decrease the cost of these mixes (See Appendix A, MAT-1).

6. Improve Asphalt Cement Specifications

Problem: Asphalt cement specifications have not been significantly changed in a number of years. Yet, there has been a proliferation a new crude sources utilized in asphalt marketed in Louisiana. Field personnel have noted changes with respect to the tackiness of the asphalt and rapid aging characteristics have been found in several of the asphalt pavements using particular crude sources.

Solution: There have been several national studies conducted by the Asphalt Institute and the Pennsylvania Transportation Institute in the last several years. Also, the Strategic Highway Research Program has as one of major areas of focus asphalt cement. Most studies to date have only indicated temperature susceptibility as the only significant change. Rapid aging characteristics such as have been observed in Louisiana have not been noted.

The Materials Section has begun an evaluation of temperature/viscosity curves and heat aging of different asphalt cement sources. The results of this study will be furnished to the field upon completion.

New technological equipment improvements and the application of existing technology such as high pressure gel permeation chromatography have been recently developed to further characterize asphalt cements. It was recommended that all asphalt cements currently being supplied to Louisiana should be examined with respect to the available technology in the interest of improving asphalt cement specifications (See Appendix B, PS-11).

7. Mixing Asphalt Cements From Different Sources

Problem: Fluctuating costs of crude sources and asphalt cements has caused contractors to shift from one asphalt supplier to another both within a project and sometimes within the same lot. It is recognized that a blend of asphalt cements from different sources and from different methods of production even though individually within specification may not result in a specification asphalt. As such, field performance and acceptance test results can not be predicted.

Solution: It was noted that a new job mix formula is required for each change in material source. It was agreed that an entire set of optimization curves would not have to be run with such a change provided that the original JMF properties were verified with the new asphalt cement. The specifications should be modified to require that existing asphalt supplies at a plant should be reduced as much as possible prior to adding a new grade or source of asphalt cement (See Appendix A, MAT-2).

8. ASTM versus DOTD Marshall Breaking Molds

Problem: DOTD currently specifies molds manufactured to the original Marshall method design specifications while ASTM has recognized a different design for these molds. A noticeable difference in the stability results is obtained dependent on which mold is used. To our knowledge, no other state is using the original design mold. This difference poses problems for contractors who work in more than one state and in attempting to relate Louisiana data to other states.

Solution: It was recommended that a study be conducted to determine the differences in Marshall properties between the two molds. The information gathered could be used to modify current specifications to conform to the ASTM procedure (See Appendix B, PS-12).

9. Review of the Asphalt Institute's MS-2 Mix Design Method

Problem: The AI mix design method utilizes a different concept to determine void properties in dense graded asphaltic concrete mixtures. This method has recently been promoted by the Federal Highway Administration in a technical memorandum.

Solution: It was recommended that no changes should be made in current mix design procedures until a comparative study can be made of the effect of the AI procedure on Louisiana mix types (See Appendix B, PS-13).

10. Asphalt Modifiers for Increased Performance

Problem: Increased loading and higher tire pressures can contribute to reduced pavement life. Additionally, the quality of asphalt concrete is susceptible with respect to moisture susceptibility, ability of lower quality aggregates to perform and the quality of asphalt cements.

Solutions: (1) Much work has been accomplished over the last several years with additives and modifiers for both asphaltic concrete and asphalt cements. Strength, reduction of temperature susceptibility, and binder and mix stiffness can be enhanced through the use of these modifiers.

Polymer modifiers have shown to be effective in both laboratory and field studies. Louisiana has already initiated several minor studies in this area, but additional work needs to be accomplished. Many new polymers are just now entering the market. Both basic and applied research in the laboratory and field should be examined with respect to fundamental materials properties and cost effectiveness (See Appendix B, PS-14).

