

# Attachment C

## Appendix 2 Tack Paving

**WEATHERTECH RACEWAY LAGUNA SECA  
SPECIFICATIONS FOR  
ASPHALT PAVING**

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## SECTION 1 GENERAL

### 1.1 Description

The work described herein shall consist of the furnishing, placing, and testing of the asphalt concrete for the Road Course, Pit Road, Base Patching, and Trench Patching for the project. The term “Owner” within these specifications refers to the Owner, the Owner’s Engineer, and the Owner’s consultants.

### 1.2 Qualifications

The Contractor shall provide evidence that they have completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance. Work on racetracks or automotive proving grounds will be considered. The Contractor shall provide key personnel, such as the foreman, experienced with paving racetracks or automotive proving grounds.

### 1.3 Submittals

The Contractor shall prepare and submit the job mix formulas (JMF), mix design test reports, aggregate quality and gradation test reports, and material certifications for aggregates, asphalt materials, and admixtures for review and approval. Release agents for truck beds and hand tools will also be submitted for review and approval. These shall be submitted for approval prior to any work being performed.

The Contractor shall submit, in writing, a proposed job specific Quality Control (QC) Plan in accordance with Section 39-2.01A(3)(c) of the *Standard Specifications* for approval before production begins. The QC Plan shall address all elements involved in the production, placement, and quality control of the asphalt mixtures incorporated in the project.

### 1.4 References

These specifications incorporate the most recent editions of the following documents:

- Asphalt Institute MS-2, Mix Design Methods
- AASHTO M320
- *2018 Standard Specifications*, State of California Department of Transportation
- *MTAG Volume I Flexible Pavement Preservation 2<sup>nd</sup> Edition*

## SECTION 2 CONSTRUCTION EQUIPMENT

### 2.1 Description

The asphalt mixing plant shall be of such capacity to produce the quantities of the asphalt mixtures required to complete the project. Hauling equipment, asphalt pavers, rollers, miscellaneous equipment, and tools conforming to Section 39-2.01C(2) Spreading and Compacting Equipment, of the *Standard Specifications*, shall be provided in enough numbers and capacity and in proper working condition to place the asphalt paving mixtures.



A material transfer vehicle or approved alternate method capable of remixing asphalt materials delivered by truck prior to entering the paving machine will be required for the Wearing course for Road Course and Pit Road. Windrow paving will not be accepted for the Wearing Course or any necessary Base patching.

## 2.2 Asphalt Mixing Plant

The asphalt mixing plant shall be an automatic or semiautomatic controlled commercially manufactured unit designed and operated to consistently produce an asphalt mixture within the job-mix formula (JMF). Drum mixers shall be prequalified at the production rate to be used during actual mix production.

## 2.3 Quality Control (QC) Laboratory

The Contractor shall provide a laboratory at the plant accredited in accordance with the Caltrans Independent Assurance Manual. The laboratory shall also be approved by the Owner prior to start of production. The laboratory shall be of enough size and be furnished with the necessary equipment and supplies to adequately and safely perform both the Contractor's quality control testing and the Owner's quality assurance testing.

The laboratory and equipment furnished by the Contractor shall be properly maintained. The Contractor shall maintain a record of all calibration results at the laboratory. The Owner may inspect measuring and testing devices at any time to confirm both calibration and condition. If the Owner determines that the equipment is not within the limits of dimensions or calibration described in the appropriate test method, the Owner may stop production until corrective action is taken. If laboratory equipment becomes inoperable, the Contractor shall cease mix production until the equipment is repaired or replaced, unless otherwise approved by the Owner.

## 2.4 Sweeping Equipment

All hard surfaces shall be thoroughly swept clean before the next application of asphalt materials, liquid or mix. For surfaces containing only stones, pebbles or other large debris, rotary power brooms are acceptable, and shall be used liberally to clean the surface. For surfaces containing dirt, dust and small particulate matter along with other foreign objects, a truck-type sweeper with a high-suction vacuum head may be required in addition to the rotary broom. All surfaces shall be approved by the Owner prior to the application of asphalt materials. Sweepers and brooms having wire bristles will not be permitted.

## 2.5 Straightedge

The Contractor shall furnish and maintain at the site and in good condition, one approved 12-foot straightedge. Straightedges shall be made available for Owner's use. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom reinforced to insure rigidity and accuracy.



2.6 Smoothness

The Contractor shall furnish an inertial profiler, computer hardware and software, and a technician to perform surface smoothness testing. The inertial profiler shall meet the requirements of California Test 387 and be approved by the Owner.

2.7 Access to Construction Equipment

The Owner shall have access, to all parts of the asphalt plant for checking adequacy of the equipment in use; inspecting operation of the plant; verifying weights, proportions, and character of materials; and checking temperatures maintained in preparation of the mixtures.

**SECTION 3 - PRODUCTION MATERIALS**

3.1 Description

The asphalt mix shall consist of coarse aggregate, fine aggregate, mineral filler, asphalt binder, and approved additives, if required. These materials shall be of the qualities and in the proportions specified and shall conform to the requirements contained in the following sections.

3.2 Mixes

The following mixes will be used in the Track Construction:

Section	Wearing	Pit Road Base and Trench Patching	Base Patching
Road Course and Pit Road	2.0" Track Mix with PG 82-22	2.0" CalTrans ½-inch HMA Type A with PG 70-10 <sup>1</sup>	4.0" ¾-inch CalTrans HMA Type A with PG 64-10

<sup>1</sup>The maximum allowed binder replacement for the ½-inch HMA Type A is 25.0 percent.

