LEE C. FINE MEMORIAL AIRPORT
CITY OF OSAGE BEACH, MISSOURI

ADDENDUM NO. 2

for

State Project No. 17-046B-1

RECONSTRUCTION OF TAXIWAY A (NEW TAXIWAY A AND A1) FROM TAXIWAY C TO RUNWAY 22 END

APRIL 24, 2018

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ADDENDUM NO. 2
RECONSTRUCTION OF TAXIWAY A (NEW TAXIWAY A AND A1) FROM TAXIWAY C TO RUNWAY 22 END

This addendum is herewith a part of the Contract Documents of the above issued project, and is issued to amend and supplement the April 9, 2018 construction plan drawings, proposal, contract documents, and specifications, and the April 9, 2018 Addendum No.1.

The **CONTRACT DOCUMENTS** are revised as follows:

SECTION 1 - NOTICE TO BIDDERS
REVISE: the first sentence to read:
"Sealed bids…will be received until **1:00 PM** Prevailing Central Time, **May 2, 2018**…"

REVISE: Contract Work Items, Base Bid:
"2. PCC Pavement Removal, 10-Inch Depth 75 SY" to read "…**96** SY"
"4. Butt Joint Construction 415 SY" to read "…**502** SY"
"16. Bituminous Surface Course 54 TON" to read "…**64** TON"
"36. Taxiway Edge Reflector 89 EA" to read "…**105** EA"
"37. Remove Taxiway Edge Reflector 66 EA" to read "…**82** EA"

CLARIFICATION: Quantities for PCC Pavement Removal, Butt Joint Construction, and Bituminous Surface Course were increased to more accurately reflect the proposed work already shown in the bid plan sheets, which did not change in this Addendum. Quantities for Taxiway Edge Reflector and Remove Taxiway Edge Reflector were increased according to revisions made to the associated plan sheets under this addendum.

SECTION 2 – INSTRUCTIONS TO BIDDERS
REVISE: Item 5, fourth paragraph, fifth line to read:
"To be opened at: **1:00 PM on May 2, 2018**"

SECTION 3 - GENERAL PROVISIONS
REVISE: Part of Table in Section 80-08 Failure to Complete on Time (page 42) to read:

Phase 1B (Work Area 1B)	**$750/DAY + $250/HOUR beyond the work period**	**8 Calendar Days (2 96-consecutive hour work periods beginning on Monday at 12:00 PM to Friday at 12:00 PM**

PROPOSAL FORMS – ACKNOWLEDGEMENT BY BIDDER
REVISE: Last sentence in Paragraph h. (page 551) to read:
"…beyond the **eight (8)** calendar day **(2 96-consecutive hour** work period) limit…"

PROPOSAL FORMS – CONTRACT AGREEMENT
REVISE: Article 6 – Liquidated Damages (page 569) to read:
"…beyond the **eight (8)** calendar day (**2 96-consecutive hour** work periods) limit, the **Phase 1C** work remains incomplete beyond the ten (10) calendar day limit…"

PROPOSAL FORMS – PROPOSAL FORM
REPLACE: The existing proposal form with the new proposal form attached to this addendum.
CLARIFICATION: Quantities for base bid items were revised as noted in the "Notice to Bidders" section of this Addendum.

ITEM P-157 LIME KILN DUST TREATED SUBGRADE
REVISE: Section 157-3.1 Kiln dust.
Delete "until a Plasticity Index of less than 10 is reached" and replace with "until a Plasticity Index of less than **20** is reached".

CLARIFICATION: Section revised to allow a more achievable target PI in the field based on high plasticity soils in the field (PI > 60) and associated maximum reduction in PI levels using Lime Kiln Dust.

REVISE: Table in Section 157-3.3 Tolerances.
Delete target Lime Kiln Dust "15%" and replace with "**10%**"
CLARIFICATION: Target Lime Kiln Dust percentage revised to reflect a more accurate, potentially conservative amount of typical Lime Kiln dust required to add to a LKD-subgrade mix.

REVISE: Table in Section 157-3.3 Tolerances.
Delete target Plastic Index "<10" and replace with "**<20**""
CLARIFICATION: Target Plastic Index revised to allow a more achievable PI reduction in the field based on high plasticity soils in the field (PI >60) and associated maximum reduction in PI levels using Lime Kiln Dust.

REVISE: Section 157-7.2
Delete "an application rate of 15 percent" and replace with "an application rate of **10** percent"
CLARIFICATION: Target Lime Kiln Dust percentage revised to reflect a more accurate, potentially conservative amount of typical Lime Kiln dust required to add to a LKD-subgrade mix.

ITEM P-401 HOT MIX ASPHALT (HMA) PAVEMENTS
DELETE: Entire specification
ADD: Entire new P-401 specification, attached to this addendum
CLARIFICATION: Revisions made to allow for either Marshall or Gyratory Design Mix. Required mix gradation revised to meet a locally available airport mix.

ITEM P-501 PORTLAND CEMENT CONCRETE PAVEMENT
DELETE: Section 501-4.1 Control Strip

DELETE: from Section 501-4.2 d. Vibrators, second paragraph, sentence three reading:
"The required daily checks…malfunction or consolidation issues."

DELETE: from Section 501-4.4 Condition of Underlying Surface, last sentence reading:
"The use of chemicals to eliminate frost in the underlying surface shall not be permitted."

DELETE: from Section 501-4.11.h Sawing of Joints, Initial Saw Cut paragraph, all text after the first sentence reading:
"The initial saw cut shall not cause damage…and maintained for the remaining cure period."

ITEM P-620 RUNWAY AND TAXIWAY MARKING
REVISE: Section 620-2.2.a. Waterborne.
ADD: Sentence at end of paragraph "Algae and mold inhibitors shall be included in the paint".
CLARIFICATION: Materials section revised to require an algaecide paint additive due to presence of excessive algae on airport pavements in the area.

CONSTRUCTION SAFETY AND PHASING PLAN
REVISE: 2. PHASING; C. Work Area Restrictions; Phase 1 – Work Area 1B, first paragraph to read, "The Contractor shall limit his work to **two** 96-hour period**s**."

REVISE: 4. PROTECTION OF NAVIGATION AIDS (NAVAIDs); Table 4-1 footnote to read, "*Phase 1B utilizes **two (2)** extended 96-hour weekday closure**s** (12:00 PM Monday to 12:00 PM Friday)"

REVISE: APPENDIX A: CONSTRUCTION ACTIVITY PLAN SHEETS, CSPP NOTES AND DETAILS; Sheet 4 of 52 – CSPP Notes Sheet 1 of 2; 2. General Phasing; Restrictions; Phase 1 – Work Area 1B, first paragraph to read, "The Contractor shall limit his work to **two** 96-**consecutive** hour **work** period**s**."

REVISE: APPENDIX A: CONSTRUCTION ACTIVITY PLAN SHEETS, CSPP NOTES AND DETAILS; Sheet 7 of 52 – Construction Activity Plan Index; NAVAID FACILITY STATUS DURING CONSTRUCTION TABLE,

footnote to read, "*Phase 1B utilizes **two (2)** extended 96-hour weekday closure**s** (12:00 PM Monday to 12:00 PM Friday)."

CONSTRUCTION PLAN SHEETS

SHEET 2 of 52 – Index to Sheets/Summary of Quantities
Revise the following quantities:
"P-101-5.1 PCC Pavement Removal, 10-Inch Depth SY 75" to "…SY **96**"
"P-101-5.3 Butt Joint Construction SY 415" to "…SY **502**"
"P-401-8.1 Bituminous Surface Course TON 54" to "…TON **64**"
"L-125-5.1 Taxiway Edge Reflector EA 89" to "…EA **105**"
"L-125-5.2 Remove Taxiway Edge Reflector EA 66" to "…EA **82**"

CLARIFICATION: Quantities for PCC Pavement Removal, Butt Joint Construction, and Bituminous Surface Course were increased to more accurately reflect the proposed work already shown in the bid plan sheets, which did not change in this Addendum. Quantities for Taxiway Edge Reflector and Remove Taxiway Edge Reflector were increased according to revisions made to the associated plan sheets under this addendum.

SHEET 4 of 52 – CSPP Notes Sheet 1 of 2
REVISE: 2. General Phasing; Restrictions; Phase 1 – Work Area 1B, first paragraph to read, "The Contractor shall limit his work to **two** 96-**consecutive** hour **work** period**s**."

SHEET 7 of 52 – Construction Activity Plan Index
REVISE: NAVAID FACILITY STATUS DURING CONSTRUCTION TABLE, footnote to read, "*Phase 1B utilizes **two (2)** extended 96-hour weekday closure**s** (12:00 PM Monday to 12:00 PM Friday)."

SHEET 15 of 52 – Demolition Plan Sheet 1 of 3
DELETE: This sheet.
ADD: Attached sheet.
CLARIFICATION: Revised sheet shows additional locations of existing taxiway edge markers to be removed adjacent to Taxiway B.

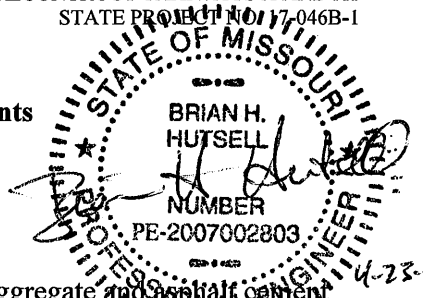
SHEET 16 of 52 – Demolition Plan Sheet 2 of 3
DELETE: This sheet.
ADD: Attached sheet.
CLARIFICATION: Revised sheet shows additional locations of existing taxiway edge markers to be removed adjacent to Taxiway C.

SHEET 34 of 52 – Marking and Electrical Plan Sheet 1 of 2
DELETE: This sheet.
ADD: Attached sheet.
CLARIFICATION: Revised sheet shows additional locations of new taxiway edge markers to be installed adjacent to Taxiway B and Taxiway C.

SHEET 39 of 52 – Electrical Details Sheet 3 of 3
REVISE: L-858 Airfield Sign Detail, Ground Rod Callout to read:
"**5/8"** x 8' Copper Clad Ground Rod"

ADD: to L-858 Airfield Sign Detail, Signage Notes:
"4. Airfield Signs Shall be Size 2, LED Style 2"

NEW TECHNICAL SPECIFICATIONS



Item P-401 Hot Mix Asphalt (HMA) Pavements

DESCRIPTION

401-1.1 This item shall consist of pavement courses composed of mineral aggregate and asphalt cement binder (asphalt binder) mixed in a central mixing plant and placed on a prepared course in accordance with these specifications and shall conform to the lines, grades, thicknesses, and typical cross-sections shown on the plans. Each course shall be constructed to the depth, typical section, and elevation required by the plans and shall be rolled, finished, and approved before the placement of the next course.

MATERIALS

401-2.1 Aggregate. Aggregates shall consist of crushed stone, crushed gravel, crushed slag, screenings, natural sand and mineral filler, as required. The aggregates should be free of ferrous sulfides, such as pyrite, that would cause "rust" staining that can bleed through pavement markings. The portion retained on the No. 4 (4.75 mm) sieve is coarse aggregate. The portion passing the No. 4 (4.75 mm) sieve and retained on the No. 200 (0.075 mm) sieve is fine aggregate, and the portion passing the No. 200 (0.075 mm) sieve is mineral filler.

a. Coarse aggregate. Coarse aggregate shall consist of sound, tough, durable particles, free from films of matter that would prevent thorough coating and bonding with the bituminous material and free from organic matter and other deleterious substances. The percentage of wear shall not be greater than 40% when tested in accordance with ASTM C131. The sodium sulfate soundness loss shall not exceed 12%, or the magnesium sulfate soundness loss shall not exceed 18%, after five cycles, when tested in accordance with ASTM C88. Clay lumps and friable particles shall not exceed 1.0% when tested in accordance with ASTM C142.

Aggregate shall contain at least 50 percent by weight of individual pieces having two or more fractured faces and 65 percent by weight having at least one fractured face. The area of each face shall be equal to at least 75% of the smallest midsectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces. Fractured faces shall be achieved by crushing.

The aggregate shall not contain more than a total of 8%, by weight, of flat particles, elongated particles, and flat and elongated particles, when tested in accordance with ASTM D4791 with a value of 5:1.

b. Fine aggregate. Fine aggregate shall consist of clean, sound, tough, durable, angular shaped particles produced by crushing stone, slag, or gravel that meets the requirements for wear and soundness specified for coarse aggregate. The aggregate particles shall be free from coatings of clay, silt, or other objectionable matter.

