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SECTION 401

EXCAVATION AND EMBANKMENT

401.01 DESCRIPTION: This work shall consist of excavation, disposal or compaction of all material not being removed under some other item which is encountered within the limits of the work necessary for the construction of the roadway in accordance with the specifications and in reasonably close conformity with the lines, grades, thicknesses and typical cross sections shown on the plans or established by the Engineer. All excavation will be classified as "common excavation", "rock excavation", "unclassified excavation", "muck excavation", or "borrow" as hereafter described.

401.02 EXCAVATION - CLASSIFICATION:

(A) Common Excavation: Common excavation shall consist of all excavation not included as rock excavation or excavation which is otherwise classified and paid for.

(B) Rock Excavation: Rock excavation shall consist of igneous, metamorphic and sedimentary rock which cannot be excavated without blasting or the use of rippers, and all boulders or other detached stones each having a volume of 0.5 cubic yard or more.

(C) Unclassified Excavation: Unclassified excavation shall consist of the excavation and disposal of all materials of whatever character encountered in the work.

(D) Muck Excavation: Much excavation shall consist of the removal and disposal of deposits of saturated or unsaturated mixtures of solid and organic matter not suitable for foundation material regardless of moisture content.

(E) Unclassified Borrow: Unclassified borrow shall be all borrow excavation, except Select Borrow.

(F) Select Borrow: Select Borrow shall be material meeting the requirements of the A-1, A-2, A-3 and A-4 soil groups as defined in the AASHTO Method of Soil Classification.

401.04 CONSTRUCTION METHODS:

(A) Roadway Excavation: The excavation and embankments for the roadway, intersections and entrances shall be finished to reasonably smooth and uniform surfaces. Top of finished subgrade shall be within the tolerances shown in Subsection 310.04. No materials shall be wasted without permission of the Engineer. Excavation operations shall be conducted so that material outside of the limits of slopes will not be disturbed. Prior to beginning excavation, grading, and embankment operations in any area, all necessary clearing and grubbing in that area shall have been performed.

Unless otherwise shown on the plans, rock, hard sandstone, shale or other solid unyielding material in the roadbed shall be excavated to a depth of at least 6 inches below subgrade and backfilled with approved material. No excavation below subgrade nor backfill will be paid for unless measured by the Engineer before backfill is placed. Excavation more than 12 inches below subgrade will not be measured for payment unless shown on the plans, or directed by the Engineer. No ridges of rock shall be left and all areas of the rock surface shall drain to the ditches. In blasting rock, a reasonably uniform face shall be left regardless

of whether or not the excavation is carried beyond the specified slopes. All breakage and slides shall be removed by the Contractor and disposed of in a manner approved by the Engineer. When the Contractor's excavation operations encounter remains of prehistoric people's dwelling sites or artifacts of historical or archeological significance, the operations shall be temporarily discontinued. The Engineer will contact archeological authorities to determine the disposition thereof. When directed by the Engineer, the contractor shall excavate the site in such a manner as to preserve the artifacts encountered and shall remove them for delivery to the custody of the proper authorities. Such excavation will be considered and paid for as extra work.

Where excavation to the finished graded section results in a subgrade or slopes of unsuitable soil, the Engineer may require the Contractor to remove the unsuitable materials and backfill to the finished graded section with approved material. The Contractor shall conduct his operations in such a way that the Engineer can take the necessary cross-sectional measurements before the backfill is placed.

The Engineer may designate as unsuitable those soils that cannot be properly compacted in embankments. All unsuitable material shall be disposed of as directed. When the location of unstable soil is shown on the plans, the removal and replacement shall be as shown.

Channel excavation will be made at locations shown on plans or as directed by the Engineer and will be paid for as unclassified excavation.

(B) Borrow Excavation: Unless otherwise designated on the plans or in the proposal, the Contractor shall make his own arrangements for obtaining borrow and shall pay all costs involved.

Widening of roadway cuts and special ditches shall be permitted only when shown on the plans or authorized by the Engineer, and materials moved from these areas shall be measured as Unclassified Excavation.

The Contractor shall provide and maintain all necessary haul roads from the borrow pits to the work at his own expense.

(C) Embankment, General: Embankment construction shall consist of constructing roadway embankments, including preparation of the area upon which they are to be placed; the construction of dikes within or outside the right-of-way; the placing and compacting of approved material within roadway areas where unsuitable material has been removed; and the placing and compacting of embankment material in holes, pits and other depressions within the roadway area. Only approved materials shall be used in the construction of embankments and backfills.

Embankments will be started at the low point and placed in layers approximately parallel to the finished grade and sections of the roadbed and sloped to provide drainage at all times.

Roadway embankment of earth material, including backfill, shall be placed in horizontal layers not exceeding 8 inches (loose measurement). All embankment material and the top 6 inches in cuts will be compacted to 95 percent of Standard Density.

No embankment shall be constructed on frozen material nor shall frozen material be placed in embankments. Effective spreading equipment shall be used on each lift to obtain an approximate uniform thickness prior to compacting. As the

compaction of each layer progresses, continuous leveling and manipulating will be required to assure uniform density. Water shall be added or removed, if necessary, in order to obtain the required density.

