

INDEX

DIVISION VII

PAGE NO.

SECTION 701	PORTLAND CEMENT CONCRETE	701
701.01	Portland Cement	701
701.02	Air-Entraining Portland Cement	701
701.03	Air-Entraining Admixtures	702
701.04	Chemical Admixtures	702
701.05	Mix Design	702
701.06	Water	702
701.07	Fine Aggregate for Portland Cement and Mortar	703
701.08	Coarse Aggregate for Portland Cement Concrete	703
SECTION 704	SLURRY SEAL	705
704.01	Materials	705
704.02	Composition of Mixtures	705
704.03	Tolerances	706
704.04	Sampling and Testing	706
SECTION 706	AGGREGATE, MISCELLANEOUS USES	707
706.01	Aggregate for Traffic Bound Surface Course	707
706.02	Soil Aggregate for Sand Cushion	708
706.03	Aggregate for Aggregate Base	708
SECTION 707	LIME	710
707.01	Hydrated Lime	710
707.02	Quick Lime	710
707.03	Agricultural Limestone	710
SECTION 708	MIXTURES FOR PLANT MIX, BITUMINOUS BASES, SURFACES	711
708.01	Approval of Materials	711
708.02	Mineral Aggregate	711
708.03	Asphalt Materials	713
708.04	Composition of Mixtures	720
708.05	Tolerances	724
708.06	Sampling and Testing	725
SECTION 710	PIPE CONDUITS	727
710.01	Concrete Pipe	727
710.02	Corrugated Galvanized Iron or Steel Culverts and Underdrains	728
710.03	Steel End Sections	728
710.04	Corrugated Polyethylene Pipe	729
SECTION 712	MASONRY BRICK	730
712.01	Masonry Brick Made From Clay or Shale	730
712.02	Concrete Building Brick	730
SECTION 713	CONCRETE CURBS AND GUTTERS	731
713.01	Materials	731
SECTION 722	JOINT FILLERS AND SEALERS FOR PORTLAND CEMENT	732
722.01	Preformed Expansion Joint Filler (Bituminous Type)	732
722.02	Preformed Expansion Joint Filler (Non-Extruding and Resilient Types)	732
722.03	Hot Poured Sealing Filler for Expansion, Contraction and Longitudinal Joints	732

722.04	Ready Mixed Cold Applied Joint Sealer for Expansion, Contraction, and Longitudinal Joints	732
722.05	Preformed Elastomeric Compression Joint Sealer	733
722.06	Polymer Type, Two Component Cold Applied Machine Extruded and Pourable Joint Sealer	734
SECTION 723	REINFORCING STEEL	736
723.01	Bar Steel Reinforcement (Billet Steel)	736
723.02	Reinforcing Steel (Axle Steel)	736
723.03	Wire Fabric Reinforcement	736
SECTION 724	MISCELLANEOUS MATERIALS	737
724.01	Metal Caps for Slip Dowel Bars	737
724.02	Wire Ties and Tie Wire	737
724.03	Metal Parting Strips	737
SECTION 734	CURING AGENTS FOR CONCRETE	738
734.01	Burlap	738
734.02	White Pigmented Membrane Curing Compound	738
734.03	Red Membrane Curing Compound	739
734.04	White Polyethylene Sheeting	740
734.05	Polyethylene Burlap	740
SECTION 735	CONCRETE SURFACE FINISH FOR STRUCTURES	741
735.01	Heavy Cement Base Mortar	741
735.02	Paint Type Spray Finish	741

SECTION 701

PORTLAND CEMENT CONCRETE

This specification covers all materials, mix designs, proportioning and testing of Portland Cement Concrete. All concrete shall be air-entrained unless otherwise shown on the plans.

701.01 PORTLAND CEMENT:

(A) Materials Covered: These specifications cover three types of Portland Cement, as follows:

Type I: For use in concrete for general concrete construction. When white Portland Cement is required, it shall meet the requirements of Type I.

Type II: For use in concrete exposed to moderate sulphate action or moderate heat of hydration, when specified on the plans or in the proposal.

Type III: For use when High-Early-Strength Concrete is required.

(B) Specifications: Portland Cement shall conform to the requirements of AASHTO M 85.

Unless otherwise permitted by the Engineer, the product of only one mill of any one brand and type of Portland Cement shall be used on the project, except for reduction of any excessive air-entrainment where air-entraining cement is used.

(C) Storage: The Contractor shall provide suitable means for storing and protecting the cement against dampness. Cement which, for any reason, has become partially set or which contains lumps of caked cement, will be rejected. Cement salvaged from discarded or used bags shall not be used.

(D) Methods of Sampling and Test: All methods shall be in accordance with the requirements of AASHTO M 85.

701.02 AIR-ENTRAINING PORTLAND CEMENT:

(A) Materials Covered: These specifications cover three types of air-entraining Portland Cement for use where air-entrainment is desired, as follows:

Type IA: For use in concrete for general concrete construction.

Type IIA: For use in concrete exposed to moderate sulfate action or moderate heat of hydration, when specified on the plans or in the proposal.

Type IIIA: For use when High-Early-Strength Concrete is required.

Unless otherwise permitted by the Engineer, the product of only one mill of any one brand and type of Portland Cement shall be used on the project, except for reduction of any excessive air-entrainment.

(B) Specifications: Air-Entraining Portland shall be of a standard brand and shall conform to all of the requirements of AASHTO M 134 for the particular type being used.

(C) Storage: Storage shall conform to Subsection 701.01(C).

SECTION 701 - PORTLAND CEMENT CONCRETE

701.03 AIR-ENTRAINING ADMIXTURES: Air-entraining admixtures for air-entrained concrete shall be those approved by the Engineer. The manufacturer shall present certified evidence that a given admixture meets all the requirements of AASHTO M 154.

An exception to the above requirement may be granted in the case of admixtures manufactured by neutralizing Vinsol resin with Caustic Soda provided the manufacturer furnishes certification that the product is Neutralized Vinsol resin and contains no other additive.

701.04 CHEMICAL ADMIXTURES: When a particular type of chemical admixture is specified, it shall conform to AASHTO M 194.

Compliance with AASHTO M 194 as evidenced by certified copies of the test reports conducted by an independent laboratory and filed with the Engineer is required for qualification of each commercially named chemical admixture proposed for the use under these specifications.

The Contractor shall furnish the Engineer a written statement from the manufacturer with each lot or shipment to the effect that the admixture supplied for use in the work is identical in all essential respects, including concentration, to the admixture tested under these specifications.

701.05 MIX DESIGN: When the 28 day compressive strength requirements is not expressly indicated on the plans or in the Special Provisions, the following shall govern:

<u>Location</u>	<u>28-Day Compressive Strength (lbs)</u>	<u>Air Content (%)</u>	<u>Slump (Inches)</u>
Curb and Gutter	3,000	5-7	1-3
Pavement Slab	3,500	5-7	1-3
Sidewalks and Driveways	3,000	5-7	1-3
Reinforced Concrete			
Box Culverts	4,000	5-7	1-3
Concrete Ditch Lining	3,000	5-7	2-4

701.06 WATER:

(A) Quality: All water used in mixing or curing Portland Cement concrete or cement treated base shall be clean and practically free from oil, salt, acid, alkali, organic matter or other substances injurious to the finished product.

(B) Tests: When required by the Engineer, the quality of the mixing water shall be determined in accordance with AASHTO T 16.

(C) Deleterious Substances: The amount of deleterious substance shall not exceed the following limits:

Clay lumps (wet on No. 4 sieve)	0.5%
Coal and lignite	1.0%
Material passing the No. 200 sieve	3.0%

When tests are made comparing the water with water of known satisfactory quality, any indication of unsoundness, marked change in time or set, or reduction in mortar strength shall be sufficient cause for rejection of the water under test.

SECTION 701 - PORTLAND CEMENT CONCRETE

Water from City water supply may be accepted without being tested. Water from doubtful sources shall not be used until tested and approved.

701.07 FINE AGGREGATE FOR PORTLAND CEMENT CONCRETE AND MORTAR:

(A) Materials Covered: These specifications cover the quality and size of fine aggregates for Portland Cement concrete pavements or bases, highway bridges and incidental structures.

(B) General Requirements: Fine aggregate shall consist of natural sand, or subject to approval, combinations of manufactured sand and natural sand, having hard, strong, durable particles and shall conform to these specifications.

701.07 FINE AGGREGATE FOR PORTLAND CEMENT CONCRETE AND MORTAR (B):

Fine aggregate from different sources of supply shall not be mixed or stored in the same pile nor used alternately in the same class of construction or mix, without permission from the Engineer, or as provided herein for manufactured sand.

When manufactured sand is approved for use in combination with natural sand, at least 50% of the total fine aggregate by weight shall be natural sand. The two materials shall conform to the requirements of these specifications, except that the mortar strength test shall be made on the blend of materials proposed for use.

Fine Aggregate shall conform to AASHTO M 6. Mortar sand shall conform to AASHTO M 45. Separate stockpiles meeting the requirements of Subsection 701.07(C) shall be provided for fine aggregate secured from different sources.

(C) Stockpiles: Separate stockpiles shall be provided for fine aggregates secured from different sources. Areas for stockpiles shall be grubbed, cleaned and compacted before storing fine aggregate. Stockpiles shall be built in such a manner as to prevent segregation and to insure reasonably uniform gradation throughout the pile.

701.08 COARSE AGGREGATE FOR PORTLAND CEMENT CONCRETE:

(A) Material Covered: These specifications cover the quality and size of coarse aggregate for use in Portland Cement concrete pavements or bases, highway bridges, and incidental structures.

(B) General Requirements: Coarse aggregates shall be a gravel or crushed stone, which shall conform to the requirements of AASHTO M 80 except as modified in these specifications.

Crushed stone for coarse aggregate shall be obtained from clean, tough, sound, and durable rock, and shall consist of angular fragments of uniform quality throughout.

Gravel for coarse aggregate shall consist of clean, tough, durable pebbles, practically free from clay, coatings of any character, disintegrated or soft pieces, conglomerates, mud balls, stocks, salt, alkali, or vegetable matter.

