Freight Technologies for Sustainable Future

Envisioning Tomorrow’s Sustainable Mobility Systems Workshop

Sushant Sharma

Texas A&M Transportation Institute

Freight mobility technology trends to achieve an efficient and decarbonized system

- Physical Internet/Smart Logistics
- Drone Delivery/Last Mile Solutions
- Autonomous and Electric Trucks
- Smart Border Crossings for Commercial Vehicles
- Truck Only Lanes for Automated Trucks or Truck Platooning

Physical Internet

New approach to logistics and transportation, aimed at creating a more efficient, sustainable, and interconnected system

Envisions a global logistics network that operates like the **digital internet**, with open and standardized protocols, shared infrastructure, and interoperable systems.

Goods are packed in standard-sized containers that can be easily transported using a variety of modes, including ships, trains, and trucks. **Optimizes** infrastructure usage and reduce inefficiencies, empty trucks and wasted space in containers.

Advanced technologies such as the Internet of Things (IoT), blockchain, and artificial intelligence (AI) to enable real-time tracking and tracing of goods, secure and transparent transactions, and predictive analytics for better decision-making.

*Vision of the Physical Internet is still in the early stages of development and implementation, but it has the potential to transform the logistics and transportation industry, **reduce carbon emissions**, and improve the overall efficiency and sustainability of the global supply chain.*

WCTR 2023 (17-21 July), Montreal, Canada: Is the **Physical Internet** Realistic? - An Oxford Style FUN Debate

High Profile Debate Team:

Benoit Montreuil

Jean-Paul Rodrigue

Anne Goodchild

Jose Holguin-Veraz

WCTRS –

Special Interest Group (SIG) Freight Modeling Group

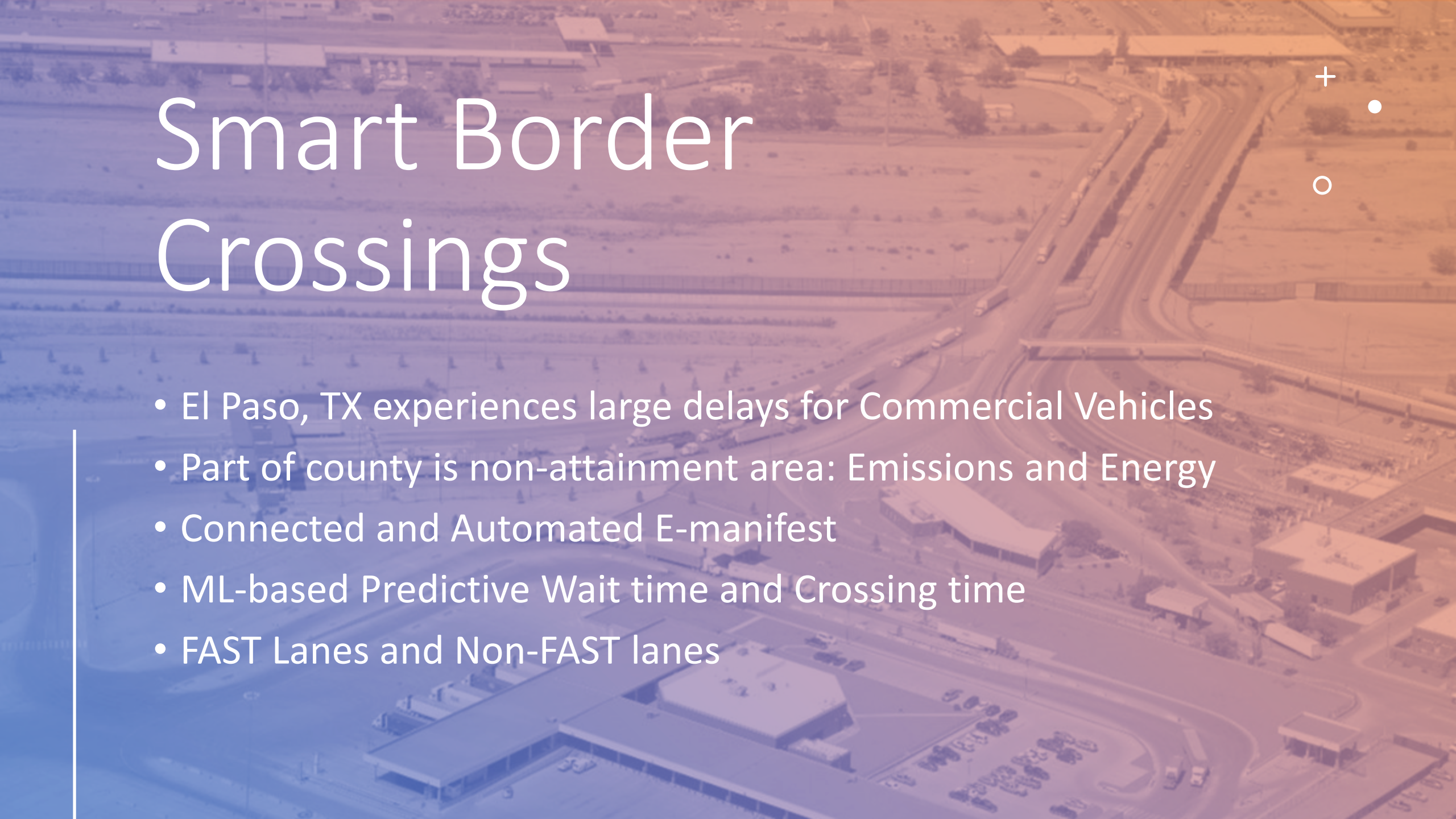
Drone Delivery/ Last Mile Solutions

- Last mile delivery accounts almost half of the total delivery cost and consumes significant energy and creates emissions (~20% of transport GHG).
- Success stories from healthcare industry during COVID-19
- High density urban and rural locations can be served efficiently by drones
- Difficult to operate in risky air space
- Perfect large scale drone delivery is very difficult
- Landing parcel in delivery zone without landing drones
- Varies by city, geography, air restrictions
- Consumers are uncertain about reliability, stolen goods, high cost, privacy, property damage, etc.
- Autonomous Vehicle Delivery is relatively more promising

