directed by the ENGINEER. No additional compensation will be allowed for such Work nor shall any additional payment be allowed for the relocation and adjusting of any utility but shall be considered Incidentals to other Work.

The CONTRACTOR shall make a concerted effort to prevent any disruption of utility services, and if an unintended disruption occurs, the CONTRACTOR shall immediately and safely restore service. If disruption of any of the utility services covered in this section is unavoidable, it will be the responsibility of the CONTRACTOR to notify affected property owners. The CONTRACTOR shall also make every effort to restore said services before quitting Work for the day. In the event this cannot be done, the CONTRACTOR shall provide temporary service to the property owners until permanent service can be restored.

A.7 STAKING AND MARKING

The survey baseline, if applicable, for the Project has been previously established. Should, prior to beginning of construction, part or all of the baseline be destroyed, it will be the Contractor's responsibility to re-establish this baseline from the reference points shown on the plans or otherwise identified.

The Contractor will furnish and be responsible for all staking necessary to control and complete the Work, according to the Specifications, to the lines and grades shown on the Plans.

The Contractor's staking party shall be under the general supervision of a Licensed Professional Land Surveyor.

A. 8 TESTING

From time to time during the progress of the Work, the ENGINEER may require that testing be performed to determine the materials provided meet the specified requirements. The Lexington-Fayette Urban County Government will select a testing laboratory to perform the testing services. The cost of such services shall be the responsibility of the OWNER. If testing reveals defective materials or Work, the cost of said testing will become the responsibility of the CONTRACTOR.

A.7.1 Codes and Standards: Testing, when required, will be in accordance with all pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.

A.7.2 Cooperation with the Testing Laboratory: Representatives of the testing laboratory shall have ready access to the Work at all times. The CONTRACTOR shall provide facilities for such access in order that the laboratory may properly perform its functions.

A.9 INSTALLATION REQUIREMENTS

Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned as suggested by the respective manufacturers, unless otherwise specified herein or directed by the ENGINEER.

A.10 PROOF OF COMPLIANCE

Whenever the Contract Documents require that a product be in accordance with Federal Specifications, ASTM Designations, ANSI Specifications, or other associations' standards, the CONTRACTOR shall present a certification from the manufacturer that the product complies therewith. When requested or specified, the CONTRACTOR shall submit supporting test data to substantiate compliance.

A.11 DUST CONTROL

The CONTRACTOR shall be responsible for minimizing the generation of dust resulting from his operations at all times. The CONTRACTOR shall be required to maintain all excavations, embankments, stockpiles, roads, permanent access roads, plant sites, waste areas, and all other Work areas within or without the project boundaries free from dust which would cause a hazard or nuisance to others. Approved temporary methods of stabilization consisting of sprinkling, chemical treatment, light bituminous treatment, or similar methods will be permitted to control dust. Dust control shall be performed as the Work proceeds, and whenever a dust nuisance or hazard occurs.

A.12 REPAIR OF DAMAGE

Any damage done to structures, fills, roadways, or other areas shall be repaired at the CONTRACTOR'S expense before final payment is made.

A.13 PROJECT EXTENT

The CONTRACTOR shall be responsible for satisfying himself as to the construction limits for the Project. The CONTRACTOR shall not establish Work, storage, or staging area outside the Project limits, unless otherwise directed or approved by the ENGINEER.

A.14 WORKING HOURS

All Work on this Project shall be restricted to daylight hours, but may be further restricted by the ENGINEER if required; except emergency Work, such as any necessary pumping, which may require 24-hour operation. If the CONTRACTOR elects to Work beyond the normal work week, he shall notify the ENGINEER of his intent as far in advance as possible. Lane closures for all streets with a functional classification above local shall occur only between the hours of 9:00 a.m. and 3:00 p.m., except as approved by the ENGINEER.

A.15 GUARANTEE

The CONTRACTOR shall assume responsibility for all workmanship and materials for a period of one year from final payment. Any Work found to be defective due to failure to comply with the provision and intent of the Contract Documents, Specifications, and Plans shall be replaced at the CONTRACTOR'S expense.

A.16 PROPERTY CONSIDERATION

Materials having a salvage value shall remain the property of the OWNER. Salvageable material rejected by the OWNER shall become the responsibility of the CONTRACTOR to dispose of in a proper manner subject to the approval of the ENGINEER.

A.17 BLASTING

Blasting is addressed in the Special Conditions.

A.18 HAZARDOUS MATERIAL - GAS LINES

The CONTRACTOR is advised to exercise caution in his operations on this project, regardless of whether the plans indicate or do not indicate the presence of any gas or hazardous materials carrying lines.

A.19 DIVERSION OF STORM WATER

Appropriate measures must be taken to sandbag the necessary manholes and to pump drainage around the area under construction. The CONTRACTOR is responsible for developing a plan to divert storm drainage around the construction area with the approval from the ENGINEER. Materials, labor, and all incidentals necessary to accomplish this diversion of storm drainage will be considered incidental to the contract.

A.20 SEWER SERVICE MAINTENANCE

This Work shall consist of maintaining existing sanitary sewer service to residents in the area during construction. Sewage is to be maintained by whatever means necessary. No surcharge of manholes will be allowed.

No separate payment will be made for Sewer Service Maintenance. Sewer Service Maintenance shall include all materials, equipment and labor necessary to maintain sewer service to residents during construction.

A.21 PROJECT SIGNS

Prior to construction Project Signs shall be installed in accordance with the Standard Drawings. The exact location shall be established prior to the beginning of the work and shall remain visible during the entire length of the Project. After all Work is complete and prior to final inspection, the signs shall be removed and disposed of properly. The cost and installation of the Project Signs will be paid per the Contract Unit Price as bid.

TECHNICAL SPECIFICATIONS

SECTION B - MAINTENANCE OF TRAFFIC

B.1 SCOPE

The Contractor shall maintain all local vehicular and pedestrian traffic along the project during construction. The Contractor shall present a plan for maintenance of traffic and traffic signs subject to the approval of the Lexington-Fayette Urban County Government Traffic Engineer prior to the beginning of Work. All bus routes shall remain in operation during scheduled bus operating hours. Loading zone space shall be made available as necessary during normal business hours. At least one lane of traffic shall be maintained on all cross streets.

B.2 MATERIALS

The Contractor shall furnish bridging plates or provide other means of maintaining safe access for pedestrians and service traffic to all businesses during normal working hours. Adequate personnel shall be available during daylight hours to assure maintenance. Metal trench covers, granular backfill or other suitable methods shall be utilized to maintain vehicular traffic through areas disturbed by construction operations.

B.3 SIGNING

The Contractor shall furnish and erect suitable barricades, signs and other necessary devices to control, guide and safeguard traffic passing through or around the construction project. All such devices shall conform in all respects to the requirements of the Manual on Uniform Traffic Control Devices for Highway Construction and Maintenance Projects. The Contractor, before erecting any barricades or changing the location of one already placed, shall notify the Engineer at least three days prior to such contemplated erection or change, except in case of an emergency. In case of an emergency, the Engineer may direct the Contractor to immediately provide safety and warning devices to safeguard traffic. All night-time control devices requiring illumination shall be lighted every night during the entire period from sunset to sunrise. The Contractor will be held responsible for all damage to Work due to failure to provide barricades, signs, lights, and watchmen to protect it; and whenever evidence of such damage is found prior to acceptance, the Engineer may order the damaged portion removed and replaced by the Contractor at the Contractor's expense. The responsibility remains the Contractor's until the project is accepted.

B.4 APPLICABLE KENTUCKY DEPARTMENT OF HIGHWAYS (KDOH) STANDARD SPECIFICATIONS

To the extent that it does not conflict with the content of the Plans, Contract Documents, and Specifications, Subsection 112 of KDOH Standard Specifications, current edition, is incorporated into this Technical Specification.

B.5 MEASUREMENT AND PAYMENT

Payment for the maintenance of traffic will be incidental to the contract unless otherwise specified in the Purchase Order.

TECHNICAL SPECIFICATIONS

SECTION C - FINAL CLEANUP

C.1 SCOPE

The Work will not be considered as complete, and final payment will not be made, until the right-of-way and all ground occupied by the Contractor in connection with the Work has been cleared of all rubbish, equipment, excess materials, temporary structures, and weeds. Rubbish and all waste materials of whatever nature shall be disposed of in waste areas provided by the Contractor. All property, both public and private, which has been damaged in the execution of the Work, shall be repaired or replaced in an acceptable manner. All ditches in the area of the Work shall be drained and areas affected by the Work shall be left unobstructed and in such condition as acceptable to the Engineer.

C.2 PAYMENT

No direct payment will be made for final cleanup. Retainage will be withheld until final cleanup is approved by Engineer.

TECHNICAL SPECIFICATIONS

SECTION D: MOBILIZATION AND DEMOBILIZATION

D.1 SCOPE

Work for this Section shall include all labor, excavation, materials, equipment, and incidentals necessary to mobilize and demobilize all personnel, equipment, supplies, and incidentals to the project site; to establish offices, buildings, and other facilities, that are necessary for performing the work: to accomplish all other work or operations that must be performed, including costs that must be incurred, to begin work on the project in accordance with the Kentucky Department of Highway Standard Specifications, Section 110.

D.2 MOBILIZATION

The Contractor shall not bid an amount for Mobilization that exceeds 5 percent of the sum of the total amounts bid for all other items in the Bid Proposal, excluding Mobilization, Demobilization, and contingent amounts established for adjustments and incentives, if applicable. The LFUCG will automatically adjust any bids in excess of this amount for bid comparisons. The LFUCG will base the award on the maximum allowable bid of 5 percent. If any errors in unit bid prices for other Contract items in a Contractor's Bid Proposal are discovered after bid opening and such errors reduce the total amount bid for all other items, excluding Mobilization, Demobilization, and contingent amounts established for adjustments and incentives, so that the percent bid for mobilization is larger than 5 percent, the LFUCG will adjust the amount bid for mobilization to 5 percent of the sum of the corrected total bid amounts

D.3 DEMOBILIZATION

The Contractor shall not bid an amount for Demobilization that is less than 3 percent of the sum of the total amounts bid for all other items in the Bid Proposal, excluding Mobilization, Demobilization, and contingent amounts established for adjustments and incentives, if applicable. The LFUCG will automatically adjust any bids that are less than this amount up to 1.5 percent to compare Bid Proposals and award the Contract. The LFUCG will award a Contract for the actual amount bid when the amount bid for demobilization exceeds 1.5 percent, or the LFUCG will award the Contract for the adjusted bid amount when the amount bid for demobilization is less than 1.5 percent.

D.4 PAYMENT

Mobilization is included in the Bid Proposal as a separate bid item and the LFUCG will make partial payment for Mobilization in two equal or approximately equal payments. The LFUCG will make the first payment on the first pay estimate on which the Contractor's total earned value on Contract items, other than Mobilization, exceeds $1,000. The LFUCG will make the second payment on the first pay estimate on which the Contractor has earned 5 percent or more of the total Contract amount for Contract items, other than Mobilization. The LFUCG will make both payments simultaneously when these requirements are met at the same time.

Demobilization is included in the Bid Proposal as a separate bid item, the LFUCG will pay for Demobilization according to the following schedule:

1) 25 percent upon formal acceptance of the project
2) 50 percent when the final estimate is submitted to the ENGINEER
3) 25 percent when the final estimate is paid.

TECHNICAL SPECIFICATIONS

SECTION E - PAYMENT/PERFORMANCE BOND COST

E.1 SCOPE

The intent of this item is to allow full payment for the direct cost of Payment and Performance Bonds required for this project. The Contractor shall be reimbursed for Payment/Performance Bond Cost in accordance with his direct cost for such bonds. The amount bid for this item shall be the direct and specific amount of the Payment/Performance Bond cost. There shall be no adjustment for the Contractor's internal cost for personnel or staff in obtaining such bonds, or for any other cost related to bonding. If such cost are not determined at the time the project is bid, the Contractor shall enter his best estimate of such cost after consulting with his bond agent. Bidder/Contractor shall also have the option of leaving this item blank, i.e. not requesting direct payment for bond costs. The final pay amount shall be the Contractor's direct cost for the Payment/Performance bond. The Contractor shall furnish a receipt from his Bonding Agent verifying the cost of the bonds. He shall also submit proof of payment that the bonds have been paid for. And, the Contractor shall submit a letter from the Bonding Agent that the bonds are in effect, are in good standing, and will be in effect for the remaining life of the project. Payment for the cost of Payment and Performance Bonds may generally be requested after the work is twenty percent (20%) complete.

E.2 BASIS OF PAYMENT

Payment for Payment/Performance Bonds shall be on a Lump Sum basis at the Contract Price quoted in the Bid Schedule. Such payment may be modified/adjusted only as permitted above, if such cost are not know at the time of submittal of the bid. Such payment will be full compensation for all labor, materials, equipment and incidentals necessary to complete the Work required by this Section.

SECTION 02100 - EROSION CONTROL

1. DESCRIPTION

This work shall consist of soil preparation, application and incorporation of materials, and mulching of areas to be seeded and protected or sodded.

2. MATERIALS

Materials shall conform to the requirements specified in the following KDOH Sections.

Topsoil	827.09
Agricultural Limestone	827.02
100-Mesh Limestone	827.03
Fertilizer	827.04
Sod	827.10
Staples	827.08
Mulch Material	827.06
Bituminous Material	827.07

3. GENERAL

Erosion control measures shall be progressively coordinated with the grading operations throughout the duration of the project in accordance with the requirements of Section 02105, Water Pollution Controls.

4. TEMPORARY SEEDING

This item shall consist of seeding a temporary cover of grass, or grass and small grain, on areas disturbed on the construction site which will not be redisturbed within a 60 day period. The determination of the area to be temporarily seeded and the time of seeding shall be made by the ENGINEER.

The seed mixtures to be used for temporary cover will be governed by the time of year the seeding is accomplished. The mixture of seeding shall be as follows:

(A) Time of Seeding - February 15 to June 1

Rye 1 1/2 bushels and rye grass 25 pounds per acre; or tall fescue 30 pounds and rye grass 20 pounds per acre.

(B) Time of Seeding - June 2 to August 15

Tall fescue 30 pounds and rye grass 20 pounds per acre; or, spring oats 2 bushels and rye grass 30 pounds per acre.

(C) Time of Seeding - August 16 to February 14

Rye 2 bushels and rye grass 20 pounds per acre; or, tall fescue 30 pounds and rye grass 200 pounds per acre.

(D) Lime will not be required for temporary seeding.

(E) Fertilize at the rate of 400 pounds per acre of 10-10-10 fertilizer, or equivalent, broadcast uniformly on the area to be seeded.

(F) All seed shall be broadcast evenly over the area to be seeded and cultipacked or otherwise pressed into the soil. Seed and fertilizer may be mixed together and applied after the seed has been prepared.

(G) All temporarily seeded areas shall be protected as specified for method 2 in paragraph 5.3.

5. PERMANENT SEEDING AND PROTECTION

Grade exposed earth and any other erodible areas to a uniform cross section or slope as soon as practical in the judgment of the Engineer and then perform permanent seeding and protection at the earliest practical time.

Prepare all areas within the construction limits and right of way limits that can be expected to sustain plant growth and are not covered by satisfactory vegetation for permanent seeding. The ENGINEER will designate areas to be seeded.

5.1 SEED MIXTURES FOR PERMANENT SEEDING

Seed Mix Type I:	30% Kentucky 31 Tall Fescue (Festuca arundinacea) 20% Creeping Red Fescue (Festuca ruba) 35% Hard Fescue (festuca longifolia) 10% Ryegrass, Perennial (Lolium perenne) 5% White Dutch Clover(Trifolium repens)
Seed Mix Type II:	60% Kentucky 31 Tall Fescue (Festuca arundinacea) 20% Ryegrass, Perennial (Lolium perenne) 10% (based on pure live seed, PLS) Little Bluestem (Schizachyrium scoparium) 10% Partridge Pea (Cassia fasciculate)
Seed Mix Type III:	40% Kentucky 31 Tall Fescue (Festuca arundinacea) 15% Perennial Ryegrass (Lolium perenne) 20% Sericea Lespedeza (Lespedeza cuneata) 15% Partridge Pea (Cassia fasciculate) 10% (based on pure live seed, PLS) Little Bluestem (Schizachyrium scoparium)

(A) Permanent seeding on slopes 3:1 or less. Apply seed mix Type I at a minimum application rate of 100 pounds per acre.

(B) Permanent seeding on slopes greater than 3:1 in Highway Districts 4, 5, 6 and 7. Apply seed mix Type II at a minimum application rate of 100 pounds per acre plus a nurse crop of either Cereal Rye or German Foxtail-Millet based on the time of year. During the months of June through August, apply 10 pounds of German Foxtail-Millet (Setaria italica). During the months of September through May, apply 56 pounds

of Cereal Rye (Secale cereale). If adjacent to golf courses replace the crown vetch with Kentucky 31 Tall Fescue.

(C) Permanent seeding on slopes greater than 3:1 in Highway Districts 1, 2, 3, 8, 9, 10, 11, and 12. Apply seed mix Type III at a minimum rate of 100 pounds per acre plus a nurse crop of either Cereal Rye or German Foxtail-Millet based on the time of year. During the months of June through August, apply 10 pounds of German Foxtail-Millet (Setaria italica). During the months of September through May, apply 56 pounds of Cereal Rye (Secale cereale). If adjacent to crop land or golf course replace the Sericea Lespedeza with Kentucky 31 Tall Fescue.

5.2 PROCEDURES FOR PERMANENT SEEDING

(A) Areas to be seeded shall be cleared of all weeds.

(B) Topsoil, which is to be obtained from existing stockpiles, shall be applied. The topsoil shall not be spread until grading and shaping of the area to receive the topsoil has been completed, and seeding and protection operations are ready to begin. The stockpiled material shall be spread to a uniform depth of approximately 6 inches over such areas that are designated in the plans or by the ENGINEER, and lightly compacted. Areas designated to receive the topsoil will normally include, but are not limited to, medians, islands, cut slopes no steeper than 3:1, and other areas that it is anticipated will be mowed in the future. After the topsoil has been spread and compacted, the areas upon which it was stockpiled shall be neatly dressed.

(C) The soil shall be loosened to a depth of 3 inches by rotary tools, discs, harrows, or other approved methods. The Engineer may reduce the depth to which the soil is loosened on steep slopes or places inaccessible to mechanical equipment. On areas subject to severe erosion, care shall be taken not to pulverize the soil as this may contribute to loss of seed and/or plant nutrients.

(D) All large or unsightly clods or stones, and other foreign materials brought to the surface shall be removed, and any gullies, washes, or disturbed areas shall be repaired before seed is applied.

(E) Prepare a seedbed and incorporate a minimum of 100 pounds of nitrogen, 100 pounds of phosphate, 100 pounds of potash, and 3 tons of agricultural limestone per acre.

(F) Add additional fertilizer and agricultural limestone as needed.

(G) Do not apply dry agricultural limestone when it may generate a traffic hazard.

(H) Remove all rock and dirt clods over 4 inches in diameter from the surface of the seedbed.

(I) Unless the ENGINEER directs otherwise, track all slopes 3:1 or greater. Ensure that tracking is performed up and down and not across.

(J) Native Grass seed should be calculated figuring seed on a pure live basis (PLS), using the least amount of inert matter available. Seed and mulch to produce a uniform vegetation cover using the seeding rates as indicated to each application.

(K) Mulch with clean, weed free straw. Place straw to an approximate 2 inch loose depth (2 tons per acre) and anchor it into the soil by mechanically crimping it into the soil surface or applying tackifier to provide a protective cover.

(L) For the periods of March 1 through May 15 and from September 1 through November 1, the option of using hydromulch at minimum rate of 1,500 pounds per acre in place of straw with tackifier will be allowed.

(M) Seed shall be drilled or worked approximately 1/4 inch into the soil, or covered by means of a cultipacker or light roller; the Engineer may waive this requirement on very steep slopes or inaccessible places provided the soil surface is rough and open.

(N) When the contract includes a bid item for crownvetch, crownvetch seed shall be uniformly sown at the rate of 30 pounds per acre on all areas having a slope of 3:1 or steeper and consisting of soil or mixtures of broken rock and soil. Crownvetch shall also be sown on soil seams and crevices within or adjacent to rock cuts, and the flat areas of benched slopes. Crownvetch seed shall be sown separately from other seeds unless seeding is done hydraulically.

(O) Each type of leguminous seed, such as crownvetch, shall be inoculated in accordance with the recommendations of the inoculant manufacturer. Five times the recommended quantity of inoculant shall be used when seeding is done hydraulically. Inoculation shall be performed the same day the seed is sown, and before the inoculated seed is mixed with the other seed.

5.3 PROTECTION

The methods of protection shall be as specified in the contract. Placing of mulch for protection shall follow seeding as soon as possible, and no later than 48 hours after seeding. In no instance shall the mulch be placed or crusted seeded areas, and any eroded areas shall be repaired and reseeded before mulch is applied. The mulch material shall be placed uniformly, all clumps loosened and scattered, and care shall be taken to avoid thicker applications than those specified as excessive mulch may hinder germination and survival of the seedlings.

After the seeding has been satisfactorily completed, the following methods or protection shall be used as required by the contract or the Engineer.

Method 1: Mulch and Netting. This method shall be used at bridge abutments, adjacent to pavements, or other areas designated on the plans or by the Engineer. Installation shall be in accordance with Standard Drawing No. RRE-002. Mulch material used under netting may be either plain or bituminous treated, unless otherwise directed, and shall be uniformly applied to approximately 2 inches loose depth (approximately 2 tons per acre).

Method 2: Bituminous Treated Mulch. Bituminous treated mulch shall be placed by equipment that will blow or eject a controlled quantity of mulch material uniformly over the entire seeded area, without appreciable cutting or breaking of the mulch material, and to a loose depth of approximately 2 inches (approximately 2 tons per acre).

Bituminous material shall be uniformly applied by jet nozzles installed at the discharge spout of the equipment at the minimum rate of 250 gallons per acre. When the initial application is less than 250 gallons per acre, neat bituminous material shall be uniformly sprayed over the mulch material until the minimum quantity had been applied.

In cool weather, the CONTRACTOR shall heat the bituminous material to ensure uniform distribution.

The CONTRACTOR shall take all necessary precautions to prevent the bituminous material from defacing structures or other roadway appurtenances, pavements, utilities, plant growth, traffic, or private property. Any such items defaced by bituminous material shall be cleaned to the satisfaction of the Engineer.

5.4 STAGE II TOPDRESSING

When quantities for 20-10-10 fertilizer are included in the plans and/or proposal, all seeded and sodded areas on the project shall receive a top-dressing of 20-10-10 fertilizer. Top-dress applications of fertilizer and agricultural limestone shall be made on all areas within the right-of-way limits on which satisfactory vegetation has been established or preserved. Top-dress applications shall be made at the time designated in the contract or by the Engineer, but shall not be made during the months of December and January, nor until a satisfactory stand or vegetation exists.

Both dry and/or liquid fertilizer will be acceptable and may be delivered to the project in bags, bulk or tank. If the dry form is used a 20-10-10 analysis fertilized shall be uniformly applied at the rate of 500 pounds per acre (11.5 lbs. per 1,000 square feet). If the liquid is used, liquid fertilizer having an analysis ratio of 2-1-1 shall be applied at the rate required to furnish 100 lbs. of Nitrogen, 50 lbs. of Phosphorus, and 50 lbs. of Potassium per acre. The CONTRACTOR shall utilize application equipment, property calibrated before use, capable of applying the fertilizer evenly over the entire designated areas at the specified rate without excessive drifting of material or damage to existing vegetation. The hydroseeder, power sprayer and/or mechanical blower type of broadcast spreaders are considered acceptable for slope and level areas. The minimum solution rate per acre to ensure uniform coverage shall be 200 gallons if a hydroseeder or power sprayer is used. Incorporation of these materials into the soil will not be required. Any areas which are top-dressed and later exhibit streaked or missed areas shall be refertilized at no additional cost to the Owner. Any vegetation severely damaged or destroyed because of Owner an excessive application of fertilizer shall be reestablished at no additional cost to the Owner.

