EXHIBIT E
SECTION 01110

SUMMARY OF WORK

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish tools, equipment, materials, supplies, manufactured articles, transportation, and services, including fuel, power, water, and essential communications.

B. Perform labor, work, or other operations required in accordance with Drawings, and UNLV Standard Specifications including such detail sketches as may be furnished by Engineer or Owner from time to time during construction in explanation of the work to be performed.

C. Work shall be complete, and work, materials, and services not expressly shown or called for on Drawings which may be necessary for complete and proper construction of Work in good faith shall be performed, furnished, and installed by Contractor as though originally so specified or shown, at no increase in cost to UNLV.

1.02 DEFINITIONS

A. The term “UNLV” as used herein, in the Standard specifications, and on Drawings shall mean The Board of Regents of the Nevada System of Higher Education, on behalf of the University of Nevada, Las Vegas.

1.03 WORK COVERED BY CONTRACT DOCUMENTS

A. The work consists of painting, crack sealing, seal coating, lot design, sign installation replacing and re-pinning of bumper blocks, asphalt repair and lane delineators/pavement markers as detailed in the UNLV Standard Specifications. The UNLV Standard Specifications closely follow the *Uniform Standard Specifications for Public Works’ Construction Off-Site Improvements, Clark County Area, Nevada.*

1.04 STREAMLINED SPECIFICATIONS

A. These specifications are written in streamlined or declarative style, using incomplete sentences. This imperative language is directed to Contractor unless specifically noted otherwise.

B. Omissions of such words and phrases as "The Contractor shall," "in conformity therewith," "shall be," "as shown on the Drawings," "a," "an," "the," and "all" are intentional in streamlined sections.

1. Omitted words shall be supplied by inference in the same manner as when a note appears on the Drawings.

2. Omission of such words shall not relieve the Contractor from providing the items and work described herein or indicated on the Drawings.

3. Words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

1.05 INTENT OF DOCUMENTS

A. The Drawings and UNLV Standard Specifications do not purport to describe each and every condition which may be encountered during construction.

B. The documents are intended to describe, in general, the extent, type, and quality of construction.

C. Contractor, by virtue of agreeing to and undertaking the Work, is deemed to have the skill and knowledge to evaluate the implications of the documents to the extent that he is aware of, and can provide for, the Work required to complete all aspects of the project for intended use.

D. Incorporate into the Work, products indicated or specified in accordance with requirements and/or recommendations of the respective manufacturers. Any additional materials and work required to meet such requirements or recommendations shall be deemed to be part of this Contract.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 CONTRACTOR USE OF PROJECT SITE

A. Limit use of project site to construction operations including on-site storage of materials, on-site fabrication facilities, and field offices.

B. Contractor to provide access to facilities and parking facilities as noted on the Drawings.

3.02 WORK BY OTHERS

A. Work may be conducted at or near site by other contractors during performance of work under this Contract.

B. Conduct operations to cause minimum of interference with Work of other contractors, and cooperate fully with such contractors.

C. Interference with Work on Utilities:

1. Cooperate fully with UNLV utility and maintenance forces or forces of public or private agencies engaged in relocating, altering, or other rearranging of facilities, which interfere with progress of Work.

2. Schedule Work to minimize interference with said relocating, altering, or rearranging of facilities and access to facilities as noted on the Drawings.

END OF SECTION 01110

EXHIBIT E
SECTION 01330

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Submittal procedures.

B. Construction progress schedule.

C. Shop drawing submittals.

D. Product data.

E. Manufacturers' certificates.

F. Mix design submittals.

G. Schedule of submittals.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 SUBMITTAL PROCEDURES

A. Accompany submittals with transmittal form provided at the end of this section or substitute form approved by Engineer. Submittals not accompanied by such a form, or where all applicable items on the form are not completed, will be returned for re-submittal.
   1. Use a separate transmittal form for each specific item or class of material or equipment for which a submittal is required.
   2. Transmittal of Shop Drawings for various items using a single transmittal form will be permitted only when the items taken together constitute a manufacturer's "package" or are so functionally related that expedience indicates review of the group or package as a whole.
   3. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic section number, as appropriate.

B. Identify Project, Contractor, Subcontractor or supplier; pertinent Drawing and detail number; and specification section number, as appropriate.

C. Apply Contractor's stamp, signed or initialed, certifying that review, verification of products required, field dimensions, adjacent construction, and coordination of information is in accordance with requirements of the Work and Contract Documents.

D. Allow 15 days for each submittal for review, excluding delivery time to and from Contractor.

E. When revised for resubmission, identify all changes made since previous submission.

F. Schedule submittals to expedite project and deliver to Engineer. Coordinate submission of related items.

G. Submittals not requested will not be recognized or processed.

3.02 CONSTRUCTION PROGRESS SCHEDULE

A. Provide a simple bar chart schedule for the Owner’s review.

B. Schedule Format:
   1. Prepare in a format that shows the order and interdependence of activities and sequence in which the Work is to be accomplished.
   2. Of sufficient detail to adequately depict proposed and actual progress of the Work from notice to proceed through final completion.
   3. Include all activities required to complete the project.
   4. Include specified milestones, including completion date for each activity, final completion, and incremental completion for coordination of other work.
   5. Give activities for submittal preparation, submittal review by Owner, procurement and delivery of materials, and obtaining permits duration consistent with specification requirements and actual planned duration.

C. Report Submittal Schedule:
   1. Prepare preliminary progress schedule covering activities to be performed within the Contract period.
   2. Submit preliminary progress schedule at least 2 working days prior to preconstruction conference. No later than 5 working days after effective date of Notice to Proceed, submit to the Engineer, proposed preliminary schedule for review.
   3. Within 10 working days following submittal of initial schedule and reports, meet with Owner to review initial schedule.
   4. Following this review, address comments provided and submit corrected initial schedule and reports within 10 working days.
   5. Once approved, this schedule will become basis for monitoring Contractor's progress.
   6. Progress payments may be withheld, at Engineer's and Owner's discretion, if Contractor fails to make required schedule submittals or if Engineer finds submittals unacceptable.

D. Adhere to approved initial schedule and approved revisions.
   1. Submit proposed schedule changes to Engineer for acceptance.
   2. Do not initiate changes in schedule until approved.

E. Approval of initial schedule or acceptance of updated schedules which indicate deviations from specification requirements shall not be considered as waiver of specified requirement. Deviations shall only be authorized by change order.

F. Acceptance of the Construction Schedule will not relieve Contractor of the responsibility for accomplishing all work in accordance with the Contract.

3.03 SHOP DRAWING

A. Submit to Engineer, Shop Drawings in accordance with the individual specification sections.

B. Submit 6 prints of each required item with Contractor's stamp of approval.

C. Stamp of approval to indicate:
   1. Contractor's name.
   2. Name and number of contract.
   3. Applicable specification section and paragraph.
   4. Applicable contract drawing.
   5. Intended use.
   6. Current revision and issue number on drawings and descriptive date.

D. Indicate and identify deviations from Contract Documents, at time of Shop Drawing submittal, in accordance with Section 01630, Product Substitution Procedures.

E. Identify applicable items when catalog pages are submitted.

F. Engineer returns 2 prints of reviewed Shop Drawings.

G. Shop Drawings returned by Engineer marked "Approved." Commence manufacture or fabrication.

H. Shop Drawings returned by Engineer marked "Approved as Noted." Commence manufacture or fabrication as noted and required.
   1. Include Engineer required revisions.
   2. Include Engineer required corrections.
   3. Provide Engineer requested information.

I. Shop Drawings returned by Engineer marked "Approved Pending Revision." May commence manufacture or fabrication contingent upon:
   1. Submit 6 prints of revised Shop Drawing to Engineer within 21 calendar days.
   2. Shop Drawings revised as required: Engineer returns 2 prints marked "Approved." Commence manufacture or fabrication.
   3. Shop Drawings not revised as required: Engineer returns 2 prints marked "Rejected." Do not commence manufacture or fabrication.

J. Shop Drawings returned by Engineer marked "Rejected." Do not commence manufacture or fabrication.
   1. Engineer returns 2 prints with reason(s), indicated in contrasting color, for rejection.
   2. Submit new Shop Drawings in accordance with Article 6 of the General Conditions.

3.04 PRODUCT DATA

A. Submit number of copies which Contractor requires, plus two copies which will be retained by Engineer.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.

C. After review, provide copies for record documents.

3.05 MANUFACTURERS' CERTIFICATES

A. When specified in individual specification sections, submit manufacturers' certificate to Engineer for review, in quantities specified.

B. Indicate that material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

3.06 MIX DESIGN SUBMITTALS

A. Prepare asphalt concrete and aggregate base mix designs as specified in appropriate sections.
   1. Determine exact proportions in which materials are to be used for different parts of Work, in conformance with Drawings and Specifications.
   2. Submit to Engineer or Owner for review prior to use in Work.

B. Mix design samples shall represent existing stockpile.
   1. Mix designs "copied" from previous projects will not be accepted unless existing stockpile aggregate is tested to assure conformity.
   2. Stockpile, additive, binder, or cement source location and/or type of material change will require new mix design.

3.07 SCHEDULE OF SUBMITTALS

A. Provide a schedule of submittals as required by the individual specification sections.

END OF SECTION

APPENDIX I

SUBMITTAL REVIEW FORM

UNLV
SUBMITTAL REVIEW FORM

Date:	**Contract No. and Title:**
To: UNLV 4505 Maryland Parkway Las Vegas, NV 89154	**Received from** **Contractor** **Designer**

Comments: _____ Please review and return by _____

_____For your information only. No return required.

Submittal No.	Qty.	Para. No.	Subject of Submittal	Review Action

Engineer's Review Comments:

Signature: **Date:**

Review Action Explanation:
A: Approved **N:** Approved As Noted **P:** Approved Pending Revision **R:** Rejected-Resubmit

EXHIBIT E
SECTION 02207

AGGREGATE MATERIAL

PART 1 - GENERAL

1.1 SUMMARY

A. This section provides for aggregate materials as required by the Drawings, written instructions from the Engineer or Owner, and/or as required by other sections of this Section. Work includes:
   1. Aggregate materials for sub-grade preparation.
   2. Aggregate materials for base material preparation.

1.2 RELATED DOCUMENTS

A. Documents affecting work off this Section include but are not necessarily limited to the Drawings (if applicable), UNLV written directions, UNLV Terms and Conditions, or Purchase Order.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Section 02752: Asphaltic Concrete Paving.
   2. Section 02754: Recycled Asphaltic Concrete Paving.

1.3 REFERENCE DOCUMENTS

A. Not used.

1.4 SUBMITTALS

A. Procedure: Submit each item in this Section and according the UNLV direction.
   1. Comply with pertinent provisions of Sections 01330, and as follows:

B. Aggregate Base: The Contractor shall submit within seven (7) calendar days after receipt of the Notice to Proceed, certification from the testing firm that the aggregate base material meets the requirements of these specifications for approval by the Engineer or Owner's representatives.

C. Approval of the certification shall be the Contractor's authorization to order the required material. There will be no deviation from the approved certification without written approval from the Engineer or Owner's representative.

1.5 REFERENCES

A. AASHTO - M147 - Materials for Aggregate and Soil-Aggregate.

B. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-inch (457 mm) Drop.

C. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.

D. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

E. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

F. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

G. ASTM D2487 - Classification of Soils for Engineering Purposes.

H. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

I. ASTM D3017 - Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

J. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.6 QUALITY ASSURANCE

A. Perform testing of proposed materials in accordance with applicable portions of References.

PART 2 - PRODUCTS

2.1 SOURCE QUALITY CONTROL

A. Type II Aggregate Material – Testing and Analysis: Perform in accordance with applicable portions of Section 02208, Base Aggregate.

B. If tests indicate materials do not meet specified requirements, change material or material source and re-test.

C. Provide materials of each type from same source throughout the Work. Provide test results confirming compliance with specifications prior to use of material.

2.2 LAB TESTING

A. The Owner shall select and pay for the service of a testing firm to perform all required testing.

B. Aggregate gradation testing will be conducted by the testing firm. Two samples shall be taken from stockpile for testing and approval before the placement of aggregate begins. The testing laboratory shall determine the maximum density as specified.

C. During the placement of aggregate base, one sample per day shall be taken for gradation testing.

PART 3 - EXECUTION

3.1 GENERAL

A. The aggregate base material will be delivered to the site in a thoroughly blended condition, and shall be handled in such a manner that there will be no excessive segregation or mixing of the underlying soil or sub-base with the base material.

3.2 STOCKPILING

A. If Stockpiling is required, Stockpile materials on-site at locations approved by Engineer or Owner and as follows:
   1. Stockpile in sufficient quantities to meet project schedule and requirements.
   2. Separate differing materials with dividers or stockpile apart to prevent mixing.
   3. Direct surface water away from stockpile site so as to prevent erosion or deterioration of materials.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.

3.4 SUBGRADE PREPARATION

A. Any ruts, holes, defects, or soft yielding places which occur in the subgrade or subbase for any cause whatsoever shall be corrected and compacted to required density and stability before an aggregate base course is placed thereon.
   1. The above mentioned repairs shall be made at no additional cost to UNLV.
   2. The tolerance to the plan elevation grade shall be +0 foot and -0.1 foot.

B. Unless otherwise specified, the top 6 inches of subgrade shall be compacted to not less than 90 percent compaction.

3.5 SPREADING AGGREGATES

A. The aggregate shall be uniformly deposited on the approved subgrade by means of the hauling vehicle with or without spreading devices. Aggregate shall be distributed over the surface to the depth specified on the Drawing or established by the Engineer or Owner.

B. After base course material has been deposited, it shall be thoroughly blade-mixed to full depth of the layer by alternately blading the entire layer to the center and back to the edges of the roadway or parking lot. The material shall then be spread and finished to the required cross section by means of a self-propelled pneumatic-tired motor grader.

C. At the option of the Contractor, the aggregate may be spread with an approved self-propelled spreader with the aggregate ready for compaction without further shaping. If this option is exercised; however, the operation shall become subject to the requirements of this Section.

D. Reference points will be established on one side of the roadway at intervals approved by the Engineer or Owner.

E. Furnish, place, maintain, remove, and dispose of all materials required to provide continuous line

and grade control to the placing machine.

3.6 WATERING AND MIXING AGGREGATES

A. The base course material and water may be mixed at the plant in a mixer approved by the Engineer or Owner.

B. Water shall be added during the mixing operation by means of spray bars in the amount necessary to provide the optimum moisture content for compacting.

C. After mixing to the extent that the product has a uniform homogeneous appearance, the material shall be transported to the job while it contains the proper moisture content and may be placed on the roadbed or parking lot by means of an approved self-propelled aggregate spreader.

D. If the material has dried appreciably prior to final compacting, additional water shall be added by means of a pressurized water truck to assist in compaction and to prevent raveling.

3.7 WATERING

A. Water may be applied prior to and during all blading and processing operations to moisten the material sufficiently to prevent segregation of the fine and coarse particles.

B. Water shall be applied during the compaction and maintenance stages in sufficient amounts to assist in compaction and prevent raveling.

3.8 COMPACTION

A. Compaction shall immediately follow the spreading operation.
   1. Where the required thickness is 6 inches or less, the base course may be spread and compacted in 1 layer.
   2. However, if vibratory compaction equipment of a type approved by the Engineer or Owner is used, and the requirement for density is complied with, the compacted thickness of any 1 layer may be increased to 8 inches.

B. Aggregate bases placed on road approaches and connections, street intersection areas, median strip areas, shoulder areas, and at locations that are inaccessible to the spreading equipment may be spread in one or more layers by any means to obtain the specified results.

C. Each layer of material shall be compacted to not less than 95 percent compaction, except for under sidewalk areas, where the material shall be compacted to not less than 90 percent compaction.

D. A loss of density in the upper portions of the material may occur due to the elements or for other reasons. Recompaction to the specified density will be required prior to placement of any subsequent course and no additional compensation will be allowed for such recompaction.

3.9 TOLERANCE FOR FINISHED SURFACE

A. When a 10-foot straightedge is laid in any direction, the finished surface shall not deviate at any point more than ½ inch from the bottom thereof.

B. The tolerance to the plan elevation grade shall be +0 foot and -0.05 foot.

3.10 FIELD TESTING

A. Field compaction testing shall be performed by the testing firm. At least one test per 1,500 square yards of prepared aggregate base shall be performed. Test sites shall be selected at random by the testing firm.

B. The testing firm shall determine the base thickness at the location of each compaction test.

C. Any areas showing insufficient compaction or thickness shall be corrected and tested.

D. The Owner's representative may require additional tests over and above the one per 1,500 square yards in or around any areas of failure.

END OF SECTION 02207

EXHIBIT E
SECTION 02580

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section provides for site markings and furniture as shown on the drawings and as specified herein for a complete and proper installation. Principal work in this Section includes:
   1. Pavement markings.

1.2 RELATED DOCUMENTS

A. Documents affecting work of this Section include but are not necessarily limited to the Drawings, or written instructions from the Engineer or Owner.

1.3 SUBMITTALS

A. Procedure; Submit each item in this Section in accordance with the referenced Sections.
   1. Comply with pertinent provisions of Section 01330.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All Materials shall comply with specifications commonly used in the Clark County area.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify conditions and measurements affecting the work of this Section at site. Make sure that detrimental conditions are corrected before proceeding with installation.