(2) Hydrated lime has been shown in the laboratory to improve asphaltic concrete in a three-fold manner: the lime works as any other mineral filler to fill voids with the larger size fraction enhancing strength characteristics and the finer fraction acting as binder thereby thickening the film coating on the aggregate; hydrated lime has demonstrated the ability to behave as an antistrip agent; and, recent studies have indicated that the use of hydrated lime can reduce oxidation of the asphalt cement. With the age hardening characteristics of some of the more recent crude sources being used in Louisiana, this last factor becomes very important. That, in addition to the increase in binder film thickness make this additive very attractive. It was recommended that a field project be undertaken to examine the performance of hydrated lime.

TRAINING

INTRODUCTION

Membership:

Mr. Joe Baker, LTRC
Mr. John Stevens, LAPA
Ms. Dee Jones, LTRC

The Training Subcommittee distributed a questionnaire to DOTD construction and maintenance sections, each district administrator, construction engineer, laboratory engineer, and training specialist, as well as to all LAPA members, steering committee members, and other representatives of the asphalt industry in Louisiana. Included in the package were lists of training materials available from LTRC and LAPA. Appendix C contains the questionnaire and the lists of available training materials.

SUMMARY OF RESPONSES

Twenty-five responses were received, mainly from LA DOTD district personnel. Additionally, Mr. Stevens has received some district requests for review and use of LAPA training materials. The questionnaire revealed that while LA DOTD personnel are familiar with LTRC-produced training materials, they have little familiarity with industry-produced information. The LTRC Training Office has, in the last year, distributed several industry-produced pamphlets and the training subcommittee is currently reviewing additional materials for possible future distribution to LA DOTD personnel.

For all topics covered by the questionnaire, responses were markedly similar. In general, it was felt that the training materials currently available were basically adequate, but in need of updating. It is to be noted that the LTRC Training Office is currently in the process of revising two asphalt training courses, Asphaltic Concrete Paving Inspection and Basic Asphaltic Concrete Plant Inspection, as well as revising the Application of Quality Control Specifications for Asphaltic Concrete Mixtures to correspond to the latest specification revision. Many of the specific recommendations of questionnaire respondents have already been addressed in the drafts of these materials. Respondents also felt that training was needed for all groups, engineers and technicians, department and industry, and that different formats could appropriately be used.

Flexible Pavement Design

Since most respondents were LA DOTD district personnel involved in materials and construction with little responsibility for pavement design, there were few comments on this topic. There was some confusion by respondents of flexible pavement design with mix design. Those few respondents who are involved with pavement design indicated a need for LA DOTD specific training in this area for design engineers. One industry respondent felt that currently pavements are designed for portland cement concrete with asphaltic concrete only an allowed substitution. He felt flexible pavements should be a first design alternative.

Mix Design

Respondents were generally familiar with all LTRC developed materials, as well as MS-2 by the Asphalt Institute. Some areas of mix design for which additional training was requested are:

Specific Gravity - AASHTO 209
V M A in Design
Design with Reclaimed Material
Correlation of Mix Design to Roadway Performance
The Development of a Standards Board for Determining Coating Results for TR 317
0.45 Power Curve

The LTRC Training Office has plans to redesign the Advanced Asphaltic Concrete Plant Inspection training course to more fully address mix design and production trouble shooting. It is expected that the areas mentioned above can be addressed in this project. The current edition of the "Application Manual" specifically addressed the design of asphaltic concrete mixtures using RAP, and the next edition will discuss the 0.45 power curve. The LTRC Training Office has also expressed a willingness to work with appropriate LA DOTD engineers to develop TR 317 standards boards and distribute them to each district.

