

DEPARTMENT OF THE ARMY  
Omaha District, Corps of Engineers  
106 South 15th Street  
Omaha, Nebraska 68102-1618

:NOTICE: Failure to acknowledge : Solicitation No. DACA45 03 R 0003  
:all amendments may cause rejec- :  
:tion of the offer. See FAR : Date of Issue: 7 NOV 2003  
:52.215-1 of Section 00100 : Date of Receiving Proposals:  
23 DEC 2003

Amendment No. 0003  
16 December 2003

SUBJECT: Amendment No. 0003 to specification and drawings for Construction of  
**UPGRADE BASE INFRASTRUCTURE PHASE III, CRWU 05-3003, BUCKELY AFB,  
COLORADO.**

Solicitation No. DACA45 03 R 0003.

TO: Prospective Offerors and Others Concerned

1. The specifications and drawings for subject project are hereby modified as follows (revise all specification indices, attachment lists, and drawing indices accordingly).

a. Specifications. (Descriptive Changes.)

No descriptive changes.

b. Specifications (New and/or Revised and Reissued). Delete and substitute or add specification pages as noted below. The substituted pages are revised and reissued with this amendment. For convenience, on the revised specification pages, changes have been identified by underlining of added text and strikeout of deleted text.

Pages Deleted

Section 02560, Pages 1 thru 14

Pages Substituted or Added

Section 02560, Pages 1 thru 19

c. Drawings (Not Reissued). The following sheets of drawing code AF 870-90-01 are revised as indicated below with latest revision date of 16 December 2003. These drawings are not reissued with this amendment.

(1) Sheet U1.00, add the following general note:

"GENERAL NOTES:

1. ALL SANITARY SEWER MANHOLES SHALL BE 6 INCHES ABOVE THE EXISTING OR NEW GRADING ELEVATION."

(2) Sheet U4.01.

(a) PUMPHOUSE WATER AND OIL PIPING FLOOR PLAN, drawing coordinate D-5, delete note reading "PROVIDE CHECK VALVE AND ISOLATION GATE VALVES AS SHOWN" and substitute:

"PROVIDE NEW 12-INCH CHECK VALVE AND ISOLATION GATE VALVES AS SHOWN."

(b) Above title block, add the following note:

"NEW CONSTRUCTION NOTES:

ALL WORK SHOWN ON THIS SHEET IS EXISTING EXCEPT FOR THE NEW CHECK VALVE AND ISOLATION VALVES INDICATED."

d. Drawings (Reissued). The following sheets of drawing code AF 870-90-01 are revised with latest revision date of 16 December 2003, and reissued with this amendment. Reissued drawings are available at:

<http://ebs-nwo.wes.army.mil>

(1) Sheets U.1.01, U1.02, U1.03, U1.04, U1.05, U1.06, U1.07 and U1.08.

e. Drawings (New). The following new sheet of drawing code AF 870-90-01 dated 16 December 2003 is hereby added to the contract drawings and is issued with this amendment. New drawing is available at:

<http://ebs-nwo.wes.army.mil>

(1) Sheet C9.01.

2. This amendment is a part of the proposing papers and its receipt shall be acknowledged on the Standard Form 1442. All other conditions and requirements of the specifications remain unchanged. If the proposals have been mailed prior to receiving this amendment, you will notify the office where proposals are received, in the specified manner, immediately of its receipt and of any changes in your proposal occasioned thereby.

a. Hand-Carried Proposals shall be delivered to the U.S. Army Corps of Engineers, Omaha District, Contracting Division (Room 301), 106 South 15th Street, Omaha, Nebraska 68102-1618.

b. Mailed Proposals shall be addressed as noted in Item 8 on Page 00010-1 of Standard Form 1442.

3. Offers will be received until 2:00 p.m., local time at place of receiving proposals, 23 DEC 2003.

Attachments:

Spec Pages listed in 1.b. above  
Dwgs. listed in 1.c. and 1.d. above

U.S. Army Engineer District, Omaha  
Corps of Engineers  
106 South 15th Street  
Omaha, Nebraska 68102-1618

16 December 2003  
DRL/4547

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## SECTION 02560

PAVEMENTS  
05/02

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

STATE DEPARTMENT OF HIGHWAYS, DIVISION OF HIGHWAYS, STATE OF COLORADO (CDOT)

CDOT Standard Specifications for Road and Bridge Construction, 1999 Edition

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180 (1997) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457 mm (18-in) Drop

AASHTO TP53 (1998; Interim 1999) Determining Asphalt Content of Hot Mix Asphalt by the Ignition Method

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185 (2001) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

