

A nighttime photograph of a city skyline, likely Pittsburgh, with several bridges spanning a river. The city lights are reflected in the water. The image has a blue tint.

North Jersey Transportation Planning Authority

Asset Management Data Model

11th National Conference on Transportation Asset Management

Minneapolis, Minnesota

July 12, 2016

Agenda

1. Brief Description of Client and Stakeholders
2. Overview of Project Goals
3. Summary of Project Tasks
4. Overview of the Project Workflow
5. Tools and Technology



NJTPA Regional Transportation System

Road Network:

- 147 million vehicle miles each day
- 26,000 miles of roads, including 177 miles of toll roads
- 4,800 bridges

Transit Network:

- 732,000 trips daily
- 13% of commuters ride transit
- 250 bus routes
- Commuter rail: 390 miles of track, 150 stations

Population:

- 8,938,174 (NJ-Statewide)
- 6,722,270 (NJTPA Region)
- 75% of total

NJTPA Region

Bergen

Essex

Hudson

Hunterdon

Jersey City

Middlesex

Monmouth

Morris

Newark

Ocean

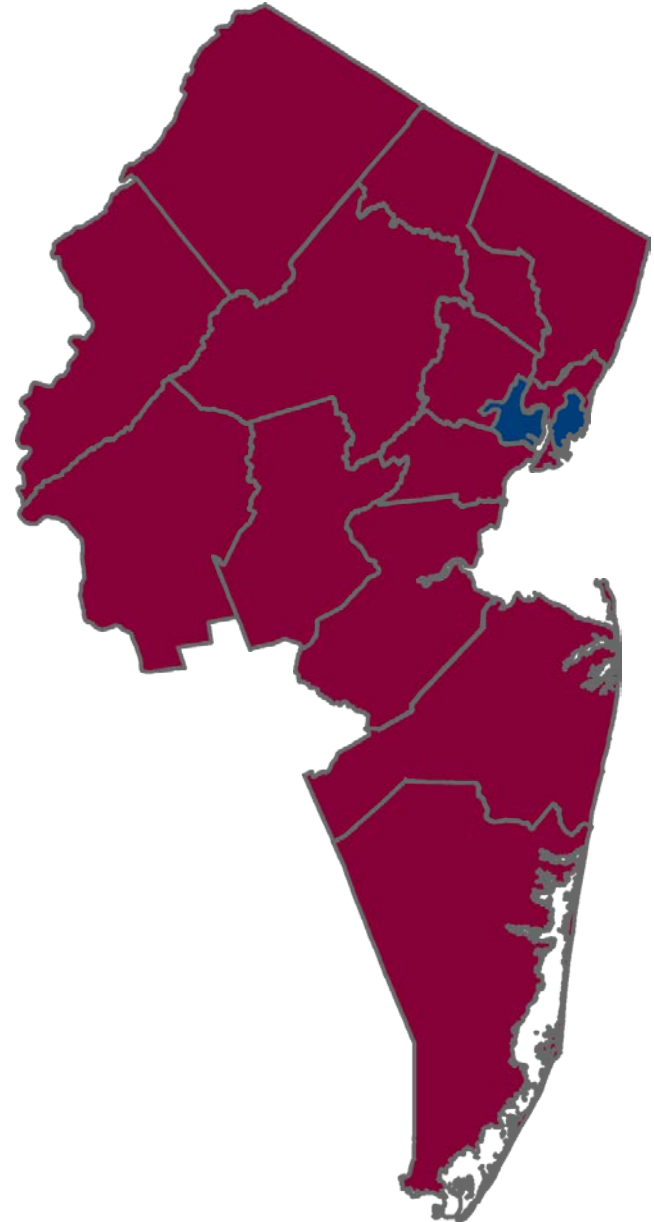
Passaic

Somerset

Sussex

Union

Warren



North Jersey Transportation Planning Authority

The Metropolitan Planning Organization for Northern New Jersey



STANDING COMMITTEES

Planning & Economic Development Committee

Project Prioritization Committee

Freight Initiative Committee

Regional Transportation Advisory Committee



Primary Project Goals

1. To develop a system and process to access key asset data from within the 13 county sub regions
2. To develop a **unified data model** that transformed the individual county asset data layers into a singular (region wide) dataset
3. To develop a reporting tool set that would support Federal MAP-21 Reporting Requirements

Project Tasks

Task 1: Data Gathering and Assessment

Task 2: Design Data Model

Task 3: Deploy and Refine Model

Task 4: Report/Document/ Training

Frequent TAC meetings to provide progress and solicit feedback

Project Tasks

Task 1: Data Gathering and Assessment

- Started with a Vision Survey
- Gathered approximately 91 datasets (13x7)
 - ✓ Bridge
 - ✓ Pavement
 - ✓ Signs
 - ✓ Signals
 - ✓ Inlets
 - ✓ Outfalls
 - ✓ Guiderails
- Published the data to ArcGIS Online

Identified County Data Sets

	Pavement	Bridges	Signs	Guiderail	Inlets	Outfalls	Signals
Bergen County		X	X	X			X
Essex County			X			X	
Hudson County			X				X
Hunterdon County		X	X		X	X	
Middlesex County		X	X		X	X	X
Monmouth County		X	X	X	X		X
Morris County		X	X		X	X	
Ocean County		X	X	X	X	X	X
Passaic County		X	X		X		
Somerset County		X	X		X	X	X
Sussex County	X	X	X	X	X	X	X
Union County	X	X	X				
Warren County			X				

LEGEND

	County data submitted and consolidated to geodatabase
X	Denotes originally identified as available data source by County

NOTE: Pavement and bridge data provided by NJDOT

Project Tasks

Task 2: Design Data Model

- Performed a detailed review of the existing data
 - ✓ *Type, format, quality, attributes, domains, commonalities, etc.*
- Design of unified AMDM schema
- Design and development of ETL scripts

NJTPA Asset Management Data Model Logical Data Diagram for the Unified Model

SIGN	
PK	OBJECTID
GLOBAL_ID	
SHAPE	
BACKGROUND_COLOR	
BARCODE_ID	
BREAKAWAY	
BREAKAWAY_TYPE	
COUNTY_NAME	
COUNTY_CODE	
COUNTY_SIGN_ID	
DATA_SRC	
FOUNDATION	
HEIGHT	
INSTALL_DATE	
INVENTORY_DATE	
LAST_INSPECTION_DATE	
LATITUDE	
LONGITUDE	
MAINT_FUND_SOURCE	
MAINTAINER	
MILEPOST	
MOUNTING_HEIGHT	
MUNICIPALITY	
MUTCD_DESIGNATION	
NJTPA_ASSET_ID	
NOTES	
OWNER	
RETRO_READING_NIGHT	
RETRO_READING_DAY	
RETRO_READING_BACKGROUND	
RETRO_STATUS	
ROAD_NAME	
ROAD_POSITION	
ROUTE_DIRECTION	
ROUTE_NAME	
SHEETING_MATERIAL	
SIGN_CONDITION	
SIGN_DIRECTION	
SIGN_OFFSET	
SIGN_SIZE	
SIGN_TEXT	
SIGN_TYPE	
SRI	
SUPPORT_CONDITION	
SUPPORT_ID	
SUPPORT_MATERIAL	
SUPPORT_TYPE	
TEXT_COLOR	
TRAVEL_DIRECTION	
WIDTH	

SIGNAL	
PK	OBJECTID
GLOBAL_ID	
SHAPE	
CONTROLLER_PRESENT	
CONTROLLER_TYPE	
COUNTY_CODE	
COUNTY_NAME	
COUNTY_SIGNAL_ID	
CROSS_STREET	
DATA_SRC	
DETECTOR_PRESENT	
HEAD_AGE	
HEAD_CONDITION	
HEAD_TYPE	
LATITUDE	
LONGITUDE	
MAINT_FUND_SOURCE	
MAINTAINER	
MILEPOST	
MUNICIPALITY	
NJTPA_ASSET_ID	
NOTES	
OWNER	
POLE_CONDITION	
POLE_TYPE	
POSTED_SPEED	
QUEUE	
ROAD_NAME	
ROUTE_NAME	
SIGNAL_CONDITION	
SIGNAL_TYPE	
SRI	

