

ALABAMA DEPARTMENT OF TRANSPORTATION

DATE: January 30, 2003

Special Provision No. 02-0427

SUBJECT: Test Section Bituminous Concrete Pavement,
Project No. 99-704-413-000-301 , Lee County.

Alabama Standard Specifications, 2002 Edition, are hereby amended by the deletion of the contents of Article 106.09 and by the addition of a NEW SECTION 412 as follows:

SECTION 106 CONTROL OF MATERIALS

106.09 Quality Control and Quality Assurance (QC/QA) Requirements for Hot Mix Asphalt (HMA) Pavement.

This Article(106.09) shall be replaced by the following.

106.09 Blank.

SECTION 412 TEST TRACK PAVEMENT TEST SECTIONS

412.01 Description.

The Contractor shall pave test sections of the National Center for Asphalt Technology (NCAT) test track in accordance with the requirements given in this Section and the requirements shown on the plans. Several State Department of Transportation agencies (referred to hereafter as sponsors) will provide materials and paving mix designs to be used in the construction of test sections on the test track.

412.02 Materials.

The Contractor will be furnished with all solid mix blend components (aggregate, mineral filler, lime, fibers, etc.) for the paving of the test sections, but will be responsible for hauling these materials to the jobsite at times that will best suit their construction logistics.

Liquid asphalt shall be purchased and hauled by the Contractor. Asphalt shall be in conformance with the requirements given in Section 804 and shall have an approved anti-strip additive designated by the NCAT. The required grade (PG 76-22, PG 67-22, etc.) will be designated in the description of the pay item for the asphalt. The polymer for the modification of the asphalt will be designated in the description of the pay item for the modified asphalt. The polymer shall meet the requirements given in Section 811.

412.03 Asphalt Mixes.

(a) GENERAL.

The Contractor shall produce the mixes in accordance with the mix design requirements furnished by NCAT. All materials shall be incorporated into the mix supplied exactly as stated on sponsors' mix designs unless substitutions are authorized beforehand by NCAT's track manager.

(b) DESIGN MIXES.

The job mix formula (JMF) will be provided to the Contractor. The Contractor shall control the gradation and asphalt content within the allowable tolerances. The initial setting of the controls for all materials shall be those amounts shown on the job-mix formula, unless changes are authorized beforehand by NCAT at the sponsor's request. The Contractor shall make changes as necessary in order that the mixture will run as close as practical to the percentage designated on the job-mix formula.

[See Subarticle 412.03 (e)]. Changes to the target JMF may be authorized by NCAT on a case-by-case basis based upon trial mix runs, sponsors' research needs, etc.

(c) TRIAL MIXES.

The contractor shall produce at least twenty tons of uniform trial mix for each test section, which shall be dumped in the bed of a single haul truck to facilitate representative quality control sampling. The Contractor shall waste both coated and uncoated material on either side of uniform trial mix to achieve the desired quality. The trial mix shall be placed by spreader and compacted to construct a vehicle parking area in the vicinity of the track's onsite plant area. The thickness and location shall be as directed by the Engineer. The wasting of trial mixes includes placement by spreader and compaction to the satisfaction of the Engineer. The production, placement and compaction will be paid for as Wasting Trial Mixes.

The Contractor shall make adjustments to the production mixes for the test sections based on the results obtained from the testing of the trial mixes. All adjustments shall meet with NCAT's approval.

(d) LAYOUT OF TEST SECTIONS.

Rutting test sections will be up to four inches thick and shall be placed in no more than three layers; structural test sections will require the placement of various layers to a depth of up to 30 inches. The Contractor shall mill rutting test sections to a depth of between 1 and 4 inches. The Contractor shall mill structural test section to a depth of approximately 23 inches. The remaining depth of the structural test section shall be removed as shown on the plans. Excavation will be required through the crushed aggregate layer. Milling and buildup requirements for each unique section are shown on the plans; however, the Engineer may direct the Contractor to adjust milled distance within a section by lift in order to maximize smoothness. Some test sections will be such that different layers will be of a different job mix formula. All test sections are to be approximately 200 feet in length, unless otherwise directed by the Engineer. The actual construction of each test section on the track surface shall be in a continuous manner with no breaks in laydown. Once construction begins on the test sections, the contractor shall continuously and diligently pursue the completion of the work.

