Ohio Department of Transportation

John R. Kasich, Governor
Jerry Wray, Director

Asset Management Implementations within the Ohio Department of Transportation

2012 - 9th National Conference on Transportation Asset Management
ODOT Districts 1 & 2 GIS contacts

John Puente
- LPA Program Manager
- GIS Coordinator
- ODOT District 1
  Lima, Ohio

Fred Judson, GISP
- GIS Coordinator
- ODOT District 2
  Bowling Green, Ohio
History of ODOT Assets

Everybody in ODOT had **Questions?**

- How many do we have?
- Where is it and how old?
- When’s the last time it was inspected?
- What’s the Life Expectancy?
- What’s the total value of our assets?
Data Integrity issues

- Multiple Data Formats
- No Department wide Standardizations - only Localized Standards
- **Log Point** used As Primary Spatial Reference
  - 1 mi = 5280 ft Most Locations Carried to .01 mile = At +/- 52.8’
  - Average Error In Log Point +/- 300 ft.
  - Mile Marker Signs Would Be Placed Wrong or not recorded correctly
  - Locations of assets recorded by multiple methods
  - Landmarks, County Log Points, State Log Points and Intersections
Collection Methods

2nd Most common location referencing method used by ODOT is GPS.

- Requires Specialized Equipment, Software and Logistical Planning
- Requires Specialized Training
- Subject To Weather Conditions
- Most Importantly: Increased Safety Risk To Field Crews And The traveling Public
Mobile App & Statewide Culvert Implementation
Reason for inventory urgency: Emergency Culvert Projects

Emergency culvert repairs and project change orders can be very expensive. And dangerous to public.

ODOT needed a systematic way to remedy this from occurring.
Culvert Inventory

Resulting Actions

Began standardization of Culvert database structure in 2004

Utilized Trimble GPS handheld units and GeoMedia OnDemand

I-480 Dec. 2001
## District Data

12 Districts within ODOT – Each had different ways of keeping data:

<table>
<thead>
<tr>
<th>District</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GIS Database</td>
</tr>
<tr>
<td>2</td>
<td>GIS Database</td>
</tr>
<tr>
<td>3</td>
<td>Old Inventory – Decided to start over</td>
</tr>
<tr>
<td>4</td>
<td>GIS Database – Different from D1 &amp; D2</td>
</tr>
<tr>
<td>5</td>
<td>Bridge Management System (BMS) Database</td>
</tr>
<tr>
<td>6</td>
<td>Access Database</td>
</tr>
<tr>
<td>7</td>
<td>Old Inventory – Decided to start over</td>
</tr>
<tr>
<td>8</td>
<td>Mainframe Database - BMS</td>
</tr>
<tr>
<td>9</td>
<td>Bridge Management System (BMS) Database</td>
</tr>
<tr>
<td>10</td>
<td>Access Database</td>
</tr>
<tr>
<td>11</td>
<td>Paper Copies</td>
</tr>
<tr>
<td>12</td>
<td>Access Database</td>
</tr>
</tbody>
</table>
A department-wide need to electronically duplicate the paper Inventory/Inspection Forms used by maintenance forces
Current Statewide Process

District 2 Mobile Culvert\Asset Program

(1) Developed from ODOT Culvert Documents and District One’s GeoMedia OnDemand Pilot
(2) Writes GeoMedia Locational Information and exports to Oracle
(3) Developed\Deployed By ODOT District 2 in 2008
(4) Standardized in 2009 by District 1
(5) Ability to Inventory\Inspect 30+ Culverts per Day
(6) Currently Manages 66,467 Culverts statewide (7 of 12 Districts)
Culvert Management Mobile GPS Application

Looks and Works the same on GPS units, Windows Mobile 6.5 and older, the ODOT Video Log and WebMap Applications
Web Mapping\GIS Applications for both ESRI and GeoMedia WebMap Platforms

Instant Updates to Three Enterprise Platforms at Once!

- GPS Units
- Web Portals
- Video Log Applications
Mobile Video Collection – Sign Data Collection
D2 Mobile Video Asset Capturing Application - Image Calibrations

• Issue: **How to extract 3D info from a 2D picture**
  • We were not sure of the camera configurations for the different video cycles.
  • We attempted to take physical measurements of everything ourselves and found that we were not very accurate.

• Solution
  • By manipulating Tao’s equations and coming up with a few of our own we were able to develop methods to calibrate the videos for our use.
  • Uses the imagery with known points and measurements to rectify accuracy.

\[
L^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2
\]

\[
H = \frac{L^2 \cos^2 \tau}{x_2 - x_1} + \frac{H^2y_{yp}^2}{\sin^2 \tau \cos^2 \tau} \left( \frac{y_2 - y_1}{y_{yp} - y_1} \right)^2
\]

\[
H = \frac{L \cos \tau}{\left( \frac{x_2 - x_1}{y_{yp} - y_1} \right)^2 + \frac{y_{yp}^2}{\sin^2 \tau \cos^2 \tau} \left( \frac{y_2 - y_1}{y_{yp} - y_1} \right)^2}
\]
Mobile Video Asset Capturing Application

Sign Collection (2003)

Select Asset Type

Collect Point at Bottom Of Sign Post
Mobile Video Asset (2007)  
New Look and Feel

Choose from Multiple Video Logs

Export Function

Added Asset Query Table
Mobile Video Asset Capturing Application (2007)

- Ability to spatially capture signs and other point data from the video log
- Ability to take Vertical and Horizontal Measurements
- Links to StreetView and Webmap Apps

Good Accuracy

Bad Accuracy
Mobile Video Asset Capturing Application (2009)

New look - 3 Screens
Enterprise Communication Made Simple

Multiple Systems Communicate Instantly

Forms are identical!

