


This Meeting Begins at 10:00am


Greater Houston Freight Committee

Regional Collaboration • Transportation Planning • Multimodal Mobility

H-GAC
METROPOLITAN PLANNING ORGANIZATION

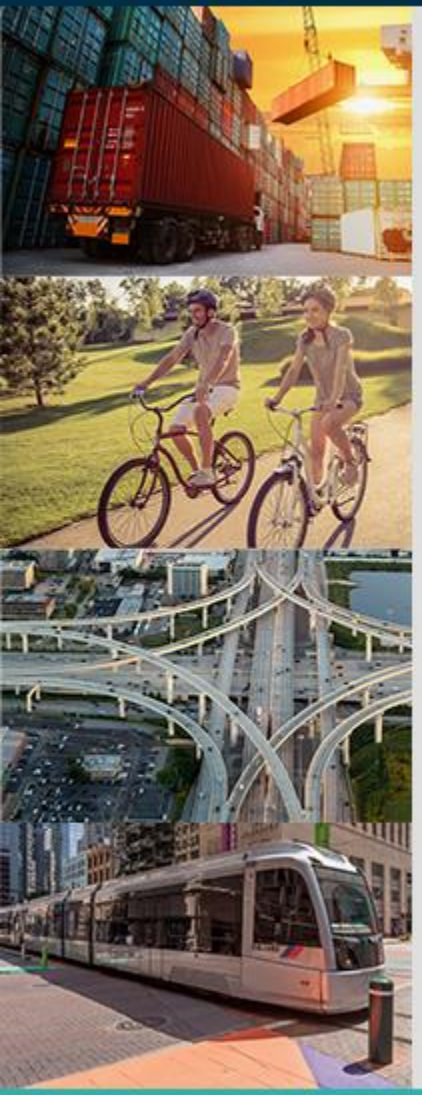

Greater Houston Freight Committee


January 13, 2021

Regional Collaboration • Transportation Planning • Multimodal Mobility

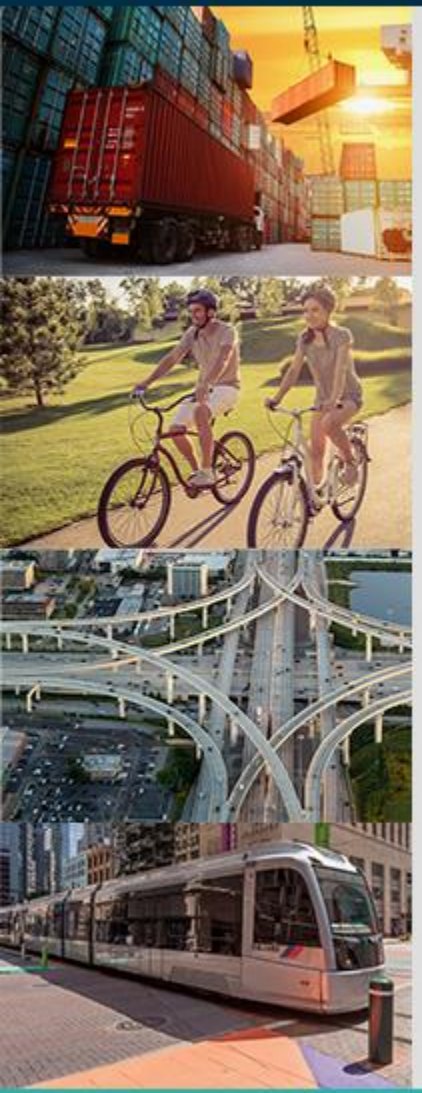
METROPOLITAN PLANNING ORGANIZATION

Agenda



Welcome & Introductions	Hon. Ed Emmett, GHFC, Fellow at Baker Institute
2021 Transportation Infrastructure Bill	Craig Raborn ,H-GAC, Transportation Director
Statewide Port and Roadway Resiliency	Dr. Zhanmin Zhang, *CRISC, Director*
Resiliency & Durability Pilot	Allie Isbell, H-GAC, *Regional Planning* Mgr
Electrification of Roadway Infrastructure	Dr. Ann Xu, TTI, Research Scientist
Regional Goods Movement Plan	Veronica Green, *H-GAC, Senior Planner*
Perspective on the Supply Chain Crisis	Brian Fielkow, GHFC, Jetco
Closing	

Agenda



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Infrastructure Investment and Jobs Act (IIJA) Update


Craig Raborn
Transportation Policy Council
November 19, 2021

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Overall Summary

- Signed into law: Monday, November 15
- $1.2 trillion total spending
  - $550 billion new spending
  - 5-year FAST Act Reauthorization
  - Beyond transportation: power, water, broadband, and more
- New programs, policies, requirements
- Three types of funding
  - Highway Trust Fund
  - Guaranteed appropriations
  - General Fund (requires Appropriations)

MPO-Related Elements

- 42 sections will impact MPOs
  - New planning requirements
  - New planning opportunities
  - Increases to existing suballocated funding programs
  - New suballocated funding programs
  - New grant coordination needs
- 11 new grant programs
- 6 new competitive pilot programs

Initial Assessment: Funding Impacts

Program	5-year Funding	% Increase	MPO Programming	H-GAC 1-year *(Initial Staff Estimate)*	H-GAC 1-year *(Initial Staff Estimate)*
National Highway Performance Program	$148.0 B	27%	--	--	--
Surface Transportation Block Grant Prog.	$72.0 B	24%	Yes	+$30 M	$155 M
Highway Safety Improvement Program	$15.6 B	34%	--	--	--
Congestion Mitigation and Air Quality	$13.2 B	10%	Yes **	+$8 M	$89 M
National Freight Program	$7.15 B	13%	--	--	--
STBGP Set-Aside (TAP/TASA)	$7.2 B	71%	Yes	+$5 M	$13 M
Metropolitan Planning (FHWA)	$2.3 B	32%	Yes		
Bridge Improvement Program	$40.0 B	new	Yes **	TBD	TBD
[NEW] Carbon Reduction Program	$6.4 B	new	Yes	~$12-14 M	~$12-14 M
[NEW] PROTECT Program	$7.3 B	new	Yes **	~$13-15 M	~$13-14 M

New Programs – Initial Highlights

- Rural Surface Transportation Grant -
  - Areas outside Urbanized Area (potential significant opportunities)
- Carbon Reduction Program
  - Eligibility similar to CMAQ
- Bridge Improvement Program
- PROTECT (Formula and Discretionary)
  - Resiliency – regional plan increases federal project share (incentive)
- Increasing Safe and Accessible Transportation Options
- Railroad Crossing Elimination Program
- Transfer and Sale of Toll Credits (state)

New Competitive Programs

- Charging and Fueling Infrastructure
- Congestion Relief Program
- Prioritization Process Pilot Program
- Reduction of Truck Emissions at Port Facilities
- Reconnecting Communities
- Safe Streets and Roads for All Grant Program

The MPO anticipates…

- Significance of grants and discretionary spending
  - New competitive programs total $100 B
- Expected coordination/support of grant applications
  - Possible single project application for multiple grant programs
- Funding notices on highly-accelerated schedule (FY2022)
- First grant programs announced within 1-2 months
- Most new programs will require time to develop guidance
- Many new rulemakings

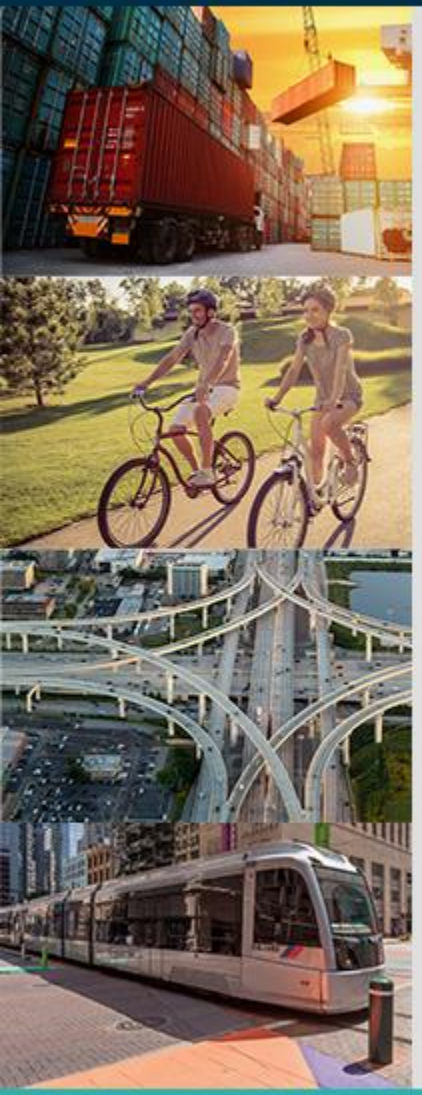
New MPO and Planning Requirements

- New programs, policies, requirements
- ~32% funding increase = ~32% more expected MPO activity
- Designation changes (probably not applicable to existing MPOs)
- Explicitly allows social media and web-based public engagement
- Adds housing to scope of planning process (RTP, etc.)
- Large MPOs may integrate housing, transportation, and economic development
- Must develop Complete Streets Standards and Prioritization Process
- Changes how fiscal constraint calculated for beyond 4 years
- Other requirements/benefits distributed through-out

How our MPO is preparing

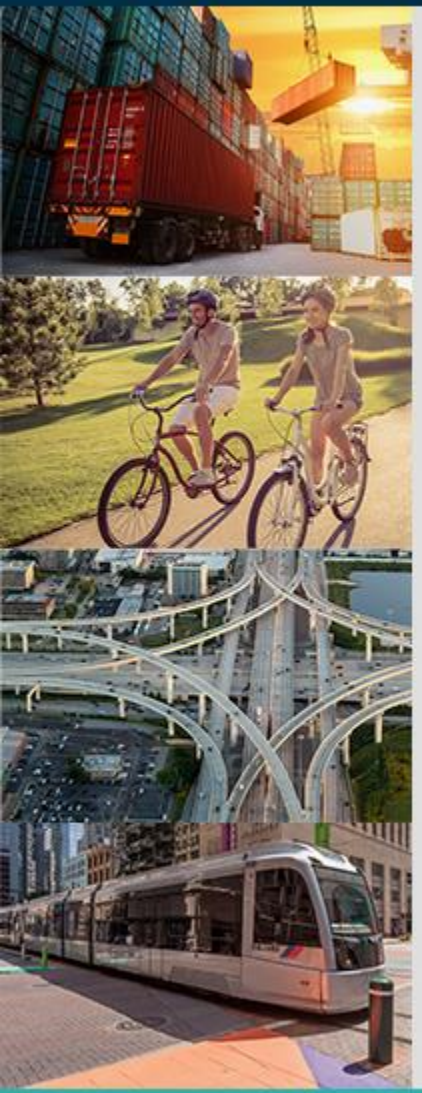
- Participate in rulemaking and development of program guidance
- Start assessing UPWP and preparing new tasks/amendments
- Track and anticipate new rules/guidance/funding announcements
- Definition of Urban/Rural will be important; engage in discussions at Census Bureau
- Regular reports and updates to TAC and TPC
- Develop strategy to identify/assemble unfunded project list
  - Immediate candidates for new programs and grants

Thank You!



Craig Raborn, AICP
MPO Director
craig.raborn@h-gac.com
www.h-gac.com (click “Mobility”)

Agenda



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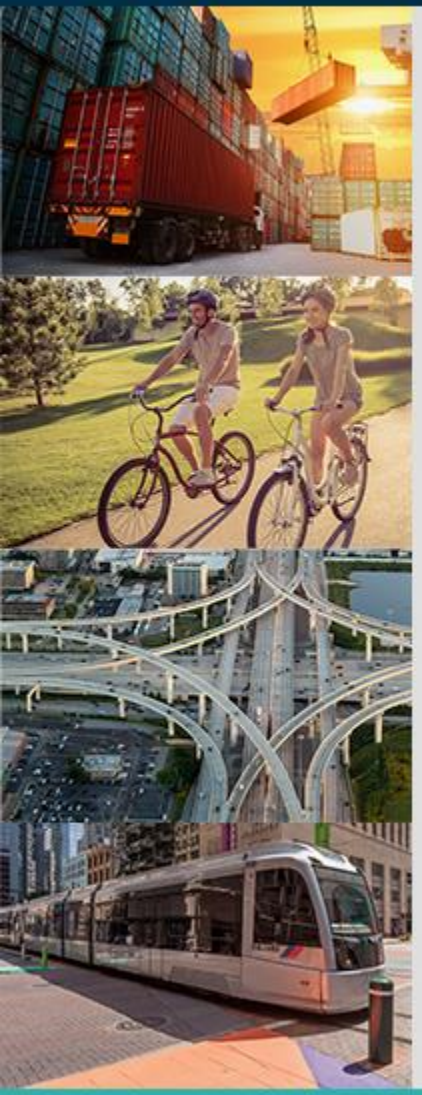

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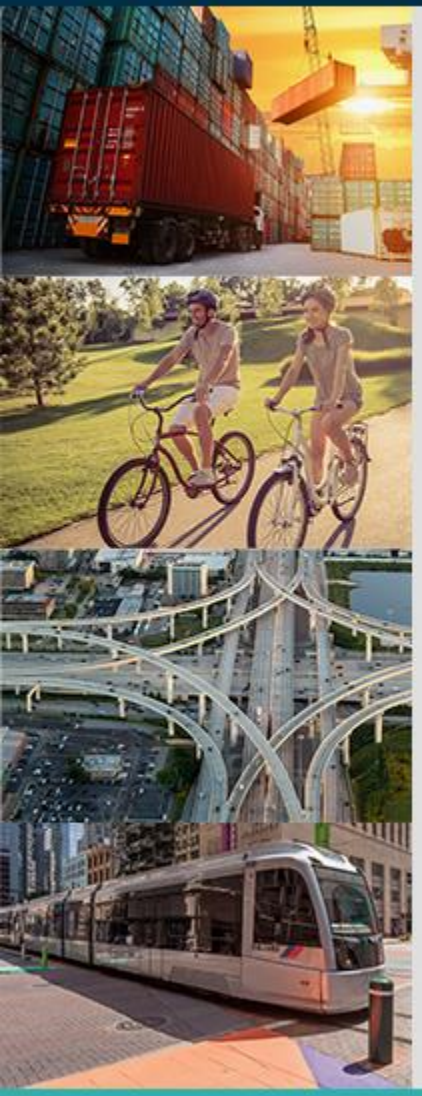
H-GAC's Resiliency and Durability to Extreme Weather Pilot Study

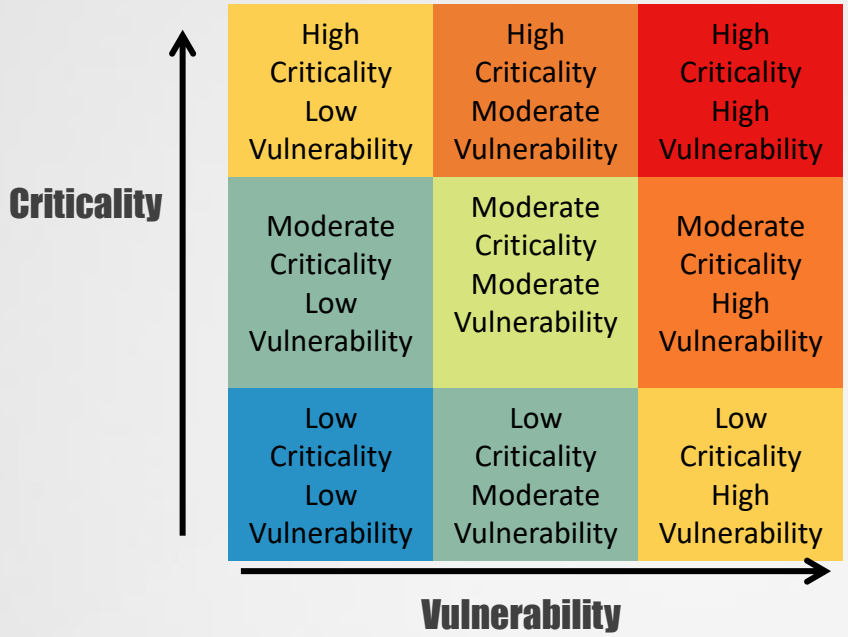

Allie Isbell, AICP
Houston-Galveston Area Council
THC August 6, 2021

Federal Highway Administration- Resilience Pilots

Study Goals



- Measure Criticality and Vulnerability of Regional Transportation Assets to Extreme Weather Events

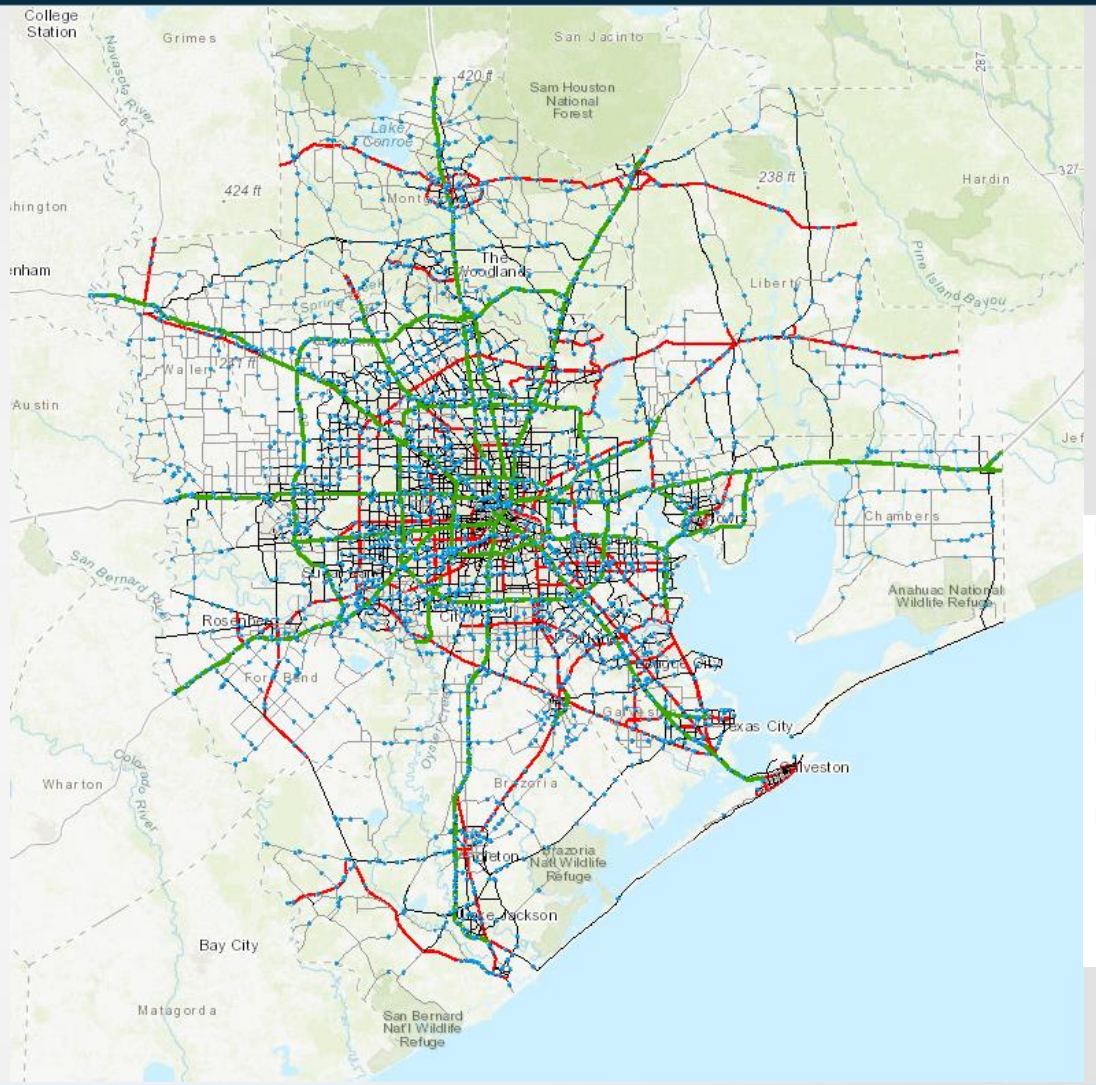


- Develop Adaptation Strategy Decision Tool that Provide Recommendations for a Resilient Transportation Infrastructure

- Update H-GAC publications and future project selection criteria

Transportation Assets

- Freeways (83 segments)
- Major roads (7,696 segments)
  - Principal arterials
  - minor arterials
  - collectors
- Bridges (3,489) with waterway



Scope, Climate/ Extreme Weather Threats

FEMA Disaster Declarations
1967 - 2018

13	Floods
11	Severe Storms
6	Hurricanes
3	Fires
2	Coastal Storms

+ Work Group Feedback =

Scenarios:

Flooding

1. 500-Year Flood
2. Hurricane Harvey

Storm Surge

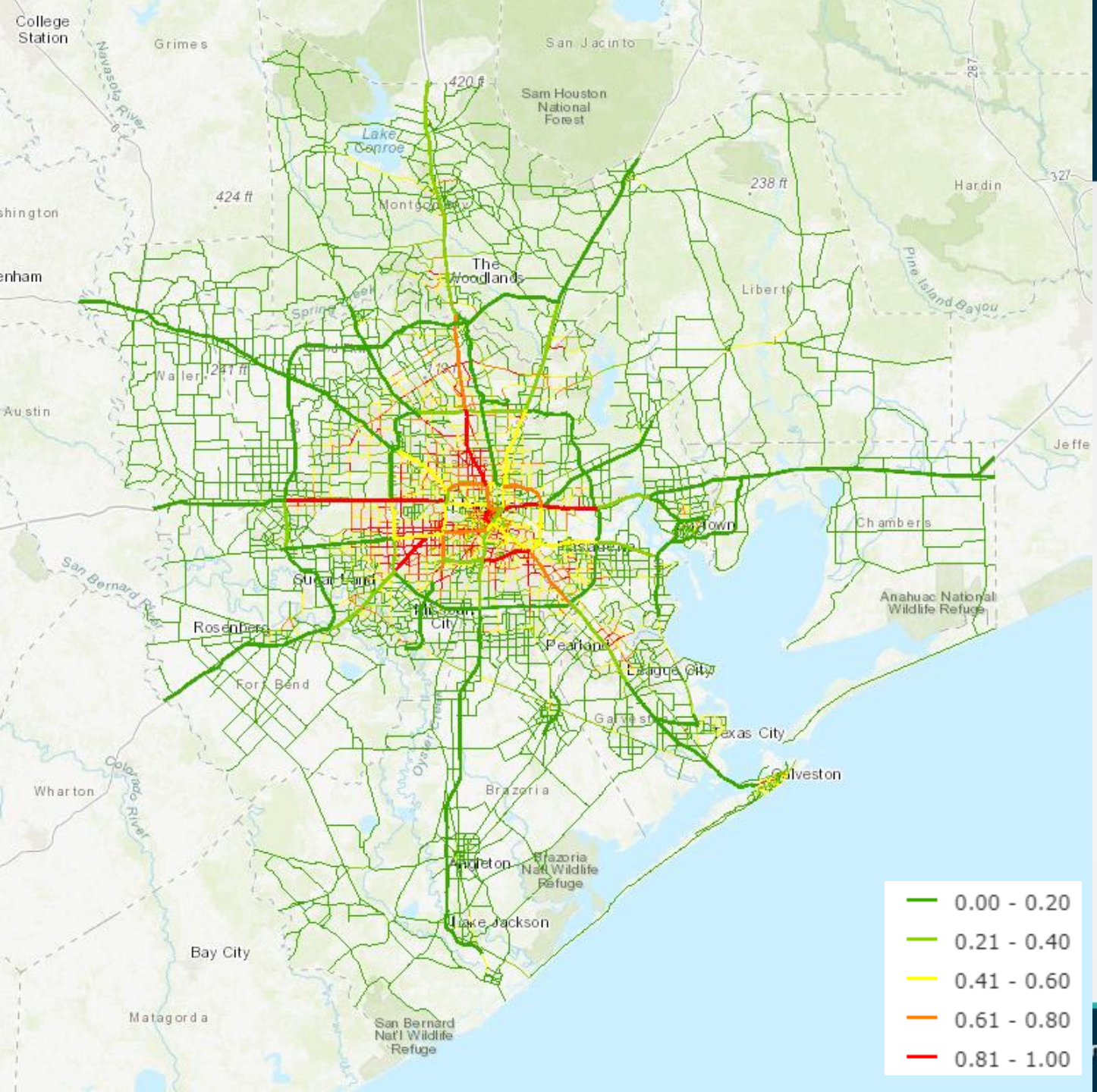
3. Category 4 Storm
4. Hurricane Ike

Sea Level Rise

5. 5-Ft Sea Level Rise

Criticality

Criticality Assessment



- **Socio-economic importance (20%)**

  link to airport; link to port; service to activity population

- **Operational & usage importance (40%)**

  AADT; AADT-truck; transit ridership

- **Health & safety importance (30%)**

  link to hospitals; link to fire stations; service to vulnerable population

- **Emergency response importance (10%)**

  evacuation route; link to shelters; link to EOCs; military access

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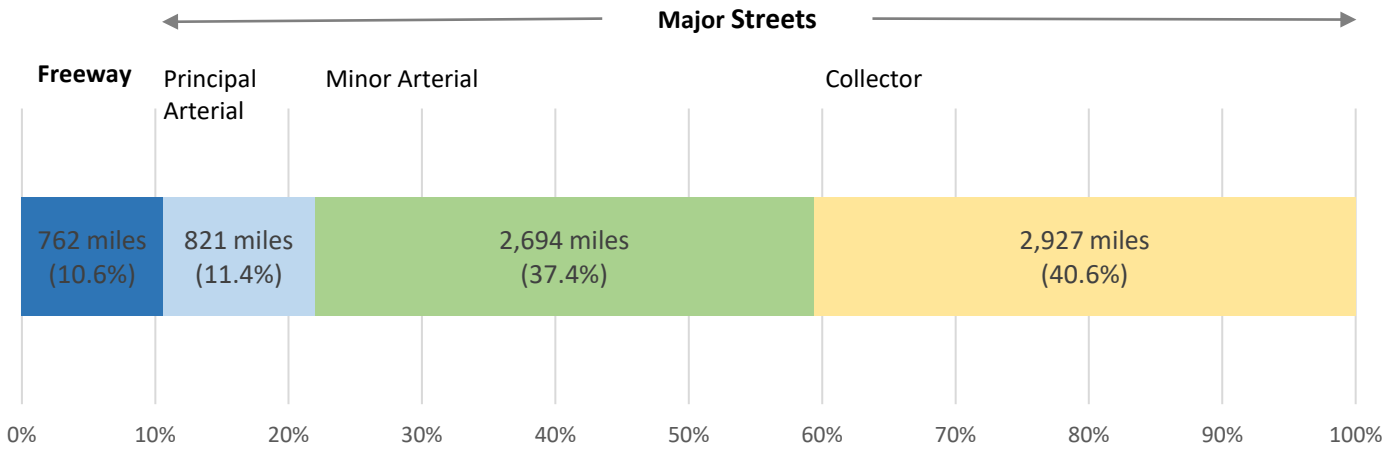
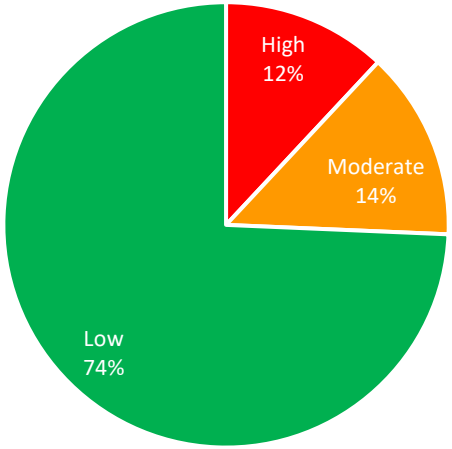
Criticality Assessment

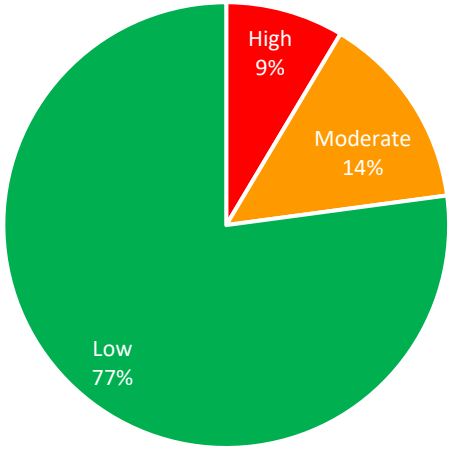
Total 7,204 centerline miles

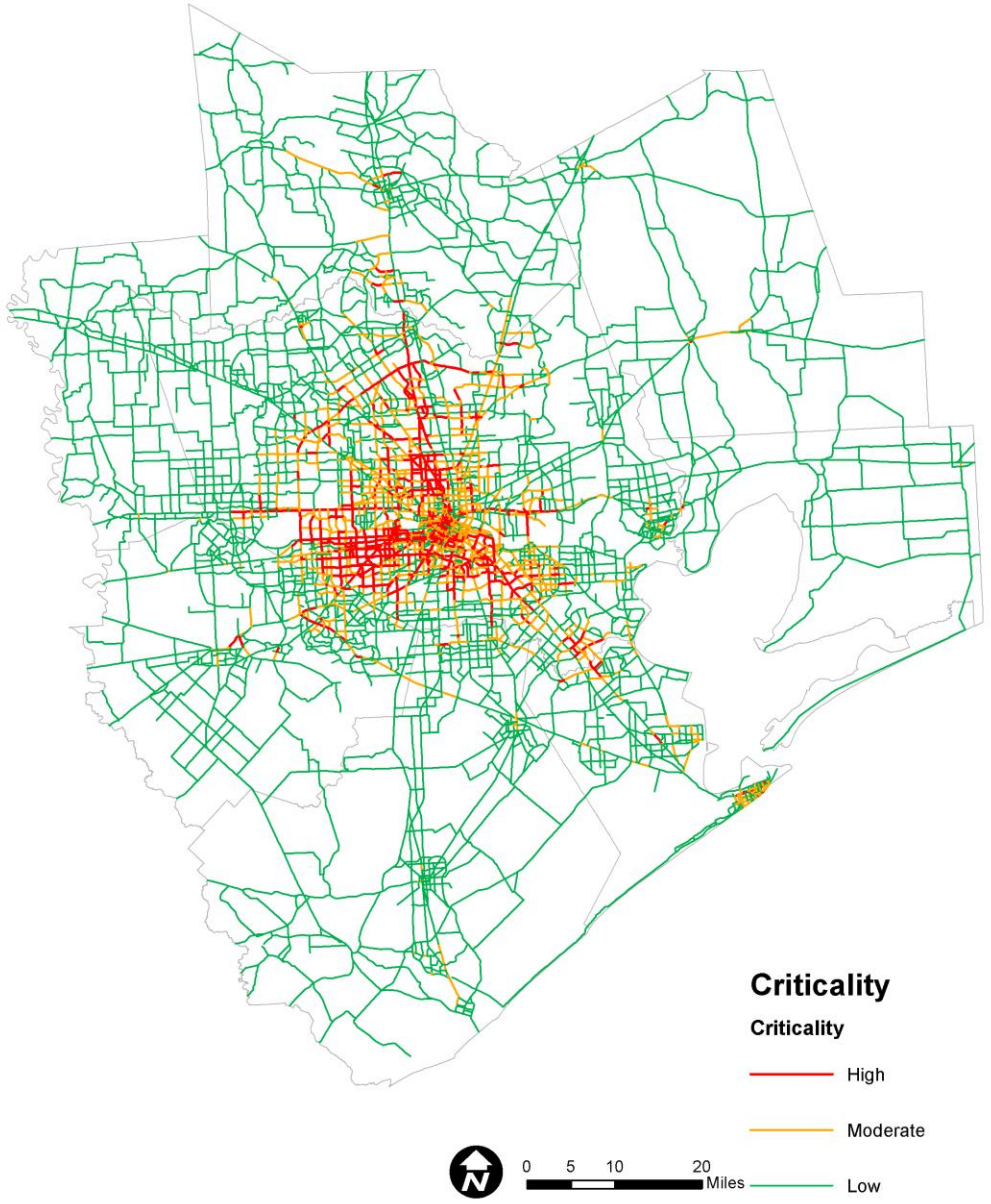


Freeways: 762 centerline miles (10.6%)



