Network Analyst: Creating Network Datasets

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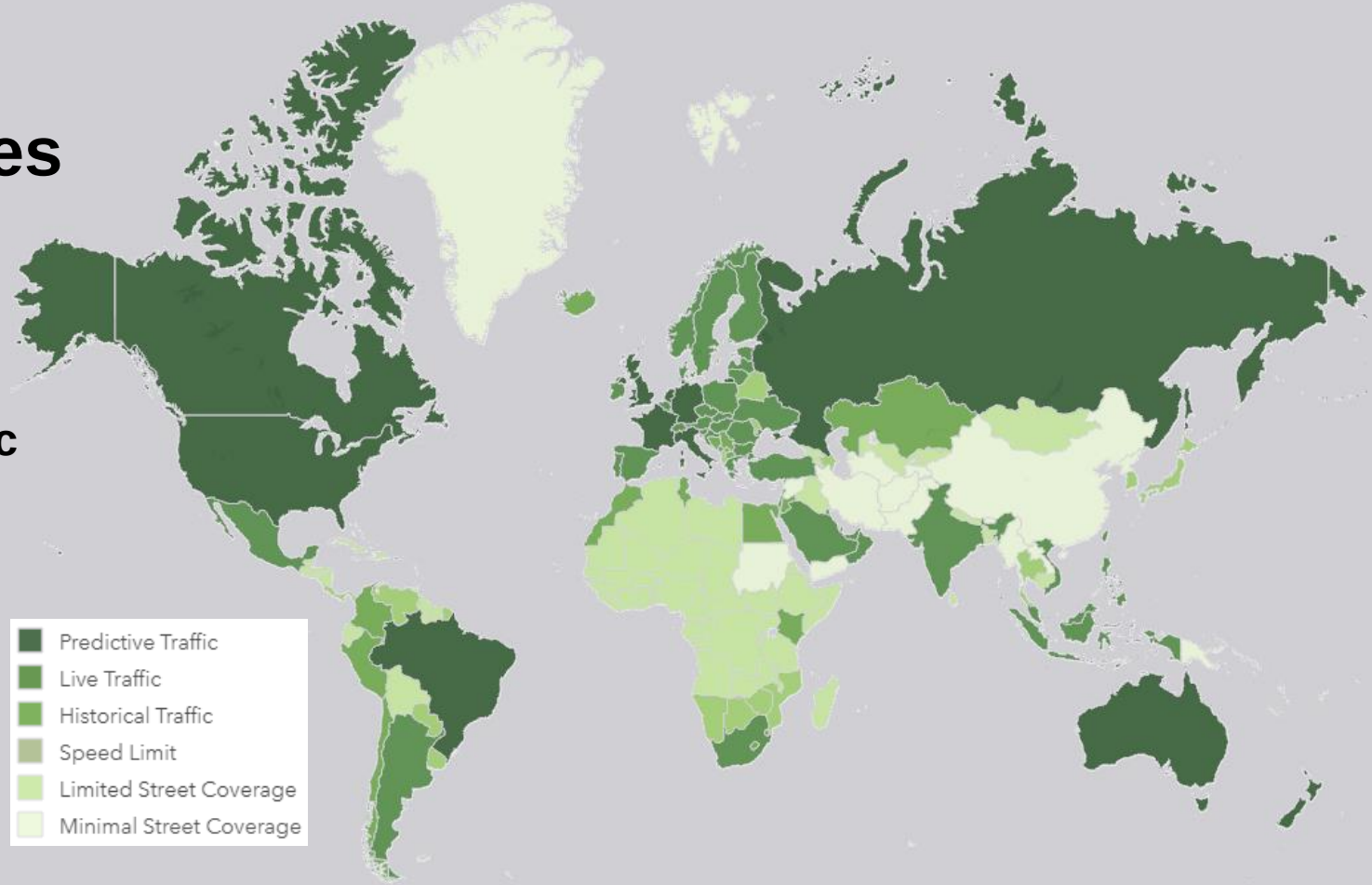
GIS INSPIRING WHAT'S NEXT

Agenda

- Do you need to create a network dataset?
- Preparing street data for use in a network dataset
- Using turns, signposts, and historical traffic data
- Parameterized attributes, travel modes, and geoprocessing
- Support & Resources
- Questions

Do I need to create my own network dataset?

- **Network analysis services**
  - **Via ArcGIS Online (uses credits)**
  - **All analysis types**
  - **Up-to-date, world-wide street data**
  - **Historical, live, and predictive traffic**
  - **No network dataset required**



Do I need to create my own network dataset?

- Compressed File Geodatabase format
- Ready to use
- Network dataset already created
- More information at http://www.esri.com/data/streetmap

Do I need to create my own network dataset?

- **Free tools for downloading OSM data to a File Geodatabase**
- **Create a network dataset using the *Create OSM Network Dataset* tool**
- **More information at https://www.esri.com/en-us/arcgis/products/arcgis-editor-for-openstreetmap**

Know Your Street Data

- Look at your data.
  - Examine the format, geometry and the attributes.

- Read the data documentation.
  - Understand the fields and values.

- Decide what type of analysis you need.

- Determine if the data has information that can be used in a network dataset.

Network sources

Sources in a Network Dataset

- Line features (at least one required)
  - Most common: Streets
- Point features
  - User defined: Street intersections
  - Automatically created: System junctions
- Turn features
  - Transitions between edges
- Traffic tables
- Directions tables and features

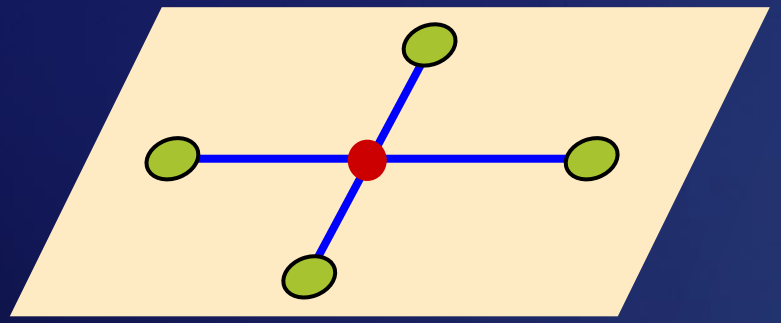
Common Fields for Street Data

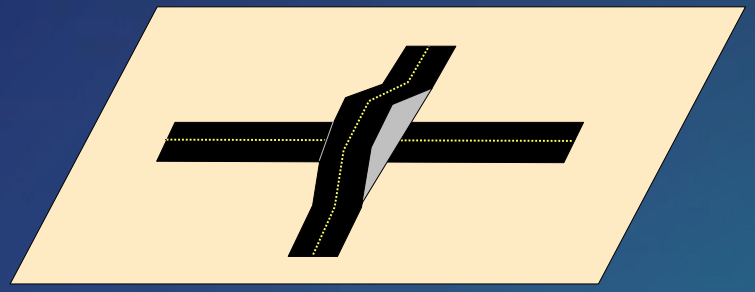
Field	Data Type	Application
Elevation	Integer	Ensures proper connectivity
Oneway	Text	Helps determine one way streets
Length	Double	Calculate the shortest route
Travel time	Double	Calculate the fastest route
Hierarchy	Integer	Ranking of streets for routing on large network datasets
Speed	Integer	May be used to calculate travel time
Road class	Integer	Classification of roads – used for formatting directions text
Street name or address data	Text	Helps generate network locations and directions

Connectivity

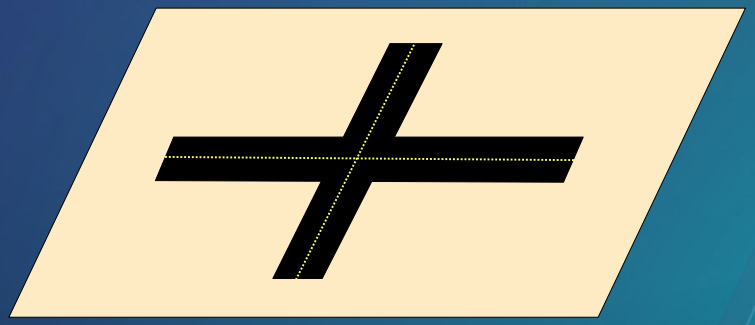
Spatial coincidence
Connectivity policies

