

City of West Linn

Public Works Standard Construction Specifications

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DIVISION FIVE – STREET TECHNICAL REQUIREMENTS

501 SUBGRADE

501.01 DESCRIPTION

- A. This section covers work necessary for preparation of the subgrade, complete. See also **Section 203, CLEARING AND GRUBBING**, and **Section 204, EXCAVATION, EMBANKMENT, BEDDING, AND BACKFILL**.
- B. Subgrade is defined as the area of new or existing roads, streets, alleys, driveways, sidewalks, or locations upon which additional materials are to be placed as a part of work covered in other Sections or by future work. Where applicable, subgrade may be considered to extend over the full width of the specified base course.

501.01.01 Untreated Subgrade

The material placed in fills or unmoved from cuts in the normal grading of the roadbed and which is brought to true line and grade, shaped and compacted as required by these specifications to provide a foundation for the pavement structure.

501.02 MATERIALS

501.02.01 Water

Conform to the requirements in *Subsection 205.02.11, Water*.

501.03 CONSTRUCTION

501.03.01 Preparation

- A. In advance of setting line and grade, complete clearing and grubbing as specified in **Section 203, CLEARING AND GRUBBING** of these specifications. Drain all depressions or ruts which contain water. Blade and shape subgrade to remove irregularities and secure a uniform surface.
- B. Subgrade upon which pavement, sidewalk, curb and gutter, driveways, or other structures are to be directly placed shall not vary more than 0.5 in. from the specified grade and cross section. Subgrade upon which subbase or base material is to be placed shall not vary more than 0.5 in. from the specified grade and cross section at any point. Variations within the above specified tolerances shall be compensating so that the average grade and cross section specified are met.
- C. In advance of setting line and grade, the Contractor shall clear and dispose of brush, weeds, vegetation, grass and debris from the subgrade. The Contractor shall drain all depressions or ruts which contain water.
- D. Prior to starting subgrade work, including backfill, all underground work contemplated in the area of the subgrade shall be completed. This requirement includes work on the contract, work to be performed by the owner or by others.
- E. The Contractor shall remove all soft or otherwise unsuitable material as directed and replace with approved material from the excavation. The Contractor shall compact to a line 1 ft. beyond the edge of paving, curb or form.

- F. Subgrade areas which cannot be compacted to specified density, but in the judgment of the City Engineer otherwise meet the requirements herein, may be removed and aerated or stabilized with an approved soil stabilizing material, all at no additional expense to the Owner.
- G. Subgrade materials which cannot be compacted to specified density because of excess moisture shall be dried out to bring materials to the optimum moisture content. The Contractor shall aerate, drain, rehandle, or by other means at his option remove the excess moisture. Unless otherwise specified in the special conditions, all costs involved in the removal of excess moisture from the subgrade material will be considered incidental and be included in the various other items of work in the Proposal.

501.03.02 Grading of Areas Not to be Paved

When specified, areas within and adjacent to the project which are intended for lawns, planting areas, flower beds and similar uses shall be finished with 4 in. of topsoil and graded smooth as directed. Topsoil, for such finishing shall be fertile, loamy natural surface soil consisting of sands, silts, clays and organic matter and shall be free of toxic substances, weeds, roots, refuse, sticks, large rocks or lumps. Topsoil available from required excavation shall be used to the greatest extent possible in this work.

501.03.03 Overexcavation and Foundation Stabilization

When, in the opinion of the City Engineer, unsuitable material or other conditions are discovered which render the subgrade, unable to be compacted to the specified density, then the City Engineer may order the Contractor to remove and dispose of the unsuitable material and then backfill with crushed rock as specified in the applicable portions of **Section 204, EXCAVATION, EMBANKMENT, BEDDING, AND BACKFILL.**

501.03.04 Embankment Construction

- A. The Contractor shall place embankments and fills of all kinds in approximately horizontal layers of a maximum of 8 in. in thickness and compact each layer separately and thoroughly to the density specified. No fragments of rock shall be larger than 6 in. in any dimension.
- B. 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 the normal compacting equipment, the Contractor shall compact to specified density by approved methods.
- C. The Contractor shall exercise caution to ensure that embankment construction and fill does not move, endanger or overstress any structure. The Contractor shall place and compact embankments at the end of bridges prior to the time that work begins on the bridge.
- D. Embankments shall not be constructed when the embankment material, or the embankment on which it would be placed is frozen.

501.03.05 Slides and Slipouts

- A. Material outside the planned roadway or ditch slopes which is unstable and constitutes potential slides, in the opinion of the City Engineer, material which has come into the roadway, channel or ditch, and material which has slipped out of new or old embankments shall be excavated and removed. The material shall be excavated to designated lines or sloped either by benching or in such manner as directed by the City Engineer. Such material shall be used in the construction of the embankments or disposed of as directed by the City Engineer.
- B. The above provisions shall not be so construed as to relieve the Contractor of his obligation to maintain all slopes true and smooth.

501.03.06 Slopes

Excavation and embankment slopes shall be finished in conformance with the lines and grades shown on the plans.

501.03.07 Finishing and Cleanup

All roadbeds, planting areas, ditches, embankments and other areas on which earthwork is performed shall be trimmed reasonably close to established lines, grades, and cross sections and shall be finished in a thoroughly workmanlike manner. They shall be kept free, throughout the work, of debris and foreign matter of all kinds and prior to final acceptance the entire right-of-way shall be cleaned up and finished as directed.

501.03.08 Compaction and Density Requirements

- A. The density of compacted materials in place will be determined by AASHTO T-191, and the maximum density by AASHTO T-180 as specified.
- B. The Contractor shall compact all embankments, fills and backfills to a minimum density in place of 95% of maximum density.
- C. Roadbed cuts and foundations for structures to a depth of 1 ft. below established subgrade or foundation elevation shall be 3 in. maximum material and shall be compacted to a minimum density in place of 95% of maximum density.
- D. Final subgrade proof-roll in the presence of the City Engineer or his/her representative with a 10 cu. yd. truck loaded with rock is required prior to placing aggregate base.

502 WATERING

502.01 DESCRIPTION

This section covers work necessary to furnish and apply water for roadway excavations, fills, subgrades, roadbeds, backfill, subbases, bases, and surfacings, and water used for the alleviation or prevention of dust within the project limits.

502.02 MATERIALS

502.02.01 Water

Water shall be free of silts and other deleterious matter. Make all necessary arrangements and pay all costs for obtaining water. Maintain an adequate supply of water at all times to complete the required work.

502.03 CONSTRUCTION

- A. The Contractor shall make all arrangements necessary for the procurement of water and its application. Water shall be obtained only from metered hydrant on 8th Street for water truck after setting up an account with the City of West Linn Finance Department. Use of a meter and doublecheck backflow device on a hydrant on the project site shall only be allowed with the approval of the City Engineer. If allowed, The Contractor shall obtain a hydrant meter from the City Engineer for the purposes of measuring all water used on the project. Use of on-site water from a nearby hydrant will generally only be approved for flushing and filling new water lines.
- B. Water 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.
- C. Perform watering at any hour of the day and on any day of the week as necessary.

503 AGGREGATE BASES

503.01 DESCRIPTION

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

503.02 MATERIALS

Aggregates for aggregate base shall be crushed rock.

503.02.01 Aggregate

Crushed aggregate shall conform to requirements of **Section 205, TYPES AND USE OF MATERIALS** and to additional requirements contained herein.

503.02.02 Sand Equivalent

Base aggregates to be incorporated in the work shall have a sand equivalent of not less than 35 when tested in conformance with AASHTO T-176.

503.02.03 Liquid Limit and Plasticity

Base aggregate shall meet the requirements for Liquid Limit and Plasticity Index of **Subsection 205.02.12.02 Materials**.

503.02.04 Grading Requirements

- A. The base aggregates shall be uniformly graded from coarse to fine and shall conform to one or another of the following grading requirements as specified in table below.

Separated Sizes					
	2-1/2"-0	2"-0	1-1/2"-0	1"-0	3/4"-0
Sieve Size	Percentages (by weight)				
3 in.	100				
2-1/2 in.	95 – 100	100			
2 in.		95 – 100	100		
1-1/2 in.			95 – 100	100	
1-1/4 in.	55 – 75				
1 in.		55 – 75		90 – 100	100
3/4 in.			55 – 75		90 – 100
1/2 in.				55 – 75	
3/8 in.					55 – 75
*1/4 in.	30 – 45	30 – 45	35 – 50	40 – 55	40 – 60

*Of the fraction passing the 1/4 in. sieve, 40% to 60% shall pass the No. 10 sieve.

- B. For determination of sizes and grading conform to AASHTO T-27. Where 1"-0 base aggregate is approved for use, at least 70% (by weight) of the material passing the 1/4 in. sieve but retained on the No. 10 sieve shall have at least one mechanically fractured face.

503.02.05 Acceptance

- A. Materials will be subject to acceptance indicated below.
- B. Crushed aggregate will be sampled for acceptance at one or more of the following times as determined by the City Engineer:
 - 1. In its final state on the roadbed after all processing and prior to the placement of subsequent surfacing materials;
 - 2. In the stockpile after all shaping work has been completed; or,
 - 3. Immediately after crushing.

503.03 CONSTRUCTION OF SUBGRADE

503.03.01 Preparation of Subgrade

Ensure that all surfaces and materials on which subbase or base is to be constructed are firm and have been prepared as specified in the applicable portions of **Section 501, SUBGRADE**.

503.03.02 Mixing

Mix to provide a homogeneous mixture of unsegregated and uniformly dispersed materials which will compact to not less than 95% maximum density as specified in **Subsection 503.03.04, Compaction**. Add water during mixing in amount sufficient to provide optimum moisture content plus or minus two percentage points.

503.03.03 Placing

503.03.03.01 Weather Limitations

When the weather is such that satisfactory results cannot be secured, the Contractor shall suspend operations. Place no surfacing materials in snow or on a soft, muddy, or frozen subgrade. Owner will not be liable to damages or claims of any kind or description by reason of operations being suspended due to weather limitation.

503.03.03.02 Equipment

- A. Furnish equipment that will provide for efficient and continuous operations insofar as practicable.
- B. Aggregate bases shall be deposited on the roadbed at a uniform quantity per linear foot so that the Contractor will not resort to spotting, picking up, or otherwise shifting of aggregate base material. Segregation of aggregates shall be avoided and the material as spread shall be free of pockets of coarse or fine material.
- C. Spreading equipment shall have an adjustable screed or strike-off assembly and it may have a receiving, mixing, and distribution system. It may be a complete and integral unit, self-propelled and powered; a crawler-track or wheeled type tractor intimately combined with a receiving, mixing, spreading, and screeding unit attached thereto; or a heavy-duty self-propelled grader, of an approved type, equipped with at least an 8 ft. blade. Equipment shall be capable of spreading or striking off material to the designed line, grade, and transverse slope with surface texture of uniform appearance without excessive segregation or fracture of material.
- D. Spreading equipment may be provided with an automatic control system if Contractor so elects or if specified.

