

EARTHWORK BALANCE SHEET  
**EARTHWORK BALANCE SHEET**

NCDOT ROADWAY DESIGN UNIT  
NOVEMBER 2009  
OAK THAMMAVONG

## **EXCEL EARTHWORK BALANCE SHEET GUIDELINES**

1. Columns in red are locked.
2. Rows in red are locked.
3. Line items not pertinent to your project may be deleted (content only).
4. Do not add or delete rows to the spreadsheet.
5. Do not add or delete columns to the spreadsheet.
6. Worksheet maybe modified when the worksheet is unprotected and all formulas cleared.
7. This balance sheet assumes all undercut material is unusable and consider them to be unsuitable waste.
8. For complex earthwork computations involving rock, rock swell, and percent usable undercut material, see Plan Checking first.
9. Do not change the order of the contingency line items. See #3 for more details.
10. Do not write anything in the diagonal lines separator rows.

## **SPREADSHEET FEATURES**

- Balance Sheet Help is available as a pull-down menu item.
- The location of the Earthwork\_BalanceSheet.CHM help file is “C:\NCDOT\_V8\_WORKSPACE\ROADWAY\_STDS\Standards\help”.
- Counties are selectable as a pull-down option.
- Shrinkage Factor is automatically entered according to the county selected. Custom SF can be entered in the table to the right of the spreadsheet.
- As part of the help item, a diagram of the North Carolina Shrinkage Factors and their respective counties are linked for quick reference.
- At bottom of the spreadsheet is an area dedicated to check if the earthwork is balanced.
- Three types of earthwork balance sheets are made available. The regular “Balance Sheet” should be used in most cases. If your project has lots of earthwork runs, more than what can be captured with the regular “Balance Sheet”, then the “Subtotals” or “2 Subtotals” and the “Balance Sheet From Sheet Totals” sheets can be used instead. Note the “Subtotals” and “2 Subtotals” sheets can be duplicated into how many necessary sheets needed to complete the project.

## **DESIGN CONSIDERATIONS**

### **“Material for Shoulder Construction” or “Shoulder Borrow”**

The amount of earth material needed to build the graded shoulders can be computed by taking an area in the cross section and multiplying it by the length of the project. All typical graded shoulder sections should be computed, including the mainline and -Y- line. Trench sections are not required to be computed.

If it is a borrow project, then include this item as “Material for Shoulder Construction” and it should be computed as a contingency item before the Project Total. If it is a waste project, then include this item as “Shoulder Borrow” at the bottom of the sheet (after the “Say” row). Do not include “Material for Shoulder Construction” and “Shoulder Borrow” or vice versa in the same balance sheet.

**Est. 5% to Replace Top Soil on Borrow Pits**

Only needed for borrow projects. This quantity is automatically computed between the Project Total and the Grand Total.

**“Rock Waste to Replace Borrow” and “Adjust for Rock Waste”**

Used up all of the rock waste first before the suitable earth waste is used (Waste in Lieu of Borrow). The volume of rock used to replace borrow should have the shrinkage factor deducted because the shrinkage factor was applied to the material within the summary points, but hard rock is not subject to the shrinkage factor.

**Undercut Line Items**

- Undercut quantity computed within the summary points.
- If undercut is computed within the summary points, then include a line item “Additional Undercut” before the Project Total.
- If undercut is **NOT** computed within the summary points, then include a line item “Per Geotech Recommendation, Estimated X,XXX Cubic Yards of Undercut to be Used in the Discretion of the Resident Engineer” after the Grand Total.

**Back Fill for Undercut**

Unless stated otherwise, backfill the undercut excavation area with suitable earth material. There will be times when select material will be recommended by Geotech as backfill material. In this case, you will have to do a separate earthwork run. First time is your regular cuts and fills. The second time is just the undercut section. Backfill it with the select material recommended by Geotech.

**X-1A Sheet**

NOTE: EMBANKMENT COLUMN INCLUDES BACKFILL FOR UNDERCUT  
Earthwork input is designed to backfill the undercut excavation with suitable earth material. Show a column for “Undercut” along with “Uncl. Exc.” and “Embt.” on the X-1A sheet when applicable.

**Unsuitable Unclassified Excavation**

Geotech will identify the areas of unsuitable unclassified excavation with hatch lines in their cross sections. Do not show unsuitable unclassified excavation hatch lines in Roadway cross sections. If the cross section has undercut, confirm with Geotech if the material above is suitable or unsuitable. By default, the earthwork input file processes the material above undercut as “Common Exc – Undercut” (Unsuitable Material). Material not directly above undercut is processed as “Common Exc – Suitable).

XSECTION

Earthwork

tolerance = 0.01

xs dgn = test\_rdy\_xsc\_rock.dgn

Proposed Finish Grade

soil type = suitable  
fill mult factor = 1.00  
type = line, line\_string  
lvname = Prop XS Finish Grade Earthwork  
lvname = Prop XS Subgrade Earthwork

Existing Ground Line

soil type = suitable  
type = line, line\_string  
lvname = Exist XS Ground Line

Existing Suitable Material

soil type = Rock  
fill mult factor = 1.00  
type = line, line\_string  
lvname = Prop XS Earthwork Geopak Lower Limit Line

Existing Suitable Material

soil type = suitable  
fill mult factor = 1.00  
type = line, line\_string  
lvname = Prop XS Earthwork Geopak Top of Rock

Excavation Limits

type = line  
lvname = Prop XS Exc Vertical Line 1  
lvname = Prop XS Exc Vertical Line 2

