Network Analysis of Travel Distance to Medical Care

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Distance Matters

- Barrier to care
- Access
  - Service location
- Continuity of care
- Most travel farther than closest facility
  - Preference
  - Available resources
  - Co-location of services
Distance Measures

Point to point
Straight line – Euclidean
Distance along some network
- Roads - driving
- Pedestrian - walking
- Bicycle
- Public Transit
Information about:

- Transit stops
- Schedules
- Connections
- Accessibility
- Great for developers, but what if…?
Add GTFS to Network Dataset

- ArcGIS Toolbox
- Developed by ESRI
- Use publicly-available data
- Create complex network dataset
- Perform routine analyses
- Working knowledge of:
  - Geodatabases
  - Feature datasets
  - Network Analyst Extension to ArcGIS
Add GTFS Toolbox

- Getting started
  - Find your data
  - [http://www2.septa.org/developer/](http://www2.septa.org/developer/)

- Download tools
  - [http://transit.melindamorang.com/overview_AddGTFSstoND.html](http://transit.melindamorang.com/overview_AddGTFSstoND.html)

- Install TransitEvaluator.dll
- Add toolboxes to ArcToolBox
- Create new geodatabase
- Add new feature dataset
Add GTFS Toolbox

1) Generate Transit Lines and Stops

- Point feature – stops
- Line feature – all transit lines
- SQL database
2) Generate Stop-Street Connectors

- Creates the link between residential address and transit system
Create Network Dataset

In ArcCatalog:

- Navigate to geodatabase
- Right-click feature dataset
- Select New and select Network Dataset
- Enter a name
- Add feature classes
Create Network Dataset

Connectivity groups

● Model multi-modal systems
● Where different sources connect
● Streets and Transit lines **must** reside in different groups
Create Network Dataset

Group 1 – streets
Group 2 – stops
Group 3 – transit lines
Configure elevation fields (if desired AND supported by the data), or click None
Create Network Dataset

Add/configure travel cost evaluator to the dataset
Create Network Dataset

- Travel Time attribute
- Set units and data type
- Click Use by Default
Travel Time Attributes

- Account for boarding/unboarding
- Pedestrian travel to transit
- Transit Evaluator
Network Analyst

- Network Analyst toolbar
  - Route
  - Service Area
  - Closest Facility
  - OD Cost Matrix
  - Vehicle Routing Problem
- Network Analyst Window
- Add locations (stops)
- Route layer properties
  - Network locations snap to streets only
Analysis Settings

Layer Properties

- **Settings**
  - Impedance: Travel Time (Minutes)
  - Use Start Time: On
  - Time of Day: 8 AM
  - Day of Week: Today
  - Specific Date: 8/22/2015
  - Use Time Windows
  - Reorder Steps To Find Optimal Route:
    - Preserve First Stop
    - Preserve Last Stop
  - U-Turns at Junctions: Allowed
  - Output Shape Type: True Shape with Measures
  - Use Hierarchy
  - Ignore Invalid Locations

- **Restrictions**
  - Onway

- **Directions**
  - Distance Units
  - Use Time Attributes:
  - Open Directions window automatically

About the route analysis layer
Route Analysis Output

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Euclidean Distance by Area
Driving Distance by Area

![Box plot showing driving distances for different geographic areas.](image)
Drive Time by Area
Transit Time by Area
ANOVA - Transit Distance

ANOVA Boxplot of Transit Distance (in miles) by Area

- Center City
- North
- Northeast
- Northwest
- South
- Southwest

F = 43.65
Prob > F < .0001
ANOVA – Transit Cost (time)
Distance Matters

- Network analysis
  - Account for mode of travel
  - Built environment
  - Systems
  - Choices
- More precise measurement
- Improve service location
- Identify gaps
Copy Traversed Source Features

- Provides detailed info
  - Wait times
  - Modes of transit (bus/rail)
  - # of transfers
- Transit Identify Tool
  - Test network behavior
    - Used/unused lines
    - Gaps
Questions?

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