STANDARD SPECIFICATIONS

FOR STATE ROAD AND BRIDGE CONSTRUCTION

METRIC VERSION

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Kansas Department
of
Transportation

Edition 1990

DIVISION 300

STABILIZED BASE AND SURFACE

SECTION 301

EQUIPMENT

Unless otherwise noted, equipment shall conform to the requirements specified in Division 150.

SECTION 302

SUBGRADE MODIFICATION

302.01 DESCRIPTION.

This work shall consist of scarifying the roadbed and the incorporation of aggregate and additives, if required, into the scarified roadbed, or the addition and mixing of aggregate with materials obtained from the ditches and shoulder slopes, and the compaction of the mixture to the depth shown in the contract documents; also the realigning of the shoulders and the cleaning and reshaping of the ditches if called for in the contract documents or designated by the Engineer.

BID ITEMS

Aggregate for Subgrade Modification (SR- *).
Aggregate for Subgrade Modification (SS- *).
Water.
Calcium Chloride.
Manipulation for Subgrade Modification.

* Type of Material.

302.02 MATERIALS.

Materials shall conform to the requirements specified in the Materials Division:

Aggregate for Subgrade Modification	Section 1100
Calcium Chloride	Section 1700

302.03 CONSTRUCTION REQUIREMENTS.

The quantity of aggregate for subgrade modification shown in the contract documents shall be hauled, windrowed, and the windrow brought to a uniform cross section. The windrowed material shall be mixed with the binder material obtained from the top portion of the roadbed or from the shoulder slopes, ditches, and back slopes. If the contract documents require that the binder be obtained from the roadbed, the roadbed shall be scarified to the width and depth shown in the contract documents. The material thus obtained shall be pulverized and mixed until not more than five percent of the material is retained on a 50 millimeter sieve and until the aggregate for subgrade modification and the roadbed soil are thoroughly mixed together. If calcium chloride is required to be added to the mixture, it shall be added at the rate shown in the contract

documents. The calcium chloride shall be thoroughly and uniformly mixed with the aggregate and roadbed materials.

After thorough mixing, the mixed material shall be brought to the specified moisture content. Exposed surfaces of the prepared subgrade shall be thoroughly sprinkled before spreading the material to insure an adequate bond between the subgrade and the modification materials. The material shall be compacted by means of sheepsfoot or pneumatic-tired rollers or vibratory compactor to a density equal to or greater than that required by the type of compaction designated or the percent of standard compaction required in the contract documents.

On shallow lifts, a pneumatic-tired roller may be required by the Engineer in lieu of a sheepsfoot roller in obtaining Type B compaction requirements. The rolling with the pneumatic-tired roller shall proceed during laying operations and shall continue until no further consolidation is in evidence.

If no compaction is designated in the contract documents, the mixed material shall be watered, shaped, and bladed to provide a consolidated surface, having the materials securely bonded and with a minimum of loose material remaining on the surface.

If called for in the contract documents, a second application of calcium chloride at the rate shown shall be applied uniformly over the surface. The surface shall then be sprinkled lightly, if necessary, as directed.

If after the subgrade modification is compacted there are areas above or below the proper grade, such areas shall be loosened and after having had additional materials added or excess material removed, as the case may require, shall be reconstructed as set out above.

If a base or surface course is to be constructed thereon and is included in the same Contract, the surface of the completed subgrade shall be satisfactorily maintained until the base or surface course has been placed. If required, additional water shall be applied to the completed subgrade to prevent checking or raveling. The Engineer shall have full authority to require the suspension of all other work on the project to insure proper maintenance of the completed subgrade.

In all cases the shoulders and shoulder slopes shall be cleaned of all spilled materials, ruts, piles of debris, etc., and shall present a neat and workmanlike appearance before acceptance.

302.04 METHOD OF MEASUREMENT.

Aggregate for subgrade modification shall be measured either on a cubic meter basis or on a metric ton basis as shown

in the Contract, and shall be measured in the vehicle at the time and place of unloading or at such point as may be designated by the Engineer. Deductions will be made for all the moisture in the material when measurement is by the ton.

Water shall be measured by the cubic meter by means of calibrated tanks or distributors or by means of an accurate water meter placed in the pipe line as close as possible to the point of delivery. Only water used for mixing of material and to keep the surface moist will be measured for pay.

Calcium chloride shall be measured by the metric ton of actual material placed in the work. When the contract documents provide for rates of application for alternate types (regular or concentrate) of calcium chloride, the quantity measured for payment will be the actual amount used whether regular or concentrate. No measurement will be made of water used in dissolving the calcium chloride in solution, regardless of whether or not the solution is specified.

Manipulation for subgrade modification shall be measured by kilometers and shall include all blading of ditches and shoulders if called for in the contract documents, the scarifying and pulverizing of the existing surface, all placing and mixing of materials on the road, the mixing of the material with water, the compacting of the materials, the finishing of the mixed materials to a specified section and crown, and the maintenance of the completed subgrade if applicable. No additional measurement will be made of widened sections or for irregular areas.

302.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per metric ton or per cubic meter for "Aggregate for Subgrade Modification", per metric ton for "Calcium Chloride", per cubic meter for "Water", and per kilometer for "Manipulation for Subgrade Modification", which prices shall be full compensation for furnishing all materials, for all labor, equipment, tools, and incidentals necessary to complete the work.

When the quantity of water furnished overruns or underruns the Contract quantity, the Contract unit price shall govern regardless of the total quantity furnished.

SECTION 303

AGGREGATE BASE COURSE AND STABILIZED SHOULDERS

303.01 DESCRIPTION.

This work shall consist of furnishing and placing one or more courses of aggregate and additives, if required, on a prepared surface in accordance with these specifications, as shown on the Plans or established by the Engineer.

BID ITEMS

Combined Material (AB- *).
Calcium Chloride.
Water.
Aggregate for Shoulders (AS- *).
Water for Shoulders.
Calcium Chloride for Shoulders.

* Type of Material.

303.02 MATERIALS.

Materials shall conform to the requirements specified in the Materials Division:

Combined Material	Section 1100
Calcium Chloride	Section 1700

303.03 CONSTRUCTION REQUIREMENTS.

(a) Subgrade Preparation.

Unless other subgrade preparation is called for in the Contract the Contractor shall, as a part of the work and prior to the delivery of materials for the base, or shoulders, prepare the roadbed or shoulder surface by sprinkling, blading, rolling, and lightly scarifying where necessary, until the proper shape or crown is obtained.

Vegetation on the shoulders shall be eliminated by discing, scarifying or blading. Excess material shall be disposed of as shown in the contract documents or as directed by the Engineer. Any additional embankment material that may be needed for shaping the shoulder surface or roadbed shall be obtained from areas provided for in the Contract.

At all grade control points, namely, existing pavements, grade bridges, etc., the subgrade shall be excavated to such

depth that the proper thickness of base may be constructed flush with the existing surface. The transition from normal to special section shall be of sufficient length to present no abrupt or noticeable change of grade and shall be excavated in accordance with the grades and lines shown in the contract documents. Excess excavation material shall be disposed of as directed. The roadbed at these points shall be excavated prior to any subgrade treatment and the subgrade modification or compaction as designated on the Plans shall be applied through these areas after being excavated. If the contract documents do not provide for separate subgrade preparation, these areas shall be compacted, after excavating, to meet the requirements of "Type B" Compaction and MR-90 Moisture Range. The depth of the compaction on the roadbed at these locations shall be 150 millimeters below the subgrade as excavated. The roadbed and shoulders shall be kept well drained at all times. It shall be the Contractor's responsibility to maintain the subgrade as prepared.

(b) Mixing.

