

STREETS

301 EARTHWORK

301.1.00 DESCRIPTION

301.1.01 General

This section covers all work necessary for excavation required in the construction of streets, alleys, sidewalks, driveways, ditches, structures and appurtenances thereto.

The City has adopted a wet weather construction standard for public street construction. When approved by the City Engineer, street construction may be allowed during the wet weather season, subject to the following conditions. The City policy requires that any project which initiates excavation for street construction prior to May 1 is required to be built with a wet weather construction standard. The City will begin considering use of the dry weather standard after May 1, depending on ground conditions and existing and forecasted weather conditions. Also any project started after May 1, but which is not scheduled for pavement by October 15 of that same calendar year, must use the wet weather construction standard. The wet weather construction standard structure for street projects in Springfield should be detailed on construction plans for the project, and generally consists of use of geotextile fabric and eight (8) inches of additional rock substructure under the standard designed street structure. Wet weather subgrade requirements on hillside projects shall be evaluated and approved by the City Engineer.

301.1.02 Unclassified Excavation

Unclassified excavation is defined as all excavation, regardless of type, nature or condition of materials encountered. Contractor shall assume full responsibility to estimate the kind and extent of various materials to be encountered in order to accomplish the work.

301.1.03 Classified Excavation

301.1.03A Rock Excavation

Rock excavation is defined as removal of solid bedrock, ledge rock, and boulders having a volume of 2 cubic yards or more that cannot be excavated or removed by dozers with rippers but which require systematic drilling or the use of pneumatic rock splitters, hammers, and wedges.

If material that is classified as rock is mechanically removed with grading/excavating equipment, the volume of material removed shall be measured and paid for as common excavation.

301.1.03B Common Excavation

Common excavation is defined as removal of all material not classified as rock excavation.

301.1.04 Borrow Excavation

Borrow excavation is defined as obtaining material from borrow source lying outside of, separated from, and independent of, planned excavation occurring within the project limits.

301.1.05 Excavation Below Grade

Excavation below grade is defined as required excavation below the planned surface of the subgrade to remove and dispose of unstable or otherwise unsatisfactory material at the time of the original move in.

301.1.06 Over-Excavation

If it is deemed necessary for additional excavation to be performed and additional mobilization is required, this excavation below the planned surface shall be Over-Excavation.

301.2.00 MATERIALS

301.2.01 General

The contractor shall provide embankment and borrow materials of approved earth, sand, gravel or rock, or combinations thereof, free of peat, humus, muck, vegetative matter, organic matter or other materials detrimental to the construction of firm, dense, and sound embankment.

The contractor shall use all approved materials originating from the required excavations as far as practicable in the formation of embankments and subgrade, and for bedding, backfilling and other work as shown in the contract documents or directed by the engineer.

301.2.02 Explosives

Explosives shall be fresh, stable materials manufactured to the standards of the "Institute of Makers of Explosives", and conform to applicable requirements of ORS Chapters 476 and 489.

301.3.00 CONSTRUCTION

301.3.01 Excavation

Contractor shall excavate, remove and dispose of all formations and materials, natural or man-made, irrespective of nature or conditions, encountered within limits hereinafter defined, or as specified in the Contract Documents necessary for construction of the project.

Incidental to excavation shall be the furnishing, installing and removal of all shoring, sheeting and bracing as required to support adjacent earth banks in excavation.

301.3.02 Preservation of Existing Improvements

Operations shall be conducted in such a manner that existing street facilities, utilities, railroad tracks, structures, and other facilities which are to remain in-place will not be damaged, as specified in Section 105 CONTROL OF WORK and ORS 751.541 to 757.571. Contractor shall furnish and install cribbing and shoring or what ever means necessary to support material carrying existing facilities, or to support the facilities themselves, and maintain such supports until no longer needed.

Temporary facilities shall be protected until they are no longer required; and, when temporary supports and other protective means are no longer required, they shall be removed and disposed of as directed.

Existing improvements damaged in the contractor's operation shall be restored or replaced at no expense to the owner.

301.3.03 Excavation of Existing Improvements

Unless otherwise specifically identified, excavation includes sawcutting, excavating, removing, hauling and depositing, including but not limited to existing pavements, walks, driveways, surfacings, slabs, curbs, gutters and similar cement concrete structures, bituminous materials, all rock or gravel road surfacing materials, abandoned sewers, pipes and conduits, logs, piling, footing, foundations, vaults and chambers, when such materials are within the limits of excavation. Volumes of such items from within excavation areas shown will be included in excavation. Payment shall be incidental to excavation.

Remaining ends of abandoned pipes or portions of other items partially removed under this work, which would be left exposed after final excavation, shall be removed to within a minimum of one (1) foot of the Sub-grade or elevation. Ends of abandoned pipes in backfill or embankment areas shall be plugged and sealed as approved. Abandoned railroad tracks shall be removed as directed. Street surfacing, rail ties, bricks, concrete foundations and all track appurtenances shall be removed by cutting or other approved

methods.

Payment for all work in this section and repair of any damage will be considered incidental to the work under bid items for excavation, backfill, or other specified earthwork items.

301.3.04 Limits of Excavation

Contractor shall excavate to the depths and widths designated in the contract documents, allowing for forms, shoring, working space, gravel, or sand base, and topsoil where required. No excavation deeper than elevation shown shall be made without approval. Excavation carried below grade lines shown or established without approval shall be replaced with approved compacted 1-1/2"-0 or 3/4"-0 crushed rock; over-excavation under footings shall be filled with concrete of strength equal to that of the footing, and cuts below grade shall be corrected by similarly cutting adjoining areas and creating a smooth transition, all at no additional expense to the Owner.

301.3.05 Slope Grading

Refer to Section 316 - SLOPE PROTECTION

In general, slopes shall be free of all exposed roots, unstable rock, and loose stones exceeding 3 inches in diameter. Tops of banks shall be shaped to circular curves with not less than 6 foot radius, unless rock makes such work impractical. All surfaces shall be left in a neat condition. Over-excavation and backfilling to the proper grade will not be accepted.

301.3.06 Foundation Stabilization

If, in the judgement of the Engineer, material in the bottom of an excavation is unsuitable for supporting foundations, piers, retaining walls, cribbing, or similar facilities, the Contractor shall over-excavate as directed and backfill to required grade conforming to Section 302 - EMBANKMENT.

301.3.07 Common Excavation

All excavation shall be completed regardless of type, nature, or condition of the material encountered. Method of excavation used is optional, but must be approved by the engineer.

301.3.08 Rock Excavation and Explosives

301.3.08A Depth of Excavation

Contractor shall excavate to the depths designated in the contract documents.

Unauthorized over-excavation shall be corrected with compacted material, as directed, at no additional expense to Owner.

301.3.08B Methods and Records Required

Before rock removal by systematic drilling and blasting or other methods will be permitted, the material shall be exposed by removing common material above it. Engineer shall be notified and with Contractor or his representative, will measure the amount of material to be removed and will record the information. Contractor shall then drill, blast, or break with power-operated tools specially designed for rock excavation, and excavate the material.

301.3.08C Use of Explosives

Contractor shall conform to applicable provisions of Section 107 Legal Relations and Responsibilities in the GENERAL REQUIREMENTS.

Explosives use shall be avoided as far as practicable, and in no case shall tunnel blasting methods be used. Such blasting as must be done shall be controlled in a manner which will avoid possible shattering or loosening of materials back of lines to which the excavations are to be made. All blasting shall be supervised and/or done by a State certified explosives technician. Contractor shall be responsible for any and all damages to property or injury to persons resulting from blasting, or accidental or premature explosions that may occur in connection with the use of explosives. Adequate warning shall be given to all affected persons and adjacent property owners prior to blasting.

Where excavations in hard, solid rock are to be made to depths of (10) feet or more, blasting thereof shall be done by the presplitting or pre-shearing method, unless other methods are approved by Engineer.

301.3.09 Disposal of Excess Material

Disposal of excess material shall be in conformance with Subsection 107.19 WASTE SITES.

301.3.10 Temporary Location of Excavated Materials

Excavated material, suitable for embankment or backfills and not excess material, may be placed only within the construction easement, right-of-way, or approved working area. It shall be piled in such a manner that it will cause a minimum of inconvenience to the public. Contractor shall furnish the Engineer a copy of written approval from each property owner prior to stockpiling material on private property.

Emergency access shall be maintained to all utilities. Clearance shall be left to enable free flow of storm water in all gutters, conduits, and natural watercourses. Contractor shall comply with Section 204 - DUST, NOISE, EROSION AND POLLUTION CONTROL.

301.3.11 Over Excavation for Roadways

Unapproved subgrade material shall be removed to such depths as directed by the engineer. Excavation below subgrade shall be of the same classification as that above subgrade, provided it is removed in the same operation.

When roadway excavation has been completed and it is required to move equipment back in to excavate unsuitable material, the work shall be performed as directed and payment for this excavation below grade shall be paid as over excavation.

Contractor shall excavate below grade and backfill to restore surfaces as directed when required by negligence in work operations, at no expense to Owner.

Overbreak is defined as that portion of any material which is excavated, displaced or loosened outside and beyond slopes, lines, or grades as staked or re-established, with exception of slides as defined in Section 302 - EMBANKMENT, regardless of whether overbreak is due to blasting, to inherent character of any formation encountered, or to any other cause. All overbreak shall be removed and disposed of at no expense to Owner. Where required additional saw cutting of existing asphalt or concrete material to provide a good butt joint shall be made at no cost to the owner.

301.3.12 Dewatering

Contractor shall furnish, install, and operate all necessary machinery, appliances, and equipment to keep excavations free from water during construction. Dewatering and disposing of water shall be accomplished so as to prevent injury to public or private property, or nuisance or menace to the public and shall conform to section 204 DUST, NOISE, EROSION AND POLLUTION CONTROL. At all times sufficient pumping equipment and machinery in good working condition shall be on hand for all ordinary emergencies, including power outage. At all times competent personnel shall be available for operation of the pumping equipment. Surface runoff shall be controlled to prevent entry or collection of water in excavations. All excavations shall be kept free of water when concrete is being deposited or during placement of backfill.

Ground water shall be controlled such that softening of the bottom of excavations or formation of 'quick' conditions or 'boils' during excavation shall be prevented. Dewatering systems shall be designed and operated so as to prevent removal of natural soils and so that ground water level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property.

Before dewatering is started, a statement of the method, installation, and details of dewatering system proposed to be used shall be submitted to the Engineer. Open and cased sumps shall not be used as primary dewatering for excavations deeper than (3) feet below static water table unless authorized.

Ground water shall be released to its static level in such a manner as to maintain the undisturbed foundation soils. Disturbances of compacted backfill and flotation or movement of structures, water mains, sewers, and other utilities, shall be prevented.

Dewatering shall be considered as incidental to, and all costs included in, the various Contract pay items in the Proposal unless listed as a separate pay item .

301.4.00 MEASUREMENT AND PAYMENT

301.4.01 Common and Unclassified Excavation

All common excavation and unclassified excavation will be measured on a cubic yard basis, all in original position prior to excavation. The quantity measured for payment will include only material from within the limits defined herein. Any additional excavation outside of these limits, unless ordered in writing by Engineer, shall be considered as having been made for Contractor's benefit and will be considered as incidental to the work.

301.4.01A Roadbed and Slope Excavation

Pay quantities shall be computed to the neat lines of cross-sections, as staked or as otherwise directed.

301.4.02 Rock Excavation

Rock excavation will be measured on a cubic yard basis for the actual quantity removed within the limits of excavation as defined for common and unclassified excavation. Quantity for payment shall be the amount approved by Engineer.

301.4.03 Dewatering Incidental

Dewatering shall be considered as incidental to and included in the pay item for excavation unless listed as a separate pay item in the Bid Proposal.

301.4.04 Driveway and Sidewalk Excavation

Unless otherwise specified in the bid documents, payment for excavation necessary for

construction of driveways and sidewalks shall be considered incidental to and included in Common Excavation.

If Common Excavation is not listed in the Bid Proposal as a pay item, payment necessary for construction of the driveways and sidewalks shall be incidental to and included in the pay items for providing the specified structure.

301.4.05 Payment

Payment will be made for any or all of the following items when listed as pay items in the Proposal for any particular Contract. If an item is not listed in the Bid Proposal that item shall be incidental.

<u>Pay Item</u>	<u>Unit of Measure</u>
Asphalt and Concrete Removal	S.Y. for street removal
Outside excavation Limits or unless otherwise specified.	L.F. for curb removal S.F. for sidewalk/driveway re- moval
Unclassified Excavation	C.Y.
Over excavation	C.Y.
Common Excavation	C.Y.
Rock Excavation	C.Y.
Borrow Excavation	C.Y.
Sawcutting	L.F.
Dewatering	MGAL

302 EMBANKMENT

302.1.00 DESCRIPTION

302.1.01 General

This section covers all work necessary for construction of embankment required in construction of streets, alleys, sidewalks, driveways, ditches, structures and appurtenances thereto.

302.1.02 Embankment

Embankment is defined as furnishing, placing, and compacting embankment materials to the depth and configuration as shown in the contract documents.

302.2.00 MATERIAL

302.2.01 Borrow and Embankment Materials

Contractor shall provide embankment and borrow materials of approved earth, and bar-run or river-run, gravel or rock, or combinations thereof, as specified or directed, free of peat, humus, frozen ground, organic matter or other materials detrimental to construction of firm, dense, and sound embankments.

The contractor shall use all approved materials originating from required excavations as far as practicable in the formation of embankments and subgrade, and for other work as shown or directed. Maximum particle size shall be as shown in the contract documents or approved.

302.2.02 Foundation Stabilization

Foundation stabilization consisting of gravel or crushed aggregate ranging in size from 2-1/2 inches - minus to 3/4-inches - minus shall be used as specified in the contract documents or directed. Material shall conform to Section 305 - AGGREGATE BASES

302.2.03 Water for Compaction

Water for compaction must conform to Section 304 - WATERING.

302.3.00 CONSTRUCTION

302.3.01 Embankment

302.3.01A Roadway Embankment

1. Preparation of Embankment Foundations.

Prior to construction of embankments, unsuitable material shall be excavated and disposed of. Excavation shall be limited to lines, grades and cross-sections as shown in the contract documents or as approved.

Basements, trenches and holes which occur within embankment limits shall be backfilled with approved material.

Concrete floor of basements shall be broken as approved.

Contractor shall compact natural ground underlying embankments to the depth of grubbing or a minimum of 12 inches, to the density specified for the embankment material to be placed.

2. Embankment Construction

Embankments and fills shall be placed in approximately horizontal layers of a maximum of eight inches (8") in thickness and each layer compacted separately and thoroughly to density specified in Subsection

302.3.02 CONSTRUCTURAL BACKFILL AND COMPACTION.

In the immediate vicinity of curbs, walks, driveways, inlets, manholes and similar structures, in holes, and where embankment and fill materials cannot be reached by normal compacting equipment, the materials shall be compacted to specified density by approved methods.

Where embankments are constructed predominantly of rock fragments, material shall be placed in layers of the thickness as directed, but not greater than (3) feet. The contractor shall distribute and manipulate rock so that interstices between larger pieces are filled with small pieces, forming a dense and compact mass.

Embankment construction and fill shall not move, endanger or over stress any structure.

Embankments at the end of bridges shall be placed and compacted and extended a

distance 3 times fill height from each bridge end prior to the time that work begins on the bridge ends. Embankments shall not be constructed when embankment material, foundation, or embankment on which it would be placed is frozen.

Embankments constructed upon natural ground slopes which are steeper than five (5) horizontal to one (1) vertical shall be keyed by means of benches excavated into the natural ground. The width of the benches for keying shall be a minimum of ten (10) feet. The vertical spacing between benches shall be a maximum of twenty (20) feet. The construction operation shall be such that a slip plane is not created between the original material and the newly compacted material.

3. Compacting and Density Requirements.

Density of compacted materials in-place will be determined by AASHTO T 191, T 205, or T 238 and maximum density by AASHTO T 99 or T 180.

All embankments, fills and backfills shall be compacted within (3) feet of established subgrade elevation to a minimum density in-place of 95 percent of maximum density and shall be within 1% above to 2% below optimum moisture.

Roadbed cuts and foundations for structures to a depth of (1) foot below established subgrade of foundation elevation shall be 3 inch maximum material and shall be compacted to a minimum density in place of 95 percent of maximum density.

Watering of materials shall be performed to provide compaction of embankments and backfills and to alleviate dust nuisance, as specified in Section 204 - DUST, NOISE, EROSION AND POLLUTION CONTROL, or as directed.

Embankment or backfill materials shall not be placed in final position until moisture in excess of optimum moisture has been removed.

If the specified compaction is not obtained, the contractor shall notify the engineer. The contractor may be required to use a modified compaction procedure or apply additional compactive effort. If approved materials meeting the specifications in the contract documents cannot be compacted to the required density regardless of compactive effort or method, the engineer may reduce the required density or direct that alternate materials be used. In no case shall earthwork operations proceed until the contractor is able to compact the material to the satisfaction of the engineer.

4. Slide Removal and Repair.

Side slopes shall be constructed as staked or re-established. In case a slope, finished to the

lines as staked or re-established, slides back of established slope into the roadway prism, or out of an embankment before acceptance of the work, slide material shall be removed and the slope reconstructed as directed. Reconstruction will be paid for as extra work, unless due to negligence by Contractor.

Materials to replace embankment slides shall be obtained from approved source. Slopes undercut at the base or destroyed in any manner due to negligence during the work shall be repaired by resloping parallel to slope or as approved, at no expense to Owner.

302.3.01B Structural Embankment

Approved materials free from roots, organic material, trash, and stones larger than 3 inch diameter shall be deposited in lifts not exceeding a 6 inch loose thickness across the full width of embankment. Each lift shall be compacted to 95 percent of maximum density at optimum moisture content, as determined by the applicable method of AASHTO T-99.

302.3.02 Structural Backfill and Compaction

302.3.02A Moisture Control

Moisture content required for compaction shall be maintained 1% above to 2% below optimum, as determined by ASTM D 698, throughout each lift of the fill. Any required moisture shall be added to material which is not predominantly granular by nature, preferably at the site of excavation. Moisture shall be added to granular backfill by sprinkling or spraying during compaction operation. Nongranular material shall not be compacted if it is significantly above optimum moisture content. It shall be aerated by such processes as scarifying, blading or disking.

302.3.02B Common Backfill

Common backfill shall be placed to lines and grades shown to produce a rough grade in areas containing no structures, paving, utilities or similar appurtenances. Material shall be deposited in lifts not exceeding 6-inches in loose thickness. Each lift shall be compacted to at least 90 percent of its maximum density at optimum moisture content, as determined by the applicable method of ASTM D 698, before placing next lift.

302.3.02C Granular Backfill Around Structures

Imported granular backfill shall be placed in lifts not exceeding a 6 inch loose thickness. Each lift shall be compacted to 95 percent of its maximum density at optimum moisture content, as determined by ASTM D 698, Method D, before placing next lift.

302.3.02D Granular Backfill Under Footings and Slabs

When shown, natural ground shall be graded and prepared as approved, and crushed granular backfill placed under footings, slabs and other structures. Material shall be deposited in lifts not exceeding a 6-inch loose thickness, and compacted to 100 percent of its relative maximum density at optimum moisture content, as determined by ASTM D 698, Method C, before placing next lift.

302.3.02E Granular Backfill Under Facilities

When shown, imported granular backfill shall be placed in previously excavated areas under sidewalks and similar structures and facilities. Material shall be placed in lifts not exceeding a 8 inch loose thickness, and compacted to 90 percent of its maximum density at optimum moisture content, as determined by ASTM D 698, Method D, before placing next lift.

302.3.02F Sand Backfill

Sand backfill shall be used wherever shown or directed, and for drainage blanket under vapor barriers where such barriers are used beneath concrete slabs. Material shall be placed in lifts not exceeding 8 inches in loose thickness and compacted to the percentage of maximum density at optimum moisture content as shown or directed and determined by ASTM D 698, Method A, before placing next lift.

302.4.00 MEASUREMENT AND PAYMENT

302.4.01 Embankment

Measurement for embankment compacted in-place will be made on a cubic yard basis. Computation of volume payment will be based on field measurement of the actual number of cubic yards constructed and accepted, complete within the limits shown or directed; where applicable, this shall be within neat lines of the staked cross-section. No measurement or payment will be made for quantities required due to shrinkage, settlement, washout, slippage or loss regardless of cause; subject however to the provisions of RESPONSIBILITY OF CONTRACTOR in Subsection 105.05 of the GENERAL REQUIREMENTS.

No deduction will be made for piers, columns, pipes or miscellaneous construction features constructed within embankment limits. Payment shall constitute full compensation for all work and all materials used, whether obtained from the site of work or imported complete as specified. The trench excavation, bedding, and backfill placed in the completed embankment will be paid for separately for the particular item and class of construction.

302.4.02 Structural and Roadway Foundation Stabilization

Measurement for these items will be made on a cubic yard or per ton basis.

302.4.03 Backfill

Unless shown in the Proposal, all backfill of the type specified shall be considered as incidental to and included in the pay item for the appurtenant structure or facility.

302.4.04 Payment

Payment will be made for any or all of the following items when listed as pay items in the Proposal for any particular Contract.

<u>Pay Item</u>	<u>Unit of Measure</u>
Embankment	C.Y.
Foundation Stabilization	C.Y. or TON
Granular Backfill Material	C.Y. or TON

303 SUBGRADE

303.1.00 DESCRIPTION

This section covers all work necessary for the complete preparation of the subgrade prior to the placement of subsequent structural courses. See also Section 203 - CLEARING AND GRUBBING for clearing and grubbing requirements, Section 301 - Earthwork for EARTHWORK and Section 302 EMBANKMENT for backfill requirements.

Subgrade is defined as the area of new or existing streets, alleys, driveways, sidewalks or other public places upon which further materials are to be placed as a part of the work covered in other sections, now or in the future.

Unless otherwise stated the subgrade shall be considered to extend over. The full width of the specified base course. The width of the subgrade under streets shall in all cases extend to one (1) foot beyond the back of future curb or edge of pavement. Subgrade shall be classified as treated or untreated.

303.1.01 Untreated Subgrade

The top 1' of material placed in embankments or the top 1' remaining from cuts in the normal grading of the roadbed, and which is brought to true line and grade, shaped and compacted as necessary to provide a foundation for the pavement structure.

303.1.02 Treated Subgrade

Subgrade which is improved by the addition of stabilizers and prepared as in untreated subgrade.

303.2.00 MATERIALS

303.2.01 Soil Stabilizing Materials

Soil stabilizing materials shall conform to the following requirements:

<u>Material</u>	<u>Type</u>	<u>Grade</u>
Hydrated Lime	AASHTO M 216, TYPE 1	GRADE A
High-Calcium Hydrated Lime	AASHTO T 27 & T 219 for grading & hydroxide	100% Passing 3/8" sieve, max. (15%) passing 100

	content, with min. 85% Calcium Hydroxide.	sieve.
Granular Quick Lime (CaO)	AASHTO T 27 & T 219 for grading & hydroxide content, with min. 85% Calcium Hydroxide.	100% passing 3/8" sieve, max. 25% passing 100 sieve.
Calcium Chloride	AASHTO M 144, SAMPLING AND TESTING IN ACCORDANCE WITH AASHTO T 143	
Sodium Chloride	AASHTO M 143	
Portland Cement	AASHTO M 85	Conform to Portland Cement in Sec. 311 - Concrete Structures

Storage of materials shall conform to Subsection 106.06 STORAGE AND PROTECTION OF MATERIALS. Quicklime in dry form requires several safety precautions be taken to prevent injury to persons and livestock. Spilled or deposited quicklime at places other than on areas designated, shall be immediately picked up, buried, or slaked with water to eliminate the hazard.

303.2.02 Water

Water shall conform to the requirements in Subsection 304 - WATERING.

303.3.00 CONSTRUCTION

303.3.01 Preparation

In advance of setting line and grade stakes the work area shall be cleared of all brush, weeds, vegetation, grass and debris. The right of way shall be flagged by the Engineer.

303.3.02 Untreated Subgrade

The subgrade shall be excavated and shaped to line, grade, and cross section and compacted to 95% maximum density as determined by AASHTO T 99 and shall be within 2% optimum moisture as determined by nuclear gauge.

Areas of extreme softness will be removed to a depth determined by the Engineer, and subsequently replaced with imported bar-run, river-run or crushed quarry rock backfill in conformance with Section 302 - EMBANKMENT.

303.3.03 Treated Subgrade

303.3.03A General

Work done under this item shall consist of treating the top layer of the subgrade with the specified stabilization material and to form a stabilized course of material. The treatment shall be made at the locations shown on the Plans, or as directed by the Engineer.

When specified, lime for stabilization purposes shall be one of the following:

1. Hydrated lime in slurry form
2. Granular quicklime in dry form
3. Quicklime in slurry form
4. Hydrated Lime in dry form

303.3.03B Area Preparation

Since it is a general rule that subsoils requiring treatment are found to be unstable, the Contractor shall be only required to shape the excavated subgrade to as neat a cross section and grade as is practicable, or as directed by the Engineer. Loosening the soil to a depth to be treated, or the addition of water to the soil prior to stabilizer application, shall be at the option of the Contractor.

303.3.03C Application

Stabilizer shall be applied at a uniform rate of between 3 to 7 percent of the dry weight of the material to be treated. The percent of stabilizer shall be set forth in the Special Provisions or as directed by the Engineer. Bagged stabilizer may be used, at the option of the contractor, where accessibility or length of the project make bulk delivery impracticable. When bagged stabilizer is used, the debris shall be safely removed from

the job-site and disposed of by the Contractor. As stabilizer applications may differ from project to project, the Contractor must be aware of the Special Provisions covering stabilization for each project.

Stabilizer shall be spread evenly over the entire area to be treated in such a manner as to eliminate undue loss of stabilizer by displacement or blowing. Such undue loss of stabilizer shall require replacement of stabilizer by the Contractor at no cost to the Owner.

Water shall be added during mixing operations to keep the mixture at optimum moisture content. Optimum moisture content must be maintained until mixing is completed.

303.3.03D Mixing

Mixing of the stabilizer, water and soil shall begin as soon as is practicable after the application of stabilizer. After the initial mixing of the material, the mixture should be allowed to slack and age for the time required for the complete mellowing of the soil. Mixing shall then continue until a homogeneous mixture is obtained in which all material, excluding stones, will pass a 1 inch sieve and at least 60 percent of which will pass a No. 4 sieve.

303.3.03E Compaction and Finishing

Immediately after the mixing has been completed, the mixture shall be spread to specified line, grade and cross-section, and the entire depth of the mixture shall be compacted to a density of not less than 95 percent of the relative maximum density as determined by AASHTO T 99. Testing methods used for determining in-place density shall be according to AASHTO T 238.

If the specified compaction is not obtained, the contractor shall notify the engineer. The contractor may be required to use a modified compaction procedure or apply additional compactive effort. If approved materials meeting the specifications in the contract documents cannot be compacted to the required density regardless of compactive effort or method, the engineer may reduce the required density or direct that alternate materials be used.

In no case shall earthwork operations proceed until the contractor is able to compact the material to the satisfaction of the engineer.

This compaction shall be attained and the surface brought to finished condition within 12 hours after compaction begins; otherwise, the mixture shall be loosened and stabilizer and water added as directed, after which the freshened material shall be remixed, relaid, and compacted at the Contractor's expense. During the compacting, the surface of the mixture

shall be maintained at proper grade and cross-section and shall be lightly watered to retain optimum moisture content. Final finishing shall be accomplished by rolling, accompanied by light watering and reshaping, to provide a finished surface free of hairline cracking and free of ridges exceeding 0.05 foot in height.

303.3.03F Tolerance In Thickness

The thickness of completed treated subgrade will be subject to determination by the Engineer from measurements in holes drilled or dug by him in the finished work at locations of his selection. Areas which are found deficient in thickness by more than 0.1 foot or excessive in thickness by more than 0.1 foot shall be reworked, as above specified, except that fresh stabilizer is to be added in an amount equal to one half of the specified original amount; all at Contractor's expense.

303.3.03G Curing and Protection

The finished surface shall be kept moist and protected from rutting, spalling, displacement and disfiguration until a subsequent course of planned construction, which will prevent drying of the mixture by evaporation or absorption is placed thereon, unless otherwise directed.

Traffic over completed treated subgrade shall be limited to wheel loads which do not cause any visible deflection of the surface and which do not rut, ravel or wear the surface in any way. Damage to the finished treatment will be cause for reworking and for the restoration of the treated area to specified construction requirements.

303.4.00 MEASUREMENT AND PAYMENT

303.4.01 Measurement

303.4.01A Incidental Work

No measurement shall be made for work involved in clearing the subgrade of vegetation and other debris, draining water from the subgrade, smoothing the subgrade in preparation for staking, or blading, shaping, and compacting the subgrade roadbed materials to a depth of 1 foot below the subgrade, to final line, grade and cross-section. All work involved in these processes will be considered incidental to and included in the various other items of work in the Proposal.

303.4.01B Work Paid in Other Sections

Excess materials which cannot be disposed of by drifting into low spots during blading and shaping operations will be measured and paid for as provided in Section 301 - EARTHWORK Suitable backfill material, when furnished and placed as directed, will be

measured and paid at the unit price for the type of material involved, as provided in Section 302, EMBANKMENT.

303.4.01C Untreated Subgrade

No measurement and payment will be made for preparation of untreated subgrade unless otherwise provided.

303.4.01D Soil Stabilizing Materials

Quantities for soil stabilizing materials will be measured by the ton, dry weight to the nearest 0.01 ton, for the materials incorporated in the work at the rate and in the quantity specified or directed. Measurement and payment of stabilizing materials will not include any which are lost, displaced, used in reworking, and used in restoration work or used contrary to direction. Packaged materials will be accepted at the net weight shown by the manufacturer, subject to periodic verification and approval. A certificate will be provided with each shipment together with a certified copy of the weight of each delivery.

303.4.01E Treated Subgrade

Quantities for treated subgrade will be measured by the square yard, to the nearest square yard of the finished surface of the treatment within the neat lines shown or established.

303.4.02 Payment

303.4.02A Soil Stabilizing Materials

Payment for soil stabilizing materials will be made on a ton basis for the type or types specified and used in the work, unless the material is specified incidental to the work being done.

303.4.02B Treated Subgrade

Payment for treated subgrade will be made on a square yard basis for the type or types specified and used in the work. Treated Subgrade will be measured on the surface to the nearest 0.1 foot. Payment will be made on a square yard basis, to the nearest 0.1 yard.

304 WATERING

304.1.00 DESCRIPTION

This section covers work necessary to furnish and apply water or combinations of water and compatible binders or additives for roadway excavations, embankments, subgrades, roadbeds, backfills, sub-bases, bases and surfacings, and water for the alleviation or prevention of dust within the project limits, as directed.

304.2.00 MATERIAL

304.2.01 Water

Water shall be free of silts and other deleterious matter. The Contractor shall make all necessary arrangements and pay all costs for obtaining water. An adequate supply of water shall be maintained at all times, as approved.

Owner shall in no way guarantee a source of water from utility owned fire hydrants. It shall be the responsibility of the Contractor to obtain the necessary permits from the involved utility and the Springfield Fire Department, prior to taking water from a fire hydrant.

304.2.02 Binders and Additives

When shown, specified or directed a mixture of water and an approved compatible binder or additive material shall be used.

304.3.00 CONSTRUCTION

Watering shall at all times be under the direction and subject to control of the Engineer, as approved.

Watering shall be by means of tank trucks equipped with spray bars, by hose and nozzle, or by other approved equal means which ensure uniform and controlled application. The use of splash boards will not be permitted without prior approval.

Watering shall be performed at any hour of the day and on any day of the week necessary. Water shall be sprinkled directly on the road only when loss by evaporation is at a minimum, unless otherwise directed.

When compatible binder material or additive is combined with water in the work, it shall be mixed in conformance with the manufacturer's directions, as specified or as directed.

304.4.00 MEASUREMENT AND PAYMENT

304.4.01 Measurement

304.4.01A Water By Volume

Quantities of water determined by volume will be measured in units of 1,000 gallons (M-gals) to the nearest 0.1 unit, exclusive of binders and additives mixed therewith. Measurement will be made in tanks or tank trucks of predetermined and approved capacities or by approved meters provided by the Contractor. Measurement and payment will be made only for quantities as are approved for use in the work.

304.4.01B Water By Weight

Quantities of water determined by weight will be measured in units to the nearest 0.01 ton. Measurement will be the actual tons used based on weight tickets from State certified scales presented for approval on the day the water is delivered. No measurement or payment will be allowed on tickets not so delivered and approved.

304.4.01C Binders and Additives

Quantities of compatible binders or additives combined with water for watering purposes will be determined separately from the water and will be measured as specified and shown on the Proposal.

304.4.02 Payment

304.4.02A Water on Incidental Basis

When neither specified nor shown in the Proposal for separate payment, all water will be considered incidental to the other items of work and no separate payment will be made.

304.4.02B Water By Volume

Payment for water will be made on a 1,000 gallon (M-gal.) basis.

304.4.02C Water By Weight

Payment for water will be made on a ton basis.

304.4.02D Binders and Additives

Payment for compatible binders or additives combined with water for watering purposes will be paid for at the applicable Contract unit price as set forth in the Proposal. Payment shall constitute full compensation for the binder material or additive, for the combining of it with the water and for all extra costs involved in the use of the binder material or additive in the watering work.

305 AGGREGATE BASES

305.1.00 DESCRIPTION

This section covers work necessary to furnish and place one or more courses of aggregates and water, as subbase or base, on a prepared surface.

305.2.00 MATERIALS

Aggregates for aggregate base shall be crushed gravel or crushed rock, including sand.

305.2.01 Aggregates

305.2.01A General

Aggregates shall be subject to approval at the source or at the actual stockpile from which the aggregate is taken for incorporation in the work. During production of the aggregate, samples of each stock pile will be provided for testing if requested by Engineer. On the basis of testing, crushing and screening operations shall be modified or adjusted to bring each separate size of aggregate within grading, proportions, and quantities as specified.

In all stages of production, transporting, and stockpiling, aggregates will be handled in such a manner as will prevent the segregation of materials and the intermingling of separate gradings or kinds of aggregates, as far as practicable.

Grading of designated aggregate sizes shall conform to the requirements of appropriate forms of work contained within applicable sections throughout these Specifications.

The determination of sizes and grading of aggregate shall conform to AASHTO T 27 and AASHTO T 11.

305.2.01B Coarse Aggregate

Coarse aggregate is all mineral matter retained on the 1/4" sieve. It consists of crushed rock or gravel free from flat, elongated, soft or disintegrated pieces, organic material, or other deleterious matter occurring in a free state or as a coating on the stone.

Crushed rock or crushed gravel shall be used for coarse aggregate in aggregate bases. Total deleterious matter shall not exceed 2 percent by weight.

Coarse aggregates shall have weighted percentages of loss which do not exceed 12 percent by weight when subjected to five alternations of the Sodium Sulfate Soundness Test (AASHTO T 104).

1. Fracture of Gravel.

Gravel shall have at least two mechanically fractured faces on not less than the following percentages (by weight) of the material retained on a 1/4" sieve.

<u>Type of Use</u>	<u>Percentages</u>
Aggregate Bases (1-1/2" - 0 and larger)	50%
Aggregate Bases (smaller than 1-1/2" - 0)	70%

2. Durability

The source material from which coarse aggregate is produced shall meet the following qualifying test requirements as shown on the following table:

<u>Test</u>	<u>Test Method</u>	<u>Requirements</u>
Degradation:		
Passing No. 20 Sieve	OSHD TM 208	30% Max.
Sediment Height	OSHD TM 208	3" Max.
Abrasion	AASHTO T 96	30% Max.

Also, other sampling and testing of coarse aggregate shall be in accordance with the following methods:

Sampling	AASHTO T 2
Materials Passing No. 200 Sieve	AASHTO T 11
Sieve Analysis	AASHTO T 27
Soundness	AASHTO T 104
Friable Particles	AASHTO T 112
Lightweight Pieces	AASHTO T 113
Fracture	OSHD TM 208

305.2.01C Fine Aggregate

Fine aggregate is all mineral matter passing the 1/4" sieve. It consists of crushed rock or gravel, fine sand, and other finely divided natural and inert mineral matter, thoroughly washed and free of clay, loam, shale, alkali, organic matter and other deleterious matter occurring either free or as a coating on the particles shall be used. Fine aggregate from different geological sources shall not be mixed and stored in the same pile nor used alternately in the same class of construction or mix.

