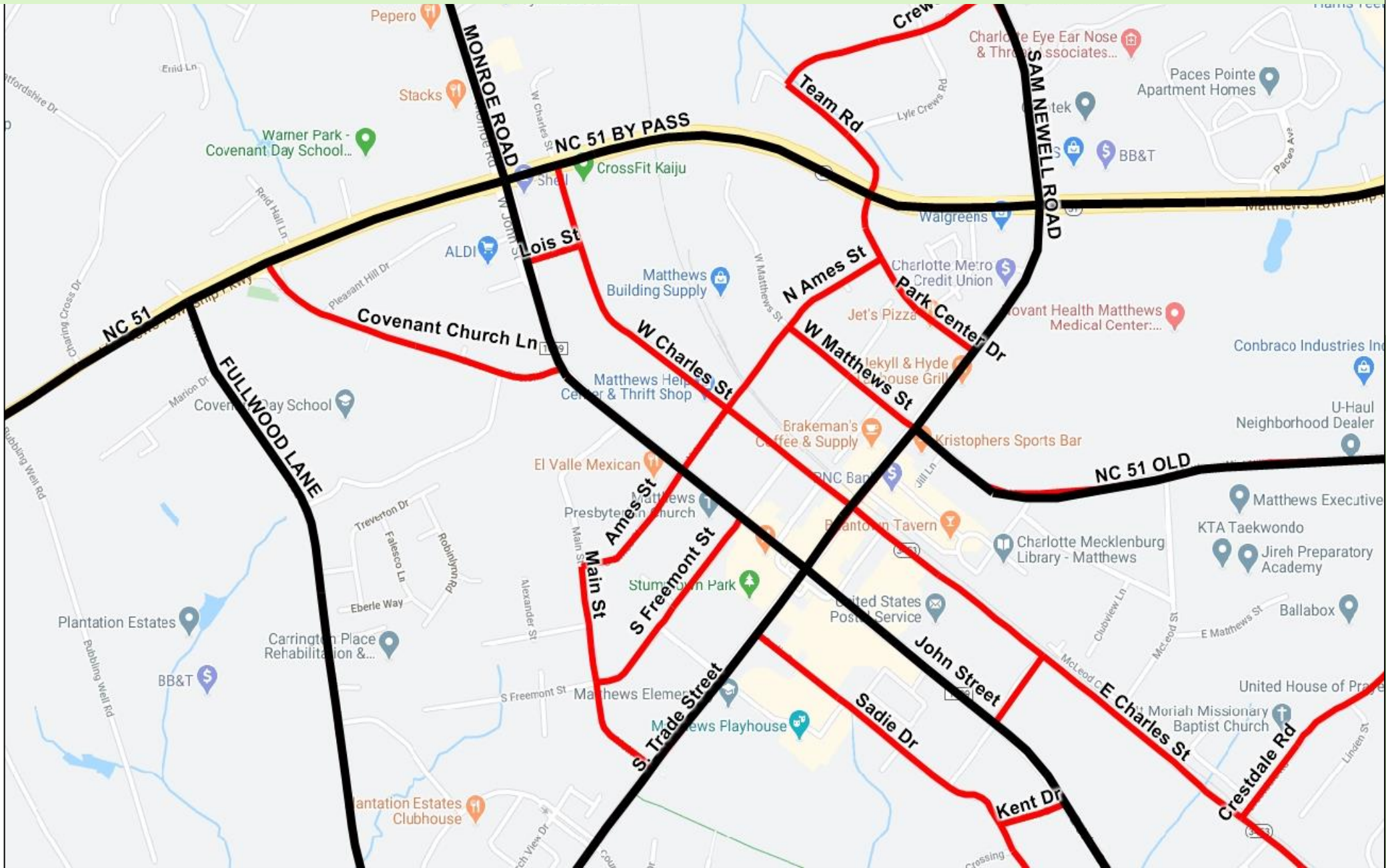
# Matthews Subarea Model




NC Model Users Group

April 20th, 2022

Craig Gresham

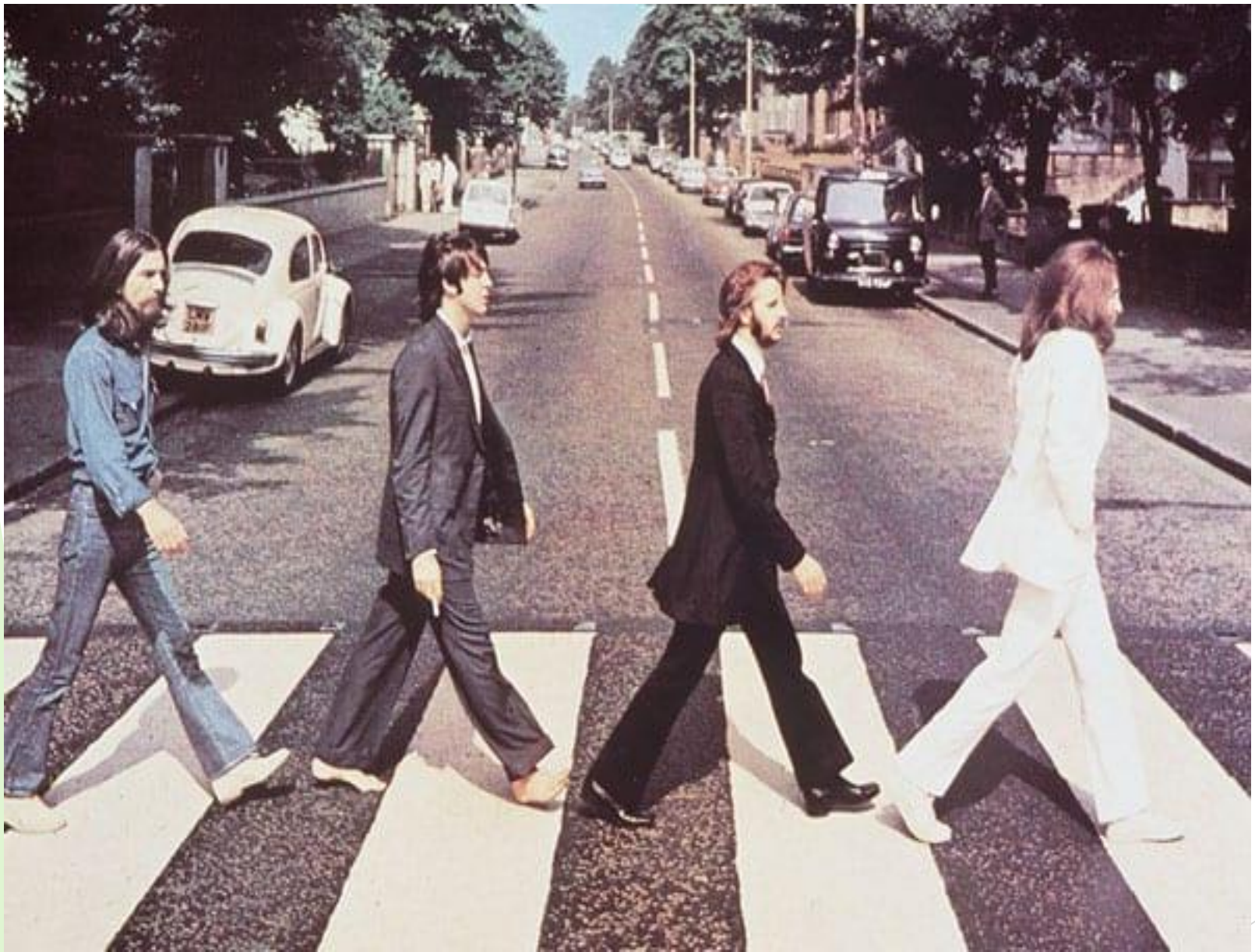
# AGENDA

1. Project Background
2. Analysis Tools
3. Overview of the Subarea Model
4. Deep dive into the Subarea Model weeds
5. If we had more time, more money, more data…..

In the style of the Beatles……..

Good morning, Good morning

# Come Together



**2018**

John Street Working Group

**2019**

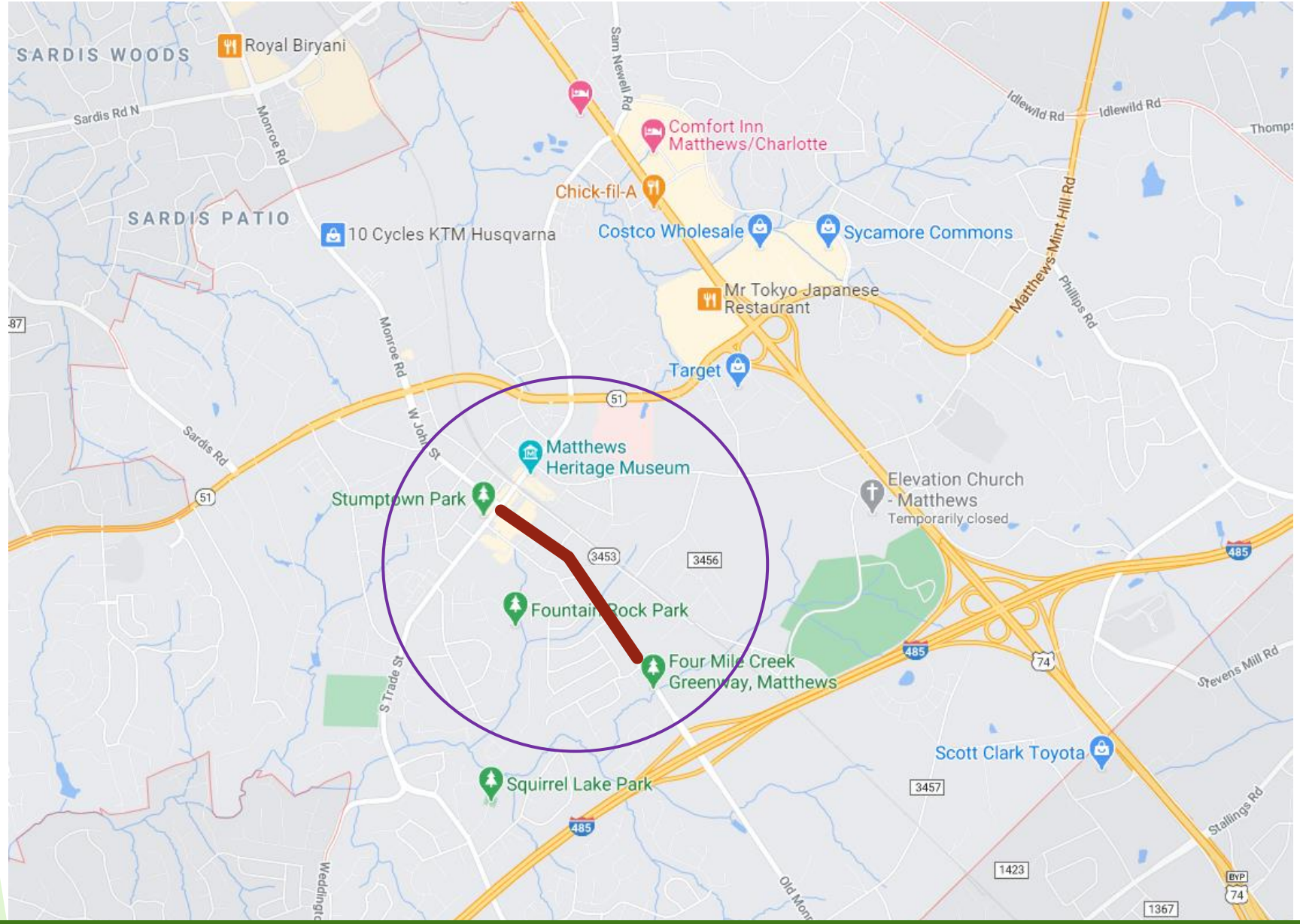
Funding Received from CRTPO

**2020**

Project Begins with Consultant Selection

- Metrolina Regional Model Coordination
- Transportation Advisory Board Briefing
- Planning Board Briefing
- Town Board Briefing

