Using Formulas in CES®

Trns•port User's Group

November 2002

Formulas in CES

- Available for all numeric fields with 5.1a
  - Identified by color of field label
- Provide the capability to perform automatic calculations within CES
- Support standard algebraic expressions and basic functions
  - Addition, subtraction, multiplication, etc.
  - Absolute value, Rounding, Truncation, etc.
  - Conditional (If, then, else)

Formulas in CES

- Support the use of standard job columns and also variables created by the Estimator
  - For example, use the length and pavement width to calculate lane miles for a job
- Formula Libraries are available to provide a way to store/catalog formulas

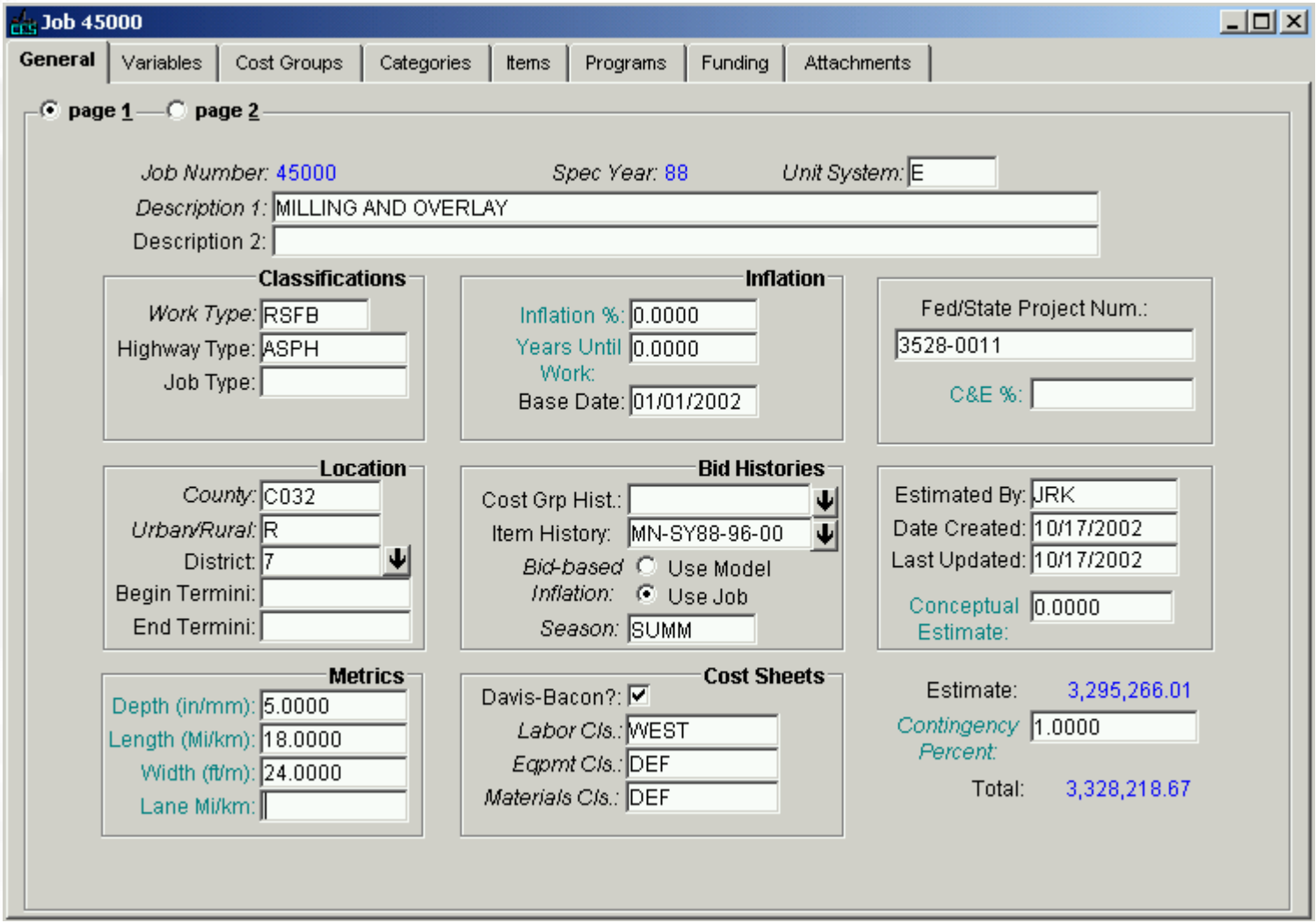
Examples

- Simple conversions
  - Example, converting 8 inches to feet
    - 8 / 12
  - Preserves the value of 8” converted to feet rather than just entering .667

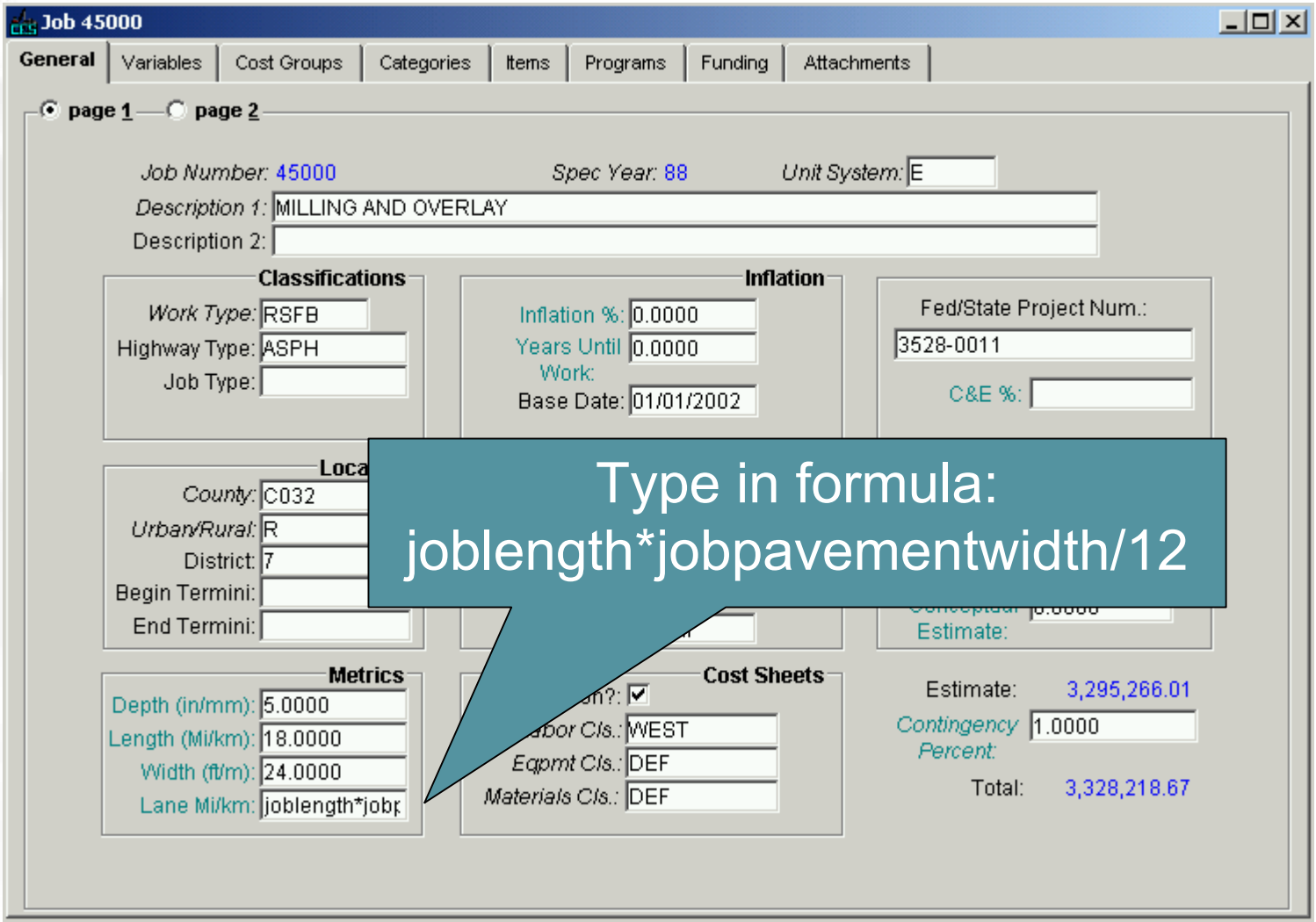
Examples

- Calculating Lane Miles
  - Using Length (miles) and Width (feet) from job and a lane as a constant 12 feet wide
  - # of lanes = Width / 12
  - Lane Miles = Length * # of lanes
  - Formula is: Length * Width / 12
- Can add a variable to store the value of lane width
  - Formula is: Length * Width / LaneWidth

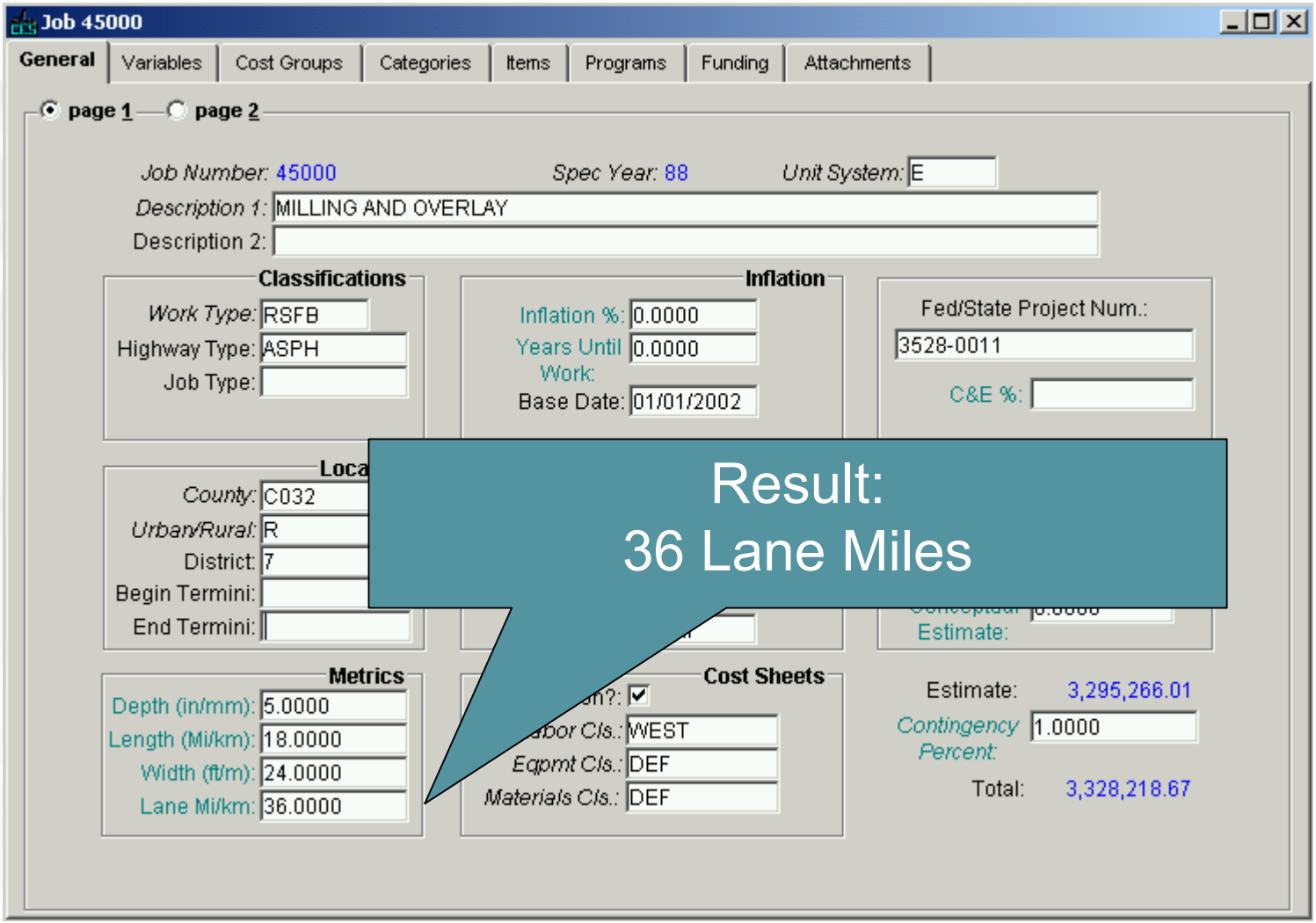
CES Job


Job 45000
General
Variables
Cost Groups
Categories
Items
Programs
Funding
Attachments
page 1
page 2
Job Number: 45000
Spec Year: 88
Unit System: E
Description 1: MILLING AND OVERLAY
Description 2:
Classifications
Work Type: RSFB
Highway Type: ASPH
Job Type:
Inflation
Inflation %: 0.0000
Years Until Work: 0.0000
Base Date: 01/01/2002
Fed/State Project Num.:
3528-0011
C&E %:
Location
County: C032
Urban/Rural: R
District: 7
Begin Termini:
End Termini:
Bid Histories
Cost Grp Hist.:
Item History: MN-SY88-96-00
Bid-based Inflation: Use Model
Use Job
Season: SUMM
Estimated By: JRK
Date Created: 10/17/2002
Last Updated: 10/17/2002
Conceptual Estimate: 0.0000
Metrics
Depth (in/mm): 5.0000
Length (Mi/km): 18.0000
Width (ft/m): 24.0000
Lane Mi/km:
Cost Sheets
Davis-Bacon?:
Labor Cls.: WEST
Eqpmt Cls.: DEF
Materials Cls.: DEF
Estimate: 3,295,266.01
Contingency Percent: 1.0000
Total: 3,328,218.67