Fine aggregates shall meet the durability requirements for coarse aggregates and shall meet the following Liquid Limit and Plasticity Index requirements:

When tested as specified, both the Liquid Limit and Plasticity Index test results shall conform to the following:

<u>Percent of Material</u>	<u>Liquid Limit</u>	<u>Plasticity Index</u>
<u>Passing No. 40 Sieve</u>	<u>(Maximum)</u>	<u>(Maximum)</u>
OSHD TM 102	OSHD TM 103	
0.0 to 5.0, inclusive	33	6
5.1 to 10.0, inclusive	30	5
10.1 to 15.0, inclusive	27	4
15.1 to 20.0, inclusive	24	3
20.1 to 25.0, inclusive	21	2
Over 25.0	21	0 or N.P.

Sampling and testing fine aggregate shall conform to the following methods:

Sampling	AASHTO T 2
Material Passing No. 200 Sieve	AASHTO T 11
Organic Impurities	AASHTO T 21
Sieve Analysis	AASHTO T 27
Soundness	AASHTO T 104
Friable Particles	AASHTO T 112
Lightweight Pieces	AASHTO T 113
Sand Equivalent	AASHTO T 176

305.2.02 Sand Equivalent

Base aggregates to be incorporated in the work shall have a sand equivalent of not less than 30 when tested in conformance with AASHTO T 176.

305.2.03 Gradation Requirements

The base aggregates shall be uniformly graded from coarse to fine and shall conform to the following grading requirements:

CRUSHED ROCK UNIFORM GRADATION

Sieve Size Passing	Percent Passing by Weight		
	<u>1-1/2" - 0"</u>	<u>1" - 0"</u>	<u>3/4" - 0"</u>
2"	100%	--	--
1-1/2"	95-100%	100%	--
1-1/4"	--	--	--
1"	--	90-100%	100%
3/4"	55-75%	--	90-100%
1/2"	--	55-75%	--
1/4"	35-50%	40-55%	40-60%
No. 10	14-30%	16-33%	16-36%
No. 40	3-18%	8-24%	8-24%
No. 200	0-8%	0-8%	0-10%

NOTE: Percent passing #200 sieve shall not exceed one-half (1/2) the percent passing the #40 sieve.

For determination of sizes and grading, conform to AASHTO T 27. For specific structures with approval of Engineer, or as directed by Engineer, refer to the typical section on the construction drawings.

305.2.04 Acceptance

Materials will be based on acceptance by pit qualifications by Lane County Materials Laboratory and/or materials on site.

Acceptance will be based on periodic samples taken following mixing.

305.3.00 CONSTRUCTION

305.3.01 Preparation of Subgrade

All surfaces and materials on which subbase or base is to be constructed will be firm and will be prepared as specified in the applicable portions of Section 303 SUBGRADE.

305.3.02 Stockpiling

The materials to be furnished in stockpiles shall be of the kinds, sizes and quality specified. Each designated size of material shall be placed in a separate stockpile. Stockpiles shall be at least 8 feet high with side slopes of 1-1/2 horizontal to 1 vertical. The method used in placing the material in the stockpile shall be such as to minimize segregation of the aggregate particles.

305.3.03 Mixing

The aggregate shall be mixed to provide a homogeneous mixture of unsegregated and uniformly dispersed materials. Water shall be added during mixing in the amount sufficient to provide optimum moisture content plus or minus two percentage points.

The subbase or base course material shall be mixed by any one of the following methods:

Stationary plant method - Materials shall be mixed in approved pug mill or rotary type mixer. After mixing, the mixture shall be transported to the job site at proper moisture content and placed by means of approved aggregate spreader.

Road mix method - After material for each layer has been placed, materials shall be mixed by motor graders or other approved equipment until mixture is uniform throughout.

305.3.04 Placing

305.3.04A Weather Limitations

When, in the judgment of the Engineer, the weather is such that satisfactory results cannot be secured, operations will be suspended.

No surfacing materials shall be placed in snow or on a soft, muddy or frozen subgrade. Owner will not be liable for damages or claims of any kind or descriptions by reason of operations suspended by Engineer.

305.3.04B Equipment

The Contractor shall furnish equipment that will provide for efficient and continuous operations insofar as is practicable.

Equipment shall conform to the following requirements:

Hauling equipment - Vehicles for hauling aggregate or mixtures of aggregate and water shall be capable of depositing the material into, or in front of spreading equipment, with minimum of segregation.

Spreading equipment - The equipment shall be capable of spreading and striking off material to the designated line, grade and transverse slope with a uniform surface texture free of excessive segregation or fracture of material.

Spreading equipment may be provided with an automatic control system if Contractor so elects.

305.3.04C Thickness of Lifts

If required compacted depth of the subbase or base course exceeds 6 inches, it shall be constructed in two or more layers of approximately equal thickness. Maximum compacted thickness of any layer shall not exceed 6 inches. Each layer shall be placed in spreads as wide as practicable and to full width of the course before a succeeding layer is placed.

305.3.05 Compaction Equipment

Aggregate bases shall be compacted with self-propelled rollers capable of compacting materials to a firm, even surface, or compacted with an alternate method as proposed by the Contractor and allowed by the Engineer. Steel wheel rollers capable of providing a weight of not less than 200 pounds per inch width of the compression roll or pneumatic tire rollers capable of exerting a ground pressure of not less than 80 pounds per square inch of tire contact area shall be used. Vibratory rollers shall provide compaction of demonstrated equivalency to that of prescribed steel wheel or pneumatic tire rollers.

305.3.06 Density

During compaction, materials shall be maintained within 2 percent of the optimum moisture content. The Contractor shall begin compaction of each layer immediately after the material is spread and continue until a density of not less than 95 percent of the maximum density has been achieved. Maximum density will be determined by AASHTO T 180. The Engineer may accept OSHD TM 106 if that test is available.

If the specified compaction is not obtained, the Contractor shall notify the Engineer. The Contractor may be required to use a modified compaction procedure or apply additional compactive effort. If approved materials meeting the specifications cannot be compacted to the required density regardless of compactive effort or method, the Engineer may

reduce the required density or direct that alternate materials be used. In no case shall aggregate placement proceed until the Contractor is able to compact the material to the satisfaction of the Engineer.

305.3.07 Surface Finish

The surface of the aggregate base shall be within -0.04 foot to +0.02 foot of plan elevation at any one point. The final surface shall not deviate at any one point more than 0.04 foot from the bottom of a 12 foot straightedge laid in any direction on the surface on either side of the roadway crown.

When directed by the Engineer, the surface shall be tested with a 12 foot straightedge furnished and operated by the Contractor. The surface shall not vary from the testing edge by more than 0.04 foot at any point. The Engineer will observe this testing and may require additional testing. The average of the variation from the design grade shall not be greater than 40 percent of the allowable maximum variation.

305.4.00 MEASUREMENT AND PAYMENT

305.4.01 Measurement

305.4.01A Square Yard Basis

Aggregate base will be measured on the surface to the nearest 0.1 foot. Payment will be on a square yard basis, to the nearest 0.1 yard.

305.4.01B Cubic Yard in Place Basis

Aggregate base will be measured and paid for on a cubic yard basis, to the nearest 0.1 yard. The thickness will be measured by depth tests, cores, or elevations.

A minimum of one measurement shall be made for each 300 square yards of material placed. The measurements shall be made to the nearest 0.01 foot.

On individual depth measurements, thicknesses more than 0.04 foot in excess of the specified thickness shall be considered to be specified thickness plus 0.04 foot in computing the yardage for payment.

305.4.01C Ton Basis

Measurement will be made on a ton basis for the number of tons of aggregate base, as weighed on approved and tested scales. Trip tickets shall normally be given to the Engineer by the end of the day delivery is made, but in no event shall they be given to the

Engineer later than 12 noon the following calendar day (Saturday, Sunday, and legal holidays excluded). Each trip ticket shall show the date and time of delivery, address delivered to, truck number or driver's name, net weight of material to the nearest .01 ton, and will be considered as valid delivery receipts only when received within the specified time period.

305.4.01D Incidental Basis

When not listed in the bid schedule, base aggregates will be considered incidental work.

305.4.02 Payment

Payment will be made on square yard, cubic yard or ton basis as shown on the Proposal.

306 ASPHALT TREATED BASES

306.1.00 DESCRIPTION

This section covers work necessary for the construction of all types of bituminous bases upon prepared foundations and subgrades.

306.1.01 Cold Mix

Cold mix asphalt treated base (ATB) is defined as a mixture of liquid asphalt or asphalt emulsion, well-graded, high quality aggregate, additives as required, plant mixed into a uniform coated mass, constructed on a prepared foundation and compacted to a specified density.

306.1.02 Hot Mix

Hot mix asphalt treated base (ATB) is defined as a mixture of asphalt cement, well-graded, high quality aggregate, mineral filler and additives as required, heated and plant mixed into a uniformly coated mass, hot placed on a prepared foundation, and compacted to specified density.

306.2.00 MATERIALS

Aggregate and asphalt will be subject to acceptance prior to mixing. Mixtures will be subject to final acceptance after blending and mixing at the plant or at the place of delivery. Acceptance will be based on periodic sampling of the materials.

306.2.01 Aggregates

Aggregates shall conform to material and grading requirements of Section 305 AGGREGATE BASES. In addition to the sizes and gradations shown in Section 305, aggregates may consist of crushed open-graded material meeting one of the following gradations:

Sieve Size <u>Percent Passing</u>	Gradations	
	<u>1"-0"</u>	<u>3/4"-0"</u>
1"	100	--
3/4"	--	100
1/2"	45-75	60-80
No.4	5-30	5-35
No.10	0-6	0-10
No.200	0-2	0-2

** Sixty five percent of the material retained on the 1/4" screen shall have a least one fractured face.

306.2.02 Recycled Materials

The contractor may use processed old asphalt concrete materials in the production of plant-mix bituminous base. Salvaged materials recycled into the new bituminous base shall not exceed 30 percent, by weight, of the total mixture.

The old asphalt concrete proposed for use in the recycled mix shall contain hard, sound, durable aggregates meeting the specified gradation requirements.

306.2.03 Asphalt

Asphalt shall conform to requirements of Section 310 ASPHALT CONCRETE PAVEMENT.

306.2.04 Mix Formulas and Tolerances

A job mix formula will be established for each aggregate source.

If there are no current approved mix formulas on file with the Owner, the contractor shall submit a mix formula for the approval of the engineer. The formula may be a current ODOT mix design.

If the mix formula is not approved by the engineer, then a new mix formula will be established at the contractor's expense.

The proportion of aggregate and asphalt cement in the mixture, by weight, shall be within the following ranges:

Aggregate	93.0 to 98.0 percent
Asphalt cement	2.0 to 7.0 percent

Within the above ranges, the job mix formula shall be comprised of either a single percentage of each of aggregate and asphalt cement or a single percentage each of new aggregate, recycled asphalt concrete, and asphalt cement. The asphalt cement content shall not vary by more than 0.5 percent from the percentage listed in the job mix formula.

The mixture will have a retained strength of not less than 70 percent when tested in accordance with ODOT TM 308.

306.3.00 CONSTRUCTION

306.3.01 Preparation of Subgrade

Preparation of subgrade shall conform to the applicable requirements of Section 303 SUBGRADE.

306.3.02 Mixing

Asphalt treated base shall be mixed in an approved stationary plant or travel plant. The plant machine shall be equipped with controls to accurately measure and monitor various components of the mix and shall produce a uniform homogeneous mixture. Stationary continuous mixing plants shall be fitted with a hopper or other suitable holding device at the discharge end of the pug mill. The mix so produced shall not exhibit excessive loss or runoff of asphalt or water, shall remain workable during the laydown operation without tearing or dragging under the screed, and shall have a mass viscosity sufficiently low to permit compaction to the required density.

306.3.03 Weather

Weather conditions under which hot mix ATB may be constructed shall conform to the requirements for placing in Section 310 ASPHALT CONCRETE PAVEMENT.

Cold mix ATB shall be placed only when there is no standing water on the surface, when the air temperature is above 50 degrees F, when not raining, and when the Engineer determines that weather conditions are proper for construction and no rain or low temperatures are forecast for the paving period.

306.3.04 Placing

Placing shall conform to the applicable requirements of Section 305 AGGREGATE BASES; Motor graders shall be used only when permitted, and then only where conditions preclude the use of other approved types of spreading equipment.

Vertical faces of curbs, gutters, catch basins, manholes and other appurtenances, against which ATB is to be placed, shall be painted with emulsified asphalt.

Unless otherwise directed, a tack coat of emulsified asphalt shall be applied to each lift of ATB prior to placing succeeding lifts. The grade of emulsified asphalt shall conform to Subsection 310.3.05 Tack Coat and the rate of application shall be in the range of 0.03 to 0.1 gallons of retained asphalt per square yard.

306.3.05 Compaction

Requirements for compaction shall be as in Section 310 ASPHALT CONCRETE PAVEMENT except as follows:

Static or vibratory steel wheel rollers shall be used for breakdown rolling of open-graded ATB. As soon as practicable after breakdown rolling, shake material at the rate of 6 to 9 pounds per square yard may be applied to the surface to prevent tire pick up if necessary.

306.3.06 Density

Density requirements for dense-graded hot or cold ATB shall conform to the applicable requirements of Section 310 ASPHALT CONCRETE PAVEMENT. Maximum density of open-graded mixes shall be achieved by rolling until all roller marks disappear.

306.3.07 Transverse Joint

Placing of a course or strip of ATB shall be as nearly continuous as practicable. Transverse joints shall be carefully constructed with vertical faces and thoroughly compacted to provide a smooth riding surface.

When the end of a course strip of ATB is to be temporarily subjected to traffic, the end shall be left with a smooth transition of approximately 20:1 (horizontal to vertical), being later cut back to a vertical edge to provide a fresh surface when construction resumes.

306.3.08 Surface Finish

The surface of the ATB shall conform to 305.3.07 Surface Finish and shall be within -0.04 foot to +0.02 foot of the Plan elevation at any point. Final surface shall not deviate at any point more than 0.03 feet from the bottom of a 12-foot straightedge laid in any direction on the surface on either side of the roadway crown. Failure to meet the above requirement

will necessitate sufficient surface correction to satisfy the requirement and shall be done at no expense to Owner.

306.4.00 MEASUREMENT AND PAYMENT

306.4.01 Measurement

306.4.01A Per Ton Basis

ATB will be measured and paid for on a per ton basis, to the nearest 0.01 ton in accordance with Subsection 305.4.01C Ton Basis. There will be no separate measurement or payment for asphalt cement contained in the mixture. No payment will be made for volumes outside the tolerances for excavation unless directed by the Engineer.

306.4.01B Square Yard Basis

Measurement will be made on a square yard basis. Measurement will be made of the width and length of each separately constructed strip of ATB wherein the width is design width or edge-to-edge width of ATB, whichever is the lesser, and length is from end to end along the center of the strip. Measurement will be on the surface of the ATB to the nearest 0.1 foot and the square yardage will be to the nearest full square yard.

Extra thickness of ATB, if directed by the Engineer, will be measured by conversion on a proportionate volume basis to an equivalent number of square yards of specified standard thickness ATB.

306.4.02 Payment

Payment will be made per square yard (specified thickness) or per ton as listed in the proposal.

<u>Payment Item</u>	<u>Unit of Measure</u>
1. Asphalt Treated Base	Per Ton
2. Asphalt Treated Base (specify thickness)	Per S.Y.

307 CEMENT TREATED BASES

307.1.00 DESCRIPTION

This section covers work necessary for the construction of all types of cement treated bases (CTB) upon foundations and subgrades compacted and cured.

307.1.01 Plant Mix

Plant mix cement treated base is defined as a mixture of Portland cement, well-graded, high quality aggregate, mineral filler, water and additives as required, well-mixed at a central mixing plant, constructed on a prepared foundation and compacted to a specified density.

307.1.02 Road Mix

Road mix cement treated base is defined as a mixture of the existing base aggregate, Portland cement, well-graded, high quality aggregate, mineral filler, water and additives as required, well-mixed at the construction site, constructed and compacted to a specified density.

307.2.00 MATERIALS

Aggregate will be subject to acceptance prior to mixing. Mixtures will be subject to final acceptance after blending and mixing at the place of delivery. Acceptance will be based on periodic sampling of the materials.

307.2.01 Aggregates

Aggregates shall conform to the applicable requirements of Section 305 AGGREGATE BASES and to the following gradations:

<u>Sieve Size</u>	<u>1-1/2"-0</u>	<u>3/4"-0</u>
<u>Passing</u>	<u>Percentages</u>	<u>(by weight)</u>
1-1/2"	100	
1"	70-90	
3/4"	65-85	100
1/2"	50-80	60-80
3/8"	--	--
1/4"	--	--
No. 4	5-30	5-35
No. 10	0-6	0-10
No. 40	--	--

No. 200

0-2

0-2

Sixty-five percent of the material retained on the 1/4-inch screen shall have at least one fractured face.

307.2.02 Portland Cement

The Portland Cement shall conform to the requirements of Subsection 311.02.01 PORTLAND CEMENT.

307.2.03 Water

The water shall conform to the requirements of Section 311.2.03 WATER.

307.2.04 Fly Ash

The fly ash shall conform to the requirements of Subsection 311.2.04C FLY ASH.

307.2.05 Mix Formulas and Tolerances

The contractor shall furnish a mix design established in accordance with Section 311.3.02 MIX DESIGN. The mix design requirement for compressive strength testing shall be replaced by the following proportion requirements:

<u>Material</u>	<u>Percent of</u>	<u>Quantity</u>
Aggregate		
Cement plus Fly Ash	Aggregate dry weight	5/0% ± .05%
Fly Ash (when proposed)	Cement	20% Max.
Compaction	Average cylinder dry density	95.0%

Fly Ash, if proposed by the Contractor, shall not exceed 20 percent by weight of the cement content. Durability on freeze/thaw and wet/dry tests shall meet PCA standards.

307.2.06 Curing Seal

The asphalt used in the curing seal shall be either CSS-1 or CSS-1H emulsified asphalt as designated. The emulsified asphalt shall conform to the requirements of Subsection

309.3.08 TACK COAT.

307.3.00 CONSTRUCTION

307.3.01 Preparation of Subgrade

Preparation of the subgrade shall conform to the applicable requirements of Section 303 SUBGRADE.

307.3.02 Plant Mix

The CTB mixture shall be mixed at a plant of the batch type or of the continuous mixing type, capable of providing a mix of aggregate, cement, water, and fly ash of uniform proportions and consistency.

307.3.02A Hauling and Placing

Vehicles for hauling the CTB mixture shall be water tight and capable of discharging the mix without segregation.

Mixture which has begun to harden or take an initial set prior to placement will be rejected.

Spreading of the CTB mixture shall be by equipment which is capable of spreading the material without segregation, dragging, or fracture of material. Placing shall be in widths which will hold the number of longitudinal joints to a minimum.

307.3.02B Thickness and Number of Layers

When the compacted depth of CTB exceeds 6 inches, it shall be constructed in two or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches.

307.3.03 Road Mix In-Place CTB

307.3.03A Preparation of Base Material

The materials to be incorporated in the base shall be broken up to the full depth of the new treated base so that all material will pass a 2-inch sieve. The surface shall be brought to uniform grade and cross section prior to adding any new aggregate.

307.3.03B Incorporation of Cement and Water

Cement shall be uniformly applied at the rate established by the accepted mix design.

The equipment and method used shall insure the uniformity of cement distribution throughout the material to be treated. Water shall be added during mixing operations to bring the mix to within 0 to +1-1/2 percent of the optimum moisture/density point. This moisture content shall be maintained until the mixing is completed.

307.3.03C Mixing

The initial mixing of the cement, water and aggregate materials shall be started within two hours after the application of the cement. If equipment is used that requires more than one pass of the mixer, at least one pass shall be made before any water is added to the material. Mixing shall continue until a homogeneous mixture is obtained.

307.3.04 Weather

Weather conditions under which cement treated base may be constructed shall conform to the requirements for placing in Section 312 PORTLAND CEMENT CONCRETE PAVEMENT.

307.3.05 Placing and Finishing

The mixture shall be spread to specified line, grade, and cross section and the entire depth of the mixture shall be compacted to the specified density within two hours after mixing has been completed.

307.3.06 Curing

Intermediate layers of CTB shall be kept continuously moist until the placement of succeeding layers of material. As soon as possible after the CTB is constructed, and while it is still moist, the surface and exposed edges shall be covered with an asphalt curing seal. The emulsified asphalt shall be applied by pressure spray method in accordance with Subsection 309.3.08 TACK COAT, at a uniform rate between 0.25 gallons and 0.35 gallons per square yard of surface or more as necessary to provide a continuous, unbroken curing membrane. After the curing seal has been applied, the CTB shall cure for a period of four days.

The curing seal on any lift of CTB may be omitted if, within two hours after the start of mixing of the preceding lift, a succeeding lift of material (CTB, bituminous base or asphalt concrete) is placed. Vibratory rollers will not be permitted in the compaction of any succeeding lift of material during the period of time from 2 hours to 96 hours after the mixing of any of the underlying lifts of CTB.

307.3.07 Compaction

Compaction shall be with vibrating type, pneumatic tire type or steel wheel type compactors. Rollers shall be capable of compacting the material to a firm, even surface.

307.3.08 Density

The contractor shall begin compaction of each layer immediately after the material is spread and continue until a density of not less than 95 percent of the maximum density has been achieved. CTB courses that have a nominal compacted thickness of three inches or greater will be determined by random testing of the compacted base surface with a nuclear density gage, according to OSHD TM 160. Maximum density will be determined according to Subsection 310.3.15D TEST STRIP METHOD.

If the specified compaction is not obtained, the contractor shall notify the engineer. The contractor may be required to use a modified compaction procedure or apply additional compactive effort. If approved materials meeting the specifications cannot be compacted to the required density regardless of compactive effort or method, the engineer may reduce the required density or direct that alternate materials be used. In no case shall CTB construction proceed until the contractor is able to compact the material to the satisfaction of the engineer.

307.3.09 Transverse Joints

Placing of a course or strip of CTB shall be as nearly continuous as practicable. Transverse joints shall be constructed carefully with vertical faces and thoroughly compacted to provide a smooth riding surface.

When the end of a course or strip of CTB is to be temporarily subjected to traffic, the end shall be left on a level of approximately 20:1 (horizontal to vertical), being later cut back to a vertical edge to provide a fresh surface when construction resumes.

307.3.10 Tolerances

The surface of the CTB shall be within -0.04 foot to +0.02 foot from plan elevation at any point. Final surface shall not deviate at any point more than 0.03 foot from the bottom of a 12-foot straightedge laid in any direction on the surface of either side of the roadway crown. Failure to meet the above requirement may require additional testing, and will necessitate sufficient surface correction to satisfy the requirement and shall be done at no expense to Owner.

307.3.11 Handling Traffic over CTB

Traffic will not be allowed on the curing CTB mixture except as allowed by the engineer. At locations where traffic must be routed over the CTB, the mixture shall be made with

Type III cement.

307.4.00 MEASUREMENT AND PAYMENT

307.4.01 Measurement The quantity of Cement Treated Base shall be measured in accordance with the contract by one of the following methods:

1. Measurement of plant mix CTB on a per ton basis to the nearest 0.10 ton.
2. Measurement by Square Yard. Measurement will be made of the width and length of each separately constructed strip of CTB wherein the width is designed width or edge-to-edge width of CTB, whichever is the lesser, and length is from end to end along the center of the strip. Measurement will be on the surface of CTB to the nearest 0.1 foot and the square yardage will be to the nearest full square yard.

Extra thickness of CTB, if directed by the Engineer, will be measured by conversion on a proportionate volume basis to an equivalent number of square yards of specified standard thickness CTB.

3. Portland Cement per Ton to the nearest 0.10 ton. When specified as a separate item in the bid proposal.
4. Fly Ash per Ton to the nearest 0.10 ton. When specified as a separate item in the bid proposal.

307.4.02 Payment

Payment will be made for any or all of the following items when listed as pay items in the Proposal for any particular Contract.

<u>Payment Item</u>	<u>Unit of Measure</u>
Cement Treated Base	Per Ton
Cement Treated Base (specify thickness)	Per S.Y.
Portland Cement	Per Ton
Fly Ash	Per Ton

308 GEOTEXTILE INSTALLATION

308.1.00 DESCRIPTION

308.1.01 Scope

This work consists of furnishing and placing geotextiles in drains, under embankments, for embankment reinforcement, under riprap, buttresses, inlays, shear keys and erosion control applications, behind retaining structures, over roadbed subgrades, and beneath pavement overlays, as shown on the plans and at other locations as directed.

308.1.02 Definitions:

(a) Geotextile - A fabric manufactured specifically for use in civil engineering applications. Fibers used in the manufacture of geotextiles consist of long chain synthetic polymers. At least 85 percent by weight of the long chain polymers are polyolephins, polyesters, or polyamides.

(1) Drainage Geotextile - For installation in subsurface drains or other drainage locations.

(2) Embankment Geotextile - For installation within or under embankments for stabilization.

(3) Riprap Geotextile - For installation behind and beneath riprap, buttresses, inlays, shear keys, and erosion control applications.

(4) Wall Geotextile - For construction of retained earth walls.

(5) Subgrade Geotextile - For installation on subgrades and in other material separation applications.

(6) Pavement Overlay Geotextile - For installation beneath an asphalt concrete overlay.

(b) Machine Direction - The long, or warp, direction of the geotextile. The cross-machine, or fill, direction is perpendicular to the machine direction.

(c) Nonwoven Geotextile - A textile produced by bonding and/or interlocking of fibers by mechanical, heat, or chemical means.

- (d) Roll - Unit of continuous geotextile without transverse seams as furnished by the manufacturer. Roll sizes may vary between manufactures and types of geotextiles.
- (e) Roll Values:
- (1) Average Roll Value - The average roll value for each property is determined by testing a representative number of samples in a roll according to the test methods specified in Section 308.05.00 - GEOTEXTILES AND SLOPE PROTECTION. An average of these tests becomes the average roll value for each roll tested.
- (2) Minimum Average Roll Value - The minimum average roll value for each property is the mean of the average roll values for all rolls tested minus 2 standard deviations, all as determined by the manufacturer. The minimum average roll value for each property is determined by testing a representative number of rolls in a production run according to ASTM D 4354 sampling procedures and the test methods specified in Section 308.05.00 - GEOTEXTILES AND SLOPE PROTECTION.
- (3) Minimum Value - The minimum value is the specified value for each geotextile property that shall be met or exceeded by the manufacturer's minimum average roll value for the production run and, if sampled and tested, by the average roll value for any roll.
- (f) Seam Allowance - The minimum distance from the edge of a geotextile to the stitchline nearest to that edge.
- (g) Seam Type - A designation relating to the essential characteristics of geotextile positioning and rows of stitching in a specified sewn seam as shown on the plans.
- (h) Selvage - The finished edge of a geotextile parallel to the machine direction.
- (i) Stitch Type - A designation relating to the essential characteristics of geotextile positioning and rows of stitching in a specified sewn seam as shown on the plans.
- (j) Ultraviolet Rays (UV) - Direct radiation from the sun during daylight hours, even on cloudy days.
- (k) Ultraviolet Stability - The ability of a geotextile to resist deterioration when exposed to UV.
- (l) Woven Geotextile - A textile comprising two or more sets of filaments or yarns interlaced in such a way that they result in a uniform pattern.
- (m) Other Definitions - Terms not defined in this subsection may be found in ASTM D 1233 and ASTM D 4439. If there is a conflict, definitions in this subsection take precedence.

308.2.00 MATERIALS

308.2.01 General

Materials shall conform to Section 308.05.00 - GEOTEXTILES AND SLOPE PROTECTION.

308.03.00 EQUIPMENT

308.03.01 Field Seam Stitching Equipment

Use field seam stitching equipment that provides an acceptable lock-type stitch as recommended by the geotextile manufacturer and approved by the Engineer.

308.03.02 Asphalt Distributor

Design, equip, maintain, and operate the asphalt distributor according to Section 309.3.04B - EQUIPMENT

308.04.00 CONSTRUCTION

308.04.01 Geotextile Installation requirements

- (a) Acquisition and Storage - Provide complete rolls of geotextile as furnished by the manufacturer and protect against damage and deterioration. Store all geotextile rolls in a dry place and off the ground at all time according to ASTM D 4873. Cover all rolls and partial rolls with a dark protective covering when received. The geotextile will be rejected for use if the Engineer determines it has defects, deterioration, or has been damaged.
- (b) Placement:
 - (1) Surface Preparation - Prepare the surface receiving the geotextile to a smooth condition free of obstructions, depressions and debris unless otherwise directed. Do not drag the geotextile on the ground or mishandle it in any way. Loosely place the geotextile without wrinkles so placement of the overlying material will not tear the geotextile. Lap or sew the geotextile at the ends and sides of adjoining sheets as specified.
 - (2) On Slopes - Place the geotextile with the machine direction oriented up-down the slope. Lap the upper sheets over the top of the lower sheets. When the geotextile is placed on a slope steeper than 6:1, securely anchor the laps to the ground surface with pins or stakes as necessary to prevent slippage and tearing of the geotextile. Start placement of fill material on the geotextile at the toe of the slope and proceed upwards.

(c) Overlaps - Minimum overlap requirements for geotextiles are:

Geotextile Application	Minimum Overlap Requirements, Inches
Drains	12
Embankment Stabilization	24
Geotextile Wall Reinforcement	24
Pavement Overlays	*
Riprap and Rock Buttresses	24
Roadbed Subgrade Stabilization	24

* Use sufficient overlap to insure closure, but not more than 6 inches.

If the Engineer determines the specified overlap is not sufficient, increase the overlap to provide adequate coverage or sew the geotextile together in the field. If field sewn, the provision of ODOT 00350.20 and 00350.40(d) apply.

(d) Field Seams:

(1) General - Obtain the Engineer's approval before field seaming and stitching. Sew field seams with polymeric thread consisting of polypropylene, polyester, or kevlar, and as resistant to deterioration as the geotextile being sewn. Use a color of thread that contrasts with the geotextile being sewn so the stitches are exposed for inspection when the geotextile is placed.

(2) Stitch Requirements - Use two rows of lock-type stitching to make the seams. The two rows of stitching shall be 1/2 inch apart with a tolerance of $\pm 1/4$ inch and not cross except for restitching.

(3) Minimum Seam Allowance - The minimum seam allowance shall conform to the manufacturers specification. An example of the seam type to be used shall be submitted for inspection prior to placement of any fabric.

(4) Protection of Geotextile - Protect the geotextile at all times from ultraviolet (UV) rays, contamination by surface runoff, and construction activities.

Traffic or construction equipment will not be permitted directly on the geotextile except as authorized in 308.04.08(e) Geotextile Placement.

When placed for construction, cover the geotextile with specified cover material as soon as possible. Do not leave in uncovered condition for more than 5 days except when used with temporary retained earth walls in accordance with Subsection 308.04.06 WALL GEOTEXTILE.

Place cover material on the geotextile in a manner that the geotextile is not torn, punctured, or shifted. Use a minimum 6 inches thick cover layer or twice the maximum aggregate size, whichever is thicker. End-dumping cover material directly on the geotextile will not be permitted.

Limit construction vehicles in size and weight so rutting in the initial layer above the geotextile is not more than 3 inches deep or 1/2 the layer thickness, whichever is lesser. Turning of vehicles on the first layer will not be permitted.

(e) Repair of Geotextile - Repair or replace all torn, punctured, or contaminated geotextiles during construction at no cost to the Owner. Repair by placing a patch of the specified geotextile over the affected area. Overlap the existing geotextile with the patch according to 308.04.01(c) Overlaps. Where geotextile seams are required to be sewn, repair any damaged sheet by sewing unless otherwise indicated on the plans or special provisions or as directed.

308.04.02 Drainage Geotextile

When used in trenches for drains, place the geotextile in the trench as shown on the plans to loosely conform to the shape of the trench with no wrinkles or folds.

308.04.03 Embankment Geotextile

Construct embankment stabilization according to details shown on the plans. Place the geotextile layers so the geotextile machine direction is transverse to the embankment centerline. Spread the geotextile so all slack and wrinkles are eliminated. Construct embankment in uniform layers according to Section 301 - EARTHWORK.

308.04.04 Riprap Geotextile

Place geotextile behind and beneath riprap, buttresses, inlays, shear keys, and erosion control applications according to the details shown. Demonstrate to the satisfaction of the Engineer that the combination of the rockfill drop height and the thickness of any aggregate cushion, when specified or required, are adequate to not puncture or damage the geotextile when placing the riprap or stone embankment material. If an aggregate cushion is used, place according to Section 316.3.08 Filter Blanket.

After placing the riprap, backfill all voids in the riprap face so the geotextile is completely covered and not visible.

308.04.05 Wall Geotextile

(a) General - Begin wall construction at the lowest portion of the excavation and

place each layer horizontally as shown on the plans. Complete each layer in its entirety before the next layer is started. Seams will be allowed only at the wall face. Overlap geotextile sheets perpendicular to the wall face according to Subsection - 308.04.01(c) - OVERLAPS, or sew seams parallel to the wall face according to subsection 308.04.01(d) - FIELD SEAMS. Stretch the geotextile in a perpendicular direction to the wall face to eliminate slack before backfilling.

(b) Forming the Wall - Use a temporary form system at the wall face during construction. Use pegs, pens, or the manufacturer's recommended method as approved by the Engineer, in combination with the forming system, to hold the geotextile in place until the cover material is placed.

(c) Backfill for Wall Construction - Compact the backfill for the wall within the limits shown or directed. Compact each layer to 95 percent of maximum density as determined by OSHD TM 109. Maintain the water content to within 3 plus or minus percent of the optimum moisture content. Sheepsfoot rollers and vibratory rollers or other rollers with protrusions will not be allowed within 3 feet of the wall face. Compact this area using approved light mechanical tampers, without damaging or distorting the wall facing or reinforcing layers.

308.04.06 Subgrade Geotextile

For roadbed subgrade separation, prepare the subgrade according to Section 301 - EARTHWORK

Correct Geotextile failures, as evidenced by soil pumping or roadbed distortion by removing any covering material in the affected area and placing a geotextile patch on the exposed geotextile according to Subsection 308.04.01(e) REPAIR OF GEOTEXTILE. Cover the patch with the specified cover material and compact before proceeding.

308.04.07 Pavement Overlay Geotextile:

(a) General - Place geotextile and pavement overlay in four basic steps:

- ! Surface preparation
- ! Sealant application
- ! Geotextile placement
- ! Overlay placement

(b) Weather Limitations - Do not place sealant and geotextile unless the weather limitations of Section 309 - SURFACE TREATMENTS are met, as appropriate, except the minimum air temperature shall be 50°F for paving grade asphalt sealant placement and 60°F for asphalt emulsion sealant placement.

(c) Surface Preparation - Prepare the pavement surface on which the sealant is to be placed according to Section 309 - SURFACE TREATMENTS and the following:

- ! Clean and fill cracks exceeding 1/8 inch width with a polymerized bituminous crack filler.
- ! Repair minor irregularities or depressions as directed.
- ! Allow crack filling material to cure before placing geotextile.
- ! Where the pavement is severely cracked, rutted, deformed, or otherwise distressed, place a leveling course as directed instead of extensive surface preparation.

(d) Sealant Application - Use a normal paving grade asphalt cement. A cationic or anionic emulsion may be used as approved. Do not use cutbacks or emulsions which contain solvents.

Uniformly spray the asphalt sealant at normal application temperature by means of a pressure distributor conforming to 309.3.05B - Equipment, on the prepared dry pavement surface. Apply at the normal rate of 0.20 to 0.30 gallon per square yard or as recommended by the geotextile manufacturer as directed.

If using emulsions, increase the application rate 50 percent or as directed. Some underlying surfaces may require a higher application rate. Within street intersections, on steep grades, or in other zones where vehicle speed changes are commonplace, reduce the normal application rate by 20 percent or as directed.

The target width of sealant application shall be geotextile width plus 6 inches. Apply the sealant only as far in advance of geotextile installation as appropriate to insure a tacky surface at the time of geotextile placement. Place geotextile the same day as the sealant. Do not allow traffic on the sealant. Clean excess asphalt from the road surface.

(e) Geotextile Placement - Place the geotextile into the sealant using mechanical or manual laydown equipment capable of providing a smooth installation with a minimum amount of wrinkling or folding before the sealant loses tackiness. When asphalt emulsions are used, allow the asphalt to separate from the water (break) before placing the geotextile.

Limit traffic to necessary construction equipment and emergency vehicles on the geotextile before and during paving unless otherwise directed. Turn the paver and other vehicles gradually. Keep turning to a minimum to avoid geotextile movement and damage. Avoid abrupt starts and stops.

(f) Overlay Placement - Place the overlay the same day the geotextile is placed. Remove sealant that bleeds through the geotextile. Do not windrow asphalt concrete material on the geotextile ahead of the paving machine. Do not use an asphalt concrete

material pickup machine.

308.05.00 GEOTEXTILES AND SLOPE PROTECTION

308.05.01 Description

308.05.02 Scope

Geotextiles will be accepted for use in various applications according to the provisions of this section.

