

# **NEVI Program Charger Placement Project**

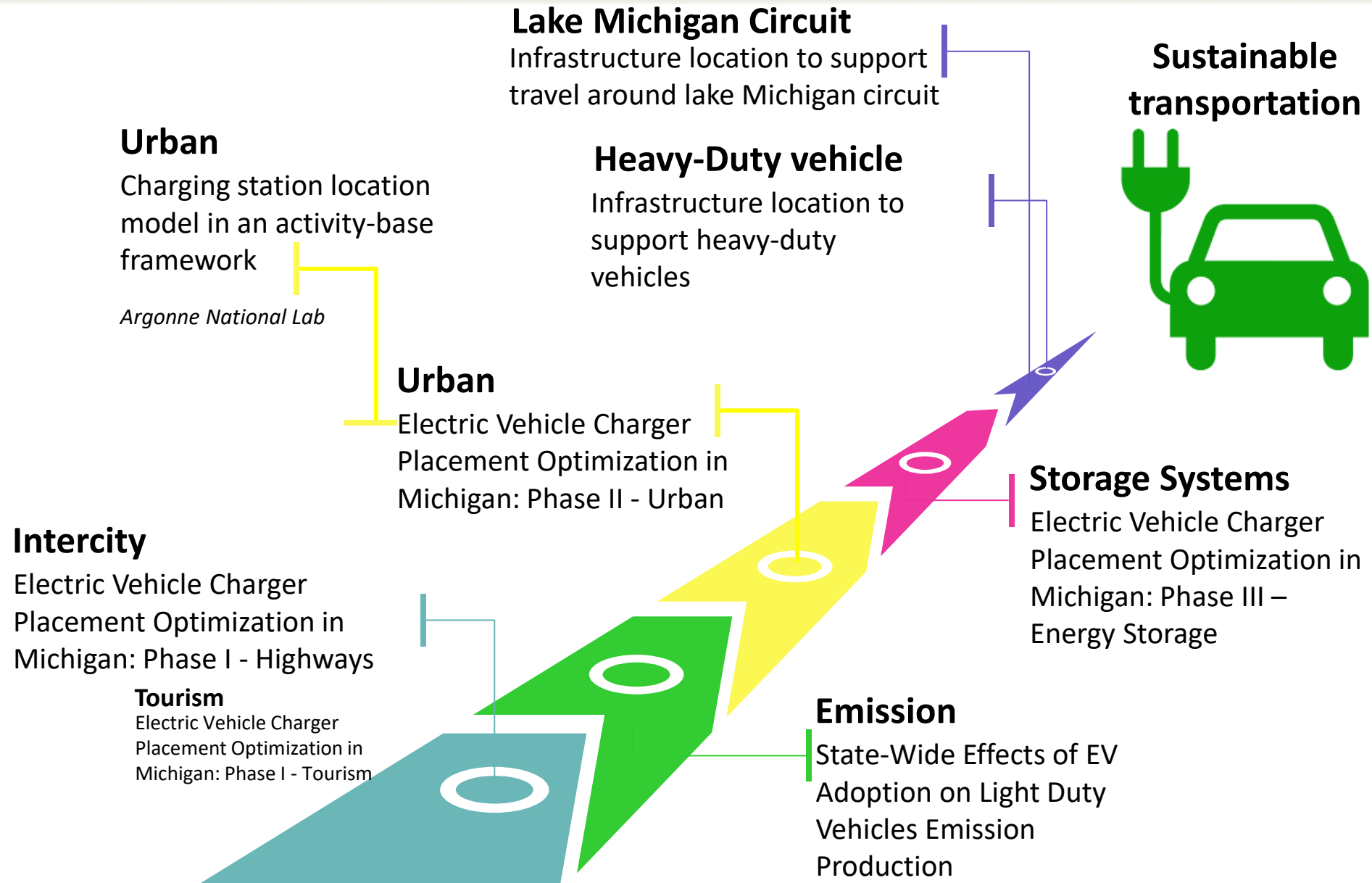


This study is commissioned and funded by the  
Michigan Department of Environment,  
Great Lakes, and Energy.



