**SECTION 502**

**PORTLAND CEMENT CONCRETE BASE AND PAVEMENT**

**502.1 Description.** This work shall consist of constructing a Portland cement concrete base or pavement, with or without reinforcement as specified, shown on the plans or directed by the engineer.

**502.2 Material.** All material, proportioning, air-entrainment, mixing, slump and transporting for Portland cement concrete shall be in accordance with [Sec 501](https://calibre-internal.invalid/OEBPS/Text/Sec501.xhtml#S501). All material shall be in accordance with [Division 1000](https://calibre-internal.invalid/OEBPS/Text/Div1000.xhtml#toc_marker-1) and specifically as follows:

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| **Item** | **Section** |
| Emulsified Asphalt (SS-1, SS-1H, CSS-1 or CSS-1H) | [1015](https://calibre-internal.invalid/OEBPS/Text/Sec1015.xhtml#S1015) |
| Steel Reinforcement for Concrete | [1036](https://calibre-internal.invalid/OEBPS/Text/Sec1036.xhtml#S1036) |
| Concrete Curing Material | [1055](https://calibre-internal.invalid/OEBPS/Text/Sec1055.xhtml#S1055) |
| Material for Joints | [1057](https://calibre-internal.invalid/OEBPS/Text/Sec1057.xhtml#S1057) |

**502.3 Concrete Mix Design.** Prior to placing any concrete on the project, the contractor shall submit a mix design in accordance with Sec 501 for approval to Construction and Materials. The plant shall be operated such that no intentional deviations from the mix design are made except as follows.

**502.3.1 Field Adjustment.** When test results indicate the concrete produced does not meet the specification requirements or is not performing satisfactory, the contractor may adjust the mix design in the field as noted herein. Field adjustments may consist of changing the constituents listed on the approved mix design by no more than 5.0 percent or changing the water cement ratio by no more than 0.02 from the approved mix design. The engineer shall be notified immediately when any change is made to the mix design. Additional fractions of material or new material will not be permitted as a field adjustment. The field adjusted mix shall meet the requirements specified in [Sec 501](https://calibre-internal.invalid/OEBPS/Text/Sec501.xhtml#S501).

**502.3.2 Field Redesign.** When the constituents listed on the approved mix design are adjusted by more than 5.0 percent or the water cement ratio is changed by more than 0.02, the contractor shall submit a new mix design meeting the requirements specified in [Sec 501](https://calibre-internal.invalid/OEBPS/Text/Sec501.xhtml#S501). The mix design shall be submitted immediately to the District for approval. The contractor will be allowed to continue production while the mix design is reviewed.

**502.4 Field Laboratory.** The contractor shall provide a Type 1 field laboratory in accordance with [Sec 601](https://calibre-internal.invalid/OEBPS/Text/Sec601.xhtml#S601). A field laboratory shall not be required for small quantity work.

**502.5 Acceptance and Payment for Work Types.**  Acceptance of concrete pavement and base will be by the QC/QA process as designated within. The applicable pay adjustments shall be based on the type of work performed.

**502.5.1 Normal Thickness.** QC/QA of concrete pavement and base eight inches or thicker shall include a lot and sublot system with a quality level analysis. The concrete adjustment and smoothness adjustment shall apply.

**502.5.2 Thin Sections.** Concrete pavement and base less than eight inches thick shall not include a lot and sublot system or be eligible for the concrete pay adjustment. For concrete paving less than eight inches in depth the smoothness adjustment shall apply.

**502.5.3 Shoulders.** Depending on their thickness, shoulders shall be subject to quality control requirements and adjustments of either normal thickness or thin sections. The smoothness adjustment shall not apply to shoulders. When placed integrally to the same thickness, shoulders shall be included with the pavement in lot and sublot system.

**502.5.4 Small Quantity.** When less than 7500 square yards of concrete paving or base is called for, the paving or base shall be considered a small quantity. This designation applies to individual projects, individual projects in combination contracts, or projects with short discontinuous sections. QA frequency for small quantities will be determined by the engineer. No concrete adjustment or smoothness adjustment shall apply to small quantity work.

