

ITEM 520

WEIGHING AND MEASURING EQUIPMENT

- 520.1 Description. This item shall govern for the weighing and measuring equipment utilized where materials are specified to be measured or proportioned by weight or volume.
- 520.2 General Requirements. Except as modified herein, all scales and scale installations shall meet the requirements of the latest revision of the National Bureau of Standards Handbooks 44 and 112 (published by the U.S. Department of Commerce and available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402), except that the required accuracy shall be 0.4 percent of the load being weighed or 1 graduation on the dial of the scale. The Contractor shall provide personnel, facilities and equipment for checking the scales to the satisfaction of the Engineer.

All scales shall be checked prior to beginning of operations, after each move and at such other times, when in the opinion of the Engineer there is a question as to their accuracy or adequacy, and at least once each 6 months. Plant operations shall cease during the checking operation. When inaccuracy or inadequacy is discovered, scale use will not be resumed until corrective measures have been completed and/or the scales calibrated as provided by this item. Whenever equipment is adjusted, the adjustments shall be so made as to bring performance errors as close as practicable to zero value.

For use of County inspection forces in checking the scales during operation, the Contractor shall furnish four 50-pound weights. In addition, the Contractor shall furnish four 5-pound weights and four 2-pound weights to be used in checking cement, asphalt and small platform scales. All weights shall be checked and certified by the Texas Department of Agriculture, Weights and Measures Section as meeting the Maintenance Tolerances for Avoirdupois Weights specified in the National Bureau of Standards Handbook 44. All scales shall be satisfactorily insulated against shock, vibrations or movement of other operating equipment in the plant.

In lieu of the above specified weights for checking the scales, the Contractor may furnish a report of calibration from a commercial scale company, approved by the Engineer, certifying that the scales meet the requirements of this item. This report of calibration will be required at least once each 6 months.

The weighing containers shall be sufficiently tight to prevent leakage of the contents and shall be of sufficient capacity to hold a complete batch without wasting or leveling by hand and shall be so designed that the entire batch will discharge quickly into the mixer. The weighing containers

shall be so constructed that if in charging, an excess is introduced into the weighing containers, it may be removed by the operator. The weighing containers shall be provided with a close fitting and quick operating cut-off gate, so that there will be no leakage of the contents into the mixer, and shall be satisfactorily attached to the batching scales.

520.3 Equipment. Any electronic device which has been adapted for weighing that meets the calibration requirements of Article 520.2 will be acceptable. This type of scale may be substituted for any of the equipment described in this section.

A. Truck Scales. Truck scales shall consist of a set of standard platform truck scales capable of weighing the load as a single draft; that is, the total weight of the truck or truck-trailer combination shall not be determined by adding together the weights obtained by separately weighing each end of such truck or by weighing individual elements of such truck or coupled combination. The Contractor shall provide a weather-tight building of sufficient size to house the Contractor's weigher and the State's checker.

B. Aggregate Batching Scales. The scales used for weighing aggregate shall be equipped with a quick adjustment at zero to provide for any change in tare. The scales shall be provided with pointers or "tell-tale" indicators of the springless dial type to indicate full load for each aggregate. The dial or "tell-tale" device shall be in full view of the operator while charging the weigh box and he shall have convenient access to all controls.

C. Portable Platform Scales. Portable platform scales shall conform to the general requirements of this specification, except that they will not be required to be checked after each move or set-up within a given project, unless directed by the Engineer.

1. Type A. This type shall consist of a portable platform scale having a container fastened securely to the platform.

The capacity of this type of scale shall be not less than 500 pounds. The weighing capacity may be obtained by means of a weigh beam and loose weights.

When this type of scale is used, the Contractor shall provide a container of approximately the same size as the platform for weighing the aggregate, or he may provide an elevated hopper, the base of which is approximately the size of the platform from which the aggregates may be discharged.

If the hopper is provided, it shall be of such design that the aggregates will be completely and quickly discharged and shall be of such construction that the position of the

aggregates while being weighed will not affect the accuracy of the weights.

