

Metro-North Railroad's Enterprise GIS Program: Yesterday, Today, and Tomorrow

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Westchester GIS User Group Meeting

May 14, 2015



Metro-North Railroad

- Three states, 12 county service area, 2,701 square miles.
- Five lines, three branches, 327 route miles, and 796 track miles.
- 1,138 bridges, 111 grade crossings, 50 D.C. substations.
- 124 stations, 1,257 railcars, 711 weekday departures carrying 284k customers.
- Full service commuter railroad with engineering responsibility for track, signals, power, structures, stations, and railcars.



Business Case

- Use companywide survey instrument to generate interest in GIS

- **Benefits:**

- Accurate mapping
- Ensure uniform standard for capturing geographic data
- Proximity analysis of assets belonging to different depts.
- Integrate multiple mapping systems in use by different depts.

- **Strategy:**

- Hire GIS Specialist, recruit via online GIS networks
- Initiate Concept of Operations study, identify early action items
- Sacrifice server resiliency/redundancy in the short-run to limit costs, but build-in expandable architecture
- Leverage Enterprise virtual server infrastructure

GIS Need	% Respondents
Describing a location (at least monthly)	90%
Communicating a location (e.g. geocodes) to an outside entity	66%
Locate a fixed asset in the field	62%
Plot a map for sharing, reporting, etc.	34%
Count features within a geographic area	62%-66%



Trigger Events

- **Identified GIS Needs**

- Real-time incident mgmt.
- Post-event re-construction

- **Superstorm Sandy**

(2012-10-20)

- Real-time storm tracking
- Elevation of key rail assets
- Post-event insurance claims
- Mapping recovery efforts
- Floodproofing future design

- **Westport 1532** (2011-07-22)

- Real-time train location
- Emergency access to ROW
- Fire/EMS jurisdictions
- Milepost/catenary pole/street address correlation

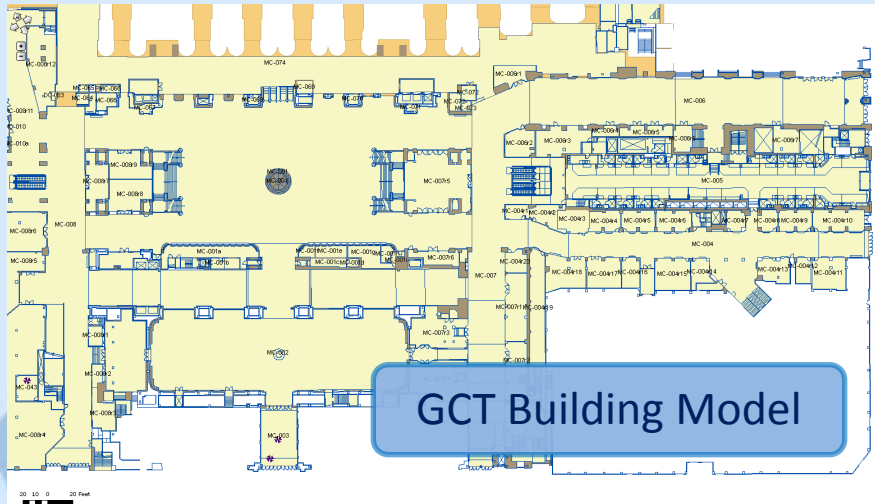


Early Action—Inventory Existing Condition

- Hardware and Software
- Existing Systems
- Data Sources
 - Past projects (e.g. PTC LiDAR)
 - Publicly available
- Business Processes
- User base and skills



Bridge Management System



GCT Building Model



VTTTS Train Tracker

Early Action—Policies

- **Human Capital:** GIS/CAD as “preferred skill” in job qualifications
- **Software:** Push users towards web apps; limit desktops
- **Boilerplates:** Require GIS deliverable in all projects
 - As-built and other drawings
 - Measuring and sensing equip.
 - Database outputs (e.g. track defect measurement system)
- **Georeferencing:** Eliminate local coordinate systems
- **Data Security:** 3 classifications
- **Data Hygiene:** Check-in/check-out, QA/QC procedures, etc.

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GIS Submission Requirements for Capital Work February 25, 2014

The following requirements for CAD drawings are designed to allow seamless import from popular CAD programs (e.g., AutoCAD) into GIS.

1. Geo-Referencing Requirements.

- All scale CAD drawings depicting Metro-North equipment, infrastructure, actual or proposed work shall be properly geo-referenced to a widely used global coordinate system (e.g., New York State Plane East, North American Datum 1983, in Feet (FIPS 3101), and/or any subsequent readjustments by the NGS, National Geodetic Survey), not using any local coordinate systems. MN has historically used NAD83 NYS East, but in special circumstances for certain projects NAD83 NYS Long Island (FIPS 3104) may be used instead upon approval from MN.
- All scale CAD drawings for which vertical elevation is an important consideration shall be properly referenced to a reasonable vertical datum (e.g., North American Vertical Datum of 1988, in Feet, and subsequent adjustments).
- MN Project Manager at his or her sole discretion shall make the final determination of geo-referencing datum where necessary, e.g. the reasonableness of the use of a certain datum or standard. If the appropriate geo-referencing datum is not clear, it is the contractor's responsibility to contact the MN Project Manager and clarify the appropriate choice of geodetic datum for a specific project.
- Geo-referencing is not required for the following types of drawings:
 - Drawings that show a typical detail present or duplicated at multiple locations (e.g., architectural, mechanical, electrical details).
 - Schematic diagrams, circuit diagrams, condensed vertical rail profiles, or other non-scale drawings those are not readily relatable to a specific location.
 - Legend pages or pages containing only text information.
 - Drawings of movable assets, such as rolling stock, those are not readily geo-referencable. A movable bridge is not a movable asset.