MICHIGAN DEPARTMENT OF  
ENVIRONMENT, GREAT LAKES, AND ENERGY

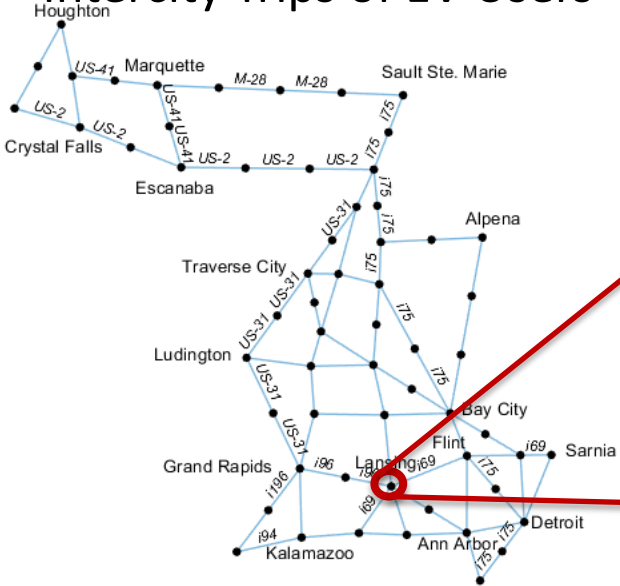




# Introduction

## Phase I-

### Intercity Trips of EV Users

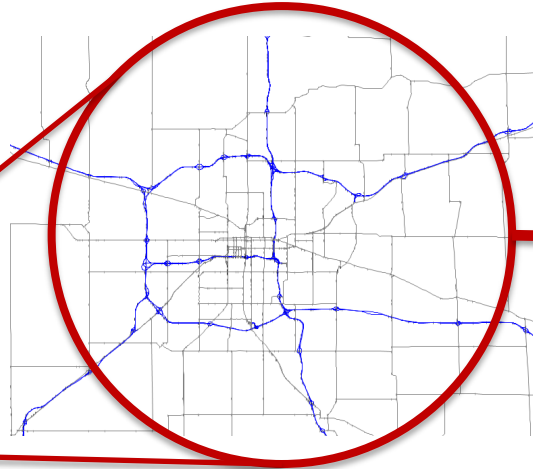


Macroscopic  
Traffic Simulation

Optimization Model  
(Aggregate O/D Demand)

## Phase II-

### Urban Trips of EV Users



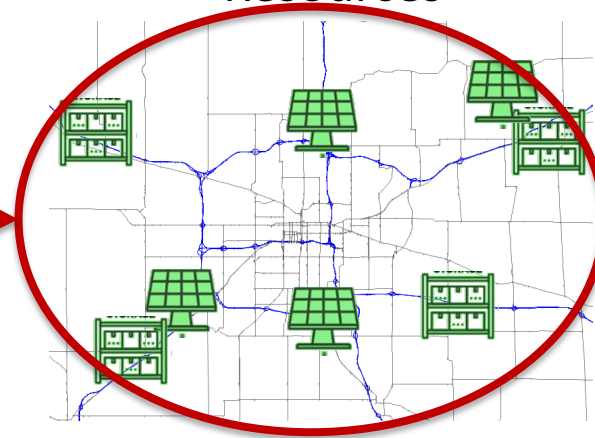
Meso/Microscopic  
Traffic Simulation

Optimization Model  
(Trip Trajectories)

Regression Model(s)  
(MNL)

## Phase III-

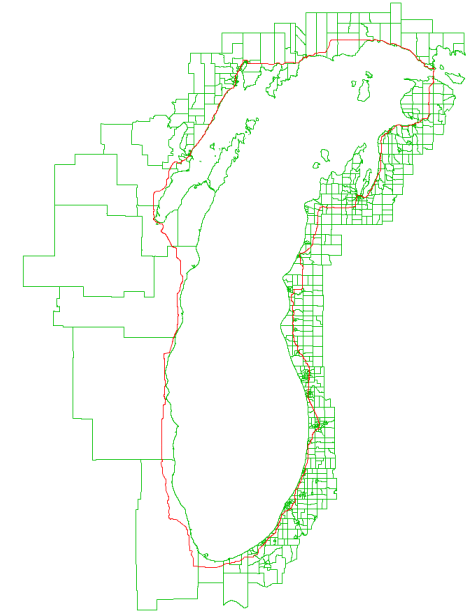
### Distributed Energy Resources



Expected EV Load  
Grid Load  
Costs

Optimization Model

## Lake Michigan Circuit



DCFC Stations  
Short-Term Stay

Level2 Stations  
Long-Term Stay



A nationwide network of 500,000 EV chargers by 2030

Every 50 miles

Less than 1 mile from Alternative Fuel Corridors (AFC)

