Ohio Department of Transportation

John R. Kasich, Governor

Jerry Wray, Director

Asset Management Implementations within the Ohio Department of Transportation

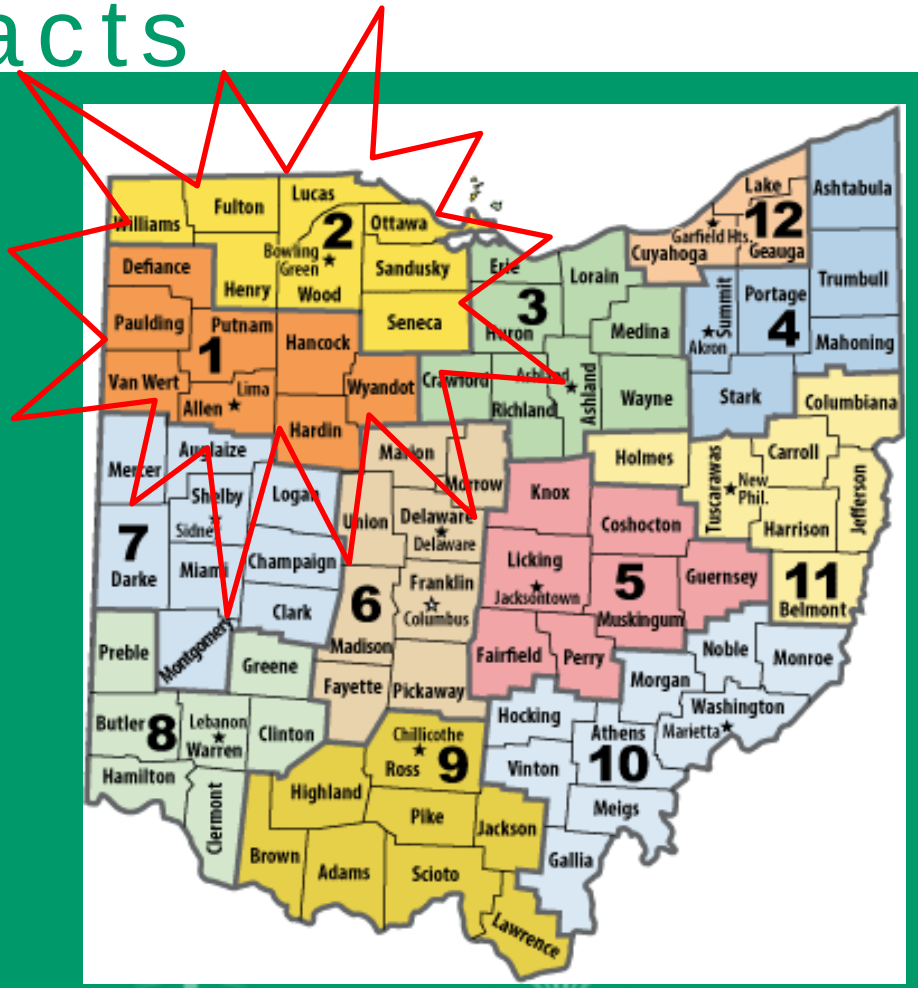
2012 - 9th National Conference on Transportation Asset Management

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? ***Questions?*** ***Questions?***

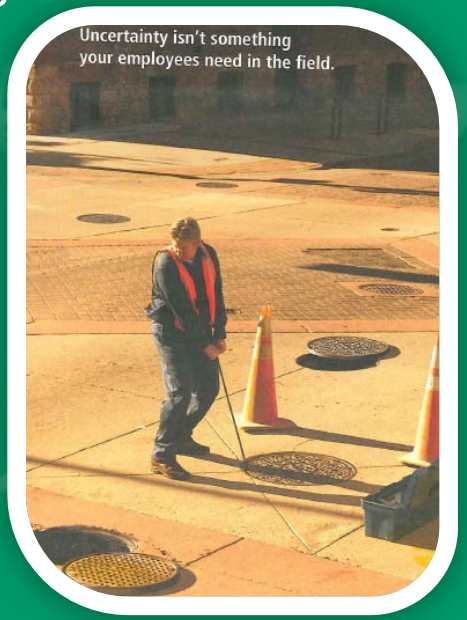
- **How many do we have?**
- **Where Is It and How Old?**
- **When's the last time it was inspected?**
- **What's the Life Expectancy?**
- **What's the total value of our assets?**

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

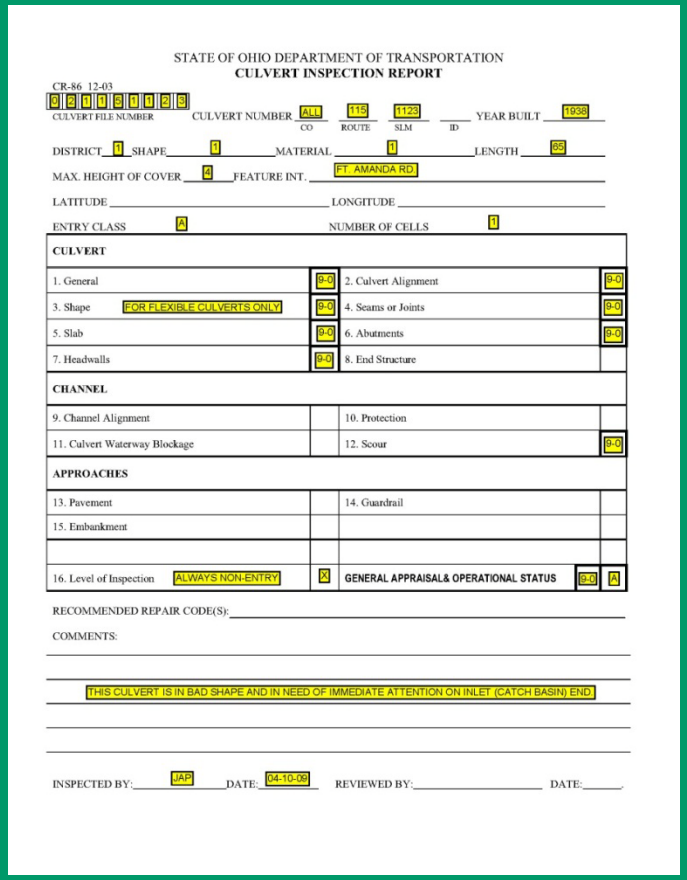
Utilized Trimble GPS handheld units and GeoMedia OnDemand

District Data

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

District	Format
1	GIS Database
2	GIS Database
3	Old Inventory – Decided to start over
4	GIS Database – Different from D1 & D2
5	Bridge Management System (BMS) Database
6	Access Database
7	Old Inventory – Decided to start over
8	Mainframe Database - BMS
9	Bridge Management System (BMS) Database
10	Access Database
11	Paper Copies
12	Access Database