2. Layering Requirements.

- The following layering requirements apply only to reference drawings (100% design) and as-built drawings. CAD drawings that depict intermediate project stages such as staging plan, temporary structures, etc. are not subject to these requirements.
 - Layers shall be organized to contain only the objects which pertain to the layer, with no extraneous objects or stray elements.
 - The drawings shall be purged thoroughly of unused layers, blocks, line types, and other material.
 - CAD drawings shall be layered such that work performed on different asset classes (corresponding to GIS feature class) shall be shown in different layers. The asset classes shall be based on the current Metro-North asset registration hierarchies. It is the contractor's responsibility to obtain a copy of the MN asset register and to clarify asset classification with the MN Project Manager if contractor is unable to determine correct classification based on MN asset registration hierarchies.

Concept of Operations (ConOps) Study

- **Goals and Objectives Meetings**
 - Co-opt senior management support
 - Loosely define user requirements
 - Find possible use cases
- **Data Inventory and Gap Analysis:**
“Fishing expedition” to discover more data and resources
- **Business & Operational Proc.:**
“Institutionalization” of GIS
 - Visual Train Tracking
 - Property Boundary Integration
 - Ridership and Demographics
 - Straight Line Diagram
- **Staffing:** “Who’s doing what?”
Add new staff if nobody there!

MTA METRO-NORTH RAILROAD
GIS CONCEPT OF OPERATIONS STUDY
COMPANY-WIDE GOALS AND OBJECTIVES



JULY 9, 2014



Agenda for Today's Meeting

- Project Overview
- Task 1 GIS Goal and Objectives
- “Sound Bites” from Stakeholder Meetings
- Company-wide Goals and Objectives
- Enterprise GIS Web Portal Live Demo
- Next Steps

Marketing

- **Portal:** “at a glance” GIS resources webpage
- **REST Services Directory:** wide open (on purpose)
- **Email Blasts:** exec. level “this is what GIS can do”
- **Infomercial Videos:** like home shopping...
- **Roadshows:** visit reg. departmental meetings or set up special targeted sessions
- **Snazzy Early Products:** use 3D visualization, heat maps, BigData, etc., and circulate example map to generate interest
- **Ask Project Manager to Approve:** when receiving data, always circle back to PM (more for education than for review)

The mapping resources below are designed to make your work at Metro-North Railroad easier, faster, more accurate, and more effective. We rely on user departments to provide the most up-to-date geospatial data. Please check back periodically as the list will continue to expand.

Web GIS Viewer Resources



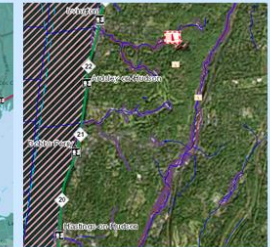
[Enterprise GIS Viewer](#)
(for all employees)



[Track Dept. Automated Sensor Data Viewer](#) (Grex, Sperry, Mermac, etc.)



[Census Demographics Viewer](#)



[Environmental Features Viewer](#)



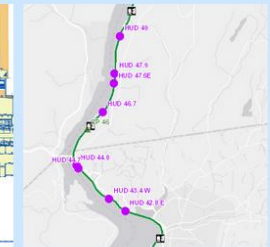
[Sandy Cable Job Information Viewer](#) (Preliminary Data)



[Quasi-Public Facilities Viewer](#) (Experimental)



