SECTION 102

STEEL REINFORCEMENT

102.1 GENERAL

The following specifications set forth the requirements for bar reinforcement, wire reinforcement, and wire mesh reinforcement. The reinforcement shall conform accurately to the dimensions and details indicated on the plans or otherwise prescribed; and before being placed in any concrete work shall be cleaned of all rust, mill scale, mortar, oil, dirt, or coating of any character which would be likely to destroy, reduce, or impair its proper bonding with the concrete. No reinforcing steel will be accepted under this specification until it has been approved by the ENGINEER as conforming with requirements prescribed therefor. When required by the ENGINEER, the CONTRACTOR or vendor shall furnish samples thereof for testing and notify the ENGINEER as to when and where they will be available. Such samples shall be furnished at the expense of the CONTRACTOR or vendor, but the cost of any testing that may be required will be borne by the OWNER. Samples shall only be taken in the presence of the ENGINEER. The CONTRACTOR shall furnish a certificate mill test report for each heat or size of steel when required by the ENGINEER.

102.2 REFERENCES

102.2.1 ASTM

A 82 A 615
A 185 A 616

102.2.2 ACI

318

102.3 BAR REINFORCEMENT

102.3.1 Reinforcing steel bars shall be deformed intermediate grade billet steel conforming with ASTM A 615. Rail steel conforming with ASTM A 616 may be permitted by the ENGINEER. The Grade shall be 40 or 60, unless Grade 60 is specified on the standard detail drawings or on the construction plans.

102.3.2 In testing bar reinforcement, only the theoretical cross-sectional area will be used in all computations.

102.3.3 Bending of steel will conform to requirements of ACI 318. The various grades of steel shall not be used interchangeably in structures. If rail steel is used, shop and field bending shall comply with the following provisions:

102.3.3.1 Continuous and uniform application of force throughout the duration of the bending operation.

102.3.3.2 Unrestricted movement of the bar at points of contact with the apparatus.

102.3.3.3 Close wrapping of the specimen around the pin or mandrel during the bending operations.

102.3.4 Bending or straightening of reinforcing steel shall be accomplished in such a manner and by such means as to insure that no damage to the material will result as a consequence thereof. Bars shall not be heated to perform bending of bars. Kinked bars shall not be used.

102.3.5 Cutting reinforcement steel or wire by means of a cutting torch is prohibited.

102.3.6 Welding of reinforcing steel or wire is prohibited.

102.4 WIRE REINFORCEMENT

Wire reinforcement shall, in all respect, fulfill requirements prescribed in ASTM A 82.

102.5 WIRE MESH REINFORCEMENT

Mesh reinforcements shall conform to ASTM A 185. The gauge of the wire and the dimensions of the mesh will be specified in the Supplementary Specifications or shown on the plans. The wire mesh reinforcement shall be so constructed as to retain its original shape and form during the necessary handling. The effective cross- sectional area

of the metal shall be equal to that specified or indicated on the plans.

102.6 WIRE TIES

Wire for ties shall be black, annealed, not lighter than 16 gauge.

102.7 CHAIRS

Chairs used for support or spacer of reinforcement shall be approved by the ENGINEER.

102.8 MEASUREMENT AND PAYMENT

Steel reinforcement will be included in the measurement for reinforced concrete per cubic yard or square yard in place, unless otherwise stipulated in the Bid Proposal. Payment will be made at the unit price per cubic yard or square yard as defined in the bid proposal.

SECTION 105

CONCRETE CURING COMPOUND

105.1 GENERAL

This section shall govern the type of concrete curing compound used, in curing fresh concrete. The curing compound shall consist of a liquid which, when applied to fresh concrete by means of a spray gun, will form an impervious membrane over the exposed surfaces of the concrete.

105.2 REFERENCES

105.2.1 ASTM

C-156
C-309
E-97

105.2.2 This Publication

Section 111

105.3 MATERIALS

105.3.1 Curing compound shall be Type 2, White Pigmented as specified in ASTM C-309, unless modified on the plans or the Supplemental Technical Specification, or as approved by the ENGINEER.

105.3.2 When required, the curing compound manufacturer shall supply certification, to the ENGINEER that his product has been tested and complies with ASTM C-309 and for Type 2 compounds, ASTM E-97.

105.3.3 EXCEPTION: Type 2, White Pigmented curing compound shall not be used on colored concrete. The curing compound used on colored concrete shall be as specified in Section 111.

105.4 APPLICATION

The curing compound shall be applied so as to form a uniform, continuous, unbroken film over the concrete surface. The rate of application shall be per the manufacturer's recommendations but in no case greater than 250 square feet per gallon.

105.5 MEASUREMENT AND PAYMENT

No separate measurement or payment will be made for curing compound. The cost of the curing compound and its application shall be included in the cost of the work it is applied too.

SECTION 116

ASPHALT CONCRETE

116.1 GENERAL: Asphalt concrete shall consist of a mixture of asphalt binder, aggregates, mineral filler and admixtures, proportioned as required, batched and delivered as specified herein. All materials and job mix formulas used in asphalt concrete, either batched at or delivered to a project, shall be certified in accordance with the requirements of these specifications. The CONTRACTOR shall be solely responsible for asphalt concrete job mix formula supplied under this specification, its proportions and manufacture. Each job mix formula submitted and authorized for use under this Specification shall be identified by a number, unique to that job mix formula. 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 cancelled as directed by the ENGINEER. A job mix formula shall not be used on a project without written approval of The ENGINEER.

116.2 REFERENCES:

116.2.1 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

116.2.2 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

116.2.3 Asphalt Institute

MS-2 Mix Design Methods, Sixth Edition
MS-2 Mix Design Methods, Sixth Edition, Section 5.16, Modified Marshall Method For Large Aggregate

116.2.4 This publication:

SECTION 101 PORTLAND CEMENT CONCRETE
SECTION 112 ASPHALT BINDER
SECTION 118 HYDRATED LIME
SECTION 336 ASPHALT CONCRETE PAVEMENT

116.3 MATERIALS

116.3.1 Asphalt binder shall comply with the requirements of SECTION 112-ASPHALT BINDER

116.3.2 Aggregates shall be crushed stone, crushed gravel, crushed asphalt concrete pavement, crushed portland cement concrete, and natural or manufactured

sand conforming to the quality and crushed particle requirements of this Specification. Coarse aggregates shall comply with the requirements of ASTM D692, Coarse Aggregate for Bituminous Paving Mixtures. Fine aggregates shall comply with the requirements of ASTM D1073, Fine Aggregate for Bituminous Paving Mixtures. The combined aggregates, proportioned as defined by the target gradation, shall comply with the requirements of Table 116.A. 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.

116.3.3 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 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.

116.3.4 Asphalt concrete shall comply with the minimum requirements of TABLE 116.C.1.H. Moisture susceptibility, % retained strength at 7% air voids, AASHTO T283, with freeze cycle. Admixtures to reduce moisture susceptibility in an asphalt concrete mix shall be either hydrated lime, portland cement, liquid admixture, or a modified asphalt binder authorized by the ENGINEER.

116.4 PROPORTIONING:

116.4.1.1 The CONTRACTOR shall be solely responsible for the asphalt concrete job mix formula (jmf) proportions and asphalt concrete either batched at and/or delivered to the site. Asphalt concrete shall be proportioned in accordance with the requirements of this Specification.

116.4.1.2 Asphalt concrete material proportioned with "performance grade binders" shall be proportioned to comply with the requirements of TABLE 116.C.1 of this specification, AASHTO MP2, Specification for Superpave™ Volumetric Mix Design, and PP-28, Superpave™ Volumetric Design for HMA. The job mix formulas 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.

116.4.2.1 Asphalt concrete for construction of street classifications of Collector, Minor and Major Arterial, and Controlled Access Roadways may be proportioned with performance grade (PG) binders.

116.4.2.2 Asphalt concrete for construction of classifications of Collector, Minor and Major Arterial, and Controlled Access Roadways may be proportioned with performance grade (PG) binders.

116.4.2.3 Asphalt concrete for construction of street classifications of Residential, Local, Major Local, and streets with design equivalent single axle loads (Esals) less than 3.0 mil, may be proportioned with a PG70-22 performance grade binder.

116.4.3 Asphalt concrete proportioned with either penetration or viscosity grade binders shall be proportioned to comply with the requirements TABLE 116.C.2. A JMF shall be prepared in a laboratory under the direct supervision of a New Mexico Registered Professional Engineer.

116.4.4 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.

116.4.5.1 An asphalt concrete job mix formula shall be proportioned to comply with the requirements of TABLE 116.B AGGREGATE GRADATION PROPERTIES and either TABLE 116.C.1 ASPHALT CONCRETE DESIGN SPECIFICATIONS PERFORMANCE GRADE BINDERS, or TABLE 116.C.2 ASPHALT CONCRETE DESIGN SPECIFICATIONS PENETRATION AND VISCOSITY GRADED BINDERS.

116.4.5.2.1 Aggregates, mineral filler, and anti-strip admixture if required, shall be proportioned to provide a combined gradation that complies with the requirements specified in Table 116.B, and have the same or similar shape characteristic gradation curve as the specification limits specified therein 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.

116.4.5.2.2 The design characteristic shape gradation curve for SP-II asphalt concrete shall be similar to a "S" shape curve, with a convex curve above the maximum density line for aggregate greater than 4.75 mm (No.4) sieve and a concave curve below the maximum density line for aggregate finer than the 4.75 mm (No.4) sieve.

116.4.5.2.3 The design characteristic shape gradation curve for Type SP-III and SP-IV asphalt concretes shall be similar to a "S" shape curve, with a convex curve above the maximum density line for aggregate greater than 2.36 mm (No.8) sieve and a concave curve below the maximum density line for aggregate finer than the 2.36 mm (No.8) sieve.

116.4.5.2.4 The design characteristic shape gradation curves for Types B, C, and D, asphalt concretes shall be similar to two convex curves above the maximum density line, one for aggregate greater than the 2.36 mm (No.8) sieve, and one for aggregate finer than the 2.36 mm (No.8) sieve. The two curves shall intersect each other at the 2.36 mm (No.8) sieve.

116.4.5.2.5 The design characteristic gradation curve shape for Type A asphalt concretes shall be similar to two convex curves above the maximum density line, one for aggregate greater than the 4.75 mm (No.4) sieve, and one for aggregate finer than the 4.75 mm (No.4) sieve. The two curves shall intersect each other at the 4.75 mm (No.4) sieve.

116.4.6 The job mix formula asphalt binder content shall be proportioned to provide a job mix formula that complies with the requirements defined either in TABLE 116.C.1 when proportioned with PG binders, or in TABLE 116.C.2, when proportioned with either penetration or viscosity graded binders. The design asphalt binder content shall be selected, based on laboratory testing, aged binder/mix required. The binder content shall include a minimum of 75% virgin binder when a job mix formula is designed with recycled asphalt concrete pavement, RAP. The design % binder content, ± 0.3%, shall not exceed the binder content at minimum VMA.

TABLE 116.A - COMBINED AGGREGATE DESIGN PROPERTIES

CHARACTERISTIC	AGGREGATE TYPE Coarse		Fine	PROCEDURE
1. Coarse aggregate angularity, material > 4.75 mm	[1]	[2]	-	ASTM D 5821
ESALs < 3.0 mil	85	80		
3.0 ▯ ESALs < 30.0 mil	95	90		
30.0 mil ▯ ESALs	100	100		
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 fracured faces
[2] coarse aggregate has two or more fractured faces

TABLE 116.B AGGREGATE GRADATION [3]

	% PASSING TYPE, Nominal Maximum Size Aggregate [1]												
	SP-II/A, 1		SP-III, 3/4		SP-IV, ½		SP-V/D, 3/8		B, 3/4		C, ½		PRODUCTION
SIEVE SIZE,	min	max	min	max	min	max	min	max	min	max	min	max	TOLERANCE
1-1/2	100	100	-	-	-	-	-	-	-	-	-	-	
1.00	86	96	100	100	-	-	-	-	100	100-	-	-	8
3/4	-	90-	89	96	100	100	-	-	88	96	100	100	8
½	62	83	-	90	88	96	100	-	-	90	88	96	8
3/8	-	-	64	85	-	90	91	97	70	85	73	90	8
no.4	31	40	37	47	52	70	-	90	51	69	57	75	7 [2]
8	19	27	23	32	28	39	47	67	35	49	39	58	6
16	10	18	12	22	14	26	38	55	28	40	32	48	6
30	6	14	8	17	8	19	28	43	21	31	24	38	5
50	4	11	5	14	5	16	19	30	14	23	16	27	5
200	3.0	7.0	3.0	8.0	2.0	10.0	3.0	10.0	2.0	8.0	3.0	10.0	3.0

NOTES: [1] SP-II and Type A gradation materials may not be used for the surface course
[2] If recycled asphalt concrete aggregate (RAP) is used, ±8%
[3] A JMF aggregate gradation may pass through the restricted zone if all JMF volumetric design criteria is in compliance. The restricted zone is defined by the material passing the no.8 to no.30 sieves for SP-II and Type A asphalt concretes. The restricted zone is defined by material passing the no.4 to no.30 sieves for all other asphalt concrete.

TABLE 116.C.1 - ASPHALT CONCRETE SUPERPAVE DESIGN SPECIFICATIONS

DESCRIPTION	Local, Major Local, Residential, Intersections [1]		Collector, Minor and Major Arterial, Controlled Access Roadway, and Intersections [1]			
A. Binder	PG70-22		PG76-28		PG76-28	
B. Equiv.. Single Axle Load, ESALs (million)	< 3		3 ▯ ESALs <30		30 ▯ ESALs [2]	
C. Voids, %	3.5 - 4.5		3.5 - 4.5		3.5 - 4.5	
D. Voids in Mineral Aggregate, VMA, %	min	max	min	max	min	max
Type SP-II [3], (1 in.)	12	14	12	14	12	14
Type SP-III, (3/4 in.)	-	-	13	15	13	15
Type SP-IV, (½ in.)	-	-	14	16	14	16
Type SP-V, (3/8 in.)	-	-	16	18	16	18
Type A, (1 in.) [3]	12	14	-	-	-	-
Type B, (3/4 in.)	13	15	-	-	-	-
Type C, (½ in.)	14	16	-	-	-	-
Type D, (3/8 in.)	16	18	-	-	-	
E. Voids filled with binder, %						
Type SP-II [3], (1 in.)	-	-	65	75	65	75
Type SP-III, (3/4 in.)	-	-	65	75	65	75
Type SP-IV, (½ in.)	-	-	65	75	65	75
Type SP-V, (3/8 in.)	-	-	65	75	65	75
Type A, (1 in.) [3]	68	78	-	-	-	-
Type B, (3/4 in.)	68	78	-	-	-	-
Type C, (½ in.)	68	78	-	-	-	-
Type D, (3/8 in.)	68	78	-	-	-	-
F. Dust Ratio, -no.200 (0.075mm) : $\%P_{be}$	0.6	1.6	0.6	1.6	0.6	1.6
G. Gyratory compaction [4] at binder compaction temp, ± 5°F				%		%
Gyrations	N	% CMPTN	N	CMPTN	N	CMPTN
N_i (initial)	7	91.0	8	89.0	9	89.0
N_d (design)	75	96.0	100	96.0	125	96.0
N_m (max)	115	98.0	160	98.0	205	98.0
H. Moisture susceptibility, % retained strength @7% air voids, AASHTO T283, with freeze cycle.	80 min		80 min		80 min	

NOTES:

[1] The intersection area shall be the core area common to all intersecting streets, and, include the distance to the curb return of the approach and departure of the intersecting streets.

[2] Level II Design Complying with NMSHTD Procedures at Date of Bid, as directed by the ENGINEER.

[3] SP-II and Type A gradations asphalt concrete shall not be used for surface course

[4] % of maximum theoretical specific gravity / density, Gmm

TABLE 116.C.2 - ASPHALT CONCRETE DESIGN SPECIFICATIONS
PENETRATION & VISCOSITY GRADE BINDERS

DESCRIPTION	Residential, Local, Major Local, and Intersections
A. Binder Grade	60-70 Pen, AC-20 Viscosity
B. Equiv. Single Axle Load, ESALs (million)	ESALs < 3.0
C. Voids, %	3.5 - 4.5
D. Voids in Mineral Aggregate, VMA, %	
Type A, (1 in.)	12 - 14
Type B, (3/4 in.)	13 - 15
Type C, (½ in.)	14 - 16
Type D, (3/8 in.)	15 - 17
E. Voids filled with binder, %	68 - 78
F. Dust Ratio, -no.200(0.075 mm) : $\%P_{be}$	0.6 - 1.6
G. Marshall Stability Design, Blow counts/ each face	50
Stability, lbs, min	1500
Flow, 0.01 in	10-18
H. Stability to Flow Ratio, minimum @target binder ± 0.5%	200
I. Moisture susceptibility, % retained strength, @ 7% air voids, AASHTO T283, with freeze cycle.	80 min

NOTES:
[1] The intersection area shall be the core area common to all intersecting streets and include the distance to the curb return of the approach and departure of the intersecting streets.

116.5.1 A design mix job mix formula submittal shall be include but not be limited to the information specified in TABLE 116.D-SUBMITTAL INFORMATION, as directed by the ENGINEER.

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

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

TABLE 116.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 either TABLE 116.C.1 or TABLE 116.C.2, as applicable, 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, projects bid after June 30, 2000.
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:)

A. Marshall Design & Modified Marshall Designs (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 ± 0.5%)
1. Design hammer blow counts, mold diameter, hammer mass and drop
2. Stability (lbs.) vs. % asphalt content
3. Flow (0.01 in.) vs.% asphalt content
4. Briquette bulk Specific Gravity and Bulk Density (as pcf) vs. % asphalt content
5. % Voids In Mineral Aggregate (% VMA) vs. % asphalt content
6. % Voids (Pa) in asphalt concrete vs. % asphalt content
7. % voids filled in Asphalt Concrete vs. % asphalt content
8. dust ratio vs.% asphalt content

B. SUPERPAVE Design (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, 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 ± 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, Gmb @ 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 @Nd
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.

116.6 PRODUCTION:

116.6.1 Asphalt concrete shall be produced in accordance with the requirements of ASTM D3515, the requirements of this Specification, or as authorized by The ENGINEER. Production facilities shall comply with the requirements of ASTM D995, and this Specification. A plant shall be certified annually, by a New Mexico Registered Professional Engineer, to comply with the requirements of this Specification. The production plant shall be calibrated annually with calibration standards traceable to the National Bureau of Standards. Certification shall be completed within 12 months prior to production of an authorized job mix formula at the plant. 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.

116.6.2 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 ± 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 ± 0.5% (laboratory analysis), T53-Quantitative Analysis of Bitumen From Bituminous Paving Mixtures, Ignition Oven Method, Method A (Modified: reference temperature for constant mass, 149 ± 3° C / 300 ± 7 °F).

116.7 DELIVERY:

116.7.1 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.

116.7.2 The CONTRACTOR shall provide with each load of asphalt concrete batched 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 116.E One copy of the ticket shall be available for each of the ENGINEER and the quality assurance testing program.

TABLE 116.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

116.8 PLACEMENT:

Asphalt concrete shall be placed in uniform layers/lifts in accordance with the requirements of Section 336. The thickness of a layer/lift shall be not less than two (2) times the maximum size aggregate and/or not greater than 4 inches for SP-II aggregate gradations. The thickness of a layer/lift shall be not less than two (2) times the maximum size aggregate of the job mix formula used but not greater than 3 inches, as directed by the ENGINEER. A pavement lift thickness shall be selected to use the maximum size aggregate, as authorized by the ENGINEER. Lift thickness(s) and asphalt concrete type, designating the maximum size aggregate, shall be either specified in the CONTRACT documents, or as directed by the ENGINEER. SP-II asphalt concrete shall not be used for a surface course.

116.9 COMPACTION:

116.9.1 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 directed by the ENGINEER. The material shall be compacted to a density of at least 93% but not greater than 97% of the theoretical maximum density as determined by ASTM D2041.

116.9.2 The CONTRACTOR shall be responsible for the development and implementation of the compaction program. The program shall be defined by the CONTRACTOR, to include equipment type and description, and procedures, reported in writing to the ENGINEER for each job mix formula/lift thickness used on a project. Changes in the compaction program shall be reported to the ENGINEER as they may occur.

116.9.3 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 a 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.

116.9.4.1 Compaction equipment shall 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.

116.9.4.2 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 adustablility 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.

116.9.4.3 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.

116.9.4.4 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.

116.10 SAMPLING AND TESTING:

116.10.1.1 Quality assurance asphalt concrete sampling and testing shall be performed in accordance with the requirements of this specification, the Supplemental Technical Specifications, or as directed by The ENGINEER.

116.10.1.2 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.

116.10.1.3 Testing equipment shall be calibrated annually with calibration standards traceable to the National Bureau of Standards. Calibration records and certifications shall be maintained at the Laboratory for review by The ENGINEER. A copy of the certifications shall be submitted to The ENGINEER upon request.

116.10.1.4 Quality assurance 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™.

116.10.1.5 Quality assurance sampling and testing shall be conducted under the direct supervision of a New Mexico Registered Professional Engineer.

116.10.2 FIELD 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.

116.10.3 MATERIAL TESTING:

116.10.3.1 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.

116.10.3.2 The asphalt concrete quality assurance sample shall be tested and the properties reported, with authorized job mix formula production limits, as specified in TABLE 116.F - FIELD SAMPLE LABORATORY TESTS.

TABLE 116.F - FIELD SAMPLE LABORATORY TESTS

I. Marshall Design Analysis
- A. Energy Reference:
  - 1 briquette mass / mold size;
  - 2 hammer size and drop; and
  - 3 number of blow counts per face;
- B. Volume characteristics of compacted briquettes, with production specifications, average of three:
  - 1 VMA, voids in mineral aggregate;
  - 2 Va, voids in asphalt concrete;
  - 3 VFA, voids filled with asphalt binder; and,
  - 4 Gmb, bulk specific gravity and density, with authorized jmf target, average of three;
- C. Gmm, maximum theoretical specific gravity/density with authorized jmf target, one test;
- D. Strength Characteristics:
  - 1 stability;
  - 2 flow; and,
  - 3 stability : flow ratio.