Edge Connectivity Policies





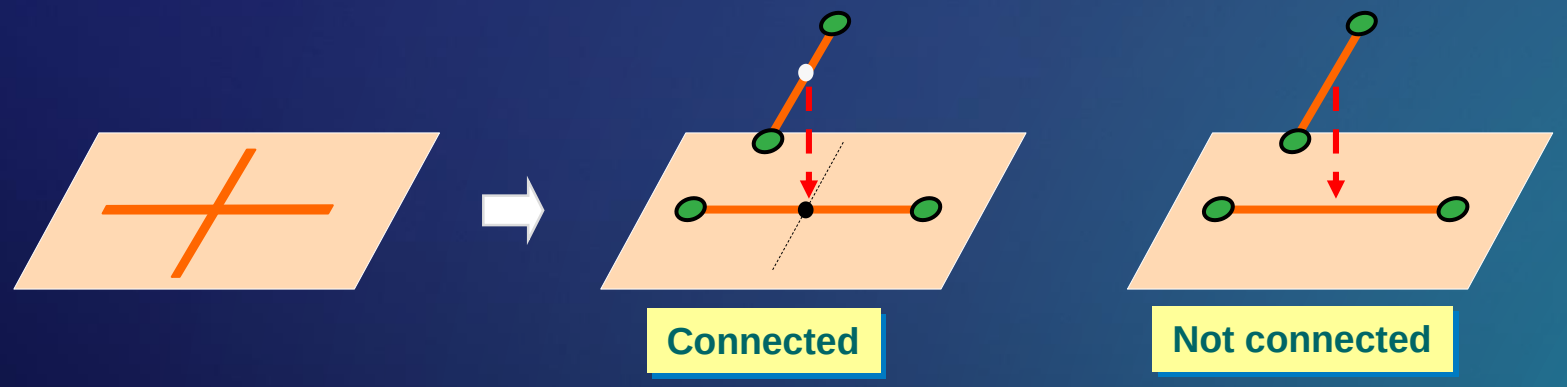
End point



Any vertex

Coincident Geometries

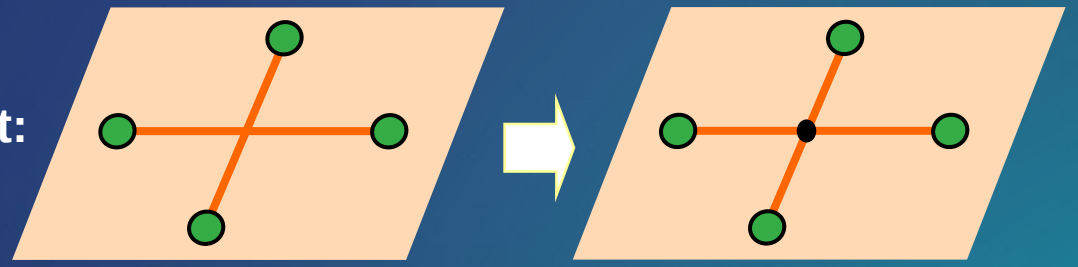
- Enable network connectivity
  - Points of coincidence should exist where line features cross or intersect



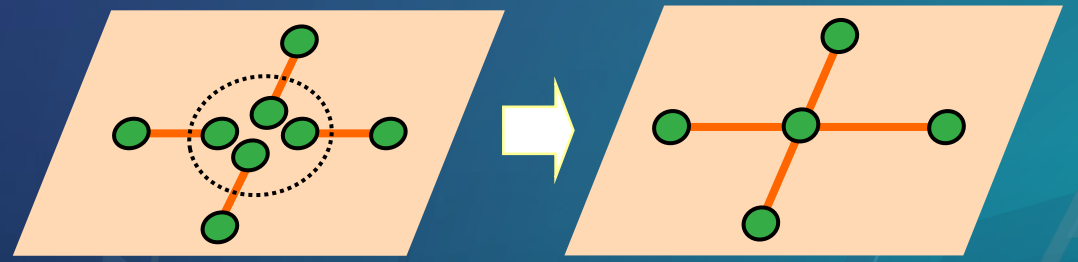
Creating Coincident Geometry

- Include sources in a Topology
- Use the *Integrate* tool (Geoprocessing)

  - Inserts vertices where features intersect:



  - Snaps features that are not coincident:



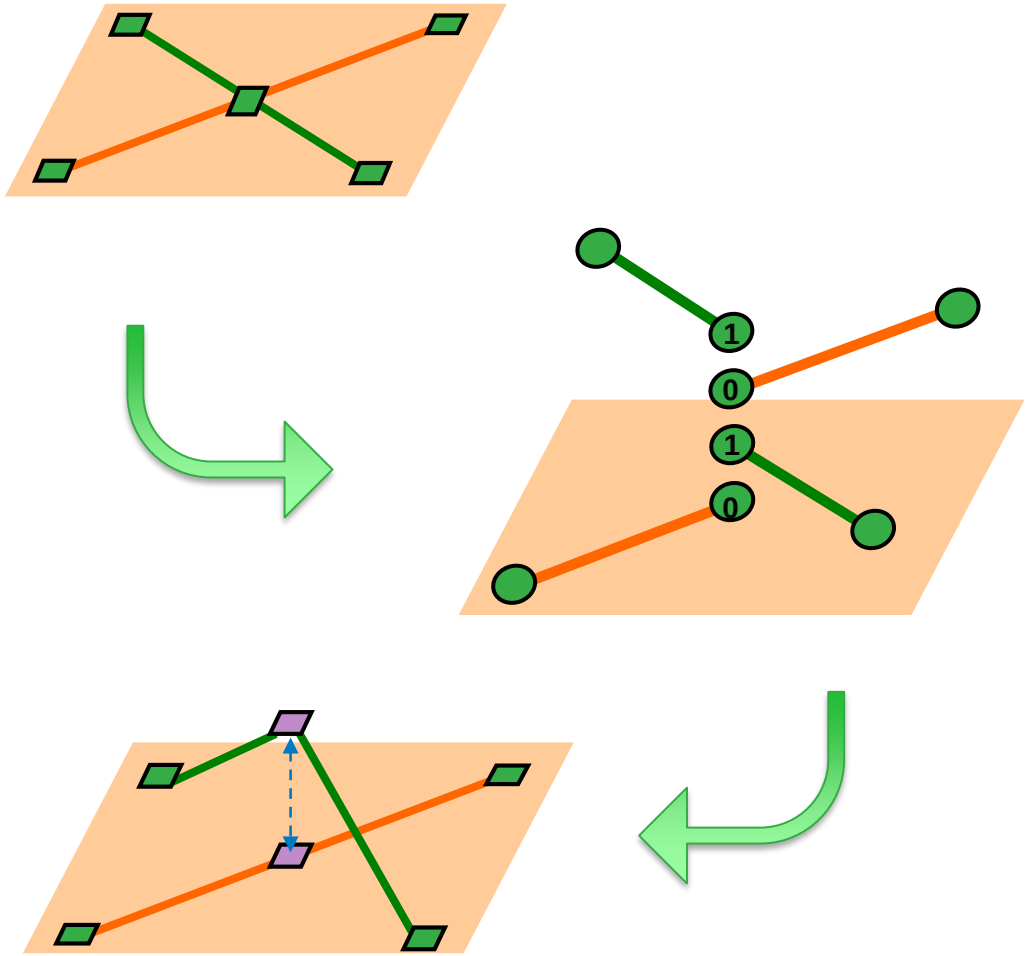
Elevation fields

- Represent multiple “levels” for line features
- Applied to the line features with coincident endpoints
- Commonly called z-levels