3.3 Aggregates

All aggregates shall be produced, tested, stockpiled, and designated for this project. Aggregate sources other than the approved stockpiles may require the submittal of a new mix design. Samples of aggregates shall be furnished to Advanced Materials Services, LLC (AMS) by the Contractor for approval of aggregate sources and stockpiles prior to the start of production and at times during production of the asphalt mixtures as requested by the Owner. Samples will be the basis of approval of specific sources or stockpiles of aggregates for aggregate requirements. Unless otherwise directed, AASHTO T 2 shall be used in sampling coarse and fine aggregate, and AASHTO T 127 shall be used in sampling mineral filler.

Aggregates shall be delivered to the site of the asphalt mixing plant and stockpiled in such a



manner as to prevent fracturing of aggregate particles, segregation, contamination, or combination of varied materials in the stockpiles or cold-feed hoppers. Mineral filler, if required, shall be delivered, stored, and introduced into the mixing plant in a manner to prevent exposure to moisture or other detrimental conditions.

Aggregates may consist of granite or other hard, durable aggregates approved by the Engineer. No reclaimed materials shall be used in the Wearing mix for the Road Course or Pit Road. The aggregates shall meet the requirements of Section 39-2.02B(4) Aggregates, of the *Construction Specifications*, and additional requirements specified herein. All coarse aggregate in the track Wearing mix shall be 100 percent crushed. No rounded stone or uncrushed gravel shall be allowed. The portion of materials retained on the No. 4 sieve shall be known as coarse aggregate; the portion passing the No. 4 sieve and retained on the No. 200 sieve as fine aggregate; and the portion passing the No. 200 sieve as mineral filler. Aggregates shall meet the requirements below for the mix designation specified below. Mineral filler shall be limestone dust, slag dust, hydrated lime, hydraulic cement, fly ash, or other suitable mineral matter conforming to the requirements of AASHTO M 17. At the time of use, mineral filler shall be freely flowing and devoid of agglomerations.

<b>Aggregate Requirements</b>	<b>Base Course</b>	<b>Road Course, Pit Road Wearing Course</b>
Sulphate Soundness (AASHTO T 104), 5 cycles	NA	5.0% max.
Los Angeles Rattler (AASHTO T96), 500 revolutions	40.0 % max.	35.0 % max.
Fractured Faces Coarse Aggregate (AASHTO T335)	95/90 <sup>1</sup> min.	100/95 min.
Flat and Elongated Particles (ASTM D4791)	10% max.	10% max.
Sand Equivalent (AASHTO T 176)	47 min.	47 min.
Fine Aggregate Angularity (AASHTO T 304)	45% min.	45% min.

<sup>1</sup>95/90 denotes that 95 percent of the coarse aggregate has one fractured face and 90 percent has two or more fractured faces.

### 3.4 Asphalt Binder

Samples of the Track Wearing asphalt binder shall be obtained by the Contractor. Sources where asphalt binder are obtained shall be selected in advance of the time when binder will be required in the work. In addition to initial qualification testing of asphalt binder by the binder supplier, samples shall be taken before and during construction when shipments of asphalt binder for the Wearing are received or when necessary to assure some condition of handling or storage has not been detrimental to the asphalt binder. The samples shall be taken by the Contractor and tested by the Owner as described in 6.2.2. Retained samples shall be made available to the Owner for testing, if necessary.

Asphalt binders shall be maintained at appropriate temperature during storage but shall not





be heated by application of direct flame to walls of storage tanks or transfer lines. Storage tanks, transfer lines, and weigh buckets, if used, shall be thoroughly cleaned before a different type or grade of asphalt cement is introduced into the system. The asphalt binder shall be heated sufficiently to allow satisfactory pumping of the material; however, the storage temperature shall be maintained per manufacturer’s recommended temperature. Provisions shall be made to agitate the modified asphalt modified to prevent separation of polymer.

The binder for the Base Course shall be a PG 70-10 conforming to the requirements of AASHTO M 320.

The Wearing Course of the Road Course and Pit Road shall be a polymer modified PG 82-22 binder conforming to the requirements of AASHTO M 320 and the following additional criteria:

Test	Specification
<b>Original Binder</b>	
Separation of Polymer (ASTM D7173), °F	4° max.
Rotational Viscosity @ 275°F (AASHTO T 316)	3.3 Pa·s max <sup>1</sup>
Penetration (AASHTO T 49) @ 77°F (100 g, 5 sec.s)	35 – 75 dmm
Softening Point (AASHTO T 53)	180 °F, min.
<b>Rolling Thin-Film Oven Residue (AASHTO T 240)</b>	
Pen Retention (AASHTO T 49) at 77 °F	50%
Elastic Recovery at 77 °F (AASHTO T 301)	70% min.

<sup>1</sup> Manufacturer shall provide recommended mixing and compaction temperatures, including a maximum mixing (discharge) temperature.

The Base asphalt used for modification shall have an absolute viscosity at 140 °F of 2000 (+/- 500) poise and a penetration range at 77 °F (100 g, 5 sec) of between 45 and 90. The polymer modified asphalt cement shall be a conventional asphalt binder using styrene-butadiene-styrene (SBS) modifiers. In addition, up to one percent Sasobit®, by weight of binder, may be added. No other modifiers will be accepted without prior approval. Test data and certification shall be performed prior to shipping. The polymer modified asphalt cement, once certified, shall not be altered in the tank in any way, including adding new material. If a certified tank is altered in any way, shipments from this tank shall cease until re-certification process is complete.

Methods of sampling and testing shall conform to standards listed in AASHTO M 320 and DOT Standard Specifications.