ODOT Culvert Management Manual



STATE OF OHIO DEPARTMENT OF TRANSPORTATION
CULVERT INSPECTION REPORT

CR-86 12-03

0 2 1 0 8 0 0 1 2 8
CULVERT FILE NUMBER

CULVERT NUMBER ALL (CO) 115 (ROUTE) 1123 (SLM) ____ (ID) YEAR BUILT 1938

DISTRICT 3 SHAPE 1 MATERIAL 1 LENGTH 65

MAX. HEIGHT OF COVER 4 FEATURE INT. FT. AMANDA RD

LATITUDE _____ LONGITUDE _____

ENTRY CLASS A NUMBER OF CELLS 1

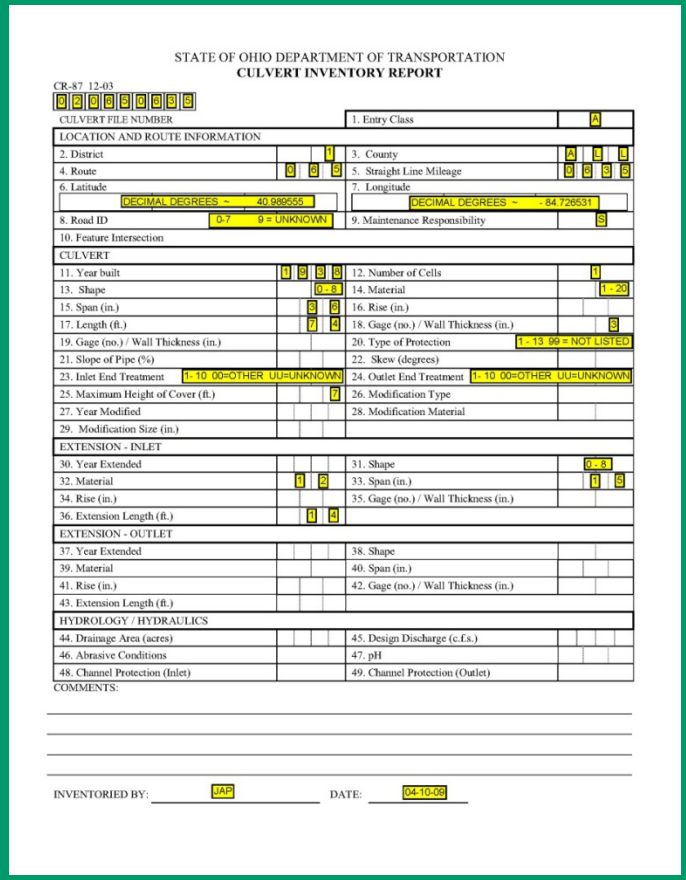
CULVERT			
1. General	9-0	2. Culvert Alignment	9-0
3. Shape FOR FLEXIBLE CULVERTS ONLY	9-0	4. Seams or Joints	9-0
5. Slab	9-0	6. Abutments	9-0
7. Headwalls	9-0	8. End Structure	
CHANNEL			
9. Channel Alignment		10. Protection	
11. Culvert Waterway Blockage		12. Scour	9-0
APPROACHES			
13. Pavement		14. Guardrail	
15. Embankment			
16. Level of Inspection ALWAYS NON-ENTRY	X	**GENERAL APPRAISAL& OPERATIONAL STATUS**	9-0 A

RECOMMENDED REPAIR CODE(S): _____

COMMENTS:

THIS CULVERT IS IN BAD SHAPE AND IN NEED OF IMMEDIATE ATTENTION ON INLET (CATCH BASIN) END

INSPECTED BY: JAP DATE: 04-10-09 REVIEWED BY: _____ DATE: _____



STATE OF OHIO DEPARTMENT OF TRANSPORTATION
CULVERT INVENTORY REPORT

CR-87 12-03

0 2 0 0 8 0 0 1 2 8
CULVERT FILE NUMBER

		1. Entry Class	A
LOCATION AND ROUTE INFORMATION			
2. District	1	3. County	A S L
4. Route	0 8 5	5. Straight Line Mileage	0 8 3 5
6. Latitude DECIMAL DEGREES ~ 40.989555		7. Longitude DECIMAL DEGREES ~ -84.726531	
8. Road ID 0-7 9 = UNKNOWN		9. Maintenance Responsibility	S
10. Feature Intersection			
CULVERT			
11. Year built	1 9 8 8	12. Number of Cells	1
13. Shape	0 - 8	14. Material	1 - 20
15. Span (in.)	8 8	16. Rise (in.)	
17. Length (ft.)	7 4	18. Gage (no.) / Wall Thickness (in.)	S
19. Gage (no.) / Wall Thickness (in.)		20. Type of Protection 1 - 13 99 = NOT LISTED	
21. Slope of Pipe (%)		22. Skew (degrees)	
23. Inlet End Treatment 1- 10 00=OTHER UU=UNKNOWN		24. Outlet End Treatment 1- 10 00=OTHER UU=UNKNOWN	
25. Maximum Height of Cover (ft.)	7	26. Modification Type	
27. Year Modified		28. Modification Material	
29. Modification Size (in.)			
EXTENSION - INLET			
30. Year Extended		31. Shape	0 - 8
32. Material	1 2	33. Span (in.)	1 8
34. Rise (in.)		35. Gage (no.) / Wall Thickness (in.)	
36. Extension Length (ft.)	1 4		
EXTENSION - OUTLET			
37. Year Extended		38. Shape	
39. Material		40. Span (in.)	
41. Rise (in.)		42. Gage (no.) / Wall Thickness (in.)	
43. Extension Length (ft.)			
HYDROLOGY / HYDRAULICS			
44. Drainage Area (acres)		45. Design Discharge (c.f.s.)	
46. Abrasive Conditions		47. pH	
48. Channel Protection (Inlet)		49. Channel Protection (Outlet)	

COMMENTS:

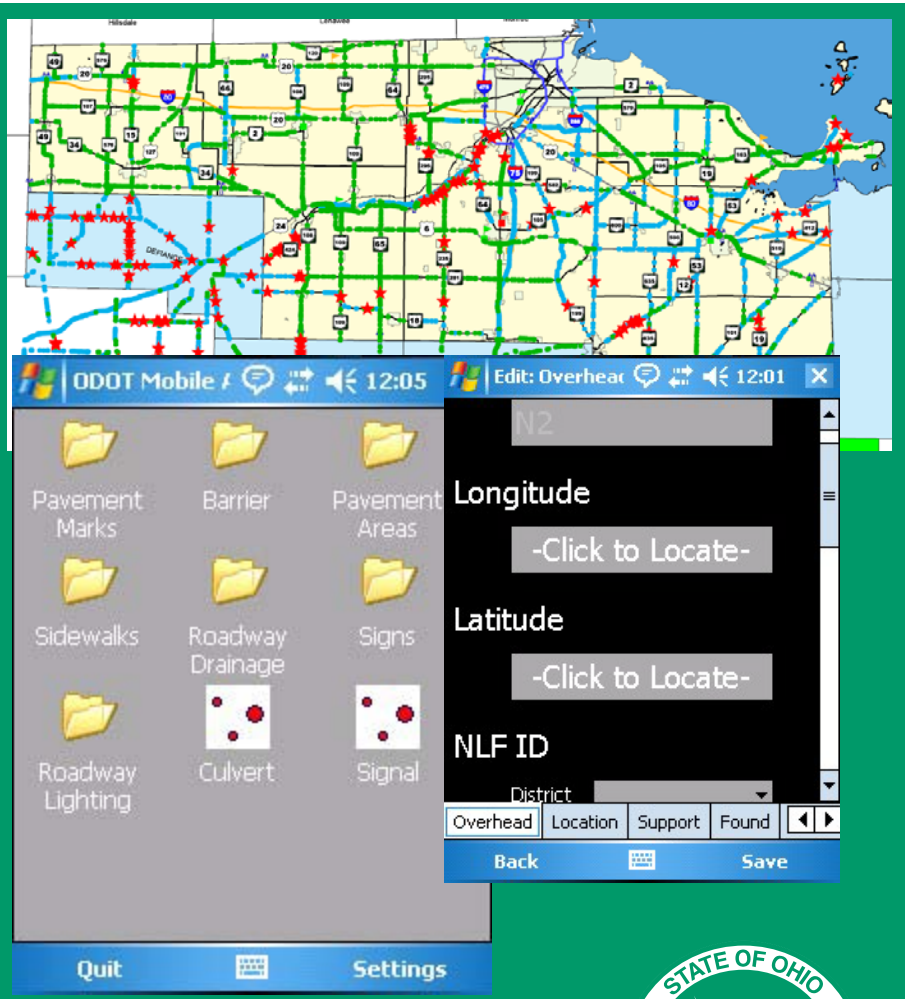
INVENTORIED BY: JAP DATE: 04-10-09

A department-wide need to electronically duplicate the paper Inventory/Inspection Forms used by maintenance forces