503.03.03 Thickness of Lifts

If the required compacted depth of the base course exceeds 6 in., construct in two or more layers of approximately equal thickness. Maximum compacted thickness of any one layer shall not exceed 6 in. Place each layer in spreads as wide as practicable and to full width of the course before a succeeding layer is placed.

503.03.04 Compaction

At the time compaction begins, the materials shall be at optimum moisture content, plus or minus 2%. Compaction of each layer shall continue until a density of 95% of Relative Maximum Density has been obtained according to ASTM D 1557/AASHTO T-180. Water shall be added to the materials, as necessary during the compaction, to maintain the proper moisture content and upon completion of each layer, the Contractor shall maintain the materials in specified conditions until it is covered by the following layer or course.

503.03.05 Surface Finish

Surface of the base shall parallel the established cross section and grade for the finished surface within 0.04 ft. The finished surface of base, when tested with a 12 ft. straight edge shall not vary from the testing edge by more than 0.04 ft. at any point.

504 CEMENT TREATED BASE

504.01 DESCRIPTION

This section covers the work necessary for the furnishing and construction of the cement treated base complete.

504.02 MATERIALS

Composition of Mixture

1. The CTB mixture shall be comprised of aggregate, Portland Cement, and water in the proportions and amounts established by the mix design. The cement content normally is to be between 4.5 and 5.5% of the dry weight of the aggregate. The mixture shall be proportioned to provide for a minimum 28-day ultimate compressive strength of 1,000 psi. The proportions of the materials will be subject to change as required to meet the herein specifications.
2. In all plants, the weight or rates of feed of aggregates and water shall be within 5% of the amounts of each material that are specified. The weights or rates of feed of cement shall be such that the variations in cement content in samples, taken from any part of a mixed batch or from different batches, or from time to time from the product of continuous mixers, or from mixtures spread on the roadbed, shall not have variations above or below the cement content designated by the City Engineer of more than 0.5 of a percentage point.

504.02.01 Aggregate

The aggregate shall meet the requirements of **Section 503, AGGREGATE BASES** and shall be crushed rock or gravel including sand conforming to specifications.

504.02.02 Portland Cement

Cement to be used shall be Portland Cement Type I or Type II conforming to the requirements of AASHTO M-85 for low alkali cement. The total alkali content shall not exceed 0.8% and the tricalcium aluminate content shall not exceed 10%.

504.02.03 Water

Water used in mixing shall be clean and free of oil, salt, acid, alkali, sugar, vegetable matter, or other substance injurious to the finished product, and shall meet the requirements of AASHTO T-26.

504.02.04 Asphalt Materials

The asphalt used for the curing seal shall be emulsified asphalt meeting the requirements of **Subsection 205.02.13, Asphalt Materials**.

504.02.05 Mix Design and Certification

- A. Ten days prior to production, the Contractor shall furnish the City Engineer a complete mix design showing the proportions of all constituents proposed for use and strength test results of samples prepared using the proposed proportions and constituents for a minimum of seven-day, 14-day, and 28-day curing periods.
- B. Also, accompanying the mix design, the Contractor shall submit the manufacturer's certification and a copy of test results with respect to the product involved. The certification shall consist of the name of the project, the name and address of the manufacturer and the testing agency and the date of testing. The certification shall also set forth a means of identification, which will permit field determination of the product delivered to the project as being the product covered by the certification.
- C. The Contractor shall be responsible for all costs of certification and testing of products in connection therewith.

504.03 CONSTRUCTION

Preparation of Underlying Course

Prior to the production or placing of cement treated base, complete all utility work and prepare the subgrade in strict accordance with **Section 501 SUBGRADE**.

504.03.01 Mixture

- A. The CTB mixture shall be mixed at a centrally located plant of the batch type or of the continuous mixing type, capable of providing a mix of aggregate, cement, and water of uniform proportions and consistency as designated by the mix design.
- B. The charging of the materials into the mixer shall be by means whereby the quantities of the several materials are accurately controlled. Mixing shall continue until a uniform and homogeneous mixture of aggregate, cement, and water has been obtained. In general, the time of mixing shall not be less than 30 seconds, except that the time may be reduced when tests indicate that the requirement for the variation of cement content, as specified, can be consistently complied with.

504.03.02 Weather Limitations

The CTB shall be constructed in accordance with the weather limitations as set forth in **Section 701, CONCRETE STRUCTURES**.

504.03.03 Equipment

Equipment used shall conform to the following requirements unless otherwise approved:

504.03.03.01 Hauling Equipment

Vehicles for hauling the mixture shall be watertight, agitating, or non-agitating, and capable of discharging the mix without waste and with practicable minimum amount of separation.

504.03.03.02 Spreading Equipment

- A. Spreading of the CTB mixture shall be by a machine, which has an adjustable screed or strike-off assembly and it may have a receiving and distribution system. The equipment shall be capable of spreading the material and striking it off to the required thickness and the designated line, grade, and transverse slope without segregation, dragging, or fracture of material. The spreading and screeding equipment may be a complete and integral unit, self-propelled and powered; a crawler-track or wheeled type tractor intimately combined with a receiving, spreading, and screeding unit attached thereto; or, if approved by the City Engineer a heavy duty self-propelled grader, equipped with at least an 8 ft. blade. The screed or strike-off assembly shall operate by an approved action, which produces specified results and a surface texture of uniform appearance.
- B. Spreading equipment which rides on freshly spread material and produces tracks or partially compacted areas thereon will be acceptable provided no displacement of material or filling of tracks occur, and provided further that the tracks are not of such depth as to be visible after compaction is completed.
- C. The spreading equipment may be provided with a control system automatically controlling the laying of the mix to specified transverse slope and longitudinal grade by means of actuation from an independent line and grade control reference, if the Contractor so elects.

504.03.03.03 Other Equipment

Equipment shall be provided to apply water by spray method to the CTB mixture during its compaction, the spray attachments being of a type that will produce a uniform and controlled fine spray. Equipment for application of the bituminous curing seal shall provide application by pressure spray method in a uniform and controlled application. Motor graders shall be available for correction of unavoidable segregation at edges of the mix.

504.03.03.04 Compacting Equipment

Compaction shall be with vibrating type, pneumatic tire type, steel wheel type, or other approved type compactor, as the Contractor may elect; provided however, that compactors with lugs, projections, or other features that would leave ruts, holes, grooves, or uneven surfaces in the CTB after compaction or which would loosen the mixture while operating will not be permitted. Either a pneumatic tire roller or a smooth steel wheel roller shall be provided for the final rolling and compacting of the mixture.

504.03.04 Hauling and Placing

- A. Maintain the surface of the underlying course in a wet condition by sprinkling just in advance of placing. The CTB mixture shall be delivered and deposited without delay. Mixture which has begun to harden and take an initial set prior to placement, or which has been retempered in transit with water, will be rejected and shall be wasted at the sole expense of the Contractor.
- B. The mixture shall be delivered to the spreading machine by direct deposit in the receiving hopper, by placing in windrows in front of the machine, or by other means acceptable to the City Engineer. If material is placed in windrows it shall be deposited on the roadbed at a uniform quantity per linear foot, which quantity shall be sufficient to provide the required compacted thickness without resorting to excess spotting, picking-up, or otherwise shifting of the mixture. The mixture shall be delivered and placed without hauling equipment operating over any uncured material.
- C. The mixture shall be spread and screeded by specified equipment in one or more layers to provide the compacted thickness called for by the Drawings. Placing shall be in strip widths which will hold the number of longitudinal joints to a practicable minimum, normally to not less than 10 ft. widths.
- D. The depositing and spreading shall progress continuously without breaks insofar as is practicable. Should stoppage of operations be of such duration as to allow the mixture to take its initial set, the Contractor shall construct a transverse construction joint as hereinafter provided.

- E. The mixture shall be spread and screeded to required thickness and to designated line, grade, and transverse slope without segregation, dragging, or fracture of the components of the mixture.
- F. Motor graders shall be used to correct unavoidable segregation at edges and to reprocess minor areas of deficiency.

504.03.05 Thickness and Number of Layers

If the required compacted depth of CTB exceeds 6 in., 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 in.

504.03.06 Construction Joints

When it is necessary, due to the termination of the day's run or to shutdown, to discontinue placing the mixture for a period of time which will allow the placed mixture to take its initial set, the Contractor shall construct a temporary transverse construction joint. This joint shall be formed with a wooden block, such as a 6 in. thick timber with width equal to or greater than the depth of the course, or with other devices acceptable to the City Engineer, extending across the width of the strip and held firmly against the vertical end of the strip of mixture which is to terminate at the joint. The top of the joint form shall be set true to the slope and grade of the CTB and shall be firm under pressure from compacting equipment. When construction of the CTB is resumed, the form shall be removed without damage to the adjacent CTB.

504.03.07 Compaction

- A. Compaction of the CTB mixture with specified compactors shall begin as soon as it has been spread and shall be continuous until completion. Not more than 60 minutes shall elapse between the start of the mixing and the time of starting compaction of the CTB mixture on the prepared subgrade. Compaction shall begin at edges and shall be controlled to prevent breakdown at the sides of a strip.
- B. Successive passes of the compactor shall be so spaced that no more than 75% of the compactive width of the compactor shall be on an uncompacted area at any time.
- C. During compacting, sprinkling with water by fine spray application shall be done at the time and in the amounts required. Surfaces of uncompacted, partially compacted mixture shall be kept moist at all times until the bituminous seal has been placed thereon.
- D. Compaction on the completed CTB shall be 95% of the maximum density indicated by the mix design.

504.03.08 Surface Finish

- A. The CTB surface shall parallel the cross section and grade of the finished surface within 0.04 ft., and when tested with a 12 ft. straight edge shall not vary from the testing edge by more than 0.03 ft. at any point.
- B. When Portland Cement Concrete pavement is to be placed on the CTB, the surface of the CTB at any point shall not extend above the grade established by the Engineer. The specified finish shall be attained by the following method.
- C. After compaction of the final lift, the surface of the CTB shall be brought within the specified tolerances by trimming with a subgrade planer, by motor grader equipped with an electronically controlled blade or by grinding. Areas on which trimming or grinding is performed shall be rolled until a smooth surface is attained.
- D. The excess material may be used at other locations in the work area provided said excess material complies with applicable specification requirements.

504.03.09 Bituminous Curing Seal

- A. As soon as possible after each layer of the CTB is constructed; as herein- before specified, and while it is still moist, the surface and exposed edges shall be covered with a bituminous curing seal. The liquefied

asphalt shall be applied at a uniform rate between .25 gal. and .35 gal. per sq. yd. by a pressure spray method.