### 3.5 Additives

An anti-stripping agent is required. The use of additives, such as anti-stripping agents (other than hydrated lime) or Warm Mix Asphalt (WMA) technologies (other than up to 1 percent



Sasobit®), is subject to approval by the Owner. Due to the possibility of some anti-stripping agents lowering the softening point of the binder, softening point testing must be performed after the addition of any liquid anti-stripping agent.

## SECTION 4 JOB MIX FORMULA

### 4.1 Description

The job mix formula (JMF) for the asphalt mixture(s) shall be furnished by the Contractor. No payment will be made for mixtures produced prior to the approval of the JMF. The formula shall indicate the percentage of each stockpile and mineral filler, the target gradation (percent passing) of the combined aggregate, the percentage of asphalt cement, and the temperature range of the completed mixture when discharged from the mixer. Anticipated plant breakdown should be considered when developing the target gradation. Tolerances are specified in Section 4.2 below; however, the final evaluation of aggregate gradation and asphalt content will be based on Section 6.4.

### 4.2 Mix Design Criteria

Aggregate gradation design range for the asphalt mixtures used for this project are presented below.

<b>Gradation Requirements</b>	<b>Base Course - Patching (CalTrans 3/4-inch HMA Type A) (percent passing)</b>	<b>Base Course – Pit Road (CalTrans 1/2-inch HMA Type A) (percent passing)</b>	<b>Wearing Course (percent passing)</b>
1”	100	100	--
3/4”	90-98	100	--
1/2”	70-90	95-98	100
3/8”	--	72-95	88 – 100
No. 4	42-58	52-69	60 – 80
No. 8	29-43	35-55	43 – 55
No. 16	--	--	26 – 38
No. 30	10-23	15-30	18 – 29
No. 50	--	--	14 – 25
No. 100	--	--	7 – 13
No. 200	2-7	2 – 8	4 – 7

The Base mix for Pit Road and any Base patching on the Road Course shall be designed according to Section 39-2.02, Type A Hot Mix Asphalt, of the *2018 Construction Specifications*. Laboratory test specimens of the Wearing Course, combined in proportions of the job-mix formula, shall be prepared and tested in accordance with AASHTO R 68 and T 245. The Wearing Course mix design shall be prepared using the Asphalt Institute’s MS-2 Marshall Design Method. A mix aging time of 30 to 60 minutes shall be used before testing



is conducted. Moisture resistance testing shall be evaluated in accordance to AASHTO T 283. Hamburg testing shall be conducted according to AASHTO T 324. Hamburg testing will be on lab compacted samples made during the mix design procedure.

Test requirements and criteria for the Track Wearing mix under these specifications shall be as follows:

Mix Design Criteria	Road Course and Pit Road Wearing Course (where specified)
Marshall Stability, 75 blows each face	4,000 lbs. min.
Flow	0.08 - 0.20 inches
Air Voids: (Laboratory Specimen) <sup>1</sup>	2.0% - 4.0%
Voids in Mineral Aggregate	15.5% min.
Expected AC content by total weight of the mixture:	6.0% - 7.0%
Hamburg Wheel Tracking at 50°C, passes to 0.25-inch rut depth	20,000
Tensile Strength Ratio	80% min., 100 psi wet strength min.

<sup>1</sup>Target middle of range for design

## SECTION 5 CONSTRUCTION

### 5.1 Description

Asphalt mixtures shall be constructed only when the aggregate base course or previously placed pavement has no free water on the surface. Proper longitudinal joint construction is critical to track performance. Paving will be accomplished using at least two asphalt pavers in echelon. Nighttime paving will not be permitted unless otherwise approved by the Owner.

### 5.2 Weather Limitations

Unless otherwise directed, the placement of asphalt courses shall not begin until the temperature of the surface of the existing pavement or base course is 45 °F or higher and the atmospheric temperature is at least 60 °F in the shade and rising.

### 5.3 Preparation of Asphalt Mixtures

Rates of feed of aggregates shall be regulated so that the moisture content and temperature of aggregates will be within specified tolerances. Aggregates, mineral filler, and asphalt binder shall be conveyed into the mixer in proportionate quantities required to meet the JMF.



Mixing time shall be as required to obtain a uniform coating of the aggregate with the asphalt material. Temperature of asphalt binder at time of mixing and discharge of the asphalt mixture shall not exceed the asphalt binder manufacturer's recommendation. Overheated and carbonized mixtures or mixtures that foam shall not be used.

#### 5.4 Storage of Asphalt Mixtures

Storage of asphalt paving mixtures shall not exceed 2 hours. Any material that has been stored longer than 4 hours shall be discarded.

#### 5.5 Transportation of Asphalt Mixtures

Transportation from paving plant to site shall be in trucks having tight, clean, smooth beds lightly coated with an approved release agent to prevent adhesion of the mixture to the truck bodies. Excessive release agent shall be drained prior to loading. Each load shall be covered with canvas or other approved material of ample size to protect mixture from weather and to prevent loss of heat. Loads that have crusts of cold, unworkable material or that have become wet will be rejected. Hauling over freshly placed material will not be permitted.

#### 5.6 Underlying Materials

##### 5.6.1 Condition

The surface of the underlying materials shall be inspected by the Contractor for adequate compaction, grade, smoothness and surface condition prior to any paving. Unsatisfactory areas shall be corrected.

##### 5.6.2 Surface Preparation

Prior to placing of the Wearing Course, the underlying course shall be cleaned of all foreign material with power brooms, hand brooms, and scrapers.

