12149660 SLCC 2013 ASPHALT IMPROVEMENTS

SECTION **TECHNICAL SPECIFICATIONS** **PAGE(S)**

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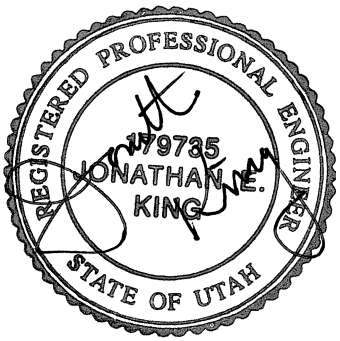

SECTION 02 41 14
PAVEMENT REMOVAL

PART 1 GENERAL

1.1 **SECTION INCLUDES**

A. Removal of roadway Pavement.

B. Milling roadway Pavement.

C. Removal of curb, gutter, sidewalk, Driveway Approach, waterway, or similar flatwork.

D. Disposal of removed materials.

1.2 **RELATED WORK**

A. Demolition of structures and utilities.

1.3 **DEFINITIONS**

A. ADA: Americans with Disabilities Act.

1.4 **SUBMITTALS**

A. Traffic control plan, Section 01 55 26.

1.5 **SITE CONDITIONS**

A. Control dust, Section 01 57 00.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION

3.1 **PREPARATION**

A. General

1. Coordinate utility location, Section 01 31 13.
2. Preserve all active utilities.
3. Notify neighborhood of day and time of operation.
4. Make sure invert covers are properly installed in storm drain and sanitary sewer systems, Section 01 71 13.
5. Mark existing utilities on redline drawings.

B. Traffic Control: Provide worker and public safety, Section 01 55 26.

C. Tree Roots:

1. Avoid or minimize damage to tree roots. Roots provide anchorage, storage of energy, and absorption and conduction of water and

mineral elements. Loss of root connection affects health and stability of tree and safety of people and property.

2. Provide certified arborist observation of root cuts larger than 4 inches diameter. Notify ENGINEER of such root cut.

D. Existing Surfaces:

1. Do not damage adjacent concrete surfaces that are not scheduled for removal.
2. Use rubber cleats or Pavement pads when operating backhoes, outriggers, track equipment, or any other equipment on or crossing paved surfaces.
3. Restore paved surfaces that are damaged by removal operations at no additional cost to the OWNER. Match the existing Pavement surface plus 1 inch.

3.2 SAW-CUT PEDESTRIAN TRIP HAZARDS

A. Make saw cuts 1:8 slope measured to grade.

B. Eliminate trip hazards across the full width of the hazard.

3.3 SAW-CUT CURB HORIZONTALLY

A. Saw cut curbs for ADA ramps at 1:12 slope. No trip hazard at gutter flow line.

B. Saw cut curbs for flares:

1. 1:4 slope measured to grade, or
2. 1:12 slope measured horizontally when complying with ADA.

3.4 REMOVE PORTLAND CEMENT CONCRETE

A. Remove concrete to the nearest expansion joint or vertical saw cut.

B. Make concrete cuts straight, vertical to the surface, true, full depth.

C. DO NOT use machine mounted impact hammers.

3.5 REMOVE ASPHALT CONCRETE

A. Saw cut full depth and remove Pavement.

B. When asphalt concrete overlays Portland cement concrete Pavements do not use a machine mounted impact hammer.

3.6 MILLING

A. Machine:

1. Equipped to prevent air pollution.
2. Equipped with a system to control slope of mill cut.

B. Tolerances:

1. Milling Depth: As indicated plus or minus 10 percent not uniformly high or uniformly low.
2. Striation Texture: Uniform, discontinuous, longitudinal, 3/16 inch deep maximum, 3/4 inch center to center.

3. Smoothness: Plus or minus 5/16 inch in 25 feet.
4. Cross Slope: Plus or minus 1/4 inch in 10 feet.

C. Performance:

1. Lower utility frames, covers, and other Street Fixtures.
2. Mill surfaces to the depth shown on the Drawings or indicated by ENGINEER. Do not disfigure adjacent work or existing surface improvements.
3. If milling exposes smooth underlying Pavement surfaces, mill the smooth surfaces to make them rough.
4 Mill off material if it ponds water or if it has been damaged by water.
5. Where vehicles or pedestrians must pass over milled edges provide safe temporary ramps suitable to speed of user vehicles (or suitable for wheel chair user needs).
6. Remove excess material and clean milled surfaces.
7. If work equipment is removed from the milling site and milled surface awaits further work, provide appropriate traffic control and cleaning.

3.7 GRINDING

A. Machine:

1. Cutting head 36 inches wide minimum.
2. 50 to 60 diamond blades per foot of head.

B. Preparation:

1. Control traffic.
2. Provide water truck, waste truck, and other support machinery.
3. Mark areas to be ground.

C. Tolerances:

1. 1/4 inch lip transverse to the direction of vehicular travel. Potential for ponding not allowed.
2. 1/8 inch lip (or dent) parallel to direction of vehicular travel.
3. Taper ground areas from the lane/shoulder line into the shoulder area at 1/4 inch per foot.

D. Performance:

1. Skid resistance of final ground surface must be comparable to adjacent sections not requiring corrective work.
2. Surface treatement of ground areas.
   a. Asphalt Concrete: Asphalt tack coat and sand blotter, Section 32 12 14.
   b. Hydraulic Concrete: Water repellant, Section 07 19 00.
3. Waste grindings legally.
4. Protect downstream fish habitat.

3.8 CLEANING

A. Remove all debris and concrete dust. Clean surrounding rails, sidewalks, Driveways, landscaping and other objects in vicinity of work.

END OF SECTION

SECTION 32 05 10
BACKFILLING ROADWAYS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roadway backfill materials.

B. Roadway backfilling requirements.

1.2 DEFINITIONS

A. Embankment: A raised earthen structure to carry a roadway.

B. Pavement: Artificially covered surfaces including but not limited to roadway surfaces, parking lot surfaces, sidewalks, curb, gutter, curb ramps, Driveway ramps, etc.

C. Subgrade: A surface of earth or Rock leveled off as to receive backfill materials.

1.3 SUBMITTALS

A. Submit maximum laboratory dry density and optimum laboratory moisture content for:

1. Subgrade material, and
2. Each type of fill to be used.

B. Submit aggregate batch delivery tickets showing name of material source, Serial number of ticket; date and truck number; name of Supplier; job name and location; volume of material delivered, And aggregate classification.

C. Upon ENGINEER's request, submit a written quality control Inspections and testing report describing source and field quality control activities performed by CONTRACTOR and its Suppliers.

1.4 QUALITY ASSURANCE

A. Do not change material sources, or aggregate without ENGINEER's knowledge.

B. Reject backfill material that does not comply with requirements specified in this section.

1.5 STORAGE

A. Safely stockpile backfill materials.

B. Separate differing materials, prevent mixing, and maintain optimum moisture content of backfill materials.

C. Avoid displacement of and injury to Work while compacting or operating equipment.

D. Movement of construction machinery over Work at any stage of construction is solely at CONTRACTOR's risk.

1.6 SITE CONDITIONS

A. Do not place, spread, or roll any backfill material over material that is damaged by water. Remove and replace damaged material at no additional cost to OWNER.

B. Control traffic and erosion. Keep area free of trash and debris. Repair settled, eroded, and rutted areas.

C. Reshape and compact damaged structural section re required density.

D. Soil Cement: Do not spread soil cement mixture when air temperature is less than 40 deg. F. in the shade.

E. Drainage: Immediately prior to suspension of construction operations for any reason, provide proper and necessary drainage of Work area.

1.7 ACCEPTANCE

A. General:

1. Native material may be wasted if there is no additional cost to substitute material acceptable to ENGINEER.
2. For material acceptance refer to.
   a. Common fill, Section 31 05 13.
   b. Crushed aggregate base, Section 32 11 23.
   c. Cement treated fill, Section 31 05 15.

B. Backfilling: One test per Lot.

Table No.1 – Lot Sizes

Material	Test Criteria	Lot Size
Subgrade	Standard (a)	1000 square yards
Common Fill	Standard (a)	PCC or AC Surface Course: 1,000 square yards per lift Driveway Approach: 400 square feet per lift Sidewalk: 400 lineal feet per lift
Crushed Aggregate Base	Modified (a)	PCC or AC Surface Course: 1,000 square yards per lift Driveway Approach: 400 square feet per lift Sidewalk: 400 lineal feet per lift Curb, Gutter, and Waterways: 200 lineal feet per lift
Flowable Fill	Strength (b)	250 cubic yards

NOTES
(a) Proctor density, Section 33 05 05
(b) Cement treated fill, Section 31 05 15
(c) Lift thickness before compaction, 8 inches.

1.8 **WARRANTY**

A. Any settlement noted in Embankment or Pavement construction will be considered to be caused by improper compaction methods and shall be corrected at no cost to the OWNER.

B. Restore incidentals damaged by settlement at no additional cost to OWNER.

PART 2 PRODUCTS

2.1 **BACKFILL MATERIALS**

A. Common Fill, Section 31 05 13.

B. Crushed aggregate base, Section 32 11 23.

C. Cement treated fill, Section 31 05 15.

2.2 **ACCESSORIES**

A. Water:

1. Make arrangements for sources of water during construction and make arrangements for delivery of water to site.
2. Comply with local Laws and Regulations at no additional cost to OWNER when securing water from water utility company.

B. Geotextile Fabric, Section 31 05 19.

PART 3 EXECUTION

3.1 **PREPARATION**

A. Verify.

1. Backfill material meets gradation requirements.
2. Areas to be backfilled are free of debris, snow, ice or water, and
3. Bearing surfaces are not frozen.

B. If extra excavation is required, secure ENGINEER’s written permission and follow Section 31 23 16 requirements.

C. Place geotextile fabrics, Section 31 05 19.

3.2 **SUBGRADE PREPARATION**

A. Protect Subgrade from desiccation, flooding, and freezing.

B. If ground water table is in the intended construction operations, dewater.

C. Before beginning backfilling operations over Subgrade, secure ENGINEER's review of Subgrade surface preparations.

3.3 EMBANKMENTS

A. Place backfill material in lifts not exceeding 8 inches after compaction.

B. Build shoulders to a grade higher than that of adjacent fills. Provide surface runoff at all times.

C. Commence compaction along edge of area to be compacted and gradually advance toward center.

D. Operate compaction equipment along lines parallel or concentric with the center-line of the Embankment being constructed.

E. Do not damage subsurface structures or utilities.

3.4 BASE COURSES

A. Place backfill material in lifts not exceeding 8 inches before compaction.

B. Maintain moisture content in compaction operations.

C. Avoid segregation when spreading backfill. Keep surfaces free from pockets of coarse and fine aggregate.

D. Rework fills which do not conform to compaction requirements until requirements are met.

E. Protect cement treated fill against freezing and traffic for 7 days.

3.5 MODIFIED BACKFILL LAYER METHOD

A. Section 33 05 20.

3.6 COMPACTION

A. Compact backfill, Section 33 05 05 as follows.

1. A-1 soils: greater than or equal to 95 percent of a Modified Proctor Density.
2. Other soils: greater than or equal to 95 percent of a Standard Proctor Density.

3.7 COMPRESSIVE STRENGTH

A. Where a flowable fill is used, provide compressive strength indicated in Section 31 05 15.

3.8 PROOF ROLLING TEST

A. Prior to placing fill material for roadbed backfills, proof roll Subgrade using gross weight of 18,000 pounds/tandem axle, with a tire pressure at least 90 psi.

B. All proof roll passes will traverse the Subgrade parallel to the roadbed centerline. All subsequent passes will be offset 1/2 the vehicle width until the entire Subgrade is tested.

C. ENGINEER will analyze, determine, designate and measure the areas, if any, requiring additional compaction or reconstruction.

D. Once Subgrade passes the proof rolling test, protect the surface from construction operations and traffic damage. Repair all cuts, ruts, and breaks. Keep surface in a satisfactory condition until geotextile fabric or base course has been placed.

3.9 CLEANING

A. Remove stockpiles from the site upon Work Completion. Grade site to prevent free standing surface water.

B. Leave borrow areas clean and neat.

END OF SECTION

SECTION 32 11 23
CRUSHED AGGREGATE BASE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Treated or untreated base course requirements.

1.2 REFERENCES

A. ASTM C 29: Standard Test Method for Unit Weight and Voids in Aggregate.

B. ASTM C 131: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

C. ASTM C 136: Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

D. ASTM D 75: Standard Practice for Sampling Aggregates.

E. ASTM D 448: Standard Classification for Sizes of Aggregate for Road and Bridge Construction.

F. ASTM D 1883: Standard Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils.

G. ASTM D 2419: Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

H. ASTM D 3665: Standard Practice for Random Sampling of Construction Materials.

I. ASTM D 3740: Standard Recommended Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

J. ASTM D 4318: Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

K. ASTM D 5821: Standard Test Method for Determining the percentage of Fractured Particles in Coarse Aggregate.

1.3 DEFINITIONS

A. Aggregate Grading Band: Allowable deviation from Target Gradation Curve based upon the number of gradation tests in a Lot. It is possible that gradation for any sieve may lie outside of its respective Master Grading Band limits.

B. Master Grading Band: Gradation limits allowed for various sieve sizes ranging from the maximum size sieve to the No. 200 sieve.

C. Mean of Deviations: The sum of the absolute values of the variance between each screen target value and each measured value divided by the number of tests in the Lot.

D. RAP (acronym for reclaimed asphalt pavement): See Section 32 01 16.

E. Target Gradation Curve: A smooth locus of points within the limits of the Master Grading Band.

1.4 **SUBMITTALS**

A. Name of Supplier and aggregate source.

B. Target Gradation Curve.

1.5 **QUALITY ASSURANCE**

A. Use a laboratory that follows and complies with Section 01 45 00 and ASTM D 3740.

1.6 **ACCEPTANCE**

A. General:

1. Defective work, Section 01290.

2. Dispute resolution, Section 01460.

B. Treated or Untreated Base Course: Lot size is one day's production. Sub-lot size is 500 tons.

1. ENGINEER is not obligated to accept changes in Target after any material is delivered to site.

2. Lot is acceptable if gradation test deviations are within pay factor 1.00 limits. At ENGINEER's discretion, a Lot with a sub-lot test deviation greater than pay factor 0.70 limits may stay in place at 50 percent cost.