308.05.03 Materials

308.05.04 Definitions

Geotextile terms are defined in 308.1.02 DEFINITIONS.

308.05.05 Acceptance:

(a) General Requirements - The geotextile shall:

- ! Be composed of a polymeric yarn or fiber oriented into a stable network which retains its relative structure during handling, placement, and design service life.
- ! Meet or exceed the properties specified in 308.05.07 Geotextile Property Values
- ! Be free of any chemical treatment or coating which might significantly reduce permeability.
- ! Have the selvage finished so the outer fibers are prevented from pulling away from the fabric.
- ! Be free of defects or tears.
- ! Be resistant to ambient temperatures, acid and alkaline conditions, micro-organisms and insects.
- ! Be for the intended purpose and have dimensional stability.

(b) Acceptance Requirements - Base the actual minimum average roll values furnished by the manufacturer on representative test results from the manufacturing plant which produced the rolls. Each test shall meet or exceed each of the specified minimum

values. Clearly label all rolls as being part of the same production run certified as meeting all applicable requirements.

(c) **Manufacturer's Documentation** - The contractor shall submit manufacturer's documentation to the Owner.

(d) **Manufacturer's Sampling/Testing** - The manufacturer's reported property values shall be based on the following sampling and testing requirements:

(1) **Sampling** - Sample all geotextiles according to ASTM D 4354. The production unit used for sampling shall be a roll.

(2) **Testing** - Perform specified tests to determine geotextile properties for the intended application(s). Test the tensile strength requirements in both machine and cross-machine directions.

If the geotextile material is modified, remanufactured, relabeled, or sewn, the contractor shall furnish additional certification from the supplier making the changes that explain the altered properties and seam strength. Determination of compliance shall be determined from these certifications.

308.05.06 Seam Testing and Acceptance:

(a) **Seams** - Where seams are made, the sheets of geotextile shall:

(1) Be sewn together using a lock-type stitch.

(2) Be sewn with polymeric thread that is at least 85 percent by weight polyolefins, polyesters, or polyamides, and be as resistant to deterioration as the geotextile being sewn.

(3) Nylon thread will not be allowed.

308.05.07 Geotextile Property Values - See Table 308.05.08.

TABLE 308.05.08 GEOTEXTILE PROPERTY VALUES

Geotextile Property	Test Method	Minimum Values							
		Drain (1) Geotxtl		Riprap (1) Geotxtl		Subgrade Geotxtl	Embkmnt Geotxtl	Wall (1) Geotxtl	Pavemt (1) Overlay Geotxtl
Grab tensile strength minimum in each principal direction	ASTM D 4632	<u>Type 1</u> 80 lb	<u>Type 2</u> 180 lb	<u>Type 1</u> 200 lb	<u>Type 2</u> 260 lb	180 lb	230 lb	---	80 lb
Grab elongation	ASTM D 4632		15%		15%	---	---	---	50%
Burst Strength, diaphragm method	ASTM D 3786 Mod. (OSHD TM 814) (TF 25.Method 3)	130 psi	290 psi	320 psi	430 psi	290 psi	430 psi	--- psi	---
Puncture strength	ASTM, D 4833 or ASTM D 3787 Mod. (OSHD TM 816)	35 lb	80 lb	80 lb	110 lb	80 lb	110 lb	---	---
Apparent opening size (AOS), U.S. Std. Sieve	ASTM D 4751 (CW-02215 Corps of Engr.)	No. 70 Sieve or smaller opening		No. 70 Sieve or smaller opening		No. 30 Sieve or smaller opening	(2)	---	---
Water permeability	ASTM D 4491	0.1 cm/sec		0.1 cm/sec		0.005 cm/sec	0.005 cm/sec	(2)	---
Ultraviolet stability	ASTM D 43 at 500 hours	---		70% strength retained		---	---	70% strength retained	---
Wide strip tensile strength	ASTM D 4355	---		---		---	---	(2)	---
Asphalt retention	OSHD TM 817 (TF25, Method 3)(3)	---		---		---	---	---	0.20 gal/sq.yd.
Melting point	ASTM D 276	---		---		---	---	---	300°F

1. Slit film or slit tape fabrics are not acceptable
2. See Special Provisions for required minimum values.
3. Task force 25 test methods, developed by the ASTM Committee on geotextiles and INDA.

308.06.00 MEASUREMENT

308.06.01 Square Unit Basis

Each geotextile installation will be measured along the lines and grades of the installation to the nearest square yard of surface area actually covered according to the plans or as required, except for drainage and wall geotextile applications.

The number of square yards of drainage geotextile will be computed by multiplying the length of the trench where geotextile is used by the perimeter of the trench as determined from the neat lines shown, or as directed.

Geotextile walls will be measured to the nearest square foot of wall face computed by multiplying the length times the sloped height of the wall.

No separate measurement will be made for constructing laps, seams joints or patches unless more than the specified lap is ordered, in which case the added lap width will be measured.

308.07.00 PAYMENT

308.07.01 Square Unit Basis - The accepted quantities for geotextiles will be paid for at the contract price per unit of measurement of the following items.

<u>Pay Item</u>	<u>Unit of Measurement</u>
(a) Drainage Geotextile	Square Yard
(b) Embankment Geotextile	Square Yard
(c) Riprap Geotextile	Square Yard
(d) Wall Geotextile	Square yard
(e) Subgrade Geotextile	Square Yard
(f) Pavement Overlay Geotextile	Square Yard

Item (d) includes all backfilling costs not covered in Section 301 - EARTHWORK AND GEOTEXTILE as shown on the plans.

Item (f) includes preparation work, sealant, and geotextile.

Payment will be payment in full for all equipment, tools, labor, and incidentals necessary to complete the work. No separate payment will be made for constructing laps, seams, joints, and patches.

If the Engineer orders geotextiles with properties more stringent than specified, price adjustment for the difference in material cost only will be allowed.

309 SURFACE TREATMENTS

309.1.00 DESCRIPTION

309.1.01 General

This work consists of the application of asphalt materials, with or without aggregate cover materials , to approved roadway surfaces.

309.1.02 Bituminous-Aggregate Mixtures

309.1.02A Plant Mix Overlay

Asphalt overlay is defined as placing a course of asphaltic concrete mixture (hot mix) to the surface of an existing asphalt or concrete pavement to a designed thickness. Asphalt overlays may be specified as non-reinforced or reinforced. When specified as reinforced it shall be understood to refer to placement of a reinforcing fabric on the existing surface in conjunction with the overlay.

309.1.02B Slurry Seal

A slurry seal is a mixture of emulsified asphalt, fine aggregate and mineral filler applied to an existing pavement surface. The cured slurry shall have a homogenous appearance, fill cracks, adhere firmly to the surface, and have a skid resistant texture. Type I is intended for crack filling and fine seal. Type II is intended for general seal and medium textured surface. Type III is intended for one course in a two-course slurry and produces a highly textured surface.

309.1.02C Micro-Surfacing

Micro-Surfacing is a mixture of polymer modified asphalt emulsion, aggregate, mineral filler, water, and other additives, applied to an existing asphalt pavement. The mix shall be capable of being spread in variably thick cross sections (wedges, ruts, scratch courses and surfaces) which, after curing and initial traffic consolidation, resists compaction throughout the entire design tolerance range of bitumen content and variable thicknesses to be encountered.

309.1.03 Bituminous-Aggregate Applications

309.1.03A Aggregate Seal and Sand Seal

Aggregate seal consists of applications of asphalt and graded aggregate in single or alternating layers binding the aggregates together to produce a firm surfacing.

309.1.04 Bituminous Applications

309.1.04A Prime Coat

A prime coat is a single application of emulsified asphalt to a prepared aggregate base. It may also include the application of cover aggregate.

309.1.04B Fog Seal

A light application of slow-setting asphalt emulsion diluted with water.

309.1.04C Tack Coat

A Tack coat is an application of emulsified asphalt or asphalt cement to an existing pavement prior to placing an overlying course of asphalt paving.

309.1.04D Crack/Joint Sealant

A material consisting of liquid asphalt ground rubber and polymer modifiers blended with extender oils. Mixture used to seal crack, joints, and seams on paved streets.

309.1.05 Cold Plane Pavement Removal

This work consists of removing existing pavement surfaces to prepare a foundation for placing new surfacing.

309.2.00 MATERIALS

BITUMINOUS-AGGREGATE MIXTURES

309.2.01 Asphaltic Concrete Overlay

309.2.01A Asphaltic Concrete

Material specified shall meet all requirements of Section 310 ASPHALTIC CONCRETE PAVEMENT.

309.2.01B Fabric Reinforcement

Fabric shall be a needle-punched non-woven 100% polymeric fiber fabric which conforms to the following requirements:

ASTM Method D-4632, Grab Method

Tensile strength, either direction, not less than 80 lbs.

Elongation at break either direction, not less than 50%

Weight, 4-5 ounces per square yard

Asphalt retention by fabric a minimum of .2-gallons per square yard

309.2.01C Asphaltic Binder and Additives

Asphalt cements, liquid asphalts, recycling additives, and emulsified asphalts, shall conform to the requirements of ODOT publication titled, "Standard Specifications for Asphalt Materials", copies of which may be obtained through the ODOT Engineer of Materials and Research. The applicable specifications are those contained in the current publication on the date the project is advertised.

309.2.01B Aggregate

Aggregates used for seal coats shall be as specified for the particular application. The mineral aggregate shall consist of crushed rock or crushed gravel of uniform quality and shall conform to requirements of Section 305 - AGGREGATE BASES. Mineral aggregate shall have a record of approved performance, or be subject to the Stripping Test for Bituminous Aggregate Mixtures, AASHTO T 182, using a sample of asphalt to be used in the major portion of the work. When so tested retention of asphalt shall be above 95 percent. Mineral aggregate failing to conform to this requirement will not be approved for use in the work except if approved anti-stripping additives or other approved measures correct the deficiency.

309.2.02 Slurry Seal

309.2.02A Asphaltic Emulsion

Bituminous binder shall be quick set asphaltic emulsion in accordance with the following specifications:

TEST ON EMULSION

Furol Viscosity at 77 degrees F, Sec.	20-50	ASTM D244
Residue from Distillation, % by weight	58+	ASTM D244
Settlement, 5 Days, % Difference	1	ASTM D244
Sieve Test (Retained on No. 20), %	.1	ASTM D244

TEST ON RESIDUE

Penetration, 77-1/4 degrees F. 100 gr 5 Sec.	40-90	ASTM D5
Solubility in Trichorethylene, % 99.0		ASTM D2042
Ductility, 77-1/4 degrees F., Cm/min	40+	ASTM D113

Emulsion must pass all ASTM Specifications for Emulsified Mixing Grade Asphalts D 977, and be able to pass the ISSA TB102 and 116 specifications for Stripping" and "Quick Set Emulsified Asphalt Slurry Seal Systems."

309.2.02B Water

All water used with the slurry mixture shall be potable and free from harmful soluble salts.

309.2.02C Aggregate

Aggregate shall consist of rock dust or other sands of a similar nature except that any combination of aggregates used in the mixture shall contain at least 50 percent of the product obtained by crushing rock. Aggregate shall have a water absorption factor of less than 1.25 percent. Slurry seal aggregate shall be clean, angular, durable, well graded, uniform and free of vegetative material or other deleterious matter. When tested by AASHTO T 176, the blended aggregate shall have a sand equivalent of not less than 60.

GRADATIONS

Gradation of aggregate shall conform to the following:

Sieve Size	Percent Passing		
	TYPE I	TYPE II	TYPE III
3/8	100	100	100
No. 4	100	90-100	70-90
No. 8	90-100	65-90	45-70
No. 16	65-90	28-50	
No. 30	40-65	19-34	
No. 50	25-42	12-25	
No. 100	15-30	10-21	7-18
No. 200	10-20	5-15	5-15

309.2.02D Mineral Fillers

Mineral fillers such as Portland Cement, limestone dust, fly ash, and others shall be considered as part of the blended aggregate and shall be used in minimum required amounts. They shall meet the gradation requirements of ASTM D242. Mineral fillers shall only be used if needed to improve the workability of the mix or gradation of the aggregate and shall be done initially in quantities predetermined by the mix design. Field adjustments if required, shall be approved by the City after review of the mix design.

309.2.02E Additives

Additives may be used, if warranted by the mix design, to accelerate or retard the break-set of the slurry seal, or improve the resulting finished surface. The use of additives in the slurry mix (and other individual materials) shall be made initially in quantities predetermined by the mix design with field adjustments if required, after approval by the City.

Additives such as liquid retardants, etc., may be used for purposes outlined only if warranted by the laboratory mix design and only if their amount of usage can be metered.

309.2.02F Laboratory Testing

Sources of all materials shall be selected prior to the time the materials are required for use in the work. All samples shall be taken according to procedures previously mentioned. All materials shall be pretested in a qualified laboratory as to their suitability for use in slurry. The theoretical asphalt content shall be determined by laboratory analysis. The laboratory shall also determine if a mineral filler is required, and if so, how much should be used. Test samples shall be made and tested on a Wet Track Abrasion Machine.

A complete laboratory analysis and test report accompanied by abraded and unabraded slurry test samples shall be submitted by the contractor before the job starts. The report will show the results of tests performed on the individual materials, comparing their values to those required by the specifications. The report will also provide the results from the following test methods on the slurry seal mixture.

<u>Test</u>	<u>Description</u>	<u>Specification</u>
ISSA T106	Slurry Consistency	visual
ISSA TB-114	Wet Stripping	Pass (90% min)
ISSA TB-100	Wet Track Abrasion	75g/ft ² max
	1 hour soak	807 g/m ²
ISSA TB-100	Mix Time	180 seconds

* Mixing tests must pass at the maximum expected air temperature.

**Must be performed using aggregate from project stockpile.

Slurry mix design testing and development shall be furnished by the contractor. All preconstruction sampling and testing shall be at the expense of the Contractor. Any additional tests deemed necessary during actual construction shall be paid for by the City. No additional payment shall be made for this work.

309.2.02G Composition and Proportioning

Weight of aggregate shall be based on a bulk specific gravity of 2.65, which shall be corrected to any variance in gravity of 0.20 points or more. Asphaltic emulsion shall be of sufficient quantity to obtain a residual content of 7.5 to 13.5 percent when tested in accordance with AASHTO T 164.

309.2.03 Latex Microsurfacing

309.2.03A Asphaltic Emulsion

The Emulsified asphalt shall be a quick-set CSS-1H emulsion and shall conform to the requirements specified in AASHTO M208 and ASTM D2397. The polymer material shall be milled or blended into the asphalt or blended into the emulsifier solution prior to the emulsification process. The latex asphalt emulsion shall conform to the requirements prescribed below:

TEST ON EMULSION

Residue from Distillation, % by weight 62 ASTM D244

TEST ON RESIDUE

Softening Point 135°F ASTM 36
 Penetration, 77° 100 gr 5 Sec. 40-80 ASTM D2397
 Kenematic Viscosity, 275°F 650 cSt/sec ASTM 2170

309.2.03B Water

All water used with the slurry mixture shall be potable and free from harmful soluble salts.

309.2.03C Aggregate

The aggregate shall be manufactured crushed stone. To assure the material is totally crushed, 100 percent of the parent aggregate will be larger than the largest stone in the gradation to be used. The material shall be free from vegetable matter and other deleterious substance. All aggregate shall be free of caked lumps and oversize particles.

The Aggregate, prior to the addition of emulsion, shall conform to the requirements of this section. Conformance with the grading requirements will be determined by AASHTO T 27 when there is a difference in specific gravity of 0.2 or more between blends of different aggregates.

The Percentage composition by weight of the aggregate shall conform to the following grading:

Sieve Size	Type II	Type III
3/8	100	100
No. 4	90-100	70-90
No. 8	65-90	45-70
No. 16	45-70	28-50
No. 30	30-50	19-34
No. 50	18-30	12-25
No. 100	10-21	7-18
No. 200	5-15	5-15

The aggregate shall conform to the following additional quality requirements:

	TEST	REQUIREMENT
Sand Equivalent	AASHTO T176	55 min
Durability index	OSHD TM206	55 min
Abrasion Resistance	ASTM C131	30% max

309.2.04 Aggregate Seal

309.2.04A Asphalt

Aggregate seal asphalt shall conform to the requirements of the Asphalt Table in the standard drawing.

309.2.04B Aggregate

Aggregate seal aggregate shall be 1/4"-#10 or 1/2"-1/4" as specified.

309.2.05 Sand Seal

309.2.05A Asphalt

Sand seal asphalt shall conform to the requirements of the Asphalt Table in the standard drawing.

309.2.05B Aggregate

Sand seal aggregate shall be well-graded fine aggregate. Sieve analysis shall conform to the requirements of Type I slurry. Durability shall conform to the requirements of Section 305.2.01C FINE AGGREGATE.

BITUMINOUS APPLICATIONS

309.2.06 Prime Coat

Prime coat asphalt shall be paving grade or emulsified asphalt as specified and conforming to ODOT 02710.10 ASPHALT MATERIALS, Additives, and Mineral Filler.

309.2.07 Fog Seal

Fog seal Asphalt shall be emulsified asphalt as specified and conforming to ODOT 02710.10 ASPHALT MATERIALS, Additives, and Mineral Filler.

309.2.08 Tack Coat

Tack coat asphalt shall be CSS-1h emulsified asphalt and shall conform to ODOT 02710.10 ASPHALT MATERIALS, Additives, and Mineral Filler.

309.2.9 Crack/Joint Sealant

Material to be a post-reacted type which when tested in accordance with manufacturers specifications will meet ASTM D-1190-74, AASHTO 173-80 standards when heated to the maximum recommended pour temperature for a period of six (6) hours.

Material to consist of a liquid asphalt ground rubber and polymer modifiers blended with extender oils to produce a product to meet the following criteria:

Softening point	180 degrees F min.
Cold-Temp. Flex	-16 degrees F Min.
Flow at 140 degrees F for 5 hours at a 75 degree angle.	5 mm Max

Material to be suitable for use in a hot oil circulated melter machine.

Under proper application, material not to be transferrable to vehicle tires and pedestrian footwear. Material will not track, pick-up or otherwise be tacky enough to require 'blotting' (i.e.; sanding) thirty (30) minutes after application.

309.3.00 CONSTRUCTION

BITUMINOUS-AGGREGATE MIXTURES

309.3.01 Asphaltic Concrete(A.C.) Overlay

309.3.01A General

Asphaltic concrete used for overlays shall be Class B or Class C as specified by the Engineer and shall meet all the requirements of this and other sections of the Standard Specifications as may be applicable.

Overlays of asphaltic concrete may be placed directly to the surface of existing pavements or may be placed in conjunction with a reinforcing fabric as directed by the Engineer.

309.3.01B Surface Preparation

Asphaltic overlays shall not be placed on any surface until that existing surface has been thoroughly cleaned of all dirt and debris and all areas of the existing pavement showing signs of base failure have been repaired. Grinding/milling and all clean up will be completed prior to paving.

309.3.01C Tack Coat

The area to be overlaid shall receive a tack coat of bituminous material as specified in Subsection 310.3.05 TACK COAT, and as directed by Engineer. Rate of application to conform with Sub-Section 309.3.08 TACK COAT.

309.3.01D Placement

All bases and foundations, on which the pavement is to be constructed, shall meet the applicable specifications and be approved prior to the start of paving. Existing bases and foundations shall be reconditioned as specified or directed.

Broken or ragged edges of existing paved surfaces underlying or abutting the new pavement shall be trimmed back to firm material. Surfaces against which asphalt concrete is to be placed shall be treated with an asphalt tack coat.

Depressed areas in existing pavement shall be tacked and leveled with an approved asphalt concrete mixture and compacted with a pneumatic tired roller. This leveling work shall be a separate operation and performed as specified. Leveling material shall be spread by means of a paving machine except in small or irregular areas where the engineer may permit the use of other equipment. At the direction of the engineer, leveled areas shall be retacked prior to placement of subsequent material.

Surface shall be dry and clean. Air temperature shall be at least 60 degrees F. Asphalt placement shall be done with a self-propelled paver.

309.3.01E Joints and Ties to Existing Pavements

Jointing shall be constructed by feathering out the material placed by proper raking to remove all larger aggregate from the mix. The feathered edges shall be blended into the existing pavement. The resulting larger aggregate shall be removed from the work area and shall not be scattered over the newly placed mat.

309.3.01F Compaction

Compaction shall be done in accordance with Subsection 310.3.14 COMPACTION. Vibratory rollers shall not be allowed on pavement where the largest rock size is over half the total lift thickness. Only one pass of a vibratory roller shall be allowed on lifts less than 1-1/2".

309.3.02 Fabric Reinforced A.C. Overlay

309.3.02A Surface Preparation

The existing pavement shall be clean and free of water and vegetation. Placement of the fabric shall be made only under the following conditions:

1. The ambient air temperature is above 60 degrees F., and rising.
2. The pavement is dry and the pavement temperature is above 55 degrees F. and rising.
3. The wind conditions are such that in Engineer's opinion, a satisfactory placement of the fabric can be achieved.

The surface area to receive the fabric shall be uniformly sprayed with a normal paving grade asphalt. A cationic or anionic emulsion may be used as approved. If using emulsions, increase the application rate 50 percent or as directed. Do not use cutbacks or emulsions which contain solvents. Apply at the normal rate of 0.2 to 0.3 gallon per square yard or as recommended by the geotextile manufacturer as directed.

The width of asphalt application will be the fabric width plus 4 inches. The paving operation shall closely follow fabric placement and no more fabric than can be covered up with the hot mix that working day shall be placed. Paving asphalt shall be applied no farther in advance of the overlay than the distance which the Contractor can maintain free of traffic.

309.3.02B Fabric Placement

Fabric placement equipment shall be mechanized, capable of handling full rolls of material and capable of laying the fabric without forming excessive wrinkles and/or folds. Manually laying the fabric will only be permitted in small areas, not practical for mechanical equipment. In both cases, miscellaneous equipment such as brooms and scissors will be required. The mechanized equipment used to place the fabric is subject to approval of Engineer.

Fabric shall be placed onto the asphaltic binder with a minimum of wrinkles prior to the binder cooling to the extent that the fabric will not adhere. If folds in the fabric exist, or wrinkles 1/2 inch in height or greater, the fabric shall be slit and allowed to lay flat. As directed by Engineer, brooming will be used to maximize fabric contact with the pavement surface.

The fabric shall overlap between six (6) and twelve (12) inches at all joints. No joints shall be lapped with more than two layers of fabric. Transverse joints shall be shingled in the direction of the paving to prevent edge pick-up by the paver.

Any fabric that is damaged for any reason is the responsibility of the Contractor and shall be removed and replaced prior to the resurfacing operation.

309.3.02C Paving Operations

The paving operation shall closely follow fabric placement and no more fabric than can be covered up with asphalt concrete that working day shall be placed. In the event that binder "bleeds" through the fabric before the asphalt concrete is placed, the binder will be

blotted by spreading hot mix asphalt concrete on those areas so affected to prevent pick-up by traffic driving on the fabric. Actual placement of asphalt mat shall be in accordance with Subsection 310.3.03, Construction, except the tack coat shall not be applied to the fabric covered areas.

309.3.02D Traffic Control

Traffic of all types shall be kept off the fabric until the hot mix is placed, except for times when it is necessary that hauling equipment and/or pilot cars must travel on the fabric after placement. The speed of all hauling equipment and pilot cars shall not exceed 15 miles per hour.

309.3.03 Slurry Seal

The field foreman must be a full time supervisor and be available at all reasonable times during the work day for consultation with the City's authorized representative. As such he/she cannot be a leadperson working member of the crew.

309.3.03B Surface Preparation

Immediately prior to applying the slurry, the surface shall be cleaned of all loose material, silt spots, vegetative matter, oil and grease spots and other objectionable material. Any standard cleaning method used to clean pavements will be acceptable, except water flushing will not be permitted in areas where considerable cracks are present in the pavement surface.

All painted traffic control markings shall be roughened or removed to insure adhesion of the slurry mixture. All non-painted traffic control devices, such as buttons, reflectors and plastic markings, shall be protected by the contractor from coating by slurry seal mixture. All devices rendered ineffective shall be replaced at no cost to the owner.

All utility covers, manhole covers and the like in the work area shall be covered or oiled. These items shall be cleaned as quickly as possible after application of slurry seal. This cleaning shall be done prior to the final cure of the applied seal coat.

Streets shall have all base failures repaired and cracks sealed (including pavement and gutter bar seam) prior to slurry applications. Crack filling material (a post-reacted type which when tested in accordance with manufacturers specifications) will meet ASTM D-1190-74. Crack filler to consist of a liquid asphalt ground rubber and polymer modifiers blended with extender oils.

309.3.03C Equipment

Cleaning equipment power brooms, power blowers, air compressors, water flushing equipment, and hand brooms shall be those normally used for this purpose. The equipment shall be capable of cleaning the surface and any cracks remaining in the old

surface.

The slurry mixing machine shall be a continuous flow mixing unit, and be capable of delivering accurately a predetermined proportion of aggregate, water and asphalt emulsion to the mixing chamber, and to discharge the thoroughly mixed product on a continuous basis. The aggregate shall be prewetted immediately prior to mixing with the emulsion. The mixing unit of the mixing chamber shall be capable of thoroughly blending all ingredients together. No violent mixing shall be permitted.

The mixing machine shall be equipped with an approved fines feeder that provides an accurate metering device, or method to introduce a predetermined proportion of mineral filler into the mixer at the same time and location that the aggregate is fed. The fines feeder shall be used whenever added mineral filler is a part of the aggregate blend.

Slurry spread equipment. Attached to the mixer machine shall be a mechanical type squeegee distributor equipped with flexible material in contact with the surface. The distributor must be capable of adjustment for crown or grade to assure a uniform spread and also prevent any loss of slurry. The spreader box shall be steerable and have an adjustable width. The box shall not cause grooving or irregularity in the slurry. The box shall be kept clean, and build-up of asphalt and aggregate on the box shall not be permitted. The use of burlap drags, and other drags, shall be approved by the Engineer.

309.3.03D Placement

The contractor shall have two (2) fully operational mixers and one (1) standby mixer for use at the project site at all times.

The contractor shall refrain from using diesel fuel or solvents of any kind for cleaning tools and equipment in such a manner as to permit spillage of diesel fuel or solvent on new or existing pavement, curbs, gutters, parkways, or other improved areas.

All equipment, tools, and machines used in the performance of this work shall be maintained in satisfactory working order at all times. Descriptive information on the slurry mixing and applying equipment to be used shall be submitted for approval not less than five (5) days before the work starts.

Application of all incidental work, such as surfacing of driveway aprons and returns, shall be done concurrently with surfacing of the street proper. The joint between the edge of pavement and the concrete gutter shall be sealed with slurry seal. Overlap shall be a neat and uniform line, one (1) to two (2) inches in width. No other structures in the work areas shall be covered with slurry mixture without prior authorization from the Engineer.

No excessive build-up nor unsightly appearance, shall be permitted on longitudinal or transverse joints.

Hand work with approved squeegees shall be used to spread slurry in areas non-

accessible to the slurry mixer. Care shall be exercised in leaving no unsightly appearance from hand work.

Treated areas will be allowed to cure until such times as the engineer permits their opening to traffic.

309.3.03E Traffic Control

The Contractor shall provide for the control of traffic in and around the work area during the actual placement of the slurry seal and until such time as the street shall be opened to traffic by the Engineer.

Such control shall conform to Part VI "Construction & Maintenance" of the MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, current edition, by the U.S. Department of Transportation Federal Highway Administration, as supplemented and amended by the OREGON SUPPLEMENTS and as shown in the OREGON STATE HIGHWAY DIVISION HANDBOOK, Signing and Flagging Standards for Short-Term Work Zones - 1990.

- (a) At least one (1) flagger shall be on duty at each intersection with an adjoining street and at each end of the street receiving the slurry, i.e., a street with four (4) intersecting streets would require six (6) flaggers. The City may require additional flaggers during the peak traffic hours.
 - (b) Barricades - shall be spaced not more than three (3) feet apart and shall close all avenues of approach to the street being surfaced.
 - (c) Signs indicating 'STREET CLOSED' shall be placed at EACH intersecting street, one (1) block distant from the work area to forewarn the motoring public.
 - (d) The following shall be in addition to the requirements of Sub-section 202.3.02 Traffic Control Within the Project: The Contractor shall be responsible for notification of the project residents and all properties whose primary access/outlet involves the project street. First notice to be placed on all residents doors (It is illegal to use the party's mailbox) a minimum of three (3) days prior to work to be done. (No Sunday posting shall be permitted). Final notification shall be done 24 hours in advance. Printed notices, or door hangers, will be provided by the City and shall be placed by the Contractor.
- In the event that the work cannot be completed as scheduled, it shall be the responsibility of the Contractor to renotify the affected property owners of the change in the work schedule by placing a second 24 hour notice, stamped 'renotification work rescheduled'. Property owners shall be informed at this time of the anticipated time or date for rescheduling. This shall be done in a prompt and courteous manner.
- (e) If parked vehicles obstruct the progress of work, after appropriate notification of closure, request for removal of the obstructing vehicles should be made by notifying the

project inspector.

309.3.03F Weather and Time Limitations

The slurry seal shall not be applied if either pavement surface or the air temperature is below 65 degrees F. Application will not be permitted if weather conditions or forecast indicates rain, thundershowers, or high humidity conditions, (such as fog) would prevail before the slurry has cured, or if morning dew is evident.

All work shall be performed prior to September 30th. Daily work shall conform to weather limitations for start times and all application shall be finished by 3:30 p.m., or as directed by the Engineer. In no case shall the curing of the slurry extend beyond 5:00 p.m.

309.3.04 Latex Microsurfacing

Construction for microsurfacing shall meet the same requirements as slurry sealing.

BITUMINOUS-AGGREGATE APPLICATIONS

309.3.05 Aggregate Seal and Sand Seal

309.4.05A Weather and Seasonal Limitations

Aggregate seal shall be placed on a clean, dry surface, when the air temperature is above 60 degrees F. Aggregate seal shall not be placed if the engineer determines that weather conditions are detrimental to proper construction.

309.3.05B Equipment

Equipment shall be provided in sufficient number and capacity to provide coordinated and uniform progress. Power brooms, self-propelled aggregate spreaders, asphalt distributors, and hauling vehicles shall be pneumatic tired.

Mechanical spreaders shall be used for spreading aggregate less than 1 inch in maximum size and shall be designed to place the larger fraction of the aggregate ahead of the finer fraction.

The asphalt distributor shall be designed, equipped, maintained and operated to apply the asphalt uniformly at variable widths up to 15 feet at determinable and controlled rates from 0.06 to 2.0 gallons per square yard, with uniform pressure, and with an allowable variation from any specified rate not to exceed 0.02 gallons per square yard. Distributor equipment shall include a tachometer, pressure gauges, accurate volume measuring devices or a calibrated tank, and a thermometer for measuring the temperature of tank contents.

Rollers shall be self-propelled steel wheeled or pneumatic tired. They shall be capable of compacting the materials to a firm, even surface. Pneumatic tired rollers shall be capable of exerting a ground pressure of not less than 80 pounds per square inch of tire contact area.

309.3.05C Sequence of Operations

Layers of aggregate shall be placed while the preceding layer of asphalt material is at or near its application temperature. Each layer of aggregate shall be shaped and compacted prior to being covered with the succeeding layer of asphalt. The seal coat layer of asphalt and aggregate shall not be applied until the underlying layers have been in place for at least 3 days and have stabilized.

309.3.05D Hauling and Spreading Aggregates

Hauling and spreading equipment shall not be operated on uncovered asphalt. Hand spreading shall be done to correct deficiencies or on areas inaccessible to mechanical equipment. Hauling over aggregate-covered asphalt shall be held to a minimum until the surface has become firm. All hauling shall be at moderate speeds which do not create loss of or hazardous movement of materials. Hauling shall be routed as uniformly as possible over the full width of the material in place.

309.3.05E Shaping and Compaction of Aggregates

Each layer of aggregate shall be shaped to prescribed line, grade, and cross section and shall then be dry-rolled until the material is interlocked, firm, partially bound with underlying asphalt, and until the aggregate does not creep or wave ahead of the roller.

Rolling shall normally commence at the low side of the prescribed cross section and progress with passes parallel to the roadway center line. Each pass shall overlap the preceding pass by at least one half the width of the roller.

Along curbs, walls, and at all places not accessible to, or not compacted by specified rollers, the aggregate shall be tamped thoroughly with mechanical tampers or with hand tampers.

Irregularities in surface smoothness, non-uniformity of texture, segregation of materials, dirt pockets, spots of excess asphalt, and other deficiencies and defects shall be corrected by: removal and replacement; addition of material; repetition of construction operations; or, other suitable means, as directed or approved by the engineer.

309.3.05F Application of Asphalt

Each layer of asphalt shall be uniformly applied at the rate specified. Building paper shall be placed over the end area of previously placed layers and the adjoining application shall start on the paper, after which the paper shall be removed and disposed of.

Rates of application shall not vary from prescribed rates by more than 10 percent. The contractor shall protect structures and vegetation from being spattered, stained or marred and shall remove stains and remedy disfigurements. Hand application or other approved means shall be used on areas inaccessible to the distributor.

During application of asphalt, and until the asphalt is covered with aggregate, traffic shall be controlled with flaggers, pilot cars, detours, or other approved means.

309.3.05G Surface Tolerance

The top surface of the aggregate seal shall not vary by more than 0.03 foot when tested with a 12-foot straightedge either parallel with or perpendicular to the centerline. The straightedge shall be furnished and operated by the contractor. The engineer will observe this testing and may require additional testing.

The surface of the finished pavement shall be within 0.02 foot of the specified line, grade and cross section.

The contractor shall correct any surface tolerance deficiency by a method that has been approved by the engineer. All corrective work shall be completed within 10 work days following notification from the engineer. All corrective work, including furnishing of materials, shall be performed at the contractor's expense and no adjustment will be made in contract time.

309.3.05H Establishment

During the period preceding construction of the seal coat, during periods when partial construction is open to traffic, and for seven days following the original completion of the course, the contractor shall perform the following operations.

- (1) The course shall be bladed or broomed to correct bleeding of asphalt, provide coverage with aggregates, to keep the surface free of ravel, traffic grooves, holes, and other deformations, and to eliminate other defects.
- (2) Rolling and compacting of materials shall be performed to maintain or restore firmness and stability to the materials.
- (3) Abutting shoulders shall be trimmed and materials which slough into side ditches shall be removed and disposed of in a manner satisfactory to the engineer.

The above operations may be performed under traffic and at frequencies which the engineer determines as being necessary to develop and establish the course to uniform firmness and stability.

309.3.05I Application Rates

Except as specified below, seal coats shall be constructed in conformance with the requirements of subsections 309.3.05A through 309.3.05H. The application rates of asphalt and aggregate shall be within the tolerance ranges specified in the following table. The exact rates shall be as directed.

RATES OF APPLICATION PER SQUARE YARD

	Size of Aggregate	Lbs. of Aggregate	Gallons of Asphalt
Aggregate Seal (Fine)	1/4" -#10	12-16	.20 - .40
Aggregate Seal (Course)	1/2" -#4	25-35	.30 - .50
Sand Seal	#8-#200	10-15	.10 - .15

BITUMINOUS APPLICATIONS

309.3.06 Prime Coat

Except as specified below, the prime coat shall be constructed in conformance with subsection 309.3.05 Aggregate Seal and Sand Seal.

309.3.06A Application Rates

The prime coat shall be constructed with a single layer of asphalt followed immediately with a single layer of cover aggregate.

Asphalt shall be spread at a uniform rate within a range of 0.25 to 0.40 gallons per square yard.

Cover aggregate shall be spread at a uniform rate of 20 to 30 pounds per square yard. The cover aggregate may be spread by spreader boxes provided no part of the spreading equipment contacts the liquid asphalt prior to placement of cover aggregate.

309.3.06B Establishment

The prime coat shall be allowed to cure and harden for a period of up to 3 days, as directed by the Engineer, before a succeeding course is placed upon it. If so directed by the Engineer, traffic shall be permitted to travel over the prime coat at any time after its construction. During the curing period, when in use by traffic, and until it is covered by a succeeding course, the prime coat shall be maintained by the contractor to the specified shape and condition.

309.3.07 Fog Seal

Fog seal shall conform to subsection 309.3.05A Weather and Seasonal Limitations and

subsection 309.3.05B Equipment. Application rate shall be in conformance with subsection 309.3.05I Application Rates.

309.3.08 Tack Coat

The surface upon which the tack coat is applied shall be dry and shall be cleaned of dirt, dust, and other matter detrimental to the adherence of asphalt.

