

Amend **Section 401 - Asphalt Concrete Pavement** to read as follows:

"SECTION 401 - ASPHALT CONCRETE PAVEMENT

401.01 Description. This section applies to the construction of asphalt concrete pavement on a prepared surface according to the contract.

Include pavement wearing course mixture and a binder course mixture when specified herein.

401.02 Materials. The plant mixed asphalt concrete includes a mixture of aggregate, filler or blending sand, if acceptable, and asphalt cement. Size, uniformly grade, and combine aggregates so that the resulting mixture meets the grading requirements of the job-mix formula. Conform to the following:

Asphalt Cement	702.01
Emulsified Asphalt	702.04
Aggregate for Hot Plant Mix Bituminous Pavement	703.09
Filler	703.15
Blending Sand	703.22
Hydrated Lime	712.03

Asphalt cement shall be PG 64-16.

401.03 Job-Mix Formula and Tests.

(A) Job-Mix Formula. Submit for acceptance, a job-mix formula for each mixture to be supplied for this project. The job-mix formula shall show the grade of cement in the mixture. Furnish only one grade of asphalt cement for the project. The Engineer may change the grade of the asphalt cement one step at no change in unit price. Make grade change only upon written acceptance by the Engineer. Submit a Certificate of Compliance, with substantiating test data, before using each lot or batch of asphalt cement. The Engineer will not accept the asphalt cement without adequate documentation.

The job-mix formula with allowable tolerances shall be within the master range for the type of asphalt concrete. The job-mix formula for a mixture shall be in effect until modified by the Engineer. Submit for acceptance a new job-mix formula before using the new material.

The job-mix formula for each mixture shall establish:

- (1) a percent of aggregate passing each required sieve size,
- (2) a percent of asphalt cement added to the aggregate, and
- (3) a temperature the mixture is delivered to the point of discharge.

The job-mix formula of the mixture furnished shall be within tolerances in Table 401-I:

TABLE 401-I - RANGE OF TOLERANCES FOR JOB-MIX FORMULA	
Passing No 4 and larger sieves (%)	± 7
Passing No. 8 to No. 100 sieves (inclusive) (%)	± 4
Passing No. 200 sieve (%)	± 2
Bitumen (%)	± 0.4
Temperature of mixture (° F)	± 20

When changing the source of material, establish a new job-mix formula before using the new material. When the results or conditions are unsatisfactory, the Engineer will require the Contractor to establish a new job-mix formula.

The Engineer may allow use of a nominal quantity of blending sand not exceeding 5 percent of the total weight of aggregate.

The Engineer may allow the use of filler material to correct deficiencies in materials passing the No. 200 sieve. Filler added shall not exceed 3 percent by weight of the fine aggregates.

Table 401-II - Limits of Bituminous Binder Content specifies the limits for each type of mixture. In case of dispute as to the optimum asphalt content, discontinue plant operations and allow the Engineer sufficient time to do the necessary laboratory testing. The Contractor may exceed the bituminous binder limits for porous aggregate only if acceptable in writing by the Engineer.

TABLE 401-II - LIMITS OF BITUMINOUS BINDER CONTENT					
MIX NO.	I	II	IV	V	VI
Used For	Binder Course	Binder or Surface Course	Surface Course	Surface Course	County Surface Course (Extra Fine)
Compacted Thickness Individual Layers (Inches)	1.5 to 3	1.25 to 3	1.25 to 3	0.75 to 3.0	1 to 2.5
Bituminous Binder Content Limits (% of dry weight of total aggregate)	4.0 - 6.5	4.5 - 6.5	4.5 - 6.6	5.0 - 7.5	6.0 - 8.0

(B) Tests. Base asphalt concrete job-mix formula on tests according to AASHTO T 245 (ASTM D 1559) or AASHTO T 246 (ASTM D 1560). The mixture shall conform to Table 401-IIIA - Job Mix Formula Design Criteria and Table 401-IIIB - Minimum Percent Voids in Mineral Aggregates. Submit the test data used to develop the job mix formula.

TABLE 401-IIIA - JOB-MIX FORMULA DESIGN CRITERIA	
HVEEM Method Mix Criteria	Binder and Surface Course
Stability, minimum	37
Swell, maximum (inch)	0.030
Air voids (%)	3 - 5
Marshall Method Mix Criteria	Binder and Surface Course
Compaction, Number of Blows each end of specimen	75
Stability, minimum (pounds)	1,800
Flow, 0.01 inch	8 - 16
Air voids (%)	3 - 5

TABLE 401-IIIB - MINIMUM PERCENT VOIDS IN MINERAL AGGREGATES					
Nominal Maximum Particle Size, (Inches)	1.5	1.0	0.75	0.50	0.375
VMA, (%) HVEEM Method	11	12	13	14	15
VMA, (%) Marshall Method	12	13	14	15	16

401.04 Bituminous Mixing Plant Requirements and Process.

(A) Plant Operation.

