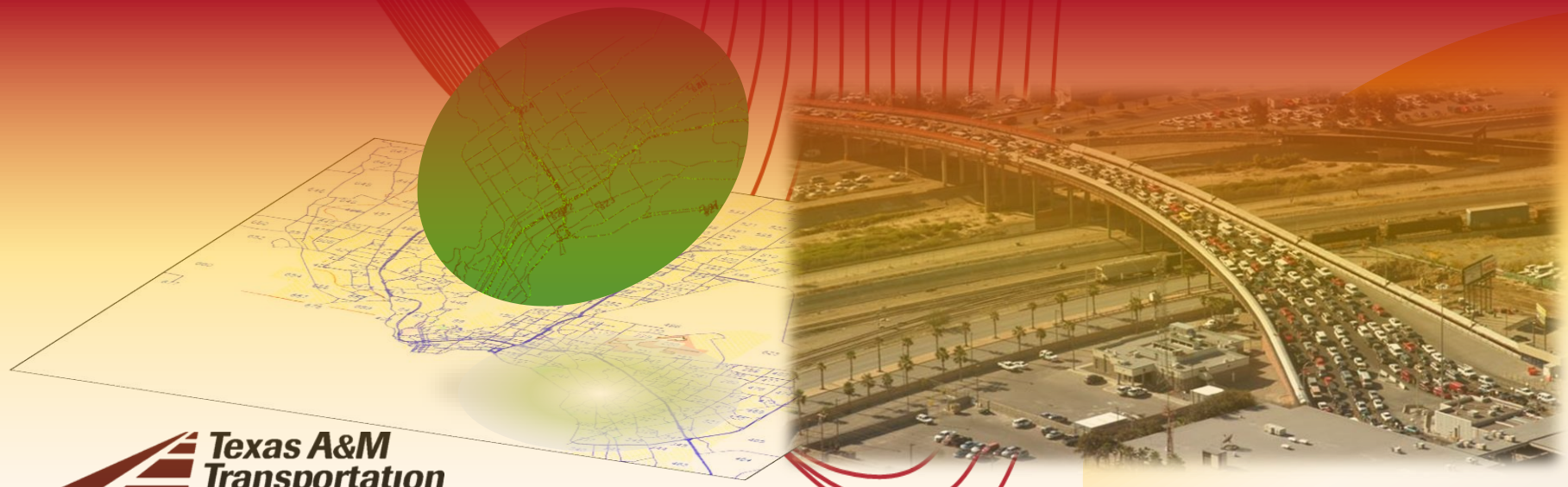
Bi-National Transportation Model for the Paso del Norte Region

Infrastructure on the Border Symposium

September 27, 2017



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Extreme Events

TX Land Ports of Entry are vital for trade and will continue to be so..

Name	Total Trade Value (Truck)	Export Value (Truck)	Import Value (Truck)	% Export Value	%Import Value	% Total Trade Value
Laredo, TX	117	54	63	17	21	19
Detroit, MI	99	58	40	18	13	16
Buffalo-Niagara, NY	62	37	26	12	9	10
El Paso, TX	51	22	29	7	10	8
Port Huron, MI	48	30	18	10	6	8
Otay Mesa, CA	33	11	22	3	7	5
Champlain Rouses Pt, NY	24	10	12	3	4	4
Hidalgo, TX	21	9	15	3	5	3
Santa Teresa, NM	18	7	10	2	3	3
Pembina, ND	17	12	5	4	2	3

Top 10 Ports by Trade Value (Billions of US$) ranked by total trade for USA- NAFTA partner trade in 2011. (U.S. DOT, Research and Innovative Technology Administration, Bureau of Transportation Statistics, TransBorder Freight Data, 2012)

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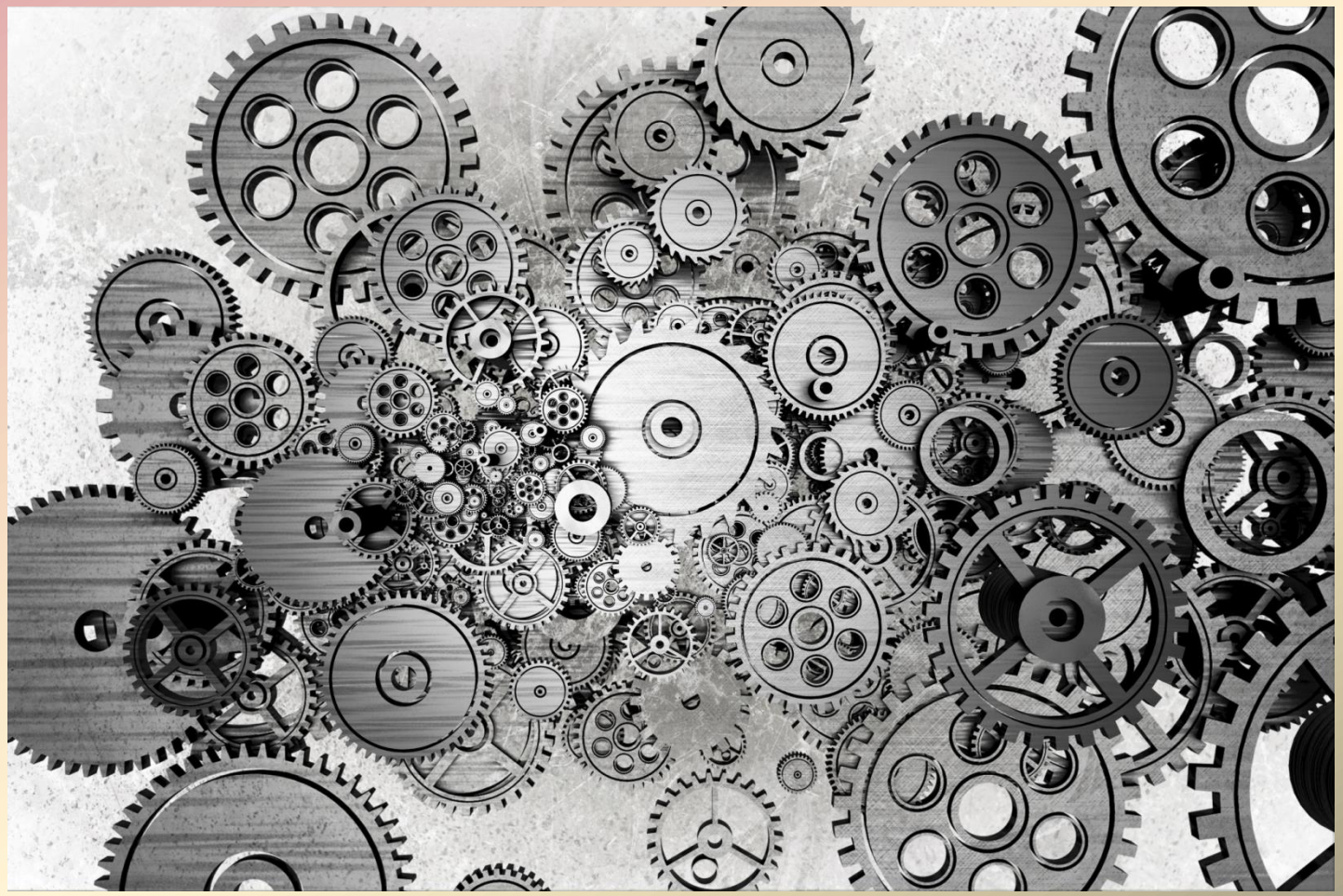
Complex Problem



Lots of moving pieces

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Complex Problem

How do you model something this complex?