3.2 PREPARATION

A. Remove dust, debris, curing and sealing compounds, and other foreign substances detrimental to epoxy adhesive and paint bond. Use a commercial degreasing solution to remove grease and oil.

B. Take field measurements and make layouts required.

3.3 PAVEMENT MARKINGS

A. Clean surfaces to be painted, and mix and apply paint in compliance with the paint manufacturer's printed instructions.

B. Paint pavement lines and legends in compliance with the layout shown on the Drawings, or written

instructions from the Engineer or Owner. The work shall be straight or curved as indicated, of uniform color and texture with edges parallel, clean, sharply defined and accurate.

C. Thickness of cured paint film shall be per specification in common use in the Clark County area.

D. Erect temporary barriers and signs, and leave them in place until the paint has thoroughly dried.

END OF SECTION 02580

EXHIBIT E
SECTION 02754

RECYCLED ASPHALTIC CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section provides for processing of recycled asphaltic concrete paving in a central plant and re-laying the reprocessed asphaltic concrete mixture on a prepared surface in accordance with the drawings, or as directed in writing by the Engineer or Owner.

The work includes installing recycled asphaltic concrete paving areas and patching and repairs to existing asphaltic concrete area. The recycled asphaltic concrete and aggregate base thickness will be shown on the drawings, or as detailed in writing by UNLV Request for Bids, or Purchase Order. Generally, on the UNLV campus, parking areas receive 2.5 inches of asphaltic concrete over 4 inches of Type II Aggregate Base. Parking lot drive aisles generally receive 3 inches of asphaltic concrete over 4 inches of Type II Aggregate Base. Heavier traffic areas such as the Thomas and Mack entry drive off of Swenson may require thicker asphalt and base sections. These areas should have a geotechnical investigation performed and a report prepared with paving recommendations.

1.2 RELATED DOCUMENTS

A. Documents affecting work of this Section include but are not necessarily limited to the conditions of the UNLV Purchase Order, UNLV Request for Bids, or other such documents.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 02207: Aggregate Materials.
2. Section 02580: Pavement Markings.
3. Section 02752: Asphaltic Concrete Paving.
4. Section 02758: Bituminous Materials

1.3 REFERENCES

A. ASTM D946 - Penetration-Graded Asphalt Cement for Use in Pavement Construction.

B. TAI - (The Asphalt Institute) - MS-2 Mix Design Methods for Asphalt Concrete and Other Hot Mix Types.

C. TAI - (The Asphalt Institute) - MS-3 Asphalt Plant Manual.

D. TAI - (The Asphalt Institute) - MS-8 Asphalt Paving Manual.

E. TAI - (The Asphalt Institute) - MS-19 Basic Asphalt Emulsion Manual.

F. TAI - (The Asphalt Institute) - Manual MS-4 - The Asphalt Handbook.

G. TAI - (The Asphalt Institute) - Manual MS-13 - Asphalt Surface Treatments and Asphalt Penetration Macadam.

H. TAI-(The Asphalt Institute)- MS-22 Construction of Hot Mix Asphalt Pavements.

1.4 SYSTEM DESCRIPTION

A. Provide recycled hot-mix asphalt pavement according to the materials, workmanship, and other applicable requirements as specified herein.

1.5 SUBMITTALS

A. Procedure: Submit each item in this Section according to these specifications and UNLV contract conditions.
   1. Comply with pertinent provisions of Section 01330.

B. Product Data and Shop Drawings: Within 5 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
   1. Product data: For each product specified. Include technical data and tested physical and performance properties.
   2. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate dedicated handicapped spaces with international graphics symbol.

C. Job-Mix Design: Certification that the proposed job-mix design is in general use in the Las Vegas Valley for each job mix proposed for this Work. Prepare mix design in accordance with Section 02755, subsection 2.1, "Composition of Mixtures."

D. Qualification Data Include lists of completed projects with project names and addresses, names and addresses of engineer, architects and owner, and other information specified.

E. Material Test Reports: Indicate and interpret test results for compliance of materials with requirements indicated.

F. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with these specifications.

B. Obtain materials from a qualified source and from same source throughout.

C. Installer Qualifications: Engage an experienced installer who has completed recycled hot-mix asphalt paving similar in material, design, and extent to that indicted for this project and with a record of successful in-service performance.

D. Manufacturers Qualifications: Engage a firm experienced in manufacturing recycled hot-mix asphaltic similar to that indicated for this project and with a record of successful in - service performance.
   1. Firm shall be a recycled asphaltic concrete paving supplier approved by UNLV.

E. Regulatory Requirements:
   1. Conform to these specifications and other UNLV terms and conditions for paving on the UNLV campus.

1.7 DELIVERY AND STORAGE

A. Deliver pavement-marking materials to project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement - marking materials in a clean, dry, protected location and within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt when ambient air, base surface or asphaltic mixture temperature does not conform to the requirements below, or when surface is wet or frozen.
   1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.
   2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
   3. Asphalt Base Course: Minimum surface temperature of 40 deg. F. and rising at time of placement.
   4. Asphalt Surface Coarse: Minimum surface temperature of 60 deg. F at time of placement.

B. Pavement Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

1.9 TESTING AGENCY

A. Contractor to use a testing agency qualified according to ASTM D 3666 for testing as indicated herein, and as documented according to ASTM E 548.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Use materials, gradations, and job mix formulas and that have performed satisfactorily in previous installations and in general use in the Las Vegas area.

B. Reclaimed aggregate shall be the product of crushed, milled, or planed bituminous pavement.

C. Course aggregate; ASTM D 692, sound, angular crushed stone, crushed gravel, or properly cured, crushed blast-furnace slag.

Fine Aggregate: ASTM D 1073, sharp edged natural sand or sand prepared from stone, gravel, properly cured blast-furnace slag, or combinations thereof. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

E. Mineral Filler: ASTM D 242, rock or slag dust, hydraulic cement, or other inert material.

F. Asphalt Binder: As manufactured by Paramount Petroleum Corporation, AC-30 or approved equal.

G. Asphalt Cement: ASTM D 3381 for viscosity-graded materials, and ASTM D 946 for penetration-graded material.

H. Tack Coat: ASTM D 977 emulsified asphalt, or ASTM D 2397, cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application, applied to an existing concrete or bituminous surface

I. Prime Coat: ASTM D 2027, MC-70 liquid asphalt applied to an aggregate base.

J. Seal Coat: SS-1h or CCS-1h, emulsified asphalt.

K. Water: Potable.

L. Recycling Agent: The recycling agent shall conform to the requirements of the following table. The grade shall be determined by the job mix formula.

SPECIFICATIONS FOR HOT-MIX RECYCLING AGENT[1]

		RA-5		RA-25		RA-75		RA-250		RA-500	
TEST	**ASTM Test Method**	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**
Viscosity @ (140°), cSt	D2170	200	800	1,000	4,000	5,000	10,000	15,000	35,000	40,000	60,000
Flash Point COC, °F	D92	400	-	425	-	450	-	450	-	450	-
Saturates, wt. %	D2007	-	30	-	30	-	30	-	30	-	30
Viscosity Ratio[3]	-	-	3	-	3	-	3	-	3	-	3
RTFC Oven Weight Change +/-%	D2872[2]	-	4	-	3	-	2	-	2	-	2
Specific Gravity	D70 or D1298	Report		Report		Report		Report		Report	

2.2 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by Environmental Protection Agency (EPA). Provide granular, liquid, or wetable powder form.

B. Sand: ASTM D 1073, Grade Nos. 2 or 3.

C. Wheel Stops: Precast, air entrained concrete, 2500 psi minimum 28 day compressive strength, 4-1/2" high, 9 "wide, 72" long. Provide chamfered corners and drainage slots on underside and hole for anchoring.

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1. The final acceptance of recycling agents meeting this specification is subject to the compliance of the reconstituted asphalt blends with current asphalt specifications.
2. The use of ASTM D1754 has not been studied in the context of this specification; however, it may be applicable. In cases of dispute, the reference method shall be ASTM D2872.
3. Viscosity Ratio = $\frac{\text{RTFC Viscosity at 140°F cSt}}{\text{Original Viscosity at 140°F cSt}}$

2.3 ASPHALT PAVING MIX

A. Hot-Mix Asphalt: Dense, recycled hot-laid, hot-mix asphalt plant mixes in general use in the Las Vegas Valley, and complying with the following requirements:
   1. Provide mixes with a history of satisfactory performance.
   2. Base Course: as specified in Section 02207, “Aggregate Material”.
   2. Surface Course: 2.5 inches for parking stalls; 3 inches for parking lot drive aisles. Other high volume traffic areas require a geotechnical investigation and report with recommended asphalt thickness.
   4. The job mix formula shall indicate the recommended grade and amount of recycling agent and/or additional bituminous material to be used in the mix. This shall be determined by recovering the asphalt cement from representative samples of the pavement to be recycled and testing the properties of the asphalt cement after adding various amounts of the recycling agent and/or additional bituminous material. The test report shall show the curves for the following properties of the recycled asphalt cement after adding various amounts of the recycling agent and/or bituminous material;
      a. Penetration at 77 degrees F (before and after RTFC test)
      b. Absolute Viscosity at 140 degrees F (before and after RTFC test).
   5. The grade and amount of recycling agent and/or additional bituminous material to be used will be that which will produce a paving grade asphaltic cement conforming to Section 02758, “Bituminous Materials”. The combined bituminous material shall meet all the requirements of an AC-20 or AC-10 grade. All properties specified for a paving grade asphalt cement shall be tested on the combined bituminous material, and the results shall be submitted with the proposed job-mix formula.

2.4 MIXTURE COMPOSITION

A. The recycled asphaltic concrete pavement plant-mix shall be composed of a mixture of reclaimed asphaltic concrete pavements, additional virgin aggregate, mineral filler, if required, recycling agent, and/or additional bituminous material.
   1. The aggregate fractions shall be sized, uniformly graded, and combined in such proportions that the resulting mixture meets the job-mix formula gradation requirements.
   2. The reclaimed asphaltic concrete pavement used in the mix shall not exceed 15 percent.
   3. More that 15 percent of the reclaimed asphaltic concrete pavement may be used in the job-mix if the Engineer or Owner determines that the resultant mix satisfies the mix design requirements.
   4. If there is a proposed change in the source of materials or reclaimed asphaltic concrete percentage, a new job-mix formula shall be established.

2.5 BITUMINOUS MIXING PLANT

A. If a batch plant is used, the plant shall be modified so that virgin aggregate can be superheated to a temperature required to produce a resultant mix temperature as specified in Section 02755,”Plantmix Asphaltic Concrete Pavements-General”, Subsection 2.1, “Mixture Composition” after adding the ambient temperature reclaimed bituminous pavement aggregate. Reclaimed aggregate shall be fed into the aggregate weigh hopper in a manner to ensure uniform proportioning.

B. If a drier drum plan is used, the plant shall be modified so that either the virgin aggregate can be super heated to a temperature required to produce the required resultant mix temperature, or the combination of reclaimed bituminous pavement aggregate and virgin aggregate can be heated to a temperature needed for the resultant mix temperature as specified in Section 02755, Subsection 2.1, “Mixture Composition”. The reclaimed aggregate shall be introduced into the plant is such a manner to ensure uniform proportioning and to protect the material from direct contact with the burner flame.

2.6 AGGREGATE PREPARATION

A. Virgin aggregates shall be prepared as specified in Section 02755, Subsection 3.8, “Aggregate Preparation”.

B. Reclaimed asphaltic concrete pavement aggregates shall be prepared so that 100 percent will pass the 1-1/2 inch sieve. The moisture content of the reclaimed bituminous pavement aggregate ate the time of introduction into the mixer shall not exceed 3 percent as determined by ASTM D2216.

C. The reclaimed bituminous pavement aggregate stockpile area shall be graded and compacted so a firm level base can be maintained at all times. Layer placing or alternate approved methods shall be used to prevent coning or segregation of component sizes. The stockpile will be limited to 10 feet in height and no equipment of any type will be allowed on top of the stockpile. Maintain the stockpile in a loose and un-compacted state. To prevent premature consolidation, reclaimed bituminous pavement aggregate shall not be stored in confined metal bins or hoppers unless slated for immediate processing.

D. Prior to feeding the reclaimed bituminous pavement aggregate into the mixing plant, the material shall first pass through a grizzly with bars spaced 2 inches apart.

2.7 SOURCE QUALITY CONTROL AND TESTS

A. Testing Laboratory Services: Provide mix design for asphalt specifically designed for this project, as indicated in these specifications.

B. Submit proposed mix design for review and approval by Engineer or Owner prior to beginning of Work.

C. Test samples in accordance with these specifications. Submit test results that confirm mix design compliance to Engineer or Owner for review prior to beginning Work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that compacted sub-grade is dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

C. Proof-roll sub-base using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

D. Notify Engineer or Owner of any unsatisfactory condition. Do not begin paving installation until these

conditions have been satisfactorily corrected.

3.2 COLD MILLING

A. Clean existing paving surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement, including hot-mix asphalt and, as necessary, unbound-aggregate base course, by cold milling to grades and cross sections indicated.
   1. Repair or replace curbs, manholes, and other construction damaged during cold milling.

3.3 SAW CUTTING AND PATCHING

A. The outline of the asphaltic concrete to be removed shall be cut in clean, straight lines with a power-driven saw to a depth equal to the depth of the existing asphaltic concrete before removing the surfacing. Surfacing and base shall be removed without damage to the pavement that is to remain in place. Damage to the pavement that is to remain in place shall be repaired to a condition satisfactory to the Engineer, or the damaged pavement shall be removed and replaced with new asphaltic concrete if ordered by the Engineer or Owner. Repairing or removing and replacing pavement damaged outside the limits of pavement to be replaced shall be at the Contractor's expense and will not be measured nor paid for by the Owner.

3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared sub-grade is ready to receive paving.
   1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

B. Herbicide Treatment: Apply herbicide according to manufacturers recommended rates and written application instructions. Apply to dry, prepared sub-grade or surface of compacted-aggregate base before applying paving materials.

3.5 BASE COURSE

A. Conforms to applicable portions of Section 02207, "Aggregate Material".

3.6 PREPARATION - PRIMER

A. Apply primer uniformly over surface of compacted aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 24 hours minimum.

B. Apply primer on aggregate and to contact surfaces of curbs, gutters and valley gutters.

C. Use clean sand to blot excess primer.

D. Apply uniformly over surface of compacted - aggregate base. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure for 24 hours minimum.
   1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use just enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
      a. Protect primed substrate from damage until ready to receive paving.

3.7 PREPARATION - TACK COAT

A. Apply tack coat uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving. Avoid smearing or staining adjoining surfaces, appurtenances, and surrounding. Remove spillages and clean affected surfaces.

B. Apply tack coat to contact surfaces of curbs, gutters and existing pavement.

C. Coat surfaces of manhole frames with oil to prevent bonding with asphalt pavement. Do not tack coat these surfaces.

3.8 PLACING ASPHALT PAVEMENT - SINGLE COURSE

A. Install Work in accordance with these specifications.

B. Machine place hot-mix asphalt mix on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment and in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness, when compacted.

C. Place asphalt within twenty-four (24) hours of applying primer or tack coat.

D. Place hot-mix asphalt surface course in single lift.

E. Spread mix at minimum temperature of 250 deg. F.

F. Begin applying mix along centerline of crown for crowed sections and on high side of one-way slopes, unless noted otherwise.

G. Install manhole frames and valve boxes in correct position and elevation.

H. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

I. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

J. Perform rolling with consecutive passes not less than 10 feet wide, except where infill edge strips of a lesser width are required, to achieve even and smooth finish without roller marks.
   1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips.

K. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.9 JOINTS

A. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
   1. Clean contract surfaces and apply tack coat.
   2. Offset longitudinal joints in successive courses a minimum of 6 in.
   3. Offset transverse joints in successive courses a minimum of 24 in.
   4. Construction transverse joints by bulkhead method or sawed vertical face method as described in 'The Asphalt Handbook'.

5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.10 COMPACTION

A. General: begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
   1. Complete compaction before mix temperature cools to 185 deg. F.

B. Breakdown Rolling: Accomplish breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Repair surfaces by loosening displaced material, filling with hot-mix asphalt, and re-rolling to required elevations.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling, while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
   1. Place to density requirements of drawings, or as directed by the Engineer or Owner.
   2. Average Density; 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges whiles still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving course over area affected and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.11 TOLERANCES

A. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
   1. Base Course: 1/4 inch.
   2. Surface Course: 1/8 inch.
   3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

B. Scheduled Compacted Thickness: Compact each course to produce the thickness indicated within the following tolerances:
   1. Base Course: Per Section 02207, “Aggregate Material”.
   2. Surface Course: Plus 1/4 inch, no minus.

C. Variation from True Elevation: Within +/-0-.05 feet.

3.12 SURFACE TREATMENTS

A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq.yd. (0.45 to 0.70 L/sq. M) to existing asphalt pavement and allow to cure. Lightly dust areas receiving excess fog seal with a fine sand.