# Help!


SARDIS WOODS
Royal Biryani
Sardis Rd N
Monroe Rd
Sam Newell Rd
Comfort Inn Matthews/Charlotte
Idlewild Rd
Idlewild Rd
Chick-fil-A
SARDIS PATIO
10 Cycles KTM Husqvarna
Costco Wholesale
Sycamore Commons
Matthews-Mint Hill Rd
Phillips Rd
Mr Tokyo Japanese Restaurant
Target
Monroe Rd
W John St
Sardis Rd
51
Matthews Heritage Museum
Stumptown Park
Elevation Church - Matthews
Temporarily closed
3453
3456
485
Fountain Rock Park
Four Mile Creek Greenway, Matthews
S Trade St
74
Stevens Mill Rd
Scott Clark Toyota
Squirrel Lake Park
3457
Stallings Rd
485
1423
BYP
74
1367

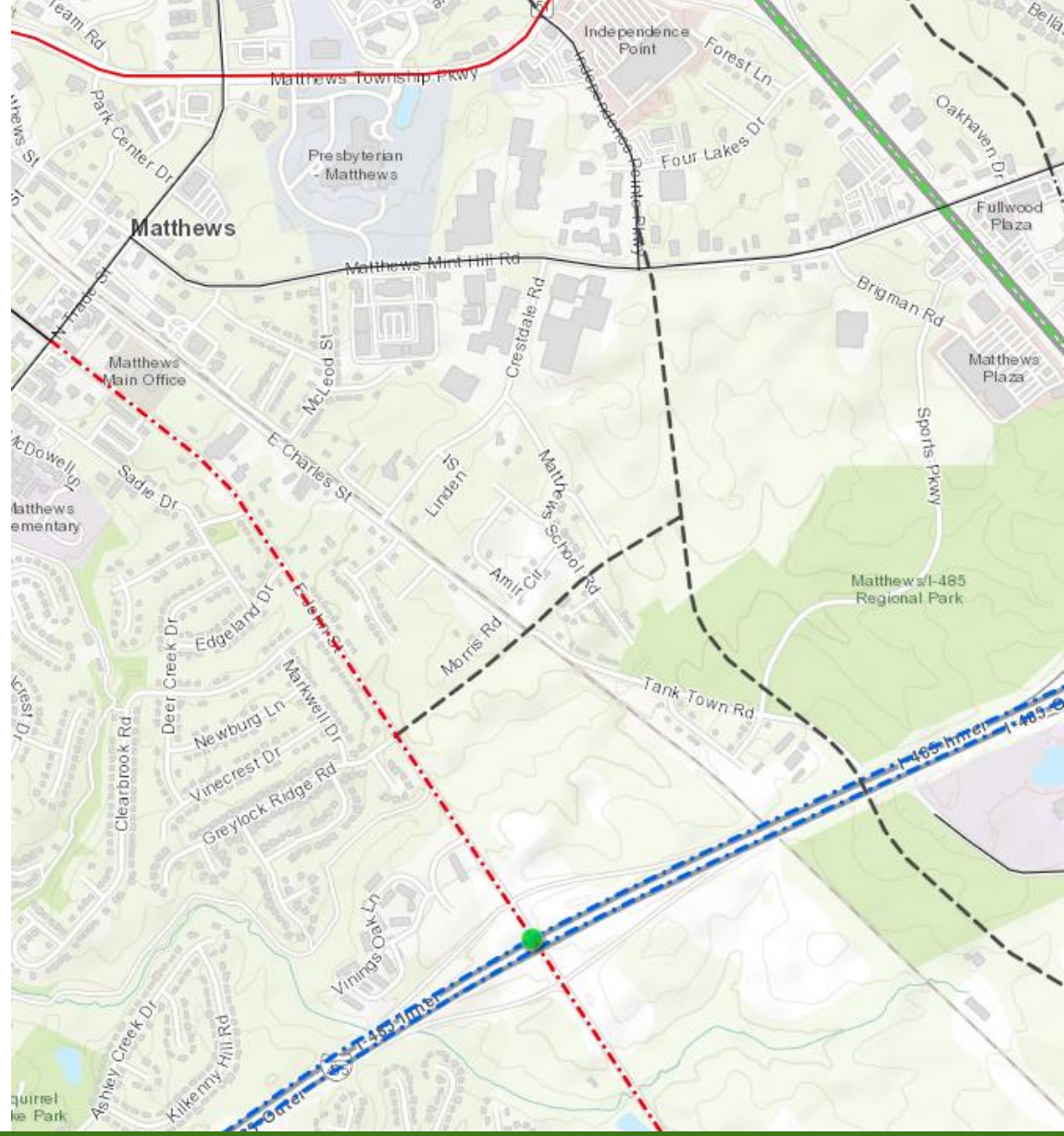
# Yesterday....

**Tools created for the Town will help it evaluate transportation projects proposed by it and others, and better link its different decision-making processes.**

# Don’t Let Me Down

# Land Use and Transportation Considerations that impact Access & Mobility in Matthews…

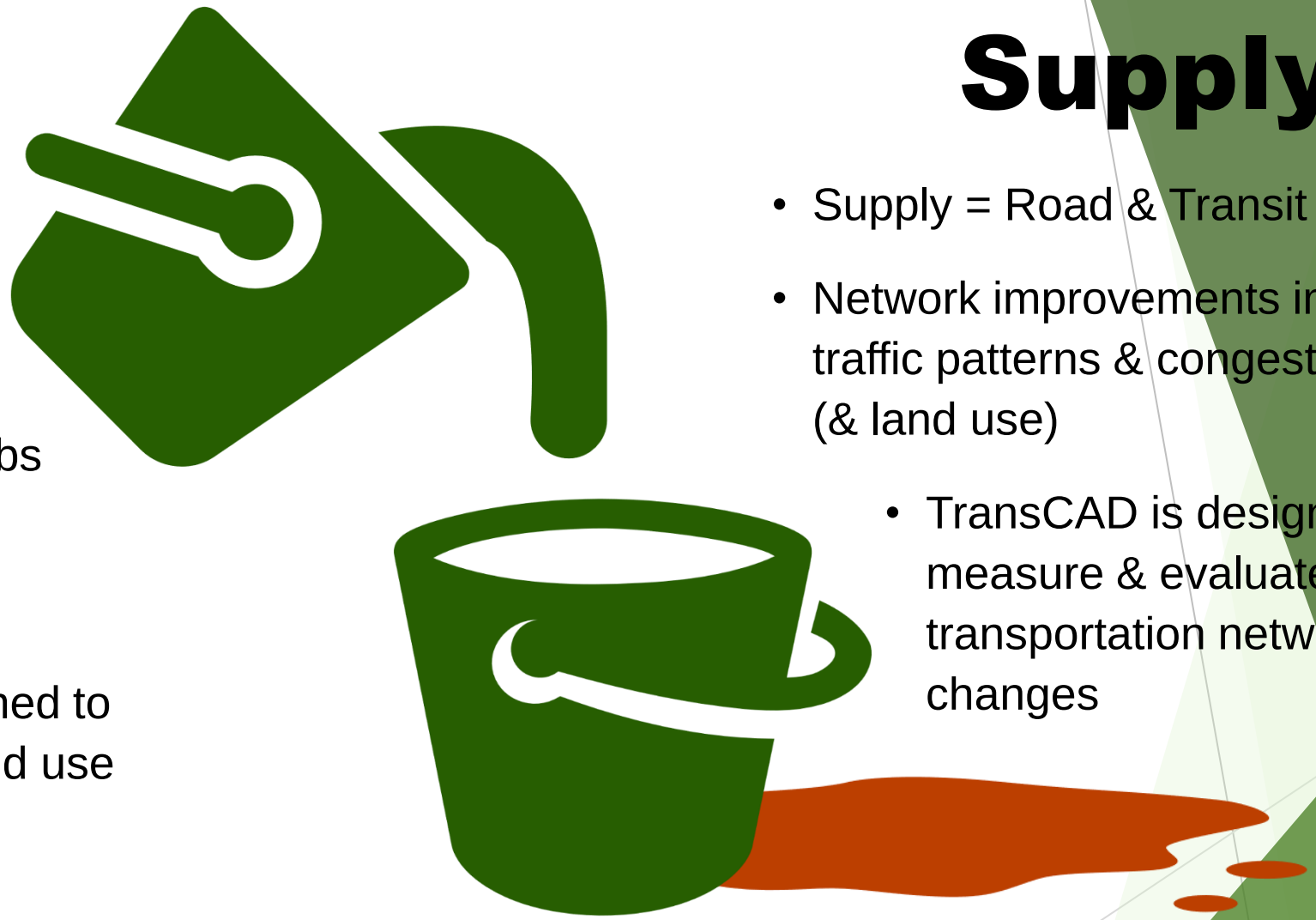
- Local versus through trips
- Emerging and future congestion locations
- Expanded (or reduced) street network capacity
- Opportunities for complimentary development and transportation projects?
- High-traffic destinations




# A Day in the Life….

# Demand

- Demand = People & Jobs
- Land use changes impact traffic
- CommunityViz is designed to measure & evaluate land use changes