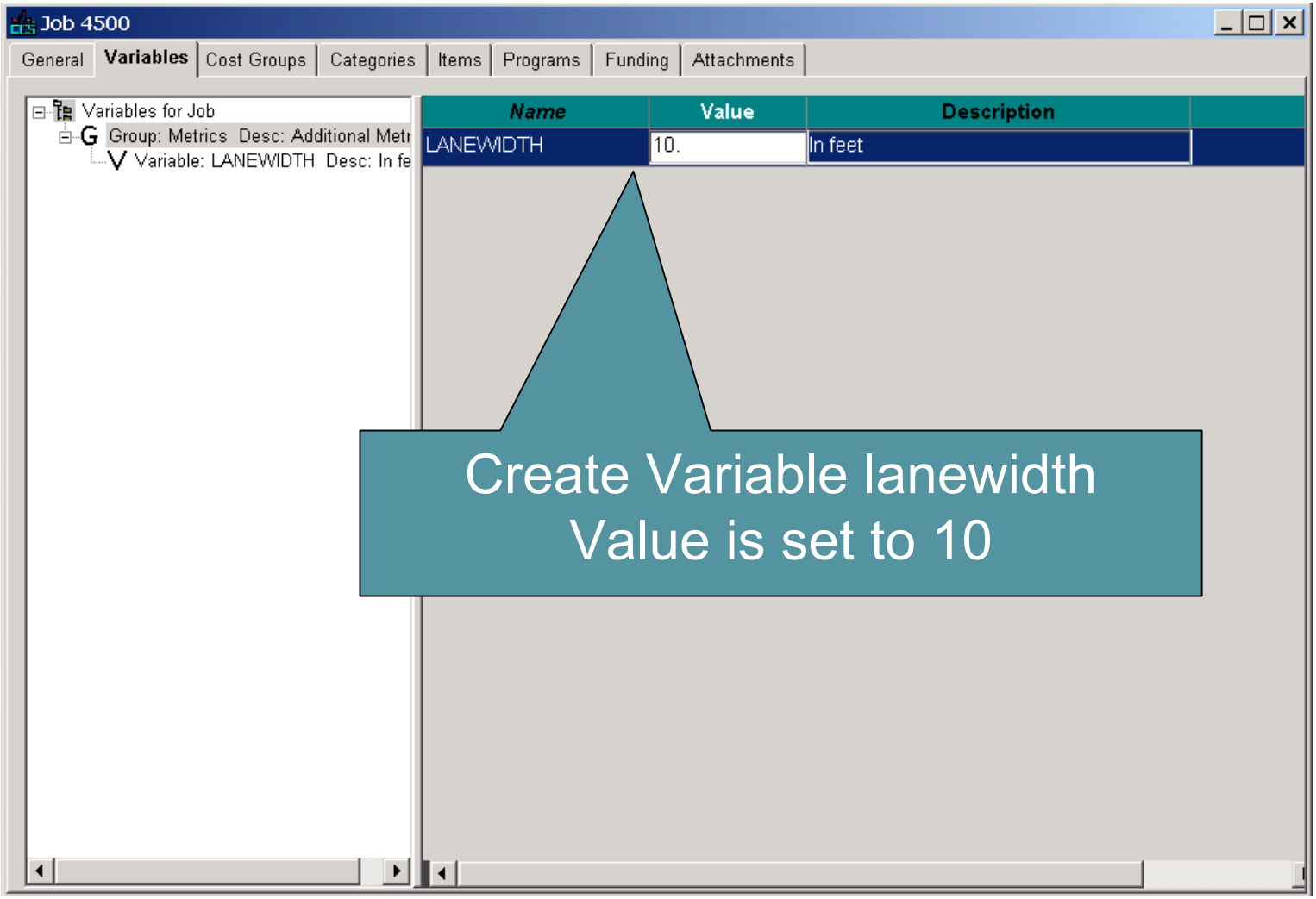
Calculating Lane Miles



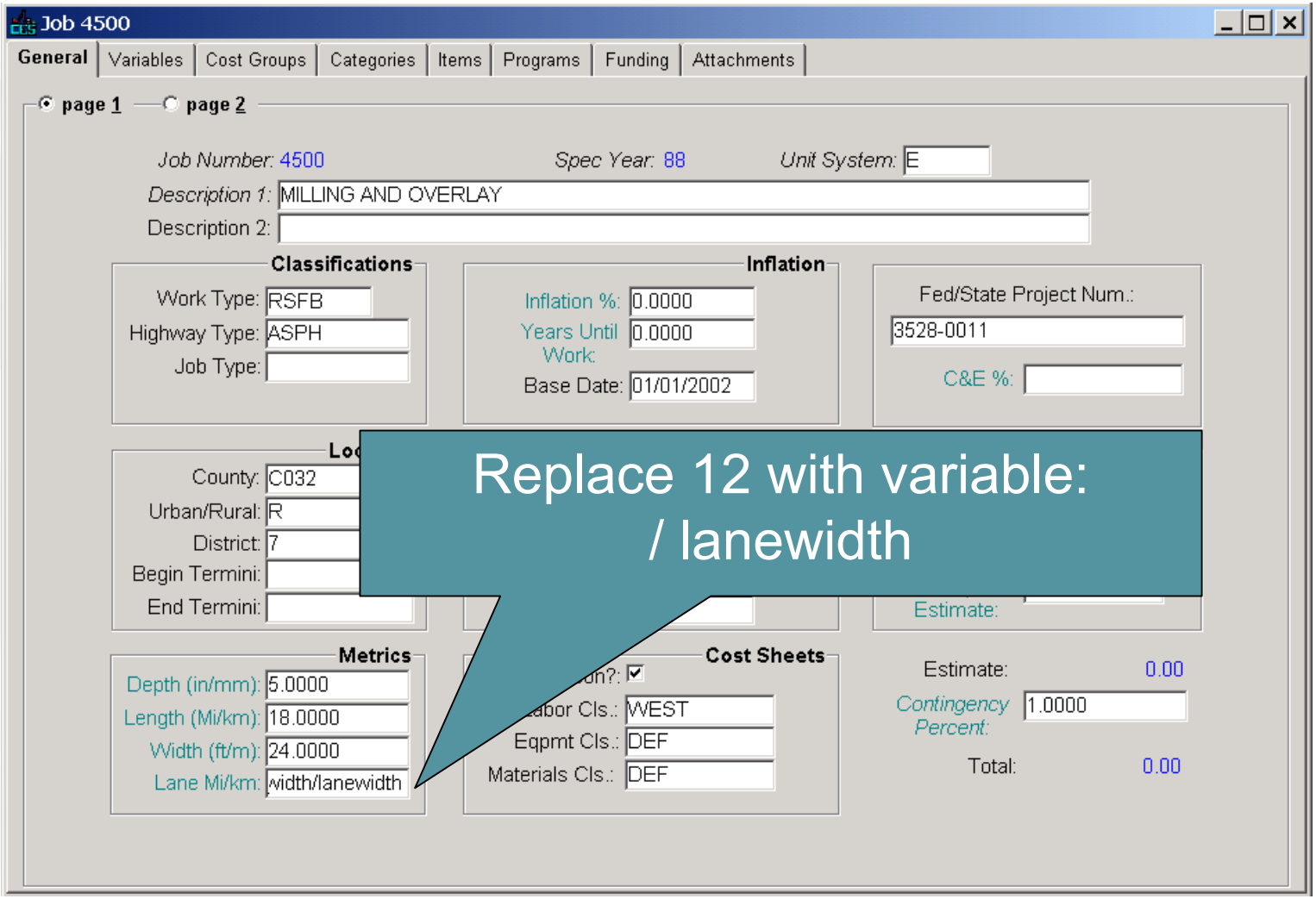
Calculating Lane Miles



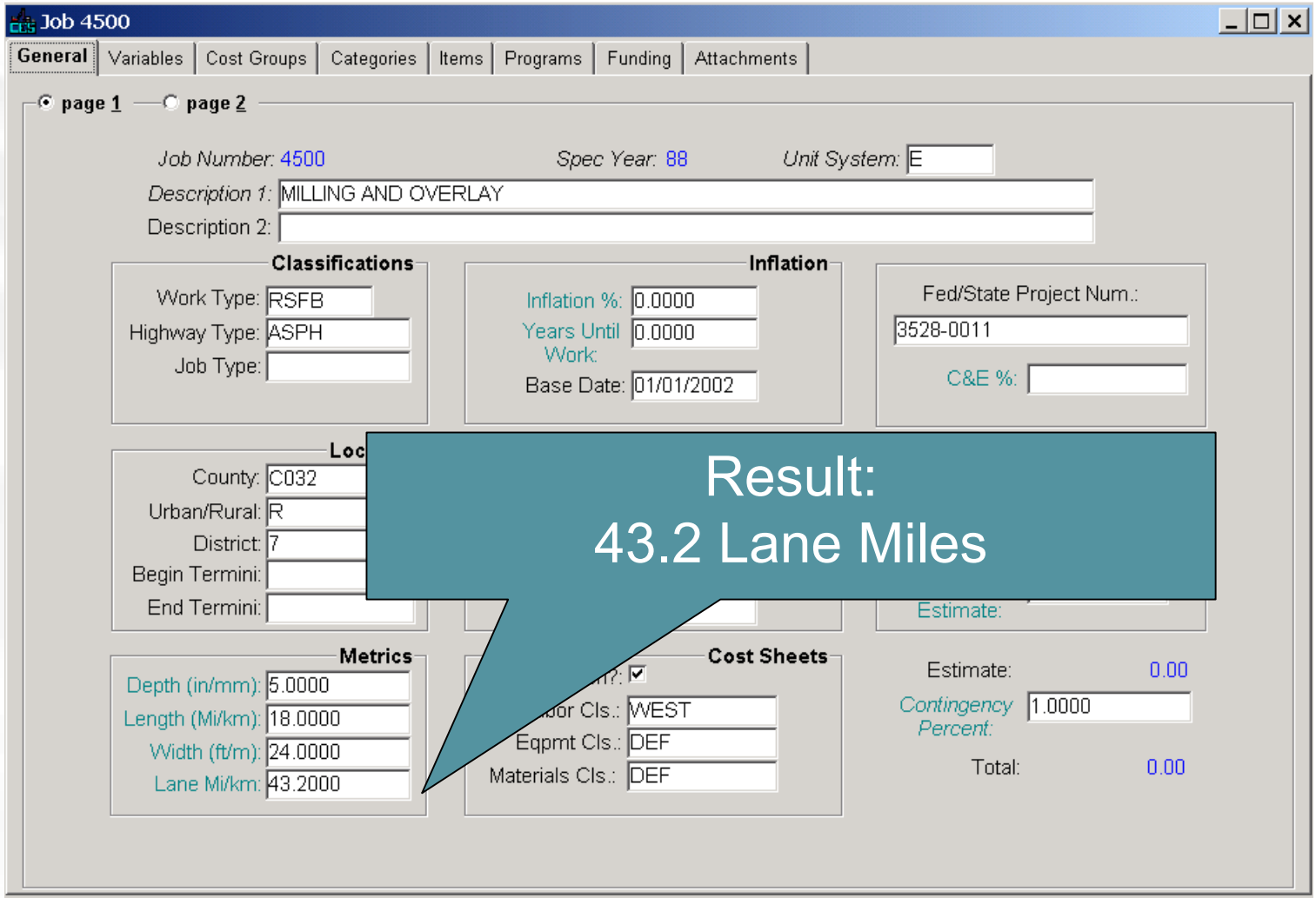
Using LaneWidth Variable



Using LaneWidth Variable



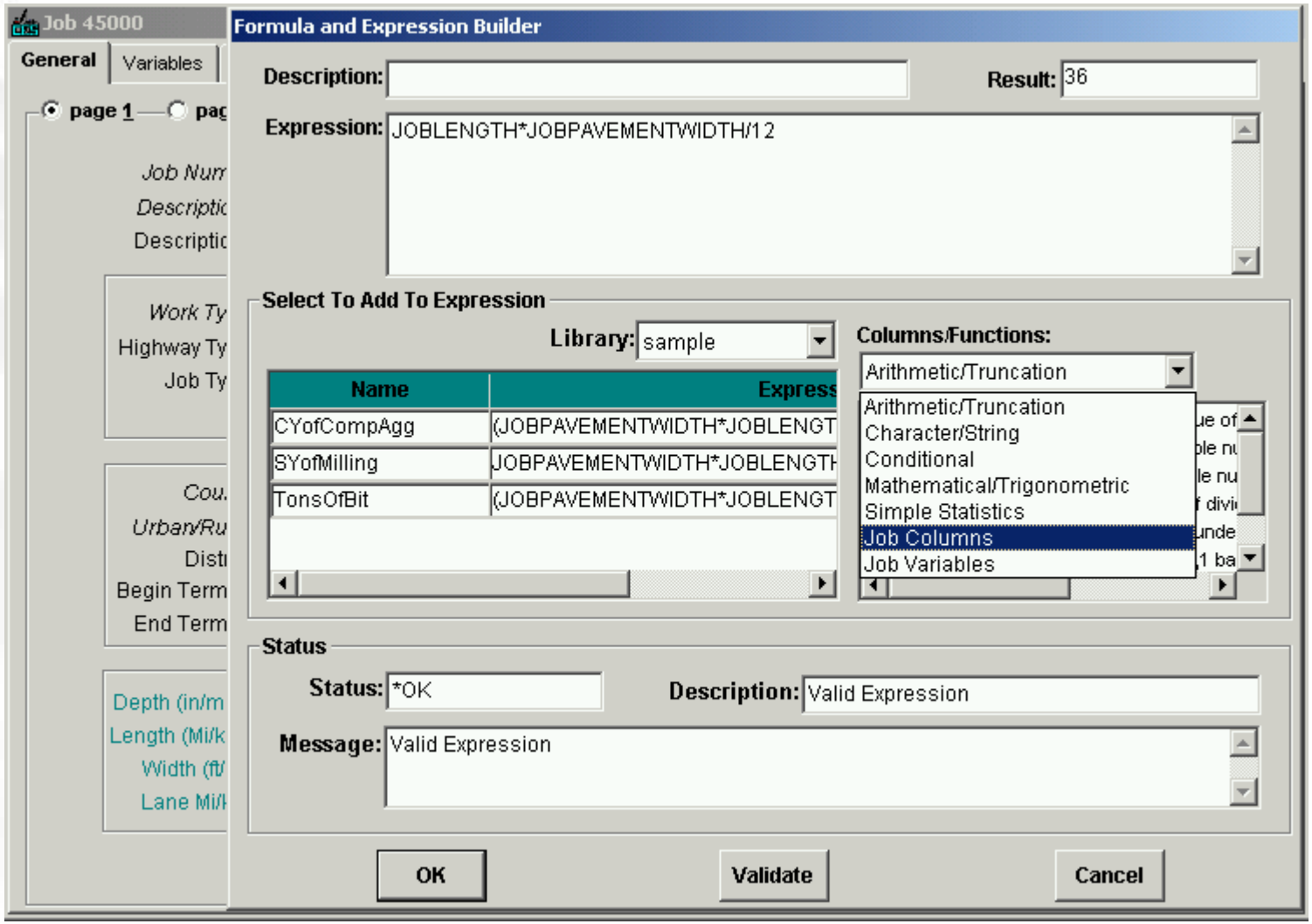
Using LaneWidth Variable



Formulas

- Improved expression builder
  - Opens with double click or menu choice
  - Optional description
  - Improved display and selection for format libraries and functions/columns
  - Displays result once validated
  - Includes status message
