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Statewide Travel Demand Models:
Applications & Benefits

North Carolina Model Users Group
May 13, 2009

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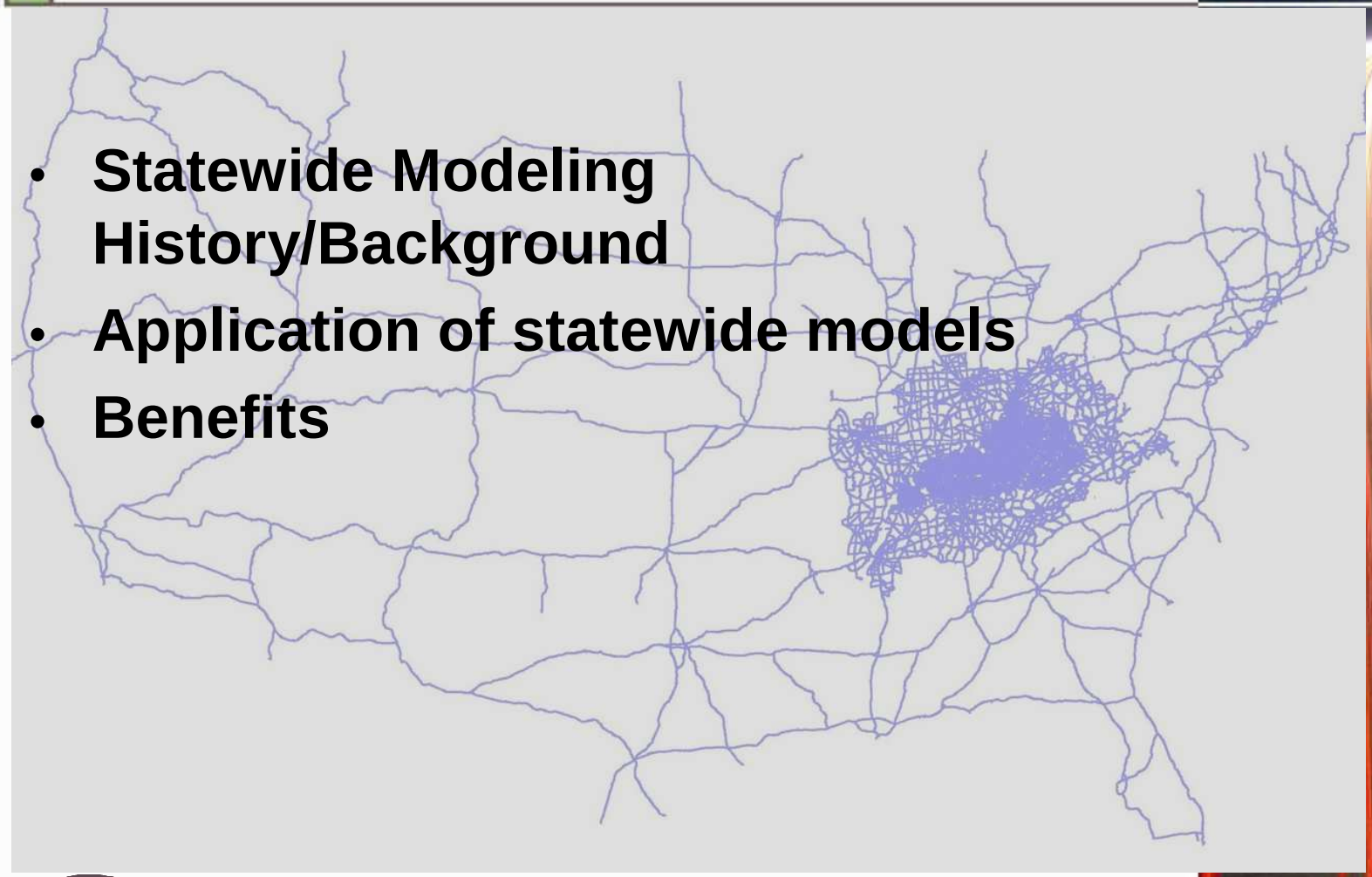
Presentation Overview



- **Statewide Modeling History/Background**
- **Application of statewide models**
- **Benefits**

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Statewide Modeling History/Background

- 1st STDM – KY developed in 1976 in Planpac, supported by extensive data collection
- Next generation – the ISTEA/corridor study inspired about 10 models including KY, MI, IN, WI
- Explosion of TDMs in 21st century – close to 30 now

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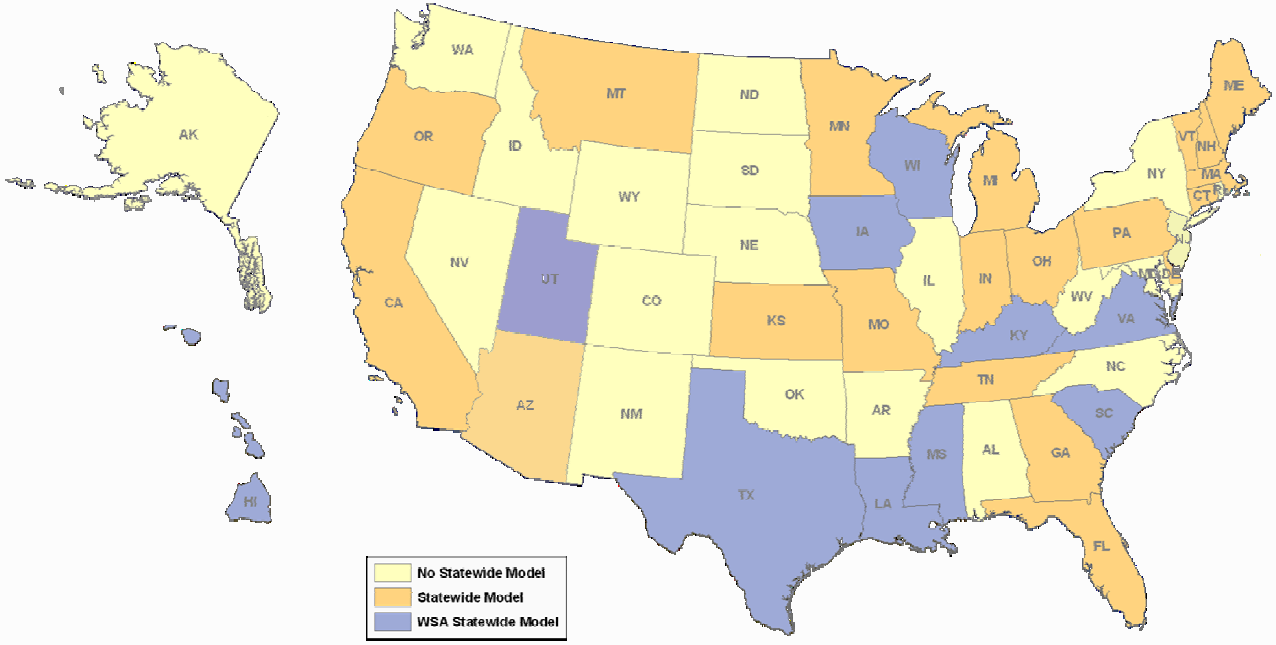
States w/ STDMs



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STDM Milestones

- 1999 Statewide Modeling Conference
  http://www.fhwa.dot.gov/planning/statewide/swtravel.pdf
- Formation of TRB Statewide Travel Forecasting subcommittee
  http://www.uwyo.edu/statewideplanning/StatewideForecasting.html
- 2004 Peer Exchange in Long Boat Key: e-circular:
  http://onlinepubs.trb.org/Onlinepubs/circulars/ec075.pdf
- Statewide Modeling synthesis:
  http://onlinepubs.trb.org/Onlinepubs/nchrp/nchrp_syn_358.pdf
- 2008 Statewide modeling track at TRB Atlanta statewide planning conference

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Statewide Modeling Applications

- Corridor studies
- Urban model support
- Freight studies
- Toll studies
- Tool development
- LRTPs
- Emergency/evacuation analysis
- HSR
- Systems analysis
- Special problems

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STDM Applications: Corridor Studies

- **Statewide models can be used to study large multi-regional corridors**
  - Long corridors may extend beyond MPO model boundaries
  - Interstates are impacted by a high number of long distance trips
  - Examples of corridors studied by statewide models include: I-66, I-69, I-10, I-74 to I-71 and Memphis River Bridge study.
  - Possible NC corridors: I-40, I-85, I-95

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I-66 Corridor in KY

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I-66 Corridor

- ISTEA high priority corridor (1991 – one of 21 corridors)
- Original nation-wide corridor had a B/C < 1.00
- KY Congressman Hal Rogers persuade Congress to fund a KY-only version of I-66
- Impetus to update KY STM in 1996-1998
- Model in MINUTP, used feedback to REMI model for generating employment & population
- KY corridor makes heavy use of existing roads
- Somerset Bypass section is under construction
- I-66 protestors in Lexington Office

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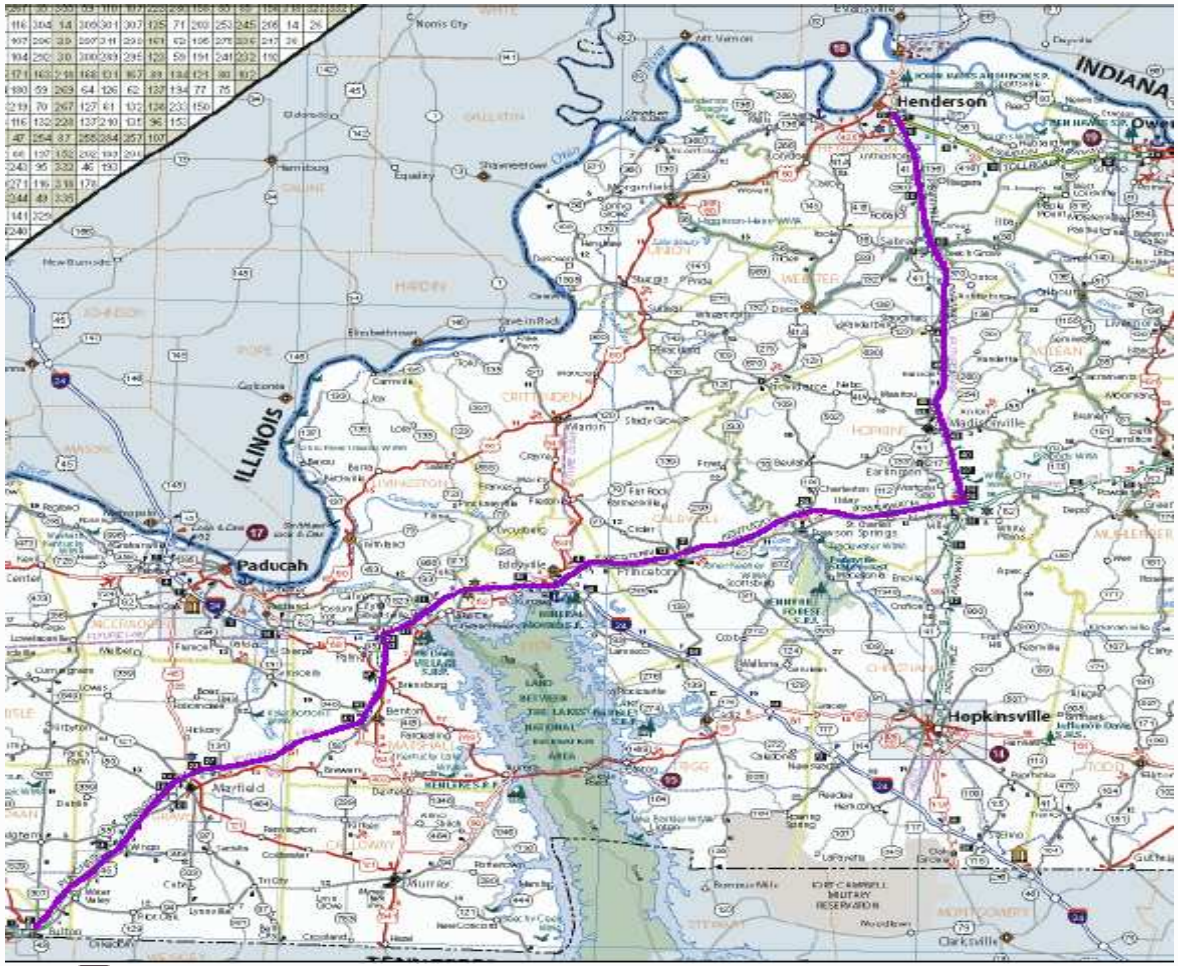
I-69 Corridor



