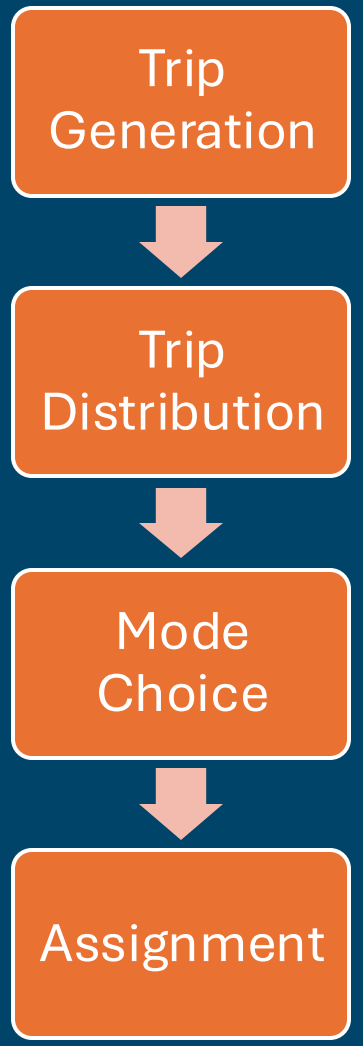
Adapting Travel Demand Modeling Networks for Use in ArcGIS

JAMES MCLANE | NCTCOG REGIONAL GIS MEETING | 12.10.2025

Travel Demand Modeling

- Well established process for modeling/forecasting travel demand
- Inputs:
  - Population and employment
  - Transportation networks
- Outputs:
  - Transportation networks with forecasted volume, congestion, etc.
- Evolving state of practice
- Typically run in specialized transportation forecasting software packages with varying levels of compatibility with Esri
  - Cube, TransCAD, EMME



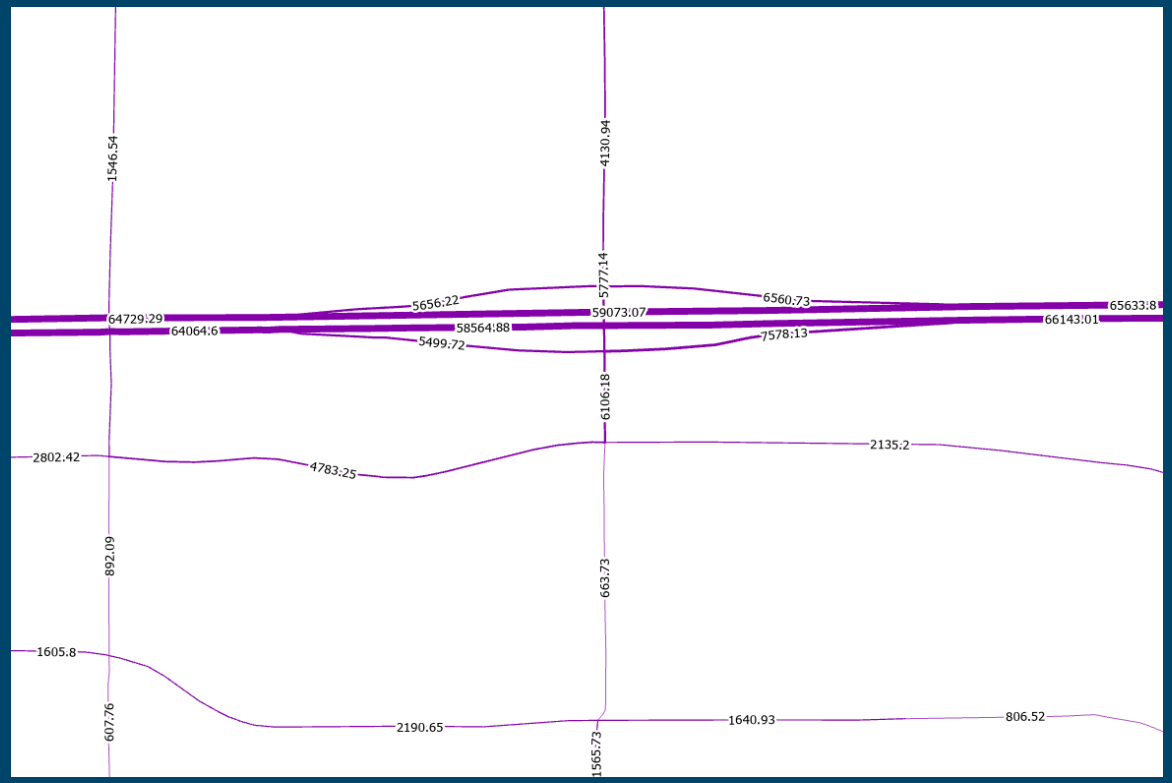
Travel Demand Modeling

- Using projected demographics and networks incorporating planned transportation facilities allows for a forecast of future conditions
- Key tool in transportation planning arsenal
- Allows for testing of different investment and demographic scenarios
- MPOs like NCTCOG required to maintain a travel demand model
  - Outputs of model runs incorporated into long-range plans
  - Provides inputs to subsequent required air quality modeling

