UNIVERSITY OF TEXAS ARLINGTON

The Impacts of Increased Adverse Weather Events on Freight Movement

TranSET 8-18-009 ITS

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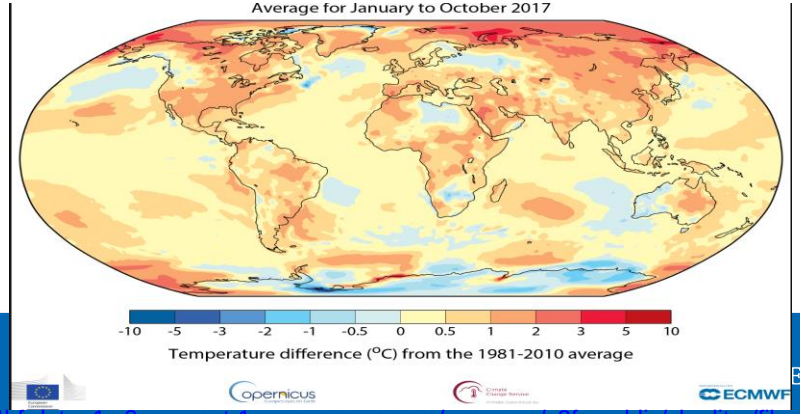
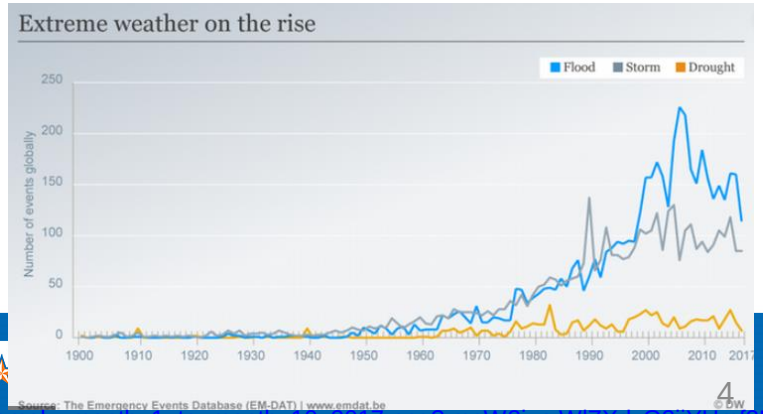
Background

- Freight movements expected to increase 42 percent by the year of 2040
- NFSP (US DOT, 2016) reported that assuming no capacity changes, truck and passenger vehicle traffic will increase peak-period congestion by 34 percent in 2040.

Adverse Weather Events

- With significant increases in freight volumes, the impacts from severe weather events to port truck traffic may cause an economic loss in Texas and throughout the region
- Because of the ports' coastal location and global climate change, adverse weather events, which include flash floods and hurricanes, have become more frequent and severe.





https://ane4bf-datap1.s3-eu-west-1.amazonaws.com/wmocms/s3fs-public/ckeditor/files/t2m_anomaly_month_1_to_month_10_2017.png?.meW3juo.WlZXdyG2iiYHmf2PgJcLMC0

Hurricane Harvey, 2017

- A Category 4 storm, Hurricane Harvey, brought catastrophic floods to the Houston area inflicting $125 billion in damage
- In the first week, the storm directly affected nearly 10 percent of all US trucking and other transportation throughout the Texas coastal area due to flooded roadways and damaged infrastructure.

Source : Forbes, CNN, Wikipedia

Texas Freight Mobility Plan

- Maintaining infrastructure and improving system efficiency by increasing the **resiliency** of the State's freight transportation system and effectively responding to natural and man-made disasters
  - A short-term regional plan: developing strategies to minimize the impacts on multimodal freight network caused by frequent adverse weather events
  - A long-range plan: designing flexible and reliable freight transportation as a regional priority

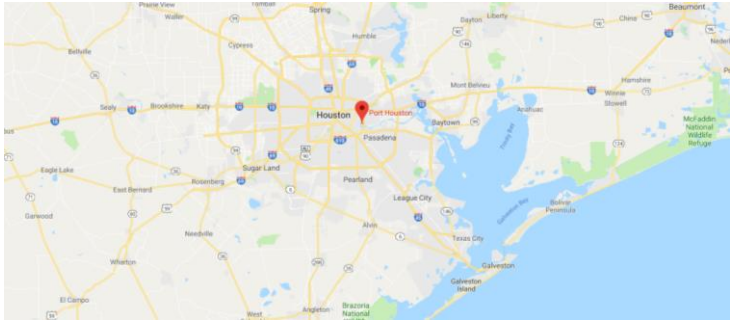
Project Goals

- Characterize the port truck movements by identifying operational patterns by associated industry and service types and evaluate system response during adverse weather events

- Investigate the port truck flows from the port of Houston throughout its metropolitan region (Houston-Galveston Area Council) and further destinations in the region

Study Area

The Port of Houston, TX



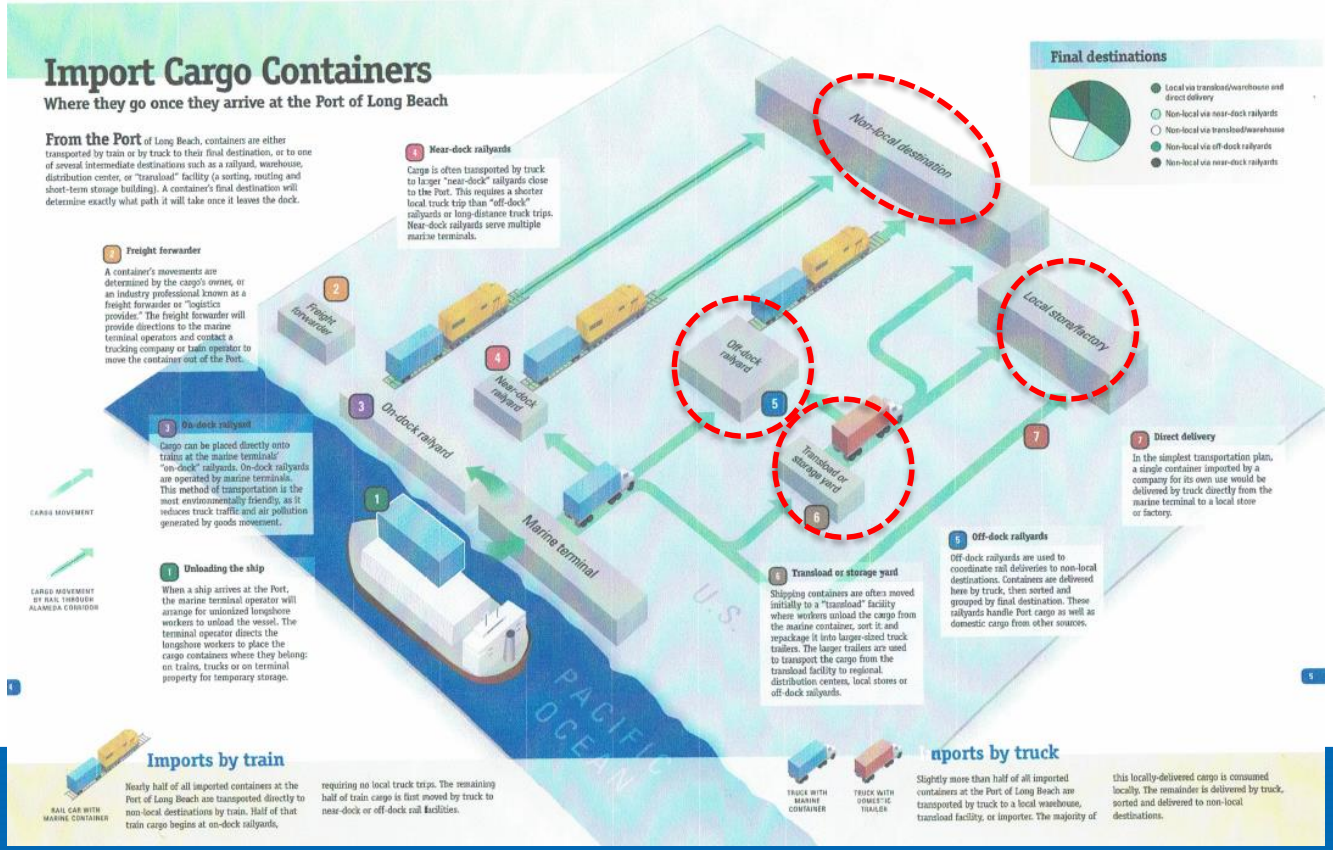
- Located in the fourth-largest city in the US
- The busiest port in the U.S. in terms of foreign tonnage,
- Second-busiest in the U.S. in terms of overall tonnage, and
- Sixteenth-busiest in the world

Growth in Houston Export Containerized Tonnage

	2011	2012	2013	2014	2015	2016	'11-'16 CAGR %
Los Angeles/Long Beach	29,973,261	27,059,059	27,886,875	28,071,297	23,672,299	28,929,355	-0.7%
Houston, TX	10,926,561	12,047,628	13,799,281	16,801,238	17,787,418	14,221,518	5.4%
Savannah, GA	14,351,476	12,518,824	11,939,780	12,463,801	11,769,924	12,062,782	-3.4%
New York/New Jersey	11,402,486	10,309,642	9,639,822	9,224,426	9,439,392	10,449,107	-1.7%
Oakland, CA	7,793,629	7,278,709	7,260,225	7,075,258	6,540,280	7,834,400	0.1%

http://www.h-gac.com/freight-planning/ports-area-mobility-study/documents/180124.HGAC.Project.Workshop-Rev-180124.pdf

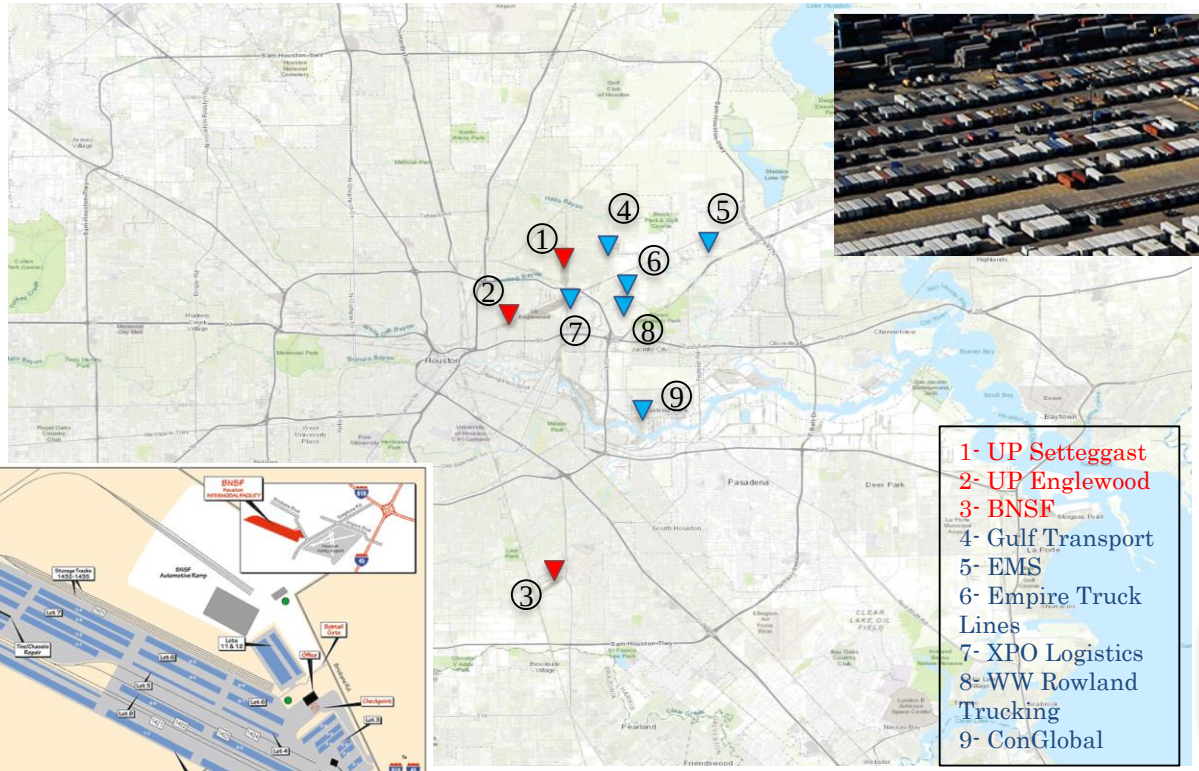
Port Truck Movement



Port of Houston

https://en.wikipedia.org/wiki/Barbours_Cut_Terminal

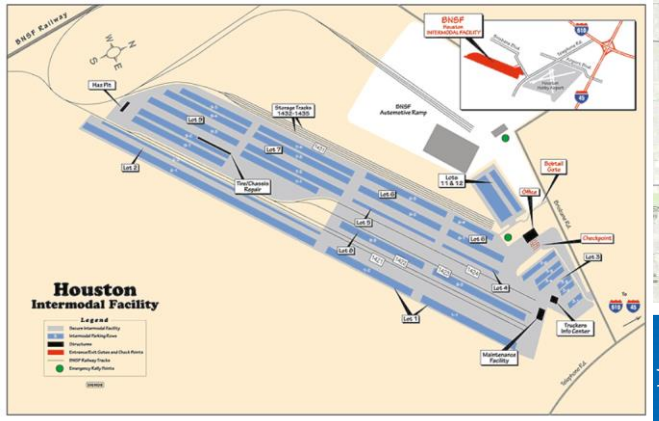
Port Facilities



1- UP Setteggast
2- UP Englewood
3- BNSF
4- Gulf Transport
5- EMS
6- Empire Truck Lines
7- XPO Logistics
8- WW Rowland Trucking
9- ConGlobal