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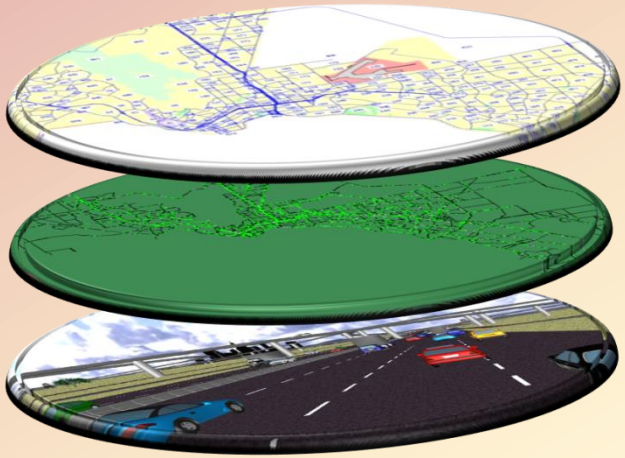
Complex Problem



Macroscopic

Mesoscopic

Microscopic

Multi-Resolution Modeling

There is no “one” modeling platform that can answer all the questions

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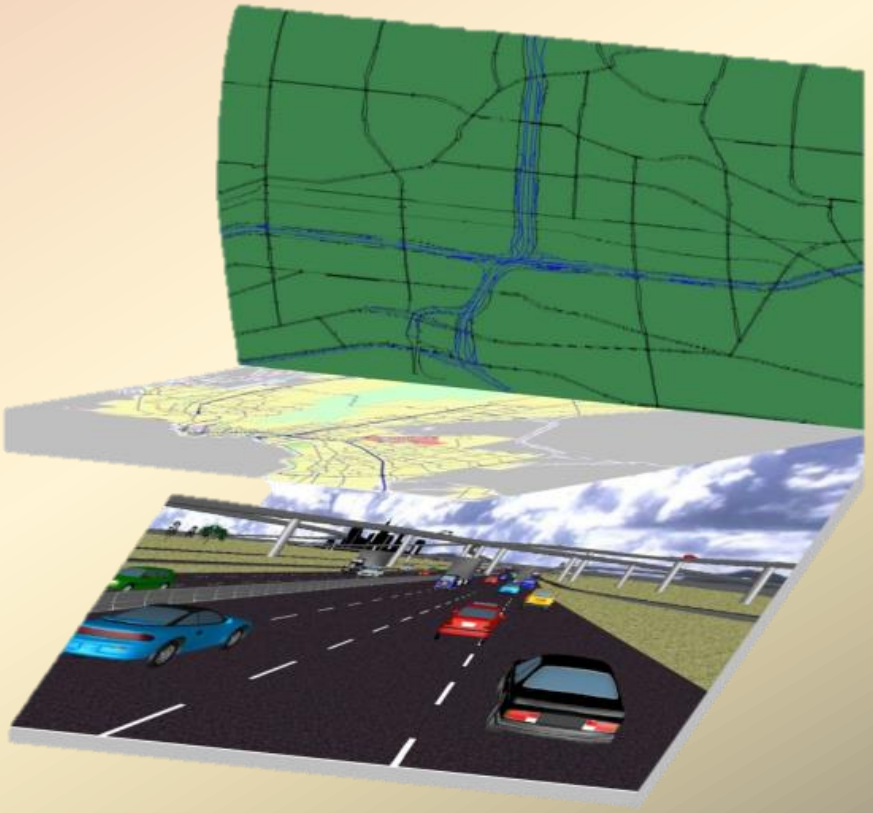
Concept - What is MRM?

- Model integration - taking the strengths of all model resolutions
  - Macro gives blueprint of network and provides O/D
  - Meso provides region-wide estimation of traffic redistribution
  - Micro- local operational analysis (individual car/lane)



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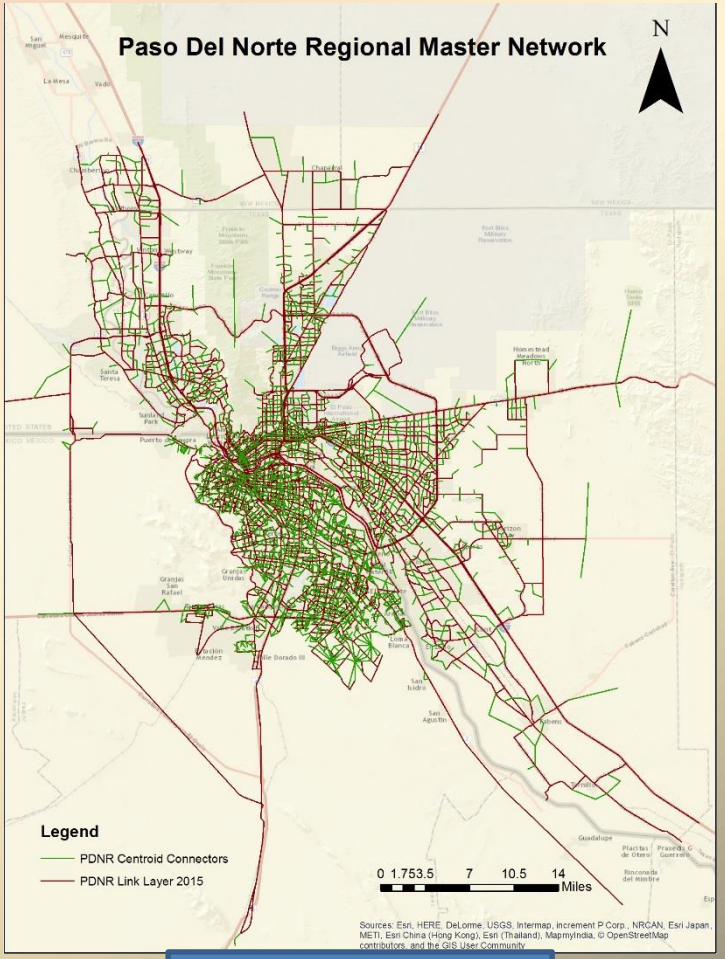
Concept - Why is MRM Important?

- Models are not mutually exclusive
- They are complimentary to one another and can accomplish optimal modeling capabilities
- Retain the best characteristics of each model
  - Incorporate multiple trip purposes
  - Realistic representation of regional traffic
  - Detailed interactions

What we did

- Developed a bi-national travel demand model in TransCAD
- Includes both El Paso and Juarez with POEs
- TAZs compatible with El Paso MPO model
- Separate matrices for cars and trucks



Macroscopic

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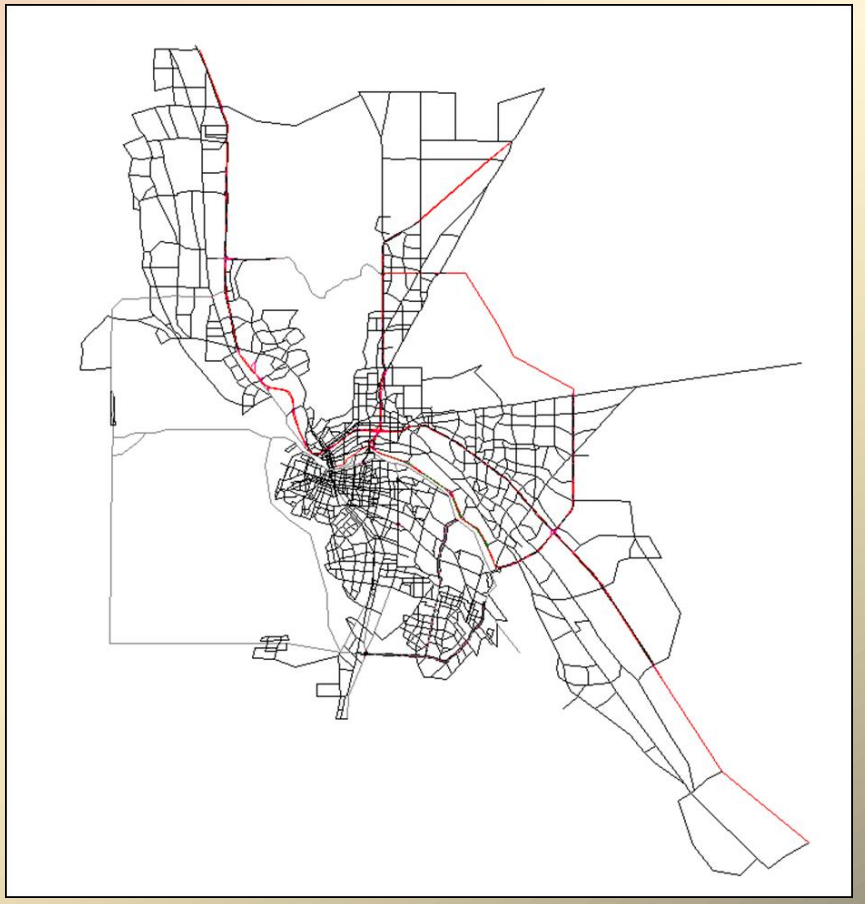
What we did