Major Streets: 6,442 centerline miles (89.4%)





Vulnerability

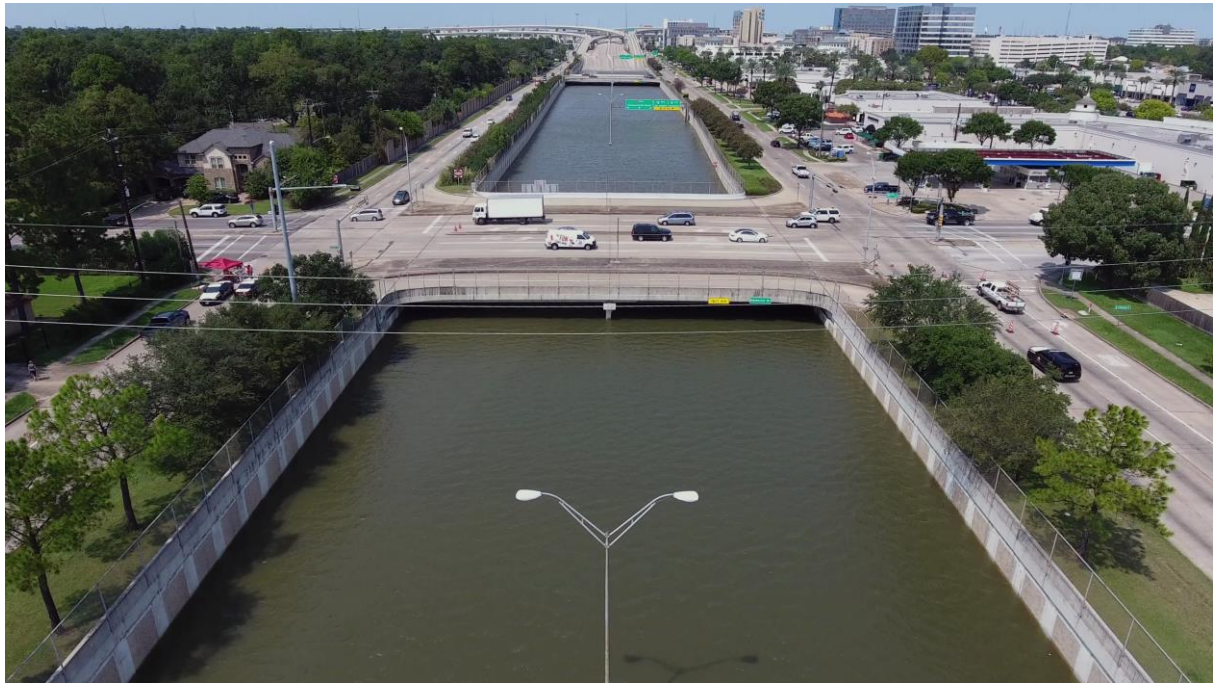
Exposure Assessment: Harvey Flooding

BW 8 at IH-10 South

Post Harvey Aerial Imagery (2017)

Flight Timeline

- Aug. 30, 2017 - Sept. 8, 2017



BW 8 at Memorial Drive

Miles
0 0.25 0.5

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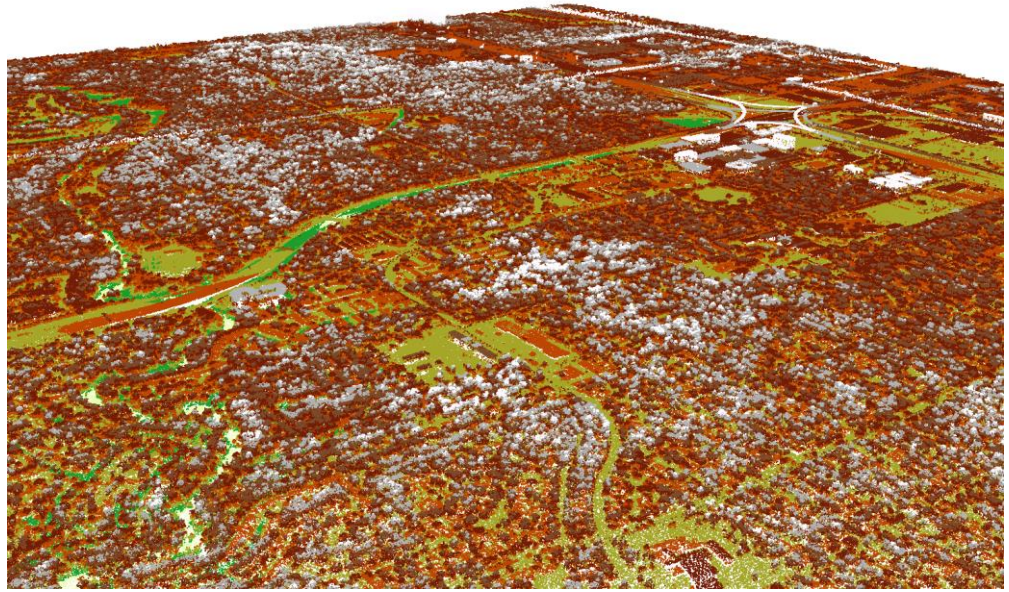
Exposure Assessment: Harvey Flooding

BW 8 at IH-10

Digital Surface Model (DSM) from 2018 LiDAR

Digital Surface Model (DSM) represents the elevations of the reflective surfaces of **roadways** and **bridges** elevated above the ground.



LiDAR LAS image

Legend

DSM

High

Low

Miles

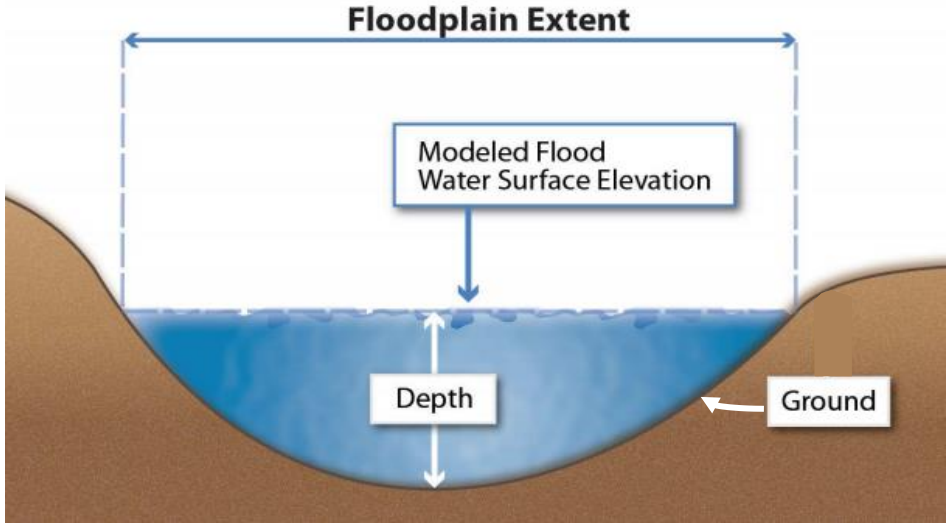
0 0.25 0.5

Exposure Assessment: Harvey Flooding

BW 8 at IH-10 South

FEMA Harvey Flood Model (2017)

Water Depth Grid =
Modeled Flood Water Surface Elevation – Ground Elevation (DEM)



Harvey Depth Grid

Feet

- 0 - 5
- 6 - 10
- 11 - 20
- 21 - 40
- 41 +

0 0.25 0.5 Miles

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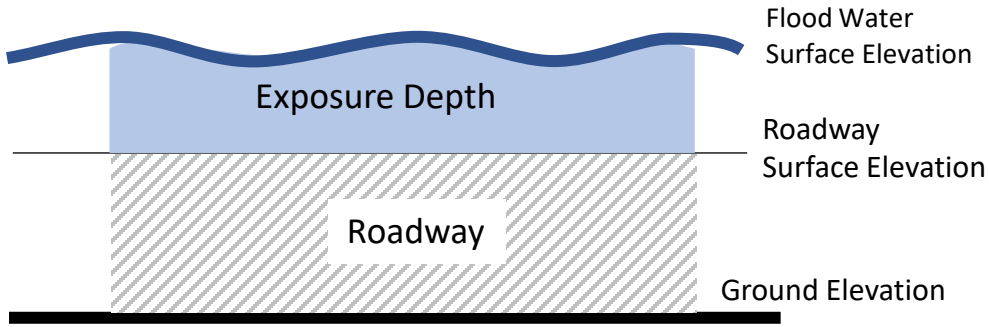
Exposure Assessment: Harvey Flooding

BW 8 at IH-10 South

Exposure Depth Grid

Exposure Depth =
Flood Water Surface Elevation – Digital Roadway Surface Elevation



Legend

Exposure Depth Grid

Exposure Level

- No exposure or low risk
- Medium-low risk
- Medium risk
- Medium-high risk
- High risk

Exposure Description	Exposure Level
Not exposed/ Less than 0 foot of flood water	No exposure or low risk
0 - 1 foot of flood water	Medium-low risk
1 - 2 feet of flood water	Medium risk
2 - 3 feet of flood water	Medium-high risk
More than 3 feet of flood water	High risk

0 0.25 0.5 Miles

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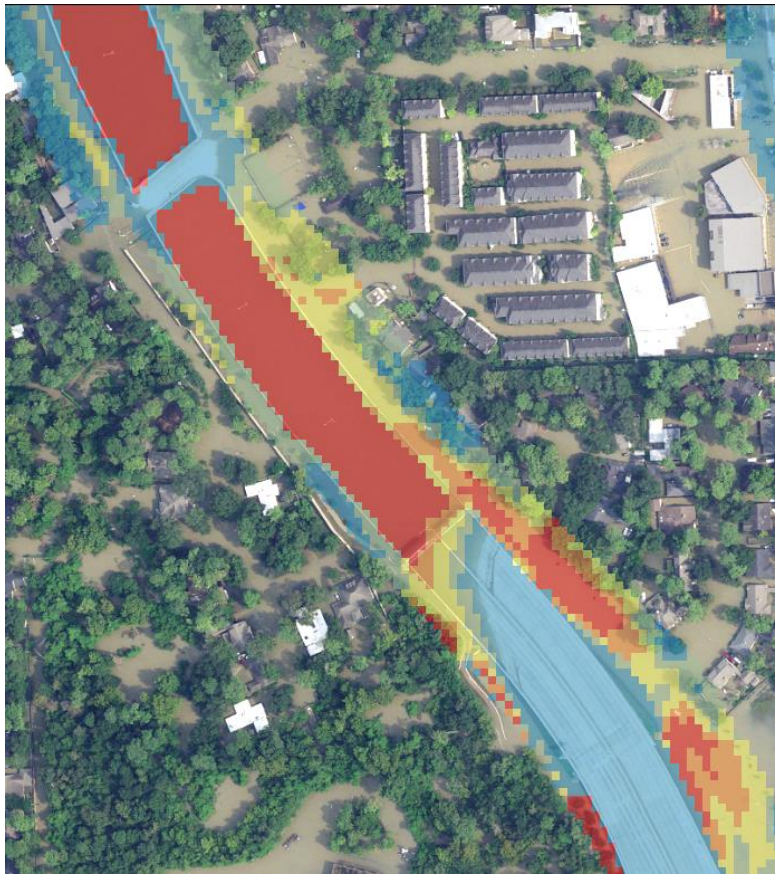
Exposure Assessment: 500-Year Flooding

BW 8 at IH-10 South



Legend

Exposure Depth Grid

Exposure Level

- No exposure or low risk
- Medium-low risk
- Medium risk
- Medium-high risk
- High risk

Miles

0 0.25 0.5

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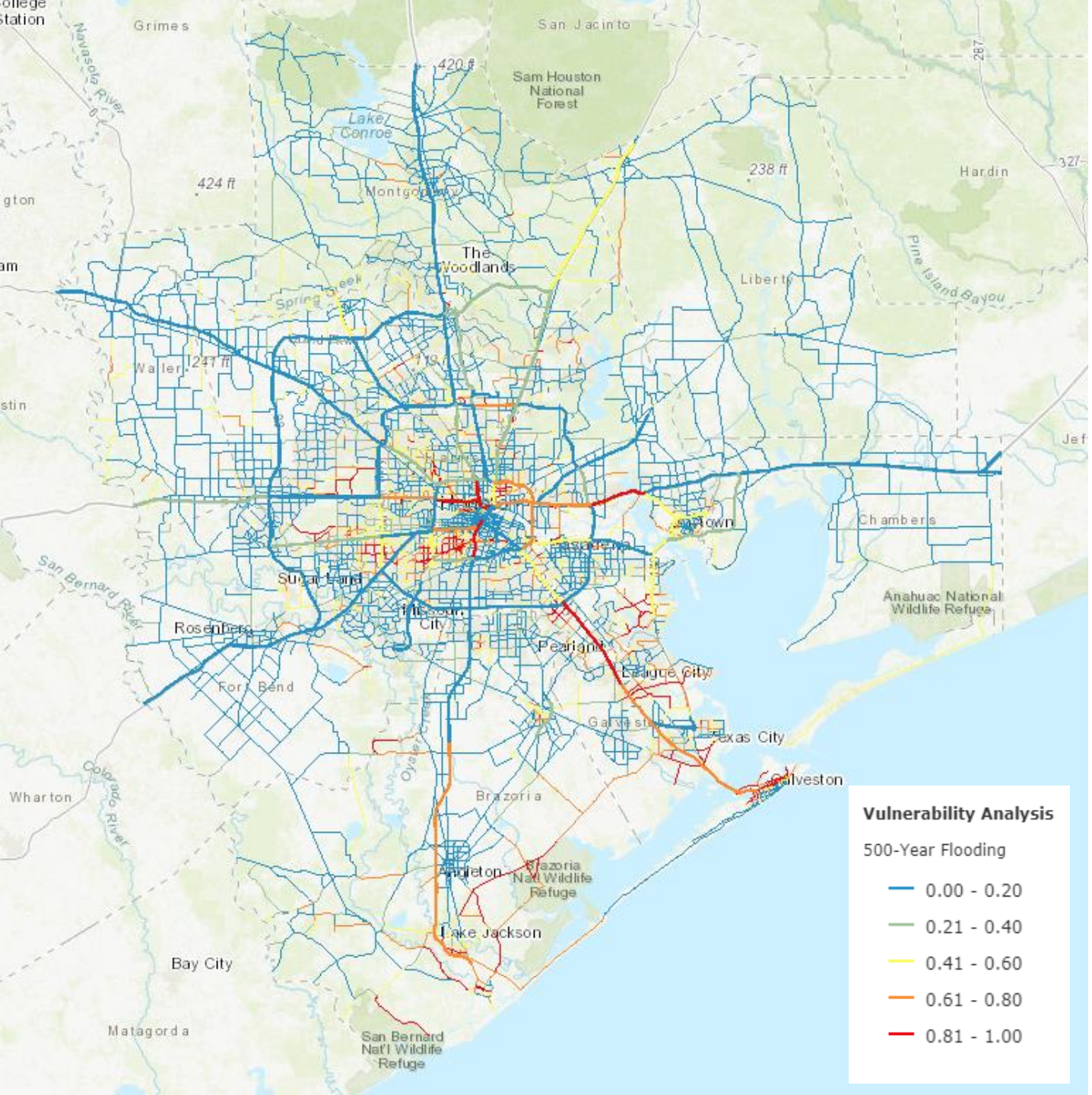
Vulnerability Assessment
VAST Tool



- **Exposure Assessment (70%)**
  - Flooding (100-year, 500-year, & Harvey)
  - Storm Surge (Hurricane Category 1 - 5 and Ike)
  - Sea-Level Rise (4 & 5 feet)

- **Sensitivity Assessment (20%)**
  - Bridge Age
  - Structural Evaluation
  - Channel Conditions
  - Scour Ratings
  - Pavement Condition
  - Past Closure

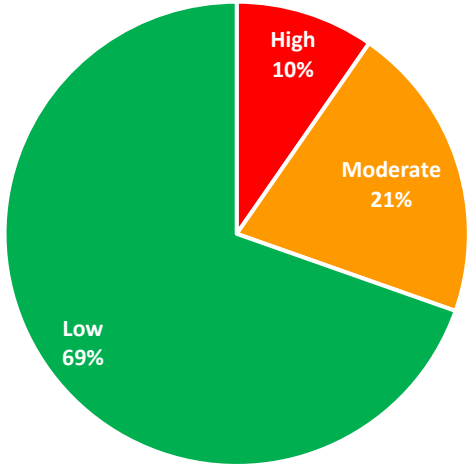
- **Adaptive Capacity Assessment (10%)**
  - Detour Length
  - Repair Cost

H-GAC METROPOLITAN PLANNING ORGANIZATION

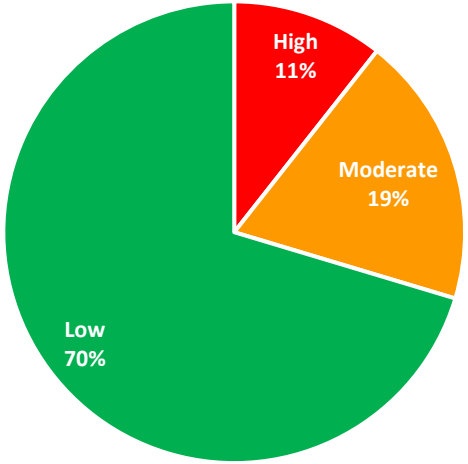
Vulnerability Assessment

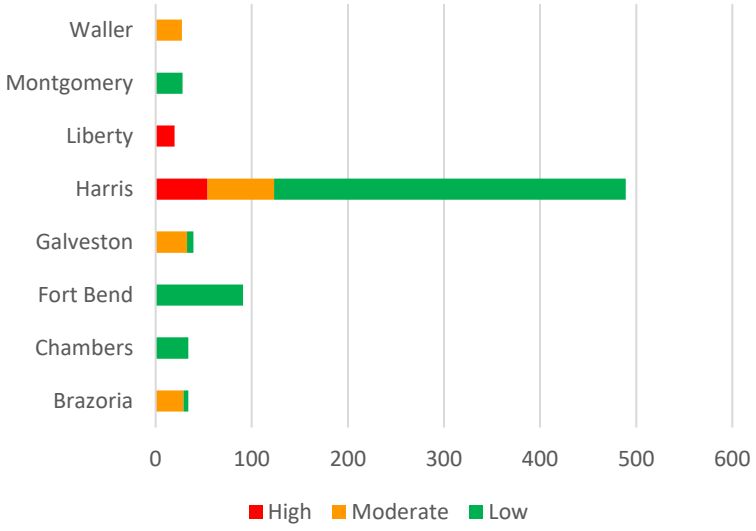
Vulnerability: Flooding (500-year flooding 50% + Harvey Flooding 50%)

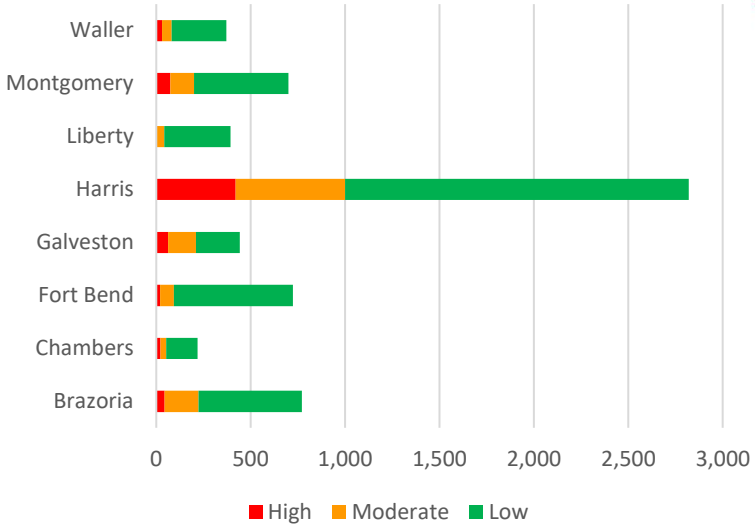
Freeways: 762 centerline miles

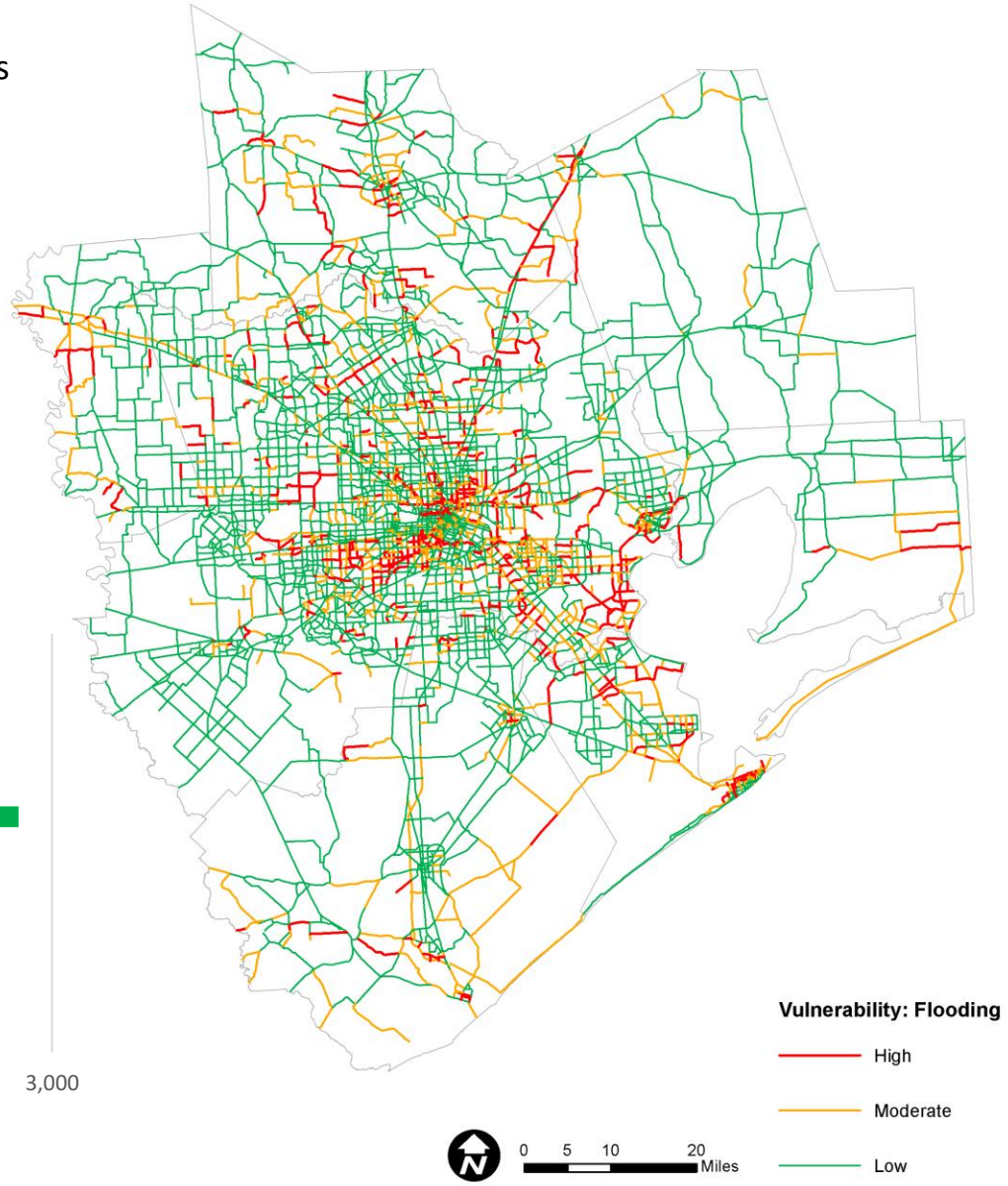


Major Streets: 6,442 centerline miles





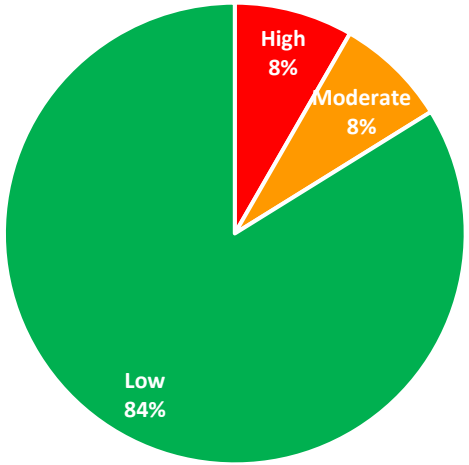




Vulnerability Assessment

Vulnerability: Storm Surge (Category 4 Storm Surge 50% + Ike Storm Surge 50%)

Freeways: 762 centerline miles



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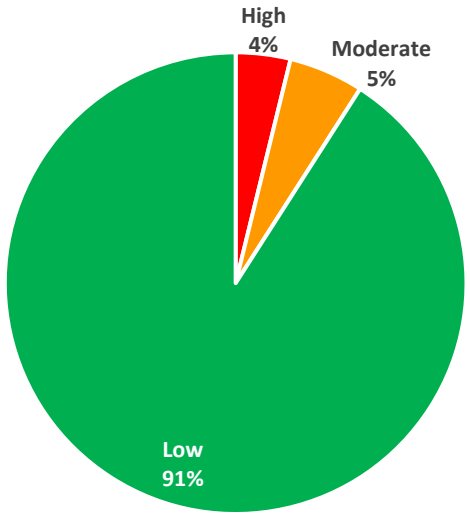
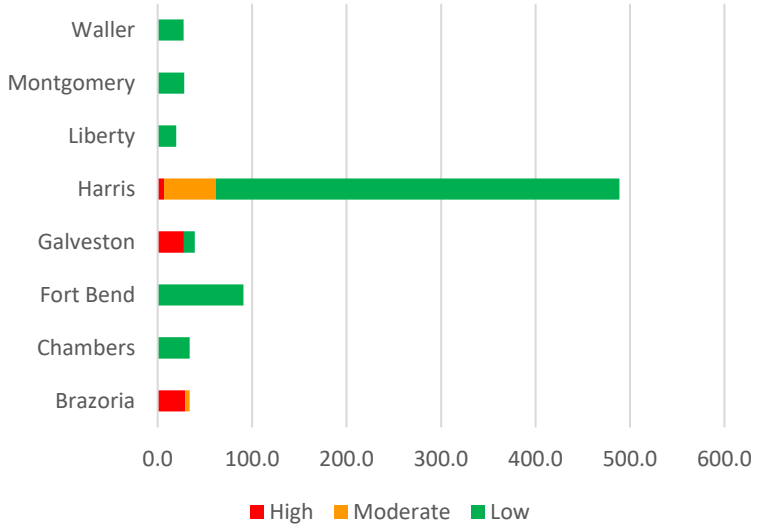
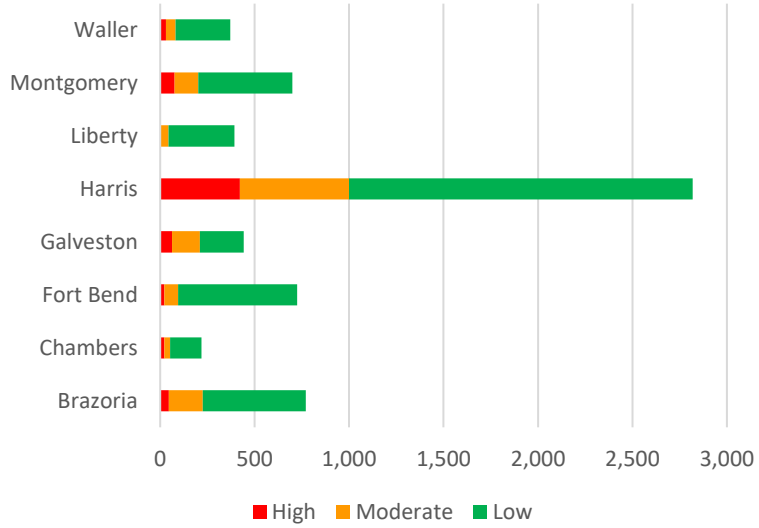
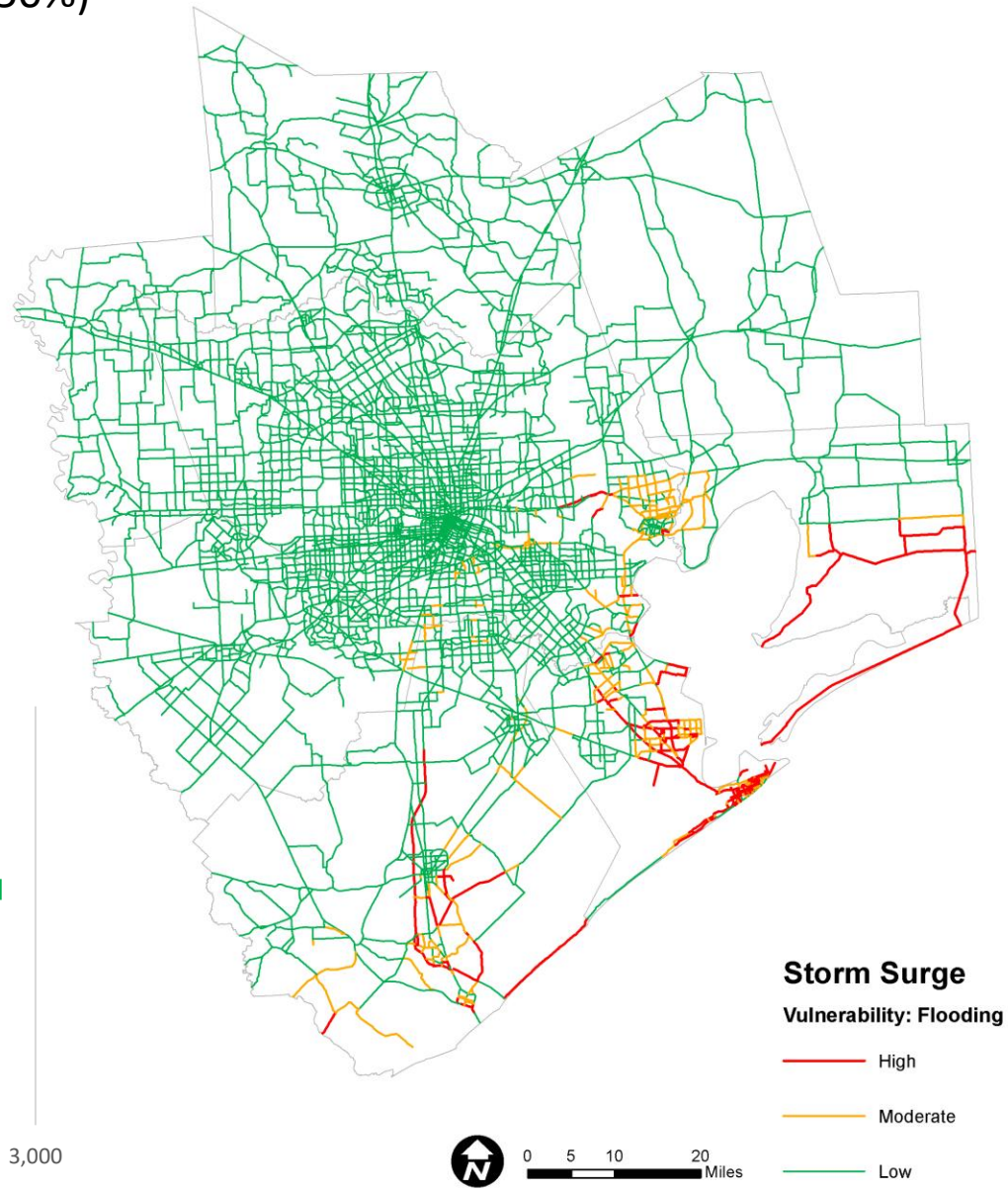