**502.6 Construction Requirements.**

**502.6.1 Weather Limitations.** Concrete shall not be placed upon frozen subgrade. All concrete shall be effectively protected from freezing until a minimum compressive strength of 3,500 psi has been attained. Regardless of precautions taken, the contractor shall assume all risks, and all frozen concrete shall be replaced at the contractor's expense.

**502.6.2 Protection Against Rain.** To protect against rain, the contractor shall have on location at all times material for the protection of the edges and surface of the unhardened concrete. The contractor shall protect the concrete from damage due to rain. Failure to properly protect unhardened concrete may constitute cause for the removal and replacement of defective concrete at the contractor's expense.

**502.6.3 Equipment.** Equipment and tools necessary for handling material and performing all parts of the work shall be satisfactory to the engineer as to design, capacity and mechanical condition. The equipment shall be at the job site sufficiently ahead of the start of construction operations to be examined thoroughly by the engineer and shall be in accordance with the following:

**502.6.3.1 Batching Plant, Mixer and Hauling Equipment.** The batching plant, mixer, water measuring equipment, weighing and hauling equipment shall be in accordance with [Sec 501](https://calibre-internal.invalid/OEBPS/Text/Sec501.xhtml%22%20%5Cl%20%22S501).

**502.6.3.2 Slip-Form Construction.** Concrete base or pavement may be constructed by the use of sliding form methods. Slip-form construction shall be in accordance with these specifications.

**502.6.3.2.1 Consolidating and Finishing Equipment.** The concrete shall be consolidated and finished by a slip-form paver designed to spread, consolidate and shape the concrete in one complete pass of the machine in such a manner to provide a smooth, dense and homogeneous pavement in conformance with the plans and specifications. No apparent slumping of the concrete shall occur within 6 inches of the pavement edge. If necessary to stop the forward movement of the paver, the vibratory and tamping elements shall be stopped immediately.

**502.6.3.3 Vibrators.** Vibrators used for full width vibration of the concrete shall be of the internal type. Vibrating equipment shall be operated in accordance with the manufacturer's recommendation at a frequency to provide satisfactory results, but shall be no less than 4500 impulses per minute. Hand vibrators shall have a frequency of no less than 4500 impulses per minute.

**502.6.3.4 Concrete Saw.** If sawed joints are required, equipment shall be capable of providing a groove of the specified dimensions in the concrete. Equipment shall be a wet-cut saw, referred to as a “conventional concrete saw” or a lighter weight dry-cut saw, referred to as an “early-entry concrete saw,” used to establish joints sooner than the conventional saw.

**502.6.3.5 Equipment for Sealing Joints.** An approved double boiler-type heating kettle equipped with a mechanical agitator and a satisfactory temperature indicating device shall be required. The equipment shall be capable of heating the joint sealing material uniformly without damage.

**502.6.3.6 Auxiliary Equipment.** Auxiliary equipment shall be available at all times as follows:

(a) A minimum of one footbridge designed to be readily transportable and having no contact with the concrete base or pavement.

(b) Metal dyes with beveled face numerals 3 inches to 5 inches high and thick enough to make an indentation of 1/4 inch. A satisfactory dye shall be used for marking the location of the station number.

**502.6.4 Setting Forms.** Forms shall be sufficiently supported to avoid displacement during paving operations. Both straight and curved forms shall be supported in such position that the face of the form shall be vertical on tangents and perpendicular to the superelevated section on curves. The top of the form shall not vary more than 1/8 inch from the true grade line during placing, compacting and finishing operations. The form alignment shall not vary more than 1/4 inch from the true alignment.

**502.6.5 Conditioning of Subgrade.** When forms have been securely set to grade, the subgrade shall be brought to proper cross-section in accordance with [Sec 209](https://calibre-internal.invalid/OEBPS/Text/Sec209.xhtml#S209). Low areas of treated bases shall be filled only with concrete integral with the pavement. No direct payment will be made for the concrete used to fill these low areas.

