Des Moines Area Metropolitan Planning Organization

Electric Vehicle Readiness

Energy Efficiency through Regional Planning

August 2014

This study provides recommendations to local governments in the Des Moines metro area to spur the adoption of electric vehicles through increased installations of charging station as a means towards a more energy efficient transportation system.

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EXECUTIVE SUMMARY

The future of transportation is in a fundamental shift to cleaner, more efficient fuels. Energy consumption affects air quality and impacts global climate as a result of emissions. Different methods of generating and acquiring power have different levels of impact on the natural environment. The cost of energy impacts the pocketbooks of people and industries. The quest for energy can lead to international political and military conflicts. Identifying and promoting innovative solutions that reduce overall consumption of energy –especially energy from non-renewable sources – would help the Greater Des Moines region maintain its current air quality. *The Tomorrow Plan*, the recently adopted regional plan for a greener greater Des Moines, recommends a strategy of promoting the use of renewable energy and reduced energy consumption. One of the more efficient and sustainable fuels is that of electric drive systems.

This report outlines some of the first steps the region can take to support and encourage electric vehicle adoption by private citizens. Despite a growing number of state and local efforts around the nation to support electric vehicle adoption, the Des Moines metro region has yet to establish a first-tier market. Due to the fact that the state has yet to see three percent of the population purchase electric vehicles, Iowa has yet to reach the early adoption phase. Because of a lack of a perceived or even real market, manufactures and local governments have seen little benefit in focusing efforts on electric vehicle readiness. Given this, the Des Moines Area Metropolitan Planning Organization has focused on three main recommendations for municipal governments to support the next steps in early adoption of electric vehicles for private use in the metro area.

Recommendtaions:

- Take the lead in the installation of publically sited electric vehicle supply equipment
- Incentivize local installation of electric vehicle supply equipment at the workplace and multi-unit residential facilities
- Integrate electric vehicle infrastructure into comprehensive plans

Local governments can be powerful catalysts to investing in energy and resource efficiency. Cities and counties can play a critical role in promoting strategies to decrease transportation related greenhouse gas emissions through the deployment of both public and private charging infrastructure. Advanced planning and early implementation by local government can spur private sector investment. Local governments in the Des Moines area can expedite the establishment of convenient, cost-effective electric vehicle infrastructure.

This report offers a summary of the first steps of support municipalities can provide and a compilation of additional resources as more interest swells from local citizens, businesses and manufactures. Ultimately, municipal government needs the support of local advocates, users, and manufactures to go beyond the recommendations offered here.

ACKNOWLEDGEMENTS:

This report was created through grant funding support from the Iowa Economic Development Authority's State Energy Program Formula award and with partial funding from the United States Department of Transportation's (DOT) Federal Highway Administration (FHWA) and Federal Transit Administration (FTA), and in part through local matching funds provided by the MPO member governments. These contents are the responsibility of the MPO. United States Government and its agencies assume no liability for the contents of this report or for the use of its contents. Electric vehicle readiness is one of a three part study the Des Moines Area MPO conducted to promote energy efficiency through transportation planning.

Benefits of Electric Vehicles

Hybrid and plug-in electric vehicles can help increase energy security, improve fuel economy, lower fuel costs, and reduce emissions.

Energy Security

The United States imports approximately 40% of the petroleum it consumes and transportation is responsible for nearly three-quarters of the total US petroleum consumption. With much of the world's petroleum reserves located in politically volatile countries, using plug-in elective vehicles (PEV) instead of conventional vehicles can help reduce U.S. reliance on imported fuels and increase energy security.

Fuel Economy. Low Operating Costs

Electric vehicles are highly efficient and can reduce fuel costs dramatically because of the low cost of electricity relative to conventional fuel. Use Find A Car tool on FuelEconomy.gov to compare fuel economy ratings of individual hybrid and conventional models.

Emissions

PEVs have significant emission benefits over convention vehicles. They produce zero tailpipe emissions and, according to Argonne National Laboratory, switching from traditional combustion engines to electric vehicles in urban areas will significantly reduce volatile organic compounds, carbon monoxide, sulfur oxide, nitrous oxide, and particulate matter. This can vary based on model and type of electric vehicle. Use the Vehicle Cost Calculator to compare life cycle emissions of individual models our region.

Infrastructure Availability

PEVs have the benefit of a flexible fueling: they can charge right in your own home overnight, at a workplace, or a public charging station such as a grocery store.

Competitive Business Advantage

While all drivers of gas-powered cars today rely on gas stations, most PEV drivers will use the home garage as their primary refueling stop. PEV drivers, at least in the early years of adoption, will look for opportunistic charging prospects while driving their EVs as opposed to making a special trip to a refueling station. These opportunistic pit stops may come in the form of a shopping trip, a meal at a restaurant, a coffee break, or at work. As PEV adoption increases, drivers may elect to shop where they can also refuel their PEVs so they can attend to two chores in one location. The presence of an EV charging station in the parking lot or garage brings an added cache of value and customer service to a business. Employers and owners of multi-unit residential facilities will similarly build competitive advantage by attracting clean-driving employees and tenants.

Enhanced Image

EV charging stations send a powerful message to employees, tenants, and the public that the organization or community is leading in sustainable transportation options. This branding will help to contribute to a "green" image that attracts and retains a quality, progressive workforce.

Electric Vehicle Basics

Vehicle Types

Plug-in electric vehicles have the ability to charge from an off-board electric power source. PEVs can be "plugged in," as opposed to hybrid electric vehicles (HEVs) which supplement power from a propulsion source and cannot be plugged in. There are two basic types of PEVs: EVs and PHEVs.

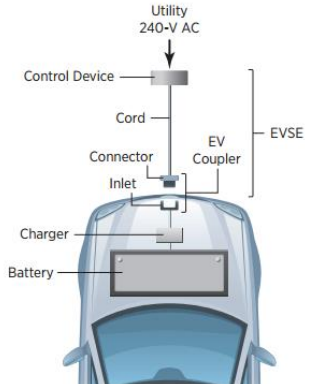
All-Electric Vehicles (EVs) use batteries to store the electrical energy that powers them. The batteries are charged by plugging the vehicle into a power source or while braking. EVs have no tail-pipe emissions. They typically have a shorter range than conventional vehicles and have a range of about 100 miles on a fully charged battery.

Plug-in Hybrid Electric Vehicles (PHEVs) use batteries and another fuel, such as gasoline, to power the vehicle. Even while running on gasoline, PHEVs consume less fuel than regular combustion vehicles. PHEVs have an all-electric driving range higher than that of EVs by 10 – 40 additional miles.

The Sierra Club has an on-line guide to EV and PHEVs vehicles currently available with reviews, price estimates, and CO2 emissions will be saved in fueling each model.

Charging Stations

There are three main types of electric vehicle supply equipment (EVSE) which differ based on supply capabilities and how quickly they can charge a vehicle. EVSE can be installed at homes, workplaces, private fleet facilities, and public stations.



Source: Electric Vehicle Charging Infrastructure deployment Guidelines

Level 1 EVSE provides charging through a 120-volt plug and will typically be used in residential settings. Depending on the battery type and vehicle, Level 1 charging adds about 2-5 miles of range to a PEV per hour of charge time. No additional equipment is needed.

Level 2 EVSE offers charging through a 240-volt or 280-volt electrical service and is a common installation for home, workplace, fleet, and public facilities. Level 2 EVSE requires the installation of charging equipment and is hard-wired for safe operation. Depending on the battery type, Level 2 charging adds about 10 to20 miles of range to a PEV per hour of charge time. Estimates for total cost of installing a typical charging station is $15,000 to $18,000.

DC Fast Charging enables rapid charging due to the 480-volt input and is recommended for sites such as heavy traffic corridors. A DC fast charger can add 60 to 80 miles of range to a PEV in 20 minutes. Installation price for a DC fast charging station ranges from $65,000 to $80,000.

Find the locations of stations in the Des Moines area by visiting the Department of Energy's Alternative Fueling Station Locator. A map of locations to date can be found in Appendix IV.

Local Government Leadership

EVs need a much different type of fueling network than gasoline engine vehicles. This new fueling system will be based on a clustering of strategically placed charging stations at homes, workplaces, and retail stores instead of the traditional quick fueling system used with gas stations today. This way of "fueling" will be quite a paradigm shift for most metro consumers.

Recommendation 1: Publically Site Charging Stations

A strong network of publically-available Level 2 charging stations is needed to encourage more PEV purchases in the Des Moines metro area. Various business and government sites are suitable for a charging station. An ideal location is convenient and highly visible to a large number of potential PEV drivers. The Des Moines Area MPO has mapped ideal locations for EVSE installation for each of the 17 member communities (Appendix I) based on the number of destination locations such as retail stores, parks, theatres, and restaurants within the Traffic Analysis Zones. Each map displays high density areas of ideal businesses where travels tend to stay parked for at least an hour.

The Des Moines Area MPO recommends each municipal government install at least one EVSE in each high density location. Local city planners can assess the ideal specific local within this destination area such as finding an ideal host. Many organizations can host Level 2 charging stations including:

- **Parking garages**
- **On-street parking**
- **Retail Stores**
- Stadiums and sports complexes
- Movie theaters
- Destination parks, zoos, and museums
- University

Charging station ownership and payment systems vary. Many stations are currently publically funded and offer free charging to encourage early adopters of PEVs. Payment systems will evolve as use becomes more mainstream.

Links to Maps of Ideal Sites for Public Access Charging Stations by Community

Altoona

Ankeny

Bondurant

Carlisle

Clive

Cumming

Des Moines, Downtown Des Moines

Grimes

Johnston

Mitchellville

Norwalk

Pleasant Hill

Polk City

Urbandale

Waukee

Windsor Heights

West Des Moines

Recommendation2: Incentivize local EVSE installation

There are three main tools a city can use to encourage the installation of EVSE on private property and the focus should be placed on multi-unit residences, workplace sites, and key inter-metro sites.

Site Types

Multi-family home

Multi-unit residences are a major obstacle to EV ownership. Residents may choose a location to live based on EV availability. An EV owner in a single family residence can easily install an EVSE. It can be as simple as hiring a contractor to install a new outlet. This is not the same for a resident of multi-unit dwelling that would need to work through a landlord, building management, or home owners association. Special consideration should be given to requiring apartments and condominiums, etc. to install a Level 2 EVSE for 2-5% of the parking.

Source: Argonne National Laboratory, 2012

Workplace

According to the Electric Power Research Institute, the workplace is the second most frequented location for charging after a PEV driver's home. This is because vehicles tend to stay parked at a workplace on average 8 to 9 hours. Workplace charging may also be an alternative to residential charging for drivers that may not have charging available in their homes if they live in a multi-unit dwelling, have a detached garage with no electricity, etc.. The Des Moines Area MPO mapped locations with a high number of employees to locate dense workplace zones to assist planners to focus on workplace charging initiatives (Appendix II). Click on the region of the community to view recommendations for workplace locations: Metro-wide, Downtown Des Moines, East Metro, West Metro, Northeast Metro, Northwest Metro, Southeast Metro, and Southwest Metro.

Inter-Metro Sites

To complete the EVSE network, a few fast charging sites will be necessary to extend the range for drivers. PEV drivers want more fast chargers to be available. This charging equipment can provide an 80% charge in as little as 30 minutes. It will service the needs of inter-regional and intra-regional travel and also provide a "safety net" charging network for all PEV drivers in the Des Moines metro area. The Des Moines Area MPO has mapped areas for optimal fast charging stations (Appendix III).

Means to Incentivize Installation

Site Design and Parking Ordinances

Residential

Update ordinances to strongly encourage new multiple-family homes be constructed to provide a 220-240-volte/40 amp outlet on a dedicated circuit and in close proximity to designated vehicle parking to accommodate the future hardwire installation of a Level 2 EVSE. Due to the fact that 60% to 70% of electric vehicle charging will happen at the owner's home at night, it will be easier to install the dedicated electrical line now vs retrofitting a building in the future.

Non-residential

Update ordinances to strongly encourage new and expanding non-parking areas to proactively provide the electrical capacity necessary to accommodate the future hardwire installation of Level-2 electric vehicle charging stations in order to accommodate future growth in demand for EV. It is recommended that a minimum ratio of 2% of the total parking spaces be prepared for charging stations.

Ordinances may also speak to site design requirements, signage, ability for police to remove illegally parked vehicles, etc. See Resource section for links to example ordinances from other communities.

Pre-App Meetings

Cities that conduct pre-app meetings should consider adding this to the check-list of considerations discussed with potential development projects.