(C) Deleterious Substances: The maximum percentages of deleterious substances shall not exceed the following values:

SECTION 701 - PORTLAND CEMENT CONCRETE

Material passing No. 300 sieve (wash)	2.0% by weight
Coal or lignite	0.5% by weight
Clay lumps (wet on #4 in. sieve)	0.5% by weight
Light weight particles (less than 1.95 Sp.Gr.)	1.0% by weight

(D) Physical Properties: The coarse aggregate shall conform to the following Los Angeles abrasion requirements:

- 100 revolutions - not more than 10%
- 500 revolutions - not more than 40%

(E) Gradation: Coarse aggregate shall be well graded between the limits specified and the size or sizes designated shall conform to the requirements given in the following table:

Sieve Size	#3 (2" to 1")	#57 (1" to No. 4)	#357 (2" to No. 4)	#7 (½" to No. 4)
2-1/2	100		100	
2	95-100		95-100	
1-1/2	35-70		100	
1	0-15	90-100	35-70	
3/4				100
½	0-5	25-60	10-30	90-100
3/8				40-70
No. 4		1-10	0-5	0-15
No. 8		0-5		0-5

1. Coarse aggregate for pavements and base courses may be furnished in the #3 and the #57. Otherwise, use only the #57. When the two separate sizes are used, the batch requirement of each size shall not be less than 35 percent nor more than 65 percent of the total quantity of coarse aggregate required for each batch.
2. Coarse aggregate for piers, abutments, retaining walls, culverts and all reinforced concrete shall be furnished in one size, the #57.
3. Coarse aggregate for abutments and wingwalls placed in the dry shall be furnished in one size, the #357 size. Coarse aggregate for erosion control structures may be either #57 or #357.
4. Coarse aggregate for Thin Section concrete shall be furnished on one size, the #7.

(F) Mixing Aggregate: Crushed stone, or gravel, from different sources of supply may be combined in the mix when batched separately in recommended proportions upon written permission of the Engineer.

(G) Stockpiles: Sites for stockpiles shall be grubbed and cleaned and compacted prior to storing materials. The stockpiles shall be built in layers not exceeding 3 feet in height, and each layer shall be completely in place before the next layer is started. The material shall be deposited in such a manner as to prevent coning. Material which becomes segregated to such an extent that it will no longer pass the specifications for grading shall be re-combined so that it will pass the grading specifications before being used in concrete. Aggregates from the different sources shall be store in separate stockpiles.

SECTION 704

SLURRY SEAL

Description: These specifications cover the materials for use in the construction of a slurry seal coat for pavements.

704.01 MATERIALS:

(A) **Approval of Materials:** Prior to use, samples of all materials proposed to be used shall be submitted to the Engineer for test and for preparation of trial blends of aggregate to determine the initial job-mix formula for gradation. The final job-mix formula shall be established in accordance with Section 502.

(B) **Mineral Aggregate:** The aggregate shall be mine chat, crushed stone, crushed slag or crushed gravel composed of hard durable pebbles or fragments which may be combined with not more than 50 percent natural or manufactured sand. The aggregate shall be free of lumps or balls of clay loosely bonded aggregations, adherent films of clay, organic material or other foreign material. Slag shall be air-cooled, blast furnace slag uniform in density.

If mineral filler is required, it shall be Portland Cement or Hydrated Lime conforming to Subsection 701.01 and 707.01. The mineral filler shall not exceed 2 percent of the dry weight of the aggregate.

Deleterious substances shall not exceed the requirements of Subsection 705.02(D). The aggregate shall be produced from a material having a percent wear not to exceed 40 for 500 revolutions. The sand equivalent of the combined aggregate shall be not less than 45.

(C) **Asphalt:** The asphalt shall be a mixing grade emulsified asphalt conforming to the provisions of AASHTO M-140 for SS-1, except that the penetration of the residue at 77 degrees F. shall be 70 to 150.

704.02 COMPOSITION OF MIXTURES: The mixture shall consist of a uniform mixture of aggregate and emulsified asphalt within the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8 In.	100
No. 4	85-100
No. 8	65-90
No. 16	45-70
No. 30	30-50
No. 50	18-30
No. 100	10-21
No. 200	5-15

Percent Residual Asphalt, soluble in solvent
(Based on the dry aggregate weight) 7.5 - 13.5

The job-mix formula for the mixture with the allowable tolerances shall be within the range specified herein. The job-mix formula for the mixture shall establish a single percentage of aggregate passing each required sieve, a single percentage of residual asphalt and a single percentage of mineral filler (if mineral filler is required). The job-mix formula for the mixture shall be in effect until modified in writing by the Engineer.

SECTION 704 - SLURRY SEAL

704.03 TOLERANCES: The paving mixture, as produced, shall conform to the job-mix formula within the following range of tolerances:

Passing the No. 100 & larger sieves	$\pm 4\%$
Passing the No. 200 sieve	$\pm 2\%$
Residual Asphalt	$\pm 0.4\%$
Mineral Filler	$\pm 0.2\%$

Should a change in sources of materials be made, a new job-mix formula shall be established before the new material is used. When unsatisfactory results or other conditions make it necessary, the Engineer may establish a new job-mix formula.

The aggregate will be accepted in stockpile at the plant site. The asphalt will be conditionally accepted at the source. The plant mix material will be accepted after blending and mixing at the plant.

704.04 SAMPLING AND TESTING: Sampling and testing shall be done in accordance with Subsection 705.06.

SECTION 706

AGGREGATE, MISCELLANEOUS USES

706.01 AGGREGATE FOR TRAFFIC BOUND SURFACE COURSE:

(A) Materials Covered: These specifications cover the requirements and test methods for aggregates to be used in the construction of traffic bound surface course.

(B) General Requirements: Traffic bound surface course material shall consist of an intimate mixture of graded aggregate, coarse and fine, and shall be practically free from vegetation or other deleterious substances. Coarse aggregate (material retained on a No. 10 sieve) shall consist of sound, tough, durable particles of fragments of gravel, stone, mine chats, disintegrated granite or combination thereof, crushed to size if necessary. Fine aggregate shall consist of sand, stone dust, or other inert finely divided mineral matter.

(C) Physical Properties: The coarse aggregate retained on the 3/8 inch sieve of the finished mixture shall not have a percent wear of more than 40 when tested in accordance with the Los Angeles Abrasion Test.

(D) Gradation: This specifications permits the selection and use of one of 4 gradations of types of surface course. The type required on the project may be specified in the bid item of the proposal. When the type is not so specified, the Contractor may select the gradation or type in advance of construction. The material produced or processed for the construction of the project shall conform in gradation and all other requirements herein for the type specified or selected and shall be used throughout the project unless otherwise permitted in writing by the Engineer.

If the Contractor elects to deliver oversize particles of rock, gravel, lumps of clay or conglomerate materials to the road, all oversize material shall be crushed to meet the specification sizes and shall then be incorporated in the surfacing material.

GRADATION REQUIREMENTS (Percent Passing)

Sieve Size	Type A	Type B	Type C	Type D
1-1/2 in.				100
1 in.	100	100	100	90-100
3/4 in.	95-100	95-100		
1/2 in.				25-60
No. 4	5-75	0-85	40-75	0-5
No. 20	0-30			
No. 40			40-40	
No. 200	0-10	0-20	8-25	
Plasticity Index			8-18	
Liquid Limit			Not more than 35	

Type A material shall consist of hard durable particles of sand, gravel, mine chats, crushed rock or a combination of any of these materials.

Type B material shall consist of hard, durable particles of disintegrated granite with natural binder.

SECTION 706 - AGGREGATE, MISCELLANEOUS USES

Type C material shall produce a bonded traffic bound surface course and shall consist of an intimate mixture of graded aggregate, coarse and fine. Coarse aggregate (material retained on a No. 20 sieve) shall consist of sound, tough, durable particles or fragments of gravel, stone, disintegrated granite or combination thereof, crushed to size if necessary. Fine aggregate shall consist of sand, stone dust, or other inert finely divided mineral matter.

Type D material shall consist of hard durable particles of gravel or crushed stone.

(E) Sampling and Testing: Test shall be conducted in accordance with the latest revision of the following AASHTO Methods except as noted:

Los Angeles Abrasion	T 96
Sieve Analysis	T 27
Sampling	T 2
Method of Preparation of Samples	T 87
Determining Liquid Limit	T 89
Standard Density	T 180 Method D

706.02 SOIL AGGREGATE FOR SAND CUSHION:

(A) Material Covered: These specifications cover the material for use as sand cushion for concrete pavement.

(B) General Requirements: Sand cushion shall all pass a one inch sieve and shall contain 5% to 35% of material passing the No. 200 sieve. The final material shall have a liquid limit of 35 or less and a plasticity index not to exceed 8.

(C) Sampling and Testing: Sampling and testing shall be in accordance with AASHTO methods except where otherwise specified.

Sampling	T 2
Sieve Analysis	T 27
Liquid Limit	T 89
Plastic Limit & Plasticity Index	T 90
Standard Density	T 99

706.03 AGGREGATE FOR AGGREGATE BASE:

(A) Materials Covered: These specifications cover the aggregate for use in the construction of Aggregate Base Courses.

(B) General Requirements: The aggregate base course material shall consist of an intimate mixture of graded aggregate, coarse and fine, and shall be practically free from vegetable or other deleterious substances. Coarse aggregate (material retained on a No. 10 sieve) shall consist of sound, tough, durable particles or fragments of gravel, stone, mine chats, disintegrated granite, crushed concrete, or a combination thereof. Fine aggregate shall be sand, stone dust or other inert finely divided mineral matter.

At least 40 percent of that portion of the completed mixture retained on the No. 4 sieve shall be composed of uniformly graded crushed particles (pieces of aggregate with one or more fractured faces resulting from the artificial crushing).

SECTION 706 - AGGREGATE, MISCELLANEOUS USES

(C) Physical Properties: The coarse aggregate retained on the 3/8 inch sieve of the finished mixture shall have a percent of wear, Los Angeles Abrasion Test, of not more than 50. No source of material used in the blend shall have a percent of wear of more than 50.

(D) Gradation: The graded aggregate when uniformly blended and sampled from trucks or windrows shall conform to the following requirements depending on the type being used.

Materials for base course which contain oversize particles of rock, gravel, lumps of clay or conglomerated material shall not be loaded into vehicles for delivery to the road. Such oversize particles of aggregate must be screened, crushed or otherwise processed to meet the specifications before delivery to the road.

