215 EXCAVATIONS AND RESTORATIONS (UTILITY LINES)

215.01 DESCRIPTION

The Work performed in conjunction with the placement or repair of utility lines consists of trenching, shoring, subgrade replacement, surface course replacement, and pavement marking replacement for composite pavements, PCC pavements, and flexible pavements. The Work shall be performed by utility companies or their contractors and shall be subject to Chapter 34 of the Public Space Regulations (title 24, DCMR). In the event of any inconsistency with another provision of these Specifications, the most stringent requirement shall govern. These Specifications shall be used in conjunction with the Department of Transportation Standard Drawings for utility excavation repairs.

215.02 USE OF STEEL PLATES

The Contractor shall place the appropriate notification signs if steel plates are used at any point in the processes described herein. Further, the Contractor shall notify the Director, District of Columbia Department of Transportation, or his or her designee, before placing any steel plates in the Public Right-of-Way.

215.03 COMPOSITE PAVEMENTS

A. TRENCH EXCAVATION - The Contractor shall cut the full depth of pavement to a neat line by means of a power saw, as per the Standard Drawings.

B. TRENCH BACKFILL FOR TEMPORARY RIDING SURFACE - The Contractor shall backfill with approved materials placed in 6 inch lifts to within 4 inches of grade.

The Contractor may use flowable fill as a backfill. If this option is employed, then the 6 inch shoulder described in 215.03(D) is not required, and the new base course described in 215.03(D) shall be anchored to the existing base on one side, as per the Standard Drawings.

C. TEMPORARY RIDING SURFACE - The Contractor shall place 4 inches of hot mix asphalt to grade, as per the Standard Drawings.

D. RESTORATION OF BASE COURSE

1. **Restoration Cut** - The Contractor shall cut the pavement parallel to the roadway's longitudinal joints, with a minimum of 6 inches of Shoulder beyond the original cut. If this puts the restoration cut within 2 feet of a joint in the base course, the cut shall be extended to the joint. The asphalt surface course shall be cut full-depth to a neat line with a power saw. The base course shall be cut in the same manner to a depth of at least 3 inches. Pneumatic tools shall be used to remove the remaining portion of the base course, as per the Standard Drawings.

2. **Replacement of Base Course** - The Contractor shall place Portland cement concrete Base Course to a minimum depth of 10 inches. The bottom of the new base course shall be even with the bottom of the existing base course. The top of the new base course shall be 2 inches below the riding surface, as per the Standard Drawings, so as not to be affected by subsequent milling and overlaying processes.

   Steel plating is required for a minimum of seventy-two (72) hours to protect the concrete before opening to traffic. Payment for steel plating shall be in accordance with 612.19.

   In the winter, the Contractor may bring the PCC Base Course up to the grade of the roadway as a temporary measure, thereby eliminating the need for a temporary asphalt patch. In this event, the Site must be permanently restored no later than April 15 following the winter months during which the measures were taken, and in the manner described in 215.03(E).

3. **Temporary Feathering** - Between the time that the concrete base course has cured and the placement of the final asphalt surface, the Contractor shall feather all edges from the existing pavement to the concrete base course with temporary hot mix asphalt or high-performance cold mix, as defined in 819, at a rate of 3 inches per inch of elevation.

E. SURFACE COURSE RESTORATION-MILL AND OVERLAY LIMITS

1. **Width** - The Contractor shall mill and overlay the entire width of the affected lane or lanes.

2. **Length** - If the utility cut is less than 30 feet in length, the Contractor shall mill and overlay the length of the cut plus the sections from each end of the cut to the nearest traverse pavement joint. If the utility cut is 30 feet or greater in length, the Contractor shall mill and overlay the entire length of the block.

3. **Special Cases**

   a. ***Special Case 1*** - Utility cut in two adjacent traffic lanes and crossing a longitudinal pavement joint

      L_1 = distance in a traffic lane from the start of a utility repair to the transverse pavement joint nearest to the cross-over to the adjacent lane

      L_2 = distance in an adjacent lane from the end of the utility repair to the transverse joint nearest to the cross-over from the adjacent lane.

      i. If L_1 is less than 30 feet, the Contractor shall mill and overlay the length of L_1 plus the sections from each end of L_1 to the nearest transverse joints. If L_2 is less than 30 feet, the same paving requirements apply.

      ii. If either L_1 or L_2 are greater than 30 feet in length, the Contractor shall mill and overlay the full length of the block.

      iii. In all cases, the Contractor shall make all cuts in the base course parallel to either longitudinal or transverse joints.

   b. ***Special Case 2 – Diagonal Utility Cut*** - If the utility cut is diagonal, the Contractor must replace the base course slab(s) through which the cut runs from joint to joint. The previous requirements on the length and width of milling and overlaying apply.

   c. ***Full Slab Replacement Option*** - The Contractor may fully replace all base course slabs affected by utility cuts in lieu of the above option of partial replacement and milling and overlaying of the surface course.