Tax Abatement

Tax abatement is offered in some communities as an encouragement to commercial projects that exemplify a commitment to improve the character of the commercial areas throughout the region. Most communities have standards and some offer a menu of options including those focused on sustainability. The Des Moines Area MPO recommends adding the option to install Level 2 EVSE charging stations (not just the wiring) to serve a minimum of ration 2% of the plan's total parking spaces.

Other incentives communities have implemented:

- Low-cost EVSE permits
- Same-day inspections
- Stream-line electrical permitting

Source: The Hardford, NREL 26470

Recommendation 3: Comprehensive Plan & Code Updates

To ensure EV-friendly local government commitment through ordinances and zoning, the Des Moines Area MPO encourages including EVs and EVSE in local comprehensive plans. Most city codes do not represent a significant barrier to EVSE installation, but adopting EV-friendly codes can encourage EVSE deployment. The plan could include new zoning ordinances to address the following:

- Define what types of EVSE are allowable by land use type
- Request developers install EVSE or wiring for future EVSE installation with new develops or significant renovations
- Establish design criteria for EVSE installations
- Provide density bonuses for EVSE installations
- Set performance measurements or target number of EVSE for the region.

Electric vehicles and Road Use Tax

A loss of road taxes can occur due to plug-in electric vehicles (PEVs) not needing gasoline and therefore not paying the tax included in the price of gasoline. To address this issue, a number of states have started implementing registration fees for PEVs. Below is a list of states that have fees in place. These descriptions are pulled from the Alternative Fuels Data Center (AFDC) Laws & Incentives database (http://www.afdc.energy.gov/laws/).

Colorado - Alternative Fuel and Advanced Vehicle Tax

Excise taxes are imposed on compressed natural gas (CNG), liquefied natural gas (LNG), and liquefied petroleum gas (LPG) effective January 1, 2014, on a per gallon basis as follows:

	2014	2015	2016	2017	2018	2019 & Beyond
CNG	$0.03	$0.06	$0.09	$0.12	$0.15	$0.183
LNG	$0.03	$0.05	$0.07	$0.08	$0.10	$0.12
LPG	$0.03	$0.05	$0.07	$0.09	$0.11	$0.135

Beginning January 1, 2014, plug-in electric vehicle (PHEV) owners must pay an annual registration fee of $50. After paying the fee, the vehicle owner must affix the PHEV registration decal to the front windshield of the vehicle. Fees contribute to the Highway Users Tax Fund and the Electric Vehicle Grant Fund. (Reference House Bill 13-1110, 2013 and Colorado Revised Statutes 39-27-102 and 42-3-304)

Illinois - Electric Vehicle (EV) Registration Fee Reduction

The owner of a dedicated all-electric vehicle may register for a discounted registration fee not to exceed $35 for a two-year registration period. The registration fee for an EV may not exceed $18 per year. To qualify for the reduced fee, the EV must weigh 8,000 pounds or less. (Reference 625 Illinois Compiled Statutes 5/3-805)

Nebraska - Alternative Fuel Vehicle (AFV) Registration

A fee of $75 is required for the registration of an AFV that operates on electricity, solar power, or any other source of energy not otherwise taxed under the state motor fuel tax laws. Compressed natural gas, liquefied natural gas, and liquefied petroleum gas (propane) are not subject to this requirement. (Reference Nebraska Revised Statutes 60-306 and 60-3,191)

North Carolina - Annual Electric Vehicle (EV) Fee

The owner of an EV that does not rely on a non-electric source of power must pay a fee of $100 in addition to any other required registration fees at the time of initial registration and annual registration renewal. (Reference Senate Bill 402, 2013, and North Carolina General Statutes 20-87)

Oregon - Plug-in Electric Vehicle (PEV) and Hybrid Electric Vehicle (HEV) Registration Fees

PEVs and HEVs are registered biennially, with the exception of new vehicles for which new registration plates are issued. Certain PEVs and HEVs, including commercial buses, follow an annual registration period. The registration fee is $43 per vehicle for each year of the registration period. There is an additional fee for PEVs or HEVs in certain weight categories. (Reference Oregon Revised Statutes 803.415 and 803.420)

Virginia - Alternative Fuel and Vehicle Tax

Liquid alternative fuels used to operate on-road vehicles are taxed at a rate of $0.175 per gallon. These fuels are taxed at the same rate as gasoline and gasohol (3.5% of the statewide average wholesale price of a gallon of self-serve unleaded regular gasoline). Alternative fuel vehicles and all-electric vehicles (EVs) registered in Virginia are subject to a $64.00 per vehicle annual license tax. EVs are also subject to an additional $50 annual license tax. Some exceptions apply. The Virginia Department of Motor Vehicles will establish a process to refund any prepaid annual license tax collected on hybrid electric vehicles for registration years beginning on or after July 1, 2014. (Reference Senate Bill 127, 2014, and Virginia Code 58.1-2217 and 58.1-2249)

Washington - Electric Vehicle (EV) Fee

EV operators must pay an annual vehicle registration renewal fee of $100. This fee expires if the legislature imposes a vehicle miles traveled fee or tax in the state. (Reference Revised Code of Washington 46.17.323)

Below are states that are considering a PEV fee through a study:

Indiana - Plug-In Electric Vehicle (PEV) and Hybrid Electric Vehicle (HEV) Road Impact Fee Study

The Interim Study Committee on Road Impact Fees (Committee) will study issues related to the imposition of road impact fees on PEV and HEV users. The Committee must report its findings and recommendations to the legislative council by November 1, 2013. (Reference Indiana Code 2-5-36.3)

Vermont - Alternative Fuel Vehicle (AFV) User Fee Study

As required by the legislature, the Vermont Agency of Transportation, in consultation with the Joint Fiscal Office, the Motor Vehicle Department, Department of Taxes, and Department of Public Service, analyzed and reported on options for user fees and fee collection mechanisms for AFVs using fuels that are not currently taxed. In addition, the Committee on Transportation Funding released a report on estimated transportation revenues over five years and potential new sources of revenue, including a tax based on vehicle miles traveled. For more information see the Vermont Transportation Funding Options Final Report*(PDF)*. (Reference House Bill 770, 2012)

Resources

Education and Outreach Materials

- Well-to-wheels life cycle analysis comparing total emissions of PEV with conventional vehicles, pg. 94
- Energizing Oregon: Workplace Charging, page 31
- Messaging and outreach links from Plug-in Electric Vehicles Collaborative
- Benefits of PeVs to Property Developers, Colorado Electric Vehicle and Infrastructure Readiness Plan, Appendix 14
- Energy security benefits of PEV Adoption, Florida Gold Coast Clean Cities, Vol 1, Section 3-15
- Plug-In Electric Vehicle Handbook for Workplace Charging Hosts
- The Daily Caller: States turn against electric cars as gas tax revenues fall.

Site Design, Permit and Signage Guidelines

- Kane County, Illinois
- EV Infrastructure Guide for Local Governments in Washington State
- EV Charging Infrastructure Deployment Guidelines for Oregon
- Sample permit for charging equipment installation
- Plug-In Electric Vehicle Handbook for Workplace Charging Hosts
- The EV Project: Accessibility at Public EV Charging Locations

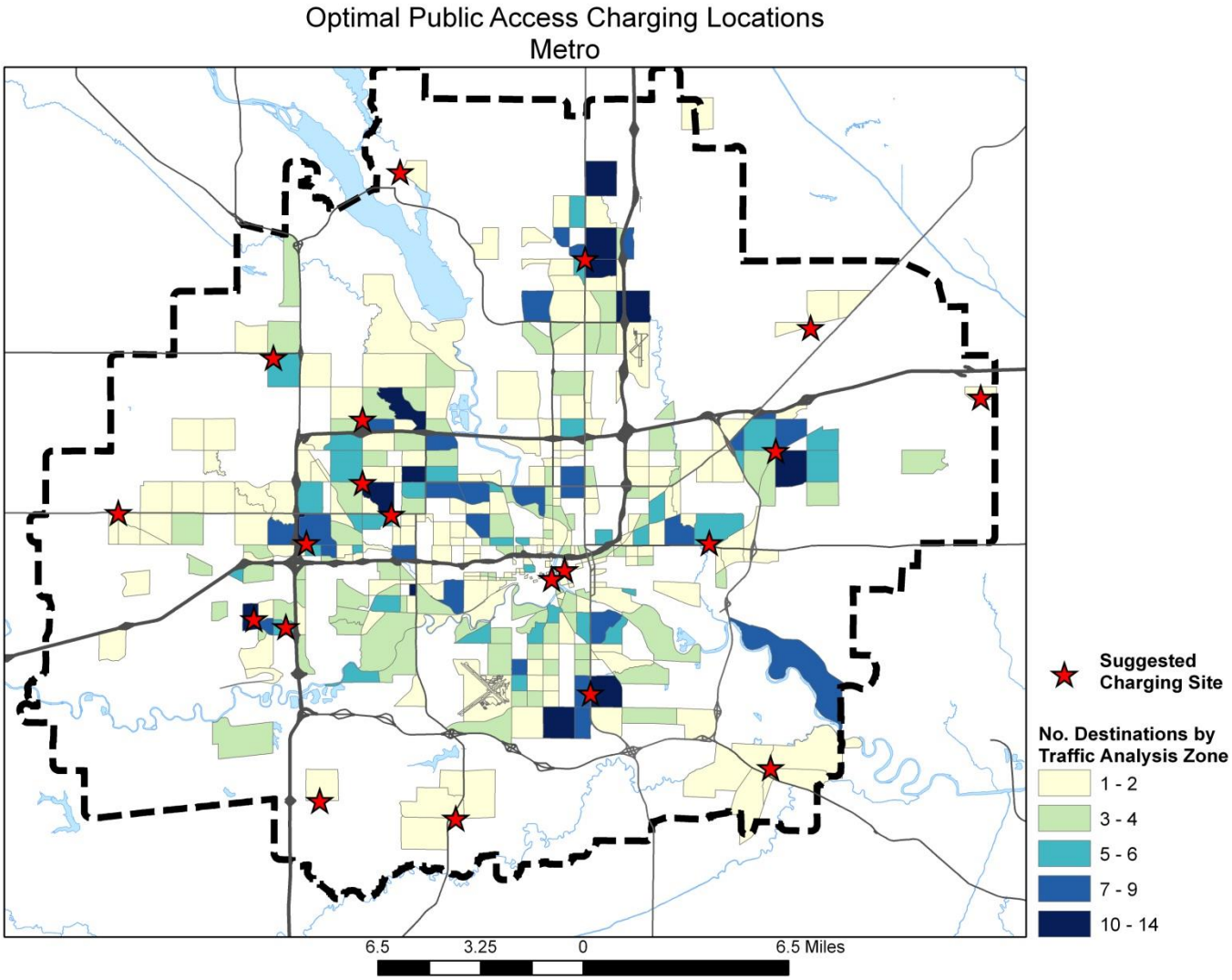
Sample Zoning and Code Language

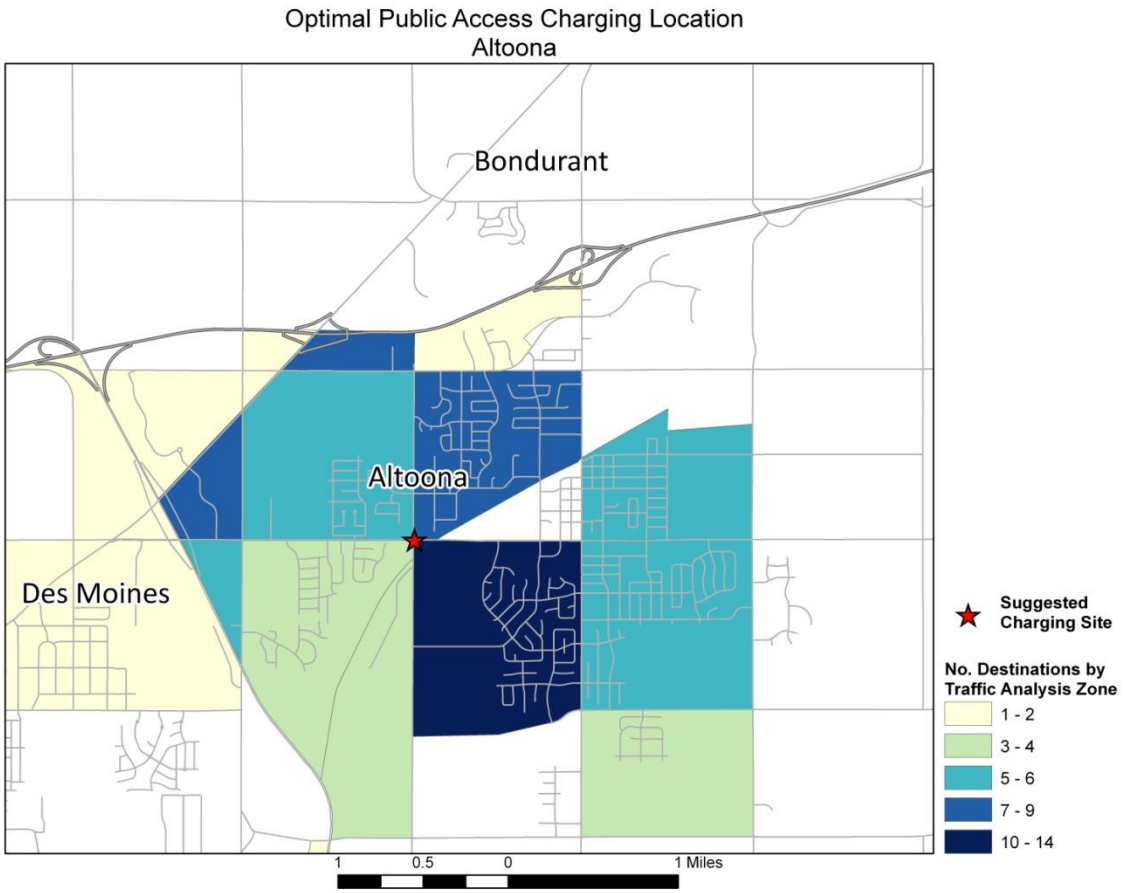
- Kane County, IL
- City of Auburn Hills, MI
- Arlington, VA
- EV Infrastructure Guide for Local Governments in Washington State
- Model ordinance and building code amendment