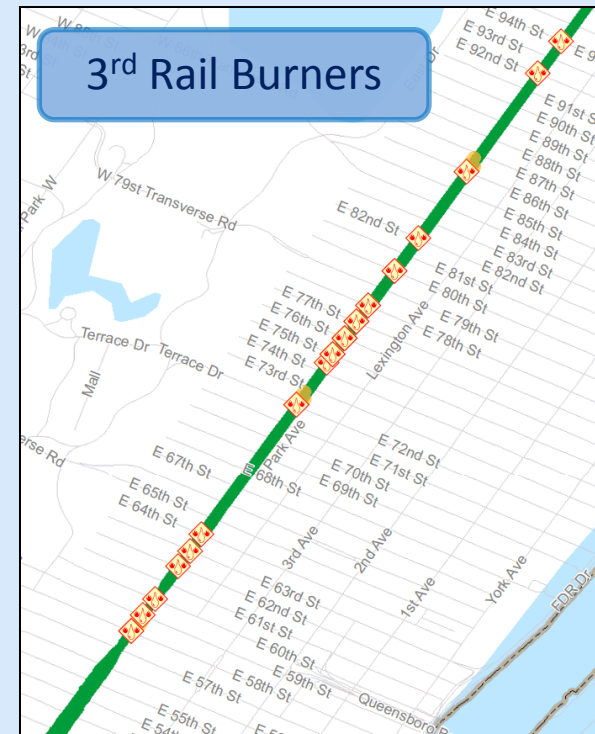
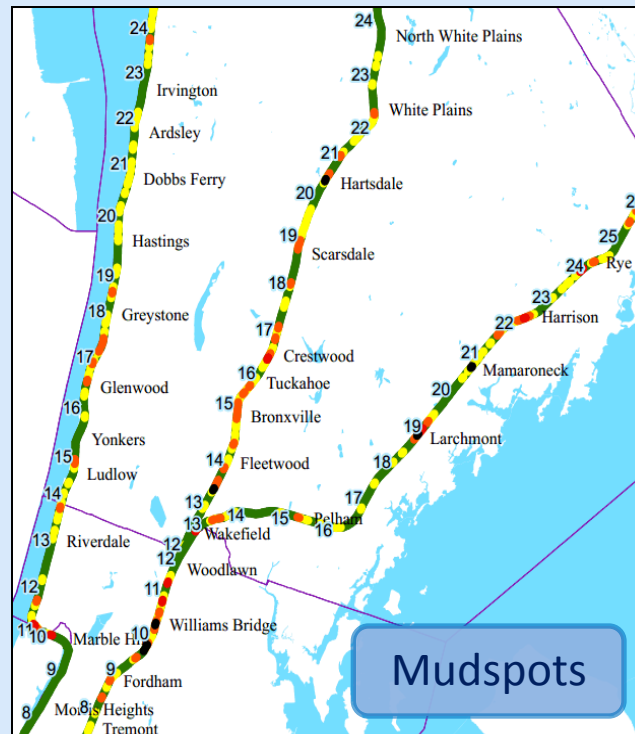
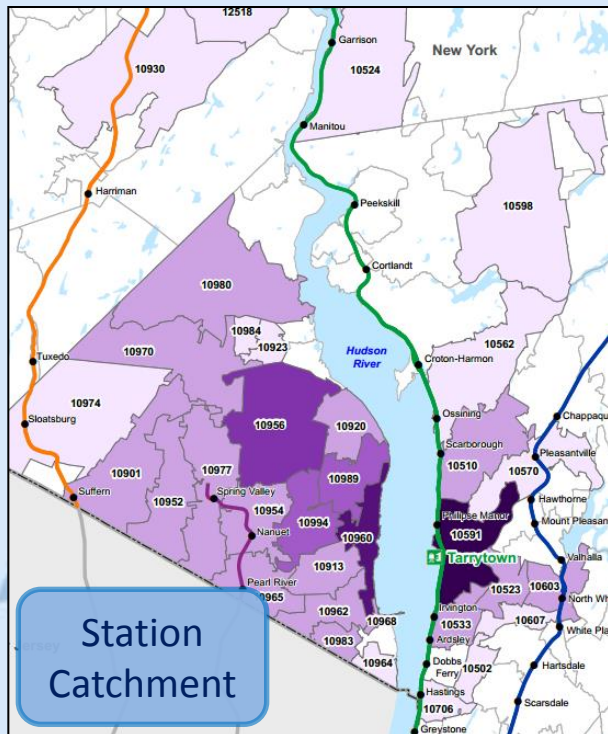
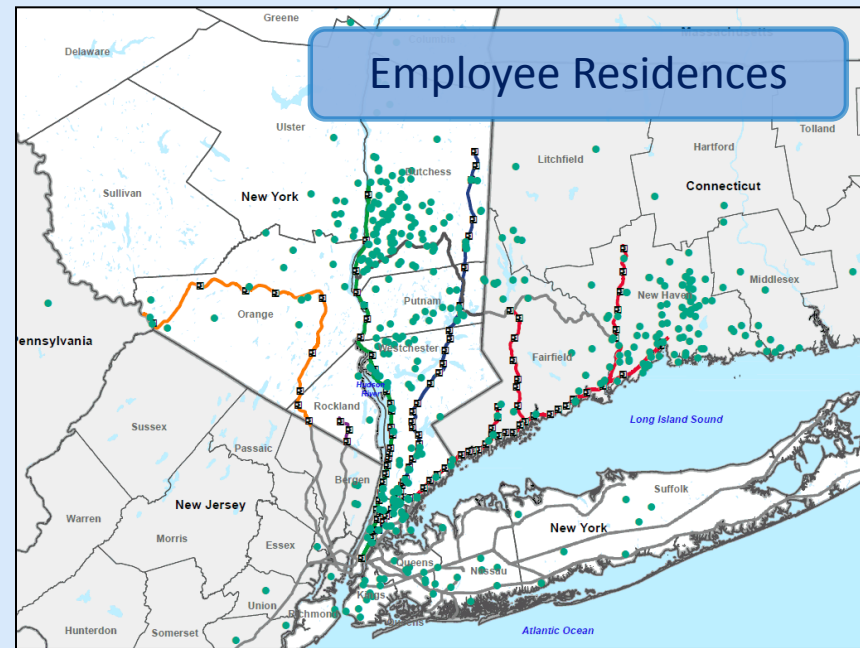
[Grand Central Terminal Viewer](#) (Not Yet Available)



[Rock Slope Viewer](#) (Experimental)

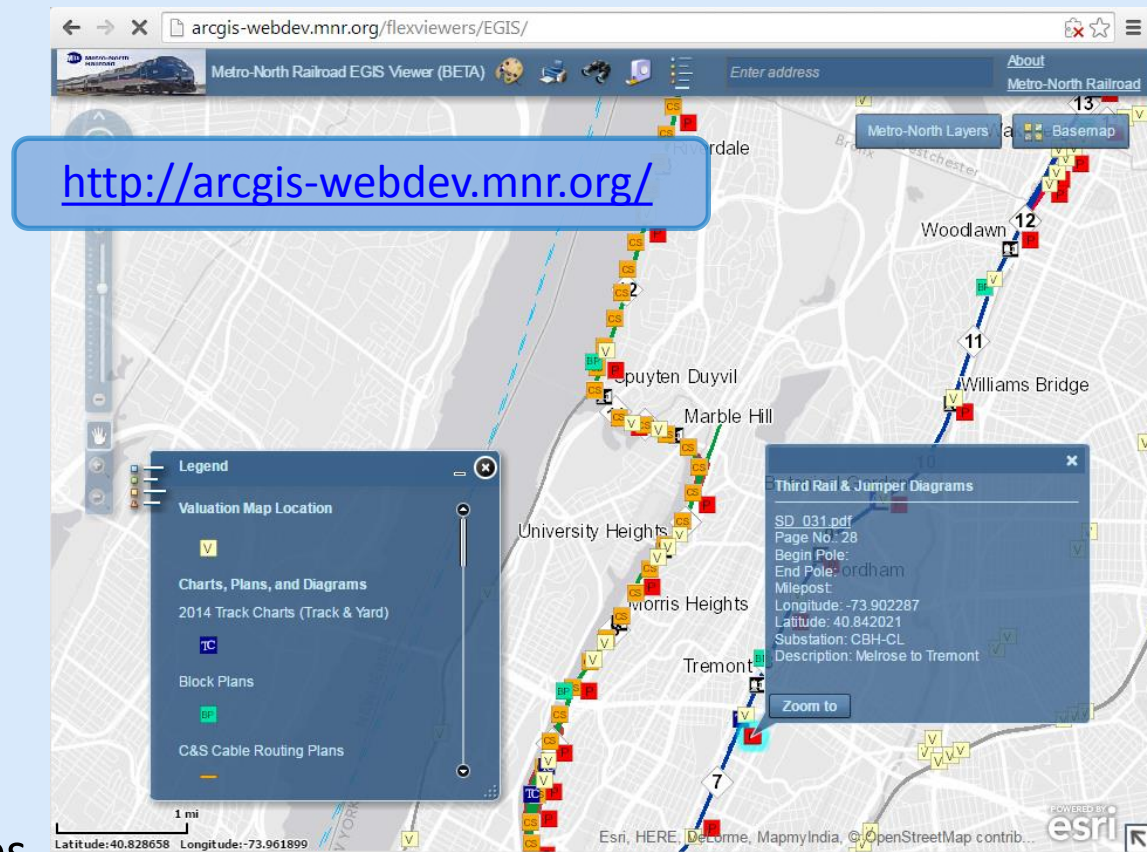
Early Data Products

- **Employee Residences** to estimate commute time
- **Station Catchment** to estimate feeder demand
- **Third Rail Burner and Mud Spot** tracking for maintenance