3.13 PAVEMENT MARKING

A. Apply pavement markings per Section 02580, Pavement Markings".

3.14 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.
   1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing, at Contractors expense, will be performed to determine compliance of corrected work with specified requirements.

C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D3549.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

E. In-Place Density: Samples of un-compacted paving mixtures and compacted pavement will be secured by testing agency according to ASDTM D979.
   1. Reference laboratory density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 1559, and compacted according to job-mix specifications.
   2. Reference maximum theoretical density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
   3. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
      a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, but in no case will fewer than 3 cores be taken.
      b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726. One test per 1000 sq. yd. or less will be taken on installed pavement.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.15 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury for seventy-two (72) hours or until surface temperature is less than 140 degrees F (60 degrees C).

END OF SECTION 02754

EXHIBIT E
SECTION 02208

BASE AGGREGATES

PART 1 - GENERAL

1.1 SUMMARY

A. This specification covers the quality and size of mineral materials used in base courses.

B. The term source shall mean any of the following:
   1. A permanent commercial location.
   2. Contractor manufactured material either commercial or on-site.

1.2 RELATED DOCUMENTS

A. Documents affecting work off this Section include but are not necessarily limited to the Drawings (if applicable), UNLV written directions, UNLV Terms and Conditions, or Purchase Order.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Section 02752: Asphaltic Concrete Paving.
   2. Section 02754: Recycled Asphaltic Concrete Paving.
   3. Section 02207: Aggregate Material.

C. Related Interagency Quality Assurance Committee (IQAC) procedures.

1.3 SUBMITTALS

A. Procedure: Submit each item in this Section and according the UNLV direction.
   1. Comply with pertinent provisions of Sections 01330, and as follows:

B. Aggregate Base: The Contractor shall submit within seven (7) calendar days after receipt of the Notice to Proceed, certification from the testing firm that the aggregate base material meets the requirements of these specifications for approval by the Engineer or Owner's representatives.

C. Approval of the certification shall be the Contractor's authorization to order the required material. There will be no deviation from the approved certification without written approval from the Engineer or Owner's representative.

PART 2 - PRODUCTS

2.1 GENERAL

A. The mineral aggregate shall be the crushed and screened product from approved aggregate deposits. The Engineer or Owner reserves the right to prohibit the use of aggregates from any source when:
   1. The character of the material is such, in the opinion of the Engineer or Owner, as to make improbable the furnishing of aggregates conforming to the requirements of these specifications.

2. The character of the material is such, in the opinion of the Engineer or Owner, that undue additional costs may be accrued by UNLV.

B. The mineral aggregate shall be clean, hard, durable, free from, any frozen lumps, deleterious matter, and harmful adherent coatings. Crushed Portland cement concrete and asphaltic concrete pavement will be permitted, subject to the requirements of these specifications. No material subject to regulation as hazardous wastes as defined in the Nevada Administration code 444.8565 shall be allowed.

2.2 IQAC SOURCE QUALIFICATION

A. For expediting of material source and type approvals, a listing of qualified materials has been provided on the IQAC website.

B. Any listed material is considered qualified for use without a material testing submittal. However, this does not relieve the Contractor of project testing and the material as required in these specifications.

C. The IQAC posted materials indicated in Table 1 are subject to re-approval annually for continued posting on the IQAC website.

Table 1 – IQAC Materials that Require Annual Qualifications

Type II Aggregate Base

2.3 DEFICIENCIES

A. If the product of a deposit is deficient in material passing the No. 16 sieve, filler from other approved deposits may be added at the crushing and screening plants. This is not to be construed as a waiver of any of the requirements contained herein.

PHYSICAL PROPERTIES AND TESTS

2.4 PLASTIC LIMITS

A. When specified, aggregates shall conform to the applicable requirements of the following table:

Table 2 – Plastic Limits

Percentage by Weight Passing 200 Sieve	Plasticity Index Minimum
0.1 to 3.0	15
3.1 to 4.0	12
4.1 to 5.0	9
5.1 to 8.0	6
8.1 to 11.0	4
11.1 to 15.0	3

2.5 TYPE II AGGREGATE BASE

A. This Aggregate shall conform to the following requirements

Table 3 – Type II Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve
1-inch	100
¾ inch	90-100
No. 4	35-65
No. 16	15-40
No. 200	2-10

Table 4 – Type II Acceptance Limits

Quality Control Test	Test Method	Requirements
Sieve Analysis	AASHTO T27	Table 8
Sampling Aggregate from Calibrated Conveyor stream or belt cut[1]	AASHTO T2	-
Fractured Faces	Nev. T230	70% Minimum
Plasticity Index	AASHTO T90[2]	Table 3
Liquid Limit	AASHTO T89	35 Minimum
Resistance (R Value) or Resilient Modulus	ASTM D2844 AASHTO T307	78 Minimum for road base 35,000 psi minimum for road base
Percentage of Wear (500 Rev.)	AASHTO T96	45% Maximum
Total Available Water Soluble Sulfates[3]	AWWA 3500-NaD AWWA 4550 E	Less than 0.3% by dry weight of soil

2.6 SOURCE QUALITY CONTROL TESTING

A. General
   1. There are 2 testing aspects to Source material acceptance.
      a. Testing by the source for annual posting on the IQAC website of qualified materials.
      b. Contractor project quality control Source testing for non –qualified materials.
   2. The acceptance of the Source material shall be at the production plant while the acceptance of the Contractor-placed materials is at the project site.
   3. Any laboratory submitting to an agency shall be R-18 AASHTO accredited in the appropriate test method in accordance with Table 5, “Source Quality Control Testing Requirements,” where applicable and testing reviewed and stamped by a Nevada professional engineer who has responsible charge of the work. The use of a professional engineer by the Source could be the Source staff engineer or third party, but the professional engineer must have responsible charge of the testing and/or inspection.

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1. Sampling from a stockpile permitted only after approval of the Engineer; the conveyor device shall be calibrated every 3 months and record attached to sample document.
2. Test specimens shall be prepared following the dry preparation procedure AASHTO T87.
3. Required only for placement around waterline pipe.

B. IQAC Annual Material Prequalification
   1. Each individual location or "pit" shall be referred to as a "Source." The responsibility for testing and inspection is the material Source. Material shall be tested, inspected, and certified in accordance with Table 5, "Source Quality Control Testing Requirements." The Source shall submit to the IQAC agency engineer assigned for that Source. The reviewing agency is listed on the IQAC website page next to the Source material.
   2. Test data shall be included with the certifying document.
   3. The maximum qualification period is 1 year, or 6 months for aggregate blended with crushed concrete. The entire qualification process shall be completed, in accordance with the sections above, prior to the first day of April, or the aggregates blended with crushed concrete, the first day of April and the first day of October of each year. This includes, but is not limited to, submittal, agency review, all required retesting, and qualification from the IQAC member.

C. Non-Prequalified Materials
   1. If the material is not posted on the IQAC web page, the Source may elect to submit non-prequalified material to the Engineer or Owner for approval prior to use that complies with the above noted specification and shall have been tested within 60 days of the intended use.

D. Submittal
   1. All tests specified in this section shall be performed.
      a. The report(s) shall include any graphical representation of plotted data such as the R-value or the Proctor value(s) along with the pit name and location.
      b. The most current ASTM, AASHTO, NDOT, and AWWA methods shall be used when performing the tests.
   2. All samples shall be "cut" from the "belt". When circumstances do not allow for sampling during production, the Source shall coordinate with the Engineer or Owner to identify an alternative plan for sampling.
   3. IQAC Annual Submitting
      a. For the purposes of IQAC submittal, the Engineer is the IQAC reviewing agency as noted on the IQAC web page.
      b. For the annual submittal by the supplier, the material to be approved for use as aggregate shall be obtained and "split" by an AASHTO accredited laboratory with the Engineer or Owner present at the time the sample is obtained with the sample large enough for a full suite of testing for the Source and Engineer or Owner.
      c. The Engineer or Owner shall be notified a minimum of 48 hours prior to obtaining the sample.
      d. If the Engineer or Owner is not present during the sampling of the material, the results for that sample will not be accepted.
      e. Sampling shall be performed during normal working hours for the Engineer or Owner.
      f. If the source laboratory results are in compliance with the above noted specifications, Source shall submit the test report to the Engineer or Owner within 21 days of sampling requesting the review and approval of the materials for the proposed use of the material.
      g. Notification by the Source of samples not in compliance with the above noted specifications is requested but not required. Samples without notification or a qualification submittal within the 21-day period will be assumed by the IQAC to be outside the above noted specifications.
      h. The agency Engineer or Owner for a particular pit may accommodate minor adjustments for "tuning" of an operation. This courtesy shall not be extended during the qualification process.

4. Non-prequalified materials (materials not posted on the IQAC list)
    a. The material to be approved for use as aggregate shall be obtained and "split" by an AASHTO accredited laboratory with the UNLV Engineer or Owner's representative present at the time the sample is obtained with the sample large enough for a full suite of testing for the Source and Engineer.
        1). The UNLV Engineer or Owner's representative shall be notified a minimum of 48 hours prior to obtaining the sample.
        2). If the UNLV Engineer or Owner's is not present during the sampling of the material, the results for that sample will not be accepted.
        3). Sampling shall be performed during normal working hours for the UNLV Engineer or Owner.
        4). If the Source laboratory results are in compliance with the above noted specifications, the Source shall submit the test report to the UNLV Engineer or Owner's representative within 21 days of sampling with a letter requesting the review and approval of the materials report for the proposed use of the material.
    b. Notification by the Source of samples not in compliance with the above noted specifications is requested but not required.
        1). Samples without notification or a qualification submittal within the 21-day period will be assumed by the UNLV Engineer or Owner's representative to be outside the above noted specifications.
    c. This qualification is for one project only.

E. Report Format

1. The report shall be prepared and stamped by, or under the direction of, a professional engineer registered in the State of Nevada. The report shall be on the standard IQAC[4] form and shall include the pit name and location. The report shall include the following:
    a. Recommendations by the Source Professional Engineer.
    b. The testing results in accordance with the appropriate Table 5, "Source Quality Control Testing Requirements," test methods and reporting requirements, along with any graphs and charts.
2. When "no expectations" are taken, a conditional posting on the web site will be provided by the IQAC within 10 days of the receipt of the submittal.
3. Discrepancies between test results will be reviewed on a case-by-case basis. The UNLV Engineer will notify the aggregate producer of substantial test variations within 10 days of receipt of the qualification submittal.

F. Sampling and Testing
1. When the Contractor/Material Source or Engineer or UNLV representative acquires aggregate samples at an aggregate production plant, the plant shall provide a calibrated mechanical means for obtaining samples.
    a. If a mechanical means is not provided, a belt cut from a stopped conveyor will be required.
    b. Any mechanical sampling device shall be approved by the Engineer or UNLV representative prior to starting the respective phase of the project, or shall have been approved as part of a prior plant inspection by the Engineer or UNLV representative or the Engineer's representative.
    c. The sampling device shall be so constructed to provide for simultaneous "cutting" of the entire section of material being discharged or conveyed, and so constructed that small representative samples may be taken frequently and

these samples combined to form the complete sample.

4. The form is on the IQAC website, or use a UNLV approved form.

d. The reference method for the mechanical procedure shall be a “belt cut” sample taken from a stopped conveyor belt.

e. Samples of the finished product of the plant shall be obtained prior to or as the material leaves the conveyor belt for the bin or stockpile.

2. Test results run from samples taken will be furnished to the Engineer by the Contractor or the Contractor’s representative. The results of such tests shall not be the basis for final acceptance of the material.

3. Sampling for final acceptance of materials will be as required in the appropriate UNLV Standard Specification sections and in general shall comply with the AASHTO requirements, where applicable, and with any exception to the method(s) listed on the IQAC website.

Table 5 – Source Quality Control Testing Requirements[5]

Spec Section	Description	Item	Reference Specification And/or Test Procedure	Frequency
02207	Type II Aggregate	Sampling from Calibrated conveyor Stream or belt cut	AASHTO T2	1/day at plant
02207	Type II	Total Available Water Soluble Sulfates*6	AWWA 3500-NaD AWWA 4550 E	1/month at plant
02207	Type II Aggregate	Plasticity Index Liquid Limit Resistance (R Value) Or Resilient Modulus	AASHTO T90 *7 AASHTO T89 ASTM D2844 ASSHTO T307	1/day at plant 1/day at plant Annually for IQAC Source Qualification Or for Project Annually for IQAC Source Qualification Or for Project

END OF SECTION 00208

5. Review the IQAC website for any exceptions to the listed test methods.
6. Required only for placement around waterline pipe.
7. Test specimens shall be prepared following the dry preparation procedure AASHTO T87.

EXHIBIT E
SECTION 02755

PLANTMIX ASPHALTIC CONCRETE PAVEMENTS - GENERAL

PART 1 - GENERAL

1.1 SUMMARY

A. These Specifications include general requirements applicable to all types of asphaltic concrete pavements of the plantmix type irrespective of gradation of aggregate, kind, and amount of bituminous materials, or pavement use.

B. Work consists of one or more courses of asphaltic concrete mixture constructed on the prepared foundation in accordance with these specifications and the specific requirements of the type under contract, and in conformity with the lines, grades, thicknesses, and typical cross sections shown on the Drawings or established by the Engineer or Owner.

1.2 PAVEMENT STRUCTURAL DESIGN

A. Pavement sections shall be designed in accordance with the 1993 AASHTO Guide for Design of Pavement Structures. The following parameters, based upon the AASHTO Guide and the 1996 Nevada Department of Transportation Pavement Structural Design and Policy Manual, shall be used in the design calculations. The design shall be stamped and signed by a professional engineer registered in the state of Nevada.

1. The reliability factor will be a minimum of 80 percent with a standard normal deviate (ZR) of -0.841 for all pavements on the UNLV Campus.
2. The standard deviation will be 0.45.
3. The initial service index will be 4.2 and the final service index 2.5 for all classifications.
4. Drainage coefficients shall not exceed 1.0.
5. The structural coefficient for asphalt will be 0.35.
6. For materials meeting Section 02207, “Aggregate Material,” the elastic modulus shall be 25,000 psi and the structural coefficient shall be 0.12.
7. If required on a project, soil testing will be performed in accordance with ASTM D2844 or AASHTO T190 to determine a representative Resistance (R) value for the prepared subgrade. The subgrade shall be prepared in accordance with the Geotechnical Soils Investigation Report, and soil sampling performed subsequent to rough grading to confirm the original results. An average of the R-values may be used if the soil classification results are consistent, or if the values do not differ by more than 10. The minimum testing requirements are 1 right-of-way R-value test and post grading soil classifications every 1,000 linear feet of roadway, with a minimum of 2 classifications per project.
8. The subgrade R-value (psi) shall be converted to a Resilient Modulus (MR, psi) using the following correlation: $MR=145*(10^{((0.0147*R)1.23)})$.
9. The minimum AC sections are 2.5 inches for parking stalls, 3.0 inches for drive aisles, 3.5 inches for entry roads.
10. All designs require a minimum of 4 inches Type II aggregate base material.
11. The subgrade shall be scarified and recompacted to a minimum of 95 percent, to minimum depth of 8 inches.

B. The minimum design equivalent axial loads (EAL) based on a 20-year design are 7.2E+3 for parking drive aisles and campus entry roads.

PART 2 - MATERIALS

2.1 MIXTURE COMPOSITION

A. The asphaltic concrete plantmix shall be composed of a mixture of aggregate, mineral filler if required, and bituminous material. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that the resulting mixture meets the grading requirements of the job-mix formula.

B. Before starting work, the contractor shall submit a proposed job-mix formula in writing, for use by the Engineer in setting the job-mix formula to be used.
   1. The proposed job-mix formula shall be determined by a testing laboratory under the direction and control of a registered professional engineer, based on tests performed in accordance with the "Marshall Method of Mix Design" as described in the Asphalt Institute Manual Series No. 2 (MS-2), latest edition.
   2. The number of compaction blows to be applied to the specimens will be based on the appropriate traffic category.
   3. Traffic Category II will use a 50-blow design and will apply to parking lots, drive aisles, and campus entry roads.
   4. Unless otherwise specified, voids determinations and effective asphalt contents will be determined and reported in accordance with procedures described herein.

C. The job-mix formula shall be selected in accordance with the following procedures:
   1. Determine asphalt content required for 4 percent air voids, and
   2. Determine the average asphalt content for:
      a. Maximum density.
      b. Maximum stability.
      c. Four (4) percent air voids.
   3. The lower of the asphalt contents obtained for a. or b. above will be used as the design asphalt content for the job-mix formula.

