

An aerial map of a suburban area with various roads and colored lines overlaid. The lines are yellow, orange, and red, with red circular markers along them. Road names visible include Waggon, Sumner, Black Rd, Watkins Rd, York Rd, and Outville Rd. The title text is overlaid on the map.

# ODOT's Implementation of Collector for ArcGIS

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OFFICE OF TECHNICAL SERVICES

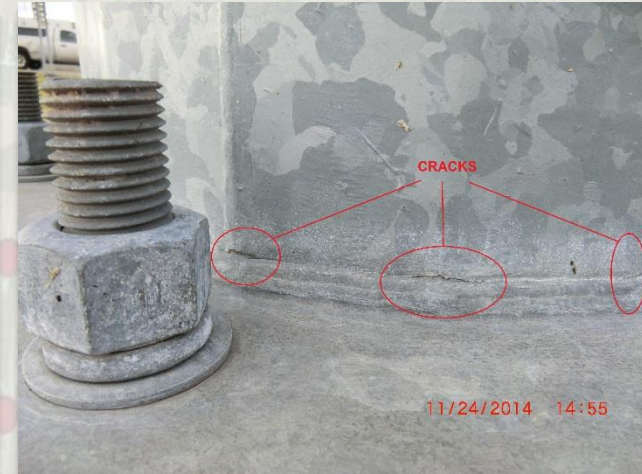
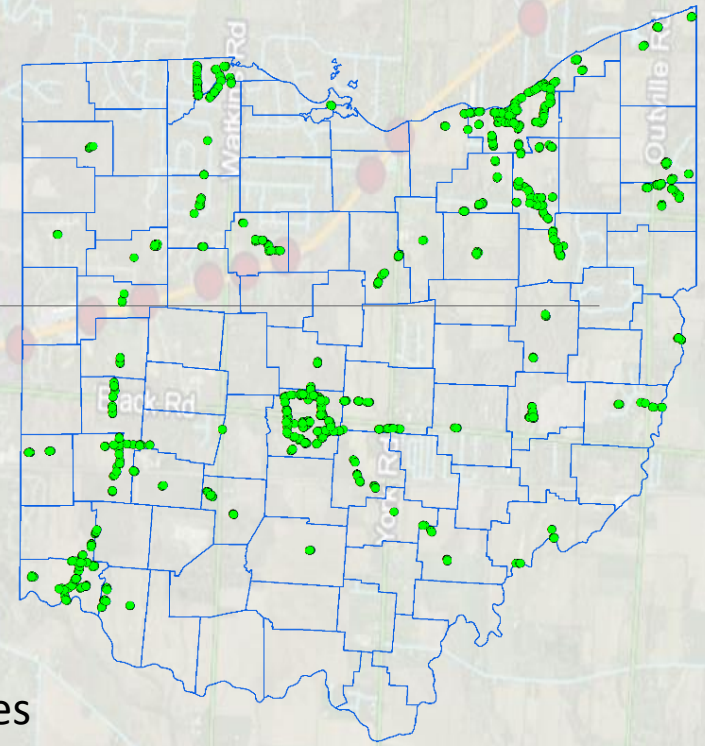
IAN KIDNER, GISP

614-752-5743 [IAN.KIDNER@DOT.OHIO.GOV](mailto:IAN.KIDNER@DOT.OHIO.GOV)

# Background

## High Mast Tower Lighting

- November 2014 – Structure failure along I-71
- Need to inventory/inspect structures statewide
- GIS team engaged to provide solution – fast!
  - Deployed in 1.5 weeks
  - 12/15/14 – 1/15/15: inventoried 5K+ structures



# Business Needs - Culverts

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- Inventory & Inspection
- Secure sign on (internal & external)
- Picture attachments (tested, but performance eliminated ability to use functionality)
- Share device across users (security & workflow challenges)
- Minimize manual data entry
- Inconsistent 4G coverage across state
  - Offline sync necessary