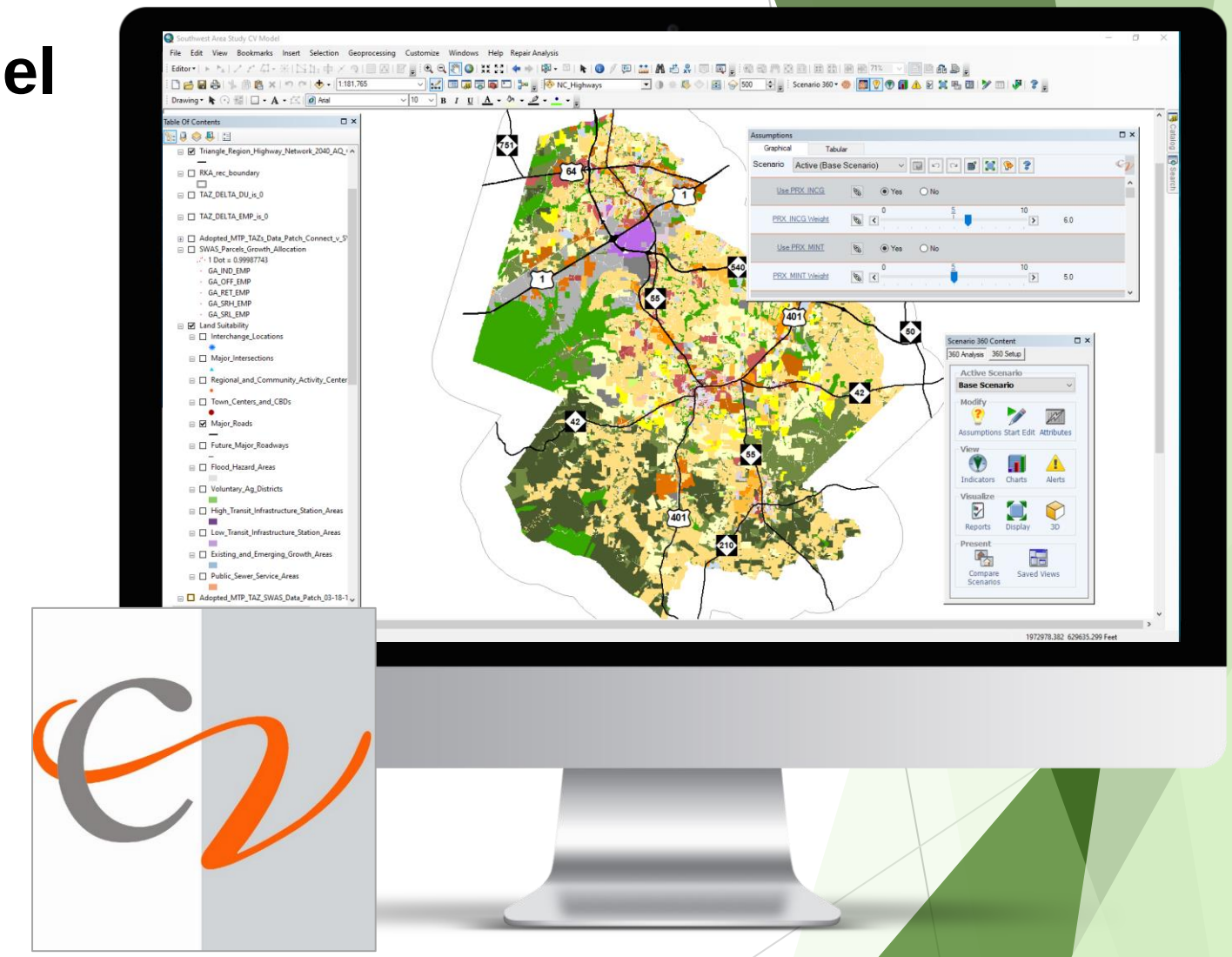
# Supply

- Supply = Road & Transit Network
- Network improvements impact traffic patterns & congestion (& land use)
- TransCAD is designed to measure & evaluate transportation network changes

# Magical Mystery Tour

# Matthews CommunityViz Model
## (Using ArcGIS Desktop)

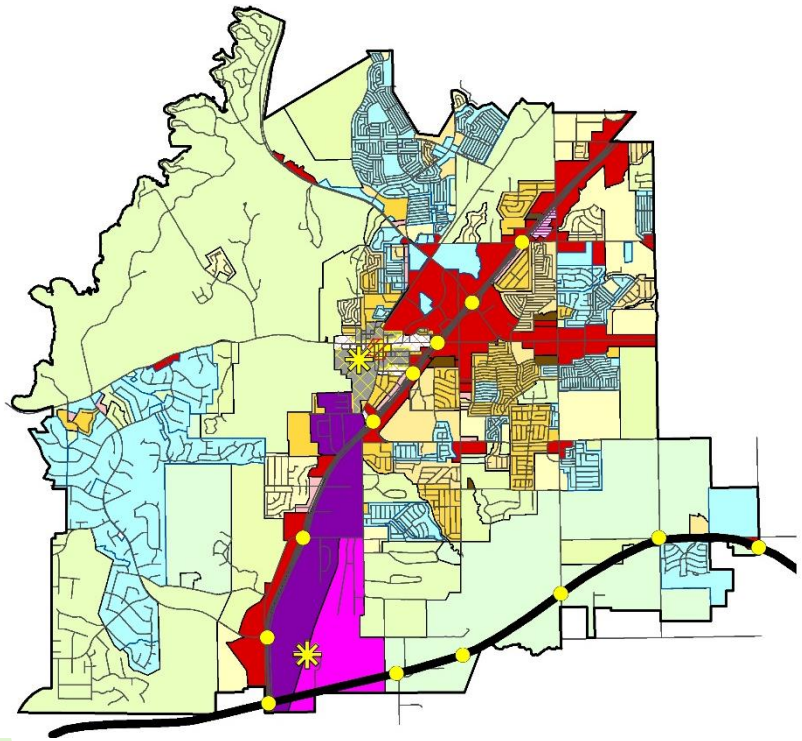
- Test Different Land Use Scenarios
- Export Anticipated Development Types, Locations, Patterns & Intensities to a *.dbf file
- Serves as Input Data for the Travel Demand Model
- Export Maps for Documents

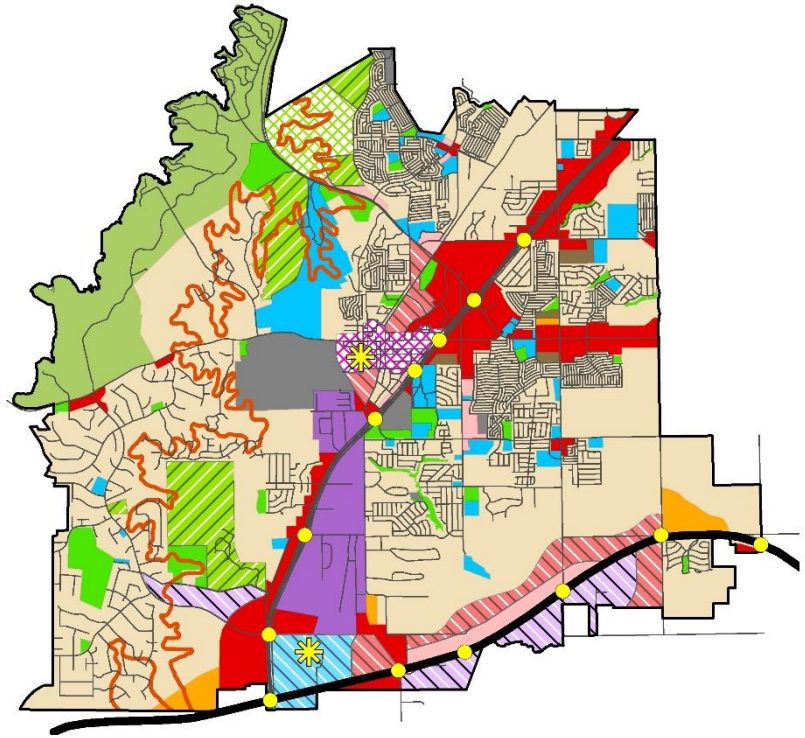



Imagine

1

Alternative Growth Scenario



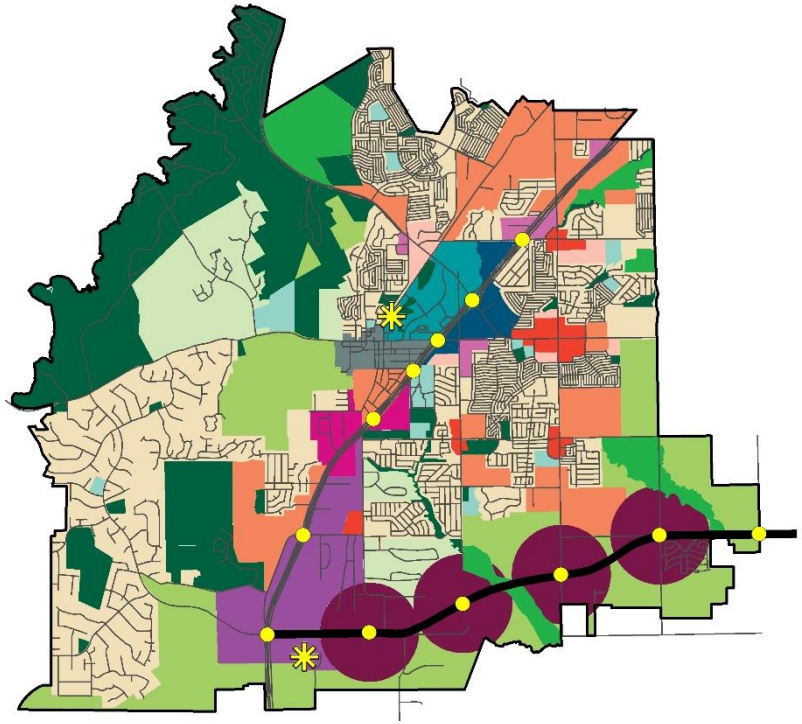


2

Alternative Growth Scenario

3

Alternative Growth Scenario



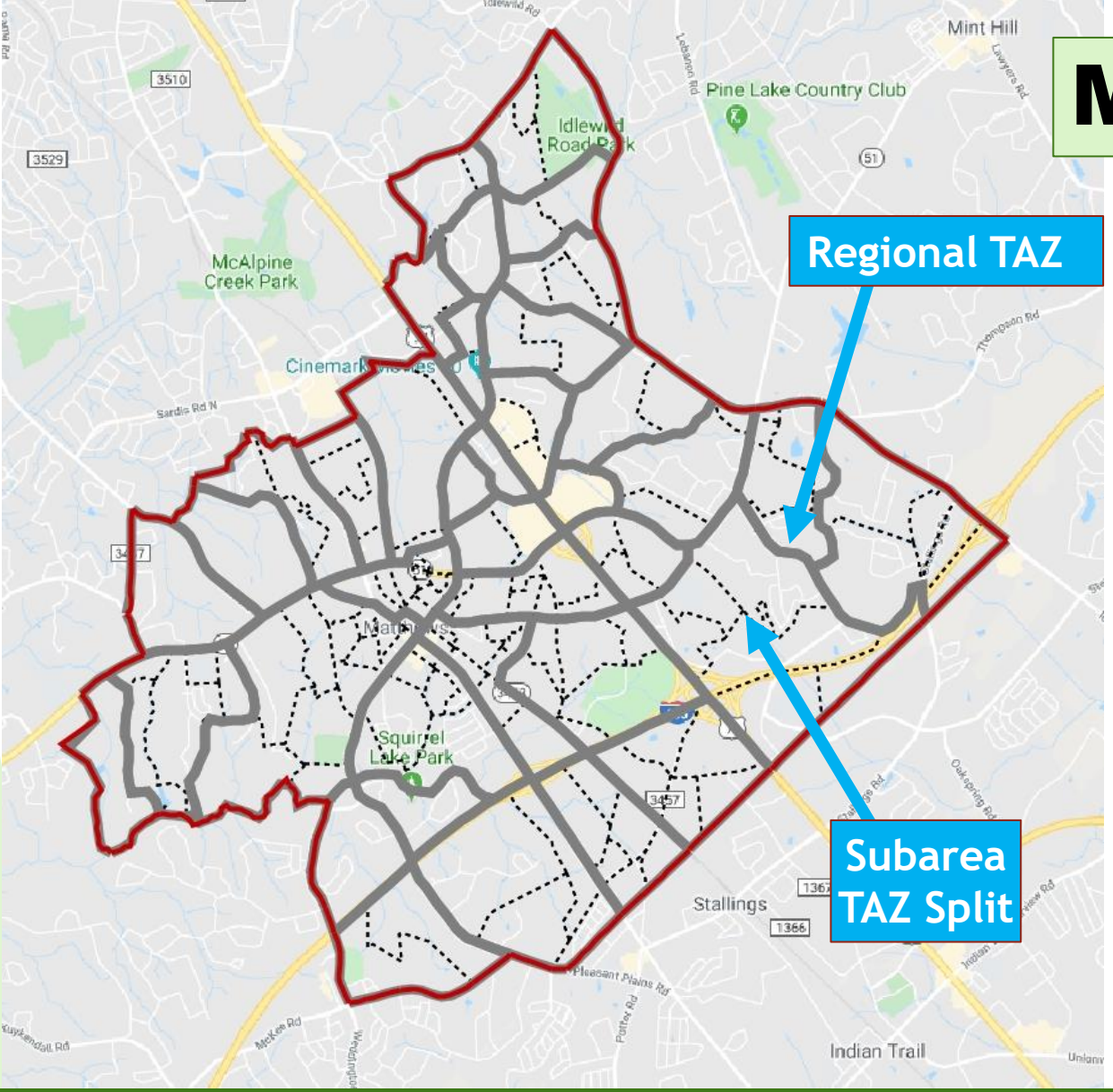
# Let it Be (?)