#### 5.7 Protection of Pavement

After final rolling, no vehicular traffic of any kind shall be permitted on the Wearing course unless approved by the Owner. No vehicular traffic shall be permitted on the Base Course until the pavement has cooled to a temperature of 100 degrees Fahrenheit.

#### 5.8 Test Strip

Prior to start of mix production of the Track Wearing mix, a test strip of at least 120 tons, using the typical thickness and widths of pavements to be placed on the project as well as the equipment and methods that will be typically used on the project, shall be constructed. The purpose of the test strip is to produce and place the mix in the same manner as will be utilized during the construction of the racetrack (i.e. same plant, equipment, etc.) in order to verify that the mixture meets all specification requirements and to perform the nuclear density gauge/core correlation referred to later in this section for the Wearing Course. The Contractor



will be required to perform Plant and Field tests (as outlined in Sections 6.2.2 and 6.2.3) and any other tests deemed necessary by the Contractor to verify the mixture characteristics regarding production and placement. Upon completion of all required tests, the Contractor and Owner shall jointly agree on target values for all aspects of the asphalt mixture to be used at the start of actual mix production. Additionally, proper joint construction techniques for echelon paving must be demonstrated prior to construction of the Wearing Course.

A nuclear density gauge/core correlation will be required for the Track Wearing Mix and shall be performed by the Contractor during the test strip construction. The correlation shall be completed by the Contractor and approved by the Owner before actual production begins. Production shall not begin until all test results, including an acceptable nuclear density gauge/core correlation, are available and an Adjusted Job Mix Formula (AJMF) is agreed upon by the Contractor and Owner, if necessary. It is also noted that a separate correlation for the surface on areas other than the track, may be required due to a change in underlying material, if deemed necessary by the Owner.

For a test strip to be incorporated into the permanent section, the mat must pass all customary mix texture/appearance/density/stability/etc. requirements. In addition, all other construction elements and procedures (joint details, tolerances, etc.) as described earlier and herein shall be strictly maintained.

If the test strip fails for any reason, additional test strips may be required at no additional cost to the Owner.

## 5.9 Tack Coat

Contact surfaces of previously constructed pavement, pavement edge, walls, and other structures, except for the Wearing Course as described in Section 5.12.2, shall be sprayed with a uniform, thin coat of SS-1h or equivalent, conforming to Section 94 Asphalt Emulsions, of the *Standard Specifications*. If necessary, loose, uncompacted material at the pavement mat edge shall be removed prior to applying the tack coat.

## 5.10 Placement of Asphalt Mixtures

### 5.10.1 General Paving Requirements

Temperature of asphalt mixtures shall not be less than the temperature required by the job mix formula or asphalt binder manufacturer's recommended temperature range when measured in the mat immediately behind the paver, unless otherwise recommended by the asphalt binder manufacturer and verified by results of the test strip process. The mechanical spreader shall be adjusted and the speed regulated so that the surface of the course being laid will be smooth and continuous without tears and pulls, and of such depth that, when compacted, the surface will conform to the cross section indicated. When segregation occurs in the mixture during placement, the spreading operation shall be suspended until the cause is determined and corrected.



### 5.10.2 Paver Speed

The maximum allowable paver speed will be 20 feet/minute, provided that acceptable surface characteristics and densities are achieved. The paver will not be allowed to stop during the paving process. The Contractor shall utilize enough trucks to consistently transport mix to the site at or slightly above the rate of production, which will be approximately 110 percent of the placement rate. The Contractor is responsible for anticipating all unknown variables and problems that can occur during mix transportation. Placement of the mixtures on the track at a consistent rate without stopping the paver is achievable and essential to create the required smooth surface. The placement of a minimum of one-half of a complete pass per workday will be required for the Wearing Course unless otherwise permitted by the Owner. The Owner is willing to discuss the exception of the “Corkscrew” from this requirement. Transverse joints will only be permitted in the tangent portions of the track that are outside braking zones. No transverse joints will be permitted in curved portions of the track.

### 5.10.3 Joint Offset

Each course shall be placed so that longitudinal joints of the course being placed will be offset from joints in the previously placed course by at least one (1) foot. Transverse joints in each course shall be offset by at least two (2) feet from transverse joints in the previously placed course unless otherwise approved by the Owner.

### 5.10.4 Handwork

Handwork of asphalt mixtures will not be permitted unless approved by the Owner in rare circumstances where no other alternative is available.

## 5.11 Compaction of Asphalt Mixtures

Rolling shall begin as soon after placing as the mixture will bear a roller without undue displacement. Delays in rolling freshly spread mixture will not be permitted. If desired by the Contractor, one of the rollers used can be a pneumatic roller except when placing the Track Wearing mix with PG 82-22. Final rolling of the Wearing course shall be done with a steel-wheel roller. A Pneumatic roller may be used to compact against curbing after the mix has cooled to the point where no pick up will occur.

After initial rolling, preliminary tests of crown, grade, and smoothness shall be made by the Contractor. Deficiencies shall be corrected so that the finished course will conform to requirements for grade and smoothness specified herein. Grade and smoothness shall be checked for compliance and will be evaluated as specified in Section 5.13. The target average density for the Base and Wearing Courses is 94.0 percent of the  $G_{mm}$  with minimum and maximum acceptable densities of 92.0 percent and 97.0 percent of the  $G_{mm}$ . A minimum of 95 percent of measured densities in any lot falling within the required range. The density will be determined and evaluated as specified in Section 6.2.3. Places inaccessible to rollers



shall be thoroughly compacted with hot hand tampers. Compaction at all walls and barriers must be achieved without walking on the mat surface unless otherwise approved by the owner.