III. SUPERPAVE 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}, @ Ni, Nd, and Nm
  - 2 Maximum theoretical specific gravity/density, Gmm
  - 3 Compaction: Gmb as % Gmm at Ni, Nd, and Nm
  - 4 Sample height, mm, at Nd
- B. Volume characteristics of compacted briquettes @ N_d, with design value and specifications
  - 1 VMA, voids in mineral aggregate
  - 2 Va, voids in asphalt concrete
  - 3 VFA, voids filled with asphalt binder

IV. Asphalt binder content, with design value and authorized production range, T53-Quantitative Analysis of Bitumen From Bituminous Paving Mixtures, Ignition Oven Method A (Modified: reference temperature for constant mass, 149 ± 3° C/ 300 ± 7°F)

V. Dust ratio, $\%P_{be}$

VI. 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, %

116.10.3.3 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. 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 "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.

16.10.4 FIELD TESTING:

116.10.4.1 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.

116.10.4.2 Qualtiy assurance in place field compaction tests shall be conducted in accordance with the requirements of this specification, as directed by the ENGINEER. A test shall determine the density of a constructed asphalt concrete roadway lift. Compaction shall be calculated as the measured in-place density, divided by the average maxium theoretical density (G_{mm}) of the samples taken for that day's placement, reported to one tenth of a percent, xxx.x.%. Maximum theoretical density (G_{mm}) shall be determined in accordance with ASTM D2041.

116.10.4.2.1 Field density for SP-II and Type A materials shall be measured from field core samples. A minimum of one core sample shall be taken for each lift of 250 tons of a material type, or fraction thereof, placed each day, but not less than 3 cores per day, as directed by the ENGINEER. The bulk density (G_{mb}) of each core shall be measured in accordance with the requirements of D2726 and reported to the nearest one-tenth pound per cubic foot , (one kilogram per cubic meter). The compaction for the shall be calculated as the average measured density of the cores for a lift of a type of material placed in a day, divided by the average of the maximum theoretical density (G_{MM}) of the samples of the same or similar materials taken for that day's placement, reported to the nearest one tenth of a percent, xxx.x.%. The maximum theoretical density (G_{MM}) shall be determined in accordance with ASTM D2041, and reported to the nearest one-tenth pound per cubic foot , (one kilogram per cubic meter). The core barrel shall be 6 inches (150mm) o.d. or greater, taken full depth. A lift sample shall be trimmed from the core at the lamination lines between lifts. The CONTRACTOR shall be responsible for material replacement at no cost to the OWNER where samples are removed.

116.10.4.2.2.1 The field density for Types B, C, D, SP-III, SP-IV, and SP-V materials shall be measured in accordance with the requirements of ASTM D2950, at the minimum rate of three tests per lift, per 500 sy of each type of asphalt material placed in a day, as directed by The ENGINEER.

116.10.4.2.2.2 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.

116.10.4.2.3.1 Compaction tests shall be taken at random locations on the asphalt being placed, as directed by The ENGINEER. The three (3) general areas in which tests are to be taken are the free edge of the 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 approximate proportions.

TABLE 116.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.

116.10.4.2.3.2 Samples of the compacted Types S-III, S-IV, B, C, and D asphalt concretes may be taken and tested to determine compaction conformance of the finished pavement with the specified requirements

either as requested by the CONTRACTOR, or as directed by the ENGINEER. Cores shall be sampled and tested in accordance with 116.10.4 - Field Testing.

116.10.5.1 Test reports shall include but not be limited to the information specified in TABLE 116.H - TEST REPORT.

TABLE 116.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
	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, ℉
	10	Ambient temperature at time of sampling, ℉
	11	Field test results with reference specification limits (compaction test)
B.		Laboratory Test Results
	1	Laboratory results as defined in TABLE 116.F
	2	Field Test Data, 116.10.4
C.		Recomended Pay Adjustment Factor for a LOT
	1	C_{LM}, material factor, see TABLE 116.J
	2	C_{LC}, placement/compaction factor, see TABLE 116.K

116.10.5.2 Test results shall be reported to The ENGINEER, CONTRACTOR, and Supplier 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 and supplier within 1 working day of completion of the test.

116.10.5.3 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.

116.11 MEASUREMENT AND PAYMENT

116.11.1 The measurement of the asphalt concrete material shall be by the ton delivered and unloaded at the project, and, by the square yard lift placement and compaction, for each mix type used on a project, each day.

116.11.2 Each LOT of asphalt concrete material shall be paid at the adjusted CONTRACT unit price for asphalt concrete, calculated in accordance with the equation below, adjusted by a material factor, PF_M, specified in TABLE 116.J, as authorized by the ENGINEER. A LOT shall be defined as the total tonnage placed in a day, for each type of material placed. Acceptance samples shall be sampled and tested in accordance with the requirements of 116.10, and tested for compliance with the specifications. a material pay factor, PF_M, shall be determined in accordance with TABLE 116.J, as defined for test results for combined aggregate gradation and asphalt content, as compared to the authorized job mix formula's production specifications. All complying acceptance samples taken in a day for a material type shall represent a LOT in the computation specified in TABLE 116.J. Non complying acceptance samples shall be evaluated in accordance with this specifications as directed by the Engineer. The material factor, PF_M, for a LOT shall be determined based on the deviation of the average value, arithmetic mean, M, of the acceptance samples' test results from the job mix formula targets, T, adjusted for the range of the test results, maximum value minus the minimum value. If the absolute value of the deviation of the daily mean from the target is greater than the maximum allowable deviation, the LOT will be removed and replaced with materials complying with the specifications 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 under a specific project condition, the LOT may be accepted under written agreement between the OWNER and the CONTRACTOR at an assigned pay factor $PF_M = 0.70$, for a LOT having a compaction pay factor, PF_C, equal

or greater than 0.85, as authorized by the ENGINEER.

$$UP' = PF_M \times UP$$

UP', adjusted contract unit price/ton
UP, Contract unit price/ton
PF_M, material adjustment factor

TABLE 116.J - MATERIAL FACTOR, PF_M, FOR GRADATION & BINDER CONTENT

NUMBER OF DAILY SAMPLES	For |T-M| equal or greater than 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
MATERIAL FACTOR, PFm [3]	0.85	0.95	1.00

[1] D, production tolerance +/- %, see TABLE 116.B and paragraph 116.4.2.2 , and 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 the 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 will 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 accepted under written agreement between the OWNER and the CONTRACTOR AT an assigned pay factor PF_M= 0.70, for compaction LOT(s) having a compaction factor, PFc, equal or greater than 0.85, as directed by the ENGINEER.

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

116.11.3 The placement and compaction factor, PF_C, for a LOT shall be determined based on the average value of the compaction tests for the LOT, with any single test neither less than 90.0% nor greater than 98%, and TABLE 116.K. If a test for a LOT is either less than 90.0% or greater than 98%, the LOT will be evaluated as directed by the ENGINEER.

TABLE 116.K - PAY FACTOR (PF_C) FOR COMPACTION

Average of Acceptance Test Results	Pay Factor, PF_C
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%	[1], [2]

[1] The material defined for the Lot shall be removed and replaced with asphalt concrete material complying with this Specification at no cost to The OWNER, as directed by The ENGINEER. Upon written agreement, the CONTRACTOR and ENGINEER may determine that for practical purposes the Lot shall not be removed. If determined by the ENGINEER to be more practical to accept a LOT, a LOT may be accepted under written agreement between the OWNER and the CONTRACTOR at an assigned compaction pay factor PF_C= 0.50 [2], for a LOT having a material factor pay factor equal or greater than 0.85, as directed by the ENGINEER.

[2] When the lift is the surface course, and is accepted at this pay factor, the CONTRACTOR shall be apply a sanded fog seal to the LOT complying with the requirements of SECTION 333, as directed by the ENGINEER, at no cost to The OWNER.

SECTION 135

CORRUGATED METAL PIPE AND ARCHES

135.1 GENERAL

135.1.1 Corrugated metal pipe, pipe arches, and connectors shall be manufactured and inspected in conformance with the requirements of AASHTO M 36 and as hereinafter specified. The size, type, and gauge of the pipe to be furnished shall be as shown on the plans or as specified in the Supplementary Specifications.

135.1.2 Nominal diameter of dimensions as referred to in M 36 shall be defined as meaning the minimum inside dimension of the pipe.

135.1.3 Corrugated metal pipe and arches shall only be used for transverse roadway culvert drainage applications.

135.2 REFERENCES

135.2.1 ASTM

A 36	A 123

135.2.2 AASHTO

M 36	M 196
M 190	M 219

135.3 MATERIALS

135.3.1 Materials for corrugated metal pipe, pipe arches, and connectors including base metal, rivets, and spelter coating shall be as specified in AASHTO M 36.

135.3.2 Headwalls or flared end sections may be used if called for on the plans or in the Supplementary Specifications.

135.4 FABRICATION

At the option of the CONTRACTOR, corrugated metal pipe may be fabricated by riveting, replacing rivets with resistance spot welds, or using a helically corrugated metal pipe with a continuous helical lock seam paralleling the corrugation or by a method of welding approved by the ENGINEER.

135.4.1 FABRICATION BY RIVETING: Pipe fabricated by riveting shall conform to AASHTO M 36.

135.4.2 FABRICATION BY WELDING: Pipe fabricated by replacing the rivets with resistance spot welds shall conform to AASHTO M 36.

135.5 FABRICATION BY CONTINUOUS LOCK SEAM

Pipes fabricated with a continuous helical lock seam parallel to the corrugations shall conform to the requirements of AASHTO M 36, M 196, and M 219.

135.6 BITUMINOUS COATING

When required by the Supplementary Specifications, pipes and connecting bands shall be protected, both inside and outside, with a bituminous coating or an asbestos fiber with a bituminous coating. The bituminous coating shall conform to the requirements of AASHTO M 190, Type A, Type B, or Type C.

135.7 REPAIR OF DAMAGED SPELTER COATING

Spelter coating which has been burned by welding or otherwise damaged in fabrication shall be repaired and recoated in accordance with AASHTO M 36.

135.8 MEASUREMENT AND PAYMENT

135.8.1 When only required as a separate material item, the following will apply:

135.8.1.1 The measurement and payment of corrugated metal pipe or corrugated metal arches will be by the linear foot measured along the centerline of the pipe or arch to the nearest foot.

135.8.1.2 Pipe culvert with beveled or skewed ends will be measured along the invert to the nearest foot.

135.8.1.3 End sections will be measured by the number of units each.

135.8.2 If this material is to be used in conjunction with a complete installation, then the measurement and payment will be defined in Section 910.

SECTION 136

STRUCTURAL STEEL PLATE FOR PIPE,
ARCHES, AND PIPE ARCHES

136.1 GENERAL

136.1.1 Structural steel plate for pipe, arches, and pipe arches shall be of the sizes, gauges, and dimensions designated on the plans or in the Supplementary Specifications and as specified herein.

136.1.2 These types of pipe shall only be used for transverse roadway culverts drainage applications.

136.2 REFERENCES:

136.2.1 AASHTO

M 36 M 190
M 167

136.3 MATERIALS

136.3.1 Plates and nuts and bolts shall conform to the specifications of AASHTO M 167.

136.3.2 Galvanized surfaces which are damaged shall be repaired in accordance with the provisions in AASHTO M 36, Repair of Damaged Spelter Coating.

136.4 DISTORTION

136.4.1 In advance of placing backfill material around circular structural plate pipes, the pipe shall be distorted.

136.4.2 Distortion may be performed either at the fabricating shop or in the field.

136.4.3 If the plates are distorted in the fabricating shop, the plates shall be distorted to provide an increase in the vertical diameter of the pipe after assembly of approximately 5 percent for the full length.

136.4.4 Plates shall be marked in order to assure that they will be placed in proper position.

136.4.5 If the pipes are distorted in the field, the method of distortion shall conform to the details shown on the plans.

136.5 MEASUREMENT AND PAYMENT

136.5.1 When only required as a separate material item, the following will apply:

136.5.1.1 The measurement of structural plate for pipe, arches, and pipe arches will be by the linear foot measured along the centerline of the pipe or arch to the nearest foot.

136.5.1.2 Structural plate for pipe with beveled or skewed ends measurement will be along the invert to the nearest foot.

136.5.1.3 Payment shall be made at the unit price per linear foot as defined in the Bid Proposal.

136.5.2 If this material is to be used in conjunction with a complete installation, then the measurement and payment will be defined in Section 910.

SECTION 201

CLEARING AND GRUBBING

201.1 GENERAL

This work shall consist of removing natural and man-made objectionable material from the right-of-way, construction areas, road approaches, material and borrow sites, areas through which ditches and channels are to be excavated, and such other areas as may be shown on the plans. Clearing and grubbing shall be performed in advance of grading operations except that in cuts over 3 feet in depth, grubbing may be done simultaneously with excavation, provided stumps, roots, embedded wood, foundations and slabs are removed as specified. Clearing and grubbing shall be in accordance with the requirements herein specified, such as erosion control requirements. Demolition of structures, other than foundations or slabs, shall be as shown on the plans.

201.2 REFERENCES

201.3 PRESERVATION OF PROPERTY

Existing improvements, adjacent property, utility and other facilities, and trees and plants not to be removed shall be protected from injury or damage resulting from the CONTRACTOR's operations. Only trees and plants designated or marked for removal by the ENGINEER shall be removed.

201.4 CONSTRUCTION METHODS

201.4.1 The natural ground surface shall be cleared of vegetable growth, such as trees, tree stumps, logs, roots or downed trees, brush, grass, weeds, and surface boulders, as well as fences, walls, rubbish, foundations and slabs.

201.4.2 Unless otherwise shown on the plans, the entire area of the project within the limit lines specified below shall be cleared and grubbed. No payment will be made to the CONTRACTOR for clearing and grubbing outside these limits, unless such work is authorized by the ENGINEER.

201.5 LIMIT LINES: Except when limit lines for clearing and grubbing are shown on the plans or are staked by the ENGINEER, clearing and grubbing shall extend only within reasonable limits of the work area.

201.6 REMOVAL OF TREES AND TREE BRANCHES

201.6.1 Trees shall be removed in such a manner as not to injure standing trees, plants, and improvements which are to remain. Tree branches extending over a roadway and which clear finish grade by 12 feet or less shall be cut off close to the boles in a workmanlike manner.

201.6.2 Trees requiring trimming to facilitate normal construction operations shall be trimmed by a tree surgeon.

201.7 REMOVAL AND DISPOSAL OF DEBRIS

Debris to be removed shall be disposed of outside the right-of-way at a location satisfactory to the ENGINEER, except when burning of combustible debris is permitted. The area to be graded and adjacent areas shall be left with a neat and finished appearance. No accumulation of flammable material shall remain on or adjacent to the property line. In case burning precedes construction operations, the piles may be placed in the center of the area; otherwise, the piles shall be placed in the most convenient location at the side of the area and beyond slope lines where they may be burned without damage to surrounding forest cover or adjacent property. Burning shall be done in conformance with local regulations and at such times and in such manner as to prevent the fire from spreading to areas adjoining the construction site. In areas where burning is prohibited by local regulations, all removed material shall be disposed in an approved solid waste disposal site.

201.8 REMOVAL AND DISPOSAL OF SALVAGEABLE ITEMS

Items and materials of salvage value as shown on the plans or as determined by the ENGINEER, unless incorporated in the new work, shall remain the property of the OWNER and shall be delivered to approved storage areas as directed by the ENGINEER. Such items and materials shall be carefully removed and delivered in such a manner as to permit re-use.

201.9 MEASUREMENT AND PAYMENT

201.9.1 CLEARING AND GRUBBING:

201.9.1.1 When the proposal includes an item for clearing and grubbing, the quantity for measurement shall be as indicated in the Bid Proposal.

201.9.1.2 The unit price per acre paid for clearing and grubbing shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in

clearing and grubbing as shown on the plans, as provided in these specifications and as directed by the ENGINEER, including the removal and disposal of resulting material.

201.9.1.3 When the Bid Proposal does not include a pay item for clearing and grubbing as above specified and unless otherwise specified in the Supplementary Specifications, full compensation for any necessary clearing and grubbing required to perform construction operations specified shall be considered as included in the price paid for other items of work and no additional compensation will be allowed therefore.

201.9.2 REMOVAL AND DISPOSAL OF TREES: If the Bid Proposal includes separate estimates of quantities for the removal of trees, the trees shall be classified by size as follows:

201.9.2.1 Trees less than 12 inches in circumference at 3 feet above the original ground surface shall be considered as included in the price for clearing and grubbing or excavation, and no additional compensation will be allowed therefor.

201.9.2.2 Trees between 12 and 30 inches in circumference shall be measured as a unit price for each tree in the item provided in the Bid Proposal for trees of this dimension.

201.9.2.3 Trees more than 30 inches in circumference shall be measured as a unit price for each tree in the item provided in the Bid Proposal for trees of this dimension.

SECTION 202

ROADWAY EXCAVATION

202.1 GENERAL

Roadway excavation shall consist of excavation involved in the grading and construction of roadways, except structure excavation, trench excavation, and any other excavation separately designated.

202.2 REFERENCES

202.2.1 This publication Section 204

202.3 UNSUITABLE MATERIAL

202.3.1 Unsuitable materials include all material that contains debris, roots, organic matter, stones or boulders too large to be used in the intended construction, or other materials that are determined by the ENGINEER to be unsuitable. Otherwise suitable materials which are unsuitable due to excess moisture content will not be classified as unsuitable material unless it cannot be dried by manipulation, aeration or blending with other materials satisfactorily as determined by the ENGINEER.

202.3.2 Material that is unsuitable for the intended use shall be excavated and removed from the site or otherwise disposed of as approved by the ENGINEER.

202.3.3 The removal and disposal of such unsuitable material will be paid for as roadway excavation for the quantities involved.

202.4 ROCK EXCAVATION

202.4.1 Rock excavation shall consist of igneous, metamorphic and sedimentary rock, naturally in place, which cannot be excavated without blasting or the use of rippers, and all boulders or other detached stones having a volume of one (1) cubic yard or more, as determined by physical measurements or visually by the ENGINEER. Where any portion of the excavation contains strata classified as Rock Excavation and the various strata are parted with strips or strata not classified as Rock Excavation which constitute twenty-five (25) percent or less of the total thickness of the rock plus non-rock layers, the entire volume of the combined layers shall be paid as Rock Excavation. Removal of Surface boulders in excess of 1 cubic yard in volume shall be paid for under Clearing and Grubbing, unless specifically identified as Rock Excavation.

202.4.2 OVERSHOOTING: Excessive blasting will not be permitted. Material outside the authorized cross section which may be shattered or loosened because of blasting shall be removed at the CONTRACTOR'S expense. The CONTRACTOR shall discontinue any method of blasting which leads to overshooting and is dangerous to the public or destructive to property or to natural features.

202.5 SLIDES AND SLIPOUTS

202.5.1 Material outside of planned roadway or ditch slopes which in the opinion of the ENGINEER is unstable and constitutes potential slides, material which has intruded into the roadway channel or ditch, and material which has escaped from new or old embankments shall be excavated and removed. The material shall be excavated to designated lines or slopes either by benching or in such a manner as approved by the ENGINEER. Such material shall be used in the construction of the embankments or disposed of as approved by the ENGINEER.

202.5.2 The removal and disposal of slide and slipout material as above specified not resulting from overshooting as defined in Subsection 202.4 will be paid for at the contract price for excavation for the quantities involved. However, if due to the character of the work the removal and disposal of such material is not properly compensable at the contract price for roadway excavation, the work may be paid for as extra work provided the CONTRACTOR requests in writing such payment prior to performing the work. Authorization for the work will be by change order.

202.5.3 Only those quantities of slide or slipout material which are actually removed as ordered by the ENGINEER will be approved for payment.

202.5.4 The above provisions shall not be so construed as to relieve the CONTRACTOR from his obligation to maintain all slopes true and smooth.

202.6 SLOPES

202.6.1 Excavation slopes shall be finished in conformance with the lines and grades shown on the plans. Debris and loose material shall be removed. When completed, the average plane of the slopes shall conform to the slopes indicated on the plans and no point on the completed slopes shall vary from the designated plane by more than 6 inches measured at right angles to the slope. Except where excavation is in rock no point shall vary more than 2 feet from the designated plane of the slope. In no

case shall any portion of the slope encroach on the construction area.

202.6.2 Tops of excavation slopes and ends of excavations shall be rounded as shown on the plans or as directed by the ENGINEER, and these quantities will not be included in the payment for excavation. This work will be considered as a part of finishing slopes, and no additional compensation will be allowed therefore.

202.6.3 Embankment slopes shall be finished in conformance with lines and grades shown on the plans. When completed, the average plane of embankment slopes shall conform to slopes indicated on the plans, and no point on completed slopes shall vary from the designated plane by more than 6 inches measured at right angles to the slope.

202.7 SURPLUS MATERIAL

202.7.1 Unless otherwise shown on the plans, specified in the Supplementary Specifications, or approved by the ENGINEER, no surplus excavated material shall be disposed of within the construction area. The CONTRACTOR shall make all arrangements for disposal of the material at offsite locations as may be approved by the ENGINEER and shall, upon request, file with the ENGINEER the written consent of the owner of the property upon which he intends to dispose of such material.

202.7.2 If the quantity of surplus material is shown in the plans or specified in the Supplementary Specifications, the quantity shown or specified is approximate only. The CONTRACTOR shall satisfy himself that there is sufficient material available for the completion of the embankments before disposing of any indicated surplus material inside or outside the area. Any shortage of material caused by premature disposal of surplus material by the CONTRACTOR shall be replaced by him, and no compensation will be allowed the CONTRACTOR for such replacement.

202.8 SELECT MATERIAL

202.8.1 Select material shall be considered as material which can be compacted to the densities specified in Section 204.

202.8.2 Select material encountered in excavation within the right-of-way shall be used for finishing the top portion of the roadbed or for constructing shoulders or used for structure backfill or used as shown on the plans or as directed by the ENGINEER.

202.8.3 Where practicable, select material shall be hauled directly from excavation to its final position in the construction prism and compacted in place, and such work will be paid for at the contract price for excavation.

202.8.4 Select material shall remain in place until it can be placed in final position as provided above, except, if ordered in writing by the ENGINEER, select material may be excavated and stock-piled at locations designated by him and later placed in final position in the construction prism.

