## 3.50 WEIGHING EQUIPMENT FOR DETERMINATION OF PAY QUANTITIES

*Specification 2001.07* describes equipment and procedures to be used when payment for an item of the contract is based on actual weight. Aggregates are generally weighed in the delivery vehicle on a platform scale. Hot Mix Asphalt mixtures may be weighed over platform scales, in silos on load cells, in weigh hoppers, or by counting batches. The specifications no longer provide for converting volume measurements to weight.

### Weight Tickets

The contractor shall provide a weight ticket for each load showing the required weight information for the procedure being used, the project number or contract description, the truck number, the date, and the type of material.

The required data to be automatically printed on the weight tickets will vary according to the method of measurement (weigh hopper, silos on load cells, batch scales, or platform scales) and type of system (automatic or semi-automatic).

#### Automatic or Semi-Automatic Weighing

- For weigh hoppers, batch scales, or silos on load cells, all tickets printed automatically shall include the gross weight, empty weight of the hopper or weight not discharged, net weight of material for each drop, and the total net weight for the load. When weighed under the semi-automatic procedure, the weighmaster may include on the ticket the calculated total net weight.
- For batch scales, the batch weight and batch count are to be automatically printed under both procedures. The total net weight may be printed with a system or calculated by a weighmaster with a semi-automatic system.
- For truck platform scales, all scale tickets printed automatically shall include gross weight, tare weight of the truck, and net weight of the load. For semi-automatic weighing the printer shall print the gross weight, and the weighmaster shall conduct all weighing and may enter by hand or by printer the tare weight of the truck and calculate the true net weight.

#### Manual Weighing

- For manual weighing of loaded trucks (project quantities less than 10,000 Mg [10,000 tons]), scale equipment on truck platform scales may or may not include a mechanical ticket printer. A weighmaster shall include the gross and tare weights and calculate the net weight on the scale ticket. The engineer may arrange for weighing to be witnessed.

The inspector will collect the accompanying load ticket for each load of material on its arrival at the work site and check to see that the ticket has been validated by the scale inspector when such scale inspection is required. The inspector will observe each load of delivered material to detect any obvious deficiencies in quality or in quantity and reject any loads which are unsatisfactory.

The inspector will sign or initial the scale ticket for each accepted load to verify the material was delivered and accumulate the tickets on a daily basis for determination of pay quantities. Quantities for each day's operation shall be totaled and checked against the contract records and any discrepancy promptly resolved.

The requirement that an inspector personally receive all load tickets at the time of delivery may be relaxed only in cases of very small quantities or intermittent deliveries

under conditions where the project engineer or inspector can visually determine the approximate quantity delivered.

On hot mix asphalt projects, it is permissible for a contractor's employee to collect the tickets and place them on a clipboard. An inspector must be present at the laydown operations at all times and observe the collection of the tickets.

**Truck Platform Scale Approval**

The specifications require that scales for weighing loaded trucks shall meet the requirements of the Iowa Department of Agriculture. A platform scale used for measurement of items such as crushed stone, base and subbase material, and hot mix asphalt mixtures, contracted for and measured by the Megagram (ton), shall be inspected by the Iowa Department of Agriculture.

Permanent scales, so inspected, have an official stamp conspicuously displayed.

Temporary scales, so inspected, have the same official stamp. If the scale is at a temporary plant location or quarry, the inspection may be identified by a certified report and affidavit. A copy of the "Portable Scale Report" to be used for portable scales is included in *Appendix 3-7*. Use of the certified report and affidavit is subject to the following special limitations, and with these limitations inspection is official by the Iowa Department of Agriculture.

- The scale is inspected by a registered scale technician. A report is then prepared that certifies the scale complies with State of Iowa regulations. A copy of the report shall be forwarded to the Iowa Department of Agriculture.
- It is effective for 90 days at the same location; however, the effective period does not extend beyond the spring thaw.
- Inspections made in the spring are after frost leaves the ground.
- The certified report and affidavit shall expire when the scale is moved.

**Weigh Hopper, Batch Scales, & Load Cell Approval**

Weigh hoppers, batch scales, and load cells will be checked for accuracy against truck platform scales that meet the requirements of the Iowa Department of Agriculture during calibration and during use as described below.

The contractor shall have, reasonably available upon request, at least 10 standard 25 kg (50 pound) test weights for the purpose of testing and calibrating weighing equipment. Whenever scales are checked with standard weights, the data showing scale readings versus increments of known standard loads should be recorded in the field notebook or on a calibration form and become a part of the permanent job record. It is the intention that contractor's personnel will be responsible for adding and removing the weights. Inspection personnel shall witness and document calibration or other scale checks.

When automatic or semi-automatic weighing is used, continuous direct observation of the weighing process by a scale inspector is not required. When weighing is not continuously observed, sufficient random checks should be made to assure the project engineer that the contractor's weighing procedures are accurate and the true net weight is recorded. This includes both verification weighing and check weighing.

Verification weighing is defined as a second weighing of the same load on the same scale, and applies only to truck platform scales. At least one verification weighing should be made daily when the pay quantity is weighed on truck platform scales.

Verification weighings are made to determine the repeatability of truck platform scales. The verification weight should not be different from the initial weight by more than 0.1%.