(e) QUALITY ASSURANCE.

1. ACCEPTANCE PROCEDURES.

All materials will be evaluated for acceptance through NCAT. NCAT will participate in determining the acceptability of the construction and materials incorporated therein. NCAT will advise the Engineer of the point in production (the production time or tonnage) for sampling at the plant (for mixture testing) and the locations for sampling and testing on the roadway (for mat density testing). The Contractor shall provide a Level I certified Asphalt Technician to work during the production of the plant mix. The Asphalt Technician shall be assigned to work in the track's onsite laboratory (where all official testing will be conducted) with NCAT for the duration of the project. The Department will have one or more inspectors observing the work performed at the plant. and test results in the Contractor's laboratory.

a. TEST SECTION COMPRISED OF THREE LAYERS.

A LOT is defined as all production of the same design job mix formula for an individual test section. Each lane of the same job mix of each layer will be defined as a subplot, thus yielding up to three sublots per LOT.

In-place density measurements will be taken at three sampling locations for each subplot. The mean absolute deviation of the density tests for each subplot shall not exceed 1.2 percent from 94 percent of TMD (Theoretical Maximum Density). Density testing may be waived for permeable surface mixes at the discretion of the Engineer.

One sample of produced mix will be taken for each of the sublots and asphalt content and gradation determined. The mean absolute deviation of the asphalt content from the JMF for each LOT shall not be more than 0.3 percent based upon up to three samples per LOT (One random sample per each subplot).

The mean absolute deviation of the gradation for each of the coarse aggregate (aggregate retained on the Number 4 sieve and larger) from the JMF shall not be more than three percent for each sieve based upon up to three samples per LOT (One random sample per each subplot).

The mean absolute deviation of the gradation of the fine aggregate from the JMF shall not be more than two percent based upon up to three samples per LOT (One random sample per each subplot).

The mean absolute deviation of the filler (material passing the Number 200 sieve) from the JMF shall not be more than one percent based upon up to three samples per LOT (One random sample per each subplot).

b. TEST SECTION COMPRISED OF BOTTOM AND TOP LAYERS.

A LOT is defined as the production of the same design job mix formula for an individual test section. Each lane of the same job mix of each layer will be defined as a subplot, thus yielding a total of up to two sublots per LOT.

In-place density measurements will be taken at three sampling locations for each subplot. The mean absolute deviation of the density tests for each subplot shall not exceed 1.2 percent from 94 percent of TMD.

One sample of produced mix will be taken for each of the sublots and asphalt content and gradation determined. The mean absolute deviation of the asphalt content from the JMF for each LOT shall not be more than 0.3 percent based upon up to two samples per LOT (One random sample per each subplot).

The mean absolute deviation of the gradation of the coarse aggregate (aggregate retained on the Number 4 sieve and larger) from the JMF shall not be more than three percent for each sieve based upon up to two samples per LOT (One random sample per each subplot).

The mean absolute deviation of the fine aggregate from the JMF shall not be more than two percent for each sieve based upon up to two samples per LOT (One random sample per each subplot).

The mean absolute deviation of the filler (material passing the Number 200 sieve) from the JMF shall not be more than one percent based upon up to two samples per LOT (One random sample per each subplot).

c. TEST SECTION COMPRISED OF A SINGLE LAYER.

A LOT is defined as the production of the design job mix formula for each test section.

In-place density measurements will be taken at three sampling locations for the LOT. The mean absolute deviation of the density tests for each LOT shall not exceed 1.2 percent from 94 percent of TMD.

At least one sample of produced mix will be taken for each LOT and asphalt content and gradation determined. The mean absolute deviation of the asphalt content from the JMF for each LOT shall not be more than 0.3 percent based upon one or more samples per LOT.

The mean absolute deviation of the gradation of the coarse aggregate (aggregate retained on the Number 4 sieve and larger) from the JMF shall not be more than three percent for each sieve based upon one or more samples per LOT.

The mean absolute deviation of the gradation of the fine aggregate from the JMF shall not be more than two percent for each sieve based upon one or more samples per LOT.

The mean absolute deviation of the filler (material passing the Number 200 sieve) from the JMF shall not be more than one percent based upon one or more samples per LOT.

d. STRUCTURAL TEST SECTIONS.