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I-69 Corridor

- ISTEA corridor, reaches between Indianapolis to San Antonio
- Had national B/C > 1.00
- Each state having independent studies
- KY using existing Parkways & upgrading (better ramps, new signs)
- I-69 only generated about 3,000 additional trips/day (beyond existing parkways)
- All Western KY projects were re-evaluated to account for I-69 impact
- Flaw of I-69 studies to date have been lack of analytical connectivity

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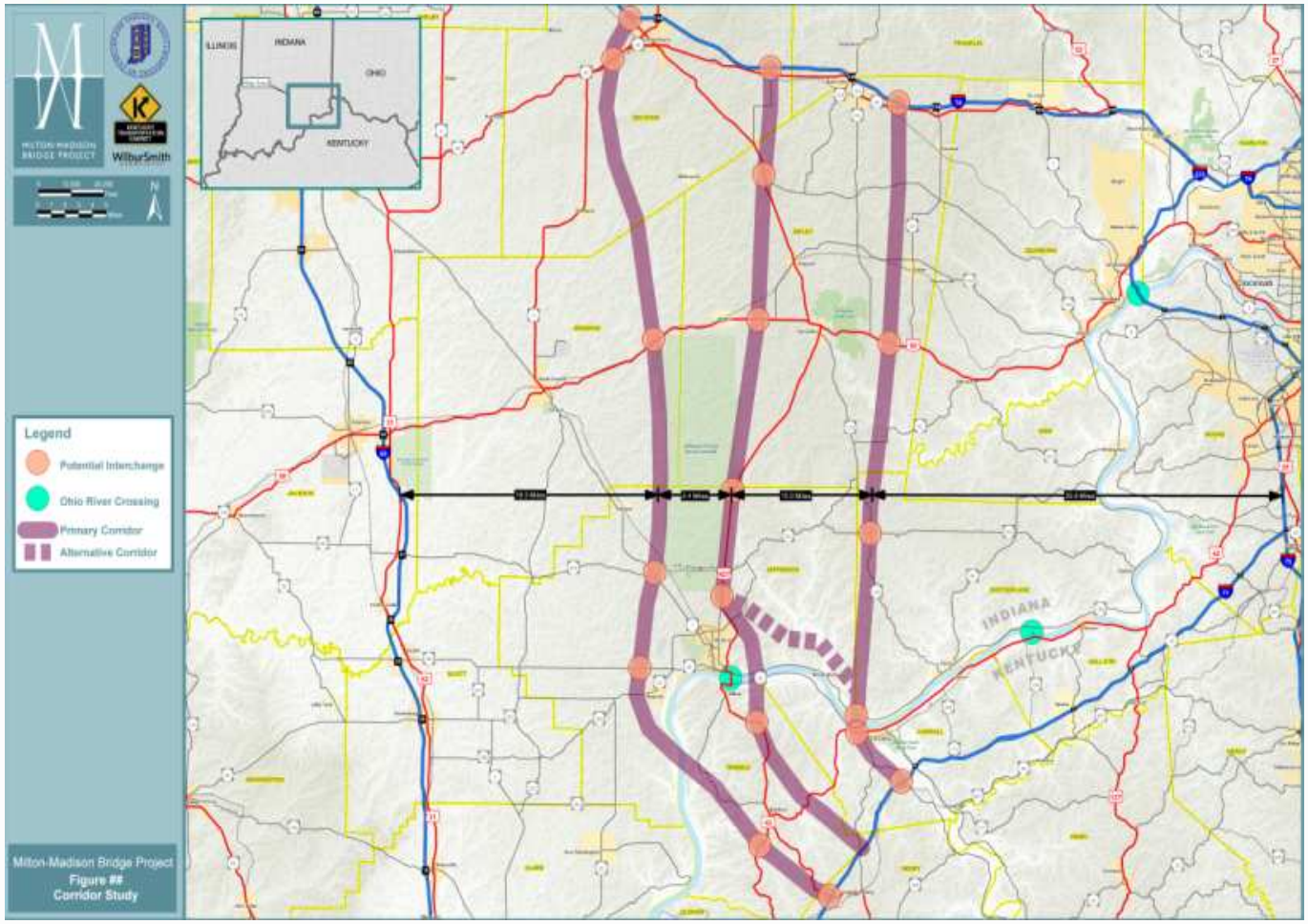
I-71 to I-74 Corridor



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I-71 to I-74 Corridor

- Part of Milton-Madison Ohio River Bridge study
- Since bridge is being replaced/upgraded, look at other options such as I-71 to I-74 corridor
- Created a bi-state model (stitched together the IN & KY STDMs)
- Net diversion in 2030 ~ 5,000 – 6,000 vpd

			2030 Bridge Volumes					
Location	**Do-Nothing**		**West Alt.**		**Middle Alt.**		**East Alt.**	
	Total	Truck	Total	Trucks	Total	Trucks	Total	Trucks
Existing Bridge	12900	700	11400	500	9600	200	9200	400
New Bridge			8000	1100	8400	1300	10000	2100
Total	12900	700	19400	1600	18000	1500	19200	2500

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New Memphis Bridge

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New Memphis River Bridge

- **Need to look at numerous bridge alternatives**
- **TN STDM was used because:**
  - Existing Memphis model had a very week West Memphis component
  - Needed to assess impact of new I-69 impact
- **Disaggregate zones, no validation, select link analysis, VMT/VHT production**

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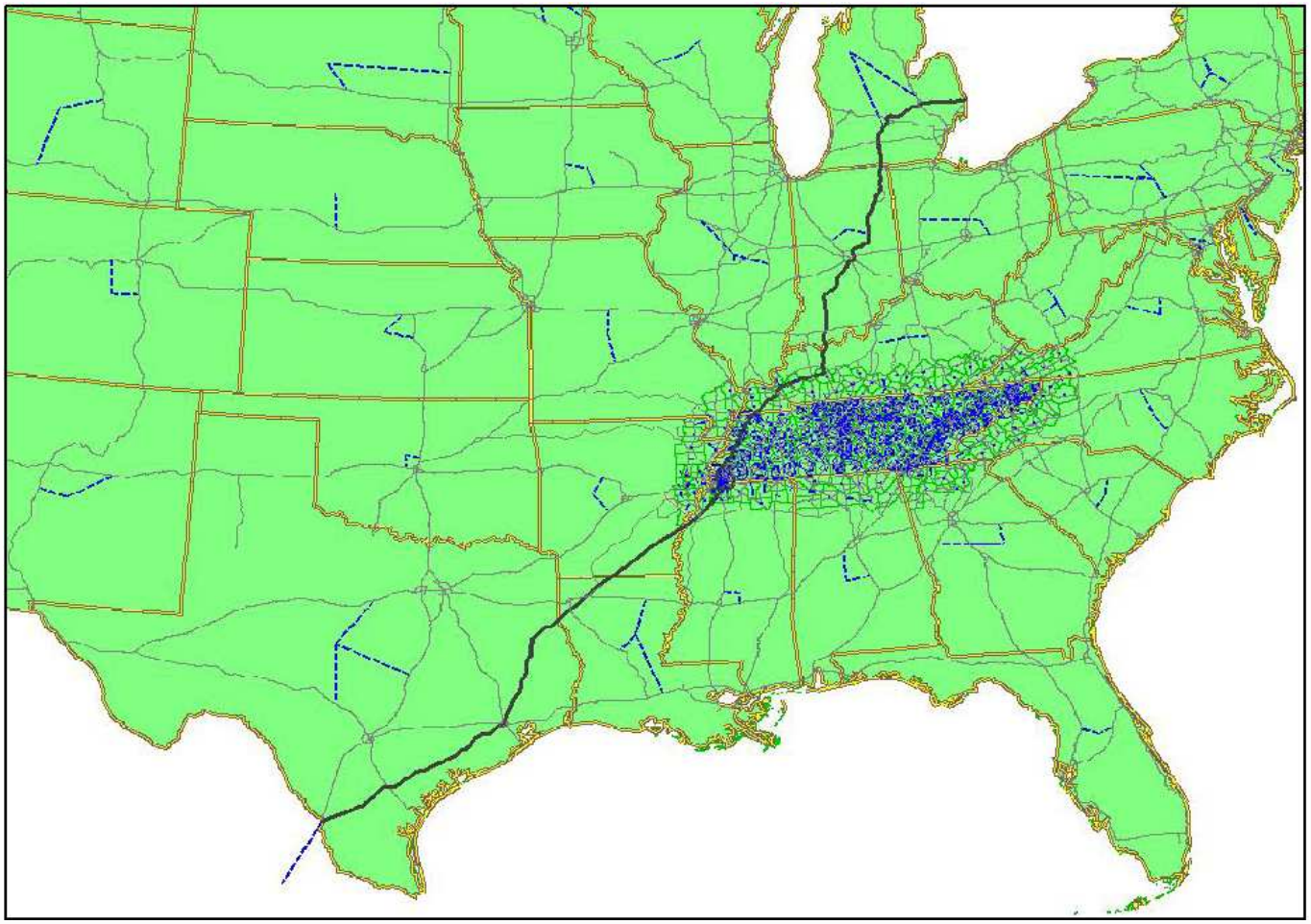
New Memphis River Bridge