BRIDGE	
PK	OBJECTID
GLOBAL_ID	
SHAPE	
AADT	
AADT_YEAR	
COUNTY_CODE	
COUNTY_NAME	
DATA_SRC	
DECK_CONDITION	
DECK_MAINT_DATE	
DECK_TYPE	
DECK_AREA	
FEAT_INTERSECT	
DRAINAGE	
LATITUDE	
LENGTH	
LONGITUDE	
MAINT_FUND_SOURCE	
MAINTAINER	
MILEPOST	
MUNICIPALITY	
NBIS_NUM	
NHS_STATUS	
NJTPA_ASSET_ID	
NOTES	
NUM_SPAN	
OWNER	
ROAD_NAME	
ROUTE_NAME	
SCOUR_INSPECTION_DATE	
SERVICE_STATUS	
SRI	
STATE_BRIDGE_ID	
STRUCT_DEFICIENT	
SUB_CONDITION	
SUBSTR_MAINTENANCE_DATE	
SUFF_RATING	
SUPER_CONDITION	
WIDTH_CC	
WIDTH_OO	
YEAR_BUILT	
YEAR_RECON	

Source attribute data to be provided from NJDOT (PONTIS or other State system where available) except where noted in bold

PAVEMENT	
PK	OBJECTID
GLOBAL_ID	
SHAPE	
AADT	
AADT_YEAR	
COUNTY_CODE	
COUNTY_NAME	
DATA_SRC	
FROM_MP	
FUNCTIONAL_CLASS	
LAST_MAINT_DATE	
LAST_MAINT_PERF	
MAINT_FUND_SOURCE	
MAINTAINER	
MUNICIPALITY	
NHS_STATUS	
NJTPA_ASSET_ID	
NOTES	
NUMBER_LANES	
IRI_COND	
STATE_PAVEMENT_ID	
OWNER	
PCI	
ROAD_NAME	
ROUTE_NAME	
SEGMENT_LENGTH	
SHAPE.STLength	
SRI	
SURF_TYPE	
TO_MP	

Source attribute data to be provided from NJDOT (HPMS or other State system where available) except where noted in bold

OUTFALL	
PK	OBJECTID
GLOBAL_ID	
SHAPE	
CONDITION	
CONSTRUCT_DATE	
COUNTY_CODE	
COUNTY_NAME	
COUNTY_OUTFALL_ID	
DATA_SRC	
EMPTYES INTO	
EROSION	
LAST_INSPECTION	
LATITUDE	
LONGITUDE	
MAINT_FUND_SOURCE	
MAINTAINER	
MILEPOST	
MUNICIPALITY	
NJTPA_ASSET_ID	
NOTES	
OUTFALL_MATERIAL	
OUTFALL_TYPE	
OWNER	
PIPE_DIAMETER	
PIPE_TYPE	
RECEIVES	
REHAB_DATE	
ROAD_NAME	
ROUTE_NAME	
SCOURED	
SRI	

INLET	
PK	OBJECTID
GLOBAL_ID	
SHAPE	
BIKE_SAFE	
CONDITION	
COUNTY_CODE	
COUNTY_INLET_ID	
COUNTY_NAME	
CURBED	
DATA_SRC	
DEPTH	
DRY_WEATHER_FLOW	
FRAME_MATERIAL	
GRATE_SIZE	
GRATE_TYPE	
INLET_TYPE	
LABEL	
LAST_INSPECTION	
LATITUDE	
LONGITUDE	
MAINT_FUND_SOURCE	
MAINTAINER	
MILEPOST	
MUNICIPALITY	
NJTPA_ASSET_ID	
NOTES	
OWNER	
RECEIVING	
RIM_ELEVATION	
ROAD_NAME	
ROUTE_NAME	
SRI	

GUIDERAIL	
PK	OBJECTID
GLOBAL_ID	
SHAPE	
BEGIN_OFFSET	
CLEAR_ZONE	
CONDITION	
COUNTY_CODE	
COUNTY_GUIDERAIL_ID	
COUNTY_NAME	
DATA_SRC	
END_OFFSET	
END_TREAT_TYPE	
FROM_MP	
GUIDERAIL_TYPE	
INSTALL_DATE	
LENGTH	
MAINT_FUND_SOURCE	
MAINTAINER	
MUNICIPALITY	
NJTPA_ASSET_ID	
NOTES	
OWNER	
POLE_SPACE	
ROAD_NAME	
ROUTE_DIRECTION	
ROUTE_NAME	
SHAPE.STLength	
SRI	
START_TREAT_TYPE	
TO_MP	

LEGEND

- Denotes County submitted data sources
Note: County data may not include attributes for all fields
- NJDOT data sources

NOTES:

Field values for County-level tables (non-State) were derived from the following three sources:
1: NJTPA SIGN SCHEMA
2: SUB-REGION COUNTY DATA (Submitted)
3: NJTPA VISION QUESTIONS

Date of last update: March 16, 2015

Project Tasks

Task 3: Deploy and Refine Model

- On-site installation
 - *Populated unified geodatabase*
 - *ETL scripts*
 - *Scheduled task*

Project Tasks

Task 4: Report/Document/Training

- System Requirements
- Implementation Plan
- Reporting tools
- User Manuals
- Conduct On-Site Training Sessions

Overview of Project Workflow

Workflow Steps:

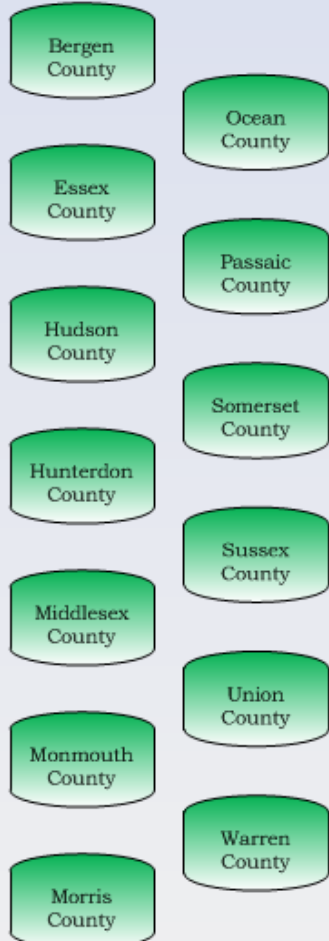
- Step 1 Acquisition of data from county sub-regions
- Step 2 Consolidation of county sub region data into file GDB's
- Step 3 Publishing of county-level feature services to NJTPA's AGO
- Step 4 Development of unified schema and geodatabase model
- Step 5 Development of ETL data migration scripts
- Step 6 Migration of county-level feature services to unified GBD
- Step 7 Deployment of unified GDB and ETL to NJTPA
- Step 8 Deployment of reporting tools to NJTPA
- Step 9 Publishing of unified feature services to NJTPA AGO

Project Workflow (9) Step Program

STEP 1:

Acquisition of relevant county data

13 County Sub Regions



Data included spreadsheets, shapefiles, PDF's, etc.

