



2-32.1 Plan Quantities

Standard spec 109.1 states that the engineer will measure the completed work for final payment. It further provides that when plan quantities of certain items are in substantial agreement with actual quantities of work performed, and when the engineer and contractor execute a written supplemental contract agreement, payment may be made based on plan quantities in lieu of actual measured quantities. Plan quantities also may be used for portions of items, and the plan quantities need not be only original plan quantities, but can be revised or corrected quantities. Plan quantities may be accepted for any item when appropriate.

2-32.2 Pay Plan Quantity (**P**)

2-32.2.1 General

Pay Plan Quantity items are designated in the schedule of items with a (**P**). It is recommended that when a **P** item is contained in a contract that the engineer should coordinate with the contractor before the work starts. The engineer and contractor should discuss the benefits of a pay plan quantity item. Those benefits can include the following:

- Reduce time need for taking measurements.
- Eliminate resolving minor quantity variations.
- Provide for quicker payment to the contractor.

The contractor and engineer should discuss that the intent of the specification should be followed and information needed to justify an adjustment. They should also discuss items that have been designated as pay plan quantity items that may be suspect to have a variation beyond the thresholds of the specification, and should agree to measure or compute the quantity during construction. Items that may not be appropriate for pay plan quantity are rural drainage items, items measured by volume with expansion factors, or repair work.

Plan quantity is defined as the contract quantity in the schedule of items as shown in Figure 1 below.

Figure 1 Schedule of Items

CONTRACT:		SCHEDULE OF ITEMS		DATE:		
20041117001		PROJECT(S):		01/26/05		
		1060-05-72		REVISED:		
CONTRACTOR :		FEDERAL ID(S):				
		NH 2004770				
LINE NO	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE DOLLARS	CTS	BID AMOUNT DOLLARS	CTS
0110	204.0170 REMOVING FENCE **P**	6,950.000 LF	.		.	
0120	204.0185 REMOVING MASONRY **P**	3.000 CY	.		.	
0130	204.0195 REMOVING CONCRETE BASES (MANDATORY SUB) **P**	42.000 EACH	.		.	
0140	204.0210 REMOVING MANHOLES **P**	10.000 EACH	.		.	
0150	204.0220 REMOVING INLETS **P**	40.000 EACH	.		.	

A pay plan quantity item indicates to the contractor that the department will not measure these designated items. These items have been designated based on guidance to the developer of the plan to select items that do not vary greatly, are measured linearly or by area, or can be measured after completion of work. A list of items that can generally be designated to pay plan quantity can be found in FDM 19-5-10.

The department will pay the quantity shown on the schedule of items, unless specified exceptions occur. If specified exceptions do occur, the department will make adjustments to the affected quantities. Specified exceptions can be found in standard spec 109.1.1.2.

When administering the exceptions it is important to administer the 2 types of exceptions separately. The 2 types are "contract revisions" and "quantity variations" (5% and \$5,000 thresholds). First determine which type of exception you have and then administer the change according to guidelines.

2-32.2.2 Adjustments for Contract Revision

[Standard spec 109.1.1.2.2](#) states that if the engineer orders a contract revision, only the quantity included for revision work will be measured and paid for. If an engineer-ordered revision eliminates an item wholly or partially, the item will be paid for according to [standard spec 109.5](#), which allows payment for preparation, restocking, cancellation, and applicable overhead.

Adjustments for contract revisions will be allowed and the engineer will either increase or decrease the affected quantity. The department will measure the revised work as specified in [standard spec 109.1.1.1](#), Bid Items Not Designated as Pay Plan Quantity. The following two examples illustrate how to deal with adjustments to the contract when the items have been designated as Pay Plan Quantity:

Example 1

Contract 20041015030; Project: 5678-90-71
 Contract quantity: Curb and gutter 10,000 LF
 The engineer orders an extension of curb and gutter beyond original plan quantity for 100 LF. The engineer pays the 10,000 LF contract quantity and the ordered revision work that measures 98 LF. The total paid curb and gutter would be 10,098 LF.

Note: The revised work is not enough for threshold of 5% or \$5000 to have all work measured. This payment is made without a change order according to [standard spec 104.2](#).

Example 2

Contract 20041015030; Project: 5678-90-71
 Contract quantity: Apron endwalls for culvert pipe aluminum 4 EACH.
 1. The engineer orders to eliminate this item.
 2. The engineer pays the negotiated dollar amount according to standard spec 109.5.

2-32.2.3 Adjustment for Quantity Variation

[Standard spec 109.1.1.2.3](#) states that if the engineer or contractor identifies an item with a variation in quantity exceeding the thresholds of 5% or \$5000 for the item, the item can be adjusted by measuring or re-computing the entire quantity or only that portion of the quantity where the variation occurred. The contractor should report this variation as soon as possible to the engineer and provide sufficient detail to justify the engineer's review, as required under [standard spec 104.3](#). Discuss at the preconstruction meeting what sufficient detail is defined as and what the expectations of the engineer are. Topics of discussion include the following points:

- Provide quantity breakdowns or tickets with location information similar to misc. quantity sheets.
- Provide measurement information with same unit of measure and measurement method according to specification for item.
- Provide activity and date information that allows engineer to recreate the events with possible pictures or video.

Pay plan quantity does not change the current practice regarding when a change order is needed and when a quantity can be paid within the same bid item without a change order. If a quantity variation is large enough to warrant a change order, the change order is issued as specified in [standard spec 104.2](#).