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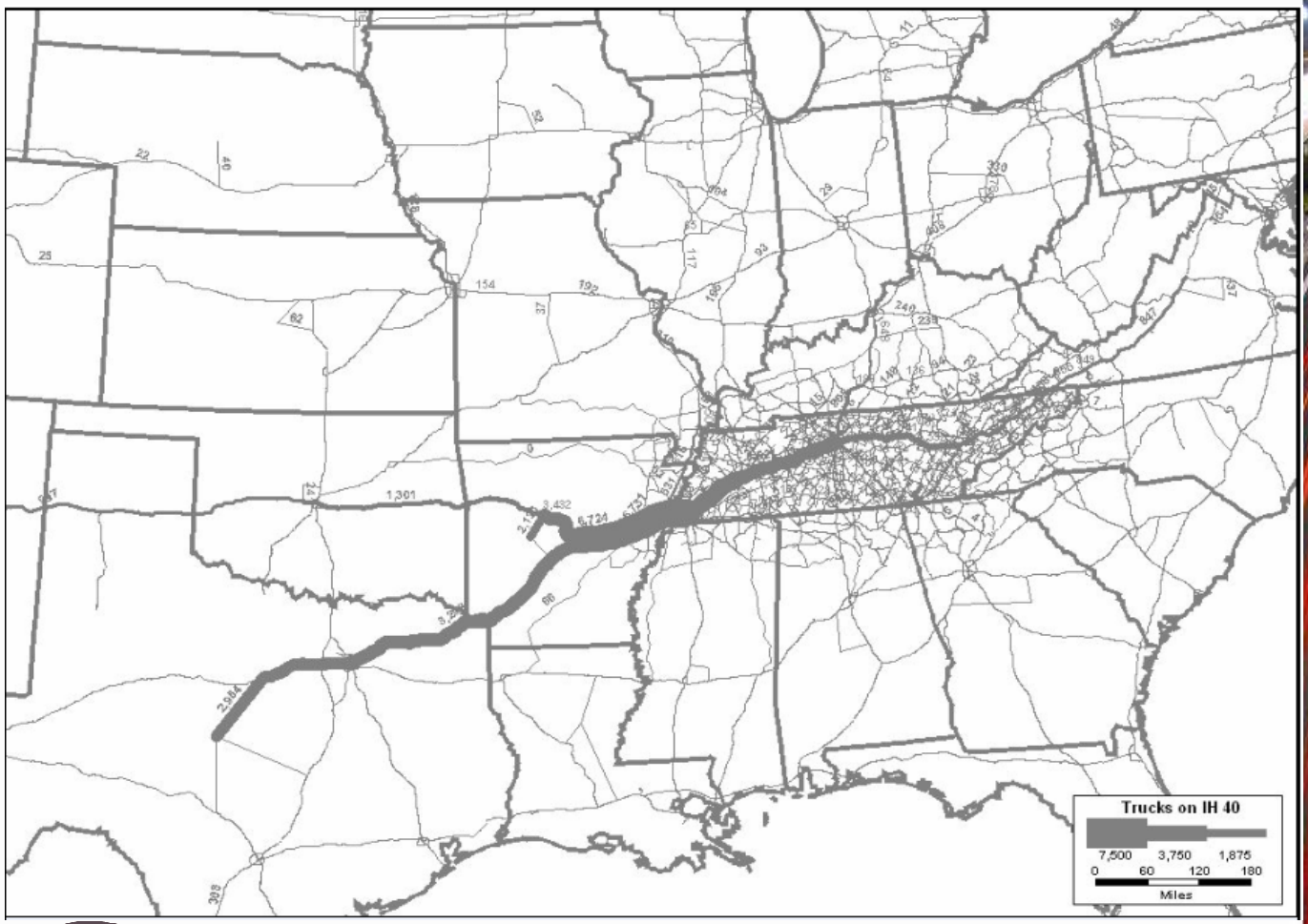
Memphis River Bridge



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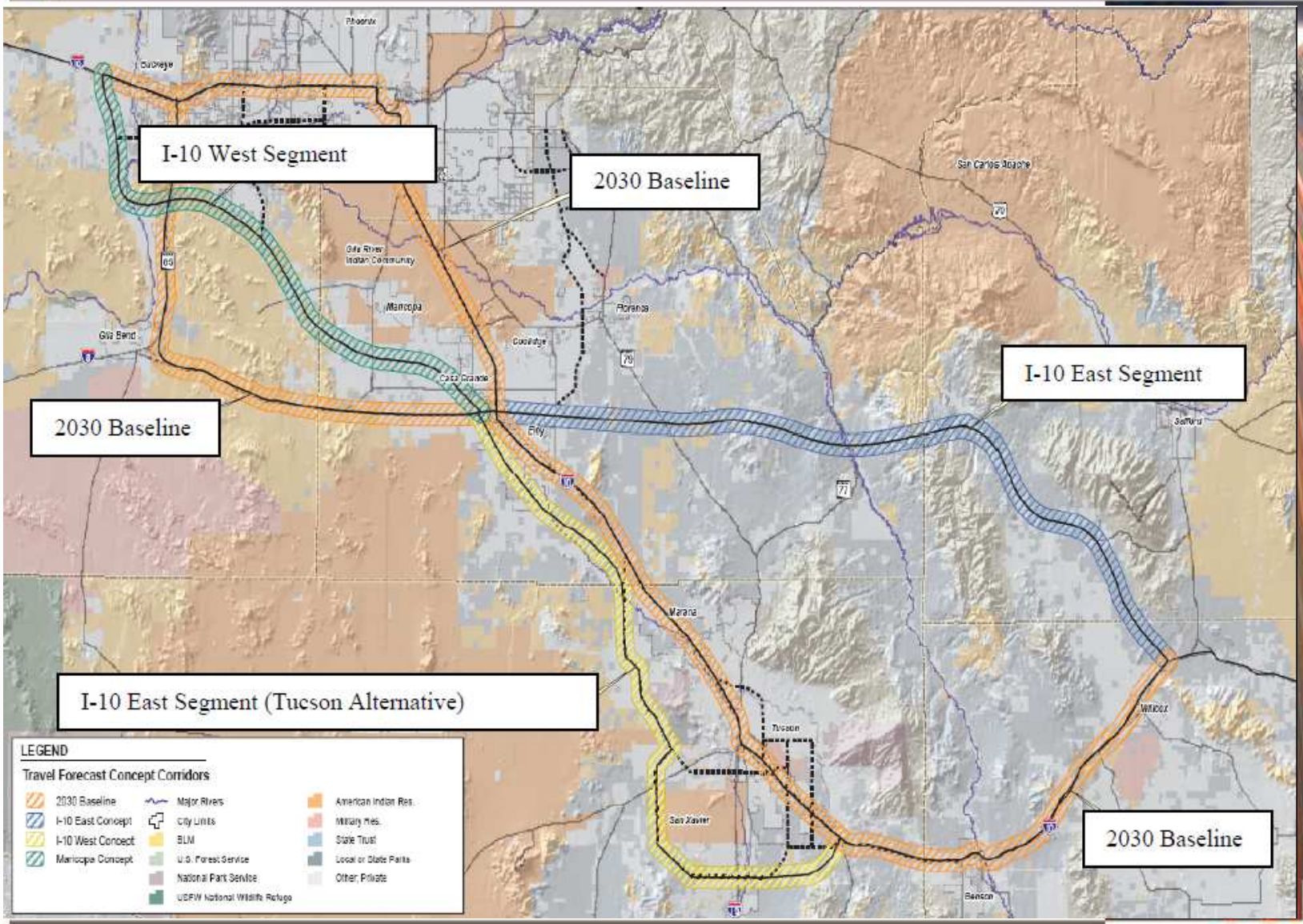
I-10 Corridor



I-10 Corridor Study

- Earlier I-10 study between CA & FL
- AZ DOT looking at alternatives in 110-mile corridor roughly between Phoenix and Tucson
- No STDM available, therefore used sketch planning techniques (manual gravity)
- Forecasts were “good enough” to warrant another more detailed study

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I-10 Corridor: AZ STDM Network

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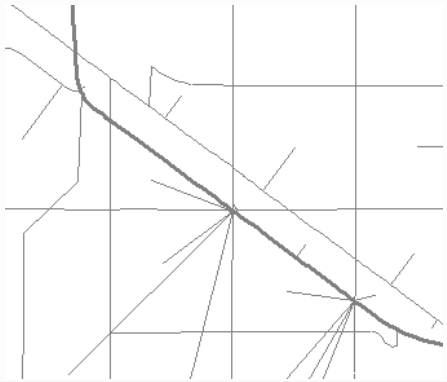
I-10/AZ STDM

- **Lessons learned:**
  - Get the right tool for the job
  - Figure out what is needed and work backwards
  - In this case
    - Need more QA/QC (check out CCs)
    - Need commodity flow data to handle truck data better
    - Use greater network detail and TAZ detail



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STDM Applications: Urban Model Support and Development

- **Statewide models can support the development and maintenance of urban models**
  - Forecast external trips for MPO models
  - Develop freight movements through the MPO area
- **Statewide models can also be a valuable resource for regional model development**
  - Network extension
  - TAZ system expansion
- **Statewide models can be useful to create subarea models for more detailed analysis**

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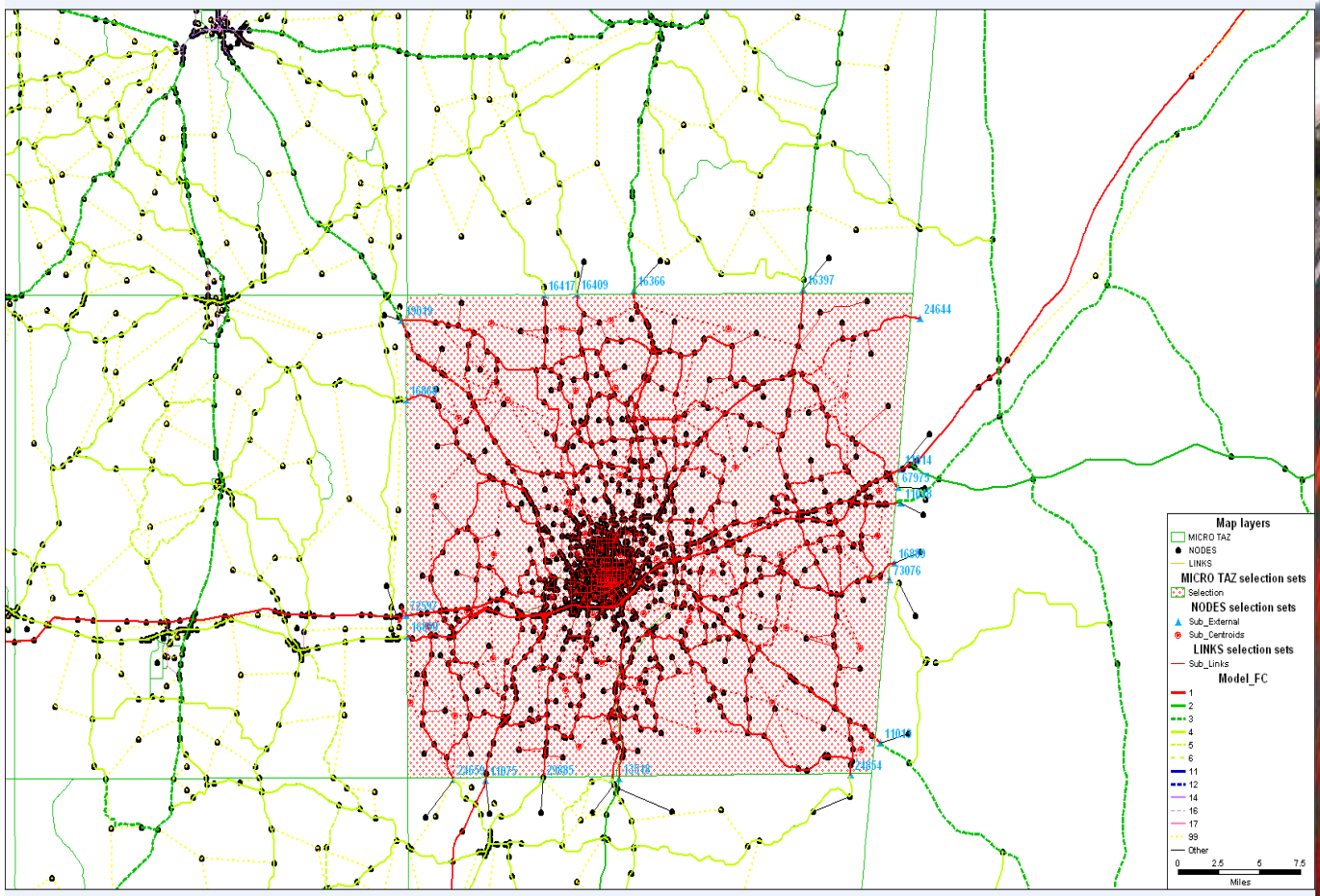
Urban Support