# Topics

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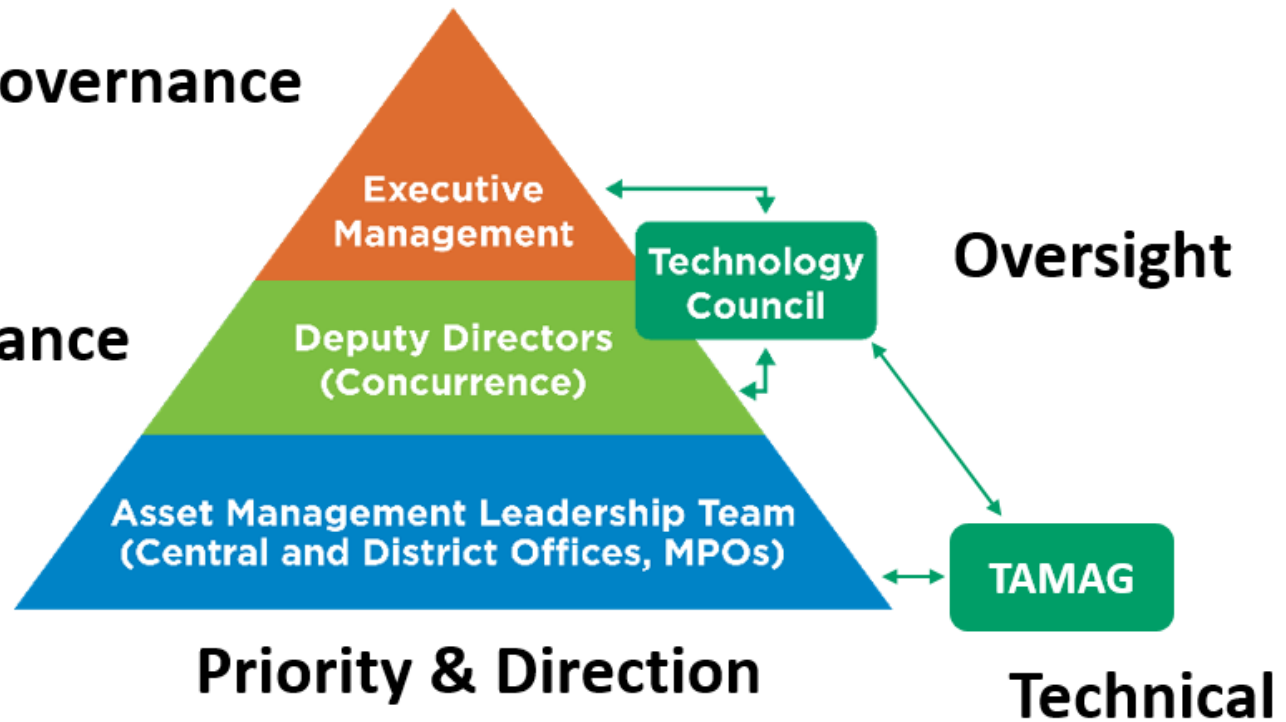
- Development Process (TAMAG and GIS Team)
- iPad Setup
- Offline Basemaps (Creating TPK files)
- ADFS Challenges
- GeoProcessing Service
- Supporting Webmapping Apps
- System Monitoring
- Collector / System Bugs
- Desired Enhancements