The materials shall be mixed by one of the following methods as specified:

(1) Central Plant Method. The materials and water shall be mixed in an approved mixer. Water shall be added during the mixing operation in the amount necessary to provide the approximate moisture content as determined by the Engineer for compacting. After mixing, the materials shall be transported to the job site while it contains the proper moisture content.

(2) Travel Plant Method. After the materials for each layer have been placed through an aggregate spreader or windrow sizing device, they shall be uniformly mixed by a traveling mixing plant. During the mixing, water shall be added in an amount sufficient to provide the specified moisture content for compacting.

(3) Road Mix Method. After the component materials for each layer have been placed in separate uniform windrows, they shall be mixed at the approved moisture content by means of motor graders or other approved equipment until the mixture is uniform throughout.

Aggregate for base course (AB-3) or other similar material predominantly limestone, shall be mixed in accordance with subsections (1) or (2) only, unless the original contract quantity of base material is less than 4,500 metric tons, in which case subsection (3) will also be acceptable.

Aggregate for other types of base course or shoulders may be mixed in accordance with any of the approved methods.

When provided for in the contract documents, calcium chloride shall be uniformly mixed with the material in the amount shown. It shall be added at the time the base or shouldering material is combined with water, in solution, flake, pellet or granular form.

For inspection of the mixing operation and issuing scale tickets for the material being hauled, the Contractor shall install scales in close vicinity of the central plant mixer or as otherwise approved.

(c) Placing and Compacting.

If the required compacted depth of the base course or shoulder exceeds 150 millimeters, they shall be constructed in two or more layers of approximate equal thickness. The maximum compacted thickness of any one layer shall not exceed 150 millimeters. When vibrating or other approved types of special compacting equipment are used, the compacted depth of a single layer may be increased to 200 millimeters upon approval of the Engineer.

No hauling of material will be permitted when, in the judgment of the Engineer, the surface of the road will be damaged. Dumping or mixing of any shouldering material on any paved surface constructed for traffic lanes will not be permitted. All mixed material will be laid full lane width or shoulder width by means of an approved aggregate spreader.

Immediately after placing, the material shall be compacted.

Aggregate base course for roadway shall be compacted uniformily to a density of not less than 95 percent of standard compaction.

The Engineer will determine by visual inspection that satisfactory compaction of stabilized shoulders is being obtained. Blading may be required while rolling is being performed.

If the material for the base or shoulder is laid and compacted in more than one layer, the Contractor shall plan and coordinate his work in such a manner that the previously placed and compacted layers are allowed ample time for curing and development of sufficient stability before vehicles hauling materials for the succeeding layers, or other heavy equipment are permitted on the base. Prior to placing the succeeding layers of material, the top of the underlayer shall be made sufficiently moist to insure a strong bond between the layers. The edges and edge slopes of the base shall be bladed or otherwise

dressed to conform to the lines and dimensions shown in the contract documents and present straight, neat lines and slopes as free of loose material as practicable.

The Contractor shall also plan his work and handle the various operations so that the least amount of water will be lost by evaporation from uncompleted surfaces. If the Contractor delays placing of succeeding layers of base material to the extent that additional water must be applied to prevent raveling or excessive drying, the application of such water will be at the Contractor's own expense and the quantity used will not be included in the quantity measured for payment. Water shall be applied at such times and in such quantities as directed by the Engineer, and the Engineer shall have full authority to require the suspension of all other work on the project to insure the proper maintenance of previously laid and compacted material. If, after completed compaction, there are areas above or below proper grade and elevation, such areas shall be loosened and after having had additional materials added or excess material removed, as the case may require, shall be reconstructed as described above.

(d) Surface Drop-off Treatment.

(1) General.

On projects that carry traffic through construction, the following criteria shall be considered a minimum for treatment of surface drop-offs adjacent to traffic lanes not physically separated by acceptable positive barrier. A surface drop-off is defined as "the vertical distance between the top of the lift being constructed or riding surface to the top of the existing shoulder or adjacent lane."

(2) Shoulder Treatment.

All lifts regardless of thickness shall be constructed with an edge slope of 1:1 or flatter. Appropriate signing and delineation as shown in the contract documents will be required.

When the surface drop-off is greater than 130 millimeters, a temporary or permanent wedge shall be constructed against the pavement edge to provide a 3:1 or flatter slope. For unusual and justifiable conditions, the Engineer may modify this requirement to permit the use of drums, barricades, or other channelizing devices in lieu of the wedge to alert drivers of the drop-off condition. Surface drop-offs greater than 130 millimeters shall not be left unprotected overnight without the wedge or channelizing devices in place. An obstruction free recovery area should be provided to the extent possible.

For multi-lift projects with lifts greater than 130 millimeters, shoulders may be considered in conjunction with the placement of all lifts or the vertical drop-off shall be treated as stated previously.

When used, wedges shall be constructed of a material acceptable to the Engineer and constructed with a final maximum slope of 3:1 or flatter. Construction of the wedge or the use of alternate channelizing devices shall be considered as subsidiary to other items of the contract.

When channelizing devices are used, the space between the devices (in meters) should be approximately one third the posted speed limit for high speed roadways. For low speed or urban streets, a closer spacing should be used.

Shouldering operations shall commence as soon as practicable and no later than three weeks after placement of the final lift. The shouldering shall be a continuous operation from that time on until completion with the weather being the only delaying factor.

(3) Centerline and Adjacent Lane Treatment.

When any compacted centerline or adjacent lane joint height is greater than a nominal 40 millimeters but not in excess of 130 millimeters, the joint shall be constructed to produce an edge slope of 3:1 or flatter. This slope shall be maintained as long as traffic is traversing the edge.

(e) Curing and Maintenance of Base.

Following the construction of the aggregate-binder base as specified above, the compacted base course shall be maintained and cured until the moisture content of the entire thickness of the base does not exceed 60 percent of optimum moisture content for bases composed of AB-1, AB-2, or AB-4 material and 70 percent of optimum moisture content for bases composed of AB-3 material. The Contractor shall blade, broom, and otherwise maintain the base, keeping it free from raveling, and other defects until such time as the bituminous prime or other surface is applied. Water shall be applied at such time and in such quantities as directed, and the Engineer shall have full authority to require the suspension of all other work on the project to insure maintenance of the previously laid and compacted material.

The Engineer shall determine when the surface of the base course has cured sufficiently to permit the bituminous application or other surfacing to be applied. If the Contractor chooses not to apply the bituminous prime or other surfacing

at that time, he must maintain the surface at his expense (including application of the necessary water) until such time as it is applied.

(f) Shoulders, Entrances, and Side Roads.

When shoulder construction is not shown in the contract documents, the Contractor shall as a part of this work, shape the shoulders to form a slope from the top of the base to the shoulder line, adequate for satisfactory drainage, and blade the shoulder slopes to form an approximately uniform shoulder line and a neat and presentable shoulder slope unless approved otherwise by the Engineer. The material bladed off the shoulders and slopes shall be distributed over the ditch bottom or on the backslope in a uniform and presentable manner.

The grade of entrances and side roads shall be raised to meet the edge of the stabilized base course. In raising the grade of the entrance or side road, sufficient embankment materials shall be added to provide a roadway width equal to that of the approaching roadway with adequate shoulder slopes and shoulder radii adjacent to the shoulder of the project. Approach grades shall slope slightly away from the edge of the stabilized base and the surface shall be adequately crowned, bladed, and consolidated to present a smooth surface with uniform lines and a neat appearance. The embankment material for this purpose shall be obtained from adjacent slopes or ditches or other sources approved by the Engineer.