**502.6.6 Proportioning and Mixing Concrete.** Concrete shall be proportioned and mixed by truck or central mixers in accordance with [Sec 501](https://calibre-internal.invalid/OEBPS/Text/Sec501.xhtml#S501). This shall consist of batching all aggregate, cement and water by means of automatic weighing or metering, with all additives dispensed automatically and interlocked with the automatic weighing or metering controls. For central mixed concrete, the mixing cycle shall be timed and interlocked with the weight batch cycle. The weight setting controls shall be equipped such that the controls may be locked when directed by the engineer. The automatic batching equipment shall be capable of conversion to manual operation if necessary. Manual operation shall not be permitted beyond 24 hours after breakdown in the automatic equipment, except by written approval of the engineer. When a project includes paving that cannot be performed in a normal sequence, the contractor will be permitted to place a maximum of 7000 square yards using manual batching methods. For all contracts having a total of no more than 20,000 square yards of concrete base coarse and concrete pavement combined, manual batching methods will be permitted.

**502.6.7 Placing Concrete.** The concrete shall be deposited over the entire width of the subgrade in such a manner as to prevent segregation and to minimize handling. Mixers, including truck mixers and trucks used for transporting concrete, will be permitted to discharge concrete by chute or by dumping directly on the subgrade or prepared base provided the underlying material is not damaged or distorted. Honeycomb in the concrete base or pavement edge may be cause for rejection of the concrete.

**502.6.8 Tie Bar Placement.** Tie bars shall be supported in the proper position by chairs driven into the subgrade, or may be placed by approved mechanical methods prior to the consolidation of the concrete after the concrete has been struck off. Tie bars shall be free from dirt, oil, paint and grease. Tie bars required at longitudinal construction joints shall be positioned before concrete base or pavement consolidation.

**502.6.9 Final Strike-off, Consolidation and Finishing.** Machine finishing by extrusion methods or by vibrating and screeding processes shall be required for all concrete except as permitted in accordance with [Sec 502.6](https://calibre-internal.invalid/OEBPS/Text/Sec502.xhtml%22%20%5Cl%20%22S502_4_8_6).7. After the final coarse of the concrete has been placed, the concrete shall be struck-off and thoroughly vibrated until concrete of a uniform and satisfactory density is attained. The surface of the pavement shall be of uniform texture and to the proper grade and typical section.

**502.6.9.1 Consolidation.** Vibrating tubes shall extend into the concrete the distance necessary to provide adequate consolidation. Vibrators shall be operated only when the machine to which the vibrators are attached is moving. Care shall be taken that the vibrator does not penetrate the subgrade or dislodge or move the joints. Vibrators shall not come in contact with the reinforcement, load transfer devices, subgrade or side forms.

**502.6.9.2 Added Finishing Water.** Moisture in any form shall not be applied to the surface of the concrete except for emergency conditions. When emergency conditions exist and it becomes necessary to apply additional moisture to the surface of the concrete in order to complete the final finishing operation, water may only be applied in the form of a fine pressure spray. Under such conditions, placement of additional concrete on the subgrade shall be discontinued until the emergency conditions cease.

**502.6.9.3 Surface Texture.** After surface irregularities have been removed, the concrete surface shall be given a uniformly roughened finish with a minimum texture depth of 1.00 mm.

**502.6.9.3.1 Minimum Diamond Grinding Length.** Diamond grinding, except for bump correction, shall be across the entire width of the traveled way and shall be continuous for a minimum of 0.1 mile.

