Using Enterprise GIS to Support Transit Asset Management

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Using Enterprise GIS to Support Transit Asset Management

• Common Transit Assets
• GIS and Transit Asset Management
• GIS Based Transit Asset Viewer
• GIS and Asset Management System (MAXIMO) Integration
Common Transit Assets

- Transit Assets by Functional Areas
  - Administrative Assets
    - Buildings
    - Stations
    - Garages
    - Yards
  - Track Side Assets
    - Tracks and Structures
    - Power
    - Drainage
    - ATC (Automated Train Control)
    - Fare Collection Assets
    - Communication Assets
  - Emergency Assets
    - ETS (Emergency Phones)
    - Standpipes
    - ETEC (Emergency Tunnel Evacuation Cart) Equipment
    - EMS Cabinet
  - Bus Assets
    - Bus Stops
    - Shelters
    - Poles
    - Signs

- Transit Assets by Spatial Types
  - Network Assets
    - Track Network
    - Bus Route Network
    - Rail Drainage Network
    - Rail Power Supply Network
    - Rail Communication Network
  - Polygon Assets
    - Facility
      - Buildings
      - Complex
      - ......
    - Functional Spaces
      - Rooms
      - Shafts
      - Platform
      - Mezzanine
      - Escalator Banks
      - Bus bays
      - ......
    - Surface Ground Spaces
      - Parking lots
      - Sidewalk
      - Kiss & ride areas
      - ......
  - Linear Assets
    - Fence
    - Tunnel
    - Bridge
  - Point Assets
    - Bus stops
    - Rail stations
    - Station Entrance
    - Access Points
    - ......
GIS and Transit Asset Management

• GIS Framework for Transit Asset Management
  – Transit Asset Spatial Data Model
  – Transit Location Referencing Systems

• Spatial Data Maintenance for Transit Assets
  – Transit Asset Data Sources
    • Track Charts
    • Engineering Drawings
    • Excel Spreadsheets
  – Transit Asset Data Compilation in GIS
    • Transit Network
      – Geometry Network
      – LRS Network
      – Schematic Network
    • Rail Station Assets
    • Real Estate Lands
  – GIS and Transit Asset Data Management System Integration
    • Asset Attributes vs. Asset Location
  – Transit Asset Data Display and Search in GIS
Transit Asset Spatial Data Model – Rail Station Assets

- **Rail Station Interior**
  - Mezzanine
  - MezzanineZones
    - Kiosk
    - FareGateArea
    - FareCardVendingMachineArea
  - PaidArea
  - OpenAccessArea
  - Rooms
  - RoomDoor
  - Passageway
  - Platform
  - PlatformEndGate
  - ElevatorBank
  - EscalatorBank
  - SafetyWalk
  - ServiceRoomFloor
  - Stairways
  - Trackbed

- **Rail Station Exterior**
  - StationEntrance
  - Pavilion
  - Busbay
  - PassengerWaiting Area
  - KissRide
  - PedestrianBridge
  - PedestrianWalkway
  - SideWalk
  - ParkingLot
  - EntranceGate
  - Landscape
  - Lawn
  - Roadbed
  - OutstationStructure
  - OffsiteFacility

- **Parking Garage**
  - GarageRamp
  - ParkingGarage
  - ParkingGarageLevel

WMATA Rail Station Mapping Data Model
Transit Assets Maintained in WMATA GIS

Track Network

- Main Revenue track
- Yard track
- Chain marker
- Switch Points
- Crossover tracks

Track schematic diagram shows main track, crossover tracks and the switch locations.
Transit Assets Maintained in WMATA GIS

Track LRS Network

LRS track network segmented by equation point measure values
Segment A ends at 92622.36 measure
Segment B ends at 92615.37 measure

(All measures are fictitious)
Transit Assets Maintained in WMATA GIS

Transit Facility

More than 400 WMATA owned and/or operated facilities captured in GIS.

WMATA engineering, planning, and land development departments are the key users of the facility information in GIS; These data with attributes are very helpful for future planning and other analytical studies.
Transit Assets Maintained in WMATA GIS

Trackside Assets

- Emergency phone location points
- Emergency exit points from tunnel
- Security Fence and Fence Gate
- Drainage Pump station
- Track Circuit
- WZ Bond
- Tie Breaker Station (TBS)
- Train Control Room (TCR)
- Traction Power Substation (TPSS)
- Chiller Plant
- Elevator and escalator

Each feature class has asset attribute information

Location ID and service work order information from Maximo
Transit Assets Maintained in GIS

Rail Station Mapping

- All 91 rail stations exterior and interior mapping
- Mezzanine Area
- Fare gates
- Fare card vending machine
- Kiosk
- Escalator & Elevator locations
- Platform Area
Transit Assets Maintained in WMATA GIS

Bus Network & Bus Assets

- WMATA bus routes.
- WMATA bus stops.