Local Resources for EV Charging stations

- Crescent Electric (several Iowa locations) – Bob Settle bob.settle@cesco.com
- Lilypad EV (based in Kansas City) – larry.kinder@lilypadev.com
- Schneider Electric (has a location in Cedar Rapids) michelle.felser@schneider-electric.com; brett.larson@schneider-electric.com
- Van Meter, Inc (with multiple Iowa locations including Urbandale) distributes EV charging equipment for several manufacturers, Eaton, ChargePoint, and Clipper Creek.
    - Brian Levin, ChargePoint Brian.Levin@ChargePoint.com 847-903-6652
    - Stuart Irwin, Clipper Creek stuart@clippercreek.net 248-408-4162

APPENDIX I: OPTIMAL LOCATIONS FOR PUBLIC ACCESS CHARGING STATIONS

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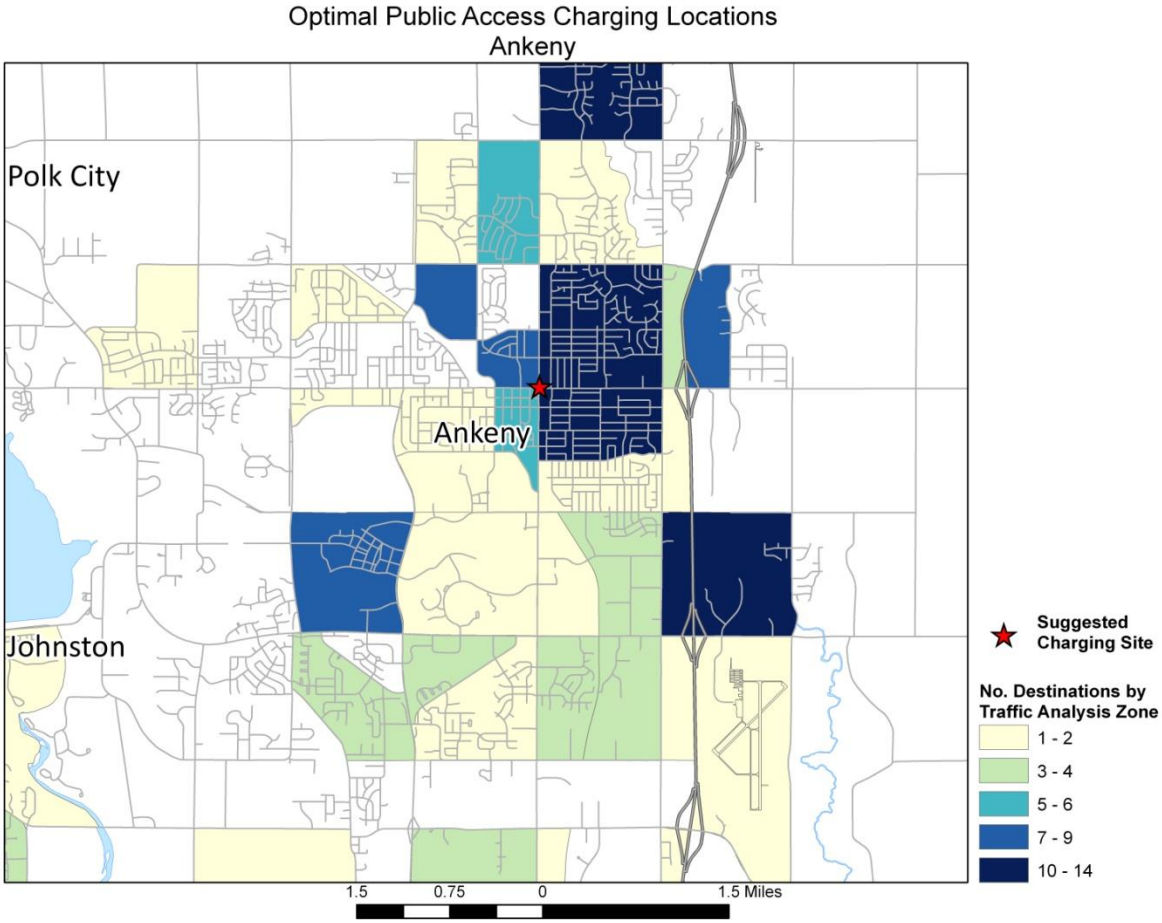
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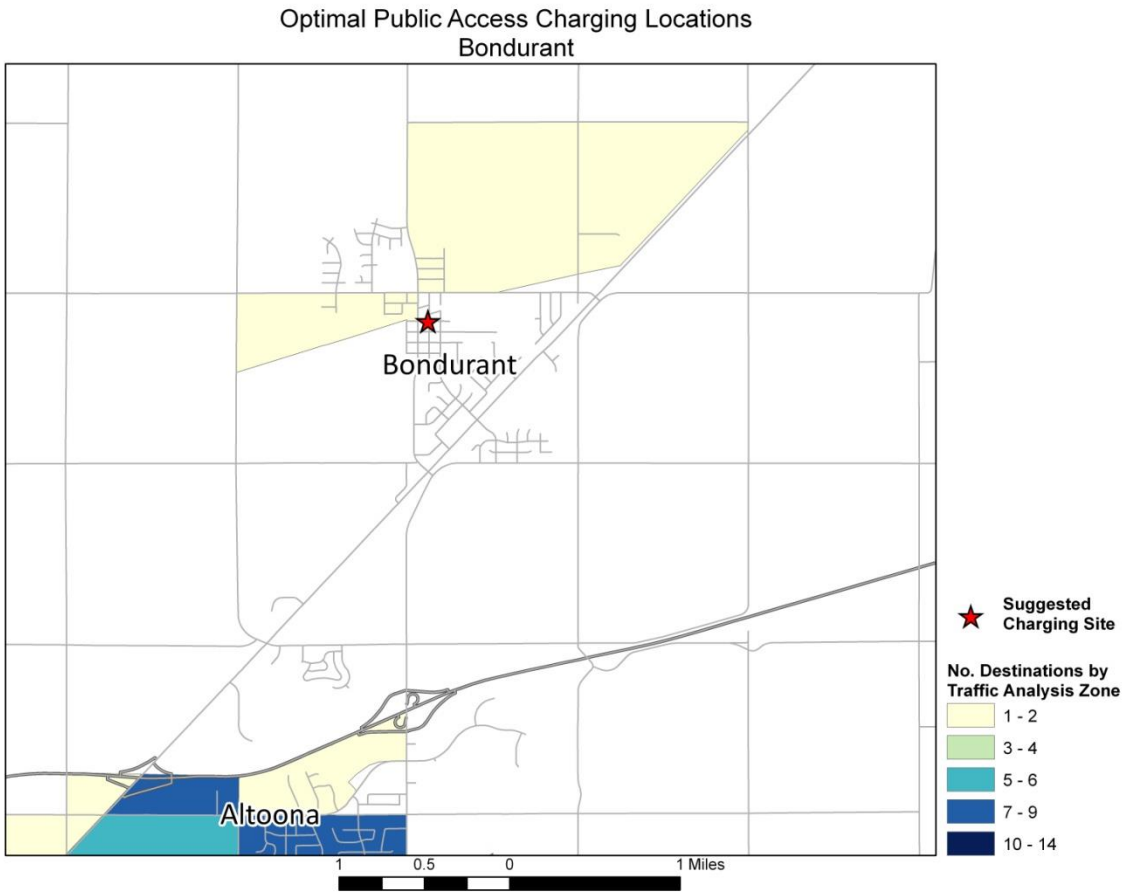
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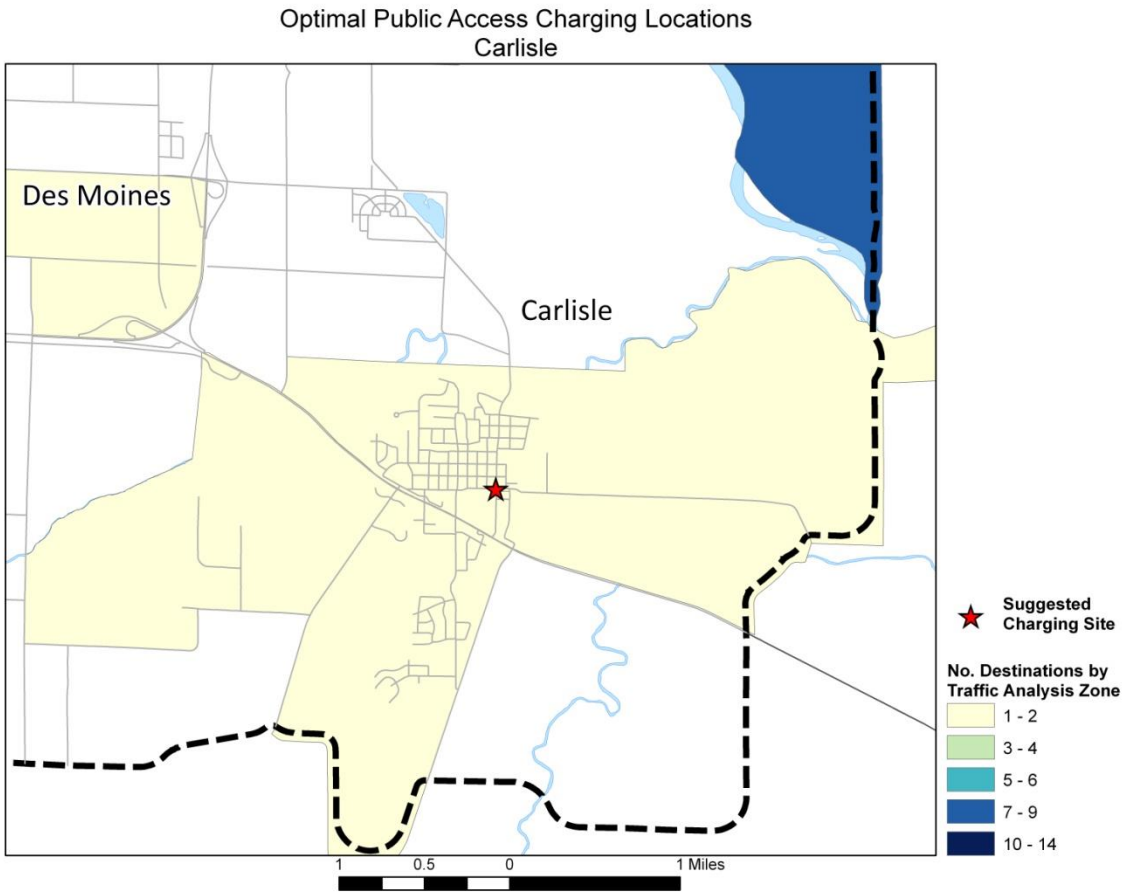
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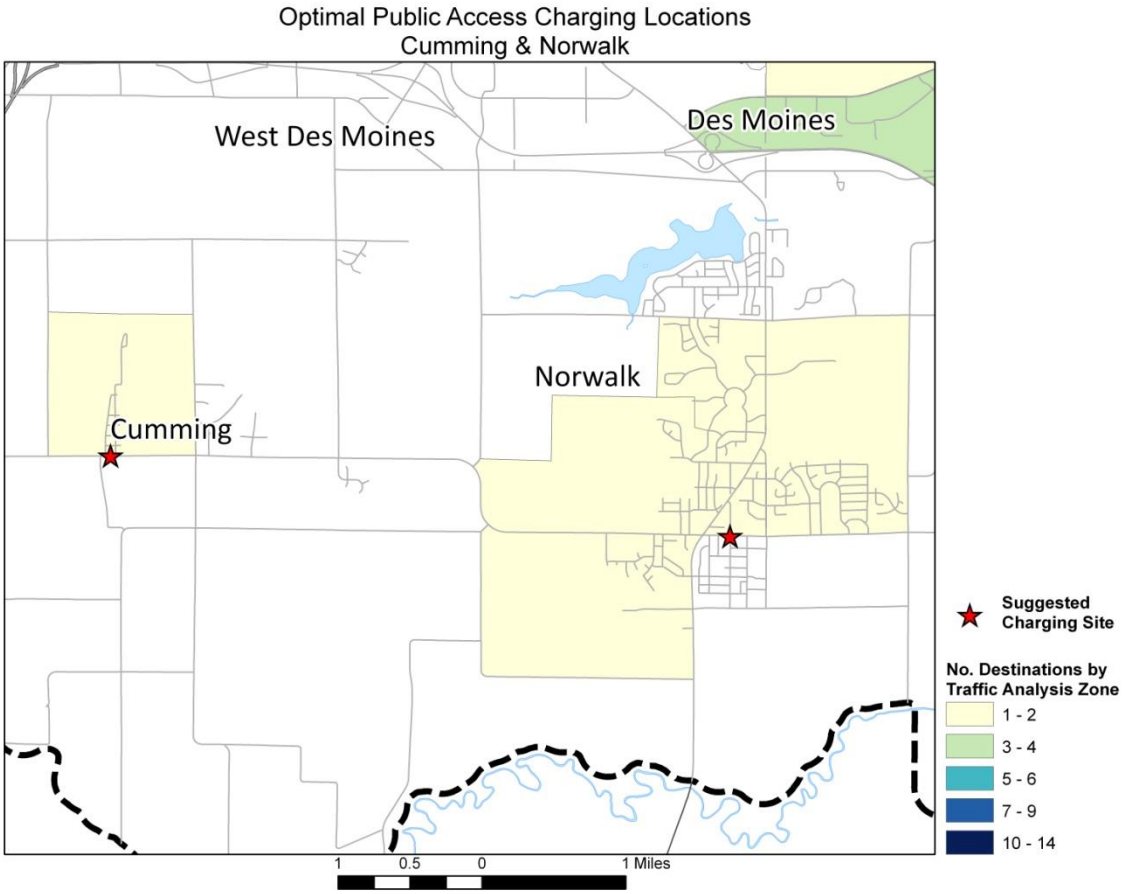
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West Des Moines
