A New Implementation of WISE

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What is our other WISE?

- Reformulation of concepts and methods faithful to the original project goals
- Takes advantage of existing MPO models
- Use of network traffic models to estimate delay and diversion
- Both static and dynamic traffic assignments can be used
- More detailed modeling of projects, construction phases, and work zones
- Incorporation of construction costs and cost escalation
- Completely new software

What is our other WISE? (cont.)

- Implemented in the TransCAD environment
- Makes use of TransCAD and TransModeler capabilities
- As such, leverages millions of dollars of prior software development and a large installed base
- Uses geographic databases to store projects and traffic impacts
- Avoids inaccurate schedule optimization heuristics
- Can accept delay estimates from other software
- Can export results to Excel and other software

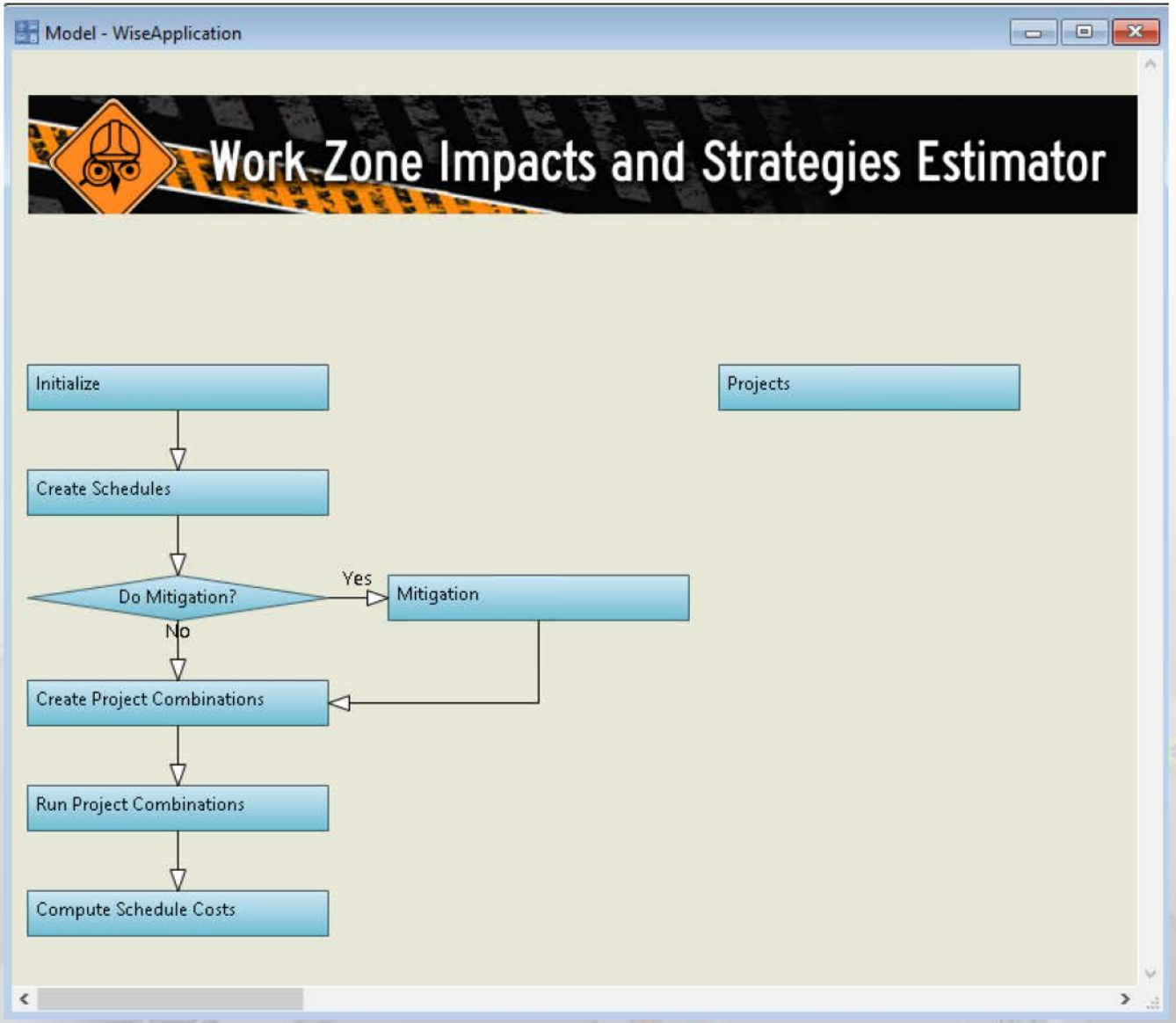
WISE Modeling Strategy

- **Project Delay Estimates**
  - Complete estimation of Vehicle Hours of Travel for all project scheduling combinations using static traffic models-thousands of model runs but they are fast
  - DTA on a subset of preferred schedules
- **Project Construction Cost Estimates**
  - Calculation of construction costs for all project scheduling combinations
  - Inflation and budget constraints taken into account

Traffic Assignment Models

- **Static and dynamic traffic models are being used to estimate traveler delay before, during, & after project construction**
- **The static models are the MPO planning model assignments in appropriate subareas**
- **Mesoscopic, Microscopic, and Hybrid traffic simulations are used for the dynamic traffic assignments in the same subareas by 15 minute time interval**