Autonomous Electric Trucks

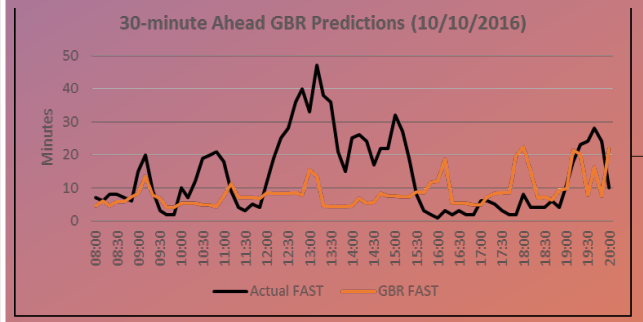
- Combination of AV and EV technology is marking a first for the industry for a Class 8 truck, Kodiak
- Certain infrastructure in place for the new technology.
- Level 2 alternating current charger, which are widely available in public settings, or a direct fast charger.
- Solo Advanced Technologies, which renamed itself in January to Terraline, is developing an autonomous electric Class 8 truck called the SD1.
- Volvo Trucks has shared vision for an electric autonomous cabless vehicle for ports and other facilities.

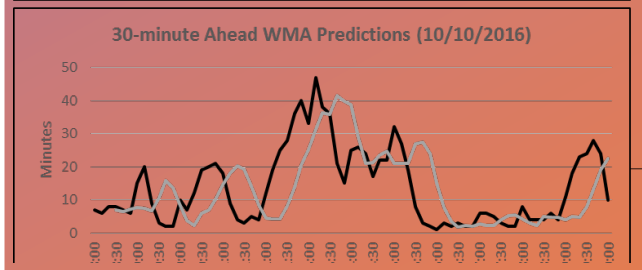
Smart Border Crossings

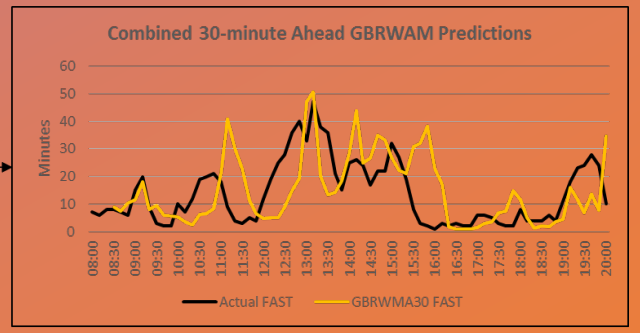


- El Paso, TX experiences large delays for Commercial Vehicles
- Part of county is non-attainment area: Emissions and Energy
- Connected and Automated E-manifest
- ML-based Predictive Wait time and Crossing time
- FAST Lanes and Non-FAST lanes