Des Moines
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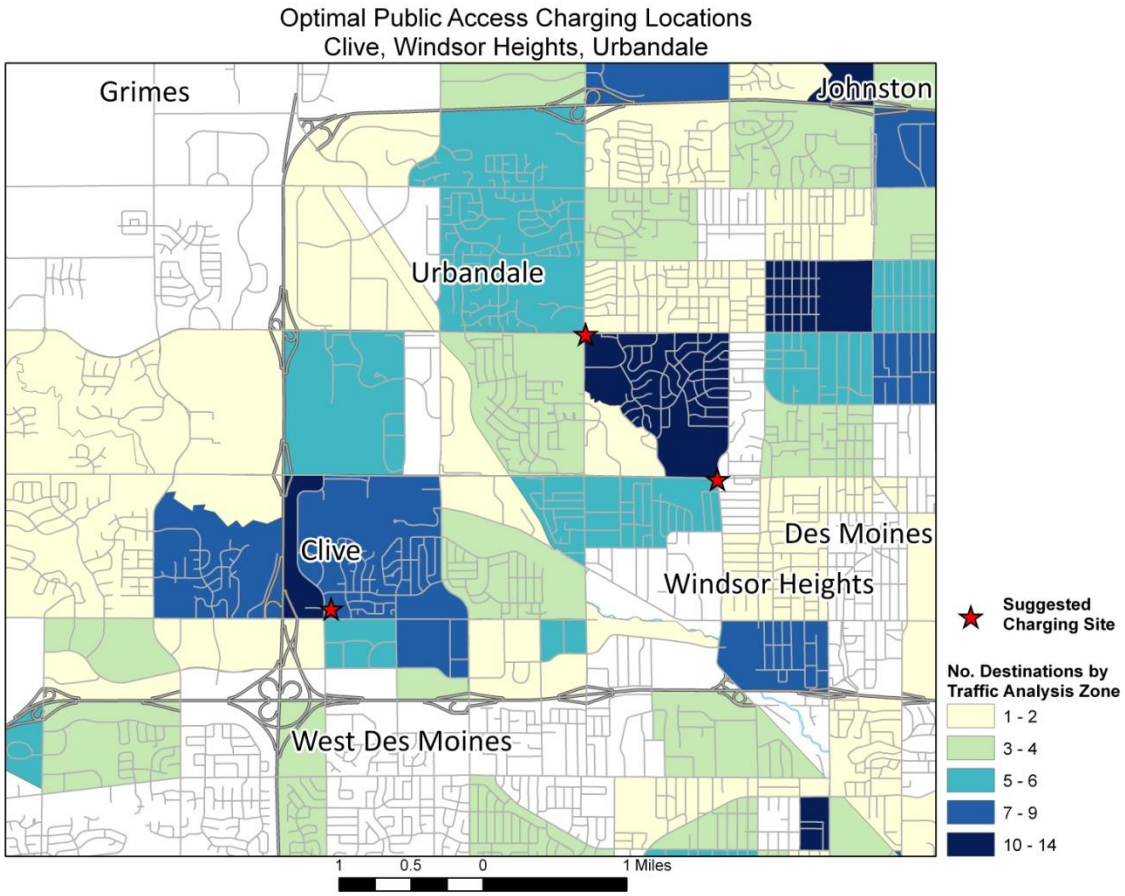
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Urbandale
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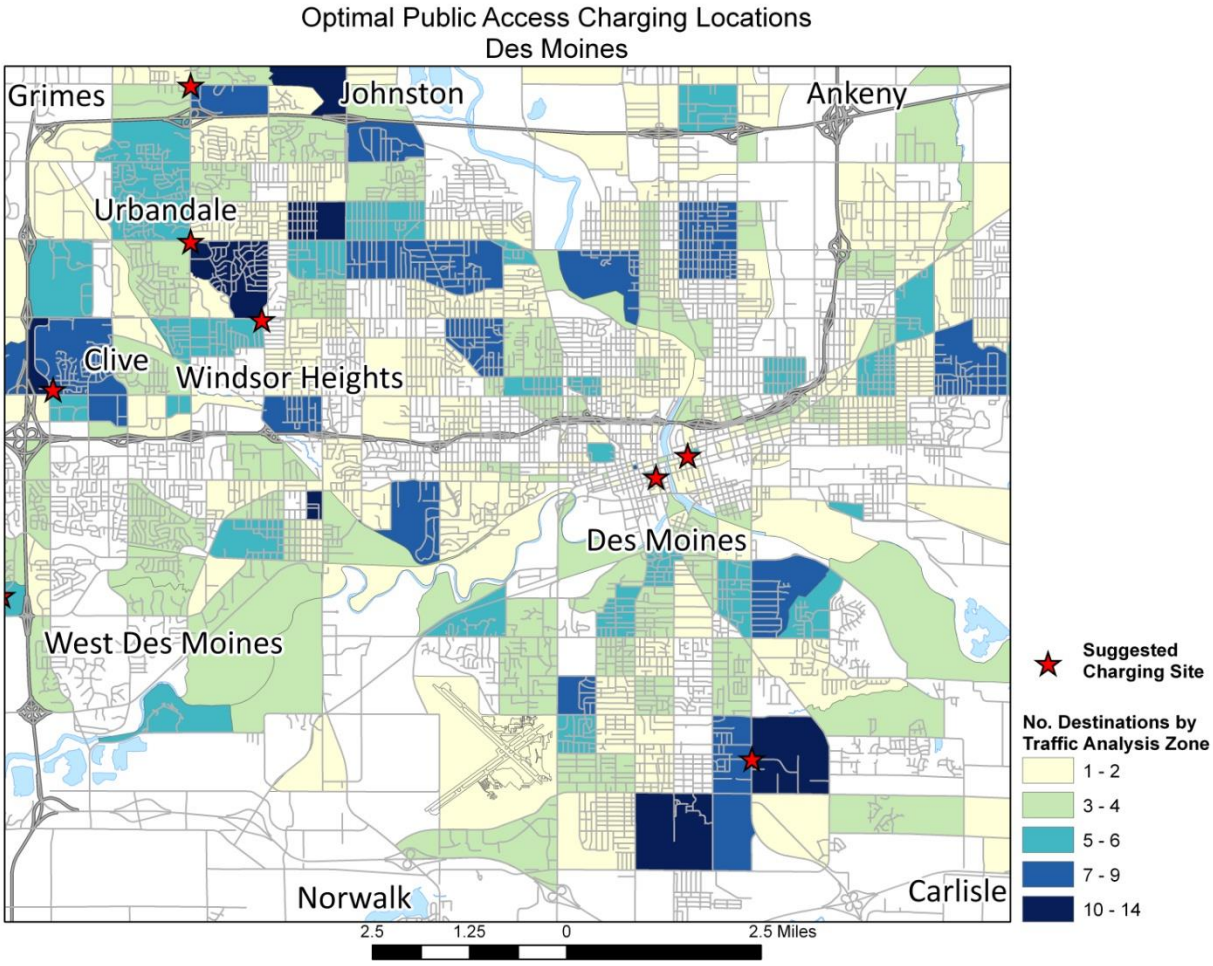
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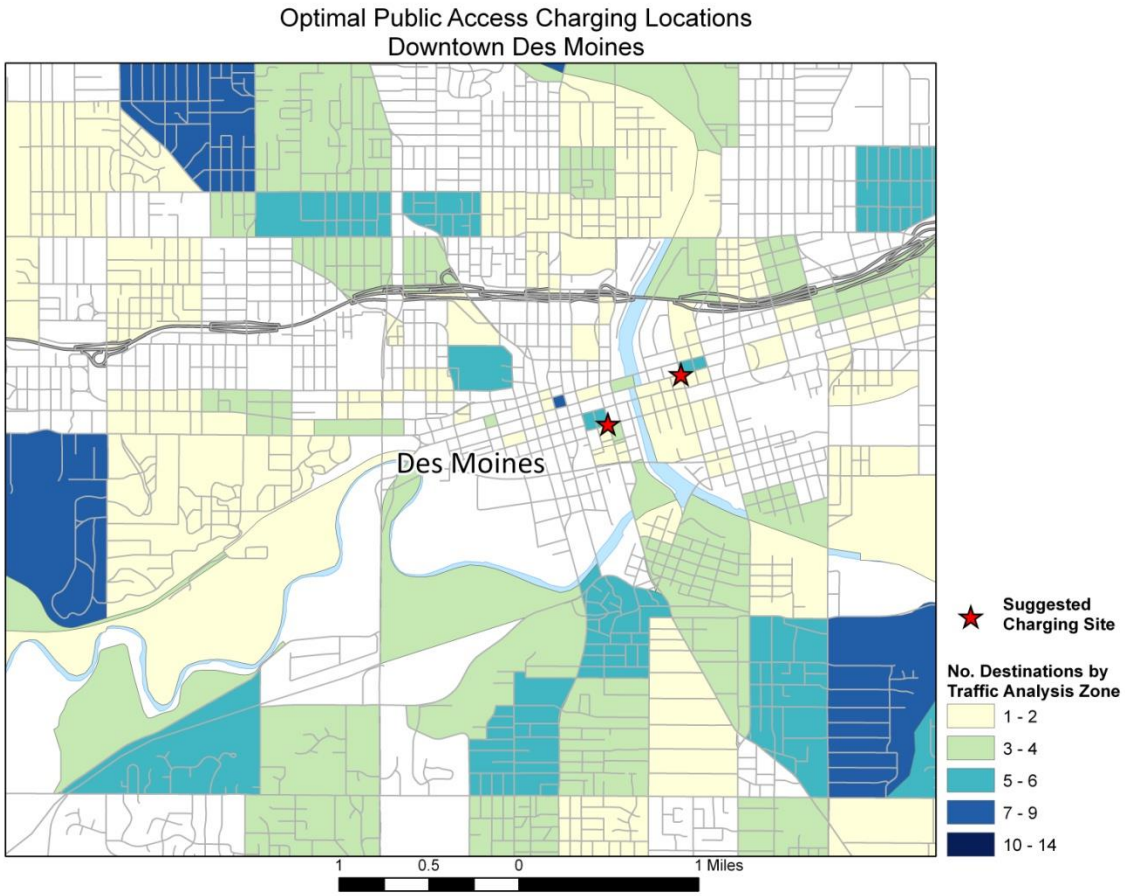
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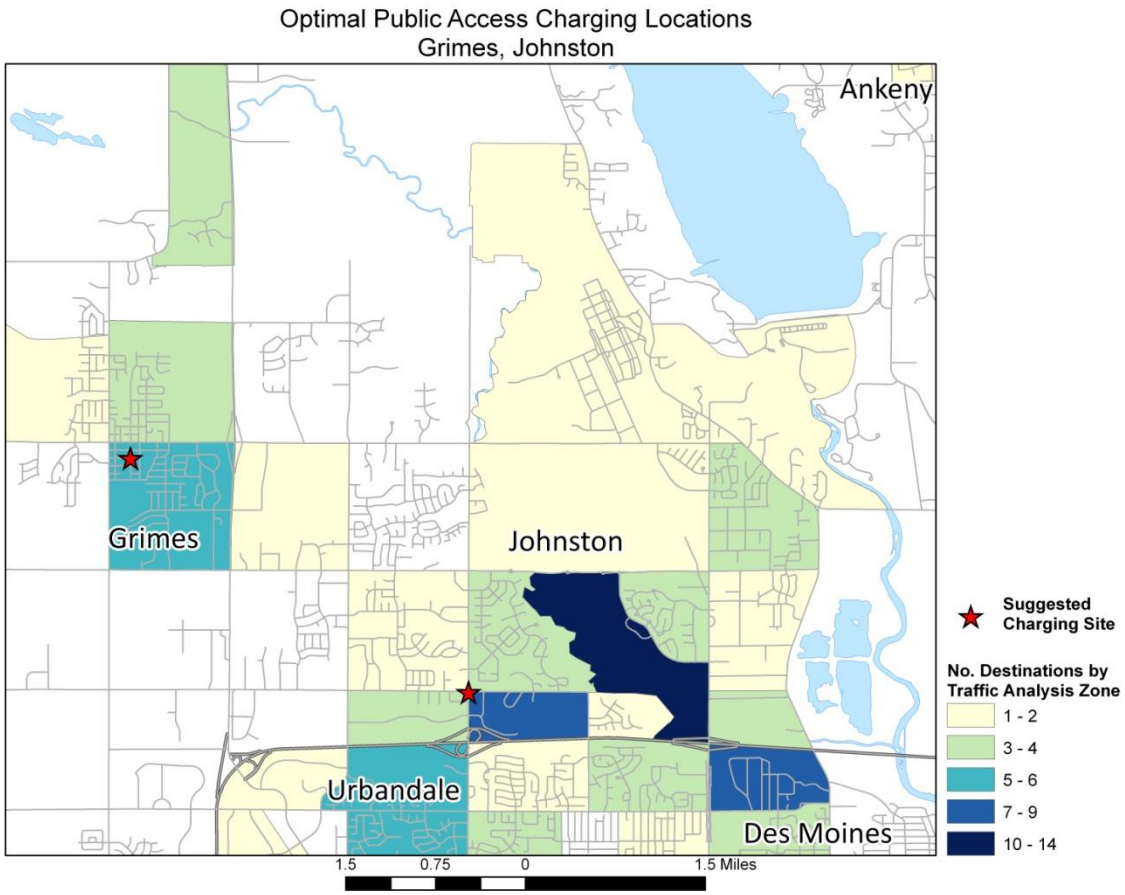
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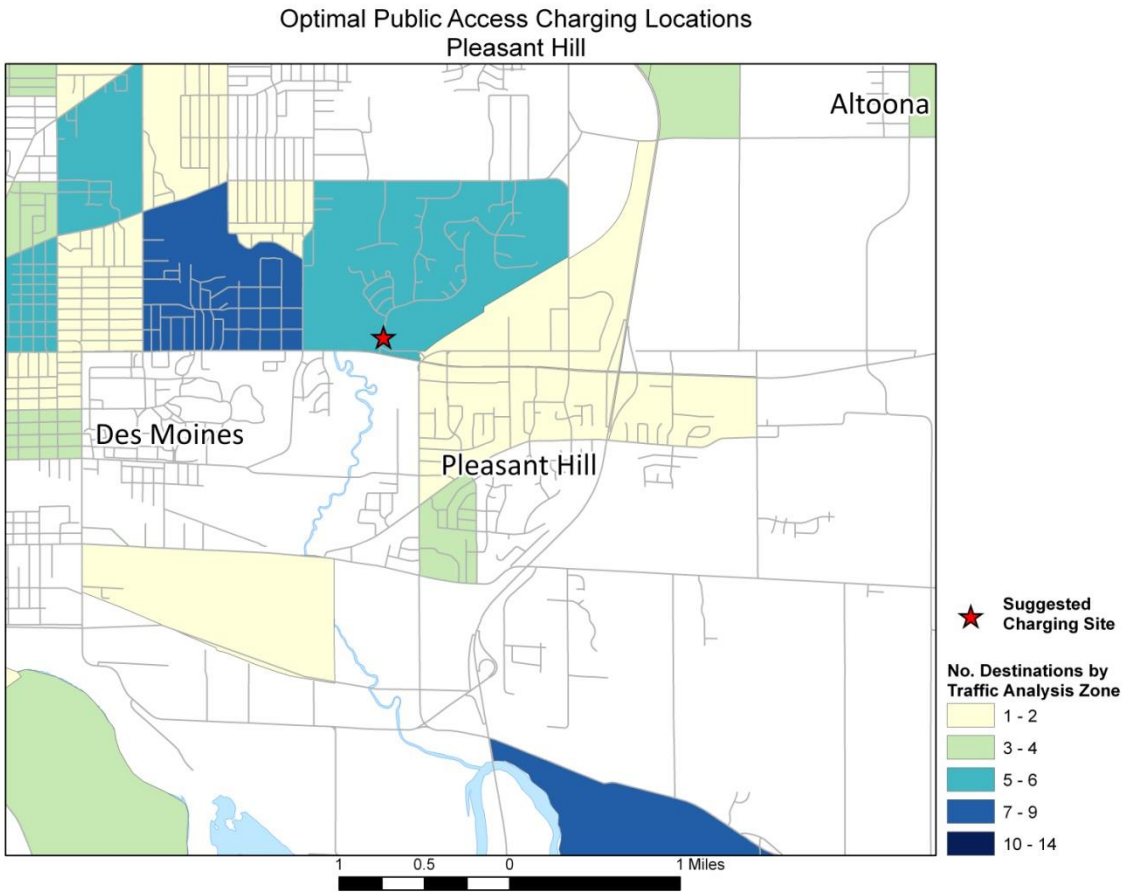