- Converted the travel demand model to simulation-based DTA
- Time-dependent matrices (24 hours)
- Cars and trucks



Mesoscopic

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What we did

- Developed microscopic models of BOTA and Zaragoza POEs
- Higher details in terms of lane assignments, queuing, delays at inspection booths
- Multiple modes of transport
  - Cars
  - Trucks
  - Transit
  - Pedestrians
  - Bicycles
  - Rail
- Realistic driver behavior
- 2D and 3D graphics

Microscopic

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What Tool to Use

- How would we model freight movement?
  - Regional analysis
    - Develop mesoscopic model of region
    - Able to paint a broader picture of traffic patterns
    - Simulate impacts of multiple POEs simultaneously
    - Diversions due to congestion
  - Individual POEs will be modeled using microscopic simulation tools
    - Provides output at a localized level
    - Help front line staff make immediate decisions

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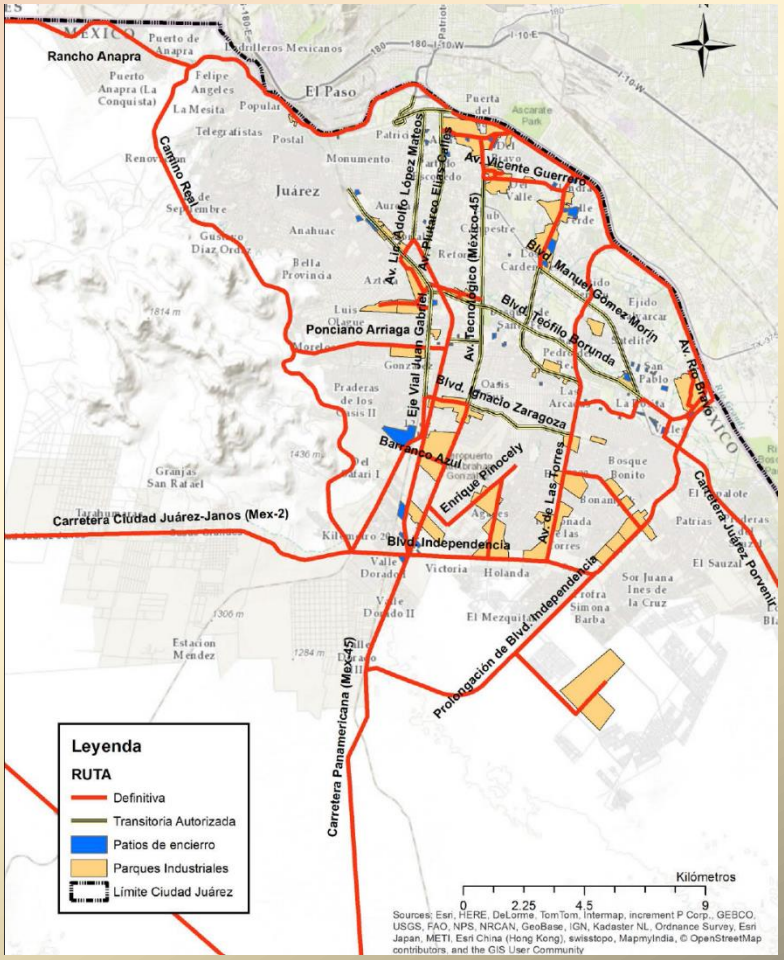
Freight Regulatory Plan

- Objectives of Juarez Freight Regulatory Plan:
  - Develop framework to organize and optimally manage freight vehicle flows
    - Safely, efficiently and clean
    - Adequate for current and future infrastructure
  - Propose improvements to regulatory framework
    - Update existing regulations
    - Define official freight routes
    - Define clearly the scope and attributions of authorities



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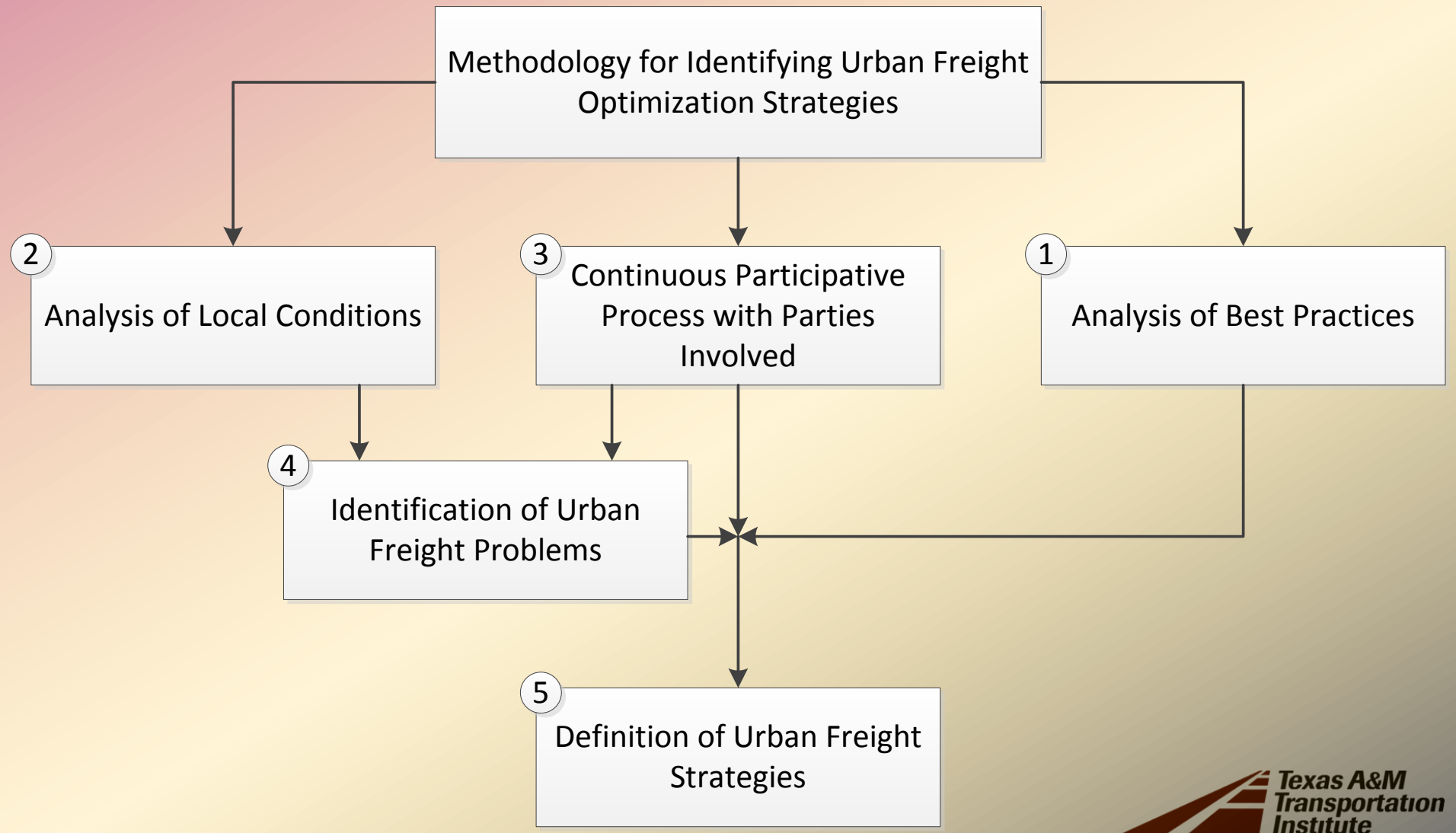
Freight Regulatory Plan



