

HiCAMS User Guide

Chapter 2: Contract Maintenance

Section 3A: Working with Conversion Factors

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About Conversion Factors

The Conversion Factor defines how many Material Units are required for each Line Item Unit. When the Material Unit of Measure (UOM) matches the Line Item UOM, the conversion factor is set to 1.000 because each payment of one unit requires one unit of the Material. When the Material UOM does not match the Line Item UOM, the Conversion Factor is generally not set to 1.000.

Conversion Factors are maintained on the General Tab of the Contract Bill of Materials window. Materials are defaulted from the Master Bill of Materials, or MBOM, when a Contract is Authorized. If the Materials on the MBOM have a Conversion Factor, the conversion factor will also default onto the Contract. When the Conversion Factor is based on contract specific quantities or is *Project Specific*, the Master Conv Unknown checkbox will be checked. These are the items that will require Conversion Factors to be calculated based on your individual contract information.

This User Guide will explain the steps to be taken to calculate Project Specific Conversion Factors and provide enough examples that you should then be able to calculate the Conversion Factor for any material on your Contract.

It will also explain how to calculate the Conversion Factors for the Materials on a Pay Item such as Reinforced Concrete Deck Slab that may represent work done in multiple locations.

The last area discussed will be setting Conversion Factors for Lump Sum items such as "Roadway Construction" or "Design, Construction and Inspection".

NOTE: *This process also applies to materials associated with Work Items.*

Calculating Project Specific Conversion Factors

When the Conversion Factor is based on contract specific quantities or is *Project Specific*, the Master Conv Unknown checkbox on the General Tab of the Review Contract BOM window will be checked. These are the items that will require Conversion Factors to be calculated based on your individual contract information.

To identify all of the Materials that have Master Conv Unknown, print the standard report "Contract BOM Report". Materials which require a Project Specific conversion factor will display 'Y' in the column of the report labeled "Mstr Conv Factor Unknown".

Calculating Conversion Factors for the Pay Item "Reinforced Concrete Deck Slab"

The first set of examples uses the Pay Item *Reinforced Concrete Deck Slab*. It is paid by the Square Foot. In these examples, there is only one bridge involved.

The following Critical Materials are defaulted from the MBOM with the Master Conv Unknown:

Material	Material Unit of Measure
Concrete, Class AA	Cubic Yards
Reinforcing Steel, Epoxy Coated	Pounds
Reinforcing Steel, Plain	Pounds

Example 1: Calculating the conversion factor for the Concrete, Class AA:

The Total Bill of Material in the Structure Plans indicates that there is 4,901.0 Square Feet of Reinforced Concrete Deck Slab on this project. The Superstructure Bill of Material on the Superstructure plans indicates that there will be three pours totaling 180.4 Cubic Yards of Concrete.

The conversion factor asks the question "How many units of this material do I need for each one of the pay item units?" In this case, how many Cubic Yards of concrete are used in each Square Foot of Reinforced Concrete Deck Slab? The conversion factor is equal to $180.4 \text{ CY} \div 4901.00 \text{ SF} = 0.037 \text{ CY/SF}$.

When 0.037 is entered as the conversion factor, the Material quantity required calculates to 181.337 CY. This is within the margin of error for this calculation.

Example 2: Calculating the conversion factor for the Reinforcing Steel:

The Total Bill of Material in the Structure Plans indicates that there is 4,901.0 Square Feet of Reinforced Concrete Deck Slab on this project. The Superstructure Bill of Material on the Superstructure plans indicates that 17,971 LB of Plain and 17,562 LB of Epoxy Coated Reinforcing Steel will be used.

The conversion factor asks the question "How many units of this material do I need for each one of the pay item units?" In this case, how many Pounds of Reinforcing Steel are used in each Square Foot of Reinforced Concrete Deck Slab? The conversion factors are equal to $17,971 \text{ LB} \div 4901.00 \text{ SF} = 3.667 \text{ LB/SF}$ for the Plain Steel and $17,562 \text{ LB} \div 4901.00 \text{ SF} = 3.583 \text{ LB/SF}$ for the Epoxy Coated Steel.

When these conversion factors are entered, the Material quantities required calculate to 17,971.967 and 17,560.283 LB respectively. This is within the margin of error for this calculation.

Calculating Conversion Factors for the Pay Item "Reinforced Concrete Deck Slab" in Multiple Locations

The next set of examples uses the Pay Item *Reinforced Concrete Deck Slab*, still paid by the Square Foot, but in this case, there are several bridges involved.

The following Critical Materials are defaulted from the MBOM with the Master Conv Unknown:

Material	Material Unit of Measure
Concrete, Class AA	Cubic Yards
Reinforcing Steel, Epoxy Coated	Pounds
Reinforcing Steel, Plain	Pounds

Example 3: Calculating the conversion factor for the Concrete, Class AA:

When there is more than one bridge on a project, there will generally be a Total Bill of Material for each bridge in the Structure Plans. This page will indicate how many Square Feet of Reinforced Concrete Deck Slab are on each bridge. The Superstructure Bill of Material on the Superstructure plans will indicate how much of the materials there are for each bridge.