202.8.5 Excavating select material and stockpiling, if required, will be paid for at the contract price for roadway excavation. Removing the select material from stockpiles and placing it in final position in the roadway prism will again be paid for at the contract price for roadway excavation, except that the quantities to be paid for will be determined from measurements of the material in the stockpiles prior to removal. No payment for stockpiling of select material will be made unless such stock- piling is ordered by the ENGINEER.

202.8.6 Topsoil placed along the tops of slopes in connection with erosion control work will not be considered as stockpiled material when determining pay quantities of earthwork.

202.9 MEASUREMENT AND PAYMENT

202.9.1 All earthwork shall be measured by the cubic yard in place at the time of excavation. The following earthwork operations will be measured as excavation for the quantities of material involved.

202.9.1.1 Excavating the construction area including public and private road approaches, connections, and driveways; excavating unsuitable material when shown on the plans or specified in the Supplementary Specifications; excavating slides and slipouts not resulting from over-shooting; excavating surplus material; excavating selected material and topsoil from within the limits of project and removing such materials from stockpiles when stockpiling is ordered; and excavating local borrow.

202.9.2 Excavation beyond the authorized cross section will not be included in measurement or payment.

202.9.3 Rock excavation will be paid by the cubic yard in place, prior to start of construction and measured to limits of excavation specified on plans. No compensation will be made to the CONTRACTOR for excess rock excavation due to over-shooting, nor for the cost of backfilling voids or depressions resulting from overshooting.

SECTION 204

FILL CONSTRUCTION

204.1 GENERAL

Fill construction shall consist of constructing roadway embankments (including the preparation of areas upon which they are to be placed), the placing and compacting of approved material within areas where unsuitable material has been removed; and the placing and compacting of suitable materials in holes, pits and other depressions.

204.2 REFERENCES

204.2.1 ASTM

D 1557
D 4254

204.3 PLACING

204.3.1 Unless otherwise specified, the upper 6 inches of the original ground area upon which fills are to be constructed shall be compacted to a density of not less than 90 percent of maximum density as determined by ASTM D 1557, or in soils containing less than 5 percent passing the #200 sieve, a minimum relative density of 70 percent as determined by ASTM D 4254.

204.3.2 Rocks, broken concrete, or other solid materials which are larger than 4 inches in greatest dimension shall not be placed in fill areas where piles are to be placed or driven.

204.3.3 When fill is to be made and compacted on hillsides or where new fill is to be compacted against existing fill or where embankment is built 1/2 width at a time, the slopes of original hillsides and old or new fills shall be started wherever the vertical cut of the next lower bench intersects the existing ground.

204.3.4 Material thus cut out shall be recompacted along with the new embankment material at the CONTRACTOR's expense, unless the width of the bench required exceeds 4 feet, in which case the excavated material in excess of 4 feet will be measured and paid for as excavation.

204.3.5 Clods or hard lumps of earth of 6 inches in greatest dimension shall be broken up before compacting the material in embankment, except as provided in the following paragraph.

204.3.6 When the fill material includes large rocky material or hard lumps, such as hardpan or cemented gravel which cannot be broken readily, such material shall be well distributed throughout the fill. Sufficient earth or other fine material shall be placed around the larger material as it is deposited so as to fill the interstices and produce a dense, compact fill. However, such material shall not be placed within 2 feet of the finished grade of the fill.

204.3.7 Embankment construction shall not be performed when material is frozen.

204.4 COMPACTING

204.4.1 Fill shall be constructed in compacted layers of uniform thickness and each layer shall be compacted in accordance with the requirements herein specified with the following exception.

204.4.2 Where fills are to be constructed across low, swampy ground which will not support the weight of hauling equipment, the lower part of the embankment may be constructed by dumping successive loads of suitable material in a uniformly distributed layer of a thickness not greater than that necessary to support the equipment while placing subsequent layers, after which the remainder of the embankment shall be constructed in layers and compacted as specified.

204.4.3 The placing and compacting of approved material within the project (where unsuitable material has been removed, and the filling of holes, pits and other depressions has been accomplished) shall conform to all of the requirements herein specified for compacting fills.

204.4.4 The loose thickness of each layer of fill material before compacting shall not exceed 8 inches, except as provided in the following paragraph for rocky material. The ENGINEER may authorize roadway fill materials to be placed in layers in excess of 8 inches thickness if the CONTRACTOR can demonstrate that the required compaction can be achieved for the full depth of the lift. However, in no case shall the loose layer exceed 24 inches. Each layer shall be compacted in accordance with the following requirements to a density of not less than 90 percent of maximum density, as determined by ASTM D 1557, or in soils containing less than 5 percent passing the #200 sieve, a minimum relative density of 70 percent as determined by ASTM D-4254. In areas of new or widened roadways and required appurtenances, the density of the upper 12 inches shall not be less than 95 percent as determined by ASTM D 1557.

204.4.5 When fill material contains by volume over 25 percent of rock larger than 6 inches in greatest dimension, the fill below a plane 3 feet below

finished grade may be constructed in layers of a loose thickness before compaction not exceeding the maximum size of rock in the material but not exceeding 3 feet in thickness. When more than 65 percent is retained on the No. 4 sieve, moisture and density control is not required.

204.4.6 The interstices around the rock in each layer shall be filled with earth or other fine material and compacted. Broken portland cement concrete obtained from the project excavation will be permitted in the fill with the following limitations.

204.4.6.1 The maximum dimensions of any piece used shall be 6 inches.

204.4.6.2 Pieces larger than 4 inches shall not be placed within 12 inches of any structure.

204.4.6.3 Pieces larger than 2 1/2 inches shall not be placed within 12 inches of the subgrade for paving.

204.4.6.4 "Nesting" of pieces will not be permitted.

204.4.7 At locations where it would be impractical to use mobile power compacting equipment, fill layers shall be compacted to the specified requirements, by any approved method that will obtain the specified relative compaction.

204.4.8 At the time of compaction the moisture content of fill material shall be optimum plus or minus 2 percent. Fill material which contains excessive moisture shall not be compacted until the material is dry enough to obtain the required relative compaction. Full compensation for any additional work involved in drying fill material to the required moisture content shall be considered as included in the unit price per Bid Proposal and no additional compensation will be allowed. Fills shall be maintained to the grade and cross sections shown on the plans until the acceptance of the contract.

204.5 MEASUREMENT AND PAYMENT

Fill construction shall include excavation, placement, compaction and all related work, and shall be measured in place after compaction. Payment will be made on the unit price per cubic yard for compacted fill unless otherwise noted on the Bid Proposal.

SECTION 205

BORROW MATERIAL

205.1 GENERAL

Borrow material shall consist of naturally occurring granular material, such as: pit-run gravel, sand, decomposed granite, or slide rock; and shall be free from wood, vegetation, or other deleterious matter, but shall contain sufficient sand or filler to permit proper compaction of the subgrade. The maximum size of this material shall not be greater than 2/3 the compacted thickness of the course placed in the subgrade. The CONTRACTOR shall notify the ENGINEER sufficiently in advance of opening any material sites so that cross section elevations and measurements of the ground surface after stripping may be taken and sufficient time for testing the material will be allowed.

205.2 REFERENCES

205.2.1 This publication:

SECTION 202
SECTION 204

205.3 PLACING AND COMPACTING

Borrow shall be placed and compacted as specified in Section 204. The CONTRACTOR shall satisfy himself that there is sufficient space available in fill locations for placing any excavated material before placing borrow. Any excess excavation which develops as a result of placing imported borrow in advance of completing excavations shall be disposed of at the CONTRACTOR's expense in accordance with the provisions in Section 202 and a corresponding reduction in the quantity of borrow to be paid for will be made, for which the CONTRACTOR will have no claim for compensation. Borrow pits shall be excavated to regular lines to permit accurate measurement; depth of excavation throughout the areas of borrow pits shall be as uniform as practicable and the side slope shall be dressed to such slope as may be directed by the ENGINEER, leaving the borrow pit area in a clean and safe condition.

205.4 MEASUREMENT AND PAYMENT

205.4.1 Quantities of borrow outside of physical limits of the work will be measured as per cubic yard. Material excavated at the borrow site and not used on the work will be deducted from the computed quantities and no payment will be made therefore.

205.4.2 If borrow is acquired from a commercial pit, alternate methods of determining cubic yardage of borrow material delivered to the site may be used. Such alternate method shall be agreed to and documented by the ENGINEER and CONTRACTOR prior to the start of any borrow operation.

SECTION 207

LEAN FILL CONSTRUCTION

207.1 GENERAL

LEAN FILL CONSTRUCTION shall consist of filling shallow excavations, pipe zones in deep excavations and as authorized by the ENGINEER, with LEAN FILL, a flowable mixture of Portland cement, aggregates, admixtures and water. It shall be identified by a unique design mix number as defined by the supplier. A design mix shall not be used on a project without written authorization of the ENGINEER.

207.2 REFERENCES

207.2.1 ASTM:

C31	C33
C94	C150
C172	C173
C192	C231
C260	C558
C618	C685
D1633	D2922
C3017	

207.2.2 ACI:

211
340.2R

207.3 PORTLAND CEMENT

207.3.1 Portland cement to be either or furnished under this specification shall conform to the requirements of ASTM C150. The type of cement shall be either Type I or Type II. "low alkai;" (LA) cement.

207.3.2 The CONTRACTOR shall submit certification of compliance signed by the Type and source (plant location), stating the Portland cement furnished to the cement manufacturer, identifying the cement project, and or used in the concrete 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 for each type of cement and each design mix used on the project.

207.3.3 Portland cement used in the manufacture of LEAN FILL for a project shall be of the same brand and type for all LEAN FILL batched and delivered to a project under the authorized design mix identification, unless authorized by the ENGINEER.

207.3 AGGREGATES

207.4.1 Aggregates shall be sampled and ASTM tested as prescribed in said specification. The CONTRACTOR shall obtain a certification of compliance identifying the aggregates, reporting test results, and stating the aggregates comply with this specification.

207.5 AGGREGATE GRADING

207.5.1 The maximum nominal aggregate size shall be one (1) inch.

207.6 WATER

207.6.1 Water shall conform to the Made by requirements of ASTM C94.

207.7 AIR ENTRAINING ADMIXTURES

207.7.1 Air entraining admixtures shall conform to the requirements of ASTM C260, as authorized by the ENGINEER.

207.8 MINERAL AOMIXTURES

207.8.1 Mineral admixtures shall be fly ash complying with the requirements of Class "F" fly ash as specified in ASTM C618 and Section 101 of this specification.

207.8.2 Mineral admixtures shall be proportioned by weight as required to improve pumpability.

207.9 PROPORTIONING

207.9.1 The CONTRACTOR shall be solely responsible for the LEAN FILL design mix proportions either batched at and/or delivered to the site. A design mix shall be prepared in a laboratory under the direct supervision of a Registered New Mexico Professional Engineer. The testing

equipment used in the design/development testing 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 certificates shall be submitted to the ENGINEER upon request. The mix shall be certified that it complies with the requirements of this specification.

207.9.1.1 The materials shall be proportioned such that if placed at maximum slump, the laboratory dry density, as determined from molded specimens, at 24 (+/- 4) hours, is equal to or greater than 95 per cent of the maximum dry density of the blended cement and aggregate, determined in accordance with ASTM D558. The dry density of the laboratory molded LEAN FILL specimens shall be computed based on the average unit weight of the compressive strength specimens, corrected for the moisture content at the time of testing.

207.9.2 The Portland cement content shall be one-half (1/2) sack, 47 lbs., per cubic yard in all LEAN FILL produced under this specification, except as noted herein, or as specified in the Supplemental Specifications, or plans or as authorized by the ENGINEER.

207.9.3 The combined aggregate gradation shall comply with the following limits.

SCREEN SIZE	% PASSING
1 in.	100
¾ in.	95-100
3/8 in	82-100
no.4	70-100
no.8	55-85
no.16	38-60
no.50	6-30
no. l00	2-10

The mix gradation, when plotted on a US Bureau of Public Road 0.45 Power Gradation Chart. shall be similar to the plots of the specified gradation limits in the shape of the characteristic gradation curve.

207.9.4 Air-entraining admixtures shall conform to the requirements of ASTM C260. Air entraining admixtures shall be proportioned to provide air entrainment of not less than 2 per cent, as authorized by the ENGINEER.

207.9.5 Water shall be proportioned as required.

207.9.6 The design mix shall be proportioned to provide a slump of not less than 5 inches and not greater than 8 inches.

207.9.7 The compressive strength of the design mix shall not exceed 60 psi at 28 days when sampled and tested in accordance with ASTM C172 and D1633, and as specified in this section.

207.9.8 Laboratory compressive strength test specimens shall consist of cylinders molded by pouring a sample of the design mix in two equal lifts, into drained rigid molds, conforming to the dimensional requirements of ASTM 0558, having a capacity of 1/30, +/-0.0004, c.f., with an internal diameter of 4.0, +/-.016, inches (4" dia. x 4.5" ht., nominal dimensions). Molds cut from PVC (SCHD40) pipe having the specified internal dimensions and volume of that specified in ASTM 0558 may be used. Molds shall be free draining at the base. If molds complying with the requirements of ASTM 0558 are used, they shall not be clamped to the base. A free draining base may be accomplished by setting the molds on plywood for molding and initial curing. The cylinders shall be cured in the molds for the first 24 +/-4 hours. After 24 +/-4 hours curing in the molds, the cylinders shall be extruded and cured until testing.

207.9.9 Laboratory strength test specimens shall be cured in accordance with ASTM C192. Test specimens shall not be cured in a curing tank.

207.9.10 Four (4) specimens shall be weighed, measured and tested for compressive strength in accordance with the requirements of ASTM D558 at one (1) day, seven (7) days, and two (2) at 28 days, respectively.

207.9.11 An optimum moisture maximum density relationship for the combined aggregates and cement, proportioned by weight as defined by the proposed blends of the aggregates and cement, shall be determined in accordance with the requirements of ASTM D558.

207.9.12 The LEAN FILL design mix submittal shall include but not be limited to

the following information, as directed by the ENGINEER:

a. Certification of compliance of the design mix under the requirements of this specification,

b. Certification of the component materials used in the design mix,

c. Plastic characteristics of the design mix to include temperature, slump, air entrainment, wet unit weight, yield and cement factor,

d. Performance characteristics of the hardened LEAN FILL to include the compressive strength of all test specimens and the corresponding average compressive strength, compressive strength test shall be reported for 1 day, 7 days and 28 days laboratory cure,

e. Dry unit weight and moisture content of the compressive strength specimens at the time of testing, average dry unit weight for each test series reported as a percent of the maximum dry density as determined by ASTM D 558,

f. The optimum moisture maximum dry density relationship for the combined aggregates and cement and a graphical plot of the moisture density relationship as determined in accordance with ASTM D 558 in the laboratory.

207.10 BATCHING, MIXING AND DELIVERY

207.10.1 Batching, mixing and delivery shall conform to the requirements of either ASTM C94 or ASTM C685. The CONTRACTOR shall provide to the ENGINEER with each load of LEAN FILL batched and delivered to the job site, before unloading at the site, a delivery ticket on which the information specified in the following table is printed, stamped or written, certifying said LEAN FILL.

TABLE 207

Name of LEAN FILL Supplier
Delivery Ticket Number
Date of Delivery
Contractor
Project (optional)
Design Mix Number
Volume of LEAN FILL in Load
Time Loaded
Batched Weight of Cement
Batched Weight of Fine Aggregate
Batched Weight of Coarse Aggregate
Batched Weight or Volume of Admixtures
Weight or volume (gal.) of water batched/ added at the plant
Reading of Mixer Drum Revolution Counter at the Start of Mixing
Certification that the materials delivered are the same brand, type and source as the materials defined in the reference Design Mix, as authorized by the ENGINEER.
Design Mix Target Proportions
Weight or Volume (gal.) of water added at the site
Weight or Volume of Admixtures added at the Job Site
Signature & name of person who authorized the addition of water at the site and affiliation to project

207.11 TESTS

207.11.1 Lean Fill material 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. A test sample shall be taken in the field for each 150 c.y. or each day's placement, whichever is greater. Field testing shall include standard tests for slump, air entrainment, unit weight, temperature, yield and cement factor. A minimum of four (4) compressive strength specimens shall be molded from a single sample. The samples shall be molded in accordance with the requirements, of paragraph 207.8. Compressive strength specimens shall not be molded with material used either for slump or air entrainment tests. The cylinders shall be allowed to set for 24 (+/-4) hours in a closed plastic bad and then transported in the molds to the laboratory. The cylinders should be extruded from the molds and moist cured until

compressive strength testing. The samples shall be tested for compressive strength in accordance with requirement of ASTM 01633. One specimen shall be tested for compressive strength at seven (7) days, two (2) samples shall be tested for compressive strength at 28 days. Test results shall be reported to the ENGINEER, CONTRACTOR, and SUPPLIER, in writing, within four (4) days of completion of a test. Non-complying test results shall be reported within one working day after completion of a test.

207.11.2 Curing of field strength specimens for acceptance tests shall be conducted in accordance with ASTM C3I. Cylinders shall not be cured in a water bath.

207.11.3 Field density/compaction tests in accordance with the requirements of ASTM 02922 and ASTM D3017 shall be taken at the rate of two tests per 150 c.y. of material or fraction thereof placed, as directed by the ENGINEER. The material shall either have an in-place density equal to or greater than 95% of maximum dry density of the combined dry materials as determined under paragraph 207.8, or 24 hours cure, prior to placement of fill, subbase, base course, treated base, pavement or structure.

207.12 TEMPERATURE/ENVIRONMENTAL CONTROLS

207.12.1 When the ambient temperature at the time of placement is less than 40 degrees F, the temperature of the LEAN FILL placed shall not be less than 50 degrees F. The materials shall be cured at a minimum temperature of 40 degrees F for 24 hours after placement.

207.13 PLACEMENT

207.13.1 LEAN FILL shall be placed in lifts not exceeding four (4) feet in height, at time intervals of not less than 1 hour per lift, as authorized by the ENGINEER. Fill shall not be placed to a height above top of pipe exceeding two (2) feet when used to fill a pipe zone, nor placed full depth in a trench to finish subgrade elevation, unless authorized by the ENGINEER. Caution should be taken in placing material in the pipe zone to above the pipe. If the buoyancy of the pipe will result in flotation, the pipe should be anchored or filled with water to counteract the buoy condition until the LEAN FILL densifies.

207.13.2 LEAN FILL shall not be placed in standing water and shall be protected from flooding for at least 12 hours after placement.

207.13.3 LEAN FILL shall not be placed on either frozen and/or saturated ground.

207.13.4 LEAN FILL shall only be vibrated after placement if required by the ENGINEER.

207.14 MEASUREMENT AND PAYMENT

207.14.1 Unless Lean Fill is specified in the specification or shown on the plans or required by the OWNER, the CONTRACTOR has the option of using Lean Fill in place of conventional backfill and compaction. The Lean Fill material, placement, and the disposal of the excess material generated by the use of the Lean Fill shall be considered incidental to the item of work in which it is used and no separate or direct payment will be made for Lean Fill.

207.14.2 When Lean Fill is specified in the specification or shown on the plans, it shall be measured by the cubic yard, complete in place. Payment for Lean Fill shall be at the contract unit price per cubic yard, complete in place, which shall include all labor, material and equipment required in placing the Lean Fill and removal and disposal of the excess material generated by the use of the Lean Fill.

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-Valve 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 sha11 be uniformly mixed and moisture conditioned using a tractor 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, sidewa1ks, 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 p1ans 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 +/- 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.

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

301.6.4 Test results shall be reported to the ENGINEER and CONTRACTOR 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.

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 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 have 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 OWNER 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
Section 301

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 consists 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 and 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 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-feet 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 life 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 days 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.

Table 302.A
ENGINEERING REQUIREMENTS

CHARACTERISTIC	SPECIFICATION LIMIT(S)	
Aggregate Type	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

	PRODUCTION RANGE (% passing)		PRODUCTION TOLERANCES (+/-%)
SIEVE SIZE/TYPE	I	II	
1-1/2 inch	100	100	
1 inch	95-100	100	
¾ inch		90-100	8
½ 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.

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 303

SUBBASE PREPARATION

303.1 GENERAL

This section defines the materials and compaction requirements for subbase, which is normally associated with but not limited to the residential or arterial, street paving section.

303.2 REFERENCES

303.2.1 ASTM:

D 1557 D 4318
D 1883

303.3 MATERIALS

303.3.1 Subbase may consist of imported or in situ natural materials, provided the following requirements are met:

303.3.1.1 Also material will be free of adobe, vegetable matter, loam, alkali, and/or other deleterious substances.

303.3.1.2 The material, when tested in accordance with ASTM D 1883, shall have a bearing ratio of 20 or more.

303.3.1.3 The requirements for materials having a bearing ratio value of 20 or more may, if approved by the ENGINEER, be satisfied by complying with the following schedule for particle size and plastic index (PI), per ASTM D 4318.

Percentage of Sample Passing#40Sieve	PI of Minus #40Material
5 - 10	10 or less
10 - 20	8 or less
20 - 30	6 or less
30 - 40	5 or less
40 - 50	5 or less
50 - 100	5 or less

303.4 SAMPLE

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

303.5 SUBBASE COMPACTION

303.5.1 The subbase material shall be compacted to 95 percent of maximum density as determined by ASTM D 1557 for full thickness of subbase.

303.5.2 The minimum compacted thickness of the subbase material shall be in accordance with the approved paving section.

303.6 MEASUREMENT AND PAYMENT

The measurement for subbase material shall be by the square yard for the specified compacted thickness. Payment will be made at the unit price per square yard per compacted thickness as specified 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 Owner, if appropriate, that there are survey reference markers that may be damaged or destroyed during street or utility construction activities. Or the ENGINEER may field reference the endangered markers or monuments for future re-establishment.

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. ENGINEER is responsible for resetting monuments.

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 336

ASPHALT CONCRETE PAVEMENT

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 Pre-Paving 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 ± 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 ± 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 be 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 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, ± 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' 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 a 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.

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 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.™

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 An 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, Pm_f, 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 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.

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 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 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). 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, oF
   10 Ambient temperature at time of sampling, oF
   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
$UP_{SUBLOTS}$, $UP'_{SL1} + UP'_{SL2} + \ldots + UP'_{SLN}$, sum of SUBLOTS' unit prices, see 336.12.2.2

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, $0.5 \times (C_{LM} + C_{LC})$, 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 there of, 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.