In no event shall the moisture content at the time of compaction be less than required for proper compaction and to obtain the specified density nor more than that which will permit compaction to the specified density. Construction equipment shall generally be routed over the entire surface of each layer.

The Contractor shall employ proper and adequate workmanship in the construction of embankments at all times to obtain the required section within reasonable limits. Rocks, broken concrete or other solid materials shall not be placed in embankment areas where piling is to be placed or driven.

If embankment is to be placed on one side only of abutments, wing walls, piers, retaining walls or culvert headwalls, care shall be taken that the area immediately adjacent to the structure is not compacted to the extent that it will cause overturning of or excessive pressure against the structure. When embankment is to be placed on both sides of a concrete wall, abutments, end bent or box type structure, operations shall be so conducted that the embankment is always at approximately the same elevation on both sides of the structure. No rocks or boulders larger than 6 inches in the largest dimension shall be placed in the embankment nearer than 5 feet to the structure. If roadway excavation does not meet this requirement, other imported material will be measured and paid for as unclassified excavation.

All excess or unsuitable excavated material, including rock and boulders, that cannot be used in embankments may be placed on the side slopes of the nearest fill in a satisfactory manner and shall be placed so as to maintain a distinct shoulder line by keeping all such waste material not less than 3 feet below the finished shoulder elevation, unless otherwise shown on the plans or as directed by the Engineer.

In case it is impossible to dispose of all such material in the manner described, the remainder shall become the property of the Contractor and disposed of by him to the satisfaction of the Engineer.

When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed on layers of the thickness prescribed without crushing, pulverizing or further breaking down the pieces resulting from excavation methods, such material may be placed in the embankment in layers not exceeding in thickness the approximate average size of the larger rocks. Each layer shall be leveled and smoothed with suitable leveling equipment and by distribution of spalls and finer fragments or earth. The lifts shall not be constructed above an elevation one foot below the finished subgrade. The balance of the embankment shall be composed of suitable material smoothed and placed in layers not exceeding 8 inches in loose thickness and compacted as specified for embankments.

The surface layer of the roadbed shall not be wetted or compacted until final finish grade stakes have been set and all embankment material is in place. The surface layer of the entire embankment shall then be manipulated by plowing and the moisture corrected, after which the entire surface layer shall be compacted to not less than 95 percent of Standard Density.

All materials shall be placed in layers and rolled except that which is inaccessible to the roller, such as adjacent to culverts or bridge abutments in which case the material shall be placed in layers not to exceed 6 inches in depth

measured loose and compacted to the density of the adjacent embankment with mechanical tampers of approved design. No additional compensation will be allowed for tamping.

(D) Sloping, Shaping, Dressing and Finishing: The slopes of all cuts, ditches, and embankments shall be constructed and dressed in a neat and workmanlike manner, as indicated on the plans or as directed by the Engineer. Shovel cuts will require the removal of the ridge which a shovel ordinarily leaves along the top of the bank, and such hand work as may be necessary to maintain approximately the designated slope and produce a backslope free from humps and hollows. The top and bottom of slopes will be rounded to the approximate typical cross section shown on the plans.

When rock extending to the top of cuts makes rounding impractical, it will not be required. Old existing banks shall be sloped, shaped and rounded as specified for new work. The quantities of excavation in rounding tops of cut slopes will be paid for at the price for roadway excavation and no other compensation will be allowed for this work. Hand trimming of slopes and shoulders will not be required where a neat uniform face is otherwise obtained. The slopes in all cuts and banks of borrow pits shall be trimmed from top to bottom in firm material.

Dressing shall include all the necessary clearing of the right-of-way of stumps, brush, weeds and other rubbish, and disposing of same as directed by the Engineer and in accordance with applicable sections of the specifications.

(E) Tolerances: The roadbed shall be finished to profile and cross section within tolerances of Section 310.

401.05 METHOD OF MEASUREMENT:

(A) Measured Quantities: When payment is specified on a volume basis, all accepted excavation shall be measured in its original position by cross sectioning the area excavated, which measurements will include overbreakage or slides in common excavation and unclassified excavation, not attributable to carelessness of the Contractor, and authorized excavation of rock, shale, muck or other unsuitable material. Volumes will be computed from the cross section measurements by the average end area method. Volumes of structures and obstructions removed, measured and paid for under Subsection 607.06 will not be measured and paid for under this Section.

Authorized excavation of rock, shale, muck or unsuitable material below grade shall consist of that excavation necessary to provide the designed thickness of backfill. If the plane of the designated bottom of excavation falls within a layer of stratum or rock, the below grade excavation to the bottom of the layer, not exceeding 12 inches below the designated bottom of excavation, will be considered as authorized and will be measured for payment. Rock excavation more than 12 inches below the designated bottom of excavation will not be paid for. If the nature of the material, the thickness of the layers or strata and method of operations are such that it is practical to excavate only to the depth shown on the plans, no measurement will be made of any material removed below the line designated. The measurements will include overbreakage in rock excavation from the backslopes to an amount not to exceed in any half station of 50 feet, 10 percent of the actual quantity required for that half station.