Structural test sections require the removal and replacement (in various bound and unbound layer combinations) of the top 30 inches of material in designated sections. In these cases, a LOT is defined as the production of the same design job mix formula for an individual test section; thus, the total number of lots in a section will equal the number of unique mixes included in the structural buildup. Each lane of mix of each layer will be defined as a subplot, potentially yielding multiple sublots per LOT. Soils, aggregates, and soil-aggregate mixtures may also be part of structural pavement sections.

In-place density measurements will be taken at three sampling locations for each subplot. The mean absolute deviation of the density tests for each subplot shall not exceed 1.2 percent from 94 percent of TMD. Density testing may be waived for permeable mixes at the discretion of the Engineer.

One sample of produced mix will be taken for each of the sublots and asphalt content and gradation determined. The mean absolute deviation of the asphalt content from the JMF for each LOT shall not be more than 0.3 percent based upon at least one random sample per each subplot.

The mean absolute deviation of the gradation of the coarse aggregate (aggregate retained on the Number 4 sieve and larger) from the JMF shall not be more than three percent for each sieve based upon at least one random sample per each subplot.

The mean absolute deviation of the fine aggregate from the JMF shall not be more than two percent for each sieve based upon at least one random sample per each subplot.

The mean absolute deviation of the filler (material passing the Number 200 sieve) from the JMF shall not be more than one percent based upon at least one random sample per each subplot.

2. ACCEPTANCE OR REJECTION.

The decision of the Engineer will be final as to the acceptance or rejection of each subplot and/or lot. Rejected sublots and/or lots shall be removed at no cost to the Department and replaced at the Contractor's cost. If NCAT deems it necessary to remove and replace new sections as a result of undesirable laboratory volumetrics that are not the result of errors on the part of the Contractor, the extra work will be paid for at the unit bid price.

412.04 Construction Requirements.

(a) GENERAL.

In general, the choice of equipment will be left to the Contractor and it shall be his responsibility to provide properly sized and amounts of equipment that will produce, deliver to the roadbed, spread, and compact the plant mixed material in sufficient quantities for the continuous movement of the spreaders under normal operation conditions. Several equipment suppliers have indicated their willingness to donate construction equipment for use on this project. This information will be provided in the pre-bid meeting so that potential bidders can reduce their unit bid prices accordingly.

The mixing plant, hauling, spreading and compaction equipment shall meet the requirements listed below; however, other equipment that will produce equally satisfactory results, such as electronically or automatically controlled devices of proven performance, will be considered for use in lieu thereof.

The Contractor shall secure approval of all equipment prior to beginning work. Any equipment found unsatisfactory shall be promptly replaced or supplemented. All tools necessary for equipment maintenance and effective construction practices shall be considered incidental to the work and provided by the Contractor.

(b) SEQUENCE OF CONSTRUCTION.

The Contractor shall construct the test sections in accordance with the Sequence of Construction shown on the Plans. Low production rates should be expected due to testing, wasting trial mixes etc. No more than five production runs are allowed in any single day, and no more than three production runs of mix to be paved on the Track are permitted (e.g., the fourth and fifth runs can be Trial Mix). Additionally, no more than two production runs of unique "research sample" mix are allowed in a single day. For the purpose of this specification, "research sample" mix is defined as the last time a unique mix is placed on the Track in its uppermost layer. Track mixes can only be produced on weekdays between the hours of 6:00 AM and 6:00 PM (Central Time) unless special permission is obtained from the Engineer.

(c) MIXING PLANT.

1. GENERAL.

The Contractor shall provide a hot mix asphalt mixing plant for the production of the hot mix asphalt for this project. If an offsite plant is to be used to produce track mixes, it must be previously approved by NCAT during the pre-bid process; however, in no case will offsite plants be considered whose location necessitates more than a 30-minute hauling time. Additionally, offsite plants must be completely dedicated to run track mix for the entire day (24 hours) on any day that either Trial Mix or Track Mix is being produced (i.e., this plant can not be used to produce mix for any other purpose for the rest of the workday). When the Engineer does not plan for test track work the following day, the track production day can be considered to end when all stockpiles have been restored. Alternatively, the Contractor may choose to temporarily install a portable plant onsite within a prepared area adjacent to the track. In this case, a portable power supply shall be provided to avoid the need for excessive high voltage electrical power. If the Contractor chooses to install an onsite plant on University property, it can only be used to produce mix for Track purposes. The area for the plant has been cleared and leveled under a previous contract.

