GIS Concept of Operations as a First Step towards Total Enterprise Asset Management: Metro-North Commuter Railroad Case Study

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Abstract

For this Enterprise Geographic Information Systems (EGIS) project, Metro-North adopted the Concept of Operations (ConOps) process to:

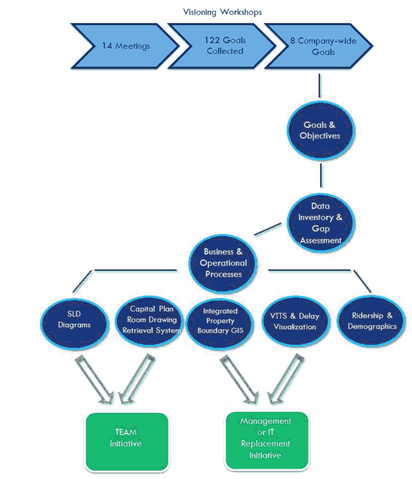
- define goals and objectives,
- inventory existing GIS assets,
- analyze data gaps,
- determine as-is and to-be business processes,
- define staffing and resource requirements, project initiatives, and
- provide a roadmap towards comprehensive companywide GIS deployment.

In contrast to the top-down approach typically employed in Total Enterprise Asset Management (TEAM) planning, Metro-North used a dynamic grassroots approach holding fourteen workshops attended by 92 employees, which were designed to collect GIS goals and objectives. The 122 goals generated from this process were distilled into 8 companywide goals ranging from increased efficiency to data sharing and decision support. Initiatives were developed for five critical business areas that had the potential to demonstrate how EGIS could help Metro-North accomplish its companywide and broader organizational goals. These pilot applications included:

- visualizing Straight Line Diagrams,
- integrating property boundary data,
- retrieving Capital Plan Room drawings,
- train tracking & delay visualization, and
- ridership and demographics.

This poster shows how a ConOps process could be used in railroad environments to think through GIS-related issues and define concrete technology projects that provide tangible benefits to user departments, allowing them to manage their assets and business issues. Although the focus of this study was on non-asset related operations within the railroad, the ConOps offers a user-centric systems planning approach that could be applied to TEAM efforts within the railroad industry or for planning corporate initiatives in any business environment.