Table 1- Pay Factors for Price Determination

Criteria	Pay Factor	Mean of Deviations of Acceptance Tests From the Target Gradation Curve Expressed in Percentage Points				
		1 Sample	2 Samples	3 Sample	4 Sample	5 or More Samples
1/2" Sieve	1.00	0 – 15	0.0 – 12.1	0.0 – 10.8	0.0 – 10.0	0.0 – 9.5
	0.95	16 – 17	12.2 – 13.9	10.9 – 12.4	10.1 – 11.5	9.6 – 11.
	0.90	18 – 19	14.0 – 15.1	12.5 – 13.5	11.6 – 12.5	11.1 – 11.9
	0.80	20 – 21	15.2 – 17.2	13.6 – 15.3	12.6 – 14.2	12. – 13.5
	0.70	22 – 23	17.3 – 18.8	15.4 – 16.7	14.3 – 15.5	13.6 – 14.7
3/8" Sieve	1.00	0 – 15	0.0 – 11.5	0.0 – 9.8	0.0 – 8.8	0.0 – 8.0
	0.95	16 – 17	11.6 – 13.2	9.9 – 11.3	8.9 – 10.1	8.1 – 9.2
	0.90	18 – 19	13.3 – 14.4	11.4 – 12.3	10.2 – 11	9.3 – 10.0
	0.80	20 – 21	14.5 – 16.3	12.4 – 13.9	11.1 – 12.5	10.1 – 22.4
	0.70	22 – 23	16.4 – 17.9	14.0 – 15.2	12.6 – 13.6	11.5 – 12.4
No. 4 Sieve	1.00	0 – 14	0.0 – 10.5	0.0 – 8.8	0.0 – 7.8	0.0 – 7.0
	0.95	15 – 17	10.6 – 12.1	8.9 – 10.1	7.9 – 9.0	7.1 – 8.0
	0.90	18	12.2 – 13.1	10.2 – 11	9.1 – 9.8	8.1 – 8.7
	0.80	19 – 20	13.2 – 14.9	11.1 – 12.5	9.9 – 11.1	8.8 – 10.0
	0.70	21 – 22	15.0 – 16.3	12.6 – 13.6	11.2 – 12.1	10.1 – 10.8
No. 16 Sieve	1.00	0 – 11	0.0 – 8.2	0.0 – 6.9	0.0 – 6.2	0.0 – 5.6
	0.95	12 – 13	8.3 – 9.4	7.0 – 7.9	6.3 – 7.1	5.7 – 6.4
	0.90	14	9.5 – 10.3	8.0 – 8.6	7.2 – 7.8	6.5 – 7.0
	0.80	15 – 16	10.4 – 11.6	8.7 – 9.8	7.9 – 8.8	7.1 – 8.0
	0.70	17	11.7 – 12.7	9.9 - 10.7	8.9 – 9.6	8.1 – 8.7

Table 1- Pay Factors for Price Determination						
Criteria	Pay Factor	Mean of Deviations of Acceptance Tests From the Target Gradation Curve Expressed in Percentage Points				
		1 Sample	2 Samples	3 Sample	4 Sample	5 or More Samples
No. 50 Sieve	1.00	0 – 9	0.0 – 7.0	0.0 – 6.1	0.0 – 5.5	0.0 – 5.2
	0.95	10	7.1 – 8.0	6.2 – 7.0	5.6 – 6.3	5.3 – 6.0
	0.90	11	8.1 – 8.8	7.1 – 7.6	6.4 – 6.9	6.1 – 6.5
	0.80	12 – 13	8.9 – 10.0	7.7 – 8.7	7.0 – 7.8	6.6 – 7.4
	0.70	14	10.1 - 10.9	8.8 – 9.5	7.9 – 8.5	7.5 – 8.1
No. 200 Sieve	1.00	0 – 4.5	0.0 – 3.4	0.0 – 2.9	0.0 – 2.5	0.0 – 2.3
	0.95	4.6 – 5.2	3.5 – 3.9	3.0 – 3.3	2.6 – 2.9	2.4 – 2.6
	0.90	5.3 – 5.6	4.0 – 4.3	3.4 – 3.6	3.0 – 3.1	2.7 – 2.9
	0.80	5.7 – 6.4	4.4 – 4.9	3.7 – 4.1	3.2 – 3.6	3.0 – 3.3
	0.70	6.5 – 7.0	4.9 – 5.3	4.2 – 4.5	3.7 – 3.9	3.5 – 3.6

3. Suitability of Source: Meet Table 2 properties. A reduction in aggregate class will be accepted providing any costs for difference in excavation, backfill, and alternate design for CBR does not increase the Contract Price.

PART 2 PRODUCTS

2.1 UNTREATED BASE COURSE

A. Material: Crushed rock, gravel, sand or other high quality mineral particle, or combination.

Table 2 – Properties					
Physical Property	Units	Aggregate Class			ASTM Test
		A	B	C	
Dry Rodded Unit Weight, min.	lb/ft^3	75			C 29
Liquid Limit, max.		25			D 4318
Plastic Index, max.		0	0	6	D 4318
Sand Equivalent, min.	percent	35			D 2419
Wear (hardness), max.	percent	50			C 131
Gradation		Table 3			C 136
Two Fractured Faces, min.	percent	90	50	50	D 5821
CBR, min.	percent	70	55	40	D 1883

NOTES
(a) Liquid limit, plastic limit, sand equivalent: Passing No. 40 sieve.
(b) Wear: Retained on No. 8 sieve.
(c) CBR: Use a 10 lb surcharge measured at 0.20 inch penetration at 95 percent of modified Proctor.
(d) Faces: Retained on No. 4 sieve.

Table 3 – Gradation			
US Sieve Size	Master Grading Bands Limits		
	Grade 1-1/2	Grade 1	Grade 3/4
2"	–	–	–
1-1/2"	100	–	–
1"	–	100	–
3/4 "	81 – 91	–	100
1/2 "	67 – 77	79 – 91	–
3/8"	–	–	78 – 92
No. 4	43 – 53	49 – 61	55 – 67
No. 16	23 – 29	27 – 35	28 – 38
No. 200	6 – 10	7 – 11	7 – 11

2.2 **ASPHALT TREATED BASE COURSE**

A. Meet requirements of this Section Article 2.1 and the following.

1. Sand equivalent and fractured face measured after asphalt residue is burned off.
2. Plasticity and wear requirements apply to virgin aggregate portion only.
3. Allowable asphalt content is controlled by CBR.

B. If aggregate contains RAP.

1. Screen crushed RAP to remove debris.
2. Mechanically blend virgin and RAP aggregates. Do not use windrows for blending.

2.4 **SOURCE QUALITY CONTROL**

A. Sample, ASTM D 75 on a random basis, ASTM D 3665.

B. Reject crushed aggregate base products that do not meet requirements of this Section.

PART 3 EXECUTION

3.1 **INSTALLATION**

A. Trenches, Section 33 05 20.

B. Structures, Section 31 23 23.

C. Landscaping, Section 32 92 19.

D. Pavements, Section 32 05 10.

3.2 **FIELD QUALITY CONTROL**

A. Remove any product found defective after installation and install acceptable product at no additional cost to the OWNER.

END OF SECTION

SECTION 32 12 03
PAVING ASPHALTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Performance graded asphalt, asphalt cement, cutback asphalt, emulsified asphalt, recycle asphalt, and crack patch asphalt.

B. Requirements for accepting non-complying paving asphalts.

1.2 REFERENCES

A. ASTM D 113: Standard Test Method for Ductility of Bituminous Materials.

B. ASTM D 977: Standard Specification for Emulsified Asphalt.

C. ASTM D 2026: Standard Specification for Cutback Asphalt (Slow-Curing Type).

D. ASTM D 2027: Standard Specification for Cutback Asphalt (Medium-Curing Type).

E. ASTM D 2028: Standard Specification for Cutback Asphalt (Rapid-Curing type).

F. ASTM D 2397: Standard Specification for Cationic Emulsified Asphalt.

G. ASTM D 3381: Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.

H. ASTM D 4552: Standard Practice for Classifying Hot-Mix Recycling Agents.

I. ASTM D 5710: Standard Specification for Trinidad Lake Modified Asphalt.

J. ASTM D 6373: Standard Specification for Performance Graded Asphalt Binder.

1.3 SUBMITTALS

A. Submit bill of lading for each shipment of paving asphalt from vendor. Identify the following.

1. Source of product (manufacturer);
2. Type and grade of asphalt, And
3. Type and amount of additives in the product.

1.4 QUALITY ASSURANCE

A. Reject paving asphalts which are not uniform in appearance and consistency or which foam when heated to mixing temperature.

B. Do not use storage containers contaminated with other types or grades of Petroleum products.

C. Do not use Petroleum product that does not comply with contract requirements.

1.5 **ACCEPTANCE**

A. General:

1. Acceptance is by Lot. One Lot is one day's production.
2. If non-complying material has been installed and no price for the material is specified, apply price adjustment against cost of work requiring material as part of its installation. Section 01 29 00
3. Dispute resolution, Section 01 35 10.

B. Performance Graded Asphalt Binder (PGAB): Sub-lot size is 20,000 gallons. Collect sub-lot Sample randomly from oil storage unit.

1. Refer to limits identified in Section 209 of UDOT's "Manual of Instruction Part 8 Materials". Pay factors are as follows.
   a. If none of the critical properties are outside rejection limit a composite price adjustment of 25 percent or less is allowed.
   b. If one or more of the critical properties falls outside the rejection limit or if a composite price adjustment is more than 25 percent, paving asphalt will be rejected.

C. Asphalt Cement (AC) Binder: Sub-lot size is 20,000 gallons. Collect sub-lot Sample randomly from oil storage unit.

1. Ductility: Meet this Section's requirements, <u>or</u>
2. Viscosity or Penetration: Meet graphics published in Section 955 of UDOT's "Manual of Instructions, Part 8 Materials".
   a. Lot may be accepted using the published graphics. If price adjustment exceeds 30 percent, reject paving asphalt, or
   b. If allowed to remain after placement, price adjustment will be 50 percent.

D. Cut-back Binder: Meet this Section's requirements for ductility.

E. Trinidad Lake Modified Asphalt: Supplier's certificate for ASTM compliance.

F. Emulsifie Asphalt: Supplier's certificate for ASTM compliance.

G. Recycle Asphalt: Identity of source (asphalt cement or tar products).

H. Crack Patch: Meet material requirements in Section 32 01 17.

PART 2 PRODUCTS

2.1 **PERFORMANCE GRADE ASPHALT BINDER (PGAB)**

A. Petroleum asphalt that complies with ASTM D 6373. Blending the paving asphalt with polymers or natural asphalts is CONTRACTOR's choice.

2.2 ASPHALT CEMENT (AC)

A. Petroleum asphalt that complies with Table 2 of ASTM D 3381 except as follows:

1. Replace ductility at 77 deg. F. (25 deg. C.) with ductility at 39.2 deg. F. (4 deg. C.). Use the following values.
   - AC-5: greater than 25.
   - AC-10: greater than 15.
   - AC-20: greater than 5.
2. Delete the loss on heating requirement on residue from "Thin-Film Oven Test".

B. AC-5 Latex Additive: Anionic emulsion of butadiene-styrene low-temperature copolymer consisting of 2 percent by weight (solids basis), stabilized with fatty-acid soap for storage stability.

2.3 TRINIDAD LAKE MODIFIED ASPHALT (TLA)

A. Petroleum asphalt that complies with ASTM D 5710 (a blend of natural asphalts).

2.4 SLOW CURE CUT-BACK ASPHALT (SC)

A. Petroleum asphalt that complies with ASTM D 2026 (fluxed with a light oil) except if penetration of residue is more than 200 and its ductility at 77 deg. F (25 deg. C) is less than 100 cm., the material will be acceptable if the ductility at 59 deg. F. (15 deg. C) is greater than 100.

2.5 MEDIUM CURE CUT-BACK ASPHALT (MC)

A. Petroleum asphalt that complies with ASTM D 2027 (fluxed or blended with a kerosene-type solvent, non-foaming when heated to application temperature) except if penetration of residue is more than 200 and its ductility at 77 deg. F. (25 deg. C) is less than 100 cm., the material will be acceptable if the ductility at 59 deg. F. (15 deg. C) is greater than 100.

2.6 RAPID CURE CUT-BACK ASPHALT (RC)

A. Petroleum that complies with ASTM D 2028 asphalt (fluxed or blended with a naphtha-solvent, non-foaming when heated to application temperature).

2.7 EMULSIFIED ASPHALT

A. Petroleum asphalt uniformly emulsified with water, homogeneous throughout, and when stored, shows no separation within 30 days after delivery. Frozen emulsions not accepted.

1. Anionic, ASTM D 977 (breaks by evaporation).
2. Cationic, ASTM D 2397 (breaks chemically).

2.8 RECYCLE ASPHALT (RA)

A. Petroleum asphalt that complies with ASTM D 4552 (homogeneous, free-flowing at pumping temperature made from maltene fractions of asphalt cement for surface revitalization or from tar products to make Pavements resistant to fuel spillage.

1. RA-1, RA-5, RA-25 or RA-75 for recycling RAP when less than 30 percent virgin aggregate is added.

2. RA-250 or RA-500 when more than 30 percent virgin aggregate is added to the RAP.

PART 3 EXECUTION

3.1 INSTALLATION

A. Prime coat, Section 32 12 13.

B. Tack coat, Section 32 12 14.

C. Plant mix paving, Section 32 12 17.

D. Road mix paving, Section 32 12 17.

E. Seal coating, Section 32 01 13.

F. Crack patch, Section 32 01 17.

END OF SECTION

SECTION 32 12 05
ASPHALT CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Composition of asphalt - aggregate mix.

B. This specification does not apply to polymer modified asphalt concrete. Refer to Section 32 12 06.

1.2 REFERENCES

A. AI Manual Series No. 2: Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.

B. AASHTO T 324: Hamburg Wheel-track Testing of Compacted Hot-Mix Asphalt (HMA).

C. ASTM C 29: Standard Test Method for Unit Weight and Voids in Aggregate.

D. ASTM C 88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

E. ASTM C 117: Standard Test Method for Materials Finer Than 0.075mm (No. 200) Sieve in Mineral Aggregates by Washing.

F. ASTM C 131: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

G. ASTM C 136: Standard Method for Sieve Analysis of Fine and Coarse Aggregate.

H. ASTM C 142: Standard Test Method for Clay Lumps and Friable Particles in Aggregates.

I. ASTM D 75: Standard Practice for Sampling Aggregates.

J. ASTM D 140: Standard Practice for Sampling Bituminous Materials.

K. ASTM D 242: Standard Specification for Mineral Filler for Bituminous Paving Mixtures.

L. ASTM D 979: Standard Methods for Sampling Bituminous Paving Mixtures.

M. ASTM D 2419: Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

N. ASTM D 3203: Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.

O. ASTM D 3381: Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.

P. ASTM D 3515: Standard Specification for Hot-Mixed, Hot-Laid

Bituminous Paving Mixtures.

Q. ASTM D 3665: Standard Practice for Random Sampling of Construction Materials.

R. ASTM D 3666: Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials.

S. ASTM D 4318: Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

T ASTM D 4552: Standard Practice for Classifying Hot-Mix Recycling Agents.

U. ASTM D 4791: Standard Test Method for Flat or Elongated Particles in Coarse Aggregate.

V. ASTM D 4867: Standard Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures.

W. ASTM D 5444: Standard Test Method for Mechanical Size Analysis of Extracted Aggregate.

X. ASTM D 5581: Standard Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus (6-jnch_Diameter Specimen)

Y. ASTM D 5821: Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.

Z. ASTM D 6307: Standard Test Method for Determining Asphalt Content of Hot-Mix Asphalt by Ignition Method.

AA. ASTM D 6373: Standard Specification for Performance Graded Asphalt Binder.

1.3 DEFINITIONS

A. Asphalt-Aggregate Designator: Alpha-numeric code that indicates type and grade of asphalt, and type and grade of aggregate in an asphalt-aggregate mix. For example;

1. "*AC-20-DM-3/4*" means asphalt-aggregate mix shall be composed of AC-20 type and grade asphalt cement and DM-3/4 type and grade aggregate.
2. "*RA-1-DM-1*" means asphalt-aggregate mix shall be composed of RA-1 type and grade asphalt recycling agent and DM-1 type and grade aggregate.
3. "*RS-1-SS-II*" means asphalt-aggregate mix shall be composed of RS-1 type and grade asphalt emulsion and SS-II type and grade aggregate.

B. Mean of Deviations: Defined in Section 32 11 23.

1.4 SUBMITTALS

A. **Quality Assurance**: Submit names, certification levels, and years of experience of testing agency's field technicians that are assigned to the Work. Verify laboratory complies with ASTM standards.

B. **Mix Design**: Submit.

1. Date of mix design. If older than 365 days, recertify mix design.

2. Asphalt cement source, type and chemical composition.
3. Aggregate gradation target.
4. Asphalt cement target, dust to asphalt ratio, moisture sensitivity (tensile strength) stability, flow and voids in the bituminous mix.
5. Paving asphalt grade if RAP is used in the mix.
6. RAP, mineral filler, antistrip, and recycle agent percentages.

C. **Pre-approved mix design**, submit name and address of Supplier.

D. **Before changing mix design**, submit a new design and give ENGINEER 10 days to evaluate the changes.

E. **Source Quality Control Inspections and Testing Report**: If requested, submit report describing CONTRACTOR's and Supplier's quality control activities and test results.

1.5 **QUALITY ASSURANCE**

A. Use a laboratory that follows and complies with ASTM D 3666.

B. Do not change aggregate source or paving asphalt source without ENGINEER's written approval.

C. Do not use non-complying sources.

1.6 **ACCEPTANCE**

A. General:

1. Acceptance is by Lot. One Lot is one day's production.
2. If non-complying material has been installed and no price for the material is specified, apply price adjustment against cost of work requiring material as part of its installation, Section 01 29 00.
3. Dispute resolution, Section 01 35 10.