ASTM C 31/C 31M (2000e1) Making and Curing Concrete Test Specimens in the Field

ASTM C 39/C 39M (2001) Compressive Strength of Cylindrical Concrete Specimens

ASTM C 88 (1999a) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

ASTM C 136 (2001) Sieve Analysis of Fine and Coarse Aggregates

ASTM C 143/C 143M (2000) Slump of Hydraulic Cement Concrete

ASTM C 192/C 192M (2000) Making and Curing Concrete Test Specimens in the Laboratory

ASTM C 231 (1997e1) Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C 566 (1997) Total Evaporable Moisture Content

## of Aggregate by Drying

ASTM C 881	(1999) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM D 946	(1982; R 1999) Penetration-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 1461	(1985; R 2001) Moisture or Volatile Distillates in Bituminous Paving Mixtures
ASTM D 1557	(2000) Laboratory Compaction Characteristics of Soils Using Modified Effort (56,000 ft-lbf/ft (2,700 kN-m/m))
ASTM D 2041	(2000) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D 2172	(1995) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D 2726	(2000) Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixture
ASTM D 2950	(1991; R 1997) Density of Bituminous Concrete in Place by Nuclear Method
ASTM D 3666	(2001) Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D 4125	(1994) Asphalt Content of Bituminous Mixtures by the Nuclear Method
ASTM D 4867/D 4867M	(1996) Effect of Moisture on Asphalt Concrete Paving Mixtures
ASTM D 5444	(1998) Mechanical Size Analysis of Extracted Aggregate
ASTM D 5893	(1996) Cold Applied, Single Component Chemically Curing Silicon Joint Sealant for Portland Cement Concrete Pavement
ASTM D 6307	(1998) Asphalt Content of Hot Mix Asphalt by Ignition Method
ASTM D 6690	(2001) Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

## CORPS OF ENGINEERS (COE) HAND BOOK FOR CONCRETE AND CEMENT

CRD-C 525	(1989) Corps of Engineers Test Method for Evaluation of Hot-Applied Joint Sealants for Bubbling Due to Heating
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ASPHALT INSTITUTE (AI)

AI MS-2 (1994) Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types

1.2 MODIFICATION TO THE CDOT

Reference to "Engineer" and "Department" in the CDOT shall mean the Contracting Officer or Representative.

1.3 DEFINITIONS

For the purposes of this specification, the following definitions apply.

1.3.1 Degree of Compaction

Degree of compaction of aggregate base course, rigid pavement base course and aggregate surface course shall be expressed as a percentage of the maximum density obtained by the test procedure presented in either ASTM D 1557 or AASHTO T 180, Method D. The maximum density shall be determined in accordance with ASTM D 1557 if the material gradation contains less than 30 percent retained on the 3/4 inch sieve or AASHTO T 180 if the material gradation contains more than 30 percent retained on the 3/4 inch sieve. In this specification, degree of compaction shall be a percentage of laboratory maximum density.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Plant, Equipment, and Tools

Job Mix Formula; G-DO.

Proposed JMF.

Mixture Proportions; G-DO.

The report of the Contractor's mixture proportioning studies showing the proportions of all ingredients and supporting information on aggregate and other materials that will be used in the manufacture of concrete, at least 14 days prior to commencing concrete placing operations.

SD-06 Test Reports

Initial Tests; G-AO.

Certified copies of test results for approval not less than 20 days before material is required for the work.

Contractor Quality Control; G-AO.

The Contractor shall submit all QC test results to the Contracting Officer

on a daily basis as the tests are performed.

Acceptability of Work; G-AO.

The Contractor shall submit all test results to the Contracting Officer on a daily basis as the tests are performed.

SD-07 Certificates

Asphalt Cement Binder; G-AO.

Copies of certified test data.

Bituminous Tack and Prime Coat; G-AO.

Copies of certified test data.

SD-08 Manufacturer's Instructions

Manufacturer's Recommendations; G-AO

Where installation procedures, or any part thereof, are required to be in accordance with the manufacturer's recommendations, printed copies of these recommendations, 20 days prior to use on the project. Installation of the material will not be allowed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

#### 1.5 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by a testing laboratory approved in accordance with Section 01451A CONTRACTOR QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements; testing shall be performed at the specified frequency. The Contracting Officer may specify the time and location of the tests.

#### 1.6 APPROVAL OF MATERIAL

The source of the material for aggregate base course, rigid pavement base course, and aggregate surface course shall be selected 30 days prior to the time the material will be required in the work. Tentative approval of material will be based on initial test results. Final approval of the materials will be based on sieve analysis, liquid limit, and plasticity index tests performed on samples taken from the completed and fully compacted base course.

#### 1.7 WEATHER LIMITATIONS

##### 1.7.1 Hot-Mix Asphalt Pavement

The hot-mix asphalt pavement shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 1. The temperature requirements may be waived by the Contracting Officer, if requested; however, all other requirements, including compaction, shall be met.