303.04 METHOD OF MEASUREMENT.

The aggregate will be measured by the metric ton in the vehicle at the time and place of unloading or at such other points as may be designated which shall include subgrade preparation, furnishing of aggregate, the placing and preparation of the materials on the road or shoulder, the mixing of the various materials together with water, the spreading, compacting, and finishing of the mixed materials, the maintenance of the completed base course, and construction of approach grades, and the dressing of shoulders and slopes, except as provided below.

Work on shoulders, shoulder slopes, entrances, and side roads shall not be paid for directly but shall be considered as subsidiary work pertaining to the item of "Combined Material" unless an item for shoulders, stabilized shoulders, or quantities for earthwork, compaction of earthwork, and water are specifically included in the contract documents for this work.

Deductions will be made for all moisture in the material in excess of five percent above optimum moisture. Mixing water will not be paid for as "Water" but as mass of aggregate up to five percent above optimum with the following exception.

When the road mix method is used, the amount of water, necessary for mixing at the moisture content specified by the Engineer will be paid for up to five percent above optimum.

Water shall be measured by the cubic meter by means of calibrated tanks or distributors or accurate water meters. Measurement will be made of water which is used in preparing the subgrade or ordered by the Engineer to be placed to keep the surface or surfaces moist during the curing period. Measurement will not be made for water used to maintain the subgrade or the various lifts of the base course during subsequent hauling operations. Calcium chloride shall be measured by the metric ton of actual material of Type II (concentrated), or equivalent, that is placed in the work. When Type I (regular) is used, 1.2 metric tons shall be considered equivalent to one metric ton of Type II (concentrated). No measurement will be made of water used in dissolving the calcium chloride in solution, regardless of whether or not the solution is required.

303.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per metric ton for "Combined Material", or "Aggregate for Shoulders", per metric ton for "Calcium Chloride", or "Calcium Chloride for Shoulders", of the designated type, and per cubic meter for "Water", or "Water for Shoulders", which prices shall be full compensation for furnishing all materials, for all labor, equipment, tools and incidentals necessary to complete the work.

When the quantity of water furnished overruns or underruns the Contract quantity, the Contract unit price shall govern regardless of the total quantity furnished.

SECTION 304

GRANULAR SUBBASE

304.01 DESCRIPTION.

This work shall consist of furnishing and placing one or more courses of aggregate and binder soil, if required, on a prepared subgrade in accordance with these specifications, as shown on the Plans or established by the Engineer.

BID ITEM
Granular Subbase (*).

* Thickness.

304.02 MATERIALS.

Material shall conform to the requirements specified in the Materials Division.

Aggregate for Granular Subbase ..... Section 1100

304.03 CONSTRUCTION REQUIREMENTS.

(a) Subgrade Preparation.

The Contractor shall prepare the subgrade surface by blading, rolling, sprinkling and scarifying until the proper crown and elevation is obtained. All soft and yielding material shall be recompacted as required. It shall be the Contractor's responsibility to maintain the subgrade as prepared until the base or surface is placed.

Prior to preparation of the subgrade surface, the roadbed shall be trimmed to the grades and cross section as shown on the Plans by means of equipment which is automatically controlled with regard to grade. The trimming by means of automatic equipment will not be required on areas of narrow width or irregular dimension where deemed impractical by the Engineer.

(b) Mixing.

The subbase material shall be mixed by one of the following methods:

(1) Central Plant Method. The subbase material and water shall be mixed in an approved mixer. Water shall be added during the mixing operation in the amount necessary to provide the moisture content for compacting.

(2) Travel Plant Method. After the material for each layer of sub-base has been placed through an aggregate spreader or windrow sizing device the base shall be uniformly mixed by a traveling mixing plant. During the mixing, water shall be added in an amount sufficient to provide the specified moisture content for compacting.

(3) Road Mix Method. After the component materials for each layer have been placed in separate uniform windrows, the materials shall be mixed at the approved moisture content by means of motor graders or other approved equipment until the mixture is uniform throughout.

Aggregate material predominantly limestone, shall be mixed in accordance with subsections 304.03 (1) or (2) only, unless the original Contract quantity of base materials is less than 5,000 square meters, in which case subsection 304.03 (3) will also be acceptable.

Aggregate for other types of subbase may be mixed in accordance with any of the approved methods.

(c) Placing and Compacting.

If the required compacted depth of the subbase exceeds 150 millimeters, the subbase shall be constructed in two or more layers of approximate equal thickness.

No hauling of material will be permitted when, in the judgment of the Engineer, the surface of the road will be damaged. Dumping or mixing of any material on any paved surface constructed for traffic lanes will not be permitted.

After mixing, the subbase material shall be transported to the job site while it contains the proper moisture content and shall be placed full lane width on the roadbed by means of an approved aggregate spreader.

Immediately after placing, the material shall be compacted to a uniform density of not less than 95 percent of standard density, except that material placed more than 600 millimeters outside of the edge of the pavement shall be compacted to a density of not less than 90 percent of standard density.

The Contractor shall maintain the density and a sufficient moisture content to avoid ravelling in the subbase until the pavement is placed.

(d) Finishing.

Following the compaction of the surface, on projects containing more than 20,000 square meters of granular subbase, the subbase shall be trimmed to the required line and grade

by means of equipment which is automatically controlled with regard to grade.

The Engineer may waive the use of automatically controlled equipment on projects containing less than 20,000 square meters of granular subbase and on narrow widths or areas of irregular dimension where operations of the automated equipment is impractical.

304.04 METHOD OF MEASUREMENT.

(a) Plan Quantity Measurement.

The quantities of granular subbase for which payment will be made shall be the quantities shown on the Plans for the main travel lane or lanes and the various paved approaches, exits, interchanges, etc., provided the project is constructed essentially to details shown on the Plans.

When the Plans have been altered or when disagreement exists between the Contractor and Engineer as to the accuracy of Plan quantities in any location or the entire project, either party shall have the right to request and cause the quantities involved to be measured.

(b) Measured Quantities.

The quantity to be paid for under this item will be the number of square meters of granular subbase completed and accepted as measured complete in place. The width for measurement will be the width of the granular subbase shown on the typical cross section of the Plans, additional widening where called for, or as otherwise directed in writing by the Engineer. The length will be measured horizontally along the centerline of each roadway or ramp.

304.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per square meter for "Granular Subbase", which price shall be full compensation for furnishing all materials, manipulation, compaction, water, maintenance of subgrade and granular subbase, and for all labor, tools, equipment, and incidentals necessary to complete the work.

SECTION 305

LIME TREATED SUBGRADE

305.01 DESCRIPTION.

This work shall consist of constructing one or more courses of a mixture of soil, hydrated or pebble quick lime and water, in accordance with these specifications, as shown on the Plans or established by the Engineer.

BID ITEMS
Lime (Pebble Quick).
Lime (Hydrated).
Water.
Manipulation (Lime Treated Subgrade).

305.02 MATERIALS.

Materials shall conform to the requirements specified in the Materials Division.

Pebble Quick Lime	Section 2000
Hydrated Lime	Section 2000
Water	Section 2400

305.03 CONSTRUCTION REQUIREMENTS.

(a) Preparation of Roadbed.

Prior to scarification or application of lime the surface of the roadbed shall be trimmed to the grades and cross sections shown on the Plans by means of equipment which is automatically controlled with regard to grade. The trimming by means of automatic equipment will not be required on areas of narrow width or irregular dimensions where deemed impractical by the Engineer. Earth ramps at grade control points; namely, existing pavement, bridges, etc., shall be removed to a depth to provide the required thickness of pavement structure. Excess excavation material shall be disposed of as directed.

(b) Maintenance of Roadbed.

Sufficient drains shall be cut through excavated material on the shoulders to drain the roadbed completely at all times. Drains shall be cut through windrowed base materials at sufficient intervals to prevent ponding of water. The windrowed

material shall be moved, when necessary, to permit the subgrade to dry.