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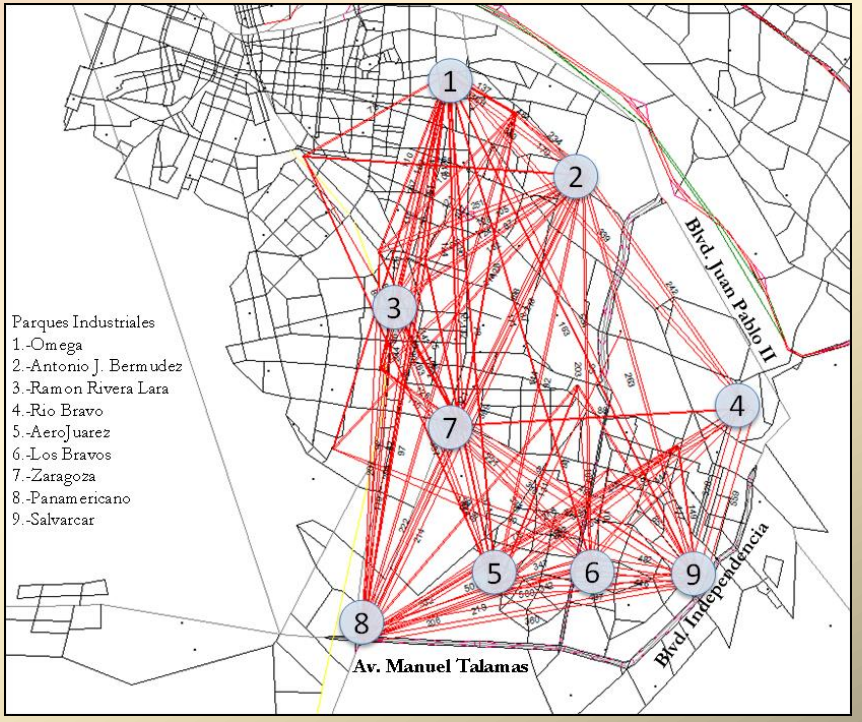
Freight Regulatory Plan

- Understand freight movement in Juarez
- Focused around maquiladoras
- Use data to calibrate model



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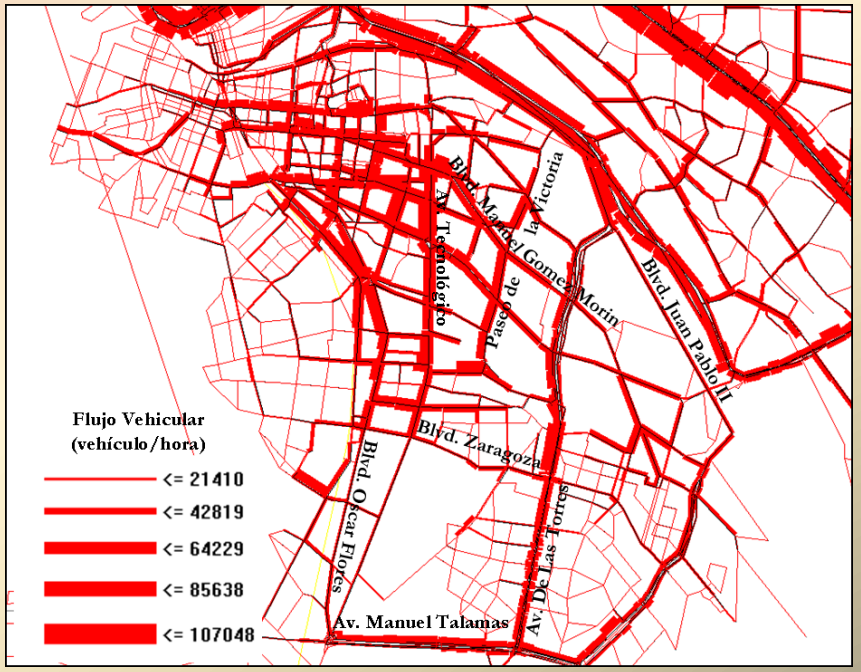
Freight Regulatory Plan

- Determine truck route options for Mexican truckers
  - Road closures
  - New routes
  - Departure times
  - Shifted some freight trips to rail



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Extreme Events

Aging Infrastructure – Underinvestment or Disinvestment in Critical Links Could be Costly…

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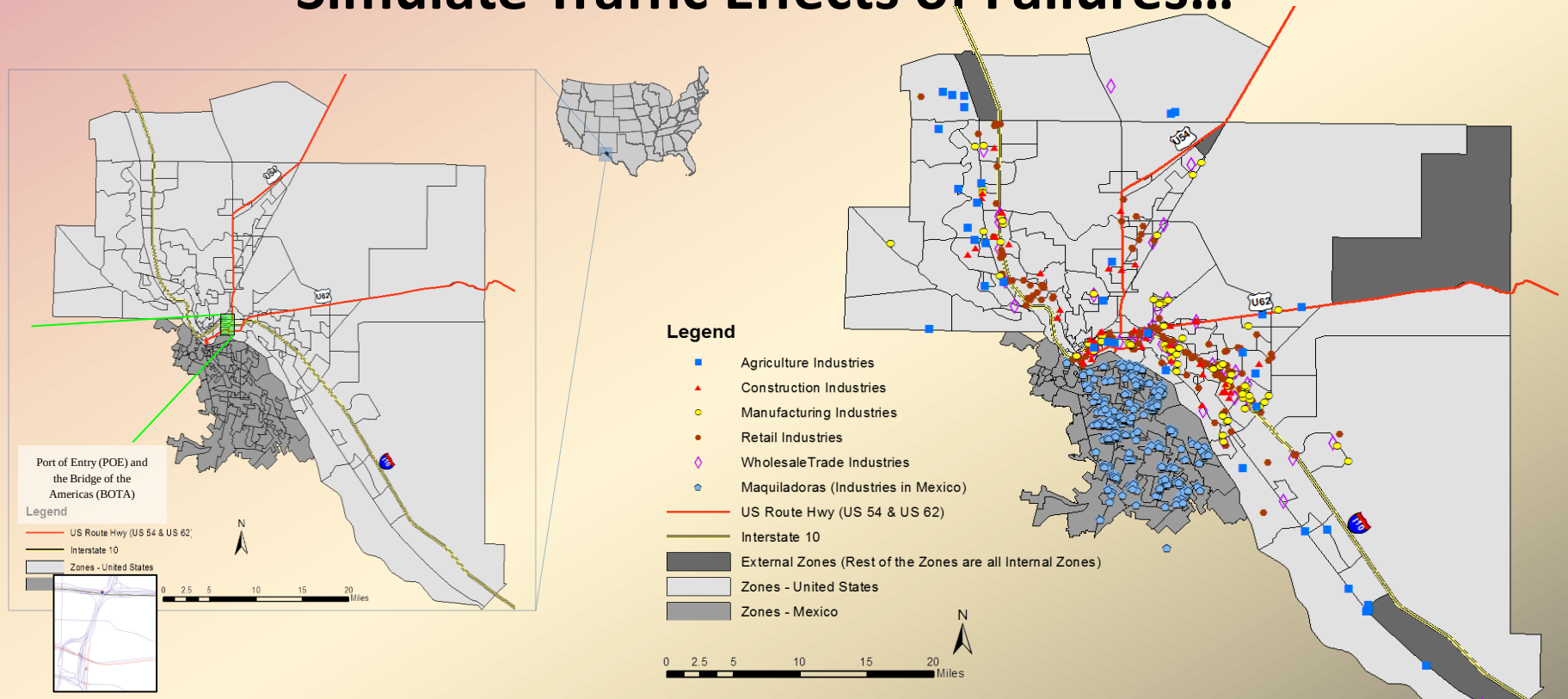
Extreme Events

Dynamic Traffic Assignment Modeling Framework to Simulate Traffic Effects of Failures…



Simulation Area: LPOE connecting to I-10 interchange.