Measurements will be made for unsuitable materials actually excavated and removed to obtain proper compaction in cut sections and in foundations for fill sections. Measurements will not be made of the suitable material temporarily removed and replaced to facilitate compaction of the material for the full depth shown on the plans.

Where it is impractical to measure material by the cross section method due to the erratic location of isolated deposits, acceptable methods involving three- dimensional measurements may be used.

Embankment will not be measured for payment as such but the cost of constructing, complete, any required embankment shall be included in the price bid for "Unclassified Excavation".

401.06 BASIS OF PAYMENT: Accepted quantities of excavation, measured as provided above, will be paid for at the contract unit price for:

Common Excavation	Cu. Yd.
Rock Excavation	Cu. Yd.
Unclassified Excavation	Cu. Yd.
Muck Excavation	Cu. Yd.
Unclassified Borrow	Cu. Yd.
Select Borrow	Cu. Yd.

which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

When water is not specified as a pay item in the contract, the water used will not be measured or paid for but will be incidental to the work.

SECTION 402

TEST ROLLING

402.01 DESCRIPTION: This work shall consist of the test rolling with heavy pneumatic tired rollers when shown on the plans or required by the specifications.

402.02 MATERIALS: In the event test rolling discloses soft, yielding or otherwise unstable areas, such areas shall be corrected by removing all unsuitable material and replacing it with suitable material. The satisfactory correction of any area shall be demonstrated by test rolling of the corrected area.

402.03 EQUIPMENT: Heavy pneumatic tired rollers shall have a minimum of four wheels abreast equipped with pneumatic tires of such size and ply that tire pressures shall not be less than 40 $\pm$ 5 psi for rolling operations. The roller wheels and axles shall be so designed that each wheel will carry an approximately equal load when the roller is operated over uneven ground. The centers of the wheels shall be spaced at not more than 1-3/4 times the rated tire width of a single tire. The roller shall have a loading platform suitable for loading with ballast sufficient to obtain a load of not less than 25,000 pounds per wheel. The Contractor shall furnish the Engineer with certified weights of the empty roller and weights of the ballast. There shall be a metal plate attached to the roller showing the tire weight and capacity of the load box.

The motivating equipment shall be capable of operation within the limits of the specification and so constructed that it can be turned without damage to the work being tested. Rolling equipment shall be approved by the Engineer.

402.04 CONSTRUCTION METHODS: The area to be tested shall be rolled with not less than six passes or 3 complete coverages. The roller shall be operated at speeds between 2 and 10 miles per hour as directed by the Engineer.

In every case when test rolling is called for on embankment, the subgrade in both cuts and fills shall be tested, and where the original ground which is to be the foundation of an embankment is accessible to the roller, as determined by the Engineer, this area shall also be tested.

402.05 METHOD OF MEASUREMENT: Test rolling will not be measured for payment. All equipment, labor, water and incidentals as may be required shall be included in the unit price bid on the items for which test rolling is designated.

SECTION 403

TREE REMOVAL

403.01 DESCRIPTION: Work included in this section shall consist of removing trees where called for on the plans or as designated by the Engineer and shall include the cutting of trees, removing stumps and roots, and properly disposing of the material. Trees to be removed shall be only those detailed on the plans or those specifically designated by the Engineer after being measured for payment and flagged or otherwise marked for removal and disposal.

403.04 CONSTRUCTION: All trees shall be removed and disposed of in a manner approved by the Engineer. All stumps and roots shall be removed to a depth of not less than 12 inches below the ground level. Where tree removal precedes new pavement construction, all stumps and roots are to be removed to a depth of not less than 12 inches below future pavement subgrades and removal shall be accomplished to a degree such that stumps and roots will not interfere with compaction of pavement subgrade.

403.05 METHOD OF MEASUREMENT: The size of trees will be determined by the average diameter of the tree trunk taken at a point measured 4 feet above the base of the tree at the ground line. The diameter will be measured to the nearest full inch.

403.06 BASIS OF PAYMENT: Trees removed will be measured as provided above and will be paid for at the contract unit price per each tree in accordance with the following schedule of sizes:

Remove Trees (4" thru 12" diameter)----------EA.
Remove Trees (13" thru 24" diameter)---------EA.
Remove Trees (25" diameter and over)---------EA.

which shall be full compensation for furnishing all equipment, labor, tools and incidentals necessary to complete the work as specified.

Removing trees less than 4 inches in diameter shall be considered as incidental work and will not be paid for directly but the cost shall be included in other bid items.

When the proposal does not include a separate item for Remove Trees, then all work specified in this section shall be considered as incidental work and shall not be paid for directly but the cost shall be included in other bid items.