NAME	F_ZLEV	T_ZLEV
State St	0	0

Elevation fields

- Model overpasses & underpasses

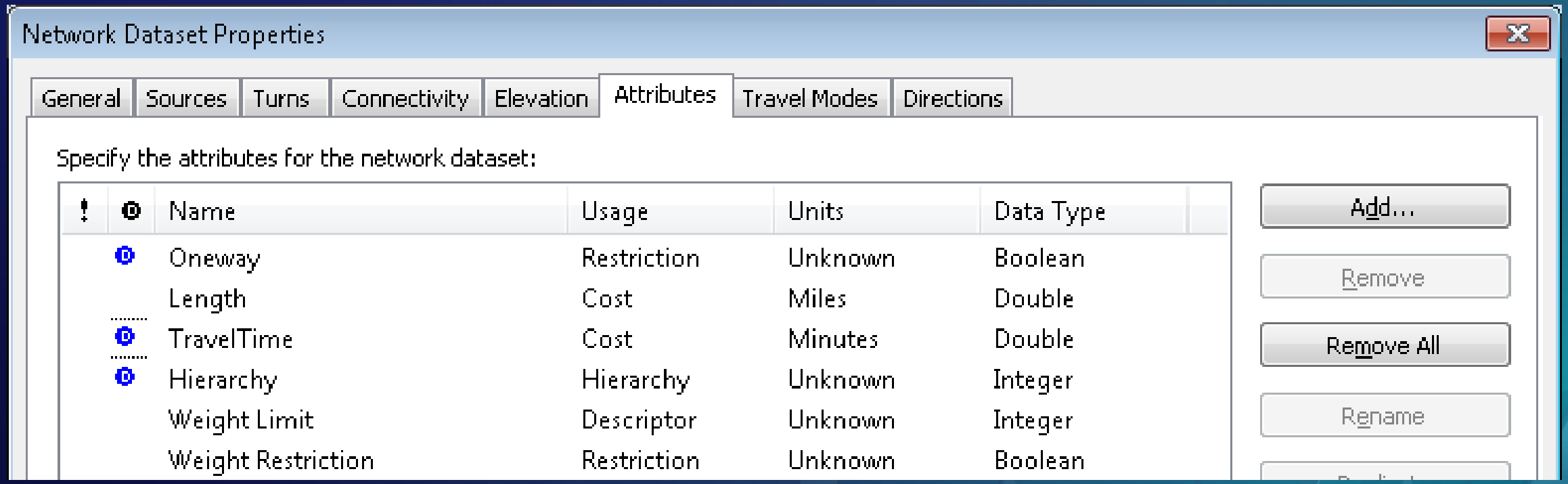


Network Attributes

Cost
Restriction
Descriptor
Hierarchy

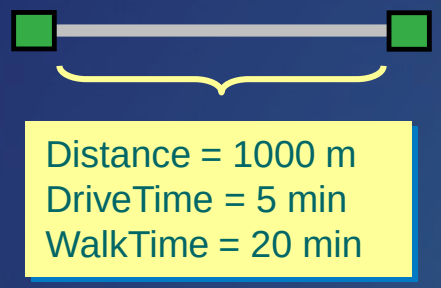
Attributes in the Network Dataset

- **Used to control navigation through the network**



Cost Attributes

- **Value that is accumulated as you traverse a network element**



- **Values are apportioned along edges**

Restrictions

- Model one-way streets, prohibited turns, height restrictions, etc.
- Evaluated as a true/false condition per network element

Example: One-way restriction

- 2-way street

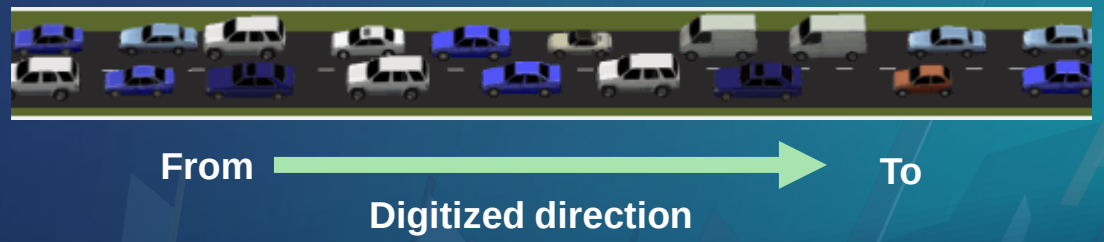
NAME	Oneway
State St	

- 1-way in digitized direction

NAME	Oneway
State St	FT

- 1-way against digitized direction

NAME	Oneway
State St	TF



Descriptor Attributes

- Description for the entire length of the network element
- Used for driving directions or deriving other attributes

RoadClass Descriptor attribute

- Used for formatting the text of driving directions

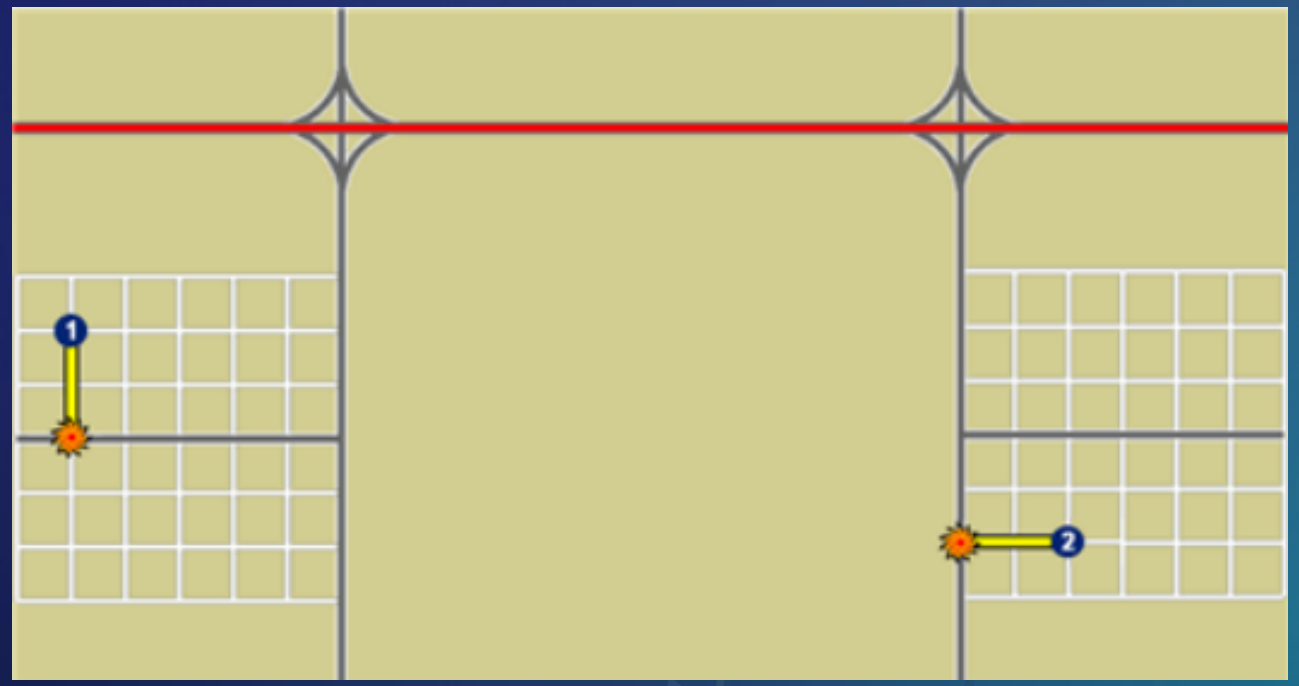
RoadClass Value	RoadClass Description	Driving Directions Text
1	Local road	“Turn left on Main St”
2	Limited access highway	“Go East on I-44”
3	Ramp	“Take ramp and go on US-7 N”
4	Ferry	“Take Lake Expy ferry”
5	Roundabout	“Take roundabout and proceed South on Main St”

Hierarchy Attribute

- Minimizes impedance while favoring higher order roads
- Classifies network edges into multiple levels
  - Lower numeric level = higher order road

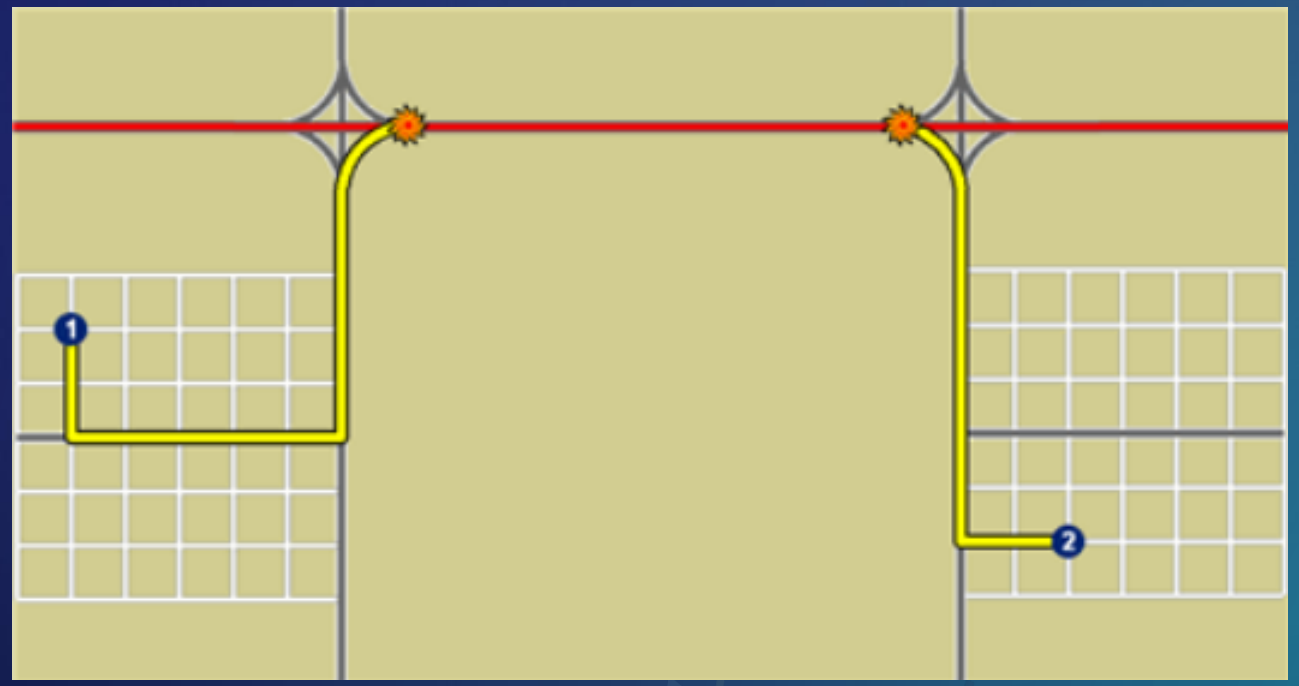
Hierarchy attribute

- First, search local roads for secondary road candidates
  - Searching occurs from both starting and ending stops