215.04 PCC PAVEMENTS

A. TRENCH EXCAVATION AND BACKFILL - The Contractor shall excavate and backfill the trench according to 215.03(A) and (B). Flowable fill is an acceptable option.

B. RESTORATION OF PAVEMENT - The Contractor shall replace pavement from joint to joint for each section affected by a utility cut. Tie rods shall be placed in the concrete at approximately half the depth of the repair and shall be embedded half the length of the rod as per Section 505.04(C). Tie rods for this purpose shall meet the requirements of 807.04 except that a length of only 20 inches will be required.

215.05 FLEXIBLE PAVEMENTS

A. TRENCH EXCAVATION AND BACKFILL - The Contractor shall excavate and backfill the trench according to 215.03(A) and (B). Flowable fill is an acceptable option.

B. RESTORATION OF SUBBASE

1. **Restoration of Cut** - The Contractor shall cut the pavement with a 6 inch shoulder around the trench. All cuts shall be either parallel or perpendicular to the curb. All cuts shall be made to the pavement's full depth and shall be made to a neat line with a power saw.

2. **Placement of Subbase** - The Contractor shall place 12 inches of stone based aggregate to within 7 inches of the riding surface. If the Contractor chooses to use flowable fill, aggregate sub base is not required. The flowable fill shall also be placed to within 7 inches of the riding surface.

C. RESTORATION OF PAVEMENT

1. **Restoration of Base Course** - The Contractor shall place 5 inches of approved base asphalt in two lifts.

2. **Restoration of Surface Course** - The Contractor shall place 2 inches of approved surface asphalt to the same grade as the roadway.

215.06 CROSSWALKS AND SIDEWALKS

A. CROSSWALKS - If a utility cut intersects one (1) or more crosswalk(s) with any material other than that of the surrounding roadway, it must be permanently restored to its original condition, and the materials used shall be identical to those of the original crosswalk(s).

B. SIDEWALKS - Contractor must restore sidewalk to its original condition using original bricks taken from the sidewalk, where feasible, or using materials similar to those of the original sidewalk.

215.07 PAVEMENT MARKINGS

If any pavement markings are affected by a utility cut, the Contractor shall replace them with temporary pavement markings within forty-eight (48) hours. Immediately upon the completion of a permanent repair, the Contractor shall replace temporary pavement markings with permanent markings per DDOT Standard Drawings. A crosswalk or stop bar must be replaced in its entirety.

215.08 REMOVAL OF PAVEMENT MARKINGS

When the location of underground utilities must be temporarily marked on the overlying pavement, the party requesting the markings shall remove all markings immediately upon:

- Completion of the excavation;
- At the time the markings are no longer necessary; or
- Twenty (20) days after a permit is granted where excavation has not commenced.

215.09 MEASURE AND PAYMENT

The unit of measure for trench restoration shall be the cubic yard. The unit of measure for asphalt shall the ton. The unit of measure for PCC shall be the square yard or cubic yard, as specified in the Contract Documents. Asphalt and PCC restoration shall be paid for through the appropriate Asphalt or PCC Standard Item.

801 HYDRAULIC CEMENT/CEMENTIOUS MATERIALS

801.01 PORTLAND CEMENT

A. GENERAL - Unless specified otherwise, Portland Cement shall be as specified in 801.01(B), except that for sewer and water work, Portland Cement shall be as specified in 801.01(C). The cement may be accepted on the basis of a manufacturer's certification furnished in accordance with the requirements of 106.13.

The temperature of the cement at time of delivery to the mixer shall not exceed 160°F. Different brands of cement, the same brand of cement from different sources, or cements for which the chemical analysis indicates them to be of different types shall not be mixed for use on a project. Different brands of cement or the same brand of cement from different sources may be used alternately on a project only in case of an emergency and with the specific approval of the Engineer.

For Portland Cement used in concrete with aggregates that are deleteriously reactive, refer to Section 817.03.C

B. STANDARD PORTLAND CEMENT - Standard Portland Cement shall meet the requirements of AASHTO M 85, Type I.

C. MODERATE HEAT OF HYDRATION PORTLAND CEMENT - Moderate heat of hydration Portland Cement for sewer and water work shall meet the requirements of AASHTO M 85, Type II.