SECTION 406

AGGREGATE BASE

406.01 DESCRIPTION: This work shall consist of furnishing and placing one or more courses of aggregates and additives, if specified, on a prepared subgrade or subbase in accordance with these specifications and in reasonably close conformity with the lines, grades, thicknesses and typical cross section shown on the plans or established by the Engineer.

Aggregate Base may be mixed off the roadbed and may be blended by plant mixing or other approved methods.

Aggregate Base may be mixed on the roadbed with approved methods that will produce a uniformly blended material.

Aggregate Base shall not be mixed on any completed base or surface course.

406.02 MATERIALS: Materials shall conform to the requirements specified in Subsection 706.03 for the type gradation specified.

The gradation shall be either Type A, Type B or Type C as specified on the plans or in the proposal.

406.04 CONSTRUCTION METHODS:

(A) Preparation of Subgrade: Prior to placing any new base material or subbase and base course material on the roadbed, the subgrade shall have been completed according to the requirements of Section 310 of these specifications or the method specified on the plans or in the proposal.

If there is existing aggregate course in place, it shall be prepared in accordance with the requirements of the method of Section 311 of these specifications as indicated on the plans and in the proposal.

(B) Mixing Aggregate Base:

1. Offsite Mixing: When mixing or blending of materials for aggregate base is done at an approved location off the roadbed one of the following procedures shall be used.

    1.1 Stationary Plant, Mixing Method: The aggregate and water shall be mixed in an approved central mixing plant of the pugmill type, rotary drum type, or in a continuous type of mixer.

    Water shall be added during the mixing operation in the amount necessary to provide the proper moisture content for satisfactory compaction.

    If a pugmill type or rotary drum type of mixer is used, the materials shall be proportioned by batch weights, and if a continuous type mixer is used, the materials may be proportioned by volume or by weight.

    Should the Contractor elect to proportion the materials by volumetric methods and perform the mixing in a continuous type mixer, the completed mixture shall be uniform in character and of the same consistency with respect to aggregates and water as that obtained by weight proportioning and batch mixing.

If a continuous type mixer is used, the correct proportions of each aggregate size introduced into the mixer shall be drawn from storage by an approved type of continuous feeder through adjustable calibrated gates, which will supply the correct amount of coarse aggregate and fine aggregate required to meet the specified gradation, and so arranged that the proportion of each aggregate size can be separately adjusted. The storage of materials shall be sufficient to supply the mixer when it is in operation at full capacity.

The weight of charge in a batch mixer or the rate of feed to a continuous type mixer shall not exceed that which will permit complete mixing of the material.

Mixing of materials shall be continued until a uniform mixture is obtained.

1.2 Travel Plant, Mixing Method: This method of producing Aggregate Base shall be performed at an approved location off the roadbed. The area selected to do this work shall be cleaned of vegetation or other deleterious substances, overlaid with a minimum of 3 inches of base material and compacted to provide a satisfactory working table for mixing operations.

When the aggregates required to produce the specified mixture are to be combined and blended on the working area, the weighed material shall be delivered and placed in measured windrows each in the proper proportions before blending. In the event a machine for mixing required a blanket of material, the windrow shall be spread to a reasonably uniform depth and width which the machine is capable of handling. The water shall be applied by means of controls which will supply a uniform rate of water in the proper amount for satisfactory compaction. Application of excess water shall be avoided, either during mixing or during compaction, in order that undue softening of the subgrade will not develop.

The device by which the mixing machine picks up the material shall be subject to control, and shall be so controlled and operated on each pass of the mixer as to pick up the material to be treated and at the same time avoid cutting into the working area.

Mixing may be accomplished in one or more passes of the mixer through the material, but in any event shall be continued until the aggregate and water are evenly distributed through the mass and a uniform mixture meeting specification requirements is obtained.

In the process of mixing, compensation shall be made for any tendency of the mixing equipment to shift material in a longitudinal direction.

2. Onsite Mixing: When the materials required to produce the specified mixture are to be combined and blended on the roadbed, the weighed material shall be delivered and placed in measured windrows each in the proper proportions before blending. Fine aggregate to be added to the mixture shall be pulverized to 100 percent passing the one inch sieve and no less than 80 percent passing the No. 4 sieve. The total

quantities for blending at one operation shall not be in excess of the amount that can be readily handled and thoroughly and uniformly mixed and blended to these requirements.

During the latter stages of the mixing and before final mixing is completed, the mixture shall be moistened as deemed necessary to provide a suitable working condition during the final stages of mixing.

Such application of water shall be accurate and uniform throughout the length of section being treated so that no excess wet or dry spots will be evidenced in the finished blend. Application of excess water should be avoided, either during mixing or during compaction, in order that undue softening of the subgrade will not develop.

(C) Spreading: Aggregate Base materials mixed at locations off the roadbed shall be transported to the roadbed by means of suitable vehicles, and deposited by means of approved spreading equipment. The layers shall be placed so that when compacted they will be true to the grades or levels required with the least possible surface disturbance. The Contractor shall make such adjustments in placing procedures or equipment as may be directed by the Engineer to obtain true grades, to minimize segregation and degradation, to reduce or accelerate loss or accretion of water, and to insure a satisfactory base.