Table 1. Surface Temperature Limitations of Underlying Course

Mat Thickness, inches	Degrees F
3 or greater	40
Less than 3	45

#### 1.7.2 Bituminous Prime and Tack Coat

Bituminous coat shall be applied only when the surface to receive the bituminous coat is dry. Bituminous coat shall be applied only when the atmospheric temperature in the shade is 50 degrees F or above and when the temperature has not been below 35 degrees F for the 12 hours prior to application.

#### 1.7.3 Portland Cement Concrete Pavement

Limitations on the placing of concrete shall conform to Section 412.09, "Limitations of Placing Concrete" of the CDOT.

#### 1.7.4 Base Course and Aggregate Surface Course

Construction of aggregate base course, rigid pavement base course, and aggregate surface course shall be done when the atmospheric temperature is above 35 degrees F. When the temperature falls below 35 degrees F, the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

### 1.8 PLANT, EQUIPMENT, AND TOOLS

All plant, equipment, and tools used in the performance of the work shall be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing pavements meeting the requirements as set forth herein.

## PART 2 PRODUCTS

### 2.1 HOT-MIX ASPHALT PAVEMENT

Bituminous wearing course shall conform to the requirements specified in the CDOT, Section 401, "PLANT MIX PAVEMENTS- GENERAL, and Section 403, "HOT BITUMINOUS PAVEMENT", except as modified herein. The aggregate grading shall be as indicated on the drawings. Coarse aggregate shall meet the following additional requirements: Percentage of loss shall not exceed 18 after 5 cycles when performed in accordance with ASTM C 88, using magnesium sulfate. The Contractor shall develop the mix design. The laboratory used to develop the job mix formula (JMF) shall meet the requirements of ASTM D 3666. A certification signed by the manager of the laboratory stating that it meets these requirements or clearly listing all deficiencies shall be submitted to the Contracting Officer prior to the start of construction. The asphalt mix shall be dense-graded and composed of a mixture of well-graded aggregate, mineral filler if required, and asphalt material. The hot-mix asphalt shall be designed using Marshall method of mix design contained in AI MS-2 and the criteria shown in Table 3. If the Tensile

Strength Ratio (TSR) of the composite mixture, as determined by ASTM D 4867/D 4867M is less than 75, the aggregates shall be rejected or the asphalt mixture treated with an approved anti-stripping agent. The amount of anti-stripping agent added shall be sufficient to produce a TSR of not less than 75. If an antistrip agent is required, it shall be provided by the Contractor at no additional cost. The hot-mix asphalt pavement shall not contain more than 15 percent reclaimed asphalt pavement.

#### 2.1.1.1 JMF Requirements

The job mix formula shall be submitted in writing by the Contractor for approval at least 14 days prior to the start of the test section and shall include as a minimum:

- a. Percent passing each sieve size.
- b. Percent of asphalt cement.
- c. Percent of each aggregate and mineral filler to be used.
- d. Asphalt viscosity grade or performance grade.
- e. Number of blows of hammer per side of molded specimen.
- f. Laboratory mixing temperature.
- g. Lab compaction temperature.
- h. Temperature-viscosity relationship of the asphalt cement.
- i. Plot of the combined gradation on the 0.45 power gradation chart, stating the nominal maximum size.
- j. Graphical plots of stability, flow, air voids, voids in the mineral aggregate, and unit weight versus asphalt content as shown in AI MS-2.
- k. Specific gravity and absorption of each aggregate.
- l. Percent natural sand.
- m. Percent particles with 2 or more fractured faces (in coarse aggregate).
- n. Fine aggregate angularity.
- o. Percent flat or elongated particles (in coarse aggregate).
- p. Tensile Strength Ratio(TSR).
- q. Antistrip agent (if required) and amount.
- r. List of all modifiers and amount.
- s. Percentage and properties (asphalt content, binder properties, and aggregate properties) of reclaimed asphalt pavement (RAP) if RAP is used.

Table 2. Marshall Design Criteria

<u>Test Property</u>	<u>50 Blow Mix</u>
Stability, pounds minimum	*1000
Flow, 0.01 inch	8-18
Air voids, percent	3-5
Percent Voids in mineral aggregate VMA, (minimum)	
Grading S	13.0
Grading SX	14.0
TSR, minimum percent	75

\* This is a minimum requirement. The average during construction shall be significantly higher than this number to ensure compliance with the specifications.

\*\* Calculate VMA in accordance with AI MS-2, based on ASTM D 2726 bulk specific gravity for the aggregate.

#### 2.1.2 Adjustments to Field JMF

The Laboratory JMF for each mixture shall be in effect until a new formula is approved in writing by the Contracting Officer. Should a change in sources of any materials be made, a new laboratory jmf design shall be performed and a new JMF approved before the new material is used.