D. HIGH EARLY STRENGTH PORTLAND CEMENT - High early strength Portland Cement shall meet the requirements of AASHTO M 85, Type III.

E. WHITE PORTLAND CEMENT - Portland Cement for white Portland Cement Concrete shall meet the requirements of AASHTO M 85, Type I, except that the cement shall contain no more than ½ percent of Ferric Oxide (Fe_2O_3) by weight.

801.02 MASONRY CEMENT

Masonry cement shall meet the requirements of ASTM C 91, Type M unless otherwise specified.

Masonry cement may be accepted on the basis of a manufacturer's certification furnished in accordance with the requirements of Masonry Cement Mill Certification available from the Engineer of Materials and Research. Different brands of cement or the same brand of cement from different sources may be used alternately on a project in the case of emergency and with the approval of the Engineer.

801.03 BLENDED HYDRAULIC CEMENT

Blended hydraulic cement shall conform to AASHTO M 240 for Type IS or IP. A manufacturer's certification shall be furnished indicating the source, amount, and composition of the blended cement, and indicate that the material was tested during production or transfer in accordance with this specification, and a report of the test results shall be furnished at the time of shipment.

801.04 GRANULATED IRON BLAST FURNACE SLAG

Granulated slag, when used as a substitute for Portland Cement, shall conform to the requirements of ASTM C 989, Grade 120 or Grade 100. When blended with Portland Cement, the blend shall meet the requirements of 801.03, AASHTO M 240, Type 1S. Certification requirements of ASTM C 989 apply.

801.05 FLY ASH USED IN PORTLAND CEMENT CONCRETE

Fly ash used in Portland Cement Concrete shall meet the requirements of AASHTO M 295, Class C or Class F, except that the maximum loss in ignition for Class C and Class F shall be 4.0 percent. The supplemental requirements of Table 2A shall apply when required by the Engineer. When blended with Portland Cement, the blend shall meet the requirements of 801.03, and AASHTO M 240, Type 1P.

Written certification is required that all pozzolan meets these Specifications for physical and chemical requirements.

803 AGGREGATES

803.01 FINE AGGREGATE FOR PORTLAND CEMENT CONCRETE

Fine aggregates for Portland Cement Concrete (other than lightweight aggregate) shall meet the size and quality requirements of AASHTO M 6 as modified herein. The weighted loss shall not exceed 15 percent by weight when the fine aggregate is subjected to 5 cycles of the magnesium sulfate soundness test, as per AASHTO T 104.

To determine the degree of uniformity of the fine aggregate, fineness modulus (FM) determinations shall be made on representative samples from each source. Thereafter, if the fineness modulus varies by more than 0.20 from the value established on representative samples, the fine aggregate shall be rejected until suitable adjustments are made in the concrete proportions to compensate for the difference in grading.

Alkaline reactivity of fine aggregate shall be tested in accordance with Section 817.03.C.

The amount of deleterious substances shall meet the requirements of AASHTO M 6, Class A. Chert, metaquartzite, or a combination of both shall not exceed 8 percent by weight per ASTM C 295.

Organic impurities shall produce a color not darker than Organic Plate No. 2 per AASHTO T 21 or ASTM C 40.

Fine aggregate for Portland Cement Concrete shall be well graded from coarse to fine and shall conform to the requirements of AASHTO M 6.

803.02 COARSE AGGREGATE FOR PORTLAND CEMENT CONCRETE

Coarse aggregate for Portland Cement Concrete, (other than light-weight aggregates) shall consist of gravel, crushed gravel, crushed stone, crushed air-cooled blast furnace slag, crushed trap rock, or other approved inert materials of similar characteristics, or a combination thereof as specified, and shall meet the quality requirements of AASHTO M 80, and shall meet the size requirements of AASHTO T 96.

The percentage of wear as determined by the Los Angeles Abrasion Test shall not exceed 40, as per AASHTO T 96. The weighted percentage of loss shall not exceed 15 percent by weight when the coarse aggregate is subjected to 5 cycles of the magnesium sulfate soundness test per AASHTO T 104.

The amount of deleterious substance shall meet the requirements of AASHTO M 6, Class A.

Chert, metaquartzite or a combination of both shall not exceed 3 percent by weight per ASTM C 295.

For alkali-carbonate reactive constituents, refer to Section 817.03.C.

Organic impurities shall produce a color not darker than Organic Plate No. 1 per AASHTO T 21 or ASTM C 40.