## 5.12 Joints

### 5.12.1 Transverse Joints

The first load placed each day shall be removed unless otherwise approved by the Owner. The distance to be removed will be determined by appearance, density, and smoothness.

The roller shall pass over the unprotected end of a pass of freshly placed material only when placing is discontinued or delivery of the mixture is interrupted to the extent that the material in place may become cold. In all cases, prior to continuing placement, the edge of previously placed pavement shall be cut back to expose an even vertical surface for full thickness of the course. In continuing placement of a pass, the asphalt paver shall be positioned on the transverse joint so that enough hot mixture will be spread to obtain a joint after rolling that conforms to the required density and smoothness specified herein. Spiral joints may be utilized to facilitate smoothness/matching joint elevation when tying in.

### 5.12.2 Longitudinal Joints

The Wearing surface of the Road Course shall be paved with two or more pavers running in echelon. The pavers must remain close enough together so that the abutting paving lanes can be compacted at the same time (hot-to-hot), effectively eliminating the longitudinal joint. Where paving cannot be completed in echelon, for example when tying into connectors, the joints shall be treated as described below, unless otherwise approved by the Engineer.

Except when approved by the owner, the Contractor shall cut and remove 4 to 6 inches of the unconfined edge of the pavement by means of a wheel or saw. If a saw is used, all sawing spoils and dust must be removed prior to applying the joint adhesive. Edges of a previously placed pass shall be prepared such that the pavement in and immediately adjacent to the joint between this pass and the succeeding pass meets the requirements for grade, smoothness, and density specified in Section 5.13 below.

Contact surfaces of previously constructed pavements or concrete appurtenances coated by dust, sand, or other objectionable material shall be cleaned by brushing. The exposed edge of the racing Wearing surface, except echelon joints, shall have CRAFCO Joint Adhesive (Part No. 34524) or approved equivalent applied prior to the placement of the next pass. A joint adhesive shall also be placed on any crash wall or curbing adjacent to the racing surface. The exposed edge of these pavements other than the racing Wearing surface shall have a thin coat of tack applied prior to



the placement of the next pass. Material shall be applied far enough in advance of placement of a fresh mixture to insure adequate curing. Care shall be taken to prevent damage or contamination of the sprayed surface.

## 5.13 Grade and Smoothness Requirements

### 5.13.1 Plan Grade

The grade of the completed surface shall not deviate more than 0.05 feet from the plan grade.

### 5.13.2 Surface Smoothness

When a 12-foot straightedge is laid on the surface parallel with the centerline of the paved area or transverse from crown to pavement edge, the surface shall vary not more than  $5/32$  inch in the longitudinal direction and  $7/32$  inch in the transverse direction from the straightedge.

In addition to the straightedge, the Wearing Course shall be checked with a profilometer or approved equivalent by the Contractor if deemed necessary by the Owner. Areas representing high points having deviations in excess of 0.3 inches in 25 feet shall be corrected by the Contractor on the Wearing Course. This requirement applies regardless of the average index of the 0.1-mile section. The maximum allowable profile index (0.1-inch blanking band) for a 0.1 mile section is less than 10 inches per mile for the Wearing Course. ProVAL settings for Profilograph simulation are as follows: blanking band = 0.1-inch, minimum scallop width = 2.0 feet, minimum scallop height = 0.030 inch, scallop rounding increment = 0.01 inch, segment length = 528 feet and using a lowpass Butterworth filter (1.97 feet). The profilometer will also be used on the milled surface to identify any bumps remaining after the milling process. These areas will be corrected prior to placing the Wearing Course.

## 5.14 Base Asphalt Patching

Base asphalt repair locations will be identified by the Owner. All Base asphalt repair areas shall have a target lift thickness of 4.0 inches unless otherwise indicated by the Owner. For areas where unbound aggregate base is exposed and are large enough to be repaired using an asphalt paver, proof rolling of the aggregate base will be required. After proof rolling, relative density testing shall be conducted according to either California Test 216 or 231. For those Base repair areas large enough for an asphalt paver, minimum in-place density criteria listed in Section 6.2.4 shall be observed. For those areas not able to be repaired using an asphalt paver, the minimum in-place density shall be reduced to 91.0 percent. In areas not able to be repaired using an asphalt paver, the aggregate base shall be compacted using a plate compactor or steel-wheel roller prior to paving.





## 5.15 Crack Repair Prior to Placement of Wearing Course

Any cracks remaining after Base Asphalt Patching will be identified and marked for repair by the owner. Repair options will be based on the type of crack, location, size, and severity. Two repair options will be available: crack sealing and trench patching. These options are described below. Other options recommended by the Contractor will be considered by the Owner.

### 5.15.1 Crack Sealing

Crack sealing shall be accomplished according to the procedures listed in Chapter 4 of the *Maintenance Technical Advisory Guide Volume I Flexible Pavement Preservation 2<sup>nd</sup> Edition*. Type 3 crack treatment material shall be used, and crack sealing will be performed using a modified Sand Fill with Recessed Finish procedure. Instead of using sand, the crack shall be filled with sealant, leaving a recessed finish at the top. The recessed finish will then be filled with millings, leaving a flushed finish with the surrounding surface.

### 5.15.2 Trench Patching

For those cracks selected for trench patching, a skid steer mill head attachment with a minimum head width of 18-inches will be used to remove the crack to a depth of 2.0 inches to remove the crack while leaving a “hard bottom” of remaining asphalt. Joint sealant will be applied to the vertical surfaces of the trench patch, the “hard bottom” shall be tacked, and the trench patch asphalt mix listed in Section 3.2 shall be used to fill the trench patch.