- B. After the curing seal has been applied, it shall cure for a period of four days and during this period no vehicle shall be permitted to use the section. In case of damage to the curing seal, after application and during the curing period, the damaged section shall be repaired by the Contractor immediately by resealing at his own expense.
- C. The curing seal on any lift of CTB may be omitted if, within two hours after the start of mixing of the preceding lift of CTB, a succeeding lift of material (CTB, bituminous base or asphalt concrete) is placed over the preceding lift. Vibratory rollers will not be permitted in the compaction of any succeeding lift of CTB, bituminous base, or asphalt concrete during the period of time from two hours to 96 hours after the mixing of any of the underlying lifts of CTB.

504.03.10 Care of Work

During the construction of the CTB, the Contractor shall exercise care to protect the work from damage. Following construction of each strip and each layer of the base and following construction of the entire course of the CTB, the Contractor shall perform such work as specified and as the City Engineer may determine to be necessary to prevent raveling and rutting, to prevent segregation of materials, and to maintain the layer or course of the CTB to the specified compaction and surface finish; all until the strip, layer, or course is covered by a following layer or course of material as specified or until all work under the contract is completed.

504.03.11 Modification of Equipment and Methods

On tapers and other areas of irregular shape, limited length, restrictive width or other condition where the City Engineer determines that full compliance with the above equipment and construction requirements is not practicable, the specified equipment and construction requirements may be modified, subject to approval by the City Engineer.

504.03.12 Timing of Operations, Adequacy of Organization, and Rejection of Mixture

- A. All operations involved in constructing the CTB shall be so timed and coordinated that regardless of daily or seasonal variations in weather, temperature and humidity, such work shall result in a finished CTB conforming in all respects to specified requirements.
- B. In this respect, the Contractor shall provide and have readily available at all times adequate equipment, tools, material, and labor; and shall achieve the hauling, spreading, compacting, and trimming of the CTB mixture within two hours after mixing.
- C. Any CTB mixture not placed and trimmed within this two-hour period shall be subject to rejection, wasting, removal, and replacement as the City Engineer determines to be applicable, and all costs involved in such removal, wasting, and replacement shall be borne by the Contractor.

504.03.13 Handling Traffic Over Cement-Treated Base

- A. At locations where traffic must be routed over the cement-treated base, the CTB mixture shall be made with Type III or Type IIIA (high early strength) cement to expedite development of strength at an early date. Any extra costs of using high early strength cement shall be considered as incidental, with payment therefore covered in the pay item "Portland Cement in CTB Mixture."
- B. If the City Engineer so directs, traffic over recently constructed CTB shall be controlled as to speed and routing.

504.03.14 Testing

Materials and Mixture

1. Aggregate and cement will be subject to acceptance as specified under **Subsection 504.02, MATERIALS**. Plant mixed mixtures will be subject to final acceptance after blending and mixing either at the plant or place of delivery. Acceptance will be based on periodic sample taking.
2. When specified, the Contractor shall furnish certified laboratory tests that show results of the tests at no expense to the City. The City Engineer may do sampling and/or testing of the materials. If evidence of non-compliance with the requirements exists, additional tests may be required to assure that the materials meet the requirements as specified at the sole expense of the Contractor.

504.03.14A In-Place Sample

The City Engineer shall be permitted to cut samples or to take cores, or to require the Contractor to cut samples or take cores, from the full depth of the compacted mixture or from the separate layers and courses thereof for testing purposes, and at such locations and at such frequencies as the City Engineer determines necessary for proper representation. Sampling shall be at the expense of the Contractor. Where samples have been taken and the samples show deficiencies according to these specifications, the Contractor shall repair the cuts or cores with like material and shall make repairs to the pavement as directed by the City Engineer, all at no expense to the City.

505 ASPHALT CONCRETE PAVEMENT

505.01 DESCRIPTION

- A. This section covers work necessary for the construction of hot mix asphalt pavements under prepared foundations or base surfaces.
- B. Hot mix asphalt concrete 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 laid on a prepared foundation and compacted to specified density.

505.02 MATERIALS

505.02.01 General

Asphalt and aggregate shall meet OSHD requirements for Light Duty AC and will be subject to approval preceding mixing. Plant mixed 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 and testing of the materials.

505.02.02 Asphalt Cement

Asphalt materials incorporated in the mix shall be PBA-5 grade asphalt that conforms to requirements of **Section 205, TYPES AND USE OF MATERIALS**.

505.02.03 Aggregates

Aggregates shall conform to requirements of **Section 205, TYPES AND USE OF MATERIALS**.

505.02.04 Mineral Filler

- A. Mineral filler shall conform to the requirements of AASHTO M-17.
- B. 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.

505.02.05 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 or for experimental purposes. 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 the bituminous material and shall be complete miscible.

505.02.06 Composition and Proportion of Mixtures

- A. The class of asphalt concrete to be used shall be as shown and shall conform to the requirements indicated in the table below.

DENSE GRADED

Sieve Size Passing	Percentage of Total Aggregate (by weight)		
	Class "B"	Class "C" (Mod.)	Class "D"
1 in.	99-100	----	----
3/4 in.	92-100	99-100	----
1/2 in.	75-94	91-100	99-100
1/4 in.	50-70	58-73	85-100
#10	21-41	24-36	37-57
#40	6-24	8-18	13-29
#200	2-7	3-8	4-9
Asphalt Cement*	4-8	3-8	4-8

*Percent of total mix (by weight).

- B. The amount of new asphalt cement to be added to the recycled mixture will vary from 3-8%.
- C. Class "B", "C", and "D" asphalt concrete shall meet the qualifying test requirements indicated in the table below.

Test	Test Method	Requirements
Stability, First Compaction	OSHD Standard Test*	35 min. (residential streets) 40 min. (arterial streets)
Voids, First Compaction	OSHD Standard Test*	7% maximum
Voids, Second Compaction	OSHD Standard Test*	1% minimum
Retained Strength	AASHTO T-165-Modified	70% minimum

*Available from Engineer or Materials, ODOT, Salem, Oregon 97310.

505.02.07 Mix Formulas

- A. The Contractor may be required to submit a job-mix formula for review by the City Engineer.
- B. The job-mix formula shall indicate the gradation of each of the several aggregate constituents to be used in the mixture and shall establish the exact proportion of each constituent to be used to produce a combined gradation of aggregate within the appropriate limits stated above.
- C. The job-mix formula shall also indicate the ASTM bulk specific gravity of each aggregate constituent, the measured maximum specific gravity of the mix at the optimum asphalt content determined in accordance with ASTM D 2041, all properties as stated in **Subsection 505.02.06, Composition and Proportion of Mixtures**, of these specifications for at least four different asphalt contents other than optimum, two of which will be below optimum and two of which will be above optimum, the percent of asphalt lost due to absorption by the aggregate, and any other information pertinent to the design of the mix.

505.02.08 Recycled Asphalt Pavement (RAP) Materials Permitted

If approved by the City Engineer, the Contractor may use processed recycled asphalt pavement materials in the production of new asphalt concrete pavement. The RAP materials proposed for use in the recycled mix shall contain hard, sound, and durable aggregates, and asphalt of a composition to provide properties equivalent to asphalt as specified in these specifications when in the mix.

505.02.09 Tolerances

- A. After the mix formula is submitted, the several constituents shall meet the following tolerances, but always within the range of proportions specified in **Subsection 505.02.06, Composition and Proportion of Mixtures**:

ASPHALT CONCRETE MIX TOLERANCES

	Tolerance (± to Job Mix Formula)
Aggregate passing 1 in., 3/4 in., 1/2 in. sieves	Within the range of the proportions specified in Subsection 505.02.06, Composition and Proportion of Mixtures

	Specifications
Aggregate passing 1/4 in. sieve	6.0%
Aggregate passing No. 10 & No. 40 sieve	5.0%
Aggregate passing No. 200 sieve	2.0%
Asphalt cement	0.5%
Temperature of mixture at time it is placed in final position	240-300°F

- B. Each day the City Engineer shall be permitted to take as many samples as he considers necessary for checking the uniformity of the mixture. When unsatisfactory results or other conditions make it necessary, the City Engineer may require a new mix formula.
- C. Should a change in source of material be made, or should conditions arise which the City Engineer determines to be justified, the Contractor shall establish a new job-mix formula.
- D. The 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 no less than 70% when tested in accordance with AASHTO T-165 as modified by OSHD test methods. The City Engineer shall be permitted to take as many samples as he considers necessary for checking the uniformity of the mixture.

505.02.10 Feathering

Asphalt concrete for use in feathering at curb or gutter lines, at intersections, at connections with existing pavement, in spot patching, and under similar conditions, shall be a fine mix of asphalt concrete such as Class "D" mix.

505.03 CONSTRUCTION

505.03.01 Repaving Conference

The Contractor and his supervisory personnel plus any subcontractors and their supervisory personnel who are to be involved in the paving work shall meet with the Project Manager and his representatives for a

preparing conference at a time mutually agreed upon. At this conference, the Contractor shall discuss his methods of accomplishing all phases of the paving work. The plan of the work, order of paving and other details of performance shall meet with the approval of the City Engineer.

505.03.02 Preparation of Bases

- A. All pavement bases and foundations constructed under this Contract shall be completed and finished as prescribed under the applicable specification for its construction.
- B. Manholes, inlets, water valve boxes, and other such structures shall have been completed, cured, and otherwise prepared, as applicable, and made clean and ready for asphalt pavement. Unless otherwise approved, manholes shall be adjusted so that they can be paved over and then later adjusted as shown on the Standard Drawing. Paint vertical surfaces that will come in contact with asphalt pavement with tack coat material to provide a good bond and seal. Cover top surfaces with paper or other material to prevent adherence of asphalt pavement, tack coat, or prime coat.
- C. Prior to placement of asphalt and no more than 24 hours before paving is scheduled to begin, a final proofroll of the prepared rock base shall be performed in the presence of the City Engineer or his/her representative.
- D. Monument boxes must be installed prior to the final lift of asphalt and shall be installed per the Clackamas County Surveyor's requirements.

505.03.03 Reconditioning Old Roadbed

- A. This work consists of reconditioning and preparing previously constructed roadbed subgrades, existing stone bases and surfacings, and existing pavements; none of which were constructed by the Contractor under the pertinent Contract but on which an additional layer or course of material is to be placed.
- B. Existing aggregate subbases, bases, and surfacings shall be bladed, scarified, leveled, and compacted in conformance to lines, grades, and cross sections as established and the density and tolerance requirements of **Section 503, AGGREGATE BASES**.
- C. Prelevel uneven or broken bituminous, cement concrete, or brick surfaces with asphalt concrete as specified. Spread and compact preleveling asphalt concrete to the density and surface condition as directed.

505.03.04 Tack Coat

- A. Asphalt shall consist of emulsified asphalts (CSS-1 or CSS-1H) or an approved equal.
- B. Spread asphalt by means of pressure-spray equipment which will provide uniformity of application at prescribed rates. Do not apply aggregate cover material to the tack coat. Asphalt shall be applied to the prepared surface at a rate of 0.05 gal. per sq. yd. for clean surfaces and up to 0.12 gal. per sq. yd. for dirty surfaces. The tack coat shall not be applied during wet or cold weather or during darkness and apply only so far in advance as is appropriate to maintain a tacky, sticky condition of the asphalt. Apply tack coat in such a manner as to offer the least interference to traffic and to permit at least one-way traffic without pickup or tracking of asphalt.