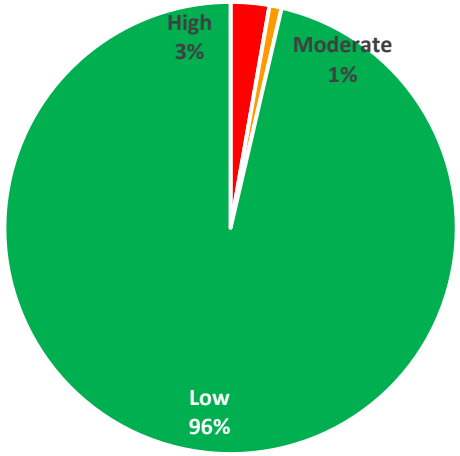




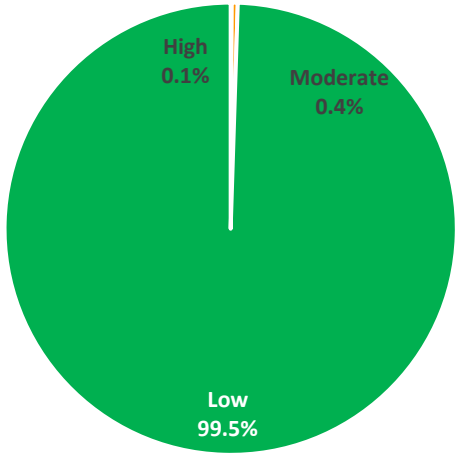
Vulnerability Assessment

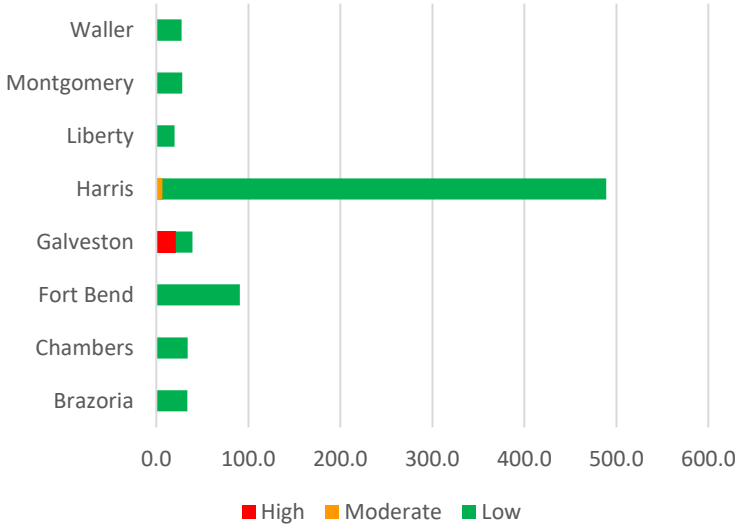
Vulnerability: Sea-Level Rise (5-ft Sea-Level Rise 100%)

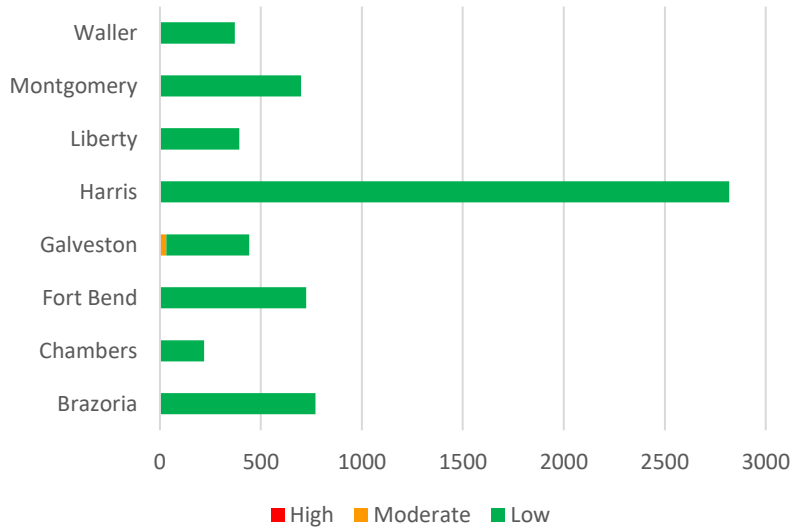
Freeways: 762 centerline miles

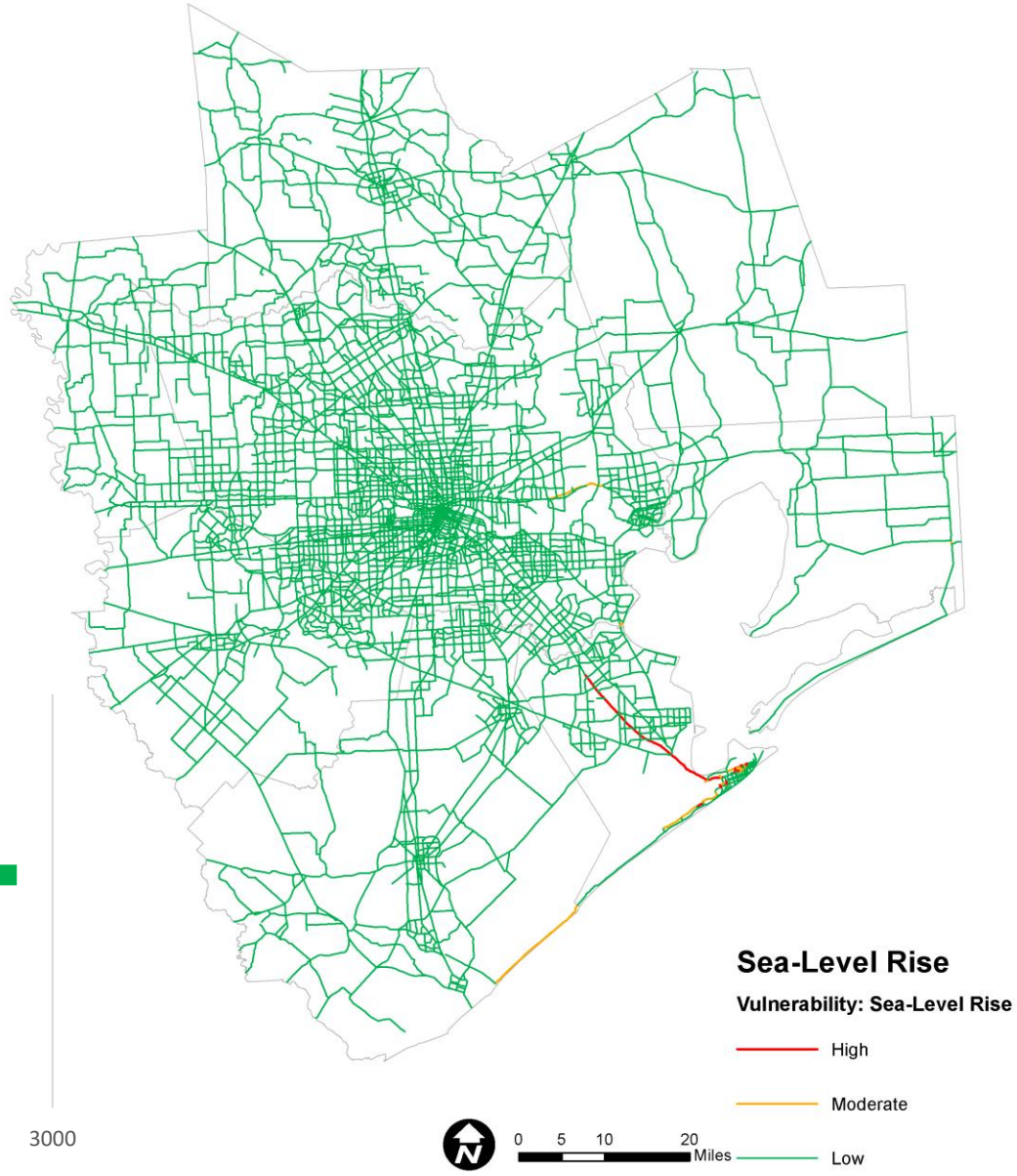


Major Streets: 6,442 centerline miles





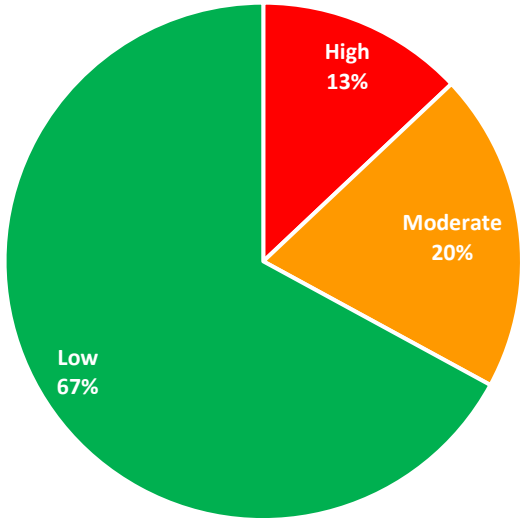


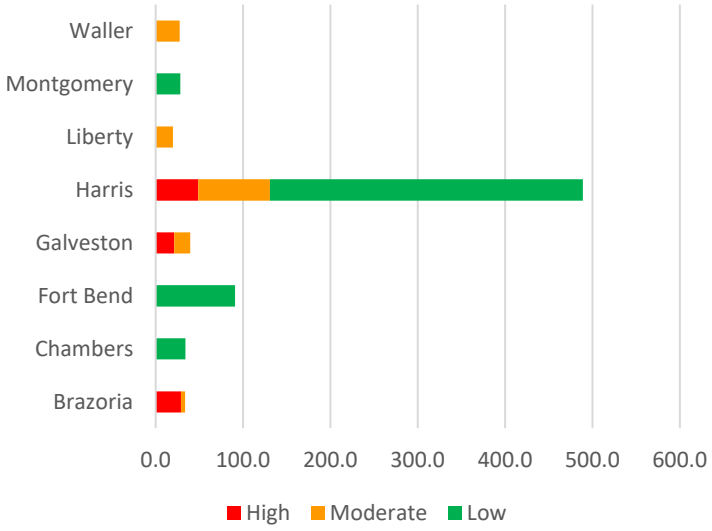


Vulnerability Assessment

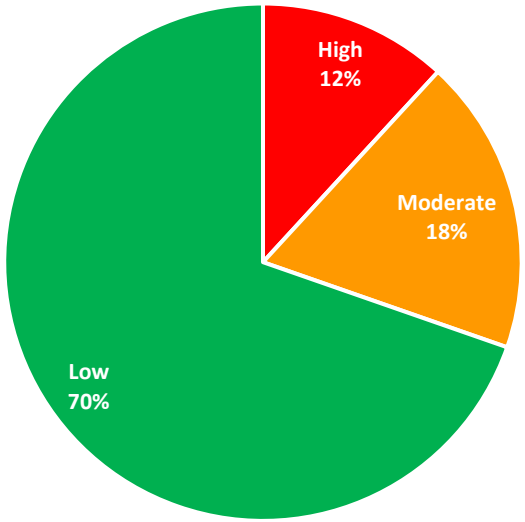
Vulnerability: Combined (Flooding 50% + Storm Surge 35% + Sea-Level Rise 15%)

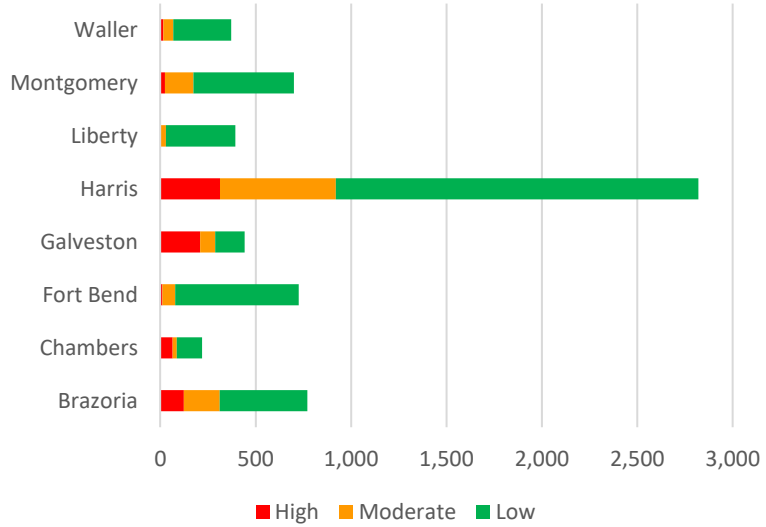
Freeways: 762 centerline miles

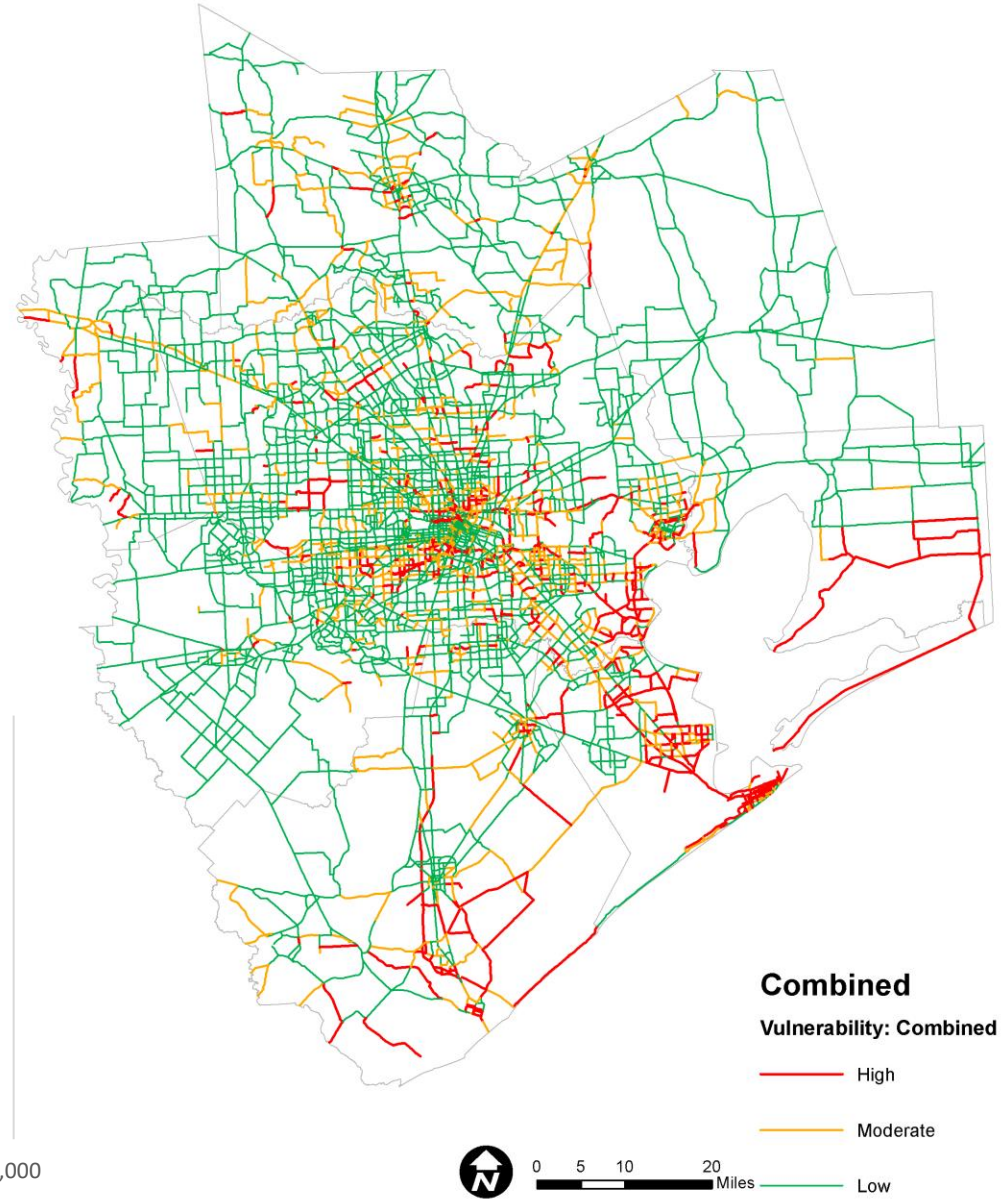




Major Streets: 6,442 centerline miles



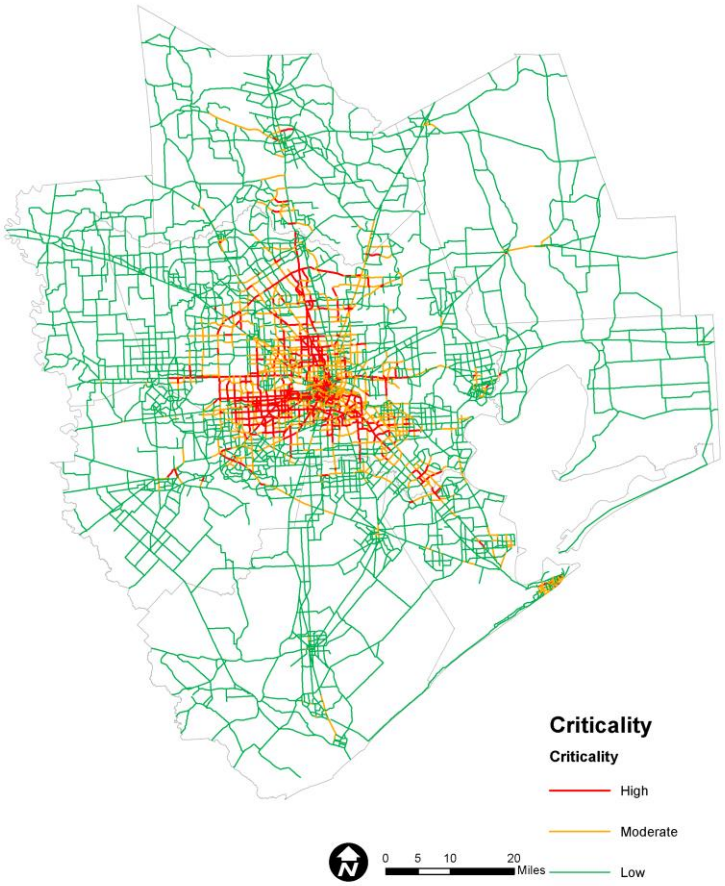




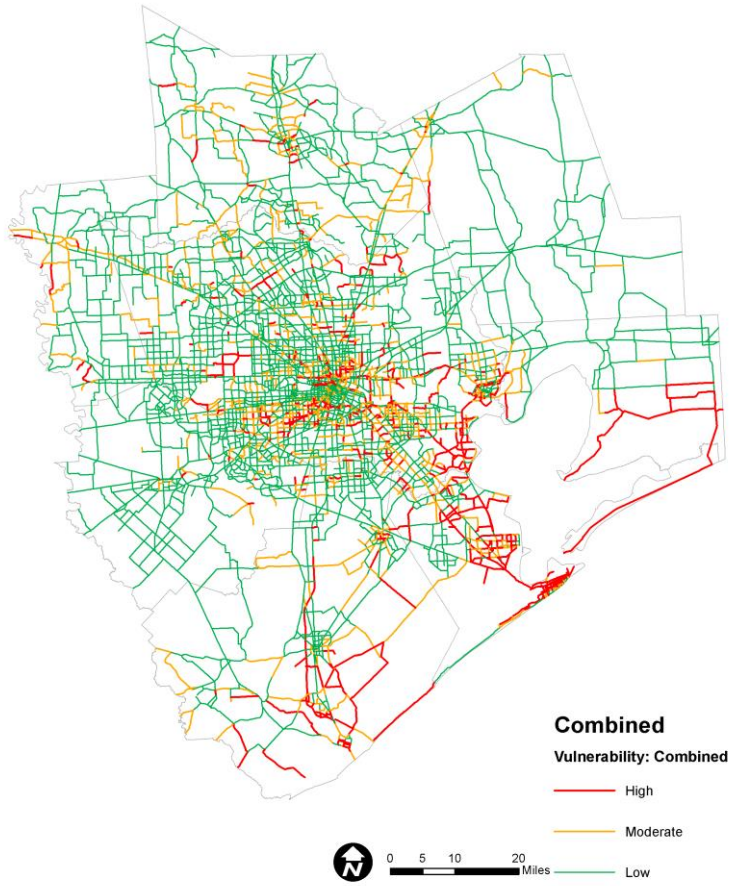
Criticality-Vulnerability Matrix

Vulnerability – Criticality Matrix

Criticality (3 types)



Vulnerability (3 types)

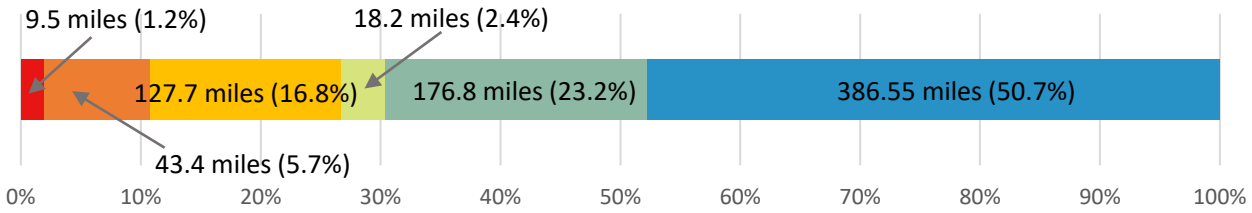


Criticality-Vulnerability Matrix (9 types)

High Criticality Low Vulnerability	High Criticality Moderate Vulnerability	High Criticality High Vulnerability
Moderate Criticality Low Vulnerability	Moderate Criticality Moderate Vulnerability	Moderate Criticality High Vulnerability
Low Criticality Low Vulnerability	Low Criticality Moderate Vulnerability	Low Criticality High Vulnerability

Vulnerability – Criticality Matrix

Freeways: 762 centerline miles

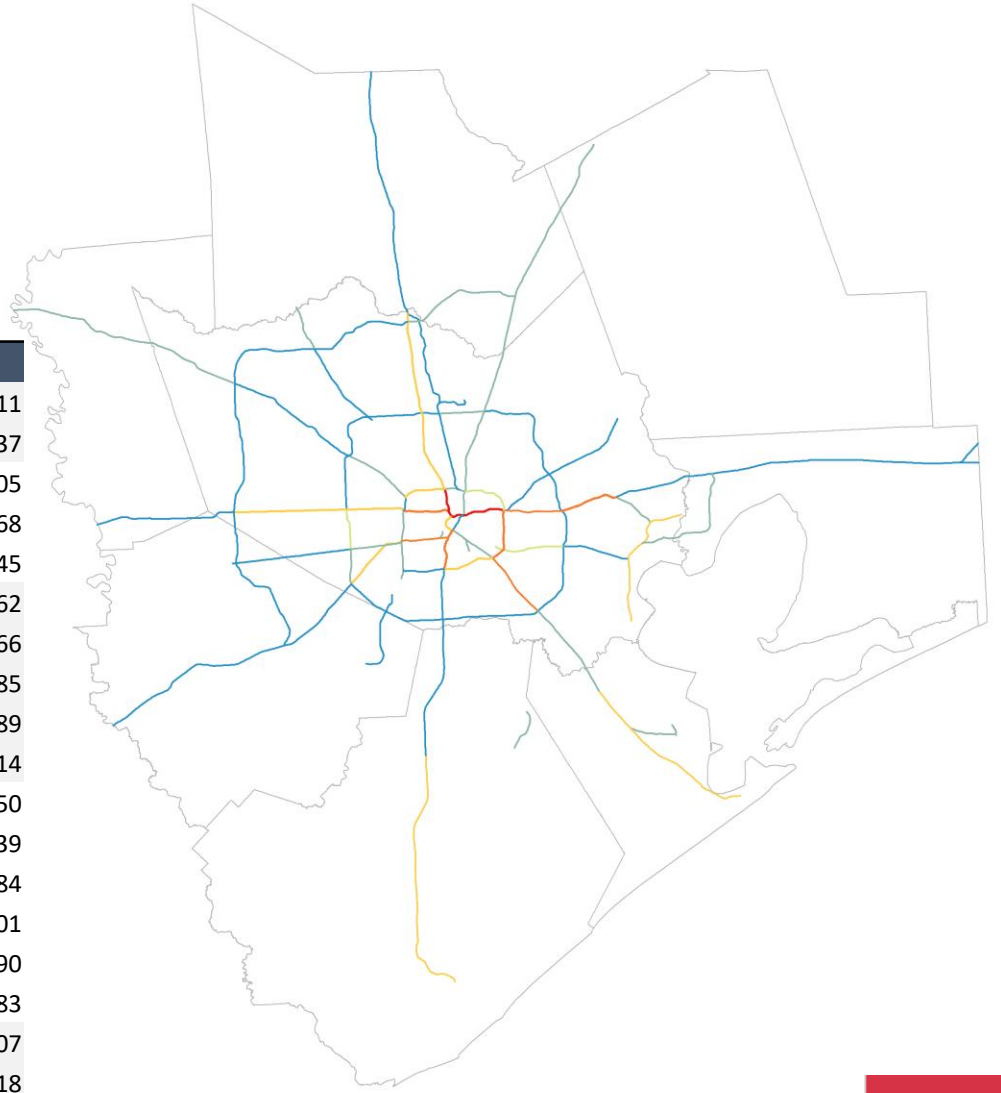


Matrix Summary

Matrix	Miles	%
Total	762.2	100.0%
High Criticality -High Vulnerability	9.5	1.2%
Moderate Criticality -High Vulnerability	23.2	3.0%
High Criticality -Moderate Vulnerability	20.2	2.6%
Low Criticality -High Vulnerability	66.2	8.7%
High Criticality -Low Vulnerability	61.5	8.1%
Moderate Criticality -Moderate Vulnerability	18.3	2.4%
Low Criticality -Moderate Vulnerability	113.7	14.9%
Moderate Criticality -Low Vulnerability	63.1	8.3%
Low Criticality -Low Vulnerability	386.5	50.7%

Freeways Details (excerpt)

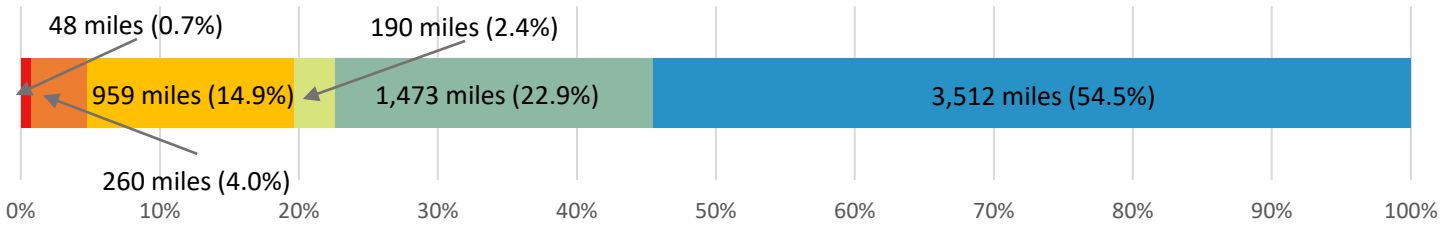
Matrix	Name	Miles
High Criticality – High Vulnerability	I-45	3.11
	IH 10 E	6.37
High Criticality -Moderate Vulnerability	GULF FWY/IH 45	8.05
	IH 10 E	6.68
	IH 69	5.45
Moderate Criticality -High Vulnerability	IH 10 E	6.62
	IH 10 W	5.66
	IH 69	0.85
	SOUTH FWY/SH 288	3.89
	SOUTH LOOP E	6.14
High Criticality – Low Vulnerability	IH 10 W	19.50
	IH 45	2.39
	IH 69	7.84
	NORTH FWY/IH 45	21.01
	NORTH LOOP	4.90
	SOUTH LOOP E	5.83
Low Criticality – High Vulnerability	GULF FWY/IH 45	21.07
	SH 146	16.18
	SH 288	28.94



