Inventorviny Geohazards of Ohio’s First Public-Private Partnership Roadway Project

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Overview

I. Introduction
II. Site Identification
III. Site Tiers
IV. Field Data Collection
V. Database Population
VI. Southern Ohio Veterans Memorial Highway
VII. Project Specifications
VIII. High-angle rope access and UAV Services
I. Introduction

- Manual last updated December 2016
- Why are Inventories important?
  - Rockfall is prevalent in Ohio, especially in unglaciated areas
  - Rockfalls can cause lost of life, highway closures, and property damage
- Key Terms
  - Rockfall: The down-slope gravitational movement of material that is comprised of at least 51% rock.
  - Rock Slope: Any slope, either natural or man-made, that has in-placed bedrock exposed at the surface.
  - Rockfall Event: A distinct period of time during which a single or multiple rock(s) and associated debris dislodges from a rock slope.
II. Site Identification

Site Criteria:

- Natural or manmade slope with exposed bedrock, i.e. “rockslope”
- At least 10 feet tall (normally)
- Not longer than 1 mile
- Not crossing county lines
III. Site Tiers

Determined by:
- Potential of rockfall occurrence
- Potential of rockfall reaching travelled lanes

Tiers:
- Tier 1 – low to moderate, low to moderate
- Tier 2 – moderate to high, moderate
- Tiers 3/4 – high to very high, high to very high
III. Site Tiers

<table>
<thead>
<tr>
<th>Potential of a Rockfall Occurrence</th>
<th>Potential of Rockfall Impacting the Traffic Lane</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very High (10)</td>
</tr>
<tr>
<td>Very High (10)</td>
<td></td>
</tr>
<tr>
<td>High (8)</td>
<td></td>
</tr>
<tr>
<td>Moderate (4)</td>
<td></td>
</tr>
<tr>
<td>Low (1)</td>
<td></td>
</tr>
</tbody>
</table>

High Potential of Rockfall Occurrence = 8 points
Moderate Potential of Rockfall Reaching the Traffic Lane = 4 points

Total Preliminary Rating Score for Inventory Site = (8 + 4) = 12 points
III. Site Tiers

<table>
<thead>
<tr>
<th>Preliminary Rating Scale</th>
<th>Tier Type</th>
<th>Data collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 to 5</td>
<td>Tier 1 Site</td>
<td>Location Information, Interviews, Preliminary Rating/ Tier 1 Field Data</td>
</tr>
<tr>
<td>8 to 11</td>
<td>Tier 2 Site</td>
<td>Geometrics, Traffic Data, and Slope Information</td>
</tr>
<tr>
<td>12 to 16</td>
<td>Tier 3 Site</td>
<td>Slope Geological Conditions, Slope Hydrogeological Conditions, Testing Data, and Office Data</td>
</tr>
<tr>
<td>18 to 20</td>
<td>Tier 4 Site</td>
<td></td>
</tr>
</tbody>
</table>


### III. Site Tiers

<table>
<thead>
<tr>
<th>Category</th>
<th><strong>LOW</strong> (1 POINT)</th>
<th><strong>MODERATE</strong> (4 POINTS)</th>
<th><strong>HIGH</strong> (8 POINTS)</th>
<th><strong>VERY HIGH</strong> (10 POINTS)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Potential of Rockfall Occurrence</strong></td>
<td>No fresh exposures</td>
<td>Few to some fresh exposures</td>
<td>Some to many fresh exposures</td>
<td>Many fresh exposures</td>
</tr>
<tr>
<td></td>
<td>No adverse joint patterns</td>
<td>Moderate weathering of rock strata within a cut section</td>
<td>Observed minor stability issues within slope face</td>
<td>Highly weathered to decomposed rock strata within a cut section</td>
</tr>
<tr>
<td></td>
<td>No undercutting evident</td>
<td>Some jointing present</td>
<td>Weathered rock strata within a cut section</td>
<td>Major adverse joint, or intersecting jointing present</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minor undercutting is present</td>
<td>Significant jointing, or adverse jointing present</td>
<td>Severe undercutting present</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Occasional cleaning required of catchment area</td>
<td>Significant undercutting present</td>
<td>Significant amounts of debris is evident within the catchment area, especially along the shoulder</td>
</tr>
<tr>
<td><strong>Potential of Rockfall to Impact Roadway</strong></td>
<td>The distance from the slope face to the travel lane is greater than the anticipated roll out distance</td>
<td>The distance from the slope face to the travel lane is greater than the impact zone, but less than the rollout zone</td>
<td>The distance from the slope face to the travel lane is within the impact zone</td>
<td>Slope is within three feet of roadway</td>
</tr>
<tr>
<td></td>
<td><strong>OR</strong></td>
<td><strong>OR</strong></td>
<td><strong>OR</strong></td>
<td><strong>OR</strong></td>
</tr>
<tr>
<td></td>
<td>An appropriately sized barrier exists between the slope face and the roadway</td>
<td>Rockfall or evidence of rockfall is present along the edge of the shoulder</td>
<td>Rockfall or evidence of rockfall within the shoulder is present</td>
<td>Rockfall or evidence of rockfall within the travel lane, median, or opposite shoulder is present</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Documentation of rockfall debris reaching the roadway including accidents or injury</td>
</tr>
</tbody>
</table>
IV. Data Collection