98 (1) **Preparation of Asphalt Cement.** Heat the asphalt cement
99 to the specified temperature to avoid local overheating. Provide
100 a continuous supply of the asphalt cement to the mixer at a uniform
101 temperature.
102

103 (2) **Preparation of Aggregate.** Dry and heat the aggregate
104 for the mixture to the required temperature. Do not exceed 320
105 degrees F. Properly adjust the flames used for drying and heating
106 to avoid damage to the aggregate and soot on the aggregate.
107 The aggregate, when dried, shall not contain more than 1 percent
108 moisture by weight.
109

110 Immediately after heating and drying, screen the aggregates
111 for batch plants into three or more fractions as specified. Convey
112 the aggregates into separate compartments ready for batching and
113 mixing with asphalt cement.
114

115 (3) **Mixing.** Combine the dried aggregates in the mixer in the
116 quantity of each fraction of aggregates required to meet the job-mix
117 formula. Measure or gage and introduce the asphalt cement into
118 the mixer in the quantity specified by the job-mix formula.
119

120 After introducing the required quantities of aggregate and
121 asphalt cement into the mixer, mix the materials until a complete
122 and uniform coating of the particles and a thorough distribution of
123 the asphalt cement throughout the aggregate is secured. The
124 Engineer will determine wet mixing time for each plant and for each
125 type of aggregate used.
126

127 For hot mix bituminous pavement, produce the mixture at
128 the lowest temperature for a workable mix; however, do not exceed
129 325 degrees F. Introduce the asphalt cement and aggregate into
130 the mixer within 25 degrees F. of each other's temperature.
131

132 (B) **Storage of Aggregates.** Provide sufficient storage space for
133 each size aggregate. Keep the different aggregate sizes separated until
134 the aggregate is delivered to the system feeding the drier. Maintain the
135 storage yard neatly and orderly. The separate stockpiles shall be readily
136 accessible for sampling.
137

138 (C) **General Requirements for Mixing Plants.** Mixing plants shall
139 be capable of handling the proposed bituminous construction.
140

141 (1) **Scales.** The scale requirements shall apply only where
142 proportioning by weight is used;
143

144 (a) **Plant Scales.** Plant scales shall be accurate to 0.5
145 percent throughout the range to be weighed by the
146 Contractor. The poises shall be locked in positions to
147 prevent unauthorized change of position. Instead of plant
148 and truck scales, an acceptable automatic printer system
149 may be provided that prints the weights of the material
150 delivered. Use a system with an acceptable automatic
151 batching and mixing control system. Show evidence of
152 such weights by a weight ticket for each load.
153

154 Measurement Standards Division of the State
155 Department of Agriculture or its authorized representatives
156 will inspect and seal the scale as often as the Engineer may
157 deem necessary to assure their continued accuracy.
158 Have not less than ten 50 pound weights for testing the
159 scales.
160

161 (b) **Truck Scales.** Weigh the bituminous mixture on
162 acceptable scales furnished by the Contractor or on public
163 scales at no cost to the State. The Measurement Standards
164 Division of the State Department of Agriculture or its
165 authorized representatives shall inspect and seal such
166 scales as often as the Engineer deems necessary.
167

168 (2) **Equipment for Preparation of Asphalt Cement.** The
169 storage tanks for the asphalt cement shall be equipped to heat and
170 hold the material at the required temperature. The tanks shall be
171 heated by steam coils or electricity so no flame is in contact with
172 the tank. The circulating system for the asphalt cement shall
173 assure proper and continuous circulation during the operating
174 period.
175

176 Equip storage tanks with provisions for measuring and
177 sampling of material. Calibrate the asphalt storage tanks to an
178 accuracy of 2 percent of the actual amount stored its storage
179 capacity. The storage tank shall be accessible for measuring.
180 Install a sampling outlet including a valve in the bitumen feed lines
181 connecting the plant storage tanks to the bitumen weighing system
182 or spray bar, so samples from the line may be withdrawn slowly
183 during plant operation. Install the sampling outlet between the
184 pump and the return line discharge in such a location that the
185 sampling outlet is readily accessible and free from obstruction.
186 Provide a drainage receptacle for flushing the outlet before
187 sampling.
188

189 (3) **Feeder for Drier.** Provide an accurate mechanical means
190 for uniformly feeding the aggregate into the drier so a uniform
191 production and uniform temperature can be obtained.

192
193 (4) **Drier.** Include driers that continuously agitate the aggregate
194 during the heating and drying process.

195
196 (5) **Screens.** Provide plant screens, capable of screening
197 aggregates to the specified sizes and proportions and having
198 normal capacities greater than the full capacity of the mixer.

199
200 (6) **Bins.** Storage bins shall be divided into at least three
201 compartments to provide separate storage of appropriate fractions
202 of the aggregate. Provide each bin with overflow pipes, of such
203 sizes and at such locations to prevent material from backing up
204 into other compartments or bins. Provide each compartment with
205 an individual outlet gate. The outlet gate shall not leak when
206 closed. The gates shall cut off quickly and completely. The bins
207 shall have means to sample the aggregates.

208
209 (7) **Bituminous Control Unit.** Provide satisfactory means,
210 either by weighing or metering, to obtain the proper quantity of
211 asphalt cement in the mixer within the tolerance specified.
212 Provide means for checking the quantity or rate of flow of asphalt
213 cement into the mixer.

214
215 (8) **Thermometric Equipment.** An armored thermometer of
216 adequate range shall be included in the bituminous feed line near
217 the charging valve at the mixer unit.

