

## SECTION 01280

# MEASUREMENT

### PART 1 GENERAL

#### 1.1 DEFINITIONS

- A. Station: 100 feet.
- B. Ton: 2,000 pounds avoirdupois.

#### 1.2 GENERAL MEASUREMENT OF QUANTITIES

- A. All work completed under the Contract is measured in U. S. Standard measure.
- B. The methods of measurement and computations for determining quantities of material furnished and of work performed under the Contract are methods generally recognized as conforming to good engineering practice.
- C. When the estimated quantities for a specific portion of the work are designated to be the pay quantities for the Contract:
  - 1. They are the final quantities for which payment for such specific portion of the work will be made, unless the plan dimensions are revised by the Engineer.
  - 2. If revised dimensions result in an increase or decrease in the quantities of work, Department will revise the final quantities for payment in the amount represented by the authorized changes in the dimensions.
- D. Measurements for area computations:
  - 1. Longitudinal measurements: made horizontally.
  - 2. Transverse measurements: the neat dimensions shown on the plans.
- E. Computing volumes of excavation: Average end area method, or computer generated Digital Terrain Model (DTM) method, unless the Engineer and Contractor agree in writing to an alternate method.
- F. Measure complete structure or structural unit, signal or lighting system, ("lump sum" work) unit to include all necessary fittings and accessories.
- G. Structures: Neat lines shown on the plans or as altered to fit field conditions.

- H. Standard manufactured items (fence, wire, plates, rolled shapes, pipe conduit, etc.), are identified by gauge, unit, weight, section dimensions, etc.
  - 1. Identification will be nominal weights or dimensions.
  - 2. Use industry manufacturing tolerances, unless more stringently controlled by specifications.
- I. Items measured by the foot, (pipe culverts, guardrail, underdrains, etc.): measure parallel with the base or foundations upon which structures are placed.
- J. The thickness of plates and galvanized sheet used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing: measured in fractions of inches.
- K. Haul materials to be measured by volume in approved vehicles, and measure at the point of delivery. Vehicles for this purpose may be of any size or type, provided the body is shaped so the actual volume may be readily and accurately determined.
- L. Materials specified to be measured by the cubic yard may be weighed and converted to cubic yard for payment purposes, when requested by the Contractor and approved by the Engineer in writing. Engineer determines and Contractor agrees to the factors for conversion from weight measurement to volume before this method of measurement of pay quantities is used.
- M. Rental of equipment: measure hours of actual working time and necessary traveling time of the equipment within the limits of the project.
  - 1. If the Engineer orders special equipment in connection with force account work, the Department measures travel time and transportation to the project.
  - 2. If the Engineer orders equipment held on the project on a standby basis, the Department pays the agreed rental rate minus the operating cost.

### **1.3 MEASUREMENT OF QUANTITIES - MATERIALS**

- A. Asphalt materials: gallon or ton.
  - 1. Department measures volumes at 60 degrees F or corrects to the volume at 60 degrees F using ASTM D 1250 for asphalts or ASTM D 633 for tars.
  - 2. Department uses net certified scale weights or weights based on certified volumes in the case of rail shipments as a basis of measurement, subject to correction when asphalt material has been lost from the car or the distributor, wasted, or otherwise not incorporated in the work.

3. When asphalt materials are shipped by truck or transport, net certified weights or volume subject to correction for loss or foaming may be used for computing quantities.

B. Cement: ton

#### **1.4 WEIGHING REQUIREMENTS AND PROCEDURES**

- A. Weigh all materials that are measured or proportioned by weight, or contract items measured by the ton, such as aggregates and asphalt materials, on scales that have been approved, certified, and which meet specification requirements.
- B. If material is shipped by rail, the car weight may be accepted provided only the actual weight of material will be paid for.
  1. Car weights are not acceptable for material processed through mixing plants.
  2. Weigh trucks used to haul material empty daily at times as directed by the Engineer, and place on each truck a legible identification mark.
- C. An inspector observes materials delivered to the project or designated site.
  1. Submit the printed or written haul ticket to Inspector.
  2. At this time, the Inspector can accept materials, and initial and retain the ticket.
  3. Department may return any loads of material that appear to be deficient or questionable to be reweighed.

#### **1.5 SCALES**

- A. Have the Utah State Department of Agriculture, Division of Weights and Measures inspect and seal all scales inspected and sealed at least once a year, and before use each time the scale is moved or adjusted.
- B. Scale accuracy: to within 0.5 percent of the maximum load required.
- C. Furnish, erect, have certified, and maintain, or use permanently installed and certified commercial scales for weighing highway and bridge construction materials that are required to be proportioned or measured and paid for by weight:
  1. Scales must be accurate within the limits set by the laws of the State of Utah, meeting requirements of the U.S. Bureau of Standards.
  2. Scales must bear a current seal of acceptance from the State of Utah Department of Agriculture, Division of Weights and Measures.