B. Installation: Accepted as specified in Section 32 12 16.

C. Materials:

1. At the Source:
   a. Aggregate: Verify gradation. Collect sample from conveyor belt or stockpile if belt is not accessible.
   b. Paving Asphalt: See Section 32 12 03 provisions.
   c. Mix: 325 deg. F. maximum in transport vehicle.
2. At the Site:
   a. One sub-lot is 500 tons.
   b. Sampling: Two random samples per sub-lot. Location as follows.
      1) Behind paver before compaction, or
      2) Where sub-lot exhibits non-uniform appearance.
3. At the Laboratory:
   a. Air Voids:
      1) Basis of evaluation is laboratory compacted samples (not field

compacted samples).

2) If test results are not within this Section's limits, options include correction of production procedures or alternate mix design acceptable to ENGINEER.

b. Dust to asphalt ratio.

c. Asphalt Content, Aggregate Gradation: Lot is acceptable if test deviations are within pay factor 1.00 limits. At ENGINEER's discretion, a Lot with a sub-lot test deviation greater than pay factor 0.85 limits may stay in place at 50 percent cost.

Table 1 – Pay Factors for Non-complying Materials

Criteria	Pay Factor	Range of Mean of Deviations of Tests Results from the Design Mix Target in Percentage Points				
		500 Tons	1,000 Tons	1,500 Tons	2,000 Tons	≥2,500 Tons
Asphalt Content	1.00	0.00–0.70	0.00–0.54	0.00–0.46	0.00–0.41	0.00–0.38
	0.975	0.71–0.80	0.55–0.61	0.47–0.52	0.42–0.46	0.39–0.43
	0.95	0.81–0.90	0.62–0.68	0.53–0.58	0.47–0.52	0.44–0.47
	0.90	0.91–1.00	0.69–0.75	0.59–0.64	0.53–0.56	0.48–0.52
	0.85	1.01–1.10	0.76–0.82	0.65–0.69	0.57–0.61	0.53–0.56
1/2" and larger Sieve	1.00	0.0–10.9	0.0–7.3	0.0–6.5	0.0–5.6	0.0–5.2
	0.975	11.0–12.9	7.4–8.3	6.4–7.1	5.7–6.3	5.3–5.8
	0.95	13.0–13.9	8.4–9.3	7.2–7.9	6.4–7.0	5.9–6.4
	0.90	14.0–14.9	9.4– 10.3	8.0–8.7	7.1–7.7	6.5–7.1
	0.85	15.0–16.0	10.4–11.3	8.8–9.5	7.8–8.4	7.2–7.7
3/8" Sieve	1.00	0.0–9.9	0.0–6.9	0.0–5.9	0.0–5.3	0.0–4.9
	0.975	10.0–10.9	7.0–7.8	6.0–6.6	5.4–6.9	5.0–5.5
	0.95	11.0–11.9	7.9–8.7	6.7–7.3	6.0–6.6	5.6–6.1
	0.90	12.0–13.9	8.8–9.6	7.4–8.0	6.7–7.2	6.2–6.6
	0.85	14.0–15.0	9.7–10.5	8.1–8.9	7.3–7.9	6.7–7.2
No. 4 Sieve	1.00	0.0–9.9	0.0–6.7	0.0–5.7	0.0–5.2	0.0–4.8
	0.975	10.0–11.0	6.8–7.6	5.8–6.3	5.3–5.8	4.9–5.4
	0.95	11.1–11.9	7.7–8.5	6.4–6.9	5.9–6.4	5.5–5.9
	0.90	12.0–12.9	8.6–9.4	7.0–7.5	6.5–7.0	6.0–6.5
	0.85	13.0-14.0	9.5–10.2	7.6–8.0	7.1–7.6	6.6–7.0
No. 8 Sieve	1.00	0.0–7.9	0.0–5.6	0.0–4.8	0.0–4.3	0.0–4.0
	0.975	8.0–8.9	5.7–6.3	4.9–5.4	4.4–4.8	4.1–4.5
	0.95	9.0–9.9	6.4–7.0	5.5–6.0	4.9–5.3	4.6–4.9
	0.90	10.0–10.9	7.1–7.7	6.1–6.6	5.4–5.8	5.0–5.4
	0.85	11.0–12.0	7.8–8.5	6.7–7.2	5.9–6.4	5.5–5.8
No. 16 Sieve	1.00	0.0–7.9	0.0–5.2	0.0–4.6	0.0–4.2	0.0–3.9
	0.975	8.0–8.9	5.3–5.8	4.7–5.1	4.3–4.6	4.0–4.3
	0.95	9.0–9.9	5.9–6.4	5.2–5.6	4.7–5.1	4.4–4.7
	0.90	10.0–10.9	6.5–7.0	5.7–6.1	5.2–5.5	4.8–5.1
	0.85	11.0–12.0	7.1–7.6	6.2–6.6	5.6–5.9	5.2–5.4
No. 50 Sieve	1.00	0.0–6.9	0.0–4.3	0.0–3.8	0.0–3.4	0.0–3.2
	0.975	7.0–7.9	4.4–4.8	3.9–4.1	3.5–3.8	3.3–3.5
	0.95	8.0–8.9	4.9–5.3	4.2–4.5	3.9–4.1	3.6–3.8
	0.90	9.0–9.9	5.4–5.8	4.6–4.9	4.2–4.4	3.9–4.1
	0.85	10.0–11.0	5.9–6.4	5.0–5.5	4.5–4.9	4.2–4.5

No. 200 Sieve	1.00	0.0–3.0	0.0–2.4	0.0–2.0	0.0–1.8	0.0–1.7
	0.975	3.1–3.5	2.5–2.7	2.1–2.2	1.9–2.0	1.8–1.9
	0.95	3.6–4.0	2.8–3.0	2.3–2.4	2.1–2.2	2.0–2.1
	0.90	4.1–4.5	3.1–3.3	2.5–2.7	2.3–2.4	2.2–2.3
	0.85	4.6–5.0	3.4–3.6	2.8–3.0	2.5–2.6	2.4–2.5

NOTES
(a) Test paving asphalt content using a burn-off oven, ASTM D 6307.
(b) Determine aggregate gradation be extraction, ASTM D 5444.

PART 2 PRODUCTS

2.1 PAVING ASPHALT

A. Asphalt Cement: Section 32 12 03. Substitutes for asphalt cement are as follows.

ASTM D 3381	ASTM D 6373
AC 10	PG 64-22 or PG 70-28
AC 20	PG 70-28

B. Recycle Asphalt: Section 32 12 03.

2.2 AGGREGATE

A. Material: Clean, hard, durable, angular, sound, consisting of crushed stone, crushed gravel, slag, sand, or combination.

B. Source: Use the following requirements to determine suitability of aggregate source and not for project control.

1. Coarse Aggregate:
   a. Angularity (fractured faces), ASTM D 5821: 50 percent maximum by weight of particles with at least 2 fractured faces.
   b. Hardness (toughness), ASTM C 131: 40 percent minimum wear of aggregate retained above the No. 4 sieve unless specific aggregates having higher values are known to be satisfactory.
   c. Flat or Elongated Particles, ASTM D 4791: 20 percent maximum retained above 3/8 inch sieve has a 3:1 length to width ratio.
2. Fine Aggregate:
   a. Friable Particles, ASTM C 142: 2 percent maximum passing No. 4 sieve.
   b. Plasticity, ASTM D 4318: Aggregate passing No. 40 sieve is non-plastic even when filler material is added to the aggregate.
      1) Liquid limit: Less than 25.
      2) Plastic limit: Less than 6.

2.3 ADMIXTURES

A. Reclaimed Asphalt Pavement (RAP) Aggregate: Restrictions include.

1. 15 percent by weight maximum providing grading and voids in the bituminous mix are met.
2. Greater than 15 percent requires separate mix design.

B. Mineral Filler: ASTM D 242.

C. Recycle Agent: ASTM D 4552.

D. Antistrip: Heat stable cement slurry or lime slurry.

2.4 MIX DESIGN

A. Selection of Materials:

1. Paving Asphalt, Section 32 12 03:
   a. AC-10 or AC-20: Light traffic pavement.
   b. AC-20: Medium traffic pavement.
   c. RA: For hot-laid recycled asphalt pavement. Choice by CONTRACTOR.
2. Aggregate: This Section Article 2.2.

B. Selection of Design Aggregate Structure:

1. Gradation: Maximum particle size is 1/2 compacted lift thickness.
   a. Target Gradation Curve must lie within one of the Master Grading Bands in the following table, or
   b. If acceptable to ENGINEER, use fractionated proportioning to select or adjust gradation.

Table 2 – Master Grading Bands

Sieve Size	Dense				Open	Friction	
	DM-1	DM-3/4N	DM-3/4	DM-1/2	OM-1/2	FM-1	FM-2
1 inch	100						
3/4 inch		100	100			100	
1/2 inch	75 – 91	74 – 99		100	100	90 –100	100
3/8 inch		69 – 91	75 – 91		93 – 100	60 – 100	90 – 100
No. 4	47 – 61	49 – 65	46 – 62	60 – 80	36 – 44	15 – 40	30 – 50
No. 8		33 – 47			14 – 21	4 – 12	5 – 15
No. 16	23 – 33	21 – 35	22 – 34	28 – 42			
No. 50	12 – 22	6 – 18	11 – 23	11 – 23			2 – 5
No.200	3 – 7	2 – 6	3 – 7	3 – 7	2 – 4	2 – 5	

NOTES
(a) Gradation expressed in percent passing by weight, ASTM C 136.
(b) It is assumed fine and coarse aggregate have same bulk specific gravity.
(c) Friction Mixture: See ASTM D 3515.
(d) DM -3/4N is 100% crushed.
(e) Percentage of fines passing No. 200 sieve determined by washing, ASTM C 117.

2. Aggregate Blend:

a. Dry-rodded Unit Weight, ASTM C 29: 75 pounds per cubic foot minimum.

b. Weight Loss (soundness), ASTM C 88: 16 percent maximum using sodium sulfate.

c. Clay Content (cleanliness), ASTM D 2419: Sand equivalent value after going through the dryer or prior to the drum mixer.

1) 45 percent minimum if Medium Traffic Classification.

2) 60 percent minimum if Heavy Traffic Classification.

The sand equivalent requirement is waived for the RAP aggregate but applies to the remainder of the aggregate blend.

C. Selection of Admixture: CONTRACTOR's choice.

1. RAP: Adjust paving asphalt grade to account for RAP binder viscosity.

2. Cement or Hydrated Lime: Add if mix is moisture sensitive.

D. Selection of Mix Properties: Use AI Manual Series No. 2 procedure for stability, flow and voids.

1. Stability, Flow Voids: If traffic classification is not specified elsewhere, use Medium Traffic Classification.

Table 3 – Stability, Flow, Voids Limits

Criteria	Traffic Classifications		
	Light	**Medium**	**Heavy**
Number of compaction blows each end of specimen	50	75	112
Stability, lbs., minimum	750	1200	1800
Flow, in 0.01 inch units	10 – 18	10 – 18	10 – 18
Voids in Mineral Aggregate (VMA), percent minimum			
1" nominal maximum particle size	13	13	13
3/4" nominal maximum particle size	14	14	14
1/2" nominal maximum particle size	15	15	15
3/8" nominal maximum particle size	16.5	16.5	16.5
Voids in Bituminous Mix, percent	3 – 5	3 – 5	3 – 5

NOTES

(a) Traffic Classifications:

Light: (ESAL $<10^4$ per year)

Class I: Parking lots, Driveways, light traffic residential streets, light traffic farm roads.

Medium: (ESAL between 10^4 and 10^6 per year)

Class II: Residential streets, rural farm and residential roads.

Class III: Urban minor collector streets, rural minor collector roads.

Heavy: (ESAL $>10^6$ per year)

Class IV: Urban minor arterial and light industrial and light industrial streets, rural major collector and minor arterial highways.

Class V: Urban major arterial and heavy industrial streets, freeways, expressways, arterial highways, rural interstate and other principal arterial highways.

(b) Stability, Flow, Voids: ASTM D 5581.
(c) VMA: ASTM D 3203
(d) Nominal maximum particle size is the largest sieve size listed in this Section upon which any material is retained.

2. Dust to Asphalt Ratio: 0.8 to 1.6.
3. Moisture Sensitivity, ASTM D 4867: Tensile strength ratio less than 0.80 using freeze-thaw conditioning. Test specimen shall be 150 mm in diameter and 95 mm in height and compacted at 7 percent plus or minus 1 percent air voids)
4. Rut Susceptibility, AASHTO T 324: Maximum rut depth is 10 mm at 20,000 passes.

2.5 **SOURCE QUALITY CONTROL**

A. General: Collect samples, ASTM D 3665. Do not change sampling points.
1. Aggregate sampling, ASTM D 75.
2. Paving asphalt sampling, ASTM D 140. Test for viscosity and penetration.

B. Asphalt-Aggregate Mix: Sample, ASTM D 979. Test for the following.
1. Air voids, ASTM D 3203 or ASTM D 5581.
2. Paving asphalt content, ASTM D 6307.
3. Aggregate gradation, ASTM D 5444.
4. Tensile strength of bitumen-aggregate mixtures, ASTM D 4867.

C. Mixing Plant: ASTM D 3515.

PART 3 EXECUTION

3.1 **INSTALLATION**

A. Roadway paving, Section 32 12 17.
B. Patching, Section 33 05 25.

END OF SECTION

SECTION 32 12 06
SUPERPAVE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Composition of performance grade asphalt - aggregate mix.

1.2 REFERENCES

A. AASHTO T304: Uncompacted Void Content of Fine Aggregate

B. AASHTO T312: Standard Method of Test for Preparing and Determining the Density of Hot-Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor.

C. AASHTO T 324: Hamburg Wheel-track Testing of Compacted Hot-Mix Asphalt (HMA).

D. AI SP-2: Superpave Series No. 2.

E. ASTM C 29: Standard Test Method for Unit Weight and Voids in Aggregate.

F. ASTM C 88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

G. ASTM C 131: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

H. ASTM C 142: Standard Test Method for Clay Lumps and Friable Particles in Aggregates.

I. ASTM C 242: Standard Specification for Mineral Filler for Bituminous Paving Mixtures.

J. ASTM D 75: Standard Practice for Sampling Aggregates.

K. ASTM D 140: Standard Practice for Sampling Bituminous Materials.

L. ASTM D 979: Standard Methods for Sampling Bituminous Paving Mixtures.

M. ASTM D 2041: Standard Test Method for Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures.

N. ASTM D 2419: Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

O. ASTM D 3203: Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.

P. ASTM D 3515: Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.

Q. ASTM D 3665: Standard Practice for Random Sampling of Construction Materials.

R. ASTM D 3666: Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials.

S. ASTM D 4318: Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

T. ASTM D 4552: Standard Practice for Classifying Hot-Mix Recycling Agents.

U. ASTM D 4791: Standard Test Method for Flat or Elongated Particles in Coarse Aggregate.

V. ASTM D 4867: Standard Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures.

W. ASTM D 5444: Standard Method for Mechanical Size Analysis of Extracted Aggregate.

X. ASTM D 5821: Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.

Y. ASTM D 6307: Standard Test Method for Asphalt Content of Hot-Mix Asphalt by Ignition Method.

1.3 DEFINITIONS

A. Asphalt-Aggregate Designator: Alpha-numeric code that indicates nominal maximum size of aggregate, and type and grade of asphalt in aggregate-asphalt mix. For example; "*12.5 PG70-28*" means aggregate-asphalt mix shall be composed of an aggregate gradation with a 12.5 mm nominal maximum size and a performance grade asphalt binder designed to perform between temperatures of 70 deg C. and –28 deg C.

B. ESAL (acronym for equivalent single axle load): Number used in designing Pavement thickness. It relates axle load of any mass and number to an equivalent number (18,000 lb).

C. Mean of Deviations: Defined in Section 32 11 23.

D. Nominal Maximum Size: One sieve size larger than first sieve size retaining more than 10 percent of the Sample. The nominal maximum size sieve will retain a minimum of 0 and a maximum of 10 percent of the sample. Maximum size is one sieve size larger than the nominal maximum size.

1.4 SUBMITTALS

A. **Quality Assurance**: Submit names, certification levels, and years of experience of testing agency's field technicians that are assigned to the Work. Verify laboratory complies with ASTM standards.