# Matthews Subarea MRM
## (Using TransCAD)

- Based on Metrolina Regional Model
  - Covers greater Charlotte area
  - Used for highway and transit planning, air quality conformity, etc.
  - Forecasts traffic to 2045
- Very detailed, but focuses on regionally significant roads
  - The more you zoom in, the more “pixelated” the results get

# All You Need is Love (and TransCAD)

# Matthews Subarea MRM

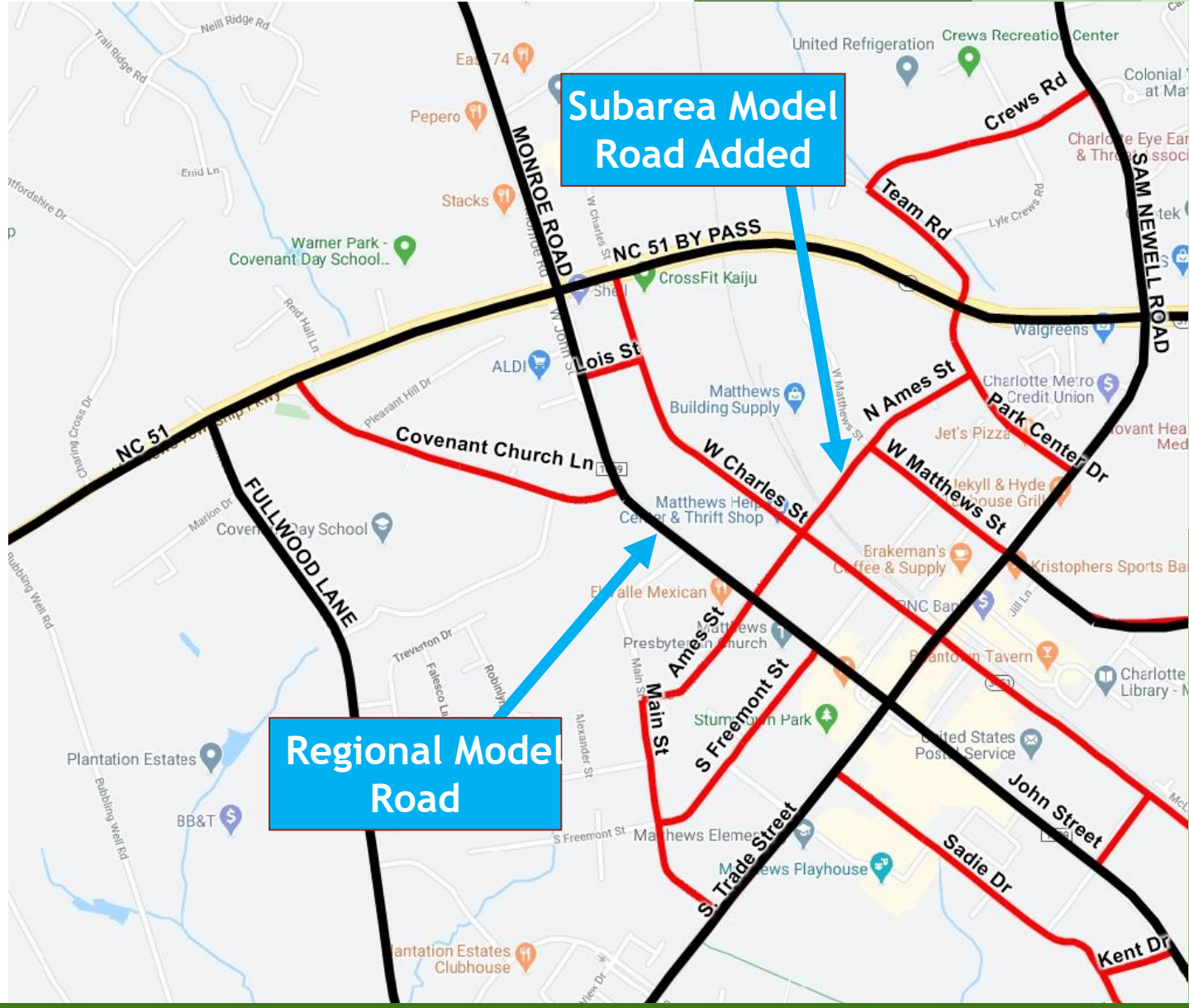



- Housing and employment is stored in “Traffic Analysis Zones” or TAZs
- The regional model has 38 TAZs in the Matthews area
- For this study, this was “disaggregated”, or broken into 137 smaller TAZs
- Can represent more locally significant roads and traffic issues in the area
- Allows for a sharper picture

# Matthews Subarea MRM

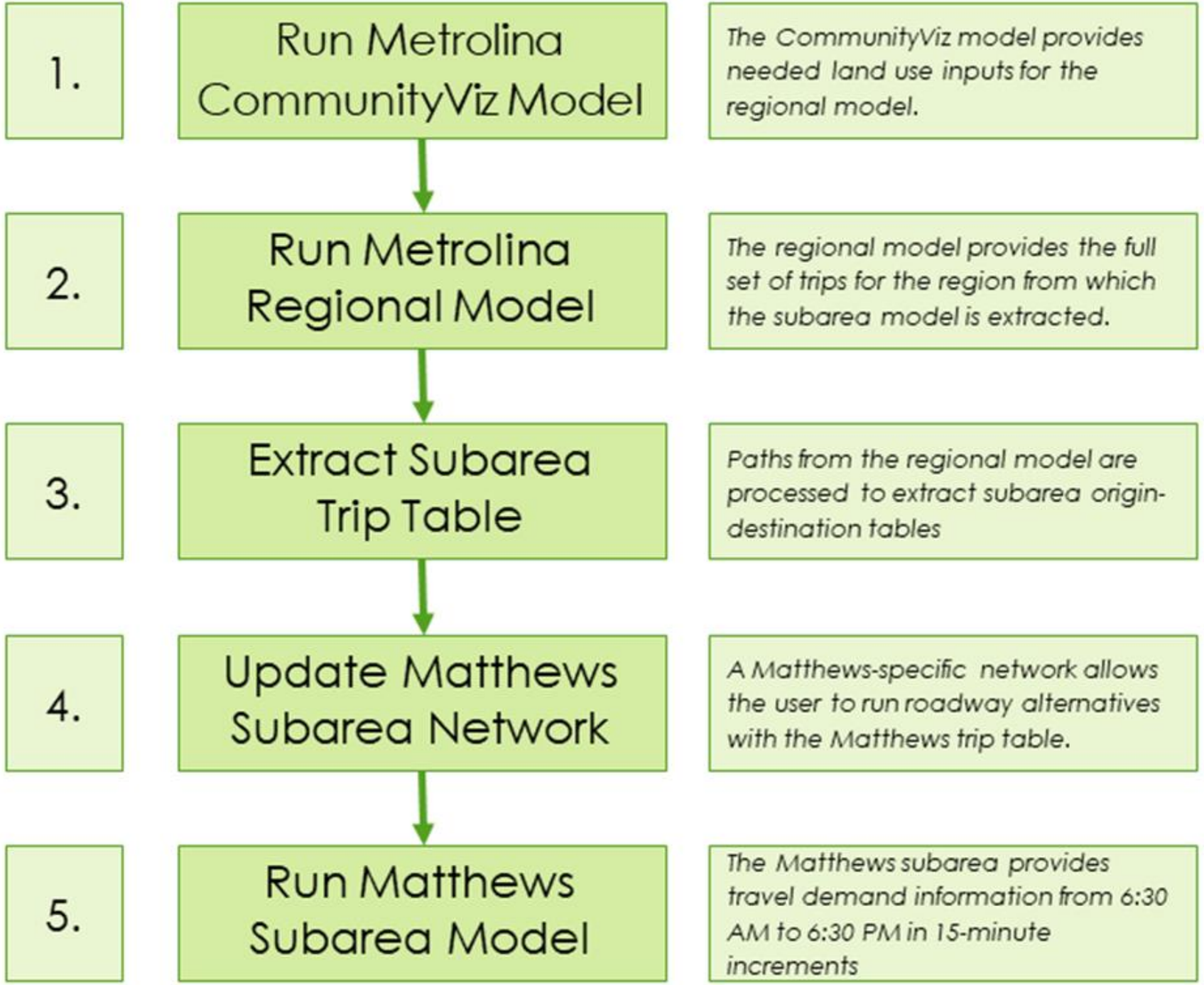
Three Major Refinements:

- Adding more local roads
- More (smaller) TAZs that better isolate different land uses
- Modeling traffic in 48 15-minute increments (6:30 AM to 6:30 PM) instead of 3 peak periods (AM, Midday, and PM)




# The Long and Winding Road

# Subarea Model Process



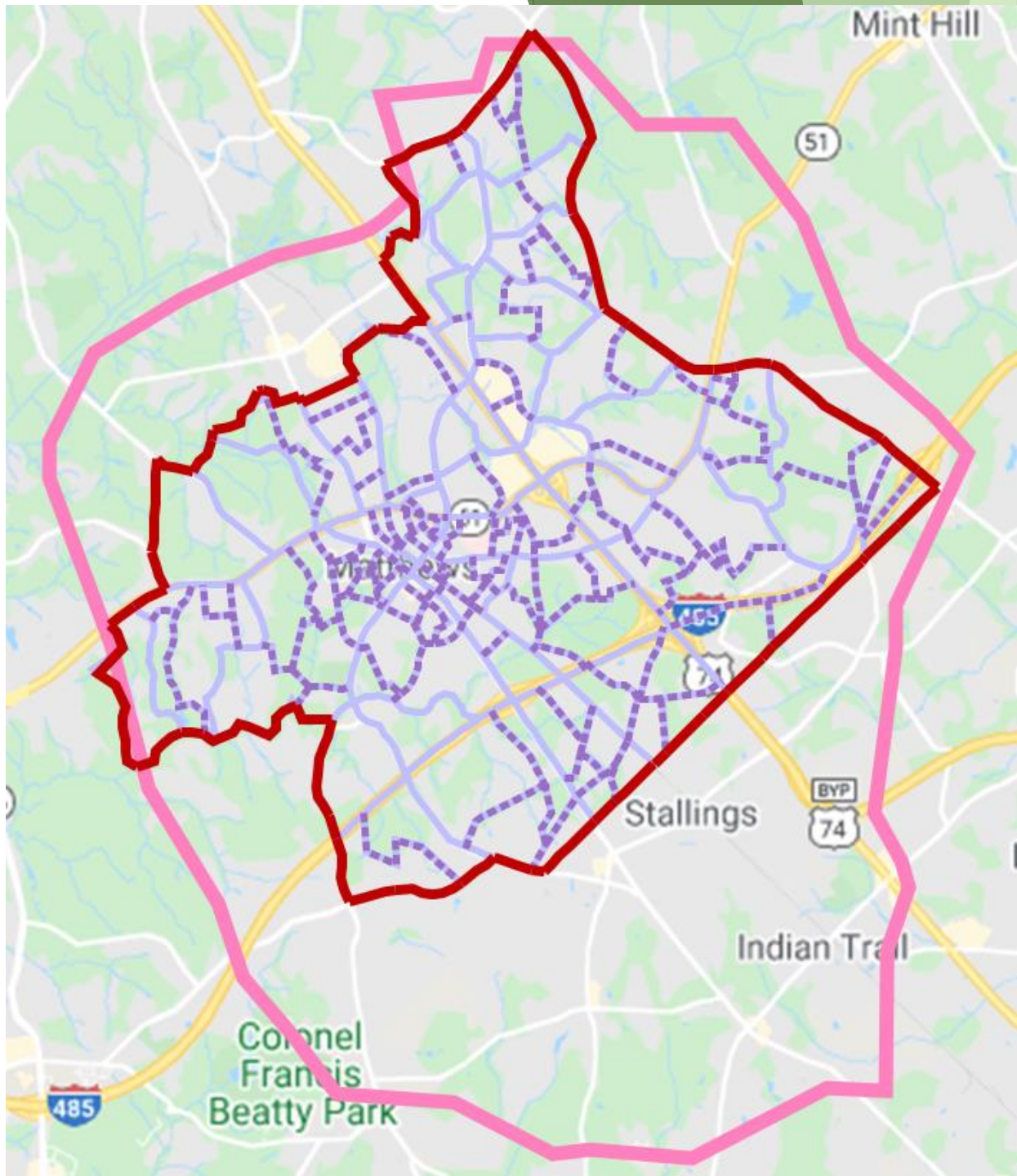
# Subarea Model Deep-dive

Ob-La-Di, Ob-La-Da….

