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
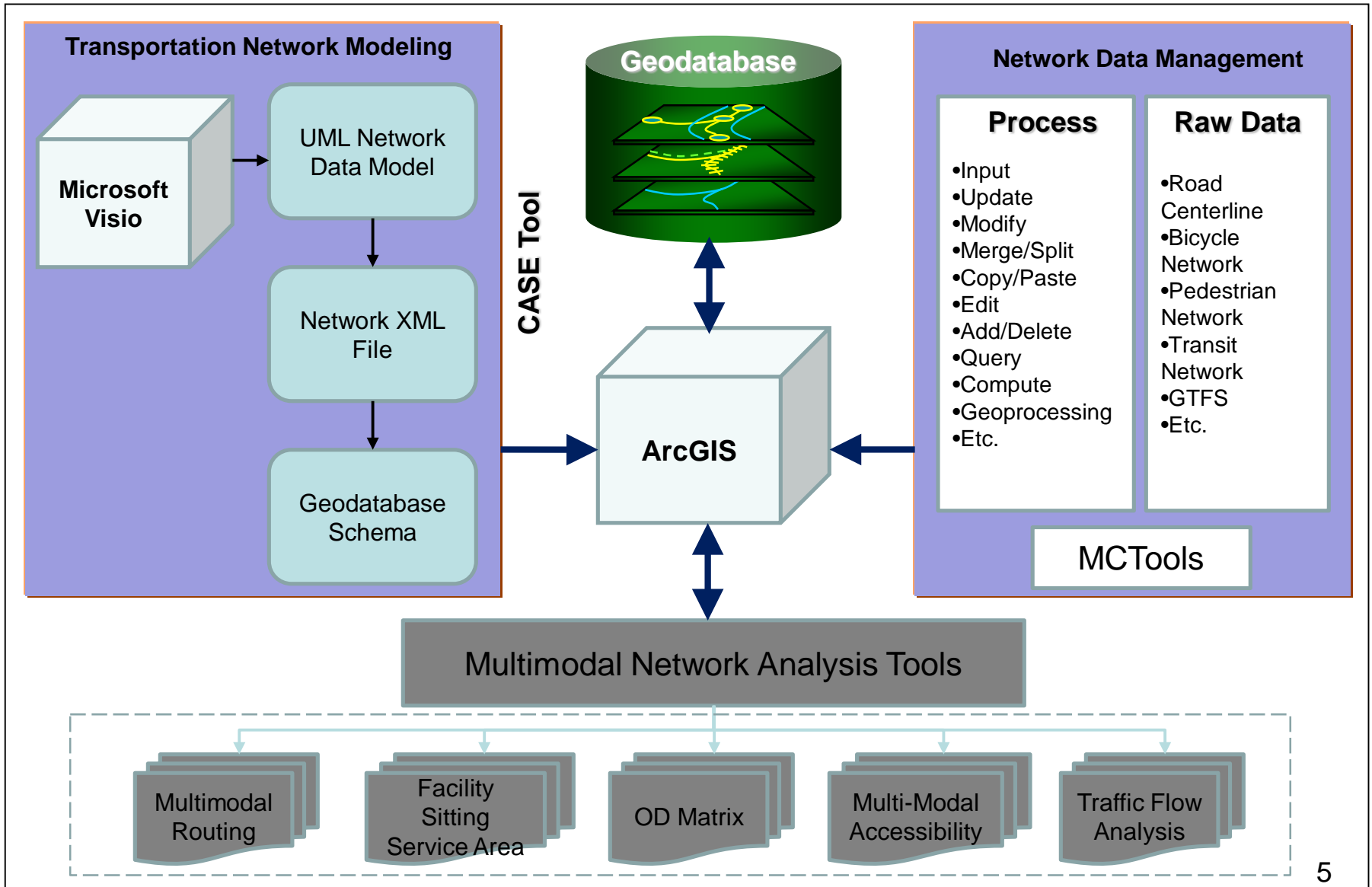
Network Application System