# Development Process

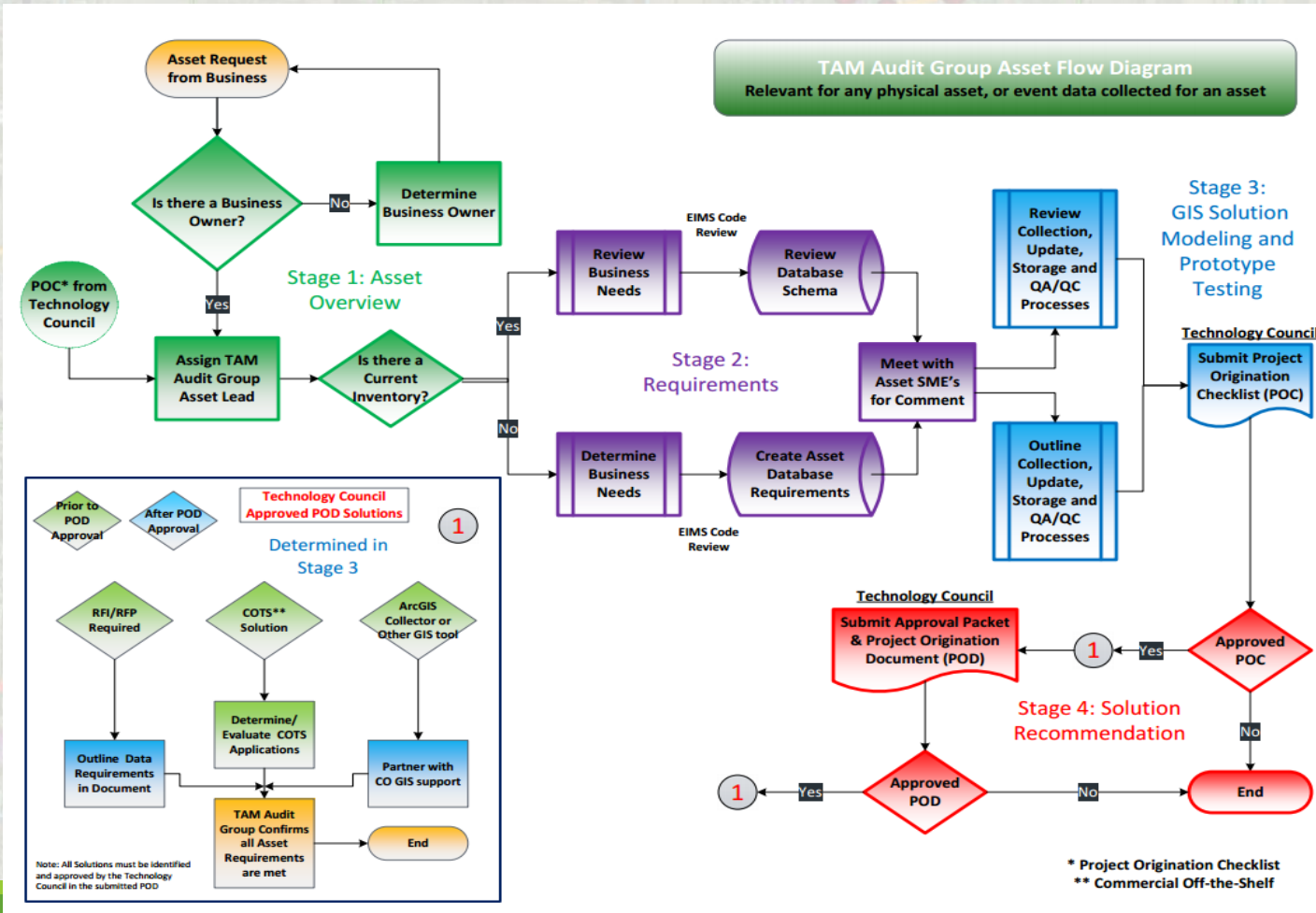
## Policy & Governance

## Guidance

## Priority & Direction



# Development Process (TAMAG)



# Development Process

Project Approved    Work Begins    Executive Scope Decision    Production Release

April 2015    June 2015    July 2015    Aug 2015    Sept 2015    Oct 2015    Nov 2015    Dec 2015    Jan 2016    Feb 2016    March 2016    April 2016    May 2016    June 2016    July 2016    Aug 2016    Sept 2016    Oct 2016

Initial System Testing

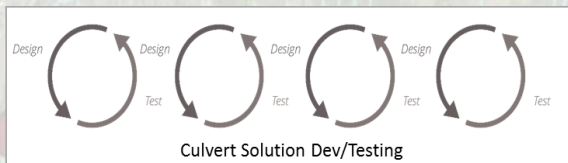
Asset Requirement Gathering

Pilot

Production Planning

Production Solution Build

Training & Rollout



*Discovered performance issues causing requirement changes & numerous instances of rebuilding the solution*

# Architecture



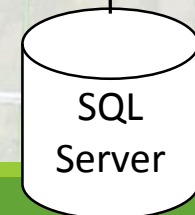
Web Server RAM doubled (to 8GB) during testing due to poor performance

Two servers  
2 Xeon CPU X5650 @2.67 GHz  
8 GB RAM



Full AGOL hosting will not facilitate easily movement of data or system integration in the future