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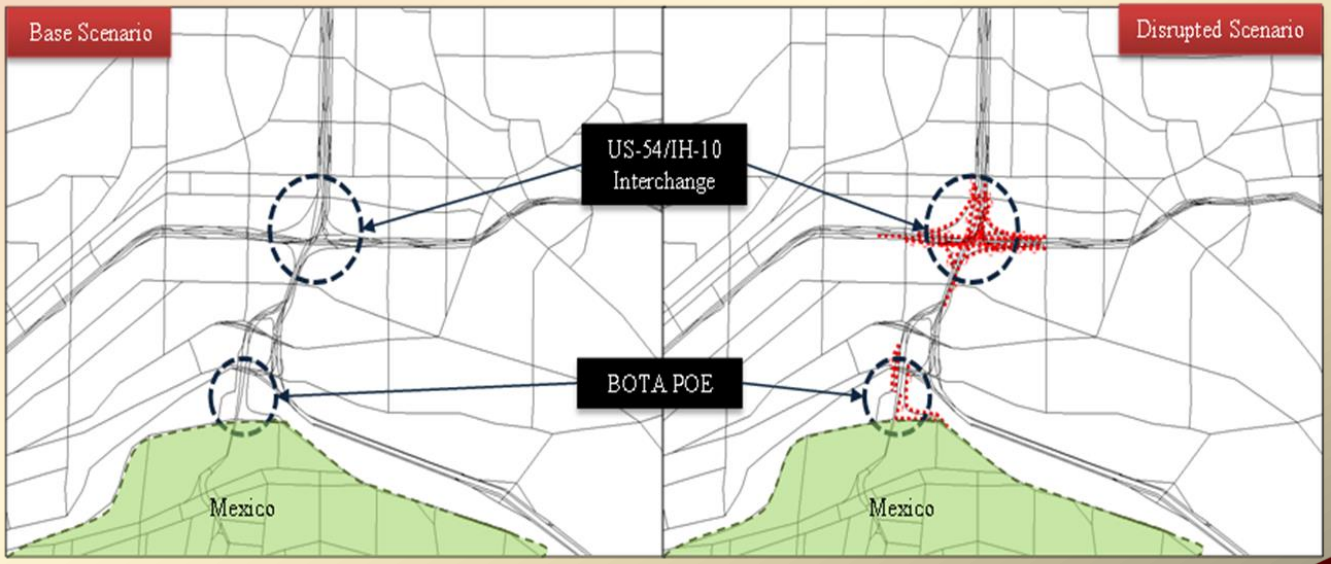
Extreme Events

- Impacts of BOTA bridge closure
  - "What if's"
  - Impact at bridges
  - Capture diversion
  - Short vs. Long-term impacts
  - Determine the economic impact of closure



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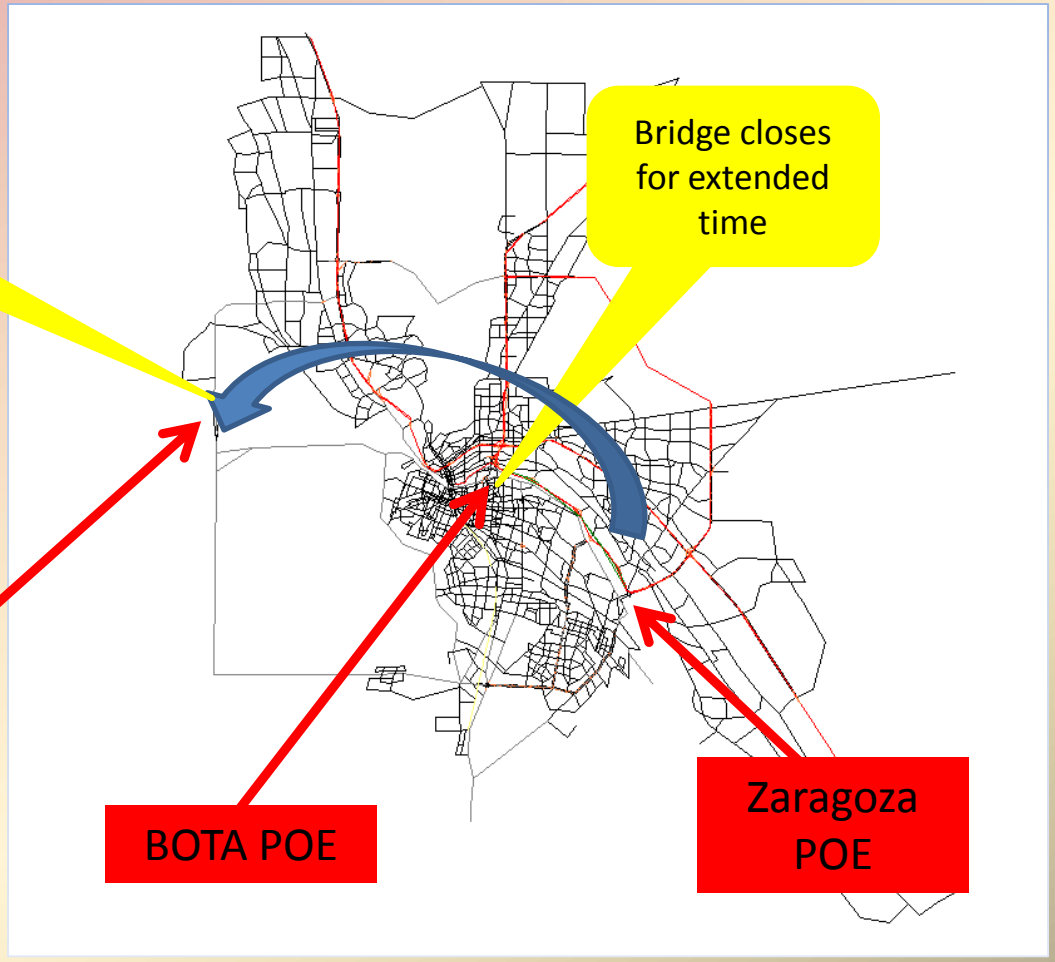
Extreme Events



