

SECTION 300

STREETS AND RELATED WORK

300.1 GENERAL

The contents of this section pertains to the construction activities, as related to streets, alleys, curbs and gutters, drivepads, median paving, and sidewalks.

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SECTION 301

SUBGRADE PREPARATION

301 GENERAL

301.1 The work performed under this specification shall include, but not be limited to providing the equipment, labor and materials for the preparation of soil subgrade and maintenance of the prepared subgrade for the construction of graded aggregate base, asphalt treated base, cement treated base, asphalt concrete, Portland cement concrete, sidewalks, curb and gutter, drive pads, valley gutter, median pavements and/or any other roadway improvements.

301.2 REFERENCES

301.2.1 ASTM:

C136	D423
D424	D698
D1140	D1557
D2844	D2922
D3017	

301.2.2 This publication:

Section 204

301.3 MATERIAL

301.3.1 Subgrade material may be on site soil, combinations of pulverized asphalt concrete and soil, and/or pulverized Portland cement concrete and soil, imported soils, complying with the requirements of this specification. Flowing, sugar sands shall not be used for subgrade material.

301.3.2 All soft and unstable material and other portions of the subgrade which will not compact readily or serve the intended purposes shall be removed and replaced with suitable material from excavation or borrow or suitable materials shall be added and, by manipulations, be incorporated into the subgrade to produce a material meeting subgrade requirements.

301.3.3 All subgrade material shall have a minimum Resistance Value (R-Value), as determined by ASTM D-2844, equal to or greater than the design R-Value for the pavement section. If the subgrade soils encountered during construction have a R-Value less than the design R-Value, those subgrade materials shall be removed to a depth of not less than two (2') feet below the finished subgrade elevation or as authorized by the ENGINEER and to the horizontal limits authorized by the ENGINEER, and replaced with subgrade material having an R-Value greater than the design R-Value. On small projects, in areas that just involve replacement of existing roadway items or when no design R-Value has been

established this R-Value requirement may be waived if authorized by the ENGINEER.

301.4 SUBGRADE COMPACTION

301.4.1 Subgrade preparation shall extend to one foot (1') beyond the limits of the improvement to be placed on the subgrade except when that improvement abuts an existing structure and/or the limits of the right of way. Where an improvement abuts an existing structure and/or the limits of right of way, the subgrade preparation shall extend to the edge of the existing structure and/or the limits of right of way, as specified in the plans, specifications, supplemental technical specifications or as directed by the ENGINEER. Where existing structures are in the right of way or construction easements, subgrade preparation shall extend to the face of the structure, as specified above. Subgrade preparation shall not extend below the bottom of the foundation of an existing structure without specific authorization by the ENGINEER.

301.4.1.1 Subgrade preparation for roadway improvements shall be performed after completion of earthwork construction, subsurface utility installation and trenching back fill within the limits specified, as directed by the ENGINEER. The subgrade preparation shall extend the full width of the roadway to either one (1) foot back of new curb and gutter, and/or to the face of existing structures, and/or the limits of right of way, as specified in the plans and specifications, as directed by the ENGINEER.

301.4.1.2 Subgrade preparation for sidewalks and drive pads shall extend a minimum of one (1') beyond the free edge of the improvement, and/or to the limits of right of way, and/or to the face of existing structures.

301.4.1.-3 The subgrade preparation for roadway construction without curb and gutter, shall extend one (1') beyond the edge of the pavement, and/or to the face of existing structures, and/or to the limits of right of way, as specified in the plans and specifications, as authorized by the ENGINEER.

301.4.1.4 Subgrade preparation shall extend the full width of roadway medians four (4) feet wide or less. In areas that the medians are wider than four feet (4') the subgrade compaction shall extend one foot (1') beyond the median edge of the pavement or back of the median curb.

301.4.2. The subgrade for arterial/collector roadway shall be ripped to a minimum depth of one (1) foot, brought to uniform moisture content, and compacted to the requirements of plans and specification, as authorized by the ENGINEER. Subgrade material with either 20 per cent or more material passing a no. 200 sieve shall be uniformly mixed and moisture conditioned using a tractor

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SUBGRADE PREPARATION

mounted mixer or disced after ripping, as specified in the plans and specifications, as authorized by the ENGINEER. The subgrade for reconstructed curb and gutter, sidewalks, drive pads, residential roadways, bicycle paths and other roadways shall be scarified to a minimum depth of six (6) inches, brought to uniform compaction moisture content, and compacted to the requirements of plans and specification, as authorized by the ENGINEER.

301.4.3 Subgrade area shall be compacted to a dry density greater than 95 per cent of maximum dry density in a moisture range of optimum moisture $\pm 2\%$ as determined in accordance with ASTM D1557, unless the material contains 35% or more material finer than the No.200 sieve. If the subgrade material has 35% or more material finer than the No.200 sieve, the subgrade shall be compacted to a dry density greater than 95 percent of maximum dry density in a moisture content range of at least optimum moisture to optimum moisture $+4\%$, as determined in accordance with ASTM D698.

301.4.4 Areas on which roadway pavement items are to be placed shall be compacted uniformly to the required subgrade density at the same time. Obtaining the required subgrade density in trench areas at a different time than obtaining the required subgrade density in the adjacent pavement areas will not be permitted.

301.4.5 Upon completion of the subgrade preparation, the CONTRACTOR shall maintain the compacted subgrade density and moisture content at the specified levels until the next lift of material is completed. The CONTRACTOR shall provide continuous moisture protection of the subgrade by either sprinkling or the application of a prime coat, as directed by the ENGINEER.

301.5 SUBGRADE TOLERANCES

Subgrade upon which pavement, sidewalk, curb and gutter, drive pads, or other structures are to be placed shall not vary more than $+1/4$ inch or $-1/2$ inch per 10 foot in any direction from the specified grade and cross section. Subgrade upon which base material is to be placed shall not vary more than $+1/2$ inch or -1 inch per 20 foot in any direction from the specified grade and cross section. Variations within the above specified tolerances

shall be compensating so that the average grade and cross section specified are met.

301.6 TESTING:

301.6.1 A sample of each type of soil encountered shall be classified in accordance with the requirements of ASTM D2487, the moisture density relationship determined in accordance either ASTM D698 or D1557, whichever is applicable and an estimated resistance R-value assigned based on plasticity index, PI, and percent material passing the No.200 sieve.

301.6.2 Compaction tests shall be taken for each 500 sy or less, as directed by the ENGINEER. Compaction tests shall be taken in accordance with ASTM D2922 and D3017. Areas represented by non complying tests shall be reworked as specified, and retested for compliance.

301.6.3 Test reports shall include but not be limited to the requirements of TABLE 301.A.

301.6.4 Test results shall be reported to the ENGINEER, CONTRACTOR, and Materials and Testing Laboratory, Construction Division, Public Works Department, in writing, within 4 working days of completion of the sampling and or field test. Non-complying test shall be reported within 1 working day of completion of the test.

301.7 MEASUREMENT AND PAYMENT:

301.7.1 Measurement for payment of roadway subgrade preparation will be by the square yard to the limits of the surfacing, as authorized by the ENGINEER. Payment for subgrade preparation shall include all labor and equipment required to shape, mix, add moisture, compact, bring to grade and maintaining the prepared subgrade moisture and density until the next course of material is placed.

301.7.2 The measurement of payment for subgrade preparation for non-pavement roadway items such as curb and gutter, valley gutter, drive pads and sidewalks etc., shall be included in that item. No separate payment will be made.

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TABLE 301.A
TEST REPORT INFORMATION

A. Field Data

- Date of Sampling/Field Test
- Project Number or
Permit Number
- Project Title
- Location of sample/field test as defined by the project plans and specifications
- Time of Sampling/field testing
- Field test results with reference specification limits

B. Laboratory Data

- Soil classification
- Soil gradation
- Plasticity index
- Liquid limit
- Optimum moisture/maximum dry density relationship and graph
- Estimated soil resistance R-Value

SECTION 302

AGGREGATE BASE COURSE CONSTRUCTION

302.1 GENERAL

The work provided under this specification shall include the furnishing, placement and compaction of aggregate base course (ABC) to the lines, grades, dimensions, moisture, density and typical sections as specified in the plans and specifications, and or as directed by the ENGINEER. The CONTRACTOR shall be solely responsible for the aggregate base course either batched at and/or delivered to the site. A job mix formula for aggregate base course, shall be certified in accordance with the requirements of Section 13 of these specifications. Each job mix formula submitted and authorized for use under this specification shall be identified by a number, unique to that job mix formula and aggregate production plant/pit. If a change in material(s) from that specified in the job mix formula occur during a project, the CONTRACTOR shall submit a new job mix formula to include the changed materials for approval by the ENGINEER. A job mix formula shall not be used on a project without written approval of the ENGINEER. A job mix formula, upon request by an aggregate supplier, may be authorized by the Department of Municipal Development for a period of 14 months, from the date of sampling of aggregates used in the job mix formula.

302.2 REFERENCES

302.2.1 ASTM:

C136	D75
D422	D423
D424	D1557
D2419	D2844
D2922	D2940
D3017	

302.2.2 This Publication:

Section 113 Emulsified Asphalts
Section 301 Subgrade Preparation

302.3 MATERIALS

302.3.1.1 Aggregate base course shall be coarse aggregate of either crushed stone, or crushed gravel, or crushed asphalt concrete, or crushed Portland cement concrete, or any combination, and natural sand, the combination of materials conforming to the requirements of ASTM D2940 and the plans and specifications, as authorized by the ENGINEER.

302.3.1.2 Coarse aggregates retained on the No.4 sieve shall consist of durable particles of either crushed gravel,

or crushed asphalt concrete pavement, or crushed portland cement concrete, or any combination, capable of withstanding the effects of handling, spreading and compacting without degradation production of deleterious fines. At least 50% of the particles retained on the 3/8-inch sieve, shall have two or more fractured faces. Coarse aggregate shall comply with the requirements of TABLE 302.A.

302.3.1.3 Fine aggregate passing the No.4 sieve shall consists of fines from the operation of crushing coarse aggregate; where available and suitable, natural sand or finer mineral matter or both, may be added. Fine aggregate shall comply with the requirements of TABLE 302.A.

302.3.1.4 The job mix formula gradation shall comply with the requirements of TABLE 302.B, and have the same or similar characteristic gradation curve as either range limit, when graphically plotted on a standard "0.45 POWER" Gradation Chart.

302.3.1.5 Aggregate base course furnished and placed under this specification shall have a resistance value, (R-Value), not less than 76 as determined by ASTM D2844.

302.3.1.6 A job mix formula, certified by a Registered New Mexico Professional Engineer to comply with the requirements of this specification, shall be submitted to and authorized for use by the ENGINEER before the material may be incorporated in the construction. A submittal shall include, but not be limited to, the items in TABLE 302.C. Prior to delivery of the material, the CONTRACTOR may be required to furnish samples of the aggregates base course to the ENGINEER for testing. Gradations for the aggregate base course used in a particular day's placement shall be submitted to the ENGINEER upon request.

302.3.2 Prime coat for surface sealing of compacted aggregate base course shall comply with the requirements of CSS-1H Cationic Emulsified Asphalt as specified in Section 113.

302.4 TRANSPORTATION AND PLACEMENT

302.4.1 Aggregate base course shall be transported in suitable vehicles with a cover. A load shall be covered immediately after loading and remain covered until unloading.

302.4.2 The CONTRACTOR shall provide to the ENGINEER with each load of batched and/or delivered to the job site, before unloading at the site, a copy of the

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AGGREGATE BASE COURSE CONSTRUCTION

delivery ticket on which is printed, stamped or written, the information defined in TABLE 302.D.

302.4.3 Aggregate base course shall be placed on prepared subgrade, prepared in accordance with the requirements of SECTION 301, the plans and specifications, and or as directed by the ENGINEER.

302.4.4 Aggregate base course shall be placed in lifts which will provide not less than four (4) inches and not more than 6 inches compacted thickness. The material shall be moisture conditioned within a range of optimum moisture plus or minus two percent (+/-2%), and compacted to a dry density greater than ninety-five (95) percent of maximum dry density as determined in accordance under the procedures specified in ASTM D1557.

302.4.5 The finish surface of the compacted aggregate base course shall not deviate from finish grade in excess of 1/2 inch in 10 feet when tested with a 10-foot straight edge in any direction. All deviations in excess of the specified shall be corrected by the CONTRACTOR prior to authorization for placement of the next lift of material.

302.4.6 Immediately upon completion of compaction, the CONTRACTOR shall seal the surface of the compacted aggregate base course with a prime coat. The prime coat shall be applied as required to provide a uniform coverage of the surface. Application shall be between 0.05 and 0.15 gallons per square yard of surface. If final surfacing is to be placed within twenty four (24) hours after completion of compaction, the prime coat may be waived as authorized by the ENGINEER. The surface shall be kept at compaction moisture until the final surfacing is placed in the event the prime coat is waived.

302.4.7 Traffic on compacted aggregate base course shall be limited to moisture control application and final surfacing traffic only, as authorized by the ENGINEER.

302.5 TESTING

302.5.1 A sample of material delivered to the project shall be taken for each 300 tons placed or each day's placement, whichever is greater, and tested for gradation and moisture density relationship. The average value of individual gradation tests, for all sieve size determinations, shall comply with the job mix formula within the tolerances specified in TABLE 302.B. Individual sample gradation test results, for all sieve size determinations, shall comply with the tolerance range plus two (2) percent. Non complying material shall be re-sampled and tested for compliance. Material not in compliance after the initial and follow up testing shall be removed and replaced by the CONTRACTOR at no cost to the OWNER, as directed by the ENGINEER.

302.5.2 Compaction tests shall be taken at the rate of one test for each 500 sy/lift placed, or as directed by the ENGINEER, in accordance with the requirements of ASTM D 2922 and D 3017. Areas represented by non complying tests shall be reworked and retested for compliance.

302.5.4 Test reports shall include but not be limited to the requirements of TABLE 302.E.

302.5.5 Test Results shall be reported to the ENGINEER, CONTRACTOR, and OWNER in writing, within 4 working days of completion of the sampling and or field test. Non-complying test shall be reported within 1 working day of completion of the test.

302.6 MEASUREMENT AND PAYMENT

302.6.1 Measurement of aggregate base course shall be by the square yard per each thickness required, complete in place.

302.6.2 Payment shall be at the contract unit price per square yard per each thickness required, complete in place which shall include all material, labor and equipment required in placing, grading and compacting the aggregate base course.

SECTION 302

AGGREGATE BASE COURSE CONSTRUCTION

Table 302.A
ENGINEERING REQUIREMENTS

CHARACTERISTIC Aggregate Type	SPECIFICATION LIMIT(S)	
	Fine	Course
Los Angeles Abrasion Wear (ASTM C 131)		40% max.
Soundness (5 cycles ASTM C 88)	15% max.	15% max.
Crushed Aggregate (% Material Retained on 3/8inch sieve by wt., having at least two (2) fractured faces)		50% max.
Maximum % passing No. 200	60% of -No.30	
Plasticity Index (Material finer than No.40 sieve)	4.0 max.	
Sand Equivalent Value	35 min.	

TABLE 302.B
GRADATION RANGES AND TOLERANCES

SIEVE SIZE/TYPE	PRODUCTION RANGE (% passing)		PRODUCTION TOLERANCES (+/-%)
	I	II	
1-1/2 inch	100	100	
1 inch	95-100	100	
3/4 inch		90-100	8
1/2 inch	64-75		8
3/8 inch		65-80	8
No.4	35-46	48-55	8
No.30	12-18	18-25	5
No.200	5-12	6-15	3

TABLE 302.C
SUBMITTAL REQUIREMENTS

- A. Supplier
- B. Date
- C. Design Mix Identification Number
- D. Contractor
- E. Construction project number
- F. Construction Project Title (contract)
- G. Certification of compliance
- H. Target Gradation of Material
- I. Optimum moisture and maximum dry density relationship of
material and graph

The submittal shall be rejected without review if the specified data is not included.

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AGGREGATE BASE COURSE CONSTRUCTION

TABLE 302.D
DELIVERY TICKET INFORMATION

- A. Name of Supplier
- B.** Date of Delivery
- C.** Delivery Ticket Number
- D.** Name of Contractor
- E.** Project Name (optional)
- F.** Job mix formula identification number
- G.** Weight of load
- H.** Time loaded

TABLE 302.E
TEST REPORT INFORMATION

- A. Field Data
 - Date of Sampling/Field Test
 - Project Number or Permit Number
 - Project Title
 - Location of sample/field test as defined by the project plans and specifications
 - Time of Sampling/field testing
 - Field test results with reference specification limits
- B. Laboratory Data
 - Base course classification
 - Gradation
 - Plasticity index
 - Liquid limit
 - Optimum moisture/maximum dry density relationship and graph
 - Estimated soil resistance R-Value

SECTION 304

LIME TREATED SUBGRADE AND/OR SUBBASE

304.1 GENERAL

This work shall consist of the treatment of one or more courses of subgrade or subbase material with hydrated lime as indicated on the plans or as specified in the Supplementary Specifications.

304.2 REFERENCES

ASTM

C 207
D 1557

This publication:

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304.3 MATERIALS

Hydrated Lime--Commercial grade hydrated lime shall conform to the requirements of ASTM C 207 or Type N granular quick-lime which is free flowing with a minimum of 94% CaO and 100% passing the No. 4 screen.

304.4 CONSTRUCTION REQUIREMENTS

General--Where designated, the depth of subgrade or subbase shown on the plans shall be treated with amounts of commercial grade hydrated lime as established by the ENGINEER.

304.4.1 The lime may be placed on the subgrade or subbase in either dry form or may be applied as a slurry. The lime or lime slurry shall be thoroughly mixed with the material to be treated as soon as practical. The CONTRACTOR shall handle the processing of lime in such a manner that lime dust will not be hazardous to workmen nor to the public. Initial mixing shall be performed the same day the lime is placed.

304.4.2 After preliminary mixing, the section so treated shall be shaped, lightly compacted, and cured for a period of 1 to 4 days as directed by the ENGINEER. During the curing period, the moisture content of the mixture shall be maintained from 2 to 5 percent above the optimum required for compaction.

304.4.3 Following the curing period, the CONTRACTOR shall again mix the treated material until 100% of the slaking fraction passes the 1 1/2 inch sieve and a minimum of 60% passes the No. 4 sieve using approved road mixers

or other approved equipment which is capable of thoroughly mixing and processing the combined materials. Compaction shall begin immediately after final mixing. Each course of lime treated subgrade and subbase shall be compacted to 90 percent of maximum density, as determined by ASTM D 1557, except that when pavement, curb, gutter, driveways, sidewalks, or other structures are to be placed directly upon the lime treated material, the top 6 inches thereof shall be compacted to 95 percent of maximum density and in accordance with the applicable provisions of Section 301, Subgrade Preparation.

304.4.4 When compacting and shaping are complete, the subgrade shall be kept moist until the first layer of base or other surfacing material has been placed, in order to prevent shrinkage cracks.

304.5 MEASUREMENT AND PAYMENT

Measurement for lime treated subgrade and subbase, except for quantity of hydrated lime, will be made on the square yard basis. Measurement to determine area shall be made horizontally. Measurement for hydrated lime will be made on the number of tons (2,000 pounds dry weight) delivered and placed as approved by the ENGINEER. Payment will be as specified in the Bid Proposal.

SECTION 305

CEMENT TREATED BASE CONSTRUCTION

305.1 GENERAL: The work provided shall include the furnishing, placement and compaction of one or more courses of plant mixed Portland cement treated base course (CTB) to the lines, grades, dimensions, moisture, density and typical sections as specified in the plans and specifications, and as directed by the ENGINEER. The CONTRACTOR shall be solely responsible for the cement treated base either batched at and/or delivered to the site. A design mix for CTB shall be certified in accordance with the requirements of Section 13 of these specifications. Each design mix submitted and authorized for use under this specification shall be identified by a number, unique to that design mix and aggregate production plant/pit. If a change in material(s) from that specified in the design mix occur during a project, the CONTRACTOR shall submit a new design mix to include the changed materials for authorization by the ENGINEER. A design mix shall not be used on a project without authorization by the ENGINEER. A design mix, upon request by a supplier, may be authorized by the Department of Municipal Development for use on City and City related projects for a period of 14 months, from the date of sampling of aggregates used in the job mix formula.

305.2 REFERENCES.

305.2.1 American Society for Testing and Materials (ASTM), (Latest Edition):

- C136 Standard Test Method for Sieve Analysis of Fine and Course Aggregates
- C150 Standard Specifications for Portland Cement
- D75 Standard Practice for Sampling Aggregates
- D422 Standard Test Method for Particle-Size Analysis of Soils
- D558 Standard Test Methods for Moisture-Density Relations of Soil-Cement Mixtures
- D559 Standard Test Methods for Wetting and Drying Compacted Soil-Cement Mixtures
- D560 Standard Test Methods for Freezing and Thawing Compacted Soil-Cement Mixtures
- D1632 Standard Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory
- D1633 Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders
- D2419 Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
- D2922 Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods

- D2940 Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports
- D3017 Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods
- D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

305.2.2 This Publication:

SECTION 113 WARRANTY AND GUARANTEE;
TESTS AND INSPECTIONS;
CORRECTIONS, REMOVAL, OR
ACCEPTANCE OF DEFECTIVE WORK
SECTION 301 SUBGRADE PREPARATION
SECTION 302 AGGREGATE BASE COURSE
CONSTRUCTION

305.3 MATERIALS.

305.3.1 Portland cement to be used or furnished under this specification shall comply either with the requirements of ASTM C150, Type II, Low Alkali (LA) cement, or as specified herein, or as specified in the Supplementary Technical Specifications, Drawings, or as approved by the ENGINEER. The CONTRACTOR shall submit certification of compliance signed by the cement manufacturer, identifying the cement Type and source (plant location), stating the Portland cement used in the cement treated base delivered to the project complies with this specification. If required, certification of the portland cement used for each day's concrete placement, shall be submitted to the ENGINEER. Portland cement specified in an authorized design mix shall be of the same source and type for all cement treated base under that design mix identification number, as specified in the design mix.

305.3.2 Aggregates for cement treated base course shall consist of a combination of crushed stone, crushed gravel, crushed portland cement concrete, and natural or manufactured sand conforming to the requirements of SECTION 302, GRADED AGGREGATE BASE COURSE CONSTRUCTION.

305.3.3 Water used in cement treated base shall be clean and free from injurious amounts of oil, acids, alkalis, salts, organic materials, or other deleterious substances. Nonpotable water shall not be used unless the requirements of ACI 318.3.4.3.2 are met.

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CEMENT TREATED BASE CONSTRUCTION

305.3.4 Prime coat for surface sealing of compacted cement treated base shall comply with the requirements of CSS-IH Cationic Emulsified Asphalt as specified in Section 112.

305.4 PROPORTIONING.

305.4.1 The CONTRACTOR shall be solely responsible for the cement treated base design mix proportions and material batched and delivered to the site.

305.4.2.1 A cement treated base design mix shall be a blend of portland cement, aggregate base course and water. The design mix shall be prepared in a laboratory under the direct supervision of a New Mexico Registered Professional ENGINEER. The testing equipment used in the design development of the design mix shall be calibrated annually with calibration standards traceable to the National Bureau of Standards. Certificates of calibration shall be maintained at the laboratory for review by the ENGINEER. A copy of the certifications shall be provided to the ENGINEER upon his request.

305.4.2.2 Portland cement shall be proportioned by percent of dry weight of aggregates. The amount of portland cement shall be the minimum cement content that will provide a aggregate cement water mixture, when compacted at optimum moisture, as determined by ASTM D558, and that will comply with the requirements of TABLE 305.A.

TABLE 305.A
CEMENT TREATED BASE PROPERTIES

CHARACTERISTIC	SPECIFICATION	
A. Weight Loss After 12 Cycles:		
Wetting and Drying Tests	15% maximum	ASTM D559
Freezing and Thawing Tests	15% maximum	ASTM D560
B. Compressive Strength (average of 2 samples)	550 750 psi @7 days	
Samples Molded	ASTM D558	Method A
Samples Cured	ASTM D1632	
Samples Tested	ASTM D1633	

305.4.2.3 A submittal for cement treated base shall include but not be limited to the TABLE 305.B.

TABLE 305.B
SUBMITTAL REQUIREMENTS

- A. Design Mix Identification Number
- B. Supplier
- C. Aggregate production plant/pit
- D. Name of CONTRACTOR
- E. Construction Project Title and Number
- F. Certifications of compliance of materials
- G. Certification of compliance of design mix
- H. Proposed proportions of materials
- J. Wet Dry Test results
- K. Freeze Thaw Test results
- L. Target gradation of aggregate
- M. Optimum moisture maximum dry density relationship and graph.
- N. Compressive strength test results, average of two briquettes (each), at 2 days, 7 days, and 28 days

The submittal shall be rejected without review if the specified data is not included.

305.5 BATCHING.

305.5.1 Cement treated base shall be proportioned and mixed in a central mixing plant, either weigh batching or volume batching. The plant shall be equipped with feeding and metering devices which will introduce the aggregates, cement and water into the mixer in the proportions specified in the authorized design mix. The plant shall be calibrated at the particular configuration, to include but not be limited to scales, belt speeds, gate settings, dispenser rates and mixing time, to proportion a specified mix. The production configuration required for a design mix shall be maintained on file at the plant for review by the ENGINEER. Certification by the supplier that the required configuration was used in the production of cement treated base for each days production shall be maintained at the batch plant for review by the ENGINEER. Batch weights of materials and/or daily production weights will be recorded at the batch plant and maintained on file for review by the ENGINEER.

305.6 TRANSPORTATION AND PLACEMENT.

305.6.1.1 Material shall be transported in suitable vehicles with a cover. Loads of material shall be covered

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CEMENT TREATED BASE CONSTRUCTION

immediately after loading and remain covered until unloading.

305.6.1.2 The CONTRACTOR shall provide to the ENGINEER with each load of material batched and/or delivered to the job site, before unloading at the site, a copy of a delivery ticket on which is printed, stamped or written, the information defined in TABLE 302.C.

TABLE 305.C
DELIVERY TICKET INFORMATION

- A. Name of Supplier
- B. Date of Delivery
- C. Delivery Ticket Number
- D. Name of CONTRACTOR
- E. Project Name (optional)
- F. Job mix formula identification number
- G. Weight of load
- H. Time loaded

305.6.2 Material shall be placed on prepared subgrade, prepared in accordance with the requirements of SECTION 301, SUBGRADE PREPARATION, in lifts to provide a compacted thickness of not less than four (4) inches and not more than six (6) inches, to the required limits and sections specified in the plans and specifications or as authorized by the ENGINEER.

305.6.3 Compaction of the material shall be initiated within sixty (60) minutes from the time of mixing. The material shall be compacted to an equivalent dry density greater than ninety five (95) percent of maximum dry density, at a moisture content range of optimum moisture to optimum moisture plus four (4) percent, as determined in accordance with ASTM D558. Compaction shall be completed within three (3) hours from the time of mixing as directed by the ENGINEER.

305.6.4 Upon completion of compaction, the surface of the compacted cement treated base shall be sealed with a prime coat. The prime coat shall be applied as required to provide a uniform coverage of the surface. Application shall be between 0.05 and 0.15 gallons per square yard of surface. If final surfacing is placed within 24 hours after completion of compaction, the prime coat may be waived as authorized by the ENGINEER. The surface shall be kept at compaction moisture until the next lift of material is placed in the event the prime coat is waived.

305.6.5 Cement treated base shall not be placed on

frozen subgrade or subgrade with a surface temperature less than 40°F. The material shall not be placed when the ambient temperature is less than 40°F.

305.6.6 Cement treated base shall be protected from freezing for a minimum of 7 days after placement. The material shall be cured before opening to traffic in accordance with the requirements of TABLE 305.D.

TABLE 305.D
CURING TO TRAFFIC SCHEDULE

CURING TEMPERATURE RANGE °F	CURING TIME (days)
40-55	7
56-75	5
T>76	3

305.6.7 The finished surface of the graded aggregate base shall not deviate in excess of ½ inch in 10 foot when tested with a 10 foot straight edge in any direction. All deviations from this tolerance shall be corrected at no expense to the OWNER. Corrections, if required shall be completed within 3 hours of mixing and prior to placement of prime coat.

305.7 TESTING.

305.7.1 Tests shall be performed in accordance with the requirements of this specification, the supplemental technical specifications, or as required by the ENGINEER. Testing equipment used in the performance of specified testing shall be calibrated annually with calibration standards traceable to the National Bureau of Standards, Certification records shall be maintained at the laboratory for review by the ENGINEER. A copy of the certifications shall be submitted upon request to the ENGINEER.

305.7.2 A construction sample of material supplied to a project shall be taken at a rate of one sample per each 300 tons delivered, or one sample per day, whichever is greater, or as directed by the ENGINEER. The sample shall be of such size to provide material for all tests specified. A sample shall be tested for but not limited to the properties specified in TABLE 305.E.

SECTION 305

CEMENT TREATED BASE CONSTRUCTION

TABLE 305.E
CEMENT TREATED BASE FIELD TESTS

- A. Gradation
- B. Moisture content
- C. Maximum density
- D. Compressive strength
 - 2 briquettes tested at 2 days
 - 2 briquettes tested at 7 days

The average values of individual tests of all sieve size determinations shall comply with the job mix formula within the permissible tolerances shown in TABLE 302.B, SECTION 302., except material passing the No.200 sieve. Results of tests of an individual sample may fall outside the permissible limits by no more than 2 percentage points on any sieve except the No.200 sieve. Non compliance shall necessitate that the entire lot be resampled and tested for compliance. Non complying material shall be removed and replaced as directed by the ENGINEER. The OWNER will only pay for complying material or as directed by the ENGINEER. Cost of removal and replacement of non complying material shall be the responsibility of the CONTRACTOR.

305.7.3 Field compaction tests shall be conducted in accordance with the requirements of ASTM D2922 and D3017, at the rate of one test per lift per 500 sy of material placed, or one (1) test per day, or as directed by the ENGINEER.

305.7.4.1 Test reports shall include but not be limited to the requirements of TABLE 305.F.

TABLE 305.F
TEST REPORT INFORMATION

- A. Field Data
 - Date of Sampling/Field Test
 - Project Number or
 - Permit Number
 - Project Title
 - Material Supplier
 - Delivery Ticket Number (material sample only)
 - Design Mix identification Number
 - Location of sample/field test as defined by the project plans and specifications
 - Time of Sampling/field testing
 - Ambient temperature at time of sampling/, °F
 - Test results with reference specification limits

- B. The laboratory test results and corresponding production limits and/or specifications.

305.7.4.2 Test results shall be reported to the ENGINEER, CONTRACTOR, within 7 working days of completion of the sampling and or field test. Non complying test shall be reported within 1 working day of completion of the test.

305.7.4.3 The testing shall be certified to have been performed in compliance with the specifications by the NM Registered Professional ENGINEER in direct charge of the testing program.

305.8 MEASUREMENT AND PAYMENT.

305.8.1 Measurement of cement treated base course shall be by the square yard per each depth specified, complete in place.

305.8.2 Payment shall be at the contract unit price per square yard per each thickness required, complete in place which shall include all material, labor and equipment required in placing, grading, compacting the cement treated base course and prime coat/moisture control, as authorized by the ENGINEER.

SECTION 306

BITUMINOUS STABILIZED BASE AND SURFACING

306.1 GENERAL

Bituminous stabilized base and surfacing shall consist of a mixture of aggregate and emulsified or liquid asphalt.

306.2 REFERENCES

306.2.1 AASHTO:

T 116 T 176

306.2.2 This publication:

SECTION 115

306.3 AGGREGATES

306.3.1 The aggregates shall consist of soil or mineral aggregates or blends thereof, which, when stabilized with asphalt and allowed to cure, will meet the specified requirements for stability. A representative sample of minus No. 4 material taken from the proposed mixture of aggregates and soil material shall yield a sand equivalent of 40 or more when tested in accordance with AASHTO T 176. The CONTRACTOR shall notify the ENGINEER if he intends to import material in sufficient time to allow for the testing thereof to determine the suitability of the material and quantity of stabilizer required.

306.3.2 Gradation will be the same as specified for Classes I or II, Section 302.3.2.

306.4 ADVANCE TESTS

When mixing is to be done on the site, a representative sample of the aggregates shall be taken from each 10,000 square feet to be stabilized. When mixing is done in a central mixing plant, samples which are representative of the aggregates to be used shall be taken for tests. The stabilizer and aggregates for the work shall meet the requirements of the Supplementary Specifications. The quantity of stabilizer shall be as specified. In the case of emulsified asphalt, the ENGINEER will determine the quantity of water to be added.

306.5 MIXING

The aggregate and asphalt shall be thoroughly mixed in a central pugmill-type mixing plant (blade mixing shall not be used). The mixture shall be uniform and contain the percent, by weight or volume, of dry aggregate and asphalt as specified. If necessary, water shall be added to the aggregate in a quantity sufficient to completely disperse the emulsified asphalt and produce a plastic mixture free from balled fines or balled asphalt.

306.5.1 CENTRAL PLANT MIXING: Bituminous stabilized base shall be placed on prepared subgrade, subbase, or base course as provided. Base course aggregate and bituminous materials shall be processed in a stationary mixing plant conforming to the requirements of Section 115, Asphalt Concrete, except that base course aggregate may not be placed in one stockpile. The base course aggregate shall be separated into not less than two bins.

306.5.2 TRAVEL MIXING:

306.5.2.1 The travel mixing machine shall be of the pug type or auger type. The traveling mixer shall have provision for introducing the asphalt and water at the time of mixing through a metering device or other approved method. Both the asphalt and the water shall be applied by means of separate controls which will supply a uniform ratio of asphalt and/or water to the amount of aggregate passing through the mixer and produce a complete mixture with a uniform moisture content. Leakage of asphalt and/or water from equipment will not be permitted and care shall be exercised to avoid the addition of asphalt or water by spilling or any other means. Prior to mixing in the traveling mixer, the aggregate shall be placed in such a manner that all the material will be passed through the mixing machine in one mixing operation. If aggregate is brought to the site in separate sizes, each of the sizes in proper amount shall be deposited by means of approved spreading device equipped with a readily adjustable strike-off device.