The fine aggregate, including any blended material for the fine aggregate, shall have a plasticity index of not more than six (6) and a liquid limit of not more than 25 when tested in accordance with ASTM D4318.

The soundness loss shall not exceed 10% when sodium sulfate is used or 15% when magnesium sulfate is used, after five cycles, when tested per ASTM C88.

Clay lumps and friable particles shall not exceed 1.0%, by weight, when tested in accordance with ASTM C142.

Natural (non-manufactured) sand may be used to obtain the gradation of the aggregate blend or to improve the workability of the mix. The amount of sand to be added will be adjusted to produce mixtures conforming to requirements of this specification. The fine aggregate shall not contain more than 15% natural sand by weight of total aggregates. If used, the natural sand shall meet the requirements of ASTM D1073 and shall have a plasticity index of not more than six (6) and a liquid limit of not more than 25 when tested in accordance with ASTM D4318.

The aggregate shall have sand equivalent values of 45 or greater when tested in accordance with ASTM D2419.

c. Sampling. ASTM D75 shall be used in sampling coarse and fine aggregate, and ASTM C183 shall be used in sampling mineral filler.

401-2.2 Mineral filler. If filler, in addition to that naturally present in the aggregate, is necessary, it shall meet the requirements of ASTM D242.

401-2.3 Asphalt cement binder. Asphalt cement binder shall conform to ASTM D6373 Performance Grade (PG) 64-22M for surface courses. A certificate of compliance from the manufacturer shall be included with the mix design submittal.

The supplier's certified test report with test data indicating grade certification for the asphalt binder shall be provided to the Engineer for each load at the time of delivery to the mix plant. A certified test report with test data indicating grade certification for the asphalt binder shall also be provided to the Engineer for any modification of the asphalt binder after delivery to the mix plant and before use in the HMA.

401-2.4 Preliminary material acceptance. Prior to delivery of materials to the job site, the Contractor shall submit certified test reports to the Engineer for the following materials:

a. Coarse aggregate:

(1) Percent of wear
(2) Soundness
(3) Clay lumps and friable particles
(4) Percent fractured faces
(5) Flat and elongated particles

b. Fine aggregate:

(1) Liquid limit and Plasticity index
(2) Soundness
(3) Clay lumps and friable particles
(4) Percent natural sand
(5) Sand equivalent

c. Mineral filler.

d. Asphalt binder. Test results for asphalt binder shall include temperature/viscosity charts for mixing and compaction temperatures.

The certifications shall show the appropriate ASTM tests for each material, the test results, and a statement that the material meets the specification requirement.

The Engineer may request samples for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

401-2.5 Anti-stripping agent. Any anti-stripping agent or additive if required shall be heat stable, shall not change the asphalt cement viscosity beyond specifications, shall contain no harmful ingredients, shall be added in recommended proportion by approved method, and shall be a material approved by the Missouri Department of Transportation.

COMPOSITION

401-3.1 Composition of mixture. The HMA mix shall be composed of a mixture of well-graded aggregate, filler and anti-strip agent if required, and asphalt binder. The several aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF).

401-3.2 Job mix formula (JMF). No hot-mixed asphalt (HMA) for payment shall be produced until a JMF has been approved in writing by the Engineer. The asphalt mix-design and JMF shall be prepared by an accredited laboratory that meets the requirements of paragraph 401-3.4.

For the Marshall Method, the HMA shall be designed using procedures contained in

Asphalt Institute MS-2 Mix Design Manual, 7th Edition. ASTM D6926 shall be used for preparation of specimens using the manually held and operated hammer for the mix design procedure. ASTM D6927 shall be used for testing for Marshall stability and flow.

If material variability exceeds the standard deviations indicated, the JMF and subsequent production targets shall be based on a stability greater than shown in Table 1 and the flow shall be targeted close to the mid-range of the criteria in order to meet the acceptance requirements.

The design criteria in Table 1 are target values necessary to meet the acceptance requirements contained in paragraph 401-5.2b. The criteria is based on a production process which has a material variability with the following standard deviations: Stability = 270 lbs (1200 N); Flow (0.01 inch (0.25 mm)) = 0.015 inches (.38 mm); Air Voids = 0.65%.

For the Gyratory Method, the HMA shall be designed using procedures contained in

Asphalt Institute MS-2 Mix Design Manual, 7th Edition. Samples shall be prepared at various asphalt contents and compacted using the gyratory compactor in accordance with ASTM D6925.

Tensile strength ratio (TSR) of the composite mixture, as determined by ASTM D4867, shall not be less than 75 when tested at a saturation of 70-80% or an anti-stripping agent shall be added to the HMA, as necessary, to produce a TSR of not less than 75 when tested at a saturation of 70-80%. If an anti-strip agent is required, it shall be provided by the Contractor at no additional cost to the Owner.

The JMF shall be submitted in writing by the Contractor at least 30 days prior to the start of paving operations. The JMF shall be developed within the same construction season using aggregates currently being produced.

The submitted JMF shall be stamped or sealed by the responsible professional Engineer of the laboratory and shall include the following items as a minimum:

a. Percent passing each sieve size for total combined gradation, individual gradation of all aggregate stockpiles and percent by weight of each stockpile used in the job mix formula.

b. Percent of asphalt cement.

c. Asphalt performance grade and type of modifier if used.

d. For Marshall Method, number of blows per side of molded specimen. For Gyratory Method, Number of gyrations.

e. Laboratory mixing temperature.

f. Laboratory compaction temperature.

g. Temperature-viscosity relationship of the PG asphalt cement binder showing acceptable range of mixing and compaction temperatures; and for modified binders include supplier recommended mixing and compaction temperatures.

h. Plot of the combined gradation on a 0.45 power gradation curve.

i. For Marshall Method, Graphical plots of stability, flow, air voids, voids in the mineral aggregate, and unit weight versus asphalt content.

For Gyratory Method, Graphical plot of air voids, voids in the mineral aggregate, and unit weight vs. asphalt content.

j. Specific Gravity and absorption of each aggregate.

k. Percent natural sand.

l. Percent fractured faces.

m. Percent by weight of flat particles**,** elongated particles, and flat and elongated particles (and criteria).

n. Tensile Strength Ratio (TSR).

o. Anti-strip agent (if required).

p. Date the JMF was developed. Mix designs that are not dated or which are from a prior construction season shall not be accepted.

The Contractor shall submit to the Engineer the results of verification testing of three (3) asphalt samples prepared at the optimum asphalt content. The average of the results of this testing shall indicate conformance with the JMF requirements specified in Tables 1 and 3.

When the project requires asphalt mixtures of differing aggregate gradations, a separate JMF and the results of JMF verification testing shall be submitted for each mix.

The JMF for each mixture shall be in effect until a modification is approved in writing by the Engineer. Should a change in sources of materials be made, a new JMF must be submitted within 15 days and approved by the Engineer in writing before the new material is used. After the initial production JMF has been approved by the Engineer and a new or modified JMF is required for whatever reason, the subsequent cost of the Engineer's approval of the new or modified JMF, including a new test strip when required by the engineer, will be borne by the Contractor. There will be no time extension given or considerations for extra costs associated with the stoppage of production paving or restart of production paving due to the time needed for the Engineer to approve the initial, new or modified JMF.

For Marshall Method,

The Marshall Design Criteria applicable to the project shall meet the criteria specified in Table 1.

Table 1. Marshall Design Criteria

Test Property	Value
Number of blows	75
Stability, pounds minimum	2150
Flow, 0.01 in.	10-16
Air voids (%)	3.5
Percent voids in mineral aggregate, minimum	See Table 2

For Gyratory Method,

The Gyratory Design Criteria applicable to the project shall meet the criteria specified in Table 1.

Table 1. Gyratory Compaction Criteria

Test Property	**Value**
Number of compactor gyrations	75
Air voids (%)	3.5
Percent voids in mineral aggregate, minimum	See Table 2

Table 2. Minimum Percent Voids In Mineral Aggregate (VMA)

Aggregate (See Table 3)	**Minimum VMA**
Gradation 3	16%
Gradation 2	15%
Gradation 1	14%

The mineral aggregate shall be of such size that the percentage composition by weight, as determined by laboratory sieves, will conform to the gradation or gradations specified in Table 3 when tested in accordance with ASTM C136 and ASTM C117.

The gradations in Table 3 represent the limits that shall determine the suitability of aggregate for use from the sources of supply; be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa.

Table 3. Aggregate - HMA Pavements

Gradation 1

Sieve Size	Percentage by Weight Passing Sieve
1 inch (25 mm)	100
3/4 inch (19 mm)	76-98
1/2 inch (12 mm)	66-86
3/8 inch (9 mm)	57-77
No. 4 (4.75 mm)	40-60
No. 8 (2.36 mm)	26-46
No. 16 (1.18 mm)	17-37
No. 30 (0.60 mm)	11-27
No. 50 (0.30 mm)	7-19
No. 100 (0.15 mm)	6-16
No. 200 (0.075 mm)	3-6
Asphalt Percent:	
Stone or gravel	4.5-7.0
Slag	5.0-7.5

The aggregate gradations shown are based on aggregates of uniform specific gravity. The percentages passing the various sieves shall be corrected when aggregates of varying specific gravities are used, as indicated in the Asphalt Institute MS-2 Mix Design Manual, 7th Edition.

401-3.3 Reclaimed asphalt pavement (RAP)

RAP shall not be used.

401-3.4 Job mix formula (JMF) laboratory. The Contractor's laboratory used to develop the JMF shall be accredited in accordance with ASTM D3666. The laboratory accreditation must be current and listed on the accrediting authority's website. All test methods required for developing the JMF must be listed on the lab accreditation. A copy of the laboratory's current accreditation and accredited test methods shall be submitted to the Engineer prior to start of construction.

401-3.5 Test section. Not Used.

CONSTRUCTION METHODS

401-4.1 Weather limitations. The HMA shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 4. The temperature requirements may be waived by the Engineer, if requested; however, all other requirements including compaction shall be met.

Table 4. Surface Temperature Limitations of Underlying Course

Mat Thickness	Base Temperature (Minimum)	
	°F	°C
3 inches or greater	40	4
Greater than 2 inches but less than 3 inches	45	7

401-4.2 HMA plant. Plants used for the preparation of HMA shall conform to the requirements of American Association of State Highway and Transportation Officials (AASHTO) M156 with the following changes:

Requirements for all plants include:

a. Truck scales. The HMA shall be weighed on approved scales furnished by the Contractor, or on certified public scales at the Contractor's expense. Scales shall be inspected and sealed as often as the Engineer deems necessary to assure their accuracy. Scales shall conform to the requirements of the General Provisions, subsection 90-01.

In lieu of scales, and as approved by the Engineer, HMA weight may be determined by the use of an electronic weighing system equipped with an automatic printer that weighs the total HMA production and as often thereafter as requested by the Engineer.

b. Testing facilities. The Contractor shall ensure laboratory facilities are provided at the plant for the use of the Engineer. The lab shall have sufficient space and equipment so that both testing representatives (Engineer's and Contractor's) can operate efficiently. The lab shall meet the requirements of ASTM D3666 including all necessary equipment, materials, calibrations, current reference standards to comply with the specifications and a masonry saw with diamond blade for trimming pavement cores and samples.

The plant testing laboratory shall have a floor space area of not less than 200 square feet, with a ceiling height of not less than 7-1/2 feet. The laboratory shall be weather tight, sufficiently heated in cold weather, air-conditioned in hot weather to maintain temperatures for testing purposes of 70°F ±5°F. The plant testing laboratory shall be located on the plant site to provide an unobstructed view, from one of its windows, of the trucks being loaded with the plant mix materials. In addition, the facility shall include the minimum:

(1) Adequate artificial lighting.

(2) Electrical outlets sufficient in number and capacity for operating the required testing equipment and drying samples.

(3) A minimum of two (2) Underwriter's Laboratories approved fire extinguishers of the appropriate types and class.

(4) Work benches for testing.

(5) Desk with chairs and file cabinet.

(6) Sanitary facilities convenient to testing laboratory.

(7) Exhaust fan to outside air.

(8) Sink with running water.

Failure to provide the specified facilities shall be sufficient cause for disapproving HMA plant operations.