Capture Diversion

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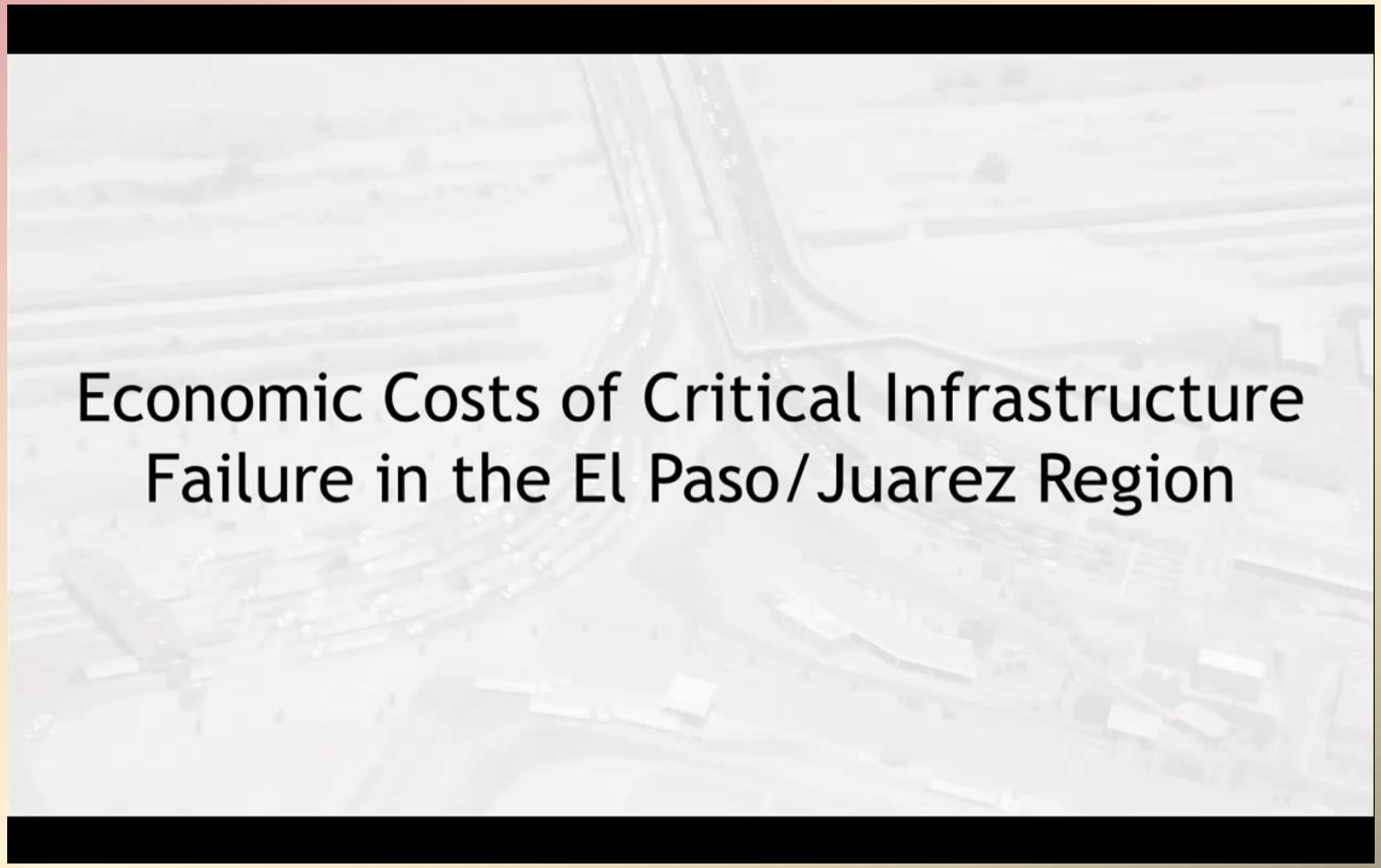
Extreme Events



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Detailed Bridge Analysis

- Determine the commuting cost of passenger vehicles on El Paso/Juarez border
  - Develop microscopic model of the Bridge of the Americas (BOTA)
  - Simulate various number of inspection stations, inspection times
- Port of Entry Emissions Inventory
  - Develop model of Zaragoza
  - Develop linkage between simulation model and MOVES
  - Calculate freight and passenger car emissions over 24 hour period

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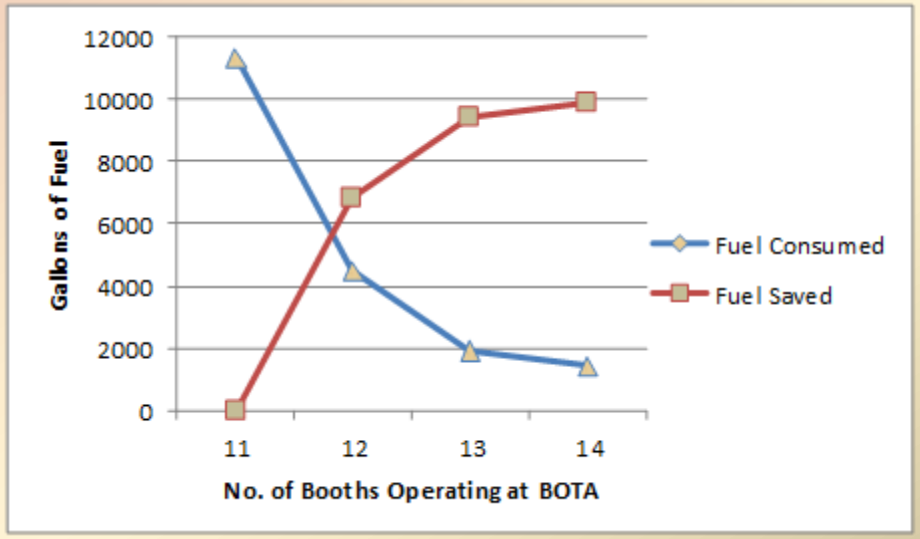
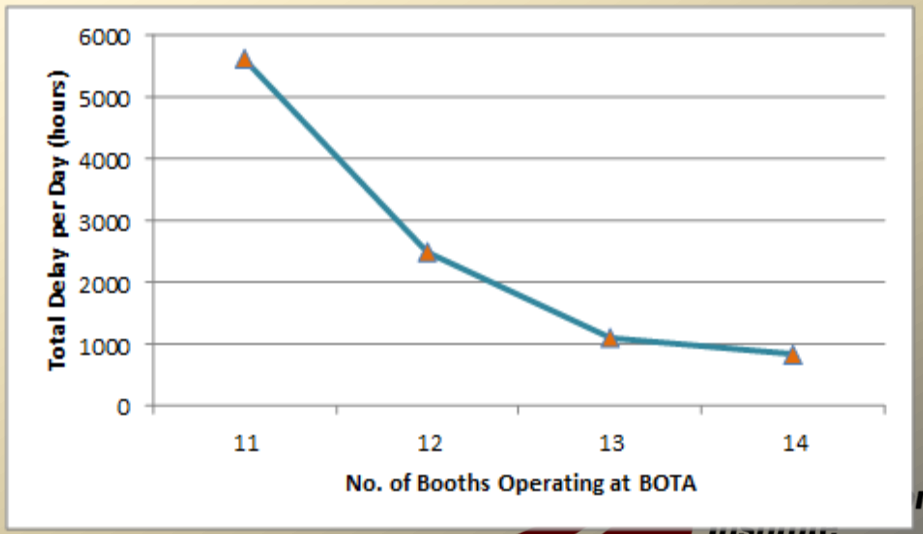
Commuting Cost

- Quantify the monetary impact of northbound traffic at BOTA
- Base on number of inspection booths open
- Derive the Value of Travel Time savings
- Calculate the commuting cost





Commuting Cost

Scenario	*Total Annual Insurance Cost (2012 US$/Year)*	*Routine Maintenance, Tires, Repair, and Depreciation Costs*	*Fuel Costs*	*Texas Vehicle Inspection or Engomado Ecológico Costs*	*CO_2 Emission Costs (US$/day)*	*Total Commuting Cost*
11 Lanes Opened	$5,602,896	$472,868	$14,972,300	$94,086	$182,482	**$21,324,632**
12 Lanes Opened	$5,955,924	$502,670	$5,941,105	$100,014	$72,270	**$12,571,983**
13 Lanes Opened	$5,956,873	$502,742	$2,561,570	$100,030	$30,715	**$9,151,930**
14 Lanes Opened	$5,958,771	$502,959	$1,930,485	$100,062	$23,488	**$8,515,765**

Annual Commuting Cost ($/year)

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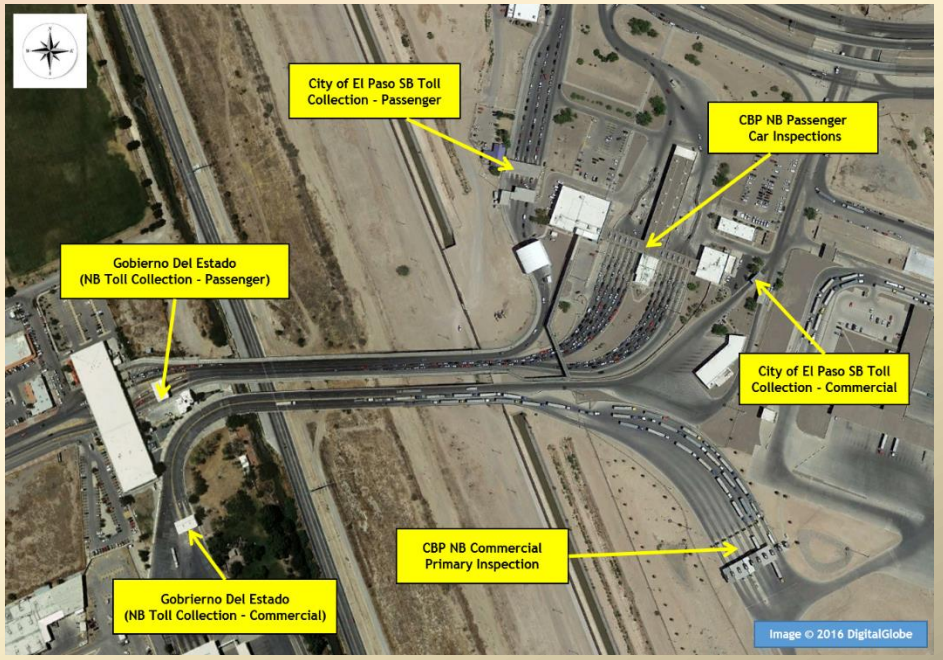
Port of Entry Emissions Analysis