Bus stop features

✓ Side walk accessible.
✓ Shelter.
Real Estate Assets
Source - Real estate department
Parcel zoning and acreage attributes
Transit Asset Data Display and Search in GIS
GIS Based Asset Viewer

• Objectives
  – Combining engineer's view of straight-line diagram (track chart) and GIS map view of geo-location
  – Providing simple navigation from 1-D straight-line diagram to 2-D GIS map based on chain marker value
  – Visualizing Asset Locations and Attributes in one single interface

• Interface Design
  – Three Viewing Panels
    • Straight-line Diagram Panel
    • Asset View Panel, can be extended to include other asset information such as document, Optram, video log, etc.
    • GIS Map Panel
  – Asset Attribute View to extend link to other business systems such as Maximo
  – LRS Search based on station or chain marker range
GIS Based Asset Viewer

Upper Panel (Straight-line Diagram)

Middle Panel (Asset View)

Lower Panel (Map View)
GIS Based Asset Viewer Design

• **Upper Panel**
  - Left Search Sub-Panel: Search by Station or Chain Marker Range
  - Right Sub-Panel – Straight-line Diagram
    - Base Tracks
    - Chain markers
    - Equation Points
    - Crossover Tracks
    - Switches
    - Station Platforms
    - Tunnel Start and End Points
    - Bridges
GIS Based Asset Viewer Design

- **Middle Panel**
  - **Left Sub-Panel – Asset List and Graphic Symbols**
    - Access Points
    - Wee-Z Bounds
    - Fence Gates
    - Emergency Phones
    - Drainage Pump Stations
    - Shafts (Vent and Fan)
    - TPSS
    - TBS
    - Fences
    - Circuits
    - Bridges
    - Tunnels
    - Track Access Guide
  - **Right Sub-Panel: Asset Graphics and Attributes**
    - Asset Graphics View – aligned with straight-line diagram based on chain markers
    - Asset Attribute Data Grid for each asset
GIS Based Asset Viewer Design

• Lower Panel
  o Map and Layers
    ▪ Basemap – Street Map or Satellite Imagery or Topo Map
    ▪ WMATA Feature Layers
    ▪ Asset Graphics Layers
  o Tools
    ▪ Map Layers
    ▪ Track Selection
    ▪ View Options – Basemap Options, Rotate Map, Google Map
    ▪ Overview Map
  o Map Navigation Tools
  o Show Track Table
GIS Based Asset Viewer - Demo

Demo - GIS Based Asset Viewer
GIS – Asset Management System (MAXIMO) Integration

• MAXIMO Asset Data Model
  – Location Hierarchy
    • Single Location Identifier
    • Linear Location Content: Location identifier (Track), Start Chainmarker, End Chainmarker
  – Asset Hierarchy
    • Asset Identifier (Asset Number)
  – Workorder relationship to Location and/or Asset
    • Location Identifier: e.g., facility
    • Asset Identifier: e.g., escalator

• GIS to MAXIMO Location Reference Model
  – Location Hierarchy Cross-reference:
    • Example: Station Manager Repair List – Fare Collection Device Repair Workorders
  – Asset Identifier Cross-reference
    • Example: Escalator Repair Workorders
  – Linear Referencing for Trackside Assets
    • Example: Radio Outage Workorders

• GIS-MAXIMO Integration
  – Spatially Enable MAXIMO Asset and Workorder Records
  – Dynamically Display Maximo Asset and Workorder Records on a Map
GIS-MAXIMO Integration

1. Geocoding
2. Add X, Y Event
3. Query Table
4. Custom Process

Maximo Workorder View

Database Connection

Maximo-GIS Location Matching

ArcGIS Server GP Service

Map Display
GIS-MAXIMO Integration

1. GIS – MAXIMO Location Matching is based on track code and start/ending chain markers
2. Location service is custom built LRS service to dynamically create linear geometry
GIS-MAXIMO Integration

1. GIS – MAXIMO Location Matching is based on Station Code and Mezzanine Code
2. Location service is feature based service (Query Table GP Process)