Data uploaded to Secure SharePoint Site by Counties

STEP 2:

Consolidation of County Data

Data downloaded from SharePoint site by Project Team

Data compiled into County-Level Geodatabases

STEP 4:

Development of unified schema and geodatabase model

STEP 5:

Development of ETL data migration scripts

STEP 6:

Migration of county-level feature services (from AGO) to unified geodatabase

STEP 3:
Publish county-level feature services

NJTPA ArcGIS Online County-Level

Same NJTPA AGO Account (Org)

NJTPA ArcGIS Online Regional-Level

Step 6 output

Populated Unified Geodatabase in Baker Development Environment (ALPHA)

STEP 7:

Deploy populated unified geodatabase and ETL scripts to NJTPA's server

Step 7 output

Populated Unified Geodatabase in NJTPA/EGIS Environment (BETA/FINAL)

Step 6 output

Step 7 input

STEP 8:

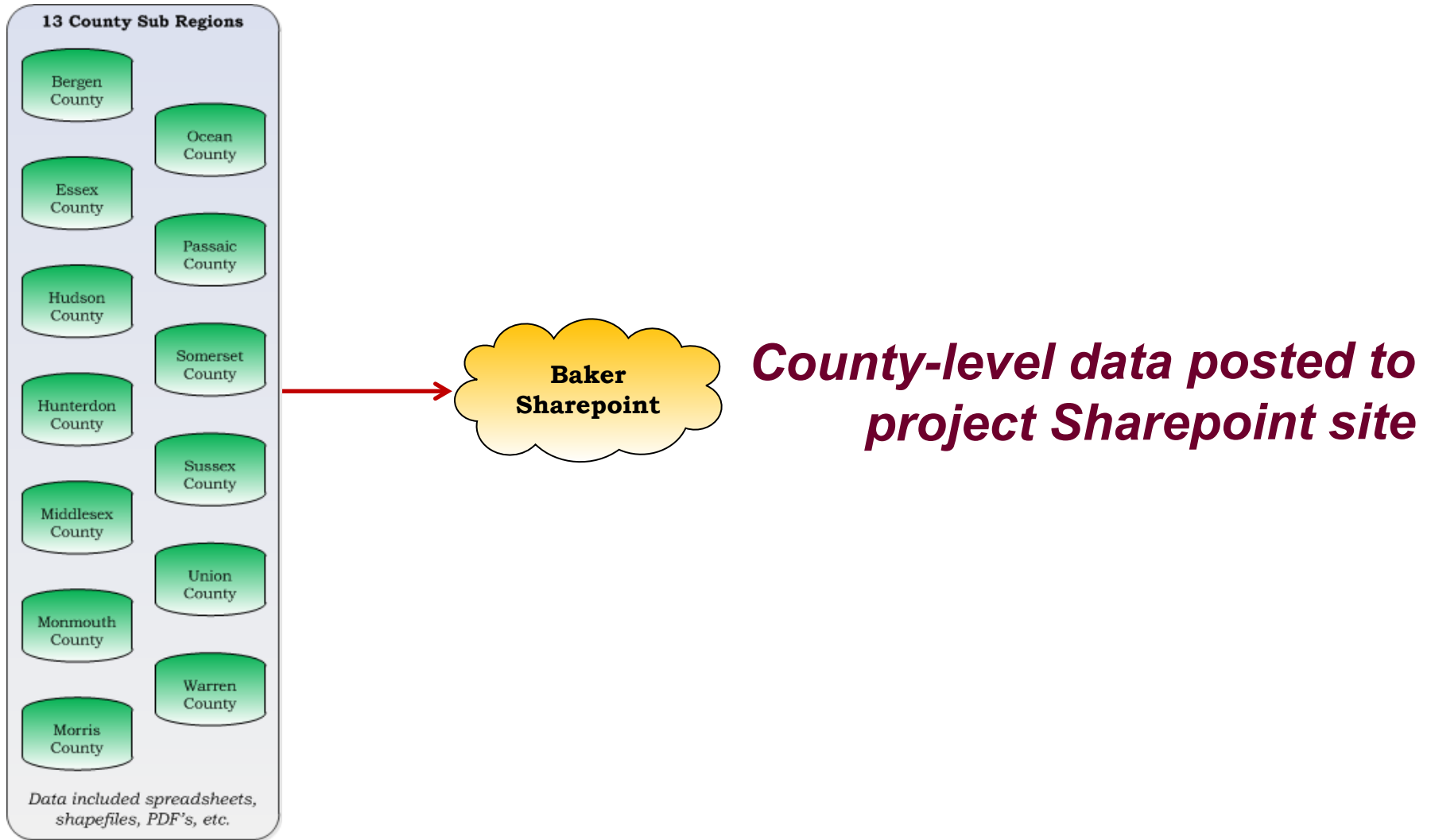
Deployment of reporting tools

STEP 9:
Feature services published to AGO (from NJTPA ArcGIS Server)

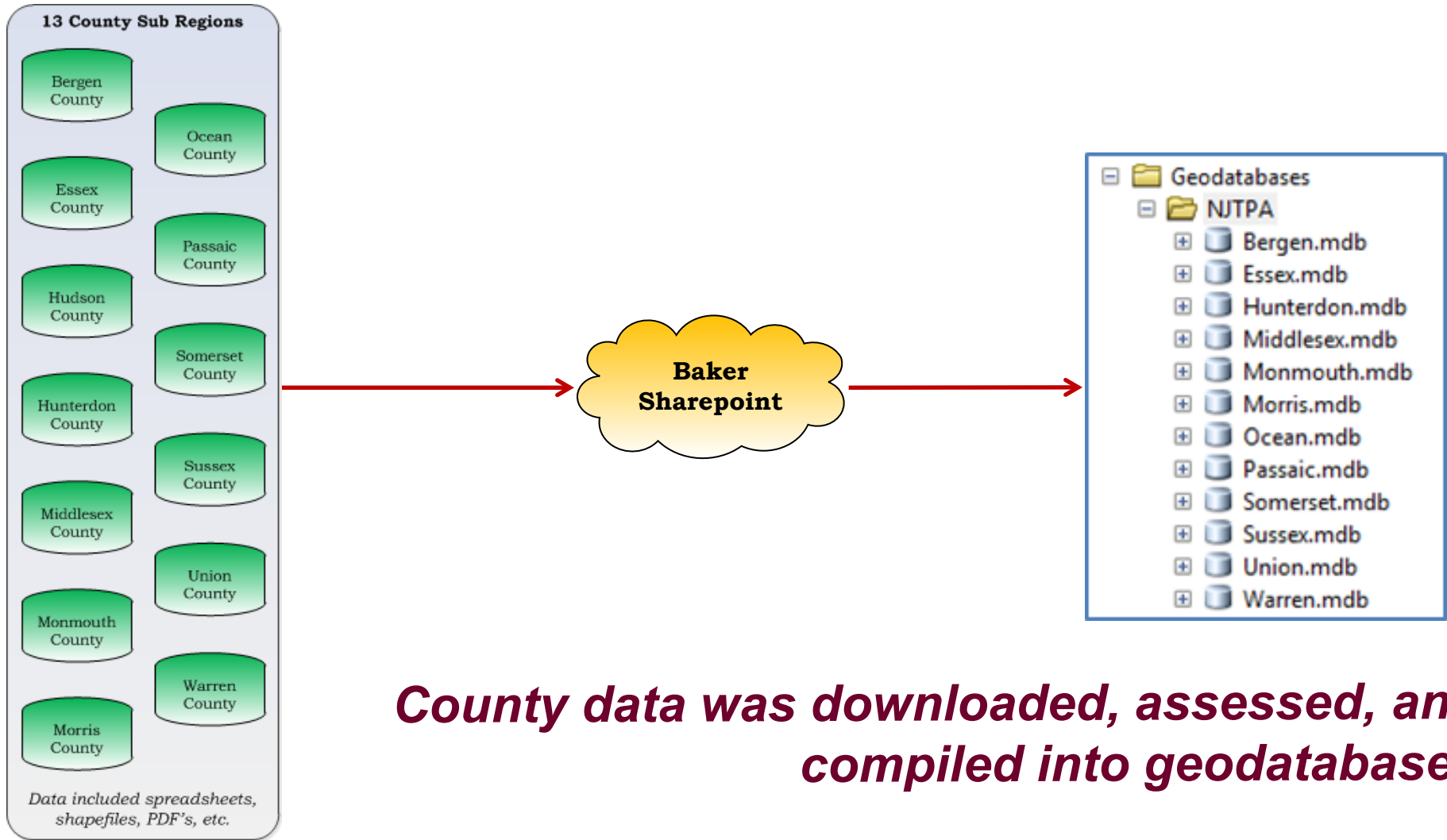
Workflow Steps:

- Step 1. Acquisition of relevant data from NJTPA county sub-regions
- Step 2. Consolidation of county sub region data into file geodatabases
- Step 3. Publishing of county-level feature services to NJTPA's AGO Organization
- Step 4. Development of unified schema and geodatabase model
- Step 5. Development of ETL data migration scripts
- Step 6. Migration of county-level feature services to unified geodatabase
- Step 7. Deploy populated unified geodatabase and ETL scripts to NJTPA's server (Alpha)
- Step 8. Deployment of the reporting tools to NJTPA's server (Beta Version)
- Step 9. Publishing of regional level feature services to NJTPA ArcGIS Online Org

Project Workflow Process

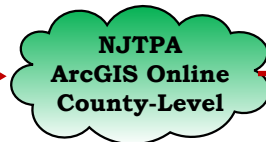
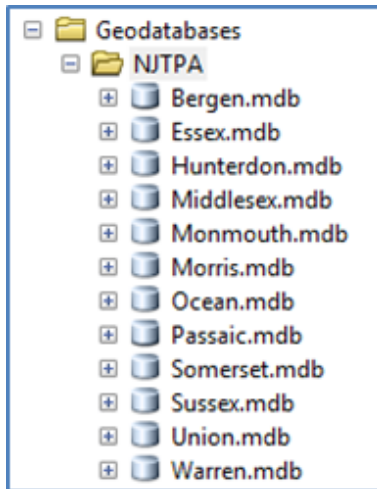


Project Workflow Process



County data was downloaded, assessed, and compiled into geodatabases

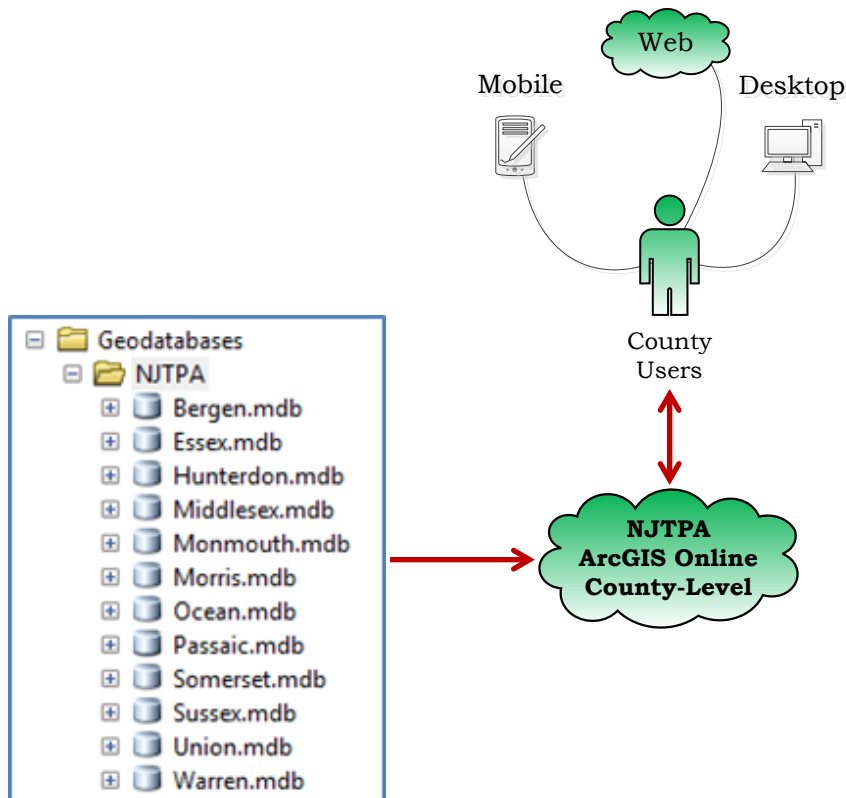
Project Workflow Process



Title	Type	Modified	Shared
Bergen County Assets	Web Map	Oct 23, 2014	Organization
Bergen_County_Assets	Feature Layer	Jul 15, 2014	Organization
Bergen_County_Assets	Service Definition	Jul 15, 2014	Organization
Bergen_County_Assets	Shapefile	Aug 8, 2014	Organization
Essex County Assets-Copy	Web Map	Jul 21, 2014	Organization
Essex_County_Assets	Service Definition	Jul 15, 2014	Organization
Essex_County_Assets	Feature Layer	Jul 21, 2014	Organization
Hunterdon County Assets	Web Map	Jul 21, 2014	Organization
Hunterdon_County_Assets	Feature Layer	Jul 15, 2014	Organization
Hunterdon_County_Assets	Service Definition	Jul 15, 2014	Organization
Middlesex_County_Assets	Feature Layer	Jul 15, 2014	Organization
Middlesex_County_Assets	Service Definition	Jul 15, 2014	Organization
Middlesex_County_Assets	Web Map	Jul 22, 2014	Organization
Monmouth_County_Assets	Service Definition	Jul 15, 2014	Organization
Monmouth_County_Assets	Feature Layer	Jul 15, 2014	Organization
Monmouth_County_Assets	Web Map	Jul 15, 2014	Organization
Morris_County_Assets	Web Map	Jul 15, 2014	Organization
Morris_County_Assets	Feature Layer	Jul 15, 2014	Organization
Morris_County_Assets	Service Definition	Jul 15, 2014	Organization
NJTPA Regional Web Map	Web Map	Jul 15, 2014	Organization

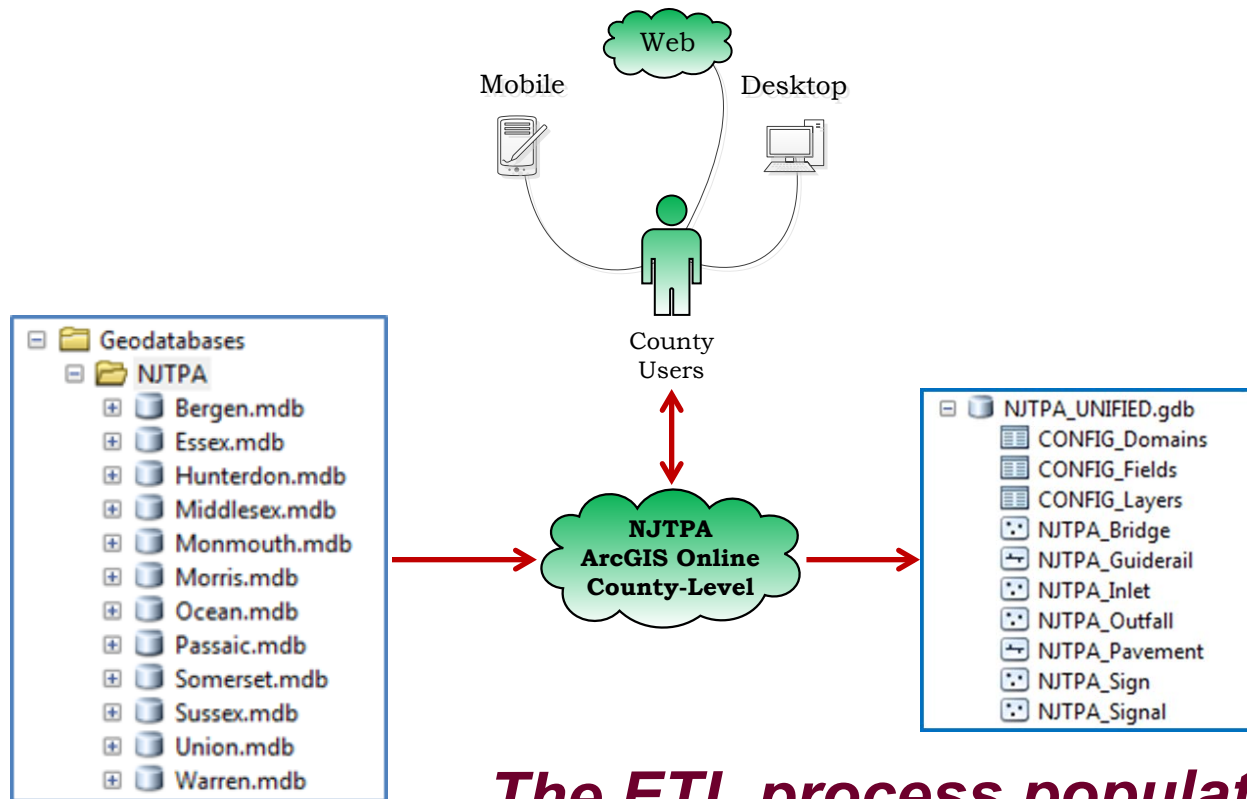
***Publish Individual County-Level Geo-databases into
NJTPA ArcGIS Online Organization***

