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Worksheet Basics

Construction worksheets are used to price unit rates for Price codes and Complex Resources.

A calculation line in a worksheet contains a resource code followed by a production calculation.

Example

A line describing two Labourers, each with a daily cost of 100 units of money, digging at 4m3 per day with a bulking factor of 20% can be set out as follows:

1. Type a resource code:
   L001

2. Hit ENTER to display the resource:
   L001 Labourer 100/day

3. Enter the production calculation:
   L001 Labourer 100/day*2/4*1.2

4. Hit ENTER to display the result:
   L001 Labourer 100/day*2/4*1.2 = 60.00

The rate of 60 will be added to the results of other calculation lines on the worksheet to arrive at the total unit rate for the worksheet.

Production calculation

The production calculation portion of the line can include text to document the calculation - much as you would write it on paper:

*2men/4m3 per day+20%for bulking = 60.00

The words, "men", "m3 per day" and “for bulking” are optional and do not affect the calculation but make it easier to understand than 2/4*1.2.

The Operators

The production calculations use the divide (/) and multiply (*) operators. The plus (+) and minus (-) operators can also be used to add or subtract percentages, eg. +20% or within brackets, eg (2+4).

Precedence order

The precedence order for calculations is: Brackets, Functions (Raise to power, Trig functions, etc), Divide, Multiply, then Add and Subtract and finally the logical operators (<?, =, > and <=>). When in doubt, use brackets to control the order of calculation.
Totalling

An equals sign ("=") on the extreme left of a blank line will total up the group of lines above to display an intermediate total:

L001 Labourer 100/day /2m3/day+20% =60.00
P001 Excavator 10000/day /200m3/day+20% =60.00
= 120.00

Totalling with a factor

If a hash ("#") is entered above the first line of a totalling group, all the lines in the group are multiplied by the factor on the 'equals' line at the bottom of the group. The phrase "APPLIED FACTOR" is automatically inserted on the 'equals' line:

1. Type the "#" sign above the first line:
   L001 Labourer 100/day /2m3/day = 50.00
   P001 Excavator 10000/day /200m3/day = 50.00

2. Type the "=" sign and factor below the group:
   L001 Labourer 100/day /2m3/day = 50.00
   P001 Excavator 10000/day /200m3/day = 50.00
   =+20%bulking

3. Hit ENTER and the factor is applied to the group:
   L001 Labourer 100/day /2m3/day = 60.00
   P001 Excavator 10000/day /200m3/day = 60.00
   = APPLIED FACTOR +20%bulking 120.00

Note

The factor is applied to each line of the group and these are totalled as the result on the 'equals' line.
Putting the common factor at one place makes it easier to manage adjustments.
A comment or heading can be typed on the "#" line - see the example below.

Aligning calculations

The production calculation portion of each line can be aligned as shown below. This may make it easier to follow the workings on the worksheet. This setting is found in the worksheet menu.

# EXCAVATION
L001 Labourer 100/day________/2m3/day = 60.00
P001 Excavator 10000/day______/200m3/day = 60.00
= APPLIED FACTOR __________________+20%bulking 120.00
Operators (again)

Worksheet lines use the multiply (*) and divide (/) operators to calculate the unit cost for the Labourer:

\[ \frac{2}{4} = 50.00 \]

Plus (+) and minus (-) operators can also be used but must be within brackets:

\[ \frac{(1 \text{ man dig} + 1 \text{ man load})}{4 \text{ m}^3/\text{day}} \]

Percentages

Percentages can be used with multiply, or with plus and minus. Note that when used with multiply, *20% is calculated as *20/100 and +20% as 120/100.

\[ \frac{2 \text{ men}}{4 \text{ m}^3/\text{day}} \times 20\% = 10.00 \]

\[ \frac{2 \text{ men}}{4 \text{ m}^3/\text{day}} + 20\% = 60.00 \]

Negating

A calculation line can be turned negative by inserting [NEG], *(−1) or [-] anywhere on the line:

\[ \frac{2 \text{ men}}{4 \text{ m}^3/\text{day}} \text{[NEG]} = -50.00 \]

\[ \frac{2 \text{ men}}{4 \text{ m}^3/\text{day}} \times (−1) = -50.00 \]

\[ \frac{2 \text{ men}}{4 \text{ m}^3/\text{day}} \text{[−]} = -50.00 \]

Waste

An allowance for waste can be made in the calculation as follows:

\[ \frac{2 \text{ men}}{4 \text{ m}^3/\text{day}} + 10\% \text{Waste} = 55.00 \]

This will add 10% to the calculation and also record the 10% as being waste. The total waste in the job can be extracted, both money and quantity on the Resource list or on the wastage analysis reports.