D. The job-mix formula asphalt content shall satisfy all Marshall Design Criteria as shown in the following table:

MARSHALL DESIGN CRITERIA

TRAFFIC CATEGORY	**II TRAFFIC INDEX (TI) < 7.0**	
Compaction Blows Each End of Specimen	**50**	
Test Property	**Min.**	**Max.**
Stability, Lb.	1500	-
Flow, 0.01 In.	8	16
Percent Total Air Voids	3	5
Percent Voids Filled With Asphalt	65	78
Minimum Voids in Mineral Aggregate-Percent	*	*

* See Table in Asphalt Institute MS-2 Manual

E. In addition to the Marshall Design Criteria set forth herein, the job-mix formula shall also meet the following tensile strength requirements for all traffic categories:

Test Property	Test Method	Requirements
Indirect Tensile Strength (Unconditioned)	AASHTO T283	65 psi minimum (50 psi minimum With AC-10 asphalt)
Indirect Tensile Strength (Retained Strength)	AASHTO T283	70 percent minimum

F. Should the job-mix formula fail to meet the tensile strength requirements, the Contractor shall add hydrated lime (hereinafter referred to as mineral filler) to the plantmix bituminous aggregates as specified in Subsection 3.8, "Preparation of Aggregates." If the addition of mineral filler fails to achieve the minimum tensile strengths, the contractor will be required to change sources of material, and submit a new job-mix formula that will satisfy all design criteria.

G. The test report shall show the curves and data tabulations used to determine the following characteristics:
1. Unit weight per cubic foot.
2. Percentage of air voids.
3. Percent voids filled with asphalt.
4. Marshall stability.
5. Percent voids in mineral aggregate (VMA).
6. Marshall flow.
7. Indirect tensile strength (Unconditioned and Retained strength).

H. Data tabulations shall include indications of the water absorption, aggregate bulk specific gravities for both coarse (retained on No. 8 sieve) and fine (passing No. 8 sieve) aggregate, theoretical specific gravity of bituminous mixture, absorbed asphalt, and effective asphalt content as determined in accordance with referenced Asphalt Institute procedures. ASTM D2041 will be used for determination of theoretical maximum specific gravity of bituminous paving mixtures.

I. The test report shall give the recommended asphalt content and the values for:
1. Unit weight per cubic foot (bulk density).
2. Stability.
3. Flow.
4. Air voids.
5. Voids filled with asphalt.
6. Voids in mineral aggregate (VMA).
7. Indirect tensile strength (Unconditioned and Retained strength).

J. The formula submitted shall propose definite single values for:
1. The percentage of aggregate passing each specified sieve.
2. The percentage of bitumen to be added (to 0.1 percent) based on weight of total mix.
3. The percentage of mineral filler to be added to the aggregate.
4. The temperature of the mixture leaving the mixer.
5. The temperature of the mixture in the hopper of the paving machine.

K. The job-mix formula aggregate with the allowable tolerances herein shall conform to Section 02756 "Aggregates for Asphaltic Concrete Courses," for plantmix bituminous base aggregates, plantmix bituminous surface aggregate, or plantmix bituminous open-graded aggregate, as applicable.

L. The Engineer or Owner will determine a job-mix formula with single values for Subsection 2.1, J.1-5, and so notify the Contractor in writing. This job-mix formula shall not be modified except with the written approval of the Engineer or Owner. The mix furnished shall conform to this job-mix formula, within the following range of tolerances:
   1. Aggregate passing the No. 4 and larger sieves: ±7 percent.
   2. Aggregate passing the No. 8 to No. 100 sieves: ±4 percent.
   3. Aggregate passing the No. 200 sieve: ±2 percent, but not to exceed upper limit of specification. Mineral filler is not considered as part of the aggregate.
   4. Bitumen content: ±0.3 percent.
   5. Temperature leaving the mixer: ±20 degrees F.
   6. Temperature in hopper of paving machine: ±20 degrees F.

M. Should there be a change in sources of material, a new job-mix formula shall be established before the new material is used. Check tests of properties of the plantmix bituminous materials shall be made on the first day of production and as requested by the Engineer or Owner during period of construction to confirm that all properties are in compliance with Marshall Design Criteria and tensile strength requirements. Adjustments in gradation, mineral filler content, and asphalt content shall be made as necessary to meet design criteria.

N. The temperature of the bituminous material just prior to mixing and of the completed mixture in the hauling vehicle just prior to leaving the plant shall conform to the following table:

PLANTMIX BITUMINOUS MIXTURE WITH ASPHALT CEMENT

Grade of Asphalt Cement	Bituminous Material		Plantmix Bituminous Base of Surface Mixtures	
	Min.	Max.	Min.	Max.
PG76-22CC, PG64-34CC	275°F	350°F	275°F	350°F
AC-40	275°F	350°F	255°F	350°F
AC-20, AC-30	265°F	330°F	245°F	325°F
AC-10	255°F	325°F	235°F	325°F
AC-20P	280°F	350°F	300°F	350°F

2.2 AGGREGATES

A. Aggregates shall comply with Section 02756, “Aggregates for Asphaltic Concrete Courses.”

2.3 COMMERCIAL MINERAL FILLER

A. Commercial mineral filler shall comply with Section 02756, Subsection 2.2.A,”Commercial Mineral Filler.”

2.4 BITUMINOUS MATERIALS

A. The bituminous material shall comply with Section 02758, “Bituminous Materials.” Bituminous material may be conditionally accepted at the source.

B. Unless otherwise specified in writing by the Engineer or Owner, for Category II pavements the grade of bituminous material for dense-graded mixes shall be AC-30 or AC-20 asphalt cement. The grade may be changed one step by the Engineer or Owner.

C. Certificates of Compliance for the asphalt, showing test values necessary for specification compliance, shall be made available upon request by the Engineer or Owner.

2.5 FIELD COMPACTION AND MIX DESIGN CORRELATION

A. Type 2 coarse mix design annual submittals only.

B. In an effort to establish the "point of refusal," if it has been determined that the in-place air voids are less than 6 percent or more than 8 percent, the mix design bitumen content shall be adjusted. This procedure will be required as a part of all new mix designs, and any field adjustment shall be noted.

C. The field compaction shall be as required in Section 3.11, "Rolling and Compaction."
   1. The in-place air voids, as based on the Maximum Theoretical Specific Gravity and 10 correlated nuclear tests or 5 cores, shall then be calculated.
   2. If the mean percent air voids is outside the limits noted above, the bitumen content shall be mathematically increased or reduced and noted on the mix design submittal. If adjustment is made, then a new control strip is required.
   3. Once the control strip meets the above requirements, it becomes the control strip for subsequent mix placements.

D. Subsequent compaction testing lots shall be tested in accordance with Section 3.12, "Acceptance Sampling and Testing of Bituminous Mixture." If the compliance cannot be maintained between the above limits, a new control strip shall be implemented to re-establish the mean density for testing.

PART 3 - CONSTRUCTION

3.1 BITUMINOUS MIXING PLANT

A. Sufficient storage space shall be provided for the aggregate, or for each size aggregate when required. The storage yard shall be maintained neat and orderly and the stockpile, or separate stockpiles when required, shall be readily accessible for sampling.

B. Mixing plants shall be of sufficient capacity and coordinated to adequately handle the proposed bituminous construction.

C. Mixing Plants. Plants used for the preparation of bituminous mixtures shall conform to the following requirements:
   1. Equipment for Preparation of Bituminous Material:
      a. Tanks for the storage of bituminous material shall be equipped to heat and hold the material at the required temperatures.
      b. The heating shall be accomplished by steam coils, electricity, or other approved means so that no flame shall be in contact with the tank or contents.
      c. The circulating system for the bituminous material shall be designed to ensure proper and continuous circulation during the operating period.
      d. Provisions shall be made for measuring and sampling storage tanks.
   2. Drier: The plant shall include a drier or driers which continuously agitate the aggregate during the heating and drying process.

3. Thermometric Equipment:
    a. An armored thermometer of adequate range in temperature reading shall be fixed in the bituminous feed line at the suitable location near the charging valve at the mixer unit.
    b. The plant shall be equipped with either an approved dial-scale, mercury-actuated thermometer, an electric pyrometer, or other approved thermometric instrument so placed at the discharge chute of the drier as to register automatically or indicate the temperature of the heated aggregate.
    c. The Engineer or Owner may require replacement of any thermometer by an approved temperature-recording apparatus for better regulation of the temperature of aggregates.
4. Smoke and Dust Control: The Contractor will be required to install satisfactory precipitation devices, or use other methods which will meet local conditions, city and county regulations as set forth by the Clark County Air Pollution Control Officer, and state laws pertinent to air pollution.
5. Truck Scales:
    a. Bituminous mixture shall be weighed on approved scales furnished by the Contractor or on public scales at no cost to UNLV.
    b. Such scales shall be platform scales.
6. Safety Requirements:
    a. Adequate and safe stairways to the mixer platform and sampling points shall be provided and guarded ladders to other plant units shall be placed at all points where accessibility to plant operations is required.
    b. Accessibility to the top of truck bodies shall be provided by a platform or other suitable device to enable the Engineer or Owner to obtain sampling and mixture temperature data.
    c. A hoist or pulley system shall be provided to raise scale calibration equipment, sampling equipment, and other similar equipment from the ground to the mixer platform and return.
    d. All gates, pulleys, chains, sprockets, and other dangerous moving parts shall be thoroughly guarded and protected.
    e. Ample and unobstructed passage shall be maintained at all times in and around the truck loading area.
    f. This area shall be kept from drippings from the mixing platform.

D. Batching Plant. Batch mixing plants shall conform to the following requirements:
1. Plant Scales:
    a. Scales shall be accurate to 0.5 percent of the minimum load that may be required. Poises shall be designed to be locked in any position to prevent unauthorized change of position.
    b. In lieu of truck scales, the Contractor may provide an approved automatic printer system which will print the weights of the material delivered, provided the system is used in conjunction with an approved automatic batching control system. Such weights shall be evidenced by a weight ticket for each load.
    c. The amount of filler material shall be determined by weighing on springless dial scales separate from the plant weigh hopper or by some method that uniformly feeds the mixer within 10 percent of the required amount.
2. Feeder for Drier: The plant shall be provided with accurate mechanical means for uniformly feeding the aggregate into the drier so that uniform production and uniform temperature will be obtained.
3. Screens: Plant screens capable of screening the aggregate to the specified sizes will be required.

4. Bins:
    a. The plant shall include storage bins of sufficient capacity to supply the mixer when it is operating at full capacity.
    b. Bins shall be arranged to ensure separate and adequate storage of appropriate fractions of the mineral aggregates.
    c. Separate dry storage shall be provided for mineral filler when used and the plant shall be equipped to feed such material into the mixer.
    d. Each bin shall be provided with overflow pipes, of such size and at such locations as to prevent backing up of material into other compartments or bins.
        1) Each compartment shall be provided with its individual outlet gate constructed so that when closed there shall be no leakage.
        2) The gates shall cut off quickly and completely.
        3) Bins shall be so constructed that samples representative of the entire material in the bin can be readily obtained.
5. Weigh Box or Hopper:
    a. All materials shall be proportioned by weight.
    b. Aggregate scales shall be one of the following:
        1) Multiple beam scales.
        2) Springless dial type scale.
        3) Fully automatic solid-state digital strain gauge transducer measuring device.
    c. Aggregate scales shall have a capacity exceeding 1-1/4 times the total amount of materials to be weighed in one operation. Each scale gradation shall be approximately 1/1000 of the total capacity of the scale.
    d. All scales used for proportioning materials shall be accurate to within 1 percent.
        1) The scales shall be sealed and certified by the State Sealer of Weights and Measures.
        2) Certifications shall be dated within the past 12 months and shall be renewed whenever required by the Engineer or Owner.
        3) If the plant is moved, a new certificate will be required.
    e. All scales shall be of such size and so arranged that they may be read easily from the operator's platform.
        1) The scales shall indicate the true net weight without the application of any factor.
        2) The dials of scales shall not be less than 12 inches in diameter.
        3) The figures on the scale dials shall be clearly legible.
    f. Weighing equipment shall be so insulated against the vibration or movement of other operating equipment in the plant that the error in weighting with the entire plant running will not exceed 1-1/2 percent for any batch.
6. Bituminous Control Unit: Satisfactory means, either by weighing or metering, shall be provided to obtain the proper amount of bituminous material in the mix within the tolerance specified. Means shall be provided for checking the quantity or rate of flow of bituminous material into the mixer.
7. Bituminous Control:
    a. The equipment used to measure the bituminous material shall be accurate to plus or minus 0.5 percent.
        1) The bituminous material bucket shall be a non-tilting type with a loose sheet metal cover.
        2) The length of the discharge opening or spray bar shall be not less than three-fourths the length of the mixer and it shall discharge directly into the mixer.

3) The bituminous material bucket, its discharge valve or valves, and spray bar shall be adequately heated.
4) Steam Jacket, if used, shall be efficiently drained and all connections shall be so constructed that they will not interfere with the efficient operations of the bituminous scales.
5) The capacity of the bituminous material bucket shall be at least 15 percent in excess of the weight of bituminous material required in any batch.
6) The plant shall have an adequately heated quick-acting, non-drip, charging valve located directly over the bituminous material bucket.

b. Bituminous material shall be measured by means of springless dial scales or metering devices. Springless dial scales shall have a capacity of not more than 1,000 pounds in 2-pound gradations.
1) The indicator dial shall have a capacity of at least 15 percent in excess of the quantity of bituminous material used in a batch.
2) The controls shall be constructed so that they may be locked at any dial setting and will automatically reset to that reading after the addition of bituminous material to each batch.
3) The dial shall be in full view of the mixer operator.

c. The flow of bituminous material shall be automatically controlled so that it will begin when the dry mixing period is over.
1) All of the bituminous material required for one batch shall be discharged in not more than 15 seconds after the flow has started.
2) The size and spacing of the spray bar openings shall provide a uniform application of bituminous material the full length of the mixer.
3) The section of the bituminous line between the charging valve and the spray bar shall be provided with a valve and outlet for checking the accuracy of the meter when a metering device is substituted for a bituminous material bucket.

8. Mixer:
a. The batch mixer shall be a twin pugmill type, steam jacketed, or heated by other approved means and capable of producing uniform mixtures within the specified tolerances.
b. It shall be equipped with a sufficient number of paddles or blades set improper order and operated at such speed as to produce a properly and uniformly mixed batch.
c. At the beginning of the mixing operation, the clearance between paddle tips and liner shall not exceed half the maximum aggregate diameter for the specified job-mix.
d. The clearance of the paddles or blades from all fixed and moving parts shall not exceed 1 inch.
e. Badly worn or defective paddles or blades shall not be used in mixing operations.

9. Control of Mixing Time:
a. The mixer shall be equipped with an accurate time lock to control the operations of a complete mixing cycle.
1) It shall lock the weigh box gate after the charging of the mixer until the closing of the mixer gate at the completion of the cycle.
2) It shall lock the mixer gates throughout the dry and wet mixing period.
3) The dry mixing period is defined as the interval of time between the opening of the weigh box gate and the start of introduction of bituminous material.
4) The wet mixing period is the interval of time between the start of introduction of bituminous material and the opening of the mixer gate.

b. The mixer shall be equipped with a timing device which will indicate by a definite audible or visual signal the expiration of the mixing period.

1) The device shall measure the time of mixing within an accuracy of 2 seconds.
2) A suitable automatic device for counting the number of completely mixed batches shall be provided and maintained in proper working condition.

c. When the aggregate and the bituminous material have been combined, the entire mass shall be mixed in an approved mixer.
1) The mixing shall continue until homogeneity and a uniform coating are achieved.
2) The output rate shall not exceed the manufacturer's capacity rating.

E. Drier Drum Mixing Plants. Drier drum mixing plants shall conform to the following requirements:
1. Aggregate Stockpiles: Comply with Subsection 3.08, paragraphs A through C.
2. Aggregate Proportioning:
a. The plant shall include a means for accurately proportioning each bin size of aggregate prior to the drying operation.
b. The plant shall have a mechanical feeder mounted under each compartment bin.
1) Each compartment bin shall have an accurately controlled individual gate for volumetrically measuring the material drawn from each compartment.
2) The feeding orifice shall be rectangular with one dimension adjustable by positive means.
3) Indicators shall be provided for each gate to show the respective gate opening in inches.
c. A meter for determining the rate of each feeder, or a revolution counter, shall be provided. Commercial filler material introduced into the mixer shall be drawn from storage bins by a continuous mechanical feeder which will uniformly feed the mixer within 10 percent of the required amount.
3. Weight Calibration of Aggregate: The plant shall include a means for calibration for each aggregate feeder by weighing test samples.
4. Bituminous Metering Device: The bituminous material shall be introduced into the mixer through a gallonage meter by a positive displacement metering device, equipped with a ready means of varying the bituminous material delivery rate.
5. Synchronization of Aggregate Feed and Bituminous Material Feed:
a. Satisfactory means shall be provided to afford a positive interlocking control between the flow of aggregate from each feeder and the flow of bituminous material.
b. The interlocking control shall indicate a visible or audible signal when the level of material in any one feeder approaches the strike off capacity of the fee gate, or shut the plant down.
6. Mixer:
a. The plant shall include a mixing device which will obtain homogeneity and a uniform coating.
b. The mixing output shall not exceed the manufacturer's capacity rating.
c. The moisture content of the bituminous mixture shall not exceed 3 percent at the discharge end of the dryer.
7. Surge Bins: the plant will be equipped with an approved surge bin at the discharge. This surge bin will be in excess of 20 tons, and shall be equipped with an approved surge batcher or other approved method satisfactory to the Engineer or Owner that will prevent segregation of the bituminous mixture as it is being discharged into the hauling vehicle.