**502.6.9.3.2 Wave Texture.**  The concrete may be tined either longitudinally or transversely.

**502.6.9.3.2.1 Wire Comb.** A wire comb shall be no less than 10 feet long with a single line of wires exposed to a length of approximately 4 inches. The wire shall be blue-tempered and polished spring steel with nominal dimensions of 0.028 inch thick and 0.100 to 0.125 inch wide. The wires shall be spaced to provide 1/2-inch clear space between wires and securely mounted in a rigid head. Except for concrete finished by hand methods, the wire comb shall be mechanically operated and capable of covering the full width of slab in a single pass, at a uniform speed and at a uniform depth. Final approval of the wire comb will be based on satisfactory performance during actual use

**502.6.9.3.2.2 Texturing with Wire Comb.** Successive passes of the comb shall be overlapped the minimum necessary to attain a continuously textured surface. The surface texture produced shall have an average texture depth of approximately 0.125 inch. Small or irregular areas, or areas not suitable for machine texturing when adjacent surrounding concrete is ready for texturing, may be textured with a hand operated device producing a textured surface equivalent to that required for machine combing.

**502.6.9.4 Edging at Forms and Joints.** After the final finish, but before the concrete initial set, the edges of the concrete along each form line, and on each side of transverse expansion joints and construction joints shall be worked with an edging tool having a radius of approximately 3/8 inch. A well-defined and continuous radius having a smooth, dense finish shall be produced. The surface of the concrete shall not be unduly disturbed by tilting of the tool during use. Tool marks on the pavement shall be eliminated by brooming or dragging the surface. In doing this, the rounding of the corner of the pavement shall not be disturbed. All concrete on top of the joint filler shall be completely removed. All joints shall be tested with a straightedge before the concrete has set, and corrections made if one side of the joint is higher than the other.

**502.6.9.5 Station Numbers.** The contractor shall indent station numbers into all pavement immediately following the final finishing operations and before the concrete’s final set. The numbers shall be placed at alternating full stations as ascertained by measurements determined by the engineer. Equations in stationing shall also be marked in the pavement. On undivided pavement, the station numbers shall be on the left side of the pavement with respect to the ascending stationing and shall be on the pavement edge unless an integral curb is involved, in which case the numbers shall be placed on the face of the curb. On divided pavement, station numbers shall be placed on the median side of each pavement. The numbers shall be placed facing the centerline of the pavement, or the centerline of each pavement in the case of divided pavements. The numbers shall be placed on a troweled area of the finished surface. No direct payment will be made for marking station numbers.

**502.6.9.6 Hand Finishing.** Compacting, vibrating and finishing concrete by hand methods will be permitted:

(a) For all curves having a form line radius of less than 200 feet or where wood forms are used.

(b) For all irregularly shaped areas.

(c) For pavement lanes less than 200 feet long.

(d) For pavement lanes less than 10 feet wide.

(e) For bridge approaches and pavement to first expansion joint.

(f) When a breakdown of the mechanical compacting and finishing equipment occurs or in the event of some other emergency. After a breakdown, only material which has already been proportioned and which may be rendered unsatisfactory for use may be finished by hand.

(g) For all Portland cement concrete base.

**502.6.10 Joints.** Joints shall be of the specified type and dimensions, and constructed at the locations shown on the plans or as approved by the engineer. Where joints are preformed, the form or joint shall be set and securely fastened to ensure the joint being in the required position when the concrete is finished. The final position of dowels and tie bars shall be parallel to the subgrade and perpendicular to the line of the joint. Dowel supporting assemblies shall conform to one of the types shown on the plans. The concrete shall be placed to avoid displacement or disarrangement of the joint installations.

**502.6.10.1 Expansion Joints.** Expansion joints shall extend for the full cross-section of the concrete pavement. Filler placed prior to the placement of the concrete shall be installed with a removable cap or edging bar as a guide for edging the joint and protection of the filler during the concrete’s placing and finishing. Joints constructed after the placement of concrete shall be sawed full depth, and the exposed edges shall be ground to a chamfer of 3/8 inch. The filler shall rest snugly on the subgrade from form to form. The joints shall be sealed in accordance with [Sec 502.5.4](https://calibre-internal.invalid/OEBPS/Text/Sec502.xhtml#S502_5_4). Upon removal of the forms, any struts or fins of concrete extending across the joint shall be removed to the full width of the joint and the full thickness of the concrete base or pavement.