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 ± %, 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| ▯ 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} ▯ 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}▯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.

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.

SECTION 337

PORTLAND CEMENT CONCRETE PAVEMENT

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.

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.

337.4.2 (Empty)

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 vibration of the consolidating and finishing equipment. Flange braces shall extend outward on the base not less than 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 1/8 inch in 10 feet, and the upstanding leg shall not vary more than 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 +/- 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:

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 riot 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 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 grove 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 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, 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 trans verse 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 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 ½ 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 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 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 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 21/2 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 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 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	$\leq$	D-d	$\leq$	0.25 in	1.00
0.25 in	<	D-d	$\leq$	0.50 in	$(d)^2/(D)^2$
0.50 in	<	D-d	$\leq$	1.00 in	[A] or [B], [C]
		D-d	>	1.00 in	[A]

Excessive Pavement Depth, D-d					PF_D
0	<	d-D	$\leq$	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.

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 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.

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 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, drivepads, 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 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 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 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 ASTM:

C-31
C-39
C-42
C-171

349.2.2 ACI:

ACI 305
ACI 306

349.2.3 This Publication:

Section 105
Section 111

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.

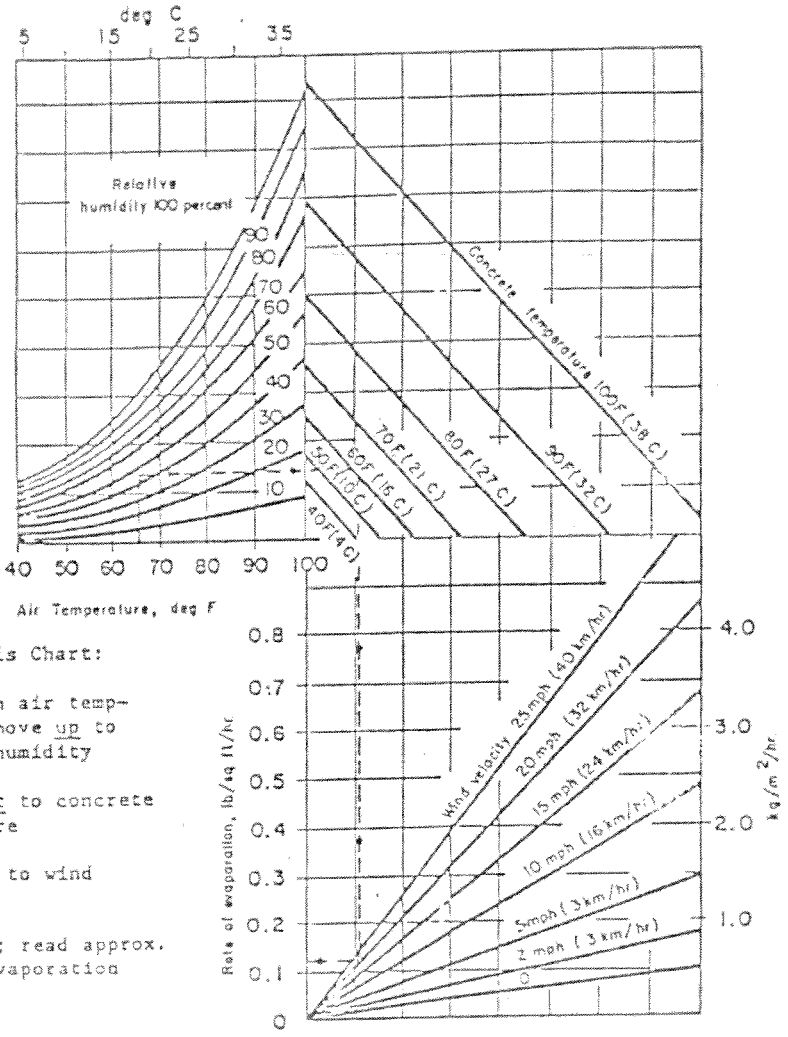
349.5 MOISTURE CONTROL

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.

EVAPORATION RATE



To Use This Chart:

1. Enter with air temperature, move up to relative humidity
2. Move right to concrete temperature
3. Move down to wind velocity
4. Move left; read approx. rate of evaporation

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.

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 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 (l0°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 (21) 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 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:

Weather Min.	Curing Days
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 or 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 made for concrete curing.

SECTION 400

TRAFFIC CONTROL

400.1 GENERAL

This section contains specifications which are relative to the protection of the public with respect to traffic control, such as: concrete wall and metal barrier, barrier posts, fencing, traffic signal equipment, street lighting equipment, signing and markings

400.2 CONTENTS

SECTION 401

CONCRETE WALL AND METAL BARRIERS

401.1 GENERAL

For the protection of the public, either in a vehicle or as a pedestrain, there is a necessity for the construction of approved concrete wall and metal barriers along hazardous locations. This section specifies the requirements for the installation of these barriers.

401.2 REFERENCES

New Mexico State Highway Department. Specifications for Road and Bridge Construction.

401.3 MATERIALS AND CONSTRUCTION

401.3.1 The materials and construction of concrete wall and metal barriers shall conform to Section 606 of the N.M.S.H.D. Specifications for Roads and Bridge Construction and to the N.M.S.H.D. Standard Detail Drawings, some of which have been included in these specifications.

401.3.2 Location of concrete wall barriers and specific anchorage details will be shown on the construction plans.

401.4 MEASUREMENT AND PAYMENT

401.4.1 Measurement for metal barriers and appurtenances shall be by the linear foot of barrier (including rail, posts and installation) or by the unit, such as end section or individual posts. Payment shall include all materials and labor necessary for the installation, as specified in the Bid Proposal.

401.4.2 Measurement for concrete wall barriers shall be by the linear foot along center line of barrier (including jointing and necessary anchoring). Payment shall include all materials and labor associated with the installation, as specified in the Bid Proposal.

SECTION 440

REFLECTORIZED PAINTED PAVEMENT MARKINGS

440.1 GENERAL: This work shall consist of furnishing and installing permanent and temporary reflectorized painted pavement markings in substantial compliance with the specifications and details shown on the plans, at the locations shown on the plans, or as established by the ENGINEER.

440.2 REFERENCES.

440.2.1 Manual on Uniform Traffic Control Devices (MUTCD), Latest Edition

440.3 MATERIALS.

440.3.1 TRAFFIC PAINT: Traffic paint shall conform to the requirements of the NMDOT for White and Yellow Traffic Line Paints Used on Construction Projects (Combination Alkyd and Hypalon - Fast Dry Type).

440.3.2 GLASS BEADS: Glass reflectorizing beads shall conform to the requirements specified in Section 441 for Glass Beads.

440.3.3 TEMPORARY MARKING TAPE

440.3.3.1 Temporary adhesive marking tape shall consist of weather and traffic resistant yellow or white reflective marking material and shall conform to the following requirements:

440.3.3.1.1 DESCRIPTION: The adhesive pavement striping material shall consist of white or yellow reflective marking material on a conformable non-metallic backing coated with a pressure sensitive adhesive and designed for marking of bituminous or portland cement concrete surfaces.

440.3.3.1.2 COLOR: The color of the visible surface shall be either white or yellow in accordance with the MUTCD and shall closely match the color of the paint specified in this Section 440.

440.3.3.1.3 REFLECTANCE: The white and yellow markings shall have the following initial minimum reflectance values at 0.2 degree and 0.5 degree observation angles and 86 degrees entrance angle as measured in accordance with the testing procedure of Federal Test Method Standard 370 unless a higher value is specified on the plans.

TEMPORARY MARKING TAPE			
Minimum Retroreflectivity (Millicandelas Per Footcandle Per Square Foot)			
OA	EA	White	Yellow
0.2	86	1770	1310
0.5	86	1270	820

Where: OA = Observation Angle in Degrees
EA = Entrance Angle in Degrees

440.3.3.1.4 ADHESION: The material shall have a precoated pressure sensitive adhesive which does not require a liner for protection from contamination, pre-adhesion, or blocking within the roll. Said material shall show no appreciable loss of adhesion after application.

440.3.3.1.5 CONFORMABILITY: The material shall be flexible and formable, shall show no cracking, flaking, or loss of reflective elements and, following application, shall remain conformed to the texture of the pavement surface.

440.3.3.6.1 PHYSICAL PROPERTIES.

440.3.3.1.6.1 DIMENSIONS: The thickness of the adhesive marking tape for normal use, shall not be less than 10 mils and shall be provided in 4-inch or 6-inch width (plus or minus 1/16 inch) unless otherwise specified.

440.3.3.1.6.2 WEAR RESISTANCE: Wear resistance samples of the adhesive pavement striping material applied to standard specimen plates and tested in accordance with Federal Test Methods No. 141, Method 6192, using a CS-17 wheel and 1000 gram load shall not exhibit a significant change in color after 5000 cycles.

440.3.3.1.7 REMOVABILITY

440.3.3.1.7.1 Temporary adhesive pavement striping material shall be readily removable from the pavement by following the manufacturer's recommendations, unless otherwise specified.

440.3.3.1.7.2 Removal shall not require sandblasting, solvent or grinding methods and shall not result in objectionable staining of the pavement surface.

440.3.3.1.8 DURABILITY: The material shall be weather resistant and show no appreciable fading, lifting, or shrinkage.

440.3.3.1.9 GENERAL

440.3.3.1.9.1 The materials as supplied shall be of good appearance and free from cracks, and the edge shall be true, straight, and unbroken.

440.3.3.1.9.2 The adhesive pavement striping material shall be packaged in accordance with accepted commercial standards, shall be stored at temperatures not to exceed 100 degrees Fahrenheit under normal conditions, and shall be suitable for use for a period of at least one (1) year after purchase.

440.3.4 ACCEPTANCE: Acceptance of traffic paint and temporary marking tape will be based upon receipt of certificates of compliance and documentation that the batch of paint and/or marking tape to be used has been tested by an independent laboratory and conforms with specifications.

440.4 CONSTRUCTION REQUIREMENTS.

440.4.1 GENERAL

440.4.1.1 The traffic paint, and beads shall be placed on the pavement by a spray type, self-propelled pavement marking machine, except that temporary striping during construction may be placed with other equipment designed for application of paint, or beads.

440.4.1.1.1 The machine shall be capable of applying a clear-cut 4-inch line or lines.

440.4.1.1.2 The machine shall be equipped with a mechanical device capable of placing a broken reflectorized centerline with a 10-foot painted segment and a 30-foot gap.

440.4.1.1.3.1 The machine shall be equipped with an air-operated glass bead drop-in dispenser controlled by the spray gun mechanism.

440.4.1.1.3.2 The dispenser shall be capable of placing the glass spheres into the paint line as the paint is applied to the pavement in such a manner as to provide satisfactory marking and delineation.

440.4.1.1.4.1 The volume of paint and glass beads in place shall be measured by the quantity per mile method. The CONTRACTOR shall provide certification of the volume of the paint and bead tanks. The CONTRACTOR shall strap the tanks prior to beginning striping operation and again after a mile has been striped. As an alternative, the CONTRACTOR may externally mark the tanks indicating a volume equivalent to the tolerances shown in this Section 440 or have a calibrated rod marked with the equivalent volumes. The volumes shall be measured after a mile has been striped. At the option of the ENGINEER, if the striping machine is equipped with air atomized spray units, (not airless), and paint and bead gauges, the volume may be determined by utilizing said gauges.

440.4.1.1.4.2 The CONTRACTOR shall be required to restripe the roadway if 50% of the paint or beads is not placed on the roadway or if the ENGINEER determines that the striping is not adhering to the pavement or the glass beads are not adhering to the paint.

440.4.1.1.5 When paint has settled excessively, the CONTRACTOR shall redisperse the settled pigments at the bottom of the paint drums, with a mixing device, prior to pumping or loading paint into the striping unit so excess pigments are not left on the bottom of the paint drum. Thinner shall not be allowed to be pumped into the paint tanks. If the CONTRACTOR uses thinner to clean his equipment, the CONTRACTOR shall be responsible for disposing of all debris including, but not limited to, thinner at disposal sites approved by government agencies regulating the disposal of such materials.

440.4.2 PLACEMENT OF BEADS AND TRAFFIC PAINT.

440.4.2.1 Reflectorized painted markings for temporary use on final surfacing is prohibited. Pavement markings shall be applied during daylight hours when the pavement surface is dry and the weather is not foggy, rainy, excessively windy, or otherwise adverse to the application of markings. The surface shall be free from excess asphalt or other deleterious substances before traffic paint or beads are applied. The CONTRACTOR shall remove dirt, debris, grease, motor oils, rocks, or chips from the pavement surface before applying markings.

440.4.2.2 The CONTRACTOR shall provide the necessary personnel and equipment to divert traffic from the installation area where the work is in progress and during drying time. The CONTRACTOR shall submit a traffic control plan to the ENGINEER for approval prior to the commencement of work. All damage to the pavement marking due to the CONTRACTOR's negligence or failure to maintain traffic control shall be repaired at the CONTRACTOR's expense.

440.4.2.3 Permanent reflectorized painted markings shall consist of two applications of markings. For painted markings on new pavement the second application of markings shall be placed no sooner than

twenty-one days after placement of the first application of markings as directed by the ENGINEER.

440.4.2.4 If paint is not adhering to the pavement or if the glass beads are not adhering to the paint, or if the second application of pavement markings are not placed over the first application of markings in accordance with this Section 440, the CONTRACTOR will be required to remove the striping, and to restripe the roadway.

440.4.3 TOLERANCE FOR PLACING PAINT AND BEADS

440.4.3.1 The finished line shall be smooth, aesthetically acceptable and free from undue waviness.

440.4.3.2 Painted lines shall be 4, 8, or 12 inches wide as shown on the plans with a tolerance of plus or minus 1/8 inch and shall be placed at a minimum rate of 19.75 gallons of paint per mile for a solid 4-inch line and 4.94 gallons per mile for a broken 4-inch line, based on a 10-foot stripe and a 30-foot gap (40-foot cycle). Other widths of striping shall be applied at the minimum rate that is the equivalent multiple of the above.

440.4.3.3 The length of painted segment and gap shall not vary more than six (6) inches in a 40-foot cycle.

440.4.3.4 The following transverse gap dimension between centerline stripes for two (2) and three (3) stripe combinations reflect a three (3) paint gun set up on the striping unit. The broken line shall be placed on the centerline of the roadway with the respective left and right no passing zones placed so a two (2) inch gap exists between the broken and no passing zone stripe. There shall be an eight (8) inch gap between the double yellow markings for no passing zones.

440.4.3.5 Glass reflectorizing beads shall be applied on the wet paint at a minimum rate of six (6) pounds to each gallon of paint. This translates into a minimum weight of beads of 29.6 lbs. per mile of broken line and 118.5 lbs. per mile of solid line.

440.4.4 PLACING TEMPORARY ADHESIVE MARKING TAPE.

440.4.4.1 Adhesive tape marking materials shall be applied as follows:

440.4.4.1.1 The CONTRACTOR shall provide the necessary personnel and equipment to warn and divert traffic during installation and removal from the area where the work is in progress as approved by the ENGINEER. The surface to which the tape is applied shall be dry and free of oils, grease, dust, dirt and other deleterious substances and shall be primed with a primer material which is recommended by the manufacturer of the tape.

440.4.4.1.2 The tape shall be rolled or tamped down immediately after application until it adheres properly and conforms to the surface of the pavement in accordance with the manufactures recommendation.

440.4.4.1.3 Where striping is continuous, there will be no more than 3 splices per 120 feet of length.

440.4.5 REMOVAL OF TEMPORARY PAVEMENT MARKINGS

440.4.5.1 TEMPORARY ADHESIVE MARKING TAPE: All temporary pavement markings placed on the final pavement surface shall be removed by the CONTRACTOR when such temporary pavement markings are no longer required for traffic control as determined by the ENGINEER. Where temporary pavement markings, which are to be removed, consist of adhesive marking tape, the removal shall be complete with no segments or pieces of tape remaining on the pavement. The use of non-reflective black adhesive marking tape to obliterate temporary pavement markings will not be permitted. Overpainting is not an acceptable method.

440.4.5.2 REFLECTORIZED PAINTED MARKINGS: Reflectorized painted markings for temporary use on final surfacing is prohibited. Reflectorized painted markings when used for temporary pavement markings shall be removed where required by traffic control plan in accordance with the provisions of Section 443 - Pavement Marking Removal.

440.4.6 COMPLIANCE WITH MUTCD: All reflectorized painted markings and temporary adhesive marking tape shall conform to the Manual on Uniform Traffic Control Devices (MUTCD).

440.5 MEASUREMENT AND PAYMENT.

440.5.1 Reflectorized painted markings will be measured by the linear foot of 4-inch width, complete in place.

440.5.2 Temporary adhesive marking tape will be measured by the linear foot of 4-inch width, complete in place.

440.5.3 Removal of adhesive marking tape will not be measured.

440.5.4 Removal of reflectorized painted markings will be measured by the linear foot of 4-inch width, complete in place, in accordance with the provisions of

Section 443 - Pavement Marking Removal.

440.5.5 The accepted quantities of reflectorized painted markings and temporary adhesive marking tape will be paid for at the contract unit price per unit of measurement for each of the pay items as shown on the bid proposal. The removal of reflectorized painted markings will be paid in accordance with the provisions of Section 443 - Pavement Marking Removal.

SECTION 441

RETROREFLECTIVE PREFORMED PLASTIC PAVEMENT MARKINGS

441.1 GENERAL: This work shall consist of furnishing and installing retroreflective preformed plastic pavement symbols, legends, stripes and markings in compliance with the specifications and the details shown on the plans at the locations shown on the plans, or as established by the ENGINEER.

441.2 REFERENCES

441.2.1 American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications, Latest Edition

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

441.2.3 Manual on Uniform Traffic Control Devices (MUTCD), Latest Edition

441.3 MATERIALS.

441.3.1 RETROREFLECTIVE PREFORMED PLASTIC PAVEMENT MARKING MATERIAL

441.3.1.1 Retroreflective preformed plastic pavement marking material shall consist of white or yellow weather-resistant reflective film conforming to the requirements set forth herein. The material shall be manufactured and packaged in such a manner as to permit storage at normal shelf temperature for a period of not less than two years from date of purchase. Prefabricated legends and symbols shall conform to the applicable shapes, sizes, and color as outlined in the Manual on Uniform Traffic Control Devices.

441.3.1.1.1 COMPOSITION: The retroreflective preformed plastic markings shall consist of high-quality plastic materials, pigments, and 1.5 index glass beads uniformly distributed throughout their cross-sectional area, with a reflective layer of beads embedded in the top surface. Materials will be furnished with the appropriate adhesive system recommended by the manufacturer for successful installation.

441.3.1.1.2 SKID RESISTANCE: The surface of the retroreflective preformed plastic marking material shall provide a minimum skid resistance value of 50 BPN when tested according to ASTM E 303-667.

441.3.1.1.3 COLOR: The retroreflective preformed plastic marking material shall be white or yellow in accordance with MUTCD unless otherwise specified.

441.3.1.1.4 THICKNESS: The thickness of the retroreflective preformed plastic marking material without adhesive shall be 60 mils (0.06").

441.3.1.1.5 DURABILITY AND WEAR RESISTANCE: The retroreflective preformed plastic pavement marking material, when properly applied, shall provide a neat, durable marking. The preformed plastic marking material shall provide a cushioned resilient substrate that reduces bead crushing and loss. The film shall be weather resistant and, through normal traffic wear, shall show no appreciable fading, lifting, or shrinkage within three years after installation, and shall show no significant tearing, rollback, or other signs of poor adhesion.

441.3.1.1.6 CONFORMABILITY AND RESEALING: The retroreflective preformed plastic marking material shall be capable of conforming to pavement contours, breaks, faults, etc., through the action of traffic at normal pavement temperatures. The film shall have resealing characteristics such that it is capable of fusing with itself and previously applied marking film of the same composition under normal conditions of use.

441.3.1.1.7 TENSILE STRENGTH: Retroreflective preformed plastic marking material shall have a minimum tensile strength of 40 pounds per square inch of cross section when tested according to ASTM D 638. A test specimen six (6) inches by one (1) inch by 0.06 inch minimum thickness shall be tested at a temperature range of 70 to 80 degrees F using a jaw speed of 0.25 inch per minute.

441.3.1.1.8 ELONGATION: Retroreflective preformed plastic marking material shall have a minimum elongation of 50% when tested in accordance with ASTM D 638.

441.3.1.1.9 PLASTIC PULL TEST: Retroreflective preformed plastic marking material shall support a dead weight of four pounds for not less than five minutes at a temperature range of 70 to 80 degrees F. Test specimen size shall be six (6) inches by one (1) inch by 0.06 inch minimum thickness.

441.3.1.1.10 PIGMENTATION: The pigment for retroreflective preformed plastic marking material shall be selected and blended to provide a plastic which is white or yellow conforming to the Manual on Uniform Traffic Control Devices through the expected life of the pavement marking plastic.

441.3.1.1.11 GLASS BEADS

441.3.1.1.11.1 The glass beads for retroreflective preformed plastic marking material shall be colorless and have a minimum index of refraction of 1.50 when tested using the liquid oil immersion method. The size and quality of the beads will be such that performance requirements shall be met.

441.3.1.1.11.2 The retroreflective preformed plastic marking material shall have glass retention qualities such that when a two (2) inch by six (6) inch specimen is bent over a ½ inch diameter mandrel with the two (2) inch dimension perpendicular to the mandrel axis, a microscopic examination of the area on the mandrel shall show no more than 10% of the beads with entrapment by the binder of less than 40%.

441.3.1.1.11.3 Bead adhesion shall be such that beads are not easily removed when the film surface is scratched firmly with a thumbnail.

441.3.1.1.11.4 Applied as per manufacturer's recommendations, retroreflective preformed plastic marking material shall have an effective performance life of up to three years.

441.3.2 ACCEPTANCE: Acceptance of retroreflective preformed plastic pavement marking material will be based upon receipt of certificates of compliance and documentation that the material has been tested by an independent laboratory and conforms with specifications.

441.4 CONSTRUCTION REQUIREMENTS.

441.4.1 The retroreflective preformed plastic pavement symbols, legends, stripes and marking shall be applied to the asphaltic and/or portland cement concrete pavement at the locations shown on the plans or as designated by the ENGINEER.