Plant Operations

Respondents were generally familiar with all LTRC developed materials, as well as some developed by plant manufacturers. Some area of plant operations for which additional training was requested are:

Absorptive Aggregates - Testing and Use
Skid Resistant Aggregates - Use and Purpose
Effects of Different Aggregate Types on Mixes
Lime
Rice Gravity
Quality Control Testing (Gradation, % AC, % Crushed, Boil Test)
Drum Mixer Plants
Storage Bins/Surge Bins/Silos - Operation and Inspection
Cold Feed Control
Trouble Shooting

Some of these topics will be addressed in Basic Asphaltic Concrete Plant Inspection, currently in revision; others will be addressed more appropriately when Advanced Asphaltic Concrete Plant

Inspection is redesigned. The LTRC Training Office has located and distributed materials on some of these topics and will continue to search for additional materials. Some of these topics can be addressed in the future in independent training documents of appropriate format (written, video, seminars).

Paving

Respondents were generally familiar with all LTRC-developed materials, as well as some LAPA and Asphalt Institute materials. Some areas for which additional training was requested are:

Training for Truck Drivers - Cleaning, Truck Exchange, etc.
(Contractor Sponsorship recommended)
When to use Tarps on Haul Trucks
Dealing with Truck Exchange Problems
Loading Trucks without Causing Segregation
Long Distance Hauling
Number of Trucks and Paver Speed Correlation
Cold and Wet Weather Paving
Equipment Inspection and Adjustments
Paver Electronics
Rolling Patterns
Patching
Handwork
Correlation of Lay-down and Compaction Problems to Mix Design and Production

The revised Asphaltic Concrete Paving Inspection, which is scheduled for publication soon, addresses some of these topics in detail. The topics specifically included in this course are: truck exchange problems, numbers of trucks and paver speed correlation, equipment inspection and adjustments, paver electronics, patching, handwork and correlation of laydown and compaction problems to mix design and production. A research report by Tom Kennedy of the University of Texas which thoroughly addresses the causes and alleviation of segregation problems was recently distributed by the LTRC Training Office to each district. This report explicitly discusses the loading of trucks without causing segregation. Other topics may be covered in the future in independent materials in appropriate format.

Specifications - Parts V and X

The primary role of the LTRC Training Office in the area of specifications is to explain specification changes through training materials and to work with appropriate LA DOTD officials to revise the Application of Quality Control Specifications of Asphaltic Concrete Mixtures. The inclusion in training materials of explanations for specification changes and the ramifications of these changes has a detrimental, as well as a positive aspect. Training materials are outdated as soon as new specification changes are implemented. This is a problem that the LTRC Training

Office has been aware of for some time and one for which a satisfactory solution is being sought. Several possibilities are being considered, including seminars for district personnel and the distribution of synopses of specification changes. Both these approaches have been used in the past.

Most comments in this area of the questionnaire were related to the problems associated with the enforcement of specifications, not with the training aspects. These comments have been referred to the appropriate LA DOTD officials.

Maintenance

The LTRC Training Office has very little training material in the area of asphaltic concrete maintenance. Therefore, the general consensus of the respondents was that more was needed. The most common modes of failure listed by respondents were as follows:

Cracking, Raveling and Subsequent Potholes
Base Failure
Raveling of old PMS
Poor Mix Design
Truck Ends
Stripping
Reflective Cracking
Lack of Maintenance

The two revised training materials including an audiovisual training course entitled Asphaltic Surface Maintenance scheduled for publication shortly will address the poor construction practices that lead to early failure. Lack of maintenance is not a problem that can be addressed by the development of additional training materials.

Financial Support of Training by Industry

The five industry respondents all indicated they were willing to support training financially. It was proposed that the Forum should be continued by the Department as a viable link for providing communication between the DOTD and industry. A valuable tool for this communication would be a series of one or two day workshops sponsored by the Forum which would provide instruction and training for Department and Industry personnel to sustain the mission of the Forum-ie. providing quality asphaltic concrete. Several suggested workshop topics included:

- Asphaltic Concrete Mix Design
- Mix Design with Absorptive Aggregates
- Dryer Drum Plant Operations
- Roadway Compaction

Questionnaire Responses Not Related to Training

For each topic area, some respondents commented on areas such as contractor-department communications, specifications, materials, enforcement of good construction practices, intradepartmental communications, etc. The training subcommittee felt that these comments were outside the scope of this report; however, they have been referred to appropriate LA DOTD officials for their information.