# Matthews Subarea Model

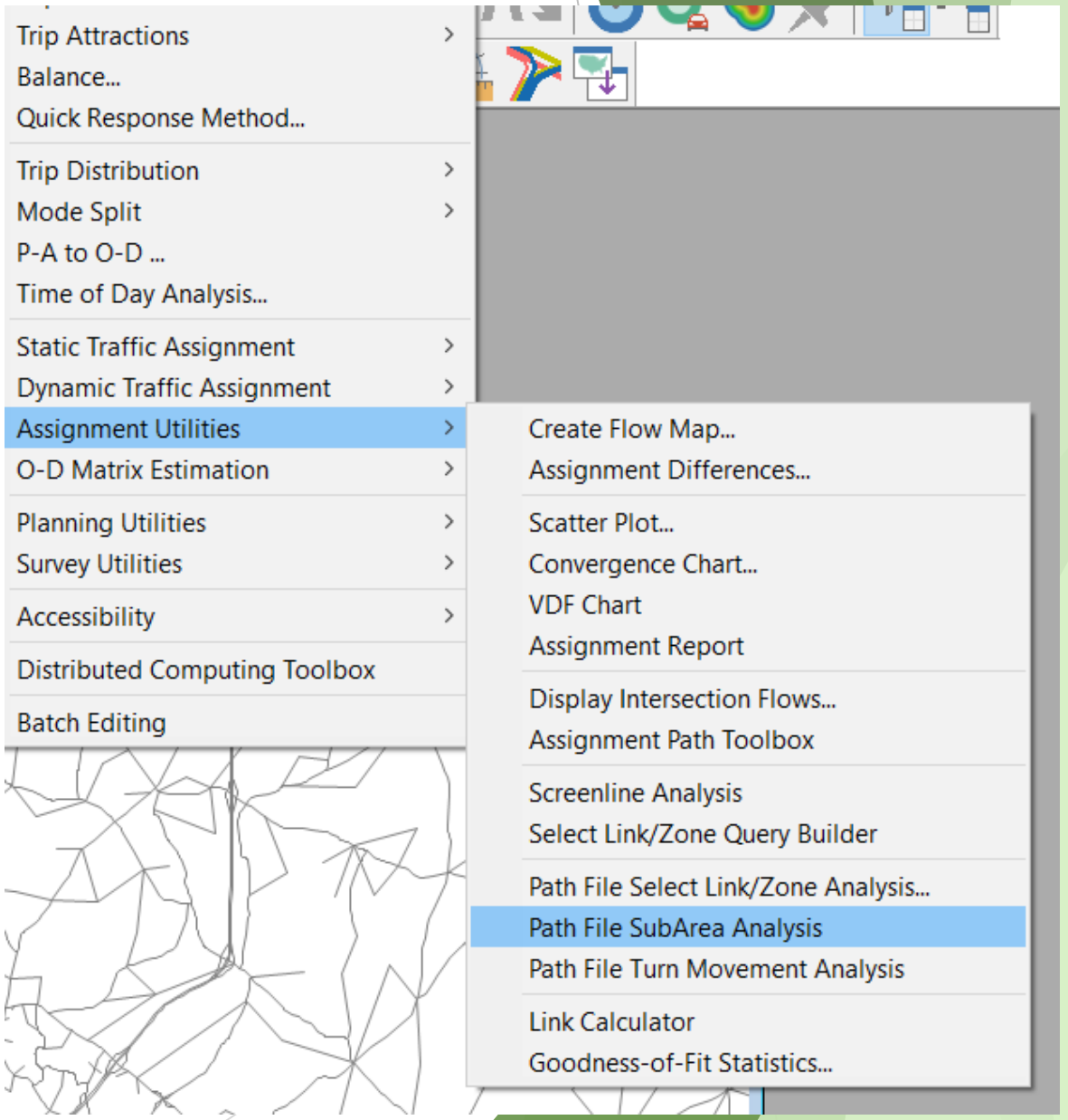
Extracts from the Regional Model

- Subarea Study Area includes Matthews planning area (red)
- Subarea selection (pink) includes additional area included to provide logical opportunities for through trips and route choices through/near the study area
- Subarea selection boundary (pink) used by TransCAD after the regional model to select OD table to extract



# Subarea Model Extraction

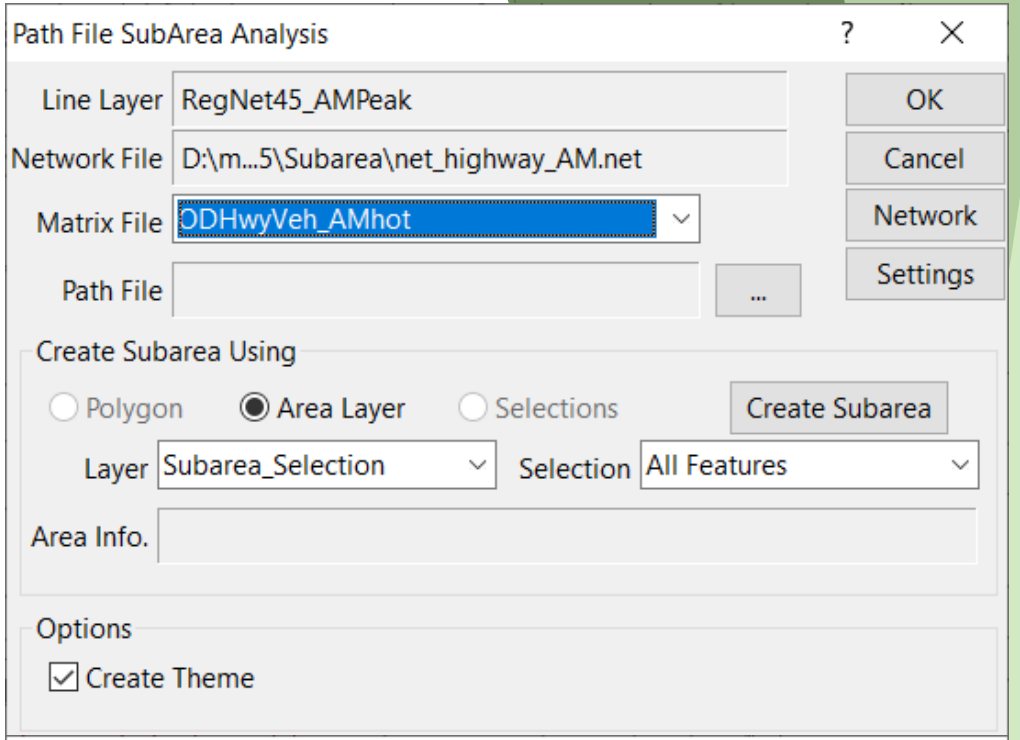
- Needs:
  - Regional Network (Regnet45)
  - .Net file specific to TOD (Run Subarea_NET_10-19-2020.rsc after regional model run)
  - Subarea Selection Boundary
  - TOD Trip matrix
  - Path file from regional assignment

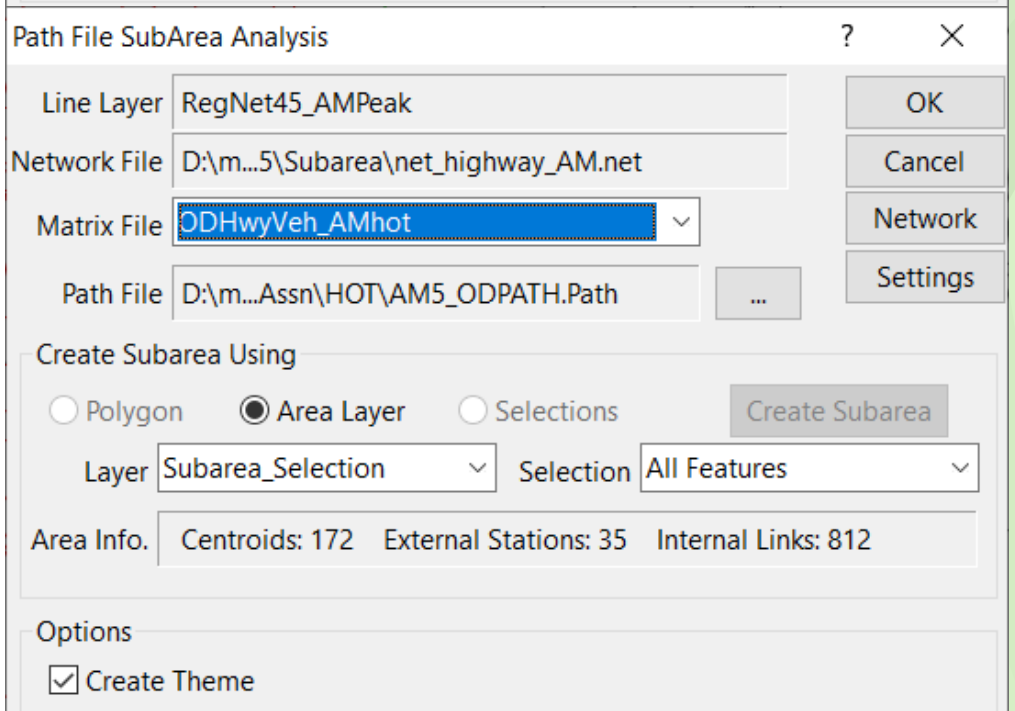


# Subarea Model Extraction

- Steps:

1. Open regional network, add subarea selection boundary
2. Open .net file and TOD matrix
3. Go to Planning->Assignment Utilities->Path File Subarea Analysis
4. In Dialog Box, select the AM Path file from Hwyassn/HOT
5. Click on “Create Subarea”
6. Hit OK to run OR cancel out to export subarea network at this point
7. Use file prefix AM_, MD_, PM_ on sub link flow output



# Subarea Matrix OD Prep and Assumptions

- Converts TOD Trip Tables into 15-minute matrices
- Auto, HOT, and Truck
- Automated within script (Subarea_TOD_10-19-2020.rsc)