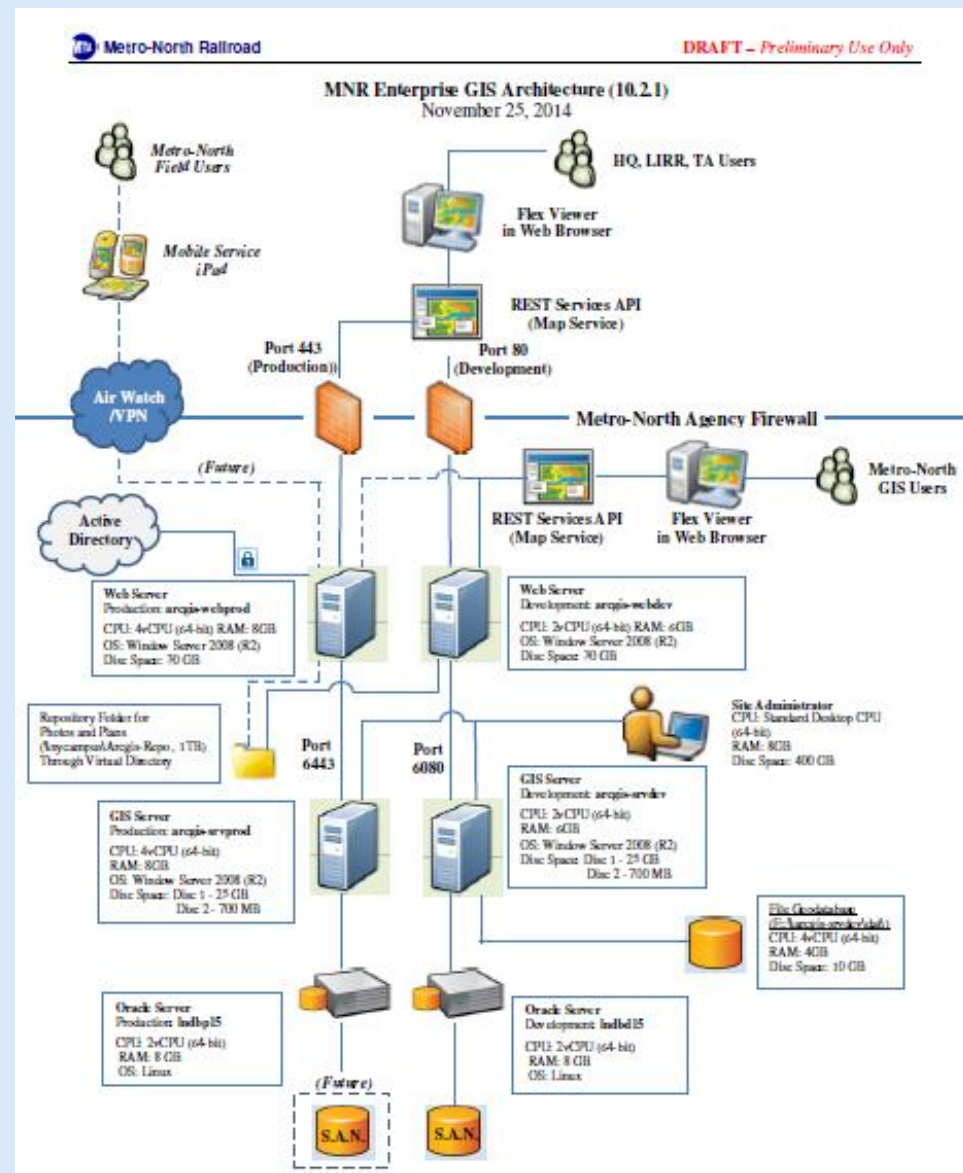
Enterprise GIS Web Viewers

- Map railroad features on web application to improve data access
- Publicly available GIS layers overlaid with railroad locations
 - Census Demographics
 - Environmental features
 - FEMA flood information; Public and Quasi-Public facilities, etc.
- Link existing PDF maps into viewer as repository of drawings
 - Signal block plans, Power sectionalizing diagrams, Val maps, etc.
 - Avoids labor intensive Georeferencing for now
- Google Maps and Street View Integration at critical points