B. **Mix Design**: Submit.

1. Date of mix design. If older than 365 days, recertify mix design.
2. Paving asphalt source, type, and chemical composition.
3. Nominal maximum size of aggregate.
4. Temperature of mix at plant and in the field for for optimum field compaction.
5. Paving asphalt target, dust to asphalt ratio, rut susceptibility, moisture sensitivity (tensile strength), voids in the mineral aggregate (VMA)

and voids filled with asphalt (VFA).

6. RAP, mineral filler, antistrip, and recycle agent percentages.
7. Compaction at N_{max}.

C. **Pre-approved mix design**, submit name and address of Supplier.

D. **Before changing mix design**, submit a new design and give ENGINEER 10 days to evaluate the changes.

E. **Source Quality Control Inspections and Testing Report**: If requested, submit report describing CONTRACTOR's and Supplier's quality control activities and test results.

1.5 **QUALITY ASSURANCE**

A. Use a laboratory that follows and complies with ASTM D 3666.

B. Do not change aggregate source or paving asphalt source without ENGINEER's written approval.

C. Do not use non-complying sources.

1.6 **ACCEPTANCE**

A. General:

1. Acceptance is by Lot. One Lot is one day's production.
2. If non-complying material has been installed and no price for the material is specified, apply price adjustment against cost of work requiring material as part of its installation. Section 01 29 00.
3. Dispute resolution, Section 01 35 10.

B. Installation: Accepted as specified in Section 32 12 16.

C. Materials:

1. At the Source:
   a. Aggregate: Verify gradation prior to the drum mixer or after going through the drier.
   b. Paving Asphalt: See Section 32 12 03 provisions.
   c. Mix: 325 deg. F. maximum in transport vehicle.
2. At the Site:
   a. One sub-lot is 500 tons.
   b. Sampling: Two random samples per sub-lot. Location as follows.
      1) Behind paver before compaction, or
      2) Where sub-lot exhibits non-uniform appearance.
3. At the Laboratory:
   a. Air Voids:
      1) Basis of evaluation is laboratory compacted samples (not field compacted samples).
      2) If test results are not within this Section's limits, options include correction o f production procedures or alternate mix design acceptable to ENGINEER.

b. Dust to asphalt ratio.

c. Asphalt Content, Aggregate Gradation: Lot is acceptable if test deviations are within pay factor 1.00 limits. At ENGINEER's discretion, a Lot with a sub-lot test deviation greater than pay factor 0.85 limits may stay in place at 50 percent cost.

Table 1 – Pay factors for Non-complying Materials

Criteria	Pay Factor	Range of Mean of Deviations of Tests Results from Design Mix Target in Percentage Points			
		500 Tons	1,000 Tons	1,500 Tons	≥ 2,000 Tons
Asphalt Content	1.00	0.0 – 0.7	0.0 – 0.54	0.0 – 0.46	0.0 – 0.41
	0.975	0.71 – 0.8	0.55 – 0.61	0.47 – 0.52	0.42 – 0.46
	0.95	0.81 – 0.9	0.62 – 0.68	0.53 – 0.58	0.47 – 0.52
	0.90	0.9 – 1.0	0.69 – 0.75	0.59 – 0.64	0.53 – 0.56
	0.85	1.01 – 1.1	0.76 – 0.82	0.65 – 0.69	0.57 – 0.61
≥ 12.5 mm Sieve	1.00	0.0 – 10.0	0.0 – 7.3	0.0 – 6.3	0.0 – 0.56
	0.975	11.0 – 12.0	7.4 – 8.3	6.4 – 7.1	5.7 – 6.3
	0.95	13.0 – 13.9	8.4 – 9.3	7.2 – 7.9	6.4 – 7.0
	0.90	14.0 – 14.9	9.4 – 10.3	8.0 – 8.7	7.1 – 7.7
	0.85	15.0 – 16.0	10.4 – 11.3	8.8 – 9.5	7.8 – 8.4
9.5 mm Sieve	1.00	0.0 – 9.9	0.0 – 6.9	0.0 – 5.9	0.0 – 5.3
	0.975	10.0 – 10.9	7.0 – 7.8	6.0 – 6.6	5.4 – 5.9
	0.95	11.0 – 11.9	7.9 – 8.7	6.7 – 7.3	6.0 – 6.6
	0.90	12.0 – 13.9	8.8 – 9.6	7.4 – 8.0	6.7 – 7.2
	0.85	14.0 – 15.0	9.7 – 10.5	8.1 – 8.9	7.3 – 7.9
4.75 mm Sieve	1.00	0.0 – 9.9	0.0 – 6.7	0.0 – 5.7	0.0 – 5.2
	0.975	10.0 – 10.9	6.8 – 7.6	5.8 – 6.3	5.3 – 5.8
	0.95	11.0 – 11.9	7.7 – 8.5	6.4 – 6.9	5.9 – 6.4
	0.90	12.0 – 12.9	8.6 – 9.4	7.0 – 7.5	6.5 – 7.0
	0.85	13.0 – 14.0	9.5 – 10.2	7.6 – 8.0	7.1 – 7.6
2.36 mm Sieve	1.00	0.0 – 7.9	0.0 – 5.6	0.0 – 4.8	0.0 – 4.3
	0.975	8.0 – 8.9	5.7 – 6.3	4.9 – 5.4	4.4 – 4.8
	0.95	9.0 – 9.9	6.4 – 7.0	5.5 – 6.0	4.9 – 5.3
	0.90	10.0 – 10.9	7.1 – 7.7	6.1 – 6.6	5.4 – 5.8
	0.85	11.0 – 12.0	7.8 – 8.5	6.7 – 7.2	5.9 – 6.4
0.075 mm Sieve	1.00	0.0 – 3.0	0.0-2.4	0.0 – 2.0	0.0 – 1.8
	0.975	3.1 – 3.5	2.5 – 2.7	2.1 – 2.2	1.9 – 2.0
	0.95	3.6 – 4.0	2.8 – 3.0	2.3 – 2.4	2.1 – 2.2
	0.90	4.1 – 4.5	3.1 – 3.3	2.5 – 2.7	2.3 – 2.4
	0.85	4.6 – 5.0	3.4 – 3.6	2.8 – 3.0	2.5 – 2.6

NOTES
(a) Test bitumen content using a burn-off oven, ASTM D 6307.
(b) Determine aggregate gradation by extraction, ASTM D 5444.

PART 2 PRODUCTS

2.1 PAVING ASPHALT

A. Performance Grade Asphalt Binder (PGAB): Section 32 12 03.

1. Blending with polymers or natural asphalts is CONTRACTOR's choice.
2. Do not use acid blends without documentation supporting need.
3. As a rule of thumb, if the two numbers in an asphalt binder designation are added together and are greater than 90, then the binder will most likely contain a polymer or natural asphalt.

B. Recycle Asphalt: Section 32 12 03.

2.2 AGGREGATE

A. Material: Clean, hard, durable, angular, sound, consisting of crushed stone, crushed gravel, slag, sand, or combination.

B. Source: Use the following requirements to determine suitability of aggregate source and not for project control.

1. Coarse Aggregate:
   a. Angularity (fractured faces), ASTM D 5821: At least one fracture as follows.
      1) 55 percent minimum if ESALs are less than 0.3 million.
      2) 85 percent minimum if ESALs are more than 0.3 million.
   b. Hardness (toughness), ASTM C 131: Retained above 2.36 mm sieve.
      1) 40 percent maximum if ESALs are less than 0.3 million.
      2) 35 percent maximum if ESALs are more than 0.3 million.
   c. Flat and Elongated Particles, ASTM D 4791: 20 percent maximum retained above the 9.5 mm sieve has a 3:1 length to width ratio.
2. Fine Aggregate:
   a. Angularity, AASHTO T304: 45 percent minimum uncompacted void content.
   b. Friable Particles, ASTM C 142: 2 percent maximum by weight passing 4.75 mm sieve.
   c. Plasticity, ASTM D 4318: Aggregate passing 4.75 mm sieve is non-plastic even when filler material is added to the aggregate.
      1) Liquid limit: Less than 25.
      2) Plastic limit: Less than 6.

2.3 ADMIXTURES

A. Reclaimed Asphalt Pavement (RAP) Aggregate: Restrictions include.

1. 15 percent by weight maximum providing grading, VMA and VFA are met.
2. Greater than 15 percent requires separate mix design.

B. Mineral Filler: ASTM D 242.

C. Recycle Agent: ASTM D 4552.

D. Antistrip: Heat stable, cement slurry, or lime slurry.

2.4 **MIX DESIGN**

A. Selection of Materials:

1. Paving Asphalt. Section 32 12 03.
   a. PG70-28: Less than 3 million EASLs.
   b. PG70-28: 3 million to 30 million EASLs.
2. Aggregate: This Section Article 2.2.

B. Selection of Design Aggregate Structure.

1. Gradation: Maximum particle size is 1/4 compacted lift thickness.
   a. Target Gradation Curve must lie within one of the following Master Grading Bands. It must lie below the restricted zone in traffic class IV and traffic class V (Table 3 Section 32 12 05). In all other classes it may lie above, below, or pass through the zone.
   b. If acceptable to ENGINEER, use fractionated proportioning to select or adjust gradation.

Table 2 – Master Grading Bands

Sieve Size (mm)		Aggregate Grade			
				12.5	**9.5**
Control Sieves	37.5	100.0	–	–	–
	25	90 – 100	100.0	–	–
	19	< 90	90 – 100	100	–
	12.5	–	< 90	90 – 100	100
	9.5	–	–	< 90	90 – 100
	4.75	–	–	–	< 90
	2.36	19 – 45	23 – 49	28 – 58	32 – 6
	0.075	1 – 7	2 – 8	2 – 10	2 – 10
Restricted Zone	4.75	39.5	–	–	–
	2.36	29.8 – 30.8	34.6	39.1	47.2
	1.18	18.1 – 24.1	22.3 – 28.3	25.6 – 31.6	31.6 – 37.6
	0.6	13.6 – 17.6	16.7 – 20.7	19.1 – 23.1	23.5 – 27.5
	0.3	11.4	13.7	15.5	18.7

NOTES
(a) Gradation in percent passing by weight, ASTM D 4759.
(b) It is assumed fine and coarse aggregate have same bulk specific gravity.
(c) Percentage of fines passing 0.075 mm control sieve determined by washing per ASTM C 117.

2. Aggregate Blend:
   a. Dry-rodded Unit Weight, ASTM C 29: 75 pounds per cubic foot minimum.
   b. Weight Loss (soundness), ASTM C 88: 16 percent maximum using sodium sulfate.
   c. Clay Content (cleanliness), ASTM D 2419: Sand equivalent value after going through the dryer or prior to the drum mixer.
      1) 45 percent minimum if ESALs are less than 0.3 million.
      2) 60 percent minimum if ESALs are more than 0.3 million.

      The sand equivalent requirement is waived for the RAP aggregate but applies to the remainder of the aggregate blend.

C. Selection of Admixture:
   1. RAP: Adjust pavement asphalt grade to account for RAP binder viscosity.
   2. Cement or Hydrated Lime: Add if mix is moisture sensitive.

D. Selection of Mix Properties: Use AI SP-2 volumetric procedure.
   1. Compaction:

Table 4 – Compaction Parameters

20 Year design ESALs (Million)	$N_{initial}$/ % of G_{mm}	N_{design}/ % of G_{mm}	N_{max}/ % of G_{mm}
Less than 0.3	6 / ≤ 91.5	50 / 96	75 / ≤ 98
0.3 to <3	7 / ≤ 90.5	75 / 96	115 / ≤ 98
3 to <30	8 / ≤ 89	100 / 96	160 / ≤ 98
30 or more	9 / ≤ 89	125 / 98	205 / 98

NOTES
(a) N = Number of gyrations.
(b) G_{mm} = maximum specific gravity of mix, ASTM D 2041 (Rice method)
(c) Specific gravity of specimen: AASHTO T 312.
(d) 20 year design ESALs defined as follows.
- Less than 0.3 = parking lots, light traffic, residential streets
- 0.3 to 3 = collector roads (most county roads)
- 3 to 90 = city streets, state routes
- 30 or more = interstate, weigh stations.

   2. Voids in the mineral aggregate (VMA) at N_{design}:

Nominal Maximum Size	Voids (VMA)
37.5 mm	11 to 13 percent
25.0 mm	12 to 14 percent
19.0 mm	13 to 15 percent
12.5 mm	14 to 16 percent
9.5 mm	16 percent minimum

3. Voids filled with asphalt (VFA) at N_{design}:

20 Year Design ESALs (million)	**Voids Filled with Asphalt (VFA)**
Less than 0.3	70 – 80 percent
0.3 to <3	65 – 78 percent
3 to <30	65 – 75 percent
30 or more	65 – 75 percent

   a. For 9.5 mm nominal maximum size mixtures, the specified VFA range is 73 percent to 76 percent for design traffic levels 3 million ESALs or greater.

   b. For 25.0 mm nominal maximum size mixtures, the specified lower limit of the VFA is 67 percent for design traffic levels less than 0.3 million ESALs.

   c. For 37.5 mm nominal maximum size mixtures, the specified lower limit of the VFA is 64 percent for all design traffic levels.

4. Dust to Asphalt Ratio:

   a. 0.6 to 1.2 if aggregate gradation passes through or over the restricted zone.

   b. 0.8 to 1.6 if aggregate gradation passes under the restricted zone.

5. Moisture Sensitivity, ASTM D 4867: Tensile strength ratio less than 0.80 using freeze-thaw conditioning. Test specimen shall be 150 mm in diameter and 95 mm in height and compacted at 7 percent plus or minus 1 percent air voids.

6. Rut Susceptibility, AASHTO T 324: Maximum rut depth is 10 mm at 20,000 passes.

2.5 SOURCE QUALITY CONTROL

A. General: Collect Samples randomly, ASTM D 3665. Do not change sampling points.

   1. Aggregate sampling, ASTM D 75.

   2. Paving asphalt sampling, ASTM D 140.

B. Asphalt-aggregate mix sampling, ASTM D 979. Test for

   1. Air voids, ASTM D 3203.

   2. Paving asphalt content, ASTM D 6307.

   3. Aggregate gradation, ASTM D 5444.

   4. Tensile strength of bitumen-aggregate mixtures, ASTM D 4867.

C. Mixing Plant: ASTM D 3515.

PART 3 EXECUTION

3.1 INSTALLATION

A. Pavement placement, Section 32 12 17.

B. Pavement restoration, Section 33 05 25.

END OF SECTION

SECTION 32 12 14
TACK COAT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Application of asphaltic material to existing asphalt concrete or portland cement concrete surfaces preparatory to placing an asphalt concrete Pavement.

1.2 SUBMITTALS

A. Certificate showing asphaltic material complies with Section 32 12 03.
   1. Identify water/asphalt dilution ratio.
   2. Identify tack coat application rate.

B. Identify asphalt material recommended by fabric manufacturer.

1.3 WEATHER

A. Apply tack coat only when air and roadbed temperatures in the shade are greater than 40 deg. F. The temperature restrictions may be waived only upon written authorization from ENGINEER.

B. Do not apply tack coat during rain, fog, dust, or other unsuitable weather. Do not apply coat to wet surfaces.

1.4 NOTICE

A. Send written notice to residents or business owners 24 hours prior to applying coat.

PART 2 PRODUCTS

2.1 ASPHALT MATERIAL

A. Select from the following.
   1. Emulsified Asphalt: Grade MS-1, SS-1 or SS-1h, Section 32 12 03.
   2. Cationic Emulsified Asphalt: Grade CSS-1 or CSS-1h, Section 32 12 03.
   3. Rapid Cure Cutback Asphalt: Grade RC-70, Section 32 12 03.

PART 3 EXECUTION

3.1 PREPARATION

A. Select and advise ENGINEER of the type of tack material to be used.

B. Clean the surface to be treated free of dust and other foreign material. If flushed, allow surface to dry. If leaves from trees, blow clean.

C. Provide surface for pedestrian access across tack coat.

D. Prevent pedestrians, vehicles, pets, etc., access to tack surfaces.

3.2 APPLICATION

A. General:

1. Triple coverage by spray bar required. Stop application if any nozzle is not working properly.
2. Apply tack only to area covered with asphalt concrete in the same day.