- Assumptions: Same TOD trip breakout for all modes within each time period
- Based on (limited) traffic count data available in 15-minute increments

| Average | Q1 | Q2 | Q3 | Q4 |
|---|---|---|---|---|
| **6:00-7:00** | | | 5.6% | 7.7% |
| **7:00-8:00** | 7.9% | 8.8% | 9.0% | 9.5% |
| **8:00-9:00** | 9.8% | 9.1% | 9.1% | 9.1% |
| **9:00-10:00** | 7.8% | 6.7% | 3.7% | 3.6% |
| **10:00-11:00** | 3.4% | 3.3% | 3.5% | 3.8% |
| **11:00-12:00** | 3.6% | 3.9% | 3.8% | 4.1% |
| **12:00-13:00** | 3.9% | 4.2% | 4.3% | 4.6% |
| **13:00-14:00** | 4.8% | 4.6% | 4.2% | 4.6% |
| **14:00-15:00** | 4.2% | 4.6% | 4.7% | 4.6% |
| **15:00-16:00** | 4.9% | 5.0% | 7.0% | 7.6% |
| **16:00-17:00** | 8.3% | 8.3% | 8.7% | 9.0% |
| **17:00-18:00** | 10.0% | 9.5% | 8.7% | 8.2% |
| **18:00-19:00** | 8.1% | 6.5% | | |

# Subarea DTA Process and Assumptions

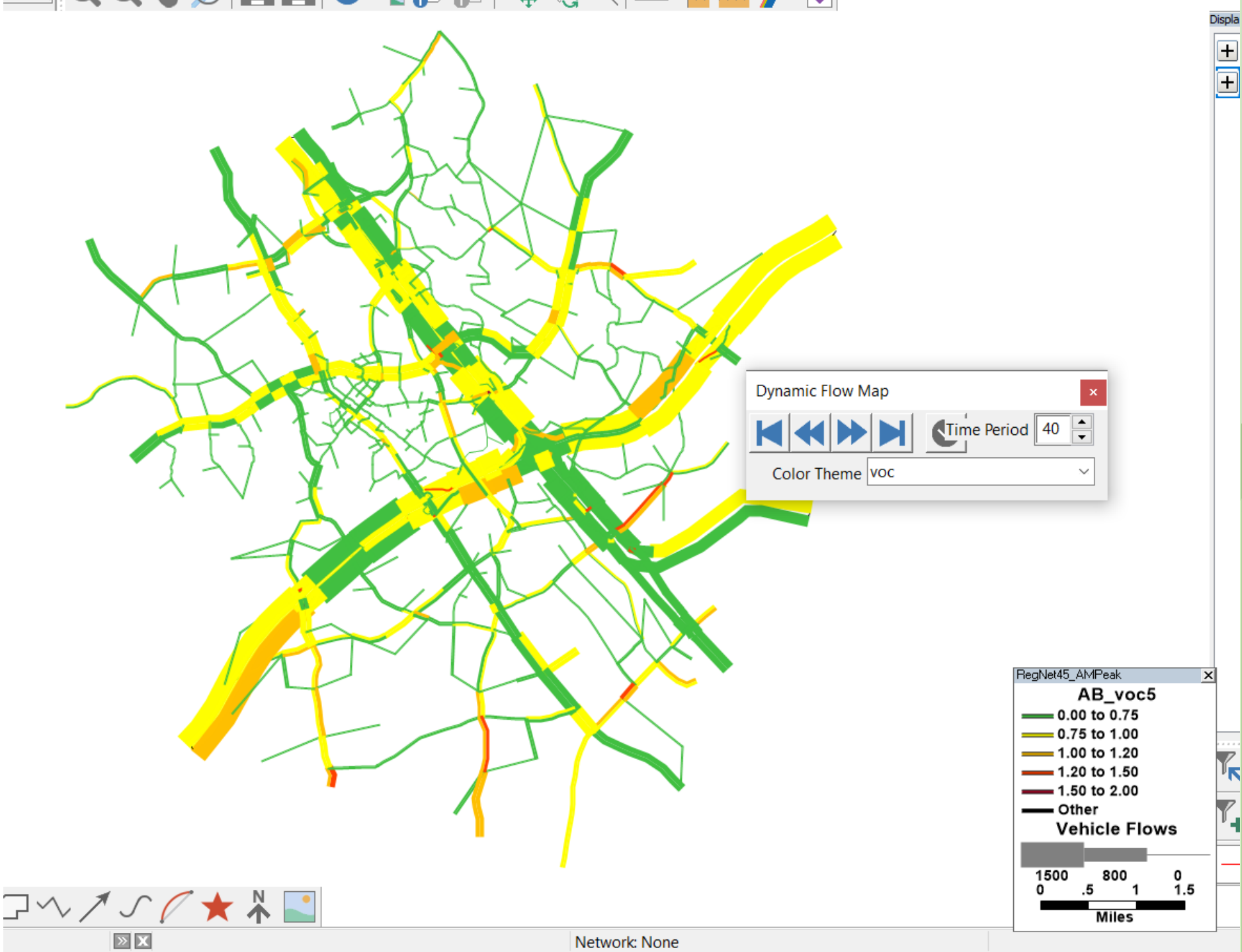
- Runs TransCAD's Dynamic Multi-Modal Multi-Class Assignment
- Assigns traffic for 48 consesctivute 15-minute periods
- 6:30 AM to 6:30 PM
- Same alpha/beta and volume-delay settings
- Modified capspeed assumption (capsub_factors.prn) for signals

- Needs additional fields:
  - AB Capacity/BA Capacity – based on MRM 1 hr with signal adjustment
  - AB/BA Capacity (15 minute)
  - AB Storage Capacity/BA Storage Capacity – Physical Area
  - AB Storage Capacity = Length*210*lanesAB + ((B_LeftLns + B_ThruLns + B_RightLns - lanesAB)*10)

# Subarea Model Output

- Provides for each 15-minute period:
  - AB/BA Flow
  - AB/BA Time
  - AB/BA VoC
  - AB/BA Speed
  - AB/BA Queue
  - AB/BA Cap Reduction
- DTA Post processor appends to network:
  - AB/BA_AMPK (AM Peak Hour Volume)
  - AB/BA_PMPK  (PM Peak Hour Volume)
  - AB/BA_AMVoC
  - AB/BA_PMVoC
  - AM_MaxVoC
  - PM_MaxVoC
  - SUB_TOTAL (12 hour volume)
  - DAY_TOTAL (24 volume – estimated)

# Dynamic Flow Map



# Matthews Subarea MRM

Dynamic Traffic Analysis Output

*(Here, there and everywhere)*

# Matthews Subarea Demand Model

2045 MTP

6:30 AM – 6:30 PM

# Run times

Time required for each step:

1. Run regional model and save path files:
   - 2x normal run time (path files are 171 – 190 GB each!)
2. Build .net files – quick
3. Extra Subarea OD matrices:
   - ~6 hours each (AM/MD/PM)
4. Prep OD matrices – quick
5. Run DTA Assignment:
   - 10 minutes to 1 hour

# Matthews Subarea Model

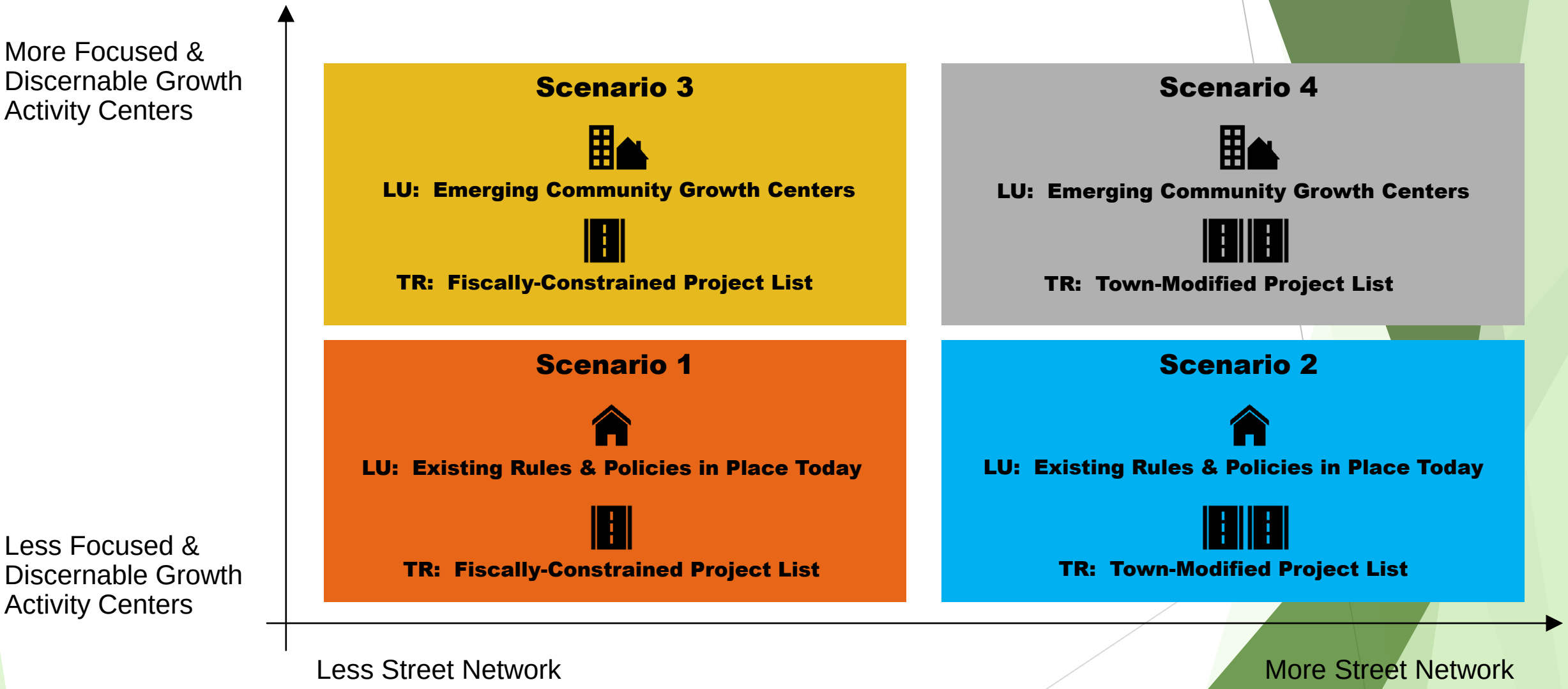
MODEL MACROS

b. Revised HOTAssn macro (HwyAssn_HOT_TCv7subpath.rsc)
c. Subarea buildnet macro (Subarea_NET_10-19-2020.rsc)
d. OD Matrix Prep macro (Subarea_TOD_10-19-2020.rsc)
e. Subarea DTA macro (Subarea_DTA_10-19-2020.rsc)