When seeding performed during the latter part of a project has not had time to attain significant growth before all other contract items are completed, the project will be declared complete without regard topdressing work Topdressing shall then be performed at a later time approved by the Engineer. The time necessary to

complete topdressing work will not be included in the contract time and no liquidated damages will be assessed, provided the work is completed within the time limits specified in KDOH Section 108-09.

5.5 EROSION CONTROL BLANKET

Install erosion control blankets in ditches, except those to be paved or rock lined, to flow depth of 1.5 feet. Install erosion control blankets on final soil-like slopes as designated on the Erosion Control Plan and as the ENGINEER directs. Prepare the bed by loosening the soil to a depth of 2 to 3 inches. Apply fertilizer, limestone, and seed t the permanent seeding rate. Cover with the erosion control blanket. Roll out the blanket in the direction of the anticipated runoff flow. Anchor the blanket at the top and toe of slopes and at the top, toe, and edges of channels and ditches as the "Anchoring Edges and Ends" figure shows. Secure the blanket by stapling as the "Stapling Pattern" figure shows. At seams, overlap the blanket as the "Seam Overlaps" figure shows. Rework areas that become unstable or do not establish vegetation.

Erosion Control Blankets must be machine constructed with two sided netting filled with curled wood fiber mat, straw, or coconut fiber combination. The blanket must be smolder resistant without use of chemical additives.

The netting shall be photodegradable extruded plastic mesh or netting with a maximum spacing width of one inch square on both sides of the blanket.

5.6 MAINTENANCE OF SEEDED AREAS

From the time seeding and protection work begins until the date the project is declared complete, the CONTRACTOR shall keep all seeded areas in good condition at all times. Any damage to seeded areas or to mulch materials shall be promptly repaired as directed.

All work and materials necessary to protect, maintain, and/or restore seeded areas during the life of the contract shall be performed at no additional cost to the Owner, except additional work caused by changes in the project by the Owner. When it becomes necessary to disturb previously seeded areas due to slope changes, addition of paved ditches not previously located, or other changes made at the direction of the Engineer, payment for a reasonable amount of additional work, as determined by the Engineer, will be made at the original contract unit prices.

No payment will be made for additional work due to changes made for the benefit of the CONTRACTOR, such as slope changes to obtain balance excavation in lieu of borrow excavation, nor will payment be made for additional work required because the CONTRACTOR has failed to properly coordinate his entire erosion control schedule thus causing previously seeded areas to be disturbed by operations that could have been performed prior to the seeding.

5.7 ACCEPTANCE OF SEEDING

An inspection to determine the acceptability of the seeding will be made by an authorized representative of the Owner no less than 3 months but no more than 6 months after completion of the entire project, except that the Engineer may delay the inspection when conditions are such that the acceptability of the seeding

cannot be determined at the end of the 6 month period. At the time of inspection, at least 90 percent of each seeded area shall have a minimum of 150 live seedlings representative of the specified seed mixture per square foot, with no vacant areas larger than 250 square feet each. This requirement shall apply to all permanent seeding performed in conjunction with the project, regardless of the type protection used or the season in which the seeding is performed.

When the seeding does not meet the live seedling requirement at the time of inspection, additional work will be required and may include preparation of a new seedbed, refertilizing, reseeding, remulching, or any erosion control items that were originally required.

Payment for additional seed mixture and protection ordered by the Engineer will be made at the agreed unit prices listed below, which payment shall be full compensation for all labor, equipment, materials and incidentals required to acceptably complete required work:

(A) The corrective seed mixture rate of application will be determined by the Engineer and shall be derived from the permanent seed mixture specified in the contract. All seed used for corrective seeding will be paid for at the rate of $1.50 per pound. This price includes all seed bed preparation, application, labor, and incidentals as directed by the Engineer.

(B) Straw mulch for corrective seeding shall be applied at the rate per acre as designated by the Engineer. The mulch shall include asphalt emulsion at a rate of 100 gallons per ton of straw. All straw mulch used for corrective seeding will be paid for at the rate of $185.00 per ton. This price shall include straw mulch, asphalt, labor, equipment, and incidentals necessary to satisfactorily perform the mulching operation.

(C) The Engineer may direct other items such as fertilizer, limestone, and crownvetch to be applied. These items will be paid for at the contract unit price.

6. SODDING

This item shall consist of furnishing, hauling, and placing sod on a prepared sod bed at locations specified in the contract or by the ENGINEER.

6.1 CUTTING SOD

Prior to cutting sod, the grass shall be mowed to a height of no more than 3 inches and the mowed area shall be raked to eliminate all clippings, cuts and trash. The sod shall be cut into rectangular sections as required. Sections may vary in length not exceeding 8 feet but shall be of uniform width of 10 inches or more, and shall be cut to a depth of at least one inch and no more than 2 inches, depending on the nature or kind of sod. The sod shall be cut to such thickness that practically all of the dense root system will be retained but exposed in the sod strip, and to such width and length so that it can be handled without undue tearing and breaking. When cut in strips, the sod shall be rolled without damage with the grass folded inside.

The sod shall be cut by means of an approved mechanical sod cutter. During dry weather, the sod shall be watered before cutting to prevent loss of soil while

handling. Sod shall not be cut when in a sufficiently wet condition which would interfere with proper handling.

All sod must be delivered to the project and placed within 24 hours after being cut, unless placing is prevented by circumstances beyond the CONTRACTOR'S control, in which case the ENGINEER may permit temporary storage.

6.2 TEMPORARY STORAGE

When temporary storage of sod is permitted, the sod shall be placed in layers with grass to grass and roots to roots. To prevent the sod from drying out, the stack shall be sprayed with water and covered with moist burlap as directed.

Sod will be rejected when permitted to decay or dry to the extent that, in the judgment of the ENGINEER, its survival is doubtful. Rejected sod shall be disposed of at no cost to the OWNER.

6.3 PREPARATION OF SOD BED

The sod bed shall be loosened to a depth of 3 inches and shaped to a smooth even surface and shall be graded to such elevation so the sod, when in place, shall be flush with any adjacent seeded or turfed area, pavement, curb, or other structures, except when otherwise directed.

Prior to placing the sod, the fertilizer and limestone shall be applied uniformly at the rates specified, and shall be harrowed, raked, or otherwise incorporated into the soil. The sod bed, when dry, shall be moistened to the loosened depth.

6.4 PLACING SOD

Sod shall be placed as the earthwork progresses insofar as practicable. Quantities of less than a normal truckload of sod will be deemed impracticable and will not be required until a truckload can be used, unless extremely erosive conditions are encountered which demand immediate attention in the judgment of the ENGINEER.

Sod shall not be placed when the atmospheric temperature is below 32°F, or when the sod or sod bed is frozen, or during other weather or soil conditions detrimental to the work.

The sod shall be carefully placed by had so that each section closely joins the adjacent sections without overlapping. All open spaces or gaps shall be plugged with sod cut to the appropriate size and shape.

When placed on slopes, the sod shall be laid with the long edges of the trips parallel to the contour starting at the bottom of the slope. Successive strips shall be neatly matched and all joints staggered or broken. The sodding shall be carried at least 18 inches beyond the top of the slope to prevent surface water from undermining the sod.

When placed on slopes 2:1 or steeper and 6 feet or more in height, and in all sodded ditches, each strip or section of sod shall be staked securely with at least 2 wood stakes or wire staples no more than 2 feet apart and driven flush with the

surface. The stakes or staples will be subject to approval by the ENGINEER on the project.

The sod, after it is placed, shall be wetted thoroughly and tamped sufficiently with approved tampers to incorporate the roots into the sod bed and to ensure tight joints between the sections or strips.

6.5 CARE AND RESTORATION

All sodded areas, including the sod bed, shall be kept thoroughly moist for at least 2 weeks after sodding. The sod shall be maintained in a good state of repair at all times during the life of the contract.

6.6 GUARANTEE

The CONTRACTOR shall guarantee a minimum of 90 percent live sod on the sodded areas at the inspection between 3 and 6 months after completion of the project and no vacant area of dead sod shall be larger than 15 square feet.

7. METHOD OF MEASUREMENT

The quantity of Agricultural Limestone and Fertilizer to be measured for payment, including materials used for top-dress applications, will be the number of tons each material weighed separately, complete and accepted in place in the final work. When 100-mesh ground limestone is substituted for agricultural limestone at the rate specified in subsection 7. 4-2 (d), the actual number of tons substituted will be converted to its equivalent in tons of Agricultural Limestone for pay purposes.

Sod measured for payment will be the number of square yards of surface area of sod conforming to the requirements specified herein complete and accepted by the ENGINEER. Additional sod necessary to restore areas that fail to meet the guarantee requirements will not be measured for payment.

8. BASIS OF PAYMENT

The accepted quantities thus measured will be paid for at the contract unit prices. Payment shall be full compensation for all work required by this Section, including all work and material necessary to fulfill guarantee requirements.

Payment will be made under:

PAY ITEM	PAY UNIT
Sodding	Square Yard
Seeding & Protection, Method I	Square Yard
Seeding & Protection, Method II	Acre
Special Seeding, Crown Vetch	Pound
Agricultural Limestone	Incidental
Fertilizer (Analysis)	Incidental
Erosion Control Blanket	Square Yard

SECTION 02105 - WATER POLLUTION CONTROL

1. DESCRIPTION

This work shall consist of temporary control measures as shown on the plans or ordered by the ENGINEER during the life of the contract to control water pollution through use of silt checks; and coordinating these measures with the permanent erosion control features specified elsewhere in the contract to the extend practicable to assure effective and continuous erosion control throughout the construction and post construction period.

2. GENERAL

The intent of this specification is to protect the quality of water through the prevention, control and abatement of any pollution resulting from the OWNER'S construction projects.

The CONTRACTOR shall exercise every reasonable precaution at all times to prevent the pollution of all streams, lakes, and reservoirs. He shall construct all permanent drainage structures and ditch checks, as soon as practicable. He shall conduct and schedule his operations so as to avoid or minimize the muddying or siltation of all streams, lakes, and reservoirs and to avoid damage to fish habitats. No partially completed item of work shall be left in a manner that will contribute to erosion during the period in which work on the item is suspended.

Material removed from the roadway shall not be deposited in streams, stream channels, other areas subject to flooding, or other locations where it may be washed away by high stream flows or fast runoff.

Fuels, oils, bitumens, calcium chloride, or other harmful materials shall not be placed where they may be carried into a stream or underground waters at any time.

Lands outside the limits of the construction, as staked, shall not be disturbed, except as may be found necessary and as permitted. Before final acceptance of the work, all such disturbed areas, including storage areas, and plant sites, shall be reshaped to conform to the adjacent ground and shall be revegetated by the CONTRACTOR at his expense.

The CONTRACTOR shall provide and maintain adequate sanitation facilities for the duration of the work. Temporary sanitation facilities shall be of the portable type.

3. TEMPORARY CONTROL MEASURES

The ENGINEER may limit the surface area of erodible earth material exposed by clearing and grubbing, the surface area of erodible earth material exposed by excavation, borrow, and fill operations, and may direct the CONTRACTOR to provide immediate permanent or temporary pollution control measures to prevent contamination of watercourses or other areas of water impoundment.

The temporary pollution control measures shall be coordinated with the permanent erosion control features to the extend deemed practicable by the ENGINEER to assure effective and continuous erosion control throughout the construction and post construction periods.

Temporary erosion control measures shall be used at any time during the life of the project when directed to prevent soil erosion and pollution of streams.

Clearing and grubbing operations shall be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter if project conditions permit; otherwise, temporary erosion control measures may be required at the CONTRACTOR'S expense between successive construction stages.

Temporary pollution controls may include construction work outside the project area where such work is necessary as a result of roadway construction such as equipment storage sites.

The erosion control features installed by the CONTRACTOR shall be acceptably maintained by him.

4. SILT CHECKS

Dams constructed of crushed stone, broken rock, soil or straw shall be constructed to retard the flow of water which is laden with eroded material in a manner to cause the eroded material to settle behind the dams. Silt checks shall be constructed, before major earth excavation takes place, at location designated on the plans or as directed, wherever it appears that eroded material will pollute adjacent property or streams. Construction methods shall be as specified herein.

Silt Check Type I - Straw bales, staked so as to remain in place, placed in the numbers and at the locations designated.

Silt Check Type II - Crushed stone such as Cyclopean Stone Rip Rap, Quarry Run Stone, or other size material approved as suitable for this use, dumped in place, at the locations designated and shaped to the configuration required.

Silt Check Type III - Blasted or broken rock dumped in place at the locations designated and shaped to the configuration required.

Unless otherwise provided or directed, the CONTRACTOR may select the type of ditch check to be constructed at each location.

Sediment deposited at silt checks shall be removed properly disposed of when deemed necessary. When their usefulness has ended, the silt checks shall be removed, surplus materials disposed of in accordance with section 4.6, and the entire area disturbed shall be seeded and protected, as directed. Silt checks may remain in place upon completion of the project only when permitted by the ENGINEER.

4.1 SILT TRAPS

Silt traps shall be constructed by excavating basins in natural or excavated channels, and shall be one of the following types:

Silt Trap Type A - Excavated pits, from 2 to 3 feet in depth, 20 to 30 feet in length, and 5 to 10 feet in width.

Silt Trap Type B - Excavated pits with the addition of a dike and overflow pipe. Dimensions of the pit and the overflow pipe shall be in accordance with the plans and/or standard drawings.

Sediment deposited in silt traps shall be removed each time the silt trap is approximately 50 percent filled. When their usefulness has ended, the silt traps shall be removed, surplus materials disposed of in accordance with KDOH Section 204.09, and the entire area disturbed shall be seeded and protected or sodded, as directed. Silt traps may retain in place upon completion of the project only when permitted by the Engineer or the plans.

4.2 TEMPORARY SILT FENCES

Temporary silt fences shall be constructed by installation of posts, and installation of metal fence fabric and geotextile fabric, in accordance with the plans and standard drawings.

Fence posts shall be at least 5 feet long, and metal fence fabric shall be at least 14 gage, 36 inches high, and with openings no larger than 6 inches x 6 inches. Geotextile fabric shall be a material recommended for this use by the manufacturer.

Fence posts and fabric will be accepted based on visual inspection by the Engineer in the field; geotextile fabric will be accepted upon receipt of a certification from the manufacturer that it is suitable for use as silt fence.

The silt fence shall be constructed at locations shown on the plans or directed by the Engineer. The silt fence shall be erected before grading is begun in the area to be protected. Posts shall be installed at 6 to 10 feet spacing (The closer spacing should be used in areas where rapid run-off can be expected) and the fence fabric attached. The geotextile fabric shall be attached to the fence, on the upstream side, using staples, hog-rings, or another approved method. The bottom 12 inches of the fabric shall be buried in a 6-inch trench cut into the ground or covered by 6 inches of fill material, to prevent sediment escaping under the fence. All earthwork shall be on the upstream side of the fence.

During the useful life of the silt fence, it shall be maintained by the CONTRACTOR, and silt accumulations that threaten damage to the fence shall be removed. After the usefulness of the fence has ended it shall be removed and disposed of, the accumulated silt shall be either removed or dressed in place as directed, and the entire area shall be seeded and protected.

5. PROGRESS REQUIREMENTS

Both permanent and temporary erosion control measures including, but not limited to, ditch checks, seeding, etc., shall bc progressively coordinated with the grading operations throughout the duration of the project.

As areas of erodible earth material are exposed to the elements of erosion, every effort should be made to stabilize and protect the areas as quickly as possible, as directed. Upon failure of the CONTRACTOR to coordinate the erosion control measures with the grading operations in a manner to effectively control erosion and to prevent water pollution, the ENGINEER may suspend the CONTRACTOR'S grading operations and/or withhold monies due the CONTRACTOR on current estimates until such time that all aspects of the work are coordinated in an acceptable manner.

In case of repeated failures on the part of the CONTRACTOR to control erosion, pollution, or siltation, the ENGINEER reserves the right to employ outside assistance or to use his own forces to provide the necessary corrective measures. Such incurred direct costs plus project engineering costs will be charged to the CONTRACTOR and appropriate deduction made form the CONTRACTOR'S pay estimate.

6. METHOD OF MEASUREMENT

The final quantity of silt checks and silt traps will be the actual number acceptably constructed, maintained, and removed. The final quantity of temporary silt fence will be the actual length acceptably constructed, maintained, and removed. All such structures shall be fully maintained, cleaned and replaced, if necessary at no additional cost.

7. BASIS OF PAYMENT

The accepted quantities thus measured will be paid for at the contract unit prices.

Payment will be made under:

PAY ITEM	PAY UNIT
Silt Trap	Each
Silt Check	Each
Silt Fence	Linear Foot
Modified Silt Check	Each
Best Management Practices	Lump Sum
Concrete Washout Pit	Each

SECTION 02110 - CLEARING, GRUBBING AND REMOVAL

1. DESCRIPTION

This Work shall consist of clearing, grubbing, stripping, and stockpiling all topsoil or unsuitable material, removing and disposing of all vegetation and foundations not removed by others, and debris which are within the construction limits, except those objects which are designated to remain or are to be removed in accordance with other sections these specifications. **All honeysuckle within the project right of way shall be removed.** This work shall also include the preservation from injury or defacement of all vegetation and objects designated to remain. This work will also include the removal of fences within the construction limits. Fences will be relocated outside the construction limits of the project.

2. GENERAL

The ENGINEER will designate all trees, shrubs, plants, and other items remain. Paint required for cut or scarred surfaces of trees or shrubs selected for retention shall be an approved asphaltum base paint prepared especially for tree surgery.

3. CLEARING AND GRUBBING

The entire area within the construction limits shall be cleared of all weeds, brush, briers, bushes, trees, stumps, and other protruding obstructions not designated to remain, except within areas the ENGINEER may designate to remain undisturbed. In addition, all bushes, trees, roots, and stumps within the line of slope stakes shall be grubbed, except undisturbed stumps, roots, and nonperishable solid objects which will be a minimum of 3 feet below subgrade or slope of embankments. Stumps and nonperishable solid objects to be left under embankments shall not extend more than 6 inches above the ground line or low water level.

The ENGINEER may permit sound trees and stumps 6 inches or larger in diameter to be cut within 3 inches of the groundline and all other trees, stumps, shrubs, and bushes to be cut flush with the groundline and left without grubbing in areas cleared outside the construction limits.

All topsoil and/or unsuitable material shall be stripped and stockpiled during the clearing and grubbing operations.

All fences within the construction limits will be removed and stored in a manner to preserve the structural strength of the fence. Upon completion of the project the fences will replaced outside the limits of construction, or as directed by the ENGINEER, in as good as the existing condition and to the satisfaction of the ENGINEER. If the ENGINEER determines that the fence has been significantly damaged during removal, then the CONTRACTOR will replace the facility incidental to the clearing and grubbing.

Right-of-way areas lying between separate roadways, whether the roadways are constructed in the same plane or different planes, and right-of-way areas lying outside the construction limits shall be selectively cleared as directed.

All clearing and grubbing operations shall be performed in accordance with applicable provisions of Section 7, Erosion Control, and Section 8, Water Pollution Control.

All materials resulting from clearing and grubbing shall be completely disposed of by the CONTRACTOR. Any burning of perishable material shall be done in accordance with the requirements of the OWNER.

Materials and debris which cannot be burned and perishable materials may be disposed of by approved methods and at approved locations on or off the project. When disposal is by burying, the cover material shall be earth, shall provide a cover of at least 12 inches, and shall be graded and shaped to present a pleasing appearance.

In no case shall the CONTRACTOR place on adjacent property any material obtained from clearing and grubbing without written permission from the property OWNER, a copy of which shall be furnished to the OWNER. No material shall be placed within view of any public road, without written approval. The ENGINEER may require material placed within view of a public road to be covered with soil that will support vegetation, and seeded and protected as required on the remainder of the project.

All merchantable timber in the clearing area which as not been removed from the right-of-way prior to the beginning of construction shall become the property of the CONTRACTOR.

Low hanging branches and unsound and unsightly branches on trees or shrubs designated to remain shall be removed as directed. Branches of trees extending over the roadbed shall be trimmed to provide a minimum clear height of 20 feet above the roadbed surface. All trimming shall be performed in accordance with accepted practice.

4. METHOD OF MEASUREMENT

The plans will indicate the entire area within the construction limits in acres. The final pay quantity of Clearing and Grubbing will be measured per acre by plane surveying standards.

The area shown on the plans is approximate only, and the contract unit price for Clearing and Grubbing shall include all work necessary to clear and grub the original construction limits in accordance with these specifications and all other requirements of the plans or proposal applicable to Clearing and Grubbing, regardless of the area actually cleared and grubbed.

No claim will be allowed for any increase over the estimated area of Clearing and Grubbing unless work is performed outside the construction limits shown on the original plans, and then only when such work is caused by a change in the plans approved, in writing, by the ENGINEER. The area of Clearing and Grubbing will not be decreased unless the total area of the original construction limits is decreased by a change in plans approved, in writing, by the ENGINEER. Approved increases and decreases will be measured in acres.

5. BASIS OF PAYMENT

The accepted quantities thus measured will be paid for at the contract unit prices.

Payment will be made under:

PAY ITEM	PAY UNIT
Clearing and Grubbing	Lump Sum

SECTION 02222 - ROADWAY AND DRAINAGE EXCAVATION

1. DESCRIPTION

Roadway and drainage excavation shall consist of the removal and satisfactory disposal of all materials taken from within limits of the work contracted, meaning the calculated material lying between the original groundline and the excavation limits established or approved by the ENGINEER as shown on the final cross sections or grading plan.

2. GENERAL

Included in this work shall be excavation for widened cuts and roadbeds, pavement, embankment subgrades, under-cutting subgrades in cut sections, shoulders, slopes, removal of unsuitable material, ditches, waterways, intersections, approaches, balance excavation, and inlet and outlet ditches, all as indicated on the plans or as directed.

Roadway and drainage excavation shall also included removal and satisfactory disposal of miscellaneous structures removed from within the limits of the roadway and drainage cross sections such as, but not limited to, all types of pavements and pavement bases, whether rigid or flexible; sidewalks; all curbs and curbs and gutters; and all conduits that have no salvage value, such as unserviceable drainage pipe, sewer pipe, waterlines, and other unserviceable utility lines. The plans may or may not indicate the exact locations of the various types and quantities of these miscellaneous items to be removed and disposed of; however, it is the intent of these specifications that the removal of any such items that fall within the limits of the roadway and drainage cross sections as hereinbefore defined, whether or not shown on the plans, shall be paid for as Roadway Excavation Unclassified.

When quantities and bid items are shown on the plans or in the proposal for the removal of various types of miscellaneous items, it is the intent of these specifications that such quantities and bid items shall include only those miscellaneous structures that are found outside of the roadway and drainage cross sections.

Except as otherwise specifically stated roadway and drainage excavation shall also include inlet and outlet ditches, regardless of the classification of the material encountered, whether shown or not shown on the plans and whether or not on the right-of-way as shown. When the work is extended by the OWNER beyond the project area limits shown on the plans, easements or additional property will be obtained by the OWNER.

