Sewer Lateral Mapping: An Automated Approach

MSGIC 2016 Fall Quarterly Meeting
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EBA Engineering, Inc.

- Established in 1981
- 250+ employees
- 5 Mid-Atlantic region offices
- Certified MBE/DBE with various state and local agencies
- 90% of work from repeat clients
- “Where commitment counts”

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Our services

- Asset management
- Civil/site engineering
- Construction management and inspection
- Environmental engineering
- Geotechnical engineering
- Geospatial services
- Materials testing
- Structural engineering
- Surveying and mapping
- Transportation engineering
- Water resources
- Water systems engineering
Geospatial Technologies

ArcIMS Server Troubleshooting and Enterprise GIS Architecture Design, Schuylkill County, PA
Geospatial technology services

- Enterprise GIS: needs assessment, planning, architecture
- Custom, desktop, mobile, and web GIS solutions
- Map centric document and database integration
- Data maintenance: workflows, procedures, and tools
- Centerline geodatabase: routable network implementation
- On-call technical support services
Surveying and Mapping

Anacostia River Tunnel, Washington, DC
Surveying and mapping services

- As-built surveys
- Boundary surveys
- GPS surveys
- Ground controls for aerial surveys
- Planimetric surveys
- Right-of-way and easement plats
- Topographic and hydrographic surveys

Cedar Branch Stream Restoration, Baltimore, MD
Transportation Engineering

MD 231 at JW Williams Road Intersections Improvements, Prince Frederick, MD
Transportation engineering services

» Transportation/traffic studies
» Multi-modal planning and design, including bicycle/pedestrian facilities
» Geometric and roadside design
» Traffic design including urban MOT
» Intersection/interchange design
» Highway drainage/SWM/E&S
» Low impact development design

Newkirk Street Reconstruction, Baltimore, MD
Water Resources
Water resources services

- Complex and basic water modeling—1-D and 2-D hydraulics
- Flood hazard analysis and flood risk management
- Funding assistance and CIP development
- MS4 program development, funding, and support
- Site evaluation, feasibility studies, and master planning
- Stormwater best management practices construction documents
- Stormwater utility study and implementation
- Watershed and stream condition assessments
Water Systems Engineering

WSSC Asset Management Program Business Case Development, MD
Water and wastewater systems design

» Pipeline condition assessment and rehabilitation
» Sewer system evaluation survey (SSES)
» Trenchless pipeline design
» Hydraulic modeling and analysis
» Pumping station design and upgrades
» Utility structures design
» Fat/oil/grease (FOG) management
» Water and wastewater treatment facility designs
Feature Project

City Dock Bulkhead Replacement, Phase II, Annapolis, MD
Goal: Expand the current GIS Sanitary Sewer Network
  • Current Mapped Assets
    • Gravity Mains
    • Pressure Mains
    • Pump Stations
    • Manholes

Create a more complete network of the actual system
  • Map Lateral lines from property line to Main line connection
  • Approximately 185,000 lateral connections
Sewer Lateral Mapping

- City Lateral
- Main to Property Line
Sewer Lateral Mapping

» Approach:

» CCTV (Closed Circuit Television) Inspection data of Sewer Mains
» Map Lateral Tap Points observed in CCTV data
» Create Laterals extending from Tap Points to Property line
» Eventually Snap Lateral to Cleanout on Property
  • Cleanouts are being mapped with GPS
Sewer Lateral Mapping

- CCTV Processor
- Available from ArcGIS
- Maps observations for each condition found in Pipe
- Model Builder Tool
Sewer Lateral Mapping

Data Returned from CCTV Inspection:
- Videos of Inspection
- Database
  - Pipes Inspected
  - Conditions Found, distance along pipe condition found
Sewer Lateral Mapping
Sewer Lateral Mapping

- All observations mapped
- Query out TAP observations

Tap Observations: Point where lateral enters Main Line
Sewer Lateral Mapping

How to Create Laterals from TAP Points?

Assumptions
• Laterals extend from Main Line at 90 degree angle
Sewer Lateral Mapping

» How to Create Laterals from TAP Points?
» ArcGIS Tool: Bearing Distance to Line
Sewer Lateral Mapping

» Start X, Y: will be calculated from TAP Point

» Distance: 70 feet

» Bearing: Need to calculate
  • Retrieve Bearing of Sewer Main
  • Add 90 Degrees or Subtract 90 Degrees depending on which side of the Main the Lateral is connecting
Sewer Lateral Mapping

Calculating Lateral Bearing

1. Calculate Main Bearing
   - COGO Tools in ArcGIS
   - Adds and calculates fields that describe the geometry of a line
     - Direction
     - Distance
     - Delta
     - Radius
     - Tangent
Sewer Lateral Mapping

Calculating Lateral Bearing

• 2\textsuperscript{nd} Spatial Join Mains to TAP Points
  • TAP Points get all the attributes of the Main Line that it Intersects
  • TAP points get the Bearing Direction of the Main

• 3\textsuperscript{rd} Need to generate the Bearing of the Lateral
Sewer Lateral Mapping

Which Side of Pipe does lateral connect to Main?

- CCTV data – Clock Position
- Position of TAP entering pipe
- Based on Flow direction
- 1-5: lateral goes to Right Side
- 7-11: Left Side
Sewer Lateral Mapping

- Right Side: Add 90 to Bearing
- Left Side: Subtract 90 from Bearing
Sewer Lateral Mapping

» TAP Point Attributes Needed for Bearing Distance to Line Tool
  • X
  • Y
  • Bearing
  • Distance

» Run Tool: Bearing Distance to Line
Sewer Lateral Mapping
Why are Laterals important in the GIS?

- Inflow & Infiltration
  - Rain events cause overflows when runoff enters cracked Laterals
- Improper Connections to the Sewer System
  - Uncapped Cleanouts
  - Sump Pump Connection
  - Gutter Downspout Connection
  - Driveway Drain Connection
  - Lead to increased Volume
Sewer Lateral Mapping

Generate Work Orders for Laterals

- Smoke Testing
- Dye Testing
- Jetting
- Root Removal
To learn more, visit www.ebaengineering.com or LinkedIn.