TAFT
Transportation Analytical Forecasting Tool

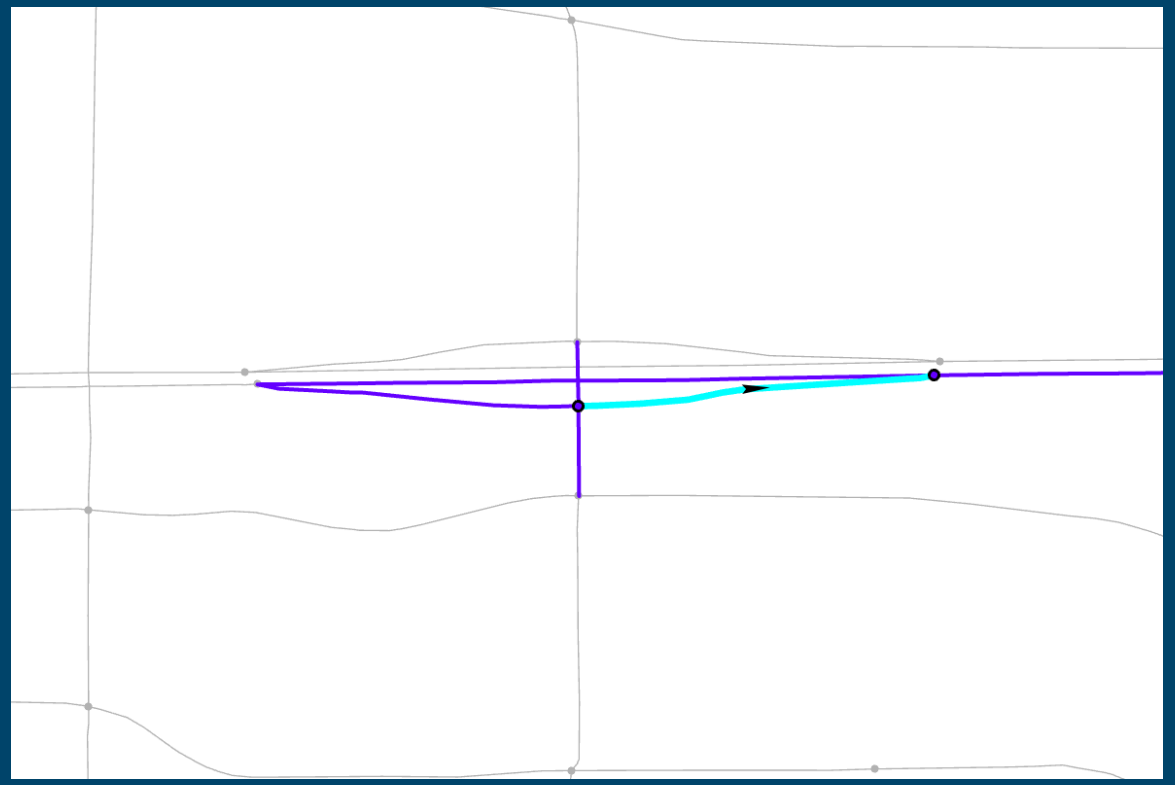
Model Outputs

- O/D Matrices
- Regional/sub-regional performance reports
- Transportation networks with forecasted attributes:
  - Roadway volumes, congestion, and travel time
  - Transit networks



Potential Applications for Networks

- Travel demand model networks need to have good connectivity and conform to specific rulesets
- Generally have all characteristics needed for network analysis in ArcGIS ready to go



Exporting from Modeling Software

- Shapefiles are only practical option for TransCAD
  - Limits on field number, names
- Manual exports were inconsistent
- Standardized through a script using TransCAD's proprietary GISDK scripting language