B. Application rate: Typically as follows.

1. Emulsions, 0.05 to 0.15 gallons per square yard.
2. Cutback, CONTRACTOR's choice.

C. Tack Substrate for Fabric Application: Comply with manufacturer's recommendation. If none, then as follows.

1. Dry Pavement surface, 0.20 to 0.30 gallons per square yard. Within street intersections, on steep grades and in zones where vehicle speed changes are commonplace reduce the application rate to no less than 0.20 gallons per square yard.
2. Heavy duty fabrics, 0.30 to 0.40 gallons per square yard.

3.3 PROTECTION

A. Protect all surfaces exposed to public view from being spattered or marred. Remove any spattering, over-coating, or marring.

B. Do not discharge bituminous material into borrow pits or gutters.

3.4 OPENING TO TRAFFIC AND MAINTENANCE

A. Do not permit traffic to travel over the tacked surface until bituminous tack coat has cured or is not picked up by traffic.

B. If detours cannot be provided, restrict operations to a width suitable at least for one-way traffic over the remaining portion of the road.

C. If one-way traffic is provided, control traffic appropriately.

END OF SECTION

SECTION 32 12 16
PLANT-MIX - ASPHALT PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Place Superpave or plant-mix asphalt concrete in base, leveling and surface courses, or overlay.

1.2 REFERENCES

A. AASHTO T 324: Hamburg Wheel-track Testing of Compacted Hot-Mix Asphalt (HMA).

B. ASTM D 979: Standard Practice for Sampling Bituminous Paving Mixtures.

C. ASTM D 2041: Standard Test Method for Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures.

D. ASTM D 3549: Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.

E. ASTM D 3665: Standard Practice for Random Sampling of Construction Materials.

F. ASTM E 950: Standard Test Method for Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference.

G. ASTM E 1274: Standard Test Method for Measuring Pavement Roughness Using a Profilograph.

1.3 SUBMITTALS

A. Before Delivery:
1. Traffic control plan, Section 01 55 26.
2. Type and number of rollers.
3. Manufacturer's certificate of compliance for paving geotextiles, Refer to Section 31 05 19.
4. Location and name of asphalt concrete production facility.
5. Proof of profilograph and profilograph operator certification.

B. At Delivery: Supply batch ticket identifying.
1. Serial number of ticket.
2. Date and truck number.
3. Job name, location, and mix identification.
4. Type, grade, and weight of asphalt.
5 Type, grade, and weight of aggregate.
6. Mix design method.

C. After Delivery:
1. Profile deviation report.

2. Profile roughness index report.
3. Quality Control Inspections and Testing Report: Upon ENGINEER's request, submit report describing source and field quality control activities and test results performed by CONTRACTOR and CONTRACTOR's Suppliers.

1.4 **QUALITY ASSURANCE**

A. Do not change asphalt or aggregate sources until ENGINEER accepts new source and new mix design.

B. Reject product and work that does not meet requirements of this Section.

C. Remove product found defective after installation and install acceptable product at no additional cost to OWNER.

D. Foreman of paving crew has completed at least three (3) projects of similar size and nature.

1.5 **WEATHER**

A. Do not pave until air temperature is 45 deg F. and rising.

B. Cease paving if air temperature falls below 50 deg F.

C. Do not pave if surface is wet or weather is unsuitable.

D. Do not pave if wind or ground cools mix material before compaction.

1.6 **NOTICE**

A. Send written notice to residents and businesseswithin affected area at least 3 days before start of paving.

B. Indicate paving time and when new surface can be used.

C. Warn of potential vehicle tow away and other construction issues affecting neighborhood.

D. Should work not occur on specified day, send a new notice.

1.7 **ACCEPTANCE**

A. General:

1. Acceptance is by Lot. Lot size is specified below.
2. If non-complying material has been installed and no price for the material is specified, apply price adjustment against cost of work requiring material as part of its installation. Section 01 29 00.
3. Dispute resolution, Section 01 35 10.
4. Opening a paved surface to traffic does not constitute acceptance.

B. Mix: Accepted as specified in Section 32 12 05, or Section 32 12 06.

C. Installation:

1. Mix Temperature:
   a. Reject mixes exceeding 325 deg F. in transport vehicle.
   b. Dispose of cold mix in paver hopper as thin spread underlay.
2. Compaction and Thickness:
   a. Lot size is 1,000 square yards or part thereof.

b. Verify with at least 2 tests per Lot.

c. Select test locations by ASTM D 3665 and sample per ASTM D 979 after compaction.

d. Compaction determinations are full core depth or overlay depth in overlay construction.

e. Thickness measurement will not apply in overlay construction.

f. Based upon core samples, compaction and thickness is acceptable if test deviations are within pay factor 1.00 limits. At ENGINEER's discretion, a Lot with a sub-lot test deviation greater than Reject may stay in place at 50 percent cost.

Table 1 – Compaction Pay Factors

Pay Factor	Density, in Percent (ASTM D 2041)	
	Average	Lowest Test
0.70	More than 96	–
1.00	92 to 96	89 or greater
0.90	92 to 96	Less than 89
Reject	Less than 92	–

NOTES
(a) At CONTRACTOR's discretion and expense, do Hamburg wheel track test (AASHTO T 324) on 3 additional random core samples from a non-complying sub-lot. The sub-lot will be accepted if average rut depth is less than 10 mm at 20,000 passes.

Table 2 – Thickness Pay Factor

Pay Factors	Thickness Deficiency, in Inches (ASTM D 3549)
1.00	0.00 to 0.25
0.90	0.26 to 0.50
0.70	0.51 to 0.75
Reject	0.76 to 1.00

3. Grade, Cross Slope: Verify tolerance is not exceeded.

4. Roughness: Verify "must grind" bumps are removed and tolerance for profile roughness index is not exceeded.

PART 2 PRODUCTS

2.1 MATERIALS

A. Asphalt concrete, Section 32 12 05.

B. Superpave, Section 32 12 06.

C. Prime coat, Section 32 12 13.

D. Tack coat, Section 32 12 14.

E. Paving geotextile, Section 31 05 19.

F. Paving geogrid, Section 31 05 21.

PART 3 EXECUTION

3.1 CONSTRUCTION EQUIPMENT

A. Lay Down Machine: Use track equipment when operating on fabrics, geogrids or Pavement mats hotter than 180 deg. F.

B. Compactors: Steel wheel static or vibratory. Use pneumatic tire roller for intermediate rolling only.

3.2 PREPARATION

A. General:

1. Coordinate utility location, Section 01 31 13. Contact utility companies and other agencies, for dangerous concentration of combustible, flammable, or explosive matter.
2. Lower Street Fixtures if paving machine is not capable of passing over the fixtures.
3. Remove vegetation from cracks, edges and joints. Sweep surface clean. Blow cracks clean. Remove leaves.
4. Fill cracks and fix Potholes, Section 32 01 17.
5. Stabilize concrete Subgrade slabs.

B. Trees, Plants, Ground Cover:

1. Protect trees, plants and other ground cover from damage.
2. Prune trees, Section 32 01 93 to allow equipment passage underneath. Repair tree damage at no additional cost to OWNER.

C. Traffic Control:

1. Provide worker and public safety, Section 01 55 26.
2. Apply temporary traffic and lane marking tape or paint after layout has been verified with ENGINEER.

D. Aggregate Base Course:

1. Verify base course is placed to grade and compacted.

2. If indicated, follow Section 31 25 00 for herbicide treatment or Section 32 12 13 for prime coat.

E. Tack Coat: Apply tack coat, Section 32 12 14 if inlay or subbase Pavement surface is dirty or older than 24 hours.

3.3 TEMPORARY SURFACING

A. Place, roll, maintain, remove and dispose of temporary surfaces.

B. In sidewalk areas construct temporary Pavements at least 1 inch thick and in all other areas at least 2 inches thick. At major intersections and other critical locations a greater thickness may be required.

3.4 PLACE PAVING FABRIC

A. Section 31 05 19.

3.5 PLACE PAVEMENT MIXTURE

A. General:

1. Provide continuous forward movement such that minimum temperature 10 feet behind paver is as follows.

Table 3 – Minimum Temperature, Degrees F.

Air Temperature Deg F.	Compacted Mat Thickness					
	3/4"	1"	1-1/2"	2"	3"	4"+
45 – 50	–	–	–	–	280	265
50 - 59	–	–	–	280	270	255
60 - 69	–	–	285	275	265	250
70 - 79	285	285	280	270	265	250
80 - 89	280	275	270	265	260	250
90 +	275	270	265	260	250	250

2. Do not leave unsafe butt joints if paving operation stops.

3. Barricade or eliminate fall off edges.

B. Overlays or Subsequent Lifts:

1. Allow new base Pavement or new inlay Pavement to harden (cure) prior to placing overlays.

2. Apply tack coat per Section 32 12 14 if inlay or sub-base pavement surface is dirty or older than 24 hours.

C. Irregular Areas: Handwork is acceptable if specified grades, slopes, compaction and smoothness is achieved.

D. Compaction:

1. Do not over compact or under compact.

2. Complete compaction before temperature drops to 180 deg. F.

E. Joints:

1. Construct joints to have same texture, density and smoothness as other sections of new Pavement course.

2. Clean contact surfaces and apply tack coat. Ensure continuous bond between old and new Pavements, or between successive day's work.

3. Offset longitudinal joints a minimum of 12 inches in succeeding

courses and at least 6 feet transversely to avoid a vertical joint through more than one course. In the top course restrict longitudinal joint to 1 foot either side of lane lines.

4. Prevent traffic, including construction traffic, from crossing vertical edges. Apply tack coat to vertical edges prior to making another pass with the paver if the mix has cooled to 90 deg. F.

3.6 TOLERANCES

A. Compaction: 94 percent plus or minus 2 percent of theoretical maximum specific gravity, ASTM D 2041 (Rice Method).

B. Lift Thickness:

1. Not less than 2 times the maximum aggregate size in compacted asphalt concrete mixes.
2. Not less than 4 times the nominal maximum aggregate size in compacted SUPERPAVE mixes.
3. Not more than limits established by pneumatic or vibratory compactor equipment manufaturer.

C. Grade: 1/8 inch in 10 feet parallel to centerline.

D. Cross Slope: 1/4 inch in 10 feet perpendicular to centerline except at cross section grade breaks.

E. Roughness:

Table 4 – Roughness Tolerance

Speed and Traffic Class		Profile Roughness Index, (PRI) Inches / Mile				Profile Deviation Inches/25 feet Maximum
		IRI		PI		
		Min	Max	Min	Max	
0 to 29 mph	I or II	–	–	–	–	0.4
	III or IV	129	177	46	66	0.4
30 to 44 mph	I or II	90	115	35	50	0.4
	III or IV	70	90	21	35	0.4
45 mph +	All Classes	–	70	–	21	0.3

NOTES
(a) Use a zero blanking band.
(b) As a minimum, trace right wheel path in direction of travel
(c) Traffic class is defined in Table 3 of Section 32 12 05.
(d) IRI (International Roughness Index), ASTM E 950
(e) PI (Profile Index), ASTM E 1274.

1. Profile Deviation: Begin traces 50 feet before edge of new pavement and end traces 50 feet after edge of new pavement. Areas exceeding profile deviation tolerance are “must grind” areas.
2. Profile Roughness Index: (PRI)
   a. Lot is 0.1 lane mile (528 feet long one lane wide). Add segments shorter than 250 feet to preceding Lot. Treat partial segments longer than 250 feet as a Lot.
   b. Exclude from the Lot are turn lanes, parking lanes, medians,

Street Fixtures, crowns of intersecting streets, bridge decks, grades greater than 8 percent, and vertical curves less than 1,000 feet radius (including super-elevation transitions).

3.7 PROTECTION AND REPAIR

A. General: All expenses are at no cost to OWNER.

B. Protection.

1. Protect all structures, including curb, gutter, sidewalks, guard rails and guide posts.
2. Remove spatter, over-coat, or mar.
3. Do not discharge bituminous materials into borrow pits or gutters.
4. Protect hot pavement from traffic until mixture has cooled enough not to become marked.
5. Protect neighborhood, storm drains and down-stream fish habitat.

C. Repair.

1. Corrective Action for Profile Deviations ("Must Grinds"): Grinding is acceptable, Section 02 41 14. Apply Section 32 12 03 cationic or anionic emulsion and sand friction blotter over grind areas.
2. Corrective Action for Profile Roughness Index: Grinding is acceptable. Skin patch for depressions is not acceptable. Raise depressions by milling and inlay. Re-profile corrected segments to verify index meets tolerance. Apply a Section 32 12 03 cationic or anionic emulsion and sand friction blotter over grind areas.
3. When thickness is deficient, place additional material over deficient areas. DO NOT skin patch. Mill for inlay if necessary.
4. Defective Joints, Seams, Edges: Repair.
5. Unacceptable Paving: Remove and replace.

END OF SECTION

SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Paints for Pavement striping.

B. Words and other markings in paint or plastic film.

C. One or two-way prismatic reflectors for Pavement marking.

1.2 REFERENCES

A. AASHTO M 237: Standard Specification and Recommended Practice for Epoxy Resin Adhesive for Bonding Traffic Markers to Hardened Concrete.

B. AASHTO M 247: Standard Specification for Glass Beads Used in Traffic Paint.

C. AASHTO M 248: Standard Specification for Ready-Mixed White and Yellow Traffic Paints.

D. AASHTO M 249: Standard Specification for White and Yellow Reflective Thermoplastic Striping Material (Solid Form).

E. ASTM D 638: Standard Test Method for Tensile Properties of Plastics.

F. ASTM E 303: Standard Method for Measuring Surface Frictional Properties Using the British Pendulum Tester.

G. FS L-S-300: Sheeting and Tape, Reflective: Nonexposed Lens.

H. Federal Standard 141: Paint, Varnish, Lacquer and Related Materials, Methods of Inspection, Sampling, and Testing.

I. Federal Standard 370: Instrumental Photometric Measurements of Retroflective Materials and Retroreflective Devices.

J. MUTCD: Manual on Uniform Traffic Control Devices for Streets and Highways.

1.3 SUBMITTALS

A. Specifications of primer to be used for tape applications.

B. Manufacturer's affidavit certifying paint products meet or exceed material requirements of this section.

C. Sample of prismatic reflector to be used along with manufacturer's statement of the reflector's minimum reflective area and specific intensity at the 0.2 degree observation angle.

D. Manufacturer's recommendation for type of epoxy to be used when installing prismatic reflectors and markers.

E. Samples of each thermoplastic or preformed plastic Pavement markings along with a statement of how the materials will be applied.

PART 2 PRODUCTS

2.1 ALKYD RESIN PAINT

A. White or yellow Type F (Fast dry) ready-mixed, AASHTO M 248.

2.2 THERMOPLASTIC PAINT

A. White or yellow, AASHTO M 249.

2.3 GLASS BEADS

A. Type 1, AASHTO M 247.

2.4 REFLECTIVE TAPE

A. Type II white or yellow with a Class 1 (pressure-sensitive) adhesive, FS L-S-300.

2.5 PREFORMED PLASTIC FILM MATERIALS

A. Film: A retroflective pliant polymer with white or yellow pigments selected and blended to conform to standard highway colors throughout the expected life of the film and glass beads distributed throughout its base cross-sectional area, with a reflective layer of beads bonded to the top surface and composed of the following materials.

Materials	Minimum Percent By Weight
Resing and Plasiticizers	20
Pigments and Extenders	30
Graded Glass Beads	33

1. Type 1: Subjected to high traffic volume and severe wear conditions such as repeated shear action from crossover, encroachment on edge and channelization lines, and stop, start, or turn movements.
   a. Class 1: Without precoated adhesive, for application with epoxy cement.
   b. Class 2: With precoated pressure sensitive adhesive.
2. Type 2: Subjected to lower traffic volumes and less severe wear action such as most highway edge lines, markings on rural highways, lane lines in well-channelized areas and transverse and word/symbols subjected primarily to free rolling traffic.
   a. Class 1: Without precoated adhesive, for application with epoxy cement.
   b. Class 2: With precoated pressure sensitive adhesive

B. Tensile Strength: Sample 6 x 1 x 0.06 inches at a temperature between 70 deg. F. and 80 deg. F. using a jaw speed of 10 inches to 12 inches per minute tested per ASTM D 638 requirements.