2. PLANT TYPE.

The mixing plant shall be either a drum mix or a batch type plant. Mixing plants shall comply with the requirements of AASHTO M 156 as modified by ALDOT-324, Mixing Plant Requirements for Hot-Mixed, Hot-Laid Asphalt Paving Mixtures. The plant shall be capable of operating at a production rate as low as one hundred and fifty tons per hour and as high as required to successfully complete the work.

3. SCALES.

A digital recorder shall be installed as part of the platform truck scales. The recorder shall produce a printed digital record on a ticket of the gross and tare weights of the delivery trucks along with a time and date print for each ticket. Provisions shall be made so that scales may not be manually manipulated during the printing process, and so interlocked as to allow printing only when the scale has come to rest. The scales and recorder shall be of sufficient capacity and size to accurately weigh the heaviest loaded truck or tractor-trailers that are used for the delivery of the hot mix asphalt from that plant.

In lieu of plant and truck scales, the Contractor may provide either (1) an approved automatic printer system which will print the weights of the material delivered (evidenced by a weight ticket for each load), provided the system is used in conjunction with an approved automatic batching and control system, or (2) an electronic load cell weigh system with associated computer hardware and automated printing system.

The Contractor may provide a "weigh batcher" system utilizing a weigh hopper equipped with load cells that determine the net amount of mix delivered from the weigh hopper. An automated weight printing system shall be provided to accurately print the weight of material delivered, and the time and the date for each ticket.

All scales which weigh the mix for pay purposes shall meet the requirements of Subarticle 109.01(h).

4. PLANT CONFIGURATION AND STORAGE REQUIREMENTS.

The asphalt plant shall be capable of uniformly adding up to 10 percent commercial mineral filler (in addition to the silo for hydrated lime) and up to 0.5 percent mineral or cellulose fiber. A silo capable of storing at least seventy-five tons of hot mix asphalt shall be available.

The plant shall have the capability of metering and proportioning all or any part of the collected fines back into the mixture.

At least three asphalt binder storage tanks shall be provided. Four tanks may be necessary if the Engineer determines that it is not possible to produce mix while pumping from a tanker. This may consist of one tank with multiple storage compartments. All tanks shall have functional circulation capabilities to avoid separation in modified binders. It may be necessary for the Contractor to modify their binder storage and pumping system to accommodate the production of mixes using European "warm asphalt" methods (information on this methodology will be provided in pre-bid meetings). Binder grade will be verified by rotational viscometer testing conducted at and interpreted by NCAT.

The plant shall have at least five aggregate cold storage bins. Additionally, a RAP feeding system and a controlled feed fiber blowing system shall also be provided. If an on-site RAP crusher is not provided, the Contractor may be required to haul RAP offsite before being included in experimental mix placement.

(d) HAULING EQUIPMENT.

Trucks used for hauling hot mix asphalt mixtures shall have tight, clean, smooth metal beds which have been thinly coated with a minimum amount of paraffin oil, lime solution or other approved material to prevent the mixture from adhering to the beds. The use of gasoline, kerosene or other volatile material is prohibited. Each truck shall be equipped with a cover of canvas or other suitable material of such size as to protect the mixture from adverse conditions. Each truck shall have a hole in the side of the body, approximately 5/16" in diameter and suitably placed, to allow for temperature measurement of the asphalt mix. When the air temperature is below 60 °F, or threatening weather exists, no mixture shall leave the plant unless it is covered entirely and the cover securely fastened. Reference is made to Article 105.12 concerning load limitations on hauling equipment.

(e) MIX TRANSFER EQUIPMENT.

The asphalt mix shall be delivered to the spreader for the placement of the test sections by transfer equipment that is capable of remixing the material prior to the materials being placed in the spreader.

(f) SPREADERS.

At least two hot mix asphalt spreaders will be required during the construction of the test sections. One spreader will be required for the placement of the test sections and one will be required for the placement of the wasted trial mixes.

