

Developing MCTool – A Network Database Management GIS Tool for Montgomery County Travel Demand Model

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Project Overview

Purpose: Montgomery County (MC) highway & transit networks updates for Travel/4 regional travel demand model inputs

- multi-year networks
- true-shape highway network and link segment distance
- integrated highway and transit networks
- facilitates updating link attributes, making maps, and sharing data
- more efficient editing of networks

Project Overview *(continued)*

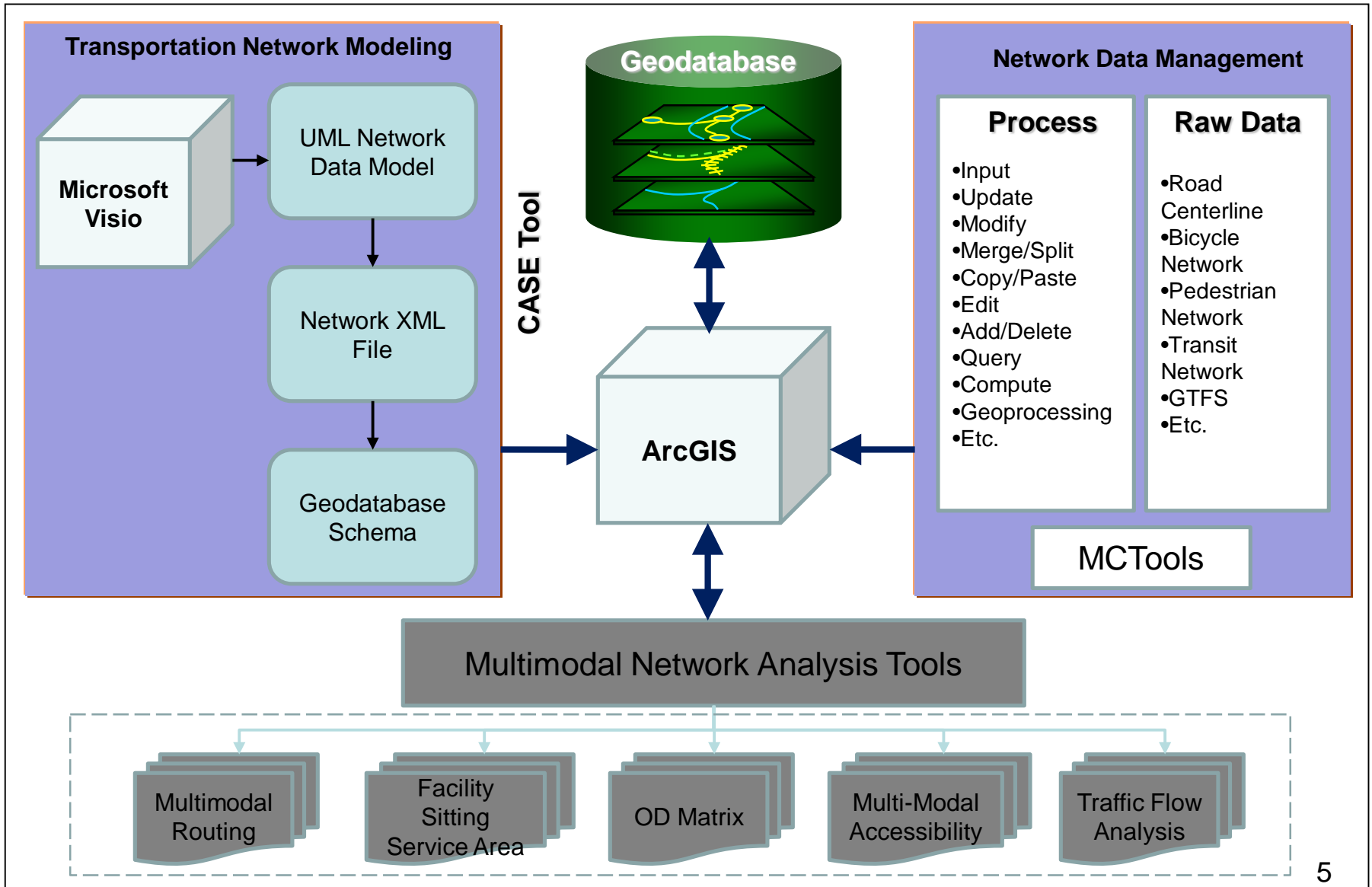
- Contract with Daniel Consultants, Inc. to develop MCTool and Montgomery County (MC) multi-year network geodatabase
- MCTool - adopted from COG/TPB's COGTool, an ArcGIS AddIn program with an interface of managing / editing the network geodatabase and exporting for modeling input files

