
Special Specification 5041

Speed Cushions



1. DESCRIPTION

Construct a Speed Cushion composed of a compacted mixture of coarse and fine aggregates and asphaltic binder, at the locations shown on the plans

2. MATERIALS

Furnish materials conforming to the following:

2.1. Coarse Aggregate.

Use gravel, crushed stone, or combination of both, that is retained on No. 10 sieve, uniform in quality throughout and free from dirt, organics, or other injurious matter occurring either free or as coating on aggregate. Use aggregate conforming to ASTM C 33 except for gradation. Furnish rock or gravel with Los Angeles abrasion loss not to exceed 40 percent by weight when tested in accordance with ASTM C 131.

Use aggregate by weight that does not contain more than 1.0 percent by weight of fine dust, claylike particles, or silt when tested in accordance with Tex-217-F, Part II.

2.2. Fine Aggregate.

Provide sand, stone screenings, or combination of both passing No. 10 sieve. Use aggregate conforming to ASTM C 33 except for gradation. Use sand composed of sound, durable stone particles free from loams, or other injurious foreign matter. Furnish screenings of same or similar material as specified for coarse aggregate. Ensure the plasticity index of that part of fine aggregate passing No. 40 sieve is not more than 6 when tested by TxDOT Tex106-E. The minimum allowable sand equivalent is 45 when tested by TxDOT Tex-203-F.

2.3. Composite Aggregate.

Conform to limits in Table 1 when graded in accordance with TxDOT Tex-200-F. Use the type specified on the plans:

Table 1
Gradation of Composite Aggregate

Sieve Size	PERCENT PASSING	
	Course Surface (TxDOT Type C)	Fine Surface (TxDOT Type D)
	-	-
¾ in.	95.0 – 100.0	-
½ in.	-	98.0 – 100.0
3/8 in.	70.0 – 85.0	85.0 -100.0
#4	43.0 – 63.0	50.0 – 70.0
#8	32.0 – 44.0	35.0 – 46.0
#30	14.0 – 28.0	15.0 – 29.0
#50	7.0 – 21.0	7.0 – 20.0
#200 *	2.0 – 7.0	2.0 – 7.0
VMA % minimum	14.0	15.0
* 2 to 8 when Test Method Tex-200-F, Part II (Washed Sieve Analysis) is used.		

2.3.1. Asphalt Binder.

Provide moisture-free homogeneous material which will not foam when heated to 347° F, meeting the requirements in Table 2.

Table 2
Asphalt Binder

PERFORMANCE GRADED BINDER	
CRITERIA/TEST	PERFORMANCE GRADE (PG64-22)
Average 7-day Maximum Pavement Design Temperature, °C	< 64
Minimum Pavement Design Temperature, °C	> -22
ORIGINAL BINDER	
Flash Point Temperature, T48; Minimum °C	230
Viscosity, ASTM D 4402; Maximum, 3Pa*s (3000 cP) Test Temperature, °C	135
Dynamic Shear, TP5; G*/sin[], Minimum, 1.00 kPa Test Temperature @ 10 rad/sec., °C	64
ROLLING THIN FILM OVEN (T240) OR THIN FILM OVEN (T179) RESIDUE	
Mass Loss, Maximum, %	1.00
Dynamic Shear, TP5, G*/sin[], Minimum, 2.20 kPa Test Temperature @ 10 rad/sec., °C	64
PRESSURE AGING VESSEL RESIDUE (PP1)	
PAV Aging Temperature, °C	100
Dynamic Shear, TP5, G*/sin[], Minimum, 5000 kPa Test Temperature @ 10 rad/sec., °C	25
Physical hardening	Report
Creep Stiffness, TP1; S, Maximum, 300 Mpa –value, Minimum, 0.300 Test Temperature @ 60 sec., °C	-12
Direct Tension, TP3; Failure Strain, Minimum, 1.0% Test Temperature @ 1.0 mm/min, °C	-12

2.4. Anti-stripping Agent.

Evaluate the mixture of aggregate, asphalt, and additives proposed for use for moisture susceptibility and requirement for anti-stripping agents. To substantiate mix design, produce and test trial mixtures using proposed project materials and equipment before placing. Test for susceptibility to moisture and trial mixture

may be waived by the Engineer when similar designs using same the material have previously proven satisfactory.

2.4.1. **Liquid Anti-stripping Agent.**

Use an anti-stripping agent with uniform liquid with no evidence of crystallization, settling, or separation of components. Submit a sample of the antistripping agent proposed for use and manufacturer's product data, including recommended dosage range, handling and storage, and application instructions.

2.5. **Pavement Markings for Speed Cushions.**

Conform to requirements of Item 666 – Retroreflectorized Pavement Markings.

3. EQUIPMENT

3.1. **Mixing Plant.**

Provide a weight-batching or drum mix plant with capacity for producing continuous mixtures meeting specifications. With exception of a drum mix plant, furnish the plant with satisfactory conveyors, power units, aggregate handling equipment, hot aggregate screens and bins, and dust collectors.