306.5.2.2 The rate of movement of the mixing machine, the amount of material mixed, and the amount of mixing shall be so regulated that a mix satisfactory to the ENGINEER shall result. The material shall be mixed so that a uniform mixture of unchanging appearance is obtained and all particles of aggregate are coated with asphalt.

306.6 PLACING AND MIXTURE

The mixed base material shall be laid to the thickness shown on the plans in layers not to exceed 6 inches in compacted thickness. Laydown of the bituminous stabilized base shall be accomplished with the use of an approved laydown machine.

306.7 COMPACTING THE MIXTURE

Rolling of the mixture shall commence immediately after it has been placed on the subgrade. Compaction shall be accomplished with the use of pneumatic rollers, steel wheel rollers, or vibratory rollers, as approved by the ENGINEER. After the specified compaction has been

SECTION 306

BITUMINOUS STABILIZED BASE AND SURFACING

secured in the top layer with the pneumatic-tired rollers, the roadway shall be thoroughly rolled with self-propelled tandem rollers with smooth steel wheels. Rolling shall commence at the outer edge of the base course and progress toward the center. Each base course layer shall be rolled until it is compacted and true to grade and cross section. Areas inaccessible to the roller shall be compacted by power tamping until as well compacted as the rolled portion. The surface of each layer shall be clean prior to placing the succeeding layer of material.

306.8 DENSITY AND TOLERANCES

Rolling shall be continued until at least 96 percent relative compaction is obtained as per AASHTO T 116. The thickness of stabilized base compacted in place may deviate not more than plus or minus 1/2 inch from that specified, provided such variations are compensating. The surface shall not show any deviations in excess of 3/8 inch when tested with a 10 foot straightedge applied parallel with the centerline of the roadway.

306.9 MEASUREMENT AND PAYMENT

306.9.1 Bituminous stabilized base will be measured horizontally by the square yard. Payment will be as specified in the Bid Proposal.

306.9.2 Asphalt binder material will be measured by the gallon or ton. Unit of payment will be as specified in the Bid Proposal.

SECTION 307

PLANT MIXED BITUMINOUS TREATED BASE CONSTRUCTION

307.1 GENERAL: The work provided under this specification shall include the furnishing, placement and compaction of one or more courses of hot plant mixed bituminous treated base course (BTB) to the lines, grades, dimensions and typical sections as specified in the plans and specifications, as directed by the ENGINEER. The CONTRACTOR shall be solely responsible for the BTB either batched at and/or delivered to the site. A job mix formula used for BTB shall be certified in accordance with the requirements of Section 13 of these specifications. Each job mix formula submitted and authorized for use under this specification shall be identified by a number, unique to that job mix formula and production plant. If a change in material(s) from that specified in the job mix formula occur during a project, the CONTRACTOR shall submit a new job mix formula to include the changed materials for approval by the ENGINEER. A job mix formula shall not be used on a project without written approval of the ENGINEER. A job mix formula, upon request by a supplier, may be authorized by the Department of Municipal Development for use on City and City related projects for a period of 14 months, from the date of sampling of aggregates used in the job mix formula.

307.2 REFERENCES.

307.2.1 American Society for Testing and Materials (ASTM), Latest Edition:

- C117 Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
- C136 Standard Test Method for Sieve Analysis of Fine and Course Aggregates
- C150 Standard Specification for Portland Cement
- C207 Standard Specification for Hydrated Lime for Masonry Purposes
- D979 Standard Practice for Sampling Bituminous Paving Mixtures
- D995 Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
- D1075 Standard Test Method for Effect of Water on Compressive Strength of Compacted Bituminous Mixtures
- D1559 Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
- D2172 Standard Test Method for Quantitative Extraction of Bitumen From Bituminous Paving Mixtures

D2493 Standard Viscosity-Temperature Chart for Asphalts

D2726 Standard Test Method for Bulk Specific Gravity and Density of Non Absorptive Compacted Bituminous Mixtures

D2950 Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods

D3515 Standard Specifications for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures

307.2.2 American Association of State Highway and Transportation Officials AASHTO:

T245 Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus

307.2.3 This Specification:

SECTION 112 ASPHALT BINDER

SECTION 302 AGGREGATE BASE COARSE CONSTRUCTION

SECTION 336 ASPHALT CONCRETE PAVEMENT

307.3 MATERIALS.

307.3.1 Aggregate for plant mixed bituminous base course (BTB) shall consist of a combination of crushed stone, crushed gravel, crushed asphalt concrete, crushed portland cement concrete, and natural or manufactured sand conforming to the requirements of sub section 302.3. SECTION 302. AGGREGATE BASE COURSE CONSTRUCTION.

307.3.2 The asphalt binder shall conform to the requirements of either SECTION 112 ASPHALT BINDER, and TABLE 307.A, the Supplemental Technical Specifications, and/or as authorized by the ENGINEER. The CONTRACTOR shall submit laboratory analysis of the asphalt binder used in the design development of the job mix formula, certification of compliance, identifying the grade and source (plant location), temperature viscosity relationship reported in accordance with ASTM D 2493, and the minimum mixing and compaction temperature ranges. The certification shall state the asphalt binder to be furnished to the project, and/or used in the bituminous treated base course delivered to the project complies with this specification. Certification of the asphalt binder used for each day's placement, shall be submitted to the ENGINEER, upon request, for each grade and each job mix formula used on the project.

SECTION 307

PLANT MIXED BITUMINOUS TREATED BASE CONSTRUCTION

TABLE 307.A ASPHALT BINDER GRADE

<u>Application</u>	<u>Grade</u>		
	<u>Penetration</u>	<u>Viscosity</u>	<u>Performance Grade (PG)</u>
All	60 70	AC 20	70 -22

307.3.3 Admixtures shall be proportioned as a percent (%) by weight or liquid ounces per unit weight, of dry aggregate shall be used in BTB provided under this specification. Antistrip admixtures shall be either hydrated lime, or portland cement, or a liquid admixture, or modified asphalt proportioned as a percent (%) by weight or liquid ounces per unit weight, of dry aggregate, as approved by the ENGINEER.

307.4 PROPORTIONING.

307.4.1 The CONTRACTOR shall be solely responsible for the bituminous treated base job mix formula proportions and material batched and delivered to the site under this specification.

307.4.2 A bituminous treated base (BTB) job mix formula shall be a blend of asphalt binder, graded aggregate base and anti strip admixture proportioned in accordance with the requirements of this specification. The job mix formula shall be prepared in a laboratory under the direct supervision of a New Mexico Registered Professional ENGINEER. The testing equipment used in the design development shall be calibrated annually with calibration standards traceable to the National Bureau of Standards. Certificates of calibration shall be maintained at the laboratory for review by the ENGINEER. A copy of the certifications shall be provided to the ENGINEER upon his request.

307.4.3 A job mix formula shall be determined based on a minimum of five (5) asphalt binder contents reference points, with a minimum of two reference points bracketing the recommended asphalt content, containing only that portion of a mix that passes a one inch sieve. Job mix formula submittals shall include all information required to verify the proposed job mix formula complies with the production ranges and/or variations specified.

307.4.4 Asphalt binder shall be proportioned by percent of dry weight of aggregates. The amount of binder shall be the minimum cement content that will provide an asphalt aggregate anti strip mixture, when

compacted in accordance with ASTM D1559, that will comply with the requirements of TABLE 307.B.

TABLE 307.B BITUMINOUS TREATED BASE PROPERTIES

<u>PROPERTY</u>	<u>SPECIFICATION</u>
Unconfined Compressive Strength	250 psi

307.4.5 The asphalt content shall be selected, based on laboratory testing such that the job mix formula physical properties do not exceed the tabulated limits for a variation in asphalt content of $\pm 0.5\%$.

307.4.6 Anti strip admixture shall be proportioned to provide a minimum compressive strength of 85% or greater retained strength as determined by ASTM D1075. BTB prepared with an anti strip admixture shall have an unconfined compressive strength at least equal to the BTB without the anti strip admixture.

307.5 SUBMITTALS.

307.5.1 A job mix formula submittal shall include but not be limited to that defined in TABLE 307.C, as directed by the ENGINEER. A submittal shall be rejected if it does not include the information specified.

**TABLE 307.C
SUBMITTAL REQUIREMENTS**

- A. Name of Supplier
- B. Date of submittal
- C. Job mix formula identification number
- D. Date of sampling of aggregates
- E. Certification of compliance of materials
- F. Temperature viscosity curve with recommended mixing and compaction temperatures for proposed asphalt binder
- G. Proposed job mix formula target proportions of materials
- H. Certification of compliance of proposed job mix formula by the NM Registered Professional Engineer
- J. Job mix formula performance target characteristics and specification limits
- K. Tabulation of laboratory design development test results
- L. Graphical representation of the following test results:
 - i. Unconfined compressive strength vs. Asphalt

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PLANT MIXED BITUMINOUS TREATED BASE CONSTRUCTION

Content

- ii. Marshall Density (pcf) vs. Asphalt Content (%)
- iii. Voids In Mineral Aggregate (%VMA) vs. Asphalt Content (%)
- M. Specific gravity of asphalt cement
- N. Bulk Specific Gravity of aggregate

307.6 BATCHING.

307.6.1 BTB shall be batched in accordance with the requirements of ASTM D3515, the requirements of this specification, and/or as approved by the ENGINEER. Batching facilities shall comply with the requirements of ASTM D 995, and this specification. A batch plant shall be certified annually by an independent New Mexico Registered Professional ENGINEER, to comply with the requirements of this specification and Section 13. Certification shall be completed within 12 months prior to submittal of a job mix formula to be produced at the plant. The batch plant shall be calibrated annually with calibration standards traceable to the National Bureau of Standards. Certificates of calibration and production certifications shall be maintained at the plant for review by the ENGINEER. A copy of the certifications shall be submitted to the ENGINEER upon request.

307.7 TRANSPORTATION AND PLACEMENT.

307.7.1 Material shall be transported in suitable vehicles with a cover. Material shall be covered immediately after loading and remain covered until unloading. Diesel fuel or other petroleum based solvents shall not be used in the bed of transport vehicles as a release agent to prevent build up of material.

307.7.1.1 The CONTRACTOR shall provide to the ENGINEER with each load of asphalt concrete batched at and/or delivered to the job site, before unloading at the site, a copy of the delivery ticket on which is either printed, stamped or written, the information defined in TABLE 307.D.

TABLE 307.D
DELIVERY TICKET REQUIREMENTS

-
- A. Name of Supplier
 - B. Date of Delivery
 - C. Delivery Ticket Number
 - D. Name of CONTRACTOR
 - E. Project Name (optional)
 - F. Job mix formula identification number
 - G. Weight of load

H. Time loaded

307.7.2 Bituminous treated base shall be placed in uniform layers/lifts in accordance with the requirements of Section 336. The thickness of a layer/lift shall not be less than 4 inches, be at least equal to three (3) times the nominal maximum size aggregate of the job mix formula used but not greater than 8 inches.

307.7.3 The material shall be compacted when the material temperature is in the range specified by the asphalt cement supplier's temperature viscosity curve in the approved job mix formula. Compaction shall be completed before the temperature of the material cools to 200 °F. Compaction shall not be allowed when the material temperature is equal to or less than 200 °F. The materials shall be compacted to a density greater than 96% of laboratory Marshall density. At the direction of the ENGINEER, core samples may be taken to verify constructed asphalt concrete properties. The CONTRACTOR shall be responsible for patching core holes with the same or similar material as the adjacent asphalt concrete. Diesel fuel or other petroleum based solvents shall not be used as a release agent to clean equipment used to place and compact asphalt concrete.

307.8 TESTS.

307.8.1 Construction quality control tests shall be performed in accordance with the requirements of this specification, the supplemental technical specifications, or as required by the ENGINEER. Testing equipment used in the performance of specified testing shall be calibrated annually with calibration standards traceable to the National Bureau of Standards. Certification records shall be maintained at the laboratory for review by the ENGINEER. A copy of the certifications shall be submitted upon request to the ENGINEER.

307.8.2 A field sample shall be taken in accordance with the requirements of ASTM D979, either for each 300 tons delivered per day to a project, or 2 samples per day, or as directed by the ENGINEER. The sample shall be of such size to provide material for all tests specified.

307.8.3 A sample shall be tested for but not limited to the properties specified in TABLE 307.E.

SECTION 307

PLANT MIXED BITUMINOUS TREATED BASE CONSTRUCTION

TABLE 307.E BTB SAMPLE TESTS [1]

- A. Marshall Density (75 blows/face) [2,3]
- B. Marshall Bulk Specific Gravity/Density
- C. Unconfined compressive strength of Marshall Briquettes (average of 3)
- D. Asphalt binder content
- E. Extracted aggregate gradation

- [1] Material used for an individual test shall be split from the same sample
- [2] Compaction temperature for material can be five (5) °F less but not more than five (5) °F greater than the median compaction temperature recommended in the temperature viscosity curve in the authorized submittal
- [3] A minimum of three (3) standard briquettes shall be molded

307.8.4 Field compaction tests shall be conducted in accordance with the requirements of ASTM D2950, at the rate of one test per lift per 500(+/- 50) sy of asphalt material placed, or fraction thereof placed, per day, or as directed by the ENGINEER. Samples of the compacted asphalt pavement may be taken and tested to determine conformance of the finished BTB with the specified requirements either as requested by the CONTRACTOR, or as directed by the ENGINEER. The CONTRACTOR shall be responsible for all sampling and material replacement at no cost to the OWNER where samples are removed. Three (3) six (6") inch diameter cores shall be taken to represent a Lot, as directed by the ENGINEER and tested for compaction in accordance with the requirements of ASTM D2726. Test results shall be reported as specified.

307.8.5 Test reports shall include but not be limited to the information defined in TABLE 307.F.

**TABLE 307.F
TEST REPORT REQUIREMENTS**

-
- A. Date of Sampling/Field Test
 - B. Project Number or Permit Number
 - C. Project Title
 - D. Supplier
 - E. Delivery Ticket Number (sample only)
 - G. Job Mix Formula Identification Number
 - J. Location of sample/test as defined by the project plans and specifications
 - K. Time of Sampling/Field Test
 - L. Material temperature at time of sampling, °F
 - M. Ambient temperature at time of sampling, °F

N. Test results with reference specification limits

307.8.6 Test results shall be reported to the ENGINEER, CONTRACTOR, supplier in writing, within 7 working days of completion of the sampling and/or field test. Noncomplying test shall be reported to the ENGINEER, CONTRACTOR, and supplier, within 1 working day of completion of the test.

307.8.7 The testing shall be certified to have been performed in compliance with the specifications by the NM Registered Professional ENGINEER in direct charge of the testing program.

307.9 MEASUREMENT AND PAYMENT.

307.9.1 Measurement of Plant Mixed Bituminous Treated Base Course shall be by the square yard per each thickness required, complete in place.

307.9.2 Payment shall be at the contract unit price per square yard per each thickness required, complete in place which shall include all material, labor and equipment required in placing, grading and compacting the Plant Mix Bituminous Treated Base Course. Payment will be made for material and placement/compaction that complies with the requirements of the specifications, as authorized by the ENGINEER.

SECTION 308

NATURAL GRAVEL SURFACING FOR UNPAVED ROADWAYS

308.1 GENERAL

This section defines the material and construction requirements for natural gravel surfacing for unpaved roadways.

Screen Or sieve	Percent Passing
1 1/2 inch	100
1 inch	90 - 100
No. 4	40 - 75
No. 200	6 - 20

308.2 REFERENCES

308.2.1 ASTM:

C 117
C 131
C 136

308.2.2 AASHTO:

T 90
T 180

308.3 MATERIALS

308.3.1 CLASSIFICATION: Materials for use as natural gravel surfacing shall be classified, in order of preference, as follows:

308.3.1.1 Processed natural material

308.3.1.2 Decomposed granite

308.3.1.3 The CONTRACTOR may supply either of these materials when natural surfacing is specified without further qualification.

308.3.2 PROCESSED NATURAL MATERIAL:

Processed natural material shall consist of hard, durable fragments of stone or gravel and a filler sand or other finely divided mineral matter. It shall be free from an excess of soft or disintegrated pieces, alkali, adobe, vegetable matter, loam or other deleterious substances.

308.3.2.1 Physical Requirements: When sampled and tested in accordance with standard testing methods, the aggregate shall meet the following requirements:

308.3.2.2 Percentage of Wear: When tested in accordance with ASTM C 131, the percentage of wear shall not exceed 40 percent after 500 revolutions.

308.3.2.3 Plasticity Index: When tested in accordance with AASHTO T 90, the plasticity index shall not be more than 8 nor less than 3.

308.3.2.4 Grading: The aggregate shall be well graded when tested in accordance with ASTM C 136 and C 117. The percentage composition by dry weight shall be within the following limits:

308.3.3 DECOMPOSED GRANITE: Decomposed granite shall be any granitoid rock which has been weathered in place and which has principle constraints granular fragments of quartz and feldspar. It may also contain fragments of granitic rock not yet broken down into the component minerals. This material shall remain stable when saturated with water. Particles larger than 2 inches which will not be broken in the process of rolling and tamping during construction, shall not be used. Decomposed granite shall meet the following specifications:

308.3.3.1 Physical Requirements: When sampled and tested in accordance with the standard testing methods the aggregate shall meet the following requirements:

308.3.3.2 Percentage of Wear: Testing shall be in accordance with ASTM C 131, except that a 15 pound total representative sample shall be utilized and that nothing shall be placed in the drum other than the sample. When tested as herein described not more than 20 percent of the total sample shall pass the No. 200 sieve after 500 revolutions. Testing of this product shall be in accordance with ASTM C 117.

308.3.3.3 Plasticity Index: When tested in accordance with AASHTO T 90, the plasticity index shall not be more than 10 nor less than 3.

308.3.3.4 Grading: When tested in accordance with ASTM C 136 and C 117, the percentage composition by dry weight shall be within the following limits:

Screen or Sieve	Percent Passing
2 inch	100
No. 4	40 - 75
No. 200	6 - 20

308.4 SAMPLE

A representative sample of proposed material to be utilized as natural gravel surfacing shall be submitted to the ENGINEER two weeks prior to intended use. This material shall be tested for specification compliance and recommendations.

SECTION 308

NATURAL GRAVEL SURFACING FOR UNPAVED ROADWAYS

308.5 CONSTRUCTION OF ROADWAY

308.5.1 Natural gravel surfacing shall have a minimum compacted thickness of 6 inches. The construction plans may require a greater thickness, due to local conditions.

308.5.2 The surfacing material shall be compacted to 95 percent of maximum density as determined by AASHTO T 180 for full thickness of surface.

308.5.3 The slope of roadway surface from crown to edge of surfacing shall be 2 percent.

308.6 MEASUREMENT AND PAYMENT

The measurement for natural gravel surfacing shall be the square yard for a specified thickness. Payment will be made at the unit price per square yard as indicated in the Bid Proposal.

SECTION 320

UTILITY AND MONUMENT ACCESS COVER ADJUSTMENTS

320.1 GENERAL

It is essential that the location of all access covers shall be known and that accessibility to operational utilities shall be maintained during paving operations.

320.2 REFERENCES

320.3 PRE-CONSTRUCTION

320.3.1 Prior to the placement of street paving materials the ENGINEER and the CONTRACTOR shall separately record in written form the locations of all existing utility and monument access covers within the construction area. Recordings shall be coordinated between the ENGINEER and CONTRACTOR.

320.3.2 The ENGINEER shall notify the City Surveyor that there are survey reference markers in the construction areas that may be damaged or destroyed during street or utility construction activities.

320.3.3 During the pre-construction conference the ENGINEER shall advise all the utility representatives that access cover adjustments may be required. The ENGINEER shall be advised by the representatives as to the actions planned for the cover adjustments.

320.4 ACCESS COVER ADJUSTMENTS

320.4.1 WATER VALVE BOXES: Grade and adjustments of valve boxes will be made in accordance with Standard Detail Drawings.

320.4.2 MANHOLES: Grade adjustments to manholes may be made by utilizing adjustment rings, by adding or subtracting layer(s) of bricks, or by adding or subtracting to the barrel of the manhole. See Standard Detail Drawings.

320.4.3 MONUMENTS: Several types of monument containers and covers would basically require removal of the container and resetting to new elevations or the possibility of using an adjustment ring. Currently the community may be using surface type markers at new construction sites. These markers can be raised or lowered by an adjusting bolt. City Surveyor's responsibility.

320.4.4 TRAFFIC OR FIRE ALARM SYSTEM BOXES: The traffic or fire alarm system boxes are of the pull box configuration and are normally located outside of the paved area. Any required grade adjustment would be made by removal and relaying the box.

320.4.5 OTHER UTILITIES: For grade adjustments to

access covers of other utility company facilities, the ENGINEER shall contact the concerned utility as to their requirements. Any details will be shown on the construction plans.

320.5 TIME OF ADJUSTMENT

320.5.1 NEW PAVING: Prior to placement of surface course all access covers shall be adjusted to final grade.

320.5.2 OVERLAY HEATER REPAVING OR OTHER TYPES OF RESURFACING

320.5.2.1 Generally overlay, heater repaving or other types of resurfacing occur in a developed area. Therefore, it is essential that all utility access cover locations be recorded as specified in Subsection 320.3.1.

320.5.2.2 If the CONTRACTOR elects to remove valve boxes, valve covers, manhole rings, or other access covers which may interfere with the milling operation, the CONTRACTOR shall replace these items immediately after the passage of the milling equipment. Under no circumstances will these openings remain covered with a flat wood or metal barrier and a paving section material for more than 8 hours after milling.

320.5.3 SURFACE SEALS: Surface sealing occurs in developed areas; therefore, access covers shall be exposed as soon as sealed surface permits vehicle access to the area. Removal of any sealing materials from covers shall be completed within two working days after application.

320.6 MEASUREMENT AND PAYMENT

Depending upon the type of street improvement being constructed the following measurements and payment shall be used:

320.6.1 For new street paving there will be no payment made for adjustments of the access covers in order to position them at the proper elevations.

320.6.2 When the work consists of overlay, slurry seal or heater remix resurfacing, the access cover adjustments may involve specific methods for various types of covers. Payment shall be made as specified in the Bid Proposal.

320.6.3 If a form of surface seal (1/4" or less in applied thickness) is used, grade adjustments should not be necessary. All access cover surfaces shall be exposed immediately after application of treatment. No separate payment will be made.

SECTION 328

QUIET ASPHALT CONCRETE PAVEMENT

328.1 GENERAL: Quiet asphalt concrete (QAC) pavement shall consist of proportioning, mixing in a central plant, aggregate, bituminous materials, admixtures as required, transporting, placing, and compaction, in substantial compliance with this specification, at the areas/volumes and dimensions specified in the CONTRACT plans and specifications. The CONTRACTOR shall be solely responsible for the QAC materials and construction. A job mix formula used for QAC shall be certified in accordance with the requirements of Section 13 of these specifications. Each job mix formula submitted and authorized for use under this specification shall be identified by a number, unique to that job mix formula and production plant. If either a change in material(s) or material supplier(s) from that specified in the job mix formula occurs during a project, authorized use of the job mix formula on the project may be canceled as directed by the ENGINEER. A job mix formula shall not be used on a project without written approval of the ENGINEER. A job mix formula, upon request by a supplier, may be authorized by the Department of Municipal Development for use on City and City related projects for a period of 14 months from the date of sampling of aggregates used in the job mix formula.

328.2 REFERENCES:

328.2.1 American Society For Testing and Materials (ASTM), (Latest Edition):

- C88 Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- C117 Method for Material Finer Than 0.75 um (No.200) Sieve In Mineral Aggregates by Washing
- C131 Test Method for Resistance to Degradation of Small-size Coarse Aggregate by Abrasion and Impact in a Los Angeles Machine
- C136 Method for Sieve Analysis of Fine and Coarse Aggregate
- D242 Specifications for Mineral Filler for Bituminous Paving Mixtures
- D692 Specification for Coarse Aggregate for Bituminous Paving Mixtures
- D979 Methods of Sampling Bituminous Paving Mixtures
- D995 Specification for Mixing Plants for Hot-Mixed, Hot Laid Bituminous Paving Mixtures
- D1073 Specification for Fine Aggregate for Bituminous Paving Mixtures
- D1074 Test Method for Compressive Strength of

Bituminous Mixtures

- D1559 Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
- D2041 Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures
- D2172 Quantitative Extraction of Bitumen From Bituminous Paving Mixtures
- D2493 Viscosity-Temperature Chart for Asphalts
- D2726 Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens
- D2851 Test for Determining the Percentage of Fractured Particles in Coarse Aggregate
- D2950 Density of Bituminous Concrete in Place by Nuclear Methods
- D3203 Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
- D3515 Standard Specification for Hot Mixed, Hot-Laid Bituminous Paving Mixtures
- D4125 Asphalt Content of Bituminous Mixtures by the Nuclear Method
- D4791 Test for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

328.2.2 American Association of State Highway and Transportation Officials (AASHTO) (Latest Edition):

- MP2 Specification for Superpave™ Volumetric Mix Design
- PP-28 Superpave™ Volumetric Design for HMA
- TP 4 Preparation of Compacted Specimens of Modified and Unmodified Hot Mix Asphalt by Means of SHRP Gyratory Compactor
- PP 2 Short and Long-term Aging of Bituminous Mixes
- T53 Quantitative Analysis of Bitumen From Bituminous Paving Mixtures, Ignition Oven Method
- T245 Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
- T283 Resistance of Bituminous Mixture To Moisture Induced Damage
- T304 Uncompacted Void Content of Fine Aggregate

328.2.3 This publication:

SECTION 13 WARRANTY AND GUARANTEE;
TESTS AND INSPECTIONS;
CORRECTIONS, REMOVAL, OR
ACCEPTANCE OF DEFECTIVE WORK
SECTION 112 ASPHALT BINDER

SECTION 328

QUIET ASPHALT CONCRETE PAVEMENT

SECTION 113 EMULSIFIED ASPHALTS

SECTION 118 HYDRATED LIME

SECTION 336 ASPHALT CONCRETE PAVEMENT

328.3 MATERIALS:

328.3.1 The asphalt binder shall be performance grade binder PG76-28 and comply with the requirements of Section 112.

328.3.2 Aggregates shall be crushed stone, crushed gravel, and natural or manufactured sand. Coarse aggregate(s) shall comply with the requirements of ASTM D692 and this specification. Fine aggregate(s) shall comply with the requirements of ASTM D1073 and this specification. Aggregates shall be certified to comply with the requirements of this specification and authorized for use by The ENGINEER before the materials may be incorporated into the construction. Prior to delivery of the aggregates or material containing the aggregates, The CONTRACTOR may be required to furnish samples of the aggregates to The ENGINEER for testing. Daily production aggregates gradations shall be submitted to the ENGINEER, upon request.

328.3.3 Mineral filler shall comply with the requirements of ASTM D242, Mineral Filler for Bituminous Paving Mixtures and as specified herein. Mineral filler shall be certified to comply with the requirements of this Specification and approved for use by the ENGINEER before the materials may be incorporated in the construction. Prior to either delivery of the mineral filler or material containing the mineral filler, The CONTRACTOR may be required to furnish samples of the mineral filler to The ENGINEER for testing.

328.3.4 Quiet asphalt concrete shall comply with the minimum requirements of TABLE 328.C. Moisture susceptibility, % retained strength at 22% air voids, AASHTO T283, with freeze cycle. Admixtures to reduce moisture susceptibility in a quiet asphalt concrete mix shall be either hydrated lime, portland cement, liquid admixture, or a modified asphalt binder as directed by the ENGINEER.

328.4 PROPORTIONING

328.4.1 The CONTRACTOR shall be solely responsible for the quiet asphalt concrete job mix formula (jmf) proportions and quiet asphalt concrete either batched at and/or delivered to the site. Quiet asphalt concrete shall be proportioned in accordance with the

requirements of this Specification.

328.4.2 Quiet asphalt concrete material shall be proportioned to comply with the requirements of TABLE 328.A, 328.B, and 328.C of this specification, AASHTO MP2, Specification for Superpave™ Volumetric Mix Design, and PP-28, Superpave™ Volumetric Design for HMA. Quiet asphalt concrete job mix formula shall be designed under the direct supervision of a New Mexico Registered Professional ENGINEER who has completed a certified SUPERPAVE Mixture Design & Analysis” Short Course.

328.4.3 Quiet asphalt concrete design and analysis shall be performed in a laboratory accredited in accordance with the requirements of the New Mexico State Highway and Transportation Department “Procedure for Approval of Testing Laboratories to Perform Inspection, Testing, and Mix Design Services”, April 13, 1998 Edition, under the direct supervision of a New Mexico Registered Professional ENGINEER.

328.4.4 The testing equipment used in the performance of design development testing shall be (1) certified to comply with the specifications, and (2) calibrated annually with standards traceable to the National Bureau of Standards, as specified by the manufacturer. Certificates of calibration and equipment standards shall be maintained at the laboratory for review and shall be submitted to the ENGINEER upon request.

328.4.5 Aggregates and mineral anti strip admixture, if required, shall be proportioned to provide a combined aggregate gradation that complies with the requirements specified in Tables 328.A and 328.B. The target gradation shall have a similar shape characteristic gradation curve as the specification limits when graphically plotted on a standard "0.45 POWER" gradation chart. The gradation shall be reported to the nearest whole per cent for material passing sieves above the 0.075 mm (no. 200) sieve, and to the nearest 0.1 per cent for material passing the 0.075 mm (no. 200) sieve. The theoretical maximum density gradation curve shall be the curve represented by a straight line drawn from the intersection of the ordinate and abscissa of the graph to the one hundred percent passing point for the nominal maximum size aggregate.

328.4.6 The asphalt binder content shall be proportioned to comply with the requirements defined in TABLE 328.C. The percentage of binder shall be determined based on laboratory testing complying with the requirements of this specification, submitted by the

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CONTRACTOR, and authorized by the ENGINEER.

The percentage asphalt binder production tolerance shall be ± 0.3 percent as determined by the tank strap method, and ± 0.5 percent for laboratory quantitative analysis methods.

328.4.7 The materials specified in a job mix formula shall be the same source and type for all quiet asphalt concrete batched, delivered, placed and compacted, under the identification code defined for the authorized job mix formula.

328.5 SUBMITTALS:

328.5.1 A job mix formula submittal shall include but not be limited to the information specified in Table 328.D.

328.5.2 A job mix formula submittal shall be accepted or rejected within ten (10) working days of receipt by the ENGINEER. A submittal shall be rejected if it does not include the specified information.

328.6 CONSTRUCTION METHOD

328.6.1 Quiet Asphalt Concrete shall be batched in accordance with the requirements of ASTM D3515, the requirements of this Specification, as authorized by the ENGINEER. Batching facilities shall comply with the requirements of ASTM D995, and this Specification. A batch plant shall be certified annually by a New Mexico Registered Professional ENGINEER, to comply with the requirements of this Specification and Section 13. Certification shall be completed within 12 months prior to submittal of a job mix formula to be produced at the plant. The batch plant shall be calibrated annually with calibration standards traceable to the National Bureau of Standards. Certificates of calibration and production certifications shall be maintained at the plant for review and shall be submitted to the ENGINEER upon request.

328.6.2 The mineral aggregate mixing temperature shall be not less than nor greater than the mixing temperature range specified in the authorized job mix formula

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TABLE 328.A - GRADATION

Sieve Designation		Percent by Weight Passing Sieve		[A]
in.	(mm)	Min	Max	± %
0.75	(19.00)	100	100	
5/8	(16.00)	92	98	8
1/2	(12.50)	70	85	8
3/8	(9.50)	40	60	8
no.4	(4.75)	15	25	7
no.16	(2.36)	5	15	5
no.50	(0.30)	3	12	5
no.200	(0.08)	2.0	6.0	2.0

A. Production Tolerance

TABLE 328.B- COMBINED AGGREGATE DESIGN PROPERTIES

CHARACTERISTIC	AGGREGATE TYPE		PROCEDURE
	Coarse	Fine	
1. Coarse aggregate angularity, material > 4.75 mm	95[1] 90[2]		ASTM D 5821
2. Fine aggregate angularity as air voids, %, min	-	45	AASHTO TP 33
3. Flat and elongated particles, 3:1 or greater dimension, material > 4.75 mm, %	20 max		ASTM D 4791
4. Clay content, min %	-	45	ASTM D 2419
5. Deleterious material, max %	1	1	ASTM C 142
6. LA Abrasion, material > 2.36 mm, max loss, %	40	40	ASTM C 131
7. Soundness, max loss after 5 cycles, %	15	15	ASTM C 88

[1] coarse aggregate has one or more fractured faces

[2] coarse aggregate has two or more fractured faces

TABLE 328.C - QUIET ASPHALT CONCRETE DESIGN SPECIFICATIONS

Characteristics @ Nd		Specification
A. Binder Content, PG76-28, %		5.5 to 6.5
B. Air voids, %		19.5 - 20.5
C. Voids filled with asphalt, VFA, minimum		35 - 45
D. Gyrotory Compactive Effort		
Compaction, % [1]	Gyrations	Specification
< 75	Ni (initial)	7
78 - 82	Nd (design)	95
< 85	Nm (max)	150
E. Moisture susceptibility, min % retained strength @ 22 % air voids, AASHTO T283		80

[1] As % of maximum theoretical specific gravity / density, Gmm.

[2] The bulk specific gravity (Gmb) of a molded briquette at Nm shall be determined based on mass (m) measured to the nearest 0.01g, and the volume (V) calculated to the nearest 0.1 cc. The volume shall be calculated based on measurements of the diameter and height of the briquette. The height (h) and diameter (d) of a briquette shall be measured to the nearest 0.001 in. The volume shall be calculated from the average of at least four (4) measurements of the height and diameter, $PI=3.1415927$, $1\text{ in}=25.4\text{ mm}$, and the formula $V=0.25PI d^2 h$. The bulk specific gravity shall be

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calculated as the mass divided by the volume, $G_{mb}@N_m = m/V$, reported to 0.001. For English units, $G_{mb}' = G_{mb}@N_m \times 62.245$ pcf.