# Matthews Subarea Model – Steps by application

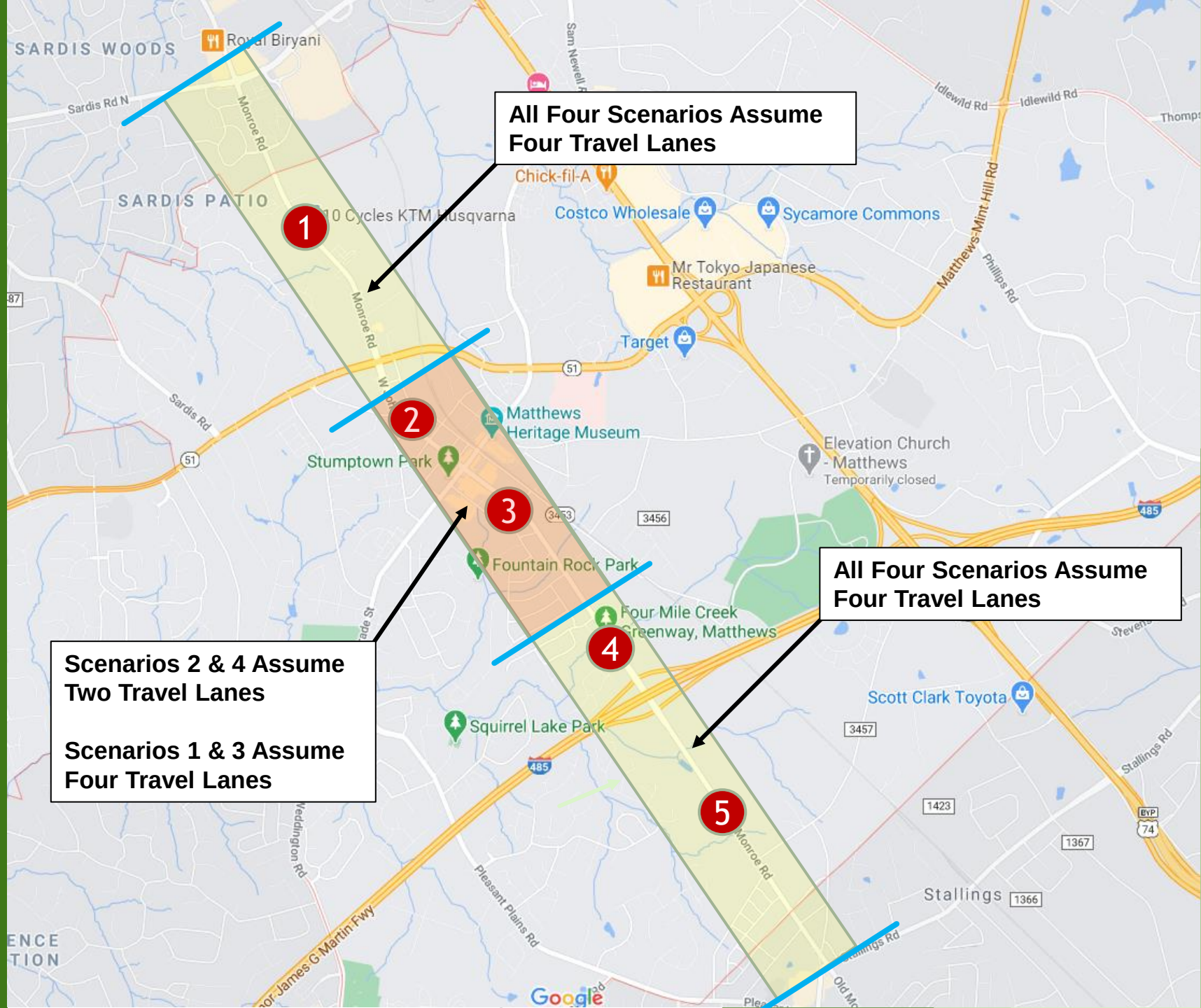
| Model Application Type | STEP | | | | | Notes |
|---|---|---|---|---|---|---|
| | 1. Update and rerun MCM Subarea Model (CommunityViz) | 2. Run Metrolina Regional Model | 3. Extract Subarea Trip Table | 4. Update Subarea Highway Network | 5. Run Subarea Model | |
| Highway Project within Study Area (non-toll) | | | | | | This is typical use of the subarea model. Includes widenings and new connections. |
| Highway Project extending beyond Study Area | | | | | | Regional model needs to be run to capture external trip changes |
| Highway Project within Study Area (toll) | | | | | | Toll projects should be analyzed in regional model only |
| Large Land Development within Study Area (>1,000 trips/day) | | | | | | Land use needs to be reallocated within CommunityViz |
| Small Land Development within Study Area (<1,000 trips/day) | | | | | | Subarea trip distribution and background traffic growth |
| Transit Project (any size) | | | | | | Transit projects should be analyzed in regional model only |

# Project Scenarios – Here, There, and Everywhere



# John Street Corridor Analysis

All Together Now



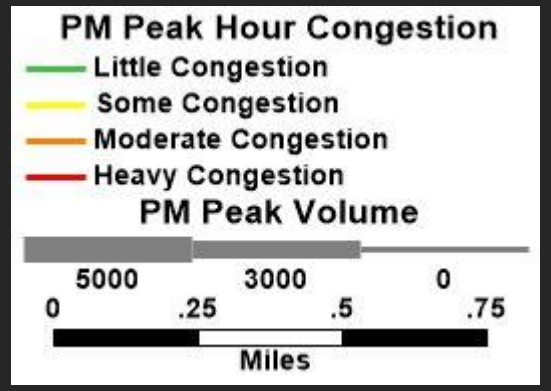
# Scenario 1

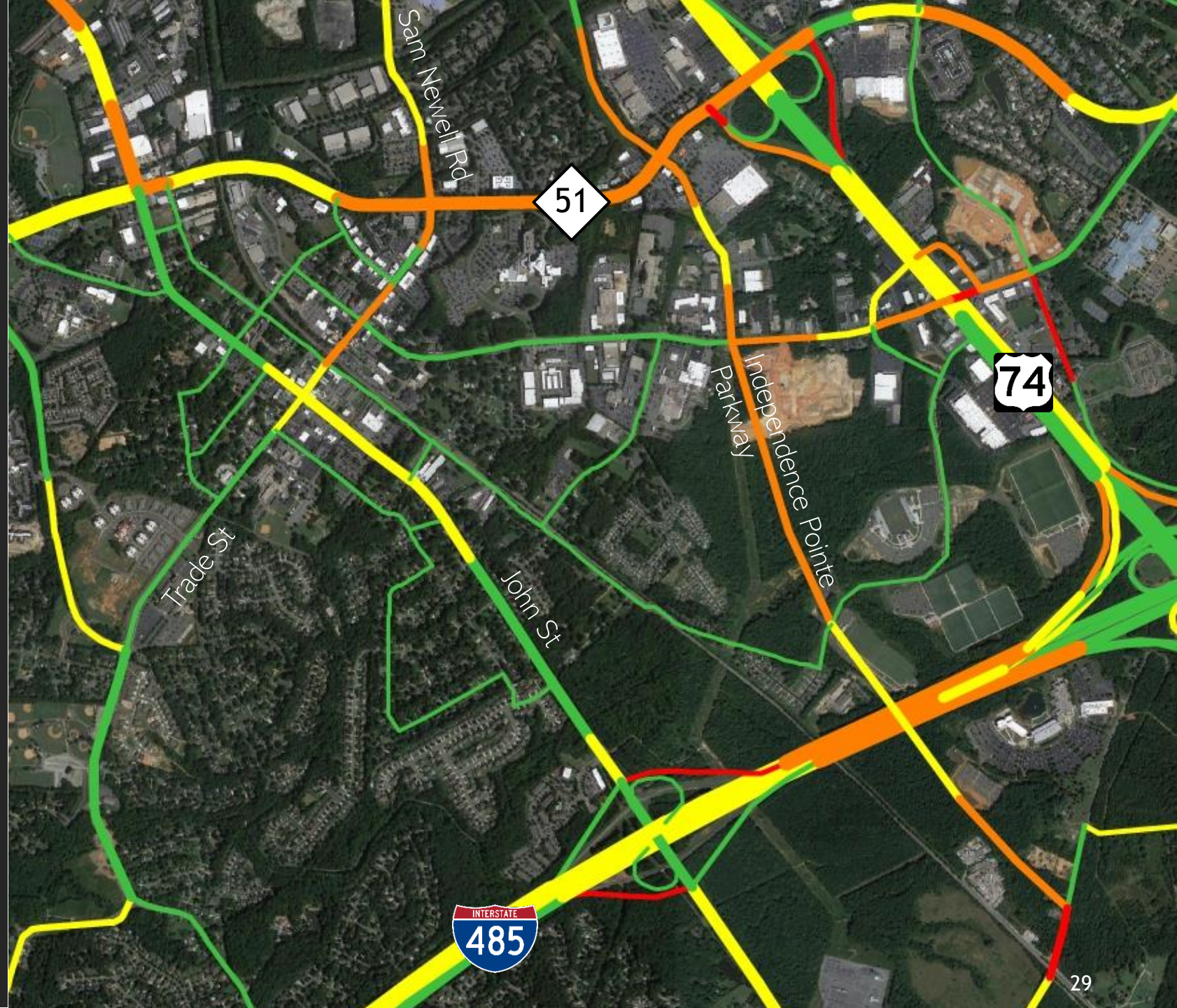
**LU: Existing Rules & Policies in Place Today**