MC Transportation Network Application for Travel Demand Model

- Network Application System - MCTool
- County-Focused Network Database
- Integrate with COG Regional Network
- Network Management Tools
- Network Analysis Applications



Network Application Framework



Network Application System

- Transportation Network Schema
 - Database structure
 - Flexible and Customizable table structure
 - Currently include highway and transit networks
 - Add bike and walk networks in future
 - Implementation with CASE Tool
- Network Data Management
 - ArcGIS/Geodatabase
 - Data Management Tools
- Network Analysis Applications

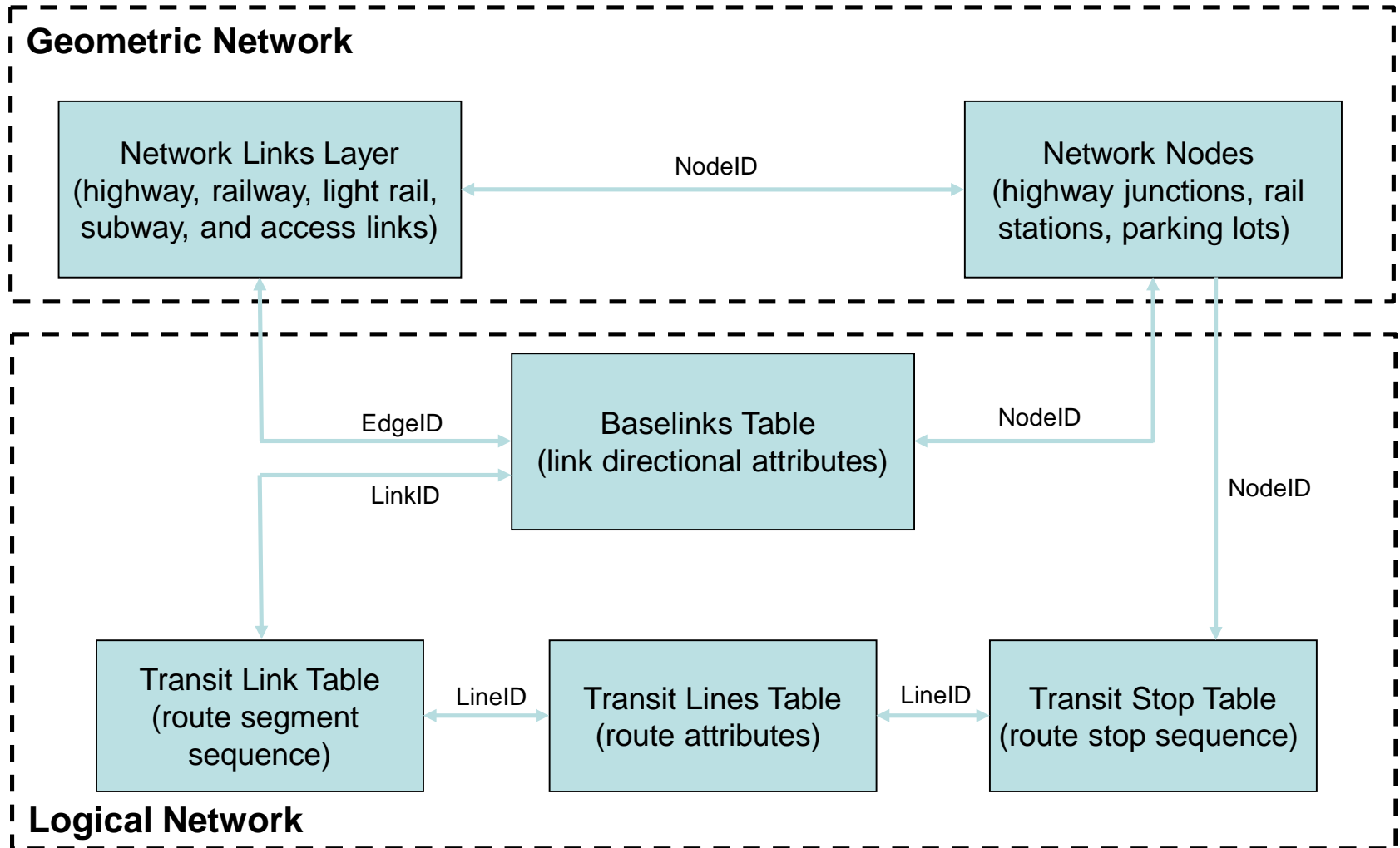
Transportation Network Geodatabase

- Network Components and Topology
 - Highway components: edges (links) and junctions (nodes)
 - Transit components: routes, stops, and segments
 - Topology: network connectivity
 - Groups: highways, buses, railways, etc.
 - Rules: nodes assigned to multiple groups
 - Allow navigation over multimodal network

Transportation Network Geodatabase

- Network Database Structure
 - Geometry network
 - Links and Nodes layers
 - True shape locations and visualization
 - Topology: A & B nodes
 - Logical network
 - Baselinks table:
 - Roadway segment attributes