**502.6.10.2 Construction Joints.** Construction joints shall be made at the close of each day's work or when the work is stopped or interrupted for more than 30 minutes. Transverse construction joint shall be located 15 feet from the last contraction joint Construction joints shall be constructed perpendicular to the top surface and the centerline of the concrete base or pavement. Construction joints may be formed with a timber header or may be sawed full depth. The final joint shall conform to the cross-section of the pavement. Before paving operations are resumed, all surplus concrete and other refuse shall be removed from the subgrade.

**502.6.10.3 Sawing Joints.** Unless otherwise provided, all transverse contraction joints and all Type L longitudinal joints shall be sawed in a single cutting operation with all joint cuts to the dimensions shown on the plans. For intersections and irregular pavement, joints shall be sawed at locations as approved by the engineer. Sawing of the joints shall begin as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling. All joints shall be established before uncontrolled shrinkage cracking takes place. The sawing of any joint shall be omitted if a crack occurs at or near the joint location prior to the time of sawing. Sawing shall be discontinued when a crack develops ahead of the saw. The engineer reserves the right to have the contractor install preformed type joints on multiple width construction when the use of sawed joints fails to prevent random cracking. Any pavement with random cracking not controlled by dowels or tie bars shall be either removed and replaced using dowels or tie bars as appropriate to the nearest controlled joint or repaired with some other method approved by the engineer at the contractor's expense.

**502.6.10.3.1 Forming Longitudinal Joint.** A joint forming device may be used to establish the longitudinal joint between the two driving lanes or between the driving lane and shoulder 6 foot wide or greater. The pavement shall have a plan thickness of 8 inches or greater.

**502.6.10.3.1.2 Joint Forming Device.** The joint forming device shall consist of a pair of straight blades mounted under the paver. The first blade shall be placed under the front of the primary pan extending forward between the vibrators, if mechanically possible. The second blade shall be placed on the finishing pan in identical alignment to the first blade. Blade depth shall be equal to one-third of the slab thickness.

**502.6.10.3.1.3 Depth Verification.** The engineer shall have access behind the paver to randomly check joint formation by inserting a thin metal strip equal to one-third of the slab thickness into the formed joint.

**502.6.10.3.1.4 Joint Continuity.** The contractor shall ensure longitudinal joint continuity between consecutive day's paving.

**502.6.10.3.1.5 Unacceptable Results.** If the test results or the quality of the joint forming process are not satisfactory to the engineer, the contractor shall saw the longitudinal joint for the length affected.

**502.6.10.4 Sealing Joints.** All sawed contraction joints shall be unsealed, unless otherwise specified. Sawed or formed expansion joints shall be sealed with joint sealing material before the pavement is opened to any traffic, including construction traffic. Immediately prior to sealing, the joints shall be thoroughly cleaned and dried. The sealing material shall be heated to the pouring temperature recommended by the manufacturer. Any material which has been heated above the maximum safe heating temperature will be rejected. Any excess material shall be removed from the pavement surface.

**502.6.10.5 Joint Filler at Railroad Crossings.** Bituminous filler for use between railroad crossing approach slabs and the crossing shall be an approved commercial bituminous mixture in accordance with [Sec 401](https://calibre-internal.invalid/OEBPS/Text/Sec401.xhtml#S401). The mixture shall be tamped into a firm and compacted state.

**502.6.11 Curing.** Immediately after the finishing operations have been completed and as soon as marring of the concrete will not occur, the entire surface and exposed edges of the newly placed concrete shall be covered and cured in accordance with one of the following methods. The concrete shall not be left exposed for more than 30 minutes between stages of curing or during the curing period.