After first dry sieving on the No. 200 sieve in accordance with AASHTO T 27, the adherent coating on coarse aggregate as tested in accordance with AASHTO T 11, with a wetting agent added to the wash water, shall not exceed 1 percent by weight.

803.03 FINE AGGREGATE FOR BITUMINOUS CONCRETE

A. FOR HOT ASPHALTIC CONCRETE PAVEMENT - Fine aggregate for hot asphaltic concrete pavement shall meet the general requirements of AASHTO M 29. The gradation of the fine aggregate or a combination of fine aggregates shall be such that, when combined with the other mix ingredients, it will produce the specified bituminous paving mixture. Each of the fine aggregates, when subjected to 5 cycles of the magnesium sulfate soundness test, shall have a weighted loss of not more than 20 percent.

Each individual ingredient or source of material combined to be fine aggregate, and the fine aggregate as a whole shall contain no clay lumps and shall be non plastic.

B. STONE-FILLED SHEET ASPHALT FOR JOINT REPAIR - Fine aggregates for stone-filled sheet asphalt surface shall meet the quality requirements of 803.03(A). The gradation of the fine aggregates or combination of fine aggregates shall be such that it will produce the specified bituminous mixture properties when combined with other mixed ingredients. The combined fine aggregates shall consist of not less than 40 percent by weight of crushed stones Grade No. 10 from an approved source containing from 8 to 15 percent fines passing the No. 200 sieve. The fine siliceous natural sand shall meet

the gradation requirements for mortar sand per 803.06(A) except that the quantity passing the No. 200 sieve shall not exceed 6 percent.

803.04 COARSE AGGREGATE FOR BITUMINOUS CONCRETE

Crushed stone or graded aggregate supplied from a quarry producing aggregates of asbestos bearing content or having asbestos present at the quarry are prohibited. Should such aggregates be utilized, both the Contractor and the stone supplier will be directed to remove all asbestos bearing aggregates and replace them with non asbestos bearing aggregates. The Contractor and supplier shall further be liable for any and all consequential damages which may result as a violation of this requirement.

A. GENERAL - Coarse aggregate for use in bituminous mixtures shall be crushed stone. Coarse aggregate for surface course shall be non-polishing rock. The portion of the total aggregate passing the No. 4 sieve shall have a sand equivalent value of not less than 35 when tested in accordance with AASHTO T 176. The portion of aggregate retained on the 9.5 mm (3/8 inch) sieve shall not contain more than 15 percent of particles by weight so flat or elongated, or both, that the ratio between the maximum and the minimum dimensions of a circumscribing rectangular prism exceeds 5:1. Coarse aggregate for bituminous concrete shall conform to the following:

TABLE 803.04 COARSE AGGREGATE SPECIFICATIONS

Abrasion by Use of Los Angeles Machine Percentage of Wear, maximum	40
Soundness, Weighted Average, Percent Loss, Maximum, 5 cycles, Magnesium Sulfate	15
Total Material finer than No. 200 sieve (AASHTO T 11), maximum percent by weight	
Material which contains clay or shale	1.0
Material free of clay or shale	1.5

After first dry sieving on the No. 200 sieve in accordance with AASHTO T 27, the adherent coating on coarse aggregate as tested in accordance with AASHTO T 11 shall not exceed 1 percent.

B. COARSE AGGREGATE FOR BITUMINOUS SURFACE COURSES - Coarse aggregate for bituminous Surface Courses shall conform to the quality requirements of 803.04(A) and aggregates containing a substantial portion of serpentine or talc minerals or carbonate aggregates containing less than 25 percent by weight insoluble residue, as determined by in sizes No. 200 to No. 10, shall not be used in surface course mixes. Shale and other material susceptible of polish shall not be used.

C. COARSE AGGREGATE FOR BITUMINOUS BASE AND BINDER COURSES - Coarse aggregate for bituminous base and binder courses shall conform to the quality requirements of 803.04(A).

803.05 MINERAL FILLER FOR BITUMINOUS CONCRETE

Mineral filler shall be limestone dust, hydrated lime or Portland Cement meeting the requirements of ASTM D 242.

Fly ash shall not be used as mineral filler unless approved by the Engineer. The mineral filler shall be uniformly graded, non plastic, free from lumps or balls or any foreign materials and shall have a moisture content of not more than 0.5 percent when incorporated into the bituminous mixture.