TABLE 328.D - SUBMITTAL INFORMATION

-
- I. Identification
 - A. Asphalt concrete supplier
 - B. Laboratory that performed design/development tests
 - C. Date of Submittal
 - D. Unique mix code identification number
 - E. Aggregate sample date
 - II. Job Mix Formula (jmf)
 - A. City type/application of asphalt concrete
 - B. Component material target proportions to include combined aggregate gradation and asphalt content, specifications, and production tolerances
 - C. 0.45 power gradation plot of combined aggregate gradation with specification and production limits
 - D. Temperature viscosity relationship of binder
 - E. Recommended mixing, compaction, and release to traffic maximum temperatures.
 - F. Tabulation of job mix formula performance characteristics defined in TABLE, at the proposed design proportions, with reference specification limits and production limits (if specified), maximum theoretical specific gravity/density (as pcf), and bulk specific gravity/density (pcf).
 - G. Reference daily production gradation, see Section 116
 - III. Certifications of Compliance
 - A. Compliance of job mix formula by NM Registered Professional ENGINEER in direct charge of design/development;
 - B. Design Laboratory Certification.
 - C. Component materials testing and certification by supplier/manufacturer with supporting test data for materials used in design development
 - D. Certification and laboratory test results of asphalt binder used in job mix formula design development, see Section 112.
 - IV. Design Development (Tables and graphs, with specifications limits of the following:)
 - 1. Trial Designs: Aggregate gradations, 3 minimum required, and trial asphalt binder content (%)
 - a) Table of Aggregate Gradations and 0.45 power plot, with specification limits
 - b) Trial design % asphalt content
 - c) Trial designs volumetric analysis for each gradation, VMA, V_a , VFA, graph not required
 - d) Trial designs compaction analysis @ N_i , N_d , and N_m , for each gradation
 - e) Dust ratio for each trial design, graph not required.
 - 2. Job Mix Formula Design, (design development with a minimum of 4 asphalt binder contents required, and the recommended design characteristic bracketed by a minimum of two test points for the design binder content $\pm 0.5\%$)
 - a) Table of design aggregate gradation and 0.45 power plot, with specification limits and production targets
 - b) Compaction analysis G_{mb} as % G_m , at N_i , N_d , and N_m , vs asphalt content (separate graphs for N_i , N_d , and N_m)
 - c) Volumetric analysis of VMA, V_a , VFA, and dust ratio at design gyration, @ N_d , vs % asphalt content
 - d) Gyratory compaction tables as height of sample versus gyration, for each asphalt content, G_{mb} @ N_m , and bulk specific gravity/density correction factor(s) (graphs not required)
 - e) Maximum theoretical specific gravity/density (as pcf), G_{mm} , vs % asphalt content
 - f) Corrected bulk specific gravity/density (as pcf), G_{mb} , vs % asphalt content
 - e) dust ratio vs.% asphalt content
 - f) Recommended gyratory sample mass(g) for 115 mm sample height at N_m
 - C. Ignition Correction Factor: Correction for material losses during asphalt content ignition oven analysis
 The correction factor shall be determined as the average value for three samples, design % asphalt content, design - 1.0%, and design +1.0%, developed in an ignition oven complying with the requirements of AASHTO T53, Method A.

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328.6.3 Asphalt binder mixing shall be not less than nor greater than the mixing temperature range specified in the authorized job mix formula when introduced into the mixture.

328.6.4 Quiet Asphalt Concrete shall be batched and placed at the design proportions specified in the authorized job mix formula within the specified production tolerances for combined aggregate gradation and asphalt binder content. Asphalt concrete placed at a project, sampled and tested in accordance with this specification, shall have a gradation that complies with the authorized design gradation \pm the production tolerance(s) specified in the authorized job mix formula. Asphalt concrete placed at a project, sampled and tested in accordance with this specification, shall have an asphalt content that complies with the design asphalt content \pm 0.5% (laboratory analysis).

328.7 DELIVERY

328.7.1.1 Quiet Asphalt Concrete shall be delivered in trucks free of fluid leaks. Trucks detected to have leaks shall not be allowed on the project. Subgrade, base course, and asphalt concrete surfaces contaminated by uncontrolled equipment fluids shall be removed and replaced with complying material. Contaminated material shall be disposed of as specified. When hauling time from the mixing plant to the job site exceeds two hours or when inclement weather prevails, bituminous mixtures shall be covered with tarpaulins while being hauled. The tarpaulins shall completely cover the load and be firmly tied down. Mixtures shall be delivered to site of the work and placed without segregation of the ingredients and within the temperature range specified in the authorized job mix formula. Diesel fuel or other petroleum based solvents shall not be used in the bed of transport vehicles as a release agent to prevent build up of the asphalt material. Material contaminated with diesel fuel or other petroleum based solvents shall be removed and replaced with complying material by the CONTRACTOR, as directed by the ENGINEER, at no cost to the OWNER.

328.7.1.2 The CONTRACTOR shall provide to The ENGINEER with each load of quiet asphalt concrete batched at and/or delivered to the job site, before unloading at the site, a delivery ticket on which is printed, stamped or written, the information defined in Table 329.D. A copy of the ticket shall be available for the ENGINEER and a copy shall be available for quality assurance sample reference. Diesel fuel or other petroleum based solvents shall not be used in the bed of transport vehicles as a release agent to prevent build up of

the SUPERPAVE asphalt material. If the use of diesel is detected, the load shall be rejected.

TABLE 328.E - DELIVERY TICKET INFORMATION

Name of Asphalt Concrete Supplier
Date of Delivery
Delivery Ticket Number CONTRACTOR
Project Name (optional)
Job Mix Formula Number
Weight of Load (tons)
Time loaded

328.7.1.3 Quiet asphalt concrete shall be delivered to a project at a temperature that allows for placement and start of compaction in the range specified in the authorized job mix formula.

328.7.2 Prior to placing quiet asphalt concrete, all foreign matter shall be swept cleaned from the surface of the existing pavement.

328.7.3 A tack coat shall be applied to provide a uniform and complete coverage, as directed by the ENGINEER. Tack shall consist of either SS-1 or SS1h emulsified asphalt, diluted with an equal volume of water, at the rate of 0.03 to 0.12 gal/yd². The exact quantities being determined by the ENGINEER. Tack shall not be puddled.

328.8 PLACEMENT AND COMPACTION:

328.8.1 Quiet Asphalt Concrete may be placed when the pavement temperature is 60 °F and rising, and the weather is favorable to construction, as authorized by the ENGINEER. Asphalt concrete may not be placed in either wet weather, or on a wet or damp surface, or on frozen supporting material.

328.8.2 In either narrow, or irregular sections, or intersections, or turning radiuses, or turnouts, where it is impractical to spread and finish the base and level the surface mixtures by machine methods, the CONTRACTOR may use placement equipment and/or acceptable hand methods, as authorized by the ENGINEER.

328.8.3 Quiet asphalt concrete shall be placed in a uniform compactor lift, equal or greater than 1 inch and less than or equal to 1.5 inch, by means of a bituminous paver conforming to the requirements of Section 336. The temperature of the mixture shall neither be less than

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nor greater than the compaction temperature range specified in the authorized job mix formula after placement on the road, behind the lay down machine.

328.8.4 Compaction shall begin when the quiet asphalt concrete temperature is in the compaction temperature range specified in the authorized job mix formula. Compaction shall be completed before the temperature of the material cools to less than 200 °F. The material shall be compacted to a density of at least 78 % but not greater than 82 % of the maximum theoretical density as determined by ASTM D2041.

328.8.5.1 Compaction equipment may be steel wheeled, pneumatic wheeled, and hand plate tampers, free of fluid leaks, selected by the CONTRACTOR, and authorized by the ENGINEER. Compaction equipment detected to have leaks shall not be allowed on the project.

328.8.5.2 Compaction may be either static or dynamic (vibratory). All equipment shall be ballasted and operated as recommended by the manufacturer. Motorized wheeled dynamic (vibratory) compaction equipment shall have the frequency rate and amplitude setting readily available for review by the ENGINEER. Frequency rate and amplitude adjustability shall be operable on so equipped motorized wheeled dynamic (vibratory) compaction equipment. Motorized compaction equipment with inoperable frequency rate and amplitude adjustment features shall not be used on the project.

328.8.5.3 Motorized compaction equipment shall be equipped with automatic wheel spray systems to apply release agents to prevent tracking of asphalt concrete. Diesel fuel or other petroleum based solvents shall not be used as a release agent to prevent build up of the asphalt material. Material contaminated with diesel fuel or other petroleum based solvents shall be removed and replaced with complying material by the CONTRACTOR, as directed by the ENGINEER, at no cost to the OWNER.

328.8.5.4 Repair and replacement of damaged adjacent property and structures, resulting from the use of vibratory rolling equipment, shall be the responsibility of the CONTRACTOR, at no cost to the OWNER.

328.8.6 The surface shall be finished smooth, true to the dimensions shown on the plans, and be free of any irregularities in excess of 3/16 inch in 10 feet, when tested with a 10 feet long straight edge resting on any two (2) supports of equal height. Any defective areas shall be immediately corrected removing the defective areas, replacing them with new material to conform to the

remainder of the pavement, as directed by the ENGINEER. Such work shall be done by the CONTRACTOR at no cost to the OWNER.

328.9 SAMPLING AND TESTING

328.9.1.1 A quality assurance asphalt concrete material field sample shall be taken in accordance with the requirements of ASTM D979 for each job mix delivered. The materials shall be sampled at the greater rate of either one sample for each 250 tons, or one sample per day, for each type of material placed on a project, as directed by the ENGINEER. The sample shall be of such size to provide material for all tests specified and a split sample to perform verification/referee tests for gradation and binder content, if required. Tests shall be performed under the direct supervision of a New Mexico Registered Professional ENGINEER who has completed a certified "SUPERPAVE Mixture Design & Analysis" Short Course, in accordance with the requirements of this Specification the Supplemental Technical Specifications, or as directed by The ENGINEER.

328.9.1.2 Quality assurance asphalt concrete analysis shall be (1) performed in a laboratory accredited in accordance with the requirements of the New Mexico State Highway and Transportation Department "Procedure for Approval of Testing Laboratories to Perform Inspection, Testing, and Mix Design Services", April 13, 1998 Edition, and (2) under the direct supervision of a New Mexico Registered Professional ENGINEER.

328.9.1.3 Testing equipment used in the performance of specified testing shall be calibrated annually with calibration standards traceable to the national Bureau of Standards. Certification records shall be maintained at the Laboratory for review by The ENGINEER. A copy of the certifications shall be submitted to The ENGINEER upon request.

328.9.2 A sample shall be tested for but not limited to the properties of combined aggregate gradation, asphalt binder content, and maximum theoretical specific gravity/density, and as required in TABLE 328.F.

328.9.3 A CONTRACTOR may challenge production material test results, binder content and aggregate gradation, and request that the retained split asphalt concrete sample of record be released to his assigned laboratory and tested for compliance, as authorized by the ENGINEER. Notification of challenge shall be made in writing to the ENGINEER by the CONTRACTOR within

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28 calendar days from date of sampling. Challenge test results shall be submitted to the ENGINEER for evaluation no later than 42 calendar days from date of sampling. Challenge test results will be evaluated in accordance with the “multi laboratory” precision tolerances specified, T53 for binder content, ASTM C117 and C136 for aggregate gradation. Challenge and record test results that comply with precision tolerances will be averaged with the companion test results of record and the material pay factor, PF_M , recalculated, as directed by the ENGINEER. Challenge and record test results that do not comply with the precision tolerances will direct the disqualification of the challenged sample, as directed by the ENGINEER. Cut/core sample(s) will be taken from the area(s) represented by the disqualified challenge sample(s) and evaluated by the lab of record under the observation of the CONTRACTOR, in accordance with the requirements of this specification and replace the disqualified sample test results. Analysis of the replacement cut/core sample(s) may not be challenged. The CONTRACTOR will submit challenge test results in writing to the ENGINEER for each split sample released to his assigned laboratory of record. Challenges filed after the time limitations will not be considered. The OWNER shall pay for all complying tests.

reported to 0.001. For English units, $G_{mb}' = G_{mb} \times 62.245$ pcf. A core shall be drilled with a core barrel having an inside diameter equal or greater than 6 inches.

328.9.4.1 Quality assurance in place field compaction tests shall be conducted in accordance with the requirements of this specification, as directed by the ENGINEER.

328.9.4.2 In place field density shall be measured in accordance with the requirements of ASTM D2950, at the greater rate of either three tests per 500 sy and fraction thereof placed in a day, or three samples per day, as directed by The ENGINEER. Compaction shall be calculated as the bulk specific gravity/density, divided by the average of the maximum theoretical density (G_{MM}) of the samples taken for that day's placement, reported to the nearest one tenth of a percent, xxx.x.%. The maximum theoretical specific gravity/density (G_{MM}) shall be determined in accordance with ASTM D2041, and reported to the nearest x.xxx / 0.01 pound per cubic foot. The bulk specific gravity (G_{mb}) of a core shall be determined based on the mass (m) measured to the nearest 0.1 g, and the volume (V) calculated to the nearest 0.1 cc. The core volume shall be calculated based on the height (h) and diameter (d) measured to the nearest 0.001 in. The volume shall be calculated using the average of at least four (4) measurements of the height and diameter, $PI=3.1415927$, 1 in = 25.4 mm, and the formula $V=0.25PI d^2 h$. The bulk specific gravity shall be calculated as the mass divided by the volume, $G_{mb}=m/V$,

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TABLE 328.F - FIELD SAMPLE LABORATORY TESTS

-
- I. Analysis (sample aging is not required)
Analysis at authorized jmf gyrations, N_i (initial), N_d (design), and N_m (max). (1) Two briquettes required. (2) Report average of test results of two briquette tests.
 - A. Compaction analysis with authorized design, and specifications (if applicable)
 - 1 Bulk specific gravity/density, G_{mb} , @ N_i , N_d , and N_m
 - 2 Maximum theoretical specific gravity/density, G_{mm}
 - 3 Compaction: G_{mb} as % G_{mm} at N_i , N_d , and N_m
 - 4 Sample height, mm, at N_d
 - B. Volume characteristics of compacted briquettes @ N_d , with design value and specification
 - 1 VMA, voids in mineral aggregate
 - 2 V_a , voids in asphalt concrete
 - 3 VFA, voids filled with asphalt binder
 - II. Asphalt binder content, with design value and authorized production range
 - III. Dust ratio with design value and specification
 - IV. Extracted Combined Aggregate, with design value(s) and authorized production range
 - A. Gradation
 - B. Coarse aggregate angularity, material > 4.75 mm, coarse aggregate has two or more fractured faces
 - C. Flat and elongated particles, 3:1 or greater dimension, material > 4.75 mm, %

TABLE 328.G - FIELD IN PLACE DENSITY PROPORTIONS

Location	% of total tests
Free Edge of Mat ¹	20 to 33
Mat Interior	33 to 60
Joints ²	20 to 33

NOTES:

- 1 The free Edge of Mat test shall be taken in the area between one (1) foot and two (2) feet in from a free edge of a lift.
- 2 Joints shall include the longitudinal and transverse butt joints between adjacent lifts of asphalt having the same finish elevation. Tests may be taken on material placed against a cold joint edge of formed surface.

328.9.4.3 A reference density test of the support material, for the asphalt concrete roadway lift to be construction, shall be taken prior to the placement of the fresh asphalt concrete lift, or defined from previous test results. The density of the support material shall be used as reference in performing the density test of a fresh asphalt concrete lift in accordance with the requirements ASTM D2950, placed over the support material. A density test of the support material shall be taken at the rate of one (1) test for each 500 sy of surface or less to be paved over in a day, as directed by the ENGINEER. The density of the support material shall be reported as "reference support material density" in the compaction test report of the constructed asphalt concrete pavement

over the area represented by the support material compaction test.

328.9.4.5 Compaction tests shall be taken at random locations, as directed by The ENGINEER. The three (3) general areas in which tests are to be taken are the free edge of a mat, mat interior, and the joints. The number of tests taken in each area will vary but the total number of tests taken on any project shall be in the following ranges. See Table 328.G.

328.9.4.6 Samples of the compacted quiet asphalt concrete pavement shall be sampled by the lab of record and tested to determine compaction at the request of the CONTRACTOR, as directed by the ENGINEER. A

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minimum of three (3) six (6") inch diameter cores shall be taken at random to represent material placed in a day, at the greater rate of one core for each 250 tons, or fraction thereof, or three cores per day, as directed by the ENGINEER. Compaction shall be calculated as the average measured bulk specific gravity/ density of the core, divided by the average of the maximum theoretical specific gravity/ density (G_{MM}) of the samples taken for that day's placement, reported to the nearest one tenth of a percent, xxx.x.%. The bulk specific gravity (G_{mb}) of a core shall be determined based on the mass (m) measured to the nearest 0.1 g, and the volume (V) calculated to the nearest 0.1 cc. The core volume shall be calculated based on the height (h) and diameter (d) measured to the nearest 0.001 in. The volume shall be calculated using the average of at least four (4) measurements of the height and diameter, $PI=3.1415927$, 1 in = 25.4 mm, and the formula $V=0.25PI d^2 h$. The bulk specific gravity shall be calculated as the mass divided by the volume, $G_{mb}=m/V$, reported to 0.001. For english units, $G_{mb}'=G_{mb} \times 62.245$ pcf. A core shall be drilled with a core barrel having an inside diameter equal or greater than 6 inches. The maximum theoretical specific gravity/density (G_{MM}) shall be determined in accordance with ASTM D2041, and reported to the nearest one-thousandth (0.001) and one-tenth pound per cubic foot. Compaction determined from cores shall supersede tests results determined under ASTM D2950. The CONTRACTOR shall be responsible for asphalt concrete material replacement at cores holes, at no cost to the OWNER, where samples are removed. The OWNER shall pay for all complying quality assurance compaction sampling and tests.

328.9.4.7 Full depth cores shall be taken, as directed by the ENGINEER, to determine the depth of structure and determine the depth pay factor, PF_D , defined in TABLE 328.J. A minimum of three full depth cores, having a minimum outside diameter of four (4) inches, shall be taken at random for each 1000 sy, or fraction thereof placed. Cores shall be evaluated in accordance with the requirements of 328.9.7. The core length, depth of the pavement, shall be determined based on the average of three measurements of the length of the core, measured from circular ends of a sample. All measurements shall

reported to the nearest 0.125" (1/8 inch).

328.9.5.1 Test reports shall include but not be limited to the information specified in TABLE 328.H - TEST REPORT.

328.9.5.2 Test results shall be reported to The ENGINEER, CONTRACTOR, Supplier and OWNER in writing, within 7 working days of completion of the sampling of the asphalt and/or the field testing. Non-complying tests shall be reported to The ENGINEER, CONTRACTOR, supplier and OWNER, within 1 working day of completion of the test.

328.9.5.3 The New Mexico Registered Professional ENGINEER in direct charge of the laboratory shall certify on a quality assurance test report that the test procedures used to generate the report complied with the specifications.

328.10 MEASUREMENT AND PAYMENT:

328.10.1 Quiet asphalt concrete shall be measured by the square yard/lift, material delivered, placed, compacted, and finished at the project, as specified in the CONTRACT DOCUMENTS. It shall be measured in a LOT, as directed by the ENGINEER. A LOT shall be each 1000 square yard/lift, or fraction thereof, or as specified in the supplemental technical specifications. Quality assurance materials sampling and testing for a LOT shall be taken for each subplot of 250 tons placed, or fraction thereof, as directed by the ENGINEER. Compaction testing shall be taken for each subplot of 500 sy in accordance with this Section.

TABLE 328.H TEST REPORT

A.	Field Data and Test Results:
1	Date of Sampling/Test
2	City of Albuquerque Project Number or Permit Number
3	Project Title
4	Asphalt Concrete Supplier

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- 5 Delivery Ticket Number (asphalt concrete sample-only)
- 6 Job Mix Formula Number
- 7 Location of sample/test as defined by Contract Documents
- 8 LOT/SUBLOT reference, as directed by the ENGINEER
- 9 Time of field sampling/testing
- 10 Material temperature at time of sampling, °F
- B. Laboratory Test Results
 - 1 Laboratory results as defined in TABLE 328.F
 - 2 Field test results with reference specification limits for each LOT
- C. Recommended Pay Adjustment Factor for a LOT
 - 1 C_{LM} , material factor, see TABLE 328.H
 - 2 C_{LC} , placement/compaction factor, see TABLE 328.I
 - 3 PF_D , depth factor defined in TABLE 336.F, see 328.J

328.10.2 Quiet asphalt concrete pavement shall be paid at the adjusted CONTRACT unit price, adjusted for payment by the equation below, as authorized by the ENGINEER.

328.10.3.1 Quiet asphalt concrete pavement placed in an area of 10 feet or more in width and 100 feet or more in length (requiring machine lay down) shall be divided into LOTS and paid at the adjusted CONTRACT unit price, specified in this section, as authorized by the ENGINEER.

328.10.3.2 Quiet asphalt concrete pavement placed in an irregular area complying with 328.7.2 shall be divided into LOTS and paid at the adjusted CONTRACT unit price, specified in this section, as authorized by the ENGINEER.

328.10.4.1 A LOT shall be paid at a unit price equal to the sum of the adjusted CONTRACT unit price, adjusted for deviation of full depth of structure from CONTRACT specification. The unit price for a LOT shall be calculated in accordance with the equation below.

$$UP' = PF_D \times F_N \times UP$$

F_N , 0.5 x (C_{LM} + C_{LC}), LOT adjustment factor

C_{LM} , material factor, see TABLE 328.H

C_{LC} , placement/compaction factor, see TABLE 328.I

PF_D , depth factor defined in TABLE 328.J

UP , CONTRACT unit price

the daily acceptance sample(s) test results of the sublots for the LOT, deviation from the CONTRACT authorized job mix formula targets (T), for either combined aggregate gradation or binder content. Acceptance samples shall be sampled and tested in accordance with the requirements of this specification.

328.10.4.3 If the deviation is equal or less than the allowable deviation, D' , the corresponding material pay factor, C_{LM} , shall be used.

328.10.4.2 The material factor, C_{LM} , is the material acceptance factor for a LOT determined in accordance with TABLE 328.H, based on the absolute value of the deviation of the average value, or arithmetic mean (M), of

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328.10.5 The LOT placement/compaction factor, C_{LC} , shall be defined in accordance with TABLE 328.I, as directed by the ENGINEER. The factor is determined based on the average of the compaction tests taken for a LOT, with no single test neither less than 77.0 % nor greater than 84.0 %. Acceptance compaction tests shall be performed in accordance with the requirements of this specification. A LOT having an average compaction either less than 77.0 % or greater than 84.0 % shall be evaluated, as directed by the ENGINEER.

328.10.6 The depth factor, PF_D , shall be defined in accordance with TABLE 328.J, based on the layer thickness of quiet asphalt concrete measured from cut samples taken from full depth cores of the construction pavement section taken at random in accordance with 328.9.4.7. The pay factor PF_D shall be determined based on the deviation of the average layer thickness (d_A) from the specified lift thickness (D_s), of a minimum of three (3) wafers cut from full depth cores. The average thickness of the wafers shall be measured to the nearest 0.125 (1/8) in. The thickness of any single wafer shall not be less than the specified section depth, minus 0.25 in. If an individual wafer thickness is identified with a thickness less than the specified depth, minus 0.25 in, additional cores may be taken to verify the condition, as directed by the ENGINEER. If the deficient condition is verified for a LOT, the depth deficient quiet asphalt concrete pavement shall be removed and replaced with complying pavement by the CONTRACTOR at no cost to the OWNER, as directed by the ENGINEER. Cores and cut wafers shall be maintained at the laboratory for a period of four weeks from date of sampling for review by the CONTRACTOR.

TABLE 328.H MATERIAL FACTOR, C_{LM} , FOR GRADATION & ASPHALT BINDER CONTENT

Number of Daily Samples	<u>D', Maximum Allowable Deviation [1, 2, 3]</u>		
1	1.40D	1.20D	D
2	D + R	D + 0.37R	D - 0.10R
3	D + 0.30R	D + 0.07R	D - 0.14R
4	D + 0.16R	D - 0.01R	D - 0.17R
5	D + 0.11R	D - 0.03R	D - 0.20R
6	D + 0.09R	D - 0.05R	D - 0.22R
7	D + 0.07R	D - 0.07R	D - 0.24R
8	D + 0.06R	D - 0.08R	D - 0.25R
9	D + 0.05R	D - 0.09R	D - 0.26R
10 or more	D + 0.04R	D - 0.10R	D - 0.27R
Material Factor, C_{LM} [3]	0.85	0.95	1.00

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- [1] D, production tolerance \pm %, specified in the authorized job mix formula;
R, range of test values, maximum - minimum values; M, average test value of a LOT's acceptance samples test results;
T, target value specified in authorized job mix formula.
- [2] The material factor, C_{LM} , shall be the lowest factor selected for $|T-M| \leq D$ calculated for either (a) the combined aggregate gradation and material passing the nominal maximum size aggregate screen, 3/8 inch (9.5 mm), and smaller screens of the project authorized job mix formula, or (b) the asphalt binder content.
- [3] If the absolute value of the deviation of the daily mean from the target exceeds the maximum allowable deviation for a LOT, $|T-M| \geq D$, the LOT shall be removed and replaced with material complying with this specification, at no cost to the OWNER, as directed by the ENGINEER. If it is determined by the ENGINEER to be more practical to accept the LOT material, it may be accepted under written agreement between the OWNER and the CONTRACTOR, at an assigned pay factor, $C_{LM} = 0.70$, for a LOT having a compaction factor, $C_{LC} \geq 0.85$, as directed by the ENGINEER.

TABLE 328.I - PLACEMENT/COMPACTION FACTOR, C_{LC}

Average Test Results	Factor, C_{LC}
84.1 % and greater	[1]
83.1 to 84.0	0.85
82.1 to 83.0	0.90
78.0 to 82.0	1.00
77.0 to 77.9	0.85
less than 77.0%	[1]

- [1] The lift defined for the LOT shall be removed and replaced by the CONTRACTOR with asphalt concrete pavement complying with this specification at no cost to The OWNER, as directed by the ENGINEER. If it is determined by the ENGINEER to be more practical to accept the LOT, it may be accepted under written agreement between the OWNER and the CONTRACTOR at an assigned compaction pay factor, $C_{LC} = 0.50$, for the LOT, if the LOT has a material pay factor, $C_{lm} \geq 0.85$, as authorized by the ENGINEER.

TABLE 328.J DEPTH FACTOR, PF_D

Deficient Pavement Depth					PF_D
0.00 in	\leq	$D_S - d_A$	\leq	0.25 in	1.00
0.25 in	$<$	$D_S - d_A$	\leq	0.50 in	$(d)^2 / (D)^2$
		$D_S - d_A$	$>$	0.50 in	[A], [B]
Excessive Pavement Depth, d-D					PF_D
		$D_S - d_A$	$<$	0	1.00

NOTES:

D_S specified depth for the pavement structure of a Lot.

d_A average depth of the pavement structure as determined in accordance with 338.8.4.7

[A] CONTRACTOR shall correct deficiencies, constructing the pavement to the depth, grade, crown, and cross slope drainage, specified in the CONTRACT documents, at no cost to the OWNER, as directed by the ENGINEER.

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PLANT MIXED SEAL COAT CONSTRUCTION

329.1 GENERAL: Plant mixed seal coat (PMSC) construction shall be used on all streets with a posted speed of 40 mph and greater, and consist of proportioning, mixing in a central plant, aggregate, bituminous materials, admixtures as required, transporting, placing, and compaction, in substantial compliance with this specification, at the areas/volumes and dimensions specified in the CONTRACT plans and specifications. The CONTRACTOR shall be solely responsible for the PMSC materials and construction. A job mix formula used for PMSC shall be certified in accordance with the requirements of Section 13 of these specifications. Each job mix formula submitted and authorized for use under this specification shall be identified by a number, unique to that job mix formula and production plant. If either a change in material(s) or material supplier(s) from that specified in the job mix formula occurs during a project, authorized use of the job mix formula on the project may be canceled as directed by the ENGINEER. A job mix formula, upon request by a supplier, may be authorized by the Department of Municipal Development for use on City and City related projects for a period of 14 months, from the date of sampling of aggregates used in the job mix formula. Plant mix seal coat shall be used on all streets with a posted speed of 40 mph and greater.

329.2 REFERENCES:

329.2.1 American Society For Testing and Materials (ASTM):

- C88 Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- C117 Method for Material Finer Than 0.75 um (No.200) Sieve In Mineral Aggregates by Washing
- C131 Test Method for Resistance to Degradation of Small-size Coarse Aggregate by Abrasion and Impact in a Los Angeles Machine
- C136 Method for Sieve Analysis of Fine and Coarse Aggregate
- D242 Specifications for Mineral Filler for Bituminous Paving Mixtures
- D692 Specification for Coarse Aggregate for Bituminous Paving Mixtures
- D979 Methods of Sampling Bituminous Paving Mixtures
- D995 Specification for Mixing Plants for Hot-Mixed, Hot Laid Bituminous Paving Mixtures
- D1073 Specification for Fine Aggregate for

Bituminous Paving Mixtures

- D1074 Test Method for Compressive Strength of Bituminous Mixtures
- D1559 Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
- D2041 Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures
- D2493 Viscosity-Temperature Chart for Asphalts
- D2726 Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens
- D2851 Test for Determining the Percentage of Fractured Particles in Coarse Aggregate
- D2950 Density of Bituminous Concrete in Place by Nuclear Methods
- D3203 Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
- D3515 Standard Specification for Hot Mixed, Hot-Laid Bituminous Paving Mixtures
- D4791 Test for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

329.2.2 American Association of State Highway and Transportation Officials (AASHTO) (Latest Edition):

- MP2 Specification for Superpave™ Volumetric Mix Design
- PP-28 Superpave™ Volumetric Design for HMA
- TP 4 Preparation of Compacted Specimens of Modified and Unmodified Hot Mix Asphalt by Means of SHRP Gyratory Compactor
- PP 2 Short and Long-term Aging of Bituminous Mixes
- T53 Quantitative Analysis of Bitumen From Bituminous Paving Mixtures, Ignition Oven Method A
- T245 Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
- T283 Resistance of Bituminous Mixture To Moisture Induced Damage
- T304 Uncompacted Void Content of Fine Aggregate

329.2.3 This publication:

SECTION 13 WARRANTY AND GUARANTEE;
TESTS AND INSPECTIONS;
CORRECTIONS, REMOVAL, OR
ACCEPTANCE OF DEFECTIVE
WORK

SECTION 329

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SECTION 112 ASPHALT BINDER
SECTION 113 EMULSIFIED ASPHALTS
SECTION 118 HYDRATED LIME
SECTION 336 ASPHALT CONCRETE PAVEMENT

329.3 MATERIALS:

329.3.1 AGGREGATE:

329.3.1.1 Aggregates shall be crushed stone, crushed gravel, and natural or manufactured sand. Coarse aggregate(s) shall comply with the requirements of ASTM D692, Coarse Aggregate for Bituminous Paving Mixtures and this specification. Fine aggregate(s) shall comply with the requirements of ASTM D1073, Fine Aggregate for Bituminous Paving Mixtures and this specification. Aggregates shall be certified to comply with the requirements of this Specification and authorized for use by The ENGINEER before the materials may be incorporated in the construction. Prior to delivery of the aggregates or material containing the aggregates, The CONTRACTOR may be required to furnish samples of the aggregates to The ENGINEER for testing. Daily production aggregates gradations shall be submitted to the ENGINEER, upon request.

329.3.2 ASPHALT BINDER

The asphalt binder shall be the performance grade binder PG76-28 and shall comply with the requirements of SECTION 112.

329.4 PROPORTIONING

329.4.1 The CONTRACTOR shall be solely responsible for a plant mixed seal coat job mix formula (jmf) proportions either batched at and/or delivered to a project. PMSC shall be proportioned with a "performance grade binder" in accordance with the procedures defined in 'Preparation of Compacted Specimens of Modified and Unmodified Hot Mix Asphalt by Means of SHRP Gyratory Compactor and requirements of the SHRP-A-407, *The SUPERPAVE Mix Design Manual for New Construction and Overlays*, Level 1 SUPERPAVE Design Mix' and TABLE 329B, and TABLE 329.C. A job mix formula shall be designed under the direct supervision of a New Mexico Registered Professional ENGINEER who has completed a certified "SUPERPAVE Mixture Design & Analysis" Short Course.

329.4.1.2 Asphalt concrete design and analysis shall be performed in a laboratory accredited in accordance with the requirements of the New Mexico State Highway and Transportation Department "Procedure for Approval of Testing Laboratories to Perform Inspection, Testing, and Mix Design Services", April 13, 1998 Edition, under the direct supervision of a New Mexico Registered Professional ENGINEER.

329.4.1.3 The testing equipment used in the performance of design development testing shall be (1) certified to comply with the specifications, and (2) calibrated annually with standards traceable to the National Bureau of Standards, as specified by the manufacturer. Certificates of calibration and equipment standards shall be maintained at the laboratory for review and shall be submitted to the ENGINEER upon request.

329.4.2 Aggregates, mineral filler, and anti-strip admixture if required, shall be proportioned to provide a combined aggregate gradation that complies with the requirements specified in Table 329.A and 329.B, and have the same or similar shape characteristic gradation curve as the specification limits when graphically plotted on a standard "0.45 POWER" gradation chart. The gradation shall be reported to the nearest whole per cent for material passing sieves above the 0.075 mm (no. 200) sieve, and to the nearest 0.1 per cent or material passing the 0.075 mm (no. 200) sieve. The theoretical maximum density gradation curve shall be the curve represented by a straight line drawn from the intersection of the ordinate and abscissa of the graph to the one hundred percent passing point for the nominal maximum size aggregate.