441.4.2 The asphaltic and/or portland cement concrete pavement surface shall be clean and free of moisture, soil or other deleterious substances. A brooming or compressed air method shall be utilized to clean the pavement surface.

441.4.3 If inlayed material is required in the plans, the reflectorized plastic marker material shall be applied to the roadway surface following the placement of bituminous pavement and before final rolling is completed at the locations shown on the plans or as designated by the ENGINEER.

441.4.4 Hot plastic retroreflective pavement marking will be considered by ENGINEER as a substitute for cold plastic provided that installation is carried out per the manufacturer's specifications. Hot plastic shall be a minimum of 90 mil thickness for lane lines and 125 mil for transverse lines. Ten pound drop-on glass beads per 100 sq. ft. is required. All markings shall be alkyd thermoplastic.

441.4.5 CONTRACTOR shall remove all conflicting existing pavement markings.

441.4.6 When designated on the plans, the CONTRACTOR shall provide temporary lane delineation by placing a twelve (12) inch long strip of four (4) inch wide plastic temporary lane marking, forty (40) feet on center, on each new lift of asphalt surfacing including temporary asphalt connections, asphalt treated base course, asphaltic concrete base course, and asphaltic concrete surface course to cover a lapse in time before the final surfacing course and final striping is placed. After final striping is placed, any temporary lane lines remaining on the final surface course shall be removed.

441.4.7 COMPLIANCE WITH MUTCD: All retroreflective preformed plastic pavement markings shall conform to the Manual on Uniform Traffic Control Devices.

441.5 MEASUREMENT AND PAYMENT.

441.5.1 The retroreflective preformed plastic pavement stripes will be measured by the linear foot of either 4-inch, 8-inch, 12-inch, or 24-inch width, complete in place.

441.5.2 The retroreflective preformed plastic pavement cross walks will be measured by the linear foot of 8-inch width, complete in place.

441.5.3 The retroreflective preformed plastic pavement stop bars will be measured by the linear foot of 12-inch width, complete in place.

441.5.4 The retroreflective preformed plastic pavement symbols, legends and markings will be measured per unit, complete in place.

441.5.5 The retroreflective preformed plastic pavement temporary lane lines will be measured by the linear foot of 4-inch width, complete in place.

441.5.6 The accepted quantities of retroreflective preformed plastic pavement stripes, stop bars, symbols, legends and temporary lane lines will be paid for at the contract unit price per unit of measurement for each of the pay items listed as shown on the bid proposal

SECTION 501

EXCAVATION AND BACKFILL
FOR STRUCTURES

501.1 GENERAL

The work performed under this specification shall include, but not be limited to providing the equipment, labor and materials for the excavation and backfill of areas related to structures, such as bridges, foundations, walls, storm drain inlets, as specified on the plans and therein or as authorized by the ENGINEER.

501.2 REFERENCES

501.2.1 ASTM:

C136	D422
D423	D424
D698	D1557
D2922	D3017
D4253	D4254

501.2.2 This Publication:

Section 207
Section 301

501.3 EXCAVATION

501.3.1 All excavation for structures shall be made in accordance with applicable regulations such as the Department of Labor's Occupational Safety and Health Administration Standards 29CFR Part 1926, Subpart P or any applicable amendments.

501.3.2 When slope limit for structural excavation is shown on the plans. Those limits are to establish the pay quantities for structural excavation and backfill only and in no way shall relieve the CONTRACTOR from meeting the requirements of 501.3.1 above.

501.3.3 The bottom width of the excavation shall be a minimum of the bottom width of the structure foundation plus one foot (1') on each side to provide space for erection and removal of forms. Additional bottom area may be required due to the type and size of compaction equipment the CONTRACTOR chooses to use.

501.3.4 CONTRACTOR shall be responsible for obtaining and maintaining a temporary storage site for usable excavated material during the period of construction. CONTRACTOR may request through the ENGINEER, approval of the OWNER to store excavated material within the street right-of-way or on OWNER's property.

501.4 COMPACTED BACKFILL

501.4.1 Backfill material shall be Class I, II, III, or Class IV soils as defined in TABLE 501.4.A, or Lean Fill complying with the requirements of Section 207. The CONTRACTOR shall not place backfill against a portland cement concrete structure until the concrete has attained 80% of the design strength as determined by the average strength of two field cured cylinders. The field cured cylinders shall be cured in the field under the same condition as the concrete in the structure, represented by the cylinders.

501.4.2 The CONTRACTOR shall remove unsuitable material which either will not compact readily or serve the intended purpose and replace it with suitable material as authorized by the ENGINEER.

501.4.3 All forms, braces, and debris shall be removed before start of backfilling.

501.4.4 Backfill material shall be placed in level lifts and each compacted lift shall not exceed 6 inches.

501.4.5 Soil used for the backfill around structures shall be compacted to a dry density of not less than 90% of maximum dry density in a moisture range of optimum moisture +/-2% as determined in accordance with ASTM D1557 (modified). unless the soil contains 35% or more finer than the No.200 sieve. If the soil used has 35% or more finer than the No.200 sieve, it shall be compacted to a dry density of 90% of maximum dry density in a moisture content range of at least optimum moisture to +4% above optimum as determined in accordance with ASTM D698 (Standard).

501.4.6 When structural backfill is within the roadway area, this area shall be compacted to 90% dry density as specified in 501.4.5 and rework and compacted to 95% dry density at the same time as the surrounding subgrade area is compacted as specified in Section 301.

TABLE 501.4.A

EMBEDMENT SOILS CLASSIFICATIONS

SOILS CLASS	SOIL TYPE	DESCRIPTION
CLASS I SOILS*		Manufactured angular, granular material, ¼ to 1-1/2 inches (6 to 40 mm) size, including materials having regional significance such as crushed stone or rock, broken coral, crushed slag, cinders, or crushed shells, complying with the requirements of Class II soils.
CLASS II SOILS**	GW	Well-graded gravels and gravel-sand mixtures, little or no fines. 50% or more of coarse fraction retained on No. 4 sieve. More than 95% retained on No. 200 sieve. Clean
CLASS II SOILS**	GP	Poorly graded gravels and gravel-sand mixtures, little or nor fines. 50% or more of coarse fraction retained on No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
CLASS II SOILS**	SW	Well-graded sands and gravelly sands, little or no fines. More than 50% of coarse fraction passes No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
CLASS II SOILS**	SP	Poorly graded sands and gravelly sands, little or no fines. More than 50% of coarse fraction passes No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
CLASS III SOILS***	GM	Silty gravels, gravel-sand-silt mixtures. 50% or more of coarse fraction retained on No. 4 sieve. More than 50% retained on No. 200 sieve.
CLASS III SOILS***	GC	Clayey gravels, gravel-sand-clay mixtures. 50% or more of coarse fraction retained on No. 4 sieve. More than 50% retained on No. 200 sieve.
CLASS III SOILS***	SM	Silty sands, sand-silt mixtures. More than 50% of coarse fraction passes No. 4 sieve. More than 50% retained on No. 200 sieve.
CLASS III SOILS***	SC	Clayey sands, sand-clay mixtures. More than 50% if coarse fraction passes No. 4 sieve. More than 50% retained on No. 200 sieve.
CLASS IV SOILS	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands. Liquid limit 50% or less. 50% or more passes No. 200 sieve.
CLASS IV SOILS	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. Liquid limit 50% or less. 50% or more passes No. 200 sieve.
CLASS IV SOILS	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.
CLASS IV SOILS	CH	Inorganic clays of high plasticity, fat clays. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.

CLASS V SOILS	OL	Organic silts and organic silty clays or low plasticity. Liquid limit 50% or less. 50% or more passes No. 200 sieve.
CLASS V SOILS	OH	Organic clays of medium to high plasticity. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.
CLASS V SOILS	PT	Peat, muck and other highly organic soils.

* Soils are as defined in ASTM D2487, except for Class I soils which is defined in ASTM D2321.
** In accordance with ASTM D2487, less than 5% passes No. 200 sieve.
***In accordance with ASTM D2487, soils with 5% to 12% passing No. 200 sieve fall in a borderline classification that is more characteristic of Class II than Class III

501.5 GRAVEL DRAINS

501.5.1 The construction plans may require the installation of weep holes in the concrete walls to relieve the surcharge pressure of ground water. Gravel drains are intended to provide a drainage course to the weep holes. The size, shape, and location of the gravel drain will be shown on the construction plans.

501.5.2 Gravel drain material shall consist of a material complying with the following gradation, and having the same or similar gradation curve as defined by the specification limits when graphically plotted on a standard aggregate gradation chart.

SIEVE SIZE	% PASSING
3 inch	100
1/2 inch	70-100
no.4	50-80
no.16	25-50
no.50	5-15
no.200	0-5

Liquid Limit NV (no value)

Plasticity Index NP(non plastic)

**The drain material shall comply with the following material size ratios:

$$12 \leq / = RS0 \leq / = 58$$

$$RSO = \frac{\text{50-percent size GDM}}{\text{50-percent size BM}}$$

$$12 \leq / = R15 \leq / = 40$$

$$R15 = \frac{\text{15-percent size GDM}}{\text{15-percent size BM}}$$

where:

GDM-represents the Gravel Drain Material
BM -represents the Base Material (surrounding soil)

501.5.3 A separator (membrane type) geotextile fabric shall be used to encase the Gravel Drain Material in areas where the surrounding solid has 30% or greater of its material passing the no. 200 sieve.

501.6 MEASUREMENT AND PAYMENT

501.6.1 Measurement:

501.6.1.1 Unless specified on the plans, in the Supplemental Technical Specification and/or in the Bid Proposal no separate measurement will be made for excavation and backfill for structures. This work shall be considered incidental to and part of the cost of the structure.

501.6.1.2 When specified on the plans, in the Supplemental Technical Specifications and/or in the Bid Proposal excavation and backfill for structures shall be measured by the cubic yard of excavation.

501.6.1.3 Gravel drains will be measured by the cubic foot based on the neat line volume shown on the plans or as authorized by the ENGINEER.

501.6.2 Payment:

501.6.2.1 Payment for excavation and backfill for structures shall be made at the contract unit price per structure or per cubic yard of excavated quantity, complete in place, which price shall include all equipment, labor and materials required to excavate, stock pile, backfill, compact, and the removal and disposal of excess material.

501.6.2.2 Payment for gravel drains shall be made at the contract unit price per cubic foot, complete in place, which price shall include all equipment, labor and materials required in furnishing the gravel and geotextile fabric, the installation of both and the compaction required.

SECTION 510

CONCRETE STRUCTURES

510.1 GENERAL

Concrete structures such as: bridges, culverts, storm inlets, retaining walls, abutments, piers, footings, foundations and similar structures, shall be constructed in conformity with these specifications and the construction plans.

510.2 REFERENCES

510.2.1 This Publication:

Section 101
Section 102
Section 103
Section 105
Section 107
Section 337
Section 349
Section 501
Section 502

510.2.2 Others

PS-1-66 Specifications for Plywood, U.S. Products Standard, U.S. Department of Commerce.

Standard Specifications for Welding for Highway and Railroad Bridges, American Welding Society.

510.3 MATERIALS

510.3.1 CONCRETE

Concrete for use in work constructed under this section shall conform to the requirements of Section 101 and as shown on the plans or as specified in the Supplementary Technical Specifications and approved by the ENGINEER.

510.3.2 STEEL REINFORCEMENT

Reinforcement bars shall conform to the requirements specified in Section 102 and 103.

510.4 SUBGRADE FOR CONCRETE STRUCTURES

Earth subgrade upon which concrete is placed shall be firm and free from water and/or frost. All subgrade on which Structural concrete is to be placed shall be compacted to the minimum density specified in Section 501 or on the plans. Ground water shall be kept twelve (12") inches below the subgrade until the concrete has set. When the subgrade is in dry earth, it shall be moistened with water from a spray nozzle immediately before concrete is placed. When the design details for the project provide for the construction of filter or drain material consisting of gravel or combination of gravel and sand, which material becomes subgrade for concrete, the placing of steel reinforcement and pouring of concrete shall follow the placing of the filter or drain material as closely as practical. The filter or drain material shall be kept dewatered to the extent necessary to prevent any portion of concrete materials being carried away before the concrete has attained its final set. When concrete is to rest on rock, the rock shall be fully uncovered. The surface of the rock shall be removed to a depth sufficient to expose sound rock. Bedrock shall be roughly leveled off or cut to approximately horizontal and vertical steps. Seams in the rock shall be grouted as directed by the ENGINEER and the base for structures shall be slush grouted or otherwise treated as the ENGINEER may direct.

510.5. FORMS

510.5.1 Forms shall be of suitable material and of type, size, shape, quality, and strength to enable construction as designed. The forms shall be true to line and grade, mortar tight, and sufficiently rigid to resist any appreciable amount of springing out of shape during placing of the concrete. The responsibility for their adequacy shall rest with CONTRACTOR. All dirt, chips, sawdust, nails, and other foreign matter shall be completely removed from forms before any concrete is deposited therein. The surfaces of forms shall be smooth and free from irregularities, dents, sags, and holes that would appreciably deface the finished surface. Forms previously used shall be thoroughly cleaned of all dirt, mortar, and foreign matter before being reused, and the reuse of forms shall be subject to approval of the ENGINEER. Before concrete is placed in forms, all inside surfaces of the forms shall be thoroughly treated with an approved releasing agent that will leave no objectionable film on the surface of the forms that can be absorbed by the concrete. Care shall be exercised that no releasing agent is deposited on previously placed concrete. Forms for all surfaces that will not be completely enclosed or hidden below the permanent surface of the ground shall be made of surfaced lumber or material which will provide a surface at least equally satisfactory. Any lumber or material which becomes badly checked or warped prior to placing concrete may be rejected. Forms for all exposed surfaces of bridges,

viaducts, over crossings, and similar structures shall be constructed of plywood or an approved equal. Plywood for forms shall conform to the specifications of the U.S. Department of Commerce, U.S. Product Standard PS 1-66 Class I or II. All form panels shall be placed in a neat, symmetrical pattern with the horizontal joints level and continuous. Unless otherwise shown on the plans, all exposed edges shall have a 3/4 inch chamfer. Forms for curved surfaces shall be so constructed and placed that the finished surface will not deviate appreciably from the arc of the curve. Forms shall be so constructed that portions, where finishing is required, may be removed without disturbing portions of form to remain. Form clamps or bolts approved by the ENGINEER shall be used to fasten forms. The use of twisted wire loop ties to hold forms in position will not be permitted, nor shall wooden spreaders be used unless authorized by the ENGINEER. Clamps or bolts shall be of sufficient strength and number to prevent spreading of the forms. They shall be of such type that they can be entirely removed or cut back 1 inch below the finished surface of the concrete. Forms for outside surfaces shall be constructed with stiff wales at right angles to the studs and all form clamps shall extend through and fasten such wales. The CONTRACTOR may, at his own option, place such portions of the concrete directly against the sides of the excavation or sheathing without the use of outside forms, provided that the following conditions are met:

510.5.1.2 If concrete is placed against sheathing, such sheathing shall be closely fitted and shall be outside of the concrete lines shown on the plans. Those surfaces against which the concrete is placed shall be faced with building paper. Except as otherwise specified hereinafter, all sheathing shall be removed but not until either at least 7 days after placing concrete or until the concrete has attained sufficient strength to support itself and any load that may be placed on it.

510.5.2 Care should be used in pulling sheathing so as to avoid damaging the concrete. Voids left by the removal of sheathing, piles, and/or similar sheathing supports shall be backfilled with material having a sand equivalent of not less than 30 and consolidated. When, in the opinion of the ENGINEER, field conditions or the type of sheathing or methods of construction used by the CONTRACTOR are such as to make the removal of sheathing impracticable, that portion of the sheathing against which concrete has been placed shall be left in place.

510.5.3 Regardless of the method used in placing concrete without outside forms, the following stipulations shall hold:

510.5.3.1 The reinforcing steel shall be accurately set and held firmly in place, to the satisfaction of the ENGINEER.

510.5.3.2 The CONTRACTOR shall assume all risks of damage to the work or to existing improvements due to any reason whatsoever that may be attributable to the method of construction outlined above.

510.5.3.3 Should the method of construction of placing directly against the sides of the excavation or sheathing without use of outside forms not prove satisfactory in the opinion of the ENGINEER, the CONTRACTOR shall discontinue said method of construction and construct the structure by using outside forms.

510.6 FALSEWORK

All falsework shall be designed and constructed to provide the necessary rigidity and to support the loads. Falsework for the support of a superstructure shall be designed to support the loads that would be superimposed were the entire superstructure placed at one time. All falsework, staging, walkways, forms, ladders, cofferdams, and similar accessories shall equal or exceed the minimum applicable requirements of the Federal and State statutes and local ordinances. Compliance with such requirements shall not relieve the CONTRACTOR from full responsibility for the adequacy and safety of said items. Falsework shall be founded upon a solid footing safe against undermining and protected from softening. When the falsework is supported on timber piles, the piles shall be driven to a bearing value as determined by the formula specified in Section 502, equal to the total calculated pile loading. Falsework and forms shall be so constructed as to produce in the finished structure the lines and grades indicated on the plans. Suitable jacks or wedges shall be used in connection with the falsework to set the forms to grade or camber shown on the plans or to take up any settlement in the formwork either before or during the placing of the concrete. However, single wedges for this purpose will not be permitted, it being required that all such wedges be in pairs to insure uniform bearing. Dead load deflection in stringers and joists will be compensated for by varying the depth of the joists or by using varying depth nailing strips. Arch centering shall be removed uniformly and gradually beginning at the crown and working toward the springline to permit the arch to take its load slowly

and evenly. Centering for adjacent arch spans shall be struck simultaneously. Falsework under any continuous unit or rigid frame shall be struck simultaneously, the supporting edges being released gradually and uniformly starting at the center and working both ways toward the supports.

510.7 REMOVAL OF FORMS

510.7.1 The falsework supporting any span of a continuous or rigid frame structure subject to bending stress shall not be released until after the last concrete placed in the span and in the adjoining spans (excluding concrete above the deck slab) has attained a compressive strength of not less than 80 percent of its design strength or 21 days after the concrete is placed, whichever occurs first. Stairway riser forms shall be removed and the finish of the steps completed on the day the concrete is poured. Metal stairway treads, if required by the plans, shall be installed immediately after the steps have been poured. Forms and falsework supporting the bottom slab of the superstructure of box girder structures shall remain in place until the curing period of the deck of the superstructure has expired. Forms for the webs of box girders shall be removed before the deck slab is poured. Forms for the upper deck slab which are to remain in place shall be supported by bolts through the girder webs or some equally satisfactory method that will prevent the transfer of any load to the lower deck slab. Forms supporting the concrete deck slab of box girders may be left, in place. All interior forms in box girders, except those permitted to remain in place, shall be completely removed and the inside of the box girder. Side forms for beams, girders, columns, railings, or other members wherein the forms do not resist dead load bending may be removed after a period of 36 hours, unless otherwise directed by the ENGINEER, provided that satisfactory arrangements are made to cure and protect. the concrete thus exposed in accordance with Section 349. Side forms for arch rings, columns, and piers shall be removed before the members of the structure which they support are placed so that the quality of the concrete may be inspected. Such forms shall be so constructed that, they may be removed without disturbing other forms which resist direct load or bending stress.

510.7.2 The periods of time at which the CONTRACTOR may remove forms, as set forth in this Section, are permissive only and subject to the CONTRACTOR assuming all risks that may be involved in such removals. At his option, the CONTRACTOR may leave the forms in place for such longer periods as are, in his opinion, required.

510.8 PLACING REINFORCEMENT

Reinforcing bars shall be accurately placed as shown on the plans and shall be firmly and securely held in position by wiring at intersections and elsewhere as necessary to prevent. shifting of bars, with wire not smaller than No. 16, and by using concrete or metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under full load. The use of wooden supports will not be permitted. Placing bars on layers of fresh concrete as the work progresses and adjusting bars during the placing of concrete will not be permitted. Before placing reinforcing steel in the forms, the reinforcing steel shall be thoroughly cleaned of mortar, oil, dirt, loose mill scale, loose or thick rust, and coatings of any character that would destroy or reduce the bonds. No concrete shall be deposited until the placing of the reinforcing steel has been inspected and approved.

510.9 SPLICING

Splices of bars shall be made only where shown on the plans or as approved by the ENGINEER. Where bars are spliced, they shall be lapped at least 20 diameters for deformed bars, unless otherwise shown on the plans. Welding of reinforcing steel will be permitted when authorized by the ENGINEER in writing and shall be in accordance with the American Welding Society (Standard Specifications for Welding for Highway and Railroad Bridges).

510.10 BENDING REINFORCEMENT

Bends and hooks in bars shall be made in the manner prescribed by the American Concrete Institute. Bars shall not be bent nor straightened in a manner that will injure the material. Bars with kinks or unspecified bends shall not be used.

510.11 WELDED WIRE FABRIC

Welded wire fabric shall be held firmly in place. Welded wire fabric shall be spliced not less than two meshes.

510.12 PLACING CONCRETE

510.12.1 Where a schedule for placing concrete is shown on the plans, no deviation will be permitted there from unless approved in writing by the ENGINEER. The placing of concrete for a given area shall start at the low point and shall proceed upgrade, unless otherwise permitted by the ENGINEER. With the exception of concrete placed in slope paving and aprons and concrete placed under water, all concrete shall be compacted by means of high frequency internal vibrators of a type, size, and number approved by the ENGINEER. The

number of vibrators employed shall be ample to consolidate the incoming concrete to a proper degree within 15 minutes after it is deposited in the forms. In all cases, at least 2 vibrators shall be available at the site of the structure in which more than 25 cubic yards of concrete is to be placed. The vibrators shall not be attached to or held against the forms or the reinforcing steel. The locations, manner, and duration of the application of the vibrators shall be such as to secure maximum consolidation of the concrete without causing segregation of the mortar and coarse aggregate and without causing water or cement paste to flush to the surface. Fresh concrete shall be spread in horizontal layers insofar as practicable, and the thickness of the layers shall not be greater than can be satisfactorily consolidated with the vibrators. If additional concrete is to be placed, care shall be taken to remove all laitance and to roughen the surfaces of the concrete to insure that fresh concrete is deposited upon sound concrete surfaces. Layers of concrete shall not be tapered off in wedge-shaped slopes but shall be built with square ends and level tops.