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Urban Support

- **Determination of EE & EI trips for Lauderdale County, MS model using MS STM**
- **Created trip matrix from STDM for Lauderdale County**
- **Calculated EE trips**
  - STM has 21 county-level EE stations
  - More accurate on higher level ADT roads
- **Compared to NCHRP 365 procedures**

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Urban Support: Truck Trips

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Urban Support: Truck Trips

- LAMTPO model (Morristown, TN)
- EE truck trips taken from TN STDM
- Internal truck trips used QRS Freight
- Relatively easy to enhance with more data collection & validation

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STDM Applications: Freight Modeling

- **The unique characteristics of freight make it ideally suited to analysis by a statewide model**
  - Freight trips can be extremely long
  - National networks can make freight entry into the State more precise
  - Truck and commodity models can take advantage of national databases
  - Some models make use of or are looking into intermodal freight networks (truck, rail, pipeline, airway, sea lanes, etc.)
    - Truck divergence to rail

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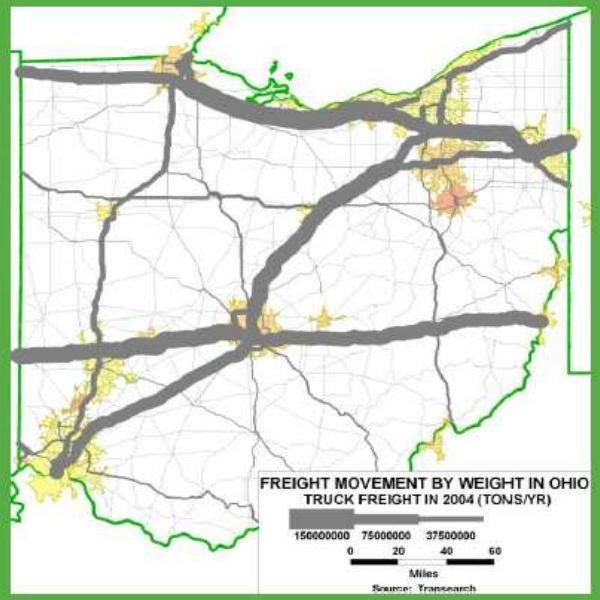
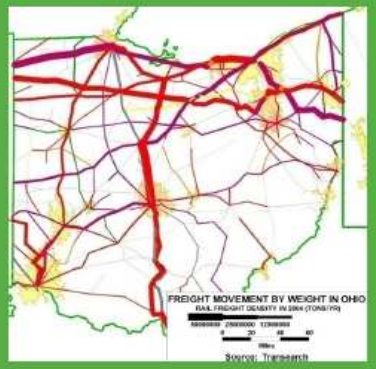
ODOT STDM Freight Output

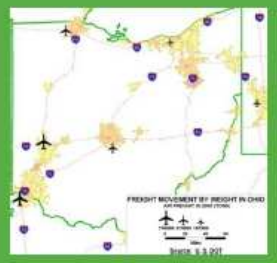
Freight Flows



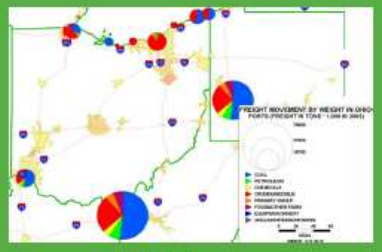
Truck



Rail



Air



Water

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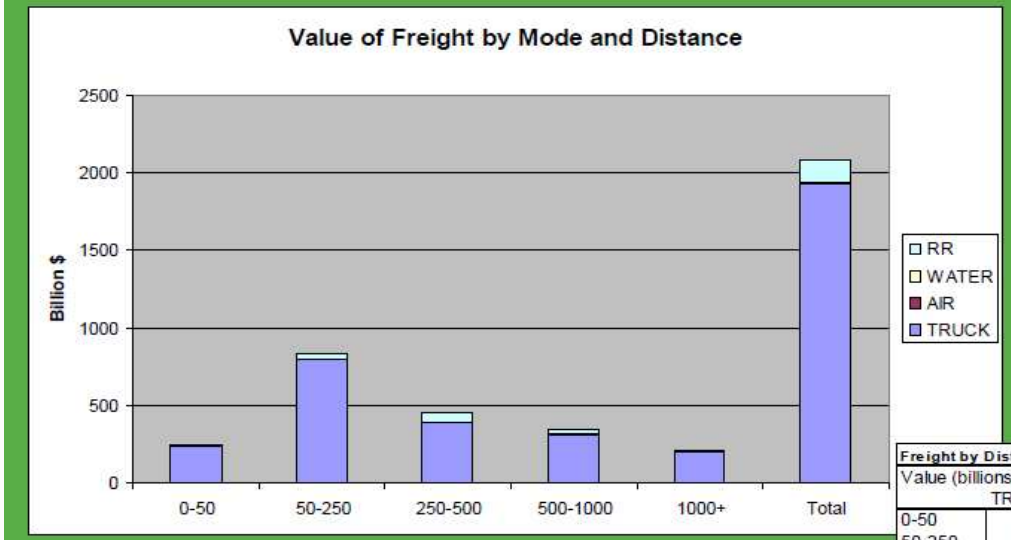
ODOT STDM Freight Output

Freight Mode Shares



Freight by Distance					
Value (billions $)					
	TRUCK	AIR	WATER	RR	TOT
0-50	232	0	1	8	241
50-250	795	0	2	33	831
250-500	384	2	2	67	455
500-1000	313	2	4	30	349
1000+	198	1	2	6	207
Total	1923	6	12	144	2084

Percentage				
	TRUCK	AIR	WATER	RR	TOT
0-50	96.2%	0.0%	0.3%	3.4%	
50-250	95.7%	0.0%	0.3%	4.0%	
250-500	84.3%	0.5%	0.5%	14.7%	
500-1000	89.6%	0.7%	1.1%	8.6%	
1000+	95.6%	0.6%	1.0%	2.8%	
Total	92.2%	0.3%	0.6%	6.9%	

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STDM Applications: Toll Modeling

- **Toll feasibility modeling and revenue forecasting can be enhanced by a statewide model**
  - Estimates travel demand for rural segments and potential toll bridges
  - Analyze potential expanded statewide toll systems
  - Some future toll corridors may be completely beyond existing model boundaries

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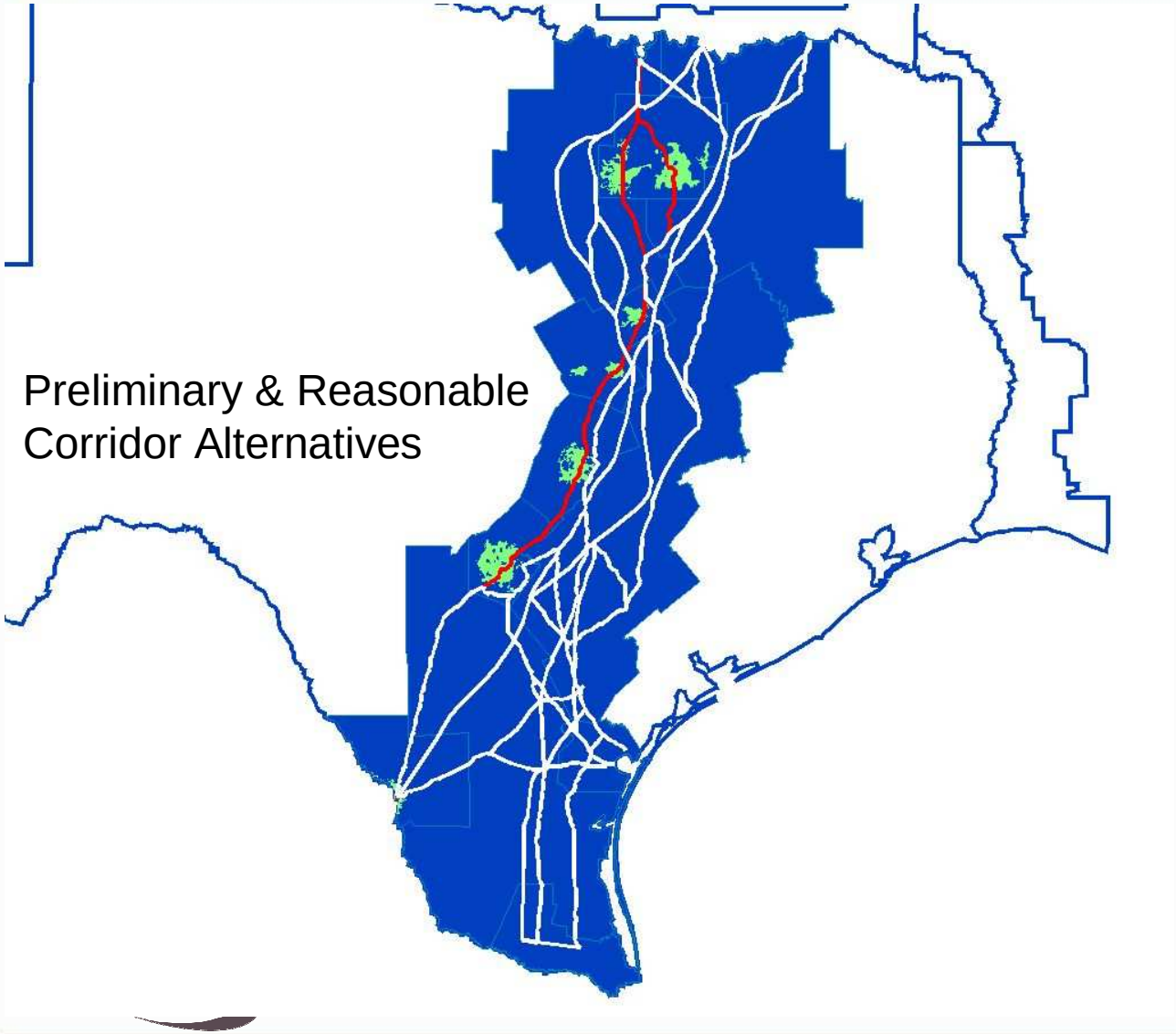
Texas Statewide Analysis Model Application