Four >150kW chargers per location

Model the entire state with preference to AFCs and candidates

## National Electric Vehicle Infrastructure Formula Program

Bipartisan Infrastructure Law



### Program Guidance

Federal Highway Administration  
February 10, 2022



## Step 1- (Basic Feasibility Map)

- Map the **current** location of DCFC
- Find the optimum location of >150kW chargers to ensure **feasibility** of intercity trips
- Overlay the current DCFC locations and optimum location of >150kW DCFC to capture the **upgrades** required

## Step 2- (NEVI Plan)

- Locate the DCFC based on **NEVI** plan requirements
- Map the **current** location of DCFC
- Find the optimum location of 4-150kW chargers or more to ensure **feasibility** of intercity trips
- Overlay the current DCFC locations and optimum location of 4-150kW DCFC to capture the **upgrades** required

## Step 3- (Future Upgrades)

- Possibility of future upgrades to >350 kW chargers



Macroscopic  
Traffic Simulation



Optimization Model  
(Aggregate O/D Demand)



- Update the Michigan intercity demand file
- Modify the modeling framework to consider current/pending charging infrastructure
- Analyze the Barebone Network considering current/pending DCFC infrastructure
- Consider the NEVI infrastructure assumption
- Update the network file
- Consider the spatial-temporal changes in demand
- Considering 6% and 25% market share
- Potential future upgrades to 350 kW



- Current location of DCFC (EGLE and AFDC)
- Road network (Michigan Department of Transportation)
- Traffic Analysis zones (Michigan Department of Transportation)
- Travel demand matrix (Michigan Department of Transportation)
- Electricity Provision Costs (Utilities)
- Charging station and charger costs (Charging Station Companies)
- Vehicle specifications (Car Companies)