218
219 Also, the plant shall be equipped with a dial-scale,
220 mercury-actuated thermometer, or an electric pyrometer placed at
221 the discharge chute of the drier to register automatically or show
222 the temperature of the heated aggregate. The heat indicating
223 device shall be accurate to the nearest 10 degrees F. Install the
224 heat indicating device such that it will reflect a fluctuation of 10
225 degrees F on the aggregate temperature within one minute.

226
227 The Engineer may require replacement of thermometers by
228 an acceptable temperature-recording apparatus for better
229 regulation of the aggregate temperature at no cost to the State.

230
231 (9) **Dust Collector.** The plant shall be equipped with a dust
232 collector constructed to waste or return uniformly to the hot
233 elevator the material collected.

235 **(10) Safety Requirements.** Provide adequate and safe
236 stairways to the mixer platform and sampling points. Place
237 guarded ladders to other plant units at points where accessibility to
238 plant operations is required. Provide accessibility to the top of
239 truck bodies by a platform or other suitable device to enable the
240 Engineer to obtain sampling and mixture temperature data.
241 Provide a hoist or pulley system to raise scale calibration
242 equipment, sampling equipment and other similar equipment from
243 the ground to the mixer platform and return. Thoroughly guard and
244 protect gears, pulleys, chains, sprockets and other dangerous
245 moving parts. Provide ample and unobstructed space on the
246 mixing platform. Maintain a clear and unobstructed passage in
247 and around the truck loading area. Keep this area free of
248 drippings from the mixing platform.
249

250 **(11) Mineral Filler Feed.** Feed the filler, when used, to an
251 accuracy of 10 percent of the required weight. Thoroughly dry the
252 filler. Do not feed the filler through the drier system. Feed the
253 filler material directly into the mixer as near the center as possible
254 for batch type operation.
255

256 **(D) Requirements for Batching Plants.**
257

258 **(1) Weigh Box or Hopper.** Include a means for accurately
259 weighing each size of aggregate in a weigh box or hopper
260 suspended on scales and ample in size to hold a full batch without
261 hand raking or running over. The gate shall close tightly so that
262 no material shall leak into the mixer while weighing a batch.
263

264 **(2) Asphalt Cement Control.** The equipment used to measure
265 the asphalt cement shall be accurate to within ± 0.5 percent. The
266 asphalt cement bucket shall be a non-tilting type with a loose sheet
267 metal cover. Introduce the binder uniformly into the mixer along
268 the center of the mixer parallel to the mixer shafts, or by pressure
269 spraying. Heat the discharge valve or valves and spray bar of
270 the asphalt cement bucket adequately. Drain the steam jackets
271 efficiently, when used. The connections shall not interfere with the
272 efficient operation of the bituminous scales. The capacity of the
273 asphalt cement bucket shall be at least 15 percent greater than the
274 weight of asphalt cement required in batches. The plant shall have
275 an adequately heated, quick-acting, non-drip, charging valve
276 located directly over the asphalt cement bucket.
277

278 The indicator dial shall have a capacity of at least 15
279 percent greater than the quantity of asphalt cement used in a
280 batch. The dial shall be in full view of the mixer operator.

281 Discharge the asphalt cement required for one batch in not more
282 than 15 seconds after the flow has started. The size and spacing
283 of the spray bar openings shall provide a uniform application of
284 asphalt cement for the full length of the mixer. Provide the section
285 of the bituminous line between the charging valve and the spray
286 bar with a valve and outlet for checking the meter when a metering
287 device is substituted for an asphalt cement bucket.

288
289 **(3) Mixer.** The batch mixer shall be capable of producing a
290 uniform mixture within the job-mix tolerances. When not enclosed,
291 equip the mixer box with a dust hood to prevent loss of dust. The
292 mixer shall be leak-tight.

293
294 The clearance of blades from fixed and moving parts shall
295 not exceed 1 inch unless the maximum diameter of the aggregate
296 in the mix exceeds 1.25 inches, in which case the clearance shall
297 not exceed 1.5 inches.

298
299 **(4) Control of Mixing Time.** The mixer shall have a timing
300 device that shows by a definite audible or visual signal the
301 expiration of the mixing period. The device shall accurately
302 measure the time of mixing to within five seconds.

303
304 The dry mixing period is defined as the interval of time
305 between the opening of the weigh box gate and the start of
306 introduction of asphalt cement. The wet mixing period is the
307 interval of time between the start of introduction of asphalt cement
308 and the opening of the mixing gate.

309
310 **(E) Requirements for Continuous Mixing Plants.**

311
312 **(1) Aggregate Proportioning.** The plant shall include means
313 for accurately proportioning each size of aggregate.

314
315 The plant shall have a feeder mounted under each
316 compartment bin. Each compartment bin shall have an accurately
317 controlled individual gate to form an orifice for volumetrically
318 measuring the material drawn from each compartment. The
319 feeding orifice shall be rectangular with one dimension adjusted by
320 positive mechanical means provided with a lock.

321
322 Each gate shall have indicators to show the respective gate
323 opening in inches.

324
325 The fine bin shall have a vibrating unit. Provide a positive
326 system to show the level of material in each bin, and as the level of

material in one bin approaches the strike-off capacity of the feed gate, the device shall automatically close down the plant instantly. The Engineer will not permit the plant to operate unless this automatic system is in good working condition.

(2) Weight Calibration of Aggregate Feed. Calibrate gate openings by weighing test samples. Make provisions so that the materials fed out of individual orifices may be bypassed to individual test boxes. Equip the plant to conveniently handle individual test samples weighing not less than 200 pounds. Provide accurate scales of adequate capacities to weigh such test samples.