329.4.3 The job mix formula asphalt binder content shall be proportioned to comply with the requirements defined in TABLE 329.C. The percentage of binder shall be determined based on laboratory testing complying with the requirements of this specification, submitted by the CONTRACTOR, and authorized by the ENGINEER. The production tolerance of an asphalt binder shall be ± 0.3 per cent as determined by the tank strap method and ± 0.5 per cent as determined by laboratory quantitative analysis methods.

329.4.4 The materials specified in a job mix formula shall be the same source and type for all plant mix seal coat batched, delivered, placed and compacted, under the identification code defined for the authorized job mix formula.

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329.4.5 The materials specified in a job mix formula shall be the same source and type for all plant asphalt concrete batched, delivered, placed and compacted, under the identification code defined for the authorized job mix formula.

329.4.6 SUBMITTALS

329.4.6.1 A job mix formula submittal shall include but not be limited to the information specified in Table 328.D.

329.4.6.2 A job mix formula submittal shall be accepted or rejected within ten working (10) days of receipt by the ENGINEER. A submittal shall be rejected if it does not include the specified information.

329.5 CONSTRUCTION METHOD:

329.5.1.1 PMSC shall be batched in accordance with the requirements of ASTM D3515, the requirements of this Specification, or as authorized by the ENGINEER. Batching facilities shall comply with the requirements of ASTM D995, and this Specification. A batch plant shall be certified annually by a New Mexico Registered professional ENGINEER, to comply with the requirements of this Specification and Section 13. Certification shall be completed within 12 months prior to submittal of a job mix formula to be produced at the plant. The batch plant shall be calibrated annually with calibration standards traceable to the National Bureau of Standards. Certificates of calibration and production certifications shall be maintained at the plant for review and shall be submitted to the ENGINEER upon request.

329.5.1.2 The mineral aggregate mixing temperature shall be not less than nor greater than the mixing temperature range specified in the authorized job mix formula.

329.5.1.3 Asphalt binder mixing temperature shall be not less than nor greater than the mixing temperature range specified in the authorized job mix formula when introduced into the mixture.

329.5.1.4 The mineral aggregate and asphalt binder shall be proportioned as specified in the authorized job mix formula and mixed until all aggregate particles are thoroughly and uniformly coated with asphalt binder.

329.6 DELIVERY

329.6.1.1 Plant mixed seal coat shall be delivered in trucks free of fluid leaks. Trucks detected to have leaks shall not be allowed on the project. Subgrade, base course, and asphalt concrete surfaces contaminated by uncontrolled equipment fluids shall be removed and replaced with complying material. Contaminated material shall be disposed of as specified. When hauling time from the mixing plant to the job site exceeds two hours or when inclement weather prevails, bituminous mixtures shall be covered with tarpaulins while being hauled. The tarpaulins shall completely cover the load and be firmly tied down. Mixtures shall be delivered to site of the work and placed without segregation of the ingredients and within the temperature range specified in the authorized job mix formula. Diesel fuel or other petroleum based solvents shall not be used in the bed of transport vehicles as a release agent to prevent build up of the asphalt material. Material contaminated with diesel fuel or other petroleum based solvents shall be removed and replaced with complying material by the CONTRACTOR, as directed by the ENGINEER, at no cost to the OWNER.

329.6.1.2 The CONTRACTOR shall provide to The ENGINEER with each load of plant mixed seal coat, a delivery ticket with the information contained in Table 329.D. A copy of the ticket shall be available for the ENGINEER and a copy shall be available for quality assurance sample reference. Diesel fuel or other petroleum based solvents shall not be used in the bed of transport vehicles as a release agent to prevent build up of the SUPERPAVE asphalt material. If the use of diesel is detected, the load shall be rejected.

329.6.1.3 PMSC shall be delivered to project at a temperature that allows for placement and start of compaction in the compaction temperature range specified in the authorized job mix formula.

329.7 PLACEMENT AND COMPACTION:

329.7.1.1 Plant mixed seal coat shall not be placed before March 1 or after September 31 of a calendar year, except as herein provided. The CONTRACTOR may be granted special permission to place Plant Mix Seal Coats after September 30, as authorized by the ENGINEER. However, under no conditions will the CONTRACTOR be permitted to place a Plant Mix Seal Coat on wet pavements, or when the ambient

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temperature is less than 60°F, or under other conditions of weather that would preclude satisfactory results.

329.7.1.2 Plant mixed seal shall be constructed only when the surface is dry, when the mat surface temperature on which it is to be placed is 60°F or above, when the weather is not foggy, rainy, or stormy; and when the weather is favorable to obtain the desired results.

329.7.1.3 Prior to placing plant mixed seal coat, all foreign matter shall be swept cleaned from the surface of the existing pavement.

329.7.1.4 A tack coat shall be applied to provide a uniform and complete coverage, as directed by the ENGINEER. Tack shall consist of either SS-1 or SS1h emulsified asphalt, diluted with an equal volume of water, at the rate of 0.03 to 0.12 gal/yd². The exact quantities being determined by the ENGINEER. Tack shall not be puddled.

329.7.2 Plant mixed seal coat shall be placed in a compacted layer equal or greater than nominal maximum size of the aggregate and/or equal or less than 3/4 of an inch, by means of a bituminous paver conforming to the requirements of Section 336. The temperature of the mixture shall be not less than nor greater than the compaction temperature range specified in the authorized job mix formula after placement on the road, behind the lay down machine.

329.7.3.1 The surface shall be finished smooth, true to the dimensions shown on the plans with a minimum of three passes with a self propelled steel wheeled roller having a minimum rated capacity of 20 tons.

329.7.3.2 Finish rolling shall begin when the quiet asphalt concrete temperature is in the compaction temperature range specified in the authorized job mix formula. Finish rolling shall be completed before the temperature of the material cools to less than 200 °F.

329.7.3.3 Finish rolling equipment shall be steel wheeled, free of fluid leaks, selected by the CONTRACTOR, and authorized by the ENGINEER. Equipment detected to have leaks shall not be allowed on the project.

329.7.3.4 Finish rolling equipment may be either static or dynamic (vibratory). All equipment shall be ballasted and operated as recommended by the

manufacturer. Motorized wheeled dynamic (vibratory) equipment shall have the frequency rate and amplitude setting readily available for review by the ENGINEER. Frequency rate and amplitude adjustability shall be operable on so equipped motorized wheeled dynamic (vibratory) equipment. Motorized wheeled dynamic (vibratory) equipment with inoperable frequency rate and amplitude adjustment features shall not be used on the project.

329.7.3.5 Finish rolling equipment shall be equipped with automatic wheel spray systems to apply release agents to prevent tracking of asphalt concrete. Diesel fuel or other petroleum based solvents shall not be used as a release agent to prevent build up of the asphalt material. Material contaminated with diesel fuel or other petroleum based solvents shall be removed and replaced with complying material by the CONTRACTOR, as directed by the ENGINEER, at no cost to the OWNER.

329.7.3.6 Repair and replacement of damaged adjacent property and structures, resulting from the use of vibratory rolling equipment, shall be the responsibility of the CONTRACTOR, at no cost to the OWNER.

329.7.4 The surface shall be finished smooth, true to the dimensions shown on the plans. It shall be free of any surface irregularities in excess of 3/16 inch in 10 feet, when tested with a 10 feet long straight edge resting on any two (2) supports of equal height. Any defective areas shall be immediately corrected removing the defective areas, replacing them with new material to conform to the remainder of the pavement, as directed by the ENGINEER. Such work shall be done by the CONTRACTOR at no cost to the owner.

329.8 SAMPLING AND TESTING

329.8.1.1 Plant mixed seal coat material shall be sampled at the greater rate of one sample for each 250 tons, or fraction thereof, placed each day as directed by the ENGINEER. Tests shall be performed under the direct supervision of a New Mexico Registered Professional ENGINEER who has completed a certified "SUPERPAVE Mixture Design & Analysis" Short Course, in accordance with the requirements of this Specification the Supplemental Technical Specifications, or as directed by The ENGINEER.

329.8.1.2 Quality assurance asphalt concrete

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analysis shall be (1) performed in a laboratory accredited in accordance with the requirements of the New Mexico State Highway and Transportation Department "Procedure for Approval of Testing Laboratories to Perform Inspection, Testing, and Mix Design Services", April 13, 1998 Edition, and (2) under the direct supervision of a New Mexico Registered Professional ENGINEER.

329.8.1.3 Testing equipment used in the performance of specified testing shall be calibrated annually with calibration standards traceable to the national Bureau of Standards. Certification records shall be maintained at the Laboratory for review by The ENGINEER. A copy of the certifications shall be submitted to The ENGINEER upon request.

329.8.2 A plant mixed seal coat sample shall be tested for but not limited to the properties combined aggregate gradation, asphalt binder content, and maximum theoretical specific gravity/density, and reported as required in 329.E.

329.8.3 A CONTRACTOR may challenge production material test results, binder content and aggregate gradation, and request that the retained split asphalt concrete sample of record be released to his assigned laboratory and tested for compliance, as authorized by the ENGINEER. Notification of challenge shall be made in writing to the ENGINEER by the CONTRACTOR within 28 calendar days from date of sampling. Challenge test results shall be submitted to the ENGINEER for evaluation no later than 42 calendar days from date of sampling. Challenge test results will be evaluated in accordance with the 'multi laboratory' precision tolerances specified, T53 for binder content ASTM C117 and C136 for aggregate gradation. Challenge and record test results that comply with precision tolerance will be averaged with the companion test results of record and the material pay factor PF_M recalculated, as directed the ENGINEER. Challenge and record test results that do not comply with the precision tolerances will direct the disqualification of the challenged and record samples, as directed by the ENGINEER. Cut/core sample(s) will be taken from the area(s) represented by the disqualified challenge sample(s) and evaluated by the lab of record under the observation of the CONTRACTOR, in accordance with the requirements of this specification and replace the disqualified sample test results. Analysis of the replacement cut/core sample(s) may not be challenged. The CONTRACTOR

will submit challenge test results in writing to the ENGINEER for each split sample released to his assigned laboratory of record. Challenges filed after the time limitations will not be considered. The OWNER shall pay for all complying tests.

329.8.4 Test results shall be reported to The ENGINEER, CONTRACTOR, Supplier and OWNER in writing, within 7 working days of completion of the sampling of the asphalt and/or the field testing. Non-complying tests shall be reported to The ENGINEER, CONTRACTOR, supplier and OWNER, within 1 working day of completion of the test.

329.8.5 The New Mexico Registered Professional ENGINEER in direct charge of the laboratory shall certify on a quality assurance test report that the test procedures used to generate the report complied with the specifications.

329.9 MEASUREMENT AND PAYMENT:

Plant mixed seal coat shall be measured separate by either the ton or square yard of materials placed on a project, measured complete, in place, and accepted, as specified in the CONTRACT. Unit of payment will be at the adjusted CONTRACT unit price(s) as specified in 329.9.1, as authorized by the ENGINEER.

329.9.1 Plant mixed seal coat shall be paid at the adjusted CONTRACT unit price, adjusted for payment by the equation below and TABLE 329.F, as authorized by the ENGINEER. The material factor, PF_M , is the acceptance factor for material placed on a project each day. It shall be defined in accordance with TABLE 329.F, based on the deviation of the average value or arithmetic mean (M) of the daily acceptance sample(s) test results, for either combined aggregate gradation or binder content, from the reference target (T), as specified in the authorized job mix formula. If the deviation of the daily mean (average), M , from the target, T , exceeds the maximum allowable deviation, D' , for a LOT, $|T-M| > D'$, the LOT shall be removed and replaced with material complying with this specification, at no cost to the OWNER, as directed by the ENGINEER. If it is determined by the ENGINEER to be more practical to accept the material, the LOT may be accepted under written agreement between the OWNER and the CONTRACTOR, at an assigned pay factor of $PF_M = 0.70$.

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$$UP' = PF_m \times UP$$

UP', adjusted CONTRACT unit price, \$/ton

UP, CONTRACT unit price, \$/ton

PF_m, PAY FACTOR (see TABLE 329.E)

TABLE 329.A - GRADATION

Sieve Designation in. (mm)	Percent by Weight Passing Sieve		Production Tolerance +/- %
	Min	Max	
3/4 (19.0)	100	100	
5/8 (16.0)	92	98	8
1/2 (12.5)	70	85	8
3/8 (9.5)	40	60	8
no.4 (4.75)	15	25	7
no.16 (2.36)	5	15	5
no.50 (0.30)	3	12	5
no.200 (0.075)	2.0	8.0	2.0

TABLE 329.B - AGGREGATE PROPERTIES

	Specification	Procedure
Fractured Faces Material > no.4 (4.75 mm)	75%, min w/2 frac faces	Visual
Clay content, min %	0.0	ASTM D 2419
Deleterious material, max %	1.0	ASTM C 142
LA Abrasion, material > no.8 (2.36 mm)	40 % max loss	ASTM C 131
Soundness	15 % max loss, after 5 cycles	ASTM C 88

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TABLE 329.C - QUIET ASPHALT CONCRETE DESIGN SPECIFICATIONS

Characteristics @ Nd		Specification
A. Binder Content, PG76-28, %		5.5 to 6.5
B. Voids in Mineral Aggregate (VMA), min %		25
C. Air voids, %		17 - 19
D. Voids filled with asphalt, (VFA), min %		30
E. Gyratory Compactive Effort @ compaction temperature[2]		
Gyrations	N	Compaction, % [1]
Ni (initial)	7	<75
Nd (design)	95	81-83
Nm (max)	150	<85
F. Moisture susceptibility, min % retained		
strength @ design % air voids, AASHTO T283		80

[1] As % of maximum theoretical specific gravity / density, Gmm.

[2] Specific by asphalt binder certification

TABLE 329.D - SUBMITTAL INFORMATION

- | |
|--|
| I. Identification |
| A. Asphalt concrete supplier |
| B. Laboratory that performed design/development tests |
| C. Date of Submittal |
| D. Unique mix code identification number |
| E. Aggregate sample date |
| II. Job Mix Formula (jmf) |
| A. City type/application of asphalt concrete |
| B. Component material target proportions to include combined aggregate gradation and asphalt content, specifications, and production tolerances |
| C. 0.45 power gradation plot of combined aggregate gradation with specification and production limits |
| D. Temperature viscosity relationship of binder |
| E. Recommended mixing, compaction, and release to traffic maximum temperatures. |
| F. Tabulation of job mix formula performance characteristics defined in TABLE, at the proposed design proportions, with reference specification limits and production limits (if specified), maximum theoretical specific gravity/density (as pcf), and bulk specific gravity/density (pcf). |
| G. Reference daily production gradation, see 116.3.2 |
| III. Certifications of Compliance |
| A. Compliance of job mix formula by NM Registered Professional ENGINEER in direct charge of design/development; |
| B. Design Laboratory Certification. |
| C. Component materials testing and certification by supplier/manufacturer with supporting test data for materials used in design development |
| D. Certification and laboratory test results of asphalt binder used in job mix formula design development, see 112.4.1.2. |
| IV. Design Development (Tables and graphs, with specifications limits of the following:) |

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PLANT MIXED SEAL COAT CONSTRUCTION

1. Trial Designs: Aggregate gradations, 3 minimum required, and trial asphalt binder content (%)
 - a) Table of Aggregate Gradations and 0.45 power plot, with specification limits
 - b) Trial design % asphalt content
 - c) Trial designs volumetric analysis for each gradation, VMA, Va, VFA, graph not required
 - d) Trial designs compaction analysis @ Ni, Nd, and Nm, for each gradation
 - e) Dust ratio for each trial design, graph not required.
2. Job Mix Formula Design, (design development with a minimum of 4 asphalt binder contents required, and the recommended design characteristic bracketed by a minimum of two test points for the design binder content $\pm 0.5\%$)
 - a) Table of design aggregate gradation and 0.45 power plot, with specification limits and production targets
 - b) Compaction analysis G_{mb} as % G_m , at Ni, Nd, and Nm, vs asphalt content (separate graphs for Ni, Nd, and Nm)
 - c) Volumetric analysis of VMA, Va, VFA, and dust ratio at design gyration, @Nd, vs % asphalt content
 - d) Gyratory compaction tables as height of sample versus gyration, for each asphalt content, G_{mb} @ NM, and bulk specific gravity/density correction factor(s) (graphs not required)
 - e) Maximum theoretical specific gravity/density (as pcf), G_{mm} , vs % asphalt content
 - f) Corrected bulk specific gravity/density (as pcf), G_{mb} , vs % asphalt content
 - e) dust ratio vs.% asphalt content
 - f) Recommended gyratory sample mass(g) for 115 mm sample height at Nm
- C. Ignition Correction Factor: Correction for material losses during asphalt content ignition oven analysis
 The correction factor shall be determined as the average value for three samples, design % asphalt content, design - 1.0%, and design +1.0%, developed in an ignition oven complying with the requirements of AASHTO T53, Method A.

TABLE 329.F - MATERIAL FACTOR, PFm, FOR GRADATION & BINDER CONTENT

Number of Daily Samples	For $ T-M \leq D'$, [1, 2] D', Maximum Allowable Deviation [3]		
1	1.40D	1.20D	D
2	D + R	D + 0.37R	D - 0.10R
3	D + 0.30R	D + 0.07R	D - 0.14R
4	D + 0.16R	D - 0.01R	D - 0.17R
5	D + 0.11R	D - 0.03R	D - 0.20R
6	D + 0.09R	D - 0.05R	D - 0.22R
7	D + 0.07R	D - 0.07R	D - 0.24R
8	D + 0.06R	D - 0.08R	D - 0.25R
9	D + 0.05R	D - 0.09R	D - 0.26R
10 OR MORE	D + 0.04R	D - 0.10R	D - 0.27R
PFm [3]	0.85	0.95	1.00

- [1] D, production tolerance \pm %, and the authorized job mix formula,
 R, range of test values, maximum - minimum values, M, average test value of a LOT's samples test results,
 T, target value specified in authorized job mix formula.
- [2] If the deviation of the daily mean from the target exceeds the maximum allowable deviation for a LOT,
 $|T-M| > D'$, the LOT shall be removed and replaced with material complying with this specification, at no cost to the OWNER, as directed by the ENGINEER. If determined by the ENGINEER to be more practical to accept the material, the LOT may be

SECTION 329

PLANT MIXED SEAL COAT CONSTRUCTION

accepted under written agreement between the OWNER and the CONTRACTOR, at an assigned pay factor $PF_m = 0.70$.

- [3] The material factor, PF_m , shall be the lowest of the factors calculated for either the combined aggregate gradation of material passing any of the nominal size aggregate screen, 3/8 inch, and smaller screens, or, the binder content.

TABLE 329.D - DELIVERY TICKET
INFORMATION

Name of Asphalt Concrete Supplier
Date of Delivery
Delivery Ticket Number CONTRACTOR
Project Name (optional)
Job Mix Formula Number
Weight of Load (tons)
Time loaded

TABLE 329.E
FIELD SAMPLE LABORATORY TESTS

-
- I. Analysis
- A. Analysis at authorized jmf gyrations, N_i (initial), N_d (design), and N_m (max). (1) Two briquettes required. (2) Report average of test results of two briquette tests. (3) Sample aging is not required.
 - B. Volume characteristics of compacted briquettes with authorized jmf production specifications @ N_i , N_d , and N_m .
 - 1 VMA, voids in mineral aggregate;
 - 2 V_a , voids in asphalt concrete;
 - 3 VFA, voids filled with asphalt binder;
 - 4 G_{mb} , bulk specific gravity and density, with authorized jmf target
- II. G_{mm} , maximum theoretical specific gravity and density, with authorized jmf target
- III. Asphalt binder content (Ignition oven ASHTO T53, method A)
- IV. Extracted Combined Aggregate
- A. Gradation
 - B. Coarse aggregate angularity, material > 4.75 mm
 - C. Flat and elongated particles, 3:1 or greater dimension, material > 4.75 mm, %
 - D. Fractured Faces, material > 4.75 mm

SECTION 330

ASPHALT EMULSION SLURRY SEAL

330.1 GENERAL

The slurry seal surface shall consist of a mixture of emulsified asphalt; mineral aggregate, and water, properly portioned, mixed, and spread evenly on the surface. The cured slurry shall have a homogenous appearance, fill all cracks, adhere firmly to the surface, and have a skid resistant texture.

330.2 REFERENCES

330.2.1 This publication:

SECTION 113
SECTION 336

330.3 MATERIALS

330.3.1 **ASPHALT EMULSION:** The emulsified asphalt shall be of the type specified by or shown on the plans and shall conform to the requirements of Section 113.

330.3.2 **AGGREGATE:** Mineral aggregates shall consist of natural or manufactured sand, slag, crusher fines, or a combination thereof complying with the requirements of Section 115.

330.3.3 **WATER:** All water used with the slurry mixture shall be potable and free from harmful soluble salts.

330.4 JOB-MIX DESIGN

A job-mix formula for the asphalt emulsion slurry seal shall be determined by an approved testing laboratory from representative samples of graded aggregate produced and stockpiled by the CONTRACTOR and meeting all of the specified requirements. The job-mix design shall specify the asphalt content, and, if required, the amount of mineral filler to be used.

330.5 EQUIPMENT

All equipment, tools, and machines used in the performance of this work will be maintained in satisfactory working order at all times.

330.5.1 SLURRY MIXING EQUIPMENT:

330.5.1.1 The slurry mixing machine will be a continuous flow mixing unit and be capable of delivering accurately a predetermined proportion of aggregate, water, and asphalt emulsion to the mixing chamber and to discharge the thoroughly mixed product on a continuous basis. The aggregate shall be prewetted immediately prior to mixing

with the emulsion. The mixing unit of the mixing chamber shall be capable of thoroughly blending all ingredients together. No violent mixing shall be permitted.

330.5.1.2 The mixing machine shall be equipped with an approved fines feeder that provides an accurate metering device or method to introduce a predetermined proportion of mineral filler into the mixer at the same time and location that the aggregate is introduced.

330.5.1.3 The mixing machine shall be equipped with a water pressure system and fog type spray bar adequate for complete fogging of the surface preceding the spreading equipment with a maximum application of 0.05 gallon per square yard.

330.5.1.4 Sufficient machine storage capacity to mix properly and apply a minimum of 5 tons of the slurry shall be provided.

330.5.2 **SLURRY SPREADING EQUIPMENT:** Attached to the mixer machine shall be a mechanical type squeegee distributor equipped with flexible material in contact with the surface to prevent loss of slurry from the distributor. It shall be maintained so as to prevent loss of slurry on varying grades and crown by adjustments to assure uniform spread. There shall be a steering device and a flexible strike-off. The spreader box shall have an adjustable width. The spreader box shall be kept clean and build up of asphalt and aggregate on the box shall not be permitted. The use of burlap drags or other drags shall be approved by the ENGINEER.

330.5.3 **CLEANING EQUIPMENT:** Power brooms, power blowers, air compressors, water flushing equipment, and hand brooms shall be suitable for cleaning the surface and cracks of the old surface.

330.5.4 **AUXILIARY EQUIPMENT:** Hand squeegees, shovels, brooms, and other equipment shall be provided as required to perform the work.

330.6 PREPARATION OF EXISTING SURFACE

330.6.1 Immediately prior to applying the slurry, the surface shall be cleaned of all loose material, silt spots, vegetation, and other objectionable material. Any standard cleaning method used to clean pavements will be accepted, except water flushing will not be permitted in areas where large cracks are present in the pavement surface. The prepared surface shall be approved by the ENGINEER prior to application of any surface treatment.

330.6.2 If the slurry seal is being applied over a brick or

ASPHALT EMULSION SLURRY SEAL

concrete surface, highly absorbent asphalt surface, or a surface where the aggregate has become exposed and is polished and slick, a 1 part emulsion to 3 parts water tack coat of the same asphalt emulsion type and grade as specified for the slurry shall be applied to the existing surface after it is cleaned and approved. The tack coat shall be applied with an approved asphalt distributor. The rate of the diluted emulsion shall be between 0.05 to 0.15 gallons per square yard as directed by the ENGINEER.

330.7 COMPOSITION AND RATE OF APPLICATION OF THE SLURRY MIX

The amount of asphalt emulsion to be blended with the aggregate shall be that amount as determined by the lab mix design and any final adjustment made in the field and approved by the ENGINEER. The rate of application shall be the rate, in pounds of per square yard, as shown on the plans or as otherwise approved by the ENGINEER.

330.8 WEATHER LIMITATIONS

The slurry seal surface shall not be applied if either the pavement or air temperature is 60 degrees F or below and falling but may be applied when both the air and pavement temperature is 55 degrees F or above and rising. The mixture shall not be applied if high relative humidity prolongs the curing beyond a reasonable period of time as determined by the ENGINEER.

330.9 APPLICATION OF THE SLURRY SURFACE

330.9.1 GENERAL: The surface shall be fogged with water directly preceding the spreader. The slurry mixture shall be of the desired consistency when deposited on the surface, and no additional materials shall be applied. Total time of mixing shall not exceed 4 minutes. A sufficient amount of slurry shall be carried in all parts of the spreader at all times so that complete coverage is obtained. No lumping, balling, or unmixed aggregate shall be permitted. No segregation of the emulsion and aggregate shall be permitted. No segregation of the emulsion and aggregate fines from the coarse aggregate will be permitted. If the coarse aggregate settles to the bottom of the mix, the slurry will be removed from the pavement. Excessive breaking of the emulsion will not be allowed in the spreader box. No streaks such as caused by oversized aggregate will be left in the finished pavement.

330.9.2 JOINTS: No excessive build-up nor unsightly appearance shall be permitted on longitudinal or transverse joints.

330.9.3 HAND WORK: Approved squeegees shall be used to spread slurry in nonaccessible areas to slurry mixer.

All hand work shall be done by experienced and skilled workmen.

330.9.4 CURING: Treated areas will be allowed to cure until such time as the ENGINEER permits their opening to traffic.

330.9.5 ROLLING: When rolling is specified, the paved surface will be rolled with a 5 ton roller. The paved area will be covered with a minimum of 5 passes of the roller. If a pneumatic roller is used, it will be operated at a tire pressure of 50 pounds per square inch.

330.10 MEASUREMENT AND PAYMENT

The quantity of slurry seal coat applied shall be measured by square yards of slurry seal coat placed and accepted. Payment will be as specified in the Bid Proposal.

SECTION 331

ASPHALT CONCRETE OVERLAY

331.1 GENERAL

Asphalt concrete overlay consists of the placing and compacting of plant mix asphalt concrete over existing pavement structure. The thickness of the overlay shall be as shown on the drawings or as specified in the Supplementary Specifications.

331.2 REFERENCES

331.2.1 This publication:

SECTION	116
SECTION	118
SECTION	336

331.3 MATERIALS

331.3.1 The aggregate gradation and percentage of asphalt binder shall be as specified by the job mix formula as described in Section 116.

331.3.2 Hydrated lime mineral filler may be an additive to the asphalt concrete overlay aggregate as a coating material. Material, mixing and proportioning shall conform to requirements contained in Section 118.

331.3.3 The tack coat, the asphalt concrete mix, and transportation of the mix shall be as specified in Section 336.

331.4 PREPARATION OF SURFACES

331.4.1 When shown on the plans or specified in the Contract, surfaces shall be prepared as follows:

331.4.1.1 Before placing asphalt concrete overlay, severely raveled, cracked, uneven areas of pavement shall be patched prior to the resurfacing operation. Over-asphalted areas or rough high spots shall be removed by burning or blading. Large cleavage cracks shall be filled with asphaltic sealing compound approved to the ENGINEER. The entire surface shall be cleaned. Raveled areas that do not require removing shall be cleaned.

331.4.1.2 After surfaces have been prepared to the satisfaction of the ENGINEER, the entire surface shall be thoroughly cleaned and shall receive a tack coat, if required, as specified in Subsection 336.

331.5 METHODS

Placing and rolling of the asphalt concrete and the smoothness of the surface shall be as specified in Section 336.

331.6 MEASUREMENT AND PAYMENT

Asphalt concrete overlay will be measured by the ton or square yard. Unit of payment will be as specified in the Bid Proposal.

SECTION 332

HEATER-REMIX RESURFACING AND HEATER-REPAVING

332.1 GENERAL

332.1.1 Heater-Remix Resurfacing consists of a "Paving Train" operation, involving heating of the existing asphaltic concrete surface to softening temperature, "soft" milling or mechanical scarification, addition (where specified) of selected aggregates to achieve a desired gradation; addition of an approved liquid rejuvenating agent, mechanical leveling of the processed material, followed by rolling and compacting of the remixed material. This process may be followed by a standard plant-mixed bituminous pavement overlay, of specified thickness and mix design.

332.1.2 Heater-Repaving consists of a single-machine operation which performs the following tasks: Preheating and final heating of existing pavement to achieve pavement surface temperatures of 225°F or greater; mechanical scarification and mechanical leveling of the existing, heated pavement material; immediate direct application of new, hot plant mixed bituminous surface course at specified rate(s), thermally bonding it to existing heated, processed pavement material and using standard "laydown" equipment consisting of pugmill and heated, vibratory screed with approved elevation-sensing devices and mechanical screed adjustment.

A tandem, steel-wheel pavement roller (10-12 Ton rated capacity) is used in addition, to achieve desired finish and degree of compaction.

332.3 REFERENCES

332.2.1 This publication

SECTION 117
SECTION 336

332.3 COORDINATION

332.3.1 Heater-Remix Resurfacing, when followed by a hot-mixed bituminous overlay, shall be performed under a single contact, to include both the heater-remixing and the bituminous overlay, to ensure close coordination between phases of the project and to expedite the work.

332.3.2 Heater-Repaving shall be performed as described in (332.1.2), above. The Heater-Repaving operation does not include furnishing of hot-mixed bituminous overlay material and may also not include transportation of material to the job site; therefore, it will be the responsibility of the CONTRACTOR to coordinate the schedules of both the production of paving materials and the transportation of these materials to the job site.

332.4 SURFACE PREPARATION

The existing pavement scheduled for treatment, shall be flushed, swept or otherwise cleaned to remove all trash, debris and other deleterious substances which might affect the quality of either Heater-Remix or Heater-Repaving operations.

332.5 WEATHER RESTRICTIONS

332.5.1 Heater-Remix Resurfacing shall not be performed when rain, or the threat of rain is present. No work of this nature shall be performed, when the ambient temperature is below 50°F.

332.5.2 Heater-Repaving shall not be performed when rain, or the threat of rain is present. No work of this nature shall be performed, when the ambient temperature is below 50°F.

332.6 REJUVENATING AGENTS

Rejuvenating agents shall be as specified in the supplemental specifications and shall comply with Section 117 and shall only be used in conjunction with Heater-Remix operations, where so specified. Rejuvenating agents shall not be used in any Heater-Repaving operations.

332.7 HEATING AND REMIXING

The existing surface shall be uniformly heated and remixed to a depth specified by the ENGINEER. The remixed surface shall be left in an evenly-spread condition and aggregate shall not be pulverized; broken or spalled. This requirement applies to both Heater-Remix Resurfacing and Heater-Repaving. In addition, where Heater-Repaving is used, the surface temperature of the scarified, level mix shall not be less than 225°F to ensure a thermal bond with the overlay material which is placed immediately thereafter.

332.8 PROTECTION OF PAVEMENT

332.8.1 Heater-Remix Resurfacing work, where a bituminous overlay is included in the project, may be opened to Traffic after completion of the Heater-Remix portion of the work, to permit additional traffic compaction prior to placement of a hot-mixed, bituminous overlay. If requested by the CONTRACTOR and if approved by the ENGINEER, the treated pavement may be opened to traffic for a period not to exceed seven (7) calendar days before placement of the overlay material. If, in the opinion of the ENGINEER a tack coat is then warranted for the

SECTION 332

HEATER-REMIX RESURFACING AND HEATER-REPAVING

Heater-Remixed pavement, prior to overlay, the tack coat will be provided by the CONTRACTOR at no additional cost to the owner.

332.8.2 Heater-Repaving work will be opened to traffic as soon as is practicable after the finish-rolling of the mixture has been completed and the pavement has "cured" sufficiently, in the opinion of the ENGINEER, to receive normally-anticipated traffic loads. The "curing" period will never be less than 30 minutes from completion of rolling to opening for traffic.

332.9 MEASUREMENT AND PAYMENT

332.9.1 Heater-Remix Resurfacing will be measured by the square yard. Asphalt rejuvenating agent will be measured by the gallon based on rate of application specified by the ENGINEER. The CONTRACTOR will not be compensated for applications exceeding the approved rate in gallons per sq. yd. Bituminous overlay when specified, will be measured by the square yard.

332.9.2 Heater-Repaving will be measured by the square yard, complete, in place; including placement and compaction of overlay. Furnishing of hot mix and transportation of hot mix are not normally a part of the Heater-Repaving Contract.

332.9.3 Payment for Heater-Remix Resurfacing and Heater-Repaving will be at the unit cost per unit of measurement, as specified in the Bid Proposal.

SECTION 333

FOG SEAL COATS

333.1 GENERAL

Fog seal coats on bituminous-paved surfaces shall consist of the application of asphaltic material as specified in the Contract and a sand blotter when directed by the ENGINEER.

333.2 REFERENCES

333.2.2 This publication:

SECTION 113

333.3 TIME OF APPLICATION AND WEATHER CONDITIONS

333.3.1 Fog seal shall not be applied to asphaltic concrete surfaces unless called for by the ENGINEER for the correction of asphalt deficiencies or for the rejuvenation of old asphaltic concrete surfaces.

333.3.2 Asphaltic material shall be applied when the surface is dry or damp but not wet and when there is no threat of rain. The ambient temperature shall be at least 60 degrees F and rising and the application shall cease when the temperature is 60 degrees F and falling.

333.4 MATERIALS

Asphaltic materials shall be of the type, grade, and amount specified or shown on the plans and shall conform to the requirements of Section 113.