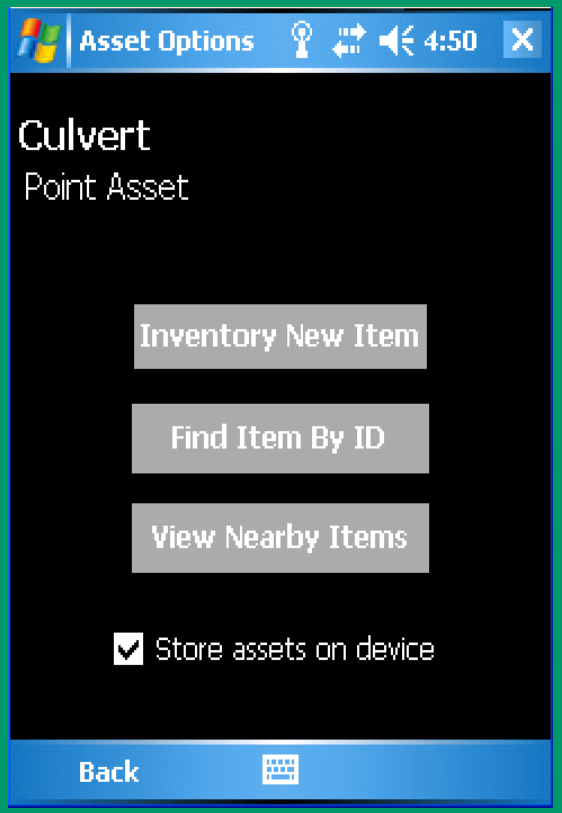
Current Statewide Process

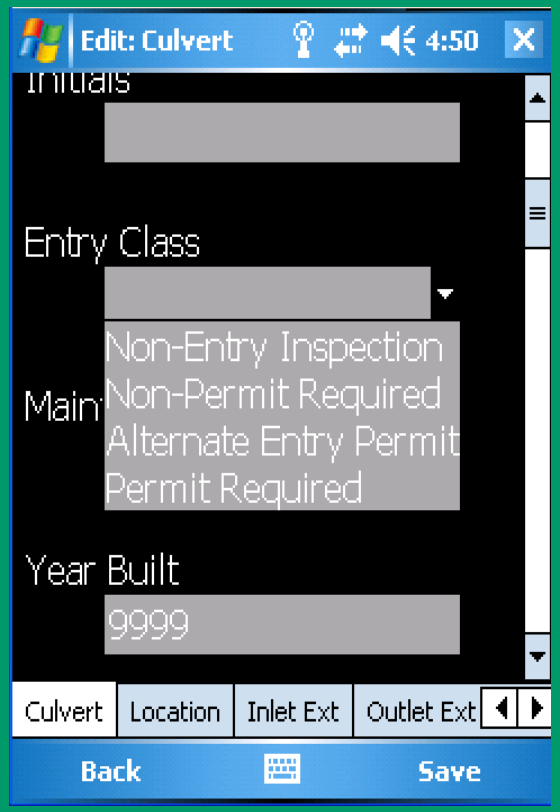
District 2 *Mobile* Culvert\Asset Program

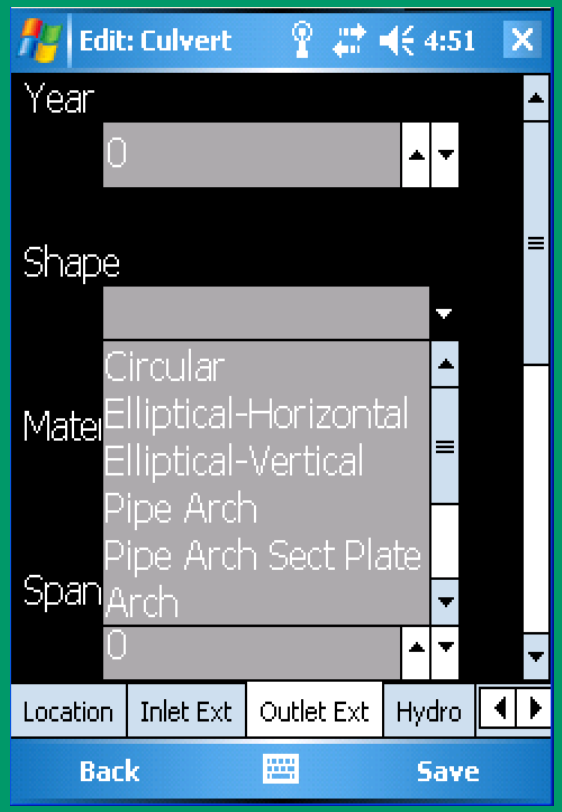
(1) Developed from ODOT Culvert Documents and District One's GeoMedia OnDemand Pilot
(2) Writes GeoMedia Locational Information and exports to Oracle
(3) Developed\Deployed By ODOT District 2 in 2008
(4) Standardized in 2009 by District 1
(5) Ability to Inventory\Inspect 30+ Culverts per Day
(6) Currently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