Note: The word 'waste' should be hard up against the percent sign with no spaces. It is not case sensitive - wAste would also work.
Logical Functions

\[ [A] = 4.00 \]
\[ [B] = 2.00 \]

\[ [C] = (IF ([A] > 10) THEN 1000 ELSE 100 \) \]
\[ ?[C] = 100.0000 \]
The condition is not fulfilled, and thus the value that is attributed to the variable is 100

\[ [D] = (IF (([A] < 10) \&\& ([B] < 5)) THEN 500 ELSE 50 \) \]
\[ ?[D] = 500.0000 \]
Both of the conditions are fulfilled, and thus the value that is attributed to the variable is 500

\[ [E] = (IF (([A] = 6) \| ([B] < 5)) THEN 200 ELSE 20 \) \]
\[ ?[E] = 200.0000 \]
One of the conditions is fulfilled, and thus the value that is attributed to the variable is 200

\[ [F] = (IF ([A] > 10) THEN 1000 ELSE IF ([A] = 4) then 45 ELSE .9 \) \]
\[ ?[F] = 45.0000 \]
The first condition is NOT fulfilled, but the second condition is fulfilled, and thus the value that is attributed to the variable is 45
Mathematical Functions

1. TRIGONOMETRIC FUNCTIONS

[SN]=(SIN(30))  
Sine of 30°  
? (SIN(30))=0.5000

[CS]=(COS(60))  
Cosine of 60°  
? (COS(60))=0.5000

[TN]=(TAN(45))  
Tangent of 45°  
? (TAN(45))=1.0000

2. ALGEBRAIC OPERATIONS

The expression must be contained within brackets

a) EXPONENT (X^N)

[P]=(4^3)  
Will provide the result of the cube of 4 \(4^3\)  
? (4^3)=64.0000

[A]=(4^2)  
Will provide the result of the square of 4 \(4^2\)  
?[A]=16.0000

b) SQUARE ROOT (SQR)

[R]=(SQR(16))  
The square root of 16 is 4  
? (SQR(16))=4.0000

3. INTEGER (INT)

[WI]=(INT(4.13))  
Width - will use the integer of 4.13 = 4.00

[LI]=(INT(5.67))  
Length - will use the integer of 5.67 = 5.00

[AR1]=([LI]*[WI])  
The result will be 20.00  
? [AR1]=20.0000
4. ROUNDDING OF NUMBERS

The following examples use the values:

\[ W = 4.13 \quad \text{Width} \]
\[ L = 5.67 \quad \text{Length} \]

a) RND

\[ AR2 = (L \times W) \]
\[ AR2 = 23.4171 \]

\[ AR3 = \text{RND}(L \times W) \]
\[ AR3 = 23.0000 \]

The calculated value is 23.4171, but the rounded result is 23.00.

b) ROUND

\[ AR5 = \text{ROUND}((L \times W); 1) \]
\[ AR5 = 23.4000 \]

The calculated value is 23.4171, but the rounded result is 23.40.

NOTE: The number following the semi-colon, in this case 1, determines the number of decimal places to which the result is rounded. This is to the nearest integer.

c) INT

If we wish to round up to the next whole number then we can use the INTEGER function above as follows:

\[ AR4 = \text{INT}(W \times L + 0.99) \]
\[ AR4 = 24.0000 \]

d) RNDUP

\[ AR6 = \text{RNDUP}(W \times L) \]
\[ AR6 = 24.0000 \]

The calculated value is 23.4171, but the rounded result is 24.00.

5. ABSOLUTE VALUE (ABS)

\[ AW = -4.13 \quad \text{Will use the negative value of 4.13} \]
\[ AL = 5.67 \]

\[ EX = (AW \times AL) \]
\[ EX = -23.42171 \]

\[ EXA = \text{ABS}(AW \times AL) \]
\[ EXA = 23.4171 \]

If we make use of the abs function, the value will be positive.

6. SYSTEM CONSTANTS ([PI] AND [SD])

There are two constants that are defined in the system, they are:

PI - the ratio of the circumference of a circle to its diameter
\[ PI = 3.1416 \]

SD - the specific density of steel
\[ SD = 7,850.0000 \]
7. AREA OF A CIRCLE

\[ \text{[AREA]} = (\pi \times (4^2)) \]

Area of a circle with a radius of 4m

? \text{[AREA]} = 50.2656 \text{ m}^2

8. MASS OF A REINFORCING BAR

\[ \text{[DIAM]} = 16 \text{ mm} \] The diameter of the rebar

\[ \text{[MASS/M]} = (\pi \times \text{[SD]} \times (\frac{\text{([DIAM]/1000)^2})}{4}) \] The mass of the bar in Kg/m

? \text{[MASS/M]} = 1.5783 \text{ Kg/m}
Worksheet Characters

The free format of the construction worksheet requires that special meaning be attached to certain characters when used at the start of a line.

Summing Worksheet Lines

“@” denotes the start of a calculated value, which performs a calculation on previous worksheet lines for information only and does not participate in the calculation of the worksheet rate.

A line may be defined on construction worksheets, which uses the calculated value of preceding lines in conjunction with a formula on the current line to calculate and print a value.

To sum up the amounts of calculation lines commence the formula with @ sign, followed by the number of lines above to be included in the calculation, this calculation ignores APPLIED FACTORS.