The Aggregate Base material shall be spread and compacted to the required density in one or more layers, as specified below, and of such width and thickness that after compacting, the finished base will conform to the required grade and cross section. The Aggregate Base material for each separate course shall be spread for the full width of the roadbed before the placing of the succeeding courses. Longitudinal and transverse joints shall be staggered a minimum of 12 inches in each succeeding course.

Aggregate Base material shall be laid in courses of a minimum of 2 inches compacted thickness and shall not exceed a maximum of 6 inches compacted thickness, except when shoulders are shown on a typical section to be constructed as a separate operation, then they may be constructed in one course providing they do not exceed 8 inches in thickness, and in two approximately equal courses where they exceed 8 inches. In either case the compacted shoulders shall meet specified density requirements.

After the blended and flattened windrow of Aggregate Base material mixed on the roadbed has been tested and approved by the Engineer it shall be spread uniformly as specified above over the full length and width of the section to be compacted. This spreading shall be done in such a manner as to prevent segregation of the mixture.

(D) Shaping Compaction: Compaction of each layer shall continue until a density of not less than 95 percent of Standard Density as determined by AASHTO T-180 Method D has been achieved.

The surface of each layer shall be maintained during the compaction operations in such a manner that a uniform texture is produced and the aggregates firmly keyed. Water shall be uniformly applied over the base materials during compaction in the amount necessary for proper consolidation.

Before applying the prime coat, the Aggregate Base material shall have cured or seasoned sufficiently to permit the prime coat to be properly applied.

(E) Tolerances: Tolerances for surface and thickness shall be within 1/2 inch in 10 feet and within 1/4 inch of plan thickness.

406.05 METHOD OF MEASUREMENT: Aggregate Base will be measured by the square yard of the specified thickness, compacted in place, to the specified density.

406.06 BASIS OF PAYMENT: Accepted Aggregate Base, measured as provided above will be paid for at the contract unit price for:

Aggregate Base---------- Tons

which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

Rolling and water as required to obtain specified density will not be a separate pay item but the cost of same shall be included in the price of other bid items.

SECTION 407

LIME TREATMENT OF THE SUBGRADE

407.01 DESCRIPTION: This item shall consist of treatment of subgrade materials by mixing them with lime and compacting the mixture and shaping to conform to the lines, grades and depths shown on the plans.

407.02 MATERIALS:

(A) Soil: The soil shall consist of soil in-place at the completion of the grading operations and suitable for lime modification. Soil shall be free of roots, sticks, sod tufts, and other deleterious concentrations of organic matter.

(B) Lime: The material shall meet the requirements of Section 707.

(C) Water: Water shall be reasonably clean and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

407.04 CONSTRUCTION METHODS: It is the primary requirement of this specification to secure a completed course of treated material containing a uniform mixture of soil and lime.

The treated material shall be free from loose and segregated areas, of uniform density and moisture content, well bound for its full depth and with a smooth surface suitable for placing the subsequent courses. It shall be the responsibility of the Contractor to regulate sequence of his work, to use the amount of lime to render the soil suitable, maintain the work, and work the course as necessary to meet requirements of these specifications.

(A) Proportioning: The amount of lime applied to the subgrade shall be sufficient to produce modification of the soil to the extent expressed by the Engineer or shown on the plans. Rate of application will be stated by percentage of lime (by weight) for the depth to be modified.

(B) Weather Limitations: No lime shall be applied unless the temperature is at least 40 degrees F. in the shade and rising. The Contractor shall be responsible for the protection and the quality of the soil-lime mixture under any weather conditions.

(C) Application of Lime:

1. Dry Method: The lime shall be applied at a uniform rate to assure equal distribution. Dry lime shall not be applied when wind conditions are such that blowing lime will be objectionable to traffic or adjacent property owners. Lime shall be placed only on that area where the first mixing operation can be completed during the same working day.

2. Slurry Method: The lime shall be mixed in a central mixing tank. Agitation shall be accomplished through integral paddles, recirculating pumps, or a combination of these devices. The distributor truck shall be equipped with a pump and the slurry will be applied through the spray bars under pressure to assure a uniform flow and distribution. The slurry shall consist of a minimum mixture of approximately one ton of lime to each 500 gallons of water (about 30% solution) and shall not contain more than one ton of lime to each 250 gallons of water (about 50% solution).

(D) First Mixing: The materials shall be mixed until a homogenous friable mixture of soil and lime is obtained, free from lumps or clods in excess of 1-1/2" in diameter. Proper moisture shall be maintained to allow uniform mixing of the materials. When the first mixing operation is completed, the moisture content shall be brought to not less than optimum and left to cure a minimum of three days or as otherwise directed by the Engineer. It shall be permissible to seal the surface of the modified area with a pneumatic roller to the extent that it will repeal water and retain the moisture below. The moisture content of the mixture shall be maintained at optimum moisture during the curing period by sprinkling.