Mineral filler shall be graded within the following limits:

TABLE 803.05 MINERAL FILTER GRADES

Sieve Designation	Percent Passing By Weight
No. 16	100
No. 30	97-100
No. 50	95-100
No. 200	70-100

817 PORTLAND CEMENT CONCRETE MIXTURES

817.01 PCC MIX DESIGN

A. GENERAL - Concrete shall be proportioned within allowable tolerances of an approved mix design. An approved mix design shall consist of an approved concrete producer, materials sources, class of concrete, and material types and proportions. Mix designs for each project must be approved by the Engineer. Approval of a mix design for a specific project, purpose, or use does not approve its use for any other project, purpose, or use. Information submitted shall have been obtained from measurements on a trial mix prepared with ingredients from the same source(s) as proposed for use. Mix designs shall have been prepared within twelve (12) months prior to the date submitted. In the event such a mix design is not in full compliance with applicable Specifications, further production of that PCC mix shall be suspended until an approved mix design has been obtained in accordance with these specification requirements. Any deviation from the approved mix design will require the approval of the Engineer.

Methods of proportioning mix designs shall be in conformance with ACI 211.1 for normal and heavy weight concrete, ACI 211.2 for lightweight concrete, and ACI 211.3 for no slump concrete.

Concrete producers should submit each mix design at the beginning of the calendar year to the Department for review and approval.

Ground granulated blast furnace slag should be used in all Class A and Class B mixtures and other mixes as required.

Each PCC mix design submitted for approval shall include the following:

1. Name and location of Project and Contract number

2. Name and address of Contractor

3. Name and address of concrete producer

4. Mix design designation(s)

5. Class(es) of concrete

6. Uses of concrete

7. Source name and location of fine aggregate, coarse aggregate, cement, admixtures and water.

8. Type of cement

9. Cement content in pounds per cubic yard of concrete

10. Saturated surface dry weight of coarse and fine aggregates in pound per cubic yard of concrete.

11. Water content, including free moisture in the aggregate, plus water in the drum, exclusive of absorbed moisture.

12. Dosage of admixture(s).

13. Sieve analysis of fine and coarse aggregate.

14. Absorption of fine and coarse aggregate.

15. Bulk specific gravity (dry and SSD) of fine and coarse aggregate.

16. Dry rodded unit weight of coarse aggregate in pounds per cubic foot.

17. Fineness Modulus (FM) of fine aggregate.

18. Materials certification for cement, admixtures and aggregates.

19. Slump of plastic concrete in inches.

20. Air content of plastic concrete in percent by volume.

21. Unit weight of plastic concrete in pounds per cubic foot.

22. Seven (7) day compressive strength of concrete in pounds per square inch.

23. Twenty-eight (28) day compressive strength of concrete in pounds per square inch.

Up to fifty (50) Calendar Days may be required for review of a proposed PCC mix design in Category 1 or 3 after it has been submitted for approval. In order to minimize the time between Notice to Proceed and completion of mix design reviews for Category 3 submittals, the apparently successful bidding Contractor may submit proposed mix designs for Project approval at anytime after bid opening date. Review of alternate mix designs may require longer than fifty (50) Calendar Days.

B. PROPORTIONS - Concrete mixtures shall be proportioned so as to secure a workable, homogeneous, placeable mixture which meets the requirements of 817.03 for its intended use. The concrete shall be proportioned by weight and shall consist of Portland Cement, fine aggregate, coarse aggregate, water, admixture(s) and other ingredients as may be specified. Unless specified otherwise, strength values are the average of 2 companion test cylinders.

817.02 MATERIALS

- 801.01: Portland Cement
- 801.04: Granulated Iron Blast Furnace Slag
- 801.02: Masonry Cement
- 801.05: Fly Ash
- Fine Aggregate
  - 803.01: Normal Weight
  - 803.07: Light Weight
- Coarse Aggregate
  - 803.02: Normal Weight
  - 803.07: Light Weight
- Admixtures
  - 814. 03: Air Entraining
  - 814.04: Chemical Admixtures
  - 814.05: Color
- 822.01: Water
- 822.15: Formulated Latex Modifier

817.03 DESIGN CRITERIA

Proportions of concrete shall be such that the design criteria herein are met for the respective class of concrete.

A. CLASSES OF CONCRETE - Unless otherwise specified, the following classes of concrete shall be as specified in Table 817.03.A.

TABLE 817.03 (A) CLASSES OF CONCRETE

Class	Designation	Uses
A	Structural	Bridge decks, sidewalks, approach slabs, and medians for superstructures. Suitable for all uses specified for Class B, Structural.
B	Structural	Reinforced structures, footings, slabs, beams, girders, columns, piers, abutments, walls, arch ribs, box culverts, precast piles, traffic barriers, and cribbing. Sewer and water work except thrust blocks and pipe cradle.
C	High Early Strength	For special and emergency uses as approved by the Engineer.
D	Prestressed	Used for prestressed or post tensioned members.
E	Paving	Alleys, alley and driveway entrances, curbs and gutters, pavements, and base.
F	General	For general use and in sidewalks, bike paths, or as specified.
H	Lightweight	As specified.
I	Latex Modified	As specified.

