Reclamation Bond Optimization Using 3d-Dig Plus

Jake Anderson - Maptek
Introduction
Overview

• Reclamation Bond
• Wyoming Guideline 12
• Bond Challenges
• Simulation Software Benefits
• Case Study (2D CAD vs. Two 3D-Dig Options)
Reclamation Bond

- Requirement for Annual Report
- Reduces Liability to State
- Becoming Increasingly Important
- Large Capital Expense for Operations
Appendix F

Calculations for Moving Material with a Caterpillar D11R Dozer

These costs are for dozing only. Material requiring drilling and blasting should have an additional $0.259/BCY added for D&B. If cast blasting will be used the D&B cost should be $0.400/BCY.

Material Movement by Dozing With D11R

1) Caterpillar D11R Dozer with U Blade
2) Operating Costs
3) Labor Costs
4) Supervisor Labor Costs
5) Supervisor Transportation
6) Total Hourly Costs

$457.68 per Hour 100% E-W
$44.97 per Hour WYDOT-WDD
$6.25 per Hour 1/8 of WYDOR-WDD
$2.35 per Hour 1/8 of 100% E-W

$512.25 per Hour

TO USE TABLE: Locate your approximate grade by referencing "Grade" column. Determine cost per LCY by using the distance that best approximates your distance.

<table>
<thead>
<tr>
<th>Distance (Ft.)</th>
<th>Productivity (LCY/Hr.)</th>
<th>Operator</th>
<th>Material</th>
<th>Visibility</th>
<th>Efficiency</th>
<th>Grade (0%)</th>
<th>Adjusted Productivity (LCY/Hr.)</th>
<th>Costs ($) /LCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>4500</td>
<td>1.0</td>
<td>1.0</td>
<td>0.90</td>
<td>0.83</td>
<td>1.00</td>
<td>3374</td>
<td>$0.152</td>
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<tr>
<td>100</td>
<td>3000</td>
<td>1.0</td>
<td>1.0</td>
<td>0.90</td>
<td>0.83</td>
<td>1.00</td>
<td>2249</td>
<td>$0.228</td>
</tr>
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Reclamations Bond Challenges

• Designing from Contours
• Using Generic Uniform Grades
• Trying to Balance Design
• How to Best Utilize Bond Methods
• What Other Challenges Can You Think Of?
Bond Challenges: Designing from Contours

- Can Guarantee Final Slopes
- Traditional Design Method
- Can be Difficult to Balance
- Time Intensive
Bond Challenges: Using Generic Grades for all Slopes

- Ensures Compliance is Met
- Makes Reconciliation Easier
- "Quick" Way of Creating Bond Surface
- Hides Subtle Details for Optimization
Bond Challenges: Difficulties in Balancing Materials

- Maintaining Cut/Fill balance Through Reserves/Volume Calcs
- Spend Extra Time Justifying Balance
- Often Taking Extra Cut to Make Balance
Bond Challenges: How to Best Utilize Bond Methods

• Picking Practical Equipment/Excavation Techniques
• Analyzing Cost Benefits of Certain Techniques
Benefits of Using a Simulation Software (3d-dig)

- Material is Transported to Design or Depletion
- Balance Checks are Simple (Excess Fill Remains in Material Log)
- Shows How Material is Transported Realistically
- Creates Simulation Videos to Share with DEQ/Shareholders/Superiors
- Decreased Learning Curve
Case Example: 2D CAD vs. Reshape Tool vs. Dozer Simulation

- Generic Pit Design
- 11 degree slope
- Comparison is in LCY (1.1 Swell Factor)
- Area of Case Study
  - 11,000,000 ft²
  - ~ 250 acres
2D CAD Results

- Total Cut: 121,000 LCY
- Average Distance: 490 ft
- WYO DEQ Guideline 12 Cost (D11R Dozer) = $91,000
- Time: 70 minutes
Reshaping Tool Results

- Total Cut: 125,000 LCY
- Average Distance: 294 ft
- WYO DEQ Guideline 12 Cost (D11R Dozer) = $56,700
- Time: 5 minutes
Dozer Simulation Results

- Total Cut: 99,000 LCY
- Average Distance: 295 ft
- WYO DEQ Guideline 12 Cost (D11R Dozer) = $45,000
- Time: 15 minutes (Including Reshaping Tool)
2D CAD vs. Reshaping Tool vs. Dozer Sim Volume Results

Results

• Simulation:
  – 22,000 LCY (19%) less material moved
  – $46,000 total savings (50%)

• Reasons Why
  – Localizing Pushes to Shorter Lengths
  – Each Zone Builds into Each Other
  – Replicates “Real World” Scenarios
Conclusion

• Reclamation Bonds are an Important Task

• Optimizing Bond Designs Increase Efficiency and Present a Cost Benefit

• Using Simulation Software allows a 3D Solution for a 3D Problem
Thank you

www.maptek.com

Jake.Anderson@Maptek.com