- Formula trace
  - Shows in what formulas a field is used

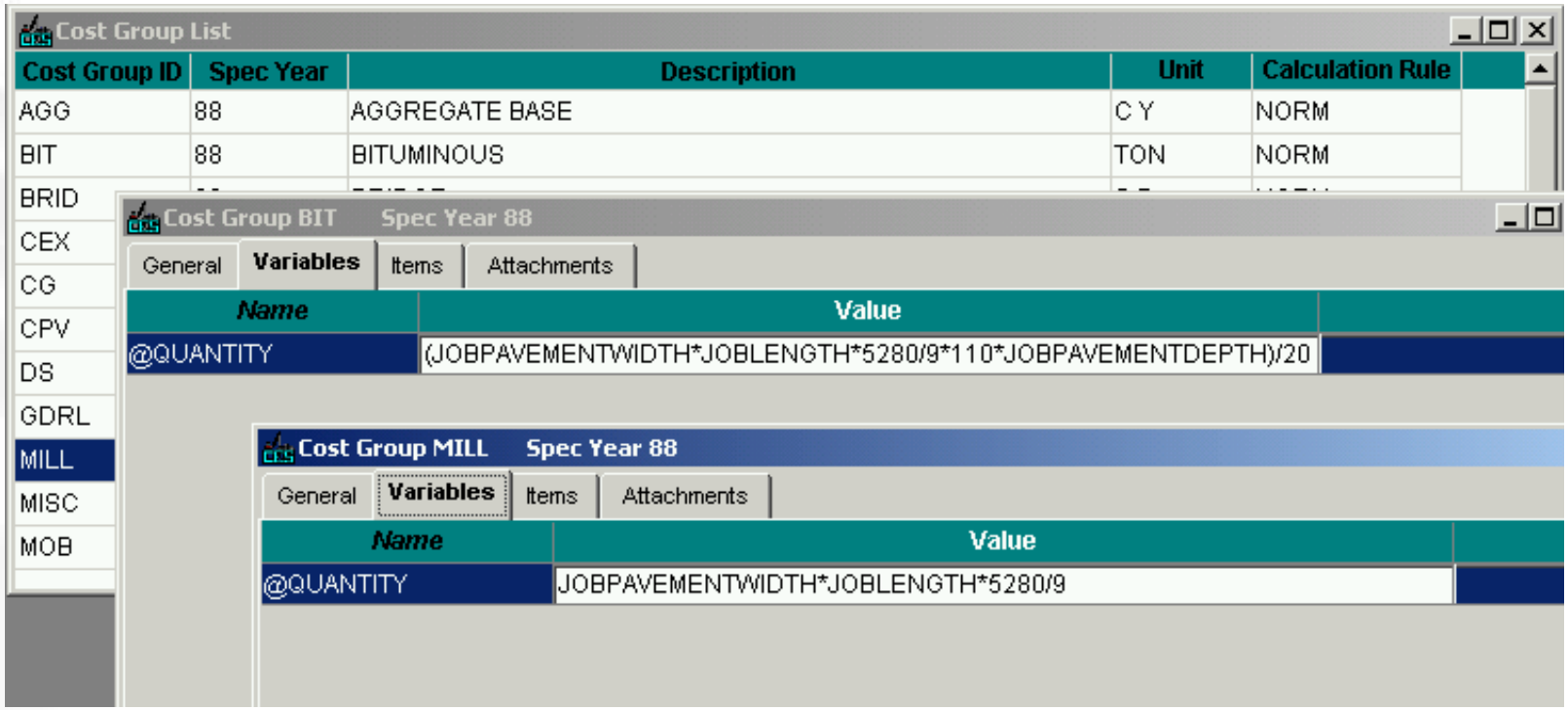
Expression Builder



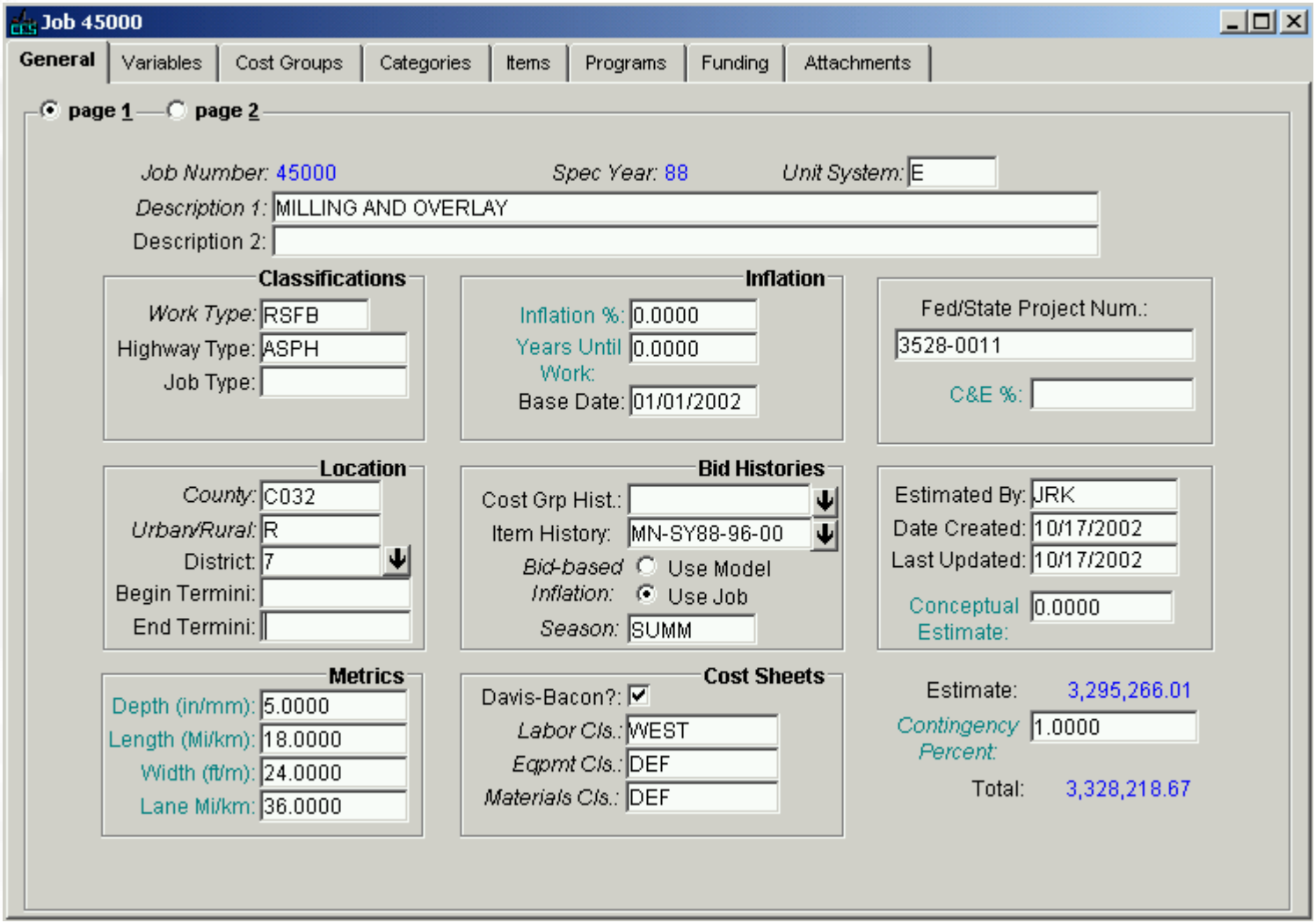
Formulas for quantity

- @QUANTITY Variable
  - automatically puts the formula in the quantity when the cost group or item is brought into a job
- Milling Cost Group in Sq Yd
  - Using Length (miles) and Width (feet)
    - Length in Feet = Length * 5280
    - Square Feet = Length in Feet * Width
    - Square Yards = Square Feet / 9
    - Formula is: Length * 5280 * Width / 9