(c) Application.

(1) Application of Pebble Quick Lime.

The pebble quick lime shall be distributed at a uniform rate across the entire surface area to be treated.

The pebble quick lime and roadbed shall then be scarified to a minimum depth of 100 millimeters and a maximum depth of approximately 25 millimeters less than the Plan depth designated for the lime treatment. The scarification shall be performed with positive depth control equipment. A blade scarifier may be permitted on a performance basis. A plow or disc will not be permitted.

(2) Application of Hydrated Lime.

The roadbed shall be scarified to a minimum depth of 100 millimeters and a maximum depth of approximately 25 millimeters less than the depth specified on the Plans for the width designated for lime treatment before the application of the lime. The scarification shall be performed with positive depth control equipment. A blade scarifier may be permitted on a performance basis. A plow or disc will not be permitted. Lime shall then be applied to the pulverized material as a slurry. The concentration of the slurry mixture may be such that the correct amount of lime may be applied without adding undue amounts of excess moisture to the subgrade. Lime that is mixed in a slurry shall be applied to the subgrade the same day that it is mixed. The method of mixing the slurry shall result in a reasonably consistent lime concentration in the slurry mixture.

(d) Addition of Water.

Additional water, as needed, shall be added to the mixture of lime and subgrade material by means of water distributors or by means of a traveling plant. Water, as needed, shall be added during mixing operations to provide a moisture content of not less than eight percent for hydrated lime and ten percent for pebble quick lime above the optimum moisture content of the raw soil being treated. The use of water pumps on water distributors will not be required.

(e) Preliminary Mixing.

The mixture of lime, water and soil shall be mixed thoroughly to the depth and width as specified on the Plans. For projects containing more than 20,000 square meters of manipulation, the depth of mixing shall be positively controlled to

maintain the specified depth by means of equipment which is automatically controlled with regard to grade. This automatic equipment may be supplemented by the use of rotary cross-shaft mixers with positive depth control.

Mixing operations stipulated in the paragraph above shall be conducted in a manner to provide that the roadbed surface below the pulverized material shall remain undisturbed and shall conform to the established cross section.

(f) Aging Period.

After the preliminary mixing is complete the surface shall be sealed with a pneumatic roller to retard loss of moisture and aged for a period of not less than 48 hours. The surface of the mixture shall be kept moist during the 48 hour aging period and until final mixing is started.

(g) Final Mixing.

(1) Following the aging period, the mixture shall be remixed to the specified depth and width by means of equipment and procedures specified under preliminary mixing.

(2) Remixing operations stipulated in paragraph (1) above shall continue until the material is reduced to the smallest practical size and is essentially free of lumps in excess of 25 millimeters in diameter as determined by visual inspection to the satisfaction of the Engineer. Additional water shall be added if necessary, to bring the moisture content of the material to not less than eight percent above the optimum moisture content of the raw soil being treated.

(h) Compaction.

After the materials have been satisfactorily mixed, aged and remixed, the mixture shall be laid and compacted to the requirements for Type B Compaction. Light sprinkling may be required during the compacting operations to maintain the specified moisture content. Compaction shall be accompanied with sufficient blading to eliminate all irregularities.

Final mixing and compaction shall be accomplished within seven days of the commencement of the 48 hour aging period. Should the final mixing and compaction exceed this seven day period, it may become necessary to add additional lime to compensate for losses due to carbonation and erosion. The need and amount of additional lime will be determined by laboratory tests and/or the Engineer.

(i) Finishing.

(1) Following the compaction of the surface, on projects containing more than 20,000 square meters of manipulation, the subgrade shall be trimmed to the required line and grade by means of equipment which is automatically controlled with regard to grade.

The Engineer may waive the use of automatically controlled equipment, on projects containing less than 20,000 square meters of manipulation and on narrow widths or areas of irregular dimensions where operations of the automated equipment is impractical. In such cases finishing will be completed as set out below.

(2) Areas of narrow width or irregular dimensions, and on projects containing less than 20,000 square meters of manipulation, finishing may be accomplished as set forth above or the surface will be lightly scarified during finishing operations and bladed to a uniform grade and cross section to eliminate any imprints left by the equipment.

(3) Final rolling of the completed surface shall be accomplished with a pneumatic tire roller.

(j) Protection and Curing.

Upon completion of the compaction and finishing of the lime treated subgrade no vehicles or equipment other than sprinkling equipment shall be permitted upon the lime treated subgrade for a period of seven days; however, the seven day curing period may be reduced to whatever period of time is required for the lime treated subgrade to gain sufficient stability to support the hauling and construction equipment, if the construction of the base course or subbase on the lime treated subgrade takes place in less than the seven day period after the completion of the treatment. In such case the first lift of the base course or subbase is considered as the curing medium. Any damage to the lime treated subgrade due to other phases of construction shall be repaired at the Contractor's expense. During the curing period the lime treated subgrade shall be cured by lightly sprinkling the surface with water at frequent intervals to prevent drying.

(k) Maintenance.

The Contractor shall be required to maintain, at his own expense, the entire roadway within the limits of the improvement, from the time work first starts until all work has been completed to the satisfaction of the Engineer. Maintenance shall

include immediate repairs of any defects that may occur during construction of the work. Repairs are to be made in a manner to insure restoration of a uniform surface and the durability of the part impaired. Maintenance of the earth subgrade and the lime treated subgrade will be considered as a part of the item of manipulation.

(l) Seasonal Limitations.

Construction of lime treated subgrade shall not start, proceed or continue when the ambient air temperature is below 5 °C or when the soil is frozen.

Additional requirements shall be based on the surface type of the project.

(1) Rigid Pavement.

The lime treated subgrade which has remained exposed over the winter shall be recompacted as directed by the Engineer.

(2) Flexible Pavement.

The lime treated subgrade shall be covered by at least 100 millimeters of base prior to hard freezing in the fall. The lime treated subgrade which has been exposed over the winter shall be recompacted with possible addition of lime. Such recompaction and addition of lime shall be based upon the extent of compaction loss and/or strength loss as determined by laboratory and/or field tests.

305.04 METHOD OF MEASUREMENT.

Hydrated lime and pebble quick lime will be measured by the metric ton. If sacked lime is used, the net mass as packed by the manufacturer will be used for measurement.

Water will be measured by the cubic meter by means of calibrated tanks or distributors or by means of accurate water meters. Only that water which is used in the preparation of the subgrade, in the lime material mix and for curing during the aging period and after final mixing and compaction will be measured.

If the Contractor chooses not to proceed with the final mixing at the end of the aging period, the surface of the mixture shall be kept moist until final mixing starts. The curing water applied between the end of the aging period until the beginning of the final mixing shall not be measured unless the aging period ends on a Friday or Saturday or the day before a holiday. In this case the curing water applied will be paid for until the first possible working day.

Certified railroad car mass or certified truck mass may be accepted provided only the actual mass of the lime will be paid for. Manipulation will be measured by the square meter and shall include the preparation of the roadbed, scarifying, pulverizing, drying of the material, mixing of the various materials, the compaction of the mixture, finishing and protection, curing and maintenance of the completed base. The yardage of manipulation for which payment will be made may be the quantities shown on the Plans provided the project is constructed essentially to details shown on the Plans. When the Plans have been altered or when disagreement exists between the Contractor and Engineer as to accuracy of the Plan quantities in any location or the entire project, either party shall have the right to request and cause the quantities involved to be measured.

305.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per metric ton for "Lime (Hydrated)", "Lime (Pebble Quick)", per cubic meter for "Water", and per square meter for "Manipulation (Lime Treated Subgrade)", which prices shall be full compensation for furnishing all materials, for all labor, equipment, tools and incidentals necessary to complete the work.