 - Year and directional information
 - Transit tables
 - Routes / Segments / Stops

Network Database Structure



Transportation Network Geodatabase

- Multimodal Transit Network
 - Transit Modes: Bus, Railway, Light Rail, BRT, and Subway
 - Bus routes follow highway network
 - Dynamically link with highway links (no geometry representations)
 - Other transit modes have geometry representations
 - Access links connect different modes

MC focused Networks

- Data Sources

Highway: Centerlines, COG

Transit: Transit Agencies, COG, [GTFS files](#)

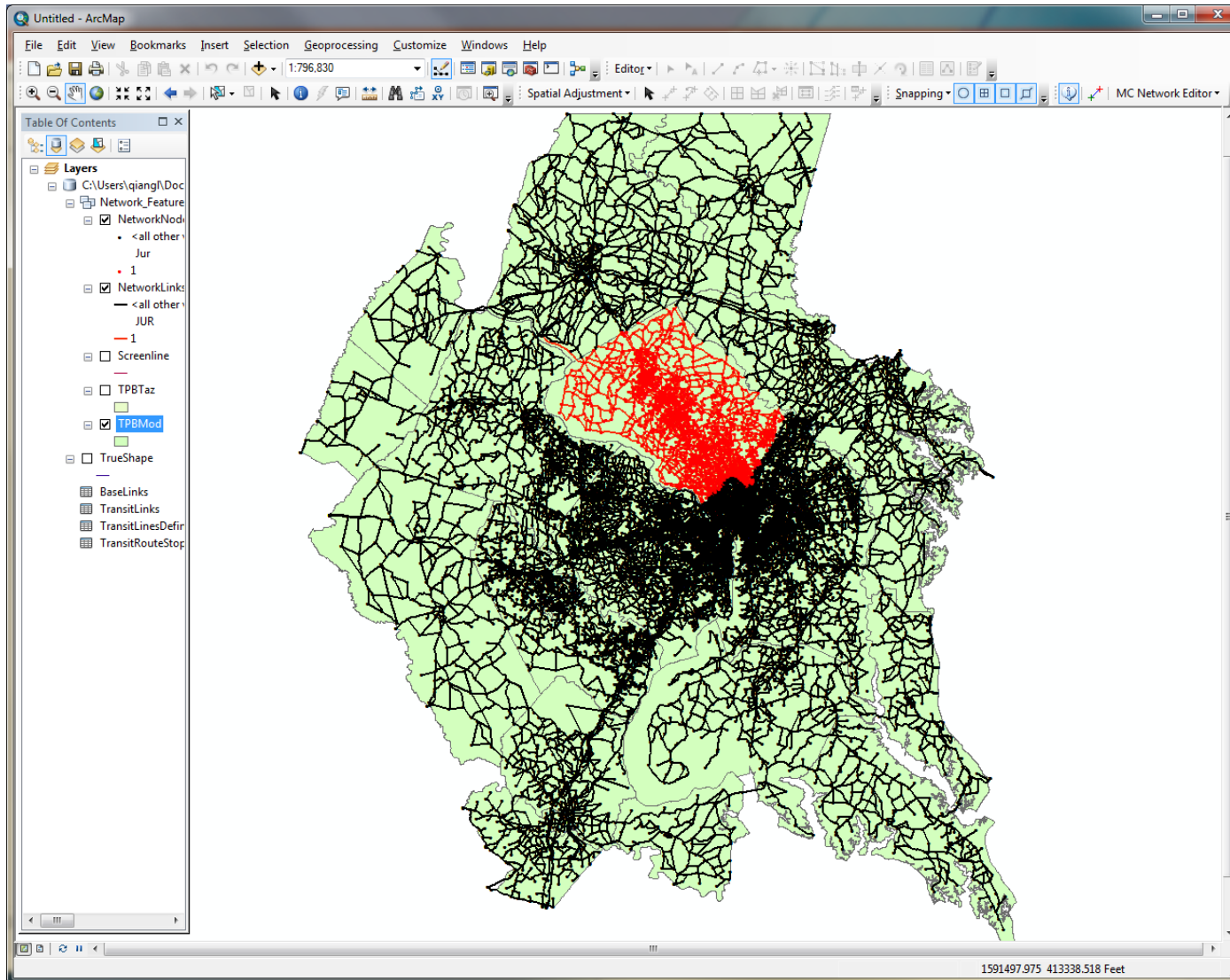
Walk: [Sidewalks, Paths, Trails](#)