All drilling, grinding, and sawing of rock, shale, concrete and other similar dust-producing materials shall be performed in accordance with the requirements of the ENGINEER.

All excavation operations shall be conducted in accordance with the applicable requirements of Section 02100, Erosion Control, and Section 02105, Water Pollution Control.

Clearing and grubbing operations for excavation areas shall be completed prior to beginning excavation operations. The CONTRACTOR shall be responsible for and shall take all necessary precautions to protect and preserve any and all existing culverts, pipelines, conduits, subdrains, or parts thereof which may be affected by his operations on the contract and which, in the judgment of the ENGINEER, may be continued in use without any change. The CONTRACTOR shall, at his own expense, satisfactorily repair or replace any damaged part of any such culvert, pipeline, conduit, or subdrain which may result from his operations or negligence during the life of the contract.

During construction, all areas effected by excavation shall be maintained at all times in such condition that it will be well drained.

3. CLASSIFICATION

Without regard to the materials encountered, all roadway and drainage excavation shall be unclassified and shall be designated as Roadway Excavation. It shall be distinctly understood that any reference to rock, earth, or any other material on the plans or cross sections, whether in numbers, words, letters, or lines, is solely for the OWNER'S information and is not to be taken as an indication of classified excavation or the quantity of either rock, earth, or any other material involved.

The bidder must draw his own conclusions as to the conditions to be encountered. The OWNER does not give any guarantee as to the accuracy of the data and no claim will be considered for additional compensation when the materials encountered are not in accord with the classification shown.

4. SLOPES

All excavation shall be performed in such a manner as will ensure against removing or loosening any material outside of the required slopes. Slopes shall be shaped to reasonable close conformity with the lines and cross sections shown on the plans, with no deviations, therefrom readily discernible from the road, except as otherwise directed. All rock cut slopes shall be left with a reasonable uniform surface and all loose and overhanging rock shall be removed. Under no condition shall holes be gouged or dug in back slopes or in embankment slopes.

The slopes in cuts may be varied by the ENGINEER during construction, depending upon the material encountered in excavation. The cuts may be widened and the slopes may be varied to secure sufficient material for the formation of embankment and shoulders, to prevent landslides, to improve sight distance, or for any other reasons that such widening or variations are deemed to be to the best advantage of the work. When a cut is made on any section of the roadway in any material that may slide, the excavation shall be removed to the slope lines as designated on the plans or as directed, and no vertical slopes will be allowed during the process of excavation of such cuts, except in stage construction when material is left in cuts for future shoulder construction. No payment will be made for any excavated material which is used for purposes other than those designated.

5. DITCHES

Ditches shall include inlet and outlet ditches and such other ditches as may be required for the satisfactory completion of the work.

Material removed from ditches shall be disposed of as provided in Section 02222 or as indicated on the plans and shall be paid for as Roadway Excavation.

6. USE OF EXCAVATED MATERIALS

All suitable material removed from excavation shall be used, insofar as practicable, in the formation of embankments, subgrade, or shoulders; as backfill for structures; or for other purposes shown on the plans or as directed. No payment will be made for any excavated materials used for any purpose other than that indicated on the plans or approved.

All sod and soft or spongy material shall be removed and disposed of as directed. Such materials shall not be used in the construction of the grade, except as provided in Section 02223.

All rocks and boulders, when directed, shall be placed in the embankments, provided the embankments are of sufficient depth to provide 12 inches or more soil cover over such rocks or boulders placed within the shoulder limits. Such rock and boulders shall be placed under the shoulders rather than under the pavement foundation when the embankment is constructed principally of soils.

No excavated material shall be wasted without permission. Excavated material in excess of that required for normal embankment construction shall not be wasted within the project area limits, except when and as specifically directed or approved. When so directed or approved, excess material may be wasted adjacent to or incorporated in the normal embankment construction, and any material so wasted shall be uniformly distributed as directed. Irregular or partial widening of embankments will not be permitted. Stones and boulders wasted along embankments shall not exceed 1/3 cubic yard each in volume. Excess material shall not be wasted between cut slopes and the project area limits, except for the purpose of filling depressions, gullies, and other cavities; and, when so wasted, the material shall be shaped to conform with the adjacent ground.

Material wasted off the project area shall be placed on approved sites obtained by the CONTRACTOR at no cost to the OWNER. Material placed within view from any public road shall be placed to avoid an unsightly appearance. All waste shall be placed to avoid the obstruction of drainage, and the wasted material shall be seeded and protected in accordance with these specifications at no additional cost to the OWNER. The application rates of agricultural limestone, fertilizer, seed, and mulch shall be the same as those on the project where the waste material originated, but the variety of seed may be altered, upon written request from the property OWNER.

The ENGINEER may require the CONTRACTOR to submit drawings of proposed waste areas, showing the configuration of the original ground and the anticipated configuration of the area upon completion of the waste operation; any preparatory work such as benching; provisions for surface and subsurface drainage of the area after wasting is completed; and any other information the ENGINEER may require before considering approval of the proposed waste area.

The CONTRACTOR shall furnish cross sections and hydraulic computations for waste area sites situated in the flood plain of any stream. This flood plain shall be defined as that area required to pass the 100 year flood. The computations shall indicate the effect that the waste site will have both the design and the 100 year flood.

The CONTRACTOR shall furnish to the OWNER copies of written agreement with the property OWNER, approval of the OWNER(S) of utilities of any nature existing within the proposed waste area.

7. ROADBED

In addition to the limits of the roadbed, the work required herein shall extend to the ditch lines or curb lines in cuts when so directed.

Where rock is encountered in the excavation, it shall be removed between ditch lines or curb lines to a depth below the required grade as shown on the plans with no points of rock projecting above such depth. The final surface of the rock shall be left so that complete

drainage will be provided, and no water will be pocketed at any point. The refill over this surface shall be made of selected materials and shall contain no stone or spalls larger than 4 inches. All refill shall be placed in layers not exceeding 12 inches in depth, loose measurement, and compacted as specified in Section 02223. No allowance will be made for excavation and refill material to a greater depth below the required grade than as shown on the plans. When not designated on the plans, the refill material shall be selected by the ENGINEER.

In cut sections the roadbed, whether it consists of existing material or refill material, shall be compacted in accordance with the requirements of Section 02223. When the material in place does not contain sufficient moisture to obtain proper compaction, the roadbed shall be thoroughly scarified and broken to minimum depth of 6 inches, the moisture content increased as directed, and the roadbed compacted. Material unsuitable for the roadbed, when encountered at subgrade elevation, shall be removed to such depths as indicated on the plans or as directed, and disposed of as directed and replaced with suitable refill or #2 stone. Material that is unstable due to excessive moisture but that is otherwise suitable for the roadbed shall either be scarified, allowed to dry, and compacted; or removed, dried, and used for refill or embankment, as directed by the ENGINEER. Manipulation to speed drying will be permitted. No additional payment will be made for scarifying or manipulation necessary to increase or decrease the moisture content as this is considered incidental to the work. Payment will be made for existing material to be removed. When the ENGINEER directs that the material removed be wasted or requires the material to be used as refill or in embankment, then any additional material necessary for refill will be incidental to Roadway Excavation.

The CONTRACTOR shall conduct roadway excavation operations so that a sufficient quantity of selected materials is available, stockpiled, or otherwise reserved for providing the required volume of material necessary to complete the roadbed in accordance with the plans and as indicated herein.

8. METHOD OF MEASUREMENT

Roadway and drainage excavation will not be measured for direct payment.

Water used to provide sufficient moisture for compaction of the roadbed in cut sections will not be measured for separate payment but will be considered incidental to other items in the contract.

8.1 PAYMENT FOR DESIGN QUANTITIES

Final payment will be made at the contract unit price for the design quantity shown within the neat lines of the cross sections or grading plans, increased or decreased by authorized adjustments.

8.2 AUTHORIZED ADJUSTMENTS

Adjustments to the design quantities of Roadway Excavation authorized by the ENGINEER will be made only for the following purposes:

A. Include changes in the quantity of work due to benching, changing slopes or grades, removing slides, and any other procedures required by the ENGINEER on the project.

B. Correct major errors on the plans. Major errors are defined as individual mistakes of 5 percent or more in the quantity of earthwork between 2 consecutive cross sections, and are intended only to include omissions, duplication, arithmetical mistakes, or other errors in the survey or plans, but are not intended to include minor discrepancies in the plotting of cross sections, in the planimetering of cross sections, and in the resulting computation of the volume of earthwork. When errors in the lines or grades shown on the plans cause major errors in earthwork quantities, the earthwork quantities will be corrected throughout the entire span of the errors. Earthwork quantities will not be adjusted when errors in the lines or grades do not cause major errors in the earthwork quantities.

9. MISCELLANEOUS ITEMS

Removing and salvaging or disposal of all other items within the project area or easements not included in this Section such as guardrails, headwalls, inlet boxes, etc., whether shown on the plans or not shall be considered incidental to the contract and no direct payment shall be allowed, unless otherwise provided.

In removing manholes, catch basins, and inlets, any live sewers connected thereto shall be rebuilt and properly reconnected, and satisfactory by-pass service shall be maintained during such construction operations.

10. BASIS OF PAYMENT

Removal of existing pavement, curb and gutter, and sidewalk shall be considered incidental to the project and no direct payment shall be made.

No direct payment shall be made for Roadway Excavation.

SECTION 02223 - EMBANKMENT

1. DESCRIPTION

This work shall consist of forming embankments with materials from sources indicated on the plans or from other approved sources, in accordance with these specifications, to conform to the lines, grades, and cross section specified.

2. MATERIALS

Only acceptable materials from sources indicated on the plans or from other approved sources shall be used in embankment formation. No frozen material, stumps, logs, roots, or other perishable materials shall be placed in any embankment. No stone or masonry fragment greater than 4 inches in any dimension shall be placed within 12 inches of the finished subgrade elevation.

3. GENERAL

Clearing and Grubbing, including removal of topsoil, of embankment areas shall be completed in accordance with the requirements of Section 02110 before embankment is placed thereon.

Sod shall be removed from all embankment areas. Sod thus removed may be uniformly distributed along the toe of the slopes or upon the embankment slopes, unless otherwise provided. Sod shall not be placed within the limits of the embankment. The removal of sod will not be required where embankments are to be constructed over marshy areas, except when otherwise specifically provided. No direct payment will be allowed for removing sod from embankment areas.

Excavation of ditches and channel changes adjacent to embankment areas should be among the first operations on the project, and shall be performed prior to placing the adjacent embankment.

Embankments shall not be constructed upon frozen areas. All snow and ice shall be removed from the area to be covered prior to placement of embankment material.

When the height of the embankment, at subgrade elevation, is greater than 3 feet above an existing rigid pavement, the pavement shall be broken to such extent that none of the fragments shall have a dimension greater than 3 feet, or the pavement may be removed entirely when the CONTRACTOR so elects. When the height of the embankment, at subgrade elevation, is 3 feet or less above the existing rigid pavement, the pavement shall be removed entirely. the broken pavement thus removed may be utilized as embankment material provided none of the fragments has a dimension greater than on foot.

Existing flexible pavements shall be scarified or broken until all cleavage planes are destroyed or shall be removed entirely as conditions demand.

Benches with horizontal and vertical faces shall be cut into the original ground of embankment foundations when indicated on the plans or directed, and shall be of the dimensions indicated or directed. The horizontal face of the benches will be paid for as Roadway Excavation or Embankment-in-Place, as applicable.

Embankment foundations shall be compacted as directed.

When noted on the plans or when directed, unsuitable materials encountered in embankment areas shall be removed prior to placement of any embankment material thereon. Materials thus removed shall be wasted, stockpiled, or otherwise disposed of as directed, and payment for such work will be made at the contract unit price per cubic yard for Roadway Excavation.

4. EMBANKMENT FORMATION

Embankments constructed of earth, soil-like shale (SDI 50 or less by KM 64-513), intermediate shale SDI greater than 50 but less than 95 by KM gravel, creek gravel, or similar materials, shall be formed by distributing the materials in successive uniform horizontal layers not exceeding 12 inches in thickness, loose depth, to the full width of the cross section. However, layers less than 12 inches in loose thickness will be required when necessary to obtain the specified density. Each layer shall be compacted to the requirements of Section 02223. The upper surface of the embankment shall be shaped so as to provide complete drainage of surface water at all times. The forming of ruts will not be permitted.

In embankments that are constructed principally of unweathered limestone, rock-like shale (SDI equal to or greater than 95 by KM 64-513), or durable sandstone, the layer thickness shall not exceed 3 feet; the maximum dimensions of boulders or large rocks placed in the embankment shall be 3 feet vertically and approximately 4.5 feet horizontally. Rocks having any dimension greater than 2 feet shall be kept at least 2 feet below subgrade elevation. The rock shall not be dumped into final position, but shall be distributed by blading or dozing in a manner that will ensure proper placement in the embankment so the voids, pockets, and bridging will be reduced to a minimum. The slopes shall conform substantially with the requirements of the plans. The rock embankment shall not be constructed to an elevation higher then 12 inches below subgrade elevation, unless otherwise provided. The remainder layers not exceeding 12 inches loose thickness and compacted as specified for embankments. Rolling will not be required in construction of rock embankment.

In areas where layers of rock and shale or soil are encountered and embankments are constructed of a mixture of rock and shale or rock and soil, the material shall be placed, manipulated, and compacted in layers not exceeding 12 inches in thickness; however, when the thickness of the rock exceeds 12 inches, the thickness of the embankment layers may be increased as necessary due to the nature of the material and as approved by the ENGINEER. In no case shall the layer thickness exceed 3 feet. The mixture shall not be dumped into final position but shall be distributed by blading or dozing in a manner that will ensure proper placement in the embankment so that voids, pockets, and bridging will be reduced to a minimum. The mixture shall then be compacted with suitable compaction equipment. When directed, the material shall be wetted to aid compaction.

When crossing marshy or otherwise unstable areas, the first embankment layer may exceed 12 inches loose depth when noted on the plans or directed. This first layer shall consist of rock or granular material, when available, and shall be constructed by placing material behind the leading edge of the layer and blading into place, to avoid unnecessary disturbance to the original ground. The maximum layer thickness shall be 3 feet unless otherwise provided or directed, and required compaction shall be as directed.

5. COMPACTION

The embankment shall be compacted to a density of at least 95 percent of maximum density as determined by KM 64-511. The in-place density will be determined by KM 64-

512 or by using nuclear gages. Tests will be made at such frequencies as deemed necessary to assure that the entire embankment is compacted to the specified density.

During compaction, the moisture content of embankment or subgrade shall not vary form the optimum moisture content as determined by KM 64-511 by more than plus 2 percent or minus 4 percent. This moisture content requirement shall gave equal weight with the density requirement when determining the acceptability of embankment or subgrade construction. Embankment material which does not contain sufficient moisture to obtain proper compaction shall be wetted as directed, and thoroughly mixed as deemed necessary. Embankment material containing an excess of moisture shall be allowed to dry before being compacted. The manipulation of wet material to speed drying will be permitted.

Construction operations shall be performed in such a manner that simultaneous rolling and placing of material in the same lane or section will be prevented. To avoid uneven compaction, the hauling equipment shall traverse, as much as possible, the full width of the cross section. Each layer shall be compacted as required before material for the next layer is deposited. Equipment shall be such as will satisfy the density requirements at all times.

5.1 WAIVING OF MOISTURE AND DENSITY CONTROLS

When specified on the plans or by the ENGINEER, the moisture and density control requirements will be waived, in which case at least one piece of compacting equipment meeting the minimum requirements set out hereinafter and operating continuously shall be provided for each 200 cubic yards, or fraction thereof, placed per hour at each location. Tamping or sheepsfoot rollers shall be the dual-drum self-cleaning type, mounted with rows of tamping feet projecting at least 7 inches form the surface of the drum. The tamping feet in each row shall be staggered with those in the alternate rows. The tamping surfaces shall have at least 5 square inches of area. All tamping feet on each roller shall have the same length and tamping area. The rollers shall be of such design as will exert contact pressures, which may be varied as directed, over a range of 200 to 450 pounds per square inch of tamping surface when supported by one row of tamping feet. The 2 drums shall be mounted abreast in a manner that will permit each drum to oscillate independently of the other. A single-drum roller will be permitted to operate only over those areas that are inaccessible to a double-drum roller. The operating speed under normal conditions shall not exceed 8 miles per hour. Pneumatic-tire rollers shall be equipped with tires of the same size, and all tires shall be uniformly inflated so the air pressures in the several tires does not vary more than 5 pounds per square inch. The rollers shall be of such design as will exert contact pressures which may be varied as directed over a range of 400 to 600 pounds per inch of tire width. The operating speed under normal conditions shall not exceed 8 miles per hour.

Heavier equipment than that specified may be used when approved.

Although moisture and density tests will not be performed when control requirements are waived, the ENGINEER may direct that extremely dry material be wetted during compaction or that material so wet as to be unstable be manipulated and/or allowed to dry prior to compaction.

6. EMBANKMENT ADJACENT TO STRUCTURES

Embankments adjacent to culverts, headwalls, and similar structures shall be constructed compacting the material in successive uniform horizontal lifts not exceeding 6 inches in

thickness, loose measurement. Each layer shall be compacted as required by means of approved mechanical tampers. Each layer shall be compacted at the proper moisture content to ensure the same minimum density adjacent to the structure as that specified for the embankment. Rock larger than 4 inches in any dimension or other material that cannot be compacted by mechanical tampers shall not be placed in embankments adjacent to structures, unless approved by the ENGINEER, and then only in the manner the ENGINEER directs.

Embankment, when placed around adjoining or opposite faces of a structure, shall be compacted to the same level on all sides before proceeding to the next lift. As precaution against wedging action, compaction for each layer shall begin next to the structure.

Embankments adjacent to structures shall be constructed as outlined, to the height of the structure and shall slope to a sufficient distance from the structure to permit easy access of compacting equipment used in normal embankment construction.

7. METHOD OF MEASUREMENT

Payment for embankment in place will be based on design quantities.

Removing and/or scarifying existing pavements in embankment areas is considered incidental to other earthwork bid items and will not be measured for separate payment.

Water used to obtain proper compaction will not be measured for separate payment, but will be considered incidental to other items in the contract.

8. BASIS OF PAYMENT

Payment for Embankment in Place shall be made for the completed and accepted quantities under the following:

PAY ITEM	PAY UNIT
Embankment in Place	Cubic Yard

SECTION 02224 - BORROW EXCAVATION

1. DESCRIPTION

This work shall consist of removal and placement of all acceptable material taken from borrow site as designated on the plans used in refill, backfill, embankment construction, or other portions of the work.

2. CONSTRUCTION REQUIREMENTS

All borrow material shall be obtained from sites approved by the ENGINEER. In all instances the borrow site shall be excavated and maintained in a manner satisfactory to the ENGINEER. After use of the sites as sources of borrow material is terminated, the sites and haul roads shall be shaped to blend with the adjacent natural terrain and to have complete natural drainage unless otherwise approved by the ENGINEER.

Before ground is broken for excavation, all weeds and other vegetation shall be cut and disposed of properly. Sod and soft or spongy material shall not be used in embankments, or other construction, unless permitted by the ENGINEER. All topsoil and/or unsuitable material shall be stripped and stockpiled in accordance with Section 02110.

Material removed from the borrow site shall be placed where directed and in accordance with the requirements of Section 02223. All borrow sites shall be cut to uniform lines.

All borrow operations shall be conducted in accordance with Section 02100, Erosion Control, and 02105, Water Pollution.

3. METHOD FOR MEASUREMENT

Borrow excavation will not be measured for payment.

4. BASIS OF PAYMENT

No direct payment shall be made for borrow excavation.

SECTION 02225 - SLOPE PROTECTION AND CHANNEL LINING

1. DESCRIPTION

This work shall consist of furnishing and placing the specified material for a protective covering for slopes or linings in channels and ditches, placed at the locations shown on the plans or as directed, all in accordance with applicable provisions of these specifications and in reasonably close conformity with the lines, grades, thickness and to the area shown or otherwise designated. Slope protection includes the following types:

Cyclopean Stone Riprap, and Crushed Aggregate Slope Protection. Channel Lining includes 4 classes: IA, II, III, IV.

2. MATERIALS

Materials shall meet requirements specified in the following Sections.

Coarse Aggregate	KDOH 805
Drain Pipe	KDOH 810
Mattress Units	KDOH 813.14
Natural Sand	KDOH 804.03

2.1 CYCLOPEAN STONE RIPRAP AND CHANNEL LINING, CLASS III

Material for cyclopean stone riprap and Channel Lining, Class III shall meet the general requirements of KDOH Section 805. No less than 80 percent, by volume, of individual stones shall range in size from 1/4 to 1 1/2 cubic feet. Stones of smaller sizes are permissible for use in filling voids in the upper surface and dressing to the proper slope.

2.2 COARSE AGGREGATE FOR CRUSHED AGGREGATE SLOPE PROTECTION

Coarse aggregate for crushed aggregate slope protection shall meet the general requirements of KDOH Section 805 and shall be of such gradation that 100 percent passes the 4-inch sieve, 25 to 100 percent passes the 2 1/2-inch sieve, and a maximum of 15 percent passes the 1 1/2-inch sieve. Coarse aggregate meeting the gradation requirements for either size No. 1 or No. 2 will meet this requirement.

2.3 AGGREGATE FOR CHANNEL LINING, CLASS IA

Aggregate for Channel Lining, Class IA shall be limestone meeting the general requirements of Section 805. This material shall be produced by using a crusher, grizzly, or sieve with openings of 5 inches, and by such additional processing as may be necessary so that no more than 20 percent of the finished product will pass through square openings 1 1/2 inches by 1 1/2 inches.

2.4 AGGREGATE FOR CHANNEL LINING, CLASS II

Aggregate for Channel Lining, Class II shall be limestone meeting the general requirements of Section 805. This material shall be produced by using a crusher, grizzly, or sieve with openings of 9 inches, and by such additional processing as

may be necessary so that no more than 20 percent of the finished product will pass through square openings 5 inches by 5 inches.

2.5 MATTRESS UNITS FOR CHANNEL LINING, CLASS IA

Mattress units for Channel Lining, Class IA shall meet requirements of KDOH Section 813.14.

2.6 ANCHOR BARS OF CHANNEL LINING, CLASS IA

Anchor bars for Channel Lining, Class IA shall be grade 40 or better steel reinforcing bars of the dimensions shown on the standard drawing. Acceptance of the anchor bars will be based on visual inspection by the Engineer.

2.7 CHANNEL LINING CLASS IV

See KDOH Subsection 204.09.01

2.8 GEOWEB SYSTEM

The Geoweb Cellular Confinement System shall be as manufactured by Presto Products Co., or equal.

The base material shall be a polyethylene polymer with a density of 58.4-60.2 IB/FT^3.

The web shall be black in color.

The polyethylene strips shall be textured and perforated such that the peak friction angle between the surface of the textured/perforated plastic and #40 silica sand at 100% relative density shall be no less than 85% of the peak friction angle of the silica sand in isolation when tested by the direct shear method per ASTM D 5321.

The short term peel strength for 8" cell depth shall be 640 IBF.

2.9 GEOWEB SYSTEM

The Geoweb Cellular Confinement System shall be installed in accordance with the manufactured specifications.

A manufacturer's representative shall be on site to monitor the installation and shall approve all connections, tendons, and anchors prior to backfilling.