333.5 PREPARATION OF SURFACES

Immediately before applying the fog seal the area to be surfaced shall be cleaned of dirt and loose material. The fog seal shall not be applied until an inspection of the surfaces has been made by the ENGINEER and he has determined that the surfaces are suitable for application of the fog seal.

333.6 APPLICATION OF ASPHALTIC MATERIAL

The asphalt material, diluted to a minimum of one part emulsion and one part water, shall be applied at the rate of approximately 1 gallon per square yard. The exact amounts will be determined by the ENGINEER.

333.7 SAND BLOTTER

If there is an excess of asphalt, the treated area shall be covered with sand blotter applied in sufficient quantity to absorb such excess. After the treated area has been opened to traffic, any excess asphaltic material that comes to the

surface shall be immediately covered with additional sand.

333.8 PROTECTION OF ADJACENT PROPERTY

The fog seal shall be protected by barricades until the ENGINEER directs that the street is to be opened to traffic.

333.9 MEASUREMENT AND PAYMENT

333.9.1 Measurement for asphaltic material in place shall be measured by the square yard.

333.9.2 Measurement for sand blotter in place shall be measured by the square yard. The ENGINEER reserves the right to increase or to omit all or any part of the sand blotter.

333.9.3 Unit of payment will be as specified in the Bid Proposal.

SECTION 334

SEAL COATS

334.1 GENERAL

334.1.1 Seal coat and chips on bituminous paved surfaces shall consist of the application of asphaltic material and aggregate.

334.1.2 Precoated chip seal coat surfacing shall consist of the application of a bitumen together with a bitumen covered material aggregate to an existing asphaltic concrete surface.

334.2 REFERENCES

334.2.1 ASTM:

C131
C136

334.2.2 AASHTO:

T96
T104

334.2.3 This Publication:

SECTION 113

334.3 MATERIALS

334.3.1 ASPHALTIC MATERIAL

The asphaltic material shall be a rapid setting emulsified asphalt of the type, grade, and amount specified, or shown on the plans, and shall conform to the requirements of Section 113.

334.3.2 AGGREGATE

334.3.2.1 Mineral Aggregate: Mineral aggregate shall consist of crushed stone or crushed gravel, free from adherent fills of clay, and shall not be of such nature that a thorough coating of the bituminous material used in the work will not strip off upon contact with water.

334.3.2.2 Fractured Faces: Crushed gravel used as the seal coat aggregate shall have a minimum of 75 percent by weight of the plus No. 4 mesh aggregate with two or more crushed fractured faces.

334.3.2.3 Percent Wear: When tested in accordance with ASTM C 131 or AASHTO T 96, the percentage of wear shall not exceed 30.

334.3.2.4 Soundness: When tested in accordance with AASHTO T 104, the loss after 5 continuous cycles of the

plus No. 4 mesh aggregate based on the gradation of aggregate as received shall be 15 or less.

334.3.2.5 Gradation of Aggregates: The gradation of the aggregates for seal coat and chips or precoated chip seal coat shall be determined by ASTM C 136. The following gradations will apply:

334.3.2.5.1 For Streets and Parking Lots:

Sieve Designation	Percent by Weight Passing
	Square Mesh Sieves
3/8"	100
No. 4	0-10
No. 10	0-2

334.3.2.5.2 For Median Surfaces:

Sieve Designation	Percent by Weight Passing
	Square Mesh Sieves
5/8"	100
No. 4	0-12
No. 10	0-2

334.3.3 PRECOATED CHIPS: The aggregate specified shall be coated with asphaltic material, using 1 1/4 percent plus or minus 1/2 percent by total weight, as approved by the ENGINEER. Precoating shall be done by running the aggregate through a suitable pug mill where the aggregate and asphaltic material will be mixed.

334.4 EQUIPMENT

334.4.1 BITUMINOUS DISTRIBUTOR: The distributor shall have pneumatic tires of such width and number that the load produced on the surface shall not exceed 650 pounds per inch of the tire width. It shall be so designed and equipped as to distribute the bituminous material uniformly at even heat on variable widths of surface at readily determined and controlled rates ranging from 0.05 to 2.0 gallons per square yard, with a pressure range of from 25 to 75 pounds per square inch with an allowable variation from any specified rate not exceeding 5%. The distributor equipment shall include an independently operated bitumen pump, tachometer, pressure gauges, volume measuring devices, a thermometer for reading the temperature of tank content, and a hose attachment suitable for applying bituminous material to spots missed by the distributor. The distributor shall be equipped for circulation and agitation of the bituminous material during the heating process.

334.4.2 STORAGE TANKS: In the event storage tanks are used, an armored thermometer with a range from 100 degrees F to 400 degrees F shall be fixed to the tank so that

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SEAL COATS

the temperature of the bituminous material may be determined at all times.

334.4.3 MECHANICAL SPREADERS: Self-propelled mechanical spreaders shall be used. Mechanical spreaders shall be adjustable and capable of spreading aggregate at controlled amounts per square yard.

334.4.4 BROOM DRAGS: The broom drags shall consist of brooms of the street type, mounted in a frame in such a manner as to spread the aggregate uniformly over the surface of the area to be treated. The drags shall be equipped with the plates for towing. Towing equipment shall be pneumatic-tired.

334.4.5 POWER BROOMS AND POWER BLOWERS: Brooms and blowers of the power type shall be suitable for cleaning effectively the surfaces to be treated. For crack cleaning, a compressor of not less than 210 cfm shall be furnished complete with necessary tools.

334.4.6 RUBBER-TIRED ROLLERS: Rubber-tired rollers shall be of the self-propelled type weighing no less than 4 tons or more than 10 tons without ballast and consist of 2 axles on which are mounted not less than 9 pneumatic-tired wheels in such manner that the rear group of tires will not follow in the tracks of the forward group. The axles shall be mounted in a rigid frame provided with a loading platform or body suitable for ballast loading. The tires shall be uniformly inflated. The rollers shall be weighed as directed by the ENGINEER.

If required, one 10-12 ton tandem steel wheel roller shall be provided.

334.5 APPLICATION REQUIREMENTS

334.5.1 TIME OF APPLICATION AND WEATHER CONDITIONS:

Surface treatment materials shall be applied only when the surface is dry and when there is no rain or threat of rain. The ambient temperature at the time of application of surface treatment materials shall be at least 60 degrees F and rising, and the application of the bituminous seal coat shall cease when the temperature is 60 degrees F and falling. Application of the bituminous coat shall be controlled to the extent that any area to which it is applied can be completely covered by the required amount of aggregate while the seal coat is still hot.

334.5.2 PREPARATION OF SURFACES:

Immediately before applying the bituminous surface treatment, cracks shall be treated as shown on the plans and specifications. In all cases, care shall be taken to remove

all dirt, clay, and other loose or foreign matter. After the cleaning operation has been completed and prior to the application of any bituminous material, the area to be treated shall be inspected by the ENGINEER to determine its fitness for receiving the treatment and seal.

334.5.3 APPLICATION OF BITUMINOUS COAT:

The asphalt shall be applied as soon as possible after preparation of surfaces. At the time of application, temperatures of the asphalt shall be as directed by the ENGINEER. The asphalt shall be applied by means of a pressure distributor and shall be so applied that uniform distribution is obtained at all points of the surface to be sealed. Unless the distributor is equipped so as to obtain satisfactory results at the junction of previous and subsequent applications, building paper shall be spread on the surface for a sufficient distance back from the ends of each application so that flow through the sprays may be started and stopped on the paper and so that all sprays will be operating at full force on the surface to be treated. Immediately after the application, the building paper shall be removed. Any spots missed by the distributor shall be properly treated with a hand spray. Bitumen shall be applied as soon as possible after preparation of surfaces and at a rate of 0.30 to 0.45 gallon per square yard. The bituminous material shall be applied by means of a bituminous distributor. The bituminous material shall be applied at the pressure and in the amounts, within the limits specified, as determined by the ENGINEER. The bituminous material shall be so applied that uniform distribution is obtained over all points of the surface to be treated. Longitudinal laps may be made from 6 to 12 inches in width. The lapping or feathering of transverse joints will not be permitted. Metal sheets, building paper, or other approved methods shall be used in making transverse joints to provide a smooth uniform surface. Any method of applying bituminous materials or aggregate which produces ridges, grooves, or other uneven surfaces will not be permitted. All spots missed by the distributor shall be properly treated with bituminous material as directed by the ENGINEER. The length of application of bituminous material shall be that which can be completely covered by the required amount of aggregate before the asphalt emulsion has set.

334.5.4 APPLICATION OF AGGREGATE:

The aggregate shall be uniformly spread over the asphalt as soon as possible after application of the asphalt and before the temperature of the asphaltic material drops below the recommended spraying temperature. The aggregate shall be uniformly placed in quantities shown on the plans or as directed by the ENGINEER. Areas having insufficient cover shall be back-spotted or sprinkled with additional aggregate by hand during the operations whenever

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necessary. Aggregate shall be applied at a rate of 15 to 25 pounds per square yard.

334.5.5 BROOMING: After the finish rolling, excess aggregate shall be broomed to a smooth and uniform surface by the use of drag brooms. The loosening of embedded material by the operation of drag brooms will not be permitted.

334.5.6 PNEUMATIC-TIRED ROLLERS: Rolling with pneumatic-tired rollers shall begin immediately after application of the aggregate. The entire surface of the aggregate shall be rolled not less than 4 times. The pneumatic rollers shall operate at a speed not to exceed 8 miles per hour and shall be as specified in Subsection 335.7.1.

334.5.7 OTHER COMPACTION: In all places not accessible to the roller, the aggregate shall be adequately compacted with hand tampers. Hand tampers shall weigh not less than 25 pounds and shall have a tamping face area of not more than 50 square inches.

334.5.8 WORK COORDINATION: The rate of placement of materials and rolling operations shall be coordinated to produce a satisfactory surface treatment. The ENGINEER may suspend the work when any phase of the operation is being jeopardized. The work shall not be resumed until the CONTRACTOR has complied with the requirements provided and as authorized by the ENGINEER.

334.5.9 CLEANING, PROTECTING, AND SWEEPING: Any aggregate that becomes coated or mixed with dirt or any other foreign material shall be removed, replaced with clean aggregate, and rerolled, as directed by the ENGINEER. All surplus aggregate shall be swept off the surface and gutters and removed. The final cleanup shall include the cleaning out of all storm water catch basins and inlets adjacent to any seal coating operations. Such basins and inlets shall be covered during spraying and chip spreading operations. The CONTRACTOR will be required to maintain brooming and rolling operations throughout the job to insure coverage, prevent or correct bleeding, as may be required for a complete job. The CONTRACTOR shall clean splattered or splashed asphalt from all curb and gutter and other improvements and shall protect or coat traffic plates, manholes, valve boxes, and other surfaces not to receive seal coat.

334.6 PROTECTION TO ADJACENT PROPERTY

Care shall be taken to prevent the spraying of asphalt upon adjacent pavements and that portion of the street being used for traffic or structures, guard rails, guide posts, markers,

trees, shrubs and adjacent property, improvements, and facilities of all kinds. All structures, such as detector boxes, manhole covers, etc., within the paved area shall be protected by the application of paper or oil treatment.

334.7 MEASUREMENT AND PAYMENT

334.7.1 SEAL COAT AND CHIPS: Seal coat and chips shall be measured by the square yard as applied and accepted. Unit of payment will be as specified in the Bid Proposal.

334.7.2 PRECOATED CHIP SEAL COAT:

334.7.2.1 Precoated chips shall be measured by the ton. No separate measurement or payment will be made for bituminous materials used for precoating chips.

334.7.2.2 Asphalt material for seal coat shall be measured by the ton as applied and accepted.

334.7.2.3 Unit of payment will be as specified in the Bid Proposal.

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PAVING FABRIC INSTALLATION

335.1 GENERAL

This work shall consist of placing a paving fabric as part of a pavement rehabilitation project in compliance with the construction plans and these specifications.

335.2 REFERENCES

335.2.1 This publication

SECTION 119

335.3 MATERIALS

335.3.1 PAVING FABRIC: The paving fabric shall comply with Section 119.

335.3.2 TACK COAT: Tack coat may be 85-100 or 120-150 penetration asphalt, CSS-1 or SS-1 emulsified asphalt, or AC-5 or AC-10 asphalt.

335.4 CONSTRUCTION REQUIREMENTS

335.4.1 WEATHER LIMITATIONS: Paving fabric and tack coat shall not be placed if paving is not permitted and if the ambient air temperature is not at least 50 degrees F and rising or at least 55 degrees F.

335.4.2 FABRIC HANDLING EQUIPMENT: Mechanical laydown equipment shall be capable of laying the fabric smoothly without excessive wrinkles or folds.

335.4.3 SURFACE PREPARATION: Prior to tack coat application all cracks wider than 0.50 inches shall be sealed with an asphalt rubber crack sealant. All joints shall be cleaned out and sealed as specified on the plans.

335.4.4 APPLICATION AND PLACEMENT OF MATERIALS:

335.4.4.1 TACK COAT: Tack coat shall be applied in accordance with fabric manufacturer's recommendations. Tack coat width shall be equal to the fabric width. Additional tack coat equal to the optimum asphalt content required by the fabric shall be uniformly applied on the overlapped fabric joints.

335.4.4.2 PAVING FABRIC:

335.4.4.2.1 The CONTRACTOR shall have qualified, manufacturer-trained representatives to supervise placement of the paving fabric.

335.4.4.2.2 The paving fabric shall be stretched, aligned,

and placed entirely on the tack coat with a minimum of wrinkles and folds. Hand and mechanical brooming shall be effected to maximize the fabric contact with the tacked roadway surface. If folds in excess of 1/2 inch occur, the fabric shall be slit to remove the fold or wrinkle then overlapped in the direction of the paving.

335.4.4.2.3 All cutting or slitting of paving fabric shall be effected by a method approved by the ENGINEER. When cutting or slitting is employed, the ENGINEER will determine the additional amount of tack coat to be applied, to assure adhesion of the double fabric layer.

335.4.4.2.4 If manual placement methods are used, the fabric shall be unrolled, stretched, aligned, and placed in increments not exceeding 30 feet.

335.4.4.2.5 The fabric shall be rolled when required to seat the fabric to prevent movement and assure fabric saturation. Care shall be taken to avoid tracking plant mix bituminous pavement material onto fabric and to avoid distorting the fabric during rolling.

335.4.4.2.6 On transverse joints where the fabric is to be continued, a minimum overlap of 12 inches shall be provided at the joint between existing fabric and new fabric to be placed. On longitudinal joints where parallel strips of fabric are to be placed, the minimum overlap between the parallel strips shall be 6 inches.

335.4.4.2.7 If necessary, a small quantity of plant mix bituminous pavement material may be spread over the top of the fabric immediately in advance of the paving operation to prevent the fabric from being picked up by construction equipment.

335.4.4.2.8 No vehicle shall be allowed on the fabric, except rolling equipment (if fabric seating is necessary), equipment needed to spread the small quantity of plant mix bituminous pavement material on top of the fabric, paving equipment, and cross traffic. Prior approval by the ENGINEER shall be received before cross traffic is permitted.

335.4.5 PAVING OPERATIONS: Paving operations shall follow placement of the paving fabric within an hour or within 1/4 mile whichever is less.

335.5 MEASUREMENT AND PAYMENT

Measurement for paving fabric shall be by the square yard of area covered, and shall include installation and tack coat. No extra.

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336.1.1 GENERAL: Asphalt concrete pavement shall consist of a mixture of mineral aggregate and asphalt binder, placed and compacted on either a prepared subgrade, or base, or asphalt concrete pavement, in conformity with the lines, grades, and dimensions shown on the plans or as specified in the supplementary Specifications, and this specification. The asphalt concrete including materials, mixing, and hauling shall comply with the requirements of SECTION 116, SECTION 328, and SECTION 329, as applicable, and the supplementary technical specifications. The CONTRACTOR shall be solely responsible for the asphalt concrete pavement supplied under this specification, materials, proportioning, placement, and compaction.

336.1.2 For construction and reconstruction street projects requiring asphalt concrete pavement placement equal or greater than either 500 tons of asphalt concrete per day, the CONTRACTOR shall have a full time asphalt pavement construction supervisor on site to direct the asphalt concrete pavement construction during test sections and pavement construction operations. The supervisor shall be certified under the New Mexico State Highway and Transportation Department/Associated CONTRACTORS of New Mexico Technical Training and Certification Program for ASPHALT and SUPERPAVE.™ The supervisor shall be identified by the CONTRACTOR at the prepaving conference and shall be the contact person for the ENGINEER during asphalt concrete pavement construction. Supervisor certification shall be made available to the ENGINEER upon request.

336.1.3 At the direction of the ENGINEER, a prepaving Conference shall be held no later than seven calendar days prior to the start of asphalt concrete pavement construction. The meeting agenda/assigned responsibilities shall be accomplished at the conference.

I. ENGINEER/OWNER

- A. Scope of the project.
- B. Identify construction management team and contact telephone numbers.
- C. Review CONTRACT requirements for asphalt pavement construction.
- D. Review Quality Assurance Program.

II. CONTRACTOR

- A. Review pavement construction schedules.
 1. Test strip location and placement schedules.
 2. Proposed pavement construction schedule for

duration of the project.

- B. Identify construction personnel and contact telephone numbers.
 1. CONTRACTOR Staff
 2. Sub-CONTRACTOR(s)
 3. Supplier(s)
 4. Safety Manger
- C. Present construction placement procedure plans.
 1. Equipment Schedule
 2. Asphalt Concrete Job Mix Formula
 3. Paving methodology
 4. Traffic Control Plan
 5. Quality Control Plan

III. DISCUSSION AND COMMENT

336.2 REFERENCES:

336.2.1 This Publication:

SECTION 13 WARRANTY AND GUARANTEE;
TESTS AND INSPECTIONS;
CORRECTIONS, REMOVAL, OR
ACCEPTANCE OF DEFECTIVE
WORK.

SECTION 112 ASPHALT BINDER

SECTION 116 ASPHALT CONCRETE

SECTION 304 LIME TREATED SUBGRADE

SECTION 305 CEMENT TREATED BASE
CONSTRUCTION

SECTION 307 PLANT MIXED BITUMINOUS
TREATED BASE CONSTRUCTION

SECTION 328 QUIET ASPHALT CONCRETE
PAVEMENT

SECTION 329 PLANT MIXED SEAL COAT
CONSTRUCTION

SECTION 333 FOG SEAL COATS

336.3 MATERIALS

336.3.1 ASPHALT CONCRETE

Asphalt concrete shall be placed at the design proportions specified in the authorized job mix formula, within the specified production tolerances for combined aggregate gradation and asphalt binder content. Asphalt concrete placed at a project, sampled and tested in accordance with this specification, shall have a gradation that complies with the authorized design gradation \pm the production tolerance(s) specified in the authorized job mix formula. Asphalt concrete placed at a project, sampled and tested in accordance with this specification, shall have an

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asphalt content that complies with the design asphalt content $\pm 0.5\%$ (laboratory analysis).

336.3.2 PRIME AND TACK COAT

336.3.2.1 Prime coat shall comply with the requirements of Section 113. It shall be applied to subgrade, aggregate base course, and concrete treated base course a minimum of 12 hours prior to placing the asphalt concrete pavement, as directed by the ENGINEER. Traffic shall not be permitted on the prime coat prior to construction of the asphalt concrete pavement.

336.3.2.2 Immediately prior to prime coat application, an inspection of the surface shall be made by the ENGINEER. The surface to be primed shall be in a uniform and well compacted condition, true to grade and cross section. All loose and foreign material shall be removed by light sweeping prior to application. Loose material shall not be mixed with asphalt concrete.

336.3.2.3 Prime coat shall be applied uniformly at the rate of 0.10 to 0.30 gallon per square yard. It shall be applied when the air temperature is 40°F and rising, as authorized by the ENGINEER.

336.3.2.4 In order to prevent lapping at the joint of two applications, the distributor shall promptly shut off. A hand spray shall be used to touch up all spots missed by the distributor.

336.3.2.5 The pressure distributor used for applying prime coat material shall be equipped with pneumatic tires and shall be so designed and operated as to distribute the prime material in a uniform spray without atomization, in the amount and between the limits of temperature specified. It shall be equipped with a speed tachometer registering feet per minute and so located as to be visible to the truck driver to enable him to maintain the constant speed required for application at the specified rate.

336.3.2.6 The pressure distributor shall be equipped with a tachometer registering the pump speed pressure gauge, and a volume gauge. The rates of application shall not vary from the rates specified by more than 10 percent. Suitable means for accuracy indicating at all times the temperature of the prime material shall be provided. The thermometer well shall be so placed as not to be in contact with a heating tube.

336.3.2.7 The distributor shall be so designed that the

normal width of application shall be not less than 6 feet, with provisions for the application "of lesser width" when necessary. If the distributor is equipped with heating attachments, the prime coat material shall be circulated or agitated to provide the application temperature specified by the manufacturer.

336.3.2.8 If the prime coat has not been completely absorbed prior to the start of placing the asphalt concrete pavement, sufficient sand shall be spread over the surface to blot the excess and prevent tracking under traffic. Sand shall be applied as directed by the ENGINEER. Prior to placing the asphalt concrete pavement, loose or excess sand shall be swept from the base. If a sand cover is specified in the Supplementary Specifications or noted on the drawings to cover a prime coat, it shall be applied within 4 hours after the application of prime coat, as authorized by the ENGINEER.

336.3.2.9 A prime coat shall be prevented from spraying upon adjacent pavements, structures, guard rails, guide posts, culvert markers, trees, and shrubbery that are not to be removed; adjacent property and improvements; and other facilities or that portion of the traveled way being used by traffic.

336.3.2.10 The CONTRACTOR shall protect a prime coat against all damage and markings, both from foot and other traffic. Barricades shall be placed where necessary to protect a prime coat. Damaged prime coat shall be repaired by the CONTRACTOR, at his expense. Asphalt concrete pavement shall not be placed until a prime coat has been accepted by the ENGINEER.

336.4 TACK COAT:

336.4.1 If the asphalt concrete pavement is being constructed directly upon an existing hard surfaced pavement, a tack coat shall be evenly and uniformly applied to existing pavement preceding the placing of the asphalt concrete, as directed by the ENGINEER. The surface shall be free of water, all foreign material, or dust when the tack coat is applied. No greater area shall be treated in any one day than will be covered by the asphalt concrete during the same day. Traffic will not be permitted over tack coat.

336.4.2 Tack coat shall consist of cationic emulsified asphalt as specified in Section 113. Application rate shall be 0.03 to 0.12 gallon per square yard.

336.4.3 A tack coat shall be applied to the surface of

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any course if, in the opinion of the ENGINEER, the surface is such that a satisfactory bond cannot be obtained between it and the succeeding course.

336.4.4 The contact surfaces of all cold pavement joints, curbs, gutters, manholes, and the like shall be painted with a tack coat immediately before the adjoining asphalt concrete is placed. Surfaces where a tack coat is required shall be cleaned of all loose material before the tack coat is applied.

336.5 PLACEMENT

336.5.1 Asphalt concrete may be placed when the ground temperature is 40°F and rising and the weather is favorable, as authorized by the ENGINEER. Quiet asphalt concrete and plant mixed seal coat may be placed when the pavement temperature is 60 °F and rising, and the weather is favorable to construction, as authorized by the ENGINEER. Materials may not be placed in either wet weather, or on a wet or damp surface, or on frozen supporting material.

336.5.2 An asphalt concrete pavement lift shall be placed uniformly, at a temperature within the compaction range specified in the authorized job mix formula, without segregation, to such a depth that after compaction it will comply with the specified cross section and grade, specified in the plans and specifications. The temperature of the mat shall be in a uniform range of 15°F transverse the mat after placement behind the paver. Asphalt concrete shall be placed and compacted in uniform layers/lifts, $\pm 3/16$ inch in 10 feet of the lift finish grade. The compacted thickness of a layer/lift shall be equal or greater than two (2) times the maximum size aggregate but less than or equal 4.0 inches for a SP-II aggregate gradations. The compacted thickness of a layer/lift shall be equal or greater than two (2) times the maximum size aggregate, but less than or equal to 3 inches for Types SP-III, SP-IV, B, C, and D aggregate gradations. Pavement lift thickness(s) shall be selected to use the maximum size aggregate. Lift thickness(s) and asphalt concrete type, designating the maximum nominal size aggregate, shall be either specified in the CONTRACT documents, or as directed by the ENGINEER. SP-II gradation mixes shall not be used for the surface course.

336.5.3 Placement shall be continuous, without interruption. No greater amount of the mixture shall be delivered in any one day than can be placed, compacted and finished that same day.

336.5.4 No asphalt concrete surface course shall be placed which cannot be finished within daylight hours of the same day it is laid unless authorized by the ENGINEER.

336.5.5 In narrow, deep, irregular sections, intersections, turning radiuses, turnouts, cul de sacs, or driveways, where it is impractical to spread and finish the base and level the surface mixtures by machine methods, the CONTRACTOR may use placement equipment or acceptable hand methods, as authorized by the ENGINEER. The CONTRACTOR shall place material in lifts a specified and not exceed the limits of depth of the compaction equipment. Hand placed and compacted material shall be placed in lifts not greater than 2 inches maximum compacted depth. The finish surface shall be checked with a 10 feet straight edge, true and level to the adjacent asphalt concrete pavement. Humps shall be milled true and level and depressions shall be filled and finished to comply with this specification.

336.5.6 Pavement cuts of 10 feet or more in width and 100 feet or more in length must be paved with an approved bituminous paving machine. Asphalt concrete should be placed with a paving machine for all sections if a paver is available.

336.5.7 Depositing and spreading of the asphaltic concrete shall be accomplished by means of a bituminous paver except as specified in 336.5.4. Bituminous pavers shall be self contained, self propelled units, provided with an automated leveling activated screed or a strike off assembly, with heating capabilities, and capable of spreading and finishing courses of bituminous plant mix material in lane widths applicable to the lifts and thickness specified in the plans and specifications. Pavers shall be free of fluid leaks. Pavers detected to have leaks shall not be allowed on the project.

336.5.8 The paver shall be equipped with a receiving hopper having sufficient capacity for uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed. The hopper shall be operated at 50% or greater capacity during paving operations. Paving shall not be allowed when the hopper is at less than 50% capacity.

336.5.9 The screed or strike off assembly shall effectively produce a uniform surface and texture without tearing, shoving or gouging the mixture. The paver shall be operated at a forward speed consistent with satisfactory laying of the mixture.

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336.5.10 The paver shall be operated with an automatic leveling device controlled from an external guide, approved by the ENGINEER. The screed shall be zeroed by the CONTRACTOR on a template or blocks set to the same depth as the loose mat behind the paver, prior to start of placement of each lift of a material, as directed by the ENGINEER. Verification of the target loose lift thickness shall be made at regular intervals during the placement. The loose lift thickness, lift thickness behind the paver shall be defined by the CONTRACTOR and reported to the ENGINEER for reference prior to startup of a lift placement. Broadcasting of excess edge material over the surface of a precompacted lift shall not be permitted.

336.6 COMPACTION:

336.6.1 Asphalt concrete compaction shall begin when the asphalt concrete temperature is in the compaction temperature range specified in the authorized job mix formula. Compaction shall be completed before the temperature of the material cools to less than 200°F. Compaction may be allowed on material with a temperature less than 200°F and greater than 185°F, as authorized by the ENGINEER. Compaction on a lift shall not be allowed when the temperature of the lift is less than 185°F. The material shall be compacted to a density of at least 93% and not greater than 97% of the theoretical maximum density as determined by ASTM D2041. The CONTRACTOR shall be responsible for the development and implementation of the compaction program. A reference compaction program shall be defined by the CONTRACTOR and reported in writing to the ENGINEER for each job mix formula/lift thickness to be used on a project. Changes in the compaction program shall be reported to the ENGINEER as they may occur. Repair and replacement of damaged adjacent property and structures, resulting from the use of vibratory rolling equipment, shall be the responsibility of the CONTRACTOR, at no cost to the OWNER. A CONTRACTOR may construct a test strip, a minimum of 10 feet wide and 250 feet long, to establish the rolling pattern for an asphalt mix and lift thickness to be placed on the project, as directed by the ENGINEER. The test strip shall be paid for in accordance with the requirements of the CONTRACT, as authorized by The ENGINEER.

336.7 JOINTS

336.7.1 Care shall be exercised in connection with the construction of joints to insure that the surface of the pavement is true to grade and cross section across the

joint. Periodically, joints shall be tested with a 10 feet straight edge to verify the smoothness of the surfaces of adjacent material(s). A 10 feet long straight edge shall be placed perpendicular to the joint extending equally on both sides of the joint. The smoothness of the surfaces across the joint shall comply with the requirements of this specification.

336.7.2 After construction of a joint along any adjoining edge such as a curb, gutter, or an adjoining pavement lift free edge, and after the hot mixture is placed by the finishing machine, sufficient hot material shall be carried back to fill any space left open. This joint shall be properly "SET UP" with the back of a rake at proper height and level to receive the maximum compaction. The work of "setting up" this joint shall be performed by competent workmen who are capable of making a correct, clean, and neat joint. Excess material shall be removed. Broadcasting excess material onto the adjacent asphalt concrete pavement surface will not be allowed. Excess material at an edge joint shall be removed and discarded if not required for compaction.

336.7.3 Longitudinal and transverse joints shall be made in a careful manner. Well bonded and sealed joints are required. Joints between old and new pavements or between successive day's work shall be carefully made in such a manner as to insure a thorough and continuous bond between the old and new surfaces. In the case of surface course, the edge of the old surface course shall be cut back for its full depth so as to expose a fresh surface and, if necessary to obtain a well bonded joint, shall be painted with a tack coat after which the hot surface mixture shall be placed in contact with it and raked to a proper depth and grade. Before placing mixture against contact surfaces of curbs, gutters, headers, manholes, etc., they shall be painted with a tack coat. Joints shall be tested with a 10 feet straight edge to verify the smoothness of the surfaces transition of adjacent material(s). A 10 feet long straight edge shall be placed perpendicular to the joint extending equally on both sides of the joint. The smoothness of the surfaces across the joint shall comply with the requirements of this specification. Longitudinal and transverse joints shall be compacted parallel to the joint. Transverse and longitudinal joints shall be staggered a minimum of 1 foot offset from the joint of a lift either below or above, and completely bonded.

336.8 PAVEMENT PENETRATIONS, MANHOLES AND VALVE COVERS: Manhole frames and valve covers shall be adjusted as per the Standard Drawings, or as directed by the ENGINEER. The finish surface at the

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top of all asphalt concrete pavement penetrations, to include but not be limited to manhole frames and valve covers, shall be constructed to and be parallel in all directions the finish surface of the surrounding asphalt concrete pavement prior to placing the surface course.

336.9 SMOOTHNESS: Upon completion, the pavement shall be true to grade and cross section. Except any changes of grade, when a 10 foot straight edge is laid on the finished surface of the roadway, the surface shall not vary from the edge of the straightedge more than 3/16 inch. After the completion of final rolling, the smoothness of the course shall be checked, and the irregularities that exceed the specified tolerances and or retain water on the surface shall be corrected by the CONTRACTOR at the no cost to the OWNER, as directed by the ENGINEER.

336.10 SAMPLING AND TESTING

336.10.1 Asphalt concrete tests shall be performed in accordance with the requirements of this specification, the Supplemental Technical Specifications, or as directed by the ENGINEER. Asphalt concrete analysis shall be performed in a laboratory accredited in accordance with the requirements of the New Mexico State Highway and Transportation Department "Procedure for Approval of Testing Laboratories to Perform Inspection, Testing, and Mix Design Services", April 13, 1998 Edition. Testing equipment used in the performance of specified testing shall be calibrated annually with calibration standards traceable to the National Bureau of Standards. Certification records shall be maintained at the Laboratory for review by the ENGINEER. A copy of the certifications shall be submitted to The ENGINEER upon request. The sampling and testing shall be performed by a technician certified under the New Mexico State Highway and Transportation Department/Associated CONTRACTORS of New Mexico Technical Training and Certification Program for ASPHALT and SUPERPAVE.TM

336.10.2 Material Sampling: A quality assurance asphalt concrete material field sample shall be taken in accordance with the requirements of ASTM D979 for each job mix delivered. The materials shall be sampled at the greater rate of either one sample for each 250 tons, or one sample per day, for each type of material placed on a project, as directed by the ENGINEER. The sample shall be of such size to provide material for all tests specified and a split sample to perform verification/referee tests for gradation and binder content, if required.

336.10.3 Material Testing

336.10.3.1 Asphalt concrete quality assurance sampling and testing shall be performed in accordance with the requirements of this Specification, the Supplemental Technical Specifications, or as directed by The ENGINEER.

336.10.3.2 A quality assurance asphalt concrete sample shall be sampled, tested, and reported in accordance with the requirements and procedures of SECTION 116- ASPHALT CONCRETE, 116.10 SAMPLING AND TESTING.

336.10.3.3 A CONTRACTOR may challenge production material test results, binder content and aggregate gradation, and request that the retained split asphalt concrete sample of record be released to his assigned laboratory and tested for compliance, as authorized by the ENGINEER. A challenge notification shall be made in writing to the ENGINEER by the CONTRACTOR within 28 calendar days from date of sampling. Challenge test results shall be submitted to the ENGINEER for evaluation no later than 42 calendar days from date of sampling. Challenge test results will be evaluated in accordance with the "multi laboratory" precision tolerances specified, T53 for binder content, ASTM C117 and C136 for aggregate gradation. Challenge and record test results that comply with precision tolerances will be averaged with the companion test results of record and the material pay factor, P_{mf} , recalculated as directed by the ENGINEER. Challenge and record test results that do not comply with the precision tolerances will direct the disqualification of the challenged and record samples, as directed by the ENGINEER. Cut/core sample(s) will be taken from the area(s) represented by the disqualified challenge sample(s) and evaluated by the lab of record under the observation of the CONTRACTOR, in accordance with the requirements of these specifications and replace the disqualified sample test results. Analysis of the replacement cut/core sample(s) may not be challenged. The CONTRACTOR will submit challenge test results in writing to the ENGINEER for each split sample released to his assigned laboratory of record. Challenges filed after the time limitations will not be considered. The OWNER shall pay for all complying tests.