#### 2.1.3 Asphalt Cement Binder

Asphalt cement shall conform to the requirements specified in Section 702, "Bituminous Materials" of the CDOT. Asphalt cement binder shall be either viscosity grade AC-10 or Performance Grade (PG) 58-34 or ASTM D 946 penetration grade 85-100. Test data indicating grade certification shall be provided by the supplier at the time of delivery of each load to the mix plant. Copies of these certifications shall be submitted to the Contracting Officer. The supplier is defined as the last source of any modification to the binder.

#### 2.2 BITUMINOUS TACK AND PRIME COAT

Test data indicating grade certification shall be provided by the supplier. Copies of these certifications shall be submitted to the Contracting Officer.

##### 2.2.1 Bituminous Prime Coat

Bituminous prime coat shall conform to the requirements specified in Section 407, Prime Coat, Tack Coat, and Rejuvenating Agent", and Section 702, "BITUMINOUS MATERIALS", of the CDOT. Bituminous materials shall be liquid asphalt, designation MC-30, or MC-70 at the Contractor's option, except that only MC-30 shall be used on dense graded base courses if MC-70 does not adequately penetrate the base course material. In lieu of

cut-back asphalt, the Contractor may use cationic emulsified asphalt, designation CSS-1 or CSS-1h.

#### 2.2.2 Bituminous Tack Coat

Bituminous tack coat shall conform to the requirements specified in Section 407, "Prime Coat, Tack Coat, and Rejuvenating Agent" of the CDOT. Bituminous material shall be emulsified asphalt designation SS-1 or SS-1h, or cationic emulsified asphalt designation CSS-1 or CSS-1h.

### 2.3 PORTLAND CEMENT CONCRETE PAVEMENT

#### 2.3.1 Portland Cement Concrete

Portland cement concrete shall conform to the requirements specified in Section 412, "Portland Cement Concrete Pavement", and Section 601 "Structural Concrete" of the CDOT. Proportioning of the mix shall conform to the requirements of Class "P" concrete, except that the required 28-day field compressive strength shall be 5500 psi. The coarse aggregate shall have a maximum nominal size of 1-1/2 inches. The maximum allowable slump of the concrete shall be 3 inches for pavement constructed with fixed forms. For slipformed pavement, the maximum allowable slump shall be 1-1/4 inches. The water-cement ratio shall not exceed 0.45. The air content of the concrete by volume shall be maintained by the Contractor at 6.0 percent plus or minus 1.0 percent. The Contractor shall submit design mixture proportions, laboratory trial mix, aggregate data, and 28-day compressive strength test results in accordance with Section 601.05, "Proportioning" of the CDOT.

#### 2.3.2 Welded Steel Wire Fabric

Welded steel wire fabric shall conform to ASTM A 185.

#### 2.3.3 Dowels Bars and Tie Bars

Dowel bars and tie bars shall conform to Section 709.03 "Dowel Bars and Tie Bars" of the CDOT.

#### 2.3.4 Epoxy Resin

Epoxy resin materials for embedding dowels shall be two-component materials conforming to the requirements of ASTM C 881, Type IV, Grade 3. Class shall be appropriate for each application temperature to be encountered.

### 2.4 CURING MATERIALS

Curing materials for portland cement concrete pavement and sidewalk shall conform to Section 711.01 "Curing Materials" of the CDOT. Liquid membrane-forming compound shall be white pigmented type 2.

### 2.5 JOINT FILLER, BACKER ROD AND SEALANT

Preformed expansion joint filler and backer rod shall conform to Section 705.01, "Joint Fillers" of the CDOT. Cold-applied silicone joint sealant shall conform to ASTM D 5893. Cold-applied silicone sealant for sidewalks shall be gray or stone in color. Hot-applied joint sealant shall conform to ASTM D 6690, Type II and CRD-C 525.

## 2.6 AGGREGATE BASE COURSE (ABC)

Aggregate base course aggregate shall conform to the requirements specified in Section 304, "AGGREGATE BASE COURSE" and Section 703.03 "AGGREGATE FOR BASES", of the CDOT, except as modified herein. Aggregate base course shall be CDOT Class 4 except as otherwise specified herein. The portion retained on the No. 4 sieve shall be known as coarse aggregate; that portion passing the No. 4 sieve shall be known as fine aggregate. Aggregates shall be angular particles of uniform density. Coarse aggregate shall be crushed gravel, crushed stone, crushed recycled concrete, or crushed slag. Fine aggregate shall consist of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally combined with the coarse aggregate. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregates shall contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel shall be manufactured from gravel particles 50 percent of which, by weight, are retained on the maximum size sieve. The percentage of loss shall not exceed 18 after 5 cycles when performed in accordance with ASTM C 88, using magnesium sulfate. The portion of the material passing the No. 40 sieve shall have liquid limit not greater than 25 and a plasticity index not greater than 5. When tested for gradation, the percentage passing the No. 200 sieve shall not exceed 10 percent and the No. 635 sieve shall not exceed 3.0 percent.