Laboratory facilities shall be kept clean, and all equipment shall be maintained in proper working condition. The Engineer shall be permitted unrestricted access to inspect the Contractor's laboratory facility and witness quality control activities. The Engineer will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting the test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

c. Inspection of plant. The Engineer, or Engineer's authorized representative, shall have access, at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant: verifying weights, proportions, and material properties; and checking the temperatures maintained in the preparation of the mixtures.

d. Storage bins and surge bins. The HMA stored in storage and surge bins shall meet the same requirements as HMA loaded directly into trucks and may be permitted under the following conditions:

(1) Stored in non-insulated bins for a period of time not to exceed three (3) hours.

(2) Stored in insulated bins for a period of time not to exceed eight (8) hours.

If the Engineer determines that there is an excessive amount of heat loss, segregation, or oxidation of the HMA due to temporary storage, no temporary storage will be allowed.

401-4.3 Hauling equipment. Trucks used for hauling HMA shall have tight, clean, and smooth metal beds. To prevent the HMA from sticking to the truck beds, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other material approved by the Engineer. Petroleum products shall not be used for coating truck beds. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary, to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers shall be securely fastened.

401-4.3.1 Material transfer vehicle (MTV). Material transfer vehicles used to transfer the material from the hauling equipment to the paver, shall use a self-propelled, material transfer vehicle with a swing conveyor that can deliver material to the paver without making contact with the paver. The MTV shall be able to move back and forth between the hauling equipment and the paver providing material transfer to the paver, while allowing the paver to operate at a constant speed. The Material Transfer Vehicle will have remixing and storage capability to prevent physical and thermal segregation.

401-4.4 HMA pavers. HMA pavers shall be self-propelled with an activated heated screed, capable of spreading and finishing courses of HMA that will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the HMA uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

If, during construction, it is found that the spreading and finishing equipment in use leaves tracks or indented areas, or produces other blemishes in the pavement that are not satisfactorily corrected by the scheduled operations, the use of such equipment shall be discontinued and satisfactory equipment shall be provided by the Contractor.

401-4.4.1 Automatic grade controls. The HMA paver shall be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated from either a reference line and/or through a system of mechanical sensors or sensor-directed

mechanisms or devices that will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller shall be capable of maintaining the screed at the desired slope within ±0.1%.

The controls shall be capable of working in conjunction with any of the following attachments:

a. Ski-type device of not less than 30 feet (9 m) in length.

b. Taut string-line (wire) set to grade.

c. Short ski or shoe.

d. Laser control.

401-4.5 Rollers. Rollers of the vibratory, steel wheel, and pneumatic-tired type shall be used. They shall be in good condition, capable of operating at slow speeds to avoid displacement of the HMA. The number, type, and weight of rollers shall be sufficient to compact the HMA to the required density while it is still in a workable condition.

All rollers shall be specifically designed and suitable for compacting HMA concrete and shall be properly used. Rollers that impair the stability of any layer of a pavement structure or underlying soils shall not be used. Depressions in pavement surfaces caused by rollers shall be repaired by the Contractor at their own expense.

The use of equipment that causes crushing of the aggregate will not be permitted.

401-4.6. Density device. The Contractor shall have on site a density gauge during all paving operations in order to assist in the determination of the optimum rolling pattern, type of roller and frequencies, as well as to monitor the effect of the rolling operations during production paving. The Contractor shall also supply a qualified technician during all paving operations to calibrate the gauge and obtain accurate density readings for all new HMA. These densities shall be supplied to the Engineer upon request at any time during construction. No separate payment will be made for supplying the density gauge and technician.

401-4.7 Preparation of asphalt binder. The asphalt binder shall be heated in a manner that will avoid local overheating and provide a continuous supply of the asphalt binder to the mixer at a uniform temperature. The temperature of unmodified asphalt binder delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles, but shall not exceed 325°F when added to the aggregate. The temperature of modified asphalt binder shall be no more than 350°F when added to the aggregate.

401-4.8 Preparation of mineral aggregate. The aggregate for the HMA shall be heated and dried. The maximum temperature and rate of heating shall be such that no damage occurs to the aggregates. The temperature of the aggregate and mineral filler shall not exceed 350°F when the asphalt binder is added. Particular care shall be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

401-4.9 Preparation of HMA. The aggregates and the asphalt binder shall be weighed or metered and introduced into the mixer in the amount specified by the JMF. The combined materials shall be mixed until the aggregate obtains a uniform coating of asphalt binder and is thoroughly distributed throughout the mixture. Wet mixing time shall be the shortest time that will produce a satisfactory mixture, but not less than 25 seconds for batch plants. The wet mixing time for all plants shall be established by the Contractor, based on the procedure for determining the percentage of coated particles described in ASTM D2489, for each individual plant and for each type of aggregate used. The wet mixing time will be set to achieve 95% of coated particles. For continuous mix plants, the minimum mixing time shall be

determined by dividing the weight of its contents at operating level by the weight of the mixture delivered per second by the mixer. The moisture content of all HMA upon discharge shall not exceed 0.5%.

401-4.10 Preparation of the underlying surface. Immediately before placing the HMA, the underlying course shall be cleaned of all dust and debris. A prime coat and tack coat shall be applied in accordance with Item P-602 and P-603 **.**

401-4.11 Laydown plan, transporting, placing, and finishing. Prior to the placement of the HMA, the Contractor shall prepare a laydown plan for approval by the Engineer. This is to minimize the number of cold joints in the pavement. The laydown plan shall include the sequence of paving laydown by stations, width of lanes, temporary ramp locations, and laydown temperature. The laydown plan shall also include estimated time of completion for each portion of the work (that is, milling, paving, rolling, cooling, etc.). Modifications to the laydown plan shall be approved by the Engineer.

The HMA shall be transported from the mixing plant to the site in vehicles conforming to the requirements of paragraph 401-4.3. Deliveries shall be scheduled so that placing and compacting of HMA is uniform with minimum stopping and starting of the paver. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to atmospheric temperature.

The Contractor shall use a material transfer vehicle to deliver HMA to the paver.

The alignment and elevation of the paver shall be regulated from outside reference lines established for this purpose for the first lift of all runway and taxiway pavements. Successive lifts of HMA surface course may be placed using a ski, or laser control per paragraph 401-4.4.1, provided grades of the first lift of HMA surface course meet the tolerances of paragraphs 401-5.2b(6) as verified by a survey. Contractor shall survey each lift of HMA surface course and certify to Engineer that every lot of each lift meets the grade tolerances of paragraph 401-5.2b (6) before the next lift can be placed.

The initial placement and compaction of the HMA shall occur at a temperature suitable for obtaining density, surface smoothness, and other specified requirements but not less than 250°F.

Edges of existing HMA pavement abutting the new work shall be saw cut and carefully removed as shown on the drawings and coated with asphalt tack coat before new material is placed against it.

Upon arrival, the HMA shall be placed to the full width by a HMA paver. It shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the HMA mat. Unless otherwise permitted, placement of the HMA shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope. The HMA shall be placed in consecutive adjacent strips having a minimum width of 10 feet except where edge lanes require less width to complete the area. Additional screed sections shall not be attached to widen paver to meet the minimum lane width requirements specified above unless additional auger sections are added to match. The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 1 foot; however, the joint in the surface top course shall be at the centerline of crowned pavements. Transverse joints in one course shall be offset by at least 10 feet from transverse joints in the previous course.

Transverse joints in adjacent lanes shall be offset a minimum of 10 feet.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the HMA may be spread and luted by hand tools.

Areas of segregation in the surface course, as determined by the Engineer, shall be removed and replaced at the Contractor’s expense. The area shall be removed by saw cutting and milling a minimum of 2 inches

deep. The area to be removed and replaced shall be a minimum width of the paver and a minimum of 10 feet long.

401-4.12 Compaction of HMA. After placing, the HMA shall be thoroughly and uniformly compacted by power rollers. The surface shall be compacted as soon as possible when the HMA has attained sufficient stability so that the rolling does not cause undue displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once.

Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until the surface is of uniform texture, true to grade and cross-section, and the required field density is obtained. To prevent adhesion of the HMA to the roller, the wheels shall be equipped with a scraper and kept properly moistened but excessive water will not be permitted.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with approved power driven tampers. Tampers shall weigh not less than 275 pounds, have a tamping plate width not less than 15 inches, be rated at not less than 4,200 vibrations per minute, and be suitably equipped with a standard tamping plate wetting device.

Any HMA that becomes loose and broken, mixed with dirt, contains check-cracking, or in any way defective shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense. Skin patching shall not be allowed.

401-4.13 Joints. The formation of all joints shall be made in such a manner as to ensure a continuous bond between the courses and obtain the required density. All joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.

The roller shall not pass over the unprotected end of the freshly laid HMA except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing the adjacent lane. In both methods, all contact surfaces shall be coated with an asphalt tack coat before placing any fresh HMA against the joint.

Longitudinal joints which have been left exposed for more than four (4) hours; the surface temperature has cooled to less than 175°F; or are irregular, damaged, uncompacted or otherwise defective shall be cut back 3 inches to 6 inches to expose a clean, sound, uniform vertical surface for the full depth of the course. All cutback material shall be removed from the project. Asphalt tack coat or other product approved by the Engineer shall be applied to the clean, dry joint, prior to placing any additional fresh HMA against the joint. Any laitance produced from cutting joints shall be removed by vacuuming and washing. The cost of this work shall be considered incidental to the cost of the HMA.

401-4.14 Saw-cut grooving. If shown on the plans, saw cut grooves shall be provided as specified in Item P-621.

401-4.15 Diamond grinding. When required, diamond grinding shall be accomplished by sawing with saw blades impregnated with industrial diamond abrasive. The saw blades shall be assembled in a cutting head mounted on a machine designed specifically for diamond grinding that will produce the required texture and smoothness level without damage to the pavement. The saw blades shall be 1/8-inch wide and there shall be a minimum of 55 to 60 blades per 12 inches of cutting head width; the actual number of blades will be determined by the Contractor and depend on the hardness of the aggregate. Each machine shall be capable of cutting a path at least 3 feet wide. Equipment that causes ravels, aggregate fractures,

spalls or disturbance to the pavement will not be permitted. The depth of grinding shall not exceed 1/2 inch and all areas in which diamond grinding has been performed will be subject to the final pavement thickness tolerances specified. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. Areas that have been ground will be sealed with a P-608 surface treatment as directed by the Engineer. It may be necessary to seal a larger area to avoid surface treatment creating any conflict with runway or taxiway markings.

401-4.16 Nighttime paving requirements. Paving during nighttime construction shall require the following:

a. All paving machines, rollers, distribution trucks and other vehicles required by the Contractor for his operations shall be equipped with artificial illumination sufficient to safely complete the work.

b. Minimum illumination level shall be twenty (20) horizontal foot-candles and maintained in the following areas:

(1) An area of 30 feet wide by 30 feet long immediately behind the paving machines during the operations of the machines.

(2) An area 15 feet wide by 30 feet long immediately in front and back of all rolling equipment, during operation of the equipment.

(3) An area 15 feet wide by 15 feet long at any point where an area is being tack coated prior to the placement of pavement.

c. As partial fulfillment of the above requirements, the Contractor shall furnish and use, complete artificial lighting units with a minimum capacity of 3,000 watt electric beam lights, affixed to all equipment in such a way to direct illumination on the area under construction.

d. A lighting plan must be submitted by the Contractor and approved by the Engineer prior to the start of any nighttime work.

MATERIAL ACCEPTANCE

401-5.1 Acceptance sampling and testing. Unless otherwise specified, all acceptance sampling and testing necessary to determine conformance with the requirements specified in this section will be performed by the Engineer at no cost to the Contractor except that coring and profilograph testing as required in this section shall be completed and paid for by the Contractor.

Testing organizations performing these tests except profilograph shall be accredited in accordance with ASTM D3666. The laboratory accreditation must be current and listed on the accrediting authority's website. All test methods required for acceptance sampling and testing must be listed on the lab accreditation. A copy of the laboratory's current accreditation and accredited test methods shall be submitted to the Engineer prior to start of construction. All equipment in Contractor furnished laboratories shall be calibrated by an independent testing organization prior to the start of operations at the Contractor's expense.

a. Hot mixed asphalt. Plant-produced HMA shall be tested for air voids (and stability and flow if Marshall Method is selected) on a lot basis. Sampling shall be from material deposited into trucks at the plant or from trucks at the job site. Samples shall be taken in accordance with ASTM D979.