505.03.05 Mixing

- A. Mix the asphalt concrete 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.
- B. The discharge temperature of the mix will vary with the type of mixing plant, climatic conditions, and other variables. However, the temperature 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°F.

505.03.06 Placing

- A. Conform to the Drawing of work, order of paving, and other details of performance as approved. Lift thickness shall be as shown on the Drawing or specified.
- B. Unless otherwise approved by the City Engineer, streets shall be paved to final grade using 2 or more lifts. Final lift shall be placed at time as directed by the City Engineer.
- C. Transport the asphalt concrete mixture from the mixing plant to the point of use in trucks. Send no loads so late in the day as to prevent the spreading and compacting of the mixture during daylight, unless approved lighting is provided.
- D. Hot mix asphalt concrete shall normally be placed on dry prepared surfaces and when air temperature in the shade is 40°F (minimum) and rising. Place Class "E" wearing surface only when the existing pavement temperature is at least 60°F. Placing during rain or other adverse weather conditions will not be permitted. The temperature of hot mix at the time it is spread into final position shall be between 240 and 300°F, except Class "E" mix shall be between 200 and 250°F.
- E. Lay the mixture in strips of such width as to hold to a practical minimum the number of longitudinal joints required. The longitudinal joints in any layer of pavement shall be offset from those joints in layers below by not less than 6 in. Before any paving is started, the Contractor shall submit a Drawing indicating locations of longitudinal joints to the City Engineer for his review. Take special care at longitudinal joints to provide positive bond and required density.
- F. Bituminous paving machines shall be self-contained, power-propelled units, 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 thicknesses, lines, grades, and cross sections. Machines used for shoulders and similar construction shall be capable of spreading and finishing to the widths shown.
- G. When the capacity of the paver to properly spread and finish exceeds the rate of delivery of mixture, operate the paver at a reduced and uniform speed to give continuous spreading and finishing.
- H. Take care at all times to prevent segregation in the mixture as evidenced by areas of fine and coarse materials, and correct any such segregation with fresh mixture either spread and worked into the surface or by complete removal and replacement of segregated mixture at no expense to the Owner. AT NO TIME SHALL THE COURSE AGGREGATE SEGREGATED FROM THE MIX FROM HAND SPREADING OR RAKING OF JOINTS BE SCATTERED ACROSS THE PAVED MAT. Such material shall be collected and disposed of.
- I. 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.
- J. Boils and slicks occurring in the pavement must be immediately removed and replaced with suitable materials, at the sole expense of the Contractor.

505.03.07 Paving Plant and Equipment

All plant and equipment used by the Contractor in the preparation and mixing of asphalt concrete shall conform to the requirements of Section 403.33, "Standard Specifications for Highway Construction" as published by Oregon State Highway Division, 1984 Edition.

505.03.08 Weigh Scales

- A. When materials are to be measured for payment by weighing on vehicle scales, the Contractor shall provide the scales and transport the materials to the scales provided.

- B. The vehicle scales furnished shall be accurate within the tolerances required by State law and shall be licensed with the Oregon Department of Agriculture. Scales shall be suitable for the weighing to be done and shall be properly installed and maintained.
- C. At each end of the vehicle scale there shall be a straight approach in the same plane as the platform. The approaches shall be of sufficient length and width to ensure the level positioning of combination vehicles longer than the scale platform during weight determinations. All vehicle brakes shall be released while combination vehicle are being weighed.
- D. Vehicle scales shall be inspected and the accuracy tested every six months by either the State Department of Agriculture or a scale service company. Scales installed at a new site shall be inspected and the accuracy tested before use. Testing by a scale service company shall be done by using a minimum of 10,000 lbs. of test weights certified by the State Department of Agriculture.

505.03.09 Hauling Equipment

- A. Vehicles used for hauling asphalt concrete mixtures shall have tight, clean, and smooth beds which have been thinly coated with a minimum amount of paraffin oil, lime solution, soapy water or other approved material to prevent the mixture from adhering to the beds. Diesel oil may be used when requested by the Contractor and approved by the City Engineer. Its use will be terminated by the City Engineer if it is not being used as specified or is a source of contamination for the asphalt mix.
- B. During each application of an approved coating material, and prior to loading, the vehicle bed shall be drained of all excess coating material by raising the truck bed, opening belly dump gates or operating the conveyer belt as appropriate for the type of equipment being used.
- C. Vehicles which cause excessive segregation, which leak badly, or which delay normal operations, as such are determined by the City Engineer, shall not be used.
- D. Contractors hauling vehicles shall be so constructed and equipped with covers to protect against moisture and against heat loss, and shall have a 3/8 in. diameter hole near the middle of the left side wall of the bed to allow access for a thermometer.

505.03.10 Asphalt Concrete Pavers

- A. Pavers shall be self-contained, power-propelled units, provided with an activated screed or strike-off assembly, heated if necessary, and capable of spreading and finishing layers of asphalt concrete material in widths applicable to the specified typical sections, and to required thicknesses, lines, grades and cross sections.
- B. Extensions added to the paver when used on travel lanes shall have the same augering and screeding equipment as the rest of the paver.
- C. The paver shall be equipped with a receiving and distribution system of sufficient capacity for a uniform spreading operation and capable of placing the mixture uniformly in front of the screed without segregation of materials.
- D. The paver shall be designed to compensate for minor irregularities of the base on which it is supported, so that such will not be reflected immediately in the surface of the layer being placed. The weight of the paver shall be supported on tracks or wheels none of which shall contact the mixture being laid. The contact area of the screed or strike-off assembly shall be uniform over the entire width of the strip of mixture being placed.
- E. The screed or strike-off assembly shall produce a finished surface of the required evenness and texture without tearing, shoving or gouging the mixture. The paver shall be equipped with either a manual or electronic line and grade control.

505.03.11 Weather Limitations

- A. Asphalt concrete mixtures shall be placed on dry prepared surfaces when the air temperature in the shade and the surface temperature is not less than those specified in the following table:

SURFACE TEMPERATURE LIMITATIONS

Compacted Thickness of Individual Courses	Travel Lanes/Wearing Course	All Other Courses
Less than 1-1/2 in.	60°F	55°F
1-1/2 in. to 2-1/2 in.	50°F	45°F
Over 2-1/2 in. and other	40°F	35°F

- B. Placing of any mixture during rain or other adverse weather conditions normally will not be permitted, except that mix in transit at the time these adverse conditions occur may be laid if of proper temperature, if the mix has been covered during transit, if placed on a foundation free of pools, or flow of water and if all other requirements of these specifications are met. Asphalt concrete mixtures shall not be placed when the underlying layer is frozen, or when, in the opinion of the City Engineer, weather conditions either existing or expected will prevent the proper handling, finishing, or compaction of the mixtures.

505.03.12 Compaction

The Contractor will not be permitted to use any equipment which crushes the aggregate to any extent. However, he will be required to obtain the densities required in **Subsection 505.03.14, Density Requirements.**

505.03.13 Compactors

Rollers shall be steel wheel, pneumatic tire, vibratory or a combination of these types as the Contractor may elect. They shall be in good condition and capable of reversing without backlash.

505.03.13.01 Steel Wheel Rollers

Steel wheel rollers shall have a minimum gross static weight of 8 tons and a minimum static weight on the drive wheel of 250 pounds per inch of width. For finish rolling a 6-ton minimum gross static weight is acceptable and the 250 pounds per inch of width will not be required.

505.03.13.02 Vibratory Rollers

Vibratory rollers shall be equipped with amplitude and frequency controls and shall be specifically designed for compaction of asphalt concrete mixtures. The rollers shall be capable of frequencies of not less than 2,000 vibrations per minute.

505.03.13.03 Pneumatic Rollers

The pneumatic-tired rollers shall be self-propelled, tandem, or multiple axles, multiple wheel type with smooth-tread pneumatic tires of equal size staggered on the axles at such spacings and overlaps as will provide uniform compacting pressure for the full compacting width of the roller and shall be capable of exerting ground pressures of at least 800 psi of tire contact area. Pneumatic-tired rollers shall be fully skirted to insulate the tires from significant heat loss during compaction.

505.03.14 Density Requirements

- A. The density of asphaltic concrete shall be at least 92% of Rice theoretical maximum density as determined in conformance with AASHTO T-209 as modified by OSHD.
- B. For final acceptance of the pavement, the density of each section of pavement will be determined by random acceptance tests using a nuclear gauge or laboratory analysis of the pavement core samples. Density tests will be taken at five randomly selected sites for each section of pavement. The average of the five density tests will constitute the density of the pavement.
- C. A section of pavement will be the area constructed from 500 consecutive tons of mixture or portion thereof. Acceptance tests will not be made within 1 ft. of the edges of the panel or from areas where the specified compacted thickness is less than 1-1/2 in.
- D. When using a nuclear gauge, two readings will be obtained at each site, the second at right angles to the first. The two readings will be averaged to obtain the test density. For any section of pavement, if the Contractor requests in writing within two work days after nuclear gauge test results are furnished to the Contractor pavement cores will be obtained at the same randomly selected sites used for the nuclear gauge tests. The density of the core samples will be determined by an independent testing laboratory. The average density of these five core samples will constitute the in-place density of the section of pavement and will prevail over the nuclear test results. If the density as determined by the core samples does not meet density requirements, the Contractor shall bear the cost of coring and testing.
- E. The City Engineer shall have the right to test any areas that appear defective in compaction. If the areas are found deficient, the City Engineer may require the Contractor to bring the areas into conformance with the specifications.
- F. The City will not accept mixture compacted to less than 89.0% of the theoretical maximum density (Rice density) or 95.7% of target density. The City Engineer may decide to allow the deficient pavement to remain in place. In that case, the City Engineer and the Contractor will agree in writing on all related matters to the terms and conditions. (Resolution 05-10 4/11/05)
- G. If the Contractor takes core samples to verify the densities, the holes shall be filled with like material and compacted and sealed to the City Engineer's satisfaction. The density of the core samples shall be tested by an independent testing laboratory in accordance with ASTM 2726. All verifying works performed by the Contractor shall be at the Contractor's expense.
- H. Where in-place mixture fails to meet the compaction standard of 92% of theoretical maximum density, the City Engineer may accept the pavement and the Contractor shall be subject to a penalty paid to the City in accordance with the following schedule: (Resolution 05-10 4/11/05)

BONDING SCHEDULE

% Maximum Density (Normal Method)	% Pay*	Bond Amount*
92.0 and above	100	0
91.5 to 91.9	95	5%
91.0 to 91.4	90	10%
90.5 to 90.9	85	15%
90.0 to 90.4	80	20%
89.5 to 89.9	70	30%
89.0 to 89.4	60	40%
88.1 to 89.0	0 to 50**	50 to 100%**
88.0 and below	0	100%

*Applies to price for in-place asphalt concrete, including asphalt cement where measured and paid for separately.