Calculate only Between Excavation Limits

Write Earthwork Shapes

plot param  
lvname = Prop XS Earthwork Shape  
Stratify Shape Color

process earthwork for baseline = L

job number = rdy  
beginning station = 10+00.00  
ending station = 16+50.00

# Rock Input

=====

| GRAND    | SUMMARY       | TOTALS | Unadjusted | Adjusted  | Mult   |
|----------|---------------|--------|------------|-----------|--------|
|          | Material Name |        | Volumes    | Volumes   | Factor |
|          |               |        | (cu. yd.)  | (cu. yd.) |        |
| -----    |               |        |            |           |        |
| SUITABLE | Common        | Exc    | 559        | 559       | 1.00   |
|          | Subgrade      | Exc    | 0          | 0         | 1.00   |
|          | Subsoil       | Exc    | 0          | 0         | 1.00   |
|          | Fill          |        | 2883       | 2883      | 1.00   |
| ROCK     | Common        | Exc    | 286        | 286       | 1.00   |
|          | Subgrade      | Exc    | 0          | 0         | 1.00   |
|          | Subsoil       | Exc    | 0          | 0         | 1.00   |
|          | Fill          |        | 0          | 0         | 1.00   |

Suitable Unclas. Exc.

Rock Exc

Total Embank.

XSECTION

Earthwork

tolerance = 0.010000

xs dgn = U3810\_rdy\_xsc\_L.dgn

```

Proposed Finish Grade
  soil type = suitable
  fill mult factor = 1.25
  type = line, line_string
  lvname = Prop XS Finish Grade Earthwork
  lvname = Prop XS Subgrade Earthwork

```

# Undercut Left

```

Existing Ground Line
  soil type = suitable
  type = line, line_string
  lvname = Exist XS Ground Line

```

```

Existing Unsuitable Material
  soil type = undercut
  fill mult factor = 1.25
  type = line, line_string
  lvname = Prop XS Undercut Exc

```

```

Excavation Limits
  type = line
  lvname = Prop XS Exc Vertical Line 1, Prop XS Exc Vertical Line 2

```

Calculate Only Between Excavation Limits

```

Write Earthwork Shapes
  plot param
  lvname = Prop XS Earthwork Shape
  Stratify Shape Color

```

End Area Decimal Places = 0

```

Process Earthwork for Baseline = L
  job number = rdy
  beg sta = 10+47.31
  end sta = 40+00.00

```

| GRAND SUMMARY |  | TOTALS       |       | Unadjusted<br>volumes<br>(cu. yd.) | Adjusted<br>volumes<br>(cu. yd.) | Mult<br>Factor |
|---------------|--|--------------|-------|------------------------------------|----------------------------------|----------------|
| SUITABLE      |  | Common Exc   | 0     | 68                                 | 68                               | 1.00           |
|               |  | Subgrade Exc | 0     | 0                                  | 0                                | 1.00           |
|               |  | Subsoil Exc  | 0     | 0                                  | 0                                | 1.00           |
|               |  | Fill         | 10192 | 12738                              | 12738                            | 1.25           |
| UNDERCUT      |  | Common Exc   | 0     | 398                                | 398                              | 1.00           |
|               |  | Subgrade Exc | 0     | 0                                  | 0                                | 1.00           |
|               |  | Subsoil Exc  | 0     | 6399                               | 6399                             | 1.00           |
|               |  | Fill         | 0     | 0                                  | 0                                | 1.25           |

Suitable Common Exc.

Material excavated above undercut (unsuitable unclassified excavation).

Regular fill, including backfill for undercut

Undercut Amount

XSECTION

Earthwork

tolerance = 0.010000

xs dgn = U3810\_rdy\_xsc\_L.dgn

```

Proposed Finish Grade
  soil type = suitable
  fill mult factor = 1.25
    type = line, line_string
    lvname = Prop XS Finish Grade Earthwork
    lvname = Prop XS Subgrade Earthwork

```

**Undercut  
Right**

```

Existing Ground Line
  soil type = suitable
  type = line, line_string
  lvname = Exist XS Ground Line

```

```

Existing Unsuitable Material
  soil type = undercut
  fill mult factor = 1.25
    type = line, line_string
    lvname = Prop XS Undercut Exc

```

```

Excavation Limits
  type = line
  lvname = Prop XS Exc Vertical Line 2, Prop XS Exc Vertical Line 3

```

Calculate only Between Excavation Limits

```

Write Earthwork Shapes
  plot param
  lvname = Prop XS Earthwork Shape
  Stratify Shape Color

```

End Area Decimal Places = 0

```

Process Earthwork for Baseline = L
  job number = rdy
  beg sta = 10+47.31
  end sta = 40+00.00

```

=====

| G R A N D | S U M M A R Y<br>Material Name | T O T A L S | Unadjusted           | Adjusted             | Mult<br>Factor |
|-----------|--------------------------------|-------------|----------------------|----------------------|----------------|
|           |                                |             | Volumes<br>(cu. yd.) | Volumes<br>(cu. yd.) |                |
| -----     |                                |             |                      |                      |                |
|           | SUITABLE                       |             |                      |                      |                |
|           | Common EXC                     |             | 500                  | 500                  | 1.00           |
|           | Subgrade EXC                   |             | 0                    | 0                    | 1.00           |
|           | Subsoil EXC                    |             | 0                    | 0                    | 1.00           |
|           | Fill                           |             | 8418                 | 10521                | 1.25           |
|           | UNDERCUT                       |             |                      |                      |                |
|           | Common EXC                     |             | 246                  | 246                  | 1.00           |
|           | Subgrade EXC                   |             | 0                    | 0                    | 1.00           |
|           | Subsoil EXC                    |             | 5283                 | 5283                 | 1.00           |
|           | Fill                           |             | 0                    | 0                    | 1.25           |