- Determine emissions impacts from passenger cars and trucks
- Develop a model of the Ysleta-Zaragoza port of entry
- Test various operational scenarios
  - Inspection time/veh
  - Number of booths open



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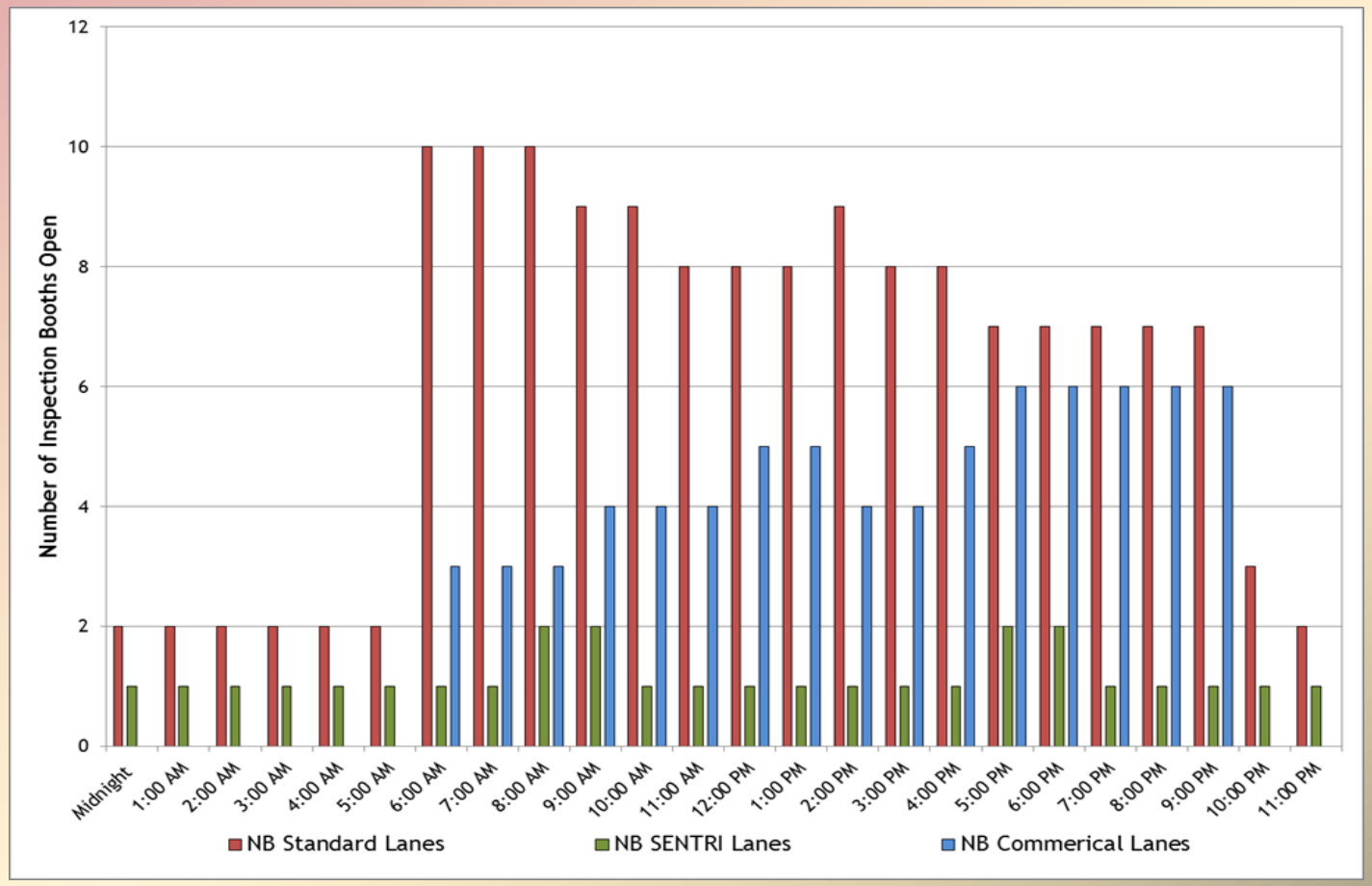
Port of Entry Emissions Analysis



Number of Inspection Booths in Operation – NB Direction

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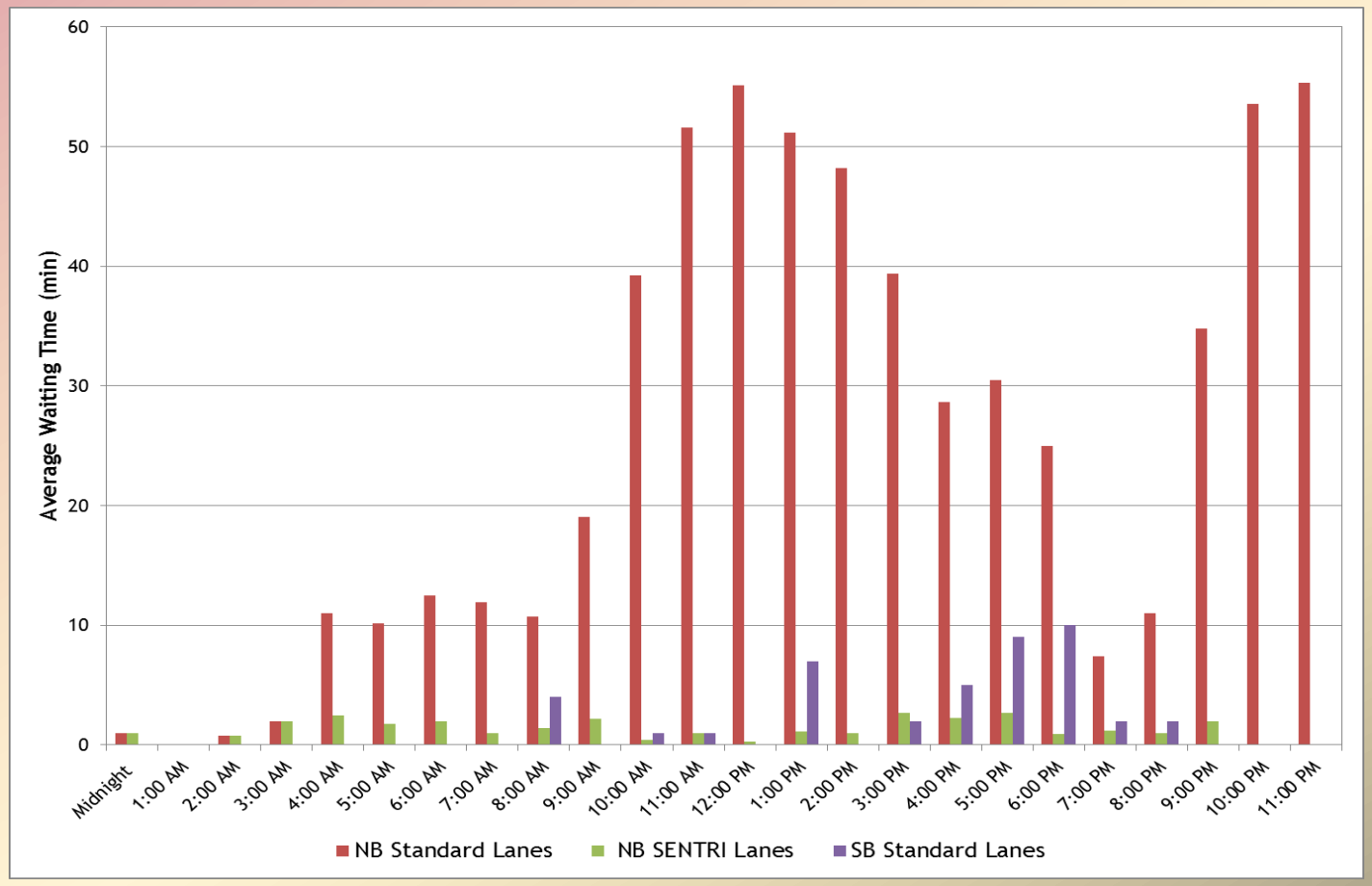
Port of Entry Emissions Analysis