Partial work completed on the **P** items should be estimated and paid on a progress payment as done in the past. The engineer will determine partial quantity completed and may use contractor information for this purpose (i.e. work is half done on project, half of quantity completed). Progress payments should be made accordingly.

The following two examples illustrate how to deal with adjustments to the quantities when the items have been designated as Pay Plan Quantity:

Example 3

Contract 20041015030; Project: 5678-90-71

Contract quantity: Curb and gutter 1000 LF

Location: 103+00 – 113+00

Contractor identifies variance and brings it to the attention of the engineer that the plan did not account for equation in stationing at 110+00=112+56 and distance is really 744 LF. They provide a mocked up plan sheet to show the equation and their actual measurement of the location.

Because the variance is greater than 5% of the quantity an adjustment is justified. Engineer can re-compute distance from station 103+00 to 110+00 and 112+56 to 113+00 or re-measure the whole length.

The engineer pays for what is constructed: 744 LF

It's important to note that even though an item was designated as Pay Plan Quantity, a price adjustment may be justified if the criteria in [standard spec 104.2](#) are met.

Example 4

Contract 20041015030; Project: 5678-90-71

Contract quantity: Gates 20 EACH; Contract unit price: \$2,700

Location: 112+00 – 1034+48

Contractor identifies variance and brings it to the attention of the engineer that there are 22 locations on plan that show gates are needed for opening. They also provide pictures of these locations.

Because the variance is greater than \$5,000 for this bid item an adjustment is justified. Engineer can re-measure or re-compute quantity.

The engineer pays for what is constructed: 22 EACH.

2-32.2.3.1 Quantity Variation Decision Matrix

The following matrix shows guidelines how to deal with changes when using Pay Plan Quantity items. The examples assume variation did not exceed \$5000.

Table 1 Pay Plan Quantity Payment Examples

Example	Plan Detail	Schedule of Items	Actual	Payment
A	25	25	25	25
B	25	24	25	24
C	24	25	25	25
D	24	25	24	25
E	24	24	25	24 + 1 = 25 ^[1]
F	25	25	24	25 - 1 = 24 ^[1]

^[1]Requested change in scope, before work performed.

2-32.2.4 Supplemental Contract Agreement

When it is agreed between the contractor and the engineer to pay for work items on the basis of plan quantity as noted in [standard spec 109.1](#), it becomes necessary to execute a formal agreement. The agreement is made as a Supplemental Contract Agreement on the department contract modification form. The form is completed using the FieldManager® software, and is approved by the contractor and the engineer. Before agreement, plan quantities should be reviewed for accuracy. Spot checks and random observations of the completed work should be made to verify the plan quantities are in substantial agreement with the quantities of completed work. A statement to this effect is included in the agreement language as shown in [Figure 2](#) below.

Figure 2 Supplemental Contract Agreement Language

Short Description		
Supplemental Contract Agreement		
Description of Changes		
The Engineer has reviewed the accuracy of the contract quantity of the item(s) identified below and on the basis of spot checks and random observations of the completed work, has verified that the contract quantity, as originally drawn or subsequently corrected or revised, is in substantial agreement with the quantity of work performed.		
In accordance with subsection 109.1.1 of the Standard Specifications for Highway and Structure Construction, the Contractor and Engineer agree that compensation for the item(s) identified below will be based on the quantity set forth in the contract, as originally drawn or subsequently corrected or revised, without measurement. Increased or decreased quantities of the item(s) resulting from modifications ordered by the Engineer will be measured in accordance with the applicable section of the Standard Specifications and the contract quantity will be adjusted accordingly to determine the final pay quantity.		
ITEM NUMBER	DESCRIPTION	UNIT
xxx.xxxx	Insert full item description here	Insert item unit of measure here

Insert the language from Figure 2 above into the appropriate fields in the FieldManager, Add Contract Modification screen. See [CMM 2-42.5](#) for contract modification procedures.

Reasonable documentation that the plan quantities are in substantial agreement with the quantities of completed work would be evidence that elevation, grade, and dimensional checks have been made. It should also include evidence of checks on the computation of quantities such as concrete masonry and bridge reinforcing steel based on neat dimensions. Evidence could consist of notes in a field survey book, FieldManager Inspectors Daily Report, or checks indicated on "As-built" construction plans.

Items that may be considered are those that lend themselves to a fixed sized and quantity that was previously measured and depicted in a detail drawing, plan sheet, bar chart, or other contract document. Typically these are structure items like abutments, parapets and wing walls where the component quantities are based on a detail that can be verified in the field. Items that should not be considered are those that typically have widely varying quantities depending on the field conditions like earthwork and aggregates or concrete items like curb and gutter, or sidewalk.

Thought should also be given to the total dollar amount of the items to be included in relation to the total contract amount.

An example of a completed Supplemental Contract Agreement contract modification is shown in [Figure 3](#) below.

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 type of material delivered, identification and capacity of the haul vehicle, time of arrival of each load, and appropriate notations as to the 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 of material delivered is not less than the volume claimed by the contractor.

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 given below.

Example 5

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:

$120 / 1.25 = 96 \text{ CY} \Rightarrow$ 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 6

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.

$96 \text{ CY} \times 0.90 = 86.4 \text{ CY} \Rightarrow$ 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.

2-32.4 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.

2-32.5 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 the following table. Quantities for items listed in the table 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 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	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