METROPOLITAN PLANNING ORGANIZATION

Vulnerability – Criticality Matrix

Major Streets: 6,442 centerline miles

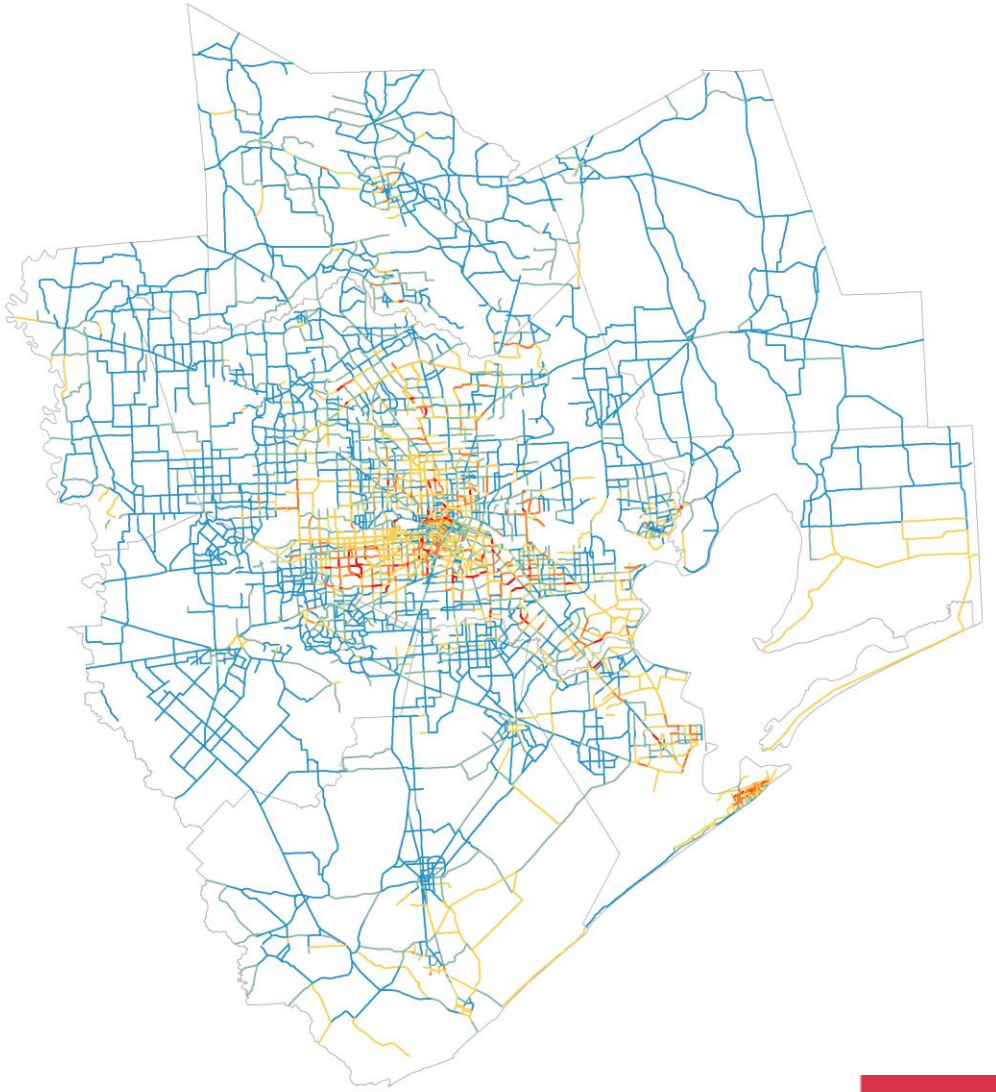


Matrix Summary

Matrix	Miles	%
Total	6,442.0	100.0%
High Criticality -High Vulnerability	48	0.7%
Moderate Criticality -High Vulnerability	119	1.9%
High Criticality -Moderate Vulnerability	140	2.2%
Low Criticality -High Vulnerability	595	9.2%
High Criticality -Low Vulnerability	364	5.7%
Moderate Criticality -Moderate Vulnerability	191	3.0%
Low Criticality -Moderate Vulnerability	861	13.4%
Moderate Criticality -Low Vulnerability	611	9.5%
Low Criticality -Low Vulnerability	3,512	54.5%

Principal Arterials Details (excerpt)

Matrix	Name	Miles
High Criticality -High Vulnerability	BROADWAY (Galveston)	2.617
	SH 3	1.537
	BROADWAY (Houston)	0.777
	COLLEGE	1.199
	CULLEN	0.735
	FAIRMONT PKWY	1.021
	FEDERAL	0.462
	FM 1960	0.142
	KIRBY DR	0.635
	LOCKWOOD DR	0.620
	MEMORIAL DR	0.637
	MONROE	0.134
	NASA RD 1	1.237
	OLD SPANISH TRAIL	0.102
	SH 35	0.794
	SH 146/LOOP 201	0.239
	SHAVER	0.437
	SPENCER HWY	0.463
	LOOP 336	0.119



METROPOLITAN PLANNING ORGANIZATION

Economic Impact Analysis

Economic Impact Analysis

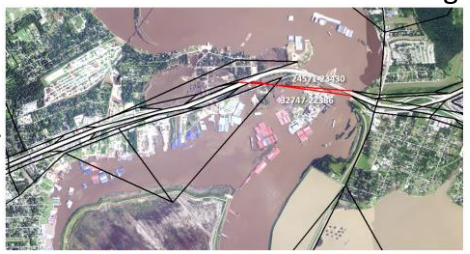
Scenario 5: US 59

Scenario 6: FM 723 & FM 359

Scenario 7: IH 10

Scenario 8: North-South Connecters along Buffalo Bayou between Memorial Dr and Briar Forest

Scenario 1: IH 10 San Jacinto Bridge



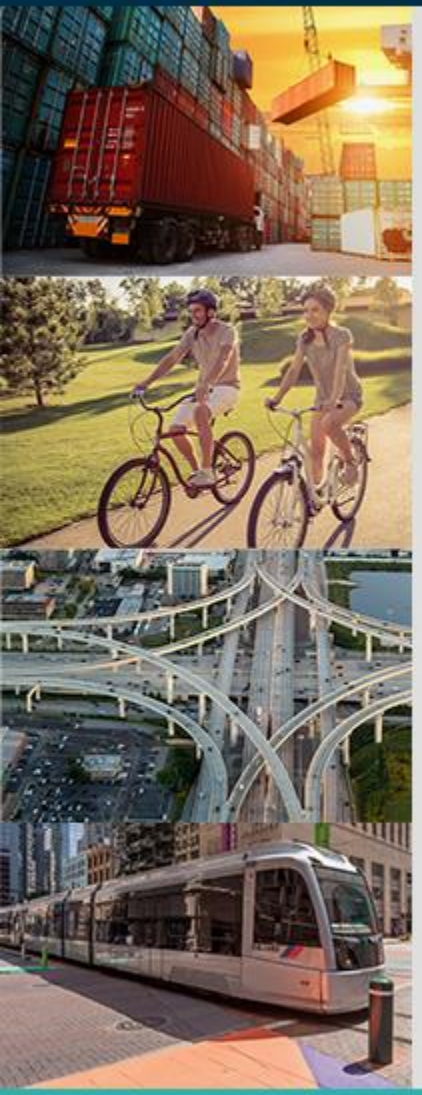
Scenario 2: Gulf Freeway Galveston Causeway

Scenario 3: SH 146 Fred Hartman Bridge

Scenario 4: SH 225/Lawndale St.

METROPOLITAN PLANNING ORGANIZATION

Economic Impact Analysis



GDP Loss (Million of Fixed Dollars in 2020) by Scenarios

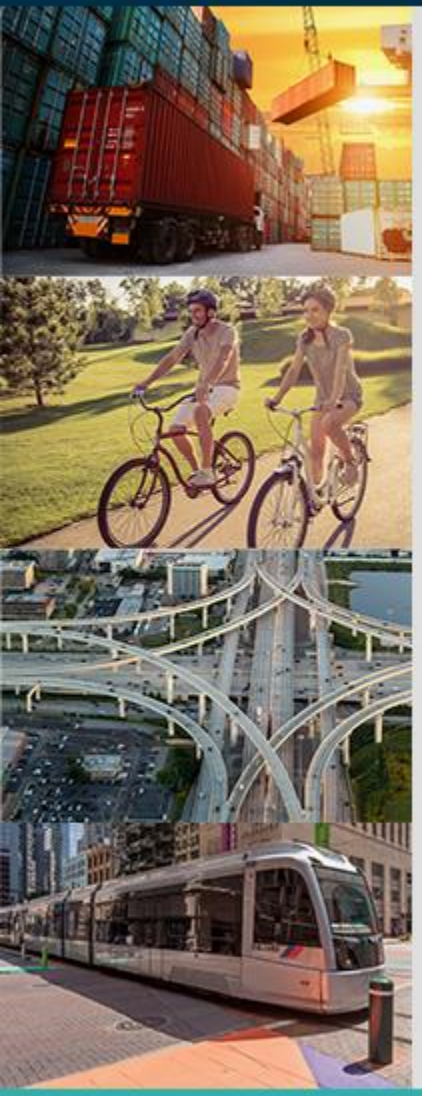
Scenario	Description	Annual	Month	Week	Day
Scenario 1	IH 10 San Jacinto Bridge	206.9	17.2	4.0	0.6
Scenario 2	Gulf Freeway Galveston Causeway	599.2	49.9	11.5	1.7
Scenario 3	SH 146 Fred Hartman Bridge	205.6	17.1	4.0	0.6
Scenario 4	SH 225/Lawndale St.	191.5	16.0	3.7	0.5
Scenario 5	US 59	182.5	15.2	3.5	0.5
Scenario 6	FM 723 & FM 359	173.6	14.5	3.3	0.5
Scenario 7	IH 10	215.3	17.9	4.1	0.6
Scenario 8	North-South Connecters along Buffalo Bayou between Memorial Dr and Briar Forest	494.8	41.2	9.5	1.4
Scenario 1+3+4		431.0	35.9	8.3	1.2
Scenario 1-8		1,407.5	117.3	27.1	4.0

Source- H-GAC Travel Demand Data and REMI Transight

Resiliency Adaptation Strategies

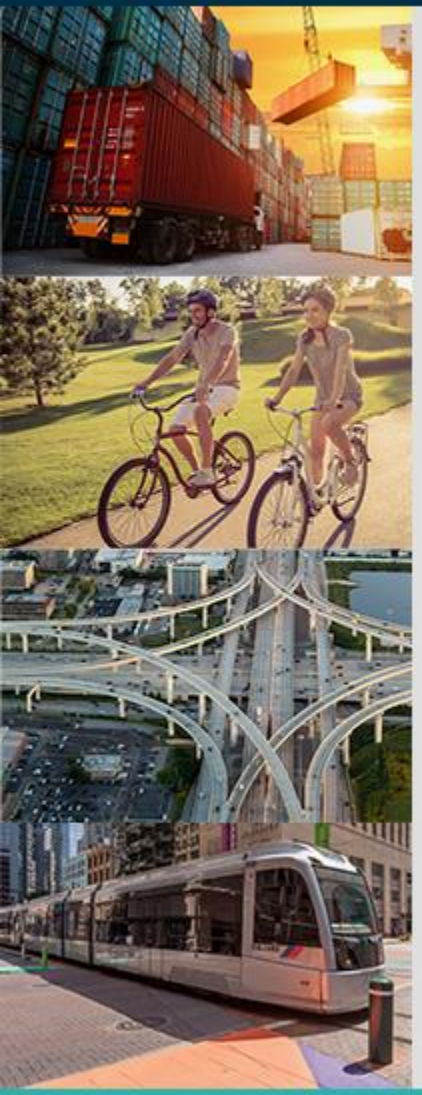
Resiliency Adaptation Strategies	Criticality			Vulnerability			Climate Stressor		
	Low	Moderate	High	Low	Moderate	High	Flooding	Storm Surge	Sea Level Rise
STORMWATER MANAGEMENT									
1. Increase Number of Swales & Ditches		X	X		X	X		X	X
2. Retention/Detention Basins		X			X		X		
3. Depressed/Raised Medians		X			X		X		
4. Bioswales	X			X			X		
5. Green Infrastructure	X	X		X	X		X		
MAINTENANCE									
1. Culvert Cleaning		X	X		X		X	X	
PLANNING/SOCIAL									
1. Stormwater Management Plan		X	X		X		X		
2. Land Use Planning / Climate Justice		X	X		X		X	X	X
3. Relocate/Abandon Roads	X					X	X		X
4. Shelter in place	X	X	X	X			X		
5. Evacuation/special Route Identification	X	X	X		X	X	X	X	X
6. Prohibiting Overweight/Oversize Vehicles			X	X	X	X	X		
7. Sensor Technologies and Monitoring Programs			X		X	X			
INFRASTRUCTURE									
1. Enhanced Road Surface		X	X	X			X		
2. Enhanced Sub Grade			X		X	X	X	X	
3. Hardened Shoulders		X	X	X	X		X	X	
4. Raised Road Profile			X		X	X	X	X	X
5. Geosynthetics/Geotextiles		X	X		X	X	X	X	
6. Permeable Pavement	X			X			X		
OTHER									
1. Maintain/Restore Wetlands	X	X	X		X	X	X		
2. Beach Nourishment/Dune Restoration		X	X		X	X		X	X
3. Vegetation for Erosion Control	X	X		X	X		X		
4. Swales/Ditches	X			X			X		
5. Wave Attenuation Devices		X	X		X	X		X	
6. Debris Deflectors for Bridge Protection		X	X		X	X			

Next Steps- Resiliency Integration



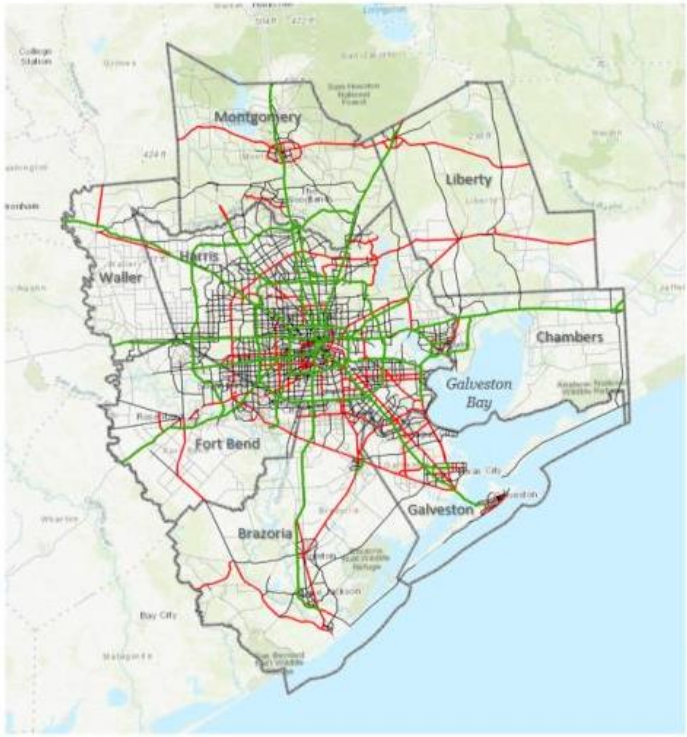
- Regional Transportation Plan
  - Significant incorporation
    - Highly Vulnerable & Highly Critical transportation infrastructure locations
    - 25 Adaptive Mitigation Strategies
- Transportation Improvement Program
  - Increase resiliency & environmental factors for project scoring to address:
    - Water Quality
    - Cultural Resources/ Open Space
    - Wetlands/ Resource Areas
    - Wildlife Preservation/ Protected habitats

Next Steps-Resilient Design



- Livable Centers
- Transit Oriented Development
- Low Impact Development
- Complete Streets

Figure 9 – TxDOT Major Road Network in Pilot Program Area



Contact and Links

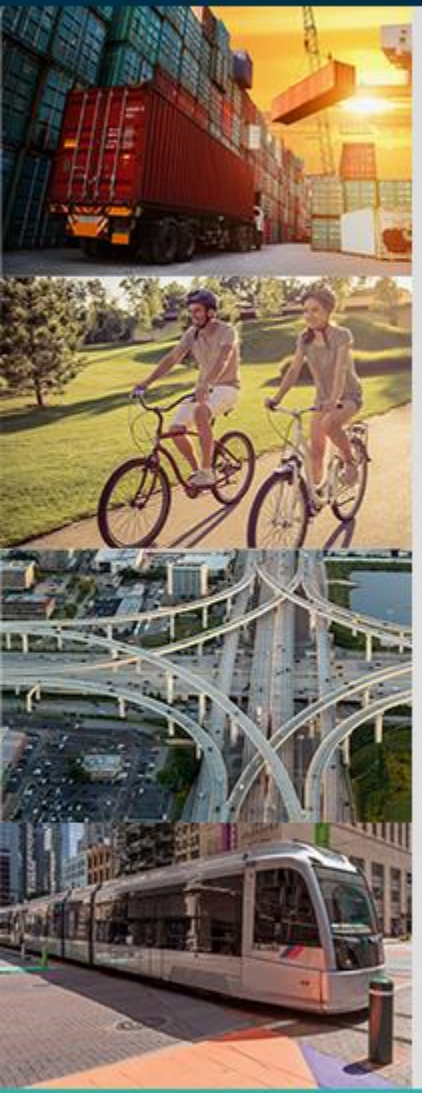
Resilience Tool

https://datalab.h-gac.com/resilience/

Contact Information

ALLIE ISBELL, AICP
Manager, Regional Planning
Houston-Galveston Area Council
Ph. No.: 713-993-2411
Email: allie.isbell@h-gac.com

Agenda



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Perspective on the Supply Chain Crisis	Brian Fielkow, GHFC, Jetco
Closing	

Scalable Truck Charging Demand Simulation for Cost-Optimized Infrastructure Planning

A Houston-Dallas Case Study

Ann Xu, Ph.D.
CEO, ElectroTempo, Inc.
ann.xu@electrotempo.com

electrotempo

About ElectroTempo

Spun out of Texas A&M Transportation Institute (TTI) and founded in 2020, **ElectroTempo** is an **Analytics-as-a-Service** company providing data insights in transportation electrification. We are solving the problem of siloed information faced by the diverse stakeholders in the e-mobility space.

Our Mission is to create the e-mobility ecosystem to accelerate EV deployment

Our Vision is to be the analytic backbone of strategic planning and impact accounting systems for EV investment

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About the Project

Team: ElectroTempo, Inc. and Texas A&M University

Funding Agency: U.S. Department of Energy Vehicle Technologies Office

Partners:

CenterPoint Energy

Houston and Dallas Clean Cities

Texas Electric Transportation Resources Alliance (TxETRA)

Find out how to get involved!

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The Problem

Long time to deploy EVs

- Diverse stakeholders
- Siloed information
- Split incentives

To deploy a diesel truck involves fleet managers & truck dealers

Order — 12 weeks — Receive

To deploy an electric truck involves fleet managers, truck dealers, charging providers & electric utilities

Plan — Build infrastructure — 18 months

Coordinate with utilities

To deploy electric cars and trucks in a region involves fleet managers, dealers, charging providers, electric utilities, property owners, & the government

Identify charging needs & opportunities — Build infrastructure — ?? years

Seek government grants and approvals

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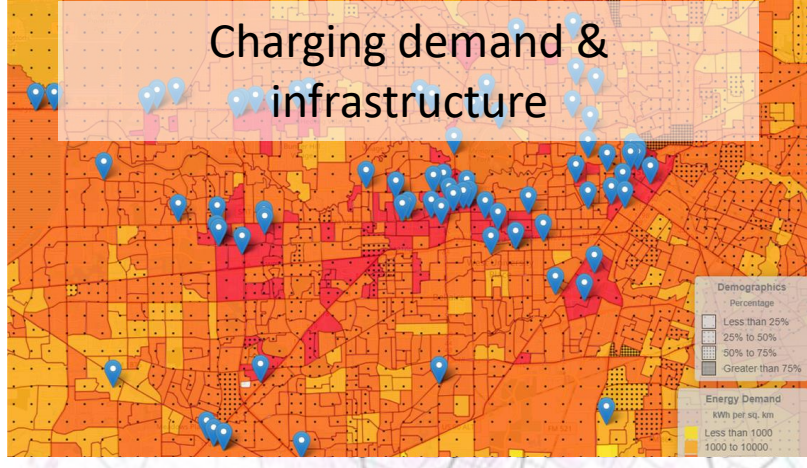
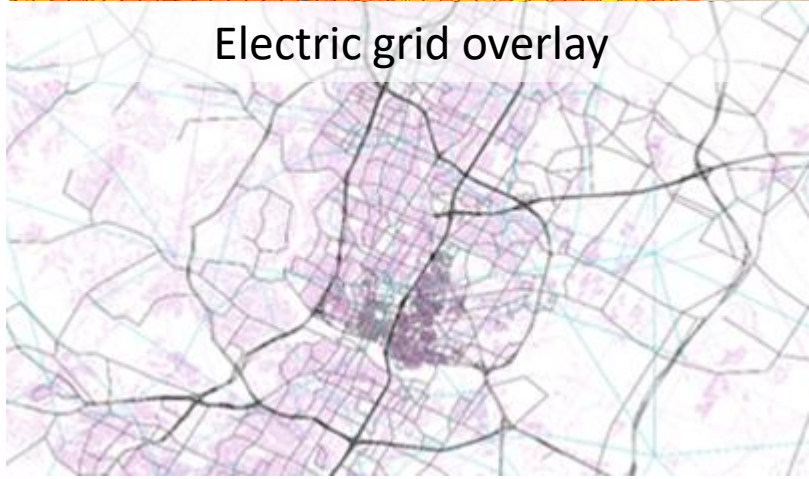
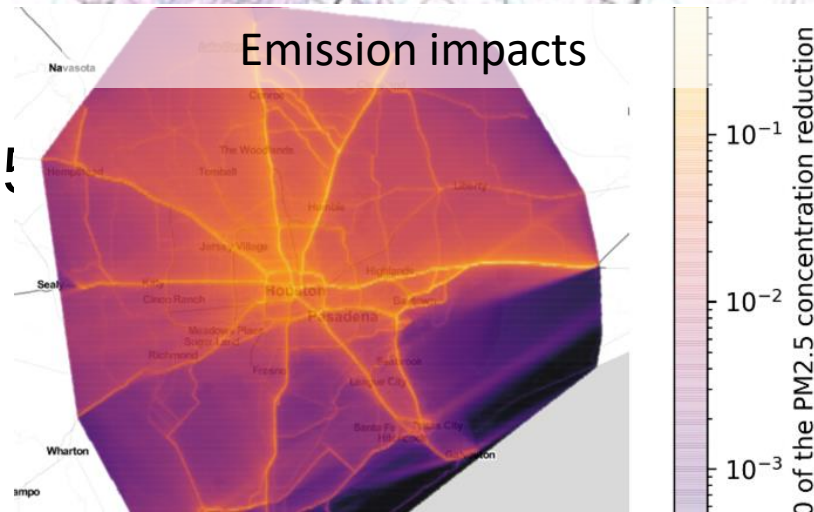
The Solution

A unifying data and simulation infrastructure integrating transportation demand, grid assets, land use, demographics, and emissions to optimally:

Accelerate EV deployment	Maximize return	Measure impacts
Through a shared view	For each stakeholder	On climate & equity







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Project Overview

Objectives

- Develop a truck charging demand model for large urban areas and along highway corridors
- Establish cost-optimization strategies for placing and sizing charging infrastructure

Scope of Work

- 2021Q4 - 2022: Truck Charging Demand Simulation and Validation
- 2023: Cost Optimization
- 2024: Stakeholder Engagement

Value to Fleets

Help electric utilities anticipate truck charging demand and thus prepare the electric grid to support charging

Estimate the type and size of chargers needed to support operations

Identify charging strategies to save up to $10k per year per truck in electricity cost

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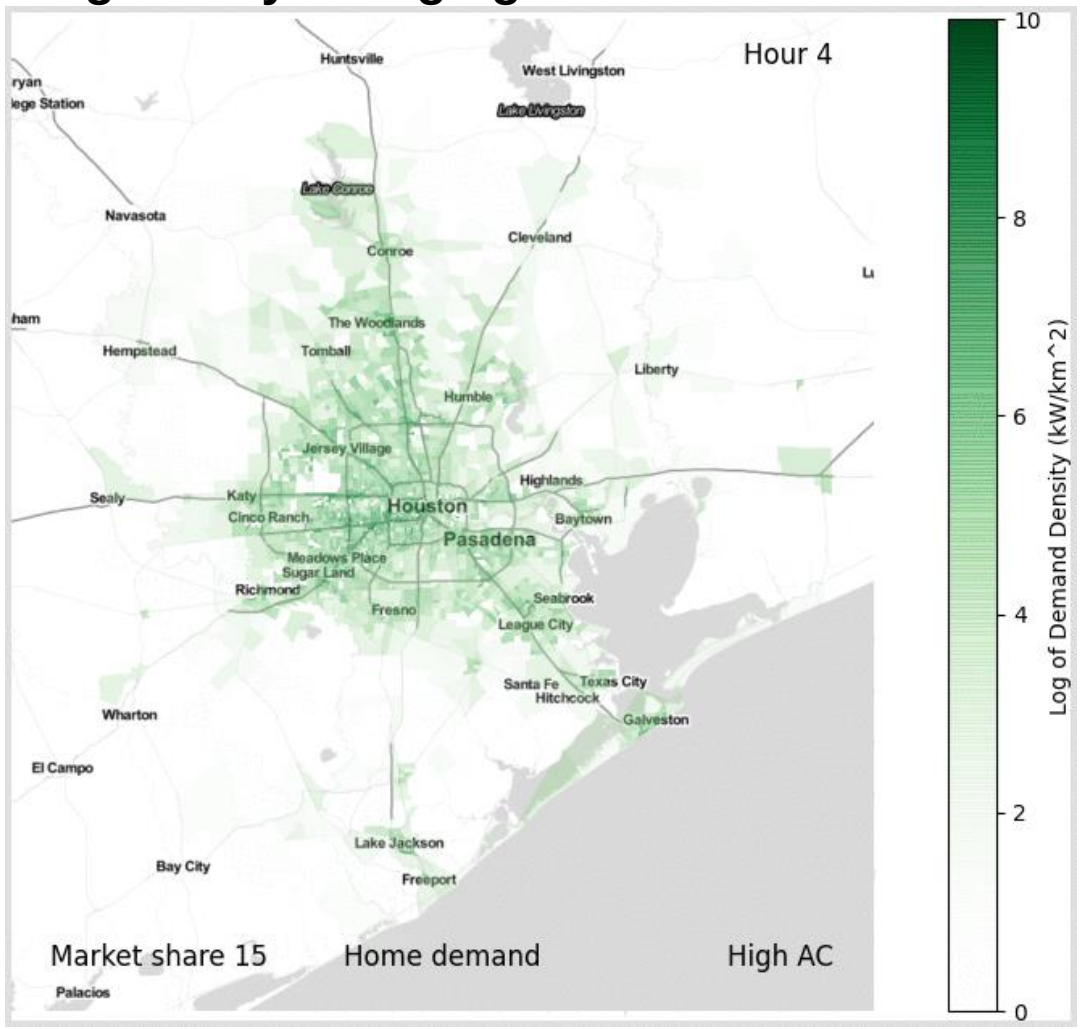
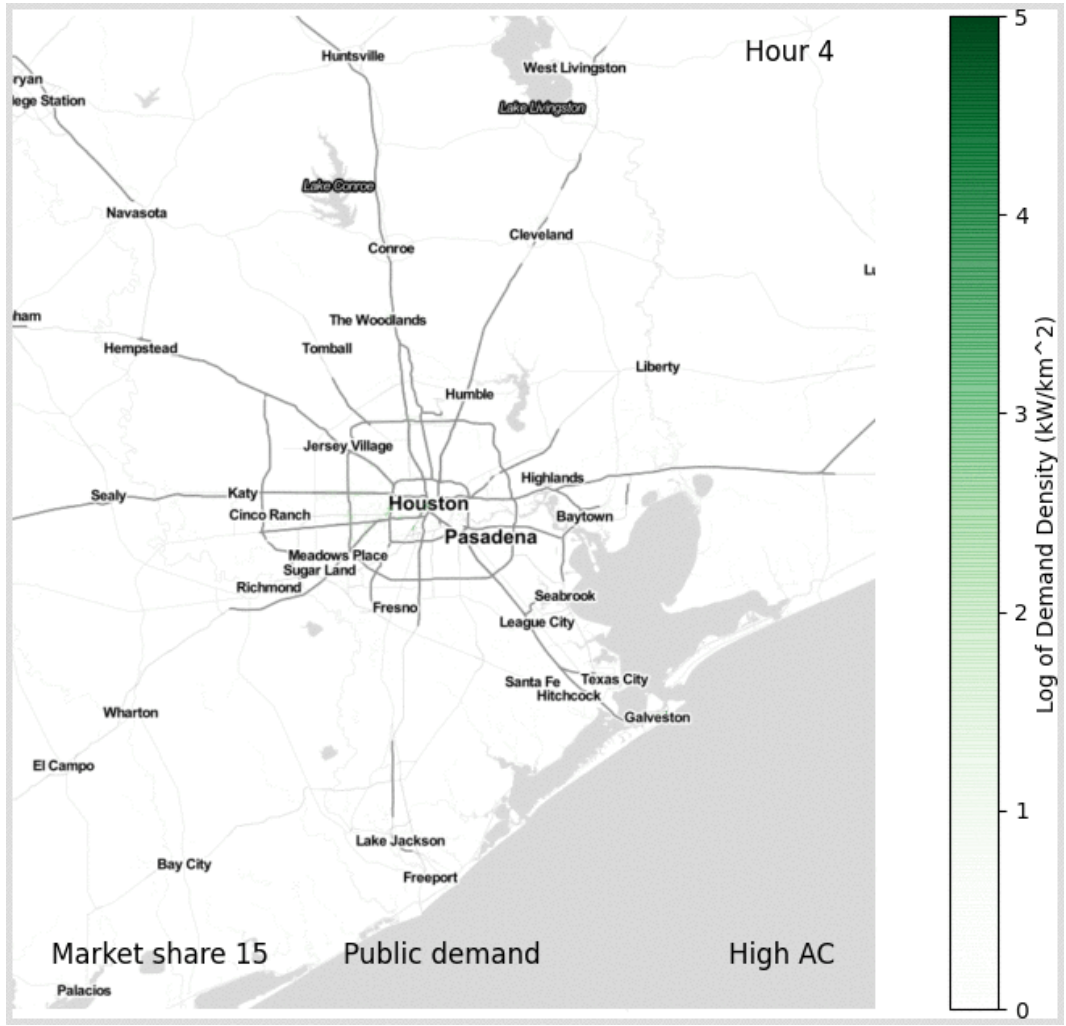
Foundational Work