**502.6.11.1 White Pigmented Membrane.** After the free water has left the pavement surface, the entire surface shall be sealed by spraying with a uniform application of white pigmented membrane curing material. The contractor shall provide satisfactory equipment to ensure uniform mixture and coverage of curing material, without loss, on the pavement at the rate of not less than one gallon for each 200 square feet. If rain falls on the newly coated pavement before the film has dried sufficiently to resist damage, or if the film is damaged in any other way, the contractor shall apply additional curing material to the affected portions. All areas cut by finishing tools subsequent to the application of the curing material shall immediately be given new applications at the rate specified above. If hairline cracking develops before the membrane can be applied, the concrete shall be initially cured with wet burlap in accordance with [Sec 502.6.2](https://calibre-internal.invalid/OEBPS/Text/Sec502.xhtml#S502_6_2) before the membrane is placed. Membrane curing shall not be used on Portland cement concrete base. Emulsified asphalt may be used to cure the concrete base if the surface coarse is to be a bituminous type.

**502.6.11.2 Burlap.** The top surface of the concrete shall be temporarily covered with thoroughly damp burlap after the concrete has set sufficiently to prevent marring of the surface. Burlap shall be handled in such a manner that contact with earth or other deleterious substances is avoided. All burlap, except burlap previously used for curing concrete, shall be thoroughly washed. The burlap shall be kept thoroughly wet until removed for application of the final curing material. Neither the top nor the edge of the concrete shall be left unprotected for more than 30 minutes. When the burlap is removed, white pigmented membrane curing material shall be continued by one of the approved methods.

**502.6.12 Removing Forms.** Forms shall be removed carefully to avoid damage to the concrete base or pavement. Honeycombed areas not rejected shall be immediately repaired. If the forms are removed less than 72 hours after placing concrete, the sides of the concrete shall be cured by one of the methods specified above. Any trench excavated for the forms shall be entirely backfilled so water will not stand next to the concrete base or pavement.

**502.6.13 Opening to Traffic.** The concrete base and pavement shall not be opened to any traffic until the concrete has attained a minimum compressive strength shown below. Prior to opening to public traffic, pavement shall be cleaned

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| **Traffic Type** | **Compressive Strength** |
| Light Construction | 2500 PSI |
| Low Volume Public |
| All Types | 3000 PSI |

**502.7 Contractor Quality Control.**

**502.7.1 Quality Control** The contractor shall control and monitor the quality of the work. The contractor's test results will be used when applicable to determine the PWL, provided the contractor's QC tests and the engineer's QA tests compare favorably, and provided the engineer's inspection and monitoring activities indicate the contractor is following the approved QC Plan.

**502.7.2 Control Charts.** If control charts are utilized by the contractor, the QC Plan shall state the location where control charts will be posted.

**502.7.3 Lot/Sublots.** A lot shall be the surface area placed in a single day. For high daily production rates exceeding 7,500 square yards per day, the contractor may choose to divide the day’s production into two equal lots. Each lot shall be divided into no less than four or more than six sublots of equal surface area. The contractor shall notify the engineer of the size of the sublot or of the decision to divide a day’s production into two equal lots prior to taking any core samples. When a day’s production involves less than 600 square yards, combine the following day’s or days’ production to reach 600 square yards and treat as a single lot, except while completing a particular mix design or project, in which case combine with the previous day’s production and treat as a single lot. The QC Plan shall identify the number of sublots each lot will utilize and describe how lots and sublots will be designated.

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**502.7.4 Random Numbers**. .Sampling location will be determined by the engineer using random sampling procedures in accordance with ASTM D 3665

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**502.7.5 Coring.** Cores shall not be taken until after all smoothness correction has been completed. Cores shall be taken in accordance with AASHTO T 24 in the diameter listed below. Cores shall not be taken until a minimum compressive strength of 3,000 psi has been attained. Cores shall be neatly cut with a core drill. The contractor shall fill the core holes with an approved non-shrink grout within one day after sampling. The contractor shall furnish all tools, labor and material for cutting samples and filling the cored hole. The QC Plan shall identify the method for determining when concrete cores can be extracted.

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| Concrete Base or Pavement Thickness | Core Diameter |
| < 12 inches | 4 inch |
| ≥ 12 inches | 6 inch |

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**502.7.6 28 Day Cylinder Compressive Strength.** See Sec 501 for requirements on sampling and testing of compressive strength cylinders. 28 Day cylinders for less than eight inch pavements shall meet the design strength shown on the plans or 3500 psi if omitted.