Culvert Management Mobile GPS Application

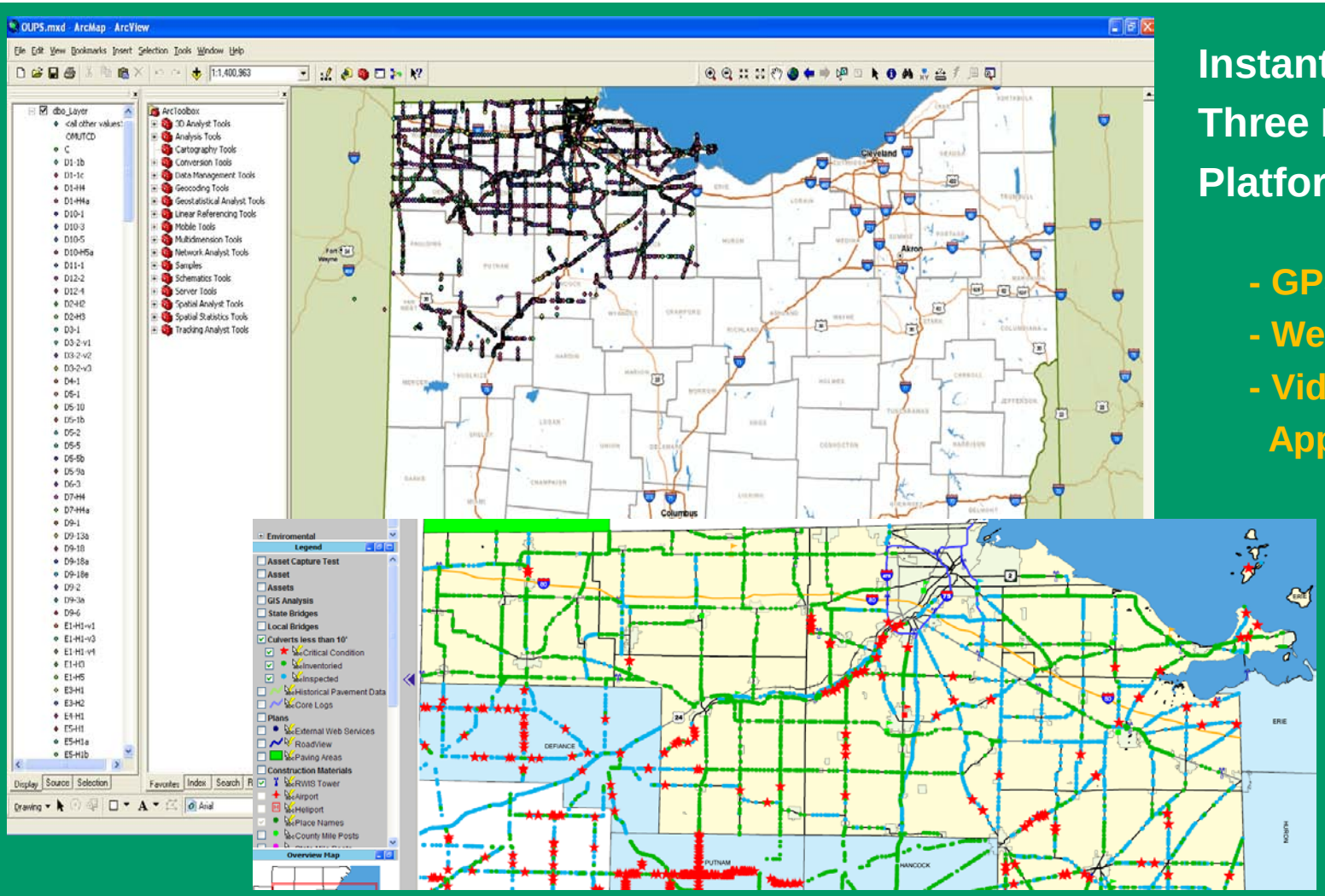






Looks and Works the same on GPS units, Windows Mobile 6.5 and older, the ODOT Video Log and WebMap Applications

Web Mapping\GIS Applications for both ESRI and GeoMedia WebMap Platforms



Instant Updates to Three Enterprise Platforms at Once!

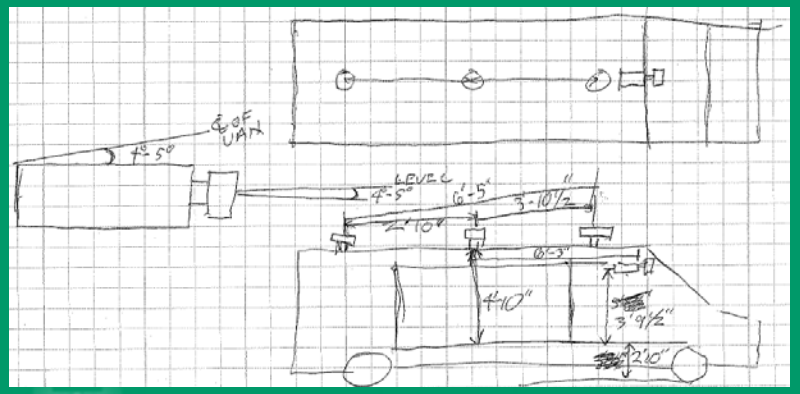
- GPS Units
- Web Portals
- Video Log Applications

STATE OF OHIO DEPARTMENT OF TRANSPORTATION

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.

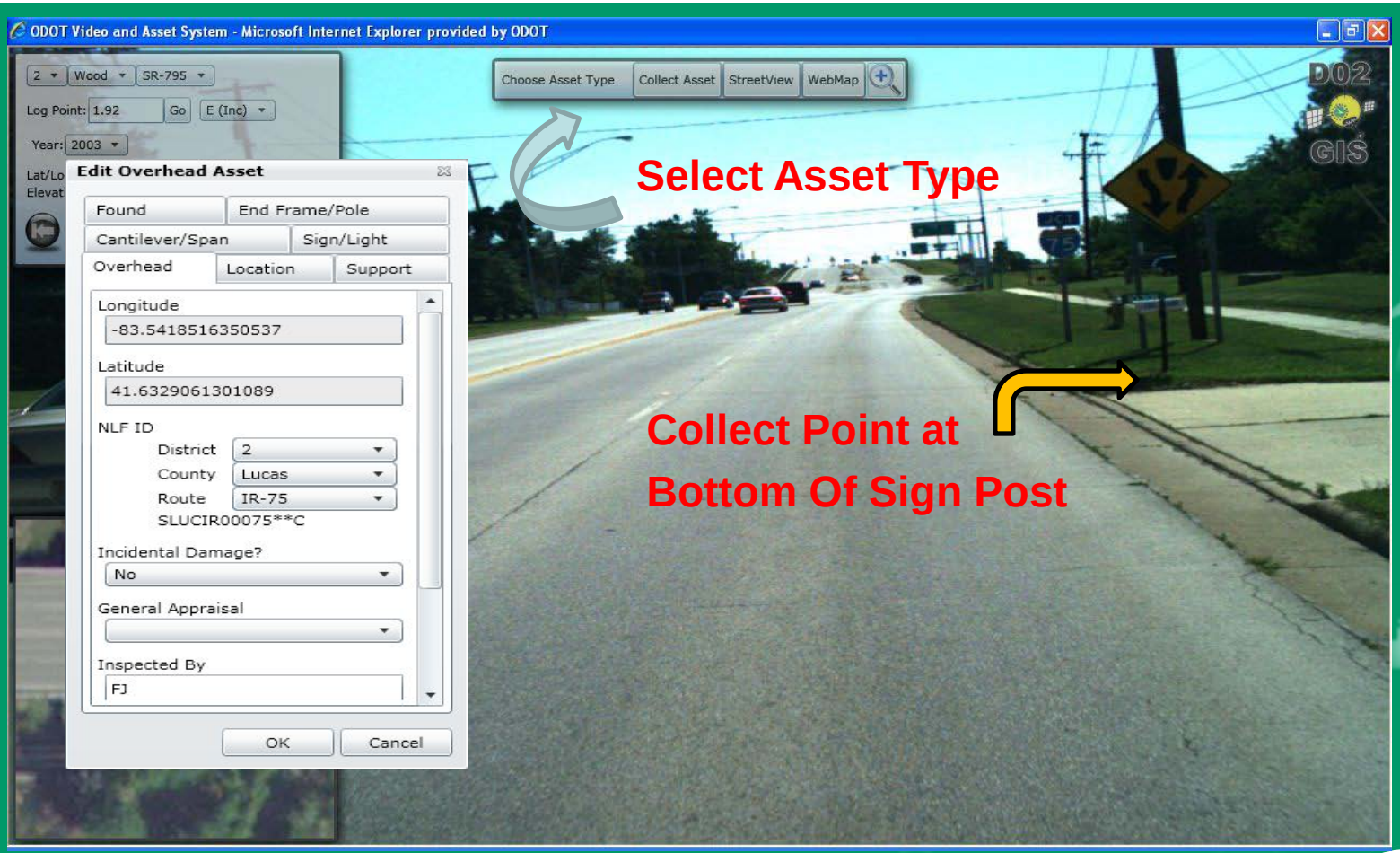
Solve for H using line on ground of known length L:

$$L^2 = (X_2 - X_1)^2 + (Y_2 - Y_1)^2$$

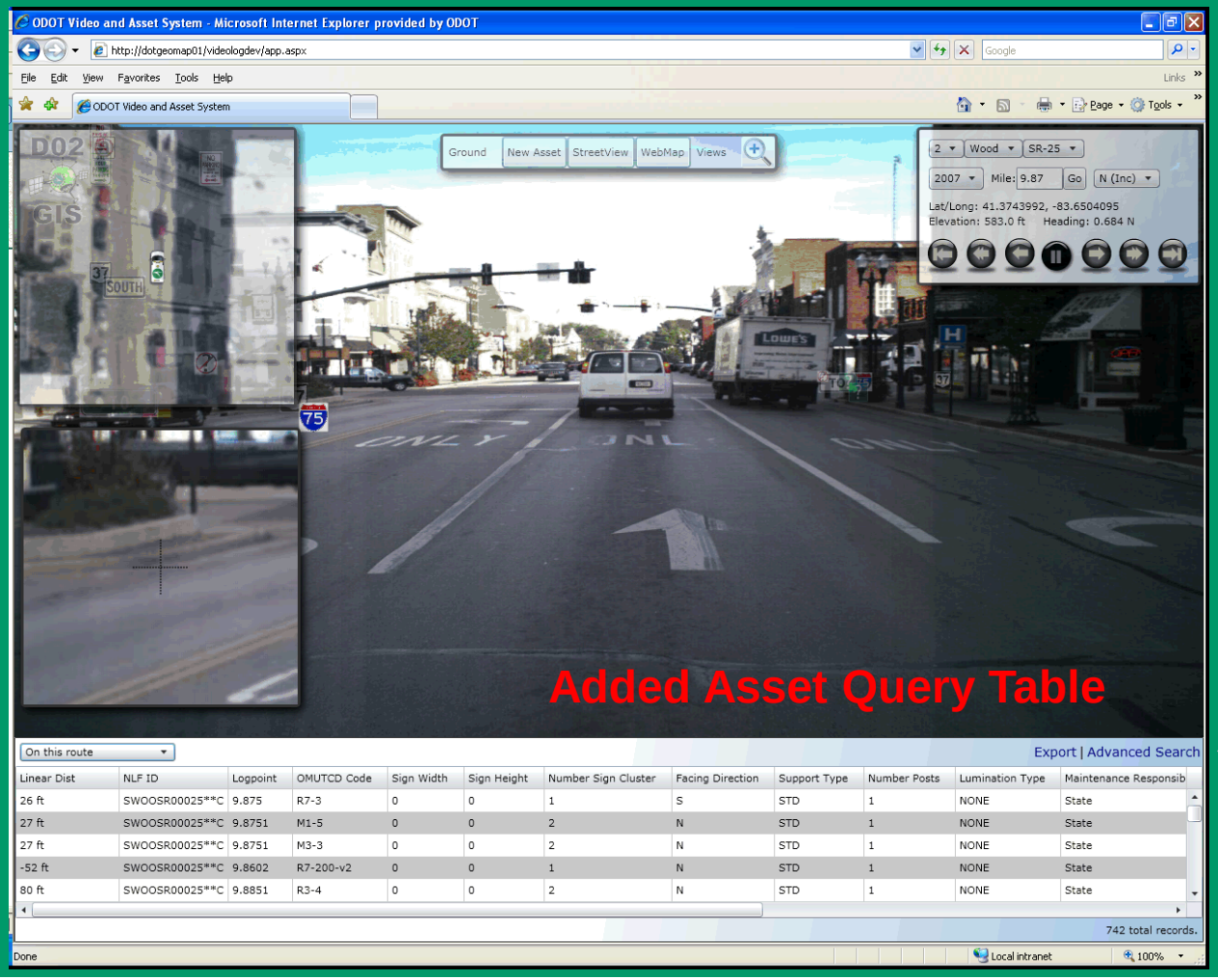
$$= \frac{H^2}{\cos^2\tau}\left(\frac{x_2}{y_{vp} - y_2} - \frac{x_1}{y_{vp} - y_1}\right)^2 + \frac{H^2 {y_{vp}}^2}{\sin^2\tau \cos^2\tau}\left(\frac{y_2 - y_1}{(y_{vp} - y_2)(y_{vp} - y_1)}\right)^2$$

$$\rightarrow H = \frac{L \cos\tau}{\sqrt{\left(\frac{x_2}{y_{vp} - y_2} - \frac{x_1}{y_{vp} - y_1}\right)^2 + \frac{{y_{vp}}^2}{\sin^2\tau}\left(\frac{y_2 - y_1}{(y_{vp} - y_2)(y_{vp} - y_1)}\right)^2}}$$

Mobile Video Asset Capturing Application Sign Collection (2003)



Mobile Video Asset (2007)
New Look and Feel



Linear Dist	NLF ID	Logpoint	OMUTCD Code	Sign Width	Sign Height	Number Sign Cluster	Facing Direction	Support Type	Number Posts	Lumination Type	Maintenance Responsib
26 ft	SWOOSR00025**C	9.875	R7-3	0	0	1	S	STD	1	NONE	State
27 ft	SWOOSR00025**C	9.8751	M1-5	0	0	2	N	STD	1	NONE	State
27 ft	SWOOSR00025**C	9.8751	M3-3	0	0	2	N	STD	1	NONE	State
-52 ft	SWOOSR00025**C	9.8602	R7-200-v2	0	0	1	N	STD	1	NONE	State
80 ft	SWOOSR00025**C	9.8851	R3-4	0	0	2	N	STD	1	NONE	State

Choose from Multiple Video Logs

Export Function

Mobile Video Asset Capturing Application (2007)