Project Workflow Process



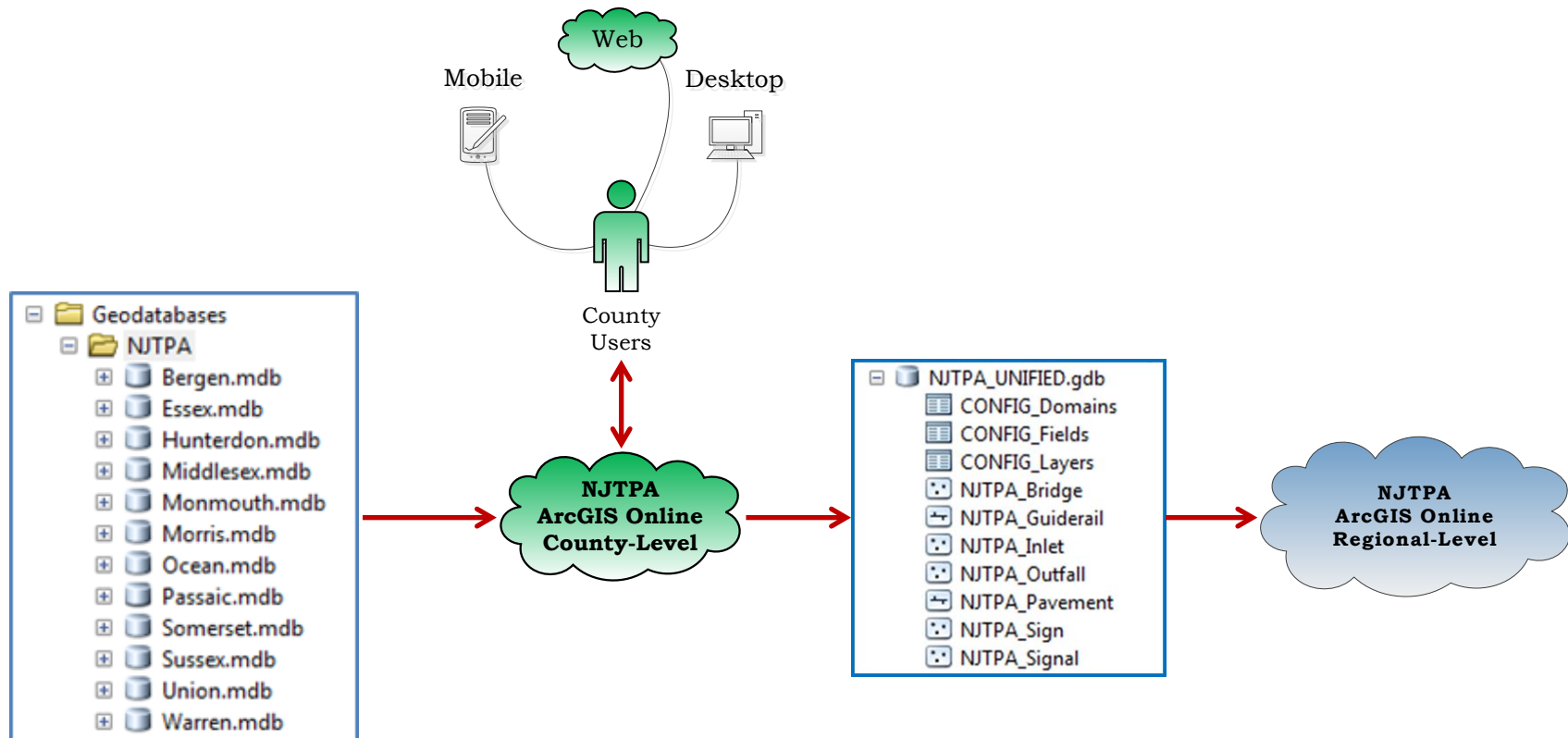
County Users have access to the feature services in AGO

Project Workflow Process



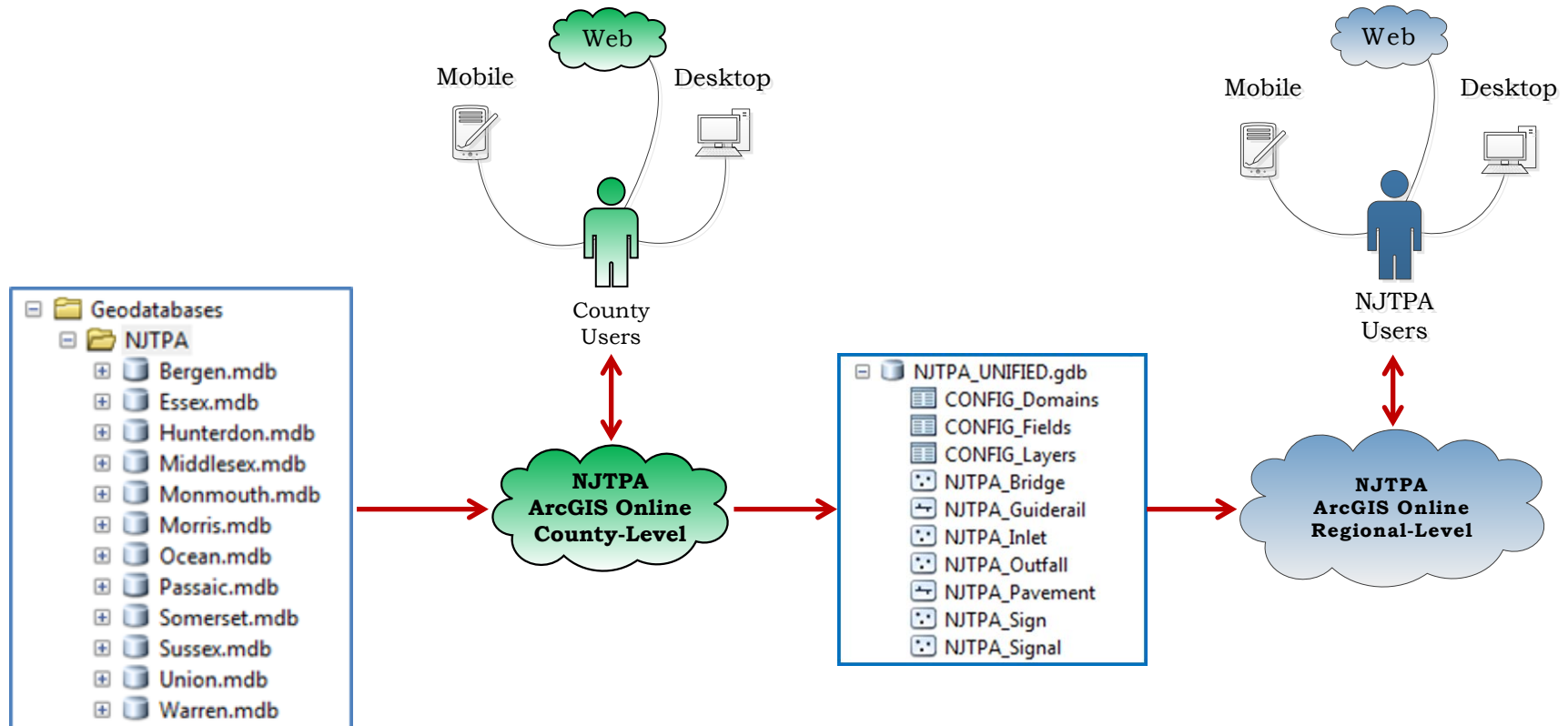
The ETL process populates the unified data model (ArcSDE) with current information. Scheduled to run on a periodic basis

