

FOR 240 Homework – Assignment 6
Using VBA to Create a Cost Analysis Program for Timber Harvesting
 Introduction to Computing in Natural Resources

In this assignment, you are required to create a VBA program, Machine Rate Program, to perform cost analysis for timber harvesting machines. A "machine rate" is a calculated hourly charge for owning and operating a piece of capital equipment (USDA Forest Service 2006). Machine rates are commonly used in construction, agriculture, and forestry. The classical approach in forestry was defined by Matthews (1942) and more recently by Miyata (1980). Costs are averaged over the ownership life of the asset to estimate a constant hourly charge. The machine rate calculations are simple, easy to understand, do not require detailed cost history, and are constant over the life of the machine. They are particularly useful for generic comparisons of equipment and operations. The major components of machine costs are ownership cost (fixed), operating cost (variable), and labor cost. The followings are the equations used in cost analysis.

(1) Ownership cost = D + IIT

Depreciation (D)

Depreciation (D) is defined as a “decline in value of a machine due to wear, obsolescence, and weathering” (Warren 1977) or “loss in value associated with the production of a unit of output” (Stuart 1977). Three methods used to compute depreciation are: (1) straight line, (2) declining balance (3) sum of year’s digits. Straight line method (i.e. value of equipment depreciates at a content rate) will be used here to calculate depreciation using the formula:

$$D (\$/SMH) = \frac{P - S}{N \times SMH}$$

Where:

- D - Depreciation
- P - Initial investment cost of equipment
- S - Salvage value (amount equipment can be sold for at disposal time)
- N - Economic life in years
- SMH - Scheduled machine hours per year

Interest, Insurance, and taxes (IIT)

$$IIT(\$/SMH) = \frac{\left[\frac{(P - S) \times (N + 1)}{2N} + S \right] \times \% IIT}{SMH}$$

(2) Variable cost

Total variable cost (\$/PHM) = M&R+ F&L

$$M\&R (\$/ PHM) = \frac{(\%M \ \& \ R) \times D}{UT}$$

Where:

- %M&R - assumed value or from records

$$\text{UT- utilization rate, UT} = \frac{PMH}{SMH} \times 100\%$$

$$\text{F\&L (\$/PMH)} = \text{Consumption rate} \times \text{price}$$

(3) Labor cost

$$\text{Labor cost (\$/SMH)} = \text{wage} \times (1.0 + \text{fringe benefit rate})$$

(4) Total hourly cost

$$\text{Total cost (\$/ PMH)} = \text{Fixed cost} + \text{variable cost} + \text{labor cost}$$

Machine rate program with VBA

You can follow the instructions below to create a machine rate program using VBA within Microsoft Excel. Figure 1 is the design and running interface.

Design Interface

Open a new workbook and a worksheet (e.g. sheet 1), create an interface same as Figure 6.6. To add the two command buttons, you need to click “Developer” in the ribbon -> “Insert” in the controls group box->command button from ActiveX Controls. Move the cursor toward to sheet 1 cell E24, click and hold the left button of the mouse and stretch the command button to the desired size.

Right click the command button, and select “properties” from the drop-down menu. You can change the name of the button to “cmdok” and caption to “OK”. Similarly, you can create another command button with name “cmdreset” and caption “Reset”.