The Concept of Operations Process

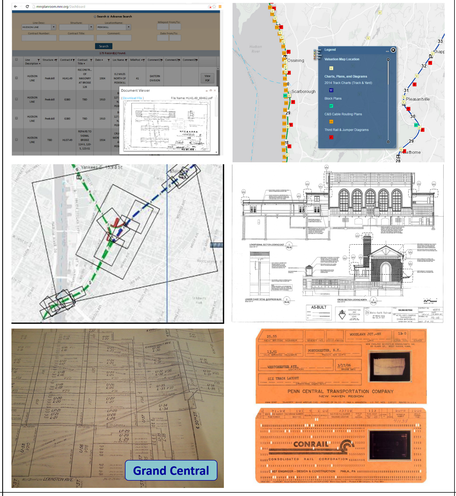


Gap Analysis

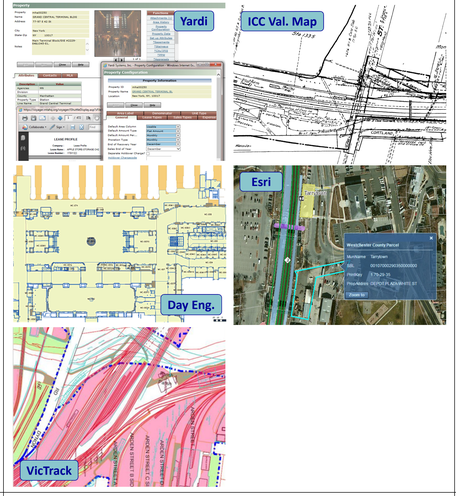
Data Source or Tool	**Wayside Monitoring and Diagnostic Systems (WMDS) and Real-Time Data Monitoring (RTDM) System (Data Source and Tool)**	
Description	M8 and M7 electric multiple-unit cars transmit train "heartbeats," critical faults, ERS and RTDM (Real Time Data Monitoring) files over Cellular Network to their respective databases. M8 cars generate 4 GB of data per day about various conditions, which can then be used to diagnose maintenance issues. For M7 units, IMS and AMS automates the recordings of train incidents and shop orders for certain critical fault codes, including low adhesion incidents. This system has mapping with attribute data associated with it, such as: • Train • Car • Fault description • System • Count • First set • Last set • Last reset • Zones • Location	
Degree of Support for EGIS Goals	Productivity ○	Data and Standardization ○
	Visualization ○	Customer Service ○
	Decision Support ◒	Project Planning ○
	Incident Management ◒	Asset Management ◒
Comments/ Assessment	• Locations tracked but not mapped currently	

Cambridge to supply some blah blah about gap analysis here. Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum. Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit

Capital Plan Room Drawing Retrieval



Integrated Property Boundary GIS



Staffing Considerations

Title	Responsibilities	Dept. Assignment
Senior Engineer, Straight Line Drawings	Ensure all maintenance departments update their portion of basic physical characteristics data shown in systemwide SLDs on a periodic and timely basis.	Maintenance of Way, Asset Management
Licenced Surveyor	GIS/GPS data collection, field surveying (including NYS legal surveys), and working with construction engineers in the field on property boundary issues.	Maintenance of Way, Track Engineering
Senior Engineer, CADD, Plans, and Drawings	Checking in/out as-built drawings for Capital Projects and ensuring they are properly catalogued and accessible in the map-based drawing retrieval system.	Capital Programs, Project Controls and Technical Services
GIS Developer, VTTS	Developing real-time visualization applications and/or putting together packages to outsource such development.	MTA I.T., GIS Group
GIS Analyst	Support companywide GIS effort as the primary technical resource for GIS data development, GPS (Trimble) operations, cartography, GIS data QA/QC, field verification, and maintaining Enterprise GIS data. Determine spatial location of infrastructure assets as required.	Capital Planning and Programming

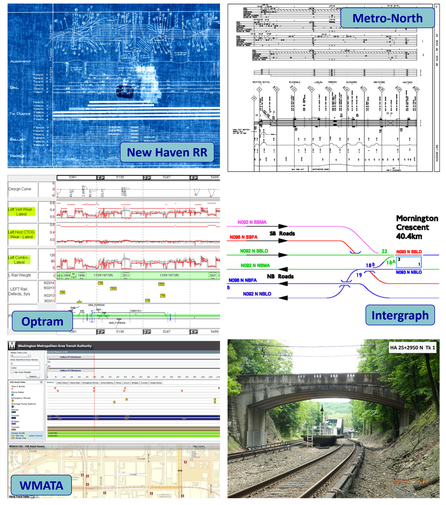
Companywide Goals & Objectives

Goals	Objectives
Increase Efficiency *By streamlining access to data and pinpointing locations.*	• Provide Enterprise GIS (EGIS) web portal, adequate staffing, and training. • Migrate existing diagrams to EGIS views.
Facilitate Project Planning *Through displaying asset locations, their proximity to ROW, and other project limits.*	• Show project plans on EGIS to improve employee location awareness. • Record old and new asset locations whenever Force Account or contractors relocate assets.
Improve Asset Management *Through common portal for location and condition data.*	• Define maintenance and condition data to be collected; create logical asset model. • Integrate EGIS with asset management systems.
Provide Shared Mapping *Improve cross-departmental coordination and collaboration by showing spatial relationships amongst assets.*	• View all fixed infrastructure assets on EGIS. • Create standard process to import and update GIS data from outside agencies. • Create security framework to regulate display, export, and flow of company GIS data.
Better Information Access *Provide a single portal for data in multiple formats, and across departments and locations.*	• Specify companywide common standards. • Make EGIS available on mobile device. • Organize visual records and electronic data in a system-wide library.
Enhance Incident Management *Faster and better pre-event planning, post-event response.*	• Display incident location to identify access points for emergency services.
Upgrade Customer Service *Improving range, variety, and quality of public data and complaint resolution.*	• Connect EGIS with scheduling and VTTS systems to drill-down (ridership, work, etc.). • Clarify asset ownership and maintenance responsibilities by displaying on EGIS.
Decision Support *Analyze location and temporal trends to drive investment, project planning.*	• Develop an improved track outage planning and foul time mapping process on EGIS. • Interface EGIS with Enterprise systems for drill-down employee data and location attributes.