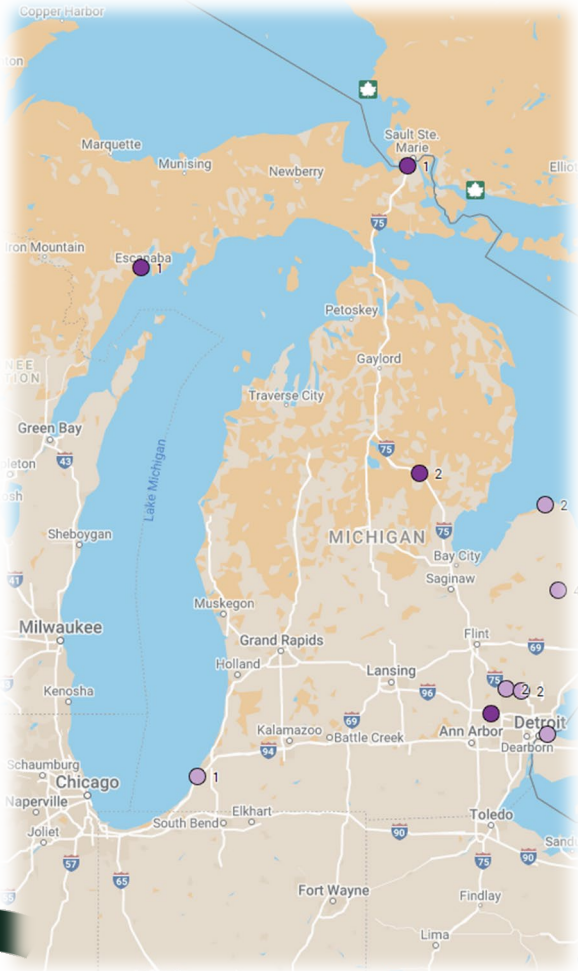




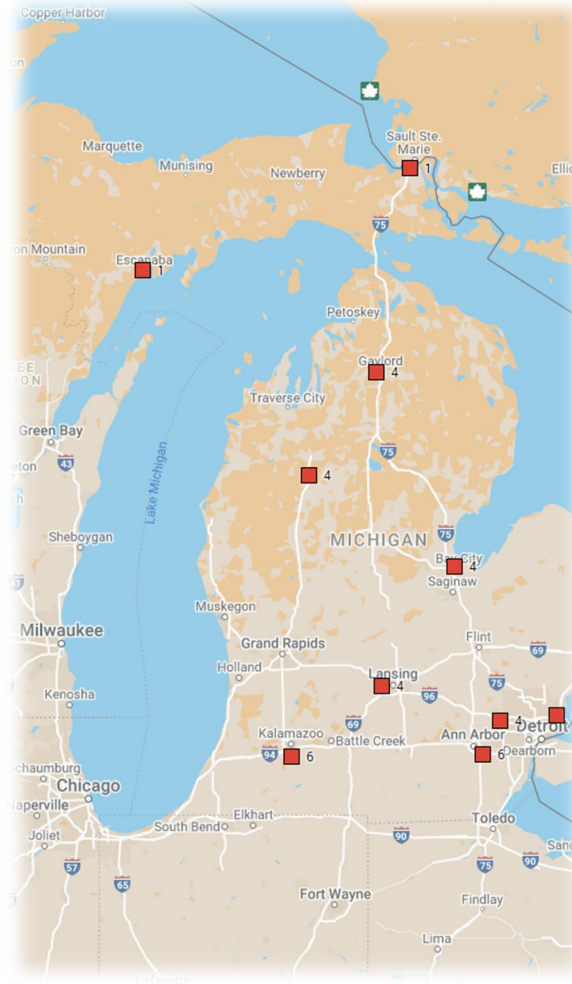


# Inputs Required

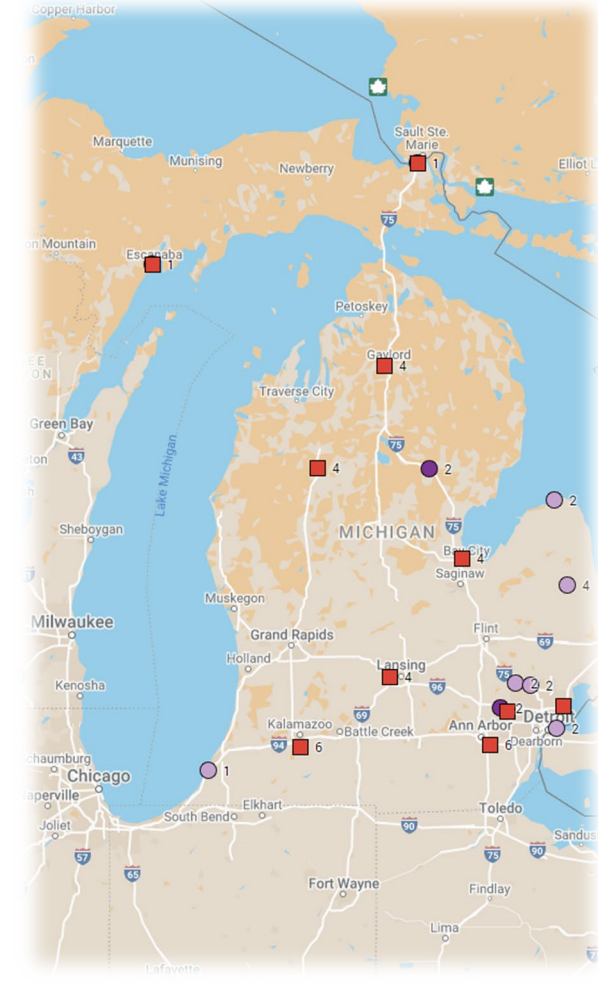
### EGLE funded DCFC >150 kw



### AFDC DCFC >150 kw



### EGLE funded and AFDC DCFC >150 kw

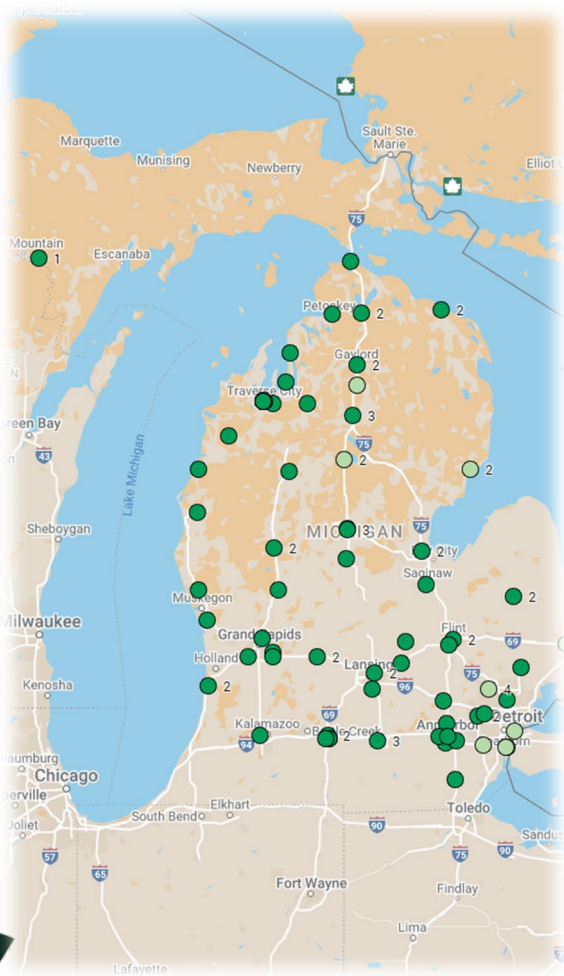


- EGLE funded DCFC, Ready, >150 kw
- EGLE funded DCFC, Pending, >150 kw
- AFDC DCFC, ready, >150 kw

