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Leveraging charging station data to inform pavement infrastructure policy

Outline

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Overarching Question	How can Departments of Transportation use EV charging station data to inform pavement infrastructure management decisions?
Introduction	Key Industry Trends How Road Condition Impacts Emissions How Electric Truck Volumes Can Help
Solution	Inputs Model Implementation
Impact	Increased GHG reduction per highway maintenance dollar spent

Adoption of electric vehicles expected to accelerate

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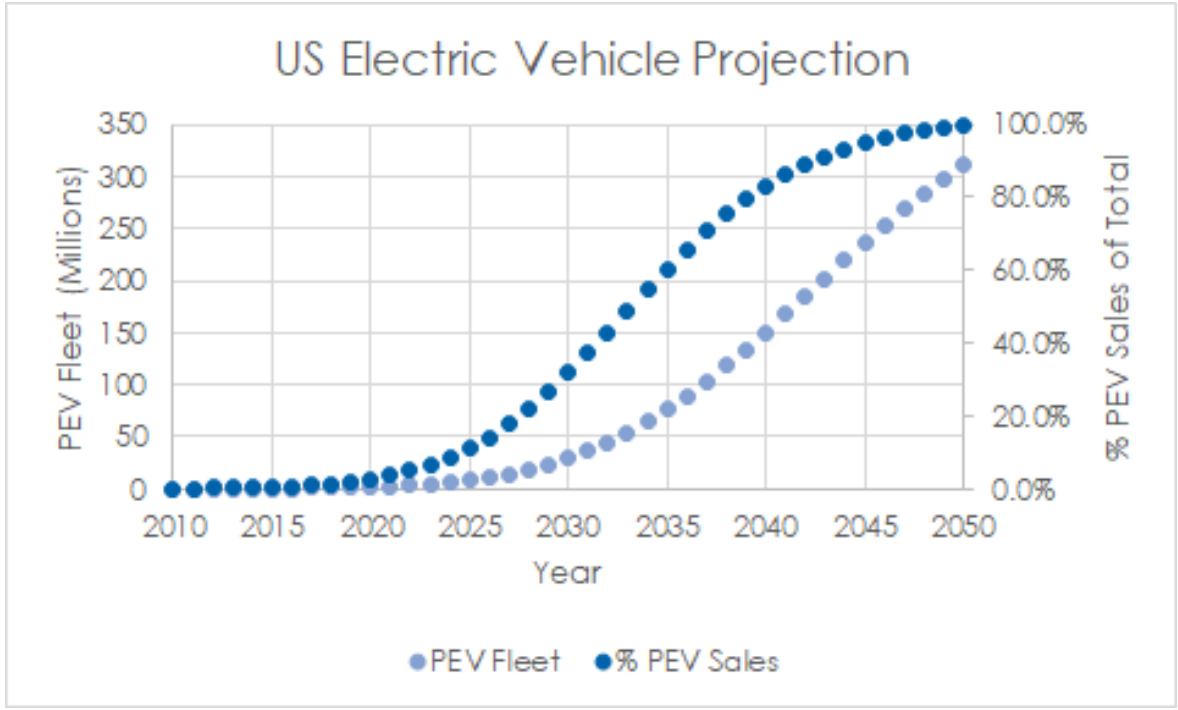
- Electric vehicles comprised 1.9% of vehicle sales in 2019 in the US[1,2]
- 17 countries have goals of having 100% of new vehicles be zero emission vehicles by 2050 [3]
- Automakers are adapting to this change in demand
- Toyota, Volkswagen, Volvo, and Cadillac all pledge 40% + sales from electric vehicles by 2030 [4]



1. *www.anl.gov/es/light-duty-electric-drive-vehicles-monthly-sales-updates*
2. *www.bea.gov/*
3. *www.zevalliance.org/international-alliance-aims-for-all-new-cars-to-be-zero-emission-by-2050/*
4. *www.businessinsider.com/promises-carmakers-have-made-about-their-future-electric-vehicles-2020-1#volkswagen-group-2*

Increased EV adoption and data provides new opportunities

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More electric vehicles

A growing fleet of electric vehicles provides opportunities to gather new information