3.2 HAULING EQUIPMENT

A. Trucks used for hauling bituminous mixtures shall be tight, clean, smooth beds which have been thinly coated with a minimum amount of paraffin oil, lime solution, or other approved material to prevent the mixture from adhering to the beds.

3.3 PAVERS

A. Bituminous pavers shall be self-contained, self-propelled units provided with an activated screed or strike-off assembly, heated if necessary, and capable of spreading the finishing courses of bituminous plantmix material in lane widths applicable to the specified typical section and thicknesses shown on the plans.

B. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of bituminous plantmix material in widths shown on the drawings, or as directed by the Engineer or Owner.

C. The asphalt paver shall operate independently of the vehicle being unloaded and shall be capable of propelling the vehicle being unloaded in a satisfactory manner.
   1. If necessary, the load of the haul vehicle shall be limited to that which will ensure satisfactory spreading.
   2. While being unloaded, the haul vehicle shall be in contact with the machine at all times, and the brakes on the haul vehicle shall not be depended upon to maintain contact between the vehicle and the machine.

D. Pavers shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed.

E. The screed or strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

F. Pavers shall be capable of placing the bituminous mixture to meet the surface tolerances specified under the respective sections of bituminous pavement.

3.4 ROLLERS

A. Rollers shall be vibratory, steel-wheeled or pneumatic-tired type, in good condition.
   1. Rollers shall be capable of reversing without backlash and operating at slow speeds to avoid displacement of the bituminous mixture.
   2. The number, type, and weight of roller shall be sufficient to compact the mixture to the required density without detrimentally affecting the completed material as determined by the Engineer or Owner.
   3. Comply with Subsection 3.11. “Rolling and Compaction.”

B. Rollers for the test strip shall meet the following requirements:
   1. Breakdown rollers shall be either a 3-wheeled steel roller or a 2-axle tandem or a 3-axle tandem weighting not less than 10 tons.
   2. Except as hereinafter permitted, pneumatic-tired roller shall comply with the following:
      a. Rollers shall consist of not less than 9 wheels equipped with pneumatic tires of equal size and diameter.
      b. Tires shall be mounted on 2 axles attached to a rigid frame, equipped with a loading platform or body suitable for ballast loading, so that the total weight of the roller can be varied to produce an operating weight per tire of between 1,000 and 2,000 pounds.

c. The tires shall have treads satisfactory to the Engineer or Owner.
d. The tires on the rear axle shall be so spaced that the entire gap between adjacent tires on the front axle will be covered by 1 tread of the following tires.
e. The tires shall be uniformly inflated so that the air pressure in the several tires will not vary more than 5 pounds per square inch. Inflation pressure in pounds per square inch shall be the tire manufacturer's recommendation.
f. Minimum tire size shall be 7.50 x 15 inches, 4 ply.

3. The use of pneumatic-tired rollers with fewer wheels and a greater maximum operating weight per tire than that specified herein will be permitted subject to the following requirements:
   a. The minimum width between the outer edge of the outside tires on a given axle shall be 60 inches.
   b. The weight of the roller and the tire pressure can be varied to produce a ground contact pressure between 50 and 70 psi.
4. The finish roller shall be a 2-axle tandem weighing not less than 8 tons.

3.5 WEATHER LIMITATIONS

A. The bituminous mixture shall not be placed upon any wet surface or when the surface temperature of the underlying course is less than specified in Table 1. The temperature requirement may be modified, but only when so directed by the Engineer or Owner.

TABLE 1 – BASE TEMPERATURE LIMITATIONS

Mat Thickness	Base Temperature (Minimum °F)
3 inches or Greater	40
Greater than 1 inch but less than 3 inches	45
1 inch or Less	50

3.6 PREPARATION OF EXISTING SURFACE

A. When the surface of the existing pavement or old base is irregular, it shall be brought to a uniform grade and cross section as shown on the plans.

B. The subgrade to receive asphalt concrete, or asphalt concrete base immediately prior to applying prime coat, shall conform to the compaction and elevation tolerance specified for the material involved and shall be free of loose or extraneous material.

C. If the plantmix bituminous surface is being constructed directly upon an existing hard-surfaced pavement, a tack coat of grade CSS-1h or SS-1h emulsified asphalt, diluted 50/50 at an approximate rate of 0.05 to 0.10 gallons per square yard, shall be uniformly applied upon the existing pavement preceding the placement of the asphalt concrete.
   1. The surface shall be free of water, foreign material, or dust when the tack coat is applied.
   2. To minimize public inconvenience, not greater area shall be treated in any one day than is planned to be covered by plantmix during the same day, unless otherwise authorized by the Engineer or Owner

D. A similar tack coat shall be applied to the surface of any previous course placed longer than 24 hours, or if a satisfactory bond cannot be obtained between the surface and a succeeding course, as determined by the Engineer or Owner.

E. The contact surfaces of all cold pavement joints, curbs, gutters, manholes, and similar structures shall be painted with grade CSS-1h or SS-1h emulsified asphalt immediately before the new asphalt concrete is placed. Comply with Section 02752, "Asphaltic Concrete Paving."

F. When specified in the contract, longitudinal and transverse joints and cracks shall be sealed by the application of an approved joint sealing compound before spreading the mixture upon a Portland cement concrete surface. Excess bituminous material shall be removed from joints and cracks prior to spreading the mixture.

3.7 PREPARATION OF BITUMINOUS MATERIALS

A. The bituminous material shall be heated to the specified temperature in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at a uniform temperature at all times.

3.8 PREPARATION OF AGGREGATES

A. Aggregates proportioned prior to the heating and drying process shall be separated into at least two general sizes:
   1. That portion of the material having a minimum of 80 percent passing No. 4 sieve.
   2. That portion of the material having a minimum of 80 percent retained on a No. 4 sieve.

B. The material shall be maintained within the limits above with a uniformity of plus or minus 5 percent. Each portion of the material shall be stored separately.

C. When moving the aggregate from storage to compartment bins, any method may be used which will not cause segregation, degradation, or combinations of aggregate which fail to meet the specified gradation requirement. Plantmix operations shall not commence until sufficient aggregate material is stockpiled to ensure one day's run.

D. Aggregate proportioned immediately after the heating and frying process shall be screened into a minimum of 2 fractions when minus ½-inch aggregate is used, and into a minimum of 3 fractions when larger sized aggregate is used. The screened material shall be conveyed to separate compartments ready for proportioning and mixing with bituminous material.

E. If the Contractor elects to introduce baghouse fines into the mix, the material shall be drawn from a storage facility in which the material is kept in a uniform free flowing condition.
   1. The baghouse fines for delivery to the plant shall be from a vane type metering device which is interlocked (electrical driven feeders shall be activated from the same circuit) to the flow of each aggregate feeder.
   2. The drive shaft on the baghouse fines vane feeder shall be equipped with a revolution counter accurate to 1/10 of a revolution, and a means for varying the rate.
   3. In a continuous mix and/or dryer drum plant, the baghouse fines shall be added at the asphalt feed line to ensure a uniform mix.
   4. In batch plants, the baghouse fines shall be added by the use of a separate bin.
   5. The baghouse fines shall be introduced at a point as approved by the Engineer or Owner at a percentage determined by the Engineer or Owner not to exceed 2 percent by dry weight of the aggregate.
   6. Baghouse fines shall be considered as part of the aggregate, and not as a mineral filler.

F. If mineral filler is required to meet the tensile strength requirements of the job-mix formula, it shall be added by one of the following methods:

1. Cold Feed Method:
    a. Hydrated lime (hereinafter referred to as mineral filler) shall be added to all plantmix bituminous aggregates at the rate of not less than 1 percent nor more than 2-1/2 percent of the weight of the fry aggregate. The exact rate of application shall be as determined by the job-mix formula.
    b. Mineral filler shall be drawn from a storage facility in which the mineral filler is agitated by air or other means to keep it in a uniform free flowing condition.
        1) The mineral filler for delivery to the mixer shall be from a vane type metering device which is interlocked, (Electrical driven feeders shall be actuated from the same circuit) to the flow of each aggregate feeder.
        2) The drive shaft on the mineral filler vane feeder shall be equipped with a revolution counter reading to 1/10 of a revolution, and a means for varying the rate.
    c. In continuous mix and/or drum dryer plants, the mineral filler shall be added to the aggregate after the aggregate is proportioned.
    d. In batch plants, the mineral filler shall be added to the aggregate prior to drying.
    e. Regardless of which type of plant is used, the following methods shall be utilized:
        1) Prior to the introduction of the mineral filler, sufficient moisture shall be added using spray bars at the aggregate bins to bring the aggregate to a moisture content where enough free surface moisture is available to thoroughly wet the aggregate and wet the lime.
            a) This content shall be a minimum of 4 percent.
            b) The actual amount of moisture required will be determined by the Engineer or Owner.
            c) After the addition of water and mineral filler, the aggregate shall be mixed using a horizontal twin-shaft pugmill.
            d) The mixing paddles shall be adjustable for angular position on the shaft to permit altering of the mixing pattern or retarding the flow to ensure that the aggregate is thoroughly coated with mineral filler.
            e) The volume of material in the pugmill shall not extend above the vertical position of the blade tips.
            f) The compound mixture shall be directly introduced into the hot plant.
            g) Stockpiling of the completed mixture is strictly prohibited.
        2) The moisture control valve shall be interlocked with the hot plant control room so the moisture control valve is automatically turned off when the cold fee belts are shut off. The control valve shall also turn on automatically when the cold feed belts are activated.
2. Marination Method:
    a. Hydrated lime (hereinafter referred to as mineral filler) shall be added to all fractions of the plantmix bituminous aggregates.
        1) The coarse aggregates shall be wet cured with mineral filler at a rate of 1 percent of the weight of dry aggregate.
        2) The fine aggregates shall be wet cured with mineral filler at a minimum rate of 2 percent of the weight of the dry aggregate.
    b. The aggregates shall be marinated (wet cured) in the stockpiles for a minimum of 48 hours.
    c. The wet cured aggregate in the stockpile shall be used within 45 calendar days. Materials marinated in stockpile in excess of 45 calendar days shall not be used for the production of plantmix bituminous aggregates unless otherwise approved by the engineer or Owner.

d. Prior to the introduction of the mineral filler, sufficient moisture shall be added using spray bars at the aggregate bins to bring the aggregates to a moisture content where enough free surface is available to thoroughly wet the aggregate and activate the lime.
   1) This content is recommended to be a minimum of 3 percent for coarse aggregates and 6 percent for the fine aggregates.
   2) The actual amount of moisture required will be determined by the Engineer or Owner.
   3) After the addition of water and mineral filler, the aggregates shall be mixed using a horizontal twin-shaft pugmill.
   4) The mixing paddles shall be adjustable for angular position on the shaft to permit altering of the mixing pattern or retarding the flow to ensure that the aggregate is thoroughly coated with mineral filler.
   5) The volume of material in the pugmill shall not extend above the vertical position of the blade tips.

e. Mineral filler shall be drawn from a storage facility in which the mineral filler is agitated by air or other means to keep it in a uniform free flowing condition.
   1) The mineral filler for delivery to the mixer shall be from a vane type metering device which is interlocked (electrical driven feeders shall be actuated from the same circuit) to the flow of each aggregate feeder.
   2) The drive shaft on the mineral filler vane feeder shall be equipped with a revolution counter reading to 1/10 of a revolution, and a means for varying the rate.

3. Slurry Method:
   a. Hydrated lime or slaked quicklime (hereinafter referred to as mineral filler) shall be added to all plantmix bituminous aggregates in slurry form.
      1) Add at a rate of not less than 1 percent nor more than 2-1/2 percent of dry mineral filler based on the weight of the dry aggregate.
      2) The exact rate of application shall be as determined by the job-mix formula.
   b. A slurry containing 1 part mineral filler and 2 parts water by weight is recommended.
      1) The actual amount of water required in the production of the slurry will be determined by the Engineer or Owner after a visual inspection to ensure that the aggregate is thoroughly and uniformly coated with the mineral filler.
      2) This addition of moisture to the aggregate prior to mixing of the mineral filler and aggregate will not normally be required.
   c. The slurry shall be prepared in a central mixing tank provided with agitation for keeping the mineral filler in suspension until applied to the aggregate.
      1) The slurry mixing tanks shall be capable of producing sufficient slurry for the hot mix asphalt manufacturing facility production rate, and shall produce a uniform slurry consistency.
      2) The plant shall be equipped with suitable pumps and meters for introducing the required amount of slurry to the aggregate. A suitable device shall be provided to the Engineer or Owner for determining the weight of mineral filler per gallon of slurry.
   d. If quicklime is used as the mineral filler, it shall be converted to hydrated lime by using one or more slaking tanks. The slaking unit shall be capable of:
      1) Complete slaking or hydration of the quicklime.
      2) Providing agitation for mixing and keeping the mineral filler in suspension until use.
   e. After the addition of the mineral filler slurry, the aggregate shall be mixed using the horizontal twin-shaft pugmill.
      1) The mixing paddles shall be adjustable for angular position of the shaft to permit altering of the mixing pattern or retarding the flow to ensure that the aggregate is thoroughly coated with mineral filler.
      2) The volume of material in the pugmill shall not extend above the vertical

position of the blade tips.

3) The completed mixture shall be directly introduced into the hot plant.
4) Stockpiling of the completed mixture is strictly prohibited.

3.9 MIXING

A. The permissible moisture content of the bituminous mixture just behind the paver shall not exceed 1-1/2 percent as determined by test method ASTM D1461 or equivalent.
   1. Should the aggregate contain excessive moisture when heated within the temperature limits, the Contractor will be required to take satisfactory corrective action before resuming plantmix operations.
   2. When an approved dryer drum mixing process is used, the moisture content of the bituminous mixture at discharge from the mixer shall not exceed 3 percent, and the resulting product at the discharge end of the direr shall be a homogenous mixture of uniformly distributed and properly coated aggregates of unchanging appearance.

B. The drier aggregate shall be combined in the mixer in the amount of each fraction of aggregates required to meet the job-mix formula. The bituminous material shall be measure or gauged and introduced into the mixer in the amount specified by the job-mix formula.

C. Commercial filler material, when required, shall be added to the mixer separately and shall be thoroughly dry. If the materials are mixed in a batching plant, the filler material shall be fed directly into the mixer as near the center as possible.

D. The time of mixing a batch shall begin on the charging stroke of the weight hopper dumping mechanism and shall end when discharge is started.
   1. Mixing shall continue until a homogenous mixture of uniformly distributed and properly coated aggregates of unchanging appearance is produced.
   2. In general, the time of mixing shall not be less than 30 seconds, except that the time may be reduced when, in the opinion of the Engineer or Owner, the sizes of aggregates are uniformly distributed and all particles are thoroughly and uniformly coated with asphalt binder.
   3. The output rate shall not exceed the manufacturer's capacity rating.

E. Should the mixture, at the plant or in place, show an excess or deficiency of bitumen, show injury or damage due to burning or overheating or show an improper combination of aggregates, due to the Contractor's failure to conform to the specified requirements, it shall be rejected and if still in the truck, shall be disposed of as required. If an unsatisfactory mix, as referred to above, has been placed, it shall be disposed of and replaced as directed. No compensation will be allowed for rejected material.

3.10 SPREADING AND FINISHING

A. The mixture shall be laid upon an approved surface, and shall be spread and struck off to the grade and elevation established. Bituminous pavers shall be used to distribute the mixture either over the entire width or over such partial width as may be practicable.

B. The forward rate of travel of the paving machine(s) shall be regulated to a speed dependent upon the capacity of the mixing plant to furnish the mixture and the rate at which the roller can obtain the required compaction. The machine shall be operated so that material does not accumulate and remain along the sides of the receiving hopper.

C. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the mixture shall be spread, raked, and compacted by hand tools. For such areas, the mixture shall be dumped, spread, and screeded to give the required compacted thickness, correct grade, and cross section.

D. The Contractor may window plantmixed bituminous base or surface material in front of the spreading and finishing machine, provided that the following conditions and requirements are strictly adhered to:
   1. The window is properly sized, thereby ensuring the delivery of the correct amount of material to the spreading and finishing machine at all times.
   2. The bituminous mixture shall be transferred from the windrow to the spreading and finishing machine in such a manner that the materials in the spreading machine will be a uniform mixture. The base upon which the windrow was formed shall not be disturbed, and there shall be no paving material remaining on this base between the pickup device and the spreading and finishing machine.
   3. The temperature requirements for the material in the hopper of the spreading and finishing machine are complied with. Plantmix bituminous mixture that does not meet the minimum temperatures specified shall not be incorporated in the work, but shall be wasted in a manner satisfactory to the Engineer or Owner.

E. Should any course of bituminous mixture placed by utilizing a windrow be interior, as determined by the Engineer or Owner, to that placed by transferring the bituminous mixture directly from the hauling vehicle to the spreading machine, the use of a windrow shall be discontinued.

F. The bituminous mixture spread through the paving machine during one day's operation shall come from a single plant manufacturer. Intermixing from more than one source shall not be allowed.

3.11 ROLLING AND COMPACTION

A. The initial or breakdown rolling shall consist of one complete coverage of the bituminous mixture with a steel-wheeled roller.
   1. Initial rolling shall commence at the lower edge and shall progress toward the highest portion of the roadbed.
   2. Under no circumstances shall the center be rolled first.