- D. Physically arrange electronic, beam, dials, platform, and other scale equipment for convenient and safe viewing.
- E. Cease using scales that overweigh (indicate more than true weight). Reduce all materials received subsequent to the last previous correct weighing accuracy test by the percentage of error in excess of one half of 1 percent.
- F. Adjust scales that underweigh (indicating less than true weight). Department will allow no additional payment to the Contractor for materials previously weighed and recorded.
- G. Include in the unit contract prices for the various pay items of the Contract, costs for furnishing, installing, certifying or testing, and maintaining scales, furnishing scale house, materials for proportioning or payment, and all other items specified in this section for the weighing of highway and bridge construction materials

## **1.6 PLATFORM SCALES**

- A. Install and maintain a level platform with rigid bulkheads at each end.
- B. Must be of adequate size and capacity so the entire power unit and hauling unit can be weighed at the same time.
  - 1. The Contractor may use a platform scale that will accommodate the power unit and the first hauling unit and all remaining hauling units in two weighing operations.
  - 2. When using two weighing operations, provide a level approach at both ends of the scale at least 75 feet in length composed of a base course and a minimum of 3 inches of Hot Mix Asphalt or 3 inches of concrete cement pavement.
  - 3. Repair or replace approach grades, or any portion that varies by more than one-tenth of one percent, or revert to weighing the entire power unit and hauling units at the same time.
- C. Contractor is responsible for costs for constructing and maintaining the approaches.

## **1.7 ELECTRONIC HOPPER SCALE REQUIREMENTS**

- A. The Contractor has the option of furnishing an electronic hopper scale system. When this type of weighing system is used, the following applies:
  - 1. Use hopper or load cells.
  - 2. Weights must be accurate to 1.0 percent of true weights.

3. Provide an automatic printer that will provide the following information:
  - a. Project number and name
  - b. Date
  - c. Time
  - d. Ticket number
  - e. Haul unit number
  - f. Gross weight (if possible)
  - g. Tare weight
  - h. Net pounds or tons
  - i. A minimum of two copies of each ticket
  - j. Description of item
  
- B. Maintain electronic and hopper scales and conduct necessary testing to assure continued scale accuracy within specification limits after certification by the Department of Agriculture and required by specification.
  
- C. Comparison Test: The accuracy of the hopper scale may be checked by comparing the weight of the material from the hopper and the weight of the material after it is weighed on another certified scale. Comparisons within 0.5 percent tolerance or within the combined tolerance of the two scales are acceptable.
  
- D. If no platform scales are readily available, use known weights to occasionally recalibrate the scales by hanging weights from the weigh hopper.
  
- E. Furnish weights equal to 12.5 percent of capacity and of known accuracy. Use a buildup procedure in combination with the weights by batching or placing a measured amount of material in the hopper and adding known weights to verify.
  
- F. Request written approval to use alternate weighing devices.

## **1.8 DEPARTMENT INSPECTION AND VALIDATION OF WEIGHTS**

- A. Continuously Observed Weighing Method to validate weights:
  1. The Department provides a scale person who must either weigh, or observe, or weigh and observe the weighing of equipment or trucks both loaded and empty to determine the payload of materials to be hauled.
  2. The scale person issues a weigh ticket at the scale site when truck scales without automatic printers are provided by the Contractor.
  
- B. Random Scale Weighing Check Method to validate weights:
  1. Use when a Department scale person does not weigh materials, or when an electronic scale with an automatic printer is used for weighing equipment, trucks, or materials.

2. The Engineer validates the equipment, truck, and material weight by random reweighing or by other methods as indicated.
- C. Engineer or Inspector randomly checks the weight of the equipment, trucks, and he material indicated on the electronically produced weigh ticket or manually prepared ticket, by reweighing the loaded truck on another certified scale, if available.
1. If no other platform scales are available, Engineer may check by operating the scale in the manual mode.
  2. When manual verification is used, Engineer reweighs the truck by running it back over the platform scale to manually check weights.
- D. Conduct frequent checks at the beginning of the operations to verify proper scale function and accuracy.
1. Frequency may be reduced after initial verification to a minimum of once per week when a substantial amount of material is being weighted.
  2. Scale Tests: Maintain scales and conduct necessary testing to verify scale accuracy within the specifications.
    - a. When the scale does not meet specified tolerance, discontinue using the scale until it is operating within specifications.
    - b. Comparison scale checks must be within a 0.5 percent tolerance of the net load or within the combined tolerance of the two scales or two weights.

## 1.9 PROJECTS WITH SMALL QUANTITIES

- A. Engineer may accept and receive small quantities of materials paid by weight when the following conditions are met.
1. The vendor, producer, or supplier issues a signed weight ticket to the truck driver, weighted on certified scales.
  2. A Department employee or inspector receives the certified weigh ticket at the site, and notes visual acceptance on the ticket for the quantity and other required information.
  3. The amount of material received on the project for any one day does not exceed:
    - a. Hot Mix Asphalt or Open Graded Surface Course - 100 tons
    - b. Untreated Base Course - 200 tons
    - c. Borrow or Granular Borrow - 300 tons

**PART 2 PRODUCTS** Not used.

**PART 3 EXECUTION** Not used.  
END OF SECTION