Any additional lime, water or recompaction which may be required under the provisions of subsections 305.03 (h) and (l) shall be at the expense of the Contractor. No additional payment will be made for any materials, labor, equipment or incidentals necessary to complete the additional work.

SECTION 306

CRUSHED STONE SUBGRADE

306.01 DESCRIPTION.

This work shall consist of a subbase composed of crushed stone for backfilling cut sections and topping of fill sections, constructed in accordance with the specifications, as shown on the Plans or established by the Engineer.

BID ITEM
Crushed Stone Subgrade.

306.02 MATERIALS.

Materials shall conform to the requirements specified in the Materials Division.

Crushed Stone for Backfill..... Section 1100

306.03 CONSTRUCTION REQUIREMENTS.

The construction methods shall conform to the following requirements:

(a) Subgrade Preparation.

The Contractor shall, as a part of the work and prior to the delivery of the material for the crushed stone subgrade, prepare the subgrade by sprinkling, blading, rolling and lightly scarifying where necessary, until the proper crown is obtained.

(b) Placing, Mixing and Compaction.

This work shall be performed in accordance with the applicable provisions of subsections 303.03 (b) and (c), except that the material shall be compacted to a uniform density of not less than 90 percent of standard compaction, and that the final rolling of the completed subgrade need not be done with a self-propelled roller. The central mix method of mixing and base aggregate spreader method of spreading will not be required for the placing of the crushed stone subgrade.

306.04 METHOD OF MEASUREMENT.

This item shall be measured by the square meter in place except that no measurements will be made of material placed beyond the neat lines indicated on the Plans.

306.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per square meter for "Crushed Stone Subgrade", which price shall be full compensation for furnishing all materials, manipulation, compaction, water, subgrade preparation, and for all labor, tools, equipment, and incidentals necessary to complete the work.

SECTION 307

LIGHT TYPE SURFACING

307.01 DESCRIPTION.

This work shall consist of the placing of aggregates for surfacing in a windrow, spreading of the windrowed material as provided by these Specifications, as shown on the Plans or established by the Engineer.

BID ITEMS
Light Type Surfacing (SA- *).
Light Type Surfacing (SS- *).

* Type of Material.

307.02 MATERIALS.

Materials shall conform to the requirements specified in the Materials Division.

Aggregates for Surfacing or Resurfacing	Section 1100
Aggregate for Surfacing or Subgrade Modification (Sec.)	Section 1100

When the Plans provide for alternate types of material for surfacing, any of the alternate types listed on the Plans may be furnished.

When the Plans provide for a single specified type of material for surfacing only the specified type shall be furnished.

307.03 CONSTRUCTION REQUIREMENTS.

(a) Preparation of Roadbed.

Unless otherwise designated on the Plans or in the Contract, the preparation of the roadway, roadbed, or subgrade shall be performed by and at the expense of the State or County and is not a part of this Contract. The work of preparing the roadway, roadbed, or subgrade shall be performed at such time and in such a manner as to cause no interference or delay to the Contractor's hauling or distributing of material.

The State and/or County will provide and maintain necessary signing to cover their operation unless they are working in an area that would normally be signed by the Contractor for his operation.

(b) Hauling and Placing Material.

The approved materials shall be hauled in vehicles having beds suitable for dumping the materials along the shoulder line as directed.

No hauling of materials will be permitted when in the judgment of the Engineer, the weather or road conditions are such that hauling operations cause excessive cutting or rutting of the road surface. No detouring of the traffic will be permitted. The Engineer may order hauling operations to cease when in his judgment such hauling causes unnecessary inconvenience to the normal highway traffic.

The materials approved for delivery to the road shall be placed in a windrow along one shoulder line of the roadbed so that the material will be uniformly distributed throughout the length of the road to be improved. Unless otherwise shown on the Plans or directed, the windrow thus formed shall be of a uniform cross section throughout and shall not be more than two meters in width and shall be located in an area contained between a line parallel to, and not less than 300 millimeters from the designated shoulder line, and a line parallel to and not more than 2.5 meters from the same shoulder line. All material shall be windrowed and placed within these limits on the same day it is placed on the roadbed. If materials are placed from more than one source they shall be so placed on the road that from each source there shall be delivered a continuous windrow of any one material not less than 1.5 kilometers in length, unless otherwise specified in writing and approved. Unless otherwise provided by the Plans, no spreading of materials by the Contractor will be required or permitted and the surfacing material will be spread by the State and/or County.

If the Plans provide that the material be spread by the Contractor, the material shall be placed in a uniform windrow before being spread on the roadbed. The material shall be spread to the dimensions shown on the Plans. All material shall be placed in a uniform windrow within the limits specified above or laid to its final section before nightfall each day.

The rate of application shall be as shown in the Plans and Contract for the various materials provided.

307.04 METHOD OF MEASUREMENT.

When the Plans and Contract provide for kilometers of Light Type Surfacing, this item shall be measured by the kilometer

for Light Type Surfacing and shall include the metric tons or cubic meters of material required for each kilometer, as measured in the vehicle at the time and place of unloading or at other points designated.

When the actual quantity of material in metric tons or cubic meters delivered to the road varies from the total quantity of material for the project as computed from the Plans, these minor variations shall be converted to kilometers by dividing the variations, in metric tons or cubic meters, by the rate of application and the total kilometers of Light Type Surfacing shall be adjusted accordingly. This method shall provide payment for discrepancies in application and shall not be construed as providing for other types of overruns or underruns.

When the Plans and Contract provide for metric tons or cubic meters of Light Type Surfacing, this item shall be measured by the metric ton or cubic meters in the vehicle at the time and place of unloading or at other points designated.

When the aggregate is measured by the metric ton, deductions will be made for all moisture in the material. Moisture determination will be in accordance with the provisions of Section 2500.

307.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per kilometer, per metric ton, or per cubic meter for "Light Type Surfacing", which price shall be full compensation for furnishing all materials, for all labor, equipment, tools, and incidentals necessary to complete the work.

SECTION 308

SURFACING FOR SIDE ROADS AND ENTRANCES

308.01 DESCRIPTION.

This work shall consist of the placing of aggregates for the surfacing of side roads, entrances, mail box locations and other areas designated on the Plans or established by the Engineer.

BID ITEM
Surfacing Material (*).

* Type of Material.

308.02 MATERIALS.

Materials shall conform to the requirements specified in the Materials Division.

Aggregate for Surfacing..... Section 1100

308.03 CONSTRUCTION REQUIREMENTS.

(a) Preparation of Roadbed.

On light type surfacing or detour surfacing projects, the preparation of the roadway, roadbed, or subgrade of side roads and entrances shall be performed by and at the expense of the State or County. On all other types of projects where the Plans and Contract specify surfacing for side roads and entrances, the Contractor shall grade the area to be surfaced to conform to the grades and lines as shown on the Plans and shall shape the surface so that it shall be free from ruts, irregularities, and loose material.

(b) Hauling and Placing Material.

The approved materials shall be hauled in vehicles having beds suitable for spreading the materials. No hauling of materials shall be permitted when in the judgment of the Engineer, the weather or road conditions are such that hauling operations would cause excessive cutting or rutting of the area to be surfaced.

The materials approved for delivery to the road shall be uniformly spread over the area to be surfaced unless otherwise shown on the Plans or directed by the Engineer.

The Contract will show the amount required for surfacing side roads, entrances, and other areas, and the Contractor may furnish any of the aggregates specified.

308.04 METHOD OF MEASUREMENT.

This item shall be measured by the metric ton or cubic meter of surfacing material in the vehicle at the time and place of unloading or at other designated points.