APPENDIX A

PROPOSED SPECIFICATION REVISIONS

CONSTRUCTION PRACTICES

CP-1

Subsection 501.01, Description: The first sentence of the third paragraph is deleted and the following substituted.

No substitutions will be allowed for shoulder wearing course, Type 7 or Type 8 mixes without written approval, except the same roadway wearing course mix may be substituted for the shoulder wearing course mix when narrow shoulders (7-feet or less) are paved at the same time and through the same paver as the adjacent roadway lane.

CP-2

Subsection 736.03, Construction Requirements: Heading (a) is amended to include the following.

The maximum forward speed of the planing machine shall be 40 feet per minute. This speed shall be reduced as directed by the engineer to provide a planed surface of uniform texture.

When indicated on the plans, the travelling stringline shall be used on the initial pass of the planing machine. The travelling stringline shall be placed on the best available adjacent surface.

The cold planing operation shall not exceed the subsequent paving operation by more than 15 calendar days. For single lift overlays requiring shoulder stabilization, the cold planing operation shall not exceed the subsequent paving operation by more than 30 days.

CP-3

Subsection 736.02, Equipment: The third sentence is deleted and the following substituted.

Equipment shall be capable of accurately and automatically establishing a profile grade along each edge of the machine by referencing from the existing pavement by means of each of the following a 30-foot minimum travelling stringline, a matching shoe or an independent grade control. Additionally, the equipment shall have an automatic system for controlling cross slope at a given rate.

CP-4

Subsection 724.03, Equipment: This subsection is amended to include the following.

The contractor shall furnish an approved vehicle with a minimum axle load of 9 tons.

Subsection 724.04, General Construction Requirements: This subsection is amended to include the following.

Prior to patching, the contractor shall proof-roll with an approved vehicle those areas designated by the project engineer to identify failures requiring patching.

CP-5

Subsection 501.07, Hauling, Spreading and Finishing: The first paragraph is amended to include the following.

Unless otherwise permitted by the engineer, haul trucks shall be loaded with a minimum of 3 drops, the last of which shall be in the middle to minimize segregation.

Heading (b) is amended to the following.

During truck exchanges, the level of mix in the spreader hopper shall not drop so low as to expose the hopper feed slats.
The paver speed and number of trucks shall be adjusted to maintain one truck waiting in addition to the one at the paver.

The second sentence of the second paragraph of Heading (b) is deleted and the following substituted.

Mixtures dropped in front of the spreader shall be either lifted into the hopper or rejected and cast aside; except the small quantity of material which cannot be dumped into the paver hopper at the end of a truck load may be placed between the wheels or tracks of the paver.

CP-6

Subsection 501.07, Hauling, Spreading and Finishing: The third paragraph of Heading (b) is amended to include the following.

Edges of the final wearing course layer, against which the additional material is to be placed, shall be tamped with a lute to a reasonably vertical face prior to rolling. The outside edges of the final wearing course layer shall be placed to an approximate 45° beveled edge either by hand or by a bevel plate on the paver.

The following paragraph is added after the third paragraph.

Longitudinal and transverse joints shall be formed conforming to Subsection 501.06.

Subsection 501.06, Joint Construction: The second paragraph is deleted and the following substituted.

Transverse joints shall be butt joints formed by cutting back on the previously placed mixture to expose the full depth of the course. A 10-foot metal straightedge shall be used to identify what length of the previously placed mixture is to be cut back so as to maintain no greater than a 1/8-inch deviation in grade. The cut face of the previously placed mat shall be lightly tacked before the fresh material is placed. All transverse joints shall be formed by an adequate crew using a stringline extended from a point approximately 10 feet prior to the joint to a point approximately ten (10) feet beyond one paver's length past the joint. Any deviation in grade from the stringline in excess of 3/16-inch shall be immediately corrected prior to the paving operation continuing beyond 100 feet of the transverse joint.