Railroad terminal

Depot

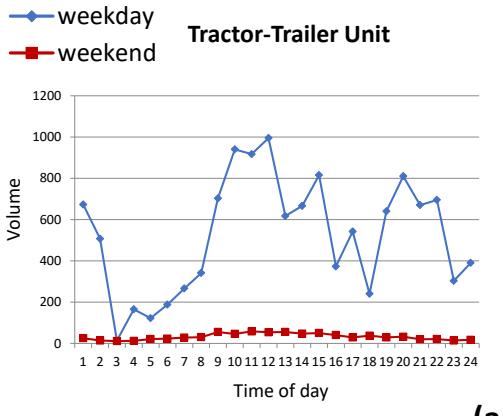


https://www.bnsf.com/ship-with-bnsf/support-services/facility-listings.html

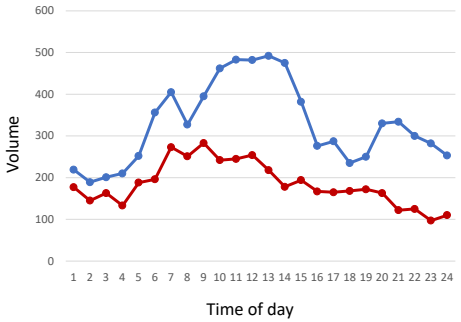
Data
- Port Truck

Truck Travel Behaviors

- Trucks serving different industries or service types have different delivery schedules and route-choice behaviors



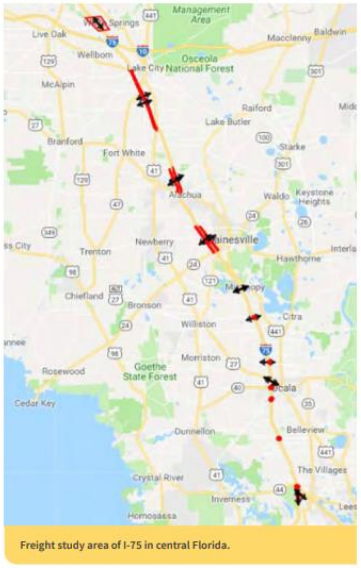
Port area
(Port of LA, CA)

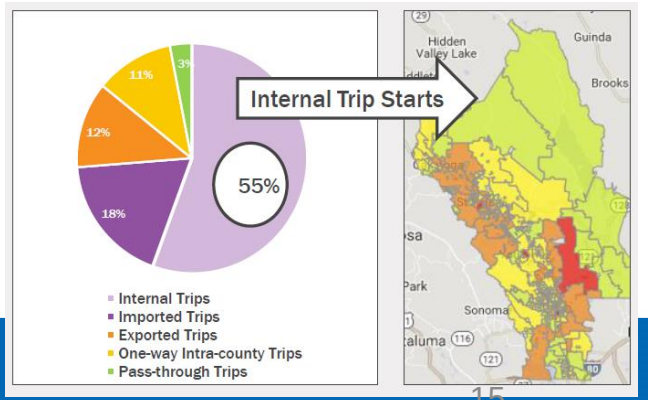


Urban area
(Downtown LA)

Streetlight GPS Data

- Large-sized GPS data will be used to represent individual trip characteristics such as travel time, origin-destination (OD), major route choice, and industry type
- The larger coverage of GPS data provides a larger portion of vehicle traffic and reduces sampling bias in traffic estimates.
- Before and after Harvey to understand the effect of weather events on truck behaviors faced with a disrupted network





Methodology

Performance Measures (PM)

Types of PMs

- Zonal OD
- Travel routes

Level of geography

- Port
- Regional: FAF
- Local
  - Railway Terminal
  - Transfer Points (Depot)
  - Local warehouses

Methodology Summary

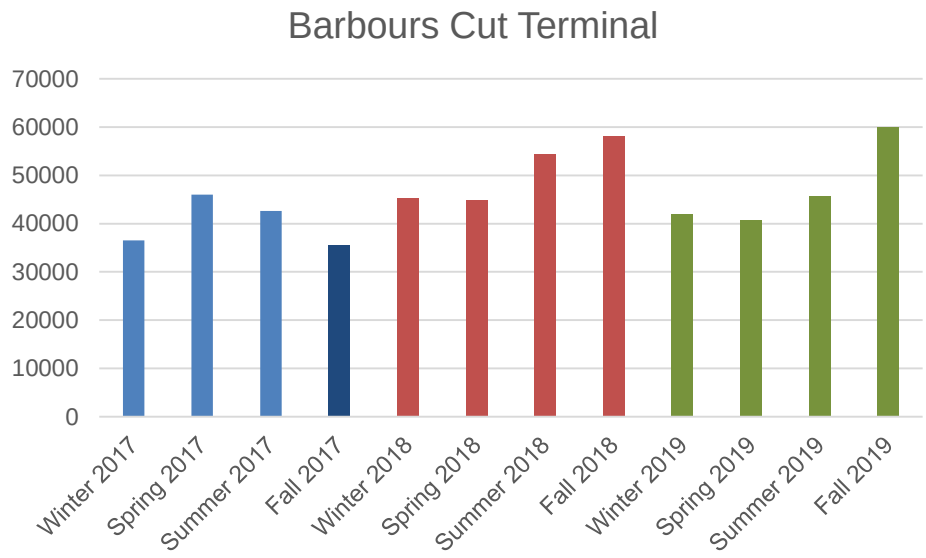
Port
- Operation prior to & during Harvey
- Major route choices

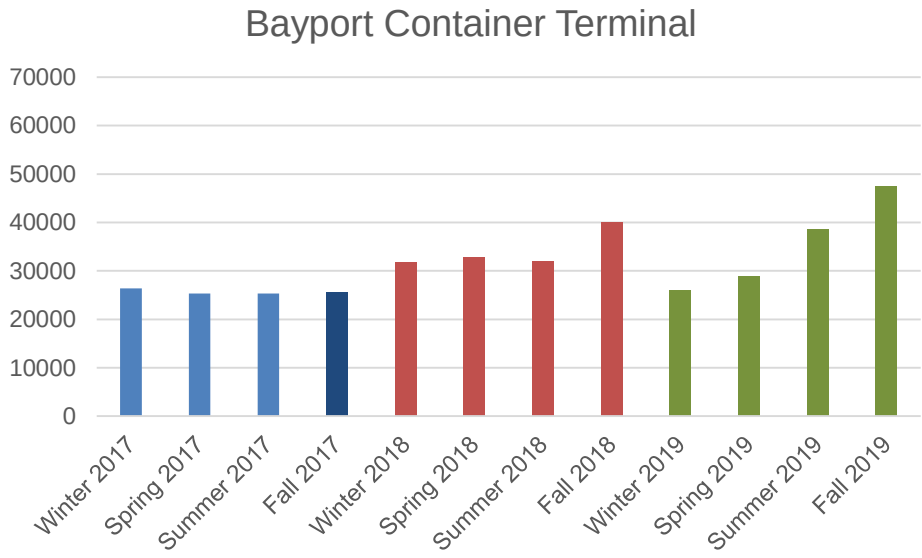
Regional
- FAF movements seasonal & during Harvey
- Impacts from link disruption

Local
- Railroad terminal and Depot
- Route choices for local trips

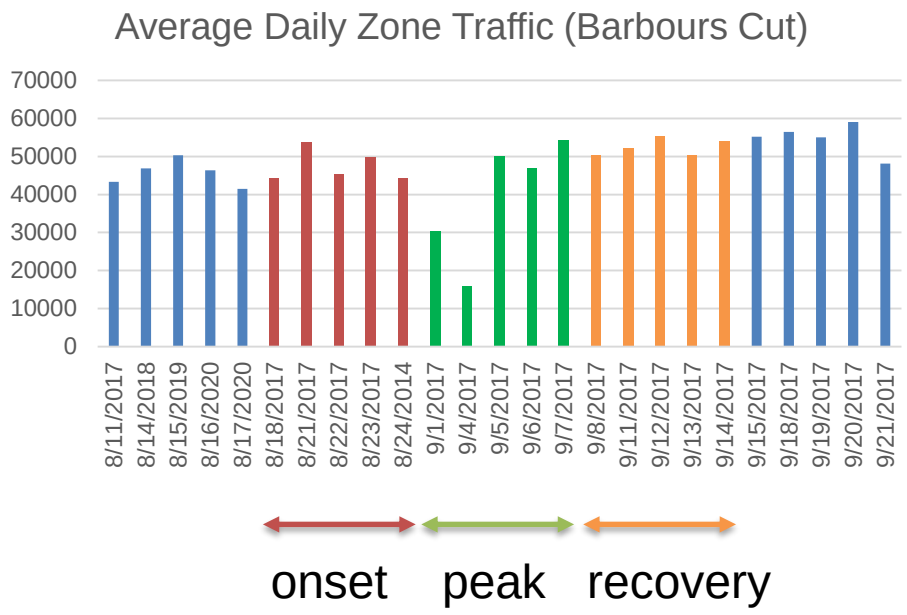
Preliminary Results

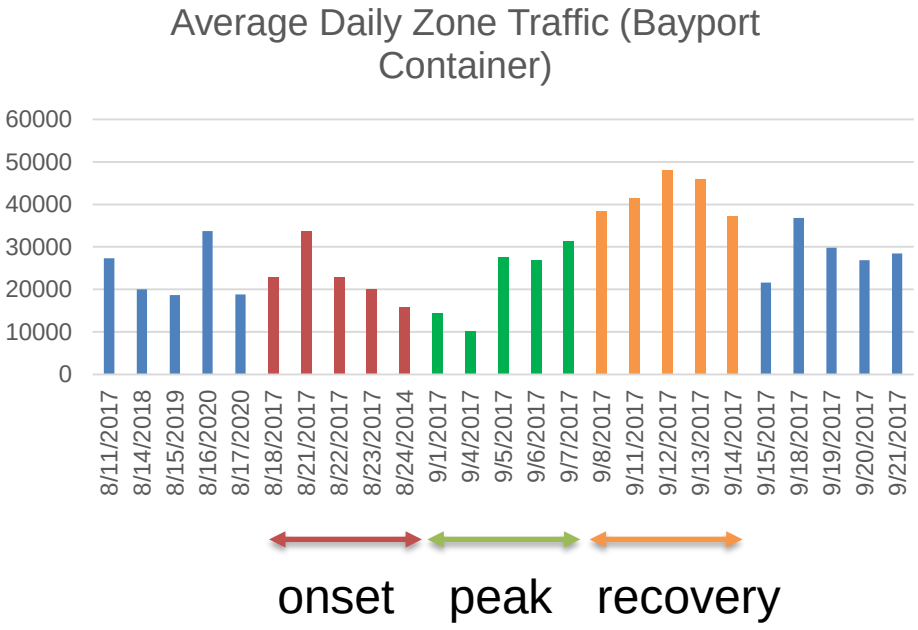
Port Operation – Seasonal





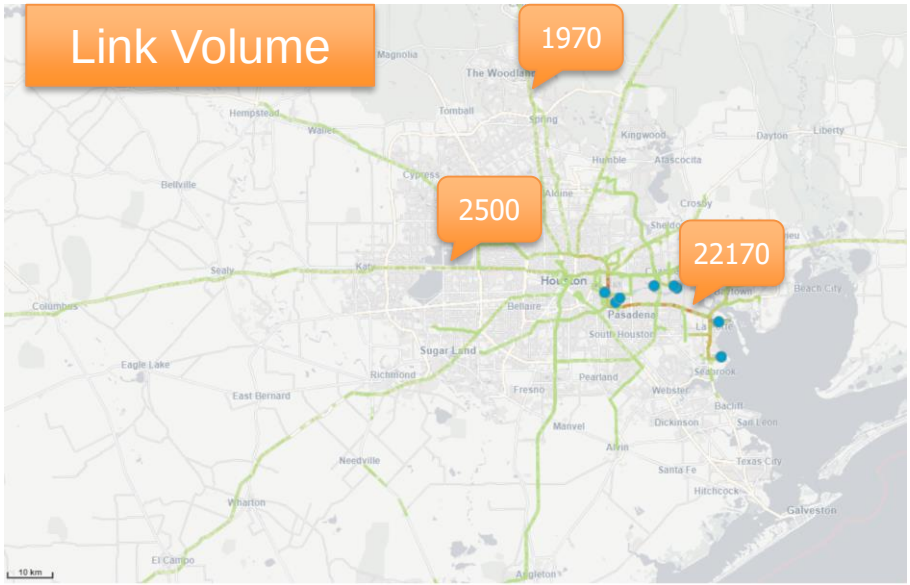
Port Operation – During Harvey



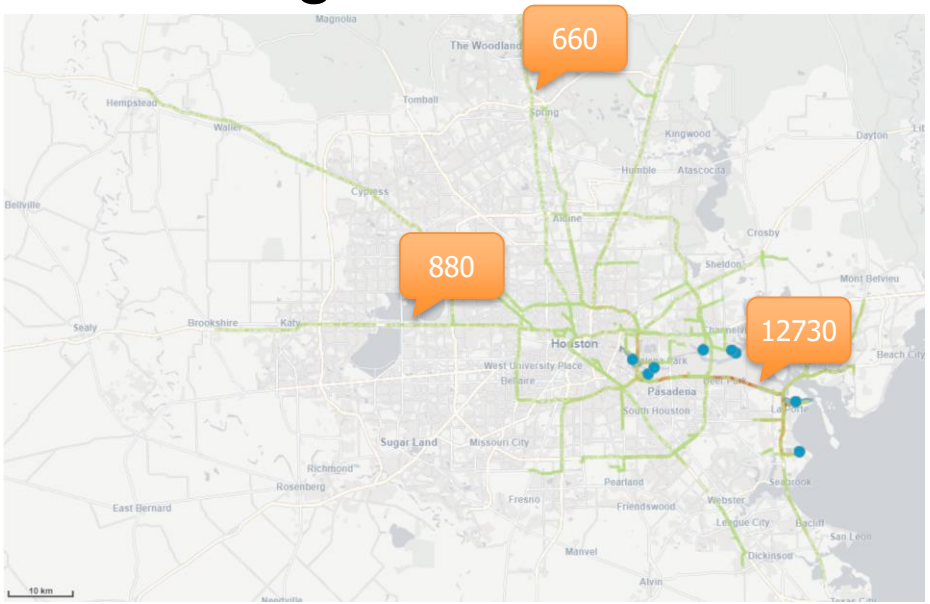


Route Choices (Port)