Criteria Required for all Sites:

- Beginning/Ending Mileage Point
- Orientation/Position of Rock Slope
- Lat/Long/Elevation
IV. Data Collection

Tier 1 Site

- Slope Configuration
  A. Single-Angle
  B. Multi-Angle
  C. Single-Angle benched
  D. Multi-Angle Benched

- Photographic Documentation

- Slope Condition
  1. Vegetation Cover (%barren, % grass, %scrub, %tree)
  2. Talus Buildup (height)
  3. Weathering (none, slight, moderate, complete)
  4. Performance (stable, potentially unstable, unstable)
  5. Lithology
IV. Data Collection

Tier 2 Site

- Geometrics and Traffic Survey Data
- Additional Slope Information
  1. Slope height
  2. Overall face angle
  3. Undercutting features
  4. Jointing patterns
  5. Catchment dimensions
  6. Rockfall Source Zone
  7. Hydrogeological Conditions
- Corrective Actions and Effectiveness
IV. Data Collection

Tier 3/4 Site

- Additional Slope Geological Conditions such as:
  1. Bench elevations and widths
  2. Slope angles and elevations
  3. Potential rockfall volume estimations
  4. Talus accumulation information

- Detailed Hydrological conditions
- Slake Durability Index (SDI) testing
- Road slope and detour distance/time
IV. Data Collection
V. Database Population
V. Database Population

![Screening Form](image)

<table>
<thead>
<tr>
<th>Probability of Rockfall occurrence:</th>
<th>Very high(10)</th>
<th>High(8)</th>
<th>Moderate(4)</th>
<th>Low(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability of Rockfall reaching the traffic lanes:</td>
<td>Very high(10)</td>
<td>High(8)</td>
<td>Moderate(4)</td>
<td>Low(1)</td>
</tr>
</tbody>
</table>

- **Site Screening**:  
  - Rated
  - Not Rated

- **Associated Sites Screening**:  
  - YES
  - NO

- **Emergency Determination**:  
  - YES
  - NO

- **Emergency Determination Comments for emergency determination**

- **Site Screening Comments**

- **Associated Sites Screening Comments**

- **Is Remediated?**

- **Save**
- **Close**
V. Database Population

![Location & GPS Interface]

### Location & GPS

- **Location**
  - District
  - County
  - Route system
  - Route number
  - Jurisdiction

### Buttons
- Save
- Close
V. Database Population
V. Database Population
V. Database Population
V. Database Population

[Image of a software interface for hydrogeological information]
V. Database Population
V. Database Population
V. Database Population

![Hydrogeological Information Interface]

- Condition type
- Elevation
- Distance from BMP
- Flow rate

Note: You should click "New" to add information, and "Save" to save information.
V. Database Population
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V. Database Population
V. Database Population
V. Database Population

![Beddings Information Interface]

- Aggregate thickness of competent beds
- Aggregate thickness of incompetent beds
- Presence of bedding

Form fields for entering data, with save and close buttons.
V. Database Population
V. Database Population
V. Database Population

<table>
<thead>
<tr>
<th>Global ID</th>
<th>Date/Time</th>
<th>Submitted by</th>
<th>Dist.</th>
<th>Cty.</th>
<th>RS</th>
<th>RM No.</th>
<th>BMP</th>
<th>DIR</th>
<th>L/R</th>
<th>Length</th>
<th>Prot. Score</th>
<th>Raw Score</th>
<th>Rank Score</th>
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<tr>
<td>9FR001002</td>
<td>2017-05-29 21:33:41</td>
<td>PSi</td>
<td>9</td>
<td>ADA</td>
<td>US</td>
<td>00032</td>
<td>8.6</td>
<td>E</td>
<td>L</td>
<td>480</td>
<td>9</td>
<td>282</td>
<td>282</td>
<td>YES</td>
<td>NO</td>
</tr>
</tbody>
</table>
V. Database Population

The image shows a screenshot of a database population screen with various fields and options. The screen includes sections for Preliminary Rating, Probability of Rockfall reaching traffic area, Remediation, Sites Screening, Site Location Information, and Basic Information. The screenshot is part of a software interface used for managing and analyzing geological data related to potential rockfall risks.
VI. What is the Southern Ohio Veterans Memorial Highway?

- Ohio’s first true design-build and public-private partnership (P3) project
- Completes the Appalachian Highway in Ohio
- Price Tag $634 million
- 16-mile four-lane divided highway
- 22 bridge structures
- 20.5 million cubic yards of earthwork
VI. Who’s Involved?
VII. Project Specification

- Tier 1 rating as defined by Ohio Department of Transportation (ODOT) by release date
- Sites can have a Tier 2 rating after release date
VIII. High-angle rope
VIII. Why use an UAV?

- Safer than rope access
- Able to determine if sites are problematic efficiently
- Photo for scalers
Remove large volume of jointed rock at Hastings hill (left side of cut) by scaling or mechanical methods.
Remove rock “bowl” by scaling or mechanical methods
Close-up of rock face, remove jointed rock by scaling, top 35 feet of section.
Questions?