Project Workflow Process



Feature services from unified model were published into NJTPA AGO

Project Workflow Process



NJTPA staff have access to the asset data via AGO

NJTPA ArcGIS Online Organization



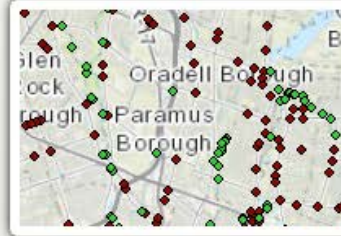
NJTPA Featured Content



Accessibility



Base Map



Bergen_County_Assets



Bergen_County_Assets

The NJTPA is the federally authorized Metropolitan Planning Organization for 6.6 million people in the 13-county northern New Jersey region. Each year, the NJTPA oversees more than \$2 billion in transportation improvement projects and provides a forum for interagency cooperation and public input. It also sponsors and conducts studies, assists county planning agencies and monitors compliance with national air quality goals.

Reporting Tool

NJTPA Asset Management Data Model Reports

Reports

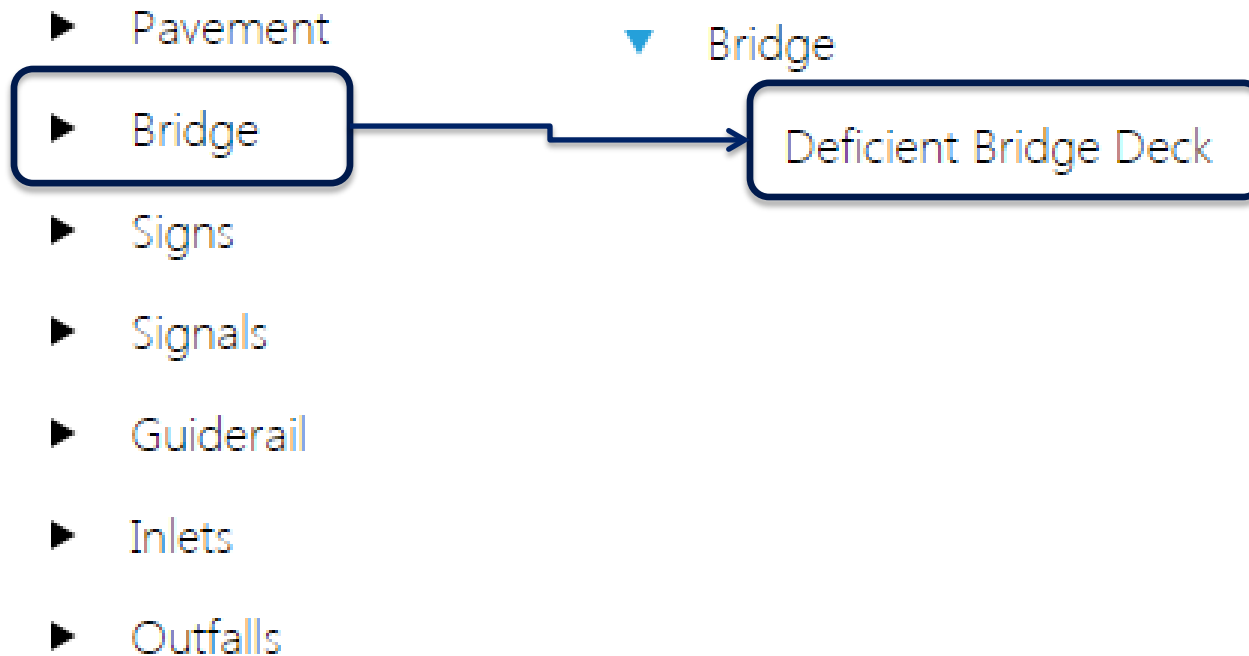
- ▶ Pavement
- ▶ Bridge
- ▶ Signs
- ▶ Signals
- ▶ Guiderail
- ▶ Inlets
- ▶ Outfalls