Smart Border Crossings for Commercial Vehicles

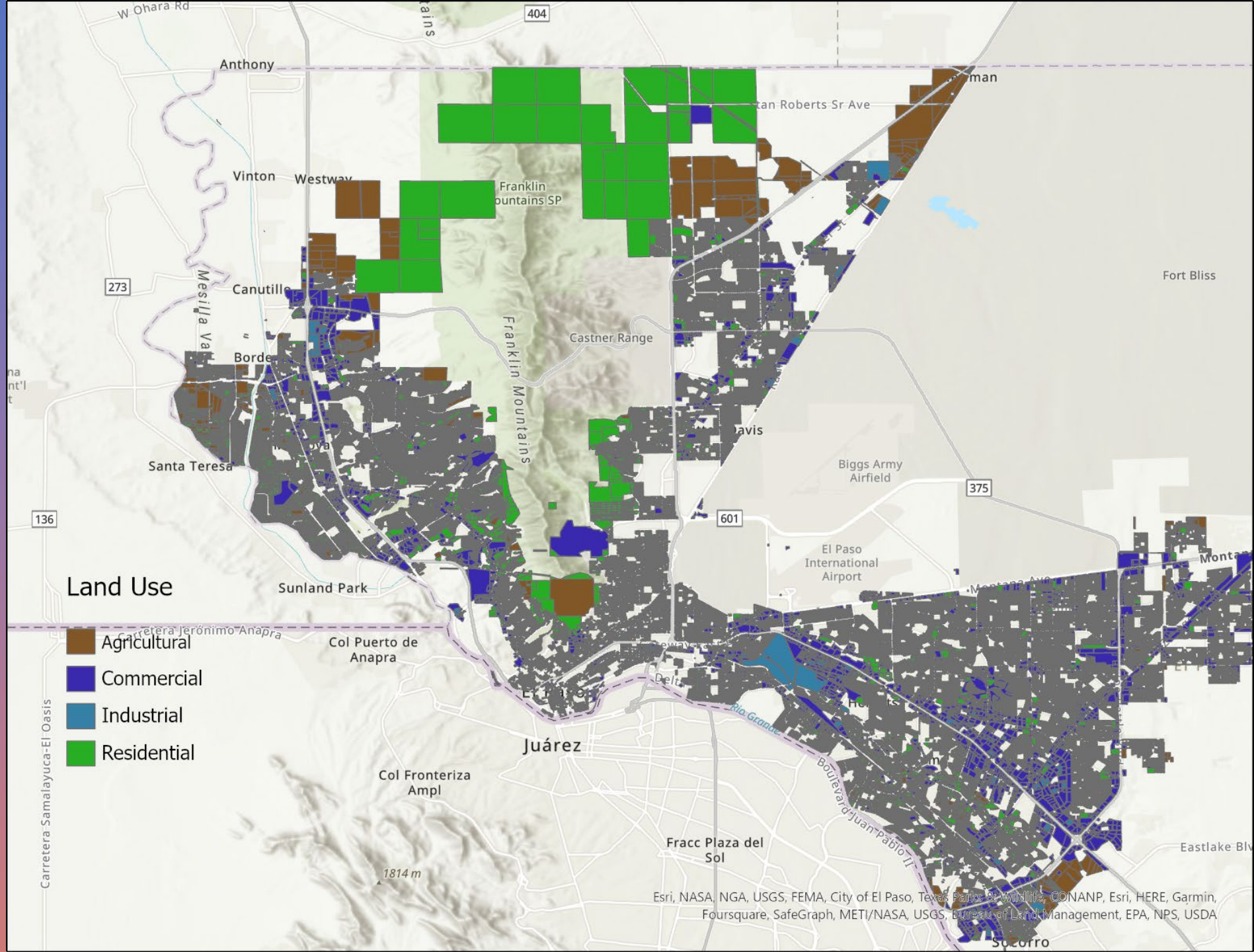


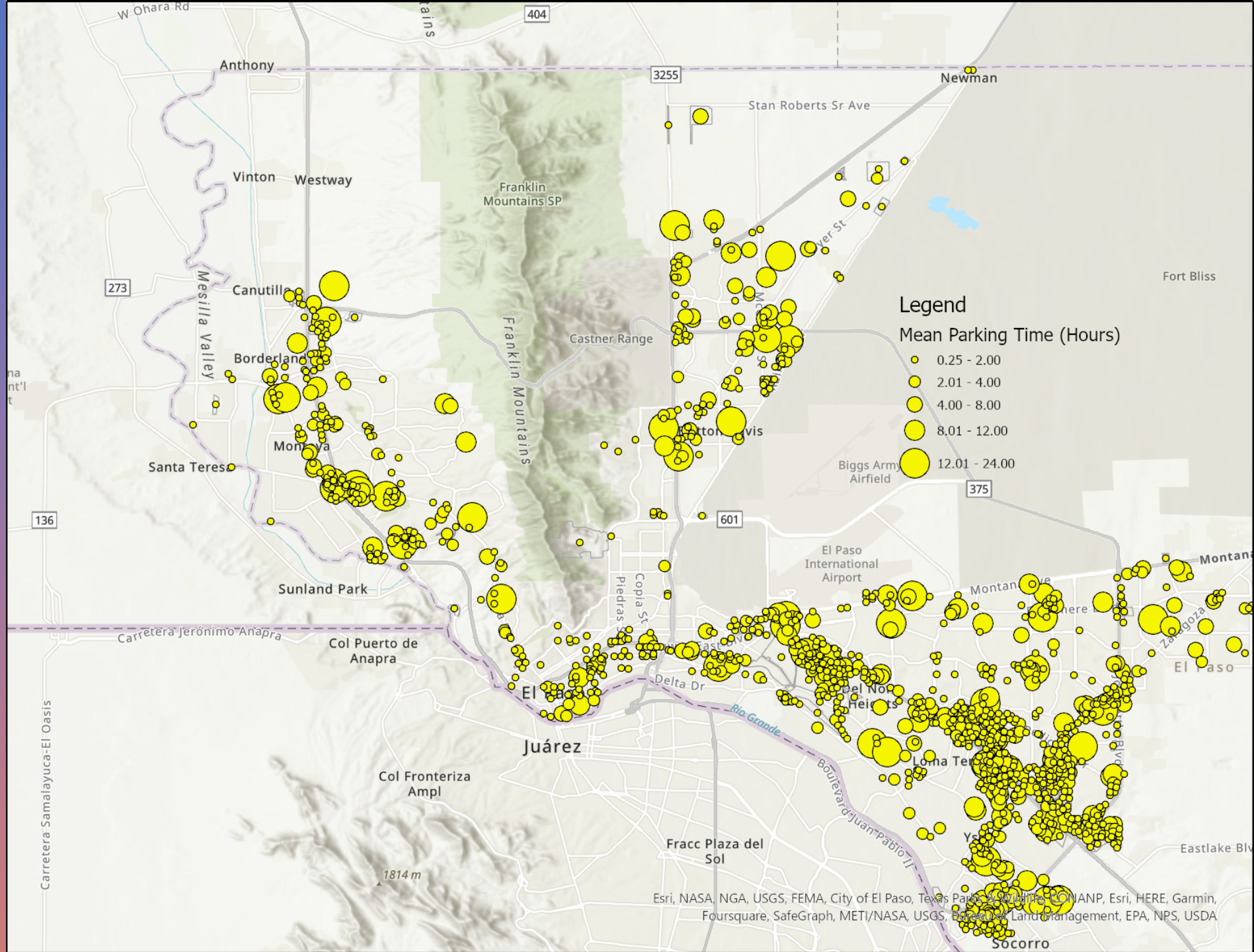


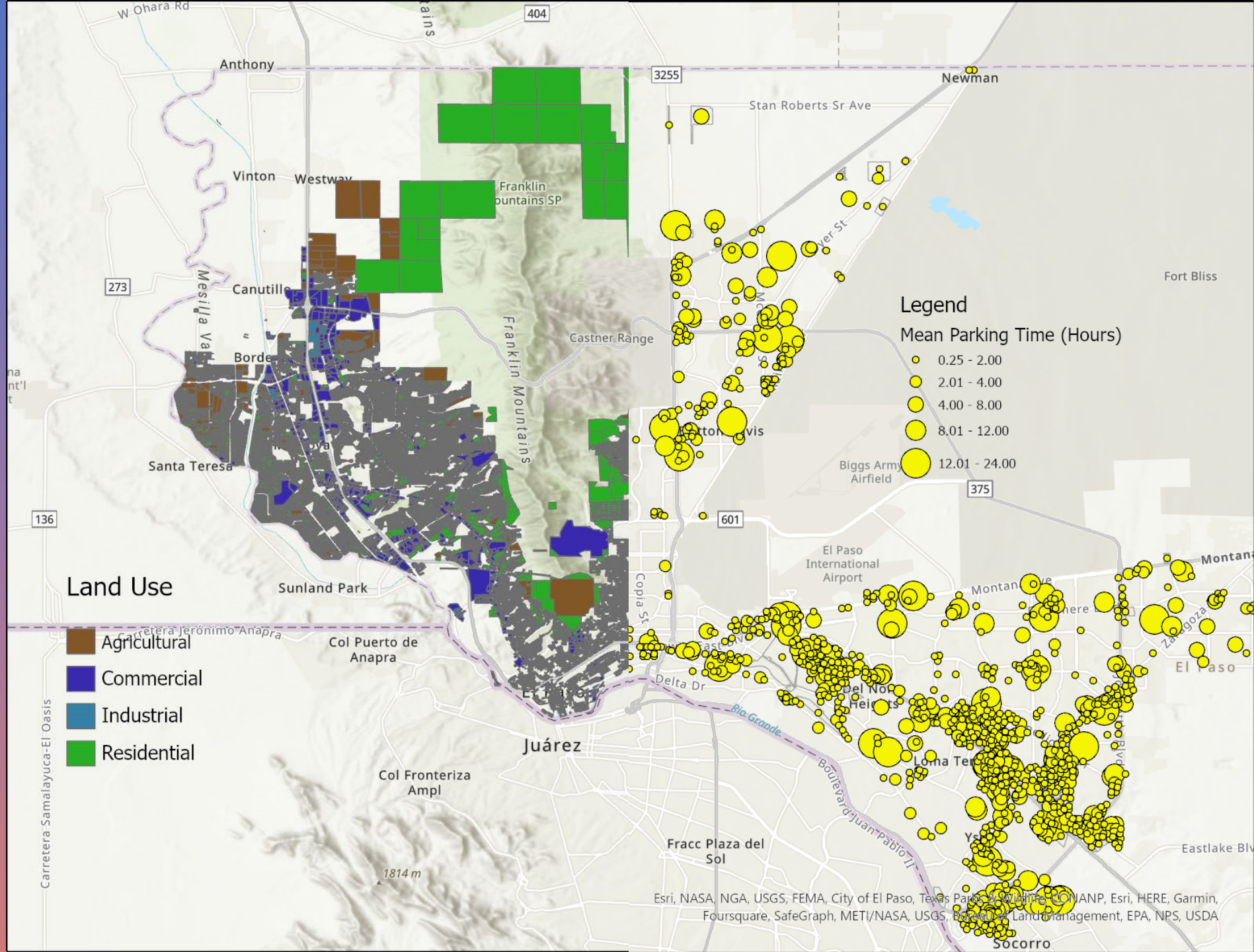


ML-based Predictive Wait time and Crossing time

Truck Parking (TPIMS)




Legend
Mean Parking Time (Hours)
0.25 - 2.00
2.01 - 4.00
4.00 - 8.00
8.01 - 12.00
12.01 - 24.00
Anthony
Newman
Stan Roberts Sr Ave
Vinton
Westway
Franklin Mountains SP
Canutillo
Mesilla Valley
Borderland
Castner Range
Franklin Mountains
Fort Bliss
Santa Teresa
Biggs Army Airfield
El Paso International Airport
Sunland Park
Carretera Jerónimo Anapra
Col Puerto de Anapra
Delta Dr
Rio Grande
Juárez
Col Fronteriza Ampl
Fracc Plaza del Sol
Boulevard Juan Pablo II
Carretera Samalayuca-El Oasis
Eastlake Blv
Socorro
Esri, NASA, NGA, USGS, FEMA, City of El Paso, Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, Foursquare, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA


Land Use
Agricultural
Commercial
Industrial
Residential
Legend
Mean Parking Time (Hours)
0.25 - 2.00
2.01 - 4.00
4.00 - 8.00
8.01 - 12.00
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Anthony
Vinton
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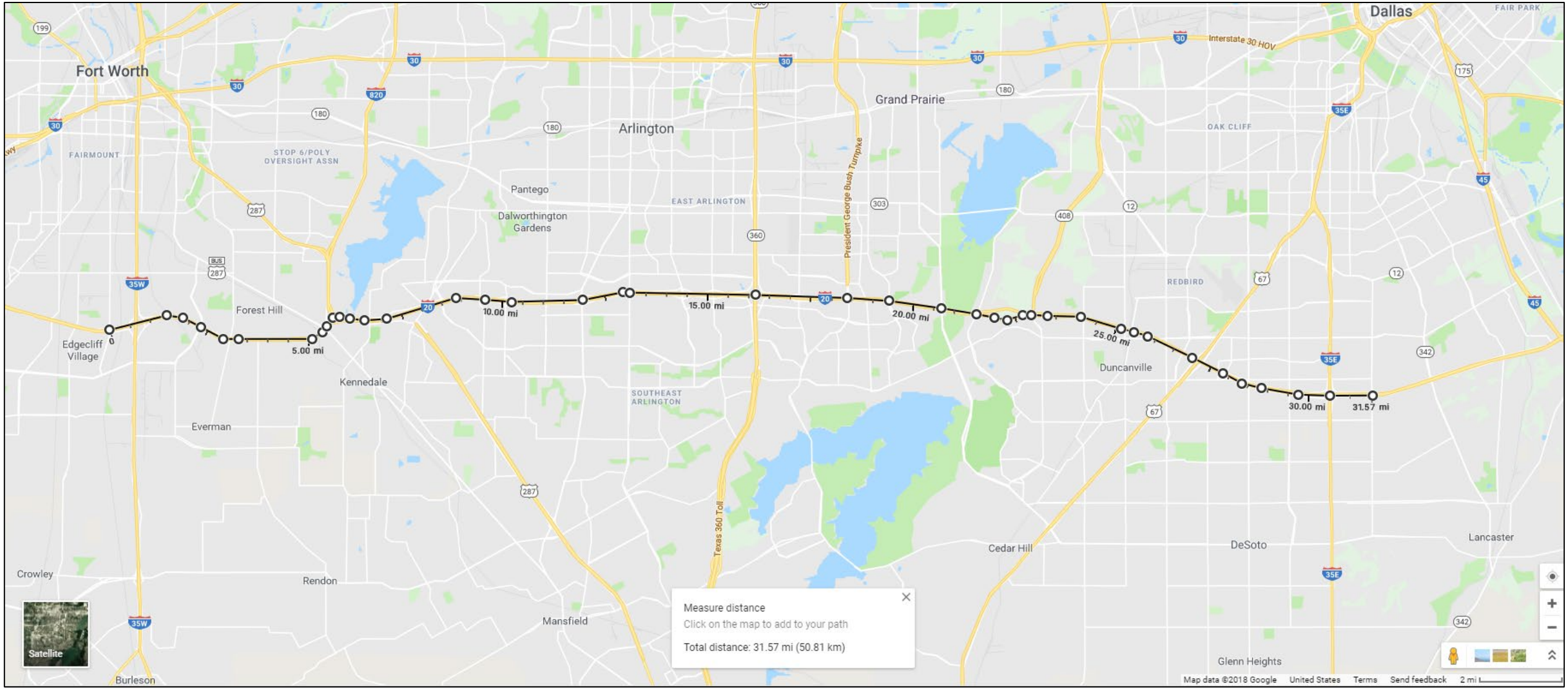
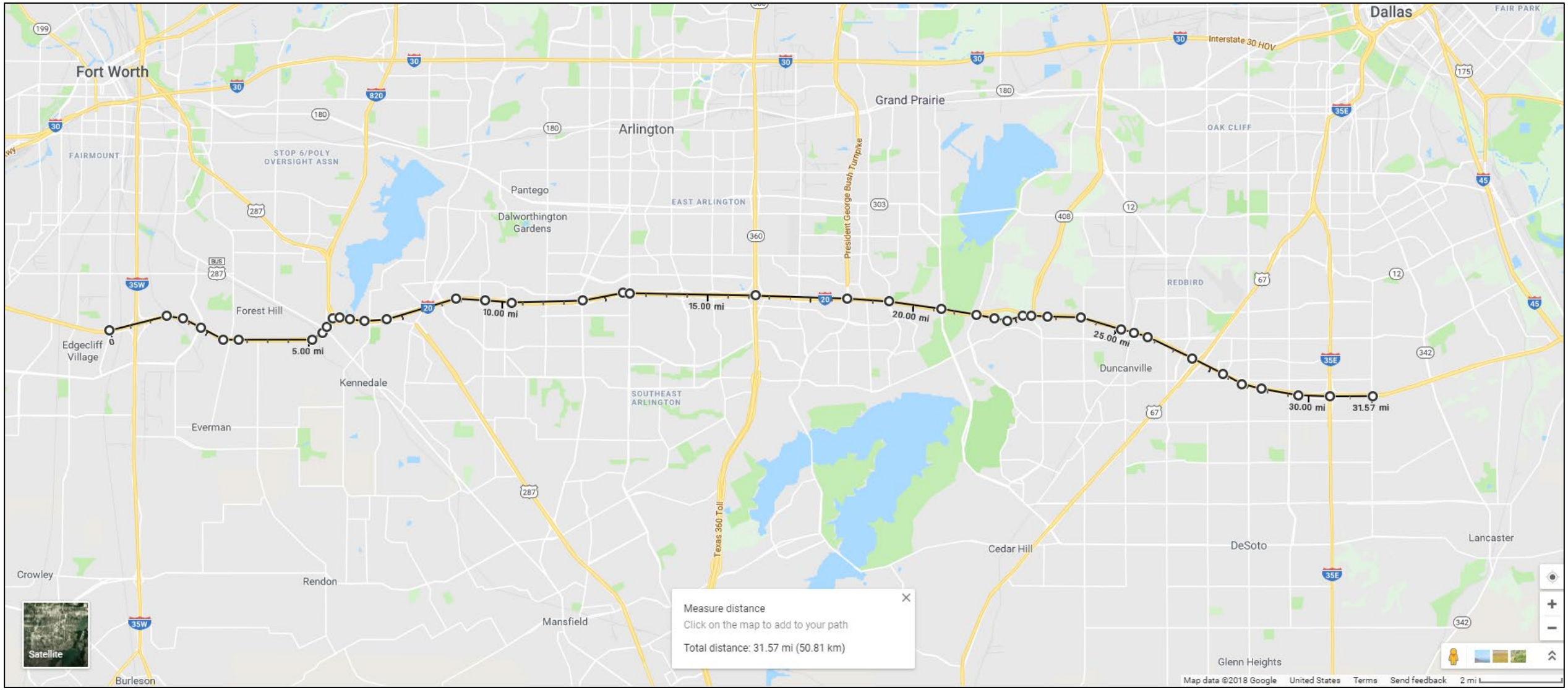
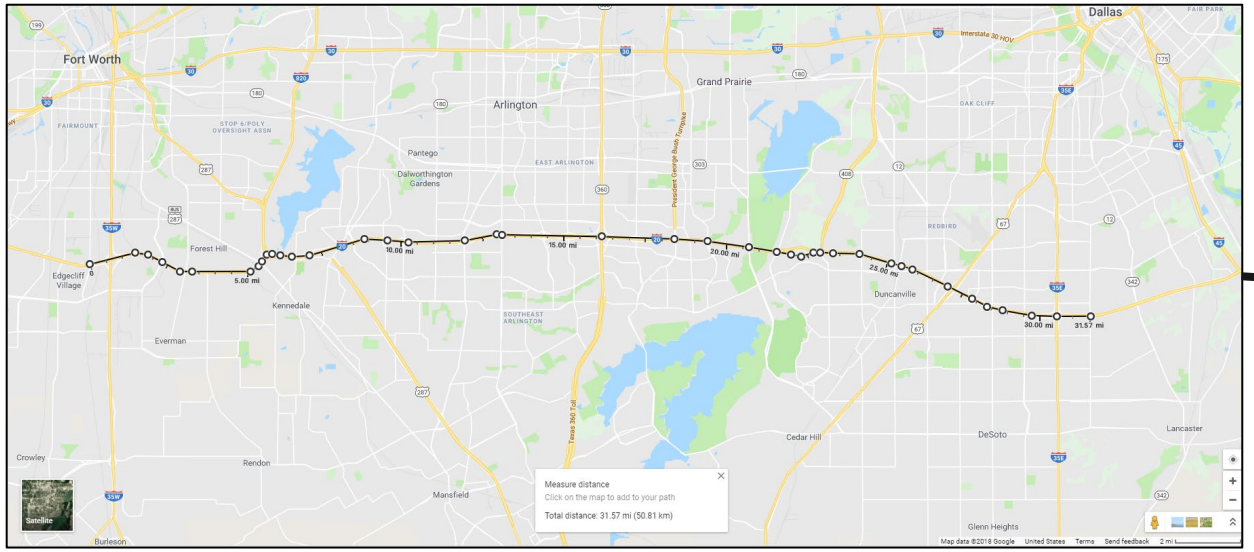
Esri, NASA, NGA, USGS, FEMA, City of El Paso, Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, Foursquare, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