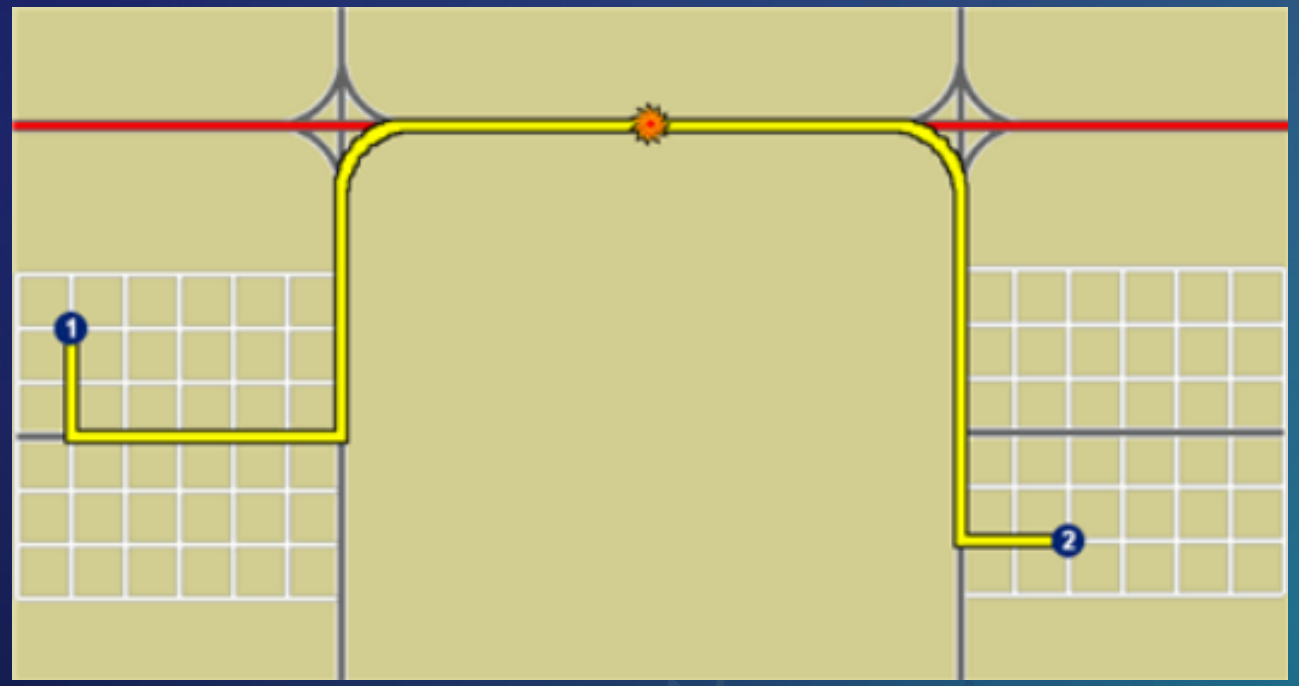
Hierarchy attribute

- Next, search secondary roads for primary road candidates
  - NOTE: Local roads are no longer searched!

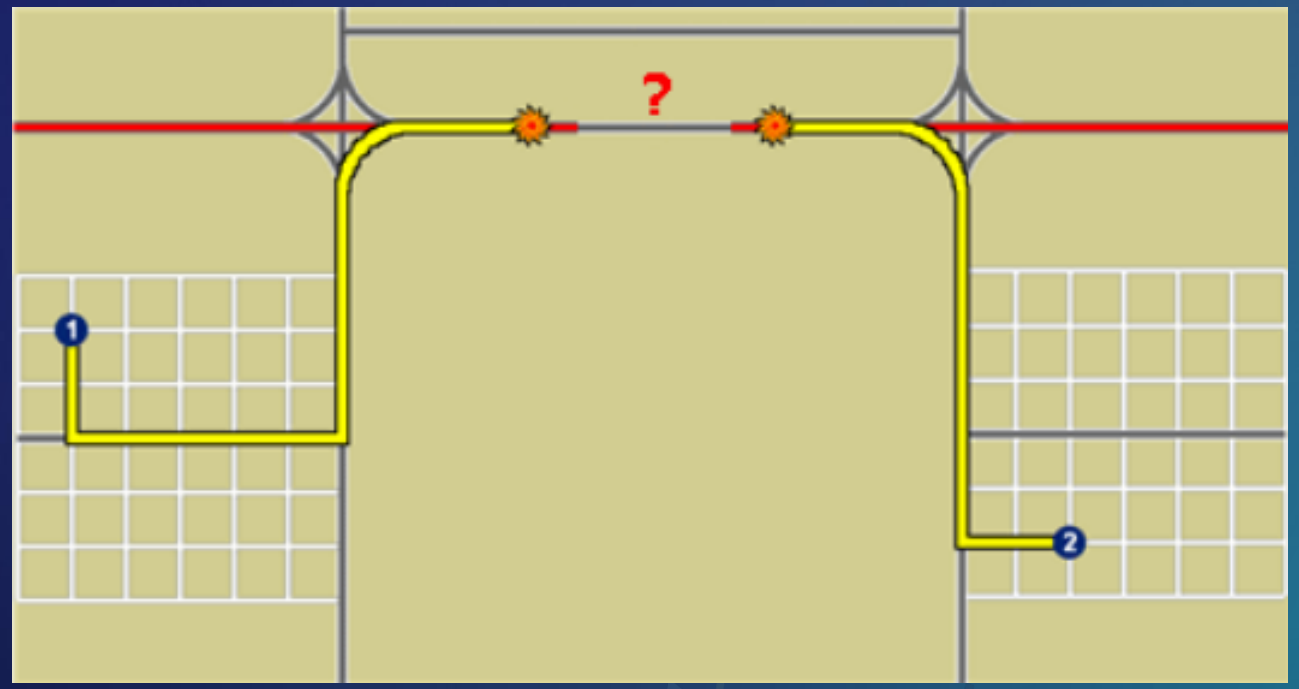


Hierarchy attribute

- Finally, search primary roads to complete the route
  - NOTE: Secondary and local roads are no longer searched!

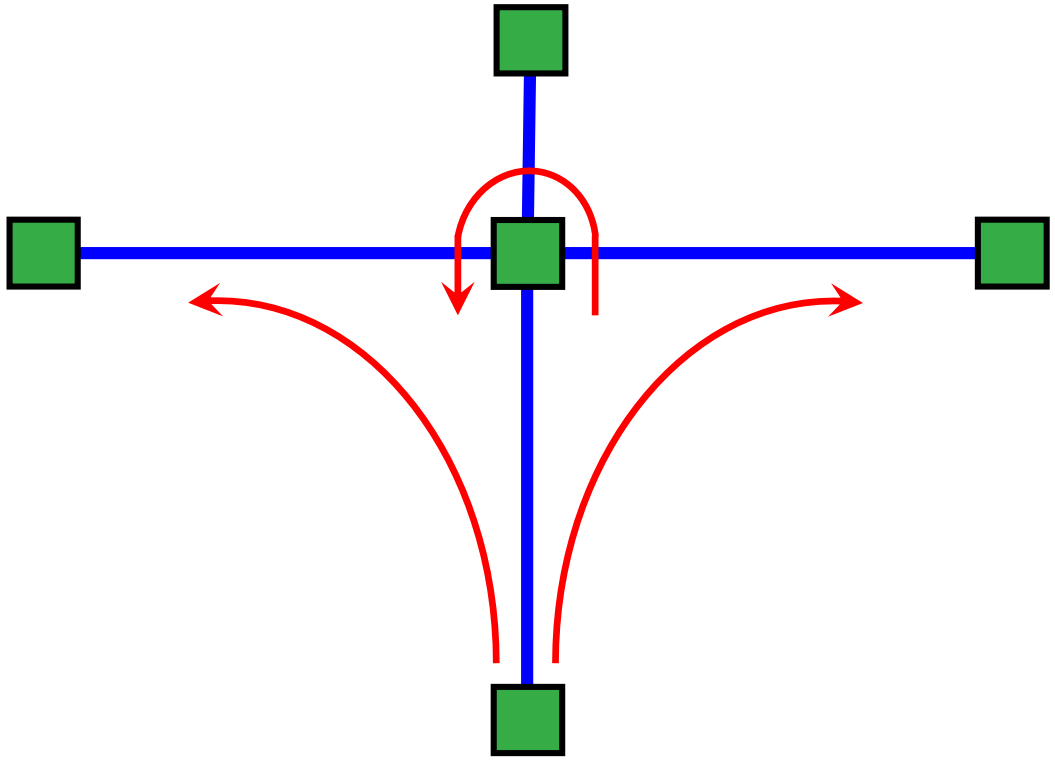


What if there is a gap in the highest level?