**As determined by the City Engineer.

- I. In addition to the specified unit price deduction, if the in-place compaction of more than 25% of the top lift mixture is 90.0% of Rice density or less, and at the City Engineer’s discretion, the Contractor shall fog seal the top lift of paving as specified by the City Engineer. The fog seal shall be done at the Contractor’s expense.
- J. Additional remedial work may be required to in-place mixture compacted to less than 88.0% as directed by the City Engineer.

505.03.15 Transverse Joints

- A. Form transverse joints by cutting back on the previous run to expose the full depth of the layer or course.
- B. Place a course or strip of asphalt concrete as nearly continuous as practicable. Carefully construct transverse joints using vertical faces and thoroughly compacted to provide a smooth riding surface. Apply a coat of bituminous material to contact surfaces just before mixture is placed against previously rolled mixture. The Contractor shall use a 10 ft. straight edge to determine the location of the full depth vertical faces.
- C. At bridge ends or at joints with other rigid type structures, existing bases shall be conditioned and compacted, and place asphalt concrete to extra thickness and compact in transverse direction as well as longitudinally.
- D. When the end of a course or strip of asphalt concrete is to be temporarily subject to traffic, the end shall be left on a bevel of approximately 20:1 (horizontal to vertical), being later cut back to a vertical edge.

505.03.16 Construction Joints

- A. Placing of a course or strip of asphalt concrete shall be as nearly continuous as practicable. Transverse joints shall be carefully constructed and thoroughly compacted to provide a smooth riding surface.
- B. The mixture shall be laid in strips of such widths as to hold to a practical minimum the number of longitudinal joints required. Longitudinal joints in the wearing course shall not occur within the area or width of a traffic lane or auxiliary lane. On median lanes and on shoulder areas such joints shall occur only at points of change in the transverse slopes as shown on the plans or designated by the City Engineer. The longitudinal joints in one layer shall offset those in the layer immediately below by a minimum of 6 in. Underlying longitudinal joints shall be within 12 in. of the edge of a lane or within 12 in. of the center of a lane, except in irregular areas, or if otherwise shown on the plans.

- C. When the end of a course or strip of asphalt concrete is to be temporarily subjected to traffic, the end shall be on a bevel of approximately 20:1 (horizontal to vertical), being later cut back to a vertical edge to provide a fresh surface against which subsequently placed asphalt concrete is to abut.
- D. When placing of asphalt concrete pavement in layers in excess of 2 in. nominal thickness is being performed under traffic, work shall be scheduled in a manner such that at the end of each working day, the full width of the area to be paved shall be completed to the same elevation with no longitudinal drop-offs within this width.
- E. When placing of asphalt concrete pavement in layers of 2 in. or less in thickness is being performed under traffic, work shall be scheduled in a manner such that at the end of each working shift, one strip of new travel lane pavement shall not extend ahead of the adjoining strip of travel lane pavement more than the distance normally covered by each shift.
- F. Where abrupt or sloped drop-offs of greater than 2.5 in. occur within or at the edge of the paved surface, the Contractor shall construct and maintain a wedge of asphalt concrete at a Slope 10:1 or flatter along the exposed joint.

505.03.17 Thickness and Number of Layers

- A. Asphalt concrete shall be placed in the number of courses and to the total compacted thickness per course called for by the typical cross sections given on the plans.
- B. In case the course of pavement involves the placing of a layer of variable thickness, as for leveling existing irregular surfacings, the course may include or consist of a layer of asphalt concrete of variable compacted thickness. The layer shall not exceed maximum thickness indicated in the table below.

Type of Mix	Maximum Compacted Thickness Layers
"B"	2.5 in.
"C"	2 in.
"D"	1 in.

- C. The top surface of each layer of asphalt concrete shall be spread at grade and cross section closely paralleling the specified top surface of the finished pavement.

505.03.18 Pavement Samples

The City Engineer shall be permitted to cut samples or to take cores from the full depth of compacted mixture or from the separate layers and courses thereof, for testing purposes, and at such locations and at such frequencies as the City Engineer determines necessary for proper representation. Where samples have been taken, and when directed by the City Engineer, the Contractor shall furnish new like material for filling the holes with no extra compensation.

505.03.19 Pavement Smoothness

- A. The top surface of the asphalt concrete pavement, when tested with a 12 ft. straightedge either parallel to or perpendicular to the centerline furnished and operated by the Contractor, shall not vary by more than 0.02 ft. The City Engineer will observe this testing and may require additional testing. The means of correction of a surface that does not meet the smoothness requirements shall have the approval of the City Engineer.

- B. When tests show the pavement is not within the above tolerances, the Contractor shall take immediate action to correct equipment or procedures in his paving operation to eliminate the unacceptable pavement roughness.
- C. Any surface irregularities exceeding the above tolerances shall be corrected by the Contractor using a method or methods listed herein and approved by the City Engineer.
- D. Corrective Action - Corrective measures by the Contractor requiring one or more of the following actions approved by the City Engineer shall be performed on deficient areas:
 - 1. Remove and replace the surface course.
 - 2. Place an overlay of a thickness approved by the City Engineer.
 - 3. Grind the pavement surface utilizing diamond blades up to a maximum depth of 0.3 in. and apply an emulsion fog coat as directed by the City Engineer.
- E. When utility appurtenances such as manhole covers and valve boxes are located in the traveled way and they are not required to be adjusted or are required to be adjusted before paving, these tolerances will not apply at the utility appurtenance.
- F. All corrective work shall be completed within 10 working days following notification from the City Engineer that the pavement does not meet the specified tolerances, unless otherwise directed by the City Engineer.
- G. All corrective work, including furnishing of materials, shall be performed at the Contractor's expense and no adjustment in contract time will be made for corrective action work.

505.03.20 Special Protection Under Traffic

In addition to other required provisions for traffic, the following shall apply to pavement construction: no traffic or equipment shall come in contact with the compacted mixture until it has cooled and set sufficiently to prevent marking; edges shall be protected from being broken down; and edge drop-offs one or more inches in height shall be marked with warning devices visible by day and night to the traveling public, and placed at spacings indicated on the plans or as directed by the City Engineer.

506 PORTLAND CEMENT CONCRETE PAVEMENT

506.01 DESCRIPTION

This section covers work necessary for construction of Portland Cement Concrete pavements, with or without reinforcement, on a prepared subgrade or base course, complete.

506.02 MATERIALS

All material shall conform to requirements of **Section 205, TYPES AND USE OF MATERIALS**.

506.03 CONSTRUCTION

506.03.01 General

The plant, equipment, and tools required in the performance of the work must be of the design, capacity, and in condition to efficiently perform their respective functions of the work. Schedule and coordinate all operations involved in constructing the 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 specified requirements. Provide and have available at all

times adequate equipment, tools, materials, and labor to achieve these results and failure to so provide will be cause for discontinuance or rejection of the work upon order of the City Engineer. Conform to applicable requirements of concrete construction in **Section 701, CONCRETE STRUCTURES**.

506.03.02 Preparation of Concrete Mix

- A. Before beginning any concrete work, the Contractor shall, at the City Engineer's request, have the concrete mix designed and submit the mix design for approval. The mix design shall be tested by a laboratory approved by the City Engineer by preparing trial batches from each of which four standard test cylinders shall be cast, cured and tested as specified for the job concrete. Certified copies of all laboratory reports, stating whether or not the items reported meet specifications, shall be sent directly to the City Engineer from the testing laboratory.
- B. Portland Cement, fine aggregate, coarse aggregate in required separated sizes, water, air-entraining agents and other admixtures as required, shall be used in the concrete in such proportions as may be determined to be necessary to produce a concrete of suitable workability, plasticity and entrained-air content and of such strength as the conditions to be met may require. The proportions may be changed by the Design Engineer from time to time during the progress of the work, but they shall at no time be such that test cylinders of the resultant concrete, made in accordance with the applicable provisions of AASHTO T-23 and tested as set forth in OSHD TM 719, will show compressive strengths of less than 4,000 psi at an age of 28 days.
- C. Changes in proportions, and particularly in the proportion of cement, may be made not only for the purpose of causing the concrete to meet specified 28-day requirements but also to produce concrete of high early strength when concrete of that kind is required. The maximum amount of cement to be used shall be 750 lbs. per cu. yd. of concrete.
- D. The proportions of water to be used shall be determined by the Design Engineer, it being the intent of the specification to have the water-cement ratio held as low as is consistent with the production of a workable, uniform and dense concrete. The maximum water-cement ratio shall be 6 gal. of water per 94 lbs. of cement.
- E. Entrained air in the concrete shall be as directed by the Design Engineer and normally will be from four to 6% by volume. The entrained air shall be obtained by use of air-entraining cement, by air-entraining additives or admixtures, or by combinations thereof as may become necessary and as the City Engineer may approve.
- F. The Contractor shall provide and use approved means for the adding of controlled amounts of additives, admixtures and retardants to the mix.
- G. No change in the source or character of any material shall be made without due notice to the City Engineer. No material shall be used in the mix until the City Engineer has approved such material and has designated the proportions of the materials in the mix based on the use of such approved materials.

506.03.03 Hauling

Hauling of Portland Cement Concrete mixed at a central plant or in transit will conform to the provisions of **Section 701, CONCRETE STRUCTURES**.

506.03.04 Forms

Conform to the applicable requirements of Forms in **Section 701, CONCRETE STRUCTURES**.

506.03.05 Handling and Placing

- A. Conform to requirements for Handling and Placing in **Section 701, CONCRETE STRUCTURES**.

- B. During the placing of concrete, making provision for the construction of joints and the placing of dowels, tie bars, and other devices as shown. The Contractor is referred to **DIVISION SEVEN - CONCRETE STRUCTURES TECHNICAL REQUIREMENTS**.

506.03.06 Preparation of Roadway

- A. Before paving operations are commenced, the base constructed under the contract and on which the pavement is to be constructed and shall be in or brought to the completed and finished condition prescribed under the applicable specification for its construction. Old base and foundations constructed under other contracts shall be brought by the Contractor to an acceptable condition as prescribed in these specifications.
- B. In addition to the base under the pavement, an area of sufficient width alongside the pavement base which will support the paving equipment shall be brought to proper grade and compacted so as to support the equipment at proper grade and cross section. The base for the pavement shall be maintained and firm and true to established grade and cross section until the concrete is placed thereon.
- C. Manholes, inlets, and other such structures shall have been completed, adjusted, cured, and otherwise prepared, as applicable, and made clean and ready to have concrete placed in contact therewith. Manhole frames and other independent metal structures in the pavement area shall be painted with suitable asphalt material.
- D. The conditioned base shall be in a compacted and smooth condition when the concrete is placed thereon, and shall be moist. Watering of the base shall be thorough and uniform.
- E. The City Engineer shall be permitted to place plates on prepared base and to reference them for later determination of thickness of concrete, and the Contractor shall exercise care to preserve such plates from displacement.

