Modeling and Mapping Metro’s Rail Stations

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Modeling and Mapping Metro’s Rail Stations

• Project Goals & Scope
• The Challenges of Mapping Metrol’s Rail Stations
• Modeling of Rail Station Spaces
• Digitizing Rail Station Spaces
• Presenting Rail Station Mapping Data
• Next Step
• Conclusions
Project Goals

• Who will benefit from the rail station mapping
  – Metro Customers: navigate through a station
  – Police and First Responders: quickly and accurately locate an incidence or a crime location
  – Emergency Management Officer: define emergency evacuation plan
  – Maintenance Crew:
    • Find where is an asset or where is a work site and how to get there
    • Find where is the closest storeroom with the required equipment and parts
  – Maintenance Manager:
    • Dispatch crews based on crew locations and work site locations
    • Calculate work load and required materials based on area, length measurements: e.g., square footage for landscape maintenance
Project Scope

• Two dimensional Floor Plan Space Mapping, including station interior, exterior and parking garages
• Space object definition is based on space usage
• The relationships between space objects include spatial relationship (hierarchy, association, etc.), as well as topological relationship such as connectivity (or adjacency)
• Deliverables
  – A model of Metro rail station spaces
  – 40 different ArcGIS feature classes for total of 91 station
  – Taxonomy of standard rail station locations
Challenges

• How to define rail station spaces
  – Rail station structure is so complex: multiple levels serving multiple purposes with different structures
  – Each station is unique in space configuration and level structure
  – Station interior, exterior and parking garage are so different in terms of structure and usage

• Data sources
  – Old design as-built drawings may not reflect the current usages
  – Most as-built drawings are scanned images, not digital CAD drawings, not georeferenced, many are “cartoon” drawings (not to scale, and not to true measurement)
  – The as-built drawings were delivered by multiple contractors with different design standard
  – No design drawings for exterior spaces for most stations

• Knowledge and skill requirements
  – Knowledge of floor plan design
  – Understanding of as-built drawings
  – Skills in converting engineering drawings to GIS features
Modeling of Rail Station Spaces

• Facility Spatial Data Model
  – ESRI Facility GIS Model
  – BIM model

• WMATA Rail Station Space Data Model
  – Station Interior
  – Station Exterior
  – Parking Garage
  – Rail Station Domain
  – Space-Asset relationships

• Rail Station Location Taxonomy
  – Space object relationships
  – Standard codes and names
  – Location Hierarchy
• Rail Station Interior
  – Mezzanine
  – MezzanineZones
    • Kiosk
    • FareGateArea
    • FareCardVendingMachineArea
    • PaidArea
    • OpenAccessArea
  – Rooms
  – RoomDoor
  – Passageway
  – Platform
  – PlatformEndGate
  – ElevatorBank
  – EscalatorBank
  – SafetyWlak
  – 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
Rail Station Interior Spaces
Digitizing Rail Station Spaces

• Standard definitions
  – Feature definition
  – Feature attribute list and definitions
  – Standard code and naming conventions

• Workflow management
  – Source data collection: as-built drawings
  – Feature markup
  – Field verification
  – Georeferencing
  – Feature capture
  – Attribute population

• Field Verification
  – Feature definition
  – Feature relationships
  – Feature attributes

• QA/QC process
Presenting Rail Station Mapping Data

• 2-D Map Display
  – Layer Structure representing multiple levels

• 3-D Model for Rail Station
  – 3-D Floor Plan Display

• Taxonomy Search
  – Location hierarchy search
  – Single code search
2-D Map Display
3-D Map Display
What’s Next?

• Emergency Exits and Rescue Areas
• Rail Station Asset Mapping: e.g., camera, detection device, emergency equipment, etc.
• 3-D Access Paths and 3-D Rail Station Mapping
• 3-D Routing
• Rail Station Evacuation Modeling
GIS-Based Rail Line Asset Viewer

DEMO
Conclusion

• The purpose of this project is to map 2-D space usages of the Metro stations for location references.
• Due to the complexity of station structure and space configuration, an 2-D station mapping data model has been developed to capture features at different levels of structures in both interior and exterior of a station.
• The outcome of this project has significant benefits for police and first responders, maintenance crews, as well as customers to locate assets, incidents on a station and navigate through a station.
Questions?

Thank You!