## 2.7 RIGID PAVEMENT BASE COURSE

Rigid pavement base course aggregate shall conform to the requirements specified in Section 304, "AGGREGATE BASE COURSE" and Section 703.03 "AGGREGATE FOR BASES", of the CDOT, except as modified herein. Rigid pavement base course shall be CDOT Class 5 except as otherwise specified herein. The aggregate shall meet the following additional properties; the aggregate shall be a crushed quarry rock, crushed gravel, crushed screenings, sand or a combination thereof. The percentage of loss shall not exceed 18 after 5 cycles when performed in accordance with ASTM C 88, using magnesium sulfate. The portion of the material passing the No. 40 sieve shall have liquid limit not greater than 25 and a plasticity index not greater than 5. When tested for gradation, the percentage passing the No. 200 sieve shall be between 9 percent and 15 percent. The No. 635 sieve shall not exceed 6.0 percent.

## 2.8 AGGREGATE SURFACE COURSE

Crushed aggregate surface course aggregate shall conform to the requirements specified in Section 304, "AGGREGATE BASE COURSE" and Section 703.03 "AGGREGATE FOR BASES", of the CDOT, except as modified herein. Aggregates shall consist of crushed stone or slag, crushed or natural gravel, sand, or other sound, durable materials processed and blended or naturally combined. Aggregates shall be durable and sound, free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign material. The aggregate shall meet the gradation requirement for Class 7. The amount of flat and elongated particles shall not exceed 20 percent. A flat particle is one having a ratio of width to thickness

greater than 3; an elongated particle is one having a ratio of length to width greater than 3. The aggregate for the surface course shall contain a minimum 80 percent crushed material. The portion of the material passing the No. 40 sieve shall have a liquid limit not greater than 35 and a plasticity index of 4 to 9.

## 2.9 INITIAL TESTS

One of each of the following tests shall be performed on the proposed aggregate base course, rigid pavement base course and aggregate surface course material prior to commencing construction to demonstrate that the proposed material meets all specified requirements when furnished. If materials from more than one source are going to be utilized, this testing shall be completed for each source.

- a. Sieve Analysis including No. 635 size material.
- b. Liquid limit and plasticity index.
- c. Moisture-density relationship.
- d. Wear.
- e. Soundness.

## PART 3 EXECUTION

### 3.1 PAVEMENT REMOVAL

Where p.c. concrete and bituminous pavement is to be removed at the locations shown on the drawings, the pavement shall be sawed with a pre-approved concrete saw so as to leave a straight true edge. P.C. concrete pavement removal shall be accomplished by a full depth double sawcut. The initial sawcut shall be located in the pavement area to be removed and shall be 18 inches from the final sawcut. The pavement material and existing base course shall be removed in a manner that will not damage the adjacent in-place pavement to remain. The Contractor must demonstrate that his method of removal will not damage adjacent concrete pavement slabs. Any slab found by the Contracting Officer to be damaged by the Contractor's removal methods shall be fully removed and replaced at no cost to the Government. Pavement material from the removal area shall be disposed of outside the limits of Government controlled land at the Contractor's expense.

### 3.2 HOT-MIX ASPHALT PAVEMENT

Hot-mix asphalt pavement wearing course shall be constructed to the requirements specified in the CDOT, Section 401, "PLANT MIX PAVEMENTS-GENERAL" and Section 403, "HOT BITUMINOUS PAVEMENT", except as modified herein.

#### 3.2.1 Contractor Quality Control

A standard lot for all requirements will be equal to 8 hours of production.

##### 3.2.1.1 Asphalt Content

A minimum of two tests to determine asphalt content will be performed per lot by one of the following methods: the extraction method in accordance

with ASTM D 2172, Method A or B, the ignition method in accordance with the AASHTO TP53 or ASTM D 6307, or the nuclear method in accordance with ASTM D 4125, provided the nuclear gauge is calibrated for the specific mix being used. For the extraction method, the weight of ash, as described in ASTM D 2172, shall be determined as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction test performed thereafter, for the duration of plant production. The last weight of ash value obtained shall be used in the calculation of the asphalt content for the mixture.

#### 3.2.1.2 Gradation

Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of recovered aggregate in accordance with ASTM D 5444. When asphalt content is determined by the nuclear method, aggregate gradation shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix plants. For batch plants, aggregates shall be tested in accordance with ASTM C 136 using actual batch weights to determine the combined aggregate gradation of the mixture.

#### 3.2.1.3 Temperatures

Temperatures shall be checked at least four times per lot, at necessary locations, to determine the temperature at the dryer, the asphalt cement in the storage tank, the asphalt mixture at the plant, and the asphalt mixture at the job site.

#### 3.2.1.4 Aggregate Moisture

The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C 566.

#### 3.2.1.5 Moisture Content of Mixture

The moisture content of the mixture shall be determined at least once per lot in accordance with ASTM D 1461 or an approved alternate procedure.