B. DESIGN REQUIREMENTS - Granulated slag may be used in an amount not to exceed 50 percent by weight of cement. Cement factor and water-cement ratio is determined on basis of combined ground granulated blast-furnace slag and Portland Cement weight.

Fly ash and granulated slag may not be used in the same mixture.

TABLE 817.03 (B) PORTLAND CEMENT CONCRETE MIXTURES

The Concrete Mixes Shall Conform to the Following:

Class Designation	Min. 28 Day Compressive Strength (psi)[a]	Min. Cement Content (Lbs/Yd^3)	Max. Water (Lbs. Water Per Lbs. Cement)	Coarse Aggregate Size No.[b]	Slump (In.)[c]	Field Air Content (% by Volume)	Max. Unit Weight (Lbs./Ft.^{3})
A[bdgh] STRUCTURAL	4,500	640	0.44	57 or 67	2 – 3	5 - 8	
B[bdgh] STRUCTURAL	4,500	640	0.44	57 or 67	2 – 3	5 - 8	
C[dj] HIGH EARLY	3,000(24 HRS)	800	0.38	57	0 – 3	5 - 8	
D[dgh] PRESTRESSED	5,000	680	0.43	57	0 – 4	5 - 8	
E[bdgh] PAVING	3,500	565	0.49	57[i], 57 & 4 or 67 & 4	0 - 3	5 - 8	
F[gh] GENERAL	3,500	565	0.49	67, 57, 57 & or 67 & 4	1 – 5	5 - 8	
G PIPE CRADLE (ONLY)	2,500	470	0.55	67, 57	1 – 5	5 - 8	
H1[dgi] LIGHTWEIGHT	4,000	658	0.44	3/4 to 4	0 – 4	5 – 8	122 - PLASTIC 117-28 DAD*
H2[gi] LIGHTWEIGHT	4,000	658	0.44	3/4 to 4	0 – 4	5 – 8	115 – PLASTIC 110-28 DAD*
I[def] LATEX MODIFIED	4,500	660	0.40	7	4 – 6	3 – 7	

*DAD = Day Air Dry

a The Materials Engineer may approve mix designs, pending twenty-eight (28) day strength results based on

the seven (7) day compressive strength for which results equal or exceed 85 percent of the compressive strength and provided that no accelerator or early strength cements are used (except for Class "C"). The compressive strength is defined as the average of 2 cylinders made in the field and cured in the Laboratory.

b Crushed trap rock and other non-polishing crushed stone may be approved by the Engineer for finished concrete bridge decks, sidewalks, median superstructures, and finished concrete roadways. Polish susceptible aggregates as defined in 803.02 shall not be used for concrete pavement surfaces.

c A maximum slump as limited by the mix design will be allowed for concrete approved with water reducing admixtures. High range water reducer may be used for concrete to be placed at higher slump with the approval of the Engineer provided that there is no aggregate segregation and the entrained air of the concrete at point of placement is within acceptable range.

d Polish susceptible fine aggregates shall not be used for concrete paving surfaces.

e Latex emulsion shall not exceed 3.5 gallons per 94 pounds cement. The latex will weigh approximately 8.40 to 8.55 pounds per gallon.

f Latex emulsion is included as part of the maximum water.

g Fly ash may be substituted for cement such that not more than 15 percent by weight of cement is removed. The mix may require more fly ash added than cement removed. Cement factor and water-cement ratio determined on basis of combined fly ash (replacing the cement) and cement weight. Granulated slag may be used in an amount not to exceed 50 percent by weight of cement. Cement Factor and water-cement ratio is determined on basis of combined granulated slag and cement. Fly ash and granulated slag may not be used in the same mixture for cement substitute.

h The chert content of the combined coarse aggregate shall be less than 3.0 percent as per AASHTO M 80 Class A.

i Coarse and fine aggregate shall conform to 803.07.

j Must be approved by the Engineer prior to use.

k Granulated Iron Blast Furnace Slag

1. The Engineer may approve, pending twenty-eight (28) day strength results, mix designs on the basis that seven (7) day compressive strength results equal or exceed 85 percent of the minimum average strength requirement as determined in 817.03(B) provided no accelerators or early strength cements are used.