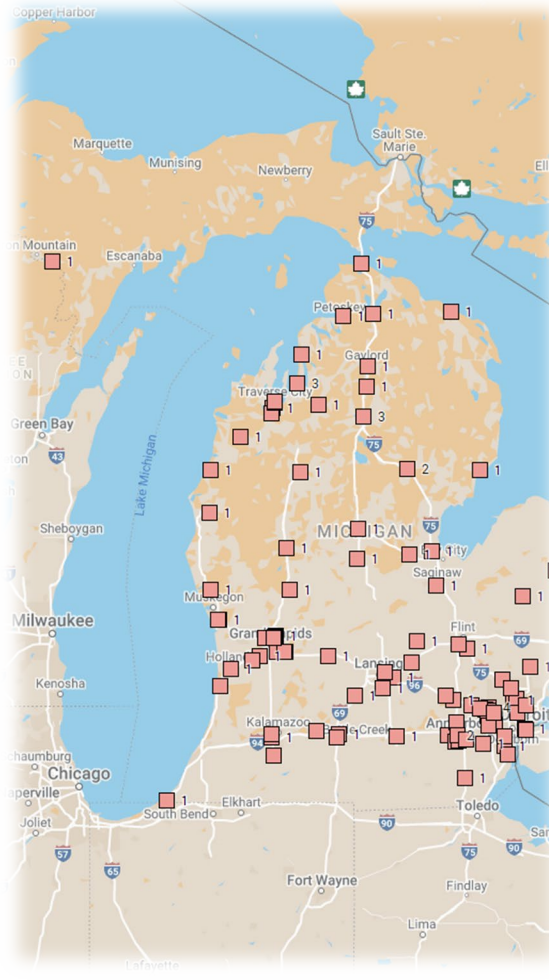


# Inputs Required

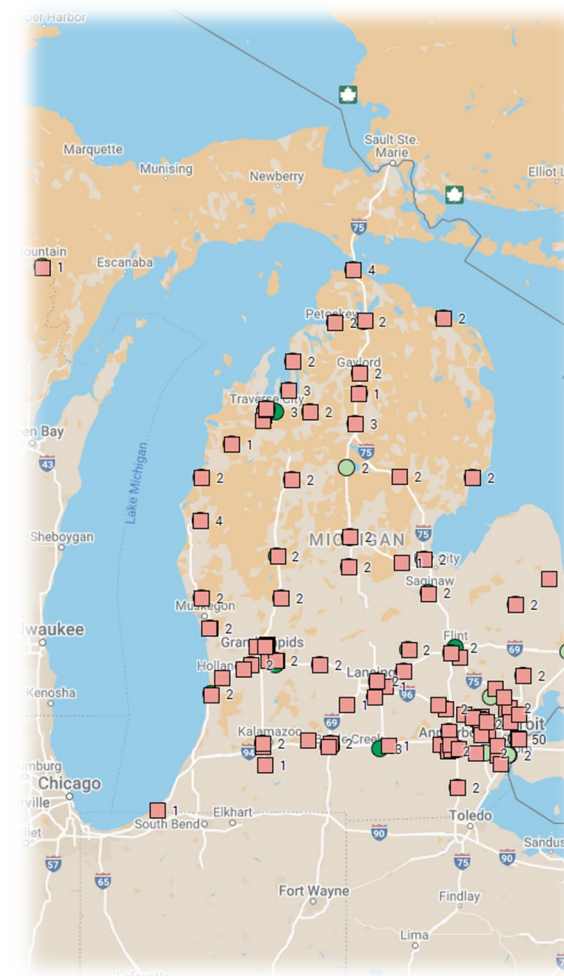
EGLE funded DCFC <150 kw



AFDC DCFC <150 kw



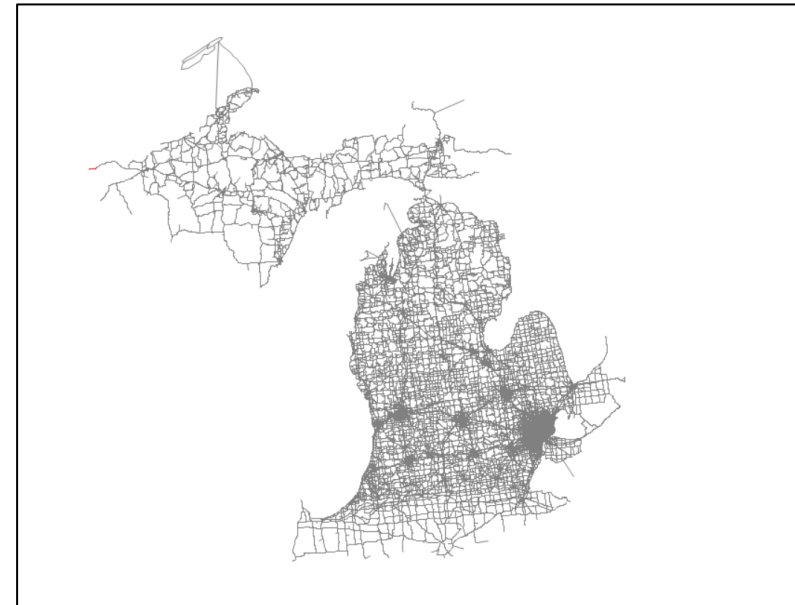
EGLE funded and AFDC DCFC <150 kw



- EGLE funded DCFC, Ready, <150 kw
- EGLE funded DCFC, Pending, <150 kw
- AFDC DCFC, ready, <150 kw



- A road network of Michigan is prepared
  - 83821 links
  - 62996 nodes



Extended road network of Michigan

- Updated travel demand (MDOT)