The samples taken from trucks or windrows after the graded aggregate has been uniformly blended, shall conform to the gradation limits by weights, and other characteristics, for the type being constructed, as follows:

Sieve Size	Percent Passing		
	<u>Type A</u>	<u>Type B</u>	<u>Type C</u>
3 in.		100	
1-1/2 in.	100	40-100	100
3/4 in.	40-100	30-75	-
3/8 in.	30-75	25-60	-
No. 4	25-60	20-50	-
No. 10	20-43	15-35	-
No. 40	8-26	7-22	-
No. 200	4-12	3-10	-

(E) The material passing the No. 200 sieve shall not be greater than two-thirds of the amount of material passing the No. 40 sieve.

(F) For all types the material passing the No. 40 sieve shall conform to the following:

The Plasticity Index shall not exceed 6.
The Liquid Limit shall not exceed 25.
The use of any material having a plasticity index
in excess of 8 will not be permitted.

(G) Type C shall be Dolese 1-1/2 inch Crusher Run Rock.

(H) Sampling and Testing: Tests shall be conducted in accordance with the latest revision of the following AASHTO Methods except as noted:

Los Angeles Abrasion	T 96
Sieve Analysis	T 27
Sampling	T 2
Determining Plastic Limit & Plasticity Index	T 90
Fractured Faces	OHD L-18
Method of Preparation of Samples	T 87
Determining Liquid Limit	T 89
Standard Density	T 180 (Method D)

SECTION 707

LIME

These specifications cover lime requirements for lime treatment of soils. These specifications apply specifically to limes made from calcium type limestone.

707.01 HYDRATED LIME:

(A) Definition: Hydrated Lime for stabilization shall consist essentially of a calcium hydroxide with a lesser amount of calcium oxide and magnesium hydroxide made from a dry powder obtained by treating quick-lime with enough water to satisfy its chemical affinity for water under the conditions of its hydration.

(B) Chemical Composition: When tested under the appropriate sections of ASTM C25, the lime shall conform to the following requirements:

Available Calcium Hydroxide: Available lime index (as in basis)
expressed as $\text{CO}(\text{OH})_2$ - not less than 90%.

(C) Fineness: When tested under the appropriate sections of ASTM C110, the lime shall conform to the following requirements:

Percent passing No. 20 sieve	99 or more
Percent passing No. 200 sieve	80 or more

707.02 QUICK LIME:

(A) Definition: Quick Lime for Stabilization Purposes - A calcined material, the major part of which is calcium oxide or calcium oxide in natural association with a lesser amount of magnesium oxide capable of slaking with water.

(B) Chemical Composition: When tested under the appropriate sections of ASTM C25, the lime shall conform to the following requirements:

Available Calcium Hydroxide expressed as Calcium Oxide:
Available Lime index (as is basis) expressed as CaO - not
less than 90%.

(C) Fineness:

1. When tested under the appropriate sections of ASTM C 110, the lime shall conform to the following requirements:

Percent passing No. 200 sieve	90 or more
Slaking Temperature Rise	40° or more
Total active Slaking Time	20 minutes or more

2. When tested in accordance with Method OHD-L28 the lime shall conform to the following requirements:

Percent passing the 5/8 inch sieve	95 or more
Percent passing the No. 200 sieve	15 or less

707.03 AGRICULTURAL LIMESTONE: Agricultural limestone shall be a high calcic or dolomite limestone having a neutralization value of at least 80 percent of calcium carbonate. It shall be of such fineness that 100 percent passes the No. 4 sieve, at least 90 percent passes the No. 8 sieve and at least 30 percent passes the No. 60 sieve. The neutralization value and sieve analysis shall be in accordance with ASTM C 602. The material shall be free from harmful quantities of toxic salts and other objectionable matter.

SECTION 708

MIXTURES FOR PLANT MIX, BITUMINOUS BASES AND SURFACES

This section covers the material requirements, mix designs, proportioning, mix tolerances, and sampling and testing methods for plant mixed bituminous bases and surfaces.

708.01 APPROVAL OF MATERIALS: Prior to use, samples of all materials proposed to be used under these specifications shall be submitted to an approved testing laboratory for tests and for preparation of trial mixtures to determine the initial job-mix formula. After the plant is in operation, the job-mix formula may be adjusted by the Engineer.

Should a change in sources of materials be made, a new job-mix formula shall be established before the new material is used. When unsatisfactory results or other conditions make it necessary, the Engineer will establish a new job-mix formula. Aggregate sources and percentage of blends must be approved on a project basis by the Engineer.

The aggregate shall be stockpiled in accordance with Subsection 701.08(G) and may be accepted in stockpile at the plant site. The plant mixed materials may be accepted after blending and mixing at the plant. Asphalt must be obtained from an approved source.

708.02 MINERAL AGGREGATE: The mineral aggregate shall be composed of coarse aggregate, fine aggregate and mineral filler as required to meet these specifications. If natural gravel is to be crushed for use in any of the mixes, a washing operation may be required to provide complete separation of all fines which may be stuck to the gravel. In no case will be blending of different material in the same storage be permitted. The aggregates shall meet the requirements set forth in Table I. The use of a crusher run or similarly graded aggregate shall not be the sole source of crushed coarse aggregate in asphalt concrete, Types A, B and C.

(A) Coarse Aggregate: The coarse aggregate shall be that part of the aggregate retained on the No. 10 sieve and shall consist of clean, tough, durable particles. It shall be practically free from soft and disintegrated pieces, shale, clay, organic, or other injurious matter occurring either free or as a coating on the aggregate. Natural gravel shall not be used as a source of insoluble material unless it has been crushed so that at least 75% of the material retained on the No. 4 sieve has two or more mechanically fractured faces. The natural gravel used as a source of insoluble materials shall have not more than 30% passing the No. 4 sieve after crushing except when used in asphalt concrete, Type D.

(B) Fine Aggregate: Fine Aggregate shall be that part of the aggregate passing the No. 10 sieve and shall consist of hard durable grains of natural sand, crushed stone, stone dust, crushed gravel, mine chat or jit-sand or any combination of these materials. Crushed materials shall be produced from material conforming to the requirements for coarse aggregate. When used in the wearing course, the material in the natural sand passing the No. 200 sieve shall be less than 50% of that contained in the combined aggregate including mineral filler.

(C) Mineral Filler: Mineral filler, when required in addition to that naturally contained in the aggregate, shall consist of thoroughly dry limestone dust, volcanic ash, Portland Cement, hydrated lime or other approved inert mineral matter. As delivered to the mixer, mineral filler shall be free from lumps or loosely bonded aggregations.

SECTION 708 - MIXTURES FOR PLANT MIX, BITUMINOUS BASES AND SURFACES

Table I
Physical Properties of Aggregates

Aggregates to be used in:

Test	Asphalt Concrete	Open Graded Friction Course	Bituminous Base		Hot Mix Cold Lay
			Fine Aggregate	Coarse Aggregate	
L.A. Abrasion (max.% wear) <u>a/</u>	4	30 <u>b/</u>	50	50	40
Sand Equivalent (min.) <u>b/</u>					
Wearing Course	45	45	NA	NA	45
Base or Binder	40	NA	25	30	40
Mechanically fractured faces (min.%) <u>b/ c/</u>	75w/2	75w/2 <u>a/</u>	NA	40w/1	75w/2
Durability Dc factor (min.) <u>a/</u>	40	40	NA	NA	40
Insoluble residue (min.%) <u>d/ e/</u>	30	30	NA	NA	NA
Flat or elongated pieces (max.%) <u>b/ c/ f/</u>	15	15	NA	NA	15
Clay balls and Friable Particles (max.%) <u>g/</u>	1.0	0	1.0	1.0	1.0
Soft particles (max.%) <u>a/</u>	5	5	NA	5	5
Sticks or roots (max.%) <u>a/</u>	0.5	0	0.5	0.5	0.5

a/ Applies to each source except as noted.

b/ Applies to the combined aggregate except as noted.

c/ Applies to the aggregate retained on the No. 4 sieve.

d/ Applies to the combined coarse aggregate.

e/ The coarse aggregate used in the asphalt concrete surface course, shoulders and detours excepted, shall contain not less than 30 percent insoluble residues.

f/ A flat or elongated piece is one in which the length is greater than five times the average thickness.

g/ Applies to the combined aggregate. Provided the maximum for the combined aggregate is not exceeded, a maximum 1.5 percent will be allowed for any one source.

SECTION 708 - MIXTURES FOR PLANT MIX, BITUMINOUS BASES AND SURFACES

708.03 ASPHALT MATERIALS:

(A) General: Bituminous materials shall meet the requirements shown in Tables 2A through 2E for the type and grade of asphalt material specified.

TABLE 2A
REQUIREMENTS FOR ASPHALT CEMENT GRADED BY VISCOSITY AT 140°F
 (Grading based on original asphalt)

Asphalt cement shall be prepared from crude petroleum by suitable methods,
 shall be homogeneous, free from water, and shall not be heated to 347°F.

TEST	VISCOSITY GRADE			
	AC-3.5	AC-7.5	AC-10	AC-20
Viscosity, 140°F, poises	350 ± 70	750 ± 150	1000 ± 200	2000±400
Viscosity, 275°F, Cs-minimum	145	215	250	300
Penetration, 77°F, 100g.5sec	220-300	110-160	80-125	60-100
Flash Point, COC, °F minimum	350	400	425	450
Solubility in trichlorethylene, percent minimum	99.0	99.0	99.0	99.0
Test on residue from Rolling Thin- Film Oven Test:				
Loss on heating, percent-maximum		1.0	1.0	1.0
Viscosity, 140°F, poises-maximum	1500	3000	4000	8000
Ductility 77°F, 5 cm per minute, cm-minimum	100 _{a/}	100	75	50
Spot test with Standard naptha solvent		Negative for all grades		

a/ If ductility is less than 100, the material will be accepted if its ductility at 60°F is 100 minimum.

SECTION 708 - MIXTURES FOR PLANT MIX, BITUMINOUS BASES AND SURFACES

TABLE 2B
REQUIREMENTS FOR CUT-BACK ASPHALT (MEDIUM CURING TYPE)

Cut-back asphalt shall be produced by fluxing an asphalt base with suitable petroleum distillates, shall show no separation or curdling prior to use, and shall not foam when heated to application temperature.