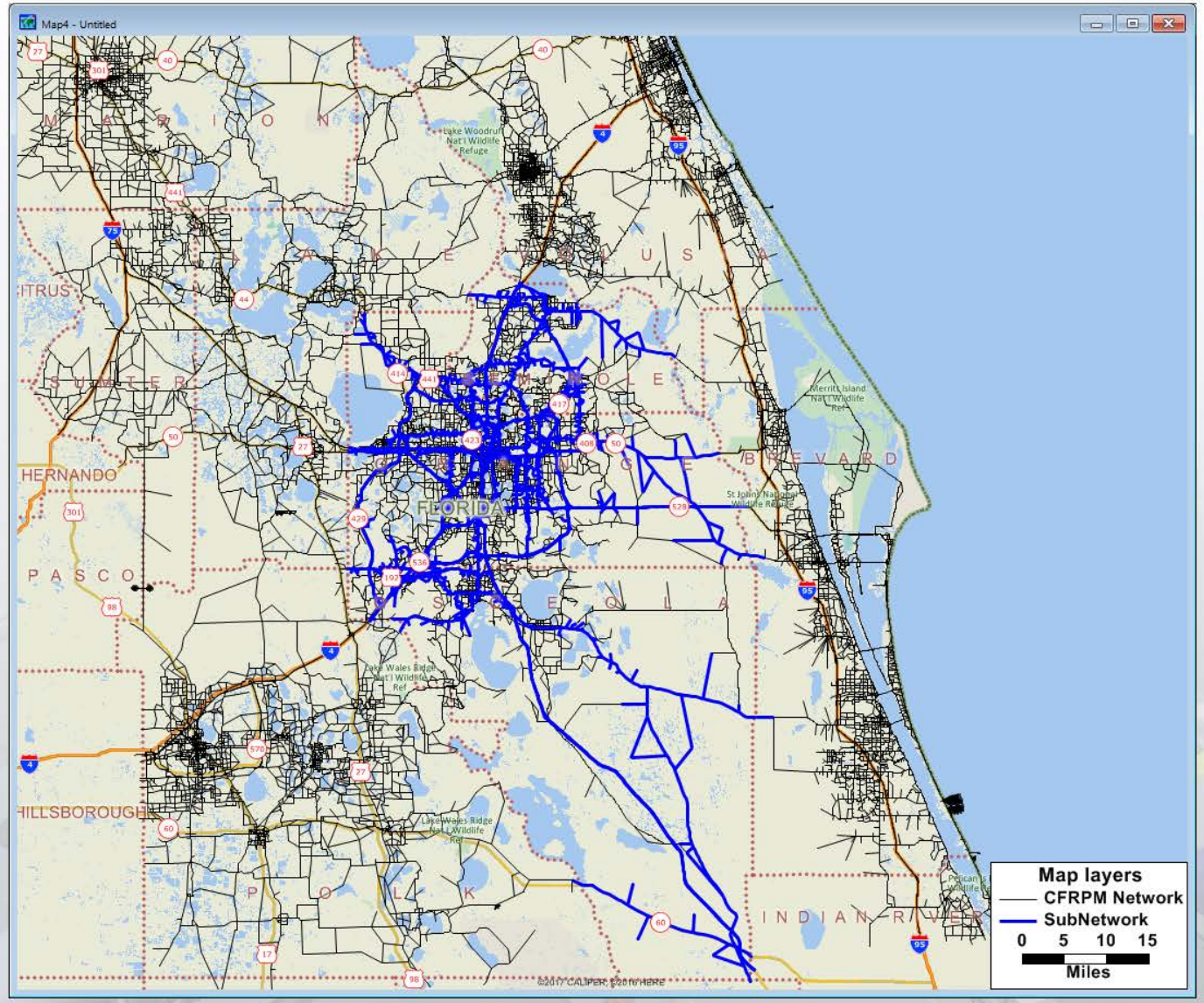
WISE Software Interface



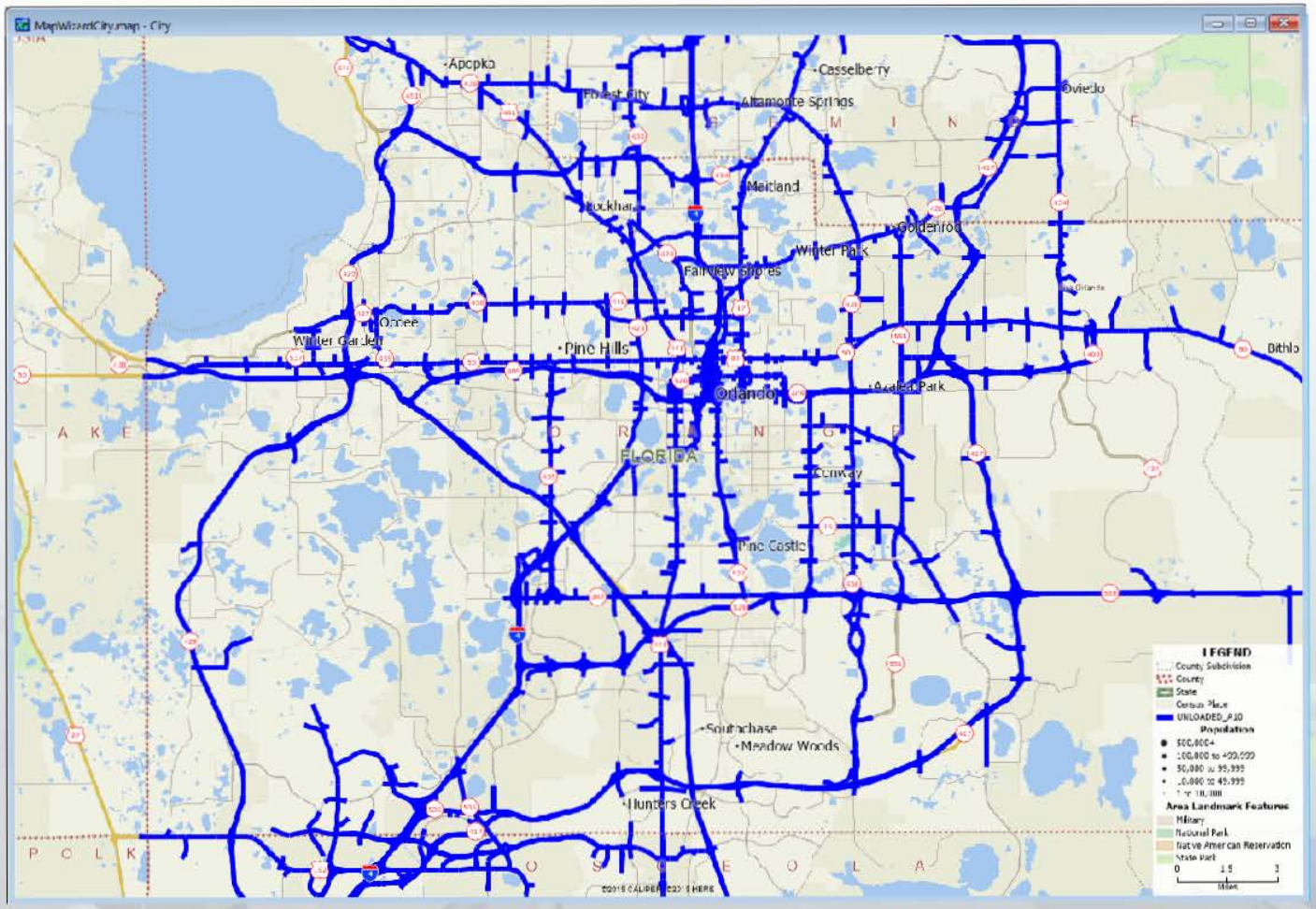
Orlando Modeling Region

- **Subregion within Orlando**
  - SR-436 to the North, SR-417 to the East and South, SR-429 to the West
  - Major highways and roads extracted out of CFRPM model network for both static and DTA highway networks
- **CFRPM (Our model) Origin-Destination Trip Matrices are being used and subarea trips are being calculated using procedure**
- **CFRPM traffic assignment procedure replicated**