The asphalt shall be spread with pressure spray equipment which will provide for uniform coverage at the prescribed rates. The rate range shall be 0.05 to 0.15 gallon per square yard of surface, actual rate to be as directed, and within a temperature range of 125 to 165 degrees F. Tack coat shall not be applied during wet or cold weather or during darkness.

Tack coat shall be applied only so far in advance as is appropriate to insure a tacky condition of the asphalt at the time of placing the next course of pavement material. Application shall be scheduled so as to offer the least interference to traffic and to permit one-way traffic without pickup or tracking. The tack coat shall be covered the same day as applied.

309.3.09 Crack/Joint Filler

Material to be applied with a squeegee evenly and level. Excess material shall be smoothed or removed. Traffic shall be kept from driving over freshly applied filler until it is cured or watered down.

309.3.10 Cold Plane Pavement Removal

Remove the existing pavement to the depth, width, grade, and cross section shown or as directed. The use of a heating device to soften the pavement will not be permitted.

309.3.10A Equipment

Equipment shall be self-propelled planing machines or grinders capable of loosening pavement material. It shall accurately establish profile grades within a tolerance of 0.02 foot by reference from either the existing pavement or from independent grade control and have a positive means for controlling cross slope elevations. It shall have a totally enclosed cutting drum with replaceable cutting teeth and effectively remove loosened material from the surface while preventing contaminants from escaping.

If the vertical edges exceed 1 inch in depth and will be subject to traffic beyond the end of the work shift, a transition of 10:1 for longitudinal dropoff and posted speed number :1 for transverse dropoffs shall be established and maintained with temporary asphalt until resurfacing.

309.3.10B Surface Tolerance

Test with a 12 foot straightedge furnished and operated by the Contractor as directed. The variation of the top of ridges from the testing edge shall not exceed 0.02 foot between any two ridge contact points.

309.3.10C Disposal of Materials

Materials removed under this section which are not used on the project, or specified for other disposal in the contract documents, become the property of the Contractor at the point of removal.

309.4.00 MEASUREMENT AND PAYMENT

309.4.00A General

This section covers the measurement and payment of the following items or their respective components:

1. Plant Mix Overlay; 309.1.02A
2. Fabric Reinforcement 309.2.01B
3. Asphaltic binder and Additives 309.2.01C
4. Slurry Seal 309.1.02B
5. Latex Microsurfacing 309.1.02C
6. Aggregate and Sand Seal 309.1.03A
7. Prime Coat 309.1.04A
8. Fog Seal 309.1.04B
9. Tack Coat 309.1.04C
10. Crack/Joint Seal 309.1.04D
11. Cold Plane Pavement Removal 309.1.05
12. Aggregate
13. Water

309.4.01 Asphaltic Concrete (A.C.) Overlay

309.4.01A Measurement and Payment

Measurement and Payment of asphaltic concrete shall be by the ton delivered and placed in accordance with the Plans and Provisions and within the limits of the work specified or directed by the Engineer. See Section 310 ASPHALT CONCRETE PAVEMENT.

309.4.02 Fabric Reinforcement

309.4.02A Measurement

Measurement of fabric reinforcement shall be by the square yard of fabric installed excluding lap allowance within the limits specified or as directed by the Engineer.

309.4.02B Payment

Reinforcing fabric shall be paid for at the unit price per square yard and shall be full compensation for all labor, equipment, and materials including asphaltic binder when placed in accordance with Subsection 309.3.05. The asphaltic concrete overlay shall be paid for as a separate item under subsection 309.4.00 MEASUREMENT AND PAYMENT.

309.4.03 Asphaltic Binder and Additives

309.4.03A Measurement

When identified as a separate pay item asphalt shall be measured by the ton. Additives shall be considered as incidental to their respective item.

309.4.03B Payment

Accepted quantities of asphalt, when not incidental, shall be paid by the ton.

309.4.04 Slurry Seal

309.4.04A Measurement

The quantities of slurry seal to be paid for will be the combined mixture measured as a single item. Measurement will be by the square yard in place and will include all costs incidental to such placement as outlined in the contract documents.

309.4.04B Payment

Payment shall be at the unit price per square yard and shall be full compensation for furnishing all labor, materials, tools, equipment and incidentals and for performing all work involved in constructing the slurry seal in accordance with Subsection 309.3.00 CONSTRUCTION.

309.4.05 Latex Microsurfacing

Latex Microsurfacing shall be measured and paid as outlined in 309.4.04 Slurry Seal.

309.4.06 Aggregate and Sand Seal

309.4.06A Measurement

(1) Aggregate By The Ton

Measurement of aggregate will be made on a ton basis for the materials delivered and placed at the rate of application specified by the Engineer.

(2) Bituminous Cement by The Ton

Measurement of bituminous cement shall be made on a ton basis. Water added to the

emulsions will not be measured or paid for as emulsified asphalt.

(3) Surface Treatment by the Square Yard

Measurement of surface treatment will be made on a square yard basis, complete in place as specified and accepted. Measurement will be made of width and length of each area completed, wherein width is the edge-to-edge width of the designed or constructed surface treatment, whichever is lesser, and length is from end to end of the area along the centerline. Measurement shall be on the surface to the nearest 0.1 foot and square yardage shall be to the nearest full square yard.

309.4.06B Payment

Payment shall be made for any or all of the following items when listed as pay items in the Proposal for any particular Contract:

Asphalt in Seal Coat	Per Ton
Aggregate (gradation) in Seal Coat	Per Ton
Seal Coat in Place	Per S.Y.

Payment shall be full compensation for all labor, equipment and materials necessary to complete the work in accordance with Subsection 309.3.04 - LATEX MICROSURFACING.

309.4.07 Prime Coat, Fog Seal, Tack Coat

309.4.07A Measurement

(1) When pay items in the proposal so indicate, the quantity measurement of bituminous material shall be made on ton basis. Water added to the emulsions will not be measured or paid for as emulsified asphalt.

(2) Surface Treatment By The Square yard. Measurement of surface treatment will be made on a square yard basis, complete in place as specified and accepted. Measurement shall be on the surface to the nearest 0.1 foot and square yardage shall be to the nearest full square yard.

309.4.07B Payment

Payment shall be made for any or all of the following items when listed as pay items in the Proposal for any particular Contract:

Bituminous Material	Per Ton.
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Surface treatment in Place Per S.Y.

Payment shall be full compensation for all labor, equipment and materials necessary to complete the work in accordance with Subsections 309.3.06, 309.3.07, and 309.3.08.

309.4.08 Crack/Joint Seal

309.4.08A Measurement

- (1) Measurement by the linear foot. Crack/Joint Seal shall be measured along the length of crack or joint actually sealed to the nearest 0.1 of a foot.
- (2) Measurement by the pound. Crack/Joint Seal material if so specified shall be measured by the pound for the material placed on the project.

309.4.08B Payment

Payment shall be made for any or all of the following items when listed as pay items in the Proposal for any particular Contract:

Bituminous Material	Per Pound
Crack/Joint Seal in Place	Per L.F.

Payment shall be full compensation for all labor, equipment and materials necessary to complete the work in accordance with Sub-Section 309.3.09.

309.4.09 Cold Plane Pavement Removal

309.4.09A Measurement

- (1) Measurement per Square Yard. The full quantity of materials removed, regardless of thickness, will be determined by measuring the actual surface area to the nearest 0.1 foot and computed to the nearest square yard.
- (2) Measurement Per Linear Foot. The length shall be measured to the nearest 0.1 foot for the actual planed length at the width specified.

309.4.09B Payment

Payment for performing all work required to remove and dispose of the existing pavement as specified, including replacement of cutting teeth, will be made at the contract price per square yard or linear foot. Any temporary wedges constructed, maintained, and removed will be at the Contractors expense.

309.4.10 Aggregate

309.4.10A Measurement

(1) Aggregate By The Ton. Measurement of aggregate will be made on a tonnage basis for the materials delivered and placed at the rate of application specified by the Engineer.

(2) Aggregate by the Square Yard. Measurement of surface treatment will be made on a square yard basis, complete in place as specified and accepted. Measurement shall be on the surface to the nearest 0.1 foot and square yardage shall be to the nearest full square yard.

309.4.10B Payment

Payment shall be made for any or all of the following items when listed as pay items in the Proposal for any particular Contract:

Aggregate	Per Ton.
Aggregate in Place	Per S.Y.

Payment shall be full compensation for all labor, equipment and materials necessary to complete the work.

309.4.11 Water No Measurement and Payment shall be made for water incorporated into Section 309.2.00 MATERIALS. Water used for dust control will be incidental unless identified as a separate item in the contract documents.

310 ASPHALT CONCRETE PAVEMENT

310.1.00 DESCRIPTION

This section covers work necessary for the construction of hot mix asphalt pavements upon prepared foundations or base surfaces.

310.1.01 Asphalt Concrete

Hot mix asphalt concrete is defined as a mixture of asphalt cement; well-graded, high quality aggregate; mineral filler and additive as required; heated and plant-mixed into a uniformly coated mass, hot placed on a prepared foundation, and compacted to specified density.

310.1.02 Recycled Asphalt Pavement (RAP)

RAP is processed recycled asphalt pavement materials used in the production of new asphalt concrete pavement. The RAP materials proposed for use in the recycled mix shall contain hard, sound, durable aggregates and asphalt cement.

310.2.00 MATERIALS

310.2.01 General

Asphalt and aggregate will be subject to approval preceding mixing. Mixtures will be subject to final approval after blending and mixing, either at the plant or at the place of delivery prior to rolling. Approval will be based on periodic sampling of the materials.

310.2.02 Asphalt

Asphalt materials incorporated in the mix shall conform to the requirements set forth by the Special Provisions. Unless otherwise specified, asphalt material shall conform to the current Oregon State Highway Division's "SPECIFICATIONS FOR ASPHALT MATERIALS" obtainable from the Engineer of Materials, Oregon Department of Transportation, Salem, Oregon. The Performance Based Asphalt (PBA) grading system shall be used for hot mix asphaltic concrete.

310.2.03 Aggregates

310.2.03A General

Aggregates shall be subject to approval at the source or at the actual stockpile from which the aggregate is taken. During production of the aggregate, samples of each size for testing shall be provided by the contractor as requested by the Engineer. The determination of sizes and suitability of aggregate shall conform to AASHTO T 27 and AASHTO T 11.

310.2.03B Coarse Aggregate

Coarse aggregate shall be crushed rock or gravel which is retained on a 1/4 inch sieve and reasonably free from flat, elongated, soft or disintegrated pieces, organic material, or other deleterious matter occurring in a free state or as a coating on the stone. Crushed rock or crushed gravel shall be used for coarse aggregate in all asphalt construction requiring coarse aggregate. Total deleterious matter shall not exceed 2 percent by weight. The Contractor shall use coarse aggregates having weighted percentages of loss which do not exceed 12 percent by weight when subjected to five alternations of Sodium Sulfate Soundness Test (AASHTO T 104).

Fracture of Gravel

A minimum of 75 percent of crushed gravel retained on the 1/4 inch sieve shall have at least two fractured faces. A minimum of 75 percent of the material passing the 1/4 inch sieve but retained on the #10 sieve shall have at least one fractured face. All aggregate shall conform to OSHD TM 213.

310.2.03C DURABILITY

The source material from which coarse aggregate is produced shall meet the following qualifying test requirements:

Test Requirements	Test Method	Maximum Values	
		<u>Coarse</u>	<u>Fine</u>
Soundness (5 cycles)	OSHD TM 206/ AASHTO 104	12%	12%
Degradation: Passing No. 20 Sieve	(OSHD TM 208)	30% Max.	30% Max.
Sediment Height	(OSHD TM 208)	3" Max.	4" Max.
Abrasion	AASHTO T 96/ (OSHD TM 211)	30% Max.	--

Also, other sampling and testing of coarse aggregate shall be in accordance with the following methods:

Sampling	AASHTO T 2
Materials Passing No. 200 Sieve	AASHTO T 11
Sieve Analysis	AASHTO T 27
Friable Particles	AASHTO T 112
Lightweight Pieces	ASSHTO T 113

310.2.03D Fine Aggregates

That portion of the aggregate passing the 1/4 inch sieve with allowable oversize shall be known as fine aggregate and shall consist of finely crushed rock or finely crushed gravel and fine sand. No more than 15 percent by weight of natural or uncrushed material passing the #10 sieve shall be re-blended into the total fine aggregate.

Asphalt cement concrete and surface treatments shall contain fine aggregate having a weighted loss of not more than 15 percent by weight when sodium sulfate is used or 20 percent by weight when magnesium sulfate is used in five cycles of the soundness test. Total deleterious matter shall not exceed 2 percent by weight.

Fine aggregates shall meet the durability requirements for coarse aggregates contained herein before, and shall meet the following Liquid Limit and Plasticity Index requirements:

Percent of Material Passing No. 40 Sieve	Liquid Limit	Plasticity Index (Maximum) AASHTO T 89	(Maximum) AASHTO T 90
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0.0 to 5.0, inclusive	33	6
5.1 to 10.0, inclusive	30	5
10.1 to 15.0, inclusive	27	4
15.1 to 20.0, inclusive	24	3
20.1 to 25.0, inclusive	21	2
Over 25.0	21	0 or N.P.

Sampling and testing fine aggregate shall conform to the following methods:

- | | |
|-----------------------------------|--------------|
| 1. Sampling | AASHTO T 2 |
| 2. Material Passing No. 200 sieve | AASHTO T 11 |
| 3. Organic Impurities | AASHTO T 21 |
| 4. Sieve Analysis | AASHTO T 27 |
| 6. Soundness | AASHTO T 104 |
| 7. Friable Particles | AASHTO T 112 |
| 8. Lightweight Pieces | AASHTO T 113 |
| 9. Sand Equivalent | AASHTO T 176 |
- Sand Equivalent shall be not less than 68

Grading - The grading of the fine aggregate shall conform to the requirements indicated in the following table:

**GRADING REQUIREMENTS
FINE AGGREGATES FOR FLEXIBLE PAVEMENTS**

Sieve Size Passing Sieve	Percentages by Weight		
	<u>1/4" - 0"</u>	<u>1/4" - #10</u>	<u>#10 - 0"</u>
3/8"	99-100	99-100	--
1/4"	85-100	80-100	99-100
#10	--	0-20	80-100
#40*	--	0-10*	29-45
#200	--	0-4	8-15

* Not required for Class 'E' Mix aggregates.

Of the fraction passing the 1/4-inch sieve, the following percentages thereof shall pass the No. 10 sieve:

Class 'B', Hot Mix	43-57%
Class 'C', Hot Mix	43-57%
Class 'D', Hot Mix	43-57%
Class 'E/F', Hot Mix	7-22%

Of the fraction passing the No. 10 sieve, the following percentages thereof shall pass the No. 40 sieve:

Class 'B', Hot Mix	30-55%
Class 'C', Hot Mix	30-55%
Class 'D', Hot Mix	30-55%

Of the fraction passing the No. 10 sieve, the following percentages thereof shall pass the No. 200 sieve:

Class 'B', Hot Mix	9-19%
Class 'C', Hot Mix	9-19%
Class 'D', Hot Mix	9-19%
Class 'E/F', Hot Mix	20-28%

310 2.03E Aggregate Treatment

When specified or directed, new aggregates shall be treated with lime in the following proportions to undergo an aging process.

<u>Separated Sizes</u>	<u>Percent Hydrated Lime (by Weight of Aggregate)</u>	<u>Tolerance (Percent)</u>
3/4"-1/4" 3/4"-1/2"		
1/2"-1/4"	0.35	+ 0.15
1/4"-0	1.5	+ 0.15
1/4"-#10	1.0	+ 0.15
#10-0	2.0	+ 0.15

Each size of aggregate shall be stockpiled separately. One of the following treatment procedures shall be used.

(1) Dry Hydrated Lime Added to Wet Aggregates - At the time of mixing the aggregate and hydrated lime, the minimum moisture content of the coarse and fine aggregate shall be 2.5 percent and 5.0 percent, respectively. Hydrated lime, water, and aggregate shall be thoroughly mixed in a pugmill or other approved mechanical mixer and shall then be stockpiled. If the aggregate contains free water (water not adhering to the aggregate surface), the excess moisture shall be removed before adding hydrated lime. The mixed material shall remain in the stockpile for a minimum of 24 hours before being used in the production of asphalt concrete mixture.

(2) Lime Slurry Added to Wet Aggregates - The lime shall be added to the aggregate in the form of a slurry. The lime slurry shall contain a minimum of 70 percent water by weight. The slurry and aggregate shall be thoroughly mixed in a pugmill or other approved mechanical mixer and shall then be stockpiled. The mixed material shall remain in the stockpile for a minimum of 24 hours before being used in the production of asphalt concrete mixture.

No additional payment will be made for lime treatment of aggregates.

310.2.03F Recycled Aggregates

Recycled material used in the asphalt concrete pavement shall have a maximum size of 1

inch prior to entering the cold feed. Any recycled material larger than 1 inch shall be separated by screening or broken down by mechanical means to pass a 1-inch sieve and reincorporated with the balance of the recycled material to form a mixture acceptable to the engineer.

The recycled material shall be blended with new aggregate to provide a mix conforming to the job mix formula. If there is evidence that the recycled material is not breaking down during the heating and mixing of the asphalt concrete mixture, the engineer may elect to modify the maximum size requirement. The fraction of recycled material in the new pavement shall not exceed 20 percent of the total aggregate by weight. A higher percent may be allowed but shall require a new mix design which shall include a recycling agent.

310.2.04 Mineral Filler

Mineral filler shall conform to the requirements of AASHTO M-17. Collector dust may be used as mineral filler, in whole or in part, provided the dust or the resultant mineral filler mixture conforms to the above requirements.

310.2.04A Portland Cement and Hydrated Lime

Portland cement filler shall meet the requirements of the OSHD Standard Specifications. Hydrated lime used as a filler or used to treat aggregates shall meet the requirements of AASHTO M 216, Type 1, Grade A. The contractor shall furnish manufacturer's certifications in conformance with Section 106.

310.2.05 Additives

Additives and admixtures may be used to prevent stripping or separation of bituminous coatings from aggregates, and to aid in the mixing or use of bituminous mixes. Contractor shall use admixtures and additives of standard recognized products of known value for the intended purpose and obtain approval on the basis of laboratory tests prior to their use. They shall have no deleterious effect on bituminous material and shall be completely miscible.

310.2.06 Composition and Proportion of Mixtures

Class of asphalt concrete to be used shall be as shown and shall conform to the following requirements:

Sieve Size	Class B	Class C	Class D	Class E	Class F
	Passing Percentages of Total Aggregate (by Weight)				
1"	99-100	--	--	--	99-100
3/4"	90-98	99-100	--	99-100	85-96
1/2"	75-91	90-100	99-100	95-100	60-71
1/4"	50-70	52-80	85-100	52-72	17-31
#10	21-41	21-46	37-57	5-15	7-19
#40	8-24	8-25	13-29	--	--
#200	2-7	3-7	4-9	1-5	1-6

Asphalt Cement	4-8*	4-8*	4-8*	4-8*	4-8*
Portland Cement or Hydrated Lime **	--	--	--	0.5-1.5*	0.5-1.5*

* The exact percentage used (mix formula) shall be as designed or approved by the Engineer on the basis of preliminary laboratory tests and analysis of aggregate.

** Contractor's option.

Class 'E' and Class 'F' are open-graded mixes and separation of asphalt from aggregate may occur. Any noticeable separation at the point of delivery will be cause for rejection. The contractor shall furnish a job mix formula which shall include the breakdown temperature for the asphalt at the time of placement for the approval of the engineer or may propose the use of a current job mix formula on file with the owner, ODOT or the Lane County Materials Lab.

A job mix formula shall be required for each aggregate source.

If a job mix formula is not approved by the engineer, then a new job mix formula will be established at the contractor's expense.

310.2.07 Mix Formula and Tolerances

At least 15 days prior to producing any of the mixture for use in asphalt concrete pavement, Contractor shall furnish representative samples of acceptable materials proposed for use in determination of the proportions of each of several constituents to be used in the mixture. Proportions so determined shall be known as the 'mix formula' and shall be changed only upon order of Engineer. No mixture will be accepted for use until the 'mix formula' for the project is determined.

After the mix formula is determined, the several constituents shall meet the following tolerances.

310.2.08 Constituent of Mixture

Tolerance
(Plus or Minus to Mix Formula)

All aggregate of sieve sizes specified in Subsection 310.2.06 - Composition and Proportion of Mixtures, except aggregate passing No. 200 sieve

4.0 percent

Aggregate passing No. 200 sieve

2.0 percent

Asphalt Cement

0.5 percent

Temperature of mixture at time of final placement

10 degrees F.

Materials to be used in the work shall be of such nature that a mixture of them, proportioned in accordance with the mix formula, will have a retained strength of not less than 70% when tested in accordance with AASHTO T 165 as modified by ODOT test methods.

310.2.09 Tack Coat

Tack Coat asphalt shall be CSS-1h emulsified asphalt and shall conform to ODOT 02710.10 Asphalt Materials, Additives, and Mineral Filler.

310.2.10 Prime Coat

Prime Coat shall be paving grade or emulsified asphalt as specified and shall conform to OSHD 02710.10 - Asphalt Materials, Additives and Mineral Filler.

310.3.00 CONSTRUCTION

310.3.01 Pre-Paving Meeting

Prior to any placement of pavement the contractor shall call for a pre-paving meeting. The meeting shall be scheduled to meet not less than 2 working days before the actual paving operation. City, contractor and any sub-contractor personnel involved with the paving operation shall be in attendance. Failure to comply shall be cause to suspend the paving operation.

310.3.02 Preparation of Bases

All pavement bases and foundations constructed under this contract shall be completed and finished as prescribed under the applicable specification for its construction.

Manholes, inlets, and other such structures shall have been completed, adjusted, cured and otherwise prepared, as applicable, and made clean and ready for asphalt placement. Vertical surfaces that will come in contact with asphalt pavement shall be painted with tack coat material to provide a good bond and seal.

Defacement of finished surfaces caused by the careless use of asphalt materials, petroleum products or use of equipment shall not be tolerated. Cleanup or replacement shall be the responsibility of the contractor.

310.3.03 Existing Paved Surfaces

Broken or ragged edges of existing paved surfaces underlying or abutting the new pavement shall be trimmed back to firm material. Surfaces against which asphalt concrete is to be placed shall be treated with an asphalt tack coat as specified in Sub - section 309.2.08 - TACK COAT

310.3.04 Prime Coat

Where specified, prime coat shall be constructed in conformance with applicable requirements of Subsection 309.3.01 - ASPHALT CONCRETE OVERLAY with the following modifications: asphalt shall be spread at a rate normally within a range of 0.25 to 0.40 gallons per square yard of surface. Cover aggregate if required shall be spread at a rate of 0.006 to 0.009 cubic yards per square yard and may include one or another of the materials specified in Section 305 AGGREGATE BASES or Section 309 SURFACE TREATMENTS.

A prime coat shall be used when the base material is to be exposed to weather or traffic where the base material would be subject to segregation or contamination.

310.3.05 Tack Coat

Asphalt emulsion shall be spread by means of pressure-spray equipment which will provide uniformity of application at prescribed rates. Normally, asphalt shall be applied to the prepared surface at a rate within a range of 0.05 to 0.15 gallon per square yard of surface, actual rate to be as directed, and within a temperature range of 125 to 165 degrees F.

Tack coat shall only be applied when the air temperature in the shade is not less than the minimum air temperature for the appropriate Asphalt Concrete graded hot mix indicated in Sub section 310.3.09 WEATHER.

The tack coat shall be applied only so far in advance as is appropriate to maintain a tacky, sticky condition of the asphalt.

Contractor shall apply tack coat in such manner as to offer the least interference to traffic and to permit at least one-way traffic without pickup or tracking of asphalt.

Aggregate cover material shall not be applied to the tack coat.

310.3.06 Mixing

Asphalt concrete shall be mixed by combining aggregate, asphalt and additives at an approved central mixing plant equipped with controls to accurately measure and monitor the various components of the mix to produce a uniform homogeneous mixture at the specified temperature.

Discharge temperature of the mix will vary with type of mixing plant, climatic conditions and other variables. However, the temperatures shall be sufficient to provide thorough mixing and coating and to provide a mass viscosity of the mix on the grade which will permit compaction to required density. Mix temperatures and asphalt in storage shall generally not exceed 325 degrees F.

310.3.07 Transporting

The asphalt concrete mixture shall be transported from the mixing plant to the point of use in trucks. No loads shall be sent so late in the day as to prevent the spreading and compacting of the mixture during daylight, unless approved lighting is provided.

310.3.08 Placing

The Contractor shall conform to the plan of work, order of paving and other details of performance as approved. Lift thickness shall be as shown in the Contract Documents.

Contractor shall remove or replace any mixture that becomes loose and broken or mixed with dirt or in any way defective.

Asphalt material dropped to the ground, to the base rock layer, to the asphalt base course or to any other cooled surface shall be removed. This material shall not be placed back into the paver, truck or the asphalt mat.

Any area showing an excess or deficiency of bituminous cement shall be removed and replaced. Broadcasting asphalt material back onto the asphalt mat shall not be allowed. Low areas in the mat shall be filled with carefully placed shovels full of asphalt material and spread with a lute to the required grade.

310.3.09 Weather

Asphalt concrete shall be placed on a dry prepared surface when the surface temperature is not less than specified below.

Nominal Specified Compacted Thickness of Individual Course* <u>Wearing Course</u>	All <u>Other Courses</u>
Less than 1-1/2"	55°F
1-1/2" to 2-1/2"	45°F
2-1/2" and over	35°F

Asphalt concrete shall not be placed during rain or adverse weather conditions, except that mix in transit at the time these adverse conditions occur may be laid if the mix has been covered during transit and is at the specified temperature, if the foundation is free from pools or flow of water, and if all other requirements of these specifications are met. Asphalt concrete mixtures shall not be placed when the foundation is frozen or when, in the opinion of the engineer, existing or expected weather conditions will prevent the proper handling, finishing or compaction of the mixture.

The temperature of hot mix at the time it is spread into final position shall conform to Subsection - 310.2.07 - Mix Formula and Tolerances.

310.3.10 Joints

The width of pavement strips shall be adjusted to minimize the number of longitudinal joints required. Longitudinal joints in the wearing course shall be at a lane line or the edge line of a traffic lane. On median lanes and on shoulder areas, joints shall occur only at points designated by the engineer. The longitudinal joints in one layer shall offset those in the layer immediately below by a minimum of 6 inches. Underlying longitudinal joints shall be within 12 inches of the edge of a lane or within 12 inches of the center of a lane, except in irregular areas.

Overlapping asphalt mix along longitudinal joints shall not be broadcast back onto the mat; but shall be mounded along the joint to be compacted by the roller operation.

310.3.11 Paver

Bituminous paving machines shall be self-contained, power propelled units in good working condition, provided with an activated screed or strike-off assembly, heated if necessary, and capable of spreading and finishing layers of bituminous mix material in lane widths applicable to the specified typical sections, and to required thickness, lines, grades and cross-sections. Machines used for shoulders and similar construction shall be capable of spreading and finishing to the widths shown.

The paver may be required to be equipped with electronic line and grade control capabilities.

310.3.12 Speed

When the capacity of the paver to properly spread and finish exceeds the rate of delivery of mixture, the paver shall be operated at a reduced and uniform speed to give continuous spreading and finishing.

310.3.13 Segregation

Care shall be taken at all times to prevent segregation in the mixture as evidenced by areas of fine and coarse materials, and any such segregation shall be corrected with fresh mixture either spread and worked into the surface or by complete removal and replacement of segregated mixture, as directed, at no expense to owner.

On areas to be patched with asphalt concrete mixture and on areas of irregular shape or limited size, the spreading and finishing requirements may be modified as approved.

Boils and slicks occurring in the pavement must be immediately removed and replaced with suitable materials, at no expense to owner.

310.3.14 Compaction

Rollers shall be steel wheel, pneumatic tire, vibratory or combination of these types, in good condition, capable of reversing without backlash, and shall be operated at speeds slow enough to avoid displacement of the bituminous mixture. Vibratory rollers shall be equipped with amplitude and frequency controls specifically designed for compaction of bituminous mixtures. Vibratory rollers shall have a minimum of two amplitude settings and a minimum frequency of 2,000 cpm. The type, number and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in workable condition. The use of equipment which crushes the aggregate to an appreciable extent will not be permitted.

Any displacement occurring as a result of the reversing of the direction of a roller, or from other causes, shall be corrected at once by the use of rakes and addition of fresh mixture when required. The line and grade of edges shall not be displaced. Steel roller wheels shall be moistened with water or other approved material to the least extent necessary to prevent pickup of mixture and yet not to cause spotting or defacement of the surface of the mixture.

Along curbs and walls, on walks, irregular areas, and other areas not practicably accessible to specified rollers, the mixture shall be compacted with small rollers, mechanical tampers, hot hand tampers or smooth irons. On depressed areas, a trench roller may be used or cleated compression strips may be used under the roller to transmit compression to the depressed area.

Contractor shall furnish the number, weight and type of rollers to obtain the required compaction while the mixture is in a workable condition.

Final rolling of the wearing course shall be performed with tandem steel wheel rollers. For Class 'E' wearing course, rollers having a minimum gross weight of 10 tons and a minimum weight of 250 psi on the drive wheel shall be used and the wearing course shall be rolled at least four times, or as directed.

Rollers shall move at a slow but uniform speed of approximately 220 Feet/Min. with the drive rolls or wheels nearest the paver. Normally rolling shall begin at the sides and proceed longitudinally parallel to the road centerline each trip overlapping one-half the roller width. On super elevated curves rolling shall begin at the low side. When paving is in echelon or when abutting a previously placed line, the longitudinal joint shall be rolled first followed by the regular rolling procedure. Rollers must not make sharp turns on the course being compacted and must not be parked on the hot mixture. Alternate trips of the roller will be stopped at least 5 feet distant longitudinally from adjacent preceding stops.

310.3.15 Density Requirements

310.3.15A Thin Lift

For a specified lift thickness of less than 1-1/2 inches, the mixture shall be compacted

with at least four coverages by rollers, excluding finish rolling.

310.3.15B Theoretical Maximum Density

For a specified lift thickness of 1-1/2 inches or greater, dense graded asphalt shall be compacted to at least 92 percent of the theoretical maximum density as determined by OSHD TM 306. Neighborhood or local streets shall be compacted to at least 90 percent of the theoretical maximum density.

310.3.15C Open Graded Mix

Open graded mixes will be compacted as directed by the Engineer.

310.3.15D Test Strip Method

The Engineer may, at the request of Contractor, allow the contractor to establish a target density by use of 200 foot control strip conforming to the Control Strip Method specified below:

PROCEDURE FOR DETERMINING TARGET DENSITY

- A. A control test strip shall be selected at the beginning of work, on each lift of pavement. The rolling pattern shall be submitted to the City at the pre-paving meeting.
- B. An initial point is selected within the control strip. The initial point must be at least 50 feet from the end of the test strip, no closer than two feet from the edge of the strip and in an area that is representative of the overall material and conditions of placement.
- C. The contractor shall roll the entire test strip with rollers, conforming to specifications. Staying within his proposed rolling pattern.
- D. The nuclear gauge is used to determine the highest density achieved, using a 1/4 or 1/2 minute count, after each roller pass over the initial point. The initial point is carefully marked so the subsequent tests are made in exactly the same position and location. A colored marker keel may be used to outline the gauge position.
- E. Record the temperature, density in place, time after lay down, type roller, and whether in vibratory mode or static, after each pass over the initial point on the Control Strip Method of Compaction Worksheet supplied by the City or ODOT Form 734-2084.
- F. The process of rolling and testing after each roller pass is repeated until nuclear gauge readings taken at the initial point indicate no further increase in the density of the material can be obtained. The density of the initial point is then tested and calculated.
- G. After the density at the initial point is obtained, five nuclear density tests are taken

at locations as determined by the engineer within the control strip section and the results recorded to the nearest 0.1 pcf on the Control Strip Method of Compaction Worksheet supplied by the City or ODOT Form 734-2084.

H. The target density is the average density of the five test locations determined by the engineer and is reported to 0.1 pcf.

Note: For the Control Strip to be Valid the target density must be at least 98 percent of the density of the initial point.

The target density must also meet specified percentages for the material being tested.

Asphalt subject to target density shall not be tested with cores unless the target density is established with cores.

The City, Lane County Lab, or a certified testing firm will perform the compaction testing. The testing shall be conducted under the observation of the Engineer. The asphalt will be compacted to at least 98 percent of the target density. All additional costs associated with the use of the control strip method shall be borne by the Contractor.

310.3.16 Compaction Density

The number and location of tests will be determined by the Engineer and will be sufficient to be representative of the lift. When requested by the Contractor, the Engineer will notify the Contractor of the results.

It shall be the responsibility of the Contractor to obtain specified density at all times, and delay in advising the Contractor of test results shall not act as a waiver of this responsibility. When it is determined that the specified density is not being obtained, all paving operations shall be discontinued until corrective measures have been taken.

Density will be determined by nuclear gauge. Two readings will be taken at each location one with the gauge parallel to the roller path and one with the gauge perpendicular to the roller path. The average of the two readings will be considered one test. If the results vary by more than 3 lbs., the test shall be repeated.

The Engineer shall have the right to test any areas that appear defective in compaction. If the areas are found deficient the Engineer may require the Contractor to bring the areas into conformance with the specifications.

Within three working days of receiving the results, the Contractor may request in writing that pavement cores be taken to verify the compaction density. If so requested the City will have at least three cores taken and tested at Lane County Testing Lab or a certified testing lab (OSHD TM 306). The cores will be taken at the exact location as the gauge

readings. The core results will be compared to the corresponding gauge tests and the average difference will be applied to all original gauge tests. The Contractor shall bear the cost of the coring and testing.

310.3.17 Transverse Joints

On wearing courses, pavement depth, line, and grade shall be maintained at least 4 feet beyond the selected transverse joint location. On all courses, a sloped end section shall be constructed. If subject to traffic, the end section shall be sloped at not less than posted speed: 1, example; if the posted speed is 35 mph the slope will be 35:1. If not subject to traffic, the end section shall be sloped at a minimum of 10:1. The joints shall be skewed 5° to 15° from the direction of travel.

When paving is not expected to continue from the transverse joint until the following day or later, paper or other suitable material shall be placed under the material ahead of the transverse joint location.

Prior to continuing the permanent paving lift, the contractor shall remove the material beyond the joint to a vertical face, by saw-cutting, against which paving will resume. The base shall be cleaned of all debris. A tack coat shall then be applied to the vertical edge and surface of the exposed area before paving is continued.

310.3.18 Surface Finish

The top surface of the asphalt concrete pavement shall not vary more than 0.02 foot when tested with a 12-foot straightedge either parallel with or perpendicular to the centerline. The straightedge shall be furnished and operated by the contractor. The engineer will observe this testing and may require additional testing.

The joint between the pavement and the top surface of utility structures, such as manhole covers and valve boxes located in the traveled way, shall meet the pavement surface tolerances.

The surface of the finished pavement shall be within 0.015 foot of the specified line, grade and cross section.

The contractor shall correct any surface tolerance deficiency by a method that has been approved by the engineer. All corrective work shall be completed within 10 work days following notification from the engineer. All corrective work, including furnishing of materials, shall be performed at the contractor's expense and no adjustment in contract time will be made.

310.4.00 MEASUREMENT AND PAYMENT

310.4.01 Asphalt Concrete Per Ton In Place

Asphalt concrete will be measured and paid for on a per ton basis, to the nearest 0.01 ton.

There will be no separate measurement or payment for asphalt cement contained in the mixture.

Measurement will be made on the number of tons of asphalt concrete, as weighed on approved and tested scales. Trip tickets shall normally be given to the Engineer by the end of the day delivery is made, but in no event shall they be given to the Engineer later than 12:00 noon the following calendar day (Saturday, Sunday, and legal holidays excluded). Tickets that are received after this deadline may not be paid.

Each trip ticket shall show destination date and time of delivery, truck number or driver's name, net weight of material, and will be considered as valid delivery receipts only when received within the specified time.

Tare weights shall be obtained twice a day on all haul vehicles at the beginning of the shift and at the mid-day break on all projects which require an excess of (4) four hours of paving time on any given day.

310.4.01A Asphalt Concrete On Square Yard Basis

Asphalt concrete will be measured on the surface to the nearest 0.1 foot. Payment will be on a square yard basis, to the nearest 0.1 yard.

Measurement will be made of width and length of each separately constructed strip of pavement, wherein width is the design width or edge-to-edge width of pavement, whichever is the lesser, and length is from end to end of pavement along the center of the strip.

310.4.02 Payment

Payment will be made for any or all of the following items when listed as pay items in the Proposal for any particular Contract:

<u>Payment Item</u>	<u>Unit of Measure</u>
Asphalt Concrete In Place (Specify Class)	Per Ton
Asphalt Concrete In Place (Specify Class)	Per S.Y.