In this example, the Total BOM indicates that the plan quantity of Bridge Deck for the bridge at 21+64.07 -L- LT is 5465.0 SF. For the bridge at 21+64.07 -L- RT, the plan quantity of Bridge Deck is 10,591.0 SF. The combined quantity of Bridge Deck is 16,056.0 SF.

The Superstructure BOM indicates that the plan quantity of Concrete for the bridge at 21+64.07 -L- LT is 217.7 CY. For the bridge at 21+64.07 -L- RT, the plan quantity of Concrete is 374.6 CY. The combined yardage is 592.3 CY.

The conversion factor asks the question "How many units of this material do I need for each one of the pay item units?" In this case, how many Cubic Yards of concrete are used in each Square Foot of Reinforced Concrete Deck Slab? The conversion factor is equal to 592.3 CY divided by 16,056 SF = 0.037 CY/SF.

When 0.037 is entered as the conversion factor, the Material quantity required calculates to 594.072 CY. This is within the margin of error for this calculation.

Example 4: Calculating the conversion factor for the Reinforcing Steel:

The same process is followed for the Plain and Epoxy coated Reinforcing Steel.

There is still 16,056.0 Square Feet of Reinforced Concrete Deck Slab on both Bridges.

The Superstructure BOM indicates that the plan quantity of Plain Reinforcing Steel for the bridge at 21+64.07 -L- LT is 13,054.0 LB. For the bridge at 21+64.07 -L- RT, the plan quantity of Plain Steel is 28,185.0 LB. The combined poundage for the Plain Steel is 41,239.0.

The conversion factor asks the question "How many units of this material do I need for each one of the pay item units?" In this case, how many Pounds of Plain Reinforcing Steel are used in each Square Foot of Reinforced Concrete Deck Slab? The conversion factors are equal to 41,239 LB. divided by 16,056.0 SF = 2.568 LB/SF for the Plain Steel.

When this conversion factor is entered, the Material quantity required calculates to 41,232.808 LB. This is within the margin of error for this calculation.

Similarly, the amount of Epoxy Coated Reinforcing Steel is 15,055.0 and 35,839.0 LB. The conversion factor calculates to 3.170 LB/SF.

Note: *A spreadsheet has been created that performs these calculations when the quantities from the Structure Bills of Materials are entered. The spreadsheet is called Conversion Factors for Multiple Locations and is located in the Contract Maintenance section of the User Guide on the HiCAMS homepage. The home page can be accessed by clicking the globe icon in the tool bar of the HiCAMS application or by going to Help > HiCAMS Homepage.*

Calculating Conversion Factors for Lump Sum Line Items

When a Pay Item has a unit of measure of Lump Sum, it indicates that the contractor will be compensated for furnishing and installing all materials, labor, and equipment for the construction of the Pay Item by a single payment, instead of receiving compensation for each task involved in that work. Materials may or may not be defaulted from the Master Bill of Materials. An example of a Lump Sum Pay Item where the Materials are defaulted is *Bridge Approach Slab Sta14+11.50*. An example of a Lump Sum Pay Item where the Materials are NOT defaulted is *Roadway Construction*.

Calculating Conversion Factors for the Pay Item "Bridge Approach Slab Sta14+11.50"

The following Critical Materials are defaulted from the MBOM with the Master Conv Unknown:

Material	Material Unit of Measure
Aggregate Base Course, Type A	Ton
Asphalt Concrete Base Course, Type B - 25.0B	Ton
Concrete, Class AA	Cubic Yards
Reinforcing Steel, Epoxy Coated	Pounds
Reinforcing Steel, Plain	Pounds

The conversion factor asks the question "How many units of this material do I need to complete this Lump Sum Pay Item?" In this case, how many Tons of Aggregate Base Course or Asphalt Concrete Base Course, how many Cubic Yards of concrete, and how many Pounds of Reinforcing Steel are used to construct the Bridge Approach Slabs?

Example 5: Calculating the conversion factor for the Aggregate Base Course, Type A:

The Structure plan sheet indicates that if Aggregate Base Course (ABC) is used under the approach slab, it will be compacted to 6" thick. It will extend 10'-0" beyond the end of the approach slab and 1'-0" outside each edge of the slab. The plans indicate that each approach slab is 15'-0" long and 30'-0" wide. The dimensions for the ABC area are then 15'-0" + 10'-0" = 25'-0" and 30'-0" + (2 X 1'-0") = 32'-0". The volume of the ABC would be 25'-0" X 32'-0" X 0'-6" or 25.0 X 32.0 X 0.5 = 400.0 Cubic Feet.

Since ABC is paid for by the ton, the weight of the Material needs to be calculated. In this example, the unit weight of the material from the quarry is 144.1 PCF. (The ABC unit weight is available on the Materials and Tests Unit homepage on the Soils Laboratory page). The weight of the ABC for this area then is 400.0 CF X 144.1 PCF = 57,640.0 LB. To obtain tons, divide the pounds by 2,000 LB/TON and the ABC needed for one approach slab is 28.8 TON. There are two identical approach slabs so the quantity is doubled and becomes 57.6 TON.