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Pleasant Hill
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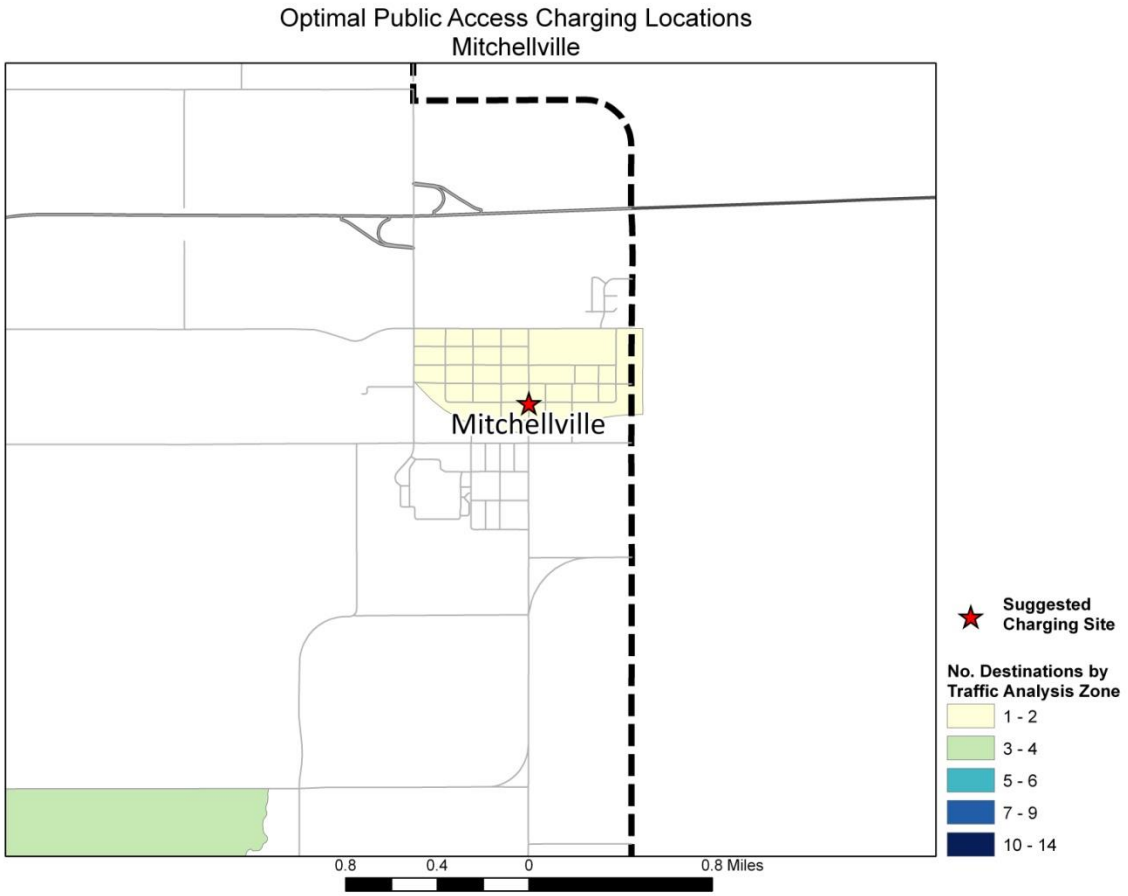
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Mitchellville
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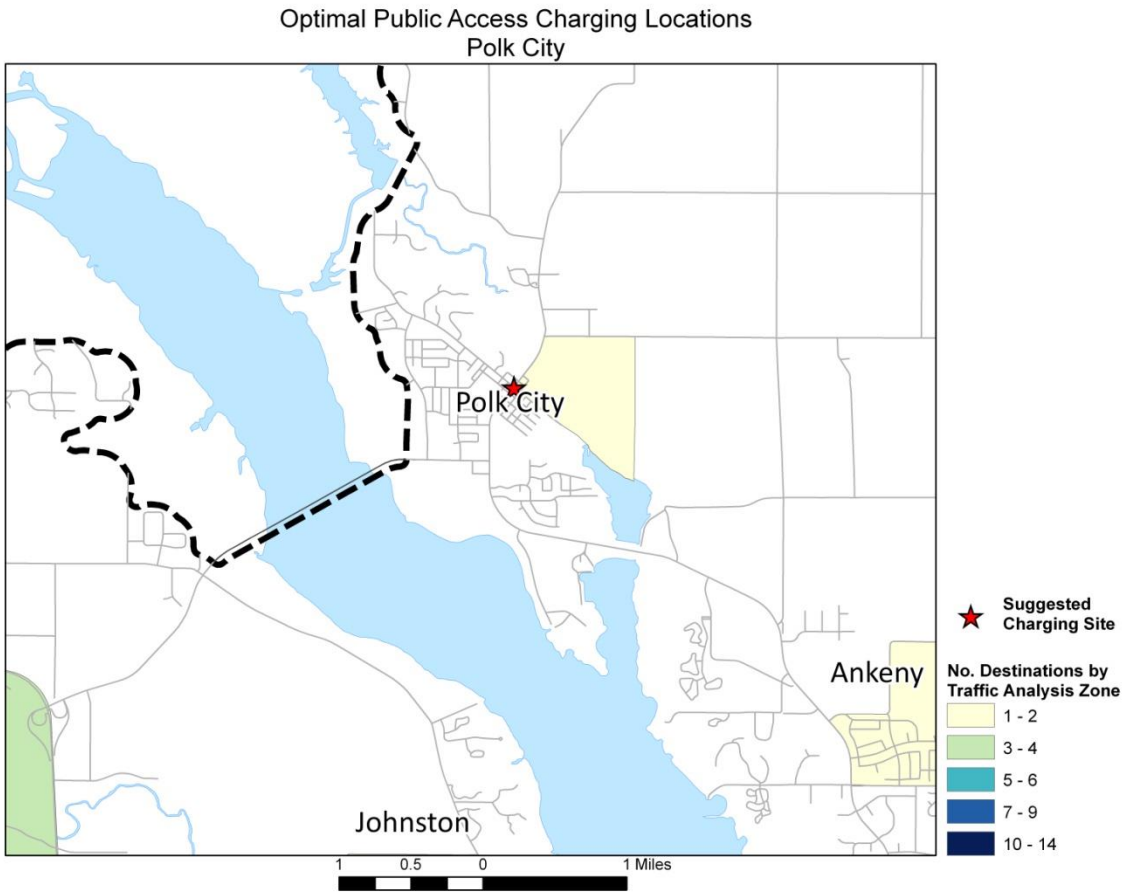
0.8 Miles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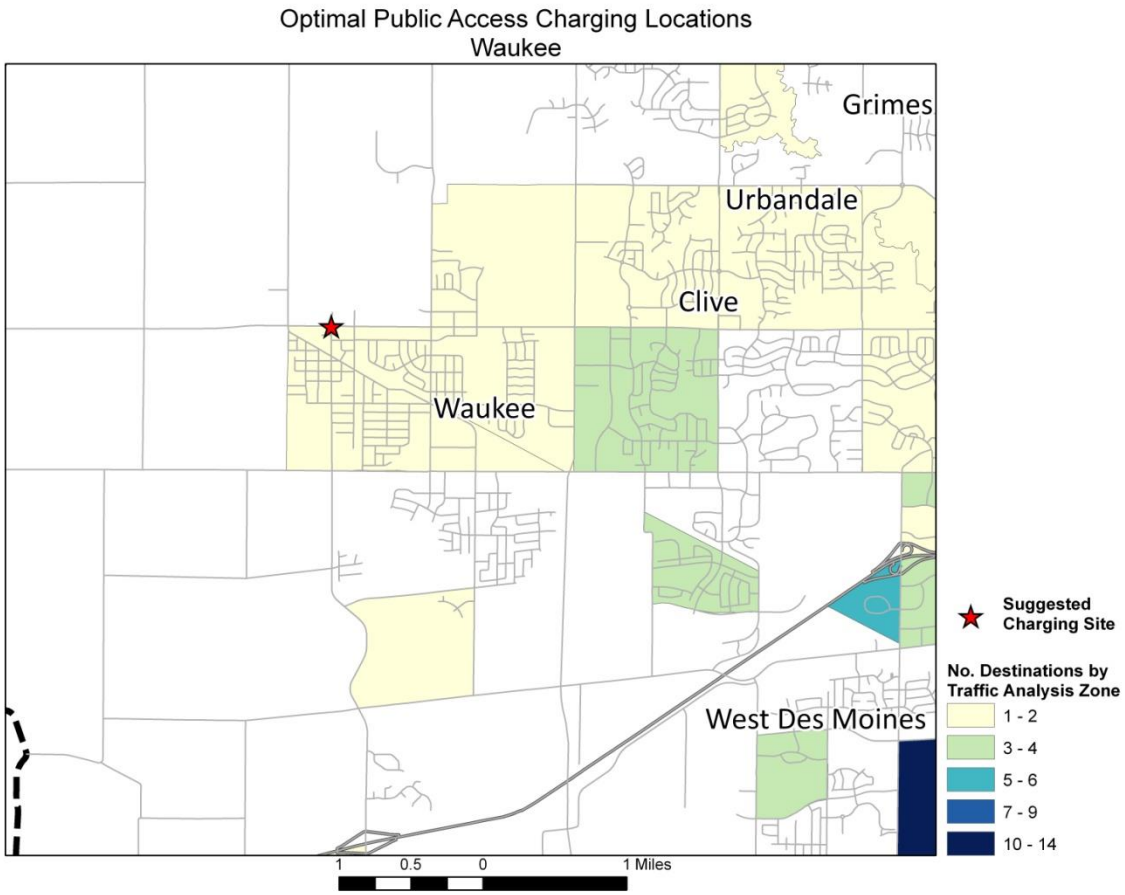
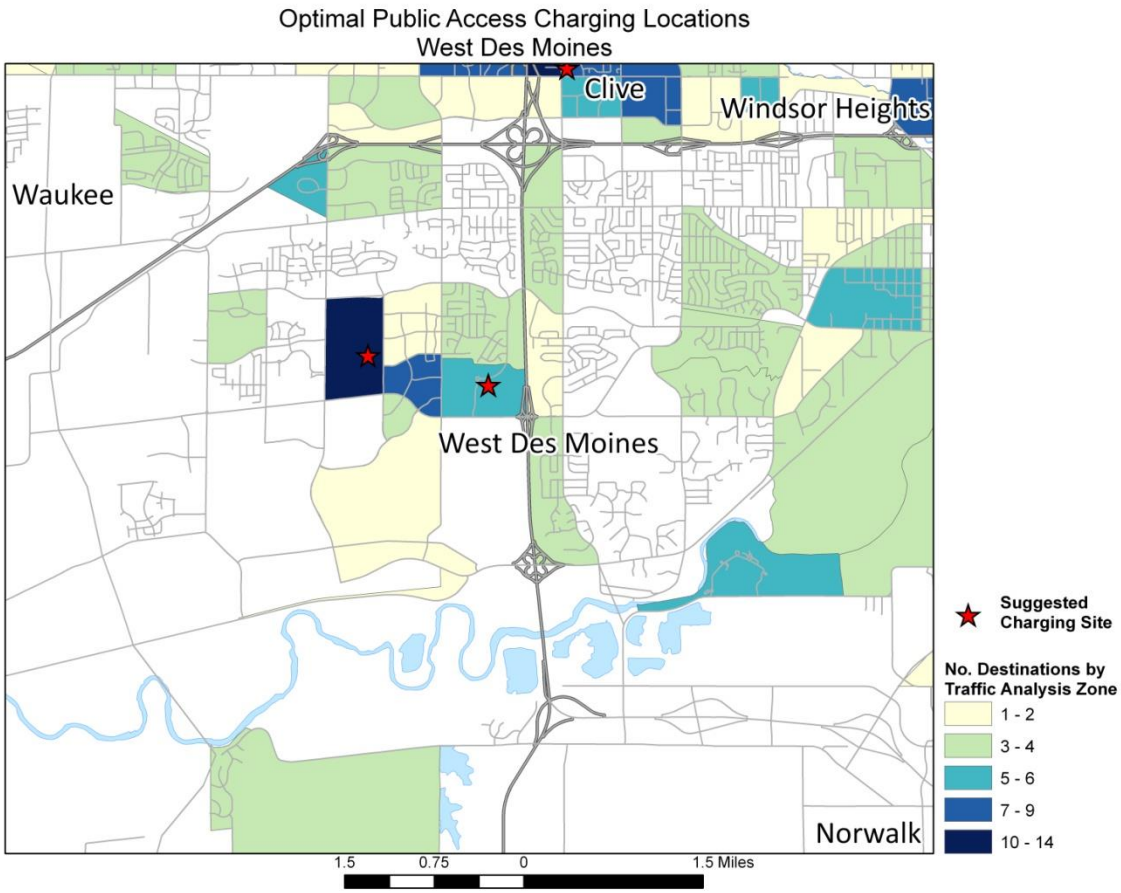
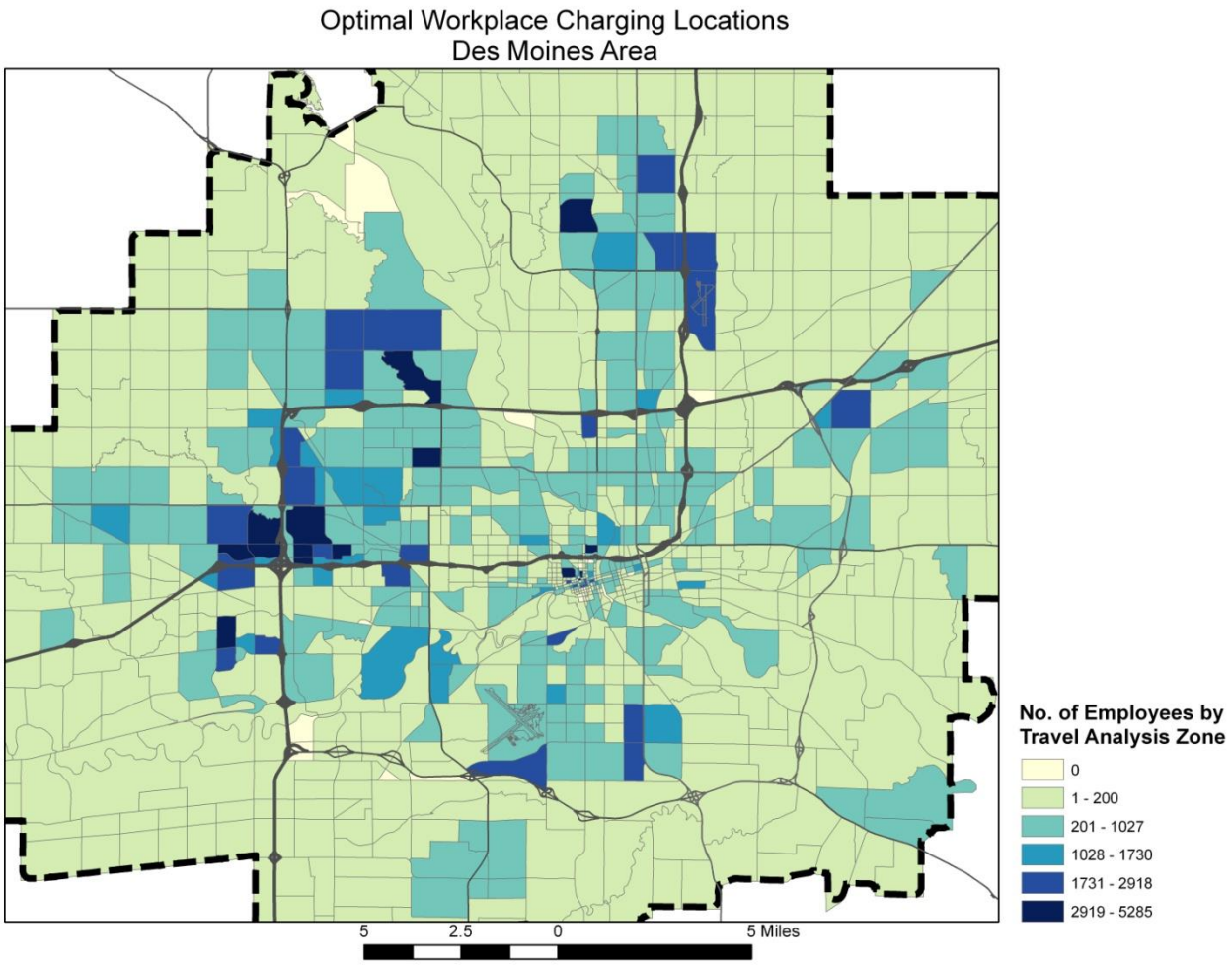
10 - 14
1 0.5 0 1 Miles