Hot mix asphalt spreaders shall be self-contained and of sufficient size, power, and stability to receive, distribute, and strike off the asphalt material at thicknesses and widths consistent with the specified typical section requirements and details shown on the plans.

All hot mix asphalt spreaders used for mainline paving, including shoulders and interchange ramps, shall be operated with a full width vibratory, or other compactive type, screed. The augers used to move the material across the width of the screed shall extend within 1.5 feet of the edge of the screed.

When laying mixtures, the spreader shall be capable of being operated at forward speeds consistent with satisfactory laying of the mixture, providing a finished surface of the required evenness and texture without tearing, gouging or shoving of the mixture.

All hot mix asphalt spreaders shall be operated with automatic grade and slope controls unless otherwise directed by the Engineer. Equipment operating together shall have the same type controls. The automatic controls may operate either from control grade wires or ski; however, when a ski is used, the spreader shall have a ski of not less than 30 feet in length. Both grade and slope controls shall be in good working order at all times. In the event of a malfunction of the automatic control system, the spreading operation shall be discontinued after one hour until the equipment is repaired and restored to first class working order.

(g) COMPACTION.

At least three types of rollers shall be available for compaction. These rollers shall be a vibratory steel wheel roller, a rubber tire roller, and a static steel wheel roller. (The static roller may be the vibratory roller operated in static mode.)

The vibratory steel wheel roller shall be maintained in good condition and shall weigh at least 10 tons. At least two vibratory steel wheel rollers shall be provided and manned to allow aggressive breakdown compaction.

The rubber tire roller shall be maintained in good condition and shall weigh at least 15 tons. The tires shall be capable of being inflated to at least 90 psi. All tires shall be well-maintained and in good condition.

The static steel wheel roller shall be maintained in good condition and shall weigh at least eight tons.

All test sections shall be compacted to a target density of ninety four percent of TMD. The mean absolute deviation shall not exceed 1.2 percent from 94 percent of the TMD as described in Subarticle 412.03(e).

412.05 Layer, Surface and Edge Requirements.

(a) PREPARATION OF MIXTURES.

1. LIQUID ASPHALT BINDER.

The liquid asphalt binder material shall be heated in a manner that insures the even heating of the entire mass under efficient and positive control at all times. Unless special arrangements are made with a sponsor, liquid asphalt binder shall be purchased, supplied, and delivered by the Contractor (with cost paid by corresponding bid item). Demurrage costs will be considered incidental to the supply of these materials. Any liquid asphalt binder material which, in the opinion of the Engineer, has been damaged shall be rejected.

2. AGGREGATE.

a. Unless special arrangements are made with a sponsor, aggregates will be donated by section sponsors and shall be delivered by the Contractor.

b. Aggregate Used for Batch Mixing Operations.

All aggregates shall be dried so that the moisture content of the hot mix asphalt at the point of sampling is less than 0.2 percent by weight in accordance with ALDOT-130. The temperature of the aggregate at the dryer shall not exceed 600 °F.

When more than two ingredients enter into the composition of the mineral aggregate, they shall be combined as directed.

The aggregate, immediately after being heated, shall be screened into one or more sizes and conveyed into bins, ready for batching and mixing with liquid asphalt binder material.

c. Aggregates for Dryer Drum Mixing Operations.

Maintenance of a uniform aggregate gradation is essential for a dryer drum operation; hence, caution and care shall be exercised in stockpiling of materials to avoid segregation.

3. MIXING.

a. General.

The temperature range of mixing shall be targeted as shown on the approved job-mix formula, and in no case shall the temperature of coated materials discharged from the mixer exceed 350 °F.

b. Batch Mixing.

The dried mineral aggregate, and measured mineral filler when used, prepared as prescribed above, shall be combined in uniform batches by weighing and conveying into the mixer the proportionate amounts of each aggregate required to meet the job-mix formula. The largest size aggregate shall be introduced first, then smaller sizes progressively, with mineral filler last, or all mineral components may be added simultaneously. The mineral filler shall be added directly into the weigh hopper. The mineral components shall be thoroughly mixed. The required quantity of liquid asphalt binder material for each batch shall be measured by weight using scales or a liquid asphalt binder material metering device attached to the liquid asphalt binder material bucket.

