STOCKPILE MEASUREMENT PILOT PROJECT

Project results & expected benefits
<table>
<thead>
<tr>
<th></th>
<th>Table of Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Project Scope</td>
</tr>
<tr>
<td>2</td>
<td>Application operation description</td>
</tr>
<tr>
<td>3</td>
<td>What we learned</td>
</tr>
<tr>
<td>4</td>
<td>Pilot project measurement results</td>
</tr>
<tr>
<td>5</td>
<td>Material cost impacts on job cost reporting</td>
</tr>
<tr>
<td>6</td>
<td>Expected benefits of stockpile measurement app</td>
</tr>
<tr>
<td>7</td>
<td>Stockpile account report examples</td>
</tr>
<tr>
<td>8</td>
<td>First functions to implement</td>
</tr>
<tr>
<td>9</td>
<td>Next steps</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>9-11</td>
</tr>
<tr>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>9</td>
<td>13</td>
</tr>
</tbody>
</table>
Project scope

• Conduct measurements/adjustments to attain results within ± 2% of LiDAR on small stockpiles.

• Conduct 2 month operations pilot in Beaumont & Lubbock districts to learn advantages and disadvantages of app in daily operations.
Application operation description

Required equipment:

• iPhone 5 or higher w/Stockpile Reports app
• 2 solid orange traffic cones
• 25’ length of rope
• Wireless internet access aids convenience

Measurement

• Set cones in front of pile, known distance apart
• Video pile circumference
  • Keep top and bottom of pile in viewfinder
  • Start at one traffic cone, slightly overlap w/starting point
• Synchronize video data w/Stockpile Reports
What we learned

- Existing stockpile management methods are not Best in Class
- Maintenance supervisors want to improve stockpile management
- Existing, accurate measurement tools are expensive and impractical
- Cost allocations to some maintenance performance measures are incorrect
- All stockpiles can be managed with the Stockpile Reports (SPR) app
- Some stockpiles currently not measurable with the SPR app
- Pilot participants had good experience with the SPR app
## Pilot project measurement results

<table>
<thead>
<tr>
<th>Phase I Measures (CY)</th>
<th>Total LiDAR Measure</th>
<th>ABV GPS Variance from LiDAR</th>
<th>ABV iPhone Variance from LiDAR</th>
<th>ABV Employee Variance from LiDAR</th>
<th>ABV MSMS Variance from LiDAR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2,521.90</td>
<td>43.90</td>
<td>36.70</td>
<td>713.80</td>
<td>618.10</td>
</tr>
<tr>
<td>% Variance from LiDAR</td>
<td></td>
<td>1.74%</td>
<td>1.46%</td>
<td>28.30%</td>
<td>24.51%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phase II Employee Measures (CY)</th>
<th>Total iPhone Measure</th>
<th>ABV Employee Variance from iPhone</th>
<th>ABV MSMS Variance from iPhone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>25,558.00</td>
</tr>
<tr>
<td>Phase II MSMS Measures (CY)</td>
<td>-</td>
<td>-</td>
<td>15,047.74</td>
</tr>
<tr>
<td>% Variance from iPhone</td>
<td></td>
<td>32.18%</td>
<td>54.11%</td>
</tr>
</tbody>
</table>
Material cost impacts on job cost reporting

FY13 Remove & Replace function (110) in-house & contract cost per CY

- In-house High Price
- In-house Low Price
- Contract Price

March 24, 2015

WASHTO Materials Subcommittee
Expected benefits of stockpile measurement app

Improve stockpile management methods with new tools that:

• Require no additional equipment investment

• Eliminate climbing on stockpiles

• Provide same accuracy as GPS at greatly reduced cost

• Provide management visibility of stockpiled inventory

• Provide more accurate performance measurement data
Stockpile summary report

Hierarchy:
Texas DOT

Site(s):
FM-570 (23304-Eastland Co)
East yard @ US90 (15305-Hondo)
FM 2676 @ RM460-461 (15305-Hondo)
FM-8 (23304-Eastland Co)

Dates:
Month to Date
Quarter to Date
Year to Date
Custom Date range
All Available

Date: 03/16/15 11:37 AM
Site Name: 1, located at: 1710 Hwy. 21, San Marcos, TX.
Site Code: 14206-0
Item Code: 74677531002
Volume CY: 392
Weight TN: 549
Full Report
Reconstructed Video
Stockpile detail report

1, located at 1710 Hwy. 21, San Marcos, TX. (14306-0) - ROCK ASPHALT; LIMESTONE, CM/CL; i#330, TYPE 1, GD AA, (74577531002)

03/16/2015 11:37:33 AM

Cubic Yards: 392
Tonnage Conversion: 1.400
Tonnage: 549
Collected By: James Petty
Collected Method: iPhone
Collection Time: 02m 36s

© 2015 StockpileReports.com
First functions to implement

Materials we keep in inventory

• Material receipts – to establish known beginning inventory

• Annual inventory – to establish known ending inventory

• Verify inventory before starting a job

• Check inventory before/after job – ensure correct quantity charged to job
Next steps

Develop the following business cases for stockpile measurement app:

- Measuring debris piles for contract hauling volumes
- Measuring materials on hand volumes
- Measuring stockpile volumes for change order negotiations
- Measuring stockpile volumes for monthly pay estimates
- Measuring monthly supplier inventories
- Measuring vendor stockpile volumes to meet testing requirements