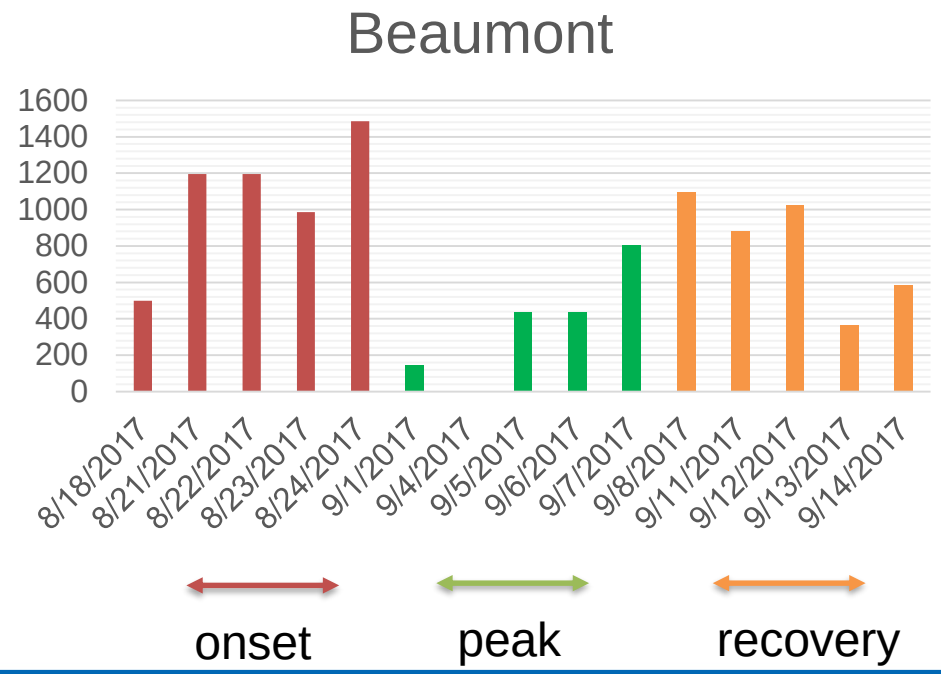
- Normal Days

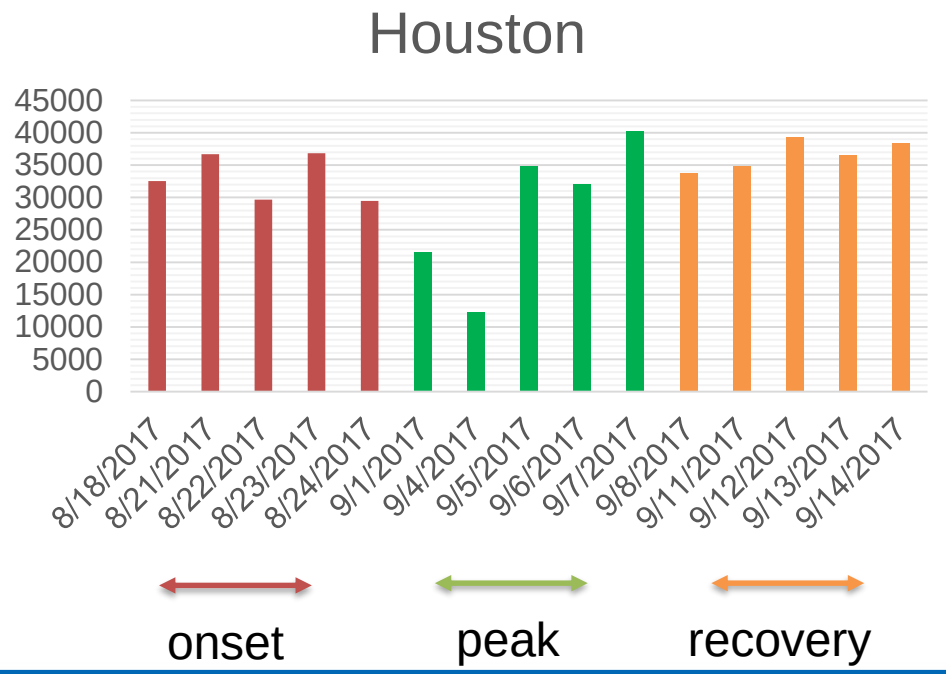


- During Hurricane



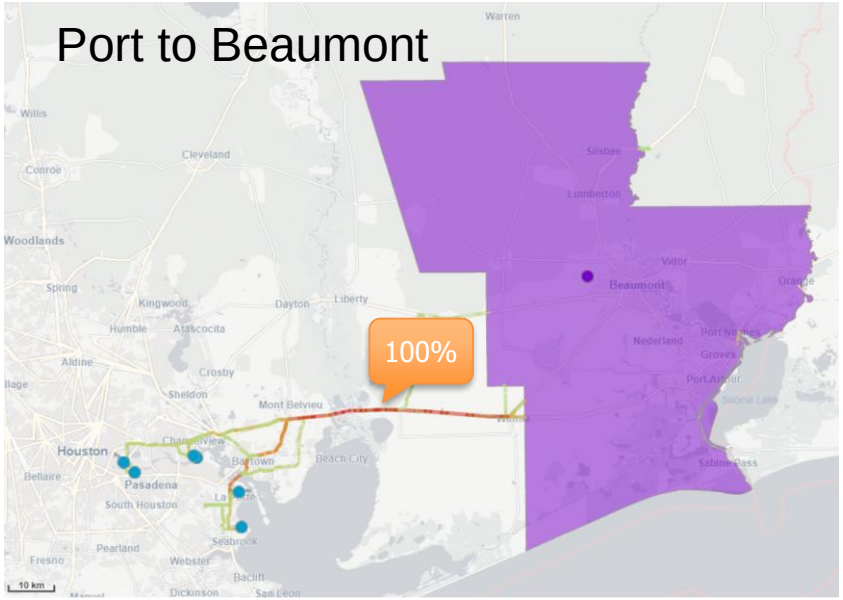
Regional Movements (Neighboring FAFs)



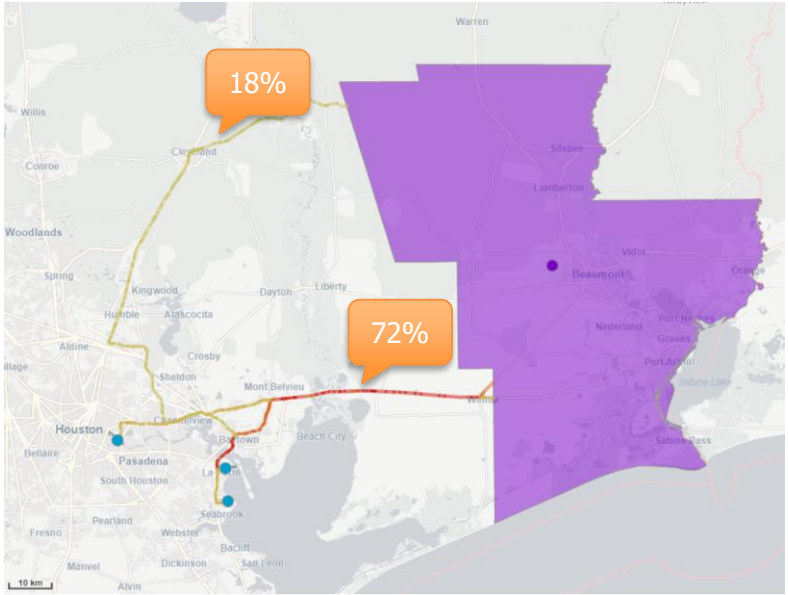


The Impact of Route Disruptions

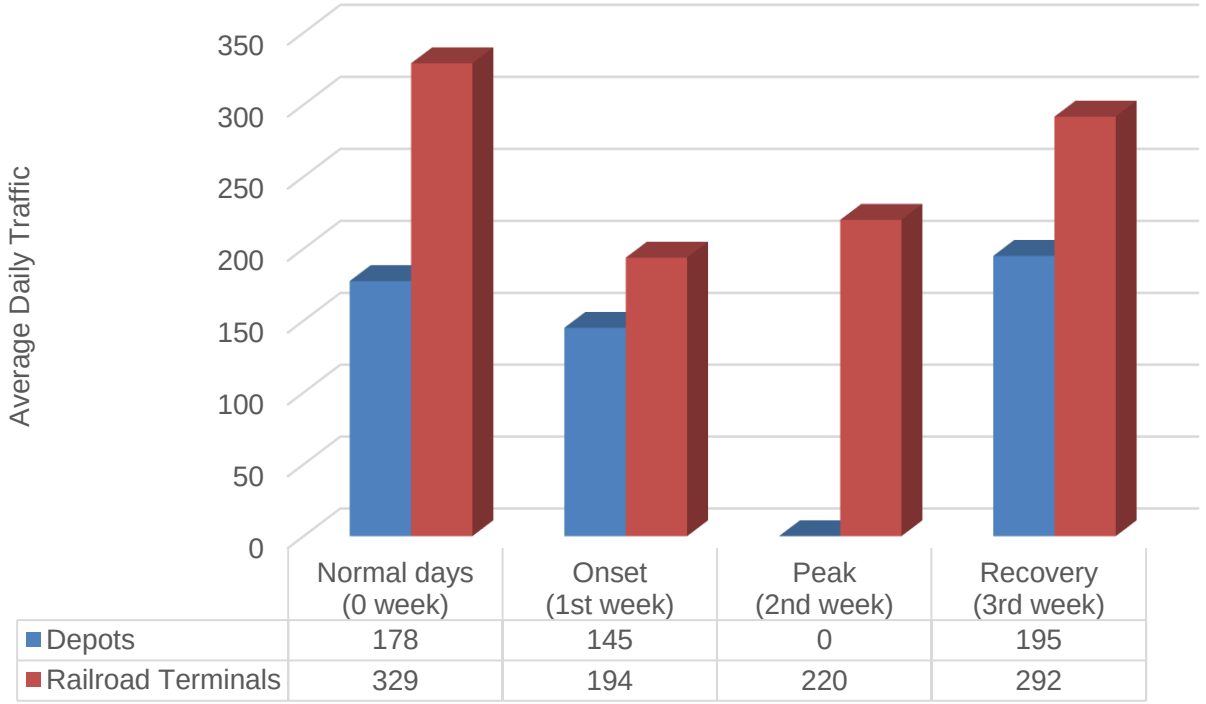
- Normal Days



- During Hurricane

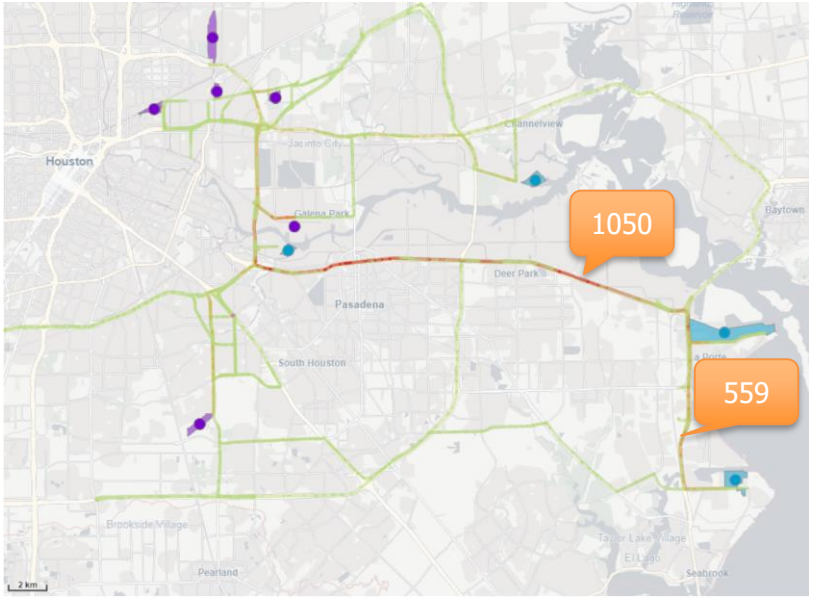


Local Movements

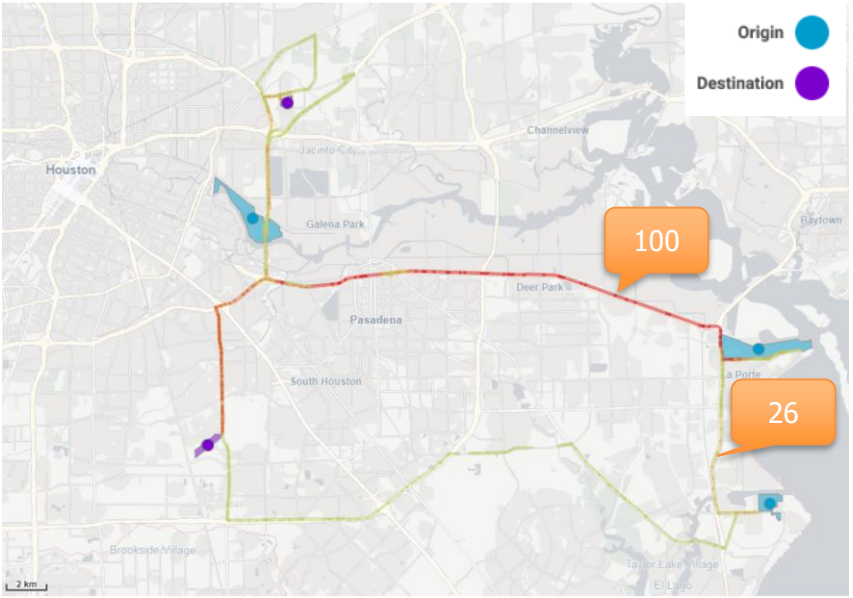


Route Choices for Local Trips

- Normal Days



- During Hurricane



Conclusion

- Hurricane impacted OD movements and Link/Route choices during a peak and/or recovery times depending on the…
  - type of ports
  - types of movements (regional vs. local)
- These spatially and temporally varying patterns (or resiliency) require further investigations on more disaggregated level of impact analysis

Future Work

- Develop resiliency measures to understand and quantify the impacts from Harvey
- Develop performance measures to detect the deviation/abnormality from typical behaviors
- Understand how a single (or multiple) link disruption(s) may affect local or regional movements

Potential Applications

- Understanding distinct port truck activities and the behavioral changes of freight movements during severe weather events such as Hurricane Harvey represents the first step for fast system recovery to minimize economic, social, and human impacts from the events
- Agencies may adopt a variety of mitigation strategies to enhance resiliency and sustainability of port truck operations by accurately predicting their route choices, transport mode choices, and delivery schedule changes caused by severe weather events.