After the mineral components have been mixed, the liquid asphalt binder material shall be added and the mixing continued for a period of at least 45 seconds, or longer if necessary to produce a homogeneous mixture. However, if a check by ASTM D 2489 (Ross Method) shows that 95 % plus coating is obtained, a shorter mixing time will suffice. The Engineer may then give written permission for a change. Each batch must be kept separate throughout the weighing and mixing operations.

The mixture shall be uniform in composition, free from lumps or balls of material containing an excess quantity of asphalt, or from pockets deficient in asphalt.

c. Dryer-Drum Mixing.

Components shall be proportioned by weight as noted hereinbefore in Item 410.03(a)1 for this method of mixing. Amounts of aggregate and liquid asphalt binder material entering the mixer, and the rate of travel through the mixer, shall be so coordinated that a uniform mixture of specified gradation and liquid asphalt binder content will be produced. An anti-stripping agent may be required to insure adequate coating of the aggregates if so directed by the Engineer.

4. MINERAL OR CELLULOSE FIBER.

a. General.

Mineral or cellulose fiber shall be added to the mix as specified in the job mix formula or as directed by the Engineer in a manner that insures complete blending of the fiber with the aggregates and liquid asphalt binder. Cellulose fiber will be furnished by NCAT.

b. Batch Plant.

In a batch plant, the fiber shall be added into the weigh hopper simultaneously with the hot aggregates. Dry mixing time shall be increased at least five seconds to insure adequate blending. Wet mixing time shall be increased at least five seconds for cellulose fibers and up to five seconds for mineral fibers.

c. Drum Plant.

In a drum plant, a separate fiber feeding system shall be used to accurately and uniformly meter the fiber into the mix. If there is any evidence of fiber in the bag-house or wet-washer fines, the liquid asphalt binder line and/or the fiber line shall be relocated so that the fiber is captured by the liquid asphalt binder spray and incorporated into the mix. If there is any evidence of clumps of fibers or pellets at the discharge chute, the contractor shall increase the mixing time and/or intensity. This may entail extending the liquid asphalt binder and fiber feeding line further into the drum.

(b) PLACEMENT OF THE MIXTURES.

1. SPREADING.

Spreading of the hot mix asphalt mixture shall be performed by equipment meeting the requirements of Subarticle 412.04(f), except as noted hereinafter in this Item. Approved specialized equipment may be employed to spread the hot mix asphalt material where standard full scale equipment is impractical due to size and irregularity of the area to be paved.

For hot mix asphalt pavement test track layers, spreading operations shall be so correlated with plant and hauling equipment that the spreading operation, once begun, shall proceed

at a speed as uniform and continuous as practical. The continual forward movement of the spreader requires the use of hauling vehicles capable of supplying the spreader with hot mix asphalt material while the spreader is in motion. Repetitive interruptions or stopping of the spreader shall be cause for the Engineer to stop the work until the Contractor evaluates the cause of the stoppage and has provided a definite action plan for correction of the interruptions. Any interruption will require a thorough check of the area immediately under the spreader and any variances shall be corrected immediately or the material removed and replaced, as directed, without additional compensation.

Material placed in the spreader shall be immediately spread and screeded to such uniform depth that the specified placement thickness after compaction is secured. Alignment of the outside edges of the pavement shall be controlled by preset control lines, and shall be finished in conformity with these controls.

Any spreading operation which cannot produce acceptable joints within the surface tolerances and density requirements shall be cause for requiring the Contractor to modify his operations to include additional spreading equipment. NCAT may require that steel plates be utilized to shim the screed as the paver initially pulls away from a new transverse joint.

2. COMPACTION.

Mix shall be placed beyond the end of the test section approximately five to 10 feet. As soon as the mixture has been spread, the paver has lifted off and moved away, and excess mix has been removed with a backhoe or other approved equipment, rolling shall begin. A delay in the initial rolling will not be tolerated and the initial or breakdown rolling should, in general, be performed by rolling longitudinally, beginning at the sides and proceeding toward the center of the surface.

When paving abuts a previously placed lane, the longitudinal joint shall be rolled in the first pass. On superelevated curves, rolling shall begin at the low side and progress toward the high side. The roller shall not compact within six inches of the edge of the surface, where an adjacent lane is to follow, while the surface is still hot.