1. Type 1: 150 pounds per square inch of cross-section.
2. Type 2: 40 pounds per square inch of cross-section.

C. Elongation: 75 percent minimum at break when tested per ASTM D 638 requirements using a Sample 6 x 1 x 0.06 inches at a jaw speed of 10 inches to 12 inches per minute.

D. Skid Resistance: Initial minimum skid resistance values are 35 BPN as measured by the British Portable Skid Test, ASTM E 303 requirements.

E. Reflectance: Minimum reflectance values at 0.2 degrees and 0.5 degrees observation angles and 86.0 degrees entrance angle as measured per the testing procedures of Federal Standard 370.

Film Type	**Observation Angles**			
	White		**Yellow**	
	0.2°	**0.5°**	**0.2°**	**0.5°**
Type 1: SL (mcd/sf/fc)	550	380	410	250
Type 2: SL (mcd/sf/fc)	960	760	680	510

1. The photometric quantity is measured in specific luminance (SL), and expressed as millicandelas per square foot per footcandle (mcd/sf/fc).
2. Use a test distance 50 feet and a Sample size of 2. x 2.5 feet.
3. Use an angular aperture of both the photoreceptor and light projector of 6 minutes of arc.
4. The reference center is the geometric center of the Sample, and the reference axis is taken perpendicular to the test Sample.

F. Film Reflectivity Retention: Not more than 15 percent of the beads lost due to popout and the predominate mode of Failure is "wear down" of the beads, when subjected to 200 cycles of a Taber Abraser Simulation test using an H-18 wheel and 125 gram load.

G. Thickness: 0.06 inch without adhesive.

H. Effective Performance Life: The film, when applied according to the recommendations of the manufacturer, will provide a neat, durable marking that will not flow or distort due to temperature if the Pavement surface remains stable. Although reflectivity is apply wear, the pliant polymer will provide a cushioned, resilient substrate that reduces bead crushing and loss. Use a film that shows no appreciable fading, lifting, or shrinkage throughout the useful life of the marking, and shows no significant tearing, roll back, or other signs of poor adhesion.

I. Abrasion Resistance: Use a material that when tested will not wear through to the conformable backing surface in less than 5,000 cycles when tested per Federal Standard 141, Method 6192, using a CS-17 wheel and a 1,000 gram load.

J. Acid Resistance: Use a material that will show resistance to etching, hazing, or delamination of bead surface after exposure to a 1 percent solution of sulfuric acid.

2.6 PRISMATIC REFLECTORS

A. Unless indicated otherwise, provide single lens snowplow resistant reflectors of the color indicated.

1. With a cast iron housing and acrylic prismatic reflector.
2. With an overall size not less than 9 inches long, 5 inches wide, and 1-3/4 inch thick with a 7/16 inch maximum projection above the roadway.
3. With a minimum reflective area of 1.6 square inches per face.

B. Reflector Specific Intensity:

	Intensity at 0.2 Degree Observation Angle	
Color	**0 Degree Entrance Angle**	**20 Degree Entrance Angle**
White	3.	1.2
Yellow	1.8	0.72

2.7 EPOXY ADHESIVE

A. Epoxy, AASHTO M 237 requirements and as recommended by the manufacturer of the reflector. Provide a minimum adhesion value of 1.1 pounds per inch width.

PART 3 EXECUTION

3.1 CONSTRUCTION EQUIPMENT

A. Use equipment manufactured for Pavement marking. Use workers experienced in operating such equipment.

B. Use equipment capable of applying a strip, or strips with a width tolerance of plus or minus 1/4 inch. Equip the machine with an automatic skip control giving a 10 feet long marked segment and a 30 feet long gap within a linear tolerance of 6 inches over that cycle.

C. If applying glass beads, locate bead applicator directly behind and synchronized with marking applicator.

D. For thermoplastic paint materials, use equipment that is designed to agitate the paint to prevent scorching, discoloration, or excessive high temperatures.

3.2 PREPARATION

A. Broom or flush the surface to remove dirt, loose stones, or other foreign material immediately prior to applying.

B. Prior to applying, mark roadway between control points established by ENGINEER. ENGINEER will establish points on tangent at least every 100 feet and at 25 feet long intervals on curves. Maintain the line within 1 inch of the established control points. ENGINEER may also designate other Pavement striping locations such as stop bars, crosswalks, zebra striping, etc.

C. Markings that adhere to asphalt concrete or Portland cement concrete by

either a pressure sensitive precoated adhesive or an epoxy cement shall mold to the Pavement contours by traffic action at normal Pavement temperatures and shall be ready for traffic immediately after application.

D. Begin Pavement painting and marking operations not later than 24 hours after receipt of written order by ENGINEER.

E. Apply striping and markings per MUTCD requirements.

F. Apply all materials in accordance with manufacturer's and ENGINEER's directions.

3.3 **APPLICATION**

A. Apply Pavement paintings and markings only when Pavement surface is dry and air temperature is above 40 deg. F. during daylight hours.

B. Do not apply paints and markings when rain is anticipated within 12 hours.

3.4 **ALKYD RESIN PAINT STRIPING**

A. Adjust Pavement striping machine to apply paint at rate recommended by paint manufacturer.

B. Glass Bead Application Rate: 5.9 to 6.1 pounds per gallon of paint.

C. Protect the markings until dry by placing approved guarding or warning device wherever necessary. Remove any markings not authorized or smeared or otherwise damaged, or correct as approved by ENGINEER.

3.5 **THERMOPLASTIC PAINT STRIPING**

A. Clean off dirt, glaze, and grease before prestriping.

B. Prestripe the application area with a binder material that will form, when sprayed, a continuous film over the Pavement surface, and will dry rapidly and mechanically adhere to the Pavement surface. Install the material in varying widths if indicated.

C. Extrude the thermoplastic material at a temperature of 412 plus or minus 12 deg. F. from approved equipment to produce a line 1/8 inch to 3/16 inch thick, continuous and uniform in shape, and have clean and sharp dimensions.

D. Do not use material which produce fumes that are toxic, obnoxious, or injurious to persons or property.

E. Apply so that finished lines have well-defined edges free of waviness.

F. Glass Beads Application Rate: 6 pounds of glass beads to every 100 square feet of marking.

3.6 **TAPE STRIPING**

A. Apply Pavement marking tape as indicated or directed. ENGINEER will establish control points.

B. Apply the tape only on surfaces that are dry and free of oils, grease, dust and dirt, and primed at the rate of approximately 1 quart per 60 feet with an approved primer material.

C. Maintain the line on established control points. Apply intermittent Pavement marking tape 24 inches long, spaced approximately 100 feet on tangents, and approximately 25 feet on curves unless otherwise

directed. The ENGINEER will designate other Pavement striping locations such as stop bars, crosswalks, zebra striping, etc.

D. Press down the tape immediately after application until it adheres and conforms to the surface of the Pavement.

E. Completely remove all tape on sections where tape conflicts with revised traffic lanes prior to opening new lanes to traffic.

3.7 PAVEMENT MARKING FILMS

A. Use Pavement marking films that are capable of being applied to new, dense, and open-graded asphalt concrete wearing courses during the paving operation in accordance manufacturer's instructions, and that are capable of conforming to Pavement contours through the action of traffic at normal Pavement temperatures.

B. Use a Pavement marking film that is capable of use for patching worn areas of the same type film.

C. Apply before traffic is allowed on the freshly paved surface.

D. Unless indicated otherwise, provide Type C, Class II, polymer film markings in specified widths and shapes. Provide and layout words and marking symbol configurations per MUTCD requirements and as indicated.

E. When indicated, inlay the markings in fresh asphalt surface by a compaction roller during the paving operation.

F. Apply all markings in accordance with manufacturer's recommendations.

3.8 PRISMATIC REFLECTOR INSTALLATION

A. Install reflectors by cutting Pavement and partially filling cut area with epoxy adhesive. Place reflector housing in the adhesive and apply pressure to properly seat. Allow epoxy to completely set before allowing traffic on markers.

B. Install marker so that housing edges are flush with Pavement and so that the angle formed by the longitudinal axis of the marker and the adjacent Pavement stripe does not exceed 5 degrees.

3.9 WORDS AND OTHER MARKINGS

A. Wet sandblast existing or temporary Pavement markings that may be confusing. Removal of markings by high-pressure water may be used if approved by ENGINEER.

B. Apply word markings, letters, numerals and symbols with indicated stencils and templates. In the absence of such information all stencils and templates shall be identical to those currently used by OWNER.

3.10 TEMPORARY PAVEMENT MARKINGS

A. Renew when stripes and markings have lost 50 percent of their original visual effectiveness.

END OF SECTION

SECTION 33 05 14
UTILITY GRADE ADJUSTMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Raise, lower, or change slope of Street Fixtures.

B. Install Cover Collars.

C. This section is NOT APPLICABLE to raising and lowering Street Fixtures that withstand internal pressure.

1.2 DEFINITIONS

A. Box: A structure such as a valve box, meter box, monument box, fire hydrant box, electrical pull box, cleanout box or other like structure not intended for human entry.

B. Cover Collar: A concrete filled annular space between metal frames and the adjacent Pavement structural section.

C. Extension Ring: A concrete or metal ring used to adjust surface elevations and surface cross slopes of Street Fixture covers. Metal rings are used between metal frames and metal covers or grates. Concrete rings are used below metal frames or in the concrete structure below.

D. Manhole: A structure designed to permit human entry and working space inside and to confine and control the flow of pipe-conveyed fluids. These structures are collectively referred to as manholes regardless of composition, design, type or depth.

E. Street Fixture: The top of existing structures such as but not limited to Manholes, catch basin, sumps, inlets, valve boxes, meter boxes, monument boxes, and similar structure in a thoroughfare surface.

F. Vault: A structure intended for human entry containing electrical/telephone facilities or other like utilities.

PART 2 PRODUCTS

2.1 PAVEMENT

A. Asphalt Concrete: AC-20-DM-1/2, Section 32 12 05.

B. Cast-in-place Concrete: Class 4000, Section 03 30 04.

2.2 **GROUT**

A. Hydraulic cement, Section 03 61 00.

2.3 **EXTENSION RINGS**

A. Metal: Cast iron or steel, Section 05 56 00.

B. Cast-in-place Concrete: Class 4000, Section 03 30 04.

PART 3 EXECUTION

3.1 **PREPARATION**

A. Determine condition of existing incidental structure. Any item not reported damaged prior to construction shall be considered unbroken and must be replaced by CONTRACTOR at no additional cost to OWNER.

B. Provide invert cover over pipe in cleanout box to prevent gravel, concrete, or debris from entering pipeline.

C. Unless indicated otherwise, arrange for utility companies to adjust their own structures.

D. Coordinate all adjustments with requirements of affected utility company.

3.2 **ADJUST STRUCTURE TO GRADE**

A. Restrict excavation around the structure to a minimum area.

B. At the completion of the structure adjustment, backfill the void around the structure and compact before paving or landscaping.

C. Apply mortar to inside and outside of concrete grade rings used to make adjustments.

D. If the cone is cracked during construction, restack the Manhole with shorter Manhole sections and install a new cone at no additional cost to the OWNER.

3.3 **ADJUST COVER IN PAVEMENT SURFACE**

A. Method A - Metal Extension Rings:

1. Use rings that lock together.
2. Set frame at desired elevation and cross-slope.
3. Seal joints between Pavement and ring, Section 32 01 17.

B. Method B – Concrete Extension Rings:

1. Place concrete grade rings under frame or in structure riser shaft.
2. Set frame at desired elevation and cross-slope.
3. Provide 100 percent concrete support under frame. Do not use wood, bricks, concrete fragments, blocks or particles as support.
4. Grout seams between concrete rings and between frame and concrete rings.

C. Method C – Place Concrete:

1. Set frame at desired elevation and cross-slope.
2. Place concrete and provide 100 percent concrete support under frame.

D. Method D – Concrete Deck:

1. Remove existing concrete deck.
2. Reset steel rebar.
3. Set frame to grade, set forms.
4. Pour concrete. Provide complete concrete support under Street Fixture.

3.4 INSTALLING COVER COLLAR

A. Open an annular space between pavement and Street Fixture cover. Unless indicated otherwise, provide 12 inches of annular space.

B. Set concrete collar to 1/4 inch minimum to 1/2 inch maximum below asphalt concrete pavement surface and 1/4 inch below portland cement concrete pavement surface.

C. Trowel finish, Section 03 35 00.

3.5 PAVEMENT SURFACE RESTORATION

A. In new streets or overlays, adjust Street Fixture cover after bituminous paving is complete.

B. Pavement restoration, Section 33 05 25.

END OF SECTION

SECTION 33 05 25
PAVEMENT RESTORATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aggregate base restoration.

B. Concrete base restoration.

C. Surface restoration.

1.2 REFERENCES

A. ACI 305: Hot Weather Concreting.

B. ACI 306: Cold Weather Concreting.

C. ASTM C 615: Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

D. ASTM C 78: Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading).

E. ASTM C 928: Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.

F. ASTM D 1664: Standard Test Method for Coating and Stripping of Bitumen-Aggregate Mixtures.

1.3 SUBMITTALS

A. Mix design for,

1. Temporary patching material.
2. Permanent cold weather patching material.

B. Manufacturer's chemical additive data sheets.

1.4 WEATHER

A. Asphalt Concrete Pavement Patch:

1. Provide temporary or permanent cold weather asphalt patching material when air and roadbed temperature in the shade are less than 40 deg. F.
2. Remove any temporary patching and provide permanent patching material when temperatures exceed 40 deg. F. CONTRACTOR may perform work after cold weather season if authorized in writing by ENGINEER.

B. Portland Cement Concrete Pavement Patch: Comply with hot and cold weather requirements, ACI 305 or ACI 306.

1.5 **ACCEPTANCE**

A. Aggregate base compaction.

B. Asphalt concrete compaction.

C. Grade and cross slope of pavement surface.

PART 2 PRODUCTS

2.1 **MATERIALS**

A. Untreated Base Course: Section 32 11 23.

B. Flowable Fill Base: Section 31 05 15.

C. Portland Cement Concrete Base: Class 4000, Section 03 30 04.

D. Tack Coat: Section 32 12 14, Grade SS-1.

E. Permanent Warm Weather Asphalt Concrete Patching Material: Section 32 12 05, AC-20-DM-1/2 unless indicated otherwise.

F. Permanent Cold Weather Asphalt Concrete Patching Material: MC-250-FM-1, Section 32 12 05 modified as follows.

1. Asphalt Cement:

   a. Kinematic viscosity at 140 deg F: 250 to 800 cSt.

   b. Flash Point: 175 deg F.

   c. Water: 0.2 percent maximum.

   d. Distillate Test:

      To 437 deg F: None.

      To 500 deg F: 0 - 15 percent.

      To 600 deg F: 15 - 75 percent.

      To 680 deg F: 75 percent minimum.

   e. Residue Tests:

      Penetration at 77 deg F: None.

      Ductility at 77 deg F: 100 cm minimum.

      Solubility in Trichloroethylene: 99 percent minimum.

2. Composition of Mixture:

   a. Minimum Mix: 115 pounds asphalt cement per finished ton (5.75 percent).

   b. Maximum Mix: 135 pounds asphalt cement per finished ton (6.75 percent).

   c. Stripping: Not more than 5 percent, ASTM D 1664, after mixing.

   d. Workability: Material stockpiled for 1 year shall be capable of being shoveled, raked, spread and compacted.

3. Chemical Additives: Capable of coating wet aggregates without stripping and maintains adhesive qualities in damp or wet applications.

G. Temporary Cold Weather Asphalt Concrete Patching Material: Type MC-250-DM-1/2, Section 32 12 05 with hydrated lime or anti-stripping agent as indicated in the mix design.

H. Pavement Sealing:

1. Slurry seal Type RS-1-SS-II, Section 32 01 13.
2. Chip seal Type MC-250-CS-A, Section 32 01 14.

I. Portland Cement Concrete Patching Material: Class 4000, Section 03 30 05.

J. High Early Strength Portland Cement Concrete Patching Material:

1. Concrete compressive strength of 3,000 psi minimum in 4 hours.
2. Cementatious Material: Rapid hardening or very rapid hardening, ASTM C 928.
3. Cement content of mix, per cement manufacturer's recommendations or approved mix design.
4. Non-reactive aggregates in applications subjected to wetting, extended exposure to humid atmosphere, or contact with moist ground.