506.03.07 Weather Limitations

- A. Except with written permission from the City Engineer, construction of Portland Cement Concrete pavement shall not be in progress or continued when a descending air temperature in the shade and away from artificial heat reaches 35°F. Unless otherwise permitted, the temperature of the mix shall be neither less than 50°F nor more than 80°F at the time of placing. Material containing frost or lumps of hardened material shall not be used.
- B. Concreting operations shall be discontinued upon order due to insufficient natural light, unless an adequate and approved artificial lighting system is provided and operated.
- C. When concrete is being placed during cold weather and the air temperature may be expected to drop below 35°, a sufficient supply of straw, hay, grass, or other suitable blanketing material shall be provided along the work. Any time the air temperature may be expected to reach the freezing point during the day or night, the material so provided shall be spread over the pavement to a sufficient depth to prevent freezing of the concrete. If required by the City Engineer, concrete laid less than 24 hours shall also be covered by approved canvas or similar enclosures and devices capable of protecting the concrete from freezing. Any concrete injured by frost action shall be removed and replaced at the Contractor's expense.
- D. The Contractor shall have available materials for the protection of the edges and surface of the unhardened concrete from the effects of rain or other precipitation at all times. Protective material may consist of sheets of burlap, paper or plastic film. It will be the Contractor's responsibility to protect the pavement from damage, and failure to properly protect unhardened concrete may constitute cause for the removal and replacement of defective pavement at the Contractor's expense.

506.03.08 Slip Form Paving

- A. Place the concrete uniformly in final position by the slip form method in one complete pass in such a manner that a minimum of finishing will be necessary to provide a dense and homogeneous pavement in

conformance to true grade and cross section. The machine shall vibrate the concrete for the full width and depth of the pavement being placed. Such vibration shall be accomplished with vibrating tubes or arms working in the concrete. The sliding forms shall be rigidly held together to prevent spreading of the forms. Use forms of sufficient length so that no appreciable slumping of the concrete will occur.

- B. Operate the slip form paver with as nearly continuous forward movement as possible and coordinate all operations of mixing, delivery, and spreading concrete to provide uniform progress. Stopping and starting the paving machine shall be held to an absolute minimum. If, for any reason, it is necessary to stop the forward motion of the paver, stop the vibratory and tamping elements immediately. Apply no tractive force to the machine, except that which is controlled from the machine. The Contractor shall stop his operation immediately if the finished work is not of specified quality. Deficient areas shall be repaired before the concrete starts to set.
- C. Ensure that supports of the slip form paver and other equipment which ride on previously placed pavement are offset over that pavement sufficiently to prevent breakage of the edge thereof and provide such supports with suitable protective means to avoid marring or chipping of the previously placed pavement.
- D. Hand-spreading and distributing shall be with shovels, not rakes, and the concrete shall not be fouled with foreign matter, nor shall joint devices be disturbed during such operations. The Contractor shall furnish hand operated mechanical vibrators of a type and design approved by the City Engineer. These vibrators shall be used in the consolidation of the concrete pavement within at least 6 ft. on each side of construction and expansion joints and such other areas as the City Engineer may direct.
- E. During the placing of concrete, provision shall be made for the construction of joints and the placing of dowels, tie bars and other devices as called for by the plans or as directed by the City Engineer.
- F. Concrete that is not in place within 45 minutes after being mixed (or one hour if mixed at a central plant or in transit) shall be subject to rejection and wasting at the direction of the City Engineer. Concrete which has begun to harden or take an initial set prior to placement, or which has been retempered with water will be rejected and shall be wasted by the Contractor in an approved manner and at his own expense.

506.03.09 Tamping and Screeding

- A. Compact the concrete pavement by means of vibrating screeds, mechanical tampers, tamping templates, and such other implements as approved. A vibratory screed or an automatic screeding and tamping machine may be substituted for a tamping template, subject to approval. Operate the equipment 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.
- B. Immediately after placing concrete upon the subgrade and before initial set has occurred, strike off the concrete and tamp by means of a tamping template, used at right angles to the centerline of the street, until the concrete is thoroughly consolidated to specified grade and crown section and sufficient mortar is brought to the surface for finishing purposes. If the design or location of the base is such as to preclude the possibility of tamping as previously described, such as a variable crown section, curb being constructed monolithic with base, in alleys, or where the grade exceeds 10%; employ other approved methods to obtain the prescribed results.

506.03.10 Finishing

- A. After the concrete is placed and compacted, strike it true to line, grade, and cross section as shown and float to a smooth, even texture with an approved long handled wood float having a troweling or smoothing surface from 6 to 12 in. wide, or other approved floating device. Apply the float to the surface of the concrete with its length parallel to the centerline of the street and operate it from bridges, planing off the high places and filling the low places. Lap preceding applications of the float by at least one-half its length. If, after such planing, low places are discovered in the surface of the concrete, add specified

grade, cross section, and surface tolerance, with a surface free from laitance, soupy mortar, marks, or irregularities.

- B. Following the float finish and at the proper set, broom finish the surface. Draw the broom transversely across the pavement with not more than one stroke per width of broom. Fill any areas of minor honeycomb or other minor defect in composition of the concrete along the exposed edges with a stiff mortar or cement and fine aggregate applied to the moistened concrete in a workmanlike manner. Areas showing serious defects in composition of the concrete shall be cause for removal of affected pavement and replacement with pavement of specified quality for the full width of strip between longitudinal joints or edges and for a length not less than 10 ft.
- C. Tool the free edges of new pavement and joints with previously placed Portland Cement Concrete with an approved edging tool 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. Perform tooling of edges at transverse joints and longitudinal joints as directed.

506.03.11 Joints

Conform to applicable requirements of **Section 701, CONCRETE STRUCTURES** and Special Conditions.

506.03.12 Tolerances

- A. At the conclusion of the finishing operation the surface of the pavement shall not vary from a true surface, when tested with a 12 ft. testing straight-edge, more than 0.02 of a foot in 12 ft.
- B. The finished surface shall not vary more than 0.03 ft. from the Drawing elevations at any point.
- C. If the surface smoothness of the pavement after curing is found to exceed the tolerance permitted, grind the high spots until they meet the tolerance. The practicable extent of grinding shall not exceed 0.5 in., nor create spalling of aggregate nor create deficiencies in pavement thickness. Low spots, if in hardened concrete may be filled with an approved epoxy grout provided such filling is performed in a neat, workmanlike manner and blend inconspicuously with adjoining concrete. All grinding to be at the sole expense of the Contractor.

506.03.13 Curing

506.03.13.01 Curing of Concrete

- A. Immediately after the final floating, surface finishing, and edging has been completed and while the concrete surface is still moist, cover the entire exposed concrete and cure in accordance with one of the following provisions as specified:
 - 1. Apply membrane-forming compound of the white pigmented type uniformly to damp concrete by pressure-spray methods at a rate which will form an impervious membranes when tested in accordance with AASHTO T-155.
 - 2. Apply white polyethylene film, waterproof paper or burlap polyethylene sheets to damp concrete as soon as it can be placed without marring the surface. Place in intimate contact with the surface, extend over and beyond the sides or edges of the slabs or forms, and weight as approved to hold the covering in position as a moisture proof covering. Laps shall be of approved dimensions and design to maintain tightness equivalent to the covering.
 - 3. Apply burlap cloth to damp concrete as soon as it can be placed without marring the surface. Saturate the cloth with water and keep fully wetted during the curing period.
- B. Regardless of which of the above methods the Contractor chooses, keep the curing medium intact and effective for a period of not less than 72 hours after application.

506.03.13.02 Protection of Concrete

- A. Erect and maintain suitable barriers to protect the concrete from traffic or other detrimental trespass until the pavement is opened to traffic. If necessary, maintain watchmen to ensure that barriers remain effective.
- B. Wherever it is necessary that traffic including Contractor's vehicles and equipment be carried from one side of the pavement to the other, construct and maintain suitable bridges over the pavement.
- C. Prior to allowing equipment or traffic on the new surface, the concrete must have attained the specified compressive strength and shall be free from scarring, abrasion, stones, loose mortar, and other matter apt to be deleterious to the concrete surface. Operate all equipment without damage to the new concrete.
- D. Repair or replace any part of the pavement, as directed, which has been damaged by traffic or from any other cause, prior to its official acceptance, at the sole expense of the Contractor.

507 CURBS, GUTTERS, DRIVEWAYS, AND SIDEWALKS

507.01 DESCRIPTION

- A. This section covers work necessary for the construction of curbs, gutters, combination curb and gutter, combination of curb, gutter and sidewalk, islands, traffic separators, driveways, sidewalks, and pathways hereinafter referred to collectively as structures.
- B. The respective structure names are specific in their use and refer specifically to those names as shown.

507.02 MATERIALS

507.02.01 General

Materials shall conform to requirements of **Section 205, TYPES AND USE OF MATERIALS** and to additional requirements contained herein.

507.02.02 Portland Cement Concrete for Extrusions

Grade the combined aggregates within the limits indicated in the table below.

Sieve Sizes	Total Passing Percent by Weight
1/2 in.	100
3/8 in.	75-00
No. 4	50-75
No. 16	20-40
No. 30	12-23
No. 50	5-15
No. 100	0-5

507.02.03 Portland Cement Concrete

Portland Cement concrete shall conform to **Subsection 205.02.02, Portland Cement Concrete** except that extruded curbs and/or gutters shall have a maximum slump of 2 in.

507.02.04 Aggregate

Aggregate materials for base, foundation, courses, leveling courses, or bedding shall conform to 1"-0 gradation in **Section 503, AGGREGATE BASES**.

507.03 CONSTRUCTION

507.03.01 Preparation of Base

507.03.01.01 Earthwork

When roadway earthwork is called for in connection with other items of work under the same contract, which includes structure construction under this section, 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 204, EXCAVATION, EMBANKMENT, BEDDING, AND BACKFILL**.

507.03.01.02 Aggregate Foundation or Bedding

- A. Construct sidewalk structures on aggregate foundation course of 2 in. of 3/4"-0 compacted gravel, on firm subgrade or bedding of selected granular material as specified.
- B. Curb proofroll shall be performed prior to placing curb and gutter on aggregate bedding with a 10CY dumptruck loaded with rock. The prepared and tested area shall extend 1 ft. behind and 1 ft. in front of location of curb/gutter, shall be the depth of the street section specified on the plans, and shall be witnessed by the City Engineer or his/her representative.
- C. When structures are to be constructed on areas where approved aggregate material is already in place, such materials may be salvaged and reused as bedding.
- D. Foundation courses or beddings involving the furnishing of new materials shall be constructed in conformance to the applicable requirements of **Section 503, AGGREGATE BASES**.

507.03.01.03 Base for Portland Cement Concrete

- A. All bases upon which new cement concrete structures are to be constructed shall be firm and free of all deleterious matter. Dampen thoroughly surfaces upon which new cement concrete is to be placed. 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.
- B. When new concrete 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. Spread epoxy at a rate which will provide a thorough coating to the surface with all voids and depressions filled. Place new structure on the epoxy cement within 15 minutes after spreading.