## SECTION 6 QUALITY CONTROL / QUALITY ASSURANCE

### 6.1 Description

The Contractor shall perform, or have performed, the inspection and tests required to assure compliance to specification requirements. Quality control includes the recognition of obvious defects and their immediate correction. This may require increased testing, communication of test results to the plant or the job site, modification of operations, suspension of asphalt mix production, rejection of material, or other actions as appropriate. The Owner shall be immediately notified of any failing tests and subsequent remedial action. Passing tests shall be reported to the Owner as soon as possible, but no later than the start of the next workday.

### 6.2 Quality Control

#### 6.2.1 Personnel

The Contractor shall provide a Quality Control (QC) Manager who shall have overall responsibility and authority for quality control. In addition to the QC Manager, the Contractor shall provide enough personnel to perform the required visual inspections,



sampling, testing, and documentation in a timely manner. All technicians who shall be performing plant sampling and testing shall be experienced in their respective duties. The Contractor shall provide a full time Asphalt Mixture Density Tester who shall be experienced in his/her respective duties to run all required density tests on the job site, unless otherwise approved by the Owner.

6.2.2 Required Asphalt Plant Tests

The testing frequencies indicated below are considered minimums. The Contractor shall conduct as many as necessary to ensure all mixture properties are met.

Parameter	Frequency of Test	Test Method
Aggregate Gradation	1 gradation per half day of production	AASHTO T 30
**Polymer Modified Asphalt Cement - Ring & Ball Test for Softening Point	Once per each delivered load of asphalt cement	AASHTO T 53
*Marshall Stability and Flow	1 per half day of production	AASHTO T 245
* Asphalt Content by Ignition Oven	1 per half day of production	CT-382 Type 1
* Air Voids Bulk Specific Gravity of Marshall Sample	1 per half day of production	AASHTO T 166
* Maximum Specific Gravity of Mixture		AASHTO T 209

\* Denotes Truck samples taken at plant.

\*\* Test will be conducted by the Owner.

Note: The Contractor shall use the test methods identified to perform the following mixture tests, at a frequency not less than that indicated. Contractor testing of all plant samples shall be completed within 6 hours of sampling.

One-quart samples of each asphalt binder type used shall be taken and stored by the Contractor for each day of mixture production as required by the Owner. Sampling may be witnessed by the Owner. Asphalt binder sample containers shall be furnished by the Contractor. The Owner will take possession of the properly identified asphalt binder samples for assurance testing if deemed necessary.



The Contractor shall split all required samples and identify the split samples per the Owner's instructions. These split samples shall be retained by the Contractor for assurance testing by the Owner and be disposed of only with the permission of the Owner. The split samples shall be stored in a dry, protected location.

The Contractor shall, when necessary, take and test additional samples (designated "check" samples) at the plant during mix production. These samples shall in no way replace the required plant samples described above. Check samples shall be tested only for the parameters deemed necessary by the Contractor. Check sample test results shall be noted in the Plant Diary and shall not be plotted on the control charts. The Contractor shall detail the situations in which check samples will be taken in the Quality Control Plan.

### 6.2.3 Required Paving Site Tests

The Contractor shall control the compaction process by testing the mix density at random locations. The Contractor shall follow the density testing procedures detailed in ASTM D 2950, "Standard Test Method for Determination of Density of Bituminous Concrete In-Place by Nuclear Method", except as otherwise noted herein.

The Contractor shall be responsible for establishing the correlation to convert nuclear density results to core densities. The Owner may require a new nuclear density gauge/core correlation if the Contractor's gauge is re-calibrated during the Project.

Quality control density tests shall be performed by the Contractor during placement of patching, Base and Wearing Courses. Quality assurance density tests shall be performed by the Owner at randomly selected locations, following the compaction of the Base and Wearing Course. The Owner's quality assurance tests of the Wearing surface shall be used for acceptance. The test locations shall be selected in a stratified random pattern with a minimum of one (1) test every 200 feet per paver width. Companion (same longitudinal distance as mat test) joint density tests will be taken at the joints between paver passes (in echelon) or previously placed pavement. Density testing shall be accomplished as soon as finish rolling is completed in the randomly located area to be tested. The Contractor's density testing technician and his/her equipment shall always be on the Project during mix placement and shall perform check tests as necessary to ensure adequate compaction is constantly being maintained. A standby correlated nuclear gauge shall be onsite in case of failure of the primary gauge.

Cores of completed pavement mats for patching and Pit Road Base Course shall be taken at approximately 5 locations per Lot (day) to determine mat thickness and density and for correlation to nuclear results. Cores shall be taken at random locations determined by the Owner. Core densities shall be determined using ASTM D 2726. All core testing shall be completed, and the results reported to the Owner prior to starting production the following day. It is the intent of the Owner that cores



**NOT** be utilized for thickness or density control in the Wearing Course unless otherwise approved by the Owner. A limited number of cores may be taken out of the race line to confirm the gauge correlation for the Wearing course.