Bike: [Bike Paths, Trails](#)

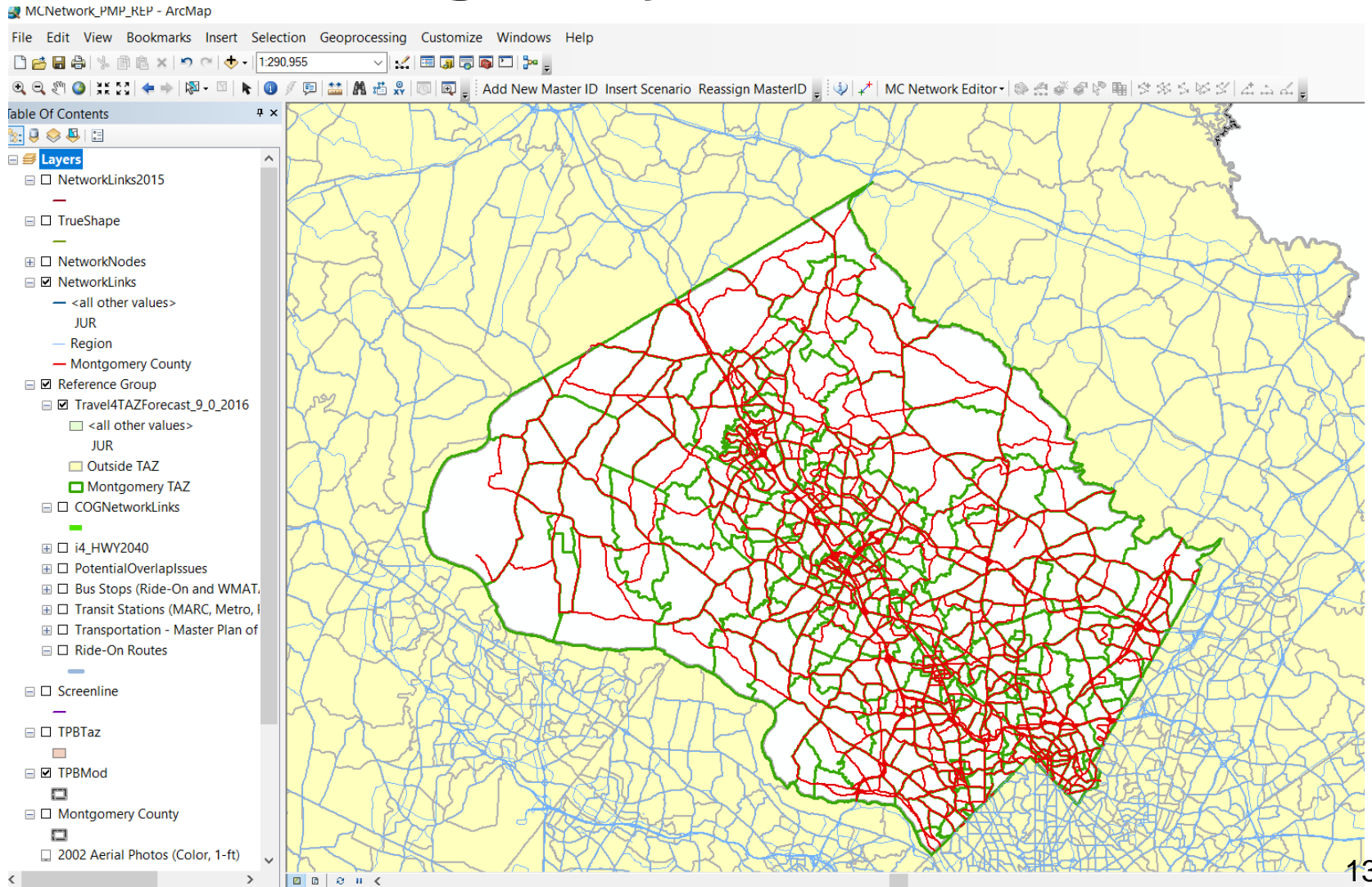
- County Network

- Detailed streets: true-shape & local streets
- County-specified TAZs
- Transit lines (routes) inside/outside/crossing MC borderline
- Node number range inside MC
- Network attributes for MC

Regional Highway Network



Montgomery County TAZ & Highway Network



MC focused Networks

- Integrate with regional network (COG)
 - Reserve the nodes and links on MC borderline
 - Update the transit lines crossing MC borderline
 - Node number range within MC consistent with COG's numbering system

Highway Network Management

- Highway Network Editing
 - Create true shape links using MD Centerlines
 - Replace any existing stick link with a true shape link
 - Add/Delete/Split existing links
- Link Attribute editing form
- Synchronize changes of highway links/nodes with bus routes

MC Network Editor

Edit Search

Link 1

- 22025 -> 22022 (2000)
- 22022 -> 22025 (2000)

Link 2

- 22027 -> 22026 (2000)
- 22026 -> 22027 (2000)

Attributes of Link 22025 -> 22022 (2000)

LinkID	40089
NetYear	2000
Distance	0.665264901819272
Status	Active
TOLL	0
TollGrp	0
FType	4
LType	T
AMLane	1
PMLane	1
DPLane	1