Use charging stations to gather data

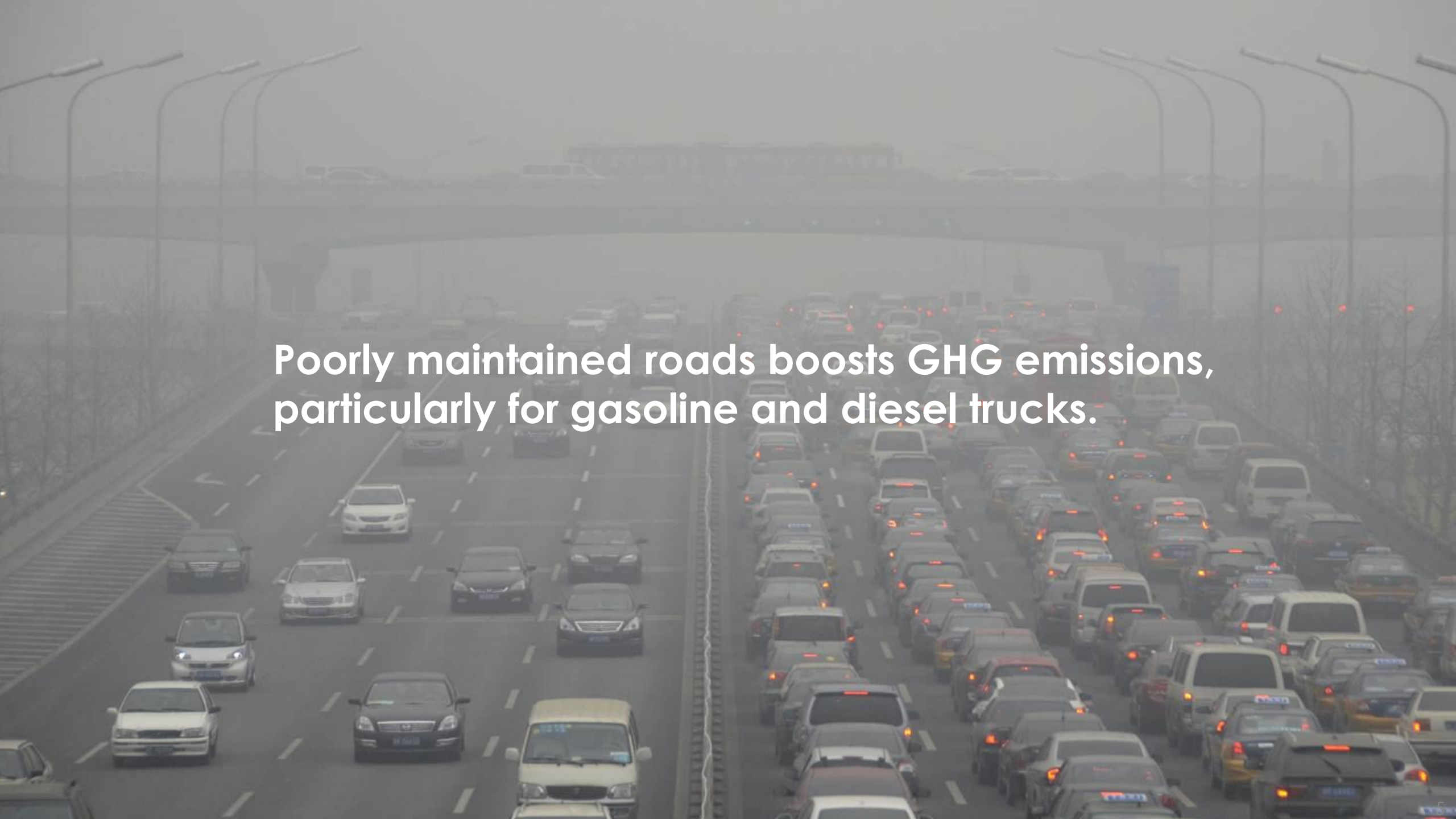
Data can be collected to paint a better picture of EV adoption at smaller scales

Empower decision makers

A wide variety of stakeholders can leverage available data to inform decision-making

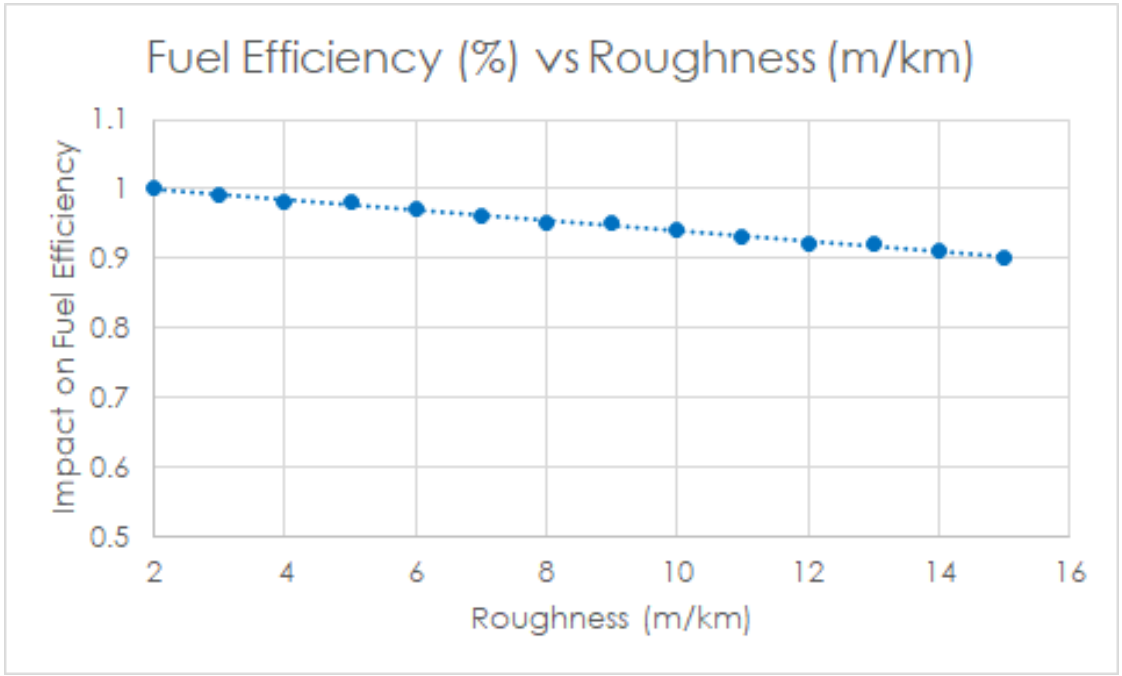
Focus Stakeholder:

U.S. Department of Transportation



Poorly maintained roads boosts GHG emissions, particularly for gasoline and diesel trucks.