336.10.4 COMPACTION TESTING

336.10.4.1 Asphalt concrete pavement quality assurance compaction sampling and testing shall be performed in accordance with the requirements of this specification, the

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Supplemental Technical Specifications, as directed by The ENGINEER. Each lift, for each type of asphalt concrete pavement placed each day, shall be tested for compaction.

336.10.4.2 An asphalt concrete pavement compaction test shall be performed in accordance with the requirements of this specification, as directed by the ENGINEER. A test shall determine the compaction at a location of a fresh constructed asphalt concrete roadway lift. Compaction shall be calculated as the field density at a location of a LOT lift, determined by either 336.11.4.3 or 336.11.4.4, divided by the average of the maximum theoretical density (G_{mm}) of the acceptance sample(s) taken for that day's placement, reported to the nearest one tenth of a percent, xxx.x.%. A maximum theoretical density (G_{mm}) shall be determined in accordance with ASTM D2041.

336.10.4.3 The field density at a location for a lift of SP-II material shall be determined from a core sample. One core sample shall be taken for each lift of 250 tons, or fraction thereof, placed each day, but not less than 3 cores per day, as directed by the ENGINEER. The density of a core shall be determined in accordance with the requirements of D2726 and reported to the nearest one-tenth pound per cubic foot.

336.10.4.4.1 The field compaction at a location for Type B, C, D, E, SP-III, and SP-IV materials, shall be measured in accordance with the requirements of ASTM D2950 Density of Bituminous Concrete in Place by Nuclear Methods, at the minimum rate of three tests per lift of 500 sy, or fraction thereof, for each type of asphalt material placed in a day, as directed by the ENGINEER.

336.10.4.4.2 A reference density test of the support material, for the asphalt concrete roadway lift to be constructed, shall be taken prior to the placement of the fresh asphalt concrete lift, or defined from previous test results. The density of the support material shall be used as reference in performing the density test of a fresh asphalt concrete lift in accordance with the requirements ASTM D2950, placed over the support material. A density test of the support material shall be taken at the rate of one (1) test for each 500 sy of surface or less to be paved over in a day, as directed by the ENGINEER. The density of the support material shall be reported as "reference support material density" in the compaction test report of the constructed asphalt concrete pavement over the area represented by the support material compaction test.

336.10.4.4.3 Core samples of the compacted asphalt

pavement of SP-III, SP-IV, B, C, D, and E asphalt concrete, may be taken and tested to determine conformance of the finished pavement with the specified requirements either as requested by the CONTRACTOR, as directed by the ENGINEER. Samples shall be taken and tested in accordance with the requirements of 336.11.4.3, at the rate of three (3) core samples per LOT lift, as directed by the ENGINEER, and paid by the OWNER. Compaction determined from cores shall supersede tests performed in accordance with the requirements ASTM D2950. The CONTRACTOR shall be responsible for asphalt concrete pavement replacement at no cost to the OWNER where core samples are taken. The OWNER shall pay for all complying tests.

336.10.4.5 Field compaction tests shall be taken at random locations on an asphalt concrete pavement lift, as directed by the ENGINEER. Three (3) general areas at which a test should be taken are either adjacent to the free edge of the mat, or the mat interior, or adjacent to a joint. The number of tests taken will vary but the total number of tests taken on any project shall be in the approximate proportions specified in TABLE 336.A.

336.10.4.6 Sampling and testing of quiet asphalt concrete, and measurement and payment shall conform to the requirements of SECTION 328.

TABLE 336.A - Asphalt Concrete Pavement Lift
Compaction Test Location Proportions

Location	% of total tests
Free Edge of Mat ¹	20 to 33
Mat Interior	33 to 60
Joints ²	20 to 33

NOTES:

1 The free Edge of Mat test shall be taken in the area between one (1) foot and two (2) feet in from a free edge of a lift.

2 Joints shall include the longitudinal and transverse butt joints between adjacent lifts of asphalt having the same finish elevation. Tests may be taken on material placed against a cold joint edge of formed surface.

336.10.5 Full depth cores of asphalt concrete shall be taken to determine the depth of structure and the depth pay factor, PF_D , defined in TABLE 336.E, as directed by the ENGINEER. A minimum of three cores, having an outside diameter equal or greater than four (4) inches, shall be taken at random for each 1000 sy, or fraction thereof, placed. Cores shall be evaluated in accordance with the requirements of 336.12.2.3.4. The core length, depth of the pavement, shall be determined based on the

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average of three measurements of the length of the core, measured from circular ends of a sample. All measurements shall be reported to the nearest 0.125" (1/8 inch). Plant mixed seal coat shall not be included in the depth of structure.

336.10.6.1 Test reports shall include but not be limited to the information specified in TABLE 336.B.

TABLE 336.B - TEST REPORT(s)

A.	Field Data and Test Results:
1	Date of Sampling/Test
2	City of Albuquerque Project Number or Permit Number
3	Project Title
4	Asphalt Concrete Supplier
5	Delivery Ticket Number (asphalt concrete sample-only)
6	Job Mix Formula Number
7	Location of sample/test as defined by Contract Documents
8	Time of Sampling/testing
9	Material temperature at time of sampling, °F
10	Ambient temperature at time of sampling, °F
11	Field test results with reference specification limits (compaction test)
B.	Laboratory Test Results
1	Laboratory results as defined in TABLE 116.F (asphalt concrete material)
2	Field Test Data as required in 336.11.4 (compaction reports)
3	Pavement Structure Depth (individual cores and average depths for Lot)
C.	Recommended Pay Adjustment Factor for a LOT
1	C _{LM} , material factor, see TABLE 336.C
2	C _{LC} , placement/compaction factor, see TABLE 336.D
3	PF _D , depth factor, see TABLE 336.E

336.10.6.2 Test results shall be reported to The ENGINEER, CONTRACTOR, Supplier and OWNER, in writing, within 7 working days of completion of the sampling of the asphalt and/or the field testing. Non-complying tests shall be reported to The ENGINEER, CONTRACTOR, supplier and OWNER, within 1 working day of completion of the test.

336.10.6.3 The New Mexico Registered Professional

ENGINEER in direct charge of the laboratory shall certify on a quality assurance test report that the test procedures used to generate the report complied with the specifications.

336.11 MEASUREMENT AND PAYMENT:

336.11.1 Measurement: Asphalt concrete pavement shall be measured by the square yard of full depth pavement including each type and lift of material delivered, placed, compacted, and finished at the project, as specified in the CONTRACT DOCUMENTS. Asphalt concrete pavement shall be measured in a LOT, as directed by the ENGINEER. A LOT shall be 500 square yards, or fraction thereof, or as specified in the supplemental technical specifications, of constructed asphalt concrete pavement specified in the CONTRACT documents, to full depth over supporting materials of either subgrade, base course, treated base course, or existing asphalt concrete pavement, as directed by the ENGINEER. Each LOT shall be divided into SUBLOT(s) for each lift thickness of asphalt concrete in the pavement.

336.11.2 PAYMENT

336.11.2.1.1 Asphalt concrete pavement placed in an area of 10 feet or more in width and 100 feet or more in length (requiring machine laydown) shall be divided into LOTS and paid at the adjusted CONTRACT unit price, specified in this section, as authorized by the ENGINEER.

336.11.2.1.2 Asphalt concrete pavement placed in an area less than 10 feet in width and/or less than 100 feet in length shall be paid at the CONTRACT unit price specified in the CONTRACT documents, adjusted in accordance with the requirements of this section, as authorized by the ENGINEER.

336.11.2.1.3 A LOT of asphalt concrete pavement shall be paid at a unit price equal to the sum of the CONTRACT unit prices of its SUBLOTS, each lift of asphalt in a LOT, the sum adjusted for deviation of full depth of structure from CONTRACT specification. The unit price for a LOT shall be calculated in accordance with the equation below.

$$UP' = PF_D \times UP_{SUBLOTS}$$

UP', LOT unit price
 PF_D, depth factor defined in TABLE 336.D
 UP_{SUBLOTS}, UP'_{SL1} + UP'_{SL2} + ... + UP'_{SLN}, sum of SUBLOTS' unit prices, see 336.12.2.2

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336.11.2.2 A SUBLOT, a lift of asphalt concrete in a LOT, shall be paid at the adjusted CONTRACT unit price determined in accordance with the equation below.

$$UP'_{SLN} = F_N \times UP_{SLN}$$

F_N , 0.5 x (C_{LM} + C_{LC}), SUBLOT adjustment factor

C_{LM} , material factor, see TABLE 336.C

C_{LC} , placement/compaction factor, see TABLE 336.D

UP_{SLN} , CONTRACT unit price for a SUBLOT

336.11.2.2.2 The material factor, C_{LM} , is the material acceptance factor for a SUBLOT determined in accordance with TABLE 336.C, based on the absolute value of the deviation of the average value, or arithmetic mean (M), of the daily acceptance sample(s) test results for the SUBLOT, deviation from the CONTRACT authorized job mix formula targets(T), for either combined aggregate gradation or binder content.

336.11.2.2.3 If the deviation is equal or less than the allowable deviation, D' , the corresponding material pay factor, C_{LM} , shall be used.

336.12.2.2.4 The SUBLOT placement/compaction factor, C_{LC} , shall be defined in accordance with TABLE 336.D, as directed by the ENGINEER. The factor is determined based on the average of the compaction tests taken for a SUBLOT, with no single test neither less than 90.0 % nor greater than 97.9 %. Acceptance compaction tests shall be performed in accordance with the requirements of 336.11.4. A SUBLOT having a compaction test(s) either less than 90.0 % or greater than 97.9 % shall be evaluated and an appropriate pay factor assigned, as directed by the ENGINEER.

336.12.2.3.5 The depth factor, PF_D , shall be defined in accordance with TABLE 336.E, based on the average depth of a minimum of three full depth cores taken at random for each 1000 sy, or fraction thereof, with no single core less than the specified section depth less 0.75 in (19 mm), as directed by the ENGINEER. If a core(s) are identified at a depth of the specified depth less 0.75 in (19 mm), additional cores shall be taken to verify the condition. The condition shall be evaluated and either an appropriate pay factor assigned or the asphalt concrete pavement removed and replaced with complying pavement, as directed by the ENGINEER.

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TABLE 336.C - MATERIAL FACTOR, C_{LM} , FOR GRADATION & ASPHALT BINDER CONTENT

NUMBER OF DAILY SAMPLES	D' , MAXIMUM ALLOWABLE DEVIATION [1, 2, 3]		
1	1.40D	1.20D	D
2	$D + R$	$D + 0.37R$	$D - 0.10R$
3	$D + 0.30R$	$D + 0.07R$	$D - 0.14R$
4	$D + 0.16R$	$D - 0.01R$	$D - 0.17R$
5	$D + 0.11R$	$D - 0.03R$	$D - 0.20R$
6	$D + 0.09R$	$D - 0.05R$	$D - 0.22R$
7	$D + 0.07R$	$D - 0.07R$	$D - 0.24R$
8	$D + 0.06R$	$D - 0.08R$	$D - 0.25R$
9	$D + 0.05R$	$D - 0.09R$	$D - 0.26R$
10 OR MORE	$D + 0.04R$	$D - 0.10R$	$D - 0.27R$
MATERIAL FACTOR, C_{LM} [3]	0.85	0.95	1.00

[1] D , production tolerance \pm %, see 336.5.1.2, and authorized job mix formula; R , of test values, maximum - minimum values; M , average test value of a SUBLOT's acceptance samples test results; T , target value specified in authorized job mix formula.

[2] The material factor, C_{LM} , shall be the lowest factor selected for $|T-M| < D'$ calculated for either (a) the combined aggregate gradation and material passing the nominal maximum size aggregate screen, 3/8 inch (9.5 mm), and smaller screens of the project authorized job mix formula, or (b) the asphalt binder content.

[3] If the absolute value of the deviation of the daily mean from the target exceeds the maximum allowable deviation a SUBLOT, $|T-M| \geq D'$, the SUBLOT shall be removed and replaced with material complying with this specification, at no cost to the OWNER, as directed by the ENGINEER. If it is determined by the ENGINEER to be more practical to accept the SUBLOT material, it may be accepted under written agreement between the OWNER and the CONTRACTOR, at an assigned pay factor, $C_{LM} = 0.70$, for a SUBLOT having a compaction factor, $C_{LC} \geq 0.90$, as directed by the ENGINEER

TABLE 336.D - SUBLOT PLACEMENT/COMPACTION FACTOR, C_{LC}

Average Test Results	Factor, C_{LC}
98.0 % and greater	[1]
97.1 to 97.9	0.85
93.0 to 97.0	1.00
92.0 to 92.9	0.95
91.0 to 91.9	0.90 [2]
90.0 to 90.9	0.85 [2]
less than 90.0%	[1], [2]

[1] The lift defined for the SUBLOT shall be removed and replaced by the CONTRACTOR with asphalt concrete pavement complying with this specification at no cost to The OWNER, as directed by the ENGINEER. If it is determined by the ENGINEER to be more practical to accept the SUBLOT, it may be accepted under written agreement between the OWNER and the CONTRACTOR at an assigned compaction pay factor, $C_{LC} = 0.50$, for the SUBLOT, if the SUBLOT has a material pay factor, $C_{lm} \geq 0.85$, as authorized by the ENGINEER.

[2] When the lift accepted at this factor is a final surface course of a street having a posted speed limit less than 40 mph, the lift shall have a FOG SEAL applied and sanded by the CONTRACTOR in accordance with SECTION 333, at no cost to the OWNER, as directed by the ENGINEER.

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TABLE 336.E DEPTH FACTOR, PF_D

Deficient Pavement Depth					PF _D
0	≤	D _S -d _A	≤	0.25 in (6 mm)	1.00
0.25 in (6 mm)	<	D _S -d _A	≤	0.50 in (12.5 mm)	(d) ² / (D) ²
		D _S -d _A	>	0.50 in (12.5 mm)	[A]
Excessive Pavement Depth, d-D					PF _D
		D _S -d _A	<	0	1.00

NOTES:

d_A , average depth of the pavement structure as determined by field cores.

D_S , specified depth of the pavement structure of a Lot.

[A] Correct deficiencies at no cost to the OWNER, as directed by the ENGINEER, constructing the pavement to the depth, grade, crown, and cross slope drainage, specified in the CONTRACT documents.

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337.1 GENERAL: Portland cement concrete pavement shall consist of a mixture of portland cement, coarse and fine aggregate, class F fly ash, entrained air, and admixtures, placed and finished on either a prepared subgrade, or base in conformity with the lines, grades, depths and dimensions shown on the plans or as specified in the supplementary Specifications, and this specification. The CONTRACTOR shall be solely responsible for the portland cement concrete pavement construction supplied under this specification, materials, proportioning, placement, finish and curing. This work shall consist of constructing a pavement composed of portland cement concrete, in one course, with or without reinforcement as specified, in compliance with the specifications, lines, grades, depths, and typical cross sections shown on the plans or directed by the ENGINEER.

337.1.1 For construction and reconstruction street projects requiring pavement placement equal or greater than either 200 cy, concrete per day, the CONTRACTOR shall have a full time portland cement concrete construction supervisor on site to direct the pavement construction. The supervisor shall be certified as either an ACI certified Concrete Field Testing Technician Grade I, or the equivalent National Institute for Certification of Engineering Technologies Technician, with Specialty Concrete Work Elements Level I 82001, 82002, and Level II 84002, 84003, 84004, 84010. The supervisor shall be identified by the CONTRACTOR at the prepaving conference and shall be the contact person for the ENGINEER during portland cement concrete pavement construction.

337.1.2 Pre-Paving Conference
At the direction of the ENGINEER, a Pre-Paving Conference shall be held no later than seven calendar days prior to the start of pavement construction. The meeting agenda/assigned responsibilities shall be accomplished at the conference.

I. ENGINEER/OWNER

- A. Scope of the project.
- B. Identify construction management team and contact telephone numbers.
- C. Review CONTRACT requirements for pavement construction.
- D. Review Quality Assurance Program.

II. CONTRACTOR

- A. Review pavement construction schedules.
Proposed pavement construction schedule for duration of the project.
- B. Identify construction personnel and contact telephone numbers.
 1. CONTRACTOR Staff
 2. Sub-CONTRACTOR (s)
 3. Supplier (s)
 4. Safety Manger
- C. Present construction placement procedure plans.
 1. Equipment Schedule
 2. Portland Cement Concrete Design Mix
 3. Paving methodology
 4. Traffic Control Plan
 5. Quality Control Plan

III. DISCUSSION AND COMMENT

337.2 REFERENCES:

337.2.1 American Society for Testing and Materials (Latest Edition) (ASTM):

- C31 Making & Curing of Concrete Test Specimens in the Field
C39 Test for Compressive Strength of Cylindrical Concrete Specimens
C94 Specification for Ready-Mixed Concrete

337.2.2 This Publication:

SECTION 101 PORTLAND CEMENT CONCRETE
SECTION 102 STEEL REINFORCEMENT
SECTION 105 CONCRETE CURING COMPOUND
SECTION 107 JOINT FILLER AND SEALANT
MATERIAL
SECTION 302 BASE COURSE
SECTION 305 CEMENT TREATED BASE
SECTION 307 PLANT MIX BITUMINOUS
TREATED BASE
SECTION 349 CONCRETE CURING

337.3 MATERIALS:

337.3.1 The Portland cement concrete used in the pavement constructed under this section shall conform to the requirements of Section 101 or as specified by the plans and/or the Supplemental Technical Specifications.

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337.3.2 Steel reinforcement used in the concrete constructed under this section shall conform to the requirements of Section 102 or as specified by the plans and/or the Supplemental Technical Specifications and the approved shop drawings of the steel reinforcement.

337.3.3 Expansion joint material, fillers, and sealants used on the concrete constructed under this section shall conform to the requirements of Section 107 or as specified by the plans and/or the Supplemental Technical Specifications and the approved shop drawings, if required.

337.3.4 Liquid membrane forming compounds for curing concrete if used on the concrete constructed under this section shall conform to the requirements of Section 105 or as specified by the plans and/or Supplemental Technical Specifications.

337.4 PROPORTIONING:

337.4.1 Proportioning of Portland cement concrete used in pavements shall be as specified in Section 101 and specified in the plans and/or Supplemental Technical Specifications. The specific proportioning shall be specified in the mix design submittal provided by the CONTRACTOR to the ENGINEER and the concrete supplied to the project.

337.5 STRENGTH REQUIREMENTS:

337.5.1 Portland Cement Concrete Pavement shall comply with the requirements specified in the plans and/or specified in the Supplemental Technical Specification.

337.5.2 Portland cement concrete pavement may be opened to traffic after it has obtained 85% of the design strength specified or after 14 days, whichever comes first. The 85% of the design strength shall be verified in accordance with Section 101 by field cured concrete cylinders cured in the field the same as the concrete they represent.

337.6 CONSTRUCTION EQUIPMENT:

337.6.1 GENERAL: Equipment and tools necessary for handling materials and performing all parts of the work shall be approved by the ENGINEER as to design, capacity, and mechanical condition. The equipment shall be at the job site sufficiently ahead of the start of construction operations to be examined

thoroughly and approved.

337.6.2 SLIP FORM PAVERS:

337.6.2.1 Machines for placing and finishing concrete pavement shall be mechanical self propelled and self leveling, of approved types and shall be capable of compacting and finishing concrete as required. Slip form pavers shall be equipped with an adjustable template or reciprocating screed or screens arranged to strike off the pavement surface to the roadway crown or slope shown on the plans. The paver shall be equipped with vibratory assemblies, with or without tamping bars which operate over the full width of the surface being placed. When the forward motion of the paver is stopped, vibratory and tamping mechanisms shall also be stopped.

337.6.2.2 For pavers of the adjustable template type, with or without reciprocating screens, the vibratory assembly shall consist of internal spud type units spaced not more than 30 inches apart across the width of the paver under the leading edge of the fixed screed. Each vibratory unit shall be operated at a minimum rate of 7,000 impulses per minute.

337.6.3 CONCRETE SAW: The CONTRACTOR shall provide sawing equipment adequate in number of units and power to complete the sawing with a water cooled diamond edge saw blade or an abrasive wheel to the required dimensions and at the required time and rate. The CONTRACTOR shall provide at least one standby saw in good working order. An ample supply of saw blades shall be maintained at the site of the work at all times during sawing operation. The CONTRACTOR shall provide adequate artificial lighting facilities for night sawing. All of this equipment shall be on the job both before and continuously during concrete placement.

337.6.4 FORMS: Straight side forms shall be made of a metal having a thickness of not less than 7/32 inch and shall be furnished in sections not less than 10 feet in length. Forms shall have a depth equal to the specified, without horizontal joint, and a base width not less than 0.8 of the depth of the forms. Flexible or curved forms of proper radius shall be used for curves of 100 foot radius or less. Flexible or curved forms shall be of a design acceptable to the ENGINEER. Forms shall be provided with adequate devices for secure setting so that when in place they will withstand, without visible spring or settlement the impact and

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vibration of the consolidating and finishing equipment. Flange braces shall extend outward on the base not less than $\frac{2}{3}$ the height of the form. Forms with battered top surfaces and bent, twisted, or broken forms shall be removed from the work. Repaired forms shall not be used until inspected and approved. Built up forms shall not be used except where the total area of pavement of any specified depth on the project is less than 100 cy. The top face of the form shall not vary from a true plane more than $\frac{1}{8}$ inch in 10 feet, and the upstanding leg shall not vary more than $\frac{1}{4}$ inch. The forms shall contain provisions for locking the ends of abutting form sections together tightly, and for secure setting.

337.6.5 JOINT SEALING APPLICATORS:

Applicators for sealing materials shall be equipped with devices to mix, heat and apply joint sealers as required by the recommendations of the manufacturers of the material being used. Applicators shall be equipped with pressure type devices with adequate hose and a nozzle so that the specified shape factor may be constructed.

337.7 PREPARATION OF GRADE:

337.7.1 After the roadbed has been graded and compacted, the grade shall be trimmed to finish grade and cross section, extending the work at least 2 feet beyond each edge of the proposed concrete pavement.

337.7.2 The subgrade or aggregate base upon which the pavement is to be placed shall not vary more than ± 0.10 foot of the finish grade elevation and cross section specified prior to placing concrete. When cement or asphalt treated bases are used, finish grading shall be done at the time the base material is placed and shall be maintained to true section and grade until concrete placement is completed. The CONTRACTOR shall set reference lines, approved by the ENGINEER, parallel to the established grade as a means of grade control for subsequent finish grading operations.

337.8 SETTING FORMS:

337.8.1 BASE SUPPORT: The foundation under the forms shall comply with the requirements of Section 301, 302, 305, and 307 and the supplemental technical specifications, as applicable, so that the form, when set, will be firmly in contact for its whole length and at the specified grade. Any grade which at the form line is found below established grade shall be filled to grade with granular material in lifts of inch or less for a

distance of 18 inches on each side of the base of the form, and thoroughly compacted. Imperfections or variations above grade shall be corrected by tamping or by cutting as necessary.

337.8.2 FORM SETTING: Forms shall be set sufficiently in advance of the point where concrete is being placed to permit checking the forms for line and grade. After the forms have been set to correct elevations, the grade shall be thoroughly tamped, mechanically or by hand, at both the inside and outside edges of the base of the forms. Forms shall be staked into place with not less than 3 pins for each 10 foot section. A pin shall be placed at each side of every joint. Form sections shall be tightly locked, free from play or movement in any direction. The forms shall not deviate from true line by more than \pm one inch at any point. No excessive settlement or springing of forms under the finishing machine will be tolerated. Forms shall be cleaned and oiled prior to the placing of concrete.

337.8.3 GRADE AND ALIGNMENT : The alignment and grade elevations of the forms shall be checked. and corrections made by the CONTRACTOR immediately before placing the concrete. When any form has been disturbed or any grade is found unstable, the form shall be reset and rechecked.

337.8.4 CONDITIONING OF SUBGRADE OR BASE COURSE:

337.8.4.1 When side forms have been securely set to grade the distance from top of form to top of subgrade or base course shall be checked in all areas to be not less than the specified pavement depth nor greater than the pavement depth plus 0.5 in, and brought to proper cross section. High areas shall be trimmed. Low areas may be filled and compacted to a condition similar to that of surrounding grade.

337.8.4.2 Unless treated base course material is specified, the subgrade or base course shall be maintained in the specified compaction moisture range when pavement is to be placed within 24 hours of completion of subgrade preparation or aggregate base course construction. If the time to pavement construction exceeds 24 hours, the prepared subgrade or aggregate base course shall be prime coated by the CONTRACTOR at no cost to the OWNER.

337.9 PLACING CONCRETE:

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337.9.1 Concrete shall be placed on the prepared subgrade or aggregate base in uniform depth for the full width of the lane or area to be paved, without segregation, and to provide a minimum of redistribution. The placing of concrete in windrows or other methods which require excessive redistribution will be permitted for slip form pavement construction only. Placing concrete shall be continuous between transverse joints without the use of intermediate bulkheads.

337.9.2 When concrete pavement is to be placed adjoining newly constructed concrete pavement, the loading placed on the previously constructed pavement shall be limited to the following.

337.9.2.1 Light loading will be permitted 3 days after placement or when the pavement has reached 50% of its design strength, whichever comes first. Light loading is the placing and operating of the placement/finishing screed and other finishing bridges,

337.9.2.2 Heavy loads will not be permitted until 14 days after placement or until the concrete has reached 85% of its design strength, whichever comes first. Heavy loads are vehicles of any size.

337.9.3 Concrete shall be thoroughly consolidated against and along the faces of all forms and along the full length and on both sides of all joint assemblies, by means of vibrators inserted in the concrete. Vibrators shall not be permitted to come in contact with a joint assembly, the grade, or a side form. In no case shall the vibrator be operated longer than 15 seconds in any one location.

337.9.4 Concrete shall be deposited as near to expansion and contraction joints as possible without disturbing them, but shall not be dumped from the discharge bucket or hopper onto a joint assembly unless the hopper is well centered on the joint assembly.

337.9.5 Should any concrete materials fall on or be worked into the surface of a completed slab, the material shall be removed immediately by approved methods.

337.10 TEST SPECIMENS: The CONTRACTOR shall furnish the concrete for casting cylinders and other required tests. Concrete testing shall comply with the requirements of SECTION 101, as directed by the

ENGINEER. The ENGINEER or an independent testing laboratory designated by the ENGINEER shall fabricate and test specimens. Results shall be reported to the ENGINEER, CONTRACTOR, supplier of the concrete, and OWNER. Sampling and testing of smaller quantities of concrete used in minor paving work will be done as required by the ENGINEER.

337.11 JOINTS:

337.11.1 GENERAL: Joints shall be constructed of the type and dimensions, and at the locations required by the plans. Unless otherwise specified on the plans or approved by the ENGINEER, transverse and longitudinal contraction joints shall be constructed to the dimensions specified in the Contract Documents and at the locations shown on authorized joint plan prepared by the CONTRACTOR and authorized by the ENGINEER. Joints shall be complete from edge of slab to edge of slab. Where integral curb is constructed, the joint shall extend through the curb and have a depth not less than the sum of the height of the integral curb and one-third the depth of the pavement slab.

337.11.2 LONGITUDINAL JOINTS:

337.11.2.1 When required, deformed steel tie bars and load transfer smooth dowel bars, of specified length, size, spacing and material shall be placed perpendicular to the longitudinal joints; they shall be placed by approved equipment or rigidly secured by chairs or other approved supports to prevent displacement during concrete placement and finishing. Deformed tie bars shall not be painted or coated with asphalt or other material, or enclosed in tubes or sleeves. When adjacent lanes of pavement are constructed separately, steel side forms shall be used which will form a key way along the construction joint. Tie bars may be bent at right angles against the form of the first lane constructed and straightened into final position before the concrete of the adjacent lane is placed or, in lieu of bent tie bars, approved two piece connectors may be used.

337.11.2.2 Longitudinal formed joints shall consist of a groove, or cleft, extending downward from, and normal to, the surface of the pavement. These joints shall be effected or formed by an approved mechanically or manually operated device to the a depth of not less than one-third the depth of the associated pavement, by not greater than one-quarter inch width, and line specified

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in the authorized joint plan, while the concrete is in a plastic state. The groove, or cleft, shall be filled with either a premolded strip or an approved sealer. Joints shall be complete from edge of slab to edge of slab. Where integral curb is constructed, the joint shall extend through the curb and have a depth not less than the sum of the height of the integral curb and one-third the depth of the pavement slab.

337.11.2.3 The longitudinal formed joint filler material shall be installed so that its ends are in contact with the transverse joints filler material, if any.

337.11.2.4 Longitudinal sawed joints shall be cut by means of approved concrete saws to the depth of not less than one-third the depth of the associated pavement, by not greater than one-quarter inch width, and line specified in the authorized joint plan. Suitable guide lines or devices shall be used to assure cutting the longitudinal joint on the true line as shown on the authorized joint plans. The sawed area shall be thoroughly cleaned and cured immediately after sawing.

337.11.3 TRANSVERSE EXPANSION JOINTS:

337.11.3.1 The preformed expansion joint filler shall be continuous from form to form, shaped to the subgrade and to the keyway along the form. Preformed joint filler shall be furnished in lengths equal to the width of one traffic lane, except that when ramp or lane width is more than 12 feet, two pieces may be used provided the minimum length installed is six feet. Damaged or repaired joint filler shall not be used unless approved by the ENGINEER.

337.11.3.2 The preformed expansion joint filler shall be held in a vertical position. An approved installing bar, or other device, shall be used if required to secure preformed expansion joint filler at the proper grade and alignment during placing and finishing of the concrete. Finished joints shall not deviate more than one half inch in the horizontal alignment from a straight line. If joint fillers are assembled in sections, there shall be no offsets between adjacent units. No plugs of concrete shall be permitted anywhere within the expansion space.

337.11.4 TRANSVERSE CONTRACTION JOINTS:

337.11.4.1 Transverse contraction joints shall consist of planes of weakness created by forming or cutting

grooves in the surfaces of the pavement, and, when shown on the plans, shall include load transfer assemblies. Joints shall be complete from and through edge of slab to edge of slab. Where integral curb is constructed, the joint shall extend through the curb and have a depth not less than the sum of the height of the integral curb and one-third the depth of the pavement slab.

337.11.4.2 Preformed Transverse strip contraction joints shall be formed by installing a parting strip to be left in place. The strip shall form a groove or cleft to a depth not less than one third the depth of the pavement and not wider than one-fourth inch.

337.11.4.3 Formed groove contraction joints shall be made by depressing an approved tool or device into the plastic concrete. The tool or device shall remain in place until the concrete has attained its initial set and shall then be removed without disturbing the adjacent concrete, unless the device is designed to remain in the joint. The groove shall be to a depth not less than one-third the depth of the pavement and not wider than one-fourth inch.

337.11.4.4 Sawed contraction joints shall be created by sawing grooves in the surface of the pavement of the dimensions and at the spacing and lines shown on the plans with an approved concrete saw. After each joint is sawed, the saw cut and adjacent concrete surface shall be immediately cured. The saw cut shall be to a depth not less than one-third the depth of the pavement and not wider than one-fourth inch.

337.11.4.5 All joints shall be sawed before uncontrolled shrinkage cracking takes place. If necessary, the sawing operations shall be carried on both during the day and night, regardless of weather conditions. The sawing of any joint shall be omitted if a crack occurs at or near the joint location prior to the time of sawing. Sawing shall be discontinued when a crack develops ahead of the saw. All contraction joints in lanes adjacent to previously constructed lanes shall be sawed before uncontrolled cracking occurs. If extreme conditions exist which make it impractical to prevent erratic cracking by early sawing, a contraction joint groove shall be formed prior to initial set of concrete as provided in Subsections 337.11.4.2 or 337.11.4.3.

337.11.4.6 Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit sawing without excessive joint edge raveling, before

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transverse shrinking cracks occur.

337.11.4.7 Transverse formed joints shall comply with the requirements of Subsection 337.11.2.2 for the longitudinal formed joints.

337.11.4.8 Transverse construction joints shall be constructed at specified transverse joint locations specified in the authorized joint plan when there is an interruption of more than 30 minutes in the concreting operation. No transverse joint shall be constructed within 10 feet of an expansion joint, contraction joint, or plane of weakness. If sufficient concrete has not been mixed at the time of interruption to form a slab at least 10 feet long, the excess concrete back to the last preceding joint shall be removed and disposed of as directed by the ENGINEER.

337.11.5 JOINT CURING:

337.11.5.1 All joints sawed in concrete pavement shall be cured after the removal of resulting dust or slurry in accordance with the following optional methods.

337.11.5.2 A strip of curing paper, polyethylene or other suitable moisture retention material, at least six inches in width, shall be centered over the joint, weighted down for its full length with soil, sand or other material to hold it in place.

337.11.5.3 A filler of paper, jute rope, or other suitable material shall be forced into the joint and sprayed with curing compound.

337.11.5.4 A tape, at least 2-1/2 inches wide, made from curing paper, polyethylene or other suitable moisture retention material and provided with adhesive material near each edge which will seal the tape to the pavement, shall be centered over the joint, and at the slab edges extend the tape 2 inches below the saw cut.

337.11.5.5 The adhesive material shall be of a type which can readily be removed from the pavement upon completion of the curing.

337.11.5.6 Alternate or other methods for curing joints may be used when approved by ENGINEER. Methods shall satisfactorily prevent the escape of moisture from the concrete at the joint and leave no detrimental residue adhering to the pavement or joint surfaces. The CONTRACTOR shall clean joints of deleterious material by flushing with water, cleaning with air jets of

adequate pressure, or by resawing, at his expense, prior to placing the sealing material.

337.11.5.7 Regardless of the type of materials or methods used curing joints, the material or methods selected shall be applied to the joint immediately after the joint is sawed and shall remain in place for a minimum of 48 hours after which the joint shall be cleaned and sealed, as provided in Subsection 337.17.