Preliminary & Reasonable Corridor Alternatives

Texas Statewide Analysis Model Application

Evaluation of Private Sector Concept

- **Developed Sketch Level Toll Diversion Component**
  - Used to evaluate traffic and revenue potential, and
  - Identify cross finance opportunities.
- **Data collection**
  - OD survey
  - Freight surveys

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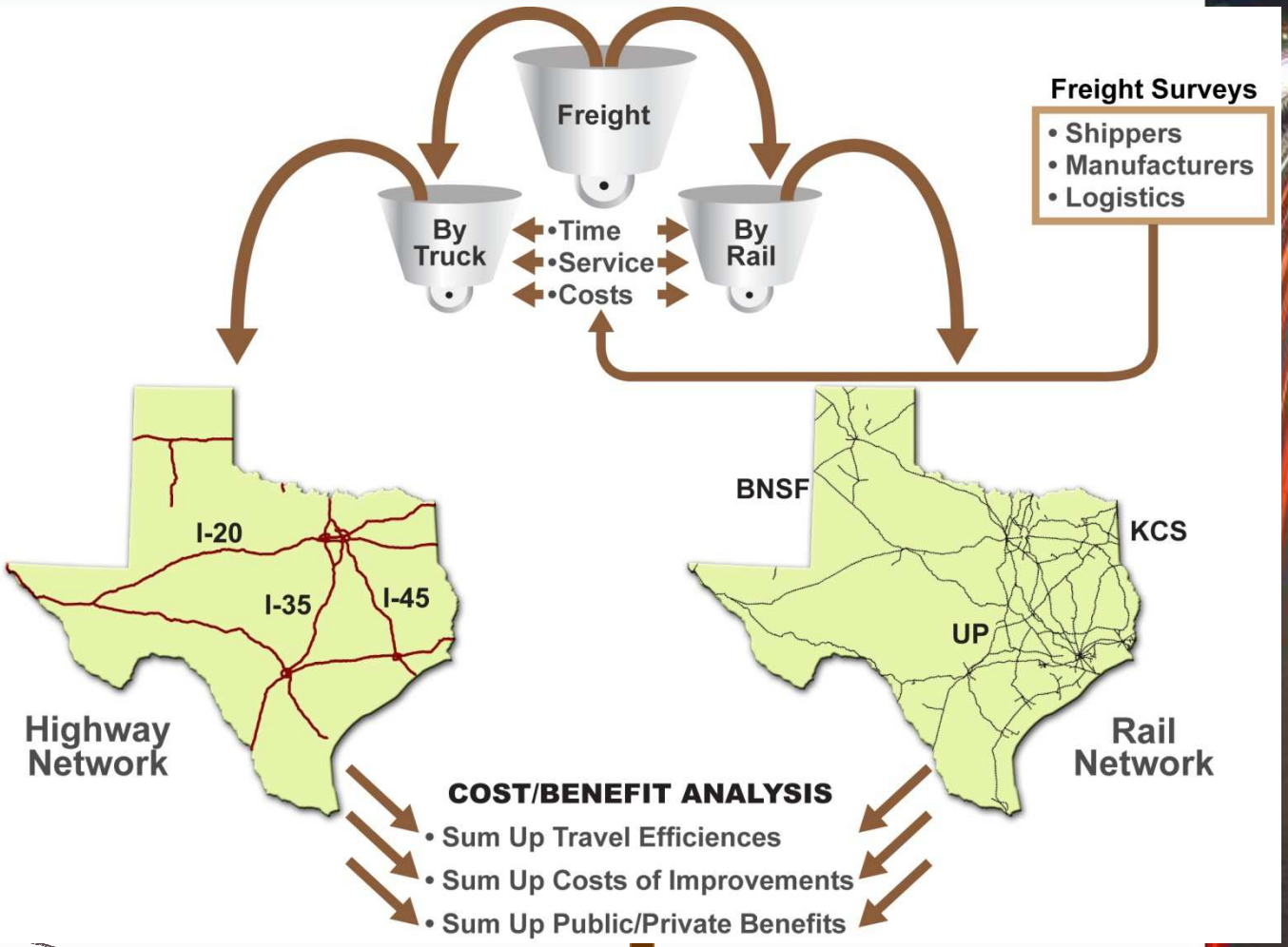
TTC-35 Planning Initiatives Summary



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STDM Applications: Information Tools Development

- **Statewide model data can be used to develop information systems and analysis tools**
  - Statewide models have extensive input and output data at the statewide level
  - Commodity Information System can identify freight generation and flows
  - User benefits analyses can estimate the economic benefits of program mixes on a regional, multi-regional, and statewide scale

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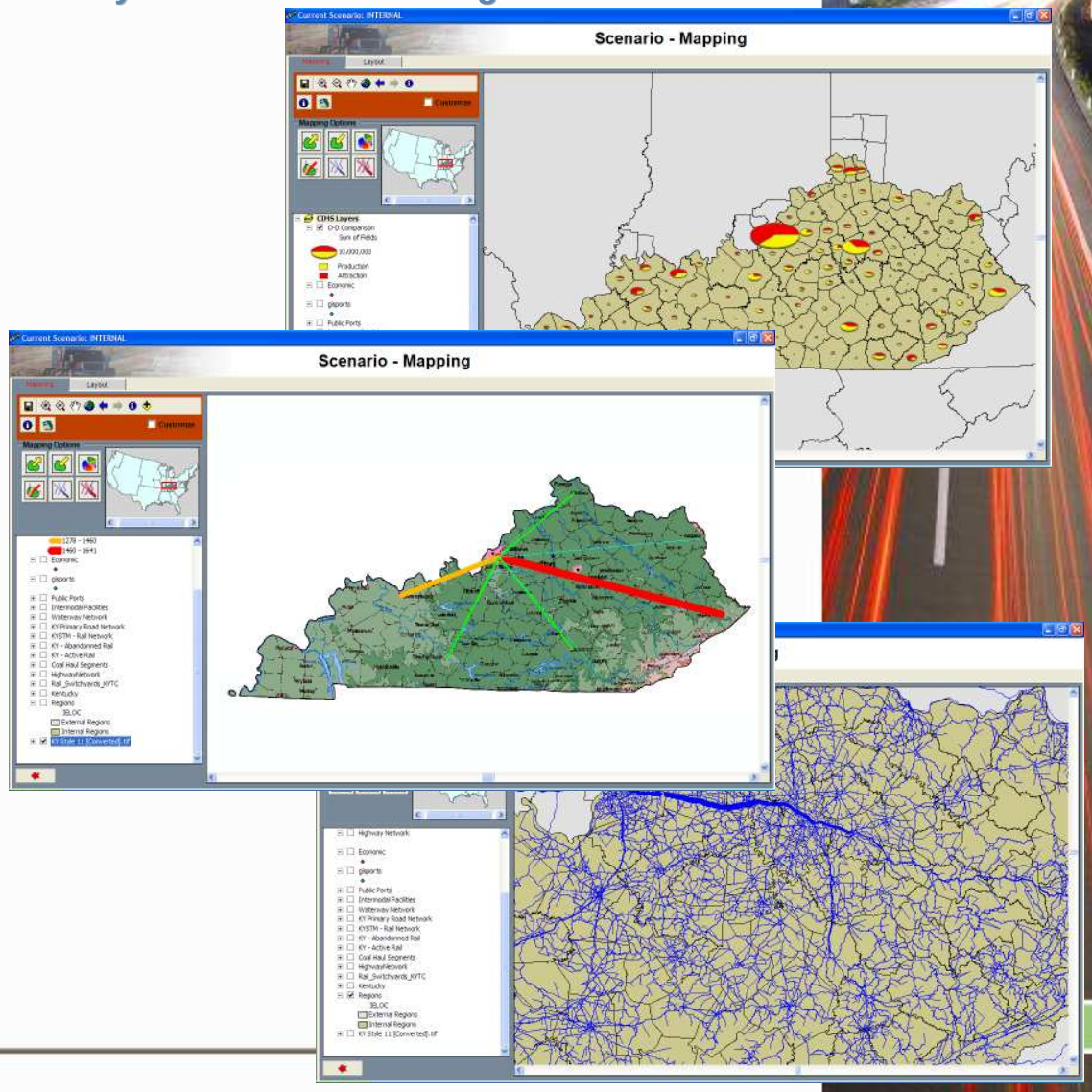
Integrated Mapping/GIS

View and Analyze Scenario Modeling Results

- Productions/ Attractions
- Zonal Movements
- Network Flows
- GIS Services



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STDM Applications: Project Prioritization

- **These models can also assist in prioritizing statewide systems plans**
  - Critical capacity deficiencies can be identified and compared throughout the state
  - Improvement program project mixes can be tested and compared simultaneously throughout the state

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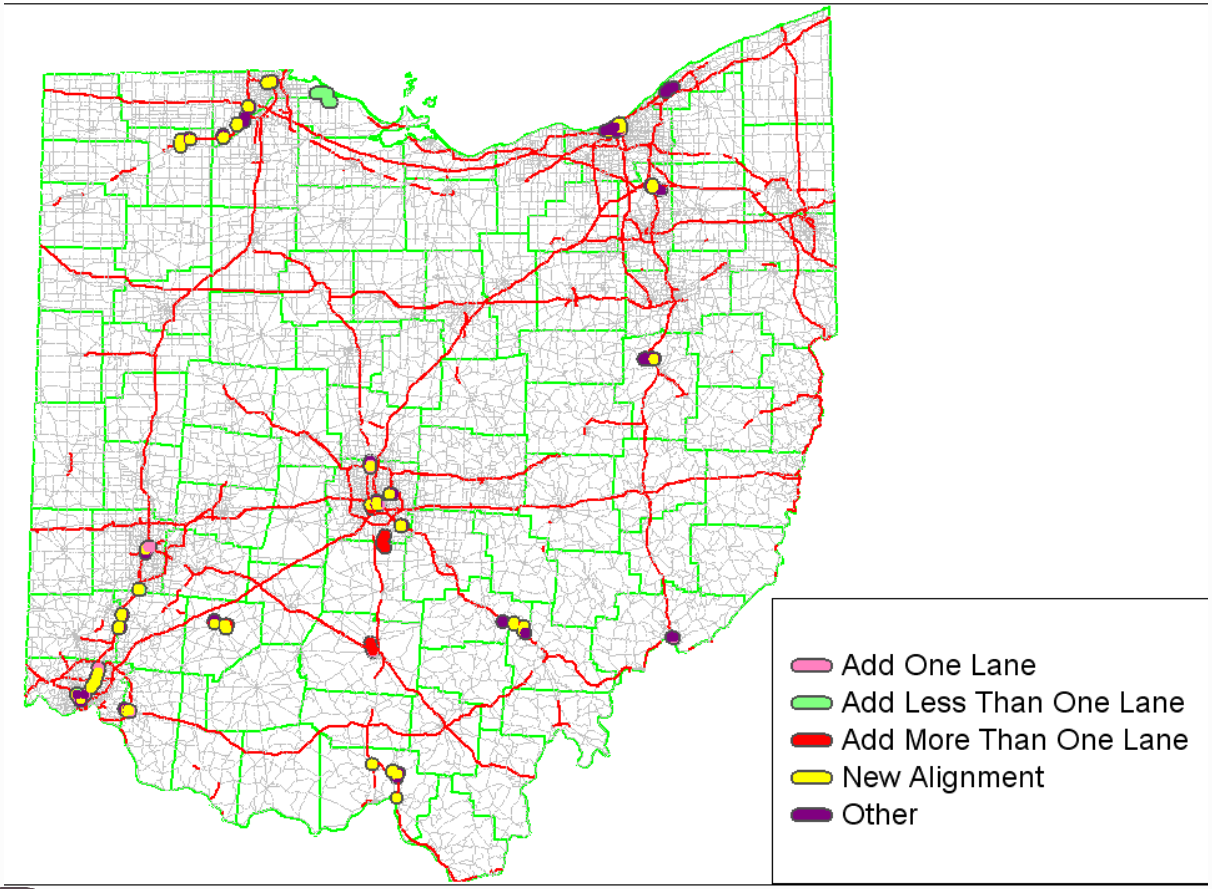
ODOT Project Prioritization