CONSTRUCTION REQUIREMENTS

3. GENERAL FOR SLOPE PROTECTION

Slopes on which protection is placed shall be no steeper than the natural angle or repose, unless otherwise indicated on the plans or directed. The slopes shall be shaped to the slope and contour indicated or directed. Slope templates shall be used in determining the slope. Depressions shall be brought to the required slope line with fill material moistened and compacted as directed.

Unless otherwise shown on the plans or unless solid rock is encountered all slope protection, except crushed aggregate slope protection, shall begin in a trench 2 feet below the natural ground. Where solid rock is encountered, the lower terminus of the slope protection shall stop at the solid rock line unless otherwise directed.

4. CYCLOPEAN STONE RIPRAP SLOPE PROTECTION

Cyclopean stone riprap shall be constructed to a minimum thickness of 2 feet measured perpendicular to the slope. The stone may be dumped in place and placing shall be conducted in a manner to produce a surface of approximate regularity not varying more than 6 inches from a true plane.

5. CRUSHED AGGREGATE SLOPE PROTECTION

Unless otherwise shown, the aggregate shall be placed to a debt of one foot measured perpendicular to the slope flush with the embankment slopes under the bridge; shall extend from the face of the abutments or end bents across the berm and down the slope to the toe of the slope; and shall extend laterally to 1 1/2 feet beyond the outer edges of the superstructure.

The crushed aggregate may be dumped in place. Placing shall be conducted in a manner to produce a uniform surface varying no more than 1 1/2 inches in 4 feet from a true plane. Hand placing will not be required except as necessary to correct irregularities exceeding the specified tolerances.

6. GENERAL FOR CHANNEL LINING

Before placing any channel lining materials, all excavation and shaping of the area to receive the channel lining shall be performed, so that the completed channel lining will be uniform, and will conform to the designated lines, grades, and cross sections.

7. CHANNEL LINING, CLASS II, III, IV

Channel Lining Classes II and III shall be constructed to the dimensions shown on the plans or directed by the Engineer. The stone may be dumped in place, and the placing shall be conducted in a manner to produce a surface of approximately regularity, varying no more than 3 inches from a true plane. Hand placing will not be required except as a necessary to correct any surfaces irregularities exceeding the specified tolerance.

7.1 CHANNEL LINING, CLASS IV

See KDOH subsection 204.09.01 and Section 204.11 for requirements covering Channel Lining, Class IV

8. CHANNEL LINING, CLASS IA

Empty mattress units shall be set to the required line and grade. Lacing wire shall be used to join the units together.

After the mattress units are set to line and grade, they shall be stretched to remove any kinks from the mesh and to hold alignment.

The mattress units shall be filled carefully with stone fill placed by hand or machine to ensure good alignment and to avoid bulging of the mesh with a minimum of voids between

the stones. After a unit has been filled, its top shall be placed so that it meets the sides and ends of each mattress unit. The top shall then be secured to the sides, ends, and the diaphragms with lacing wire as shown on the standard drawing.

If the mattress unit is placed on a grade the placing of the stone shall begin at the bottom of the slope and progress upgrade. Mattress units shall be overfilled approximately one inch to allow for settlement.

When a complete mattress unit cannot be installed on the slope because of space limitations, the unit shall be cut to fit, in the manner indicated on the plans.

When required, anchor bars shall be driven in place at the location shown on the standard drawing.

9. METHOD OF MEASUREMENT

Cyclopean stone riprap or crushed aggregate for slope protection will be measured in tons for the material complete and accepted in the final work.

Stone used in each class of channel lining except channel lining, Class IV will be measured in tons complete and accepted in the final work.

All excavation required for the construction of slope protection will be considered incidental to the construction and will not be measured for separate payment. No separate measurement will be made for excavation below the upper surface of any channel lining as this is considered incidental to the channel lining.

No separate measurement will be made for anchor bars, wire mesh, lacing wire, or other material necessary to acceptably complete the wire mattress units for Channel Lining, Class IA, as these materials are considered incidental to Channel Lining, Class IA.

10. BASIS OF PAYMENT

The accepted quantities of cyclopean stone riprap or crushed coarse aggregate will be paid for at the contract unit price per ton. The accepted quantity of stone for each specified class of channel lining will be paid for at the contract unit price. Such payment shall be full compensation for furnishing all materials, labor, and equipment necessary to complete the work.

Payment will be made under:

PAY ITEM	PAY UNIT
Cyclopean Stone Riprap	Ton
Crushed Aggregate Slope Protection	Ton
Channel Lining, Class IA	Ton
Channel Lining, Class II	Ton
Channel Lining, Class III	Ton
Channel Lining, Class IV	See KDOH Section 204.12

SECTION 02230 - SUBGRADE

1. DESCRIPTION

Preparation of the subgrade shall include compacting to the required density and shaping to conform to the required lines, grades, and cross sections, all in accordance with the applicable provisions of these specifications.

2. GENERAL

Before construction of the base course, pavement, or surface is begun, the subgrade shall be prepared to the full width of the widest course plus one foot additional width beyond each edge, unless otherwise shown on the plans.

The subgrade shall be shaped to conform to the lines, grades, and cross section indicated on the plans or established by the ENGINEER. All high areas of the roadbed shall be removed, by scarifying when necessary, and all low areas shall be filled with approved material and compacted. The roadbed shall not be disturbed below subgrade elevation, except when necessary to comply with requirement herein specified.

The subgrade shall be compacted, as nearly as practicable, to a uniform density throughout. Except when otherwise provided, the compaction and moisture control requirements shall be in accordance with the requirements of Section 02223 as governed by the requirements for the embankment construction in the same contract. Should the subgrade subsequently lose its density due to exposure to severe weather conditions, after having been previously compacted to the required density during the construction of the grade, it shall be recompacted to the required density.

Areas of yielding or unstable material shall be excavated and backfilled with approved material as directed. The expense of such work in embankment areas shall be borne by the CONTRACTOR.

When the material in place does not contain sufficient moisture, or is too wet, to obtain proper compaction, the moisture content shall be increased or reduced as directed, and the material compacted. Scarifying of the subgrade may be required.

When a sheepsfoot roller is used, the compaction shall be finished by either a 3-wheel roller or a multiple-wheel pneumatic-tire roller of sufficient weight to smooth out and compact the indentations made by the sheepsfoot roller. On subgrade for traffic bound courses, the indentations, may be removed by a blade grader.

When excess dust is present on the subgrade, it shall either be wetted or completely removed and replaced by suitable material before any aggregate is placed thereon, at no additional cost to the OWNER.

A grading machine shall be operated over all subgrades as necessary to maintain a uniform cross section free from irregularities. All subgrades shall be prepared a sufficient distance ahead of the base course or pavement construction to permit the required testing and checking of the subgrade before any aggregate is placed. The CONTRACTOR shall furnish templates and labor required for checking the subgrade.

When the original grade is constructed to an elevation higher than that of the subgrade, the subgrade shall be formed by trenching. This work shall consist of cutting a channel in the roadway to the width of the base or pavement plus one foot additional width beyond each

edge. All provisions set forth in this Section shall be required as applicable to the type of construction.

3. CONSTRUCTION TOLERANCES

All subgrades being prepared for base or surface courses, except traffic bound courses, shall show no deviation greater than 1/2 inch from the specified crown section, and shall be constructed uniformly so the subsequent base and/or surface courses can be constructed within their specified tolerances.

4. PROTECTION AND MAINTENANCE

All ditches and drains shall be completed in order to drain the roadbed effectively before any construction materials are placed thereon. The CONTRACTOR shall take every precaution to protect the subgrade and shall repair and restore to proper condition all damage that may be caused by hauling of material or by other causes, and not material shall be placed on any subgrade until it has been restored and accepted.

Equipment used for hauling materials over the completed subgrade shall be equipped with pneumatic tires. Equipment of such weight as to cause rutting shall not be permitted to operate over the subgrade.

No storage or stockpiling of materials will be permitted on a completed subgrade unless otherwise provided.

No surfacing materials shall be placed on a frozen, muddy, soft, or yielding subgrade.

Under no circumstances shall holes be gouged or dug in the back slopes or the embankment to obtain materials for correcting the subgrade, or for any other purpose.

5. METHOD OF MEASUREMENT

Preparation of the subgrade will not be measured for payment, and is incidental to the roadway excavation or embankment in place.

Water used for maintaining moisture for subgrade compaction and water used for conditioning the subgrade immediately in advance of base or pavement construction will not be measured for payment, but will be considered incidental to other items in the contract.

6. BASIS OF PAYMENT

The accepted quantities thus measure will be paid for at the contract unit prices. Payment shall be full compensation for all work required by this Section.

Payment will be made under:

PAY ITEM	PAY UNIT
Roadway Excavation	See Section 02222
Embankment in Place	See Section 02223

SECTION 02231 - DENSE GRADED AGGREGATE BASE

11. BASIS OF PAYMENT

1. DESCRIPTION

This base course shall consist of graded aggregate and water mixed with or without an admixture, placed on a prepared subgrade, and shaped and compacted to the line, grades, and cross sections shown on the plans.

2. MATERIALS

Materials shall meet the requirements specified in the following KDOH sections.

Aggregate	805
Calcium Chloride	825

Water used in the mixture will be subject to approval by the ENGINEER on the project.

When approved by the ENGINEER, the aggregate may be produced by blending 2 or more aggregate sizes. When blending is permitted, the separate aggregate sizes shall be fed uniformly into the mixer and a synchronized proportioning system between the separate feeders shall be provided.

3. GENERAL

The subgrade shall be prepared in accordance with Section 6, and shall be maintained free from irregularities.

It is intended that the dense-graded aggregate base course shall be completely covered with the specified pavement courses before the work is suspended for the winter months. The CONTRACTOR shall make every reasonable effort to accomplish this objective. When the dense-graded aggregate base course is not completely covered with the specified pavement courses, the ENGINEER will then determine the extent of any further work necessary to protect and maintain the uncompleted work during the winter months and until the beginning of spring paving operations. When extra materials, methods, and construction techniques, not a part of the specified construction, are determined to be necessary to protect, maintain, and repair any portion of the uncompleted work, the cost of such extra materials, methods, and techniques shall be borne by the CONTRACTOR.

4. MIXING

The dense-graded aggregate and the water shall be thoroughly mixed in a twin shaft pugmill type mixer, unless another type of mixer is approved. The amount of water added to the aggregate shall be approved and shall be an amount which will provide the mixture with a satisfactory moisture content for compaction to the specified in-place density. The rate of flow of the water to the pugmill shall be controlled by valves or other devices which can be easily reset when a change in the rate of flow is desirable. The water supply system shall be equipped with a positive cut-off control which will stop the flow of water simultaneously with any stoppage in the flow of aggregate in the pugmill.

5. TRANSPORTING

The plant-mixed material shall be transported in such manner as to deliver the mix to the project without loss or segregation. Each truck load shall be covered with a heavy canvas sheet to reduce the loss of moisture in transit whenever the time between loading the truck and spreading the mixture exceeds 30 minutes.

6. PLACING AND SPREADING

The mixture shall be placed and shaped, by power equipment, to the specified lines, grades, cross sections, and depths, without segregation.

Placing, spreading, shaping, and compacting shall be continuous as practicable during each day's run. The base shall be wetted as directed during shaping and compaction operations to maintain the moisture content at the level necessary to ensure proper compaction.

Unless otherwise provided or permitted, the compacted depth of each layer shall be no less than 3 inches nor more than 6-1/2 inches.

Before placing the base material, the subgrade or previous base layer shall be wetted as directed.

7. COMPACTING

Each layer of base material, after being shaped to the required lines and cross section, shall be compacted to a density of no less than 84 percent of solid volume throughout the layer. The density determination will be based on the oven-dry, bulk specific gravity KM 64-607.

When the total compacted thickness of the base is 4 inches or less, acceptability of compaction will be determined either by nuclear gages or by visual inspection, at the option of ENGINEER; in all other cases in-place density will be determined by nuclear gages or by KM 64-512. When compaction of base 4 inches or less in thickness is accepted by visual inspection, no reduction of compactive effort is intended.

Manually operated mechanical tampers shall be used in areas inaccessible to power equipment

Initial layers of base shall be maintained to a uniform grade and cross section during compaction. the final layer shall be shaped, with additional material added when necessary, so that the completed base is true to the required lines, grades, and cross sections.

8. MAINTENANCE AND PROTECTION

Traffic on the completed base should be held to the minimum necessary to complete the work and/or maintain public traffic. Any damage such as raveling or areas which lose density shall be repaired as directed before covering with base or surface courses. Areas subject to traffic shall be moistened as directed, to avoid the loss fine materials, and the surface of these re-checked for grade and cross section and necessary corrections made as directed, before base or surface courses are constructed. At the CONTRACTOR'S option, dilute emulsified asphalt may be used for dust control, at the CONTRACTOR'S expense.

9. SURFACE TOLERANCES

The surface of the top course of the base shall be smooth and uniform and shall not deviate more than 1/2 inch from the specified cross section at any point and shall not deviate from

the specified longitudinal grade more then 3/8 inch in 10 feet at any location. When final grading is to be performed by an automatic grading machine, the base shall be trimmed to such accuracy that the succeeding base and/or surface courses will meet their respective specified surface and thickness tolerances.

The CONTRACTOR shall furnish all devices necessary to check the surface, such as stringlines, straightedges, etc., and the labor necessary to handle the devices.

10. METHOD OF MEASUREMENT

Water used to moisten the subgrade prior to placing base, in mixing the base material, and to maintain moisture during compaction and maintenance of the base will not be measured for separate payment, but will be considered incidental to DGA Base.

11. BASIS OF PAYMENT

Payment shall be made for the completed and accepted quantities under the following:

PAY ITEM	PAY UNIT
DGA Base	Ton

SECTION 02510 - BITUMINOUS CONCRETE BASE

1. DESCRIPTION

This base course shall consist of one or more courses of hot-mixed, hot-laid bituminous concrete mixture constructed on a prepared subgrade, old surface, or underlying course, and in reasonably close conformity with the lines, grades, and typical cross sections shown on the plans, or as otherwise directed.

2. MATERIALS

Materials shall conform to the requirements of KDOH Sections 401 through 403.

3. GENERAL

The requirements of KDOH Sections 401 through 403 shall apply, except as provided herein.

Each layer of bituminous concrete base shall be constructed to a compacted thickness no less than 2 inches nor more than 4 inches, unless otherwise directed.

4. DENSITY REQUIREMENTS

Resurfacing and Initial Treatment Projects. All requirements of KDOH Section 403 concerning roller coverage shall be met when the total bituminous concrete base is less than 4 inches thick. Unless otherwise specified in the contract, the density requirements specified hereinafter for New Construction shall apply to resurfacing, initial treatment, reconstruction, or rehabilitation projects when bituminous concrete base has a total thickness of 4 inches or more.

New Construction. In lieu of the roller coverage requirements of KDOH Section 401.17, density requirements as specified in this Section will be applicable on all new construction projects. Laboratory density determinations will be made in accordance with KM 64-411 using the Marshall Stability test method in order to establish a job-mix formula design density for the bituminous mixture to be used in the work. The ENGINEER will make one density determination in accordance with KM 64-412 for each 1,200 square yards of base course placed. The density of each 1,200 square yard section determined by KM 64-412 shall not be less than 95.0 percent of the job-mix formula design density as established by KM 64-411, and the average density of any 10 consecutive sections no less than 96.0 percent of the job-mix formula design density. In the event the in-place density is less than 95.0 percent of the design density, the CONTRACTOR shall resume and continue compaction until such time additional tests indicate satisfactory density has been obtained, or until the ENGINEER determines it is impractical to continue rolling. Compaction equipment shall be such that the required density is obtained and all other requirements of KDOH Section 403 are met.

When the specified density is not being consistently obtained, the ENGINEER may suspend placing operations until the CONTRACTOR makes such changes in equipment, or other phases of the operation, as may be necessary to obtain the specified density.

The ENGINEER may accept density less than specified for the first course of bituminous concrete base placed directly on DGA base, gravel base, subgrade, or an existing pavement, if the CONTRACTOR provides suitable compaction equipment and procedures, and the ENGINEER determines that additional compactive effort may be detrimental.

The lift thickness may be increased when approved, providing satisfactory results are obtained.

No additional payment will be made for special equipment or work necessary to obtain the specified density as this is considered incidental to the price bid for Bituminous Concrete Base.

5. THICKNESS TOLERANCES

5.1 Initial Treatment and Resurfacing Projects

Total combined thickness of all layers of bituminous concrete base shall be in reasonable close conformity with the requirements of the plans. Thickness will be controlled by controlling the rate of application. The mixture shall be placed at the weight per square yard designated by the plans or by the ENGINEER. The rate of application shall not exceed the designated rate by more than 5 percent. No payment will be made for any material placed in excess of this 5 percent tolerance.

5.2 New Construction

(A) General. The ENGINEER will make thickness checks in accordance with KM 64-420, as soon as is practical after completion of all, or a major portion, of the bituminous concrete base. When the CONTRACTOR so elects, coring may be performed in accordance with KM 64-420 by the CONTRACTOR'S personnel and equipment, provided the work is performed under the ENGINEER'S supervision and all measurement of cores is performed by the ENGINEER.

When an overlay is placed as hereinafter required, the gradation of the overlay material may be modified when thin overlays are necessary, but any modification must be approved before the material is used. When an overlay is constructed, adjacent work such as storage lanes, approaches, entrances, etc., shall be overlaid to the extent necessary to match their grades to the overlay section, whether these adjacent areas are deficient in thickness or not.All core holes shall be filled by the CONTRACTOR, either with compacted bituminous mixtures or portland cement concrete, and all remedial overlay work completed before the final course is placed. Neither measurement and payment nor deduction will be made for material and labor necessary to fill core sample holes.

(B) Payment on Basis of Weight. When payment for Bituminous Concrete base is based on tonnage placed, the total combined thickness of all layers shall be within plus or minus 0.5 inch of compacted plan thickness.

In the event core thickness in excess of 0.5 inches of compacted plan thickness is encountered, a theoretical deduction of Bituminous Concrete Base as determined excess shall be deducted from payment. The deduction shall be for that thickness exceeding the 0.5 inch tolerance. When calculating the deduction for excess thickness, any leveling course placed at the CONTRACTOR'S expense will not be included in the thickness measurements. Leveling or other material placed on top of the

completed base at the direction of the ENGINEER, and at the OWNER'S expense, will not be included when calculating excess thickness.

If the ENGINEER deems it necessary to check the thickness of the overlaid area by coring, the cost of this additional coring will be deducted from monies due or to become due to the CONTRACTOR when deficient thickness is found on recording.

If the placement of additional material is not feasible due to the proximity of structures, blocking of drainage, or other engineering reasons, the ENGINEER may waive the requirement for overlaying. In this event, the ENGINEER will require a deduction form payment of the theoretical quantity of Bituminous Concrete Base as determined deficient.

6. METHOD OF MEASUREMENT

Unless otherwise provided, Bituminous Concrete Base will be measured in tons and shall be weighed in accordance with the requirements of KDOH Sections 109 and 402.

7. BASIS OF PAYMENT

The accepted quantities thus measured will be paid for at the contract unit price per ton. Payment shall be full compensation for furnishing, hauling, and placing all materials, and all labor, equipment, and incidentals necessary to complete the work specified.

Partial payments will be made as the work progresses, based on the ENGINEER'S estimate of materials placed.

Payment will be made under:

PAY ITEM	PAY UNIT
Bituminous Concrete Base	Ton

SECTION 02511 - BITUMINOUS CONCRETE SURFACE

1. DESCRIPTION

This work shall consist of constructing one or more courses of bituminous concrete surface on a prepared base in accordance with these specifications, and in reasonably close conformity with the lines, grades, thickness, and typical cross sections shown on the plans or established by the ENGINEER.

This bituminous surface shall be composed of a mixture of aggregate, filler when required, and bituminous material.

2. MATERIALS

See KDOH Section 401 through 403.

Bituminous Concrete Surface mixtures used in the final surface course shall contain polish resistant aggregate meeting the requirements of KDOH Sections 804 and 805.

3. CONSTRUCTION REQUIREMENTS

See KDOH Section 403.

4. METHOD OF MEASUREMENT

The bituminous concrete mixture will be weighed in accordance with KDOH Sections 109 and 403.

5. BASIS OF PAYMENT

The accepted quantities thus measured will be paid for at the contract unit price per ton. Payment shall be full compensation for all work required by this Section.

Payment will be made under:

PAY ITEM	PAY UNIT
Bituminous Concrete Surface	Ton

SECTION 02512 - BITUMINOUS PRIME AND TACK COAT

1. DESCRIPTION

This work shall consist of preparation of existing bases or surfaces, and the application thereto of liquid bituminous material prior to the placing of courses of bituminous mixtures or treatments.

2. MATERIALS

Any of the following emulsions are permitted for use as a tack material: SS-1, SS-1h, CSS-1, CSS-1h, AE-60, RS-1, or CRS-1. Cutback asphalts may be used only with the written permission of the ENGINEER, and shall be in conformance with all applicable laws and regulations concerning air pollution control. All tack materials shall meet the applicable requirements of KDOH Section 806.

Bituminous material for prime shall meet the requirements of KDOH Section 806. Primer-L shall be furnished unless other material is permitted by the contract.

3. GENERAL

Bituminous Prime Coat shall consist of the application of liquid bituminous material, having penetrating properties, to granular type bases.

Bituminous Tack Coat shall consist of the application of liquid bituminous material to the surface of concrete or brick pavements and bases, to existing bituminous surfaces, and, when necessary, to newly constructed bituminous courses.

All equipment required for performance of this work shall be approved before construction is started, and shall be maintained in a satisfactory operating condition.

The CONTRACTOR shall provide hand brooms and other small tools and equipment essential to the completion of the work in addition to a mechanical broom or sweeper, bituminous heating equipment, and a pressure distributor as hereinafter described.

The temperature limitations for applying prime and tack coats shall be that specified for the type of construction with which such work is included. Prime and tack coats shall not be applied to wet surfaces.

4. WEATHER LIMITATIONS

The temperature limitations for applying prime and tack coats shall be that specified for the type of construction with which such work is included. Prime and tack shall not be applied to wet surfaces.

5. EQUIPMENT

A mechanical broom or sweeper shall be provided which is adjustable to uniform contact with the surface and designed to thoroughly clean without cutting into the surface being swept.

Equipment for heating bituminous material in tanks, railroad cars, trucks and distributors shall meet with the approval of the ENGINEER and shall be capable of heating the material to the required temperature without introduction of moisture, localized overheating or otherwise changing the characteristics of the material.

The pressure distributor shall be mounted on a self-propelled motor vehicle equipped with pneumatic tires and shall have sufficient power to maintain a constant and uniform speed under all operating conditions. The distributor shall be designed to apply the material uniformly at the rate required for the type of construction. For tack coat treatments, a minimum rate of application of 0.8 pound (0.05 gallon) per square yard will be required. The distributor shall meet the following requirements:

(A) Tank. The tank shall have a capacity of at least 600 gallons. It shall be equipped with a removable manhole cover, an overflow pipe, and a dial gage for indicating the contents mounted so as to be plainly visible to the operator. An accurate measuring stick shall be carried on the distributor at all times.

(B) Heating System. The heating system shall be so designed that even heating of the bituminous material will be ensured with efficient and positive control at all times. A temperature measuring device shall be provided that will quickly and accurately determine the temperature of the material.

(C) Distributing System. The pressure distributing system shall contain a separate power and pump unit of sufficient capacity to distribute the required quantity of bitumen at constant flow and uniform pressure. A dial pressure gage shall be mounted so as to be plainly visible to the operator.