- ## 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
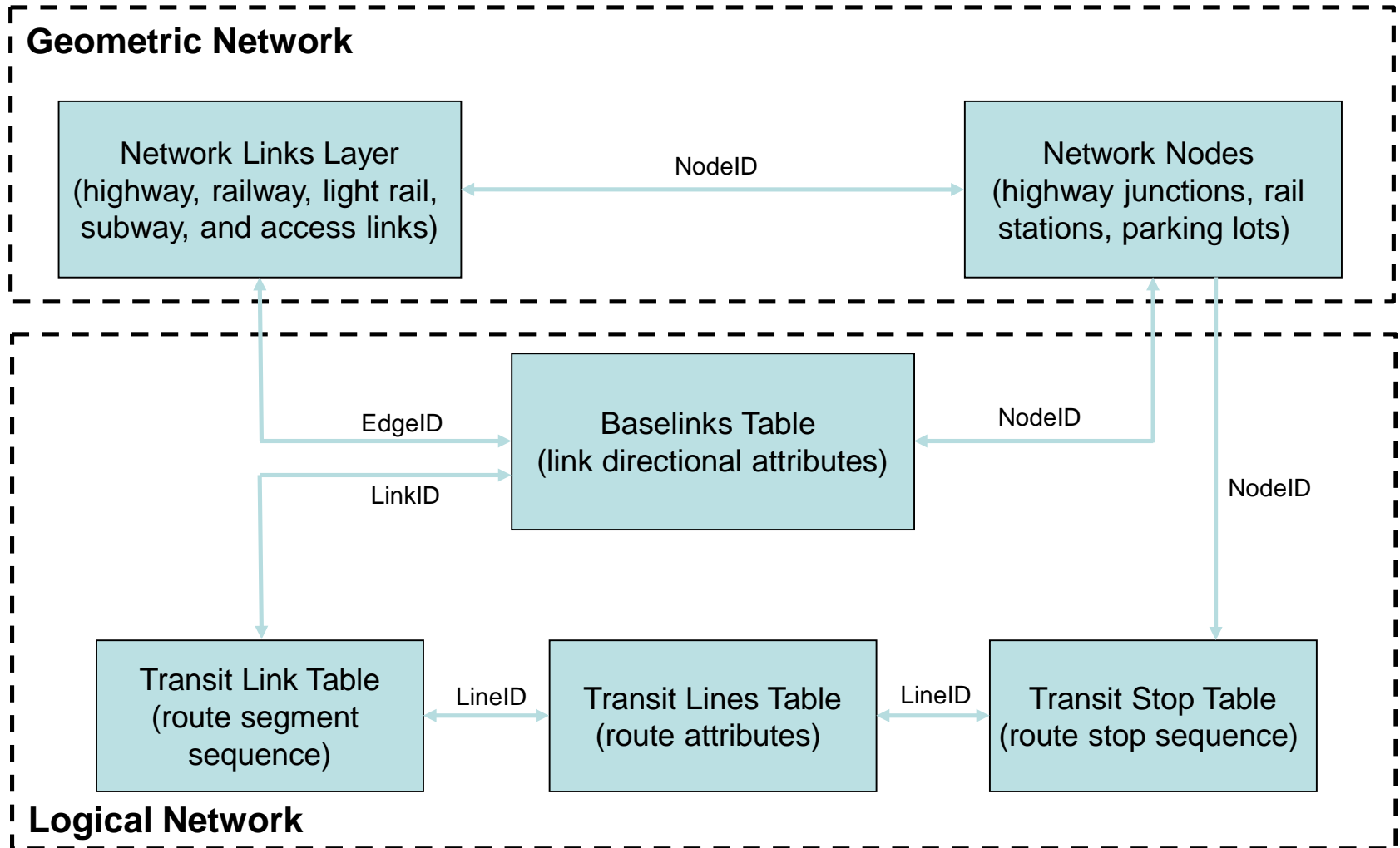 - Data Management Tools

- ## 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

Geometric Network

| Network Links Layer (highway, railway, light rail, subway, and access links) | ←— NodeID —→ | Network Nodes (highway junctions, rail stations, parking lots) |

Logical Network

- EdgeID
- LinkID
- Baselinks Table (link directional attributes)
- NodeID
- NodeID

- Transit Link Table (route segment sequence)
- LineID
- Transit Lines Table (route attributes)
- LineID
- Transit Stop Table (route stop sequence)