**502.7.7 Pavement Thickness.** The pavement thickness shall be taken by direct physical measurement of the freshly placed concrete. Acceptable thickness for any measurement occurs if the thickness is less than 10 percent deficient from the plan thickness.

**502.7.8 Core Thickness.** Pavements eight inches or greater shall be cored and the core thickness determined by the average caliper measurement in accordance with AASHTO T 148. Acceptable thickness for any measurement occurs if the thickness is less than 10 percent deficient from the plan thickness. For small quantities, pavement thickness may be used in lieu of core thickness

**502.7.9 28 Day Core Compressive Strength.** A core For small quantities, 28 day cylinder compressive strength may be used in lieu of core compressive strength.

**502.7.10 Weak Longidudinal Joint.** The contractor shall indicate in the Quality Control Plan if the longitudinal joint forming device is going to be utilized on the project. To ensure the joint forming device is producing weakness in the finished concrete joint, the contractor shall take 4-inch diameter cores of the longitudinal joint. Cores shall be taken at random locations determined by the engineer and tested the following day after paving. The cores shall be centered within ± ½ inch around the joint forming trail. The first one-third of the slab thickness and the second one-third of the slab thickness of each core shall be sawed off from the top and tested in the vertical position for split tensile strength. The average strength ratio of the first and second cores shall be 1/3 or less.

**502.7.10.1 Testing Frequency.**  On the first day of paving the rate shall be doubled to four cores per day. If satisfactory results are consistently achieved, the engineer may reduce the frequency table rate of cores taken.

**502.7.11 General Concrete Requirements.** Sec 501 quality control requirements shall apply as modified below.

**502.7.11.1 Entrained Air Content.**  The as placed air content shall be calculated using the as delivered air content measurement and air loss when applicable and used for all requirements. The as placed air content shall be 5.0 percent or greater. The contractor shall halt production and make appropriate adjustments whenever the as-placed air content is between 4.5 and 5.0 percent. Whenever the as delivered air content minus the air loss indicates the as placed air content would be less than 4.5 percent re-dosing shall be required or the entire truck rejected.

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**502.7.12 Surface Smoothness.** See Sec 610 for additional details. Smoothness testing is waived for concrete base.

**502.7.13 Surface Texture.** Testing will be waived if the contractor elects to diamond grind or tine the concrete with a wire comb. Surface texture testing is waived for concrete base.

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**502.7.14 Opening to Traffic.**  For early opening traffic prior to 28 days after placement, a single early break cylinder meeting the requirements is acceptable.

**502.7.15 Vibration Rate.**  The contractor shall have a tachometer available at all times for checking the vibration frequency of vibratory equipment. Acceptable vibration rates are a minimum of 4500 impulses per minute.

**502.8 Quality Assurance.** The engineer or designated representative will be responsible for monitoring the work and quality control efforts of the contractor.

**502.8.1 Independent QA Samples.**  The engineer's test results, including all raw data, will be made available to the contractor when completed and no later than the next working day. For 28 day cylinder or core compressive strength and thickness results a favorable comparison will be obtained when the engineer's QA test results are within two standard deviations from the mean of the QC’s results for that particular lot. For all other independent QA samples, a favorable comparison will be obtained when QA samples meet the same specification criteria as QC.

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 **502.8.2 Split Samples.** There are no QA split samples for Sec 502 other than those general concrete requirements of Sec 501.

**502.8.3 Material Rendered Unfit.**  The engineer may at any time reject and require the contractor to dispose of any batch of concrete mixture which is rendered unfit for use due to contamination, segregation, improper slump or improper entrained air content. Such rejection may be based on only visual inspection. In the event of such rejection, the contractor may while in the presence of the engineer, take a representative sample of the rejected material and test it to determine acceptability.

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**502.8.4 Contractor Responsibility for QA Cores.**QA strength and thickness cores that are not in possession of the engineer for the entire time from extraction till testing shall be sealed in tamper proof bags after extraction.