Problem: Poorly maintained roads boost GHG emissions



- Roads tend to wear out after extended use
- A rough road increases friction between the road surface and tires, reducing fuel efficiency

Problem: Poorly maintained roads boost GHG emissions

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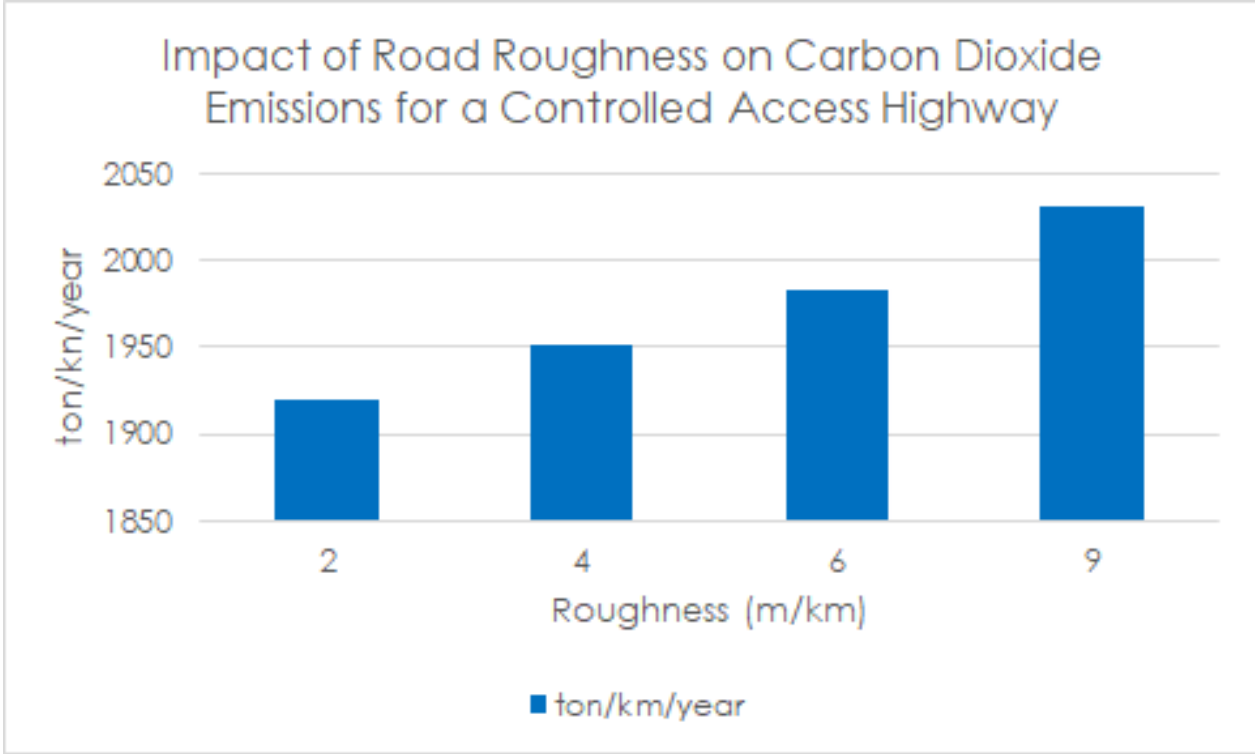
What does this mean for the environment?

When the roughness is increased from 2 to 9 m/km, emissions increase by 5.8%.[1]

How can we prevent this?

On average, every kg of CO_2 invested in paving/road maintenance can reduce approx.36 kg of CO_2 of emissions.[2]



1. *oecd.org/derec/adb/47170274.pdf*
2. *roadmaintenanceday.org/wp-content/uploads/2018/04/fact_sheet_IRMD_ENG.pdf*

Charging station data can help identify routes most used by electric trucks and maximize GHG reductions by optimizing investments

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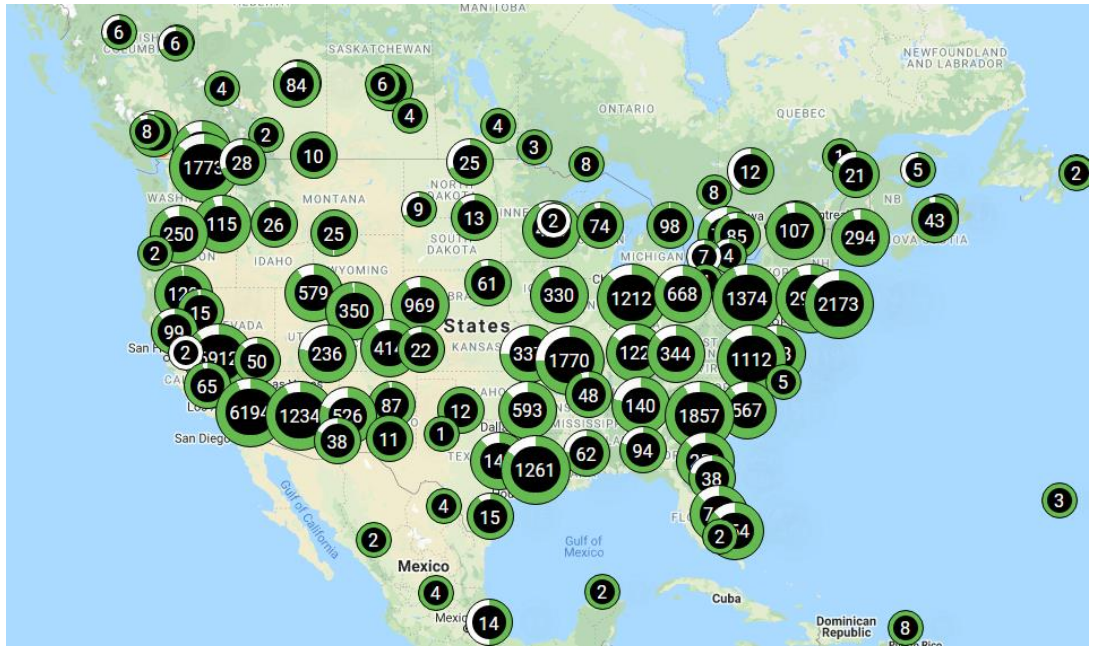
The efficiency of electric vehicles does drop on poorly maintained roads, but they do not contribute to GHG emissions directly