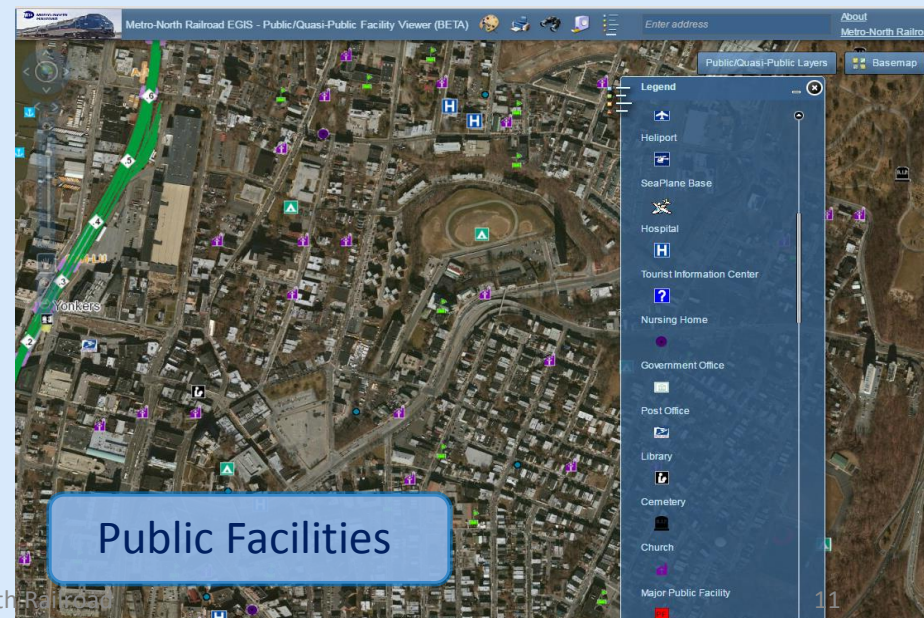
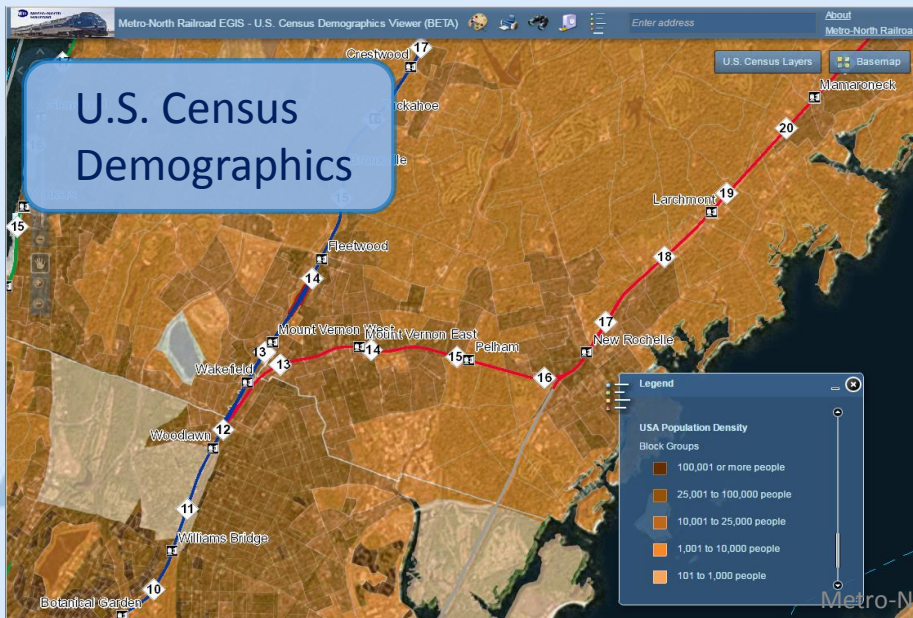
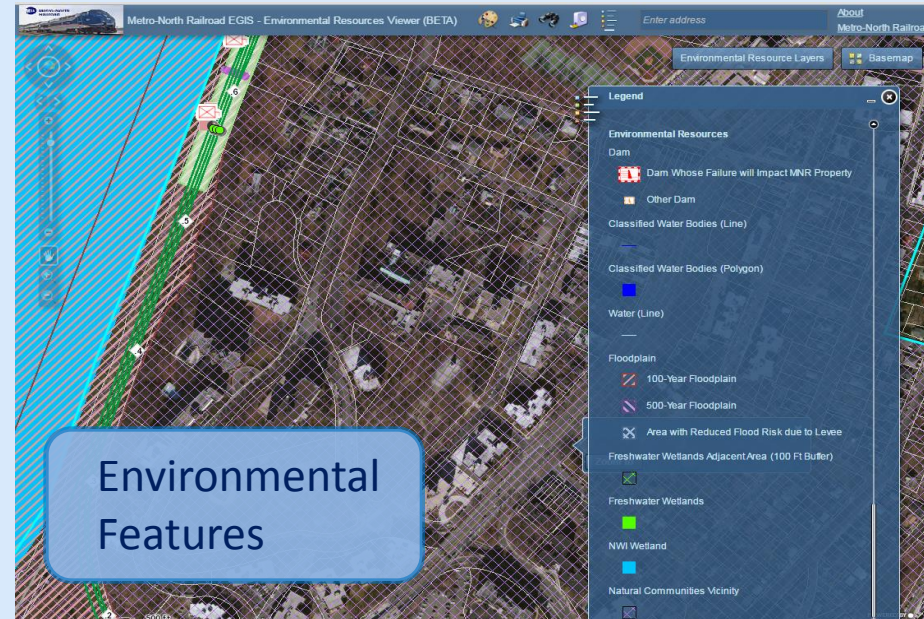
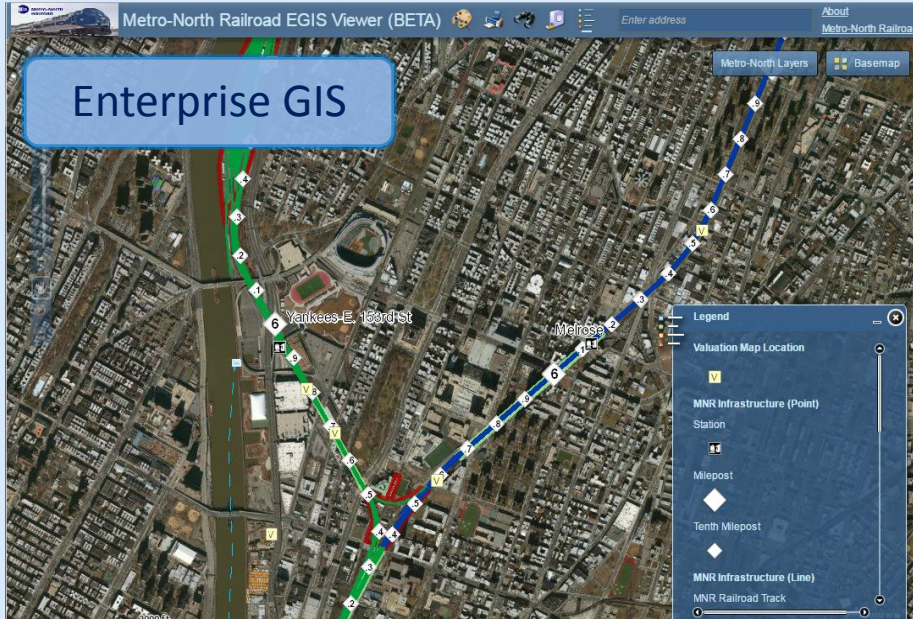