The Contractor will not be permitted to increase the size of the original platform by constructing another platform on top of the original unless provision is made to set the tare weight of the container or hopper separately from the batch weight. Separate scales for fine and coarse aggregate will be required.

2. Type B. This type shall consist of a portable platform scale having a platform sufficiently large to permit the weighing of loaded wheelbarrows or carts.

The capacity of this type of scale shall be not less than 800 pounds. The weighing capacity may be obtained by means of a weigh beam and loose weights. The scale shall preferably be equipped with a double weigh beam, in order that the tare weight of the wheelbarrow or other vehicle for transporting the aggregates may be set off on the weigh beam separately from the batch weights. When the scale is equipped with a single beam or a single beam and a tare beam, separate scales shall be provided for fine and coarse aggregates.

When this type of equipment is designed to weigh more than one kind of material on the same scale, it shall be equipped with separate charging beams and a tare beam. Each charging beam shall be equipped with a release lever to throw the beam in and out of service. This type of scale may also be equipped with a "tell-tale" dial meeting the requirements of these specifications.

- D. Suspended Hopper. This type shall consist of a weighing container or hopper completely suspended from the scale equipment. Suitable provisions shall be made for leveling the scale equipment.

The appliances used for placing materials within or upon the weighing equipment shall so regulate and control the quantity supply that accurate adjustment to the weights required can be secured with little expenditure of time and labor. A convenient means shall be provided for the addition or the removal of small amounts of material to adjust the quantity to the exact weight per batch.

- E. Cement Weighing Equipment. Where bulk cement is used it shall be batched by weight. The scales shall be of rugged construction. Provision shall be made for indicating to the operator that the required load in the weigh box or container is being approached, which device shall indicate at least 50 pounds of load. Where a

closed type cement weigh box is used, the cement weighing scales shall be provided with a springless dial to indicate when the weigh box is empty. This indicator for the empty condition of the weigh box shall be in continuous operation. The weigh box shall be fitted with an approved vent, a tightly covered inspection opening of not less than 12 inches by 12 inches. The box and scales shall be maintained in a condition to meet the requirements for accuracy of weight.

Where Portland cement to be mixed with subgrade, subbase or base material is not batched by weight and bulk cement is furnished, each truck shall have the weight of cement certified by a bonded public weigher or the Contractor shall place a set of standard platform truck scales or hopper scales at a location approved by the Engineer.

F. Belt Scales. Belt scales used for proportioning aggregate into asphaltic mixtures shall be accurate to within 1.0 percent, average of 3 test runs, where no individual test run shall exceed 2.0 percent when checked as outlined in Test Method Tex-920-K. Material tests shall be performed at least once each six months. Simulated belt loading tests may be used as expeditious checks of scale accuracy between material tests. The manufacturer's operation and maintenance manual shall be made available to the Engineer.

G. Automatic Proportioning Devices.

1. Portland Cement Concrete. When required by the plans or special provisions, batching plants shall be equipped to proportion by weight, aggregates and bulk cement, by means of automatic proportioning devices of an approved type.

The scales shall be automatic to the extent that the only manual operation required for proportioning the aggregates for one batch shall be a single operation of a switch or a starter.

The bulk cement batcher and aggregate batcher shall be so interlocked that a new batch cannot be started until all weigh hoppers are empty, the scale at zero and the discharge gates closed. The interlock shall permit no part of the batch to be discharged until all aggregate hoppers and the cement hopper have been filled with the correct charge. The discharge gate on the cement hopper shall be so designed as to permit regulating the flow of the cement into the aggregate as directed by the Engineer.

Material discharged from the bins shall be controlled by gates or by mechanical conveyors. The means of

withdrawal from the bins and the discharge from the weigh box shall be so interlocked that not more than one bin can discharge at a time; that the order of discharge can be changed as directed by the Engineer; and that the weigh box cannot be tripped until the required quantity from each of the bins has been deposited therein. Should a separate weigh box be used for each size aggregate, all may be operated and discharged simultaneously.