(3) Synchronization of Aggregate Feed and Asphalt Cement Feed. Provide means to afford positive interlocking control between the flow of aggregate from the bins and the flow of asphalt cement from the meter or other proportioning device satisfactorily. Control this by interlocking mechanical means.

The mechanically driven aggregate feeders shall be connected directly with the drive on the asphalt binder pump. Equip the drive shaft on the feed with a revolution counter reading to 1/100 revolution and with sufficient capacity to register the total number of revolutions in a day's run.

(4) Mixer. Include a continuous mixer of an acceptable type, adequately heated and capable of producing a uniform mixture within the job-mix tolerances.

The mixer shall have a discharge hopper with dump gates that will permit rapid and complete discharge of the mixture. The paddles shall be adjustable for angular position on the shafts and reversible to retard the flow of the mix. The mixer shall have a manufacturer's plate giving the net volumetric contents of the mixer at the several heights inscribed on a permanent gage. Provide charts showing the rate of feed of aggregate per minute for the aggregate being used.

(F) Requirements for Drier-Drum Mixing Plant.

(1) Cold Storage for Plants Utilizing Cold-Feed Control. Drier-drum plants equipped with cold-feed control shall separate the virgin aggregate for Asphalt Concrete Mix No. II into three or more sizes. Separate the virgin aggregate for Asphalt Concrete Mix Nos. III, IV, V and VI into two or more sizes. Request written acceptance from the Engineer when separating the aggregate for Asphalt Concrete Mix No. II into less than three sizes.

374 After separating the aggregates, store each size separately.
375 Each of the storage, except storage for filler material, shall
376 contribute a minimum of 10 percent to the total weight of the
377 aggregate.
378

379 **(2) Drying.** Feed the aggregates directly to a drier-drum mixer
380 at a uniform rate.
381

382 The drier-drum mixer shall have a device that shows the
383 temperature of the material leaving the drier-drum mixer. The
384 temperature-indicating device shall be accurate to the nearest 10
385 °F and show changes of 10 degrees F. in temperature of the
386 material within one minute.
387

388 The drier-drum mixers shall have dust collectors. The dust
389 shall be disposed of or returned to the aggregate.
390

391 **(3) Proportioning for Continuous Mixing.** Introduce the
392 asphalt binder into the mixer at constant pressure through a meter.
393 Install a gage for checking said pressure. The system shall be
394 capable of varying the rate of delivery of binder. During
395 production, the temperature of asphalt binder shall not vary more
396 than 40 degrees F. Heat and insulate the meter and lines. Equip
397 the binder storage with a device for automatic plant cut-off when
398 the level of binder is lowered sufficiently to expose the pump
399 suction line.
400

401 When using filler, proportion the filler by weight or volume
402 by a method that uniformly feeds the material within 10 percent of
403 the required amount. Discharge the filler material from the
404 proportioning device directly into the mixer.
405

406 **(4) Proportioning for Drier-Drum Mixing with Cold-Feed**
407 **Control.** When using cold-feed control with drier-drum mixing,
408 equip the asphalt feeder, the aggregate feeders, the filler material
409 feeder, and the combined aggregate feeder with devices by which
410 the rate of feed can be determined while the plant is in full
411 operation.
412

413 Weigh the combined aggregate using a belt scale. The belt
414 scale shall be of such accuracy that, when the plant is operating
415 between 30 percent and 100 percent of belt capacity, the average
416 difference between the shown weight of material delivered and the
417 actual weight delivered shall not exceed 1 percent of the actual
418 weight for three 2-minute runs. For the three individual two-minute
419 runs, the shown weight of material delivered shall not vary from the
420 actual weight delivered by more than 2 percent of the actual
421 weight. Determine the actual weight of material delivered by a

422 vehicle platform scale that has been sealed. Equip the plant so that
423 this accuracy check can be made after each relocation and set-up,
424 but before the first operation and at other times as required by the
425 Engineer.
426

427 Interlock the belt scale for the combined aggregate, the
428 proportioning devices for filler material, and the asphalt
429 proportioning meter so that the rates of feed of the aggregates and
430 asphalt shall be adjusted automatically to maintain the bitumen
431 ratio (pounds of asphalt per 100 pounds of dry aggregate including
432 filler if used) according to the approved mix design. Do not operate
433 the plant unless this automatic system is operating.
434

435 Equip the asphalt meters and aggregate belt scales used for
436 metering the aggregates and asphalt into the mixer with resettable
437 totalizers, so that the actual asphalt and aggregate introduced into
438 the mixer can be determined.
439

440 Equip the bin(s) containing the fine aggregate and filler with
441 a vibrating unit. Before the quantity of material in one bin reaches
442 the strike-off capacity of the feed gate, a device shall automatically
443 close down the plant.
444

445 Determine the moisture content of the aggregate at least
446 once during each production day. Adjust the moisture control
447 equipment accordingly.
448

449 In the absence of an acceptable aggregate sampling device
450 for the combined aggregate at a point before the aggregate enters
451 the drum drier and while the plant is in full operation, provide other
452 suitable sampling means acceptable to the Engineer.
453

454 When using filler, install a suitable, safe sampling device in
455 each feed line or surge tank preceding the proportioning device for
456 the filler.
457

458 **(5) Drier-Drum Mixing.** Mix the aggregate, filler and asphalt
459 binder in a drier-drum mixer. Mixing shall continue for a sufficient
460 time and at a sufficiently high temperature that, at discharge from
461 the mixer, the sizes of aggregates are uniformly distributed through
462 the completed mixture and particles are thoroughly and uniformly
463 coated with asphalt binder.
464

465 Discharge the drier-drum mixer into a storage silo or into a
466 surge bin. Provide a means of diverting the flow of asphalt
467 concrete away from the silo or surge bin, when starting and

468 stopping the plant production, to prevent incompletely mixed
469 portions of the mixture from entering the silo.