Add @QUANTITY to Cost Group



CES Job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page 1
page 2
Job Number: 45000
Spec Year: 88
Unit System: E
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Highway Type: ASPH
Job Type:
Inflation
Inflation %: 0.0000
Years Until Work: 0.0000
Base Date: 01/01/2002
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C&E %:
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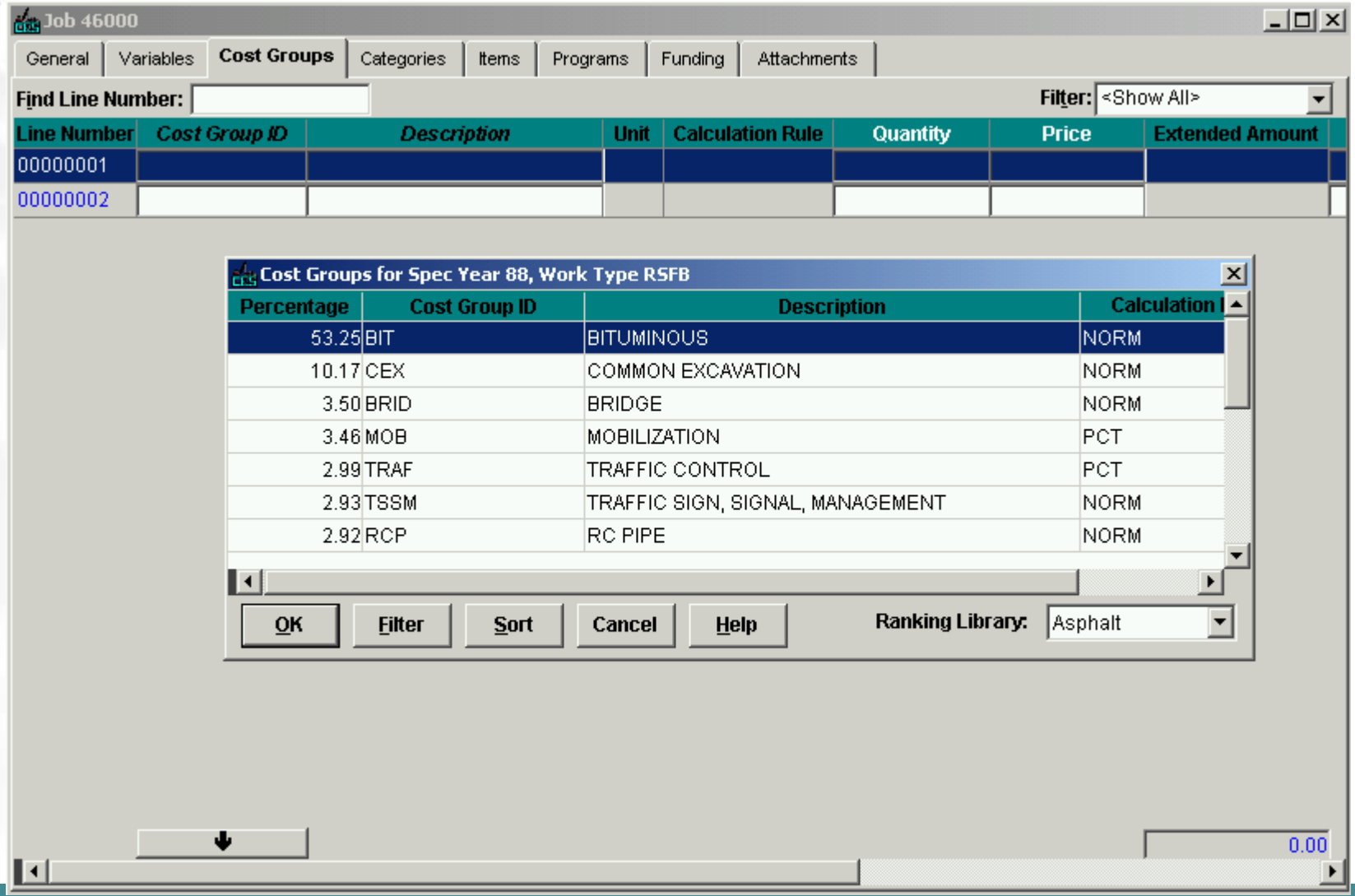
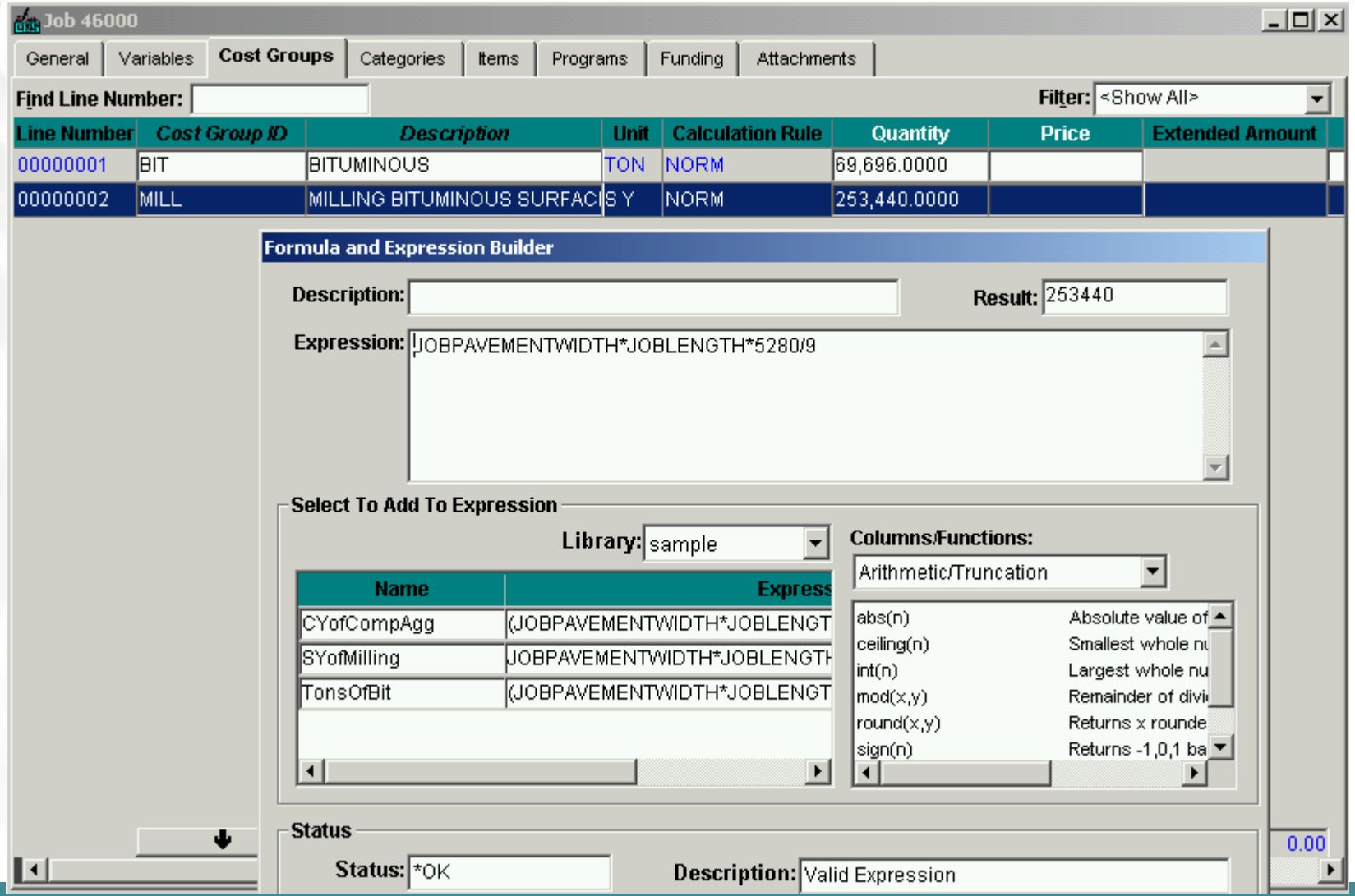
Lane Mi/km: 36.0000
Cost Sheets
Davis-Bacon?:
Labor Cls.: WEST
Eqpmt Cls.: DEF
Materials Cls.: DEF
Estimate: 3,295,266.01
Contingency Percent: 1.0000
Total: 3,328,218.67