#### 3.2.1.6 Laboratory Air Voids, Marshall Stability and Flow

Mixture samples shall be taken at least four times per lot and compacted into specimens, using 50 blows per side with the Marshall hammer. After compaction, the laboratory air voids of each specimen shall be determined, as well as the Marshall stability and flow.

#### 3.2.2 Acceptability of Work

The pavement will be accepted on the basis of tests made by the the Contractor or its suppliers, as specified herein. The Government may, at its discretion, make check tests to validate the results of the Contractor's testing.

##### 3.2.2.1 Sampling Pavements

Samples of the finished pavement, shall be obtained by the Contractor. The location of the samples shall be as directed and the cores shall be at least 4 inches in diameter. The samples shall be tested by the Contractor to determine conformance to density. Specimens shall be tested in accordance with the requirements of ASTM D 2726. Three samples shall be taken and tested for each 750 tons or less of bituminous mixture placed

each day. A minimum of one core shall be obtained from the longitudinal joint. The Contractor shall fill all cores holes with new material and shall meet the requirements as described herein.

#### 3.2.2.2 Laboratory Air Voids

Laboratory air voids will be calculated by determining the Marshall density of each laboratory compacted specimen using ASTM D 2726 and determining the theoretical maximum density of every other subplot sample using ASTM D 2041.

Laboratory air void calculations for each subplot will use the latest theoretical maximum density values obtained, either for that subplot or the previous subplot. The mean absolute deviation of the four laboratory air void contents (one from each subplot) from the JMF air void content will be evaluated. The mean absolute deviation shall be less than 1.00. All laboratory air void tests will be completed and reported within 24 hours after completion of construction of each lot.

#### 3.2.2.3 In-place Density

Density of the compacted mixture of the bituminous wearing course shall be between 97 and 100 percent (joint density 95 to 100 percent) of the maximum laboratory compacted density. The maximum laboratory compacted specimens shall be determined from the same mixture taken from the plant in accordance with ASTM D 2041. Densities of the in-place compacted mixture may be determined by the nuclear method in accordance with ASTM D 2950 for Contractor quality control purposes. In any event, the basis of acceptance for density shall be determined from the specific gravity method.

#### 3.2.2.4 Surface Smoothness

After the final rolling, but not later than 24 hours after placement, the surface of the pavement in each entire lot shall be tested by the Contractor in such a manner as to reveal all surface irregularities exceeding the tolerances specified below. If any pavement areas are ground, these areas shall be retested immediately after grinding. All testing shall be performed in the presence of the Contracting Officer. Detailed notes of the results of the testing shall be kept and a copy furnished to the Government immediately after each day's testing. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines. The transverse lines shall be 25 feet or less apart, as directed. The longitudinal lines shall be at the centerline of each paving lane for lines less than 20 feet and at the third points for lanes 20 feet or greater. Other areas having obvious deviations shall also be tested. Longitudinal testing lines shall be continuous across all joints. Where drawings show required deviations from a plane surface (crowns, drainage inlets, etc.), the surface shall be finished to meet the approval of the Contracting Officer. The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points. The finished surfaces of the pavements shall have no abrupt change of 3/16 inch or more, and all pavements shall be within the tolerances specified in Table 3 when checked with an approved 10 foot straightedge.

Table 3. Straightedge Surface Smoothness--Pavements

Pavement Category	Direction of Testing	Tolerance, inches
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All	Longitudinal	3/16
paved areas	Transverse	3/16

3.3 BITUMINOUS TACK AND PRIME COAT

Except as otherwise specified herein, application of bituminous tack and prime coat shall be in accordance with Section 407, PRIME COAT, TACK COAT, AND REJUVENATING AGENT" of the CDOT. Following application of the bituminous material and prior to the application of the pavement, the bituminous coat shall be allowed to cure and to obtain evaporation of any volatiles or moisture.

3.3.1 Bituminous Tack Coat

Contact surfaces of previously constructed pavement, curbs, manholes, and other structures shall be sprayed with a thin coat of bituminous tack coat. Rate of application shall be not less than 0.05 gallon nor more than 0.15 gallon per square yard.

3.3.2 Bituminous Prime Coat

A prime coat will be required if it will be at least seven days before a the surfacing (Asphalt cement hot mix concrete)layer is constructed on the underlying aggregate base course. The type of liquid asphalt and application rate will be as specified herein. The Contractor shall protect the underlying from any damage (water, traffic, etc.) until the surfacing is placed. If the Contractor places the surfacing within seven days, the choice of protection measures or actions to be taken is at the Contractor's option. Damage to the underlying material caused by lack of, or inadequate, protection shall be repaired (recompacted or replaced) by approved methods at no additional cost to the Government. If the Contractor options to use the prime coat, it shall be applied as soon as possible after consolidation of the underlying material. Rate of application shall be not less than 0.15 gallon nor more than 0.40 gallon per square yard. To obtain uniform application of the prime coat on the surface treated at the junction of previous and subsequent applications, building paper shall be spread on the surface for a sufficient distance back from the ends of each application to start and stop the prime coat on the paper. Immediately after application, the building paper shall be removed and destroyed. Prime coat shall be allowed to cure without being disturbed for a period of at least 48 hours or longer, as may be necessary to attain penetration into the treated course.