	<u>MC-30</u>		<u>MC-70</u>		<u>MC-250</u>		<u>MC-800</u>		<u>MC-3000</u>	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Kinematic Viscosity at 140°F centistokes	30	60	70	140	250	500	800	1600	3000	6000
Flash Point (Tag, open-cup), degrees F	100	...	100	...	150	...	150	...	150	...
Water percent	...	0.2	...	0.2	...	0.2	...	0.2	...	0.2
Distillation test:										
Distillate percentage by volume of total distillate to 680°F										
to 437°F	...	25	0	20	0	10	...	...	...	...
to 500°F	40	70	20	60	15	55	0	35	0	15
to 600°F	75	93	65	90	60	87	45	80	15	75
Residue from distillation to 360°C 680°F Volume percentage of sample by difference	50	...	55	...	67	...	75	...	80	...
Tests on residue from distillation:										
Absolute viscosity at 140°F, poises	400	1200	400	1200	400	1200	400	1200	400	1200
Ductility, 5 cm/min., cm. _a /	100		100		100		100		100	
Solubility in Trichloroethylene, percent	99.0	...	99.0	...	99.0	...	99.0	...	99.0	...
_Spot test with Standard naptha					Negative for all grades					

a/ If the ductility at 77°F is less than 100, the material will be acceptable if its ductility at 60°F is more than 100.

SECTION 708 - MIXTURES FOR PLANT MIX, BITUMINOUS BASES AND SURFACES

TABLE 2C
REQUIREMENTS AND TYPICAL APPLICATIONS FOR EMULSIFIED ASPHALT

The emulsified asphalt shall be homogeneous. Within 30 days after delivery and provided separation has not been caused by freezing, the emulsified asphalt shall be homogeneous after thorough mixing.

_Type Grade	Rapid-Setting				Medium-Setting					
	RS-1		RS-2		MS-1		MS-2		MS-2h	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Tests on emulsion:										
Viscosity, Saybolt Furol at 77°F,s	20	100	...	...	20	100	100	...	100	...
Viscosity, Saybolt Furol at 122°F,s	...	...	150	400 _c /	...	...	...	...	...	...
Storage stability test, 24-h,%	...	1	...	1	...	1	...	1	...	1
Demulsibility, _a / 35 ml, 0.02 N CaCl ₂ ,%	60	...	60	...	...	...	...	...	...	...
Coating ability and water resistance										
Coating	...		...		good		good		good	
Coating Retention	...		...		fair		fair		fair	
Sieve Test, %	...	0.10	...	0.10	...	0.10	...	0.10	...	0.10
Residue by distillation, %	55	...	63	...	55	...	65	...	65	...
Tests on residue from distillation test:										
Viscosity, 140°F, poises _d /	400	1200	400	1200	400	1200	400	1200	1600	4800 _d /
Penetration, 77°F, 100 g, 5s	100	200	100	200	100	200	100	200	40	90
Ductility, 77°F, 5 cm/min, cm	40	...	40	...	40	...	40	...	40	...
Solubility in trichloroethylene, percent	97.5	...	97.5	...	97.5	...	97.5	...	97.5	...

Typical applications _b/:

For RS-1: Surface treatment, penetration macadam, sand seal coat, tack coat, mulch.

For RS-2: Surface treatment, penetration macadam, coarse aggregate seal coat (single and multiple).

For MS-1: Cold plant mix, road mix, sand seal coat, crack treatment, tack coat.

For MS-2: Cold plant mix, coarse aggregate seal coat (single and multiple), crack treatment, road mix, tack coat, sand seal coat.

For MS-2h: Cold plant mix, hot mix, coarse aggregate seal coat (single and multiple), crack treatment, road mix, tack coat.

SECTION 708 - MIXTURES FOR PLANT MIX, BITUMINOUS BASES AND SURFACES

TABLE 2C (CONTINUED)

_Type Grade	HFMS-1		High Float HFMS-2		HFMS-2h		HFMS-2s		Slow Setting SS-1		SS-1h	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Tests on emulsion:												
Viscosity, Saybolt												
Furol at 77°F,s	20	100	100	...	100	...	50	...	20	100	20	100
Viscosity, Saybolt												
Furol at 122°F,s	...	...	...	...	...	...	...	...	...	...	...	...
Storage stability												
test, 24-h,%	...	1	...	1	...	1	...	1	...	1	...	1
Coating ability and												
water resistance												
Coating	good		good		good		good		good		good	
Coating Retention	fair		fair		fair		fair		fair		fair	
Cement mixing text,%	...	...	...	...	...	...	...	...	2.0	...	2.0	...
Sieve Test,%	0.10	...	0.10	...	0.10	...	0.10	...	0.10	...	0.10	...
Residue by distillation,%	55	...	65	...	65	...	65	...	57	...	57	...
Tests on residue from distillation test:												
Viscosity, 140°F,												
poises	400	1200	400	1200	1600	4800d/	200	600	400	1200	1600	4800d/
Penetration, 77°F,												
100 g, 5s	100	200	100	200	40	90	200	...	100	200	40	90
Ductility, 77°F,												
5 cm/min, cm	40	...	40	...	40	...	40	...	40	...	40	...
Solubility in												
trichloroethylene,%	97.5	...	97.5	...	97.5	...	97.5	...	97.5	...	97.5	...
Float test, 140°F,s	1200	...	1200	...	1200	...	1200	...	...		...	

Footnotes appear on the following page.

SECTION 708 - MIXTURES FOR PLANT MIX, BITUMINOUS BASES AND SURFACES

TABLE 2C (CONTINUED)

Typical applications b/:

HFMS-1: Cold plant mix, road mix, sand seal coat, crack treatment, tack coat.

HFMS-2: Cold plant mix, coarse aggregate seal coat (single and multiple), crack treatment, road mix, tack coat.

HFMS-2h: Cold plant mix, hot plant mix, coarse aggregate seal coat (single and multiple), crack treatment, road mix, tack coat.

HFMS-2s: Dense-graded cold plant mix and road mix, stockpile mix, crack treatment, patching mix.

SS-1 & SS-1h: Cold plant mix, road mix, slurry seal coat, tack coat, fog seal, dust layer, mulch.

a/ The demulsibility test shall be made within 30 days from date of shipment.

b/ These typical applications are for use only as a guide for selecting and using the emulsion for pavement construction and maintenance.

c/ Maximum viscosity at the point of manufacture shall be 500 seconds. The viscosity at the job site shall be from 100 to 400 seconds.

d/ Variability will be limited to ± 600 poises from the target value established by the manufacturer.

SECTION 708 - MIXTURES FOR PLANT MIX, BITUMINOUS BASES AND SURFACES

TABLE 2D

REQUIREMENTS AND TYPICAL APPLICATIONS FOR CATIONIC EMULSIFIED ASPHALT

The emulsified asphalt shall be homogeneous. Within 30 days after delivery and provided separation has not been caused by freezing, the emulsified asphalt shall be homogeneous after thorough mixing.

_Type Grade	Rapid-Setting				Medium Setting				Slow Setting			
	CRS-1		CRS-2		CMS-1		CMS-2		CSS-1		CSS-1h	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Tests on emulsion:												
Viscosity, Saybolt												
Furol at 77°F,s	...	...	...	...	...	...	...	...	20	100	20	100
Viscosity, Saybolt												
Furol at 122°F,s	20	100	150	400 <u>d/</u>	50	500	50	450	...	...	...	...
Storage stability												
test, 24-h, % <u>a/</u>	...	1	...	1	...	1	...	1	...	1	...	1
Demulsibility, <u>a/</u> 35 ml												
0.8% Sodium dioctyl												
sulfosuccinate %	40	...	40	...	...	...	...	...	...	...	...	...
Classification test	Passes		Passes									
Coating ability and												
water resistance:												
Coating	...	...	...	...	Good		Good		Good		Good	
Coating Retention	...	...	...	...	Fair		Fair		Fair		Fair	
Particle charge test	Positive		Positive		Positive		Positive		Positive <u>b/</u>		Positive <u>b/</u>	
Sieve Test,%	...	0.10	...	0.10	...	0.10	...	0.10	...	0.10	...	0.10
Cement mixing test,%	...	...	...	...	...	...	...	...	...	2.0	...	2.0
Distillation:												
Oil distillate, by												
volume of emulsion,%	...	0.1	...	0.1	...	8	...	12	...	...	...	...
Residue,%	60	...	65	...	65	...	65	...	57	...	57	...
Tests on residue from distillation test:												
Viscosity, 140°F,												
poises	400	1200	400	1200	<u>f/</u>	...	400	1200	400	1200	1600	4800 <u>a/</u>
Penetration, 77°F,												
100 g, 5s	100	250	100	250	300	...	100	250	100	250	40	90
Ductility, 77°F,												
5 cm/min, cm	40	...	40	...	40	...	40	...	40	...	40	...
Solubility in												
trichloroethylene,%	97.5	...	97.5	...	97.5	...	97.5	...	97.5	...	97.5	...

SECTION 708 - MIXTURES FOR PLANT MIX, BITUMINOUS BASES AND SURFACES

TABLE 2D (CONTINUED)

Typical applications c/:

CRS-1: Surface treatment, penetration macadam, sand seal coat, tack coat, mulch.

CRS-2: Surface treatment, penetration macadam, coarse aggregate seal coat (single and multiple).

CMS-1: Cold plant mix, road mix, hot mix-cold lay.

CMS-2: Cold plant mix, coarse aggregate seal coat (single and multiple), crack treatment, road mix, tack coat, sand seal coat.

CSS-1 & CSS-1h: Cold plant mix, road mix, slurry seal coat, tack coat, fog seal, dust layer, mulch.

Footnotes for Table 2D:

a/ The 24 hour storage stability test results do not necessarily predict satisfactory 5 day settlement test results.

b/ If the particle charge test result is inconclusive, material having a maximum pH value of 6.7 will be acceptable.

c/ These typical applications are for use only as a guide for selecting and using the emulsion for pavement construction and maintenance.

d/ Maximum viscosity at the point of manufacture shall be 500 seconds. The viscosity at the job site shall be from 150 to 400 seconds.

e/ Variability will be limited to ± 600 poises from the target value established by the manufacturer.

f/ The Saybolt Furol viscosity of the residue shall be 200-600 seconds when tested at 180°F (82°C).

SECTION 708 - MIXTURES FOR PLANT MIX, BITUMINOUS BASES AND SURFACES

708.03 ASPHALT MATERIALS: Continued

(B) Handling: The handling, loading, hauling, transfer pumping or similar operations connected with the movement of bituminous materials shall be in compliance with the requirements of the Oklahoma Department of Transportation, Materials Division. If at any time materials furnished for use under these specifications fail to produce satisfactory results, further shipments will be rejected. The material will not be accepted for further work until the producer satisfied the Engineer that the material has been so corrected as to produce satisfactory results.