Two servers  
1 Xeon CPU X5670 @2.93 GHz  
4 GB RAM





# Development Process (GIS Team)

## ■ Create the Prototypes in Dev

- Feature Classes
- Domains
- Relationship Classes
- Webmaps
- Webmapping Apps

## ■ In-House Testing

- Database, Geoprocessing, Collector, Webmapping Apps

## ■ UAT (User Acceptance Testing)

- Collector
- Webmapping Apps

Culvert Inventory Items

Alias	Database Field Name	Data Type	Data Input Required by User (Business)	Display in Mobile Application	Edit in Mobile Application	Display in General Viewer and QC Application	Edit in QC Application	Domain Applied	Domain Name	Default Required (ESRI Feature Edit Template)
Culvert Owner	CULVERT_OWNER	Char(1)	Y	Y	Y	Y	Y	Coded	D_CULVERT_MAINTAIN_RESPONSIBLE	Default (S)
Maintenance Responsibility	MAINTAIN_RESPONSIBLE	Char (1)	Y	Y	Y	Y	Y	Coded	D_CULVERT_MAINTAIN_RESPONSIBLE	Default (S)
Feature Intersected	FEATURE_INTERSECTED	Char (250)	N	Y	Y	Y	Y	N		
Status	STATUS	Char (1)	Y	Y	N	Y	Y	Coded	D_CULVERT_STATUS	Default (1) Active
Year Built	YEAR_BUILT	Number (4)	N	Y	Y	Y	Y	Range	D_R_L_YEAR_1900_2050	
Number of Cells	NUMBER_OF_CELLS	Number (2)	Y	Y	Y	Y	Y	Coded	D_CULVERT_NUMBER_OF_CELLS	Default (1)
Broken Back	BROKEN_BACK	Char (1)	Y	Y	Y	Y	Y	Coded	D_GENERIC_YES_NO_FIELD	Default (N)
Culvert Shape	CULVERT_SHAPE	Char (2)	Y	Y	Y	Y	Y	Coded	D_CULVERT_SHAPE	Default (1)
Culvert Material	MATERIAL	Char (2)	Y	Y	Y	Y	Y	Coded	D_CULVERT_MATERIAL	Default (1)
Span (Inches)	SPAN_INCHES	Number (3)	Y	Y	Y	Y	Y	Range	D_CULVERT_R_12_119	
Rise (Inches)	RISE_INCHES	Number (3)	Y	Y	Y	Y	Y	Range	D_R_L_INT_1(03 Digits)	
Length (Feet)	LENGTH_FEET	Number (4)	Y	Y	Y	Y	Y	Range	D_R_L_INT_1(04 Digits)	

# Development Process

Attach condition pictures (5 or more) to inspection table

- ODOT has not actually implemented in production yet



Credit: Scott Fierro GISP, Dustin Brown

esri Google pitney bowe

In [Esri Technology](#), [Government](#), [Location Intelligence](#), [Open Source](#)

## ODOT reveals workaround for using FILESTREAM & Collector with large datasets

By Scott Fierro, Dustin Brown

*In this article, experts from the Ohio Department of Transportation provide a detailed workflow example, with step by step instruction, for using FILESTREAM with Collector for ArcGIS to gather, manage and store extremely large datasets in the best ways possible for performance, management and scalability, in line with current industry best practices.*

# Equipment

- iPad Mini 4 (128GB) – 200 purchased; another 200 planned
  - 4 per county (88), 3 per district (12), 12 for training
- Accessories
  - Water resistant, drop protection cases
  - Hand strap & lanyard attachment
  - Vehicle chargers
  - Screen protectors
  - Stylus



# Equipment

- Docking Stations



# iPad Setup

- Configured using a combination of:
  - DEP ([Device Enrollment Program](#))
  - VMware [AirWatch](#)
- Load Basemap using iTunes
- Manual Settings
- Push PDFs to iBooks
  - Looking into Airwatch Content Locker



# Basemaps (TPK files)

- Created Statewide Mosaic Dataset from County Mosaics
- Generate a Local Tile Cache
- Created TPK files (12 Districts)
  - LRS (Styled and Labelled)
- We've had requests for more layers.
  - Mile Markers
  - Municipal Boundaries
  - Delivery / Device Configuration will be tricky



# Active Directory Challenges

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- Internal Active Directory
  - Employees Windows Login
- External Active Directory (ODOTONLINE)
  - Support External Vendors / Contractors
- Can we create a One Way Trust?
  - We are on the verge, but we ran out of time.
- We used ODOTONLINE ADFS
  - Employees had to request ODOTONLINE accounts
  - We had to provide a lot of support

# Geoprocessing Service

- How to generate Standard Attributes without changing Editor Tracking fields.
  - [pyodbc](#) provides direct access to SQL database.
  - Update Features using OID as Primary key
- OdotLrsTools (Server Object Extension)
  - Find Nearest Route and Log Point.
- Stored Procedure
  - on Update, the NLFID in Look-Up table to generate County and District names
- Geoprocessing Service
  - Finds Records that have been added or modified within specific number of days.
  - Runs every night