Modeling Region



Modeling Region

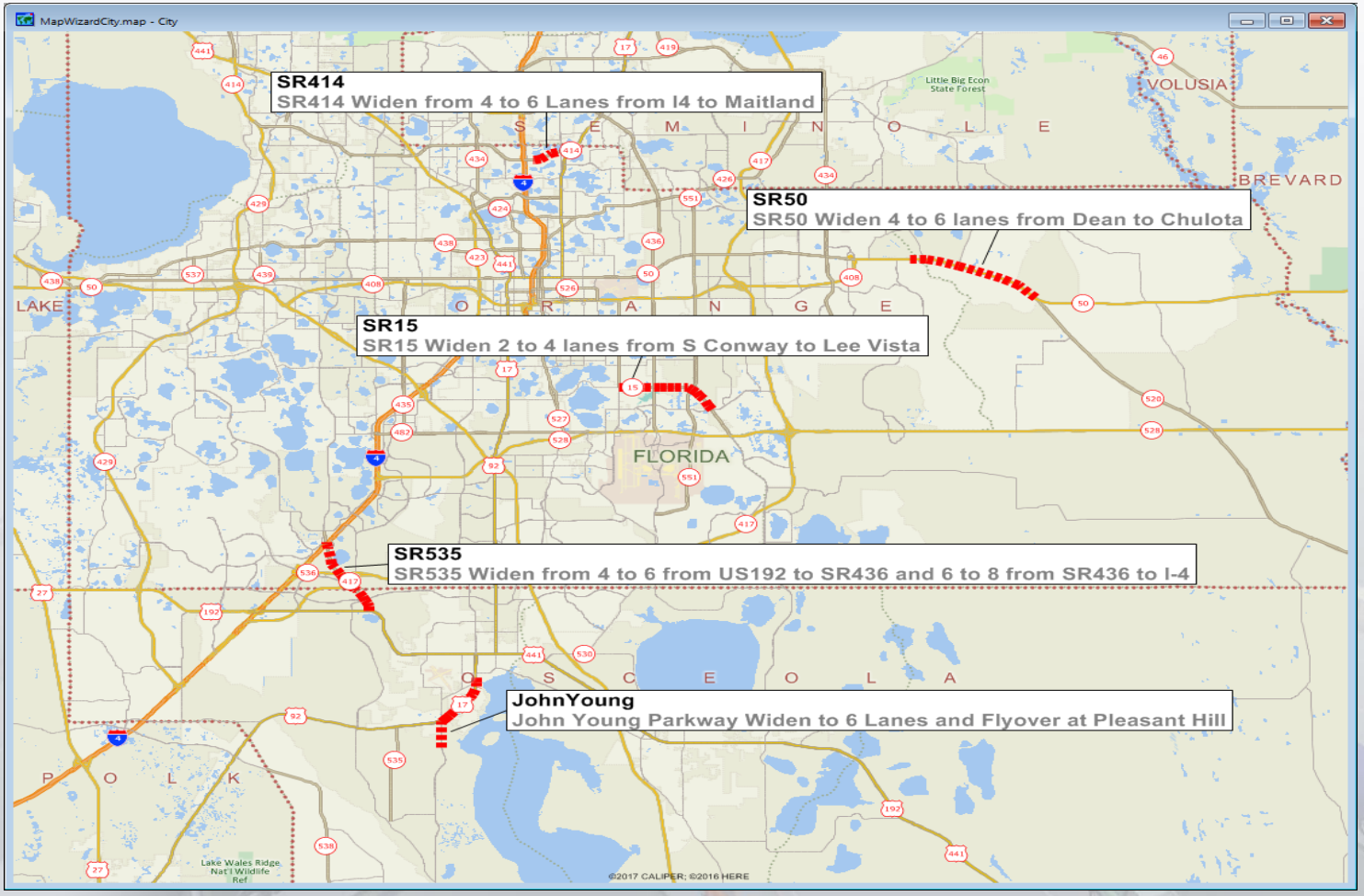


Projects

- **Taken from actual TIP/RTP with 5-10 year time horizon goal**
  - Most projects are lane widenings, one contains new construction
  - Projects have defined traffic impact
  - Projects not too complex

Projects

- **5 projects chosen in total**



Project Attributes