308.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per cubic meter or metric ton for "Surfacing Material", which price shall be full compensation for furnishing all materials, labor, equipment, tools, and other incidentals necessary to complete the work.

SECTION 309

PORTLAND CEMENT TREATED BASE

309.01 DESCRIPTION.

This work shall consist of constructing one or more courses of a mixture of soil or aggregate and Portland cement on a prepared surface in accordance with these specifications, as shown on the Plans or established by the Engineer.

BID ITEMS
Portland Cement Treated Base.
Cement.
Water.
Asphalt (*).

* Type and Grade of Material

309.02 MATERIALS.

Materials shall conform to the requirements specified in the Materials Division.

Portland Cement	Section 2000
Fly Ash	Section 2000
Water	Section 2400
Aggregate	Section 1100
Asphalt	Section 1200

309.03 PROPORTIONING AND DESIGN.

(a) Proportioning.

The exact proportions of cement and other ingredients will be determined by the Engineer and will be based on laboratory testing of materials proposed for use on the project. The minimum cement content will be five percent by mass of dry aggregate and the maximum will be ten percent by mass. The actual cement content will be selected on the basis of test results.

(b) Design Requirements.

Mixtures of aggregate, cement and water will be tested in the laboratory and approval of job-mix design will be based on the Compressive strength, seven days minimum of four megapascals.

The compressive strength of the Portland Cement Treated Base (PCTB) will be determined in accordance with Section 2500.

(c) Job-Mix Design.

The job-mix design, once approved, shall remain in effect until such time as a new or revised job-mix is approved by the Engineer. Any revision in cement content or standard density will require the submission of new samples for laboratory testing and approval.

(d) Laboratory Testing.

Laboratory testing and approval shall be understood to mean the Materials and Research Center of the Kansas Department of Transportation. Samples are to be submitted at least three weeks prior to desired commencement of work utilizing such materials.

Samples are to be addressed to:

Engineer of Tests
Materials and Research Center
Kansas Department of Transportation
2300 Van Buren
Topeka, Kansas 66611

309.04 CONSTRUCTION REQUIREMENTS.

(a) Preparation and Maintenance of the Subgrade.

(1) The surface of the subgrade shall be trimmed to the required line and grade by means of equipment which is automatically controlled with regard to both line and grade.

(2) The Engineer may waive the use of automatically controlled equipment on narrow widths or areas of irregular dimensions where operations of the automated equipment is impractical. In such cases finishing shall be accomplished by sprinkling, blading and rolling until the proper crown is obtained. Light scarifying may be required on some areas to obtain the required section and crown. However, in the process of shaping the roadbed, the original compacted crust or top portion of the roadbed shall be disturbed as little as possible. When completed and ready for base construction, the roadbed shall be well compacted, smooth, hard and uniform, with all irregularities bladed out and rolled down.

(3) At all grade control points, namely, existing pavements, bridges, etc., the subgrade shall be excavated to such depth

that the proper thickness of base may be constructed flush with the existing surface. The transition from normal to special section shall be of sufficient length to present no abrupt or noticeable change of grade and shall be excavated in accordance with the grades and lines shown on the Plans. Excess excavated material shall be disposed of as directed.

The roadbed at these points shall be excavated prior to any subgrade treatment and subgrade modification or compaction, as designated on the Plans, shall be applied through these areas after being excavated. If the Plans do not provide for separate subgrade preparation, these areas shall be compacted after excavating, to meet the requirements of Type "B" compaction and MR-90 moisture range. The depth of the compaction shall be 150 millimeters below the subgrade as excavated. The roadbed at these locations shall be kept well drained at all times.

The roadbed of the entire project shall be maintained by the Contractor from the time the work is started throughout the duration of the project. Sufficient drains shall be cut through excavated material on the shoulders to drain the roadbed completely at all times. Drains shall be cut through windrowed base materials at sufficient intervals to prevent ponding of water and the windrowed material shall be moved, when necessary, to permit the subgrade to dry. It shall be the Contractor's responsibility to maintain the subgrade as prepared, and any defects which may develop shall be corrected at his expense.

(b) Plant Mixed Materials.

(1) Quantities of aggregate, cement and water shall be accurately proportioned continuously or for each batch or charge of the mixer. Feeding or metering devices on a continuous mixer shall be so regulated that the correct proportions of aggregate, cement and water are uniformly introduced into the mixing chamber. The charge in a batch mixer, or rate of feed to a continuous mixer, shall not exceed that which will permit complete mixing of all the materials. Mixing of each charge in the mixer shall continue until the cement and water are uniformly distributed throughout the mass and a homogeneous mixture is produced. Mixing will not be permitted when the aggregate is frozen.

(2) The aggregate, cement and water shall be thoroughly and uniformly mixed at the rates shown on the Plans or designated by the Engineer.

(3) The metering of water into the mixer shall be controlled so that the moisture content of the mixture immediately after mixing will be such that not less than 95 percent density can be obtained. Normally this will be between the optimum moisture content and three percentage points above optimum moisture content.

(4) Immediately prior to spreading the cement-treated base material, the surface of the compacted subgrade shall be moistened.

If the base thickness is 150 millimeters or less, the mixture may be spread in one lift. If the required thickness of the completed base is more than 150 millimeters, the mixture shall be spread in two or more lifts of approximately equal thickness. The width of the laydown shall be varied so that the longitudinal joints in multi-course work will not be directly over the previous course joint and will be offset not less than 150 millimeters. The maximum compacted thickness in any one lift shall not exceed 150 millimeters. The surface of each lift shall be kept moist until the succeeding lift is spread thereon. The exposed surface areas of the lower lifts shall be covered with the final lift during the day's operations. Spreading operations shall proceed in such a manner that adjacent lanes are placed within 60 minutes after the placement of the proceeding lane, unless separated by a longitudinal construction joint.

(5) Each lift of cement treated base shall be thoroughly compacted to a density of not less than 95 percent of the standard compaction determined by averaging the three most recent field molded densities using plant mixed base material. One standard mold shall be compacted at the required moisture content for each day's operation and the density therefrom used in establishing the average. The moisture content at the time of molding will be within the specified range for plant mixing. Density and moisture content shall be determined in accordance with the provisions of Section 2500, or the Engineer may elect to determine the density of the mixture as placed and compacted by means of an approved nuclear testing device.

The density of the cement treated base shall be determined within one day after rolling, except that if authorized by the Engineer, density may be determined by means of cores extracted from the cured base.

(6) Not more than two hours shall elapse between the time water is added to the aggregate and cement, and the time of completion of initial compaction prior to trimming. Not more than 2½ hours shall elapse between the time water is added

to the aggregate and cement and the time of completion of final compaction after trimming.

The Contractor shall plan the work and various operations so that the least amount of water will be lost by evaporation from uncompleted surfaces. If the Contractor delays placing of succeeding layers of base material to the extent that additional water must be applied to prevent excessive drying, the application of such water will be at the Contractor's expense and the quantity used will not be included in the quantity measured for payment. Water shall be applied at such times and in such quantities as directed by the Engineer, and the Engineer shall have full authority to require the suspension of all other work on the project to insure the proper maintenance of previously laid and compacted material.

(c) Finishing.

(1) The surface of the cement-treated base shall be trimmed to the required line and grade by means of equipment which is automatically controlled with regard to both.

The Engineer may waive the use of automatically controlled equipment on narrow widths or areas of irregular dimensions where operations of the automated equipment is impractical.

(2) When required, the surface shall be lightly scarified to loosen any imprints left by the compacting and shaping equipment. The resulting surface shall then be thoroughly rolled with steel-wheel or pneumatic-tired rollers or both.