**502.9 QC/QA Frequency Table**

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| **Tested Property** | **QC Frequency** | **QA Frequency**  | **QC Small Quantity Frequency** |
| **Independent Samples** | **Split** **Samples** |
| < 8 Inches | 28 Day Cylinder Compressive Strength | 1 per 7500 Square Yards | 1 per 30000 Square Yards | - | 1 per Day |
| Pavement Thickness | 1 per Location  |
| ≥ 8 Inches  | Core Thickness | 1 per Sublot | 1 per Lot | 1 per Day |
| 28 Day Core Compressive Strength | 1 per Location |
| Weak Longitudinal Joint | 2 per Day | 1 per Week | 1 per Project |
| General Concrete Requirements | Per Section 501 |
| Surface Smoothness | Per Section 610 |
| Surface Texture | 1 per Sublot | - | - | 1 per Project |
| Opening to Traffic | 1 per Location | 1 per Day | 1 per Location |
| Vibration Rate | 2 per Day | - | - |

**502.10 Method of Measurement.** Final measurement of the completed pavement will not be made except for authorized changes during construction, or where appreciable errors are found in the contract quantity. Where required, measurement of the Portland cement concrete base and pavement complete in place, will be made to the nearest 1/10 square yard. The revision or correction will be computed and added to or deducted from the contract quantity.

**502.11 Basis of Payment.**

**502.11.1 Compensation.** The contract unit price for Portland cement concrete base and pavement will be considered as full compensation for all material, including reinforcement, dowels, dowel supports, tie bars and any other items entering into the construction of the traveled way pavement or Portland cement concrete shoulders, and for the cost of QC testing. No additional compensation will be allowed for any excess thickness.

**502.11.2 Payment.** The accepted quantities of concrete base will be paid for at the contract unit price with proper allowance made for any deductions for deficiency in thickness and compressive strength. The accepted quantities of Portland cement concrete pavement will be paid for at the contract unit price with proper allowance made for any deductions for deficiency in thickness, compressive strength, smoothness or marred surface.

**502.11.3 Width.** When paving widths are greater than the travel lane widths, payment for profiling will apply to the traffic lane design driving width only, normally 12 feet. Random lane coring for thickness or required lane replacement will include the full paved lane width to the longitudinal joints or edge of shoulder, whichever is first.

**502.11.4 Concrete Adjustment.**  Each lot of material shall have its contract unit price adjusted based off the pay factor total.

**502.11.4.1 Pay Factor Total.** The total pay factor ( PFTOTAL ) for each lot is equal to the weighted sum of the pay factors ( PF ) for each pay factor item for each lot, and is determined as follows:

 PFTOTAL = + ( 0.5 ) PFTHICKNESS + ( 0.5 ) PFCOMPRESSIVE STRENGTH

The PF for each pay factor item for each lot is based on the PWLTOTAL of each pay factor item of each lot and is determined as follows:

When PWLLOWER ≥ 70: PF = ( 0.5 ) PWLTOTAL + 55

When PWLLOWER < 70: PF = ( 2.0 ) PWLTOTAL - 50

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**502.11.4.2 Quality Level Analysis.** Compressive strength and thickness shall be evaluated for acceptance on a lot-by-lot basis using a Quality Level Analysis (QLA) as defined in Sec 106 and herein. For thickness and compressive strength in this specification, PWLUPPER shall be 100.

**502.11.4.3 Lower Specification Limits.** The lower specification limit (LSL) for compressive strength and thickness shall be 4,000 psi for compressive strength and plan thickness minus ½ inch for thickness.

**502.11.5 Smoothness Adjustment.** The contract unit price for concrete pavements will be adjusted in accordance with Sec 601.5. The contract unit prices for concrete pavement will be considered full compensation for the costs of the smoothness testing and correction.

**502.11.6 Payment for Material Rendered Unfit.** Any material rrendered unfit per Sec 502.8.3 and subsequently proved acceptable by the contractor shall be paid for at the contract unit price.