(D) Spray Bar and Nozzles. The spray bar shall be full circulating and shall be adjustable in length to conform to the width of the application being made without overlapping. The spray bar shall be designed to swing laterally over a distance of 9 inches or more. There shall be provided a positive and immediate cut off and means for preventing dripping of the material onto the road surface when the flow is shut off. The nozzles shall be designed and maintained to provide an equal flow from all nozzles at the same time. To prevent clogging the nozzles, the circulating system shall be provided with screens which shall be dept clean. A hand spray bar and nozzle having an adequate length of flexible steel hose with packed couplings shall also be provided.

(E) Tachometer or Synchronizer. A tachometer shall be attached to the truck in such a manner as to be visible to the truck operator and to enable him to maintain the constant speed necessary for the correct application of the specified quantity of

bitumen. Suitable charts shall be furnished showing the truck speeds necessary to obtain the required results.

When a synchronizer is used, the tachometer my be omitted. The synchronizer shall deliver a specified quantity of bituminous material onto the road surface independent of the speed of the truck.

6. PREPARATION OF SURFACE

All surfaces shall be thoroughly cleaned of all dirt and other matter foreign to the surface being treated. Mechanical sweepers will be required for cleaning old paved surfaces when necessary. Sweeping with wire hand brooms will be required when necessary. Sweeping shall extend beyond the edges of the surface to ensure a thorough cleaning of the full width to be treated.

Under extremely dry conditions and prior to the prime treatment, the ENGINEER may require an application of water to granular bases, applied at the rate of approximately 0.15 gallon per square yard.

Existing traffic-bound base receiving an application of bituminous prime shall be graded and shaped to the required grade and cross section before any bituminous material is applied. Floater material shall be wetted and rolled into the existing traffic-bound macadam or wasted, as directed.

The surface as prepared shall be approved before the prime coat or tack coat is applied.

7. APPLICATION

Prime coats shall be applied at the rate specified in the contract, or as directed when conditions justify variations in the rates of application.

The number of applications of the prime coat shall be as directed. The material shall be applied under pressure. Hand pouring shall not be used except for special conditions, and then only when approved.

The prime shall be allowed to cure for at least 36 hours before being covered by the bituminous course unless otherwise approved.

At the time of application, the temperature of prime and tack materials shall be within the following ranges, in degrees Fahrenheit:

PRIME

MC-30	85*
MC-70	120*
Primer L	60-120
RT-2	60-125

TACK

SS-1, SS-1h, CSS-1, CSS-1h, AE-60	70-160
RS-1, CRS-1	70-140
RC-70	120*
RC-250	165*

* These temperatures should be used unless higher temperatures are required for satisfactory coverage. Caution must be exercised to prevent fire or explosion.

When RS-1, CRS-1, RC-70, or RC-250 is furnished for tack they shall be applied undiluted at the rate of 0.4 pound (0.05 gallon) per square yard, unless otherwise specified in the requirements for the bituminous mixture being placed.

When SS-1, SS-1h, CSS-1, CSS-1h, or AE-60 is furnished for tack the material may be applied without dilution providing uniform and satisfactory coverage is achieved. If an acceptable tack coat is not consistently achieved, the ENGINEER may direct that the SS-1, SS-1h, CSS-1, CSS-1h, or AE-60 be diluted with an equal quantity of water conforming to Section 803, be thoroughly mixed before application, and be applied a sufficient time in advance of the paver to ensure that all water has evaporated before the bituminous mixture is placed. Unless otherwise specified in the requirements for the bituminous mixture being placed, the application rate for undiluted SS-1, SS-1h, CSS-1, CSS-1h, or AE-60 shall be 0.4 pound (0.05 gallon) per square yard; when the ENGINEER requires dilution, the diluted material shall be applied at 0.8 pound (0.1 gallon) per square yard.

As specified in KDOH Section 404, tack material for Open Graded Friction Course shall be applied undiluted at the rate of 0.8 pound (0.1 gallon) per square yard.

If the initial application of any tack material is not uniform, the CONTRACTOR shall apply additional material as directed at no additional cost to the OWNER.

The tack coat may be applied with a spray bar which can be raised to a sufficient height so as to uniformly and completely coat the entire surface. When a uniform application, at the rate required, cannot be obtained from a spray bar, then the tack coat shall be applied by fogging with a hand spray attachment, and only complete and uniform coverage will be acceptable.

When, on newly constructed bituminous base courses or binder courses, the bituminous coating has been stripped from the aggregate due to abrasive action from traffic or to other causes, a light application of tack coating may be required.

Bituminous material applied in excess of requirements shall be removed, or shall be covered with blotter course of dry sand or stone chips as directed.

On projects over which public-traffic is being maintained, the tack coat shall be applied over one-half of the pavement width not to exceed one-half day's work in advance of the

construction of the bituminous cover course; provided, that at no time shall the tack coat application end at a location hazardous to traffic. Tack coat application requiring an overnight lane closures will not be allowed, unless approved in writing. The work shall be arranged so that at the end of runs all tack shall be covered with the bituminous mat or a sand blotter course. At road intersections or other traffic crossings, the ENGINEER may require the application of a sand blotter course over the tack coat.

When a bituminous paving material is placed adjacent to curbs, existing pavement, or other structures, the contact surface of the existing structure shall first be coated with tack material.

When RC-70 or RC-250 is furnished for the tack coat, a sufficient time and distance shall be allowed in advance of the paver to ensure that the volatiles have evaporated before any of the surface mixture is laid on the tacked surface. The surface mixture shall not be placed on the tacked surface until authorized.

When Sand for Blotter is included in the contract as a item, the tack coat shall be covered with surface dry natural sand in a minimum quantity sufficient to prevent pickup by traffic. The sand shall be applied uniformly at the rate as directed not to exceed 5 pounds per square yard. (The normal rate is 2 to 3 pounds per square yard.) All necessary precautions shall be exercised to prevent spotting or discoloring curbs, headwalls, and other structures. When any such discolorations occur, they shall be removed at the CONTRACTOR'S expense.

The CONTRACTOR shall provide necessary barricade, warning sign, and flagmen to ensure against traffic traveling over freshly applied prime or tack coat, and shall further provide for public convenience and safety as specified in Sections 104 and 107.

8. METHOD OF MEASUREMENT

When an approved cut-back asphalt is furnished for the tack coat, the actual quantity will be measured for payment. Only the actual quantity of undiluted SS-1, SS-1h, CSS-1, CSS-1h, or AE-60 furnished will be measured for payment, as the cost of the water for dilution will be considered incidental to the contract unit price for Bituminous Tack Coat. No measurement will be made for water used to prepare dry surfaces for prime, as this is considered incidental to the prime coat.

Bituminous materials for prime or tack will be weighed in accordance with the requirements of KDOH Section 109.

Sand for blotting tack coat will be weighed in accordance with the requirements of KDOH Section 109.

9. BASIS OF PAYMENT

No direct payment shall be made for prime and tack coat. All materials and labor required as prescribed in this section shall be considered incidental to the project.

SECTION 02520 – CONCRETE PAVEMENT

PART 1 - GENERAL

1.0 DESCRIPTION

This section includes, but is not limited to, all work necessary for final trimming of subgrade or subbase, integral curb, bars and reinforcement, joints and sealing, surface curing and pavement protection of concrete pavement.

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

KDOH Division 500 and 600

1.2 SUMMARY

A. This Section covers the requirements for the construction of unreinforced concrete pavement, with or without subbases, and may also include attached or integral curbs.

B. Related Sections may include the following:

Section 02231 - Subgrade
Section 02231 – Dense Graded Aggregate

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, slag cement, and silica fume; subject to compliance with requirements.

B. Cold Weather: a period when for more than three successive days the average daily outdoor temperature drops below 40°F (5°C). The average daily temperature is the average of the highest and lowest temperature during the period from midnight to midnight. When temperatures above 50°F (10°C) occur during more than half of any 24 h duration, the period shall no longer be regarded as cold weather.

C. Construction Joint: a joint constructed from two separate placements where the first has undergone final setting before the next placement.

D. Contraction Joint: formed, sawed, or tooled groove in a concrete structure to create a weakened plane and regulate the location of cracking resulting from the dimensional change of different parts of the structure.

E. Dowel Bars: steel pins, commonly plain round steel bars that extend into adjoining portions of a concrete construction, as at a joint in a pavement slab, to transfer shear loads.

F. Exposure Conditions:

1. Negligible: absence of exposure to freezing and thawing or to deicing agents.
2. Moderate: exposure to a climate where the concrete will not be in a saturated condition when exposed to freezing and will not be exposed to deicing agents or other aggressive chemicals.
3. Severe: exposure to deicing chemicals or other aggressive agents or where the concrete can become saturated by continual contact with moisture or free water before freezing.

G. Free Edge: the edge of pavement abutting an isolation joint or the edge of the pavement against which no concrete is placed.

H. Hot Weather: any combination of the following conditions that tend to impair the quality of freshly mixed or hardened concrete by accelerating the rate of moisture loss and rate of cement hydration, or otherwise resulting in detrimental results.

1. high ambient temperature above 90°F (32°C);
2. high concrete temperature;
3. low relative humidity;
4. wind velocity; and
5. solar radiation.

M. Isolation Joint: a separation between adjoining parts of a concrete structure, usually a vertical plane, at a designed location such as to interfere least with performance of the structure, yet such as to allow relative movement in three directions and avoid formation of cracks elsewhere in the concrete and through which all or part of the bonded reinforcement is interrupted.

N. Panel: an individual concrete slab bordered by joints or slab edges.

O. Project Drawings: graphic presentation of project requirements.

S. Subgrade: the soil prepared and compacted to support the pavement system.

T. Tie Bar: a reinforcing bar, commonly a deformed steel bar intended to transmit tension, compression, or shear through a construction joint.

V. Tolerances: the permitted deviation from a specified dimension, location, or quantity. Plus (+) tolerance increases the amount or dimension to which it applies or raises a level alignment. Minus (-) tolerance decreases the amount or dimension to which it applies or lowers a level alignment. A non-signed tolerance means + or -. Where only one signed tolerance is specified (+ or -), there is no limit in the other direction.

W. Unreinforced Concrete Pavement: concrete pavement that does not contain distributed deformed steel reinforcing bars or welded wire fabric. Pavement may include dowel bars at the joints (construction and possibly contraction joints) and tie bars in some locations.

X. Water/Cementitious Ratio (*w/cm*): the ratio of the mass of water, exclusive only of that absorbed by the aggregates, to the mass of cementitious material (hydraulic) in concrete, stated as a decimal.

Y. Work: the entire construction or separately identifiable parts thereof required to be furnished under the Contract Documents.

1.4 REFERENCED STANDARDS AND MANUALS

All standards and manuals referenced herein shall be the latest versions or editions. Check with the reference organization for latest published version and utilize this version on the project.

1. AASHTO M182: Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats

2. ACI 301: Specifications for Structural Concrete

3. ACI 306.1: Standard Specification for Cold Weather Concreting

4. ACI 308.1: Standard Specification for Curing Concrete

5. ACI CP-1: Technical Workbook for ACI Certification of Concrete Field Testing Technician-Grade 1

6. ASTM A36/A36M: Standard Specification for Carbon Structural Steel

7. ASTM A615/A615M: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

8. ASTM A775/A775M: Standard Specification for Epoxy-Coated Steel Reinforcing Bars

9. ASTM WK34874: New Specification for Epoxy-Coated Steel Dowels for Concrete Pavement

10. ASTM A820/A820M: Standard Specification for Steel Fibers for Fiber-Reinforced Concrete

11. ASTM C31/C31M: Standard Practice for Making and Curing Concrete Test Specimens in the Field 12. ASTM C33: Standard Specification for Concrete Aggregates

12. ASTM C39/C39M: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

13. ASTM C42/C42M: Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

14. ASTM C94/C94M: Standard Specification for Ready-Mixed Concrete

15. ASTM C138/C138M: Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete

16. ASTM C143/C143M: Standard Test Method for Slump of Hydraulic-Cement Concrete

17. ASTM C150: Standard Specification for Portland Cement

18. ASTM C171: Standard Specification for Sheet Materials for Curing Concrete

19. ASTM C172/C172 M: Standard Practice for Sampling Freshly Mixed Concrete

20. ASTM C173/C173M Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

21. ASTM C231/C231M: Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

22. ASTM C260/C260M: Standard Specification for Air-Entraining Admixtures for Concrete

23. ASTM C309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

24. ASTM C494/C494M: Standard Specification for Chemical Admixtures for Concrete

25. ASTM C595: Standard Specification for Blended Hydraulic Cements

26. ASTM C618: Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

27. ASTM C989: Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars

28. ASTM C1017/C1017M: Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete

29. ASTM C1064/C1064M: Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete

30. ASTM C1074: Standard Practice for Estimating Concrete Strength by the Maturity Method

31. ASTM C1077: Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation

32. ASTM C1116/C1116M: Standard Specification for Fiber-Reinforced Concrete

33. ASTM C1157: Standard Performance Specification for Hydraulic Cement

34. ASTM C1240: Standard Specification for Silica Fume Used in Cementitious Mixtures

35. ASTM C1260: Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)

36. ASTM C1293: Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction

37. ASTM C1567: Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)

38. ASTM C1602/C1602M: Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete

39. ASTM D698: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3))

40. ASTM D994/D994M: Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)

41. ASTM D1751: Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

42. ASTM D1752: Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

43. ASTM D2628: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

44. ASTM D3406: Standard Specification for Joint Sealant, Hot-Applied, Elastomeric-Type,for Portland Cement Concrete Pavements

45. ASTM D3963/D3963M: Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars

46. ASTM D5893/D 5893M: Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

47. ASTM E329: Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

48. ASTM E548: Standard Guide for Proficiency Testing by Interlaboratory Comparisons

49. ASTM E1980: Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces

50. CRSI's "Manual of Standard Practice," Latest Edition.

51. NRMCA QC 3 – Checklist for Certification of Ready Mixed Concrete Production Facilities

1.5 SUBMITTALS

A. Design Mixtures:

1. For each concrete mixture proposed for the Work.

2. Submit changes to design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

3. Only submit adjustments that involve changes in material sources or when the quantity of cementitious materials and aggregates vary by more than ±5% of that in the design mixtures or admixture quantities exceed the manufacturers recommended range

4. Indicate on delivery tickets of delivered batches of concrete amounts of mixing water withheld for addition at Project site.

B. Dowel and Tie Bar Steel Reinforcement Drawings: Drawings that detail placement. Include bar sizes, lengths, material, grade, and supports for concrete reinforcement.

C. Qualification Data: For each plant supplying, vehicle transporting, installer, laboratory, and technician involved in testing concrete for paving, submit documentation that the appropriate certifications have been obtained and are currently valid.

D. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories.
4. Fiber reinforcement.
5. Curing compounds.
6. Joint filler.

F. Field quality-acceptance inspection and testing reports as described in Section 3.11.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on project personnel qualified as ACI-certified Concrete Flatwork Technician and a supervisor who is an ACI-certified Concrete Flatwork Finisher.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer's production facilities and delivery vehicles certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities"
2. Personnel responsible for quality control/quality assurance of concrete, certified as NRMCA Concrete Technologist Level 2 or equivalent certification required by state highway agency in the jurisdiction of the Work.

C. Testing Agency Qualifications: An independent agency, complying with the requirements of ASTM C1077 and ASTM E329 for quality assurance testing indicated, as documented according to ASTM E548, or similar and acceptable to the Engineer.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program. Equivalent certification programs shall include a component that evaluates performance of the test methods.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength TestingTechnician or Concrete Laboratory Testing Technician - Level I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician -Level II.

D. Source Limitations: Use the same source of cementitious materials, aggregates, chemical admixtures and other ingredients for concrete mixtures for the duration of the project, unless otherwise permitted.

E. Concrete Mixture Design: A qualified laboratory shall perform material evaluation tests and design concrete mixtures. The qualified laboratory can be the concrete supplier's laboratory facility or an independent testing agency either of which shall be accredited for testing concrete mixtures and aggregates by the AASHTO Accreditation Program (AAP) or similar as accepted by the Engineer.

1.7 DELIVERY, STORAGE, AND HANDLING

Dowel and Tie Bar Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings, if used, on steel reinforcement.

PART 2 – PRODUCTS

2.1 CONCRETE MATERIALS

A. Comply with ASTM C94/C94M and the following requirements.

1. Cement: Conforms to ASTM C150, C595 or C1157.

2. Supplementary Cementitious Materials (SCMs):

   a. Fly ash conforming to ASTM C618.
   b. Slag cement conforming to ASTM C989.
   c. Silica fume conforming to ASTM C1240.

3. Water: Conforms to ASTM C1602/C1602M. Provide documentation required by ASTMC1602/C1602M when non-potable water is proposed for use.

4. Aggregates: Conform to ASTM C33.

2.2 STEEL REINFORCEMENT

A. Dowel and Tie Reinforcing Bars: When used, dowel and tie bars shall comply with the sizes and grades as shown on the plans. If dowel and tie bar material requirements are not shown on plans, comply with ASTM A615, Grade 60 (Grade 420) and:

   1. Dowel bars shall be plain bars cut true to length with ends square and free of burrs.

   2. Epoxy-Coated Joint Dowel Bars shall comply with ASTM A775/A775M1 epoxy coated.

   3. Plate Dowels shall be manufactured from hot rolled steel plate meeting ASTM A36.

   4. Tie bars shall be deformed bars.

B. Bar Supports: Dowel bar chairs or other devices for spacing, supporting, and fastening reinforcing bars in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.

2.3 ADMIXTURES

A. Air-Entraining Admixture: Conform with ASTM C260/C260M.

B. Chemical Admixtures: The following admixtures are permitted. Do not use calcium chloride or admixtures containing calcium chloride.

   1. Water-Reducing Admixture: ASTM C494/C494M, Type A.

   2. Retarding Admixture: ASTM C494/C494M, Type B.

3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.

5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.

6. Special Performance Admixture: ASTM C494/C494M, Type S.

7. Plasticizing Admixture for flowing concrete: ASTM C1017/C1017M, Type I.

8. Plasticizing and Retarding Admixture for flowing concrete: ASTM C1017/C1017M, Type II.

2.4 FIBER REINFORCEMENT

A. Carbon-Steel Fiber: Comply with ASTM A820.

B. Synthetic Fiber: Utilize polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C1116/C1116M, Type III.

2.5 CURING MATERIALS

A. Liquid Membrane-Forming Compounds: Utilize a Membrane-Forming Curing Compound complying with ASTM C309, Type 2, Class A consisting of a waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: If used, comply with AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz/yd2 (305 g/m2) when dry.

C. Moisture-Retaining Cover: If used, comply with ASTM C171, polyethylene film or white burlap-polyethylene sheet.

2.6 JOINT AND SEALANT MATERIALS

A. Isolation Joint Materials: When used, comply with ASTM D994/D994M, D1751, or D1752, or as shown on plans.

B. Joint Sealing Materials: When used, comply with the following:

1. Hot-Poured Elastomeric Type; ASTM D3406

2. Silicone Rubber Type (cold applied); ASTM D5893/D5893M

3. Single-Component Elastomeric Type (preformed); ASTM D2628

2.7 CONCRETE MIXTURES

A. Mixture Design: Prepare design mixtures for each type and strength of concrete required, proportioned on the basis of field test records or laboratory trial mixtures according to ACI 301. Use a qualified laboratory in accordance with Section 1.6.E for preparing and reporting proposed mixture designs when proposed mixtures are based on laboratory trial mixtures.

1. Supplementary Cementitious Materials (SCMs): For concrete that will be in a Severe Exposure Condition, limit percentage of supplementary cementitious materials, by weight of total cementitious materials, to a maximum quantity as follows:
   a. Fly Ash: 25 percent.
   b. Slag Cement: 50 percent.
   c. Silica Fume: 10 percent.

2. Strength: Specified compressive strength shall be 4,000 psi (28 MPa) at 28 days, unless otherwise specified.

3. Total Air Content: Comply with Table 1, unless otherwise specified. The tolerance for air content shall be ±1.5%.

4. Aggregates: Nominal maximum aggregate size shall not exceed 1/3 of the specified pavement thickness.

   a. When required by the Engineer, provide results of aggregate tests for alkali silica reactivity in accordance with ASTM C1260. Concrete Pavement for Parking Lot Applications 32 13 13.50 - 10 NRMCA 01/2012 (Revision 0)

   b. When ASTM C1260 expansion at 14 days measured on each source of aggregate exceeds 0.10%, provide test results with the aggregate and proposed combination of cementitious materials with an expansion that is less than or equal to 0.10% at 14 days, in accordance with ASTM C1567.

5. Slump: For pavements placed other than by using slipform equipment, nominal slump shall be 4 in. (100 mm), unless otherwise permitted. For pavements placed using slipform equipment the maximum slump shall be 2 in. (50 mm), unless otherwise permitted. Tolerance for slump stated in ASTM C94/C94M shall apply.

B. Submit documentation for mixture proportions of concrete mixtures proposed for use in accordance with ACI 301 and Section 1.5.B herein.

PART 3 – EXECUTION

3.1 SUBGRADE PREPARATION

A. Prepare subgrade as required by the plans.

B. Re-grade and re-compact subgrade disturbed by concrete delivery vehicles or other construction equipment to the requirements of Section 3.1.A.

C. Do not use sand or loose material to obtain final subgrade elevation.

3.2 FORMWORK

A. Construct formwork so concrete pavement is of size, shape, alignment, elevation, and position indicated and so that the pavement is within the tolerance limits of Section 3.10 Tolerances.

B. Construct forms tight enough to prevent loss of concrete mortar.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces.

D. Clean forms and adjacent surfaces to receive concrete. Remove debris from forms just before placing concrete.

E. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

F. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement, if used.

G. The edge of previously placed concrete may be used as a form. Do not apply form release agent to previously placed concrete, unless prevention of bond between the new and the old concrete is desired.

H. Formwork may be removed after cumulatively curing at not less than 50°F (10°C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

I. Clean and repair surfaces of forms to be reused in the Work. Damaged forms will not be acceptable. Apply new form-release agent.

J. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets.

3.2 STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Clean dowel and tie bar reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Place joint reinforcement at locations indicated on project drawings. Align dowels exactly centered over the joint line.

D. Anchor dowel baskets securely into the subgrade. For paving lane widths greater than 12 ft (3.66 m), install a minimum of 4 stakes on the leave side of both basket legs.

E. Do not place bent dowel baskets. Do not leave bent dowel baskets in place.

F. At time of paving, make sure all dowels are parallel to the center line of the drive lane, parallel to the base, baskets are properly pinned, and the center of each basket (i.e., the joint location) is clearly marked. NRMCA 01/2012 (Revision 0)

G. Place and align to meet the requirements of Section 3.10, Tolerances.

H. For epoxy-coated dowel bar reinforcement, if used, repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D3963/D3963M.

3.3 CONCRETE PLACEMENT

A. Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, and ASTM C1116/C1116M when fibers are used, and furnish batch ticket information required by these specifications.

B. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

C. When placing and finishing fixed-form concrete pavement, comply with the following steps:

1. Deposit concrete directly from the transporting equipment onto the subgrade or subbase.

2. Do not place concrete on frozen subgrade or subbase.

3. Other methods of conveying the concrete may be used when specified or permitted by the Engineer.

5. Deposit concrete between the forms to a uniform height.

6. Consolidate concrete to remove voids and air pockets. Do not move concrete horizontally with a vibrator.

7. Strike off concrete between forms using a form riding paving machine, vibrating screed, or laser screed. Other strikeoff devices may be used, such as a highway straightedge or scraping straightedge, when approved by the Engineer.