(3) The surface of the material shall be kept moist during all finishing operations. Surface compaction and finishing of the section being processed shall be performed in such a manner as to produce a relatively smooth, dense surface, essentially free from surface compaction planes, cracks, ridges or loose material. The completed base course shall conform to the grades, lines and typical cross section shown on the Plans with compacted and dressed edge slopes and all evidence of laps between the various sections eliminated. With the approval of the Engineer, surface finishing operations may be varied provided the quality of the work is as outlined above.

(4) Sufficient equipment shall be in operation on the project so that all operations can be carried on in their proper sequence without delay and final compaction, rolling and finishing can be completed during daylight hours.

(5) At the end of each day's operations or in case of construction delays that will cause operations to cease and at a point where satisfactory construction has been completed, a

straight transverse construction joint shall be formed by cutting back into the completed work to form a true vertical face. A protective covering of earth shall be placed on the newly constructed base course for a distance back of the joint required for the turning of equipment used on the following day's work. The thickness of the covering shall be such that the equipment will not mar or damage the completed work.

(d) Protection and Curing.

(1) Unless the use of bituminous material for curing is specified on the Plans, immediately after the completion of finishing operations, the base shall be protected against loss of moisture for a period of seven days by covering the surface with an approved moisture barrier such as moist earth, moist burlap, polyethylene, etc.

(2) Regardless of the type of curing specified or used, the surface of the base course shall be kept damp until the curing material is applied and shall be protected from freezing for the entire seven day curing period. The water distributor shall be equipped with a side mounted spray bar or nozzle to moisten the surface without driving equipment over the completed base.

After the completion of the seven day curing period, the material used for curing shall be removed and satisfactorily disposed of.

(3) When called for on the Plans, an application of bituminous material shall be applied to the surface as soon as practical after the completion of the finishing operations. The type and grade of bituminous material shall be as designated on the Plans. This curing shall be maintained for a period of seven days.

Immediately prior to the application of the bituminous curing membrane the surface of the base course shall be thoroughly moistened by means of approved pressure distributing equipment. Care shall be exercised to see that no free water remains on the surface in the form of ponds or puddles.

The heating and temperature of the bituminous material at time of application shall be in accordance with the provisions of Division 600.

Immediately after the surface of the base course has been thoroughly moistened, the bituminous material shall be applied at an approved rate. Care shall be taken to cover the edge slopes and to obtain uniform and complete coverage of the entire base course. Hand sprays shall be used to apply the bituminous material to inaccessible areas.

If the application of the bituminous material is delayed for any reason, the surface of the cement treated base shall be kept moist by the application of water. When bituminous materials are being applied, the surfaces of all structures and other roadway appurtenances shall be protected in a satisfactory manner to prevent them from being splattered with bituminous material or marred by equipment operation. In the event that any appurtenances become splattered or marred, the Contractor shall at his own expense, remove all traces of bituminous material and repair all damage and leave the appurtenances in as good condition as they were before the work began.

(4) The Contractor shall keep all traffic, including construction equipment, off the cement treated base after the application of the bituminous material, until the base has cured for a period of seven days. Any locations where the bituminous material is disturbed prior to the end of the curing period shall be repaired immediately at the Contractor's expense. At crossings and other locations where it is necessary to carry traffic across the treated base, the bituminous curing membrane may be blotted immediately after application with an approved aggregate. A layer of sand-clay, or other equally stable earth, of not less than 200 millimeters compacted depth, shall be placed over the base for such widths as required to adequately protect the base during such crossings. Other approved methods of protecting the base and distributing loads may be used.

(5) After the expiration of the curing period, should it become necessary, the bituminous curing membrane shall be lightly blotted with one of the aggregates being produced for the base or surface course. The aggregate used for blotting shall be the one most suited for this purpose.

(6) The Contractor will be permitted to place the Portland Cement Concrete Pavement on the Portland Cement Treated Base after a minimum cure time of 24 hours provided all traffic, including construction equipment, is kept off the treated base. The concrete pavement shall be considered as the curing medium.

(e) Maintenance.

The Contractor shall be required to maintain, at his own expense, the entire roadway within the limits of the improvement, in good condition from the time work first starts until all work has been completed. Maintenance shall include immediate repairs of any defects that may occur either before or after the

cement is applied and repairs to the bituminous curing membrane. Repairs are to be made in a manner to insure restoration of a uniform surface and the durability of the part repaired.

(f) Coordinating of Operations.

The Engineer shall have the full authority to require complete coordination of the various phases of the work and may order additional equipment and/or the suspension of certain operations in order to obtain a satisfactory schedule of progress.

309.05 WEATHER LIMITATION.

When cement-treated base is constructed in cold weather it shall be accomplished as specified for cold weather concrete in subsection 402.07 (b).

309.06 METHOD OF MEASUREMENT.

(a) Portland Cement Treated Base shall be measured by the square meter complete and in place except that no measurement will be made of material placed beyond the neat lines indicated on the Plans unless authorized by the Engineer. The quantity for which payment is made may be the quantities shown on the Plans provided the project is constructed essentially to the details shown on the Plans. When the Plans have been altered or when disagreement exists between the Contractor and Engineer as to the accuracy of the Plan quantities, in any location or the entire project, either party shall have the right to request and cause the quantities involved to be measured.

(b) Cement shall be measured by the metric ton based on the theoretical plan depth and computed from the actual cement content selected from tests run on the aggregate to be used. If sack cement is used, the net mass as packed by the manufacturer will be used for comparison. Certified railroad car mass or certified truck mass of the cement as computed or the actual mass as used may be paid. Payment for cement shall be the actual metric tons used or the theoretical tons required, whichever is less. Cement content shall be figured on a total project basis.

(c) Water will be measured by the cubic meter by means of calibrated tanks or distributors or by means of accurate water meters. Only that water which is used in the preparation of the

subgrade, in the aggregate-cement mix and for curing the completed base will be measured.

(d) No measurement will be made for materials used for blotting purposes. They shall be subsidiary.

(e) Bituminous materials shall be measured by the metric ton as provided in Division 100. Deductions shall be made for the number of tons which are not placed on the road.

309.07 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price as follows:

(a) Per square meter for "Portland Cement Treated Base", which shall include preparing and trimming the subgrade, furnishing aggregate, mixing, hauling, placing, compacting and shaping the base;

(b) Per metric ton for "Cement". Due to possible variations in the gradation design or mass per cubic meter of the aggregates, the quantity of cement used may vary from the contract quantities and no adjustment in Contract unit price will be made because of such variations;

(c) Per metric ton for "Asphalt", which shall include curing and protection of the completed base; any blotting material shall be subsidiary;

(d) Per cubic meter for "Water". When the quantity of water furnished overruns or underruns the Contract quantities, the Contract unit price shall govern regardless of the total quantity furnished.

The Contract unit prices of the above items shall be full compensation for furnishing all materials, equipment, labor, tools and any other items necessary to complete the work.

SECTION 310

FLY ASH MODIFIED SUBGRADE

310.01 DESCRIPTION.

This work shall consist of constructing one or more courses of a mixture of soil, fly ash, and water, in accordance with these specifications, as shown on the Plans or established by the Engineer.

BID ITEMS
Water.
Fly Ash.
Manipulation for Fly Ash Treated Subgrade.

310.02 MATERIALS.

Materials shall conform to the requirements specified in the Materials Division.