TRAC Tier I Projects



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STDM Applications: Emergency Analysis

- **Many emergency scenarios have impacts which extend beyond the immediate urban area**
- Evacuation models can use statewide models as a starting point
- Measure impacts to travel due to a catastrophic event
  - Bridge collapse
  - Rockslide
  - Road closures due to multi-day forest fire events

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Florida Evacuation Study

- As a peninsula, Florida can expect a hurricane to approach from any direction
- Every region in Florida needs to be able to accurately estimate clearance times for evacuations
- Growth Management legislation requires a consistent methodology and data set throughout Florida
- Statewide model used as the foundation for the evacuation highway network

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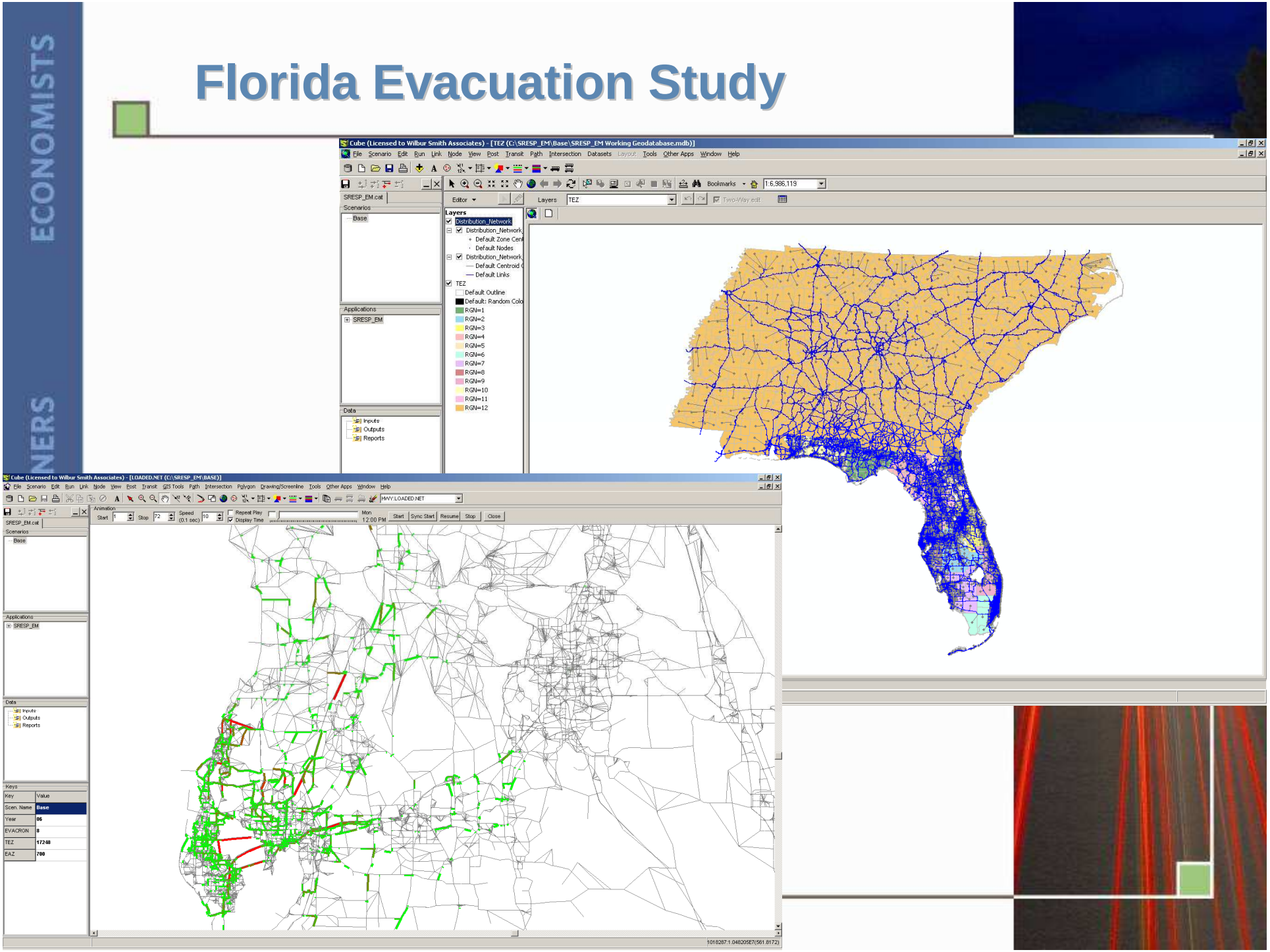
Florida Evacuation Study



Systems Analysis

- **Evolving/new STDM applications include:**
  - Air Quality/carbon footprint scenario analysis
  - Travel time indices (the TTI measures such as travel time index)
  - VMT analysis – may be useful combined with an economic tool tie-in

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STDM Applications: Passenger Rail

- **Passenger rail systems can be modeled**
  - High Speed Rail corridors can run the length of an entire state and/or pass through multiple states
  - Commuter Rail corridors are usually regional, but may also be interregional

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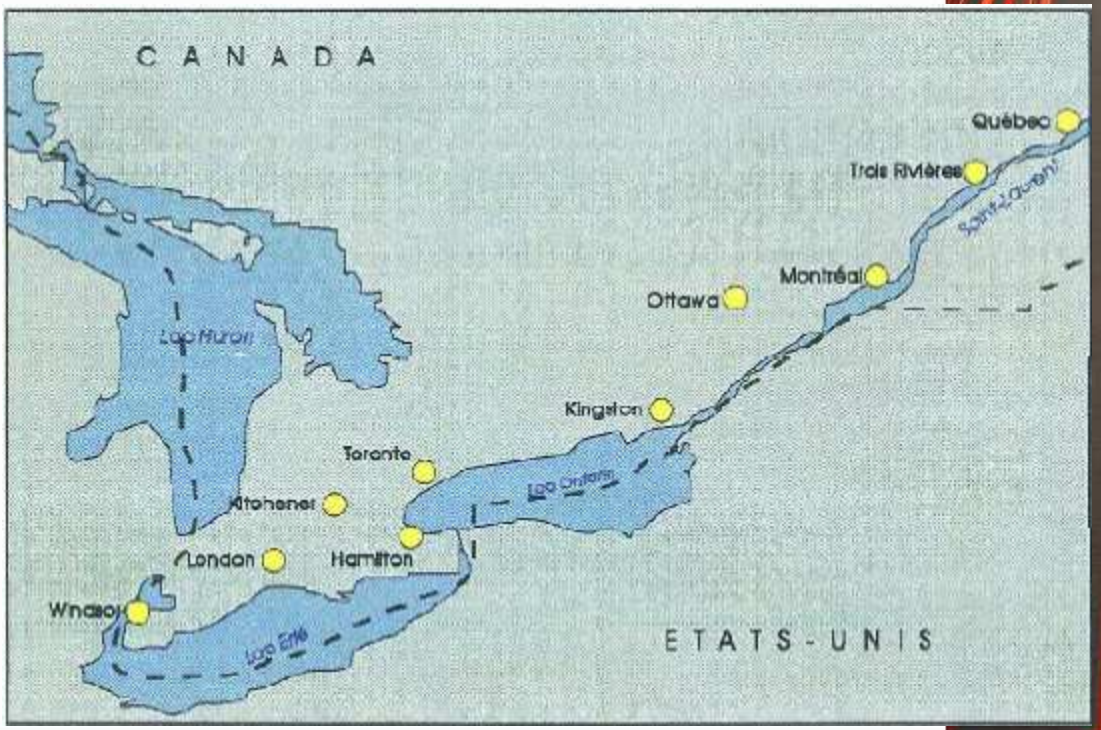
Canada HSR Corridor

- **Updating 1993 study**
  - New OD surveys
  - New stated preference survey
  - New Ridership



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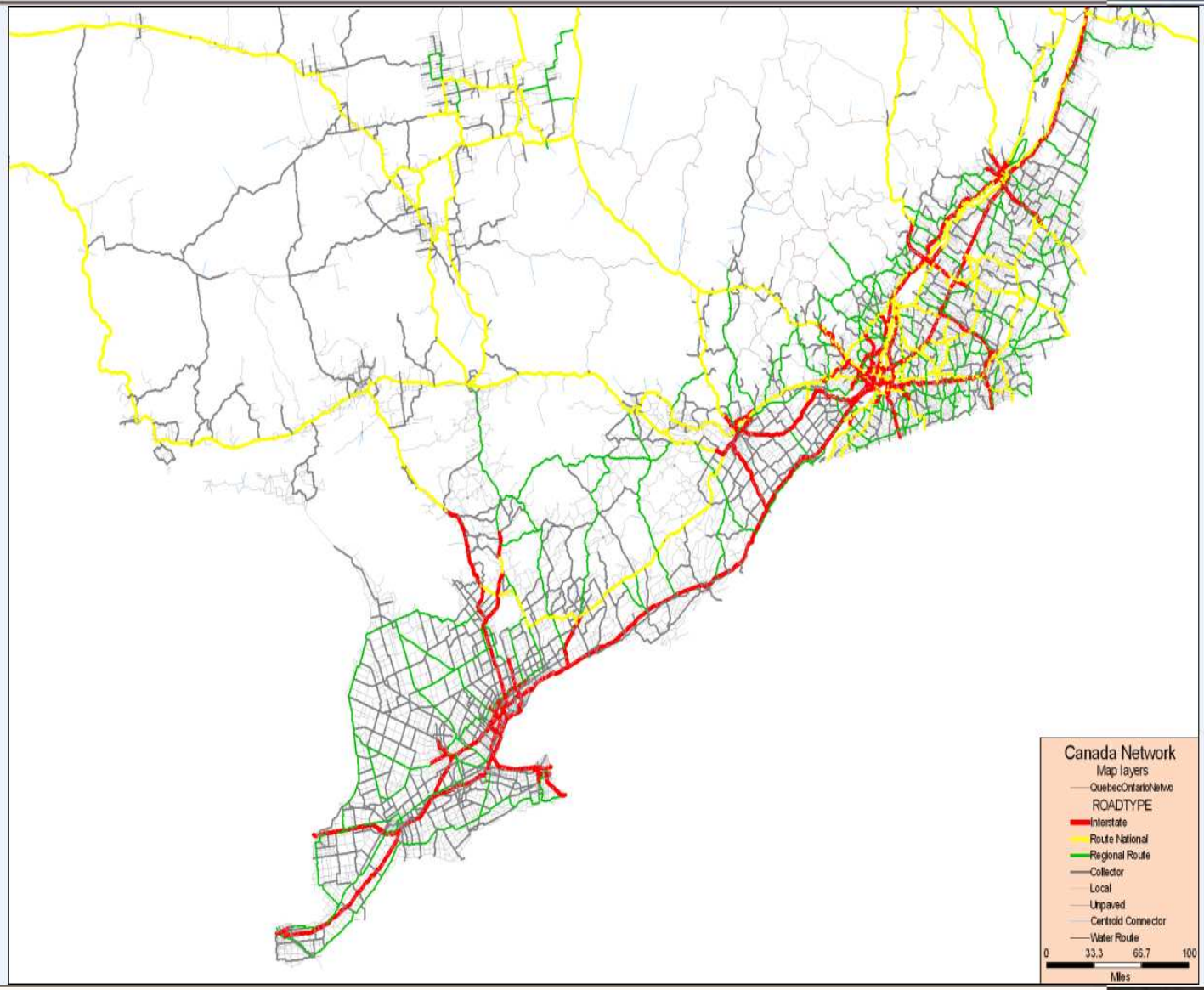
Canada HSR Network