When the discharge from the bin is controlled by gates, each gate shall be actuated automatically so that the required weight is discharged into the weigh box after which the gate shall automatically close and lock.

The automatic weighing device shall be so designed that the number of proportions required may be set at the same time and that proportions and the sequence of weighing individual sizes may be changed without delay. The locking mechanisms or devices shall be so arranged that they may be locked at the direction of the Engineer.

When shown on the plans, automatic scales shall be equipped with a recorder capable of printing the weight of each proportion and the total batch weight.

Automatic proportioning devices shall comply with the general requirements for scales. In order to check the accuracy of batch weights, the gross weight and tare weight of batch trucks, truck mixers and truck agitators shall be determined when directed by the Engineer. The equipment shall be weighed on truck scales conforming to the requirements of Subarticle 520.3.(A). of this specification.

2. Asphaltic Mixtures.

- a. Weigh-batch Plant. When specifically indicated on the plans, asphaltic mixture mixing plants used in the production of asphaltic base and surface mixtures shall be equipped with approved fully automatic devices for the batching and cycling operations. There shall be interlock cut-off circuits to interrupt and stop all operations at any time there is a malfunctioning of any part of the control system.

The automatic proportioning controls shall include the necessary equipment of accurately proportioning batches of the various components of the mixture into each batch. The mixture shall be proportioned by weight except that an asphalt meter, measuring by volume, may be used in lieu of an asphalt scale.

Visible dial scales shall be provided to show the weights of each batch ingredient. If an asphalt meter is used, a suitable digital readout shall be provided to show the amount of asphalt used.

Over and under asphalt and aggregate weight check sensors shall be included in the proportioning system to check the accuracy of the asphalt and aggregate bin weights. The over-under tolerance limits for aggregate shall be selected by the Engineer after the amounts of the various ingredients have been determined for a batch of mixture. The equipment shall be capable of a tolerance range of $\pm 0.5\%$ to $\pm 2\%$ as applied to the material being weighed. The tolerance limits for asphalt shall be $\pm 1\%$ of the total asphalt being weighed. The tolerance limits for the no-load condition shall be ± 1 scale graduation for the aggregate scales and ± 3 graduations for the asphalt scales. The tolerances shall be locked in such manner that the settings for the over and under sensors cannot be altered or bypassed without the written approval of the Engineer. The system shall incorporate provisions for a manual check which the operator would perform periodically as requested by the Engineer.

At least one set of scale dials shall be provided, one dial for aggregate and one dial for asphalt. The scale dials shall be divided into increments not to exceed $1/1000$ of the total dial capacity. The scale dials may be located either in the dust proof control room or on the plant near the weighing hopper. In either location, the scale dials shall accurately indicate the weight in the weighing hopper from zero load to the maximum batch weights.

If the scale dials are located on the plant outside the control room, there shall be provided either an identical set of scale dials inside the control room or digital weight indicators which for either type shall duplicate within a tolerance of \pm one graduation for aggregate scales and \pm one graduation for asphalt scales any reading of the scale dial indicators located outside on the plant. Wherever located, the scale dials shall be so positioned that the dial and indicators are in full view of the operator in the electronic control room. The normal weight of a batch of aggregate shall be not less than one-half the aggregate scale dial capacity.

The automatic proportioning system shall be provided with low bin indicators arranged in such manner that under normal working operations the batching operation will be automatically stopped when the level of material in any supply bin is not sufficient to complete the weighing of a complete batch of the asphaltic mixture.

The system shall include a batch counter which can be preset for determining the number of batches which may be desired in one uninterrupted production sequence, and a counter to show the number of batches for the day's run.

The mixer shall have an accurate timelocking device to control the operation of a complete mixing cycle by locking the weigh box gate(s) after charging the mixer. It shall remain locked until the mixing cycle is complete, the mixture has been dumped, and the mixer discharge gate is closed. The timing device shall automatically control the dry and wet mixing period in accordance with the governing specification.