A standard lot shall be equal to one day's production or 2000 tons whichever is smaller. If the day's production is expected to exceed 2000 tons, but less than 4000 tons, the lot size shall be 1/2 day's production. If the day's production exceeds 4000 tons, the lot size shall be an equal sized fraction of the day's production, but shall not exceed 2000 tons.

Where more than one plant is simultaneously producing HMA for the job, the lot sizes shall apply separately for each plant.

(1) Sampling. Each lot will consist of four equal sublots. Sufficient HMA for preparation of test specimens for all testing will be sampled by the Engineer on a random basis, in accordance with the procedures contained in ASTM D3665. Samples will be taken in accordance with ASTM D979.

The sample of HMA may be put in a covered metal tin and placed in an oven for not less than 30 minutes nor more than 60 minutes to stabilize to compaction temperature. The compaction temperature of the specimens shall be as specified in the JMF.

(2) Testing.

For Marshall Method,

Sample specimens shall be tested for stability and flow in accordance with ASTM D6927. Air voids will be determined by the Engineer in accordance with ASTM D3203. One set of laboratory compacted specimens will be prepared for each sublot in accordance with ASTM D6926 at the number of blows required by paragraph 401-3.2, Table 1. Each set of laboratory compacted specimens will consist of three test specimens prepared from the same sample. The manual hammer in ASTM D6926 shall be used.

For Gyratory Method,

Air voids will be determined by the Engineer in accordance with ASTM D3203. One set of laboratory compacted specimens will be prepared for each sublot in accordance with ASTM D6925 at the number of gyrations required by paragraph 401-3.2, Table 1. Each set of laboratory compacted specimens will consist of three test specimens prepared from the same sample.

Prior to testing, the bulk specific gravity of each test specimen shall be measured by the Engineer in accordance with ASTM D2726 using the procedure for laboratory-prepared thoroughly dry specimens for use in computing air voids and pavement density.

For air voids determination, the theoretical maximum specific gravity of the mixture shall be measured one time for each sublot in accordance with ASTM D2041. The value used in the air voids computation for each sublot shall be based on theoretical maximum specific gravity measurement for the sublot.

The stability and flow for each sublot shall be computed by averaging the results of all test specimens representing that sublot.

(3) Acceptance. Acceptance of plant produced HMA for stability, flow, and air voids shall be determined by the Engineer in accordance with the requirements of paragraph 401-5.2b.

b. In-place HMA. HMA placed in the field shall be tested for mat and joint density on a lot basis. A standard lot shall be equal to one day's production or 2000 tons whichever is smaller. If the day's production is expected to exceed 2000 tons, but less than 4000 tons), the lot size shall be 1/2 day's production. If the day's production exceeds 4000 tons, the lot size shall be an equal sized fraction of the day's production, but shall not exceed 2000 tons.

(1) Mat density. The lot size shall be the same as that indicated in paragraph 401-5.1a and shall be divided into four equal sublots. One core of finished, compacted HMA shall be taken by the Contractor from each sublot. Core locations will be determined by the Engineer on a random basis in accordance with procedures contained in ASTM D3665. Cores for mat density shall not be taken closer than one foot from a transverse or longitudinal joint.

(2) Joint density. The lot size shall be the total length of longitudinal joints constructed by a lot of HMA as defined in paragraph 401-5.1a. The lot shall be divided into four equal sublots. One core of finished, compacted HMA shall be taken by the Contractor from each sublot. Core locations will be determined by the Engineer on a random basis in accordance with procedures contained in ASTM D3665. All cores for joint density shall be taken centered on the joint. The minimum core diameter for joint density determination shall be 5 inches.

(3) Sampling. Samples shall be neatly cut with a diamond core drill bit. Samples will be taken in accordance with ASTM D979. The minimum diameter of the sample shall be 5 inches (125 mm). Samples that are clearly defective, as a result of sampling, shall be discarded and another sample taken. The Contractor shall furnish all tools, labor, and materials for cutting samples, cleaning, and filling the cored pavement. Cored pavement shall be cleaned and core holes shall be filled in a manner acceptable to the Engineer and within one day after sampling. Laitance produced by the coring operation shall be removed immediately.

The top most lift of HMA shall be completely bonded to the underlying layer. If any of the cores reveal that the surface is not bonded to the layer immediately below the surface then additional cores shall be taken as directed by the Engineer in accordance with paragraph 401-5.1b to determine the extent of any delamination. All delaminated areas shall be completely removed by milling to the limits and depth and replaced as directed by the Engineer at no additional cost.

(4) Testing. The bulk specific gravity of each cored sample will be measured by the Engineer in accordance with ASTM D2726. Samples will be taken in accordance with ASTM D979. The percent compaction (density) of each sample will be determined by dividing the bulk specific gravity of each sublot sample by the average bulk specific gravity of all laboratory prepared specimens for the lot, as determined in paragraph 401-5.1a(2). The bulk specific gravity used to determine the joint density at joints formed between different lots shall be the lowest of the bulk specific gravity values from the two different lots.

(5) Acceptance. Acceptance of field placed HMA for mat density will be determined by the Engineer in accordance with the requirements of paragraph 401-5.2b(1). Acceptance for joint density will be determined by the Engineer in accordance with the requirements of paragraph 401-5.2b(3).

c. Partial lots. When operational conditions cause a lot to be terminated before the specified number of tests have been made for the lot, or when the Contractor and Engineer agree in writing to allow overages or other minor tonnage placements to be considered as partial lots, the following procedure will be used to adjust the lot size and the number of tests for the lot.

The last batch produced where production is halted will be sampled, and its properties shall be considered as representative of the particular sublot from which it was taken. In addition, an agreed to minor placement will be sampled, and its properties shall be considered as representative of the particular sublot from which it was taken. Where three sublots are produced, they shall constitute a lot. Where one or two sublots are produced, they shall be incorporated into the next lot, and the total number of sublots shall be used in the acceptance plan calculation, that is, n = 5 or n = 6, for example. Partial lots at the end of asphalt production on the project shall be included with the previous lot. The lot size for field placed material shall correspond to that of the plant material, except that, in no cases, shall less than three (3) cored samples be obtained, that is, n = 3.

401-5.2 Acceptance criteria.

a. General. Acceptance will be based on the following characteristics of the HMA and completed pavement as well as the implementation of the Contractor Quality Control Program and test results:

(1) Air voids

(2) Mat density

(3) Joint density

(4) Thickness

(5) Smoothness

(6) Grade

(7) Stability (for Marshall Method)

(8) Flow (for Marshall Method)

Mat density and air voids will be evaluated for acceptance in accordance with paragraph 401-5.2b(1). For the Marshall Method, stability and flow will be evaluated for acceptance in accordance with paragraph 401-5.2b(2). Joint density will be evaluated for acceptance in accordance with paragraph 401-5.2b(3).

Thickness will be evaluated by the Engineer for compliance in accordance with paragraph 401-5.2b(4). Acceptance for smoothness will be based on the criteria contained in paragraph 401-5.2b(5). Acceptance for grade will be based on the criteria contained in paragraph 401-5.2b(7).

The Engineer may at any time, reject and require the Contractor to dispose of any batch of HMA which is rendered unfit for use due to contamination, segregation, incomplete coating of aggregate, or improper mix temperature. Such rejection may be based on only visual inspection or temperature measurements. In the event of such rejection, the Contractor may take a representative sample of the rejected material in the presence of the Engineer, and if it can be demonstrated in the laboratory, in the presence of the Engineer, that such material was erroneously rejected, payment will be made for the material at the contract unit price.

b. Acceptance criteria.

(1) Mat density and air voids. Acceptance of each lot of plant produced material for mat density and air voids shall be based on the percentage of material within specification limits (PWL). If the PWL of the lot equals or exceeds 90%, the lot shall be acceptable. Acceptance and payment shall be determined in accordance with paragraph 401-8.1.

(2) Stability and flow. (for the Marshall Method only) Acceptance of each lot of plant produced HMA for stability and flow shall be based on the PWL. If the PWL of the lot equals or exceeds 90%, the lot shall be acceptable. If the PWL is less than 90%, the Contractor shall determine the reason and take corrective action. If the PWL is below 80%, the Contractor must stop production until the reason for poor stability and/or flow has been determined and adjustments to the HMA are made.

(3) Joint density. Acceptance of each lot of plant produced HMA for joint density shall be based on the PWL. If the PWL of the lot is equal to or exceeds 90%, the lot shall be considered acceptable. If the PWL is less than 90%, the Contractor shall evaluate the reason and act accordingly. If the PWL is less than 80%, the Contractor shall cease operations and until the reason for poor compaction has been determined. If the PWL is less than 71%, the pay factor for the lot used to complete the joint shall be reduced by five (5) percentage points. This lot pay factor reduction shall be incorporated and evaluated in accordance with paragraph 401-8.1.

(4) Thickness. Thickness of each lift of surface course shall be evaluated by the Engineer for compliance to the requirements shown on the plans. Measurements of thickness shall be made by the Engineer using the cores extracted for each sublot for density measurement. The maximum allowable deficiency at any point shall not be more than 1/4 inch less than the thickness indicated for the lift. Average thickness of lift, or combined lifts, shall not be less than the indicated thickness. Where the thickness tolerances are not met, the lot or sublot shall be corrected by the Contractor at his expense by removing the deficient area and replacing with new pavement. The Contractor, at his expense, may take additional cores as approved by the Engineer to circumscribe the deficient area.

(5) Smoothness. The final surface shall be free from roller marks. After the final rolling, but not later than 24 hours after placement, the surface of each lot shall be tested in both longitudinal and transverse directions for smoothness to reveal all surface irregularities exceeding the tolerances specified. The Contractor shall furnish paving equipment and employ methods that produce a surface for each pavement lot having an average profile index meeting the requirements of paragraph 401-8.1d when evaluated with a profilograph; and the finished surface course of the pavement shall not vary more than 1/4 inch when evaluated with a 12-foot straightedge. When the surface course smoothness exceeds specification tolerances which cannot be corrected by diamond grinding of the surface course, full depth removal and replacement of surface course corrections shall be to the limit of the longitudinal placement. Corrections involving diamond grinding will be subject to the final pavement thickness tolerances specified. The Contractor shall apply a surface treatment per Item P-608 or P-609 to all areas that have been subject to grinding as directed by the Engineer.

(a) Transverse measurements. Transverse measurements will be taken for each lot placed. Transverse measurements will be taken perpendicular to the pavement centerline each 50 feet or more often as determined by the Engineer.

(i) Testing shall be continuous across all joints, starting with one-half the length of the straightedge at the edge of pavement section being tested and then moved ahead one-half the length of the straightedge for each successive measurement. Smoothness readings will not be made across grade changes or cross slope transitions; at these transition areas, the straightedge position shall be adjusted to measure surface smoothness and not design grade or cross slope transitions. 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. High spots on final surface course > 1/4 inch in transverse direction shall be corrected with diamond grinding per paragraph 401-4.15 or by removing and replacing full depth of surface course. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The area corrected by grinding should not exceed 10% of the total area and these areas shall be retested after grinding.

(ii) The joint between lots shall be tested separately to facilitate smoothness between lots. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface, with half the straightedge on one side of the joint and the other half of the straightedge on the other side of the joint. Measure the maximum gap between the straightedge and the pavement surface in the area between these two high points. One measurement shall be taken at the joint every 50 feet or more often if directed by the Engineer. Deviations on final surface course > 1/4 inch in transverse direction shall be corrected with diamond grinding per paragraph 401-4.15 or by removing and replacing full depth of surface course. Each measurement shall be recorded and a copy of the data shall be furnished to the Engineer at the end of each days testing.

(b) Longitudinal measurements. Longitudinal measurements will be taken for each lot placed. Longitudinal tests will be parallel to the centerline of paving; at the center of paving lanes when widths of paving lanes are less than 20 feet; and at the third points of paving lanes when widths of paving lanes are 20 ft or greater.

(i) Longitudinal Short Sections. Longitudinal Short Sections are when the longitudinal lot length is less than 200 feet and areas not requiring a profilograph. When approved by the Engineer, the first and last 15 feet of the lot can also be considered as short sections for smoothness. The finished surface shall not vary more than 1/4 inch when evaluated with a 12-foot straightedge. Smoothness readings will not be made across grade changes or cross slope transitions; at these transition areas, the straightedge position shall be adjusted to measure surface smoothness and not design grade or cross slope

transitions. Testing shall be continuous across all joints, starting with one-half the length of the straightedge at the edge of pavement section being tested and then 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. Deviations on final surface course > 1/4 inch in longitudinal direction will be corrected with diamond grinding per paragraph 401-4.15 or by removing and replacing full depth of surface course. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The area corrected by grinding should not exceed 10% of the total area and these areas shall be retested after grinding.