Enterprise GIS Architecture

- Esri ArcGIS for Server 10.2
 - with Web Adaptor
 - Access via web viewers and REST services (intranet only)
- File geodatabase on server
 - Migrating to Oracle
 - Effectively read-only for now
 - Power users on Desktops
 - GIS Manager is gatekeeper
- Mobile access via tablets w/ “AirWatch” VPN software
- Inter-agency (MTA, LIRR, TA) access via selected opening in the firewall



Metro-North Enterprise GIS Web Viewers



Metro-North Enterprise GIS Web Viewers

Metro-North Railroad GIS Viewer for M of W

Enter address

About Metro-North Railroad

Metro-North Layers

Track Sensor Data

Legend

- Track and Tie Defect
- Rail End Mismatch Conditions
- Sperry Car Defects
- Spring 2014 Track Geo Defect
 - Priority (MNR defect)
 - Urgent (FRAdefect)
- Joint Bar Tie Conditions
 - BAD Joint Bar Ties
 - FAILED Joint Bar Ties
- Bad/Failed Tie Cluster
 - BAD Tie Cluster
 - FAILED Tie Cluster

Metro-North Railroad Rock Slope Viewer (BETA)

Enter address

About Metro-North Railroad

Metro-North Layers

Basemap

Rock Slopes

Rock Slope

5 of 5

LINE	HUD
VP	29.8
LONG_	-73.869001654
LAT_	41.141795479
SITE_NAME	HUD 29.8
PRIORITY	
RATING_2013	
CP	CP 26 - CP 33
TK	3

Zoom to

Legend

- Interlocking
 - Interlocking (Point)
- MNR Points
- Rock Slope
- Station
- MNR Railroad Track

Metro-North Railroad EGIS Viewer with Sandy Information (BETA)

Enter address

About Metro-North Railroad

Metro-North Layers

Basemap

Sandy Project

Legend

- Sandy Information (12-11-2014)
 - Manhole
 - Pullbox
 - Vault
 - Wall Mounted Box
 - Equipment Platform Center Point
 - Equipment Platform Corner

Metro-North Railroad EGIS Viewer with WOH Signal Imp...