8. Immediately after strikeoff and before bleed water appears on the surface, level concrete with a bullfloat.

9. Do not use steel trowels or power finishing equipment, unless otherwise specified or permitted.

9. Finish the pavement to the elevations, cross slope, and thickness specified in the project drawings and meet the requirements of Section 3.10, Tolerances.

D. When placing and finishing slipform concrete pavement, comply with the following steps:

1. Deposit and finish concrete in conformance with Section 3.5.C.

2. The slipform paver shall be operated with adherence to continuous forward movement as possible, and as such, all delivery and spreading of concrete shall be coordinated so as to provide uniform progress without stopping and starting the machine. Coordination with the concrete supplier is especially important to achieve the desired result.

3. Adjust the vibrator frequency for varying paver speeds and turn off vibrators when the paver stops.

4. When the slipform paver is to ride on the edge of a new concrete pavement, the concrete strengths of the riding surface shall be greater than 2,000 psi (14 MPa), determined by testing field cured specimens in accordance with ASTM C31 or maturity methods.

5. String lines or other means for setting grade should be checked frequently.

E. Edging:

1. Edge top surface edges to a radius of 1/4 in. (6 mm).

2. Do not tool edges if the joint is to be widened to provide a reservoir for joint sealant.

F. Final Surface Texture: Complete final texturing as soon as possible after finishing, but before the concrete has attained its initial set.

1. Artificial Turf Drag:

a. Drag artificial turf longitudinally along the concrete pavement surface after finishing. The turf shall be mounted on a work bridge or a moveable support system capable of varying the area of turf in contact with the pavement.

b. The turf drag shall be a single piece of artificial turf of sufficient length to span the full width of the pavement being placed. The turf shall have a means to adjust the height and/or length so as to always maintain a minimum of 4 ft (1.2 m) longitudinal length of turf in contact with the concrete being placed. Where construction operations necessitate and with the approval of the Engineer, the length and width of the turf may be varied to accommodate pecific applications.

c. The turf used shall be an artificial grass type having a molded polyethylene pile face. The pile shall contain blades that are curled and/or fibrillated. The pile shall not contain straight, smooth monofilament blades. The pile shall include blade lengths of 0.6 to 1.3 in. (15 to 33 mm). The turf shall have a minimum weight of 60 oz/yd2 (2,035 g/m2). The backing shall be a strong, durable material not subject to rot, and shall be adequately bonded to withstand use as specified.

d. Turf dragging operations should be delayed if there is excessive bleed water.

e. Prevent the turf from getting plugged with grout or dragging larger aggregates or foreign materials by cleaning or replacing as necessary.

f. Measures should be taken to ensure a surface of uniform appearance that is free from deep striations.

g. Turf should be thoroughly cleaned or replaced at the end of each day's use. Damaged or worn turf should be repaired and/or replaced.

h. When surface corrections for pavement smoothness are made in the hardened concrete, no additional texturing is required.

2. Broom Finish:

a. Broom concrete surface with a steel or fiber broom to produce corrugations between 1/16 and 1/8 in. (2 and 3 mm) deep.

b. Broom perpendicular to nearest edge of pavement. Broom all areas of a panel in the same direction.

c. Use the same type and manufacture of broom for all paved surfaces to provide a consistent appearance.

d. Other methods of producing final surface texture may be permitted when specified or accepted by the Engineer.

G. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, initial freezing, freezing and thawing cycles, or low temperatures.

1. Concrete temperature as delivered and temperature of placed concrete shall be maintained within the temperature range required by ACI 301.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified or permitted.

H. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 95°F (35°C) at time of placement. Chilled mixing water or ice may be used to control temperature. Quantity of ice used shall be included in the total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.4 CONCRETE PROTECTION AND CURING

A. Protect the concrete from damage due to rain. Have available, near the site of the work, materials for protection of the edges and surface of the concrete. Should any damage result, the Engineer will suspend operations until corrective action is taken and may require removal and replacement of the rain-damaged concrete.

B. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

C. Apply curing compound immediately after final surface texture has been obtained and water sheen has disappeared.

D. Apply membrane-forming curing compound to all exposed surfaces at a maximum coveragerate of 180 ft2/gal. (5 m2/L).

E. When using liquid membrane-forming compounds, if the evaporation rate2 during paving operations does not exceed 0.1 lb/ft2/hr (0.49 kg/m2/hr), then only 1 coat of membrane curing compound at an individual application rate not to exceed 180 ft2/gal. (5 m2/L) is permissible. Do not allow the concrete surface to dry before applying the curing compound. Remove any standing pools of bleed water that may be present on the surface before applying the curing compound. Apply the first coat within 10 min. after completing texturing operations. If applicable, apply the second coat within 30 min. after completing texturing operations.

F. Maintain and promptly repair damage to curing materials on exposed surfaces of concrete pavement continuously for at least 3 curing days, or until the pavement is open to the traveling public, whichever occurs first. A curing day is defined as a 24-hr. period when either the temperature taken in the shade away from artificial heat is above 50°F (10°C) for at least 19 hr. or when the surface temperature of the concrete is maintained above 40°F (5°C) for 24 hr. Curing begins when the concrete curing system has been applied. Stop concrete paving if curing compound is not being applied promptly and maintained adequately.

G. Apply curing compound to pavement edges after forms, if used, have been removed.

H. Alternative curing methods may be used in accordance with this specification or with ACI 308.1 when acceptable to the Engineer.

3.5 JOINTS

A. Construct joints at the locations, depths, and with dimensions indicated on the project drawings or accepted drawings submitted by the contractor.

B. If jointing requirements are not indicated on the project drawings, the contractor shall submit drawings describing proposed jointing in accordance the requirements of 3.7.B.1 through 3.7.B.9. The contractor shall not proceed with work until the jointing requirements are accepted by the Engineer.

1. Indicate locations of contraction joints, construction joints, and isolation joints. Spacing between contraction joints shall conform to Table 2, unless otherwise permitted.

2. The larger dimension of a panel shall not exceed 125% of the smaller dimension.

3. The minimum angle between two intersecting joints shall be 80 degrees, unless otherwise specified or permitted.

4. Joints shall intersect pavement free edges at 90-degree angles and shall extend straight for a minimum of 1-1/2 ft (0.5 m) from the pavement edge, where possible.

5. Align joints of adjacent panels.

6. Align joints in integral curbs with joints in pavement.

7. Ensure joint depth and width dimensions are as specified.

8. Minimum contraction joint depth, using a conventional saw, hand tools, or inserts, shall be 1/4 of the pavement thickness. Minimum joint width for saw cutting is 1/8 in. (3 mm). When using an early-entry dry-cut saw, the depth of the cut shall be at least 1 in. (25mm).

9. Use isolation joints only where pavement abuts buildings, foundations, existing pavements, manholes, and other fixed objects.

C. Construct contraction joints by one of the following methods:

1. Tool contraction joints in fresh concrete after the concrete has set sufficiently to maintain the formed joint to the specified depth and width.

2. Insert plastic strips vertically into the fresh concrete. Depress strips into pavement until flush with surface.

3. Saw-cut concrete after concrete has hardened sufficiently to prevent aggregate being dislodged and soon enough to control pavement cracking. Discontinue sawing joint if a crack precedes the saw-cut. Resume sawing at the next joint location.

D. Extend isolation joints through the full depth of the pavement. Fill the entire isolation joint with isolation joint material, unless otherwise required by project drawings or by accepted jointing drawings submitted by the contractor (see Section 2.6 for material requirements).

Table 2. Spacing Between Contraction Joints.

Pavement Thickness, in. (mm)	Maximum Spacing, ft. (m)
3-1/2 (90)	8-1/2 (2.5)
4, 4-1/2 (100, 110)	10 (3)
5, 5-1/2 (125, 140)	12-1/2 (4)
6 or greater (150 or greater)	15 (4.5)

3.6 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Hot-Poured Liquid Sealants:

1. Place joint sealer when the pavement and surrounding air temperature are 40°F (5°C) or higher.

2. Where specified, backer rods shall be installed to provide proper shape factor.

3. Use an indirect heating kettle with an agitator to prevent localized overheating. Discard overheated material.

4. Use insulated hoses. Fit the application wand with a recirculation line to prevent the temperature of the sealant in the hose from dropping below application temperature.

5. Make sure that the top of the sealant is 1/8 to 1/4 in. (3 to 6 mm) below the pavement surface.

6. Clean any spilled or overfilled joint sealant from the concrete surface.

D. Cold-Poured Silicone Sealants:

1. Place joint sealer when the pavement and surrounding air temperature are 40°F (5°C) or higher.

2. Where specified, backer rods shall be installed to provide proper shape factor.

3. Use joint primer provided by the manufacturer to ensure a good bond between the sealant and the joint reservoir face.

4. Tool non-self-leveling sealants before the material cures.

5. Clean any spilled or overfilled joint sealant from the concrete surface.

E. Preformed Compression Sealers:

1. Check joint width for compatibility.

2. Make sure the joint width doesn't vary, especially at points where the saw reenters the joint.

3. Clean and dry the saw cut reservoir before sealing the joint. Seal joints only when the joint surfaces appear dry.

4. Follow the manufacturer's recommendation for sealant sizing and installation.

5. Make sure the sealant is lubricated, straight, vertical, and undamaged before installation.

6. Make sure that the installation device does not stretch the sealant.

3.7 OPENING TO TRAFFIC

Do not open the pavement to vehicular traffic until the in-place compressive strength is at least 3,000 psi (21 MPa), or 75% of the specified strength, or until the pavement is accepted by the Engineer for opening to traffic. In-place strength shall be determined using field cured cylinders in accordance with ASTM C31/C31M or maturity methods in accordance with ASTM C1074.

3.8 TOLERANCES

A. Construct pavement to comply with the following tolerances:

1. Elevation: 3/4 in. (19 mm)

2. Thickness: +3/8 in., -1/4 in. (+10 mm, -6 mm)

3. Surface: In any direction, the gap below a 10 ft (3 m) unleveled straightedge resting on high spots shall not exceed 1/2 in. (13 mm)

B. Joint reinforcement:

Tie bars: alignment of tie bar end relative to line perpendicular to edge of pavement: 1/2 in./ft (13 mm/300 mm) of tie bars

C. Dowels:

1. Lateral alignment and spacing: 1 in. (25 mm)

2. Vertical alignment: 1/4 in. (6 mm)

3. Alignment of dowel bar end relative to line perpendicular to edge of pavement: 1/4 in./ft (6 mm/300 mm) of dowel

D. Joint spacing (see Table 2)

1. Contraction joint depth: +1/4 in. (6 mm), -0 in.
2. Joint width: +1/8 in. (3 mm), -0 in.

3.9 FIELD QUALITY ACCEPTANCE

A. Testing and Inspecting: Contractor shall engage a qualified testing and inspecting agency meeting the requirements of Section 1.6.C to perform tests and inspections and to submit reports for acceptance in accordance with Section 1.5.F.

B. Inspections: Prior to commencement of portions of the work, the inspection agency shall provide verification that the following items meet the specification requirements:

1. Subgrade and/or subbase density and elevation.

2. Steel tie and dowel bar reinforcement placement, if used.

3. Use of required design mixture.

4. Concrete placement, including conveying and depositing.

5. Curing procedures.

6. Concrete strength before removal of forms, if used.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:

1. Preliminary Samples/Tests: Preliminary samples to measure slump and air content and to make necessary adjustments to mixtures to achieve specified requirements are permitted in accordance with ASTM C94/C94M.

2. Testing Frequency: Obtain at least one random composite sample for each 50 cubic yards, or fraction thereof of each concrete mixture placed each day. a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C143/C143M; one test at point of placement for each composite sample when compressive strength specimens are made, but not less than one test for each day's pour of each concrete mixture.

4. Air Content: ASTM C231/C231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Density: ASTM C138/C138M; one test for each composite sample when strength specimens are made.

6. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40°F (5°C) and below and when 80°F (27°C) and above, and one test for each composite sample when strength specimens are made.

7. Compression Test Specimens: ASTM C31/C31M; two sets of two standard-cured cylinder specimens for each composite sample. Specimen sizes of 6 x 12 in. (150 x 300 mm) or 4 x 8 in. (100 x 200 mm) are permitted.

8. Compressive-Strength Tests: ASTM C39/C39M; test one set of two standard-cured specimens at 7 days and one set of two specimens at 28 days. A compressive-strength test result shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated. Strength of each concrete mixture is satisfactory if every average of any three consecutive compressive-strength

test results equals or exceeds specified compressive strength and no compressive-strength test result falls below specified compressive strength by more than 500 psi (3.5 MPa).

D. Reporting: Test results shall be reported in writing to Engineer within 48 hours of testing. Reports shall contain Project identification information, date of concrete placement, name of concrete testing and inspecting agency, and location of concrete batch in Work.

E. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Engineer.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

G. Correct deficiencies in the Work that test reports and inspections indicate does not comply with this specification and/or the Contract Documents.

3.10 METHOD OF MEASUREMENT

A. Measurement will be in square yards for each different thickness of concrete pavement. The area of manholes, intakes, or other fixtures in the pavement will not be deducted from the measured pavement area.

3.11 BASIS OF PAYMENT

Payment will be at the unit price per square yard for each thickness of concrete pavement. Unit price includes, but is not limited to, final trimming of subgrade or subbase, integral curb, bars and reinforcement, joints and sealing, surface curing and pavement protection, safety fencing, concrete for rigid headers, and box outs for fixtures.

PAY ITEM	PAY UNIT
Concrete Pavement	Square yard

SECTION 02609 - PIPE CULVERT AND STORM DRAINS

1. DESCRIPTION

This work shall consist of furnishing and installing circular pipe for culverts, or storm drains. All units shall conform to the dimensions, fabrication, material, and strength requirements for the type, class, size, and shape in accordance with the plans and these specifications. Units shall be bedded and backfilled in accordance with applicable provisions included herein and shall be constructed to the lines and grades shown or established.

2. MATERIALS FOR STORM DRAINS

The following type of pipe may be specified for use as storm drains and shall meet the requirements of the following KDOH Sections.

Reinforced Concrete Circular Pipe	810.03
Corrugated Steel Pipe	810.04
Thermoplastic Pipe	810.06

Other materials proposed as alternates must be approved for use by the ENGINEER and the LFUCG Division of Engineering. The CONTRACTOR shall be responsible for obtaining the approval.

3. OTHER MATERIALS

Materials for headwalls or joints shall meet requirements of the following KDOH Sections.

Concrete, Class	601
Steel Reinforcement	602
Cement	801
Mortar	601.03
Bituminous Mastic Joint Sealing Compound	807
Rubber Gaskets	701.03.05

Sand for pipe bedding shall meet the requirements of KDOH Section 804.07.

4. POLYPROPYLENE STORM PIPE (12" Through 60" ADS HP, or Equal)

A. Pipe Requirements

12- through 30-inch (300 to 750 mm) pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2736 and AASHTO M 330.

36- through 60-inch (900 to 1500 mm) pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2881 and AASHTO M330.

Manning's "n" value for use in design shall be 0.012.

B. Joint Performance

Pipe shall be joined with a gasketed integral bell & spigot joint meeting the requirements of ASTM F2736 or F2881, for the respective diameters.

12- through 60- inch (300 to 1500 mm) shall be watertight according to the requirements of ASTM D3212. Spigots shall have gaskets meeting the requirement of ASTM F477. Gasket shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during joint assembly.

12- through 60- inch (300 to 1500 mm) diameters shall have a reinforced bell with a polymer composite band installed by the manufacturer.

C. Fittings

Fittings shall conform to ASTM F2736, ASTM F2881 and AASHTO M330, for the respective diameters. Bell and spigot connections shall utilized a spun-on, welded or integral bell and a spigot with gaskets meeting ASTM F477. Bell & spigot fittings joint shall meet the watertight joint performance requirements of ASTM D3213. Corrugated couplings shall be split collar, engaging at least 2 full corrugations.

D. Field Pipe and Joint Performance

To assure watertightness, field performance verification may be accomplished by testing in accordance with ASTM F2487. Appropriate safety precautions must be used when field testing any pipe material. Contact the manufacturer for recommended leakage rates.

E. Material Properties

Polypropylene compound for pipe and fitting production shall be impact modified copolymer meeting the material requirements of ASTM F2736, Section 4, ASTM F2881, Section 5 and AASHTO M330, Section 6.1, for the respective diameters.

F. Installation

Installation shall be in accordance with ASTM D2321 and ADS recommended installation guidelines, with the exception that minimum cover in traffic areas for 12- through 48-inch (300 to 1200 mm) diameters shall be one foot (0.3 m) and for 60-inch (1500mm) diameters, the minimum cover shall be 2 feet (0.6 m) in single run applications.

5. POLYPROPYLENE STORM PIPE (4" Through 12" ADS N12 WT IB, or Equal)

A. Pipe Requirements

ADS N-12 WT IB pipe (per ASTM F2648) shall have a smooth interior and annular exterior corrugations and shall meet ASTM F2648.

Manning's "n" value for use in design shall be 0.012.

B. Joint Performance

4- through 12- inch (100 to 1500 mm) shall be watertight according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM

F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.

12-inch diameters shall have reinforced bell with a polymer composite band. The bell tolerance device shall be installed by the manufacturer.

C. Fittings

Fittings shall conform to ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the watertight joint performance requirements of ASTM f2306.

D. Field Pipe and Joint Performance

To assure watertightness, field performance verification may be accomplished by testing in accordance with ASTM F2487. Appropriate safety precautions must be used when field testing any pipe material. Contact the manufacturer for recommended leakage rates.

E. Material Properties

Material for pipe production shall be an engineered compound of virgin and recycled high-density polyethylene conforming with the minimum requirements of cell classification 424420C (ESCR Test Condition B) for 4- through 10-inch (100 to 250 mm) diameters, and 435320 C (ESCR Test Condition B) for 12-inch diameters, as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed 4%.

F. Installation

Installation shall be in accordance with ASTM D2321 and ADS recommended installation guidelines, with the exception that minimum cover in trafficked areas for 4- through 12-inch (100 to 1200 mm) diameters shall be one foot the minimum cover situations shall consist of Class 1 (compacted).

6. GENERAL

No unit shall be laid until the proposed location has been approved by the ENGINEER. When plans show the top of a unit positioned less than 2 feet below subgrade elevation, the ENGINEER may lower the pipe to obtain 2 or more feet of cover over the pipe when feasible. Soundings for foundation design shall be taken by the CONTRACTOR at the inlet and outlet of each culvert and at intervals no greater than 20 feet along the grade line of the bottom of the pipe, and to depths of 1/2 inch per foot of embankment height over the top of the pipe or one foot, whichever is greater. The maximum depth to which these soundings must be taken is 0.75 Hc, where Hc is the outside to outside vertical height of the pipe. In the event 0.75 Hc is less than 12 inches, sounding shall be taken to a depth of 12 inches. Where ledge rock, gravel, hardpan, or other unyielding material is encountered or known to exist within the limits stated, the foundation shall be prepared in accordance with the plans. The pipe shall be cambered when specified and bedded as specified.

When an unstable foundation is encountered at the grade established, the unstable material shall be removed and replaced with a suitable material to a width and depth and in a manner that will provide a uniform and firm foundation.

In all operations such as placing the pipe, jointing, bedding, backfilling, and embankment construction care shall be exercised; and it shall be the CONTRACTOR'S responsibility to see that pipes are not damaged during unloading or placement on the bed, during compaction of the backfill, by movement of excessively heavy equipment over the fill, or by any other forces that may cause damage. Any pipe which is not in true alignment and grade or which shows undue settlement after laying, or is otherwise damaged, shall be removed and replaced without extra compensation.

7. BEDDING AND BACKFILLING

The method for bedding and backfilling shall be in accordance with the standard details shown on the LFUCG Standard Drawings. Backfill material shall be satisfactory to the ENGINEER, and shall be compacted to the same density as that required for embankment on the project. The pipe shall be cambered when designated on the plans or by the ENGINEER.

8. LAYING RIGID PIPE

Rigid pipe shall be placed beginning at the outlet end of the culvert with the bell or groove end being laid upgrade. Successive spigot ends shall extend fully into each adjoining hub. Pipe having marks designating top and/or bottom shall be laid so the designating mark is no more than 5 degrees from the vertical plane throughout the longitudinal axis of the pipe. Any lift holes shall be covered after the pipe has been installed by: 1) coating areas at least 8 inches wider than the holes on the outside of the pipe with a bituminous mastic, 2) placing a piece of sheet metal at least 4 inches wider than the holes over each hole, and 3) applying an additional coating of mastic over the entire area of previously applied metal. Precast lift holes plugs may be used in lieu of the mastic and sheet metal.

Joints for rigid pipe shall be made with any of the following: (a) mortar; (b) bituminous mastic joint sealing compound; (c) rubber gaskets; or (d) a combination of these materials unless one type is specified, except that only one type of jointing material shall be used throughout any single structure.

A. MORTAR JOINTS. The mixture shall be one part portland cement and 2 parts sand. The quantity of water in the mixture shall be sufficient to produce a stiff, workable mortar, but shall not exceed 5 1/2 gallons of water per sack of cement.

The ends of the pipe shall be thoroughly cleaned and wetted before joints are made. Stiff mortar shall then be placed in the lower half of the bell or groove section which has been laid. Mortar shall then be applied to the upper half of the spigot or tongue of the pipe being laid. The spigot or tongue shall then be inserted in the bell or groove of the pipe already laid, the joint being pulled tight, with care being taken to see that inner surfaces of the abutting sections are flush and even. After a section of pipe is laid, and before the succeeding section is laid, the lower portion of the hub of the preceding section shall be plastered thoroughly on the inside with mortar to such a depth to ensure a smooth joint between the abutting sections. The remainder of the joint shall then be filled flush with mortar. The inside of the joint shall then be finished and wiped smooth around the full circumference. After the initial set, the mortar shall be protected from air and sun with a thoroughly wetted earth or burlap cover.

B. FLEXIBLE PLASTIC GASKETS. The primer, rate and method of primer application, width and method of application of the flexible plastic gaskets shall all be in accordance with recommendations of the manufacturer of the flexible plastic gaskets. The CONTRACTOR shall provide the ENGINEER with the manufacturer's literature which describes installation procedures.

C. RUBBER GASKETS. In addition to the material requirements of the applicable Section references under paragraph 2 or 3, joints of the sections to be joined shall be of a design and manufacture in accordance with the applicable requirements of AASHTO M 198. The cement and lubricant used to facilitate joining the conduit shall be that recommended by the manufacturer of the rubber gaskets. The rubber gaskets shall be installed in such a manner to snugly fit the beveled surface of the tongue and groove ends of the section so as to form a flexible water-tight seal under all conditions of service.

9. TRANSPORTING, HANDLING, AND LAYING FLEXIBLE PIPE

Coated pipe shall be handled and shipped at all times with equipment and methods which will prevent damage to the coating. Pipe shall be stored on the project supported on wooded timbers to hold the pipe off the ground. Pipe shall be hoisted to the trench by use of equipment and methods which will prevent damage to the coating. Any damaged coating shall be repaired before lowering the pipe into the trench. Repairs should be made using asphalt mastic or coatings recommended by the manufacturer.

At all times, the CONTRACTOR should use every precaution to prevent damage to the protective coating. No metal tools or heavy objects shall be unnecessarily permitted to come in contact with the finished coating. Any damage to the protective coating from any cause during installation and before final acceptance, shall be repaired as directed, by and at the expense of the CONTRACTOR.

Backfilling shall at all times be conducted in a manner to prevent damage and abrasion to the coating.