Payment shall be full compensation for all labor, equipment, material, and incidentals necessary to complete construction of asphalt concrete paving.

310.4.03 PAYMENT DEDUCTIONS AND REJECTION OF PAVEMENT

310.4.03A Aggregate Gradation and Asphalt Content

A deduction of 1.0 percent of the in-place price of asphalt concrete and cement will be made for each 1.0 percent cumulative weighted deviation beyond the allowable tolerance of each component of the job mix formula based on tolerances established in 310.2.07 Mix Formula and Tolerances.

Quantities of asphalt concrete mix components shall be determined by the following tests:

- (1) asphalt cement, OSHD TM 324;
- (2) aggregation, AASHTO T-27 and AASHTO T-11.

The number and location of tests will be determined by the engineer, and will be sufficient to be representative of the lift. When requested by the contractor, the engineer and/or the lab will notify the contractor of the results.

The following factors shall be used to calculate deductions due to deviations from the accepted job mix formula.

DEVIATION WEIGHING	
Asphalt Cement	12 X Deviation
200 Screen	3 X Deviation
#10 Screen	1.5 X Deviation
#40 Screen	1.5 X Deviation
All Other Sizes	1 X Deviation

The cumulative weighted deviation is the sum of all weighted deviations as determined from the table above. Where the cumulative weighted deviation equals or exceeds 15.0 percent, the materials shall be removed and replaced at no cost to the owner.

When asphalt paving materials with a cumulative deviation of less than 15.0 percent are furnished, the engineer may require the contractor to remove and replace defective materials at no cost to the owner or shall deduct from payments to the contractor an amount equal to the cumulative weighted percentage deviations from the job mix formula.

310.4.03B COMPACTION

Asphalt concrete pavement which does not comply with compaction requirements shall be removed and replaced or, at the discretion of the engineer, be subject to a price reduction determined from the following table.

PRICE REDUCTION SCHEDULE PERCENTAGE
MAXIMUM DENSITY % **TARGET DENSITY (For Rice Value)**

Arterial/Collector	Local	% Pay*	Control Strip Method
92.0 and above	90.0 and above	100	98.0 and above
91.5 - 91.9	89.5 - 89.9	95	97.5 - 97.9
91.0 - 91.4	89.0 - 89.4	90	97.0 - 97.4
90.5 - 90.9	88.5 - 88.9	85	96.5 - 96.9
90.0 - 90.4	88.0 - 88.4	80	96.0 - 96.4
89.5 - 89.9	Below - 88	70	95.5 - 95.9
89.0 - 89.4	Below - 88	60	95.0 - 95.4
Below 89.0	Below - 88	0 - 50	Below - 95.0

Note: Density shall be rounded to the nearest 1/10th of a percent.

* Applies to price for in-place asphalt concrete.

310.4.03C Pavement Thickness

In determining payment reductions for deficient or excessive pavement thickness, a section of pavement will normally be one full roadway station (100 lineal feet). For non-roadway paving and in other situations where the engineer determines the above section is inappropriate, the engineer may establish a different unit of work on which to calculate average thicknesses and price reductions.

When pavement thickness, as determined by the engineer's measurements or test cores, is found deficient by more than the thickness of the specified surface course of asphalt concrete, the engineer may allow the contractor to place an additional lift of asphalt concrete to bring the total thickness of the pavement into conformance with the specifications.

When the pavement in any section of pavement is found deficient in thickness by less than the specified thickness of the surface course, and the engineer allows the pavement to remain in place, payment for that pavement will be made at an adjusted price determined from the following table.

% Deficiency in thickness	% Reduction in pay* (Payment on weight basis)	% Reduction in pay* (Payment on area basis)
0.0 to 5.0	No deduction	No deduction
5.1 to 10.0	No deduction	1.0 x Deficiency
10.1 to 20.0	0.5 x Deficiency	1.5 x Deficiency
20.1 to 30.0	1.0 x Deficiency	2.0 x Deficiency

* Applies to price for in-place asphalt concrete, including asphalt cement.

No payment will be made for an area of pavement found deficient in thickness by more than 30.0 percent even though the work is permitted by the engineer to remain in place.

When the pavement in any section is found to exceed the specified thickness by more than 0.02 foot, the engineer shall calculate the tonnage of material in the excess thickness of the pavement and shall deduct that quantity from tonnage payments due under the contract.

311 PORTLAND CEMENT CONCRETE AND CONCRETE STRUCTURES

311.1.00 DESCRIPTION

This section covers PCC (Portland Cement Concrete), plain or reinforced, precast or cast-in-place, in bridges, box culverts, retaining walls, hydraulic structures and incidental work. Bridge construction must conform to Oregon Department of Transportation specifications, and APWA guidelines.

311.2.00 MATERIALS

311.2.01 Portland Cement

Portland Cement shall meet all the requirements of AASHTO M 85 for the type and class of Portland Cement specified.

311.2.02 Aggregates

Aggregates shall conform to requirements of Sections 305 AGGREGATE BASES, and 310 ASPHALT CONCRETE PAVEMENT as applicable, and the additional requirements contained herein.

311.2.02A Fine Aggregate

Fine aggregate must be graded from coarse to fine within the following limits:

GRADING REQUIREMENTS

FINE AGGREGATE - PORTLAND CEMENT CONCRETE

Sieve Size	Percentages
<u>Passing</u>	<u>(by Weight)</u>
3/8"	100
No. 4	90-100
No. 16	45- 75

No. 30	25- 55
No. 50	5- 30
No. 100	0- 8

Fine aggregate shall have a sand equivalent of not less than 68, and shall develop in the mortar strength test taken at seven days a compressive strength of at least 95 percent of mortar using Ottawa Sand.

311.2.02B Coarse Aggregate

Coarse aggregate must conform to the specified maximum size, and when each maximum size is separated into designated sizes, the separated designated sizes shall be as follows:
Maximum Size

<u>of Aggregates</u>	<u>Separated Sizes</u>
1-1/2 inch	(1-1/2-3/4"),(3/4"-No.4)
1 inch	(1" - No. 4)
3/4 inch	(3/4" - No. 4)

Oversized and undersized materials shall not exceed a combined 15 percent for any separated size, nor shall any pieces have any dimensions greater than twice the maximum screen size for the specified grading.

Grading of each of specified separated sizes of coarse aggregate shall conform with the following:

GRADING REQUIREMENTS

COARSE AGGREGATE - PORTLAND CEMENT CONCRETE
Separated Sizes

<u>Sieve Size</u>	<u>1-1/2"-3/4"</u>	<u>1"-1/4"</u>	<u>3/4"-1/4"</u>
<u>Passing</u>	<u>Percentages (by Weight)</u>		
2"	100	--	--
1"-1/2"	90-100	100	--
1"	0-65	90-100	100
3/4"	0-15	50-80	90-100
3/8"	--	15-40	20-50
No. 4	--	0-10	0-10

Elongated pieces in the coarse aggregate will be determined as described in OSHD TM 229 N, with the proportional caliper device set at a ratio of 5:1, and shall not exceed 10 percent by weight of the material retained on the No. 4 sieve.

All determinations of sizes and gradings will be made by the use of laboratory sieves having square openings.

311.2.02C Fracture of Rounded Rock

Fracture of rounded rock will not be required in the construction of sidewalks, approaches, curb and gutter and other flat work. Fractured rock shall be required in concrete pavement and other concrete work considered to be structural. See section 312, PORTLAND CEMENT CONCRETE PAVEMENT Subsection 312.2.01 Aggregate.

311.2.03 Water

Water used in mixing PCC shall be clean and free of oil, salt, acid, alkali, sugar, organic matter, or other deleterious substances, and shall conform to AASHTO T 26. Water of approved potable quality may be used without testing

311.2.04 Admixtures

311.2.04A Air Entraining Admixtures

Air entraining admixtures shall conform to AASHTO M 154 using one or another of several tests as directed by the Engineer. Chloride content of admixtures used in concrete in contact with embedded metals must not exceed 0.5 percent by weight of the weight of the admixture. Admixture shall not have more than 50 percent of calcium chloride.

The admixture shall be able to produce 16 percent air in a Portland Cement mortar when tested in accordance with AASHTO T 137.

311.2.04B Water Reducing, Retarding and Accelerating Admixtures

Water reducing, retarding and accelerating admixtures shall conform to AASHTO M 194 using one or more of several tests as the Engineer may direct. Chloride content of admixture must not exceed 0.5 percent by weight.

311.2.04C Fly Ash

Fly ash, or Pozzolan, may be used in PCC as an additive or to replace a portion of the Portland Cement. The replacement ratio shall be 1.2 pounds of fly ash for each pound of cement replaced. In no case shall the total weight of fly ash exceed 100 pounds per cubic yard of concrete.

Fly ash shall be Class C or Class F conforming to AASHTO M 295 including Tables 1 and 3 except that:

1. Loss on Ignition (LOI) shall be 1.5 percent maximum.
2. Moisture content shall be 1 percent maximum.
3. Amount retained on the No. 325 Sieve shall be 30 percent minimum.
4. The Pozzolan Activity Index shall be 75 percent minimum of control.

Fly ash will be accepted for immediate use if accompanied by a quality compliance certificate. As a check on material conformance, fly ash may be sampled at the site of

work for verification testing.

311.2.04D Chemical Admixtures

Admixtures may be used after the Contractor provides a quality compliance certificate.

If two or more admixtures are used in the same mix, provide certification from the manufacturer(s) that are compatible for use together.

Chloride content of any admixture used in PCC in contact with embedded metals shall not exceed 0.5 percent by weight of the weight of the admixture when tested to OSHD TM 505. Admixtures shall conform to the following requirements:

<u>Admixture</u>	<u>Test</u>
Air Entraining	AASHTO M 154 (ASTM C 260)
Water Reducing	AASHTO M 194 (ASTM C 494)
Retarding	AASHTO M 194 (ASTM C 494)
Accelerating	AASHTO M 194 (ASTM C 494)

311.2.04E Formulated Latex Admixture

Formulated Latex admixture shall be a nontoxic, film-forming, polymeric emulsion in water to which all stabilizers have been added at the point of manufacturer, shall be homogeneous and uniform in composition, and meet the following requirements:

Polymer Type	Styrene Butadiene
Stabilizers:	
Latex	Nonionic Surfactants
Portland Cement Composition	Polydimethyl Siloxane
Solids, percent by weight, min.	46.0
Weight per gallon, lbs. min.	8.4 @ 25 degrees C
pH, pH units	9.0 to 11.0
Color	White

Provide a quality compliance certificate according to ODOT Standard Specifications for Highway Construction, Section 00165.60.

Latex admixtures that have not been stored according to the manufacturer's recommendations will not be accepted.

311.2.05 Curing Materials

Curing material(s) shall conform to the following requirements or as specified:

White Polyethylene Film for Curing Concrete

AASHTO M 171

311.2.06 Joint Materials

311.2.06A Preformed Expansion Joint Fillers

Preformed expansion joint fillers for concrete conforming to AASHTO M 153 or AASHTO M 213 shall be used except that those furnished under AASHTO M 213 shall be tested in conformance to ASTM D 1751. Fillers conforming to AASHTO M 213, except the binder, if other than bituminous material, may be used provided they otherwise meet this specification and they have been demonstrated to be rot and vermin proof for a period of at least 5 years.

311.2.06B Preformed Elastomeric Joint Seals

Preformed elastomeric joint seals shall conform to AASHTO M 220.

311.2.06C Poured Filler

Poured filler for concrete joints shall conform to AASHTO M 173.

311.2.07 Reinforcement Materials

- (1) Bar Reinforcement. Bars shall be deformed and fabricated from billet steel conforming to the requirements of ASTM A 615, rail steel conforming to the requirements of ASTM A 616, or axle steel conforming to the requirements of ASTM A 617. All bars in reinforced concrete pavement shall be Grade 60.
- (2) Dowels. Dowels shall conform to the requirements of AASHTO M 227, Grade 70.
- (3) Bar Mats. Steel for bar or rod mats shall conform to the requirements of ASTM A 184.
- (4) Welded Wire Fabric. Welded wire fabric shall conform to AASHTO M 55.
- (5) Ties and Supports. Ties shall be of 16 gauge, black, soft-annealed wire and bar supports approved by Engineer for intended use. Bar supports in slabs exposed to view after stripping must be galvanized or plastic coated. Concrete supports will be used for reinforcing in concrete placed on grade. Galvanizing shall conform to ASTM A 153, Class D. Plastic shall not chemically react with concrete, shall be impervious and a minimum thickness of 3/32 inches at point of contact with form.
- (6) Certification and Identification. Certification that reinforcing bars identified and delivered to the project site are as specified, shall be furnished. For identification and tagging, copies of heat numbers, chemical compositions and physical tests performed on

that heat will be included.

311.3.00 CONSTRUCTION

311.3.01 General

When purchasing concrete from others during performance of the Contract, Contractor shall be fully responsible for such concrete conforming to all requirements contained herein.

311.3.02 MIX DESIGN

311.3.02A Classes of Concrete

Classes of concrete shall designate design field strength of concrete in 28 days (p.s.i.) followed by maximum size of aggregate to be used in the concrete, i.e., Class 3000 - 1-1/2 shall indicate a design field strength of 3000 p.s.i. in 28 days with 1-1/2 inch maximum size aggregate used in that concrete.

The class of concrete specified or shown for each component part of the project shall be used, and if not so specified or shown, Class 3000 - 1-1/2 concrete shall be used.

Certifications of compliance for Portland Cement, fly ash, and admixtures must be submitted with the mix design.

In all precast-prestressed concrete members, in the stems of post-tensioned box girders, and in all other members where the spacing of the reinforcement is less than 2 inches, 1 inch maximum size aggregate shall be used, unless specified otherwise.

311.3.02B Classification and Proportioning of Concrete Mixtures

The PCC mixture shall be designed in accordance with the requirements of ACI 211.1 or a modification employing the "absolute volume" method. This shall include the proportions by weight of cement, water, fine aggregate, coarse aggregate, air-entraining admixture, and any other materials or admixtures needed to produce a workable and durable concrete which conforms to the specifications.

During the progress of work, if the concrete strength and quality as determined by cylinders and tests taken by the Engineer fail to attain the requirements specified, all concrete work shall be suspended and necessary adjustments made to obtain the required results.

A mix using different proportions or aggregate sizes of any concrete materials in the mix may be requested to satisfy a particular production schedule or for other reasons. Any requested and authorized alteration to proportions of any of the concrete materials in the

mix shall be made at no expense to the Owner.

The mix shall be designed to meet the following requirements unless otherwise specified:

- (1) Entrained air range 4 percent to 7 percent (percent by volume). AASHTO T 152.
- (2) Slump range - 2 inches minimum to 4 inches maximum. AASHTO T 119.
- (3) Maximum water-cement ratio (gallons of water per 94-pound sack of cement) shall range from 0.40 (lb./lb.) to 0.54 (lb./lb.).
- (4) When using 3/4 inch maximum size aggregate, fine aggregate shall be between 40 percent and 48 percent of the total aggregate used.
- (5) When using 1-1/2 inch maximum size aggregate, fine aggregate shall be between 35 percent and 45 percent of the total aggregate used.
- (6) When specified, a water reducing admixture in conformance with manufacturer's recommendations shall be used.
- (7) Concrete shall conform to the following minimum cement content per cubic yard for class specified:

<u>Class (Field Design Strength)</u>	<u>Minimum Cement Content</u>
2500	517 Pounds (5.5 sacks)
3000	564 Pounds (6.0 sacks)
3500	592 Pounds (6.3 sacks)
4000	658 Pounds (7.0 sacks)
4500	677 Pounds (7.2 sacks)
5000	705 Pounds (7.5 sacks)
5500	733 Pounds (7.8 sacks)
6000	752 Pounds (8.0 sacks)

Field design strength is defined as equal to 85 percent of the strength of the laboratory cured cylinder and the required test results for laboratory cured cylinders shall satisfy these higher values. The destructive strength tests of the laboratory cured cylinders shall be 1.15 times the required field strength; i.e., 3000 psi concrete shall break at 3450 psi.

Tests for strength shall be made in accordance with the following:

Molding Concrete Specimens in the Field	AASHTO T 23
Compressive Strength of Molded Cylinders	AASHTO T 22

Curing of cylinders shall conform to AASHTO T 23 except for cylinders that will be cast in single-use plastic molds.

311.3.02c Flexural Strength

Structural concrete pavement mix designs shall include test results from a trial batch of concrete mixture of each proposed new mix using the same materials including admixtures that will be used on the project. Prepare and test the trial batch and cast, cure, and test the compressive strength of cylinders and the flexural strength of beams.

Compressive tests shall be made on no less than five (5) test cylinders and three (3) flexural beams for each mix design. Tests shall be performed at 28 days cure.

All strength specimens shall be cast and cured according to AASHTO T 23 or T 126.

Cylinders shall be tested according to AASHTO T 22. Beams shall be tested and according to AASHTO T 97 and have an average 28 day strength of no less than 600 psi.

311.3.03 Consistency

In general, a mixture which contains the minimum amount of water consistent with required workability shall be used. Consistency of concrete shall be gauged by ability of the equipment to properly place it without segregating or honeycombing.

311.3.04 Measurement of Materials

Facilities for weighing shall be provided and all materials shall be measured by weight, except water, when batching concrete; fine and coarse aggregates shall be weighed separately. Contractor shall take representative samples and determine the moisture content for each kind of aggregate. Aggregates shall be stored and handled so that their water content remains reasonably constant during any day's run. Equipment for weighing materials shall provide convenient and positive means of determining quantities in the batch of concrete, and means shall be provided for the addition or removal of small quantities of materials to obtain the exact weight per batch. Devices for measuring water shall show accurately the quantity in gallons and be so designed that the water supply will be automatically cut off while water is being discharged into the mixer. Water shall be assumed to weigh 8.34 pounds per gallon.

311.3.05 MIXING

311.3.05A General

All concrete shall be machine mixed.

311.3.05B Truck Mixing

Unless otherwise authorized by the Engineer, only revolving drum type truck mixers that are watertight and so constructed that concrete can be mixed to insure a uniform

distribution of materials throughout the mass shall be used.

All solid materials for concrete shall be accurately measured in accordance with Subsection 311.3.04, MEASUREMENT OF MATERIALS, and charged into the drum at the proportioning plant. Except as subsequently provided, the truck mixer shall be equipped with a tank for carrying mixing water. Only the prescribed amount of water will be placed in the tank unless the tank is equipped with a device by which the quantity of water added can be readily verified. Mixing water may be added directly to the batch in which case a tank will not be required. Truck mixers may be required to be provided with means by which the mixing time can be readily verified by the Engineer.

No batch in a truck mixer shall exceed the maximum rated capacity of the mixer as stated by the manufacturer and stamped in metal on the mixer. Truck mixing shall continue for not less than 70 revolutions nor more than 100 revolutions of the drum at the rate of rotation designated by the manufacturer and stamped in metal on the mixer. Mixing shall commence after all ingredients, including water, are in the drum. Additional mixing, if any, shall be of the rate of rotation as designated by the manufacturer as the agitating speed. Mixing shall begin within 30 minutes after the cement has been added to either the water or the aggregate. When the cement is charged into a mixer drum containing water or surface-wet aggregate and when the temperature is above 90 degrees Fahrenheit, or when high-early strength Portland Cement is used, this limit shall be reduced to 15 minutes.

The limitation on time between the introduction of cement to aggregates and the beginning of mixing may be waived when, in the judgement of the Engineer, aggregates are sufficiently free from moisture so that there will be no harmful effects on the cement.

311.3.05C Time of Hauling and Placing Mixed Concrete

Contractor shall completely discharge and place in the forms all concrete transported to the project in a truck mixer or truck agitator within ninety (90) minutes after the introduction of mixing water to cement and aggregate, or cement to aggregate, or before 250 revolutions of the truck or blades, whichever comes first.

As directed by the Engineer, this time shall be reduced during conditions which contribute to the accelerated setting of concrete, or when the temperature of concrete is 85 degrees Fahrenheit, or above.

No water shall be added to concrete during hauling or before discharge, unless ordered by the Engineer. Engineer will not approve any additional water which increases the slump by more than 1 inch or exceeds the design water-cement ratio.

311.3.05D Delivery

Plant capacity and transportation equipment shall be adequate to insure the continuous delivery of concrete during concreting operations and shall provide for the proper

handling, placing and finishing of concrete. The rate of delivery shall be such that the interval between batches does not exceed 20 minutes. Methods of delivery and handling concrete shall allow placement with a minimum of rehandling and without damage to the structure or concrete.

311.3.05E Retempering

Concrete shall be mixed only in such quantities as are required for immediate use and no concrete shall be used which has developed initial set. Concrete which has partially hardened shall not be retempered or remixed.

311.3.06 Falsework

For structures requiring poured-in-place concrete superstructures, working drawings and calculations for falsework prepared by an Engineer registered to practice in the State of Oregon may be required to be submitted for approval.

For designing falsework, a weight of 150 pounds per cubic foot of green concrete shall be assumed. All falsework shall be designed and constructed to support the total applied loads with a deflection span ratio not to exceed 1/500 in any falsework span. Screw jacks or hardwood wedges shall be employed to take up any settlement in the formwork either before or during the placing of concrete. Falsework shall be set to give finished structure the camber specified or shown. Falsework for post-tensioned structures shall be designed to carry full dead load and any additional vertical or horizontal loads caused by the prestressing operation.

Contractor is directed to the fact that post-tensioned structures are not self-supporting until post-tensioning is complete and Contractor shall consider this fact in the design, maintenance and protection of falsework.

311.3.07 Forms

All forms shall be mortar-tight and set so the finished concrete will conform to proper dimensions and contours, and be sufficiently rigid to prevent distortion due to pressure of the concrete and other loads incident to construction operations. Forms shall be constructed and maintained to prevent warping and opening of joints.

Forms shall be designed to withstand the effect of vibration of concrete as it is placed.

Wood forms for concrete surfaces not subject to backfill shall be made of dressed lumber of uniform thickness with a form liner of an approved type. Shiplap or S4S boards are acceptable, provided forms are mortar-tight. Plywood will be acceptable as a form liner if supported in an approved manner. All formwork for exposed concrete surfaces shall be smooth with grain running in the same direction to give a good finished appearance. Metal ties or anchorage shall be constructed within forms to permit their removal to a depth of at least 1 inch from the face without injury to the concrete. Where wire ties are

permitted, all wires, upon removal of forms, shall be cut back at least 1/4 inch from the face of the concrete with chisels or nippers; for green concrete, nippers are necessary. All fittings for metal ties shall be designed so that upon their removal, cavities which are left will be of the smallest possible size. Cavities shall be filled with cement mortar and the surface left sound, smooth, even and uniform in color.

When forms appear to be unsatisfactory in any way, either before or during the placing of concrete, work may be ordered stopped until the defects have been corrected.

Contractor shall maintain the shape, strength, rigidity, water-tightness and surface smoothness of reused forms at all times. Warped or bulged lumber, and forms which, in the opinion of the Engineer, are unsatisfactory in any respect shall not be reused. Reused forms shall be thoroughly cleaned of all dirt, mortar, and foreign matter.

All forms shall be treated with an approved form oil or wax or saturated with water immediately before placing concrete. Material which will adhere to or discolor concrete shall not be used.

311.3.08 Removal of Falsework and Forms

Contractor shall assume full responsibility for all damage resulting from the premature removal of forms. Earth backfill shall not be placed against walls below grade, and forms and shoring not be removed from structural slabs until the concrete has reached an actual field strength equal to 75 percent of the specified 28 day design field strength. Actual field strength shall be determined from field cured test cylinders which shall be cured under conditions equivalent to the most unfavorable conditions for the portions of concrete which the cylinders represent.

Methods of form removal likely to cause over-stressing of the concrete shall not be employed. In general, forms shall be removed from the bottom upwards. Forms and their supports shall not be removed without approval. Supports shall be removed in such a manner as to permit concrete to uniformly and gradually take the stresses due to its own weight.

311.3.09 Weather Limitations

311.3.09A General

Contractor shall assume full responsibility for the concrete work during any unusual weather conditions including but not limited to hot and cold weather. Any work not in conformance to the Plans and Specifications may be rejected by the Engineer and replaced or repaired at the Contractor's expense.

The Contractor shall coordinate all operations involved in constructing the pavement so the work will result in a finished pavement conforming to specifications regardless of the daily or seasonal variations in weather, temperature and humidity under which the work is

permitted to proceed.

311.3.09B Hot Weather

Special precautions shall be taken for hot weather in placing, finishing and curing concrete when the ambient temperature reaches 85 degrees Fahrenheit or higher or whenever relative humidity, wind velocity or exposure to sun at lower air temperatures are expected to cause hot weather conditions for the concrete. Cool materials shall be specified for the mix. Forms, subgrades and other areas to be in contact with concrete work shall be wet at the time of placing the concrete. No standing water will be allowed. Concrete will be placed and finished as soon as possible after truck mixing. Evaporation from concrete may be reduced by the usage of windbreaks and covers. Curing materials shall be applied as soon as possible.

311.3.09C Cold Weather

Portland Cement Concrete shall not be placed during periods of rain. PCC shall not be placed on frozen bases. Placement shall not occur when descending air temperature falls below 40 degrees Fahrenheit, nor shall it resume until ascending air temperature reaches 35 degrees Fahrenheit. Air temperature shall be measured in the shade and away from artificial heat.

Weather-damaged pavement shall be removed and replaced at no expense to the Owner.

311.3.10 Handling and Placing

311.3.10A General

Concrete shall not be placed without the approval of the Engineer. Concrete placed without the Engineer's approval may be rejected and removal required.

In preparation for the placing of concrete, all sawdust, chips, and other construction debris and extraneous matter shall be removed from the interior of forms. Struts, stays and braces, serving temporarily to hold forms in correct shape and alignment, shall be removed prior to the placing of concrete, when the concrete placing has reached a position rendering their service unnecessary. These temporary members shall be entirely removed from the forms and not left buried in the concrete.

Concrete shall be placed so as to avoid segregation of material and displacement of reinforcement. Long troughs, chutes and pipes shall not be used for conveying concrete from mixer to forms except with written authorization of Engineer. In case an inferior quality of concrete results from the use of such conveyors, the Engineer may order discontinuance of their use and substitution of a satisfactory method of placing material.

For open troughs and chutes, steel or steel lined material shall be used. Where steep slopes are required, chutes shall be equipped with baffles or made in short lengths that

reverse direction of movement. All chutes, troughs and pipes shall be kept clean and free from coatings of hardened concrete by thoroughly flushing with water after each run; water used for flushing shall be discharged clear of structure and not discharged into any sewer or culvert or appurtenances thereto.

Contractor shall be responsible for removing all dollops or piles of concrete waste from the project site.

When placing operations would involve dropping concrete more than 5 feet, steel pipes shall be used for depositing it.

After initial set of concrete, forms shall not be jarred nor strain placed on ends of reinforcing bars which project.

Concrete shall be thoroughly compacted during and immediately after depositing.

Compaction shall be provided by mechanical vibration subject to the following provisions:

1. Internal vibration shall be used unless special authorization of other methods is given by Engineer or as provided herein.
2. Vibrators of an approved type and design, capable of transmitting vibration to concrete at frequencies of not less than 4,500 impulses per minute shall be used.
3. Intensity of vibration such as to visibly affect mass of concrete of 1 inch slump over a radius of at least 18 inches shall be provided.
4. A sufficient number of vibrators to properly compact each batch immediately after it is placed in forms shall be provided.
5. Vibrators will be manipulated so as to thoroughly work concrete around reinforcement and embedded fixtures and into corners and angles of forms.
6. Vibration shall be applied at point of deposit and in areas of freshly deposited concrete. Vibrators shall be inserted and withdrawn from concrete slowly. Vibration shall be of sufficient duration and intensity to thoroughly compact concrete but shall not be continued so as to cause segregation. Vibration shall not continue at any one point to the extent that localized areas of grout are formed.
7. Application of vibrators at points shall be uniformly spaced and not farther apart than twice the radius over which vibration is visibly effective.
8. Vibrating directly or through reinforcement to section or layers of concrete which have cured to the degree that concrete is no longer plastic shall not be allowed. No attempt shall be made to vibrate concrete to flow when the distance would cause

segregation of the mixture.

9. Vibration shall be supplemented by such spading as is necessary to insure smooth surfaces and dense concrete, along form surfaces and in corners and locations impossible with vibrators.

Concrete shall be placed in horizontal layers not more than 12 inches thick except as hereinafter provided. When less than a complete layer is placed in one operation, it shall terminate in a vertical bulkhead. Each layer shall be compacted so as to avoid formation of a surface of separation with a preceding layer.

When placing of concrete is temporarily discontinued, and after concrete has become firm enough to retain its form, laitance and other objectionable materials shall be cleared off to a sufficient depth to expose sound concrete. Top surface of concrete adjacent to forms shall be smoothed with a trowel. Where a 'feather edge' might be produced at a construction joint, as in the sloped top surface of a wing wall, inset formwork shall be used to produce a blocked out portion in the preceding layer which produces an edge thickness of not less than 6 inches in succeeding layer. Work shall not be discontinued within 18 inches of top of any face, unless provision has been made for a coping, in which case, a construction joint shall be made at under side of coping.

311.3.10B Footings, Base Slabs, Walls and Columns

Base slab or footings shall be placed and allowed to set before walls are constructed. Provisions shall be made for bonding walls to base by means of a construction joint. A construction joint conforming to the requirements for construction joints as hereinafter specified shall be used.

Concrete pours in columns and walls shall be stopped at bottoms of caps, cross-beams, girders or any widened portion of the column or wall, and concrete allowed to obtain shrinkage and settlement before pour is continued. Contractor shall delay a minimum of 2 hours for pours less than 4 feet in height and a minimum of 12 hours for pours over 4 feet in height. At horizontal construction joints in walls and columns, a rough concrete surface shall be provided or shear keys formed as engineered.

311.3.10C Pumping

Placement of concrete by pumping will be permitted provided approved clean equipment is used which is of sufficient size and capacity to satisfactorily handle the concrete mix specified. A steel or rubber pipe shall be used for the discharge line from the pump. Additional cement or additives required to obtain a pumpable mix shall be provided at no expense to Owner.

Contractor shall furnish evidence of backup means of placing structural concrete in the event of failure of equipment during placement.

311.3.10D Depositing Concrete Under Water

Concrete shall be placed under water only with the approval of the Engineer. Concrete placed under water shall be carefully placed in a consolidated mass, in its final position, by means of a tremie or by pumping and shall not be disturbed after being deposited. Still water shall be maintained at the point of placement.

Concrete seals shall be maintained continuously from start to finish and the surface of the concrete shall be kept horizontal at all times. To ensure thorough bonding, each succeeding layer of a seal shall be placed before the preceding layer has taken initial set. The concrete in seals shall be poured at a minimum rate of 50 cubic yards per hour.

A tremie shall consist of a tube having a minimum diameter of 10 inches, of sufficient length to reach from bottom of excavation up to concrete placing elevation above water line with an attached receptacle or hopper for receiving concrete. A jointed tremie will be permitted, provided joints are of flanged and gasketed type and waterproof. Tremies shall be supported to permit movement of discharge end over entire top surface of work and to permit rapid lowering when necessary to retard or stop flow of concrete. At start of work and on any withdrawal of pipe for moving to a new location, discharge end shall be closed to prevent water from entering pipe. During progress of work, pipe shall be entirely sealed at all times and kept full of concrete to bottom of hopper. When a batch is dumped into hopper, flow of concrete shall be induced by slightly raising discharge end, always keeping it in deposited concrete. Contractor shall place concrete continuously until work is completed.

Dewatering may proceed when concrete seal is of sufficient strength as determined by tests.

All laitance or other unsatisfactory material shall be removed from exposed surface by scraping, chipping or other means which will not injure surface of the concrete.

311.3.11 Construction Joints

311.3.11A General

Construction joints shall be used only where shown or designated on the Plans, unless otherwise approved. Wooden key forms shall be tapered and pre-soaked to prevent swelling. When placing operation is interrupted for any reason, construction joints shall be placed as approved by Engineer and provided with keys to resist shear and dowels to develop bond as directed by Engineer.

311.3.11B Bonding

Surface of hardened concrete shall be roughened, thoroughly cleaned and saturated with water, surfaces covered with at least 2 inches of grout, and concrete placed immediately. Proportions of sand and cement in grout shall be the same as those for sand and cement in

the concrete mixture, and only sufficient water to provide a creamy consistency. Feather edges at construction joints shall be avoided by blocking out in the preceding layer to produce an edge thickness at least 6 inches in that layer.

311.3.12 Expansion and Fixed Joints

311.3.12A Open Joints

Open joints shall be placed in locations shown. They shall be constructed by insertion and subsequent removal of a template of approved material without chipping or breaking corners of the concrete. Reinforcement shall not extend across an open joint.

311.3.12B Filled Joints

Poured expansion joints shall be constructed similar to open joints. When premolded types are specified, they shall be anchored into the concrete when it is placed. Premolded joint filler shall be placed in forms in proper position before concrete is poured.

Pre-molded filler shall be placed in position inside the form as the concrete on the first side of the joint is placed. When the form is removed, the concrete on the other side of the pre-molded filler shall be placed.

311.3.12C Steel Joints

Contractor shall shape plates, angles or other structural shapes accurately at the shop to conform to the section of concrete. Steel joints shall be fabricated and painted to conform to requirements of these Specifications. The surface in finished plane shall be true and free of warping. Positive methods shall be employed in placing joints to keep them in correct position during placing of concrete. Opening at expansion joints at normal temperature shall be as shown. Impairment of clearance of any manner shall be avoided.

311.3.12D Preformed Elastomeric Joint Seals

Compression joint seals in the longest practicable lengths for longitudinal joints shall be used. In transverse joints, one factory splice will be permitted where the required length of material in any one joint exceeds manufacturer's standard stock length. Such splices shall be made true and smooth on the outside surface with no offsets of abutting surfaces and with complete bond on all abutting surfaces.

Joints shall be clean and dry and free of spalls and irregularities which would impair a tight seal in service. Seals shall be placed in the joint under compression, as recommended by the manufacturer, using a lubricant-adhesive as a covering film applied to both sides of the seal just prior to its installation.

For lubricant-adhesive material, Contractor shall use a compound of same base polymer

as a joint seal with which it is used, blended with a suitable volatile solvent. Lubricant-adhesive must be compatible with joint seal and concrete and be relatively unaffected by normal moisture in the concrete. It shall maintain a suitable consistency at the temperature at which joint seal is installed.

The seal shall be set as shown and it shall contact walls of joint throughout its length. Longitudinal elongation of an installed seal by 3 percent or more of its original length will be cause for its removal and reinstallation.

All lubricant-adhesive which comes upon the exposed top of an installed seal shall be removed before it dries, and all seals removed which show twist, curl, nicks or other malformation, as installed. All ends of preformed elastomeric joint seals shall be sealed with a watertight plug prior to installation of joint seal.

A foam rubber plug or other acceptable closed cell cellular material which is compressible to 15 percent of its non-compressed thickness shall be used. Plug shall be a minimum of 2 inches in length and be secured in elastomeric joint seal with an adhesive which will insure a watertight plug.

311.3.13 Surface Finishing

311.3.13A General

After forms have been removed, all depressions resulting from removal of form ties or from other causes shall be carefully pointed with mortar using a standard premixed mortar conforming to ASTM C 387 or mortar proportioned with 1 part Portland Cement to 2 parts clean, well-graded sand which conforms to AASHTO M 45. Thorough saturation of concrete surface shall be maintained during pointing and patching. Type of finish shall be specified or shown.

311.3.13B Surface Finishes

1. General Surface Finish - General surface finish shall consist of filling all depressions resulting from removal of form ties and repairing all rock pockets. All form bolts and any metal placed for the convenience of the contractor shall be removed to a depth of 1 inch below the surface of the concrete. All rock pockets and other unsound concrete shall be removed and the resulting holes or depressions filled with mortar. When rock pockets affect the strength of the structure or endanger the life of the reinforcement, the concrete shall be removed and replaced. For exterior surfaces where only a Class 1 finish is required, white cement shall be added to the mortar to tint the mortar to match the concrete being repaired.
2. Class 1 Surface Finish (Unpainted) - Class 1 surface finish shall consist of all work required for general surface finish, plus removal of bulges, fins, depressions, stains, discolorations, and other imperfections to produce a smooth, even surface of uniform texture and appearance.