337.11.6 LOAD TRANSFER DEVICES:

337.11.6.1 Dowels, when used, shall be held in position parallel to the surface and center line of the slab by a metal device that is left in the pavement. Dowels shall be located at the mid depth of a pavement slab, perpendicular and centered on the joint, aligned parallel to the longitudinal centerline of the pavement.

337.11.6.2 One-half the length of each dowel painted with one coat of lead or tar paint shall be thoroughly coated with asphalt MC 70, or an approved lubricant, to prevent the concrete from binding to that portion of the dowel. An approved dowel Cap or sleeve conforming to the requirements shall be furnished for each dowel bar used with the expansion joints. The caps or sleeves shall fit the dowel bar tightly and the closed end shall be water tight. The sleeved end of the dowel shall be lubricated as specified above.

337.11.6.3 In lieu of using dowel assemblies at contraction joints, dowel bars may be placed in the full thickness of pavement by a mechanical device approved by the ENGINEER.

337.12 FINISHING:

337.12.1 SEQUENCE: The sequence of finishing operations shall be strike off and consolidation, floating, straight edging, and final surface texturing. The addition of water to the surface of the concrete to assist in finishing operations will not be permitted. The humidity above the fresh concrete surface may be allowed to be improved with a fine fog spray generated by means of approved fogging equipment.

337.12.2 FINISHING AT JOINTS:

337.12.2.1 The concrete adjacent to formed joints shall be compacted or firmly placed without voids or segregation against the joint material, also under and around all load transfer devices, joint assembly units,

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and other features designed to extend into the pavement. Concrete adjacent to joints shall be mechanically vibrated.

337.12.2.2 After the concrete has been placed and vibrated adjacent to the joints, the finishing machine shall be brought forward, operating in a manner to avoid damage or misalignment of joints.

337.12.3 MACHINE FINISHING: Vibrators for full width vibration of concrete paving slabs shall meet the requirements in Subsection 337.6.2. If uniform and satisfactory density of concrete is not obtained by the vibratory method at joints, along forms, at structures, and throughout the pavement, the CONTRACTOR will be required to furnish equipment and methods which will produce pavement conforming to the specifications. During the first pass of the finishing machine, a uniform ridge of concrete shall be maintained ahead of the front screed for its entire length.

337.12.4 HAND FINISHING:

337.12.4.1 Hand finishing methods will not be permitted except under the following conditions:

337.12.4.2 In the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade when breakdown occurs. Hand tools shall have a length of not less than 3 feet and shall be floats or darbies only. Trowels, “fresno’s”, and slicks shall not be used.

337.12.4.3 Narrow widths or areas of irregular dimensions where operations of the mechanical equipment is impractical may be finished by hand methods. Concrete, as soon as placed, shall be struck off and screeded. An approved portable screed shall be used.

337.12.4.4 The screed for the surface shall be at least 2 feet longer than the maximum width of the slab to be struck off. It shall be of approved design, sufficiently rigid to retain its shape without deflection, and be constructed either of metal or of other suitable material shod with metal. Prior to operating a hand screed, the screed shall be set on the forms and the distance from the bottom of the screed and the top of finish subgrade or base, full width of the formed pavement section, shall be checked to be at least equal to the depth of the pavement slab to be constructed and not greater than

the sum of the depth of the pavement slab plus one-half inch. If a uniform cross section cannot be attained by the screed, it may not be used for the construction.

337.12.4.5 Consolidation shall be attained by the use of a suitable internal type vibrator or other approved equipment.

337.12.4.6 In operation the screed shall be moved forward on the forms with a combined longitudinal and transverse shearing motion, moving always in the direction in which the work is progressing and so manipulated that neither end is raised from the side forms during the striking surface is of uniform texture, true to grade and cross section, and free from porous areas. Vibratory and roller screeds shall be drawn forward in the vibrating and rolling off process. If necessary, this shall be repeated until the action mode. Transverse movement is not required for vibratory and roller screeds.

337.12.5 FLOATING:

337.12.5.1 After the concrete has been struck off and consolidated, it shall be further smoothed, trued, and consolidated by means of a longitudinal float, using one of the following methods as specified or permitted. A transverse and or longitudinal float shall be required for all pavement whether finishing is accomplished by hand methods, with a slip form machine or with fixed forms, except as hereinafter provided.

337.12.5.2 The requirements for floating may be waived for the slip form method of placement if it is successfully demonstrated that a satisfactory surface is being obtained by other means.

337.12.5.3 Hand Method: The hand operated transverse float shall be not less than 12 feet in length and 6 inches in width, properly stiffened to prevent flexibility and warping. The float shall be worked with a sawing motion transverse the slab from edge to edge. Movement ahead along the center line of the pavement shall be in successive advances of not more than one half of the length of the float.

337.12.5.4 Mechanical Method: The mechanical float shall be of a design approved by the ENGINEER, and shall be in good working condition. The tracks from which the float operates shall be accurately adjusted to the required finish pavement surface profile. The forward speed shall be adjusted so that the float will lap

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the distance as directed by the ENGINEER. The float shall pass over each area of pavement until the surface is uniformly closed.

337.12.5.5 Alternative Mechanical Method: As an alternative to the mechanical method above, the CONTRACTOR may use a machine composed of a cutting and smoothing float, or floats, suspended from and guided by a rigid frame. The frame shall be carried by four or more visible wheels or tracks. When strike off and consolidation are done by the hand method and the crown of the pavement will not permit the use of the longitudinal float, the surface shall be floated transversely by means of the long handled float. Care shall be taken not to work the crown out of the pavement during the operation.

337.12.6 STRAIGHTEDGE TESTING AND SURFACE CORRECTION: After the floating has been completed, but while the concrete is still plastic, the surface of the concrete shall be trued with a 10 foot (3.0 m) straight edge. For this purpose the CONTRACTOR shall furnish and use an accurate 10 foot (3.0 m) straightedge. The straightedge shall be drawn transverse across the surface of the concrete pavement from edge to edge. Advance along the road shall be in successive stages of not more than $\frac{1}{2}$ the length of a straightedge. Any depressions found shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the requirements for smoothness. Straightedge trueing and surface corrections shall continue until the entire surface is found to be free from observable departures from the straightedge and the slab conforms to the required grade and cross section. If a slip form paver is used, the maximum deviation from a true cross section within the area bounded by lines 6 inches from the edges of the pavement shall be $\frac{1}{4}$ inch. Additional floating, edging and surface work, except texturing shall not be allowed after the surface has been trued with the straight edge.

337.12.7 FINAL FINISH: The final finish shall be one of the following:

337.12.7.1 The surface texture is to be a longitudinal drag finish except at intersections, and approaches and departures to intersections. A drag shall consist of a seamless strip of damp burlap, cotton fabric or other material approved by the ENGINEER, which shall

produce a uniform surface of gritty texture after dragging it longitudinally along the full width of pavement. The dimensions of the drag shall be such that a strip of burlap or fabric at least 3 feet wide is in contact with the full width of the pavement surface while the drag is used. The drag shall consist of not less than 2 layers of burlap with the bottom layer approximately 6 inches wider than the upper layer. The drag shall be maintained in such condition that the resultant surface is of uniform appearance and reasonably free from grooves over $\frac{1}{16}$ inch in depth. Drags shall be maintained clean and free from encrusted mortar. Drags that cannot be cleaned shall be discarded and new drags substituted.

337.12.7.2 The surface texture at intersections, and a minimum of 100 feet of approaches and departures to intersections shall be a transverse rake tine grove or similar finish as authorized by the ENGINEER. The grove shall be at one eighth to one quarter inch wide by one eighth to three sixteens inch deep. The groves shall be spaced not less than two times the grove width and not more than 6 times the grove width. A tine float shall not be used. Transverse tine grooving of the highest traffic street shall be carried through the intersection.

337.12.8 EDGING AT FORMS AND JOINTS:

337.12.8.1 Edging shall be completed prior to straight edge trueing of the surface, but before the concrete has taken its initial set, the edges of the pavement along each side of each slab, and on each side of transverse expansion joints, formed joints, transverse construction joints, and emergency construction joints shall be worked with an approved tool and rounded to the radius required by the plans. A well defined and continuous radius shall be "produced and a smooth, dense mortar finish obtained. The surface of the slab shall not be unduly disturbed by tilting of the tool during use.

337.12.8.2 At all joints, all tool marks appearing on the slab adjacent to the joints shall be eliminated by texturing. The rounding of the corner of the slab shall not be disturbed. All concrete on top of the joint filler shall be completely removed.

337.12.8.3 All joints shall be trued with a straightedge bisected by and drawn parallel to the joint before the concrete has set, and correction made if one side of the joint is higher than the other, or if they are higher or lower than the adjacent slabs. The joint shall be straight

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edge trued after correction and prior to texturing.

337.13 CONCRETE PAVEMENT SLIP FORM METHOD:

337.13.1 GENERAL: Pavement may be constructed without the use of fixed forms by the slip form method as authorized by the ENGINEER.

337.13.2 GRADE: After the grade or base has been placed and compacted to the required density, the areas which will support the paving machine shall be cut to the proper elevation by means of a properly designed machine. The grade on which the pavement is to be constructed shall then be brought to the proper profile by means of a properly designed machine. If the density of the base is disturbed by the grading operations, it shall be corrected by additional compaction before concrete is placed. The grade should be constructed sufficiently in advance of the placing of the concrete. If any traffic is allowed to use the prepared grade, the grade shall be checked and corrected immediately ahead of the placing of the concrete.

337.13.3 ALIGNMENT: The horizontal alignment of full width slabs shall not deviate from the line shown on the plans or established by the ENGINEER by more than one half (½) inch at any point.

337.13.4 PLACING CONCRETE: The concrete shall be placed with an approved slip form paver designed to spread, consolidate, screed, and float finish the freshly placed concrete in one complete pass of the machine or machines in such manner that a minimum of hand finish will be necessary to provide a dense and homogeneous pavement in conformance with the plans and specifications. The machine shall vibrate the concrete for the full width and depth of the strip of pavement being placed. Such vibration shall be accomplished with vibrating tubes or arms working in the concrete or with a vibrating screed or pan operating on the surface of the concrete. The sliding forms shall be rigidly held together laterally to prevent spreading of the forms. The concrete shall be held at a uniform consistency, having a slump which lies within the range of 1 to 2-1/2 inches. The slip form paver shall be operated with as nearly a continuous forward movement as possible and all operations of mixing, delivering, and spreading concrete shall be so coordinated as to provide uniform progress with stopping and starting of the paver held to a minimum.

If, for any reason, it is necessary to stop the forward movement of the paver, the vibratory and tamping elements shall also be stopped immediately.

337.13.5 FINISHING: The surface smoothness and texture shall meet the requirements of Subsection 337.12.7.

337.14 SURFACE TEST:

337.14.1 The pavement surface shall be tested with a 10 foot straightedge or other device approved by the ENGINEER. Areas showing high spots of more than 1/8 inch but not exceeding ½ inch in 10 feet shall be marked and immediately ground down with an approved grinding tool to an elevation where the area or spot will not show deviations in excess of 1/8 inch when tested with a 10 foot straightedge. Where the departure from correct cross section exceeds ½ inch, or where irregularities in the finished surface of the pavement vary more than ½ inch above or ½ inch below the grade elevation established by the ENGINEER, the pavement shall be removed and replaced by the CONTRACTOR at no expense to the OWNER.

337.14.2 Any area or section so removed shall be removed as a panel from transverse joint to transverse joint, the full width of the lane involved.

337.15 CURING: Immediately after the finishing operations have been completed the CONTRACTOR shall initiate the curing of the concrete as specified in Section 349 and/or as approved by the ENGINEER.

337.16 REMOVING FORMS: Unless otherwise provided, forms shall not be removed from freshly placed concrete until it has been set for at least 12 hours, except auxiliary form used temporarily in widening areas. Forms shall be removed carefully so as to avoid damage to pavement. After the forms have been removed, the sides of the slabs shall be cured as outlined in Section 349. Honeycombed areas will be considered as defective work and shall be removed and replaced. Any area or section so removed shall be removed as a panel from transverse joint to transverse joint, the full width of the lane involved.

337.17 SEALING JOINTS:

337.17.1 Joints shall be filled with joint sealing material before the pavement is opened to traffic and as

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soon after completion of the curing period as is feasible. Just prior to sealing, each joint shall be thoroughly cleaned of all foreign material, including membrane curing compound and the joint faces shall be clean and surface dry when the seal is applied.

337.17.2 The sealing material shall be applied to each joint opening to conform to the details shown on the plans and the manufacturer's recommendation for the authorized sealant. The placing shall be done in such a manner that the material will not be spilled on the driving surfaces of the concrete. Any excess material on the driving surface of the concrete pavement shall be removed immediately and the pavement surface cleaned. The use of sand or similar material as a cover for the seal will not be permitted. Joint sealing material shall not be placed when the air temperature in the shade is less than 50°F., unless approved in writing by the ENGINEER. A backer rod or form shall be used and placed at the specified depth as the bottom form for the sealant. The backer rod shall be compatible with the sealant material and maintain its shape and cross section after placement of sealant.

337.17.3 The joint sealant detail shall be used at all sawed/embedded traffic control devices. The joints and sealants shall be constructed as specified.

337.18 PROTECTION OF PAVEMENT:

337.18.1 The CONTRACTOR shall protect the pavement and its appurtenances against both public traffic and traffic caused by his own employees and agents. This include watchmen and the erection and maintenance of warning signs, lights, pavement bridges, or crossovers, etc.

337.18.2 Any damage to the pavement, occurring prior to final acceptance, shall be repaired or the pavement replaced by the CONTRACTOR at no expense to the OWNER, as directed by the ENGINEER.

337.19 OPENING TO TRAFFIC: The pavement will not be opened to traffic until the pavement has met the strength requirements of Subsection 337.5. The pavement shall be cleaned of all loose material and debris, striped for traffic control prior to opening to traffic.

337.20 PROTECTION AGAINST RAIN: In order that the concrete may be properly protected against the effects of rain before the concrete is sufficiently

hardened, the CONTRACTOR will be required to have available at all times materials for the protection of the edges and surface of the unhardened concrete. When rain appears imminent, all paving operations shall stop and all available personnel shall begin placing forms against the sides of the pavement and covering the surface of the unhardened concrete with the protective covering.

337.21 DISCONTINUE PAVING OPERATIONS:

When the surface finish of completed pavement is not in accordance with Subsection 337.14 or an excessive number of surface irregularities are detected when the completed pavement is tested in accordance with Subsection 337.14, or the edge of the pavement slumps more than 1/4 inch below the established cross section, or other recurring defects are apparent on successive working days, paving operations shall be discontinued as directed by the ENGINEER. Suitable equipment and methods shall be provided by the CONTRACTOR to correct the deficiencies at no cost to the OWNER.

337.22 TOLERANCE IN PAVEMENT THICKNESS:

337.22.1 Full depth cores shall be drilled by the CONTRACTOR and submitted to the ENGINEER, in pavement to verify constructed pavement depth. Cores shall be drilled at not less than two nor more than four locations for each Lot, 100 cy, as directed by ENGINEER. Pavement depth for a lot will be the average of the cores taken in the Lot. The depth of the pavement at a core location shall be the average of four measurements of the homogeneous length of the core taken at right angles around the core circumference, as directed by the ENGINEER. The CONTRACTOR shall patch the core holes with the authorized design mix placed in the surrounding pavement.

337.22.2 Where the structural strength of the concrete is seriously affected by the deficiency in thickness, the ENGINEER may order the removal and replacement of the work so affected at no additional expense to the OWNER.

337.23 STRENGTH TEST REQUIREMENTS

Minimum strengths which must be achieved for acceptance are those set forth in Subsection 337.5, STRENGTH REQUIREMENTS.

337.24.1 MEASUREMENT: Portland cement concrete pavement shall be measured by the square yard per each thickness specified on the plans and in the bid

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proposal.

337.24.2 PAYMENT: The payment for Portland Cement Concrete Pavement shall be at the adjusted contract unit price per square yard for each pavement thickness specified, complete in place, adjusted in accordance with the following equation, and this specification, as authorized by the ENGINEER. Payment shall include all material, equipment and labor required in placing, finishing, curing, backfilling and cleanup.

$$UP' = PF_M \times PF_D \times UP$$

UP', adjusted contract unit price

UP, contract unit price

PF_M, material price adjustment,

see SECTION 101.16.2

PF_D, see 327.24.3

337.24.3 The depth factor, PF_D, shall be defined in accordance with TABLE 337.24.3.A, based on the average of a minimum 3 full depth cores taken in each lot of 1000 cy, as directed by the ENGINEER. The depth of the pavement at a core location shall be the average of three measurements of the homogeneous length of the core taken at right angles around the core circumference, as directed by the ENGINEER.

TABLE 337.24.1 DEPTH FACTOR, PF_D

Deficient Pavement Depth, D-d					PF _D
0	≤	D-d	≤	0.25 in	1.00
0.25 in	<	D-d	≤	0.50 in	(d) ² / (D) ²
0.50 in	<	D-d	≤	1.00 in	[A] or [B], [C]
		D-d	>	1.00 in	[A]
Excessive Pavement Depth, D-d					PF _D
0	<	d-D	≤	1.00 in	1.00
		d-D	>	1.00 in	[E] or [F]

NOTES:

- d, average depth of the pavement structure of a Lot as determined by field cores.
- D, specified depth for the pavement structure of a Lot.
- A. Remove and replace at no cost to the OWNER, as directed by the ENGINEER.
- B. If determined by the ENGINEER to be more practical to accept the pavement, the LOT may be accepted under written agreement between the OWNER and the CONTRACTOR, at an assigned pay factor.
PF_D = (d)² / (D)², for LOT(s), as directed by the ENGINEER.
- C. No single core height less than the specified depth less 1.25 in.
- E. Remove and replace at no cost to the OWNER, if excessive uncontrolled cracking is observed, as directed by the ENGINEER.
- F. If determined by the ENGINEER to be more practical to accept the pavement, the LOT may be accepted under written agreement between the OWNER and the CONTRACTOR, at an assigned pay factor of PF_D = 1.00, as directed by the ENGINEER.

SECTION 340

PORTLAND CEMENT CONCRETE CURBS, GUTTERS, WALKS, DRIVEWAYS, ALLEY INTERSECTIONS, SLOPE PAVING, AND MEDIAN PAVING

340.1 GENERAL:

340.1.1 Portland cement concrete curbs, walks, gutters, cross gutters, valley gutters, driveways, alley intersections, slope paving and median paving constructed of concrete having a minimum compressive strength as specified in Section 101, unless otherwise noted on the plans or specified in the Supplementary Technical Specifications.

340.1.2 Subgrade preparation for concrete curbs, gutters, walks, driveways, alleys, intersections, and slope paving conform to the requirements of Section 301, unless otherwise noted on the plans or specified in the Supplementary Technical Specifications.

340.1.3 Unless otherwise specified or indicated on the plans and except as otherwise prescribed in Subsection 340.8, the minimum thickness of walks shall be 4 inches. The minimum thickness of gutters, driveway aprons, and alley intersections shall be 6 inches unless otherwise shown on the plans. The height and thickness of the curb section including other details of construction for items in Section 340 will be shown on the plans, or Standard Detail Drawings.

340.2 REFERENCES:

340.2.1 American Society for Testing and Materials (Latest Edition) (ASTM):

D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort

340.2.2 This Publication:

SECTION 101 PORTLAND CEMENT CONCRETE
SECTION 102 STEEL REINFORCEMENT
SECTION 105 CONCRETE CURING COMPOUND
SECTION 107 JOINT FILLER AND SEALANT
MATERIAL
SECTION 301 SUBGRADE PREPARATION
SECTION 337 PORTLAND CEMENT CONCRETE
PAVEMENT
SECTION 349 CONCRETE CURING

340.3 FORMS:

340.3.1 Form material shall be free from warp, with smooth and straight upper edges and, if used for the face

of curb, shall be surfaced on the side against which the concrete is to be placed. Timber forms may be used for forming curved sections but shall not be used for straight work unless authorized in writing by the ENGINEER. Metal forms for such work being of a gauge that will provide proper rigidity and strength for the purpose for which they are intended. Wood forms used on curb returns shall be not less than 3/4 of an inch in thickness, cut in the length and radius as shown on the plans and held rigidly in place by the use of metal stakes and clamps. The curb face forms shall be cut to conform exactly with the curb face batter, as well as being cut to the required length and radius. In every case, however, the forms shall be of sufficient rigidity and strength and shall be so supported as to adequately resist springing or deflection as a consequence of the placing and consolidation of the concrete.

340.3.2 All formed curb and combined curb and gutter shall be divided into blocks or stones in lengths not to exceed 12 feet long using metal templates' not less than 1/16 inch thick cut to the same cross section as the curb or curb and gutter being constructed. Templates shall be securely attached to forms to prevent movement during concrete placement.

340.3.3 Form material shall be thoroughly clean at the time it is used and shall be given a coating of light oil or other suitable material immediately prior to the placing of the concrete.

340.3.4 Forms, except curb back planks, shall be set with the upper edges thereof flush with the specified grade of the finished surface of the adjacent portion of the work and shall be not less than a depth equivalent to the full specified depth of thickness of the concrete to be supported thereby.

340.3.5 Back forms shall be held securely in place by means of stakes driven in pairs, one at the front form and one at the back, at intervals not to exceed 4 feet; clamps, spreaders, and braces being used in connection therewith to such extent as may be necessary to insure proper rigidity of the forms. Forms for walks, gutters, and similar work shall be firmly secured by means of stakes driven flush with the upper edge of the forms at intervals not to exceed 5 feet. The stakes shall be of sufficient size and shall be so driven as to properly and adequately support the forms.

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340.3.6 Form clamps, specifically designed and manufactured for the curb and gutter to be constructed, may be used if, in the opinion of the ENGINEER, they fulfill the requirements above specified for curb and gutter forms.

340.4 PLACING CONCRETE:

340.4.1 The concrete shall be placed on a thoroughly dampened subgrade sufficiently moist to insure that no moisture will be absorbed from the fresh concrete.

340.4.2 Surfaces of structures in sidewalks, curbs, and gutters shall be adjusted as necessary prior to placing of concrete to meet the contiguous sidewalk surfaces.

340.4.3 Concrete shall be placed in horizontal layers not to exceed 6 inches each in thickness, each layer being spaded along the forms and thoroughly consolidated. However, if the section is more than 6 inches in depth, the concrete may be placed to provide the thickness shown or specified, if mechanical internal vibrators are used or if, in the opinion of the ENGINEER, the spading and tamping is sufficient to consolidate the concrete for its entire depth.

340.4.4 After the concrete has been placed between the side forms, a strike off shall be used to bring the surface to the proper section to be compacted. It shall then be spaded along the form faces.

340.4.5 After the concrete has been placed and consolidated, the upper surface shall be struck off uniformly smooth and true to the specified grade.

340.5 EXPANSION JOINTS:

340.5.1 Expansion joints shall be constructed in curbs, walks, and gutters as hereinafter specified, being filled with premolded joint filler strips conforming with the requirements prescribed therefor in Section 107. No such joints shall, however, be constructed in cross gutters, alleys, intersections, or driveway aprons.

340.5.2 Spacing: Unless otherwise shown on the plans or authorized by the ENGINEER, the location and spacing of expansion joints shall be as specified in the Standard Detail Drawings and herein.

340.5.2.1 Expansion joints in all types of curb and gutters shall be placed at both ends of returns except

where cross gutters are being constructed, and at regular intervals not to exceed 200 feet between expansion joints. Expansion joints shall be placed at both ends of the cross gutter transitions.

340.5.2.2 Expansion joints in all types of sidewalk shall be placed where the sidewalk abuts Wheel Chair Ramps and drivepads; at regular intervals not exceeding 18 feet between expansion joints; between the walk and any building or structure; around utility pads and light foundations; and between the walk and water meter areas.

340.5.2.3 Expansion joints at wheel chair ramps and drivepads shall be placed between these items of work and the back of the curb and gutters and the adjoining sidewalks.

340.5.2.4 Expansion joint filler strips shall be vertical and shall extend to the full depth and width of the work in which they are installed, being constructed at right angles or radially to the line of the curb or gutter as the case may be. The filler strips shall completely fill these joints at least to within 1/4 of an inch of any surface of the concrete that will be exposed upon completion of the work and must fully extend at least to those surfaces that will not be exposed. However, before the work will be accepted, any joint filler that protrudes beyond a surface that will not be exposed or beyond 1/4 of an inch below a surface that is exposed shall be trimmed off to the specified dimension in a neat and workmanlike manner. During the placing and consolidation of the concrete, the filler strip shall be held rigidly and securely in proper position.

340.5.3 CONTRACTION JOINTS

340.5.3.1 Contraction joints shall be constructed in slip formed curbs, curb and gutter, walks, and gutters as hereinafter specified. The joint shall be either cut or tooled to a minimum depth of 1 inch at curb, curb and gutter, and gutter, and the greater of either 1 inch or 1/4 the actual depth of the concrete at sidewalks and slabs on grade. The contraction joint shall be tooled at all exposed faces of the fresh placed concrete.

340.5.3.2 Spacing: Unless otherwise shown on the plans or authorized by the ENGINEER, the location and spacing of contraction joints shall be as specified in the Standard Detail Drawings and herein.

340.5.3.3 Contraction joints in extruded curb, curb

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and gutter, and gutters shall be placed at regular intervals not to exceed 12 feet.

340.5.3.4 Contraction joints shall be placed in all types of sidewalk at regular intervals not less than the width of the sidewalk nor greater than 6 feet.

340.6 FINISHING: Surfaces of the various items of work shall be finished as specified herein. Edges of concrete at expansion joints shall be rounded to 1/4 inch radius. Upon completion, the finished surface shall be true to line and grade and free from irregularities.

340.6.1 CURB:

340.6.1.1 The front forms may be stripped as soon as the concrete has set sufficiently but must be removed before the expiration of 6 hours after pouring. Immediately following the stripping of these forms, Class A mortar, as prescribed therefor in Section 106 thinned to the consistency of grout, shall be applied to the curb face. If monolithic curb and gutter is being constructed, this mortar shall be applied to the full exposed face; otherwise, it shall extend for an additional 2 inches below the gutter.

340.6.1.2 The face and top of the curb shall then be carefully troweled with a "steel mule" shaped to match the profile of the curb, curb and gutter, to a smooth and even finish, the top being finished to a transverse slope of 1/4 of an inch toward the front, with both edges rounded to a radius of 3/4 of an inch. Contraction joints, perpendicular to the flow line and in returns radial to the curve, shall be placed in the curb top and face and in the gutter. The surface shall be finished with a fine hair broom parallel with the line of the flow line.

340.6.2 SIDEWALK:

340.6.2.1 Following the placing of concrete, the surface shall be struck and floated to a true and even grade, free from waves and irregularities. After the floating contraction joints shall be made to a depth of 1 inch. The work shall then be carefully floated to a smooth and even finish, with the contraction joint and expansion joint edges rounded to a radius of 1/8 of an inch. The finished surface shall be given a fine hair broom finish, applied transverse the direction of travel of the sidewalk.

340.6.2.2 Contraction joints or block joints shall not exceed intervals of 6 feet. On straight work, the joints

shall be parallel with and at right angles to the line of the work; at curves the joints shall, in general, be along lines concentric with the curve radius. The contraction joint shall be made with jointer tools that will round the edges to a radius of 1/8 of an inch, with a depth of not less than 1 inch. The finished joint opening, exclusive of radii, shall not be not less than 1/8 inch nor greater than 3/16 inch. The CONTRACTOR will be required to have a sufficient number of jointer tools on the job to accomplish the above specified requirements.

340.6.2.3 The concrete shall be cured in accordance with the requirements of SECTION 349.

340.6.3 GUTTER:

340.6.3.1 After the concrete has been thoroughly consolidated the surface shall be worked to a true and even grade by means of a float. Contraction joints shall be sawed or tooled at intervals not to exceed 6 feet, perpendicular to the flow line. The finished surface shall be textured longitudinally with a fine hair broom finish.

340.6.3.2 Side forms shall remain in place until the concrete is sufficiently set, after completion of the gutter, but must be removed before the work will be accepted. The concrete shall be cured in accordance with the requirements of SECTION 349.

340.6.3.3 Valley gutter or cross gutter sections reinforcement steel and steel placement shall be constructed accordance with the plans and detail drawings. The reinforcement steel shall be in accordance with Section 102. The finished surface shall conform to the required roadway section as to both line and grade. The gutter sections will not be opened to traffic until specimen cylinders have attained a compressive strength of not less than 85% of its design strength or after 14 days or as authorized by the ENGINEER.

340.6.4 CONCRETE SLOPE PAVEMENT:

340.6.4.1 All subgrade preparation required for this item shall be done in accordance with applicable provisions of Section 301 with the exception that minimum density requirements will be 90% of maximum density as determined by ASTM D1557 or ASTM D698.

340.6.4.2 Reinforcement shall be included where shown on the plans or as specified.

SECTION 340

PORTLAND CEMENT CONCRETE CURBS, GUTTERS, WALKS, DRIVEWAYS, ALLEY INTERSECTIONS, SLOPE PAVING, AND MEDIAN PAVING

340.6.4.3 Thickness of concrete shall be as specified or as shown on the plans. Concrete shall be screeded and finished with ten foot straight edge, lapped at ½ its length or equivalent, to a plane surface having no variation when measured with a 10 foot straight edge in excess of 1/4 inch, unless a curvilinear surface is designated for a particular job. All concrete work shall be in accordance with Sections 101 and 349.

340.7 CURING:

340.7.1 GENERAL: Immediately after the operations have been completed on all concrete, the CONTRACTOR shall initiate the curing of the concrete as specified in Section 349 and/or as approved by the ENGINEER.

340.8 DRIVEWAY ENTRANCES:

340.8.1 Driveway entrances shall be provided in new curbs at all existing driveways along the line of the work and at locations shown on the plans or as directed by the ENGINEER.

340.8.2 The location and construction details for driveways shall conform to the construction plans or Standard Detail Drawings, or as authorized by the ENGINEER.

340.8.3 Where walks are to be constructed across driveways, the thickness of the walk shall be not less than 6 inches, unless otherwise specified or shown on the plans.

340.9 DRAINAGE OUTLETS THROUGH CURB: The CONTRACTOR will be required to construct suitable outlets through the new curb for all existing building drains along the line of the work, as per Standard Detail Drawings.

340.10 MISCELLANEOUS TYPES OF CURB, GUTTERS, SIDEWALKS: Extruded type concrete curb and gutter, precast curb and gutter sections, cut stone curbs, brick sidewalks, flagstone " sidewalks, etc., will be permitted where approved by the ENGINEER and in accordance with the plans and Supplementary Technical Specifications.

340.11 REPAIRS AND REPLACEMENTS:

340.11.1 New work that is found to be defective or

damaged prior to acceptance and/or existing work damaged by the CONTRACTOR's operation shall be repaired or replaced by the CONTRACTOR at no expense to the OWNER. Defective or damaged concrete areas shall be repaired by neatly saw cutting at right angles to the face of curb and removing and replacing the effected area. Removals of defective concrete shall be either the entire area between existing joints or if a minimum of 6 feet can be maintained to an existing joint, an intermediate saw cut may be permitted when approved by the ENGINEER.

340.12 TESTS: Testing procedures shall be as provided for in SECTION 101.

340.13 BACKFILLING AND CLEANUP: Backfilling and compaction to the finished surface of the newly constructed improvement must be completed before acceptance of the work.

340.14 MEASUREMENT AND PAYMENT:

340.14.1 MEASUREMENT:

340.14.1.1 Concrete curbs and gutters shall be measured by the linear foot per each type of curb and gutter.

340.14.1.2 Concrete sidewalks, driveways, valley gutters, gutters alley intersections shall be measured by the square foot per each type of improvement.

340.14.2 PAYMENT:

340.14.2.1 The payment for concrete curb and gutter shall be at the contract unit price and SECTION 101 per linear foot per each type of curb and gutter, complete in place, which shall include all materials, equipment and labor required in the final grading, subgrade preparation (subgrade compaction), placing, finishing, curing, backfilling and cleanup.

340.14.2.2 The payment for concrete sidewalks, driveways, valley gutters, gutters and alley intersections shall be at the contract unit price and SECTION 101 per square foot per each type of improvement, complete in place, which shall include all materials, equipment and labor required in the final grading, subgrade preparation (subgrade compaction), steel reinforcement (when and where required), placing, finishing, curing, backfilling and cleanup.

SECTION 340

PORTLAND CEMENT CONCRETE CURBS, GUTTERS, WALKS,
DRIVEWAYS, ALLEY INTERSECTIONS, SLOPE PAVING, AND MEDIAN PAVING

SECTION 341

EXTRUDED ASPHALT CURB

341.1 GENERAL

341.1.1 The work covered by this section consists of furnishing all plant, labor, equipment, materials, and in performing all operations in connection with the construction of asphalt curbs in accordance with these specifications.

341.2 REFERENCES

341.3 MATERIALS

341.3.1 The asphaltic concrete for asphaltic concrete curb construction shall be produced with 60-70 penetration asphalt or AC-20 viscosity grade asphalt and in accordance with an approved job mix formula.

341.4 EQUIPMENT

341.4.1 All equipment, tools, and machines used in the performance of the work covered by this section of the specifications shall be subject to the approval of the ENGINEER and shall be maintained in a satisfactory working condition at all times.

341.5 CONSTRUCTION METHODS

341.5.1 Asphalt curbs shall be machine laid. The machine shall be approved by the ENGINEER and shall be of a type in which the asphalt material is extruded or pushed out through a mold form under compaction pressure by a horizontal conveyor screw. A tack coat, as approved by the ENGINEER, shall be applied to the portion of the pavement to which the curb is to be affixed prior to extrusion.

