Designation: D 995 – 95

AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures[1]

This standard is issued under the fixed designation D 995; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This specification has been approved for use by agencies of the Department of Defense. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.

1. Scope

1.1 This specification covers requirements for plants suitable for producing hot-mixed, hot-laid bituminous paving mixtures.

1.2 The values stated in inch-pound units are to be regarded as the standard.

2. Referenced Documents

2.1 *ASTM Standards:*

C 136 Test Method for Sieve Analysis of Fine and Coarse Aggregates[2]

D 8 Terminology Relating to Materials for Roads and Pavements[3]

D 140 Practice for Sampling Bituminous Materials[3]

3. Requirements for All Plants

3.1 *Uniformity*—The plant shall be capable of uniformly combining and mixing various sizes of aggregate from stockpiles, reclaimed asphalt pavement, if required, and bituminous material.

3.2 *Equipment for Preparation of Bituminous Material:*

3.2.1 Tanks for storage of bituminous material shall be equipped for heating the material, under effective and positive control at all times, to the temperature required in the paving mixture specifications. Heating shall be by steam or oil coils, electricity, or other means such that no flame shall contact the heating tank.

3.2.2 The circulating system for the bituminous material shall be of adequate capacity to provide proper and continuous circulation between storage tank and proportioning units during the entire operating period.

3.2.2.1 The discharge end of the bituminous material circulating pipe shall be kept below the surface of the bituminous material in the storage tank to prevent discharging the hot bituminous material into the open air.

3.2.2.2 All pipe lines and fittings shall be steam or oil-jacketed or otherwise properly insulated to prevent heat loss. When the bituminous material is emulsified asphalt, provisions should be made in the bitumen transfer system that will enable the operator to turn off or reduce the heat media from all lines, pumps, and jacketed bituminous material buckets as soon as the system is open and circulating properly.

3.2.3 Storage tank capacity shall be such as to ensure continuous operation of the plant and uniform temperature of the bituminous material when it is introduced into the aggregate. Tanks shall be calibrated accurately to 100-gal (378.5-L) intervals and shall be accessible for measuring the volume of bituminous material at any time.

3.2.4 A sampling tap, complying with the requirements of Practice D 140, shall be provided in the bituminous material feed lines connecting the storage tanks to the bituminous control unit.

3.2.5 When filled or native bituminous materials are used, means shall be provided for agitation to maintain a uniform product.

3.3 *Mineral Filler*—Adequate dry storage shall be provided for mineral filler, when required, and provision shall be made for accurate proportioning.

3.4 *Cold Aggregate Feeder*—The plant shall be provided with mechanical means for uniformly feeding the aggregates into the dryer so that uniform production and temperature may be assured. When aggregates must be blended from two or more bins at the cold feed to meet the requirements of the paving mixture specifications, a synchronized proportioning method shall be provided.

3.4.1 If recycling capability is required, the plant shall be equipped with mechanical means for feeding the desired weight of reclaimed asphalt pavement into the mix. Facilities shall be provided for obtaining samples of the reclaimed asphalt pavement.

3.5 *Dryer*—A dryer of satisfactory design capable of drying and heating the aggregate to the moisture and temperature requirements of the paving mixture specifications shall be provided.

3.6 *Bituminous Control Unit:*

3.6.1 Satisfactory means, either by weighing or metering, shall be provided to obtain the proper amount of bituminous material. Accuracy of the metering devices shall be within 1.0 % of the actual weight being measured when that weight

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[1] This specification is under the jurisdiction of ASTM Committee D-4 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.23 on Plant-Mix Bituminous Surfaces and Bases.

Current edition approved Feb. 15, 1995. Published April 1995. Originally published as D 995 – 48 T. Last previous edition D 995 – 88.

[2] *Annual Book of ASTM Standards*, Vol 04.02.

[3] *Annual Book of ASTM Standards*, Vol 04.03.

has been determined using another measuring device and shall be within 0.5 % when that weight has been determined using test weights. Bituminous material scales shall conform to 6.5.

3.6.2 Suitable means shall be provided, either by steam or oil jacketing, or other insulation, for maintaining the specified temperature of the bituminous material in the pipe lines, meters, weigh buckets, spray bars, and other containers or flow lines.

3.7 *Thermometric Equipment:*

3.7.1 An armored recording thermometer of suitable range shall be fixed in the bituminous material feed line at a suitable location near the discharge at the mixer unit.

3.7.2 Approved recording thermometers, pyrometers, or other recording thermometric instruments shall be fixed at the discharge chute of the dryer and, when applicable, in the hot fines bin to register and record automatically the temperature of the heated aggregate or heated mixture.

3.8 *Emission Controls:*

3.8.1 A dust collecting system shall be provided. The system shall be made to waste the material so collected, or to return all or any part uniformly to the mixture.