NLFID	ODOT	County	Coun	Route Type	Route Numb	Route Suffix	CTL B	STL Be	Latitude	Longitud	R-Special Designatio	CFN	CRS Des	R-Culvert Owne	R-Status	O-Yea	OBJECTI	created_u	created_date	last_edit	last_edited_date
SSANSR0005	2	SANDUSK	SAN	State Route	00053	<Null>	13.36	70.398	41.4044	-83.1018	M - Mainline	19000	SAN0005	S - State Departm	Active	2016	1900083	aclark4	10/14/2016 11:59:45	aclark4	10/14/2016 11:59:45
SERISR00002	3	ERIE	ERI	State Route	00002	<Null>	10.97	<Null>	41.3976	-82.6739	M - Mainline	19040	ERI00002	S - State Departm	Active	2016	1904037	aclark4	10/14/2016 12:00:48	aclark4	10/14/2016 12:00:48
SHURSR0010	3	HURON	HUR	State Route	00103	<Null>	7.046	76.672	41.0525	-82.6741	M - Mainline	19040	HUR0010	S - State Departm	Active	2016	1904038	aclark4	10/14/2016 12:01:04	aclark4	10/14/2016 12:01:04
SCRASR0060	3	CRAWFO	CRA	State Route	00602	<Null>	13.30	13.304	40.9443	-82.8538	M - Mainline	19000	CRA0060	S - State Departm	Active	2016	1900084	aclark4	10/14/2016 12:01:20	aclark4	10/14/2016 12:01:20
SCRASR0000	3	CRAWFO	CRA	State Route	00004	<Null>	14.68	165.88	40.8886	-82.9590	M - Mainline	19000	CRA0000	S - State Departm	Active	2016	1900085	aclark4	10/14/2016 12:01:33	aclark4	10/14/2016 12:01:33
SDELUS0002	6	DELAWA	DEL	United States	00023	<Null>	0.27	103.24	40.1406	-83.0173	M - Mainline	19000	DEL0002	S - State Departm	Active	2016	1900086	aclark4	10/14/2016 12:02:15	aclark4	10/14/2016 12:02:15
SFRAUS0002	6	FRANKLIN	FRA	United States	00023	<Null>	23.70	102.02	40.1237	-83.0161	M - Mainline	19000	FRA0002	S - State Departm	Active	2016	1900087	aclark4	10/14/2016 12:02:24	aclark4	10/14/2016 12:02:24
SFAIUS00033	5	FAIRFIEL	FAI	United States	00033	<Null>	22.16	159.66	39.6441	-82.5556	M - Mainline	19040	FAI00033	S - State Departm	Active	2016	1904039	aclark4	10/14/2016 12:02:42	aclark4	10/14/2016 12:02:42
SFAIUS00159	5	FAIRFIEL	FAI	State Route	00159	<Null>	0.794	21.149	39.5677	-82.7690	M - Mainline	19040	FAI00159	S - State Departm	Active	2016	1904040	aclark4	10/14/2016 12:02:53	aclark4	10/14/2016 12:02:53



# Supporting Web Apps

Collector Program  
Collector Program › Home

All Sites

Districts ▾ Divisions ▾ Support & Tools ▾

Libraries  
Site Pages

Lists  
Calendar  
Tasks  
Assets

Discussions  
Team Discussion

Recycle Bin  
All Site Content

## Welcome to the Collector Program Website

This site organizes all the information products associated with each asset utilizing the [ESRI Collector App](#). Each asset contains links to various webmapping applications, inventory manuals and other related documents.

### Assets

<input type="checkbox"/> Asset	Dashboard	Map Viewer	QA Map	Validation Report	Inventory Manual	Feedback
<input type="checkbox"/> BMP	BMP Dashboard	BMP Viewer	BMP Editor	BMP Validation Reports	BMP Manual	BMP Feedback
<input type="checkbox"/> Culverts	Culvert Dashboard	Culvert Viewer	Culvert Editor	Culvert Validation Reports	Culvert Manual	Culvert Feedback

[Add new item](#)

### Help Documents

Type	Title	Name	Modified	Modified By
	FAQ for Culverts	FAQ_Culverts_2016-0729	7/29/2016 10:09 AM	Anthony Clark
	Docking Station QRG	DockingStation_QRG_20160726	8/1/2016 8:06 AM	Anthony Clark
	Culverts Dev Links	Culverts Dev Links	8/11/2016 9:40 AM	Anthony Clark
	MyODOT and ArcGIS for Culverts	MyODOT_and_ArcGIS_20160812_Culverts	8/12/2016 12:46 PM	Anthony Clark
	Device Configuration for Collector	DeviceConfiguration_Collector_2016-0818	8/18/2016 3:11 PM	Anthony Clark
	Collector User Guide	Collector_User_Guide_2016-0801	8/22/2016 1:23 PM	Anthony Clark

[Add document](#)

### Contacts

Ian Kidner  
614-752-5743  
[Ian.Kidner@dot.ohio.gov](mailto:Ian.Kidner@dot.ohio.gov)

Tony Clark  
614-466-4779  
[Anthony.M.Clark@dot.ohio.gov](mailto:Anthony.M.Clark@dot.ohio.gov)

Michael Weakley  
614-644-8648  
[Michael.Weakley@dot.ohio.gov](mailto:Michael.Weakley@dot.ohio.gov)

Stephen Hale  
614-752-6921  
[Stephen.Hale@dot.ohio.gov](mailto:Stephen.Hale@dot.ohio.gov)

Matthew Thompson  
614-466-3108  
[Matt.Thompson@dot.ohio.gov](mailto:Matt.Thompson@dot.ohio.gov)

Links to different applications

# Supporting Web Apps Viewer – WebApp Builder

**Culvert Inventory Viewer**

**Query**

Click one of the following task items to execute the query.