(C) Application Temperature: The temperature to which asphalt materials shall be heated at the time of use shall be as shown in Table 2E, unless otherwise specified.

**TABLE 2E
SUGGESTED TEMPERATURES FOR USE OF ASPHALT MATERIALS**

Mixing	Mixture at for Spraying	Asphalt Temperature of Asphalt	Max. °F	Type or Grade °F	Discharge	for
	AC-20		350	275-350	285-350	
	AC-10		325	275-325	285-350	
	AC-7.5		325	275-325	285-350	
	AC-3.5		325	240-290	260-325	
	MC-30			50-120	50-120	
	MC-70			80-150	80-150	
	MC-250	200		100-200	100-200	
	MC-800	210		160-210	185-260	
	MC-3000	250		200-250	225-275	
	ALL EMULSIONS			50-160	50-160	

708.04 COMPOSITION OF MIXTURES:

(A) Asphalt Mix Design and Initial Job-Mix Formula: The asphalt mix design and initial job-mix formula are the responsibility of the contractor and shall be submitted to the Engineer for approval.

The initial job-mix formula shall meet the requirements of Table 3A or 3B and Table 4 for the type mix specified on the plans or in the proposal. The Engineer may require the contractor to prepare a trial mixture to confirm the initial job-mix formula.

If the trial mixture, prepared at the initial job-mix formula proportions, fails to meet the requirements of Table 4, the contractor may propose changes to the job-mix formula. If these changes do not result in a mixture meeting the requirements of Table 3A or 3B and Table 4, the Engineer will require a new mix design.

If the changes do result in a mixture meeting these specifications, the job-mix formula will be adjusted accordingly.

SECTION 708 - MIXTURES FOR PLANT MIX, BITUMINOUS BASES AND SURFACES

The job-mix formula shall establish a single percentage of aggregate passing each required sieve, a single percentage of asphalt to be contained in the mixture, and a single temperature of the mixture at point of discharge from the plant.

For all mixtures, except the open graded friction course, the job-mix formula with allowable tolerances shown in Table 5 shall establish the specification limits for that mixture. These limits may be outside the broad range given in Table 3A or 3B except for the absolute maximum size sieve. (For example, the absolute maximum size sieve for asphalt concrete, type C is the ½ inch sieve).

For the open graded friction course, the job-mix formula with allowable tolerances shall be within the broad range given in Table 3A.

(B) Plant Produced Mixtures: The plant produced mixture shall be a uniform mixture of the combined aggregate and asphalt and shall conform to the requirements of Table 4 and the specification limits established by the job-mix formula with allowable tolerances.

After the plant is in operation, the contractor may propose adjustments to the job-mix formula within the limits shown in Table 3A or 3B. If test results indicate these adjustments will result in a mixture meeting the requirements of Table 4, the job-mix formula will be adjusted accordingly.

Should a change in sources of materials be made, a new job-mix formula shall be established before the new material is used. When unsatisfactory results or other conditions make it necessary, the Engineer will require a new job-mix formula.

The job-mix formula for asphalt is the target value. Every effort shall be made by the contractor to incorporate that amount of asphalt into the mixture irregardless of the allowable tolerances.

For temporary construction, such as crossovers and detours, the requirements given in Table 3A for minimum percent asphalt and Table 4 for retained strength and V.M.A. will be waived.

(C) Recycled Bituminous Pavements: Bituminous mixtures containing up to 40 percent reclaimed asphalt concrete pavement (RACP) will be accepted, except in the wearing course, providing all the requirements of these specifications are met.

The following table shall be used in selecting the viscosity grade asphalt cement to be used in recycling the RACP:

Penetration of Recovered Asphalt Cement	Allowable Percentages of RACP	
	For AC-20	For AC-10
0-22	0-20	21-40
23-27	0-25	26-40
28-32	0-30	31-40
33-37	0-35	36-40
38 and up	0-40	(Not Permitted)

SECTION 708 - MIXTURES FOR PLANT MIX, BITUMINOUS BASES AND SURFACES

TABLE 3A
TABLE OF MIXTURES (Hot Mix - Hot Lay)

Mixture:	Asphalt Concrete			Bituminous Base			
Type:	A	B	C	D	Fine	Coarse	Open Graded Friction
Sieve Size	I/	I/	I/	a/ Percent Passing	Aggregate	Aggregate	Surface b/
1-1/2"	100					100	
1"	90-100				100	-	
3/4"	-	100				60-90	
1/2"	70-90	90-100	100			-	100
3/8"	-	70-90	90-100	100		45-80	90-100
No. 4	40-65	45-70	60-80	80-100	75-100	35-65	25-45
No. 10	25-45	25-50	35-60	50-90	55-100	25-50	0-10
No. 40	10-26	12-30	15-35	20-50	25-75	10-35	-
No. 80	6-18	7-20	8-22	10-30	-	-	-
No. 200	see j/	see j/	see j/	5-15	7-17	4-9	0-5
% AC Soluble in Solvent c/	3.8-6.5	4.7-7.5	5.1-7.5	5.5-7.5	4.5-7.5	3.5-6.0	see h/
Viscosity Grade Asphalt Cement	AC-20	AC-20	AC-20	AC-20	AC-20	AC-20	AC-20

TABLE 3B
TABLE OF MIXTURES (Hot Mix - Cold Lay)

Gradation Size:	HC1		HC2		HC3		HC4a/
Sieve Size			Percent Passing d/ e/ f/ g/				
1-1/2"	100						
1"	90-100						
3/4"	-		100				
1/2"	70-90		90-100		100		
3/8"	-		70-90		90-100		100
No. 4	40-65		45-70		60-80		80-100
No. 10	25-45		25-50		35-60		50-90
No. 40	10-26		12-30		15-35		20-50
No. 80	6-18		7-20		8-22		10-30
No. 200	3-6		4-7		4-8		5-15
Asphalt Type c/	MC-800	MC-800	AC 3.5 or MC-800		MC-800		
						or CMS-1	Emulsion

SECTION 708 - MIXTURES FOR PLANT MIX, BITUMINOUS BASES AND SURFACES

Footnotes for Tables 3A and 3B:

- a/ Shall be a blend of at least 75 percent crushed stone with a maximum of 25 percent sand.
- b/ Aggregate to be 100 percent crushed material. A minimum of 55 percent of the aggregate shall be retained between the 3/8-inch and the No. 4 sieves. An approved anti-stripping agent shall be used at the rate of five (5) gallons per 1,000 gallons of asphalt cement.
- c/ Expressed as a percent of total mix weight. Lower limit may be adjusted if the effective specific gravity of the combined aggregates is greater than 2.65. This adjustment will only be allowed if the lab molded specimens meet the VMA requirement at 4 percent air voids.
- d/ If emulsion or MC grade asphalt is used, the aggregate shall be surface dry and heated to a temperature above 160°F.
- e/ AC Type Mixtures. The aggregate shall be thoroughly dried and delivered to the mixer at a temperature above 200°F and not higher than the temperature of the asphalt binder. Water, not exceeding 3 percent and primer not exceeding 1.2 percent of the aggregate by weight, shall be added as necessary to assure the required workability of the mixture. The quantity of water and primer added to the aggregate shall be accurately controlled by a meter or other suitable measuring device. Except as otherwise requested by the Engineer, the workability of the mixture shall be suitable for stockpiling and use at ambient temperatures.
- f/ The temperature of the aggregate shall not be heated in excess of the temperature of the liquid asphalt at time of mixing.
- g/ MC-3000 may be substituted for MC-800 when specified or approved by the Engineer.
- h/ The job-mix formula for percent AC in the open graded friction course is calculated by the following equation:
- $$\% \text{ AC} = (16.5) / (\text{Effective Specific Gravity} + 0.165)$$
- i/ If the ADT is 2,500 or more, the total amount of natural sand and gravel shall not exceed 15 percent of the combined aggregate. For ADT less than 2,500, the natural sand and gravel shall not exceed 25 percent of the combined aggregate.
- j/ For types A, B, and C asphalt concrete, the ratio of the percent passing the No. 200 sieve to the percent asphalt cement shall be a minimum of 0.6 to a maximum of 1.2. This ratio will establish the master range for the job-mix formula on the No. 200 sieve. The job-mix formula, with allowable tolerances, will establish a specification range which may be outside the master range.

SECTION 708 - MIXTURES FOR PLANT MIX, BITUMINOUS BASES AND SURFACES

TABLE 4
PROPERTIES OF LABORATORY MOLDED SPECIMENS

Mixture Property	Asphalt Concrete	Bituminous Base Fine Aggregate	Coarse Aggregate	Hot Mix-Cold Lay
Density, % of max. theo.sp.gr				
5000 ADT or More	94-96	82 min.	92-97	93-97
1000 to 5000 ADT	95-97	82 min.	92-97	93-97
1000 ADT or less	96-98	82 min.	92-97	93-97
Hveem Stability, min. 2500 ADT or more <u>a/</u>	40	25	40	35
Less than 2500 ADT	35	20	35	35
% Retained Strength min. for 2500 ADT or more	75	NA	75	NA
ASPHALTIC CONCRETE				
	Type A	Type B	Type C	Type D
V.M.A. min. % <u>b/</u>	13	15	16	17

a/ Includes all city streets regardless of ADT.

b/ V.M.A. (Voids in the Mineral Aggregate) is based on the effective specific gravity of the aggregates.

708.05 TOLERANCES: The tolerances shown in Table 5 shall be applied to the job-mix formula (JMF) as described in Subsection 708.04.

The job average for gradation shall meet the stated tolerances. An individual sample will be allowed 1-1/2 times the tolerance shown for gradation, providing adjustments are made and the subsequent sample is within the stated tolerance.