(ii) Profilograph Testing. Profilograph testing shall be performed by the contractor using approved equipment and procedures as described as ASTM E1274. The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate “must grind” bumps and the Profile Index for the pavement using a 0.2 inch blanking band. The bump template must span one inch with an offset of 0.4 inches. The profilograph must be calibrated prior to use and operated by a factory or State DOT approved operator. Profilograms shall be recorded on a longitudinal scale of one inch equals 25 feet and a vertical scale of one inch equals one inch. A copy of the reduced tapes shall be furnished to the Engineer at the end of each days testing.

The pavement must have an average profile index meeting the requirements of paragraph 401-8.1d. High spots, or “must grind” spots, on final surface course in longitudinal direction shall be corrected with diamond grinding per paragraph 401-4.15 or by removing and replacing full depth of surface course. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The area corrected by grinding should not exceed 10% of the total area and these areas shall be retested after grinding.

Where corrections are necessary, second profilograph runs shall be performed to verify that the corrections produced an average profile index of 15 inches per mile or less. If the initial average profile index was less than 15 inches, only those areas representing greater than 0.4 inch deviation will be re-profiled for correction verification.

(iii) Final profilograph of runway. Final profilograph, full length of runway, shall be performed to facilitate testing of smoothness between lots. Profilograph testing shall be performed by the contractor using approved equipment and procedures as described as ASTM E1274.The pavement must have an average profile index meeting the requirements of paragraph 401-8.1d. The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate “must grind” bumps and the Profile Index for the pavement using a 0.2 inch blanking band. The bump template must span one inch with an offset of 0.4 inches. The profilograph must be calibrated prior to use and operated by a factory or State DOT approved, trained operator. Profilograms shall be recorded on a longitudinal scale of one inch equals 25 feet and a vertical scale of one inch equals one inch. A copy of the reduced tapes shall be furnished to the Engineer at the end of each days testing. Profilograph of final runway shall be performed one foot right and left of runway centerline and 15 feet right and left of centerline. Any areas that indicate “must grind” will be corrected as directed by the Engineer.

Smoothness testing indicated in the above paragraphs except paragraph (iii) shall be performed within 24 hours of placement of material. Smoothness testing indicated in paragraph (iii) shall be performed within 48 hours of paving completion. The primary purpose of smoothness testing is to identify areas that may be prone to ponding of water which could lead to hydroplaning of aircraft. If the contractor’s machines and/or methods are producing significant areas that need corrective actions then production should be stopped until corrective measures can be implemented. If corrective measures are not implemented and

when directed by the Engineer, production shall be stopped until corrective measures can be implemented.

(6) Grade. Grade shall be evaluated on the first day of placement and then as a minimum, at the completion of every lift to allow adjustments to paving operations if measurements do not meet specification requirements. The Contractor must submit the survey data to the Engineer by the following day after measurements have been taken. The finished surface of the pavement shall not vary from the gradeline elevations and cross-sections shown on the plans by more than 1/2 inch. The finished grade of each lot will be determined by running levels at intervals of 50 feet or less longitudinally and all breaks in grade transversely (not to exceed 50 feet) to determine the elevation of the completed pavement. The Contractor shall pay the cost of surveying of the level runs that shall be performed by a licensed surveyor. The documentation, stamped and signed by a licensed surveyor, shall be provided by the Contractor to the Engineer. The lot size shall be 2,000 square yards. When more than 15% of all the measurements within a lot are outside the specified tolerance, or if any one shot within the lot deviates 3/4 inch or more from planned grade, the Contractor shall remove the deficient area to the depth of the final course plus 1/2 inch of pavement and replace with new material. Skin patching shall not be permitted. Isolated high points may be ground off provided the course thickness complies with the thickness specified on the plans. The surface of the ground pavement shall have a texture consisting of grooves between 0.090 and 0.130 inches wide. The peaks and ridges shall be approximately 1/32 inch higher than the bottom of the grooves. The pavement shall be left in a clean condition. The removal of all of the slurry resulting from the grinding operation shall be continuous The grinding operation should be controlled so the residue from the operation does not flow across other lanes of pavement. High point grinding will be limited to 15 square yards. Areas in excess of 15 square yards will require removal and replacement of the pavement in accordance with the limitations noted above. The Contractor shall apply a surface treatment per P-608 to all areas that have been subject to grinding.

c. Percentage of material within specification limits (PWL). The PWL shall be determined in accordance with procedures specified in Section 110 of the General Provisions. The specification tolerance limits (L) for lower and (U) for upper are contained in Table 5.

For Marshall Method:

Table 5. Marshall acceptance limits for stability, flow, air voids, density

Test Property	Pavements Designed for Aircraft Gross Weights Less than60,000 lbs or Tire Pressures Less than100 psi	
Number of Blows	50 blows	
	Specification Tolerance	
	L	U
Stability, minimum (pounds)	1000	--
Flow, 0.01 inch	8	20*
Air Voids Total Mix (%)	2	5
Surface Course Mat Density (%)	96.3	101.3
Base Course Mat Density (%)	95.5	101.3
Joint Density (%)	93.3	--

* Upper flow limit requirements do not apply for any mix with a polymer-modified binder (where the difference between the upper and lower temperature number is 90°F or greater).

For Gyratory Method:

Table 5. Gyratory Acceptance Limits For Air Voids, Density

TEST PROPERTY	Specification Tolerance	
	L	U
Air Voids Total Mix (%)	2	5
Mat Density (%)	96.3	101.3
Joint Density (%)	93.3	-

d. Outliers. All individual tests for mat density and air voids shall be checked for outliers (test criterion) in accordance with ASTM E178, at a significance level of 5%. Outliers shall be discarded, and the PWL shall be determined using the remaining test values. The criteria in Table 5 is based on production processes which have a variability with the following standard deviations: Surface Course Mat Density (%), 1.30; Base Course Mat Density (%), 1.55; Joint Density (%), 2.1.

The Contractor should note that (1) 90 PWL is achieved when consistently producing a surface course with an average mat density of at least 98% with 1.30% or less variability, (2) 90 PWL is achieved when consistently producing a base course with an average mat density of at least 97.5% with 1.55% or less variability, and (3) 90 PWL is achieved when consistently producing joints with an average joint density of at least 96% with 2.1% or less variability.

401-5.3 Resampling pavement for mat density.

a. General. Resampling of a lot of pavement will only be allowed for mat density, and then, only if the Contractor requests same, in writing, within 48 hours after receiving the written test results from the Engineer. A retest will consist of all the sampling and testing procedures contained in paragraphs 401-5.1b and 401-5.2b(1). Only one resampling per lot will be permitted.

(1) A redefined PWL shall be calculated for the resampled lot. The number of tests used to calculate the redefined PWL shall include the initial tests made for that lot plus the retests.

(2) The cost for resampling and retesting shall be borne by the Contractor.

b. Payment for resampled lots. The redefined PWL for a resampled lot shall be used to calculate the payment for that lot in accordance with Table 6.

c. Outliers. Check for outliers in accordance with ASTM E178, at a significance level of 5%.

401-5.4 Leveling course. Not Used.

CONTRACTOR QUALITY CONTROL

401-6.1 General. The Contractor shall develop a Quality Control Program in accordance with Section 100 of the General Provisions. The program shall address all elements that affect the quality of the pavement including, but not limited to:

a. Mix design

b. Aggregate grading

c. Quality of materials

d. Stockpile management

e. Proportioning

f. Mixing and transportation

g. Placing and finishing

h. Joints

i. Compaction

j. Surface smoothness

k. Personnel

l. Laydown plan

The Contractor shall perform quality control sampling, testing, and inspection during all phases of the work and shall perform them at a rate sufficient to ensure that the work conforms to the contract requirements, and at minimum test frequencies required by paragraph 401-6.3 and Section 100 of the General Provisions. As a part of the process for approving the Contractor's plan, the Engineer may require the Contractor's technician to perform testing of samples to demonstrate an acceptable level of performance.

No partial payment will be made for materials that are subject to specific quality control requirements without an approved plan.

401-6.2 Contractor testing laboratory. The lab shall meet the requirements of ASTM D3666 including all necessary equipment, materials, and current reference standards to comply with the specifications.

401-6.3 Quality control testing. The Contractor shall perform all quality control tests necessary to control the production and construction processes applicable to these specifications and as set forth in the approved Quality Control Program. The testing program shall include, but not necessarily be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, field compaction, and surface smoothness. A Quality Control Testing Plan shall be developed as part of the Quality Control Program.

a. Asphalt content. A minimum of two asphalt content tests shall be performed per lot in accordance with ASTM D6307 or ASTM D2172 if the correction factor in ASTM D6307 is greater than 1.0. The asphalt content for the lot will be determined by averaging the test results.

b. Gradation. Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of extracted aggregate in accordance with ASTM D5444, ASTM C136, and ASTM C117.

c. Moisture content of aggregate. The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C566.

d. Moisture content of HMA. The moisture content shall be determined once per lot in accordance with ASTM D1461.

e. Temperatures. Temperatures shall be checked, at least four times per lot, at necessary locations to determine the temperatures of the dryer, the asphalt binder in the storage tank, the HMA at the plant, and the HMA at the job site.

f. In-place density monitoring. The Contractor shall conduct any necessary testing to ensure that the specified density is being achieved. A nuclear gauge may be used to monitor the pavement density in accordance with ASTM D2950.

g. Additional testing. Any additional testing that the Contractor deems necessary to control the process may be performed at the Contractor's option.

h. Monitoring. The Engineer reserves the right to monitor any or all of the above testing.

401-6.4 Sampling. When directed by the Engineer, the Contractor shall sample and test any material that appears inconsistent with similar material being sampled, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

401-6.5 Control charts. The Contractor shall maintain linear control charts both for individual measurements and range (that is, difference between highest and lowest measurements) for aggregate gradation, asphalt content, and VMA. The VMA for each sublot will be calculated and monitored by the Quality Control laboratory.

Control charts shall be posted in a location satisfactory to the Engineer and shall be kept current. As a minimum, the control charts shall identify the project number, the contract item number, the test number, each test parameter, the Action and Suspension Limits applicable to each test parameter, and the Contractor's test results. The Contractor shall use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the Contractor's projected data during production indicates a problem and the Contractor is not taking satisfactory corrective action, the Engineer may suspend production or acceptance of the material.

a. Individual measurements. Control charts for individual measurements shall be established to maintain process control within tolerance for aggregate gradation, asphalt content, and VMA. The control

charts shall use the job mix formula target values as indicators of central tendency for the following test parameters with associated Action and Suspension Limits:

Control Chart Limits For Individual Measurements		
Sieve	**Action Limit**	**Suspension Limit**
¾ inch (19 mm)	±6%	±9%
½ inch (12 mm)	±6%	±9%
3/8 inch (9 mm)	±6%	±9%
No. 4 (4.75 mm)	±6%	±9%
No. 16 (1.18 mm)	±5%	±7.5%
No. 50 (0.30 mm)	±3%	±4.5%
No. 200 (0.075 mm)	±2%	±3%
Asphalt Content	±0.45%	±0.70%
VMA	-1.00%	-1.50%

b. Range. Control charts for range shall be established to control process variability for the test parameters and Suspension Limits listed below. The range shall be computed for each lot as the difference between the two test results for each control parameter. The Suspension Limits specified below are based on a sample size of n = 2. Should the Contractor elect to perform more than two tests per lot, the Suspension Limits shall be adjusted by multiplying the Suspension Limit by 1.18 for n = 3 and by 1.27 for n = 4.

Control Chart Limits Based On Range (Based On n = 2)	
Sieve	**Suspension Limit**
1/2 inch (12 mm)	11%
3/8 inch (9 mm)	11%
No. 4 (4.75 mm)	11%
No. 16 (1.18 mm)	9%
No. 50 (0.30 mm)	6%
No. 200 (0.075 mm)	3.5%
Asphalt Content	0.8%

c. Corrective Action. The Contractor Quality Control Program shall indicate that appropriate action shall be taken when the process is believed to be out of tolerance. The Plan shall contain sets of rules to gauge when a process is out of control and detail what action will be taken to bring the process into control. As a minimum, a process shall be deemed out of control and production stopped and corrective action taken, if:

(1) One point falls outside the Suspension Limit line for individual measurements or range; or

(2) Two points in a row fall outside the Action Limit line for individual measurements.