- Inventory - Created >
- Inspection - Created >
- Inventory Modifications - Created >
- Inventory - Edited >
- Inspection - Edited >
- Inventory Modifications - Edited >

Clear Results

**Layer List**

Operational Layers

- Culvert Inventory
- Reference
- Culvert Inspection
- Culvert Inventory Modifications

Options | Filter by Map Extent | Zoom to | Clear Selection | Refresh

Culvert Inventory

NLFID	ODOT District	County	County CD	Route Type	Route Number	Route Suffix	CTL Begin Number	STL Begin Number	Latitude DD Begin	Longitude DD Begin	R-Special Designation (Formally Road ID)	Culvert File Number (CFN)	Old Culvert File Number	
SFRAIR00270**6		FRANKLIN	FRA	Interstate	00270		32.817		40.049611	-82.901635	M - Mainline	1799710	252700064	F
SFRAIR00270**6		FRANKLIN	FRA	Interstate	00270		32.618		40.052552	-82.901763	M - Mainline	1799711	252700069	F

2606 features 0 selected

# Supporting Web Apps Editor – Flex App Builder

**Culvert Editor**  
Inventory, Inspection and Inventory Modification

Basemap

**Layer List**

Layer Visibility

- Check Geometry
- Statewide
- D01
- D02
- D03
- D04
- D05
- D06
- D07

**Edit**

Select template to create feature

- Check Geometry
- Statewide
- D01
- D02
- D03

Culvert Inventory

50 km 40 mi

Latitude: 40.774297 Longitude: -84.954673

POWERED BY **esri**

Attribute Table

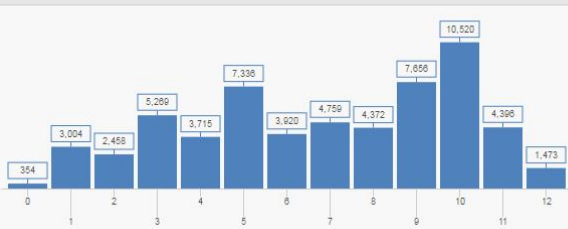
Check Geometry													Table Options	
R-Special Designati...	R-Maintenance ...	O-Feature Intersected			R-Culver...	R-Culvert Material	R...	R...	R-Le...		O...	R...	R-Inlet End Treatment	
RR - Ramp to the Right	C - County Agency	Springfield - Urbana Pike		1	1 - Circular	1 - Plain or Reinforced Concrete	24.00	24.00	212.00		1.00	0.00	2 - Half Height Concrete Headwa	
M - Mainline	S - State Department of		1	1	1 - Circular	1 - Plain or Reinforced Concrete	30.00	30.00	178.00		0.40	0.00	2 - Half Height Concrete Headwa	
M - Mainline	S - State Department of		1	1	1 - Circular	1 - Plain or Reinforced Concrete	48.00	48.00	475.00		0.50	0.00	1 - Full Height Concrete Headwal	
RR - Ramp to the Right	S - State Department of	RAMP H GORE TO RESI AREA EB	1	1	1 - Circular	1 - Plain or Reinforced Concrete	84.00	84.00	344.00	/		20.0	2 - Half Height Concrete Headwa	
RL - Ramp to the Left	S - State Department of	RAMP FROM 4 + 36 TO 33 E	1	1	1 - Circular	2 - Corrugated Metal, Pipe (Shape Code 1)	36.00	36.00	154.00	G 1 0		0.00	2 - Half Height Concrete Headwa	