ChargePoint data can help USDOT track routes most used by electric vehicles

DOTs can prioritize maintaining roads that see more non-electric truck traffic

The GHG emissions associated with pavement roughness are highest for gasoline and diesel trucks.



North American Charging Network[1]

1. *www.oecd.org/derec/adb/47170274.pdf*

Model Implementation

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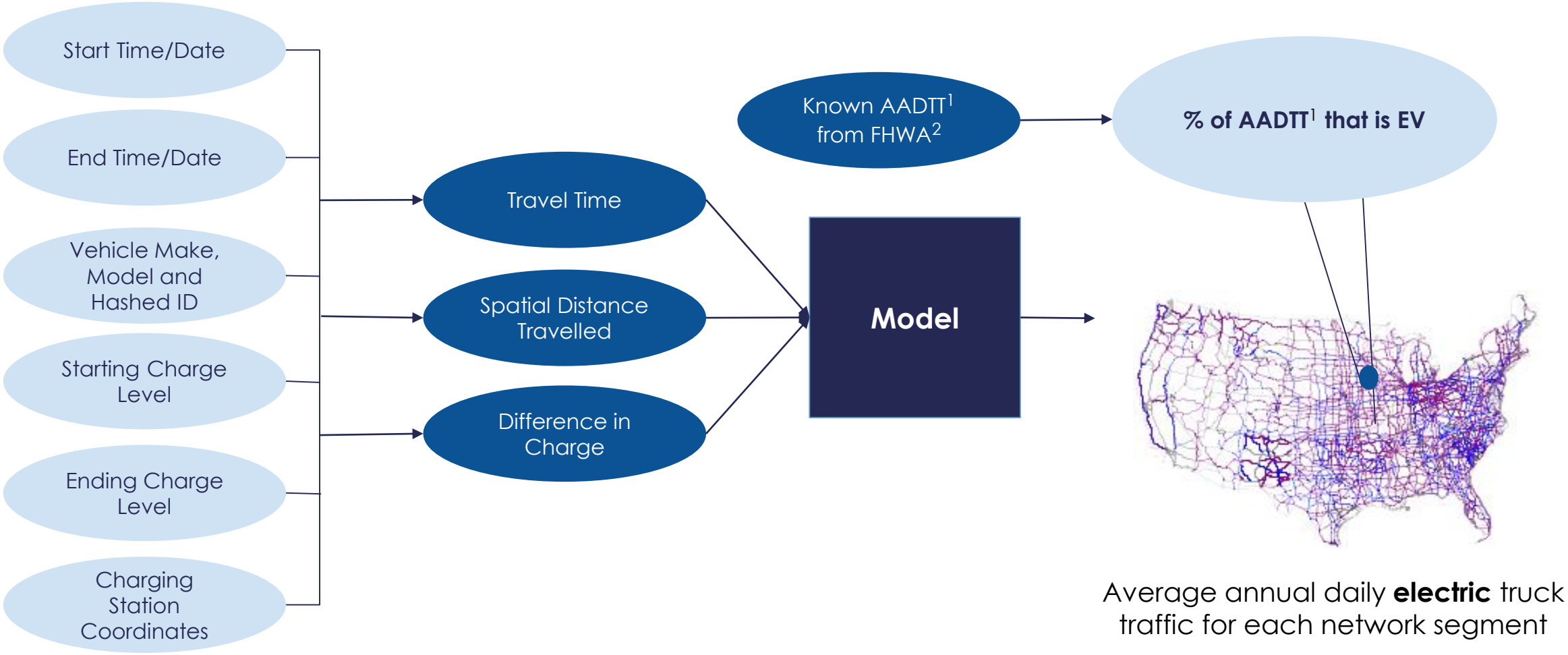
Six key model inputs for each charging session are required



Average annual daily **electric** truck traffic for each network segment

1. *Average Annual Daily Truck Traffic*
2. *Federal Highway Administration*

Granularity: daily downloads of parameters allows for electric truck volume averages to form along the network