470
471 When using a surge bin:

- 472
473 a. do not hold the mixture beyond one hour,
474
475 b. do not segregate the mixture,
476
477 c. the mixture shall not be lumpy, and
478
479 d. the mixture shall meet temperature and quality
480 requirements of the contract.

481
482 The burner used for heating the aggregate in the drier-drum
483 shall achieve complete combustion of the fuel.

484
485 **(G) Asphalt Concrete Storage.** Store the asphalt concrete only in
486 silos. Do not stockpile the asphalt concrete. The minimum quantity of
487 asphalt concrete in storage during mixing shall be 20 tons except for the
488 period immediately following a shutdown of the plant of two hours or
489 more. Provide a means to show that the storage into each silo as
490 required is maintained.

491
492 Equip the storage silo to prevent segregation of the completed
493 mixture as the mixture is discharged into the silo.

494
495 Do not use asphalt concrete with hardened lumps in the mixture.
496 Do not use the storage facilities that contained the material with the
497 hardened lumps for further storage until the cause of the lumps is
498 corrected.

499
500 **401.05 Construction Requirements.**

501
502 **(A) Weather Limitations.** Do not place the bituminous plant mix:

- 503
504 (1) on wet surfaces, as determined by the Engineer, or
505
506 (2) when the air temperature is below 50 degrees F. or
507
508 (3) when weather conditions prevent the proper handling or
509 finishing of the bituminous mixtures.

510
511 **(B) Equipment.**
512

513 (1) **Hauling Equipment.** Trucks hauling bituminous mixtures
514 shall have tight, clean, smooth and metal beds that have been
515 thinly coated with a minimum quantity of detergent, paraffin oil, or
516 lime solution to prevent the mixture from adhering to the beds.
517 The use of diesel or petroleum-based liquids, except for paraffin
518 oil, to prevent the mixture from adhering to the beds is prohibited.
519

520 Each truck shall have a canvas cover to protect the mixture
521 from the weather. Protect each load from the weather with
522 covering securely fastened on all four sides of the truck bed.
523

524 Each truck shall raise their beds with tailgate closed before
525 discharging to prevent segregation.
526

527 Do not refuel equipment over newly paved surfaces.
528 Refuel equipment over a catch pan or a surface that will prevent
529 the fuel from coming in contact with the asphalt pavement. After
530 the refueling operation is completed, remove the above devices
531 until needed.
532

533 (2) **Bituminous Pavers.** Bituminous pavers shall be:
534

535 (a) self-contained, power-propelled units,
536

537 (b) provided with an activated screed or strike-off
538 assembly, heated if necessary, and
539

540 (c) capable of spreading and finishing courses of
541 bituminous plant mix material in lane widths applicable to
542 the specified typical section and thicknesses shown in the
543 contract.
544

545 Equip the paver with a receiving hopper having sufficient
546 capacity for uniform spreading operation. Equip the hopper with
547 a distribution system to place the mixture uniformly in front of the
548 screed.
549

550 Prior to each days paving operation, check the screed or
551 strike-off assembly surface with a straight edge to insure
552 straightness. The screed or strike-off assembly shall effectively
553 produce a finished surface of the required evenness and texture
554 without tearing, shoving or gouging the mixture. When the
555 spreading equipment leaves ridges, indentations, or other marks in
556 the surface that cannot be eliminated by rolling or prevented by
557 adjustment in operation, discontinue its use and furnish other
558 acceptable equipment.

559 Equip the paver with an acceptable electronic screed control
560 device. The electronic device shall include a grade sensor
561 mounted on each side of the paver. Each sensor shall take its
562 grade reference from a 30-foot ski for the first pass. For
563 subsequent passes, the Contractor may substitute one ski with a
564 joint-matching shoe riding on the finished adjacent pavement.
565

566 Demonstrate the competence of personnel operating the
567 grade and crown control device according to the contract before
568 placing surface courses. When the automatic control system
569 becomes inoperative during the day's work, the Engineer will
570 permit the Contractor to finish the day's work using manual
571 controls. Do not resume work thereafter until the automatic control
572 system is made operative. The Engineer may waive the use of the
573 electronic screed control device when paving gores, shoulders, or
574 transitions and miscellaneous reconstruction areas.
575

576 When laying mixtures, the paver shall be capable of
577 operating at forward speeds consistent with satisfactory laying of
578 the mixture. Do not change the forward speed of the paver after
579 start of paving operation. If necessary, the Engineer will limit the
580 load of the haul vehicle such that the Contractor will get
581 satisfactory spreading.
582