**NORTH JERSEY
TRANSPORTATION
PLANNING AUTHORITY**

Reporting Tool

Reports



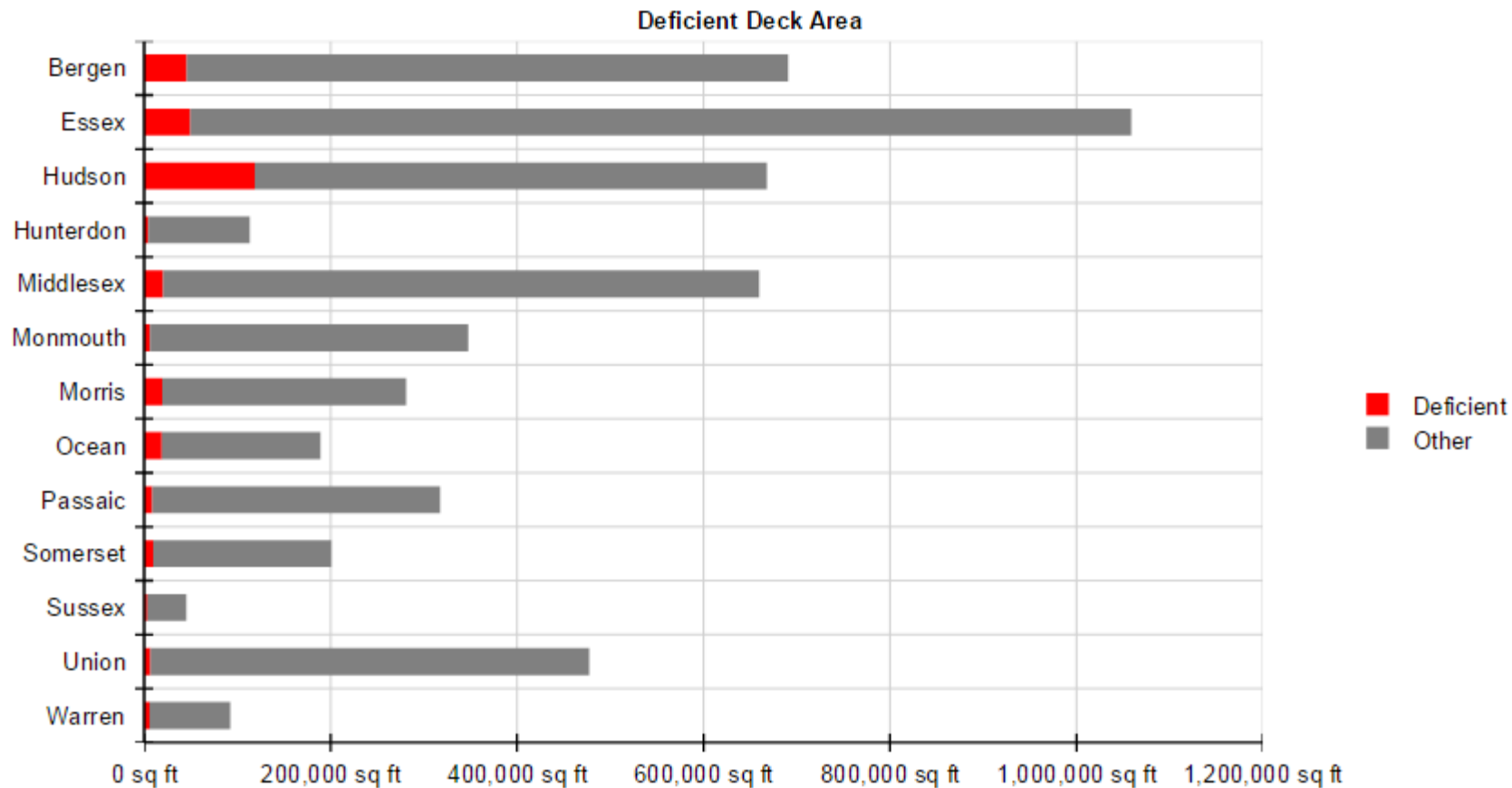
DEFICIENT BRIDGE DECK AREA REPORT

(Based on Deck Condition Rating of 4 or Less)

[Click here for additional information](#)



County	Summary of Deficient Deck Area (Sq. Ft.)	Total Deck Area (Sq. Ft.)	Deficient Deck Area Percentage
<input type="checkbox"/> Bergen	45,683	647,179	7 %
<input type="checkbox"/> Essex	49,384	1,009,499	5 %
<input type="checkbox"/> Hudson	118,745	627,610	19 %
<input type="checkbox"/> Hunterdon	4,327	109,026	4 %
<input type="checkbox"/> Middlesex	20,323	639,502	3 %
<input type="checkbox"/> Monmouth	6,240	342,106	2 %
<input type="checkbox"/> Morris	19,585	261,301	7 %
<input type="checkbox"/> Ocean	18,755	170,587	11 %
<input type="checkbox"/> Passaic	8,929	310,021	3 %
<input type="checkbox"/> Somerset	9,596	191,015	5 %
<input type="checkbox"/> Sussex	3,429	41,599	8 %
<input type="checkbox"/> Union	6,562	470,820	1 %
<input type="checkbox"/> Warren	5,841	86,512	7 %
Total Deficient Deck Area in NJTPA Subregion		317,399.00	



NOTES:

4/18/2015

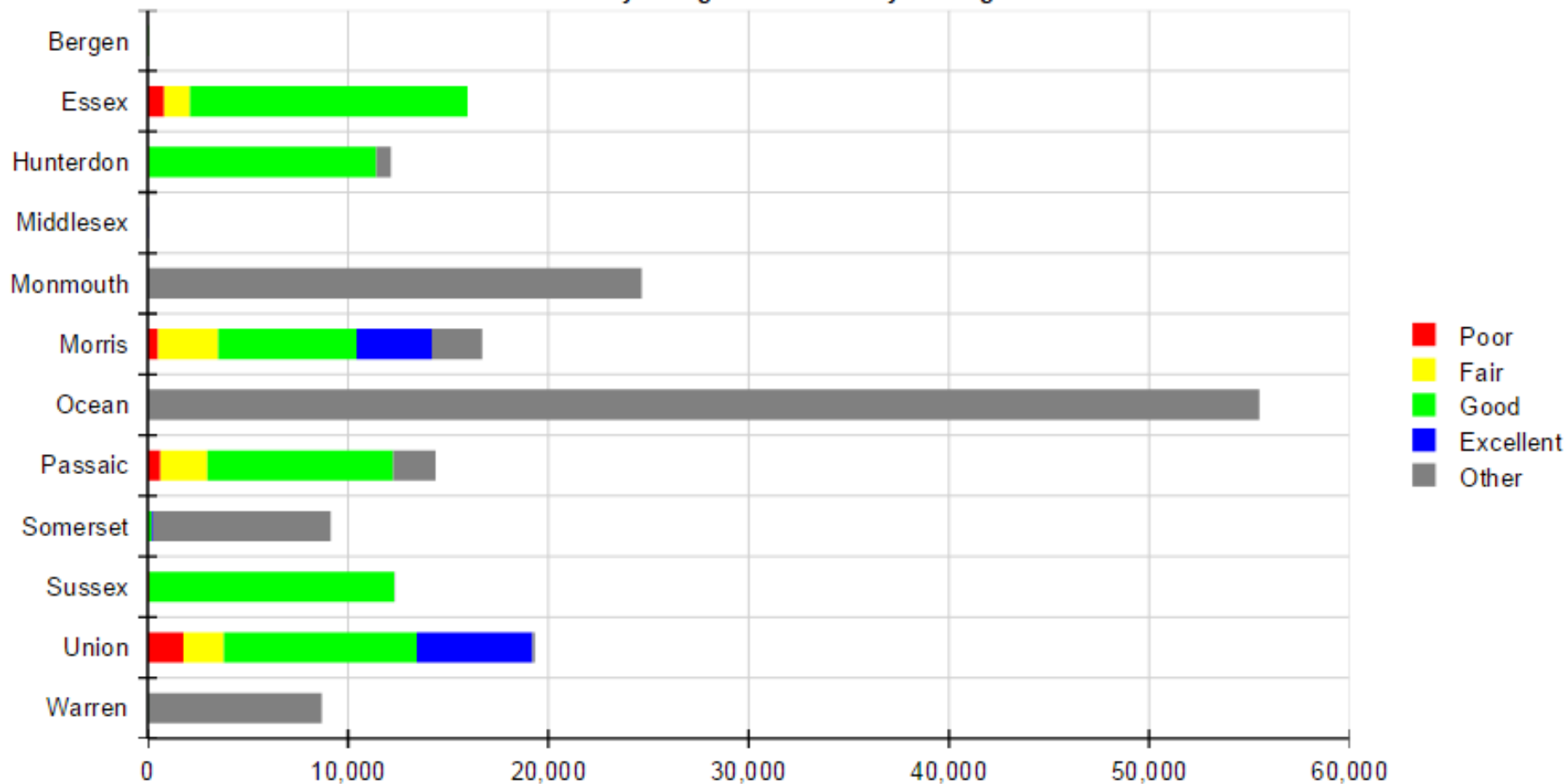
Page 1 of 1

Sign Summary Report

[Click here for additional information](#)