Thank you

Questions?
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THE UNIVERSITY OF TEXAS AT AUSTIN
CENTER FOR TRANSPORTATION RESEARCH

A Perspective on Intraregional Freight Planning Capabilities

and the Implications for Megaregional Planning

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Rydell Walthall

Graduate Research Assistant

The University of Texas at Austin

Today's Talk

- Importance of understanding planning capabilities
- Creation of a regional planning database
- How planning capabilities vary across MPOs and regions
- Steps for more consistent freight planning

Today's Talk

- **Importance of understanding planning capabilities**
- Creation of a regional planning database
- How planning capabilities vary across MPOs and regions
- Steps for more consistent freight planning

Importance of understanding planning capabilities

- Planning capabilities can affect the types of projects considered and will affect project evaluation.
- Planning capabilities vary from organization to organization, even within the same megaregion.

Importance of understanding planning capabilities

What do we mean by planning capabilities?

- For this presentation: planning capabilities include the tools and inputs do planners have available
  - An example of a tool would be the travel demand model available
  - An example of input would be voting seats or committees for stakeholder involvement

Today's Talk

- Importance of understanding planning capabilities
- **Creation of a regional planning database**
- How planning capabilities vary across MPOs and regions
- Steps for more consistent freight planning

Creation of a Regional Planning Database

- Database developed in collaboration with two other CM2 projects
- Variables in the database attempt to capture **each MPO's inputs for non-automobile modes**:

Creation of a Regional Planning Database

- CM2 Researchers created a comprehensive database of all 404 MPOs across the country
- **The database compiles information about how each MPO addresses planning for non-automotive modes, including freight.**
- Parts of the database:
  - Governance Structures
  - Committees
  - Modeling Capabilities

Creation of a Regional Planning Database

Governance Variables in the Database

- This section of the database examines the size and make-up of each MPO's decision-making body
- Looks separately at voting and non-voting representation on each MPO's Policy Board
- Variables include the total seats on the policy board, the total voting seats, and the voting and ex-officio seats for non-automotive modes

Creation of a Regional Planning Database

Committee Variables in the Database

- Committees provide platforms for stakeholders to provide the MPO with feedback on projects
- This part of the database shows for each MPO whether it has a dedicated planning committee for each mode, separate from general planning committees.

Creation of a Regional Planning Database

Modeling Variables in the Database

- These variables examine the travel demand model each MPO uses for its long-range travel plan
  - Answers the question: Does the MPO use forecasting models capable of predicting project outcomes for non-automotive modes?
- If the MPO's models cannot analyze the benefits accruing to a mode, that mode might receive relatively low funding for projects.

Creation of a Regional Planning Database

Sources for the Database

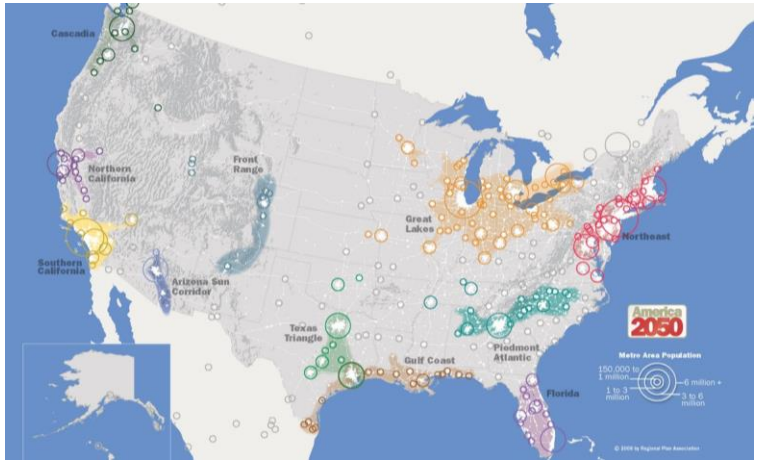
- Researchers used publicly available resources where available:
  - MPO bylaws
  - MPO websites
  - Model documentation
- When information was not readily available, researchers contacted MPOs directly.

Today's Talk

- Importance of understanding planning capabilities
- Creation of a regional planning database
- **How planning capabilities vary across MPOs and regions**
- Steps for more consistent freight planning

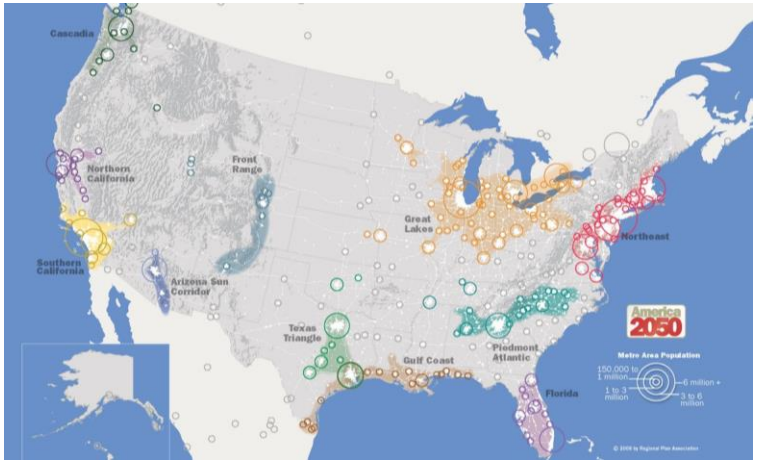
How planning capabilities vary across MPOs and regions

- With the MPO database, it is possible to answer two types of questions:
  - How do different MPO's plan for non-automotive modes?
  - **How consistent is planning across a megaregion?**



How planning capabilities vary across MPOs and regions

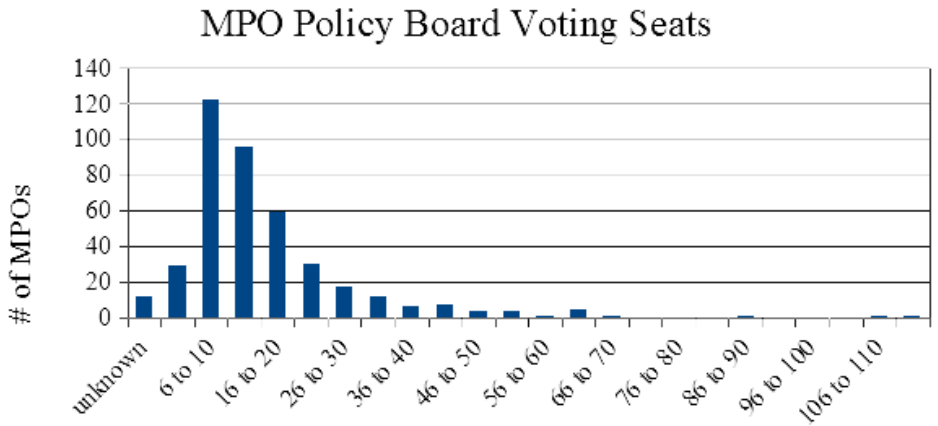
- To achieve megaregional planning for projects spanning many MPOs, we need to know how freight planning is handled across an entire megaregion
- The impacts of freight projects often extend far beyond the region in which the project occurs.
- This is even more important for projects affecting whole corridors.



How planning capabilities vary across MPOs and regions

Database Governance Findings

- Most MPOs have up to twenty voting seats, but the distribution has a long right tail.
- Number of voting seats is not directly related to MPO population



How planning capabilities vary across MPOs and regions

Database Governance Findings

- Very few small MPOs have voting seats dedicated to transit representation, but most in the upper twenty percentile population do.
- Very few MPOs of any size have voting seats dedicated to freight stakeholders.

How planning capabilities vary across MPOs and regions

Database Committee Findings

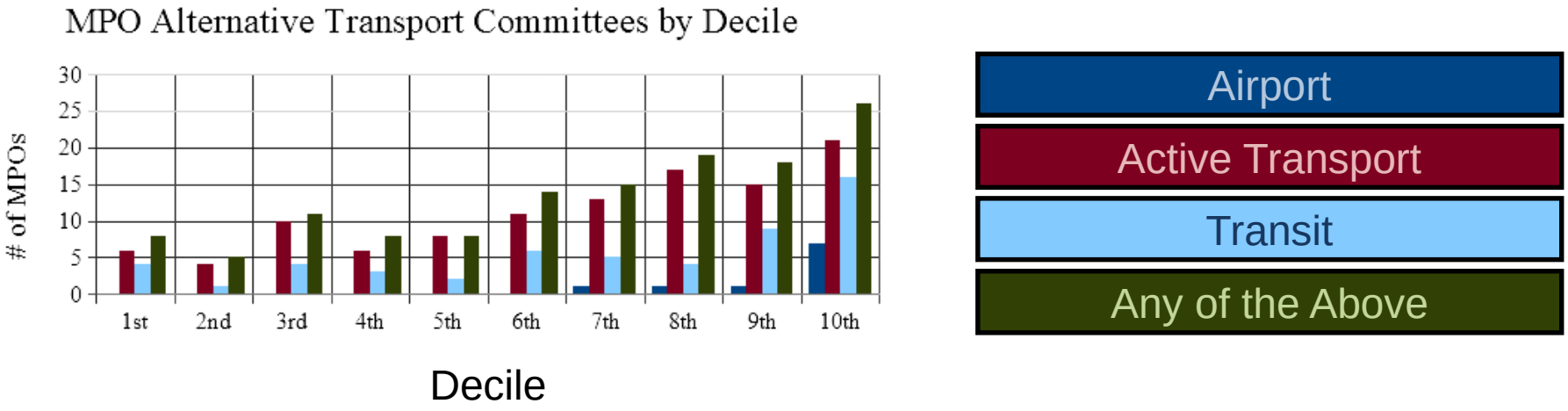
- About one in four MPOs have active transport committees; about one in eight have transit committees.
- Fewer than one in forty MPOs have freight or airport committees.
  - SCAG and NCTCOG are examples of large MPOs with such committees
  - Orange County in New York is the smallest MPO with such a committee (population 373,000 in 2010)

	Has Committee	Does Not Have Committee
Airport	10	394
Active Transport	106	298
Transit	54	350

How planning capabilities vary across MPOs and regions

Database Committee Findings

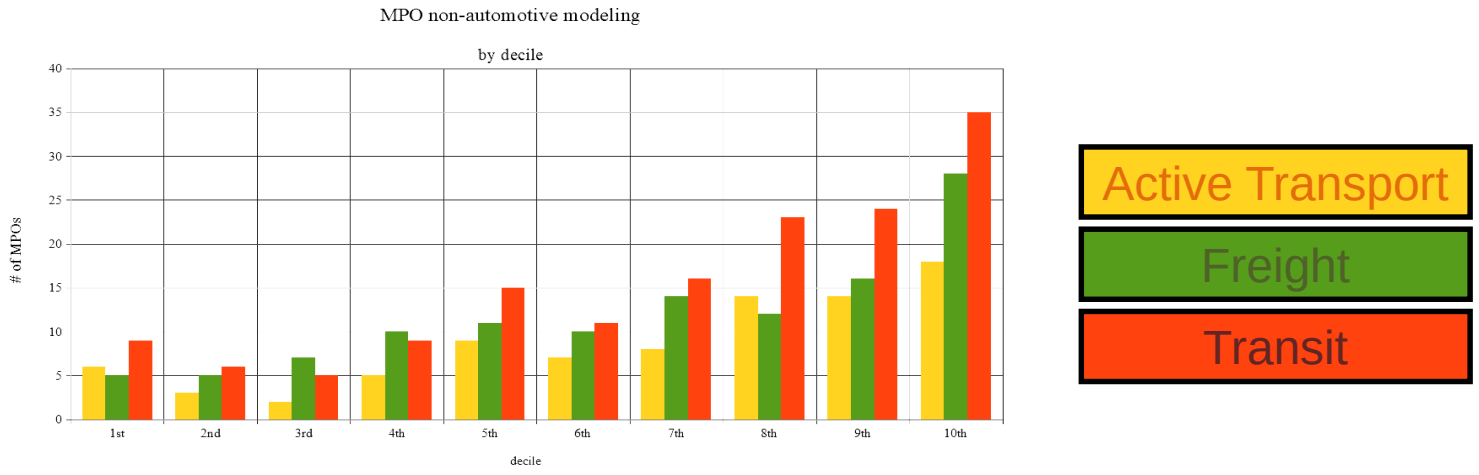
- Larger-population MPOs are far more likely to have committees for non-automotive transport.
- Almost no MPOs have committees dedicated to freight issues, but several of the larger MPOs have airport committees



How planning capabilities vary across MPOs and regions

Database Modeling Findings

- MPOs in every population decile model freight movements, but the largest MPOs are far more likely to do so.
- Freight is more likely to be modeled than active transport; less likely than transit

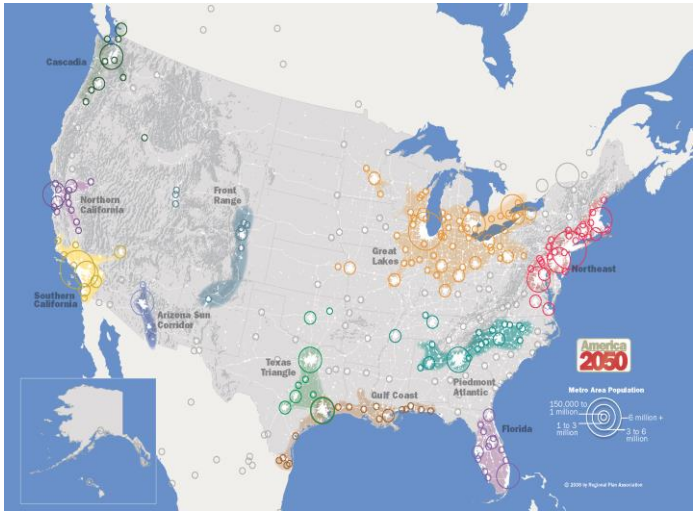


Today's Talk

- Importance of understanding planning capabilities
- Creation of a regional planning database
- How planning capabilities vary across MPOs and regions
- **Steps for more consistent freight planning**

Steps for More Consistent Megaregional Planning

- Many MPOs across the country are considering freight issues, but there is not consistency across Megaregions.
- Returning to the America 2050 Megaregion Map, many important freight projects go beyond the scope of any single MPO, or even state DOT.