Truck Only Lanes for Automated Trucks or Truck Platooning

Truck Only Lane Study on I-20 (32 miles) with Real-time information Systems




Fort Worth
Arlington
Grand Prairie
Dallas
FAIRMOUNT
STOP 6/POLY OVERSIGHT ASSN
Pantego
Dalworthington Gardens
EAST ARLINGTON
OAK CLIFF
FAIR PARK
Interstate 30 HOV
President George Bush Turnpike
Forest Hill
Edgecliff Village
0
5.00 mi
10.00 mi
15.00 mi
20.00 mi
25.00 mi
30.00 mi
31.57 mi
REDBIRD
Duncanville
Kennedale
SOUTHEAST ARLINGTON
Everman
Crowley
Rendon
Mansfield
Texas 360 Toll
Cedar Hill
DeSoto
Lancaster
Glenn Heights
Burleson
Satellite
Measure distance
Click on the map to add to your path
Total distance: 31.57 mi (50.81 km)
Map data ©2018 Google
United States
Terms
Send feedback
2 mi


Fort Worth
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Forest Hill
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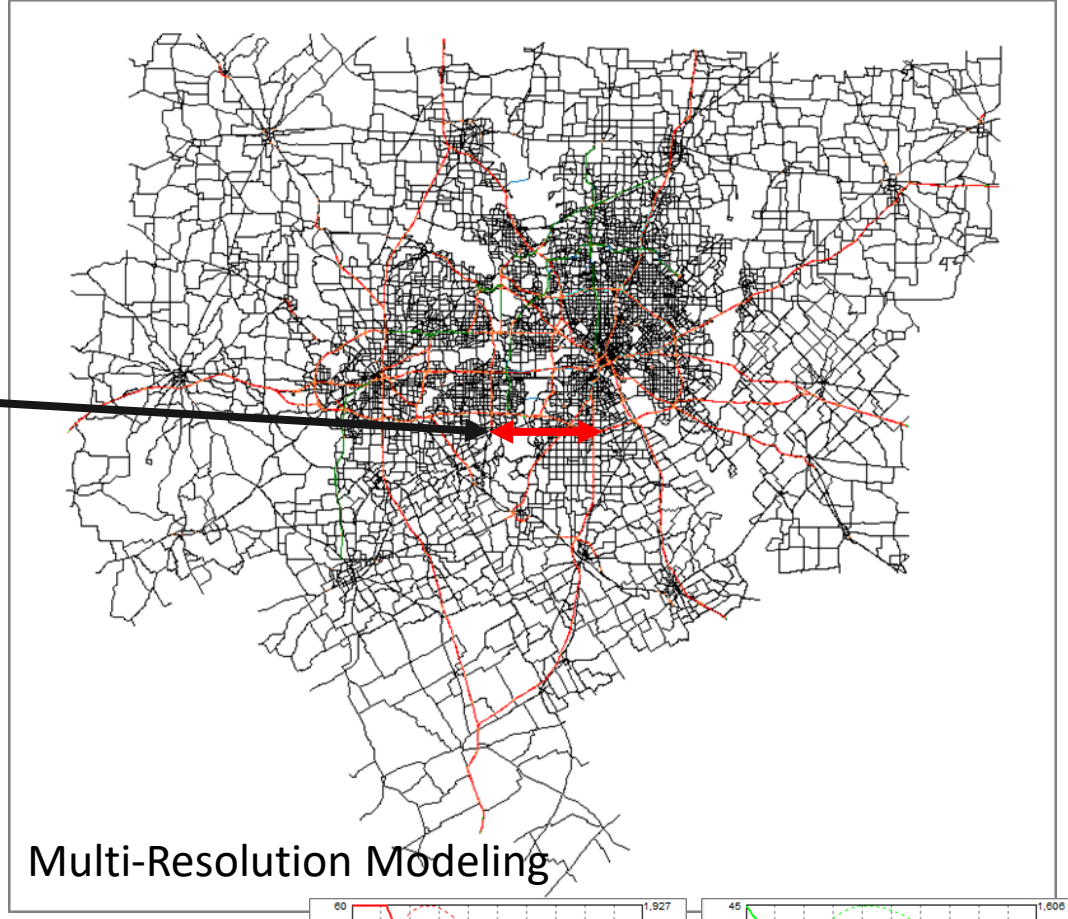
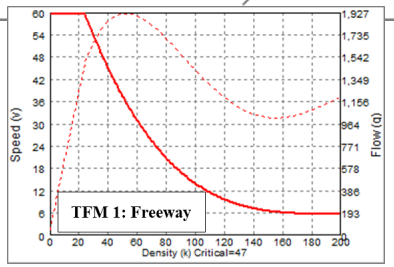

Multi-Resolution Modeling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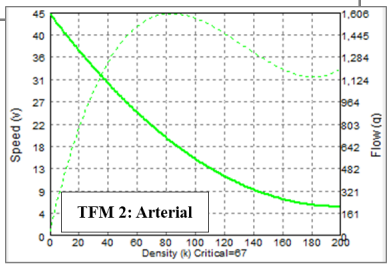
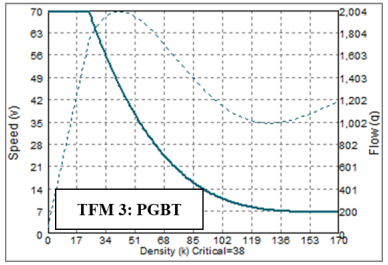
Flow (q)
Density (k) Critical=47