6.2.4 Control Limits

Target values shall be determined by applying adjustment factors to the AJMF where applicable. The target values shall be plotted on the control charts within the following control limits (gradation control limits may fall outside of the specified range):

Parameter	Control Limits	
	Individual Test	Moving Avg. of 4 Tests
% Passing (All Mixtures)		
12.5 mm (1/2 inch)	± 6 %	± 4 %
4.75 mm (No. 4)	± 5 %	± 4 %
2.36 mm (No. 8)	± 3 %	± 2 %
600 µm (No. 30)	± 3 %	± 2 %
75 µm (No. 200)	± 1.5 %	± 1 %
Marshall Stability	Greater than Target <sup>1</sup>	Greater than Target <sup>1</sup>
Ring & Ball Test for Softening Point	Greater than Target <sup>2</sup>	Greater than Target <sup>2</sup>
Asphalt Content (All Mixture)	± 0.3 %	± 0.2 %
Voids (All Mixtures)	± 1.0 %	± 1.0 %
VMA (All Mixtures)	Greater than Target <sup>1</sup>	Greater than Target <sup>1</sup>
In-place Density, Mat and Joint (% of Gmm)	92.0 – 97.0 %	Lot Avg. 94.0 – 97.0 %

<sup>1</sup> Target defined in Section 4.2

<sup>2</sup> Target defined in Section 3.4

6.3 Corrective Action

6.3.1 Required Asphalt Plant Tests

When an individual test result exceeds its control limit, the Contractor shall immediately resample and retest. This result shall be recorded as a retest. If the retest passes, the Contractor may continue the required plant test frequency. The Owner



may also request cores of the in-place material.

If the retest exceeds control limits, mix production shall cease and immediate corrective action shall be instituted by the Contractor. The required corrective action is two-fold: 1) identify the cause of the out-of-specification material and prevent reoccurrence, and 2) determine the disposition of the out-of-specification material. Out of specification material may warrant removal and replacement, including such examples as: low stability, low asphalt content, high asphalt content resulting in bleeding or excessive in-place density, high air voids, or significant gradation change resulting in a noticeable change in surface texture. After corrective action, mix production shall be restarted, the mix production shall be stabilized, and the Contractor shall immediately resample and retest. Mix production may continue when approved by the Owner. The corrective action shall be documented.

Inability to control mix production is cause for the Owner to stop the operation until the Contractor completes an investigation identifying the problems causing failing test results.

#### 6.3.2 Required Paving Site Tests

When an individual density test exceeds the control limits, the Contractor shall immediately retest in an area immediately surrounding the failed density test to determine the extent of the mat that exceeds the control limit. If the retest passes, the Contractor shall continue the normal density test frequency. An additional density check test shall be performed to verify the mix compaction.

If the retest fails, the Contractor shall make additional roller passes and test again.

If the second retest fails, the Contractor shall immediately consult the Owner for a joint resolution to the problem. If the Contractor is not controlling the compaction process and is making no effort to take corrective action, the operation, as directed by the Owner, shall stop. Removal and replacement of the defective pavement may be required.

#### 6.3.3 Moving Average

When the moving average values trend toward the moving average control limits, the Contractor shall take corrective action and increase the sampling and testing frequency. The corrective action shall be documented.

The Contractor shall notify the Owner whenever the moving average values exceed the moving average control limits. If two consecutive moving average values fall outside the moving average control limits, the Contractor shall cease operations. Corrective action shall be immediately instituted by the Contractor. Operations shall not be reinstated without the approval of the Owner. Failure to cease operations shall subject all subsequently produced material to be considered unacceptable.



#### 6.4 Quality Assurance

The Owner will conduct independent assurance tests on split samples taken by the Contractor for quality control testing. Sample time and tonnage will be designated by the Owner. The Contractor shall retain all split samples for quality assurance testing for use by the Owner. The overall quality assurance testing frequency will be determined by the Owner. The Owner may select any or all split samples for assurance testing. The Owner will initiate independent assurance testing during mixture field verification. These tests may be performed at any time. The Contractor's nuclear density gauge/core correlation may be verified utilizing the Owner's own nuclear gauge.

The Owner may witness the sampling and testing being performed by the Contractor. The Owner may document all witnessed samples and tests.

The Owner will promptly notify the Contractor of observed deficiencies. If the Owner observes that the sampling and quality control tests are not being performed according to the applicable test procedures, production shall stop until corrective action is taken.

The Owner may elect to obtain samples for testing, separate from the Contractor's quality control process, to verify specification compliance.

Differences between the Contractor's and the Owner's split sample test results will be considered acceptable if within the following limits:

<b>Test Parameter</b>	<b>Acceptable Limits of Precision</b>
<b>Percent (%) Passing</b>	<b>Percent (%) Difference</b>
12.5 mm (1/2 inch)	5.0
4.75 mm (No. 4)	4.0
2.36 mm (No. 8)	2.0
600 $\mu$ m (No. 30)	2.0
75 $\mu$ m (No. 200)	1.5
Asphalt Content	0.3
Maximum Specific Gravity ( $G_{mm}$ )	0.019
Bulk Specific Gravity ( $G_{mb}$ )	0.045
Density (Percent Compaction)	1.0 (Corrected)

In the event comparison of the required plant test results is outside the above acceptable limits of precision, any test by the Owner (split or independent sample) fails the control limits, or a continual trend of difference between the Contractor's and Owner's test results is identified, the Owner and Contractor shall immediately investigate. The Owner may suspend



production while the investigation is in progress. The investigation may include testing by the Owner of any remaining split samples or a comparison of split sample test results on the mix currently being produced. The investigation may also include review and observation of the Contractor's technician performance, testing procedure, and equipment.

If a problem is identified with the asphalt mixture, the Contractor shall take immediate corrective action. After corrective action, the Contractor shall immediately resample and retest following the procedures in Section 6.2.2.

In the event comparison of the required field test results (densities) are outside the above acceptable limits of precision, any test by the Owner (split or independent sample) fails the density limits, or a continual trend of difference between the Contractor's and Owner's test results is identified, the Owner and Contractor shall immediately investigate. The Owner may establish additional locations for testing by the Contractor. The investigation shall also include review and observation of the Density Tester's performance, testing procedure, and equipment. The original correlation and/or comparison data, for all gauges, shall be reviewed as part of the investigation process. If the problem continues, the Owner may require a new correlation be performed.