3. Class 2 Surface Finish (Ground and Painted) - After completion of the General and Class 1 surface finish the surface shall be ground with a power grinder, or other approved method, to remove laitance and surface film which may impair adherence of the paint. The unpainted surface shall then be thoroughly saturated with water and painted while damp with a latex emulsion paint. A minimum of two coats of paint shall be applied, with additional coats as necessary to provide uniformity in coverage and appearance.
4. Class 3 Surface Finish (Ground, Floated, and Painted) - After completion of the General and Class 1 surface finish, the surface shall be thoroughly ground with a power grinder or other approved method to remove all laitance and surface film resulting from form treatment. The surface shall then be finished by floating with a suitable float using a paste of fine sand and cement to fill all air holes and voids and to bring the surface to a smooth and uniform texture. The surface shall be kept damp until the finish has set so that dusting will not occur when the surface is rubbed. After the paste has set for at least 24 hours, the surface shall be thoroughly saturated with water and, while damp, painted with a latex emulsion paint. A minimum of two coats of paint shall be applied with additional coats as necessary to provide uniform coverage and appearance.
5. Brush Finish. After concrete has been struck off, the surface shall be thoroughly worked and floated by skilled and experienced concrete finishers. Before this last finish has set, the surface shall be lightly broomed, with a fine brush to remove surface cement leaving a fine-grained, smooth, but sandy texture.
6. Float Finish. In lieu of a brush finish, surface shall be finished with a rough carpet or wood float, leaving surface even and free of voids, but distinctly sandy or pebbled in texture.

311.3.14 Curing

Concrete surfaces shall be cured by covering with material conforming to Subsection 311.2.05, CURING MATERIALS. Covering shall be placed as soon as concrete has hardened sufficiently to support covering without damage. A covering which is best suited to existing conditions will be used. If such coverings are not required, surfaces will be kept moist by flushing or sprinkling. Sprinkling system will be arranged so outside of all forms can be kept damp for a period of 7 days after placing of concrete so that no moisture is taken away from concrete by forms. Curing and finishing will be coordinated when both requirements are to be met at same time.

Slab concrete exposed to conditions causing premature drying shall be protected during placing operations by providing wind breaks, fog spray or by other approved methods.

311.3.15 Reinforcement

311.3.15A General

This section covers work necessary for reinforcing steel, welded wire fabric, dowels, and accessories, for concrete structures, complete.

311.3.15B Construction

1. Shop Drawings. Prior to fabrication and before ordering material, all order lists and bending diagrams shall be submitted for approval. Such approval by Engineer in no way relieves Contractor of responsibility for correctness of lists and bending programs. Any expense incident to the revision of material furnished in accordance with such lists and bending diagrams in compliance with Plans, shall be borne by Contractor.

2. Fabrication. Contractor shall fabricate, ship, tag and mark bar reinforcement in conformance with Manual of Standard Practice by Concrete Reinforcing Steel Institute (CRSI).

All bars shall be bent cold.

3. Delivery and Storage. Contractor shall deliver steel reinforcement with suitable hauling and handling equipment. It will be protected at all times from injury, and kept free from dirt, detrimental rust or scale, paint, oil or other foreign substance.

4. Placing. All steel reinforcement will be accurately placed in positions shown on Plans and held firmly during placing and setting of concrete. Bars in top mats of footings will be tied at all intersections. All other bars will be tied at all intersections except where spacing is less than one foot in each direction, alternate intersections will be tied.

Distance from forms shall be maintained by means of stays, blocks, ties, hangers, or other approved supports. Blocks for holding reinforcement from contact with the forms shall be precast mortar of approved shape and dimensions and with same compressive strength as concrete in which they are placed. Metal chairs in contact with exterior surface of concrete shall be fabricated from stainless steel conforming to ASTM A 493, Type 430. Legs of chairs will be turned up a minimum of 1/8 inch. Layers of bars will 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 wood blocks will not be permitted. Reinforcement in any manner shall be placed and then inspected and approved by Engineer before placing of concrete begins. Concrete placed in violation of this provision may be rejected and removal required.

If fabric reinforcement is shipped in rolls, it shall be straightened into flat sheets before placing it. Fabric reinforcement shall be extended to within 2 inches of edges of slab, and splices tapered at least 1-1/2 courses of fabric with a minimum of 6 inches. Laps and splices in fabric shall be securely tied at ends and at least every 24 inches.

5. Splicing. Contractor shall furnish all reinforcement in the full length indicated on plans. Splicing of bars, except when shown on plans, will not be permitted without written approval of Engineer. Splices will be staggered as far as possible.

Splice for No. 11 bars and smaller shall be lapped as shown on Plans. In lapped splices, bars shall be placed in contact and wired together in such a manner as to maintain not less than the minimum clearance to the surface of concrete as shown on plans.

Lap splicing of No. 14 and No. 18 bars will not be permitted. These sizes shall be spliced in conformance with the following:

(a) Splice shall develop at least the specified minimum ultimate strength of reinforcing bars in compression and in tension. Where bars of different sizes or strengths are connected, the governing strength shall be the strength of the small or weaker bar.

(b) Splices shall be made by an approved mechanical butt splicing method utilizing a ferrous filler metal and an enclosing steel sleeve. Method will be submitted to Engineer for approval prior to making splices. Completed splices will be subject to testing at no expense to Owner.

311.4.00 MEASUREMENT AND PAYMENT

311.4.01 Concrete

When not specified or shown as a separate pay item in the Proposal, payment for concrete is considered to be incidental to related items of concrete work and no separate payment will be made.

When reinforcing steel, metal expansion plates, or miscellaneous metal items are not specified or shown as a separate pay item in the Proposal, payment for said item is considered to be incidental to the related item of work and no separate payment will be made.

311.4.01A Lump Sum Basis

Measurement and payment will be made on a lump sum basis as shown in the Proposal.

311.4.01B Cubic Yard Basis

Measurement and payment will be made on a cubic yard basis for each class of concrete as shown in the Proposal.

311.4.02 Reinforcement

311.4.02A Incidental Basis

When not specified or shown as a separate pay item in the Proposal, payment for reinforcement is considered to be incidental to related items of concrete work and no separate payment will be made.

Reinforcement in precast structures, where reinforcement is specified and included in the

Contract price for other pay items, will not be included as a pay item for reinforcement.

311.4.02B Lump Sum Basis

Measurement and payment for reinforcement will be made on a lump basis as shown in Proposal.

311.4.02C Unit Price Basis

Measurement and payment for reinforcement will be made on a unit price per pound basis as shown in the Proposal.

311.4.02D Partial Payment for Failing Compressive Strength

When the compressive strength of concrete fails to meet the required cylinder breakage for 28 days, the Owner shall have just cause to adjust the unit bid price or make partial payment of concrete-in-place. This shall be accomplished by ascertaining the average of the concrete tests based on a 28 day break. This average value of field tests shall be compared to the specified strength. That deficiency in excess of 5.0 percent, times 2.0 the entire deficiency, shall be the percentage of reduction in pay for that bid item, or the portion failing to meet compressive requirements. The percentage shall determine the new unit bid price.

<u>% Deficiency in Strength</u>	<u>% Reduction in Pay*</u>
0 - 5.0	No Deduction
5.0 - 25.0	2.0 x Deficiency

*Applies to the in-place price for Portland Cement concrete pavement.

As an example, if the deficiency in strength is 6.0 percent, the reduction would be 2.0 x the deficiency, or 12.0 percent reduction in pay.

311.4.02E Replacement of Concrete

When concrete fails as a result of severe weather conditions, e.g., spalling or cracking due to inclement weather conditions during the early periods of curing, the Contractor shall be responsible for the removal and replacement of the damaged concrete, to the satisfaction of the Engineer. Contractor shall also repair, or remove and replace, concrete which has been vandalized during the contract period before the construction is finalized and accepted by the Owner. All repairs or removal and replacement of damaged or defective concrete shall be at the Contractor's expense, and no additional cost to the Owner.

312 PORTLAND CEMENT CONCRETE PAVEMENT

312.1.00 DESCRIPTION

This section covers work necessary to construct Portland Cement concrete pavement, on an approved base, with or without reinforcement.

312.2.00 MATERIALS

All materials shall conform to the requirements of Section 311 PORTLAND CEMENT CONCRETE AND CONCRETE STRUCTURES and Section 305 AGGREGATE BASES as applicable.

312.2.01 Aggregate

Aggregate in concrete mixtures shall meet fracture of rounded rock as determined by and according to OSHD TM 213. Contractor shall provide at least one mechanically fractured face on not less than 60 percent of the particles retained on each of the designated sieve sizes from 1/4 inch and larger.

312.2.02 Poured Filler

Poured filler for concrete joint seals shall conform to AASHTO M 173.

312.3.00 CONSTRUCTION

312.3.01 General

Contractor shall schedule and coordinate all operations involved in constructing continuously reinforced concrete, reinforced, and nonreinforced concrete pavement so that, regardless of the daily or seasonal variations in weather, temperature, and humidity under which the work is permitted to proceed, such work will result in a finished pavement conforming in all respects to the specified requirements. Contractor shall conform to the applicable requirements of concrete construction as outlined in Section 311 PORTLAND CEMENT CONCRETE AND CONCRETE STRUCTURES, and Section 305 AGGREGATE BASES as applicable.

312.3.02 FOUNDATION PREPARATION

312.3.02A Excavation

Unless otherwise specified in the Special Provisions, all excavation shall be in accordance with Section 301 EARTHWORK.

312.3.02B Bedding Aggregate

Bedding aggregates shall be placed and compacted as shown on the Plans to a true line and grade, and in accordance with Section 305 AGGREGATE BASES. The finished subgrade and bedding material shall be kept smooth and compacted until the concrete has been placed. Construction equipment shall not operate in the paving lane when conditions of the project will allow operating from outside the lane, unless otherwise directed by Engineer. Contractor shall make every effort to diminish subgrade or bedding displacement when working within the limits of the paving lane.

Before paving operations begin, the base shall be brought to the finished condition as required by the specifications. If the equipment used by the contractor requires additional width for support, the contractor shall provide the support necessary to assure the equipment maintains proper grade and cross section.

Manholes, inlets, and other such structures shall be completed, adjusted, cured, and otherwise prepared, as applicable, and made clean and ready to have concrete placed in contact with them.

312.3.03 Reinforcement

Reinforcement for PCC pavement shall conform to the requirements of Subsection 311.2.07 REINFORCEMENT MATERIALS. Provision shall be made for placing dowels, tie bars, and other devices called for by the Contract Documents, during placement of the PCC. Reinforcement shall be placed on supporting devices, or "chairs," and maintained in position while the PCC is being placed.

312.3.04 Hauling

Hauling of Portland Cement concrete mixed at a central plant or in a transit mixer shall conform to the provisions of Section 311 PORTLAND CEMENT CONCRETE AND CONCRETE STRUCTURES.

312.3.05 Forms

All forms shall conform to the applicable requirements of Section 311 PORTLAND CEMENT CONCRETE AND CONCRETE STRUCTURES.

312.3.06 Handling and Placing

The handling and placing of concrete pavement shall conform to the requirements of Section 311 PORTLAND CEMENT CONCRETE AND CONCRETE STRUCTURES. Contractor shall make provisions for the construction of joints and the placing of dowels, tie bars, and other devices as shown or directed.

Damage to the subgrade, base or reinforcement shall be corrected prior to placement of the PCC.

312.3.07 Slipform Paving

The pavement shall be consolidated and finished with a slipform paving machine. The machine shall be operated with as nearly continuous forward movement as possible, at speeds that will allow for the coordination of mixing, delivery and spreading of the concrete in a uniform manner. The machine shall vibrate the concrete with vibrating tubes or arms working in the concrete for the full width and depth of the pavement being placed.

If for any reason it becomes necessary to stop the forward motion of the paver, all vibratory and tamping elements shall also be stopped. No traction force shall be applied to the machine except that which is controlled from the machine itself. Starting and stopping of the paving machine will be kept to an absolute minimum.

312.3.08 Tamping and Screeding

The placed concrete mass shall be compacted by means of vibrating screeds, mechanical tampers, tamping templates and such other implements as approved. A vibrating screed or an automatic screeding and tamping machine may be substituted for a tamping template, when approved. The equipment shall be operated in such a manner that a satisfactory compaction of the concrete is produced, and the surface of the pavement is uniform, true to grade, and cross-section.

312.3.09 Roadway and Alley Finishing

After the pavement has been struck off and consolidated, it shall be scraped with a straightedge 12 feet long equipped with a handle to permit operation from the edge of the pavement. Any excess water and laitance shall be removed from the surface of the pavement. The straightedge shall be operated parallel to the centerline of the pavement and shall be moved forward one-half its length after each pass. Irregularities shall be corrected by adding or removing concrete. All disturbed places shall be again straight-edged.

After the Portland Cement concrete has been given a preliminary finish, the surface of the pavement shall be checked by the contractor with a straightedge device not less than 12 feet in length. Each successive check with the straightedge device shall lap the previous check path by at least half the length of the straightedge. Surface deviations exceeding 0.01 foot shall be corrected.

Upon completion of the surface floating, but before any required edge tooling or joint tooling, and before initial set of the surface PCC, the pavement shall be given a textured finish perpendicular to the center line.

The textured finish shall be accomplished by a steel tine tool that will mark the finished PCC to a depth of 1/8 inch plus or minus 1/16 of an inch. The markings shall be about 1/8 inch in width, randomly spaced, averaging about 3/4 inch on center perpendicular to the center line.

At the conclusion of the finishing operation the surface of the pavement shall not vary from a true surface, when tested with a 12 foot testing straightedge, more than 1/8 inch in 12 feet.

The finished surface shall not vary more than 0.03 foot from the Plan profile at any point.

The free edges of new pavement and joints with previously placed PCC shall be tooled to remove laitance and mortar resulting from finishing operations and to provide a clean rounded edge to the new pavement. Tooling shall not form ridges on the surface of the concrete.

312.3.10 Joints

312.3.10A General

Construction joints, expansion joints, and all longitudinal joints shall be placed as indicated in the Contract Documents. Transverse construction joints shall be as shown in the Standard Drawing. Transverse joints shall extend continuously through the pavement and curb.

312.3.10B Transverse Contraction Joints

Transverse contraction joints shall consist of planes of weakness created by forming or cutting grooves in the surface of the pavement. They shall be equal to at least one-third the depth of the slab.

1. Transverse strip contraction joints shall be formed by installing a parting strip to be left in place.
2. Formed grooves shall be made by depressing an approved tool or device into the plastic concrete. The tool or device shall remain in place until the concrete has attained its initial set and shall then be removed without disturbing adjacent concrete.
3. Sawed contraction joints shall be created by sawing grooves in the surface of the pavement with an approved concrete saw. After each joint is sawed, the saw cut and adjacent concrete surface shall be thoroughly cleaned. The contractor shall be responsible for clean up of sawing tailings and to not let tailings and cooling water to enter the storm system.

Sawing of the joints shall begin as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling, usually 4 to 24 hours. All joints shall be sawed before uncontrolled shrinkage cracking occurs. If necessary, the sawing operations shall be carried on both day and night, regardless of weather conditions. A standby saw shall be available in the event of breakdown.

The sawing of any joint shall be omitted if a crack occurs at or near the joint location before the time of sawing. Sawing shall be discontinued if a crack develops ahead of the saw. In general, all joints shall be sawed in sequence. All contraction joints in lanes adjacent to previously constructed lanes shall be sawed before uncontrolled cracking occurs. If extreme conditions make it impracticable to prevent erratic cracking by early sawing, the contraction joint groove shall be formed before initial set of concrete, as provided above.

4. Transverse formed contraction joints shall consist of a groove or cleft extending downward from and normal to the surface of the pavement. These joints shall be made while the concrete is plastic by an approved mechanically or manually operated device to the dimensions indicated in the Contract Documents. Transverse contraction joints shall be perpendicular or skewed as shown in the Contract Documents or as directed by the Engineer.

312.3.10C Transverse Construction Joints

Transverse construction joints of the type shown in the plans shall be placed whenever the placing of concrete is suspended for more than 45 minutes. A butt joint with dowels or a thickened-edge joint shall be used if the joint occurs at the location of a contraction joint. Keyed joints with tie-bars shall be used if the joint occurs at any other location. Care shall be taken when forming construction joints to assure that the reinforcement and its supports are not displaced, distorted, or otherwise disturbed.

312.3.10D Transverse Expansion Joints

Transverse expansion joints shall consist of a vertical expansion joint filler placed in a butt-type joint with or without dowel bars as shown in the Contract Documents. The expansion joint filler shall be continuous from form to form shaped to the subgrade, curb section, and to the keyway along the form. Preformed joint filler shall be furnished in lengths equal to the pavement width or equal to the width of one lane. Damaged or repaired joint filler shall not be used unless approved by the Engineer.

The expansion joint filler shall be held in a vertical position. An approved installing bar or other device shall be used if necessary to ensure proper grade and alignment during placing and finishing of the concrete. Finished joints shall not deviate in horizontal alignment more than 1/4 inch from a straight line. If joint fillers are assembled in sections, there shall be no offsets between adjacent units. No plugs of concrete shall be permitted anywhere within the expansion space.

312.3.10E Longitudinal Joints

Longitudinal contraction joints shall consist of planes of weakness created by forming or cutting grooves in the surface of the pavement. They shall be equal to at least one-third the depth of the slab plus,

1. Sawed longitudinal joints shall be grooves made with a concrete saw at approximately the same time the transverse joints are sawed, or within 24 hours of the paving.
2. Longitudinal groove joints are formed in the same manner as transverse formed groove joints.
3. Longitudinal strip joints are formed in the same manner as transverse strip joints.
4. Longitudinal construction joints shall be of the dimension shown in the Contract Documents. Where a key is required, it shall be constructed by forming when the first lane adjacent to the joint is placed. These joints shall be finished with an edger of the radius shown in the Contract Documents. When placing the second slab, concrete must not be left overhanging the lip formed in the first slab by the edging tool.

312.3.10F Sealing Joints

Joints to be sealed shall be filled with joint-sealing material before the pavement is opened to traffic and as soon after completion of the curing period as is feasible. Just before sealing, each joint shall be thoroughly cleaned of all foreign material, including membrane curing compound, and joint faces shall be clean and surface-dry when seal is applied. Heated-sealing material for seal applied hot shall be augured during heating to prevent overheating.

The heated-sealing material shall be applied to each joint opening in accordance with the details shown in the Contract Documents or as directed by the Engineer. The joint filling shall be done without spilling material on the exposed surfaces of the concrete. Any excess material on the surface of the concrete pavement shall be removed immediately and the pavement surface cleaned. The use of sand or similar material to cover the seal shall not be permitted. Joint-sealing material shall not be placed when the air temperature in the shade is less than 50 degrees Fahrenheit, unless approved by the Engineer.

312.3.11 Curbs

Curbs, and curbs and gutters, may be constructed integrally with the pavement using slipform or extrusion equipment or placed immediately after finishing operations by hand forming or using face forms. Curbs may also be constructed as a separate operation before or after pavement construction using forms or slipform or extrusion equipment. The edge of each gutter bar may be used as a form in lieu of setting forms.

Refer to Section 313 CURBS AND GUTTERS of these Specifications.

When curb and gutter is constructed independently of pavement, the curb and gutter shall be tied to the concrete pavement with #5 bars, min., on centers determined by the Engineer, but no greater than 24". The bars shall be hard set in the curb. The bars shall be 24" long and have equal penetration each way.

Curbs and gutters shall have a lightly broomed finish to match the pavement with the broom being drawn parallel to the centerline. Curbs and gutters shall be in conformance to Subsection 313.3.04B PORTLAND CEMENT CONCRETE.

312.3.12 Pavement Protection

The Contractor shall at all times have available materials to protect the concrete surface against detrimental weather conditions and cold. These materials shall consist of burlap, curing paper, or plastic sheeting. When slipform construction is being used, materials such as wood planks or forms to protect the edges of the pavement shall also be required.

The contractor shall erect and maintain suitable barriers to protect the concrete from traffic or other detrimental trespass until the pavement is opened to traffic. If necessary, the contractor shall provide security guards. Concrete damaged as a result of detrimental trespass shall be replaced at the direction of the Engineer at no expense to the Owner.

312.3.13 Curing

For additional information on concrete curing, Contractor shall refer to Subsection 311.3.14 CURING.

Concrete shall be cured by protecting it against loss of moisture, rapid temperature change, and mechanical injury for at least 3 days after placement.

Moist curing, waterproof paper, white polyethylene sheeting, white liquid membrane compound, or a combination thereof may be used. After finishing operations have been completed, the entire exposed surface of the newly placed concrete shall be covered and cured for at least 72 hours by whatever curing medium is applicable to local conditions and approved by Engineer. The edges of concrete slabs exposed by the removal of forms shall be protected immediately to provide these surfaces with continuous curing treatment equal to the method selected for curing the slab and curb surface.

Contractor shall have at hand and ready to install the equipment needed for adequate curing before the actual concrete placement begins.

312.3.13A Moist Curing

Moist curing shall be accomplished by a covering of burlap or other approved fabric mat used singly or in combination. Curing mats shall be thoroughly wet when applied and kept continuously wet and in intimate contact with the pavement surface for the duration of the moist curing period. Burlap or fabric mats shall be long enough to cover the entire width and edges of the pavement lane and lapped at joints to prevent drying between adjacent sheets.

312.3.13B Waterproof Paper or White Polyethylene

Waterproof paper or white polyethylene film, a minimum of 4 mils in thickness, shall be applied to damp concrete as soon as the film or paper can be placed without marring or discoloring the surface. Sheets shall be in pieces large enough to cover the entire width and edges of the slab and shall be lapped not less than 18 inches. The paper or polyethylene shall be adequately weighted to prevent displacement or billowing due to wind, and material folded down over the side of the pavement edges shall be secured by a continuous bank of earth. Tears or holes appearing in the paper or polyethylene during the curing period shall be immediately repaired.

312.3.13C Membrane

The liquid-membrane method of curing shall be applied behind the final finishing operation after all free water has disappeared from the surface. Complete and uniform coverage at the required rate of one gallon per 150 square feet shall be required. The compound shall be kept agitated to prevent the pigment from settling, and it shall be applied to the pavement edges immediately after the forms have been removed. The compound shall form an impervious membrane when tested in accordance with OSHD TM 721. Membrane curing will not be permitted in frost-affected areas on paving that will be exposed to deicing chemicals within 30 days after completion of the curing period.

312.3.13D Cold Weather Protection

Contractor shall also refer to Subsection 311.3.09 WEATHER LIMITATIONS.

Except by specific written authorization, concrete placing shall cease when the descending air temperature in the shade and away from artificial heat falls below 40 degrees Fahrenheit. It shall not be resumed until the ascending air temperature in the shade and away from artificial heat rises to 35 degrees Fahrenheit.

When concrete has been placed in cold weather and the temperature may drop below 35 degrees Fahrenheit, straw, hay, insulated curing blankets, or other suitable material shall be provided along the line of work. Whenever the air temperature may reach the freezing point during the day or night, the material shall be spread over the concrete deep enough to prevent freezing of the concrete. Concrete shall be protected from freezing

temperatures until it is at least 10 days old. Concrete injured by frost action shall be removed and replaced at Contractor's expense.

312.3.14 Opening to Traffic

Engineer shall decide when the pavement shall be opened to traffic. It shall not be opened to traffic, nor shall the Contractor operate construction equipment on newly placed PCC, until the field-cured concrete has attained its designed flexural or specified 28-day compressive strength.

312.3.14A Compressive Strength

Acceptance sampling and testing for strength will be based on 28-day strength tests. Compliance of the hardened PCC will be based on tests performed by Lane County Materials Lab or certified testing lab and on any check tests performed by the Engineer.

Cylinders will be sampled, prepared, and cured according to AASHTO T 141 and T 23 for compressive strength testing. One of the four cylinders will be tested for information at 7 days. The other three will be tested at 28 days, according to AASHTO T 22. Sampling and testing shall also comply with Subsection 311.3.02B CLASSIFICATION AND PROPORTIONING OF CONCRETE MIXTURES.

The average of the 28-day compressive strength tests of the three cylinders will constitute the strength test value. If any one of the three cylinders tested indicates a compressive strength more than ten percent below the average strength of the other two cylinders, the results from that cylinder will be discarded and the test strength value will be based on the average strength of the two remaining cylinders.

The Engineer may require removal and replacement of any work incorporating concrete that fails to comply with compressive strength requirements. If deficient PCC is allowed by the Engineer to remain in place, payment will be adjusted in conformance with subsection 312.4.02A Partial Payment for Failing Compressive Strength.

312.4.00 MEASUREMENT AND PAYMENT

312.4.01 Measurement

Measurement of Portland Cement concrete pavement will be made on a square yard basis for the pavement complete in place as specified, and accepted. Measurement will be made for width and length of each separately constructed strip of pavement, wherein the width is the design width or edge-to-edge width of pavement, whichever is the lesser, and the length is from end to end of pavement to the nearest 0.1 foot and the square yardage shall be to the nearest square yard.

Extra thickness of pavement, when shown or specifically directed to be placed, or integral curb and gutter will be measured by conversion on a proportionate volume basis to an equivalent number of square yards of specified standard thickness pavement.

312.4.02 Payment

Payment will be made for any or all of the following items when listed as pay items in the Proposal for any particular Contract.

<u>Payment Item</u>	<u>Unit of Measure</u>
1. Continuous Reinforced Concrete Pavement (specify class, thickness, reinforcing steel)	Per S.Y.
2. Reinforced Concrete Pavement (specify class, thickness, reinforcing steel)	Per S.Y.
3. Nonreinforced Concrete Pavement (specify class, thickness)	Per S.Y.
4. Integral Curb and Gutter	Per L.F.

Payment for concrete pavement, whether continuously reinforced, reinforced or nonreinforced, shall be full compensation for furnishing and placing all materials including water, reinforcement, joint materials, dowels, tie bars, and performing all work specified to complete the item including preparation of the base.

312.4.02A Partial Payment for Failing Compressive Strength

Field design strength is defined as equal to 85 percent of the strength of the laboratory cured cylinder and the required test results for laboratory cured cylinders shall satisfy these higher values. The destructive strength tests of the laboratory cured cylinders shall be 1.15 times the required field strength, i.e., 3000 psi concrete shall break at 3450 psi.

When the compressive strength of concrete fails to meet the required cylinder breakage for 28 days, the Owner shall have just cause to adjust the unit bid price or make partial payment of concrete-in-place. This shall be accomplished by ascertaining the average of the concrete tests based on a 28 day break. This average value of field tests shall be compared to the specified strength. That deficiency in excess of 5.0 percent, times 2.0 the entire deficiency, shall be the percentage of reduction in pay for that bid item, or the portion failing to meet compressive requirements. The percentage shall determine the new unit bid price.

<u>% Deficiency in Strength</u>	<u>% Reduction in Pay*</u>
0 - 5.0	No Deduction
5.0 - 25.0	2.0 x Deficiency

*Applies to the in-place price for Portland Cement concrete pavement.

As an example, if the deficiency in strength is 6.0 percent, the reduction would be 2.0 x the deficiency, or 12.0 percent reduction in pay.

312.4.02B Replacement of Concrete

When concrete fails as a result of severe weather conditions, e.g., spalling or cracking due to inclement weather conditions during the early periods of curing, the Contractor shall be responsible for the removal and replacement of the damaged concrete, to the satisfaction of the Engineer. Contractor shall also repair, or remove and replace, concrete which has been vandalized during the contract period before the construction is finalized and accepted by the Owner. All repairs or removal and replacement of damaged or defective concrete shall be at the Contractor's expense, and no additional cost to the Owner.

313 CURB AND GUTTER

313.1.00 DESCRIPTION

This section covers work necessary for the construction of curbs, gutters and combination curb and gutter hereinafter referred to collectively as structures.

313.2.00 MATERIALS

313.2.01 General

Materials shall conform to the requirements for SECTION 311 - PORTLAND CEMENT CONCRETE AND CONCRETE STRUCTURES and Section 310 - ASPHALT CONCRETE PAVEMENT respectively, and to the additional requirements contained herein.

313.2.02 Portland Cement Concrete For Extended Structures

313.2.02A Extruded Bonded Curb

The combined aggregates shall be graded within the following limits:

Total Passing

Sieve Size	Percent by Weight
1/2"	100
3/8"	75-100
No. 4	50-75
No. 16	20-40
No. 30	12-23
No. 50	5-15
No. 100	0-5

313.2.02B Standard and Straight Concrete Curb

The combined aggregates shall conform to Sub Section 311.2.02 Course Aggregates.

Portland Cement per cubic yard of concrete shall be a minimum of 592 pounds (6.3 sacks) 3500 psi.

313.2.03 Asphalt Concrete

Asphalt concrete shall conform to Class 'C' Hot Mix in Section 310 ASPHALT CONCRETE PAVEMENT.

313.2.04 Aggregate For Bases

Aggregate materials for base, foundation courses, leveling courses or bedding shall conform to 1-1/2"-0 or 3/4"-0 gradation in Section 305 AGGREGATE BASES.

313.2.05 Metal Reinforcement

Metal reinforcement shall conform to the requirements of Sub- Section 311.2.07 - REINFORCING MATERIAL.

313.2.06 Dowels

Dowels shall conform to the requirements of Section 311 - PCC and CONCRETE STRUCTURES.

313.2.07 Joint Material

Joint Materials shall conform to the requirements of Sub-Section 311.2.06 - JOINT MATERIALS.

313.2.08 Epoxy Cement

Epoxy Cement shall be a two component epoxy resin adhesive conforming to the requirements of AASHTO M 235.

313.2.09 Curing Material

Curing Material shall conform to the requirements of Sub- Section 311.2.05 - CURING MATERIALS.

313.2.10 Fly Ash

Fly Ash shall conform to the requirements in Sub-Section 311.2.04c FLY ASH.

313.2.11 Water

Water shall conform to the requirements in Sub-Section 311.2.03 WATER.

313.2.12 Admixtures

Admixtures shall conform to the requirements in sub-Section 311.2.04 ADMIXTURES.

313.3.00 CONSTRUCTION

313.3.01 Preparation of Base

313.3.01A Earthwork

All excavation, backfilling and berm construction for the structures and in the vicinities thereof as required or as shown shall conform to applicable requirements of Section 301 EARTHWORK and Section 302 EMBANKMENT.

Earthwork for structures in this section shall be performed as follows:

Excavations shall be made to the required depths, lengths and widths for the appropriate structure.

The surface the structure is to be constructed upon shall be even and well compacted.

All soft and unsuitable material shall be removed.

Areas adjacent to the work shall be trimmed and shaped to a neat condition and disturbed areas restored to their original condition.

For additional conditions refer to Section 206 - RESTORATION AND CLEANUP

313.3.01B Aggregate Foundation Or Bedding

Foundation courses or beddings shall be constructed in conformance to the applicable requirements of Section 305 AGGREGATE BASES.

313.3.01C Base For Portland Cement Concrete

All bases upon which new concrete structures are to be constructed shall be compacted and free of all deleterious matter. Surfaces upon which new cement concrete is to be placed shall be thoroughly dampened. No payment will be made for water and the work of placing base materials.

The cost of preparing bases shall be considered as incidental to the construction of structures.

When Bonded curb is placed by the mechanical extrusion method, vertical dowel fastening to underlying concrete or asphalt may be eliminated and the bond between new concrete and underlying concrete or asphalt provided with epoxy cement applied in conformance with the manufacturer's recommendations as approved. Epoxy shall be spread at a rate which will provide a thorough coating to the surface with all voids and depressions filled. The new structure shall be placed on the epoxy cement within 15 minutes after spreading.

313.3.01D Base For Asphalt Concrete

The base for new asphalt concrete shall be brought to proper grade, compacted, dry and free of deleterious matter.

Where asphalt bonded curb is placed by mechanical extrusion method upon existing asphalt or concrete surfaces a light coating of emulsified asphalt conforming to the requirements in Sub-Section 310.3.05 - Tack Coat or an application of epoxy cement, as set forth herein for use with portland cement concrete, shall be used to provide positive bond between the new and old materials in conformance to the manufactures specifications.

313.3.02 Forms

313.3.02A General

Forms shall conform to requirements for forms in Section 311 -PCC AND CONCRETE STRUCTURES

Portland Cement Concrete shall not be placed against existing asphalt concrete. If a new structure is to come into contact with existing asphalt concrete the asphalt concrete shall be sawcut to expose a vertical face a minimum of 6 inches away from the new structure. After the structure is in place the new asphalt concrete shall be placed.

313.3.02B Equipment

Plant and equipment requirements as described in Section 310 ASPHALT CONCRETE PAVEMENT and Section 311 - PORTLAND CEMENT CONCRETE AND CONCRETE STRUCTURES may be modified as approved, when circumstances

warrant.

The machine for extruding portland cement concrete structures or asphalt concrete curb shall be of the self-propelled type equipped with a material hopper, distributing screw, and adjustable curb forming devices capable of placing and compacting Portland Cement concrete or asphalt concrete to the lines, grades and cross-section as shown, in an even homogeneous manner.

Top of curb grade shall be set by an offset guide line using the survey marks established by the Engineer. A grade line gauge or pointer shall be attached to the machine in such manner that a continual comparison can be made between the curb being placed and established curb grade as indicated by the offset guide line.

In lieu of the above method for maintaining the curb grade, the extrusion machine may be operated on approved rails or forms set at the proper relative grade.

The extrusion machine may be required to be equipped with electronic line and grade capabilities.

313.3.03 Placing Material

No asphalt or concrete shall be placed until the surface and forms, where used, have been inspected and approved.

313.3.03A Portland Cement Concrete

Portland Cement concrete structures shall be constructed between approved forms or by an approved mechanical extrusion method, as the Contractor may elect. If forms are used, a 2 to 4 inch slump shall be maintained and the concrete thoroughly compacted and struck off. If the structures are constructed by an approved mechanical extrusion method, a 1 to 2 inch slump shall be maintained. Portland Cement concrete shall be fed into the extruding machine at a uniform rate and the machine operated under sufficient restraint in a forward motion to produce a well-compacted mass of concrete.

313.3.03B Asphalt Concrete

Extruded asphalt concrete curbs shall be placed as a temporary structure and only with the advance approval of the engineer in conformance with the requirements in Section 310 ASPHALT CONCRETE PAVEMENT.

313.3.03C Weep Holes And Curb Drains

Weepholes and curb drains shall be formed in any curb or similar structure that would prevent the natural drainage of surface water unless the intent of the structure is to block such drainage. Weepholes and openings for curb drains shall be located at all points

where the natural flow of water shall be evident due to the configuration of the land. Weepholes shall also be placed opposite dwelling downspouts and foundation drains.

Adjacent to undeveloped land, weepholes shall be located five (5) feet to each side of all fronting lot corners. When the distance between fronting lot corners exceeds one hundred (100) feet, the distance between weepholes shall not exceed seventy five (75) feet or as directed by the engineer.

The flowline of the weephole shall be not more than one half (1/2") inch above, nor lower than level with the gutter bar. When placed in curbs, a contraction joint shall be formed in the curb at the apex of the weephole.

Weepholes shall be formed at the time the structure is placed by any means the Contractor may elect that will result in a perfectly round hole not less than three (3) inches and no more than four (4) inches in diameter

Weepholes that are inadvertently left out of the structure for any reason shall be formed by core drilling in accordance with the Standard Drawings 3-5 and 3-6. Notching of the curb shall not be allowed.

Weepholes and curb drains shall be incidental to the cost of the structure in which they are placed.

313.3.04 Finishing

313.3.04A General

All structures shall be constructed within 1/4 inch of true line, within 1/4 inch of established surface grade, cross-section and slope, and within 1/8 inch of specified thickness, and all finished surfaces shall be free from humps, sags, or other irregularities. When a straightedge 12 feet long is laid on a finished surface tangent, the surface shall not vary more than 0.02 feet from edge of the straightedge. The contractor shall provide the straightedge and the personnel to preform the work.

313.3.04B Portland Cement Concrete

Forms shall be removed after the concrete has taken initial set and while the concrete is still green. Minor defects shall be repaired with mortar containing one part Portland cement and two parts sand. Plastering will not be permitted on the faces and exposed surfaces. Honeycombed and other defective concrete shall be removed and replaced at no expense to Owner. While the concrete is still green, exposed surfaces shall be finished as required to provide a uniform broomed texture parallel to the length of the structure.

When constructing precast concrete curbs, the proportions of sand, gravel and cement, the type of forms used, and the method of compacting the concrete in the forms shall all be such that as dense, smooth and uniform a surface as is practicable for a concrete masonry

unit will be obtained on the finished curb units. The faces that are to be exposed shall be free from chips, cracks, air holes, honeycomb or other imperfections.

313.3.05 Curing Portland Cement Concrete

After the concrete has been placed and finished, it shall be cured by application of a membrane-forming compound applied uniformly to the damp concrete by pressure spray methods or by keeping the concrete protected and moist for at least 72 hours. The concrete structure shall be kept from contact and strain for at least 7 days.

Curing of concrete in this section shall conform to the requirements for curing in Sub-Section 311.3.14 CURING.