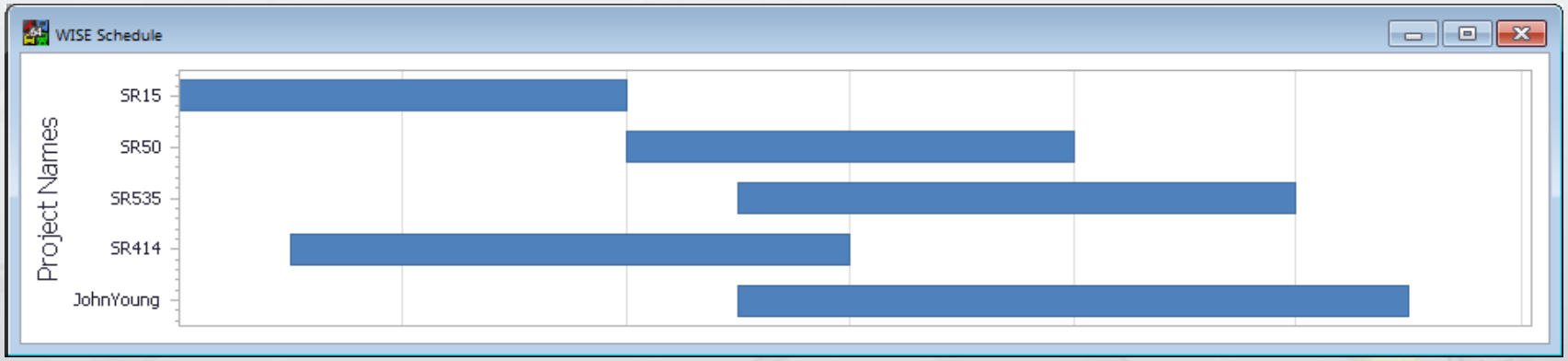
- **From network or RTP/TIP information**
  - Project location
  - Speed limits or free flow speeds
  - After construction lanes/capacities
  - Construction costs
- **Derived**
  - Construction link speeds and capacities
  - Construction durations, time windows and times of day
  - Construction priorities and mitigation effects