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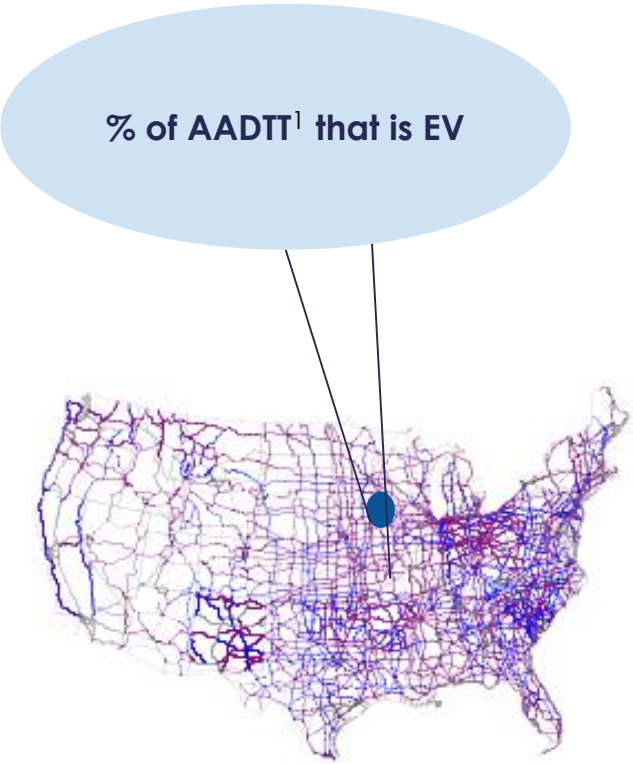
- Start Time/Date
- End Time/Date
- Vehicle Make, Model and Hashed ID
- Starting Charge Level
- Ending Charge Level
- Charging Station Coordinates

These parameters are needed for every truck that charges, anywhere in the country.

Each day the model accumulates data to continue vehicle paths, and the "EV % of AADTT" figure for any given highway section becomes more informed.



1. *Average Annual Daily Truck Traffic*

Step 1: Determining path taken between two charging stations

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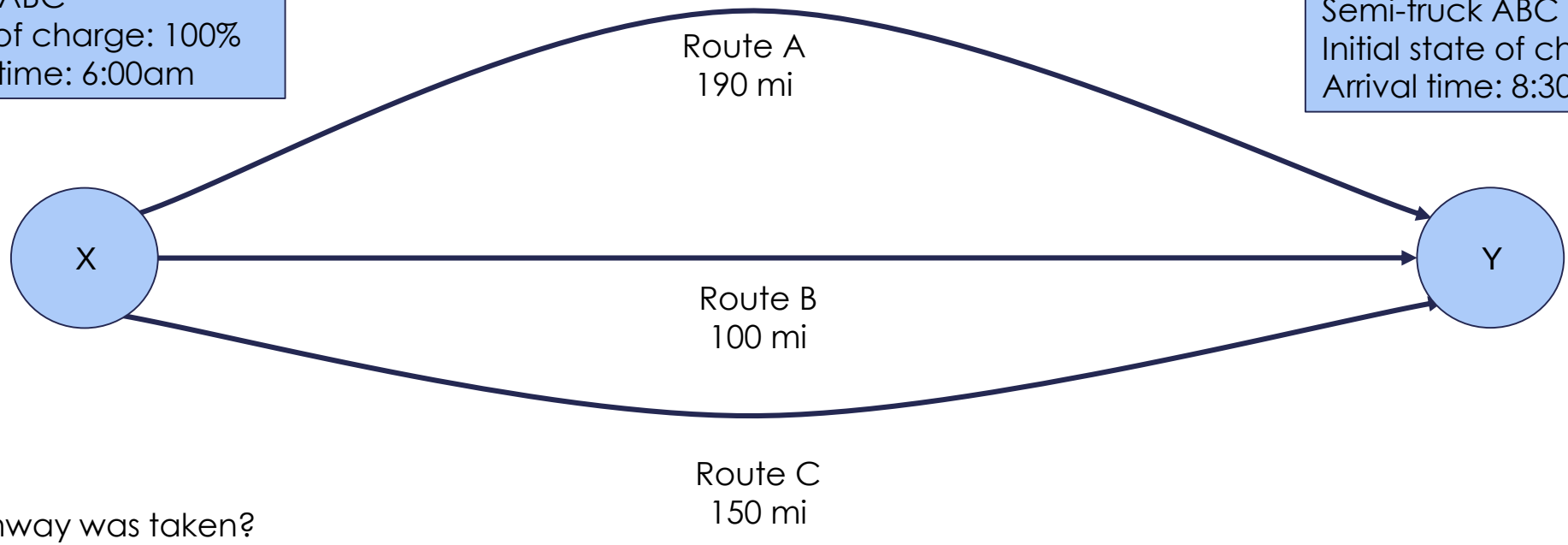
Semi-truck ABC
Final state of charge: 100%
Departure time: 6:00am



Semi-truck ABC
Initial state of charge: 35%
Arrival time: 8:30am

Which highway was taken?