313.3.06 Joints In Portland Cement Concrete

313.3.06A Contraction Joints In Curbs

Contraction joints shall be placed in curbs, at intervals not exceeding 15 feet. Joints shall be provided opposite abutting joints in adjacent pavement and structures, over joints in underlying concrete, at the ends of curved portions of structures, at connections to existing structures and at other locations as required. Top of curb shall be finished with a steel trowel and edges finished with a steel edging tool. Final finish shall be with a light broom.

Expansion joints, in conformance with Sub-Section 311.3.12 EXPANSION AND FIXED JOINTS, may be required at 30' intervals.

313.3.06B Requirements Near Existing Structures

Existing curbs, walks, driveways and other such structures shall be cut back to permit the new construction., Where the new structures are to be constructed against inches of the end, edge or side of existing structures, the new construction shall include the construction of approved connections therewith, using the same kind of material as is used in the new construction. The joint between the old and new material shall be made with a saw cut.

In this work, Contractor shall furnish and place pre-formed expansion joint filler, minimum 1/2-inch thickness, between new and old Portland cement concrete.

313.3.07 Dowels, Tie Bars, Reinforcing

Refer to Sub-Section 311.2.07 Reinforcement Materials.

Metal reinforcing bars and wire fabric reinforcement shall be provided as shown.

313.3.08 Concrete Valley Gutter

Concrete valley gutter shall be constructed as shown in the Contract Documents or as

directed by Engineer.

313.4.00 MEASUREMENT AND PAYMENT

313.4.01 Measurement

313.4.01A Curb

Curb will be measured on linear foot basis along the face of the curb for the actual length constructed.

313.4.01B Combination Curb and Gutter

Combination curb and gutter will be measured on a linear foot basis along the face of the curb for the actual length constructed.

313.4.01C Precast Concrete Curb

Precast concrete curb will be measured on a linear foot basis along the face of the curb in place, or on a per each basis for the actual number of precast concrete sections in place.

313.4.01D Concrete Valley Gutter

Concrete valley gutter will be measured on a linear foot or square yard basis for the actual linear feet or square yards of gutter constructed as specified by bid item in the in the bid proposal.

313.4.01E Aggregate Base

Aggregate base under curb and gutter will be paid for as a part of the street structure as shown in the typical drawing.

When not in conjunction with street construction base material for structures described in this section shall be incidental to the structure in place.

313.4.02 Payment

Payment will be made for any or all of the following items when listed as pay items in the Proposal for any particular Contract:

<u>Payment Item</u>	<u>Unit of Measure</u>
Curb (specify asphalt or concrete)	Per L.F.
Precast Concrete Curb	Per L.F. or EA.
Concrete Curb and Gutter	Per L.F.
Concrete Valley Gutter	Per L.F. or S.Y

313.4.02A Partial Payment For Failing Compressive Strength

When the compressive strength of concrete fails to meet the required cylinder breakage for 28 days, the OWNER shall have just cause to adjust the unit bid price or make partial payment of concrete-in-place. This shall be accomplished by ascertaining the average of the concrete tests based on a 28 day break. This average value of field test shall be compared to the specified strength. That deficiency in excess of 5.0 percent, times 2.0 the entire deficiency, shall be the percentage of reduction in pay for that bid item, or the portion failing to meet compressive requirements. The percentage shall determine the new unit bid price.

<u>% Deficiency in Strength</u>	<u>% Reduction in Pay*</u>
0 - 5.0	No Deduction
5.0 - 25.0	2.0 X Deficiency

*Applies to the in-place price for Portland Cement concrete pavement.

As an example, if the deficiency in strength is 6.0 percent, the reduction would be 2.0 X the deficiency, or 12.0 percent reduction in pay.

313.4.02B Replacement of Concrete

When concrete fails as a result of severe weather conditions, e.g., spalling or cracking due to inclement weather conditions during the early periods of curing, the Contractor shall be responsible for the removal and replacement of the damaged concrete, to the satisfaction of the Engineer. Contractor shall also repair, or remove and replace, concrete which has been vandalized during the contract period before the construction is finalized and accepted by the Owner. All repairs or removal and replacement of damaged or defective concrete shall be at the Contractor's expense, and no additional cost to the Owner.

314 DRIVEWAYS, SIDEWALKS, HANDICAP RAMPS AND PATHWAYS

314.1.00 DESCRIPTION

This section covers work necessary for the construction of sidewalks, handicap ramps, driveways and pathways. The respective structure names are specific in their use and refer specifically to those names as shown.

314.2.00 MATERIALS

314.2.01 General

Materials shall conform to the requirements for Section 310 ASPHALT CONCRETE PAVEMENT and Section 311 PORTLAND CEMENT CONCRETE AND CONCRETE STRUCTURES.

314.2.02 Portland Cement Concrete

Portland Cement Concrete shall conform to Class 3000-3/4 requirements as shown in Subsection 311.3.02B, CLASSIFICATION AND PROPORTIONING OF CONCRETE MIXTURES.

314.2.03 Asphalt Concrete

Asphalt Concrete shall conform to Class 'C' hot mix in Subsection 310.2.06, COMPOSITION AND PROPORTION OF MIXTURES.

314.2.04 Aggregate

Aggregate materials for base, foundation courses, leveling courses or bedding shall conform to the specifications for 3/4"-0 crushed aggregate as shown in Section 305 AGGREGATE BASES.

314.3.00 CONSTRUCTION

314.3.01 Utility Relocations

Prior to construction, utility companies shall relocate their respective facilities outside the limits of construction, wherever practicable. Water meters, hydrants, poles and utility enclosures will not be allowed in driveway, sidewalk or handicap ramp areas.

314.3.02 PREPARATION OF BASE

314.3.02A Earthwork

Earthwork for driveways, sidewalks, handicap ramps and pathways shall conform to Sections 301 EARTHWORK, 302 EMBANKMENT and 206 RESTORATION AND CLEANUP.

Earthwork shall be performed as follows: excavations for the structures shall be made to required depths, lengths and widths and the bottoms thereof to a compacted, even surface. All soft and unsuitable material will be removed and replaced with 3/4"-0 crushed rock.

314.3.02B Aggregate Foundation or Bedding

Sidewalk, driveway, handicap ramp and pathway structures shall be constructed on an aggregate foundation course with a minimum of 2 inches of 3/4"-0 crushed rock.

Foundation courses shall be constructed in conformance to the applicable requirements of Section 305 AGGREGATE BASES.

314.3.02C Base for Portland Cement Concrete

All bases upon which new cement concrete structures are to be constructed shall be compacted and free of all deleterious matter. Surfaces upon which new cement concrete is to be placed will be thoroughly dampened.

314.3.02D Base for Asphalt Concrete

The base of new asphalt concrete structures shall be brought to proper grade, compacted, dry and free of deleterious matter.

Where asphalt concrete comes into contact with previously placed Portland Cement concrete, asphalt concrete or bituminous surfaces, the area of contact shall be given an application of epoxy cement as specified for use with Portland Cement concrete, or a light coating of emulsified asphalt conforming to the requirements for Subsection 310.3.05, TACK COAT.

314.3.03 Forms

Contractor shall conform to requirements for forms in Section 311 CONCRETE STRUCTURES. No asphalt or concrete shall be placed until the surface and forms have been inspected and approved.

314.3.04 Equipment

Plant and equipment requirements as described in Section 310 ASPHALT CONCRETE PAVEMENT and Section 312 PORTLAND CEMENT CONCRETE PAVEMENT may be modified as approved, if circumstances warrant.

314.3.05 Placing Materials

314.3.05A Portland Cement Concrete

Portland Cement concrete structures shall be constructed between approved forms or by an approved mechanical extrusion method. A 2 to 4 inch slump will be maintained and the concrete thoroughly compacted and struck off. Cement concrete shall be fed into the extruding machine at a uniform rate and the machine operated under sufficient restraint in a forward motion to produce a well-compacted mass of concrete. Extruded concrete shall maintain thickness, line and grade.

314.3.05B Asphalt Concrete

Asphalt concrete for sidewalks, driveways and pathways shall be placed uniformly or by a paving machine and thoroughly compacted in conformance with the requirements in Section 310 ASPHALT CONCRETE PAVEMENT.

Asphalt concrete for sidewalks may be spread by small or special pavers or spreader boxes. It may be compacted with small, self-propelled rollers or vibratory compactors. The mixture may be spread or compacted by hand methods only when approved.

314.3.06 Underdrains

The Contractor shall insure that all natural drainage, existing underdrains and downspouts have access to the street gutter, storm sewer or drainage way, by means of the size and

type of pipe or conduit indicated and approved for such use, or as shown on the Standard Drawing No. 3-6 for weepholes and underdrains.

Drain pipe or conduits shall be placed under all sidewalks perpendicular to the curb at weephole locations to form a continuous watertight facility. Drain pipes will not be allowed in driveway approaches and must be at least 6 inches outside of the transition flares.

When located under sidewalks, the pipe or conduit shall be placed prior to placing of concrete or asphalt. Concrete sidewalks shall be scored by means of a contraction joint along the apex of the prior placed pipe or conduit to control cracking.

It shall be the responsibility of Contractor to determine the number of underdrains required.

314.3.07 Finishing

314.3.07A General

All structures shall be constructed within 1/4 inch of the true line, within 1/4 inch of established surface grade, cross-section and slope, and within 1/8 inch of specified thickness, and all finished surfaces shall be free from humps, sags, or other irregularities. When a straightedge 12 feet long is laid on a finished surface tangent, the surface shall not vary more than 0.02 foot from edge of the straightedge. Contractor shall provide the straightedge and the personnel to perform the work.

314.3.07B Portland Cement Concrete

Contractor shall finish surface of concrete to grade and cross section with a bull float, trowel smooth, score if required, then finish with a broom. Concrete adjacent to expansion joints shall be finished with an edger tool. Light brooming shall be transverse to the line of traffic and if water is necessary, it shall be lightly applied to the surface immediately in advance of brooming.

314.3.07C Slab Finishes

1. Contractor shall not use 'Jitterbugs' or other special tools designed for the purpose of forcing coarse aggregate away from the slab surface. Dusting of surfaces with dry materials will not be permitted. Contractor shall round off the edges of slabs with a 1/2 inch radius steel edging tool, unless specified otherwise.
2. Wood Float Finish. Contractor shall finish by screeding with straightedges to bring surface to required line as shown. While concrete is still green, but hardened sufficiently to bear cement finisher's weight, float surface shall be worked to a true and uniform plane with no coarse aggregate visible.

Sufficient pressure must be applied on wood floats to bring moisture to surface. After surface moisture has disappeared, concrete shall be steel troweled to produce a smooth, impervious surface, free from trowel marks. An additional troweling will be given to surface for the purpose of burnishing. Dry cement or additional water shall not be used in troweling. Excessive troweling will not be allowed.

3. Broomed Finish. Contractor shall finish concrete as specified for the wood float finish above, except for omitting the final troweling. The concrete will be finished by drawing a fine-hair broom lightly across the surface. All brooming shall be in the same direction and parallel to expansion joints, or in cases of inclined slabs, perpendicular to slope.
4. Sidewalk and Driveway Approach Finish. Contractor shall strike off the surfaces true to line and grade by means of a strike board and float with a wooden or cork float. The surfaces shall be broomed at right angles to the direction of traffic. Sidewalk surfaces shall be laid out in blocks five feet wide with an approved grooving tool as shown or as directed.
5. Handicap Ramp Finish. Contractor shall finish the ramp surface of all handicap ramps with a raised diamond pattern, placed within the length and breadth of the slope, or throat of the ramp only. Texturing with a deep broom swirl pattern will no longer be allowed. The flared wings shall have a deep swirl pattern.
6. Residential/Commercial P.C. Concrete Driveway Approaches. All driveway approaches shall be defined as either Residential or Commercial. Any driveway serving property which is zoned other than Single Family Residential shall be designated as and built to the standards of a Commercial driveway. A concrete alley apron serving public right-of-way shall also be built to the standards of a Commercial driveway.

All concrete in a commercial or alley driveway approach shall be 8 inch minimum thickness, 3500 psi field strength, with 2 inch compacted 3/4"-0" crushed rock base, and placed with No. 4 rebar on 12 inch centers both ways at 2 inches above the bottom of the slab, or placed with two layers of 6X6X10 welded wire mesh at 2 inches above the bottom of the slab. Transition flares shall also be constructed to the same 8 inch thickness and 2 inch rock base throughout the width of the apron, including rebar or wire mesh, placed and measured at right angles to the curb.

All concrete in a residential driveway approach shall be 6 inch minimum thickness, 3000 psi field strength, with 2 inch compacted 3/4"-0" crushed rock base. No rebar or welded wire mesh will be required for residential driveway approaches. Transition flares shall also be constructed to the same 6 inch thickness and 2 inch rock base throughout the width of the apron, placed and measured at right angles to the curb.

Sidewalks extending behind the approach shall be the same minimum thickness and

contain the same reinforcing, if any, as the driveway approach.

314.3.08 Curing Portland Cement Concrete

Curing of concrete shall conform to the requirements for curing in Section 312 - PORTLAND CEMENT CONCRETE PAVEMENT.

314.3.09 Joints in Portland Cement Concrete

314.3.09A Expansion Joints

Transverse expansion joints shall be provided opposite abutting expansion joints, over expansion joints in underlying concrete, and at each point of tangency in the structure alignment, and at each cold joint. Additional transverse expansion joints will be provided as required to confine the expansion joint spacing to a maximum distance of 30 feet. Expansion joints will also be provided between driveways and PCC pavements, around poles, boxes and other fixtures which protrude through, into or against the structure. Expansion joints will also be required for fixtures which extend alongside or transverse to the new surfacing of both new and abutting Portland Cement concrete. Each expansion joint will be placed at right angles to the structure alignment, vertical to the structure surface, and provide complete separation between concrete surfaces.

The width of joints and thickness of filler shall match those of the joints in abutting or underlying concrete; elsewhere it shall be not less than 1/2 inch.

314.3.09B Contraction Joints

Transverse contraction joints shall be formed in the exposed surfaces of cement concrete at such locations as are required to confine the contraction joint spacing to a maximum of 15 feet. The joints shall be formed to a depth of 1/3 of the thickness of concrete and to a width of about 1/8 inch. Joint edges shall be tooled.

314.3.09C False Joints

Sidewalk false joints shall be deep jointed to a depth equal to 1/5 the thickness of the structure. False joints shall be spaced on five foot centers, in increments of equal-sized panels, which shall be spaced in between the 30 feet maximum distance required for transverse expansion joints.

314.3.10 Reinforcement

When required by the Plans or Specifications, reinforcement shall be as shown and shall conform to the applicable requirements of Section 311 PORTLAND CEMENT CONCRETE AND CONCRETE STRUCTURES.

314.3.11 Protection of Concrete

The Contractor shall erect and maintain suitable barriers to protect the concrete from pedestrian traffic or other detrimental trespass until no damage will result from traffic. If necessary, the Contractor shall provide security guards. Concrete damaged as a result of detrimental trespass shall be replaced or repaired at the direction of the Engineer at no expense to the owner.

The Contractor shall not operate construction equipment or allow traffic on newly placed Portland Cement concrete until the concrete attains the specified 28-day compressive strength.

314.3.12 Compressive Strength

The Contractor shall refer to Section 311 PORTLAND CEMENT CONCRETE AND CONCRETE STRUCTURES. Compressive strength cylinders shall be taken each day that concrete is poured. Frequency of tests shall be determined per each 1/2 day shift of concrete placing, i.e., one set of cylinders before noon and one set after noon. Contractor shall notify the Engineer at least 24 hours before the pouring of concrete.

The Engineer may require removal and replacement of any work incorporating concrete that fails to comply with compressive strength requirements. If deficient PCC is allowed by the Engineer to remain in place, payment will be adjusted in conformance with Subsection 314.4.02A, PARTIAL PAYMENT FOR FAILING COMPRESSIVE STRENGTH.

314.3.13 Handicap Ramps

The construction of all handicap ramps for the wheelchair access and vision impairment of disabled persons at intersection corners shall conform to the current Americans with Disabilities Act (ADA) federal regulations, and to current Oregon Department of Transportation requirements.

314.3.13A Ramp Locations

Handicap ramp approaches shall be positioned to, and shall be wholly contained within, the crosswalk markings, or as directed by the Engineer. Handicap flares may extend beyond the markings. No above-ground facilities, such as power poles, fire hydrants, street signs, et cetera, shall be permitted within the ramp area, including handicap flares. Ramp approaches shall not be positioned directly in the path of catch basin grates.

Where applicable, two handicap ramps shall be located at each intersection corner which shall allow ramp approaches to be positioned for direct access into the street. One handicap ramp per intersection corner in non-stripped intersections may be acceptable, or if directed by Engineer, to accommodate unusual crosswalk markings or irregular intersection alignments.

314.3.13B Typical Ramp Specifications

Handicap ramp approaches shall be constructed with a 12:1 slope on straight grade and on flare grades. All ramp approaches shall be 4 feet wide. For curbside sidewalks, standard flares shall be 6 feet wide at the curb, or as directed by the Engineer. For setback sidewalks, the width of flares shall be 3 feet wide, or as directed by the Engineer.

314.3.13C Detectable Ramp Warnings

Each handicap ramp shall be installed with a detectable warning throughout the ramp approach. The detectable approach shall be finished with a raised diamond pattern.

Above-ground facilities which are difficult for vision impaired persons to detect, such as NBU's (Neighborhood Box Units) that overhang into the pedestrian zone, shall be provided with detectable warnings.

Overhanging or projecting objects within 27 inches and 80 inches above the sidewalk may not project more than 4 inches beyond their bases into the sidewalk area. Objects that project or overhang beyond 4 inches shall have a platform or detection device placed before them.

314.4.00 MEASUREMENT AND PAYMENT

314.4.01 MEASUREMENT

314.4.01A Driveways, Sidewalks, Handicap Ramps and Pathways

Measurement of Portland Cement or asphalt concrete driveways, sidewalks, handicap ramps and pathways shall be by the square foot basis on the actual surface of the specified thickness of concrete or asphalt completed and accepted.

314.4.01B Earthwork

When not incidental to the cost of the bid unit proposal, measurement of earthwork for the excavation of driveways, sidewalks, handicap ramps and pathways shall be made on a cubic yard basis for the length, width and depth specified, completed and accepted, as determined by the cross-section method, end to end.

314.4.01C Underdrain

Measurement shall be per the linear foot of drain pipe or conduit placed under concrete sidewalks or other structures, to the satisfaction of Engineer.

314.4.01D Aggregate Base

When not incidental to the cost of the bid unit proposal, aggregate base material for driveways, sidewalks, handicap ramps and pathways will be measured on a basis per ton as set forth in Section 305 AGGREGATE BASES.

314.4.02 Payment

Payment will be made for any or all of the following items when listed as pay items in the Proposal. When not listed as pay items, they shall be incidental.

<u>Pay Item</u>	<u>Unit of Measure</u>
Driveways	S.F.
Handicap Ramp	S.F.
Sidewalk (specify asphalt or concrete and thickness)	S.F.
Pathway (specify asphalt or concrete and thickness)	S.F.
Underdrains	L.F.
Aggregate Base (when not incidental)	Ton
Earthwork (when not incidental)	C.Y.

Payment for all items based on the above units of measure, whether or not the items are incidental to the cost of the bid proposal, shall be full compensation for all labor, equipment and materials necessary to construct driveways, sidewalks, handicap ramps and pathways.

No payment will be made for water and the work of placing base materials. The cost of preparing bases shall be considered as incidental to the construction of structures.

314.4.02A Partial Payment for Failing Compressive Strength

Field design strength is defined as equal to 85 percent of the strength of the laboratory cured cylinder and the required test results for laboratory cured cylinders shall satisfy these higher values. The destructive strength tests of the laboratory cured cylinders shall be 1.15 times the required field strength; i.e., 3000 psi concrete shall break at 3450 psi.

When the compressive strength of concrete fails to meet the required cylinder breakage for 28 days, the Owner shall have just cause to adjust the unit bid price or make partial payment of concrete-in-place. This shall be accomplished by ascertaining the average of the concrete tests based on a 28 day break. This average value of field tests shall be compared to the specified strength. That deficiency in excess of 5.0 percent, times 2.0 the entire deficiency, shall be the percentage of reduction in pay for that bid item, or the portion failing to meet compressive requirements. The percentage shall determine the new unit bid price.

% Deficiency in Strength % Reduction in Pay*

0 - 5.0	No Deduction
5.0 - 25.0	2.0 x Deficiency

*Applies to the in-place price for Portland Cement concrete pavement.

As an example, if the deficiency in strength is 6.0 percent, the reduction would be 2.0 x the deficiency, or 12.0 percent reduction in pay.

314.4.02B Replacement of Driveways, Sidewalks, Handicap Ramps and Pathways

When concrete fails as a result of severe weather conditions, i.e., spalling or cracking due to inclement weather conditions during the early periods of curing, the Contractor shall be responsible for the removal and replacement of the damaged concrete, to the satisfaction of the Engineer. Contractor shall also repair, or remove and replace, concrete which has been vandalized during the contract period before the construction is finalized and accepted by the Owner. All repairs or removal and replacement of damaged or defective concrete shall be at the Contractor's expense, and no additional cost to the Owner.

315 FENCES AND MAILBOXES

315.1.00 DESCRIPTION

This section covers work to be done in the fabrication and erection of woven wire, chain link, wood fences, and mailboxes.

315.2.00 MATERIALS

315.2.01 Woven Wire Fence

Woven wire for fence construction shall be 12-1/2 gauge galvanized steel wire conforming to the requirements of ASTM A 116-Class 3 coating or 12-1/2 gauge aluminum-coated steel wire conforming to the requirements of ASTM A 584, Class 2 coating.

315.2.01A Chain Link Fence

Fence materials may be (Heavy Weight), Schedule 40, (Medium Weight) or Master Halco structural grade or equal (Light Weight) as specified in the Contract Documents.

315.2.02 WOOD FENCE

Material for wood fence construction shall match existing on-site materials, or as specified. Posts and braces for wood fences shall conform to Sub-section 315.2.03 (Posts and Braces).

Rails shall be 2"X4" S4S Douglas Fir or Western Hemlock of Standard and Better grade or #1 grade Western Red Cedar.

Slats shall be 1" Western Red Cedar of width and length as specified, and shall be #1 Grade or better.

Fence Clips shall be 28 ga galvanized with supplied attachment hardware.

Nails shall be 6d box, galvanized or aluminum.

Concrete shall be 2500#, 3/4" mix.

315.2.03 Posts and Braces

315.2.03A Treated Wood

Wood posts and brace rails used for fences, and posts and cross members used for mailbox installations, shall be pressure-treated with either ammoniacal copper arsenate, chromated copper arsenate, or pentachloroenol, all in conformance with AWWA standards for the treatment of structural timber. The use of creosote in any form shall not be allowed.

Treated wood posts and treated wood brace rails shall be of the respective sizes and dimensions called for by the Standard Drawing 3-13 or Contract Documents.

The members shall be of sound Douglas Fir, Western Hemlock or Western Pine, free from decay, end splits and multiple crooks. Seasoning checks of not more than 5/16-inch width, surface measurement, will be permitted. Allowable crooks may be in one plane only. A line drawn between the centers of the butt and tip of each post and brace rail shall not fall outside of the actual longitudinal centerline of the post or rail by more than 1.67 percent of its length with an allowable maximum of 2 inches.

The posts and brace rails may be square, rough dressed lumber, or they may be peeled round posts, as the Contractor may elect. Round members shall be free from bark, protruding knots and irregularities.

The fabrication of posts and brace rails shall be done prior to pressure treatment of the wood members. Holes in gate posts for gate hinge bolts and holes for dowels may be bored prior to pressure treatment or may be bored in the field and treated with the same preservative as used initially, applied by thorough swabbing or applied under pressure by an approved bolthole treater, as the Contractor may elect. Where field boring or field cutting of a treated member is required, the exposed untreated surface of the member to be used shall be similarly field-treated. The size of holes after treatment shall not exceed the size of the dowels or bolts to be inserted therein by more than 1/16 inch.

Posts intended to be driven may be machine-pointed on one end prior to pressure treatment.

315.2.03B Steel Posts and Braces

Metal fence posts, braces and appurtenances shall be of the design shown in the contract documents. Posts for chain link fence shall conform to the requirements of AASHTO M 181 except as follows:

1. Tubular steel posts and braces shall conform to the requirements of ASTM A 53 with galvanizing in accordance with AASHTO M 111 and shall be provided with a snug-fitting galvanized metal cap.
2. 'H' shaped steel posts shall be formed structural steel, hot-rolled carbon steel, or hot-rolled rail steel having a minimum yield strength of 40,000 psi and shall be galvanized in accordance with AASHTO M 111.

Metal posts and braces, other than tubular shape, for barbed wire and woven wire fences shall conform to ASTM A 702, except that galvanizing may conform to the requirements of ASTM A 123. The posts and braces may be either galvanized or painted. Wire fasteners shall be galvanized with a Class 1 coating.

315.2.04 Chain Link Fabric

Chain link fabric shall conform to the requirements of AASHTO M 181 supplemented and modified as follows:

1. Optional Materials - Fabric may be zinc-coated steel, aluminum-coated steel or aluminum alloy as the Contractor may elect provided that only one type is used on any one project.
2. Mesh - For fences 96 inches or more in height using 11-gauge wire, the mesh size shall be 1-3/4 inches.
3. Strength of Wire - The base metal of steel wire shall have a minimum tensile strength of 80,000 psi base on coated wire diameter.
4. Aluminum coated steel wire shall be capable of being wrapped 180 degrees around its own diameter without cracking or flaking the coating.

315.2.05 Fence, Gates and Hardware

315.2.05A General

The materials used for the fabrication of gates shall be as shown in the contract documents for the particular type of fence specified.

Tubular steel gate frames shall be galvanized steel pipe conforming to ASTM A 53, galvanized in accordance with AASHTO M 111. Fabric in gates used with woven wire fences shall be 2 inch diamond mesh, 2"x4" V mesh or 2 inch by 4 inch rectangular mesh

as the Contractor may elect, conforming to the requirements, of Subsection 315.2.01. WOVEN WIRE FENCE. Fabric for chain link fence gates shall conform to the requirements of Subsection 315.2.04 CHAIN LINK FABRIC.

315.2.05B Tension Wire and Wire Ties

For all wire fabric ties, wire ties, hog rings and tension wire furnished for use in conjunction with zinc-coated fabric or with aluminum-coated steel fabric, zinc-coated wire or aluminum-coated steel wire will be used. For those in conjunction with aluminum alloy fabric, aluminum alloy wire will be used.

Tension wire shall have the same strength as required for the fabric of the same material. Zinc-coated wire shall be coated with prime western spelter or equal (AASHTO M 120) applied at a rate of not less than 0.7 oz. per square foot of uncoated wire surface.

Aluminum-coated wire shall be coated with aluminum alloy applied at the rate of not less than 0.3 oz. per square foot of uncoated wire surface.

For wire used for zinc-coated or aluminum-coated wire fabric ties, wire ties and hog rings, ductile steel coated with prime western spelter or equal (AASHTO M 120) applied at a rate of not less than 0.7 oz. per square foot of uncoated wire surface will be used.

315.2.05C Barbed Wire

Barbed wire, if specified, shall conform to ASTM A 121 and consist of 2-strand 12-1/2 gauge wire with 4-point barbs spaced evenly at 5-inch intervals, with Class 3 galvanizing.

315.2.05D Top Rail

When top rail is specified, couplings of outside-sleeve type, minimum of 7 inches long will be used. Springs shall be provided to permit expansion movement, as recommended by manufacturer. Top rail shall be constructed to extend through line post tops to form continuous brace from end to end of each stretch of fence.

315.2.05E Fittings

Extension arms with fittings will be included for all specified barbed wire, bracket supports, stretcher bars and clamps, clips, tension rods, brace rods, hardware, fabric bands, fastenings and all accessories. Single or double forty-five degree bracket type supports will be provided for barbed wire where shown.

315.2.05F Gates

Gates will be provided with all fittings, braces, sag rods, ball-and-socket type hinges, and single or plunger bar type latches or semi-automatic outer latches to secure gates in opened position, as specified. Latches and plunger bars will be arranged for locking with padlocks. Gates shall be diagonally braced with adjustable rods to prevent sagging in conformance with manufacturer's standard practice and as approved.

315.2.05G Fence Hardware

Fence and gate hardware for chain link fence shall conform to the requirements of AASHTO M 181 with galvanizing of steel items in accordance with AASHTO M 111 or ASTM A 153 as applicable.

315.2.06 Mailboxes

The term "Mailbox" shall refer to a complete unit consisting of support post member, cross pieces and mailboxes. The post member shall be a 6"x6"x4'-6" long pressure-treated post. 2"x6" or 4"x6" S4S cross pieces shall be used. Pressure-treatment shall be as specified in Subsection 315.2.03A TREATED WOOD.

315.3.00 CONSTRUCTION

315.3.01 General

The Contractor shall construct fence, to a true line and grade. The spacing of posts shall be to the dimensions specified. No attempt shall be made to follow any surface unevenness when reconstructing or replacing existing fences. Contractor shall take every effort to keep the established line and grade at either end of the existing fence, unless otherwise directed by Engineer.

The exact location of all fences, shall be determined and staked in the field by Engineer.

315.3.02 Woven Wire Fence

Woven wire fence shall be constructed as shown in the contract documents, and in keeping with the approved standard practice for woven wire fence construction. The fence posts and braces shall be set firmly in place as shown. No movement of the posts shall be evident during fabric installation or after the fabric has been attached.

The fabric shall be securely attached to the posts as specified, and shall be taut and free of sags.

Any areas of the installed fence which appear loose or show signs of failure shall be removed and replaced at no cost to Owner.

315.3.03 Wood Fence

Wood Fence shall conform to Sub-section 315.3.01 General and to the following:

1. Posts shall be set 24" deep in concrete with 8' or less spacing as staked.
2. Slats shall have 1/4" maximum spacing, and be securely attached, 4 nails minimum. Panels shall alternate in direction of face or present the same face to both sides.

3. Height shall be as specified on the plans.

315.3.03A Replace Fence

Contractor shall remove and replace only those sections of fence as shown on the construction drawings or approved by the engineer. Fences shall be restored to as good or better condition, and to the satisfaction of the Engineer.

Any areas of the installed fence which are loose or show signs of failure shall be removed and replaced at no cost to Owner.

315.3.04 Chain Link Fence

The post holes shall be dug as specified and the posts placed. Contractor shall then fill the space around the post with concrete to a point 2 inches above the finish grade, crowning the top surface to shed water.

The chain link fabric shall be stretched between end posts in an approved manner and fastened with clamps. Line posts, top rail, and top tension wire will be attached with wire on 15 inch centers or bands on 24 inch centers.

Gate posts shall be braced diagonally to adjacent line posts to insure stability. Gates shall be hung and adjusted so that they will operate freely in the open or closed positions as approved.

315.3.05 Mailboxes

It shall be the responsibility of Contractor to contact the Springfield Postmaster prior to beginning any work that involves the temporary removal and/or location of mailboxes, and to coordinate that action with the Postmaster's request in order that continued mail service will result.

Contractor shall contact the owner of each mailbox and inform said owner as to the exact location of the temporary delivery site.

Mailboxes shall be permanently relocated at the location specified by the Postmaster and in accordance with the City of Springfield Standard Drawings 3-13. Neighborhood box units (NBU) shall be supplied and installed by the U.S. Postal Service.

Mailboxes installed in the sidewalks and extending more than 4" outside of posts shall have a warning device for the visionally impaired in accordance with the Americans with Disabilities Act, (ADA) and the applicable portions of 313.C Detectable Ramp Warnings.

Ornamental mailbox posts or standards shall only be relocated at the request of the property owner and when approved by the Postmaster and Engineer for relocation. Ornamental posts or standards not relocated shall remain the possession of the property owner.

315.4.00 MEASUREMENT AND PAYMENT

315.4.01 Fences: Woven Wire, Chain Link

315.4.01A Lump Sum Basis

When so specified and shown in the Proposal, measurement and payment for woven wire, or chain link fences shall be as a lump sum and shall include full compensation for all labor, material and excavation. Gates shall be included in the lump sum price for fence

in-place.

315.4.01B Linear Foot Basis

Measurement and payment for woven wire, wood or chain link fence will be made on a linear foot basis for closed fence and on a per each basis for each width of single and double gate. Measurement will be along line and grade of each continuous run of fence as constructed.

315.4.01C Fence Weight

Payment for chain link fence will be made on grade of fence as bid; heavy weight, medium weight or light weight.

315.4.02 Mailboxes

Measurement shall be for each mailbox post in place and in accordance with the Standard Drawing 3-13, including all labor, equipment and materials required to complete the installation all to the satisfaction of the Postmaster and the City Engineer. Payment shall be for each mailbox post installed and accepted by the Engineer.

315.4.03 Wood Fence

Measurement and payment shall be per lineal foot for fence installed and shall include all labor, equipment, and materials necessary to construct the fence, with gates, braces etc.

315.4.04 Fence Removal

Measurement and payment shall be per lineal foot, for fence removed.

316 SLOPE PROTECTION

316.1.00 DESCRIPTION

This section covers work necessary for slope paving or riprap as slope protection.

Slope paving shall consist of precast cement blocks, poured Portland Cement concrete, pneumatically placed Portland cement concrete, and asphalt concrete paving, constructed on prepared slopes.

Riprap shall consist of broken stone, wire enclosed stone (gabions), grouted stone, or sacked concrete, constructed on prepared slopes or filter blanket or other places.

316.2.00 MATERIALS

316.2.01 Paving Blocks

Precast cement concrete blocks must conform to ASTM C 90 for hollow block and C 145 for solid block, Grade N II. Blocks may be manufactured with integral spacer devices that will provide required 1/2-inch mortar joint.

316.2.02 Wire Mesh

Wire mesh shall conform to ASTM A 185 and ASTM A 82.

316.2.03 Asphaltic Materials

Asphaltic materials shall conform to requirements of Section 310 ASPHALTIC CONCRETE.

316.2.04 Broken Stone

Loose riprap shall consist of stone that is hard, durable, angular in shape, resistant to weathering and meets gradation requirements for class specified. Neither breadth nor thickness of a single stone shall be less than one-third its length. Rounded stone or boulders will not be accepted unless authorized. Broken concrete may be substituted for stone if approved by Engineer. Shale or stone with shale seams is not acceptable.

The stone shall conform to the following requirements:

Percent Absorption (AASHTO T 85)	6 Max.
Degradation Passing No. 20 Sieve	35%
Sediment Height	8-in. Max.
Soundness (AASHTO T 104)	
Average Loss for 2-1/2" - 1-1/2" and 1-1/2" - 3/4" Fraction	16%

Riprap shall be free from overburden, spoil, shale and organic material.

Grading of loose riprap by class and size of stone shall to be specified by the Engineer, or if specified by class, shall conform to the following:

Class	Class	Class	Class	Class	Percent by weight
50	100	200	700	2000	
(Size of stone (lb.))					
50-30	100-60	200-140	700-500	2000-1400	20
30-15	60-25	140-80	500-200	1400-700	30
15-2	25-2	80-8	200-20	700-40	40
2-0	2-0	8-0	20-0	40-0	10

Each load of riprap will be graded reasonably well from smallest to maximum size specified.

Control of gradation will be by visual inspection as herein set forth. Contractor shall provide, at a location satisfactory to Engineer and in close proximity to project, a mass of rock sample of at least 5 tons meeting gradation for class specified. This sample will be used as a frequent reference for judging gradation of riprap supplied. Any difference of opinion between Engineer and Contractor will be resolved by dumping, checking and estimating the gradation of two random truck loads of stone. Contractor shall provide mechanical equipment, a sorting site and labor needed to assist in checking gradation at no additional expense to Owner.

316.2.05 Filter Blanket

A filter blanket will consist of one or more layers of gravel or rock of thickness and gradation designated. All material comprising filter blanket must be composed of tough,

durable particles, reasonably free from thin, flat and elongated pieces, and containing no organic matter or soft friable particles in quantities in excess of those approved.

316.2.06 Gabions

316.2.06A Stone

Stone shall meet requirements of Section 316.2.04 - BROKEN STONE and be open graded 2" to 10".

316.2.06B Enclosures

Enclosures shall comply with O.D.O.T. Section 2340, ROCK GABION BASKETS.

316.2.07 Sacked Concrete

Portland cement concrete shall be provided in loosely woven burlap sacks of roughly 19.5 by 26 inch dimensions. Slump of cement concrete shall be between 3 and 5 inches. Concrete shall have a minimum 28 day compressive strength of 2,200 psi.

316.2.08 Geotextiles

Geotextiles and filter fabrics shall comply with Section 308, GEOTEXTILES.

316.2.09 Portland Cement Concrete

Portland Cement concrete shall comply with Section 311, PORTLAND CEMENT CONCRETE AND CONCRETE STRUCTURES.