341.6 MEASUREMENT AND PAYMENT

341.6.1 Asphalt curb shall be measured by the linear foot. Measurement shall be made along the bottom edge of the street side of the curb. Asphalt curb shall be paid for at the contract unit price per linear foot bid, which price and payment shall be full compensation for furnishing all material, labor, equipment, and in performing all operations and incidentals necessary to complete the work, including placement of a tack coat on existing pavement beneath base of curb.

SECTION 342

SOIL STERILIZATION

342.1 GENERAL

342.1.1 The work covered by this section of the specifications consists of furnishing all materials, labor, and equipment and in performing all operations in connection with the application of soil sterilant type herbicide, complete, in strict accordance with this section of the specifications and applicable drawings and subject to the terms and conditions of the Contract.

Soil sterilization will be measured by the square yard. Measurements will be taken parallel to the ground. The accepted quantities of soil sterilization will be paid for at the contract unit price per square yard complete in place.

342.2 REFERENCES

342.3 MATERIALS

Herbicide soil sterilants shall be an aqueous solution of:

342.3.1 Dupont 85% CMU weed killer

342.3.2 Telvar

342.3.3 Sodium TCA-90

342.3.4 Monobor-chlorate

342.3.5 Hyvar XL

342.3.6 Or approved equal

342.4 EQUIPMENT

All equipment, tools, and machines used in the performance of the work required by this section of the specifications shall be subject to the approval of the ENGINEER and shall be maintained in satisfactory working condition at all times.

342.5 CONSTRUCTION METHODS

Soil Sterilization--It is anticipated that certain areas, as determined by the ENGINEER, will need soil sterilization to insure pavement protection from weed growth. After the curb and gutter has been placed and grading is complete to subgrade, the subgrade shall be thoroughly scarified to a depth of 6 inches and watered to near optimum moisture content. Then an aqueous solution of an approved herbicide soil sterilant shall be applied to the subgrade at the rate recommended by the manufacturer. Compaction of the subgrade shall then be handled in the usual manner with the provision that the prime coat be applied before the subgrade has a chance to dry out. This provision is necessary due to the fact that the weed killers require a certain amount of moisture to be effective.

342.6 MEASUREMENT AND PAYMENT

SECTION 343

REMOVAL AND DISPOSAL OF EXISTING PAVEMENTS, CURB AND GUTTER, SIDEWALK, DRIVEPADS, AND SLOPE PAVEMENT

343.1 GENERAL

343.1.1 The work covered by this section consists of furnishing all labor, equipment, materials, and incidentals necessary for the removal and disposal of existing pavement, curb and gutter, sidewalk, and drivepads as specified herein. Pavement removal and replacement in connection with trenching operations is covered in Section 801 of these specifications.

343.1.2 Removal of existing pavement, curb and gutter, sidewalk, and drivepads shall only be performed at the locations within the limits shown on the drawings or as directed by the ENGINEER.

343.2 REFERENCES

343.2.1 This Publication:

SECTION 801

343.3 REMOVAL METHODS

343.3.1 CURB AND GUTTER: Existing Portland cement concrete curb and gutter, median curbs, curbs, alley curbs, laydown curbs, or valley gutters shall be removed by such means as required to prevent damage to any adjacent structures designated to remain in place. Existing asphalt curb shall be removed by means that prevent damage to the pavement on which the curb is situated. When any curb cannot be removed without damaging the adjacent pavement, the pavement may be cut to allow a minimum of 1 foot clearance parallel to the edge of the curb adjacent to the pavement.

343.3.2 SIDEWALK, DRIVEPADS, AND SLOPE PAVEMENT: Existing Portland cement concrete sidewalk and drivepads shall be removed by means and methods such that no adjacent structures to remain in place are damaged.

343.3.3 PAVEMENT:

343.3.3.1 Prior to any cutting of pavement, the perimeter of the proposed cut shall be suitably outlined and shall consist of smooth, regular lines approved by the ENGINEER.

343.3.3.2 The pavement shall be cut along the marked perimeter of the area to be removed with such equipment as to produce a cut carried in a vertical plane through the

pavement along a smooth horizontal line. For bituminous pavement removal, a power saw or steel-type cutter mounted on a motor grader or an air hammer equipped with a suitable cutting spade or other approved equipment which will score a smooth continuous line in the pavement to correct depth shall be used. Saw cutting only may be required by the ENGINEER if other methods of cutting leave an irregular or unsightly cut line.

343.3.3.3 The depth of cut made in asphalt pavement shall be sufficient to permit removal without damaging adjacent pavement. For Portland cement concrete pavement, a concrete saw which will score a continuous line in the pavement to a minimum depth of from 1 1/2 to 1 inches shall be used. Any unnecessary irregular breakage caused by the CONTRACTOR through inexperience or careless workmanship or otherwise shall be replaced by the CONTRACTOR at no additional expense. Any irregular breakage regardless of the cause shall be trimmed back as directed by the ENGINEER.

343.3.3.4 After the perimeter cut is made, any convenient and effective equipment may be used to break up and remove the pavement within, provided the following conditions are met:

343.3.3.4.1 The surrounding pavement and pavement perimeter shall not be damaged.

343.3.3.4.2 Any existing structures at the perimeter and/or within the vicinity of pavement removal shall not be damaged, whether they be surface or subsurface, as indicated on the drawings.

343.3.3.4.3 The normal functions of any utilities which may exist at the perimeter and/or within the area of pavement removal shall not be damaged, whether they be surface or subsurface, as indicated on the drawings.

343.4 DISPOSAL

The CONTRACTOR shall be responsible for disposing of all removed pavement, curb and gutter, sidewalk, drivepads, and slope pavement in accordance with local regulations and as directed by the ENGINEER.

343.5 MEASUREMENT AND PAYMENT

343.5.1 Measurement shall be made as follows:

343.5.1.1 Removal and Disposal of Existing

SECTION 343

REMOVAL AND DISPOSAL OF EXISTING PAVEMENTS, CURB AND GUTTER, SIDEWALK, DRIVEPADS, AND SLOPE PAVEMENT

Pavement--Measurement shall be made to the nearest square yard on the top surface of the pavement removed as directed by the ENGINEER. Pavement shall be defined as Portland cement concrete surfacing or asphaltic concrete surfacing together with the respective underlying base course of whatever character. Oil mats or dust pallative treated surfaces will be considered ordinary excavation for which no separate payment will be made for removal.

343.5.1.2 Removal and Disposal of Existing Curb and Gutter or Asphalt Curbs--Measurement shall be made to the nearest linear foot along with the face of the curb at the gutter line, at the pavement surface for curbs, at the flow line of valley gutters, or along the centerline of alley curbs as applicable.

343.5.1.3 Removal and Disposal of Existing Sidewalk, Drivepads, and Slope Pavement--Measurement shall be made to the nearest square yard on the top surface of the sidewalk or drivepad or slope pavement removed.

343.5.2 Payment will be made at the contract unit price per unit for the applicable item of removal, which payment shall be full compensation for performing all removal and disposal of the item and for furnishing all labor, equipment, and incidentals necessary to complete the work in the manner specified.

343.6 ALTERNATE METHOD OF MEASUREMENT AND PAYMENT

If a removal item does not appear as a bid item in the Bid Proposal, then no direct payment will be made for removal and disposal of existing pavement, curbs, gutters, sidewalks, and drivepads. All costs for such work shall be included in the lump sum price for site preparation.

SECTION 344

COLD MILLING OF PAVEMENT SURFACES

344.1 GENERAL

Cold milling shall consist of the removal of nominal thicknesses of asphalt or concrete pavement surfaces, as designated by the ENGINEER by approved roto-milling equipment. The cold milled material shall be removed from the pavement surface and transported to:

344.1.2 Areas within one mile of the job site as designated by the ENGINEER.

344.1.3 Salvage or disposal areas provided by the CONTRACTOR.

344.2 REFERENCES

344.3 COLD MILLING OF CONCRETE PAVEMENTS

Cold milling of concrete pavement surfaces shall consist of the removal of thicknesses as designated by the ENGINEER. The thicknesses of pavement removal shall be described as a nominal thickness for payment. The nominal thickness for concrete pavement removal is described as follows:

344.3.1 Nominal 3/4 inch cut: 3/4 inch average of cuts ranging from 0 to 1 1/2 inches.

344.3.2 The milled surface shall be cleaned of all milled material. The milled material shall be transported to:

344.3.2.1 Areas within one mile of the job site as designated by the ENGINEER.

344.3.2.2 Salvage or disposal areas as provided by the CONTRACTOR.

344.4 COLD MILLING OF ASPHALT PAVEMENTS

The cold milling of asphalt pavement surfaces shall consist of the removal of surface thicknesses as designated by the ENGINEER. For payment, the thickness of pavement removal shall be described as a nominal thickness. The ranges in nominal thickness are described as follows:

344.4.1 Nominal 1 inch cut: 1 inch average of cuts ranging from 0 to 2 inches. Nominal 1 1/2 inch cut: 1 1/2 inch average of cuts ranging from 0 to 3 inches. Nominal 2 inch cut: 2 inch average of cuts ranging from 0 to 4 inches.

344.4.4.2 The milled surface shall be cleaned of all milled material. The milled material shall be transported to:

344.4.4.2.1 Areas within one mile of the job site as designated by the ENGINEER.

344.4.2.2 Salvage or disposal areas provided by the CONTRACTOR.

344.5 MEASUREMENT AND PAYMENT

Payment for cold milling shall be per square yard of the applicable material, to the nominal depth, as designated by the ENGINEER. Payment shall include transportation of the milled material as specified in the Bid Proposal.

SECTION 346

TEXTURED CONCRETE

346.1 GENERAL

346.1.1 The work covered by this section consists of furnishing all plant, labor, equipment, materials, and in performing all operations in connection with the construction of colored or non-colored textured concrete in accordance with these specifications, the plans and/or as modified by the Supplemental Specification, and as authorized by the ENGINEER.

346.2 REFERENCES

346.2.1 This publication:

Section 101 Portland Cement Concrete
Section 105 Concrete Curing Compound
Section 107 Joint Filler & Sealant Material
Section 111 Colored Portland Cement Concrete

346.3 MATERIALS

346.3.1 The cement, aggregates, water, fly ash, and admixtures used in the concrete used in the work constructed under this section shall conform to the requirements of Section 101 or as modified herein or by the plans and/or the Supplemental Specifications and the approved concrete mix design(s).

346.3.2 If required, colored concrete used in the work constructed under this section shall conform to the requirements of Section 111 or as modified by the plans and/or the Supplemental Specifications and the approved concrete mix design(s).

346.3.3 AGGREGATES

346.3.3.1 When an exposed aggregate texture is specified, a specific size, shape and/or color of aggregate shall be specified on the plans and/or in the Supplemental Specifications.

346.3.3.2 When a stamped texture is specified the maximum nominal size of coarse aggregate shall not be greater than 1/2 inch.

346.4 SUBMITTALS

346.4.1 Along with the normal concrete mix design(s) submittals, the CONTRACTOR shall submit the procedure he will use to remove the cement paste to expose the aggregate when exposed aggregate texture is required. This procedure shall be in accordance with the suppliers' recommendations.

346.4.2 If required by the ENGINEER, whether colored concrete is used or not, a sample of texture shall be made in accordance with Section 111 as modified by the plans and/or Supplemental Specifications.

346.5 CONSTRUCTION REQUIREMENTS

346.5.1 All textured concrete shall have a minimum gradient of 1.5% unless modified on the plans and/or Supplemental Specifications. All textured concrete shall be placed so that the finish lowest elevation of the exposed aggregate or the embedment shall daylight (drain freely) and not trap water.

346.5.2 The forms used for exposed aggregate concrete will need to be raised above the final grade the same height as the height of the concrete paste to be removed to insure free drainage.

346.5.3 Patterned concrete shall be consolidated, struck-off to grade and the surface floated to attain a uniform surface. The concrete shall then be stamped, scribed or embossed with the pattern specified here in or called for in the plans and/or Supplemental Specifications, or as approved by the ENGINEER. The depth of the pattern into the concrete surface shall be uniform throughout the entire area and shall not exceed 3/8 inch. All pattern placement shall be completed before the concrete takes its initial set. The pattern tools shall be as manufactured by Bomivite, Impresco, or approved equal.

346.6. TEXTURED CONCRETE CURING

When the textured concrete is covered as part of the curing process, the CONTRACTOR shall use and place the covering in such a manner that the textured finish is not damaged or marred in any way. When colored concrete is used and the curing compound is used, it shall be as specified in Section 111.

346.7 MEASUREMENT AND PAYMENT

Unless modified in the Supplemental Specifications and/or the Bid Proposal textured concrete shall be measured by the square foot for each type and thickness and be paid for at the contract unit price per square foot, which price shall include the subgrade preparation to a depth of two feet (2'), materials, labor, and equipment needed in the placement, consolidation, finishing, and texturing of the concrete.

SECTION 347

BRICK SIDEWALK

347.1 GENERAL

The sidewalk bricks and their installation, specified in this section, are intended for use as a surface material to support pedestrian traffic.

347.2 REFERENCES

347.2.1 ASTM

C 33
C 902
D 1557

347.2.2 This Publication:

SECTION 101
SECTION 108

347.3 CERTIFICATION

Before installation of the paving bricks the ENGINEER will be furnished with a certification from the brick manufacturer that the paving brick meets these specifications.

347.4 MATERIALS

347.4.1 SAND: Sand for the setting bed shall conform to ASTM C 33 for fine aggregate.

347.4.2 BRICK: Classification of pedestrian and light traffic paving brick shall conform to Class SX for weather and Type I for traffic, as defined in ASTM C 902 and Section 108. Color and size of the brick shall be designated on the construction plans.

347.4.3 CONCRETE: Concrete for dividers and footings shall be 3000 psi and shall conform to the specifications in Section 101.

347.5 MATERIAL HANDLING

347.5.1 Sand shall be stored in stock piles on dry ground and shall be segregated from other materials to prevent mixing.

347.5.2 Brick shall be stored on dry ground or on pallets and shall be protected during storage and handling to prevent chipped edges.

347.6 INSTALLATION

347.6.1 SUBGRADE: The subgrade will be graded and

shaped to the lines shown on the construction plans. Compaction of the subgrade shall be 90 percent of maximum density, as determined in ASTM D 1557, for a depth of 6 inches.

347.6.2 EDGE CURBS:

347.6.2.1 Either concrete or soldier course brick headers may be used along the longitudinal and transverse edges of the sidewalk to confine the sand and bricks.

347.6.2.2 Soldier course brick shall be embedded 4 inches into a concrete footing. Dimensions of footing will be shown on the construction plans.

347.6.3 BEDDING:

347.6.3.1 Sand Setting Bed: The sand bedding shall be confined by the headers and shall be 4 inches thick after compaction and grading. Sand bed material shall be compacted to a maximum density of 90 percent as determined by ASTM D 1557.

3.4.7.6.3.2 Concrete Bedding: The concrete portion of the bedding shall conform to Section 101 for sidewalks and shall be 4 inches thick. The brick may then be placed in fresh mortar (1/2 inch thick) or asphalt paving material (1/4 inch to 3/8 inch thick). Mortaring between the brick surfaces is optional and should be shown on the plans as a requirement.

347.6.4 BRICK: Brick shall be laid on a smooth sand setting bed, with side surfaces in close contact. Lay brick flat in running bond, parallel to curbs or headers, except where otherwise shown. Joints in the vicinity of cut brick shall be adjusted such that no units smaller than half-brick shall be used. After an area of brick is laid, the brick shall be tamped into the sand bed to obtain a uniform top surface, over compacted sand bed. Top surface shall accurately match the lines and grades of curbs, headers and other construction. After the surfaces are uniform and compact, fine sand shall be swept over the surface, repeating this operation until joints are filled and all brick are firmly bedded.

347.6.5 CROSS-SLOPE OF SIDEWALK: The cross-slope of the brick sidewalk shall be the same as for concrete sidewalks, namely 1/4 of an inch per foot.

347.7 MEASUREMENT AND PAYMENT

Brick sidewalks shall be measured by the square foot. Payment shall be made at the unit price per square foot as

specified in the Bid Proposal, and shall include subgrade and sand bedding preparation, headers and brick with installation. Or if required, concrete bedding and setting material shall be included in the unit price.

SECTION 348

BRICK PAVEMENT FOR VEHICULAR TRAFFIC

348.1 GENERAL

The paving brick and its installation, specified in this section, are intended for the use as a surface material for vehicular traffic.

348.2 REFERENCES

348.2.1 ASTM

C 902

348.2.2 This Publication:

SECTION 101
SECTION 305
SECTION 108
SECTION 337
SECTION 115
SECTION 340
SECTION 301

348.3 CERTIFICATION

Before installation of the paving bricks the ENGINEER will be furnished with a certification from the brick manufacturer that the bricks meet these specifications.

348.4 MATERIALS

348.4.1 CONCRETE: Concrete for brick foundation and containment walls shall meet the requirements as per Section 101 for concrete pavement, drivepads, or walls.

348.4.2 ASPHALT SETTING MATERIAL: The asphalt setting material will be a mixture of sand and bituminous material and shall conform to the requirements of Section 115.

348.4.3 BRICK: The brick to be used for street or drivepad surface course shall conform to the requirements of Section 108.

348.5 MATERIAL HANDLING

Brick shall be stored on dry ground or on pallets and shall be protected during storage and handling to prevent chipped edges.

348.6 INSTALLATION

348.6.1 SUBGRADE AND TREATED BASE COURSE: The subgrade preparation and the installation of the cement

treated base course shall comply with the requirements of Sections 301 and 305, respectively. Thickness of these materials is shown on the Standard Detail Drawings. Drivepads do not require treated base course.

348.6.2 CONTAINMENT OR CUT-OFF WALLS: The containment or cut-off walls shall comply with the Standard Detail Drawings or with the construction plans.

348.6.3 PORTLAND CEMENT CONCRETE BRICK FOUNDATION: The construction of the concrete foundation shall conform to the requirements of Section 337 and 340. For arterial, collector and industrial street areas the foundation will be 4,000 psi compressive strength and will be a minimum of 8 inches thick. For residential streets and drivepads the foundation will be 4,000 psi and 3,000 psi compressive strength, respectively, and will be a minimum of 6 inches thick. The surface of the concrete foundation shall be screeded to grade and then finished with a wood float.

348.6.4 EXPANSION JOINT MATERIAL: Expansion joint material shall be installed between the concrete foundation and the containment walls and the curb and gutter. This material shall extend from the bottom of the concrete foundation to the top surface of the brick.

348.6.5 ASPHALT SETTING MATERIAL: Prior to the application of the asphalt setting material and the setting of the bricks the surface shall be kept moist for proper concrete curing. Curing compounds will not be used. The asphalt setting material will be applied to the foundation surface to a thickness of 3/8 inch minimum to 5/8 inch maximum. Immediately after application of the setting material the bricks will be installed.

348.6.6 BRICK INSTALLATION: Brick patterns and surface trueness requirements will be as follows:

348.6.6.1 Pedestrian Crosswalks: The bricks shall be laid in a running bond pattern with no less than half bricks being used. The long dimension of the brick shall be perpendicular to the normal flow of traffic.

348.6.6.2 Entire Street Intersections or Other Large Areas: The bricks shall be laid in accordance with the City approved construction plans. No less than half bricks shall be used.

348.6.6.3 Trueness: A 10-foot straight-edge shall be used to test the trueness of the pavement surface. The straight-edge shall be held in contact with the brick surfaces in all directions from a point. Adjustments shall immediately be made to conform to the straightedge. The

SECTION 348

BRICK PAVEMENT FOR VEHICULAR TRAFFIC

CONTRACTOR shall furnish the straightedge.

348.7 OPENING TO TRAFFIC

There will be no difference in the opening to traffic requirements for the concrete foundation as there is for concrete pavement as per Section 337.

348.8 DRIVEPAD CONFIGURATIONS:

Prior to the installation of a brick surfaced drivepad, the construction plans, showing the configuration, shall be submitted to the ENGINEER for approval. Brick surfacing shall not be used in the street gutter area.

348.9 MEASUREMENT AND PAYMENT

348.9.1 Brick surfaced street pavement and drivepad shall be measured by the square yard and shall include subgrade preparation, cement treated base course, concrete foundation, asphalt setting material and brick, both material and installation. Payment will be made at the unit price per square yard as specified in the Bid Proposal.

348.9.2 Measurement for concrete containment walls may be by the lineal foot or by the cubic yard. Payment will be the unit price per unit of measurement as defined in the Bid Proposal.

SECTION 349

CONCRETE CURING

349.1 GENERAL

The work covered in this section consists of furnishing all plant, labor, materials, and equipment, and in performing all operations in connection with the curing of all concrete placed in accordance with these specifications, or as modified by the plans and/or the Supplemental Specifications, and as authorized by the ENGINEER.

349.2 REFERENCES

349.2.1 American Society for Testing and Materials (Latest Addition)(ASTM)

- C-31 Making and Curing of Concrete Test Specimens in the Field
- C-39 Test for Compressive Strength of Cylindrical Concrete Specimens
- C-42 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
- C-171 Specification for Sheet Materials for Curing Concrete

349.2.2 ACI:

- ACI 305 Hot Weather Concreting
- ACI 306 Cold Weather Concreting

349.2.3 This Publication:

- Section 105 Concrete Curing Compound
- Section 111 Colored Portland Cement Concrete

349.3 CURING

Curing is defined as the process of maintaining a satisfactory moisture content and temperature in the constructed concrete so that the specified compressive strength is attained before the concrete is placed into full service. The curing process starts with the concrete placement.

349.4 PLACEMENT

349.4.1 The placement of all concrete shall be in accordance with the following guidelines unless otherwise authorized by the ENGINEER.

349.4.1.1 Concrete shall not be placed on frozen ground nor in forms that have frost, snow, or ice in or on the forms, reinforcement and/or embedment items.

349.4.1.2 Concrete shall not be placed in standing or running water.

349.4.1.3 Concrete shall not be placed on mud or uncompacted subgrade. Unstable subgrade shall be removed and replaced with suitable, compacted material.

349.4.1.4 Concrete shall not be placed in wooden forms that have not been sealed or treated with form oil or a form release agent.

349.4.1.5 The subgrade on which concrete is to be placed shall be moistened immediately before the concrete is placed.

349.5 MOISTURE CONTROL

349.5.1 The CONTRACTOR shall minimize the loss of moisture from the plastic concrete by evaporation during the placement and finishing of the concrete. When the estimated evaporation rate, as determined from Chart 349.1 is greater than 0.20 lb/sf/hr., the CONTRACTOR shall either take steps to reduce the evaporation below the specified rate, or discontinue the placement. The CONTRACTOR shall confer with the ENGINEER when weather conditions are such that the specified evaporation rate is reached on the protection method he is planning to use to be able to continue the placement of the concrete.

349.5.2 Moisture shall not be applied to the surface of the concrete to aid the surface finishing. If plastic or surface shrinkage cracks develop either prior to or during the finishing, that concrete shall be removed and replaced.

349.5.3 After completion of the finishing of the concrete, the CONTRACTOR shall initiate immediately the final curing of the concrete. The final curing method used by the CONTRACTOR shall be as specified in this section and as approved by the ENGINEER.

349.5.4 When forms are removed prior to the completion of the curing period specified herein, the CONTRACTOR shall protect the formed concrete surfaces by the same curing method used on the exposed surfaces of the concrete.

349.6 TEMPERATURE CONTROL

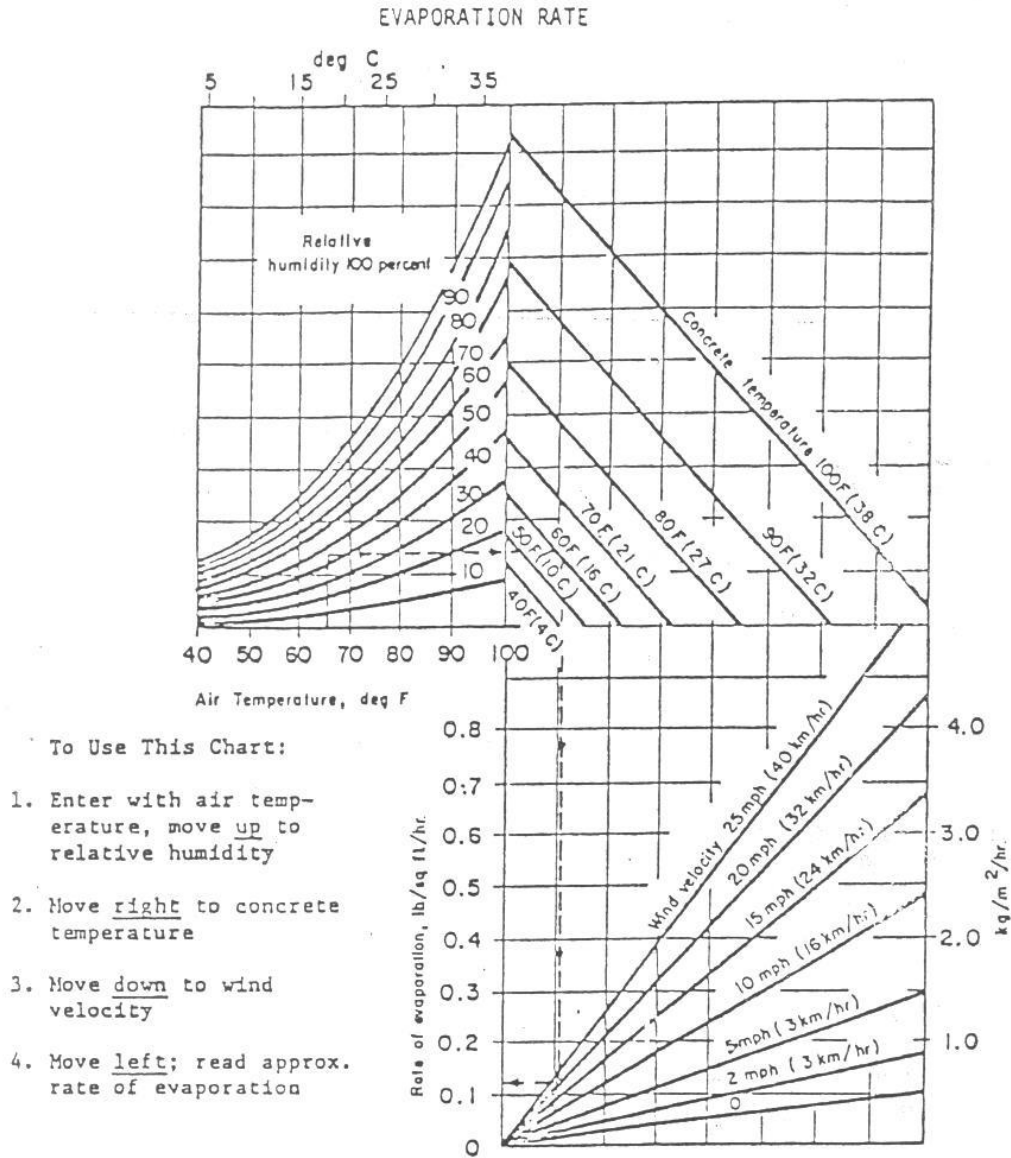
349.6.1 The temperature of all concrete placed shall be a minimum of 50°F(10°C) and a maximum of 90°F (32.2°C). The water, aggregates, and sand can be heated to maintain the minimum temperature and ice can be used to replace some of the water to maintain the concrete under the maximum temperature as long as the specified water to cementitious material ratio is not exceeded.

349.6.2 After completion of the finishing of the concrete, the CONTRACTOR shall initiate immediately the final

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CHART 349.1



Effect of concrete and air temperatures, relative humidity, and wind velocity on the rate of evaporation of surface moisture from concrete. This chart provides a graphic method of estimating the loss of surface moisture for various weather conditions. To use the chart, follow the four steps outlined above. If the rate of evaporation approaches 0.2 lb per sq ft per hr (1.0 kg/m²/hr), precautions against plastic shrinkage cracking are necessary.

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curing of the concrete. Temperature control during and for the duration of the curing period is essential to provide a satisfactory temperature to assure hydration of the portland cement to achieve the specified compressive strength of the concrete.

349.6.2.1 During cold weather, the CONTRACTOR shall maintain the temperature of all newly constructed concrete at not less than 50°F (10°C) for the curing period by the use of insulated blankets, an outside heating source, or other methods approved by the ENGINEER.

349.6.2.2 During hot weather, the CONTRACTOR may find it necessary to cover or shade newly constructed concrete to reduce the temperature build up and moisture loss (flash setting) in the concrete.

349.6.3 The ENGINEER shall monitor and record the high and low temperature of the concrete for every 24-hour period during the curing period when temperature protection is used by the CONTRACTOR, or at intervals deemed necessary by the ENGINEER. High-low thermometers or other temperature monitoring/recording systems may be used by the ENGINEER. The ENGINEER will notify the CONTRACTOR when the temperature of the newly constructed concrete reaches a low temperature of 53°F (11.7°C) or a high temperature of 100°F (37.8°C) so that the CONTRACTOR can modify his method of curing to maintain the proper curing temperature.

349.7 CURING METHODS

349.7.1 Immediately after the finishing operation has been completed and as soon as marring of concrete will not occur, the CONTRACTOR shall initiate the final curing of the concrete by one (1) or a combination of the following methods or a method the CONTRACTOR has submitted and received authorization from the ENGINEER to use.

349.7.1.1 Curing Compound: All curing compounds used shall be in accordance with Section 105 or Section 111 if applied to colored concrete.

349.7.1.2 Waterproof Paper: Waterproof paper shall comply with ASTM C-171. The Paper shall be new and unused. The paper shall be placed so as to cover the entire area of concrete plus two (2) feet in all directions, with an 18" overlap at each joint and be weighed down at all joints and along all edges. Any area that is damaged during the curing period shall be repaired or replaced the same day.

349.7.1.3 Plastic Film - Polyethylene Sheeting: The sheeting shall be a minimum of 4 mils thick; clear, white

or black and comply with ASTM C-171. The sheeting shall be placed in the same manner as the waterproof paper. Black sheeting should only be used when there is a need to retain heat in the new concrete.

349.7.1.4 Ponding, immersion, fog spraying, or sprinkling: Anyone of these four (4) curing methods can be used directly on the new concrete surface only when the CONTRACTOR submits to the ENGINEER as part of his curing program a plan that addresses these items:

- A. Water source.
- B. Equipment to be used and backup.
- C. Plan to ensure continuous application of water throughout the curing period.
- D. Protection against erosion of the concrete surface.
- E. Disposal of the water used and protection of the supporting and surrounding areas.

These methods can only be used if approved by the ENGINEER.

349.7.1.5 Burlap, Cotton Mats, or Rugs: Burlap or other materials must be free of sizing or any substances that are injurious to portland cement or causes discoloration. The sections shall be lapped one-half (1/2) their width and 12" at each end. The sections shall be placed so as to extend two (2') feet beyond the edge of the concrete in all directions. The material shall be kept moist and not be allowed to become dry at any time during the curing period.

349.7.1.6 Earth or Sand: The use of earth or sand as a curing cover will not be permitted on any concrete placed in any channel. Earth or sand used as a curing cover shall have particles larger than one inch (1") and shall be free of any organic matter. Earth or sand shall be placed on the new concrete in a minimum thickness of two inches (2") and extend one foot (1') beyond the edge of the concrete. The earth or sand shall be kept moist and not be allowed to become dry at any time during the curing period.

349.7.1.7 Straw or Hay: The use of straw or hay as a curing cover will not be permitted on any concrete placed in any channel. Straw or hay shall be placed on the new concrete in a minimum thickness of six inches (6") and held in place by wire or a cover to protect against the wind relocating the material. The straw or hay shall be kept moist and not be allowed to become dry at any time during the curing period.

349.8 CURING PERIOD

349.8.1 It is the CONTRACTOR'S responsibility to place and cure all concrete in a manner that will ensure that the specified concrete strength is reached. The curing period

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that is required for a particular volume of concrete will depend on the concrete mix that is placed, the location that it is placed in, how the CONTRACTOR controls the moisture loss and temperature in the concrete, and the weather conditions during placement and curing. The CONTRACTOR is responsible for providing active curing as listed above and/or passive curing for any length of time that it takes for all constructed concrete to reach its specified strength.

349.8.2 The minimum active curing period for all construction concrete shall be based on minimum strength gained or Strength-Maturity Relations Analysis or minimum time table, whichever is the shortest, or as authorized by the ENGINEER.

349.8.2.1 Minimum Strength: Active curing may be discontinued when the average strength of two (2) field cured concrete cylinders or three (3) drilled cores is 85% or higher of the specified concrete strength.

349.8.2.1.1 The field cured cylinders shall be standard concrete cylinders molded in accordance with ASTM C-31, cured the same as the concrete they represent and tested in accordance with the requirements of ASTM C-39.

349.8.2.1.2 The drilled cores shall be sampled in accordance with ASTM C-42 and tested in accordance with the requirements of ASTM C-39, with no single core test strength being less than 75% of the specified concrete strength.

349.8.2.2 Strength-Maturity Relationship: The active curing may be discontinued at the end of the period defined by a Strength-Maturity Relationship Analysis

prepared by a Registered Professional Engineer in accordance with ACI 306 and approved by the ENGINEER.

349.8.2.3 Minimum Time Table:

<u>Weather Min.</u>	<u>Curing Days</u>
Warm to Hot	10
Cold	14

Cold weather is defined as when the temperature reaches or goes below 35°F (1.7°C) for one (1) hour during any 24-hour period during the curing period.

349.9 SUBMITTALS:

When required in Section 1502 of the Supplemental Technical Specification or requested by the ENGINEER, the CONTRACTOR shall submit along with the concrete mix design(s) a curing plan for each strength and application of concrete on the project. The plan shall outline which curing method(s) the CONTRACTOR is proposing to use, where each method(s) will be used and the estimated period of active curing each location or type of structure will require.

349.10 MEASUREMENT AND PAYMENT

The measurement and payment for all materials, labor and equipment required in the curing process of the concrete constructed shall be included in the cost of the concrete to which it is applied, separate measurement or payment will be made for concrete curing.