9

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
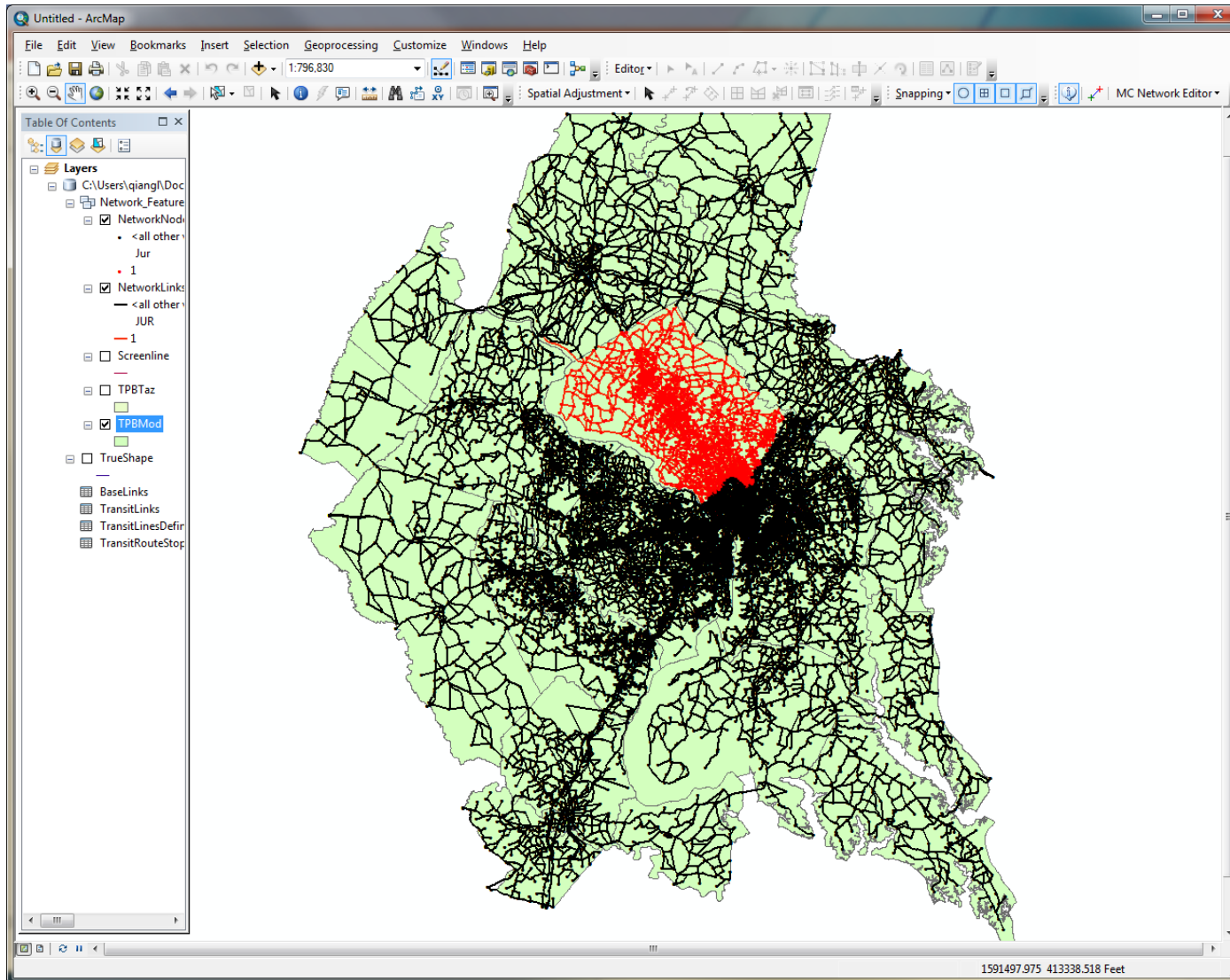