Save Reset Remove Clear

Batch Update Add Record

Copy Attribute Exit

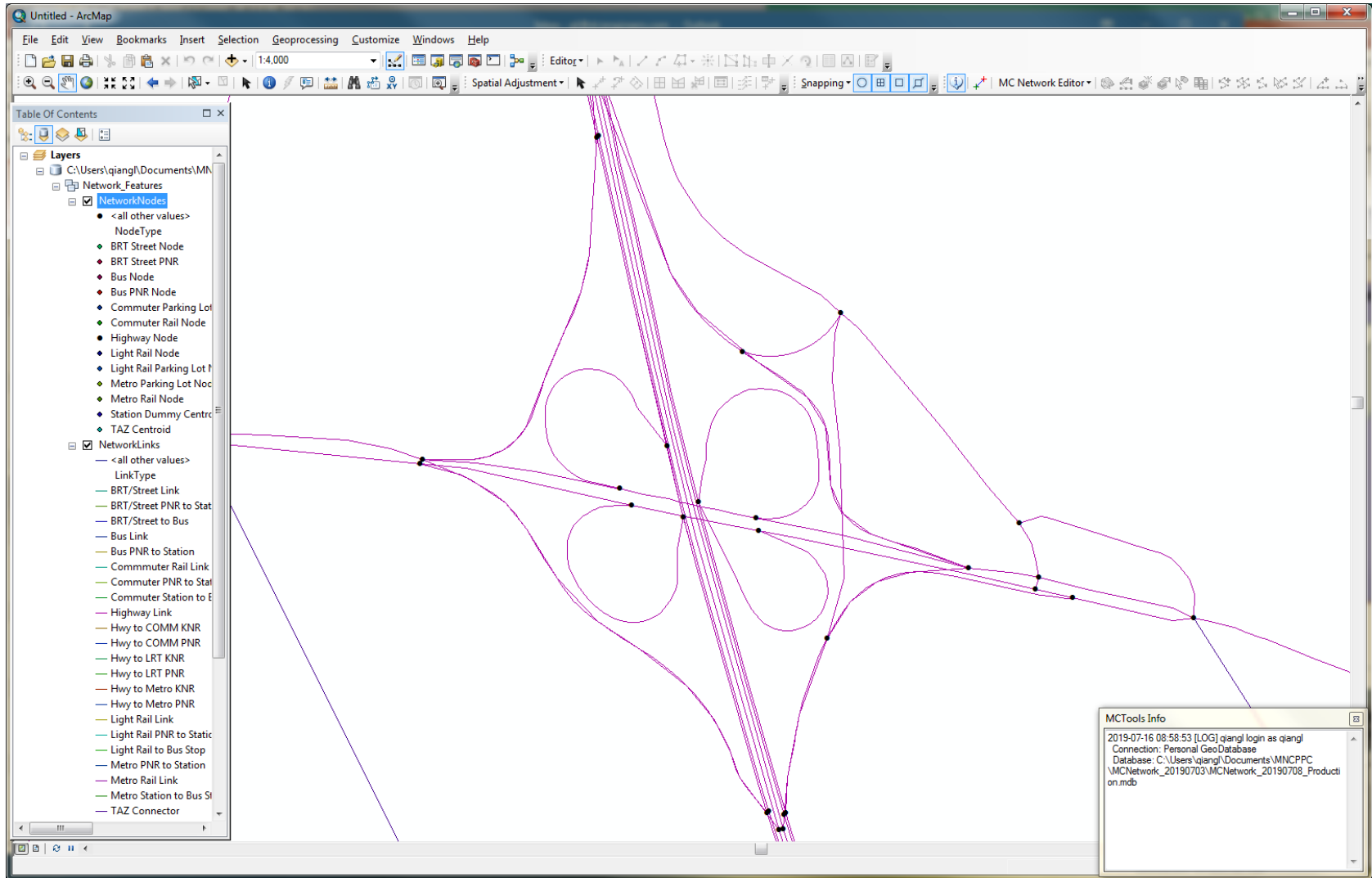
Routes Affected

Routes auto update (split link or add record):

- 2002: MT91AO - OP
- 2002: RO70AO - OP
- 2002: RO70BO - AM
- 2002: WM30BO - AM
- 2009: MT91AO - OP
- 2009: RO70AO - OP
- 2009: RO70BO - AM
- 2009: WM30BO - AM
- 2010: MT91AO - OP
- 2010: RO70AO - OP

OK

True-Shape Interchange



MCTools Info
2019-07-16 08:58:53 [LOG] qiang login as qiang
Connection: Personal GeoDatabase
Database: C:\Users\qiang\Documents\VMNCPPC
\MCNetwork_20190703\MCNetwork_20190708_Product
on.mdb

Transit Network Management

- Transit route editing tools
 - Add new transit route
 - Remove transit route
 - Shrink (Cut)/Extend transit route
 - Modify transit route alignment
- Transit attribute editing form