Check weighing is defined as a second weighing of the same load on another certified truck platform scale. Check weighings shall be made to determine the accuracy for all types of weighing equipment. For check weighing of weigh hoppers, load cells or batch weight tickets, it will be necessary to also get the tare weight of the delivery truck and consider a suitable fuel adjustment to determine the accuracy of the total net weight. Recognizing that in a batch plant some material may remain in the mixing chamber after a drop, the results of two check weighings may be averaged.

Check weighing for truck platform scales should not be different from the initial weight by more than 0.3%. Check weighing for weigh hoppers, batch scales, and silos on load cells shall not be less than the initial weight by more than 45 kg (100 pounds).

One check weighing should be performed on the first day of hot mix asphalt production or aggregate weighing. One additional random check weighing should be performed for project quantities exceeding 4,536 Mg (5,000 tons). If these check comparisons had been made for another project within the time stipulated, documentation in the project diary will be satisfactory and separate checks will not be required.

If the check shows weighings that compare within the tolerances allowed, the scales should be considered satisfactory.

If the check shows weighings that do not compare within the tolerances allowed, the scales should be considered satisfactory only after the following additional investigations show it as warranted:

(1) The scale can be checked against another platform scale.

(2) The deviation of each scale from the true weight can be determined from the scale calibration prepared during the inspection if available. The scale operator is given this calibration, but is not required to keep it. The tolerance to be maintained is 1.8 kg per 900 kg (2 pounds per 1,000 pounds).

    If one scale is heavy just within this tolerance and the other scale is light just within this tolerance, a difference in compared weights for a 23 Mg (50,000 pounds) load can be 90 kg (200 pounds) and still be legal and satisfactory. Some allowance should be made for actual difference in weight because of gasoline 0.84 kg/L (7 pounds/gallon) if there is sufficient distance between scales.

For true verification and check weighing, selection of random loads shall be done without advance warning to the contractor. Allow a reasonable fuel adjustment, if appropriate.

Where random checks show errors beyond the tolerances specified in the specifications, the project engineer should review the weighing procedures used by the contractor and may require that the scales be inspected. The contractor shall take prompt action to make necessary repairs. Should errors continue to be discovered, it will be necessary to suspend further weighing until the weighing procedures are correct and accurate. Further investigation is necessary when the error exceeds the tolerance in either the plus or minus direction.

### Scale Checks for Sensitivity

- **Batch Scale, Hopper Scale, and Load Cells**
  *The sensitivity should be checked at least once during a normal working day by placing a weight equal to one-tenth percent the batch weight on the fully loaded scales and observing the movement of the indicator*. A properly sensitive scale will exhibit a visible indicator movement when so tested. If no indicator movement is visible, immediate corrective action must be taken by the contractor.

  Specified scale tolerance limits should be checked by periodically witnessing the batch weighing operation. Each scale indicator should consistently indicate the required weight within the specified delivery tolerance and return to zero when unloaded within the specified 0.5 percent tolerance.

  Refer to *Materials I.M. 508* for automatic batch weighing equipment settings and/or adjustments.

- **Truck Platform Scales**
  The following paragraphs apply to permanent platform scales as well as portable platform scales.
  A. The working parts of scales (platform and beam linkage) must operate freely to preserve the scales accuracy and sensitivity. The scale should be kept clean on and under the platform to assure accuracy.
  B. Each scale should be *checked for sensitivity initially (0.1 percent of the quantity being weighed) and at least once each working day by carefully balancing the scale*, then observing if movement of the equilibrium indicator is discernible upon application of a weight equal to one of the minimum gradations but not more than 9 kg (20 pounds).

### Truck Platform Scale Use

*Each truck to be weighed shall be tared daily*. Taring of trucks should be on a random basis during the day's operation, using the previous day's tare weight until a new tare weight for that day is determined. No truck may be used for hauling material paid for on a weight basis until tared.

### Use of Weighmasters

In order to make more productive use of contract inspection personnel, a program has been implemented whereby contractors and/or producers will furnish weighmasters *(Code of Iowa, Chapter 214, Section 6-8)* to conduct the weighing of highway construction materials. The specifications presently limit the weighmaster requirement to weighing of hot mix asphalt mixtures and aggregates under procedures for semi-automatic weighing and manual weighing of loaded trucks.

- **Weighmaster's Oath**
  To be qualified, a weighmaster must sign an oath. A copy of the "Oath of Weighmaster" is included in *Appendix 3-8*. Personnel desiring to become a weighmaster may obtain additional forms and procedures from the Iowa Department of Agriculture's Division of Weights and Measures, Des Moines, Iowa.
- **Responsibilities**
  The weighmaster must be the person actually operating the weighing and recording equipment. He/she shall include on the scale ticket the tare weight and the calculated true net weight. The weighmaster shall sign the ticket for the first weighing each day and initial subsequent tickets. The project engineer may arrange for weighing to be witnessed. If witnessed, the witness will also initial the ticket.

Weighmaster will daily establish tare weights of all delivery vehicles weighed in a truck platform scale. These tare weights will be established at random times throughout the day in accordance with procedures set up with project inspection personnel. A list of these weights will be provided to the engineer on request. When weighing in trucks, the weighmaster shall enter the truck tare weight by hand or this information can be printed out where it can be entered directly to the automatic weigh recorder.

Misrepresentation of weights or weighing equipment that is known to be inaccurate will result in the removal of the weighmaster from the approved list maintained by the Iowa Department of Agriculture. No further material will be hauled to the project from the site of the infraction until another weighmaster is provided or the equipment repaired to meet the standards of the Department of Agriculture Certification Program.