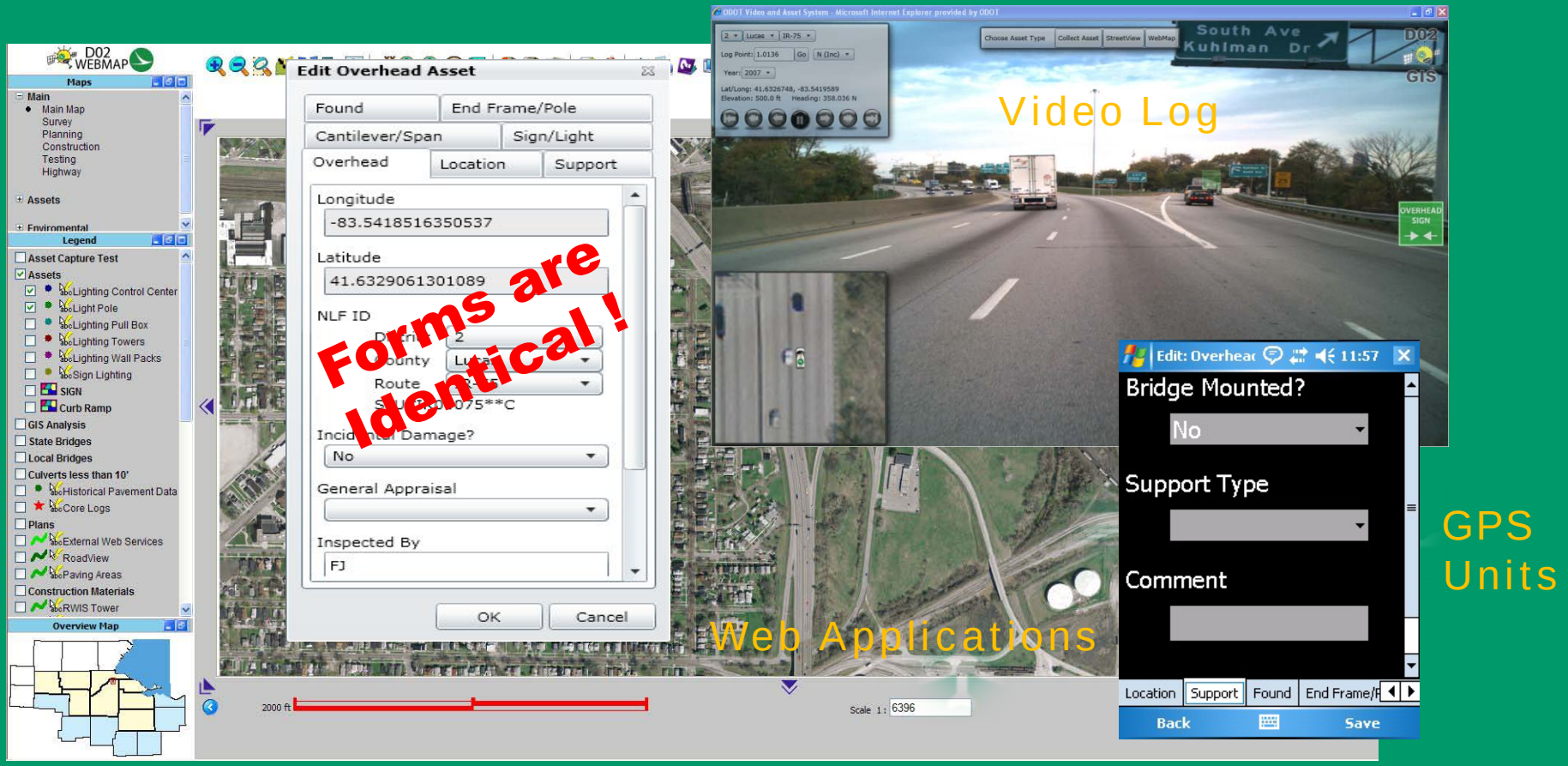
Ability to spatially capture signs and other point data from the video log

Ability to take Vertical and Horizontal Measurements

Mobile Video Asset Capturing Application (2009)

New look - 3 Screens

Enterprise Communication Made Simple



Multiple Systems Communicate Instantly

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 Cabinets
  - 405 Poles
  - 273 Pole Boxes
  - 42 Towers
- Inspection – Yearly Contract

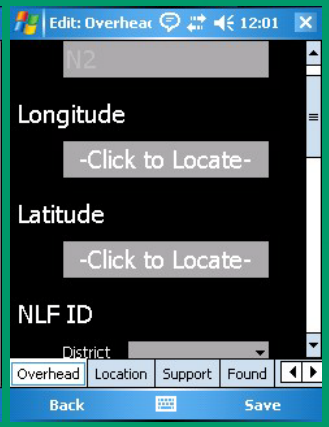
Complete!

Complete!

D01 Complete!

ADA Curb Ramps – 279 (D02)
- Inventory

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



Enterprise Communication Model

Interoperability

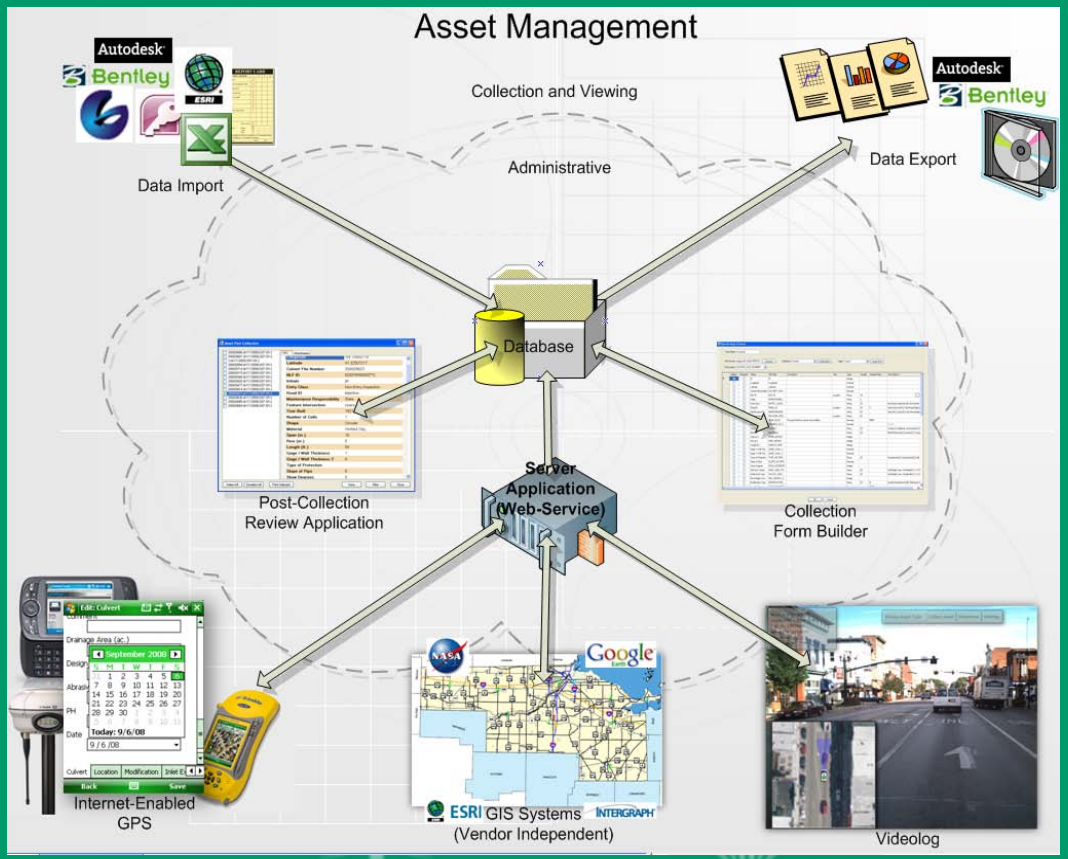
- Communicate With Internal And External Customers
- Conflate To Meet ODOT Standards