Montgomery County TAZ & Highway Network
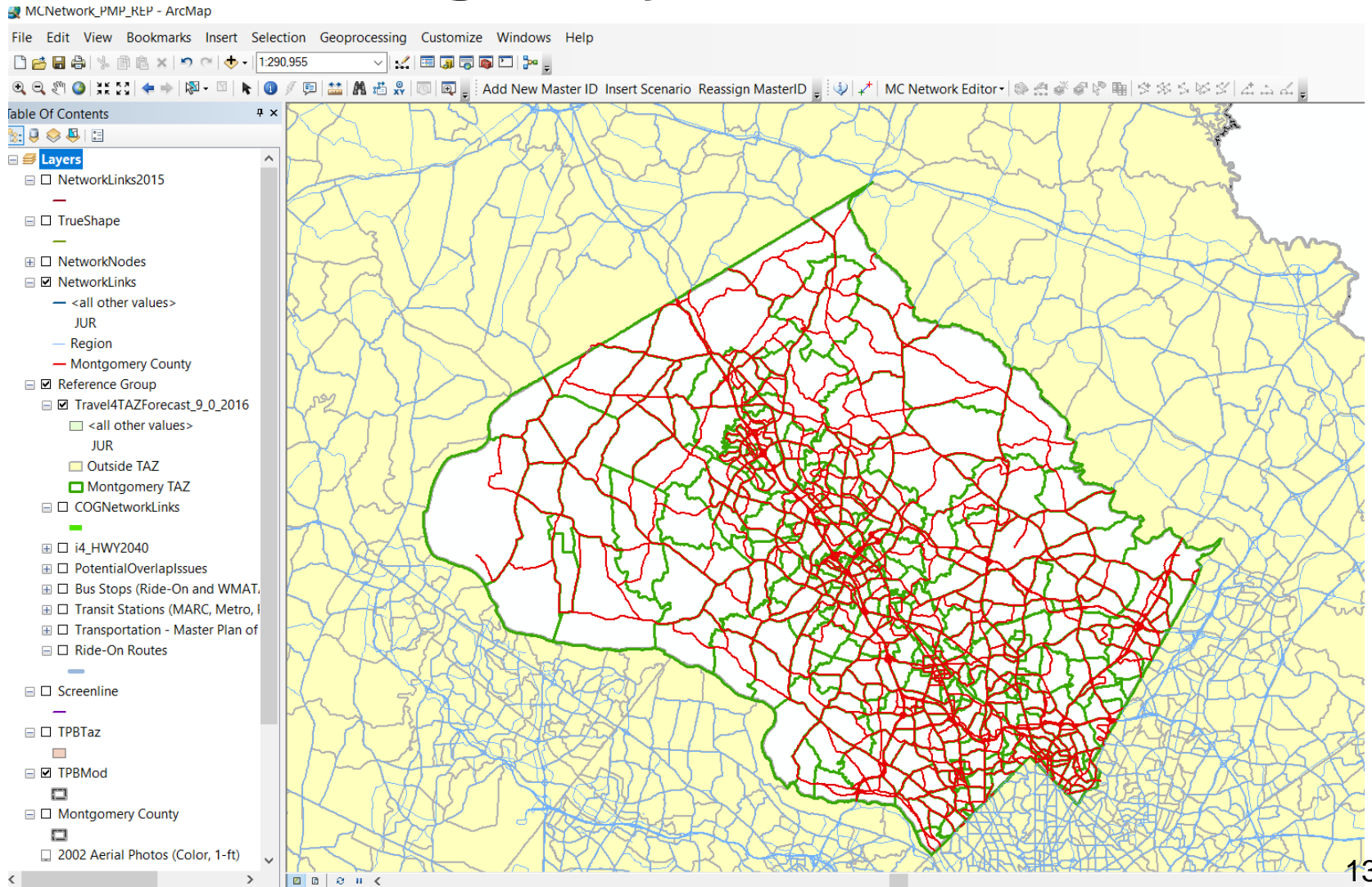
MC focused Networks