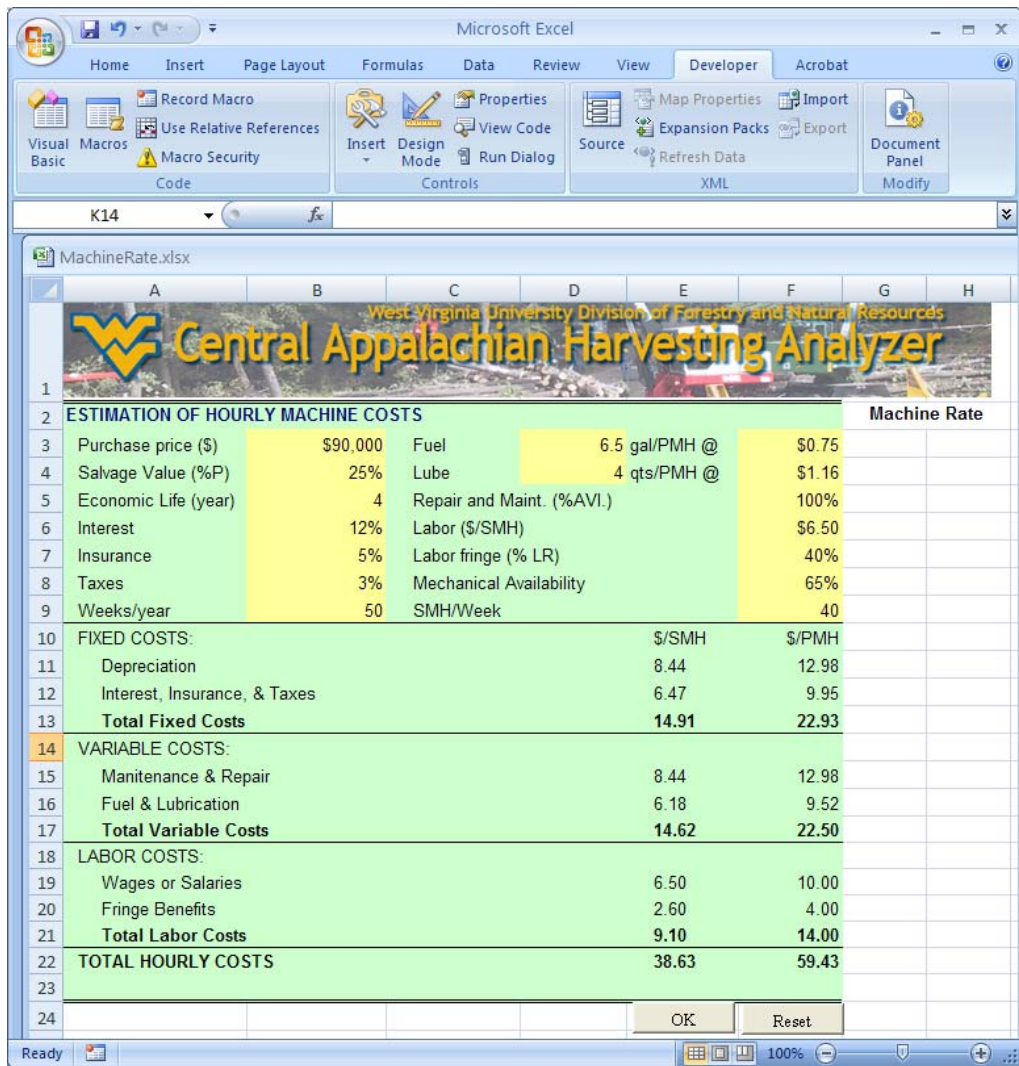


Figure 1. Machine rate program designed by VBA.

Write code

Once finishing the interface design, you can add some code behind the command buttons. Right click the command “OK” and select “View Code” from the drop-down menu. Your cursor will be located in following section:

```
Private Sub cmdok_Click()
End
```

The two code lines are automatically generated for the command “OK” by Visual Basic Application. To trigger this event, you just need to click on the “OK” button in sheet 1. For another command “Reset”, you can carry out the similar procedures. You will see:

```
Private Sub cmdReset_Click()
```

End

Now, let's prepare the code for the machine rate program. In the code window:

Option Explicit

```
Private Sub cmdok_Click()
```

```
Range("E11").Value = (Range("B3").Value - Range("B3").Value * Range("B4").Value) /  
(Range("B5").Value * Range("B9").Value * Range("F9").Value)
```

```
Range("E12").Value = (((Range("B3").Value - Range("B3").Value * Range("B4").Value) *  
(Range("B5").Value + 1) / (2 * Range("B5").Value) + Range("B3").Value * Range("B4").Value)  
* (Range("B6").Value + Range("B7").Value + Range("B8").Value) / (Range("B9").Value *  
Range("F9").Value))
```

```
Range("E13").Value = Range("E11").Value + Range("E12").Value
```

```
Range("F11").Value = Range("E11").Value / Range("F8").Value
```

```
Range("F12").Value = Range("E12").Value / Range("F8").Value
```

```
Range("F13").Value = Range("F11").Value + Range("F12").Value
```

```
Range("F15").Value = Range("E11").Value * Range("F5").Value / Range("F8").Value
```

```
Range("F16").Value = Range("D3").Value * Range("F3").Value + Range("D4").Value *  
Range("F4").Value
```

```
Range("F17").Value = Range("F15").Value + Range("F16").Value
```

```
Range("E15").Value = Range("F15").Value * Range("F8").Value
```

```
Range("E16").Value = Range("F16").Value * Range("F8").Value
```

```
Range("E17").Value = Range("E15").Value + Range("E16").Value
```

```
Range("E19").Value = Range("F6").Value
```

```
Range("E20").Value = Range("F6").Value * Range("F7").Value
```

```
Range("E21").Value = Range("E19").Value + Range("E20").Value
```

```
Range("E22").Value = Range("E13").Value + Range("E17").Value + Range("E21").Value
```

```
Range("F19").Value = Range("E19").Value / Range("F8").Value
```

```
Range("F20").Value = Range("E20").Value / Range("F8").Value
```

```
Range("F21").Value = Range("F19").Value + Range("F20").Value
```

```
Range("F22").Value = Range("F13").Value + Range("F17").Value + Range("F21").Value
```

```
End Sub
```

```
Private Sub cmdReset_Click()
```

```
    Range("B3").Value = 90000
```

```
    Range("B4").Value = 0.25
```

```
    Range("B5").Value = 4
```

```
    Range("B6").Value = 0.12
```

```
    Range("B7").Value = 0.05
```

```
Range("B8").Value = 0.03  
Range("B9").Value = 50
```

```
Range("D3").Value = 6.5  
Range("D4").Value = 4  
Range("F3").Value = 0.75  
Range("F4").Value = 1.16  
Range("F5").Value = 1  
Range("F6").Value = 6.5  
Range("F7").Value = 0.4  
Range("F8").Value = 0.65  
Range("F9").Value = 40
```

```
Range("E11", "F13").Value = 0  
Range("E15", "F17").Value = 0  
Range("E19", "F22").Value = 0
```

```
End Sub
```

After coding the two buttons, you can save your program. Click “Yes” when you see a message box. Now, go back to excel, input any parameters in excel and then click “OK” to run the program.