2. Crushed trap rock and other non-polishing crushed stone may be approved by the Engineer for finished concrete bridge decks, sidewalks, median superstructures, and finished concrete roadways as per 803.02.

3. Consistency limits are those allowable with water. A maximum slump as limited by the mix design will be allowed for concrete approved with water reducing admixtures.

4. Fine aggregate shall conform to 803.01.

5. Light weight fine aggregate shall conform to 803.07.

6. Latex emulsion conforming to 822.15 shall be added in an amount of 3.5 gallons per 94 pounds of cement. The latex will weigh approximately 8.40 to 8.55 pounds per gallon. Proportions of cement to fine aggregate to coarse aggregate on a dry weight basis shall be 1 to 2.5 to 2.0 with a tolerance of 10 percent on the fine and coarse aggregate ratios.

7. Latex emulsion is included as part of the maximum water.

8. Fly ash may be substituted for cement such that not more than 15 percent by weight of cement is removed. The mix may require more fly ash added than cement removed. Cement factor and water-cement ratio determined on basis of combined fly ash and cement weight. Fly ash shall conform to the requirements of 801.05.

C. PROTECTION OF CONCRETE AGAINST ALKALI REACTIVITY –

Preventive Measures for Aggregate Alkali-Silica Reactivity (ASR). All aggregate, both coarse and fine, intended for use in concrete shall be tested for ASR in accordance with C 1260. Testing shall be performed by an accredited laboratory. Coarse and fine aggregate from the same source shall be tested separately. Testing shall be performed once every 3 years.

The following limitations apply for C 1260 results:

EXPANSION @ 14 DAYS	CLASS AND REACTIVITY STATUS	MITIGATION NOTE
≤0.10%	RO – Innocuous	No mitigation required
>0.10 but ≤0.20%	R1 – Potentially Reactive	Mitigation Required*
>0.20 but ≤0.30%	R2 – Reactive	Mitigation Required*
.0.30%	Highly Reactive	Shall not be used in PCC

*See Table 817.03.C for the minimum Supplementary Cementitious Material (SCM) replacement levels for ASR mitigation

Optional C 1293 Concrete Prism Testing. Testing in accordance with C 1293 is non mandatory but recommended. The test may be used to verify the ASR class status of aggregate having C 1260 result greater than 0.10 percent expansion. If C 1293 testing is not performed, then compliance is assessed based entirely on the C 1260 result.

The requirements for compliance when using C 1293 are as follows,

(a) Test frequency is once every 3 years.

(b) The Administration will not perform this test. Testing must be performed by an accredited laboratory.

(c) Coarse and Fine aggregate from the same source shall be tested separately.

(d) Each sample shall be split and tested in accordance with both C 1260 and C 1293. This is required to provide comparable data for future reference. Scheduling of the testing is at the producer's discretion, but both results must be submitted together for approval review.

(e) The C 1293 result will supersede the C 1260 result for compliance status.

The following limitations apply for C 1293 results:

EXPANSION AT 1 YEAR	CLASS AND REACTIVITY STATUS	MITIGATION NOTE
≤0.04%	RO – Innocuous	No mitigation required
>0.04 but ≤0.12%	R1 – Potentially Reactive	Mitigation Required*
>0.12 but ≤0.24%	R2 – Reactive	Mitigation Required* **No structural uses allowed.**
.0.24%	Highly Reactive	Shall not be used in PCC

*See Table 817.03.C for the minimum Supplementary Cementitious Material (SCM) replacement levels for ASR mitigation

TABLE 817.03.C

SCM Type	**Low** Alkali Cement (≤0.7% Na_2O equiv.) **R1**	**Normal** Alkali Cement (0.7% to 1.0% Na_2O equiv.) **R1**	**Low** to **Normal** Alkali Cement (≤0.1% Na_2O equiv.) **R2**
Class F Fly Ash	25%	25%	25%
Slag (GGBFS)	35%	50%	50%
Ternary Blends	Approval Required	Approval Required	Approval Required

Ternary blends using two SCM's will require C 1567 testing by an accredited laboratory. The expansion test results shall not be greater than 0.10 percent to be considered acceptable. Changes to the SCM blend percentages will require retesting.

817.04 DESIGN ADJUSTMENTS

Concrete mix design can be revised to improve placement during cold, hot, or unusual weather as long as the requirements of 803 are met and the revision is approved by the Engineer.

When sources of materials change from those of the approved mix design or when the fineness modulus of the fine aggregate changes by more than 0.20 from the mix design, the mix design will be reviewed and may require a new design.