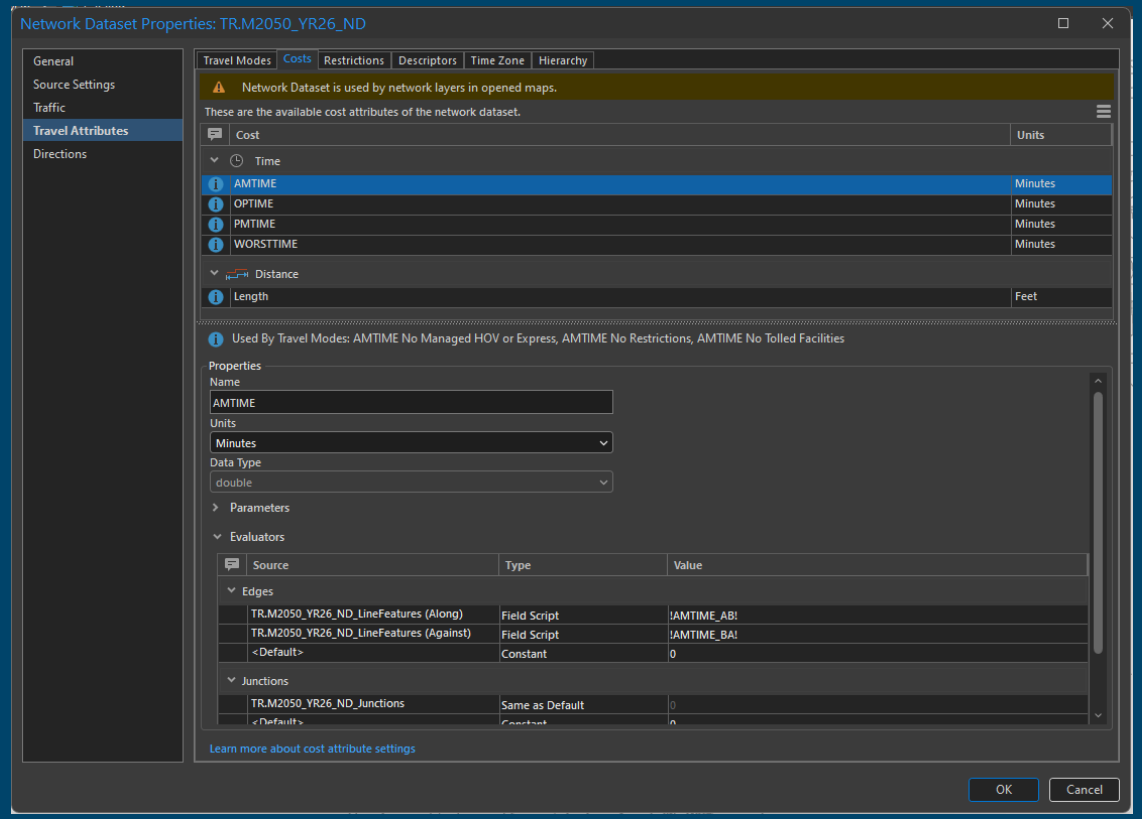
```
If GetRecordCount(layerinfo[11],"Selection") > 0 then do
        SelectByQuery("Selection", "Subset", query)
        end
Else do
        SelectByQuery("Selection", "Several", query)
        end

//Export a shapefile to the user-specified location using the export fields array and the user-specified location.

ExportArcViewShape(layerinfo[11]+"|Selection", usershppath, {{"Fields", shpfields}, {"Projection", "nad83:4202", {"units=us-ft"}}})
```

Building ArcGIS Network Datasets

- Lots of experimentation needed to mimic the network behaviors of TransCAD and our network
- Costs based on forecasted travel times
- AB/BA travel on same link (Along/Against)
- Restrictions to allow for modeling of no-toll and no-ML trips and to force correct behavior of reversible lanes



Building ArcGIS Network Datasets

Costs:

- AM/PM/Off-Peak/Worst Travel Time
- Length

Restrictions:

- Correctly model one-way flow
- Tolling
- Managed/HOV

Results in 12 distinct modes

Networks are not aware of time-of-day

Automating Network Creation

- Networks all have the same schema and rulesets
- Create Template From Network Dataset and Create Network Dataset from Template GP tools
  - Resulting XML hardcodes feature class and dataset names
- Python script automates conversion of shapefiles to network datasets
  - Writes networks to file or enterprise geodatabases

```
msg('Creating network dataset...')
arcpy.na.CreateNetworkDatasetFromTemplate(definition_xml_new, f'{sde}\\{network_name}_NFD')

msg('Building network...')
arcpy.na.BuildNetwork(f'{sde}\\{network_name}_NFD\\{network_name}_ND','FORCE_FULL_BUILD')
```