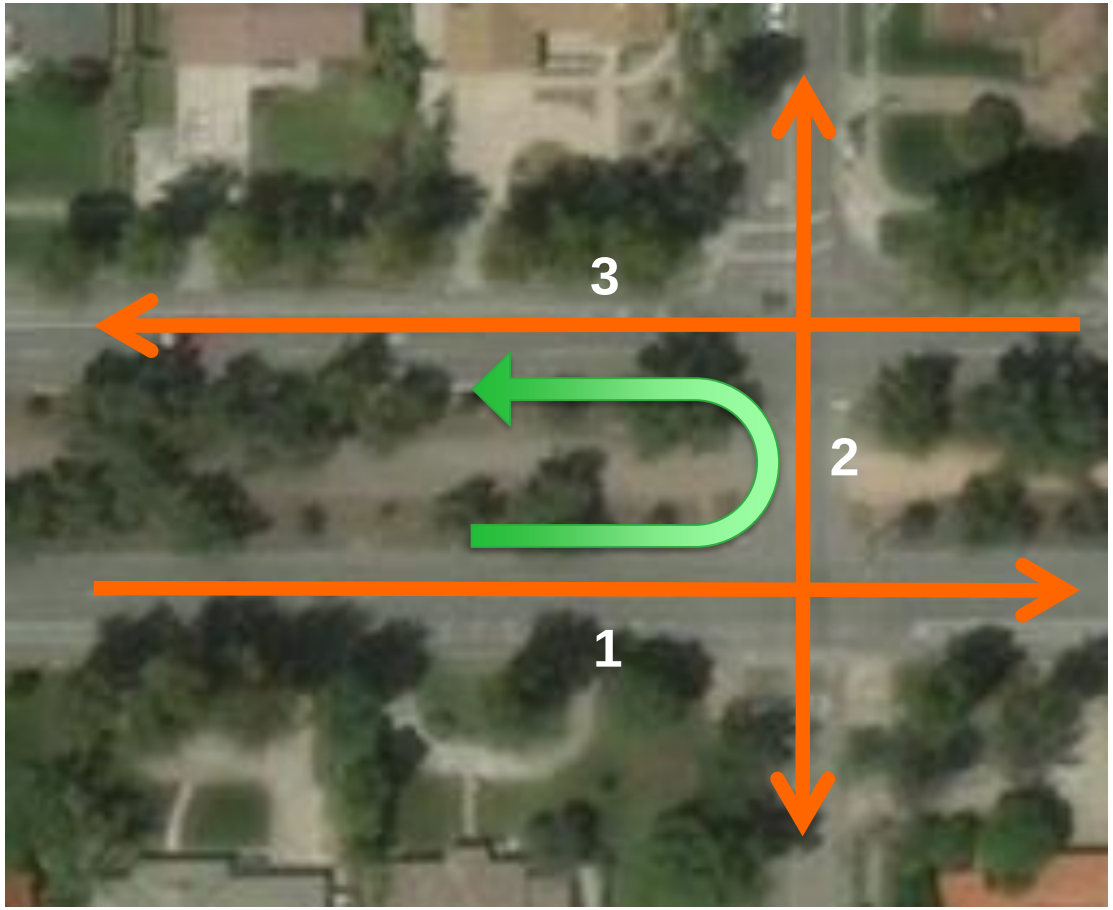
Adding Fields for Routing

to TIGER/LINE® Street Data



Turns

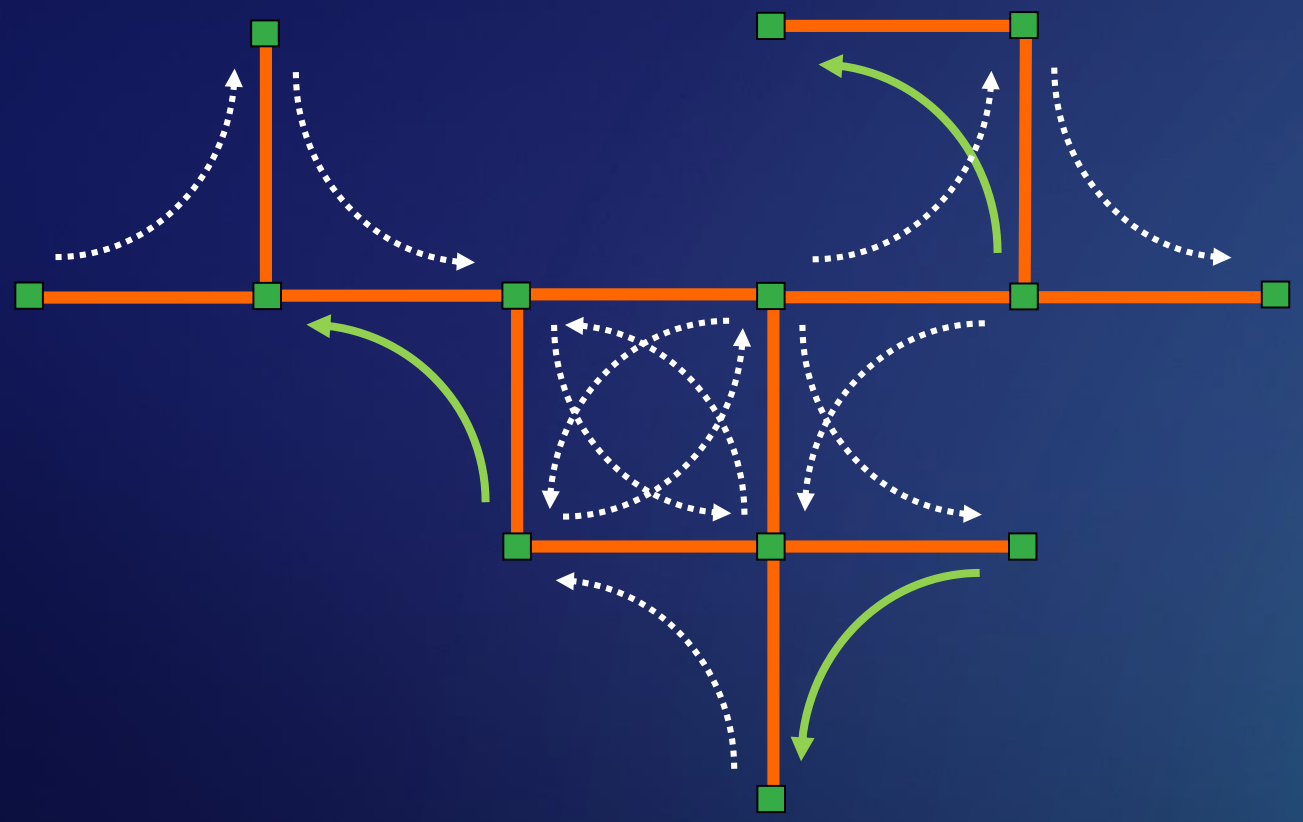
- Describe transitions between edges
- Model costs or restrictions
- Model as:
  - Turn features
  - Global turns