583 **(3) Rollers.** Rollers shall be the self-propelled, steel-tired
584 tandem pneumatic-tired or vibratory type. Rollers shall be capable
585 of reversing without backlash. The number and weight of rollers
586 shall be sufficient to compact the mixture to the required density
587 while the mixture is still in a workable condition. Do not use
588 equipment that results in excessive crushing of the aggregate.
589 Operate the rollers according to the manufacturer's
590 recommendations.
591

592 **(a) Steel-Tired Tandem Rollers.** Check the steel-wheel
593 rims for wear. When the rolling drum is grooved or pitted,
594 do not use the roller. Excessively worn scrapers and
595 wetting pads shall be replaced.
596

597 Steel-tired tandem rollers used for breakdown (initial)
598 or intermediate rolling passes shall have a minimum gross
599 weight of 12 tons. Steel-tired tandem rollers shall provide a
600 minimum of 250 pound weight per linear inch of width on the
601 compaction roller (drive wheel).
602

603 Steel-tired tandem rollers used for finish (final) rolling
604 passes shall have a minimum gross weight of eight tons.

605 **(b) Pneumatic-Tired Rollers.** Pneumatic tire rollers
606 shall be the oscillating type with smooth (tread) pneumatic
607 tires of equal size and diameter. Inflate and maintain the
608 tires to the designated pressure so that the air pressure will
609 not vary more than five psi from the established pressure.
610 Space the tires so that the gaps between adjacent tires are
611 covered by the following tires.

612
613 The pneumatic-tired rollers used for breakdown or
614 intermediate rolling passes shall have a total weight that can
615 be varied to produce an operating weight per tire of not less
616 than 3,000 pounds. The tires shall have a minimum wheel
617 diameter of 20 inches. The tire inflation pressure shall be
618 within 70 psi to 75 psi when cold and 90 psi when hot.
619 During cold or windy weather condition, equip the rollers
620 with skirt-type devices (mounted around the tires) to
621 maintain the temperature of the tires during rolling
622 operations.

623
624 The pneumatic-tired rollers used for kneading a
625 finished asphalt surface shall have a total weight that can be
626 varied to produce an operating weight per tire of not less
627 than 1,500 pounds. The tires shall have a minimum wheel
628 diameter of 15 inches and a 50 psi to 60 psi tire inflation
629 pressure.

630
631 **(c) Vibratory Rollers.** Vibratory rollers shall be
632 steel-tired tandem rollers, having a minimum weight of 7
633 tons. The vibratory rollers shall have amplitude and
634 frequency controls, speedometer, and be specifically
635 designed to compact the material on which the vibratory
636 roller is used. Operate the vibratory roller according to the
637 manufacturer's recommendations.

638
639 **(4) Hand Tools.** Keep hand tools used in the production,
640 hauling, or placement of asphalt concrete pavement clean and
641 free of contaminants. Liquids, such as diesel or mineral spirits,
642 may be used to clean the hand tools. Do not contaminate the
643 asphalt concrete pavement with cleaning liquids. Clean hand tools
644 over a catch pan with the capacity to hold all the cleaning liquid in
645 the container should it spill. Dry the hand tools before using with
646 the asphaltic material.

647
648 **(5) Material Transfer Vehicle (MTV).**

649
650 **(a) Usage.** Unless otherwise indicated in the contract
651 documents, MTV usage applies to paving projects on all
652 islands except Lanai and Molokai. When placing hot mix

asphalt surface course, use MTV to independently deliver mixtures from hauling equipment to paving equipment. MTV usage will not be required for the following:

1. Projects with less than 1,000 tons of hot mix asphalt.
2. Temporary pavements.
3. Bridge deck approaches.
4. Shoulders.
5. Tapes.
6. Turning lanes.

(b) Equipment. When using MTV, install minimum 10-ton-capacity hopper insert in conventional paver hopper. Provide the following equipment:

- (1) High capacity truck unloading system in MTV capable of receiving hot mix asphalt from hauling equipment.
- (2) MTV storage bin with minimum 15-ton capacity.
- (3) Auger mixing system in MTV storage bin, paver hopper insert, or paver hopper to continuously mix hot mix asphalt prior to discharging to conveyor system.

(c) Performance Evaluation. The Engineer will evaluate performance of MTV and mixing equipment by measuring mat temperature profile immediately behind paver screed on first day paving.

Six temperature profile measurements will be taken of mat surface using non-contact thermometers at 50-foot intervals behind paver. Each temperature profile will consist of three surface temperature measurements taken transversely across mat in approximately a straight line from screed while paver is operating. For each profile, temperature will be measured approximately 1 foot from each edge and in middle of mat; and difference between maximum and minimum temperature measurements within each temperature profile shall not exceed 10 degrees F. If

any two or more temperature profiles exceed allowable 10-degree F temperature differential, halt paving operation and adjust MTV or mixing equipment to ensure that material placed by paver meets specified temperature requirements.

Once adjustments are made, the Engineer will repeat measurement procedure to verify that material placed by paver meets specified temperature requirements. Terminate paving if temperature profile requirements are not met during repeated measurement procedure. If equipment fails to meet measurements after measurement procedure is repeated once, equipment replacement will be required before the Engineer conducts any further temperature profile measurements.

The Engineer may perform additional surface temperature profile measurements at any time during project. If two consecutive temperature profiles fail to comply with specified allowable temperature differential, halt paving operation and adjust MTV or mixing equipment to ensure that HMA placed by paver complies with temperature requirements.