B. The initial or breakdown rolling shall be followed by rolling such that uniform density is obtained throughout the depth of the layer of the material being compacted.
   1. At least two rollers, one steel-wheeled, the other pneumatic-tired, shall be used.
   2. The total number of roller used shall be sufficient to obtain the required compaction while the mixture is in a workable condition.

C. The final rolling of the bituminous mixture shall be performed with the same type of roller used for breakdown rolling.

D. Rolling shall be performed in such a manner that cracking, shoving, or displacement will be avoided.
   1. All rollers shall be in good condition and the reversing mechanism maintained so that the roller is capable of changing directions smoothly.
   2. The roller shall be kept in continuous motion while rolling so that all parts of the pavement receive equal compression.
   3. The motion of the roller shall be slow enough at all times to avoid displacement of the pavement.
   4. Any displacement occurring as a result of reversing the direction of the roller, or from any

other cause, shall be corrected immediately by the use of rakes and fresh mixture when required.

E. To prevent adhesion of the mixture to the roller, the wheels shall be kept properly maintained.
   1. The use of diesel oil on pneumatic-tired rollers shall be kept to a minimum as determined by the Engineer or Owner.

3.12 ACCEPTANCE SAMPLING AND TESTING OF BITUMINOUS MIXTURE

A. At no cost to UNLV, field thickness and density determinations of the bituminous mixture shall be made in lots, each lot representing one day's placement.
   1. A lot shall be divided into 5 equal sublots, and 1 test shall be made for each sublot.
   2. The location of the field tests may be chosen on a random basis using ASTM D3665, Section 4.3, except that any random location given shall be set back 2 feet from a curb or 3 feet from an edge, joint, or seam.
   3. A summary of the random number chart used and the lot description shall be completed and approved by the Engineer or Owner prior to sampling and shall be included in the finished test results.

B. Determination of the field thickness of the compacted bituminous mixture, as required by the Engineer or Owner shall be accomplished by ASTM D3549, "Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens."

C. Determination of the field density of the compacted bituminous mixture shall be accomplished by either of the methods listed below. In case of dispute, ASTM D1188 as modified shall govern.
   1. ASTM D2950, "Density of Bituminous Concrete in Place by Nuclear Method." When this method is used, the nuclear device shall first be correlated with the density of core samples.
   2. ASTM D1188, Bulk Specific Gravity of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens." When this method is used, the procedure shall be modified to require the use of "Coated Specimens" (Parafilm or Paraffin) only. The use of Bulk Specific Gravity determinations by SSD (surface saturated dry) method are prohibited.

D. The use of ASTM D2950 shall include correlation of test results to drilled cores.
   1. A minimum of 1 lot (one full day's production), and not less than 5 sublots, shall be used for this correlation.
   2. Should any nuclear test density in the first lot differ from its corresponding drilled core density by more than 3.00 percent relative compaction, a second lot shall be correlated and the average of all sublots in the first and second lots, but not less than 10 sublots, shall be used for the correlation. The 4-inch cores shall be transferred to the Engineer or Owner along with the random number generator listing station/offset locations.

E. The theoretical maximum density of the bituminous mixture shall be determined by taking random samples of the mixture delivered to the job-site and testing in accordance with ASTM D2041, "Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures."
   1. At least 2 theoretical maximum density determinations shall be made for each day's production of bituminous mixture used in the work.
   2. If the day's production is less than 500 tons, then only 1 theoretical maximum density determination is required.

F. As a quality control measure, the Contractor shall, at no cost to UNLV, make periodic checks on the field density of the compacted bituminous mixture at any time during paving operations. The testing performed by the Contractor may be used by the Engineer or Owner in part or in whole as the basis of acceptance in addition to the Quality Assurance testing to be done by the Engineer or Owner.

G. The pavement thickness acceptance criteria are as listed below:
   1. If the average of all measurements meets or exceeds the design thickness, with no core more than 10 percent less than the design thickness, the placement is acceptable.
   2. If there is only an isolated thin area, the limits of the area should be identified to determine if a construction resolution is necessary.
   3. If the core results indicate a consistently thin section, with no core more than 15 percent less than the design thickness and the approval of the Engineer or Owner, the Contractor has the option of proposing a construction resolution or contributing an amount equivalent to the reduction in the asset value. Calculation of the lost asset value is accomplished with the following steps:
      a. Determine the annual numbers of 18-kip equivalent single axle loads (ESAL), based upon the design traffic index (TI), a 20-year design life and an assumed traffic growth rate.
      b. Calculate the composite structural number of the designed road section (i.e., the AC and aggregate base sections).
      c. Using the average AC thickness, calculate the structural number of the constructed road section.
      d. Determine the ESAL value that correlates with the reduced structural number.
      e. Based upon the annual ESAL counts, determine the corresponding design life of the reduced section.
      f. Using a 3 percent inflation factor and the unit cost of the AC (on a $/square yard basis) determine the equivalent uniform annual cost (EUAC) of each section.
      g. Multiply the reduction in design life by the EUAC to determine the reduced value of the pavement, on a unit cost basis.
      h. Multiply the unit cost by the pavement area.
   4. If the core results yield an average thickness greater than the design thickness, but are alternately very high and very low (more than 10 percent out), the Engineer or Owner may reject the placement.

H. The pavement density acceptance criteria for production placements shall be as listed below, otherwise specified in the project plans or contract documents:
   1. The average density for parking lots, parking lot aisles and campus entry roads shall be 92 percent +/2.0 percent (90.0 percent – 94.0 percent), with no single density deviating more than 4 percentage points (all measurements between 88 percent – 96 percent). If the average is between 2.0 percent – 4.0 percent out (88 percent – 90.0 percent or 94.0 – 96 percent), with no density more than 5.0 percent out (all measurements between 87 percent – 97 percent), the Contractor has the option of contributing the lost asset value of $1.22 per square yard per percentage point deviation from the acceptance range.

3.13 MAINTAINING TRAFFIC

A. Traffic shall not be allowed on newly placed pavement for at least 24 hours or until the bituminous paving mix in-place temperature has dropped below 104 degrees F.

B. Exceptions shall be made at the discretion of the Engineer or Owner. Artificial means to reduce the pavement temperature may be used as approved by the Engineer or Owner.

3.14 JOINTS

A. Placing of the bituminous paving shall be as continuous as possible.
   1. Rollers shall not pass over the unprotected end of the freshly laid mixture unless authorized by the Engineer or Owner.

2. Transverse joints shall be conformed by cutting back on the previous run to expose the full depth of the course.
3. A brush coat of asphalt emulsion shall be used on contact surface of transverse joints just before additional mixture is placed against the previously rolled material.

B. Longitudinal joints shall be spaced so that joints in succeeding courses will be at least 6 inches horizontally from joints in any preceding course. Lanes will be evened up each day to eliminate cold longitudinal joints insofar as practicable.

C. Transverse joints shall be spaced so that joints in succeeding courses will be a minimum of 5 feet horizontally from joints in any adjacent course. Lanes shall be evened up each day to eliminate cold transverse joints insofar as practicable.

D. Comply with Subsection 3.10, “Spreading and Finishing.”

3.15 SURFACE TOLERANCES

A. Surface tolerances will be specified under the respective section of bituminous pavement.

END OF SECTION 02755

EXHIBIT E
SECTION 02756

AGGREGATES FOR ASPHALTIC CONCRETE COURSES

PART 1 - GENERAL

1.1 GENERAL

A. The mineral aggregate shall be the crushed and screened product of approved deposits.

B. The Engineer or Owner reserves the right to prohibit the use of aggregates from any source when:
   1. The character of the material is such, in the opinion of the Engineer or Owner, as to make improbable the furnishing of aggregates conforming to these specifications; or
   2. The character of the material is such, in the opinion of the Engineer or Owner, that undue additional costs may be accrued by UNLV; or
   3. The maximum allowable water absorption of either coarse or fine aggregate exceeds 2.5 percent when tested in accordance with ASTM C127 (coarse aggregate) and ASTM C128 (fine aggregate).

C. The mineral aggregate shall be clean, hard, durable, and free from frozen lumps, deleterious matter, and harmful adherent coatings.

D. When producing plantmix aggregate, all natural fines passing the No. 4 sieve shall be screened from the coarse aggregate and may be reintroduced into the mix at a rate not to exceed 20 percent by dry weight of the combined aggregates.

E. The natural fines may be used only when all applicable mix design criteria have been met.

1.2 DEFICIENCIES

A. If the product of any deposit is deficient in the fraction passing the No. 50 sieve, additional filler from other approved deposits meeting the physical requirements may be added.

B. The added material shall be fed to the drier in a uniform manner from a separate stockpile.

C. If the added material is a commercial mineral filler, it shall be uniformly fed directly to the plant. This shall not be construed as waiver of any of the requirements contained herein.

PART 2 - PRODUCTS

2.1 PLANTMIX AND ROADMIX BITUMINOUS BASE AND SURFACE AGGREGATE, TYPES TWO FINE AND COARSE AND THREE

A. The aggregate shall conform to this subsection.

B. Test specimens shall be prepared following dry preparation procedure described in ASTM D4318, Section 10.2 through Section 10.2.5.

TABLE 1 – PLANTMIX AND ROADMIX AGGREGATE GRADATION

	Percent By Weight Passing Sieve
Sieve Sizes	**Parking Lots and Campus Entry Roads**
1-inch	100
¾-inch	90-100
½-inch	78-94
3/8-inch	68-84
No. 4	50-65
No. 8	30-49
No. 50	7-25
No. 200	2-9

TABLE 2 – PLANTMIX AND ROADMIX AGGREGATE SPECIFICATIONS

Project Tests	**Test Methods**	**Requirements**
Sieve Analysis	AASHTO T27	Above
Sampling Aggregate	ASTM D75	-
Fractured Faces	NEV. T230	Traffic Category II: 35% Minimum (2 Fractures minimum)
Plasticity Index	ASTM D4318	All Traffic Categories: 6 Maximum
Liquid Limit	ASTM D4318	All Traffic Categories: 35 Maximum
Methylene Blue Test	ASSHTO TP57	10 Maximum
Fine Aggregate Angularity	AASHTO T33	Traffic Category I: 45%

Source Tests	**Test Methods**	**Requirements**
Stripping Test	ASTM D1664	Satisfactory
Percentage of Wear (500 Rev.)	ASTM C131	All Traffic Categories: 35% Maximum
Elongation @ 5:1	ASTM D4791	10% Maximum
Soundness Test	ASTM C88	All Traffic Categories: 8% Maximum
Deleterious Materials	ASTM C142	All Traffic Categories: 0.3% Maximum

2.2 COMMERCIAL MINERAL FILLER

A. Commercial mineral filler shall conform to ASTM C977 for quicklime, ASTM C1097 for hydrated lime, and ASTM D3910 and ASTM D242 for slurry seal and microsurfacing.

B. Sampling of the mineral aggregate and mineral filer shall conform to AASHTO T2/ASTM D75 methods.
   1. All aggregate shall be from the same source.
   2. No field blending will be allowed.

C. When tested according to the following tests, the mineral aggregate shall meet the following requirements:

TABLE 3 – MINERAL FILLER AGGREGATE GRADATION

Property	Test Method	Specification
Sand Equivalent	AASHTO T176 / ASTM D2419	50 Minimum for Slurry and 65 Minimum for Microsurfacing
Plasticity Index	ASTM D4318	NP
Soundness, %	AASHTO T104/ ASTM C88	15 Maximum (using NA_2SO_4)
Abrasion Resistance, %	ASSHTO T96/ ASTM C131	30 Maximum. Abrasion test shall be run on the aggregate before it is crushed.

D. When tested in accordance with AASHTO T27, AASHTO T11, ASTM C136, and ASTM C117, the mineral aggregate with mineral filler shall conform to the gradations indicated below. Percentage passing shall not vary from the high limit to the low limit on any 2 consecutive sieves.

2.3 SCREENINGS

A. The screenings shall conform to the following requirements:

TABLE 4 – SCREENINGS GRADATION

	Percentage By Weight Passing Sieve	
Sieve Sizes	**½-Inch**	**3/8-Inch**
½-inch	100	-
3/8-inch	90-100	100
No. 4	15-35	20-45
No. 16	0-4	0-6
No. 200	0-2	0-2

TABLE 5 – SCREENINGS SPECIFICATIONS

Projects Tests	Test Methods	Requirements
Sieve Analysis	AASHTO T27	Above
Sampling Aggregate	ASTM D75	-
Fractured Faces	NEV. T230	90% Minimum (2 fractures minimum)

Source Tests	Test Methods	Requirements
Percentage of Wear (500 Rev.)	ASTM C131	37% Maximum

2.4 SAND BLOTTER

A. The sand shall conform to the following requirements:

TABLE 6 – SAND BLOTTER GRADATION

Sieve Sizes	Percentage by Weight Passing Sieve
½-inch	100
No. 4	90-100
No. 16	30-75
No. 200	0-12

TABLE 7 – SAND BLOTTER SPECIFICATIONS

Project Tests	Test Methods	Requirements
Sieve Analysis	AASHTO T27	Above
Sampling Aggregate	ASTM D75	-
Organic Impurities	ASTM C40	-

TABLE 8 – ISSA, TYPE I GRADATION

Sieve Size	Mix Design Range (Percentage By Weight Passing Each Sieve)	Stockpile Tolerance
3/8-inch	100	0
No. 4	100	0
No. 8	90-100	+/- 5%
No. 16	65-90	+/- 3%
No. 30	40-65	+/- 3%
No. 50	25-42	+/- 3%
No. 100	15-30	+/- 2%
No. 200	10-20	+/- 2%

TABLE 9 – ISSA, TYPE II GRADATION

Sieve Size	Mix Design Range (Percentage By Weight Passing Each Sieve)	Stockpile Tolerance
3/8-inch	100	0
No. 4	90-100	+/- 5%
No. 8	65-90	+/- 5%

TABLE 10 – ISSA, TYPE II GRADATION

Sieve Size	Mix Design Range (Percentage By Weight Passing Each Sieve)	Stockpile Tolerance
No. 16	45-70	+/- 3%
No. 30	30-50	+/- 3%
No. 50	18-30	+/- 3%
No. 100	10-21	+/- 2%
No. 200	5-15	+/- 2%

TABLE 11 – ISSA, TYPE III GRADATION

Sieve Size	Mix Design Range (Percentage By Weight Passing Each Sieve)	Stockpile Tolerance
3/8-inch	100	0
No. 4	70-90	+/- 5%
No. 8	45-70	+/- 5%
No. 16	28-50	+/- 3%
No. 30	19-34	+/- 3%
No. 50	12-25	+/- 3%
No. 100	7-18	+/- 2%
No. 200	7-15	+/- 2%

2.5 SET CONTROL ADDITIVES

A. The type and quantity of additives in slurry seal and microsurfacing mix shall be determined by the material mix design and conform to the applicable sections of ASTM D3910 and ISSA T102.

END OF SECTION 02756

SECTION 02758

BITUMINOUS MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

A. This specification covers the quality of asphalt cement, liquid asphalt, emulsified asphalt, cationic emulsion, anionic emulsion and rubber asphalt crack sealant.

1.2 MATERIAL SOURCE RESPONSIBILITY

A. Bituminous materials supplied under these specifications shall be provided from a source authorized by the Engineer or Owner and/or IQAC.

1.3 SHIPPING NOTICE

A. Shipping notices shall be mailed upon making shipment and shall contain the following information:

1. Consignee and destination.
2. UNLV contract number.
3. Delivery point.
4. Date shipped.
5. Car initials or number of truck transport delivery ticket number.
6. Type and grade of material.
7. Quantity loaded.
8. Loading temperature.
9. Net quantity.
10. Signature of shipper or authorized representative.

B. When shipments of materials arrive on the project after normal working hours, the Contractor shall notify the engineer or Owner sufficiently in advance to make arrangements for an inspector to be present when the material is sampled. All sampling by the supplier or Contractor shall be performed or observed by an NAQTC certified technician.

C. Three copies of the shipping notice shall be mailed to UNLV.

1.4 REFINERY TEST REPORT

A. Refinery test reports shall be mailed to the Engineer or Owner as soon as tests have been completed. The report shall contain the following data:

1. Date of Shipment.
2. Car initials or number of truck transport delivery ticket number.
3. Destination and consignee.
4. UNLV contract number (or Purchase Order Number).
5. Type and grade of material.
6. Certificate of grade. Certify that material conforms these specifications, and itemize results on tests performed and date of test.
7. Signature of refinery's authorized representative.

PART 2 - PRODUCTS

2.1 ASPHALT CEMENTS

A. Asphalt cement shall be prepared by the distillation of crude petroleum. This asphalt shall be homogeneous, free from water, and shall not foam when heated to 347 degrees F.

B. These specifications cover the following viscosity grades: AC-2.5, AC-5, AC-10, AC-20, AC-30, AC-40 and the Superpave Performance Grades (PG) for the Southern Nevada region as listed in Tables 1, 2, 2A, and 2B.