Turn Features

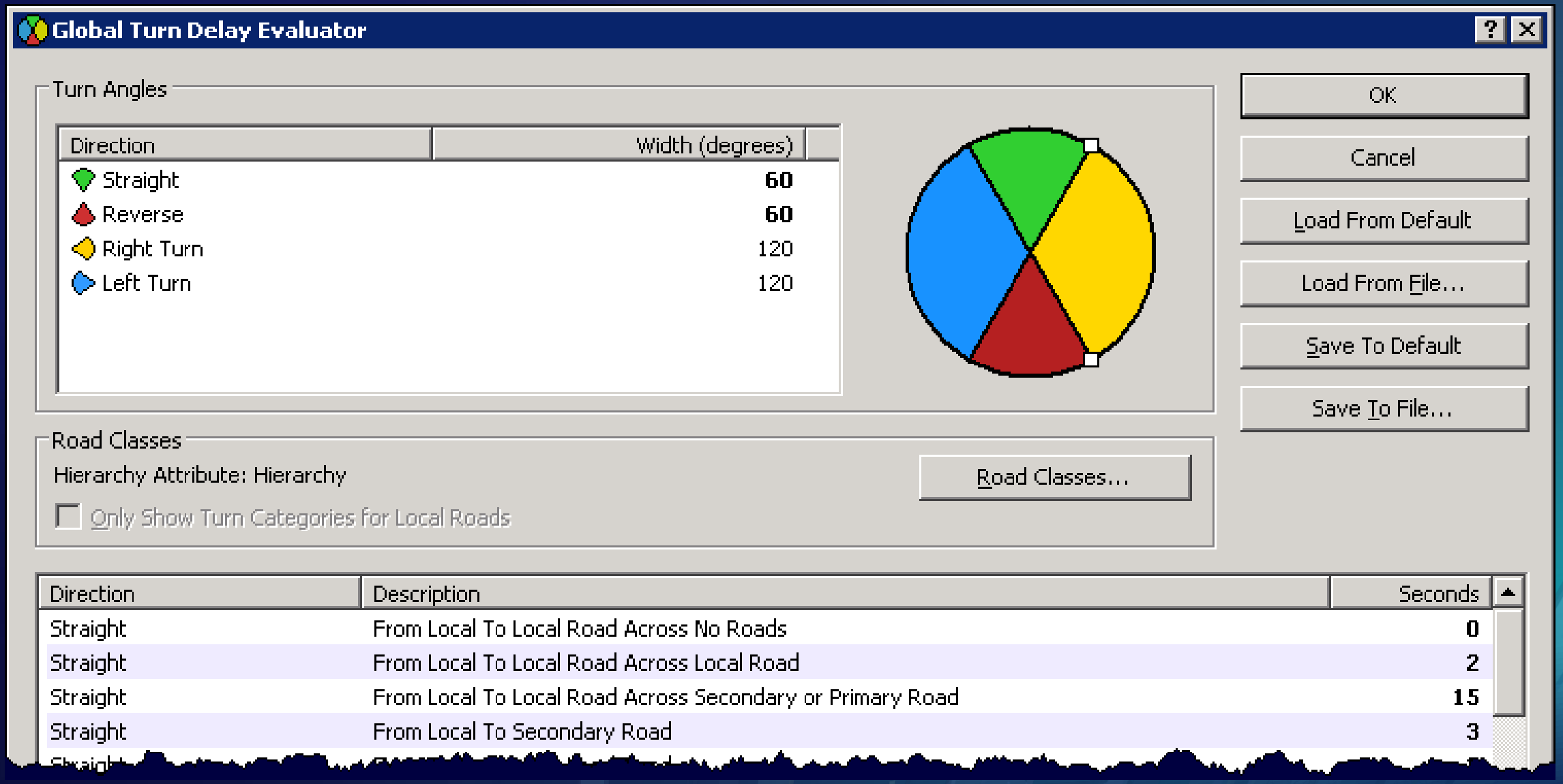
- Digitize as a line feature
- Can span multiple edges
- Reference edges by:
  - Feature Class ID
  - Feature ID
  - Position

Global turns



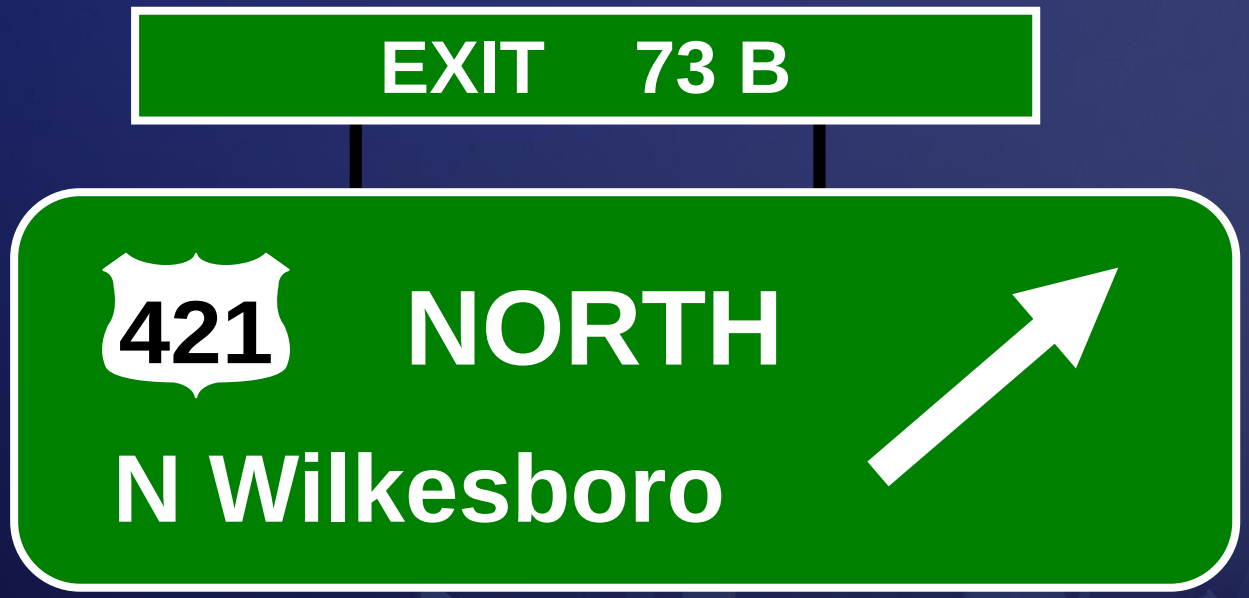
- Consist of:
  - All implied two-edge turning sequences in the network
  - No need to create a turn feature for every two-edge sequence in the network
- Turn features override global turns

Global Turn Delay evaluator



Signpost data

- Enhance the text of driving directions with text from highway signs:
  - Example: “At exit 73B, take ramp to US-421 North toward N Wilkesboro”