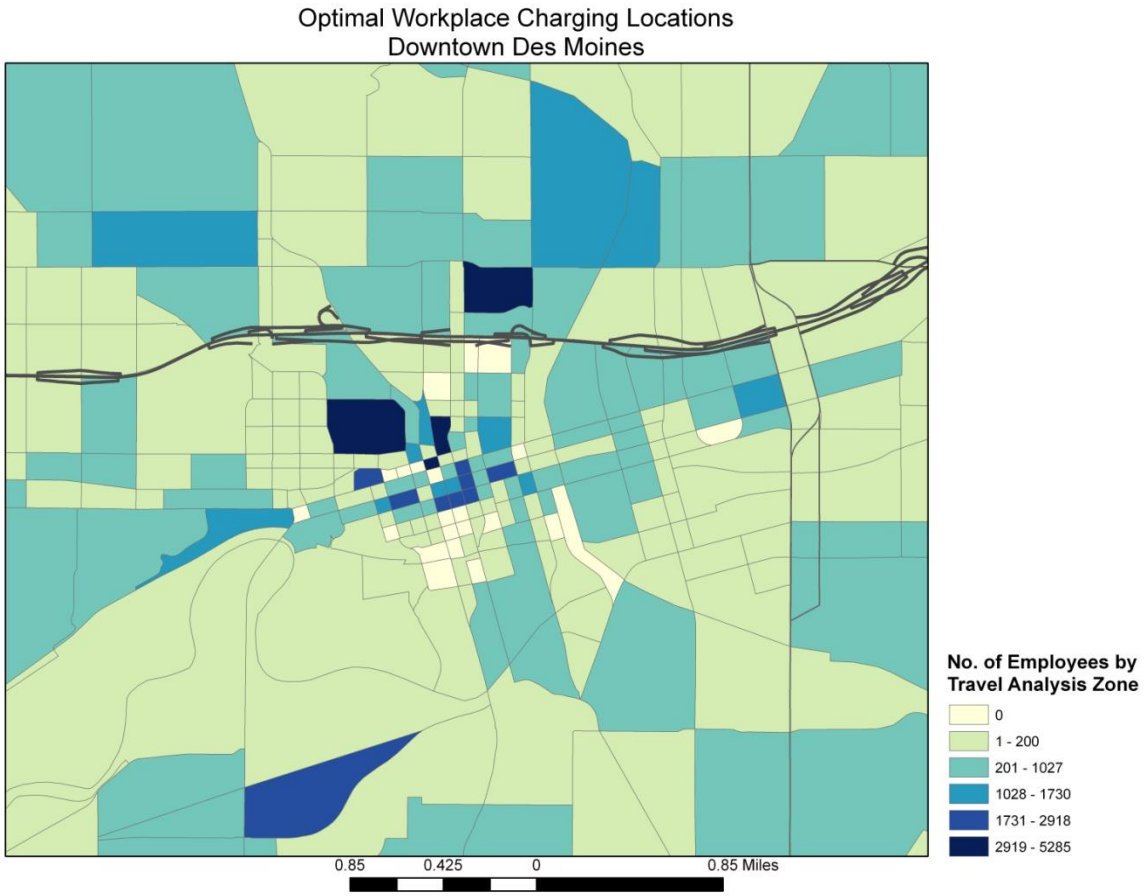

Optimal Public Access Charging Locations
Waukee
Grimes
Urbandale
Clive
Waukee
West Des Moines
Suggested Charging Site
No. Destinations by Traffic Analysis Zone
1 - 2
3 - 4
5 - 6
7 - 9
10 - 14
1
0.5
0
1 Miles

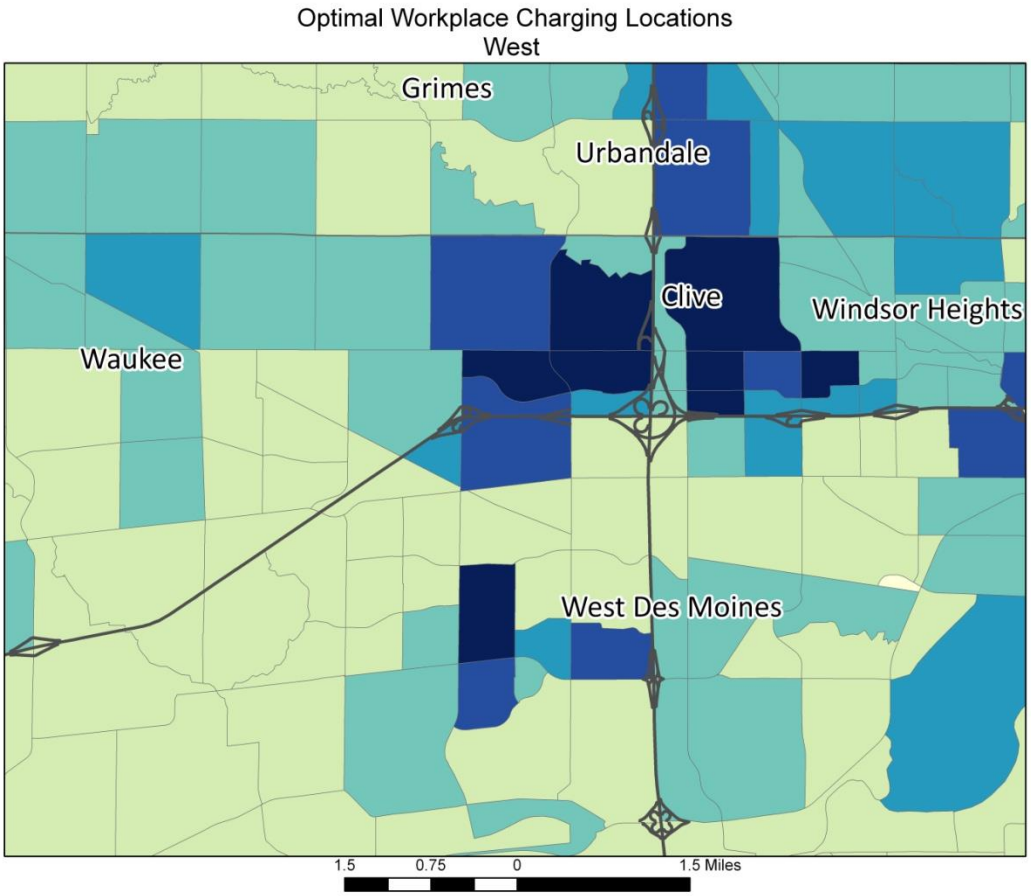

Optimal Public Access Charging Locations
West Des Moines
Clive
Windsor Heights
Waukee
West Des Moines
Norwalk
Suggested Charging Site
No. Destinations by Traffic Analysis Zone
1 - 2
3 - 4
5 - 6
7 - 9
10 - 14
1.5
0.75
0
1.5 Miles