Transverse joints in succeeding courses shall be offset at least 2 feet.

CP-7

Subsection 501.08, Compaction: The fifth paragraph is deleted and the following substituted.

If continuous roller operation is discontinued, rollers shall be removed to cooler areas of the mat, where they will not leave surface indentations.

CP-8

Subsection 501.12, Acceptance Requirements: The first sentence of the second paragraph is deleted and the following substituted.

A standard lot is 1,000 tons of consecutive production of asphaltic concrete mix from the same job mix formula produced for the Department at an individual plant.

The third paragraph is deleted and the following substituted.

When historical records indicate good and uniform mix, the standard lot size to be used for each lot on a particular project may be increased when agreed upon by the engineer and contractor. Any individual lot within a project may be reduced by 25 percent from the project's standard lot size provided the lot is represented by four samples for stability acceptance and that these samples represent all sublots of the standard lot. The engineer may terminate a lot at any size when either (1) the interval between continuous production exceeds 2 days or, (2) a new job mix formula is accepted or (3) for the final lot of a project. In either of these three cases, the plant mix will be accepted on the average values of those tests run.

MATERIALS

MAT-1

Section 501, TABLE 1 (15 of 18): The second and third sentences of Note 1 are deleted and the following substituted.

Limestone screenings may be used in all mixes. A minimum of 65% of the new aggregates used in the roadway and airport wearing course mixtures shall be crushed aggregate, the remaining 35% may be fine and coarse sands and mineral filler.

MAT-2

Subsection 501.02 (1 of 18) Materials: Heading (a) is amended to include the following.

The contractor shall reduce the amount of asphalt cement in his tank to 20% or less before adding another grade of asphalt cement or asphalt cement from another source.

APPENDIX B

STAGE I PROBLEM STATEMENTS

PS-1

I. **PROBLEM TITLE:** Truck Exchange Segregation of Asphaltic Concrete

II. **PROBLEM STATEMENT:** Systematic open-textured areas of asphaltic concrete pavements have been found to be associated with segregation occurring during haul truck exchanges with bituminous paving machines. Not withstanding that the cause of this problem may be related either to mix design or to truck loading and/or unloading procedures, it is obvious that on a job-to-job basis the particular solution to the cause of the problem is not being readily found in a timely manner. A solution is necessary as it has been determined that these areas will fail prematurely due to a combination of coarse gradation, low asphalt content and high air voids.

III. **RESEARCH PROPOSED:** An evaluation is needed of a piece of equipment - similar to that presently under design or consideration by several equipment manufacturers - which will receive mix from haul trucks and subsequently feed this material to the paver; in the interim, this equipment will act as a surge bin for the paver and provide for a means of re-mixing any segregated and/or cooled areas.

IV. **URGENCY:** Immediately

PS-2

I. **PROBLEM TITLE:** Reduction of Reflective Cracking

II. **PROBLEM STATEMENT:** Several materials or techniques have been introduced to reduce the amount of reflective cracking that occurs through overlays of jointed PCC pavements and over cement treated bases. These cracks permit water intrusion into the pavement system which can lead to stripping, erosion of subbase material, faulting of the concrete slabs, spalling around the cracks and ravelling. These distress mechanisms reduce the serviceability of the roadway and lead to early failure of the system.

III. **RESEARCH PROPOSED:** The use of geotextiles, stress absorbing membranes, waterproofing tape, sawing and sealing of joints and cracking and seating have been recommended as possible methods to reduce reflective cracking. A literature search should be conducted to evaluate the relative success of these different materials and techniques. Based on economic analysis and chance of success, the most promising methods should be examined in the field.

IV. **URGENCY:** The literature search should be accomplished as soon as possible to identify the most promising methods. A field trial should be constructed by next spring.