The control of the timing shall be adjustable and capable of being preset at the time intervals directed by the Engineer. Changes in mixing time shall be made only when approved in writing by the Engineer.

The aggregate dryer and asphalt tank heaters shall be equipped with burners that are automatically controlled by thermostats. This automatic equipment shall control the heat of the materials within the specified tolerances. Manual controls shall be used only as directed by the Engineer.

Temperature recording devices shall be supplied to record the temperatures of the aggregate prior to the mixing operation and the asphalt near the discharge valve into the mixer unit.

The automatic heat control panel and the temperature recording devices shall be located inside the dust-proof control room.

Automatic controls shall be housed in a dust-proof room located in such manner that the mixer discharge chute is in full view of the operator.

If at any time the automatic control devices become inoperative, the plant operations will be allowed to

continue under manual controls for not more than two days of operation, at which time all plant operations shall cease until the necessary repairs are made. Continuous and frequent breakdowns of the automatic control devices shall be cause for suspending operations until the devices are properly repaired.

When specifically provided for in the plans, the proportioning system shall be equipped with an automatic digital record printer and will record batch weights and print out the required information on a continuous tape or ticket through the use of a printing calculator. When requested by the Engineer, the Contractor shall demonstrate the accuracy of the printout device, within a tolerance of \pm one graduation for asphalt scales. The printout accuracy shall also apply to the no-load condition.

In the event of a breakdown of the recording equipment, the pay weights shall be determined by weighing the mix in the trucks on approved platform and recording scales or by calculated batch weights for a maximum period of not more than two working days. Continuous and frequent breakdowns of the recording equipment shall be cause for suspending operations until the recorder is properly repaired.

Each individual ticket or continuous tape shall contain the following readable information printed automatically by the digital record printer:

Project Job Number.

Time of day to the nearest minute at intervals not greater than for each truck load, or at intervals not greater than 10 batches when material is being deposited into a storage bin.

The gross weight, tare weight and net weight of the truck load.

Mix Design Number.

Zero scale record for aggregate and asphalt to be printed at intervals not greater than before each truck loading or at intervals not greater than 10 batches when material is being deposited in a storage bin.

Weight of each aggregate for each batch recorded accumulatively or separately.

Total weight of all aggregate in each batch.

Weight of asphalt in batch.

Total of batch weights (combined mixture of asphalt and aggregate) for the day and/or any part of a day as required by the Engineer. This printing will be required on the tape or ticket at the times specified herein during each day of operation.

Total of either the aggregate or the asphalt for the day and/or any part of a day as requested by the Engineer. This printing will be required on the tape or ticket at the times specified herein during each day of operation.

One copy of the tape shall be provided the Engineer at the end of each day's run. If tickets are used, the Engineer shall be furnished three tickets with each truck load.

The recording unit shall be in the same room as the automatic batching console unit. The recording unit may be separate from the console.

- b. Continuous Mixing Plant. Continuous mixing plants shall provide satisfactory means to afford positive interlocking or mechanical control between the flow of aggregate through the gates and flow of asphaltic material through the asphalt meter. Means shall be provided to check the rate of flow of the asphaltic material by scale weight per revolution.

When shown on the plans, devices capable of automatically sampling and weighing the quantity of each hot bin aggregate size and sampling, weighing, or metering the asphaltic material fed to the pugmill during either a known number of revolutions of the plant or a known interval of time shall be installed as part of the plant equipment. In addition, each aggregate hot bin, mineral filler bin, and the asphaltic material feed line shall have interlock circuits such that the plant operations will be stopped if either aggregate or asphaltic material flow is discontinued or reduced.

The plant shall proportion size of aggregate to the pugmill with such accuracy that the weight of material from each hot bin shall not deviate from the design value by an amount more than 1.5% of the total weight of asphaltic concrete delivered per revolution or interval of time. Where the separate addition of mineral filler is required, it shall be added so as not to deviate more than 0.5% on the basis stated above for aggregates. The asphaltic material shall be added so as not to deviate more than 0.1% on the basis stated above for aggregates. In no case shall the total weight of asphaltic concrete vary from the design weight by more than $\pm 2\%$ of the design weight.