**TR: Fiscally-Constrained Project List**

## 2045 Traffic Projections
## PM Peak Conditions

### Town Center Inset



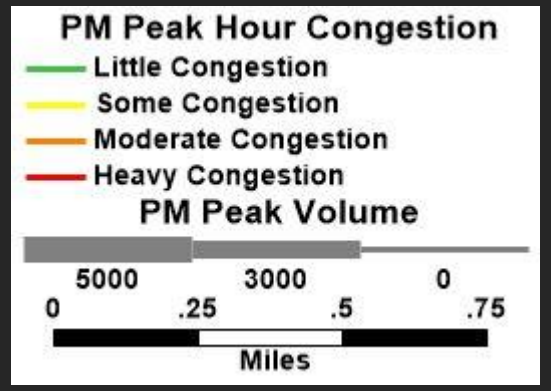
# Scenario 2

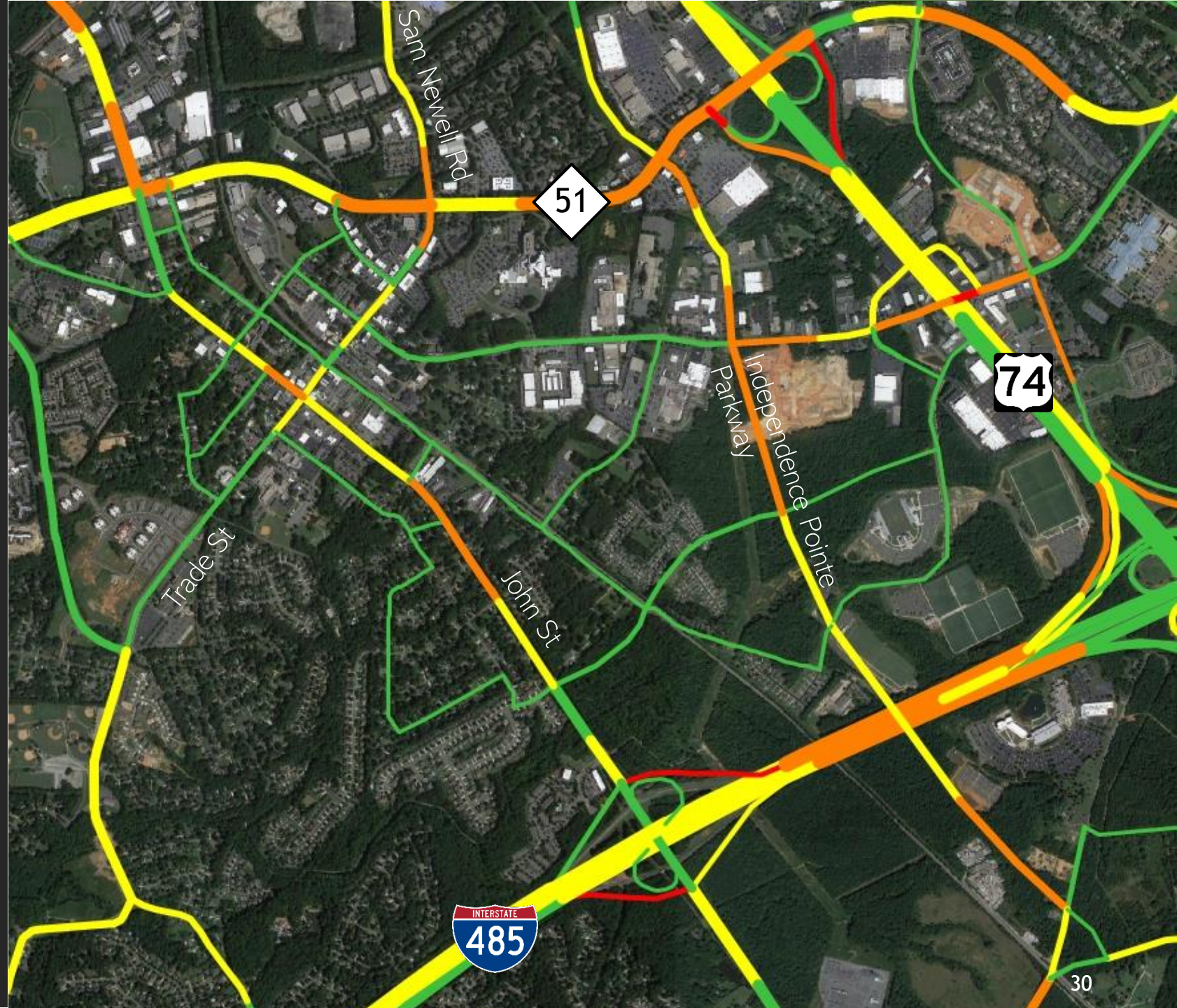
**LU: Existing Rules & Policies in Place Today**

**TR: Town-Modified Project List**

## 2045 Traffic Projections
## PM Peak Conditions

### Town Center Inset



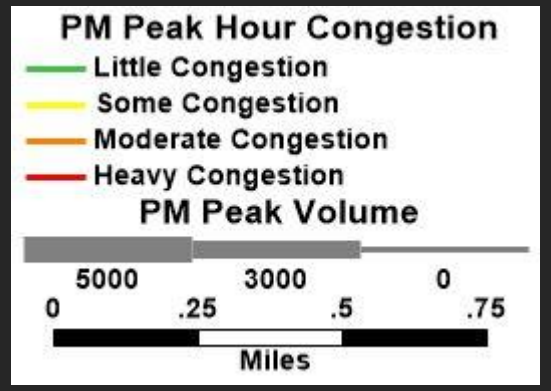
# Scenario 3

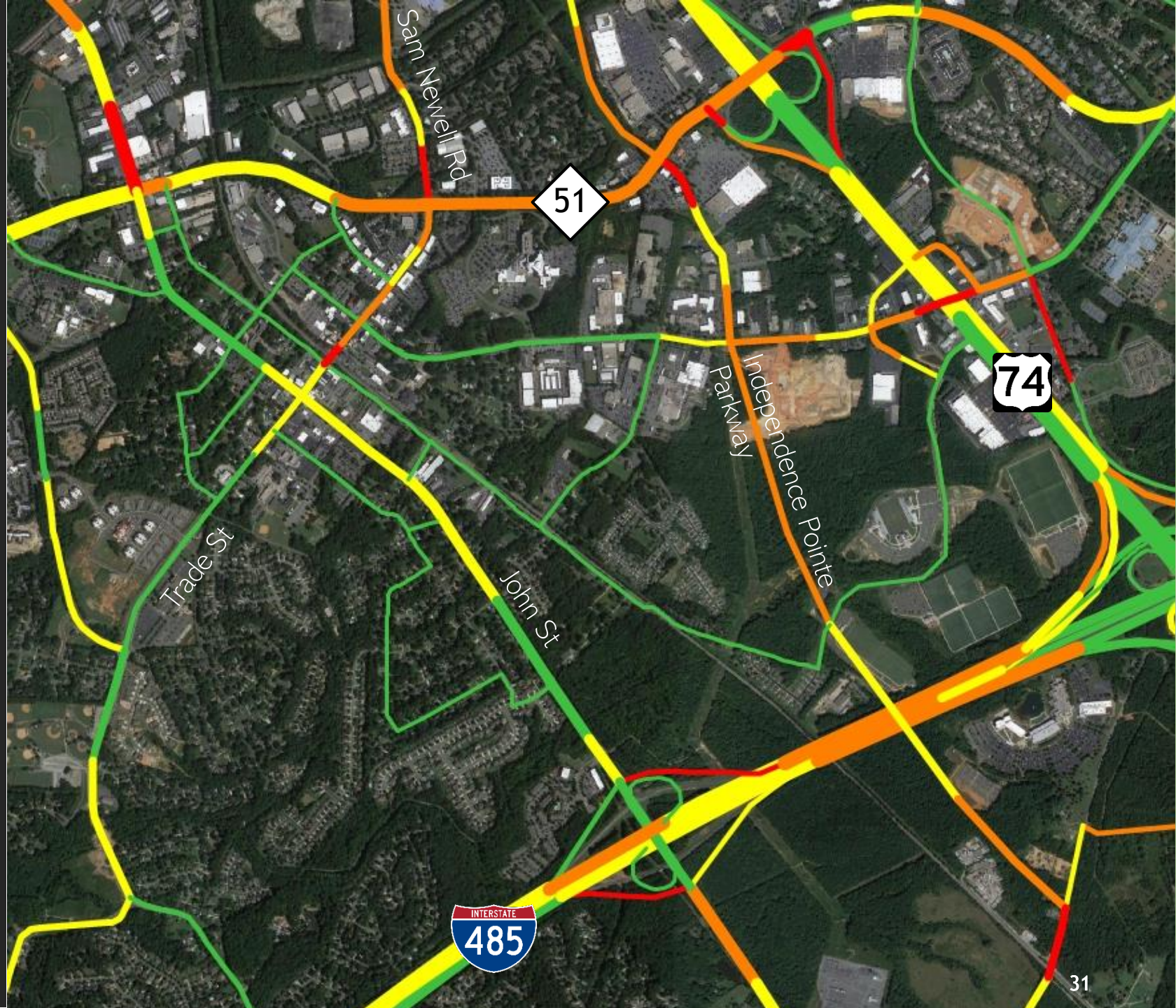
**LU: Emerging Community Growth Centers**

**TR: Fiscally-Constrained Project List**

## 2045 Traffic Projections
## PM Peak Conditions

### Town Center Inset



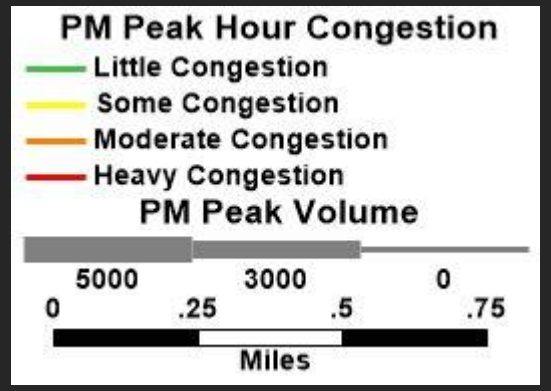
# Scenario 4

**LU: Emerging Community Growth Centers**

**TR: Town-Modified Project List**

## 2045 Traffic Projections
## PM Peak Conditions

### Town Center Inset



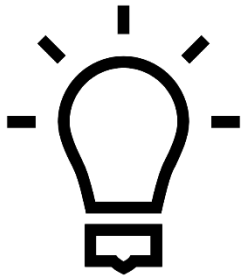
# John Street Corridor
# Estimated Level of Service

| Road | Segment | Existing | Scenario 1 MTP Trend Dev | Scenario 2 Town Plan Trend Dev | Scenario 3 MTP Emerging Ctr | Scenario 4 Town Plan Emerging Ctr |
|---|---|---|---|---|---|---|
| Monroe Rd | Sardis Rd N to NC 51 | C | D | D | E | E |
| John St | NC 51 to Trade St | D | C | D | C | D |
| John St | Trade St to Greylock Ridge Rd | D | C | E | C | E |
| John St | Greylock Ridge Rd to I-485 | D | C | C | D | C |
| Old Monroe Rd | I-485 to Stallings Rd | F | E | D | E | E |

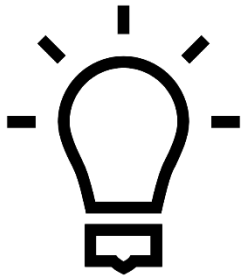
LOS C
LOS D
LOS E
LOS F

## Strawberry Fields Forever

# Study Findings & Conclusions



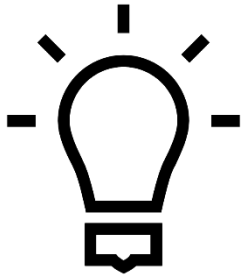
East John St can stay two lanes if the Town relies on the street-system-as-a whole to manage traffic needs.



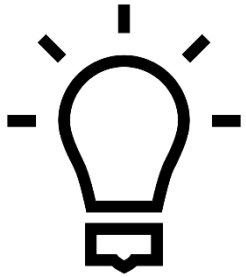
Traffic moving through the center of Town is reduced by 20-25% with implementation of the proposed street network.

The "pinch points" in the system are apparent and we know where to focus efforts for improvements.

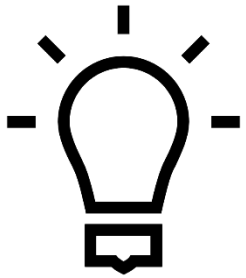
# We Can Work it Out



It comes down to a choice of place-making vs. through-put considerations for key corridors in the Town.



The “emerging centers” land use scenarios create a new chapter for the Town.



Two-lane street cross section, with lower traffic volumes, will better support needs for the emerging centers scenario to create safe, walkable environments.

# Ticket to Ride

# When I'm Sixty-Four….

- **Fine-tune capacities** – Review subarea capacities and test modifications - for example, is there queuing present? Is it reasonable?
- **Signal Timing data** – It is possible to include signal timing data within the DTA assignment. This requires the following data for each signal:
  - Definition of phases and which movements are given green in each phase
  - Cycle lengths and phase timings, including green, yellow, and red times
  - Definition of phase order
- **Additional 15-minute count/speed data** – The subarea model trip table was disaggregated into 15-minute increments using available 15-minute count data in the area from NCDOT. It is possible that the disaggregation of trips into 15-minute increments could be enhanced utilizing additional count and INRIX speed data. Or go to five minute intervals?
- **24-Hour Modeling** – the subarea model analyzes trips from 6:30 AM to 6:30 PM. It is feasible to add the missing 12 "night" hours to the subarea model. This would require additional data and modification of the script to capture night trips as well. Overall run time and hard drive space requirements also increase with the addition of night trips.

**Dana Stoogenke, Transportation Planner**

**Susan Habina-Woolard, PE Town Engineer**

Town of Matthews North Carolina

**Craig Gresham, PE Travel Demand**

CLEARBOX

**Matt Noonkester, AICP Land Use**

City Explained Inc.

# With a Little Help from my Friends....