TABLE 1 – LOCATION OF BITUMINOUS GRADE USE	
Location	**Viscosity grades**
Clark County Region below 5,000 feet elevation	PG 76-22CC, AC-30[1], or PG 64-22*[1]
Roads at and above 5,000 feet elevation	PG 64-34CC

1. For use in detours, below PCCP, permanent pavement patches, or other locations As determined by the Engineer.

C. The various grades set forth above shall conform to the requirements and the methods of testing shown in Table 2, Table 2A, and Table 2B.
   1. Performance grade material must have been prepared from crude petroleum product.
   2. The asphalt cements shall be homogenous, free from water and shall not foam when heated to 347 degrees F.
   3. Blending of asphalt cements to produce a specified performance grade shall result in a uniform, homogenous blend with no separation.
   4. Modified binders shall be blended at the source of supply and delivered as a completed mixture to the job site.
   5. It shall not be transported via railroad car.
   6. Only elastomeric Styrene Butadiene (SBS), Styrene-Butadiene (SB), Styrene-Butadiene Rubber (SBR), and Styrene Ethylbutylene Styrene (SEBS) rubber shall be added to the base binder asphalt cement, to produce a binder that complies with specification requirements.

2.2 LIQUID ASPHALTS

A. Liquid asphalts shall consist of materials conforming to the following classifications:
   1. Rapid curing (RC) products: Paving asphalt with a penetration of approximately 85 to 100 fluxed or blended with a naptha solvent.
   2. Medium curing (MC) products: Paving asphalt fluxed or blended with a kerosene solvent.
   3. Slow curing (SC) products: Natural crude oils or residual oils from crude asphaltic petroleum.

B. When tested in accordance with the standard methods of AASHTO and ASTM, the grades of liquid asphalt shall conform to the requirements specified in Table 2, Table 3, and Table 4.

2.3 EMULSIFIED ASPHALT

A. Emulsified asphalt for slurry seal shall conform to CQS-1h as specified in Table 7 when tested in accordance with AASHTO and ASTM.

2.4 SLURRY SEAL

A. The slurry seal and its components shall conform to the requirements of Table 7 when tested in accordance with AASHTO, ASTM, and ISSA procedures.

2.5 MICROSURFACING

A. The microsurfacing and its components shall conform to the requirements of Table 8 when tested in accordance with AASHTO, ASTM, and International Slurry Seal Association (ISSA) procedures.

2.6 POLYMER MODIFIED EMULSION MEMBRANE

A. This material shall consist of a polymer modified asphalt emulsion. Its role is to form a water impermeable seal at the existing pavement surface and to bond the new hot mix to the existing surface. The product shall be smooth and homogeneous and conform to the requirements in Table 10.

TABLE 2 – NEVADA TABLE 2 REQUIREMENTS
FOR ASPHALT CEMENT GREADED BY VISCOSITY AT 140°F
(Grading Based on Original Asphalt)

Test	AASHTO Test Method	Viscosity Grade					
		AC-2.5	AC-5	AC-10	AC-20	AC-30	AC-40
Viscosity at 140°F poise	T202	200-300	400-600	800-1,200	1,600-2,400	2,400-3,600	3,200-4,800
Viscosity at 275°F, cSt, Minimum	T201	125	175	250	300	350	400
Penetration at 77°F, 100 g/5 seconds, minimum	T49	220	140	80	60	50	40

TABLE 2 - NEVADA TABLE 2 REQUIREMENTS FOR ASPHALT CEMENT GRADED BY VISCOSITY AT 140°F
(Grading Based on Original Asphalt)

Test	AASHTO Test Method	VISCOSITY GRADE					
		AC-2.5	AC-5	AC-10	AC-20	AC-30	AC-40
Flash point (C.O.C., °F minimum)	T48	325	350	425	450	450	450
Solubility in Trichloroethylene (percent, minimum)	T44	99	99	99	99	99	99
Ductility at 39°F 1 cm/min. cm minimum	T51	50	25	15	5	--	--
Tests on Residue From RTFO							
Loss on heating, percent maximum	T240	--	1	0.5	0.5	0.5	0.5
Viscosity at 140°F poise maximum	T202	1,000	2,000	4,000	8,000	12,000	16,000

TABLE 2A - PERFORMANCE GRADE FOR ORIGINAL MATERIALS

Test	Test Method	PG 76-22CC Modified	PG 64-34CC Modified	PG 64-22
Original Materials				
Flash Point Degrees (°C) - minimum	AASHTO T48	230		
Viscosity (Brookfield) @135°C, Pa·s Maximum	ASTM D4402	3.0	3.0	3.0
Dynamic Shear G*/sin ä = minimum @ 10 rad/s at Grade Test Temp. °C	AASHTO T315	1.3	1.0	1.0
Ductility at 4°C, 5 cm/min. cm - minimum	NDOT T746	20	30	30
#10 Sieve Test, Particulates retained	NDOT T730	0		
Solubility in Trichloroethylene, percent (%) - minimum	AASHTO T44	99		
Polymer Content, % by mass minimum	(1)	3.0	3.0	N/A
Toughness in-lb – minimum(2)	NDOT T745	150	75	N/A
Tenacity in-lb - minimum	NDOT T745	100	50	N/A
If T&T fails, Elastic Recovery, percent (%) - minimum	AASHTO T 301	60	60	N/A

(1) Certificates of compliance provided for the material shall certify that the minimum polymer content is present.
(2) NV T 745 Method of Toughness and Tenacity: Scott Tester (or equivalent), inch-pounds @ 77° F., 20 inches per minute pull with tension head 7/8-inch diameter.

TABLE 2B - PERFORMANCE GRADE FOR RTFO AND PAV CONDITIONING

Tests On Residue From RTFO NDOT T728				
Test	**Test Method**	**PG 76-22CC Modified**	**PG 64-34CC Modified**	**PG 64-22**
Ductility at 5°C, 5cm/min. cm - minimum	NDOT T746	10	10	10
Mass Loss, Percent (%) - maximum	NDOT T728	1.0	1.0	1.0
Dynamic Shear, G*/sin ä = minimum kPa @ 10 rad/s at Test Temp. in °C	AASHTO T315	2.2	2.2	2.2
Test On Residue After PAV				
PAV, Test Temp. in °C	AASHTO R28	110	100	100
Dynamic Shear, G*/sin ä = Max kPa @ 10 rad/s at Grade Test Temp. in °C	AASHTO T315	5,000	5,000	5,000
BBR - Creep Stiffness, S -MPa maximum @ 60 sec, atGrade Test Temp. in °C	AASHTO T313	300	300	300
BBR m-value = minimum @ 60s, at Grade Test Temp. in °C	AASHTO T313	0.300	0.300	0.300
Direct Tension, Failure Strain = % minimum @ 1.0 mm/min, at Grade Test Temp. in °C	AASHTO T314	1.0	1.0	1.0

TABLE 3 - UNIFORM PACIFIC COAST SPECIFICATIONS FOR RAPID CURING (RC) LIQUID ASPHALTS

Test	**AASHTO Test Method**	**ASTM Test Method**	**GRADES**							
			RC-70		**RC-250**		**RC-800**		**RC-3000**	
			Min.	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**
Kinematic Viscosity at 140°F cSt	--	D2170	70	140	250	500	800	1,600	3,000	6,000
Flash Point (Tag Open Cup), °F	T79	D1310	--	--	80	--	80	--	80	--
Distillation										
Distillate percent of total distillate to 680°F	--	--	10	--	--	--	--	--	--	--
to 437°F	T78	D402	50	--	30	--	15	--	--	--
to 500°F	--		70	--	60	--	45	--	25	--
to 600°F	--	--	85	--	80	--	75	--	70	--
Residue from distillation to 680°F, volume percent by difference	--	--	55	--	65	--	75	--	80	--
Test on Reside from Distillation										
Penetration, 77°F, 100g/5 seconds	T49	D5	80	120	80	120	80	120	80	120
Ductility, 77°F, cm*	T51	D113	100	--	100	--	100	--	100	--
Solubility in Trichloroethylene, %	T44	D2042	99.5	--	99.5	--	99.5	--	99.5	--
Water, %	T55	D95	--	0.2	--	0.2	--	0.2	--	0.2
GENERAL REQUIREMENT: The material shall not foam when heated to application temperature recommended by the Asphalt Institute.										
* If ductility is less than 100, material will be accepted if ductility at 60°F is 100 minimum at a pull rate of 5 cm/min										

TABLE 4 - UNIFORM PACIFIC COAST SPECIFICATIONS FOR MEDIUM CURING (MC) LIQUID ASPHALTS

Test	AASHTO Test Method	ASTM Test Method	GRADES							
			MC-70		MC-250		MC-800		MC-3000	
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Kinematic Viscosity at 140°F cSt	T201	D2170	70	140	250	500	800	1,600	3,000	6,000
Flash Point (Tag Open Cup), °F	T79	D1310	100	--	150	--	150	--	150	--
Distillation										
Distillate percent of total distillate to 680°F	--	--	--	--	--	--	--	--	--	--
to 437°F	--	--	--	20	--	10	--	--	--	--
to 500°F	T78	D402	20	60	15	55	--	35	--	15
to 600°F	--	--	65	90	60	87	45	80	15	75
Residue from distillation to 680°F, volume percent by difference	--	--	55	--	67	--	75	--	80	--
Test on Reside from Distillation										
Penetration, 77°F, 100g/5 seconds	T49	D5	120	250	120	250	120	250	120	250
Ductility, 77°F, cm*	T51	D113	100	--	100	--	100	--	100	--
Solubility in Trichloroethylene, %	T44	D2042	99.5	--	99.5	--	99.5	--	99.5	--
Water, %	T55	D95	--	0.2	--	0.2	--	0.2	--	0.2
GENERAL REQUIREMENT: The material shall not foam when heated to application temperature recommended by the Asphalt Institute.										
* If penetration of residue is more than 200 and ductility at 77°F is less than 100, material will be accepted if ductility at 60°F is 100+										

TABLE 5 - UNIFORM PACIFIC COAST SPECIFICATIONS FOR SLOW CURING (MC) LIQUID ASPHALTS

Test	AASHTO Test Method	ASTM Test Method	GRADES							
			SC-70		SC-250		SC-800		SC-3000	
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Kinematic Viscosity at 140°F cSt	T201	D2170	70	140	250	500	800	1,600	3,000	6,000
Flash Point (Tag Open Cup), °F*	T48	D1310	150	--	175	--	200	--	250	--
Distillation										
Total Distillate to 680°F, % by volume	T78	D402	10	30	4	20	2	12	--	5
Tests on Residue From Distillation										
Kinematic Viscosity of Distillation Residue at 140°F, stokes	T201	D2170	4	70	8	85	20	140	40	350
Ductility at 77°F, 5cm/min., cm	T51	D113	100	--	100	--	100	--	100	--
Solubility in Trichloroethylene, %	T44	D2042	99.5	--	99.5	--	99.5	--	99.5	--
Water, %	T55	D95	--	0.5	--	0.5	--	0.5	--	0.5
* Flash point by Cleveland Open Cup may be used for products having a flash point greater than 175°F										

TABLE 6 - UNIFORM PACIFIC COAST SPECIFICATIONS FOR ANIONIC EMULSIFIED ASPHALTS

Test	AASHTO Test Method	ASTM Test Method	Rapid Setting				Slow Setting			
			RS-1		RS-2		SS-1		SS-1h	
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Test on Emulsions										
Viscosity SSF @ 77°F, sec.	T72	D88	20	100	--	--	20	100	20	100
Viscosity SSF @ 122°F, sec.	T72	D88	--	--	75	400	--	--	--	--
Settlement, 5 days, % [1]	T59	D244	--	5	--	5	--	5	--	5
Storage Stability, 1 day, % [2]	T59	D244	--	1	--	1	--	1	--	1
Demulsibility, 35ml .02N, Calcium Chloride. % [3]	T59	D244	60	--	60	--	--	--	--	--
Cement Mixing Test, %	T59	D244	--	--	--	--	--	2.0	--	2.0
Sieve Test, %	D59	D244	--	0.10	--	0.10	--	0.10	--	0.10
Residue by distillation, %	T59	D244	55	--	63	--	57	--	57	--
Test on Residue from Distillation Test [4]										
Penetration @ 77°F, 100g, 5sec.	T49	D5	100	200	100	200	100	200	40	90
Ductility @ 77°F, 5m/min., cm	T51	D113	40	--	40	--	40	--	40	--
Solubility in Trichloroethylene, %	T44	D2042	97.5	--	97.5	--	97.5	--	97.5	--

[1] The test requirement for settlement may be waived when the emulsified asphalt is used in less than 5 days' time, or the purchaser may require that the settlement test be run from the time the sample is received until it is used, if the elapsed time is less than 5 days.

[2] The 24-hour 1-day storage stability test may be used instead of the 5-day settlement test.

[3] The demulsibility test shall be made within 30 days from the date of shipment.

[4] A harder base asphalt meeting current paving asphalt specifications may be specified with the provision that the test requirements on the Residue from Distillation be waived.

TABLE 7 - UNIFORM PACIFIC COAST SPECIFICATIONS FOR CATIONIC EMULSIFIED ASPHALTS

Test	Test Method		Rapid Setting				Medium Setting				Slow Setting				Quick Setting [6]			
			CRS-1		CRS-2		CMS-2S		CMS-2		CMS-2H		CSS-1		CSS-1h		CQS-1h	
	AASHTO	ASTM	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Test on Emulsions																		
Viscosity SSF @ 77°F, sec.	T72	D88	--	--	--	--	--	--	--	--	--	--	20	100	20	100	20	100
Viscosity SSF @ 122°F, sec.	T72	D88	20	100	100	400	50	450	50	450	50	450	--	--	--	--	--	--
Settlement, 5 days, % [1]	T59	D244	--	5	--	5	--	5	--	5	--	5	--	5	--	5	--	5
Storage Stability, 1 day [2]	T59	D244	--	1	--	1	--	1	--	1	--	1	--	1	--	1	--	1
Demulsibility, 35 ml 0.8% sodium dioctyl sulfosuccinate, % [3]	T59	D244	40	--	40	--	--	--	--	--	--	--	--	--	--	--	--	--

Coating Ability/Water Resistance:	T59	D244	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Coating, dry aggregate			--	--	--	--	Good	--	Good	--	Good	--	--	--	--	--	--	--
Coating, after spraying			--	--	--	--	Fair	--	Fair	--	Fair	--	--	--	--	--	--	--
Coating, wet aggregate			--	--	--	--	Fair	--	Fair	--	Fair	--	--	--	--	--	--	--
Coating, after spraying			--	--	--	--	Fair	--	Fair	--	Fair	--	--	--	--	--	--	--
Particle Charge Test	T59	D244	Positive		Positive		Positive		Positive		Positive		Positive [5]		Positive [5]		Positive	
Sieve Test, %	T59	D244	--	0.10	--	0.10	--	0.10	--	0.10	--	0.10	--	0.10	--	0.10	--	0.10
Cement Mixing Test, %	T59	D244	--	--	--	--	--	--	--	--	--	--	--	2.0	--	2.0	--	--
Distillation																		
Oil Distillate by volume of emulsion, %	T59	D244	--	3	--	3	--	20	--	12	--	12	--	--	--	--	--	--
Residue, %	T59	D244	60	--	65	--	60	--	65	--	65	--	57	--	57	--	60	--
Tests on Residue from Distillate Test [4]																		
Penetration, 77°F, 100g, 5sec.	T49	D5	100	250	100	250	100	250	100	250	40	90	100	250	40	90	45	60
Ductility, 77°F, 5cm/min., cm	T51	D113	40	--	40	--	40	--	40	--	40	--	40	--	40	--	40	--
Solubility in Trichloroethylene, %	T44	D2042	97.5	--	97.5	--	97.5	--	97.5	--	97.5	--	97.5	--	97.5	--	97.5	--

[1] The test requirement for settlement may be waived when the emulsified asphalt is used in less than 5 days' time, or the purchaser may require that the settlement test be run from the time the sample is received until it is used, if the elapsed time is less than 5 days.

[2] The 24-hour 1-day storage stability test may be used instead of the 5-day settlement test.

[3] The demulsibility test shall be made within 30 days from the date of shipment.

[4] A harder base asphalt meeting current paving asphalt specifications may be specified with the provision that the test requirements on the Residue from Distillation be waived.

[5] Must meet a PH requirement of 6.7 maximum (ASTM E70) if the Particle Charge Test result is inconclusive.

[6] Does not apply to polymer modified emulsion.