Flexible pipe shall be laid so the outside laps of circumferential joints point upstream with no longitudinal joints in the lower quadrant. Field joints shall be made by abutting the ends of the sections and by securing with a metal coupling band of the same material firmly bolted in place. Coupling bands shall meet the requirements of KDOH Section 810. Corrugated metal pipe having a paved material shall always be placed with the paving along the bottom or flowline. Vertical elongation of corrugated metal pipe shall be in accordance with the plans and shall not be removed until embankment over the structure has been completed.

10. EXTENSIONS TO EXISTING PIPE CULVERTS

All pertinent requirements in the foregoing paragraphs shall apply to the extensions of existing pipe culverts. The extensions shall conform to the lines and grades as established and to the dimensions shown.

The portions of the existing structure designated to be removed shall be removed in such a manner to provide a neat junction with the extension and leave undamaged that portion of the existing structure to remain in service. Any damage to the portion remaining in service shall be repaired by the CONTRACTOR at his expense. All silt or other debris that may

have collected within the barrel of the existing structure shall be removed and disposed of by the CONTRACTOR, payment for which shall be incidental to the work.

11. METHOD OF MEASUREMENT

Pipe will be measured in linear feet for each type, class, and size complete and accepted in the final work. The number of linear feet for each type, class, and size of pipe will be determined by multiplying the actual net laying length of the units or sections by the number of full units or sections laid as directed. Joint materials required for jointing sections will not be measured for payment. Bends, elbows, crosses, tees, reducers, laterals, wyes, and other shapes will be measured in linear feet along the central axis of the pipe to the end of the main member of the join and from the end of each branch member of the joint to the outside wall of the main member. Concrete and steel reinforcement complete and in place in accepted headwalls will be measured as specified in KDOH Sections 601.28 and 602.10, respectively. Material removed from unstable foundations will be measured in cubic yards, up to a maximum width of 3 times the outside diameter of the pipe or the outside diameter of the pipe plus 4 feet, whichever is least. Unstable material removed outside these limits will be measured and paid for as roadway excavation or embankment-in-place, as applicable; unstable material removed within these limits and below the normal bedding excavation will be measured as Pipe Undercut.

All excavation required for construction of pipe, except excavation of unstable material from the foundation, will be considered incidental and no consideration will be given to any increase or decrease in the volume of excavation required for the proper installation of each size of additional culvert pipe at the locations directed by the ENGINEER unless there is a material increase in the excavation required for a particular size or sizes of the pipe due to changes by the ENGINEER in lengths or locations. A material increase in the excavation is defined as an increase of more than 10 percent over the original average excavation per linear foot which would have been installed exactly as depicted on the plans. Excavation of unstable material from the foundation will not be considered in determining the percentage of a material increase in excavation. Only when the CONTRACTOR can verify, prior to performing the excavation, that a substantial increase in excavation will be required for a size or sizes of the additional pipe will any measurement be made by the ENGINEER to determine the extent of the increase in excavation. After the volume of excavation required for a size of the additional pipe has been determined, only that portion of the excavation that is in excess of 10 percent over the average original excavation per linear foot for that size will be eligible for payment. The excess volume eligible for payment will be measured in cubic yards as Roadway Excavation Unclassified.

Trench rock excavation shall be measured in cubic yards based on a trench width of the pipe outside diameter plus two feet. The depth of trench rock shall be an average of fifty foot stations as measured in the field to a depth of six inches below the pipe grade. Additional stone backfill in rock excavations will not be measured for payment.

12. BASIS OF PAYMENT

The accepted quantities of each type, class, and size of pipe will be paid for at the contract unit price per linear foot. Payment for pipe bends, elbows, crosses, tees, reducers, laterals, wyes, and other shapes of joints will be made at the contract price per linear foot of pipe for the largest diameter pipe included in the joint. That price will include all necessary excavation and bedding except excavation of unstable material from the foundation, or excavation exceeding 10 percent as designated in paragraph 8; backfilling; and furnishing and installing the pipe. The accepted quantities of concrete and steel reinforcement for

headwalls will be paid for as specified in KDOH Section 601.29 and 602.11, respectively, and that price will include payment for any excavation necessary installation of each until. The accepted quantities of excavation exceeding 10 percent as defined in paragraph 8 will be paid for at the contract unit price for Roadway Excavation.

No payment will be made for excavation or backfill in excess of the limits described in these specifications that may be necessary to achieve safe working conditions.
Payment will be made under:

PAY ITEM	PAY UNIT
Pipe, Size	Linear Foot
Concrete, Class	See KDOH 601
Steel Reinforcement	See KDOH 602
Roadway Excavation	See Section 02222
Trench Rock	Cubic Yard

SECTION 02800 - FENCE

1. DESCRIPTION

This work shall consist of furnishing and erecting fence and gates of the height and type shown on the plans, or otherwise directed during construction.

2. MATERIALS

A. Materials shall conform to requirements specified in the following KDOH Sections:

Woven Wire Fencing Materials (12 ga)	816
Concrete	601

B. The CONTRACTOR may select any class of concrete specified in Section 601, unless otherwise specified.

3. CONSTRUCTION REQUIREMENTS

A. Fence and gates shall be constructed with new materials in accordance with KDOH Section 722.

B. Fence shall be constructed in accordance with the KDOH Standard Drawing RFC-001-07 and RPG-005-05 for chain link right-of-way fence and gates.

C. Four plank fencing shall be constructed in accordance with the details shown on the plans. The fence shall be painted black.

D. Diamond Mesh Fencing

1. Fence fabric shall be manufactured from Class 3 galvanized steel wire, 4, 000 pounds minimum breaking strength, and painted black with application rate approved by the ENGINEER.

2. Horizontal wire shall be double twisted 12.5 gauge, spaced 4 inches apart. Vertical angled wire shall be 14 gauge, woven around horizontal wire, and spaced 2 inches apart at the widest point.

3. Fence posts shall be 5-inch diameter pressure treated pine, 8 feet in length, and painted black with application rate as approved by ENGINEER.

4. Corner posts and end posts shall be 8-inch diameter pressure treated pine, 9 feet in length, and painted black with application rate approved by ENGINEER.

5. Fence rail shall be Centaur design, or equal, 5-inch-wide-flexible rail and shall be painted black with application rate approved by the ENGINEER.

6. Tensioners and mounting brackets for 5-inch-wide-flexible rail and shall be painted black with application rate approved by ENGINEER.

7. 4-inch wood brace shall be installed at the corner posts and end posts as shown in the Drawings and as recommended by the manufacturer.

8. Brace wire shall be installed at the corner posts and end posts as down in the Drawing and as recommended by the manufacturer.

4. INSTALLATION (DIAMOND MESH FENCING)

A. Fence posts shall be 8 feet on center, and shall be driven 2 feet-6 inches into the ground with tops cut at an angle to drain.

B. Corner posts and end posts shall be placed 3 feet-6 inches into the ground, and placed into a 4-foot deep by 18-inch-diameter-concrete footing. Concrete footing shall be Class B concrete in accordance with Section 601 of the KDOH Standard Specification.

C. Staples shall be placed to overlock wire joints and the same row of diamonds shall be used from top to bottom to ensure wire is square on posts.

D. When finishing fence ends, diamond mesh shall be cut leaving approximately 8 inches after the staples on the post. Strip the diamond mesh wire leaving the horizontal double cabled wires, always leaving 1 diamond after the fence staples. Horizontal wires shall be wrapped around the posts, pulled tight and stapled down to the back of the post.

5. METHOD OF MEASUREMENT

Fence will be measured in linear feet along the top of the fence from outside to outside of end posts of fence installed, with deductions made for gates, complete and accepted in the final work. Gates will be measured in individual units, complete and accepted in the final work.

6. BASIS OF PAYMENT

The accepted quantities for four flank and diamond mesh fence and gates shall be paid for at the unit prices per linear foot and each, respectively.

Payment shall be made under:

PAY ITEM	PAY UNIT
Four Plank Fence	Linear Foot
Diamond Mesh Fence	Linear Foot

SECTION 02910 – DURABLE PAVEMENT STRIPING

1. SCOPE OF WORK

Furnish and install durable marking materials, thermoplastic or Type I tape, to provide lane lines, edgelines, and gore markings as specified in the Contract.

2. MATERIALS AND EQUIPMENT

A. THERMOPLASTIC

Conform to Section 837. (KYDOH 2012 Specifications)

B. TYPE I TAPE

Conform to Section 836. (KYDOH 2012 Specifications)

C. BINDER

Furnish a binder that the manufacturer of the pavement marking material recommends and the Engineer approves. Provide a binder that forms a continuous film that dries rapidly and adheres to the pavement. Provide a material that does not discolor or cause any noticeable change in the appearance of the pavement outside of the finished pavement marking. Submit the material and method of application to the Engineer and obtain written approval from the Engineer and the manufacturer of the pavement marking material before applying.

D. DROP ON GLASS BEADS

Use beads that will ensure the pavement marking material will meet retroreflectivity requirements. The Department will evaluate the beads as part of the marking system through retroreflectivity readings.

E. THERMOPLASTIC APPLICATION EQUIPMENT

Provide equipment with an extrusion die that simultaneously deposits and shapes lines at a minimum thickness of 90 mils on the pavement surface. Do not use spray and ribbon gun applicators.

Ensure the application equipment conforms to the following:

1. Capable of providing continuous and uniform heat to maintain the material between 400 and 440°F throughout the mixing, conveying, and dispensing.

2. The kettle is capable of continuous agitation during mixing and heated storage and is equipped with an automatic thermostat control device and material thermometer.

3. Motorized and capable of applying a uniform line at a rate of 3 mph.

4. Equipped with a cutoff device that provides clean, square stripe ends.

5. Equipped with an automatic bead dispenser.

3. CONSTRUCTION

A. Provide yellow centerline markings, which are defined as those separating traffic moving in opposite directions. Provide white lane line markings, which are defined as those separating traffic moving in the same direction. Ensure that these markings are skip lines and solid lines as required by Part 3 of the MUTCD. Ensure that edge lines are solid lines, and determine the color from Part 3 of the MUTCD.

B. Install pavement striping at the width specified in the Contract. Ensure that all lines have clean edges with a width tolerance of plus ½ inch. The Engineer may waive the tolerances when deviations are caused by undulation in the pavement surface.

C. Construct skip lines with a stripe-to-gap ratio of a 10-foot stripe to a 30-foot gap. Ensure that the length of the stripe is between 10 and 10.5 feet. Ensure that the stripe-gap cycle is between 40 and 40.5 feet.

D. Use Type I Tape for markings on bridge decks, JPC pavement and JPC intersections. Do not use thermoplastic materials on bridge decks, JPC pavement and JPC intersections.

E. LAYOUT

Install all pavement markings according to Part 3 of the MUTCD and the following requirements.

1. Make the width of lane lines and edgelines as specified in the Plans or as the Engineer directs. Make lines for gore area markings twice the normal width line for that section of roadway.

2. Unless striping plans are included in the proposal or otherwise directed by the Engineer, install gore area markings as shown in Figures 3B-8 and 3B-9 of the MUTCD. Do not use the optional markings shown (transverse lines in the neutral area and dotted extension of the right edgeline).

3. Due to the possibility that water may be retained on the roadway by the thermoplastic edgelines, place a one foot gap every 20 feet in all thermoplastic edgelines. Do not install gaps for taped edgelines.

4. Offset longitudinal lines at least 2 inches from longitudinal pavement construction joints. Offset longitudinal lane lines on multi-lane highways 2 inches towards the median.

5. On resurfacing, pavement restoration, and pavement rehabilitation projects, prepare and keep a written record of the locations of existing pavement markings, and furnish a copy to the Engineer before removing or obliterating the markings. The Engineer will notify you of any changes to the existing markings.

6. Before applying the pavement marking material, pre-mark the pavement surface and obtain the Engineer's approval of the proposed location, alignment, and control guides.

F. SURFACE PREPARATION

1. Remove existing pavement markings and clean grease, oil, mud, dust, dirt, grass, loose gravel, or other deleterious material from the surface where pavement markings are to be applied, as directed by, and by method acceptable to, the Engineer.

2. Remove existing pavement markings until a minimum of 90 percent of the pavement surface is uniformly exposed throughout. Ensure that the pavement surface is in proper condition for successful bonding of the pavement markings and provides a neat appearance. Do not leave any loose or flaking existing pavement markings.

3. When removing the existing pavement markings, ensure that the finished pavement surface is not damaged or left in a condition that may mislead or misdirect the motorist. Repair any damage to the pavement, pavement joint materials, or the pavement surface caused by the removal of the existing pavement markings in a manner acceptable to the Engineer. After completing these operations, use compressed air to blow clean the pavement surface of residue and debris resulting from the removal of exiting pavement markings.

4. When removal of existing pavement markings and objectionable materials obscures existing pavement markings of a lane occupied by public traffic, immediately remove this residue, including dust, from the surface being treated. Obtain the Engineer's approval of the removal methods.

5. Place the final pavement markings on the same day that the existing pavement markings are removed.

6. On concrete surfaces and as the Engineer directs on older asphalt pavements, apply binder to the area where placing pavement marking material.

7. On new concrete pavement surfaces, remove the curing compound from the pavement surface before applying the binder and the pavement marking material.

G. APPLICATION

1. TYPE I TAPE

Apply according to the manufacturer's recommendations. When applied to concrete, cut the tape at all joints.

2. THERMOPLASTIC

a. Install the thermoplastic material at a minimum thickness of 90 mils on the pavement surface in a melted state at a temperature from 400 and 440 °F.

b. Apply additional glass beads by drop-on or pressure spray methods in sufficient quantities to obtain the retroreflectivity requirements specified in Subsection 714.03.06.

c. Verify the adhesion of the thermoplastic to the asphalt pavements by performing bond checks, at least 4 per mile of line, as follows. Approximately 60 to 120 seconds after applying a thermoplastic line to the roadway surface, cut and lift approximately a 6-inch section of thermoplastic. The thermoplastic is successfully bonding to the pavement surface if a layer of asphalt clings to the removed thermoplastic stripe and the pavement surface under the removed stripe is shiny and black.

d. Provide finished markings that are continuous and uniform in shape, having clear and sharp dimensions. Ensure that all lines have well-defined edges.

H. RESTRICTIONS

1. Do not apply the pavement marking material when air and pavementmtemperatures are below 50 °F.

2. Do not apply the pavement marking material when the surface of the pavement contains evidence of moisture in amounts significant enough to prevent the pavement marking material from bonding to the pavement. Significant amounts of moisture can be caused by heavy dew or very humid nights as well as from rainfall.

3. If encountering significant amounts of moisture while applying the thermoplastic, the Contractor, at his own risk, may attempt to apply thermoplastic subject to the following restrictions. Heat the thermoplastic material to the upper temperature limit specified by the manufacturer, and apply at a test line on the pavement. Perform a bond check according to Subsection G. If the thermoplastic successfully bonds to the pavement continue to apply the thermoplastic lines, provided there is evidence that the moisture is escaping through the surface of the line, as indicated by very small pinholes. If there is excessive moisture, as indicated by larger sized holes or bubbles on the surface of the line, do not apply thermoplastic until the moisture can be effectively dealt with. Perform a sufficient number of bond check to ensure that the thermoplastic is bonding to the pavement.

I. PROVING PERIOD FOR DURABLE MARKINGS

1. A 180 day proving period will follow the application of the durable markings. During this period, the Engineer will make such observations

as are necessary to determine if the markings are acceptable. The proving period begins when the facility is opened to traffic.

2. REQUIREMENTS

A. Type I Tape

During the proving period, ensure that the pavement marking material shows no signs of failure due to blistering, excessive cracking, bleeding, staining, discoloration, oil content of the pavement materials, deterioration due to contract with grease deposits, oil, diesel fuel, or gasoline drippings, chipping, spalling, poor adhesion to the pavement, loss of retroreflectivity, vehicular damage, and normal wear. Type I Tape is manufactured off site and warranted by the manufacturer to meet certain retroreflective requirements. As long as the material is adequately bonded to the surface and shows no sign of failure due to the other items listed in Subsection 714.06.06 A) 1), retroreflectivity readings will not be required. In the absence of readings, the Department will accept tape based on a nighttime visual observation.

B. Thermoplastic

During the proving period, ensure that the thermoplastic pavement marking material shows no signs of failure due to blistering, excessive cracking, bleeding, staining, discoloration, oil content of the pavement materials, smearing or spreading under heat, deterioration due to contact with grease deposits, oil, diesel fuel, or gasoline drippings, chipping, spalling, poor adhesion to the pavement materials, loss of retroeflectivity, vehicular damage and normal wear.

The minimum retroflectivity requirements at the end of the proving period, as measured with a Department approved 30 meter geometry handheld or mobile retroreflectometer, are as follows:

White: 300/mcd/lux/square meter
Yellow: 225/mcd/lux/square meter

Measurements will be made between 150 and 210 days after the start of the proving period, with acceptance based on KM 202 or KM 203 as applicable. If the markings are acceptable, the installation of the markings will be considered compete.

3. FAILURE

During the proving period, the Engineer will consider markings defective when the retroreflectivity falls below the minimum required or the material fails to meet the other requirements of A) above. Additionally, when more than 10 percent of any one-mile section or individual gore area is defective, the Engineer will consider the entire section defective.

The Engineer will consider each edge line, centerline, lane line and gore area marking separately.

4. CORRECTIVE WORK

If a line is found to be defective, repair or remove and replace the line. Perform pavement marking replacement according to the requirements specified in his subsection for the initial application. The corrective work will be subject to a proving period as listed above.

J. MARKING REMOVAL

Remove all markings made in error or not conforming to the traffic operation in use. Do not paint with asphalt binder or other material to obliterate the markings. Remove pavement striping, temporary or permanent, from asphalt or concrete pavement using ultra-high pressure water. Marking removal totaling 1,000 linear feet or less may be removed by an abrasive method to the satisfaction of the Engineer. Vacuum all marking material and removal debris concurrently with the marking removal operation.

Do not damage the pavement in any way and protect all joint seals. If damage is observed, stop the removal process until the operation can provide an acceptable marking removal. Repair any damage to the pavement as a result of the marking removal. Removal of marking will not be measure for payment.

Waterblast to remove temporary or permanent striping is completely as the Engineer directs.

4. MEASUREMENT

A. THERMOPLASTIC PAVEMENT MARKINGS

The Engineer will measure for payment by the units listed in the Quantity Summary. The Engineer will not measure sampling, testing, surface preparation, pre-marking, interim marking, and binder application for payment and will consider them incidental to the thermoplastic bid items. The Engineer will not measure corrective work for payment.

B. DURABLE PAVEMENT MARKINGS, TYPE I

The Engineer will measure for payment by the units listed in the Quantity Summary. The Engineer will not measure sampling, testing, surface preparation, pre-marking, and binder application for payment and will consider them incidental to the thermoplastic bid items. Corrective work will not be measured for payment.

C. PAYMENT STRIPING REMOVAL

When listed as a bid item, the Engineer will measure for payment by the units listed in the Quantity Summary. The Engineer will not measure for payment the removal of existing pavement markings that have not been authorized by the Engineer. When the Contract does not list a bid item, the Engineer will consider existing pavement marking removal incidental to the other pavement marking bid items. The Engineer will not measure for payment any corrective work required due to the removal work.

D. PAYMENT

The accepted quantities for thermoplastic pavement striping shall be paid for at the unit prices for linear foot.

Pay Item	Pay Unit
Pavement Striping-Thermoplastic, width, color	Linear Foot

SECTION 02920 – PANEL TRAFFIC SIGNS

1. SCOPE OF WORK

Furnish and install extruded panel traffic signs. Traffic signs include ground mounted, overhead structure mounted, or bridge mounted signs.

2. MATERIALS

a. Panel Signs. Conform to Section 833. (KYDOH 2012 Specifications)
b. Concrete. Conform to Section 3300.
c. Steel Reinforcement. Confirm to Section 3200.
d. Structural Steel. Conform to Section 812. (KYDOH 2012 Specifications)
e. Miscellaneous Metals. Conform to Section 813. (KYDOH 2012 Specifications)
f. Retroreflective Materials. Conform to Section 830. (KYDOH 2012 Specifications)
g. "Pop" Fasteners. Use corrosion resistant protruding head "pop" rivets with a minimum diameter of 1/8 inch. Obtain the Engineer's approval before use.

3. CONSTRUCTION

A. Perform the work according to the requirements specified in the following publications:

- MUTCD
- AASHTO Specifications for Design and Construction of Structural Supports for Highway Signs
- Federal Standard 595, Standard Highway Sign Colors
- Standard Highway Signs

Use Class A concrete according to Section 3300.

B. LOCATION

Use the Plans as general guidance for the extent and general arrangement of signs. Consider sign locations specified in the Plans as approximate only. Determine the exact location for each sign and obtain the Engineer's approval. Submit all proposed revisions in writing to the Engineer for written approval.

C. MESSAGES

Sign messages specified in the Plans are the final messages. Conform message spacing o the applicable requirements of the previously cited publications for guide signs, and the manufacturer's recommendations for sign sizes indicated, as the Engineer approves.

D. ATTACHMENT

Attach letters, symbols, numbers, and borders to sign faces with "pop" fasteners ("pop" rivets).

E. SHOP DRAWINGS

Submit shop drawings to the Engineer for written approval before fabricating signs.

F. FABRICATION

1. Hot dip galvanize all steel components after completing fabrication. Regalvanize or paint all abraded or damaged surfaces with 2 coats of commercially available zinc rich paint.

2. Ensure that sign structures are free from kinks, twists, or bends and are uniform in appearance. Assemble completed sections in the shop and check them for straightness, alignment, and dimensions. Correct any irregularities.

3. Consider sign post lengths as approximate only. Conform to the applicable requirements contained in AWS for welded fabrication.

4. MEASUREMEMT

The quantity of signs shall be measured in square feet for each size and type. All concrete, steel reinforcement, or sign supports shall not be measured and shall be considered incidental to the sign construction.

5. PAYMENT

Payment will be made for the completed and accepted quantities under the following:

PAY ITEM	PAY UNIT
Sign Panels, Type and Size	Square Foot

SECTION 03200 - CONCRETE REINFORCEMENT

1. DESCRIPTION

This work shall consist of furnishing and placing steel for reinforcement of concrete. The reinforcement shall consist of bars, of the quality, type, size, and quantity designated by these specifications and as shown on the plans.

2. MATERIALS

Materials shall meet requirements specified in the following KDOH Section.

Steel Reinforcement	811

The CONTRACTOR shall provide the Engineer with copies of the steel manufactures manifest which indicates the heat or test identification numbers and the grade of steel provided.

3. PROTECTION OF MATERIAL

Proper care shall be used in handling and storing steel reinforcement to prevent bending, excessive rusting, or coating with objectionable substances.

4. CONDITION OF MATERIAL

Reinforcement, when incorporated into the work, shall be reasonably free from dirt, paint, oil, grease, loose-thick rust, or other foreign substance, and, when deemed necessary, shall be cleaned to the satisfaction of the ENGINEER. Tight-thin or powdery rust on these materials shall not be cause to require cleaning. Reinforcement which is rusted sufficiently to cause it to fail to meet specified physical properties shall be rejected.

5. STRAIGHTENING

Reinforcement which may have become bent during shipment or handling shall be straightened before being placed in the work. Straightening shall be done in a manner which will not injure the steel. Heating will not be allowed. Sharp kinks shall be cause for rejection.

6. BENDING

Reinforcement shall be bent cold. It shall be bent accurately to the dimensions and shapes shown on the plans and to within tolerances designated in the CRSI Manual of Standard Practice. In bending, care shall be taken not to injure the steel and only proper appliances and competent workmen shall be employed on the work. Bars shall be bent in the shop before shipment and shall not be bent in the field, unless otherwise noted.