TABLE 5
RANGE OF TOLERANCES (PERCENT)

Passing Sieve Size	Asphalt Concrete	Asphalt Surf.Course (HM-CL)	Bituminous Base F.A.	Open Graded C.A.	Friction Course
No.4 & larger	±7	±7	<u>a/</u>	±7	±7
No. 10	±4	±5		±5	±4
No. 40	±4	±4		±5	
No. 80	±4	±4			
No. 200	±2	±2	±3	±3	±2
Asph. Soluble in Solvent	±0.4 <u>c/</u>	±0.5 <u>c/</u>	±0.5 <u>c/</u>	±0.3 <u>b/</u>	
Temp. of mix as discharged from mixer °F	±20	±20	±20	±20	

SECTION 708 - MIXTURES FOR PLANT MIX, BITUMINOUS BASES AND SURFACES

- a/ The job-mix formula and tolerance apply only to the No. 200 sieve and to the percent asphalt.
- b/ The percent asphalt used in the open graded friction course may be determined by the tank strap method of measurement or the printed batch weights from an approved automatic printer system or the gallon counter on a drum-mix plant.
- c/ The tolerances shown for asphalt content are for individual samples. The average asphalt content, by extraction, shall be within ± 0.2 percent of the job-mix formula.

708.06 SAMPLING AND TESTING:

(A) Methods: Sampling and testing shall be done in accordance with AASHTO methods, except as noted below:

1. Sampling and Testing Aggregates:

Sampling	T 2
Sieve Analysis	T 27
Material Passing No. 200 Sieve	T 11
Wear (Los Angeles Abrasion)	T 96
Mud, Clay Balls, Sand Clusters, Sticks and Roots, Retained on No. 4 Sieve	OHD L-9
Fractured Faces	OHD L-18
Sand Equivalent	T 176
Durability Factor (Plastic Fines in Aggregates)	T 210
Insoluble Residue	OHD L-25
Soft Particles	OHD L-38
2. Sampling and Testing Bituminous Mixtures

Mechanical Analysis of Extracted Aggregate	T 30
Sampling <u>a/</u>	T 168
Bitumen Content	OHD L-26
Recovery of Asphalt from Solution by Abson Method	T 170
Maximum Specific Gravity of Bituminous Paving Mixtures	T 209
Bulk Impregnated Specific Gravity of Aggregates <u>b/</u>	OHD L-7
Compacting Materials for Stabilometer Value (Texas Gyration)	OHD L-8
Specific Gravity and Wt. per C.F. of Compressed Bituminous Mixture	OHD L-14
Test for Stabilometer Value (Hveem)	OHD L-16
Retained Strength	OHD L-36
- a/ The sample size of compacted bituminous pavement shall be in accordance with T 166.
- b/ OHD L-7 shall only be used when the results obtained from AASHTO T 209 are suspect.
3. Testing Asphalt Materials:

Absolute Viscosity	T 202
Kinematic Viscosity	T 201
Saybolt Furol Viscosity	T 72
Penetration	T 49
Flash Point	T 48
Solubility in Trichloroethylene	T 44
Thin Film Oven Test	T 179

SECTION 708 - MIXTURES FOR PLANT MIX, BITUMINOUS BASES AND SURFACES

Ductility	T 51
Spot Test	T 102
Water	T 55
Rolling Thin Film Oven Test	T 240
Distillation	T 78
Flash Point	T 79
Testing Emulsified Asphalt	T 59
pH of Aqueous Solutions with the Glass Electrode	T 200
Coating & Retention Testing for Mixing Grade Emulsions	T 59
	Modified
Specific Gravity by Pycnometer	T 228
Specific Gravity by Hydrometer	ASTM
	D3142

(B) Method and Procedure for Sampling Bituminous Materials: Sampling of bituminous materials shall be in accordance with AASHTO T 40, except that the method at the project site or mixing plant shall be in accordance with OHD L-5.

The methods of sampling, testing and acceptance as specified may be modified for the bituminous materials under the Engineer's direction.

The producers of the bituminous materials shall be furnished with the correct project designation and instructed that such designation shall be used in connection with all materials shipped on the project. Sampling will be done at the point of manufacture whenever the quantity shipped will warrant such procedure and samples may also be taken at the point of destination. Bituminous materials shall not be used until conditionally approved at the source by the Engineer.

SECTION 710

PIPE CONDUITS

This section covers the requirements for materials for pipe conduits of the kind specified on the plans and meeting the requirements of Section 604.

710.01 CONCRETE PIPE:

(A) Materials: Non-reinforced Concrete Pipe, Reinforced Concrete Circular, Elliptical and Arch Pipe; Precast Reinforced Concrete Box Sections and Manhole Sections shall meet the following requirements:

1. Concrete Sewer, Storm Drain, and Culvert Pipe; AASHTO M-86.
2. Reinforced Concrete Culvert, Storm Drain and Sewer Pipe; AASHTO M-170.
3. Precast Reinforced Concrete Manhole Sections; AASHTO M-199.
4. Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe AASHTO M-206.
5. Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe AASHTO M-207.
6. Reinforced Concrete D-load Culvert, Storm Drain, and Sewer Pipe AASHTO M-243.
7. Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers; ASTM C-789.

(B) Pipe Rejection: A lot of pipe represented by test samples may be rejected for failure to meet any of the requirements of the governing specifications. Lots of pipe, less than 30 days of age, which meet all requirements, except the strength tests, may be retested at a later date when so requested by the manufacturer. Individual sections of pipe may be rejected for failure to meet the specification requirements of manufacture, and damages acquired in handling, delivery and installation, with the following exceptions:

1. A single end crack that does not exceed the depth of the joint;
2. Damaged ends when chips do not extend more than half of the joint, either from the end of the joint or along the circumference of the pipe, and providing that in the opinion of the Engineer satisfactory permanent patching can be performed during installation.

(C) Joint Filler: Joint filler for joints in concrete pipe culverts shall meet the requirements of one of the following materials:

1. Cold Applied Mastic Type: This compound, when applied according to the manufacturer's directions, shall be resilient and adhesive and maintain an effective seal through repeated cycles of expansion and contraction. The material shall comply specifically with the following requirements:

SECTION 710 - PIPE CONDUITS

Specific Gravity 25C/25	1.190	1.350
Pounds per Gallon	10.75	11.25
Percent Soluble in Trichlorethylene	45.0	-
Percent Ash	50.0	55.0
Percent Water by Volume	-	0
Penetration (Standard Cone)		
150 gr., 5 sec., 25 degree C.	175	200

2. Flexible Watertight Gaskets: The joint materials shall meet the requirements of AASHTO M-198 and provide a proper fit for a satisfactory seal. A certification stating the material meets AASHTO M-198 shall be submitted to the Engineer.

710.02 CORRUGATED GALVANIZED IRON OR STEEL CULVERTS AND UNDERDRAINS:

Materials shall meet the requirements of AASHTO M 36.

710.03 STEEL END SECTIONS:

(A) Description: This Subsection covers metal culvert end sections for attachment to the inlet and outlet of corrugated galvanized steel pipe and corrugated galvanized steel pipe arch culverts.

(B) Materials: The materials shall comply with the requirements of AASHTO M 36 for Base Metal, Spelter Coatings, Rivets, Riveting and Sampling, Accepted Brands of Metal, Sheet Manufacturer's Certified Analysis, Sheet Manufacturer's Guarantee and thickness Determination and Tolerance.

(C) Fabrication:

1. Bolts: Galvanized bolts may be used for assembly of end sections where more than one piece is used to form the skirt, when sections have not been riveted together.

2. Workmanship: It is the essence of these specifications that in addition to compliance with the details of construction, the completed unit show careful finished workmanship in all particulars. This requirement applies not only to the individual unit, but to the shipment as a whole.

The following defects are specified as constituting poor workmanship and the presence of any of them in any individual unit in any shipment, shall constitute sufficient cause for rejection; not meeting specified dimensions, not of the specified shape, uneven laps, ragged sheared edges, loose, unevenly lined or spaced rivets, poorly formed rivet heads, illegible brands, lack of rigidity, or dents or bends in the metal itself.

(D) Inspection: All steel culvert end sections will be inspected for compliance with the provisions governing fabrication heretofore given.

710.04 CORRUGATED HDPE DRAINAGE PIPE:

(A) Description: This subsection covers corrugated high density polyethylene smooth lined culvert and underdrain pipe from 12-inches to 36-inches. This type of pipe is to only be used for storm sewer applications in which the drainage system runs parallel to the curbline and behind the back of curb, and shall be approved by the City Engineer.

SECTION 710 - PIPE CONDUITS

(B) Materials Specification: Smooth wall corrugated polyethylene pipe shall be manufactured from high density polyethylene HDPE virgin compounds and shall conform to AASHTO A-252 (latest edition) and AASHTO M-294 (latest edition). A certificate of compliance shall be furnished, by the contractor, for each type of polyethylene pipe used. Coupling bands shall be spaced equally on each of the pipes being connected, they shall have gaskets of a closed-cell expanded rubber neoprene, and shall form a tightly closed joint that precludes infiltration.

(C) Construction Specifications: Construction of smooth wall corrugated polyethylene pipe storm sewers shall be in accordance with the manufacturer's recommended construction specifications. The distributor shall have a representative on site when construction starts and shall certify in writing, to the City Engineer, that the smooth wall corrugated polyethylene pipe is being installed in accordance with the manufacturer's recommended specifications. The HDPE smooth lined pipe shall be installed in accordance with the City's standard detail set DD-13 sheets 1 and 2 or an approved method recommended by the manufacturer.

(D) Design Limitations: The maximum conveyance factor shall be based on a Manning's "n" value of 0.012 and using appropriate culvert design methods examining headwater and tailwater control.

SECTION 712

MASONRY BRICK

This section covers the requirements for masonry brick manufactured from either clay, concrete or shale. The particular type shall be specified on the plans or in the proposal and shall comply with the requirements set out below for each type.

712.01 MASONRY BRICK MADE FROM CLAY OR SHALE: Masonry brick of this type shall comply with the requirements of AASHTO M-114 for building brick. Unless otherwise shown on the plans, grade "MW" brick shall be used.

712.02 CONCRETE BUILDING BRICK: Concrete building brick shall conform to the requirements of ASTM C 55. Unless otherwise shown on the plans, Type I, Grade S-1 shall be used.

Concrete brick shall not be used in the construction or reconstruction of sanitary sewer manholes.

SECTION 713

CASTINGS FOR SEWER MANHOLES AND INLETS

This item shall consist of manhole frames and covers, sewer inlet frames and gratings, and steps for manholes and inlets. All castings shall conform strictly to the standard design or designs designated, or to special designs when required. Castings shall be of cast iron or cast steel as designated.

713.01 MATERIALS: Steel castings shall conform to the requirements of the standard specifications for Mild to Medium Strength Carbon Steel Castings for General Application, AASHTO M 103. Grade 65-35 shall be furnished unless otherwise specified.