PS-3

I. **PROBLEM TITLE:** Characterization of Type 8 Asphaltic Concrete for Pavement Design

II. **PROBLEM STATEMENT:** The strength characteristics of the new Type 8 asphaltic concrete needs to be assessed for review and assignment of appropriate design parameter values which represent the strength of the material.

III. **RESEARCH PROPOSED:** A data file search (MATT system) with statistical analysis is needed to characterize the type 8 asphaltic concrete in terms of expected strength based on what has been achieved to date.

IV. **URGENCY:** As soon as possible.

PS-4

I. **PROBLEM TITLE:** Central Plant Mixing of Stabilized Base Materials

II. **PROBLEM STATEMENT:** Portland cement and other stabilizing agents need to be blended with soil and/or aggregate and water to produce a base material with uniform performance characteristics in terms of cracking and support.

III. **RESEARCH PROPOSED:** Determine thee benefits, if any, afforded by a uniformly blended stabilized base course as compared to the stabilization-in-place procedure currently in use on all projects in Louisiana.

IV. **URGENCY:** As soon as possible.

PS-5

I. **PROBLEM TITLE:** Management of Composite Pavements

II. **PROBLEM STATEMENT:** The department's approach to management of composite pavements needs to studied in an effort to increase the serviceable life of resurfacing on these pavements. This is particularly true on routes where movement of the underlying jointed concrete pavement frequently reduces the ride quality.

III. **RESEARCH PROPOSED:** Determine the life cycle and performance characteristics of the major composite pavement systems in Louisiana. Specifically study the life cycle, serviceability change, rehabilitation methods and drainage needs. Provide recommendations to improve performance.

IV. **URGENCY:** Immediately

PS-6

I. **PROBLEM TITLE:** Cost/Benefit Analysis of Thin Overlay Design

II. **PROBLEM STATEMENT:** In the last several years due the economically depressed budget a policy decision called for the minimum design thickness for asphaltic concrete overlays. Reflective cracking occurred shortly after construction. A performance evaluation needs to be conducted to determine the effectiveness of such a design policy with respect to cost/ benefit.

III. **RESEARCH PROPOSED:** All pavements constructed under the minimum design thickness policy during the last several years should be identified. These pavements should be grouped into the various classes of roadways. Performance evaluations including distress and serviceability ratings should be conducted on selected projects. An economic appraisal should be made to determine the utility of thin lift design.

IV. **URGENCY:** As soon as possible.

PS-7

I. **PROBLEM TITLE:** Effectiveness of Breaking and Seating of Jointed Concrete Pavement Prior to Asphaltic Concrete Overlay

II. **PROBLEM STATEMENT:** Several techniques for breaking and seating have been employed by various states to control reflective cracking in composite pavements produced when jointed concrete pavement is overlaid with asphaltic concrete. The procedures need to be evaluated and optimized for Louisiana. Varying thicknesses of asphaltic concrete are needed to optimize selection of overlay thickness to meet performance objectives.

III. **RESEARCH PROPOSED:** Four methods of crack and seating have been examined throughout the country: (1) Minnesota method - transverse cracking only with 12 - 36 inch crack spacing; (2) California method - transverse and longitudinal cracking; (3) Kentucky method - cracking to achieve 12 - 36 inch diameter size pieces; and, (4) complete rubblizing. The techniques need to be tried on plain and reinforced jointed concrete pavements with control sections to optimize the breaking and seating technique and to optimize the overlay thickness used in conjunction with the breaking and seating technique employed.

IV. **URGENCY:** Immediately

PS-8

I. **PROBLEM TITLE:** Asphaltic Concrete Skid Resistant Surfaces

II. **PROBLEM STATEMENT:** Due to the problems with skid resistant surfaces on asphaltic concrete roadways in Louisiana, the different types of skid resistant surfaces using crushed aggregates needs to be evaluated for both performance and cost effectiveness.