K. Pavement Marking: Tape or paint, Section 32 17 23.

PART 3 EXECUTION

3.1 PREPARATION

A. At site, post name, address and telephone number of CONTRACTOR to contact in emergencies.

B. Notify ENGINEER within 24 hours of commencing work of this section but not less than 4 hours.

C. Provide worker and public safety; Section 01 55 26.

D. Cutting Pavements: Cut full depth and straight, Section 02 41 14. Remove all bonding inhibitors.

3.2 AGGREGATE BASE OR FLOWABLE FILL BASE

A. Match depth of existing aggregate base or 8 inches thick minimum.

B. Place crushed aggregate base in lifts not exceeding 8 inches before compaction. Compact per Section 33 23 26 to a Modified Proctor Density of 95 percent or greater.

C. When providing controlled low strength material (CLSM as specified in 31 05 15) match depth of existing aggregate base. Use fill that flows easily and vibration is not required. Cure the fill before placing surface patch.

3.3 CONCRETE SUBSTRATE

A. Apply concrete bonding compound, Section 03 30 10, to edge of existing concrete. Place concrete, Section 03 30 10.

3.4 ASPHALT CONCRETE PATCH

A. Match existing Pavement thickness plus 1 inch, but not less than 4 inches.

B. Clean all vertical surfaces that butt against new patchwork. Provide full coverage spray tack coat. Do not spray tack coat on surfaces exposed to public view. Do not apply tack coat by brush.

C. Place asphalt concrete in lifts not exceeding 3 inches after compaction

D. Compaction: 94 percent of ASTM D 2041 (Rice) plus or minus 2 percent.

E. Match adjacent surface slopes.

1. Plane off surface distortions that exceed 1/4-inch vertical deviation in 10 feet.
2. Coat planed surfaces with a cationic or anionic tack emulsion that complies with Section 32 12 03. Cover tack with sand.

3.5 PORTLAND CEMENT CONCRETE PATCH

A. Full Depth restorations:

1. Clean vertical surfaces in patchwork. Install dowels in vertical load bearing joints. Apply concrete bonding compound, Section 03 30 10.
2. Match adjacent surface slopes. Apply membrane forming compound, Section 03 39 00 immediately to protect work from hot or cold weather.
3. After concrete cure, plane off surface distortions that exceed 1/4 inch deviation in 10 feet. Use a water repelling product, Section 07 19 00 to water proof planed surfaces.
4. Do not allow traffic on the repaired area until concrete strength is achieved.

B. Partial Depth Patching:

1. Chip, hydro-blast or saw cut concrete to a minimum depth of 1 inch.
2. Make surfaces free of frost, ice, mud, water, grease, dirt and other materials that hamper bonding.
3. Install bonding agent per manufacturer's recommendations.
4. Apply membrane forming compound, Section 03 39 00 immediately to protect work from hot or cold weather.
5. After concrete cure, plane off surface distortions that exceed 1/4 inch deviation in 10 feet. Use a water repelling product, Section 07 19 00 to water proof planed surfaces.
6. Do not allow traffic on the repaired area until concrete strength is achieved.

3.6 CONCRETE PAVERS

A. Screed Bedding with a notched and cambered screed board to achieve a crown between existing pavers. Use graded aggregate, geotextile, and bedding sand, Section 32 14 13.

B. In asphalt concrete or portland cement concrete surfaces place pavers against Pavement cuts to form a border course, i.e. the short side of the paver against the cut except at corners.

C. After placement, use a plate-type vibrating compactor to compact pavers. Size compactor to provide at least 5,000 lbf. force. Sweep sand into the joints and vibrate until joints are full. Remove excess sand.

D. Match adjacent surface grades with no more than 1/4 inch vertical deviation in 10 feet.

3.7 PAVEMENT MARKINGS

A. Unless indicated otherwise, repair all damaged Pavement markings with matching type of materials and installation.

END OF SECTION

Recommended Performance Guideline For Emulsified Asphalt Slurry Seal

A105
(Revised February 2010)

NOTICE

It is not intended or recommended that this guideline be used as a verbatim specification. It should be used as an outline, helping user agencies establish their particular project specification. Users should understand that almost all geographical areas vary as to the availability of materials. An effort should be made to determine what materials are reasonably available, keeping in mind system compatibility and specific job requirements. Contact ISSA for answers to questions and for a list of ISSA member contractors and companies.

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RECOMMENDED PERFORMANCE GUIDELINE FOR EMULSIFIED ASPHALT SLURRY SEAL

1. SCOPE

The intent of this guideline is to aid in the design, testing, quality control, measurement and payment procedures for the application of Emulsified Asphalt Slurry Seal Surfacing.

2. DESCRIPTION

Slurry seal shall consist of a mixture of an emulsified asphalt, mineral aggregate, water, and additives, proportioned, mixed and uniformly spread over a properly prepared surface as directed by the Buyer's Authorized Representative (B.A.R.). The slurry seal shall be applied as a homogeneous mat, adhere firmly to the prepared surface, and have a skid-resistant texture throughout its service life.

3. SPECIFICATIONS

It is not normally required to run all tests on every project. A compilation of results from the listed tests should be indicative of system performance. Failure to meet specification for an individual test does not necessarily disqualify the system. If, for example, the system to be used on the project has a record of good performance, individual requirements for testing may be waived. Agency and testing methods are listed in the appendix (see Appendix A) and form a part of this guideline.

4. MATERIALS

4.1 EMULSIFIED ASPHALT

The emulsified asphalt, and emulsified asphalt residue, shall meet the requirements of AASHTO M 140 or ASTM D 977 for SS-1 or SS-1h. For CSS-1, CSS-1h, or CQS-1h, it shall meet the requirements of AASHTO M 208 or ASTM D 2397.
Each load of emulsified asphalt shall be accompanied with a Certificate of Analysis/Compliance to indicate that the emulsion meets the specifications.

4.2 AGGREGATE

4.2.1 GENERAL

The mineral aggregate used shall be the type specified for the particular application requirements of the slurry seal. The aggregate shall be crushed stone such as granite, slag, limestone, chat, or other high-quality aggregate, or combination thereof. To assure the material is 100 percent crushed, the parent aggregate will be larger than the largest stone in the gradation to be used.

4.2.2 QUALITY TESTS

The aggregate should meet agency specified polishing values and these minimum requirements:

TEST	TEST METHOD		SPECIFICATION
	AASHTO	ASTM	
Sand Equivalent Value of Soils and Fine Aggregate	T 176	D 2419	45 Minimum
Soundness of Aggregates by Use of Sodium Sulfate of Magnesium Sulfate	T 104	C 88	15% Maximum w/NA_2SO_4 25% Maximum w/$MgSO_4$
Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine[1]	T 96	C 131	35% Maximum

[1]The abrasion test is run on the parent aggregate.

4.2.3 GRADATION

When tested in accordance with AASHTO T 27 (ASTM C 136) and AASHTO T 11 (ASTM C 117), the mix design aggregate gradation shall be within one of the following bands (or one recognized by the local paving authority):

SIEVE SIZE		TYPE I PERCENT PASSING	TYPE II PERCENT PASSING	TYPE III PERCENT PASSING	STOCKPILE TOLERANCE FROM THE MIX DESIGN GRADATION
3/8	**(9.5 mm)**	100	100	100	
# 4	**(4.75 mm)**	100	90 - 100	70 - 90	± 5%
# 8	**(2.36 mm)**	90 - 100	65 - 90	45 - 70	± 5%
# 16	**(1.18 mm)**	65 - 90	45 - 70	28 - 50	± 5%
# 30	**(600 um)**	40 - 65	30 - 50	19 - 34	± 5%
# 50	**(330 um)**	25 - 42	18 - 30	12 - 25	± 4%
#100	**(150 um)**	15 - 30	10 - 21	7 - 18	± 3%
#200	**(75 um)**	10 - 20	5 - 15	5 - 15	± 2%

The gradation of the aggregate stockpile shall not vary by more than the stockpile tolerance from the mix design gradation (indicated in the table above) while also remaining within the specification gradation band. The percentage of aggregate passing any two successive sieves shall not change from one end of the specified range to the other end.

The aggregate will be accepted at the job location or stockpile based on five gradation tests sampled according to AASHTO T 2 (ASTM D 75). If the average of the five tests is within the stockpile tolerance from the mix design gradation, the material will be

accepted. If the average of those test results is out of specification or tolerance, the contractor will be given the choice to either remove the material or blend additional aggregate with the stockpile material to bring it into compliance. Materials used in blending must meet the required aggregate quality test specifications in Section 4.2.2 before blending and must be blended in a manner to produce a consistent gradation. Aggregate blending may require a new mix design.

Screening shall be required at the stockpile if there are any problems created by oversized materials in the mix.

Type I. This aggregate gradation is used to fill surface voids, address moderate surface distresses, and provide protection from the elements. The fineness of this mixture provides the ability for some crack penetration.

Type II. This aggregate gradation is used to fill surface voids, address more severe surface distresses, seal, and provide a durable wearing surface.

Type III. This aggregate gradation provides maximum skid resistance and an improved wearing surface.

4.3 MINERAL FILLER

Mineral filler may be used to improve mixture consistency and to adjust mixture breaking and curing properties. Portland cement, hydrated lime, limestone dust, fly ash, or other approved filler meeting the requirements of ASTM D 242 shall be used if required by the mix design. Typical use levels are normally 0.0 - 3.0 percent and may be considered part of the aggregate gradation.

4.4 WATER

The water shall be free of harmful salts and contaminants. If the quality of the water is in question, it should be submitted to the laboratory with the other raw materials for the mix design.

4.5 ADDITIVES

Additives may be used to accelerate or retard the break/set of the slurry seal. Appropriate additives, and their applicable use range, should be approved by the laboratory as part of the mix design.

5. LABORATORY EVALUATION

5.1 GENERAL

Before work begins, the contractor shall submit a signed mix design covering the specific materials to be used on the project. This design will be performed by a laboratory which has experience in designing Emulsified Asphalt Slurry Seal Surfacing. After the mix design has been approved, no material substitution will be permitted unless approved by the B.A.R.

ISSA can provide a list of laboratories experienced in slurry seal design.

5.2 MIX DESIGN

Compatibility of the aggregate, emulsified asphalt, water, mineral filler and other additives shall be evaluated in the mix design. The mix design shall be completed using materials consistent with those supplied by the contractor for the project. Recommended tests and values are as follows:

TEST	ISSA TB NO.	SPECIFICATION
Mix Time @ 77°F (25°C)	TB 113	Controllable to 180 Seconds Minimum
Slurry Seal Consistency	TB 106	0.79 – 1.18 inches (2.0 – 3.0 cm)
Wet Cohesion @ 30 Minutes Minimum (Set) @ 60 Minutes Minimum (Traffic)	TB 139 (For quick-traffic systems)	12 kg-cm Minimum 20 kg-cm or Near Spin Minimum
Wet Stripping	TB 114	Pass (90% Minimum)
Wet-Track Abrasion Loss One-hour Soak	TB 100	75 g/ft^2 (807 g/m^2) Maximum
Excess Asphalt by LWT Sand Adhesion	TB 109 (Critical in heavy-traffic areas)	50 g/ft^2 (538 g/m^2) Maximum

The Wet Track Abrasion Test is performed under laboratory conditions as a component of the mix design process. The purpose of this test is to determine the minimum asphalt content required in a slurry seal system. The Wet Track Abrasion Test is not recommended as a field quality control or acceptance test. ISSA TB 136 describes potential causes for inconsistent results of the Wet Track Abrasion Test.

The mixing test is used to predict the time the material can be mixed before it begins to break. It can be a good reference check to verify consistent sources of material. The laboratory should verify that mix and set times are appropriate for the climatic conditions expected during the project.

The laboratory shall also report the quantitative effects of moisture content on the unit weight of the aggregate (bulking effect) according to AASHTO T19 (ASTM C29). The report must clearly show the proportions of aggregate, mineral filler (if used) and emulsified asphalt based on the dry weight of the aggregate.

The percentages of each individual material required shall be shown in the laboratory report. Based on field conditions, adjustments within the specific ranges of the mix design may be required.

The component materials shall be designed within the following limits:

COMPONENT MATERIALS	SUGGESTED LIMITS
Residual Asphalt	Type I: 10 - 16% Type II: 7.5 - 13.5% Type III: 6.5 - 12% (Based on dry weight of aggregate)
Mineral Filler	0.0 - 3.0% (Based on dry weight of aggregate)
Additives	As needed
Water	As required to produce proper mix consistency

5.3 MIX TOLERANCES

Tolerances for the slurry seal mixture are as follows:

a. After the residual asphalt content is determined, a variation ±1% by weight of dry aggregate will be permitted.
b. The slurry consistency, as determined according to ISSA TB No. 106, shall not vary more than ± 0.2" (± 0.5 cm) from the job mix formula after field adjustments.
c. The rate of application shall not vary more than ± 2 lb/yd^2 (± 1.1 kg/m^2) when the surface texture does not vary significantly.

6. EQUIPMENT

6.1 GENERAL

All equipment, tools, and machines used in the application of slurry seal shall be maintained in satisfactory working condition at all times.

6.2 MIXING EQUIPMENT

The machine shall be specifically designed and manufactured to apply slurry seal. The material shall be mixed by an automatic-sequenced, self-propelled, slurry seal mixing machine of either truck-mounted or continuous-run design. Continuous-run machines are those that are equipped to self-load materials while continuing to apply slurry seal. Either type machine shall be able to accurately deliver and proportion the mix components through a mixer and to discharge the mixed product on a continuous-flow basis. Sufficient storage capacity for all mix components is required to maintain an adequate supply to the proportioning controls.

The B.A.R. should decide which type of equipment best suits the specific project. In some cases, truck-mounted machines may be more suited, i.e. cul-de-sacs, small narrow roadways, parking lots, etc. On some projects, continuous-run equipment may be chosen due to the continuity of mix and the reduction of start-up joints. Generally, truck-mounted machines or continuous-run machines may be used on similar projects.

If continuous-run equipment is used, the machine shall provide the operator with full control of the forward and reverse speeds during application of the slurry seal. It shall be equipped with a self-loading device and opposite-side driver stations. The self-loading device, opposite-side driver stations, and forward and reverse speed controls shall be of original-equipment-manufacturer design.

6.3 PROPORTIONING DEVICES

Individual volume or weight controls for proportioning mix components shall be provided and properly labeled. These proportioning devices are used in material calibration to determine the material output at any time.

6.4 SPREADING EQUIPMENT

The mixture shall be placed uniformly by means of a spreader box attached to the paver and mechanically equipped, if necessary, to agitate and spread the material evenly throughout the box. With some quick-set systems, mechanical agitation may extend mix time. The slurry seal mixture shall have the proper consistency as it enters the spreader box. Spraying of additional water into the spreader box will not be permitted.

A front seal shall be utilized to ensure no loss of the mixture at the road contact point. The rear seal shall act as final strike-off and shall be adjustable. The spreader box and rear seal shall be designed and operated to provide uniform mix consistency behind the box. The spreader box shall have suitable means to side shift to compensate for variations in the pavement width. A burlap drag or other approved screed may be attached to the rear of the spreader box to provide a highly textured uniform surface. A drag stiffened by hardened slurry is ineffective and should be replaced immediately.

6.5 AUXILIARY EQUIPMENT

Suitable surface preparation equipment, traffic control equipment, hand tools, and other support and safety equipment necessary to perform the work shall be provided by the contractor.

7. CALIBRATION

Each mixing unit to be used in performance of the work shall be calibrated in the presence of the B.A.R. prior to the start of the project. Previous calibration documentation covering the exact materials to be used may be acceptable, provided the calibration was performed during the previous 60 days. The documentation shall include an individual calibration of each material at various settings, which can be related to the machine's metering devices. Any equipment replacement affecting material proportioning requires that the machine be recalibrated. No machine will be allowed to work on the project until the calibration has been accepted. ISSA Inspector's Manual describes a method of machine calibration. ISSA contractors and/or machine manufacturers may also provide methods of machine calibration.

8. WEATHER LIMITATIONS

The slurry seal shall not be applied if either the pavement or air temperature is below 50°F (10°C) and falling, but may be applied when both pavement and air temperatures are above 45°F (7°C) and rising. No slurry seal shall be applied when there is the possibility of freezing temperatures at the project location within 24 hours after application. The mixture shall not be applied when weather conditions prolong opening to traffic beyond a reasonable time.