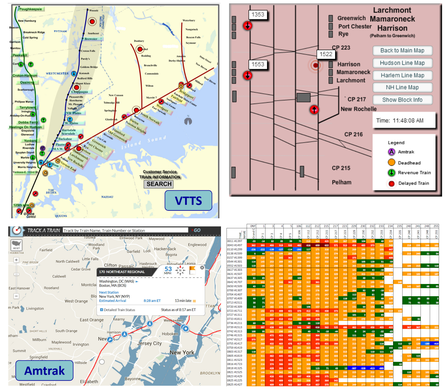
Priority Areas

1. **Define GIS/CAD/Asset Hierarchy Standards.**
   - Develop complete GIS/AutoCAD standards for positional accuracy, naming conventions, and database formats.
   - Disseminated and adopt standards throughout the organization.
   - Provisions should be included in consultant contracts to ensure all deliverables adhere to them.
   - Coordination with outside stakeholders (MTA, ConnDOT) should be undertaken to ensure systems interoperability and share information.
2. **Handheld Field Device GIS Strategy.**
   - Mobile devices are preferred data access points for field workers.
   - Opportunities to use mobile devices to access and capture data in the field.
3. **Make Non-Sensitive Data Available on MTA OpenData.**
   - GIS data not accessible outside of Metro-North.
   - Non-sensitive datasets should be shared consistent with MTA's security policies.
4. **Enhance Incident Management GIS Capabilities.**
   - Applications elements could support enhanced incident management, but not easily accessible to first responders in real-time.
   - Develop better train-location system to enhance geospatial accuracy of train locations on maps and allow data from multiple sources to be displayed along with train attribute data.
5. **Develop Procedure for Data Updates.**
   - Establish and maintain a workflow process for capturing location data, updating asset data, and keeping relevant data current.
   - Organizational responsibilities with regard to database maintenance should be established.
   - Workflow processes should be developed for updating asset locations in real time as they are modified in the field.
   - Verify the accuracy of location and asset data that is submitted by contractors.
   - Staffing needs to support updates should also be identified.

Straight Line Diagrams and Views



Replace Virtual Train Tracking System



Lessons Learnt and Next Steps

Based this ConOps study and other efforts, Metro-North now has numerous MTA-approved budget items:

1.SLD and **Plan Room** GIS applications deemed eligible for asset management funding, being progressed as TEAM initiatives.
2.Real Estate GIS system moving forward as an operating-funded management initiative.
3.VTTS Replacement deemed an I.T. state-of-goof-repair effort and progressed as platform migration project.
4.Ridership and Demographics Visualization will not move forward.

Ultimate implementation and budgeting political in nature, but ConOps process accomplished numerous objectives:

1.Educating decision makers regarding latent needs, solutions in the marketplace and benefits of technologies
2.Clearly scope out data and system needs, allowing established costing process to assign a price in terms of internal manpower and third party contracting
3.Examine linkages between different system parts and assigning functions to logical parts of the company
4.Providing rational basis for higher-level discussions on funding prioritization

This user-centric systems planning approach could be used for planning initiatives in any business environment.