Provide equipment to supply materials adequately in accordance with rated capacity of plant and produce finished material within specified tolerances. Provide the following essential equipment:

- Cold aggregate bins and proportioning device
- Dryer
- Screens
- Aggregate weight box and batching scales
- Mixer
- Asphalt storage and heating devices
- Asphalt measuring devices
- Truck scales

3.2. **Bins.**

Separate the aggregate into a minimum of four bins to produce consistently uniform grading and asphalt content in completed mix. Provide one cold feed bin per stockpile.

3.3. **Mixes.**

3.3.1. Employ certified testing laboratory to prepare design mixes. Test in accordance with TxDOT Tex-126-E or Tex-204-F, Tex-206-F, Tex-208-F, Tex-530-C, and Tex-531-C.

Meet the Density, Stability, and Air Void Requirements provided in Table 3 below:

**Table 3
Density, Stability and Air Void Requirements**

Percent Density		Percent Optimum	HVEEM Stability Percent Not Less Than
Min	Max		
94.5	97.5	96	35

4. CONSTRUCTION

Construct a Speed Cushion composed of a compacted mixture of coarse and fine aggregates and asphaltic binder, at the locations shown on the plans.

4.1. Examination.

Verify the compacted base course is ready to support imposed loads. Verify lines and grades are correct.

4.2. Preparation.**4.2.1. Tack Coat.**

Conform to requirements of Item 300, "Asphalts, Oils and Emulsions." Where the mixture adheres to the surface on which it is placed without use of a tack coat, the tack coat may be eliminated when approved by the Engineer.

4.2.2. Milling of Pavement for Speed Cushions.

Mill pavement (concrete or asphalt) to a depth of one in. and a width between 18 and 24 in. around the entire perimeter of the proposed speed cushion, as shown in the detail for the speed cushion design.

4.3. Placement.

Do not place asphalt pavement less than 2 in. thick when the surface temperature taken in the shade and away from artificial heat is below 50° F and falling. Placing asphalt when the temperature is above 40° F and rising is allowed.

Haul the prepared and heated asphaltic concrete mixture to the project in tight vehicles previously cleaned of foreign material. Only place mixture when the mixture temperature is between 250° F and 325° F.

Spread the material into place with an approved mechanical spreading and finishing machine of the screening or tamping type.

4.3.1. Joints.

Pass the roller over unprotected ends of the freshly laid mixture only when mixture has cooled. When work is resumed, cut back laid material to produce a slightly beveled edge for the full thickness of course. Remove old material which has been cut away and lay the new mix against the fresh cut.

In smaller restricted areas where use of a paver is impractical, spread the material by hand. Compact asphalt by mechanical means. Carefully place materials to avoid segregation of the mix. Do not broadcast the material. Remove lumps that do not break down readily.

4.4. Compaction.

Construct a test strip to identify the correct type, number, and sequence of rollers necessary to obtain the specified in-place density or air-voids when directed by the Engineer. Prepare the test strip at least 1,000 ft. in length, comparable to placement and compaction conditions for the project.

Begin rolling while pavement is still hot and as soon as it will bear roller without shoving, displacement or hair cracking. Keep wheels properly moistened with water to prevent adhesion of surface mixture. Do not use excessive water or petroleum by-products.

Compact the surface thoroughly and uniformly, first with power-driven, 3-wheel, or tandem rollers weighing a minimum of 8 tons. Obtain subsequent compression by starting at one side and rolling longitudinally toward the center of pavement, overlapping on successive trips by at least one-half width of the rear wheels. Make alternate trips slightly different in length. Continue rolling until no further compression can be obtained and rolling marks are eliminated. Complete rolling before mat temperature drops below 185 F.

Use a tandem roller for final rolling. Double coverage with approved pneumatic roller on asphaltic concrete surface is acceptable after flat wheel and tandem rolling is complete.

Compact binder course and surface course to a minimum density of 91 percent of maximum possible density of voidless mixture composed of the same materials in like proportions.

4.5. **Tolerances.**

Ensure dimensions of speed cushions conforms to the details for speed cushion design and speed cushion height tolerances as shown on the Speed Cushions Arrangement Sheet.

4.6. **Nonconforming Pavement.**

Replace speed cushions which do not conform to requirements of details, or which are rejected by the Engineer.

4.7. **Protection.**

Do not open pavement to traffic until completion of rolling and the temperature cools to set the asphaltic concrete surface, or as shown on the plans, or as directed.

Maintain asphalt pavement in good condition until completion of the work. Repair defects immediately by replacing asphalt pavement to full depth.

4.8. **Pavement Markings for Speed Cushions.**

Apply pavement markings to speed cushions in conformance with dimensions shown on detail for speed cushion design.

5. MEASUREMENT

Speed Cushions will be measured by each location (line of three complete in place) that speed cushions are installed.

6. PAYMENT

The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit bid price for "Speed Cushions."

This price is full compensation for milling of existing pavement, tack coat, thermoplastic markings applied to speed cushion, hauling, preparing, and placing materials, equipment, labor, tools, and incidentals.