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

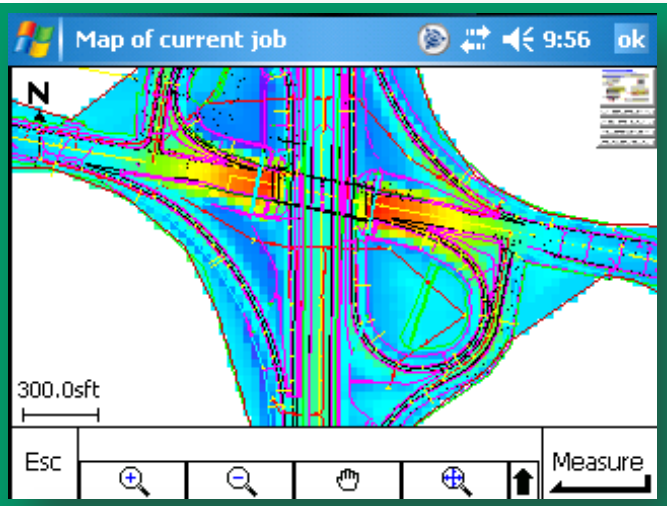
Construction GPS

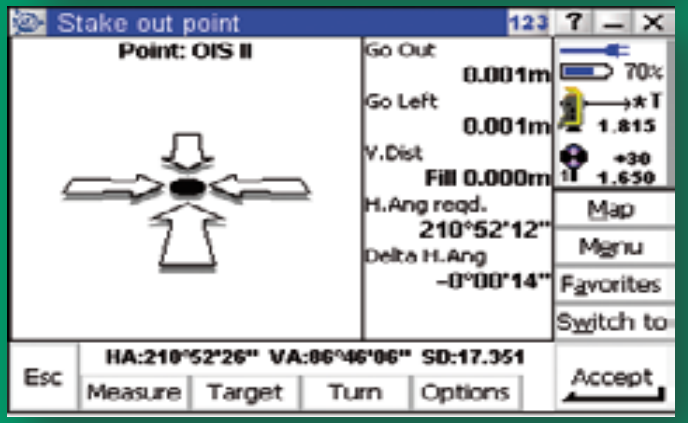
Construction GPS

- **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

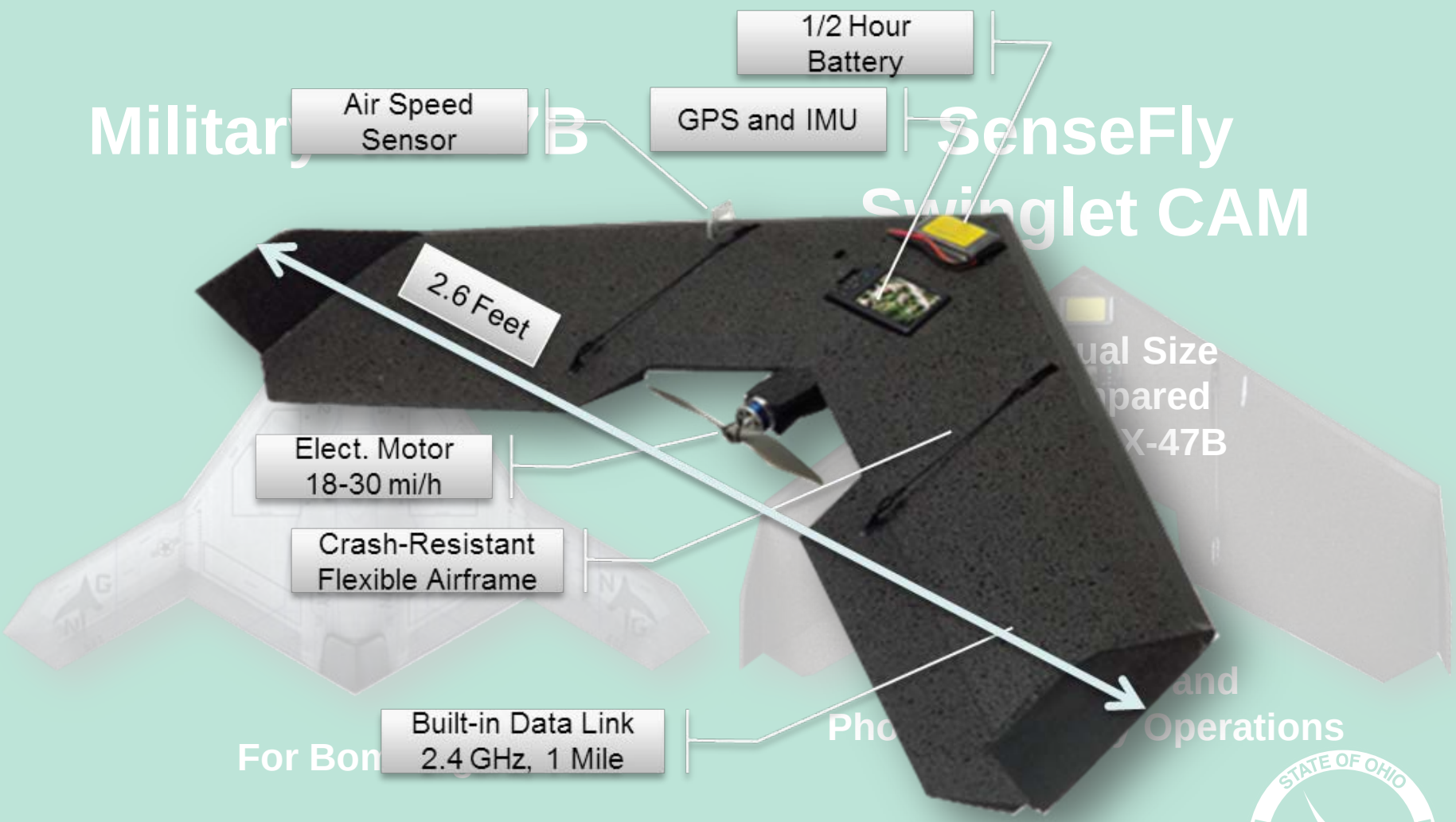
- **D-2 purchased first GPS units in 2008**
- **Currently have 7 units in field**
  - Engineers
  - Units with Training
- **Reduce Demand on Survey Department**
- **Reduce construction Costs**
  - Staking
- **Reduce Change Orders**
  - Mitigate Construction Issues Quickly
  - Profile\Sections and Cut\Fill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





UAS Implementation

UAS Implementation

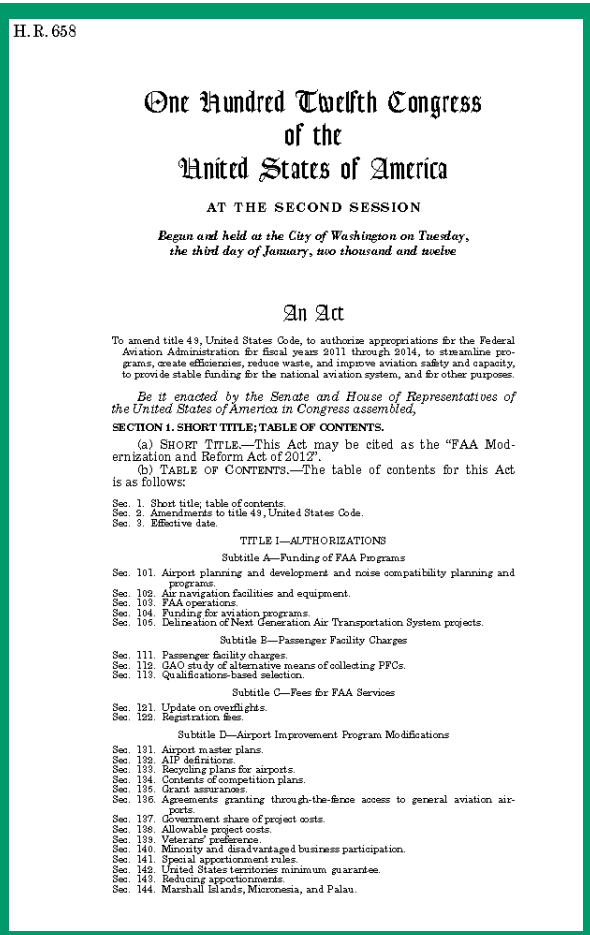


UAS Implementation

- **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



H. R. 658

One Hundred Twelfth Congress
of the
United States of America

AT THE SECOND SESSION

Begun and held at the City of Washington on Tuesday, the third day of January, two thousand and twelve