401-6.6 Quality control reports. The Contractor shall maintain records and shall submit reports of quality control activities daily, in accordance with the Contractor Quality Control Program described in General Provisions, Section 100.

METHOD OF MEASUREMENT

401-7.1 Measurement. HMA shall be measured by the number of tons of HMA used in the accepted work. Recorded batch weights or truck scale weights will be used to determine the basis for the tonnage.

BASIS OF PAYMENT

401-8.1 Payment. Payment for a lot of HMA meeting all acceptance criteria as specified in paragraph 401-5.2 shall be made based on results of tests for smoothness, mat density and air voids. Payment for acceptable lots shall be adjusted according to paragraph 401-8.1a for mat density and air voids and 401-8.1c for smoothness, subject to the limitation that:

a. The total project payment for plant mix bituminous concrete pavement shall not exceed 100 percent of the product of the contract unit price and the total number of tons (kg) of HMA used in the accepted work (See Note 1 under Table 6).

b. The price shall be compensation for furnishing all materials, for all preparation, mixing, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

c. Basis of adjusted payment. The pay factor for each individual lot shall be calculated in accordance with Table 6. A pay factor shall be calculated for both mat density and air voids. The lot pay factor shall be the higher of the two values when calculations for both mat density and air voids are 100% or higher. The lot pay factor shall be the product of the two values when only one of the calculations for either mat density or air voids is 100% or higher. The lot pay factor shall be the lower of the two values when calculations for both mat density and air voids are less than 100%. If PWL for joint density is less than 71 percent then the lot pay factor shall be reduced by 5% but be no higher than 95%.

For each lot accepted, the adjusted contract unit price shall be the product of the lot pay factor for the lot and the contract unit price. Payment shall be subject to the total project payment limitation specified in paragraph 401-8.1. Payment in excess of 100% for accepted lots of HMA shall be used to offset payment for accepted lots of bituminous concrete pavement that achieve a lot pay factor less than 100%.

Table 6. Price Adjustment Schedule [1]

Percentage of Material Within Specification Limits (PWL)	Lot Pay Factor (Percent of Contract Unit Price)
93 – 100	103
90 – 93	PWL + 10
70 – 89	0.125 PWL + 88.75
40 – 69	0.75 PWL + 45
Below 40	Reject [2]

[1] Although it is theoretically possible to achieve a pay factor of 103% for each lot, actual payment above 100% shall be subject to the total project payment limitation specified in paragraph 401-8.1.

[2] The lot shall be removed and replaced. However, the Engineer may decide to allow the rejected lot to remain. In that case, if the Engineer and Contractor agree in writing that the lot shall not be removed, it shall be paid for at 50% of the contract unit price and the total project payment shall be reduced by the amount withheld for the rejected lot.

d. Profilograph smoothness. When the final average profile index (subsequent to any required corrective action) does not exceed 7 inches per mile (18 cm per 1.6 km), payment will be made at the contract unit price for the completed pavement. If the final average profile index (subsequent to any required corrective action) exceeds 7 inches per mile (18 cm per 1.6 km), but does not exceed 15 inches per mile (38 cm per 1.6 m), the Contractor may elect to accept a contract unit price adjustment in lieu of reducing the profile index.

e. Basis of adjusted payment for smoothness. Price adjustment for pavement smoothness will be made in accordance with Table 7. The adjustment will apply to the total tonnage of HMA within a lot of pavement and shall be applied with the following equation:

(Tons of asphalt concrete in lot) × (lot pay factor) × (unit price per ton) × (smoothness pay factor) = payment for lot

Table 7. Profilograph Average Profile Index Smoothness Pay Factor

Inches/miles per 1/10 mile	Short Sections	Pay Factor
0.0 - 7	00.0 - 15.0	100%
7.1 - 9	15.1 - 16	98%
9.1 - 11	16.1 - 17	96%
11.1 - 13	17.1 - 18	94%
13.1 - 14	18.1 - 20	92%
14.1 - 15	20.1 - 22	90%
15.1 and up	22.1 and up	Corrective work required[1]

[1] The Contractor shall correct pavement areas not meeting these tolerances by removing and replacing the defective work. If the Contractor elects to construct an overlay to correct deficiencies, the minimum thickness of the overlay should be at least three times the maximum aggregate size (approximately four (4) times the nominal maximum aggregate size). The corrective overlay shall not violate grade Criteria and butt joints shall be constructed by sawing and removing the original pavement in compliance with the thickness/ maximum aggregate size ratio. Skin patching shall not be permitted.

HMA placed above the specified grade shall not be included in the quantities for payment.

Payment will be made under:

Item P-401-8.1 Bituminous Surface Course - per ton

TESTING REQUIREMENTS

ASTM C29	Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C127	Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate
ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C183	Standard Practice for Sampling and the Amount of Testing of Hydraulic Cement
ASTM C566	Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D979	Standard Practice for Sampling Bituminous Paving Mixtures
ASTM D1073	Standard Specification for Fine Aggregate for Bituminous Paving Mixtures
ASTM D2172	Standard Test Method for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D1461	Standard Test Method for Moisture or Volatile Distillates in Bituminous Paving Mixtures
ASTM D2041	Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D2489	Standard Practice for Estimating Degree of Particle Coating of Bituminous-Aggregate Mixtures
ASTM D2726	Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
ASTM D2950	Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods
ASTM D3203	Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures

ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM D3666	Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D4867	Standard Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures
ASTM D5444	Standard Test Method for Mechanical Size Analysis of Extracted Aggregate
ASTM D6084	Standard Test Method for Elastic Recovery of Bituminous Materials by Ductilometer
ASTM D6307	Standard Test Method for Asphalt Content of Hot Mix Asphalt by Ignition Method
ASTM D6752	Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Automatic Vacuum Sealing Method
ASTM D6926	Standard Practice for Preparation of Bituminous Specimens Using Marshall Apparatus
ASTM D6927	Standard Test Method for Marshall Stability and Flow of Bituminous mixtures
ASTM E11	Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves
ASTM E178	Standard Practice for Dealing with Outlying Observations
ASTM E1274	Standard Test Method for Measuring Pavement Roughness Using a Profilograph
AASHTO T030	Standard Method of Test for Mechanical Analysis of Extracted Aggregate
AASHTO T110	Standard Method of Test for Moisture or Volatile Distillates in Hot Mix Asphalt (HMA)
AASHTO T275	Standard Method of Test for Bulk Specific Gravity (Gmb) of Compacted Hot Mix Asphalt (HMA) Using Paraffin-Coated Specimens
AASHTO M156	Standard Specification for Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
AASHTO T329	Standard Method of Test for Moisture Content of Hot Mix Asphalt (HMA) by Oven Method

Asphalt Institute MS-26, Asphalt Binder Handbook

Asphalt Institute MS-2, Mix Design Manual, 7th Edition

MATERIAL REQUIREMENTS

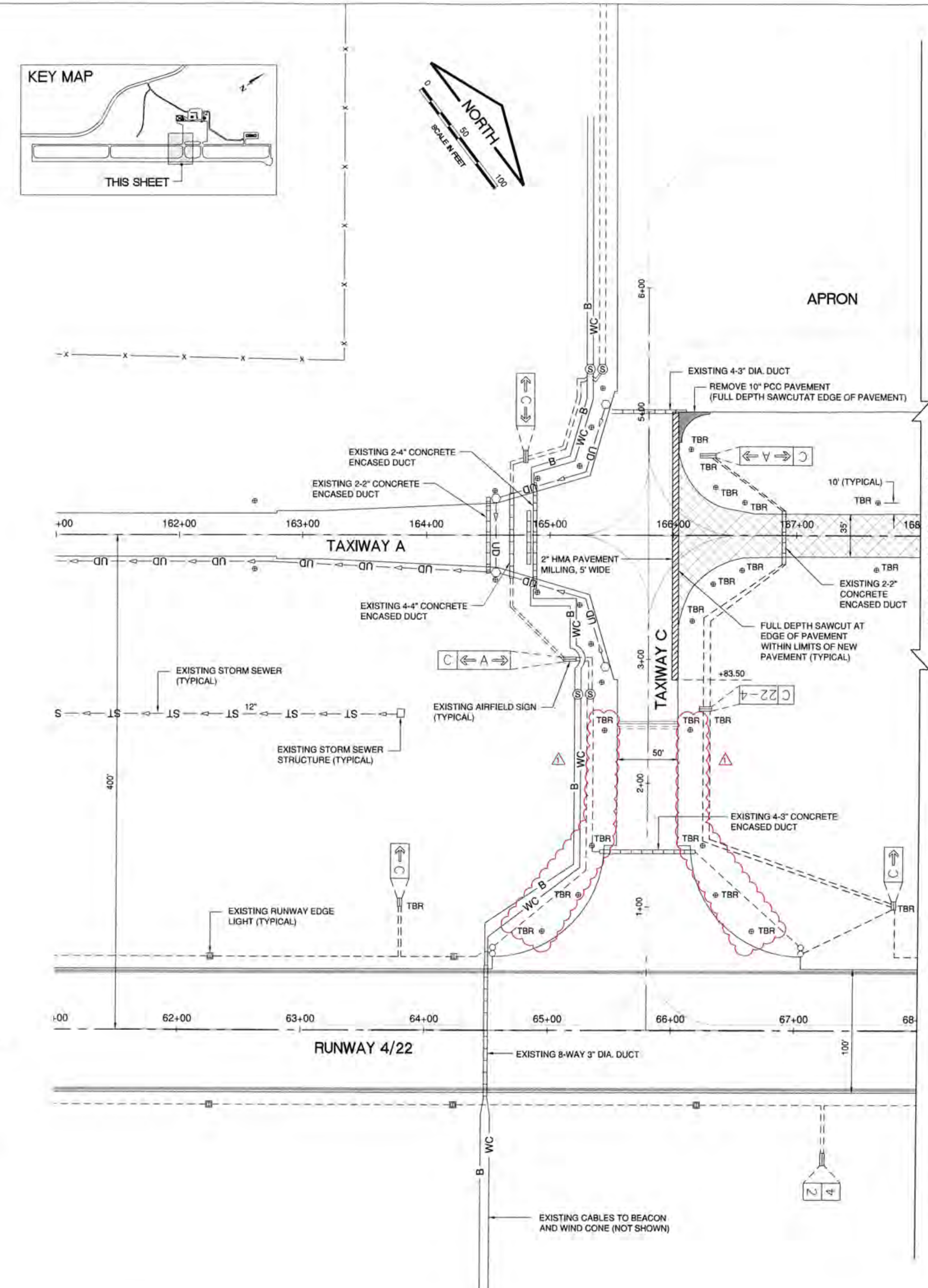
ASTM D242	Standard Specification for Mineral Filler for Bituminous Paving Mixtures
ASTM D946	Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction
ASTM D3381	Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D4552	Standard Practice for Classifying Hot-Mix Recycling Agents
ASTM D6373	Standard Specification for Performance Graded Asphalt Binder