Light-Duty Charging Demand Simulation





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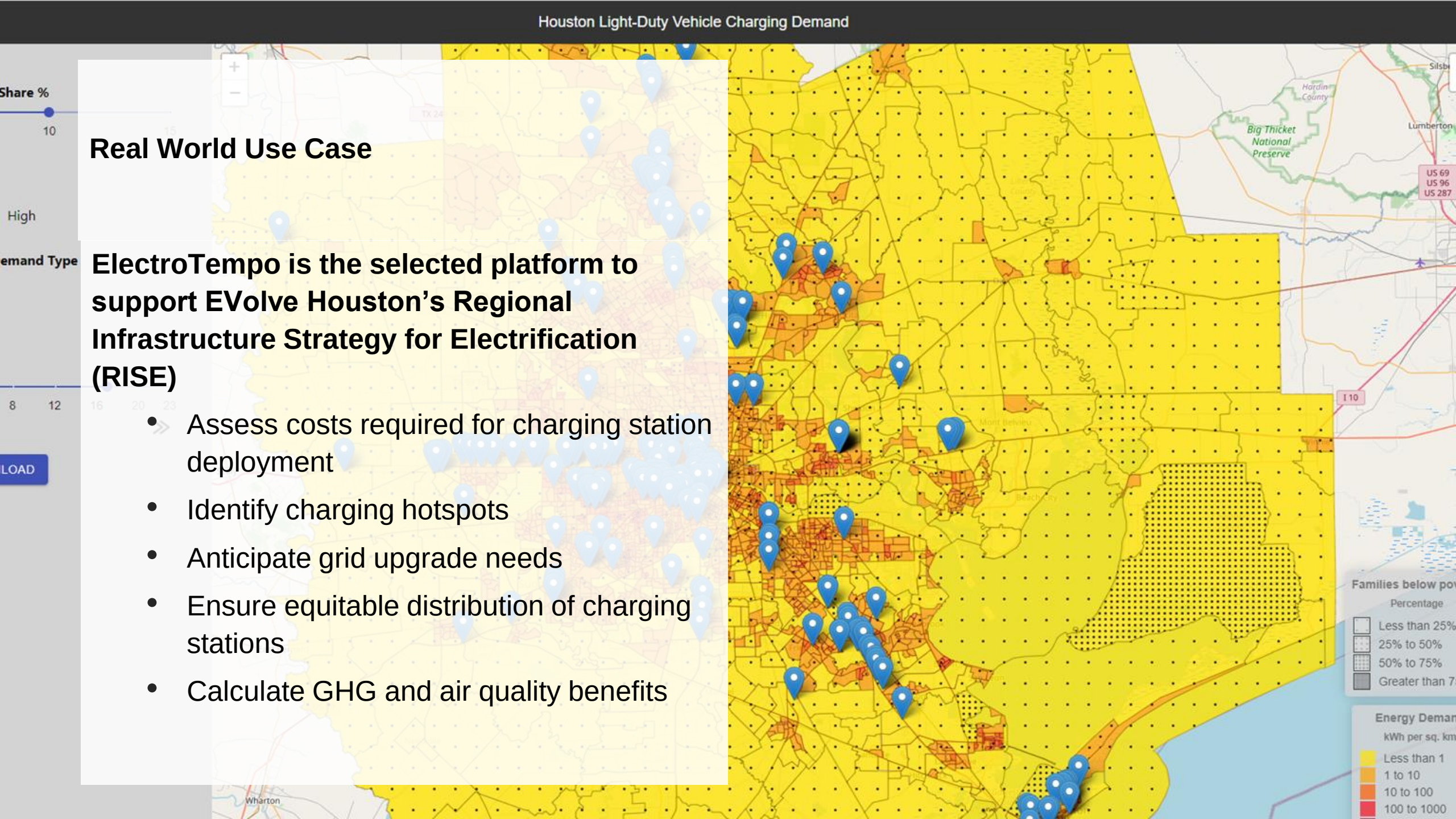
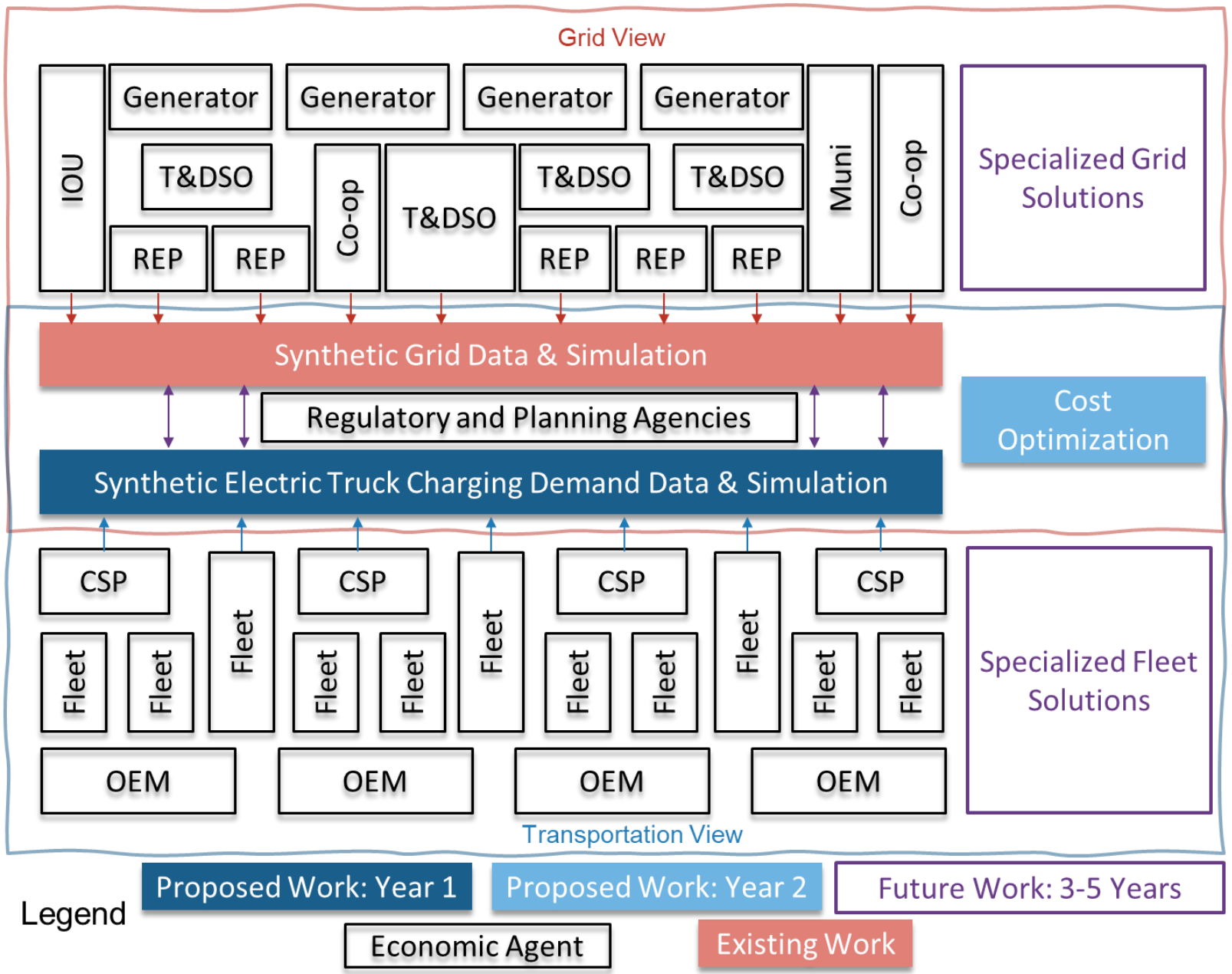

Houston Light-Duty Vehicle Charging Demand
Share %
10
High
emand Type
8
12
LOAD
Real World Use Case
ElectroTempo is the selected platform to support EVolve Houston's Regional Infrastructure Strategy for Electrification (RISE)
Assess costs required for charging station deployment
Identify charging hotspots
Anticipate grid upgrade needs
Ensure equitable distribution of charging stations
Calculate GHG and air quality benefits
Big Thicket National Preserve
Lumberton
US 69
US 96
US 287
I 10
Families below po
Percentage
Less than 25%
25% to 50%
50% to 75%
Greater than 7
Energy Deman
kWh per sq. km
Less than 1
1 to 10
10 to 100
100 to 1000
Wharton

Ecosystem View

- IOU: investor-owned utilities
- T&DSO: transmission and distribution system operators
- Muni: municipal utilities;
- Co-op: electric utility cooperatives
- REP: retail electricity providers
- CSP: charging service providers
- OEM: (truck) original equipment manufacturers



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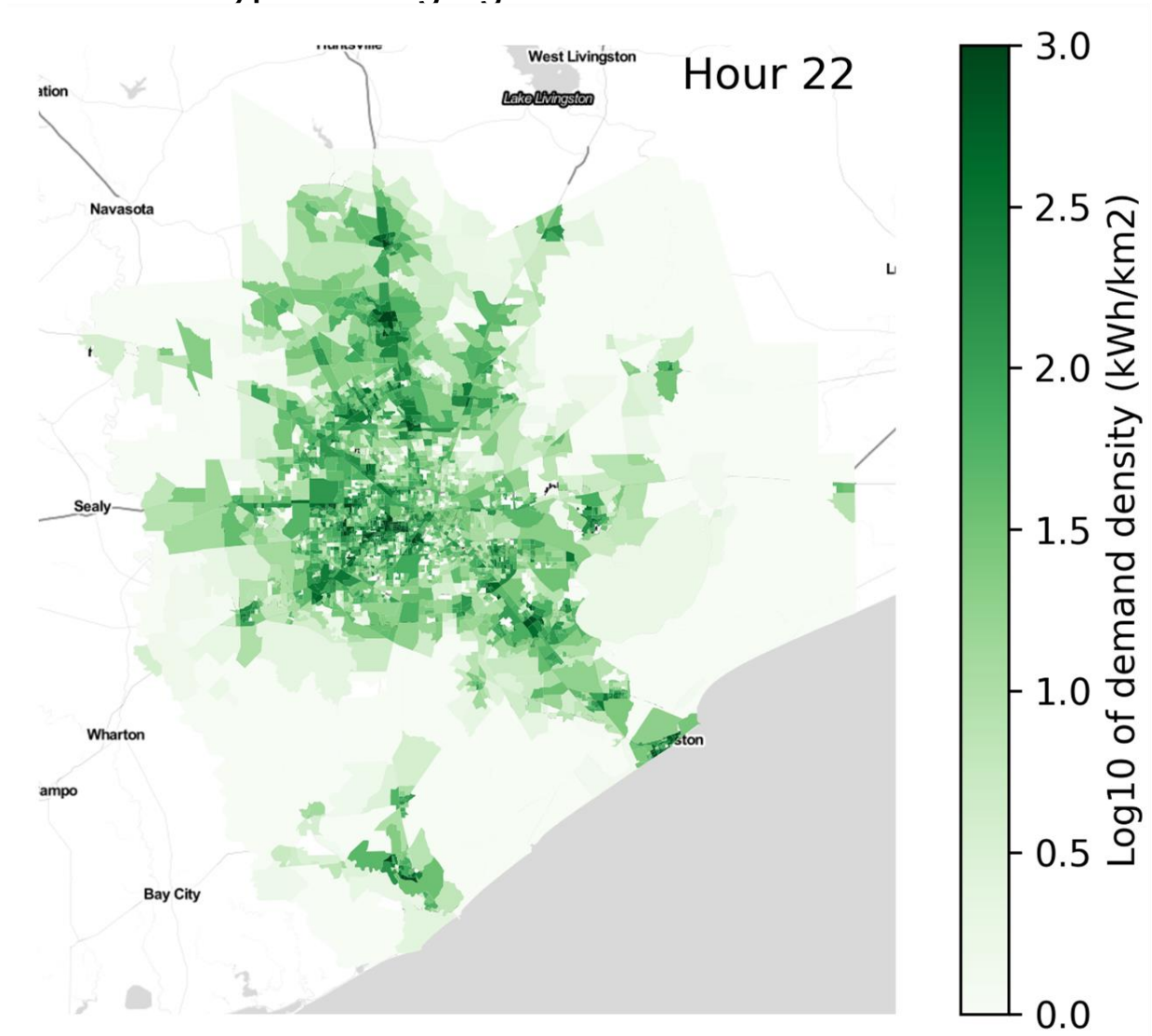
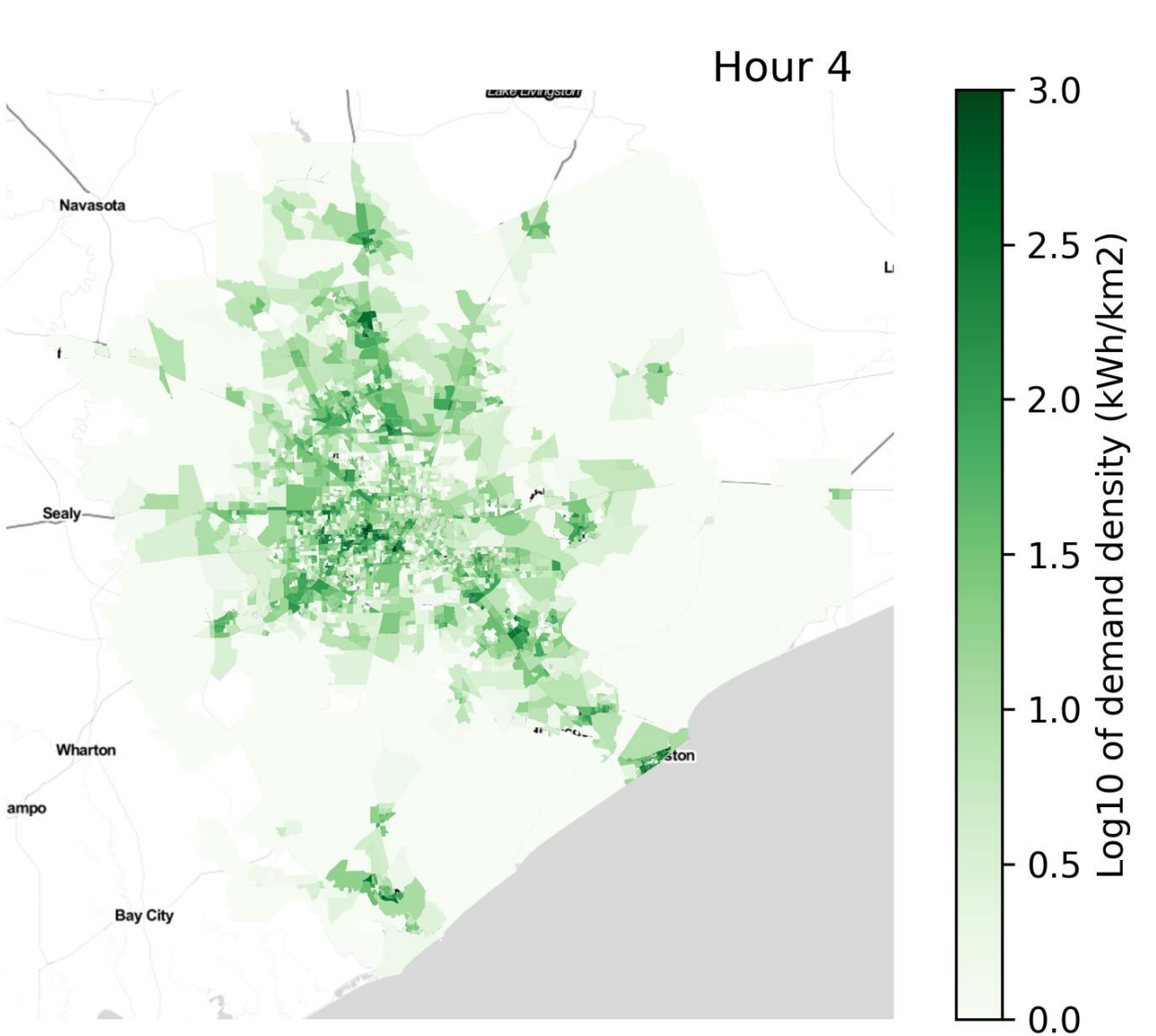
Current Status

Prototype Charging Demand Simulation





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Data Assimilation to Refine the Model

Charging Type

- Depot charging
- Destination charging
- Highway charging

Data Type

- Land use
- Travel demand
- Traffic volume

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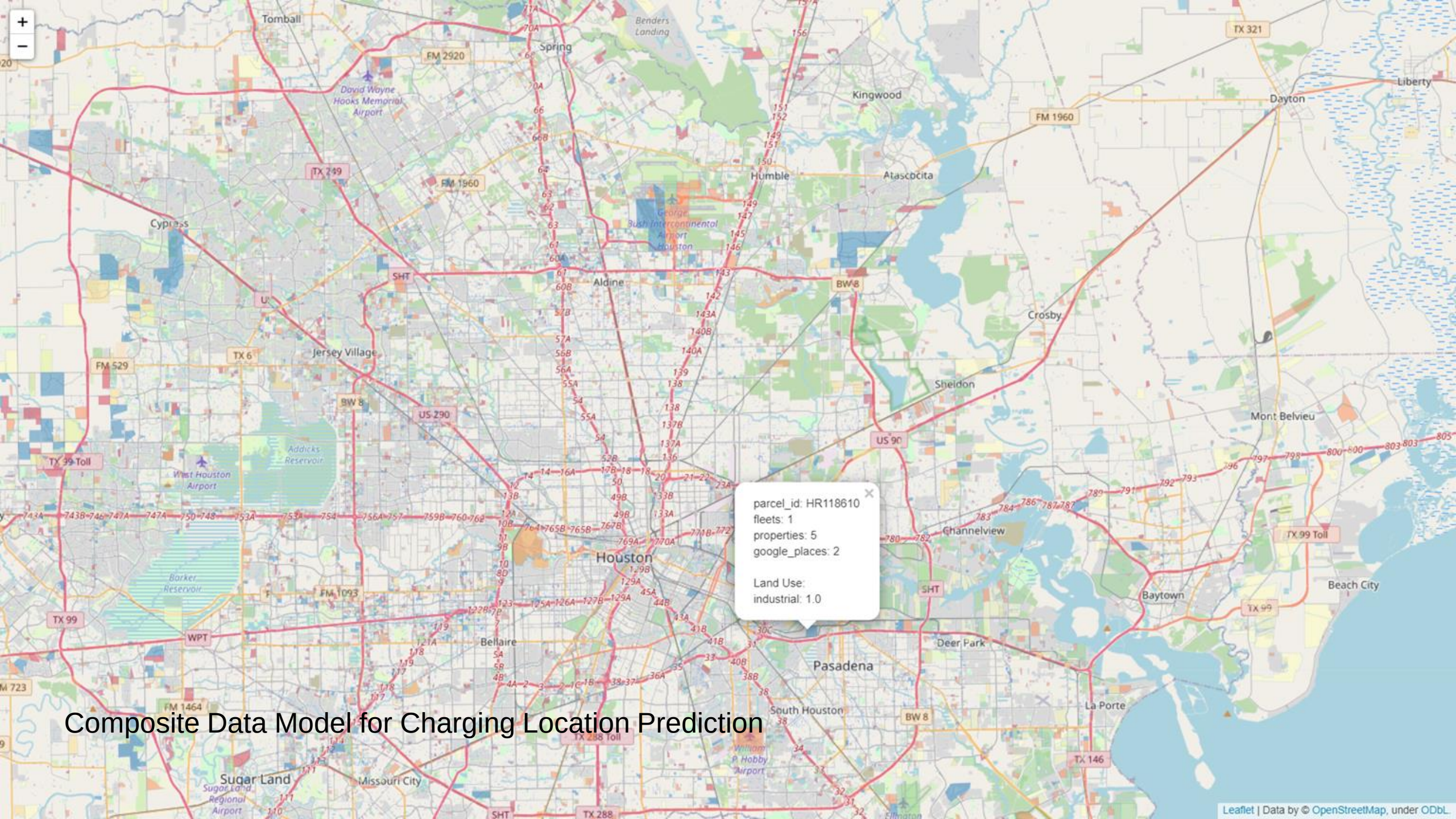

Composite Data Model for Charging Location Prediction

Next Steps

What to Expect This Year

Milestone	Description	Quarter
Base Urban Truck Charging Demand Simulator Implemented	The base urban truck charging demand simulator is developed for subsequent refinement	1
Urban Truck Traffic Simulation Validated	The urban truck traffic module is refined by land use and vocational characteristics; The resulting truck traffic simulation is validated	2
Truck Energy Consumption Estimates Validated	Truck energy consumption is estimated by vocation and validated against a DOE-recognized source	3
Long-haul Truck Traffic Simulation Validated	The long-haul truck traffic module is refined by cargo and destination; The resulting truck traffic simulation is validated against real-world data or a credible simulation model	4

Get Involved

Simply send an email indicating your interest to info@electrotempo.com. Space on the board is limited, so priority will be given to the first applicants across each industry category. We will be in touch with you shortly to discuss participation.

Become an Industry Advisor

What is the commitment?	What are the benefits to me?
• There is no cost associated with joining the ElectroTempo Industry Advisory Board • Beta test new products being developed by ElectroTempo and provide feedback • Participate in quarterly board meetings to provide feedback on ElectroTempo's latest tools and provide guidance towards future product development activities • Provide operational data if you wish to obtain targeted analytics for your organization	• Access customized electrification reports for your organization • Obtain potential revenue and projections for different scenarios to help determine where the primary costs and benefits of electrification may lie for your organization • Gain the ability to help shape the future of vehicle electrification planning and operational tools to ensure they fit your organization's needs • Network and collaborate with other electrification stakeholders

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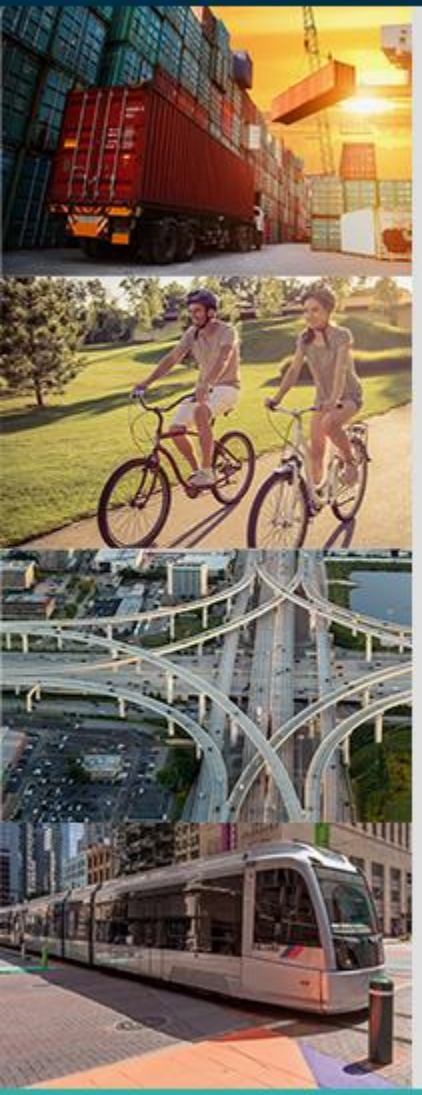
Agenda



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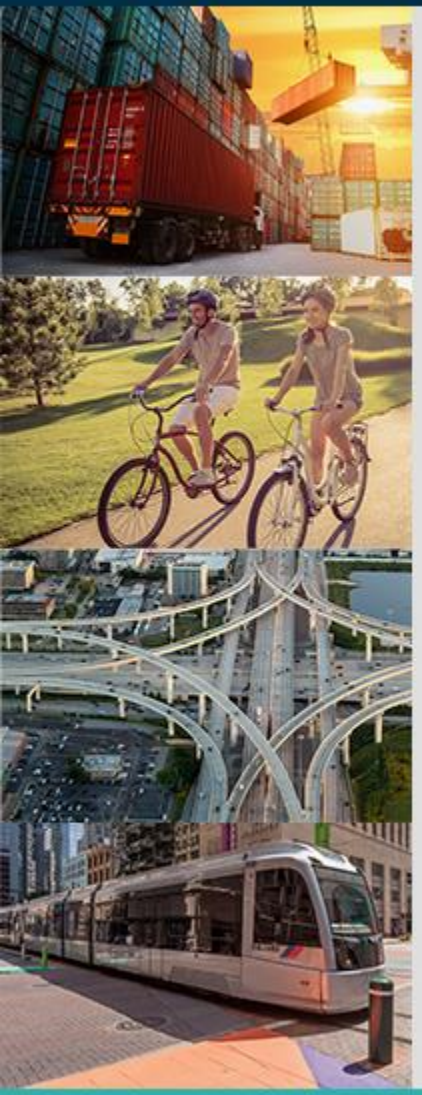
Regional Goods Movement Plan

Greater Houston Freight Advisory Committee
Meeting 1/13/2022

Regional Collaboration • Transportation Planning • Multimodal Mobility

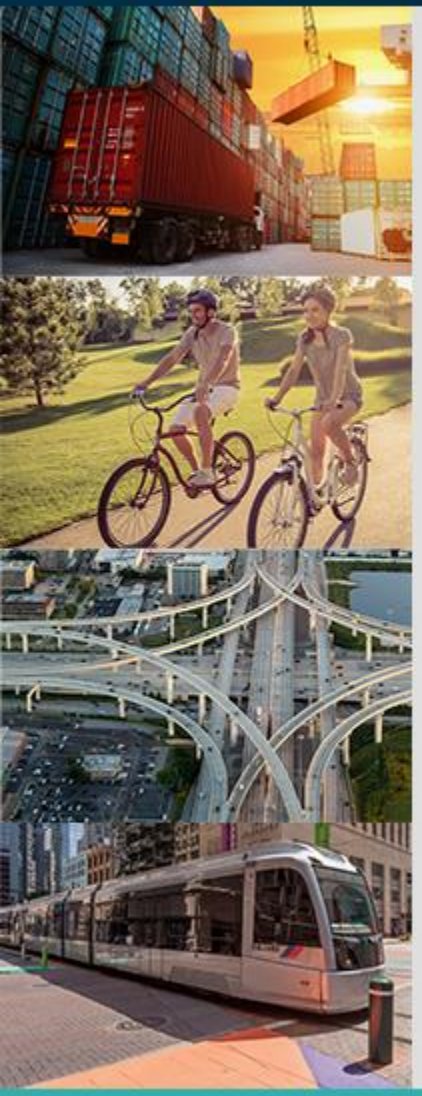
METROPOLITAN PLANNING ORGANIZATION

Agenda



1. Purpose
2. Project schedule
3. Vision & Goals
4. Study area
5. What we learned so far (stakeholders)
6. Freight dashboard and data
7. Issues and Needs
8. Key analysis & Information

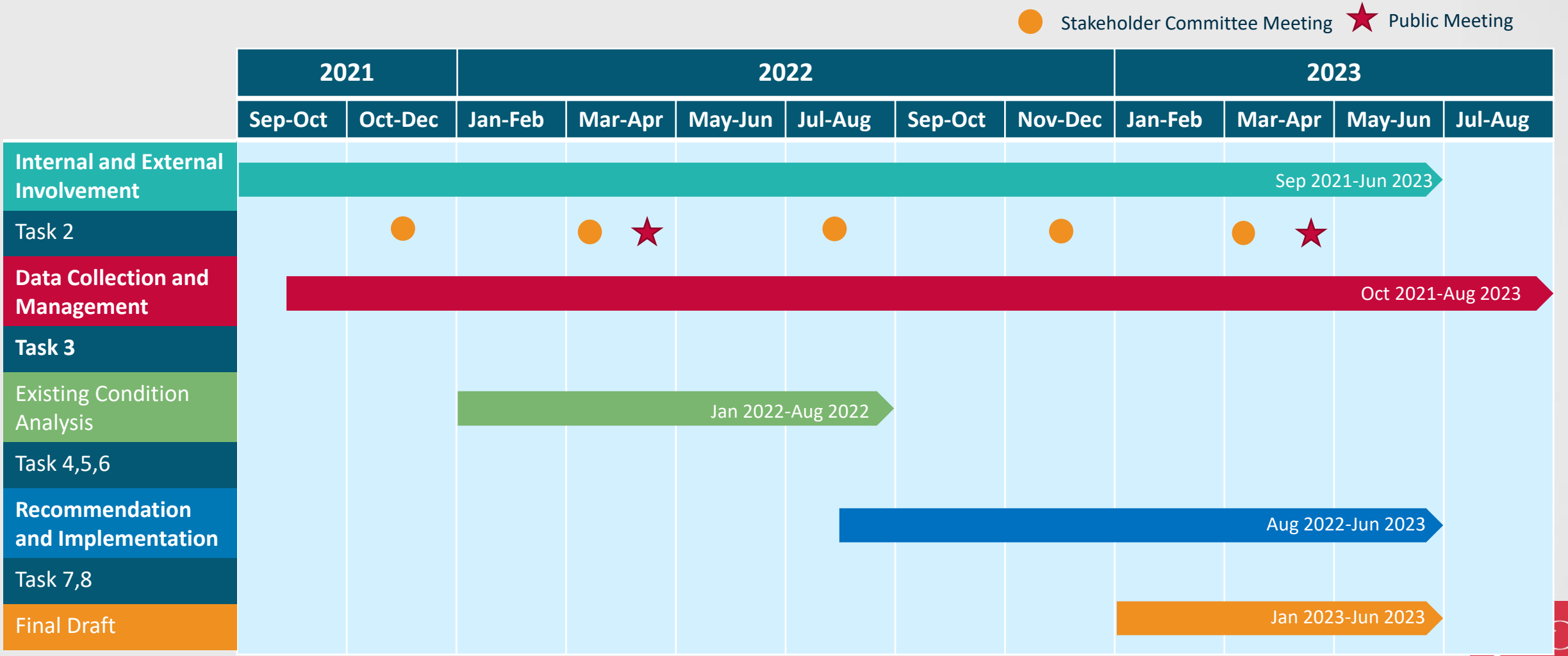
Purpose of RGMP



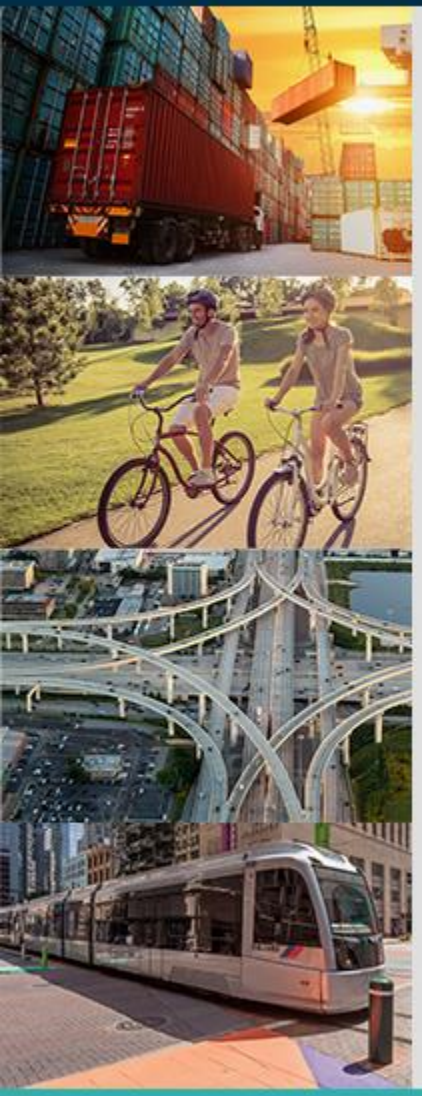
Focus areas

- Assess all freight modes
- Identify Needs and Issues
- Develop recommendations
- Guide advancement of multimodal freight transportation system
- Serve as roadmap for future investment

Project Schedule



Vision & Goals



Regional Goods Movement 2013

VISION

A connected, multimodal, world-class system that enhances the region's economic vitality while supporting the mobility and livability needs of its economic vitality while supporting the mobility and livability needs of its citizens

GOALS

- Regional Mobility
- Air Quality
- Safety
- Community Livability

Regional Goods Movement 2023

VISION

A multimodal freight transportation system that is efficient, reliable, and safe, that supports the economy, the environment, and equity.