III. **RESEARCH PROPOSED:** Some of the types of surfaces that need to be evaluated are:

1. Non-polishing, skid resistant, crushed aggregate used in dense graded wearing course (type 8);

2. ACFC mixtures using good quality crushed aggregates and improved AC to increase design life;

3. Sprinkle treatment using good skid resistant aggregate;, and

4. Staged construction or chip seals to extend performance life of the roadway wearing surface.

IV. **URGENCY:** There is a need to have economical alternative methods of getting good skid resistant surfaces on new construction and an economical method to rehabilitate roadways with poor skid resistant surfaces.

PS-9

I. **PROBLEM TITLE:** Use of Crushed Aggregates in Louisiana Asphalt Mixtures

II. **PROBLEM STATEMENT:** A study is needed to determine the type and quantities of crushed aggregates needed in DOTD's asphalt mixtures to improve skid resistance of the wearing course surface and to decrease the potential of rutting on both wearing and binder courses on high truck volume roadways.

III. **RESEARCH PROPOSED:** For siliceous gravel mixtures, the type (one crushed face vs. two) and the quantity (% crushed aggregate vs. percentage of natural sands) of crushed aggregate in a mix design need to be evaluated in terms of final in-place skid resistance on the roadway and improved stability to prevent rutting. The plus No. 4 and the minus No. 4 (screenings) portions of the crushed aggregate should be evaluated.

IV. **URGENCY:** The volume of all vehicles and heavy trucks with their high tire pressures have increased over the past several years. This is putting much more stress on our highways.

PS-10

I. PROBLEM TITLE: Evaluation of Mix Design Procedures for Absorptive Aggregates

II. PROBLEM STATEMENT: Over the last construction cycle there were a proportionately large number of projects exhibiting segregation and ravelling of the surface courses. An evaluation of the mix designs and source materials indicated that the absorptive nature of the coarse aggregates was leading to under asphalted mixes; the absorption of a portion of the binder into the aggregate was reducing the effective film coating on the aggregate surface such that there was insufficient binder to prevent segregation due to handling and ravelling due to loss of adhesion.

Current mix design procedures do not account for the loss of asphalt cement behaving as film coating in those mixes where absorptive aggregates are used.

III. RESEARCH PROPOSED: Whenever absorptive aggregates are used the time period between production of mix and fabrication of specimen for design testing becomes critical. The produced mix must remain at temperature for a sufficient amount of time to simulate absorption of asphalt during the actual construction process. The mix should remain at temperature long enough to allow the absorption process to occur but not so long as to cause oxidation of the asphalt which might impair the compaction effort. The ideal design procedure would permit sufficient time for absorption to achieve a proper estimate of specific gravities for voids determination based on the effective film thickness and to test for stability at the increased asphalt content necessary due to absorption.

Research should examine Marshall properties for specimen which have allowed for absorption prior to compaction. several different time periods should be used to permit the absorption to occur. In order to account for oxidation of the asphalt in the mix during heating in the oven, control specimen should also be examined. A range of absorptive aggregates and asphalt cements should be utilized as it is recognized that asphalt absorption occurs at different rates for different aggregates and asphalt cements harden at different rates

IV. URGENCY: Immediately

PS-11

I. **PROBLEM TITLE:** Variation in Physical and Chemical Properties of Asphalt Cements

II. **PROBLEM STATEMENT:** Asphalt cement specifications have not been significantly modified in a number of years. Yet, there has been a proliferation of new crude sources utilized in asphalt marketed in Louisiana. Field personnel have noted changes with respect to the tackiness of the asphalt and rapid aging characteristics have been found in several of the asphalt using particular crude sources.

III. **RESEARCH PROPOSED:** It is proposed that all of the currently supplied asphalt used in Louisiana should be characterized by existing specifications and by newer test methods which have been introduced to characterize asphalt cements. Tests such as low temperature ductility, force-ductility, compositional analysis and high pressure-gel permeation chromatography should be included along with other tests which emanate as part of the Strategic Highway Research Program.