Iron castings shall conform to the Standard Specifications for Gray Iron Castings, Class No. 20 of AASHTO M 105.

Castings shall be free from pouring faults, sponginess, cracks, blow holes and other defects in locations affecting the strength and value of the castings for the service intended, shall be filleted at angles and the arrises shall be sharp and true. All castings shall be free from warp and seat uniformly and solidly. Where weight is specified or shown on the plans, castings shall conform to such requirements.

Accessories such as bolts, rivets, spacers, small I-beams, channels, plates, etc., used for assembling or supporting gratings in multiple grating sewer inlet installations shall be first quality standard, commercial materials, free from defects which affect their value for the service intended.

SECTION 722

JOINT FILLERS AND SEALERS FOR PORTLAND CEMENT CONCRETE

This section establishes the requirements for Joint Fillers and Sealers for Portland Cement Concrete.

722.01 PREFORMED EXPANSION JOINT FILLER (Bituminous Type): General Requirements: This joint filler shall conform to the requirements of AASHTO M 33. This type filler should not be used in joints for which the plan detail requires a sealer.

722.02 PREFORMED EXPANSION JOINT FILLER (Non-Extruding and Resilient Types): General Requirements: This joint filler shall conform to the requirements of AASHTO M 153 or M 213 as applicable.

722.03 HOT POURED SEALING FILLER FOR EXPANSION, CONTRACTION AND LONGITUDINAL JOINTS: General Requirements: This joint sealer shall conform to the requirements of AASHTO M 173.

722.04 READY MIXED COLD APPLIED JOINT SEALER FOR EXPANSION, CONTRACTION, AND LONGITUDINAL JOINTS:

(A) Description: The Ready Mixed Cold Applied Joint Sealer shall consist of a rubbery, resilient and adhesive internal set-up mastic joint sealer. The sealer shall have the quality of bonding perfectly to fresh concrete.

(B) Material: The joint sealing compound furnished and used under this specification shall be a cold applied, ready-mixed material consisting of a homogenous blend of asphalt, rubber, inert filler and a suitable solvent or solvents. The sealing compound shall contain not less than 5% virgin rubber and the Contractor shall furnish manufacturer's certified statement of compliance with this requirement. When installed in accordance with the manufacturer's recommendations, the material shall be a resilient, adhesive compound capable of effectively sealing properly cleaned joints and cracks in concrete pavements against the infiltration of moisture throughout repeated cycles of contraction and expansion, and which will not flow from the joints or be picked up by vehicle tires particularly at summer temperatures.

When approved by the Engineer, the manufacturer's test results showing compliance with these specifications may be used as a basis for acceptance.

(C) Requirements: The compound furnished under this specification when tested in accordance with the methods hereinafter described, shall conform with the following requirements:

Penetration:

At 77°F. (As received) 150 gm., 5 sec.	Minimum 2.75 cm. Maximum 3.50 cm.
(After evaporation of solvent) 150 gm., 5 sec.	Minimum 1.30 cm.
At 32°F. (After evaporation of solvent) 200 gm., 60 sec.	Minimum 1.30 cm. Maximum 1.90 cm.

SECTION 722 - JOINT FILLERS AND SEALERS FOR PORTLAND CEMENT CONCRETE

Flow: 24 hrs. at 77°F., 5 hrs. at 140°F. not more than 0.5 cm.

Bond: Separate tests conducted on wet and dry mortar blocks.

There shall be no cracking of the filler or failure in the bond between the sealer and the mortar test blocks through 5 cycles.

(D) Testing: Testing shall be in accordance with OHD-L-22.

722.05 PREFORMED ELASTOMERIC COMPRESSION JOINT SEALER:

(A) Description: These specifications cover preformed elastomeric compression joint sealers for use in Portland Cement concrete pavements and concrete bridge floors.

(B) Materials:

1. Preformed Joint Seals: The joint seals shall be manufactured from an elastomeric material that is resistant to heat, oil, jet fuel and ozone. The material shall be compatible with concrete and shall conform to the physical requirements of AASHTO M 220. All tests will be made on samples taken from the preformed joint sealer.

2. Shape and Dimensions: The molded joint seals shall be of cross sectional dimensions, lengths and tolerances shown on the plans. The sealer shall be one piece for the full length of the transverse joint and in practical lengths for longitudinal joints.

3. Samples: Two 2-foot long pieces of each size of sealer to be used shall be submitted to an approved testing laboratory for tests as warranted.

4. Inspection: Representative sections of each lot shall be subject to surface and dimensional inspection by the Engineer to determine visual compliance with applicable requirements of this specification which do not require physical tests.

5. Lubricant-Adhesive: Any lubricant-adhesive used shall be compatible with the sealer and the concrete and relatively unaffected by the normal moisture in the concrete. The lubricant-adhesive shall be a compound consisting of the same base polymer as the sealer, blended with a suitable volatile solvent. It shall maintain a suitable consistency at the temperature at which the seal is installed.

6. Manufacturer's Certification: The Contractor shall furnish the manufacturer's certification that the material proposed for use is in compliance with the specification requirements and include copies of the required tests by an approved laboratory.

The Contractor shall also furnish manufacturer's certification that a stipulated quantity of material, with identification, furnished for the specified project, is identical in all essential respects to the material tested under these specifications.

The Engineer may perform any of the specified tests as may be warranted.

SECTION 722 - JOINT FILLERS AND SEALERS FOR PORTLAND CEMENT CONCRETE

722.06 POLYMER TYPE, TWO COMPONENT COLD APPLIED MACHINE EXTRUDED AND POURABLE JOINT SEALER:

(A) Description: These specifications cover two component, polymer type, rubber-like, cold applied joint sealing compounds for use in Portland Cement concrete pavements and bridge floors.

A primer, when recommended by the manufacturer, shall be used in accordance with the manufacturer's recommendation.

(B) Materials:

1. General:

1.1 Inspection: Each batch of the joint sealer manufacturer shall be subject to inspection and approval by the Engineer before acceptance or shipment.

1.2 Packaging: The joint sealer shall be packaged in sealed containers identified by the name of the manufacturer, the manufacturer's lot number, the date of manufacture and shall bear instructions for mixing and application. Containers including the curing agent shall be marked "A" and containers including the polymer shall be marked "B". Proper instructions for use of the primer shall be given on its container.

1.3 Sampling: Samples selected by the Engineer, of each component and the primer of each lot of material, shall be submitted to an approved laboratory for test purposes at least 3 weeks before use. Regardless of previous tests, material that has not been used within 6 months shall be resampled and retested. Additional tests may be made at the discretion of the Engineer. For the extrusion machine type, a 5-gallon sample of each component shall be furnished. The unused portion will be returned. For the pourable type, a 1-quart sample of Component "B" and the proper quantity and mixing ratio of Component "A" shall be furnished. If a primer is required, a 1/4-pint sample shall be furnished.

1.4 Tests: Tests shall be made in accordance with OHD L-21.

1.5 When approved by the Engineer, the manufacturer's test results showing compliance with these specifications may be used as a basis for acceptance.

2. Machine Extruded Joint Sealer:

2.1 General: The joint sealer shall be a modified polysulfide polymer consisting of 2 components to be machine mixed in a 1:1 ratio by volume and machine extruded directly into the joints.

Upon opening, Component "B" shall not exhibit more than a slight degree of skinning.

2.2 Properties of Unmixed Material:

Determination	Requirements
*Viscosity of Components	150 to 800 poises
*The viscosity of either component shall not be more than 2-1/2 times the viscosity of the other component.	

SECTION 722 - JOINT FILLERS AND SEALERS FOR PORTLAND CEMENT CONCRETE

2.3 Properties of Laboratory Mixed Material:

Determination	Requirements
Penetration at 77°F.	50 to 120
Penetration at 158°F.	1.5 x Penetration at 77°F.
Cold Flow 3 minutes	3/4 - inch minimum
40 minutes	1/2 - inch maximum
Resilience at 77°F.	70% minimum **60% minimum
Resilience of oven aged sample at 7 days	70% minimum **60% minimum
Resilience at 158°F.	60% minimum **50% minimum
Bond to concrete ¹ , 100% extension, dry at -20°F.	No Failure
Bond to concrete, 100% extension, wet, at -20°F.	No Failure
Non-Volatile content	88% minimum

**This requirement applies if penetration at 77°F. is 90 to 120.

¹Cure sample for 24 hours at 77°F., then oven age at 158°F. for 7 days before testing.

3. Pourable Joint Sealer:

3.1 General: The joint sealer shall be a polymeric material consisting of 2 components to be uniformly mixed and poured directly into the joints. The weight of Component "A" in the mixture shall be not less than 10 percent of the weight used of Component "B".

Upon opening, neither component shall exhibit more than a slight degree of skinning.

3.2 Properties of Laboratory Mixed Material:

Determination	Requirements
Viscosity, 5 minutes after mixing	200 to 350 poises
Application time (pot life or time to reach 2,000 poises) at 77°F.	1 hr. minimum
Penetration at 77°F. after 24 hours aging at 77°F.	150 maximum
*Penetration at 77°F.	50 to 120
*Penetration at 158°F.	1.5 x Penetration at 77°F.
*Resilience at 77°F.	70% minimum **60% minimum
*Resilience at 158°F.	60% minimum **50% minimum
Resilience of oven aged sample at 7 days	70% minimum **60% minimum
*Bond to concrete ¹ ; 100% extension, dry, at -20°F.	No Failure
100% extension, wet, at -20°F.	No Failure
Non-volatile content	88% minimum

*After 96 hours aging at 77°F.

**This requirement applies if penetration at 77°F., after 96 hours aging at 77°F., is 90 to 120.

¹Cure sample for 24 hours at 77°F., then oven age at
158°F. $\pm$ 2°F. for 7 days before testing.

SECTION 723

REINFORCING STEEL

723.01 BAR STEEL REINFORCEMENT (BILLET STEEL):

(A) Materials Covered: These specifications cover plain and deformed billet-steel bars for concrete reinforcement, and shall apply to all bar steel used in the work.

(B) Requirements: Billet-steel reinforcement bars shall conform to the requirements of AASHTO M 31, Grade 40.

1. Bars for reinforced concrete shall be deformed bars meeting the above specification for bar reinforcement.

2. Dowel bars across transverse joints shall be smooth round bars meeting the above specifications for bar reinforcement.