In the example below this function is used to establish the m2 rate of formwork, for reference, as the worksheet rate is in m3. @6 indicates that the value of the 6 preceding lines immediately above are summed and divided by the variable [FMWK] to arrive at the rate per m2.

<table>
<thead>
<tr>
<th>C301b Price code worksheet  Amended: JFV 18/05/2010</th>
<th>Selling Rate: Rate: 1,000.67</th>
</tr>
</thead>
<tbody>
<tr>
<td>20MPa concrete in thrust blocks including foo</td>
<td>Stored: 25 Aug 15 Recal: 25 Aug 15</td>
</tr>
<tr>
<td>1:2A  ...uses Price code description</td>
<td>Material: 157.51</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>512113 28/19 MPa conc mix &amp; del</td>
<td></td>
</tr>
<tr>
<td>512116 Placing gang c+8</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>480681 Formwork (general)</td>
<td></td>
</tr>
<tr>
<td>211412 Formwork gang c+2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>49.56sum<em>3.59</em>[FMWK]</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1,008.07</td>
</tr>
</tbody>
</table>

The result is purely cosmetic and does not affect the worksheet value in any way. It is intended for calculating intermediate rates for review purposes. This line type can also be used within a gang calculation but the applied factor is disregarded, i.e., the preceding lines use the value printed when the line is executed.

Note

Variables may be used and spaces are not required but may be used for clarity. Lines other than resource lines are ignored but form part of the line count. Omitting the line count implies 1 line, i.e., use the line immediately above.
Worksheet Line Calculator

“?” denotes the start of a **line calculation**, in the example below we use this function to derive the production of the JCB excavator which is to be used in the APPLIED FACTOR.

![Image of worksheet](image-url)
Worksheet Variables

The use of Worksheet Variables not only save time when used in multiple worksheet lines of formulae, but more importantly assist in the compilation of a consistent and structured pricing document.

Candy offers three types of Worksheet Variables:

- Local Variables
- Global Variables
- Global Parameters

Local Variables

Local Variables are defined on each individual worksheet and can be used on one or many lines of formulae. The name of a Local Variable is defined between boxed brackets and can be up to 8 characters long.

In the example below the first five variables\(^1\) have a single value entry, these are used in a formula to derive the value of the production variable\(^2\), which is used as the Applied Factor\(^3\).

The calculated value of a Variable derived from a formula can be seen by pressing enter on the production calculation line, see below.
Global Variables

Global Variables should be used for any numeric element that applies to the job as a whole, such as the project duration, working days in a week, working hours in a day. These are applied to worksheets similar to Local Variables.

Global Variables are defined in by going to Estimating > Main > Definitions & Settings > 2.4 Global Variables.

From the example in Local Variables above the value of the Variable named “HOURS” is used directly in the production formula as it has already been defined, see below. This function is particularly useful when calculating the effect of a change of method, by making a decision to change the working hours of a day to say 10, all worksheets with the Global Variable named “HOURS” will be changed and a new net price calculated.
Global Parameters

Global Parameters are a powerful variant to Global Variables where each Price code can have its own value for the Global Variable.

The power of this tool is that the value of these Variables can be displayed on any Price code document.

Tip: An allowance for waste is used on numerous worksheets but has a different value depending on the material used and the situation it is to be used. Follow the examples below to price waste.

1. Define the Global Parameter. Go to Estimating > Main > Definitions & Settings > 2.4 Global Variables.
2. Enter the Variable, unit and default value and set as a Global Parameter.

3. Go to any Price code document and add column 2.1 Net Global Parameters.
4. Enter the Parameter value for WASTE against each Price code.
5. The Global Parameter on each worksheet is entered in the same way as the Global Variable, but the value comes from the WASTE value on the Price code document.

NB. If there is no value entered on the Price code document the default value in Definitions & Settings will apply, see Price code C7821 above which will have the default value of 5% waste.
Conversion of calculation lines to negative values

**Method 1**

\[
221351 \text{ Steelfixer} \quad \frac{49.50}{\text{Day}} \times \frac{8 \text{ hr}}{\text{day}} \times 70 \text{ hr/ton} \times (-1) = -433.13
\]

**Method 2**

\[
221351 \text{ Steelfixer} \quad \frac{49.50}{\text{Day}} \times \frac{8 \text{ hr}}{\text{day}} \times 70 \text{ hr/ton} \times [-] = -433.13
\]

**Method 3**

\[
221351 \text{ Steelfixer} \quad \frac{49.50}{\text{Day}} \times \frac{8 \text{ hr}}{\text{day}} \times 70 \text{ hr/ton} \times \text{NEG} = -433.13
\]

All of the above methods can be used in applied factors:

\[
# \quad 221351 \text{ Steelfixer} \quad \frac{49.50}{\text{Day}} = -49.50
\]

\[
= \quad \text{APPLIED FACTOR} \quad *(\text{-1}) \quad -49.50
\]
Worksheet Views

Amounts

Worksheets can be viewed in Rate mode or Amount mode. On the worksheet Go to View > Change to display Rates/Amounts will toggle from one to another, see below.

The amount is derived by the Rate x Quantity.