Semi-truck ABC rated range: 240mi

Estimated distance travelled: 240mi * (100-35)% = 156mi

Route C is likely, verify speed

150mi / 2.5hr = 60mi/hr, reasonable

Result: **Route C was taken**

Step 2: Placing truck pathway on interstate freeway network

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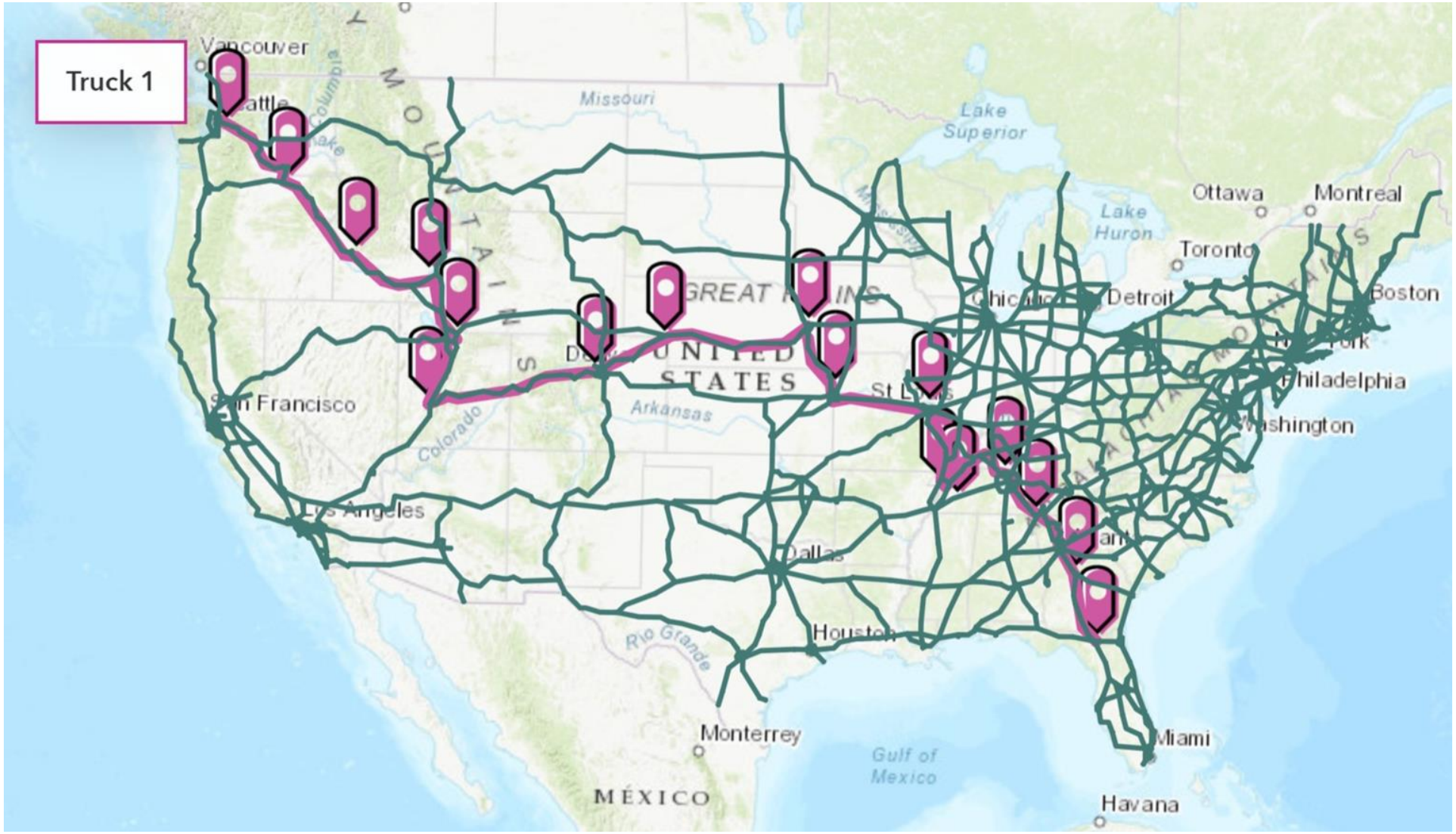
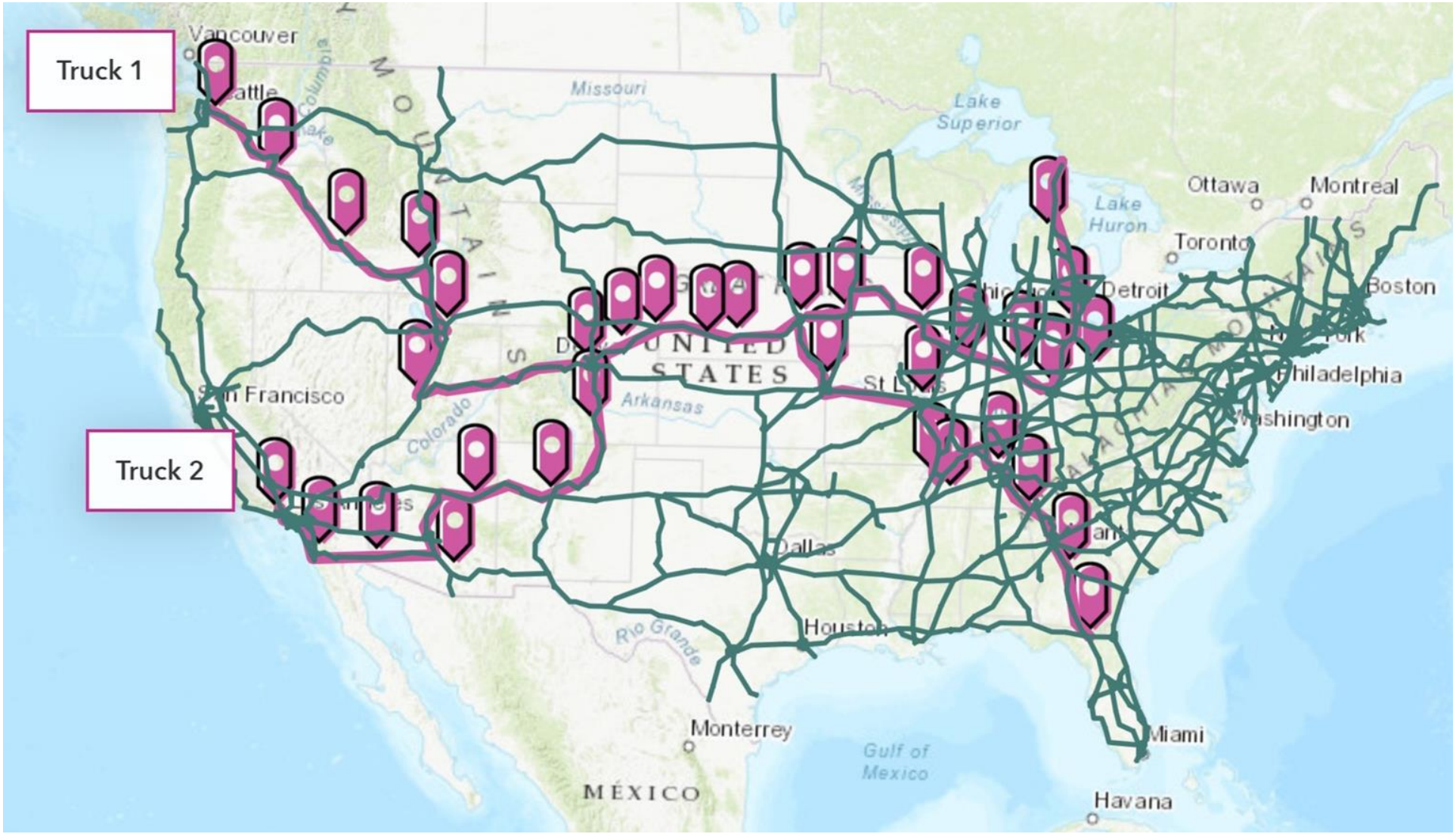