9. NOTIFICATION AND TRAFFIC CONTROL

9.1 NOTIFICATION

Homeowners and businesses affected by the paving shall be notified at least one day in advance of the surfacing. Should work not occur on the specified day, a new notification will be distributed. The notification shall be posted in written form, stating the time and date that the surfacing will take place. If necessary, signage alerting traffic to the intended project should be posted.

9.2 TRAFFIC CONTROL

Traffic control devices shall be in accordance with agency requirements and, if necessary, conform to the requirements of the Manual on Uniform Traffic Control Devices. Opening to traffic does not constitute acceptance of the work.

In areas that are subject to an increased rate of sharp-turning vehicles, additional time may be required for a more complete cure of the slurry seal mat to prevent damage. Tire marks may be evident in these areas after opening but typically diminish over time with rolling traffic.

10. SURFACE PREPARATION

10.1 GENERAL

Prior to applying the slurry seal, loose material, oil spots, vegetation, and other objectionable material shall be removed. Any standard cleaning method will be acceptable. If water is used, cracks shall be allowed to dry thoroughly before slurry surfacing. Manholes, valve boxes, drop inlets and other service entrances shall be protected from the slurry seal by a suitable method. The B.A.R. shall approve the surface preparation prior to surfacing.

10.2 TACK COAT

Normally, tack coat is not required unless the surface to be covered is extremely dry and raveled or is concrete or brick. If required, the emulsified asphalt should be SS, CSS, or the slurry seal emulsion. Consult with the slurry seal emulsion supplier to determine dilution stability. The tack coat may consist of one part emulsified asphalt/three parts water and should be applied with a standard distributor. The distributor shall be capable of applying the dilution evenly at a rate of 0.05-0.15 gal/yd^2 (0.23-0.68 l/m^2). The tack coat shall be allowed to cure sufficiently before the application of slurry seal. If a tack coat is to be required, it must be noted in the project plans.

10.3 CRACKS

It is recommended to treat cracks wider than 0.25" (0.64cm) in the pavement surface with an approved crack sealer prior to application of the slurry seal.

11. APPLICATION

11.1 GENERAL

If required, it is recommended that a test strip be placed in conditions similar to those expected to be encountered during the project.

The surface may be wetted with water ahead of the spreader box. The rate of application of the water spray shall be adjusted during the day to suit temperature, surface texture, humidity, and dryness of the pavement. Pooling or standing water shall be avoided.

The slurry seal shall be of the desired consistency upon exiting the mixer. A sufficient amount of material shall be carried in all parts of the spreader box at all times so that complete coverage is achieved. Overloading of the spreader shall be avoided.

No lumping, balling, or unmixed aggregate shall be permitted.

Significant streaks, such as those caused by oversized aggregate or broken mix, shall not be left in the finished surface. If excessive streaking occurs, the job will be stopped until the cause of the problem has been corrected. Some situations may require screening the aggregate prior to loading it into the units going from the stockpile area to the jobsite.

11.2 RATE OF APPLICATION

The slurry seal mixture shall be of the proper consistency at all times so as to provide the application rate required by the surface condition. The average application rate shall be in accordance with the following table:

AGGREGATE TYPE	LOCATION	SUGGESTED APPLICATION RATE
Type I	Parking Areas Urban and Residential Streets Airport Runways	8 - 12 lb/yd^2 (4.3 - 6.5 kg/m^2)
Type II	Urban and Residential Streets Airport Runways	10 - 18 lb/yd^2 (5.4 - 9.8 kg/m^2)
Type III	Primary and Interstate Routes	15 - 22 lb/yd^2 (8.1 - 12.0 kg/m^2)

Suggested application rates are based upon the weight of dry aggregate in the mixture. Application rates are affected by the unit weight and gradation of the aggregate and the demand of the surface to which the slurry seal is being applied.

11.3 JOINTS

No excess buildup, uncovered areas, or unsightly appearance shall be permitted on longitudinal or transverse joints. The contractor shall provide suitable equipment to produce a minimum number of longitudinal joints throughout the project. When possible, a longitudinal joint shall not be placed in a wheel path. Less than full box width passes will be used only as required. If less than full box width passes are used, they shall not be the last pass of any paved area. A maximum of 6" (15.2 cm) shall be allowed for overlap of longitudinal joints.

11.4 MIXTURE

The slurry seal shall possess sufficient stability so that premature breaking of the material in the spreader box does not occur. The mixture shall be homogeneous during and following mixing and spreading. It shall be free of excess liquids which create segregation of the aggregate. Spraying of additional water into the spreader box will not be permitted.

11.5 HANDWORK

Areas which cannot be accessed by the mixing machine shall be surfaced using hand squeegees to provide complete and uniform coverage. If necessary, the area to be handworked shall be lightly dampened prior to mix placement. Handwork shall exhibit the same finish as that applied by the spreader box and shall be completed prior to final surfacing.

11.6 LINES

Care shall be taken to apply straight lines along curbs, shoulders, and intersections. No run-off on these areas will be permitted. Roofing felt or heavy plastic may be used to begin or end a pull cleanly. This also provides for easy removal of excess slurry.

11.7 ROLLING

Rolling is usually not necessary for slurry seal on roadways. Airports and parking areas should be rolled by a self-propelled, 10-ton (maximum) pneumatic tire roller equipped with a water spray system. All tires should be inflated per manufacturer's specifications. Rolling shall not start until the slurry has cured sufficiently to avoid damage by the roller. Areas which require rolling shall receive a minimum of two (2) full coverage passes.

11.8 CLEAN UP

All utility access areas, gutters and intersections, shall have the slurry seal removed as specified by the B.A.R. The contractor shall remove any debris associated with the performance of the work on a daily basis.

12. QUALITY CONTROL

12.1 INSPECTION

Inspectors assigned to projects must be familiar with the materials, equipment and application of slurry seal. Local conditions and specific project requirements should be considered when determining the parameters of field inspection.

Proper mix consistency should be one of the major areas of inspector concern. If mixes are too dry, streaking, lumping and roughness will be present in the mat surface. Mixes applied too wet will flow excessively and not hold straight lane lines. Excessive liquids may also cause an asphalt-rich surface with segregation.

12.2 MATERIALS

To account for aggregate bulking, it is the responsibility of the contractor to check stockpile moisture content and to set the machine accordingly. At the B.A.R.'s discretion, material tests may be run on representative samples of the aggregate and emulsion. Tests will be run at the expense of the buyer. The buyer must notify the contractor immediately if any test fails to meet the specifications.

12.3 SLURRY SEAL

If required, representative samples of the slurry seal may be taken directly from the slurry unit(s). Consistency (ISSA TB No. 106) and residual asphalt content (ASTM D2172) tests may be run on the samples. Please note that the consistency test may not be applicable to certain Quick-Set and Quick-Traffic systems because of erratic results due to setting characteristics. If this test is run, it must be performed immediately after the sample is taken. Tests will be run at the expense of the buyer. The buyer must notify the contractor immediately if any test fails to meet specifications.

Data obtained from the proportioning devices on the slurry seal unit may be used to determine individual material quantities and application rate.

12.4 NON-COMPLIANCE

If any two successive tests fail on the stockpile aggregate, the job shall be stopped. If any two successive tests on the mix from the same machine fail, the use of the machine shall be suspended. It will be the responsibility of the contractor, at his expense, to prove to the B.A.R. that the problems have been corrected.

13. PAYMENT

The slurry seal shall be measured and paid for by the unit area or weight of aggregate and the weight of emulsion used on the work completed and accepted by the buyer. If paid by the weight of the aggregate and emulsified asphalt, the contractor shall submit to the B.A.R. certified delivery tickets which show quantities of each material delivered to the job site and used on the project. Payment shall be full compensation for all preparation, mixing and application of materials, and for all labor, equipment, tools, testing, cleaning, and incidentals necessary to complete the job as specified herein.

APPENDIX A

AGENCIES

AASHTO: **American Association of State Highway and Transportation Officials**
ASTM: **American Society for Testing and Materials**
ISSA: **International Slurry Surfacing Association**

TEST METHODS

EMULSIFIED ASPHALT

AASHTO TEST NO.	ASTM TEST NO.	TEST
M 140	D 977	Standard Specification for Emulsified Asphalt
M 208	D 2397	Specification for Cationic Emulsified Asphalt
T 40	D 140	Sampling Bituminous Materials
T 59	D 244	Test Methods and Practices for Emulsified Asphalts
T 59	D 6997	Distillation of Emulsified Asphalt

AGGREGATE AND MINERAL FILLER

AASHTO TEST NO.	ASTM TEST NO.	TEST
T 176	D 2419	Sand Equivalent Value of Soils and Fine Aggregate
T 104	C 88	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
96	C 131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine (This test should be performed on the parent rock that is used for crushing the finer gradation Micro Surfacing material.)
T 27	C 136	Sieve Analysis of Fine and Coarse Aggregates
T 11	C 117	Test Method for Materials Finer than 75µm (No. 200) Sieve in Mineral Aggregates by Washing
T 2	D 75	Sampling Aggregates
M 17	D 242	Mineral Filler for Bituminous Paving Mixtures
T 19	C 29	Bulk Density (“Unit Weight”) and Voids in Aggregate

APPENDIX A

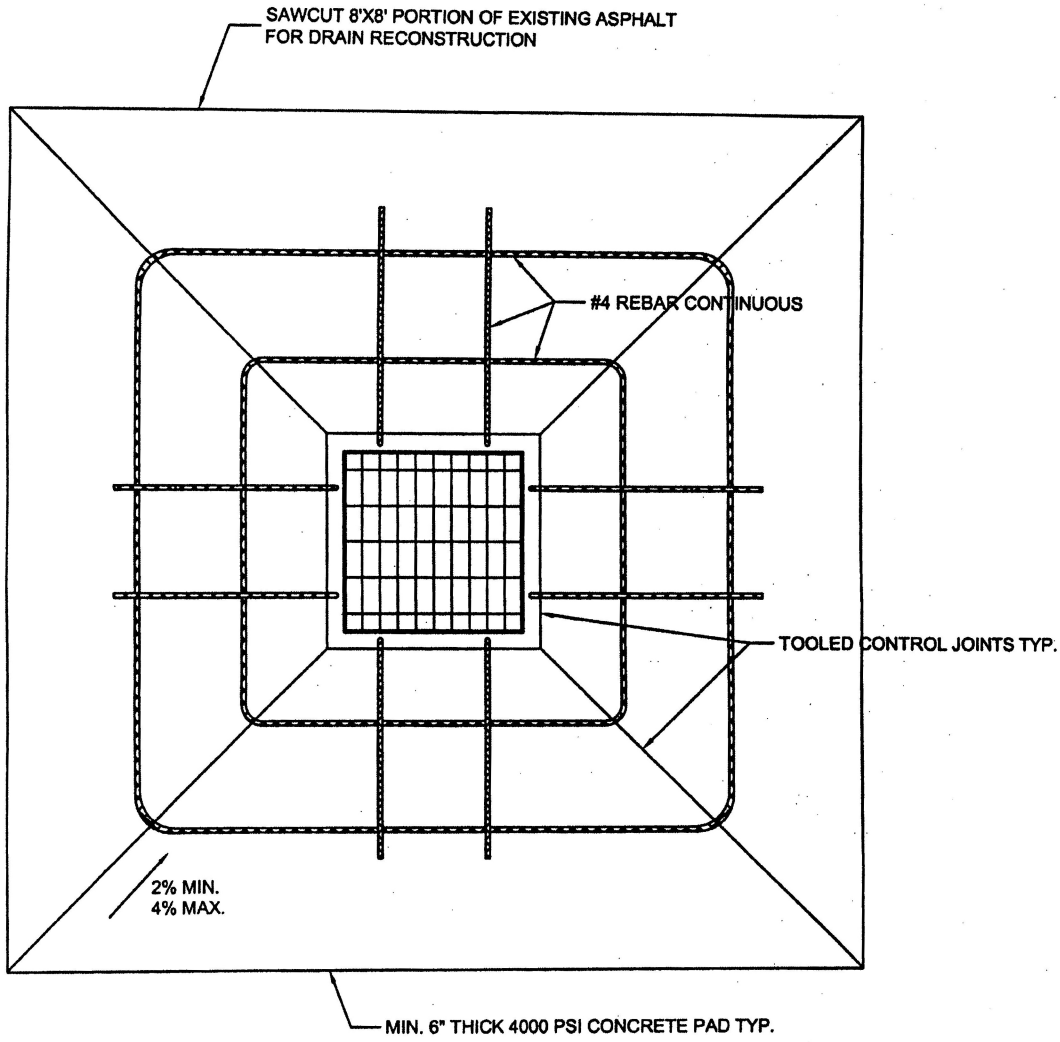
TEST METHODS (CONTINUED)

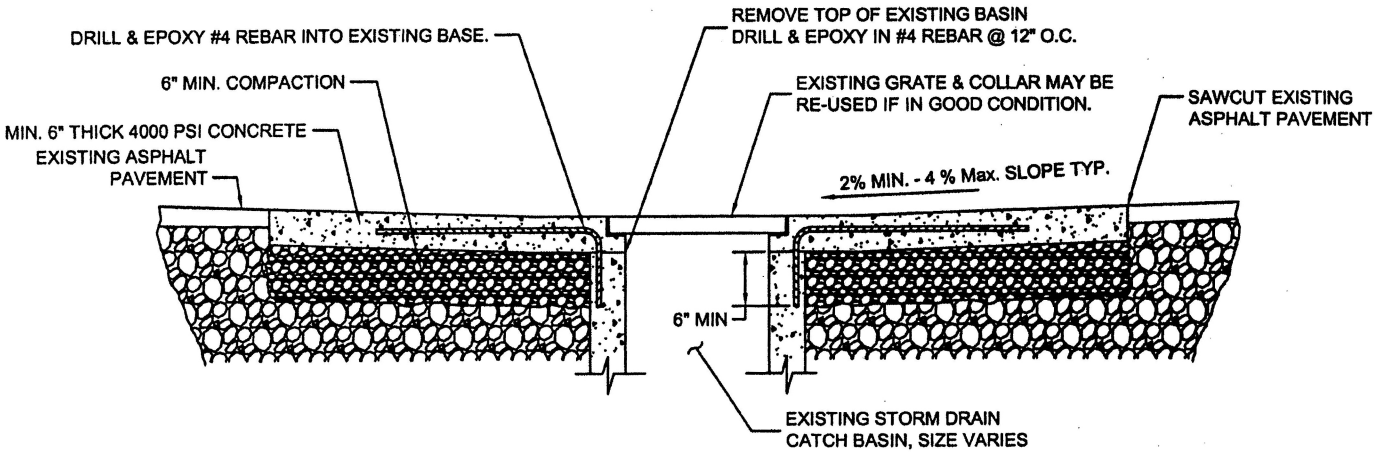
SLURRY SEAL SYSTEM

ISSA TEST NO.	Test
TB 100	Test Method for Wet Track Abrasion of Slurry Surfaces
TB 101	Guide for Sampling Slurry Mix for Extraction Test
TB 106	Measurement of Slurry Seal Consistency
TB 109	Test Method for Measurement of Excess Asphalt in Bituminous Mixtures by Use of a Loaded-Wheel Tester
TB 111	Outline Guide Design Procedure for Slurry Seal
TB 112	Method of Estimate Slurry Seal Spread Rates and To Measure Pavement Macrotexture
TB 113	Trial Mix Procedure for Slurry Seal Design
TB 114	Wet Stripping Test for Cured Slurry Seal Mixes
TB 115	Determination of Slurry Seal Compatibility
TB 139	Method of Classified Emulsified Asphalt, Aggregate Mixtures by Modified Cohesion Test Measurement of Set and Cure Characteristics
A105	Design, Testing, and Construction of Slurry Seal

NOTES:
ASTM D 3910, Standard Practice for Design, Testing, and Construction of Slurry Seal, is a combined reference of the ISSA Test Bulletins listed above.

ASTM D 2172, Standard Test Methods for Quantitative Extraction of Bitumen From Bituminous Paving Mixtures, is referenced in Section 12.3.





STORM DRAIN RECONSTRUCTION DETAIL

DO NOT SCALE