Cost groups with @QUANTITY



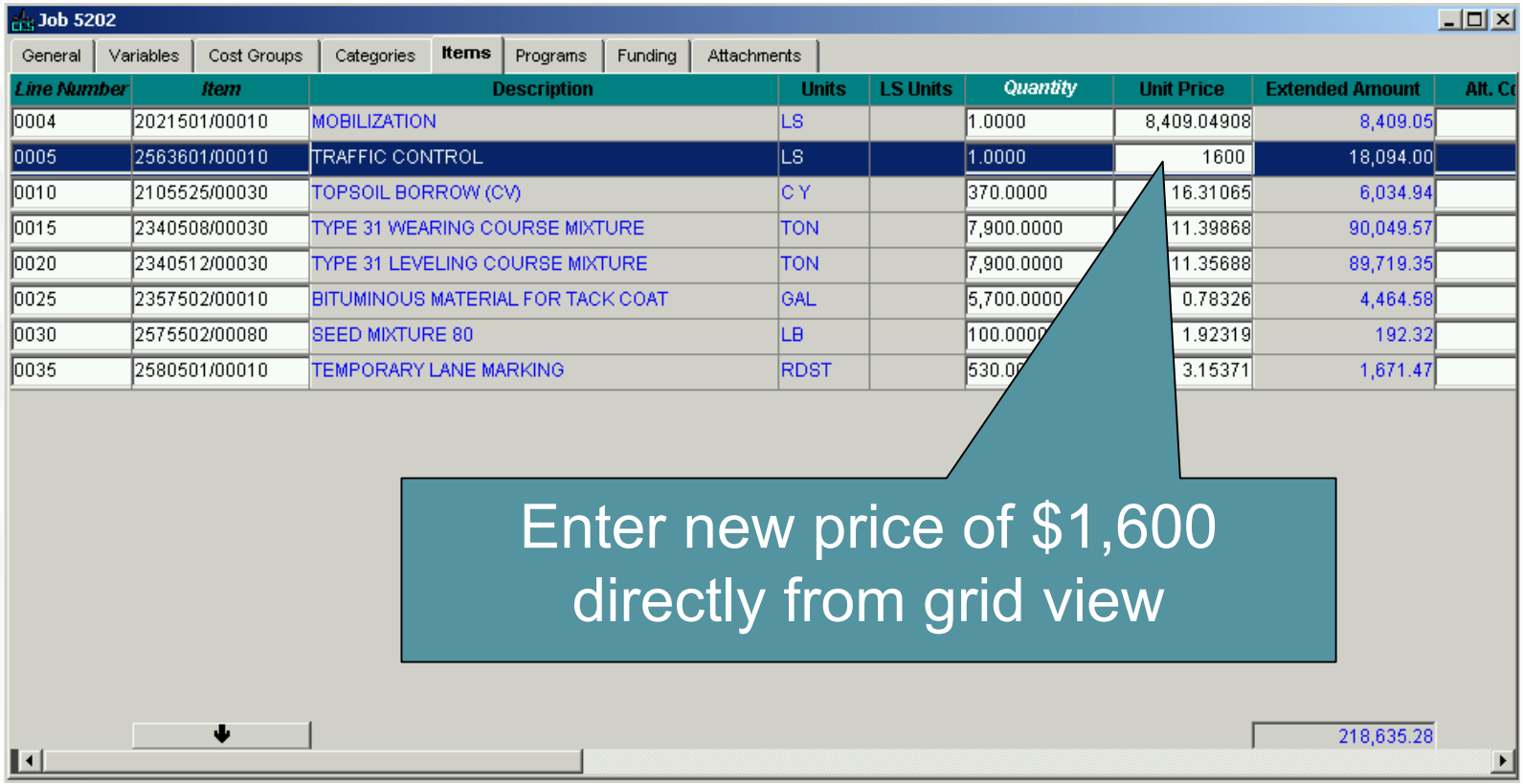
Cost groups with @QUANTITY



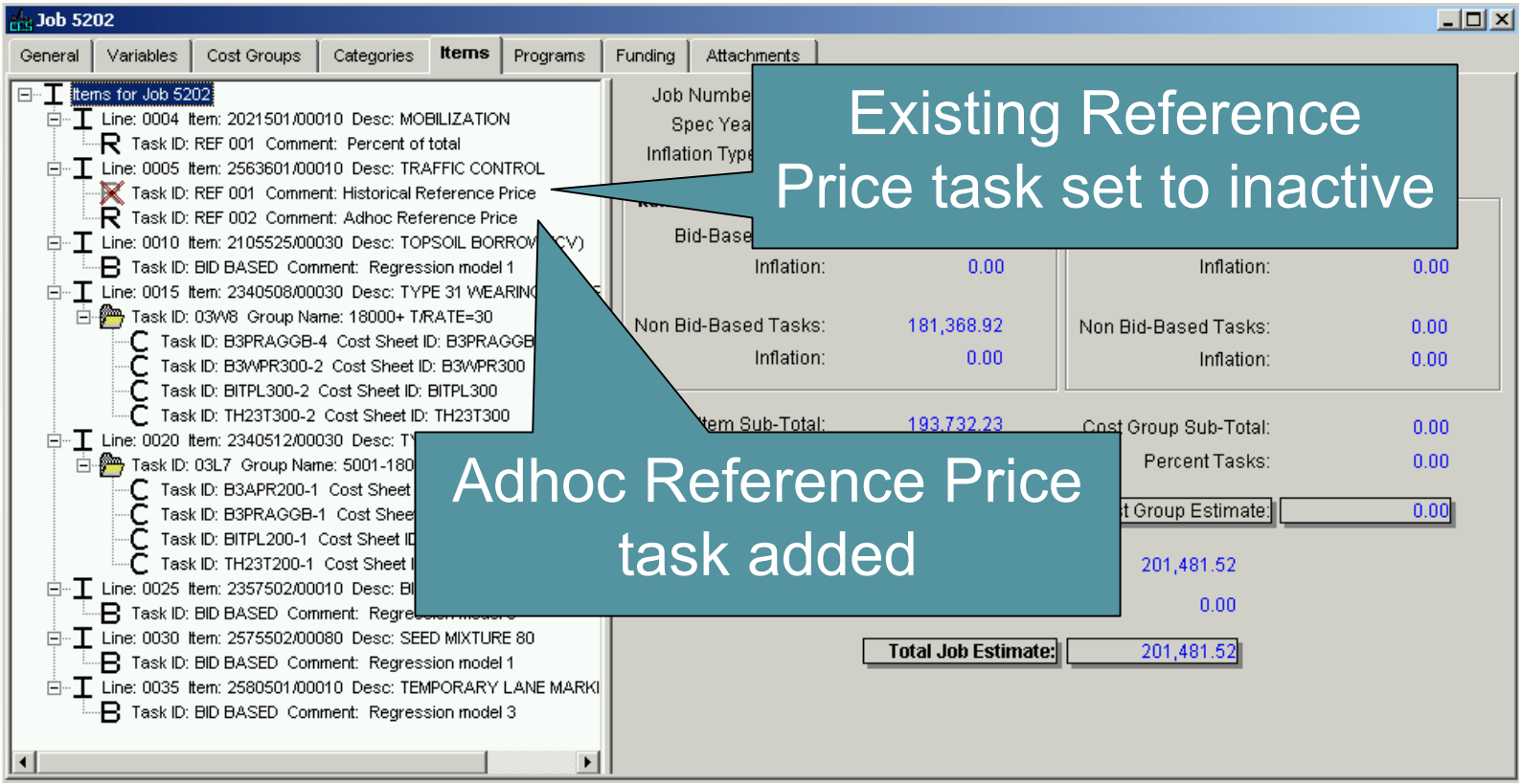
Related New Features in CES

- Ad Hoc price can now be entered from the grid view
  - Automatically creates a new Ad Hoc reference price task
  - Deactivates all task currently associated with the item
  - Formulas only on the tree view

Adhoc Price


Job 5202
General
Variables
Cost Groups
Categories
Items
Programs
Funding
Attachments
Line Number
Item
Description
Units
LS Units
Quantity
Unit Price
Extended Amount
Alt. Cc
0004 2021501/00010 MOBILIZATION LS 1.0000 8,409.04908 8,409.05
0005 2563601/00010 TRAFFIC CONTROL LS 1.0000 1600 18,094.00
0010 2105525/00030 TOPSOIL BORROW (CV) C Y 370.0000 16.31065 6,034.94
0015 2340508/00030 TYPE 31 WEARING COURSE MIXTURE TON 7,900.0000 11.39868 90,049.57
0020 2340512/00030 TYPE 31 LEVELING COURSE MIXTURE TON 7,900.0000 11.35688 89,719.35
0025 2357502/00010 BITUMINOUS MATERIAL FOR TACK COAT GAL 5,700.0000 0.78326 4,464.58
0030 2575502/00080 SEED MIXTURE 80 LB 100.0000 1.92319 192.32
0035 2580501/00010 TEMPORARY LANE MARKING RDST 530.00 3.15371 1,671.47
218,635.28
Enter new price of $1,600 directly from grid view

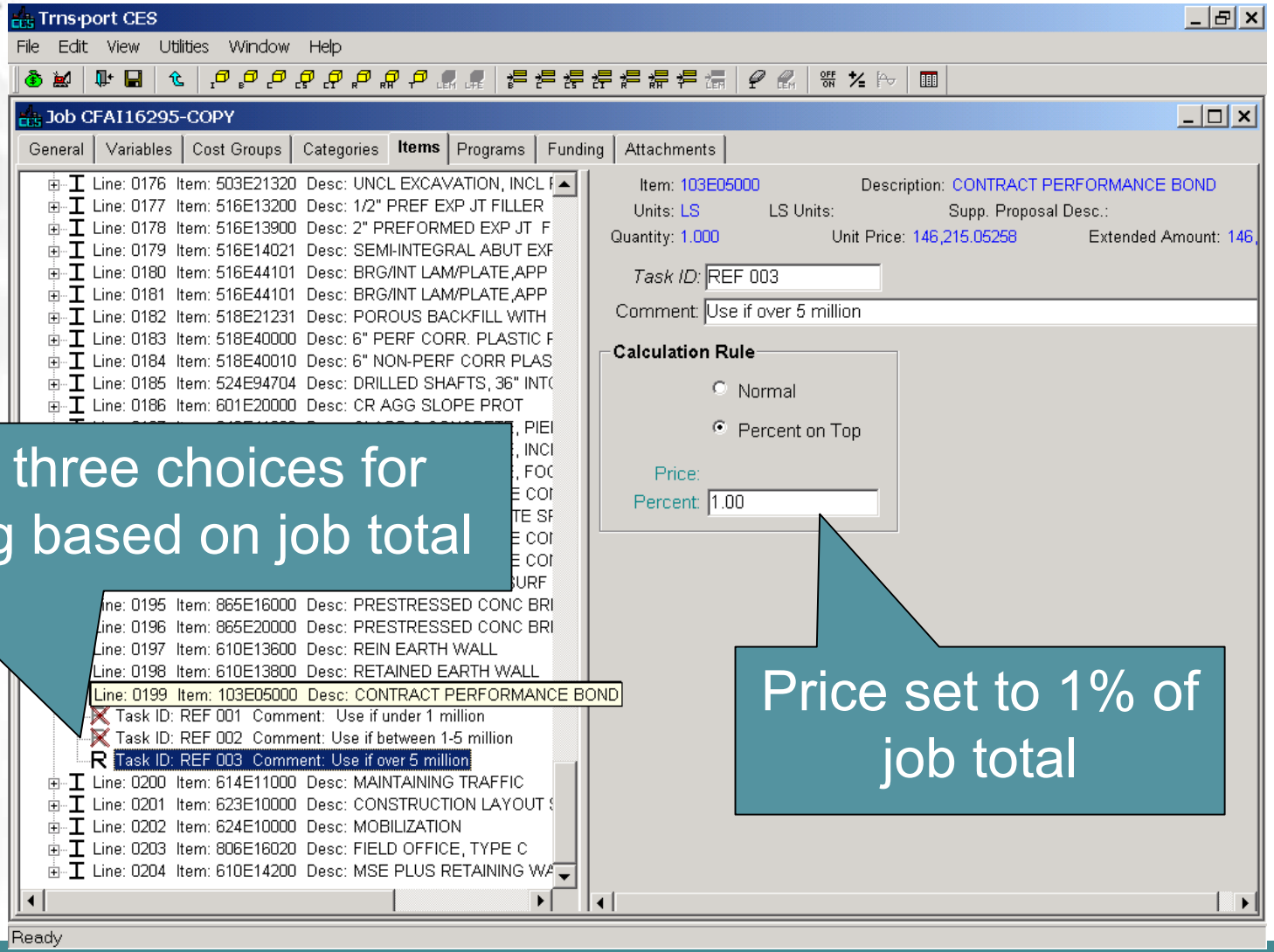
Adhoc Price


Job 5202
General
Variables
Cost Groups
Categories
Items
Programs
Funding
Attachments
Items for Job 5202
Line: 0004 Item: 2021501/00010 Desc: MOBILIZATION
Task ID: REF 001 Comment: Percent of total
Line: 0005 Item: 2563601/00010 Desc: TRAFFIC CONTROL
Task ID: REF 001 Comment: Historical Reference Price
Task ID: REF 002 Comment: Adhoc Reference Price
Line: 0010 Item: 2105525/00030 Desc: TOPSOIL BORROW
Task ID: BID BASED Comment: Regression model 1
Line: 0015 Item: 2340508/00030 Desc: TYPE 31 WEARING
Task ID: 03W8 Group Name: 18000+ T/RATE=30
Task ID: B3PRAGGB-4 Cost Sheet ID: B3PRAGGB
Task ID: B3WPR300-2 Cost Sheet ID: B3WPR300
Task ID: BITPL300-2 Cost Sheet ID: BITPL300
Task ID: TH23T300-2 Cost Sheet ID: TH23T300
Line: 0020 Item: 2340512/00030 Desc:
Task ID: 03L7 Group Name: 5001-180
Task ID: B3APR200-1 Cost Sheet
Task ID: B3PRAGGB-1 Cost Shee
Task ID: BITPL200-1 Cost Sheet ID
Task ID: TH23T200-1 Cost Sheet
Line: 0025 Item: 2357502/00010 Desc:
Task ID: BID BASED Comment:
Line: 0030 Item: 2575502/00080 Desc: SEED MIXTURE 80
Task ID: BID BASED Comment: Regression model 1
Line: 0035 Item: 2580501/00010 Desc: TEMPORARY LANE MARKI
Task ID: BID BASED Comment: Regression model 3
Job Numbe
Spec Yea
Inflation Type
Bid-Base
Inflation: 0.00
Non Bid-Based Tasks: 181,368.92
Inflation: 0.00
Inflation: 0.00
Non Bid-Based Tasks: 0.00
Inflation: 0.00
tem Sub-Total: 193,732.23
Cost Group Sub-Total: 0.00
Percent Tasks: 0.00
t Group Estimate: 0.00
201,481.52
0.00
Total Job Estimate: 201,481.52
Existing Reference Price task set to inactive
Adhoc Reference Price task added

Related New Features in CES

- Item price can be based on a percent of the total job cost
  - Percent can also be calculated using a formula
- New price breakdown panel included
  - Displays subtotals for primary components