WISE Modeling Strategy

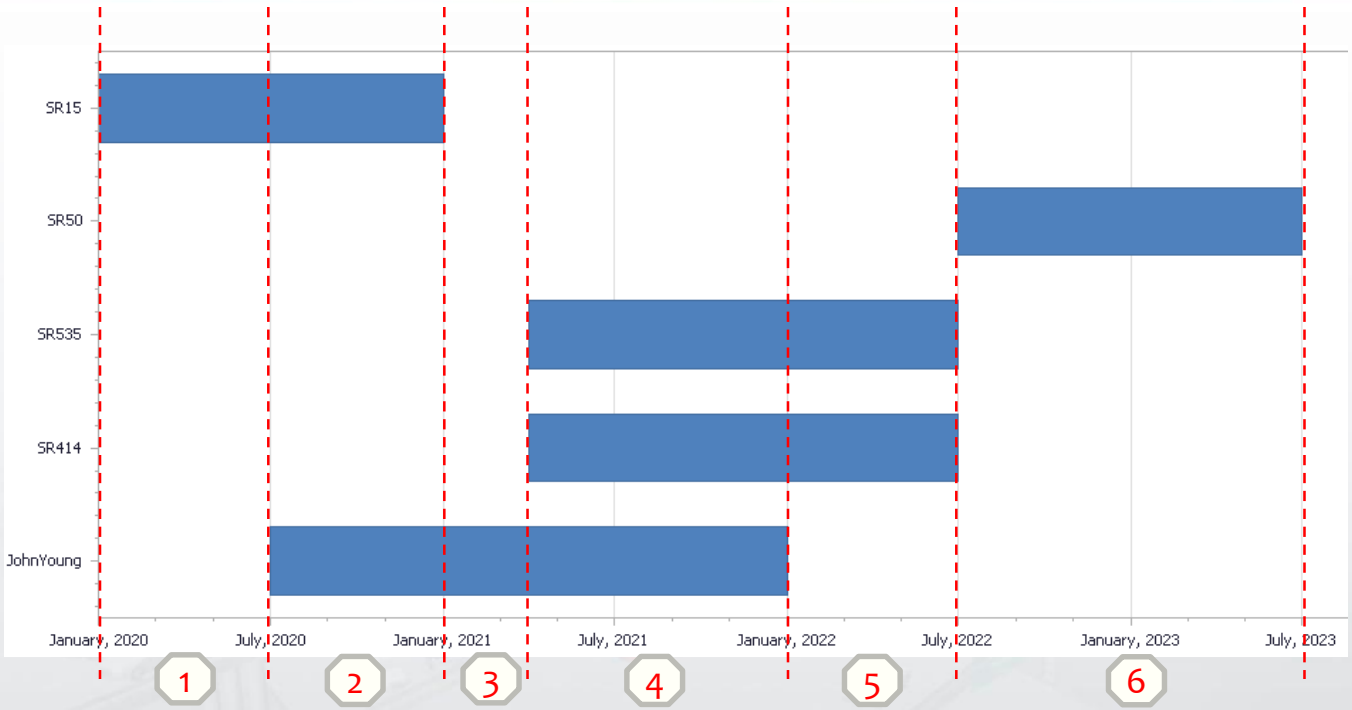
- **Model ALL schedules and combinations**
  - Calculate project delay for all combinations
  - Calculate construction costs
- **Calculated weighted cost**

Project Schedules

- Start and end dates for each project
- Scheduling done by quarters
- Enumeration of every schedule



Project Combinations Illustration



Combination	1	2	3	4	5	6
SR15	During	During	After	After	After	After
SR60	Before	Before	Before	Before	Before	During
SR535	Before	Before	Before	During	During	After
SR414	Before	Before	Before	During	During	After
JohnYoung	Before	During	During	During	After	After