- 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

Network Management Tools (MCTool)

- Toolbar embedded in ArcGIS through Dynamic Link Library (COM Technology)
- Function Tools
  - Highway network management tools
  - Transit network management tools
  - Export network tools

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

16

True-Shape Interchange

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

Editing Bus Routes

Export Networks for Regional Travel Demand Model

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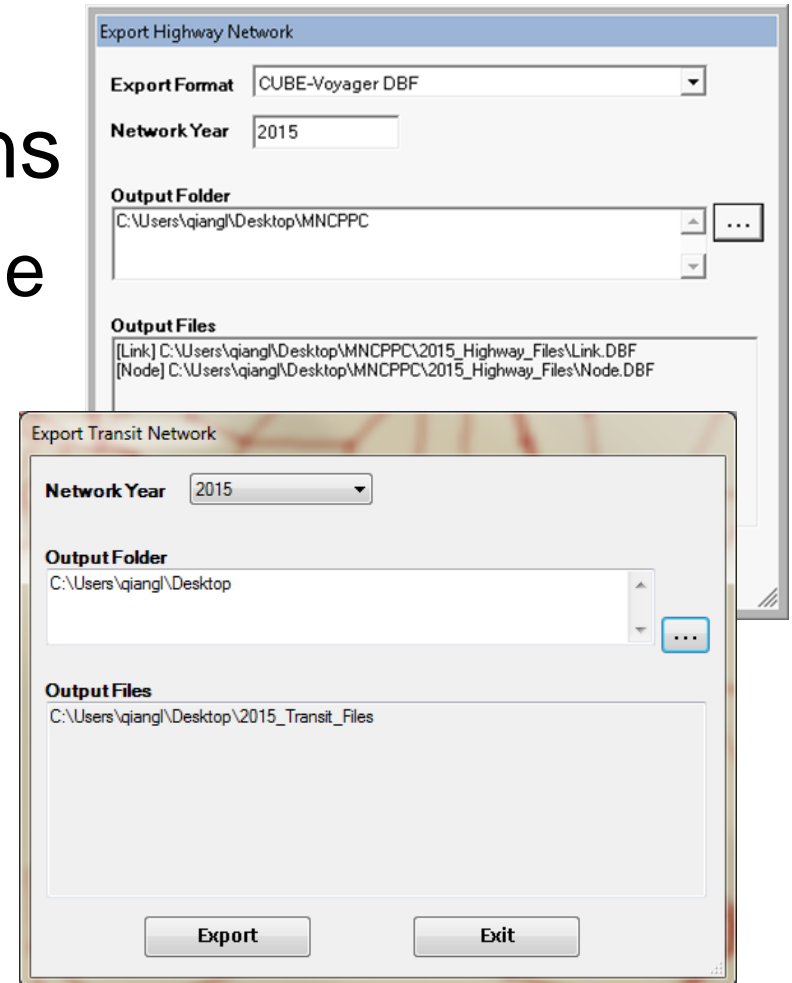
Development Challenges

- Automated process to integrate MC network with MWCOG regional network

- Automated process to update transit routes inside MC or crossing MC borderline

- Integrate MC TAZs with MWCOG 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
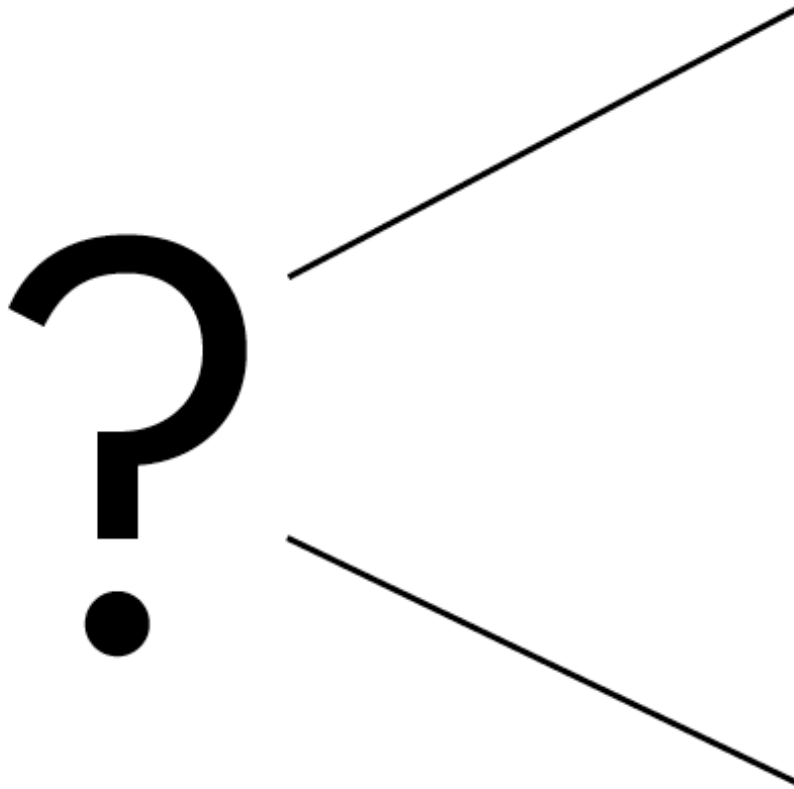- Build 2020 and 2045 networks
- Improve MCTool

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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