In the event concrete with the required workability or consistency cannot be obtained within the maximum water cement ratio with the materials furnished by the Contractor or producer, changes shall be made as necessary to secure the desired properties subject to the requirements of 817 and the approval of the Engineer.

817.05 LOW PERMEABILTY STRUCTURAL CONCRETE

At least 2 trial batches shall be prepared using approved Portland Cement Concrete (PCC) mix design materials. Test specimens shall be cast by the Contractor and tested by a certified laboratory for permeability and strength at least thirty (30) Calendar Days prior to construction. The permeability samples shall be cylindrical, 4 inches in diameter and 6 inches in length. The samples shall be moist cured as per ASTM C 39, except that the last twenty-one (21) days shall be cured at a temperature of 38° C ± 6° (100 ° F ± 10°). Test cylinders shall be tested at twenty-eight (28) Calendar Days as per ASTM C 1202 and reported as the average of 2 test specimens from each lot (100 cubic yards). Permeability values obtained for trial batches shall be 500 coulombs below the maximum values specified in Table 817.05.

A. ACCEPTANCE TESTS - A lot shall be a day's production of PCC for the job. For each set of cylinders made for compressive strength tests, 2 additional cylinders shall be made for the permeability testing purposes.

For all classes of PCC, initially 1 set of permeability cylinders shall be tested in accordance with AASHTO T 277. If the average coulomb value for this test is less than the value shown in Table 817.05, the lot will be accepted at the full Contract unit price.

If the average test result exceeds the coulomb value in Table 817.05, payment for PCC in that element (in-place cost) shall be reduced 0.005 percent for each coulomb above the coulomb value given in Table 817.05. However, the reduction in price shall not exceed 5 percent of the bid price of the PCC. PCC with a coulomb value that exceeds the maximum allowed in Table 817.05 by 1000 coulombs shall be rejected. However, bridge deck PCC with a coulomb value exceeding the maximum by over 1000 coulombs or more may be accepted by the Engineer at 95 percent of the Contract bid price provided it meets the minimum compressive strength requirement, and the Contractor applies an epoxy PCC overlay at his own expense. In such cases, deck grooving will not be required. Any adjustments to the Roadway grade shall be made as required by the Engineer at the Contractor's expense.

PCC abutments and pier caps with a coulomb value that exceeds the maximum required in Table 817.05 by more than 1000 coulombs may be accepted at 95 percent of the Contract bid price provided that the compressive strength meets the Contract minimum specified requirements and that the Contractor applies an approved epoxy overlay, at his expense.

The reduction in the bid price specified above shall be applied to the total volume of PCC in the Bridge members (deck slab of a single span, deck slab of a group of continuous spans, pier or abutments), of which any portion of the PCC in the member did not meet the permeability test requirements.

TABLE 817.05 COULOMB REQUIREMENTS

PCC Class Requirement	Approved Use(s)	Coulomb
Class A Structural	Bridge Decks, Sidewalks Approach Slabs, Medians For Superstructures, Suitable for all Class B Structural specified uses	1,500 Max
Class B Structural	Reinforced Structures- Footings, Beams, Girders, Columns, Piers, Abutments, Walls, Arched Ribs, Box Culverts Pre-cast Piles, Traffic Barriers, and Cribbing	2,000 Max.
Class H Lightweight	As Specified	1,500 Max.
Latex Modified	As Specified	1,500 Max

817.06 CONSTRUCTION METHODS

Aggregates and Portland Cement shall be proportioned by weight; water may be proportioned by volume or by weight. Batch weights of aggregates for the concrete shall be corrected for free moisture, as calculated from moisture determination performed by the Contractor. These moisture determinations shall be made at a minimum of every four (4) hours. PCC consistency shall be checked in accordance with 501.15.

All tolerances for measurement of materials will be applied to the approved mix design quantities. Tolerances for proportioning are as follows:

TABLE 817.06 TOLERANCES FOR MATERIALS

Material	Tolerance, Percent by Weight of Mix Design
Cement	+ 4, - 0
Coarse Aggregate	± 2
Fine Aggregate	± 2
Water	± 1
Admixtures	± 3

The approved mix design shall not be changed except as provided below:

A. ADJUSTMENT FOR VARIATION IN FINENESS MODULUS (FM) - If the FM of the fine aggregate exceeds the limits specified in 803.01, the mix design shall be adjusted as provided in 817.04.

B. ADJUSTMENTS FOR NEW MATERIALS - Change in source or character of the materials shall be made only after tests on trial mixes and with the Engineer's written approval.