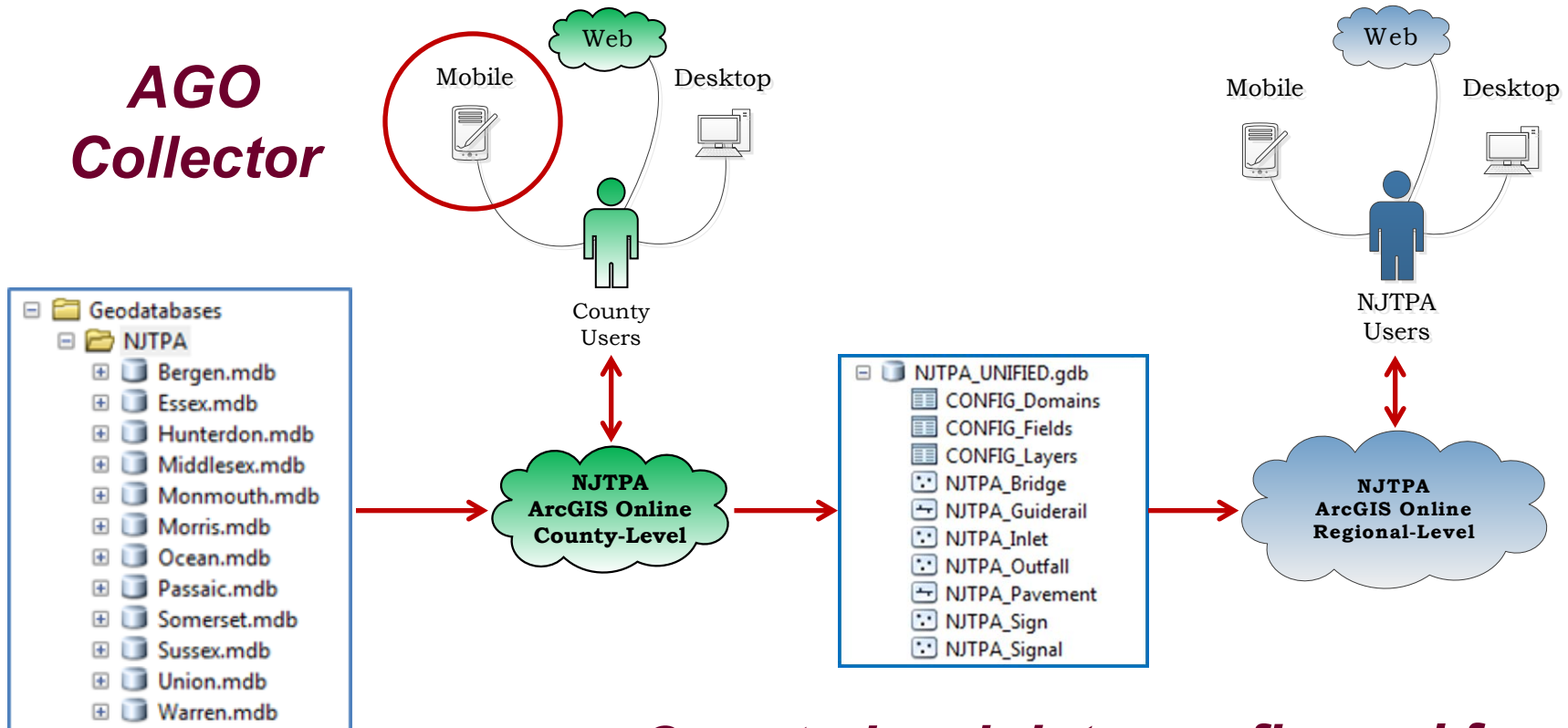
County	Total Number of Signs by County
Bergen	87
Essex	15,965
Hunterdon	12,136
Middlesex	31
Monmouth	24,653
Morris	16,695
Ocean	55,487
Passaic	14,378
Somerset	9,129
Sussex	12,339
Union	19,335
Warren	8,690
Total number of signs in NJTPA Subregion	188,925

Summary of Signs Condition by Subregion



Project Workflow Process: (Data Maintenance)

AGO Collector



*County-level data configured for use
with Collector*

Using ArcGIS Collector

Cancel Sign In

Collector for ArcGIS (iOS) wants to access your account information

Sign In **esri**

Username

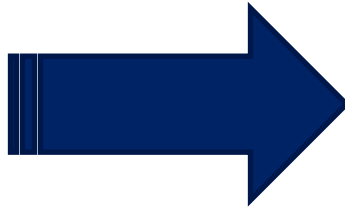
Password

SIGN IN

[Forgot username or password?](#)

[Sign in with your enterprise login](#)

Collector for ArcGIS (iOS) developed by:



Collector ALL

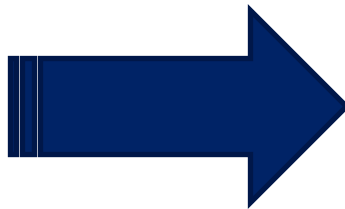
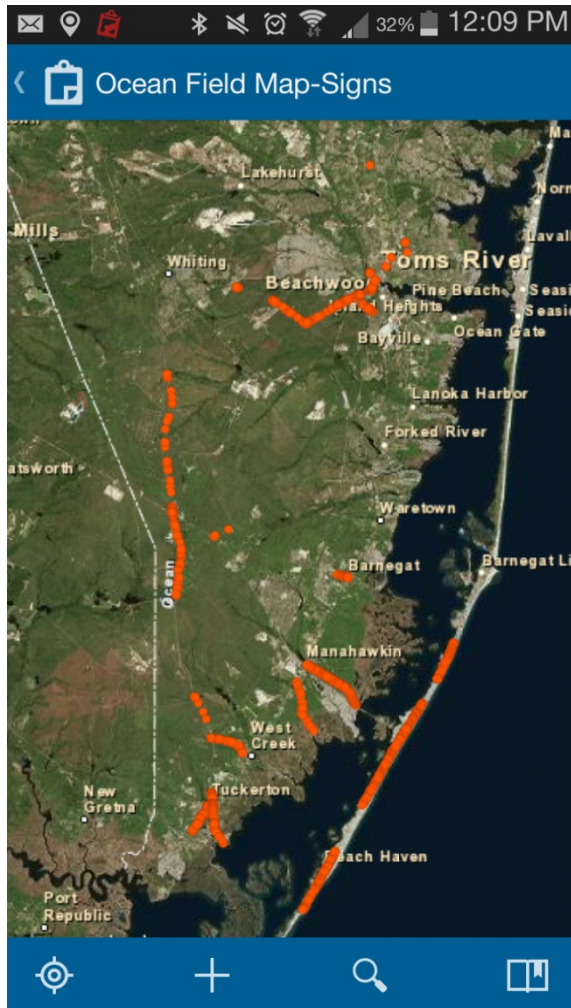
All Maps 12

Ocean Field Map-Signs
Nov 12, 2014 | Gabrielle Fausel [Download](#)

Ocean County Signs Field Map
Nov 12, 2014 | Gabrielle Fausel [Download](#)

Cap_Field Map
Nov 4, 2014 | Gabrielle Fausel [Download](#)

Using ArcGIS Collector



Using ArcGIS Collector

✓ | ☰ | 🗺️

📍 Ocean Signs
Missing location

BARCODE_ID

MUTCD_CODE

CLASS

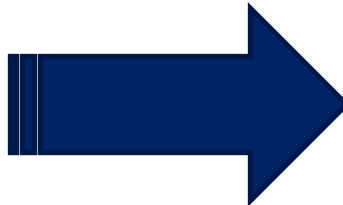
DESCRIPTION

SHEETING

BACKING
<No value>

BACKGROUND

👤 ⚙️



✓ | ☰ | 🗺️

LEGEND

SUPPORT

BREAKAWAY
<No value>

Yes there is an attachment
No there is no attachment
<No value>

RETROREFLECTIVITY

MOUNTING HEIGHT

👤 ⚙️

Using ArcGIS Collector

✓ | ☰ | 📍

● Ocean Signs
long:-74.259578 lat:39.921475

BARCODE_ID
030500

MUTCD_CODE
M1-6

CLASS
Guide

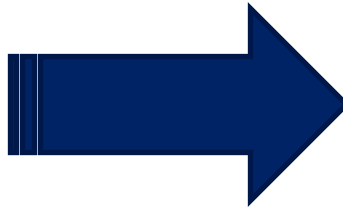
DESCRIPTION
Rt 530

SHEETING
Engineer Grade

BACKING
Wood

BACKGROUND

👤 ⚙️



Challenges/Accomplishments

Challenges

- County data schemas were variable and inconsistent (except for signs)
- TAC committee reviews – differing opinions often made it difficult to maintain, scope schedule and budget
- Need common workflow from counties to maintain integrity of unified data base

Accomplishments

- Facilitated County collaboration
- Provided examples of the value of data standardization
- Tool to support field-based asset updates
- Regional asset feature reporting

Questions/Comments?

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Director of Asset Management
Michael Baker International,
Inc.
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ttiner@mbakerintl.com