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About Metro-North Railroad

Metro-North Layers

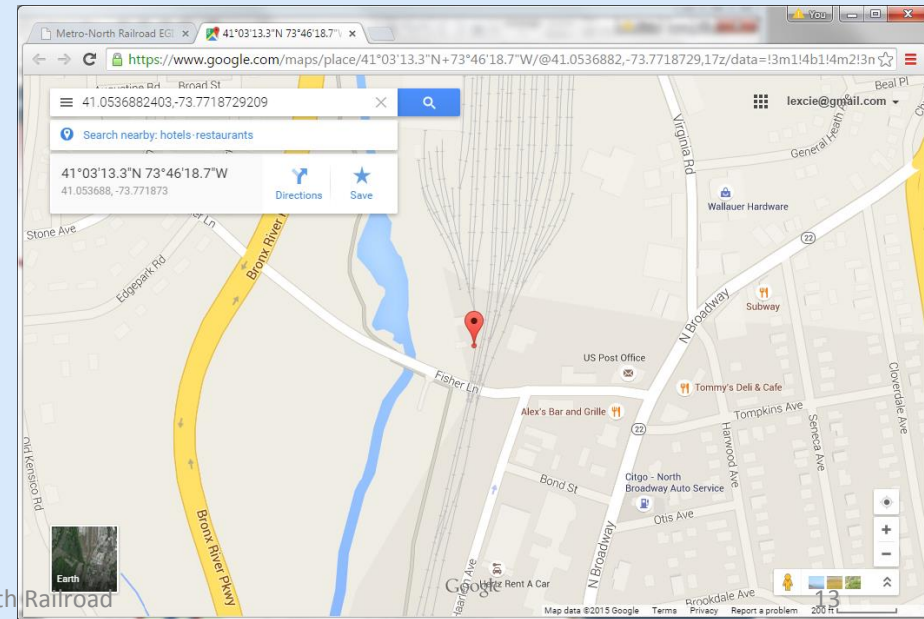
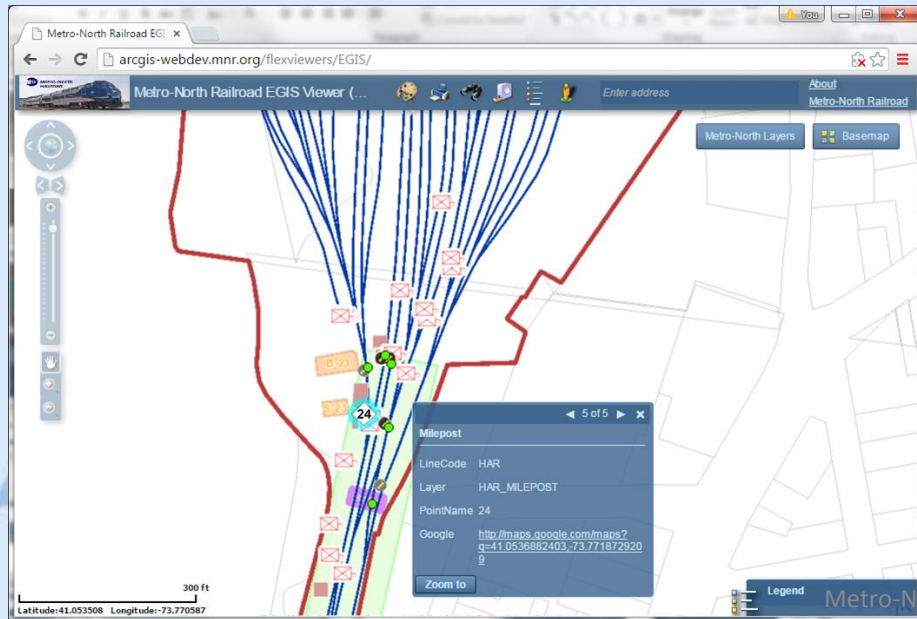
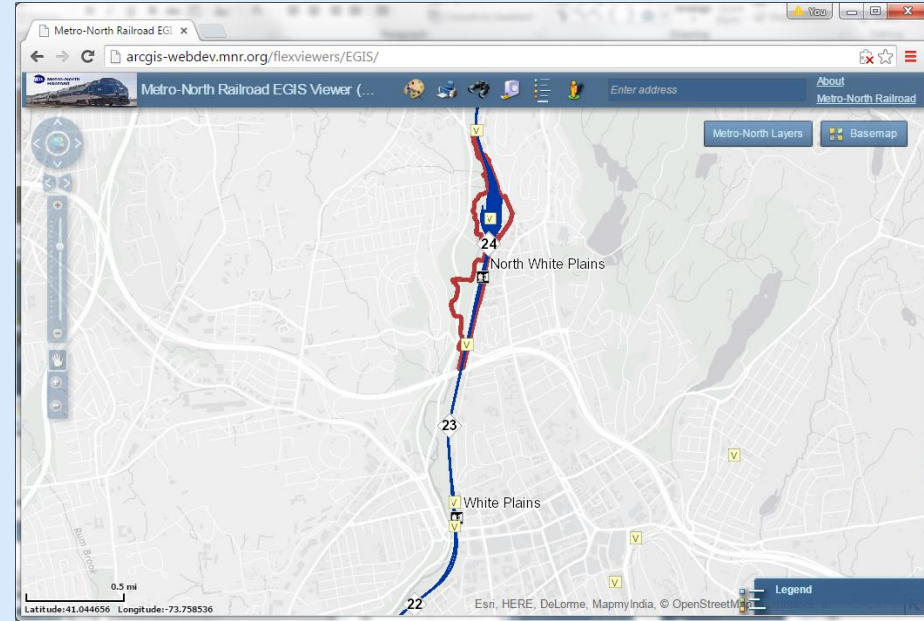
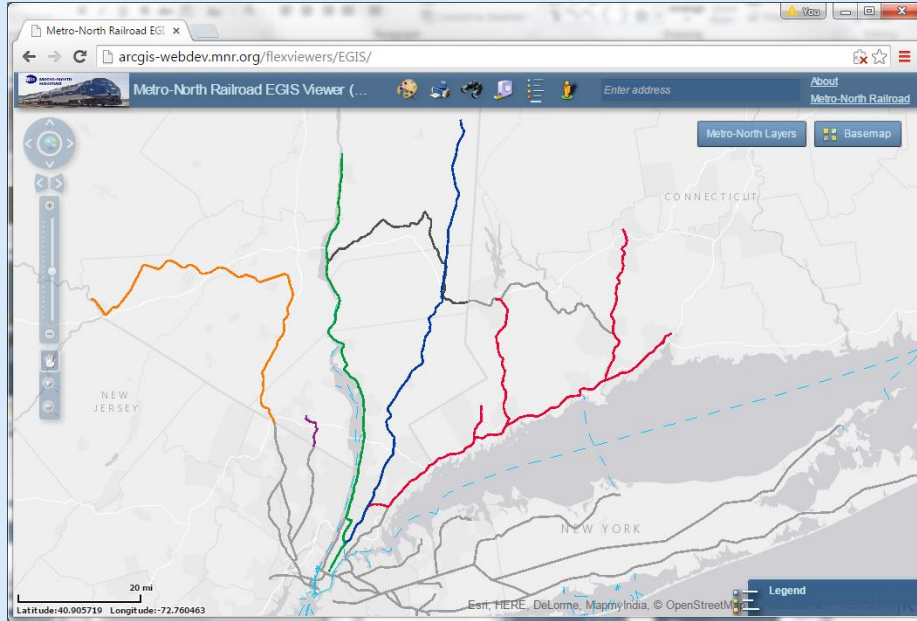
Basemap