END OF ITEM P-401

REVISED CONSTRUCTION PLAN SHEETS

NOTES

1. THE EXISTING PAVEMENT TO BE REMOVED SHALL BE SAWED FULL DEPTH AROUND THE PERIMETER OF THE REMOVAL LIMITS. THE COST OF SAWCUTTING AND DISPOSAL OF PAVEMENT SHALL BE CONSIDERED INCIDENTAL TO THE PAY ITEM. ANY DAMAGE TO THE PAVEMENT BEYOND THE LIMITS AS SHOWN ON THE PLANS AND LAID OUT BY RESIDENT ENGINEER SHALL BE REMOVED AND REPLACED BY THE CONTRACTOR AT HIS EXPENSE.
2. SEE GEOTECHNICAL REPORT FOR PAVEMENT CORE DATA AND BORING LOGS.
3. ALL EXISTING AIRFIELD CABLES SHOWN SPACED APART FROM EACH OTHER FOR CLARITY, EXACT LOCATIONS TO BE DETERMINED BY THE CONTRACTOR AND ASSOCIATED UTILITY OWNERS IN THE FIELD. (COST INCIDENTAL).
4. THE LIGHTS, SIGNS, TRANSFORMERS AND REFLECTORS TO BE REMOVED SHALL BE TURNED OVER TO THE AIRPORT. ANY REMOVAL ITEMS THE AIRPORT DOES NOT WANT SHALL BE DISPOSED OF BY THE CONTRACTOR.
5. ANY TEMPORARY CABLING AND CONDUITS REQUIRED FOR THIS PROJECT SHALL BE CONSIDERED INCIDENTAL, INCLUDING CONDUIT PUSHES (BORE AND JACK) AND UNCOVERING OF EXISTING CONDUITS TO KEEP CIRCUITS WORKING. NO TEMPORARY CABLING SHALL BE ALLOWED ABOVE GROUND IN ANY TAXIWAY OBJECT FREE AREA AND RUNWAY SAFETY AREA (SEE SEQUENCE PLANS).
6. IN AREAS WHERE REMOVED CONDUIT, DUCT BANK, UNDERDRAIN, DRAIN TILE OR STORM SEWER OR ANY REMOVAL ITEM IS BELOW LIMITS OF PROPOSED PAVEMENTS, TRENCH SHALL BE BACKFILLED AND COMPACTED PER SECTION 701 OF THE PROJECT SPECIFICATIONS. COST OF BACKFILLING SHALL BE INCIDENTAL TO THE RESPECTIVE REMOVAL ITEM.
7. ITEMS REMOVED DUE TO PROPOSED PAVEMENT EXCAVATION WILL NOT BE PAID FOR SEPARATELY BUT WILL BE CONSIDERED INCIDENTAL TO UNCLASSIFIED EXCAVATION UNLESS OTHERWISE NOTED ON THE PLANS.
8. THE CONTRACTOR SHALL TAKE THE NECESSARY PRECAUTIONS TO PROTECT THE EXISTING AND PROPOSED PAVEMENT STRUCTURE AND SUBGRADE FROM DAMAGE, WHICH MAY INCLUDE BUT NOT BE LIMITED TO USE OF TRACKED EQUIPMENT, SHORT HAUL TRUCKS OR TRACKED PAVERS, AT NO ADDITIONAL COST TO CONTRACT.
9. AT ALL TIMES THE CONTRACTOR SHALL PERFORM ALL MAINTENANCE WORK NECESSARY TO KEEP EACH PAVEMENT SECTION LAYER IN A SATISFACTORY CONDITION.
10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DAMAGE DONE BY HIS HAULING, CONSTRUCTION EQUIPMENT AND CONSTRUCTION OPERATIONS. ANY WORK NECESSARY TO CORRECT DAMAGED WORK, EXISTING AND NEW PAVEMENT SHALL BE PERFORMED BY THE CONTRACTOR AND AT THE EXPENSE OF THE CONTRACTOR.
11. NO EXTRA COMPENSATION WILL BE ALLOWED FOR ANY VARIANCE IN EXISTING PAVEMENT SECTIONS ENCOUNTERED.
12. CONTRACTOR SHALL TAKE MEASURES TO PROTECT EXISTING BITUMINOUS AND PCC PAVEMENT, ANY PAVEMENT DAMAGED BY CONTRACTORS EQUIPMENT SHALL BE SAW CUT PER RESIDENT ENGINEER LAYOUT AND REPLACED IN KIND AT NO ADDITIONAL COST TO CONTRACT.
13. CONTRACTOR SHALL TAKE MEASURES TO PROTECT EXISTING AND NEW STORM SEWER PIPE AND UNDERDRAIN FROM DAMAGE DUE TO CONSTRUCTION EQUIPMENT.
14. CONTRACTOR TO TAKE MEASURES TO PROTECT ALL UNDERGROUND UTILITIES INCLUDING, BUT NOT LIMITED TO, POWER, GAS, COMMUNICATION, SANITARY, STORM SEWER PIPE AND UNDERDRAIN FROM DAMAGE DUE TO CONSTRUCTION EQUIPMENT.
15. CLEAN AGGREGATE AND HMA MILLINGS REMOVED AS PART OF THIS PROJECT SHALL BE STOCKPILED ON AIRPORT PROPERTY. EXACT LOCATION TO BE COORDINATED IN THE FIELD WITH RESIDENT ENGINEER AND AIRPORT MANAGER.
16. PRIOR TO REMOVING DUCT/CONDUIT OR DISTURBING AREA OVER/ADJACENT TO DUCT, CONTRACTOR SHALL HAND DIG DUCT/CONDUIT ENDS AND VERIFY IF CABLES ARE PRESENT AND ACTIVE. IF CABLES ARE ACTIVE CONTRACTOR SHALL NOTIFY RESIDENT ENGINEER. COST SHALL BE INCIDENTAL TO THE CONTRACT.
17. FOUNDATIONS FOR EXISTING SIGNS AND LIGHTS TO BE REMOVED SHALL BE CONSIDERED INCIDENTAL TO SIGN AND LIGHT REMOVAL PAY ITEM.
18. EXISTING PAVEMENT MARKING AND REMOVALS NOT SHOWN ON DEMOLITION PLANS. REFER TO MARKING AND ELECTRICAL PLAN SHEETS.
19. ASPHALTIC CONCRETE SHALL BE REMOVED COLD - RECYCLING BY GRINDING, MILLING, OR PLANNING. MILLINGS ARE TO BE USED AS NEEDED THROUGHOUT THE PROJECT OR STOCKPILED NEAR THE CONTRACTOR EMPLOYEE PARKING TO BE USED BY THE AIRPORT/CITY.
20. CONTRACTOR SHALL REMOVE CABLES IN EXISTING DUCTS (COST INCIDENTAL).
21. EXISTING SIGN PANELS SHALL BE SALVAGED AND OFFERED TO THE AIRPORT.



LEGEND

EXISTING TAXIWAY RETROREFLECTIVE MARKER	EXISTING WIND CONE CABLE (WC)
EXISTING DUCT	EXISTING BEACON CABLE (B)
EXISTING RUNWAY EDGE LIGHT	EXISTING VASI CABLE (VASI)
EXISTING THRESHOLD LIGHT	EXISTING VASI APPROACH SLOPE INDICATOR (VASI) FAA OWNED
EXISTING TAXIWAY ENTRANCE-EXIT LIGHT	EXISTING SPLICE CAN
EXISTING AIRFIELD SIGN	EXISTING AIRPORT PROPERTY LINE
EXISTING AIRFIELD SIGN LEGEND	EXISTING HYDRANT
EXISTING ELECTRICAL CABLE, L-824 #8, 5000V, 1-C	TBR — EXISTING ITEM TO BE REMOVED
EXISTING STORM SEWER (ST)	EXISTING 6.5" (AVG.) BITUMINOUS PAVEMENT TO BE REMOVED
EXISTING STORM SEWER STRUCTURE	EXISTING CONCRETE PAVEMENT TO BE REMOVED
EXISTING UNDERDRAIN (UD)	PROPOSED BITUMINOUS BUTT JOINT
EXISTING FENCE (X)	

REVISIONS

NUMBER	BY	DATE
1	MND	4/23/2018

0 1 2
THIS BAR IS EQUAL TO 2" AT FULL SCALE (34X22). PLOT 1

LEE C. FINE MEMORIAL AIRPORT
1111 LEE C. FINE ROAD
BRUMLEY, MILLER COUNTY, MO 65017

RECONSTRUCTION OF TAXIWAY A FROM TAXIWAY C TO RUNWAY 22 END

STATE OF MISSOURI — BRIAN H. HUTSELL — NUMBER PE-2007002803 — PROFESSIONAL ENGINEER
DATE: 4-25-18

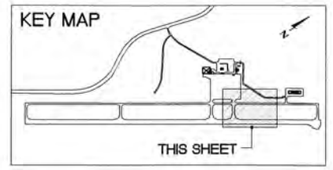
CMT
ONE MEMORIAL DRIVE, SUITE 500
ST. LOUIS, MO 63102
(314) 436-6500
PROFESSIONAL ENGINEERING - 000631

FILE:	
DESIGN BY:	MND
DRAWN BY:	JRO
CHECKED BY:	MND
APPROVED BY:	BHH
DATE:	APRIL 9, 2018
JOB No:	17486-02

DEMOLITION PLAN
SHEET 1 OF 3

SEE DEMOLITION PLAN
SHEET 1 OF 3
FOR LEGEND AND NOTES

KEY MAP



NORTH
0 50 100
SCALE IN FEET

REVISIONS		
NUMBER	BY	DATE
1	MND	4/23/2018

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THIS BAR IS EQUAL TO 2" AT FULL SCALE (34X22). PLOT 1

LEE C. FINE MEMORIAL AIRPORT

1111 LEE C. FINE ROAD
BRUMLEY, MILLER COUNTY, MO 65017

RECONSTRUCTION OF TAXIWAY A FROM TAXIWAY C TO RUNWAY 22 END

STATE OF MISSOURI
BRIAN H. HUTSELL
NUMBER PE-2007002803
PROFESSIONAL ENGINEER
DATE: 4-27-18
BRIAN H. HUTSELL, P.E.
P.E. #2007002803
CIVIL ENGINEER

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ONE MEMORIAL DRIVE, SUITE 900
ST. LOUIS, MO 63102
(314) 436-5500
PROFESSIONAL ENGINEERING - 000631

FILE:	
DESIGN BY:	MND
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DATE:	APRIL 9, 2018
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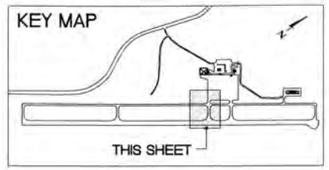
DEMOLITION PLAN
SHEET 2 OF 3