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US HSR Corridors

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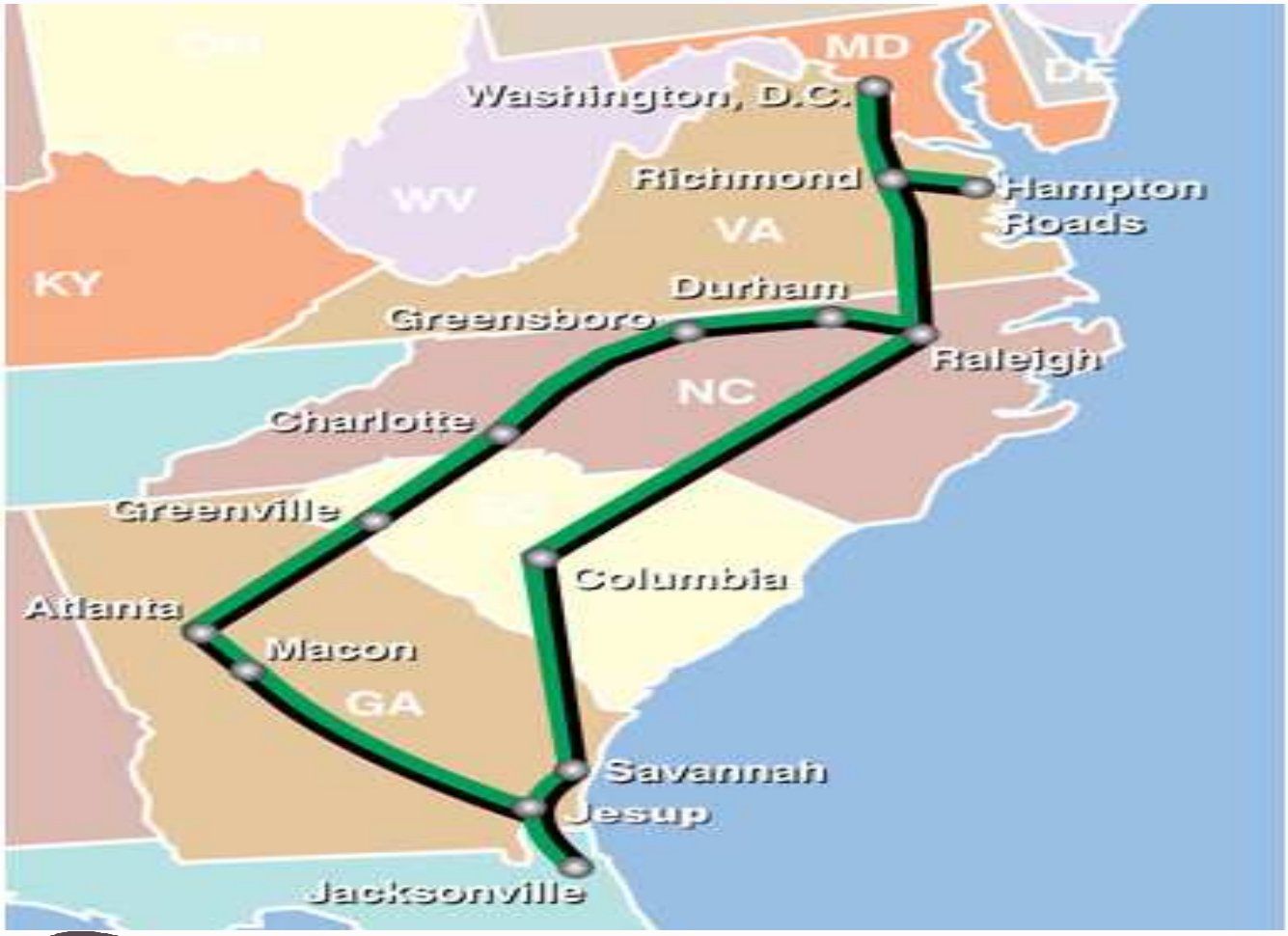
NC HSR Corridor



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NC HSR Corridor Info

- **Overview**
  - Southeast High-Speed Rail Corridor consists of a number of segments covering all the South Atlantic States Transportation have begun to implement on an incremental basis.
  - Plans show that with up to 110 mph speeds, trip times of two hours (Washington-Richmond) and four and one-half hours (Richmond-Charlotte) would be feasible.
- **Status**
  - Virginia and North Carolina, together with the FHWA and FRA, in October 2002 completed a Tier I Environmental Impact Statement (EIS) and selected a route from Washington, DC to Charlotte,
  - NC employing the abandoned CSX “S” line between Petersburg, VA, and Norlina, NC.
  - Pat Simmons, Director of NC DOT Rail Division is the point person.

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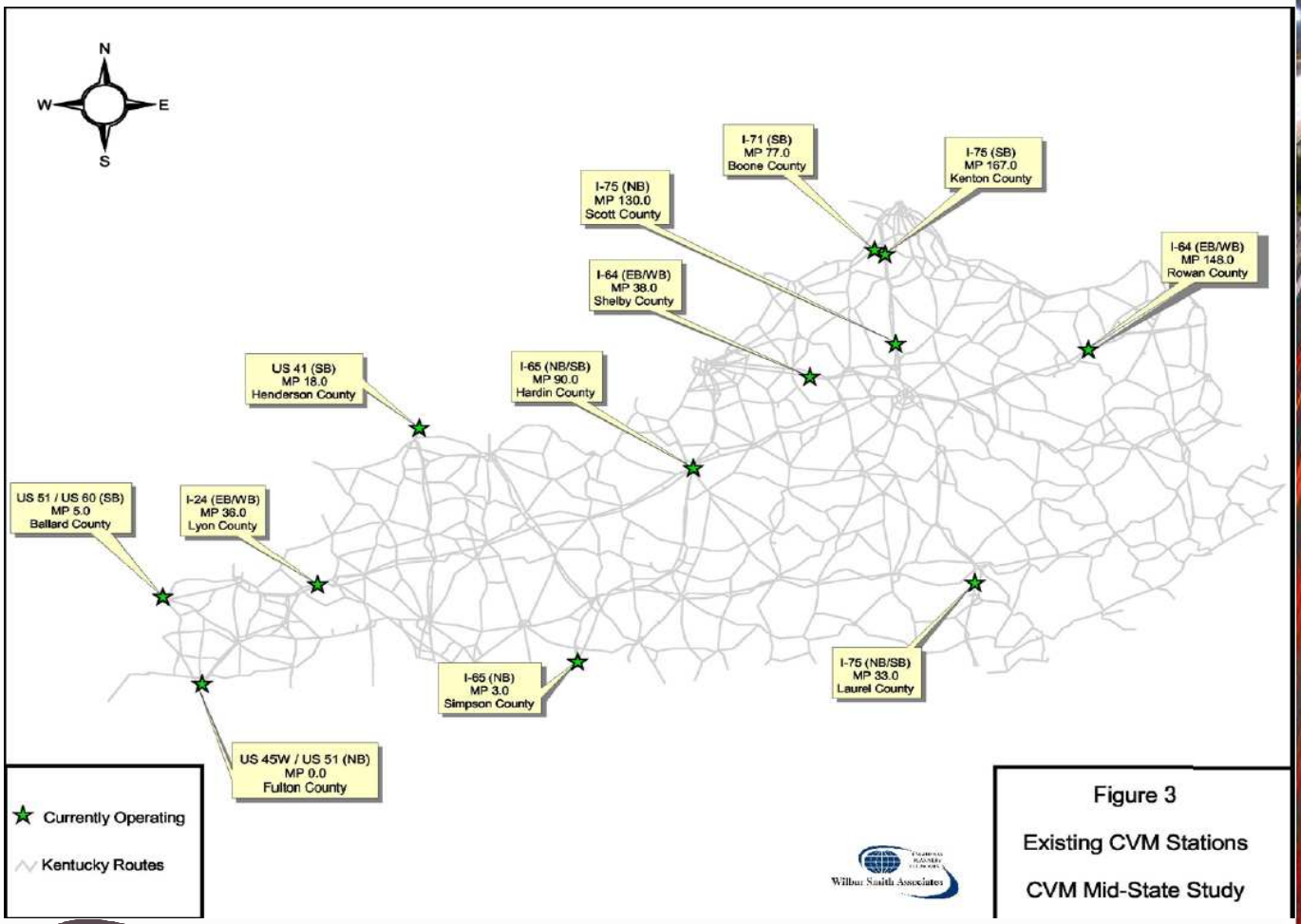
Special Problems: CVM Optimization