IV. **URGENCY:** As soon as possible to coordinate with the anticipated specification revisions.

PS-12

I. **PROBLEM TITLE:** Evaluation of Marshall Breaking Molds - ASTM vs. DOTD

II. **PROBLEM STATEMENT:** An evaluation is needed to develop correlation factors on Marshall test properties for different types of asphalt mixtures using ASTM vs. DOTD Marshall breaking molds.

III. **RESEARCH PROPOSED:** Develop a correlation factor for each different type of mix and determine the necessary changes in specifications and design limits for Louisiana to change to the ASTM Marshall breaking mold.

IV. **URGENCY:** Over the next several years, DOTD will have to replace about 80 percent of its present Marshall breaking molds.

<u>**PS-13**</u>

I. **PROBLEM TITLE:** Comparison Study of DOTD and Asphalt Institute MS-2 Asphalt Mix Design Procedures

II. **PROBLEM STATEMENT:** With the continued increase in the number of different types and sources of aggregates used in Louisiana' asphalt mixtures, several modifications have been made in design procedures and values. In order for Louisiana to evaluate their mixes with those of other states, a comparison of DOTD to Asphalt Institute design is needed.

III. **RESEARCH PROPOSED:** Evaluate a number of different type mixtures using a number of different aggregates or a combination or blend of different aggregates. Develop design limits for VMA using Louisiana mixtures.

IV. **URGENCY:** The FHWA has requested that Louisiana change to AASHTO T-209 for maximum specific gravity and start using VMA in the mix design procedure.

PS-14

I. **PROBLEM TITLE:** Laboratory Investigation of Asphaltic Concrete with Polymer Modified Binders

II. **PROBLEM STATEMENT:** Concern has been expressed with respect to increased loading and the use of higher tire pressures by commercial traffic which are predicted to reduce service life through structural degradation and increased rutting. Additionally higher temperature susceptibilities and rapid age hardening of asphalt cements have been noted over the last several years.

Polymerized asphalt cements can be used to address such problems. Selected polymers have demonstrated the ability to reduce temperature susceptibility, increase binder and mix stiffness at high temperatures and decrease binder and mix stiffness at low temperatures. However, the cost of some modifiers may be prohibitive. An examination of fundamental engineering properties of polymer modified asphaltic concrete is needed to assess the potential use of these materials.

III. **RESEARCH PROPOSED:** Laboratory work should consist of binder and mix characterization. Binder properties should be determined to the extent possible recognizing that traditional physical testing may not be appropriate for polymerized materials. Mix testing should concentrate on those dynamic properties which could be used to estimate additional service life that might be expected due to the polymer modification. Such data would be useful in determining potential economic advantages of polymer modified mixes.

IV. **URGENCY:** This alternate binder material should be developed as soon as possible. Commercial traffic loading and tire pressures are not anticipated to decrease in the near future.

PS-15

I. **PROBLEM TITLE:** Laboratory and Field Evaluation of Hydrated Lime

II. **PROBLEM STATEMENT:** Investigations over the last several years have determined that asphaltic mixtures are sensitive to the particular combination of individual materials utilized. Moisture susceptibility has been found to reduce pavement service life. Siliceous gravel is acutely sensitive to moisture. While liquid antistrip agents appear to perform during laboratory testing, it has been noted that they generally do not have an impact on film thickness. An additional problem is the rapid age hardening of asphalt which have been supplied to Louisiana since the oil embargoes of the early eighties. Recent research has indicated that the use of hydrated lime can address these problem areas with addition rates in the range of one to three percent.

III. **RESEARCH PROPOSED:** The use of hydrated lime should be investigated in both the field and the laboratory. A field project is recommended using lime at various addition rates to determine optimum performance with respect to lime's role as filler, antistrip and anti-oxidant.

IV. **URGENCY:** Immediately

APPENDIX C

LIST OF AVAILABLE TRAINING MATERIALS