SHEET 16 OF 52 SHEETS

KEY MAP



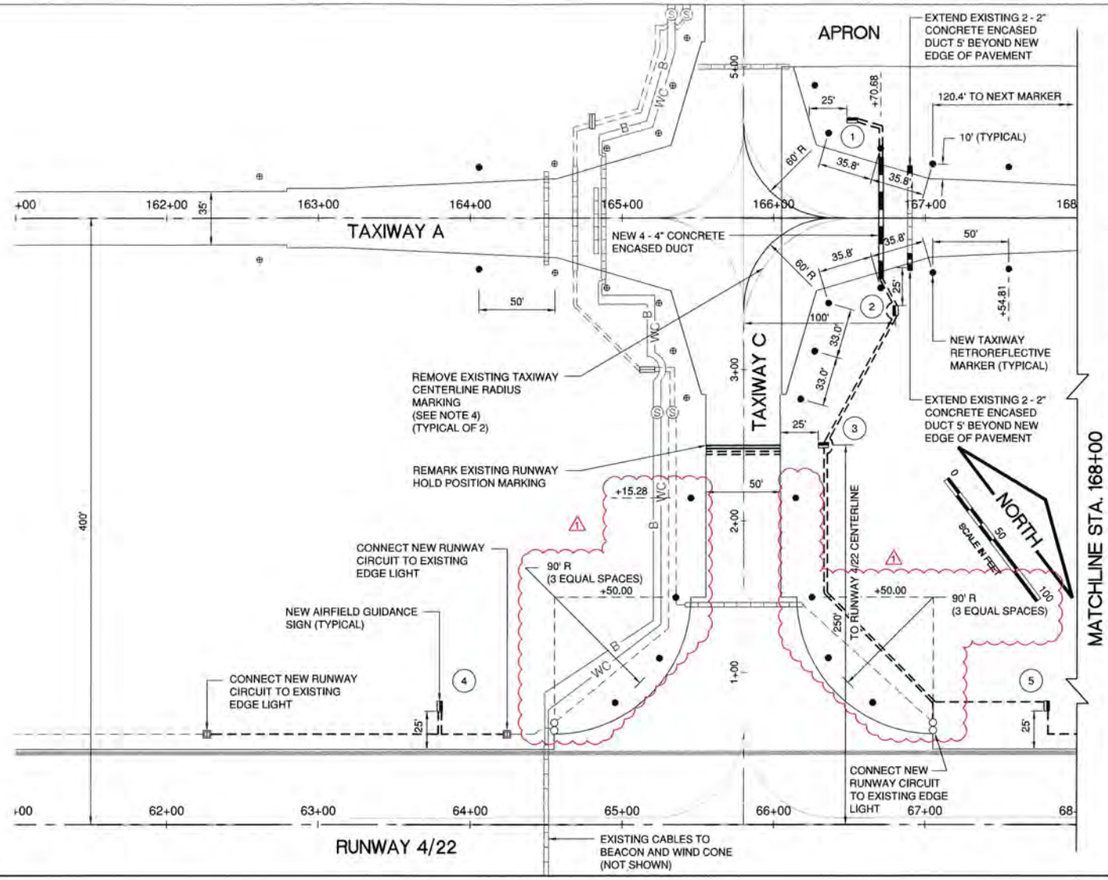
LEGEND

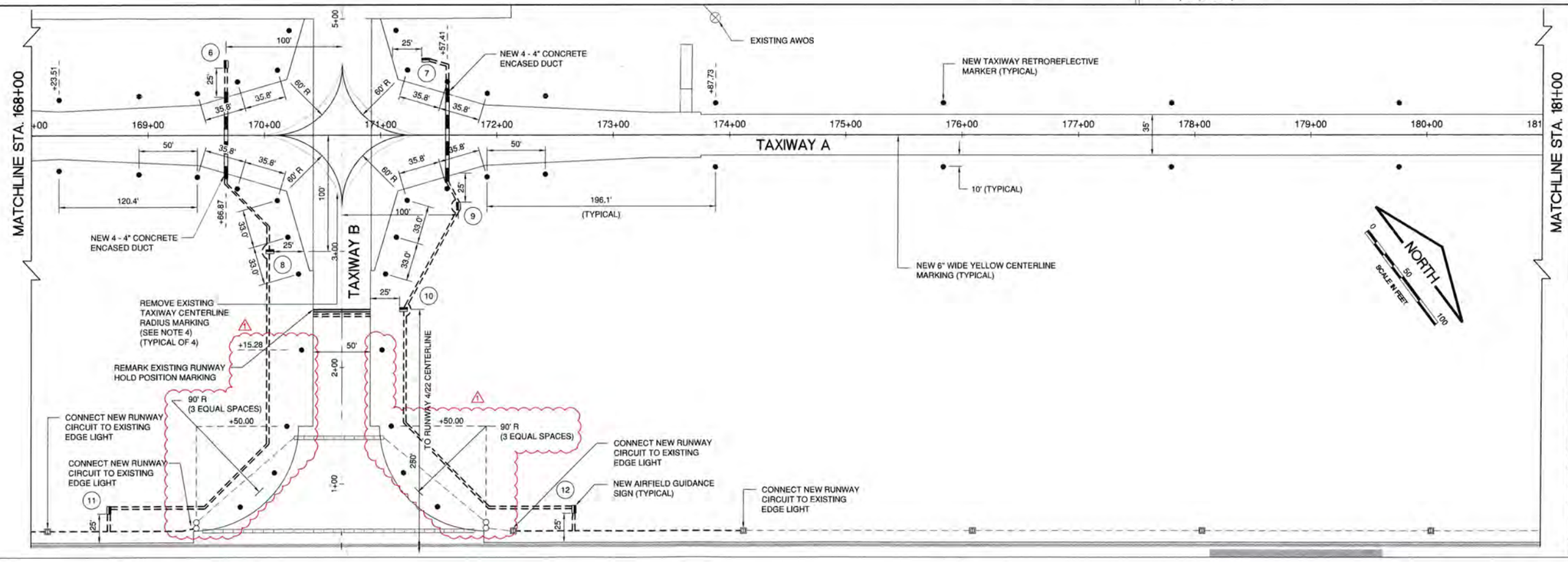
- NEW TAXIWAY RETROREFLECTIVE MARKER
- (10) NEW AIRFIELD GUIDANCE SIGN AND SIGN NUMBER
- EXISTING RUNWAY 4/22 CIRCUIT
- VASI EXISTING VASI CIRCUIT
- EXISTING AIRFIELD SIGN
- EXISTING RUNWAY LIGHT
- EXISTING RUNWAY EDGE LIGHT
- EXISTING TAXIWAY ENTRANCE/EXIT LIGHT
- EXISTING DUCT
- EXISTING VASI
- NEW PAVEMENT MARKING
- NEW 1/C #8 L-824, TYPE C, 5KV CABLE IN UNIT DUCT
- NEW DUCT

NOTES

1. ALL MARKINGS EXCEPT BLACK SHALL RECEIVE TYPE III GLASS BEADS PER ITEM P-620.
2. ALL MARKINGS SHALL RECEIVE A 6" BLACK BORDER EXCEPT RUNWAY EDGE MARKING.
3. SPACING FOR RETROREFLECTIVE MARKERS IS THE SAME ON BOTH SIDES OF THE TAXIWAY UNLESS SHOWN OTHERWISE.
4. CONTRACTOR SHALL COORDINATE TIMING OF TAXIWAY CENTERLINE MARKING REMOVAL WITH THE PAVEMENT REMOVAL OPERATIONS AND OVERALL CONTRACTOR PHASING PLAN.

SEE MARKING AND ELECTRICAL PLAN SHEET 2 OF 2 FOR SIGNAGE SCHEDULE





REVISIONS		
NUMBER	BY	DATE
1	MND	4/23/2018

0 1 2

THIS BAR IS EQUAL TO 2" AT FULL SCALE (34X22). PLOT 1

LEE C. FINE MEMORIAL AIRPORT

1111 LEE C. FINE ROAD
BRUMLEY, MILLER COUNTY, MO 65017

RECONSTRUCTION OF TAXIWAY A FROM TAXIWAY C TO RUNWAY 22 END

STATE OF MISSOURI
BRIAN H. HUTSELL
NUMBER PE-2007002803
PROFESSIONAL ENGINEER
DATE: 4-23-18
BRIAN H. HUTSELL, P.E.
P.E. #2007002803
CIVIL ENGINEER

CMT
ONE MEMORIAL DRIVE, SUITE 500
ST. LOUIS, MO 63102
314.436.5600
PROFESSIONAL ENGINEERING - 000531

FILE:	
DESIGN BY:	MND
DRAWN BY:	JRO
CHECKED BY:	MND
APPROVED BY:	BHH
DATE:	APRIL 9, 2018
JOB No:	17486-02

MARKING AND ELECTRICAL PLAN SHEET 1 OF 2

SHEET 34 OF 52 SHEETS

NEW PROPOSAL FORM

PROPOSAL FORM
CITY OF OSAGE BEACH, MISSOURI
State Block Grant Project No. **17-046B-1**

TO: Public Works Director/City Clerk

The undersigned, in compliance with the request for bids for construction of the following Project:

RECONSTRUCTION OF TAXIWAY A (NEW TAXIWAY A AND A1) FROM TAXIWAY C TO RUNWAY 22 END

hereby proposes to furnish all labor, permits, material, machinery, tools, supplies and equipment to faithfully perform all work required for construction of the Project in accordance with the project manual, project drawings and issued Addenda within the specified time of performance for the following prices:

BASE BID

BID ITEM	FAA SPEC.	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS		UNIT PRICE		EXTENSION	
					DOLLARS	CTS	DOLLARS	CTS
1	C-105-4.1	MOBILIZATION	1	LS				
2	P-101-5.1	PCC PAVEMENT REMOVAL, 10-INCH DEPTH	96	SY				
3	P-101-5.2	ASPHALT PAVEMENT REMOVAL, 6-INCH DEPTH	11,780	SY				
4	P-101-5.3	BUTT JOINT CONSTRUCTION	502	SY				
5	P-101-5.4	REMOVE PAINT	2,030	SF				
6	P-101-5.5	REMOVE INLET	1	EA				
7	P-152-4.1	UNCLASSIFIED EXCAVATION	5,543	CY				
8	P-152-4.2	ROCK EXCAVATION	1,257	CY				
9	P-156-5.1	SILT FENCE	5,250	LF				
10	P-156-5.2	INLET PROTECTION	9	EA				
11	P156-5.3	EROSION CONTROL BLANKET	2,100	SY				
12	P-157-8.1	12" LIME KILN DUST TREATED SUBGRADE	11,190	SY				
13	P-157-8.2	LIME KILN DUST	851	TON				
14	P-208-5.1	AGGREGATE BASE COURSE SUBGRADE IMPROVEMENT	865	CY				
15	P-209-5.1	6" CRUSHED AGGREGATE BASE COURSE	14,830	SY				
16	P-401-8.1	BITUMINOUS SURFACE COURSE	64	TON				
17	P-501-8.1	6" PORTLAND CEMENT CONCRETE PAVEMENT	23	SY				
18	P-501-8.2	10" PORTLAND CEMENT CONCRETE PAVEMENT	13,900	SY				
19	P-620-5.1	PAVEMENT MARKING, WHITE	560	SF				
20	P-620-5.2	PAVEMENT MARKING, YELLOW	2,350	SF				
21	P-620-5.3	PAVEMENT MARKING, BLACK	4,130	SF				
22	D-701-5.1	15-INCH REINFORCED CONCRETE PIPE	23	LF				

BASE BID								
BID ITEM	FAA SPEC.	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS		UNIT PRICE		EXTENSION	
					DOLLARS	CTS	DOLLARS	CTS
23	D-705-5.1	4" PERFORATED UNDERDRAIN PIPE	3,330	LF				
24	D-705-5.2	4" NON-PERFORATED UNDERDRAIN PIPE	660	LF				
25	D-705-5.3	UNDERDRAIN CLEANOUT	7	EA				
26	D-705-5.4	UNDERDRAIN, DIRECT CONNECTION	7	EA				
27	D-705-5.5	UNDERDRAIN COLLECTION STRUCTURE	6	EA				
28	D-752-5.1	PRECAST REINFORCED CONCRETE FLARED END SECTION, 15-INCH	1	EA				
29	P-901-5.1	SEEDING	7	AC				
30	T-904-5.1	SODDING	960	SY				
31	T-908-5.1	MULCHING	7	AC				
32	L-108-5.1	NO. 8 AWG, 5 KV, L-824, TYPE C CABLE, INSTALLED IN UNIT DUCT	5,135	LF				
33	L-108-5.2	NO. 6 AWG, SOLID, BARE COUNTERPOISE WIRE, INSTALLED IN TRENCH, ABOVE THE DUCT BANK OR CONDUIT, INCLUDING GROUND RODS AND GROUND CONNECTORS	3,540	LF				
34	L-110-5.1	CONCRETE ENCASED ELECTRICAL CONDUIT, 4-4"	300	LF				
35	L-110-5.2	CONCRETE ENCASED DUCT EXTENSION, 2-2"	30	LF				
36	L-125-5.1	TAXIWAY EDGE REFLECTOR	105	EA				
37	L-125-5.2	REMOVE TAXIWAY EDGE REFLECTOR	82	EA				
38	L-125-5.3	GUIDANCE SIGN, LED, ON NEW FOUNDATION, COMPLETE	16	EA				
39	L-125-5.4	REMOVE GUIDANCE SIGN AND FOUNDATION, COMPLETE	12	EA				
40	SP-1-5.1	BITUMINOUS MILLING PLACEMENT	865	CY				
41	SP-3-5.1	STABILIZATION GRID	5,190	SY				

ADDITIVE ALTERNATE 1								
BID ITEM	FAA SPEC.	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS		UNIT PRICE		EXTENSION	
					DOLLARS	CTS	DOLLARS	CTS
42	SP-2-5.1	HAUL EXCESS BITUMINOUS MILLINGS OFFSITE	1	LS				

ACKNOWLEDGEMENT

Each bidder shall acknowledge receipt of this **Addendum No. 2** of ***RECONSTRUCTION OF TAXIWAY A (NEW TAXIWAY A AND A1) FROM TAXIWAY C TO RUNWAY 22 END*** by his/her signature affixed hereto, and shall attach this Addendum to the original bid.

CERTIFICATION BY BIDDER

SIGNATURE _____

TITLE _____

COMPANY _____

DATE _____

FAX TRANSMITTAL

To: Crawford, Murphy & Tilly, Inc
Attention: Brian Hutsell
Re: Addendum #2
Fax 314.436.0723
From:
(name) _____

(company) _____

Date:

To verify that all contractors are in receipt of this addendum, Contractors are asked to sign and date this acknowledgement sheet. The Contractor should fax or mail to Crawford, Murphy, & Tilly, Inc. at the number listed below by **April 26, 2018.**

Crawford, Murphy, & Tilly, Inc.
One Memorial Drive, Suite 500
Saint Louis, Missouri 63102

Fax: (314) 436-0723
Phone: (314) 436-5500

BY: CRAWFORD, MURPHY, & TILLY, INC.