510.12.2 Mixed concrete, after being deposited, shall be consolidated until all voids are filled and free mortar appears on the surface. The concrete shall be placed as nearly as possible in its final position. The use of vibrators for extensive shifting of the mass of fresh concrete will not be permitted. Fresh concrete shall not be permitted to fall from a height greater than 6 feet without the use of adjustable length pipes or "elephant trunks" or "Trimmies." The use of approved external vibrators for compacting concrete will be permitted when the concrete is inaccessible for adequate compaction, provided the forms are constructed sufficiently rigid to resist displacement or damage from external vibration. During the placing of concrete, care shall be taken that methods of consolidation used will result in a surface of even texture free from voids, water, or air pockets and that the coarse aggregate is forced away from the forms in order to leave a mortar surface. Spades or broad-tined forks shall be provided and used to produce the desired results if required by the ENGINEER. The use of chutes in conveying or depositing concrete will be allowed only at the discretion of the ENGINEER; and wherever they are used, they shall be laid at such inclination as will permit the flow of concrete of such consistency as is required. The use of additional water in mixing the concrete to promote free flow in chutes of low inclination will not be allowed. Where necessary in order to prevent segregation, chutes shall be provided with baffle boards or a reversed section at the outlet. Columns shall be poured preferably through pipes of adjustable length and not less than 6 inches in diameter. Horizontal members or sections shall not be placed until the concrete in the supporting vertical members or sections has been consolidated and settlement has occurred.

510.13 JOINTS

The work shall be so prosecuted that construction joints will occur at designated places shown on plans unless specifically permitted otherwise by the ENGINEER. The CONTRACTOR shall complete, by continuous depositing of concrete sections of the work comprised between such joints. The joints shall be kept moist until adjacent concrete is placed. All construction joints at the bottom of walls or arches, at the top of walls, and all longitudinal construction joints having a keyed, stepped, or roughened surface shall be cleaned by sandblasting prior to pouring the adjacent concrete. Any quality of sand may be used which will accomplish the desired results. Other methods of cleaning joints may be used provided the method and result is approved by the ENGINEER. Joint cleaning operations shall be continued until all unsatisfactory concrete and all laitance, coatings, stains, debris, and other foreign materials are removed. The surface of the concrete shall be washed thoroughly to remove all loose material. The method used in disposing of waste water employed in washing the concrete surfaces shall be such that the waste water will not stain, discolor, or affect exposed surfaces of the structure. The method of disposal will be subject to the approval of the ENGINEER. All horizontal construction joints or those on slight slopes shall be covered with mortar. Expansion and contraction joints in the concrete structures shall be formed where shown on the drawings and as directed by the ENGINEER. In general, such joints shall have smooth abutting surfaces, painted, or separated and sealed in accordance with Section 107 or as detailed on the plans. No reinforcement shall be extended through the joints, except where specifically noted or detailed on the plans.

510.14 PLACING CONCRETE UNDER ADVERSE WEATHER CONDITIONS

Concrete for structures shall not be placed on frozen ground nor shall it be mixed or placed while the ambient temperature is below 40°F. Concrete shall not be placed during rainfall unless adequate protection is provided. Upon written notice from the ENGINEER, all concrete which may have become damaged due to adverse weather conditions, shall

be replaced by the CONTRACTOR at no expense to the OWNER.

510.15 SURFACE FINISHES

The classes of surface finish described hereafter shall be applied to various parts of concrete structures as specified. Bridge decks shall be finished in conformity with Section 337. When required by the ENGINEER, the CONTRACTOR, prior to placing of concrete, shall provide a test section for evaluation of the surface finish to be employed. There will be no separate payment made for the test sections.

510.15.1 ORDINARY SURFACE FINISH

510.15.1.1 Immediately after the forms have been removed, all exterior form bolts shall be removed to a depth of at least 1 inch below the surface of the concrete and the resulting holes or depressions cleaned and filled with mortar, except on the interior surfaces of box girders the bolts shall be removed flush with the surface of the concrete. Mortar shall consist of 1 part by volume of cement to 2 parts of sand. Mortar shall be mixed approximately 45 minutes in advance of use. Care shall be exercised to obtain a perfect bond with the concrete. After the mortar has thoroughly hardened, the surface shall be rubbed with a carborundum stone in order to obtain the same color in the mortar as in the surrounding concrete. All fins caused by form joints and other projections shall be removed and all pockets cleaned and filled. Mortar for filling pockets shall be treated as specified for bolt holes.

510.15.1.2 In the judgment of the ENGINEER, if rock pockets or other defects are of such extent or character as to affect the strength of the structure materially or to endanger the life of the steel reinforcement, he may declare the concrete defective and require the removal and replacement of the structure affected.

510.15.1.3 Ordinary Surface Finish shall be applied to all concrete surfaces either as a final finish or preparatory to a higher class finish. Ordinary Surface Finish, unless otherwise specified, shall be considered as a final finish on the following surfaces:

510.15.1.3.1 The undersurfaces of slab spans, box girders, filled spandrel arch spans, and floor slabs between T girders or superstructures not for grade separation structures.

510.15.1.3.2 The inside vertical surface of T girders or superstructure not for grade separation structures and the exposed surfaces of channel walls.

510.15.1.3.3 Surfaces which are to be buried underground or covered with embankment and surfaces above finished ground of culverts where not visible from the traveled way.

510.15.1.4 On surfaces which are to be buried underground or surfaces which are completely enclosed, such as the cells of box girders, the removal of fins and form marks and the rubbing of mortared surfaces to a uniform color will not be required.

510.15.2 CLASS 1 SURFACE FINISH

510.15.2.1 After completion of the Ordinary Surface Finish, the entire surface specified shall be sanded with a power sander or other approved abrasive means as required to obtain a uniform color and texture. The use of power carborundum stones or discs will be required to remove unsightly bulges or irregularities. The Class 1 Surface Finish shall be applied after the removal of forms. The object of these operations is to obtain a smooth, even surface of uniform appearance and to remove unsightly bulges or depressions due to form marks and other imperfections. The degree of care in building forms and the character of materials used in formwork will be a contributing factor in the amount of such sanding and grinding requirement, and the ENGINEER shall be the sole judge in this respect.

510.15.2.2 Class 1 Surface Finish as hereinafter specified shall be applied to the following surfaces unless otherwise specified in the Supplementary Technical Specifications.

510.15.2.2.1 All surfaces of superstructures for grade separation structures.

510.15.2.2.2 All exposed surfaces of bridge piers, columns and abutments, and retaining walls and to at least 1 foot below finished grade.

510.15.2.2.3 The outside vertical surfaces and bottom surface of outside girders and the under surfaces of cantilever sidewalks, safety curbs, and floor slabs overhanging outside girders only of superstructures not for grade separation structures.

510.15.2.2.4 All surfaces of open spandrel arch rings, spandrel columns, and abutment towers.

510.15.2.2.5 Exposed surfaces of culvert headwalls and retaining walls, where visible from a traveled way.

510.15.2.2.6 Surfaces inside of culvert barrels having a height of 4 feet or more for a distance inside the barrel at least equal to the height of the culvert.

510.15.2.2.7 All interior surfaces of pump house motor and control rooms and engine generator rooms.

510.15.3 CLASS 2 SURFACE FINISH

Class 2 Surface Finish as hereinafter specified shall be applied to the following surfaces unless otherwise specified in the Supplementary Specifications: all surfaces of concrete railing, including barrier railing, rail posts rail end posts, and rail base. When Class 2 Surface Finish is specified, the Ordinary Surface Finish and Class 1 Surface Finish shall be completed in succession. The process specified under Class 2 Surface Finish shall then be deferred until all other work, which would in any way affect or mar the final finish, is complete. The CONTRACTOR shall then apply a brush coat or surface film of thin cement mortar composed of 1 part Portland cement and 1 part of fine sand of such size that it will pass a No. 16 sieve or, at the option of the ENGINEER, a neat cement wash. In either case, an amount of calcium chloride equal to 5 percent by volume of the cement shall be used in the brush coat. When the cement film has set sufficiently so that the sand particles or cement will not drag out of surface pin but before the final set has taken place, the entire surface shall be thoroughly rubbed either by hand or by mechanical means with fine carborundum stone until a smooth surface of even texture, color, and appearance is obtained. No greater amount of mortar shall be applied in advance of rubbing than can be completely rubbed before final setting takes place. Immediately following the rubbing process, the finished surface shall be thoroughly washed with water.

510.16 CURING

Immediately after the completion of the finishing operations as the condition of the concrete will permit without danger of consequent damage thereto, the CONTRACTOR shall initiate the curing of the concrete as specified in Section 349 and/or as approved by the ENGINEER.

510.17 TESTS

Testing procedures shall be as provided for in Section 101. The number of test specimens to be taken for compression tests shall be as specified in Section 101 or as otherwise required by the ENGINEER.

510.18 MEASUREMENT: Structural Concrete for Concrete Structures shall be measured by the cubic yard or as part of a lump sum item as indicated in the Bid Proposal.

510.18.2 PAYMENT: The payment for Structural Concrete shall be at the contract unit price per cubic yard or lump sum, complete in place. Payment shall include all material, equipment and labor required in forming, supporting, placing, finishing, curing, form and support removal, and cleanup.

SECTION 701

TRENCHING, EXCAVATION AND BACKFILL

701.1 GENERAL

Trench excavation and backfill for underground utilities, sanitary sewer, storm sewer, water lines, and appurtenances shall conform to these specifications or as specified in the Supplemental Technical Specifications or as authorized, in writing, by the ENGINEER.

701.2 REFERENCES

701.2.1 ASTM:

D-422 D-698
D-1557 D-2321
D-2487 D-2922
D-3017 D-4318

701.2.2 This Publication:

Section 207
Section 301
Section 302
Section 336
Section 337
Section 340

701.3 TERMINOLOGY

701.3.1 For the purpose of these specifications in this Section, the descriptive terms "flexible," "plastic" and "non-rigid" are similarly interchangeable as utilized in these specifications and appurtenant reference material.

701.3.2 Rigid pipe: shall be reinforced concrete, concrete cylinder, and vitrified clay pipes.

701.3.3 Flexible pipe shall be polyvinyl chloride, polyethylene, ductile iron, and corrugated metal pipes.

701.3.4 Standard Detail Drawings show the trench cross-sections which identify the meaning and limits of terminology used in these specifications for the terms "foundation, bedding, haunching, initial backfill, final backfill, embedment, pipe zone, cover, springline, and pipe width."

701.3.5 The Unified Soil Classification System in ASTM D2487 Shall be utilized for the purpose of material classifications. See Table 701.3.A for a listing of referenced soil classes.

701.4 NOTIFICATION OF FORTHCOMING WORK

701.4.1 To assure that the construction work progresses in a timely manner and that good public relations are maintained with the property owners, the following actions are considered essential:

701.4.1.1 Prior to the start of construction the CONTRACTOR shall assist the ENGINEER in notifying the adjacent property owners as to when construction will start, the estimated completion date, anticipated access blockages.

TABLE 701.3.A
EMBEDMENT SOILS CLASSIFICATIONS

SOILS CLASS	SOIL TYPE	DESCRIPTION
CLASS I SOILS*		Manufactured angular, granular material, ¼ to 1-1/2 inches (6 to 40 mm) size, including materials having regional significance such as crushed stone or rock, broken coral, crushed slag, cinders, or crushed shells, complying to the requirements of Class II soils.
CLASS II SOILS**	GW	Well-graded gravels and gravel-sand mixtures, little or no fines. 50% or more of coarse fraction retained on No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
CLASS II SOILS**	GP	Poorly graded gravels and gravel-sand mixtures, little or no fines. 50% or more of coarse fraction retained on No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
CLASS II SOILS**	SW	Well-graded sands and gravelly sands, little or no fines. More than 50% of coarse fraction passes No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
CLASS II SOILS**	SP	Poorly graded sands and gravelly sands, little or no fines. More than 50% of coarse fraction passes No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
CLASS III SOILS***	GM	Silty gravels, gravel-sand-silt mixtures. 50% or more of coarse fraction retained on No. 4 sieve. More than 50% retained on No. 200 sieve.
CLASS III SOILS***	GC	Clayey gravels, gravel-sand-clay mixtures. 50% or more of coarse fraction retained on No. 4 sieve. More than 50% retained on No. 200 sieve.
CLASS III SOILS***	SM	Silty sands, sand-silt mixtures. More than 50% of coarse fraction passes No. 4 sieve. More than 50% retained on No. 200 sieve.
CLASS III SOILS***	SC	Clayey sands, sand-clay mixtures. More than 50% of coarse fraction passes No. 4 sieve. More than 50% retained on No. 200 sieve.
CLASS IV SOILS	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands. Liquid limit 50% or less. 50% or more passes No. 200 sieve.
CLASS IV SOILS	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays, Liquid limit 50% or less. 50% or more passes No. 200 sieve.
CLASS IV SOILS	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.
CLASS IV SOILS	CH	Inorganic clays of high plasticity, fat clays. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.
CLASS V SOILS	OL	Organic silts and organic silty clays or low plasticity. Liquid limit 50% or less. 50% or more passes No. 200 sieve.
CLASS V SOILS	OH	Organic clays of medium to high plasticity. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.
CLASS V SOILS	PT	Peat, muck and other highly organic soils.

* Soils are as defined in ASTM D2487, except for Class I Soil which is defined in ASTM D2321
** In accordance with ASTM D2487, less than 5% passes No. 200 sieve.
*** In accordance with ASTM D2487, soils with 5% to 12% passing No. 200 sieve fall in a borderline classification that is more characteristic of Class II than of Class III.

701.4.1.2 Prior to the start of trenching operations, including pavement cutting and removal, the CONTRACTOR should coordinate with the ENGINEER any problem areas and involving traffic control, access to private properties, stockpiling of excavated materials, and other utility conflicts.

701.4.1.3 The CONTRACTOR shall provide the ENGINEER with the name and telephone number of at least two contact persons during non-working hours.

701.5 TRENCH SAFETY

The CONTRACTOR shall be responsible for maintaining all trenches in a safe condition; thereby protecting the workers and the general public. Trench slopes and other protection shall be in accordance with applicable regulations such as the Department of Labor's Occupational Safety and Health Administration Standards 29CFR Part 1926, subpart P *or* any applicable amendments.

701.6 BRACING EXCAVATIONS

701.6.1 Excavation for pipe shall normally be by open unsupported trenches unless local conditions warrant trench bracing.

701.6.2 Excavations shall be braced and sheeted. to provide complete safety to persons working therein and bracing shall comply with applicable Federal (OSHA), State and local laws and ordinances. Support systems for trenches in excess of 20 feet deep and adjacent to existing improvement or subject to vibrations or ground water shall be in accordance with OSHA regulations. The CONTRACTOR shall be fully responsible for sufficiency and adequacy of bracing excavations with respect to work under construction and adjacent utility lines and private property.

701.6.3 If the soil conditions within the trench area require support, the CONTRACTOR may elect to use tight sheeting, skeleton sheeting, stay bracing, trench jacks, or movable trench shield to support the trench during pipe laying operations, such as: bedding preparation, pipe laying, backfilling of haunches and initial zone.

701.6.4 No sheeting shall be permitted to remain in the trench except when, in the opinion of the ENGINEER, field conditions or type of sheeting or methods of construction used by the CONTRACTOR, warrant the supports must remain. The ENGINEER may opt to have the lower portion (within the pipe zone) of the sheeting to remain. If the CONTRACTOR plans on removing the sheeting, he shall submit method to the ENGINEER for approval to treat the void created by the removal of the sheeting within the pipe zone and below.

701.6.5 When a movable trench shield is used, the trailing half of the shield should be notched to the height of the top of the pipe. This will allow the haunch area of the pipe to be compacted properly to the wall of the trench. If the trench shield is not notched, a subtrench shall be excavated for pipe installation such that the bottom of the trench shield does not enter the pipe zone.

701.7 DEWATERING

701.7.1 Trenching and pipe laying operations may encounter standing water or ground water which would preclude the proper placing of bedding, backfilling, and laying pipe. The water shall be removed by pumps and associated equipment, such as well points, to lower the water level. Dewatering shall continue for a minimum 24 hours after placement of any concrete.

701.7.2 Dewatering operations shall remove the water to achieve a stable foundation for pipe embedment and backfilling. The ENGINEER shall determine if adequate foundation has been attained. The ground water shall be lowered to a minimum depth of 6 inches below pipe grades. Should over excavation be necessary due to unsuitable foundation conditions, the ground water shall be additionally lowered as necessary.

701.7.3 The CONTRACTOR shall submit a plan for approval by the ENGINEER as to how and where the waste water will be disposed. Waste water will not be discharged into traffic and pedestrian lanes or onto private properties.

701.7.4 The CONTRACTOR shall obtain permit from the New Mexico State Engineer prior to commencing dewatering operations.

701.7.5 The CONTRACTOR shall also responsible for any adverse effect his dewatering operation has to private property, including providing temporary water to residences and/or business necessitated by the effect on private wells.

701.7.6 The CONTRACTOR shall arrange dewatering operation in a neat and orderly manner such that access to adjacent, properties is maintained, the discharge system does not leak and that any power generation complies with applicable noise
limit regulations .

701.8 REMOVAL OF EXISTING PAVEMENT SIDEWALK, AND DRIVEWAY

701.8.1 Existing concrete pavement, sidewalk, or driveway removed in connection with construction shall be replaced , neatly sawed edges. Cuts shall be neat and to true straight lines with no shatter outside the removal area. If a saw cut would fall within 30 inches of a construction joint, cold joint, expansion joint, or edge, the concrete shall removed and replaced to the joint or edge. Concrete sidewalk and/or driveway may removed so that a minimum of 30-inch square is replaced. If the saw cut would fall within 12 inches of a score mark, the score mark.

701.8.2 Existing bituminous pavement removed in connection with construction shall be cut with a saw, pavement break cutting wheel, or other suitable tool approved by the ENGINEER. Care shall taken to assure that the edge of removed pavement does not vary from a straight line more than 2 inches from r mean.

701.8.3 Saw cutting shall be 1-1/2 inches in depth or 1/4 the thickness of the pavement, sidewalk, or driveway, whichever is greater. All saw cuts or other scoring shall be made perpendicular to the surface of the material to be cut.

701.8.4 Any unnecessarily irregular breakage or cracking caused by the CONTRACTOR shall be removed and replaced by the CONTRACTOR without added expense to the OWNER.

701.8.5 The CONTRACTOR shall be responsible for the disposal of removed materials.

701.8.6 Saw cutting is required on all concrete or asphalt paving on State maintained streets or roads.

701.8.7 Paving cuts for manholes and valve boxes and other utility appurtenances shall be square and at dimensions specified the Standard Detail Drawings or on the construction plans.

701.9 MAXIMUM LENGTH OF OPEN TRENCH

In developed areas, no more than 300 feet of trench shall be opened in advance of pipe laying operations. This distance may be reduced due to traffic control considerations. Backfilling shall begin as soon as pipe is laid and inspected and shall keep pace with the pipe laying. In advance of trenching operations in undeveloped areas, the CONTRACTOR shall submit in writing or on plans for the ENGINEER'S approval, the maximum length of trench that will be open at anyone time. Except by permission of the ENGINEER, the maximum length of open trench in anyone location where concrete structures are cast in -p1ace will be that which is necessary to permit uninterrupted progress. Construction shall be pursued as follows: excavation, formwork, and setting of reinforcing steel, placing of floor slab, walls, and cover slab or arch shall follow each other without anyone of these operations preceding the next nearest operation by more than 200 feet. Failure by the CONTRACTOR to comply with the limitations specified herein or as may be specifically authorized by the ENGINEER may result in a written order from the ENGINEER to halt progress of the work until such time as compliance with this paragraph has been achieved and the work can be proceeded in an orderly sequence of operations.

701.10 WIDTH OF TRENCHES

Trench widths will vary according to the type of pipe used, size of pipe, depth of trench, and soil conditions, The minimum width requirements, indicated below, are for proper laying, aligning and jointing of pipe as well as trench grading, bedding preparation, and backfilling.

701.10.1 TRENCH WIDTH FOR RIGID PIPE MATERIALS: Trench widths from bottom of pipe to a point 12 inches above the top of the pipe shall be kept to the practical minimum required for properly laying, aligning, grading, jointing, and backfilling of the pipe, but no less width than pipe outside diameter plus 16 inches. For stable soils which will stand a vertical cut, the maximum trench width at a point 12 inches above the top of pipe or at a point 5 feet above the bottom of the trench, whichever is less, shall be as follows:

- The pipe outside diameter plus 2 feet for pipes 27 inches in diameter and smaller.

- 1.6 times the nominal diameter for pipes 30 inches in diameter or larger.

701.10.1.3 When soil will not stand vertical. the trench sides shall be sloped to provide not less than the outside diameter plus 16 inches at the pipe invert.

701.10.2 TRENCH WIDTH FOR NON-RIGID PIPES: The minimum clear width of the trench measured at the springline of the pipe should be 1 foot greater than the outside diameter of the pipe. The maximum clear width of the trench at a point 1 foot above the top of the pipe is equal to the pipe outside diameter plus 2 feet. If the maximum recommended trench width must be exceeded *or* if the pipe is installed in a compacted embankment, then pipe embedment should be compacted to a point of at least 2-1/2 pipe diameters from the side of the pipe or to the trench walls.

701.11 ROCK EXCAVATION

701.11.1 Rock is defined as material which cannot be excavated without drilling and blasting. All stone or boulders less than 8 cubic feet in volume will be classified as earth; all larger boulders shall be classified as rock. If blasting is necessary to excavate such materials as shale, hardpan, soft sandstone, cemented gravel, or loose rock which normally can be classified as earth excavation, then this excavation shall be classified as rock excavation. Whenever a ledge of solid rock encountered with earth below it or where alternate layers of solid rock and earth occur, the earth shall be included in the allowance for rock when the thickness of the layer of earth is less than 12 inches, thus requiring it to be removed by blasting along with the ledges of rock. Blasting will be considered necessary when the soil and rock cannot be excavated at a rate of 50 cubic yards per hour by a competent operator with a back-hoe that has a minimum bucket curling force of 25,000 pounds (John Deere 690 or equivalent).

701.11.2 Whenever rock is encountered in the trench or elsewhere in any excavation required to be made, it shall be excavated to the line and grade as shown on the plans and within the limits described therein, unless otherwise authorized, in writing, by the ENGINEER.