(d) Transport.

1. Trailered MTV. Transport MTV by means of truck-tractor/trailer combination in accordance with Chapter 104 of Title 19, Department of Transportation, entitled 'The Movement by Permit of Oversize and overweight Vehicles on State Highways'.

2. Crossing Bridges for Self-Powered MTV. When self-powered MTV exceeds legal axle or total weight limits for vehicles under the HRS, Chapter 291, conform to the following when crossing bridges within project limits unless otherwise indicated in the contract documents:

- a. Completely remove mix from MTV.
- b. Move MTV at relatively constant speed not exceeding 5 miles per hour. MTV will not be allowed to stop on bridge.
- c. No other vehicle or equipment will be allowed on bridge.

749 **(C) Preparation of Surface.** Before laying the asphalt concrete
750 pavement, prepare the surface according to the contract. For resurfacing
751 work, surface preparation shall include the removal of traffic tapes, and
752 raised pavement markers, prior to application of the tack coat. The
753 removal of thermoplastic line markings and epoxy adhesives are not
754 required. When the prepared surface becomes damaged or
755 unsatisfactory, repair the damaged or unsatisfactory surface at no cost to
756 the State before work proceeds.

757
758 Paint the contact surfaces of curbs, gutters, manholes, and other
759 structures with a thin, uniform coating of asphalt paint before placing the
760 bituminous mixture against them.

761
762 For resurfacing work, bring irregular surfaces to uniform grade and
763 cross section before paving the existing pavement. Fill and compact the
764 holes, cracks and wheel ruts with Asphalt Concrete Pavement, Mix No. V,
765 before resurfacing. Also, mark the location of existing manholes, valves,
766 and handholes on the roadway so the location after paving can be
767 determined. Unless otherwise noted, adjust all existing frame and cover
768 to new finish pavement finish grade after finish pavement is completed.

769
770 **(D) Spreading and Finishing.** Lay, spread, and strike off the mixture
771 upon an acceptable surface to the grade and elevation established.
772 Use the bituminous pavers to distribute the mixture either over the entire
773 width or over such partial width as may be practicable.

774
775 The longitudinal joint in one layer shall offset that in the layer
776 immediately below by approximately 6 inches; however, the joint in the top
777 layer shall be at the centerline of the pavement when the roadway
778 comprises two lanes of width, or at lane lines when the roadway is more
779 than two lanes in width.

780
781 The minimum temperature of the bituminous mixture as discharged
782 to the paver shall not be less than 250 degrees F.

783
784 On areas where irregularities or unavoidable obstacles make the
785 use of mechanical spreading and finishing equipment impracticable,
786 spread, rake, and lute the mixture by hand tools. For such areas, dump,
787 spread, and screed the mixture to give the required compacted thickness.

788
789 When the production of the mixture can be maintained and when
790 practicable, use the pavers in echelon to place the wearing course in
791 adjacent lanes.

792
793 When the lanes are required to be opened to public traffic, pave
794 the full travelway or total width of roadway each day. However, at the
795 discretion of the Engineer, the Contractor may construct a transition taper
796 at the longitudinal pavement drop so as not to leave a vertical face.

797 The transition taper shall be along the lane line and formed by a one foot
798 slope shoe attached on the paving machine, that would produce a wedge
799 with a maximum height of three inches down to zero inch. Remove the
800 transition taper before placing adjacent lifts.
801

802 The minimum and maximum allowable laying thickness for the
803 various types of mixture are specified in Table 401-II - Limits of
804 Bituminous Binder Content.
805

806 **(E) Compaction.** Immediately after spreading and striking off the
807 bituminous mixture and adjusting surface irregularities, thoroughly and
808 uniformly compact the mixture by rolling.
809

810 Initiate the compaction of the mixture when the mix temperature is
811 the highest at which the mixture can be compacted without excessive
812 horizontal movement. The temperature shall not be less than 220 degrees
813 F.
814

815 Use pneumatic or steel-tired tandem rollers for initial or breakdown
816 rolling. Do not use pneumatic tire rollers for initial or breakdown rolling
817 on final lifts of a traveled way including auxiliary lanes.
818

819 Finish rolling using a tandem roller weighing not less than eight
820 tons. Roll at or above 175 degrees F.
821

822 Rolling shall begin at the sides and proceed longitudinally parallel
823 to the road centerline, each trip overlapping half the roller width, gradually
824 progressing to the crown of the road. When using vibratory roller, the
825 overlap shall be less than 6 inches. When paving in echelon or abutting
826 a previously placed lane, roll the longitudinal joint first followed by the
827 regular rolling procedures. On superelevated curves, the rolling shall
828 begin at the low side and progress to the high side by overlapping of
829 longitudinal trips parallel to the centerline.
830

831 Correct the displacements occurring as a result of the reversing
832 direction of a roller, or from other causes, at once by the use of rakes and
833 addition of fresh mixture when required. Roll so as not to displace the
834 line and grade of the edges of the bituminous mixture.
835

836 To prevent adhesion of the mixture to the rollers, keep the wheels
837 properly moistened with water or water mixed with very small quantities of
838 detergent. The Engineer will not permit excess liquid. Do not use diesel
839 or petroleum-based liquids on the rollers.
840

841
842 Along forms, curbs, headers, walls and other places not accessible
843 to the rollers, thoroughly compact the mixture with hot hand tampers,
844 smoothing irons or with mechanical tampers. On depressed areas, use

845 a trench roller or cleated compression strips under the roller to transmit
846 compression to the depressed areas.