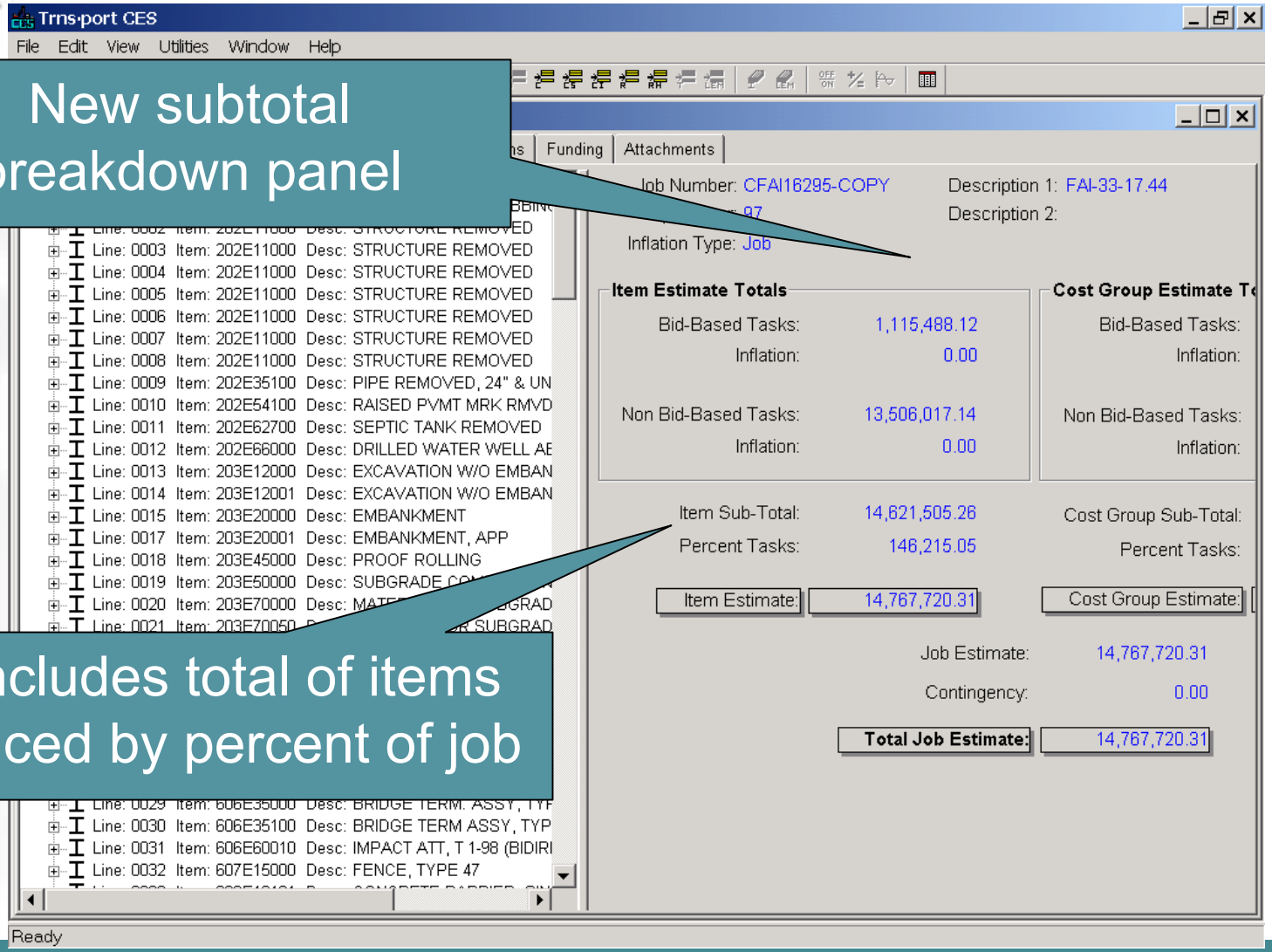
Item price based on percent



Has three choices for pricing based on job total

Price set to 1% of job total

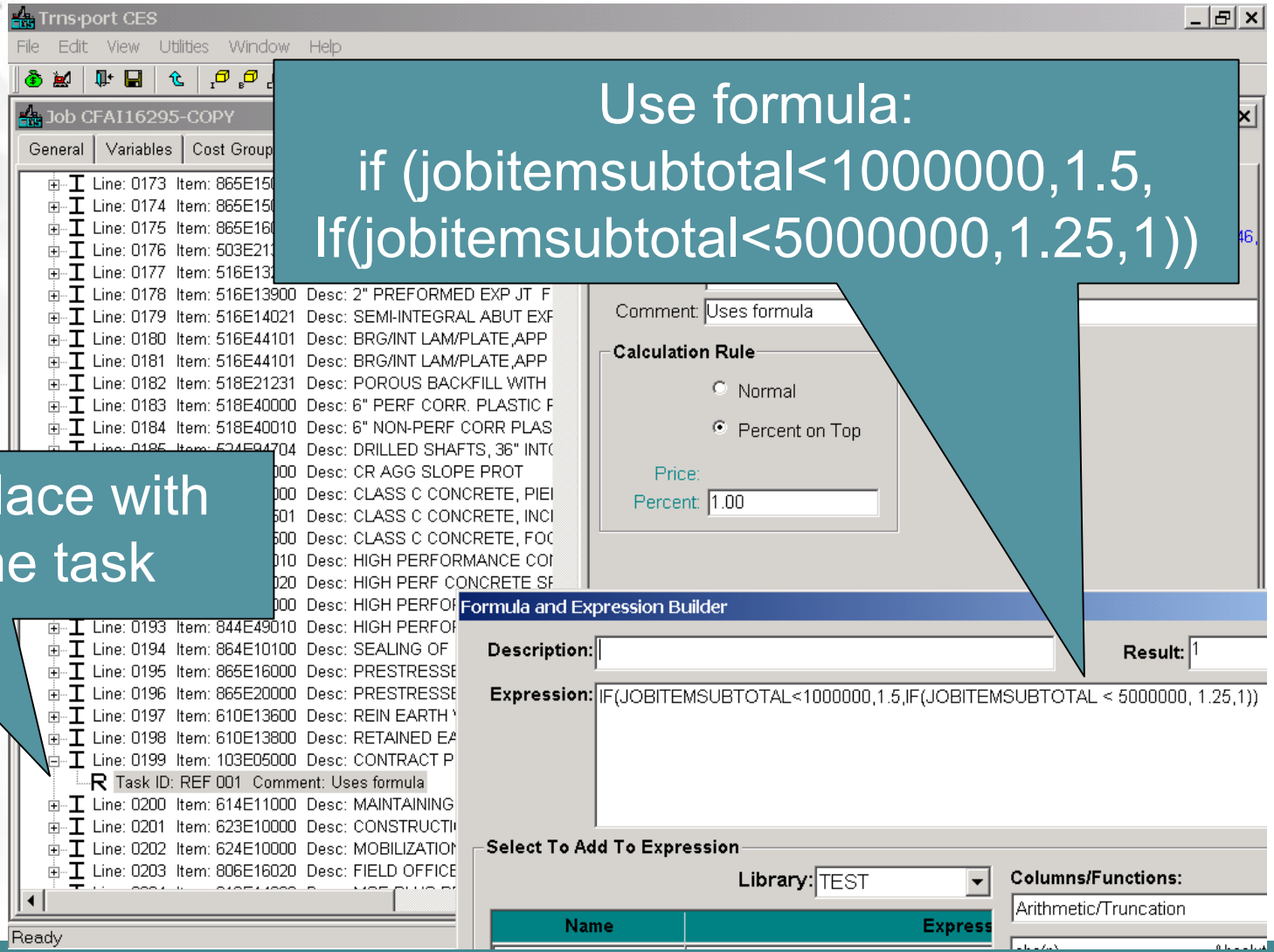
Item price based on percent



New subtotal breakdown panel

Includes total of items priced by percent of job

Using formula for percent

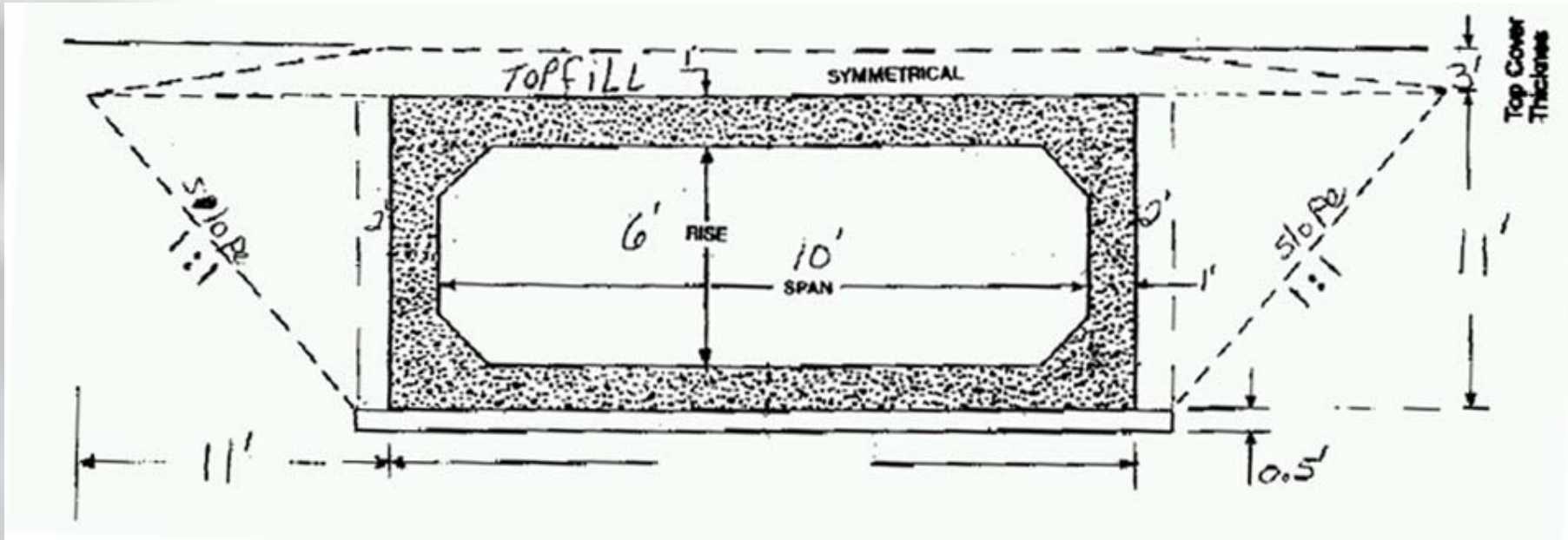


Using variables at the item level

- Look at commonly used items that have only a few attributes that vary between jobs
- Create variables for the Estimator to use for the values of the attributes
- Build a formula using the variables to perform the calculations

Box Culvert

- Attribute that changes between jobs
  - Height of Cover is used the calculation for excavation and backfill