If any displacement occurs during rolling, it shall be corrected at once. To prevent adhesion of surface mixture to the rollers, the wheels shall be kept adequately moistened with water and a non-foaming detergent or approved diluted release agent, but an excess of water will not be permitted.

Adequate precaution shall be taken to prevent dropping of gasoline or oil on the pavement. In places inaccessible to a roller, compaction shall be obtained with hand or mechanical tampers of adequate weight to produce required density.

Sufficient personnel shall be provided by the Contractor to allow two rollers to be simultaneously operated throughout the compaction process.

3. JOINTS.

a. GENERAL.

Placing of hot mix asphalt paving layers shall be as continuous as possible. All joints shall be made in a careful manner in such a way as to provide a smooth, well-bonded and sealed joint meeting the density and surface requirements given in this Section. Failure to meet requirements noted above shall be cause for ordering the removal and reconstruction of the joint without extra compensation.

The contact surface shall be treated with a thin coat of an approved rubberized liquid asphalt binder material prior to construction of the joint. NCAT will provide the rubberized liquid asphalt binder material. This material shall be placed by the Contractor at the direction of the Engineer without direct payment. When directed by the Engineer, the same treatment noted above shall be used on cold asphalt joints.

b. LONGITUDINAL.

Longitudinal joints in the wearing surface shall conform with the edges of proposed traffic lanes insofar as practical. Any necessary longitudinal joints in underlying layers shall be offset wherever possible so as to be at least six inches from the joint in the next overlying layer. The Contractor shall use a mechanical saw of sufficient size to saw the joints if the Engineer determines that the joints are improperly formed. The saw shall be furnished without additional compensation.

c. TRANSVERSE.

Transverse joints shall be carefully constructed. Rollers shall not pass over the unprotected edge of the freshly laid mixture unless laying operations are to be discontinued. To facilitate the expeditious removal of the plant mix joint when laying operations are resumed, the

Contractor shall use any equipment necessary to remove excess material and facilitate successful construction of a smooth joint.

Upon resumption of the work, a neat joint shall be formed by sawing back vertically into the previously laid material to expose the full depth of the layer. A 15-foot straight edge will be used to verify a smooth transition before sawing can commence. The fresh mixture shall be raked and tamped to provide a well-bonded and sealed joint meeting surface and density requirements. A thin coat of rubberized liquid asphalt binder material shall be used to tack adjacent layers prior to placement.

When a section ends (at the far end) against a section that is not being replaced, mat thickness shall be targeted slightly on the high side. If deemed necessary, diamond grinding (considered incidental to the work) shall be used to achieve the required smoothness; however, diamond grinding will not be allowed within the middle 150 (research) feet of any section. The ends of all milled sections shall be trimmed with a masonry saw to produce a vertical face to aid in compaction and smoothness.

(c) LAYER THICKNESS.

Each test section will be no more than four inches thick and shall be placed in no more than three layers (except structural sections). Any test section that does not result in a compacted thickness within the required limits shall be removed by milling and shall be replaced at no cost to the Department. The final surveyed thickness of completed sections must average no more than 0.2 inches from the specified target with a standard deviation within the section of no more than 0.1 inches.

(d) SURFACE SMOOTHNESS.

1. GENERAL.

Surface smoothness and roadway section will be checked by the use of string, Engineer's level, straight edge, and an NCAT-provided longitudinal profiler(s).

The Contractor shall furnish string, straightedges, and the necessary personnel to handle them under the supervision of the Engineer. NCAT will be responsible for supplying, operating, and interpreting results from specialized longitudinal profiling equipment.

Surface smoothness tests shall be made continuously during and immediately after rolling so that irregularities may be eliminated to the extent possible by rolling while the material is still workable; otherwise, deficiencies shall be corrected as provided in Article 410.06.

2. REQUIREMENTS FOR ALL SURFACES.

The finished surface of all base, binder, and wearing surface layers shall not vary more than 1/4 inch from the required section measured at right angles to the pavement centerline. The finished surface shall not vary more than 3/8 inch in any 25-foot section from a taut string applied parallel to the surface and roadbed centerline at the following locations: one foot inside of the edges of pavement, at the centerline, and at other points as designated. The variance from the designated grade shall not increase or decrease more than 1/2 inch in 100 feet.