Steps for More Consistent Megaregional Planning

- Many megaregions have a large number of MPOs with no mechanism in place to ensure consistent planning across the megaregion.
- One exception is Florida, where all MPOs meet planning guidelines set-out by Florida DOT.

Megaregion	MPOs within megaregion	MPOs adjacent to megaregion
Arizona Sun Corridor	4	1
Cascadia	11	3
Florida	23	3
Front Range	7	1
Great Lakes	71	20
Gulf Coast	19	2
Northeast	46	11
Northern California	12	3
Piedmont Atlantic	34	6
Southern California	6	3
Texas Triangle	9	7

Steps for More Consistent Megaregional Planning

- State legislatures and DOTs play large roles in determining MPO governance structures.
- They may be key in providing more representation for non-automotive modes.
- In Florida, MPOs use models created by the state DOT.
  - This has ensured broad planning consistency across the entire Florida Megaregion.
  - The Florida DOT is in the process of developing more advanced activity-based and dynamic assignment models, meaning the Florida Megaregion could become the first to use such planning tools across an entire megaregion.

Summary:

- There is a lot of inconsistency in the availability of planning tools and the methods of stakeholder inclusion across MPOs in each megaregion.
- Larger MPOs have more planning resources. Smaller MPOs may require assistance to plan for freight projects spanning an entire corridor through a megaregion.
- There are similar trends for other non-automotive modes aside from freight.

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Methods and Tools for Freight Flow Disaggregation

March 4, 2020

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K. Pujats, M. Golias, S. Mishra, Univ. of Memphis

Contents

Background

TN DOT Ongoing Study (Began April 2019)

Objective

- Review freight disaggregation methods
- Develop in-house GIS tools

Team members:

- TNDOT: D. Pallme, A. Kosanovic
- UoM: M. Golias, S. Mishra, K. Pujats

Methods

How do we create disaggregate freight OD?

Approach 1: Productions/Attractions => OD Matrix

Approach 2: OD Disaggregation

Both consider relationship between:

- Commodity producing/consuming industries
- Socio-economic variables
- Some impedance function

Used Data Sources and Crosswalk Tables

Data Sources:

- Transearch
- InfoUSA
- Bureau of Economic Analysis (BEA) Input-Output (IO) Accounts Supply and Use tables
- Network Data (Zones, Links, Facilities)

Crosswalk Tables:

- BEA IO Account code to NAICS code crosswalk
- SCTG 2-digit to NAICS 3-digit crosswalk (see Anderson et al., 2013)

Anderson, M., Blanchard, L., Neppel, L., Khan, T., 2013. Validation of Disaggregate Methodologies for National Level Freight Data. International Journal of Traffic and Transportation Engineering 2013, 2(3): 51-54. DOI: 10.5923/j.ijtte.20130203.05

GIS Toolbox

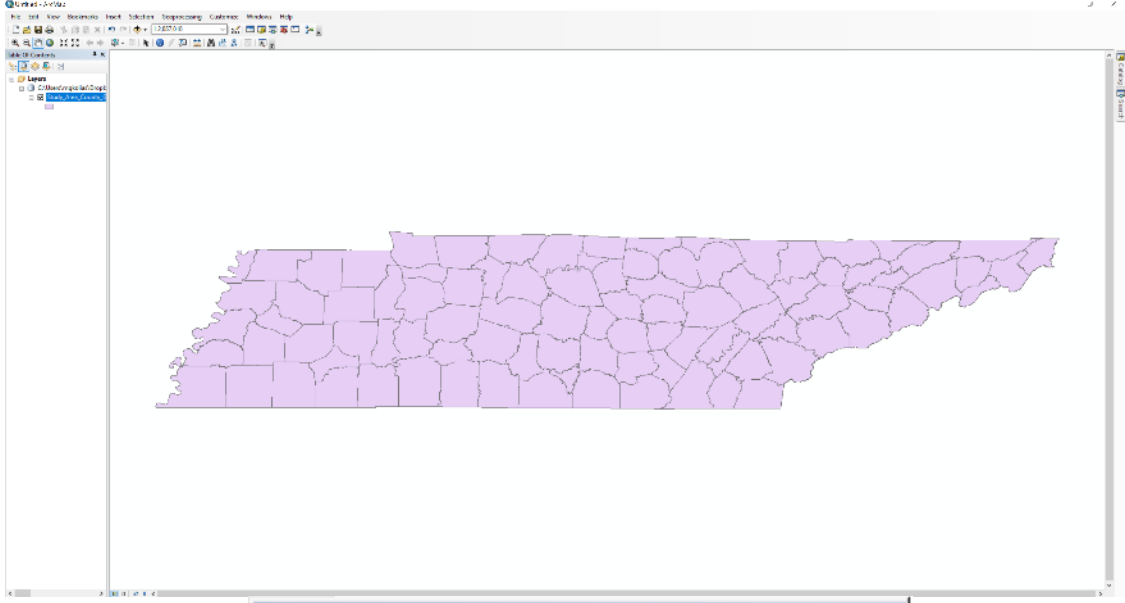
Preprocessing tools:

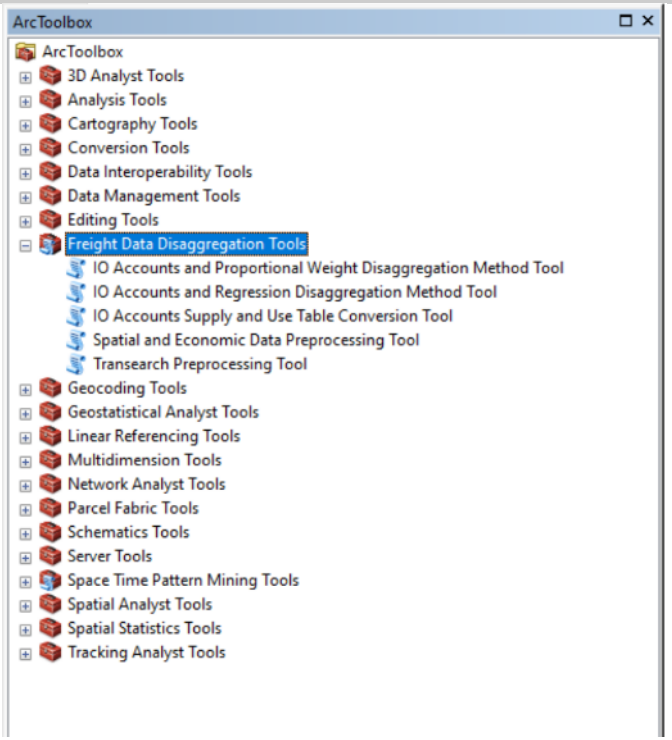
1. Transearch: SCTG3=>SCTG2 (County level in TN)
2. IO Accounts Supply and Use: Industry shares (producing and using) by IOCode, NAICS
3. Spatial and economic data (InfoUSA): Aggregate and disaggregate values/shares for sq. ft., value of sales, employment

Disaggregation tools:

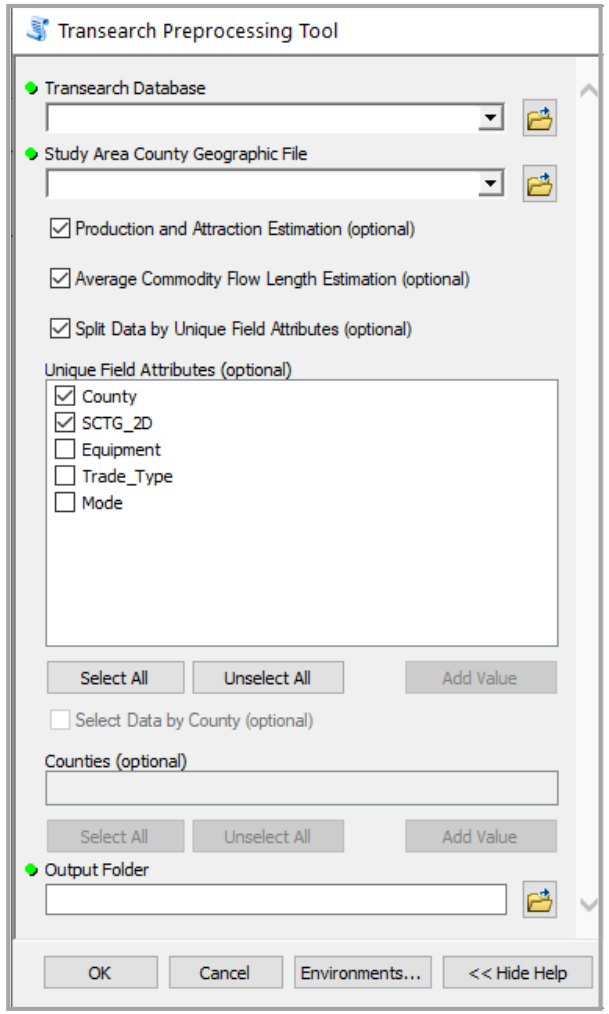
1. Trip productions/attractions disaggregation=> Create OD