(C) Sampling and Testing: A sample shall consist of two bars, not less than 24 inches in length, from each lot of bars in the shipment. The term "lot" used in this paragraph means all bars of one size bearing one manufacturer's roll mark.

Testing shall be in accordance with ASTM E 8.

723.02 REINFORCING STEEL (AXLE STEEL):

(A) Materials Covered: This specification covers plain and deformed axle-steel bars for concrete reinforcement, which may be used in lieu of billet-steel bars, as specified in Subsection 723.01.

(B) Requirements: Axle-steel shall conform to the requirements of AASHTO M 53, Grade 40.

(C) Sampling and Testing: Sampling and Testing shall conform to Subsection 723.01(C).

723.03 WIRE FABRIC REINFORCEMENT:

(A) Materials Covered: These specifications cover cold drawn steel wire to be used as such, or in fabricated form, for the reinforcement of concrete.

(B) Requirements: Wire fabric reinforcement shall consist of a series of longitudinal wires combined with a series of transverse wires arranged at right angles thereto and electrically welded at all points of intersection. The size and spacing of wires in the fabric shall be as shown on the plans. Welds shall be of sufficient strength that they will not be broken during handling or placing.

Reinforcing fabric shall be furnished in flat sheets or rolls. Any material that may have become bent or distorted must be straightened and otherwise put in proper condition before using. When placed in the work, the fabric shall be free from excessive rust, scale or coating of any character which will impair its bond with the concrete. The fabric shall be manufactured from cold-drawn wire, the finished members of which shall comply with the requirements of AASHTO M 55 or AASHTO M 221.

(C) Sampling and Testing: Two samples, each 24 inches in length, cut from the fabric shall be submitted for each different bar size in the fabric. Samples shall be submitted for each 10 tons or less of material. Testing shall be done in accordance with ASTM E 8.

SECTION 724

MISCELLANEOUS MATERIALS

724.01 METAL CAPS FOR SLIP DOWEL BARS: Metal caps for slip dowel bars shall be four and one-half (4-1/2) to five (5) inches long and of a diameter to permit them just slipping over a three-fourths (3/4) inch round smooth bar, unless otherwise specified. In no instances shall the diameter of the cap be more than one-eighth (1/8) inch greater than the diameter of the bar it is to fit, and it shall grip the bar sufficiently to remain in position when once placed. One (1) end of the cap shall be tightly closed and the metal cap shall provide unobstructed expansion space of not less than one (1) inch to permit movement of the dowel bar. The metal shall be not lighter than number twenty-six (no. 26) gauge.

724.02 WIRE TIES AND TIE WIRE: Wire ties and tie wire for metal reinforcement shall be number sixteen (no. 16) soft annealed black iron wire and shall be free from rust or other defects. The length of wire ties shall be sufficient to twist and fasten securely.

724.03 METAL PARTING STRIPS:

(A) Materials Covered: These specifications cover metal parting strips for use in forming longitudinal joints in concrete pavement or concrete base courses.

(B) General Requirements: Metal parting strips shall be shaped from metal of a gauge shown on the plans and shall be free from bends and kinks. It shall conform to the dimensions and be punched for pins and tie bars as shown on the plans. Punching for pins may not be farther apart than 3 feet center to center. Sections of metal parting strips shall not be less than 10 feet in length and so designed that adjoining sections may be securely fastened together by lapping and pinning, by means of a slip joint, or other approved method.

SECTION 734

CURING AGENTS FOR CONCRETE

Concrete curing agents shall consist of burlap, pigmented membrane curing compound or polyethylene film. The curing agents shall be reasonably free from ingredients which may damage or be detrimental to the surface of the concrete, and unless otherwise specified, shall conform with the requirements of these specifications.

734.01 BURLAP: Burlap cloth shall conform to AASHTO M-182, Class 3 or better. Burlap shall be new burlap or burlap which has been used for no purpose other than the curing of concrete. New burlap not previously used for curing concrete shall be reasonably free from starch, filler, or other substances added during the process of manufacturing, or shall be washed by repeated rinsing in clear water until reasonably free from such substances. Worn burlap or burlap with holes will not be permitted. Burlap shall be not less than 10 ounce material and the strip after full shrinkage shall be at least 2 feet longer than the width of the pavement slab.

734.02 WHITE PIGMENTED MEMBRANE CURING COMPOUND:

(A) General Requirements:

1. **Material:** The material shall be a membrane curing compound of the highest quality capable of high water retention, and shall consist of finely ground pigment in the curing vehicle.
2. **Color:** The compound, when applied to a new concrete surface at the specified coverage, shall provide a uniformly white appearance and shall effectively obscure the original color of concrete.
3. **Containers:** Curing compound shall be shipped in barrels, upon which shall be plainly stenciled the manufacturer's name and a lot number indicating the particular batch of which the contents are a part. A jobber's name or brand may supplement, but not replace, the manufacturer's name and lot number. Quantities smaller than a barrel may be shipped in a suitable container providing that the manufacturer's name and lot number appear on the label.

(B) Special Requirements:

1. **Hiding Power:** After the compound has dried in a curing cabinet for 24 hours, it shall have an apparent daylight reflectance of not less than 65 percent compared to magnesium oxide as determined by ASTM E 97.
2. **Viscosity:** The viscosity of the material furnished shall be such as to enable it to be used at atmospheric temperatures above 49°F. It will be applied to the concrete as a fine mist by means of an atomizing nozzle at an air pressure of 50 pounds or less.
3. **Reaction with Concrete:** There shall be no deleterious reaction between the concrete and the curing compound.
4. **Drying Time:** The material shall dry to touch on moist concrete in one to four hours under ordinary conditions. The resulting surface shall not be tacky or slippery when walked upon.

SECTION 734 - CURING AGENTS FOR CONCRETE

5. Adherence: The material, when sprayed on moist concrete, either vertical or horizontal, shall adhere to the moist surface and make a tight bond to the concrete. The dry membrane shall not disintegrate or peel within 30 days; however, by the end of 60 days it is expected that the membrane will chalk away due to weather and erosion.
6. Moisture Retention: When tested in accordance with OHD L 17, the curing compound shall have a water retention of at least 90 percent.
7. Storage: Membrane curing compounds, particularly those containing paraffin or similar wax, should be stored inside where they will not freeze. Freezing may cause hard deposits of wax or resin difficult to redissolve. Storage temperatures of 60°F. or higher are desirable.
8. The compound shall be thoroughly mixed by air jet or by mechanical stirring before use in the field.

734.03 RED MEMBRANE CURING COMPOUND:

(A) General Requirements:

1. The material desired is a membrane curing compound of the highest quality capable of high water retention.
2. The material shall be a colored liquid, homogeneous in character, consisting of a suitable blend of oils and/or waxes and resins dissolved in a suitable solvent. It shall be ready for use as received.
3. The material shall be translucent and essentially free from undissolved, suspended, or residual or foreign matter. Settled out material or hard deposits in the container will be considered evidence of unsatisfactory curing compound.
4. Curing compound shall be shipped in barrels, upon which shall be plainly stenciled the manufacturer's name and a lot number indicating the particular batch of which the contents are a part. A jobber's name or brand may supplement, but not replace, the manufacturer's name and lot number. Quantities smaller than a barrel may be shipped in a suitable container provided the manufacturer's name and lot number appear on the label.

(B) Special Requirements:

1. Color: The liquid shall be colored by a red fugitive dye so that inspection may indicate complete coverage. The color must be maintained at least 4 hours after which it should gradually disappear.
2. Viscosity: The viscosity of the material furnished shall be such as to enable it to be used at atmospheric temperatures above 40°F. It will be applied to the concrete as a fine mist by means of an atomizing nozzle at an air pressure of 50 pounds or less.
3. Reaction with Concrete: There shall be no deleterious reaction between the concrete and the curing compound. Application of the compound shall produce no darkening or disfigurement of the concrete, except temporarily, as caused by the fugitive color in the compound referred to above.

SECTION 734 - CURING AGENTS FOR CONCRETE

4. Drying Time: The material shall dry to touch on moist concrete in one to four hours under ordinary conditions, and dry hard in 24 hours. The resulting surface shall not be tacky or slippery when walked upon.
5. Adherence: The material when sprayed on moist concrete, either vertical or horizontal, shall adhere to the moist surface and make a tight bond to the concrete. The dry membrane shall not disintegrate or peel within 30 days; however, by the end of 60 days it is expected that the membrane will chalk away due to weather and erosion.
6. Moisture Retention: When tested in accordance with OHD L 17, the curing compound shall have a water retention of at least 90 percent.
7. Storage: In accordance with Subsection 734.02(B)7.
8. Mixing: In accordance with Subsection 734.02(B)8.

734.04 WHITE POLYETHYLENE SHEETING:

- (A) Materials: Materials shall meet the requirements of AASHTO M 171, except that the material shall have a moisture retention of at least 90 percent when tested in accordance with OHD L 17.

734.05 POLYETHYLENE BURLAP:

- (A) Materials: The material shall be a combination of 10 ounce burlap and 4 mill white opaque polyethylene plastic film fused together in such a way as to remain one integral unit throughout the curing period. Moisture loss and reflectivity shall be the same as for the white polyethylene sheeting in Subsection 734.04.

SECTION 735

CONCRETE SURFACE FINISH FOR STRUCTURES

This section covers materials for concrete surface finishing compounds for structures.

735.01 HEAVY CEMENT BASE MORTAR:

(A) Materials:

1. Heavy cement base mortar packaged in dry powder form for mixing with water.

- 1.1 Plastic Mix: For plastic gun application.

- 1.2 Brush and float mix for brush and float application.

(B) Bonding Agent: A formulation of acrylic polymers and modifiers in liquid form for use as an additive with Portland Cement mixer to assure adhesion.

(C) Proportioning and Consistency: The bonding agent and water shall be proportioned in accordance with the manufacturer's recommendation. A copy of those recommendations shall be furnished to the Engineer.

735.02 PAINT TYPE SPRAY FINISH:

(A) Materials: Materials for paint type spray finish shall be a commercial product designed specifically for this purpose and consisting of a synthetic elastomer - polyester base, with fiberglass, asbestos, perlite, and mica additives with durable tinting pigments.

Materials to be furnished for spray finish shall conform to the requirements specified in the Standard Specifications for Highway Construction for the Oklahoma State Highway Commission. A certification of compliance shall be submitted to the Engineer.