The surface shall not vary more than 1/4 inch from a 15-foot straightedge placed parallel to the centerline at points directed. A 15-foot rolling straightedge, equipped with marking capability, may be used in lieu of the fixed straightedge if approved by the Engineer.

(e) EDGE REQUIREMENTS.

Surface, binder, and leveling pavement edges not confined by curbing or other structures shall be lightly tamped, generally with a lute immediately behind the placement operation, to form an approximately 1:1 slope as a preventative measure against cracking and bulging during the rolling process. This procedure shall also be required on the initial edge of a longitudinal cold joint. These edges shall be neatly shaped to line behind the breakdown roller and shall be trimmed as necessary after final rolling, to an accurately lined string or wire providing a maximum tolerance of two inches outside the theoretical edge of pavement, with a maximum variation from a true line of 1/2 inch in 10 feet and a slope not flatter than 1:1. Edges that are distorted by rolling shall be corrected promptly.

(f) RIDEABILITY REQUIREMENTS.

Average roughness (as defined by the International Roughness Index, or IRI) within the middle 150 feet of any section shall not exceed 45 inches per mile (as the average of the left and right wheelpaths). The average roughness for the entire track (including the joints) shall not exceed 80 inches per mile. Conformance with this requirement will be determined by NCAT-provided longitudinal profiler(s). Diamond grinding will not be allowed within the middle 150 (research) feet of any section to achieve the required smoothness.

(g) MILLING REQUIREMENTS.

The Contractor shall mill each section prior to construction as indicated on the plans. Any section deemed defective or deficient as a result of the operations of the Contractor shall be removed by milling at no cost to the Department. Milling depth and smoothness are of critical importance and shall be controlled precisely. Average mill depth shall be within 0.1 inches of the specified target (on average, with a standard deviation within milled sections of no more than 0.2 inches) based on before and after surveying by the Engineer.

412.06 Defective or Deficient Areas.

Areas of the test sections that are determined to be defective due to the operations of the Contractor shall be removed and replaced at no cost to the Department. If NCAT deems it necessary to remove and replace new sections as a result of undesirable laboratory volumetrics that are not the result of errors on the part of the Contractor, the extra work will be paid for at the unit bid price.

412.07 Method of Measurement.

Rutting test sections will be measured per section.
 Structural test sections will be measured per section.
 Wasting trial mixes will be measured in units of trial mix run.
 Sponsor-Provided aggregate will be measured in units of tons.
 Sponsor-Provided mineral filler will be measured in units of tons.
 Asphalt will be measured in units of tons.

412.08 Basis of Payment.

(a) GENERAL.

Items of work will be paid for at the contract unit price. This price shall be full compensation for all materials (except materials furnished to the Contractor), equipment, tools and labor required to complete the work.

(b) RUTTING TEST SECTION.

The contract unit price for a rutting test section shall include the production and placement of the required paving mixes.

(c) STRUCTURAL TEST SECTION.

The contract unit price for a structural test section shall include the production and placement the required structural materials and paving mixes.

(d) WASTING TRIAL MIXES.

The contract unit price for wasting trial mixes shall include the production of the mix and the placement of the mix to construct a paved surface.

(e) SPONSOR-PROVIDED AGGREGATE.

The contract unit price for sponsor-provided aggregate shall include the handling and hauling of the aggregate.

(f) SPONSOR-PROVIDED MINERAL FILLER.

The contract unit price for sponsor-provided mineral filler shall include the handling and hauling of the filler.

(g) ASPHALT.

The contract unit price for the asphalt shall include the handling and hauling of the asphalt.

(h) PAYMENT WILL BE MADE UNDER ITEM NUMBER:

412-A Rutting Test Section - per section

412-B Structural Test Section - per section

412-C Wasting Trial Mixes - per run

412-D Sponsor-Provided Aggregate (*) - per ton

412-E Sponsor-Provided Mineral Filler (*) - per ton

* State (Alabama, Georgia, Mississippi, Missouri, etc.)

412-F Asphalt (**) - per ton

** Type of Asphalt (Unmodified PG 67-22, SBR Modified PG 76-22, etc.)