GPS Units

Video Log

Web Applications
Current Inventories
Asset Management – Current Managed Asset Processes

**Culverts** - 5,181 (D02) 11,568 (D01)
- Inventory
- Inspection Every 5 Years
- Managed Process 4 Years

**Signs** - 40,000 (D02) 23,152 (D01)
- Inventory
- Est. $4 Million Value
- Work Order – In Development

**Overhead Signs** - 320 (D02)
- Inventory
- Inspection Every 7 Years

**Lighting** (D02)
- Inventory – 40% Complete
  - 22 Control Centers
  - 405 Poles
  - 278 Pole Boxes
  - 42 Towers
- Inspection – Yearly Contract

**ADA Curb Ramps** – 279 (D02)
- Inventory

**Roadway Weather information Systems (RWIS)**
- 34 Towers
- 117 Sensors
- 4 Repeaters
- Work Order - Development

Complete! Complete!
Enterprise Communication Model

Interoperability
• Communicate With Internal And External Customers
• Conflate To Meet ODOT Standards

Asset Administrative and Reporting Programs
• Add Change Or Remove Assets
• Reporting Functions For Documentation

Asset Collection and Maintenance
• Ensures The Data Is Updated
• All Assets Stored In ODOT Databases.
• Currently Moving To ODOT Enterprise Oracle Database
Asset Management – Collection\Maintenance

GPS Units – Already In Place
- Survey Grade
  - Highly Accurate, Most Expensive
  - Used For Construction Projects
    - Contractor Compliance
    - Future Automated Job Closing And Asset Collection
- Mapping Grade
  - Accurate, Less Expensive
  - Used for Areas And Accurate Asset Location
- Cell Phones
  - Least Accurate, Least Expensive
  - Used For Most Asset Information
  - Real-Time Data Updates and Work Orders Information
  - 1 Mapping GPS = 33 Cell Phones In Cost
  - 1 Survey GPS = 167 Cell Phones In Cost

Video Log Asset Collection
- Safest And Most Efficient Method For Collection
- Available For Entire State - NOW
- Flexible
  - We can add delete or change any asset any time.
- Independent From Any Vendor
- User Friendly And Efficient
- Leverage Existing Investments
  - OGRIP – LBRS \ OSIP \ VRS
  - ODOT – All Available Video Cycles
- 100% ODOT Owned and Developed
  - Supported in-house

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Construction GPS
Construction GPS

GPS Technology
- Contractors
  - Machine Control
  - Increased Demand on Our Survey Department

PN 623\823
- Plan Note Modification
- Purchase GPS Units Stays the Property of ODOT
  - Used to Maintain the Roadway Through its Lifecycle
  - Provide Training
  - Provide Data

FHWA – Funds and Approval
Construction GPS

- D-2 purchased first GPS units in 2008
- Currently have 7 units in field
  - Engineers
  - Units with Training
- Reduce Demand on Survey Department
- Reduce construction Costs
  - Staking
- Reduce Change Orders
  - Mitigate Construction Issues Quickly
  - Profile\Sections and Cut\Fill Real-Time
  - Area and Volume Calculations
UAS Implementation
UAS Implementation

Military's X-47B SenseFly Swinglet CAM

- Air Speed Sensor
- GPS and IMU
- 1/2 Hour Battery
- Elect. Motor 18-30 mi/h
- Crash-Resistant Flexible Airframe
- Built-in Data Link 2.4 GHz, 1 Mile
- 2.6 Feet

Actual Size Compared to the X-47B

For Bombing and Photogrammetry Operations
UAS Implementation

- Reduce need for expensive traditional aerial photography.
- $450 per hour – Traditional
- $120 per hour – UAS
- Big plane – 1.3 Million
- UAS – 13k

On-Demand Aerial Photography

- Highest Resolution
- 0.75 inch per pixel or less.
UAS Implementation Timeline

- **FAA Requirements**
  - Pass Written Private Pilots Test
  - Scheduled for next week
  - Private Pilots License???

- **HR 658 - FAA Modernization and Reform Act of 2012**
  - Next Generation Air Transportation System
  - Commercial UAS’s NAS In Three Years (Mid 2014)
  - sUAS’s for Governmental Public Safety Use
Future Asset Management Direction

Current

- Large Asset Management Implementations
  - Problem Identified
  - Consultant Hired To Study
  - Personnel To Manage Process
  - Consultant Hired To Implement
  - Equipment and Software Purchased
  - Yearly Maintenance
  - Internal Personnel Hired\Reassigned to Maintain
  - $$$$$$$ 100’s Thousands - Millions

Disruptive Innovation
Future Asset Management Direction

Cloud + 5 + =
Future Asset Management Direction

- Benefits of Cloud Technologies
  - Cost Savings
  - Reduce Labor Costs
  - Reduce IT Infrastructure
  - Standardization Through Common Platforms
  - Innovation\Implementation At Any Level
  - Reduce Complex Bureaucracies
  - Enable All Mobile and Desktop Platforms
• Formed for AM Collaboration
• Data
• Documents (Standards)
• Code
• 65 Members
• 13 DOT’s
• Target Asset
• Last Asset - Signs
• Survey
• Data
• Previous Transportation Presenters
• New York DOT
• South Carolina DOT
• Ohio DOT
• Iowa DOT
• Kentucky

E-mail: Fred.Judson@dot.state.oh.us
Most Important - Complete Picture

- Federal Base Station
- Network Control
- Used to Measure
- Signs Caused Multi-Path Errors In GPS Signals
- Establish CORS Network

Big Picture?
Questions\Contact
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