The screenshot displays a software interface for managing transit routes. At the top, there are filters for Year (2012), Name (03AI), and Operation (OP), along with an Exit button. The main area is divided into two columns: Links and Nodes. The Links column shows a list of 16 routes for 03AI, each with a number and a direction (e.g., 1: 46077 -> 46029). The Nodes column shows a list of 16 nodes for 03AI, each with a number and a node ID (e.g., 1: 46077). Below these lists are two identical attribute editing forms for Transit Route 03AI. Each form contains a table with the following data:

Attributes of Transit Route 03AI	
TransitRouteID	1101
TransitRouteName	03AI
Operator	LOCAL BUS
OriginNode	46077
DestinationNode	45132
OriginNodeName	
DestiNodeName	
Mode	1
Headway	0
RunTime	46
Operation	2
TransitYear	2012
Scenario	

At the bottom of the interface, there are buttons for Apply, Reset, Make Reverse Route, Save Route, and Discard Editing.

Editing Bus Routes

The screenshot shows the ArcMap interface with the MC Network Editor window open. The map displays a network of red lines representing transit routes. A specific route, RO440, is highlighted in blue. The MC Network Editor window is open, showing the route details and a 'Make Reverse Route' button.

MC Network Editor

Year: 2015 | Name: RO440 | Operation: AM | Exit

Links

- RO440
 - 1: 22672 -> 23469
 - 2: 23469 -> 90203
 - 3: 90203 -> 23680
 - 4: 23680 -> 23562
 - 5: 23562 -> 22341
 - 6: 22341 -> 23561
 - 7: 23561 -> 22504
 - 8: 22504 -> 90202
 - 9: 90202 -> 90201
 - 10: 90201 -> 22351
 - 11: 22351 -> 22370

Nodes

- RO440
 - 1: 22672
 - 2: 23469
 - 3: 90203
 - 4: 23680
 - 5: 23562
 - 6: 22341
 - 7: 23561
 - 8: 22504
 - 9: 90202
 - 10: 90201
 - 11: 22351
 - 12: 22370

Attributes of Transit Route RO440

TransitRouteID	960
TransitRouteName	RO440
Operator	Ride On Bus
OriginNode	22672
DestinationNode	22370
OriginNodeName	TWINBROOK STATIO...
DestiNodeName	ROCKVILLE STATION ...
Mode	6
Headway	30
Runtime	20

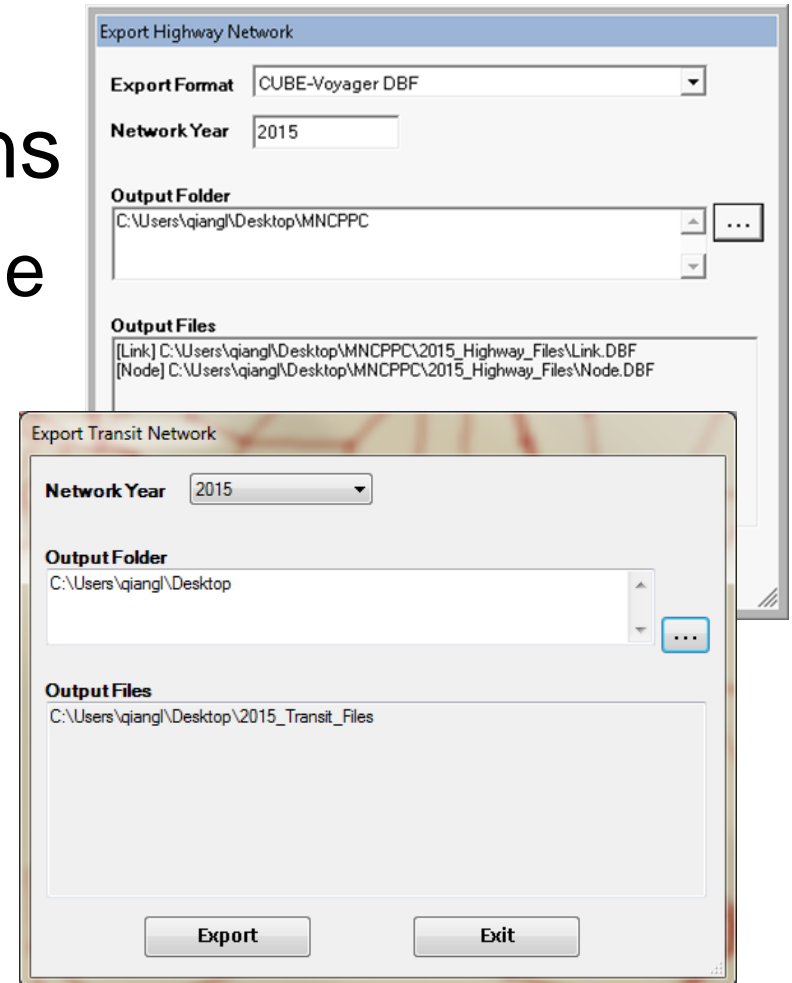
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OriginNode	22672
DestinationNode	22370
OriginNodeName	TWINBROOK STATIO...
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Mode	6
Headway	30
Runtime	20