(E) Final Mixing: After the required curing time, the material shall be uniformly remixed. At this time all material shall be pulverized to the extent that when all non-slacking aggregates retained on the No. 4 sieve are removed, the remainder of the material will meet the following requirements when tested dry by laboratory sieves:

Minimum passing 1-1/2" sieve----------100%
Minimum passing No. 4 sieve---------- 60%

(F) Compaction: Compaction of the material shall be completed as soon as possible after final mixing, preferably the same day. Compaction shall be such that the modified material will be of uniform density for the full depth and area. The density shall be not less than 100% of Standard Density.

In addition to the requirements for density, the material shall be compacted to the extent that it will remain firm and stable under construction equipment. If the material fails to meet the density requirements, it shall be reworked as necessary to meet these specifications. Throughout this entire operation, the shape of the course shall be maintained by blading, and the surface, upon completion, shall be smooth and in conformance with established lines, grades, and depth shown on the plans. Should the material, due to any reason or cause, lose the required stability, density, or finish before the next course is placed or the work is accepted, it shall be recompacted and refinished at the sole expense of the Contractor.

407.05 METHOD OF PAYMENT: Lime Treated Subgrade will be measured by the square yard. Water and rolling will not be measured for payment but shall be considered incidental to the work.

407.06 BASIS OF PAYMENT: The accepted quantities, measured as provided above, will be paid for at the contract unit price for:

Lime Treated Subgrade----------SQ. YD.

which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

SECTION 408

BITUMINOUS BASE - FINE AGGREGATE TYPE

408.01 DESCRIPTION: This work shall consist of mineral aggregate, sand, stone screenings, gravel or a combination of these mixed with bituminous material in a central plant, spread and compacted in accordance with these specifications and in reasonably close conformity with the lines, grades, thicknesses and typical cross sections shown on the plans or established by the Engineer.

408.02 MATERIALS: Materials shall meet the requirements specified in Section 705. Bituminous plant mix shall be composed of a mixture of aggregate, filler, if required, and bituminous material. The several aggregate fractions shall be sized uniformly, graded and combined in such proportions that the resulting mixture meets the grading requirements of the job-mix formula. When materials from two sources are used they will be independently controlled by the cold feed.

Prior to use, samples of all materials proposed to be used under these specifications shall be submitted to an approved laboratory for testing and for the preparation of trial mixtures to determine the initial job-mix formula. Testing cost shall be borne by the Contractor. After the plant is in operation a satisfactory job-mix formula will be determined.

The job-mix formula with the allowable tolerances shall be within the master range specified. The job-mix formula for each mixture shall be in effect until modified in writing by the Engineer. The job-mix formula shall establish a single percentage of aggregate passing each required sieve size, a single percentage of bituminous material to be added to the aggregate and a single temperature at which the mixture is to be delivered at the point of discharge. After the job-mix formula is established, all mixtures furnished for the project shall conform thereto within the following ranges of tolerances:

Passing No. 200	±	5%
Asphalt Cement	±	0.5%

Should a change in source of material be made, a new job-mix formula will be established before the new material is used.

408.03 EQUIPMENT: The equipment used for producing, heating, mixing, hauling, spreading, compacting and finishing bituminous base shall meet the requirements of Section 411 of the Standard Specifications for Highway Construction of the Oklahoma State Highway Commission.

408.04 CONSTRUCTION METHODS:

(A) Weather Limitations: The minimum air temperature in the shade at which asphalt may be laid shall be 35 degrees F. if rising or 40 degrees F. if falling. No asphalt base shall be laid when there is frost in the foundation course. When a strong wind is blowing or conditions otherwise are such that the material becomes chilled to an extent which prevents proper leveling and thorough consolidation, the Engineer shall stop the laying of the asphalt base.

(B) Heating Bituminous Material: The bituminous material for the base mixture shall be heated at the mixing plant to a temperature of 275 degrees F. to 325 degrees F.

(C) Preparation of Mineral Aggregates: Mineral aggregates shall be dried and heated at the paving plant so that when delivered to the mixer they shall be at as low a temperature as is consistent with proper mixing. The minimum

temperature shall be such that the average moisture content of the aggregate in the plant binds does not exceed 1%. In no case shall the temperature exceed 325 degrees F. All effort shall be exerted to ensure a uniform heat of the dried aggregate.

(D) Preparation of Bituminous Mixtures: The hot aggregate prepared as prescribed above shall be accurately measured and conveyed into the mixer in the proportionate amounts of each aggregate required to meet the specified grading.
When batch type mixers are used, wet mixing time shall be determined by the Engineer for each plant and for each type of aggregate used.

(E) Loading and Transportation of Mixture: In discharging the bituminous mixture from the mixer to trucks, every precaution shall be taken to prevent segregation of materials. The mixture shall be transported from the paving plant to the work in tight vehicles with metal bottoms previously cleaned of foreign materials.

The vehicles shall be provided with canvas or other suitable material as may be required to protect the mixture from adverse weather conditions. The inside surface of all vehicles used for hauling mixtures may be lightly lubricated with a thin oil or soap solution just before loading, but excess of lubricant will not be permitted. No loads shall be sent out so late in the day as to interfere with spreading and compacting the mixture during daylight unless artificial light satisfactory to the Engineer is provided.