3.4 PORTLAND CEMENT CONCRETE PAVEMENT

Except as otherwise specified herein, portland cement concrete shall be constructed in accordance with the requirements specified in Section 412, "PORTLAND CEMENT CONCRETE PAVEMENT", and Section 601, "STRUCTURAL CONCRETE" of the CDOT. Tining and stationing of concrete is not required.

3.4.1 Spreading

Spreading shall be by machine or hand method. Hand spreading will be permitted only when approved for odd widths or shapes of slabs, or for

placement of separate, isolated slabs during removal and replacement type repair operations, or for lanes 50 feet or less in length. Hand spreading, where permitted, shall be done with shovels; rakes shall not be used. Where the concrete is delivered to the form in truck mixers, suitable chutes may be used, provided windrows cover essentially the entire area within the form. In no case shall dumping of concrete in piles be permitted.

#### 3.4.2 Placing Reinforcing Steel

Reinforcement shall be positioned on suitable chairs securely fastened to the subgrade prior to concrete placement, or may be placed on an initial layer of consolidated concrete, with the subsequent layer placed within 30 minutes of the first layer placement.

#### 3.4.3 Joints

Transverse and longitudinal contraction joints shall be of the weakened plane type and shall be formed by sawing. Joints shall be sealed with hot-applied or cold-applied sealant immediately following curing of the concrete or as soon thereafter as weather conditions permit. Before sealing operations commence, a copy of the Manufacturer's Recommendations pertaining to the storage, heating and application of the sealant shall be submitted to the Contracting Officer.

#### 3.4.4 Contractor Quality Control

The Contractor shall perform the inspection and tests described below at the placement and, based upon the results of these inspections and tests, shall take the action required and submit reports as specified. When, in the opinion of the Contracting Officer, the paving operation is out of control, concrete placement shall cease. The Contractor shall furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory.

##### 3.4.4.1 Air Content Testing

Air content tests shall be made when test specimens are fabricated. In addition, at least two other tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of paving. All air content measurements shall be determined in accordance with ASTM C 231. Whenever air content reaches specified limits, an immediate confirmatory test shall be made. If the second test also shows air content at or exceeding specified limits, an adjustment shall immediately be made in the amount of air-entraining admixture batched to bring air content within specified limits. If the next adjusted batch of concrete is not within specified limits, concrete placement shall be halted until concrete air content is within specified limits.

##### 3.4.4.2 Slump Testing

Slump tests shall be made when test specimens are fabricated. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. All slump tests shall be made in accordance with ASTM C 143/C 143M. Whenever slump approaches the maximum limit, an adjustment shall immediately be made in the batch masses of water and fine aggregate. When a slump result exceeds the specification limit, no further concrete shall be delivered to the paving site until

adjustments have been made and slump is again within the limit.

#### 3.4.4.3 Temperature

The temperature of the concrete shall be measured when strength specimens are fabricated.

#### 3.4.4.4 Concrete Strength Testing

Four (4) cylinders from the same batch shall be fabricated, cured and tested for compressive strength, testing two cylinders at 7-day and two cylinders at 28-day age. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. A minimum of one set of four (4) cylinders shall be fabricated, cured and tested for each shift of concrete placement nor less than once for each 250 cubic yards of concrete or fraction thereof. All test cylinders shall be 6 by 12 inch cylinders and shall be fabricated in accordance with ASTM C 192/C 192M, using only steel molds, cured in accordance with ASTM C 31/C 31M, and tested in accordance with ASTM C 39/C 39M. Control charts for strength, showing the 7-day and 28-day CQC compressive strengths, and the 28-day required compressive strength, shall be maintained and submitted with weekly CQC Reports.

#### 3.4.5 Acceptability of Work

The pavement will be accepted on the basis of tests made by the Contractor or its suppliers, as specified herein. The Government may, at its discretion, make check tests to validate the results of the Contractor's testing.

##### 3.4.5.1 Strength Requirements

A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. The strength of the concrete will be considered satisfactory so long as the running average of all sets of three consecutive test results equals or exceeds the specified 28-day field compressive strength and no individual test result falls below the specified strength by more than 500 psi. The Contractor shall furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory.