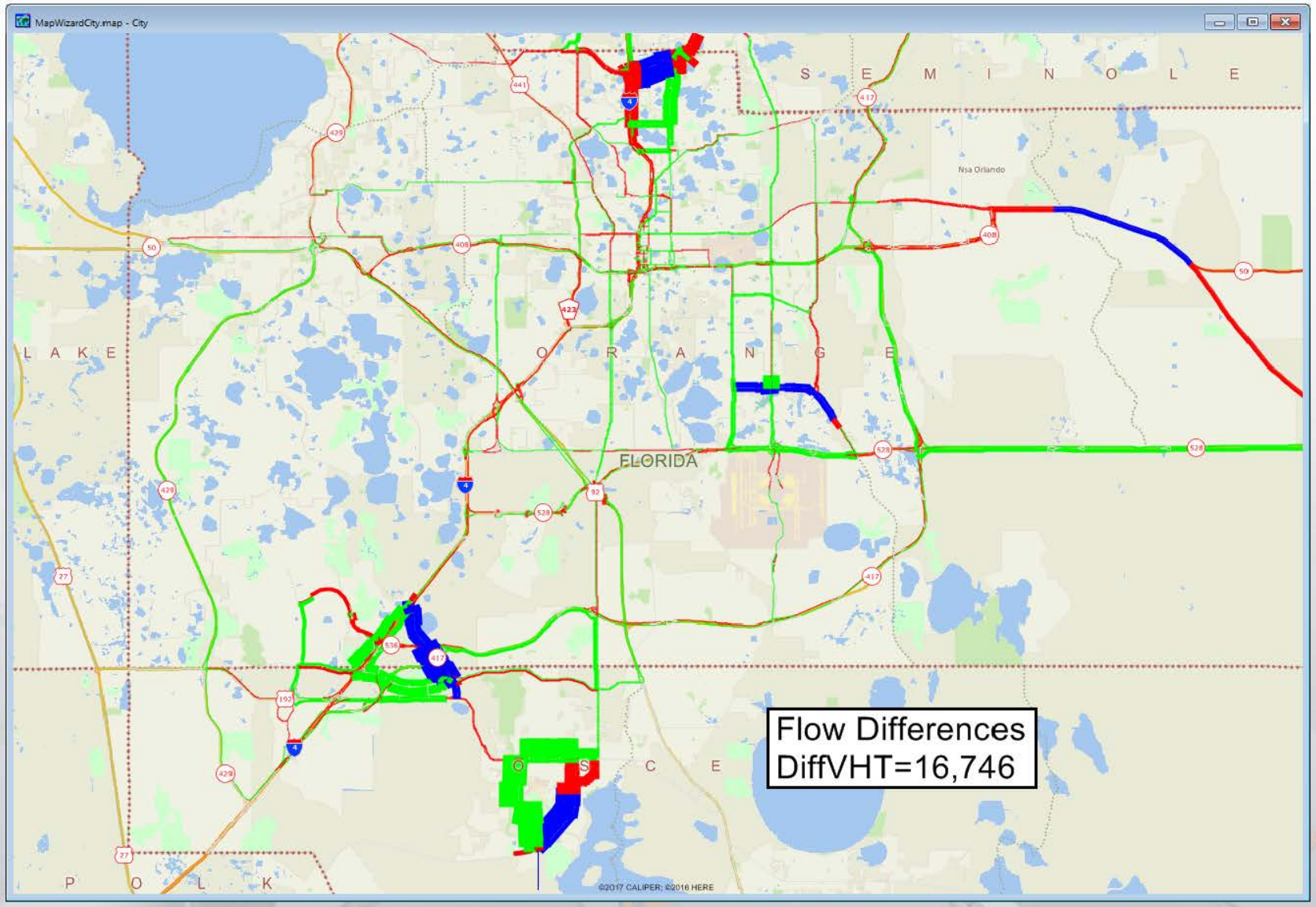
Project Combinations

- **At each quarter in the schedule, projects are either not started, under construction, or finished**
  - Code speeds and capacities for each project and status in network
- **Determine delay based upon project combination at quarter**
- **Compile and estimate delay for every possible project combination**

Delay Calculations

- **Use static equilibrium traffic assignment**
  - Very fast
  - Used by travel models to determine project impacts
  - Can model travelers taking alternate paths due to construction congestion
  - Models effect of multiple project interactions
- **Assignment output is flow and time**
  - Vehicle hours (VHT) = Flow*Time
- **Delay = VHTconstruction – VHTnot_started**

Delay Calculations



Assignment Model

- **4 Time Periods**
  - AM, Midday, PM, Night
  - Models varying levels of congestion, construction periods
- **Demand matrices at beginning and end of study period (from CFRPM and subarea)**
- **Model reflects CFRPM traffic assignment**
- **~1,800 project combination assignments**
- **~5-10 seconds/assignment**
- **~1.5 hours total run time**