701.11.3 For trenches, rock shall be excavated to a depth of 6 inches minimum below the outside bottom of the conduit except at points of rock and earth transitions at which points the rock shall be excavated to a minimum of 12 inches below the outside bottom of the conduit as shown on the detail sheets for trench cuts and backfill of rock. Any depression in the bottom of the trench caused by overshoot and/or excavating and being 6 inches or greater in depth from a theoretical bottom of trench grade shall be filled to the theoretical bottom of the trench with select soils. The trench shall be backfilled with select backfill material to a point 1 foot above the top of the conduit. The remainder of the trench shall be backfilled as specified herein. The complete trench backfill from the bottom through to the top of the subgrade shall meet the compaction and/or moisture requirements as specified herein.

701.11.4 BLASTING: Suitable weighted covering or mats shall be provided to confine all materials lifted by the blasting within the limits of the trench and to prevent injury of persons or damage to property. Blasting shall be under the supervision of a person qualified and experienced in the use and handling of explosives. All blasting operations shall be done in accordance with applicable local, state, and federal laws, ordinances, and codes regulating the transportation, storage, and use of explosives. Forty-eight hours prior to blasting operations, the CONTRACTOR shall notify the local law enforcement agency.

701.12 FOUNDATION

701.12.1 All pipe shall be bedded on a stable foundation in a trench which is completely free of water. The ENGINEER shall determine the adequacy of the foundation. Class V soils shall not be used as a foundation. If Class V soils are encountered at the bottom of the trench it shall be removed to the depth authorized by the ENGINEER and replaced with Class I, II or III soils.

701.12.2 Where an unstable foundation condition is encountered, it must be stabilized before laying pipe or alternative foundation methods utilized. The CONTRACTOR will be paid for foundation stabilization when required by the ENGINEER. Failure to notify the ENGINEER of an obvious unstable foundation condition prior to proceeding with placement of the pipe shall result in complete removal of the affected pipe, foundation stabilization, and replacement of the pipe at the CONTRACTOR'S expense.

701.12.3 Should the trench be inadvertently over-excavated below the foundation, the area of over-excavation shall be filled with select material in 6 inch lifts and compacted to a density of not less than 95 percent of maximum density, as determined by ASTM D 1557.

701.12.4 Unless specifically approved in writing by the ENGINEER, the CONTRACTOR shall not proceed with pipe embedment in a trench where water is present or the foundation is saturated. Adequate dewatering, as specified in Section 701.7, shall be utilized.

701.13 PIPE EMBEDMENT

701.13.1 GENERAL:

701.13.1.1 The class of bedding used for each pipe shall be as shown on the plans or as specified in the Supplemental Technical Specifications.

701.13.1.2 The CONTRACTOR may request a change in the class of bedding required on a pipe, if authorized by the ENGINEER, all increase in the cost of labor and materials required to include upgrading of the pipe class will be at the CONTRACTOR'S expense with no additional cost to the OWNER.

701.13.2 RIGID PIPE EMBEDMENT:

701.13.2.1 The trenches shall be excavated in conformance with the trench width requirements in Section 701.10 and 701.5.

701.13.2.2 Embedment material shall be Class I, II, III, or IV soils, or lean fill as specified in Section 207.

701.13.2.3 All soil in the embedment zone shall be placed in lifts not exceeding 8 inches in uncompacted depth, except that material along the side of the pipe shall not be placed above the spring1ine until the haunch area of the pipe is adequately filled and sliced such that no voids remain.

701.13.2.4 All soil shall be compacted to a density not less than 90 percent of maximum density, as determined by ASTM D 1557. The CONTRACTOR shall take care to assure that the pipe is not damaged or misaligned during compaction of the embedment.

701.13.3 FLEXIBLE PIPE EMBEDMENT:

701.13.3.1 Proper placement of soils in the embedment zone is extremely important in achieving a satisfactory installation of flexible pipe. The CONTRACTOR shall be aware that the soil classes have differing requirements relative to embedment. There are also differing requirements for embedment in dry and wet conditions (wet conditions meaning that the embedment zone will be subject to ground water).

701.13.3.2 Embedment material shall be Class I, II, or III soils, or lean fill as specified in Section 207.

701.13.3.3 Embedment soil shall be placed in lifts not exceeding 8 inches loose depth. The haunch shall be properly compacted by hand tampers utilizing due caution such that the pipe is not damaged or misaligned. Mechanical tampers shall not be utilized directly over the pipe in the embedment zone.

701.13.3.4 The CONTRACTOR may utilize acceptable on site soils in the embedment area which are in conformance with these specifications. The CONTRACTOR has the option of importing a different soil, however, additional compensation will only be allowed if the on site soils are Class IV or V.

701.13.3.5 Class I soil shall comply with the requirements of Section 302, AGGREGATE BASE COURSE.

701.13.3.6 Class II and III soils shall be compacted to a density of not less than 95 percent of maximum density in the embedment area, as determined by ASTM D 1557. The moisture content shall not exceed 5 percent above optimum.

701.14 FINAL BACKFILL

701.14.1 Final backfill shall consist of homogeneous soil except that boulders, frozen clumps, rubble, and Class V soils are excluded.

701.14.2 Final backfill shall be compacted to a density of not less than 90 percent of maximum density, as determined by ASTM D 1557 unless otherwise specified in the Contract Documents.

701.14.3 The upper portion of the final backfill may require specific soils and compaction in order to provide a suitable foundation for pavements, curb and gutter, sidewalk, or other type of structure.

701.15 COMPACTION METHODS

701.15.1 The CONTRACTOR shall be responsible for the compaction method utilized during foundation preparation, embedment placement, and final backfill except as otherwise specified herein or in the Supplemental Technical Specifications.

701.15.2 The use of mechanical vibratory compactors directly over the pipe is prohibited in the embedment area. Extreme care shall be taken

when utilizing mechanical compactors in the haunch and initial backfill area in order to avoid damage to or misalignment of the pipe. The ENGINEER shall examine any damaged pipe and has the authority to direct that it be replaced with new pipe at no additional cost to the OWNER.

701.15.3 Flooding or jetting shall be allowed if the subsurface soils are compatible to its usage, as authorized by the ENGINEER. It shall not be used for compaction of flexible pipe, when the soil has a plastic limit of 7 or greater, and in areas of collapsible soils. The CONTRACTOR shall take any necessary precautions to minimize to negligible flotation of the pipe.

701.15.4 The CONTRACTOR shall, at the direction of the ENGINEER, excavate the compacted fill as necessary for the purpose of determining the adequacy of the compaction.

701.16 PAVEMENT

701.16.1 Either new street construction or pavement replacements shall satisfy the following design and construction requirements:

701.16.1.1 Unless permanent pavement is specified to be placed immediately, a temporary dust-free patch shall be placed wherever excavation is made through existing pavements, sidewalks, or driveways. The patch shall be placed, rolled, and maintained by the CONTRACTOR to provide a smooth surface for traffic until a permanent pavement is constructed within the time frame specified by the ENGINEER.

701.16.1.2 The subgrade preparation of the area to be paved shall be in accordance with Section 301 of these specifications. The asphalt pavement placed shall be in accordance with Section 336 and the concrete pavement shall be in accordance with Section 337. The placement of the other roadway items shall be in accordance with Section 340.

701.16.1.3 Material thickness for all pavement replacements within residential or arterial streets shall conform to the plans or the Standard Detail Drawings or match the existing pavement as authorized by the ENGINEER.

701.16.1.4 Pavement cuts of 8 ft. or more in width and 100 ft. or more in length shall be paved with a laydown machine.

701.16.1.5 When authorized by the ENGINEER, asphalt concrete base course may be used to replace surface course thickness requirements on streets that are scheduled for overlay.

701.16.1.6 The edges of all trenches at the base course level shall be neatly trimmed before beginning any paving replacement. All edges of the existing pavement adjacent to the trench cut shall be inspected. Undermined, broken, cracked, or unevenly cut portions shall be removed and the pavement edges retrimmed prior to pavement replacement. All vertical edges of the existing asphalt pavement adjacent to the trench cut and all surface areas for a width of at least 4 inches and no greater than 8 inches, shall be thoroughly cleaned and a tack coat applied prior to placing any hot mix asphalt. The finished surface of the pavement replacement shall be graded to conform to the existing contour both in cross section and profile.

701.16.1.7 Concrete pavement to replace cuts made in concrete paved streets, arterials, etc., shall conform to the Standard Detail Drawings for concrete pavement or in accordance with New Mexico Department of Transportation requirements where applicable.

701.16.1.8 When more than one-half of the surface area of a manhole, lamphole or valve box is found to extend into the area to receive a permanent asphaltic hot-mix surfacing and/or base pavement replacement, the existing pavement surrounding the manhole, lamphole, or valve box shall be removed to within those limits which will permit a permanent pavement replacement to be made in accordance with the approved plans.

701.16.1.9 Asphaltic hot mix shall not be placed upon the concrete collar, nor shall traffic be permitted upon the collar for at least 24 hours, or longer, if so directed by the ENGINEER. A tack coat of asphaltic emulsion may be applied after the concrete has taken its final set. During this time adequate barricading of the area shall be maintained by the CONTRACTOR.

701.16.1.10 If in the course of a pavement removal, a manhole, lamphole, and/or valve box is encountered and has a concrete collar about it and the collar is performing adequately, no special construction need be made in the permanent pavement replacement.

701.16.1.11 The CONTRACTOR shall make any small grade or alignment adjustment of the manhole, lamphole, and/or valve box encountered that is necessary to provide a smooth riding surface between the existing pavement and the patch and/or within the patch itself.

701.16.1.12 TESTING

701.16.1.12.1 A sample of each type of soil encountered shall be classified in accordance with the requirements of ASTM D2487, and the moisture density relationship determined in accordance either ASTM D698 or D1557, whichever is applicable.

701.16.1.12.2 A compaction test shall be taken for each 2 feet depth per 200 feet trench length 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 and re-tested for compliance.

701.17 MEASUREMENT AND PAYMENT

701.17.1 TRENCHING, BACKFILLING, AND COMPACTION:

701.17.1.1 Trenching, backfilling, and compaction shall be combined into one unit and shall be measured and paid for as follows:

701.17.1.2 Measurement shall be made along the center1ine of the pipe.

701.17.1.3 The unit of measurement shall be by the linear foot *per* pipe diameter per specified increment of depth.

701.17.1.4 The following depth increments will apply:

701.17.1.4.1 For water line installations the costs for trenching, backfilling and compaction shall be included in the unit price per linear foot of pipe per pipe diameter for maximum depth, such as: 4 to 14 inch diameter at 6 feet, 16 to 24 inch diameter pipe at 7 feet and all pipe larger than 24 inch at 8 feet. Separate payment will be specified in the Bid Proposal when required depths exceed the above depths.

701.17.1.4.2 For sewer installations the increments shall be 8 feet or less, 8 feet to 12 feet, 12 feet to 16 feet, 16 feet to 20 feet and thereafter at 4 foot intervals.

701.17.1.4.3 All depths shall be measured to the nearest foot.

701.17.1.5 All depths shall be measured from the invert of the pipe to the top of existing ground elevation. The existing ground elevation shall be the elevation of the surface that exists along the centerline of the pipe at the time of construction staking for said trenching.

701.17.1.5.1 Whenever a special pipe embedment detail is specified, on the plans, the trench depth shall be measured from the bottom of the embedment to the top of existing ground elevation. However, no additional trench depth shall be measured as a result of inadvertent over-excavation nor to accommodate trench dewatering.

701.17.1.6 Payment will be made at the unit price per linear foot per diameter of pipe per depth increment as specified in the Bid Proposal, and will include trenching, backfilling, and compaction for all trench zones. No additional payment will be made for compacted materials to bring trench backfill up to required depth.

701.17.2 OVER-EXCAVATION: Required over-excavation for foundation stabilization shall be measured by the cubic yard of material removed and replaced with compacted suitable material. Payment will be made at the unit price per cubic yard of compacted replacement material and shall include excavation, backfill material, and compaction.

701.17.3 ROCK EXCAVATION: Rock excavation will be measured by the cubic yard within the specified limits of the trench configuration. Blasting will be included in the rock excavation. Payment will be made at the unit price per cubic yard.

701.17.4 UNSUITABLE MATERIALS: Removal and disposal of unsuitable materials from the construction site shall be measured by the cubic yard of excavated material. Payment will be made at the unit price per cubic yard of excavated material.

701.17.5 PAVEMENT. SIDEWALK, AND DRIVEWAYS: Removal and disposal of existing pavement, sidewalks, and driveways will be measured by the square yard or square foot whichever is apropos. Payment will be made at the unit price per square yard or square foot as specified in the Bid Proposal.

701.17.6 SELECT MATERIALS: Where selected material is required in the backfilling operations, the quantity of material will be measured by the cubic yard of compacted material in place in the trench. Payment will be made at the unit price per cubic yard of select material as indicated above.

701.17.6.1 Whenever a special pipe embedment detail is specified, measurement and payment shall be as identified in the Bid Proposal.

701.17.7 DEWATERING: Dewatering operations for trench work shall be measured by the linear foot along the center-line of that portion of the trench which requires dewatering. Payment will be made at the unit price per linear foot of dewatered trench.

701.17.8 PAVEMENT:

701.17.8.1 Permanent or temporary pavement surfacing shall be measured and paid for in accordance with the paving section elements as defined under Section 300 for the specific item of work.

701.17.8.2 Permanent resurfacing or permanent surface patching will be measured on the basis of the square yard for new surfacing as provided in the applicable section of these specifications. For payment purposes, the normal maximum pavement cut width shall be as defined in the Table No. 701.17.8.2

TABLE No. 701.17.8.2

NORMAL MAXIMUM PAVEMENT CUT WIOTHS ALLOWED FOR PAYMENT PURPOSES

Soil Stability	Trench Depth (TD)	Pipe Size	Max. Pavement Cut Width
Stable. Soil stands in a vert. cut	Less than or equal to 5 feet	ND less than or equal to 27"	00 + 2 feet
"	Greater than 5'	ND less than or equal to 54"	TD + 2 feet
"	"	ND greater than 54"	1.6 X ND + TD + 3'
Unstable. Soil does not stand in vert. cut	Any	Any	2 X TD + OD

NOTES: 1. TD is trench depth; ND is nominal pipe diameter; and OD is outside pipe diameter.

2. Individual locations or conditions may warrant greater cut widths than those specified above. The ENGINEER shall authorize in writing the increase in the above pavement cut widths.

SECTION 910

STORM SEWER PIPE INSTALLATIONS

910.1 GENERAL

910.1.1 The construction items, specified in this section, are common to storm sewer pipe installation and pipe type culverts.

910.1.2 Reinforced concrete pipe may be used for storm sewer pipe installations or pipe type culverts. Corrugated metal pipe will only be used for pipe-type culverts.

910.2 REFERENCES

910.2.1 ASTM

C 43	C 478
C 361	D 3034
C 425	F 679
C 443	

910.2.2 AWWA

C 603

910.2.3 This publication per SECTIONS:

101	125
102	129
105	135
106	136
108	137
121	161
123	801
124	

910.3 MATERIALS

910.3.1 PIPE: Sewer line pipe and fittings shall be as specified in other sections, as follows:

Reinforced Concrete Pipe	Section 123
Reinforced Concrete Pressure Pipe	Section 124
Corrugated Metal Pipe and Arches	Section 135
Structural Plate for Pipe, Arches, and Pipe Arches	Section 136
Corrugated Aluminum Pipe and Arches	Section 137

910.4 CERTIFICATION

The OWNER/ENGINEER will be supplied with a certification on each item or type of material required in the sewer line, as to that item meeting the specifications and/or the reference specifications before that item is installed.

910.5 INSTALLATION

910.5.1 GENERAL:

910.5.1.1 Pipe and appurtenances shall be new and unused. The type of pipe to be installed shall be as approved by these specifications or unless otherwise shown on the drawings. Pipe and appurtenances shall be handled in such a manner as to insure delivery to the trench in sound, undamaged condition. Particular care shall be taken to prevent damage to any pipe coating.

910.5.1.2 The interior of the pipe shall be thoroughly cleaned of foreign material before being lowered into the trench and shall be kept clean during construction operations. When work is not in progress, the open ends of pipe shall be securely closed so that no foreign materials will enter the pipe. Any section of pipe found to be defective before or after laying shall be replaced with sound pipe, or repaired in a manner satisfactory to the ENGINEER, without additional expense to the OWNER.

910.5.1.3 The CONTRACTOR shall install a plug in the new sewer at any point of connection to an existing system. The plug shall remain in place until the ENGINEER authorizes its removal in writing. The CONTRACTOR shall not flush or otherwise discharge any flow into an existing system unless approved in writing by the ENGINEER.

910.5.1.4 Pipe shall be laid to line and grade as shown on the plans and as staked in the field. The bottom of the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the pipe barrel. Suitable excavation shall be made to receive the bell of the pipe and the joint shall not bear upon the bottom of the trench. All adjustment to the line and grade shall be made by scraping away or filling in with pipe zone material under the body of the pipe, and not by wedging or blocking. When connections are to be made to any existing manhole, pipe, or other improvement, the actual elevation or position of which cannot be determined without excavation, the CONTRACTOR shall excavate for and expose the existing improvement before laying the connecting pipe or conduit. When existing underground improvements may reasonably be expected to conflict with the line

or grade established for the new sewer line, the ENGINEER shall request and the CONTRACTOR shall excavate as necessary to expose and locate such potentially conflicting underground improvements prior to laying the new pipe. Any adjustment in line or grade which may be necessary to accomplish the intent of the plans will be made, and the CONTRACTOR will be paid for any additional work resulting from such change in line or grade in the manner provided for in the General Conditions.

910.5.1.5 CONTRACTOR shall submit to the ENGINEER the proposed method for making connections to existing manholes. Connection methods will be dependent upon manhole size and pipe sizes. Unnecessary damage to the existing manhole should be avoided.

910.5.1.6 Pipe shall be laid upgrade in a continuous operation from structure to structure, with the socket or collar ends of the pipe upgrade unless otherwise permitted by the ENGINEER. Concrete pipe with elliptical reinforcement shall be laid with the minor axis of the reinforcement cage in a vertical position. Corrugated metal pipe shall be laid with the external laps of the circumferential seams toward the inlet end.

910.6 JOINTS FOR PIPE

910.6.1 JOINT FOR CONCRETE PIPE:

910.6.1.1 The type of joint to be used shall be O-ring rubber gasket joints conforming to ASTM C 361 and C 443.

910.6.1.2 Gasketed Type of Joints for Reinforced Concrete Pipe

910.6.1.2.1 General--The ends of the pipe shall be so formed that when the pipes are laid together and joined, they shall make a continuous and uniform line of pipe with a smooth and regular surface.

910.6.1.2.2 Rubber gaskets for making compression-type joints for concrete pipe shall be factory fabricated in accordance with ASTM C 443; for pipes 12 inches in diameter and larger shall be O-ring and shall be handled, primed, installed, etc. in strict accordance with the manufacturer's recommendations.

910.6.1.2.3 The CONTRACTOR'S attention is particularly called to ASTM C 443, regarding storage of gaskets.

910.6.1.2.4 The CONTRACTOR shall furnish the ENGINEER complete information concerning the type and make of all joint material which he intends to use under the contract, including certification that the joint material meets the requirements of the specifications.

910.6.2 JOINTS FOR CORRUGATED METAL PIPE:

910.6.2.1 The seams of the pipe are to be placed at the sides, not on the bottom. The inside circumferential seams should be placed pointing downstream. Care should be taken to insure that dirt or other particles do not get between the outside of the pipe and the pipe coupling. Paved inverts should be placed and centered on the bottom of the trench. Any damage to the protective lining and coating shall be repaired prior to the backfilling around the pipe.

910.6.2.2 If waterproof joints are called for on the plans or specified in the Supplementary Specifications, the caulking compound or other waterproofing material used shall be subjected to the approval of the ENGINEER.

910.7 TESTING FOR LEAKAGE

Normally storm sewer lines need not be tested, but if in the opinion of the ENGINEER, the workmanship or materials do not appear to be satisfactory, the ENGINEER may require that a section of the storm sewer line be tested in a similar manner as that for a sanitary sewer line, see Section 905.

910.8 CLEANING AND INSPECTION

910.8.1 CLEANING: No pipe spalls, rocks, dirt, joint compounds, cement mortar and other trash or obstructions shall be left in a sewer pipe of any size or type. During flushing operations the manhole outlet shall be bagged or plugged so that the debris will not be carried into an existing active line.

910.8.2 INSPECTION: Before lines become operational or final acceptance of the installation, small size lines shall be inspected by a television camera and larger size lines will be inspected by walking through the line.

910.8.3 TELEVISION: After the CONTRACTOR has cleaned and flushed the line, the CONTRACTOR will notify the ENGINEER that the line is ready for television inspection, if required. Prior to the television inspection (possibly during flushing operation) the CONTRACTOR will insert a 1/4-inch nylon rope in the line for the purpose of

towing the television unit through the pipe. The OWNER will perform the first television inspection at no cost to the CONTRACTOR. If during the first inspection debris is found in the line, the television inspection will cease. When further cleanup has been completed, the CONTRACTOR will request the ENGINEER to have a second inspection performed. The cost of the second inspection and any subsequent inspections of that segment of the line will be paid for by the CONTRACTOR at the rate of $75.00 per hour while the television crew is at the line site.

910.9 MEASUREMENT AND PAYMENT

910.9.1 STORM SEWER PIPE: Installed pipe shall be measured and paid for as follows:

910.9.1.1 For straight lines the pipe length shall be the intervening distance between the centers of manholes along a line parallel to the pipe invert.

910.9.1.2 For curvilinear lines the pipe length shall be the intervening arc distance between the centers of manholes along a line parallel to the pipe invert.

910.9.1.3 For lateral lines, such as from main or manhole to a storm inlet, the pipe length shall be the distance between the center of a manhole or centerline of the main to the interior wall face of the storm inlet along a line parallel to the pipe invert.

910.9.1.4 Payment for pipe will be in accordance with the unit price per linear foot per size and material as defined in the Bid Proposal, and shall include pipe installed in the trench, jointing and coupling materials, and other materials necessary to connect to other sections of pipe, manholes, and other appurtenances.