(F) Prime Coat: Prime coat, if required by the plans, shall be in accordance with Section 412.

(G) Tack Coat: Tack coat shall be in accordance with Section 411.

(H) Placing the Base Course: The asphalt mixture shall be laid at a temperature of from 250 degrees F. to 300 degrees F. and only upon an approved base or subgrade which is dry. The mixture shall be delivered on the job at a minimum workable temperature which will produce the density herein specified after final compaction. After the minimum workable temperature is determined, it shall not vary more than plus or minus 20 degrees F.

The alignment of one edge shall be established by a string or wire line in advance of the placing of the asphalt.

The asphalt mixture shall be spread by means of a mechanical self-powered paver capable of spreading the mixture reasonably true to the line, grade, and crown set by the Engineer.

When the asphalt mixture is placed in a narrow strip along the edge of an existing pavement, or placed in small irregular areas where the use of a finishing machine is not practical, the finishing machine may be eliminated, when authorized by the Engineer, provided a satisfactory surface can be obtained by other approved methods.

Immediately after any course is screeded, and before roller compaction is started, the surface shall be checked, any irregularities adjusted, all fat sandy accumulation from the screed removed by a rake or hoe, and all fat spots in any course removed and replaced with satisfactory material. Irregularities in alignment and grade along the outside edge shall also be corrected by the addition or removal of mixture before the edge is rolled.

Placing of asphalt mixture shall be as continuous as possible and the roller shall pass over the unprotected edge of the fresh-laid mixture only when the laying of this course is to be discontinued for such length of time as to permit the asphalt mixture to become chilled.

(I) Joints: Longitudinal and transverse joints shall be staggered approximately 6 inches. Well bonded and sealed joints are required.

Transverse or longitudinal joints accumulating mud, dust or other foreign matter shall be cleaned to the satisfaction of the Engineer.

(J) Compaction: As soon after being spread as it will bear rollers without undue displacement, the asphalt mixture shall be thoroughly and uniformly compacted with the rollers.

Rolling shall be done in such a manner and sufficient number of complete passes made so that a surface will be obtained meeting the tolerances of smoothness and density requirements specified herein.

Along curbs, headers, and similar structures, and at all places not accessible to the roller, the mixture shall be thoroughly compacted by approved methods.

After final compaction each course shall at no point have a density less than 95 percent of laboratory density.

The Contractor shall cut test samples from the pavement by sawing or coring at locations directed by the Engineer.

(K) Tolerances: Tolerances in thickness shall be the same as those required in Section 501. Surface tolerance shall be 1/4" in 10 feet tested with a 10 foot straightedge provided by the Contractor. The tests shall be perpendicular and parallel to the centerline at locations determined by the Engineer. Conditions exceeding the specified tolerances shall be corrected by the Contractor in a manner approved by the Engineer.

408.05 METHOD OF MEASUREMENT:

(A) Bituminous Base, Fine Aggregate Type, shall be measured by the square yard of base laid in place and accepted.

(B) Prime Coat, when required, will be measured and paid for in accordance with Section 412.

(C) Tack Coat will be measured and paid for in accordance with Section 411.

408.06 BASIS OF PAYMENT: The accepted quantities measured as provided above will be paid for at the contract unit price for:

Bituminous Base, Fine Aggregate Type----------SQ.YD.

which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

SECTION 409

SAND CUSHION

409.01 DESCRIPTION: This work shall consist of furnishing and placing a course of sandy material as a foundation for concrete pavement in accordance with these specifications and in reasonably close conformity with the lines, grades, thicknesses and typical cross sections shown on the plans or established by the Engineer.

409.02 MATERIALS: Materials shall meet the requirements specified in Subsection 706.02.

409.04 CONSTRUCTION METHODS:

(A) Preparation of Subgrade: The subgrade shall be constructed as specified in Section 310 of these specifications, or the method indicated on the plans and in the proposal.

(B) Compaction-Density: The sand cushion material shall be placed on the roadbed in sufficient quantities and uniformly spread to such thickness and width that the completed sand cushion will conform to the plan width, thickness and grade. Thickness tolerances shall be 1/4 inch plan thickness and surface tolerances shall be in accordance with Subsection 408.04(K).

The sand cushion material shall be manipulated, sprinkled and rolled to secure not less than 100 percent of Standard Density.

409.05 METHOD OF MEASUREMENT: Sand Cushion will not be measured for payment. All equipment, labor, water and incidentals as required shall be included in the unit bid price for some other item on the proposal.

SECTION 411

TACK COAT

411.01 DESCRIPTION: This work shall consist of preparing and treating an existing bituminous or concrete surface with bituminous material in accordance with these specifications and in reasonably close conformity with the lines shown on the plans or established by the Engineer.

411.02 MATERIALS: Materials shall meet the requirements specified in Section 708 of the Standard Specifications for Highway Construction of the Oklahoma State Highway Commission for Emulsified Asphalt, SS-1.