##### 3.4.5.2 Surface Smoothness Requirements

The surface of the pavement shall be tested with a 3 m (10 foot) straightedge to identify all surface irregularities exceeding the tolerances specified above. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines approximately 15 feet apart. The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length and measuring the maximum gap between the straightedge and the pavement surface, in the area between these two high points. The finished surfaces of the pavements shall have no abrupt change of 1/8 inch or more. All pavements shall have a surface smoothness tolerance within 1/4 inch in the transverse and longitudinal direction, except that roads and streets shall have tolerance of 3/16 inch in the longitudinal direction. In areas not

meeting the specified limits for surface smoothness, high areas shall be reduced to attain the required smoothness, except as depth is limited below. High areas shall be reduced by grinding the hardened concrete with a surface grinding machine after the concrete is 14 days or more old. The depth of grinding shall not exceed 1/4 inch. All pavement areas requiring surface smoothness corrections in excess of the specified limits, shall be removed and replaced. All areas in which grinding has been performed will be subject to the thickness tolerances specified in paragraph Thickness. Any grinding performed on individual slabs with excessive deficiencies shall be performed at the Contractor's own decision without entitlement to additional compensation if eventual removal of the slab is required.

#### 3.4.5.3 Edge Slump Testing and Conformance

When slip-form paving is used, not more than 15 percent of the total free edge of any 10 inch or thicker slab of the slipformed portion of the pavement, shall have an edge slump exceeding 1/4 inch and no slab shall have an edge slump exceeding 3/8 inch. Edge slump shall be determined as above for surface smoothness, at each free edge of each slipformed paving lane constructed. Measurements shall be made at 5 to 15 foot spacings, and as directed. When edge slump exceeding the limits specified above is encountered on either side of the paving lane, additional straightedge measurements shall be made, if required, to define the linear limits of the excessive slump. The concrete for the entire width of the paving lane within these limits of excessive edge slump shall be removed and replaced. Adding concrete or paste to the edge or otherwise manipulating the plastic concrete after the sliding form has passed, or patching the hardened concrete, shall not be used as a method for correcting excessive edge slump.

#### 3.4.5.4 Thickness Determination

The thickness of the pavement shall be determined by the Government on the basis of measurements made on 4 inch diameter cores which shall be drilled by the Contractor, within 7 days after placement of the concrete. Cores shall be drilled at the points directed by the Contracting Officer and there shall be at least one core taken from each separate pavement areas of 4000 sq yd or less. The Contractor shall fill the core holes with an approved non-shrink high strength grout. For pavements less than 8 inches in thickness, when any core shows a deficiency in thickness greater than 1/4 inch, the pavement area represented by the core shall be removed and replaced by the Contractor at no cost to the Government. For pavements greater than 8 inches in thickness, when any core shows a deficiency in thickness greater than 1/2 inch, the pavement area represented by the core shall be removed and replaced by the Contractor at no cost to the Government.

### 3.5 AGGREGATE COURSES

Aggregate base course, rigid pavement base course, and aggregate surface course shall conform to, and be constructed in accordance with, the requirements specified in Section 304, "AGGREGATE BASE COURSE" and Section 703.03, "AGGREGATE FOR BASES" of the CDOT, except as modified herein. The aggregate base course, rigid pavement base course, and aggregate surface course shall be compacted to 100 percent of laboratory maximum density.

#### 3.5.1 Acceptability of Work

The aggregate base course, rigid pavement base course, and aggregate surface course will be accepted on the basis of tests made by the

Contractor as specified herein. The Government may, at its discretion, make check tests to validate the results of the Contractor's testing.

#### 3.5.1.1 In-Place Tests

One of each of the following tests shall be performed on samples taken from the placed and compacted aggregate course. Samples shall be taken and tested at the rates indicated for each layer of material placed.

a. Density tests shall be performed on every lift of material placed and at a frequency of one set of tests for every 250 square yards, or portion thereof, of completed area.

b. Sieve Analysis including No. 635 size material shall be performed on every lift of material placed and at a frequency of one test for every 1000 square meters, or portion thereof, of completed area for every 500 tons, or portion thereof, of material placed.

c. Liquid limit and plasticity index tests shall be performed at the same frequency as the sieve analysis.

#### 3.5.1.2 Thickness

The total compacted thickness of the aggregate course shall be within 1/2 inch of the thickness indicated. Where the measured thickness is more than 1/2 inch deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2 inch thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 1/4 inch of the thickness indicated. The total thickness of the aggregate course shall be measured at intervals in such a manner as to ensure one measurement for each 500 square yards of aggregate course. Measurements shall be made in 3 inch diameter test holes penetrating the aggregate course.

#### 3.5.1.3 Smoothness

The surface of the top layer shall show no deviations in excess of 3/8 inch when tested with a 10 foot straightedge applied parallel with and at right angles to the centerline of the area to be paved. Measurements shall be taken in successive positions parallel to the centerline of the area to be paved. Measurements shall also be taken perpendicular to the centerline at 50 foot intervals. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

-- End of Section --