910.9.2 REMOVAL AND DISPOSAL OF STORM SEWER PIPE: Removal and disposal of storm sewer pipe shall be measured by the linear foot within the specified pipe size increments. Payment will be made on the unit price per linear foot of specified pipe size in the Bid Proposal. Trenching, backfilling, and pavement removal and replacement will be paid for based on the unit prices for each appropriate bid item in the Bid Proposal. If new pipe is to be installed in the same trench as the removed pipe, only one payment will be made for trenching, backfilling, and pavement removal and replacement.

910.9.3 TESTING OF PIPE: No payment will be made for required initial or subsequent tests on sections of the storm sewer line.

SECTION 915

STORM SEWER DRAINAGE APPURTENANCES

915.1 GENERAL

The construction items, specified in this section, are related to the storm sewer underground facilities.

915.2 REFERENCES

915.2.1 This publication:

SECTION 300	SECTION 701
SECTION 501	SECTION 910

915.3 MATERIALS

915.3.1 The construction plans will specify the size and material for the pipe between the storm sewer main and the storm water collection structure.

915.3.2 The various types of storm inlets and their relation to curb and gutter, or valley gutter are shown on the Standard Detail Drawings. Construction plans will identify the type to be constructed.

915.3.3 Grating size, material, and configuration shall conform to the Standard Detail Drawings.

915.4 INSTALLATION OF DRAINAGE FACILITIES

915.4.1 Excavation and backfilling for the storm inlet shall be accomplished in accordance with Section 501.

915.4.2 Trenching, backfilling, and compaction for the connecting pipe between the storm sewer main and the storm inlet shall conform to the specifications contained in Section 701. Pipe shall be installed in accordance with Section 910.

915.4.3 All pipe and structures shall be installed per location and elevations, as shown on the construction plans. If during the course of installation, an underground obstruction (i.e., existing utility line) the work shall stop and the ENGINEER shall be immediately notified so that the problem can be resolved.

915.4.4 Direct connection to storm sewer main will be permitted if the main is a minimum of 36 inches in diameter (I.D.) and the connecting line is not greater than 12 inches (I.D.). If storm sewer mains are 48 inches (I.D.) or larger, the connecting line diameter may be increased to 18 inches (I.D.). For connecting line sizes greater than those specified above, the connection to the main will be made into a manhole or by inserting into the main a factory constructed wye. Connection to the main will comply with the Standard Detail Drawings.

915.4.5 Removal of curb and gutter, and sidewalk for installation of a storm inlet shall be made at a scored or full depth joint.

915.4.6 Existing pavement removal and replacement shall conform to Sections 300 and 801 and shall conform to residential or arterial pavement sections of the same material (asphalt or Portland Cement concrete) as the existing pavement.

915.4.7 No width greater than 1/2 inch will be permitted between the inlet grate and the roadside portion of the inlet frame.

915.5 Private drainage facility installations, which are to be constructed under the authorization of "Drainage Facilities Within Public Right-of Way," shall comply with the Standard Detail Drawings and appropriate sections of this publication.

915.6 MEASUREMENT AND PAYMENT

915.6.1 Pavement removal and replacement will be measured by the square yard. Payment will be made at the unit price per square yard per type of replacement paving material, as specified in the Bid Proposal.

915.6.2 Trenching, backfilling, and compaction shall be measured by the linear foot from the main side wall of the inlet to the centerline of the main. Payment will be made at the unit price per linear foot per the average depth increment between connection points, as defined in the Bid Proposal.

915.6.3 Connecting pipe shall be measured by the linear foot along centerline of pipe from the main side wall of the inlet to the centerline of the main. Payment will be made at the unit price per linear foot per type and size of pipe, and shall include pipe in place and all necessary jointing materials.

915.6.4 Storm inlets shall be measured on a unit basis. Payment will be made at the unit price per each type of storm inlet, and shall include structure, grating, excavation, backfilling and compaction, and curb removal and replacement, as defined in Bid Proposal.

915.6.5 Removal and replacement of sidewalk shall be measured by the square foot and payment will be made at the unit price per square foot.

915.6.6 Measurement and payment for manholes will be as indicated in Section 920.

SECTION 1200

BARRICADING AND TEMPORARY TRAFFIC CONTROL

1200.1 GENERAL: The work under this section includes, but is not limited to, traffic control standards needed to ensure safety to motorists, the public, construction workers, and special event participants when City roadways are temporarily disrupted due to construction efforts or special events.

1200.2 REFERENCES

1200.2.1 Manual on Uniform Traffic Control Devices, (MUTCD), Part VI, FHWA.

1200.2.3 The American Traffic Safety Services Association (ATSSA), Quality Standards for Work Zone Traffic Control Devices.

1200.2.3 This Publication, Latest Edition

SECTION 400 TRAFFIC CONTROL

1200.3 BARRICADING STANDARDS

1200.3.1 Before construction begins all traffic control signs and barricades must be installed in accordance with the approved traffic control plan, construction plans, barricading detour plan or as directed by the OWNER. No construction signing and barricading shall commence until CONTRACTOR is assured that all equipment, manpower, and resources are available to start and complete the work. Where applicable, all signs, barricades, and/or barrels will be moved forward as the construction progresses.

1200.3.2 The name and telephone number of the owner shall be permanently stenciled on all barricades and traffic control equipment. The name and telephone number shall be a non-retroreflective color not over 2 inches in height, and be placed on a non-retroreflective surface of all equipment. Graffiti shall be promptly removed from any all barricades and traffic control equipment. If notified by the OWNER or the ENGINEER, graffiti shall be removed, or the equipment replaced with clean equipment, within four hours or the barricade permit is subject to revocation.

1200.3.3 All advance warning signs approaching a construction zone shall be double indicated (one sign each on left and right sides of approaching traffic) for all multiple-lane roadways with painted or raised medians and where adequate space is available. All double indicated signs shall be the same size. When a sign is placed in a painted median, especially a two-way continuous left-turn lane, a reflectorized barricade must be placed on the back side of the sign to alert motorists approaching from the opposite direction.

1200.3.4 It shall be the responsibility of the CONTRACTOR to remove all construction barricades, signing, and traffic control devices not required at the end of the working day.

1200.3.5 All advance warning signs shall be a minimum of thirty-six inches by thirty-six inches in size with super engineering grade sheeting or better. On high-speed (posted 45mph and above), rural section roadways where adequate pedestrian space is available, forty-eight inch by forty-eight inch signs is preferred. The use of forty-eight inch signs shall be required at locations as published on a list by the ENGINEER. All advance-warning signs not directly applicable shall be removed when not needed, and shall not be left in public right-of-way. All construction signing shall be black on a reflectorized orange field unless otherwise specified.

1200.3.6 Existing posts may be used at some locations, with approval of the ENGINEER. Portable sign supports will be acceptable as an alternate for signs which are to be in place for less than three (3) weeks. The bottom of advance warning signs mounted on barricades or temporary sign supports shall be no less than one foot above the traveled way. All regulatory and advisory signs shall be mounted on sign stands or as otherwise approved by ENGINEER . The placement of portable sign supports shall not block or impede pedestrian access. All signs ground mounted on single or double posts shall have the bottom of the sign seven (7) feet above pavement level.

1200.3.7 Barrels and different types of barricades are generally not intended to be intermixed in the same series of channelization. All barrels may have sand or water ballast limited to one hundred (100) pounds. All barricades shall be placed correctly with diagonal stripes sloping downwards in the direction traffic is to pass. Where barricades extend entirely across a roadway, the stripes must slope downward in the direction toward which traffic must turn. Where both right and left turns are provided, the stripes must slope downward in both directions from the center of the barricade or barricades. Where no turns are intended, the stripes must slope downward toward the center of the barricade or barricades.

1200.3.8 The CONTRACTOR shall inspect and maintain all barricades at least once each day except for barricades on or adjacent to arterial and collector streets which shall be checked twice daily, including inspection during hours of darkness. A log of these inspections showing project, location, date, and time

shall be kept and a copy sent to the Construction Coordination Division upon request. Upon request, the CONTRACTOR shall immediately produce current traffic control logs. Failure to do so may result in suspension of work or revocation of barricade permit.

1200.3.9 All traffic control devices required within traveled lanes after dark are to be equipped with warning lights. Type (A) flashing warning lights shall be used on all devices which are intended to warn motorists or pedestrians of hazards or obstructions in or near the travel path. Type © steady burn lights shall be used on all devices which are intended to define the travel path. All lights shall be operational. Traffic control devices that are damaged, dirty or have substandard reflectorization shall be immediately brought up to standard. Reflectorized sheeted panels shall not be considered as a replacement for a required warning light. Warning lights shall be incidental to payment for traffic control.

1200.3.10 Equipment and materials are not to be stored within fifteen (15) feet of a traveled lane during non-working hours, unless approved by the ENGINEER, which approval cannot be unreasonably withheld.

1200.3.11 CONTRACTOR shall provide and maintain a safe and adequate means of channelizing pedestrian traffic around all work areas throughout the periods of construction. All such channelization shall be arranged to prevent pedestrians from having to enter the roadway in order to pass around the work area. Where required, pedestrian detour signs will be installed by the CONTRACTOR. Where construction impedes or obstructs sidewalk access, CONTRACTOR shall barricade sidewalks and place "Sidewalk Closed" signs accompanied with the appropriate pedestrian detour signing. Pedestrian detour signs shall be incidental to payment for traffic control.

1200.3.12 CONTRACTOR shall provide and maintain a safe and adequate means of channelizing bicycle traffic around all work area throughout the periods of construction when existing bicycle trails, lanes, or routes are designated. Where possible, adequate space for bicyclists must be provided, and bicycle detour signs, including "Share the Road" signs shall be installed. When adequate space is not available to provide for bicycle access, the bicycle facilities shall be adequately detoured around the construction site. The detour route shall minimize out-of-direction travel distance, and shall be adequately signed and directed. Bicycle detour signs shall be incidental to payment for traffic control.

1200.3.13 All barricades, signs, and traffic control equipment shall be properly and adequately ballasted for normal wind loads. For equipment placed for extended periods (seven days or more), or during the months of February through May, additional ballast shall be required.

1200.3.14 The use of roll-up advance warning signs is allowed, so long as the reflectivity required in the MUTCD is provided. Such signs shall be adequately braced to resist rotation under normal wind loads.

1200.3.15 The use of orange warning flags mounted atop construction warning signs is encouraged and is required in certain instances. Flags mounted atop construction signs is required on all "Reduced Speed Ahead (R2-5a)" signs, "Reduced Speed (R2-5b and R2-1)" signs, all "Double Fine Zone" signs, "Road Closed Ahead (W20-3)" signs, "Detour Ahead (W20-2)" signs, "Flagger Ahead (W20-7)" signs, "Flagger Symbol (W20-7a)" signs, and "Be Prepared to Stop (W20-7b")" signs.

1200.3.16 Cones are an acceptable traffic control device under certain situations. Traffic cones are not to be used to separate traffic traveling in different directions. All cones must be a minimum of 28 inches tall. The use of cones as traffic control devices is not allowed during nighttime hours; however if used, all cones used at night must include white, reflectorized bands per MUTCD standards. The use of cones is encouraged for daytime moving closure operations, projects in duration of two hours or less, and special events.

1200.3.17 Type III barricades must be used at all road closures. Multiple type III barricades of the same configuration placed next to each other in the same direction is allowed. A type III barricade or illuminated arrow panel must be used for each lane closure. A minimum of two feet of exposed railing is required on the traveled side (open lanes) of type III barricades. The minimum length of type III barricade for each lane closure is eight (8) feet per lane twelve (12) feet or less in width, and the minimum length of type III barricade required for a sidewalk closure is four (4) feet. The minimum length of type III barricades for a double lane closure is sixteen (16) feet. Additional barricades above the minimum required may be required to fill in gaps for wide lanes, multiple lane closures, or shoulder areas.

1200.3.18 Road closures shall be pre-warned by the use of a "Road Closed to Through Traffic" (R11-4) sign, where appropriate. These signs shall be placed at intersections approaching the road closure with appropriate detour signing. When mounted on a three rail barricade support, the maximum width of sign support shall be six feet. If the detour route is more than one intersection before the road closure, then additional R11-4 signs shall be placed at each intersection between the detour route and the road

closure. "Road Closed to Through Traffic" signs are encouraged to be placed on or near the center of the roadway, but R11-4 signs shall not be placed in an area that block sight distance for motorists and pedestrians. Where sight distance becomes a problem, low-volume intersections may be temporarily converted to a four-way Stop condition, with the approval of the ENGINEER.

1200.3.19 Illuminated arrow panels with a minimum size of 32 square feet may be used in lieu of type III barricades for lane and roadway closures. Arrow panels must be battery or solar powered. The use of diesel, or other noise generating power sources, is not allowed. For roadways with a previously posted speed limit of 35 mph or higher, the use of arrow panels is required for all lane closures. An arrow panel is required for each lane reduction, but is not required for shifting tapers. In residential areas where the arrow panel will be used at night, directional lighting limited to 30 degrees or less must be used to reduce glare into nearby properties. When illuminated arrow panels are used for a lane closure, then the use of vertical panels at the regular MUTCD minimum spacing for the lane reduction taper is allowed.

1200.3.20 For work expected to last one hour or less and for moving closures, reduced barricading may be allowed as approved by the ENGINEER. Reduced barricading on arterial or collector roads shall consist of a minimum of one advance warning sign, a minimum of a three barricade or cone taper, and an illuminated arrow panel.

1200.3.21 For emergency utility work on arterial or collector roadways, the CONTRACTOR must notify the traveling public. If a variable message board is not required by the ENGINEER, a "Utility Emergency Ahead" sign must be installed for each direction of arterial / collector traffic approaching the work site. The "Utility Emergency Ahead" sign must be placed in addition to, and preceding, the three normally required advance warning signs at the same spacing required in the MUTCD for advance warning signs.

1200.3.2 Double fine zones shall be delineated by the
use of "Double Fine Zone" signs as outlined in this section. Double fine zones shall be delineated for construction zones and construction curtilage zones at the request of either the OWNER or ENGINEER. In addition, double fine zones are required on all arterial / collector roadways where there is a: 1.) reduced speed limit; 2.) lane reduction; 3.) reduced design speed; or 4.) traffic hazard. Double fine zones are required for all flagging operations, and work zones with an imminent danger to workers, regardless of the roadway classification. The beginning of the double fine zone shall be clearly marked with a sign stating: "*Construction* - Begin Double Fine Zone". The end of the double fine zone shall be clearly marked with a sign stating: "*Construction* - End Double Fine Zone". If the double fine zone extends beyond one-half mile in length, intermittent signs must be placed no more than one-half mile apart stating: "*Construction* - Double Fine Zone". Additional intermittent signs are needed following side street entrances. Details for the double fine zone signs are on file with the ENGINEER. Placement of the Begin Double Fine Zone sign shall be immediately following the "Road Work Ahead" sign. Placement of the End Double Fine Zone sign shall be immediately preceding the "End Road Work" sign.

1200.3.23 On arterial or collector roadways with multiple lane closures, the advance warning signs shall indicate the correct number of lanes closed. Arrow panels are required for each lane closure of multiple lane closures on arterial or collector roadways, regardless of the previously posted speed limit.

1200.4 CONFLICTS WITH EXISTING SIGNING, STRIPING, AND SIGNALS

1200.4.1 CONTRACTOR shall not remove, realign, or adjust any official OWNER traffic control device including stop signs, warning signs, or any other traffic or parking control signs, unless approved by the OWNER. CONTRACTOR shall give the OWNER three (3) working day's prior notice of any official OWNER traffic control device that needs to be moved. The OWNER shall take all appropriate actions as soon as practical thereafter. When CONTRACTOR places regulatory signing reducing the posted speed limit as approved by the OWNER, the CONTRACTOR must temporarily cover any and all conflicting speed limit signs. Such covers must be immediately removed once the temporary speed limit reductions are removed.

1200.4.2 The CONTRACTOR is responsible for obliteration of any conflicting striping and responsible for all temporary striping. For temporary situations lasting seven days or less, conflicting pavement markings may be addressed with the proper use of channelization devices and signing, unless otherwise approved or required by the ENGINEER.

1200.4.3 When the construction activity or traffic detouring plans result in less than two signals being visible in any direction at a signalized intersection, additional temporary traffic signals shall be required. A minimum of two signals must be visible within a twenty degree horizontal and vertical cone of vision, as measured from the stop bar for each lane approaching a signalized intersection.

1200.5 STREET AND LANE CLOSURES

1200.5.1 CONTRACTOR shall maintain access to all public and private facilities adjacent to the construction area at all times, including businesses and/or residents. When denying access is unavoidable, CONTRACTOR must coordinate access restriction to times and locations that are reasonably convenient to the property owners and/or residents affected. CONTRACTOR shall construct and maintain access roads, including paved ramps, where deemed necessary by ENGINEER to maintain traffic flow. Business access signs may be required to direct traffic to existing businesses, as directed by ENGINEER or OWNER. No more than three businesses shall be placed on a single sign. In areas of multiple adjacent businesses, only generic "Business Access Only (arrow)" signs are required. For shopping centers with multiple business tenants, the name of the shopping center shall be placed on a sign at each access location. Access signs shall have 5 inch high, white letters with a directional arrow on a reflectorized blue background. Business access shall be rectangular in shape, no taller than wide, and shall be no larger than four feet wide by three feet tall. Business access signs shall not be placed where they block sight distance for either motorists or pedestrians.

1200.5.2 CONTRACTOR shall notify the following services forty-eight (48) hours in advance of any complete street or access closures: Police Department, Fire Department, U.S. Postal Service, Solid Waste Department, Ambulance Services, local schools, and the Transit Department. The CONTRACTOR shall also notify all businesses and residents directly affected by the road closure. For the total closure of arterial or collector roadways, a variable message board must be installed for a minimum of two days prior to the road closure notifying motorists of the dates and times for the closure. A minimum of one variable message board is required for each direction of closure. For the total closure of a local roadway, a sign must be installed for a minimum of two days prior to the road closure notifying motorists and residents of the dates and times of the closure. A minimum of one sign is required for each direction of closure.

1200.5.3 The CONTRACTOR shall be responsible, and shall make appropriate accommodation, for garbage and trash collection, mail delivery, and other essential services needed by residents and businesses affected by CONTRACTOR operations. This effort shall include coordination with U.S. Post Office, Solid Waste Department, and other agencies. Where required, CONTRACTOR shall notify all residents in writing at least two days prior. Such notice shall include at a minimum: dates and times of construction activities and the name and telephone number of the CONTRACTORS contact person. CONTRACTOR shall collect all trash and garbage in the project area and deliver to an accessible location for collection by 7:00 a.m. on the designated trash collection day. Such trash and garbage cannot be deposited onto private property, must not block access, and shall be immediately cleaned up by CONTRACTOR upon pick up by the Solid Waste Department or private trash collection company.

1200.5.4 Total or partial closure of some streets may be restricted to certain hours of the day by the OWNER. Streets having working hour limitations may be noted on the approved construction plans. In cases of emergency work or permit work, streets having working hour limitations will be designated by the ENGINEER. Waivers of the working hour limitations can be obtained from the ENGINEER.

1200.5.5 If construction on streets with working hour limitations is expected to extend past the allowed working hours, plating of the trench and/or temporary asphalt concrete pavement shall be provided so that the roadway is opened to traffic within the allowable work hours. Such excavations must be plated, temporarily patched or resurfaced prior to opening to traffic. A minimum width of 11 feet for each lane of traffic shall be provided, unless otherwise directed by the ENGINEER.

1200.5.6 When detouring low and moderate-volume traffic onto a previously unpaved area, see Table 1200.1 for surfacing requirements.

Table 1200.1

Time	Shoulder Residential	Shoulder (Other)	Local / Residential	Major Local	Collector	Arterial
Under one day	Compacted Subgrade	Compacted Subgrade	Compacted Subgrade	Compacted Subgrade	Gravel or millings	Gravel or millings
1-3 days	Compacted Subgrade	Gravel or millings	Gravel or millings	Gravel or millings	Treated Millings	2" Asphalt
4-7 days	Gravel or millings	2" Asphalt	Gravel or millings	Treated Millings	2" Asphalt	2" Asphalt
8-30 days	Treated Millings	2" Asphalt	Treated Millings	2" Asphalt	4" Asphalt	4" Asphalt

Table Notes:

The contractor shall be responsible to continually maintain all detours, providing a smooth, drained, and safe roadway surface. All compacted subgrade areas shall be graded regularly to provide a smooth driving surface, and must be treated regularly with water or other approved dust control palliative. During periods of dry and/or windy weather, a water truck must be on-site at all times, and frequent watering may be necessary.

Gravel, millings, or treated millings must be bladed and compacted to provide a stable, smooth driving surface prior to opening to traffic. Such surfacing shall be regularly maintained to provide a smooth and stable driving surface. All temporary asphalt pavement shall be placed upon a compacted subgrade which shall be graded to drain. Treated millings includes millings stabilized with an applied emulsive asphalt.

1200.6 MEASUREMENT AND PAYMENT

1200.6.1 Measurement and payment for barricading and temporary traffic control shall be per lump sum per project except for the items listed below. Payment of additional items will only be made if such traffic control device or services is either approved in the construction plan set or requested by the OWNER in writing. Payment shall include the cost of obtaining all permits and approvals; preparation of traffic control plans; working restricted or extended hours when required; notification to all affected residents, businesses, agencies, or other public contacts; setting and resetting barricades, maintaining barricades, daily removal of barricades when required, flagman operations when required, installation of temporary traffic signals when not required by the OWNER or in the construction plans; coordination with ENGINEER on traffic signal re-timing; hiring of off-duty Police Department Officers; and any and all other costs associated with temporary traffic control except the following:

1200.6.1.1 Measurement and payment of the installation of temporary striping shall be made per lineal foot of striping installed per four inch wide.

1200.6.1.2 Measurement and payment of business access and special signs shall be made on a per square foot basis project duration.

1200.6.1.3 Measurement and payment of Variable Message Boards shall be made per each on a per day (24-hour period) basis.

1200.6.1.4 Measurement and payment of illuminated arrow boards required by the OWNER, or required in the construction plans, shall be made per each on a per day (24-hour) basis.

1200.6.1.5 Measurement and payment of temporary wall barrier shall be made per lineal foot of wall barrier installed and removed at each location per project.

1200.6.1.6 Measurement and payment for temporary traffic signals required by the OWNER, or required in the construction plans, shall be made per each per project duration at each location.