316.2.10 Mortar (Grout)

316.2.10A Portland Cement

Portland Cement shall comply with Subsection 311.2.01 PORTLAND CEMENT.

316.2.10B Water

Water for mixing mortar shall comply with Subsection 311.2.03, WATER.

316.2.10C Sand

Sharp, clean sand containing not less than 3 nor more than 6 percent moisture by weight shall be used.

316.2.10D Proportioning and Mixing

Proportion of sand to Portland Cement shall be 3 to 1 by volume. Sand and cement shall

be thoroughly mixed before water is added. Water content will be maintained at a minimum for proper placement and shall not exceed 6 gallons per sack of Portland Cement unless authorized by Engineer.

316.3.00 CONSTRUCTION

316.3.01 Slope Preparation

Slopes to be protected will be free of brush, trees, stumps, and other organic material and dressed to a smooth surface. All soft or spongy material will be removed to a depth shown or as directed, replaced with approved material and compacted to density as specified. A toe trench will be dug when and as shown, and maintained until riprap is placed.

Protection for structural foundations will be provided as early as the foundation construction permits. Area to be protected will be cleaned of waste materials and surface prepared to be protected as shown.

Contractor shall shape slopes to allow full thickness of specified riprap and any bedding or filter gravel. Slopes will not be steeper than natural angle of repose of slope as shown or directed. Wherever possible, excavation will be to undisturbed material, or where this is not possible, underlying material will be compacted to at least 90 percent of maximum density at optimum moisture content, as determined by AASHTO T 99.

316.3.02 Paving Blocks

Specified paving blocks will be placed in a uniform plane and in such a manner that they rest firmly and evenly against slope with no rocking. Blocks will be placed in horizontal parallel courses and joints in successive courses shall be offset or overlapped one-half of the paving block width to form a running bond. Joints between blocks will be grouted to provide neat appearing, dense and impervious joints. Grout shall comply with Subsection 316.2.10 MORTAR (Grout).

Mortar shall be mixed only in such quantities as are required for immediate use and no mortar shall be used which has developed initial set. Mortar which has partially hardened shall not be remixed or retempered.

316.3.03 Poured Portland Cement Concrete

Contractor shall place 2,500 psi Portland Cement Concrete upon slope in such a manner as to form a compact, dense and impervious concrete with a uniform plane surface. Thickness shall be four inches, unless otherwise shown or specified.

Wire mesh will be lapped a minimum of one mesh spacing. Laps will be securely fastened at ends. During placement of concrete, wire mesh reinforcement will be placed and held so as to provide a minimum of 1-1/2 inches of cover.

Where required, the concrete will be applied and cured in conformance with requirements contained in Section 311, PORTLAND CEMENT CONCRETE AND CONCRETE STRUCTURES.

316.3.04 Pumped Portland Cement Concrete

Pumped Portland cement concrete shall conform to the requirements of Subsection 311.3.10c, PUMPING.

316.3.05 Asphalt Concrete Slope Paving

A prime coat as specified in Section 310.2.10, PRIME COAT will be applied to the prepared slope surface before paving with asphalt mix. Contractor shall deposit and compact asphalt concrete mix on slope in such a manner so as to form a compact, dense and impervious asphalt pavement with a uniform plane surface. Total thickness shall be four inches, compacted in two layers. After each lift of the asphalt bituminous mixture has been spread, struck off, and surface irregularities and other defects remedied, it shall be thoroughly and uniformly compacted to a minimum of 90 percent of relative maximum density, as determined by AASHTO T 230. Maximum density shall be determined by AASHTO T 245 or AASHTO T 246.

If specified, wire mesh will be placed between two layers of asphalt concrete.

A tack coat will be applied between each lift as specified in Subsection 309.2.08 TACK COAT.

If specified, an asphalt seal coat will be applied to compacted finished surface of the asphalt concrete pavement.

316.3.06 Broken Stone Riprap

Broken stone riprap will be placed on the prepared area in a manner which will produce a reasonably well-graded uniform mass of stone. Full course thickness shall be placed in one operation in such a manner as to avoid displacing underlying material.

Contractor shall distribute larger stones well and conform entire mass of stone approximately to gradation specified. All material going into riprap protection will be placed and distributed so that there will be no large accumulations of either larger or small sizes of stone.

All sizes of riprap will be placed in proper proportions to produce a fairly compact stone protection. Hand placing or rearranging of individual stones by mechanical equipment may be required to the extent necessary to secure results specified.

Unless otherwise approved, riprap in conjunction with construction of embankment will

be placed with only sufficient lag in construction of stone protection as may be necessary to allow for proper construction of the portion of embankment protected and to prevent mixture of embankment and stone. Broken stone slope protection will be maintained until accepted and any material displaced by any cause will be replaced at no additional expense to Owner.

Where riprap and filter material are placed under water, thickness shall be increased as shown on the Standard Plans or as directed, and methods used that will minimize segregation and insure that minimum required thickness of well-graded material will be obtained in both stone and filter.

316.3.07 Grouted Stone Riprap

Stones shall be placed on the prepared slope substantially to dimensions shown. Stones will be thoroughly moistened and any excess of fines sluiced to underside of riprap before grouting.

Grout shall comply with Section 316.2.10 Mortar (Grout) when delivered to the place of final deposit by any means that will insure uniformity and prevent segregation of the grout. Grout will be spaded or rodded into interstices to completely fill voids in the riprap. During pressure grouting, stones shall not be unseated. Grout will penetrate to depth shown on Plans. When rough surface is specified, stone will be brushed until from 1/4 to 1/2 of depth of surface stone is exposed. For a smooth surface, interstices will be filled with grout to within a half inch of the surface.

Grout application shall comply with that shown in Subsection 316.3.02 PAVING BLOCKS.

Weepholes will be provided through riprap if shown or directed. Where depth specified for grouting is in excess of 12 inches, riprap will be placed in lifts of 12 inches or less and each lift grouted prior to placing next lift. Contractor shall construct and grout succeeding lifts before grout in previous lift has hardened.

Weather limitations to application shall comply with Section 311.3.09 WEATHER LIMITATIONS.

316.3.08 Filter Blanket

When specified, a filter blanket will be placed on prepared area to full thickness of each layer in one operation, using methods which will not cause segregation of particle sizes within the layer. Surface of finished layer will be reasonably even and free from mounds or irregularities.

Additional layers of filter material, when required, will be placed in same manner, using methods which will not cause mixture of material in different layers.

316.3.09 Gabions

Gabions shall be installed according to O.D.O.T. Section 00395.43 ROCK GABIONS, or as approved by the Engineer.

316.3.10 Sacked Concrete

Contractor shall use approved burlap sacks as herein specified and fill with concrete, allowing only enough space in sack for folding at top. Bags will be placed on prepared slope as soon after mixing as possible. Bags will be placed by staggering joints of each successive tier. The Contractor shall place bags as shown or as directed. Contractor shall comply with weather limitations as specified in section 311.3.09 WEATHER LIMITATIONS.

316.3.11 Finishing Slope Paving

Newly constructed cement concrete surfaces will be finished by means of wood float and scored as shown. The Contractor shall roll or compact newly constructed asphalt surfaces to a smooth surface free from irregularities. Finished surface of both cement concrete and asphalt surfaces must not vary more than 0.03 foot from planned grades, dimensions or elevations at any point. Contractor shall comply with weather limitations as specified in section 311.3.09 WEATHER LIMITATIONS.

316.3.12 Riprap Finishing

The Contractor shall install riprap so surfaces present a reasonably neat and regular appearance and generally conform to within 0.2 foot of planned grades, dimensions or elevations, as approved.

316.3.13 Geotextiles

Contractor shall comply with SECTION 308, GEOTEXTILES.

316.4.00 MEASUREMENT AND PAYMENT

316.4.01 Measurement by Square or Cubic Yard

Measurement of quantities of slope protection to be paid for on a square yard basis or a cubic yard basis will be determined from dimensions shown or limits established by Engineer for type of slope protection placed and accepted. Slope protection placed outside of these dimensions or limits will be considered to have been constructed for Contractor's convenience and no payment will be made therefor. Measurements shall be made along the surface, either horizontal, or slope. Measurement and payment of geotextiles shall be made according to Subsections 308.06.00, Measurement, and 308.07.00, Payment.

316.4.02 Measurement by Ton

316.4.02A Asphalt Concrete, Stone

Measurement will be based on number of tons of slope protection material.

Measurements shall be made according to Section 109 MEASUREMENT AND PAYMENT.

316.4.03 Payment on Lump Sum Basis

When shown in the Proposal, payment will be made on a lump sum basis and this payment will include full compensation for all work and materials necessary for the slope protection within limits shown and as specified.

Payment will be made for any or all of the following items as are listed as pay items in Proposal for any particular contract. Some payment items may be considered incidental to work performed.

<u>Payment Item</u>	<u>Unit of Measure</u>
Preparation of Slopes	per S.Y.
Paving Block Slope	per S.Y.
Poured Cement Concrete Slope Paving	per S.Y.
Pumped Cement Concrete Slope Paving	per S.Y.
Asphalt Concrete Slope Paving (with or without wire mesh specified)	per S.Y. or Ton
Asphalt Prime Coat	per S.Y. or Incidental
Asphalt Seal Coat	per S.Y. or Incidental
Broken Stone Riprap (class of stone specified)	per S.Y. C.Y. or Ton
Grouted Stone Riprap (class of stone per S.Y. specified)	C.Y. or Ton
Filter Blanket (gradation specified)	per C.Y. or Ton
Gabions	per C.Y.
Sacked Concrete	per C.Y.
Geotextiles	per S.Y.

317 PERMANENT TRAFFIC CONTROL

317.1.00 DESCRIPTION

This section covers the work necessary to furnish and install permanent traffic control of vehicular and pedestrian traffic other than traffic signals which are addressed in Section 501 TRAFFIC SIGNALS and work necessary to fabricate and erect metal beam guard rails, street barricades, and guide posts.

317.2.00 MATERIALS

317.2.01 General

All materials and installations, unless otherwise specified, shall be in conformance with the most recent version of the Manual On Uniform Traffic Control Devices (MUTCD), published by the U.S. Department of Transportation and the State of Oregon Supplements.

317.2.02 Roadside Signs

317.2.02A Sign Panels

Aluminum - The aluminum materials shall conform to the following requirements:

Extruded Aluminum Shapes.....	ASTM B 221
Rolled or Extruded Structural Shape..	ASTM B 308
Aluminum sheet.....	ASTM B 209

Aluminum to be color coated, shall be of an alloy which is compatible with the coating applied and with the application process. The color coated aluminum shall have a temper which, after coating and aging, provides an ultimate strength of 30,000 psi and a yield strength of 25,000 psi.

Fabricate sheet aluminum signs from alloy 6061-T6, 5052-H38, 5154-H38, or approved equal, and give a chromate treatment conforming to ASTM B 449, Class 2. Signs shall be of the thickness shown as follows:

Sign Width (Horizontal Measure)	Sheet Aluminum	Thickness
Less than 20".....	0.063"	
20" through 30".....	0.080"	
31" through 48".....	0.100"	
over 48".....	0.125"	

Sheet Aluminum - Sheet aluminum for sign fabrication shall be cut to size and shape as specified. The sign panel shall be free of buckles, warps, dents, cockles, burrs and defects resulting from fabrication.

Before application of reflective or nonreflective sheeting, treat the entire surface of the sign with a conversion film according to the recommendations of the manufacturer of the sheeting.

Mounting holes - Signs having a vertical dimension of less than 48 inches and mounted on wood or metal posts shall have at least two mounting holes and signs having a vertical dimension of 48 inches or greater shall have three mounting holes. Fabricate the third mounting hole near the center of the sign. Locate mounting holes so the mounting hardware will not cover any portion of the legend.

Use of reinforced sheet aluminum signs will not be permitted.

Reflective Sheeting

General - The reflective sheeting shall conform to AASHTO M 268, Type II and meet or exceed 3M Brand(TM) material. It shall consist of spherical lens elements embedded within a transparent plastic having a smooth, flat outer surface. The material shall provide weather resistant sheeting with a protected pre-coated adhesive backing.

Photometrics - The reflective sheeting shall have the following minimum coefficient of retro-reflection values at 0.2°, 0.5°, and 2.0° observation angle expressed as average candela lux per meter squared. Measure according to Federal Test Method Standard 370. The coefficient of retro-reflection of the reflective sheeting, totally wet by rain, shall not be less than 90% of the values found in Sheeting Table 02910-2 "MINIMUM COEFFICIENT OF RETRO-REFLECTION VALUES OF REFLECTIVE SHEETING" on page 842 of the Standard Specifications For Highway Construction, Oregon Department of Transportation State Highway Division, 1991 version or most recent.

Film

General - The reflective sheeting shall be sufficiently flexible to be easily cut to shape. Conditioned for 48 hours, the tensile strength of the sheeting shall be 5 to 20 lb./in. width when tested according to ASTM D 828. Following liner removal, a 9" square of the reflective sheeting shall not shrink in any dimension more than 1/32" in 10 minutes nor more than 1/8" in 24 hours at 75° and 50% relative humidity.

The sheeting, when applied according to manufacturer's recommendations to cleaned and etched 0.020" x 2" x 8" aluminum, conditioned (24 hours), and tested at 72°F and 50% relative humidity, shall be sufficiently flexible to show no cracking when bent around a 3/4" mandrel.

If required for application, the sheeting may be pre-perforated with holes not greater than 0.02" in diameter. The perforations are to be approximately 0.4" apart in rows which are approximately 1.5" apart.

Surface - The sheeting shall be smooth and flat, facilitate cleaning and wet performance, and exhibit 85° glossmeter rating of not less than 40 (ASTM D 523). The sheeting surface shall be readily processed and compatible with recommended transparent and opaque process colors and show no loss of the color coat with normal handling, cutting and application.

The sheeting shall permit cutting and color processing at temperatures of 60°F to 100°F and relative humidities of 20% to 80%. The sheeting shall be heat resistant and permit force curing without staining of unapplied sheeting at temperatures up to 150°F and up to 200° on applied sheeting. Clean the sign face according to the manufacturer's recommendation. The process colors and adhesive shall show no damage when sign face cleaning is done according to current industry standards.

The sheeting and the adhesive used shall be compatible with nonreflective permanent cut-out legend.

Lens Elements - The reflective sheeting shall contain stable and durable spherical lens elements.

Durability - Process and apply according to the manufacturers recommendations. The reflective material shall be weather resistant, with no discoloration, cracking, crazing, blistering or dimensional change.

Not less than 80% of the specified minimum coefficient of retro-reflection values when exposed to 1,200 hours accelerated weathering according to ASTM G 26 (Method 1, standard cam, 50-60% relative humidity, 145°F black- panel temperature).

The sheeting surface shall be capable of being readily refurbished by cleaning and clear over-coating according to manufacturer's recommendations.

Acceptance - If requested by the Engineer, furnish a quality compliance certification that all reflective sheeting meets the above requirements.

Legend

General - The reflective sheeting shall conform to AASHTO M 268, Type III and meet or exceed 3M Brand (TM) material. It shall be silver-white and consist of spherical lens elements adhered to a synthetic resin and encapsulated by a flexible transparent plastic having a smooth outer surface. The sheeting shall have an adhesive coated back.

Acceptance Sampling and Testing - If required submit sample letters of each size of legend used on the project to the Engineer for test purposes. The number of samples submitted shall equal 5 percent of the letters of each size with a minimum of 2 letters of each size of legend submitted. Submit 2 samples of each size border material used on the project. The letters submitted shall be letters used on the signs for the project.

If requested by the Engineer, the Contractor shall substitute sample letters for actual letters used on the project signs and the Engineer will test the letters removed from the signs according to 2910.30 (c) Photometrics and (e) Durability of the State Specifications. Failure of one letter of border sample will result in the rejection of the sign. If additional testing is required, the Engineer will specify the letters to be tested from each sign. All testing will be at the Contractor's expense.

Photometric - The reflective sheeting shall have the following minimum coefficient of retro-reflection values at 0.2°, 0.5°, and 2.0° observation angles expressed as average candela per lux meter squared.

317.2.02B Sign Posts

Sign Posts shall be supplied by the contractor and shall be 2" pre-drilled galvanized steel pipe schedule 40 manufactured in accordance with ASTM A 120 and AWWA C 800 unless otherwise specified.

317.2.02C Sign Bases

Sign bases shall be supplied by the City to the Contractor. The Contractor shall give the City five (5) working days notice prior to picking up sign bases from the City Maintenance Facility.

317.2.03 Raised Pavement Markers

317.2.03A General

Type I ReflectORIZED Raised Pavement Marker - Provide reflectORIZED markers with one or two reflective faces as required to reflect incident light from the specified directions.

Type II Non reflectORIZED Raised Pavement Marker - Non reflectORIZED markers shall be polyester binder 4-inch diameter.

All pavement markers shall be approved by the Engineer.

317.2.03B Non-Reflective Pavement Markers

Type II non-reflective pavement markers shall consist of a dense material capable of withstanding sustained roadway traffic. The bottoms of the ceramic markers shall be free from gloss or glaze and shall have a number of integrally formed protrusions (between

50-200) approximately 0.050-inch projecting from the surface in a uniform pattern of parallel rows. Each protrusion shall have a face parallel to the bottom of the marker. The area of each parallel face shall be between 0.01 and 0.065 square inches and the combined area of these faces shall be between 2.2 and 4 square inches. The protrusions shall be circular in section.

Non-reflective pavement markers shall conform to the following finish:

Finish. The top surface of the marker shall be convex and the radius of curvature shall be between 3-1/2 inches and 6 inches, except that the radius of the 1/2-inch nearest the edge may be less. Any change in curvature shall be gradual.

The top and sides shall be smooth and free of mold marks, pits, indentations, air bubbles, or other objectionable marks or discolorations.

317.2.03C Reflective Raised Pavement Markers

Reflective raised pavement markers used shall be of the corner cube retro-reflective type consisting of methyl methacrylate or suitably compounded acrylonitrile butadiene styrene (ABS) and shall be filled with a mixture of an inert thermosetting compound and filler material. The exterior surface of the shell shall be smooth and contain one or two methyl methacrylate prismatic reflector faces of the color specified.

The reflective lens shall not contain any voids or air space and the back of the lens shall be metalized.

The shell shall be fabricated in a manner that will provide a mechanical interlock between the thermosetting compound and the shell. The thermosetting compound shall bond directly to the backside of the metalized lens surface.

The base of the marker shall be flat (the deviation from a flat surface shall not exceed 0.05-inch), rough textured and free from gloss or substances which may reduce its bond to the adhesive.

Reflective pavement markers shall conform to the following color and testing requirements:

Color: The color of the reflectors when illuminated by an automobile, headlight shall be an approved clear, white, yellow, blue or red color as designated. Off-color reflection shall constitute grounds for rejection.

<u>Reflectance</u>	<u>Specific Intensity</u>				
		White	Yellow	Red	Blue
0° Entrance Angle, min.	3.0	1.5	0.75	0.75	0.75
20° Entrance Angle, min.	1.2	0.60	0.30	0.30	0.30
Strength	2,000 lbs. min.				
Water Soak Resistance	No delamination of the marker nor loss of reflectance.				

317.2.03D Adhesive

The adhesive used to affix traffic markers to the paved surface shall be of a type recommended by the manufacturer of the raised markers and shall be approved by the Engineer.

317.2.03E Sampling and Testing

Raised Markers - If requested by the Engineer, a sample of 5% of each lot or shipment, up to a maximum sample of 20 markers, shall be submitted for testing. If not more than 5% of the sample markers tested fail to pass all tests, the lot will be accepted. If more than 5% but not more than 10% fail to meet all tests, the lot will be re-sampled if requested by the Contractor. Of the re-sample specimens, 100% must meet all requirements. If more than 10% of the original samples fail to pass all tests, the lot or shipment will be rejected.

A supplier may qualify the markers for this project by certifying that the type of markers they propose to use on this project conform to these special provisions and have been tested and qualified by the Oregon Department of Transportation.

Adhesive - A sample of one quart of the approved adhesive shall be submitted for testing if requested by the Engineer.

STRENGTH REQUIREMENTS AND TESTING OF RAISED MARKERS

Method of Test - If requested by the Engineer the Contractor shall submit three specimens of any type of marker for testing as outlined in Section 02840.60 of the 1991 O.D.O.T. Standard Specification for Highway Construction.

317.2.04 Plastic Pavement Markings

317.2.04A General

The preformed markings shall consist of white or yellow films with pigments selected and blended to conform to standard highway colors through the expected life of the film.

Plastic pavement markings shall meet or exceed the quality and testing standards of 3M Brand (TM) markings product #5730 or #420. All plastic pavement markings shall be approved by the Engineer before in-field application.

The films shall have reflective glass spheres distributed throughout the base films and/or bonded to the top surface. The size quality or refractive index of the glass beads shall be such that the performance requirements for the markings shall be met. The bead adhesion shall be such that beads are not easily removed when the material surface is scratched with a thumbnail.

The film shall have glass bead retention qualities such that when a 2" x 6" sample is bent over a 1/2" diameter mandrel, with the 2" dimension perpendicular to the mandrel axis, microscopic examination of the area on the mandrel shall show no more than 105 of the beads with entrapment by the binder of less than 40%.

The preformed markings shall be capable of being adhered to asphalt concrete or Portland cement concrete by a liquid contact cement. The preformed marking film shall mold itself to pavement contours by action of traffic at normal pavement temperatures. After application, the markings shall be immediately ready for traffic.

317.2.04B Composition

The retro-reflective pliant polymer pavement marking film shall consist of a mixture of high quality polymeric materials, pigments, and glass beads distributed throughout its base cross-sectional area, with a reflective layer of beads bonded to the top surface. The film shall be composed of the following materials:

<u>Component</u>	<u>Min. Percent By Weight</u>
Resins and Plasticizers	20
Pigments and Extenders	30
Graded Glass Beads	33

The remaining percentage shall be comprised of the above materials in various proportions.

This film shall be capable of being fabricated into pavement markings of specified

dimensions and of being adhered to asphalt or Portland cement concrete by a liquid contact cement which is applied at the time of installation. The liquid contact cements shall meet or exceed 3M Brand (TM) Stamark E-44. The surface of the retro-reflective pliant polymer film shall provide an initial minimum skid resistance value of 50 BPN when tested according to ASTM E 303-74.

317.2.04C Reflectance

The white and yellow films shall have the following initial minimum reflectance values at 0.2 degrees and 0.5 degrees observation angles and 86.0 degrees entrance angle as measured in accordance with the testing procedures of ASTM D 4061. The photometric quantity to be measured shall be specific luminance (SL), and shall be expressed as millicandelas per square foot per footcandle. The metric equivalent shall be expressed as millicandelas per square meter per lux. The test distance shall be 50 ft. (15 m) and the sample size shall be a 2.0 x 2.5 ft. rectangle (0.61 x 0.76 m).

The angular aperture of both the photoreceptor and light projector shall be 6 minutes of arc. The reference center shall be the geometric center of the sample, and the reference axis shall be taken perpendicular to the test sample.

317.2.04D Applicability to Pavement Surfaces

Plastic pavement markings shall be installed as recommended by the manufacturers specifications and as approved by the Engineer. Markings shall be applied to freshly paved in-layed surfaces within four (4) hours of the final pavement lift and thoroughly rolled, without vibration, into the pavement.

317.2.04E Tensile Strength

The film shall have a minimum tensile strength of 40 pounds per square inch of cross-section when tested according to ASTM D 638-76. Elongation shall be no less than 75% using a sample 6" x 1"x 0.06", and shall be tested at a temperature between 70 degrees F. and 80 degrees F. using a jaw speed of 10 to 12 inches per minute.

317.2.04F Thickness

Material thickness shall correspond to the manufacturers standards or as specified in the Special Provisions.

317.2.04G Effective Performance Life

The film, when applied according to the recommendations of the manufacturers, shall provide a neat, durable marking that will not flow or distort due to temperature if the pavement surface remains stable. Although reflectivity is reduced by wear, the pliant polymer shall provide a cushioned, resilient substrate that reduces bead crushing and loss. The film shall be weather resistant and, through normal traffic wear, shall show no

significant tearing, roll back, or other signs of poor adhesion.

317.2.05 Pavement Paint Striping and Markings

All paints used for the striping of pavements or for the markings of symbols and/or legends shall conform to all applicable requirement of 'Standard Specifications for Highway Paint White Bead Binder', and 'Standard Specifications for Highway Paint Yellow Bead Binder', O.D.O.T. Oregon State Highway Division (1991 edition).

317.2.06 Glass Beads

The glass spheres shall lend themselves readily to firm embedment in the traffic paint when dropped on a freshly placed paint line. The embedment shall be of such character as to provide a highly reflectorized surface on the paint with reserve reflectorizing capacity in the lower sections of the paint film. The reflection shall be effectively manifest to the operator of a motor vehicle when the headlights of the vehicle are played on the marking. A minimum 90% of the spheres by count shall be colorless, true spheres, and shall be free of dark spots, milkiness, air inclusions and surface scratches which involves a substantial part of any individual sphere.

The glass spheres shall conform to within 5% of the following diameter size:

- 100% shall be less than .028 in.
- 100% - 95% shall be less than .023 in.
- 40% - 70% shall be less than .0165 in.
- 10% - 35% shall be less than .0117 in.
- 5% - 15% shall be less than .0083 in.
- 0% - 5% shall be less than .0059 in.
- 100% - shall be greater than .0029 in.

317.2.07 Metal Beam Guardrail

317.2.07A Metal Beam Rail

The metal beam rail and end sections shall be formed from galvanized steel. Galvanized sheet shall conform to AASHTO M 180, for Class A rail. Zinc coating shall conform to Type 2, AASHTO M 180, applied after fabrication, and subject to the single spot test. Backup plates will be accepted with ungalvanized edges and bolt holes, provided that these exposed surfaces are field-coated with an approved galvanizing substitute.

317.2.07B Guardrail Posts (Wood)

Wood posts for guardrail or barricades shall be sawed, square, S4S, manufactured from Douglas Fir (coast type), West Coast Hemlock, White Fir, or Pine, which meets the grade set forth in the Provisions. The posts will meet all the requirements of O.D.O.T. 1991 Standard Specifications for Highway Construction, Subsection 2110.10 except preservative treatment shall be of pentachlorophenol and shall be of the dimensions shown on the Plans.

317.2.07C Guardrail Hardware

Contractor shall provide steel bolts, nuts, washers and other fittings which are interchangeable with similar parts and galvanized to conform to ASTM A 153. Galvanized hardware used with aluminum alloy rail members shall be insulated from physical contact with aluminum in a manner approved by Engineer.

317.2.07D Street Barricades

Permanent street barricades shall be constructed as "Metal Beam Guardrail" as shown in Standard Drawing 5-19.

317.2.08 Guide Posts

The term guide post shall refer to a complete unit consisting of support post member, target panel, and one or more reflectors or reflective tape mounted on the target. The details as to color, et cetera, shall be as indicated by the applicable pay item set forth in the Bid Schedule. All materials used shall meet the requirements of City of Springfield Standard Drawing 5-23.

317.3.00 CONSTRUCTION

317.3.01 Roadside Signs

Roadside signs shall be installed at the locations shown on the plans or as directed by the Engineer. Sign installations shall be as shown on Standard Drawing 5-17 or as specified in the Contract Plans and Provisions.

Sign details not shown shall be understood to conform with the MUTCD and Oregon Supplements (current edition).

Sign panels shall be affixed to posts or standards as shown or directed. Not less than two (2) 5/16" diameter zinc plated bolts and nuts will be used to affix the sign panel. Flat, zinc plated washers shall be used at each end of the bolt. When recommended by the manufacturer, use approved lubricant on metal washers to prevent sign sheeting deformation.

Portland Cement Concrete with a minimum compressive strength of 3,000 psi shall be used for all roadside sign bases.

Reflective and non reflective sheeting shall be applied according to the recommendations of the manufacturer on extruded aluminum sign panels. Only one manufacturer's splice will be permitted per sign. No contractor splices will be allowed.

Legend Installation - The word "legend" shall mean the entire message and border for a sign. A group of words, numbers, and/or symbols constitutes the "message" for a sign. Install the type of legend for each traffic sign as shown and according to Sub-Section 317.2.02A Sign Panels.

Space between letters and/or numbers shall be according to the "Standard Alphabets for Highway Signs" manual (1991 edition). Spacing between words for Series "E" (modified) legend shall be 1-1/2" times the upper case letter height. Spacing between words for other fonts shall be as tabulated below unless otherwise shown:

Legend Series Word Spacing

B.....	(0.531)H
C.....	(0.625)H
D.....	(0.835)H
E.....	(1.000)H

The value "H" is the height of the upper case letter.

The space between symbols and vertical/horizontal layout shall be according to the "Standard Highway Signs" manual unless otherwise shown.

Border Sizes - Unless otherwise shown, the width of the sign borders shall be according to the following:

Maximum Letter Size	Border Width
5" Capital or Upper Case	1/2"
8" or 10-2/3" Upper Case	1"
10" or 12" Upper Case	1"
13-1/3" or 16 Upper Case	2"
15" or 16" Upper Case	2"

The corner radii shall be approximately one-eighth of the least dimension of the sign, except that such radii shall not exceed 12 inches on any sign. Do not round the corners of the aluminum panels.

If sign installation is a replacement for and existing sign, install the new sign immediately after removal of the existing sign unless otherwise directed.

317.3.02 Raised Pavement Markers

317.3.02A General

Raised pavement markers conforming to the requirements of Sub-section 317.2.03 Raised Pavement Markers shall be furnished and placed at the locations shown on the Plans or where directed by the Engineer.

317.3.02B Placement

Unless stated otherwise, markers shall be cemented to the pavement with rapid set adhesive conforming to the requirements of Subsection 317.2.03D ADHESIVE.

Horizontal and vertical alignment shall be within four (4) inches of the dimensions shown on the plans and as detailed in Standard Drawing 5-21 (Striping Detail). Questions on the plans should be discussed with the Engineer prior to installation. Any changes need to be authorized by the Engineer prior to placement.

Raised pavement markers shall be protected from all traffic for at least three (3) hours after installation when the average ambient temperature is 55 degrees F. or above, at least 24 hours when said temperature is between 40 degrees F. and 55 degrees F., and at least 48 hours when said temperature is 40 degrees F. or below.

The marker shall be protected against impact until the adhesive has hardened to the degree sufficient to bear traffic.

Regardless of the type of adhesive used, no markers shall be placed when either the pavement or the air temperature is 32 degrees F. or less. No markers shall be placed if the relative humidity of the air is greater than 80 percent or if the pavement is not surface dry.

The portion of the highway surface to which the marker is to be bonded by the adhesive shall be free of dirt, curing compound, grease, oil, moisture, loose or unsound layers, paint and any other material which would adversely affect the bond of the adhesive. The adhesive shall be placed uniformly on the cleaned pavement surface or on the bottom of the marker in a quantity sufficient to result in complete coverage of the area of contact of the marker with no voids present and with a slight excess after the marker has pressed in place. The marker shall be placed in position and pressure applied until firm contact is made with the pavement. Reflective faces of the markers shall be oriented perpendicular to the roadway centerline.

No pavement markers shall be placed over longitudinal or transverse joints of the pavement surface.

317.3.03 Plastic Pavement Markings

When markings are specified in the Contract for newly paved asphalt concrete surfaces, they shall be applied before public traffic is allowed on the freshly paved surface. Preferably, the markings should be inlaid in the fresh surface by a compaction roller during the paving operation, but in any case they shall be applied before the close of the shift on which the surface is paved.

Markings shall be applied to freshly paved surfaces within four (4) hours of the final pavement life and thoroughly rolled, without vibration, into the pavement.

Unless otherwise directed, all markings shall be applied in accordance with manufacturer's recommendations.

317.3.04 Pavement Paint Striping and Markings

317.3.04A General

This work shall consist of furnishing and installing pavement paint striping and markings as shown on the plans, and directed by the Engineer. All materials used shall conform to Subsection 317.2.05 PAVEMENT PAINT STRIPING and Markings and 317.2.06 GLASS BEADS.

The painting of freshly laid asphalt pavement should not be attempted until the surface of the new pavement has been allowed to cure for a period of 48 hours.

The pavement surface shall be allowed to dry after inclement weather.

No striping or marking shall be attempted during inclement or threatening weather.

The paint once applied shall be protected from the traffic with cones or other suitable devices until dry.

317.3.04B Striping and Markings

Prior to installing final striping, the contractor shall pre-mark all lane lines, pavement markers, pavement legends, crosswalks, and limit lines. Horizontal and vertical alignment of all Pre-marking shall be within four (4") of the dimensions shown on the plans. Paint shall be applied by either compressed air or airless spray equipment to the prescribed width and thickness of film specified, at the locations shown on the plans or as directed by the Engineer. Line striping equipment shall be capable of spraying 3 separate lines at a time at the prescribed width, and shall be of such design and operation to allow for one or more of the spray heads to apply a skip line at the prescribed ratio.

Paint film thickness for paint striping and markings shall be as follows:

Wet Paint	.001 inch
Dry Paint	.005 inch

Glass beads conforming to Subsection 317.2.06 GLASS BEADS shall then be applied using a pressurized dispenser on the fresh placed paint at the rate of 4 pounds per gallon of paint.

Pavement legends (markings) shall be applied at the same film thickness as striping with compressed air or airless spraying equipment. Templates used shall be clean and in good repair and shall provide a sharp edge to the legend when sprayed on the pavement surface. Any other spray shall be removed as quickly as possible without damage to the pavement. Glass beads shall be applied to the freshly painted legend at the rate of 4 pounds per gallon of paint. The glass beads shall be evenly spread and inspected to insure that approximately the upper third of the beads are epoxyed and free of paint.

317.3.05 Guardrail, Guide Posts, Barricades

317.3.05A Guardrail

Contractor shall excavate to lines and grades established by the Engineer and to the depths shown on Standard Drawings 5-20 (Guardrail) and 5-19 (Barricades). Pavement cuts shall be made by mechanical means such as sawing, knife edge cutters or rotary drills, saw cutting or as approved by the engineer. Cuts below the pavement shall be made by any means that will prevent undue disturbance of abutting areas. Any area unnecessarily damaged or contaminated shall be removed and replaced at no cost to Owner.

Areas to be backfilled shall be free of water or deleterious material which would impair stability of backfill.

Areas occupied by aggregates, bituminous material and pavements shall be backfilled with like materials placed to same thickness and density as adjacent materials. In other areas, backfill shall be granular material. Backfill shall be placed in layers not exceeding 6 inches and each layer compacted to a firm, dense condition.

Adjoining areas which become misshapen or disturbed during excavation and backfilling operations shall be removed, replaced, repaired or restored as directed, at Contractor's expense. Excess materials shall be disposed of in an approved manner.

Posts may be set in prior excavations or they may be driven in place, as Contractor may elect.

Posts, anchors or other components which are damaged during installation will be removed and replaced with sound components. All posts shall be firm and at proper line, grade and spacing within a tolerance of 1/2 inch.

The rails shall be hung and all bolts drawn tight, except adjustment bolts may be left loose until all the rail members have been set. Any damage to the surface finish shall be repaired with an approved standard galvanizing substitute.

Painting of the rail members when specified shall be in accordance with recognized standards for painting guardrails as outlined by the State of Oregon O.D.O.T. Highway Division Standard Specifications Subsection 606.35 00594, (1991 edition).

317.3.05B Guide Posts

The support post shall be driven or set firmly in the ground to the height specified and as shown on the Standard Drawing 5-21 (Guide Posts). Any post which becomes damaged during this operation shall be replaced with an undamaged post.

Target members and reflectors of the type and color specified shall be assembled, fastened, and aligned as called for on the Plans and/or as directed by Engineer.

317.4.00 MEASUREMENT AND PAYMENT

317.4.01 Roadside Signs

Roadside signs may be measured and paid as a lump sum item or as a cost per each for the type of sign specified. In either case the measurement and payment shall include and be full compensation for all materials, labor, tools and equipment involved in furnishing and installing the roadside signs as specified on the Plans or as directed by Engineer.

317.4.02 Raised Pavement Markers

Reflective and non-reflective pavement markers shall be measured by the actual count of each items shown in the Contract Proposal, installed and accepted by Engineer.

317.4.03 Plastic Pavement Markings

Plastic stripe and plastic markings will be measured by the linear foot for the actual length covered or by Each as listed in the Contract Proposal.

317.4.04 Painted Stripes and Markings (Legends)

Painted stripes will be measured by the linear foot for the actual length covered.

317.4.05 Guardrail

Measurement and payment for street guardrail will be made on a linear foot basis. Measurement will be between post centerlines along top of guardrail. End pieces and anchors shall be per piece.

317.4.06 Guideposts

Measurement and payment for guide posts shall be per each post installed complete and to the satisfaction of the Engineer.