7. PLACING AND FASTING

All steel reinforcement shall be accurately placed in positions shown and firmly held in position during placement and hardening of concrete. All steel reinforcement shall be spaced to within a tolerance of plus or minus 1/2 inch and placed to within a tolerance of plus or minus 1/4 inch of specified clearance from the face of concrete. Dimensions shown from the face of concrete to bars are clear distances, unless otherwise noted. Bar spacings are from center to center of bars. Bars shall be tied at all intersections, except where

spacing is less than one foot in both directions, then alternate intersections shall be tied. Vertical stirrups shall always pass around the main tension members and shall be securely attached thereto.

Distances from forms shall be maintained by means of stays, blocks, ties, hangers, or other approved supports. Supports for holding reinforcement from contact with the forms shall be approved precast blocks composed of mortar or approved metal chairs. The tips of metal chair supports which are in contact with the surface of the concrete shall be plastic coated steel. When plastic coated steel supports are used, there shall be a minimum of 1/8-inch thickness of the plastic material between the metal tips and the exposed surface of the concrete. The steel placed in reinforced concrete slabs shall also be securely tied down with wire 0.148 inch or greater in diameter at intervals not greater than 8 feet in both the longitudinal and transverse directions to prevent any possibility of steel rising above the specified elevation during placing, vibrating, and finishing the concrete. Metal supports shall have a shape that will be easily enveloped by the concrete.

The top mat and bottom mat of bars shall be separated by precast mortar blocks or by other equally suitable devices. The use of pebbles, pieces of broken stone or brick, metal pipe, and wooden blocks shall not be permitted as separators. Reinforcement in any member shall be securely placed and then inspected and approved before the placing of concrete begins. Concrete placed in violation of this provision may be rejected.

8. SPLICING

No splicing of reinforcement will be permitted, except those splices of the type and at the locations shown, without written permission. Acceptable splices may include lapped splices, welded splices, mechanical splices, or other positive connection splices designated by the plans or ENGINEER.

Lapped splices, except splices for spiral shapes, shall have a length of no less than 40 times the nominal diameter of the reinforcement being spliced, unless otherwise designated. Lapped splices in areas not designated on the plans shall be rigidly clamped or wired together in an approved manner.

Welded splices shall be in conformance with the AWS Reinforcing Steel Welding Code, current edition. Bars to be welded shall be butted and welded so as to develop, in tension, at least 125 percent of the specified yield strength of the bars. Welded splices will not be permitted unless shown on the plans or approved by the ENGINEER.

Mechanical splices shall be used primarily for bars required for compression only. Mechanical splices for bars designed to carry critical tension or compression shall be equivalent in strength to approved welded splices.

All splices added in the field and not shown on the plans shall be made as far from the point of maximum tensile stress in the member as practicable and splice points shall be staggered 3 feet or more in adjacent bars, when possible. No splices shall be used which reduce the clear distance between the splice and the closest bar to less than the minimum clear distance of 4 inches.

All splices shall be made with clean, sound materials properly affixed to the members being spliced and shall be free of any substances that would weaken or contaminate the splice or concrete surrounding the splice.

When welded or mechanical splices are permitted, 2 test specimens of the spliced reinforcement shall be prepared and submitted to the ENGINEER for testing prior to the incorporation of such splices into the work, and on additional test specimen shall be submitted for each 100 splices made. The welded splices shall be made only by workmen who are qualified in conformance with the AWS Reinforcing Steel Welding Code.

9. METHOD OF MEASUREMENT

Reinforcing steel will be measured by the pound, based on the theoretical number of pounds complete in place as shown or as ordered and accepted in the final work.

The quantities of materials furnished and placed shall be based upon the calculated weights of the reinforcing steel actually placed in accordance with these specifications. Bars used to replace test specimens will also be measured for payment. The weights calculated will be based upon the following table.

ASTM STANDARD REINFORCING BARS

BAR SIZE	NOMINAL WEIGHT	NOMINAL DIMENSIONS -- ROUND SECTIONS		
	Pounds Per Foot	Diameter Inches	Cross-Sectional Area, Sq. Inches	Perimeter Inches
# 3	0.376	0.375	0.11	1.178
# 4	0.668	0.500	0.20	1.571
# 5	1.043	0.625	0.31	1.963
# 6	1.502	0.750	0.44	2.356
# 7	2.044	0.875	0.60	2.749
# 8	2.670	1.000	0.79	3.142
# 9	3.400	1.128	1.00	3.544
#10	4.303	1.270	1.27	3.990
#11	5.313	1.410	1.56	4.430
#14	7.650	1.693	2.25	5.320
#18	13.600	2.257	4.00	7.090

10. BASIS OF PAYMENT

Payment shall be made for the completed and accepted quantities under the following:

PAY ITEM	PAY UNIT
Steel Reinforcement	Pound

SECTION 03300 - CAST IN PLACE CONCRETE

1. DESCRIPTION

All concrete box or arch culverts, sidewalks, curb and gutter, and headwalls for pipe shall be built as indicated, in reasonably close conformity to line, grade, dimensions and design shown on the plans, and in accordance with these specifications.

2. MATERIALS

Materials and construction shall meet requirements specified in the following KDOH Sections and/or Technical Specifications.

Concrete, Class A	KDOH Section 601
Steel Reinforcement	TS Section 03200
Concrete Pipe	KDOH Section 810.03

3. GENERAL

All concrete construction shall conform to the applicable requirements of KDOH Section 601.

4. TESTING

All concrete testing shall be provided by a qualified Geotechnical Engineering Consultant; meeting at a minimum the "Manual of Field Sampling and Testing Practices" guidelines with all costs borne by the CONTRACTOR, and results provided to the ENGINEER.

Compressive strength specimens will be cast and tested in accordance with KM 64-304 and ASTM C 39, respectively. In cases of failures, cylinder results will be evaluated in accordance with KM 64-314 to determine whether in-place investigation may be necessary.

5. SIDEWALKS

Sidewalks shall be constructed on a prepared, compacted, smooth subgrade of uniform density formed by trenching or filling to the required elevations.

Large boulders and ledge rock found in the subgrade shall be removed to a minimum depth of six inches below the finished subgrade elevation and the space shall be backfilled with suitable material.

The CONTRACTOR shall furnish a template and check the subgrade prior to depositing concrete.

Sidewalks may be placed by use of side forms or an approved slip form method.

The minimum thickness for sidewalks shall be 4.5 inches.

Slip forming shall comply with the requirements of KDOH Section 601.20, Part C. Any excess slumping or irregularities shall be corrected immediately after passage of the slip form machine, and finished and broomed to blend with the general appearance of the adjacent concrete.

Before concrete is given final finish and brooming, the surfaces shall be checked with a 10 foot straight edge and any irregularities or more than 1/4 inch shall be eliminated.

All edges shall be rounded to 1/4 inch radius.

The surfaces of sidewalks shall be divided into rectangular areas by means of a jointer having a radius of 1/4 inch and forming a groove no less than an inch in depth for the full width of the walk, or the joints may be sawed in accordance with KDOH Section 501.18. The length of the rectangle formed shall not exceed the width of the sidewalk being constructed unless otherwise directed.

6. CURB AND GUTTER

Curbs, gutters, and combination curb and gutters may be cast in place by use of side forms meeting the requirements of KDOH Section 601.

The subgrade shall be prepared and moistened before concrete is placed. During placement, the concrete shall be thoroughly spaded and vibrated or tamped until the mortar entirely covers the surface and all honeycombs and voids are eliminated.

Expansion joints shall be constructed at all breaks in alignment, at all drainage boxes and other fixed objects, at the beginning and ending points of curves, and at the beginning, quarter, middle and ending points of semicircular curves, except joints at the quarter points will not be required for semicircles having radii of 5 feet or less.

A curb and gutter adjacent to median shall be constructed with a cross slope which matches that of the adjoining pavement.

7. STRUCTURE EXCAVATIONS

Any and all excavation relative to safe structure placement/construction shall be incidental to the structure cost. No payment will be made for structure excavation.

8. BASIS OF PAYMENT

Concrete and steel reinforcement for structures and headwalls, other than sloped and flared inlet/outlet headwalls, will be paid for at the unit price bid for the items in accordance with KDOH 601. No payment will be made for structure excavation or backfill; such excavation and backfill shall be incidental to the cost of the structure.

Payment will be made under:

PAY ITEM	PAY UNIT
KYDOH Junction Box	Each
Class A Concrete	Cubic Yard

SECTION 03350 – DETECTABLE WARNING SURFACE TILE

1. SCOPE OF WORK

This Section specifies the type and installation of the Detectable Warning Surface Tiles here indicated and is concurrent with the installation of concrete sidewalk ramps. Tiles shall be Access Tile (Tactile System) Cast in Place Replaceable Tile manufactured by Access Products, Inc. (241 Main Street Suite 100–Buffalo, NY 14203, Tel: 888-679-4022, Fax: 877-679-4022, email for Tech Support: tech@accessproducts.com).

2. RELATED WORK

Sections 03300 cast in place concrete.

3. DELIVERY, STORAGE AND HANDLING

A. Replaceable Cast in Place Detectable/Tactile Warning Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy plastic wrappings to protect tile from concrete residue during installation and tile type shall be identified by part number.

B. Replaceable Cast in Place Detectable/Tactile Warning Tiles shall be delivered to location for storage prior to installation.

4. SUBMITTALS

Shop drawings shall be submitted in accordance with the general conditions.

5. QUALITY ASSURANCE

A. Provide Replaceable Cast in Place Detectable/Tactile Warning Tiles and accessories as produced by a single manufacturer with a minimum of three (3) years experience in the manufacturing of Cast in Place Detectable/Tactile Warning Tiles.

B. Installer's Qualifications: Engage an experienced installer certified in writing by Replaceable Cast in Place Detectable/Tactile Warning Tile manufacturer as qualified for installation, who has successfully completed installations similar in material, design, and extent to that indicated for project.

C. Americans with Disabilities Act (ADA): Provide Replaceable Detectable/Tactile Warning Tiles which comply with the detectable warnings on walking surfaces section of the Americans with Disabilities Act (Title III Regulations, 28 CFR Part 36 ADA STANDARDS FOR ACCESSIBLE DESIGN, Appendix A, Section 4.29.2 DETECTABLE WARNINGS ON WALKING SURFACES).

D. Engineered Polymer Composite Replaceable Cast in Place Detectable/Tactile Warning Tiles shall be manufactured from an ultra violet stabilized polymer composition with fiberglass reinforcement, the tile shall incorporate an in line pattern of truncated domes measuring nominal 0.2" height, 0.91" base diameter, and 0.45" top diameter, and spaced center to center 2.35" as measured side by side. For wheelchair safety the field area shall consist of a high density, diamond grip™ pyramid micro texture of raised points 0.05" high; "Access Tile" as manufactured by Access Products, Inc., Tel: 888-679-4022, or approved equal.

1. Dimensions: Replaceable Cast in Place Detectable/Tactile Warning Tiles shall be held within the following dimensions and tolerances: Specifiers Note: Edit section below by selecting desired length and width. Delete non relevant dimensions. Length and Width: [12x12] [24x36] [24x48] [24x60] [36x48] [36x60] [10' Radius Curve] {+/□ .5"] Fasteners/Anchors: 12 min.

2. Compressive Strength of Tile when tested by ASTM D 695□08 not to be less than 25,000 PSI.

3. Tensile Strength of Tile when tested by ASTM D 638□08 not to be less than 12,500 PSI.

4. Flexural Strength of Tile when tested by ASTM D 790□07 Procedure A not to be less than 30,000 PSI.

6. SITE CONDITIONS

A. Environmental Conditions and Protection: Maintain minimum temperature of 40°F in spaces to receive Replaceable Cast in Place Detectable/Tactile Warning Tiles for at least 24 hours prior to installation, during installation, and for not less than 24 hours after installation.

B. The use of water for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the general public. Provide barricades or screens to protect the general public.

7. WARRANTY

A. Replaceable Cast in Place Detectable/Tactile Warning Tiles shall be warranted in writing for a period of five (5) years from date of final completion. The guarantee includes defective work, breakage, deformation, fading and loosening of tiles.

8. PRODUCTS

A. MANUFACTURERS

1. The Engineered Polymer Composite Replaceable Cast In Place Detectable/Tactile Warning Tile specified is based on Access Tile manufactured by Access Products, Inc. (888□679□4022) existing engineered and field tested products, which have been in successful service for a period of three (3) years are subject to compliance with requirements, may be incorporated in the work and shall meet or exceed the specified test criteria and characteristics.

2. Color: Yellow conforming to Federal Color No. 33538. Color shall be homogeneous throughout the tile.

9. EXECUTION

A. INSTALLATION

1. During the Replaceable Cast in Place Detectable/Tactile Warning Tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.

2. Prior to placement of the Replaceable Cast in Place Detectable/Tactile Warning Tile system, review manufacturer's instructions and contract drawings with the Contractor prior to the construction and refer any and all discrepancies to Project Engineer.

3. The specifications and related materials shall be in strict accordance with the contract documents and the guidelines set by their respective manufacturers.

4. The physical characteristics of the concrete shall be consistent with the contract specifications while maintaining a slump range of 4 □ 7 to permit solid placement of the Replaceable Cast in Place Detectable/Tactile Warning Tile system. An overly wet mix will cause the tile to float. Under these conditions, suitable weights such as sandbags shall be placed on tile.

5. The concrete pouring and finishing operations require typical mason's tools, however, a 4' long level with electronic slope readout, and 10 lb. sandbags are specific to the installation of the Replaceable Cast in Place Detectable/Tactile Warning Tile system.

6. The factory□installed plastic sheeting must remain in place during the entire installation process to prevent the splashing of concrete onto the finished surface of the tile.

7. When preparing to set the tile, it is important that no concrete be removed in the area to accept the tile. It is imperative that the installation technique eliminates any air voids under the tile. Gaps in the tile perimeter allow air to escape during the installation process.

8. The concrete shall be poured and finished true and smooth to the required dimensions and slope prior to the tile placement. Immediately after finishing concrete, the electronic level should be used to check that the required slope is achieved. The tile shall be placed true and square to the curb edge in accordance with the contract drawings. The Replaceable Cast in Place Detectable/Tactile Warning Tiles shall be tamped (or vibrated) into the fresh concrete to ensure that the field level of the tile is flush to the adjacent concrete surface. The embedment process should not be accomplished by stepping on the tile as this may cause uneven setting which can result in air voids under the tile surface. The contract drawings indicate that the tile field level (base of truncated dome) is flush to adjacent surfaces to permit proper water drainage and eliminate tripping hazards between adjacent finishes.

9. In cold weather climates it is recommended that the Replaceable Cast in Place Detectable/Tactile Warning Tiles be set deeper such that the top of domes are level to the adjacent concrete on the top and sides of ramp. This installation will reduce the possibility of damage due to snow clearing operations. Care should be taken to finish the concrete on the side of the tile with the lower elevation, adding channels to allow water to drain from the field surface of the tile.

10. Immediately after placement, the tile elevation is to be checked to adjacent concrete. The elevation and slope should be set consistent with contract drawings to permit water drainage to curb as the design dictates. Ensure that the field surface of the tile is flush with the surrounding concrete and back of curb so that no ponding is possible on the tile at the back side of curb.

11. While concrete is workable, a 1/8" radius edging tool shall be used to create a finished edge of concrete, then a steel trowel shall be used to finish the concrete around the tile's perimeter, flush to the field level of the tile.

12. During and after the tile installation and the concrete curing stage, it is imperative that there is no walking, leaning or external force

placed on the tile that may rock the tile causing a void between the underside of tile and concrete.

13. Following tile placement, review installation tolerances to contract drawings and adjust tile before the concrete sets. Suitable weights of 10 to 25 lb each may be required to be placed on each tile as necessary to ensure solid contact of the underside of tile to concrete.

14. Following the concrete curing stage, protective plastic wrap is to be removed from the tile surface by cutting the plastic with a sharp knife, tight to the concrete/tile interface. If concrete bled under the plastic, a soft brass wire brush will clean the residue without damage to the tile surface.

15. Tiles can be cut to custom sizes, or to make a radius, using a continuous rim diamond blade in a circular saw or mini□grinder. Use of a straightedge to guide the cut is advisable where appropriate.

B. REPLACING TILES, PROTECTING AND MAINTENANCE

1. Protect tiles against damage during construction period to comply with Tactile Tile manufacturer's specification.

2. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.

3. Replace tiles by method specified by Tactile Tile manufacturer.

4. Comply with manufacturer's maintenance manual for cleaning and maintaining tile surface. It is recommended to perform annual inspections for safety and tile integrity.

10. BASIS OF PAYMENT

Accepted quantities under this section shall be paid for at the unit bid price per square foot for the appropriate size of Detectable Warning Surface Tile installed. Payment shall be considered full compensation for all materials and labor required to complete the work described in this section.

PAY ITEM	PAY UNIT
Detectable Warning Strip	SF

SECTION 03400 - SMALL DRAINAGE STRUCTURES

1. DESCRIPTION

This work shall include either construction, reconstruction, or adjustment of inlets, outlets, manholes, junction boxes, and other small drainage or sanitary structures in accordance with the plans and these specifications.

2. MATERIALS

Materials shall meet requirements specified in the following KDOH Sections.

Concrete, Class	601
Steel Reinforcement	602
Manhole Pipe	810
Preformed Joint Filler	807
Dense Graded Aggregate	805
Gravel Base	805
Pipe	810
Mortar	601
Structural Steel	812
Miscellaneous Metals	813
Steel Manhole Risers	813.02
Manhole Covers and Lids	813.03
Precast Manhole Sections	815.03

Class A Concrete shall be used in concrete construction specified herein.

3. NEW CONSTRUCTION

All small drainage structures shall be constructed in accordance with details shown and at elevations and locations indicated on the plans or established by the ENGINEER.

All cast iron grates and lids and all structural steel grates shall be attached to the frames, or to the concrete in the event there is no frame, with a chain of sufficient length to permit removal for clean out and maintenance purposes. Shop drawings for the security device, when difference from that shown on the plans, must be approved in writing by the ENGINEER.

Pipe extending through the walls of small drainage structures shall be the same size, type, and meet the same requirements as the pipe with which is to be connected. Extensions shall be of sufficient length to provide for connections and construction as may be necessary to prevent leakage of the pipe and structure wall joint.

All backfill around small drainage structures placed under the pavement, curb, gutter, or sidewalk shall be dense graded aggregate or gravel base, wetted as directed and compacted in layers not to exceed 6 inches loose thickness.

No brick structures shall be constructed.

Concrete pipe cones for manholes may be concentric or eccentric as shown on the plans or approved by the ENGINEER. Precast concrete pipe sections may be used for the base portion of Type A or Type B manholes only when one line of intercepted pipe goes through the section in a straight line and on the same grade. Cast-in-place bases shall be used for

other situations. When a pipe intercepts the tower in the upper portion between the base and the cone, that particular portion of the tower shall be cast-in-place to elevations of one foot above and one foot below the outside diameter of the pipe.

Square outside cast-in-place bases may be used in lieu of round bases.

The channel in the base of circular pipe manholes shall be U-shaped, formed and constructed of Class A Concrete for a smooth continuation of the pipe. The channel height shall not be less than three fourths of the diameter of the smaller pipe that is intercepted.

The tops of box inlets shown on the plans shall be constructed to the same cross slope as any existing or proposed pavements, shoulders, sidewalks, medians, or islands which will abut the box inlets.

Polypropylene plastic coated steel steps shall be installed, in accordance with the plans, in all manholes 4 feet or greater in depth.

Frames, grates, and lids made of structural steel or cast iron for any of the structures will not require painting.

4. PRECAST STRUCTURES EXCEPT MANHOLES

Before fabrication begins, copies of the approved shop drawings shall be furnished to the ENGINEER.

The concrete used shall equal or exceed the requirements for Concrete, Class A. Fabrication of the structures and requirements for a mix design and a Certified Concrete Technician shall be in accordance with KDOH Section 605.

The precast structures shall be set on a foundation of at least 4 inches of dense graded aggregate compacted using mechanical tampers. Box inlets with cantilevered portions shall be backfilled to the elevations of the bottom of the cantilevered element and 4 inches of compacted dense graded aggregate placed, before the cantilevered element is placed.

Positive seals between the pipe and the precast structure, and between individual precast segments of the structure, shall be made in the field. Any special materials required for joint construction shall be furnished to the CONTRACTOR by the structure fabricator at no additional cost to the Owner.

All materials used in manufacture of the precast elements, including cement, aggregates, water, admixtures, steel reinforcement, and galvanized metal items will be sampled and tested according to the KDOH'S standard procedures for these items. Fabrication shall not begin until these materials have been approved.

Structures damaged during handling, transporting, erecting, or backfilling, or any structure that cannot be placed satisfactorily shall be repaired or replaced, as directed or approved.

No additional payment will be made for any additional work or materials required because precast structures are furnished.

5. WATER QUALITY INSERTS

All storm inlets shall be constructed with inlet filter systems, Flexstorm Inlet Filter, or equal, designed for collecting silt and sediment from surface storm water runoff. The

permanent filters shall be capable for removing shall particles, hydrocarbons, and other contaminates.

The inlet system shall be comprised of a corrosion resistant steel frame and a replaceable geotextile sediment bag attached to the frame with a stainless steel locking band. The bag shall be suspended from the rigid frame at a distance below the grate that shall allow full water flow into the drainage structure if the bag is completely full of sediment.

The sediment bag shall be for post-construction conditions (PC) with standard woven polypropylene sediment bags lined with Absorb-It Filter Fabric. The rate of flow through the bags shall be a minimum of 125 gal/square foot.

The bag size shall be determined by the clear opening dimensions of the drainage structure.

All filters shall be installed in accordance with the manufacturer's recommendations.

6. RECONSTRUCTION

This item shall included reconstruction of existing units to be required line and elevation so as to essentially conform to the details shown. This work shall include reconditioning of structures where such work is in excess of the limits for Adjusting.

7. ADJUSTING

Unless otherwise designated, existing frames and covers or gratings shall be adjusted to the proper elevation. This shall be accomplished by removing or adding cast-in-place concrete masonry, precast reinforced concrete masonry, brick masonry, or an adjusting ring, for a vertical distance not to exceed one foot above or below the existing masonry, and replacing existing castings firmly and permanently in place.

When specified, the Adjusting Ring Method as described hereinafter, shall be used for adjusting manhole castings to grade; or when applicable, the Adjusting Ring Method may be used in lieu of the methods outlined in the preceding paragraph. Raising a casting may be accomplished by inserting an additional casting into the existing frame as described under (A), (B), or (C).

A. The adjusting casting shall be of an approved type and shall be held rigidly to the existing frame by use of set screws in the bearing leg of the ring, or the adjusting ring and the existing frame may be spot welded in 4 equally spaced locations.

B. Existing manhole covers shall be adjusted to the proper elevation by inserting a variable height adjustable casting meeting the approval of the ENGINEER into the existing frame. The adjustable casting shall be capable of diameter adjustment as well as vertical height adjustment.

When the difference between the existing elevation and the proposed elevation is less than the outer thickness of the cover or grate plus 1/2 inch, the casting shall provide for receiving a new casting which shall be 2 inches less in diameter in any horizontal measurement than the existing casting. The CONTRACTOR shall furnish a new cover or grate similar in design to the existing cover or grate, except for diameter or other horizontal dimension.

C. Steel expanding manhole risers shall be of the correct height, and shall be designed to receive the existing manhole cover.