Cost Calculations

- **Construction cost input for each project**
  - Assumed start at beginning of time window
  - Inflation factor applied if project starts later
- **Apply budget, project constraints**
- **Calculate schedule costs and delays**
- **Calculate weighted cost**

$$WeightedCost = \alpha * ConstructionCost + (1 - \alpha) * VOT * Delay$$

$$\alpha = Delay\ Weight\ Factor$$

$$VOT = Value\ of\ Time$$

$$Delay = VHT\ Travel\ Delay$$

Results

- Project Delays for every project combination
- Schedule costs and delays
- Cost minimization
- Schedule visualization

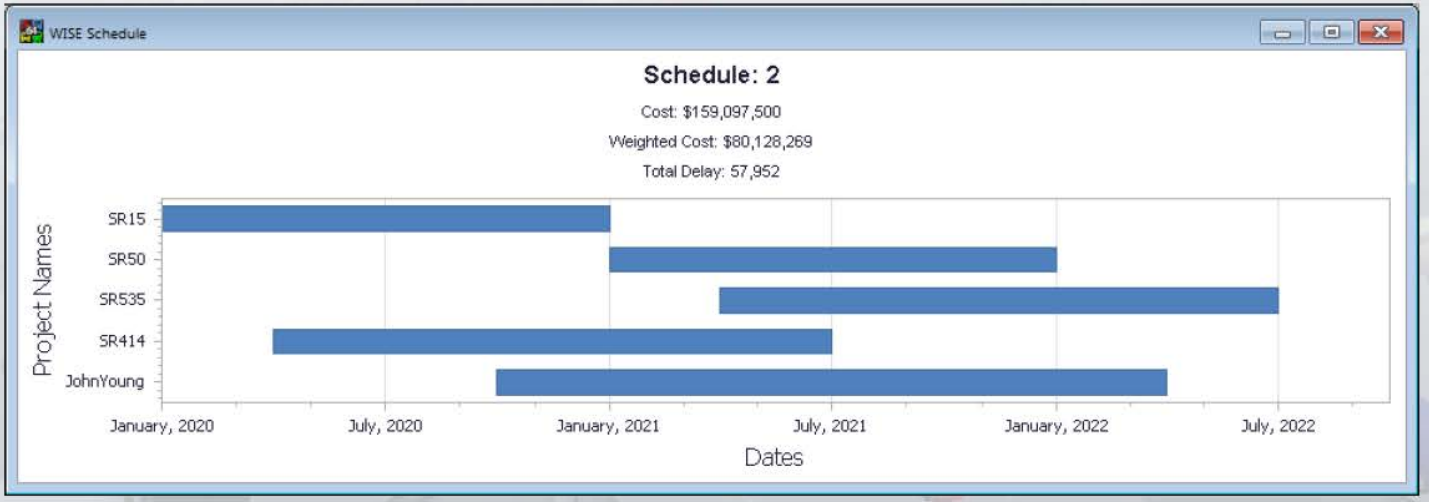
Results

Dataview4 - CombinationTable

CombinationID	VHT_Start	Delay_Start	VHT_End	Delay_End
1	1,017,965	3,663	1,385,810	7,808
2	1,018,651	1,312	1,389,475	1,069
3	1,019,471	2,132	1,390,603	2,197
4	1,015,449	1,906	1,379,516	2,162

Dataview6 - ScheduleCostsTable

ScheduleID	ConstructionCost	TotalDelay	WeightedCost	StartDate	EndDate
1	$158,900,000	57,545	$80,025,454	1/1/2020	7/1/2022
2	$159,097,500	57,952	$80,128,269	1/1/2020	7/1/2022
3	$159,295,000	58,319	$80,230,691	1/1/2020	7/1/2022
4	$159,492,500	58,426	$80,330,513	1/1/2020	10/1/2022
5	$159,690,000	58,271	$80,427,708	1/1/2020	1/1/2023



Observations

- **Results look reasonable**
  - **Minimum construction cost schedules are schedules where projects begin as early as possible**
  - **Minimum traffic delay schedules are schedules with minimal overlap of project construction**
- **Full enumeration of schedules and project combinations is possible within reasonable modeling times (~1.5 hours total)**
- **Static traffic assignment methods may be reasonable from a macro perspective**

Progress Summary

- **Software is feature complete and nearly done**
- **Static analysis has been completed**
- **DTA models are running**
- **Documentation and report writing remain to be done**