Publishing to ArcGIS Server/Enterprise

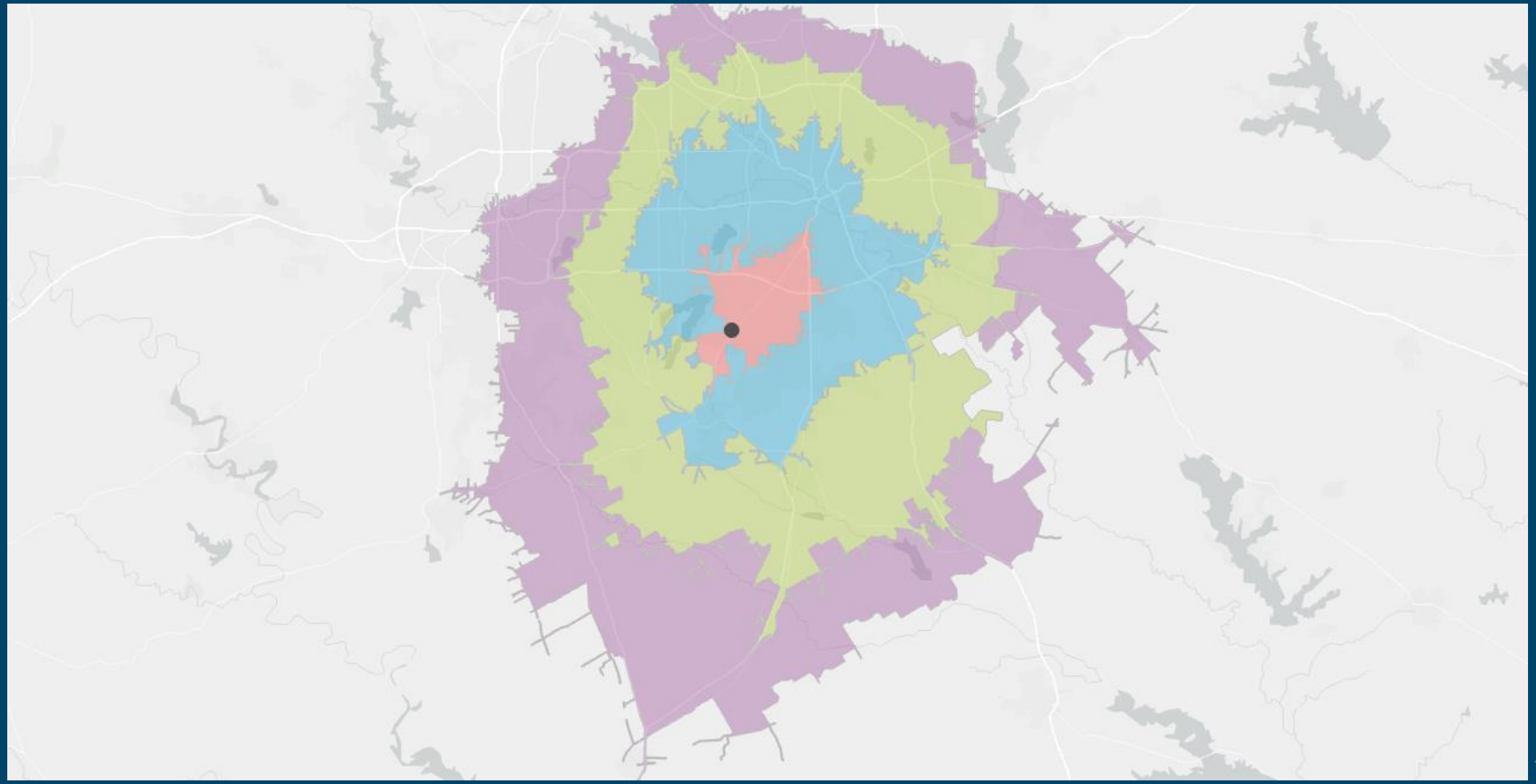
- Previous processes create network datasets stored on disk or EGDBs
- Desire to share networks with stakeholders
  - Helps communicate the recommendations and impact of our long-range plan
- Creating network analysis web applications
- Need to bring consistency to network analyses
- Unburdening user machines from computation
- Networks may see minor updates/tweaks

- New Enterprise infrastructure (11.5) now present
  - Dedicated GP server!