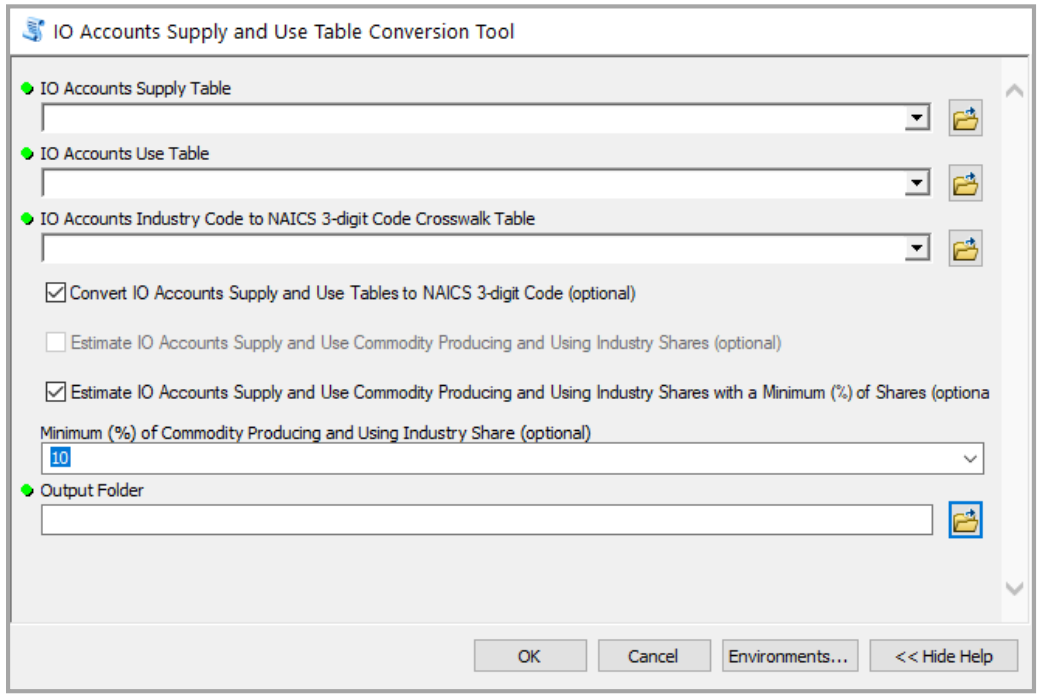
2. Direct OD Disaggregation

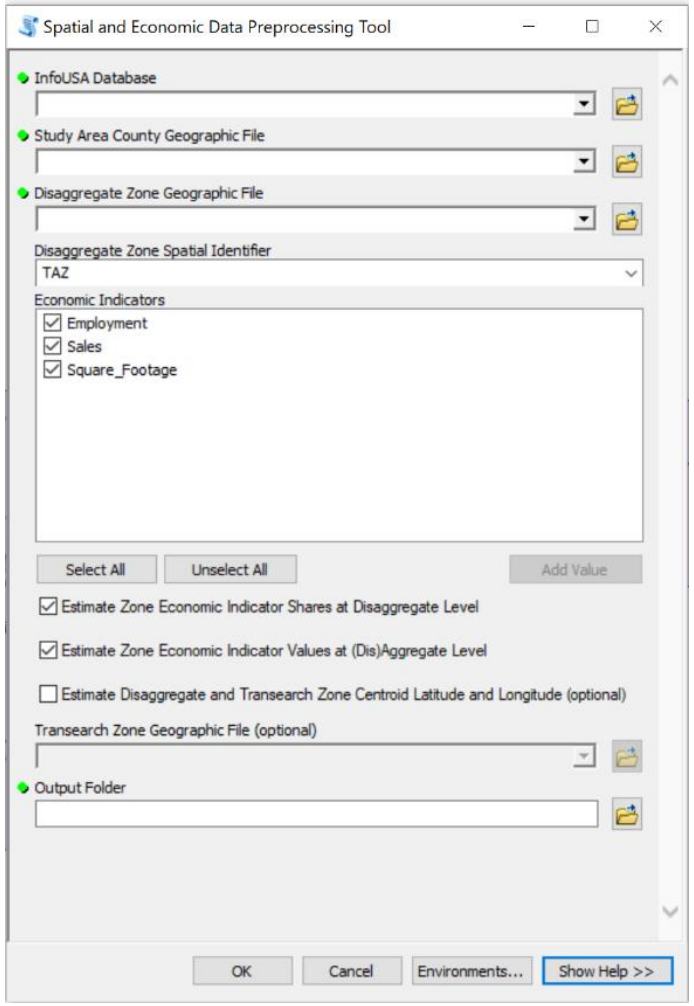




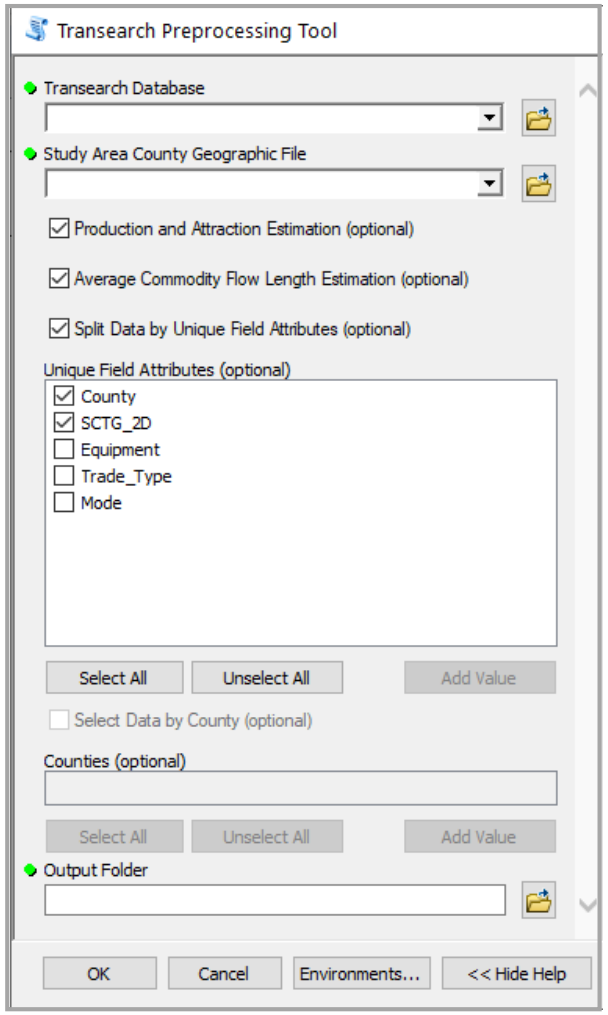
Preprocessing Tools



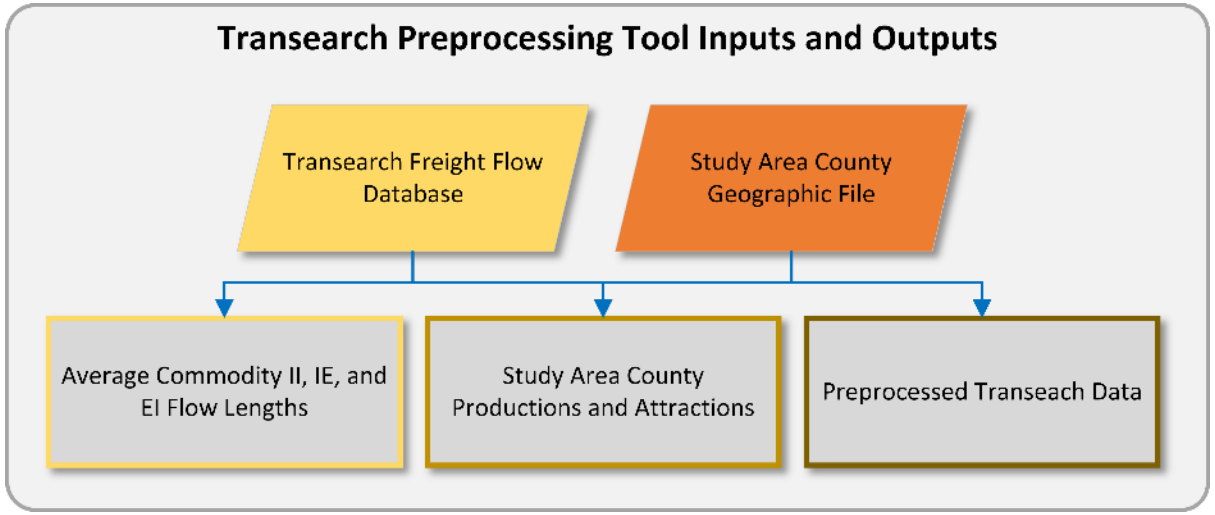




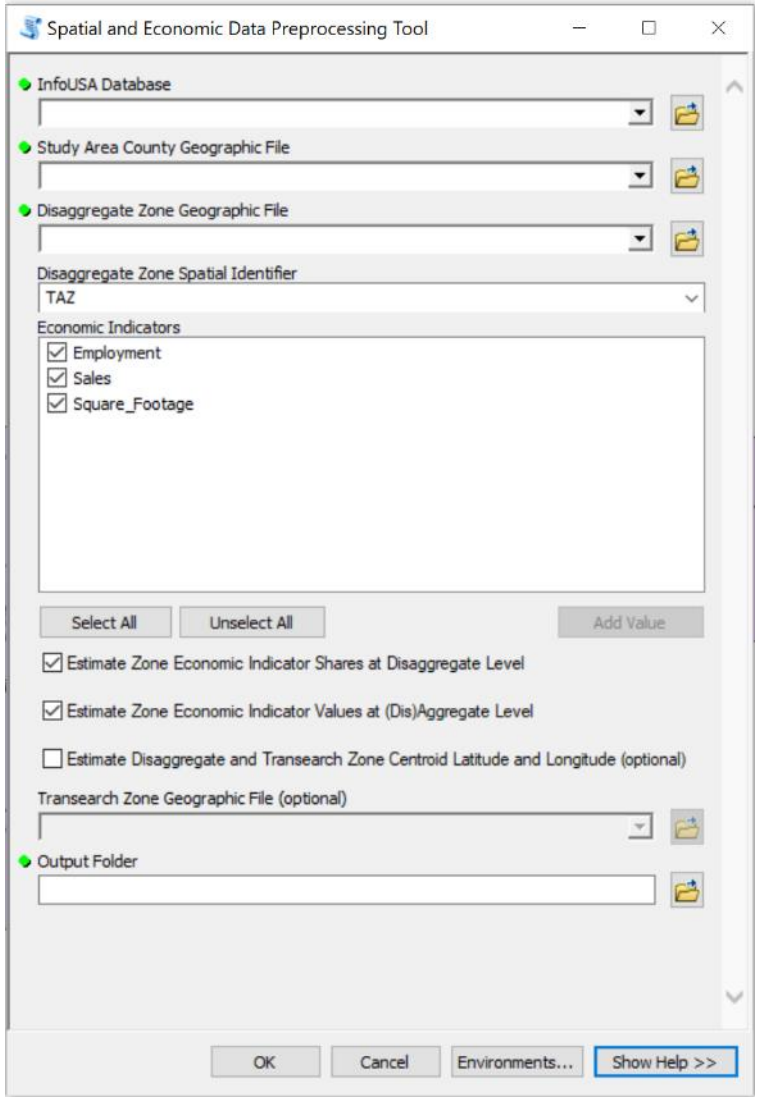
Transearch Preprocessing Tool



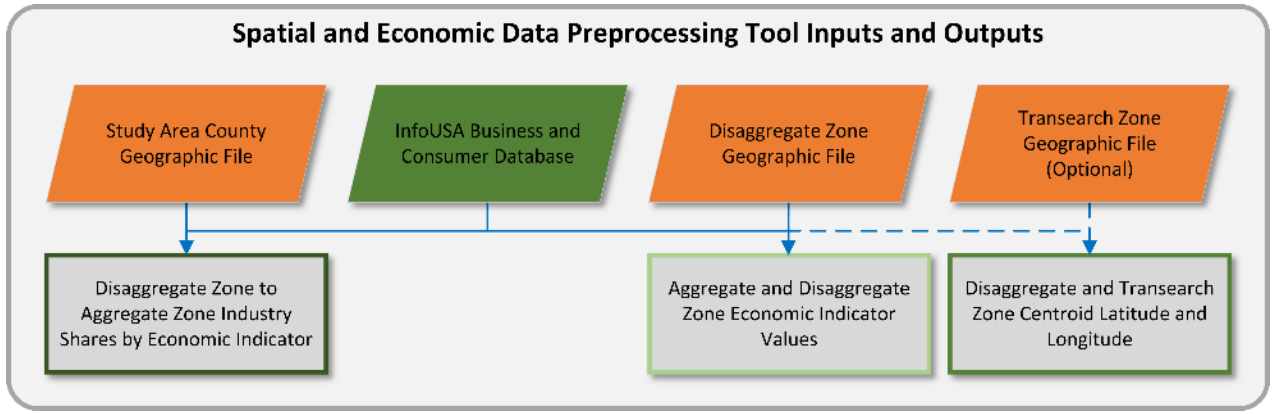
- From SCTG 3 to SCTG 2 digit code BY:
    i. Equipment type
    ii. Trade type
    iii. Mode
- Average length (miles between ODs)
- Estimate Productions and Attractions (Aggregate Level)



Spatial and Economic Data Preprocessing Tool

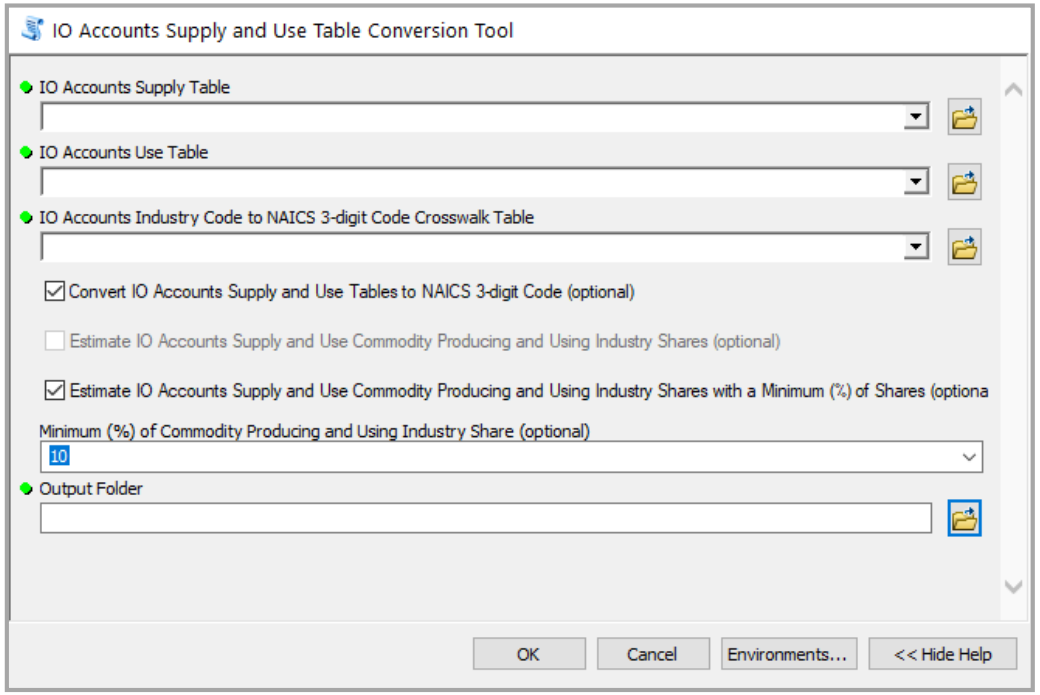


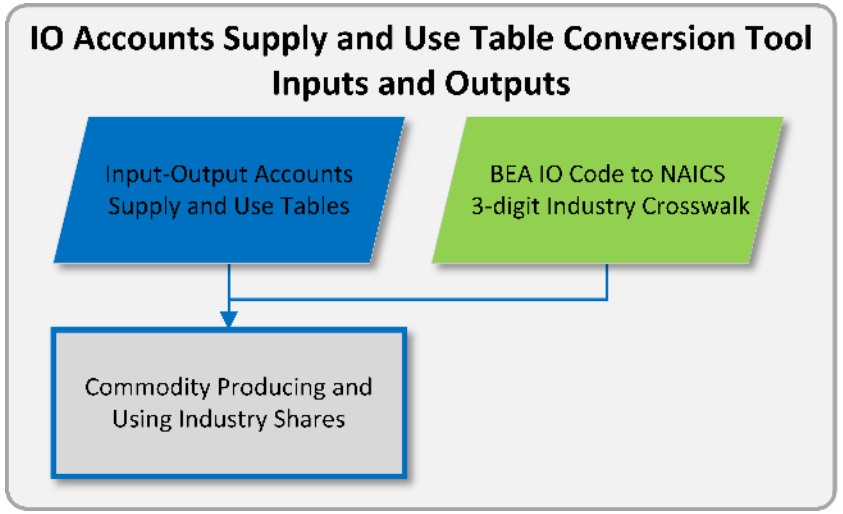
- Economic indicator shares and values at disaggregate level
- Centroid of disaggregate and Transearch zones (estimate travel times or length)