The SS-1 will be diluted as specified or directed by the Engineer to insure the desired coverage of the old surface. For average conditions a blend of 50% SS-1 and 50% additional water will be used.

411.03 EQUIPMENT: Distributors, heating equipment and supply tanks shall meet the requirements of Section 401 of the Standard Specifications for Highway Construction of the Oklahoma State Highway Commission.

411.04 CONSTRUCTION METHODS: The existing surface or course shall be dry and cleaned to the satisfaction of the Engineer before the tack coat is placed. The tack coat shall be applied as directed by the Engineer, with an approved distributor or spray equipment at the rate of not to exceed 0.10 gallons per square yard of surface.

All contract surfaces of curbs and gutters, manholes, and other structures shall be painted with a thin uniform coating of the approved tack coat material.

The tack coat shall be applied in such a manner as to offer the least inconvenience to traffic and to permit one-way traffic without pickup or tracking of the bituminous material.

Tack coat shall not be applied during wet or cold weather, after sunset, or to a wet surface. However the surface may be damp.

The quantity, rate of application, temperature and areas to be treated shall be approved prior to application.

411.05 METHOD OF MEASUREMENT: Tack Coat will be measured before dilution. It will be measured by the gallon in accordance with Section 109 of the Standard Specifications for Highway Construction of the Oklahoma State Highway Commission. Water used in dilution of emulsified asphalt will not be measured for payment.

411.06 BASIS OF PAYMENT: Tack coat shall be included in the price for asphalt which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

SECTION 412

PRIME COAT

412.01 DESCRIPTION: This work shall consist of preparing and treating an existing surface with bituminous material, and blotter material, if required, in accordance with these specifications and in reasonably close conformity with the lines shown on the plans or established by the Engineer.

412.02 MATERIALS: Materials shall meet the requirements specified in Section 708, of the Standard Specifications for Highway Construction of the Oklahoma State Highway Commission for:

Prime Material MC-30 or MC-70
Prime Material SS-1 (diluted)

Blotter material, if required, shall meet the requirements of Section 402 of the Standard Specifications for Highway Construction of the Oklahoma State Highway Commission.

412.03 EQUIPMENT: Distributors, heating equipment and supply tanks shall meet the requirements of Section 401 of the Standard Specifications for Highway Construction of the Oklahoma State Highway Commission.

412.04 CONSTRUCTION METHODS:

(A) Weather Limitations: Bituminous material shall not be applied when the temperature is below 50 degrees F. air temperature in the shade, unless otherwise provided or when weather conditions would otherwise prevent the proper construction of the prime coat.

(B) Preparation of Surface: Before priming, the subgrade, subbase or base shall be cleaned of loose material and shall be in a condition that maximum penetration of the prime will be obtained.

(C) Priming Subgrades, Subbases or Bases That Are Non-Cohesive: Subject to the approval of the Engineer, when friable or non-cohesive materials are encountered in the surface to be primed, the bituminous material shown on the plans may be changed to an asphalt emulsion and sprinkling water with asphalt emulsion added may be used in the final operations of sprinkling, manipulation, shaping and rolling of the subgrade, subbase or base. Additional applications may be made if required to form a firm, bonded, working table.

(D) Application of Bituminous Material: Bituminous material shall be applied to the width of the section to be primed by means of a pressure distributor in a uniform, continuous spread at the approximate rate of 0.1 to 0.4 gallons per square yard as directed by the Engineer. When traffic is maintained, not more than ½ of the width of the section shall be treated in one application. Care shall be taken that the application of bituminous material at the junctions of spreads is not in excess of the specified amount. Excess bituminous material shall be removed from the surface. Skipped areas or deficiencies shall be corrected.

When traffic is maintained, one-way traffic shall be permitted on the untreated portion of the roadbed. As soon as the bituminous material has been absorbed by the surface and will not pick up, traffic shall be transferred to the treated portion and the remaining width of the section shall be primed.

SECTION 412 - PRIME COAT

The quantities, rate of application, temperatures and areas to be treated shall be approved before application of the prime coat.

Succeeding applications of bituminous materials or other courses shall not be applied until after sufficient time has elapsed to allow both proper penetration and hardening of the prime coat. Extreme care will be exercised to prevent the entrapment of volatiles in the prime materials.

(E) Application of Blotter Material: If, after the application of the prime coat, the bituminous material fails to penetrate within the time specified and the roadway must be used by traffic, blotter material shall be spread in the amounts required to absorb any excess bituminous material.

412.05 METHOD OF MEASUREMENT: Bituminous material will be measured by the gallon in accordance with Section 109 of the Standard Specifications for Highway Construction of the Oklahoma State Highway Commission. If an asphalt emulsion is substituted for the bituminous material shown on the plans, measurement will be made before dilution with water on the project.

Blotter material, if required, will not be measured for payment.

412.06 BASIS OF PAYMENT: The accepted quantities of prime coat, measured as provided above, will be paid for at the contract unit price for:

Prime Coat----------GAL.

which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.