507.03.02 Forms

507.03.02.01 Forms

Conform to requirements for Forms in **Section 701, CONCRETE STRUCTURES**.

507.03.03 Equipment

- A. Plant and equipment requirements as described in **Section 505, ASPHALT CONCRETE PAVEMENT** and **Section 506, PORTLAND CEMENT CONCRETE PAVEMENT** may be modified as approved, when circumstances warrant. For asphalt sidewalks or islands, spread asphalt concrete by small or special pavers, by spreader boxes, or by blade graders. Compact with small, self-propelled rollers, vibratory compactors, or mechanical tampers. Spread or compact the mixture by hand methods only when approved.
- B. The machine for extruding cement concrete curb 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 cement concrete or asphalt concrete to the lines, grades, and cross section as shown, in an even homogeneous manner. Cement concrete curb shall be free of honeycomb and cracks.
- C. Set top of curb grade by an offset guide line using the survey marks established by the Design Engineer. The forming tube portion of the extrusion machine shall be readily adjustable vertically during the forward motion of the machine to provide, when necessary, a variable height of curb conforming to the predetermined curb grade. 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.
- D. 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.

507.03.04 Placing Material

No asphalt or concrete shall be placed until the surface and forms, where used, have been inspected and approved.

507.03.04.01 Portland Cement Concrete

Construct Portland Cement Concrete structures between specified forms or by an mechanical extrusion method, as the Contractor may elect. If forms are used, maintain a 2 to 4 in. slump, and thoroughly compact and strike off. If the structures are constructed by a mechanical extrusion method, maintain a maximum slump of 2 in. Feed cement concrete into the extruding machine at a uniform rate and operate the machine under sufficient restraint in a forward motion to produce a well-compacted mass of concrete.

507.03.05 Finishing

507.03.05.01 General

- A. Construct all structures within 1/4 in. of true line and within 1/4 in. of established surface grade, cross section and slope, and within 1/4 in. of specified thickness, and all finished surfaces shall be free from humps, sags, or other irregularities. When a straightedge 10 ft. long is laid on a finished surface, the surface shall not vary more than 0.02 ft. from edge of the straightedge.
- B. Where Portland Cement Concrete sidewalks or pathways are to be placed around or adjacent to manholes, pipe inlets, or other miscellaneous structures, form around the miscellaneous structure and allow a minimum of 18 in. of clearance, after the sidewalk is poured and cured, adjust miscellaneous structures to grade and finish placing the sidewalk or pathway.

507.03.05.02 Portland Cement Concrete

- A. Sidewalks, Approaches and Other Structures
 - 1. Finish surface of concrete to grade and cross section with a bull float, trowel smooth, score if required, then finish with a broom. Use floats of not less than 10 ft. in length for straight grade

sections and not less than 5 in. in width. Finish concrete 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.

2. The surface of concrete sidewalks shall be marked into rectangles with a scoring tool which will leave the edges rounded. Scoring and dimensions shall be as shown on the appropriate Standard Drawing or as directed. Sidewalks shall have a slope of 1/4 in. per foot from the top of curb to the back of walk unless otherwise shown.
3. Joints shall be finished with a 3 in. shine in new construction, or if construction is infill work, finish shall match existing pattern. A light broom finish is required on all sidewalk and curb ramps perpendicular to the direction of travel.

B. Curbs

1. Remove forms 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 only while the concrete is still green. Plastering will not be permitted on the faces and exposed surfaces. Honeycombed, cracked, chipped and structurally defective concrete shall be removed and replaced at no expense to Owner. While the concrete is still green, finish exposed surfaces as required to provide a uniform texture and smooth surface.
2. 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. Repair or patching of said imperfections is not permitted; curb and gutter section shall be removed and replaced in sections not smaller than 3' in length.
3. Furnish and install a minimum of two 3 in. PVC Sch. 40 pipe curb drains to serve each lot. Blockouts shall be of adequate size to accommodate a 3 in. PVC drain pipe. PVC pipe shall conform to ASTM D 2241. Curb drains will be considered incidental work for which no separate payment will be made.
4. Where curb and gutter are present and when removing only the face of the curb (as in an approach installation), doweling will be required. Rebar (#5) shall be drilled into the existing gutter section at 18 in. on center and bent up into the forms for the curb face. Two longitudinal sections of rebar (#5) shall be drilled into the existing curb and gutter on both sides of the removed section of curb face, overlap 12 in. if more than one piece of rebar is used.

507.03.06 Curing Portland Cement Concrete

- A. After the concrete has been placed and finished in curb structures, as specified, it shall be cured by application of a white pigmented liquid 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 seven days.
- B. Curing of concrete in all other structures shall conform to the requirements for Curing in **Section 506, PORTLAND CEMENT CONCRETE PAVEMENT.**

507.03.07 Joints in Portland Cement Concrete

- A. Contraction Joints in Walks and Incidental Surfacing

Form transverse contraction joints of the weakened plane or dummy type in the exposed surfaces of cement concrete walks and incidental surfacings at such locations as are required to confine the

contraction joint spacing to a maximum of 15 ft. The joints shall be formed to a depth of 1/3 of the thickness of concrete and to a width of about 1/8 in. Joint edges shall be tooled.

B. Contraction Joints in Curbs

Place contraction joints in curbs at intervals not exceeding 15 ft. Contraction joints shall be of the open joint type and shall be provided by inserting a thin, oiled steel sheet vertically in the fresh concrete to force coarse aggregate away from the joint. The steel sheet shall be inserted 1/2 the depth of the curb. After initial set has occurred in the concrete and prior to removing the front curb form, the steel sheet shall be removed with a sawing motion. Finish top of curb with a steel trowel and finish edges with a steel edging tool. Contraction and expansion joints of curbs should coincide with joints in sidewalks and streets.

C. Requirements Near Existing Structures

Cut back existing curbs, walks, driveways and other such structures to permit the new construction and where the new structures are to be constructed against or within 4 in. of the end, edge or side of other structures, the new construction shall include the construction of approved connections therewith, using the same kind of concrete as is used in the new construction. Make the joint between the old and new material with a saw cut.

507.03.08 Dowels, Tie Bars, Reinforcing

Provide metal reinforcing bars and wire fabric reinforcement when and as shown. When shown, provide and place dowels with "slip sleeves" as load transfer mediums. Provide and place dowels, but without "slip sleeves," as fastenings or ties between new concrete and existing underlying concrete when shown. Provide tie bars when shown. Place reinforcing, dowels and tie bars in conformance to the applicable requirements in **Section 702, REINFORCEMENT**.

508 GEOTEXTILE FABRICS

508.01 GENERAL

This work consists of furnishing and placing geotextile fabrics in on subgrades (0 subgrade geotextile) and beneath an asphalt overlay (pavement overlay geotextile) as shown on the plans or as directed by the City Engineer.

508.02 MATERIALS

Geotextile materials shall conform to **Subsection 205.02.14, Controlled Density Fill**.

508.03 CONSTRUCTION

508.03.01 General

General requirements for placement of geotextile shall be in accordance with **Subsection 205.03.01, Description**.

508.03.02 Subgrade Geotextile

- A. For roadbed subgrade separation, prepare the subgrade according to **Section 501, SUBGRADE**.
- B. 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. Cover the patch with the specified cover material and compact before proceeding.

508.03.03 Pavement Overlay Geotextile

A. General

Place geotextile and pavement overlay in four basic steps.

- a. Surface preparation
- b. Sealant application
- c. Geotextile placement
- d. Overlay placement

B. Weather Limitations

Do not place sealant and geotextile unless the weather limitations of 00745.40 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 specifications and the items listed below.

- a. Clean and fill cracks exceeding 1/8 in. width with bituminous crack filler from the Division's Qualified Product List.
- b. Repair minor irregularities or depressions as directed.
- c. Allow crack filling material to cure before placing geotextile.
- d. 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

1. Use a normal paving grade asphalt. A cationic or anionic emulsion may be used as approved. Do not use cutbacks or emulsions which contain solvents.
2. Uniformly spray the asphalt sealant at normal application temperature by means of a pressure distributor on the prepared dry pavement surface. Apply at the normal rate of 0.20 to 0.30 gal. per sq. yd. or as recommended by the geotextile manufacturer as directed.
3. If using emulsions, increase the application rate 50% 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% or as directed.
4. The target width of sealant application shall be geotextile width plus 6 in. 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

1. 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.
2. Slit wrinkles or folds exceeding 1 in. and lay flat. Shingle-lap not more than 6 in. in the direction of the paving. Broom and/or pneumatic roll to maximize geotextile contact with the pavement surface. Additional hand-placed sealant material may be required at laps as determined.

3. 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 machines. Do not use an asphalt concrete material pickup machine. In the event of rain, the contractor shall place sand over uncovered fabric to absorb sealant.

509 COLD PLANE PAVEMENT REMOVAL

509.01 GENERAL

This work shall consist of preparing a foundation for placement of new surfacing by removal of existing surfacing to the depth, width, and cross section shown on the plans.

509.02 WORKMANSHIP

509.02.01 Equipment

The existing surfacing shall be removed with a self-propelled planning machine or grinder. The equipment shall be capable of accurately establishing profile grades within a tolerance of 0.02 ft. by reference from either the existing pavement or from independent grade control and shall have a positive means for controlling cross slope elevations. The equipment shall incorporate a totally enclosed cutting drum with replaceable cutting teeth and shall have an effective means for removing excess material from the surface and for preventing dust from escaping into the air. The use of a heating device to soften the pavement will not be permitted.

509.02.02 Pavement Removal

- A. The existing pavement shall be removed to the depth, width, grade, and cross section shown on the plans or as directed by the City Engineer to provide a surface profile true to specified grade and transverse slope.
- B. Except where samples are taken to establish a job mix formula, the existing surfacing shall not be removed more than five days prior to construction of the new surfacing, unless otherwise approved by the City Engineer.
- C. Wherever samples are obtained from existing surfacing more than five days prior to construction of the new surfacing, the Contractor shall patch the samples areas with asphalt concrete at his own expense.

509.02.03 Surface Tolerance

The new surface resulting from the pavement removal will be tested by the City Engineer for trueness to specified grade and transverse slope at selected locations. Testing will be with a 12 ft. straightedge. The variation of the surface from the testing edge of the straightedge between any two contact points shall not exceed 0.02 ft.

509.02.04 Disposal of Materials

- A. Materials removed under this specification which are not recycled and used on the project shall become the property of the Contractor at the point of removal and shall be disposed of off the limits of the project in a manner satisfactory to the City Engineer.

- B. The Contractor is encouraged to salvage any removed cold planed materials which are not recycled and used on the project for use on future projects.