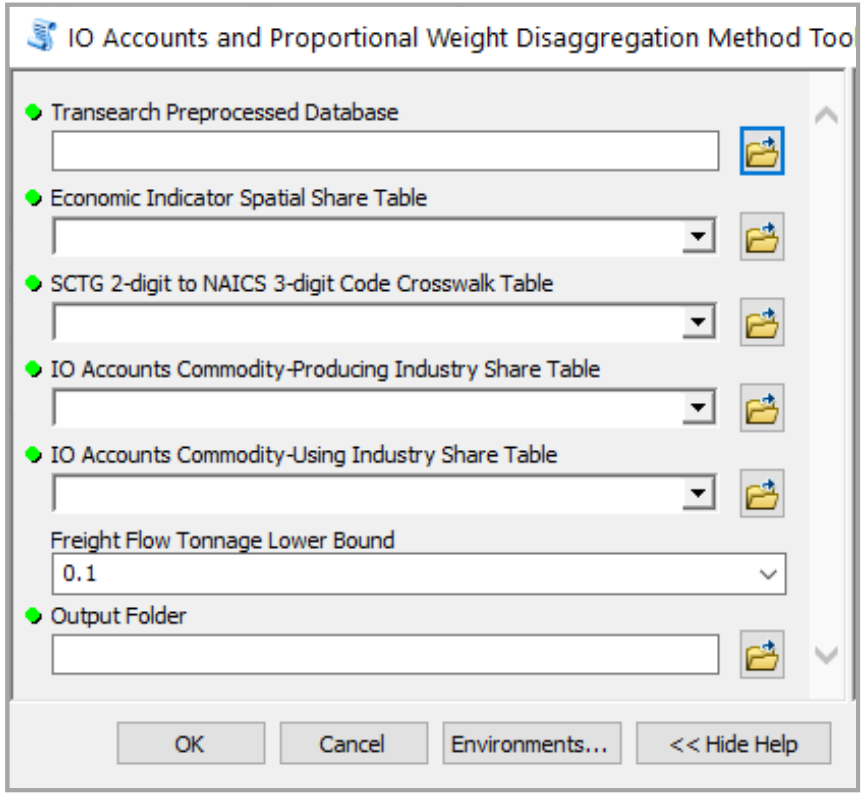
IO Accounts Supply and Use Table Conversion Tool

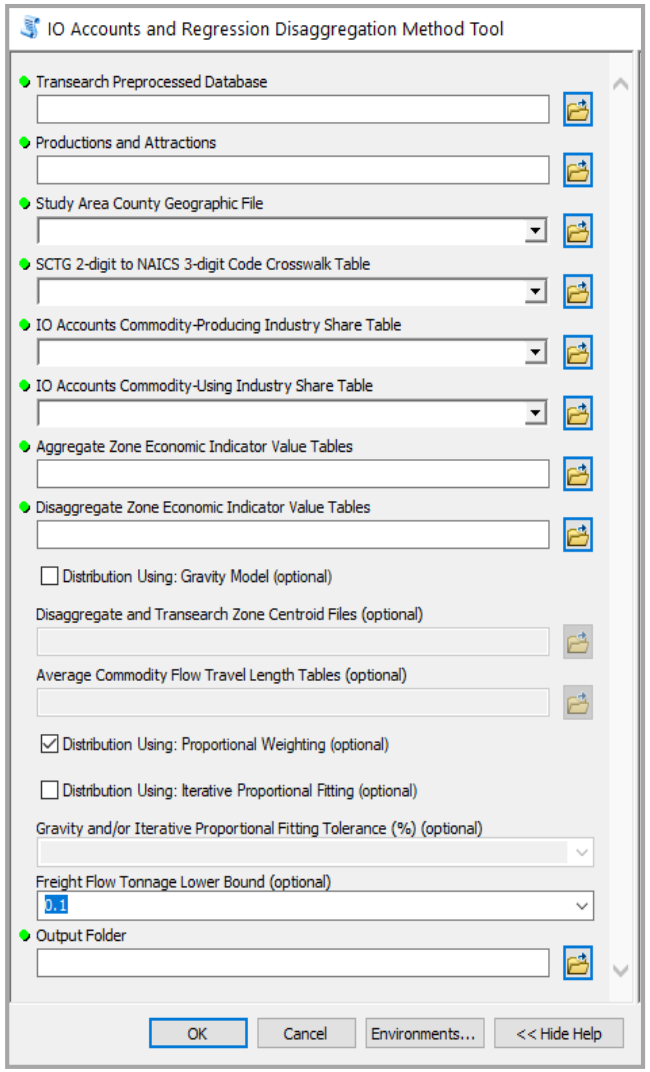
- Supply and Use Shares (any level of aggregation available)