An Act

To amend title 49, United States Code, to authorize appropriations for the Federal Aviation Administration for fiscal years 2011 through 2014, to streamline programs, create efficiencies, reduce waste, and improve aviation safety and capacity, to provide stable funding for the national aviation system, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE; TABLE OF CONTENTS.

(a) SHORT TITLE.—This Act may be cited as the "FAA Modernization and Reform Act of 2012".

(b) TABLE OF CONTENTS.—The table of contents for this Act is as follows:

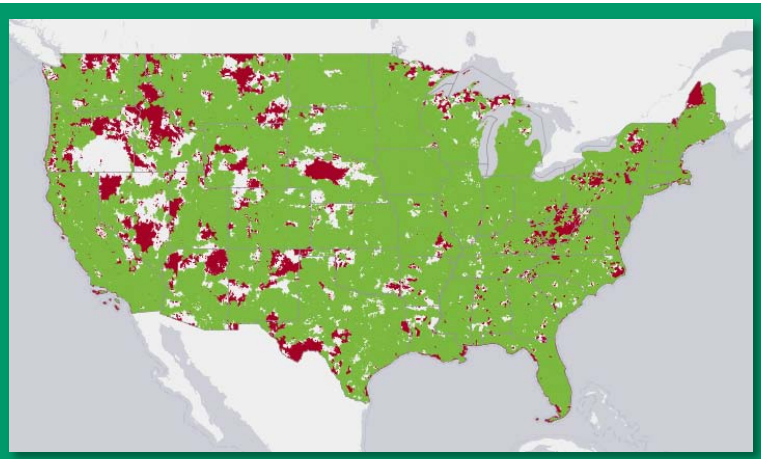
Future Asset Management Direction

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 + + 

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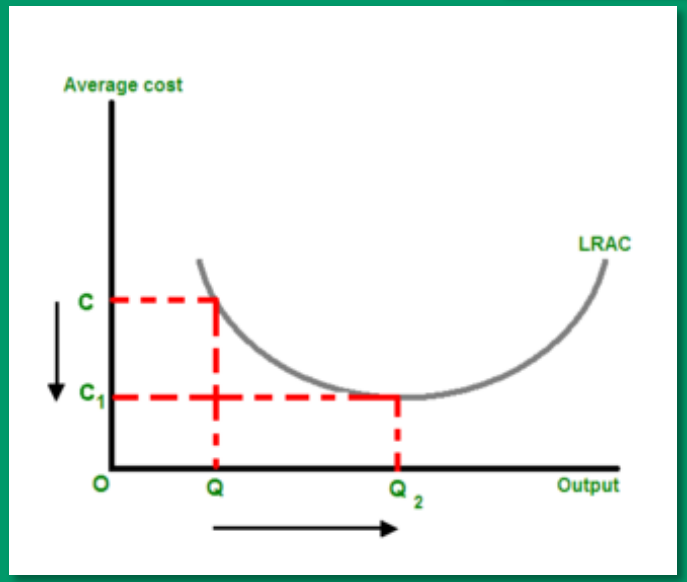


Future Asset Management Direction

- **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

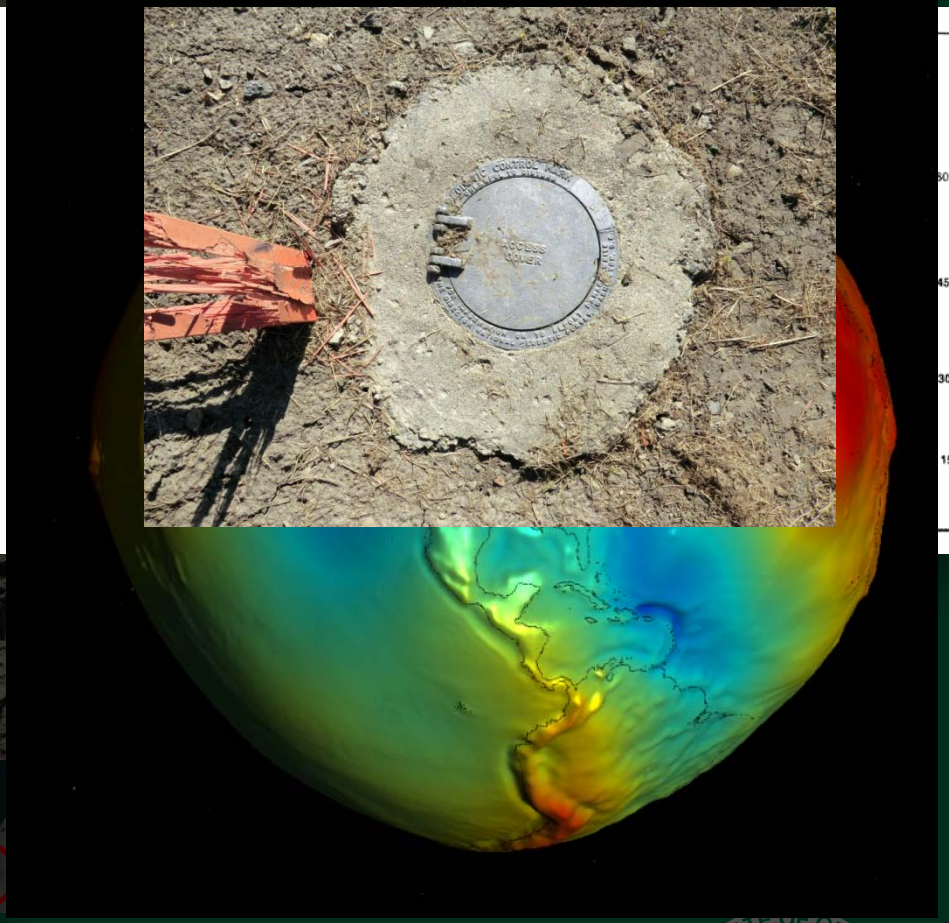
- Formed fo
  - Data
  - Docur
  - Code
- 65 Membe
- 13 DOT's
- Target Ass
  - Last A
    - Su
    - Da
- Previous T
  - New Y
  - South
  - Ohio D
  - Iowa D
  - Kentu

E-mail: Fred.Judson@dot.state.oh.us

Asset Management – Final Thought

Most Important- Complete Picture

- I-35 Federal Base Network Control Station
- Used to Measure Crustal Movement
- Establish CORS Network
- Signs Caused Multi-Path Errors In GPS Signals



Big Picture?

Ohio Department of Transportation

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Questions\Contact

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