Step 3: Overlaying each unique vehicle's path along network



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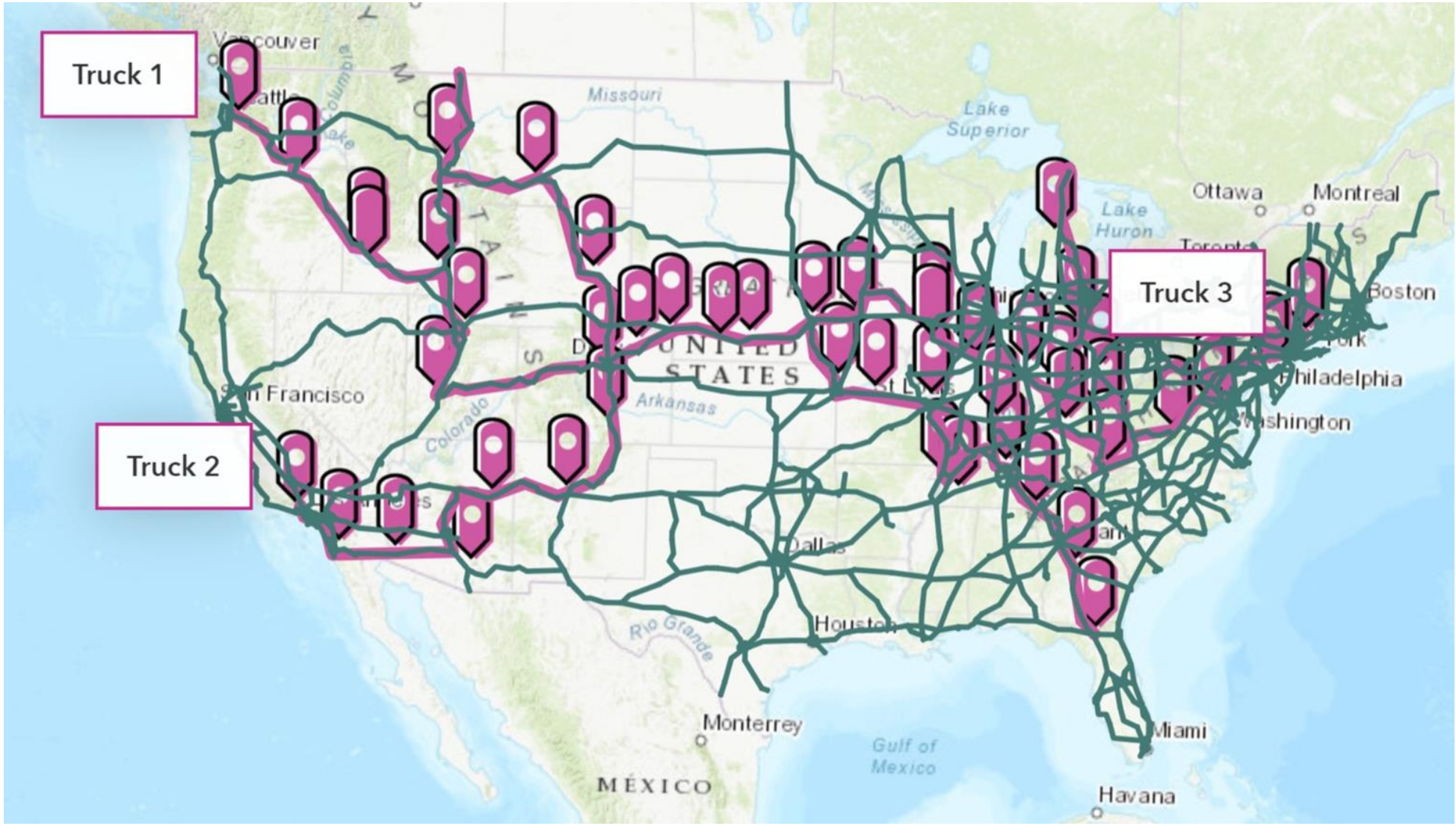
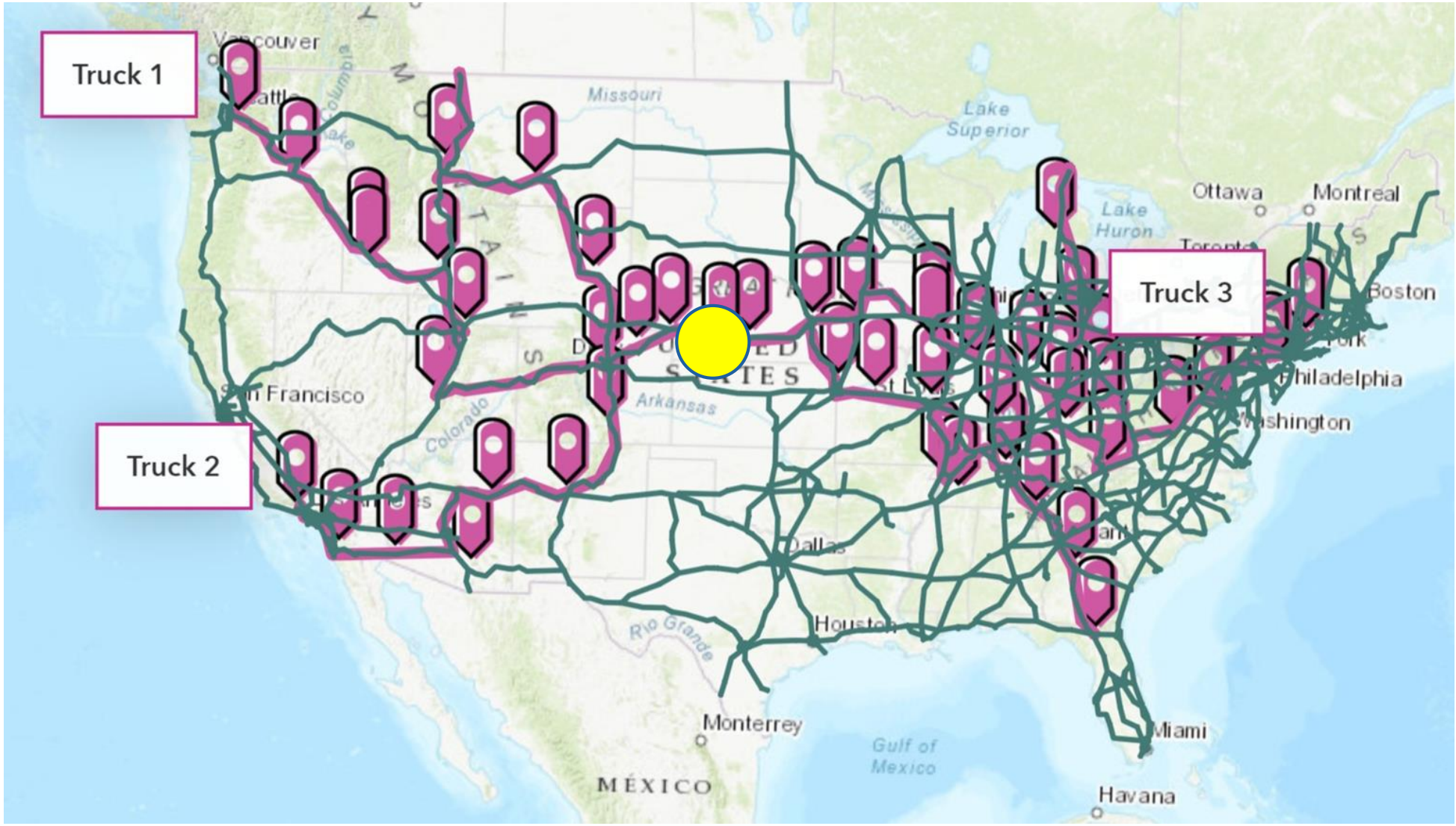