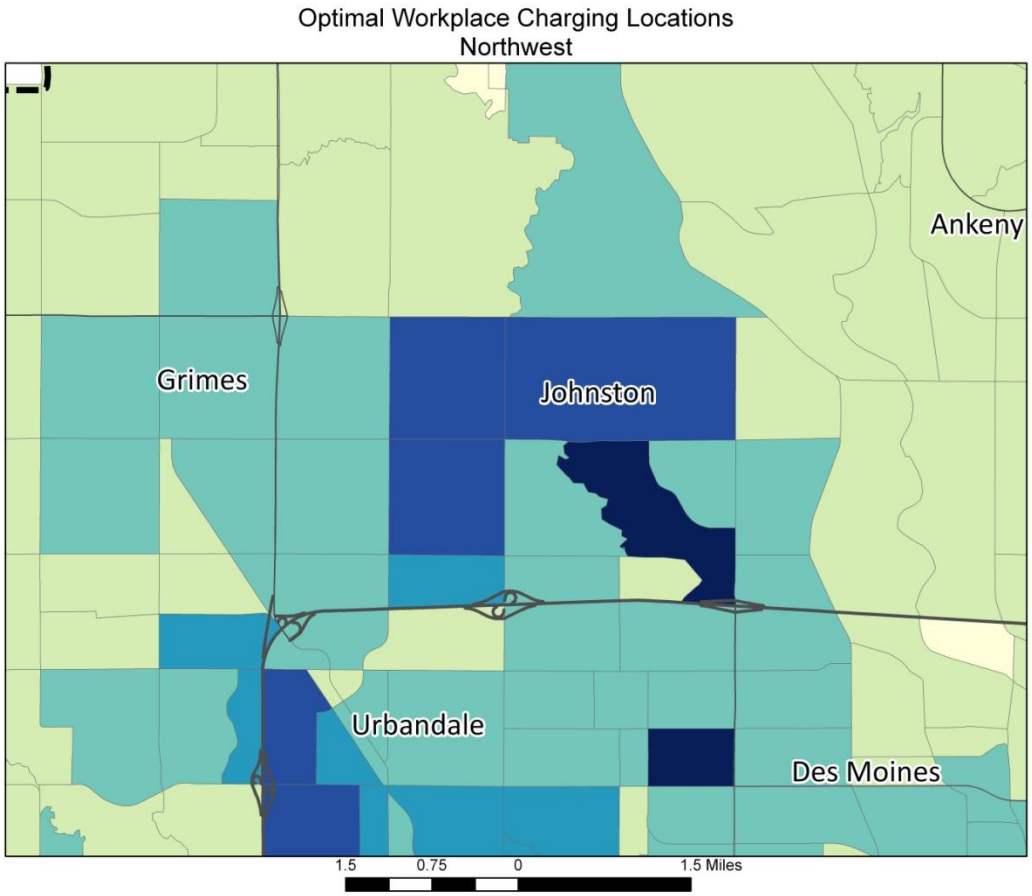
I

Appendix II: Optimal Workplace Charging Locations

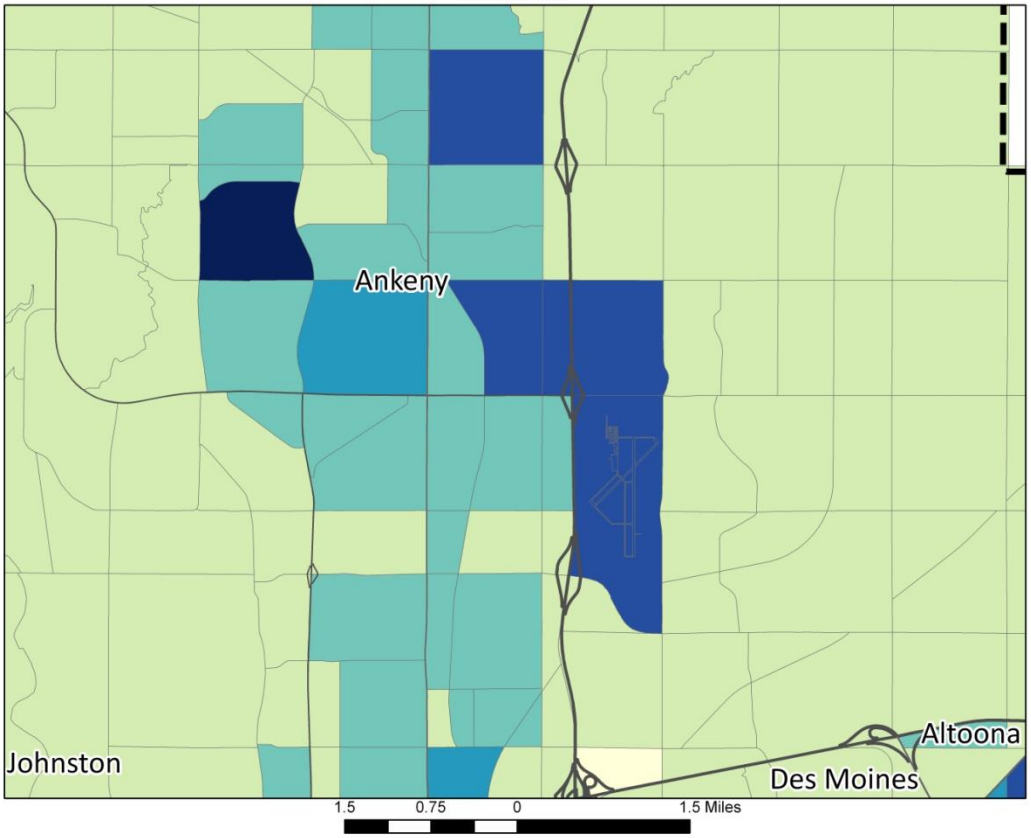


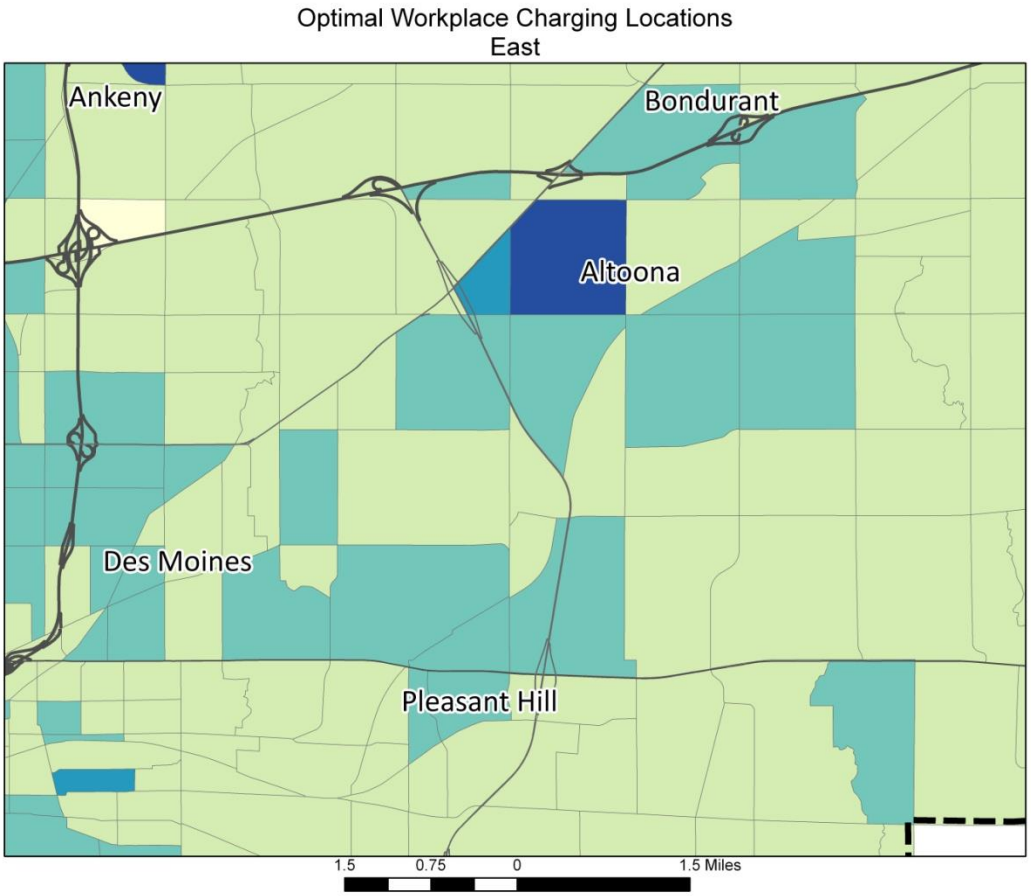

Optimal Workplace Charging Locations
Downtown Des Moines
No. of Employees by Travel Analysis Zone
0
1 - 200
201 - 1027
1028 - 1730
1731 - 2918
2919 - 5285
0.85
0.425
0
0.85 Miles


Optimal Workplace Charging Locations
West
Grimes
Urbandale
Clive
Windsor Heights
Waukee
West Des Moines
1.5
0.75
0
1.5 Miles

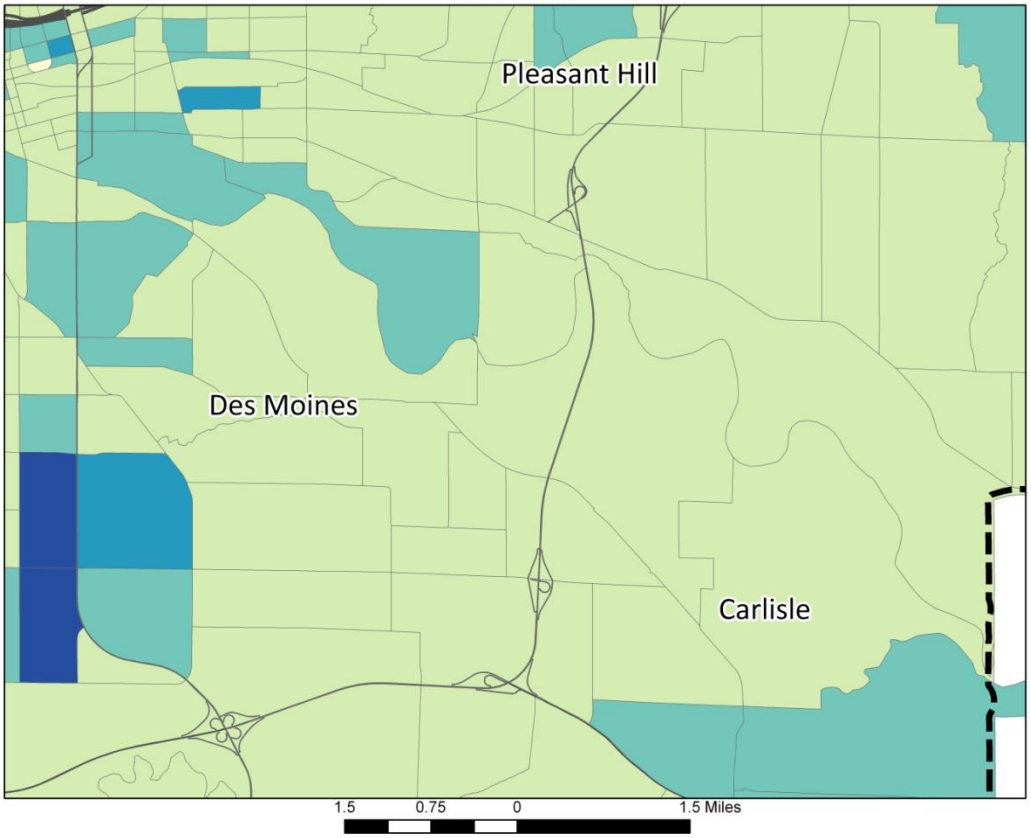

Optimal Workplace Charging Locations
Northwest
Ankeny
Grimes
Johnston
Urbandale
Des Moines
1.5
0.75
0
1.5 Miles

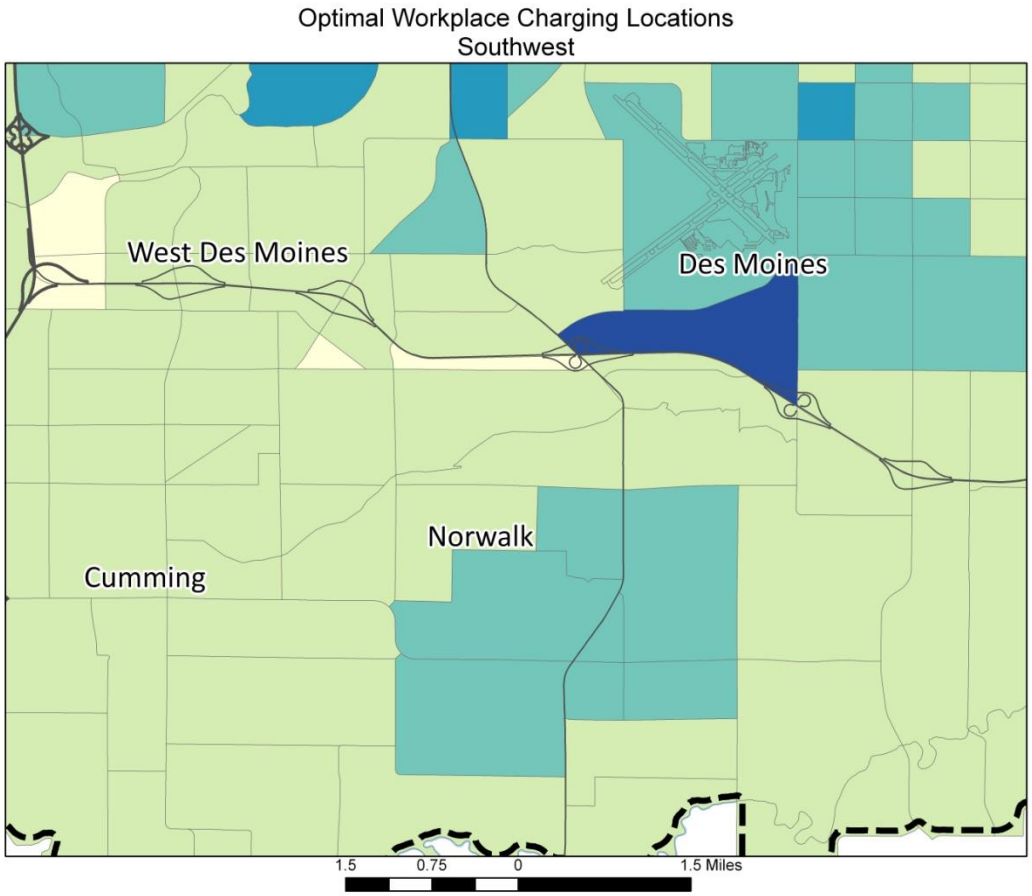
Optimal Workplace Charging Locations
Northeast




Optimal Workplace Charging Locations
East
Ankeny
Bondurant
Altoona
Des Moines
Pleasant Hill
1.5
0.75
0
1.5 Miles

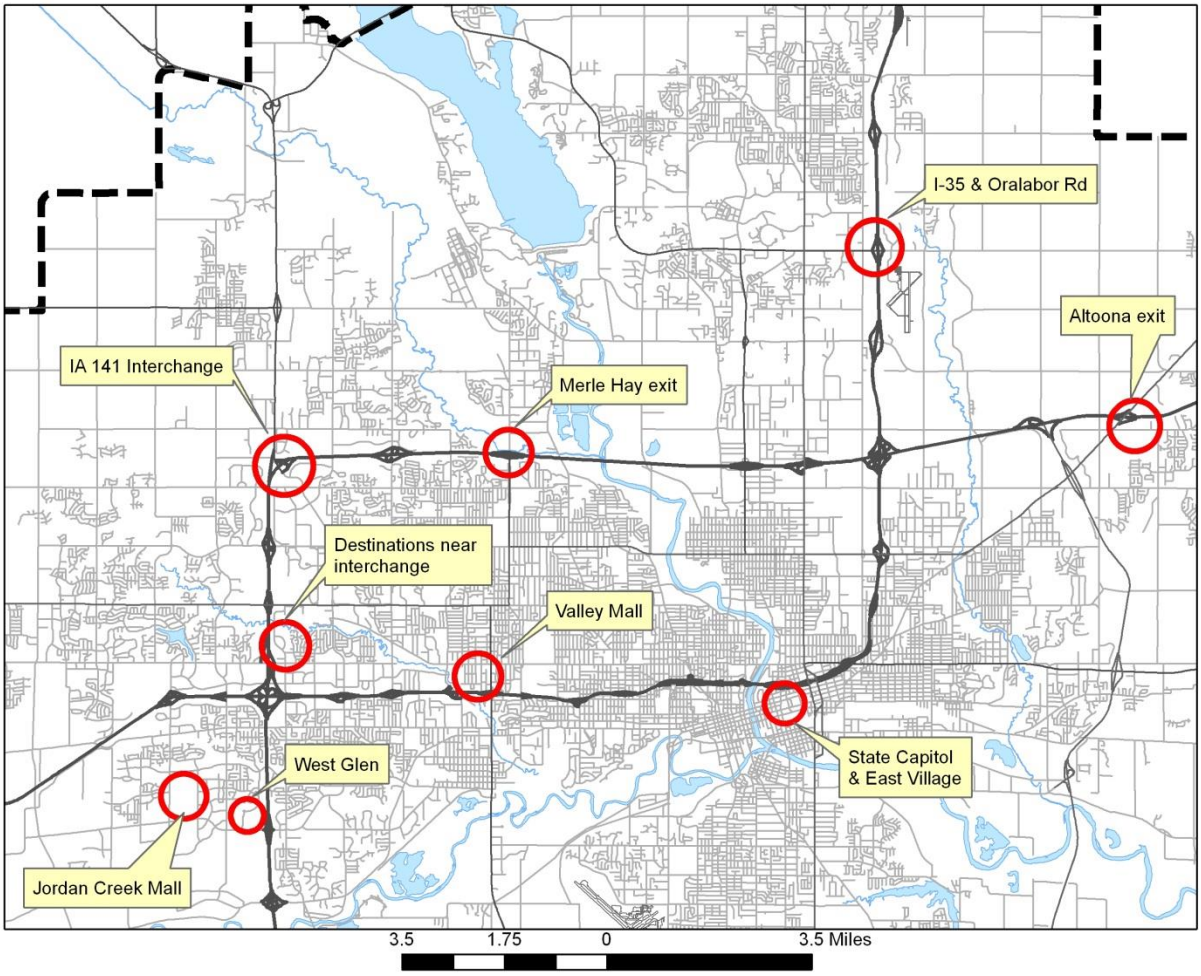
Optimal Workplace Charging Locations
Southeast




Optimal Workplace Charging Locations
Southwest
West Des Moines
Des Moines
Norwalk
Cumming
1.5
0.75
0
1.5 Miles

APPENDIX III: OPTIMAL FAST CHARGE LOCATIONS

Optimal Fast Charge Locations, Metro Area



APPENDIX IV: CURRENT LOCATIONS OF CHARGING STATIONS IN THE METRO