West of Hudson Signal Project

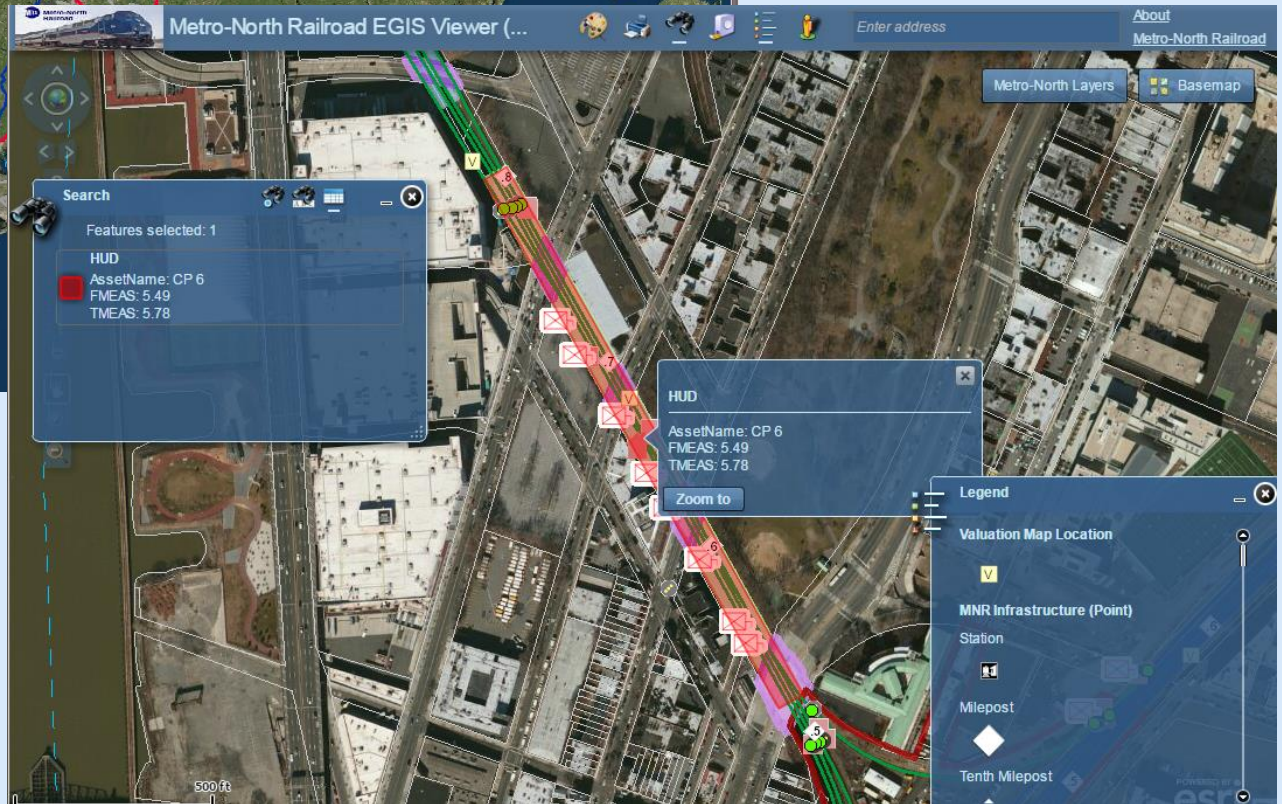
Legend

- Power Service
- Power Vault
- C & S Vault
- Snow Melt Box
- D Mark
- Cable Tray

Metro-North EGIS: Asset Locations



Metro-North EGIS Tools: Search



Enterprise GIS Tools: Measure Distance

Metro-North Railroad EGIS Viewer (...)

Enter address

About
Metro-North Railroad

Metro-North Layers Basemap

Measure

Clear Measurements

Line Color [Blue] Style Solid

Width 5 Alpha 1

Show Measurements
 Show Drawing Tips

Distance Units Feet

Font Arial Color [Black] Size 12

Legend

Valuation Map Location

MNR Infrastructure (Point)

Station

Milepost

Tenth Milepost

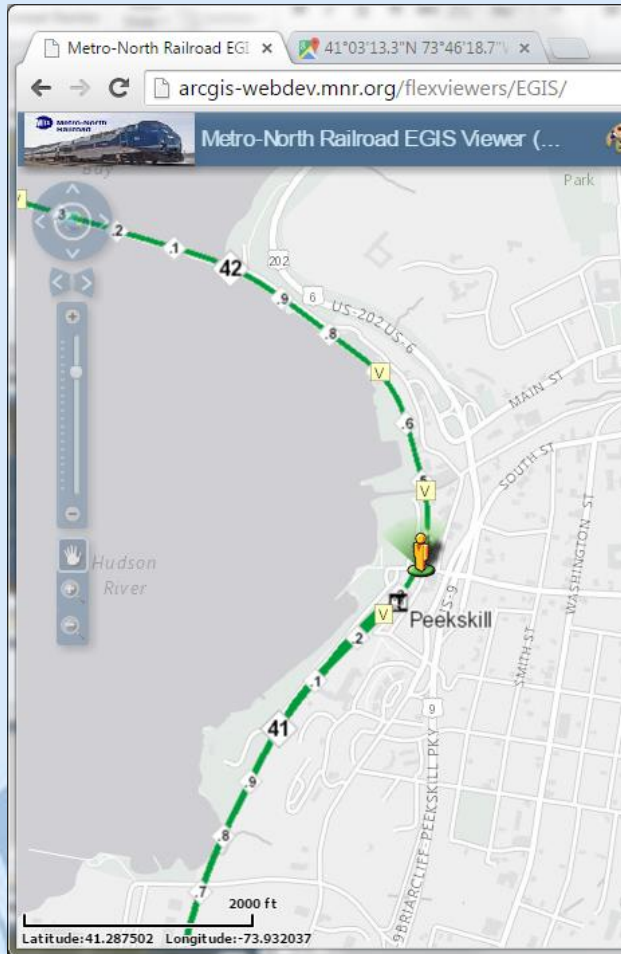
500ft

Latitude:40.819467 Longitude:-73.929197

Metro-North Railroad

POWERED BY esri

Enterprise GIS Tools: Google Street View



Enterprise GIS Tools: Base Map Choices

The screenshot displays a web browser window with the URL `arcgis-webdev.mnr.org/flexviewers/EGIS/`. The main map area shows a street grid in Harlem, New York, with several colored lines (green, blue, red) representing different Metro-North Railroad routes. A sidebar on the right, titled "Metro-North Layers", contains a "Basemap" section with the following options:

- Imagery
- Imagery with Labels
- USA Topo Maps
- World Light Gray Base
- Light Gray Canvas
- Streets
- Terrain with Labels
- Topographic

Below the basemap options is a "Legend" section with the following items:

- Valuation Map Location (represented by a yellow 'V' icon)
- MNR Infrastructure (Point) (represented by a yellow 'V' icon)

At the bottom left of the map, the coordinates are displayed as Latitude: 40.840765 / Longitude: -73.875053. A scale bar indicates 0.5 miles. The browser's address bar shows the URL and the page title "Metro-North Railroad EGIS Viewer".

EGIS Next Steps

- **Migration Issues**
 - ArcGIS 9.2 to 10.3
 - Dev/Prod Resiliency
- **GIS Staffing Roles**
 - Field Technician
 - Demographer
 - Program Developer
 - Archivist/Data Librarian
- **Advanced Training**
- **Implement Four Baseline Applications**
- **Other Applications**
 - GCT Building Model
 - Plan Room Drawing Retrieval System
 - Emergency Management Application
- **Coordination with Enterprise Asset Management**



Questions? Data Request?

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