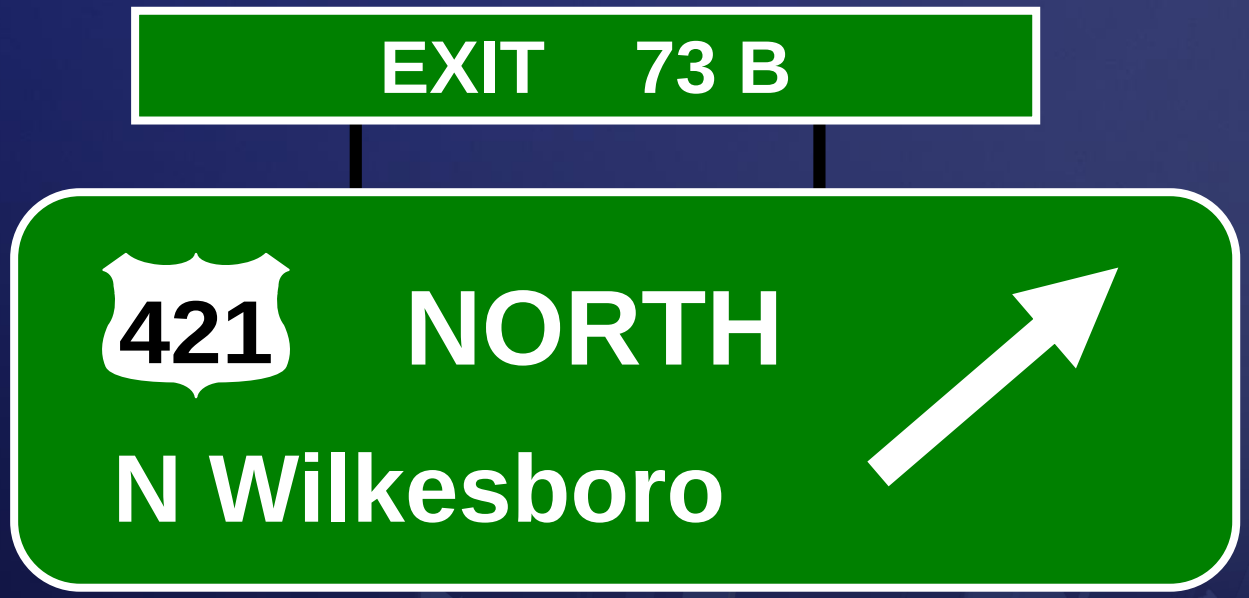
Signpost data

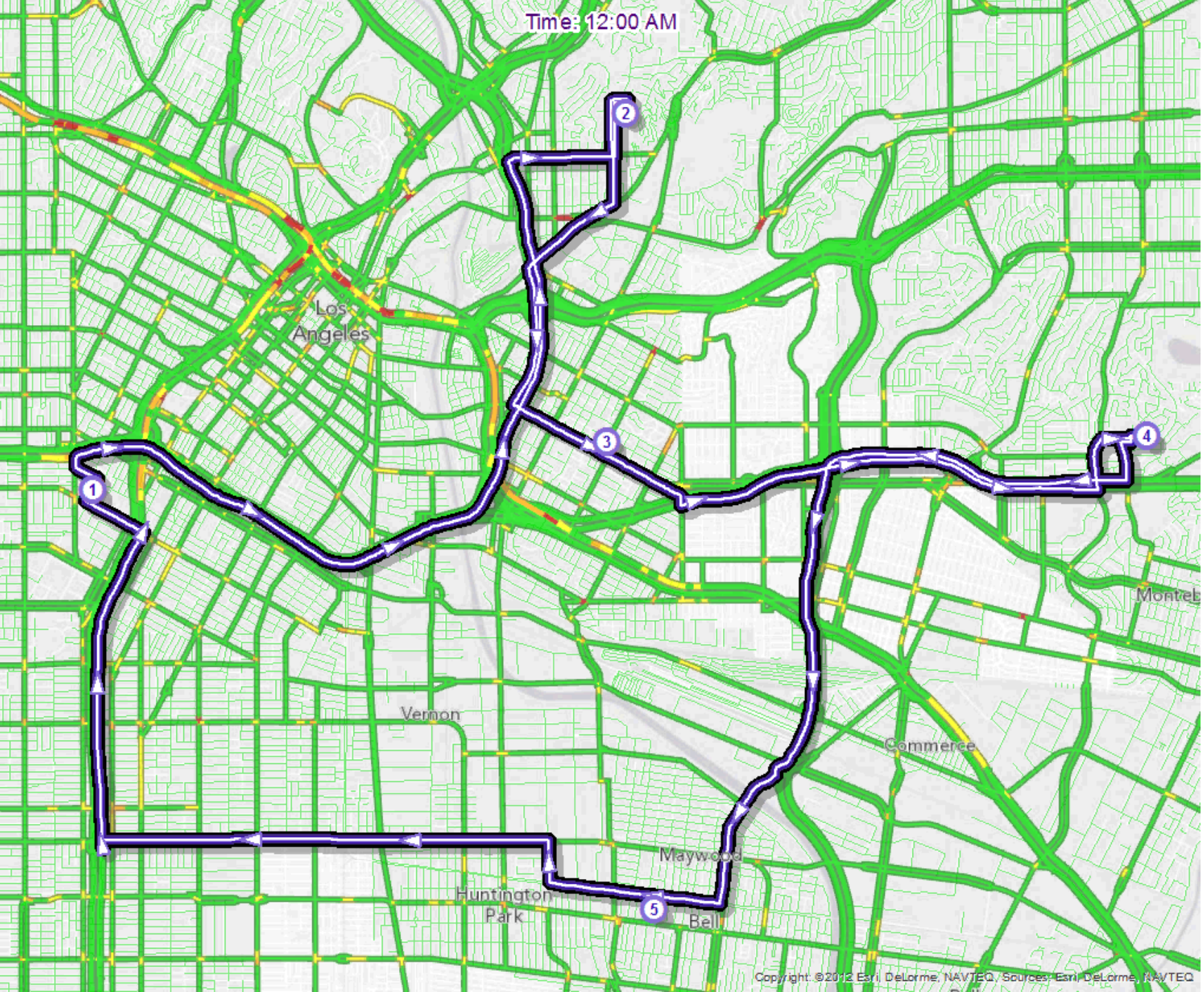
- **Signpost feature class**

Object ID	1
Exit number	73 B
Street name(s)	US-421
Direction	North
Destination(s)	N Wilkesboro

- **Signpost streets table**
  - **Streets traversed when following the sign**

Signpost ID	1
Edge feature class ID	12
Edge feature ID	41





Traffic

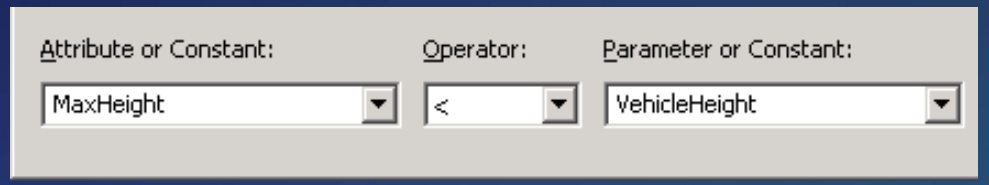
- **Live**
  - **Can include predictive**
- **Historical**
- **Configure through tables and network dataset properties**

Using Turns, Signposts, and Historical Traffic

Parameterized Attributes

- Network attribute that accepts a parameter
- Model dynamic aspects of an attribute's value

Example: Height limit restriction



- Compare a descriptor attribute…
  - To specific the road's height limit
- …and a parameter
  - To specify the height of the vehicle
- …in a restriction attribute
  - To see if the vehicle is too tall to travel that segment of road

Restriction Usage Parameter

Layer Properties

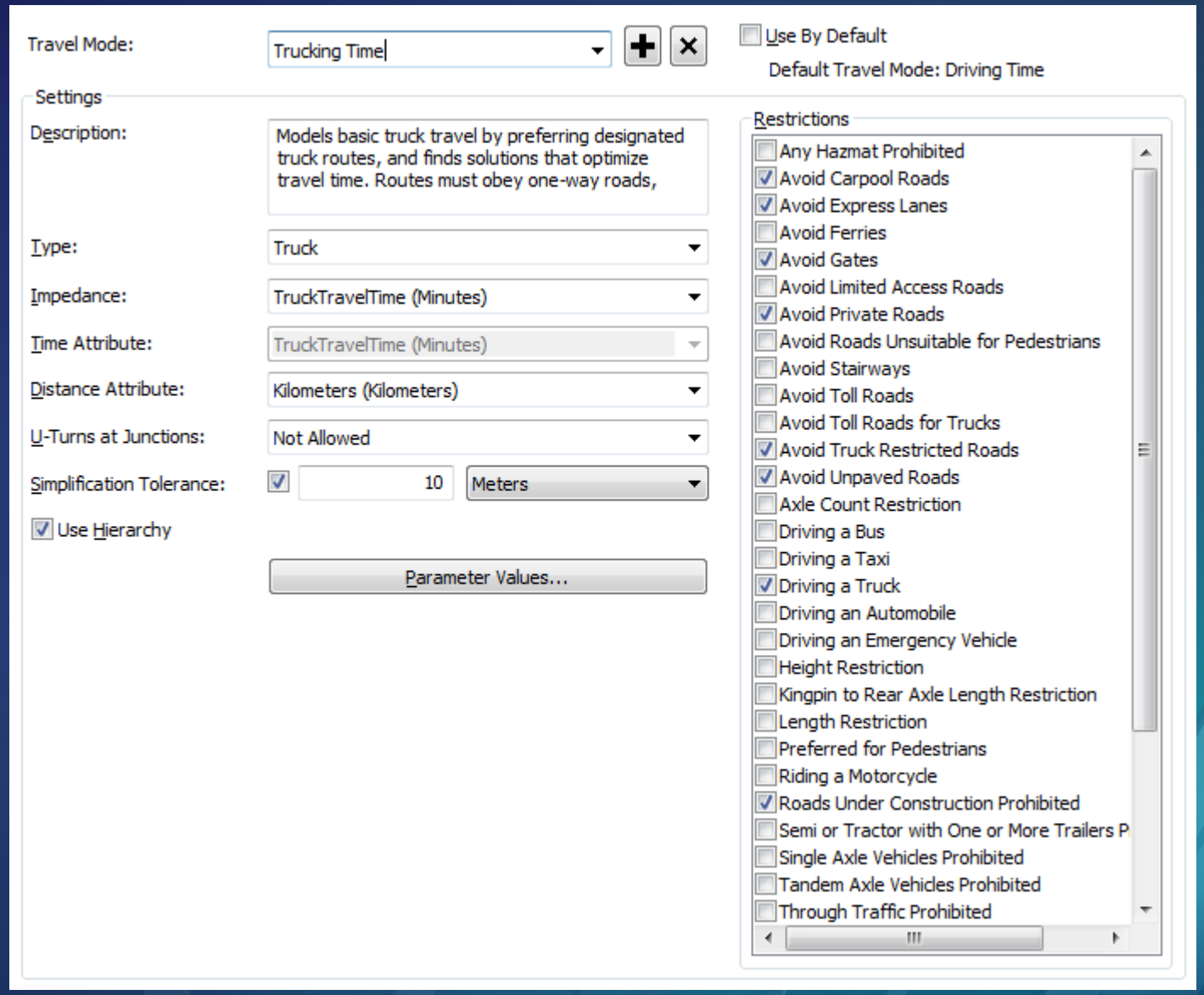
General | Layers | Source | Analysis Settings | Accumulation | Attribute Parameters | Network Locations

Specify the parameter values for the network attributes.