TFM 2: Arterial
Speed (v)
Flow (q)
Density (k) Critical=67


TFM 3: PGBT
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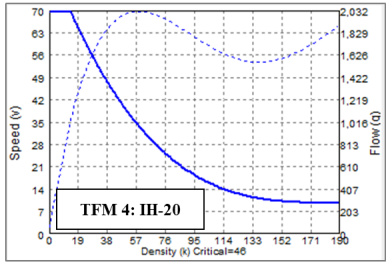
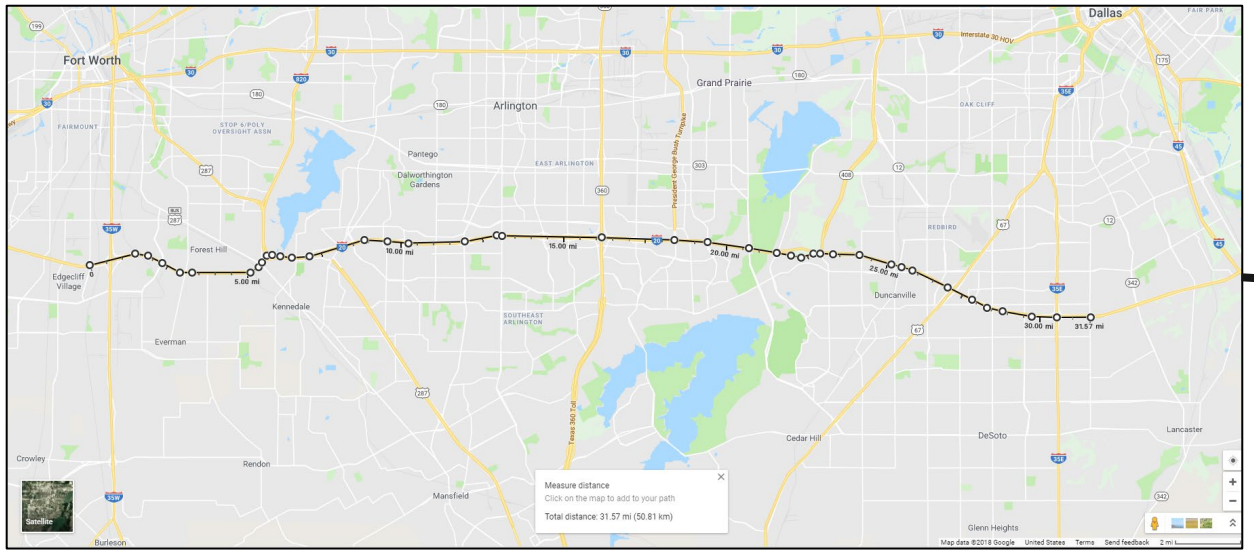
Flow (q)
Density (k) Critical=38


TFM 4: IH-20
Speed (v)
Flow (q)
Density (k) Critical=46


Dallas
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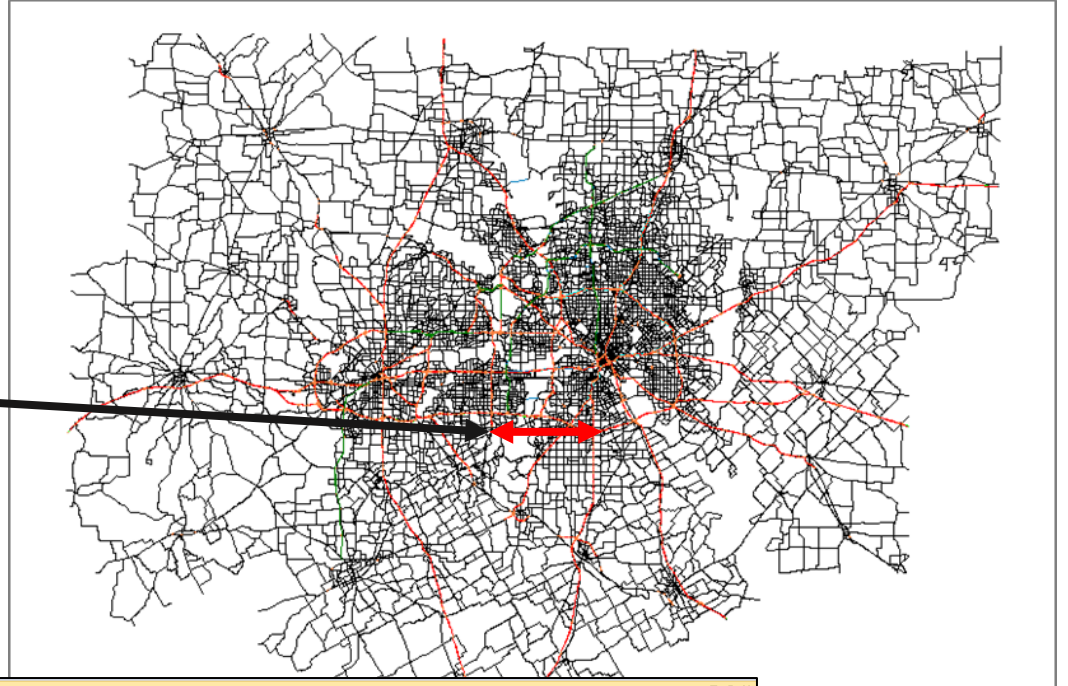