510 POROUS PAVEMENT

510.01 GENERAL CONSIDERATIONS

- A. Use of porous pavement is encouraged in private development within West Linn to reduce stormwater impacts from impervious area associated with development. However, design, construction, and maintenance criteria for this pavement type are key to its successful installation and effectiveness. The following sections describe these key considerations.
- B. A typical porous asphalt pavement consists of a top porous asphalt course, a filter course, a reservoir course (designed for runoff detention and frost penetration), and existing soil or subbase material.
- C. The top porous asphalt course is an open-graded asphalt concrete surface course approximately 2-4 in. thick. This course consists of porous asphalt concrete containing little sand or dust, with a pore space of approximately 16% (as compared to 2-3% for conventional asphalt concrete). Strength and flow properties of porous asphalt concrete are similar to conventional asphalt concrete.
- D. The filter course is a 1 to 2 in. thick layer of 1/2 in. crushed stone aggregate. In addition to providing some filtration (limited by the relatively large pore space), the filter course also provides stability for the reservoir course during application of the asphalt mix.¹
- E. The reservoir course is a base of 1-1/2 to 3 in. stone of a depth determined by the storage volume needed. In addition to transmitting mechanical loads, the reservoir course stores runoff water until it can infiltrate into the soil. On slopes, reservoir courses at the higher end are not credited with storage capability due to lateral drainage.
- F. Where soils have low permeability, the reservoir course thickness should be increased to provide additional storage. With soils composed primarily of clay or silt, the infiltration capacity may be so slow that the soil is unacceptable as a subgrade, necessitating replacement by suitable borrow material. If the natural material beneath is relatively impermeable, drainage may have to be provided. The drainage may take the form of subsurface drains, french drains or dutch drains.
- G. Another 2 in. filter course can be applied below the reservoir course to allow additional infiltration. Below the filter course, we recommend a Filter fabric.
- H. Under the filter fabric is the undisturbed soil.

510.02 PLANNING CONSIDERATIONS

- A. Soil tests should be conducted to determine permeability, load bearing capacity, resistance to frost heave, swell and shrink. Soils with a permeability rating of A or B are probably more suitable than soils with a permeability rating of C. Evaluate the soils and drainage area to estimate the amount of water that may enter the porous pavement, and how fast this water will percolate through the soil. Underlying soils should have a minimum infiltration rate of 0.27 in. per hr., or 0.52 in. per hr. for full exfiltration systems.
- B. Plan to design any necessary Diversions in conjunction with the porous pavement. Diversions should be placed around the perimeter of the porous pavement to keep runoff and sediment completely away from the site both before and during construction.
- C. Do not store heavy equipment on the area in which porous asphalt pavement will be laid. Heavy equipment will compact soils and reduce the soil's infiltration.

510.03 DESIGN CONSIDERATIONS

Porous asphalt pavement systems should be designed by registered professional engineers.

1. Slope

The slope of porous asphalt pavement should not exceed 5% and is best when as flat as possible. If low spots do develop in the parking lot, it may be advisable to install drop inlets to divert runoff into the stone reservoir more quickly.

2. Depth

The depth of the stone reservoir should be such that it drains completely within 72 hours. This allows the underlying soils to dry out between storms (improving pollutant removal) and also preserves capacity for the next storm. If the site has marginal soils for infiltration (e.g. loams, silt loams), or covers a wide area, it may be prudent to design the reservoir to drain within 48 hours.

3. Residence Time

Care should be taken in spacing the underdrain network in partial exfiltration systems. If perforated underdrains are too close together, runoff may be collected too efficiently to provide the exfiltration needed for high pollutant removal. As a general design rule, a minimum residence time of 12 hours should be a target for the design storm.

4. Effects of Frost

If frost penetrates deeper than the thickness of the pavement and reservoir courses, and the subgrade soil has potential for frost heaving, it is recommended that additional material be added to the reservoir course to below the frost zone. If the subsurface freezes, the effectiveness of this BMP is diminished.

510.04 CONSTRUCTION CONSIDERATIONS

- A. Before the entire development site is graded, the planned area for the porous pavement should be roped off by Construction Barriers to prevent heavy equipment from compacting the underlying.
- B. Install Diversions as needed to keep runoff off the site until the porous pavement is in place.
- C. Excavate the subgrade soil using equipment with tracks or over-sized tires. Narrow rubber tires should be avoided since they compact the soil and reduce its infiltration capabilities.
- D. After excavation is complete, the bottom and sides of the stone reservoir should be lined with filter fabric to prevent upward piping of underlining or underlying soil. The fabric should be placed flush with a generous overlap between rolls. Follow manufacturer's specifications.
- E. Clean, washed 1.5 to 3 in. aggregate should be placed in the excavated reservoir in lifts, and lightly compacted with plate compactors to form the reservoir or base course. Unwashed stone has enough sediment to pose a clear risk of clogging at the soil/filter cloth interface. The minimum depth of this layer is usually 9 in.
- F. A 1 to 2 in. thick layer of 0.5 in. stone should be placed over the reservoir or base course, and manually graded to plan specifications.
- G. Add the porous asphalt layer (2 to 4 in. thick), but only when the air temperature is above 50°F and the laying temperature is between 230-260°F. Failure to follow these guidelines can lead to premature hardening of the asphalt and subsequent loss of infiltration capacity.
- H. Asphalt used in porous asphalt concrete ranges from a 50% to 100% penetration grade, depending upon the ambient temperatures and viscosity characteristics desired. Generally, the grades used in a given locality for conventional asphalt concretes will suffice for porous asphalt as well. However, the porous product is more subject to scuffing, which occurs when the front wheels of stationary vehicles are turned. It is therefore suggested that for porous asphalt, an 85 to 100% penetration grade be used.

- I. The percent of asphalt should be specified between 5.5 and 6, based on the total weight of the pavement. The lower limit is to assure adequately thick layers of asphalt around the stones, and the upper limit is to prevent the mix from draining asphalt during transport.
- J. To avoid damage due to photo-oxidative degradation of the asphalt, the asphalt coatings on the aggregate surfaces should be thicker than usual. In this case, the asphalt can form skins or otherwise be mildly degraded without significant loss of cementing properties.
- K. Roll the asphalt when it is cool enough to withstand a ten-ton roller. Normally, only one or two passes of the roller are necessary. More frequent rolling can reduce the infiltration capabilities on the open-graded asphalt mix.
- L. After rolling is complete, all traffic should be kept out of the porous pavement area for a minimum of one day to allow proper hardening.

510.05 AFTER CONSTRUCTION

- A. Stabilize the surrounding area and any established outlet following specifications in the Seeding and Mulching or Sodding BMPs. This will prevent sediment from entering the porous pavement.
- B. Where applicable, remove temporary Diversions after vegetation is established.
- C. Post signs to prevent vehicles from entering the area with muddy tires. If muddy vehicle access cannot be prevented, a temporary Access Road should be installed.
- D. Although snow and ice tends to melt more quickly on porous pavement, it may still be necessary to apply de-icing compounds to melt snow and ice. Do not use sand or ash because they may cause clogging of the pavement.

511 ADJUSTMENT OF EXISTING STRUCTURES TO GRADE

511.01 DESCRIPTION

This section covers the work necessary for adjusting tops of existing structures (e.g., manholes, sumps, catch basins, inlets, valve boxes, meter boxes, monument boxes, and similar structures) to required elevation and/or horizontal alignment complete. See *Subsection 511.03.03, Raised Tops of Masonry Structures*, *Subsection 511.03.04, Lowering Tops of Masonry Structures*, and *Subsection 511.03.05, Adjusting Metal Structures*, for adjustment of new structures to grade.

511.02 MATERIALS

511.02.01 General

Materials used in adjustment of existing structures may be materials salvaged from the existing installation and brought to a condition approved for reuse by the City Engineer.

511.03 CONSTRUCTION

511.03.01 Excavation and Backfill

- A. Excavation shall be unclassified and shall include whatever materials are encountered to the depths as shown.
- B. Saw cut around structures to be adjusted when pavement work has been completed. Do not use a jack hammer for pavement cutting. Replace pavement to previous density and grade.

- C. Backfill shall be done in accordance with the applicable requirements of **Section 204, EXCAVATION, EMBANKMENT, BEDDING AND BACKFILL.**

511.03.02 Salvage of Frames, Covers, and Grates

- A. Metal frames, covers, grates, and fittings may be salvaged from structures to be adjusted or abandoned, and if of suitable size and condition, as determined by the City Engineer, may be reused in the work.
- B. Salvaged components to be reused shall be cleaned of foreign material by solvents, sand blasting, or other methods that will not harm the component but will restore it to a nearly new condition. Salvaged frames, covers, and grates not reused on the project shall become the property of the Owner.

511.03.03 Raising Tops of Masonry Structures

- A. After existing frames, covers, and grates have been removed, expose the top surface on which new mortar or concrete is to be placed and chip away at least 1/5 in. to expose firm concrete. The new surface shall be cleaned by brushing and shall be moistened with water at the time of placing new concrete. New concrete shall then be placed to required grade and cured at least three days, after which the frame shall be seated in fresh mortar and brought to the proper grade.
- B. Masonry of bricks or concrete blocks shall be raised with new bricks, blocks, mortar, or combinations thereof or with Portland Cement Concrete, as conditions may require. Concrete boxes may be lifted and placed on precast concrete box extensions, on new brick, or on cast-in-place concrete as may be suitable.
- C. Mortar for building up existing masonry shall not be placed to a depth exceeding 1 in. Concrete shall not be placed to a depth of less than 4 in. To conform to these requirements, existing shells or walls of structures to be raised shall be cut down as necessary to provide space for the new construction.
- D. Fabricated metal rings or plates may be furnished and used in adjustment work, provided the metal and its fabrication design is at least equal to specified characteristics of strength and support required of the covers or grates to be placed, that uniform bearing of bearing surfaces is assured, and positive provision is afforded against displacement when in service.

511.03.04 Lowering Tops of Masonry Structures

Where the top of an existing masonry structure is to be lowered, the masonry portion of the structure shall be exposed to required depth, cut off, or removed to an elevation below that established for the bottom of metal frame or cover which is to be reset on masonry and shall then be built up with mortar, concrete, brick, or concrete blocks, or with metal rings or plates to required elevation and top design. Joining of new material to old, minimum thickness of new mortar and concrete, limitations, curing, and other details shall be as specified in **Section 701, CONCRETE STRUCTURES.**

511.03.05 Adjusting Metal Structures

- A. Metal inlets, valve boxes, meter boxes, monument boxes, or other like structures shall be raised or lowered to grade normally by resetting the entire structure on firm foundation. In the case of raising the structure to a point where it would not enclose or protect its contents, add metal extensions of like design below the original structure.
- B. Contractor may replace the structure with a new structure of adequate design as approved and at the Contractor's sole expense. Salvaged structures not reused on the project shall become the property of the Owner. Metal structures shall meet the surface smoothness requirements of **Subsection 209.03.04.04, Surface Smoothness.** Conform to applicable Sections of **DIVISION THREE - SANITARY SEWER TECHNICAL REQUIREMENTS** and **DIVISION FOUR - WATER TECHNICAL REQUIREMENTS.**