TABLE 8 SPECIFICATION FOR SLURRY SEAL MIX

TEST ON MIXTURE	TEST METHOD	REQUIREMENTS
Residual Asphalt, % of dry wt. of aggregate	--	7.5 - 13.5
Consistency, flow	ASTM D3910/ISSA T106	2 - 3 cm
Wet Cohesion, 30-minute set	ISSA T139	12 -13 kg/cm
Wet Cohesion, 60-minute set	ISSA T139	20 - 21 kg/cm
Set Time, 30 minutes	ASTM D3910	Negative
Excess Asphalt by LWT and Sand Adhesion	ASTM T109	50 g/ft² max.
Wet Stripping, % coating	ASTM T114	90 min.
Wet track Abrasion (6-day soak)	ASTM D3910/ISSA T100	75 g/ft² max.
Wet track Abrasion (1-hour soak)	ASTM D3910/ISSA T100	75 g/ft² max.
System Compatibility	ISSA T115	Pass
Mix time @ 77°F	ASTM D3910/ISSA T113	Controllable to 180 sec. minimum

TABLE 9 SPECIFICATION FOR MICRO-SURFACING MIX

TEST ON MIXTURE	TEST METHOD	REQUIREMENTS
Residual Asphalt, % of dry wt. of aggregate	--	5.5 - 9.5
Wet Cohesion, 30-minute set	ISSA T139	12 kg/cm
Wet Cohesion, 60-minute set	ISSA T139	20 kg/cm
Excess Asphalt by LWT and Sand Adhesion	ISSA T109	50 g/ft² max.
Wet Stripping, % coating	ISSA T114	90 min.
Wet track Abrasion (6-day soak)	ASTM D3910/ISSA T100	75 g/ft² max.
Wet track Abrasion (1-hour soak)	ASTM D3910/ISSA T100	50 g/ft² max.
Mix time @ 77°F	ASTM D3910/ISSA T113	Controllable to 120 sec minimum
Mix time @ 104°F	ASTM D3910/ISSA T113	Controllable to 120 sec minimum
Lateral Displacement	ISSA T147	5% max.
Classification Compatibility	ISSA T144	(AAA, BAA) 11 grade points minimum

Table 10 - SPECIFICATION FOR POLYMER MODIFIED EMULSION MEMBRANE

TEST ON EMULSION	Method	Min.	Max.
Viscosity @ 77°F, SSF	ASTM D88	20	100
Sieve Test, %	AASHTO T59	--	0.05
24-Hour Storage Stability, % [1]	AASHTO T59	--	1
Residue from Distillation @ 400°F, %	AASHTO T59	63	--
Oil portion from distillation ml of oil per 100 g emulsion [2]	AASHTO T59	63	--
TEST ON RESIDUE FROM DISTILLATION			
Solubility in TCE, % [3]	AASHTO T44	97.5	--
Elastic Recovery @ 50°F, % [4]	AASHTO T301	58	--
Penetration @ 77°F, 100 g, 5 sec, dmm	AASHTO T49	60	150

[1] After standing undisturbed for 24 hours, the surface shall show no white, milky colored substance, but shall be a smooth homogeneous color throughout.

[2] ASTM D244 with modifications to include a 400°F ± 10°F maximum temperature to be held for a period of 15 minutes. Alternatively, ASTM D244 (Sections 21-27) Residue by Evaporation may be utilized as a surrogate procedure. However, Residue by Distillation is preferred and shall be used as the reference procedure.

[3] ASTM D5546, "Standard Test Method for Solubility of Asphalt Binders in Toluene by Centrifuge," may be substituted where polymers block the filter in Method D2042.

[4] ASTM D5976, "Standard Specification for Type I Polymer Modified Asphalt Cement for Use in Pavement Construction," Section 6.2 with exception that the elongation is 20 cm and the test temperature is 50°F.

END OF SECTION 02758

EXHIBIT E
SECTION 02760

TACK COAT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section provides for preparing ant treating an existing asphalt concrete surface with asphaltic emulsion in accordance with these specifications and in conformance with the lines shown on the drawings, as established by the engineer, or as established by UNLV.

1.2 RELATED DOCUMENTS

A. Documents affecting work of this Section include but are not necessarily limited to the conditions of the UNLV Purchase Order, UNLV Request for Bids, or other such documents.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Section 01330: Submittal Procedures..

1.3 REFERENCES

A. Sections 01330, Submittal Procedures, and 01630, Product Substitution Procedures.

1.4 SUBMITTALS

B. Procedure: Submit each item in this Section according to these specifications and UNLV contract conditions.
   1. Comply with pertinent provisions of Section 01330.

C. Product Data and Shop Drawings: Within 5 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
   1. Product data: For each product specified. Include technical data and tested physical and performance properties.

D. Job-Mix Design: Certification that the job-mix design is in general use in the Las Vegas Valley for each job mix proposed for this Work.

D. Material Test Reports: Indicate and interpret test results for compliance of materials with requirements indicated.

E. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with these specifications.

B. Obtain materials from a qualified source and from same source throughout.

C. Installer Qualifications: Engage an experienced installer who has completed crack sealing similar in

material, design, and extent to that indicted for this project and with a record of successful in-service performance.

D. Manufacturers Qualifications: Engage a firm experienced in manufacturing crack sealing material similar to that indicated for this project and with a record of successful in-service performance.

E. Regulatory Requirements:
1. Conform to these specifications and other UNLV terms and conditions for crack sealing on the UNLV campus.

1.6 DELIVERY AND STORAGE

A. Deliver pavement-marking materials to project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

PART 2 - PRODUCTS

2.1 BITUMINOUS MATERIALS

A. The type and grade of bituminous material shall be SS-1h or CSS-1h asphalt emulsion.
1. The grade may be changed by the Engineer or Owner during construction
2. The bituminous material shall comply with Section 02758, "Bituminous Materials".
3. The bituminous material may be conditionally accepted at the source.

B. Asphalt emulsion used as a tack coat between the courses of plantmix surface or over an existing surface shall be of the type and grade specified and prepared for application as follows;
1. The emulsion shall be cut back by warm water.
2. The water shall be added to the emulsion to total 50 percent of the emulsion by weight.

PART 3 - EXECUTION

3.1 EQUIPMENT

A. The Contractor shall provide equipment for heating and applying the bituminous material.

B. The distributor shall be designed, equipped, maintained, and operated such that bituminous material at even heat may be applied:
1. Uniformly on variable widths of surface up to 14 feet.
2. At readily determined and controlled rates from 0.05 to 2.0 gallons per square yard with uniform pressure.
3. With an allowable variation from any specified rate not to exceed 0.02 gallons per square yard.

C. The distributor equipment shall include a tachometer, pressure gauges, accurate volume measurement devices or a calibrated tank, and thermometer for measuring tank contents temperatures.

D. The distributors shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.

3.2 WEATHER LIMITATIONS

A. Application of bituminous material will not be permitted when:
   1. The surface to be treated is damp or wet.
   2. Weather conditions are unsuitable.
   3. When the surface temperature is below 50 degrees F.

3.3 PREPARATION OF SURFACE

A. The existing surface shall be patched and cleaned and be free of irregularities to provide a smooth and uniform surface to receive the treatment.

B. The edges of existing pavements that will be adjacent to new pavement shall be cleaned to permit the adhesion of bituminous materials.

C. Where the Contractor is applying tack upon a previously constructed course under this contract, the patching, cleaning, repairing, and so forth will be at no additional const to UNLV unless directed otherwise.

D. Where the Contractor is applying tack upon a previously constructed course not a part of the contract, and when there are no items or provisions to pay for preparing the existing surface, the Contractor shall be paid for such preparation at a cost negotiated between UNLV and the Contractor.

3.4 APPLICATION OF ASPHALTIC EMULSION

A. The asphaltic emulsion shall be uniformly applied at the rate called for on the drawings or ordered by the Engineer or Owner.

B. The temperature of the material to be spread shall conform to Table 1 of Section 02761, “Prime Coat”, Subsection 3.4, “Application of Bituminous Material”.

C. The tack coat shall be applied so as to offer the least inconvenience to traffic and to permit one-way traffic without pickup or tracking of the bituminous material.
   1. Tack coat shall be applied only so far in advance that it will be covered during the following 36 hours.
   2. The tack coat shall be completely “broke” prior to being covered.

END OF SECTION 02760

EXHIBIT E
SECTION 02761

PRIME COAT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section provides for preparing ant treating an existing aggregate base with bituminous material, and blotter material, if required, in accordance with these specifications and in conformity as shown on the drawings, as directed by the Engineer, or owner.

1.2 RELATED DOCUMENTS

A. Documents affecting work of this Section include but are not necessarily limited to the conditions of the UNLV Purchase Order, UNLV Request for Bids, or other such documents.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 01330: Submittal Procedures.
2. Section 02758: Bituminous Materials
3. Section 02756: Aggregates for Asphaltic Concrete Pavements
4. Section 02760: Tack Coat

1.3 SUBMITTALS

B. Procedure: Submit each item in this Section according to these specifications and UNLV contract conditions.
1. Comply with pertinent provisions of Section 01330.

C. Product Data and Shop Drawings: Within 5 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
1. Product data: For each product specified. Include technical data and tested physical and performance properties.

D. Job-Mix Design: Certification that the job-mix design is in general use in the Las Vegas Valley for each job mix proposed for this Work.

D. Material Test Reports: Indicate and interpret test results for compliance of materials with requirements indicated.

E. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with these specifications.

B. Obtain materials from a qualified source and from same source throughout.

C. Installer Qualifications: Engage an experienced installer who has completed crack sealing similar in material, design, and extent to that indicted for this project and with a record of successful in-service

performance.

D. Manufacturers Qualifications: Engage a firm experienced in manufacturing crack sealing material similar to that indicated for this project and with a record of successful in-service performance.

E. Regulatory Requirements:
1. Conform to these specifications and other UNLV terms and conditions for crack sealing on the UNLV campus.

1.5 DELIVERY AND STORAGE

A. Deliver pavement-marking materials to project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

PART 2 - PRODUCTS

2.1 BITUMINOUS MATERIALS

A. The type and grade of bituminous material shall be MC-70 liquid asphalt unless otherwise specified . The grade may be changed 1 step by the Engineer or Owner during construction.

B. The bituminous material shall meet the applicable requirements of Section 02758, "Bituminous Material." The bituminous material may be conditionally accepted at the source.

2.2 SAND BLOTTER

A. Sand blotter shall meet the requirements of Section 02756.2.4, "Sand Blotter." The material may be accepted at the stockpile source.

PART 3 - EXECUTION

3.1 EQUIPMENT

A. The Contractor shall provide equipment for heating and applying the bituminous material and for applying blotter material.

B. The equipment shall beet the requirements of Section 02760.3.1, "Equipment."

3.2 WEATHER LIMITATIONS

A. Application of bituminous material will not be permitted when:
1. On a wet surface that has free-standing water.
2. When the atmospheric temperature is below 50 degrees F.
3. When weather conditions, in the opinion of the Engineer or Owner would prevent the proper construction of the prime coat.

3.3 PREPARATION OF SURFACE

A. The surface on which the bituminous prime coat is to be placed shall conform to the established lines and grades, shall be smooth and uniform, and shall be compacted to the required density.

B. If the required density deteriorates between the time the gravel course was compacted originally and the time the prime coat is placed, for any reason whatsoever, then the surface shall be recompacted to the required density at no additional cost to UNLV.

C. When required by the Engineer or Owner, an application of water shall be applied immediately before bituminous application.

3.4 APPLICATION OF BITUMINOUS MATERIAL

A. Bituminous material shall be applied to the width of the section to be primed by means of a pressure distributor in a uniform, continuous spread.

1. When traffic is maintained, not more than ½ of the width of the section shall be treated in one application.
2. Care shall be taken that the application of bituminous material at the junctions of spreads is not in excess of the specified amount.
3. Excess bituminous material shall be squeegeed from the surface.
4. Skipped areas or deficiencies shall be corrected.

B. When traffic is maintained, 1-way traffic shall be permitted on the untreated portion of the roadbed.

C. As soon as the bituminous material has been absorbed by the surface and will not pick up, traffic shall be transferred to the treated portion and the remaining width of the section shall be primed.

D. Application rate shall be between 0.10 and 0.25 gallon per square yard.

E. The temperature requirements pertaining to the application of liquid asphalts and asphaltic emulsions shall conform to the requirements of the following Table 1:

TABLE 1
SPRAYING TEMPERATURES OF LIQUID ASPHALTS
AND ASPHALTIC EMULSIONS

	Distributor Spraying Temperatures	
Grade & Type RC,MC,& SC	**Minimum ºF**	**Maximum ºF**
70	120	180
255	165	220
800	200	255
3000	235	290
Grade of Asphalt Emulsion		
RS-1, CRS-1	75	130
RS-2, CRS-2	110	160
SS-1, CSS-1	75	130
SS-1h, CSS-1h	75	130
CMS-2S	100	160

3.5 APPLICATION OF BLOTTER MATERIAL

A. If, after the application of the prime coat, the bituminous material fails to penetrate within 24 hours, blotter material may be spread in the amounts required to absorb any excess bituminous material.

B. Excess sand blotter shall be removed prior to the placement of the subsequent courses.

3.6 MAINTENANCE

A. All loose sand shall be completely removed from the treated areas before placing any pavement or surfacing material thereon.

B. Immediately in advance of placing asphalt concrete or asphalt concrete base, additional prime coat shall be applied as directed by the Engineer or Owner to areas where the prime coat has been damaged, and loose or extraneous material shall be removed, and no additional compensation will be allowed therefore.

END OF SECTION 02761

EXHIBIT E
SECTION 02762

SEAL COAT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section for the work to apply bituminous material on a compacted and bonded bituminous surface and blotter sand, if required, in accordance with these specifications and in conformity with the drawings or as established by the Engineer or Owner.

1.2 RELATED DOCUMENTS

A. Documents affecting work of this Section include but are not necessarily limited to the conditions of the UNLV Purchase Order, UNLV Request for Bids, or other such documents.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 01330: Submittal Procedures.
2. Section 02758: Bituminous Materials
3. Section 02756: Aggregates for Asphaltic Concrete Pavements
4. Section 02760: Tack Coat
5. Section 02761: Prime Coat

1.3 SUBMITTALS

B. Procedure: Submit each item in this Section according to these specifications and UNLV contract conditions.
1. Comply with pertinent provisions of Section 01330.

C. Product Data and Shop Drawings: Within 5 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
1. Product data: For each product specified. Include technical data and tested physical and performance properties.

D. Job-Mix Design: Certification that the job-mix design is in general use in the Las Vegas Valley for each job mix proposed for this Work.

D. Material Test Reports: Indicate and interpret test results for compliance of materials with requirements indicated.

E. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with these specifications.

B. Obtain materials from a qualified source and from same source throughout.

C. Installer Qualifications: Engage an experienced installer who has completed crack sealing similar in

material, design, and extent to that indicted for this project and with a record of successful in-service performance.

D. Manufacturers Qualifications: Engage a firm experienced in manufacturing crack sealing material similar to that indicated for this project and with a record of successful in-service performance.

E. Regulatory Requirements:
1. Conform to these specifications and other UNLV terms and conditions for crack sealing on the UNLV campus.

1.5 DELIVERY AND STORAGE

A. Deliver pavement-marking materials to project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

PART 2 - PRODUCTS

2.1 BITUMINOUS MATERIALS

A. Unless otherwise specified, the type and grade of bituminous material shall be SS-1h or CSS-1h asphalt emulsion. The grade may be changed by the Engineer or Owner during construction.

B. The bituminous material shall meet the applicable requirements of Section 02758, "Bituminous Material." The bituminous material may be conditionally accepted at the source.

2.2 SAND BLOTTER

A. Sand blotter shall meet the requirements of Section 02756, "Aggregates for Asphaltic Concrete Courses", Subsection 2.4, "Sand Blotter." The material may be accepted at the stockpile source.

PART 3 - EXECUTION

3.1 EQUIPMENT

A. The Contractor shall provide equipment for heating and applying the bituminous material and for applying blotter material.

B. The equipment shall beet the requirements of Section 02760, "Tack Coat", Subsection 3.1, "Equipment."

3.2 WEATHER LIMITATIONS

A. Application of bituminous material will not be permitted when:
1. On a wet surface that has free-standing water.
2. When the atmospheric temperature is below 50 degrees F.
3. When weather conditions, in the opinion of the Engineer or Owner would prevent the proper construction of the prime coat.

3.3 PREPARATION OF SURFACE

A. Immediately before applying the bituminous material, the surface to be sealed shall be thoroughly cleaned of all dirt and loose material by sweeping with power brooms supplemented by hand brooms in necessary.

B. The process of cleaning shall continue until dirt and loose material are removed from the entire width of the surfacing.

3.4 APPLICATION OF BITUMINOUS MATERIAL

A. Bituminous material shall not be spread later in the day than will permit the stopping of traffic control prior to darkness.

B. Bituminous material shall be applied to only one designated traffic lane at a time and the entire width of the lane shall be covered in one operation.

C. The bituminous material shall be uniformly applied at the rate called for on the plans or ordered by the Engineer or Owner.

D. The temperature of the bituminous material shall conform to the applicable requirements of Section 02761, “Prime Coat”, Subsection 3.4, “Application of Bituminous Material.”

E. The seal coat shall be applied in a manner to offer the least inconvenience to traffic and to permit 1-way traffic without pickup or tracking of the bituminous material.

F. When seal and screenings are to be applied to the central portion of the pavement, the shoulder seal coat shall be applied at least 4 days in advance of the application of the adjacent surface treatment requiring screenings, and the seal coats shall be applied so that the joints between the 2 types will present a neat and uniform appearance true to the line shown on the typical cross section and as established by the Engineer or Owner.

3.5 APPLICATION OF BLOTTER MATERIAL

The applicable requirements of Section 02761, “Prime Coat,” shall apply to this section when sand blotter is required.

END OF SECTION 02762