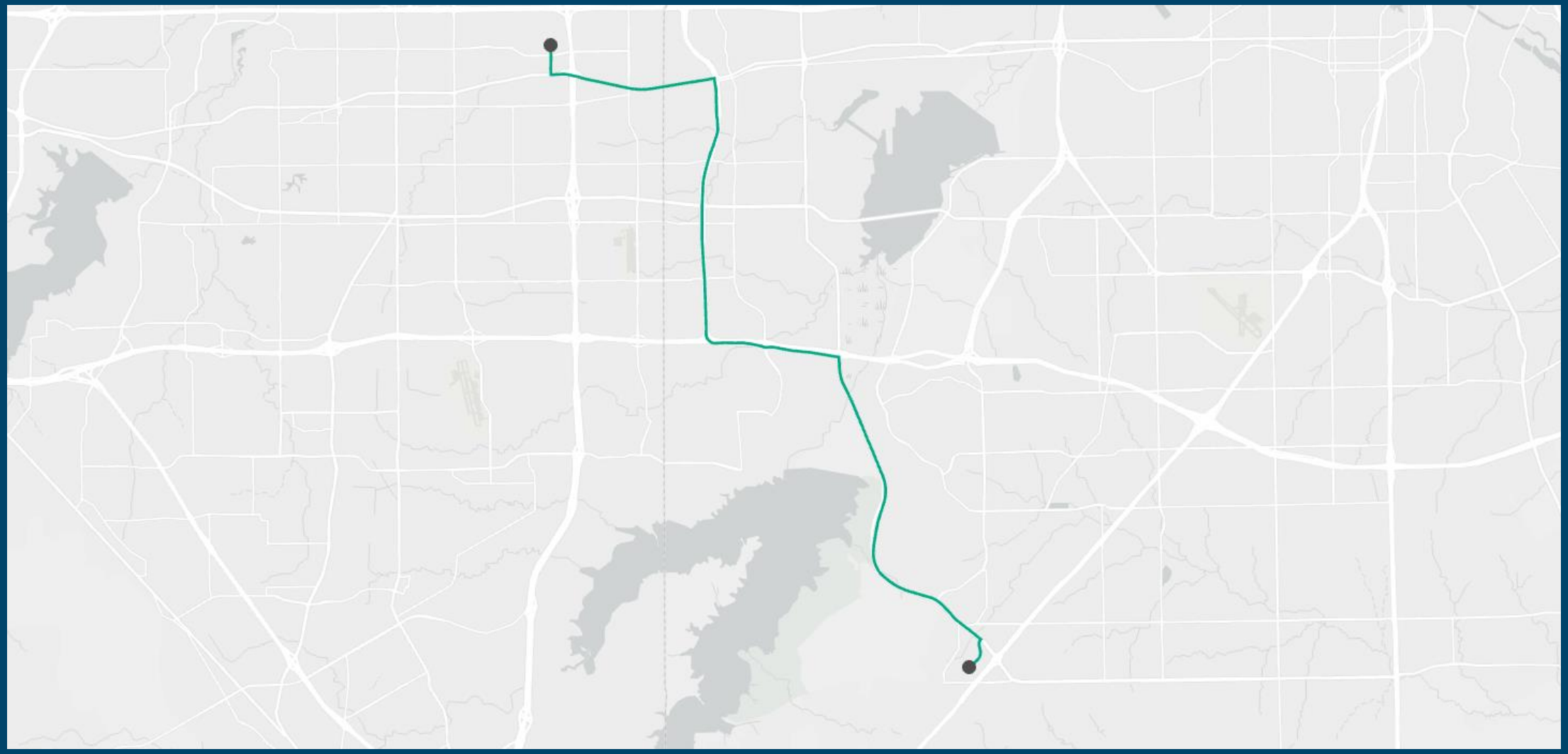
Publishing to ArcGIS Server/Enterprise

- Can publish directly from ArcGIS Pro
  - Sharing Network Dataset layer creates Network service on Server
  - Can be consumed in Pro clients to shift network analysis tasks to server
  - Does not create specific solvers for web clients
- Publishing from Portal interface
  - Allows for specific solvers to be enabled for web clients
- "Publish Routing Services" command line utility

Applications



Applications



Resources

- “Publish routing services” (ArcGIS Server documentation)
- “Publish standard routing services” (ArcGIS Pro documentation)
- Create Template From Network Dataset (GP Tool Reference)
- “What is a network dataset?” (ArcGIS Pro documentation)
- “The Travel Model Song (A Brief Overview of Travel Demand Modeling)”

Questions?

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