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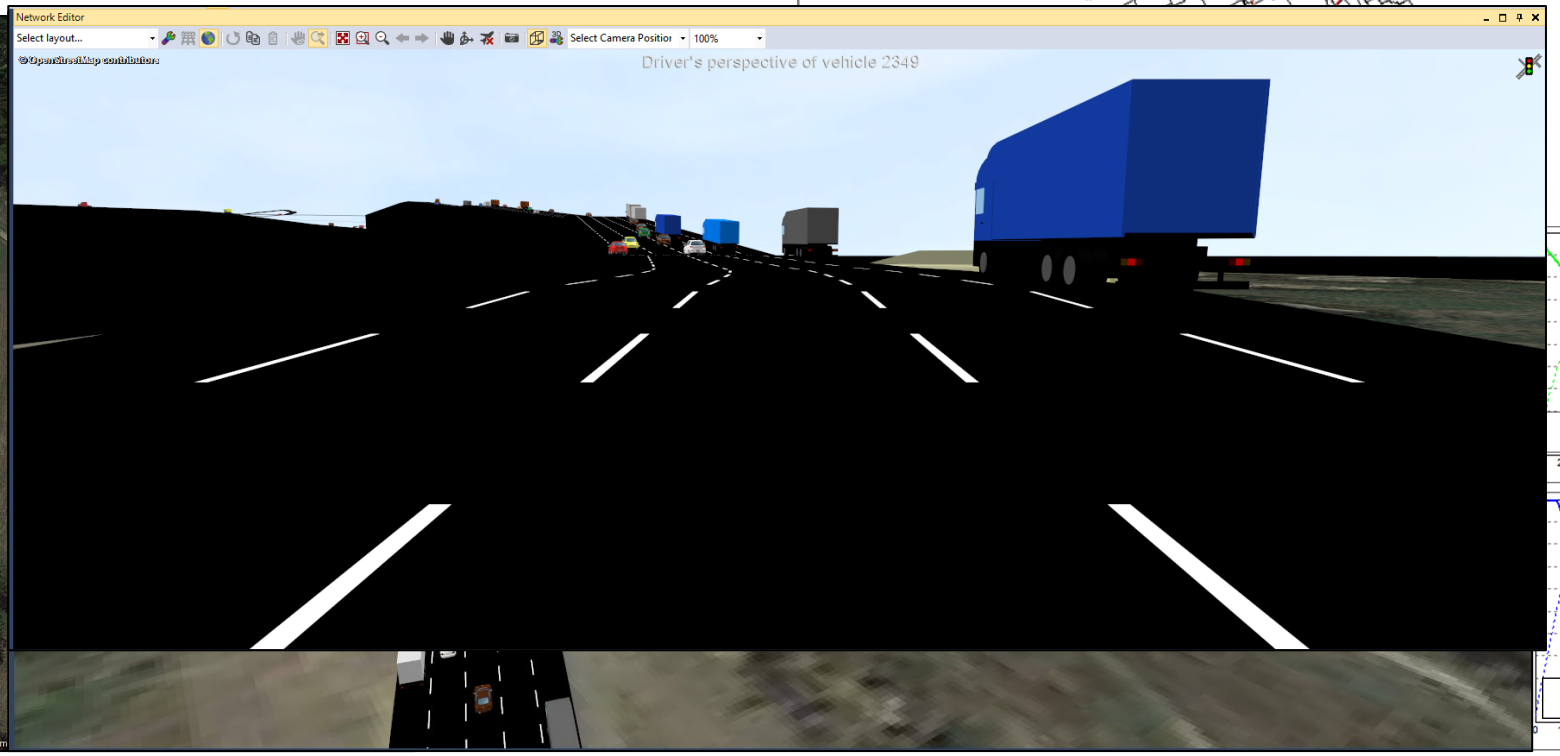
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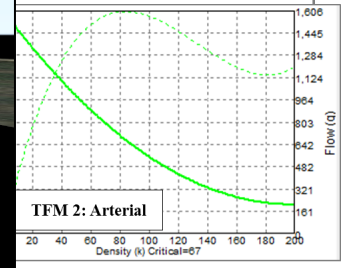
© OpenStreetMap contributors
Driver's perspective of vehicle 2349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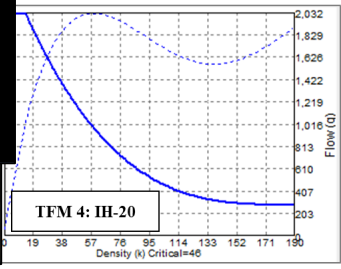
TFM 4: IH-20
Flow (q)
Density (k) Critical=46

Freight mobility technology is rapidly evolving to support a more efficient and decarbonized system. Here are some of the trends and technologies that are shaping the industry:

1. Electric trucks: One of the most promising technologies for decarbonizing the freight industry is electric trucks. Electric trucks produce zero emissions, which can significantly reduce greenhouse gas emissions from the freight sector. As battery technology improves and charging infrastructure expands, electric trucks are becoming a more viable option for long-haul transportation.
2. Autonomous trucks: Autonomous trucks, also known as self-driving trucks, have the potential to improve efficiency and reduce costs in the freight industry. With the ability to drive around the clock without rest breaks, autonomous trucks could significantly reduce delivery times and increase capacity utilization.
3. Big data analytics: Data analytics is a crucial tool for optimizing freight transportation. By analyzing data on traffic, weather, and other factors, freight companies can optimize routes, reduce fuel consumption, and minimize delivery times.
4. Blockchain: Blockchain technology can help improve supply chain visibility and reduce the risk of fraud and counterfeiting. By creating an immutable record of transactions, blockchain can help improve transparency and trust in the freight industry.
5. Drones and delivery robots: Drones and delivery robots are being tested for last-mile delivery, which could reduce delivery times and improve efficiency. These technologies are particularly promising for urban areas where congestion is a major issue.
6. Digital freight marketplaces: Digital freight marketplaces are platforms that connect shippers with carriers, allowing them to find the most efficient and cost-effective transportation options. By improving visibility and transparency in the industry, these platforms can help reduce waste and improve efficiency.

Overall, these technologies are key to achieving a more efficient and decarbonized freight transportation system. As they continue to evolve and become more widespread, they will play an increasingly important role [redacted] eight mobility.

And ChatGPT says..

Thanks!

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