3.8.2 Other emissions, such as smoke but excepting water vapor, shall be controlled to be in compliance with applicable limits.

3.9 *Surge and Storage Bins*—If bins are used for surge or storage, they shall be such that mixture drawn from the bin meets the requirements of the paving mixture specification.

3.10 *Safety Requirements:*

3.10.1 Adequate and safe stairways to the mixer platform shall be provided if applicable. Guarded ladders to other plant units shall be located where required.

3.10.2 All gears, pulleys, chains, sprockets, and other dangerous moving parts shall be thoroughly protected.

3.10.3 Ample unobstructed space shall be provided on the mixing platform if applicable.

3.10.4 An unobstructed passage shall be maintained at all times in and around the truck-loading space. This space shall be kept free of drippings from the mixing platform. A ladder or platform shall be located at the truck-loading space to permit easy and safe inspection of the mixture as it is delivered into the trucks. Overhead protection shall be provided where necessary.

4. Significance and Use

4.1 This standard specification describes the various components of batch, continuous mix, and drum mix plants. This standard is useful to help evaluate existing plants and for specifying new plants to ensure the plant is capable of producing a quality product. This standard does not address plant operation and control or mixture production.

5. Requirements for Plants Controlling Gradation of Hot, Dry Aggregates

5.1 *Plant Screens:*

5.1.1 Plants shall be equipped with plant screens located between the dryer and hot aggregate bins and shall have adequate capacity and size range to separate the heated aggregate into the sizes required for proportioning so that they may be recombined consistently within the specification limits.

5.1.2 The nominal maximum size aggregate in the fines bin shall be specified. The screen type and size shall be determined by the operator. No aggregate shall be larger than the maximum specified.

5.1.3 Control shall be based on frequent bin samples tested in accordance with Test Method C 136. Aggregate in each bin, including mineral filler, shall be combined in proper proportions, and the composite shall be checked for compliance with the paving mixture specifications.

5.2 *Hot Aggregate Bins:*

5.2.1 Hot-bin storage of sufficient capacity to ensure uniform and continuous operation shall be provided. Bins shall be divided into the specified number of compartments arranged to ensure separate and adequate storage of appropriate fractions of the aggregate.

5.2.2 Each compartment shall be provided with an overflow chute of such size and at such a location to prevent any backing up of material into other compartments or into contact with the screen.

5.2.3 Bins shall be equipped with "tell-tale" devices to indicate the position of the aggregate in the bins at the lower quarter points. An automatic plant shut-off shall be provided to operate when any aggregate bin becomes empty.

5.2.4 Adequate and convenient facilities shall be provided for obtaining aggregate samples from each bin.

6. Requirements for Plants Controlling Gradation of Cold, Damp Aggregates

6.1 *Maximum Aggregate Size*—Oversize aggregate shall be rejected by suitable methods or devices before the aggregate enters the cold feed, or by plant screens complying with 5.1.

6.2 *Cold Feed Bins:*

6.2.1 Cold feed bins shall be equipped with "tell-tale" devices to indicate the position of the aggregate in the bins at the lower quarter points. An automatic plant shut-off shall be provided to operate when any aggregate bin becomes empty or the flow from any bin gate becomes restricted.

6.2.2 Adequate and convenient facilities shall be provided for obtaining samples of the full flow of aggregate from each cold feed bin and from the total cold feed.

6.2.3 Adequate and convenient facilities shall be provided for diverting aggregate flow into trucks or other suitable containers to check the accuracy of the aggregate delivery system.

6.2.4 Control shall be based on frequent samples from each cold-feed bin and the total cold feed tested by Test Method C 136. Results of total cold-feed samples shall be checked for compliance with the paving mixture specifications.

7. Requirements for Batch Plants

7.1 *Control of Aggregate Gradation*—The plant shall be equipped to control aggregate gradation in accordance with the requirements of either Section 5 or Section 6.

7.2 *Weigh Box or Hopper:*

7.2.1 Means shall be provided for weighing aggregate from each bin into a weigh box or hopper, suspended on scales, and ample in size to hold a full batch.

7.2.2 The weigh box or hopper shall be supported on fulcrums and knife edges that will not easily be thrown out of alignment or adjustment.

7.2.3 Gates, both on the bins and the hopper, shall not leak.

7.3 *Aggregate scales:*

7.3.1 Scales for any weigh box or hopper may be either beam or springless-dial type and shall be of standard make and design. The accuracy of the weighing device shall be within 1.0 % of the actual weight being measured when that weight has been determined using another measuring device and shall be within 0.5 % when that weight has been determined using test weights.

7.3.2 The change in load required to alter noticeably the position of rest of the indicating element (or elements) of a nonautomatic indicating scale shall not be greater than 0.1 % of the nominal scale capacity.