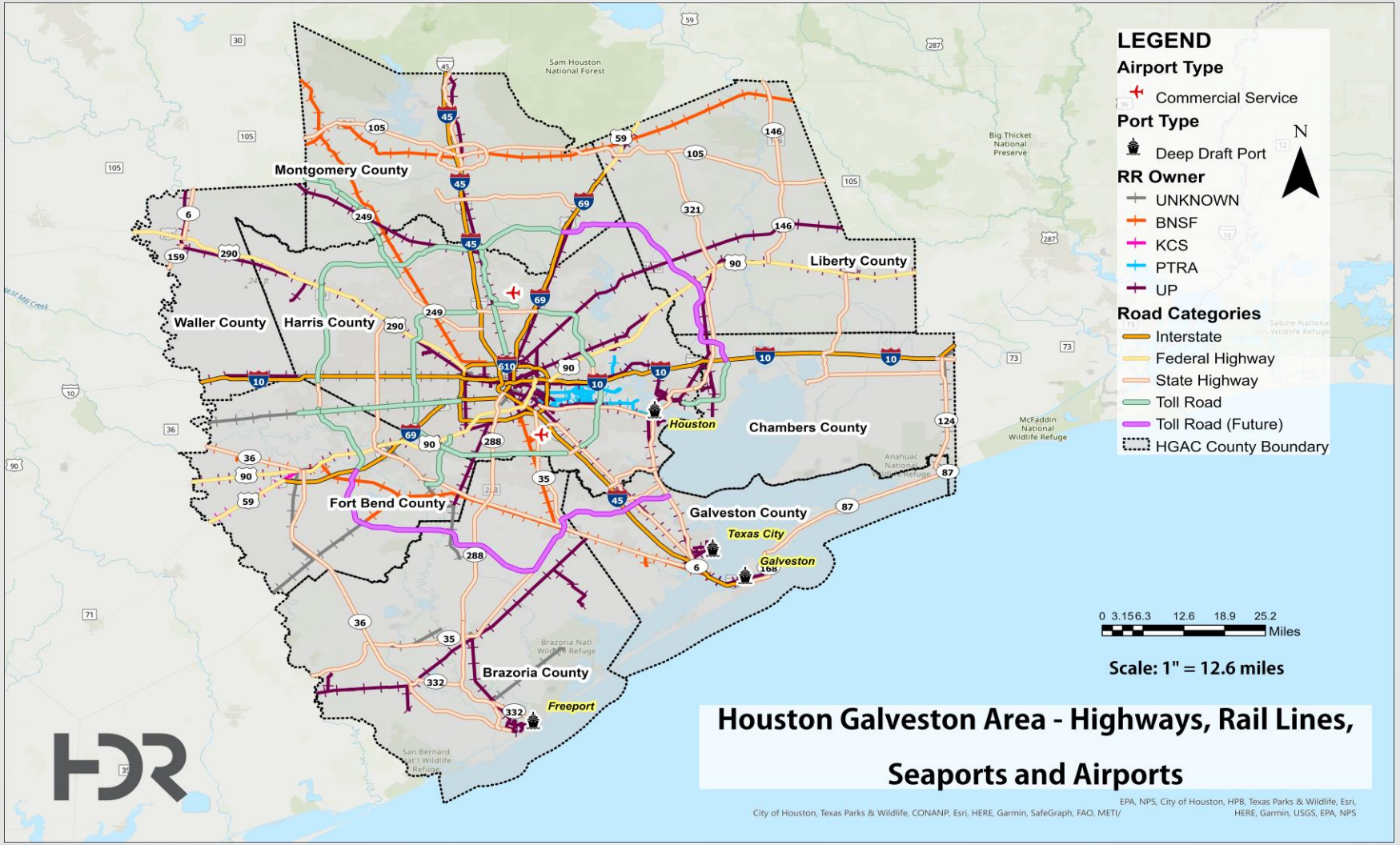
GOALS

- Mobility
- Safety
- Infrastructure – new projects & maintain existing assets
- Economic development
- Environmental
- Equity

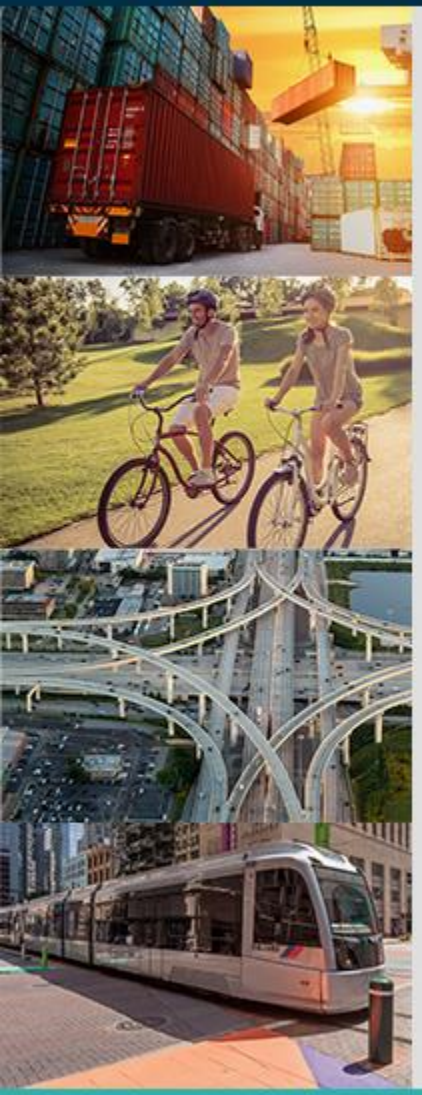
Role of GHFC during RGMP development

- Attend Meetings
- Receive Updates on Study Progress
- Provide Input on Transportation Issues and Needs
- Review draft documents
- Provide Feedback on Proposed Recommendations
- Help Publicize the RGMP

Study Area


LEGEND
Airport Type
Commercial Service
Port Type
Deep Draft Port
RR Owner
UNKNOWN
BNSF
KCS
PTRA
UP
Road Categories
Interstate
Federal Highway
State Highway
Toll Road
Toll Road (Future)
HGAC County Boundary
N
Montgomery County
Liberty County
Waller County
Harris County
Chambers County
Fort Bend County
Galveston County
Brazoria County
Houston
Texas City
Galveston
Freeport
Sam Houston National Forest
Big Thicket National Preserve
McFaddin National Wildlife Refuge
0 3.15 6.3 12.6 18.9 25.2
Miles
Scale: 1" = 12.6 miles
Houston Galveston Area - Highways, Rail Lines, Seaports and Airports
EPA, NPS, City of Houston, HPB, Texas Parks & Wildlife, Esri, HERE, Garmin, USGS, EPA, NPS
City of Houston, Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, SafeGraph, FAO, METI/

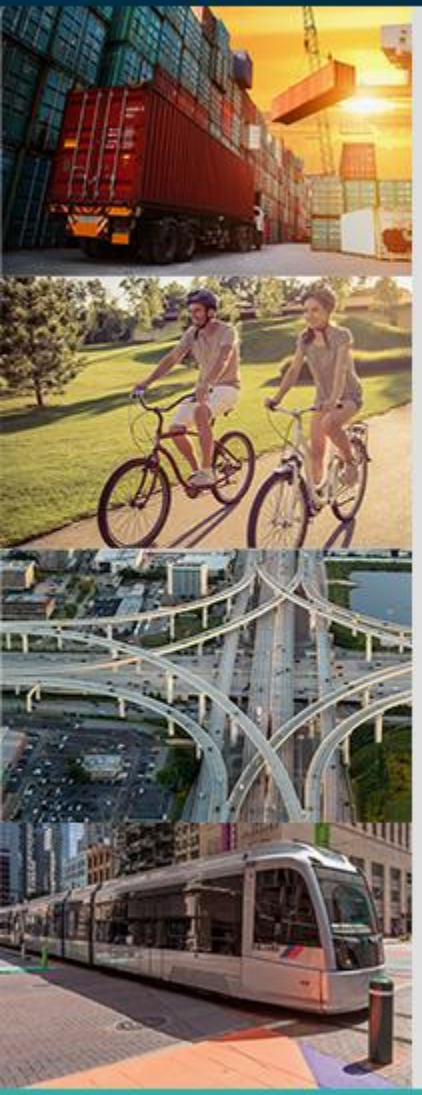
Stakeholder Criteria



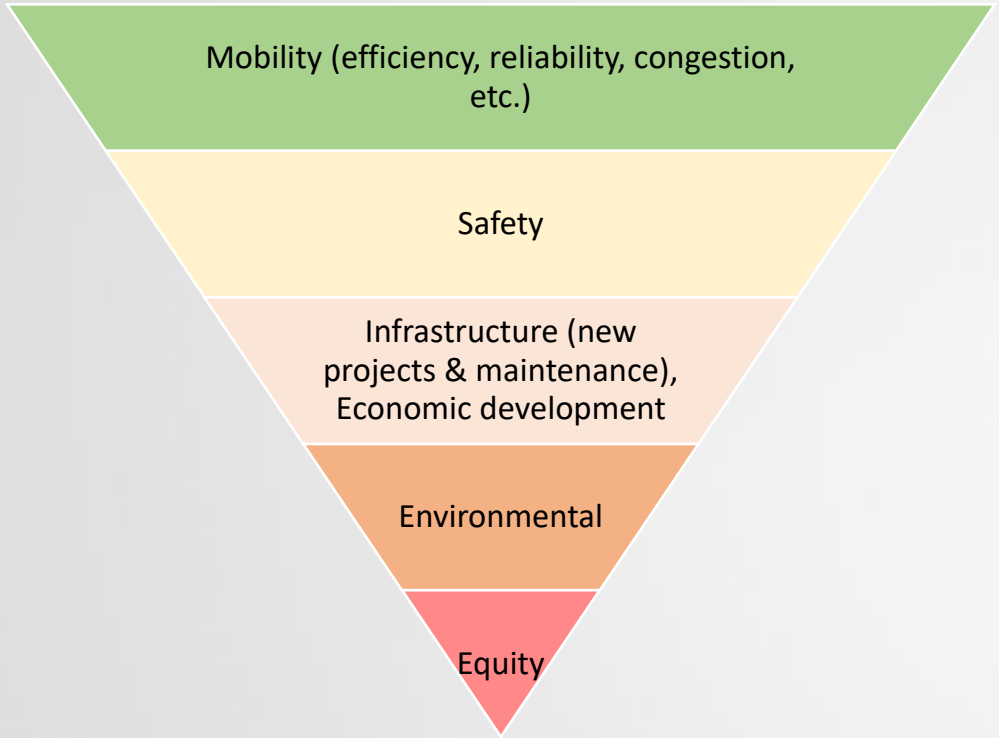
Criteria for recommending the stakeholders:

- Key industries
- Freight modes: trucking, rail, air cargo, pipeline, maritime
- Freight nodes: rail intermodal, seaports, airports, logistics, distribution & manufacturing hubs
- Geographical representation (8 county region)
- Local economic development

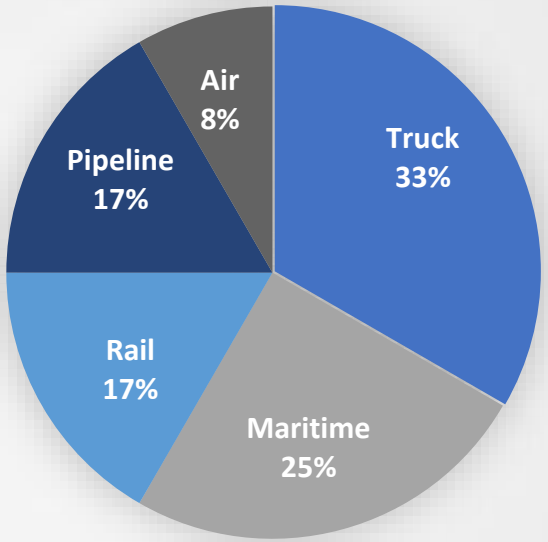
Stakeholder Survey Results



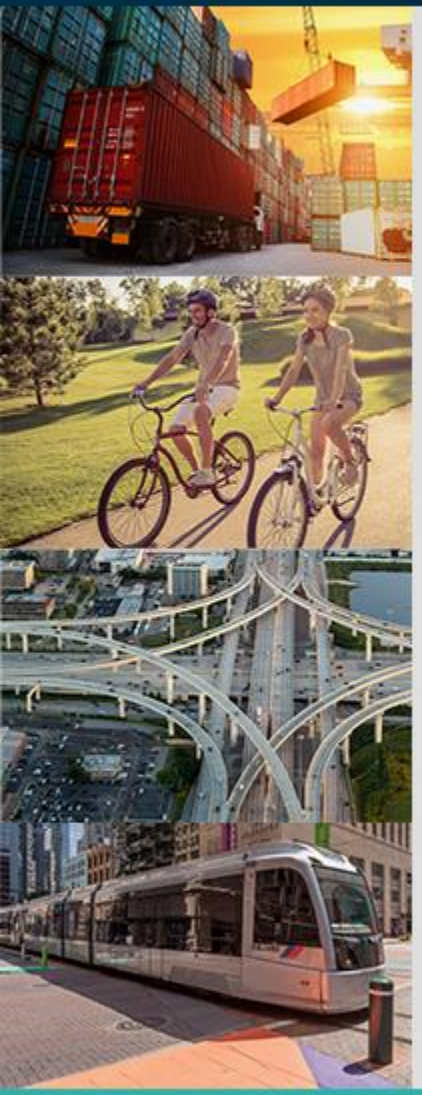
Goal areas by order of importance:



Modes of freight transportation actively used by respondents



Stakeholder Survey Results



Top current issues facing:

Freight Transportation

1. Freight network resilience
2. Condition of the region's Roadway network (efficiency, reliability, resiliency, & safety)
3. Funding and financing to maintain and expand the roadway network
4. Shortage of labor (truck drivers & rail engineers)

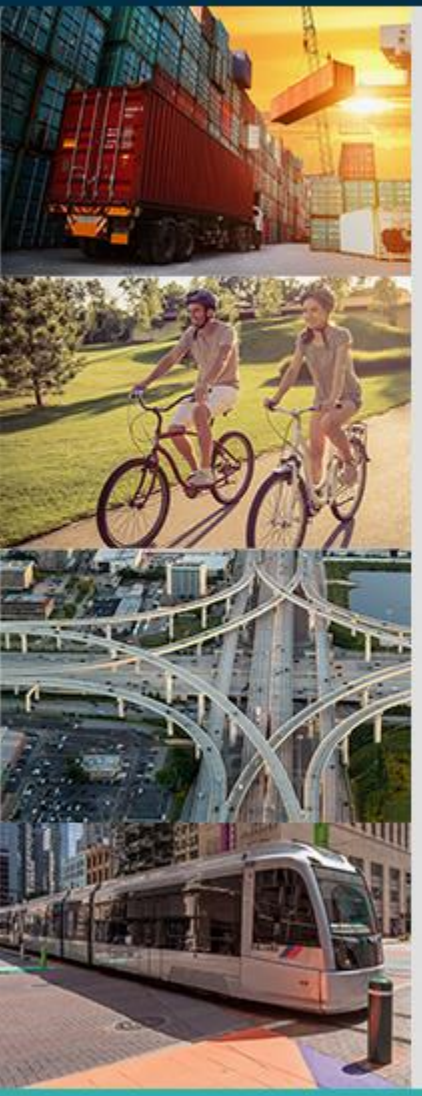
Shippers transporting goods and commodities to market

1. Freight transportation costs
2. Carrier capacity/availability
3. Carrier reliability (picking up and/or delivering on time)

Carriers transporting goods and commodities to market

1. Workforce (hiring qualified drivers/operators & retention)
2. Equipment costs (Trucks, trailers, etc.)
3. Operating costs (fuel, maintenance & labor)
4. Customer hours of operation & scheduling
5. Risk management – Safety (crashes & violations), security (theft & cargo damage), insurance, legal support

Stakeholder Survey Results



Truck safety concerns by importance:

Lack of an efficient & integrated truck routing system

Environmental conditions (Weather, climate change)

Hazardous materials being transported

Recuring congestion

Low underpasses

Roadway geometry & condition

Driver/operator behavior (speeding, in-cab distractions)

At-grade rail crossings

Information on roadway situations

Freight trend concerns by importance:

Maintaining supply chains (efficient, reliable & flexibility)

Autonomous vehicle operation

Environmental (climate change)

Alternative fuels (Electric, hydrogen, CNG/LNG)

Workforce (availability & skills)

Integrating new technology (training & costs)

Regulatory requirements

Switching from fuel taxes to Mileage Based User Fee

Transportation operating costs (Maintenance, fuel & wages, labor)

Freight dashboard

FAF-5 Dashboard: 2017 Tons (M)

Summaries by Flow Type

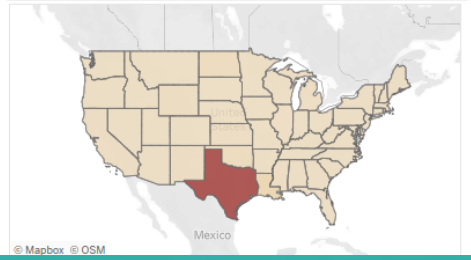
Trade	Houston Internal	Rest of US to Houston	Houston to Rest of US	FAF Through	Add'l Est Through	Grand Total
Domestic	381.86	292.26	145.10		4.55	823.77
Export	23.55		29.16	76.05	0.58	129.34
Import	57.10	26.84		35.26	1.02	120.23
Grand Total	462.52	319.09	174.26	111.32	6.15	1,073.34

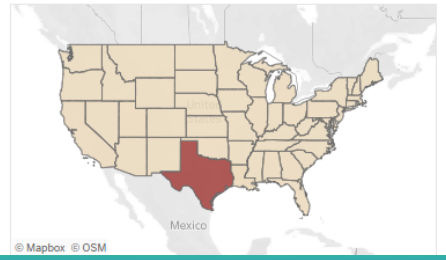
Domestic Mode	Houston Internal	Rest of US to Houston	Houston to Rest of US	FAF Through	Add'l Est Through	Grand Total
Truck	197.77	88.64	72.85	84.61	4.43	448.30
Pipeline	119.10	127.33	24.23	11.40		282.05
Water	65.50	56.43	37.09	2.10		161.12
Multiple Modes	20.98	17.46	26.07	7.47		71.99
Rail	21.24	29.10	13.75	5.65	1.72	71.46
No Domestic M..	37.93					37.93

Commodity Group (SCTG2)	Houston Internal	Rest of US to Houston	Houston to Rest of US	FAF Through	Add'l Est Through	Grand Total
Fuel Oils (includes D..	80.14	30.35	28.12	24.35	0.02	162.98
Gasoline, Aviation T..	78.50	34.66	28.97	16.29	0.10	158.52
Other Coal and Petr..	62.89	73.45	11.61		0.11	148.07
Crude Petroleum	45.46	72.57	1.76	11.47	0.18	131.44
Basic Chemicals	53.98	26.99	20.99	18.97	0.33	121.26

Domestic Origin S..	Origin FAF Region	
TX	Houston-The Woodlands, TX CFS Area	672.04
	Remainder of Texas	110.57
	Beaumont-Port Arthur, TX CFS Area	41.05
	Dallas-Fort Worth, TX-OK CFS Area (T..	37.29
	Corpus Christi-Kingsville-Alice, TX CF..	18.07

Domestic Destinat..	Destination FAF Region	
TX	Houston-The Woodlands, TX CF..	857.67
	Beaumont-Port Arthur, TX CFS ..	35.44
	Remainder of Texas	29.20
	Dallas-Fort Worth, TX-OK CFS ..	19.43
	Corpus Christi-Kingsville-Alice,..	11.57





Commodities by Trade Type and Domestic Mode

Commodity Group (SCTG2)	Domestic	Export	Import	Grand Total
Fuel Oils (includes Diesel, Bunker ..	119.20	32.59	11.20	162.98
Gasoline, Aviation Turbine Fuel, an..	128.32	26.95	3.25	158.52
Other Coal and Petroleum Products	148.06		0.01	148.07
Crude Petroleum	64.55	11.47	55.43	131.44
Basic Chemicals	91.69	23.86	5.72	121.26

Commodity Group (SCTG2)	Truck	Pipeline	Water	Multiple Modes	Rail	No Domestic Mode
Fuel Oils (includes Diesel, Bunker ..	64.50	46.65	43.88	3.78	4.17	
Gasoline, Aviation Turbine Fuel, a..	63.13	66.40	19.21	4.80	4.98	
Other Coal and Petroleum	20.17	65.76	42.50	9.96	9.67	
Crude Petroleum	2.96	83.74	6.70		0.11	37.93
Basic Chemicals	41.87	19.50	36.44	9.54	13.90	

Trading Partners and International Modes

Foreign Origin for Imports	Water	Pipeline	Truck	Rail	Multiple Modes	Air	Unknown	Grand Total
Mexico	23.91	0.12	5.27	0.70	0.77	0.03	0.03	30.83
Rest of Americas	21.62					0.01	0.00	21.63
South, Central, Western A..	20.73					0.01	0.00	20.74
Europe	15.94				0.00	0.07	0.00	16.01
Canada	0.60	10.84	0.45	1.09	0.20	0.00	0.00	13.19

Foreign Destination for Exports	Water	Truck	Rail	Pipeline	Unknown	Air	Multiple Modes	Grand Total
Rest of Americas	42.68				0.02	0.02	0.00	42.71
Mexico	20.03	4.93	3.31	1.08	0.00	0.01	0.08	29.45
Europe	17.32				0.11	0.05	0.00	17.49
Eastern Asia	14.60				0.04	0.03	0.00	14.68
South, Central, Western A..	7.33				0.00	0.04	0.00	7.37

Flow Direction
- [ ] (All)
- [ ] Null
- [x] Add'l Est Through
- [x] FAF Through
- [x] Houston Internal
- [x] Houston to Rest of US
- [x] Rest of US to Houston

Trade
- [x] (All)
- [x] Domestic
- [x] Export
- [x] Import

Commodity Group (SCTG2)
(All)

Foreign Inbound Mode at US Gateway
(All)

Foreign Origin for Imports
(All)

Domestic Origin State
(All)

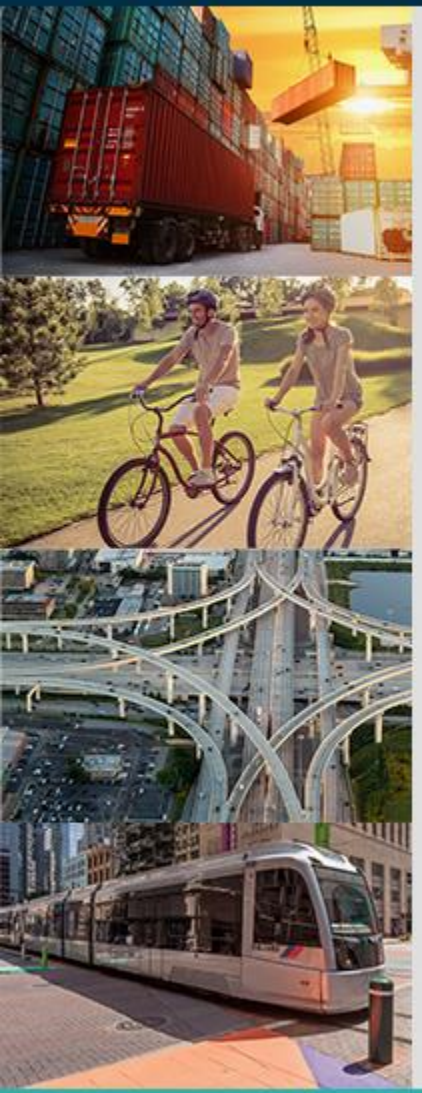
Domestic Mode
- [x] (All)
- [x] Air
- [x] Multiple Modes
- [x] No Domestic Mode
- [x] Pipeline
- [x] Rail
- [x] Truck
- [x] Unknown
- [x] Water

Domestic Destination State
(All)

Foreign Destination for Exports
(All)

Foreign Outbound Mode at US Gateway
(All)

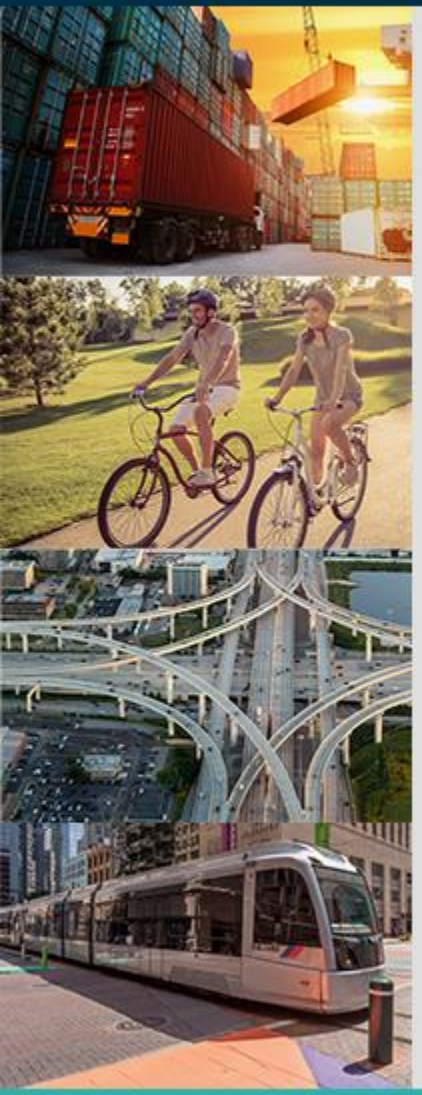
Data & information sources



- Designated Freight Networks
- Truck GPS Data
- Establishment Level Data (Freight Clusters)
- Truck Parking
- Crash Data
- Pavement and Bridge Conditions
- LOS & V/C Ratios
- Truck Counts
- Road Configurations
- Grade Crossing Stats
- Port Volumes
- Bridge Strikes
- Freight Rail Waybills

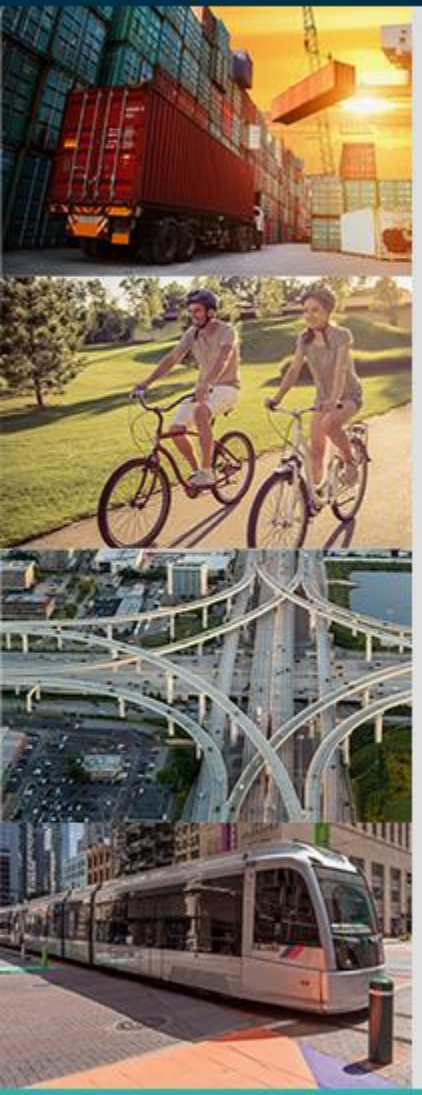
- Texas Freight Mobility Plan
- Texas Rail Plan
- Statewide Truck Parking Study
- Houston-Beaumont Rail Study
- Houston District Truck Mobility Study
- H-GAC Port Area Mobility Study
- H-GAC Regional Aviation System Plan
- H-GAC Regional Transportation Plan
- H-GAC Critical Regional Freight Corridors
- H-GAC Regional Goods Movement Study (2011)
- Economic Development Plans
- Airport Master Plans

Issues, Needs, Challenges



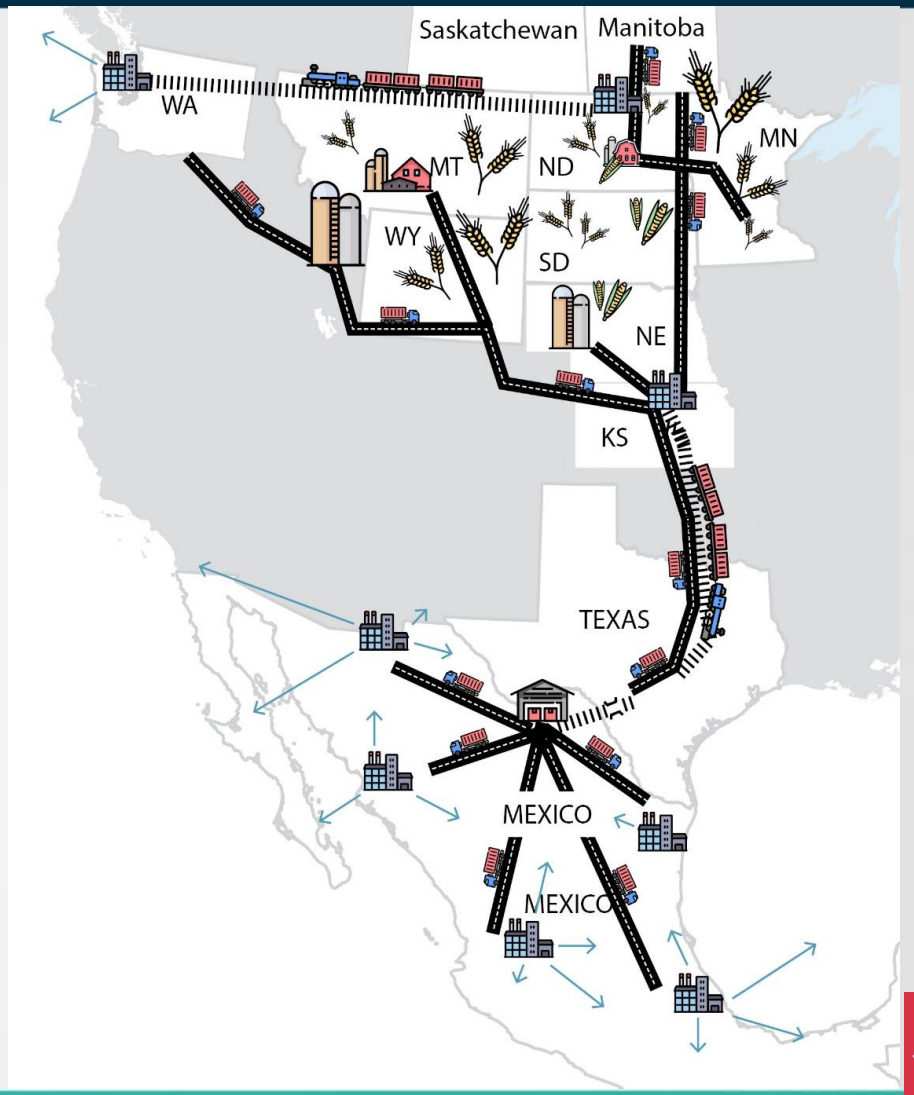
1. System Identification & Capacity
2. System Operations, ITS & IT
3. Safety/Security
4. Intermodal Connectivity
5. Critical Urban Freight Corridors
6. Export / Import Challenges
7. Energy/Environment/Equity
8. Education/Public Awareness
9. Public and Private Sector Coordination
10. Funding/Financing
11. Other

