The Evolution of a Geohazard Management Program

Ohio Department of Transportation
Office of Geotechnical Engineering
Accessing 1.5 Million Documents

20-30 person hours per week to retrieve information
$1/2 billion in assets
Falcon DBMS

- Searchable Meta Data

- Process
  - Scanned 5x7 Reference Cards
    - 19 Attribute fields
  - Scanned the Documents
    - Project Types
    - Document Types
      - Meta Data

- Georeferencing
### LOG OF BORING

**Date Started:** 7-5-67  
**Date Completed:** 7-6-67

**Sampler Type:** SS  
**Casing Length:** 15'  
**Diameter:** 1.3/8"  
**Station & Offset:** 2/15 + 19', 00' Lt. (Forward Abnormal)

**Surf Elevation:** 253.21
**Water Elev:**

<table>
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<th>Elev.</th>
<th>Depth</th>
<th>Cone Penetration</th>
<th>Rec. Loss</th>
<th>Description</th>
<th>Sample</th>
<th>% Ca</th>
<th>% Co</th>
<th>% F</th>
<th>% Silt</th>
<th>% Clay</th>
<th>% L.L.</th>
<th>Pr.</th>
<th>W.C.</th>
<th>Class</th>
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*Refusal*
Development of a National Geotechnical Data Exchange Standard for Transportation Applications

www.diggsml.org
“A geologic hazard is one of several types of adverse geologic conditions capable of causing damage or loss of property and life.”

1 Wikipedia, 2012
Geohazard Inventories and Risk Assessments

- Staged data collection approach
- Compiles data from Tier to Tier
- Increasing Tiers corresponding to Relative Risk
**Data Management** enable user to manage the data fields of a given site.
- Part A Management
- Part B Management
- Part C Management

**GIS Map** enable user to manage the site information on GIS Map.
- Data Management based on GIS Map

**System Management** enable user to manage user, user group and validation rules.
- User management
- Role management
- Group management
- User Approval
- System Tools

**Data Management Extension** enable user to manage the data fields of a given site.
- Exports
- Cost of remediation
- RCDA Link
- Documents/Pictures
- Inspection

**User Forum** enable user to post questions and responses.
- User Forum

**Notification** enable user to post and manage potential geohazard site information.
- Geohazard Report Notification
Underground Mine Subsidence
AUMIRA

- **Initial Evaluation**
  - 1776 Sites
    - 1324 Confirmed Mapped Sites that represent 67% of the Total Number of AUMIRA Sites

- **Surface Deformation**
  - 98 Sites

- **Mine Opening**
  - 265 Sites

- **High Risk**
  - 342 Sites
AUMIRA

Surface Deformation | Mine Opening | High Risk | Low Risk

47% | 20% | 26% | 7%

Total of 1,324 Inventoried Sites
Underground Void Inventory & Risk Assessment

- Utilizes a Single Scoring Matrix
  - Eliminates Duplication of Input Data
- Consistent with Rockfall and Landslide Matrixes
- Transformation of Data from AUMIRA to UVIRA
  - Problems
Cost for Development and Implementation of AUMIRA/UVIRA

- Developed Internally
  - 1500-hrs @ $120/hr = $180,000*

- Support
  - Mine Maps and Database Development
    - Cost = $153,684

- Population of the Database
  - 2001 through 2006
    - Consultant Field Teams
    - GIS Support
    - Cost = $2,049,549

TOTAL COST: $2,383,233
Landslides
Landslide Inventory

- Non-Rated Sites: 79%
- Moderated Rated Sites: 12%
- High Rated Sites: 8%
- Very High Rated Sites: 1%

11,478 Sites in 50 of 88 Counties

- Low: 1.0-hr
- Moderate: 2.07-hrs
- High: 2.27-hrs
- Very High: 2.17-hrs
Cost for Development and Implementation of Landslide Inventory and Risk Assessment

- Developed through University of Akron
  - Cost = $536,827
    - Included 2–yrs of Maintenance and Service
- Support
  - Additional Maintenance and Service
    - Cost = $163,361
- Population of the Database
  - 2008 through 2013
    - Consultant Field Teams
    - GIS Support
    - Cost = $4,036,479

TOTAL COST: $4,736,667
Rockfall Inventory

- Low Rated Sites: 0.03%
- Moderate Rated Sites: 9%
- High Rated Sites: 19%
- Very High Rated Sites: 72%

5,540 Sites in 88 Counties

- Low: 0.84-hr
- Moderate: 1.69-hrs
- High: 5.12-hrs
- Very High: 6.03-hrs
Cost for Development and Implementation of Rockfall Inventory and Risk Assessment

- Developed through Kent State University
  - Cost = $162,391

- Support
  - Hardware, software & equipment
    - Cost = $71,205

- Population of the Database
  - 2008 through 2013*
    - Consultant Field Teams
    - GIS Support
  - Cost = $3,112,733

TOTAL COST: $3,346,329
Remediation Cost Database

- Build application and establish a database for developing planning level cost estimates
- Calculates estimated cost of preferred and alternative remediation measures
- Utilizes information developed from the field inventory data for geohazards
Researcher: Ohio State University
Completion date: March of 2005
Cost = $181,011

Full integration with Geohazard Management System in 2011
Statewide Geohazard Inspection

- Starting in 2012
  - Inspections of:
    - Underground Voids
    - Rockfall Sites
    - Landslide Sites
  - Inspection Schedule 1 to 10 years
  - All Geohazard “Types” will be inspected by the field teams
  - Consultant using 2 Field Teams
    - Geologist and Engineering Geologist or Geotech Eng.
  - Cost = $773,640 per yr
What is the total cost?

- AUMIRA/UVIRA = $2,383,233
- Landslide = $4,736,667
- Rockfall = $3,346,329
- RCDA = $181,011

Grand Total = $10,647,240

Annual Costs
- Geohazard Inspections
- System Maintenance and Service
How is this level of expenditure justified?

- Based on a study conducted in 2001, OhioDOT spent an average of $17.3M per year repairing landslides.
- Nearly 45% of the geohazard remediation was funded through emergency programs.
- Significant impact on planning resources.
- Up to an 80% reduction in remediation cost of landslides if problems are addressed in their infancy.
- Extent of the problems across the state and risk were unknown.
Example: Underground Mines

- **AUMIRA/UVIRA**
  - Underground Coal & Clay
    - 1324 sites
    - 555 lane miles of priority sites
    - $4.8 million per lane mile
    - Total Cost is estimated at $2.66 Billion
Geologic Site Management Program (GSMP)

- **Purpose:** Proactively Address High Priority Geologic Hazards
- **Funding Levels:** Started at $12M/yr, Currently at $18M/yr
  - 25 to 30 Remediation Projects each year
  - Low-drill to assist with Landslide Remediation using drilled shafts.
Thank You!

QUESTIONS?

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