- c. Drum Mix Plant. Drum mix plants shall provide satisfactory means to assure positive interlock between dry weight of aggregate flow and the flow of asphaltic material to the drum mixer.

The total aggregate feed shall be weighed continuously by a belt scale meeting the requirements of this specification. Provisions shall be made for introducing the moisture content of the total aggregate feed into the belt scale weighing signal and correcting wet aggregate weight to dry aggregate weight. The proportioning system shall be capable of adjusting the flow of asphaltic material to compensate for any variation in the dry weight of aggregate flowing into the drum mixer. Automatic digital readings of both the dry weight of aggregate flow and asphaltic material flow shall be displayed and totaled in appropriate units of weight and time.

The automatic proportioning system shall be provided with bin flow indicators arranged in such manner that under normal working conditions a signal will automatically be given when flow of aggregate from any cold aggregate bin is interrupted.

The drum mixer burner and asphalt tank heaters shall be automatically controlled by thermostats. This automatic equipment shall control the heat of the materials within the specified limits. Plants shall be equipped to record mixture temperature as it leaves the drum mixer.

- H. Asphaltic Material Bucket. The asphaltic material bucket shall be of sufficient size to hold the necessary asphaltic material for one batch. If the material is measured by weight, the bucket shall be properly attached to the scales. If the proportioning is by volume

based on weight, the measuring bucket used shall be of the overflow type and shall meet the requirements of the Engineer. The valves at the asphaltic material bucket shall be of a quick cut-off type that do not leak.

I. Asphalt Meter.

1. Weigh-batch Plant. Pressure type flow meters for volumetric measurement of asphalt shall automatically measure the asphaltic material within an accuracy of 1.0 percent when tested in accordance with Test Method Tex-921-K. The meter shall be so constructed that any setting may be locked and the meter will automatically reset itself to this setting after the discharge of the asphaltic material to the batch. A thermometer shall be installed in the asphalt line to accurately measure the temperature within plus or minus 5 F over a range from 50 F to 400 F. Provisions of a permanent nature shall be made for checking the accuracy of meter output, including scales and container of such size that a full batch of asphaltic material may be weighed.
2. Continuous and Drum Mix Plants. Asphalt flow meters shall provide an automatic digital display of the volume or weight of asphaltic material which has passed through the line leading to the spray bar. The meter shall register within an accuracy of 1.0 percent when checked in accordance with Test Method Tex-921-K. Accuracy of asphalt flow meters shall be checked at least once each six months.

- J. Water. The measuring device for measuring water by volume shall indicate the quantity in gallons and fractions thereof for asphaltic mixtures. The quantity shall be measured in gallons for Portland cement concrete. When a volumetric tank or bucket is used for measuring the water, the supply inlet shall cut off automatically and remain off until the container has emptied completely and the discharge line to the mixer is closed. When water is measured by weight, the weigh bucket shall be properly attached to scales meeting the general requirements of this specification. When a pressure type flow meter for volumetric measurement of the water is used, it shall be so constructed that any setting may be locked and the meter shall be capable of being manually or automatically reset to the locked setting after the addition of water to each batch.

Regardless of the method of water measurement used, the operating mechanism shall regulate the quantity of water required for any given batch to within plus or minus 0.2 percent of the total batch for bituminous mixtures and to within plus or minus 1 gallon of the specified quantity of water required for Portland cement concrete mixes. Provisions of a permanent nature shall be made for checking the accuracy herein specified.

520.4 Measurement and Payment. The furnishing, erection, checking, calibration and operation of items listed under this specification will not be measured and paid for directly but shall be considered subsidiary to other bid items.

There are line code(s), description(s), and unit(s) for this item.

END OF ITEM 520