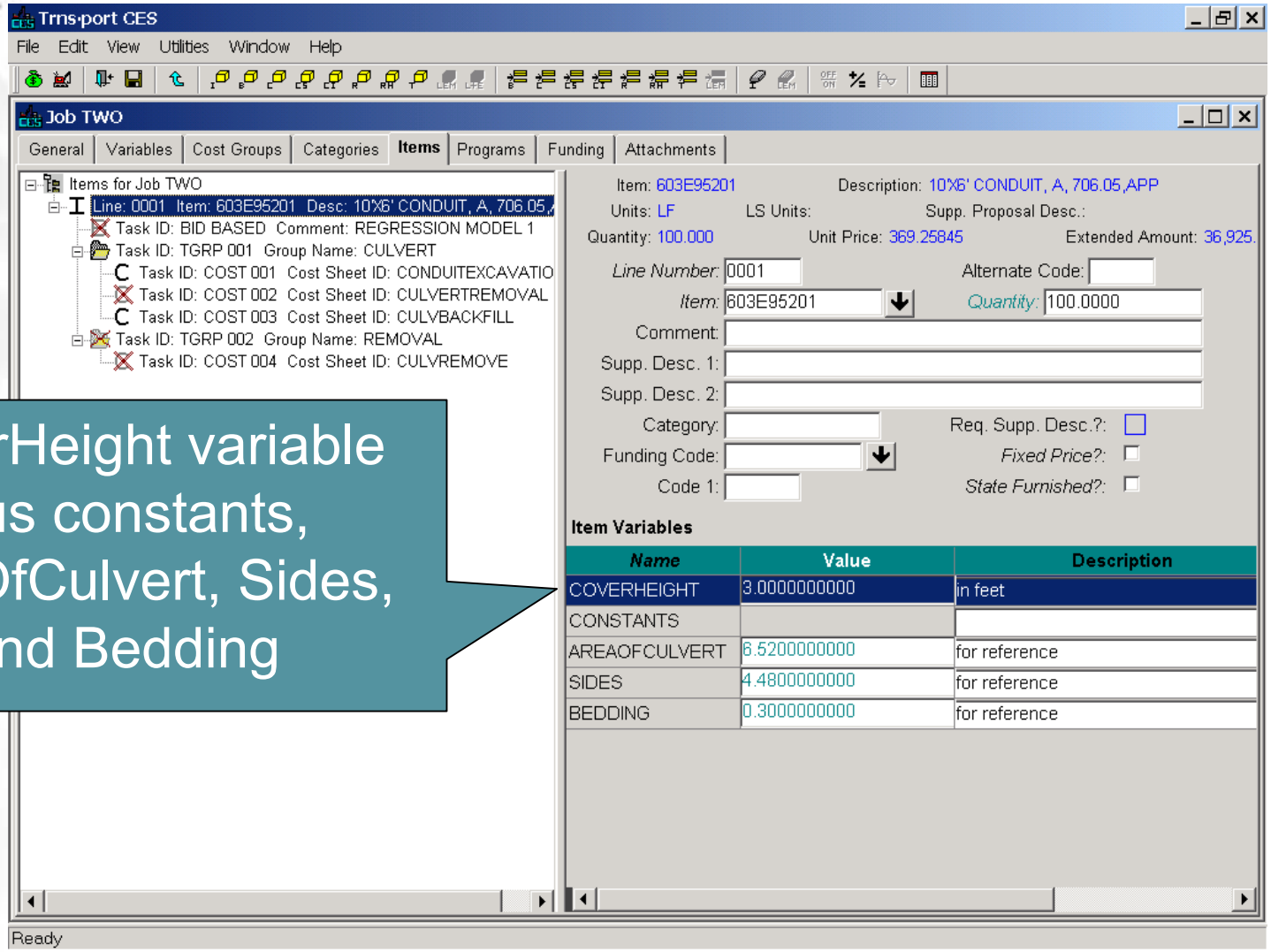
Sample spreadsheet

	Height of Cover: 3'			
10' x 6' Box Culvert				
	Width	Depth	Cu. Yd./	Cost /
	Lin. Ft.	Lin. Ft.	Lin. Ft.	Lin. Ft.
Excavation				
Area of Culvert	16.00	11.00	6.52	
Left Side	11.00	11.00	2.24	
Right Side	11.00	11.00	2.24	
Total:			11.30	165.00
Bedding	16.00	0.50	0.30	
Backfill				
Backfill	16.00	11.00	6.52	
Left Side	11.00	11.00	2.24	
Right Side	11.00	11.00	2.24	
Sub - Total			11.30	
Minus Culvert	12.00	8.00	3.56	
Total:			7.74	193.52

Spreadsheet formulas

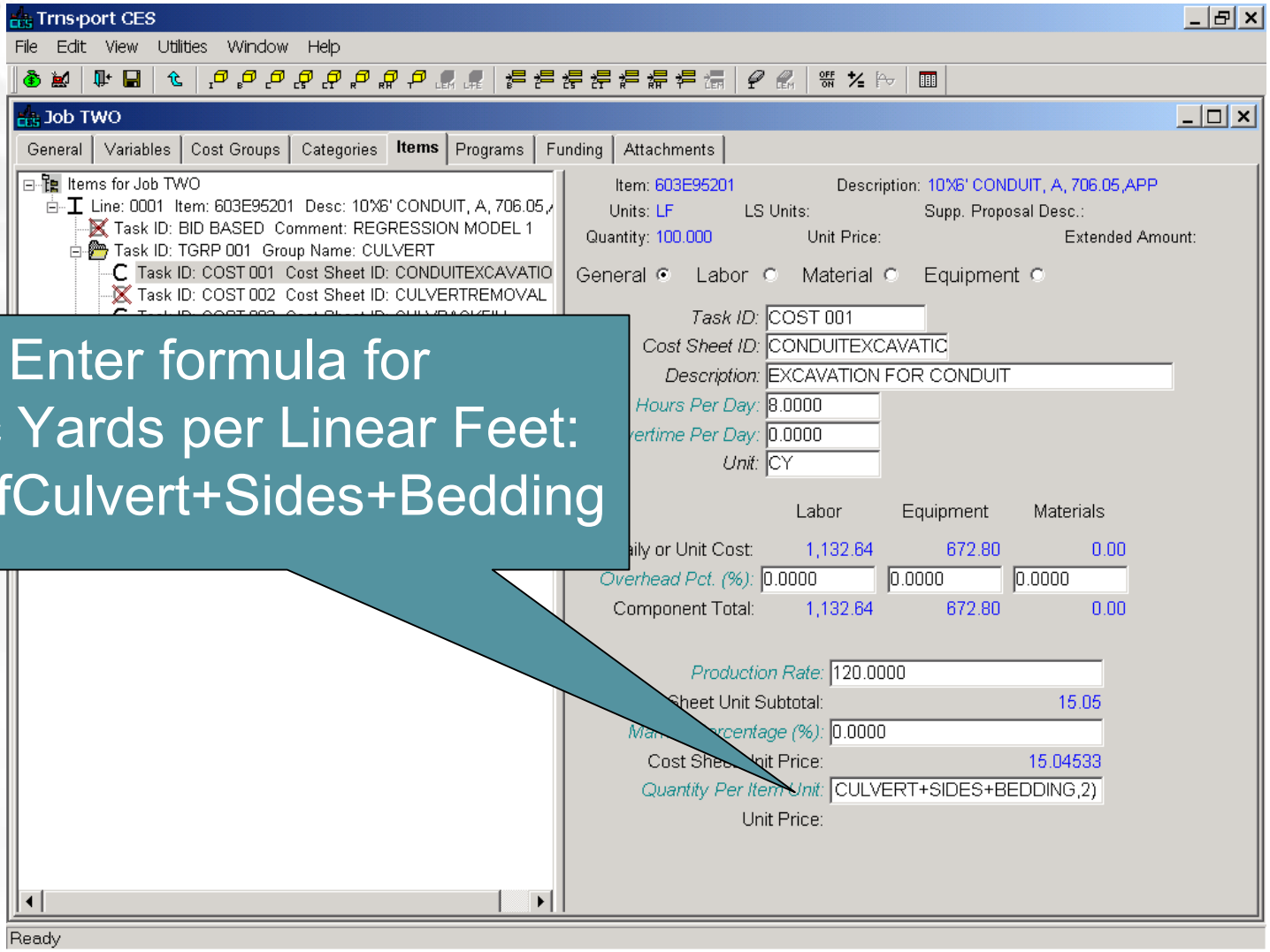
	Height of Cover: 3'			
10' x 6' Box Culver				
	Width	Depth	Cu. Yd./	Cost /
	Lin. Ft.	Lin. Ft.	Lin. Ft.	Lin. Ft.
Excavation				
Area of Culvert	=(10+1+1+2+2)	=(6+1+1+C1)	=(B6*C6)/27	
Left Side	=C7	=C6	=0.5*(C7*B7)/27	
Right Side	=C8	=C6	=0.5*(C8*B8)/27	
Total:			=SUM(D6:D8)+D11	=D9*15
Bedding	=(10+1+1+2+2)	0.5	=(C11*B11)/27	
Backfill				
Backfill	=(10+1+1+2+2)	=(6+1+1+C1)	=(B14*C14)/27	
Left Side	=C15	=C14	=0.5*(C15*B15)/27	
Right Side	=C16	=C14	=0.5*(C16*B16)/27	
Sub - Total			=SUM(D14:D16)	
Minus Culvert	=(10+1+1)	=(6+1+1)	=-C18*B18*27	
Total:			=SUM(D17+D18)	=D19*25

Create Variables



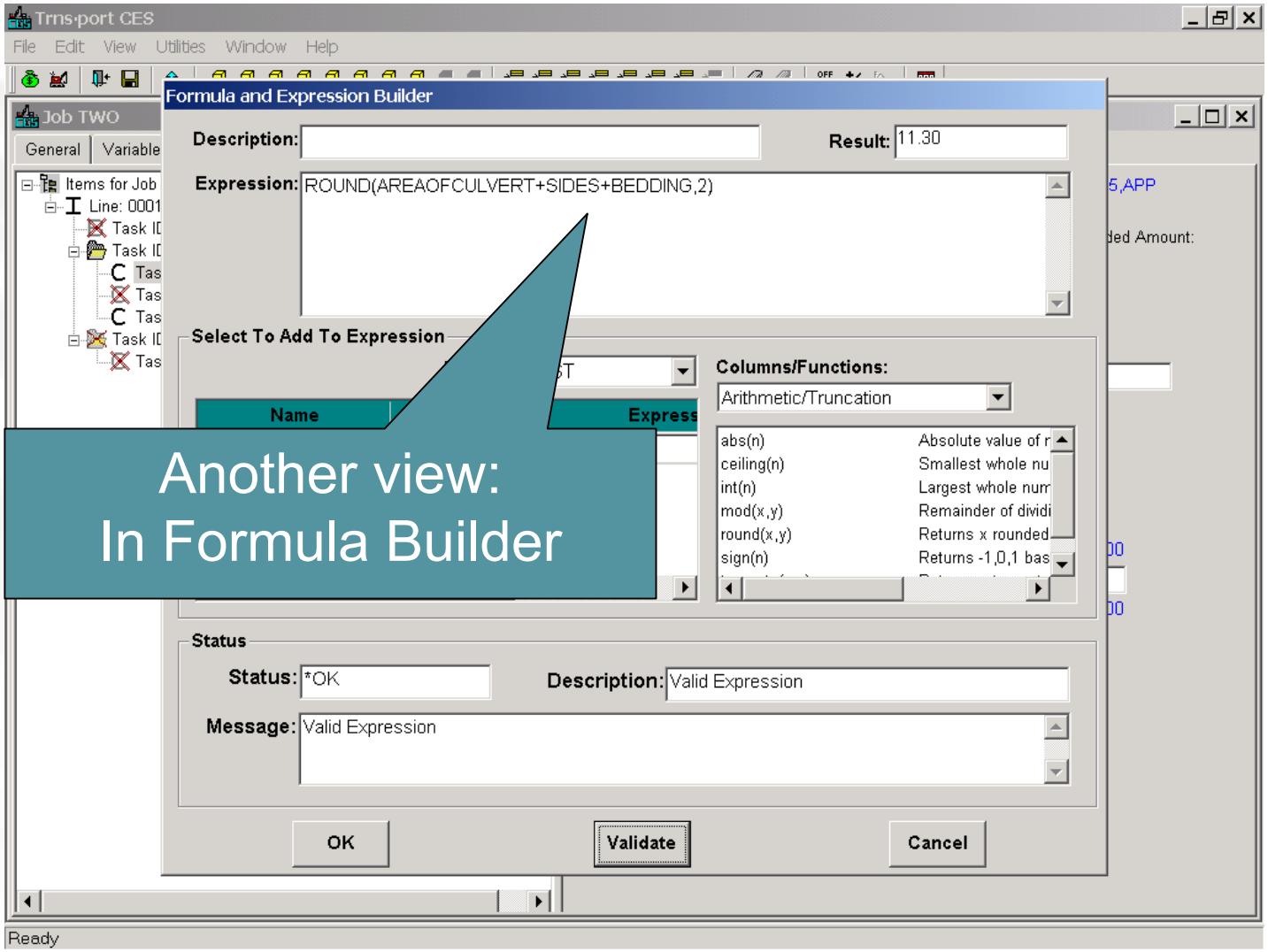
CoverHeight variable plus constants, AreaOfCulvert, Sides, and Bedding

