

SECTION 232 Measurement and Payment

232.1 General

[Standard spec 109.1](#) states that the engineer will measure the completed work for final payment. As work progresses, estimated quantities may be utilized to pay for items on intermediate pay estimates. If using an estimated quantity, the engineer must reference the basis of payment for the quantity. A quantity may be estimated for intermediate payment by scaling the plans, station to station counts, or approximated field measurements. The engineer must still complete and document final measurement required under the standard specifications before making full payment.

Before acceptance and making full payment, the item must be considered acceptably complete. To be acceptably complete, the item must meet all of the following:

- Installation conforms to the contract.
- Materials test results conform to the contract.
- All quantities have been measured and documented for payment.
- Other required documentation has been submitted.

If the item is not acceptably complete and the decision is to leave it in place, justification to accept and pay for the item must be documented.

232.2 Volume Measurements

The quantity of materials paid for on the basis of volume measured in the vehicle will be based on a load count by an inspector at the point of delivery. Since the quantity of materials normally measured by volume in the vehicle is small, it is not necessary to provide a double check on the quantity by maintaining another inspector at the source.

The inspector will maintain a daily log as a part of the permanent project record, showing the type of material delivered, identification and capacity of the haul vehicle, time of arrival of each load, and use of the material, including spread with reference to project stationing. The inspector must determine the hauling capacity by volume of each vehicle and ensure the volume of each load delivered is not less than the volume the contractor claims.

When excavated material is placed into a truck, it is fluffed up and occupies greater volume than it had occupied in its original position. When the intent of an excavation item is to measure the material in its original position, a volume correction factor must be applied to volumes measured in the truck to reflect the true volume that it would have occupied in the original condition. Values for this adjustment may typically be around 1.1 - 1.5, but each soil type and condition will vary, so the region soils engineer should be consulted to determine the applicable volume correction factor in each instance. The contractor and department should agree on the adjustment factor before any hauling or measurement of earthwork quantities in a truck box. A simple example to illustrate these ideas is shown in the following examples:

Example 3

The contractor wants to move a small amount of borrow using dump trucks. After consulting the region soils engineer, you agree with the contractor that the expansion factor for the particular soil being moved is 1.25. You have also mutually agreed that each loaded truck will hold 12 cubic yards of material. The contractor hauls 10 full truckloads of borrow excavation.

Contractor hauled 10 loads x 12 yards/load = 120 CY

Now apply expansion factor to get yards of material in its original position:

$120 / 1.25 = 96$ CY --- You pay for 96 CY of borrow excavation.

It's important to recognize that the volume of the material after it is placed and compacted will be different than in its original position. There is a separate factor to determine this volume.

Example 4

Determine the volume of the material from the previous example after it is placed and compacted. The factor from in place to compacted volume is 0.90.

96 CY x $0.90 = 86.4$ CY --- The original volume of 96 yards in place expanded to 120 CY in the trucks, then was compacted to a final volume of 86.4 CY in the roadway foundation.

Refer to [FDM 11-5-10](#) for a thorough discussion of earthwork expansion factors.

232.3 Measure and Payment of S.I. Metric/U.S. Standard Measure Substitutions

When typical section or plan detail dimensions are modified at the request of a contractor to accommodate a change from S.I. metric to U.S. standard measure or conversely, the quantities to be measured for payment will be the quantities of the various items actually constructed or the theoretical quantity based on plan dimensions, whichever is less.

When a manufactured product measured by mass, volume or area, is substituted for another of greater or lesser mass, volume or area, the quantity measured for payment will be the lesser of the quantity furnished and constructed or the theoretical quantity based on plan dimensions, whichever is less.

When a manufactured product is substituted for another or equivalent size, such as conduit or culvert pipe, the quantity measured for payment will be the quantity furnished and constructed.

232.4 Accuracy of Pay Units

Quantities of pay items are measured and reported by the unit of measure, such as cubic yard, linear foot, square foot, ton, each, etc., as designated in the contract for the particular item. The engineer is to accurately measure constructed contract items and carefully check the computations before submittal of each progress pay estimate.

Report measured items to the nearest full unit of measure in each progress payment unless otherwise specifically required in the contract or listed in table 232-2. Quantities for listed items should be reported in the pay estimate to the nearest indicated decimal. In any case, measure subtotals to any decimal of a unit commensurate with accuracy and value, and round the totals to the reporting decimal or whole unit for payment.

TABLE 232-2 Accuracy of Pay Units

Item	Unit	Accuracy
Clearing or Grubbing; Roadside Clearing	ACRE	0.01
Obliterating Old Road	STA	0.1
Asphaltic Material, Asphaltic Pavement	TON	0.1
Concrete Masonry	CY	0.1
Mortar Rubble Masonry	CY	0.1
Concrete Pavement Approach Slab	SY	0.1
Concrete Surface Drains	CY	0.1
Treated Lumber and Timber	MBM ^[1]	0.01
Storm Sewer	LF	0.1
Structural Plate Pipe	LF	0.1
Structural Plate Pipe Arch	LF	0.1
Calcium Chloride Surface Treatment	TON	0.1
Fertilizer	CWT	0.1
Agricultural Limestone Treatment	TON	0.1
Mulching	TON	0.1
Locating No Passing Zones	MI	0.01

^[1] MBM = 1000 Board Feet, see: [DT2074](#) Board-Foot Calculator.