847
848 When the mixture becomes loose and broken, mixed with dirt, or is
849 defective, remove, replace, and compact the mixture with fresh hot
850 mixture to conform with the surrounding area. Remove and replace
851 areas showing an excess or deficiency of asphalt cement.

852
853 Rollers shall move at a slow but uniform speed with the drive
854 wheels nearest the paver. Continue the rolling to attain the desired
855 density and until the roller marks are eliminated.

856
857 **(1) Courses Equal to or Greater Than 1.5 Inches Thick.**

858 The relative compaction requirement for pavement courses that
859 have a nominal compacted thickness equal to or greater than 1.5
860 inches shall be not less than 92 percent nor greater than 97
861 percent based on AASHTO T 209 modified by deletion of
862 supplemental procedure for Mixtures Containing Porous
863 Aggregate. The type of rollers and their relative position in the
864 compaction sequence shall generally be the Contractor's option.

865
866 **(2) Courses Less Than 1.5 Inches Thick.** Compaction to a
867 specified density for pavement courses that have a nominal
868 compacted thickness of less than 1.5 inches will not be required.

869
870 Initiate rolling by a non-vibratory steel-tired tandem roller.

871
872 Do intermediate rolling by a pneumatic tired roller. The
873 rolling shall continue until after compacting the entire surface by a
874 minimum of four coverage of the roller. Do additional coverage as
875 necessary to obtain thorough compaction of the mixture.

876
877 Finish the rolling using a steel-tired tandem roller.
878 Continue rolling until the entire surface has been compacted by a
879 minimum of three coverage of the roller and the roller marks have
880 been eliminated.

881
882 Do not use the vibratory roller.

883
884 **(3) Special Areas Not Designed For Vehicular Traffic.** The
885 relative compaction of areas such as bikeways not shown as part
886 of the roadway and other areas not subjected to vehicular traffic
887 shall be not less than 90 percent based on AASHTO T 209
888 modified by deletion of supplemental procedure for mixture
889 containing porous aggregate. The type of rollers and their relative
890 position in the compaction sequence shall generally be the

Contractor's option. However, the Contractor shall increase the asphalt content by at least 0.5 percent above that used for asphaltic concrete pavements.

(F) Joints. Placing of the bituminous paving shall be as continuous as possible. Rollers shall not pass over the unprotected end of a freshly laid mixture. Form the transverse and longitudinal joints by cutting back on the previous run to expose the full depth of the course. Use a brush coat of asphalt paint on contact surfaces of transverse and longitudinal joints before placing additional mixture against the previously rolled material.

(G) Pavement Samples. Cut samples from the compacted pavement for testing within 48 hours of lay down. The cut pavement samples shall be 12 inches by 12 inches or 4-inch diameter cores, minimum. Take samples of the mixture for the full depth of the course at the location shown by the Engineer. Place and compact the sampled area with new materials to conform with the surrounding area.

(H) Surface Tolerances. The Engineer will test the surface using a ten-foot straightedge at selected locations. The variation of the surface from the testing edge of the straightedge between two contacts with the surface shall not exceed 3/16 inch.

The thickness of the finished pavement shall be within 0.02 foot of the planned thickness at points of the cross section.

When specified by the Engineer, correct irregularities of the pavement exceeding the above limits including removal and replacement at no cost to the State.

(I) Protection of Pavement. In multiple layer construction, the Engineer will not permit construction equipment except those directly connected with paving operations, on intermediate layers without written authorization by the Engineer. An intermediate layer is defined as layers other than the finished surface layer.

The Engineer will not permit traffic on courses of asphalt concrete until the asphalt concrete has cooled and set, except such traffic as may be necessary for construction purpose.

(J) Tack Coat. Apply tack coat to bituminous and concrete surfaces before placing the asphalt concrete pavement. The tack coat shall conform to Section 407 - Bituminous Tack Coat.

401.06 Method of Measurement. The Engineer will measure asphalt concrete pavement per ton.

401.07 Basis of Payment. The Engineer will pay for the accepted asphalt concrete pavement at the contract unit price per ton complete in place.

The price includes full compensation for preparing the surface; removing and disposing of all existing raised pavement markers and traffic tapes; furnishing the asphalt concrete pavement; spreading, furnishing, applying, and protecting the tack coat; compacting, and finishing the asphalt concrete pavement; sampling; protecting the pavement; and furnishing labor, material, tools, equipment, and incidentals necessary to complete the work.

The Engineer will make payment under:

Pay Item	Pay Unit
Asphalt Concrete Pavement, Mix No. _____	Ton"

The Engineer may, in lieu of requiring removal and replacement, use the sliding scale pay factor to accept asphalt concrete pavements compacted to 90, 91, or 98 percent. The Engineer will make payment for the material in that production day at a reduced price arrived at by multiplying the contract unit price by the pay factor as shown in Table IV.

TABLE IV - SLIDING SCALE PAY FACTOR	
Percent Compaction	Percent Payment
>98	Removal
98	95
92 - 97	100
90 - 91	80
<90	Removal

END OF SECTION