# Supporting Web Apps Operations Dashboard

## Culvert Inventory Dashboard

Ohio Department of Transportation

### Total Culverts and Storm Sewers >=36"



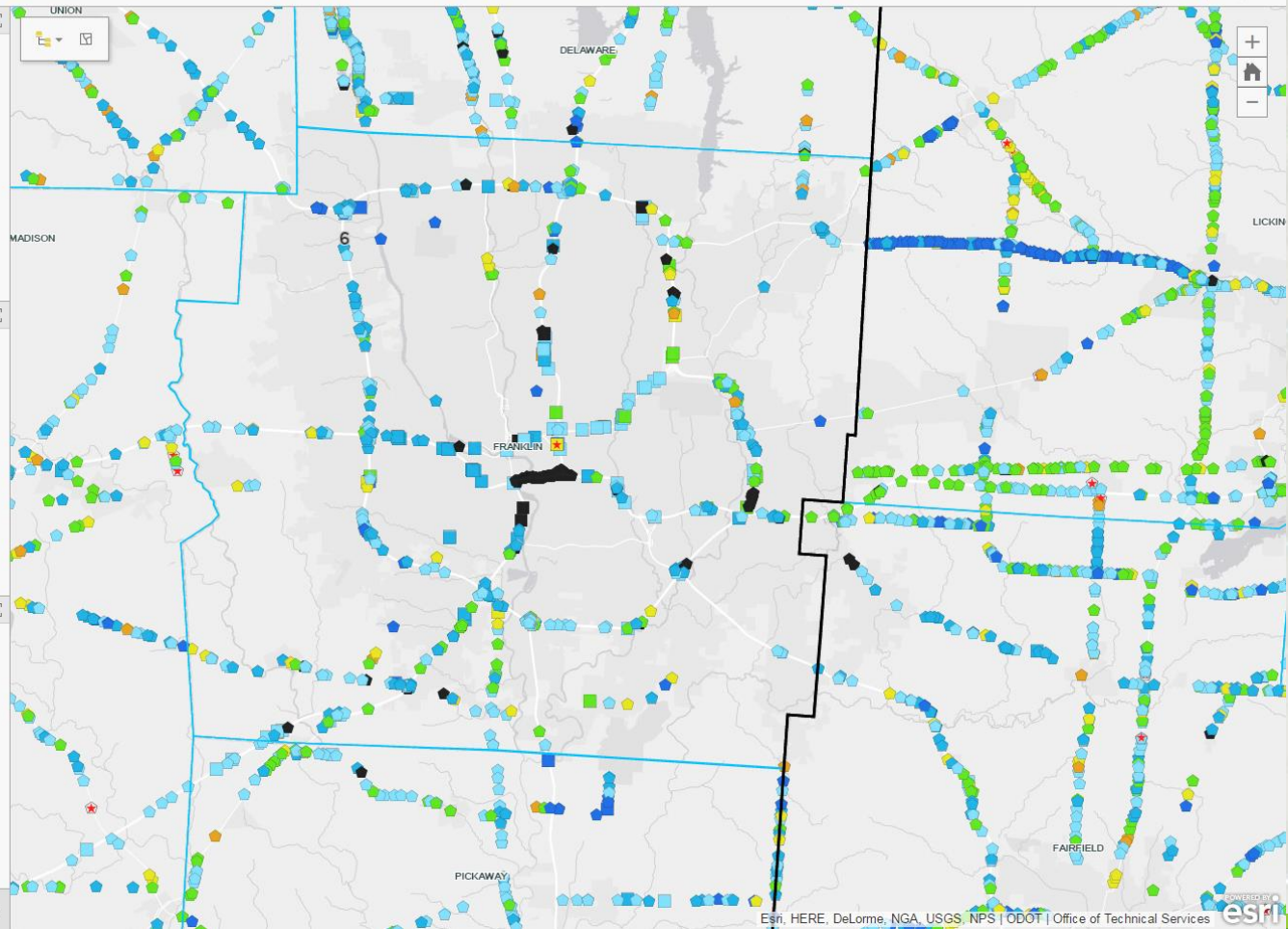
per District

### Total Culverts

**56,488**

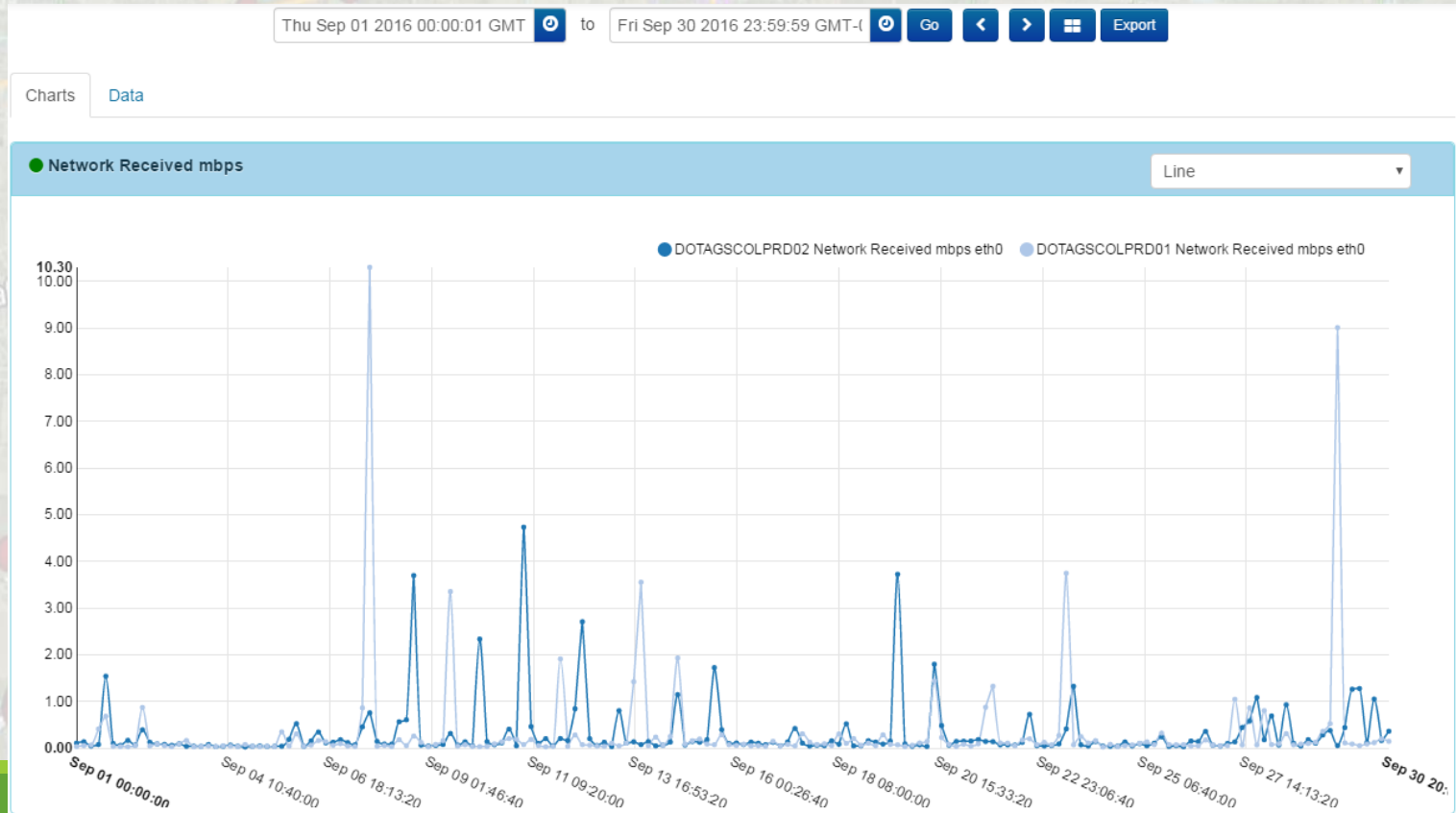
### Total Storm Sewers >=36"

**2,744**



# System Monitoring

- ESRI System Monitor v1.1.6
  - Generate Log Collectors are set for each Host and Process



# Usage

- Trained 250+ individuals
  - 30 active users now
  - Most culvert inspections occur Dec – March
- 700+ inventories/inspection to date

OID	last_edited_user	Count_last_edited_user
19	mbutler5	153
25	rtownsen	126
0	brike	64
7	dnovotny1	53
30	tthomps1	50
1	bworkman	33
9	jboohar2	33
4	dhoops1	25
17	lmincek2	23
8	dyacchar1	20
18	lpembert	17
13	jreel	15
15	Jreising1	15
5	Dhoops1	14
26	seagle1	13
31	wbenning2	11
27	slentz1	7
29	tmathews2	7
10	Jburton	6
14	jreising1	5
20	mmccole1	4
3	claughre1	3
12	jmiller19	3
2	cfierbau2	2
6	dkraz11	2
16	jsmith20	2
23	mretta2	2
24	rkinzer1	2
28	tmahon1	2
11	jmeyer5	1
21	morndorf1	1
22	mratliff1	1

# Bugs / Enhancements

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## ■ Bugs

- Collector Sync Error
  - GUID Error / Replica Database
- Collector Search Results
  - Can't Add a New Related Record from Feature Details

## ■ To Do

- Upgrade to ArcGIS Server 10.4 (or 10.5)
  - Collector can Download Offline Maps without downloading Attachments
- Create Passthrough so Internal AD works with External

## ■ Wishlist

- Smart Forms similar to Survey123
  - Required Fields
  - Skip Logic
- Search Multiple Fields in Same Layer