Fly Ash	Section 2000
Water	Section 2400

310.03 EQUIPMENT.

(a) The machinery, tools, and equipment necessary for proper execution of the work shall be on the project and approved by the Engineer prior to beginning of construction operations. Pulverization of existing subgrade and blending of the mixture shall be accomplished with equipment with a recycling or mixing drum and an automatic water proportioning system. Initial compaction shall be achieved using a vibratory roller having a minimum operating mass of eleven metric tons with a minimum centrifugal force of 214 newtons. Rubber-tired or smooth-wheeled rollers shall be used for final compaction of the stabilized section. All machinery, tools and equipment used shall be maintained in satisfactory and workmanlike manner.

(b) Fly ash shall be stored and handled in closed weatherproof containers until immediately before distribution. Fly ash exposed to moisture prior to mixing with recycled material shall be discarded.

(c) If fly ash is furnished in trucks, each truck shall have the mass of fly ash certified on public scales or the Contractor shall place a set of standard platform truck scales or hopper scales at a location approved by the Engineer.

310.04 CONSTRUCTION REQUIREMENTS.

(a) General.

The purpose of this specification is to secure a completed section of treated material which contains a uniform mixture of fly ash and pulverized material with no loose or segregated areas, has a uniform density and moisture content, and is well bound for its full depth. It shall be the responsibility of the Contractor to regulate the sequence of his work, to process a sufficient quantity of material to provide full depth as shown on the Plans, to use the proper amounts of fly ash, to maintain the work, and to rework areas as necessary to meet the above requirements.

(b) Weather Limitations.

Fly ash mixing operations shall not be performed when the subgrade is frozen or when the ambient air temperature is less than 10°C. The Contractor shall be responsible for the protection and quality of the fly ash modified subgrade mixture under any weather conditions.

(c) Preparation of Roadbed.

The subgrade shall be brought within reasonably close conformity to the line and grade shown on the Plans. On projects containing more than 20,000 square meters of manipulation, the subgrade shall be trimmed by means of automatically controlled equipment with regard to grade. The Engineer may waive the use of automatically controlled equipment in areas of irregular dimension where operations of automatic equipment is impractical.

(d) Treatment of Subgrade.

The subgrade material shall be pulverized through use of the specified equipment. Depth of pulverization shall be as designated. The pulverized subgrade material and fly ash shall be mixed thoroughly until a uniform mixture is obtained. All clods shall be reduced in size by mixing until the pulverized subgrade material-fly ash mixture meets the following size requirement when tested.

Sieve Size	Percent Retained
37.5 mm	0
12.5 mm	50 maximum

(e) Moisture Control.

Prior to application of fly ash, the moisture content of the pulverized subgrade material shall be adjusted so that follow-

ing the application of fly ash, the moisture content of the mixture is within the range specified. If the moisture content of the pulverized material is below the required limit, water shall be added and blended thoroughly with the material by continued mixing. The addition of water in the mixing drum of the stabilizing unit during incorporation of fly ash is acceptable providing it can be demonstrated that adequate control of moisture content can be maintained.

The required moisture content will be established by the Engineer based on laboratory tests on the site materials and specific fly ash content to be used for the treatment. Final moisture content of the mix, immediately prior to compaction shall be uniform and not exceed plus or minus three percentage points of the optimum moisture content of the mix. If the moisture content exceeds the specified limits, additional fly ash may be added to lower the moisture content to the required limits. Lowering the moisture content by aeration following addition of fly ash will not be allowed. If the moisture contents are below the specified limits, additional water shall be added and uniformly blended with the mixture. Additional fly ash added to lower the moisture content shall be at the expense of the Contractor.

(f) Application.

If necessary, immediately prior to application of fly ash, the roadway shall be bladed to allow uniform distribution of fly ash.

The fly ash shall be spread in an approved manner at the rate specified. Care shall be taken to prevent the fly ash from flowing off the area to be treated.

The fly ash shall be distributed at a uniform rate in such a manner as to minimize the scattering of fly ash by wind. Fly ash shall not be applied when wind conditions, in the opinion of the Engineer, are such that blowing fly ash becomes objectionable to adjacent property owners or significantly reduces the amount of fly ash incorporated into the work.

When required by the Plans, retarder shall be applied immediately following distribution of fly ash by an approved distributor capable of providing the specified rate of application. The retarder can be diluted with mix water to ensure more uniform application provided initial soil moisture contents are at a suitable level to accommodate the additional water. Retarder shall be subsidiary.

(g) Mixing.

The pulverized subgrade material and fly ash shall be thoroughly mixed and the mixing continued until a homogeneous,

friable mixture of pulverized subgrade material and fly ash meeting the specified size requirements is obtained.

(h) Compaction.

Compaction of the mixture shall begin immediately after mixing and confirmation that the moisture content is within the specified range. Mixing shall be completed within 1/2 hour following incorporation of fly ash. The material shall be sprinkled as necessary to maintain the specified moisture content. Compaction of the mixture shall begin at the bottom and shall continue until the entire depth of mixture is uniformly compacted to the specified density.

All non-uniform (too wet, too dry or insufficiently treated) areas which appear shall be corrected immediately by scarifying the areas affected, adding or removing material as required and reshaping and recompacting.

The stabilized section shall be compacted to a minimum of 95 percent of the combined materials maximum dry density as determined in accordance with Section 2500.

In addition to the requirements specified for density, the section shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section is completed, tests will be made by the Engineer. If the material fails to meet the density requirements, the Engineer may require it be reworked as necessary to meet those requirements and/or require the Contractor to change his construction methods to obtain required density on the next section. Additional fly ash will be added to the areas that are reworked at no additional cost to the owner, and the amount required will be established by the Engineer. Should the section, due to any reason or cause, lose the required stability, density and finish before the surface is placed or the work is accepted, it shall be reprocessed, recompacted and refinished at the sole expense of the Contractor. Reprocessing shall follow the same patterns as the initial stabilization including the addition of fly ash.

(i) Time Limitation.

Compaction on the surface of each section shall be completed within two hours after incorporation of the fly ash. Any areas failing to meet this requirement will be rejected and shall be reprocessed.

(j) Finishing and Curing.

Following the compaction of the stabilized section, on projects containing more than 20,000 square meters of manipu-

lation, the treated section will be trimmed to the required lines and grade by means of equipment which is automatically controlled with regard to grade. The surface shall then be compacted with a smooth wheel or pneumatic tired roller.

The Engineer may waive the use of automatically controlled equipment on projects containing less than 20,000 square meters of manipulation and on narrow or irregular dimensions where operation of the automated equipment is impractical. Finishing of these areas may be as set forth above or the surface will be lightly scarified during finishing operations and bladed to a uniform grade and cross section to eliminate any imprints left by the equipment.

After the fly ash treated section has been finished as specified herein, the surface shall be protected against rapid drying by either of the following curing methods for a period of not less than seven days or until the surface course has been placed:

(1) Maintain in a thorough and continuously moist condition by sprinkling.

(2) Apply an asphaltic prime coat.

310.05 METHOD OF MEASUREMENT.

(a) Fly Ash will be measured by the metric ton. Delivery tickets showing mass of the fly ash delivered to the project will be furnished to the Engineer.

(b) Manipulation for Fly Ash Treated Subgrade will be measured by the unit shown on the Plans, complete in place.

(c) Water will be measured by the cubic meter by means of calibrated tanks or distributors for the amount used in the mixing operation. Curing water will not be paid for.

310.05 BASIS OF PAYMENT.

The amount of completed and accepted work, measured as provided above, shall be paid for at the Contract unit price per metric ton for "Fly Ash", per unit as shown on the Plans for "Manipulation for Fly Ash Treated Subgrade" and per cubic meter of "Water" which shall be full compensation for all material, pulverizing, mixing, spreading, drying, application of fly ash, shaping and maintaining, for all curing including all curing water and/or other curing materials, for all manipulations required, for all hauling and freight involved, for all tools, equipment, labor, and incidentals necessary to complete the work.