Finding the balance

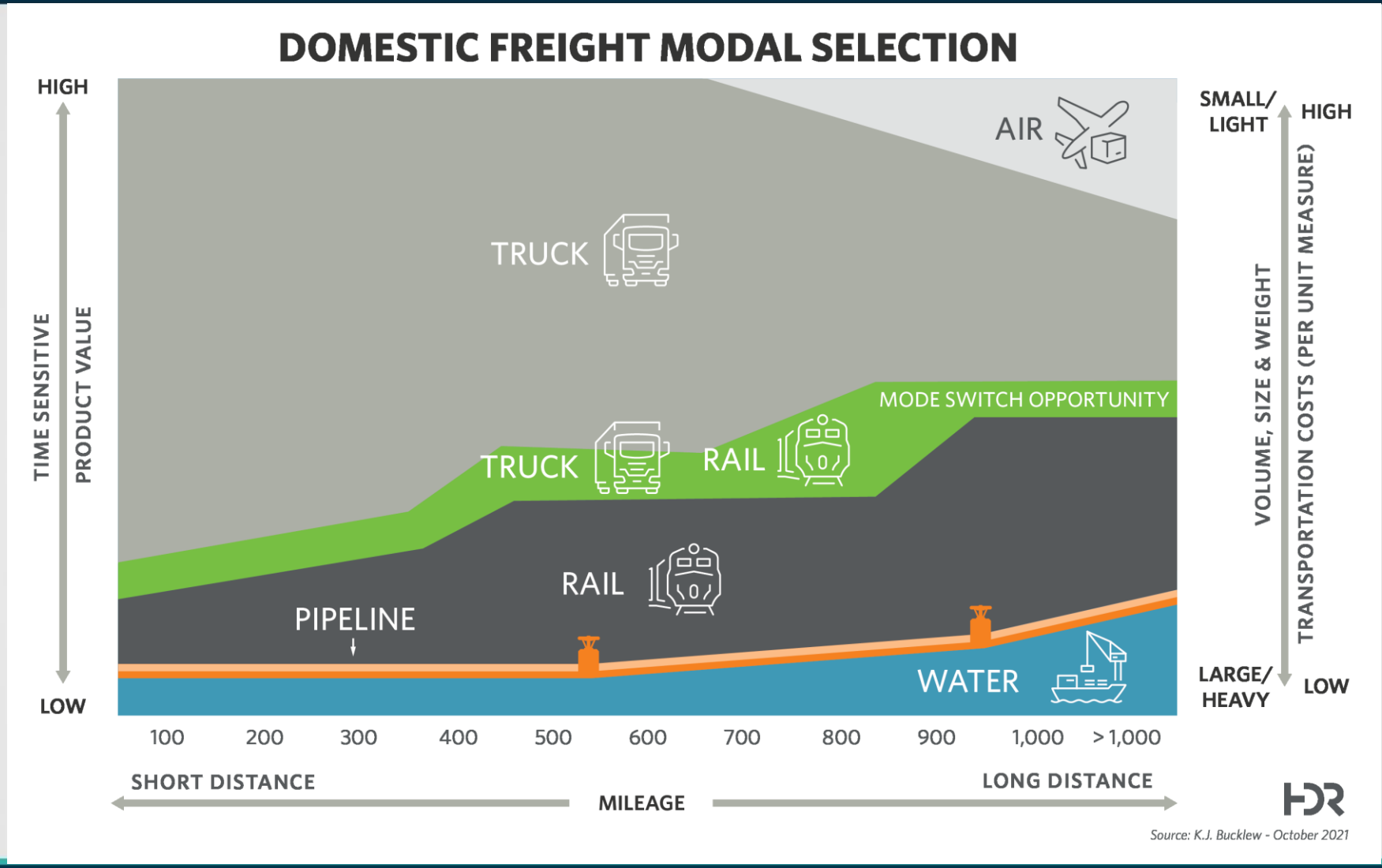


Supply Chains

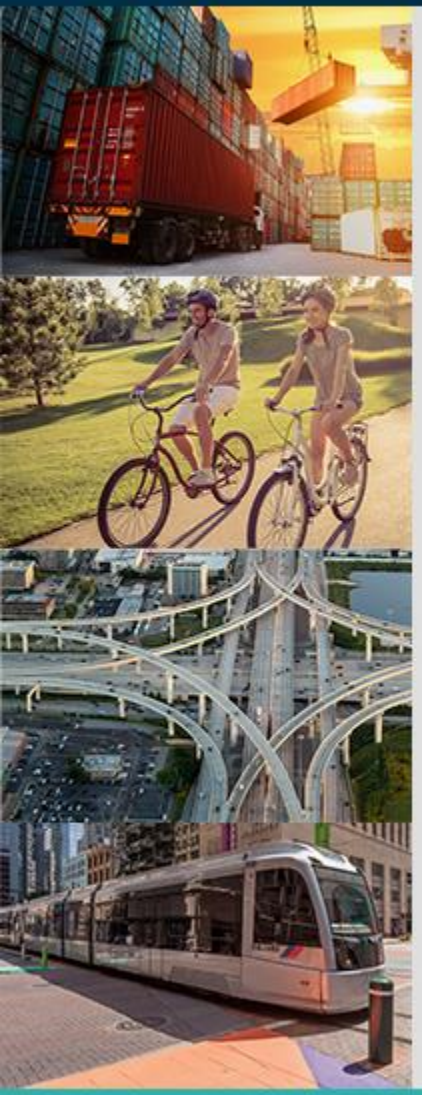
- Freight mobility is the link(s) to get products from the source to the destination.
- Supply chains are designed with **two** criteria: Service and Cost.
- Other important criteria affecting cost and service
  - Security
  - Safety
  - Resiliency
  - Reliability



Multimodal Freight Movement



Key Analysis & Information



Freight System

- ❑ 4 Seaports
- ❑ 2 Commercial Airports
- ❑ Railroad network
- ❑ Pipeline networks
- ❑ Roadway freight network
- ❑ Intermodal connectivity

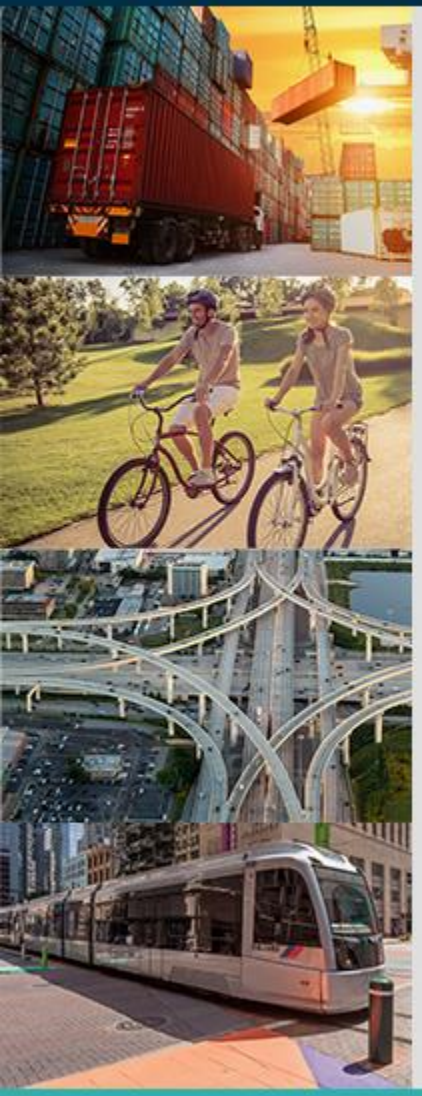
Economics

- ❑ Key industries
- ❑ Supply chain analysis

Interactive Maps & Graphics

- ❑ Multimodal freight system
- ❑ Critical urban freight system
- ❑ Rail system map
- ❑ Commodity flow maps
- ❑ Truck trip forecasts
- ❑ Truck counts
- ❑ Freight & logistics clusters
- ❑ Truck parking
- ❑ Safety crash information
- ❑ Freight system impediments

Contact Us



Veronica Green

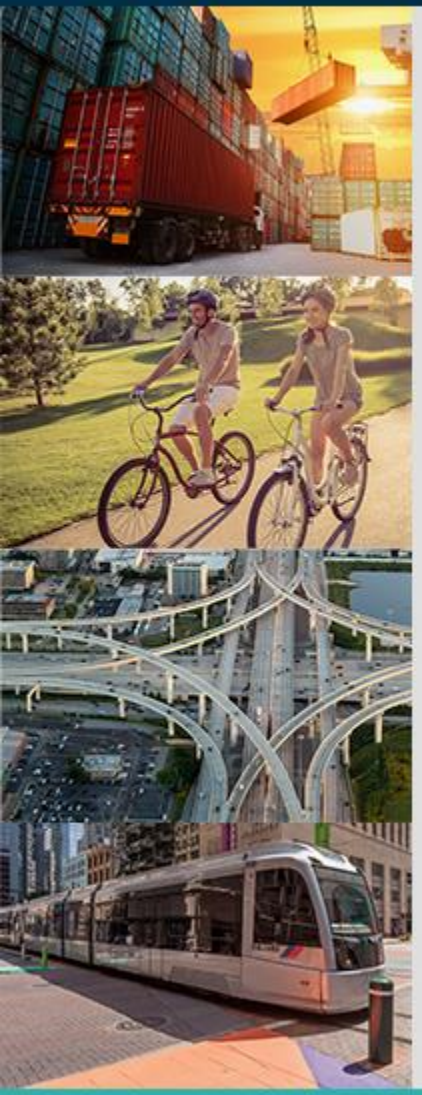
Veronica.Green@h-gac.com

Project Manager

Regional Goods Movement Webpage

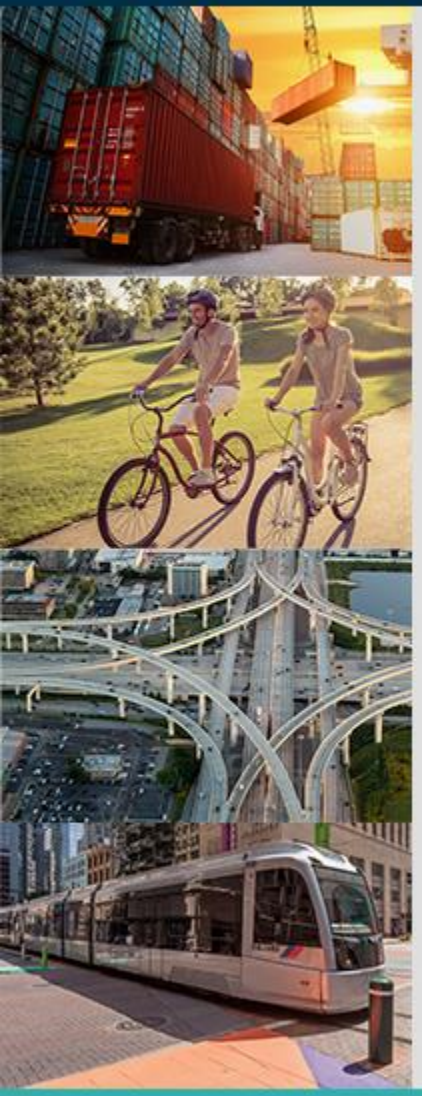
https://engage.h-gac.com/regional-goods

Agenda



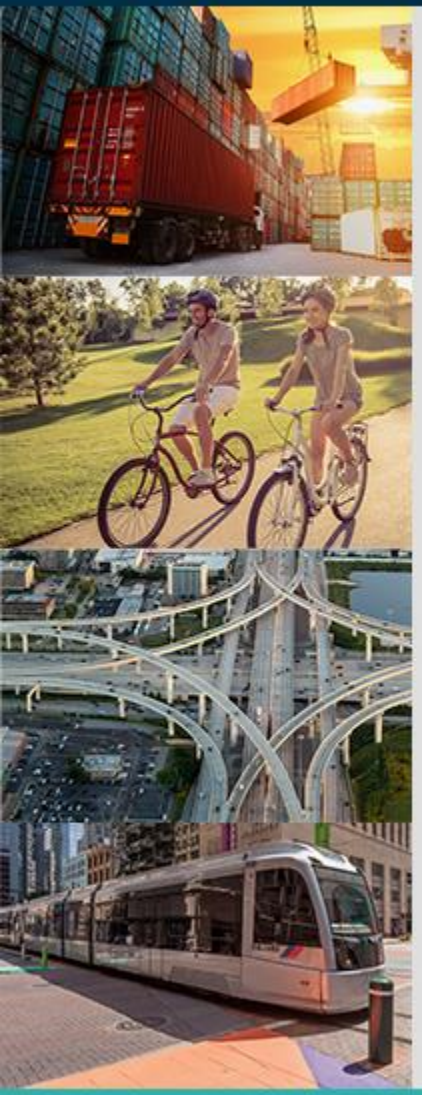
Welcome & Introductions	Hon. Ed Emmett, GHFC, Fellow at Baker Institute
2021 Transportation Infrastructure Bill	Craig Raborn ,H-GAC, Transportation Director
Statewide Port and Roadway Resiliency	Dr. Zhanmin Zhang, *CRISC, Director*
Resiliency & Durability Pilot	Allie Isbell, H-GAC, *Regional Planning* Mgr
Electrification of Roadway Infrastructure	Dr. Ann Xu, TTI, Research Scientist
Regional Goods Movement Plan	Veronica Green, *H-GAC, Senior Planner*
Perspective on the Supply Chain Crisis	Brian Fielkow, GHFC, Jetco
Closing	

Announcements



- Transportation Advisory Committee 1/18/2022, 9:30a-11:30a
- Transportation Policy Committee 1/28, 2022, 9:30a-11:00a
- Regional Goods Movement Public Mtg 03/31/2022, 1:00p-3:00p

Thank You



Regional Collaboration • Transportation Planning • Multimodal Mobility

METROPOLITAN PLANNING ORGANIZATION

Creating a Resilient Port System in Texas: Assessing and Mitigating Extreme Weather Events

Zhanmin Zhang, Ph.D.

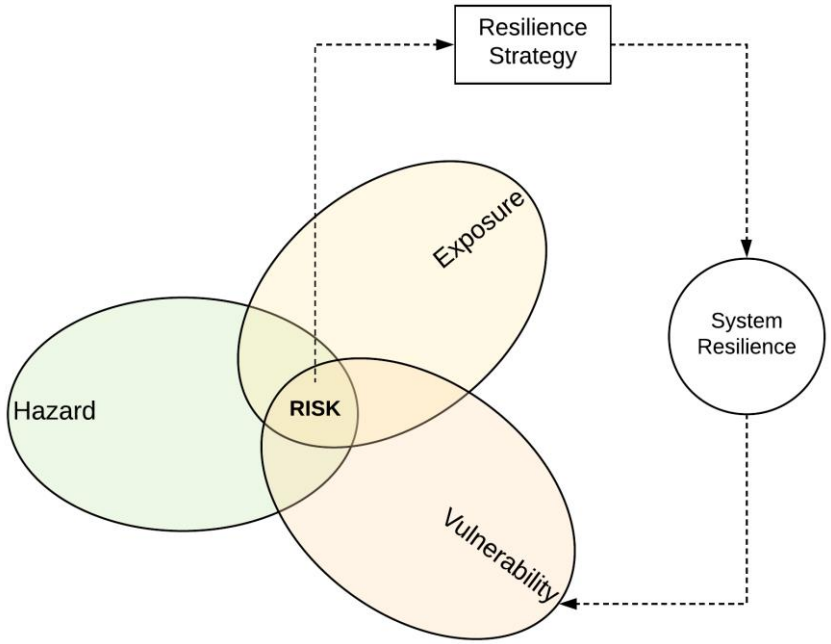
Clyde E. Lee Endowed Professor In Transportation Engineering

CENTER FOR TRANSPORTATION RESEARCH

THE UNIVERSITY OF TEXAS AT AUSTIN

Research Goals

- Systematic investigation of the resilience of the Texas Port System by assessing network-level and port-level exposure, risks, vulnerabilities, and resilience capacity.
- The specific objectives are:
  - Identify and characterize potential extreme weather events.
  - Identify the network- and port-level vulnerabilities of Texas ports and supporting infrastructure.
  - Quantify the physical and economic risks posed by extreme events to Texas ports.
  - Develop metrics and evaluate the resilience of Texas ports
  - Provide recommendations for improving Texas port system resilience



Relationship between hazard, exposure, vulnerability, risk and resilience.

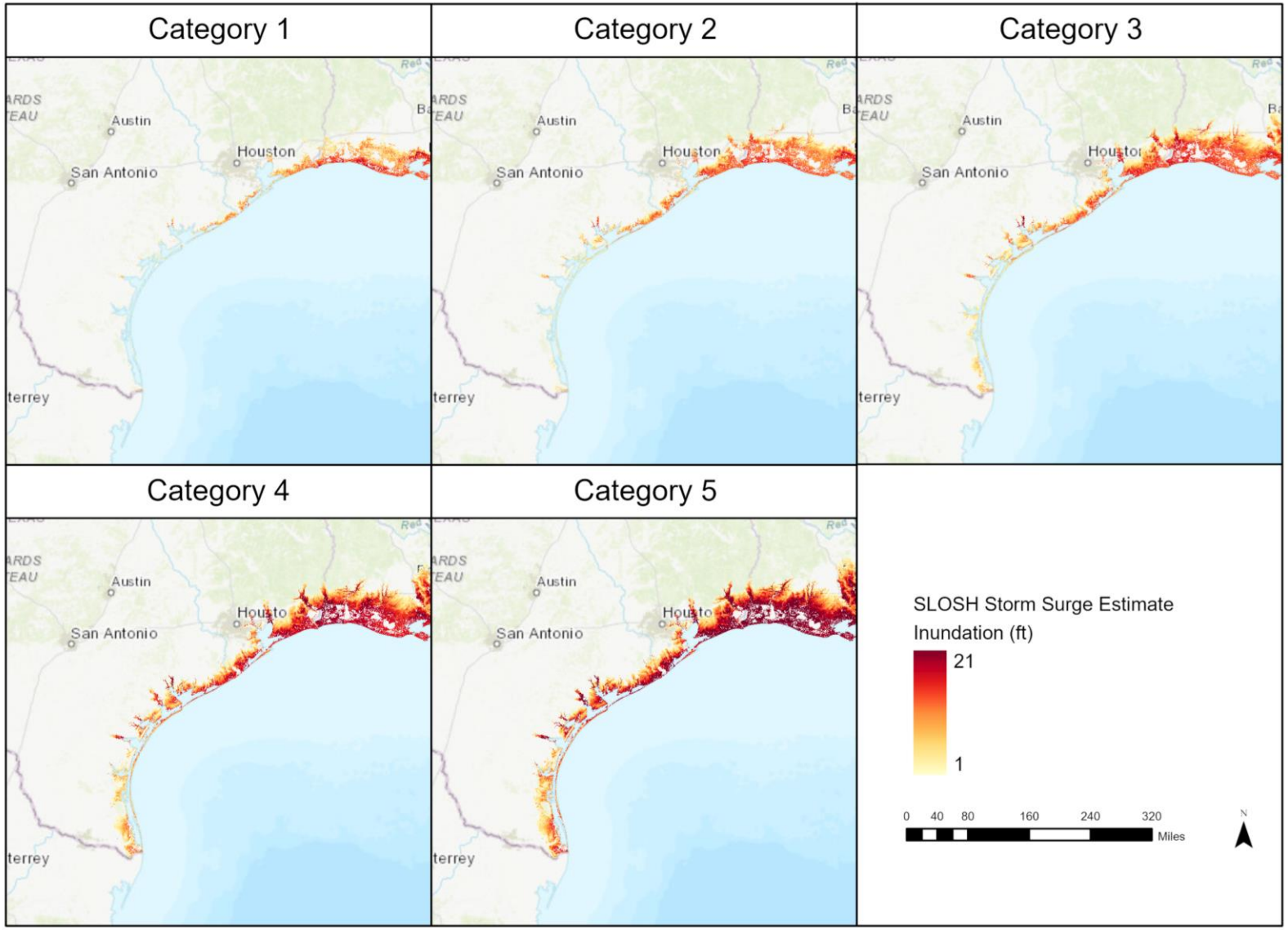
Synthesis of Literature

Comprehensive literature review of data sets, assessment methods, and best practices:

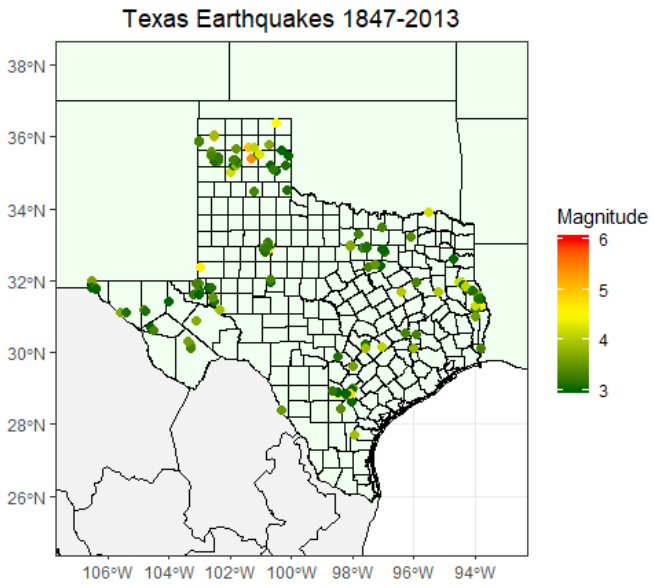
- Extreme weather events
  - Hurricanes, flooding, tornadoes, fires, earthquakes
- Port vulnerabilities, physical and economic risks
  - Physical, operational, economic
- Existing resilience metrics for intermodal seaport facilities
  - Academic studies, Gulf of Mexico Alliance PRI
- Port resilience enhancement best-practices
  - Operational/governance methods preferred due to cost-effectiveness and relative ease of implementation; physical improvements also viable in some instances

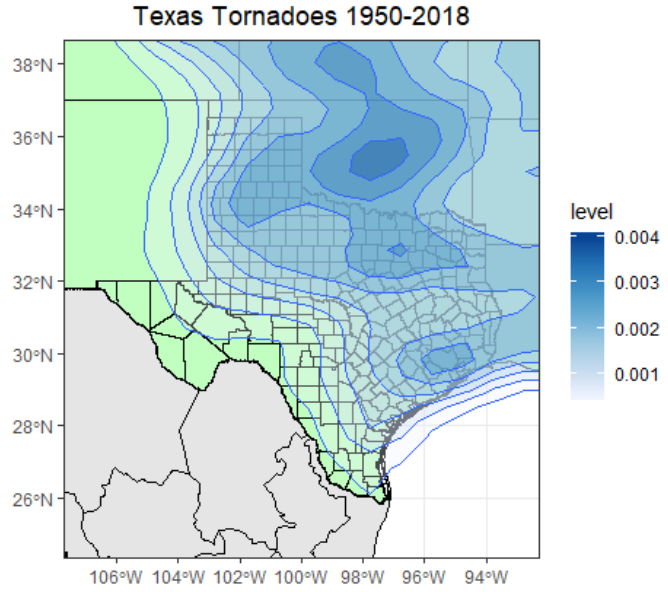
Identify and Characterize Potential Extreme Weather Events

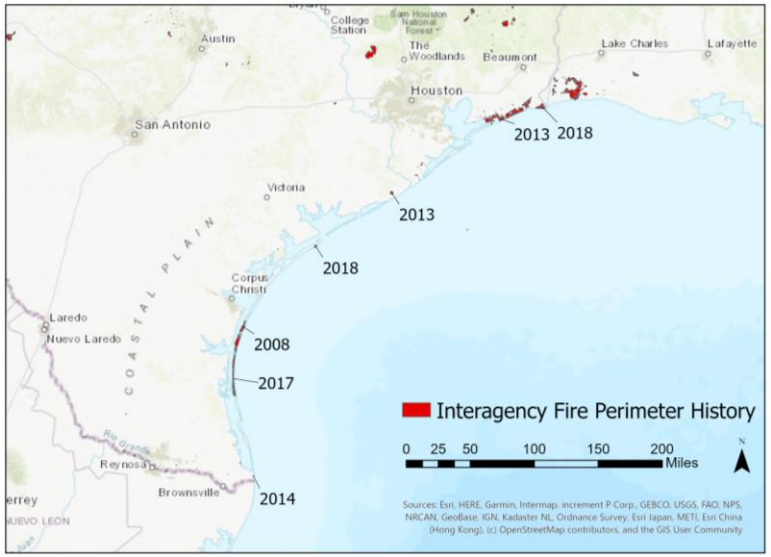
Texas coast storm surge flood exposure by hurricane intensity, inundation depth raster (data from NHC)



Identify and Characterize Potential Extreme Weather Events (Contd.)







- Earthquakes, tornadoes, wildfires also examined but occurrences are either infrequent, low-severity, or non-natural in origin
- Analyses under the study primarily focus on <u>hurricane storm surge and sea level rise</u>

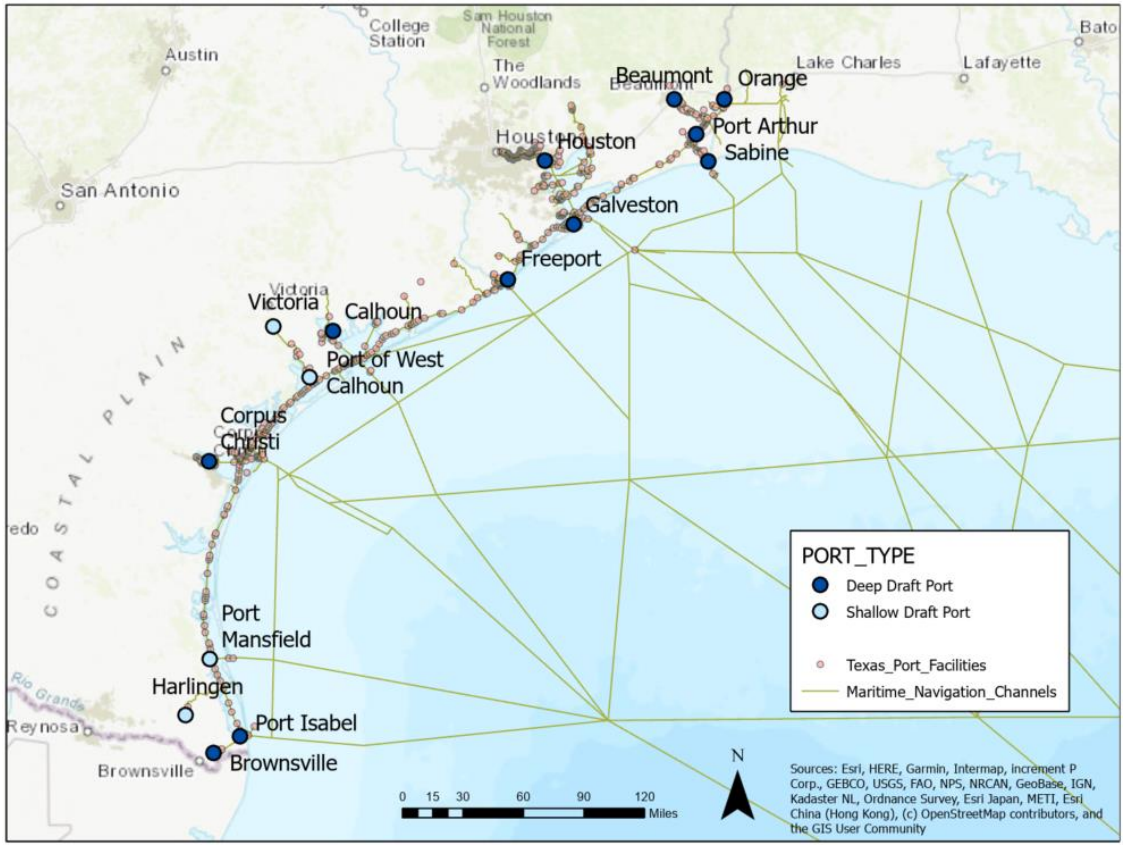
Enhance the Inventory of Port System and Supporting Infrastructure

Identify and extract network-level information on existing port infrastructure

- Port facilities (deep- and shallow-draft) and connected transportation systems (roadway, railway, water channels)
- Supporting infrastructure (pipelines and electric grid)

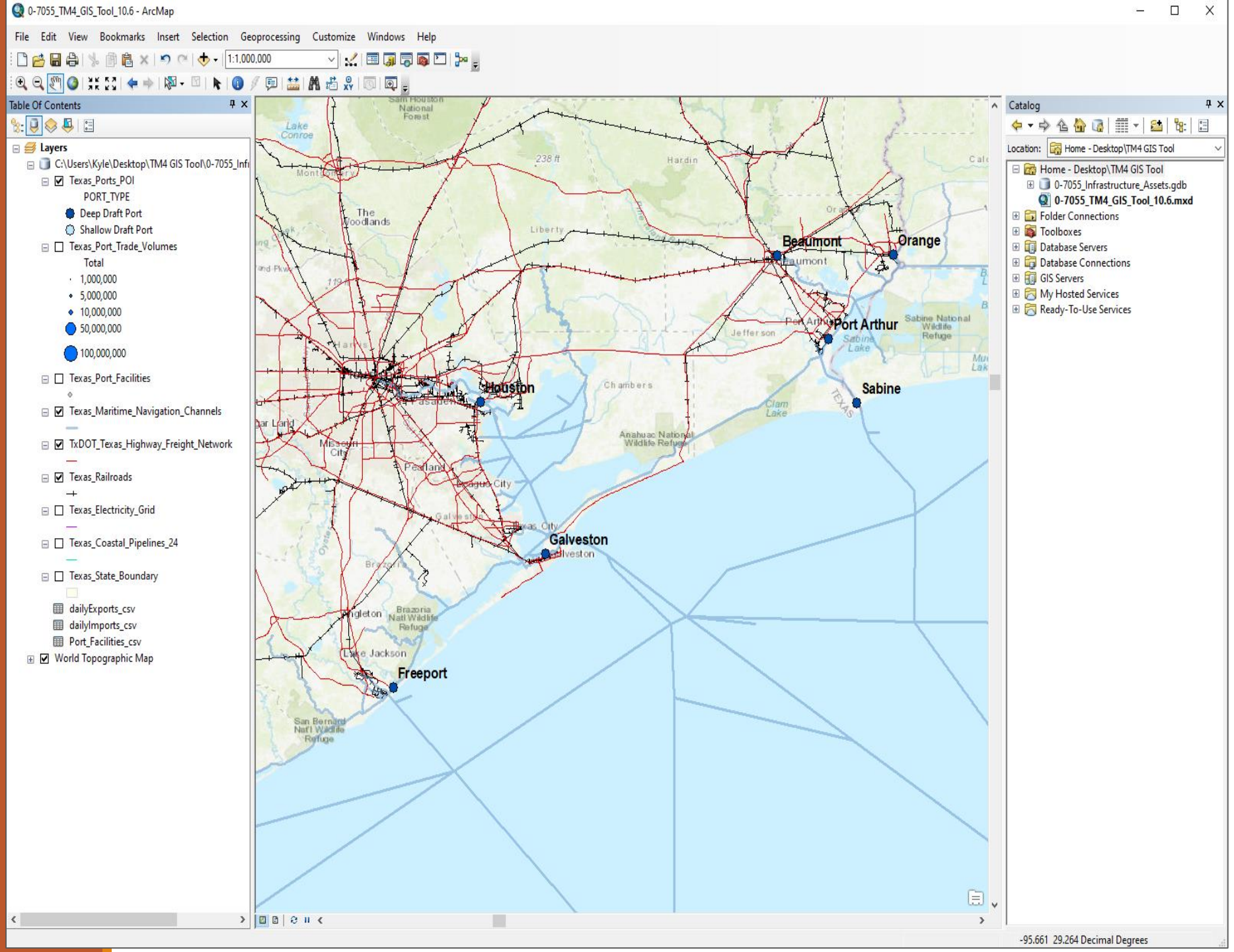
Collect port trade data

- Port-level trade data categorized based on imports and exports, commodity type, and value for quantifying economic impacts