Add formula to cost sheet



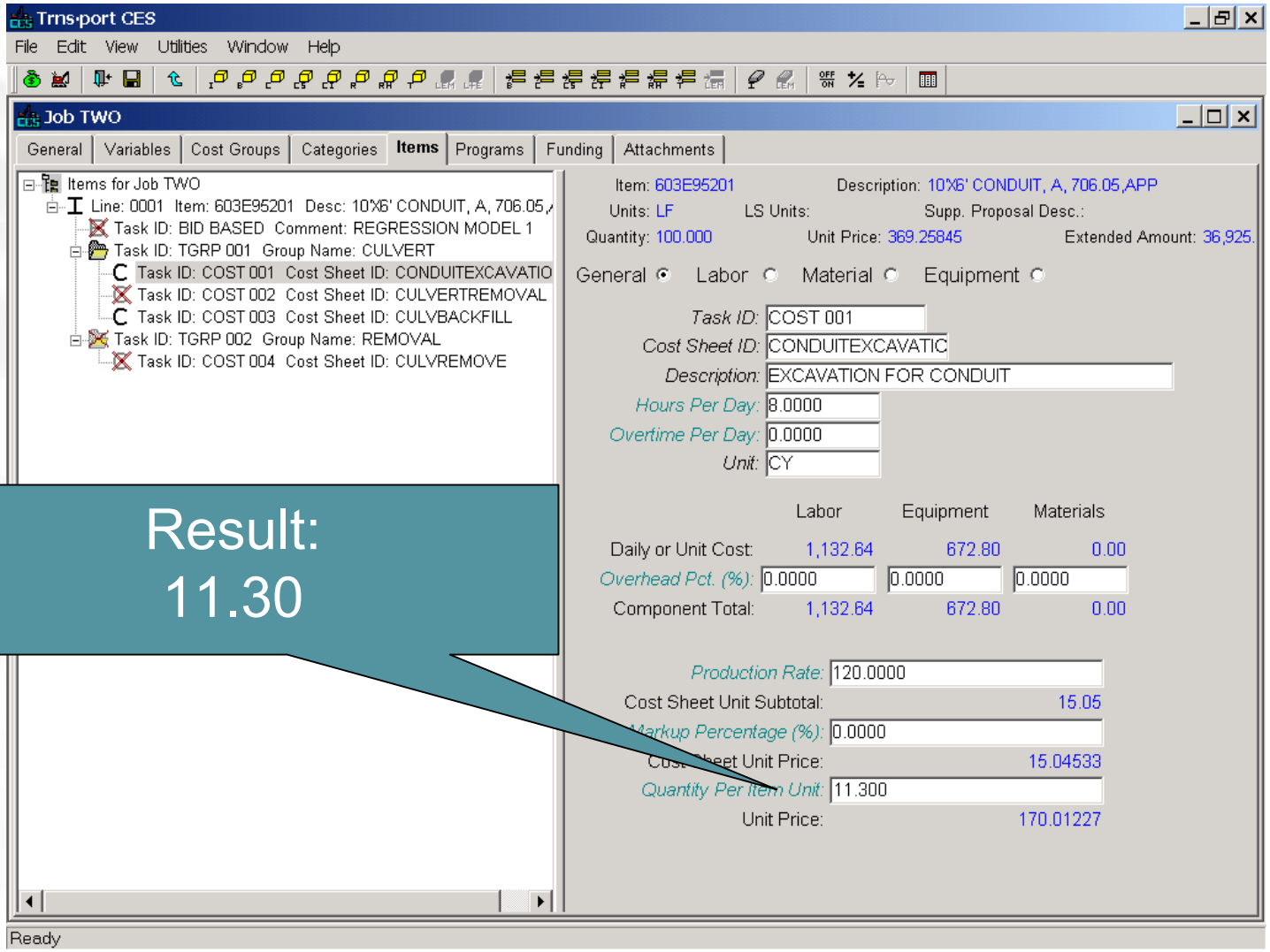
Enter formula for
Cubic Yards per Linear Feet:
AreaOfCulvert+Sides+Bedding

Add formula to cost sheet



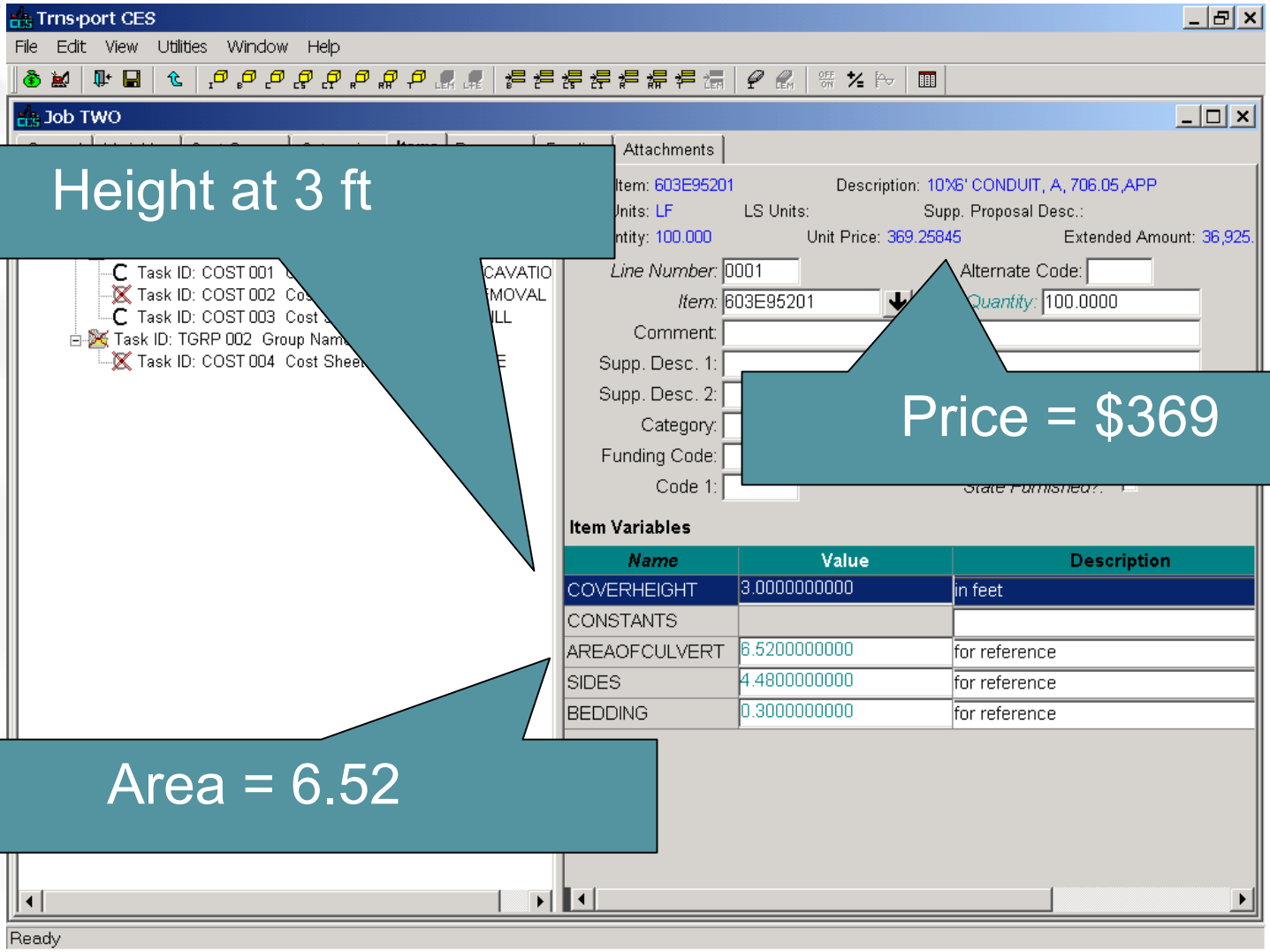
Another view:
In Formula Builder

Create Variables



Result:
11.30

Change cover height

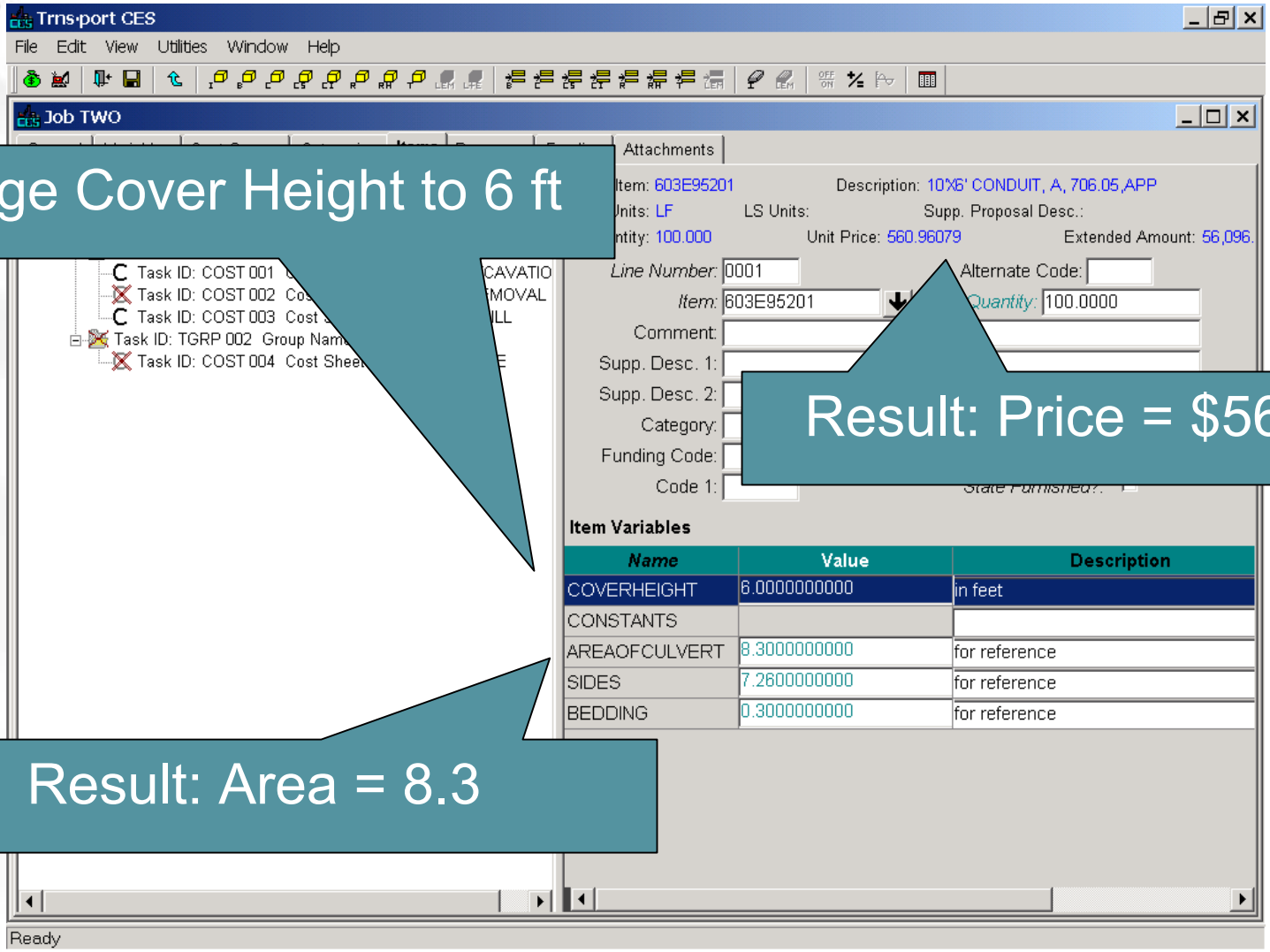


Height at 3 ft

Price = $369

Area = 6.52

Change cover height



Change Cover Height to 6 ft

Result: Price = $560

Result: Area = 8.3

Benefits of CES Formulas

- Assist with building the estimate
  - Allows take-offs previously done externally to be integrated within CES
  - Supports multiple levels of tasks
    - From basic number calculations to the creation of variables to store specific calculations
  - Preserves the methods the estimate was built from for later review and updates
- Save time and provide consistency across estimates

Using Formulas in CES®

QUESTIONS

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