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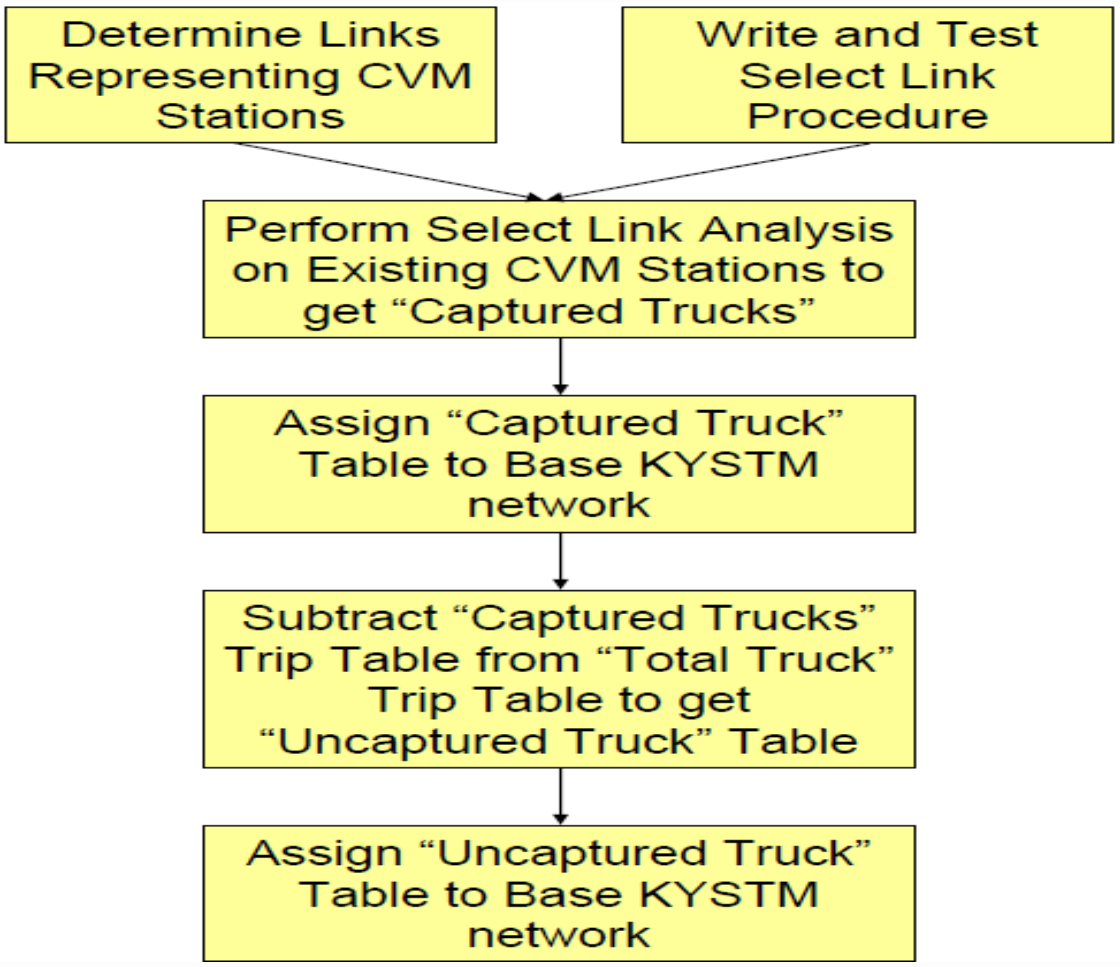
CVM Optimization



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CVM Optimization

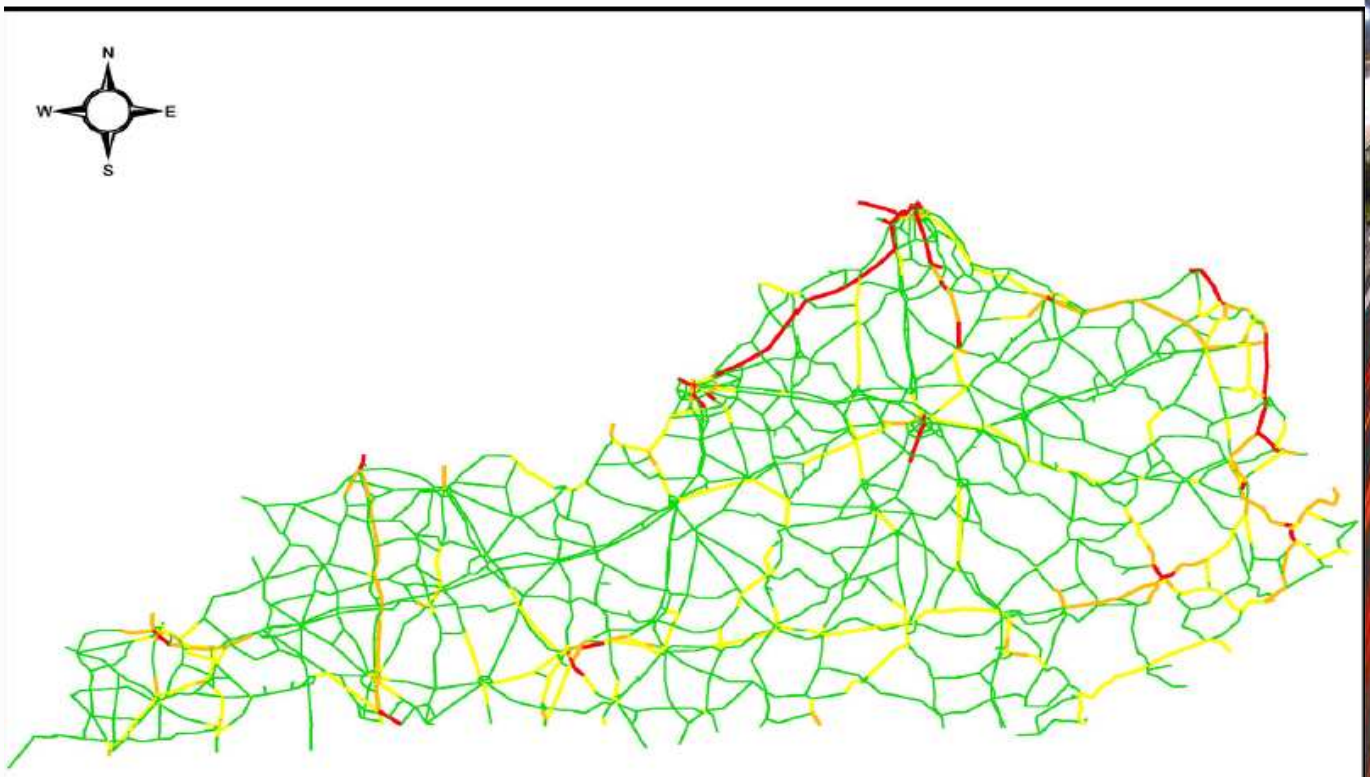

Figure 5

Uncaptured Truck Trips in Kentucky (Existing Stations)

CVM Mid-State Study

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CVM Optimization

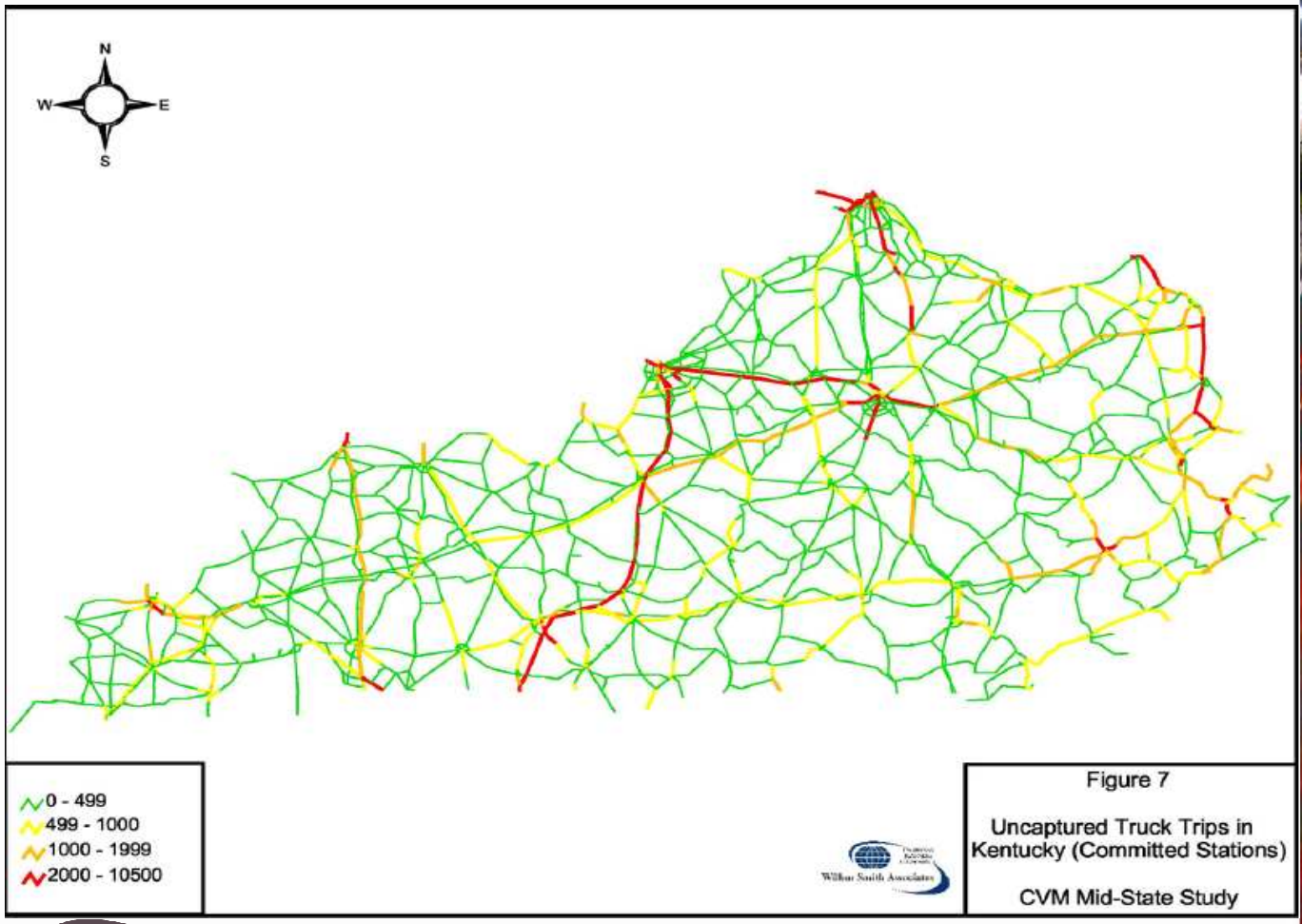

Figure 7

Uncaptured Truck Trips in Kentucky (Committed Stations)

CVM Mid-State Study

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STDM Benefits

- **Statewide model benefits include:**
  - Comprehensive modeling data at a statewide level
    - Socioeconomic Data
    - Highway Networks
  - Ability to measure flows throughout the state and even outside the state
    - County to county
    - City to city
    - MPO to MPO

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STDM Benefits

- **Statewide model benefits (cont.):**
  - Captures long distance travel behavior
    - Freight
    - Tourists
    - Pass through trips
  - Can incorporate data from neighboring states
  - Fills in the gaps between urban area models for long corridors
  - Can create subarea models as needed

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STDM Benefits

- **Statewide model benefits (cont.):**
  - Statewide trip tables can be used for passenger rail analysis
  - Can include variable target years so that scenario year data can be interpolated on the fly for any year
  - Relatively high levels of accuracy for inter-urban segments of major arterials and freeways
  - Captures rural trip making activity

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STDM Benefits

- **Cost of STDM development and maintenance is a very small part of major project costs.**
  - $1,000,000 - $2,000,000
- **There really is not a viable alternative for the analysis of:**
  - Projects that border other states
  - Include long distance truck trips
  - Have intercity corridors.

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STDM Cons

- **Statewide model Cons include:**
  - Lower levels of accuracy in the urban areas and on lower order facilities
  - May require extensive data collection efforts depending on what is desired

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Conclusion

- STDMs have a wide range of potential applications.
- STDMs have many benefits and are cost effective.
- Questions & comments: rbostrom@wilbursmith.com & rmiquel@wilbursmith.com

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