When 57.6 is entered as the conversion factor, the Material quantity required calculates to 57.6 TONS which matches the calculated quantity needed.

Example 6: Calculating the conversion factor for the Asphalt Concrete Base Course, Type B - 25.0B:

The Structure plan sheet indicates that if Asphalt Concrete Base Course Type B - 25.0B is used under the approach slab, it will be compacted to 4" thick. It will extend 1'-0" beyond the end of the approach slab and the width shall be the same as that of the approach slab. The plans indicate that each approach slab is 15'-0" long and 30'-0" wide. The dimensions for the Base Course area are then 15'-0" + 1'-0" = 16'-0" and 30'-0". The square footage of the Base Course would be 16'-0" X 30'-0" or 16.0 X 30.0 = 480.0 Square Feet.

Since the Base Course is paid for by the ton, the weight of the Material needs to be calculated. The approximate application rate for asphalt material is 110 pounds per square yard at 1 inch thick. A square foot of asphalt material would be 110.0 LB/SF divided by 9 SF/SY = 12.2 LB/SF for 1 inch thick. Four Inches would be 4 X 12.2 = 48.8 LB/SF. The weight of the Base Course for this area then is 480.0 SF X 48.8 LB/SF = 23,424.0 LB. To obtain tons, divide the pounds by 2,000 LB/TON and the Base Course needed for one approach slab is 11.7 TON. There are two identical approach slabs so the quantity is doubled and becomes 23.4 TON.

When 23.4 is entered as the conversion factor, the Material quantity required calculates to 23.4 TONS which matches the calculated quantity needed.

Example 7: Calculating the conversion factor for the Concrete, Class AA:

The Bill of Material in the Structure Plans indicates that there is 18.1 Cubic Yards of Concrete needed for the Approach Slab at End Bent 1 and the same amount for the Approach Slab at End Bent 2.

The conversion factor asks the question "How many units of this material do I need to complete this Lump Sum Pay Item?" In this case, how many Cubic Yards of concrete, are used to construct the Bridge Approach Slabs?

Add the two quantities obtained from the Bill of Materials together for a total quantity of 36.2 Cubic Yards of Concrete. When 36.2 is entered as the conversion factor, the Material quantity required calculates to 36.2 CY which matches the plan quantity.

Example 8: Calculating the conversion factor for the Reinforcing Steel:

The Bill of Material on the Structure plans indicates that 1184 Lbs. of Plain and 1619 Lbs. of Epoxy Coated Reinforcing Steel will be used for the approach slab at End Bent 1 and the same amounts for the Approach Slab at End Bent 2.

Add the two quantities obtained from the Bill of Materials together for a total quantity of 2,368.0 LB of Plain Steel and 3,238.0 LB of Epoxy Coated Steel. When these numbers are entered as the conversion factors, the Material quantity required calculates to the numbers that match the plan quantity.

Calculating Conversion Factors for the Pay Item "Roadway Construction"

According to the Contract document for this example, the Pay Item "Roadway Construction" consists of clearing and grubbing; excavation and embankment; pipes; drainage structures; pavement removal, pavement structure; furnish and place borrow materials; undercut; erosion contract, construction surveying if applicable, and all incidentals necessary to complete the work required of the plans.

HiCAMS Version 6.0 contained new functionality called Review Work Items that aids in constructing the Contract Bill of Materials for Lump Sum Pay Items. Work Items are added to the Lump Sum Pay Item. Once they have been added, the materials are manipulated the same as individual Materials. The benefit to using Work Items is that may default materials based on the Master Bill of Materials.

In the example above, the user has two options when entering the materials for the pavement structure. The first option is to add each of the materials used (Asphalt Concrete Base Course, Type B 25.0B and/or Asphalt Concrete Base Course, Type RB 25.0B) to the Contract BOM. The conversion factor for these materials would be equal to the quantity of that material that the contractor planned to use, for example, 600 TON. The Material quantity is then calculated by multiplying the 600 TON by the Line Item Quantity (1.000) to obtain a Material Quantity of 600 TON.

The other option is to add the Work Item to the Pay Item in the Review Work Items window. If the Work Item added was Asphalt Concrete Base Course, Type B 25.0B, both materials ACBC Type B 25.0B and ACBC Type RB 25.0 B are added to the contract with a conversion factor of 1.000. HiCAMS then calculates the Material Quantity by multiplying the Plan Quantity of the Work Item by the Conversion Factor. The Material Quantity is again equal to 600 TON.

If the Master Conversion Factor for a Material associated with the Work Item is unknown, the user would perform the same type of calculations as in the previous examples.

Remember

1. Materials must be listed on the Contract BOM before they are available for selection in the Material Receipts, Tickets, Material Prepayments, Field Inspection Reports, and Sample windows.
2. Care should be taken when entering the Conversion Factor. Unless the Units of Measure for the Line Item and the Material are the same, the Conversion Factor is probably not 1.000.
3. For specific help with calculating conversion factors for your project, please contact your HiCAMS specialist at the Construction Unit or Materials and Test Unit. Contact numbers are available on the HiCAMS homepage in the section labeled "Help".