## **SECTION 7 ACCEPTANCE**

### **7.1 Description**

Final acceptance will be based on the following:

- Validation of the Contractor's quality control by the quality assurance process.
- The Contractor's process control charts and actions.
- Owner quality assurance tests for voids and density.
- Owner quality assurance tests for uniform texture.
- Contractor's tests for vertical and horizontal geometry accuracy.
- Owner quality assurance tests (straightedge and vehicle) and Contractor's profilometer tests, described below, for surface smoothness.

If any of the above acceptance criteria are not met, the work will be considered in non-conformance with the contract. Corrective actions will be determined by the Owner based on the severity of the non-conformance.

### **7.2 Grade**

Grade-conformance tests shall be conducted by the Contractor. The finished surface of the pavement will be tested for conformance with plan-grade requirements. Camber and cross-slopes will be checked. Areas that birdbath or otherwise hold water are unacceptable.



### 7.3 Smoothness

After milling of the existing pavement and completion of final rolling, the compacted surfaces of Base and Wearing Courses shall be tested with straightedges. Measurements will be made perpendicular to and across all mats at distances as directed by the Owner. Location and deviation from straightedge of all measurements will be recorded. Any joint or mat area surface deviation which exceeds the tolerance given in Section 5.13.2 shall be corrected to meet the specification requirements. The Contractor shall remove the deficient area and replace with fresh paving mixture at no additional cost to the Owner. Enough material shall be removed to allow at least 1-inch of asphalt concrete to be placed. Skin patching for correcting low areas or planing for correcting high areas shall not be permitted for the Wearing Course.

Corrective action shall be taken to produce a track pavement with the required grade, smoothness, and thickness. Corrective actions may include diamond grinding, or milling and replacement of asphalt Wearing course, or removal and replacement of pavement. Diamond grinding is permitted for removal of bumps. Grinding of significant portions of the surface shall not be permitted. Where surface corrections are made, the Contractor shall establish a uniform texture. On sections where corrective actions are made, the pavement shall be retested by the Contractor to verify that corrections have produced the required smoothness.

In addition, the surface of the Wearing Course will be evaluated by the Owner under actual driving conditions using a standard production vehicle or racing vehicle. This test is used to uncover any defects or other unacceptable conditions that are beyond discovery with conventional measuring and testing techniques. Correction and leveling of the areas identified by all the different means of testing and measurement shall be made in accordance with the Corrective Action Table by the Contractor, and the track shall be re-tested and re-corrected as necessary until the desired performance is obtained.

### 7.4 Deficient Areas

Mixtures that become contaminated or are defective shall be removed to the full thickness of the course. Edges of the area to be removed shall be cut so that sides are perpendicular and parallel to the direction of traffic and so that the edges are vertical. Edges shall be sprayed with a thin layer of tack coat before correcting any deficient areas. Fresh paving mixture shall be placed in the excavated areas in enough quantity so that the finished surface will conform to grade and smoothness requirements. Paving mixture shall be compacted to the density specified herein. Skin patching of an area that has been rolled shall not be permitted.





<b>Corrective Action Table for Construction Related Problems</b>		
<b>Defect</b>	<b>Base Course</b>	<b>Wearing Course</b>
Non-conformance to In-place Density and/or Asphalt Mix Properties	Remove and Replace	
Instability, Rutting, lack of Support, or lack of Bond between layers	Remove and Replace	
Serious Non-Conformance to Horizontal / Vertical Geometry	Remove and Replace	
Minor Non-Conformance to Horizontal / Vertical Geometry	Mill or Grind	
Major Segregation or Texture Variation	Remove and Replace	
Minor Segregation or Texture Variation	Repair Procedure to be Determined by the Owner	
Serious Smoothness Non-Conformance – Bump	Mill or Grind	Repair Procedure to be Determined by the Owner
Serious Smoothness Non-Conformance – Dip	Asphalt Wedge and Level (See Note 1)	Repair Procedure to be Determined by the Owner
Minor Smoothness Non-Conformance – Bump	Mill or Grind (See Note 3)	
Minor Smoothness Non-Conformance – Dip	Asphalt Wedge and Level (See Note 1)	(See Note 2)

Notes to CORRECTIVE ACTION TABLE:

General: Corrective action shall be taken to produce a track pavement with the required grade, smoothness, and thickness. Where surface corrections are made, the Contractor shall establish a uniform texture. On sections where corrective actions are made, the pavement shall be re-tested by the Owner and Contractor to verify that corrections have produced the required smoothness.

1. The Contractor shall provide the mix design or use a currently produced mix as approved by the Owner when it is determined that a wedge / leveling mix is required. This typically will be a high stability mix.



2. As wedging and leveling will not be allowed on the Wearing course, the Owner will direct diamond grinding to occur on either side of the dip to lessen the severity and effect of the dip. This shall be done until the dip is effectively “eliminated”.

3. Milling to correct smoothness deficiencies will only be allowed on non-Wearing Course lifts unless the intent is to mill and replace as directed by the Owner.

#### 7.5 Documentation

The Contractor shall be responsible for documenting all observations, records of inspection, adjustments to the asphalt mixtures, test results, retest results, and corrective actions. Copies of this information shall be provided to the Owner upon request. The Contractor shall also provide the Owner full access to all documentation throughout the progress of the Project.

The Contractor shall be responsible for the maintenance of all permanent records whether obtained by the Contractor, the Contractor's consultants, or the producer of the asphalt mix material.

#### **Disclaimer**

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