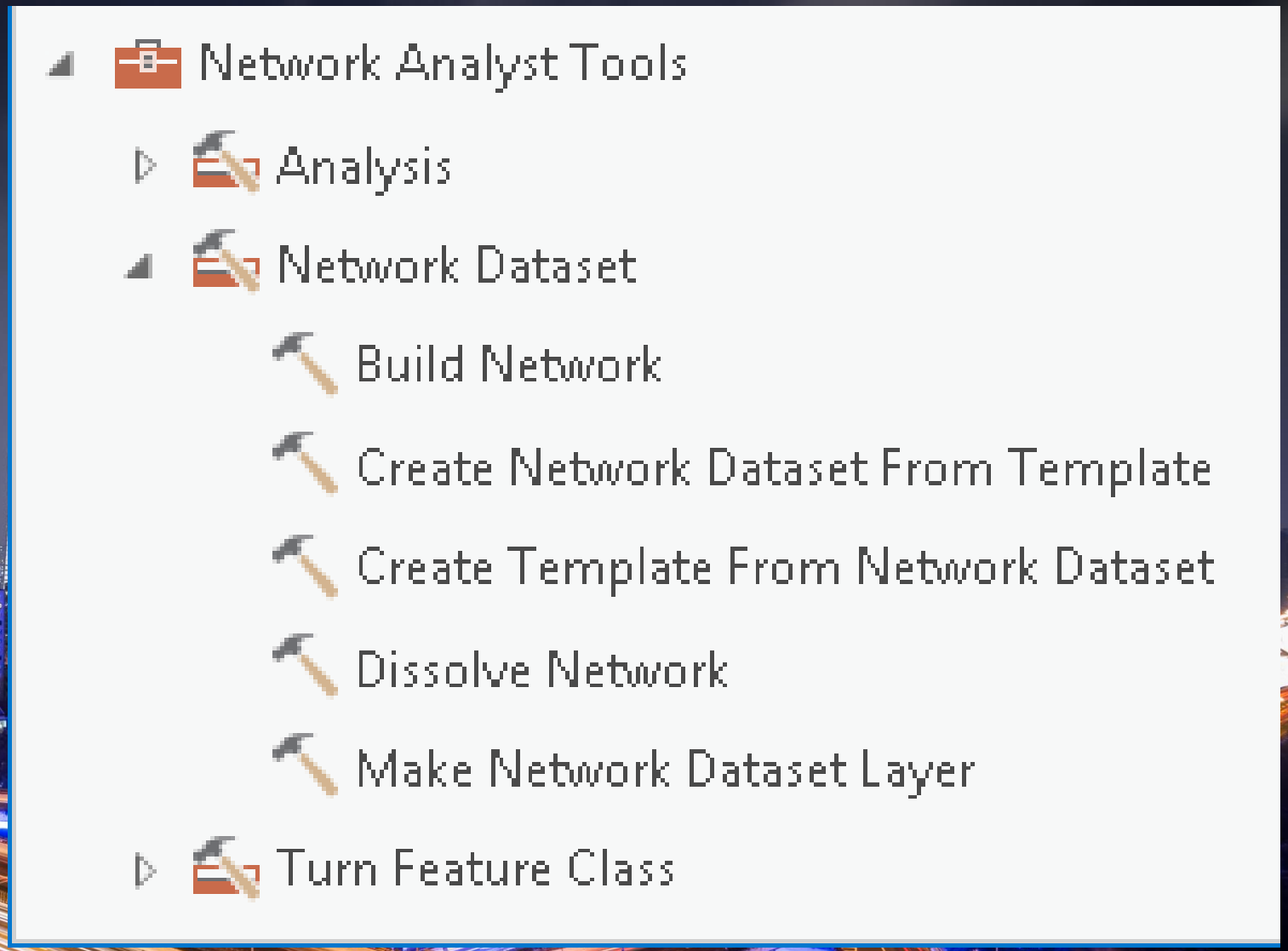
Attribute	Parameter	Value
Avoid Ferries	Restriction Usage	Avoid: Medium
Avoid Gates	Restriction Usage	Avoid: Medium
Avoid Limited Access Roads	Restriction Usage	Avoid: Medium
Avoid Private Roads	Restriction Usage	Avoid: Medium
Avoid Toll Roads	Restriction Usage	Avoid: Medium
Avoid Unpaved Roads	Restriction Usage	Avoid: Medium
Divider Restriction	Restriction Usage	Prohibited

Travel Modes

- A collection of settings that define how to move through a network



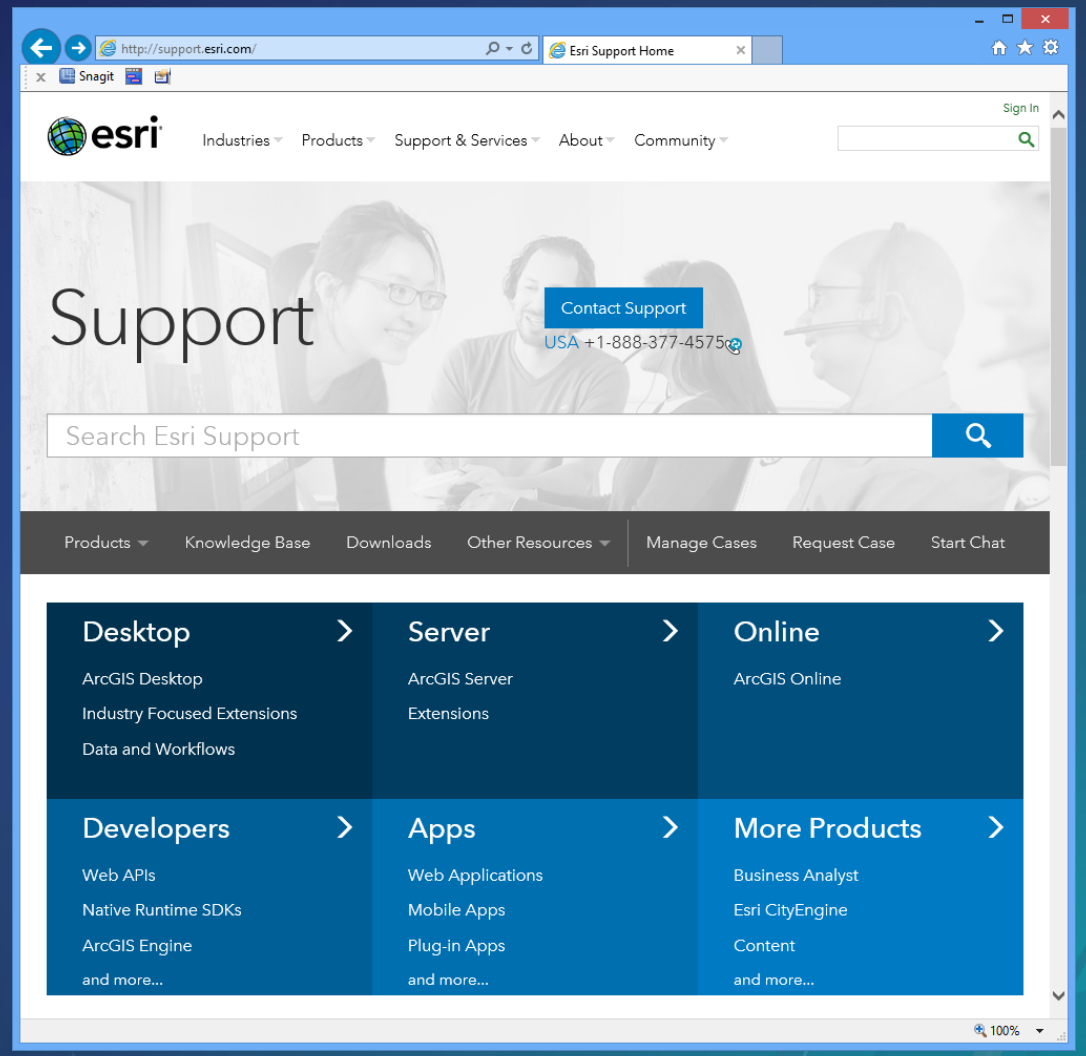
Geoprocessing Tools



Support & Resources

Esri Support Center

- Online portal to technical information
- Knowledge Base
  - Technical articles
  - White papers
- Downloads
  - Patches
  - Service packs
  - Samples
- Other Resources
  - GeoNet
  - Blogs



http://support.esri.com

For more information

- Network Analyst product page
  - Links to Demos and Other Resources
  - http://www.esri.com/software/arcgis/extensions/networkanalyst

- Free recorded training seminar with current maintenance subscription
  - Using Network Analyst in ArcGIS Desktop 10
  - http://training.esri.com/gateway/index.cfm?fa=catalog.webCourseDetail&CourseID=1955