Step 4: Estimating number of avg. daily electric truck trips at each segment of network



Knowing the percentage of daily trucks that are electric allows for prioritization of highway maintenance funds

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5% of AADTT Electric

25% of AADTT Electric

Result: Increased GHG reduction per highway maintenance dollar spent

Knowing the percentage of daily trucks that are electric allows for prioritization of highway maintenance funds

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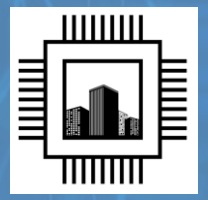
5% of AADTT Electric

PRIORITIZE PAVEMENT MAINTENANCE

25% of AADTT Electric

Result: Increased GHG reduction per highway maintenance dollar spent

Thank You!



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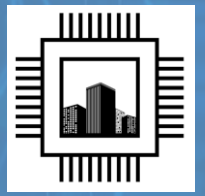
Q&A



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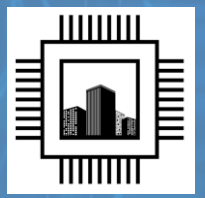
Appendix



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Why trucks?

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Fleet trucks are a major contributor to inter-state travelling. Due to lengthy travels they often make use of charging stations on highways which makes it easier to predict their route.

The future of Fleet trucks is electric. Based on industry demand and planned production, the number of electric trucks in U.S is expected to grow from 2,000 in 2019 to 54,000 in 2025.[1]

The increase in electric fleet trucks along with easy to predict route patterns, can help policy makers develop a refined data set.

This data set can then be applied to inter-state highways to develop maintenance schedules.

1. *www.woodmac.com/press-releases/us-electric-truck-sales-set-to-increase-exponentially-by-2025/*