Make Reverse Route

Export Networks for Regional Travel Demand Model

- MCTool Export Functions
 - Cube Voyager compatible files (DBF, GDB, ASCII)
 - Year highway network
 - Links/Nodes Tables
 - Year transit network
 - Modes/Stations files
 - Year integrated network



Development Challenges

- Automated process to integrate MC network with MWCOCG regional network
- Automated process to update transit routes inside MC or crossing MC borderline
- Integrate MC TAZs with MWCOCG TAZ system (e.g. adjust TAZ connectors, re-allocated land use/economic data)



Project Status

Completed:

- Geodatabase MCTool and User's Manual
- Network Geodatabase: 2015, 2040
- SDE compatibility

Working on:

- Refine 2015/2040 network database
- Build 2020 and 2045 networks
- Improve MCTool

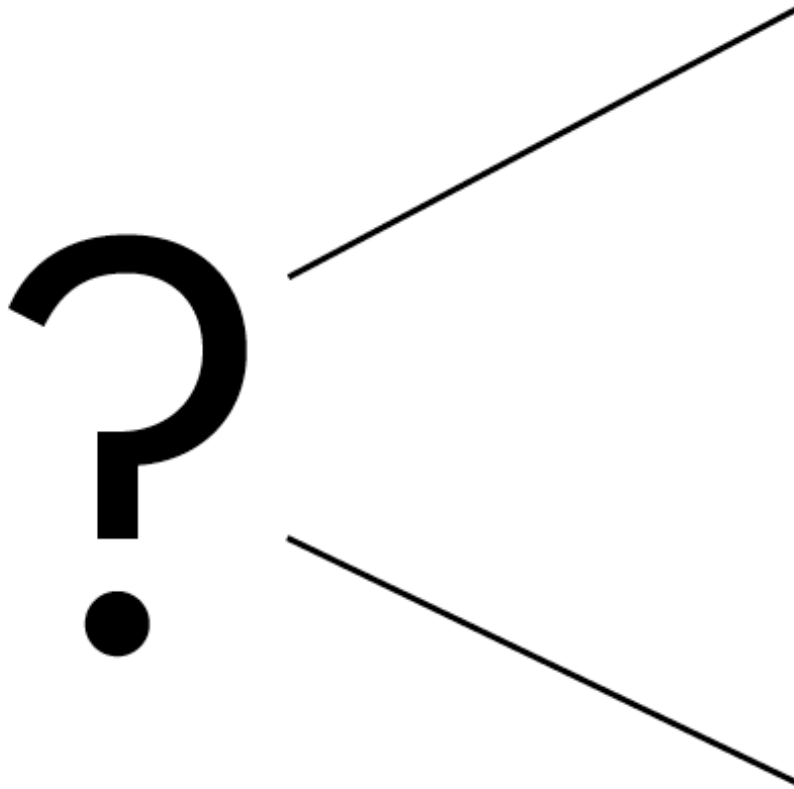
Project Schedule:

- Contract started in summer 2017
- Contract extended twice, to 1/31/2020



Acknowledgements

- **Eric Graye**, supervisor – providing oversight
- **Russell Provost** - testing MCTool,
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- **Patrick Patterson** - editing network using MCTool
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