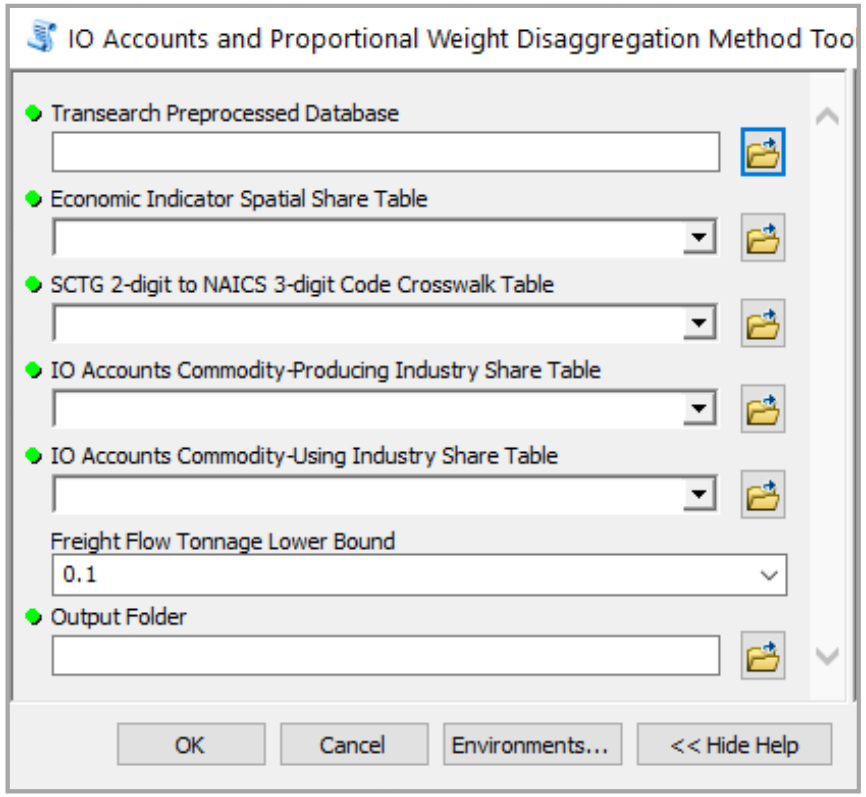


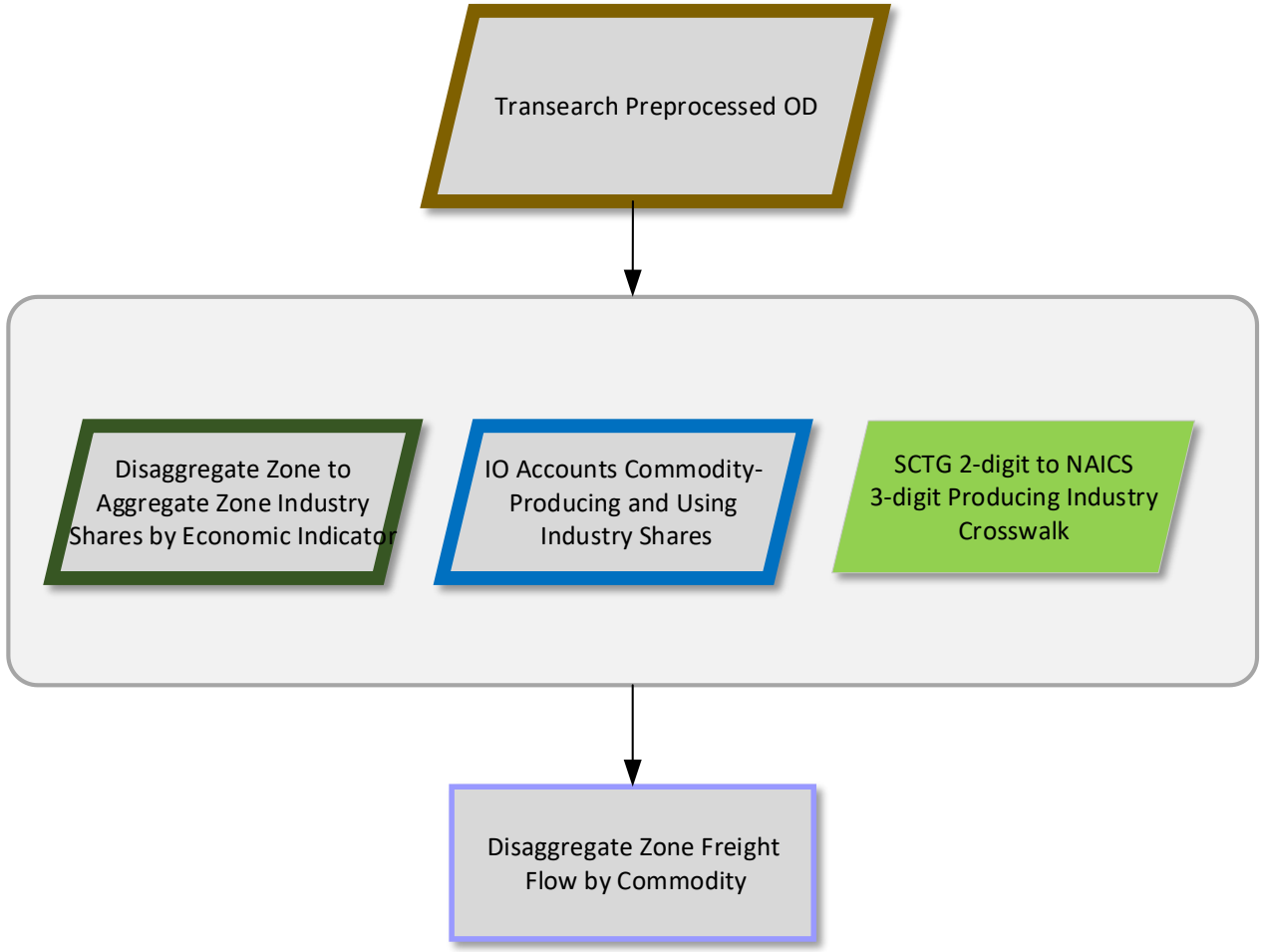
OD Estimation/Disaggregation



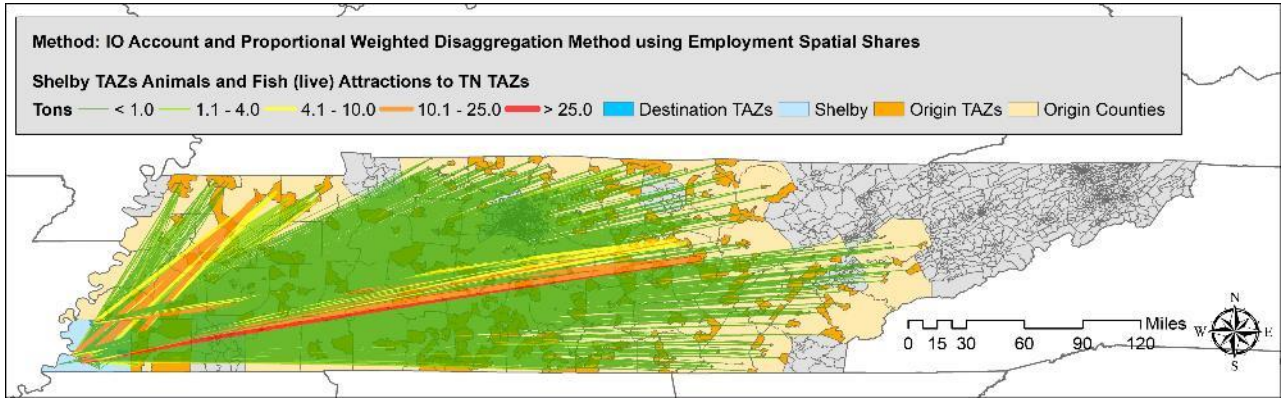


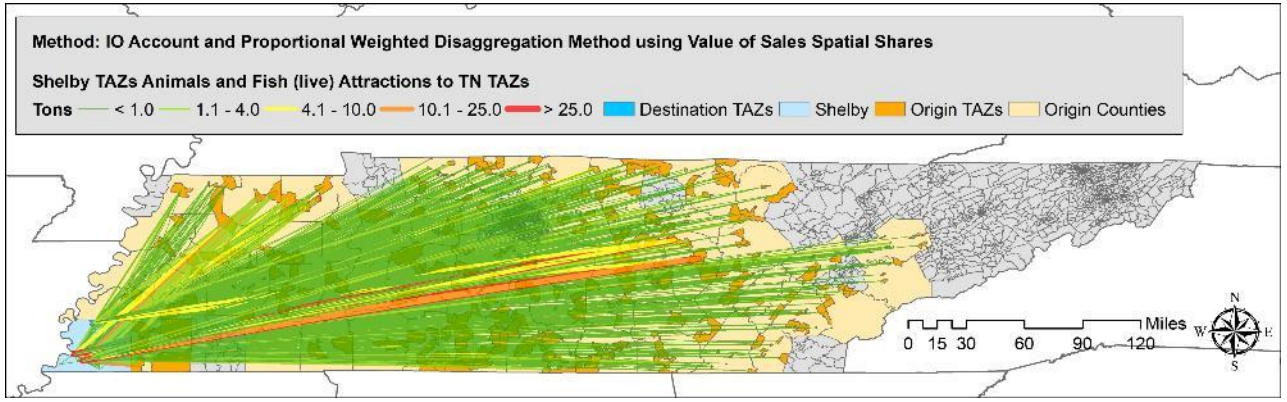
Proportional Weight OD Disaggregation

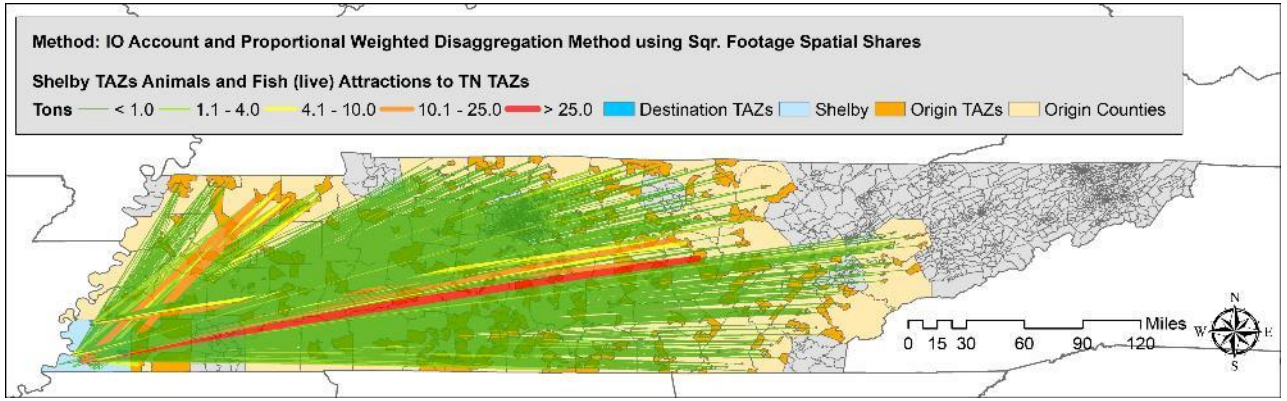




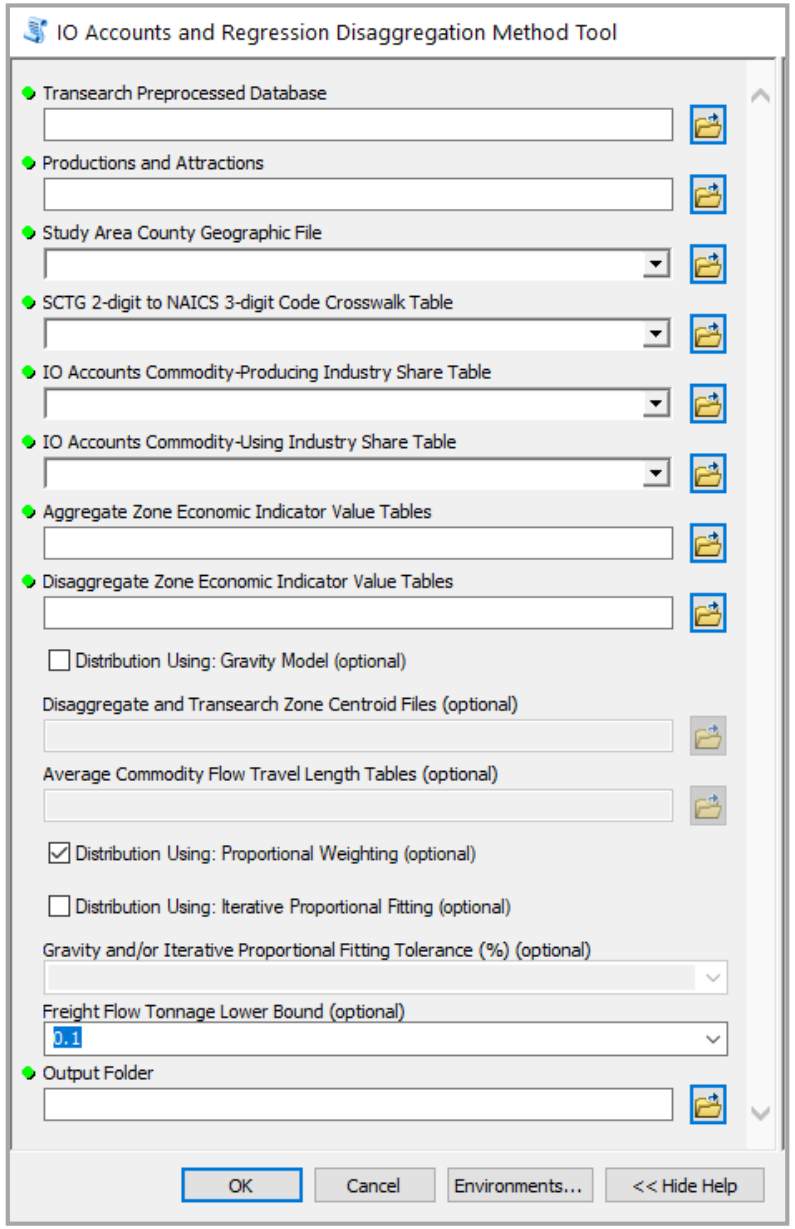
Proportional Weight OD Disaggregation Example Output

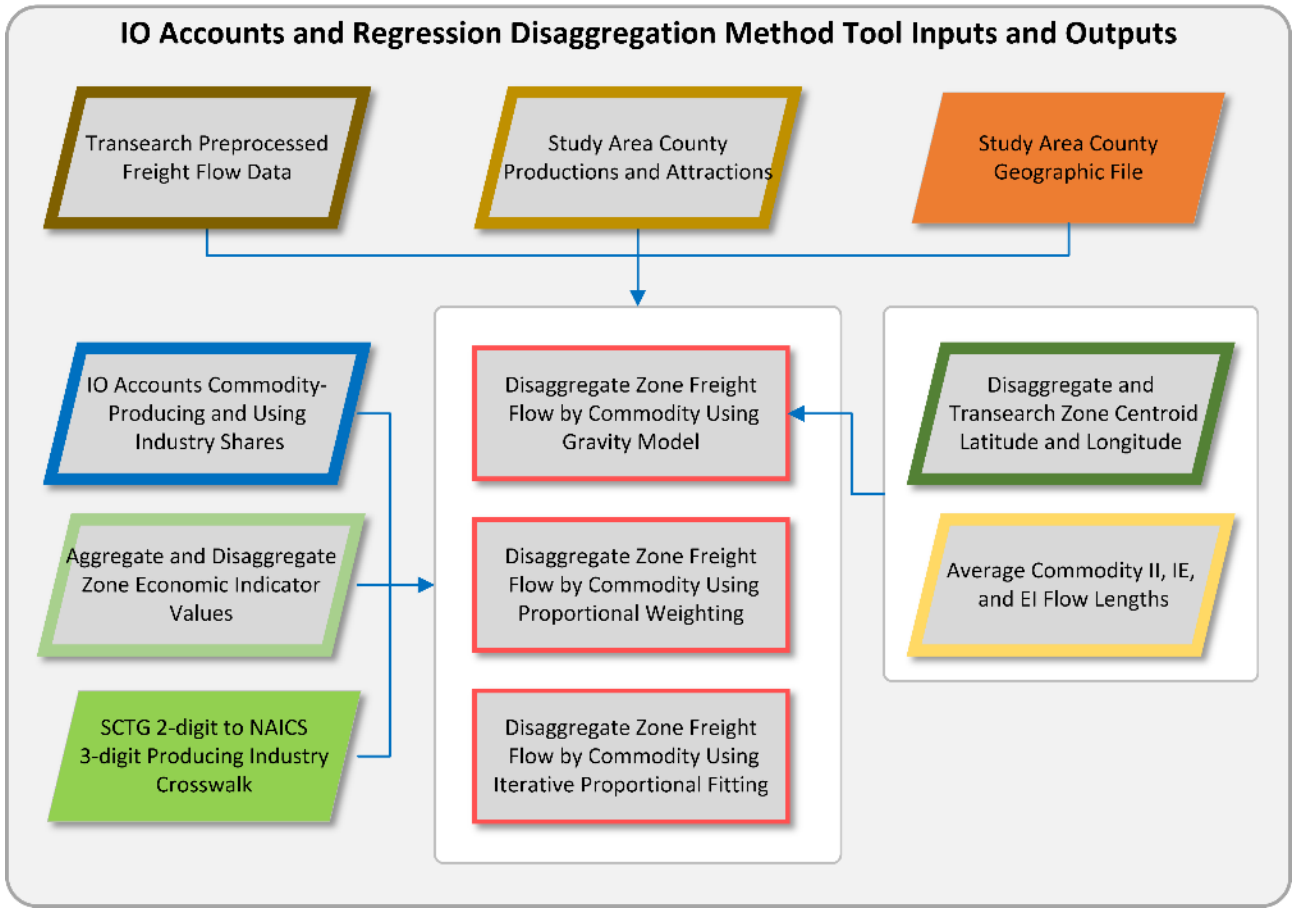




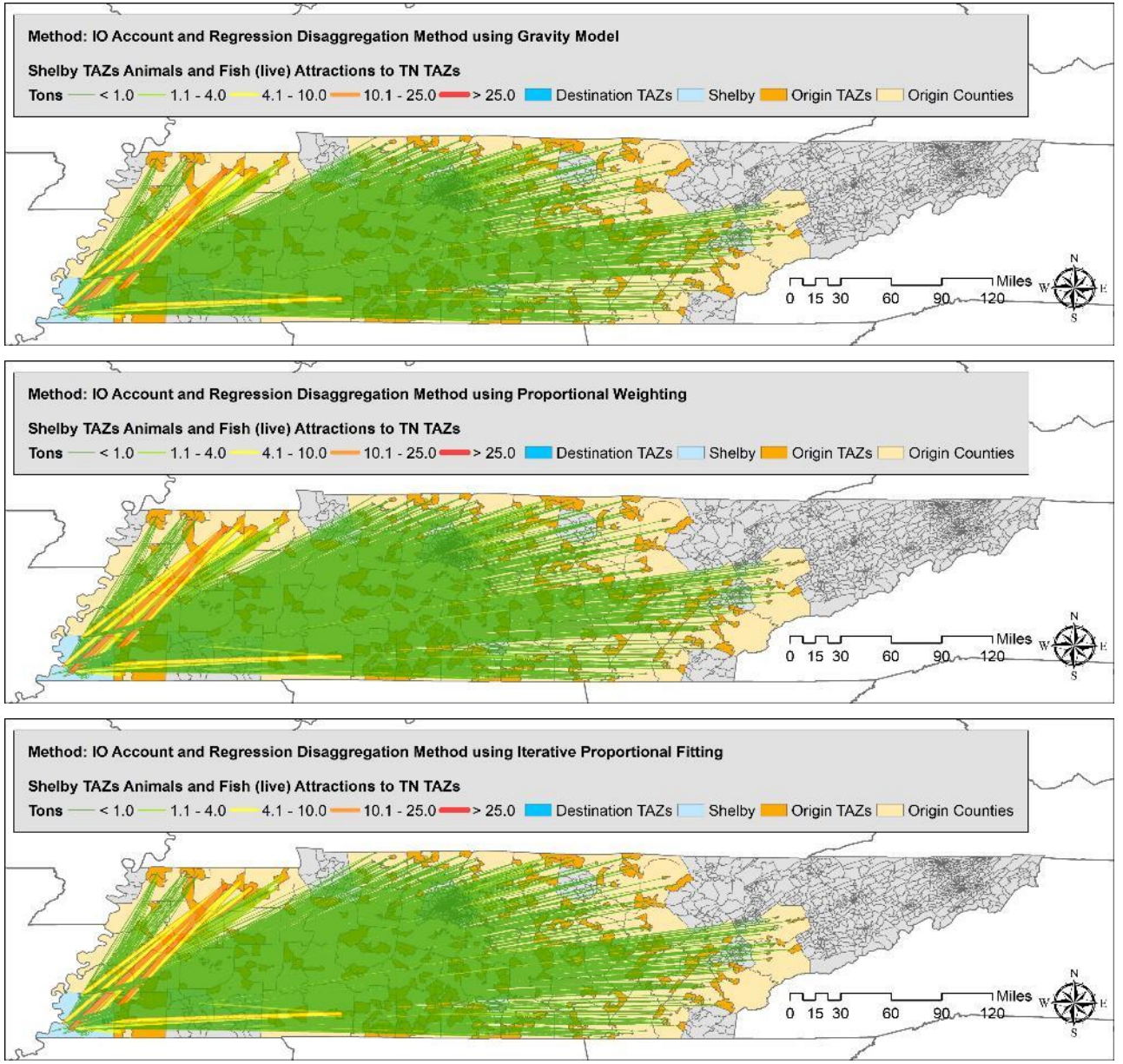


Regression Disaggregation Method Tool





Regression Method Tool Example Output



Next Steps

- Finalize GIS Tool Test
  - Tonnage to Truck Trip Conversion
  - Fix Bugs (if any)
- Validation/ Comparison of the two methods
- Finalize report by August 2020

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Methods and Tools for Freight Flow Disaggregation

March 4, 2020

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