Texas port facilities, port assets, navigational markers, and navigable waterways

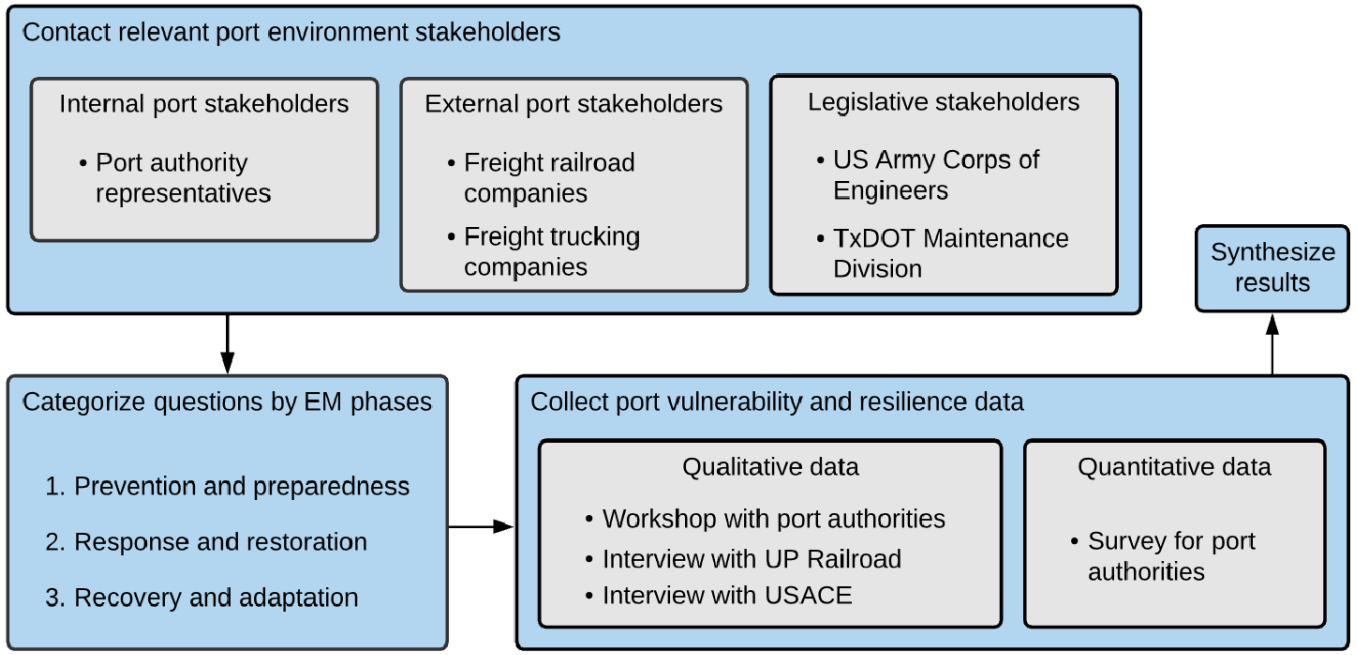
GIS Dataset Tool



Gather Information on Port Vulnerability and Resilience

Conduct workshops, surveys, and interviews with relevant stakeholders to fill knowledge gaps and identify vulnerabilities and resilience capabilities for port infrastructure, focusing on:

- The existing status of resilience in the Texas port environment.
- Inherent inadequacies that could amplify physical or functional damages.



Gather Information on Port Vulnerability and Resilience (Contd.)

Summary of port stakeholder outreach activities

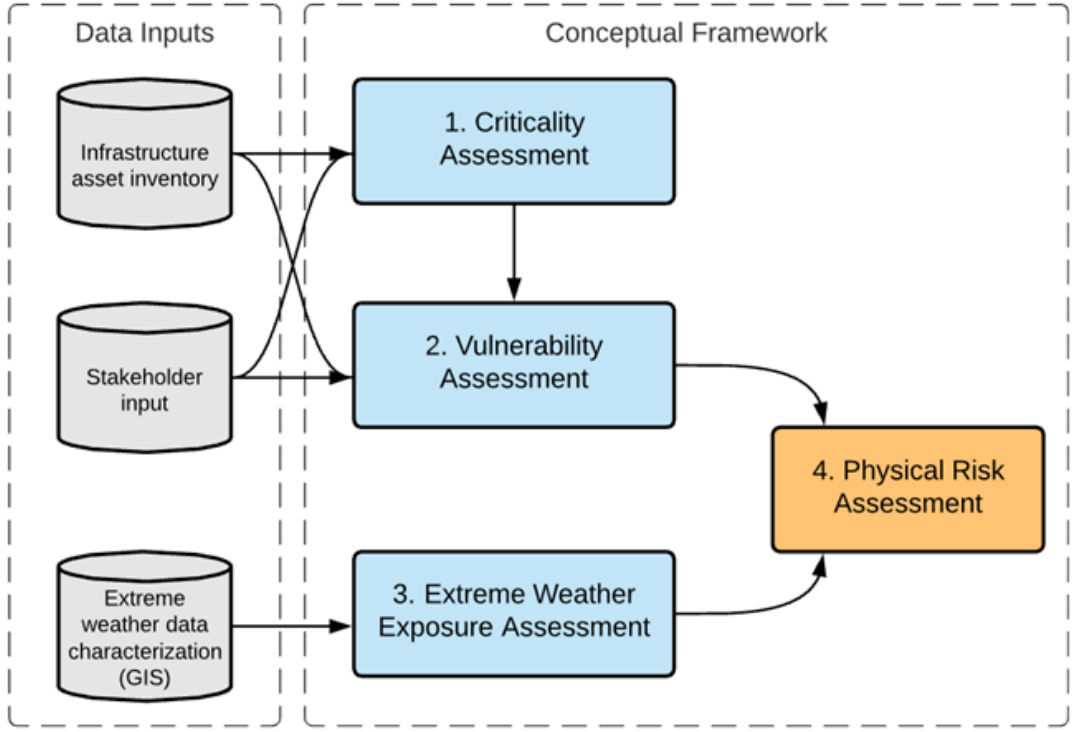
No.	Activity	No. of Participants	No.	Activity	No. of Participants
1	Port authority workshop	6	**5**	Port authority interview	1
2	Port authority online Qualtrics survey	8	**6**	Texas trucking online Qualtrics survey	244
3	Freight railroad interview	1	**7**	US (non-Texas) trucking online Qualtrics survey	322
4	Public sector stakeholder interview	1	**8**	Trucking interviews	5

Quantify Physical Risks on Texas Port System

Developed a framework to assess the risk of the physical infrastructure systems in a port environment

Analysis focuses on network level impacts but could be adopted for an individual port

- Stakeholder input from surveys and workshops are included where necessary
- Case study for Houston-Galveston-Beaumont region was performed to demonstrate implementation

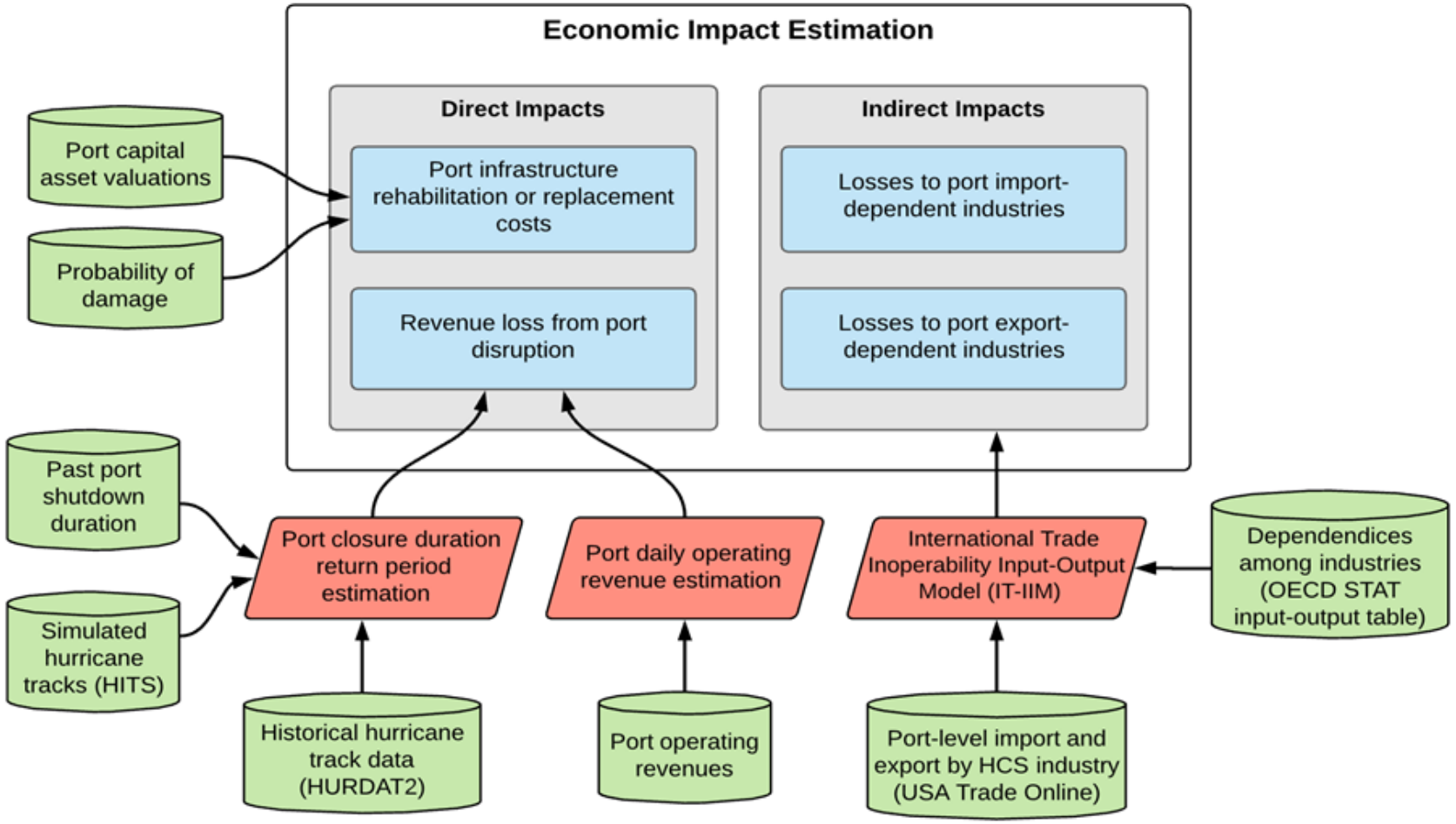


Risk assessment framework

Quantify Economic Risks of Port System Disruptions

Direct-microeconomic risks: Direct losses incurred by the port due o damaged components and revenue losses

Indirect-macroeconomic risks: Losses incurred by industries that are dependent on goods transported through ports as a result of destroyed or unavailable commodities due to port disruptions



Quantify Economic Risks of Port System Disruptions (Direct Impact)

Daily revenue multiplied by shutdown durations to obtain expected losses for hurricanes by storm Category

Port	Daily Operating Revenue ($ Thousands)	Losses from disruption to port operations ($ Thousands)					
		Cat +0	Cat +1	Cat +2	Cat +3	Cat +4	Cat +5
Corpus Christi	310.24	399.47	979.44	1148.76	1194.43	1539.93	1985.55
Freeport	91.98	97.28	209.93	359.14	428.97	546.87	735.85
Galveston	74.95	75.92	185.59	300.15	355.01	435.07	584.64
Houston	1070.50	908.49	2103.87	3499.67	3955.98	4756.42	6530.04
Port Lavaca	4.16	5.18	13.40	15.95	16.79	20.65	29.94
Brownsville	29.67	41.89	93.46	111.36	128.63	135.58	164.44
Beaumont	70.54	63.73	196.08	231.96	256.49	334.59	373.87
Orange	6.06	6.08	18.40	19.92	22.02	29.81	32.71

Quantify Economic Risks of Port System Disruptions (Indirect Impact)

Port	Case A Indirect Losses (in $Million)					
	Cat +0	Cat +1	Cat +2	Cat +3	Cat +4	Cat +5
Corpus Christi	113.13	277.12	324.48	337.63	434.98	561.26
Freeport	92.96	199.95	342.02	408.67	521.80	701.58
Galveston	26.81	65.84	106.19	125.83	153.97	207.07
Houston	636.56	1,475.32	2,448.88	2,770.91	3,325.09	4,568.25
Port Lavaca	6.06	15.73	18.76	19.74	24.28	35.18
Brownsville	10.25	22.91	27.27	31.56	33.23	40.29
Beaumont	40.76	125.89	148.98	164.83	214.65	240.01
Orange	0.001	0.002	0.003	0.003	0.004	0.004

Port	Case B Indirect Losses (in $Million)					
	Cat +0	Cat +1	Cat +2	Cat +3	Cat +4	Cat +5
Corpus Christi	96.68	236.84	277.31	288.55	371.75	479.68
Freeport	38.66	83.16	142.24	169.96	217.01	291.77
Galveston	18.32	44.98	72.55	85.97	105.20	141.48
Houston	499.44	1,157.52	1,921.36	2,174.02	2,608.82	3,584.19
Port Lavaca	4.91	12.74	15.20	15.99	19.67	28.49
Brownsville	6.54	14.61	17.39	20.13	21.19	25.69
Beaumont	37.22	114.98	136.07	150.55	196.04	219.20
Orange	0.001	0.002	0.003	0.003	0.004	0.004

Develop Port Resilience Metric

- Assessing resilience by the 4R dimensions for resilience improvements
- Organizing user input questions along the four steps of the emergency management (EM)
- Developing Port Resilience and Economic Impact Assessment Tool (PortRESECO)

Resilience Dimension	Scope
Port Robustness	The physical aspects of a port that could potentially reduce the impact of extreme weather events
Port Redundancies	The pre-disaster arrangements for substituting port operations and components in case of a port failure
Port Resourcefulness	The pre-disaster arrangements for mobilizing resources for restoration and recovery actions
Port Response Rapidity	The preparations to speed up restoration and recovery actions

PortRESECO – Resilience Module

Resilience Assessment Module

Input

Preparedness | Response | Recovery | Adaptation | Weight tool | Calculate Score

Output

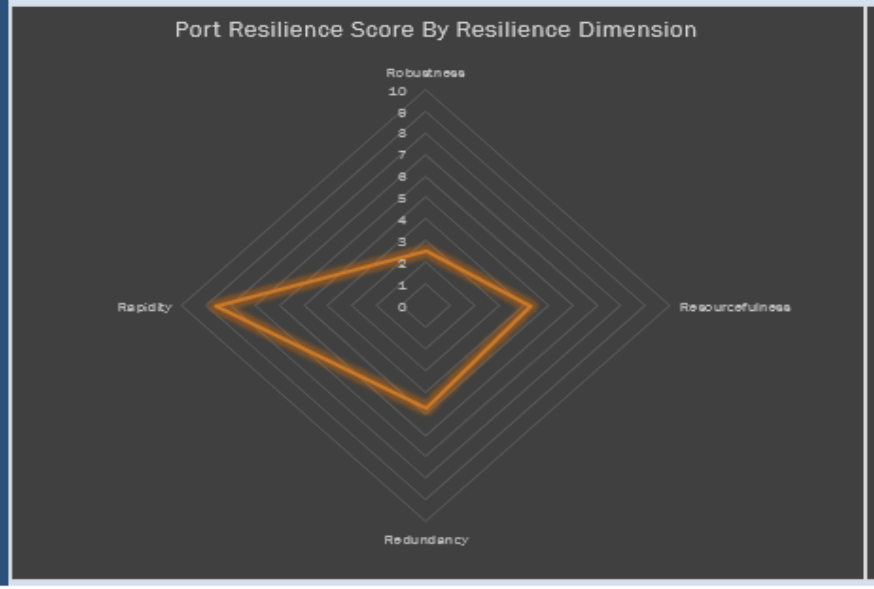
Resilience Dimensions

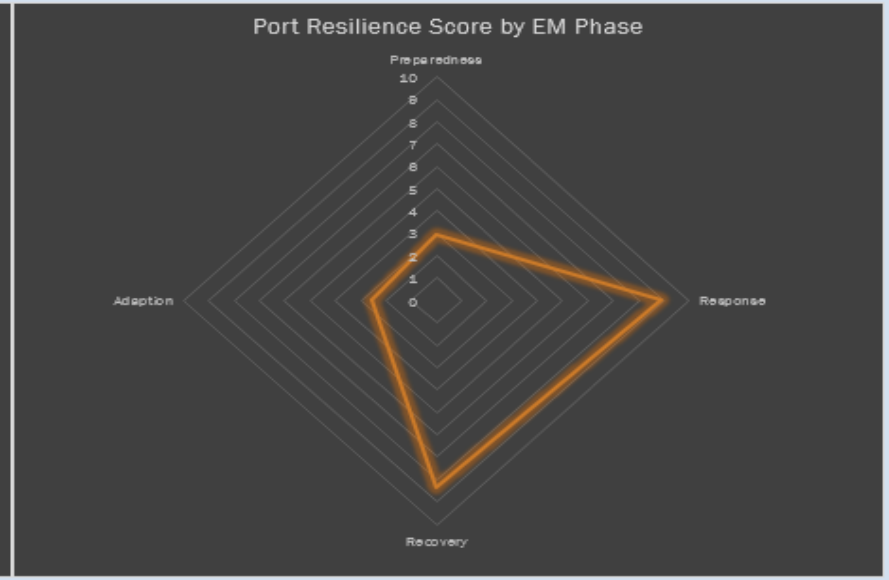
Dimension	Score
Robustness	2.5
Resourcefulness	4.3
Redundancy	4.8
Rapidity	8.6
Total Resilience*	**23.3**

*Total resilience is estimated using the area formed by the spider chart below

Emergency Management Phases

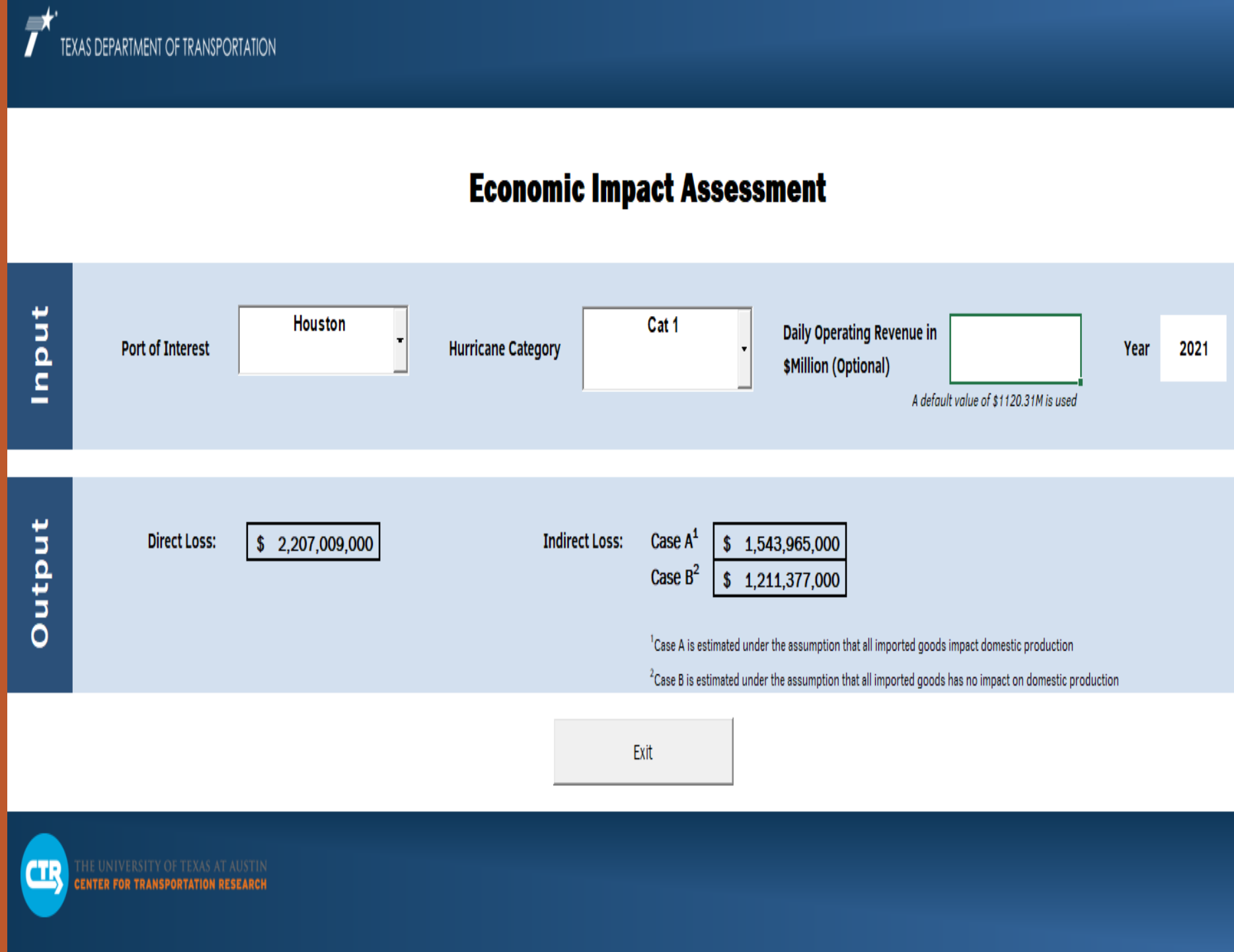
Phase	Score
Preparedness	3.0
Response	8.9
Recovery	8.3
Adaption	2.6





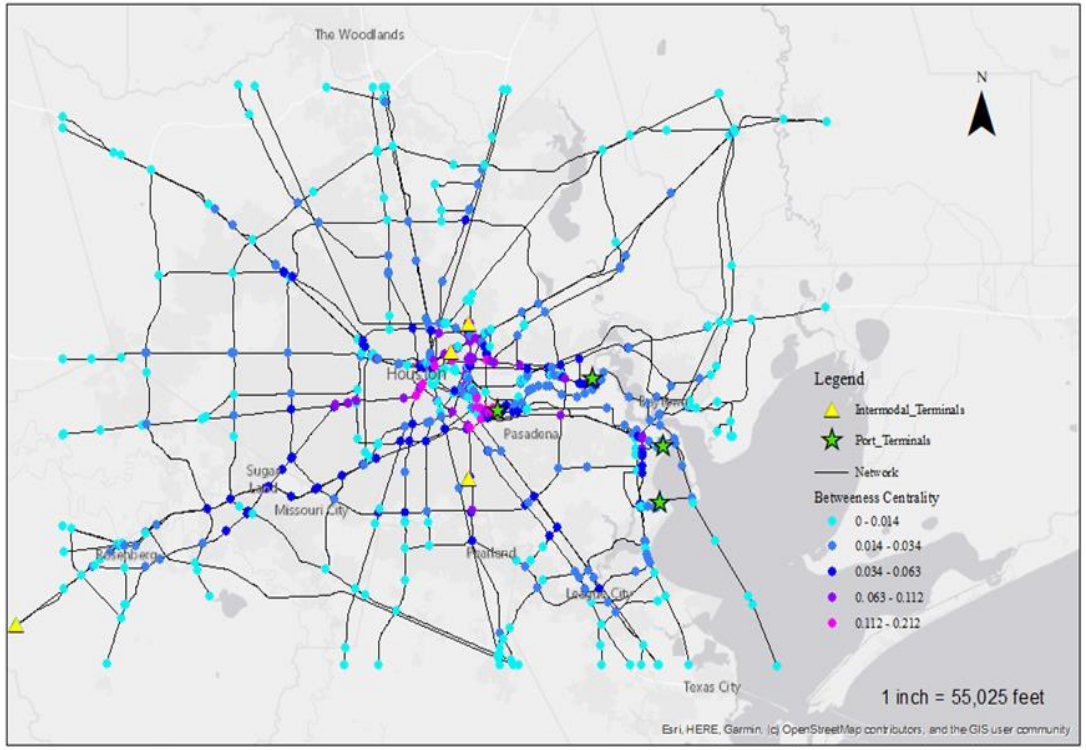
Exit

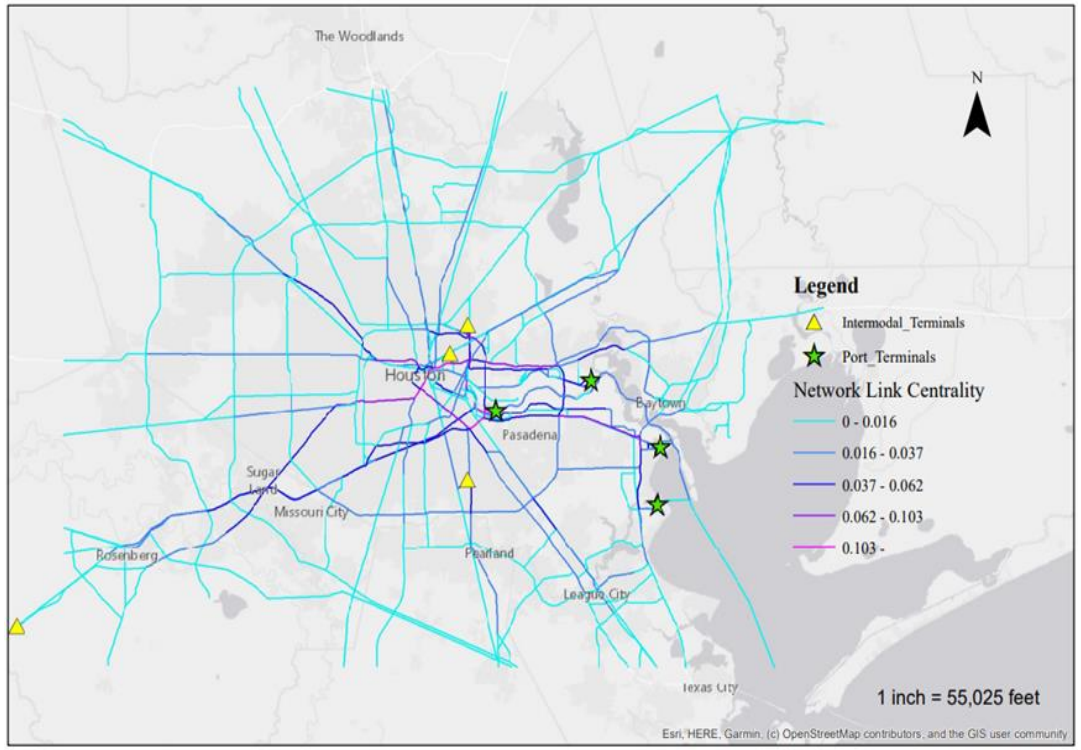
PortRESECO – Economic Impact Module



Assessing Network-level Resilience

Network criticality is assessed using betweenness centrality of both nodes and links



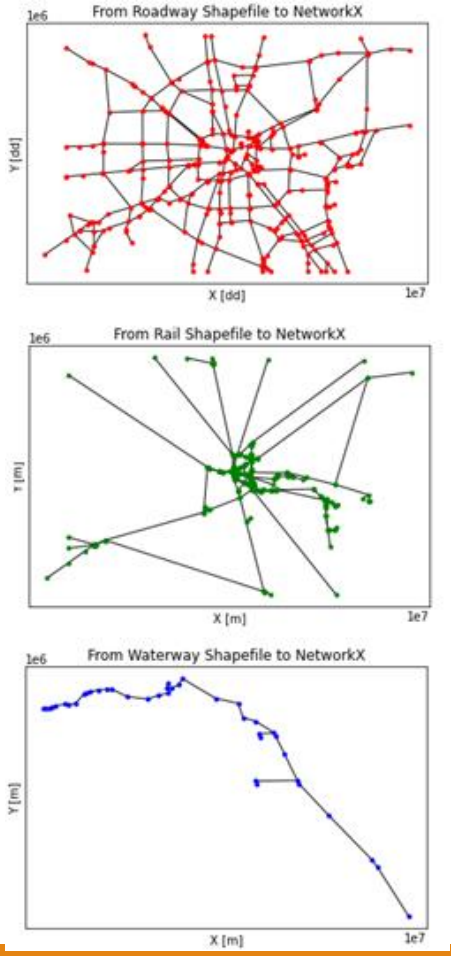


Assessing Network-level Resilience (Contd.)

Network vulnerability is assessed using total graph diversity (TGD)

Path diversity measures the number of disjoint links in an alternate path between a given node pair as compared to the shortest path for the given node pair

Network	Total Graph Diversity (TGD)	Vulnerability Indicator (V_i)
Roadway	0.66	0.33
Railroad	0.40	0.60
Navigation Channel	0.00	1.00



Provide Recommendations for Improving Port System Resilience

- Document appropriate resilience best-practices that could improve the resilience of Texas port system
- Provide recommendations for improving the resilience of critical components in Texas ports and supporting infrastructure
- Prioritize recommendations categorized by intended stakeholder:
  1. TxDOT (7 recommendations)
  2. Texas legislature (2 recommendations)
  3. Port authorities and port tenants (4 recommendations)
- Provide generic recommendations for port hurricane preparedness and response (20 recommendations)
- Finalize recommendations are available in the project final report (R1)

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