# Barebone, Current and NEVI

Market Share: 6%

Battery: 70 kWh

Month: February

Total Number of Stations = 47

Total Number of Chargers = 270

Station Investment Cost (million \$) = 8.91

Land Investment Cost (million \$) = 0.51

Charger Investment Cost (million \$) = 20.58

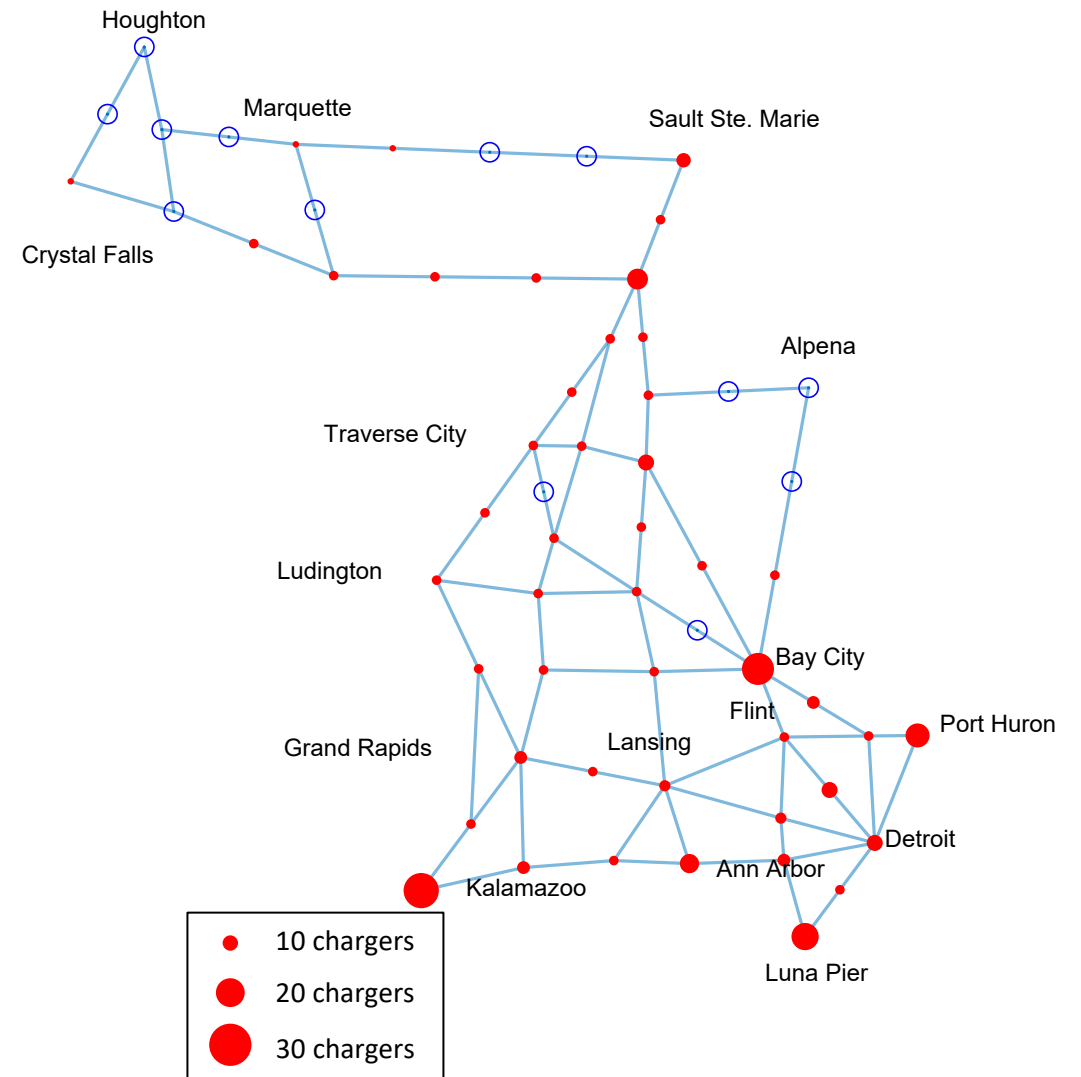
Total Cost (million \$) = 30.01

Total Refueling Time (h) = 1084.80

Total Queuing Time (h) = 0.00

Average Delay (min) = 12.36

Total Energy Demand (MWh) = 130



# Cost breakdown of NEVI and Barebone Network

Item	Current/ Pending	NEVI	New	Total
Number of Stations	15	28	4	47
Number of Chargers	55	127	88	270
Station Investment Cost (million \$)	2.97	5.29	0.65	8.91
Land Investment Cost (million \$)	0.10	0.24	0.17	0.51
Charger Investment Cost (million \$)	4.19	9.68	6.71	20.59
Total Cost (\$ million)	7.27	15.21	7.53	30.01



- Optimum location of DCFC in compliance with NEVI
- Upgrades required at current locations
- Costs and investment strategies



# Thank You

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