7.3.3 Beam type scales shall be equipped with a device to indicate that the required load is being approached. This device shall indicate at least the last 200 lb (91 kg) of the load.

7.3.4 Graduation intervals for either beam or dial scales shall not be greater than 0.1 % of the nominal scale capacity. Scale graduations and markings shall be plainly visible.

7.3.5 On dial scales, parallax effects shall be reduced to the practical minimum with clearance between the indicator index and scale graduations not exceeding 0.06 in. (1.5 mm).

7.3.6 Scales shall be equipped with adjustable pointers for marking the weight of each material to be weighed into the batch.

7.3.7 Not less than ten test weights, each of 50-lb (22.7-kg) nominal weight and each stamped with its actual weight to within ±0.05 %, shall be provided for the purpose of testing and calibrating the scales. For each scale a suitable cradle or platform shall be provided for applying the test loads. The test weights shall be kept clean and conveniently located for calibration of the scale.

7.4 *Bituminous Material Bucket:*

7.4.1 If a bucket is used, it shall be large enough to handle a batch in a single weighing.

7.4.2 The filling system and bucket shall be of such design, size, and shape that the bituminous material will not overflow, splash, or spill outside the bucket during filling and weighing.

7.4.3 The time required to add the bituminous material shall not exceed 20 s. Where the quantity of bituminous material is metered, provision shall be made to check the delivery of the meter by actual weight.

7.4.4 The bucket shall be steam or oil-jacketed or equipped with properly insulated electric heating units. It shall be arranged to deliver the bituminous material in a thin uniform sheet or in multiple sprays over the full length of the mixer.

7.5 *Bituminous Material Scales*—Scales for the weighing of bituminous material shall meet the requirements for aggregate scales, as specified in 7.3 except a device to indicate at least the last 20 lb (9.1 kg) of the approaching total load shall be provided. Beam-type scales shall be equipped with a tare beam or adequate counterbalance for balancing the bucket and compensating periodically for the accumulation of bituminous material on the bucket.

7.6 *Mixer Unit for Batch Method:*

7.6.1 The plant shall include a batch mixer of an approved twin-shaft pugmill type capable of producing a uniform mixture.

7.6.1.1 The mixer shall be designed to provide means of adjusting the clearance between the mixer blades and liner plates to ensure proper and efficient mixing.

7.6.1.2 If not enclosed, the mixer box shall be equipped with a dust hood to prevent loss of dust by dispersion.

7.6.1.3 The mixer shall be constructed to prevent leakage of the contents.

7.6.1.4 Mixer discharge shall not cause appreciable segregation.

7.6.2 The mixer shall be equipped with a positive means for governing mixing time and an accurate time lock to control the operation of a complete mixing cycle by locking the weigh-box gate after the charging of the mixer until the closing of the mixer gates at the completion of the cycle; it shall lock the bituminous material bucket throughout the dry-mixing period and shall lock the mixer gate throughout the dry- and wet-mixing periods.

7.6.2.1 The dry-mixing period is defined as the interval of time between the opening of the weigh-box gate and the application of bituminous material. The wet-mixing period is the interval of time between the start of the application of bituminous material and the opening of the mixer gate.

7.6.2.2 The timing control shall be flexible and capable of being set at intervals of not more than 5 s throughout cycles up to 3 min.

7.6.2.3 If required by the specifications, a mechanical batch counter shall be installed as part of the timing device and shall be designed to register only completely mixed batches.

7.7 *Automation of Batching:*

7.7.1 If required by the specifications, an automatic weighing, cycling, and monitoring system shall be installed as part of the batching equipment.

7.7.2 The system shall include equipment for accurately proportioning the various components of the mixture by weight or by volume in the proper order, and equipment for controlling the cycle sequence and timing of mixture operations. There shall be auxiliary interlock cut-off circuits to interrupt and stop the automatic batching operations whenever an error exceeding the acceptable tolerance occurs in proportioning.

7.7.3 *Accuracy*—The automatic proportioning system shall be capable of consistently delivering materials within the full range of batch sizes within the following tolerances:

	Total Batch Weight of Paving Mix, %
Batch aggregate component	±1.5
Mineral filler	±0.5
Bituminous material	±0.1
Zero return (aggregate)	±0.5
Zero return (bituminous material)	±0.1

The electrical circuits for the above delivery tolerances of each cut-off interlock shall be capable of providing the total span for the full allowable tolerance for maximum batch size. Tolerance controls shall be automatically or manually adjustable to provide spans suitable for less than full-size batches (Note 1). The automatic controls and interlock cut-off circuits shall be capable of being consistently coordinated with the batching scale or meter within an accuracy of 0.2 % of the nominal capacity (Note 2) of said scale or meter