Average Wait Time—Passenger Vehicles

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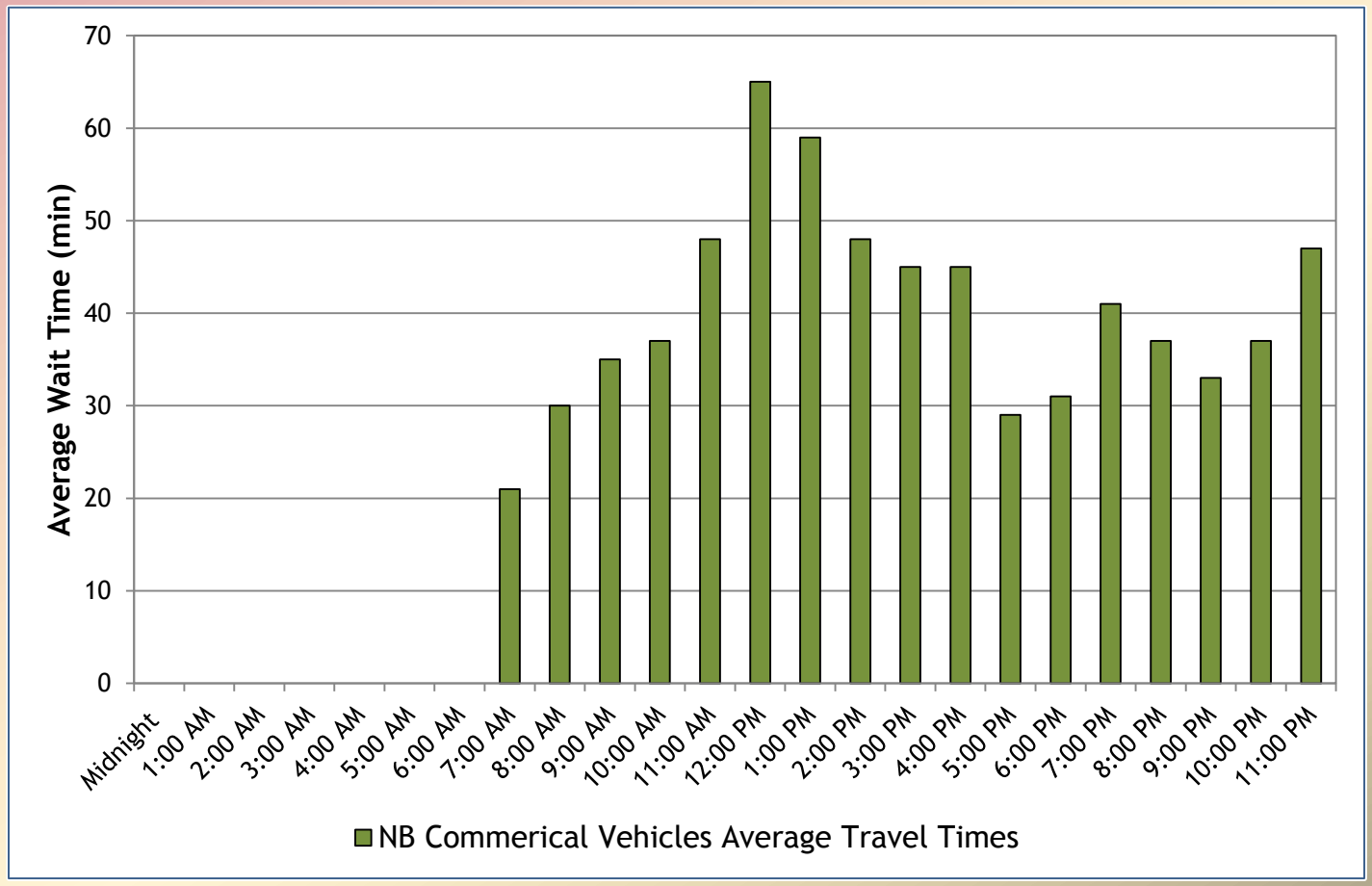
Port of Entry Emissions Analysis



Average Wait Time—Commercial Vehicles

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Port of Entry Emissions Analysis

Cars

Scenario	Vehicle Type	Direction	CO (gm)	CO_2 (gm)	NO_X (gm)	PM_{10} (gm)	$PM_{2.5}$ (gm)	PMEC (gm)	THC (gm)
Base	Car	Northbound	284,276	10,116,953	27,657	384	340	50	17,198
x10	Car	Northbound	272,959	9,650,190	26,894	373	330	48	16,363
x15	Car	Northbound	225,589	7,845,430	22,937	327	289	42	13,220
x20	Car	Northbound	218,040	7,572,766	22,220	317	281	41	12,754
x25	Car	Northbound	210,950	7,316,178	21,557	308	273	40	12,313

Trucks

Scenario	Vehicle Type	Direction	CO (gm)	CO_2 (gm)	NO_X (gm)	PM_{10} (gm)	$PM_{2.5}$ (gm)	PMEC (gm)	THC (gm)
Base	Truck	Northbound	110,795	25,173,720	259,551	12,570	11,564	5,344	22,199
x10	Truck	Northbound	111,633	25,382,394	261,517	12,672	11,658	5,401	22,346
x15	Truck	Northbound	111,955	25,447,076	262,244	12,705	11,688	5,407	22,422
x20	Truck	Northbound	110,188	25,043,140	258,013	12,512	11,511	5,341	22,044
x25	Truck	Northbound	109,987	24,991,579	257,534	12,486	11,487	5,325	22,012

Reduction in Inspection Time/Vehicle

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Port of Entry Emissions Analysis

Cars

Scenario	Vehicle Type	Direction	CO (gm)	CO_2 (gm)	NO_X (gm)	PM_{10} (gm)	$PM_{2.5}$ (gm)	PMEC (gm)	THC (gm)
Base	Passenger	Northbound	210,950	7,316,178	21,557	308	273	40	12,313
25% Reduction in Capacity	Passenger	Northbound	238,631	8,393,126	23,740	331	293	43	14,206
50% Reduction in Capacity	Passenger	Northbound	267,057	9,494,845	26,008	358	317	46	16,131
75% Reduction in Capacity	Passenger	Northbound	270,667	9,638,504	26,263	363	321	47	16,387

Trucks

Scenario	Vehicle Type	Direction	CO (gm)	CO_2 (gm)	NO_X (gm)	PM_{10} (gm)	$PM_{2.5}$ (gm)	PMEC (gm)	THC (gm)
Base	Commercial	Northbound	109,987	24,991,579	257,534	12,486	11,487	5,325	22,012
25% Reduction in Capacity	Commercial	Northbound	106,618	24,256,000	249,751	12,105	11,136	5,164	21,335
50% Reduction in Capacity	Commercial	Northbound	107,267	24,395,220	251,331	12,170	11,197	5,175	21,490
75% Reduction in Capacity	Commercial	Northbound	107,796	24,535,832	252,978	12,237	11,258	5,190	21,632

Number of Inspection Booths Open and 25 Percent Reduction in Wait Time

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Bridge of the Americas

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Thank You!!

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